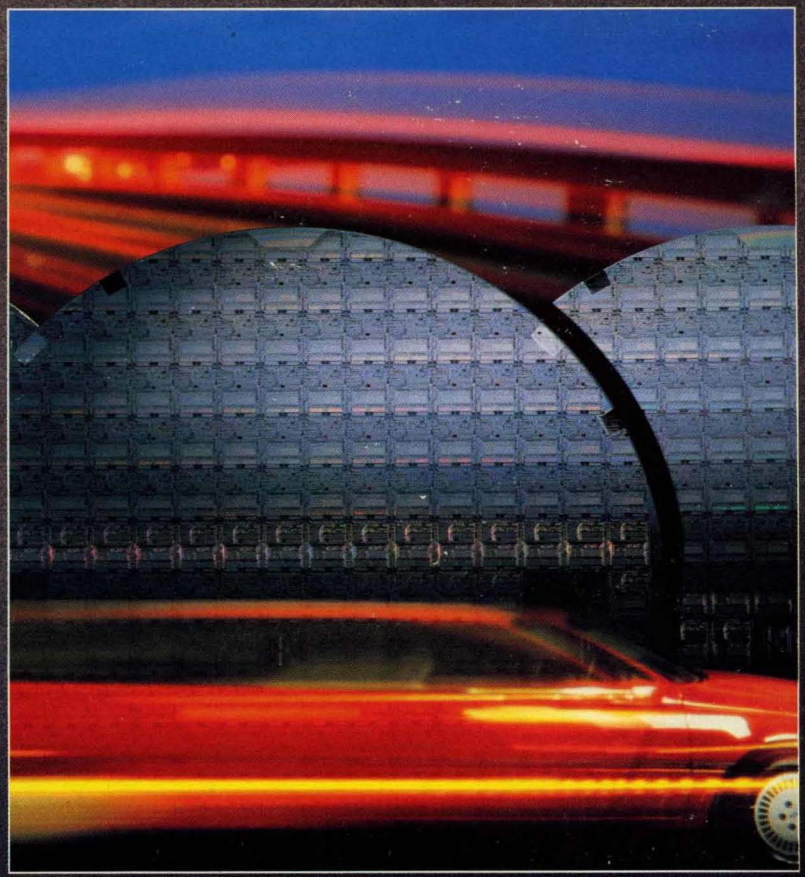
SPG-201R

PRODUCT SELECTION GUIDE

HARRIS

A Short-Form Reference to
Harris Semiconductor Products



PRODUCT SELECTION GUIDE

HARRIS SEMICONDUCTOR

HARRIS · RCA · GE · INTERSIL

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HARRIS SEMICONDUCTOR

This product guide represents the full line of Harris Semiconductor products. A detailed Table of Contents shows product categories and references page numbers. Only key product information — features, ratings, or characteristics — is furnished.

For complete, current and detailed technical specifications on any Harris device please contact the nearest Harris sales, representative or distributor office; or direct literature requests to:

Harris Semiconductor Literature Department
P.O. Box 883, MS CB1-28
Melbourne, FL 32901
(407) 724-3739
FAX 407-724-3937

Printed in U.S.A., 2/1990

Harris Semiconductor products are sold by description only. All specifications in this product guide are applicable only to packaged products; specifications for die are available upon request. Harris reserves the right to make changes in circuit design, specifications and other information at any time without prior notice. Accordingly, the reader is cautioned to verify that information in this publication is current before placing orders. Reference to products of other manufacturers are solely for convenience of comparison and do not imply total equivalency of design, performance, or otherwise.

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ASIC Standard Cells and Gate Arrays

The Harris ASIC product line includes a full range of cost-effective design elements for use in designing application-specific integrated circuits (ASICs). Capabilities include state-of-the-art cell based, gate array, and full custom design technologies. Each is supported by the powerful Harris FASTRACK™ CAD system, which leads you from conception to reality in one integrated environment. If your preference is for third party design systems, Harris offers full support for most libraries on Daisy, Mentor Graphics™, Valid, and OrCad design tools.

Full Range of Cost-Effective Design Elements

Standard Cells

- SC3000 — 2 micron; double layer metal; extensive library, compiled RAM, PLA, and crosspoint switch; analog blocks; 74HC and CD4000 series macros
- HSC3500 — 1.5 micron scale of SC3000
- HSC4000 — 1.5 micron ADVANCELL® family; joint venture of Harris, Toshiba, and Siemens; 400 cells; compilable RAM, PLA, Dual Port RAM, and FIFOs; analog functions; 35 MHz VCO; RTX and 20C51 core micros
- HSC4500 — 1 micron ADVANCELL®; scale of HSC4000 (Introduction 2QCY90)

Gate Arrays

- CGA200 — 1.5 micron; high density gate structure; alternate source of VLSI Technology Inc.'s VGT200; 280 cells; 13 arrays up to 30K usable gates.

Harris FASTRACK™ Integrated Design Tool

FASTRACK™ provides a comprehensive design environment for completing high performance digital and full custom analog designs. Designed with an open architecture, FASTRACK™ integrates proprietary Harris tools with state-of-the-art third party tools to provide the user with the utmost in capability. Harris chose the flexible Cadence Design FRAMEWORK™ as the underlying structure of the FASTRACK™ tool set. The use of this system enables broad technology support and portability to various hardware platforms. FASTRACK™ is currently supported on the SUN3/4, and Sparcstation systems. An Apollo release is also available. Netlists can also be imported from a wide range of industry-standard tools, including: Daisy, Mentor Graphics™, Valid, and OrCad design systems.

Long Experience

With more than 20 years of experience producing custom and semicustom parts, Harris has satisfied the most demanding customers in data processing, industrial, consumer, automotive, and military markets. Over 10 million circuits have been sold in the automotive market alone. Harris ASICs have a first-time-success rate of over 95%.

Features

- Standard cells and gate arrays
- Extensive cell libraries
- High-reliability circuits
- Fully supported design automation software
- Quality and reliability
- Fast turnaround

Service and Support

Harris provides a Training Course in automated ASIC circuit design as well as technical documentation covering both hardware and software.

Quality and Reliability

In addition to total commitment to the very highest levels of quality and reliability in the development and manufacture of its products, Harris Semiconductor provides a comprehensive design audit system to assure the customer that the design will work the first time. Moreover, by supplying the design verification samples and the subsequent production quantities from the same factory and fabrication equipment, the customer is assured of a reliable and quality product that is replicated throughout its production run.

CMOS Application-Specific Integrated Circuit Design

ASICS fall into two product groups:

- Gate Arrays
- Standard Cells

Gate arrays are the simplest semicustom IC. For a logic circuit design based on a gate array, the starting point is the user's list of simulated network connections (netlist) and a standardized CMOS base array provided by Harris Semiconductor containing NMOS and PMOS transistors. By the addition of a double layer of metallization, the base array is converted into a specific

LSI logic circuit. The metallization layers are custom designed for a specific application by the customer using Harris software at a computer terminal.

Standard cells are also building blocks for LSI circuit designs. Harris provides an extensive library of standard cells and supercells each designed to provide a specific logic function. All the cells are characterized and verified. As with the gate arrays, the customer, with training and software supplied by Harris Semiconductor, combines these cells into the configuration that best serves the application.

After the user-specified circuit design is completed, Harris provides design verification samples for pre-production review. At the customer's option, and after design verification samples are approved, production can be started.

Gate Arrays

A gate array is a CMOS LSI chip consisting of p devices, n devices, and tunnels in a repetitive, ordered structure on either a silicon or a sapphire substrate. All device nodes (gates, drains, and sources) are accessible. Gate arrays are available for both double-level and single-level metallization.

In double-level-metal gate arrays, a sequence of four "personalization" masks (contact, first metal, via and second metal) defines the interconnect pattern that implements the required logic function. In single-level-metal gate arrays, a single personalization metal mask defines the logic function.

Gate arrays are a proven high-reliability, low-cost solution to ASIC circuit design. Because gate arrays use standard chips customized by one or four personalization masks, design turnaround time is short and the correction of potential system-integration errors or design change is easily accomplished. Gate arrays rival the speed of bipolar devices and offer the additional inherent CMOS advantages.

Services Available

Harris Semiconductor offers the customer of the CMOS ASIC design program five separate and distinct services for optimizing semicustom circuit requirements. These services are:

TRAINING — Utilizing the best circuit-design software tools available in the industry, Harris Semiconductor has an extensive network of Design Centers and Design Representatives. Contact the nearest Harris Semiconductor Sales Office for a list of Harris Semiconductor ASIC Design Centers and Training Facilities.

SOFTWARE — Harris offers the FASTRACK™ ASIC Design System on SUN and Apollo platforms. The MIMIC™ Logic Simulator is available on Apollo, SUN, and VAX-based platforms. In addition, Harris offers standard cell and gate array libraries on the most popular work stations: Daisy, Mentor™, Valid, and OrCad. Most library kits include schematic capture, logic simulation, and netlist extraction. Some kits even have ERC capabilities.

COMPUTER ACCESS SERVICE — Minimal charges for use of local terminal and CPU time.

NRE — A one-time all-inclusive nonrecurring engineering development charge. There are no hidden costs, no addon extras for design consultation and the like. One half of the charge is payable upon receipt of order. The balance is payable upon delivery by Harris Semiconductor of functional design-verification samples (DVs). Production quantity commitments are not required for this design development service.

PRODUCTION — Harris Semiconductor can deliver production quantities 10 to 12 weeks after approval of the design verification sample. Production is from the same factory that produced the original samples for design verification.

The ABCs of Harris Semicustom LSI Design

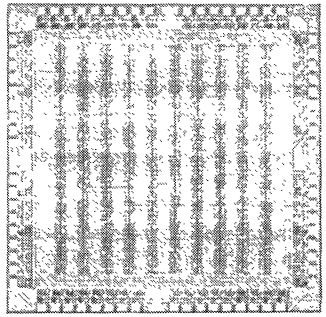
One of the reasons Harris Semiconductor is successful in the semicustom marketplace is the flexibility it provides for the customer-interface procedure. Because of this flexibility, Harris Semiconductor and the customer can determine the procedure that is in the customer's best interest for an LSI circuit design. The customer's entry level into the design program and the degree of Harris Semiconductor participation are both selected by the customer. The customer, consequently, has maximum control of both the design and the costs.

The three-step design process is charted below.

Chart of the Design Process Showing User-Selectable Alternatives

Entry Level	STEP A Logic Design & Simulation	STEP B Automatic Placement, Routing & Connectivity Check	STEP C Mask Tooling & Prototype Production
1	Harris	Harris	Harris
2	User	Harris	Harris
3	User	User	Harris

Gate Array



Gate Array Die Photo

Gate Arrays

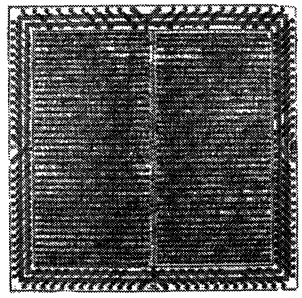
Libary	Technology	Typical Gate Delay @ 5V (ns)	Operating Voltage Range (V)	No. of Usable Gates	No. of I/O Pads
CGA200	1.5 micron; double layer metal	0.75	4.5-5.5	960	48
				2,018	68
				3,285	88
				5,302	112
				7,260	128
				8,640	140
				10,140	152
				12,790	172
				16,934	196
				22,118	224
				32,854	272

Workstation Library Availability

Family	Mentor	Daisy	Valid	OrCad	P-CAD	F'NET
HSC4000	Des	Des	Des	Sim	-	-
HSC3500	Des	Des	Des	Sim	Sim	Sch
SC3000	Des	Des	Des	Sim	Sim	Sch
CGA200	Sch	Des	Sch	-	-	-

Des (Designer's Kit) = Schematic Capture, Simulation and ERCs
Sim (Simulation Kit) = Schematic Capture and Simulation
Sch (Schematic Kit) = Schematic Capture
F'NET = FutureNet

Standard Cell



Standard Cell Die Photo

SC3000/HSC3500 - Standard Cells

Characteristic	SC3000/HSC3500 - DLM
Gate Complexity	12000 + Subchips
In/Output Profile	Low, High
Delay Time (ns) Internal Gate 2-Input NAND (F = 2)	1/0.8
Output Buffer CL = 15pF	1.5/1.2
Input Buffer	1/0.8
Power Dissipation at 1MHz	17μW/Gate 1mW/Output Buffer CL = 50pF
Operating Temperature Commercial Industrial Military (Ceramic Package)	 0°C to +70°C -40°C to +85°C -55°C to +125°C
Supply Voltage Absolute Maximum Operating	 -0.3V to +6.5V +2V to +6V
I/O Interface	TTL CMOS Compatibility
Technology	2μ Drawn 1.5μ Effective Si-Gate/ 1.5μ Drawn 1.1μ Effective Si-Gate CMOS Double Level Metal N-Well
Compilable Macros	RAM, ROM, PLA
Bit-Slice Macros	16 Cells Equivalent to A2900 Family
Analog Cells	10 Basic Cells
Soft Macros	63 CD4000 Macros 151 TTL Macros UART/Adder/Multiplier

HSC4000 - Standard Cells

CHARACTERISTIC	ADVANCELL® - 1.5 DLM
Gate Complexity	30K + Subchips
In/Output Profile	Medium, High
Delay Time (ns) Internal Gate 2-Input NAND (F = 2)	0.8
Output Buffer CL = 15pF	1.5
Input Buffer	1
Power Dissipation at 1MHz	17μW/Gate 1mW/Output Buffer CL = 50pF
Operating Temperature Commercial Industrial Military (Ceramic Package)	 0°C to +70°C -40°C to +85°C -55°C to +125°C
Supply Voltage Absolute Maximum Operating	 -0.3V to +6.5V +2V to +6V
I/O Interface	TTL CMOS Compatibility
Technology	1.5μ Drawn 1.1μ Effective Si-Gate CMOS Double Level Metal N-Well
Compilable Macros	RAM, PLA, FIFO, Dual Port
Bit-Slice Macros	16 Cells Equivalent to A2900 Family
Core Microprocessor	80C51 Equivalent, RTX 2000, 6805
Analog Cells	10 Basic Cells
Soft Macros	108 Macros = 74 LS Family 20 Macros = UART, Timer, Interrupt Controller, DMA, CRT Controller, Adder, ALU, etc.

CMOS Digital Design

Features

- Supports Harris 1.5-Micron Double-Level-Metal Standard Cell Libraries (HSC4000 and SC3000)
- Schematic Capture and Simulation for SSI, MSI Functions
- RAM, PLA and FIFO Compilers
- MIMIC™ Logic and Fault Simulation Capabilities Include Best Case, Worst Case, Typical
- Back Annotation of Fanout and Routed Delays Provided
- Supports Logic Area and Timing Optimization
- Support Logic Synthesis from HDL Input
- Supported on Sun and Apollo Platforms

Description

HARRIS FASTRACK™ provides schematic capture, design verification and place and route capability for Harris cell families. The package has been extensively used at Harris to develop high-performance standard products and customer-specific designs.

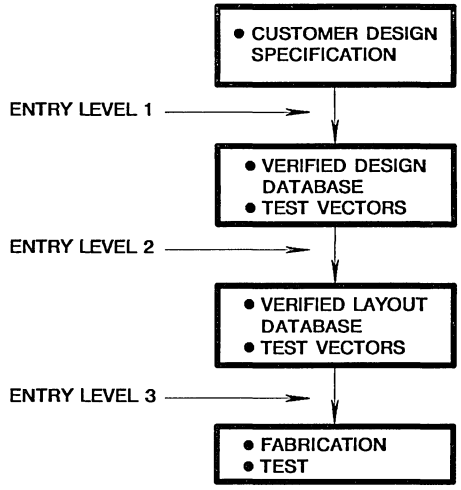
The design package supports the entire design process from design capture through physical layout. The customer can enter the design process at three levels, diagrammed below:

1) High-Level Specification

2) Schematic capture and design verification

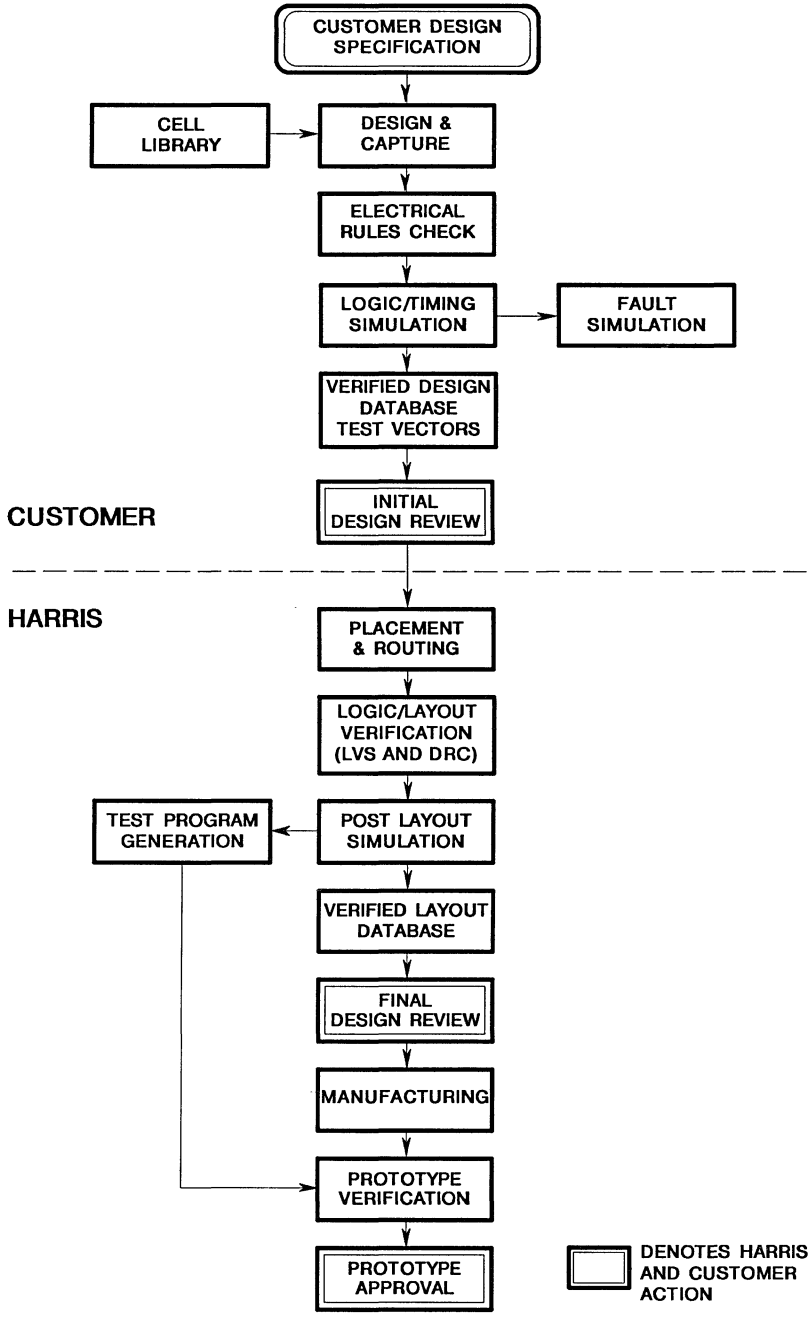
3) Fully verified layout database

ASIC Design Flow



CMOS Digital Design (Continued)

Typical Design Flow



CMOS Digital Design (Continued)

Features

The features of the design package are described below. The descriptions are in sequence with the design flow on the opposite page.

Schematic Capture

The schematic capture system is hierarchical and flexible in the choice of design style. Electrical Rules Checks (ERCs) are an integral part of the schematic capture system, and are available at any point during a design by a simple menu pick. Facilities for adding custom cells and macroblocks to a design are also provided.

Simulation and Fault Simulation

The system simulator, provides functional, gate level timing and fault simulation capabilities. Gate-level simulation capabilities include best case, worse case, typical timing data as well as back-annotation of fanout and routing delays. Fault simulation capabilities include statistical or deterministic fault simulation using "stuck-at-one" or "stuck-at-zero" fault model.

Logic Optimization and Synthesis

The Synopsys Design Compiler™ and HDL Compiler™ are part of the Harris FASTRACK™ ASIC Design System. The Design Compiler enables ASIC designers to optimize logic for either maximum speed, minimum area, or any combination of these requirements. The HDL Compiler is a VHDL logic synthesis tool that automatically generates functionally correct gate-level logic directly from a high-level VHSIC Hardware Description Language (VHDL) input. Schematics, complete with back-annotated timing information, are automatically created within the FASTRACK™ environment.

Place and Route

The place and route package allows the user to continue the design process through the layout generation stage. Place and route is a menu driven operation used to simplify the task. The interface allows the user to complete a hands off layout of simple "rows only" designs or to interact with the software for more complex designs. Mixed standard cell/macrocell layouts may also be done in a fully automatic mode. After satisfactory completion of placement and routing, manufacturing test structures to monitor process parameters are added to the design.

Layout Versus Schematic (LVS)

The LVS utility compares the final layout to the captured schematic to ensure integrity of the design. This is performed by extracting a transistor level netlist from the layout and comparing it to the extracted schematic data base.

Design Rule Checks (DRCs)

DRCs are run as a final check before the masks are made and the circuit is committed to manufacture. This function checks that all layout geometries conform to the manufacturing requirements of the target process and fabrication line.

Compiled Functions

The compiler menu is selected from the schematic capture menu. From the compiler menu, the designer may select either the RAM, PLA, or FIFO compiler and answer several questions about the desired configuration. Several performance and aspect ratio options are presented to the user for evaluation. After an option is selected, a symbol and simulation model are automatically created and placed in the design hierarchy for later use. At the layout phase, the layout for the defined function is generated and routed as a block in the design.

The Harris HSC Library Description

The Harris HSC libraries are a common set of cells on multiple process technologies. The libraries are forward compatible with advances in processing capability.

The libraries support commercial, industrial and military applications.

The two HSC libraries are the HSC4000 Advancell® (1.5 micron DLM) and SC3000 (2.0 micron DLM). The Advancell® library is alternate sourced by Toshiba and Siemens. See individual library data sheets for details.

Each library is complemented by versatile options: compiled cells and macrocells.

The base library option consists of logic primitives and popular 74XX series cells.

The compiled cell options include RAM up to 16K bits.

Macrocell Families

- 29XX Series ALU Functions
- RTX Core Microcontroller
- Microprocessor Peripheral Functions
- Communication Functions
- Multiplier Functions
- 20C51 CPU Microcontroller
- 6805 Core Microcontroller

Bipolar Analog Design

Features

- Bipolar Analog Design Toolset on HARRIS FASTRACK
- Transistor-Level Analog IC Design Capability
- Menu-Driven Interface
- Hierarchical Schematic Capture
- Coupled Electrical and Physical Design Features
- Electrical Design Rules Checking and Layout vs. Schematic Checking
- User Variable Diffused and Thin Film Resistors
- Automatic Device Model Parameter Determination
- Self-Contained Statistical Process/Device Data Bases
- A Variety of High Performance Bipolar Analog Processes
- User Variable Transistor Geometries
- Powerful Electrical Statistical Simulation Capability
- Layout Modifications and Parasitics Automatically Back Annotated to Schematics
- Supported on Sun and Apollo Platforms

Description

The Bipolar Analog Design toolset provides comprehensive software for the full custom design of analog circuits using bipolar technology. The toolset contains all tools necessary to perform both the electrical and physical design of an analog IC using Harris wafer fabrication processing. The toolset also contains a complete statistical description of the process being used, allowing a comprehensive statistical analysis of circuit performance using Monte Carlo procedures.

The geometry of transistors and other circuit elements is determined by the user, according to the individual application, using built-in software.

The design toolset includes software tools for design capture, device design, electrical simulation, and data analysis. The physical design system provides tools for layout graphics editing, layout to schematic checking, layout groundrule checking, and parasitic extraction.

General Purpose Process Features

- Dielectrically Isolated
- Complementary Vertical Bipolar Transistors
- P Channel JFET
- Various Diffused Resistors
- Laser Trimmable NiCr Resistors
- High Quality Capacitor

	NPN	PNP
BVCEO	40V	40V
HFE	250	125
F_T	750MHz	400MHz

High Frequency Process Features

- Dielectrically Isolated
- Complementary Vertical Bipolar Transistors
- Double Level Metal Interconnect
- P Channel JFET
- Various Diffused Resistors
- Laser Trimmable NiCr Resistors
- High Quality Capacitor

	NPN	PNP
BVCEO	20V	20V
HFE	150	125
F_T	1.2GHz	1.0GHz

Bipolar Analog Design (Continued)

Bipolar Analog Processes

General Discussion

Bipolar analog processes at Harris are implemented using Dielectric Isolation (DI) techniques, and are intended for high performance applications, particularly those requiring precision and high speed.

DI provides true electric isolation between electrical components, particularly between the transistors. This eliminates the parasitic lateral and substrate devices and SCR's found in Junction Isolated (JI) structures, as well as the latch-up and other forms of electrical instability associated with these parasitic devices. This makes it possible to model the actual structure of the active devices more accurately than when parasitic devices are present, and eliminates the parasitic devices as a cause of circuit malfunction. DI also eliminates the leakage and minimizes the capacitance effects associated with the substrate. This facilitates the implementation of high speed and precision circuits, and allows the designer to consider the transistors to be discrete components as far as isolation is concerned.

Electrical Design Tools

Design Capture - Using this tool, the designer constructs a schematic diagram on an engineering workstation which includes descriptive information for all active and passive components, and shows their interconnection.

Device Design - This software allows the user to quickly determine an optimum device geometry for each transistor, resistor, and capacitor in the circuit. The procedure makes use of a family of variable geometry generic devices, and a highly developed device optimization software package.

Electrical Simulation - Using SLICE, a proprietary SPICE based circuit simulator developed by Harris Semiconductor as the core analysis tool, the system provides DC, AC, and transient simulation capability, in both deterministic and statistical modes. In the statistical mode, circuit performance is evaluated using Monte Carlo techniques, and output data is statistical in nature.

Data Analysis - This tool is used by the designer to evaluate the data generated by a statistical simulation. Capabilities include performance parameter statistics by histogram, yield to performance limits, correlation of performance parameters to process/device parameters, sensitivity of yield to performance parameters, overall yield estimation, and test development.

Physical Design Tools

Device Library Generation - This software examines the final circuit schematic and generates a library of the components required to layout the circuit. Also included in this library are all additional structures that must be included in the circuit for manufacturability, such as alignment marks, etc.

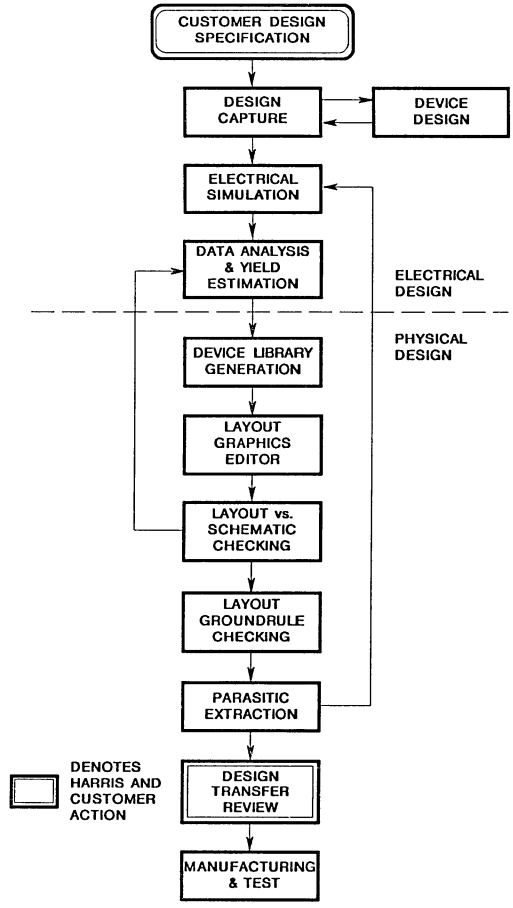
Layout Graphics Editor - Using this software, the designer physically arranges the components relative to each other subject to thermal, matching, and topological constraints and constructs the interconnections between them.

Design Rule Checker (DRC) - The function of this software is to check the layout for conformance to the various lateral spacing and overlap requirements of the particular process being used. This check can be incremental, in which the check is performed on those portions of the layout that have been constructed or changed since the last check, or it can be done on the entire layout.

Layout Versus Schematics Checker (LVS) - This tool compares the layout to the captured schematic for accuracy. Among those items checked are device type and geometry, resistor type, geometry and value, capacitance value, and overall interconnection topology.

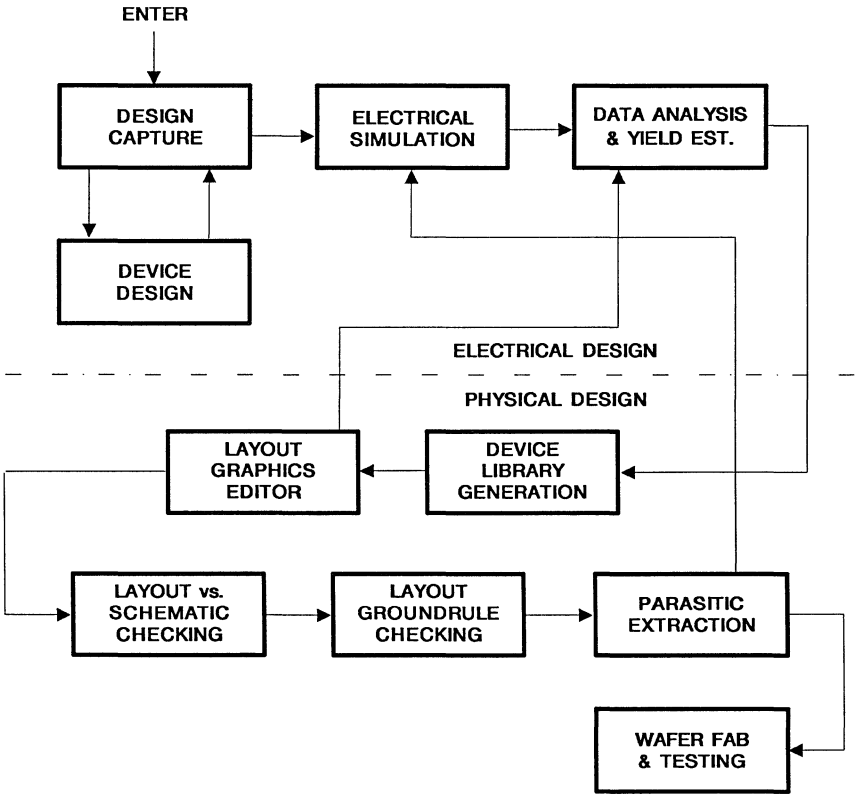
Parasitic Extraction - This software examines the completed layout and determines the magnitude and location of electrical parasitics, including the capacitance associated with metal interconnect. These parasitic elements are filtered according to user-controlled limits and a new electrical circuit representation, which includes the retained elements, is prepared for simulation.

ASIC Design Flow



Bipolar Analog Design (Continued)

Design Flow



Daisy™ Designers' Toolkit

HSC4000, SC3000, and CGA200

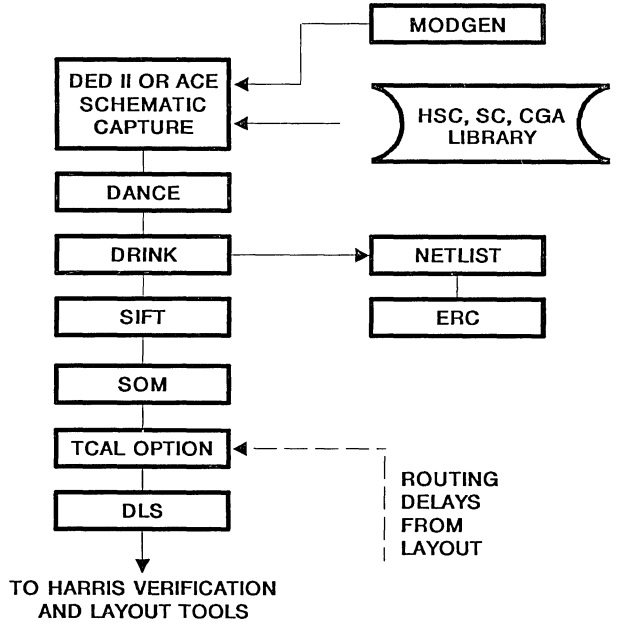
Features

- Compatible with Standard Daisy Platforms - Supports Standard Daisy Tools
- Supports Harris Cell-Based and Gate Array Families
- Schematic Capture, Simulation and Netlisting Using SSI, MSI Functions
- Simulation Capabilities Include Min/Typ/Max Delays for All Functions
- Supports DED II and ACE Schematic Capture - DeMorgan Symbols For Many Functions
- Additional Harris Tools Enchance Daisy Productivity
  - ERC
  - TCAL
  - MODGEN

Description

The Harris Daisy Designers' Toolkit supports the Harris HSC4000, SC3000, and CGA200 cell-based and gate array families on standard Daisy logic design tools. Symbols for ACE™ and DED II™ schematic capture packages and SPARC™ models for the DLS™ simulator are provided for minimum, typical and maximum delay conditions. Additionally, a Harris electrical rules checker and other design management functions are provided to improve design productivity.

Daisy Design Flow



Additional information is available in the Daisy Users Guide available from Harris.
Daisy™, ACE™, DED II™, SPARC™ and DLS™ are Trademarks of Daisy Systems Corporation.

Daisy Designers' Toolkit (Continued)

Tool Overview

1. Standard Cell Library
2. DED II and ACE - Schematic Drawing Editors
3. DANCE - Schematic Compiler
4. DRINK - Hierarchy Linking
5. SIFT - Attaches Delay Information to Drawings
6. SOM - Defines Simulation Input Stimulus
7. TCAL - Adjusts Delays Based on Fanout and Parallel Drivers
8. DLS - Daisy Logic Simulator
9. Netlist - Generates MIMIC™ Input
10. Chip Statistics - Calculates Gate Count and Cell Usage
11. ERC - Electrical Rule Checking

The Harris HSC Library Description

The Harris HSC libraries are a common set of digital cells on multiple process technologies. The libraries are forward compatible with advances in processing capability.

Each library has a base library complemented by models of RAM, Dual-Port RAM, PLA, and FIFO compiled cells, and macrocells.

The base library option consists of logic primitives and popular 74XX series cells.

Macrocell Families

Contact Harris for availability.

- Microprocessor Peripheral Functions
- Communication Functions
- Multiplier Functions

ADVANCELL ® HSC4000-Series Standard Cells

Features

- Low-power silicon-gate CMOS technology
- 1.0 ns speed (2-input NAND gate, fanout = 2, Al = 2 mm)
- Maximum toggle frequency - 150 MHz
- More than 250 cell types (primitives, I/Os, 74HC series-compatible macrofunctions)
- CPU peripherals
- 2900-Series macros
- Supported by MIMIC™ simulation system
- Wide range of packaging capabilities
- Commercial and military temperature range
- Alternately sourced by Siemens and Toshiba
- Commercial, extra value, or high-reliability screening available

SC3000-Series Standard Cells

Features

- Low-power silicon-gate CMOS technology
- Supply voltage - 5 volts
- Implement user-defined logic
- Supported by MIMIC simulation system
- Wide range of packaging capabilities
- Commercial and military temperature range
- Double-level metal
- LSTTL and CMOS compatibility

CGA200-Series Gate Arrays

Features

- Continuous Gate architecture offers maximum layout efficiency with 30% gate utilization for random logic netlists
- Available in 13 sizes from 960 to 32,000 usable gates (3,200 to 110,000 available gates)
- Proven 1.5-micron (drawn) silicon-gate double-level-metal CMOS technology
- High performance with balanced drive - 0.56 ns typical for a 2-input NAND gate with a fanout of 2 (0.21pF load)
- TTL, CMOS, and Schmitt Trigger I/O compatibility
- Flip-flop toggle frequency 250 MHz
- Programmable output drive from 2 to 16 mA
- Separate I/O and core power bus capability for noise reduction
- Extensive portable Macro libary
- High reliability - with 2000 V ESD and 400 mA at 125°C

Mentor™ Designers' Toolkit

HSC4000, SC3000, and CGA200

Features

- Supports Harris Cell-Based and Gate Array Families
- Schematic Capture, Simulation and Netlisting for SSI, MSI Functions
- Ability to Integrate with Mentor Graphics Board-Level Simulations
- Simulation Capabilities Include Scaled Delays for Voltage, Temperature, and Process Variations for all Functions
- Interfaces fully with Harris' MIMIC™ Logic Simulator
- Back Annotation of Fanout Delays
- Compilable RAM, Dual-Port RAM, PLA, Crosspoint Matrix, and FIFO
- Additional Harris Design Management Tools Enhance Mentor Graphics Productivity:
  - ▸ Comprehensive Electrical Rule Checking (ERCs)
  - ▸ Tester Interface
  - ▸ Design Transfer
  - ▸ Gate Count/Die Size Estimates

Toolkit Description

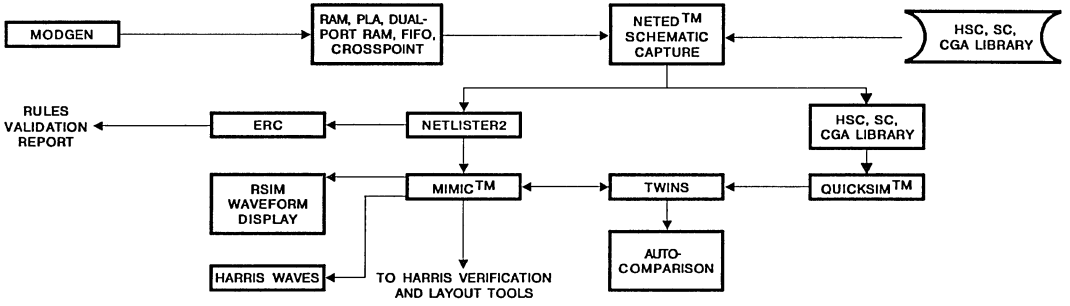
Harris provides a high-performance, enhanced-functionality toolkit for Mentor Graphics supporting Harris HSC4000, SC3000, and CGA200 cell-based and gate array families. The design flow for this toolkit is shown below.

The toolkit for Mentor Graphics will run on any Mentor IDEA™ Series workstation, and is based on Mentor Graphics schematic capture and simulation tools. It interfaces to Harris tools for layout and layout verification.

Behavioral models provide increased simulation and compilation speed while reducing disk usage for large designs.

Applications support is provided as a service by Harris.

Mentor Design Flow



Additional information is available in the Mentor Graphics Users Guide available from Harris.

Mentor Designers' Toolkit (Continued)

Tool Overview

Designs are captured and simulated using standard Mentor Graphics-provided tools including NETED, SYMED™, Expand and QuickSim™. In addition, several functions are provided by Harris to speed the Mentor Graphics design and verification process.

In addition to supporting QuickSim, Harris' MIMIC™ Logic Simulator is fully supported within the Mentor environment.

1. ERC (Electrical Rules Checking)
   The ERC program performs comprehensive Design Rule checks on the design. These checks are the first step in ensuring that the designer has not done anything incorrect in the design process, such as connecting two cell outputs together, unconnected inputs, outputs tied to power, etc. When a condition is found that violates the design rules, a warning or error is issued to inform the designer of a potential problem.
2. LOADS
   Because the performance of CMOS cells varies with fanout, the circuit connections are analyzed by the LOADS program and the simulation models are modified to reflect this fanout dependent variation. This increases the accuracy of the simulation that the designer would be able to do if he had only the Semicustom Cell Library described above. Warnings are issued when heavily loaded nodes are found and a capacitive loading summary table is provided for the user.

   In addition, scaling for voltage, temperature, and process variation is allowed. The effect of predicted or actual routing capacitance fed back by the layout can also be included.
3. NETLISTER2
   The NETLISTER2 translates the Mentor Graphics database into a format usable by Harris tools.

   By bypassing EXPAND, it is 10 to 100 times faster than competitiors' netlisters.
4. TWINS
   The TWINS program translates the results of the Mentor Graphics simulation into an intermediate format compatible with the Harris design verification and test generation flows. It is also a check for tester compliance.
5. MODGEN
   The MODGEN program creates compiled RAM, Dual-Port RAM, PLA, FIFO or crosspoint switch that is fully compatible with SYMED, NETED, and Harris' MIMIC Simulator.
6. INSTALL
   The INSTALL utility automatically installs the toolkit software and library databases on the workstation with a minimum amount of user involvement.

ADVANCELL ® HSC4000-Series Standard Cells

Features

- Low-power silicon-gate CMOS technology
- 1.0 ns speed (2-input NAND gate, fanout = 2, Al = 2 mm)
- Maximum toggle frequency - 150 MHz
- More than 250 cell types (primitives, I/Os, 74HC series-compatible macrofunctions)
- CPU peripherals
- 2900-Series macros
- Supported by MIMIC™ simulation system
- Wide range of packaging capabilities
- Commercial and military temperature range
- Alternately sourced by Siemens and Toshiba
- Commercial, extra value, or high-reliability screening available

SC3000-Series Standard Cells

Features

- Low-power silicon-gate CMOS technology
- Supply voltage - 5 volts
- Implement user-defined logic
- Supported by MIMIC™ simulation system
- Wide range of packaging capabilities
- Commercial and military temperature range
- Double-level metal
- LSTTL and CMOS compatibility

CGA200-Series Gate Arrays

Features

- Continuous Gate architecture offers maximum layout efficiency with 30% gate utilization for random logic netlists
- Available in 13 sizes from 960 to 32,000 usable gates (3,200 to 110,000 available gates)
- Proven 1.5-micron (drawn) silicon-gate double-level-metal CMOS technology
- High performance with balanced drive - 0.56 ns typical for a 2-input NAND gate with a fanout of 2 (0.21pF load)
- TTL, CMOS, and Schmitt Trigger I/O compatibility
- Flip-flop toggle frequency 250 MHz
- Programmable output drive from 2 to 16 mA
- Separate I/O and core power bus capability for noise reduction
- Extensive portable Macro libary
- High reliability - with 2000 V ESD and 400 mA at 125°C

Valid™ Designers' Toolkit

HSC4000, SC3000, and CGA200

Features

- Supports Harris Cell-Based and Gate Array Families
- Schematic Capture, Simulation and Netlisting for SSI, MSI Functions
- Simulation Capabilities Include Scaled Delays for Voltage, Temperature, and Process Variations for all Functions
- Support for Harris MIMIC™ Logic Simulator
- Back Annotation of Fanout Delays
- Compilable RAM, Dual-Port RAM, PLA, Crosspoint Matrix, and FIFO
- Additional Harris Design Management Tools Enhance Valid™ Productivity:
  - ▸ Comprehensive Electrical Rule Checking (ERCs)
  - ▸ Tester Interface Package
  - ▸ Design Transfer
  - ▸ Gate Count/Die Size Estimates

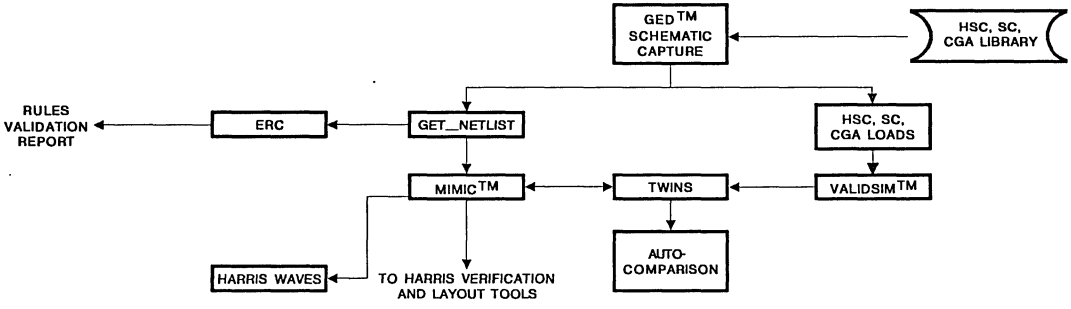
Toolkit Description

Harris provides a high-performance, enhanced-functionality toolkit for Valid Logic supporting Harris HSC4000, SC3000 and CGA 200 cell-based and gate array families. The design flow for this toolkit is shown below.

The Valid Designers' Toolkit runs on any Sun or SCALD system and is based on Valid Logic schematic capture and simulation tools. It interfaces to Harris tools for layout and layout verification.

Applications support is provided as a service by Harris.

Valid Design Flow



Additional information is available in the Valid Users Guide available from Harris.

Valid™, ValidSim™ and GED™ are Trademarks of Valid Logic Systems.

MIMIC™ is a Trademark of Harris Corporation.

Valid Designers' Toolkit (Continued)

Tool Overview

Designs are captured and simulated using standard Valid Logic-provided tools including GED™. In addition, several functions are provided by Harris to speed the Valid Logic design and verification process.

In addition to supporting GED™, Harris' MIMIC™ Logic Simulator is fully supported within the Valid environment.

1. ERC (Electrical Rules Checking)
   The ERC program performs comprehensive Design Rule checks on the design. These checks are the first step in ensuring that the designer has not done anything incorrect in the design process, such as connecting two cell outputs together, unconnected inputs, outputs tied to power, etc. When a condition is found that violates the design rules, a warning or error is issued to inform the designer of a potential problem.
2. LOADS
   Because the performance of CMOS cells varies with fanout, the circuit connections are analyzed by the LOADS program and the simulation models are modified to reflect this fanout dependent variation. This increases the accuracy of the simulation that the designer would be able to do if he had only the Semicustom Cell Library described above. Warnings are issued when heavily loaded nodes are found and a capacitive loading summary table is provided for the user.

   In addition, scaling for voltage, temperature, and process variation is allowed. The effect of predicted or actual routing capacitance fed back by the layout can also be included.
3. GET_NETLIST
   Harris' patented hierarchical netlist extraction tool translates the Valid database into a format (HDL) usable by Harris tools.
4. TWINS
   The TWINS program translates the results of the Valid simulation into an intermediate format compatible with the Harris design verification and test generation flows. It is also a check for tester compliance.
5. MODGEN
   The MODGEN program creates compiled RAM, Dual-Port RAM, PLA, FIFO or crosspoint switch that is fully compatible with GED™ and Harris' MIMIC™ Simulator.
6. INSTALL
   The INSTALL utility automatically installs the toolkit software and library databases on the workstation with a minimum amount of user involvement.

ADVANCELL ® HSC4000-Series Standard Cells

Features

- Low-power silicon-gate CMOS technology
- 1.0 ns speed (2-input NAND gate, fanout = 2, Al = 2 mm)
- Maximum toggle frequency - 150 MHz
- More than 250 cell types (primitives, I/Os, 74HC series-compatible macrofunctions)
- CPU peripherals
- 2900-Series macros
- Supported by MIMIC™ simulation system
- Wide range of packaging capabilities
- Commercial and military temperature range
- Alternately sourced by Siemens and Toshiba
- Commercial, extra value, or high-reliability screening available

SC3000-Series Standard Cells

Features

- Low-power silicon-gate CMOS technology
- Supply voltage - 5 volts
- Implement user-defined logic
- Supported by MIMIC™ simulation system
- Wide range of packaging capabilities
- Commercial and military temperature range
- Double-level metal
- LSTTL and CMOS compatibility

CGA200-Series Gate Arrays

Features

- Continuous Gate architecture offers maximum layout efficiency with 30% gate utilization for random logic netlists
- Available in 13 sizes from 960 to 32,000 usable gates (3,200 to 110,000 available gates)
- Proven 1.5-micron (drawn) silicon-gate double-level-metal CMOS technology
- High performance with balanced drive - 0.56ns typical for a 2-input NAND gate with a fanout of 2 (0.21pF load)
- TTL, CMOS, and Schmitt Trigger I/O compatibility
- Flip-flop toggle frequency 250 MHz
- Programmable output drive from 2 to 16 mA
- Separate I/O and core power bus capability for noise reduction
- Extensive portable Macro libary
- High reliability - with 2000 V ESD and 400 mA at 125°C

Custom/Semicustom

RTX Micros

The UHRTX core macrocell is compatible with the Harris ADVANCELL® standard cell library. The UHRTX core is a self-contained Central Processing Unit that forms the heart of the Harris RTX™ family of microprocessor and microcomputer devices. Based on the RTX2001A™ high-performance microprocessor architecture, the UHRTX core implements the full RTX Forth instruction set and contains all associated buses, control logic, and registers. In addition, two 64-word stacks, stack controller, interrupt controller, and COP watch-dog have been added. The resulting UHRTX core macrocell can be incorporated into customer designs to develop unique application specific versions of the RTX family.

Utilizing the Harris FASTRACK™ ASIC development system, designers can define varying amounts of ROM, RAM, and application specific I/O. Digital and analog functions can be integrated on-chip and simulated using Harris' MIMIC™ logic simulator and the UHRTX gate level model.

Prototyping and software development is accomplished via the present RTX Development System (RTXDS™), which includes a PC-based editor, compiler, disassembler, and debugger.

RTX Core Features

- RTX2001A architecture
- Compatible with ADVANCELL® library - scaleable to 0.8 micron
- 64K byte address space
- Dual 64-word stacks
- Interrupt Controller
- On-chip oscillator
- Master and Power-on Reset
- 10MHz/10 MIPs performance at 1.5 microns
- User definable RAM/ROM/IO logic
- Digital and analog functions available

RTX Microcomputers

Harris will be introducing in late 1990 a family of standard RTX microcontrollers based on the UHRTX macrocell approach. Built around the RTX core, standard MCU family members will offer varying amounts of on-chip ROM, RAM, and peripheral functions. Peripheral features will include:

- Serial Interfaces
  - Serial Communications Interface (SCI)
  - Serial Peripheral Interface (SPI)
- Parallel Ports
- Timer/Counters
  - Timer capture inputs
  - Timer compare outputs
  - PWM capability
- A/D Converters
  - Multiple channel
  - 8/10-bit resolution
- Hardware multipliers

A2900-Series Bit-Slice Macrocells

A family of A2900-series bit-slice microprocessor cells is available in the Harris ADVANCELL® standard cell library. Functionally compatible with standard bipolar 2900-series products, these macrocells form the building blocks with which users can develop high-performance (50 ns typical cycle times) bit-slice microprocessors or microcomputers.

A host of standard digital and analog functions available in the ADVANCELL® library can also be embedded in the device. Macrocell netlists and gate level simulation models are available for simulation using Harris' MIMIC logic simulator.

Consistent with the Harris ADVANCELL® library philosophy, Siemens and Toshiba provide alternate sources for user-developed 2900-series micros.

The following macrocells are available:

A2901	4-Bit Slice ALU
A2902	Carry Look-Ahead Generator
A2904	Status and Shift Control Unit
A2910	12-Bit Microsequencer
A2913	Priority Interrupt Expander
A2966	Noninverting Tristate Memory Driver
A29334	4-Port 64 x 18 Static RAM
A29516	16 x 16 Multiplier
A29517	16 x 16 Multiplier with Single Clock
A29520	Dual 2-level Pipeline Register
A29521	4-level Pipeline Register

Custom/Semicustom (Continued)

UH20C51 Macrocell

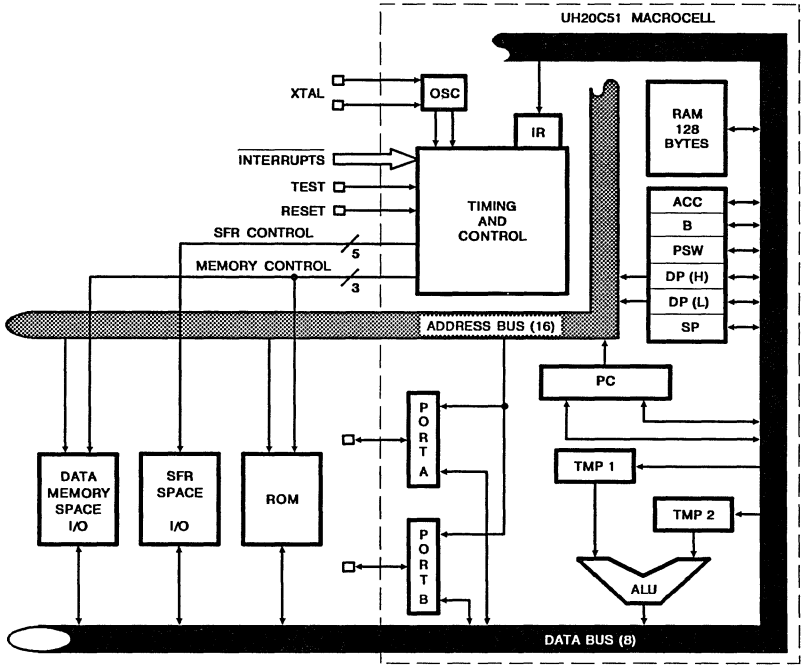
The Harris UH20C51 Macrocell is a general-purpose 8-bit microprocessor cell based on the industry-standard 80C51 architecture. Its instruction set is object-code compatible with the 80C51 and machine cycle equivalent. Included in the cell are the CPU registers, special function registers, buses, oscillators, interrupt controller, and 128 bytes of RAM.

Because the cell is compatible with the Harris ADVANCELL® standard cell library, users can add varying amounts of ROM, RAM, and application specific I/O to create unique 20C51 microcontrollers suiting their particular needs. Standard peripheral functions available in the Harris library are 80C51-compatible timers and UARTs, bidirectional I/O ports, and a full array of digital and analog functions.

An evaluation IC is available for prototyping. This device incorporates the UH20C51 macrocell CPU, full external address and data bus, two bidirectional I/O ports, and three timers.

UH20C51 Core Features

- ADVANCELL® library compatible - scaleable to 0.8 micron
- 80C51 Instruction Set
  - ▸ Multiply and divide instruction
  - ▸ Bit control operations
- Intel 80C51 object-code compatible - machine cycle equivalent
- Idle and power down modes
- On-chip oscillator - 3.5MHz to 12MHz operation
- Addressable Memory
  - ▸ 64K data memory
  - ▸ 64K program memory
- Two 8-bit I/O ports - bit programmable
- 6 vectored interrupts
- Evaluation IC available
- 82XX peripheral functions
- Analog blocks



UH20C51 SYSTEM BLOCK DIAGRAM

Custom/Semicustom (Continued)

Custom 6805 Micros

The 6805 core micro offered by Harris is compatible with Harris ADVANCELL® and HSC3500 standard cell libraries. Based on the 8-bit industry-standard 68HC05 microcomputer architecture, the 6805 CPU is a self-contained processing unit, to which application specific I/O and memory can be added. Utilizing Harris development tools, users can define unique versions of the 6805 microcomputer family, which can be implemented as custom designs to suit their particular needs.

With Harris FASTRACK™ design tools, users can develop, simulate, and debug 6805 peripheral circuitry. Designers can choose from a wide range of digital and analog functions available in Harris standard cell libraries. Industry-standard I/O functions and compilable blocks such as ROM and RAM modules can be included in the peripheral design. The resulting netlist provides the basis for a customer specific 68HC05 microcomputer.

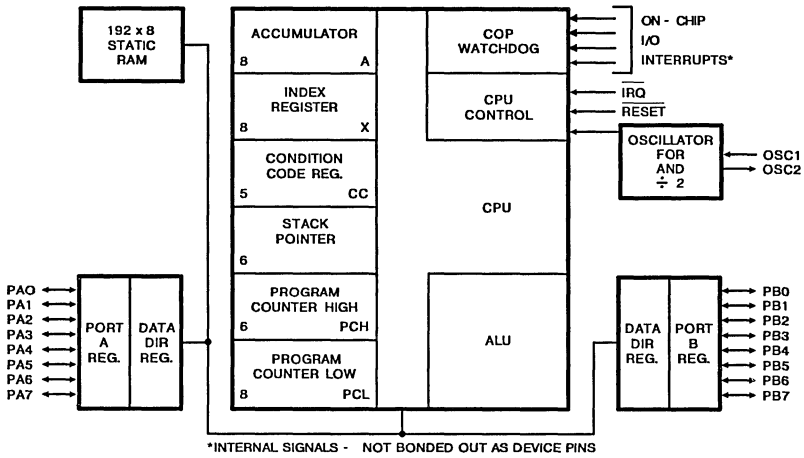
A 6805 behavioral model, compatible with the Harris MIMIC logic simulator, allows designers to debug device hardware and software through rapid simulation.

Prototyping and in-circuit emulation can also be accomplished using the EZ-Prop® development station provided by American Automation. In addition, programmers can write source code in the high-level language "C" and compile into ROMable object code via the C6805 C-compiler available from Bytecraft, Ltd. Both of these development tools are compatible with IBM Corp. PC-DOS® and Microsoft, Inc. MS-DOS®.

The custom 6805 CPU contains a fully machine-cycle-compatible 68HC05 instruction set, including Stop/Wait and Multiply instructions. Address range has been extended to 16 Kbytes and software integrity safety traps have been added. 192 bytes of RAM, on-chip oscillator, and two bit-programmable I/O ports are also included, resulting in the minimum processor configuration shown below.

Custom 6805 Features

- 8-bit industry-standard architecture
- Fully static operation
- Power saving Stop and Wait modes
- 16-Kbyte address range
- Master Reset (bidirectional) and Power-on Reset
- Computer-Operating-Properly watchdog timer
- Illegal opcode trap
- On-chip oscillator - crystal/resonator or RC
- Prototype mode
- Temperature range: -40°C to +125°C
- Voltage range: 2.5V to 6V
- True bit manipulation
- Indexed addressing
- 8 x 8 unsigned multiply instruction
- SCI, SPI, and timer peripheral functions
- 82XX peripheral functions
- Custom analog

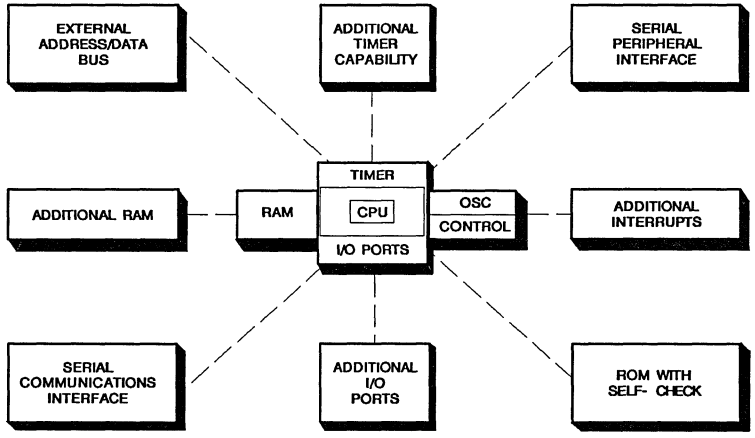


Minimum Configuration Custom 6805 Micro. User Defines Additional Amounts of RAM, ROM and I/O

Standard Products

6805-Series Microcontrollers

All members of the Harris CDP6805 CMOS Family of MCUs are designed around a common core which consists of a CPU, timer, oscillator, control section (for interrupts and reset), bidirectional I/O lines, RAM, and ROM. This common core is expanded to provide versions of the CDP6805 with additional memory, I/O lines, interrupts, timer capability, and serial interfaces. This versatile common-core design offers five different CDP6805 CMOS Family micros that allow the user to choose the device best suited for a particular application. Alternatively, Harris can provide custom versions of the 6805 (see ASIC Microcontrollers - Custom 6805 Micros).



CDP6805 CMOS FAMILY CORE ARCHITECTURE BLOCK DIAGRAM

General 6805 Family Features

Hardware

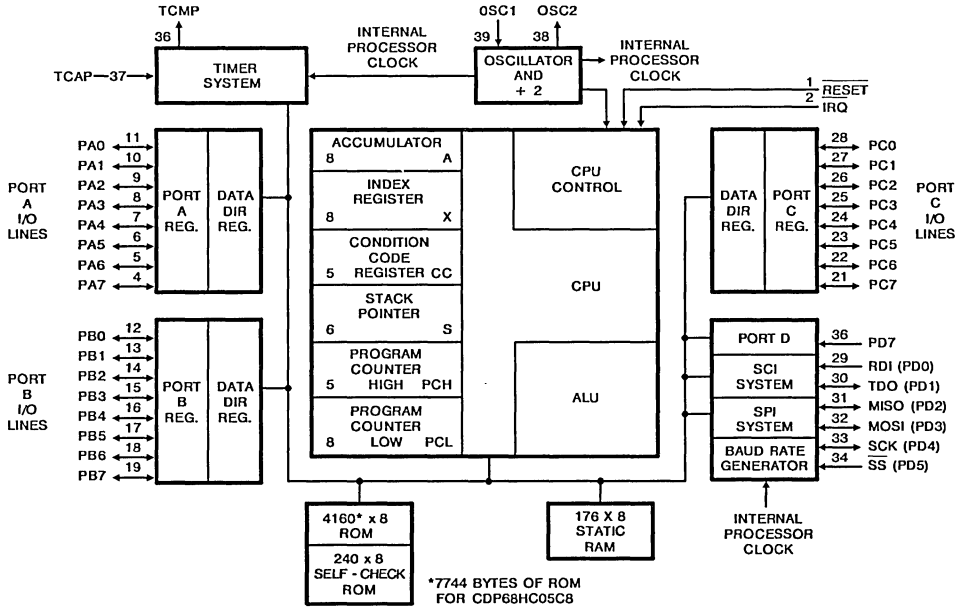
- 8-bit architecture
- Fully static operation
- Self-check mode
- Master Reset and Power-on Reset
- Single 3-6V power supply
- Power-saving Stop and Wait modes

Software

- Software compatible with entire 6805 family
- 61 instructions and 10 addressing modes
- Indexed addressing for tables
- True bit manipulation
- Memory-mapped I/O
- Efficient use of program space
- Versatile Interrupt handling
- 8 x 8 multiply instruction in C4, C8 and D2 versions.

Standard Products (Continued)

6805-Series Microcontrollers



MICROCOMPUTER BLOCK DIAGRAM (68HC05C4 VERSION SHOWN)

Comparison of CMOS CDP6805 Family Microcontrollers

Type	On-Chip RAM	On-Chip ROM	Max. Clock Freq. (MHz)	Instruction Time Min./Max. (µs)	Timer/ Counter Bits	Prescalers	Interrupts	I/O Lines	Serial Interface	Max. Operating Temp. Range (°C)	Package*
CDP6805F2 CDP6805F2C†	64	1089	4.0	2.0/10.00	8	Program	V	16	-	0 to 70	28D, 28E, 28Q
CDP6805G2 CDP6805G2C†	112	2106	4.0	2.0/10.00	8	Program	V	32	-	0 to 70	40D, 40E
CDP68C05D2 o	96	2176	4.2	0.95/5.23	16	÷4	V	28	SPI	-40 to +125	40D, 40E, 44Q
CDP68C05C4 o	176	4160	4.2	0.95/5.23	16	÷4	V	24	SPI/SCI	-40 to +125	40D, 40E, 44Q
CDP68C05C8 o	176	7744	4.2	0.95/5.23	16	÷4	V	24	SPI/SCI	-40 to +125	40D, 40E, 44Q

V = Vectored address
† "C" version has -40°C to +85°C operating temperature range
o Multiply instruction in the CDP68HC05C4, 68HC05C8 and 68HC05D2
* See packaging section

Standard Products (Continued)

6805-Series Microcontrollers

CMOS High-Performance Silicon-Gate 8-Bit Microcomputer Piggyback Emulators

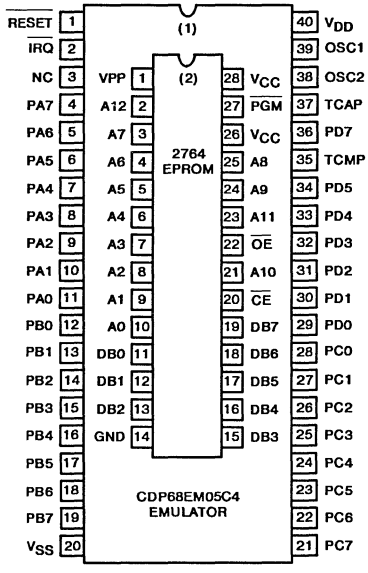
The CDP68EM05C4 and CDP68EM05D2 are microcomputer emulator equivalents of the CDP68HC05C4 and CDP68HC05D2 CMOS microcomputers, respectively. Memory locations occupied by the on-chip ROM of the microcomputers are accessed as external locations with their emulator counterparts. The data bus, address bus, and control signals of the emulator devices are available externally to facilitate prototype development. The ceramic piggyback package of the emulator devices is designed to accept industry-standard, 28-pin EPROM memories (e.g., 27C64). This feature permits prototype development of systems for mask-programmed applications. The same microcomputer options for on-chip oscillator type, external interrupt sense, and crystal startup delay (D2 version only) are also available on the corresponding emulator devices.

CDP68HC05C4 Features

- All CDP68HC05C4 hardware and software features
- Un-multiplexed external address, data, and READ control lines
- Full 8K byte address space available (7984 bytes available externally)
- 176 bytes of on-chip RAM, no ROM
- Direct interface to industry-standard EPROMs
- 40-lead piggyback package (1) with 28-hole socket for 2764 EPROM (2)
- Also can be used for CDP68HC05C8 emulation

Terminal Assignment

40-LEAD PIGGYBACK
TOP VIEW

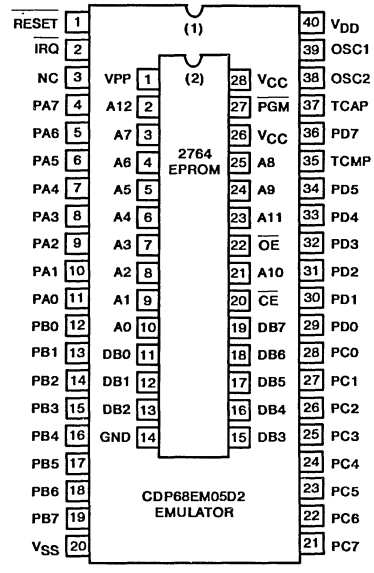


CDP68HC05D2 Features

- All CDP68HC05D2 hardware and software features
- Un-multiplexed external address, data, and READ control lines
- Full 8K byte address space available (8064 bytes available externally)
- 96 bytes of on-chip RAM, no ROM
- Direct interface to industry-standard EPROMs
- 40-lead piggyback package (1) with 28-hole socket for 2764 EPROM (2)

Terminal Assignment

40-LEAD PIGGYBACK
TOP VIEW



RTX 2000™/RTX 2001A

Features

- Fast 100ns machine cycle
- Single cycle instruction execution
- Direct execution of FORTH
  - ▸ Eliminates assembly language programming
- Single cycle16-bit multiply (RTX 2000)
- Fast division, square root
- Single cycle subroutine call/return
- Three cycle interrupt latency
- Two On-chip 256 word stacks
- On-chip interrupt controller
- Three On-chip16-bit timer/counters
- ASIC BUS™ for off-chip extension of architecture
- 1 Megabyte total address space
- Word and byte memory access
- Low power CMOS..... 5mA/MHz typical
- Fully static
- 84-Pin PGA package
- Available in Harris standard cell library

Description

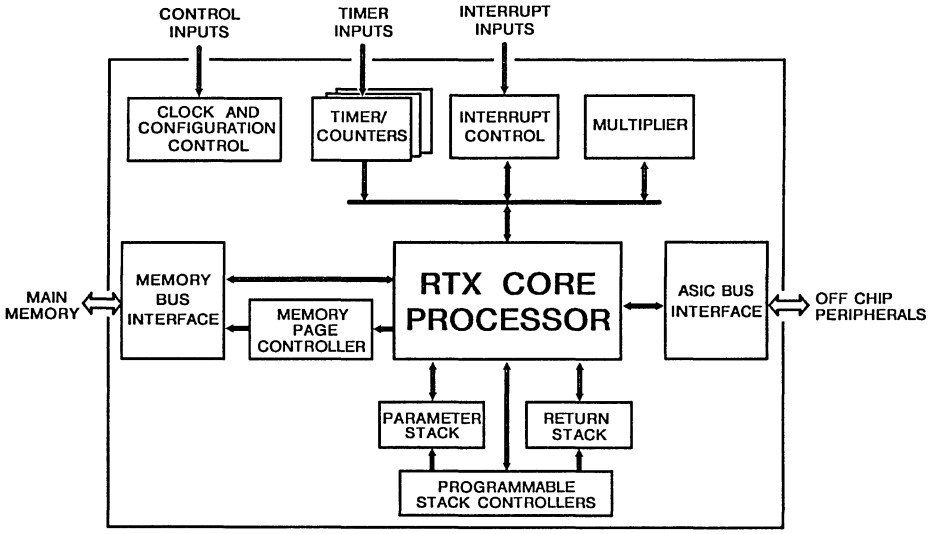
The RTX 2000/2001A is a high performance 16-bit microcontroller with on-chip times, interrupt controller, and multiplier (RTX 2000 only). A unique feature of this processor is the high performance ASIC Bus, which provides for architecture extension using application specific I/O devices.

Utilizing a stack oriented, multiple bus architecture and one or two cycle instruction timers, the RTX 2000/2001A allows the efficient implementation of such real-time applications as Digital Signal Processing (DSP), Digital Control Processing, Image Processing, Robotics, Graphics, Simulation, Animation, and many other applications. Because these applications can be supported in high level languages such as FORTH and C on the RTX 2000/2001A, the development cycle time to system implementation is drastically reduced.

The RTX 2000/2001A Microprocessor is an exceptionally powerful device with the ability to meet numerous application specific needs. The advantages of the RTX are further enhanced through the use of optional peripherals and by the development system support which Harris provides for the RTX hardware and IBM™ PC-based software.

The RTX 2000/2001A has been designed and fabricated utilizing the Harris Advanced Standard Cell and Compiler Library. As part of the Harris family of compatible cell libraries, the RTX 2000/2001A can be incorporated into customer ASIC designs.

RTX 2000 Block Diagram



80C86/88 and 80C286 CMOS Static Microprocessors

Type	Function	Features	Package Number of Pins*
80C286	High-Performance Microprocessor with Memory Management and Protection	• Compatible with NMOS 80286 • Static CMOS design for low power operation ▸ ICCSB = 5mA maximum ▸ ICCOP = 20mA/MHz maximum • High performance processor (up to 14 x 8086 throughput) • Two 80C86 upward compatible operating modes ▸ 80C286 real address mode ▸ Protected virtual address mode • Wide range of clock rates: ▸ DC to 25 MHz (80C286-25) ▸ DC to 20MHz (80C286-20) ▸ DC to 16MHz (80C286-16) ▸ DC to 12.5MHz (80C286-12)	68-Pin TF
80C86	16-Bit Microprocessor	• Compatible with NMOS 8086 • Completely static design ▸ DC to 5MHz (80C86) ▸ DC to 8MHz (80C86-2) • Low power operation ▸ 10mA/MHz operating current ▸ 500µA standby current • 1 MByte of direct memory addressing capability	40-Pin DF FF BN NG
80C88	8-Bit Microprocessor	• Compatible with NMOS 8088 • Completely static design ▸ DC to 5MHz (80C88) ▸ DC to 8MHz (80C88-2) • Low power operation ▸ 10mA/MHz operating current ▸ 500µA standby current • Software compatible with 80C86/8086/8088 • 1 MByte of direct memory addressing capability	40-Pin DF FL BN NG

* See Packaging Section

6805-Series Microprocessors

General 6805 Family Features

Hardware

- 8-bit architecture
- Fully static operation
- Self-check mode in microcomputers
- Master Reset and Power-on Reset
- Single 3-6V power supply
- Power-saving STOP and WAIT modes

Software

- Software compatible with entire 6805 family
- 61 instructions and 10 addressing modes
- Indexed addressing for tables
- True bit manipulation
- Memory-mapped I/O
- Efficient use of program space
- Versatile Interrupt handling

Comparison of CMOS CD6805 Family Microprocessors

Type	Memory Add. (Bytes)	On-chip RAM (Bytes)	Max. Clock Freq. (MHz)	Instruc. Time Min./Max. (μs)	Timer/ Counter Bits	Prescalers	Bus Structure	Interrupts	Latched I/O Lines	Maximum Operation Temperature (°C)	Package No. of Pins*
CDP6805E2 CDP6805E2C#	8K	112	5.0	2.0/10.00	8	Program	Multiplexed Address Data	V	16	0 to +70	40D, E 44Q
CDP6805E3 CDP6805E3C#	64K	112	5.0	2.0/10.00	8	Program	Multiplexed Address Data	V	13	0 to +70	40D, E 44Q

V = Vectored address # 'C' Version has -40 to +85°C operating temperature range. * See Packaging Section

1800-Series Microprocessors and Microcomputers

General Features:

- 16 x 16 matrix of registers for use as multiple program counters, data pointers or data registers
- Single-phase clock; optional on-chip crystal-controlled oscillator
- Flexible programmed I/O mode
- Four flag inputs directly tested by branch instructions
- Programmable single-bit output port
- Static circuitry - no minimum clock frequency
- 8-bit parallel organization with bi-directional data bus and multiplexed address bus

Type	Memory Add. (Bytes)	On-chip RAM (Bytes)	On-chip ROM (Bytes)	Max. Clock Freq. (MHz)	Instruc. Time Min./Max. (μs)	Timer/ Counter Bits	Pre-scalers	Bus Structure	Interrupts	Latch I/O	Max. Oper. Temp. (°C)	Pkg No. of Pin*
CDP1802A CDP1802AC	64K	-	-	3.2	5.0/7.5	-	-	Multiplexed Address Lines	✓	Off-chip	-55 to +125	40D 40E 40Q
CDP1802BC	64K	-	-	5.0	3.2/4.8	-	-	Multiplexed Address Lines	✓	Off-chip	-55 to +125	40D 40E 40Q
CDP1804AC	64K	64	2K	5.0	3.2/16.0	8	÷32	Multiplexed Address Lines	✓	Off-chip	-55 to +125	40D 40E
CDP1805AC	64K	64	-	5.0	3.2/16.6	8	÷32	Multiplexed Address Lines	✓	Off-chip	-55 to +125	40D 40E 40Q
CDP1806AC	64K	-	-	5.0	3.2/16.0	8	÷32	Multiplexed Address Lines	✓	Off-chip	-55 to +125	40D 40E 40Q

* See Packaging Section

80C86/88 and 80C286 Peripherals

Type	Function	Features	Package No. of Pins*
82C37A	DMA Controller	• Compatible with NMOS 8237A • Provides control for direct memory access operation • Up to 4Mb/s transfer rate with 8MHz clock • Four independently programmable DMA channels • Low power operation • 12.5MHz operation with 0 wait state DMA transfers • 16-bit DMA transfer capability	40 CH FE BN NF
82C50A	Asynchronous Communication Element	• Complete serial communication interface ▸ UART ▸ Baud rate generator • 80C86/88 Compatible • DC to 10MHz operation (DC to 625Kbaud) • Modem interface control lines • Low CMOS power dissipation • Compatible with NMOS 8250A	40 CJ FE NF
82C52	Serial Controller Interface	• UART/Baud rate generator in a single 28-pin package • Operates from DC to 1Mbaud with an asynchronous 16X clock • 72 programmable baud rates • Low power operation: ▸ 1mA/MHz operating current, typical • 40-pin version available (HD-6406)	28 1M FJ BK NE
82C54	Programmable Interval Timer	• Compatible with NMOS 8254 • Enhanced version NMOS 8253 • Three independent 16-bit counters • Six programmable counter modes • Completely TTL compatible • 8MHz count frequency • Low power operation: ▸ ICCOP: 10mA @ 8MHz count frequency ▸ ICCSB: 10μA maximum	24 SF FG BM NE
82C55A	Programmable Peripheral Interface	• Three independent programmable 8-bit I/O ports • High speed, no "wait state" operation with 5MHz/8MHz 80C86/88 • Fully TTL compatible • 2.5mA drive capability on all I/O port outputs • Compatible with NMOS 8255A • 24 programmable I/O pins • Enhanced control word read capability • High darlington drive outputs on all ports • Standby current: 10μA, maximum	40 CH FD BP NH
82C59A	Priority Interrupt Controller	• Compatible with NMOS 8259A • Eight maskable interrupt inputs • Cascade operation allows up to 64 interrupt inputs with no additional circuitry • Supports both 8080/85 and 80C86/88 formats • Standby current: 10mA, maximum • Fully TTL compatible • Programmable interrupt modes	28 1M FJ BK ND

* See Packaging Section

CDP1800-Series and CDP6805-Series Peripherals

Family Features

- CMOS Static Operation
- Compatible With Many Industry-Standard Microprocessors and Microcomputers, CMOS & NMOS
- Wide Variety of I/O Functions
- 36 I/O Configurations
- Programmable I/Os
- Byte-Wide Latches
- Decoders
- UARTs and ACIAs
- Multiply-Divide Units (MDUs)
- Buffers
- Counters
- Clocks
- Video Interface
- Interrupt Controllers
- Serial Peripheral Interface (SPI) Circuits

Input Levels: CMOS for All Types

Type	Description and Function	Features	Operating Voltage Range Volts	Operating Temp Range (T_A) † °C	Fanout (TTL Loads)	No. of Pins* Package
I/O PORTS						
CDP1851 CDP1851C	Programmable I/O Interface	• 20 Programmable I/O lines • Programmable for operation in four modes: ▸ Input ▸ Bidirectional ▸ Output ▸ Bit-Programmable • Operates in either I/O or memory space	4 to 10.5 4 to 6.5	-40 to +85	1	40 D E
CDP1852 CDP1852C	Byte-Wide Input/Output Port	• Static silicon-gate CMOS circuitry • Parallel 8-bit data register and buffer • Handshaking via service request flip-flop • Low quiescent and operating power • Interfaces directly with CDP1800-series µPs • Single voltage supply • Full military temperature range: (-55°C to +125°C)	4 to 10.5 4 to 6.5	-40 to +85	1	24 D E
CDP1872 CDP1872C CDP1874C	High-Speed 8-Bit Input Port	• Parallel 8-bit I/O register with buffered outputs • High-speed data-in to data-out: ▸ 85ns (max) at V_{DD} = 5V • Flexible applications in µP systems as buffers & latches • High order address-latch capability in CDP1800 series µP systems • Output sink current = 5mA (min) at V_{DD} = 5V • Three-state output	4 to 6.5	-40 to+85	3	22 D E
CDP1875C	High-Speed 8-Bit Output Port	• Parallel 8-bit input/output register with buffered outputs • High-speed data-in to data-out: ▸ 85ns (max) at V_{DD} = 5V • Flexible applications in µP systems as buffers & latches • High order address-latch capability in CDP1800 series µP systems • Output sink current = 5mA (min) at V_{DD} = 5V	4 to 6.5	-40 to +85	3	22 D E
CDP6823	Parallel Interface (MOTEL Bus)	• 24 individual programmed I/O pins • MOTEL circuit for bus compatibility with many µPs • Multiplexed bus compatible with: ▸ CDP6805E2 and competitive µPs • Data direction registers for ports A, B and C • Reset input to clear interrupts and init. internal reg's • Four port C I/O pins may be used as control lines for: ▸ Four interrupt inputs ▸ Output pulse ▸ Input byte latch ▸ Handshake activity • 15 registers addressed as memory locations • Handshake control logic for input & output periph. oper. • Interrupt output pin • 3V to 5.5V operating V_{DD}	4.5 to 5.5	0 to +70	1	40 D E 44 Q

† T_A indicates operating temperature range over which the published electrical data are specified
* See Packaging Section

CDP1800-Series and CDP6805-Series Peripherals (Continued)

Input Levels: CMOS for All Types

Type	Description and Function	Features	Operating Voltage Range Volts	Operating Temp Range (T_A)† °C	Fanout (TTL Loads)	No. of Pins* Package
MEMORY I/O INTERFACE						
CDP1853 CDP1853C	N Bit 1-of-8 Decoder	• Provides direct control of up to 7 input & 7 output devices • Chip Enable (CE) allows easy expansion for multi-level I/O systems	4 to 10.5 4 to 6.5	-40 to +85	1	16 D E
CDP1881 CDP1881C	6-Bit Latch and Decoder Memory Interface	• Performs memory address latch and decoder functions multiplexed or non-multiplexed • Decodes up to 16K bytes of memory • Interfaces directly with CDP 1800-series µPs at maximum clock frequency	4 to 10.5 4 to 6.5	-40 to +85	1	20 E
CDP1882 CDP1882C	6-Bit Latch and Decoder Memory	• Performs memory address latch and decoder functions multiplexed or non-multiplexed • Decodes up to 16K bytes of memory • Interfaces directly with CDP1800-series µPs at maximum clock frequency	4 to 10.5 4 to 6.5	-40 to +85	1	18 D E
CDP1883 CDP1883C	7-Bit Latch and Decoder Memory Interface	• Performs memory address latch and decoder functions multiplexed or non-multiplexed • Interfaces directly with the CDP1800-series µPs • Allows decoding for systems up to 32K bytes	4 to 10.5 4 to 6.5	-40 to +85	1	20 E
SERIAL I/O						
CDP1854A CDP1854AC	Programmable Universal Asynchronous Receiver/ Transmitter (UART)	• Two operating modes: ▸ Mode 0: functionally compatible with industry types such as the TR1602A ▸ Mode 1: interfaces directly with CDP1800-series µPs without additional components • Full or half duplex operation • Parity, framing, and overrun error detection • Baud rate: ▸ DC to 200K bits/s at V_{DD} = 5V ▸ DC to 400K bits/s at V_{DD} = 10V • Fully programmable with externally selectable word length (5-8 bits), parity inhibit, even/odd parity, and 1, 1.5 or 2 stop bits • False start bit detection	4 to 10.5 4 to 6.5	-40 to +85	1	40 D E 44 Q
CDP6402 CDP6402C	UART	• Low-power CMOS circuitry: 7.5mW typ at 3.2MHz (max freq) at V_{DD} = 5V • Baud rate: ▸ DC to 200K bits/s (max) at V_{DD} = 5V, 85°C ▸ DC to 400K bits/s (max) at V_{DD} = 10V, 85°C • Automatic data formatting and status generation • Fully programmable with externally selectable word length (5-8 bits), parity inhibit, even/odd parity, and 1, 1.5 or 2 stop bits • Operating temperature range: ▸ (CDP6402D, CD) -55°C to +125°C ▸ (CDP6402E, CE) -40°C to +85°C • Replaces industry types IM6402 and HD6402	4 to 10.5 4 to 6.5	-40 to +85	1	40 D E

† T_A indicates operating temperature range over which the published electrical data are specified
* See Packaging Section

CDP1800-Series and CDP6805-Series Peripherals (Continued)

Input Levels: CMOS for All Types Except CDP65C51,A and CDP6853 (TTL)

Type	Description and Function	Features	Operating Voltage Range Volts	Operating Temp Range (T_A) † °C	Fanout (TTL Loads)	No. of Pins* Package
SERIAL I/O (Continued)						
CDP65C51 CDP65C51A	Asynchronous Communications Interface Adapter (ACIA)	• Compatible with 8-bit microprocessors • Full duplex operation with buffered receiver and transmitter • Data set/modem control functions • Internal baud-rate generator with 15 programmable baud rates (50 to 19,200) • Program-selectable internally or externally controlled receiver rate • Operates at baud rates up to 250,000 via proper crystal or clock selection • Programmable word lengths, number of stop bits, and parity-bit generation and detection • Programmable interrupt control • Program reset • Program-selectable serial echo mode • Two chip selects • 4MHz operation (CDP65C51-4, CDP65C51A-4) • 2MHz operation (CDP65C51-2, CDP65C51A-2) • 1MHz operation (CDP65C51-1, CDP65C51A-1) • Full TTL compatibility	3 to 6 3.to 6	0 to +70	1	28 D E M
CDP6853	ACIA with MOTEL Bus	• Compatible with 8-bit microprocessors • Multiplexed address/data bus (MOTEL bus) • Full duplex operation with buffered receiver and transmitter • Data set/modem control functions • Internal baud rate generator with 15 programmable baud rates (50 to 19,200) • Operates at baud rates up to 250,000 via proper crystal or clock selection • Program-selectable internally or externally controlled receiver rate • Programmable word lengths, number of stop bits and parity bit generation and detection • Programmable interrupt control • Program reset • Program-selectable serial echo mode • Two chip selects • One chip enable • Full TTL compatibility • 4MHz, 2MHz, or 1MHz operation: ▸ CDP6853-4, CDP6853-2, CDP6853-1, respectively	3 to 6	0 to +70	1	28 D E
MULTIPLY/DIVIDE (MDU)						
CDP1855 CDP1855C	8-bit Programmable Multiply/Divide Unit	• Cascadable up to 4 units for 32-bit by 32-bit multiply or 64 ÷ 32 bit divide • 8-bit by 8-bit multiply or 16 ÷ 18 bit divide in 5.6μs at 5V or 2.8μs at 10V • Direct Interface to CDP1800 series microprocessors • Easy interface to other 8-bit microprocessors • Significantly increases throughput of microprocessor used for arithmetic calculations	4 to 10.5 4 to 6.5	-40 to +85	1	28 D E

† T_A indicates operating temperature range over which the published electrical data are specified
* See Packaging Section

CDP1800-Series and CDP6805-Series Peripherals (Continued)

Input Levels: CMOS for All Types

Type	Description and Function	Features	Operating Voltage Range Volts	Operating Temp Range (T_A)† °C	Fanout (TTL Loads)	No. of Pins* Package
KEYBOARD INTERFACE						
CDP1871A CDP1871AC	Keyboard Encoder	• Directly interfaces with CDP1800-series microprocessors • Low power dissipation • Three-state outputs • Scans and generates code for 53 key ASCII keyboard plus 32 HEX keys (SPST mechanical contact switches) • Shift, control and alpha lock inputs • RC controlled debounce circuitry • N-key lockout	4 to 10.5 4 to 6.5	-40 to +85		40 D E 44 Q
SPI I/O						
CDP68HC 68A2	Serial 10-Bit A/D Converter	• 10-bit resolution • 8-bit mode for single data byte transfers • SPI (Serial Peripheral Interface) compatible • Operates ratiometrically referencing V_{DD} or an external source • 14µs 10-bit conversion time • 8 multiplexed analog input channels • Independent channel select • Three modes of operation • On-chip oscillator • Low-power CMOS circuitry • Intrinsic sample and hold	4.5 to 6 3 to 7	-40 to +85	1	16 E 20 M
CDP68HC 68P1	Single-Port Input/Output	• Fully static operation • Compatible with Harris/Motorola SPI bus • 2 external address pins tied to V_{DD} or V_{SS} to allow up to 4 devices to share the same chip • Versatile bit-set and bit-clear capability • Accepts either SCK clock polarity - SCK voltage level is latched when chip enable goes active • All inputs are Schmitt-Trigger • 8-bit I/O port - each bit can be individually programmed as an input or output via an 8-bit data direction register • Programmable on-board comparator • Simultaneous transfer of compare information to CPU during read or write - separate access not required	3 to 6	-40 to +85	1	16 D E M
CDP68HC 68R1	128-Word by 8-Bit Static RAM	• Fully static operation • Typically standby current = 1µA • Directly compatible with Harris/Motorola SPI bus • Separate data input and three-state data output pins • Input data and clock buffers gated off with chip enable • Automatic sequencing for fast multiple-byte accesses • Low minimum data retention voltage: 2V	3 to 5.5	-40 to +85	1	8 E
CDP68HC 68R2	256-Word by 8-Bit Static RAM	• Fully static operation • Typically standby current = 1µA • Directly compatible with Harris/Motorola SPI bus • Separate data input and three-state data output pins • Input data and clock buffers gated off with chip enable • Automatic sequencing for fast multiple-byte accesses • Low minimum data retention voltage: 2V	3 to 5.5	-40 to +85	1	8 E

† T_A indicates operating temperature range over which the published electrical data are specified
* See Packaging Section

CDP1800-Series and CDP6805-Series Peripherals (Continued)

Input Levels: CMOS for All Types

Type	Description and Function	Features	Operating Voltage Range Volts	Operating Temp Range (T_A) † °C	Fanout (TTL Loads)	No. of Pins* Package
SPI I/O (Continued)						
CDP68HC 68T1	Real-Time Clock with RAM and Power Sense/ Control	• SPI (Serial Peripheral Interface) • Full clock features: sec., min., hours. (12/24, AM/PM), day of week, date, month, year, (0-99), auto leap year • 32-word x 8-bit RAM • Seconds, minutes, hours alarm • Automatic power loss detection • Minimum standby (timekeeping) voltages: 2.2V • Selectable crystal or 50/60Hz line input • Buffered clock output • Battery input pin • Three independent interrupt modes: alarm, periodic or power-down sense	3 to 6	-40 to +85	1	16 D E 20 M
CDP68HC 68W1	Digital Pulse-Width Modulator	• Programmable frequency and duty cycle output • Serial bus input; compatible with Harris/Motorola SPI bus, simple shift-register type interface • Schmitt trigger clock input • 4-7V operation, -40°C to +85°C temperature range • 8MHz clock input frequency	4 to 7	-40 to +85	1	8 E
CDP68HC 68S1	Serial Bus Interface	• Differential bus for minimal EMI • Ideal for twisted-pair wiring • Data-collision detection • Bus arbitration • Idle detection • Programmable clock divider • Power-on reset	4 to 7	-40 to +85	1	14 E
TIMER FUNCTIONS						
CDP1878 CDP1878C	Dual Counter-Timer	• Compatible with general-purpose and CDP1800-series microprocessor systems • Two 16-bit down-counters and two 8-bit control registers • 5 modes including a versatile variable duty cycle mode • Programmable gate level select • Two-complemented output pins for each counter-timer • Software-controlled interrupt output • Addressable in memory space or CDP1800-series I/O space	4 to 10.5 4 to 6.5	-40 to +85	1	28 D E
CDP1879 CDP1879C-1	Real-Time Clock	• CPU interface for use with general-purpose µPs • Time of day/calendar • Reads seconds, minutes, hours • Reads day of month and month • Alarm-circuit with seconds, minutes or hours operation • Power down mode • Separate clock output selects 1 of 15 square-wave signals • Interrupt output activated by clock output and/or alarm circuit • Data integrity sampling for clock rollover eliminated • On-board oscillator ▸ 4.19MHz, 2.09MHz or 1.048MHz at 10V (CDP1879) crystal operation ▸ 4.19MHz, 2.09MHz, 1.048MHz or 32kHz at 5V (CDP1879C-1) crystal operation ▸ 4.19MHz, 2.09MHz, 1.048MHz or 32kHz at 10V or 5V external clock operation • Addressable in memory space or CDP1800-series I/O mode • Low standby (timekeeping) voltage with external clock	4 to 10.5 4 to 6.5	-40 to +85	1	24 D E

† T_A indicates operating temperature range over which the published electrical data are specified
* See Packaging Section

CDP1800-Series and CDP6805-Series Peripherals (Continued)

Input Levels: CMOS for All Types

Type	Description and Function	Features	Operating Voltage Range Volts	Operating Temp Range (T_A) † °C	Fanout (TTL Loads)	No. of Pins* Package
TIMER FUNCTIONS (Continued)						
CDP6818	Real-Time Clock with RAM (MOTEL Bus)**	• Low-power, high-speed CMOS • Internal time base and oscillator • Counts seconds, minutes and hours of the day • Counts days of the week, date, month and year • Time base input options: ▶ 4.194304MHz ▶ 1.048576MHz ▶ 32.768kHz • Time base oscillator for parallel resonant crystals • 40 to 200µW typical operating power at low frequency time base • 4.0 to 20mW typical operating power at high frequency time base • Binary or BCD representation of time, calendar and alarm • 12 or 24 hour clock with AM and PM in 12 hour mode • Daylight savings time option • Automatic end of month recognition • Automatic leap year compensation • Microprocessor bus compatible • Selectable between Motorola and competitor bus timing • Multiplexed bus for pin efficiency • Interfaced with software as 64 RAM locations • 14 bytes of clock and control registers • 50 bytes of general purpose RAM • Status bit indicates data integrity • Bus compatible interrupt signals ($\overline{IRQ}$) • Three interrupts are separately software maskable and testable ▶ Time-of-day alarm, Once-per-second to Once-per-day ▶ Periodic rates from 30.5µs to 500ms ▶ End-of-clock update cycle • Programmable square-wave output signal • Clock output may be used as microprocessor clock input at time base frequency ÷ 1 or ÷ 4	3 to 6	0 to +70	1	24 D E
CDP6818A						24 D E 28 Q
INTERRUPT CONTROLLER						
CDP1877 CDP1877C	Programmable Interrupt Controller (PIC)	• Compatible with CDP1800-series • Programmable long branch vector address and vector interval • 8 levels of interrupt per chip • Easily expandable • Latched interrupt requests • Hard wired interrupt priorities • Memory mapped • Multiple chip select inputs to minimize address space requirements	4 to 10.5 4 to 6.5	-40 to +85	1	28 D E

† T_A indicates operating temperature range over which the published electrical data are specified
* See Packaging Section
** MOTEL Bus not included in 'A' version

Bit Rate Generator (BRG)

Type	Function	Features	Package No. of Pins*
HD-4702	Bit Rate Generator (BRG)	• Low power dissipation • Programmable bit rate selection • 13 commonly used bit rates • Uses standard 2.4575MHz crystal • Conforms to EIA RS-404 • On-chip input pull-up circuits	16 4Z 7H LA

Manchester Encoders/Decoders (MEDs)

Type	Function	Features	Package No. of Pins
HD-6408	Asynchronous Serial Manchester Adapter (ASMA)	• 1Mb/s data rate • Sync identification and lock-in • Clock recovery • Manchester II encode and decode • Low bit error rate • Industrial temperature range: -40°C to +85°C	24 7C
HD-6409	Manchester Encoder/Decoder (MED)	• 1Mb/s data rate • Digital PLL clock recovery • On-chip oscillator • Independent Manchester II encode and decode • Wide temperature ranges available: -40°C to +85°C, -55°C to +125°C	20 CK 7M BE
HD-15530	Manchester Encoder/Decoder (MED)	• Support of MIL-STD-1553 • 1.25Mb/s data rate • Sync identification and lock-in • Clock recovery • Separate encode and decode • Low operating power: 50mW @ 5V • Full temperature range: -55°C to +125°C	24 4K 7C BA
HD-15531	Manchester Encoder/Decoder (MED)	• Support of MIL-STD-1553 • 1.25Mb/s data rate • 2.5Mb/s option (HD-15531B) • Sync identification and lock-in • Clock recovery • Variable frame length to 32 bits • Separate encode and decode • Low operating power: 50mW @ 5V • Full temperature range: -55°C to +125°C	40 CH FD BP

* See Packaging Section

Universal Asynchronous Receiver/Transmitters (UARTs)

Type	Function	Features	Package No. of Pins*
CDP1854A	Programmable UARTs	• Programmable word length, stop bits and parity • Baud rate to 200K bits/s at 5V (400K at 10V) • Two operating modes (CDP1854A) selected by pin 2 ▶ Mode 0: (pin 2 grounded) - hardware programmable word length, stop bits and parity ▶ Mode 1: (pin 2 at V_{DD}) - interfaces directly to 1800-series µPs without additional components; software-selectable word length, stop bits and parity • CDP6402 industry standard pinout (pin 2, no connection). Direct replacement for IM6402 and HD6402 • Single, noncritical voltage supply • Operating temperature range (maximum ratings): ▶ Ceramic package (D): -55°C to +125°C ▶ Plastic package (E and Q): -40°C to +85°C	40 D E 44 Q
CDP6402			40 D E
HD-6402R, HD-6402B	UART	• Operates from DC to 8MHz (DC to 500Kbaud) • Programmable word length, stop bits and parity • Industry-standard pinout • Single +5V power supply • Fully TTL compatible • Automatic data formatting and status generation	40 CH FD
HD-6406	Programmable Asynchronous Communications Interface	• UART/Baud rate generator in a single 40 pin package • Data rates from DC to 1Mbaud with an asynchronous 16X clock • 72 programmable baud rates • Complete modem interface signals • DMA handshaking operation • Low power operation: ▶ 1mA/MHz, typical • 28 pin version available (82C52)	40 CH FE BN NF

Transmitter/Receiver

Type	Function	Features	Package No. of Pins*
ICL232	+5V Powered Dual RS-232 Transmitter/Receiver	• Meets all EIA RS-232C Specification • Requires single +5V power supply • CMOS/TTL input compatibility • Two on-board charge pump voltage converters • Available in a variety of operating temperature ranges: ▶ 0°C to +70°C ▶ -25°C to +85°C ▶ -55°C to +125°C	16 PE JE

* See Packaging Section

Asynchronous Communications Interface Adapter (ACIAs)

Type	Function	Features	Package No. of Pins*
CDP65C51	ACIAs	• Compatible with 8-bit microprocessors • Full duplex operation with buffered receiver and transmitter • Data set/modem control functions • Internal baud rate generator with 15 programmable baud rates (50 to 19,200)	28 D E M
CDP6853		• Program-selectable internally or externally controlled receiver rate • Programmable word lengths, number of stop bits and parity bit generation and detection • Operates at baud rates up to 250,000 via proper crystal or clock selection • Single 3V to 6V power supply • Programmable interrupt control • Program reset • Program-selectable serial echo mode • Two chip selects • One chip enable (CDP6853 only) • 4MHz, 2MHz or 1MHz operation: ▸ CDP65C51-4, CDP65C51-2, CDP65C51-1, respectively • Multiplexed address/data bus • Operating temperature range (maximum rating): ▸ Ceramic package (D): -55°C to +125°C ▸ Plastic package (E and M): -40°C to +85°C	28 D E
CDP68C51A	ACIA	• Compatible with 8-bit microprocessors • Full duplex operation with buffered receiver and transmitter • Data set/modem control functions • Internal baud rate generator with 15 programmable baud rates (50 to 19,200) • Program-selectable internally or externally controlled receiver rate • Operates at baud rates up to 250,000 via proper crystal or clock selection • Progammable word lengths, number of stop bits & parity bit generation & detection • Programmable interrupt control • Program reset • Program-selectable serial echo mode • Two chip selects • 4MHz, 2MHz or 1MHz operation: ▸ CDP65C51A-4, CDP65C51A-2, CDP65C51A-1, respectively • Single 3V to 6V power supply • Full TTL compatibility • Synchronous $\overline{CTS}$ operation	28 D E M

* See Packaging Section

80C86/88 Systems Logic

Type	Description	Features
82C84A	Clock Generator/Driver	• Compatible with bipolar 8284A • Output frequencies up to 8MHz • Provides ready synchronization • Parallel resonant crystal inputs • ICCOP: 40mA @ 8MHz system frequency • TTL compatible inputs/outputs
82C85	Static Clock Controller/Generator	• Provides complete static clock control for 80C86 and 80C88 systems • Supports stop-clock, stop-oscillator and low frequency operation • 80C86/88 status line interface allows software control • DC to 8MHz system clock • Low CMOS power dissipation • 24 pin slimline package
82C88	Bus Controller	• Pin compatible with bipolar 8288 • Generates system control signals for maximum mode 80C86/88, 8086/88 • Bipolar drive capability • Low power operation: ▶ ICC standby: 10μA maximum ▶ ICC operating: 1mA/MHz maximum
82C89	Bus Arbiter	• Pin compatible with bipolar 8289 • Provides bus control arbitration in multi-master processor systems • Low power operation: ▶ ICCSB: 10μA maximum ▶ ICCOP: 1mA/MHz maximum • Bipolar drive capability
82C82	Octal Latching Bus Driver	• Bipolar 8282 function compatible • Propagation delay guaranteed: 35ns maximum ▶ Full temperature range ▶ 10% power supply tolerances ▶ Load capacitance: 300pF • Gated inputs reduce operating power • ICCSB: 10μA maximum
82C83H	Octal Latching Inverting Bus Driver	• Bipolar 8283 function compatible • Full eight-bit latching buffer with inverted data output • Guaranteed propagation delay of 25ns maximum at C_L = 300pF • Gated inputs reduce operating power • ICCSB: 10μA maximum • High output sink current: 20mA
82C86H	Octal Transceiver	• Bipolar 8286 function compatible • Eight-bit bidirectional bus transceiver • Guaranteed propagation delay of 32ns maximum @ C_L = 300pF • Gated inputs reduce operating power • ICCSB: 10mA maximum • High output sink current: 20mA
82C87H	Octal Inverting Transceiver	• Bipolar 8287 function compatible • Eight-bit bidirectional bus transceiver with inverting data outputs • Guaranteed propagation delay of 30ns maximum @ C_L = 300pF • Gated inputs reduce operating power dissipation • ICCSB: 10μA maximum • High output sink current: 20mA

High-Speed CMOS Logic*

Type CD54/74	Function/Description	No. of Pins
BUFFERS/BUS DRIVERS		
HC/HCT125	Quad Three-State Buffer	14
HC/HCT126	Quad Three-State Buffer	14
HC/HCT240	Octal Buffer/Line Driver; Three-State; Inverting	20
HC/HCT241	Octal Buffer/Line Driver; Three-State	20
HC/HCT244	Octal Buffer/Line Driver; Three-State	20
HC/HCT365	Hex Buffer/Line Driver; Three-State	16
HC/HCT366	Hex Buffer/Line Driver; Three-State Inverting	16
HC/HCT367	Hex Buffer/Line Driver; Three-State	16
HC/HCT368	Hex Buffer/Line Driver; Three-State; Inverting	16
HC/HCT540	Octal Buffer/Line Driver; Three-State; Inverting	20
HC/HCT541	Octal Buffer/Line Driver; Three-State	20
FLIP-FLOPS		
HC/HCT173	Quad D-Type Flip-Flop with Set and Reset; Positive-Edge Trigger; Three-State	16
HC/HCT374	Octal D-Type Flip-Flop; Positive-Edge Trigger; Three-State	20
HC/HCT534	Octal D-Type Flip-Flop; Positive-Edge Trigger; Three-State; Inverting	20
HC/HCT564	Octal D-Type Flip-Flop; Positive-Edge Trigger; Three-State; Inverting	20
HC/HCT574	Octal D-Type Flip-Flop; Positive-Edge Trigger; Three-State	20
BUS TRANSCEIVERS		
HC/HCT242	Quad Bus Transceiver; Three-State; Inverting	14
HC/HCT243	Quad Bus Transceiver; Three-State	14
HC/HCT245	Octal Bus Transceiver; Three-State	20
HC/HCT640	Octal Bus Transceiver; Three-State; Inverting	20
HC/HCT643	Octal Bus Transceiver; Three-State; True/Inverting	20
HC/HCT646	Octal Bus Transceiver; Three-State	24
HC/HCT648	Octal Bus Transceiver; Three-State; Inverting	24
HC/HCT7038	9-Bit Bus Transceiver with Latch	24
LATCHES		
HC/HCT373	Octal Transparent Latch; Three-State	20
HC/HCT533	Octal Transparent Latch; Three-State; Inverting	20
HC/HCT563	Octal Transparent Latch; Three-State; Inverting	20
HC/HCT573	Octal Transparent Latch; Three-State	20

* All types have a bus driver output stage. For more information on this family, refer to the Logic IC section of this product guide, "High-Speed CMOS Logic ICs"

Advanced CMOS Logic*

Type CD54/74	Function/Description	No. of Pins
BUFFERS/BUS DRIVERS		
AC/ACT240	Octal Buffer/Line Driver; Three-State; Inverting	20
AC/ACT241	Octal Buffer/Line Driver; Three-State	20
AC/ACT244	Octal Buffer/Line Driver; Three-State	20
AC/ACT540	Octal Buffer/Line Driver; Three-State; Inverting	20
AC/ACT541	Octal Buffer/Line Driver; Three-State	20
FLIP-FLOPS		
AC/ACT374	Octal D-Type Flip-Flop; Positive-Edge Trigger; Three-State	20
AC/ACT534	Octal D-Type Flip-Flop; Positive-Edge Trigger; Three-State; Inverting	20
AC/ACT564	Octal D-Type Flip-Flop; Positive-Edge Trigger; Three-State; Inverting	20
AC/ACT574	Octal D-Type Flip-Flop; Positive-Edge Trigger; Three-State	20
BUS TRANSCEIVERS		
AC/ACT245	Octal-Bus Transceiver; Three-State	20
AC/ACT623	Octal-Bus Transceiver; Three-State	20
AC/ACT646	Octal-Bus Transceiver/Register; Three-State	24
AC/ACT647	Octal-Bus Transceiver/Register with Open Drain	24
AC/ACT648	Octal-Bus Transceiver/Register; Three-State; Inverting	24
AC/ACT649	Octal-Bus Transceiver/Register with Open Drain; Inverting	24
AC/ACT651	Octal-Bus Transceiver/Register; Three-State; Inverting	24
AC/ACT652	Octal-Bus Transceiver/Register; Three-State	24
AC/ACT653	Octal-Bus Transceiver/Register with Open Drain (A Side); Three-State (B Side); Inverting	24
AC/ACT654	Octal-Bus Transceiver/Register with Open Drain (A Side); Three-State (B Side)	24
AC/ACT7623	Octal-Bus Transceiver; Three-State (B Side); Open-Drain (A Side)	20
AC/ACT651	Octal-Bus Transceiver/Register; Three-State; Inverting	24
LATCHES		
AC/ACT373	Octal Transparent Latch; Three-State	20
AC/ACT533	Octal Transparent Latch; Three-State; Inverting	20
AC/ACT563	Octal Transparent Latch; Three-State; Inverting	20
AC/ACT573	Octal Transparent Latch; Three-State	20

* For more information on this family, refer to the Advanced CMOS ICs section of the product guide, "Advanced CMOS Logic ICs"

BiMOS FCT Bus-Interface Logic*

Type CD54/74	Function/Description	No. of Pins
INVERTERS/BUFFERS/BUS DRIVERS		
FCT240	Octal Buffer/Line Driver; Three-State; Inverting	20
FCT241	Octal Buffer/Line Driver; Three-State	20
FCT244	Octal Buffer/Line Driver; Three-State	20
FCT540	Octal Buffer/Line Driver; Three-State; Inverting	20
FCT541	Octal Buffer/Line Driver; Three-State	20
FCT827A	10-Bit Buffer/Line Driver; Three-State	24
FCT828A	10-Bit Buffer/Line Driver; Three-State; Inverting	24
FLIP-FLOPS/REGISTERS		
FCT273	Octal D-Type Flip-Flop with Reset; Positive-Edge Trigger	20
FCT374	Octal D-Type Flip-Flop; Positive-Edge Trigger; Three-State	20
FCT377	Octal D-Type Flip-Flop; Positive-Edge Trigger with Data Enable	20
FCT534	Octal D-Type Flip-Flop; Positive-Edge Trigger; Three-State; Inverting	20
FCT564	Octal D-Type Flip-Flop; Positive-Edge Trigger; Three-State; Inverting	20
FCT574	Octal D-Type Flip-Flop; Positive-Edge Trigger; Three-State	20
FCT821A	10-Bit D-Type Flip-Flop; Positive-Edge Trigger; Three-State	24
FCT822A	10-Bit D-Type Flip-Flop; Positive-Edge Trigger; Three-State; Inverting	24
FCT823A	9-Bit D-Type Flip-Flop; Positive-Edge Trigger; Three-State	24
FCT824A	9-Bit D-Type Flip-Flop; Positive-Edge Trigger; Three-State; Inverting	24
FCT29520A	Multilevel Pipeline Register	24
FCT29521A	Multilevel Pipeline Register	24
BUS TRANSCEIVERS		
FCT245	Octal Bus Transceiver; Three-State	20
FCT543	Octal Register-Transceiver; Three-State	24
FCT544	Octal Register-Transceiver; Three-State; Inverting	24
FCT623	Octal Bus Transceiver; Three-State	20
FCT640	Octal Bus Transceiver; Three-State; Inverting	20
FCT643	Octal Bus Transceiver; Three-State; True/Inverting	20
FCT646	Octal Bus Transceiver/Register; Three-State	24
FCT647	Octal Bus Transceiver/Register with Open Drain	24
FCT648	Octal Bus Transceiver/Register; Three-State; Inverting	24
FCT649	Octal Bus Transceiver/Register with Open Drain; Inverting	24
FCT651	Octal Bus Transceiver/Register; Three-State; Inverting	24
FCT652	Octal Bus Transceiver/Register; Three-State	24
FCT653	Octal Bus Transceiver/Register; Open-Drain (A Side); Three-State (B Side); Inverting	24
FCT654	Octal Bus Transceiver/Register; Open-Drain (A Side); Three-State (B Side)	24
FCT861A	10-Bit Bus Transceiver; Three-State	24
FCT862A	10-Bit Bus Transceiver; Three-State; Inverting	24
FCT863A	9-Bit Bus Transceiver; Three-State	24
FCT864A	9-Bit Bus Transceiver; Three-State; Inverting	24
FCT2952A	Octal Register-Transceiver; Three-State	24
FCT2953A	Octal Register-Transceiver; Three-State; Inverting	24
FCT7623	Octal Bus Transceiver; Three-State (B Side); Open-Drain (A Side)	20
LATCHES		
FCT373	Octal Transparent Latch; Three-State	20
FCT533	Octal Transparent Latch; Three-State; Inverting	20
FCT563	Octal Transparent Latch; Three-State; Inverting	20
FCT573	Octal Transparent Latch; Three-State	20
FCT841A	10-Bit Transparent Latch; Three-State	24
FCT842A	10-Bit Transparent Latch; Three-State; Inverting	24
FCT843A	9-Bit Transparent Latch; Three-State	24
FCT844A	9-Bit Transparent Latch; Three-State; Inverting	24

* For more information on this family, refer to the "BiMOS FCT Interface Logic ICs (CD54/74FCT Series)" section of this product guide

CD4000B Series

The Harris CMOS Product line covers a broad range of SSI, MSI-1 and MSI-2 functions from simple gates to complex counters, registers, and arithmetic circuits, and includes both standard circuits types for commercial and industrial applications and high-reliability slash (/) series types for aerospace, military, and critical industrial applications.

Specific design features for CMOS devices and the performance advantages of CMOS technology provide the logic system designer with the capability to achieve outstanding performance, excellent reliability, and simplified circuitry in a wide variety of equipment designs.

The CD4000B-series ICs incorporate the latest improvements in processing technology and plastic and ceramic packaging techniques. Product quality is real-time controlled using elevated-temperature group quality screening in which measured dc parameters are criticized against tight product limits.

Harris offers a comprehensive line of high-voltage ("B"-series) CMOS digital integrated circuits which meet, in all respect, the industry standard specifications established by JEDEC.

Standardized Maximum Ratings and Recommended Operating Conditions for B-Series CMOS Integrated Circuits

Maximum Ratings, Absolute-Maximum Values:

DC SUPPLY-VOLTAGE (V_{DD}) ..... -0.5 to 20V
(Voltage referenced to V_{SS} Terminal)
INPUT VOLTAGE RANGE, ALL INPUTS ..... -0.5 to V_{DD} +0.5V
DC INPUT CURRENT, ANY ONE INPUT ..... ±10mA
POWER DISSIPATION PER PACKAGE (P_D):
For T_A = -40 to +60°C (PACKAGE TYPE E) 500mW
For T_A = +60 to +85°C (PACKAGE TYPE E) ..... Derate Linearly at 12mW/°C to 200mW
For T_A = -55 to +100°C (PACKAGE TYPE D, F) 500mW
For T_A = +100 to +125°C (PACKAGE TYPE D, F) ..... Derate Linearly at 12mW/°C to 200mW
DEVICE DISSIPATION PER OUTPUT TRANSISTOR:
For T_A = FULL PACKAGE-TEMPERATURE RANGE (All Package Types) 100mW
OPERATING -TEMPERATURE RANGE (T_A):
PACKAGE TYPES D, F, H ..... -55 to +125°C
PACKAGE TYPE E ..... -40 to +85°C
STORAGE TEMPERATURE RANGE (T_{STG}) ..... -65 to +150°C
LEAD TEMPERATURE (DURING SOLDERING):
At distance 1/16 ±1/32in. (1.59 ± 0.79mm) from case for 10s maximum ..... +265°C

Recommended Operating Conditions:

For maximum reliability, normal operating conditions should be selected so that operation is always within the following ranges:

Characteristics	Limits		Units
	Min	Max	
Supply-Voltage Range (For T_A = Full Package Temperature Range)	3	18	V

Product Classification Chart

Gates			Buffers & Inverters	Multi-Function /AOI	Decoders/ Encoders	Schmitt Trigger	Multivibrators	
NOR/NAND		OR/AND					Flip-Flop/Latches	
CD4001B	CD4012B	CD4071B	CD4007UB	CD4019B	CD4028B	CD4093B	CD4013B	CD4096B
CD4001UB	CD4023B	CD4072B	CD4009UB	CD4030B■	CD4514B	CD40106B	CD4027B	CD4099B**
CD4002B	CD4025B	CD4073B	CD4010B	CD4048B	CD4515B		CD4042B	CD4508B
CD4011B	CD4068B	CD4075B	CD4041UB	CD4070B■	CD4532B		CD4043B	CD4724B**
CD4011UB	CD4078B	CD4081B	CD4049UB	CD4077B■	CD4555B*		CD4044B	CD40174B
CD4572UB	CD40107B	CD4082B	CD4050B	CD4085B	CD4556B		CD4076B**	CD40175B
			CD4069UB	CD4086B	CD40147B		CD4095B	**Astable/ Monostable**
			CD4502B	CD4519B				CD4047B
			CD4503B					**Monostable**
			CD4572UB					CD4098B
			CD40107B					CD4538B
								CD14538B

■ See Comparators
* See Demultiplexers
** See Storage Registers

CD4000B Series (Continued)

Product Classification Chart (Continued)

Registers			Counters		Multiplexers/ Demulti-plexers			
Shift	Storage	FIFO Buffer	Binary Ripple	Synchro-nous	Analog/ Digital Data Selectors	Phase Locked Loop	Quad Bilateral Switches	Interface Circuits
CD4006B CD4014B CD4015B CD4021B CD4031B CD4034B CD4035B CD4094B CD4517B CD40100B CD40194B	CD4034B CD4076B† CD4099B CD4724B CD40174B CD40175B †See Flip/Flops	CD40105B	CD4020B CD4024B CD4040B CD4060B CD4521B **TIMERS** CD4045B CD4536B CD4541B CD4566B	CD4017B CD4018B CD4022B CD4029B CD4059A CD4510B CD4516B CD4518B CD4520B CD4522B CD4522B CD40102B CD40103B CD40160B CD40161B CD40162B CD40163B CD40192B CD40193B	CD4016BΔ CD4019B CD4051B CD4052B CD4053B CD4066BΔ CD4067B CD4097B CD4512B CD4519B CD4529B CD4555Bϕ CD4556Bϕ CD40257B ΔSee Quad Bilateral Switch	CD4046B ϕSee Decoders/ Encoders	CD4016B□ CD4066B□ □See Multiplexers	CD4009UB CD4010B CD4049UB CD4050B CD4054B CD4504B CD40107B CD40109B CD40115 CD40116Δ CD40117B CD7211Δ# CD7211AΔ# CD7211MΔ# CD7211AMΔ#

Arithmetic Circuits			Display Drivers			
Adders/ Comparators		ALU/Rate Multipliers	With Counter	For LCD* Drive		For LED** Drive
CD4008B CD4030B †See Multifunction /AOI	CD4063B CD4070B† CD4077B† CD4585B CD4560B	CD4089B CD4527B	CD4026B CD4033B CD40110B	CD4054B CD4055B CD4056B CD4543B *Liquid Crystal Display	CD7211MΔ# CD7211AMΔ# CD7211Δ# CD7211AΔ#	CD4511B **Light-Emitting Diode

Δ Indicates types designed for special applications. Ratings and characteristics data for these types differ in some aspects from the standardized data for B-series types. # Interchangeable with Harris types ICM7211IPL, ICM7211AIPL, ICM7211MPL, ICM7211AMPL, respectively.

Function Selection Chart

Function	Type No.	No. of Pins
Gates		
NOR/NAND		
2-Input NOR, 2 Input NAND	CD4572UB	16
Dual 4-input NOR	CD4002B	14
Dual 4-input NAND	CD4012B	14
Triple 3-input NOR	CD4025B	14
Triple 3-input NAND	CD4023B	14
Quad 2-input NOR	CD4001B	14
	CD4001UB	14
Quad 2-input NAND	CD4011B	14
	CD4011UB	14
8-input NOR/OR	CD4078B	14
8-input NAND/AND	CD4068B	14
Dual 2-input NAND buffer/driver	CD40107B	8,14
OR/AND		
Dual 4-input OR	CD4072B	14
Dual 4-input AND	CD4082B	14
Triple 3-input OR	CD4075B	14
Triple 3-input AND	CD4073B	14
Quad 2-input OR	CD4071B	14
Quad 2-input AND	CD4081B	14

Function	Type No.	No. of Pins
Buffers and Inverters		
Dual complementary pair plus inverter	CD4007UB	14
Hex inverter	CD4069UB	14
Quad Inverter	CD4572UB	16
Hex inverter/buffer (3-state)	CD4502B	16
Hex buffer (3-state non-inverting)	CD4503B	16
Hex buffer/converter (inverting)	CD4009UB	16
	CD4049UB	16
Hex buffer/converter (non-inverting)	CD4010B	16
	CD4050B	16
Quad true/complement buffer	CD4041UB	14
Dual 2-input NAND buffer/driver	CD40107B	8,14
Multifunction/AOI		
Quad exclusive-OR	CD4030B	14
	CD4070B	14
Quad exclusive-NOR	CD4077B	14
	CD4519B	16
Quad AND/OR Select	CD4019B	16
4-Bit AND/OR Selector	CD4519B	16

CD4000B Series (Continued)

Function Selection Chart (Continued)

Function	Type	No. of Pins
Multifunction/AOI		
Dual 2-wide, 2-input AND/OR invert (AOI)	CD4085B	14
Expandable 4-wide, 2-input AND/OR invert (AOI)	CD4086B	14
Multifunctional expandable 8-input (3-state output)	CD4048B	16
Decoders/Encoders		
BCD-to-decimal decoder	CD4028B	16
8-input priority encoder	CD4532B	16
10-line to 4-line BCD priority encoder	CD40147B	16
4-bit latch/4-to-16 line decoder (outputs high)	CD4514B	24
4-bit latch/4-to16 line decoder (outputs low)	CD4515B	24
Dual 1-of-4 decoder/demultiplexer (outputs high)	CD4555B	16
Dual 1-of-4 decoder/demultiplexer (outputs low)	CD4556B	16
Schmitt Trigger		
Quad 2-input NAND	CD4093B	14
Hex	CD40106B	14
Interface		
Quad low-to-high voltage	CD40109B	16
Hex high-to-low voltage (inverting)	CD4009UB	16
	CD4049UB	16
Hex high-to-low voltage (non-inverting)	CD4010B	16
	CD4050B	16
Hex voltage level shifter (TTL-CMOS, or CMOS-CMOS)	CD4504B	16
Dual 2-input NAND buffer/driver	CD40107B	8,14
8-bit bidirectional CMOS-to-TTL level converter	CD40116△#	22
Programmable dual 4-bit terminator	CD40117B△	14
Multivibrators		
Monostable/astable	CD4047B	14
Dual Monostable	CD4098B	16
Dual precision monostable	CD4538B	16
	CD14538B	16
Flip-Flops		
Dual "D" with set/reset capability	CD4013B	14
Dual "J-K" with set/reset capability	CD4027B	16
Gated "J-K" (non-inverting)	CD4095B	14
Gated "J-K" (inverting and non-inverting)	CD4096B	14
Hex "D"	CD40174B	16
4-bit "D" with 3-state outputs	CD4076B	14
Quad "D"	CD40175B	16
Latches		
Quad Clocked "D"	CD4042B	16
Quad NOR R/S (3-state outputs)	CD4043B	16
Quad NAND R/S (3-state outputs)	CD4044B	16
Dual 4-bit	CD4508B	24
8-bit addressable	CD4099B	16
	CD4724B	16

Function	Type	No. of Pins
Registers		
Shift Registers-Static		
Dual 4-stage with serial input/ parallel output	CD4015B	16
18-stage	CD4006B	14
64-stage	CD4031B	
Dual 64-bit	CD4517B	16
8-stage with synchronous parallel or serial input/serial output	CD4014B	16
8-stage with asynchronous parallel input or synchronous serial input/serial output	CD4021B	16
4-stage parallel-in/parallel-out with J-K input and true/complement output	CD4035B	16
4-bit universal bidirectional with asynchronous master reset	CD40194B	16
8-stage bidirectional parallel or serial input/parallel output	CD4034B	24
32-bit left/right	CD40100B	16
8-stage shift-and-store bus	CD4094B	16
Storage Registers		
8-bit addressable latch	CD4099B	16
	CD4724B	16
4-bit "D"-type with 3-state outputs	CD4076B	16
FIFO Buffers Registers		
4-bit x 16 word	CD40105B	16
Counters		
Binary Ripple		
7-stage	CD4024B	14
12-stage	CD4040B	16
14-stage	CD4020B	16
14-stage counter/divider and oscillator	CD4060B	16
24-stage frequency divider with oscillator section	CD4521B	16
Timers		
21-stage	CD4045B	14
Time base generator	CD4566B	16
Programmable	CD4536B	16
	CD4541B	14
Synchronous		
Decade counter/divider plus 10 decoded decimal outputs	CD4017B	16
Divide-by-8 counter/divider with 8 decimal outputs	CD4022B	16
Presettable divide-by-"N" counter, fixed or programmable	CD4018B	16
Programmable-divide-by-"N" counter	CD4059A	24
Programmable BCD divide-by-"N"	CD4522B	16
Presettable up/down counter, binary or BCD-decade	CD4029B	16
Presettable 4-bit BCD up/down counter	CD4510B	16
	CD40192B	16
Presettable 4-bit binary up/down counter	CD4516B	16
	CD40193B	16
Presettable 2-decade BCD down counter	CD40102B	16
Presettable 8-bit binary down counter	CD40103B	16

△ Indicates types designed for special applications. Ratings and characteristics data for these types differ in some aspects from the standardized data for B-series types. # CMOS/SOS device.

CD4000B Series (Continued)

Function Selection Chart (Continued)

Function	Type	No. of Pins
Counters (Continued)		
Dual BCD up counter	CD4518B	16
Dual binary up counter	CD4520B	16
Decade counter/asynchronous clear	CD40160B	16
Binary counter/asynchronous clear	CD40161B	16
Decade counter/synchronous clear	CD40162B	16
Binary counter/synchronous clear	CD40163B	16
Display Drivers With Counter		
Decade counter/divider with 7-segment display outputs and display enable	CD4026B	16
Decade counter/divider with 7-segment display outputs and ripple blanking	CD4033B	16
Up/Down Counter-Latch-Decoder-Driver	CD40110B	16
For Liquid-Crystal-Display Drive		
4-segment display driver	CD4054B	16
BCD-to-7-segment decoder/driver with "display-frequency" output	CD4055B	16
BCD-to-7-segment decoder/driver with strobed-latch function	CD4056B CD4543B	16 16
4-digit decoder/driver with hexadecimal display	CD7211△	40
4-digit decoder/driver with decimal display	CD7211A△	40
4-digit decoder/driver with hexadecimal display	CD7211M△	40
4-digit decoder/driver with decimal display	CD7211AM△	40
For Light-Emitting-Diode Drive		
BCD-to-7-segment latch decoder/driver	CD4511B	16
Multiplexers/Demutiplexers		
Digital		
Triple 2-channel	CD4053B	16
Differential 4-channel	CD4052B	16
Single 8-channel	CD4051B	16
Differential 8-channel	CD4097B	24
Single 16-channel	CD4067B	24
Quad bilateral switch	CD4016B	14
Quad bilateral switch	CD4066B	14
Digital (Data Selectors) Quad AND/OR select	CD4019B	16
Dual 1-of-4 decoder/demultiplexer (outputs high)	CD4555B	16

Function	Type	No. of Pins
Digital (Continued)		
Dual 1-of-4 decoder/demultiplexer (outputs low)	CD4556B	16
Quad 2-line-to-line	CD40257B	16
8-channel	CD4512B	16
Quad 2-channel	CD4519B	16
Analog (Data Selectors)		
Dual 4-channel	CD4529B	16
Phase-Locked Loop		
Micropower	CD4046B	16
Arithmetic Circuits		
Adders/Comparators		
4-bit full adder with parallel Carry out	CD4008B	16
Triple serial adder, positive logic	CD4032B	16
Triple serial adder, negative logic	CD4038B	16
4-bit magnitude comparator	CD4063B CD4585B	16 16
Quad exclusive-OR gate	CD4030B	14
NBCD adder with 4 sum-outputs plus carry out	CD4560B	16
Quad exclusive-OR gate	CD4070B	14
Quad exclusive-NOR gate	CD4077B	14
ALU/Rate Multipliers		
BCD rate multiplier	CD4527B	16
Binary rate multiplier	CD4089B	16
Quad Bilateral Switches		
For transmission or multiplexing of analog or digital signals	CD4016B CD4066B	14 14
Industrial Controller		
16-channel precision timer/driver	CD22401△	40
Sync Generator		
TV Camera Sync Generator	CD22402	24
Telecommunication Circuits		
Crosspoint Switches		
4x4 crosspoint switch with control memory	CD22100△	16
4x4x2 crosspoint switch with control memory	CD22101△	24
4x4x2 crosspoint switch with control memory	CD22102△	24
Timer/Driver		
16-channel precision timer/driver	CD22401△	40

△ Indicates types designed for special applications. Ratings and characteristics for these types differ in some aspects from the standardized data for the A- and B-series types.

CD54/74HC/HCT Series

The Harris HC/HCT series of high-speed CMOS logic integrated circuits includes an extensive line of products that are pin compatible with many existing bipolar 54/74 LSTTL and CMOS 4000 series of digital logic types. The new HC/HCT series ICs provide high-speed CMOS replacements for the most popular LSTTL devices in existing designs and also offer low-power all-CMOS designs for the new digital systems. Key family features of the Harris HC/HCT types include:

- Speeds equivalent to LSTTL types with typical gate delays of 8ns.
- Fanout to 10 74LSTTL loads; 15 loads using Bus Driver 54/74 types.
- Operating frequencies equivalent to LSTTL types, typically 50MHz.
- Full Operating Temperatue Ranges:
  F Package: -55 to +125°C
  E & M Packages: -40 to +125°C
- The high voltage noise immunity characteristic of CMOS, typically 45 percent of V_{CC}, a two to three times improvement over LSTTL (HC-series types.)
- Wide range of power supply operating voltages, 2 to 6 volts.
- CMOS low static power consumption, typically less than 1 microwatt.

The product line consists of CD54/74HC-series types, which feature CMOS input voltage level compatability, and CD54/74HCT-series types, which are input voltage level compatible with LSTTL devices. The line also includes a limited number of single-stage, unbuffered inverter types (CD54/74HCU-series) for added versatility in oscillator and amplifier applications.

Standardized Maximum Ratings and Recommended Operating Conditions for CD54/74HC, CD54/74HCT, and CD54/74HCU Integrated Circuits

Maximum Ratings, Absolute-Maximum Values:

DC Supply-Voltage (V_{CC})
(Voltages referenced to ground) ..... -0.5 to +7V
DC Input Diode Current, I_{IK} (for $V_I < -0.5V$ or $V_I > V_{CC} + 0.5V$) ..... ±20mA
DC Output Diode Current, I_{OK} (for $V_O < -0.5V$ or $V_O > V_{CC} + 0.5V$) ..... ±20mA
DC Drain Current, Per Output (I_O) (for $-0.5V < V_O < V_{CC} + 0.5V$):
Standard Output ..... ±25mA
Bus Driver Output ..... ±35mA
DC V_{CC} or Ground Current (I_{CC}):
Standard Output ..... ±50mA
Bus Driver Output ..... ±70mA
Power Dissipation Per Package (P_D):
For T_A = -40 to +100°C (Package Type E) 500mW
For T_A = +100 to +125°C (Package Type E) ..... Derate Linearly at 8m/°C to 300mW
For T_A = -55 to +100°C (Package Type F, H) 500mW
For T_A = +100 to +125°C (Package Type F, H) ..... Derate Lineraly at 8mW/°C to 300mW
For T_A = -40 to +70°C (Package Type M) 400mW
For T_A = +70 to +125°C (Package Type M) ..... Derate Linearly at 6mW/°C to 70mW
Operating-Temperature Range (T_A):
Package Types F, H ..... -55 to +125°C
Package Type E, M ..... -40 to +125°C
Storage Temperature (T_{STG}) ..... -65 to +150°C
Lead Temperature (During Soldering):
At distance 1/16 ± 1/32in. (1.59 ± 0.79mm) from case for 10s maximum ..... +265°C
Unit inserted into PC board min. thickness 1/16in.
(1.59mm) with solder contacting lead tips only ..... +300°C

Recommended Operating Conditions:
For maximum reliability, normal operating conditions should be selected so that operation is always within the following ranges:

Characteristics		Limits Min	Limits Max	Units
Supply-Voltage Range (For T_A = Full Package-Temperature Range) V_{CC}:*				
	CD54/74HC Types (and CD54/74HCU04)	2	6	V
	CD54/74HCT Types	4.5	5.5	V
DC Input or Output Voltage, V_I, V_O		0	V_{CC}	V
Operating Temperature, T_A:	CD74 Types	-40	+125	
	CD54 Types	-55	+125	°C
Input Rise and Fall Times t_r, t_f	at 2V	0	1000	ns
	at 4.5V	0	500	ns
	at 6V	0	400	ns

* Unless otherwise specified, all voltages are referenced to ground.

CD54/74HC/HCT Series (Continued)

Product Classification Chart

Gates

NOR/NAND

CD54/74HC/HCT

HC/HCT02
HC/HCT03*
HC/HCT27
HC/HCT4002

Exclusive-NOR

HC7266

HC/HCT00
HC/HCT10
HC/HCT20
HC/HCT30

Inverters

HC/HCT04
HCU04

OR/AND

CD54/74HC/HCT

HC/HCT08
HC/HCT11
HC/HCT21
HC/HCT32
HC/HCT4075

Exclusive OR

HC/HCT86

Buffers Line-Drivers

CD54/74HC/HCT

HC/HCT240 •
HC/HCT241 •
HC/HCT244 •
HC/HCT355 •
HC/HCT366 •
HC/HCT367 •
HC/HCT368 •
HC/HCT540 •
HC/HCT541 •

High-to-Low Level Shifters

HC4049
HC4050

Bus Drivers

CD54/74/HC/HCT

HC/HCT125
HC/HCT126
HC/HCT241 •
HC/HCT244 •
HC/HCT365 •
HC/HCT366 •
HC/HCT367 •
HC/HCT368 •
HC/HCT540 •
HC/HCT541 •

Multi-Function AOI

HC/HCT86
HC/HCT266

Decoders/Encoders/

CD54/74/HC/HCT

HC/HCT42
HC/HCT137
HC/HCT138
HC/HCT139
HC/HCT147
HC/HCT154
HC/HCT237
HC/HCT238
HC/HCT4511
HC/HCT4514
HC/HCT4515
HC/HCT4543

Schmitt Trigger

HC/HCT14
HC/HCT132

Multivibrators

Flip-Flops/Latches

Flip-Flops

CD54/74HC/HCT

HC/HCT73
HC/HCT74
HC/HCT107
HC/HCT109
HC/HCT122
HC/HCT173 •
HC/HCT174
HC/HCT175
HC/HCT273
HC/HCT374 •
HC/HCT377
HC/HCT534 •
HC/HCT564 •
HC/HCT574 •

Latches

CD54/74HC/HCT

HC/HCT75
HC/HCT259
HC/HCT373 •
HC/HCT533 •
HC/HCT563 •
HC/HCT573 •

Monostable

HC/HCT123
HC/HCT221
HC/HCT423
HC/HCT4538†

Registers

Shift

CD54/74HC/HCT

HC/HCT164
HC/HCT165
HC/HCT166
HC/HCT194
HC/HCT195
HC/HCT299 •
HC/HCT597
HC/HCT4015
HC/HCT4094
HC/HCT40104 •

FIFO Buffer

CD54/74HC/HCT

HC/HCT40105
HC/HCT7030 •

Multiport

CD54/74HC/HCT

HC/HCT670

Counters

Binary Ripple

CD54/74HC/HCT

HC/HCT93
HC/HCT390
HC/HCT393
HC/HCT4020
HC/HCT4024
HC/HCT4040
HC/HCT4060
HC/HCT40103

Programmable

HC/HCT4059

Sychronous

CD54/74HC/HCT

HC/HCT160
HC/HCT161
HC/HCT162
HC/HCT163
HC/HCT190
HC/HCT191
HC/HCT192
HC/HCT193
HC/HCT4017
HC/HCT4510
HC/HCT4516
HC/HCT4518
HC/HCT4520
HC/HCT40102

Digital Multiplexers

CD54/74HC/HCT

HC/HCT151
HC/HCT153
HC/HCT157
HC/HCT158
HC/HCT251
HC/HCT253 •
HC/HCT257 •
HC/HCT258
HC/HCT354 •
HC/HCT356 •

Phase Locked Loops

HC/HCT297
HC/HCT4046A
HC/HCT7046A

Bilateral Switches

HC/HCT4016△
HC/HCT4066△
HC/HCT4316△

Analog Multiplexers/Demultiplexers

HC/HCT4051
HC/HCT4052
HC/HCT4053
HC/HCT4067
HC/HCT4051
HC/HCT4352
HC/HCT4353

Interface Circuits

BUS Transceivers

HC/HCT242 •
HC/HCT243 •
HC/HCT245 •
HC/HCT640 •
HC/HCT643 •
HC/HCT646 •
HC/HCT647 •
HC/HCT648 •
HC/HCT649 •
HC/HCT651 •
HC/HCT652 •
HC/HCT653 •
HC/HCT654 •
HC/HCT7038 •

Arithmetic Circuits

Adders/Comparators

CD54/74HC/HCT

HC/HCT85
HC/HCT283
HC/HCT583
HC/HCT688

ALU/Rate Multipliers

CD54/74HC/HCT

HC/HCT181
HC/HCT182

Parity Gernerator/Checker

CD54/74HC/HCT

HC/HCT280

Display Drivers

For LCD Drive

CD54/74HC/HCT

HC/HCT4543
See Decoders/Encoders

For LED Drive

CD54/74HC/HCT

HC/HCT4511

* Open Collector
△ Quad type
• With Bus Driver output stage
† Precision type

CD54/74HC/HCT Series (Continued)

Function Selection Chart

Type CD54/74	Function/Description	Classification	No. of Pins
	NAND/NOR Gates		
HC/HCT00	Quad 2-Input NAND Gate	SSI	14
HC/HCT02	Quad 2-Input NOR Gate	SSI	14
HC/HCT03	Quad 2-Input NAND Gate with Open Drain	SSI	14
HC/HCT10	Triple 3-Input NAND Gate	SSI	14
HC/HCT20	Dual 4-Input NAND Gate	SSI	14
HC/HCT27	Triple 3-Input NOR Gate	SSI	14
HC/HCT30	8-Input NAND Gate	SSI	14
HC/HCT4002	Dual 4-Input NOR Gate	SSI	14
	AND/OR/EXCLUSIVE-OR Gates		
HC/HCT08	Quad 2-Input AND Gate	SSI	14
HC/HCT11	Triple 3-Input AND Gate	SSI	14
HC/HCT21	Dual 4-Input AND Gate	SSI	14
HC/HCT32	Quad 2-Input OR Gate	SSI	14
HC/HCT86	Quad 2-Input EXCLUSIVE-OR Gate	SSI	14
HC/HCT4075	Triple 3-Input OR Gate	SSI	14
HC7266	Quad Exclusive NOR Gate	SSI	14
	Inverters/Buffers/Bus Drivers		
HC/HCT04	Hex Inverter/Buffer	SSI	14
HCU04	Hex Inverter (Unbuffered)	SSI	14
HC/HCT125*	Quad 3-State Buffer	MSI	14
HC/HCT126*	Quad 3-State Buffer	MSI	14
HC/HCT240*	Octal Buffer/Line Driver; 3-State; Inverting	MSI	20
HC/HCT241*	Octal Buffer/Line Driver; 3-State	MSI	20
HC/HCT244*	Octal Buffer/Line Driver; 3-State	MSI	16
HC/HCT365*	Hex Buffer/Line Driver; 3-State	MSI	16
HC/HCT366*	Hex Buffer/Line Driver; 3-State; Inverting	MSI	16
HC/HCT367*	Hex Buffer/Line Driver; 3-State	MSI	16
HC/HCT368*	Hex Buffer/Line Driver; 3-State; Inverting	MSI	16
HC/HCT540*	Octal Buffer/Line Driver; 3-State; Inverting	MSI	20
HC/HCT541*	Octal Buffer/Line Driver; 3-State	MSI	20
HC4049	Hex Inverting HIGH-to-LOW Level Shifter	SSI	16
HC4050	Hex HIGH-to-LOW Level Shifter	SSI	16
	Flip-Flops		
HC/HCT73	Dual JK Flip-Flop with Reset; Negative-Edge Trigger	FF	14
HC/HCT74	Dual D-Type Flip-Flop with Set and Reset; Positive-Edge Trigger	FF	14
HC/HCT107	Dual JK Flip-Flop with Reset; Negative-Edge Trigger	FF	14
HC/HCT109	Dual JK Flip-Flop with Set and Reset; Positive-Edge Trigger	FF	16
HC/HCT112	Dual JK Flip-Flop with Set and Reset; Negative-Edge Trigger; 3-State	FF	16
HC/HCT173*	Quad D-Type Flip-Flop with Set and Reset; Positive-Edge Trigger; 3-State	MSI	16
HC/HCT174	Hex D-Type Flip-Flop with Reset; Positive-Edge Trigger	MSI	16
HC/HCT175	Quad D-Type Flip-Flop with Reset; Positive-Edge Trigger	MSI	16
HC/HCT273	Octal D-Type Flip-Flop with Reset; Positive-Edge Trigger	MSI	20
HC/HCT374*	Octal D-Type Flip-Flop; Positive-Edge Trigger; 3-State	MSI	20
HC/HCT377	Octal D-Type Flip-Flop with Data Enable; Positive-Edge Trigger	MSI	20
HC/HCT534*	Octal D-Type Flip-Flop; Positive-Edge Trigger; 3-State; Inverting	MSI	20
HC/HCT564*	Octal D-Type Flip-Flop; Positive-Edge Trigger; 3-State; Inverting	MSI	20
HC/HCT574*	Octal D-Type Flip-Flop; Positive-Edge; 3-State	MSI	20
	Shift/FIFO Buffer/Multiport Registers		
HC/HCT164	8-Bit Serial-In/Parallel-Out Shift Register	MSI	14
HC/HCT165	8-Bit Parallel-In/Serial-Out Shift Register	MSI	16
HC/HCT166	8-Bit Parallel/Serial-In Serial Out Shift Register	MSI	16
HC/HCT194	4-Bit Bidirectional Universal Shift Register	MSI	16
HC/HCT195	4-Bit Parallel Access Shift Register	MSI	16
HC/HCT299*	8-Bit Universal Shift Register; 3-State	MSI	20

* Types with a bus driver output stage.

CD54/74HC/HCT Series (Continued)

Function Selection Chart (Continued)

Type CD54/74	Function/Description	Classification	No. of Pins
	Shift/FIFO Buffer/Multiport Registers (Continued)		
HC/HCT597	8-Bit Shift Register With Input Latch	MSI	16
HC/HCT670*	4 x 4 Register File; 3-State	MSI	16
HC/HCT4015	Dual 4-Stage Static Shift Register	MSI	16
HC/HCT4094	8-Stage Shift-and-Store Bus Register; 3-State	MSI	16
HC/HCT7030*	9-Bit x 64 Word FIFO Register; 3-State	MSI	28
HC/HCT40104*	4-Bit Bidirectional Universal Shift Register; 3-State	MSI	16
HC/HCT40105	4 Bits x 16 Words FIFO Register	MSI	16
	Arithmetic Circuits		
HC/HCT85	4-Bit Magnitude Comparator	MSI	16
HC/HCT181	4-Bit Arithmetic Logic Unit	MSI	24
HC/HCT182	Look-Ahead Carry Generator	MSI	16
HC/HCT280	9-Bit Odd/Even Parity Generator/Checker	MSI	14
HC/HCT283	4-Bit Binary Full Adder With Fast Carry	MSI	16
HC/HCT583	4-Bit BCD Full Adder with Fast Carry	MSI	16
HC/HCT688	8-Bit Magnitude Comparator	MSI	20
	Counters		
HC/HCT93	4-Binary Ripple Counter	MSI	14
HC/HCT160	Presettable Synchronous BCD Decade Counter; Asynchronous Reset	MSI	16
HC/HCT161	Presettable Synchronous 4-Bit Binary Counter; Aysnchronous Reset	MSI	16
HC/HCT162	Presettable Synchronous BCD Decade Counter; Synchronous Reset	MSI	16
HC/HCT163	Presettable Synchronous 4-Bit Binary Counter; Synchronous Reset	MSI	16
HC/HCT190	Presettable Synchronous BCD Decade Up/Down Counter	MSI	16
HC/HCT191	Presettable Synchronous 4-Bit Binary Up/Down Counter	MSI	16
HC/HCT192	Presettable Synchronous BCD Decade Up/Down Counter	MSI	16
HC/HCT193	Presettable Synchronous 4-Bit Binary Up/Down Counter	MSI	16
HC/HCT390	Dual Decade Ripple Counter	MSI	16
HC/HCT393	Dual 4-Bit Binary Ripple Counter	MSI	14
HC/HCT4017	Decade Counter/Divider with 10 Decoded Outputs	MSI	16
HC/HCT4020	14-Stage Binary Ripple Counter	MSI	16
HC/HCT4024	7-Stage Binary Ripple Counter	MSI	16
HC/HCT4040	12-Stage Binary Ripple Counter	MSI	16
HC/HCT4059	Programmable Divide by "N" Counter	MSI	24
HC/HCT4060	14-Stage Binary Ripple Counter with Oscillator	MSI	16
HC/HCT4510	Presettable BCD Up/Down Counter	MSI	16
HC/HCT4516	Presettable Binary Up/Down Counter	MSI	16
HC/HCT4518	Dual Synchronous BCD Counter	MSI	16
HC/HCT4520	Dual 4-Bit Synchronous Binary Counter	MSI	16
HC/HCT40102	Synchronous 2-Decade BCD Down Counter	MSI	16
HC/HCT40103	8-Bit Synchronous Binary Down Counter	MSI	16
	One-Shot Multivibrators		
HC/HCT123	Dual Retriggerable Monostable Multivibrator with Reset	MSI	16
HC/HCT221	Dual Monostable Multivibrator with Reset	MSI	16
HC/HCT423	Dual Retriggerable Monostable Multivibrator with Reset	MSI	16
HC/HCT4538	Dual Retriggerable Precision Monostable Multivibrator	MSI	16
	Analog and Digital Multiplexers/Demultiplexers		
HC/HCT151	8-Input Multiplexer	MSI	16
HC/HCT153	Dual 4-Input Multiplexer	MSI	16
HC/HCT157	Quad 2-Input Multiplexer	MSI	16
HC/HCT158	Quad 2-Input Multiplexer; Inverting	MSI	16
HC/HCT251	8-Input Multiplexer; 3-State	MSI	16
HC/HCT253*	Dual 4-Input Multiplexer; 3-State	MSI	16
HC/HCT257*	Quad 2-Input Multiplexer; 3-State; Non-Inverting Outputs	MSI	16
HC/HCT258	Quad 2-Input Multiplexer; 3-State; Inverting Outputs	MSI	16
HC/HCT354*	8-Input Multiplexer/Register; 3-State	MSI	20
HC/HCR356*	8-Input Multiplexer/Register; 3-State	MSI	20

* Type with a bus-driver output stage.

CD54/74HC/HCT Series (Continued)

Function Selection Chart (Continued)

Type CD54/74	Function/Description	Classification	No. of Pins
	Analog and Digital Multiplexers/Demultiplexers (Continued)		
HC/HCT4051	8-Channel Analog Multiplexer/Demultiplexer	MSI	16
HC/HCT4052	Dual 4-Channel Analog Multiplexer/Demultiplexer	MSI	16
HC/HCT4053	Triple 2-Channel Analog Multiplexer/Demultiplexer	MSI	16
HC/HCT4067	16-Channel Analog Multiplexer/Demultiplexer	MSI	24
HC/HCT4351	Dual 4-Channel Analog Multiplexer/Demultiplexer with Latch	MSI	20
HC/HCT4352	Triple 2-Channel Analog Multiplexer/Demultiplexer with Latch	MSI	20
HC/HCT4353	16-Channel Analog Multiplexer/Demultiplexer with Latch	MSI	20
	Decoders/Encoders		
HC/HCT42	BCD to Decimal Decoder (1-of-10)	MSI	16
HC/HCT137	3-to-8-Line Decoder with Latch; Inverting	MSI	16
HC/HCT138	3-to-8-Line Decoder/Demultiplexer; Inverting	MSI	16
HC/HCT139	Dual 2-to-4-Line Decoder/Demultiplexer	MSI	16
HC/HCT147	10-to-4-Line Priority Encoder	MSI	16
HC/HCT154	4-to-16-Line Decoder/Demultiplexer	MSI	24
HC/HCT237	3-to-8-Line Decoder/Demultiplexer with Address Latches	MSI	16
HC/HCT238	3-to-8-Line Decoder/Demultiplexer Non-Inverting	MSI	16
HC/HCT4511	BCD-to-7-Segment Latch/Decoder/Driver	MSI	16
HC/HCT4514	4-to-16-Line Decoder/Demultiplexer with Input Latches	MSI	24
HC/HCT4515	4-to-16-Line Decoder/Demultiplexer with Input Latches	MSI	24
HC/HCT4543	BCD-to-7-Segment Latch/Decoder/Driver for LCDs	MSI	16
	Analog Switches		
HC/HCT4016	Quad Bilateral Switch	SSI	14
HC/HCT4066	Quad Bilateral Switch	SSI	14
HC/HCT4316	Quad Analog Switch	MSI	16
	Bus Transceivers		
HC/HCT242*	Quad Bus Transceiver; 3-State; Inverting	MSI	14
HC/HCT243*	Quad Bus Transceiver; 3-State	MSI	14
HC/HCT245*	Octal Bus Transceiver; 3-State	MSI	20
HC/HCT640*	Octal Bus Transceiver; 3-State; Inverting	MSI	20
HC/HCT643*	Octal Bus Transceiver; 3-State; True/Inverting	MSI	20
HC/HCT646*	Octal Bus Transceiver; 3-State	MSI	24
HC/HCT648*	Octal Bus Transceiver; 3-State; Inverting	MSI	24
HC/HCT7038*	9-Bit Bus Transceiver with Latch	MSI	24
	Schmitt Triggers		
HC/HCT14	Hex Inverting Schmitt Trigger	SSI	14
HC/HCT132	Quad 2-Input NAND Schmitt Trigger	SSI	14
	Latches		
HC/HCT75	Dual 2-Input Bistable Transparent Latch	FF	16
HC/HCT259	8-Bit Adressable Latch	MSI	16
HC/HCT373*	Octal Transparent Latch; 3-State	MSI	20
HC/HCT533*	Octal Transparent Latch; 3-State; Inverting	MSI	20
HC/HCT563*	Octal Transparent Latch; 3-State; Inverting	MSI	20
HC/HCT573*	Octal Transparent Latch; 3-State	MSI	20
	Phase-Locked Loops (PLL)		
HC/HCT297	Digital Phase-Locked Loop Filter	MSI	16
HC/HCT4046A	Phase-Locked Loop with VCO	MSI	16
HC/HCT7046A	Phase-Locked Loop with In-Lock Detection	MSI	16

* Type with a bus-driver output stage.

CD54/74AC/ACT Series

The Advanced High-Speed CMOS Logic product line represents the second generation of high-speed CMOS logic. Designated the CD54/74AC and CD54/74ACT families, these devices match Fairchild's bipolar FAST™ devices in speed, performance and logic/type output drive, but at CMOS power levels.

Featuring < 3ns gate propagation delays, Advanced CMOS Logic is the fastest CMOS logic yet available. (By contrast, the standard propagation delay for CMOS logic is 90ns, and for high-speed CMOS logic, 9ns.) ACL can operate at more than 150MHz. Output drive capability is 24mA, compared with 6mA for HC/HCT. This capability enables AC/ACT types to drive 50Ω transmission lines, yet still generate the voltages necessary to operate the receiving logic devices safely.

Benefits of the Advanced CMOS Logic family compared to other logic families include:

- Lower Power Dissipation
- Balanced Propagation Delay
- Superior Input Characteristics: Larger Noise Immunity and Noise Margin Input Switching Voltage Stability with Temperature Variation
- Lower Input Current
- Improved Output Source Current with Better Balance
- Wider Operating Supply Voltage Range
- Wider Commercial-Product Operating-Temperature Range
- Lower 3-State Output Leakage (High-Z-Mode)
- Improved Reliability in General, and Particulary in Surface-Mount (Small-Outline) Packages
- Rail-To-Rail Output Voltage Swing

Maximum Ratings, Absolute-Maximum Values:

DC Supply-Voltage (V_{CC}) ..... -0.5 to 6V

DC Input Diode Current, I_{IK} (for $V_I < -0.5V$ or $V_I > V_{CC} + 0.5V$) ..... ±20mA

DC Output Diode Current, I_{OK} (for $V_O < -0.5V$ or $V_O > V_{CC} + 0.5V$) ..... ±50mA

DC Output Source Or Sink Current per Output Pin, I_O (for $V_O > -0.5$ or $V_O < V_{CC} - 0.5V$) ..... ±50mA

DC V_{CC} or Ground Current (I_{CC} or I_{GND}) ..... ±100mA*

Power Dissipation Per Package (P_D):

For T_A = -55°C to +100°C (Package Type E) 500mW

For T_A = +100°C to +125°C (Package Type E) ..... Derate Linearly at 8mW/°C t 300mW

For T_A = -55°C to +70°C (Package Type M) 400mW

For T_A = +70°C to +125°C (Package Type M) ..... Derate Linearly at 6mW/°C to 70mW

Operating-Temperature Range (T_A) ..... -55°C to +125°C

Storage Temperature (T_{STG}) ..... -65°C to +150°C

Lead Temperature (During Soldering):

At distance 1/16 ± 1/32 in. (1.59 ± 0.79mm) form case for 10s maximum ..... +265°C

Unit inserted into PC board min. thickness 1/16 in.

(1.59mm) with solder contacting lead tips only ..... +300°C

* For up to 4 outputs per device; add ±25mA for each additional output.

Recommended Operating Conditions:

For maximum reliability, normal operating conditions should be selected so that operation is always within the following ranges:

Characteristics	Limits		Units
	Min	Max	
Supply-Voltage Range, (For T_A = Full Package-Temperature Range) V_{CC}*			
AC Types	1.5	5.5	V
ACT Types	4.5	5.5	V
DC Input or Output Voltage, V_I, V_O	0	V_{CC}	V
Operating Temperature, T_A	-55°C	+125°C	°C
Input Rise and Fall Slew Rate, dt/dv			
at 1.5V to 3V (AC Types)	0	50	ns/V
at 3.6V to 5.5V (AC Types)	0	20	ns/V
at 4.5V to 5.5V (ACT Types)	0	10	ns/V

* Unless otherwise specified, all voltages are referenced to ground.

CD54/74AC/ACT Series (Continued)

Product Classification Chart

Gates			Buffers Line-Drivers	Bus Drivers	Decoders/ Encoders	Schmitt Trigger	Multivibrators	
							Flip-Flops/Latches	
NOR/NAND	Inverters	OR/AND/ Exclusive-OR					Flip/Flops	Latches
CD/54/74AC/ACT			CD54/74/AC/ACT				CD54/74AC/ACT	
AC/ACT00 AC/ACT02 AC/ACT10 AC/ACT20	AC/ACT04 AC/ACT05**	AC/ACT08 AC/ACT32 AC/ACT86	AC/ACT240 AC/ACT241 AC/ACT244 AC/ACT540 AC/ACT541	AC/ACT240 AC/ACT241 AC/ACT244 AC/ACT540 AC/ACT541	AC/ACT138 AC/ACT139 AC/ACT238	AC/ACT14	AC/ACT74 AC/ACT109 AC/ACT112 AC/ACT174 AC/ACT175 AC/ACT273 AC/ACT374 AC/ACT534 AC/ACT564 AC/ACT574	AC/ACT373 AC/ACT533 AC/ACT563 AC/ACT573

Registers		Counters	Multiplexers/ Demultiplexers	Interface Circuits	Arithmetic Circuits	Phase-Locked Loop
Shift	FIFO Buffer	Synchronous				
CD54/74AC/ACT		CD54/74AC/ACT	CD54/74AC/ACT	CD54/74AC/ACT	CD54/74AC/ACT	
AC/ACT164 AC/ACT299 AC/ACT323	AC/ACT7201 AC/ACT7202	AC/ACT161 AC/ACT163 AC/ACT191 AC/ACT193 AC/ACT7060 AC/ACT7061	AC/ACT138 AC/ACT139 AC/ACT151 AC/ACT153 AC/ACT157 AC/ACT158 AC/ACT238 AC/ACT251 AC/ACT253 AC/ACT257 AC/ACT258	**Bus Transceivers** AC/ACT245 AC/ACT623 AC/ACT646 AC/ACT647† AC/ACT648 AC/ACT649† AC/ACT651 AC/ACT652 AC/ACT653** AC/ACT654** AC/ACT7623** AC/ACT7651	**Adders/ Comparators** AC/ACT283 **Parity Generator/ Checker** AC/ACT280	AC/ACT297

†Open Drain **Open Drain (one side)

Function Selection Chart

Type CD54/74	Function/Description	Classification	Number of Pins
	NAND/NOR Gates		
AC/ACT00	Quad 2-Input NAND Gate	SSI	14
AC/ACT02	Quad 2-Input NOR Gate	SSI	14
AC/ACT10	Triple 3-Input NAND Gate	SSI	14
AC/ACT20	Dual 4-Input NAND Gate	SSI	14
	AND/OR/Exclusive-OR Gates		
AC/ACT08	Quad 2-Input AND Gate	SSI	14
AC/ACT32	Quad 2-Input OR Gate	SSI	14
AC/ACT86	Quad 2-Input Exclusive-OR Gate	SSI	14
	Inverters/Buffers/Bus Drivers		
AC/ACT04	Hex Inverter/Buffer	SSI	14
AC/ACT05	Hex Inverter/Buffer with Open-Drain Outputs	SSI	14
AC/ACT240	Octal Buffer/Line Driver; 3-State; Inverting	MSI	20
AC/ACT241	Octal Buffer/Line Driver; 3-State	MSI	20
AC/ACT244	Octal Buffer/Line Driver; 3-State	MSI	20
AC/ACT540	Octal Buffer/Line Driver; 3-State; Inverting	MSI	20
AC/ACT541	Octal Buffer/Line Driver; 3-State	MSI	20

CD54/74AC/ACT Series (Continued)

Function Selection Chart (Continued)

Type CD54/74	Function/Description	Classification	No. of Pins
	Flip-Flops/Latches		
AC/ACT74	Dual D-Type Flip-Flop with SET and RESET; Positive-Edge Trigger	FF	14
AC/ACT109	Dual JK Flip-Flop with SET and RESET; Positive-Edge Trigger	FF	16
AC/ACT112	Dual JK Flip-Flop with SET and RESET	FF	16
AC/ACT174	Hex D-Type Flip-Flop with RESET	MSI	16
AC/ACT175	Quad D-Type Flip-Flop with RESET	MSI	16
AC/ACT273	Octal D-Type Flip-Flop with RESET	FF	20
AC/ACT374	Octal D-Type Flip-Flop; Positive-Edge Trigger; 3-State; Non-Inverting	FF	20
AC/ACT534	Octal D-Type Flip-Flop; Positive-Edge Trigger; 3-State; Inverting	FF	20
AC/ACT564	Octal D-Type Flip-Flop; Positive-Edge Trigger; 3-State; Inverting	FF	20
AC/ACT574	Octal D-Type Flip-Flop; Positive-Edge Trigger; 3-State	FF	20
	Shift/FIFO Buffer/Multiport Registers		
AC/ACT164	8-Bit Serial-In Parallel-Out Shift Register	MSI	14
AC/ACT299	8-Bit Universal Shift Register; 3-State	MSI	20
AC/ACT323	8-Bit Universal Shift Register; 3-State (w/Synchronous RESET)	MSI	20
AC/ACT7202	1024 x 9 Bit Parallel In-Out FIFO	MSI	28
AC/ACT7201	512 x 9 Bit Parallel FIFO	MSI	28
	Arithmetic Circuits		
AC/ACT280	8-Bit Odd/Even Parity Generator/Checker	MSI	14
AC/ACT283	4-Bit Full Adder with Fast Carry	MSI	16
	Counters		
AC/ACT161	Presetable Synchronous 4-Bit Binary Counter; Asynchronous RESET	MSI	16
AC/ACT163	Presettable Synchronous 4-Bit Counter; Synchronous RESET	MSI	16
AC/ACT191	Presettable Synchronous 4-Bit Binary Up/Down Counter	MSI	16
AC/ACT193	Presettable Synchronous 4-Bit Binary Up/Down Counter	MSI	16
AC/ACT7060	14-Stage Binary Ripple Counter with Oscillator	MSI	20
AC/ACT7061	14-Stage Binary Ripple Counter with Oscillator	MSI	20
	Analog and Digital Multiplexers/Demultiplexers		
AC/ACT138	3-to-8-Line Decoder/Demultiplexer, Inverting	MSI	16
AC/ACT139	Dual 2-of-4-Line Decoder/Demultiplexer	MSI	16
AC/ACT151	8-Input Multiplexer	MSI	16
AC/ACT153	Dual 4-Input Multiplexer	MSI	16
AC/ACT157	Quad 2-Input Multiplexer	MSI	16
AC/ACT158	Quad 2-Input Multiplexer, Inverting	MSI	16
AC/ACT238	3-to-8-Line Decoder/Demultiplexer	MSI	16
AC/ACT251	8-Input Multiplexer; 3-State	MSI	16
AC/ACT253	Dual 4-Input Multiplexer; 3-State	MSI	16
AC/ACT257	Quad 2-Input Multiplexer; 3-State; Non-Inverting Outputs	MSI	16
AC/ACT258	Quad 2-Input Multiplexer; 3-State; Inverting Outputs	MSI	16
	Decoders/Encoders		
AC/ACT138	3-to-8-Line Decoder/Demultiplexer Inverting	MSI	16
AC/ACT139	Dual 2-of-4-Line Decoder/Demultiplexer	MSI	16
AC/ACT238	3-to-8-Line Decoder/Demultiplexer	MSI	16
	Bus Transceivers		
AC/ACT245	Octal Bus Transceiver; 3-State	MSI	20
AC/ACT623	Octal Bus Transceiver; 3-State; Non-Inverting	MSI	20
AC/ACT646	Octal Bus Transceiver/Register; 3-State	MSI	24
AC/ACT647	Octal Bus Transceiver/Register with Open Drain, Non-Inverting	MSI	24
AC/ACT648	Octal Bus Transceiver/Register, 3-State; Inverting	MSI	24
AC/ACT649	Octal Bus Transceiver/Register with Open Drain, Inverting	MSI	24
AC/ACT651	Octal Bus Transceiver/Register with Open Drain, Inverting	MSI	24
AC/ACT652	Octal Bus Transceiver/Register, 3-State; Non-Inverting	MSI	24
AC/ACT653	Octal Bus Transceiver/Register, 3-State (B Side), Open-Drain (A Side); Inverting	MSI	24
AC/ACT654	Octal Bus Transceiver/Register; 3-State (B-Side), Open-Drain (A-Side); Non-Inverting	MSI	24
AC/ACT7623	Octal Bus Transceiver; 3-State (B-Side), Open-Drain (A-Side); Non-Inverting	MSI	20
AC/ACT7651	Octal Bus Transceiver/Register; 3-State; Inverting	MSI	24

CD54/74AC/ACT Series (Continued)

Function Selection Chart (Continued)

Type CD54/74	Function/Description	Classification	No. of Pins
	Latches		
AC/ACT373	Octal Transparent Latch; 3-State	MSI	20
AC/ACT533	Octal Transparent Latch; 3-State; Inverting	MSI	20
AC/ACT563	Octal Transparent Latch; 3-State	MSI	20
AC/ACT573	Octal Transparent Latch; 3-State	MSI	20
	Schmitt Trigger		
AC/ACT14	Hex Inverting Schmitt Trigger	SSI	14
	Phase-Locked Loop		
AC/ACT297	Digital Phase-Locked Loop	MSI	16

BiMOS FCT Interface Logic ICs

CD54/74FCT Series

FCT Products for Backplane-Interface Applications

Harris FCT products are developed to provide a reliable interface with modern high-speed backplanes. The FCT types vastly reduce power consumption, avoid bus contention, minimize switching noise, and provide outputs that are specifically tailored to interface with VME buses or their equivalents.

The speed of the FCT family is comparable to that of bipolar FAST types. Sink current ranges from 48 milliamperes to 64 milliamperes depending on product type.

FCT Features

Speed	Competitive with similar bipolar F/AS TTL functions. Typical delay is 3.5 nanoseconds.
Sink/Source Current	All types have sink and source currents meeting VME, multibus, etc., standards. Output edges are monotonic through the TTL switch point with fully populated backplanes. A BiMOS output driver stage is used.
Simultaneous Switching Transient	(Ground bounce) Competitive with similar bipolar TTL and CMOS products. Output swing is 3.5 volts. Controlled output-edge rate.
Operating and Standby Power	Ultra-low pure CMOS operating power and standby power of almost zero.
Pinout	Standard

Fully populated buses, such as the 21-slot VME can be reliably interfaced. Products are most economically packaged in plastic DIP and gull-wing surface-mount pinouts. As with the Harris AC/ACT family of logic devices, simultaneous switching transients are controlled to levels comparable to similar bipolar logic functions (1 volt peak area for octal ground bounce).

The two competitive bipolar families (FAST™ and BCT), compared with FCT products, are 150 times higher in quiescent power consumption and 10 times higher in operating power consumption at a continuous five megahertz operation.

FCT Benefits

- Swift delay requirements dictated by modern control-system backplane-interface logic present no problems.
- Optimized output drives minimize backplane reflections in worst-case situations.
- EMI and RFI emissions minimized. Good signal-pulse integrity.
- Meets low-power needs of down-sized computers without fans, etc. Low battery drain.
- Provided in minimum and most economically sized DIP and SOP.
- Minimum CAD/CAM, burn-in board, and PC-board real estate costs with no performance sacrifice.

CD54/74FCT Series (Continued)

Maximum Ratings, Absolute-Maximum Values:

DC Supply-Voltage (V_{CC}) ..... -0.5 to 6V
DC Input Diode Current, I_{IK} (for $V_I < -0.5V$) ..... -20mA
DC Output Diode Current, I_{OK} (for $V_O < -0.5V$ ..... -50mA
DC Output Sink Current per Output Pin, I_O ..... +70mA
DC Output Source Current per Output Pin, I_O ..... -30mA
DC V_{CC} Current (I_{CC}) ..... N (I_{OH}) + M (ΔI_{CC}) mA
DC Ground Current (I_{GND}) ..... N (I_{OH}) + M (ΔI_{CC}) mA where N = No. of outputs
M = No. of inputs

Power Dissipation per Package (P_D):
For T_A = -55 to +100°C (Package Type E) 500mW
For T_A = +100 to +125°C (Package Type E) ..... Derate Linearly at 8mW/°C to 300mW
For T_A = -55 to +70°C (Package Type M) 400mW
For T_A = +70 to +125°C (Package Type M) ..... Derate Linearly at 6mW/°C to 70mW
Operating Temperature Range (T_A):
Package Type E, M ..... -55 to +125°C
Storage Temperature (T_{STG}) ..... -65 to +150°C
Lead Temperature (During Soldering):
At distance 1/16 ± 1/32 in. (1.59 ± 0.79mm) from case for 10s maximum ..... +265°C
Unit inserted into PC board min. thickness 1/16 in. (1.59mm) with solder contacting lead tips only ..... +300°C

Recommended Operating Conditions:
The following are normal operating ranges for these devices. For maximum reliability, devices should always be operated within these ranges:

Characteristics	Limits		Units
	Min	Max	
Supply-Voltage Range, V_{CC}*:			
T_A = 0 to 70°C	4.75	5.25	V
T_A = -55 to +125°C	4.5	5.5	V
DC Input or Output Voltage V_I, V_O	0	V_{CC}	V
Operating Temperature, T_A	-55°C	+125°C	°C
Input Rise and Fall Slew Rate, dt/dv	0	10	ns/V

*Unless otherwise specified, all voltages are referenced to ground.

Production Selection Guide

Type CD54/74	Function/Description	No. of Pins
	Inverters/Buffers/Bus Drivers	
FCT240	Octal Buffer/Line Driver; 3-State; Inverting	20
FCT241	Octal Buffer/Line Driver; 3-State	20
FCT244	Octal Buffer/Line Driver; 3-State	20
FCT540	Octal Buffer/Line Driver; 3-State; Inverting	20
FCT541	Octal Buffer/Line Driver; 3-State	20
FCT827A	10-Bit Buffer/Line Driver; 3-State	24
FCT828A	10-Bit Buffer/Line Driver; 3-State; Inverting	24
	Flip-Flops/Registers	
FCT273	Octal D-Type Flip-Flop with Reset; Positive-Edge Trigger	20
FCT374	Octal D-Type Flip-Flop; Positive-Edge Trigger; 3-State	20
FCT377	Octal D-Type Flip-Flop; Positive-Edge Trigger with Data Enable	20
FCT534	Octal D-Type Flip-Flop; Positive-Edge Trigger; 3-State; Inverting	20
FCT564	Octal D-Type Flip-Flop; Positive-Edge Trigger; 3-State; Inverting	20
FCT574	Octal D-Type Flip-Flop; Positive-Edge Trigger; 3-State	20
FCT821A	10-Bit D-Type Flip-Flop; Positive-Edge Trigger; 3-State	24
FCT822A	10-Bit D-Type Flip-Flop; Positive-Edge Trigger; 3-State; Inverting	24
FCT823A	9-Bit D-Type Flip-Flop; Positive-Edge Trigger; 3-State	24
FCT824A	9-Bit D-Type Flip-Flop; Positive-Edge Trigger; 3-State; Inverting	24
FCT29520A	Multilevel Pipeline Register	24
FCT29521A	Multilevel Pipeline Register	24

CD54/74FCT Series (Continued)

Production Selection Guide (Continued)

Type CD54/74	Function/Description	No. of Pins
	Bus Transceivers	
FCT245	Octal Bus Transceiver; 3-State	20
FCT543	Octal Register-Transceiver; 3-State	24
FCT544	Octal Register-Transceiver; 3-State; Inverting	24
FCT623	Octal Bus Transceiver; 3-State	20
FCT640	Octal Bus Transceiver; 3-State; Inverting	20
FCT643	Octal Bus Transceiver; 3-State; True/Inverting	20
FCT646	Octal Bus Transceiver/Register; 3-State	24
FCT647	Octal Bus Transceiver/Register with Open Drain	24
FCT648	Octal Bus Transceiver/Register; 3-State; Inverting	24
FCT649	Octal Bus Transceiver/Register with open Drain; Inverting	24
FCT651	Octal Bus Transceiver/Register; 3-State; Inverting	24
FCT652	Octal Bus Transceiver/Register; 3-State	24
FCT653	Octal Bus Transceiver/Register; Open-Drain (A Side); 3-State (B Side); Inverting	24
FCT654	Octal Bus Transceiver/Register; Open-Drain (A SIde); 3-State (B Side)	24
FCT861A	10-Bit Bus Transceiver; 3-State	24
FCT862A	10-Bit Bus Transceiver; 3-State; Inverting	24
FCT863A	9-Bit Bus Transceiver; 3-State	24
FCT864A	9-Bit Bus Transceiver; 3-State; Inverting	24
FCT2952A	Octal Register-Transceiver; 3-State	24
FCT2953A	Octal Register-Transceiver; 3-State; Inverting	24
FCT7623	Octal Bus Transceiver; 3-State (B Side); Open-Drain (A Side)	20
	Latches	
FCT373	Octal Transparent Latch; 3-State	20
FCT533	Octal Transparent Latch; 3-State; Inverting	20
FCT563	Octal Transparent Latch; 3-State; Inverting	20
FCT573	Octal Transparent Latch; 3-State	20
FCT841A	10-Bit Transparent Latch; 3-State	24
FCT842A	10-Bit Transparent Latch; 3-State; Inverting	24
FCT843A	9-Bit Transparent Latch; 3-State	24
FCT844A	9-Bit Transparent Latch; 3-State; Inverting	24

32,768 x 8 - 256K Asynchronous

RAM Type	Supply-Voltage Range V_{SS} to V_{DD}	Operating Temp. Range (T_A)	Electrical Characteristics at V_{DD} = 5 Volts								TTL Input	JEDEC Dual-In-Line Package
			Data Retention		Max. Standby Current	Min. Sink Current	Min. Source Current	Max. Operating Current	Max. Access Time			
			Voltage	Quiescent Current					From Address Change	From Chip Enable		
			Min.	Max.								
	Volts	°C	Volts	µA	µA	mA	mA	mA	ns	ns		No. of Pins
CDM62256-10	4.5 to 5.5	0 to +70	2	50*	100	2.1	-1	70 •	100	100	Yes	28D, 28E
CDM62256-10I	4.5 to 5.5	-40 to +85	2	100*	200	2.1	-1	70 •	100	100	Yes	28D, 28E

* VDD = 3 Volts • Output open-circuited, cycle time = 1µs, except as noted

8192 x 8 - 64K Asynchronous

RAM Type	Supply-Voltage Range V_{SS} to V_{DD}	Operating Temp. Range (T_A)	Electrical Characteristics at V_{DD} = 5 Volts								TTL Input	JEDEC Dual-In-Line Package
			Data Retention		Max. Standby Current	Min. Sink Current	Min. Source Current	Max. Operating Current	Max. Access Time			
			Voltage	Quiescent Current*					From Address Change	From Chip Enable		
			Min.	Max.								
	Volts	°C	Volts	µA	µA	mA	mA	mA	ns	ns		No. Of Pins
HM-65642-8	4.5 to 5.5	-55 to +125	2	150	250	4	-1	20	150	150	Yes	28DK
HM-65642-9	4.5 to 5.5	-55 to +125	2	150	250	4	-1	20	150	150	Yes	28DK
HM-65642B-8	4.5 to 5.5	-55 to +125	2	75	100	4	-1	20	150	150	Yes	28DK
HM-65642B-9	4.5 to 5.5	-40 to +85	2	75	100	4	-1	20	150	150	Yes	28DK
CDM6264-3	4.5 to 5.5	0 to +70	2	50 •	100	2.1	-1	45□	150	150	Yes	28E
CDM6264LE12	4.5 to 5.5	0 to +70	2	10 •	20	4	-1	80□	120	120	Yes	28E

* V_{DD} = Specified data retention voltage, except as noted • V_{DD} = 3 Volts □ Output open-circuited minimum cycle time

2048 x 8 - 16K Synchronous

RAM Type	Supply-Voltage Range V_{SS} to V_{DD}	Operating Temp. Range (T_A)	Electrical Characteristics at V_{DD} = 5 Volts								TTL Input	JEDEC Dual-In-Line Package
			Data Retention		Max. Standby Current	Min. Sink Current	Min. Source Current	Max. Operating Current	Max. Access Time			
			Voltage	Quiescent Current*					From Address Change	From Chip Enable		
			Min.	Max.								
	Volts	°C	Volts	µA	µA	mA	mA	mA	ns	ns		No. of Pins
HM-6516B-8	4.5 to 5.5	-55 to +125	2	25	50	3.2	-1	10	120	120	Yes	24, 5J, 7Z
HM-6516B-9	4.5 to 5.5	-40 to +85	2	25	50	3.2	-1	10	120	120	Yes	24, 5J, 7Z
HM-6516-5	4.5 to 5.5	0 to +70	2	250	500	3.2	-1	10	200	200	Yes	24, 5J, 7Z
HM-6516-8	4.5 to5.5	-55 to +125	2	50	100	3.2	-1	10	200	200	Yes	24, 5J, 7Z
HM-6516-9	4.5 to 5.5	-40 to +85	2	50	100	3.2	-1	10	200	200	Yes	24, 5J, 7Z

* V_{DD} = Specified data retention voltage

2048 x 8 - 16K Asynchronous

RAM Type	Supply-Voltage Range V_{SS} to V_{DD}	Operating Temp. Range (T_A)	Electrical Characteristics at V_{DD} = 5 Volts								TTL Input	JEDEC Dual-In-Line Package
			Data Retention		Max. Standby Current	Min. Sink Current	Min. Source Current	Max. Operating Current	Max. Access Time			
			Voltage	Quiescent Current*					From Address Change	From Chip Enable		
			Min.	Max.								
	Volts	°C	Volts	µA	µA	mA	mA	mA	ns	ns		No. of Pins
HM-651625-9	4.5 to 5.5	-40 to +85	2	40	100	4	-1	70	55	55	Yes	24, 5F, 7Z
HM-65162B-8	4.5 to 5.5	-55 to +125	2	20	50	4	-1	70	70	70	Yes	24, 5F, 7Z
HM-65162B-9	4.5 to 5.5	-40 to +85	2	20	50	4	-1	70	70	70	Yes	24, 5F, 7Z
HM-65162-8	4.5 to 5.5	-55 to +125	2	40	100	4	-1	70	90	90	Yes	24, 5F, 7Z
HM-65162-9	4.5 to 5.5	-40 to +85	2	40	100	4	-1	70	90	90	Yes	24, 5F, 7Z
HM-65162C-8	4.5 to 5.5	-55 to +125	2	300	900	4	-1	70	90	90	Yes	24, 5F, 7Z
HM-65162C-9	4.5 to 5.5	-40 to +85	2	300	900	4	-1	70	90	90	Yes	24, 5F, 7Z
CDM6116A-2	4.5 to 5.5	0 to +70	2	15 •	30	2.1	-1	35□	200	200	Yes	24E
CDM6116A-3	4.5 to 5.5	0 to +70	2	25 •	50	2.1	-1	35□	150	150	Yes	24E
CDM6116A-9	4.5 to 5.5	-40 to +85	2	50 •	100	2.1	-1	40□	250	250	Yes	24E, 24D

* V_{DD} = Specified data retention voltage, except as noted
• V_{DD} = 3 Volts
□ Output open-circuited minimum cycle time

16,384 x 1 - 16K Asynchronous

RAM Type	Supply-Voltage Range V_{SS} to V_{DD}	Operating Temp. Range (T_A)	Electrical Characteristics at V_{DD} = 5 Volts								TTL Input	JEDEC Dual-In-Line Package
			Data Retention		Max. Standby Current	Min. Sink Current	Min. Source Current	Max. Operating Current	Max. Access Time			
			Voltage	Quiescent Current*					From Address Change	From Chip Enable		
			Min.	Max.								
	Volts	°C	Volts	µA	µA	mA	mA	mA	ns	ns		No. of Pins
HM-65262S-9	4.5 to 5.5	-40 to +85	2	20	50	8	-4	50	55	55	Yes	24, CL, 7F
HM-65262B-8	4.5 to 5.5	-55 to +125	2	20	50	8	-4	50	70	70	Yes	24, CL, 7F
HM-65262B-9	4.5 to 5.5	-40 to +85	2	20	50	8	-4	50	70	70	Yes	24, CL, 7F
HM-65262-8	4.5 to 5.5	-55 to +125	2	30	50	8	-4	50	85	85	Yes	24, CL, 7F
HM-65262-9	4.5 to 5.5	-40 to +85	2	20	50	8	-4	50	85	85	Yes	24, CL, 7F

* V_{DD} = Specified data retention voltage

4096 x 1 - 4K Synchronous

RAM Type	Supply-Voltage Range V_{SS} to V_{DD}	Operating Temp. Range (T_A)	Electrical Characteristics at V_{DD} = 5 Volts									JEDEC Dual-In-Line Package
			Data Retention		Max. Standby Current	Min. Sink Current	Min. Source Current	Max. Operating Current	Max. Access Time		TTL Input	
			Voltage	Quiescent Current*					From Address Change	From Chip Enable		
			Min.	Max.								
	Volts	°C	Volts	µA	µA	mA	mA	mA	ns	ns		No. of Pins
HM-65045-8	4.5 to 5.5	-55 to +125	2	25	50	2	-1	7	120	120	Yes	18, 5E, 7D, LB
HM-65045-9	4.5 to 5.5	-40 to +85	2	15	25	2	-1	7	120	120	Yes	18, 5E, 7D, LB
HM-6504B-8	4.5 to 5.5	-55 to +125	2	25	50	2	-1	7	220	200	Yes	18, 5E, 7D, LB
HM-6504B-9	4.5 to 5.5	-40 to +85	2	15	25	2	-1	7	220	200	Yes	18, 5E, 7D, LB
HM-6504-8	4.5 to 5.5	-55 to +125	2	25	50	2	-1	7	320	300	Yes	18, 5E, 7D, LB
HM-6504-9	4.5 to 5.5	-40 to +85	2	15	25	2	-1	7	320	300	Yes	18, 5E, 7D, LB

* V_{DD} = Specified data retention voltage

1024 x 4 - 4K Synchronous

RAM Type	Supply-Voltage Range V_{SS} to V_{DD}	Operating Temp. Range (T_A)	Electrical Characteristics at V_{DD} = 5 Volts									JEDEC Dual-In-Line Package
			Data Retention		Max. Standby Current	Min. Sink Current	Min. Source Current	Max. Operating Current	Max. Access Time		TTL Input	
			Voltage	Quiescent Current*					From Address Change	From Chip Enable		
			Min.	Max.								
	Volts	°C	Volts	µA	µA	mA	mA	mA	ns	ns		No. of Pins
HM-6514S-8	4.5 to 5.5	-55 to +125	2	25	50	2	-1	7	120	120	Yes	18, 5E, 7D, LB
HM-6514S-9	4.5 to 5.5	-40 to +85	2	15	25	2	-1	7	120	120	Yes	18, 5E, 7D, LB
HM-6514B-8	4.5 to 5.5	-55 to +125	2	25	50	2	-1	7	220	200	Yes	18, 5E, 7D, LB
HM-6514B-9	4.5 to 5.5	-40 to +85	2	15	25	2	-1	7	220	200	Yes	18, 5E, 7D, LB
HM-6514-8	4.5 to 5.5	-55 to +125	2	25	50	2	-1	7	320	300	Yes	18, 5E, 7D, LB
HM-6514-9	4.5 to 5.5	-40 to +85	2	15	25	2	-1	7	320	300	Yes	18, 5E, 7D, LB

* V_{DD} = Specified data retention voltage

1024 x 4 - 4K Asynchronous

RAM Type	Supply-Voltage Range V_{SS} to V_{DD}	Operating Temp. Range (T_A)	Electrical Characteristics at V_{DD} = 5 Volts								TTL Input	JEDEC Dual-In-Line Package
			Data Retention		Max. Standby Current	Min. Sink Current	Min. Source Current	Max. Operating Current*	Max. Access Time			
			Voltage	Quiescent Current*					From Address Change	From Chip Enable		
			Min.	Max.								
	Volts	°C	Volts	µA	µA	mA	mA	mA	ns	ns		No. of Pins
MWS5114-1	4.5 to 6.5	0 to +70	2	125	250	2	-0.4	8	300	-	Yes	18D, 18E
MWS5114-2	4.5 to 6.5	0 to +70	2	50	100	2	-0.4	8	250	-	Yes	18D, 18E
MWS5114-3	4.5 to 6.5	0 to +70	2	50	100	2	-0.4	8	200	-	Yes	18D, 18E

* V_{DD} = Specified data retention voltage
• Output open-circuited, cycle time = 1µs, except as noted

1024 x 1 - 1K Synchronous

RAM Type	Supply-Voltage Range V_{SS} to V_{DD}	Operating Temp. Range (T_A)	Electrical Characteristics at V_{DD} = 5 Volts								TTL Input	JEDEC Dual-In-Line Package
			Data Retention		Max. Standby Current	Min. Sink Current	Min. Source Current	Max. Operating Current	Max. Access Time			
			Voltage	Quiescent Current*					From Address Change	From Chip Enable		
			Min.	Max.								
	Volts	°C	Volts	µA	µA	mA	mA	mA	ns	ns		No. of Pins
HM-6508B-8	4.5 to 5.5	-55 to +125	2	5	10	3.2	-0.4	4	180	180	Yes	16, 5C, 7I
HM-6508B-9	4.5 to 5.5	-40 to +85	2	5	10	3.2	-0.4	4	180	180	Yes	16, 5C, 7I
HM-6508-8	4.5 to 5.5	-55 to +125	2	10	10	3.2	-0.4	4	250	250	Yes	16, 5C, 7I
HM-6508-9	4.5 to 5.5	-40 to +85	2	10	10	3.2	-0.4	4	250	250	Yes	16, 5C, 7I
HM-6508-5	4.5 to 5.5	0 to +70	2	100	100	1.6	-0.2	4	310	300	Yes	16, 5C, 7I
HM-6518B-8	4.5 to 5.5	-55 to +125	2	5	10	3.2	-0.4	4	180	180	Yes	18
HM-6518B-9	4.5 to 5.5	-40 to +85	2	5	10	3.2	-0.4	4	180	180	Yes	18
HM-6518-8	4.5 to 5.5	-55 to +125	2	10	10	3.2	-0.4	4	250	250	Yes	18
HM-6518-9	4.5 to 5.5	-40 to +85	2	10	10	3.2	-0.4	4	250	250	Yes	18
HM-5418-5	4.5 to 5.5	0 to +70	2	100	100	1.6	-0.2	4	310	300	Yes	18

* V_{DD} = Specified data retention voltage

256 x 4 - 1K Synchronous

RAM Type	Supply-Voltage Range V_{SS} to V_{DD}	Operating Temp. Range (T_A)	Electrical Characteristics at V_{DD} = 5 Volts								TTL Input	JEDEC Dual-In-Line Package
			Data Retention		Max. Standby Current	Min. Sink Current	Min. Source Current	Max. Operating Current	Max. Access Time			
			Voltage	Quiescent Current*					From Address Change	From Chip Enable		
			Min.	Max.								
	Volts	°C	Volts	µA	µA	mA	mA	mA	ns	ns		No. of Pins
HM-6551B-8	4.5 to 5.5	-55 to +125	2	10	10	1.6	-0.4	4	220	220	Yes	22, 4M, FK
HM-6551B-9	4.5 to 5.5	-40 to +85	2	10	10	1.6	-0.4	4	220	220	Yes	22, 4M, FK
HM-6551-8	4.5 to 5.5	-55 to +125	2	10	10	1.6	-0.4	4	300	300	Yes	22, 4M, FK
HM-6551-9	4.5 to 5.5	-40 to +85	2	10	10	1.6	-0.4	4	300	300	Yes	22, 4M, FK
HM-6551-5	4.5 to 5.5	0 to +70	2	100	100	1.6	-0.2	4	360	350	Yes	22, 4M, FK
HM-6561B-8	4.5 to 5.5	-55 to +125	2	10	10	1.6	-0.4	4	220	220	Yes	18, 4N, 7D
HM-6561B-9	4.5 to 5.5	-40 to +85	2	10	10	1.6	-0.4	4	220	220	Yes	18, 4N, 7D
HM-6561-8	4.5 to 5.5	-55 to +125	2	10	10	1.6	-0.4	4	300	300	Yes	18, 4N, 7D
HM-6561-9	4.5 to 5.5	-40 to +85	2	10	10	1.6	-0.4	4	300	300	Yes	18, 4N, 7D
HM-6561-5	4.5 to 5.5	0 to +70	2	100	100	1.6	-0.2	4	360	350	Yes	18, 4N, 7D

* V_{DD} = Specified data retention voltage

256 X 4 - 1K Asynchronous

RAM Type	Supply-Voltage Range V_{SS} to V_{DD}	Operating Temp. Range (T_A)	Electrical Characteristics at V_{DD} = 5 Volts								TTL Input	JEDEC Dual-In-Line Package
			Data Retention		Max. Standby Current	Min. Sink Current	Min. Source Current	Max. Operating Current□	Max. Access Time			
			Voltage	Quiescent Current•					From Address Change	From Chip Enable		
			Min.	Max.								
	Volts	°C	Volts	µA	µA	mA	mA	mA	ns	ns		No. of Pins
CDP1822*	4.0 to 10.5	-40 to +85	2	100	500	2	-1	8	450	450	No	22D, 22E
MWS5101-L2	4.0 to 6.5	0 to +70	2	10	50	2	-1	8	250	250	No	22D, 22E
MWS5101-L3	4.0 to 6.5	0 to +70	2	50	200	2	-1	8	350	350	No	22D, 22E
MWS5101A-L2	4.0 to 6.5	0 to +70	2	10	50	2	-1	8	250	250	Yes	22D, 22E
MWS5101A-L3	4.0 to 6.5	0 to +70	2	50	200	2	-1	8	350	350	Yes	22D, 22E

* Data available for V_{DD} = 10 Volts
• V_{DD} = Specified data retention voltage
□ Output open-circuited, cycle time = 1 µs

128 x 8 - 1K Asynchronous

RAM Type	Supply-Voltage Range V_{SS} to V_{DD}	Operating Temp. Range (T_A)	Electrical Characteristics at V_{DD} = 5 Volts								TTL Input	JEDEC Dual-In-Line Package
			Data Retention		Max. Standby Current	Min. Sink Current	Min. Source Current	Max. Operating Current□	Max. Access Time			
			Voltage	Quiescent Current•.					From Address Change	From Chip Enable		
			Min.	Max.								
	Volts	°C	Volts	µA	µA	mA	mA	mA	ns	ns		No. of Pins
CDP1823*	4.0 to 10.5	-40 to +85	2	100	500	2	-1	8	450	250	No	24D, 24E

* Data available for V_{DD} = 10 Volts
• V_{DD} = Specified data retention voltage
□ Output open-circuited, cycle time = 1µs

64 x 8 - 512 Byte Asynchronous

RAM Type	Supply-Voltage Range V_{SS} to V_{DD}	Operating Temp. Range (T_A)	Electrical Characteristics at V_{DD} = 5 Volts								TTL Input	JEDEC Dual-In-Line Package
			Data Retention		Max. Standby Current	Min. Sink Current	Min. Source Current	Max. Operating Current•	Max. Access Time			
			Voltage	Quiescent Current*					From Address Change	From Chip Enable		
			Min.	Max.								
	Volts	°C	Volts	µA	µA	mA	mA	mA	ns	ns		No. of Pins
CDP1826C	4.0 to 6.5	-40 to +85	2.5	25	50	1.6	-1	10	700	700	No	22D, 22E

* V_{DD} = Specified data retention voltage
• Output open-circuited, cycle time = µs

32 x 8 - 256 Byte Asynchronous

RAM Type	Supply-Voltage Range V_{SS} to V_{DD}	Operating Temp. Range (T_A)	Electrical Characteristics at V_{DD} = 5 Volts								TTL Input	JEDEC Dual-In-Line Package
			Data Retention		Max. Standby Current	Min. Sink Current	Min. Source Current	Max. Operating Current□	Max. Access Time			
			Voltage	Quiescent Current•					From Address Change	From Chip Enable		
			Min.	Max.								
	Volts	°C	Volts	µA	µA	mA	mA	mA	ns	ns		No. of Pins
CDP1824*	4.0 to 10.5	-40 to +85	2.5	10	50	1.8	-0.9	8	710	710	No	18D, 18E

* Data available for V_{DD} = 10 Volts
• V_{DD} = Specified data retention voltage
□ Output open-circuited, cycle time = 1µs

LCC RAM Module - 8K x 8 - 64K Asynchronous

Type	Features	Access Time	Power Supply Current		Replaces Pin for Pin	Module Substrate No. of Pins
			Operating	Standby		
HM-8808AS	• Full CMOS Design	100ns	70mA	250µA	EDH8808A	28, MJ
HM-8808AB	• 6-Transistor Memory Cell	120ns	70mA	250µA	IDT7M864	
HM-8808A	• Low Voltage Data Retention 2.0V	150ns	70mA	900µA	HM6264	
	• CMOS/TTL-Compatible Inputs/Outputs					
HM-8808S	• JEDEC Approved Pinout	100ns	70mA	250µA	EDH8808	
HM-8808B	• Equal Cycle and Access Time	120ns	70mA	250µA	IDT8M864	
HM-8808A	• No Clocks or Stobes Required	150ns	70mA	900µA		
	• Single 5-Volt Supply					
	• Gated Inputs - No Pull-Up or Pull-Down Resistors Required					
	• Wide Temperature Range 55°C to +125°C					
	• Easy Microprocessor Interfacing					
	• Dual Chip Enable Control (HM-8808A)					

LCC RAM Module - 16K x 8 - 128K Asynchronous

Type	Features	Access Time	Power Supply Current		Replaces Pin for Pin	Module Substrate No. of Pins
			Operating	Standby		
HM-8816H	• Low Data-Retention Supply voltage 2.0V	85ns	400mA	800µA	-	28, MK
HM-8816HB	• Wide Operating Temp. Range -55°C to +125°C	70ns	400mA	800µA	-	
	• CMOS/TTL-Compatible Inputs/Outputs					
	• JEDEC Approved Pinout					
	• Full CMOS - Six Transistor RAM Cells					
	• No Clocks or Strobes Required					
	• Single 5V Power Supply					
	• Standard DIP Size - 0.6" x 1.5"					
	• Easy Microprocessor Interfacing					
	• Gated Inputs					

LCC RAM Module - 32K x 8 - 256K Asynchronous

Type	Features	Access Time	Power Supply Current		Replaces Pin for Pin	Module Substrate No. of Pins
			Operating	Standby		
HM-8832	• Full CMOS Six-Transistor Memory Cell	180ns	20mA	900µA	EDH8832	28, MJ
	• Low Data-Retention Supply Voltage 2.0V				IDT7M856	
	• CMOS/TTL-Compatible Inputs/Outputs				HM62256	
	• JEDEC approved Pinout				MSM5256	
	• Equal Cycle and Access Times				µPD43256	
	• No clocks or Strobes Required				TC55256	
	• Single 5V Power Supply					
	• Easy Microprocessor Interfacing					
	• Wide operating-temperature ranges: ▸ HM-8832-9 -40°C to +85°C ▸ HM-8832-8 -55°C to +125°C					
	• Standard DIP Size - 0.6" x 1.4"					

LCC RAM Modules - 16384 x 16 / 32768 x 8 - 256K Synchronous

Type	Features	Access Time	Power Supply Current		Replaces Pin for Pin	Module Substrate No. of Pins
			Operating	Standby		
HM-92560-8 HM-92560-9	• Data Retention 2.0V Min V_{CC} • Three-State Outputs	150ns	30/15mA	500µA	-	48, MD
HM-92560-5	• Organizable as 32K x 8 or 16K x 16 Array • On-Chip Address Registers • 48-Pin DIP Pinout - 2.66″ x 1.30″ x 0.29″ • Synchronous Operation Yields Low Operating Power 30mA/MHz • Wide Operating-Temperature Ranges: ▸ HM-92560-5 0°C to +70°C ▸ HM-92560-9 -40°C to +85°C ▸ HM-92560-8 -55°C to +125°C	250ns	35/20mA	3.5mA	-	

LCC Buffered RAM Module - 16384 x 16 / 32768 x 8 - 256K Synchronous

Type	Features	Access Time	Power Supply Current		Replaces Pin for Pin	Module Substrate No. of Pins
			Operating	Standby		
HM-92570-8 HM-92570-9	• Data Retention 2.0V • Three-State Outputs	250ns	30/15mA	600µA	EDH892570	48, MG
HM-92570-5	• Organizable as 32K x 8 or 16K x 16 Array • Buffered Address and Control Lines • On-Chip Address Registers • 48-Pin DIP Pinout - 2.66″ x 1.30″ x 0.29″ • Wide Operating-Temperature Ranges: ▸ HM-92570-5 0°C to +70°C ▸ HM-92570-9 -40°C to +85°C ▸ HM-92570-8 -55°C to +125°C	300ns	35/20mA	3.5mA		

LCC Buffered RAM Module - 65536 x 16 / 131072 x 8 - 1M Asynchronous

Type	Features	Access Time	Power Supply Current		Replaces Pin for Pin	Module Substrate No. of Pins
			Operating	Standby		
HM-91M2	• Low Data-Retention Supply Voltage 2.0V • CMOS/TTL-Compatible Inputs/Outputs • Buffered Address and Control Lines • 48-Pin DIP Pinout - 2.66″ x 1.3″ x 0.3″ • Wide Operating-Temperature Ranges: ▸ HM-91M2-9 -40°C to +85°C ▸ HM-91M2-8 -55°C to +125°C	180ns	20mA	750mA	EDH891M2	48, MG

CMOS Static RAM Modules

LCC RAM Module - 16384 x 4 / 8192 x 8 - 64K Synchronous

Type	Features	Access Time	Power Supply Current		Replaces Pin for Pin	Module Substrate No. of Pins
			Operating	Standby		
HM5-6564	• Low Power Standby 4mW Maximum	350ns	56/28mA	800µA	-	40, MA
HM5-6564-5	• Low Power Operation 280mW/MHz Maximum • Data Retention 2.0V Minimum • TTL-Compatible In/Out • Three-State Outputs • Fast Access Time 350ns Maximum • Wide Operating-Temperature Ranges: ▸ HM-6564-5 0°C to +70°C ▸ HM-6564-9 -40°C to +85°C ▸ HM-6564-2/-8 -55°C to +125°C • On-Chip Address Registers • Organizable 8K x 8 or 16K x 4 • 40-Pin DIP Pinout - 2.000" x 0.900"	450ns	60/30mA	5.6mA	-	

CMOS PROMs - 4K and 16K

512 x 8 - 4K Synchronous

Type	Features	Fuse Element	Access Time	Power Supply Current		Replaces Pin for Pin	Package No. of Pins
				Operating	Standby		
HM-6642B	• TTL-Compatible In/Out • Popular Pinout Like Bipolar 7641 • Three-State Outputs	NiCr	120ns	20mA/MHz	100µA	Harris 6641 Similar to: Harris 7641	24 5J, DC
HM-6642	• Address Latches Included On-Chip • Easy Microprocessor Interfacing • Wide Operating Temperature Ranges: ▸ HM-6642-9 -40°C to +85°C ▸ HM-6642-8 -55°C to +125°C	NiCr	200ns	20mA/MHz	100µA	Signetics 82S141	

2048 x 8 - 16K Synchronous

Type	Features	Fuse Element	Access Time	Power Supply Current		Replaces Pin for Pin	Package No. of Pins
				Operating	Standby		
HM-6617B	• Industry-Standard Pinout • Single 5.0V Supply • TTL-Compatible Inputs • High Output Drive 12 LSTTL Loads	NiCr	90ns	20mA/MHz	100µA	Harris 6616 Similar to: NMOS 2716 National 27C16	24 5J, DC
HM-6617	• Synchronous Operation • On-Chip Address Latches • Separate Output Enable • Wide Operating-Temperature Range: ▸ HM-6617-9 -40°C to +85°C ▸ HM-6617-8 -55°C to +125°C	NiCr	120ns	20mA/MHz	100µA	National 6716	

D/A Converters

Harris supplies digital-to-analog converters (D/A converters) with 8-bit, 10-bit, 12-bit, 14-bit and 16-bit resolution. All are four-quadrant multiplying D/A converters using thin-film resistors and CMOS circuitry for high accuracy and low power dissipation. All are microcomputer compatible, with input protection against damage from electrostatic discharge.

CMOS D/A Converters

Type	Res. (Bits)	Settling Time to ½ LSB	Integral Non-Linearity (± %FSR : LSB)	Diff. Non-Linearity (± LSB)	Gain Error (±%FSR)	Output I/V	Input Buffer	Power Supply (V)	Temp. Range (°C)	Comment
AD7523	8	200ns max.	0.2 : ½ 0.1 : ¼ 0.05 : ⅛	Guaranteed monotonic	1.8 max.	I	No	5 to 16	0 to +70 -55 to +125	Multiplying DAC Industry standard
CA3338 CA3338A	8	20ns	0.4 : 1 0.3 : ¾	¾ ½		V	Yes	5	-40 to +85 -55 to +125	Video applications Low glitch
AD7520 AD7530	10	500ns	0.2 : 2 0.1 : 1 0.05 : ½		0.3	I	No	5 to 16	0 to +70 -25 to +85 -55 to +125	Multiplying DAC Industry standard
AD7533	10	800ns max.	0.2 : 2 0.1 : 1 0.05 : ½		1.5 max	I	No	5 to 16	0 to +70	Multiplying DAC Industry standard Low cost
AD7521 AD7531	12	500ns	0.2 : 8 0.1 : 4 0.05 : 2		0.3	I	No	5 to 16	0 to +70 -25 to +85 -55 to +125	Multiplying DAC Industry standard
AD7541	12	1µs max.	0.024 : 1 0.012 : ½ 0.012 : ½	 >½	0.4 max.	I	No	5 to 16	0 to +70 -25 to +85 -55 to +125	Multiplying DAC High performance Industry standard
AD7545	12	2µs max.	0.05 : 2 0.024 : 1 0.012 : ½	4 1 1	0.6 0.4 0.2	I	Yes	5 to 15	0 to +70 -40 to +85 -55 to +125	Mulitplying DAC Industry standard
ICL7134	14	1µs	0.012 : 3/2 0.006 : 1 0.003 : ½	12 Bit 13 mono- 14 tonic	0.024 0.012 0.006	I	Yes double	3.5 to 6.0	0 to +70 -25 to +85 -55 to +125	On-chip PROM Controlled Correction DAC
ICL7121	16	3µs max.	0.009 : 6 0.006 : 4 0.003 : 2 (1 LSB typ.)	14 Bit 15 mono- 16 tonic	0.04 0.02 0.01	I	Yes	4.5 to 5.5	0 to +70 -55 to +125	On-chip PROM Controlled Correction DAC

Bipolar D/A Converters

Type	Res. (Bits)	Settling Time to ½ LSB	Integral Non-Linearity (± %FSR : LSB)	Diff. Non-Linearity (± LSB)	Gain Error (±%FSR)	Output I/V	Input Buffer	Power Supply (V)	Temp. Range (°C)	Comment
ICL8018A ICL8019A ICL8020A	4	200ns (12 bits)	0.01 Maximum absolute error at any 0.1 Input Code 1			I	No	+5 -15	0 to +70 -55 to +125	4-bit expandable current-switch
HI-562A	12	300ns	0.012 : ½	½	0.024	I	No	+5 -15	0 to +75 -25 to +85 -55 to +125	Industry standard
HI565A	12	350ns	0.012 : ½	¾	0.1	I	No	±12	0 to +75 -55 to +125	On-chip +10V reference
HI-DAC80V	12	1.5µs	0.012 : ½	¾	0.3 max.	V	No	±15	0 to +75	On-chip reference and output op-amp
HI-DAC85V	12	1.5µs	0.012 : ½	½	0.15 max.	V	No	±15	-25 to +85	On-chip reference and output op-amp
HI-DAC87V /883	12	2.0µs	0.018 : ¾	1	0.45 max.	V	No	±15	-55 to +125	On-chip reference and output op-amp Mil. temp. range
HI-DAC16B HI-DAC16C	16	1µs (14 bits)	0.002 : 3/2 0.0045 : 3 (typ.)	1 2 (typ.)	0.1	I	No	±15	0 to +75	High temperature stability

A/D Converters

Type	Resolution (Bits)	Clock Rate (MHz)	Conversion Time (μs)	Power Dissipation Typ. (mW)	Integral Linearity (LSB)	Diff. Linearity (LSB)	Package Number of Pins*
CMOS/SOS Parallel (Flash) Types							
CA3304	4	20	-	30	¼	¼	16 E, D
CA3304A	4	25	-	35	⅛	⅛	16 E, D
CA3306C	6	10	-	55	½	½	18 E, D
CA3306	6	15	-	70	½	½	18 E
CA3306A	6	15	-	70	¼	¼	18 D
CA3318C	8	15	-	150	1.5	+1/-0.8	24 E, D
	Has input bandwidth restriction of 2.5MHz.						
CA3310	10	-	13	-	-	-	-
	½, 1 LSB max. linearity TTL, 3-state output 8mA fm ±5V. Temperature ranges: -40 to +85°C, -55 to +125°C						
HI-7151	10	-	10	150	½	½	28
	TTL, 3-state output						
HI-7152	10	-	5	150	½	½	28
	45mA fm ±5V. Temperature ranges: 0 to +70°C, -40 to +85°C, -55 to +125°C						
I^2L Integrating Types							
CA3162	3 Digits	-	10 (ms)	60	1 (Count)	NMC	16 E
	Part of 2-chip set. To make complete DPM, add CA3161 and 3 PNP transistors.						
CA3162A	3 Digits	-	10 (ms)	60	1 (Count)	NMC	16 E
	-40 to +85°C specified version of CA3162.						

NOTES: 1. A+ 5V supply voltage for all types.
2. Power dissipation is at given sampling rate, at given supply voltage, and does not include reference current.
3. All converters operate from single supply. Specifications are limit values unless noted as typical.
4. All flash and successive approximation A/D converters have three-state CMOS bus driver outputs.
5. Unless noted, all flash and successive approximation A/D converters will accept Nyquist rate input bandwidths.

NMC = No missing codes *See Packaging Section

Type	Special Features	Digital Output Format	Input Voltage Range	V_{SUPPLY} / I_{SUPPLY}	Roll Over Error	Package Number of Pins*
4½ Digit						
ICL7135	Under & over range outputs, polarity output	Multiplexed BCD strobes	0 to ±0.2V 0 to ±2V	±5V (typ.) 3mA (max.)	±1 Count	JI, PI
12-Bit						
ICL7109**	Run/hold input, UART handshake. ±12-bit resolution, 1 LSB max. linearity, TTL, 3-state output, 130ms conversion time. Temp. ranges: 0 to +70°C, -25 to +85°C, -55 to +125°C	8/4 bits, separate enables	0 to ±4V 0 to ±3.5V	±5V (typ.) 3mA (max.)	±1 Count	DL, JL, PL
14-Bit						
ICL7104-14 ICL8052	2-chip set, low input leakage, 30pA max. Typical noise (30μV). ±16-bit resolution, 1 LSB max. linearity, TTL, 3-state output, 300ns conversion time. Temp. range: 0 to +70°C	8/6 bits, separate enables	±10V	+5V and ±15V (typ.) 14mA from ±5V	+1 LSB	DL, JL, PL DD, PD
ICL7104-14 ICL8068	2-chip set, low input noise. 2μV typical	8/6 bits, separate enables	±10V	+5V and ±15V (typ.) 1mA (max.)	+1 LSB	DL, JL, PL JD
16-Bit						
ICL7104-16 ICL8052	2-chip set, low input leakage, 30pA max.	8/8 bits, separate enables	±10V	+5V and ±15V (typ.) 1mA (max.)	+1 LSB	DL, JL, PL DD, PD
ICL7104-16 ICL8068	2-chip set, low input noise. 2μV typical.	8/8 bits, separate enables	±10V	+5V and ±15V (typ.) 1mA (max.)	1 LSB	DL, JL, PL JD

Operating temperature range (T_A): 0 to +70°C * See Packaging Section **Operating temperature range also -25 to +85°C, -55 to +125°C

Successive-Approximation Types

Type	Special Features	Digital Output Format	Conversion Speed (μs)	V_{SUPPLY} / I_{SUPPLY}	Operating Temperature Range (T_A) (°C)	Package Number of Pins*
8-Bit						
ADC0802	Differential inputs	8-bit binary	114 (max.)	+5V (typ.) 2.5mA (max.)	0 to +70, -40 to +85 -55 to +125	LCN, LCD, LD
ADC0803	Differential inputs	8-bit binary	114 (max.)	+5V (typ.) 2.5mA (max.)	0 to +70, -40 to +85 -55 to +125	LCN, LCD, LD
ADC0804	Differential inputs, 8-bit resolution, max. linearity ½ LSB, TTL, 3-state output	8-bit binary	114 (max.)	+5V (typ.) 2.5mA (max.)	0 to +70, -40 to +85 -55 to +125	LCN, LCD
For operation with 8080A or 280μP control bus: ADC0802 Total unadjusted error: ±½ LSB. ADC0803 Total full-scale adjusted error: ±½ LSB. ADC0804 Total unadjusted error: ±1 LSB.						
12-Bit						
ICL7112 J/K/L	High-speed, 12-bit resolution, ½, 1 LSB max. linearity, TTL, 3-state output	8/16 bits	40 (max.)	+5V (typ.) 2mA (typ.)	0 to +70, -25 to +75 -55 to +125	CDL, IDL, MDL
14-Bit						
ICL7115 J/K/L	High-speed, 14-bit resolution, 2, 3 LSB max. linearity, TTL, 3-state output	8/16 bits	40 (max.)	+5V (typ.) 8mA (typ.)	0 to +70, -25 to +85 -55 to +125	CDL, IDL, MDL

NOTE: Input voltage range = 0 to -5 volts. For ICL7115 also 0 to -5 volts.

*See Packaging Section

Microprocessor Compatible

12-Bit A/D Converters with µP Interface

Type	Features	Res. Bits	Temperature Range (°C)	Linearity Error Max, +25°C (LSB)	+25°C Differential Nonlinearity Max No Missing Codes	Gain Drift ppm/°C, Max Full Temp	Conversion Speed (µs) Max Over Temperature	
							12 Bits	8 Bits
HI-574AJD-5	• Complete with reference and clock • 150ns bus access time • 20µs typ. conversion time (full temp. range) • ±12V to ±15V operation • No missing codes over temperature • Minimal set-up time for control signals • Byte enable/short cycle (A_0 input) • Improved alternate source for the AD574A & HS574 • Available in 28-pin ceramic, DIP and leadless chip carrier	12	0 to +75	±1	11 bits	±45	25	17
HI-574AKD-5		12	0 to +75	±½	12 bits	±25	25	17
HI-574ALD-5		12	0 to +75	±½	12 bits	±10	25	17
HI-574ASD-2		12	-55 to +125	±1	11 bits	±50	25	17
HI-574ASD/883		12	-55 to +125	±1	11 bits	±50	25	17
HI-574ATD-2		12	-55 to +125	±½	12 bits	±25	25	17
HI-574ATD/883		12	-55 to +125	±½	12 bits	±25	25	17
HI-674AJD-5	• Complete with reference and clock • Fast conversion: 12µs typ., 15µs max. for 12 bits • Selectable 8 or 12 line bus interface to microprocessor • 150ns bus access time • Same pinout and functions as the HI-574A and AD574A • No missing codes over temperature • Available in 28-pin ceramic, DIP and leadless chip carrier	12	0 to +75	±1	11 bits	±45	15	10
HI-674AKD-5		12	0 to +75	±½	12 bits	±25	15	10
HI-674ALD-5		12	0 to +75	±½	12 bits	±10	15	10
HI-674ASD-2		12	-55 to +125	±1	11 bits	±50	15	10
HI-674ASD/883		12	-55 to +125	±1	11 bits	±50	15	10
HI-674ATD-2		12	-55 to +125	±½	12 bits	±25	15	10
HI-674ATD/883		12	-55 to +125	±½	12 bits	±25	15	10
HI1-774J-5	• Complete with reference and clock • 9µs (max.) conversion time over commercial temperature • 150ns bus access time • Superior alternate source to the AD574A, HS574 and HI574A • No missing codes over temperature • Full 8, 12 or 16-bit µP interface • Error correction • Available in 28-pin DIP	12	0 to +75	±1	11 bits	±9	9	6.8
HI1-774AK-5		12	0 to +75	±½	12 bits	±5	9	6.8
HI1-774S-2		12	-55 to +125	±1	11 bits	±20	11	8.3
HI1-774T-2		12	-55 to +125	±½	12 bits	±10	11	8.3
HI1-774S/883		12	-55 to +125	±1	10 bits	±50	11	8.5
HI1-774T/883		12	-55 to +125	±½	11 bits	±25	11	8.5

A/D Converters with Display Drivers

Integrating A/D Converters are characterized by high inherent accuracy, excellent noise rejection, non-critical associated components and low cost. They are relatively slow, with conversion rates up to 30 conversions per second. All Harris integrating converters provide fully precise Auto-Zero, Auto-Polarity (including ± null indication), single reference operation, very high input impedance, true input integration over a constant period (for maximum EMI rejection), fully ratiometric operation, overrance indication and a medium-quality built-in reference.

Type	Special Features	Conversions/ Sec	V_{SUPPLY}/ I_{SUPPLY}	Package Number of Pins*
3½-Digit Types for direct Drive of LCD 7-Segment Displays				
ICL7106	• Auto zero to <10µV • Zero input drift: <1µV/°C • Rollover and linearity errors: <1 count • Input voltage range: 0 to 2V • Hold reading input retains display reading in ICL7116	0.1 to 15	+9V (typ.) 1.8mA (max.)	JL, M44, PL
ICL7116		0.1 to 15	+9V (typ.) 1.8mA (max.)	PL, M44
ICL7126	• ICL7126 plug-in replacement for ICL7106 with change in passive components • ICL7136 low-power version of ICL7106 but with max. supply current of only 100µA ideally suited for 9-volt battery operation	0.1 to 4	+9V (typ.) 100µA (max.)	PL, M44
ICL7136		0.1 to 4	+9V (typ.) 100µA (max.)	PL, M44
3½-Digit Types for Direct Drive of LED 7-Segment Displays				
ICL7137	• Features same as above • ICL7137 improved version of ICL7107 • ICL7107 similar to ICL7137, but requires 1.8mA max. supply current • ICL7117 has all the features of the ICL7107 with the addition of a HOLD Reading Input	0.1 to 4	±5V (typ.) 200µA (max.)	PL
ICL7107		0.1 to 15	±5V (typ.) 1.8mA (max.)	IL, PL
ICL7117		0.1 to 15	±5V (typ.) 1.8mA (max.)	PL
3¾-Digit Auto Ranging DMM's with On-Chip Duplex LCD Display Drive				
ICL7139	• Input voltage range to 400 volts • DC current to 4A; resistance to 4MΩ • Power dissipation <20mW • ICL7139 has 13 ranges (one for AC voltage) • ICL7149 has 18 ranges (two for AC voltage with optional AC circuit)	2.4	+9V (typ.) 2.4mA (max.)	PL, M44
ICL7149		2.4	+9V 2.4mA (max.)	PL, M44
4½-Digit Single-Chip Type for Direct Drive of Multiplexed LCD Displays				
ICL7129	• For high-quality battery-operated equipment • Accuracy full-scale/better than 0.005%, and resolution down to 10µV/count	2	+9V (typ.) 1.5mA (max.)	PL
101-Segment LCD Bargraph for Direct Drive of Multiplexed LCD Displays				
ICL7182	• Differential input voltage range: 200mV to 1.1V • Precision on-chip reference: 50 ppm/°C, can extend operating supply voltage range from 3 to 40V	25	+5V (typ.) 1.8mA (max.)	PL, M44

Operating Temperature Range: 0 to +70°C (ICL7182 also -25 to +85°C)

*See Packaging Section

Display Drivers and Interface ICs

Type	Features and Comments	# Of Characters Or Digits						Display Type						Font			Interface				
		# of 7-Segment Digits	# of Decimal Points or Annunciators	# of Alphanumeric 14 Segments + D.P.	# of Alphanumeric 16 Segments + D.P.	# of Alphanumeric 18 Segments	# of Dot Matrix	LED, Common Anode Non-MUX	LED, Common Cathode MUX	LED, Common Anode MUX	LCD, Direct Drive	LCD, # of Ways MUX'D	Vacuum Fluourescent	Hexadecimal (0-9, A-F)	Code B (0-9, H, E, L, P, -, and Blank)	ASCII	MUX BCD (BCD + Digit Select Strobes)	Random Access (Data + Address + WR)	Bit Parallel, Digit Serial	Bit Serial	Cycle Time (ns)
ICM7211	Drives conventional LCD displays. Includes RC oscillator, divider chain, latches, interface and LCD drivers.	4									•			•			•				1000
ICM7211A		4									•				•		•				1000
ICM7211M		4									•			•				•			200
ICM7211AM		4									•				•			•			200
ICM7212	Drives common anode LED displays. 28 current controlled outputs. Includes latches, interface and brightness control.	4						•						•			•				1000
ICM7212A		4						•							•		•				1000
ICM7212M		4						•						•				•			200
ICM7212AM		4						•							•			•			200
ICM7218A	3 decode formats drives up to 64 independent LED's. Includes 8 x 8 memory, multiplexed LED drivers, decoders, interface and control. applications include bar graphs.	8	8							•				•	•				•		550
ICM7218B		8	8						•					•	•			•			550
ICM7218C		8	8							•				•	•				•		500
ICM7218D		8	8						•					•	•			•			500
ICM7218E		8	8							•				•	•			•			500
ICM7228A		8	8							•				•	•				•		550
ICM7228B		8	8						•					•	•			•			550
ICM7228C		8	8							•				•	•				•		500
ICM7228D		8	8						•					•	•			•			500
ICM7231A	8 digits, 16 annunciators on COM, hexadecimal	8	16									3		•				•			500
ICM7231B	8 digits, 16 annunciators on COM 3, code B	8	16									3			•			•			500
ICM7231C	8 digits, 16 annunciators on COM 1 + 3, code B	8	16									3			•			•			500
ICM7232A	10 digits, 20 annunciators on COM 3, hexadecimal	10	20									3		•						•	350
ICM7232B	10 digits, 20 annunciators on COM 3, code B	10	20									3			•					•	350
ICM7232C	10 digits, 20 annunciators on COM 1 + 3, code B	10	20									3			•					•	350
ICM7233A	4 alphanumeric characters.					4						3				•		•			500
ICM7233B	4 alphanumeric characters. Full-width numbers					4						3				•		•			500
ICM7243A	8 alphanumeric characters + decimal pt. can be daisy chained or cascaded.				8				•							•		•	•		250
ICM7243B				8					•							•		•	•		250

Decoder Drivers

Type	Description	Supply Voltage Range (V)	Electrical Characteristics (T_A = 25°C)				
			Output Drive Current Capability (mA)	Standby Power Dissipation Typ. (mW)	Max. Supply Current (I**) (mA)	Package Number of Pins*	Operating T_A Range (°C)
CA3161	BCD-to-7-segment type for common-anode LED displays (in combination with CA3168 for digital readout systems)	4.5 to 5.5	25/seg** (constant current)	18	8	16E	-25 to +85
CA3168	2-digit, 7-segment type for common-anode LED displays for 2-digit display such as numbers for TV and channel selection and other 0-99 counting applications	4.5 to 6	25/seg (V_{sat} = 1V @ 25mA)	85	25	24E	0 to 70
CD7211 CD7211A CD7211M CD7211AM	Non-multiplexed 4-digit, 7-segment LCD types	3-6	Backplane signal frequency (kHz)	0.05	On-board oscillator frequency (kHz)	40E	-20 to 70
	Decodes multiplexed binary to hexadecimal (CA7211, CA7211M) and decimal (CD7211A, CD7211AM) outputs		125		16		

*See Packaging Section **Typical

General-Purpose High-Current Silicon NPN Transistor Arrays

Type	Description	Array Configuration	Max. I_C (mA)	Typical $V_{CE\ SAT}$ (at 50 mA) V	Operating Range T_A (°C)	Package Number of Pins*
CA3081 CA3082	Directly drive 7-segment incandescent and LED displays	7-transistor common emitter common collector	100	0.4	-55 to +125	16E, F
CA3251 CA3250		8-transistor common emitter common collector	100	0.4		16E, F

*See Packaging Section

BiMOS Sequencer Driver and Segment Latch-Driver for Driving Vacuum Fluorescent Display Devices

Type	Description		Operating Output Voltage Range (V)	Will Source	Operating T_A Range (°C)	Package Number of Pins*
CA3207	Sequencer driver	Sequentially turns on 1 of 14 characters (2 of 28) when used with two CA3208's	35 to 55	40mA/ character	-40 to +85	22E
CA3208	Segment latch-driver	Drives any combination of 14 outputs selected by DATA input		7.5mA/ segment		22E

*See Packaging Section

Video Line Driver, High-Speed Operational Amplifier

Type	Description	Electrical Characteristics (T_A = 25°C)				Package Number of Pins*
		Output Drive Current Capability (mA)	A_{OL} @ f = 5MHz (dB)	f_F (MHz)	Slew Rate (AV ≥ 10) (V/μs)	
CA3450	For Driving: • Multiple transmission lines • Flash A/D converters	±75	>40	220 (C_C = 0)	330 (C_C = 0) (R_L = 50Ω)	16E

Operating Temperature Range (T_A): 125°C to -85°C *See Packaging Section

CMOS 32-KHz Quartz Analog Clock Circuit Supply Voltage Range: 1.1 to 5V

Type	Description	Oscillator			Operating Current (Pin 7 Open) μA	Package Number of Pins*
		Input Frequency KHz	Starting Volts (I_{OL} = ±1μA) V	Stability PPM/V		
CD22777	For quartz crystal-controlled analog clocks with stepping motor drives. Nominal 1.5V operation.	32.678	1.0 (min.)	2 (typ.)	5 (V_{DD} = 1.2V) 50 (V_{DD} = 3.5V)	8E

See Packaging Section

Interface ICs Timers/Counters Without Display Drivers

Type	Description	Package Number of Pins*
ICM7555	Low-power VMOS equivalent of industry standard 555 timer - only 80μA supply current. Does not have the large supply current transients of the bipolar 555 and does not require the large by-passing capacitors needed by the 555. Low leakage threshold and trigger inputs allow use of higher impedance RC timing components for extra-long time delays. T_A Range: 0 to +70°C, -25 to +85°C, -55 to +125°C	AB JD PA PD TT
ICM7556	Dual ICM7555, CMOS, low-power equivalent of the Bipolar 556 Timer.	
ICM7240 ICM7250	Programmable CMOS counter/timer. Uses on-board RC oscillator or an external clock. The count is programmed by wire-AND connection of the outputs. Excellent for ON/OFF delay timers, ÷ N counters. Special features: ICM7240, Binary 0-225; ICM7250; BCD 0-99 T_A Range: -25 to +85°C	JE
ICM7242	RC oscillator + 8-bit counter, similar to ICM7240 but with fixed 256 count. Used for extremely long time delays. Cascadable. Special Features: Fixed 128/255 T_A Range: 0 to +70°C, -25 to +85°C	BA JA PA

*See Packaging Section

CMOS Real-Time Clock

Type	Description	Package Number of Pins*
ICM7170	Microprocessor bus-compatible peripheral IC uses an 8-bit bidirectional bus for the data I/O circuitry. Device access time (300ns) eliminates the need for any microprocessor wait states or software overhead. Standby μ power operation: 2μA typ. at 3 volts with 32kHz crystal. T_A Range: -55 to +125°C, -40 to +85°C	BG DG PG

*See Packaging Section

Time Base Generators

Type	Output Frequency (Hz)	Supply Voltage (V)	Typical Current (μA)	Leakage Current (μA)	Crystal Frequency (MHz)	Package Number of Pins*
ICM7209	250kHz-10MHz	4.5-5.5	11,000	±10■	1-10	JA PA
		Choice of 2 output frequencies: oscillator and oscillator ÷ 8. Drives up to 5 TTL loads.*				
ICM7207 CMOS		4-5.5	260	50□	2-10	JD PD EV/KIT
		Low power dissipation: ≤2mW with 5V supply. Count Windows: ICM7207 (10/100ms) with 6.5536#, ICM7207A (0.1 to 1 sec.) with 5.24288#				
ICM7207A CMOS	Like ICM7207 but the Gating Output RESET and the MULTIPLEX Output provides both pull up and pull down					

Operating Temperature Range: ICM7207, ICM7207A: -25 to +85°C. ICM7209: -20 to +85°C

*See Packaging Section □ Output (all Outputs ($\overline{\text{STORE}}$ Only) ■ Disable Input (Either "1" or "0" State) # MHz crystal

Available with and without on-board display drivers. Harris' broad range of Timer/Counters circuits serves a wide variety of control functions. For separate Display Driver circuits, see separate section.

Timer/Counters with Display Drivers

Type	Typical Applications and Comments	Display: LED: Common Anode, Non-MUX	Display: LED: Common Cathode, MUX	Display: LED: Common Anode, MUX	Display: LCD: Direct Drive, Non-MUX	Display: VF: Non-MUX	Functions: Unit Count: Up/Down	Functions: Unit Count: Up Only	Functions: Unit Count: Decade	Functions: Unit Count: Modulo 60 (Hr/Min/Sec)	Functions: Universal Counters: Frequency	Functions: Universal Counters: Period	Functions: Universal Counters: Frequency Ratio	Functions: Universal Counters: Time Interval	Functions: MUX BCD Outputs	Functions: Display Latch	Functions: Display Blanking	Functions: Count Enable	Functions: Leading Zero Blanking	Functions: Preset Count	Functions: Comparison Register	Functions: Equal and Zero Output	Max Count Speed (MHz)	Evaluation Kit Available
4 DIGIT																								
ICM7217	Industrial control: preset predetermining counters, sequencers, on off delay timers, batch counters. Presets and loads compare register from thumbwheel switches.			•			•		•		■				•	•	•		•	•	•	•	2	
ICM7217A			•				•		•		■				•	•	•		•	•	•	•	2	
ICM7217B				•			•			•					•	•	•		•	•	•	•	2	
ICM7217C			•				•			•					•	•	•		•	•	•	•	2	
4½ DIGIT																								
ICM7224	10μA operating current. Can be cascaded for more digits.				•			•	•		■					•		•	•				15	•
ICM7225	Has brightness adjustment. 10μA current with display blanked, cascadable.	•						•	•		■					•	•	•	•				15	•
5½ DIGIT																								
ICM7249	Event timer counter, hour meter. 14 programmable modes. Selectable input filtering				•			•	•					•					•					
7 DIGIT																								
ICM7208	Use with ICM7207A for a 7-digit frequency counter.		•					•	•		■					•	•	•	•				2.5	
8 DIGIT																								
ICM7216A	Universal frequency counter with display drivers. 4 internal gate times, auto decimal point, leading zero blanking, overflow indication. Display off, hold, and reset inputs			•				•	•		•	•	•	•		•	•		•				10	
ICM7216B			•					•	•		•	•	•	•		•	•		•				10	
ICM7216C				•				•	•		•					•	•		•				10	
ICM7216D			•					•	•		•					•	•		•				10	
ICM7226A	Same as ICM7216 plus period and time interval averaging. BDC outputs, μP PIA compatible			•				•	•		•	•	•	•	•	•	•	•	•				10	•
ICM7226B			•					•	•		•	•	•	•	•	•	•	•	•				10	

■ These counters will measure frequency when used with the ICM7207 (0.01 and 0.1 second timebase) or the ICM7207A (0.1 and 1 second timebase)

Clocks/Timers/Counters

Timers/Counters Without Display Drivers

Type	Special Features	Description
ICM7555		Low power CMOS equivalent of industry standard 555 timer - only 80 µA supply current. ICM7555 does not have the large supply current transients of the bipolar 555 and does not require the large bypassing capacitors needed by the 555. Low leakage threshold and trigger inputs allow use of higher impedance RC timing components for extra long time delays.
ICM7556		An ICM7556 is a dual ICM7555, a CMOS, low power equivalent of the Bipolar 556 Timer.
ICM7240 ICM7250	Binary 0-225 BCD 0-99	Programmable CMOS counter timer. Uses on-board RC oscillator or an external clock. The count is programmed by wire-AND connection of the outputs. Excellent for ON OFF delay timers. ÷ N counters, and long period delays.
ICM7242	Fixed 128/255	RC oscillator + 8-bit counter, similar to ICM7240 but with fixed 256 count. Used for extremely long time delays. Cascadable.

Oscillator/Divider Selector Guide

Type	Output Frequency	Supply Voltage (V)	Typical Current (µA)	Pulse Width (ms)	Crystal Frequency	Other Outputs/Comments
ICM7209	250kHz-10MHz	4.5-5.5	11,000	Sq. Wave	1-10Mhz	Two buffered outputs - crystal Frequency and ÷ 8 output. Drives up to 5 TTL loads.

Multipliers

Type	Function	Description	Features	Standby Power Supply Current (I_{CCSB})-µA	Operating Power Supply Current (I_{CCOP})-mA	Clock Multiply Time (t_{MC})-ns
HMU16 HMU17	16 x 16 bit parallel multiplier	High-speed, low-power CMOS, 16 x 16 bit multiplier with full 32-bit product, 68-Pin Grid Array (PGA) 68-Pin Plastic Leaded Chip Carrier (PLCC)	HMU16 - compatible with AM29516, LMU16, IDT7216, CY7C516 HMU17 - compatible with AM29517, LMU17, IDT7217, CY7C517. Supports two's complement, unsigned magnitude and mixed mode multiplication TTL compatible Three-state outputs	500 (max.)	7 (max.)	35 (max.) 45 (max.)
HMU18	16 x 16 bit multiplier	High-speed, low-power CMOS, 16 x 16 bit multiplier with full 32-bit product, 85-Pin Grid Array (PGA)	Compatible with LMU18			35 (max.)
HMA510	16 x 16 bit multiplier	High-speed low-power CMOS, 16 x 16 bit multiplier with full 32-bit product, 68-Pin Grid Array (PGA), 68-Pin Plastic Leaded Chip Carrier (PLCC)	Compatible with IDT7210, CY7C510			45 (max.)
HA-2556/2557	Broadband 4-quadrant multiplier		35MHz signal bandwidth Direct voltage output (HA-2556) User friendly			

Type	Function	Description	Package Number of Pins
ISP9110	12-bit Micro-Program Sequencer	12-bit microprogram sequencer/controller used for high speed execution of microprogram instructions stored in external memory. The ISP9110 is typically used in conjunction with bit slice processor systems and DSP building blocks to control the sequence of execution of instructions stored in microprogram memory, but can also be used in digital systems as a stand-alone control element.	40 DIP 44 PLCC
ISP9119	FIFO RAM Controller	The ISP9119 FIFO RAM Controller (FRC), together with a static RAM array, forms a First-in-First-Out (FIFO) buffer. The ISP9119 FRC, implemented in Harris' 1.5 micron AVLSI CMOS technology, is pin-for-pin compatible with 57/674219. This process allows the ISP9119 to operate at twice the speed, but one tenth the power dissipation of its bipolar counterpart.	40 DIP 44 PLCC
ISP9128	Finite Impulse Response Filter Controller	This 16-bit FIR Filter (FFC) provides all the data, history, storage, and programmable filter cycle control logic required to implement FIR filters of up to 128 filter points.	64 DIP 68 PLCC 68 PGA
ISP9326	32-Bit Floating Point Processor	The ISP9326 is a high-speed floating point processor unit. It performs 32-bit single precision floating point addition, subtraction, and multiplication operations in a single CMOS VLSI integrated circuit using the format specified by the IEEE floating point standard 754.	144 PGA
ISP9520 ISP9521	Multilevel Pipeline Register	The ISP9520 and ISP9521 are multilevel pipeline registers implemented using Harris' 1.5 micron AVLSI CMOS technology. The ISP9520/21 operate at bipolar speeds with one tenth the power dissipation of their bipolar counterparts. The ISP9520 and ISP9521 are pin-for-pin compatible replacements for industry standard multilevel pipeline registers such as the bipolar AM29520 and AM29521.	24 (300-mil) (skinny) DIP

Type	Description		Package Number of Pins*
CDPS100	CMOS Programmable Digital FIR Filters (39 or 40 tap linear phase filter operation	20MHz throughput rate. Provides 39/40 tap linear phase or 20 tap arbitrary phase filter, 8-bit input data, 11 bit output data in 2's complement form. Expandable with no speed degradation.	68-Q
CDPS110	CMOS Least Mean Square (LMS) Adaptive FIR Filter (high-speed 8th order type)	10MHz clock rate. Expandable to any order in multiples of 8. Eight-bit input data. 12-bit output data in two's complement format.	68-Q
CDPS200	CMOS Programmable Length FIFO (2 to 1281 sample by 10-bit wide shift register)	DC to 40MHz shift rate: Write or recirculate mode, 10 bits wide. Provides programmable length of 2 to 1281 clock cycles.	44-Q

*See Packaging Section

General Purpose

	Type	V_{IO} Max. mV	I_I Max. nA	I^+ Max. Ma	Max. V^+, V^-	A_{OL} (Min.) dB	Unity Gain BW Typ. MHz	SR (Typ.) V/μs	Pkg. No. of Pins+
SINGLES	CA081 •	15	50pA	2.8	±18	88	5	13	8E
	CA081 •	6	40pA	2.8	±18	94	5	13	8E
	CA101	5	0.05	2.5	±44	94	1	-	8E, S, T
	CA201, LM201†	7.5	0.15	3	±44	85	1	-	8E, S, T
	CA301A, LM301A†	7.5	0.025	3	±36	88	1	10	8E, S, T
	CA307, LM307†	7.5	250	3	±36	88	1	-	8E, S T
	CA741, LM741†	5	500	2.8	±44	94	1	0.5	8E, S T
	CA741C, LM741C†	6	500	2.8	±36	86	1	0.5	10T, 14E
	CA748, LM748†	5	500	2.8	±44	94	1	0.5	8E, S T
	CA748C, LM748C†	6	500	2.8	±35	86	1	0.5	8E, S, T
	CA3193 •	0.5	40	3.5	±18	100	1.2	0.25	8E, S, T
	CA3193A •	0.2	20	3.5	±18	110	1.2	0.25	
	CA3420 •	10	5pA	0.65	±11	80	0.5*	0.5	8E, S, T
	CA3420A •	5	5pA	0.65	±11	86	0.5*	0.5	
	CA3440 •	10	50pA	0.017	±12.5	80	63kHz	0.03	8E, S T
	CA3440A •	5	40pA	0.017	±12.5	80	63kHz	0.03	
	CA3450	15	350	35	±8.5	60	220	330	16E
	CA3493 •	0.5	40	3.5	±18	100	1.2*	0.25	8E, S, T
	CA3493A •	0.2	20	3.5	±18	110	1.2*	0.25	
	CA6741	Low-Noise CA741		See Note 1					

	Type	V_{IO} Max. mV	I_I Max. nA	I^+ Max. Ma	Max. V^+, V^-	A_{OL} (Min.) dB	Unity Gain BW Typ. MHz	SR (Typ.) V/μs	Pkg. No. of Pins+
DUALS	CA082 •	15	50pA	5.6	±18	88	5	13	8E
	CA082A •	6	40pA	5.6	±18	94	5	13	8E
	CA158	5	150	1.2	±13	94	1	-	8E, S, T
	CA158A	2	50	1.2	±13	94	1	-	
	CA258	5	150	1.2	±13	94	1	-	8E, S, T
	CA258A	3	80	1.2	±13	94	1	-	
	CA358, LM358†	7	250	1.2	±13	88	1	-	8E, S, T
	CA358A	3	100	1.2	±13	88	1	-	8E, S, T
	CA747	5	500	2.8	±44	94	1	0.5	10T, 14E
	CA747C	6	500	2.8	±36	86	1	0.5	
	CA1458, LM1458†	6	500	2.8	±36	86	1	0.5	8E, S, T
	CA1558, LM1558†	5	500	2.8	±44	94	1	0.5	8E, S, T
	CA2904, LM2904†	7	250	1.2	±13	100*	1	-	8E, S, T
	CA5422 • Ampl A	10	5pA	0.7	±11	60	160kHz	0.25	14E
	Ampl B	20	25pA	0.7	±11	50	800kHz	1	14E
QUADS	CA084 •	15	50pA	11.2	±18	88	5	13	14E
	CA084A •	6	40pA	11.2	±18	94	5	13	14E
	CA124	5	150	2	±16	94	1	-	14E
	CA224	7	250	2	±16	86	1	-	14E
	CA324, LM324†	7	250	2	±16	86	1	-	14E
	CA3401	-	300	10	±18	60	5	0.6	14E
	CA3410 •	15	40	12	±18	86	5.4	10	16E
	CA3410A •	8	30	10	±18	86	5.4	10	16E

+ See packaging section

• BiMOS type

* ft.

† Technical data on LM Branded Types are identical to the corresponding CA Branded Types

NOTE: 1. "Popcorn" (Burst) Noise. Device rejected if total noise voltage (burst + 1/f) referred to input exceeds 20μV peak during 30-second test period.

General Purpose (Continued)

	Type	Temperature Range	Pinout See This Sect.	Gain Bandwidth Product (MHz)	Slew Rate (V/μs)	Offset Voltage (mV0	Bias Current (nA)	1kHz Noise Voltage (nV/√Hz)	Open Loop Gain (kV/V)	Minimum Gain Stable	Supply Current (mA/ Pkg.	Comments
SINGLES	HA-2500	-55°C to +125°C	1, 2	12	30	2	100	21	30	Unity	4	High slew, wide bandwidth
	HA-2502	-55°C to +125°C	1, 2	12	30	4	125	21	25	Unity	4	High slew, wide bandwidth
	HA-2505	0°C to +75°C	1, 2	12	30	4	125	21	25	Unity	4	High slew, wide bandwidth
	HA-2600	-55°C to +125°C	1, 2	12	7	0.5	1	16	150	Unity	3	Wide band
	HA-2602	-55°C to +125°C	1, 2	12	7	3	15	16	150	Unity	3	Wide band
	HA-2605	0°C to +75°C	1, 2	12	7	3	5	16	150	Unity	3	Wide band
	HA-5101	-55°C to +125°C 0°C to +75°C	14, 15	10	10	0.5	100	3.5	1000	Unity	4	Low noise
	HA-5111	-55°C to +125°C 0°C to +75°C	1, 2	100	50	0.5	100	3.5	1000	10	4	High slew, wide bandwidth, low noise
	HA-5147	-55°C to +125°C 0°C to +75°C	25, 26, 27	120	35	-	±15	-	1500	10	-	Precision, wide bandwidth, high slew
	HA-5147A	-55°C to +125°C 0°C to +75°C	25, 26, 27	120	35	-	±10	-	1800	10	-	0.5 MHz full power bandwidth
DUALS	HA-5102	-55°C to +125°C 0°C to +75°C	11, 12, 30	8	3	0.5	130	4.3	230	Unity	3	Low noise
	HA-5112	-55°C to +125°C 0°C to +75°C	11, 12, 30	60	20	0.5	130	4.3	230	10	3	Low noise, wide bandwidth
QUADS	HA-4741	-55°C to +125°C	23, 24	3.5	1.6	0.5	60	9	100	Unity	<5	Quad 741, JI
	HA-4741	0°C to +75°C	24	3.5	1.6	1	60	9	50K	Unity	<7	Quad 741, JI
	HA-5104	-55°C to +125°C 0°C to +75°C	23, 24	8	3	0.5	130	4.3	230	Unity	5	Low noise, compensated
	HA-5114	-55°C to +125°C 0°C to +75°C	23, 24	60	20	0.5	130	4.3	230	10	5	Low noise, uncompensated, high slew, wide bandwidth

	Type	Description	V_{OS} (mV Max)	I_{BIAS} (pA Max)	Slew Rate (V/μs)	GBW (MHz)	Compensation	V_{Supply}	Temperature Range (°C)
SINGLES	ICL7611	CMOS, Selectable I_Q	2, 5, 15	50	1.6	1.4	INT	±5	0 to 70 -55 to +125
	ICL8007M	JFET Input Op-Amp	20	20	6	1.0	INT	±15	-55 to +125
	ICL8007C	JFET Input Op-Amp	50	50	6	1.0	INT	±15	0 to +70
DUALS	ICL7621	CMOS, Fixed I_Q	2, 5, 15	50	0.16	0.48	INT	±5	0 to +70 -55 to +125
	ICL8043M	JFET Input Op-Amp	20	20	6	1.0	INT	±15	-55 to +125
	ICL8043C	JFET Input Op-Amp	50	50	6	1.0	INT	±15	0 to +70
TRIPLES	ICL7631	CMOS, Selectable I_Q	5, 10, 20	50	1.6	1.4	INT	±5	0 to +70 -55 to +125
QUADS	ICL7641	CMOS, Fixed I_Q	5, 10, 20	50	1.6	1.4	INT	±5	0 to +70 -55 to +125

Low/Ultra-Low Offset Voltage

	Type	Description	V_{OS} (μV Max)	$\Delta V_{OS}/\Delta T$ (μV/°C) (Max)	$\Delta V_{OS}/\Delta t$ (nV/month) (Typ)	I_{BIAS} (pA Max)	GBW (MHz)	V_{Supply} (V Max)	Temperature Range (°C)
SINGLES	ICL7650C	CMOS, Chopper-stabilized	±8	±0.02	100	20	2.0	±9	0 to +70 &
	ICL7650I	CMOS, Chopper-stabilized	±10	±0.02	100	50	2.0	±9	-25 to +85 &
	ICL7650M	CMOS, Chopper-stabilized	±20	±0.03	100	500	2.0	±9	-55 to +125
	ICL7652C	Low-noise 7650C	±7	±0.01	100	30	0.5	±9	0 to 70 &
	ICL7652I	Low-noise 7650I	±10	±0.02	100	30	0.5	±9	-25 to +85 &
	ICL7652M	Low-noise 7650M	±50	±0.1	100	500	0.5	±9	-55 to +125
	ICL420	High Voltage Chopper	±5	±0.05	100	30	0.5	±16.5	0 to +70 &
	ICL421	High Voltage Chopper	±5	±0.05	100	30	0.5	±16.5	-40 to +85 &
	ICL422	High Voltage, Low Power	±5	±0.05	100	30	0.4	±16.5	-55 to +125
	ICL423	High Voltage, Low Power	±5	±0.05	100	30	0.4	±16.5	

Low Input Bias Current

	Type	Description	I_{BIAS} (pA Max)	I_{OS} (pA Typ)	V_{OS} (mV Max)	GBW (MHz)	Compen-sation	V_{Supply} (V Max)	Temperature Range (°C)
SINGLES	ICL7611	CMOS, Selectable I_Q	50	0.5	2, 5, 15	1.4	INT	±9	0 to +70 &
	ICL7612	CMOS, Extended CMVR	50	0.5	2, 5, 15	1.4	INT	±9	-55 to +125
	ICL8007M	JFET Input Op-Amp	20	0.5	20	1.0	INT	±18	-55 to +125
	ICL8007AM	JFET Input, Low Bias	4.0	0.2	30	1.0	INT	±18	-55 to +125
	ICL8007C	JFET Input Op-Amp	50	0.5	50	1.0	INT	±18	0 to +70
	ICL8007AC	JFET Input, Low Bias	4.0	0.2	30	1.0	INT	±18	0 to +70
	ICH8500A	PMOS Input, Low Bias	0.01	-	50	0.7	INT	±18	-25 to +85
	ICH8500	PMOS Input	0.1	-	50	0.7	-	±18	-
DUALS	ICL7621	CMOS, Fixed I_Q	50	0.5	2, 5, 15	0.48	INT	±9	0 to +70 & -55 to +125
	ICL8043M	JFET Input Op-Amp	20	0.5	20	1.0	INT	±18	-55 to +125
	ICL8043C	JFET Input Op-Amp	50	0.5	50	1.0	INT	±18	0 to +70
TRIPLES	ICL7631	CMOS, Selectable I_Q	50	0.5	5, 10, 20	1.4	INT	±9	0 to +70 & -55 to +125
QUADS	ICL7641	CMOS, Fixed I_Q	50	0.5	5, 10, 20	1.4	INT	±9	0 to +70 &
	ICL7642	CMOS, Fixed I_Q	50	0.5	5, 10, 20	0.044	INT	±9	0-55 to +125

Lower Power

	Type	Temperature Range	Pinout See Pkg. Section	Supply Current (μA/Amp)	Supply Range (V)	Slew Rate (V/μs) @ Indicated Supply Current	Gain Bandwidth Product (kHz) @ Indicated Supply Current	Output Swing (V) ±15V Power Supplies	Offset Voltage (mV)	Single Supply Operation	Comments
SINGLES	HA-5180	-55°C to +125°C -25°C to +85°C 0°C to +75°C	15, 16	700	±5/±20	7	2000	±12	1.0		J-FET Ultra-low bias
SINGLES	HA-5151	-55°C to +125°C 0°C to +75°C	9, 10	200	±1.5/±15 +3/+30	4.5	1300	>±10	0.5	Yes	New
SINGLES	HA-5141	-55°C to +125°C 0°C to +75°C	9, 10	50	±1.5/±15 +3/+30	1	400	0/+4 (+5Vs)	2	Yes	Ultra-low power
DUALS	HA-5152	-55°C to +125°C 0°C to +75°C	11, 12, 30	200	±1.5/±15 +3/+30	4.5	1300	>±10	0.5	Yes	New
DUALS	HA-5142	-55°C to +125°C 0°C to +75°C	11, 12, 30	50	±1.5/±15 +3/+30	1	400	0/+4 (+5Vs)	2	Yes	Ultra-low power
QUADS	HA-5154	-55°C to +125°C 0°C to +75°C	23, 24	200	±1.5/±15 +3/+30	4.5	1300	>±10	0.5	Yes	New
QUADS	HA-5144	-55°C to +125°C 0°C to +75°C	23, 24	50	±1.5/±15 +3/+30	1	400	0/+4 (+5Vs)	2	Yes	Ultra-low power

Lower Power

	Type	Description	$I_{Quiescent}$ (Per Amplifier) (μA Typ)	V_{Supply} (V Max)	V_{OS} (mV Max)	I_{BIAS} (nA Max)	GBW (MHz)	Compen-sation	Temperature Range (°C)
SINGLES	ICL7611	CMOS, Selectable I_Q	10	±5	2, 5, 15	0.05	0.044	INT	0 to 70 &
SINGLES	ICL7612	CMOS, Extended CMVR	10	±5	2, 5, 15	0.05	0.044	INT	-55 to +125
SINGLES	ICL8021M	Bipolar, Selectable I_Q	30	±15	3	20	0.27	INT	-55 to +125
SINGLES	ICL8021C	Bipolar, Selectable I_Q	30	±15	6	30	0.27	INT	0 to +70
TRIPLES	ICL7631	CMOS, Selectable I_Q	10	±5	5, 10, 20	0.05	0.044	INT	0 to +70 &
TRIPLES	ICL8023M	Triple 8021M	30	±15	3	20	0.27	INT	-55 to +125
TRIPLES	ICL8023C	Triple 8021C	30	±15	6	30	0.27	INT	0 to +70
QUADS	ICL7642	CMOS, Fixed I_Q	10	±5	5, 10, 20	0.05	0.044	INT	0 to +70 & -55 to +125

Wide Bandwidth

	Type	Temperature Range	Pinout See Pkg. Section	Gain Bandwidth Product (MHz)	Full Power Bandwidth (MHz)	Slew Rate (V/μs)	Bias Current (nA)	Open Loop Gain (kV/V)	Minimum Gain Stable	Comments
SINGLES	HA-2510	-55°C to +125°C	1, 2, 20	12	1.0	65	100	15	Unity	
	HA-2512	-55°C to +125°C	1, 2	12	1.0	60	125	15	Unity	
	HA-2515	0°C to +75°C	1, 2	12	1.0	60	125	15	Unity	
	HA-2520	-55°C to +125°C	1, 2, 20	20	2.0	120	100	15	3	
	HA-2522	-55°C to +125°C	1, 2	20	1.6	120	125	15	3	
	HA-2525	0°C to +75°C	1, 2	20	1.6	-120	125	15	3	
	HA-2529	-55°C to +125°C	1, 2, 20	20	2.6	150	50	18	3	New
	HA-2539	-55°C to +125°C -25°C to +85°C 0°C to +75°C	3, 21	600	9.5	600	5000	30	10	
	HA-2540	-55°C to +125°C -25°C to +85°C 0°C to +75°C	4, 13	400	6.0	400	5000	30	10	
	HA-2541	-55°C to +125°C 0°C to +75°C	5, 6	40	4.5	280	6000	16	Unity	New, Fast Settling
	HA-2542	-55°C to +125°C 0°C to +75°C	7, 32	70	5.5	375	6000	30	2	New, High Output Current
	HA-2544	-55°C to +125°C 0°C to +75°C	14,15, 20	50	4.2	150	8000	6	Unity	New, Video
	HA-2548	-55°C to +125°C -40°C to +85°C 0°C to +75°C	2, 8	150	1.91	120	5	3162	5	New
	HA-2620	-55°C to +125°C	2, 20, 27	100	0.6	35	1	150	5	
	HA-2622	-55°C to +125°C	2, 27	100	0.6	35	5	150	5	
	HA-2625	0°C to +75°C	2, 27	100	0.6	35	5	150	5	
	HA-5137	-55°C to +125°C 0°C to +75°C	25, 26, 27	63	0.3	17	8	1800	5	New, Precision
	HA-5160	-55°C to +125°C 0°C to +75°C	19	100	1.0	120	0.02	150	10	J-FET
	HA-5162	-55°C to +125°C 0°C to +75°C	19	100	1.0	70	0.02	100	10	J-FET
	HA-5190	-55°C to +125°C	4, 13, 18	150	6.5	200	5000	30	5	Fast Settling
	HA-5195	0°C to +75°C	4, 18	150	6.5	200	5000	30	5	Fast Settling
	HA-5221	-55°C to +125°C -40°C to +85°C 0°C to +75°C	25, 26	100	0.40	25	40	2512	1	
	HFA-0001	-55°C to +125°C -40°C to +85°C 0°C to +75°C	33, 34	350	53	1000	15000	200	1	New
	HFA-0002	-55°C to +125°C -40°C to +85°C 0°C to +75°C	35, 36	1000	11.4	250	230	105	10	New
	HFA-0005	-55°C to +125°C -40°C to +85°C 0°C to +75°C	33, 37	300	22	420	15000	230	1	New
DUALS	HA-5102	-55°C to +125°C 0°C to +75°C	11, 12, 30	8	0.05	3	130	230	Unity	Low Noise
	HA-5222	-55°C to +125°C -40°C to +85°C 0°C to +75°C	23, 24	100	0.4	25	40	2512	1	New
QUADS	HA-2400	-55°C to +125°C	29, 31	40	0.5	30	50	150	10	Addressable
	HA-2404	-25°C to +85°C	29	40	0.5	30	50	150	10	Addressable
	HA-2405	0°C to +75°C	29	40	0.5	30	50	150	10	Addressable
	HA-2406	0°C to +75°C	29	30	0.3	20	50	150	10	Addressable
	HA-5104	-55°C to +125°C 0°C to +75°C	23, 24	8	0.05	3	130	230	Unity	Low Noise

Wide Bandwidth (Continued)

	Type	V_{IO} Max. mV	I_I Max. nA	I^+ Max. Ma	Max. V^+, V^-	A_{OL} (Min.) dB	Unity Gain Bandwidth Typ. MHz	SR (Typ.) V/μs	Package No. of Pins+
SINGLES	CA3010	5	12μA	2.5	±8	66	16	3	12T
	CA3010A	2	4μA	3.3	±8	66	16	3	12T
	CA3015	5	24μA	7.3	±16	72	60	7	12T
	CA3015A	2	6μA	7.3	±16	72	60	7	12T
	CA3029	5	12μA	2.5	±8	60	16	3	14E
	CA3029A	2	4μA	3.5	±8	60	16	3	14E
	CA3030	5	24μA	7.3	±16	72	60	7	14E
	CA3030A	2	6μA	7.3	±16	72	60	7	14E
	CA3037	5	12μA	2.5	±8	60	16	3	14D
	CA3037A	2	4μA	3.3	±8	60	16	3	14D
	CA3038	5	24μA	7.3	±16	72	60	7	14D
	CA3038A	2	6μA	7.3	±16	72	60	7	14D
	CA3100 •	5	2000	10.5	±18	56	38*	70	8E, S, T
	CA3130 •	15	50pA	15	±8	94	15	30	8E, M,
	CA3130A •	5	30pA	15	±8	94	15	30	S, T
	CA3140 •	15	50pA	6	±18	86	4.5*	9	8E, S,
	CA3140A •	5	30pA	6	±18	86	4.5*	9	T, M
	CA3160 •	15	50pA	15	±8	94	4*	10	8E, S,
	CA3160A •	5	30pA	15	±8	94	4*	10	T, M
	CA3450 •	15	130	35	±8.5	60	220	330	16E
DUALS	CA3240 •	15	50pA	12	±18	86	4.5*	9	8E, 8T,
	CA3240A •	5	40pA	12	±18	86	4.5*	9	8S, 14EI
	CA3260 •	15	50pA	15.5	±8	94	4*	10	8E, M,
	CA3260A •	5	30pA	15.5	±8	94	4*	10	T, S

+ See package section
• BiMOS type
* ft.

High Slew Rate

	Type	Temperature Range	Pinout See This Section	Slew Rate (V/μs)	Gain Bandwidth Product (MHz)	Full Power Bandwidth (MHz)	Bias Current (nA)	Open Loop Gain (kV/V)	Minimum Gain Stable	Comments
SINGLES	HA-5221	-55°C to +125°C -40°C to +85°C 0°C to +75°C	25, 26	25	100	0.40	40	25	1	New
	HA-2620	-55°C to +125°C	2, 20	35	100	0.6	1	150	5	
	HA-2622	-55°C to +125°C	2, 20	35	100	0.6	5	150	5	
	HA-2625	0°C to +75°C	2	35	100	0.6	5	150	5	
	HA-2548	-40°C to +85°C 0°C to +75°C	2, 8	120	150	1.91	5	3162	5	New
	HA-0005	-	-	600	-	25.8	250 MHz unity gain bandwidth ±50mA high output drive			
	HA-5111	-55°C to +125°C 0°C to +75°C	1, 2, 20	50	100	0.8	100	1000	10	New, Low Noise
	HA-2512	-55°C to +125°C	1, 2, 20	60	12	1.0	125	15	Unity	
	HA-2515	0°C to +75°C	1, 2	60	12	1.0	125	15	Unity	
	HA-2510	-55°C to +125°C	1, 2	65	12	1.0	100	15	Unity	
	HA-5162	-55°C to +125°C 0°C to +75°C	19	70	100	1.0	0.02	100	10	J-FET
	HA-5160	-55°C to +125°C 0°C to +75°C	19	120	100	1.0	0.02	150	10	J-FET
	HA-2520	-55°C to +125°C	1, 2	120	20	2.0	100	15	3	
	HA-2522	-55°C to +125°C	1, 2, 20	120	20	1.6	125	15	3	
	HA-2525	0°C to +75°C	1, 2	120	20	1.6	125	15	3	
	HA-2544	-55°C to +125°C 0°C to +75°C	14, 15, 20	150	50	4.2	8000	6	Unity	New, Video
	HA-2529	-55°C to +125°C	1, 2, 20	150	20	2.6	50	18	3	New
	HA-5190	-55°C to +125°C	4, 13, 18	200	150	6.5	5000	30	5	Fast Settling
	HA-5195	0°C to +75°C	4, 18	200	150	6.5	5000	30	5	Fast Settling
	HFA-0002	-55°C to +125°C -40°C to +85°C 0°C to +75°C	35, 36	250	1000	11.4	230	105	10	New
	HA-2541	-55°C to +125°C 0°C to +75°C	5, 6	280	40	4.5	6000	16	Unity	New, Fast Settling
	HA-2542	-55°C to +125°C 0°C to +75°C	7, 32	375	70	5.5	6000	30	2	New, High Output Current
	HA-2540	-55°C to +125°C -25°C to +85°C 0°C to +75°C	4, 13	400	400	6.0	5000	30	10	
	HFA-0005	-55°C to +125°C -40°C to +85°C 0°C to +75°C	33, 37	420	300	22	15000	230	1	New
	HA-2539	-55°C to +125°C -25°C to +85°C 0°C to +75°C	3, 21	600	600	9.5	5000	30	10	
	HFA-0001	-55°C to +125°C -40°C to +85°C 0°C to +75°C	33, 34	1000	350	53	15000	200	1	New
DUALS	HA-5112	-55°C to +125°C 0°C to +75°C	11, 12, 30	20	60	0.3	130	230	10	Low Noise
	HA-5222	-55°C to +125°C -40°C to +85°C 0°C to +75°C	23, 24	25	100	0.40	40	2512	1	New
QUADS	HA-2400	-55°C to +125°C	29, 31	30	40	0.5	50	150	10	Addressable
	HA-2404	-40°C to +85°C	29	30	40	0.5	50	150	10	Addressable
	HA-2405	0°C to +75°C	29	30	40	0.5	50	150	10	Addressable
	HA-2406	0°C to +75°C	29	20	30	0.3	50	150	10	Addressable

Wideband High-Slew Rate Types (>50 V/μs)

Type	V_{IO} Max. mV	I_I Max. nA	I^+ Max. Ma	Max. V^+, V^-	A_{OL} (Min.) dB	Unity Gain Bandwidth Typ. MHz	SR (Typ.) V/μs	Package No. of Pins+
CA3080	5	5000	1.2	±18	□	2#	50	8E, S,
CA3080A	2	5000	1.2	±18	□	2#	50	T
CA3100 •	5	2000	10.5	±18	56	38#	70	8E, S, T
CA3280	3	5000	4.8	±18	94	9#	125	16E
CA3280A	0.5	5000	4.8	±18	94	9#	125	16E
CA3250	15	350	35	±8.5	60	220	330	16E

+ See package section

• BiMOS type

Open-loop bandwidth

Precision

	Type	Temperature Range	Pinout See This Sect.	Offset Voltage (μV)	Offset Voltage Drift (μV/°C)	Bias Current (nA)	Open Loop Gain (kV/V)	1kHz Noise Current (pA/√Hz)	1kHz Noise Voltage (nV/√Hz)	CMRR (dB)	PSRR (dB)	Supply Current (mA/amp)	Comments
SINGLES	HA-5170	-55°C to +125°C 0°C to +75°C	14, 15, 20	100	2	0.02	600	0.01	10	100	105	1.9	J-FET
	HA-5180	-55°C to +125°C 0°C to +75°C	15, 16	1000	5	0.0003	1000	0.01	70	110	105	0.7	J-FET
	HA-5127A	-55°C to +125°C 0°C to +75°C	25, 26, 27	10	0.2	±10	1800	0.4	3.0	126	120	3	
	HA-5127	-55°C to +125°C 0°C to +75°C	25, 26, 27	20	0.3	±12	1800	0.4	3.0	123	120	3	
	HA-5137A	-55°C to +125°C 0°C to +75°C	25, 26, 27	10	0.2	±10	1800	0.4	3.0	126	120	3	
	HA-5137	-55°C to +125°C 0°C to +75°C	25, 26, 27	20	0.3	±12	1800	0.4	3.0	123	120	3	
	HA-2548	-55°C to +125°C -40°C to +85°C 0°C to +75°C	2, 8	300	4	20	3162	0.4	8.3	90	95	12	High Speed 150 Vμs Slew Rate 200ns 0.01% Settling Time
	HA-5221	-55°C to +125°C -40°C to +85°C 0°C to +75°C	25, 26	300	0.5	40	2512	0.97	3.4	95	100	8	New
DUALS	HA-5222	-55°C to +125°C -40°C to +85°C 0°C to +75°C	12	300	0.5	40	2512	0.97	3.4	95	100	8	New
QUADS	HA-5134A	-55°C to +125°C 0°C to +75°C	23, 24	50	1.2	±10	3000	1	7	120	120	1	New
	HA-5134	-55°C to +125°C 0°C to +75°C	23, 24	50	2	±10	3000	1	7	120	116	1.6	New, Quad

5-Volt BiMOS Microprocessor Types for Low-Supply Voltage, Low-Input-Current Applications

Type	V_{IO} Max. mV	I_I Max. nA	I^+ Max. Ma	Max. V^+, V^-	A_{OL} (Min.) dB	Unity Gain Bandwidth Typ. MHz	SR (Typ.) V/μs	Package No. of Pins+
CA5130	10	15pA	0.4	±8	85	15	30	8E, M,
CA5130A	4	10pA	0.4	±8	90	15	30	S, T
CA5160	10	15pA	0.4	±8	85	3*	8	8E, S,
CA5160A	4	10pA	0.4	±8	90	3*	8	T
CA5260	15	15pA	1.8	±8	80	3*	8	8E, M,
CA5260A	4	15pA	1.8	±8	83	3*	8	S, T
CA5420	10	2pA	0.5	±11	85	0.5	0.5	8E, S, T
CA5420A	5	1pA	0.5	±11	85	0.5	0.5	8E, S, T
CA5422 Ampl. A	10	5pA	0.7	±11	60	160kHz	0.25	14E
Ampl. B	20	25pA	0.7	±11	50	800kHz	1	14E

+ See packaging section
* ft.

High-Voltage

Type	Description	Features
HA-2640, HA-2645	High Voltage Op-Amp	Slew rates: 1V/μs, Bandwith: 4MHz, Input offset voltage: 4mV, Offset current: 5nA Output voltage swing: ±35V, Input voltage swing: ±35V, Supply range: ±10V to ±40V Output overload protection

High-Speed

Wideband, Dual, BiMOS-E

Type	V_{IO} Max. mV	I_I Max. pA	I^+ Max. Ma	Max. V^+, V^-	A_{OL} (Min.) dB	Unity Gain Bandwidth Typ. MHz	SR (Typ.) V/μs	Package No. of Pins+
CA5202△	3	0.1nA	8	±8	65	50	100	8E, M, 8T, S

+ See packaging section
△ T_A = -40 to +85°C
Internal Compensation

Programmable

Type	Features	V_{OS} (mV Max.)	I_{BIAS} (pA Max.)	I_{IO} nA Max.	A_{OL} dB Min.	V_{Supply} Range V	Package No. of Pins+
LM4250	Standby P_D as low as 500nW	5	10	6	25K	±1 to ±18	JA, PA, TA

Electrical characteristics at $0^oC \leq T_A \leq +70^oC$
Operating temperature range (T_A): −55 to +125°C, 0 to +70°C
+ See packaging section

Programmable with Memory

Type	V_{IO} Max mV		V_{IO} (Min) mV (Hyst.)	I_{IB} (Max) mA		I_O (Min) mA	Switching Times (Typ.) ns				Packaging No. of Pins+
	LR	HR					t_d	t_f	t_r	t_s	
CA3098	6	10	20	100	100	100	600	50	500	4500	8E, S, T
CA3098	6	10	20	pnp	npn	100	600	50	500	4500	8E, S, T

+ See packaging section

OTAs (Programmable, Variable) Micropower (Single-Unit Types)

Type	V_{IO} Max. mV	I_I Max. nA	I^+ Max. Ma	Max. V^+, V^-	A_{OL} (Min.) dB	Unity Gain Bandwidth Typ. MHz	SR (Typ.) V/μs	Package No. of Pins+
CA3060††	5	5000	3.6	±18	100	1.5	8	16E
CA3078	4.5	32	0.13	±7	88	0.8	1.5	8E, T
CA3078A	3.5	12	0.025	±18	92	0.8	1.5	8E, T
CA3080	5	5000	1.2	±18	100	2#	50	8E, S, T
CA3080A	2	5000	1.2	±18	100	2#	50	8E, S, T

+ See packaging section
• BiMOS type
Open-loop bandwidth
†† Triple unit

BiMOS-E Types

Type	V_{IO} Max. mV	I_I Max. pA	I^+ Max. Ma	Max. V^+, V^-	A_{OL} (Min.) dB	Unity Gain Bandwidth Typ. MHz	SR (Typ.) V/μs	Package No. of Pins+
CA5470■	15	10	6	±18	80	14	5	14E, M
CA5470□	18	11nA	7	±8	80	12	5	14E, M

+ See packaging section
■ $T_A = 12^oC$
□ $T_A = -55$ to $+125^oC$

Operational Amplifiers: Pinouts

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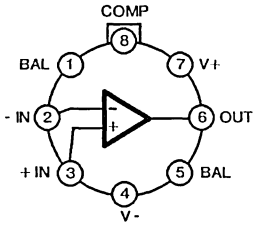

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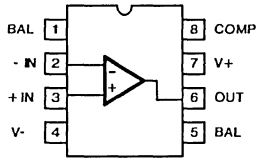

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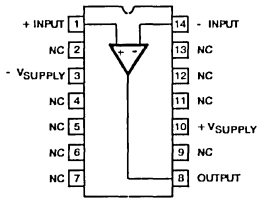

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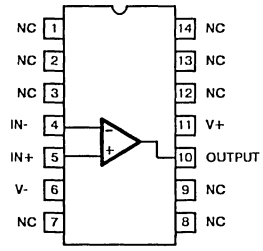

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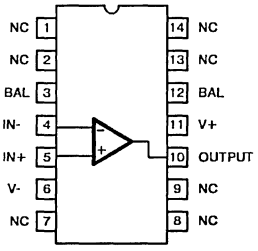

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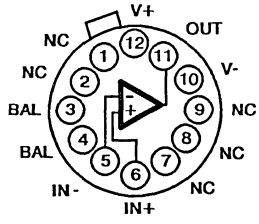

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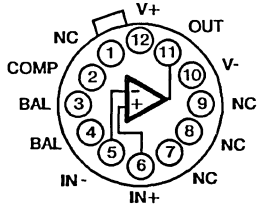

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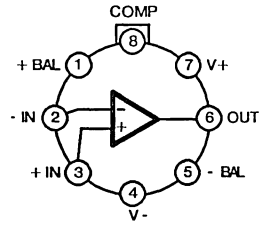

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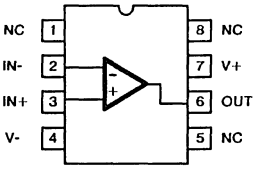

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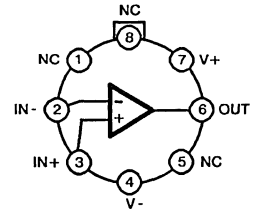

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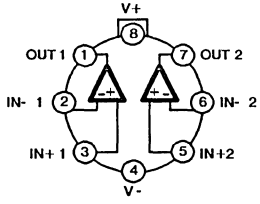

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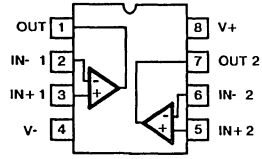

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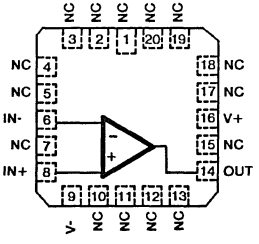

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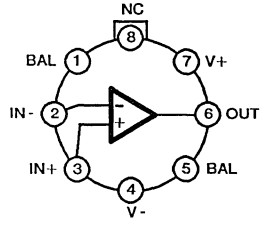

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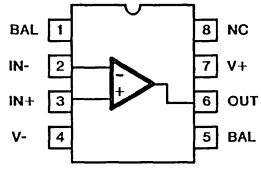

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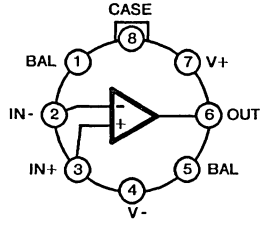

Operational Amplifiers: Pinouts

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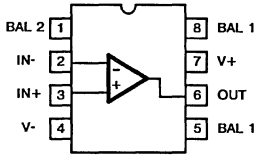

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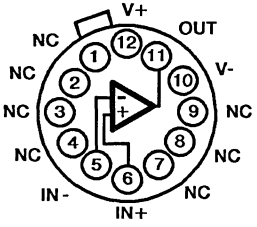

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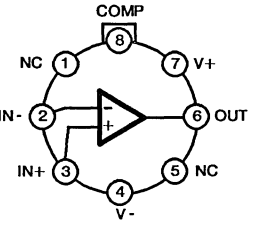

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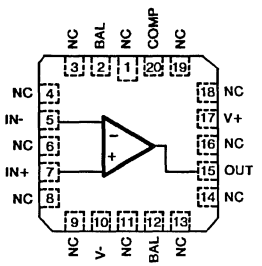

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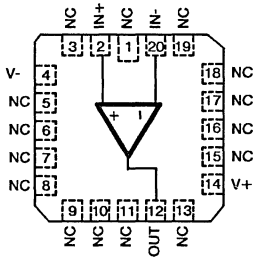

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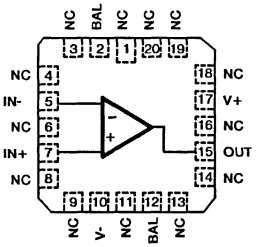

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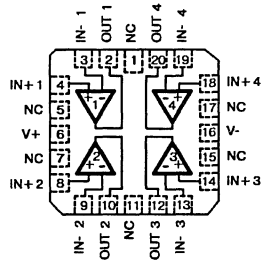

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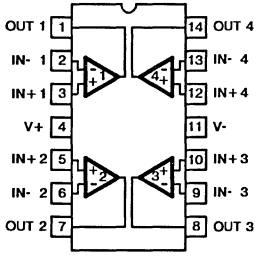

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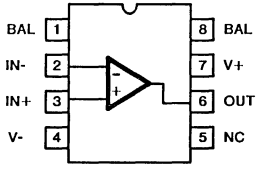

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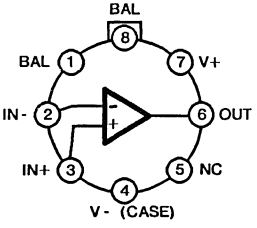

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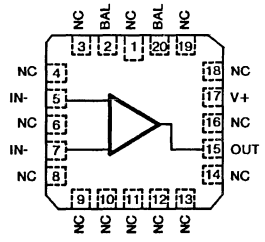

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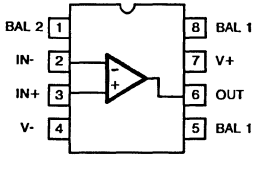

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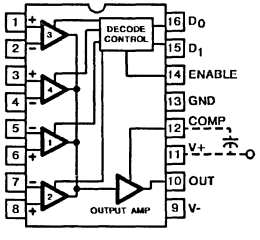

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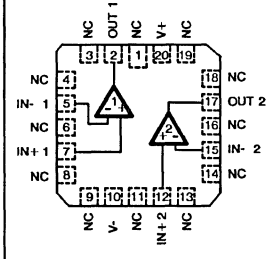

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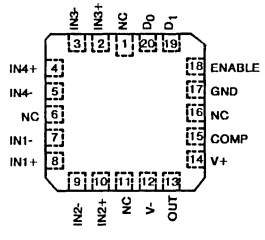

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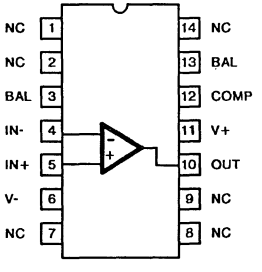

Operational Amplifiers: Pinouts

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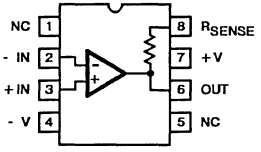

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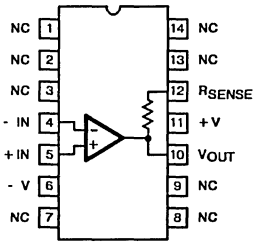

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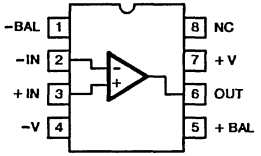

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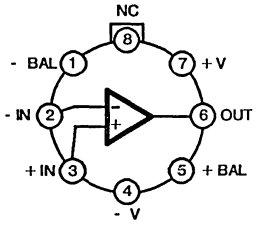

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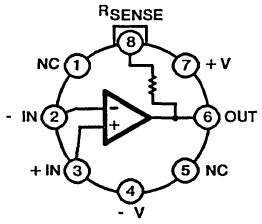


Special Function

Type	Description	V_{OS} Typ. µV	$\Delta V_{OS}/\Delta T$ Typ. µv/°C	$\Delta V_{OS}/\Delta t$ Typ. µV/yr	I_{BIAS} Typ. nA	CMRR Typ. dB	Package No. of Pins+	V_{ICR}
ICL7605/(C, I, M)	CMOS Commutating Auto-Zero (CAZ) Instrumentation Amplifiers	±2	0.05	0.5	1.5	100	JN	0.3V Above Supply Rail
ICL7606/(C, I, M)		Uncompensated version of ICL7605					JN	
ICL7600/(I, M)		±5	0.005	0.2	0.3	88	JD	
ICL7601/(I, M)		Uncompensated version of ICL7600					JD	
ICL8063	Power Transistor Driver	Takes typ. 11-volt output levels from an op amp and boosts them ±30 volts to drive power transistors such as 2N3055 npn, and 2N3789 pnp. ICL outputs will supply 100 mA to the base leads of the external power transistors. T_A Range: 0 to +70°C, -55 to +125°C					JE PE	
ICL8048/ ICL8049	Log/Antilog Amplifier	1/2% full scale accuracy, Temperature compensated for 0°C to +70°C scale factor 1V/decade, Adjustable 120dB dynamic current range (8048), 60dB dynamic voltage range (8048 & 8049), Dual JFET-Input Op-Amps						
HA-5002	Buffered Amplifiers: Video	Voltage gain: 0.995, High slew rate: 1300V/µs, -3dB bandwidth: 110MHz, High output current: 200mA, Pulsed output current: 400mA, Low supply current: 8.3mA, Monolithic construction						
HA-5004		High slew rate: 1200V/µs, High output current: ±100mA Unity gain bandwidth: 90MHz, Gain range: 1 to 10V/V, Current-mode feedback, Thermal overload protection, Output enable/disable						
HA-5033		Differential phase error: 0.1°, Differential gain error: 0.1% High slew rate: 1300V/µs, -3dB bandwidth: 250MHz, High output current, Monolithic construction						
HA-2400, 2404, HA-2405, 2406	Addressable Op-Amp	Four channels addressable, High slew rate: 30V/µs, Wide gain bandwidth product: 40MHz, High gain: 150K, TTL compatible						
HA-2444	Video Four-Channel Multiplexed Amplifier	Four digitally selectable input channels, 50MHz unity gain bandwidth, 5MHz full power bandwidth, Guaranteed differential phase (0.11°) and differential gain (0.04dB)						

+ See packaging section

Operating Supply Voltage Range:
ICL7600 Series: 4 to 16V, Down to = 2V
ICL7605 Series: 4 to 10V, Down to = 2V

T_A Range:
C Suffix Types: 0 to +70°C
I Suffix Types: -25 to +85°C
M Suffix Types: -25 to ±125°C

JFET

Type	Description	Features
HA-5242, HA-5243	High-Speed JFET Amp.	100MHz gain bandwidth products (HA-5243), 40MHz unity gain bandwidth (HA-5242) 25pA bias current

Differential Amplifiers

Type	Description	Features	Freq. Range DC to MHz	A (typ.) dB	BW (3dB Point) (typ.) kHz	I/F, NF (typ.) dB	AGC Range (typ.) dB	Pkg. No. of Pins*
CA3000	DC Amplifier	• Balanced differential-amplifier configuration with controlled constant-current source • RF, if, and video frequency capability • Balanced agc capability • Operation from dc to 500MHz • CA3028B is controlled for input offset voltage, current, and input bias current, and is intended for "balance" requirements • Push-pull inputs and outputs • CA3005 and CA3006 are identical except for input offset voltage • CA3028 and CA3053 are identical except for 100-MHz noise specification • CA3051 and CA3050 are identical except for package • CA3054 and CA3026 are identical except for package and substrate connection	30	37	650	-	90	10T
CA3001	Video & Wideband Amplifier		29	19	29■	5	60	12T
CA3002	IF Amplifier		20	24	11■	4#	-	10T
CA3026	Dual Independent		120	32□	550†	3.25	75	12T
CA3028A	Differential /Cascode Amplifiers		120	40□	-	7.2#	62	8C, S, T
CA3028B			120	40	8	7.2#	62	
CA3040	Amplifier		55	37	5.5	7.5	-	12T
CA3049	Dual High Frequency		500	22	1.35▲	53	75	12T
CA3050	Dual Differential Amplifiers		20	-	4.3°/600†	-	60	14, D, E
CA3051			20	-	4.3°/600†	-	60	
CA3053	Differential /Cascode Amplifier		120	40	Recommended for IF Amplifier Applications			8E, S, T
CA3054	Dual Independent		120	32	550†	3.25	75	14E
CA3102	Dual High-Frequency		500	22	1.35▲	1.5	7.5	14E

*See Packaging Section °Min ■RMS ▲GHz #NF °Transistor Array †f_T (mHz) □G_P Min. at 100MHz Cascode. 16dB. Diff Ampl. 14dB

V_{OUT} (p-p V): CA3000, 6.4; CA3001, 5; CA3002, 5.5; CA3028B, 11.5; CA3040, 05. (RMS). T_A Range: -55 to +125°C except for types CA3051, CA3054 (-40 to +85°C)

Sample-and-Hold Amplifiers

Type	Sample/Hold Type	Temperature Range	Package*	Acquisition Time (to 0.01%) Typ, +25°C	Charge Transfer Typ, +25°C	Aperture Time Typ, +25°C	Gain Bandwidth Product Typ, +25°C
HA1-2420-2	Low droop rate	-55°C to +125°C	14-pin cerdip	3.2µs (C_H =1,000pF)	10pC	30ns	2.5MHz
HA1-2425-5		0°C to +75°C	14-pin cerdip				
HA1-2420/883		-55°C to +125°C	14-pin cerdip				
HA3-2425-5		0°C to +75°C	14-pin epoxy				
HA4-2420-8		-55°C to +125°C	20-pin LCC ceramic				
HA4P2425-5		0°C to +75°C	20-pin PLCC epoxy				
HA1-5320-2	High speed Low charge transfer Precision Complete-includes hold capacitor	-55°C to +125°C	14-pin cerdip	1µs (C_H = Internal)	0.1pC	25ns	2.0MHz C_H = 100pF
HA1-5320-5		0°C to +75°C	14-pin cerdip				
HA1-5320-8		-55°C to +125°C	14-pin cerdip				
HA4-5320-8		-55°C to +125°C	20-pin LCC ceramic				
HA1-5330-5	Very high speed Precision monolithic Complete-includes hold capacitor	0°C to +75°C	14-pin cerdip	500ns (C_H = Internal)	0.05pC	20ns	4.5MHz
HA1-5330-4		-25°C to +85°C	14-pin cerdip				
HA1-5330-2		-55°C to +125°C	14-pin cerdip				
HA1-5330/883		-55°C to +125°C	14-pin cerdip				
HA4-5330/883		-55°C to +125°C	20-pin LCC ceramic				

*See Packaging Section

General Purpose

Electrical Characteristics, $T_A = 25^oC$

Type	V_{IO} Max. mV	I_I Max. nA	I^+ Max. Ma	Max. V^+, V^-	A_{OL} (Min.) dB	Unity Gain BW Typ. MHz	SR (Typ.) V/μs	Pkg. No. of Pins*
Single-Unit Types								
CA311	7.5	250	8	±18	106	Response Time 1		8E, S, T
Dual-Unit Types								
CA3290	20	50pA	3	±18	88	Response Time 2		8E, S, T 14E1
CA3290A	10	40pA	3	±18	88			
Quad-Unit Types								
CA139	5	100	8	±18	-	Response Time 3		14E
CA139A	2	100	8	±18	94			14E
CA239	5	250	2	±18	-			14E
CA239A	2	250	2	±18	94			14E
CA339	5	250	2	±18	94			14E
CA339A	2	250	2	±18	94			14E

Type	V_{IO} mV	I_{IO} nA	Comments	Response Time	Pkg. No. of Pins*
HA4900 HA4902 HA4905	2	10	Single or dual supply. Analog and logic supplies separated for easier interface and noise immunity	130ns	16

*See Packaging Section.

Response Time:

1 - 200 ns
2 - tr = 1.2 μs, tf = 200 ns
3 - tr = 1.3 μs, tf = 300 ns

High-Speed

Type	V_{IO} mV	Propagation Delay ns	Tracking Bandwidth MHz
HFA-003	0.1	<3	300

Transistor Arrays

Electrical Characteristics at $T_A = 25^oC$

Type	Description	$V_{(BR)}$ CEO (Min.) V	$V_{(BR)}$ CBO (Min.) V	hFE (Min.)	I_C (Max.) mA	Package Number of Pins*
CA3018	Two Isolated Transistors plus a Darlington Pair	15	20	30	50	12T
CA3018A		15	30	60	50	
		h_{FE} matched ± 10%. V_{BE} matched ±2mV and ±5mV max. Operation from dc to 120MHz.				
CA3045	Three Transistors plus a Differential Pair	15	20	40	50	14D, 14F
CA3046		15	20	40	50	14E
		f_t > 300MHz 2 matched pairs ±5mV				
CA3050	Dual Differential Amplifiers plus Diode Bias String	15	20	f_T▲600	50	14D
CA3051		15	20	MHz (typ.)	50	14E
		I_{IO} = 70 nA max., I_{IB} = 500 nA max., V_{IO} = 5mV max.				
CA3081	General-Purpose n-p-n High-Current Transistors	16	20	40	100	16E, 16F
		Seven Common-Emitter				
CA3082		16	20	40	100	16E, 16F
		Seven Common-Collector				
CA3083		15	20	40	100	16E, 16F
		Five independent transistors Q_1 and Q_2 matched: (I_{IO} at 1mA.) 2.5µA maximum.				
CA3086	Three Isolated Transistors plus a Differential Pair	15	20	40	50	14E, 14F
		f_T > 550MHz typ. Operation from dc to 120MHz				
CA3127	Five Independent Transistors	15	20	40	20/trans.	16E, 16F
		f_T > 1 GHz. Operation from dc to 500MHz.				
CA3146	Three Transistors plus a Differential Pair	30	40	30	50	16E
CA3146A		40	50	30	50	
		f_T > 500MHz typ. Operation from dc to 120MHz.				
CA3183	Five High-Current Transistors	30	40	40	75	16E
CA3183A		40	50	40	75	
		High-voltage versions of CA3083 Transistors Q_1 and Q_2 matched at 1mA.				
CA3227	Five Independent Transistors	8	12	40	20/trans.	16E
		ft = 3GHz typ. Operation from dc to 1.5GHz.				
CA3246	Three Independent Transistors plus a Differential Pair	8	12	40	20	14E
		f_t = 3GHz typ. Operation from dc to 1.5GHZ.				
CA3250	General-Purpose n-p-n High-Current Transistors	20	20	40	100	18E, 18F
		Eight Common-Collector				
CA3251		20	20	40	100	
		Eight Common-Emitter				

▲ For single transistor
*Pinouts included in this section, also see Packaging Section.

Transistor Arrays (Continued)

Type	Description	$V_{(BR)CEO}$ (Min.) V n-p-n/p-n-p	$V_{(BR)CBO}$ (Min.) V n-p-n/p-n-p	h_{FE} (Min..) n-p-n/p-n-p	I_C (Max.) n-p-n/p-n-p	Package Number of Pins*
CA3096	Five Independent Transistors, 3 n-p-n, 2 p-n-p	35/-40	45/-40	150/20	50/-10	16E
CA3096A		35/-40	45/-40	150/20	50/-40	
CA3096C		24/-24	30/-24	100/15	50/-10	
		n-p-n		p-n-p		
		$\lvert V_{IO}\rvert$ = 5mV max.		5mV max.		
		$\lvert I_{IO}\rvert$ 0.6 μA max.		0.25 μA max.		
CA3097	Thyristor/Transistor Array 1 n-p-n, 1 n-p-n/p-n-p transistor pair, 1 zener, 1 PUT, 1 SCR	30/-40	50/-50	n-p-n/p-n-p pr. 8000 typ.	100/-10	16E
		PUT: I_P = 15nA, V_{AK} = ±30V Zener V_Z = 8V ± 10% Z_Z = 15Ω typ. at 10mA				

Amplifier Arrays •

Electrical Characteristics at T_A = 25°C

Type	Description	f_T MHz	A_{OL} (typ.) dB	NF (typ.) dB	Push-Pull Input/Output	Package Number of Pins*
CA3026	Dual Independent Differential Amplifiers	550■	32	3.25■	X	12T
CA3054		Maximum input offset voltage ±5mV. Useful from dc to 120MHz. Types are identical except for package and substrate connection.				14E
CA3049	Dual High-Frequency Differential Amplifiers	1350	23†	4.6†	X	12T
CA3102		Independently accessible inputs and outputs. Useful from dc to 500MHz. CA3102 like the CA3049 except that it has a separate substrate connection.				14E
CA3060	Three, Independent. Identical OTA Arrays	Includes unique zener diode regulator system. For data see OP Amp Section.			X	16E

■ For single transistor † At 200 MHz • 1/f at 1 kHz △ At 100 kHz ‡ Each amplifier

Diode Arrays

Electrical Characteristics at T_A = 25°C. Apply for each Diode

Type	Description	$V_{(BR)}$ R (Min.) V	I_R (Max.) μA	C_D (Typ.) pF	$V_{F1} - V_{F2}$ (Max.) mV	Package No. of Pins*
CA3019	Quad Plus 2 Uncommitted	4	10	1.8	5 (I_F = 1 mA)	10T
		• Ultra-fast low-capacitance matched diodes				
CA3039	6 Individual	5	0.1	0.65	5 (I_F = 1 mA)	12T
		• Ultra-fast low-capacitance matched diodes				
CA3141	10 High Reverse Breakdown Voltage Diodes□□	30	0.1	0.3	0.55 (typ. ea. diode pr.)	16E
		• Low-noise performance • Low-leakage current				

□□ Six connected to form 3 common-cathode diode pairs. Four connected to form 2 common-anode diode pairs.

*Pinouts included in this section, also see Packaging Section.

CMOS Array

Electrical Characteristics at T_A = 25°C

Type	Description	Features	Package Number of Pins*
CD54/74 HC UO4	QMOS Hex Inverter (Unbuffered) Linear Wideband Amplifier	t_{PLH}, t_{PHL} = 6 ns @ V_{CC} = 5V, 2 - 6V operation T_A = -40 to +85°C	14E, 14M
		For application information, refer to RCA Application Note. ICAN7637 'Linear Application of the CD74HCUO4 QMOS Inverter.'	

*Pinouts included in this section, also see Packaging Section.

High-Speed CMOS Arrays

20-Lead (E), (F) and (M) Packages

Type V_{CC} = 4.5V	V_{IH} Min. V	V_{IL} Max. V	V_{OH} Min. V	V_{OL} Max. V	I_I Max. µA	I_{CC} Max. µA	Switching Characteristics C_L = 50 pF, t_r, t_f = 6 ns		
							t_{PLH}, t_{PHL}• Max. ns	t_{TLH}, t_{THL}• Max. ns	C_1 Max. pF
CD54/74 HC688	3.15	1.35	4.4/3.98*	0.1/0.26*	±0.1†	8†	34/24‡	15	10
CD54/74 HCT688	2	0.8	4.4/3.98*	0.1/0.26*	±0.1†	8†	34/24‡	15	10

* CMOS/TTL loads

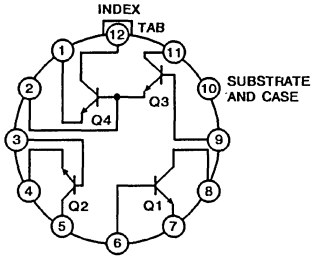
† V_{CC} = 6V

‡ Rand B data to output/enable to output

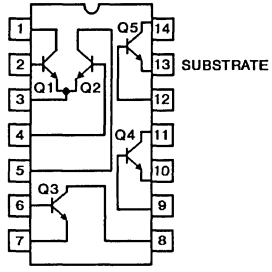
Note: For information on Power Darlington Transistor/Arrays, see section on Bipolar Power Transistors

Transistor Arrays

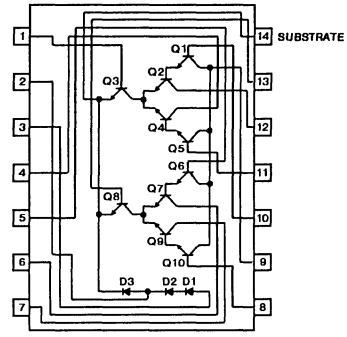
CA3018
CA3018A
TOP VIEW



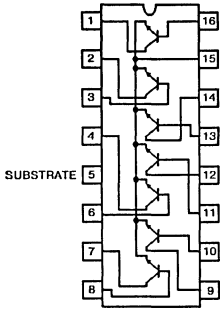
CA3045, CA3146
CA3046, CA3146A
CA3086, CA3246
TOP VIEW



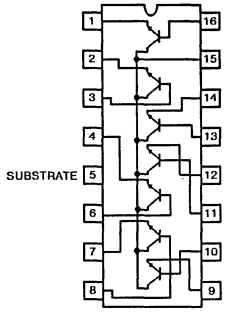
CA3050, CA3051
TOP VIEW



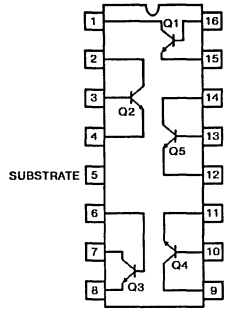
CA3081
TOP VIEW



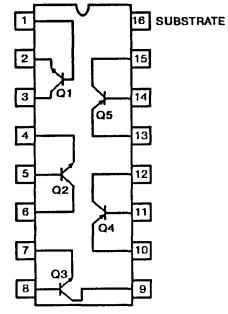
CA3082
TOP VIEW



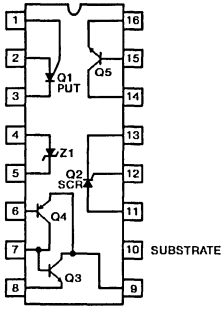
CA3083
CA3183
CA3183A
TOP VIEW



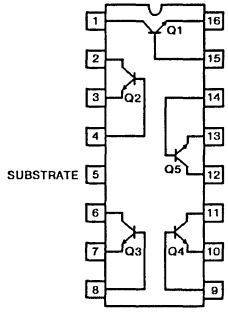
CA3096
CA3096A
CA3096C
TOP VIEW



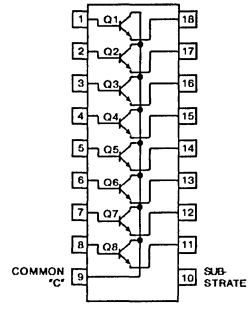
CA3097
TOP VIEW



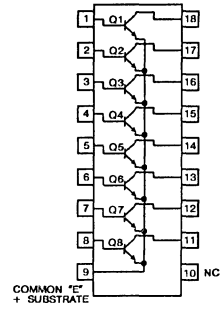
CA3127, CA3227
TOP VIEW



CA3250

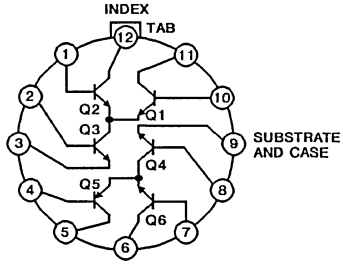


CA3251

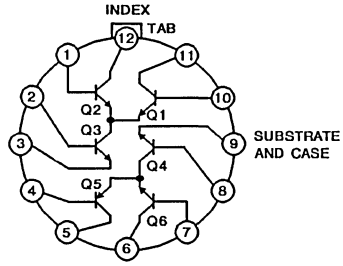


Amplifier Arrays

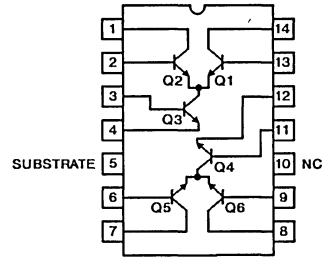
CA3026
TOP VIEW



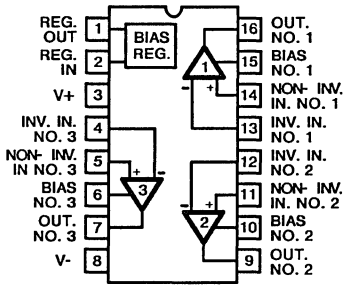
CA3049
TOP VIEW



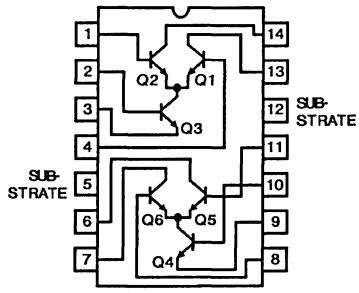
CA3054
TOP VIEW



CA3060
TOP VIEW

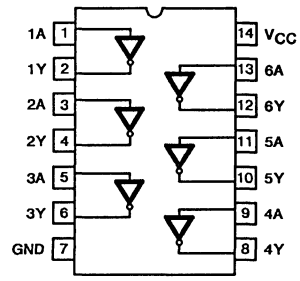


CA3102
TOP VIEW



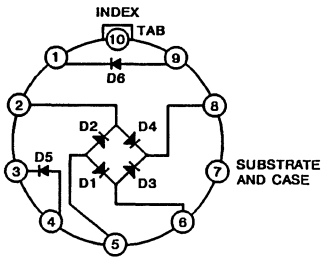
CMOS Array

CD54/74HCU04

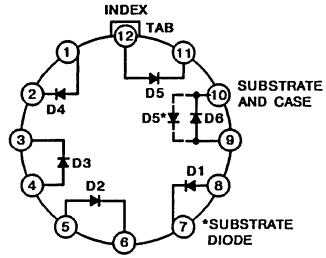


Diode Arrays

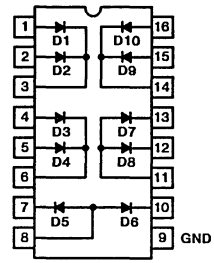
CA3019
TOP VIEW



CA3039
TOP VIEW



CA3141
TOP VIEW



General Purpose

Part Number	Multiplexer Type	Temperature Range	Package	R_{ON} Max Full Temp (Ω)	Off Output Leakage (nA) Max, Full Temp	Access Time (ns) Typ, +25°C	Settling Time (0.1%) Typ, +25°C
HI1-0506-2	Single-ended 16-channel	-55°C to +125°C	28-pin cerdip	400	300	250	1.2µs
HI1-0506-4		-25°C to +85°C	28-pin cerdip				
HI1-0506-5		0°C to +75°C	28-pin cerdip				
HI3-0506-5		0°C to +75°C	28-pin epoxy dip				
HI1-0506/883		-55°C to +125°C	28-pin cerdip				
HI4-0506/883		-55°C to +125°C	28-pin LCC ceramic				
HI4P0506-5		0°C to +75°C	28-pin PLCC epoxy				
HI1-0507-2	Differential 8-channel	-55°C to +125°C	28-pin cerdip	400	200	250	1.2µs
HI1-0507-4		-25°C to +85°C	28-pin cerdip				
HI1-0507-5		0°C to +75°C	28-pin cerdip				
HI3-0507-5		0°C to +75°C	28-pin epoxy dip				
HI1-0507/883		-55°C to +125°C	28-pin cerdip				
HI4-0507/883		-55°C to +125°C	28-pin LCC ceramic				
HI4P0507-5		0°C to +75°C	28-pin PLCC epoxy				
HI1-0508-2	Single-ended 8-channel	-55°C to +125°C	16-pin cerdip	400	200	250	360ns
HI1-0508-4		-25°C to +85°C	16-pin cerdip				
HI1-0508-5		0°C to +75°C	16-pin cerdip				
HI3-0508-5		0°C to +75°C	16-pin epoxy dip				
HI1-0508/883		-55°C to +125°C	16-pin cerdip				
HI4-0508/883		-55°C to +125°C	20-pin LCC ceramic				
HI4P0508-5		0°C to +75°C	20-pin PLCC epoxy				
HI1-0509-2	Differential 4-channel	-55°C to +125°C	16-pin cerdip	400	100	250	360ns
HI1-0509-4		-25°C to +85°C	16-pin cerdip				
HI1-0509-5		0°C to +75°C	16-pin cerdip				
HI3-0509-5		0°C to +75°C	16-pin epoxy dip				
HI1-0509/883		-55°C to +125°C	16-pin cerdip				
HI4-0509/883		-55°C to +125°C	20-pin LCC ceramic				
HI4P0509-5		0°C to +75°C	20-pin PLCC epoxy				
HI1-1818A-2	Single-ended 8-channel Low-Power	-55°C to +125°C	16-pin cerdip	500	250	350	1.0µs
HI1-1818A-5		0°C to +75°C	16-pin cerdip				
HI3-1818A-5		0°C to +75°C	16-pin epoxy dip				
HI1-1818A/883		-55°C to +125°C	16-pin cerdip				
HI4P1818-5		0°C to +75°C	20-pin PLCC epoxy				
HI1-1828A-2	Differential 4-channel Low-power	-55°C to +125°C	16-pin cerdip	500	125	350	1.0µs
HI1-1828A-5		0°C to +75°C	16-pin cerdip				
HI3-1828A-5		0°C to +75°C	16-pin epoxy dip				
HI1-1828A/883		-55°C to +125°C	16-pin cerdip				
HI4P1828-5		0°C to +75°C	20-pin PLCC epoxy				

Mux Family	Special Features	r_{DS} (ON) (Ω Max)	I_D (OFF) (nA Max)	t_{ON} (ns Max)	t_{OFF} (ns Max)	Analog Voltage Range V_{Supply} = (±15V)	Configuration			
							8 Channel Single Ended	4 Channel Differential	16 Channel Single Ended	8 Channel Differential
DG5XXA Series		400	10	1500	1000	-15 to +15	DG508A	DG509A		
		400	10	1500	1000	-15 to +15			DG506A	DG507A
DG52X Series	Multiplexer/Demultiplexer with latches for µP based systems	400	10	1500	1000	-15 to +15	DG528	DG529		
		400	10	1500	1000	-15 to +15			DG526	DG527

General Purpose (Continued)

Mux Family	Special Features	$r_{DS(ON)}$ (Ω Max)	$I_{D(OFF)}$ (nA Max)	t_{ON} (ns Max)	t_{OFF} (ns Max)	Analog Voltage Range V_{Supply} = (±15V)	Configuration			
							8 Channel Single Ended	4 Channel Differential	16 Channel Single Ended	8 Channel Differential
IH5000 Series	Industry standard pinouts, fault protection up to ±25V input, low leakage, low input current	1200	1.0	1500	1000	-25 to +25 (Input)	IH5108	IH5208		
		1200	1.0	1500	1000	-25 to +25 (Input)			IH5116	IH5216
IH6000 Series	Industrial standard pinouts, low leakage, low $R_{DS(ON)}$ break before make switching	300	2.0	1500	1000	-14 to +14	IH6108	IH6208		
		600	2.0	1500	1000	-14 to +14			IH6116	IH6216
IH9108	High Voltage Multiplexer/ Demultiplexer with latches for µP based systems	120	2.5	2000	1000	-50 to +50 *	IH9108			
DG5XXA Series		400	10	1500	1000	-15 to +15	DG508A	DG509A		
		400	10	1500	1000	-15 to +50			DG506A	DG507A
DG52X Series	Multiplexer/Demultiplexer with latches for µp based systems	400	10	1500	1000	-15 to +15	DG528	DG529		
		400	10	1500	1000	-15 to +15			DG526	DG527

*±60V for IH9108

High Speed/Mode Programmable

Part Number	Multiplexer Type	Temperature Range	Package	R_{ON} Max Full Temp (Ω)	Off Output Leakage (nA) Max, Full Temp	Access Time (ns) Typ, +25°C	Settling Time (0.1%) Typ, +25°C
HI1-0516-2	16-channel/dual 8	-55°C to +125°C	28-pin cerdip	1.0K	100	130	250ns
HI1-0516-5		0°C to +75°C	28-pin cerdip				
HI3-0516-5		0°C to +75°C	28-pin epoxy dip				
HI4-516-8		-55°C to +125°C	28-pin LCC ceramic				
HI1-0518-2	8-channel/dual 4	-55°C to +125°C	18-pin cerdip	1.0K	50	130	250ns
HI1-0518-5		0°C to +75°C	18-pin cerdip				
HI3-0518-5		0°C to +75°C	18-pin epoxy dip				
HI1-0518/883		-55°C to +125°C	18-pin cerdip				
HI4P0518-5		0°C to +75°C	20-pin PLCC epoxy				

Special Purpose

Part Number	Multiplexer Type	Temperature Range	Package	R_{ON} Max Full Temp (Ω)	Off Output Leakage (nA) Max, Full Temp	Access Time (ns) Typ, +25°C	Settling Time (0.1%) Typ, +25°C
HI1-0524-2	4-channel video with low 10MHz crosstalk	-55°C to +125°C	18-pin cerdip	1.5K	50	150	200ns
HI1-0524-5		0°C to +75°C	18-pin cerdip				
HI3-0524-5		0°C to +75°C	18-pin epoxy dip				
HI1-0524/883		-55°C to +125°C	18-pin cerdip				
HI4P0524-5		0°C to +75°C	20-pin PLCC epoxy				
HI1-539-2	Differential 4-channel low, level matched	-55°C to +125°C	16-pin cerdip	1.1K	25	250	900ns
HI1-539-5		0°C to +75°C	16-pin cerdip		2.5		
HI3-539-5		0°C to +75°C	16-pin epoxy dip		2.5		
HI4P539		0°C to +75°C	20-pin PLCC epoxy		2.5		

Overvoltage-Protected

Part Number	Multiplexer Type	Temperature Range	Package	R_{ON} Max Full Temp (Ω)	Off Output Leakage (nA) Max, Full Temp	Access Time (ns) Typ, +25°C	Settling Time (0.1%) Typ, +25°C
HI1-0506A-2	Single-ended	-55°C to +125°C	28-pin cerdip				
HI1-0506A-5	16-channel	0°C to +75°C	28-pin cerdip				
HI3-0506A-5	70Vp-p input	0°C to +75°C	28-pin epoxy dip	1.8K	300	500	1.2µs
HI1-0507A-2	Differential	-55°C to +125°C	28-pin cerdip				
HI1-0507A-5	8-channel	0°C to +75°C	28-pin cerdip				
HI3-0507A-5	70Vp-p input	0°C to +75°C	28-pin epoxy dip	1.8K	200	500	1.2µs
HI1-0508A-2	Single-ended	-55°C to +125°C	16-pin cerdip				
HI1-0508A-5	8-channel	0°C to +75°C	16-pin cerdip				
HI3-0508A-5	70Vp-p input	0°C to +75°C	16-pin epoxy dip	1.8K	200	500	1.2µs
HI1-0509A-2	Differential	-55°C to +125°C	16-pin cerdip				
HI1-0509A-5	4-channel	0°C to +75°C	16-pin cerdip				
HI3-0509A-5	70Vp-p input	0°C to +75°C	16-pin epoxy dip	1.8K	100	500	1.2µs
HI1-546-2	Single-ended	-55°C to +125°C	28-pin cerdip				
HI1-546-4	16-channel	-25°C to +85°C	28-pin cerdip				
HI1-546-5	70Vp-p input	0°C to +75°C	28-pin cerdip				
HI3-546-5		0°C to +75°C	28-pin epoxy dip	1.8K	300	500	1.2µs
HI1-546/883	With R_{ON} Matching	-55°C to +125°C	28-pin cerdip				
HI4-546/883		-55°C to +125°C	28-pin LCC ceramic				
HI4P546-15		-55°C to +125°C	28-pin PLCC epoxy				
HI1-547-2	Differential	-55°C to +125°C	28-pin cerdip				
HI1-547-4	8-channel	-25°C to +85°C	28-pin cerdip				
HI1-547-5	70Vp-p input	0°C to +75°C	28-pin cerdip				
HI3-547-5		0°C to +75°C	28-pin epoxy dip	1.8K	200	500	1.2µs
HI1-547/883	With R_{ON} Matching	-55°C to +125°C	28-pin cerdip				
HI4-547/883		-55°C to +125°C	28-pin LCC ceramic				
HI4P547-5		-55°C to +125°C	28-pin PLCC epoxy				
HI1-548-2	Single-ended	-55°C to +125°C	16-pin cerdip				
HI1-548-4	8-channel	-25°C to +85°C	16-pin cerdip				
HI1-548-5	70Vp-p input	0°C to +75°C	16-pin cerdip				
HI3-548-5		0°C to +75°C	16-epoxy dip	1.8K	200	500	1.2µs
HI1-548/883	With R_{ON} Matching	-55°C to +125°C	16-pin cerdip				
HI4-548/883		-55°C to +125°C	20-pin LCC ceramic				
HI4P548-5		-55°C to +125°C	20-Pin PLCC epoxy				
HI1-549-2	Differential	-55°C to +125°C	16-pin cerdip				
HI1-549-4	4-channel	-25°C to +85°C	16-pin cerdip				
HI1-549-5	70Vp-p input	0°C to +75°C	16-pin cerdip				
HI3-549-5		0°C to +75°C	16-epoxy dip	1.8K	100	500	1.2µs
HI1-549/883	With R_{ON} Matching	-55°C to +125°C	16-pin cerdip				
HI4-549/883		-55°C to +125°C	20-pin LCC ceramic				
HI4P549-5		-55°C to +125°C	20-pin PLCC epoxy				

General Purpose Analog Switches

Harris offers two general-purpose switch lines, each with various switch configurations. The first consists of bipolar drivers controlling an associated set of field-effect switching transistors in a multi-chip structure that provides a wide choice of parameters at low cost. The second is a monolithic CMOS structure capable of improved performance and greater reliability. All have break-before-make switch action. All switches are available in commercial and military temperature ranges. Package options include Plastic S.O.I.O. (not all options are available for all devices types).

General Purpose Analog Switches

Switch Family†	Special Features	Switch Type	Switches Parameters				
			$R_{DS(ON)}$ Ω Max	$I_{D(OFF)}$ nA Max	t_{ON} ns Max	t_{OFF} ns Max	Analog Voltage Range (V_{Supply} = ±15V)
Multichip							
DG123-125	Inverting/non-inverting logic Inputs	PMOS	600	4	300	1000	-
DG126-145	Dual Channel/Single Channel	N-JFET	10 15 30 50 80	10 10 1 1 1	1000 1000 600 600 600	2500 2500 1600 1600 1600	- - - - -
DG180-191	Mature, industry-standard switch, JAN38510 Approved	N-JFET	10 30 75	10 1 1	300 150 250	250 130 130	-7.5 to +15 -7.5 to +15 -10 to +15
Monolithic							
DG200/201	Industry-standard low cost	CMOS	70/80	2.0	1000	500	-15 to +15
DG201A DG202	Inverting Non-Inverting	CMOS CMOS	175 175	1.0 1.0	600 600	450 450	-15 to +15 -15 to +15
DG211 DG212	Inverting Non-Inverting	CMOS	175	5.0	1000	500	-15 to +15
DG300A-303A	TTL compatible, low power	CMOS	50	1.0	300	250	-15 to +15
DG308A DG309	Normally-Closed Normally-Open	CMOS CMOS	100 100	1 1	200 200	150 150	-15 to +15 -15 to +15
IH5040-47 IH5052-53	Low quiescent current Low $R_{DS(ON)}$	CMOS	75 75	1.0 1.0	1000 500	500 250	-10 to +10 -11 to +11
IH5140-45	High speed, low power, low leakage	CMOS	50	0.5	175 200	125* 125	-11 to +11
IH5148-51	Low $R_{DS(ON)}$, high speed, low power	CMOS	25	1.0	250 350 500	200 250 250	-14 to +14

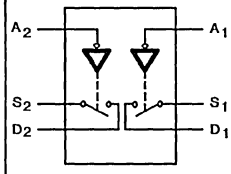
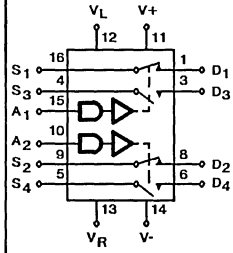
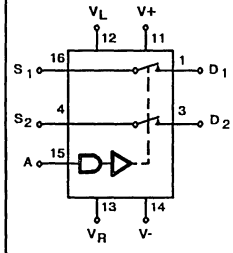
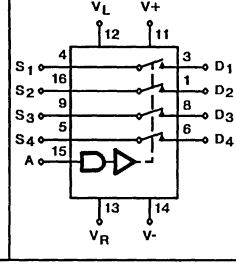
*Switching times are for the IH5140 and IH5145 †Switch configurations included in this section.

General Purpose (Continued)

Type	Switch Type	Temperature Range °C	Package	R_{ON} Max, Full Temp	Off Output Leakage Max, Full Temp	Switch ON Time Max, +25°C	Power Dissipation Typ, +25°C
HI1-0301-2		-55°C to +125°C	14-pin cerdip	75Ω	100nA	300ns	1.5mW
HI1-0301-5		0°C to +75°C	14-pin cerdip	75Ω	100nA	300ns	1.5mW
HI1-0301-7		0°C to +75°C	14-pin cerdip	75Ω	100nA	300ns	1.5mW
HI2-0301-2		-55°C to +125°C	TO-100 can	75Ω	100nA	300ns	1.5mW
HI2-0301-5		0°C to +75°C	TO-100 can	75Ω	100nA	300ns	1.5mW
HI2-0301-7		0°C to +75°C	TO-100 can	75Ω	100nA	300ns	1.5mW
HI2-0301-8		-55°C to +125°C	TO-100 can	75Ω	100nA	300ns	1.5mW
HI1-0305-2		-55°C to +125°C	14-pin cerdip	75Ω	100nA	250ns	1.5mW
HI1-0305-5		0°C to +75°C	14-pin cerdip	75Ω	100nA	250ns	1.5mW
HI1-0305-7		0°C to +75°C	14-pin cerdip	75Ω	100nA	250ns	1.5mW
HI2-0305-2		-55°C to +125°C	TO-100 can	75Ω	100nA	250ns	1.5mW
HI2-0305-5		0°C to +75°C	TO-100 can	75Ω	100nA	250ns	1.5mW
HI2-0305-7		0°C to +75°C	TO-100 can	75Ω	100nA	250ns	1.5mW
HI2-0305-8		-55°C to +125°C	TO-100 can	75Ω	100nA	250ns	1.5mW
HI1-0387-2		-55°C to +125°C	14-pin cerdip	75Ω	100nA	300ns	1.5mW
HI1-0387-5		0°C to +75°C	14-pin cerdip	75Ω	100nA	300ns	1.5mW
HI1-0387-7		0°C to +75°C	14-pin cerdip	75Ω	100nA	300ns	1.5mW
HI2-0387-2		-55°C to +125°C	TO-100 can	75Ω	100nA	300ns	1.5mW
HI2-0387-5		0°C to +75°C	TO-100 can	75Ω	100nA	300ns	1.5mW
HI2-0387-7		0°C to +75°C	TO-100 can	75Ω	100nA	300ns	1.5mW
HI2-0387-8		-55°C to +125°C	TO-100 can	75Ω	100nA	300ns	1.5mW
HI1-5042-2		-55°C to +125°C	16-pin cerdip	75Ω	500nA	370ns*	1.5mW
HI1-5042-5		0°C to +75°C	16-pin cerdip	75Ω	500nA	370ns*	1.5mW
HI1-5042-7		0°C to +75°C	16-pin cerdip	75Ω	500nA	370ns*	1.5mW
HI1-5042/883		-55°C to +125°C	16-pin cerdip	75Ω	500nA	370ns*	1.5mW
HI3-5042-5		0°C to +75°C	16-pin epoxy dip	75Ω	500nA	370ns*	1.5mW
HI1-5050-2		-55°C to +125°C	16-pin cerdip	75Ω	500nA	370ns*	1.5mW
HI1-5050-5		0°C to +75°C	16-pin cerdip	75Ω	500nA	370ns*	1.5mW
HI1-5050-7		0°C to +75°C	16-pin cerdip	50Ω	500nA	370ns*	1.5mW
HI1-5050/883		-55°C to +125°C	16-pin cerdip	75Ω	500nA	370ns*	1.5mW
HI3-5050-5		0°C to +75°C	16-pin epoxy dip	75Ω	500nA	370ns*	1.5mW
HI1-0303-2		-55°C to +125°C	14-pin cerdip	75Ω	100nA	300ns	1.5mW
HI1-0303-5		0°C to +75°C	14-pin cerdip	75Ω	100nA	300ns	1.5mW
HI1-0303-7		0°C to +75°C	14-pin cerdip	75Ω	100nA	300ns	1.5mW
HI1-0307-2		-55°C to +125°C	14-pin cerdip	75Ω	100nA	250ns	1.5mW
HI1-0307-5		0°C to +75°C	14-pin cerdip	75Ω	100nA	250ns	1.5mW
HI1-0307-7		0°C to +75°C	14-pin cerdip	75Ω	100nA	250ns	1.5mW
HI1-0390-2		-55°C to +125°C	14-pin cerdip	75Ω	100nA	300ns	1.5mW
HI1-0390-5		0°C to +75°C	14-pin cerdip	75Ω	100nA	300ns	1.5mW
HI1-0390-7		0°C to +75°C	14-pin cerdip	75Ω	100nA	300ns	1.5mW
HI1-5043-2		-55°C to +125°C	16-pin cerdip	75Ω	500nA	370ns*	1.5mW
HI1-5043-5		0°C to +75°C	16-pin cerdip	75Ω	500nA	370ns*	1.5mW
HI1-5043-7		0°C to +75°C	16-pin cerdip	75Ω	500nA	370ns*	1.5mW
HI1-5043/883		-55°C to +125°C	16-pin cerdip	75Ω	500nA	370ns*	1.5mW
HI3-5043-5		0°C to +75°C	16-pin epoxy dip	75Ω	500nA	370ns*	1.5mW
HI4-5043/883		-55°C to +125°C	0.35" Sq LCC pack	75Ω	500nA	370ns*	1.5mW
HI1-5051-2		-55°C to +125°C	16-pin cerdip	50Ω	500nA	370ns*	1.5mW
HI1-5051-5		0°C to +75°C	16-pin cerdip	50Ω	500nA	370ns*	1.5mW
HI1-5051-7		0°C to +75°C	16-pin cerdip	50Ω	500nA	370ns*	1.5mW
HI1-5051/883		-55°C to +125°C	16-pin cerdip	50Ω	500nA	370ns*	1.5mW
HI3-5051-5		0°C to +75°C	16-pin epoxy dip	50Ω	500nA	370ns*	1.5mW

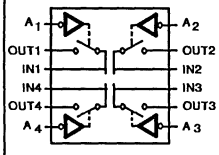
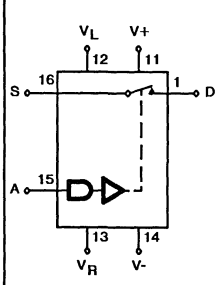
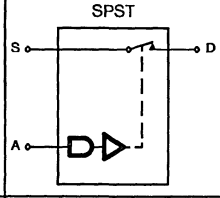
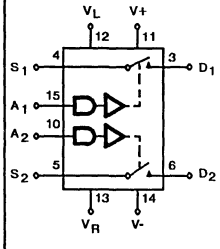
*Typical Value

General Purpose (Continued)

Type	Switch Type	Temperature Range	Package	R_{ON} Max, Full Temp	Off Output Leakage Max, Full Temp	Switch ON Time Max, +25°C	Power Dissipation Typ, +25°C
HI1-5044-2		-55°C to +125°C	16-pin cerdip	75Ω	500nA	370ns*	1.5mW
HI1-5044-5		0°C to +75°C	16-pin cerdip	75Ω	500nA	370ns*	1.5mW
HI1-5044-7		0°C to +75°C	16-pin cerdip	75Ω	500nA	370ns	1.5mW
HI1-5044/883		-55°C to +125°C	16-pin cerdip	75Ω	500nA	370ns*	1.5mW
HI3-5044-5		0°C to +75°C	16-pin epoxy dip	75Ω	500nA	370ns*	1.5mW
HI1-0381-2		-55°C to +125°C	14-pin cerdip	75Ω	100nA	300ns	1.5mW
HI1-0381-5		0°C to +75°C	14-pin cerdip	75Ω	100nA	300ns	1.5mW
HI1-0381-7		0°C to +75°C	14-pin cerdip	75Ω	100nA	300ns	1.5mW
HI2-0381-2		-55°C to +125°C	TO-100 can	75Ω	100nA	300ns	1.5mW
HI2-0381-5		0°C to +75°C	TO-100 can	75Ω	100nA	300ns	1.5mW
HI2-0381-7		0°C to +75°C	14-pin cerdip	75Ω	100nA	300ns	1.5mW
HI1-0200-2		-55°C to +125°C	14-pin cerdip	100Ω	500nA	240ns*	15mW
HI1-0200-4		-25°C to +85°C	14-pin cerdip	100Ω	500nA	240ns*	15mW
HI1-0200-5		0°C to +75°C	14-pin cerdip	100Ω	500nA	240ns*	15mW
HI1-0200-7		0°C to +75°C	14-pin cerdip	100Ω	500nA	240ns*	15mW
HI1-0200/883		-55°C to +125°C	14-pin cerdip	100Ω	500nA	240ns*	15mW
HI2-0200-2		-55°C to +125°C	TO-100 can	100Ω	500nA	240ns*	15mW
HI2-0200-4		-25°C to +85°C	TO-100 can	100Ω	500nA	240ns*	15mW
HI2-0200-5		0°C to +75°C	TO-100 can	100Ω	500nA	240ns*	15mW
HI2-0200-7		0°C to +75°C	TO-100 can	100Ω	500nA	240ns*	15mW
HI2-0200/883		-55°C to +125°C	TO-100 can	100Ω	500nA	240ns*	15mW
HI3-0200-5		0°C to +75°C	14-pin epoxy dip	100Ω	500nA	240ns*	15mW
HI1-0302-2		-55°C to +125°C	14-pin cerdip	75Ω	100nA	300ns	1.5mW
HI1-0302-5		0°C to +75°C	14-pin cerdip	75Ω	100nA	300ns	1.5mW
HI1-0303-7		0°C to +75°C	14-pin cerdip	75Ω	100nA	300ns	1.5mW
HI1-0306-2		-55°C to +125°C	14-pin cerdip	75Ω	100nA	250ns	1.5mW
HI1-0306-5		0°C to +75°C	14-pin cerdip	75Ω	100nA	250ns	1.5mW
HI1-0306-7		0°C to +75°C	14-pin cerdip	75Ω	100nA	250ns	1.5mW
HI1-0384-2		-55°C to +125°C	14-pin cerdip	75Ω	100nA	300ns	1.5mW
HI1-0384-5		0°C to +75°C	14-pin cerdip	75Ω	100nA	300ns	1.5mW
HI1-0384-7		0°C to +75°C	14-pin cerdip	75Ω	100nA	300ns	1.5mW
HI1-5045-2		-55°C to +125°C	16-pin cerdip	75Ω	500nA	370ns*	1.5mW
HI1-5045-5		0°C to +75°C	16-pin cerdip	75Ω	500nA	370ns*	1.5mW
HI1-5045-7		0°C to +75°C	16-pin cerdip	75Ω	500nA	370ns	1.5mW
HI1-5045/883		-55°C to +125°C	16-pin cerdip	75Ω	500nA	370ns*	1.5mW
HI3-5045-5		0°C to +75°C	16-pin epoxy dip	75Ω	500nA	370ns*	1.5mW
HI4-5045/883		-55°C to +125°C	0.35" Sq LCC pack	75Ω	500nA	370ns*	1.5mW
HI1-5049-2		-55°C to +125°C	16-pin cerdip	50Ω	500nA	370ns*	1.5mW
HI1-5049-5		0°C to +75°C	16-pin cerdip	50Ω	500nA	370ns*	1.5mW
HI1-5049-7		0°C to +75°C	16-pin cerdip	50Ω	500nA	370ns	1.5mW
HI1-5049/883		-55°C to +125°C	16-pin cerdip	50Ω	500nA	370ns*	1.5mW
HI3-5049-5		0°C to +75°C	16-pin epoxy dip	50Ω	500nA	370ns*	1.5mW
HI1-5046-2		-55°C to +125°C	16-pin cerdip	75Ω	500nA	370ns*	1.5mW
HI1-5046-5		0°C to +75°C	16-pin cerdip	75Ω	500nA	370ns*	1.5mW
HI1-5046-7		0°C to +75°C	16-pin cerdip	75Ω	500nA	370ns	1.5mW
HI1-5046/883		-55°C to +125°C	16-pin cerdip	75Ω	500nA	370ns*	1.5mW
HI3-5046-5		0°C to +75°C	16-pin epoxy dip	75Ω	500nA	370ns*	1.5mW
HI1-5046A-2		-55°C to +125°C	16-pin cerdip	50Ω	500nA	370ns*	1.5mW
HI1-5046A-5		0°C to +75°C	16-pin cerdip	50Ω	500nA	370ns*	1.5mW
HI1-5046A-7		0°C to +75°C	16-pin cerdip	50Ω	500nA	370ns	1.5mW
HI1-5046A/883		-55°C to +125°C	16-pin cerdip	50Ω	500nA	370ns*	1.5mW
HI3-5046A-5		0°C to +75°C	16-pin epoxy dip	50Ω	500nA	370ns*	1.5mW

*Typical Value

General Purpose (Continued)

Type	Switch Type	Temperature Range	Package	R_{ON} Max, Full Temp	Off Output Leakage Max, Full Temp	Switch ON Time Max, +25°C	Power Dissipation Typ, +25°C
HI1-5047-2		-55°C to +125°C	16-pin cerdip	75Ω	500nA	370ns*	1.5mW
HI1-5047-5		0°C to +75°C	16-pin cerdip	75Ω	500nA	370ns*	1.5mW
HI1-5047-7		0°C to +75°C	16-pin cerdip	75Ω	500nA	370ns	1.5mW
HI1-5047/883		-55°C to +125°C	16-pin cerdip	75Ω	500nA	370ns*	1.5mW
HI3-5047-5		0°C to +75°C	16-pin epoxy dip	75Ω	500nA	370ns*	1.5mW
HI1-5047A-2		-55°C to +125°C	16-pin cerdip	50Ω	500nA	370ns*	1.5mW
HI1-5047A-5		0°C to +75°C	16-pin cerdip	50Ω	500nA	370ns*	1.5mW
HI1-5047A-7		0°C to +75°C	16-pin cerdip	50Ω	500nA	370ns	1.5mW
HI1-5047A/883		-55°C to +125°C	16-pin cerdip	50Ω	500nA	370ns*	1.5mW
HI3-5047A-5		0°C to +75°C	16 pin epoxy dip	50Ω	500nA	370ns*	1.5mW
HI1-0201-2		-55°C to +125°C	16 pin cerdip	100Ω	500nA	185ns*	15mW
HI1-0201-4		-25°C to +85°C	16-pin cerdip	100Ω	250nA	185ns*	15mW
HI1-0201-5		0°C to +75°C	16 pin cerdip	100Ω	250nA	185ns*	15mW
HI1-0201-7		0°C to +75°C	16-pin cerdip	100Ω	250nA	185ns*	15mW
HI1-0201/883		-55°C to +125°C	16-pin cerdip	100Ω	500nA	185ns*	15mW
HI3-0201-5		0°C to +75°C	16-pin epoxy dip	100Ω	250nA	185ns*	15mW
HI4-0201/883		-55°C to +125°C	0.35" Sq LCC pack	100Ω	500nA	185ns*	15mW
HI1-0201HS-2		-55°C to +125°C	16-pin cerdip	75Ω	100nA	50ns	120mW
HI1-0201HS-4		-25°C to +85°C	16-pin cerdip	75Ω	50nA	50ns	120mW
HI1-0201HS-5		0°C to +75°C	16 pin cerdip	75Ω	50nA	50ns	120mW
HI1-0201HS/883		-55°C to +125°C	16 pin cerdip	75Ω	100nA	50ns	120mW
HI3-0201HS-4		-25°C to +85°C	16-pin epoxy dip	75Ω	50nA	50ns	120mW
HI3-0201HS-5		0°C to +75°C	16-pin cerdip	75Ω	50nA	50ns	120mW
HI4-0201HS-5		0°C to +75°C	16-pin epoxy dip	75Ω	50nA	50ns	120mW
HI1-5040-2		-55°C to +125°C	16-pin cerdip	75Ω	500nA	370ns*	1.5mW
HI1-5040-5		0°C to +75°C	16-pin cerdip	75Ω	500nA	370ns*	1.5mW
HI1-5040-7		0°C to +75°C	16-pin cerdip	75Ω	500nA	370ns	1.5mW
HI1-5040/883		-55°C to +125°C	16-pin cerdip	75Ω	500nA	370ns*	1.5mW
HI3-5040-5		0°C to +75°C	16-pin epoxy dip	75Ω	500nA	370ns*	1.5mW
HI1-0222-2		-55°C to +125°C	14-pin cerdip	60Ω	200nA	150ns	120mW
HI1-0222-4		-25°C to +85°C	14-pin cerdip	60Ω	200nA	150ns	120mW
HI1-0222-5		0°C to +75°C	14-pin cerdip	40Ω	200nA	150ns	120mW
HI1-0222-7		0°C to +75°C	14-pin cerdip	40Ω	200nA	150ns	120mW
HI1-0300-2		-55°C to +125°C	14-pin cerdip	75Ω	100nA	300ns	1.5mW
HI1-0300-5		0°C to +75°C	14-pin cerdip	75Ω	100nA	300ns	1.5mW
HI1-0300-7		0°C to +75°C	14-pin cerdip	75Ω	100nA	300ns	1.5mW
HI2-0300-2		-55°C to +125°C	TO-100 can	75Ω	100nA	300ns	1.5mW
HI2-0300-5		0°C to +75°C	TO-100 can	75Ω	100nA	300ns	1.5mW
HI2-0300-7		0°C to +75°C	14-pin cerdip	75Ω	100nA	300ns	1.5mW
HI1-0304-2		-55°C to +125°C	14-pin cerdip	75Ω	100nA	250ns	1.5mW
HI1-0304-5		0°C to +75°C	14-pin cerdip	75Ω	100nA	250ns	1.5mW
HI1-0304-7		0°C to +75°C	14-pin cerdip	75Ω	100nA	250ns	1.5mW
HI2-0304-2		-55°C to +125°C	TO-100 can	75Ω	100nA	250ns	1.5mW
HI2-0304-5		0°C to +75°C	TO-100 can	75Ω	100nA	250ns	1.5mW
HI2-0304-7		0°C to +75°C	14-pin cerdip	75Ω	100nA	250ns	1.5mW
HI1-5041-2		-55°C to +125°C	16-pin cerdip	75Ω	500nA	370ns*	1.5mW
HI1-5041-5		0°C to +75°C	16-pin cerdip	75Ω	500nA	370ns*	1.5mW
HI1-5041-7		0°C to +75°C	16-pin cerdip	75Ω	500nA	370ns	1.5mW
HI1-5041/883		-55°C to +125°C	16-pin cerdip	75Ω	500nA	370ns*	1.5mW
HI3-5041-5		0°C to +75°C	16-pin epoxy dip	75Ω	500nA	370ns*	1.5mW
HI1-5048-2		-55°C to +125°C	16-pin cerdip	50Ω	500nA	370ns*	1.5mW
HI1-5048-5		0°C to +75°C	16-pin cerdip	50Ω	500nA	370ns*	1.5mW
HI1-5048/883		-55°C to +125°C	16-pin cerdip	50Ω	500nA	370ns*	1.5mW
HI3-5048-5		0°C to +75°C	16-pin epoxy dip	50Ω	500nA	370ns*	1.5mW

*Typical Value

Virtual Ground JFETs (P-Channel)

Switch Configuration				Features	Special Features	$r_{DS(on)}$ (Ω Max.)	Package Number of Pins*
SPST	Dual SPST	Triple SPST	Quad SPST				
IH5022	IH5017 IH5018			• 4 channels analog gating eliminate external drivers.	Common Output	100 150	DD, JD, PA
		IH5014	IH5009 IH5010	• Odd number devices drive directly from TTL open-collector logic (15V).			DD, JD, PD
IH5024	IH5019 IH5020			• Each channel simulates SPDT switch. t_{on}/t_{off} = 500ns. I_D (off) = 0.2nA	Separate Output	100 150	DE, JE, PA
		IH5016	IH5011 IH5012				PA, PE

T_A Range: 0°C to +70°C, -55 to +125°C

*See Packaging Section

RF/Video Switches, CMOS

Switch Configuration		Features	$r_{DS(on)}$ (Ω Max.)	$I_{D(off)}$ (nA Max.)	t_{on} (ns Max.)	t_{off} (ns. Max.)	Package Number of Pins*
Dual SPST	Quad SPST						
IH5341		• Superior I/O isolation enhances video, rf performance	75	1.0	300	150	PD, TW
	IH5352	• Switch attenuation varies <3dB from dc to 100MHz					

T_A Range: 0°C to +70°C, -25 to +85°C, -55 to +125°C

*See Packaging Section

Separate Driver/Switch Combinations

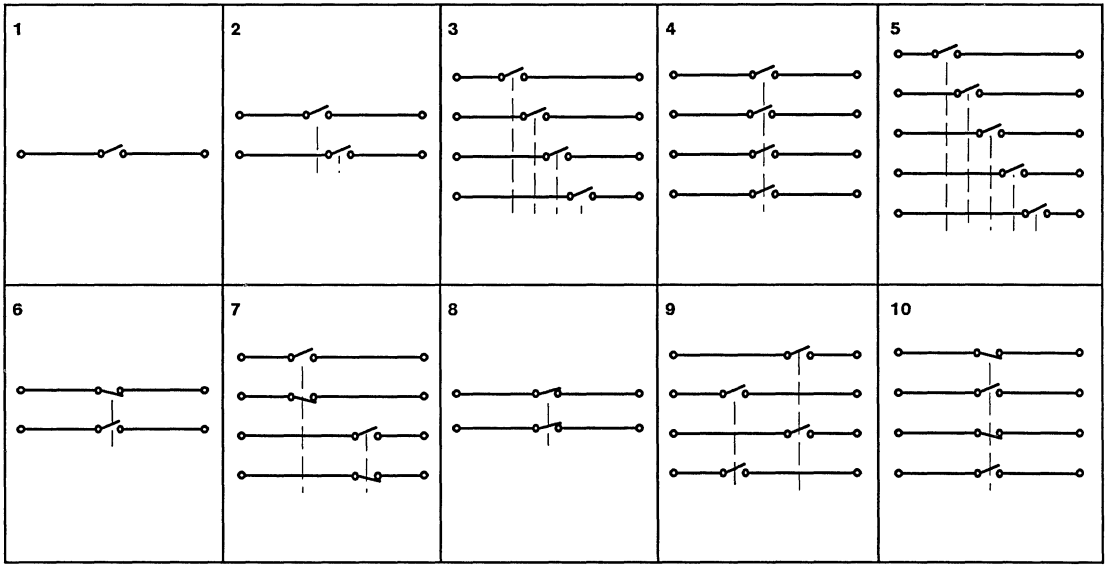
IH6201	TTL level translator/driver	N-JFET	30	0.5	50 (Typ)	150 (Typ)	15p-p (Min)
IH401/A	Low charge injection switch		50	0.5	50 (Typ)	150 (Typ)	20p-p (Min)

Drivers for FET Switches

Monolithic bipolar drivers convert low-level positive logic to high-level positive and negative voltages necessary to drive FET switches.

Type	Number of Channels	Output Swing		t_{ON} ns Max	t_{OFF} ns Max
		Positive (V Max)	Negative (V Max)		
IH6201	2 TTL	+14.0	-14.0	400	300

Switch Configurations



Switch Configuration (Diagram)									
SPST (1)	Dual SPST (2)	Quad SPST (3)	4PST (4)	Five SPST (5)	SPDT (6)	Dual SPDT (7)	DPST (8)	Dual DPST (9)	DPDT (10)
				DG123 DG125					
	DG141 DG133 DG134				DG146 DG144 DG143			DG140 DG129 DG126	DG145 DG139 DG142
	DG180 DG181 DG182				DG186 DG187 DG188	DG189 DG190 DG191		DG183 DG184 DG185	
	DG200	DG201 DG201A DG202							
		DG211 DG212			DG301A				
	DG300A	DG308A DG309				DG303A		DG302A	
IH5040	IH5041	IH5052/53	IH5047		IH5042	IH5043	IH5044	IH5045	IH5046
IH5140	IH5141				IH5142	IH5143	IH5144	IH5145	
	IH5148				IH5150	IH5151		IH5149	
		IH401/A							

Power-Supply Supervisory Circuits

Type	Function	Description	Package Number of Pins*
ICL7663S	Programmable micro-power positive voltage regulator	Low-power, high-efficiency device (I_Q = 4μA max.) that accepts an input of 1 to 16V and provides an adjustable output over the same range at up to 40mA load. T_A Range: 0 to +70°C, -25 to +85°C. Line and load regulation and ESP protection (>2000V).	BA, JA, PA, TV
ICL7680	-5V to ±15V voltage converter/regulator	Boost-type switched-mode converter inverter chip to convert +5 to ±15V regulated outputs. Features current limiting protection with external shut down. T_A Range: 0 to +70°C.	JE, PE
ICL7660S	Voltage converter	Performs supply voltge conversion from positive to negative. Input range is +1.5V to +10V resulting in complementary output voltages of -1.5V to -12V. Can be connected as a voltge doubler to generate output voltage of -18.6V. T_A Range: 0 to +70°C, -55 to +125°C. ICL7660S improved version of ICL7660. Has extended supply voltage range, lower supply current, and ESD protection (>2000V).	BA, PA, TV
ICL7662S	Voltage converter	Similar to the ICL7660 in its operation, except the output voltages are -4.5V to -20V. Doubler output 22.6V.	PA, TV
ICL7665S ICL7665	Programmable micro-power under/over voltage detector	Contains two individually programmable voltage comparators and requires only 3μA supply current. Intended for battery-operated systems that require low or high voltage warnings, etc. Open drain outputs for interfacing. T_A Range: 0 to +70°C, -25 to +85°C. ICL7665S improved ICL7665. For features, see ICL7663S.	BA, JA, PA, TV
ICL8211	Programmable voltage level detector	Contains a 1.15V reference, a comparator, a hysteresis output and a non-inverting main-output. Provides a 7mA current-limited output sink when voltage on threshold terminal is <1.15V. T_A Range: 0 to +70°C, -55 to +125°C.	BA, JA, PA, TV
ICL8212	Programmable voltage level detector	Similar in operation to the ICL8211 except that its main output is inverting as opposed to non-inverting. Requires a voltage in excess of 1.15V to switch its output on (no current limit). T_A Range: Same as ICL8211.	
ICL7667	Dual power MOSFET driver	TTL-compatible high-speed CMOS driver designed to provide high output current (1.5A) and voltage (up to +15V) for driving the gates of power MOSFETs in high-frequency switched-mode power converters. T_A Range: 0 to +70°C, -55 to +125°C.	BA, JA, PA, TV
HV-250/255	MOSFET drivers	Complementary power. Wide supply range (20V to 450V). High peak output current of 2A. High switching speed 200ns.	-
HV-350/355		Totem pole N-channel power MOSFET driver. Wide supply range (20V to 450V). High peak output current of 2A. High switching speed of 200ns.	-
ICL7673	Automatic battery backup switch	Automatically switches between a main power supply (eg., +5V) and a battery back-up supply, when the main supply is removed. Wide supply range: 2.5V to 15V. T_A Range: 0 to +70°C, -25 to +85°C.	BA, PA, TV
ICL7675 ICL7676	Switched-mode power-supply controller set	Two-chip set provides required control circuitry for a 50W - 150W isolated-type flyback-type switching power supply. ICL7675 primary side controller provides main power-switch drive. ICL7676 secondary side controller monitors the regulated output. T_A Range: 0 to +70°C, -25 to +85°C, -55 to +125°C.	JA, PA
ICL7677	CMOS power fail detector	Used on primary side of power supply with opto isolators transmitting the fault indication to the equipment on the secondary side. Also used on secondary side to drive TTL/CMOS logic at fault indicating outputs. T_A Range: 0 to +70°C, - 25 to +85°C, -55 to +125°C.	JN, PN

*See Packaging Section

Special Purpose Circuits

Type	Description	Features
ICL8069	Low voltage reference	1.2V temperature compensated voltage reference uses band-gap principal for excellent stability and low noise at reverse currents down to 50μA. 0 to 70°C and -55 to +125°C temperature ranges (metal only). Temperature coefficients of 0.005 and 0.01/°C.
HV-1205	Monolithic power supply	120VAC to 5VDC conversion. 50mA output drive.

Type	Description	V_I Range V	V_O Range V	I_O (Max) mA	Load Regulation % V_O (Max)	$V_I - V_O$ V (Min)	Short-Circuit Current Limit mA (Typ)	Package Number of Pins*
CA3085	Voltage regulators	7.5 to 30	1.8 to 26	12**	0.1	4	96	8T,
CA3085A		7.5 to 40	1.7 to 36	100	0.15	4	96	8S,
CA3085B		7.5 to 50	1.7 to 46	100	0.15	3.5	96	8E
CA723		9.5 to 40	2 to 37	150	0.03	3	65	10T
CA723C		9.5 to 40	2 to 37	150	0.03	3	65	14E
		**This value may be extended to 100mA; however, regulation is not specified beyond 12mA. Operating temperature range (T_A): -55 to +125°C. Electrical characteristics at T_A = 25°C						

Type	Description	V_{CC} (Pin 7) V	V_{CC} Range V	I_{CC} mA	Error Voltage Ref. (Pin 1) V	Pulse Output V_{OL}(Pin 6) V	Pulse Output V_{OH} (Pin 6) V	Max Load Duty Cycle %
CA1523	Voltage regulator control circuit	13	10-15	27	6.5	1.0	12	50
		Variable internal pulse regulator. Operating temperature range (T_A): 0 to +70°C. Characteristics shown are typical @ T_A = 25°C.						

Type	Description	V^+ Range V	V_O Range V	Load Regulation % V_O (Typ)	Ripple Rejection dB (Typ)	Total Standby Current Is (mA) (Max)	$V_{CE\ SAT}$ V (Typ)
CA1524	Regulating pulse-width modulators	8 to 40	4.8 to 5.2	0.2	66	10	0.8
CA2524		8 to 40	4.8 to 5.2	0.2	66	10	0.8
CA3524		8 to 40	4.6 to 5.4	0.2	66	10	0.8
		Electrical characteristics at V^+ = 20V, f = 20kHZ. T_A = -55 to +125°C for CA1524; 0 to +70°C for CA2524, CA3534. 16-lead dual-in-line (E) & (F) packages. Short-circuit current limit: 100mA typ. Temperature stability: 1% max.					

Type	Description	AC Input Voltage @ 50-60 & 400Hz (VAC)	Max. DC Supply Volts (V)	Max. Input Current (μA)	Sensor Range (R_X) kΩ	Control Current to Thyristor Gate (mA)
CA3059	Zero voltage switches	24 120 208/230 277	14	1	2 to 100	Up to 124 with internal supply; up to 240 with one external supply
CA3079			10	2	2 to 50	
		Electrical characteristics at T_A = 25°C. 14-lead dual-in-line (E) package. Operating temperature range (T_A): -55 to +125°C.				

*See Packaging Section

Special Purpose Circuits (Continued)

Type	Description	Features	I_{CEX} Max. (V_{CE} = 50V) µA	$V_{CE\ SUS}$ Min. (I_C = 100mA) V	$V_{CE(sat)}$ Max. (I_C = 600mA) V	I^+ Max. I_C = 700mA V_{CC} + 5.5V mA	I_R Max. (V_R = 50V) µA	t_{PHL}, t_{PLH} Max. µs	Package Number of Pins*
		Inverting Types							
CA3262 CA3272**	Quad-gated power drivers (interface low-level logic to high-current loads)	Independent over-current limiting for each output • (0.7 min. A). Independent over-temperature limiting for each output (155 typ. °C)	100# 100#	25# 35#	0.7△ 0.6△	80□ 5■ 60□	100 100	10 10	16E 28Q
CA3242		Overload protection circuitry	100△	25△	0.8#	80□ 5■	100	20	16E
		Non Inverting Types							
CA3252		Input latch with external feedback resistor	100△	25△	0.7#	80□ 5■	100	30	16E
		□ All outputs ON # V_{IN} = 0.8V △ V_{IN} = 2.4V **w/fault mode flag ■ All outputs OFF • V_{OUT} = 4.5V to 24.5V Electrical characteristics at T_A = +25°C, V_{CC} = 5V; T_A range: -40 to +85°C							

Type	Description	Characteristics		Limits Min.	Limits Typ.	Limits Max.	Units
CA3169	Solenoid and motor driver (½H drive)	Output leakage current (Pin 2 or Pin 3)		-110	±0.5	110	µA
		Quiescent current (Pin 1): Input terminals shorted	V_{CC} = 14V	-	70	100	mA
		Input terminals open		-	17	40	
		Overvoltage shutdown circuit (Pin 1) Upper trip point		20	25	27	V
		Lower trip point		18	21.4	23	
		Source output short circuit current (Pin 2-G)		0.65	1.11	2.6	A
		Sink output (I_{SINK} 600mA) output saturation voltage		-	0.3	0.85	V
		Operating temperature range: -40 to +85°C. Electrical characteristics at T_A = 25°C, V_{CC} = 10.5V to 18V Versa V1 TO-220 style package					

Type	Description	Sections	Features	V_{IO} Max. mV	I_{IB} Max. µA	V_{ICR} Max. V	I^+ Max. mA	h_{FE}	$V_{CE(sat)}$ Max. V	Package Number of Pins*
CA3177	Op amp/ comparator	Operational amplifier	Has shutdown control and isolated transistor	100	15	12 2 •	10 3 •			8EI
		Q14 amplifier						45 Note 1	0.6 Note 2	
		Q1 amplifier	High output current 50mA max.						0.4 Note 3	
		Note 1: V_{CE} = 10V, I_6 = 0.1mA and 2mA • Min. Note 2: I_7 = 0.2mA, I_6 = 2mA Note 3: I_8 = 0.15mA, I_1 = 30mA Electrical characteristics at T_A = 25°C, T_A range: 0 to +70°C								

*See Packaging Section

Special Purpose Circuits (Continued)

Type	Description	V_S* Max. V	I_{OUT} (Peak) A	BW 60W kHz	P_{OUT} RMS W	IMD @ (200mW) %
HC2000H	Multipurpose 7-A op amps	75	7	30	Up to 100	0.6
HC2500		75	7	30	Up to 100	0.06

	Output Protection Network	Frequency Compensation	Operating Mode	Commutating Diodes
HC2000H	Yes	LC filter on output	Class B	Yes
HC2500	No	Capacitor on sig. terminals	Class AB	No

Features
- Operation from either single or split power supplies
- Output currents up to 7A; power output up to 100W
- Bandwidth of 30kHz at 60W
- Adjustable idling current
- Direct coupling to load
- Built-in load-line limiting circuit to protect amplifier from short-circuiting output terminals (HC2000H)
- Metal hermetic package

*Power supply: Single 30 to 75V; split ±15 to 37.5V. Operating temperature range: -55 to +125°C

CA3020, CA3020A — Multipurpose wideband power amplifiers

Characteristics	CA3020	CA3020A	Units
Maximum power output (P_O) at THD = 10%	550	1000	mW
Sensitivity (C_{IN})	35	45	mV
Power gain (G_P)	75	75	dB
Input resistance (R_{IN})	55	55	kΩ
Signal-to-noise ratio (I/N)	70	66	dB
Total harmonic distortion at 150mW (THD)	3.1	3.3	%
Bandwidth (-3db point) (BW)	8	8	MHz

Operating temperature range (T_A): -55 to +125°C
Typical electrical characteristics at T_A = 25°C
12-lead (T) package

Modules

Type	Function	Output Ratings		File No.
		Voltage	Current	
SP205	Single AC Switch	$130V_{RMS}$	$2A_{RMS}$	35.5
SP210	Dual DC Source	$56V_{DC}$	$2A_{DC}$	35.4
SP215	Dual DC Sink	$56V_{DC}$	$2A_{DC}$	35.4

Control ICs

Type	Function	File No.
SP600	500V Half-Bridge Driver-Direct Input Protocol	2428
SP601	500V Half-Bridge Driver-Indirect Input Protocol	2429

Recommended Power Switches for the SP600-Series Control ICs

Type	Ratings		Part No.	Current Sensing	Package	File No.
	Volts	Amps.				
120 VAC Rectified Systems (170VDC)						
MOSFET	250	3.8	IRF624	No	TO-220AB-3-lead	2167
MOSFET	275	3.8	IRF626	No	TO-220AB-3-lead	2167
MOSFET	250	8.1	IRF634	No	TO-220AB-3-lead	2168
MOSFET	275	8.1	IRF636	No	TO-220AB-3-lead	2168
MOSFET	250	14.0	IRF644	No	TO-220AB-3-lead	2169
MOSFET	275	14.0	IRF646	No	TO-220AB-3-lead	2169
IGT	500	10.0	GS1510	Yes	TO-220-5-lead	2326
IGT	500	10.0	IGT5E10CS	Yes	TO-220-5-lead	2326
IGT	500	25.0	GS1525	Yes	TO-218-5-lead	2327
IGT	500	25.0	IGT7E20CS	Yes	TO-218-5-lead	2327
IGT	500	50.0	GS1550	Yes	TO-218-5-lead	2328
IGT	500	50.0	IGT7E50CS	Yes	TO-218-5-lead	2328
220 VAC Rectified Systems (310 VDC)						
MOSFET	500	4.5	IRF430R	No	TO-204AA-3-lead	1996
MOSFET	500	8.0	IRF440R	No	TO-204AA-3-lead	2007
MOSFET	500	13.0	IRF450R	No	TO-204AA-3-lead	2008
MOSFET	500	2.5	IRF820R	No	TO-220AB-3-lead	2020
MOSFET	500	4.5	IRF830R	No	TO-220AB-3-lead	2021
MOSFET	500	8.0	IRF840R	No	TO-220AB-3-lead	2034
IGT	500	10.0	GS1510	Yes	TO-220-5-lead	2326
IGT	500	10.0	IGT5E10CS	Yes	TO-220-5-lead	2326
IGT	500	25.0	GS1525	Yes	TO-218-5-lead	2327
IGT	500	25.0	IGT7E20CS	Yes	TO-218-5-lead	2327
IGT	500	50.0	GS1550	Yes	TO-218-5-lead	2328
IGT	500	50.0	IGT7E50CS	Yes	TO-218-5-lead	2328

CMOS Crosspoint Switches with Control Memory

Type Number	Features	Configuration	R_{ON} Typ. @12V	DR_{ON} Typ. @12V	Frequency Response Typ. -3dB R_L = 1k, 10V	Crosstalk Typ. -40dB (Fq.), 10V	Supply Voltage	Package*
CD22100	• "Built-in" control latches • Large analog signal capability $\pm V_{DD}/2$ • 10MHz switch bandwidth • High linearity - 0.5% distortion (typ.) at f = 1kHz, V_{IN} = 5Vp-p, V_{DD} = 10V, and R_L = 1kΩ • Standard CMOS noise immunity • 100% tested for maximum quiescent current at 20V	4 x 4 x 1	75Ω	18Ω	40MHz	1.5MHz	3V to 18V	16-Pin DIP E, F
CD22101	• Strobed control input • "Built-in" latched inputs • Large analog signal capability $\pm V_{DD}/2$ • 10MHz switch bandwidth • High linearity - 0.25% distortion (typ.) at f = 1kHz, V_{IN} = 5Vp-p, V_{DD}-V_{SS} = 10V, and R_L = 1kΩ • Standard CMOS noise immunity	4 x 4 x 2	75Ω	8Ω	40MHz	2.5MHz	3V to 18V	24-Pin DIP E, F
CD22102	• Same as CD22101, but has Set/Reset flip-flop control input instead of strobed control input	4 x 4 x 2	75Ω	8Ω	40MHz	2.5MHz	3V to 18V	24-Pin DIP E, F
CD54/74HC(T)22106†	• 64 analog switches in an 8 x 8 x 1 array • On-chip line decoder and control latches • Automatic power-up reset by using a 0.1μF capacitor at the MR pin • R_{ON} resistance 95Ω max. @ V_{CC} = 4.5V • Analog signal capability $V_{CC}/2$	8 x 8 x 1	64Ω□	25Ω□	6MHz •	7MHz •	2V to 10V	28-Pin DIP E

† HCT version is TTL-compatible, while HC version is CMOS-compatible

□ V_{CC} = 4.5V

• V_{CC} = 4.5V, R_L = 600Ω

* See packaging section

CMOS Modems

Type	Features	Command Interface	Supply Voltage	Package*
CD22212	• Full-duplex operation at 0-300 and 1200 BPS • FSK (300 BPS) or PSK (1200 BPS) encoding • Compatible with industry-type 8048, 80C51 µps • Four internal 8 bit control/status registers • Maskable interrupts • Serial port for data transfer • Selectable asynch/synch; scrambler/descrambler functions • Coherent demodulation technique provides optimum performance • Call progress, carrier, and long-loop detect monitor • DTMF tone generator • Test modes available - ALB, DLB, RDL, Mark, Space Alternating bit patterns • CMOS technology for low power consumption (120 mW) • Low power IDLE mode uses < 10 mW • TTL and CMOS compatible inputs and outputs • Interchangeable with SSI73K212	Parallel	12 V @ 25 mA (max.)	28 Pin DIP-E 28 Pin PLCC
CD22212E1	• Same features as the CD22212	Serial	12 V @ 25 mA	22-Pin DIP-E
CD22223	• Single-chip 1200 BPS FSK modem • CCITT V.23 compatible • Built-in loop-back test • Switched capacitor receive filter • Low power CMOS (2 mA @ 5-V typ.) • Single-supply operation • Lower error rate (5 x 10^{-3} @ 8-dB SNR)	Serial	4.5 V to 13 V @ 2 mA (typ.)	16-Pin DIP-E

*See Packaging section.

CMOS Modem Controller

Type	Features	Command Interface	Supply Voltage	Package*
CD22MOC6805E	• Implements Hayes Standard "AT" Command Set @ 1200 Baud • EEPROM storage of "S" parameters - eliminates DIP switch • Stored number dialing (using external EEPROM) • 2400-BPS maximum data rate • Supports CCITT and Bell standards • Custom command-set capable • On-chip diagnostics	Parallel	5 V @ 7 mA (max.)	40-Pin DIP-E

* See Packaging section.

PCM Line Repeaters

Type	Features	Output	Supply Voltage	Package*
Bipolar				
CD22301	• Automatic line buildout • For T1 1.544 Mbits/s bipolar carrier system • For T148 2.37 Mbits/s ternary carrier system • For CCITT 2.048 Mbits/s bipolar carrier system	Buffered	5.1 V ±5%, 30 mA (max.)	18-Pin DIP-E
BiMOS-E				
CD22641	• Dual automatic line buildout - 1 op amp • For T1 1.544 Mbits/s carrier systems • For European T1 2.048 Mbits/s carrier systems	Buffered	5.1 V @ 5 mA (typ.)	18-Pin DIP-E 20-Pin SOP
CD22641E1	• Triple automatic line buildout - 2 op amps • For T1, 1.544 M bits/s Carrier Systems • For European T1, 2.048 M bits/s Carrier Systems • For T1C, 3.152 M bits/s Carrier Systems	Buffered	5.1 V @ 5 mA (typ.)	22-Pin DIP-E 24-Pin SOP

* See Packaging section.

PCM Transcoders

Type	Features	Output	Codes	Supply Voltage	Package*
HC-5560	• Mode selectable coding • North American and European compatibility • Simultaneous encoding and decoding • Asynchronous operation • Loop-back control • Transmission error detection • Alarm indication signal • Replaces MJ1440, MJ1471, and TCM2201 transcoders	3.2mA @ 0.4 V	AMI (T1 and T1C) B6ZS□ (T2) B8ZS□ (T1) HDB3 (PCM30)	5 V @ 10 mA (typ.)	20-Pin DIP-E
CD22103A	• Simultaneous encoding and decoding • HDB3 coding and decoding for data rates from 50 kbits/s to 10 Mbits/s in a manner consistent with CCITT G703 recommendations • HDB3/AMI transmission coding/reception decoding with code error detection is performed in independent coder and decoder sections • All transmitter and receiver inputs/outputs are TTL compatible • Internal loop test capability	1.6mA @ 0.5 V	HDB3/AMI per CCITT G703 Annex Recommendation	5 V ± 10% @ 100 mA (max.)	16-Pin DIP-E, D

□ Bipolar with 6 and 8 zero substitution.
* See Packaging section.

Subscriber Line Interface Circuits (SLICs)

Type	Features	Loop Current mA DC	Ringing Type	Typical Supply Voltages	Package*
HC-5502A	• Monolithic integrated device • DI high voltage process • Compatible with worldwide PBX performance requirements • Controlled supply of battery feed current for short loops (30mA) • Internal ring relay driver • Low power consumption during standby • Switch hook, ground key and ring trip detection functions • Selective denial of power to subscriber loops	30	Single-Ended Ground Reference	-48 V, +12 V	24-Pin DIP E or C 28-Pin PLCC
HC-5502B	• Same features as HC-5502A plus: • Low Voltage +5 V (VB+) Capability • Pin for Pin replacement for the HC-5502A	30	Single-Ended Ground Refernce	-48 V, +12 V or +5 V	24-Pin DIP E or C 28-Pin PLCC
HC-5504	• Monolithic integrated device • DI high voltage process • Compatible with worldwide PBX performance requirements • Controlled supply of battery feed current for short loops (40 mA) • Internal ring relay driver • Allows interfacing with negative superimposed ringing systems • Low power consumption during standby • Switchhook, ground key and ring trip detection functions • Selective denial of power to subscriber loops	40	Single-Ended Battery or Ground Reference or Balanced Ringing	-48 V, +12 V	24-Pin DIP E or C 28-PLCC
HC-5504B	• Same features as HC-5504 plus: • Added low voltage +5 V (VB+) capability • Pin for Pin replacement for the HC-5504	40	Single-Ended Battery or Ground Reference or Balanced Ringing	-48 V, +12 V or 5 V	24-Pin DIP E or C 28-PLCC
HC-5504DLC	• Same features as HC-5504B plus: • Switch hook detect threshold allows • multi-phone operation	40	Single-Ended Battery or Ground Reference or Balanced Ringing	-48 V, +12 V or +5 V	24-Pin DIP E or C 28-Pin PLCC
HC-5509B	• Monolithic integrated device • DI high voltage process • Compatible with worldwide PBX and OC performance requirements • Controlled supply of battery feed current for short loops • Internal ring relay driver and a utility relay driver • High-temperature alarm output • Programmable loop current limit • Low power consumption during standby functions • Switch hook, ground key, and ring trip detection • Selective power denial to subscriber • On-chip op amp for 2 wire impedance matching on-hook transmission	20 to 60	Single-Ended Battery or Ground Reference or Balanced Ringing	-48 V, +5 V	28-Pin DIP E or C 44-Pin PLCC

*See Packaging section.

CMOS DTMF Receivers

Type	Features	Ouput 3-State Output Code	Supply Voltage	Package*
CD22202	• Detects either 12 or 16 standard DTMF signals • Central-office quality • No front-end band splitting filters required • Single, low-tolerance, 5V supply • Uses inexpensive 3.579545MHz crystal for reference • Excellent speech immunity • Synchronous or handshake interface • Three-state outputs	4-bit Hexa-decimal or binary coded 2-of-8	5V ± 10%	18-Pin DIP-E
CD22203	• Same as CD22202, but also has early defect output	4-bit Hexa-decimal or binary coded 2-of-8	5V ± 10%	18-Pin DIP-E
CD22204	• No front-end band splitting filters required • Single, low-tolerance, 5V supply • Three-state outputs for microprocessor-based systems • Detects all 16 standard DTMF digits • Uses inexpensive 3.579545MHz crystal • Excellent speech immunity • Output in 4-bit hexadecimal code	4-bit Hexa-decimal Only	5V ± 10%	14-Pin DIP-E

* See Packaging Section.

CMOS DTMF Transmitters

Type	Features	Output	Supply Voltage	Package*
CD22859	• Mute drivers on chip • Device power can either be regulated dc or telephone loop current • Use of an inexpensive 3.579545MHz TV crystal provides high accuracy and stability for all frequencies	350mV into 82 Ω	2.5V to 10V	16-Pin DIP D, E

*See Packaging Section

Continuously Variable Slope Delta (CVSD)

Type	Features All Digital, Useable From 9Kbits/s to Above 64Kbits/s. Requires Power External Parts	Package No. of Pins*
HC55536	Decode Only. Convert serial NRZ digital signal to an analog (voice) signal-conversion delta demodulation	14 DIC
HC55564	Duplex Mudulator/Demodulator. Convert voice signals into serial NRZ digital data and to reconvert that data into voice-conversion delta modulation	14 DIC

*See Packaging Section.

BiMOS-E Crosspoint Switches with Control Input Memory

Type	Features	Configu-ration	R_{ON} (Typ.) @ 12V	ΔR_{ON} (Typ.) @ 12V	Fq. Response (Typ.) -3dB, R_L = 1K, 10V	Crosstalk (Typ.) -40dB (Fq.), 10V	Supply Voltage	Package †
CD22M3494	• Optional on-chip strobe-independent address latches • Manual and automatic power-on resets • Crosstalk: -90dB (min) @ 10kHz • BiMOS-E Technology • Parallel input addressing • HC/HCT ground-referenced inputs available • 2kV minimum ESD protection • Latch-up current: 50mA (min) • Pin and functionally compatible with the SGS M3494	16 x 8 x 1	36Ω	6Ω	45MHz□	3MHz□	4V to 14V	40-Pin DIP-E 44-Pin PLCC
CD22M093	• Optional on-chip strobe-independent address latches • Manual and automatic power-on resets • Crosstalk: -90dB (min) @10kHz • BiMOS-E Technology • Parallel input addressing • HC/HCT ground-referenced inputs available • 2kV minimum ESD protection • Latch-up current: 50mA (min) • Pin and functionally compatible with the SGS M093	12 x 8 x 1	36Ω	6Ω	45MHz□	3MHz□	4V to 14V	40-Pin DIP-E 44-Pin PLCC

□VDD = 5V, RL = 1kΩ
† See Packaging Section.

CMOS CODECs

Type	Features	Clock Rates	Supply Voltage	Package †
CD22354A*	• Meets or exceeds all AT&T D3/D4 specifications and CCITT recommendations • Complete CODEC and filtering systems: No external components for sample-and-hold and auto-zero Receive output filter with SIN X/X correction and additional 8kHz suppression • Variable data clocks - from 64kHz to 2.1MHz • Synchronous and asynchronous operation • TTL or CMOS compatible logic • ESD protection on all inputs and outputs • Adjustable gain for transmit input • Provides μ-law companding (US) • Synchronous and asynchronous operation	64kHz to 2.1MHz	±5V ±5% @ 90mW (max)	16-Pin DIP-E
CD22357A*	• Meets or exceeds all AT&T D3/D4 specifications and CCITT recommendations • Complete CODEC and filtering systems: No external components for sample-and-hold and auto-zero Receive output filter with SIN X/X correction and additional 8kHz suppression • Variable data clocks - from 64kHz to 2.1MHz • Synchronous and asynchronous operation • TTL or CMOS compatible logic • ESD protection on all inputs and outputs • Adjustable gain for transmit input • Provides A-law companding (CCITT) • Synchronous and asynchronous operation	64kHz to 2.1MHz	±5V ±5% @ 90mW (max)	16-Pin DIP-E

*'A' versions supersede CD22354/357 types.
† See Packaging Section.

CVSD - Continuous Variable Slope Delta

Type	Features	Clock Rates	Supply Voltage	Package*
HC-55564	• Modulator/Demodulator Functions • All digital • Requires few external parts • Low power drain: 1.5 mW typical from single 3V-7V supply • Time constants determined by clock frequency; no calibration or drift problems; automatic offset adjustment • Half duplex operation under digital control • Filter reset under digital control • Automatic overload recovery • Automatic "Quiet" pattern generation • AGC control signal available	9kHz to 64kHz	5V @ 1.5mA (max)	14-Pin DIP-C
HC-55536	• Demodulator Only Functions • All Digital • Requires fewer external parts • Low power drain: 1.5 mW from single 3-7V supply • Time constants determined by clock frequency; no calibration or drift problems; automatic offset adjustment • Filter reset by digital control • Automatic overload recovery • Automatic "Quiet" pattern generation	9kHz to 64kHz	3V to 7V @ 1.5mA (max)	14-Pin DIP-C

*See Packaging section.

Quad-Gated Power Drivers

For Interfacing Low-Level Logic to High-Current Loads
Electrical Characteristics at T_A = 25°C, V_{CC} = 5V

Types	Features	I_{CEX} Max. (V_{CE} = 50V) µA	$V_{CE\ sus}$ Min. (I_C = 100mA) V	$V_{CE\ (sat)}$ Max. (I_C = 600mA) V	I^+ Max. (I_C =700 mA, V_{CC} = +5.5V) mA	I_R Max. (V_R = 50V) µA	t_{PHL}, t_{PLH} Max. µs	T_A (Operating Temp. Range) °C	Pkg. No. of Pins†
Inverting Types									
CA3262	Independent overcurrent limiting for each ouput • (0.7 min. A).	100#	25#	0.7△	80□ 5■	100	10	-40 to +85	16E
CA3272*	Independent over-temperature limiting for each output (155 °C typ.)	100#	35#	0.6△	60□	100	10		28Q
CA3242	Overload protection circuitry	100△	25△	0.8#	80□ 5■	100	20	-40 to +85	16E
Non-Inverting Types									
CA3252	Input latch with external feedback resistor	100△	25△	0.7#	80□ 5■	100	30	-40 to +85	16E

□ All outputs ON
■ All outputs OFF
VIN = 0.8 V
• VOUT = 4.5 to 24.5 V
△ VIN = 2.4 V
* With fault mode flag
† See Packaging Section

Solenoid and Motor Driver (½H Drive)

Electrical Characteristics at T_A = 25°C, V_{CC} = 10.5 to 18V

Type	Characteristics		Limits Min.	Limits Typ.	Limits Max.	Operating Temp. Range (oC)	Units	Package
CA3169	Output Leakage Current (Pin 2 or Pin 3)		-110	±0.5	110	-40 to +85	µA	Versa V1 TO-220 Style
	Quiescent Current (Pin 1): Input Terminals Shorted	V_{CC} = 14V	-	70	100		mA	
	Input Terminals Open		-	17	40			
	Overvoltage Shutdown Circuit (Pin 1) Upper Trip Point Circuit (Pin 1) Lower Trip Point		20 18	25 21.4	27 23		V	
	Source Output Short Circuit Current (Pin 2-G)		0.65	1.11	2.6		A	
	Sink Output (I_{SINK} 600mA) Output Saturation Voltage		-	0.3	0.85		V	

Electronic Switching Circuit For Ignition Applications

Electrical Characteristics at T_A = 25°C, V = 13V

Type	Characteristics	Test Period	Limits						Operating Temp. Range (°C)	Units	Package†
			CA3165E1			CA3165E					
			Min.	Typ.	Max.	Min.	Typ.	Max.			
CA3165	Input Current at Term*	Dwell Spark	– –	18.4 17.5	– –	– –	18.4 17.5	– –	-40 to +85	mA	8E, 14E
	Output Voltage at Term 4 V_4	Dwell Spark	12.8 –	– –	– 0.5	12.8 –	– –	– 0.5		V	
	Output Voltage at Term 7 V_7	Dwell	–	–	1	–	–	–		V	
	Output Voltage at Term 8 V_8	Dwell Portion of Spark	– 1.2	– –	0.9 –	–	–	–		V	
	Oscillator Voltage at Term 2 V_2	Dwell Spark	– –	4.4 0.6	– –	– –	4.4 0.6	– –		V_{P-P}	

* CA3165E Term 7 I_7
CA3161E1 Term 12 I_{12}
† See Packaging Section

Speed-Control System

Type	Typical Switching Characteristics					Operating Temp. Range (°C)	Package†
CA3228	Driver Command Input Hold Times: (Based on 0.68 μF capacitor on Pin 4)					-40 to +85	24E
	Acceleration (ms)	Coast (ms)	Resume (ms)	On (ms)	Off (ms)		
	50	50	330	50	50		
	Internal Oscillator Frequency, f_{OSC} = 10 kHz (Based on 0.001 μF capacitor on Pin 5)						
	Typical Performance Characteristics						
	(f_{OSC} = 50 kHz; fs/Speed Ratio, 2.22 Hz/mph)						
	Speed Sensor Input Frequency Range (fs) at Pin 8 (Hz)	Speed Resolution (mph)	Minimum Operating Speed (mph)	Maximum Stored Speed (mph)	Redundant Brake Speed (mph)		
	62 to 222	0.45	25	100	11		

† See Packaging Section

High-Side Driver High-Stress Applications

Type	Characteristic	Test Condition	Limits (T_A = -40 to +85°C)			Units
			Minimum	Typical	Maximum	
CA3273	Operating Voltage Range, V_{CC}	V_{CC} ref. to V_{SW}	4	-	24	V
	Sat. Voltage (V_{CC} -V_O): V_{SAT1}	IO = -400mA, V_{SW} = 0V V_{CC} = 16V	-	-	0.5	V
	Operating Load, RL	V_{CC} = 16V to 24V	40	-	-	Ω
	Overvolt, T_{HD}, V_{CC} (THD) (Increase V_{CC})	V_{SW} = 0V, RL = 1kΩ (V_O goes low)	25	-	40	V
	Current Limiting, I_O (I_{IM})	V_{CC} = 16V, V_{SW} = 1V	-	-	1	A
	Control Current, Switch On: I_{SW} (no load) I_{SW} (max. $load_1$)	V_{CC} = 16V, V_{SW} = 0V IO = 0mA IO = -400mA	-	-15 -22	-	mA mA
	Control Current, Switch On: I_{SW} (max. $load_2$)	V_{CC} = 24V, I_O = -600mA V_{SW} = 0V	-	-33	-	mA
	Max. Control Current - High V_{CC}: I_{SW} (Hi V_{CC}) Low V_{CC}: I_{SW} (Lo V_{CC})	RL = 40Ω, V_{SW} = 1V V_{CC} = 24V V_{CC} = 7V	-50 -50	-	-	mA mA
	Output Current, Cutoff: I_O (SWOFF1) $I_{O(SWOFF2)}$	V_O = 0V, V_{CC} = 16V V_{SW} = 16V V_{SW} = 15V	-100 -100	-	+100 +100	µA µA
	Control Current, Switch Off No Load: I_{SW} (Hi V_{CC}) No Load I_{SW} (Lo V_{CC})	V_O = open V_{CC} = 24V, V_{SW} = 23V V_{CC} = 7V, V_{SW} = 6V	-200 -200	-	+50 +50	µA µA

Power Switch with Current Limiter Sense Flag

Type	Characteristic	Symbol	Limits (T_A = -40 to +85°C)			Units
			Minimum	Typical	Maximum	
CA3274	Power Supply Current: S1 = 2 Control = High (Output On) Control = Low (Output Off)	 I_{CCH} I_{CCL}	 - -	 - -	 25 5	 mA mA
	Control Input: S1 = 3 Thd. voltage, High Thd. Voltage, Low Hystersis Leakage, 0.0 to 5.5 V	 V_{thdH} V_{thdL} V_{thdH} - V_{thdL} I_{IL}	 - 0.9 0.4 -20	 - - 0.65 -	 3.5 - 2.0 +20	 V V V µA
	Driver In, Out (Pin 6, 5): S1 = 3 Output Saturation Voltage, I_{CC1} = 200mA, $V_{Control}$ = High Collector Output Leakage, $V_{Control}$ = Low	 V_{sat} I_{leak}	 - -	 - -	 0.5 100	 V µA
	Flag Output Low: S1 = 2 V_{Sense} = High, I_{flag} = 3mA Flag Output High: S1 = 3 Output leakage, V_{CC} = V_{flag} = 10V	 V_{fsat} I_{fleak}	 - -	 - -	 0.8 10	 V µA
	Prop. Delay: S1 = 1 Control In to Drive Out Drive off to Flag off Flag Delay from Control In	 t_{on}, t_{off} t_{flag} t_d	 - - 150	 5 10 -	 - - 600	 µs µs µs
	Sense Input Thd. Level: S1 = 1	V_{senthd}	310	335	360	mV
	Power Supply Rejection Ratio	PSSR	50	-	-	dB

Unless otherwise specified: V_{CC} = V_{CC1} = V_{CC2} = 7 to 10 Volts;
V_{Sense} = 'Low'; $V_{Control}$ = 'Low';
'Low' = 0.0V; 'High' = 5.0V

Dual H-Driver For Instrumentation

Electrical Characteristics: T_A = 25°C, V_{CC} = 16V, except as noted

Type	Characteristic	Symbol	Limits			Units
			Minimum	Typical	Maximum	
CA3275	Operating Supply Voltage Range	V_{CC}	8	-	16	V
	Supply Current, Note 1	I_{CC}	-	8	20	mA
	Input Levels:					
	Logic Input, Low Voltage	V_{IL}	-	-	0.8	V
	Logic Input, High Voltage	V_{IH}	3.5	-	-	
	Logic Input, Low Current, V_{IH} = 0V	I_{IL}	-10	-	-	µA
	Logic Input, High Current, V_{IH} = 5V	I_{IH}	-	-	10	
	Output: RLA = RLB = 138Ω					
	Maximum Source Saturated Voltage	V_{SAT} - High	-	1.2	1.75	V
	Maximum Sink Saturated Voltage	V_{SAT} - Low	-	0.25	0.5	
	Diff. V_{SAT} Voltage, Both Outputs Saturated	Diff - V_{SAT}	-	10	100	mV
	Propagation Delay: T_A = 25°C					
	Source Current					
	Turn-Off Delay	t_{sc-off}	-	-	2	µs
	Fall Time	t_{sc-f}	-	-	2.2	
	Turn-On Time	t_{sc-on}	-	-	1	
	Rise Time	t_{sc-r}	-	-	0.4	
	Sink Current					
	Turn-Off Delay	t_{sk-off}	-	-	1.6	
	Fall Time	t_{sk-f}	-	-	0.4	
	Turn-On Delay	t_{sk-on}	-	-	0.6	
	Rise Time	t_{sk-r}	-	-	0.2	

Note 1: No load, PWMA = PWMB = 5V, DIRA = DIRB = 0V.

Voltage Regulator With Reverse Battery Protection

Functional Operating Ranges at T_A = 25°C, V_{IN} = 5.7 to 16 Volts V_{CC1} & V_{CC2} Filter Capacitors = 3.3µF, C_{RST} = 0.47µF, unless otherwise specified.

Type	Characteristic	Symbol	Limits		Units
			Minimum	Maximum	
CA3276	Standby Regulator:				
	Output Voltage	V_{CC1}	4.75	5.25	V
	Output Current	I_{CC1}	-	50	mA
	Dropout Voltage:				
	V_{IN} = 4.75V, I_{CC1} = 50mA	$V_{IN} - V_{CC1}$		0.6	V
	Output Clamp	V_{CP1}	-	6	V
	Power Supply Rejection Ratio	PSSR	-48	-	dB
	Enable Input High	V_{IH}	3.5	V_{CC} - 0.5	V
	Enable Input Low	V_{IL}	-0.5	0.9	V
	Enable Regulator:				
	Output Voltage	V_{CC2}	4.75	5.25	V
	Output Current	I_{CC2}	-	100	mA
	Enable Input High	V_{IH}	3.5	V_{CC} - 0.5	V
	Enable Input Low	V_{IL}	-0.5	0.9	V
	Output Clamp	V_{CP2}	-	6	V
	I_{SK} Saturation Voltage: I_{SK} = 100mA	V_{SAT}	-	0.5	V
	Low Voltage Reset (V_{ARY} V_{IN})	V_{IN}	4	4.5	V
	Reset Output Low: RST = 300Ω to 5V, V_{IN} = 4V	V_{RST}	-	0.8	V
	Reset Delay Time:				
	(C_{rst} = 0.47µF; V_{IN} = 10V step turn-on meas. V_{CC1})	T_{RST}	100	200	ms

BiMOS Single-Chip Detector/Alarm System

Type	Description	T_A (Operating Temp. Range) °C	Electrical Characteristics @ T_A = 25°C				Package Number of Pins*
			Operating Voltage Range (V)	Input Leakage Current Max. (μA)	Standby by Battery Current Typ. (μA)	Available Reference Source Current Min. (μA)	
CA3164A	With Integral Drivers for Mechanical or Piezoelectric Horn Alarms	0 to +50	7 - 11	1	8 •	5	14E

• Adjustable to 5μA
* See Packaging Section

BiMOS Sequencer Driver and Segment Latch-Driver for Driving Vacuum Fluorescent Display Devices

Type	Description		Operating Output Voltage Range (V)	Will Source	T_A (Operating Temperature Range) °C	Package Number of Pins*
CA3207	Sequencer Driver	Sequentially turns on 1 of 14 Characters (2 of 28) when used with two CA3208's	35 to 55	40mA/Character	-40 to +85	22E
CA3208	Segment Latch-Driver	Drives any combination of 14 outputs selected by DATA input		7.5mA/Segment		22E

* See Packaging Section

Voltage-Regulator Control Circuit Variable-Interval Pulse Regulator

Typical Electrical Characteristics at T_A = 25°C

Type	Features	(T_A) (Operat. Temp. Range) °C	V_{CC} (Pin 7) V	V_{CC} Range V	I_{CC} mA	Error Voltage Ref. (Pin 1) V	Pulse Output V_{OL} (Pin 6) V	Pulse Output V_{OH} (Pin 6) V	Max. Load Duty Cycle %	Pkg. No. of Pins*
CA1523	■ Operation up to 200 kHz ■ ESD Protection: Pins are protected against ESD ■ Remote On/Off: Activates regulator ■ Slow start with Reset: Soft start ensured at power-up and restart ■ Over-current sensing: Protects power device from over-dissipation over-current trip (Pin), 1.25 V) ■ Supply voltage monitor: Locks out the drive unit until V_{Supply} has reached 9 V ■ Bandgap reference voltage (internal): Provides temperature-compensated 1.2V and 6.8V references ■ Lower peak currents than PWM regulator: Less prone to magnetic saturation	0 to +70	13	10 -15	27	6.5	1	12	50	14E

* See Packaging Section

General

Type	Function	Description	Package No. of Pins**
ICM7206	CMOS Touch-Tone* Encoder	2-of-8 sine wave DTMF generator for telephone dialing systems. Requires a 3.58MHz crystal & will work with 3 x 4 or 4 x 4 keypads. Has high-current bipolar output driver providing low harmonic distortion. T_A Range: -40°C to +85°C	PE
ICL8038	Precision Waveform Generator/ Voltage-Controlled Oscillator	Bipolar type. Capable of producing high accuracy sine, square & triangular waveforms. Frequency range 0.001Hz to 300kHz. T_A Range: 0°C to +70°C, -55°C to +125°C	JD PD
AD590	2-Wire Current-Output Temperature Transducer	Output current varies linearly at 1μA/°K for supply voltages between -55°C and +150°C in which conventional electrical temperature sensors are now employed. T_A Range: -55°C to +150°C	IH JH
ICL8069	Low-Voltage Reference	A 1.2V temperature-compensated bandgap voltage reference. It achieves excellent stability and low noise at currents as low as 50μA. T_A Range: 0°C to +70°C, -55°C to +125°C	SQ ZR
ICL8048	Log/Antilog Amplifiers	Full temperature compensated, will handle 6 decades of current input or 3 decades of voltage input. Generates 1V of output for each decade change of input. T_A Range: 0°C to +70°C	JE
ICL8049	Log/Antilog Amplifiers	Antilogarithmic version of ICL8048, generates 1 decade of output voltage for each one voltage change at the input	JE
ICL8063	Power Transistor Driver/ Amplifier	Converts ±12V outputs from op amps and other devices to ±30V levels. • Can deliver > 50W to external loads • Produces 25mA quiescent current in power output stages • Built-in ±13V regulators • T_A Range: 0°C to +70°C, -55°C to +125°C	JE PE

*Trademark of Bell Labs, Inc.
**See Packaging Section
° 0°C to +70°C for TO-92

Type	Function	Description	Electrical Characteristics @ T_A = +25°C				Package No. of Pins*
			Operating Voltage Range (V)	Input Leakage Current Max (pA)	Standby Battery Current Typ (μA)	Available Reference Source Curr. Min (μA)	
CA3164A	BiMOS Single-Chip Detector/ Alarm System	With Integral Drivers for Mechanical or Piezo-electric Horn Alarms	7 - 11	1	8*	5	14, E

Operating Temperature Range (T_A): 0°C to +50°C
* Adjustable to 5μA

Type	Function	Features	Temperature Range	Package*
HA-2546	Analog Multiplier	• 30MHz signal bandwidth • 17MHz control bandwidth • Voltage output stage • Low multiplication error 1.6% • Monolithic construction		
ICL8013	Four Quadrant Analog Multiplier	• Bipolar, four-quadrant • Output proportional to algebraic product of two input signals • Internal op-amp provides level shifting • Can generate division and square root functions • Potentiometers time gain accuracy, offset voltage and feedthrough performance	0°C to +70°C -55°C to +125°C	10 Pin TO-100 Metal Can

*See Packaging Section

Type	Function	Features	Operating Temperature Range	Package
IM2110	256 x 12 Color Lookup-Table and DAC	• Three 4-bit DACs • Microprocessor Interface • Color Lookup-Table on Ram May be written asynchronously by 8 or 16-bit microprocessor • Three overlay registers overlay cursors, grids, text, etc. • Simultaneously displays 256 of 4096 colors at 25MHz rate for a 640 x 480 non-interlaced display • Generates RS-343-A compatible red, green, and blue analog signals • Drives doubly-Terminated 75Ω coax directly	$0^{o}C$ to $+70^{o}C$	40 Pin Plastic Dip

Type	Description	Pkg. No. of Pins*
Signal Transmission Modulator		
CA1890	TV Video/Audio, RF Modulator	14E
RF/IF		
CA7607	Video IF Amplifier System Suitable for FET Applications	16E
CA7611	Video IF Amplifier System for N-P-N Tuner Stages	16E
LM1822N	Video IF Amplifier/PLL Detector System	24E
LM1823N	Like LM1822N but Intended for Cable TV	24E
MOSFETs Dual-Gate-Protected		
3N187	For Military and Industrial Application up to 300MHz	4T
3N200	For Military and Industrial Applications up to 500MHz	4T
3N204	RF Amplifier for VHF TV Applications	4T
3N205	Mixer for VHF TV Applications	4T
3N206	IF Amplifier for VHF TV Applications	4T
40673	For RF Amplifier Applications up to 400MHz	4T
40819	For RF Amplifier Applications up to 250MHz	4T
40821	For Mixer Applications in VHF TV Tuners up to 250MHz	4T
40822	For RF Applications in FM Tuners up to 150MHz	4T
40823	For Mixer Applications in FM Tuners up to 150MHz	4T
40841	General-Purpose Type for Applications from DC to 500MHz	4T
Video/Chroma/Luma Processing		
CA3126	TV Chroma Processor (PAL CA3128)	16E, Q
CA3217	Single-Chip TV Chroma/Luminance Processor	28E
Video Switches Analog Multiplexers/Demultiplexers		
CA3256	CMOS/BiMOS Analog Video Switch and Amplifier	18E
Mixers		
CA3253	Video Processor	24E
CA3256	CMOS/BiMOS Analog Video Switch and Amplifier	18E
Sync Generators		
CA3254	RS-170 Sync Generator (EIA RS-170 Standard with 2:1 Interlace) for 525-Line 60-Hz Systems	24E
CA3255	Like CA3254, but Designed for Use in 625-Line, 50-Hz Systems	24E

Type	Description	Pkg. No. of Pins*
Video Processors		
CA3156	Video/Chroma Processor	16E
CA3194	Single-Chip PAL Luminance/Chroma Processor	24E
CA3253	Video Processor for Video Camera Applications	24E
CA3256	CMOS/BiMOS Analog Video Switch and Amplifier	18E
Sync Processor		
CA555	Precision Timer and Oscillator	8E, S, T
CA3202	TV Horizontal/Vertical Countdown Digital Sync System	14E
CA3210	TV Horizontal/Vertical Countdown Digital Sync System for 525-Line Operation	24E
CA3218	TV Horizontal/Vertical Countdown Digital Sync System	16E
CA3236	TV Horizontal/Vertical Countdown Digital Sync System Complete Decoder for NTSC or PAL 525-Line Operation	28E
CA3241	Like CA3236, but for 625-Line Operation	28E
CA3223	Like CA3210, but for 625-Line Operation	24E
CRT Drive CRT Bias		
CA3224	Automatic Picture Tube Bias Circuit	22E
Horizontal/Vertical Scan		
CA555	Precision Timer and Oscillator	8E, S, T
CA1391	TV Horizontal Processor (Positive Horizontal Sawtooth Input)	8E
CA1394	Like CA1391, but with Negative Horizontal Sawtooth Input	8E
CA3154	TV Sync/AGC/Horizontal Sync Processor	16E
CA3218	TV Horizontal/Vertical Countdown Digital Sync System	16E
CA3261	AFC Horizontal Oscillator Signal Processor with Sync Separator and AGC	18E
CA3210	TV Horizontal/Vertical Countdown Digital Sync System	24E
CA3223	Like CA3210, but intended for 625-Line Operation	24E
CA3236	TV Horizontal/Vertical Countdown Digital Sync System Complete Decoder for NTSC or PAL (525-Line Operation	28E
CA3241	Like CA3236, but for 625-Line Operation	28E

Note: Package designator (T) indicates TO-5 package with straight leads.
*See Packaging Section

Type	Description	Package Number of Pins*
RF Modulators		
CA1890	TV Video/Audio, RF Modulator	14E
IR Preamplifier		
CA3237	IR Remote Control Amplifier	9 SIP
Tuning Control		
CA3163	1.25GHz ÷ 64/÷ 256 Dual-Mode VHF/UHF Prescaler	14E
CA3179	1.25GHz ÷ 64/÷ 256 Dual-Mode Prescaler	14E
CA3199	1.25GHz ÷ 4 Prescaler	8E
CA3232	200MHz ÷ 20 Prescaler	8E
CA3263	Bandswitch Operational Amplifier	14E
CA3247	Analog Interface Unit (AIU)	40E
Display		
CA3207	BiMOS Sequencer Driver	22E
CA3208	BiMOS Segment Latch-Driver	22E
Power Supply Regulators		
CA1523	Voltage Regulator Control Circuit for Variable Switching Regulator	14E
AM/FM Radio, AM Radio		
CA3088	AM Receiver Subsystem and General-Purpose Amplifier Array	16E
IF Without Detector		
CA3011	Wide-Band Amplifier	10T
CA3012	Wide-Band Amplifier	10T
IF With Detector		
CA2111A/2136A	FM/IF Amplifier-Limiter and Quadrature Detector	14E, Q
CA3013/3014	Wide-Band Amplifier Discriminator	10T
CA3089	FM/IF System	16E
CA3189	Like CA3089 but Particularly Suitable for High-Fidelity FM and Electronically Tuned Radios	16E
CA3209	FM/IF Systems for Search and Scan	16E
Audio		
CA3259	Stereo Sound Volume/Tone Control	18E
Stereo Demodulators		
CA3195	RC Phase-Lock-Loop Stereo Decoder	16E
CA3257	PLL FM Multiplex Stereo Demodulator	16E
CA3258	Noise Blanker	-

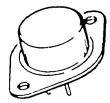
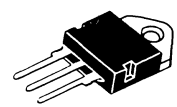
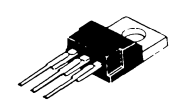
Note: Package designator (T) indicates TO-5 package with straight leads.
* See Packaging Section

Type	Description	Pkg. No. of Pins*
Tuners MOSFETs		
3N200	For Military & Indust. Applic. up to 500MHz	4T
3N204	RF Amplifier for VHF TV Applications	4T
3N205	Mixer for VHF TV Applications	4T
40673	For RF Amplifier Applications up to 400 MHz	4T
Tuner Control		
CA3247	Analog Interface Unit (AIU)	40E
CA3140	BiMOS Operational Amplifier	8E, S, T
CA3163	1.25GHz ÷ 64/÷ 250 Dual Mode VHF/UHF Prescaler	14E
CA3199	1.25GHz ÷ 4 Prescaler	8E
IR Preamplifier		
CA3237	IR Remote-Control Amplifier	9 SIP
AFT and Video IF (PIX)		
LM1822N	Video IF Amplifier/PLL Detector System	24E
LM1823N	Like LM1822N, but intended for Cable TV Sys.	24E
CA7607	Video IF Amplifier System for FET Applications	16E
CA7611	Video IF Amp System for NPN Tuner Stages	16E
Sound IF Detector/Audio		
CA1190	Sound IF and Audio Output Subsystem	16Q
CA1191	Like CA1190, but with Integral Bentdown Wing Tab Heat Sink	16E
CA3065	IF Amplifier-Limiter, FM Detector, Electronic Attenuator, Audio Driver	14E, Q
CA1191	Like CA1190 but with Integral Bent-Down Wing Tab Heat Sink	16E
CA2111A	FM/IF Amplifier-Limiter and Quadrature Detector	14E, Q
CA3012	Wide-Band Amplifier	10T
CA3013	Wide-Band Amplifier Discriminator	10T
CA3014	Wide-Band Amplifier Discriminator	10T
CA3089	FM/IF System	16E
CA3189	Like CA3089 but Particularly Suitable for High-Fidelity FM and Electonically Tuned Radios	16E
CA3209	FM/IF System for Search and Scan	16E

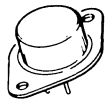
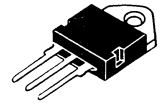
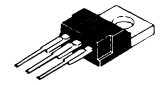
Type	Description	Pkg. No. of Pins*
Audio Output		
CA1191	Like CA1190, but with Integral Bentdown Wing Tab Heat Sink	16E
Audio/Video Selector/Amplifier		
CA3256	CMOS/BiMOS Analog Video Switch and Amp	18E
Chroma/Luma Processors		
CA3070	TV Chroma System (Complete Subcarrier Regeneration System)	16E
CA3121	TV Chroma Amplifier/Demodulator	16E
CA3126	TV Chroma Processor	16E, Q
CA3151	Single-Chip TV Chroma Processor/Demod.	24E
CA3194	Single-Chip PAL Luma/Chroma Processor	24E
CA3217	Single-Chip TV Chroma/Luminance Processor	28E
Deflection Circuits Horizontal and Vertical		
CA3202	TV Horiz/Vert Countdown Digital Sync System	14E
CA3218	TV Horizontal/Vertical Countdown Digital Sync System for 525-Line Operation	16E
CA3223	Like CA3210, but for 625-Line Operation	24E
CA3236	TV Horizontal/Vertical Countdown Digital Sync System for 525-Line Operation	28E
CA3241	Like CA3236, but for 625-Line Operation	28E
Horizontal		
CA1391	TV Horizontal Processor with Positive Horizontal Sawtooth Input	8E
CA1394	Like CA1391, but with Negative Horizontal Sawtooth Input	8E
CA3154	TV Sync/AGC/Horizontal Signal Processor	16E
CA3261	AFC/Horizontal Oscillator Signal Processor with Sync Separator and AGC	18E
Display Drivers		
CA3207	BiMOS Sequencer Driver	22E
CA3208	BiMOS Segment Latch-Driver	22E

Note: Package designator (T) indicated TO-5 package with straight leads.
*See Packaging Section

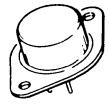
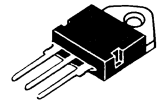
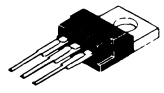
RF and BUZ-Series Power MOSFETs — N-Channel

Maximum Ratings: BV_{DSS} (V)	I_{DS} (A)	$r_{DS(ON)}$ OHMS	 TO-204	 TO-205	 TO-218	 TO-220
50	2	0.75		RFL2N05		
	4	0.60				RFP4N05
	13	0.12				BUZ71A
	14	0.10				BUZ71
	15	0.14	RFM15N05			RFP15N05
	25	0.07	RFM25N05			
	25	0.047				RFP25N05
	30	0.04				BUZ11
	45	0.04	RFK45N05		RFH45N05	
60	2	0.75		RFL2N06		
	4	0.60				RFP4N06
	15	0.14	RFM15N06			RFP15N06
	25	0.07	RFM25N06			RFP25N06
	45	0.04	RFK45N06		RFH45N06	
80	1	1.20		RFL1N08		
	2	1.05				RFP2N08
	12	0.20	RFM12N08			RFP12N08
	18	0.10	RFM18N08			RFP18N08
	35	0.055	RFK35N08		RFH35N08	
100	1	4.50		RFL1N10		
	2	1.05				RFP2N10
	9	0.25				BUZ72A
	12	0.20	RFM12N10			RFP12N10/BUZ20
	18	0.10	RFM18N10			RFP18N10
	19	0.10				BUZ21
	35	0.055	RFK35N10		RFH35N10	
120	1	1.90		RFL1N12		
	2	1.75				RFP2N12
	4	0.40		RFL4N12		
	10	0.30	RFM10N12			RFP10N12
	15	0.15	RFM15N12			RFP15N12
	30	0.075	RFK30N12		RFH30N12	
150	1	1.90		RFL1N15		
	2	1.75				RFP2N15
	4	0.40		RFL4N15		
	10	0.30	RFM10N15			RFP10N15
	15	0.15	RFM15N15			RFP15N15
	30	0.075	RFK30N15		RFH30N15	
180	1	3.65		RFL1N18		
	2	3.50				RFP2N18
	8	0.50	RFM8N18			RFP8N18
	12	0.25	RFM12N18			RFP12N18
	25	0.15	RFK25N18		RFH25N18	
200	1	3.65		RFL1N20		
	2	3.50				RFP2N20
	5.8	0.6				BUZ73A
	8	0.50	RFM8N20			RFP8N20
	9.5	0.4				BUZ32
	12.5	0.2				BUZ31
	12	0.25	RFM12N20			RFP12N20
	25	0.15	RFK25N20		RFH25N20	
350	4	1.50	RFM4N35			RFP4N35
	7	0.75	RFM7N35			RFP7N35
	12	0.38	RFM12N35		RFH12N35	

RF and BUZ-Series Power MOSFETs — N-Channel (Continued)

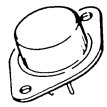
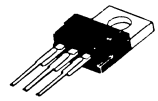
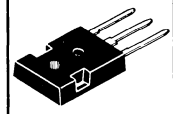
Maximum Ratings / Package						
BV_{DSS} (V)	I_{DS} (A)	$r_{DS(ON)}$ OHMS	TO-204	TO-205	TO-218	TO-220
400	4	1.50	RFM4N40			RFP4N40
	7	0.75	RFM7N40			RFP7N40
	12	0.38	RFM12N40		RFH12N40	
	4.5	1.50				BUZ60B
	5.5	1.00				BUZ60
	3.0	1.8				BUZ76
	2.6	2.5				BUZ76A
	11.5	0.4			BUZ351	
450	3	2.50	RFM3N45			RFP3N45
	6	1.25	RFM6N45			RFP6N45
	10	0.60	RFM10N45		RFH10N45	
500	3	2.50	RFM3N50			RFP3N50
	4.0	2.0				BUZ42
	4.5	1.50				BUZ41A
	6	1.25	RFM6N50			RFP6N50
	8.3	0.80	BUZ45A			
	9.6	0.60	BUZ45			
	10	0.60	RFM10N50		RFH10N50	
	10	0.50	BUZ45B			

RF-Series Power MOSFETs — P-Channel

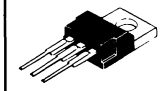
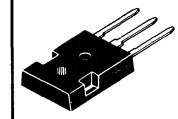
Maximum Ratings / Package						
BV_{DSS} (V)	I_{DS} (A)	$r_{DS(ON)}$ OHMS	TO-204	TO-205	TO-218	TO-220
80	1	3.15		RFL1P08		
	2	3.00				RFP2P08
	6	0.60	RFM6P08			RFP6P08
	8	0.40	RFM8P08			RFP8P08
	12	0.30	RFM12P08			RFP12P08
	25	0.15	RFK25P08		RFH25P08	
100	1	3.15		RFL1P10		
	1.5	3.65		2N6895*		
	2	3.00				RFP2P10
	6	0.60	RFM6P10			RFP6P10
	6	0.60	2N6896*			
	8	0.40	RFM8P10			RFP8P10
	12	0.30	RFM12P10			RFP12P10
	12	0.30	2N6897*			
	25	0.20	2N6898*			
	25	0.15	RFK25P10		RFH25P10	
120	5	1.00	RFM5P12			RFP5P12
	10	0.50	RFM10P12			RFP10P12
150	5	1.00	RFM5P15			RFP5P15
	10	0.50	RFM10P15			RFP10P15

*QPL approved types

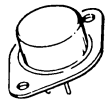
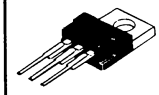
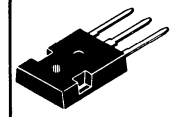
IRF-Series Power MOSFETs — N-Channel

Maximum Ratings / Package							
BV_{DSS} (V)	I_{DS} (A)	$r_{DS(ON)}$ OHMS	TO-204	TO-205	TO-220	TO-247	4-Pin DIP
60	0.40	3.20					IRFD1Z3
	0.50	2.40					IRFD1Z1
	0.80	0.80					IRFD113
	1	0.60					IRFD111
	1.1	0.40					IRFD123
	1.3	0.30					IRFD121
	3	0.80		IRFF113			
	3.50	0.60		IRFF111			
	3.50	0.80			IRF513		
	4	0.60			IRF511		
	5	0.40		IRFF123			
	6	0.30	IRF121				
	7	0.25		IRFF133			
	7	0.40	IRF123		IRF523		
	8	0.18		IRFF131			
	8	0.30		IRFF121	IRF521		
	12	0.25	IRF133		IRF533		
	14	0.18	IRF131		IRF531		
	24	0.11	IRF143		IRF543		
	27	0.085	IRF141		IRF541		
	33	0.08	IRF153			IRFP153	
	40	0.055	IRF151			IRFP151	
100	0.4	3.20					IRFD1Z2
	0.5	2.40					IRFD1Z0
	0.80	0.80					IRFD112
	1	0.60					IRFD110
	1.10	0.40					IRFD122
	1.30	0.30					IRFD120
	3	0.80		IRFF112			
	3.50	0.60		IRFF110			
	3.50	0.80			IRF512		
	4	0.60			IRF510		
	5	0.4		IRFF122			
	6	0.30		IRFF120			
	7	0.25		IRFF132			
	7	0.40	IRF122		IRF522		
	8	0.18		IRFF130			
	8	0.30	IRF120		IRF520		
	12	0.25	IRF132		IRF532		
	14	0.18	IRF130		IRF530		
	24	0.11	IRF142		IRF542		
	27	0.085	IRF140		IRF540		
	33	0.08	IRF152			IRFP152	
	40	0.055	IRF150			IRFP150	
150	0.25	7.50					IRFD2Z3
	0.32	5.00					IRFD2Z1
	0.45	2.40					IRFD213
	0.60	1.50					IRFD211
	0.70	1.20					IRFD223
	0.80	0.80					IRFD221
	1.80	2.40		IRFF213			
	2	2.40			IRF613		
	2.20	1.50		IRFF211			
	2.50	1.50			IRF611		
	3	1.20		IRFF223			
	3.50	0.80		IRFF221			

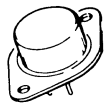
IRF-Series Power MOSFETs — N-Channel (Continued)

Maximum Ratings / Package							
BV_{DSS} (V)	I_{DS} (A)	$r_{DS(ON)}$ OHMS	TO-204	TO-205	TO-220	TO-247	4-Pin DIP
150	4	1.20	IRF223		IRF623		
	4.50	0.60		IRFF233			
	5	0.80	IRF221		IRF621		
	5.5	0.40		IRFF231			
	8	0.60	IRF233		IRF633		
	9	0.40	IRF231		IRF631		
	16	0.22	IRF243		IRF643		
	18	0.18	IRF241		IRF641		
	25	0.12	IRF253			IRFP253	
	30	0.085	IRF251			IRFP251	
200	0.25	7.50					IRFD2Z2
	0.32	5.00					IRFD2Z0
	0.45	2.40					IRFD212
	0.60	1.50					IRFD210
	0.70	1.20					IRFD222
	0.80	0.80					IRFD220
	1.80	2.40		IRFF212			
	2	2.40			IRF612		
	2.20	1.50		IRFF210			
	2.50	1.50			IRF610		
	3	1.20		IRFF222			
	3.50	0.80		IRFF220			
	4	1.20	IRF222		IRF622		
	4.50	0.60		IRFF232			
	5	0.80	IRF220		IRF620		
	5.50	0.40		IRFF230			
	8	0.60	IRF232		IRF632		
	9	0.40	IRF230		IRF630		
	16	0.22	IRF242		IRF642		
	18	0.18	IRF240		IRF640		
	25	0.12	IRF252			IRFP252	
	30	0.085	IRF250			IRFP250	
350	0.30	5.00					IRFD313
	0.40	3.60					IRFD311
	0.40	2.50					IRFD323
	0.50	1.80					IRFD321
	1.15	5.00		IRFF313			
	1.30	5.00			IRF713		
	1.35	3.60		IRFF311			
	1.50	3.60			IRF711		
	2	2.50		IRFF323			
	2.50	1.80		IRFF321			
	2.50	2.50	IRF323		IRF723		
	3	1.80	IRF321	IRFF333	IRF721		
	3.50	1.00		IRFF331			
	4.50	1.50	IRF333		IRF733		
	5.50	1.00	IRF331		IRF731		
	8	0.80	IRF343		IRF743		
	10	0.55	IRF341		IRF741		
	13	0.40	IRF353			IRFP353	
	15	0.30	IRF351			IRFP351	

IRF-Series Power MOSFETs — N-Channel (Continued)

Maximum Ratings / Package							
BV_{DSS} (V)	I_{DS} (A)	$r_{DS(ON)}$ OHMS	TO-204	TO-205	TO-220	TO-247	4-Pin DIP
400	0.30	5.00					IRFD312
	0.40	3.60					IRFD310
	0.40	2.50					IRFD322
	0.50	1.80					IRFD320
	1.15	5.00		IRFF312			
	1.30	5.00			IRF712		
	1.35	3.60		IRFF310			
	1.50	3.60			IRF710		
	2	2.50		IRFF322			
	2.50	2.50	IRF322		IRF722		
	2.50	1.80		IRFF320			
	3	1.50		IRFF332			
	3	1.80	IRF320		IRF720		
	3.50	1.00		IRFF330			
	4	1.50	IRF332				
	4.50	1.50			IRF732		
	5	1.00			IRF730		
	5.5	1.00	IRF330				
	8	0.80	IRF342		IRF742		
	10	0.55	IRF340		IRF740		
	13	0.40	IRF352			IRFP352	
	15	0.30	IRF350			IRFP350	
450	1.40	4.00		IRFF423			
	1.60	3.00		IRFF421			
	2	4.00	IRF423		IRF823		
	2.25	2.00		IRFF433			
	2.50	3.00	IRF421		IRF821		
	2.75	1.50		IRFF431			
	4	2.00	IRF433		IRF833		
	4.50	1.50	IRF431		IRF831		
	7	1.10	IRF443		IRF843		
	8	0.85	IRF441		IRF841		
	12	0.50	IRF453			IRFP453	
	13	0.40	IRF451			IRFP451	
500	1.40	4.00		IRFF422			
	1.60	3.00		IRFF420			
	2	4.00	IRF422		IRF822		
	2.25	2.00		IRFF432			
	2.50	3.00	IRF420		IRF820		
	2.75	1.50		IRFF430			
	4	2.0	IRF432		IRF832		
	4.5	1.50	IRF430		IRF830		
	7	1.1	IRF442		IRF842		
	8	0.85	IRF440		IRF840		
	12	0.50	IRF452			IRFP452	
	13	0.40	IRF450			IRFP450	

JEDEC Types — N-Channel

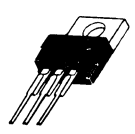
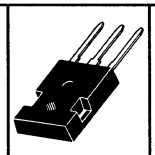
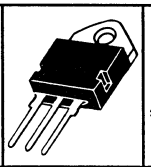
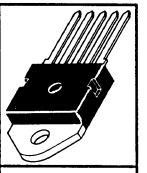
Maximum Ratings / Package				
BV_{DSS} (V)	I_{DS} (A)	$r_{DS(ON)}$ OHMS	TO-204	TO-205
60	12	0.25	2N6755	
	30	0.80	2N6763	
100	3.50	0.60		2N6782*
	6	0.30		2N6788*
	8	0.18		2N6796*
	14	0.18	2N6756*	
	38	0.055	2N6764*	
150	8	0.60	2N6757	
	25	0.12	2N6765	
200	2.25	1.50		2N6784*
	3.50	0.80		2N6790*
	5.50	0.40		2N6798*
	9	0.40	2N6758*	
	30	0.085	2N6766*	

*QPL-Approved Types

Maximum Ratings / Package				
BV_{DSS} (V)	I_{DS} (A)	$r_{DS(ON)}$ OHMS	TO-204	TO-205
350	4.50	1.50	2N6759	
	12	0.40	2N6787	
400	1.25	3.60		2N6786*
	2	1.80		2N6792*
	3	1.00		2N6800*
	5.50	1.00	2N6760*	
	14	0.30	2N6768*	
450	4	2.00	2N6761	
	11	0.50	2N6769	
500	1.50	3.00		2N6794*
	3.50	1.50		2N6802*
	4.50	1.50	2N6762*	
	12	0.40	2N6770*	

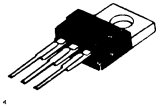
*QPL-Approved Types

MegaFET Product Series — N-Channel

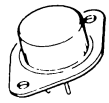
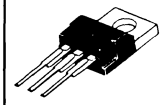
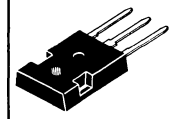
Mqximum Ratings / Package									
BV_{DSS} (V)	I_{DS} (A)	$r_{DS(ON)}$ OHMS	E_{AS} (mj)	TO-251	TO-252	TO-220	TO-247	TO-218	TO-218 5 Lead
50	10	0.10	100	RFD10N05	RFD10N05SM				
	14	0.10	100	RFD14N05	RFD14N05SM	RFP14N05			
	16	0.047	200	RFD16N05	RFD16N05SM				
	25	0.047	200			RFP25N05			
	50	0.022	400			RFP50N05	RFG50N05		
	75	0.010	800					RFH75N05	
	100	0.010	800						RFA100N05
100	16	0.080	*	RFD16N10	RFD16N10SM				
	22	0.080	*			RFP22N10			
	40	0.040	*			RFP40N10	RFG40N10		

*More complete ruggedness capability now specified UIS current vs. time in avalanche graph on data sheet.

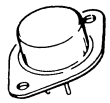
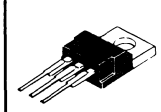
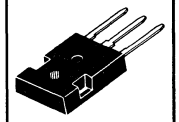
Advanced Discrete — N-Channel

Maximum Ratings / Package				
BV_{DSS} (V)	I_{DS} (A)	$r_{DS(ON)}$ OHMS	ESD (kV)	TO-220
80	1	0.75	2	RLP1N08L

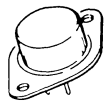
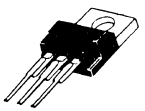
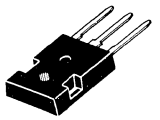
Rugged-Series Power MOSFETs — N-Channel

Maximum Ratings / Package								
BV_{DSS} (V)	I_{DS} (A)	$r_{DS(ON)}$ OHMS	E_{AS} (mj)	TO-204	TO-205	TO-220	TO-247	4-Pin DIP
60	0.80	0.80	19					IRFD113R
	1	0.60	19					IRFD111R
	1.1	0.40	36					IRFD123R
	1.3	0.30	36					IRFD121R
	3	0.80	19		IRFF113R			
	3.50	0.80	19		IRFF111R	IRF513R		
	4	0.60	19			IRF511R		
	5	0.40	36		IRFF123R			
	6	0.30	36		IRFF121R			
	7	0.25	69		IRFF133R			
	7	0.40	36			IRF523R		
	8	0.18	69		IRFF131R			
	8	0.30	36			IRF521R		
	12	0.25	69	IRF133R		IRF533R		
	14	0.18	69	IRF131R		IRF531R		
	24	0.11	100	IRF143R		IRF543R	IRFP143R	
	27	0.085	100	IRF141R		IRF541R	IRFP141R	
	33	0.080	150	IRF153R			IRFP153R	
	40	0.055	150	IRF151R		IRFP151R		
100	0.80	0.80	19					IRFD112R
	1	0.60	19					IRFD110R
	1.1	0.40	36					IRFD122R
	1.3	0.30	36					IRFD120R
	3	0.80	19		IRFF112R			
	3.5	0.60	19		IRFF110R			
	3.5	0.80	19			IRF512R		
	4	0.60	19			IRF510R		
	5	0.40	36		IRFF122R			
	6	0.30	36		IRFF120R			
	7	0.25	69		IRFF132R			
	7	0.40	36			IRF522R		
	8	0.18	69		IRFF130R			
	8	0.30	36			IRF520R		
	12	0.25	69	IRF132R		IRF532R		
	14	0.18	69	IRF130R		IRF530R		
	24	0.11	100	IRF142R		IRF542R	IRFP142R	
	27	0.085	100	IRF140R		IRF540R	IRFP140R	
	33	0.08	150	IRF152R			IRF152R	
	40	0.055	150	IRF150R			IRFP150R	
150	0.45	2.40	30					IRFD213R
	0.60	1.50	30					IRFD211R
	0.70	1.20	85					IRFD223R
	0.80	0.80	85					IRFD221R
	1.80	2.40	30		IRFF213R			
	2	2.40	30			IRF613R		
	2.2	1.50	30		IRFF211R			
	2.5	1.50	30			IRF611R		
	3	1.20	85		IRFF223R			
	3.5	0.80	85		IRFF221R			
	4	1.20	85			IRF623R		
	4.5	0.60	150		IRFF233R			
	5	0.80	85			IRF621R		
	5.5	0.40	150		IRFF231R			
	8	0.60	150	IRF233R		IRF633R		
	9	0.40	150	IRF231R		IRF631R		
	16	0.22	300	IRF243R		IRF643R	IRFP243R	

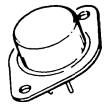
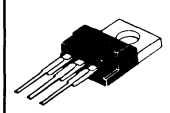
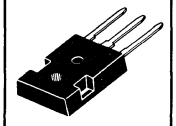
Rugged-Series Power MOSFETs — N-Channel (Continued)

Maximum Ratings / Package								
BV_{DSS} (V)	I_{DS} (A)	$r_{DS(ON)}$ OHMS	E_{AS} (mj)	TO-204	TO-205	TO-220	TO-247	4-Pin DIP
150	18	0.18	300	IRF241R		IRF641R	IRFP241R	
	25	0.12	500	IRF253R			IRFP253R	
	30	0.085	500	IRF251R			IRFP251R	
200	0.45	2.40	30					IRFD212R
	0.60	1.50	30					IRFD210R
	0.70	1.20	85					IRFD222R
	0.80	0.80	85					IRFD220R
	1.80	2.40	30		IRFF212R			
	2	2.40	30			IRF612R		
	2.20	1.50	30		IRFF210R			
	2.50	1.50	30			IRF610R		
	3	1.20	85		IRFF222R			
	3.5	0.80	85		IRFF220R			
	4	1.20	85			IRF622R		
	4.5	0.60	150		IRFF232R			
	5	0.80	85			IRF620R		
	5.5	0.40	150		IRFF230R			
	8	0.60	150	IRF232R		IRF632R		
	9	0.40	150	IRF230R		IRF630R		
	16	0.22	300	IRF242R		IRF642R	IRFP242R	
	18	0.18	300	IRF240R		IRF64OR	IRF240R	
	25	0.12	500	IRF252R			IRFP252R	
	30	0.085	500	IRF250R			IRFP250R	
250	3.30	1.50	120			IRF625		
	3.80	1.10	120			IRF624		
	6.50	0.68	180	IRF235		IRF635	IRFP235	
	8.10	0.45	180	IRF234		IRF634	IRFP234	
	13	0.34	550	IRF245		IRF645	IRFP245	
	14	0.28	550	IRF244		IRF644	IRFP244	
	21	0.17	1000	IRF255			IRFP255	
	23	0.14	1000	IRF254			IRFP254	
275	3.30	1.50	120			IRF627		
	3.80	1.10	120			IRF626		
	6.50	0.68	180	IRF237		IRF637	IRFP237	
	8.10	0.45	180	IRF236		IRF636	IRFP236	
	13	0.34	550	IRF247		IRF647	IRFP247	
	14	0.28	550	IRF246		IRF646	IRFP246	
	21	0.17	1000	IRF257			IRFP257	
	23	0.14	1000	IRF256			IRFP256	
350	0.30	5.00	45					IRFD313R
	0.40	3.60	45					IRFD311R
	0.40	2.50	100					IRFD323R
	0.50	1.80	100					IRFD321R
	1.15	5.00	45		IRFF313R			
	1.30	5.00	45			IRF713R		
	1.35	3.60	45		IRFF311R			
	1.50	3.60	45			IRF711R		
	2	2.50	100		IRFF323R			
	2.50	1.80	100		IRFF321R			
	2.50	2.50	100			IRF723R		
	3	1.80	100			IRF721R		
	3	1.80	300		IRFF333R			
	3.50	1.00	300		IRFF331R			
	4.50	1.50	300	IRF333R		IRF733R		

Rugged-Series Power MOSFETs — N-Channel (Continued)

Maximum Ratings / Package								
BV_{DSS} (V)	I_{DS} (A)	$r_{DS(ON)}$ OHMS	E_{AS} (mj)	TO-204	TO-205	TO-220	TO-247	4-Pin DIP
350	5.50	1.00	300	IRF331R		IRF731R		
	8	0.80	400	IRF343R		IRF743R	IRFP343R	
	10	0.55	400	IRF341R		IRF741R	IRFP341R	
	13	0.40	700	IRF353R			IRFP353R	
	15	0.30	700	IRF351R			IRFP351R	
400	0.30	5.00	45					IRFD312R
	0.40	3.60	45					IRFD310R
	0.40	2.50	100					IRFD322R
	0.50	1.80	100					IRFD320R
	1.15	5.00	45		IRFF312R			
	1.30	5.00	45			IRF712R		
	1.35	3.60	45		IRFF310R			
	1.50	3.60	45			IRF710R		
	2	2.50	100		IRFF322R			
	2.50	2.50	100			IRF722R		
	2.50	1.80	100		IRFF320R			
	3	1.50	300		IRFF332R			
	3	1.80	100			IRF720R		
	3.50	1.00	300		IRFF330R			
	4.50	1.50	300	IRF332R		IRF732R		
	5.50	1.00	300	IRF330R		IRF730R		
	8	0.80	400	IRF342R		IRF742R	IRFP342R	
	10	0.55	400	IRF340R		IRF740R	IRFP340R	
	13	0.40	700	IRF352R			IRFP352R	
	15	0.30	700	IRF350R			IRFP350R	
	22	0.25	980	IRF362			IRFP362	
	25	0.20	980	IRF360			IRFP360	
450	1.40	4.00	210		IRFF423R			
	1.60	3.00	210		IRFF421R			
	2	4.00	210			IRF823R		
	2.25	2.00	300		IRFF433R			
	2.50	3.00	210			IRF821R		
	2.75	1.50	300		IRFF431R			
	4	2.00	300	IRF433R		IRF833R		
	4.50	1.50	300	IRF431R		IRF831R		
	7	1.10	450	IRF443R		IRF843R	IRFP443R	
	8	0.85	450	IRF441R		IRF841R	IRFP441R	
	12	0.50	860	IRF453R			IRFP453R	
	13	0.40	860	IRF451R			IRFP451R	
500	1.40	4.00	210		IRFF422R			
	1.60	3.00	210		IRFF420R			
	2	4.00	210			IRF822R		
	2.25	2.00	300		IRFF432R			
	2.50	3.00	210			IRF820R		
	2.75	1.50	300		IRFF430R			
	4	2.00	300	IRF432R		IRF832R		
	4.50	1.50	300	IRF430R		IRF830R		
	7	1.10	450	IRF442R		IRF842R	IRFP442R	
	8	0.85	450	IRF440R		IRF840R	IRFP440R	
	12	0.50	860	IRF452R			IRFP452R	
	13	0.40	860	IRF450R			IRFP450R	
	17	0.35	960	IRF462			IRFP462	
	20	0.27	960	IRF460			IRFP460	
600	5.40	1.60	570	IRFAC42R		IRFBC42R		
	5.90	1.60	410				IRFPC42R	
	6.20	1.20	570	IRFAC40R		IRFBC40R		
	6.80	1.20	410				IRFPC40R	

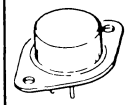
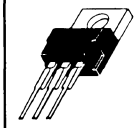
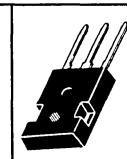
Rugged-Series Power MOSFETs — P-Channel

Maximum Ratings / Package								
BV_{DSS} (V)	I_{DS} (A)	$r_{DS(ON)}$ OHMS	E_{AS} (mj)	TO-204	TO-205	TO-220	TO-247	4-Pin DIP
60	0.6	1.6	170					IRFD9113
	0.8	0.8	370					IRFD9123
	2.5	1.6	170			IRF9513		
	3	1.2	170			IRF9511		
	3.5	0.8	370		IRFF9123			
	4	0.6	370		IRFF9121			
	5	0.8	370			IRF9523		
	5.5	0.4	500		IRFF9133			
	6	0.6	370			IRF9521		
	6.5	0.3	500		IRFF9131			
	10	0.4	500	IRF9133		IRF9533		
	12	0.3	500	IRF9131		IRF9531		
	19	0.2	960	IRF9141		IRF9541	IRFP9141	
	15	0.3	960	IRF9143		IRF9543	IRFP9143	
	25	0.15	1300	IRF9151			IRFP9151	
100	0.7	1.2	170					IRFD9110
	1	0.6	370					IRFD9120
	2.5	1.6	170			IRF9512		
	3	1.2	170			IRF9510		
	3.5	0.8	370		IRFF9122			
	4	0.6	370		IRFF9120			
	5	0.8	370			IRF9522		
	5.5	0.4	500		IRFF9132			
	6	0.6	370			IRF9520		
	6.5	0.3	500		IRFF9130			
	6.5	0.3	N.R.		2N6849*			
	10	0.4	500	IRF9132		IRF9532		
	12	0.3	500	IRF9130		IRF9530		
	12	0.3	N.R.	2N6804*				
	19	0.2	960	IRF9140		IRF9540	IRFP9140	
	15	0.3	960	IRF9142		IRF9542	IRFP9142	
	25	0.15	1300	IRF9150			IRFP9150	
150	0.5	2.4	290					IRFD9223
	2.0	2.4	290		IRFF9223			
	2.5	1.5	290		IRFF9221			
	3.0	2.4	290			IRF9623		
	3.5	1.2	500		IRFF9233			
	3.5	1.5	290			IRF9621		
	4.0	0.8	500		IRFF9231			
	5.5	1.2	500	IRF9233		IRF9633		
	6.5	0.8	500	IRF9231		IRF9631		
	9	0.7	790	IRF9243		IRF9643	IRFP9243	
	11	0.5	790	IRF9241		IRF9641	IRFP9241	
200	0.6	1.5	290					IRFD9220
	2.0	2.4	290		IRFF9222			
	2.5	1.5	290		IRFF9220			
	3.0	2.4	290			IRF9622		
	3.5	1.2	500		IRFF9232			
	3.5	1.5	290			IRF9620		
	4.0	0.8	500		IRFF9230			
	4.0	0.8	N.R.		2N6851*			
	5.5	1.2	500	IRF9232		IRF9632		
	6.5	0.8	500	IRF9230		IRF9630		
	9	0.7	790	IRF9242		IRF9642	IRFP9242	
	11	0.5	790	IRF9240		IRF9640	IRFP9240	

N.R. = Not Rated

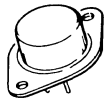
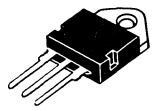
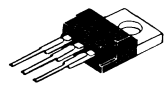
*QPL - Approved Types

Logic Level - L^2FETs — N-Channel Types

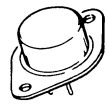
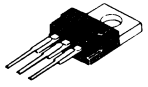
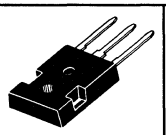
Maximum Ratings / Package									
BV_{DSS} (V)	I_{DS} (A)	$r_{DS(ON)}$ OHMS	E_{AS} (mj)	TO-204	TO-205	TO-220	TO-251	TO-252	TO-247
50	2	0.75	N.R.		RFL2N05L				
	4	0.60	N.R.			RFP4N05L			
	15	0.14	N.R.	RFM15N05L		RFP15N05L			
	14	0.100	100			RFP14N05L	RFD14N05L	RFD14N05LSM	
	16	0.047	200				RFD16N05L	RFD16N05LSM	
	25	0.047	200			RFP25N05L			
	50	0.22**				RFP50N05L			RFG50N05L
60	2	0.75	N.R.		RFL2N06L				
	4	0.60	N.R.			RFP4N06L			
	12	0.135**				RFP12N06RLE	RFD13N06RLE	RFD12N06RLESM	
	12	0.180**				RFP3055RLE	RFD3055RLE	RFD3055RLESM	
	15	0.14	N.R.	RFM15N06L		RFP15N06L			
	17	0.100	N.R.			RFP17N06L			
	25	0.07	N.R.			RFP25N06L			
80	1	1.20	N.R.		RFL1N08L				
	2	1.05	N.R.			RFP2N08L			
	12	0.20	N.R.	RFM12N08L		RFP12N08L			
100	1	1.20	N.R.		RFL1N10L				
	1.50	1.40	N.R.		2N6901*				
	2	1.05	N.R.			RFP2N10L			
	12	0.20	N.R.	2N6902*					
	12	0.20	N.R.	RFM12N10L		RFP12N10L			
120	1	1.90	N.R.		RFL1N12L				
	2	1.75	N.R.			RFP2N12L			
	10	0.30	N.R.	RFM10N12L		RFP10N12L			
150	1	1.90	N.R.		RFL1N15L				
	2	1.75	N.R.			RFP2N15L			
	10	0.30	N.R.	RFM10N15L		RFP10N15L			
180	1	3.65	N.R.		RFL1N18L				
	2	3.50	N.R.			RFP2N18L			
	8	0.50	N.R.	RFM8N18L		RFP8N18L			
200	1	3.65	N.R.		RFL1N20L				
	1.5	3.65	N.R.		2N6903*				
	2	3.50	N.R.			RFP2N20L			
	8	0.65	N.R.	2N6904*					
	8	0.50	N.R.	RFM8N20L		RFP8N20L			

N.R. = Not Rated *QPL Approved Types **More Complete Ruggedness Capability Now Specified

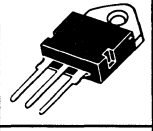
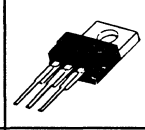
N-Channel Enhancement-Mode Conductivity Modulated Power Field-Effect Transistors—IGBTs Optimized for Switching Applications

Maximum Ratings				Package			
BV_{CES} (V)	I_{CE} (A)	t_f (μs)	V_{CE} (V)	TO-204AA	TO-218AC	TO-220AB
400	5	1.0	2.0	2N6975		
	5	0.5	2.0	2N6977		
	10	1.0	2.5	IGTM10N40	IGTH10N40	IGTP10N40
	10	0.5	2.5	IGTM10N40A	IGTH10N40A	IGTP10N40A
	20	1.0	2.5	IGTM20N40	IGTH20N40	IGTP20N40
	20	0.5	2.5	IGTM20N40A	IGTH20N40A	IGTP20N40A
500	5	1.0	2.0	2N6976		
	5	0.5	2.0	2N6978		
	10	1.0	2.5	IGTM10N50	IGTH10N50	IGTP10N50
	10	0.5	2.5	IGTM10N50A	IGTH10N50A	IGTP10N50A
	20	1.0	2.5	IGTM20N50	IGTH20N50	IGTP20N50
	20	0.5	2.5	IGTM20N50A	IGTH20N50A	IGTP20N50A

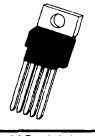
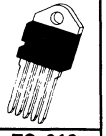
IGBTs Optimized for Motor Drive Applications

Maximum Ratings				Package					
B_{CES} (V)	I_{CE} (A)	V_{CE} (V)	SOA I_{CE}	TO-204AA	TO-220AB	TO-247	TO-251	TO-252
400	3	2.5	7.5A				IGT3N40	IGT3N40SM
	5	2.5	11A				IGT5N40	IGT5N40SM
	18	2.5	30A	IGT6D10	IGT4D10			
	18	2.5	30A	IGT6D11	IGT4D11			
	32	2.2	50A	IGT6D20		IGT8D20		
	32	2.5	50A	IGT6D21		IGT8D21		
500	3	2.5	7.5A				IGT3N50	IGT3N50SM
	5	2.5	11A				IGT5N50	IGT5N50SM
	18	2.5	30A	IGT6E10	IGT4E10			
	18	2.5	30A	IGT6E11	IGT4E10			
	32	2.2	50A	IGT6E20		IGT8E20		
	32	2.5	50A	IGT6E21		IGT8E21		

IGBTs with Integral Reverse Diode

Maximum Ratings				Package		
V_{CES} (V)	I_{CE} (A)	V_{CE} (V)	t_f (μs)	TO-218AC	TO-220AB
400	10	2.5	1.0	IGTH10N40D	IGTP10N40D
	10	2.5	0.5	IGTH10N40AD	IGTP10N40AD
	20	2.5	1.0	IGTH20N40D	
	20	2.5	0.5	IGTH20N40AD	
500	10	2.5	1.0	IGTH10N50D	IGTP10N50D
	10	2.5	0.5	IGTH10N50AD	IGTP10N50AD
	20	2.5	1.0	IGTH20N50D	
	20	2.5	0.5	IGTH20N50AD	

IGBTs with Integral Current Sensing

Maximum Ratings				Package		
V_{CES} (V)	I_{CE} (A)	V_{CE} (V)	t_f (μs)	TO-220 5-lead	TO-218 5-lead
500	10	2.3	1.2	GS1510	
	10	2.3	1.2	IGT5E10CS	
	25	2.6	1.2		GS1525
	25	2.6	1.2		IGT7E20CS

Through a fourth terminal, these devices provide a nonintrusive means of monitoring the collector-to-emitter current.

Surgectors

Surgector Types

Type No.	Function	V_Z min. V	V_{BO} max. (100V /µs) V	I_{TSM} (1 x 2 µs) A	I_H mA/	Pkg. Style
SGT10S10	Var Clamp	100	*	300	> 100	A
SGT27S10	Var Clamp	270	*	300	> 100	A
SGT03U13	Uni-Direct	30	< 50	300	> 130	B
SGT06U13	Uni-Direct	60	< 85	300	> 130	B
SGT23U13	Uni-Direct	230	< 275	300	> 130	B
SGT23B13	Bi-Direct	230	< 275	300	>130	B
SGT27B13	Bi-Direct	270	< 340	300	> 130	B
SGT27B27	Bi-Direct	270	< 350	600	> 270	B

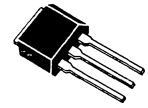
* Dependent on trigger circuit

Surgector Characteristics

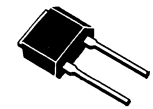
- High impedance until breakdown (i.e., low leakage)
- Repeatable breakdown/threshold voltage
- High surge-current handling capability
- Withstand and respond to rapidly recurring surges
- Fast recovery to high-impedance state (turn-off)
- Dual-polarity protection
- No degradation of essential characteristics with use

Surgector Packages

Modified TO-202 Package Style



Package A

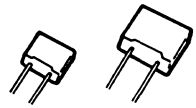


Package B

Metal-Oxide Varistors (MOVs)

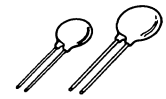
CH

RA



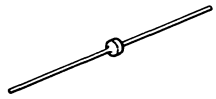
CP

LA

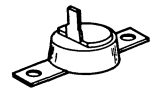


ZA

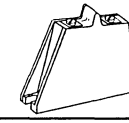
MA



PA

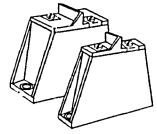


DA

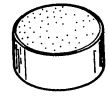


DB

BA, BB



CA



Family Characteristics

Series	CH	RA	CP	LA, ZA	MA	PA	DA/DB, HE	BA, BB	CA
Operating Ambient Temp. (w/out derating)	-55 to +125°C	-55 to +125°C	-55 to +125°C	-55 to +85°C	-55 to +85°C	-55 to +85°C	-55 to +85°C	-55 to +85°C	-55 to +85°C
Storage Temperature	-55 to +150°C	-55 to +150°C	-55 to +150°C	-55 to +125°C	-55 to +125°C	-55 to +125°C	-55 to +125°C	-55 to +125°C	-55 to +125°C
† HiPot Encapsulation Volts dc for 1 Min.	NA	2500	NA	2500	1000	NA	5000	5000	NA
Voltage Temp. Coefficient (V_C at Specified Test Current)	<0.01%/°C	<0.01%/°C	<0.01%/°C	<0.01%/°C	<0.01%/°C	<0.01%/°C	<0.01%/°C	<0.01%/°C	<0.01%/°C
Insulation Resistance (MΩ)	NA	>1000	NA	>1000	>1000	NA	>1000	>1000	NA

† Dielectric withstand per MIL STD 202, Method 301, 2500 V_{DC} min.

MOV Selection Chart

Voltage			CH Series	CP Series			MA Series*	LA, ZA Series				
Vm (ac)	Vm (dc)	Vn (dc)	CH8 5 x 8 mm	CP16 16 Gauge	CP20 20 Gauge	CP22 22 Gauge	3 mm	5 mm	7 mm	10 mm	14 mm	20 mm
4	5.5	8.2						V8ZA05	V8ZA1	V8ZA2		
6	8	12						V12ZA05	V12ZA1	V12ZA2		
10	14	18	V18CH8				V18MA1B, S	V18ZA05	V18ZA1	V18ZA2	V18ZA3	V18ZA40
14	18	22	V22CH8				V22MA1B, S	V22ZA05	V22ZA1	V22ZA2	V22ZA3	
14	18	24										V24ZA50
17	22	27	V27CH8				V27MA1B, S	V27ZA05	V27RA1	V27ZA2	V27ZA4	V27ZA60
20	26	33	V33CH8				V33MA1B, S	V33ZA05	V33ZA1	V33ZA2	V33AZ5	
21	27	33										V33ZA70
23	31	36										V36ZA80
25	31	39	V39CH8		V39CP20	V39CP22	V39MA2B, S	V39ZA05	V39ZA1	V39ZA3	V39ZA6	
30	38	47	V47CH8	V47CP16	V47CP20	V47CP22	V47MA2B, S	V47ZA05	V47ZA1	V47ZA3	V47ZA7	
35	45	56	V56CH8				V56MA2B, S	V56ZA05	V56ZA2	V56ZA3	V56ZA8	
40	56	68	V68CH8				V68MA3B, S	V68ZA05	V68ZA2	V68ZA3	V68ZA10	
50	66	82	V82CH8				V82MA3B, S	V82ZA05	V82ZA2	V82ZA4	V82ZA12	
60	81	100	V100CH8				V100MA4B, S	V100ZA05	V100ZA3	V100ZA4	V100ZA15	
75	102	120	V120CH8				V120MA2B, S	V120ZA05	V120ZA1	V120ZA4	V120ZA6	
92	127	150					V150MA2B	V150ZA05				
95	127	150	V150CH8						V150ZA1	V150ZA4	V150ZA8	
110	152	180					V180MA3B	V180ZA05				
115	153	180	V180CH8						V180ZA1	V180ZA5	V180ZA10	
130	175	200		V200CP16	V200CP20	V200CP22						
130	175	200	V200CH8						V130LA1, 2	V130LA5	V130LA10A	V130LA20A, B
140	180	220	V220CH8					V220ZA05	V140LA2	V140LA5	V140LA10A	
150	150	240	V240CH8	V240CP16	V240CP20	V240CP22						
150	200	240							V150LA1, 2	V150LA5	V150LA10A	V150LA20A, B
175	225	270						V270ZA05	V175LA2		V175LA10A	
210	275	330						V330ZA05				
230	300	360	V360CH8						V230LA4	V230LA10	V230LA20A	
250	330	390	V390CH8					V390ZA05	V250LA2, 4	VA250LA10	V250LA20A	V250LA40A, B
275	369	430	V430CH8					V430ZA05	V275LA2, 4	V275LA10	V275LA20A	V275LA40A, B
300	405	470						V470ZA05	V300LA2, 4			
320	420	510									V320LA20A	V320LA40B
420	560	680						V680ZA05		V420LA10	V420LA20A	V420LA20B
480	640	750						V750ZA05			V480LA40A	V480LA80B
510	675	820									V510LA40A	V510LA80B
575	730	910									V575LA40A	V575LA80B
660	850	1050									V660LA50A	V660LA100B
750	970	1200										
880	1150	1500										
1000	1200	1600									V1000LA80A	V1000LA160B
1100	1400	1800										
1400	1750	2200										
1700	2150	2700										
2000	2500	3300										
2400	3000	3900										
2800	3500	4700										

* Additional voltage selections are available for the MA series.

Features:

CH Series

Surface-Mount Varistors

- Better Performance
- Higher Reliability
- Lower Equipment Cost
- Saves on Board Height/Bulk/Weight

CP Series

Connector-Pin Varistors

- Provides Transient Protection in Connectors
- Available in 22-, 20-, and 16-Gauge Sizes

MA Series

- Axial Package
- Wide Voltage Range
- Automatic Insertion

LA Series

- Radial Package
- Line-Voltage Operation
- UL Recognized

ZA Series

- Radial Package
- Low-Voltage Operation

MOV Selection Chart (Continued)

Voltage			RA Series			PA Series	DA/DB Series		BA/BB Series	CA Series		
Vm (ac)	Vm (dc)	Vn (dc)	RA8	RA16	RA22	20 mm	DA 40 mm	DB 40 mm	60 mm	32 mm	40 mm	60 MM
4	5.5	8.2	V8RA8									
6	8	12	V12RA8									
10	14	18	V18RA8	V18RA16								
14	18	22	V22RA8	V22RA16								
14	18	24			V24RA22							
17	22	27	V27RA8	V27RA16								
20	26	33	V33RA8	V33RA16								
21	27	33										
23	31	36			V36RA22							
25	31	39	V39RA8	V39RA16								
30	38	47	V47RA8	V47RA16								
35	45	56	V56RA8	V56RA16								
40	56	68	V68RA8	V68RA16								
50	66	82	V82RA8	V82RA16								
60	81	100	V100RA8	V100RA16								
75	102	120	V120RA8	V120RA16								
92	127	150										
95	127	150	V150RA8	V150RA16								
110	152	180										
115	153	180	V180RA8	V180RA16								
130	175	200										
130	175	200	V200RA8	V200RA16	V200RA22	V130PA20A, C	V131DA40	V131DB40	V131BA60	V131CA32	V131CA40	
140	180	220	V220RA8	V220RA16								
150	150	240										
150	200	240	V240RA8	V240RA16	V240RA22	V150PA20A, C	V151DA40	V151DB40	V151BA60	V151CA32	V151CA40	
175	225	270	V270RA8	V270RA16	V270RA22							
210	275	330										
230	300	360	V360RA8	V360RA16								
250	330	390	V390RA8	V390RA16	V390RA22	V250PA40A, C	V251DA40	V251DB40	V251BA60	V251CA32	V251CA40	V251CA60
275	369	430	V430RA8	V430RA16	V430RA22	V275PA40A, C	V271DA40	V271DB40	V271BA60	V271CA32	V271CA40	V271CA60
300	405	470										
320	420	510				V320PA40A, C	V321DA40	V321DB40	V321BA60	V321CA32	V321CA40	V321CA60
420	560	680				V420PA40A, C	V421DA40	V421DB40	V421BA60	V421CA32	V421CA40	V421CA60
480	640	750				V480PA80A, C	V481DA40	V481DB40	V481BA60	V481CA32	V481CA40	V481CA60
510	675	820				V510PA80A, C	V511DA40	V511DB40	V511BA60	V511CA32	V511CA40	V511CA60
575	730	910				V575PA80A, C	V571DA40	V571DB40	V571BA60	V571CA32	V571CA40	V571CA60
660	850	1050				V660PA100A, C	V661DA40	V661DB40	V661BA60	V661CA32	V661CA40	V661CA60
750	970	1200					V751DA40	V751DB40	V751BA60	V751CA32	V751CA40	V751CA60
880	1150	1500							V881BA60			V881CA60
1000	1200	1600										
1100	1400	1800							V112BB60			V112CA60
1400	1750	2200							V142BB60			V142CA60
1700	2150	2700							V172BB60			V172CA60
2000	2500	3300							V202BB60			V202CA60
2400	3000	3900							V242BB60			V242CA60
2800	3500	4700							V282BB60			V282CA60

Features:

RA Series
- Low Height Profile
- High-Temperature Capability
- Precise Seating Plane
- In-Line Leads

PA Series
- Rigid Mountdown
- NEMA Creep-and-Strike Distance
- Quick-Connect Terminal
- UL Recognized

DA/DB & BA Series
- High-Energy Capability
- Rigid Terminals
- Isolated
- Low Inductance
- Improved Creep and Strike
- UL Recognized

CA Series
- Industrial Discs

High Reliability Series
- 100% Prescreened
- 100% Process Conditioning
- Meets Military Specifications

General Purpose

Type No.	$V_{CEO}(sus)$ V	$V_{CEV}(sus)$ V	P_T W	h_{FE}	I_C A	V_{CE} V	$V_{CE}(sat)$-V	I_C A	I_B A	f_T(Typ) MHz	JEDEC Package
2N1482 FAMILY (n-p-n)			**8.75W max**								
2N1479	40	60	5	20-60	0.2	4	1.4	0.2	0.02		
2N1481	40	60	5	35-100	0.2	4	1.4	0.2	0.02		
2N1700	40	60	5	20-80	0.1	4	1	0.1	0.01		
40347V1	40	60	4.4	25-100	0.45	4	1	0.45	0.045		
40347	40	60	8.75	25-100	0.45	4	1	0.45	0.045	1.5	TO-205AA/
2N1480	55	100	5	20-60	0.2	4	1.4	0.2	0.02		TO-5
2N1482	55	100	5	35-100	0.2	4	1.4	0.2	0.02		
40348V1	65	90	4.4	30-125	0.3	4	0.75	0.3	0.03		
40348	65	90	8.75	30-125	0.3	4	0.75	0.3	0.03		
2N3441 FAMILY (n-p-n)			**50W max**								
2N6263	120	140□	20	20-100	0.5	4	1.2	0.5	0.05		
2N3441	140	160□	25	25-100	0.5	4	1	0.5	0.05	0.8	TO-213AA/
40913	150	170□	5.8	20-60	1	2	0.5	1	0.1		TO-66
2N6264	150	170□	50	20-60	1	2	0.5	1	0.1		
2N3442 FAMILY (n-p-n)			**150W max**								
2N4347	120	140□	100	15-60	2	4	1	2	0.2	0.4	TO-204AA/
2N3442	140	160□	117	20-70	3	4	1	3	0.3		TO-3

‡ $V_{CER}(sus)$ □ $V_{CEX}(sus)$

General Purpose (Continued)

Type No.	$V_{CEO(sus)}$ V	$V_{CEV(sus)}$ V	P_T W	h_{FE}	I_C A	V_{CE} V	$V_{CE(sat)}$-V	I_C A	I_B A	f_T(Typ) MHz	JEDEC Package
2N5303 FAMILY (n-p-n)			**200W max**								
2N5301	40	-	200	15-60	15	3	0.75	10	1		
2N6326	60	-	200	6-30	30	4	3	30	7.5		
2N5302*	60	-	200	15-60	15	3	0.75	10	1		
2N5885	60	-	200	20-100	10	4	1	15	1.5	8	TO-204AA/
2N6327	80	-	200	6-30	30	4	3	30	7.5		TO-3
2N5303	80	-	200	15-60	10	2	1.5	15	1.5		
2N5886	80	-	200	20-100	10	4	1	15	1.5		
2N5496 PLASTIC FAMILY (n-p-n)			**50W max**								
2N6129	40	40*	50	7 min.	7	4	1.4	7	3		TO-220
2N5490	40	60	50	20-100	2	4	1	2	0.2		TO-220AB
2N5491	40	60	50	20-100	2	4	1	2	0.2		TO-220AA
2N5494	40	60	50	20-100	3	4	1	3	0.3		TO-220AB
2N5495	40	60	50	20-100	3	4	1	3	0.3		TO-220AA
2N6130	60	60*	50	7 min.	7	4	1.4	7	3		TO-220
RCA3055	60	70‡	75	20-70	4	4	1.1	4	0.4	1	TO-220
2N5492	55	75	50	20-100	2.5	4	1	2.5	0.25		TO-220AB
2N5493	55	75	50	20-100	2.5	4	1	2.5	0.25		TO-220AA
2N5496	70	90	50	20-100	3.5	4	1	3.5	0.35		TO-220AB
2N5497	70	90	50	20-100	3.5	4	1	3.5	0.35		TO-220AA
2N6131	80	80*	50	7 min.	7	4	1.8	7	3		TO-220
BD501B	80	90*	75	20 min.	3.5	4	1	3.5	0.35		TO-220
2N5783 FAMILY (p-n-p)			**10W max**								
2N5783	-40	-45‡	10	20-100	-1.6	-2	-1	-1.6	-0.16		
2N5782	-50	-65‡	10	20-100	-1.2	-2	-0.75	-1.2	-0.12	20	TO205AA/
2N5781	-65	-80‡	10	20-100	-1	-2	-0.5	-1	-0.1		TO-5
2N5786 FAMILY (n-p-n)			**10W max**	**Complementary to 2N5783 Family**							
2N5786	40	45‡	10	20-100	1.6	2	1	1.6	0.16		
2N5785	50	65‡	10	20-100	1.2	2	0.75	1.2	0.12	1.5	TO-205AA/
2N5784	65	80‡	10	20-100	1	2	0.5	1	0.1		TO-5
2N5954 FAMILY (p-n-p)			**75W max**	**Complementary to 2N6372 Family**							
2N5956	-40	-50‡	40	20-100	-3	-4	-1	-3	-0.3		
2N4898	-40	-	25	20-100	-0.5	-1	-0.6	-1	-0.1		
2N5955	-60	-70‡	40	20-100	-2.5	-4	-1	-.25	-0.25		
2N4899	-60	-	25	20-100	-0.5	-1	-0.6	-1	-0.1	10	TO-213AA/
2N4900	-80	-	25	20-100	-0.5	-1	-0.6	-1	-0.1		TO-66
2N5954	-80	-90□	40	20-100	-2	-4	-1	-2	-0.2		
2N6467	-100	-110□	40	15-150	-1.5	-4	-1.2	-1.5	-0.15		
2N6468	-120	-130□	40	15-150	-1.5	-4	-1.2	-1.5	-0.15		
2N6312 FAMILY (p-n-p)			-								
2N6312	-40	-40*	75	25-100	-1.5	-4	-0.7	-1.5	-0.15		
2N6313	-60	-60*	75	25-100	-1.5	-4	-0.7	-1.5	-0.15	4	TO-213AA/
2N6314	-80	-80*	75	25-100	-1.5	-4	-0.7	-1.5	-0.5		TO-66

*JAN types available ‡ $V_{CER(sus)}$ □ $V_{CEX(sus)}$

General Purpose (Continued)

Type No.	$V_{CEO}(sus)$ V	$V_{CEV}(sus)$ V	P_T W	h_{FE}	I_C A	V_{CE} V	$V_{CE}(sat)$-V	I_C A	I_B A	f_T(Typ) MHz	JEDEC Package
2N6107 FAMILY (p-n-p)			**70W max**	**Complementary to 2N6292 Family**							
2N6110	-30	-40□	40	30-150	-3	-4	-1	-3	-0.3		TO-220AA
2N6111	-30	-40□	40	30-150	-3	-4	-1	-3	-0.3		TO-220AB
TIP30	-40	-	30	15-150	-1	-4	-0.7	-1	-0.125		TO-220AB
TIP32	-40	-	40	10-50	-3	-4	-1.2	-3	-0.375		TO-220AB
2N6124	-45	-	40	25-100	-1.5	-2	-0.6	-1.5	-0.15		TO-220AB
BD240	-45	-55□	30	40 min.	-0.2	-4	-0.7	-1	-0.2		TO-220AB
BD242	-45	-55□	40	25 min.	-1	-4	-1.2	-3	-0.6		TO-220AB
BD277	-45	-	70	30-150	-1.75	-2	-0.5	-1.75	-0.1		TO-220AB
BD534	-45	-	50	25 min.	-2	-2	-0.8	-2	-0.2		TO-220AB
BD796	-45	-	65	25 min.	-3	-2	-1	-3	-0.3		TO-220AB
2N6108	-50	-60□	40	30-150	-2.5	-4	-1	-2.5	-0.25		TO-220AA
2N6109	-50	-60□	40	30-150	-2.5	-4	-1	-2.5	-0.25		TO-220AB
BD240A	-60	-70‡	30	40 min.	-0.2	-4	-0.7	-1	-0.2		TO-220AB
BD242A	-60	-70‡	40	25 min.	-1	-4	-1.2	-3	-0.6		TO-220AB
TIP30A	-60	-	30	40 min.	-0.2	-4	-0.7	-1	-0.125		TO-220AB
TIP32A	-60	-	40	25 min.	-1	-4	-1.2	-3	-0.375		TO-220AB
2N6125	-60	-	40	25-100	-1.5	-2	-0.6	-1.5	-0.15		TO-220AB
BD536	-60	-	50	25 min.	-2	-2	-0.8	-2	-0.2	10	TO-220AB
BD798	-60	-	65	25 min.	-3	-2	-1	-3	-0.3		TO-220AB
2N6106	-70	-80□	40	30-150	-2	-4	-1	-2	-0.2		TO-220AA
2N6107	-70	-80□	40	30-150	-2	-4	-1	-2	-0.2		TO-220AB
BD240B	-80	-90‡	30	40 min.	-0.2	-4	-0.7	-1	-0.2		TO-220AB
BD242B	-80	-90‡	40	25 min.	-1	-4	-1.2	-3	-0.6		TO-220AB
2N6126	-80	-	40	20-80	-1.5	-2	-0.6	-1.5	-0.15		TO-220AB
BD538	-80	-	50	25 min.	-2	-2	-0.8	-2	-0.2		TO-220AB
BD800	-80	-	65	15 min.	-3	-2	-1	-3	-0.3		TO-220AB
TIP30B	-80	-	30	15-150	-1	-4	-0.7	-1	-0.125		TO-220AB
TIP32B	-80	-	40	10-50	-3	-4	-1.2	-3	-0.375		TO-220AB
2N6475	-100	-110□	40	15-150	-1.5	-4	-1.2	-1.5	-0.15		TO-220AB
TIP30C	-100	-	30	15-150	-1	-4	-0.7	-1	-0.125		TO-220AB
TIP32C	-100	-	40	10-50	-3	-4	-1.2	-3	-0.375		TO-220AB
BD802	-100	-	65	15 min.	-3	-2	-1	-3	-0.3		TO-220AB
BD240C	-100	-115‡	30	40 min.	-0.2	-4	-0.7	-1	-0.2		TO-220AB
BD242C	-100	-115‡	40	25 min.	-1	-4	-1.2	-3	-0.6		TO-220AB
2N6476	-120	-130□	40	15-150	-1.5	-4	-1.2	-1.5	-0.15		TO-220AB
2N6247 FAMILY (p-n-p)			**160W max**	**Complementary to 2N6472 Family**							
2N6594	-40	-45‡	100	5-100	-12	-4	-4	-12	-2.4		
2N6469	-40	-50‡	125	20-125	-5	-4	-1.3	-5	-0.5		
2N6246	-60	-70‡	125	20-100	-7	-4	-1.3	-7	-0.7		
BDX18	-60	-70‡	115	20-70	-4	-4	-1.1	-4	-0.4	16	TO-204AA/
MJ2955	-60	-70‡	150	20-70	-4	-4	-1.1	-4	-0.4		TO-3
2N3791	-60	-	150	30-150	-1	-2	-1	-5	-0.5		
2N6247	-80	-90‡	125	20-100	-6	-4	-1.3	-6	-0.6		
2N3792	-80	-	150	50-150	-1	-2	-1	-5	-0.5		
2N6248	-100	-110‡	125	20-100	-5	-4	-1.3	-5	-0.5		

‡ $V_{CER}(sus)$ □ $V_{CEX}(sus)$

General Purpose (Continued)

Type No.	V_{CEO}(sus) V	V_{CEV}(sus) V	P_T W	h_{FE}	I_C A	V_{CE} V	V_{CE}(sat)-V	I_C A	I_B A	f_T(Typ) MHz	JEDEC Package
2N6292 FAMILY (n-p-n)			**65W max**	**Complementary to 2N6107 Family**							
2N6288	30	40□	40	30-150	3	4	1	3	0.3		TO-220AB
2N6289	30	40□	40	30-150	3	4	1	3	0.3		TO-220AA
TIP29	40	-	30	15-150	1	4	0.7	1	0.125		TO-220AB
TIP31	40	-	40	10-50	3	4	1.2	3	0.375		TO-220AB
BD239	40	55‡	30	40 min.	0.2	4	0.7	1	0.2		TO-220AB
BD241	45	55‡	40	25 min.	1	4	1.2	3	0.6		TO-220AB
2N6121	45	-	40	25-100	1.5	2	0.6	1.5	0.15		TO-220AB
BD533	45	-	50	25 min.	2	2	0.8	2	0.2		TO-220AB
BD795	45	-	65	25 min.	3	2	1	3	0.3		TO-220AB
2N6290	50	60	40	30-150	2.5	4	1	2.5	0.25		TO-220AB
2N6291	50	60	40	30-150	2.5	4	1	2.5	0.25		TO-220AA
BD239A	60	70‡	30	40 min.	0.2	4	0.7	1	0.2		TO-220AB
BD241A	60	70‡	40	25 min.	1	4	1.2	3	0.6		TO-220AB
TIP29A	60	-	30	15-150	1	4	0.7	1	0.125	8	TO-220AB
TIP31A	60	-	40	10-50	3	4	1.2	3	0.375		TO-220AB
2N6122	60	-	40	25-100	1.5	2	0.6	1.5	0.15		TO-220AB
BD535	60	-	50	25 min.	2	2	0.8	2	0.2		TO-220AB
BD797	60	-	65	25 min.	3	2	1	3	0.3		TO-220AB
2N6292	70	80	40	30-150	2	4	1	2	0.2		TO-220AB
2N6293	70	80	40	30-150	2	4	1	2	0.2		TO-220AA
BD239B	80	90‡	30	40 min.	0.2	4	0.7	1	0.2		TO-220AB
BD241B	80	90‡	40	25 min.	1	4	1.2	3	0.6		TO-220AB
2N6123	80	-	40	20-80	1.5	2	0.6	1.5	0.15		TO-220AB
BD537	80	-	50	25 min.	2	2	0.8	2	0.2		TO-220AB
BD799	80	-	65	15 min.	3	2	1	3	0.3		TO-220AB
TIP29B	80	-	30	15-150	1	4	0.7	1	0.125		TO-220AB
TIP31B	80	-	40	10-50	3	4	1.2	3	0.375		TO-220AB
2N6473	100	110□	40	15-150	1.5	4	1.2	1.5	0.15		TO-220AB
TIP29C	100	-	30	15-150	1	4	0.7	1	0.125		TO-220AB
TIP31C	100	-	40	10-50	3	4	1.2	3	0.375		TO-220AB
2N6474	120	130□	40	15-150	1.5	4	1.2	1.5	0.15	4	TO-220AB
BD239C	100	115‡	30	40 min.	0.2	4	0.7	1	0.2		TO-220AB
BD241C	100	115‡	40	25 min.	1	4	1.2	3	0.6		TO-220AB
BD801	100	-	65	15 min.	3	2	1	3	0.3		TO-220AB
2N6478 FAMILY (n-p-n)			**50W max**								
2N6477	120	140	50	25-150	1	4	1	1	0.1	0.8	TO-220AB
2N6478	140	160	50	25-150	1	4	1	1	0.1		TO-220AB

‡ V_{CER}(sus) □ V_{CEX}(sus)

General Purpose (Continued)

Type No.	V_{CEO}(sus) V	V_{CEV}(sus) V	P_T W	h_{FE}	I_C A	V_{CE} V	V_{CE}(sat)-V	I_C A	I_B A	f_T(Typ) MHz	JEDEC Package
2N6488 FAMILY (n-p-n)			**75W max**	**Complementary to 2N6491 Family**							
2N6486	40	50□	75	20-150	5	4	1.3	5	0.5		
TIP41	40	-	65	15-150	3	4	2	6	0.6		
BD243	45	55‡	65	30 min.	0.3	4	1.5	6	1		
2N6487	60	70□	75	20-150	5	4	1.3	5	0.5		
TIP41A	60	-	65	15-150	3	4	2	6	0.6		
BD243A	60	70‡	65	30 min.	0.3	4	1.5	6	1	8	TO-220AB
2N6488	80	90□	75	20-150	5	4	1.3	5	0.5		
TIP41B	80	-	65	15-150	3	4	2	6	0.6		
BD243B	80	90‡	65	30 min.	0.3	4	1.5	6	1		
TIP41C	100	-	65	15-150	3	4	2	6	0.6		
BD243C	100	115‡	65	30 min.	0.3	4	1.5	6	1		
2N6491 FAMILY (p-n-p)			**75W max**	**Complementary to 2N6488 Family**							
2N6132	-40	-40•	50	7 min.	-7	-4	-1.4	-7	-3		
2N6489	-40	-50□	75	20-150	-5	-4	-1.3	-5	-0.5		
TIP42	-40	-	65	15-150	-3	-4	-2	-6	-0.6		
BD244	-45	-55‡	65	30 min.	-0.3	-4	-1.5	-6	-1		
BD500	-50	-55‡	75	15-90	-5	-4	-1	-5	-0.5		
2N6133	-60	-60•	50	7 min.	-7	-4	-1.4	-7	-3		
2N6490	-60	-70□	75	20-150	-5	-4	-1.3	-5	-0.5		
BD244A	-60	-70‡	65	30 min.	-0.3	-4	-1.5	-6	-1	8	TO-220AB
TIP42A	-60	-	65	15-150	-3	-4	-2	-6	-0.6		
2N6134	-80	-80•	50	7 min.	-7	-4	-1.8	-7	-3		
2N6491	-80	-90□	75	20-150	-5	-4	-1.3	-5	-0.5		
BD500B	-80	-85‡	75	15-90	-3.5	-4	-1	-3.5	-0.35		
BD244B	-80	-90‡	65	30 min.	-0.3	-4	-1.5	-6	-1		
BD244C	-100	-115‡	65	30 min.	-0.3	-4	-1.5	-6	-1		
TIP42B	-80	-	65	15-150	-3	-4	-2	-6	-0.6		
TIP42C	-100	-	65	15-150	-3	-4	-2	-6	-0.6		

‡ $V_{CER(sus)}$ □ $V_{CEX(sus)}$ • V_{CBO}

General Purpose (Continued)

Type No.	$V_{CEO(sus)}$ V	$V_{CES(sus)}$ V	P_T W	h_{FE}	I_C A	V_{CE} V	$V_{CE(sat)}$-V	I_C A	I_B A	f_T(Typ) MHz	JEDEC Package
D40D FAMILY (n-p-n)			-	**Complementary to D41D Family**							
D40D1	30	45	6.25	10 min.	1	2	0.5	0.5	0.05		
D40D2	30	45	6.25	20 min.	1	2	0.5	0.5	0.05		
D40D4	45	60	6.25	10 min.	1	2	0.5	0.5	0.05	200	TO-202
D40D5	45	60	6.25	10 min.	1	2	0.5	0.5	0.05		
D40D7	60	75	6.25	10 min.	1	2	1	0.5	0.05		
D40D8	60	75	6.25	10 min.	1	2	1	0.5	0.05		
D40E FAMILY (n-p-n)			-	**Complementary to D41E Family**							
D40E1	30	45	8	10 min.	1	2	1	1	0.1	230	TO-202
D40E5	60	70	8	10 min.	1	2	1	1	0.1		
D41D FAMILY (p-n-p)			-	**Complementary to D40D Family**							
D41D1	-30	-45	6.25	10 min.	-1	-2	-0.5	-0.5	-0.05		
D41D2	-30	-45	6.25	20 min.	-1	-2	-0.5	-0.5	-0.05		
D41D4	-45	-60	6.25	10 min.	-1	-2	-0.5	-0.5	-0.05	150	TO-202
D41D5	-45	-60	6.25	10 min.	-1	-2	-0.5	-0.5	-0.05		
D41D7	-60	-75	6.25	10 min.	-1	-2	-1	-0.5	-0.05		
D41D8	-60	-75	6.25	10 min.	-1	-2	-1	-0.5	-0.05		
D41E FAMILY (p-n-p)			-	**Complementary to D40E Family**							
D41E1	-30	-45	8	10 min.	-1	-2	-1	-1	-0.1		
D41E5	-60	-70	8	10 min.	-1	-2	-1	-1	-0.1	175	TO-202
D41E7	-80	-90	8	10 min.	-1	-2	-1	-1	-0.1		
D42C FAMILY (n-p-n)			-	**Complementary to D43C Family**							
D42C1	30	40	12.5	10 min.	1	1	0.5	1	0.1		
D42C2	30	40	12.5	20 min.	2	1	0.5	1	0.05		
D42C3	30	40	12.5	20 min.	2	1	0.5	1	0.05		
D42C4	45	55	12.5	10 min.	1	1	0.5	1	0.1		
D42C5	45	55	12.5	20 min.	2	1	0.5	1	0.05		
D42C6	45	55	12.5	20 min.	2	1	0.5	1	0.05	50	TO-202
D42C7	60	70	12.5	10 min.	1	1	0.5	1	0.1		
D42C8	60	70	12.5	20 min.	2	1	0.5	1	0.05		
D42C9	60	70	12.5	20 min.	2	1	0.5	1	0.05		
D42C10	80	90	12.5	10 min.	1	1	0.5	1	0.1		
D42C11	80	90	12.5	20 min.	2	1	0.5	1	0.05		
D42C12	80	90	12.5	20 min.	2	1	0.5	1	0.05		

General Purpose (Continued)

Type No.	$V_{CEO}(sus)$ V	$V_{CES}(sus)$ V	P_T W	h_{FE}	I_C A	V_{CE} V	$V_{CE}(sat)$-V	I_C A	I_B A	f_T(Typ) MHz	JEDEC Package
D43C FAMILY (p-n-p)			-	**Complementary to D42C Family**							
D43C1	-30	-40	12.5	10 min.	-1	-1	-0.5	-1	-0.1		
D43C2	-30	-40	12.5	20 min.	-2	-1	-0.5	-1	-0.05		
D43C3	-30	-40	12.5	20 min.	-2	-1	-0.5	-1	-0.05		
D43C4	-45	-55	12.5	10 min.	-1	-1	-0.5	-1	-0.1		
D43C5	-45	-55	12.5	20 min.	-2	-1	-0.5	-1	-0.05		
D43C6	-45	-55	12.5	20 min.	-2	-1	-0.5	-1	-0.05	40	TO-202
D43C7	-60	-70	12.5	10 min.	-1	-1	-0.5	-1	-0.1		
D43C8	-60	-70	12.5	20 min.	-2	-1	-0.5	-1	-0.05		
D43C9	-60	-70	12.5	20 min.	-2	-1	-0.5	-1	-0.05		
D43C10	-80	-90	12.5	10 min.	-1	-1	-0.5	-1	-0.1		
D43C11	-80	-90	12.5	20 min.	-2	-1	-0.5	-1	-0.05		
D43C12	-80	-90	12.5	20 min.	-2	-1	-0.5	-1	-0.05		
D44C FAMILY (n-p-n)			-	**Complementary to D45C Family**							
D44C1	30	40	30	10 min.	1	1	0.5	1	0.1		
D44C2	30	40	30	20 min.	2	1	0.5	1	0.05		
D44C3	30	40	30	20 min.	2	1	0.5	1	0.05		
D44C4	45	55	30	10 min.	1	1	0.5	1	0.1		
D44C5	45	55	30	20 min.	2	1	0.5	1	0.05		
D44C6	45	55	30	20 min.	2	1	0.5	1	0.05	50	TO-220AB
D44C7	60	70	30	10 min.	1	1	0.5	1	0.1		
D44C8	60	70	30	20 min.	2	1	0.5	1	0.05		
D44C9	60	70	30	20 min.	2	1	0.5	1	0.05		
D44C10	80	90	30	10 min.	1	1	0.5	1	0.1		
D44C11	80	90	30	20 min.	2	1	0.5	1	0.05		
D44C12	80	90	30	20 min.	2	1	0.5	1	0.05		
D45C FAMILY (p-n-p)			-	**Complementary to D44C Family**							
D45C1	-30	-40	30	10 min.	-1	-1	-0.5	-1	-0.1		
D45C2	-30	-40	30	20 min.	-1	-1	-0.5	-1	-0.05		
D45C3	-30	-40	30	20 min.	-2	-1	-0.5	-1	-0.05		
D45C4	-45	-55	30	10 min.	-1	-1	-0.5	-1	-0.1		
D45C5	-45	-55	30	20 min.	-1	-1	-0.5	-1	-0.05		
D45C6	-45	-55	30	20 min.	-2	-1	-0.5	-1	-0.05	40	TO-220AB
D45C7	-60	-70	30	10 min.	-1	-1	-0.5	-1	-0.1		
D45C8	-60	-70	30	20 min.	-1	-1	-0.5	-1	-0.05		
D45C9	-60	-70	30	20 min.	-2	-1	-0.5	-1	-0.05		
D45C10	-80	-90	30	10 min.	-1	-1	-0.5	-1	-0.1		
D45C11	-80	-90	30	20 min.	-1	-1	-0.5	-1	-0.05		
D45C12	-80	-90	30	20 min.	-2	-1	-0.5	-1	-0.05		
D44H FAMILY (n-p-n)			-	**Complementary to D45H Family**							
D44H1	30	30	50	20 min.	4	1	1	8	0.8		
D44H2	30	30	50	40 min.	4	1	1	8	0.4		
D44H4	45	45	50	20 min.	4	1	1	8	0.8		
D44H5	45	45	50	40 min.	4	1	1	8	0.4	50	TO-220AB
D44H7	60	60	50	20 min.	4	1	1	8	0.8		
D44H8	60	60	50	40 min.	4	1	1	8	0.4		
D44H10	80	80	50	20 min.	4	1	1	8	0.8		
D44H11	80	80	50	40 min.	4	1	1	8	0.4		

General Purpose (Continued)

Type No.	$V_{CEO(sus)}$ V	$V_{CEV(sus)}$ V	P_T W	h_{FE}	I_C A	V_{CE} V	$V_{CE(sat)}$-V	I_C A	I_B A	f_T(Typ) MHz	JEDEC Package
D45H FAMILY (p-n-p)			-	**Complementary to D44H Family**							
D45H1	-30	-30	50	20 min.	4	1	1	8	0.8		
D45H2	-30	-30	50	40 min.	4	1	1	8	0.4		
D45H4	-45	-45	50	20 min.	4	1	1	8	0.8		
D45H5	-45	-45	50	40 min.	4	1	1	8	0.4	40	TO-220AB
D45H7	-60	-60	50	20 min.	4	1	1	8	0.8		
D45H8	-60	-60	50	40 min.	4	1	1	8	0.4		
D45H10	-80	-80	50	20 min.	4	1	1	8	0.8		
D45H11	-80	-80	50	40 min.	4	1	1	8	0.4		
RCA8638 FAMILY (n-p-n)			**250W max**	**Complementary to RCA9116 Family**							
BD751	90	100‡	200	15-60	7.5	2	1.5	7.5	0.75		
BD751B	100	110	250	15-60	7.5	2	1.5	7.5	0.75		
RCA8638E	100	110‡	200	25-100	10	2	0.8	7.5	0.75		
2N5629	100	-	200	25-100	8	2	1	10	1		
BD550	100	130‡	150	15-75	4	4	2	4	0.5		
BD751A	120	130	200	25-100	5	2	1	5	0.5		
RCA8638D	120	130‡	200	25-150	5	2	1	5	0.5	4	TO-204AA/
2N5630	120	-	200	20-80	8	2	1	10	1		TO-3
BD751C	130	140	250	25-100	5	2	1	5	0.5		
RCA3773	140	150‡	150	15-60	8	4	1.4	8	0.8		
MJ15001	140	-	200	25-150	4	2	1	4	0.4		
MJ15003	140	150‡	250	25-150	5	2	1	5	0.5		
2N5631	140	-	200	15-60	8	2	1	10	1		
RCA8638C	140	-	200	25-150	5	2	1	5	0.5		
RCA9116 FAMILY (p-n-p)			**250W max**	**Complementary to RCA8638 Family**							
BD750	-90	-100	200	15-60	-7.5	-2	-1.5	-7.5	-0.75		
RCA9116E	-100	-110‡	200	25-100	-7.5	-2	-0.8	-7.5	-0.75		
BD750B	-100	-110	250	15-60	-7.5	-2	-1.5	-7.5	-0.75		
BD750A	-120	-130	200	25-100	-5	-2	-1	-5	-0.5		
RCA9116D	-120	-130‡	200	25-150	-5	-2	-1	-5	-0.5	4	TO-204AA/
BD750C	-130	-140	250	25-100	-5	-2	-1	-5	-0.5		TO-3
2N6609	-140	-160□	150	15-60	-8	-4	-1.4	-8	-0.8		
MJ15002	-140	-	200	25-150	-4	-2	-1	-4	-0.4		
MJ15004	-140	-150‡	250	25-150	-5	-2	-1	-5	-0.5		
RCA9116C	-140	-150‡	200	25-150	-5	-2	-1	-5	-0.5		
RCA 9166 FAMILY (n-p-n)			**250W max**								
RCA9166B	200	225‡	250	30 min.	3	4	1	3	0.3		
MJ15022	200	225‡	250	15-60	8	4	1.4	8	0.8	7	TO-204AA/
RCA9166A	250	275‡	250	30 min.	3	4	1	3	0.3		TO-3
MJ15024	250	275‡	250	15-60	8	4	1.4	8	0.8		

‡ $V_{CER(sus)}$ □ $V_{CEX(sus)}$

High-Speed Switching

Type No.	V_{CEO}(sus) V	V_{CER}(sus) V	P_T W	h_{FE} at V_{CE} = 10V, Current - mA: 0.01	0.1	10	50	150	500	V_{CE}(sat)-V	I_C mA	I_B mA	t_r µs	t_f µs	JEDEC Package
2N2102 FAMILY (n-p-n)			7W max	**Complementary to 2N4036 Family; f_T = 120MHz min.**											
2N697	-	50	2	-	-	-	-	40-120	-	1.5	150	15	-	-	
2N1613	-	50	3	-	20 min.	35 min.	-	40-120	20 min.	1.5	150	15	30†	-	
2N3053	40	50	5	-	-	-	-	50-250	-	1.4	150	15	-	-	
2N2270	45	60	5	-	-	-	-	50-200	-	0.9	150	15	-	-	
40407	50	-	1	-	-	°40-200	-	-	-	-	-	-	-	-	TO-205AD/
2N3053A	60	70	5	-	-	-	-	50-250	-	0.3	150	15	-	-	TO-39
2N699	-	80	2	-	-	-	-	-	-	5	150	15	-	-	
2N2102	65	80	5	10 min.	20 min.	35 min.	-	40-120	25 min.	0.5	150	15	30†	-	
2N1893	80	100	3	-	20 min.	35 min.	-	40-120	-	5	150	15	-	-	
40408	90	-	1	-	-	•40-200	-	-	-	-	-	-	-	-	
2N2405	90	140	5	-	-	35 min.	-	60-200	-	0.5	150	15	-	-	

° - measured @ V_{CE} = 10V, I_C = 1mA • - measured @ V_{CE} = 4V, I_C = 10mA

Type No.	V_{CEO}(sus) V	V_{CEX}(sus) V	P_T W	h_{FE}: I_C A	V_{CE} V	V_{CE}(sat)-V	I_C A	I_B A	t_r µs	t_f µs	JEDEC Package
2N3879 FAMILY (n-p-n)			35W max	**f_T to 60MHz min.**							
2N3878	50	65‡	35	40-200	0.5	2	2	4	0.4	-	-	
2N5202	50	75‡	35	10-100	4	1.2	1.2	4	0.4	0.4	0.4	TO-213AA/
2N3879*	75	90‡	35	20-80	4	5	1.2	4	0.4	0.4	0.4	TO-66
2N6500	90	110‡	35	15-60	3	2	1.5	3	0.3	0.4	0.5	
2N4036 FAMILY (p-n-p)			7W max	**Complementary to 2N2102 Family; f_T = 60MHz min.**							
40319	-40	-	5	35-200	-50m	-4	-1.4	-150m	-15m	-	-	
2N4037	-40	-60‡	7	50-250	-150m	-10	-1.4	-150m	-15m	-	-	
40362	-	-70‡	5	35-200	-50m	-4	-1.4	-150m	-15m	-	-	TO-205AD/
2N4036	-65	-85‡	7	40-140	-150m	-10	-0.65	-150m	-15m	0.07	0.1	TO-39
2N4314	-65	-85‡	7	50-250	-150m	-10	-1.4	-150m	-15m	-	-	
40406	-50	-	1	30-200	-0.1m	-10	-	-	-	-	-	
2N5038 FAMILY (n-p-n)			140W max	**f_T to 80MHz min.**							
BDY92	60	80	40	30-120	5	5	0.5	5	0.5	-	0.2	
BDY55	60	100	117	20-70	4	4	1.1	4	0.4	0.5	2	
2N5039*	75	120	140	20-100	10	5	1	10	1	0.5	0.5	
BDY91	80	100	40	30-120	5	5	0.5	5	0.5	-	0.2	
2N5038*	90	150	140	20-100	12	5	1	12	1.2	0.5	0.5	TO-204AA/
BDY90	100	120	40	30-120	5	5	0.5	5	0.5	-	0.2	TO-3
2N6496	110	130‡	140	12-100	8	2	1	8	0.8	0.5	0.5	
2N6354	120	130	140	10-100	10	2	1	10	1	0.3	0.2	
BDY56	120	150	117	20-70	4	4	1.1	4	0.4	0.5	2	
BUX40A	125	150‡	120	15-80	10	4	1.2	10	1	1.2	0.4	
2N5320 FAMILY (n-p-n)			10W max	**Complementary to 2N5322 Family; f_T = 50MHz min.**							
2N5321	50	75**	10	40-250	500m	4	0.8	500m	50m	80†	800#	TO-205AD/
2N5320	75	100**	10	30-130	500m	4	0.5	500m	50m	80†	800	TO-39

*JAN types available † t_{on} units are ns # t_{off} units are ns m = mA value ‡ V_{CER}(sus) ** V_{CEV}(sus)

High-Speed Switching (Continued)

Type No.	$V_{CEO}(sus)$ V	$V_{CEX}(sus)$ V	P_T W	h_{FE}	I_C A	V_{CE} V	$V_{CE}(sat)$-V	I_C A	I_B A	t_r µs	t_f µs	JEDEC Package
2N5322 FAMILY (p-n-p)			**35W max**	**Complementary to 2N5320 Family; f_T to 60MHz min.**								
2N5323	-50	-75**	10	40-250	-500m	-4	-1.2	-500m	-50m	100†	1000#	TO-205AD/
2N5322	-75	-100**	10	30-130	-500m	-4	-0.7	-500m	-50m	100†	1000#	TO-39
2N5671 FAMILY (n-p-n)			**175W max**	**f_T to 50MHz min.**								
2N5671*	90	120	140	20-100	15	2	0.75	15	1.2	0.5■	0.5	
BUX39	90	120	120	15-45	12	4	1.6	20	2.5	1.5■	0.3	
2N5672*	120	150	140	20-100	15	2	0.75	15	1.2	0.5■	0.5	TO-204AA/
BUX10A	125	160	150	20-60	10	2	1.5	20	2	1.5■	0.2	TO-3
BUX20A	125	140‡	140	20-60	20	2	0.8	20	2	0.7■	0.5	
2N6033 FAMILY (n-p-n)			**140W max**	**f_T to 50MHz min.**								
2N6032*	90	120	140	10-50	50	2.6	1.3	50	5	1	0.5	TO-204AE/
2N6033*	120	150	140	10-50	40	2	1	40	4	1	0.5	TO-3
2N6688 SwitchMax FAMILY (n-p-n)			**200W max**									
RCA6340	140	-	200	12 min.	25	2.5	1.8	25	2.5	0.3	0.25	
RCA6341	150	-	200	12 min.	25	2.5	1.8	25	2.5	0.3	0.25	
2N6686@	160	260	200	15 min.	25	2	1.5	25	2.5	0.35	0.25	
BDY58R	160	250**	175	20-60	10	4	1.4	10	1	1■	2•	TO-204AA/
2N6687@	180	280	200	15 min.	25	2	1.5	25	2.5	0.35	0.25	TO-3
BUX11A	190	250**	200	20-60	8	2	0.6	8	0.8	1■	0.4	
2N6688@	200	300	200	15 min.	20	2	1.5	20	2	0.35	0.25	
BUX21	200	250**	250	20-60	12	2	0.6	12	1.2	1.2■	0.4	
2N6704 SwitchMax FAMILY (n-p-n)			**50W max**	**f_T to 50MHz min.**								
2N6702	90	140	50	20	5	2	0.8	5	0.5	0.25	0.5	
BUW64A	90	140	50	20	5	2	0.8	5	0.5	0.25	0.5	TO-220AB
2N6703	110	160	50	20	5	2	0.8	5	0.5	0.25	0.5	Plastic
BUW64B	110	160	50	20	5	2	0.8	5	0.5	0.25	0.5	Package
2N6704	130	180	50	20	4	2	0.7	4	0.4	0.25	0.5	
BUW64C	130	180	50	20	4	2	0.7	4	0.4	0.25	0.5	
D44VH FAMILY (n-p-n)			**-**	**Complementary to D45VH Family**								
D44VH1	30	50	83	20 min.	4	1	0.4	8	0.4	0.25	0.18	
D44VH4	45	65	83	20 min.	4	1	0.4	8	0.4	0.25	0.18	TO-220AB
D44VH7	60	80	83	20 min.	4	1	0.4	8	0.4	0.25	0.18	Plastic
D44VH10	80	100	83	20 min.	4	1	0.4	8	0.4	0.25	0.18	Package
D44VM FAMILY (n-p-n)			**-**	**Complementary to D45VM Family**								
D44VM1	30	50	50	20 min.	6	1	0.6	6	0.3	0.25	0.075	
D44VM4	45	70	50	20 min.	6	1	0.6	6	0.3	0.25	0.075	TO-220AB
D44VM7	60	80	50	20 min.	6	1	0.6	6	0.3	0.25	0.075	
D44VM10	80	100	50	20 min.	6	1	0.6	6	0.3	0.25	0.075	

* JAN types available m = mA value # t_{OFF}, units are ns ‡ $V_{CER}(sus)$ ** $V_{CEV}(sus)$ ■ t_{ON} • t_{OFF} † t_{ON}, units are ns @ SwitchMax types

High-Speed Switching (Continued)

Type No.	$V_{CEO}(sus)$ V	$V_{CEX}(sus)$ V	P_T W	h_{FE}	I_C A	V_{CE} V	$V_{CE}(sat)$-V	I_C A	I_B A	t_r µs	t_f µs	JEDEC Package
D45VH FAMILY (p-n-p)			-	**Complementary to D44VH Family**								
D45VH1	-30	-50	83	20 min.	-4	-1	-1	-8	-0.8	0.25	0.1	TO-220AB
D45VH4	-45	-70	83	20 min.	-4	-1	-1	-8	-0.8	0.25	0.1	
D45VH7	-60	-80	83	20 min.	-4	-1	-1	-8	-0.8	0.25	0.1	
D45VH10	-80	-100	83	20 min.	-4	-1	-1	-8	-0.8	0.25	0.1	
D45VM FAMILY (p-n-p)			-	**Complementary to D44VM Family**								
D45VM1	-30	-50	50	20 min.	-6	-1	-0.6	-6	-0.3	0.25	0.075	TO-220AB
D45VM4	-45	-70	50	20 min.	-6	-1	-0.6	-6	-0.3	0.25	0.075	
D45VM7	-60	-80	50	20 min.	-6	-1	-0.6	-6	-0.3	0.25	0.075	
D45VM10	-80	-100	50	20 min.	-6	-1	-0.6	-6	-0.3	0.25	0.075	
D72 FAMILY (n-p-n)			-	**Complementary to D73 Family**								
D72F5T1	50	60*	20	30 min.	3	1	0.4	3	0.15	0.1■	0.1	TO-251/2
D72F5T2	50	60*	20	30 min.	3	1	0.4	3	0.15	0.1■	0.1	
D73 FAMILY (p-n-p)			-	**Complementary to D72 Family**								
D73F5T1	-50	-60*	20	30 min.	-3	-1	-0.4	-3	-0.15	0.1■	0.1	TO-251/2
D73F5T2	-50	-60*	20	30 min.	-3	-1	-0.4	-3	-0.15	0.1■	0.1	
RJH6688 SwitchMax FAMILY (n-p-n)			-									
RJH6686	160	210	200	15 min.	25	2	1.5	25	2.5	0.6	0.8	TO-218AC
RJH6687	180	230	200	15 min.	25	2	1.5	25	2.5	0.6	0.8	
RJH6688	200	250	200	15 min.	20	2	1.5	20	2	0.6	0.8	

■ t_{ON} values *V_{CBO}

High-Voltage

Type No.	$V_{CEO}(sus)$ V	$V_{CEV}(sus)$ V	P_T W	h_{FE}	I_C A	V_{CE} V	$V_{CE}(sat)$ - V	I_C A	I_B A	f_T(Typ) MHz	JEDEC Package
2N3439 FAMILY (n-p-n)			10W max	**Complementary to 2N5415 Family**							
40346	-	175‡	10	25 min.	0.01	10	0.5	0.01	0.001	25	TO-205AD/ TO-39
40346V1	-	175‡	10	25 min.	0.01	10	0.5	0.01	0.001		
40412	-	250‡	10	40 min.	0.03	20	0.5	0.01	0.001		
40321	-	300‡	5	25-200	0.02	10	-	-	-		
40327	-	300‡	5	40-250	0.02	10	-	-	-		
2N3440*	250	300‡	10	40-160	0.02	10	0.5	0.05	0.004		
2N4064□	250	-	10	40-160	0.02	10	0.5	0.05	0.004		
2N3439*	350	400‡	10	40-160	0.02	10	0.5	0.05	0.004		
2N4063■	350	-	10	40-160	0.02	10	0.5	0.05	0.004		
2N3585 FAMILY (n-p-n)			40W max	**Complementary to 2N6213 Family**							
BUX67	-	200	35	10-150	1	5	2.5	1	0.15	25	TP-213AA/ TO-66
2N3583	175	250‡	35	40 min.	0.1	10	5	1	0.125		
2N3584*	250	300‡	35	40 min.	0.1	10	0.75	1	0.125		
40318	-	300‡	35	50 min.	0.5	10	-	-	-		
40322	-	300‡	35	75 min.	0.5	10	-	-	-		
BUX67A	-	300	35	10-150	1	5	2.5	1	0.15		
BUX67B	-	350	35	10-150	1	5	2.5	1	0.15		
2N3585*	300	400‡	35	40 min.	0.1	10	0.75	1	0.125		
2N4240	300	400‡	35	30-150	1	10	1	0.75	0.075		
BUX67C	-	400	35	10-150	1	5	2.5	1	0.15		

*JAN types available ‡ $V_{CER}(sus)$ ■ 2N4063 - 2N3439 with flange □ 2N4064 - 2N3440 with flange

High-Voltage (Continued)

Type No.	$V_{CEO}(sus)$ V	$V_{CEV}(sus)$ V	P_T W	h_{FE}	I_C A	V_{CE} V	$V_{CE}(sat)$-V	I_C A	I_B A	f_T(Typ) MHz	JEDEC Package
2N5240 FAMILY (n-p-n)			150W max								
BUX16	200	250	100	15-130	0.4	10	2.5	2	0.25		
BD550B	250	275‡	150	10-50	2	4	2	2	0.25		
2N5239	225	250‡	100	20-80	2	10	2.5	2	0.25		
2N5838	250	275	100	8-40	3	2	1	3	0.375		
BUX16A	250	325	100	15-130	0.4	10	2.5	2	0.25		
2N5839	275	300	100	10-50	2	3	1.5	2	0.2	5	TO-204AA/
2N5240	300	350‡	100	20-80	2	10	2.5	2	0.25		TO-3
BUX16B	300	375	100	15-130	0.4	10	2.5	2	0.25		
2N5840	350	375	100	10-50	2	3	1.5	2	0.2		
BUX16C	350	425	100	15-130	0.4	10	2.5	2	0.25		
RCA1B04	200	225	150	15-75	2	5	2	2	0.255		
RCA1B05	250	275	150	15-75	2	5	2	2	0.255		
2N5415 FAMILY (p-n-p)			10W max	Complementary to 2N3439 Family							
BFT28	-100	-150‡	5	20 min.	-10	-10	-0.6	-10	-1		
BFT19	-150	-200‡	5	20 min.	-50	-10	-2.5	-30	-3		
BFT28A	-150	-200‡	5	20 min.	-10	-10	-0.6	-10	-1		
BFT28B	-200	-250‡	5	20 min.	-10	-10	-5	-10	-1		
2N5415	-200	-	10	30-150	-50	-10	-2.5	-50	-5	35	TO-205AD/
BFT19A	-250	-300‡	5	20 min.	-50	-10	-2.5	-30	-3		TO-39
BFT28C	-250	-300‡	5	20 min.	-10	-10	-5	-10	-1		
2N5416	-300	-350‡	10	30-120	-50	-10	-2	-50	-5		
BFT19B	-350	-400‡	5	20 min.	-50	-10	-2.5	-30	-3		
2N6079 FAMILY (n-p-n)			45W max								
2N6078	250	275□	45	12-70	1.2	1	0.5	1.2	0.2		
2N6077	275	300□	45	12-70	1.2	1	0.5	1.2	0.2	7	TO-213AA/
2N6079	350	375□	45	12-50	1.2	1	0.5	1.2	0.2		TO-66
2N6213 FAMILY (p-n-p)			35W max	Complementary to 2N3585 Family							
BUX66	-150	-200	35	10-150	-1	-5	-2.5	-1	-0.15		
2N6420	-175	-	20	40-200	-0.5	-10	-5	-1	-0.125		
2N6211*	-225	-275	35	10-100	-1	-2.8	-1.4	-1	-0.125		
BUX66A	-250	-300	35	10-150	-1	-5	-2.5	-1	-0.15		
2N6421	-250	-	20	25-100	-1	-10	-0.75	-1	-0.125		
2N6212*	-300	-350	35	10-100	-1	-3.2	-1.6	-1	-0.125	30	TO-213AA/
BUX66B	-300	-350	35	10-150	-1	-5	-2.5	-1	-0.15		TO-66
2N6422	-300	-	20	25-100	-1	-10	-0.75	-1	-0.125		
2N6423	-300	-	20	30-150	-0.75	-10	-1	-0.75	-0.075		
2N6213*	-350	-400	35	10-100	-1	-4	-2	-1	-0.125		
BUX66C	-350	-400	35	10-150	-1	-5	-2.5	-1	-0.15		
2N6214	-400	-450	35	10-100	-1	-5	-2.5	-1	-0.125		
2N6251 FAMILY (n-p-n)			175W max								
2N6249	200	225	175	10-50	10	3	1.5	10	1		
2N6250	275	300	175	8-50	10	3	1.5	10	1.25	6	TO-204AA/
2N6251	350	375	175	6-50	10	3	1.5	10	1.67		TO-3

*JAN types available ‡ $V_{CER}(sus)$ □ $V_{CEX}(sus)$

High-Voltage (Continued)

Type No.	$V_{CEO(sus)}$ V	$V_{CEV(sus)}$ V	P_T W	h_{FE}	I_C A	V_{CE} V	$V_{CE(sat)}$-V	I_C A	I_B A	f_T(Typ) MHz	JEDEC Package
2N6673 SwitchMax FAMILY (n-p-n)			**150W max**								
BUX42	250	300□	120	15-45	4	4	1.2	4	0.4		
2N6542	300	650	100	12-60	1.5	2	1	3	0.6		
2N6544	300	650	125	12-60	2.5	3	1.5	5	1		
2N6671■*	300	450	150	10 min.	5	3	1	5	1		
BUX43	325	400□	120	15-60	3	4	1.6	5	1	20	TO-204AA/
2N6672■	350	550	150	10 min.	5	3	1	5	1		TO-3
2N6673■*	400	650	150	10 min.	5	3	1	5	1		
BUX14	400	450□	150	15-60	3	4	1.5	6	1.2		
BUX44	400	450□	120	15-45	2	4	1	2	0.2		
2N6678 SwitchMax FAMILY (n-p-n)			**175W max**								
BUX17	150	250□	150	7 min.	10	3	2	10	2		
BUX17A	250	350□	150	7 min.	10	3	2	10	2		
BUX12	250	300□	150	10 min.	10	4	1.5	10	1.25		
BUX17B	300	400□	150	7 min.	8	3	3	8	1.5		
2N6546	300	650	175	12-60	5	2	1.5	10	2		
2N6674■*	300	450	175	8-20	10	2	1	10	2		
2N6676■*	300	450	175	8 min.	15	3	1	15	3		
TIP562	300	-	100	20 min.	1	4	2	15	5	20	TO-204AA/
BUX13	325	400□	150	8 min.	8	4	1.5	8	1.6		TO-3
BUX17C	350	450□	150	7 min.	8	3	3	8	1.5		
2N6677■	350	550	175	8 min.	15	3	1	15	3		
TIP563	400	-	100	20 min.	1	4	2	15	5		
2N6547	400	450□	100	6-30	10	2	1.5	10	2		
2N6675■*	400	650	175	8-20	10	2	1	10	2		
2N6678■*	400	650	175	8 min.	15	3	1	15	3		
2N6740 SwitchMax FAMILY (n-p-n)			**100W max**								
2N6738■	300	450	100	10-40	5	3	1	5	1		
BUW41■	300	450	100	10-40	5	-	-	-	-		
2N6739■	350	550	100	10-40	5	3	1	5	1		
BUW41A■	350	550	100	10-40	5	-	-	-	-	30	TO-220AB
2N6740■	400	650	100	10-40	5	3	1	5	1		
BUW41B■	400	650	100	10-40	-	-	-	-	-		
2N6754 SwitchMax FAMILY (n-p-n)			**150W max**								
BUY69C	200	500□	100	15	2.5	10	3.3	8	2.5		
BUY69B	325	800□	100	15	2.5	10	3.3	8	2.5		
2N6751■	400	800	150	8-40	5	3	1	5	1		
BUX32■	400	800	150	8-40	6	3	1	6	1.2		
BUY69A	400	1000□	100	15	2.5	10	3.3	8	2.5		
2N6545	400	850	125	12-60	2.5	3	1.5	5	1		
BUX31	400	800	150	8-40	4	3	2	8	2		
BUX47	400	850□	107	-	-	-	1.5	6	1.2		
2N6752■	450	850	150	8-40	5	3	1	5	1	20	TO-204AA/
BUX32A■	450	900	150	8-40	6	3	1	6	1.2		TO-3
BUX31A	450	900	150	8-40	4	3	2	8	2		
2N6753■	500	900	150	8-40	5	3	1	5	1		
BUX45	500	500□	120	14-45	1	4	2	2	0.4		
2N6754■	500	1000	150	8-40	5	3	1	5	1		
BUX32B■	500	1000	150	8-40	6	3	1	6	1.2		
BUX15	500	500□	150	8 min.	4	4	1	4	0.8		
BUX31B	500	1000	150	8-40	4	3	2	8	2		

*JAN types available □ $V_{CEX(sus)}$ ■ SwitchMax transistor

High-Voltage (Continued)

Type No.	V_{CEO}(sus) V	V_{CEV}(sus) V	P_T W	h_{FE}	I_C A	V_{CE} V	V_{CE}(sat)-V	I_C A	I_B A	f_T(Typ) MHz	JEDEC Package
2N6773 SwitchMax FAMILY (n-p-n)			**40W max**								
2N6771■	300	450	40	10-50	1	3	1	1	0.2		
2N6772■	350	550	40	10-50	1	3	1	1	0.2		
2N6773■	400	650	40	10-50	1	3	1	1	0.2		
TIP47	250	-	40	10 min.	1	10	1	1	0.2		
TIP48	300	-	40	10 min.	1	10	1	1	0.2	25	TO-220AB
TIP49	350	-	40	10 min.	1	10	1	1	0.2		
TIP50	400	-	40	10 min.	1	10	1	1	0.2		
BUW40	300	450	40	10-50	1	3	1	1	0.2		
BUW40A	350	550	40	10-50	1	3	1	1	0.2		
BUW40B	400	650	40	10-50	1	3	1	1	0.2		
D40V FAMILY (n-p-n)											
D40V1	250	300*	9	20 min.	0.04	10	1	0.02	0.002		
D40V2	250	300*	9	30 min.	0.04	10	1	0.02	0.002	50 min.	TO-202
D40V3	300	350*	9	20 min.	0.04	10	1	0.02	0.002		
D44Q FAMILY (n-p-n)											
D44Q1	125	200*	31.25	30 min.	2	10	1	2	0.2	50	TO-220AB
D44Q3	175	250*	31.25	30 min.	2	10	1	2	0.2		
D44T FAMILY (n-p-n)											
D44T1	250	300*	31.2	30 min.	0.5	10	1	0.5	0.05		
D44T2	250	300*	31.2	75 min.	0.5	10	1	0.5	0.05	45	TO-220AB
D44T3	300	400*	31.2	30 min.	0.5	10	1	0.5	0.05		
D44T4	300	400*	31.2	75 min.	0.5	10	1	0.5	0.05		
RJH6674 SwitchMax FAMILY (n-p-n)											
RJH6674■	300	450	175	8-20	10	2	1	10	2		
RJH6676■	300	450	175	8 min.	15	3	1	15	3		
RJH6677■	350	550	175	8 min.	15	3	1	15	3		TO-218AC
RJH6675■	400	650	175	8-20	10	2	1	10	2		
RJH6678■	400	650	175	8 min.	15	3	1	15	3		

■ SwitchMax transistor *V_{CES}

High-Speed, High-Voltage Switching

D44TD FAMILY (n-p-n)											
D44TD3	300	400	50	5 min.	2	3	1	2	0.4		
D44TD4	350	500	50	5 min.	2	3	1	2	0.4	15 min.	TO-220AB
D44TD5	400	600	50	5 min.	2	3	1	2	0.4		

High-Speed, High-Voltage Switching (Continued)

Type No.	$V_{CEO(sus)}$ V	$V_{CEV(sus)}$ V	P_T W	h_{FE}	I_C A	V_{CE} V	$V_{CE(sat)}$-V	I_C A	I_B A	f_T(Typ) MHz	JEDEC Package
D64VS FAMILY (n-p-n)				**JEDEC Equivalent is 2N6676, 77, 78**							
D64VS3	300	450	195	8 min.	15	2	1	15	2.5		
D64VS4	350	500	195	8 min.	15	2	1	15	2.5	15	TO-204AA/ TO-3
D64VS5	400	550	195	8 min.	15	2	1	15	2.5		
MJE13000 FAMILY (n-p-n)											
MJE13004	300	600	75	8 min.	2	5	0.6	2	0.5	4 min.	
MJE13070	400	650	80	8 min.	3	5	1	3	0.6	-	TO-220AB
MJE13005	400	700	75	8 min.	2	5	0.6	2	0.5	4 min.	
MJE13071	450	750	80	8 min.	3	5	1	3	0.6	-	
RJH6678 FAMILY (n-p-n)											
MJH13090	400	650	125	8 min.	10	3	1	10	2		
MJH13091	450	750	125	8 min.	10	3	1	10	2		TO-218AC
MJH16010	450	850	175	5 min.	15	5	3	10	1.3		
MJH16012	450	850	135	5 min.	15	5	3	10	1.3		
2N6678 FAMILY (n-p-n)											
MJ13090	400	650	175	8 min.	10	3	1	10	2		
MJ13091	450	750	175	8 min.	10	3	1	10	2		
MJ16010	450	850	175	5 min.	15	5	3	10	1.3		TO-204AA/ TO-3
MJ16012	450	850	135	5 min.	15	5	3	10	1.3		
MJ16014	450	850	250	5 min.	20	5	3	15	2		
MJ16016	450	850	250	5 min.	20	5	3	15	2		

Darlington Power Transistors

Type No.	I_C A	V_{CEO} V	h_{FE}@	I_C A	V_{CE} V	P_T W	JEDEC Package
2N6284 FAMILY (n-p-n)			**Complementary to 2N6287 Family**				
2N6057	12	60	750 min.	6	3	150	
2N6282	20	60	750 min.	10	4	160	
2N6058	12	80	750 min.	6	3	150	TO-204AA/
2N6283	20	80	750 min.	10	4	160	TO-3
2N6059	12	100	750 min.	6	3	150	
2N6284	20	100	750 min.	10	4	160	
2N6287 FAMILY (p-n-p)			**Complementary to 2N6284 Family**				
2N6050	-12	-60	750 min.	-6	-3	150	
2N6285	-20	-60	750 min.	-10	-4	160	
2N6051	-12	-80	750 min.	-6	-3	150	TO-204AA/
2N6286	-20	-80	750 min.	-10	-4	160	TO-3
2N6052	-12	-100	750 min.	-6	-3	150	
2N6287	-20	-100	750 min.	-10	-4	160	

Darlington Power Transistors (Continued)

Type No.	I_C A	V_{CEO} V	h_{FE}	I_C A	V_{CE} V	P_T W	JEDEC Package
2N6385 FAMILY (n-p-n)			**Complementary to 2N6650 Family**				
2N6383	10	40	1000 min.	5	3	100	
BDX83	10	45	1000 min.	5	3	125	
2N6055	8	60	750 min.	4	3	100	
2N6384	10	60	1000 min.	5	3	100	
2N6576	15	60	2000 min.	4	3	120	
BDX83A	10	60	1000 min.	5	3	125	
RCA1000	5	60	1000 min.	3	3	90	TO-204AA/
2N6056	8	80	750 min.	4	3	100	TO-3
2N6385	10	80	1000 min.	5	3	100	
BDX83B	10	80	1000 min.	5	3	125	
RCA1001	5	80	1000 min.	3	3	90	
2N6577	15	90	2000 min.	4	3	120	
BDX83C	10	100	1000 min.	5	3	125	
2N6578	15	120	2000 min.	4	3	120	
2N6388 FAMILY (n-p-n)			**Complementary to 2N6666 Family**				
2N6386	8	40	1000 min.	3	3	65	
BDX53	8	45	750 min.	3	3	60	
BD643	8	45	750 min.	3	3	62.5	
BD895, A	8	45	750 min.	3	3	70	
BDX33	10	45	750 min.	4	3	70	
BDX53A	8	60	750 min.	3	3	60	
BD645	8	60	750 min.	3	3	62.5	
BD897, A	8	60	750 min.	3	3	70	
2N6043	8	60	1000 min.	4	4	75	
2N6387	10	60	1000 min.	5	3	65	
BDX33A	10	60	750 min.	4	3	70	
TIP100	8	60	1000 min.	3	4	80	
TIP120	8	60	1000 min.	3	3	65	
2N6044	8	80	1000 min.	4	4	75	TO-220AB
2N6388	10	80	1000 min.	5	3	65	
BDX33B	10	80	750 min.	3	3	70	
TP101	8	80	1000 min.	3	4	80	
TP121	8	80	1000 min.	3	3	65	
BDX53B	8	80	750 min.	3	3	60	
BD647	8	80	750 min.	3	3	62.5	
BD899, A	8	80	750 min.	3	3	70	
2N6045	8	100	1000 min.	4	4	75	
BDX33C	10	100	750 min.	3	3	70	
TIP102	8	100	1000 min.	3	4	80	
TIP122	8	100	1000 min.	3	3	65	
BDX53C	8	100	750 min.	3	3	60	
BD901	8	100	750 min.	3	3	70	
BDX33D	10	120	750 min.	3	3	70	
2N6530 FAMILY (n-p-n)							
2N6530	8	80	1000-10,000	5	3	65	
2N6531	8	100	500-10,000	3	3	65	TO-220AB
2N6532	8	100	1000-10,000	5	3	65	
2N6533	8	120	1000-10,000	3	3	65	

Darlington Power Transistors (Continued)

Type No.	I_C A	V_{CEO} V	h_{FE}	I_C A	V_{CE} V	P_T W	JEDEC Package
2N6650 FAMILY (p-n-p)			**Complementary to 2N6358 Family**				
2N6648	-10	-40	1000-20,000	-5	-3	70	TO-204AA/ TO-3
2N6649	-10	-60	1000-20,000	-5	-3	70	
2N6650	-10	-80	1000-20,000	-5	-3	70	
2N6668 FAMILY (p-n-p)			**Complementary to 2N6388 Family**				
2N6666	-8	-40	1000 min.	-3	-3	65	TO-220AB
BDX34	-10	-45	750 min.	-4	-3	70	
BDX34A	-10	-60	750 min.	-4	-3	70	
2N6667	-10	-60	1000 min.	-5	-3	65	
TIP125	-8	-60	1000 min.	-3	-3	65	
BDX34B	-10	-80	750 min.	-3	-3	70	
2N6668	-10	-80	1000 min.	-5	-3	65	
TIP126	-8	-80	1000 min.	-3	-3	65	
BDX34C	-10	-100	750 min.	-3	-3	70	
TIP127	-8	-100	1000 min.	-3	-3	65	
BDX34D	-10	-120	750 min.	-3	-3	70	
D40C FAMILY (n-p-n)							
D40C1	0.5	30	10000 min.	0.2	5	6.25	TO-202
D40C4	0.5	40	10000 min.	0.2	5	6.25	
D40C7	0.5	50	10000 min.	0.2	5	6.25	
D40K FAMILY (n-p-n)			**Complementary to D41K Family**				
D40K1	2	30	1000 min.	1.5	5	10	TO-202
D40K3	2	30	1000 min.	1	5	10	
D40K2	2	50	1000 min.	1.5	5	10	
D40K4	2	50	1000 min.	1	5	10	
D41K FAMILY (p-n-p)			**Complementary to D40K Family**				
D41K1	-2	-30	1000 min.	-1.5	-5	10	TO-202
D41K3	-2	-30	1000 min.	-1	-5	10	
D41K2	-2	-50	1000 min.	-1.5	-5	10	
D41K4	-2	-50	1000 min.	-1	-5	10	
D44D FAMILY (n-p-n)			**Complementary to D45D Family**				
D44D1, 2	6	40	2000 min.	1	2	30	TO-220AB
D44D3, 4	6	60	2000 min.	1	2	30	
D44D5, 6	6	80	2000 min.	1	2	30	
D44E FAMILY (n-p-n)			**Complementary to D45E Family**				
D44E1	10	40	1000 min.	5	5	50	TO-220AB
D44E2	10	60	1000 min.	5	5	50	
D44E3	10	80	1000 min.	5	5	50	
D45D FAMILY (p-n-p)			**Complementary to D44D Family**				
D45D1, 2	-6	-40	2000 min.	-1	-2	30	TO-220AB
D45D3, 4	-6	-60	2000 min.	-1	-2	30	
D45D5, 6	-6	-80	2000 min.	-1	-2	30	

Darlington Power Transistors (Continued)

Type No.	I_C A	V_{CEO} V	h_{FE}	I_C A	V_{CE} V	P_T W	JEDEC Package
D45E FAMILY (p-n-p)			**Complementary to D44E Family**				
D45E1	-10	-40	1000 min.	-5	-5	50	TO-220AB
D45E2	-10	-60	1000 min.	-5	-5	50	
D45E3	-10	-80	1000 min.	-5	-5	50	
D64DV FAMILY (n-p-n)							
D64DV5	50	400	50 min.	50	5	180	TO-204AE/ TO-3
D64DV6	50	450	50 min.	50	5	180	
D64DV7	50	500	50 min.	50	5	180	
D64EV FAMILY (n-p-n)			**Devices have Integral Base Speed-up Diode**				
D64EV5	50	400	50 min.	50	5	180	TO-204AE/ TO-3
D64EV6	50	450	50 min.	50	5	180	
D64EV7	50	500	50 min.	50	5	180	
D72 FAMILY (n-p-n)							
D72Y1.5D1, 2	1.5	30	4000 min.	0.15	2	10	TO-251/2
The Following are Complementary to the D73 Family Types:							
D72K3D1, 2	3	40	1000 min.	3	2	15	TO-251/2
D72FY4D1, 2	4	80	1000 min.	3	2	15	
D73 FAMILY (p-n-p)			**Complementary to D72 Family**				
D73K3D1, 2	-3	-40	1000 min.	-3	-2	15	TO-251/2
D73FY4D1, 2	-4	-80	1000 min.	-3	-2	15	

Darlington Power Transistors (Continued)

Type No.	I_C A	V_{CEO} V	h_{FE}	I_C A	V_{CE} V	P_T W	JEDEC Package
GE10015 FAMILY (n-p-n)			**Devices have Integral Base Speed-up Diode**				
GE10015	50	400	25 min.	20	5	250	
GE10016	50	500	25 min.	20	5	250	
GE10020	60	200	75 min.	15	5	250	TO-204AE/
GE10021	60	250	75 min.	15	5	250	TO-3
GE10022	40	350	50 min.	10	5	250	
GE10023	40	400	50 min.	10	5	250	
RCA8766 FAMILY (n-p-n)							
RCA8766	10	350	100 min.	6	3	150	
RCA8766A	10	350	100 min.	4	3	150	
RCA8766B	10	400	100 min.	6	3	150	TO-204AA/
RCA8766C	10	400	100 min.	4	3	150	TO-3
BUX37	15	400	20 min.	15	5	35	
RCA8766D	10	450	100 min.	6	3	150	
RCA8766E	10	450	100 min.	4	3	150	
RCA9202, RCA9203 (n-p-n)							
RCA9202A	4	300	750 min.	2	3	65	
RCA9202B	4	350	750 min.	2	3	65	TO-220AB
RCA9202C	4	400	750 min.	2	3	65	Plastic
RCA9203A	4	250	500 min.	2	3	50	Package
RCA9203B	4	300	500 min.	2	3	50	
RCA9228 (n-p-n)			**Complementary to RCA9229 Family**				
RCA9228A	50	60	2000 min.	25	3	300	
RCA9228B	50	80	2000 min.	25	3	300	TO-204AE/
RCA9228C	50	100	2000 min.	25	3	300	TO-3
RCA9228D	50	120	2000 min.	25	3	300	
RCA9229 (p-n-p)			**Complementary to RCA9228 Family**				
RCA9229A	-50	-60	2000 min.	-25	-3	300	
RCA9229B	-50	-80	2000 min.	-25	-3	300	TO-204AE/
RCA9229C	-50	-100	2000 min.	-25	-3	300	TO-3
RCA9229D	-50	-120	2000 min.	-25	-3	300	
TIP110 (n-p-n)			**Complementary to TIP115 Family**				
TIP110	2	60	1000 min.	1	4	50	TO-220AB
TIP111	2	80	1000 min.	1	4	50	Plastic
TIP112	2	100	1000 min.	1	4	50	Package
TIP115 (p-n-p)			**Complementary to TIP110 Family**				
TIP115	-2	-60	1000 min.	-1	-4	50	TO-220AB
TIP116	-2	-80	1000 min.	-1	-4	50	Plastic
TIP117	-2	-100	1000 min.	-1	-4	50	Package

Small-Signal Bipolar Transistors (In Order of Ascending I_C)

NPN Signal Transistor Selector Guide

Type	I_C (Max.) mA	$V_{(BR)CEO}$ (Min.) V	Beta Range h_{FE}	Package
2N3390	100	18	400-800	TO-98
2N2923	100	25	115 Typ.	TO-98
2N2924	100	25	155 Typ.	TO-98
2N2925	100	25	215 Typ.	TO-98
2N2926	100	25	35-70	TO-98
2N2926-5	100	25	235-470	TO-98
2N3391	100	25	250-500	TO-98
2N3391A	100	25	250-500	TO-98
2N3392	100	25	150-300	TO-98
2N3393	100	25	90-180	TO-98
2N3394	100	25	55-110	TO-98
2N5172	100	25	100-500	TO-98
MPS5172	100	25	100-500	TO-92
PN5172	100	25	100-500	TO-92
2N3858	100	30	60-120	TO-98
2N3859	100	30	100-200	TO-98
2N3860	100	30	150-300	TO-98
2N5232	100	50	250-500	TO-98
2N5232A	100	50	250-500	TO-98
2N5249	100	50	400-800	TO-98
2N5249A	100	50	400-800	TO-98
2N3858A	100	60	60-120	TO-98
2N3859A	100	60	100-200	TO-98
MPS-L01	150	120	50-300	TO-92
2N4124	200	25	120-360	TO-92
2N4123	200	30	50-150	TO-92
2N3903	200	40	50-150	TO-92
2N3904	200	40	100-300	TO-92
• 2N5305	300	25	2K-20K	TO-98
• 2N5306	300	25	7K-70K	TO-98
• GES5305	300	25	2K-20K	TO-92
• GES5306	300	25	7K-70K	TO-92
• GES5306A	300	25	7K-70K	TO-92
• 2N5306A	300	40	7K-70K	TO-98
• 2N5307	300	40	2K-20K	TO-98
• 2N5308	300	40	7K-70K	TO-98
• 2N5308A	300	40	7K-70K	TO-98
• GES5307	300	40	2K-20K	TO-92
• GES5308	300	40	7K-70K	TO-92
• GES5308A	300	40	7K-70K	TO-92

• Darlington types

NPN Signal Transistor Selector Guide

Type	I_C (Max.) mA	$V_{(BR)CEO}$ (Min.) V	Beta Range h_{FE}	Package
GES2221	400	30	40-120	TO-92
GES2222	400	30	100-300	TO-92
MPS2222	400	30	100-300	TO-92
PN2222	400	30	100-300	TO-92
GES2221A	400	40	40-120	TO-92
GES2222A	400	40	100-300	TO-92
MPS2222A	400	40	100-300	TO-92
PN2222A	400	40	100-300	TO-92
2N3414	500	25	75-225	TO-98
2N3415	500	25	180-540	TO-98
GES3414	500	25	75-225	TO-92
GES3415	500	25	180-540	TO-92
• MPS-A12	500	20	20K Min.	TO-92
• MPS-A13	500	30	5K Min.	TO-92
• MPS-A14	500	30	10K Min.	TO-92
2N4424	500	40	180-540	TO-92
2N3416	500	50	75-225	TO-92
2N3417	500	50	180-540	TO-92
GES3416	500	50	75-225	TO-92
GES3417	500	50	180-540	TO-92
MPS-A05	500	60	50 Min.	TO-92
MPS-A06	500	80	50 Min.	TO-92
MPS-A43	500	200	50-200	TO-92
MPS-A42	500	300	40 Min.	TO-92
MPS6532	600	30	30 Min.	TO-92
2N4400	600	40	50-150	TO-92
2N4401	600	40	100-300	TO-92
MPS6531	600	40	40-120	TO-92
GES5551	600	160	80-250	TO-92
GES5810	750	25	60-200	TO-92
GES5812	750	25	150-500	TO-92
GES5814	750	40	60-160	TO-92
GES5816	750	40	100-200	TO-92
GES5818	750	40	150-300	TO-92
GES2218	800	30	35 Min.	TO-92
GES2218A	800	30	75 Min.	TO-92
GES2219	800	30	35 Min.	TO-92
GES2219A	800	40	75 Min.	TO-92

PNP Signal Transistor Selector Guide

Type	I_C (Max.) mA	$V_{(BR)CEO}$ (Min.) V	Beta Range h_{FE}	Package
2N6076	-100	-25	100-500	TO-98
2N4126	-200	-25	120-360	TO-92
2N4125	-200	-30	50-150	TO-92
2N3905	-200	-40	50-150	TO-92
2N3906	-200	-40	100-300	TO-92
• MPS-A63	-300	-30	5K Typ.	TO-92
• MPS-A64	-300	-30	10K Typ.	TO-92
• MPS-A65	-300	-30	20K Min.	TO-92
2N5365	-300	-40	40-120	TO-98
2N5366	-300	-40	100-300	TO-98
MPS3638	-350	-25	30 Min.	TO-92
MPS3638A	-350	-25	100 Min.	TO-92
GES2906	-350	-40	40-120	TO-92
GES2907	-350	-40	100-300	TO-92
MPS2906	-350	-40	40-120	TO-92
MPS2907	-350	-40	100-300	TO-92
GES2906A	-350	-60	40-120	TO-92
MPS2906A	-350	-60	40-120	TO-92
GES2907A	-350	-60	100-300	TO-92

PNP Signal Transistor Selector Guide

Type	I_C (Max.) mA	$V_{(BR)CEO}$ (Min.) V	Beta Range h_{FE}	Package
MPS2907A	-350	-60	100-300	TO-92
• MPS-A55	-500	-60	50 Min.	TO-92
MPS-A56	-500	-80	50 Min.	TO-92
MPS-A93	-500	-200	30-150	TO-92
MPS-A92	-500	-300	30 Min.	TO-92
2N4402	-600	-40	50-150	TO-92
2N4403	-600	-40	100-300	TO-92
GES2904	-600	-40	40-120	TO-92
GES2905	-600	-40	100-300	TO-92
MPS6534	-600	-40	40-120	TO-92
GES2904A	-600	-60	40-120	TO-92
GES2905A	-600	-60	100-300	TO-92
MPS-L51	-600	-100	40-250	TO-92
GES5401	-600	-150	60-240	TO-92
GES5811	-750	-25	60-200	TO-92
GES5813	-750	-25	150-500	TO-92
GES5815	-750	-40	60-160	TO-92
GES5817	-750	-40	100-200	TO-92
GES5919	-750	-40	150-300	TO-92

• Darlington Types

Unijunction Transistors and Switches

Silicon Unijunction Transistors (UJTs) are intended for general-purpose industrial applications where circuit economy is of primary importance. UJT applications include use as:

SCR triggers, relaxation oscillators, timers, sawtooth generators, frequency dividers and stable voltage-sensing circuits.

Silicon Unilateral Switches (SUSs) are silicon planar, monolithic ICs having thyristor electrical characteristics closely approximating those of "ideal" four-layer diodes. These devices are designed to switch at 8 volts with a 0.02%/°C temperature coefficient. A gate lead is provided to eliminate rate effect, obtain triggering at lower voltages and to obtain transient-free waveforms.

Silicon Bilateral Switches (SBSs) are silicon planar, monolithic ICs having the electrical characteristics of a bilateral thyristor. Designed to switch at 8 volts with a 0.02%/°C temperature coefficient, they have characteristics which are excellently matched in both directions. A gate lead is provided to eliminate rate-effect and is used to obtain triggering at lower voltages. The SBS is ideally suited for half-wave and full-wave triggering in low-voltage SCR and Triac phase-control circuits.

Programmable Unijunction Transistors (PUTs) are three-terminal, planar passivated p-n-p devices. These devices allow the designer to select R_1 and R_2 to program unijunction characteristics such as η, R_{SS}, I_P, and I_V to meet their particular needs. PUTs feature low leakage and peak point current together with low forward voltage. Typical applications included SCR triggering, pulse and timing circuits, oscillators, sensing circuits and sweep circuits.

Type	Structure	I_F (Max.) mA	V_R (Min.) V	V_S or n	Package
2N4870	UJT	50	30	0.56-0.75	TO-92
2N4871	UJT	50	30	0.7-0.85	TO-92
GES2646	UJT	50	30	0.56-0.75	TO-92
GES2647	UJT	50	30	0.68-0.82	TO-92
GET4870	UJT	50	30	0.56-0.75	TO-18
GET4871	UJT	50	30	0.7-0.85	TO-18
2N2646	UJT	500	30	0.56-0.75	TO-18
2N2647	UJT	500	30	0.68-0.82	TO-18
2N4987	SUS	175	30	6.0-10.0	TO-98
2N4990	SUS	175	30	7.0-9.0	TO-98
2N4988	SUS	175	30	7.5-9.0	TO-98
2N4989	SUS	175	30	7.5-8.2	TO-98
2N6027	PUT	150	40	0.2-1.6	TO-98
2N6028	PUT	150	40	0.2-0.6	TO-98
GES6027	PUT	150	40	0.2-1.6	TO-92
GES6028	PUT	150	40	0.2-0.6	TO-92
2N4991	SBS	175	-	6.0-10.0	TO-98
2N4992	SBS	175	-	7.5-9.0	TO-98

Switching Transistors

Junction FETs - N-Channel

Type	Package**	$r_{DS(ON)}$ Ω Max	V_P V Min	V_P V Max	I_{GSS} pA Max	BV_{GSS} V Min	$I_{D(OFF)}$ pA Max	I_{DSS} mA Min	I_{DSS} mA Max	t_{ap} ns Max	C_{rss} pF Max	C_{iss} pF Max
• 2N4091	TO-18	30	-5.0	-10.0	-200	-40	200	30	-	65	5	16
• 2N4092	TO-18	50	-2.0	-7.0	-200	-40	200	15	-	95	5	16
• 2N4093	TO-18	80	-1.0	-5.0	-200	-40	200	8	-	140	5	16
2N4391	TO-18	30	-4.0	-10.0	-100	-40	100	50	150	55	3.5	14
2N4392	TO-18	60	-2.0	-5.0	-100	-40	100	25	75	75	3.5	14
2N4393	TO-18	100	-0.5	-3.0	-100	-40	100	5	30	100	3.5	14
• 2N4856	TO-18	25	-4.0	-10.0	-250	-40	250	50	-	34	8	18
• 2N4857	TO-18	40	-2.0	-6.0	-250	-40	250	20	100	60	8	18
• 2N4858	TO-18	60	-0.8	-4.0	-250	-40	250	8	80	120	8	18
• 2N4859	TO-18	25	-4.0	-10.0	-250	-30	250	50	-	34	8	18
• 2N4860	TO-18	40	-2.0	-6.0	-250	-30	250	20	100	60	8	18
• 2N4861	TO-18	60	-0.8	-4.0	-250	-30	250	8	80	120	8	18
2N5432	TO-52	5	-4.0	-10.0	-200	-25	200	150	-	41	15	30
2N5433	TO-52	7	-3.0	-9.0	-200	-25	200	100	-	41	15	30
2N5434	TO-52	10	-1.0	-4.0	-200	-25	200	30	-	41	15	30
2N5638	TO-92	30	-	-12.0	-1nA	-30	1nA	50	-	24	4	10
2N5639	TO-92	60	-	-8.0	-1nA	-30	1nA	25	-	44	4	10
2N5640	TO-92	100	-	-6.0	-1nA	-30	1nA	5	-	63	4	10
2N5653	TO-92	50	-	-12.0	-1nA	-30	1nA	40	-	24	3.5	10
2N5654	TO-92	100	-	-8.0	-1nA	-30	1nA	15	-	44	3.5	10
J108	TO-92	8	-3.0	-10.0	-3nA	-25	3nA	80	-	41	-	-
J109	TO-92	12	-2.0	-6.0	-3nA	-25	3nA	40	-	41	-	-
J110	TO-92	18	-0.5	-4.0	-3nA	-25	3nA	10	-	41	-	-
J111	TO-92	30	-3.0	-10.0	-1nA	-35	1nA	20	-	48	-	-
J112	TO-92	50	-1.0	-5.0	-1nA	-35	1nA	5	-	48	-	-
J113	TO-92	100	-0.5	-3.0	-1nA	-35	1nA	2	-	48	-	-
PN4091	TO-92	30	-5.0	-10.0	-200	-40	200	30	-	65	5	16
PN4092	TO-92	50	-2.0	-7.0	-200	-40	200	15	-	95	5	16
PN4093	TO-92	80	-1.0	-5.0	-200	-40	200	8	-	140	5	16
PN5432	TO-92	5	-4.0	-10.0	-200	-25	200	150	-	41	15	30
PN5433	TO-92	7	-3.0	-9.0	-200	-25	200	100	-	41	15	30
PN5434	TO-92	10	-1.0	-4.0	-200	-25	200	30	-	41	15	30
U1897	TO-92	30	-5.0	-10.0	-400	-40	200	30	-	65	5	16
U1898	TO-92	50	-2.0	-7.0	-400	-40	200	15	-	95	5	16
U1899	TO-92	80	-1.0	-5.0	-400	-40	200	8	-	140	5	16

Junction FETs - P-Channel

Type	Package**	$r_{DS(ON)}$ Ω Max	V_P V Min	V_P V Max	I_{GSS} pA Max	BV_{GSS} V Min	$I_{D(OFF)}$ pA Max	I_{DSS} mA Min	I_{DSS} mA Max	t_{ap} ns Max	C_{rss} pF Max	C_{iss} pF Max
2N3382	TO-72	300	1.0	5.0	15nA	30	-2nA	-3	-30	-	-	16 typ
2N5018	TO-18	75	-	12.0	2nA	30	-10nA	-10	-	100	10	45
2N5019	TO-18	150	-	7.0	2nA	30	-10nA	-5	-	215	10	45
• 2N5114	TO-18	75	5.0	10.0	500	30	-500	-30	-90	37	7	25
• 2N5115	TO-18	100	3.0	6.0	500	30	-500	-15	-60	66	7	25
• 2N5116	TO-18	150	1.0	4.0	500	30	-500	-5	-25	102	7	25
J174	TO-92	85	5.0	10.0	1nA	30	-1nA	-20	-135	22	-	-
J175	TO-92	125	3.0	6.0	1nA	30	-1nA	-7	-70	45	-	-
J176	TO-92	250	1.0	4.0	1nA	30	-1nA	-2	-35	70	-	-
J177	TO-92	300	0.8	2.25	1nA	30	-1nA	-1.5	-20	90	-	-
PN5114	TO-92	75	5.0	10.0	500	30	-500	-30	-90	37	7	25
PN5115	TO-92	100	3.0	6.0	500	30	-500	-15	-60	68	7	25
PN5116	TO-92	150	1.0	4.0	500	30	-500	-5	-25	102	7	25

• Also available as JAN/JANTX

* Most TO-92's are available lead formed to a TO-18 or TO-5 pinout. Also available in tape and reel (EIA STD RS-468).

Amplifier Transistors

Junction FETs - N-Channel

Type	Package**	g_{fs} µmho Min	I_{DSS} mA Min	I_{DSS} mA Max	V_P V Min	V_P V Max	I_{GSS} pA Max	BV_{GSS} V Min	C_{iss} pF Max	C_{rss} pF Max	e_n nV/√Hz Max
2N3684	TO-72	2000	2.5	7.5	-2.0	-5.0	-100	-50	4	1.2	150 @ 20Hz
2N3685	TO-72	1500	1.0	3.0	-1.0	-3.5	-100	-50	4	1.2	150 @ 20Hz
2N3686	TO-72	1000	0.4	1.2	-0.6	-2.0	-100	-50	4	1.2	150 @ 20Hz
2N3687	TO-72	500	0.1	0.5	-0.3	-1.2	-100	-50	4	1.2	150 @ 20Hz
2N4117	TO-72	70	0.03	0.09	-0.6	-1.8	-10	-40	3	1.5	-
2N4117A	TO-72	70	0.03	0.09	-0.6	-1.8	-1	-40	3	1.5	-
2N4118	TO-72	80	0.08	0.24	-1.0	-3.0	-10	-40	3	1.5	-
2N4118A	TO-72	80	0.08	0.24	-1.0	-3.0	-1	-40	3	1.5	-
2N4119	TO-72	100	0.2	0.6	-2.0	-6.0	-10	-40	3	1.5	-
2N4119A	TO-72	100	0.2	0.6	-2.0	-6.0	-1	-40	3	1.5	-
2N4223	TO-72	3000	3.0	18.0	-0.1	-8.0	-250	-30	6	2	-
2N4224	TO-72	2000	2.0	20.0	-0.1	-0.8	-250	-30	6	2	-
2N4338	TO-18	600	0.2	0.6	-0.3	-1.0	-100	-50	7	3	65 @ 1kHz
2N4339	TO-18	800	0.5	1.5	-0.6	-1.8	-100	-50	7	3	65 @ 1kHz
2N4340	TO-18	1300	1.2	3.6	-1.0	-3.0	-100	-50	7	3	65 @ 1kHz
2N4341	TO-18	2000	3.0	9.0	-2.0	-6.0	-100	-50	7	3	65 @ 1kHz
2N4416	TO-72	4500	5.0	15.0	-	-6.0	-100	-30	4	2	-
2N5397	TO-72	6000	10.0	30.0	-1.0	-6.0	-100	-25	5.0	1.2	3.5dB @ 450MHz
2N5398	TO-72	5500	5.0	40.0	-1.0	-6.0	-100	-25	5.5	1.3	-
2N5457	TO-92	1000	1.0	5.0	-0.5	-6.0	-1nA	-25	7	3	3dB @ 1kHz
2N5458	TO-92	1500	2.0	9.0	-1.0	-7.0	-1nA	-25	7	3	3dB @ 1kHz
2N5459	TO-92	2000	4.0	16.0	-2.0	-8.0	-1nA	-25	7	3	3dB @ 1kHz
2N5484	TO-92	3000	1.0	5.0	-0.3	-3.0	-1nA	-25	5	1	120 @ 1kHz
2N5485	TO-92	3500	4.0	10.0	-0.5	-4.0	-1nA	-25	5	1	120 @ 1kHz
2N5486	TO-92	4000	8.0	20.0	-2.0	-6.0	-1nA	-25	5	1	120 @ 1kHz
J210	TO-92	4000	2.0	15.0	-1.0	-3.0	-100	-25	4 typ.	1 typ.	10 typ. @ 1kHz
J211	TO-92	6000	7.0	20.0	-2.5	-4.5	-100	-25	4 typ.	1 typ.	10 typ. @ 1kHz
J212	TO-92	7000	15.0	40.0	-4.0	-6.0	-100	-25	4 typ.	1 typ.	10 typ. @ 1kHz
PN4302	TO-92	1000	0.5	5.0	-	-4.0	-1nA	-30	6	2	2dB @ 1kHz
PN4303	TO-92	2000	4.5	10.0	-	-6.0	-1nA	-30	6	2	2dB @ 1kHz
PN4304	TO-92	1000	0.5	15.0	-	-10.0	-1nA	-30	6	2	3dB @ 1kHz
PN4338	TO-92	600	0.2	0.6	-0.3	-1.0	-100	-50	7	3	1dB @ 1kHz
PN4339	TO-92	800	0.5	1.5	-0.6	-1.8	-100	-50	7	3	1dB @ 1kHz
PN4340	TO-92	1300	1.2	3.6	-1.0	-3.0	-100	-50	7	3	1dB @ 1kHz
PN4341	TO-92	2000	3.0	9.0	-2.0	-6.0	-100	-50	7	3	1dB @ 1kHz
PN4416	TO-92	4500	5.0	15.0	-	-6.0	-100	-30	4	2	-

Junction FETs - P-Channel

Type	Package**	g_{fs} µmho Min	I_{DSS} mA Min	I_{DSS} mA Max	V_P V Min	V_P V Max	I_{GSS} pA Max	BV_{GSS} V Min	C_{iss} pF Max	C_{rss} pF Max	e_n nV/√Hz Max
2N2609	TO-18	2500	-2.0	-10.0	1.0	4.0	30nA	30	30	-	180 @ 1kHz
2N5460	TO-92	1000	-1.0	-5.0	0.75	6.0	5nA	40	7	2	115 @ 100Hz
2N5461	TO-92	1500	-2.0	-9.0	1.0	7.5	5nA	40	7	2	115 @ 100Hz
2N5462	TO-92	2000	-4.0	-16.0	1.8	9.0	5nA	40	7	2	115 @ 100Hz
2N5463	TO-92	1000	-1.0	-5.0	0.75	6.0	5nA	60	7	2	115 @ 100Hz
2N5464	TO-92	1500	-2.0	-9.0	1.0	7.5	5nA	60	7	2	115 100Hz
2N5465	TO-92	2000	-4.0	-16.0	1.8	9.0	5nA	60	7	2	115 @ 100Hz
J270	TO-92	6000	-2.0	-15.0	0.5	2.0	0.200	30	32 typ.	4 typ.	6 typ. @ 1kHz
J271	TO-92	8000	-6.0	-50.0	1.5	4.5	0.200	30	31 typ.	4 typ.	6 typ. @ 1kHz

* Most TO-92's are available lead formed to a TO-18 or TO-5 pinout. Also available in tape and reel (EIA STD RS-468).

Switching/Amplifier Transistors

MOSFETs - N-Channel

Type	Package	$V_{GS(TH)}$ V Min	$V_{GS(TH)}$ V Max	BV_{DSS} V Min	I_{DSS} pA Max	I_{GSS} pA Max	g_{fs} µmho Min	$r_{DS(ON)}$ Ω Max	$I_{D(ON)}$ mA Min	$I_{D(ON)}$ mA Max
2N4351	TO-72	1.0	5.0	25	10nA	10	1000	300	3	-
3N170	TO-72	1.0	2.0	25	10nA	10	1000	200	10	-
3N171	TO-72	1.5	3.0	25	10nA	10	1000	200	10	-
IT1750	TO-72	0.5	3.0	25	10nA	10	3000	50	10	-
M116	TO-72	1.0	5.0	30	10nA	100	-	100	-	-
M117	TO-72	1.0	5.0	30	10nA	1	-	100	-	-

MOSFETs - P-Channel

Generally used where max. isolation between signal source and logic drive is required. Switch "ON" resistance varies with signal amplitude.

Type	Package	$V_{GS(TH)}$ V Min	$V_{GS(TH)}$ V Max	BV_{DSS} V Min	I_{DSS} pA Max	I_{GSS} pA Max	g_{fs} µmho Min	$r_{DS(ON)}$ Ω Max	$I_{D(ON)}$ mA Min	$I_{D(ON)}$ mA Max
2N4352	TO-72	-1.0	-5.0	-25	-10nA	10	1000	600	-3	-
3N163	TO-72	-2.0	-5.0	-40	-200	-10	2000	250	-5	-30
3N164	TO-72	-2.0	-5.0	-30	400	10	1000	300	-3	-30
3N172	TO-72	-2.0	-5.0	-40	-400	-200	-	250	-5	-30
3N173	TO-72	-2.0	-5.0	-30	-10nA	-500	-	350	-5	-30
IT1700	TO-72	-2.0	-5.0	-40	200	-	2000	400	-2	-
IT1701	TO-72	-2.0	-5.0	-40	200	100	2000	400	-2	-

Diodes, Low Leakage

Used to protect the inputs of MOSFETs such as 3N163, while maintaining input leakage < 0.1 pA.

Type	Package	I_R @ 1V (pA) Typ	I_R @ 10V, 125°C (nA) Max	BV_R @ 1µA (V) Min	V_F @ 10mA (V) Min	V_F @ 10mA (V) Max
ID100	TO-78	0.1	10	30	0.8	1.1
ID101	TO-71	0.1	10	30	0.8	1.1

Differential Amplifier Transistors - Monolithic Duals

Junction FETs - N-Channel

Type	Package	V_{GS1-2} mV Max	ΔV_{GS} µV/°C Max	I_G pA Max	BV_{GSS} V Min	V_P V Min	V_P V Max	g_{fs} mmho* Min	g_{fs} mmho* Max	I_{DSS} mA Min	I_{DSS} mA Max	e_n nV/√Hz Max
2N3954	TO-71	5	10	-50	-50	-1.0	-4.5	1	3	0.5	5.0	160 @ 100Hz
2N3954A	TO-71	5	5	-50	-50	-1.0	-4.5	1	3	0.5	5.0	160 @ 100Hz
2N3955	TO-71	10	25	-50	-50	-1.0	-4.5	1	3	0.5	5.0	160 @ 100Hz
2N3955A	TO-71	5	15	-50	-50	-1.0	-4.5	1	3	0.5	5.0	160 @ 100Hz
2N3956	TO-71	15	50	-50	-50	-1.0	-4.5	1	3	0.5	5.0	160 @ 100Hz
2N3957	TO-71	20	75	-50	-50	-1.0	-4.5	1	3	0.5	5.0	160 @ 100Hz
2N3958	TO-71	25	100	-50	-50	-1.0	-4.5	1	3	0.5	5.0	160 @ 100Hz
2N5196	TO-71	5	5	-15	-50	-0.7	-4.0	0.7 @ 200µA		0.7	7.0	20 @ 1kHz
2N5197	TO-71	5	10	-15	-50	-0.7	-4.0	0.7 @ 200µA		0.7	7.0	20 @ 1kHz
2N5198	TO-71	10	20	-15	-50	-0.7	-4.0	0.7 @ 200µA		0.7	7.0	20 @ 1kHz
2N5199	TO-71	15	40	-15	-50	-0.7	-4.0	0.7 @ 200µA		0.7	7.0	20 @ 1kHz

* @ I_{DSS}

Differential Amplifier Transistors - Monolithic Duals (Continued)

Junction FETs - N-Channel (Continued)

Type	Package	V_{GS1-2} mV Max	ΔV_{GS} µV/°C Max	I_G pA Max	BV_{GSS} V Min	V_P V Min	V_P V Max	g_{fs} mmho* Min	g_{fs} mmho* Max	I_{DSS} mA Min	I_{DSS} mA Max	e_n nV/√Hz Max
2N5902	TO-78	5	5	-3	-40	-0.6	-4.5	0.07	0.250	0.03	0.50	100 @ 1kHz
2N5903	TO-78	5	10	-3	-40	-0.6	-4.5	0.07	0.250	0.03	0.50	100 @ 1kHz
2N5904	TO-78	10	20	-3	-40	-0.6	-4.5	0.07	0.250	0.03	0.50	100 @ 1kHz
2N5905	TO-78	15	40	-3	-40	-0.6	-4.5	0.07	0.250	0.03	0.50	100 @ 1kHz
2N5906	TO-99	5	5	-1	-40	-0.6	-4.5	0.07	0.250	0.03	0.50	100 @ 1kHz
2N5907	TO-99	5	10	-1	-40	-0.6	-4.5	0.07	0.250	0.03	0.50	100 @ 1kHz
2N5908	TO-99	10	20	-1	-40	-0.6	-4.5	0.07	0.250	0.03	0.50	100 @ 1kHz
2N5909	TO-99	15	40	-1	-40	-0.6	-4.5	0.07	0.250	0.03	0.50	100 @ 1kHz
2N5911	TO-99	10	20	-100	-25	-1.0	-5.0	5/10 @ 5mA		7.0	40.0	20 @ 10kHz
2N5912	TO-99	15	40	-100	-25	-1.0	-5.0	5/10 @ 5mA		7.0	40.0	20 @ 10kHz
2N6483	TO-71	5	5	-100	-50	-0.7	-4.0	1	4	0.5	7.5	10 @ 10Hz
2N6484	TO-71	10	10	-100	-50	-0.7	-4.0	1	4	0.5	7.5	10 @ 10Hz
2N6485	TO-71	15	25	-100	-50	-0.7	-4.0	1	4	0.5	7.5	10 @ 10Hz
IT500	TO-71	5	5	-5	-50	-0.7	-4.0	0.7/1.6 @ 200µA		0.7	7.0	35 @ 10Hz
IT501	TO-71	5	10	-5	-50	-0.7	-4.0	0.7/1.6 @ 200µA		0.7	7.0	35 @ 10Hz
IT502	TO-71	10	20	-5	-50	-0.7	-4.0	0.7/1.6 @ 200µA		0.7	7.0	35 @ 10Hz
IT503	TO-71	15	40	-5	-50	-0.7	-4.0	0.7/1.6 @ 200µA		0.7	7.0	35 @ 10Hz
IT504	TO-71	25	100	-5	-50	-0.7	-4.0	0.7/1.6 @ 200µA		0.7	7.0	35 @ 10Hz
IT505	TO-71	50	200	-5	-50	-0.7	-4.0	0.7/1.6 @ 200µA		0.7	7.0	35 @ 10Hz
ITC5911	TO-99	10	20	-100	-25	-1.0	-5.0	5/10 @ 5mA		7.0	40.0	20 @ 10kHz
ITC5912	TO-99	15	40	-100	-25	-1.0	-5.0	5/10 @ 5mA		7.0	40.0	20 @ 10kHz

* @ I_{DSS}

MOSFETs - Monolithic Dual P-Channel (Enhancement)

Type	Package	$V_{GS(TH)}$ V Min	$V_{GS(TH)}$ V Max	BV_{DDS} V Min/Max	I_{DSS} pA Max	I_{GSS} pA Max	g_{fs} µmho Min	$I_{D(ON)}$ mA Min	$I_{D(ON)}$ mA Max	$r_{DS(ON)}$ Ω Max	V_{GS1-2} mV Max
3N165	TO-99	-2	-5	-40	-200	-10	1500	-5.0	-30	300	100
3N166	TO-99	-2	-5	-40	-200	-10	1500	-5.0	-30	300	-
3N190	TO-99	-2	-5	-40	-200	-10	1500	-5.0	-30	300	100
3N191	TO-99	-2	-5	-40	-200	-10	1500	-5.0	-30	300	-

* @ I_{DSS}

Bipolar Monolithic Dual Transistors - NPN

Type	Package	V_{BE1-2} mV Max	ΔV_{BE} µV/°C Max	h_{FE} (Note 1) Min	I_{B1-2} (Note 1) nA Max	BV_{CEO} V Min	I_{CBO} nA Max	NF dB Max	f_t MHz @ I_C Min	C_{obo} pF Max
2N2920	TO-78	3	10	150	-	60	2	3 typ	60 @ 0.5mA	6
2N4044	TO-78	3	3	200	5	60	0.1	2	200 @ 1mA	0.8
2N4045	TO-78	5	10	80	25	45	0.1	3	150 @ 1mA	0.8
2N4100	TO-78	5	5	150	10	55	0.1	3	150 @ 1mA	0.8
2N4878	TO-71	3	3	200	5	60	0.1	2 typ	200 @ 1mA	0.8
2N4879	TO-71	5	5	150	10	55	0.1	3 typ	150 @ 1mA	0.8
2N4880	TO-71	5	10	80	25	45	0.1	3 typ	150 @ 1mA	0.8
IT120	TO-78 TO-71	2	5	200	5	45	1.0	2 typ	220 @ 1mA	2
IT120A	TO-78 TO-71	1	3	200	2.5	45	1.0	2 typ	220 @ 1mA	2

NOTE: 1. I_C = 10µA

Differential Amplifier Transistors - Monolithic Duals (Continued)

Bipolar Monolithic Dual Transistors - NPN (Continued)

Type	Package	V_{BE1-2} mV Max	ΔV_{BE} µV/°C Max	h_{FE} (Note 1) Min	I_{B1-2} (Note 1) nA Max	BV_{CEO} V Min	I_{CBO} nA Max	NF dB Max	f_t MHz @ I_C Min	C_{obo} pF Max
IT121	TO-78 TO-71	3	10	80	25	45	1.0	2 typ	180 @ 1mA	2
IT122	TO-78 TO-71	5	20	80	25	45	1.0	2 typ	180 @ 1mA	2
IT126	TO-78 TO-71	1	3	150	2.5	60	0.1	1 typ	250 @ 10mA	3
IT127	TO-78 TO-71	2	5	150	5	60	0.1	1 typ	250 @ 10mA	3
IT128	TO-78 TO-71	3	10	100	10	55	0.1	1 typ	250 @ 10mA	3
IT129	TO-78 TO-71	10	20	70	20	45	0.1	1 typ	250 @ 10mA	3

NOTE: 1. I_C = 10µA

Bipolar Dual Transistors - PNP

Type	Package	V_{BE1-2} mV Max	ΔV_{BE} µV/°C Max	h_{FE} (Note 1) Min	I_{B1-2} (Note 1) nA Max	BV_{CEO} V Min	I_{CBO} nA Max	NF dB Max	f_t MHz @ I_C Min	C_{obo} pF Max
2N3810	TO-78	3	10	100	-	-60	10	3 typ	100 @ 1mA	4
2N3810A	TO-78	1.5	5	100	-	-60	10	3 typ	100 @ 1mA	4
2N3811	TO-78	3	10	225	-	-60	10	3 typ	100 @ 1mA	4
2N3811A	TO-78	1.5	5	225	-	-60	10	3 typ	100 @ 1mA	4
2N5117	TO-78	3	3	100	10	-45	0.1	4 typ	100 @ 0.5mA	0.8
2N5118	TO-78	5	5	100	15	-45	0.1	4 typ	100 @ 0.5mA	0.8
2N5119	TO-78	5	10	50	40	-45	0.1	4 typ	100 @ 0.5mA	0.8
IT130	TO-78 TO-71	2	5	200	5	-45	1.0	2 typ	110 @ 1mA	2
IT130A	TO-78 TO-71	1	3	200	2.5	-45	1.0	2 typ	110 @ 1mA	2
IT131	TO-78 TO-71	3	10	80	25	-45	1.0	2 typ	90 @ 1mA	2
IT132	TO-78 TO-71	5	20	80	25	-45	1.0	2 typ	90 @ 1mA	2
IT136	TO-78 TO-71	1	3	150	2.5	-60	0.1	2 typ	250 @ 10mA	4
IT137	TO-78 TO-71	2	5	150	5	-60	0.1	2 typ	250 @ 10mA	4
IT138	TO-78 TO-71	3	10	100	10	-55	0.1	2 typ	250 @ 10mA	4
IT139	TO-78 TO-71	5	20	70	20	-45	0.1	2 typ	250 @ 10mA	4

NOTE: 1. I_C = 10µA, V_{CE} = 5V

Axial-Lead Rectifiers (In order of increasing t_{rr})

Ultra-Fast-Recovery Rectifier Selector Guide

Type	Reverse Voltage V_{RRM} V_{pk}	Avg. Fwd. Current I_O A @ T_A °C		Foward Pk. Surge I_{FSM} A	Current Peak I_{FM} A	Fwd. Volt. $T_A = +25°C$ V_{FM} V	Rev. Rec. Time t_{rr} ns	Package
GE1001	50	1	75	30	1	0.975	25	DO-204AP
GE1002	100	1	75	30	1	0.975	25	DO-204AP
GE1003	150	1	75	30	1	0.975	25	DO-204AP
GE1101	50	2.5	75	50	2	0.975	25	DO-204AP
GE1102	100	2.5	75	50	2	0.975	25	DO-204AP
GE1103	150	2.5	75	50	2	0.975	25	DO-204AP
GE1301	50	6	75	150	6	0.925	30	GE-4
GE1302	100	6	75	150	6	0.925	30	GE-4
GE1303	150	6	75	150	6	0.925	30	GE-4
A214F	50	2	55	50	5	0.95	35	DO-204AP
A214A	100	2	55	50	5	0.95	35	DO-204AP
A214G	150	2	55	50	5	0.95	35	DO-204AP
A214B	200	2	55	50	5	0.95	35	DO-204AP
A315F	50	3	55	150	5	0.95	35	GE-4
A315A	100	3	55	150	5	0.95	35	GE-4
A315G	150	3	55	150	5	0.95	35	GE-4
A315B	200	3	55	150	5	0.95	35	GE-4
GE1004	200	1	75	30	1	0.975	40	DO-204AP
GE1104	200	2	50	20	1	1.25	50	DO-204AP
GE1304	200	5	50	70	3	1.25	50	GE-4

Fast-Recovery Rectifier Selector Guide

Type	Reverse Voltage V_{RRM} V_{pk}	Avg. Fwd. Current I_O A @ T_A °C		Foward Pk. Surge I_{FSM} A	Current Peak I_{FM} A	Fwd. Volt. $T_A = +25°C$ V_{FM} V	Rev. Rec. Time t_{rr} ns	Package
A114F	50	1	75	40	1	1.1	200	DO-204AP
A114A	100	1	75	40	1	1.1	200	DO-204AP
A114B	200	1	75	40	1	1.1	200	DO-204AP
A114C	300	1	75	40	1	1.1	200	DO-204AP
A114D	400	1	75	40	1	1.1	200	DO-204AP
A114E	500	1	75	40	1	1.1	200	DO-204AP
A114M	600	1	75	40	1	1.1	200	DO-204AP
A115F	50	3	55	110	5	1.1	200	GE-3
A115A	100	3	55	110	5	1.1	200	GE-3
A115B	200	3	55	110	5	1.1	200	GE-3
A115C	300	3	55	110	5	1.1	200	GE-3
A115D	400	3	55	110	5	1.1	200	GE-3
A115E	500	3	55	110	5	1.1	200	GE-3
A115M	600	3	55	110	5	1.1	200	GE-3

Axial-Lead Rectifiers (Continued)

General-Purpose Rectifier Selector Guide

Type	Reverse Voltage V_{RRM} V_{pk}	Avg. Fwd. Current I_O A @ T_A °C		Forward Pk. Surge I_{FSM} A	Current Peak I_{FM} A	Fwd. Volt. $T_A = +25°C$ V_{FM} V	Rev. Rec. Time t_{rr} µs	Package
1N4245	200	1	55	25	1	1.2	5	DO-204AP
1N4246	400	1	55	25	1	1.2	5	DO-204AP
1N4247	600	1	55	25	1	1.2	5	DO-204AP
1N4248	800	1	55	25	1	1.2	5	DO-204AP
1N4249	1000	1	55	25	1	1.2	5	DO-204AP
1N5624	200	3	70	125	5	1.1	5	GE-4
1N5625	400	3	70	125	5	1.1	5	GE-4
1N5626	600	3	70	125	5	1.1	5	GE-4
1N5627	800	3	70	125	5	1.1	5	GE-4
A15F	50	3	70	125	5	1.1	5	GE-4
A15A	100	3	70	125	5	1.1	5	GE-4
1N5059	200	1	100	50	1	1.2	6	DO-204AP
1N5060	400	1	100	50	1	1.2	6	DO-204AP
1N5061	600	1	100	50	1	1.2	6	DO-204AP
1N5062	800	1	100	50	1	1.2	6	DO-204AP
A14F	50	1	100	50	2.5	1.25	6	DO-204AP
A14A	100	1	100	50	2.5	1.25	6	DO-204AP
A14C	300	1	100	50	2.5	1.25	6	DO-204AP
A14E	500	1	100	50	2.5	1.25	6	DO-204AP
A14P	1000	1	100	50	2.5	1.25	6	DO-204AP
GER4001	50	1	75	30	1	1.1	6	DO-204AP
GER4002	100	1	75	30	1	1.1	6	DO-204AP
GER4003	200	1	75	30	1	1.1	6	DO-204AP
GER4004	400	1	75	30	1	1.1	6	DO-204AP
GER4005	600	1	75	30	1	1.1	6	DO-204AP
GER4006	800	1	75	30	1	1.1	6	DO-204AP
GER4007	1000	1	75	30	1	1.1	6	DO-204AP

Full-Wave Bridge Rectifiers

Product Selector Guide

Type	Reverse Voltage V_{RRM} V_{pk}	Avg. Fwd. Current I_O A @ T_A °C		Forward Pk. Surge I_{FSM} A	Current Peak I_{FM} A	Fwd. Volt. $T_A = +25°C$ V_{FM} V	Package
DB1F	50	1	40	50	1	1.1	BR-4
DB1A	100	1	40	50	1	1.1	BR-4
DB1B	200	1	40	50	1	1.1	BR-4
DB1D	400	1	40	50	1	1.1	BR-4
DB1M	600	1	40	50	1	1.1	BR-4
DB1N	800	1	40	50	1	1.1	BR-4
DB1P	1000	1	40	50	1	1.1	BR-4

Ultra-Fast-Recovery Rectifiers

Ultra-Fast-Recovery Rectifier Selector Guide

Type	Reverse Voltage V_{RRM} V_{pk}	Avg. Forward Current I_F A @ T_C °C		Surge Current I_{FSM} A	Rev. Rec Time t_{rr} ns	Junction Capacitance C_J pF	Package
BYW51-100	100	2 x 8*	125	100	35	40	TO-220AB
BYW51-150	150	2 x 8*	125	100	35	40	TO-220AB
BYW51-200	200	2 x 8*	125	100	35	40	TO-220AB
MUR-810	100	8	125	100	35	40	TO-220AC
MUR-815	150	8	125	100	35	40	TO-220AC
MUR-820	200	8	125	100	35	40	TO-220AC
MUR-840	400	8	150	100	50	-	TO-220AC
MUR-850	500	8	150	100	50	-	TO-220AC
MUR-860	600	8	150	100	50	-	TO-220AC
MUR-870	700	8	150	100	75	-	TO-220AC
MUR-880	800	8	150	100	75	-	TO-220AC
MUR-890	900	8	150	100	75	-	TO-220AC
MUR-8100	1000	8	125	100	75	-	TO-220AC
MUR-1610CT	100	2 x 8*	125	100	60	40	TO-220AB
MUR-1615CT	150	2 x 8*	125	100	60	40	TO-220AB
MUR-1620CT	200	2 x 8*	125	100	60	40	TO-220AB
RUR-810	100	8	125	100	35	40	TO-220AC
RUR-815	150	8	125	100	35	40	TO-220AC
RUR-820	200	8	125	100	35	40	TO-220AC
RUR-840	400	8	150	100	50	-	TO-220AC
RUR-850	500	8	150	100	50	-	TO-220AC
RUR-860	600	8	150	100	50	-	TO-220AC
RUR-D810	100	2 x 8*	125	100	35	40	TO-220AB
RUR-D815	150	2 x 8*	125	100	35	40	TO-220AB
RUR-D820	200	2 x 8*	125	100	35	40	TO-220AB
RUR-D1610	100	2 x 16†	125	275	35	80	TO-204AA
RUR-D1615	150	2 x 16†	125	275	35	80	TO-204AA
RUR-D1620	200	2 x 16†	125	275	35	80	TO-204AA
RUR-1610CT	100	2 x 8*	150	100	60	40	TO-220AB
RUR-1615CT	150	2 x 8*	150	100	60	40	TO-220AB
RUR-1620CT	200	2 x 8*	150	100	60	40	TO-220AB

*8 A average per junction
†16 A average per junction

Optoisolators/Optocouplers

Optoelectronic components sense the presence and intensity of light, the position of objects which break or reflect a light beam, and transmit electronic signals without electrical connections. These characteristics provide high speed and high reliability at low cost for a variety of useful functions, from automatic light-level control in copy machines, or sensing the right instant to fire an automobile's spark plug, to allowing delicate computer circuitry to control high-power machine tools.

Features

- Isolation Capability to 5000-volt
- Broadest line of PROELECTRON and JEDEC registered isolators
- High-output PROELECTRON and JEDEC registered IRED emitters and detectors
- Highest sensitivity thyristor and digital isolators
- 6-Pin DIP isolators available in surface-mount form
- Custom interrupter modules can be provided using the discrete IRED emitters and photodectors of your choice. The same devices that have established our industry-standard modules as the leaders in quality, versatility, and cost-effectiveness, can be put into a module of your design, completely assembled, tested and ready for insertion in your equipment.
- Optoisolators are U.L. component recognized under File #E51868 and VDE-Approved to Specification 0883/6.80 Certificate #35025

Type #	Description	Surge Isolation Voltage RMS Min	Current Transfer Ratio Min	BV_{CEO} (Volts) Min	Typical (μs)		V_{CE} (SAT) Max	Package*
					t_r	t_f		
CNX35	Photo	4000V	40-160%	30	2	2	.4	296
CNX36	Transistor	4000V	80%	30	2	2	.4	296
CNY17I	Output	3000V	40-80%	70	2	2	.3	296
CNY17II		3000V	63-125%	70	2	2	.3	296
CNY17III		3000V	100-200%	70	2	2	.3	296
CNY17IV		3000V	160-320%	70	2	2	.3	296
CNY32		4000V	20%	30	3	3	.4	297
CNY47		2000V	20-60%	30	2	2	.4	296
CNY47A		2000V	40%	30	2	2	.4	296
CNY51		4000V	100%	70	2	2	.4	296
CQY80		4000V	60%	30	2	2	.4	296
GEPS2001		1770V	30%	30	5	5	.3	296
GFH600I		2800V	63-125%	70	5	5	.3	296
GFH600II		2800V	100-200%	70	5	5	.3	296
GFH600III		2800V	160-320%	70	5	5	.3	296
GFH601I		2800V	40-80%	70	5	5	.4	296
GFH601II		2800V	63-125%	70	5	5	.4	296
GFH601III		2800V	100-200%	70	5	5	.4	296
GFH601IV		2800V	160-320%	70	5	5	.4	296
H11A1		2500V	50%	30	2	2	.4	296
H11A2		2500V	20%	30	2	2	.4	296
H11A3		2500V	20%	30	2	2	.4	296
H11A4		2500V	10%	30	2	2	.4	296
H11A5		2500V	30%	30	2	2	.4	296
H11A520		4000V	20%	30	2	2	.4	296
H11A550		4000V	50%	30	2	2	.4	296
H11A5100		4000V	100%	30	2	2	.4	296

* See Packaging Section
# Functional Diagram Included In This Section

Optoisolators/Optocouplers (Continued)

Type #	Description	Surge Isolation Voltage RMS Min	Current Transfer Ratio Min	BV_{CEO} (Volts) Min	Typical (μs)		V_{CE} (SAT) Max	Package*
					t_r	t_f		
H11AG1	Photo	4000V	300%	30	5	5	0.4	296
H11AG2	Transistor	4000V	200%	30	5	5	0.4	296
H11AG3	Output	2500V	100%	30	5	5	0.4	296
H11AV1		4000V	100%	70	5	5	0.4	296
H11AV1A		4000V	100%	70	5	5	0.4	295
H11AV2		4000V	50%	70	5	5	0.4	296
H11AV2A		4000V	50%	70	5	5	0.4	295
H11AV3		4000V	20%	70	5	5	0.4	296
H11AV3A		4000V	20%	70	5	5	0.4	295
H24A1		4242V	100%	30	3	3	0.4	297
H24A2		4242V	20%	30	3	3	0.4	297
4N25		2500V	20%	30	3	3	0.5	296
4N25A		1775V	20%	30	3	3	0.5	296
4N26		1500V	20%	30	3	3	0.5	296
4N27		1500V	10%	30	3	3	0.5	296
4N28		500V	10%	30	3	3	0.5	296
4N35		2500V	100%	30	5	5	0.3	296
4N36		1750V	100%	30	5	5	0.3	296
4N37		1050V	100%	30	5	5	0.3	296
H74A1		2500V		15				296
MCT2		2500V	20%	30	5	5	0.4	296
MCT2E		2500V	20%	30	5	5	0.4	296
MCT26		2500V	6%	30	5	5	0.4	296
MCT210		2500V	150%	30	5	5	0.4	296
SL5500		2500V	40-300%	30	20	50	0.4	296
SL5501		2500V	25-400%	30	20	50	0.4	296
SL5504		2500V	25-400%	80	50	150	0.4	296
SL5511		2500V	25%	30	20	50	0.4	296
H11D1	High-Voltage	4000V	20%	300	5	5	0.4	296
H11D2	Photo	2500V	20%	300	5	5	0.4	296
H11D3	Transistor	2500V	20%	200	5	5	0.4	296
H11D4	Output	2500V	10%	200	5	5	0.4	296
4N38		2500V	10%	80	5	5	1.0	296
4N38A		2500V	10%	80	5	5	1.0	296
CNY33		2500V	20%	300	5	5	0.4	296

* See Packaging Section

Functional Diagram Included In This Section

Optoisolators/Optocouplers (Continued)

Type #	Description	Surge Isolation Voltage RMS Min	Current Transfer Ratio Min	BV_{CEO} (Volts) Min	Typical (μs)		V_{CE} (SAT) Max	Package*
					t_r	t_f		
H11B1	Photo	4000V	500%	25	125	100	1.0	296
H11B2	Darlington	4000V	200%	25	125	100	1.0	296
H11B3	Output	4000V	100%	25	125	100	1.0	296
H11B255		2500V	100%	55	125	100	1.0	296
H24B1		4242V	1000%	30	125	100	1.4	297
H24B2		4242V	400%	30	125	100	1.4	297
4N29		2500V	100%	30	5	40	1.0	296
4N29A		2500V	100%	30	5	40	1.0	296
4N30		2500V	100%	30	5	40	1.0	296
4N31		2500V	50%	30	5	40	1.2	296
4N32		2500V	500%	30	5	100	1.0	296
4N32A		2500V	500%	30	5	100	1.0	296
4N33		2500V	500%	30	5	100	1.0	296
CNY31		4000V	400%	30	125	100	1.4	297
CNY48		1500V	600%	30	125	100	1.0	296
MCA230		2500V	100%	30	5	100	1.0	296
MCA231		2500V	200%	30	5	100	1.0	296
MCA255		2500V	100%	55	5	100	1.0	296
H11G1	High Voltage	4000V	1000%	100	5	100	1.0	296
H11G2	Photo Darlington	4000V	1000%	80	5	100	1.0	296
H11G3	Output	4000V	200%	55	5	100	1.0	296
H11G45		4000V	250%	55	50	500	1.0	296
H11G46		4000V	500%	55	50	500	1.0	296

Type #	Description	Surge Isolation Voltage RMS Min	DC Output Voltage @ I_F = 3.5mA		AC Output Voltage @I_I = 1 (pk-pk)		-6db Bandwidth Type	Operating Voltage		Package*
			Min	Max	Min	Max		Min	Max	
H11V1	Video/Wideband	4000V	2.0	7.0	0.5	1.25	0-10MHz	5V	15V	296
H11V2	Linear Isolator	4000V	2.0	7.0	0.75	-	0-10MHz	5V	15V	296
H11V3		4000V	2.0	7.0	0.33	-	0-10MHz	5V	15V	296

* See Packaging Section
\# Functional Diagram Included In This Section

Optoisolators/Optocouplers (Continued)

Type #	Description	Surge Isolation Voltage V_{IO} (RMS)	I_F Trigger Max	Blocking Voltage (Min)	Typical TON (μs)	V_F (Max)	Package*
H11C1	Photo SCR	4000V	20mA	200	1	1.5	296
H11C2	Output	2500V	20mA	200	1	1.5	296
H11C3		2500V	30mA	200	1	1.5	296
H11C4		4000V	20mA	400	1	1.5	296
H11C5		2500V	20mA	400	1	1.5	296
H11C6		2500V	30mA	400	1	1.5	296
H11M1		4000V	7mA	800	1	1.5	296
H11M2		4000V	15mA	800	1	1.5	296
H11M3		4000V	7mA	600	1	1.5	296
H11M4		4000V	15mA	600	1	1.5	296
4N39		1060V	14mA	200	1	1.5	296
4N40		1060V	14mA	400	1	1.5	296
H74C1		2500V		200			296
H74C2		2500V		400			296
CNY30		1770V	20mA	200	1	1.5	296
CNY34		1770V	20mA	400	1	1.5	296
MCS2		2500V	14mA	200	1	1.5	296
MCS2400		2500V	14mA	400	1	1.5	296
MCS21		3000V	20mA	200	1	1.5	296
MCS2401		3000V	20mA	400	1	1.5	296

Type #	Description	Surge Isolation Voltage V_{IO} (RMS)	I_F Trigger Max	Blocking Voltage Min	On-Stage Voltage 1_{46} =100mA Max	Typical dv/dt V/μs Static	Package*
H11J1	Triac	4000V	10mA	250V	3.0V	2.0	296
H11J2	Driver	4000V	15mA	250V	3.0V	2.0	296
H11J3	Output	2500V	10mA	250V	3.0V	2.0	296
H11J4		2500V	15mA	250V	3.0V	2.0	296
H11J5		2500V	25mA	250V	3.0V	2.0	296
GE3009		4000V	30mA	250V	3.0V	6.0	296
GE3010		4000V	15mA	250V	3.0V	6.0	296
GE3011		4000V	10mA	250V	3.0V	6.0	296
GE3020		4000V	30mA	400V	3.0V	6.0	296
GE3021		4000V	15mA	400V	3.0V	6.0	296
GE3022		4000V	10mA	400V	3.0V	6.0	296
MOC3009		7500Vpk	30mA	250V	3.0V	6.0	296
MOC3010		7500Vpk	15mA	250V	3.0V	6.0	296
MOC3011		7500Vpk	10mA	250V	3.0V	6.0	296
MOC3020		7500Vpk	30mA	400V	3.0V	6.0	296
MOC3021		7500Vpk	15mA	400V	3.0V	6.0	296
MOC3022		7500Vpk	10mA	400V	3.0V	6.0	296

* See Packaging Section
# Functional Diagram Included In This Section

Optoisolators/Optocouplers (Continued)

Type #	Description	Surge Isolation Voltage V_{IO} (RMS)	Current Transfer Ratio Min	BV_{CEO} (Volts) Min	Typical (μs)		V_{CE} (SAT) Max	Package*
					t_r	t_f		
H11A10	Programmable Threshold Isolator	2500	10%	30	2	2	0.4	296
H11AA1	AC Input Isolator	1770V	20%	30	2	2	0.4	296
H11AA2		1770V	10%	30	2	2	0.4	296
H11AA3		1770V	50%	30	2	2	0.4	296
H11AA4		1770V	100%	30	2	2	0.4	296
CNY35		1060V	10%	30	2	2	0.4	296

Type #	Description	Surge Isolation Voltage V_{IO} (RMS)	On-State Resistance Max Ω	Off-State Resistance Min Ω	Break Down Voltage	Turn-on Time (μs)	Turn-off Time (μs)	Package*
H11F1	Bialateral	2500	200	300M	30	15	15	296
H11F2	Output Analog	2500	330	300M	30	15	15	296
H11F3	FET	2500	470	300M	15	15	15	296

Type #	Description	Surge Isolation Voltage V_{IO} (RMS)	Current Transfer Ratio Min	BV_{CEO} (Volts) Min	Typical (μs)		V_{CE} (SAT) Max	Package
					t_r	t_f		
H11K1	Darlington	2500V	1000%	250	20	40	2.5	296
H11K2		2500V	500%	200	20	40	2.5	296

Type #	Description	Surge Isolation Voltage V_{IO} (RMS)	Turn On Current I_{FON} Max	Hystersis I_{OFF}/I_{ON} Ratio		Output Voltage $VOL(I_O = 17mA)$ Max	Maximum Data Rate NRZ	Operating Voltage		Package*
				Min	Max			Min	Max	
H11L1	Schmitt	2500V	1.6mA	0.3	0.9	0.4V	1.0MHz	3V	16V	296
H11L2	Trigger	2500V	10mA	0.3	0.9	0.4V	1.0MHz	3V	16V	296
H11L3	Output	2500V	5mA	0.3	0.9	0.4V	1.0MHz	3V	16V	296
H11N1		4000V	3.2mA	0.65	0.95	0.5V	5.0MHz	4V	15V	296
H11N2		4000V	5mA	0.65	0.95	0.5V	5.0MHz	4V	15V	296
H11N3		2500V	10mA	0.65	0.95	0.5V	5.0MHz	4V	15V	296

* See Packaging Section
#Functional Diagram Included In This Section

IR Emitters and Detectors

F5G series Gallium-Aluminum-Arsenide IREDs represent leading-edge emitter technology. Their high power output at 880 nanometers proides a significant increase in system efficiency, compared to GaAs IREDs.

The L14 series silicon detectors are available with transistor and Darlington-connected output. These high-sensitivity detectors combine with high-output emitters to increase efficiency in optoelectronic circuits.

Infrared Emitters

Type	Min P_O @ I_F = 100mA	Max V_F @ I_F = 100mA	Peak Emission Wavelength Typ. n Meters	Rise Time Typ. µs	Fall Time Typ. µs	Max P_D mW	Max I_F Cont. mA	Package*
1N6264	6.0mW	1.7V	940	1.0	1.0	1300	100	54A
1N6265	6.0mW	1.7V	940	1.0	1.0	1300	100	54
1N6266	25mW/sr	1.7V	940	1.0	1.0	1300	100	54A
CQX14	5.4mW	1.7V	940	1.0	1.0	1300	100	54A
CQX15	5.4mW	1.7V	940	1.0	1.0	1300	100	54
CQX16	1.5mW	1.7V	940	1.0	1.0	1300	100	54A
CQX17	1.5mW	1.7V	940	1.0	1.0	1300	100	54
F5D1	12mW	1.7V	880	1.5	1.5	1300	100	54A
F5D2	9mW	1.7V	880	1.5	1.5	1300	100	54A
F5D3	10.5mW	1.7V	880	1.5	1.5	1300	100	54A
F5E1	12mW	1.7V	880	1.5	1.5	1300	100	54
F5E2	9mW	1.7V	880	1.5	1.5	1300	100	54
F5E3	10.5mW	1.7V	880	1.5	1.5	1300	100	54
F5F1	0.28mW/sr	1.7V	940	1.0	1.0	100	60	56
F5G1	0.6mW/sr	1.85V	880	1.5	1.5	100	50	56
LED55C	5.4mW	1.7V	940	1.0	1.0	1300	100	54A
LED55B	3.5mW	1.7V	940	1.0	1.0	1300	100	54A
LED56	1.5mW	1.7V	940	1.0	1.0	1300	100	54A
LED55CF	5.4mW	1.7V	940	1.0	1.0	1300	100	54
LED55BF	3.5mW	1.7V	940	1.0	1.0	1300	100	54
LED56F	1.5mW	1.7V	940	1.0	1.0	1300	100	54

Detectors

Type #	Description	Sensitivity (ma/mw/cm²) Min	Sensitivity (ma/mw/cm²) Max	BV_{CEO} (V)	BV_{CBO} (V)	I_D (nA) Max	Switching Typ t_r (µs)	Switching Typ t_f (µs)	Typ V_{CE} (SAT)	Package
BPW36	Photo	.6	-	45	45	100	5	5	0.4	55
BPW37	Transistors	.3	-	45	45	100	5	5	0.4	55
L14C1		.1	-	50	50	100	5	5	0.2	57
L14C2		.05	-	50	50	100	5	5	0.2	57
L14G1		.6	-	45	45	100	5	5	0.4	55
L14G2		.3	-	45	45	100	5	5	0.4	55
L14G3		1.2	-	45	45	100	5	5	0.4	55
L14N1		.6	-	30	40	100	10	14	0.4	57
L14N2		1.2	-	30	40	100	12	16	0.4	57
L14P1		4.0	-	30	40	100	10	14	0.4	55
L14P2		8.0	-	30	40	100	12	16	0.4	55
L14Q1		.2	-	30	-	100	$8t_{on}$	$50t_{off}$	0.4	56A
BPW38	Photo	15.0	-	25	25	100	75	50	0.8	55
L14F1	Darlingtons	15.0	-	25	25	100	75	50	0.8	55
L14F2		5.0	-	25	25	100	75	50	0.8	55
L14R1		5.0	-	30	-	100	$45t_{on}$	$250t_{off}$	0.9	56A

* See Packaging Section
\# Functional Diagram Included In This Section

IR Emitters and Detectors (Continued)

Matched Emitter-Detector Pairs

Type #	Description	Output Current		I_{CEO} (na)	BV_{CEO} (V)	Typical TON (µs)	Typical T_I (µs)	V_{CE} (SAT) Max	Package
H23A1	Photo Transistor Output	I_F = 30mA	1.5mA	100	30	8	50	0.4	321
H23A2		I_F = 30mA	1.0mA	100	30	8	50	0.4	321
H23B1	Photo Darlington Output	I_F = 10mA	7.5mA	100	30	45	250	1.0	321

Type #	Description	Turn On Current I_F (On) Max	Hysteresis I_F (Off)/I_F(On) Min	Hysteresis I_F (Off)/I_F(On) Max	Output Voltage Vol Max	Operating Voltage Min	Operating Voltage Max	Package*
H23L1	Schmitt Trigger Output	20mA	0.5	0.9	0.4V	4V	15V	321

Photon-Coupled Interrupter Modules

Type # +	Description	Output Current		I_{CEO} (nA)	BV_{CEO} (V)	Typical TON (µs)	Typical t_f (µs)	V_{CE} (SAT) Max	Package*
H21A1	Photo Transistor Output	I_F = 20mA	1.0mA	100	30	8	50	0.4	319
H21A2		I_F = 20mA	2.0mA	100	30	8	50	0.4	319
H21A3		I_F = 20mA	4.0mA	100	30	8	50	0.4	319
H21A4		I_F = 20mA	1.0mA	100	55	8	50	0.4	319
H21A5		I_F = 20mA	2.0mA	100	55	8	50	0.4	319
H21A6		I_F = 20mA	4.0mA	100	55	8	50	0.4	319
H22A1		I_F = 20mA	1.0mA	100	30	8	50	0.4	320
H22A2		I_F = 20mA	2.0mA	100	30	8	50	0.4	320
H22A3		I_F = 20mA	4.0mA	100	30	8	50	0.4	320
H22A4		I_F = 20mA	1.0mA	100	55	8	50	0.4	320
H22A5		I_F = 20mA	2.0mA	100	55	8	50	0.4	320
H22A6		I_F = 20mA	4.0	100	55	8	50	0.4	320
CNY28		I_F = 20mA	200µA	100	30	5	5	0.4	319
CNY36		I_F = 20mA	200µA	100	30	5	5	0.4	320
H21B1	Photo Darlington Output	I_F = 10mA	7.5mA	100	30	45	250	1.0	319
H21B2		I_F = 10mA	14mA	100	30	45	250	1.0	319
H21B3		I_F = 10mA	25mA	100	30	45	250	1.0	319
H21B4		I_F = 10mA	7.5mA	100	55	45	250	1.0	319
H21B5		I_F = 10mA	14mA	100	55	45	250	1.0	319
H21B6		I_F = 10mA	25mA	100	55	45	250	1.0	319
H22B1		I_F = 10mA	7.5mA	100	30	45	250	1.0	320
H22B2		I_F = 10mA	14mA	100	30	45	250	1.0	320
H22B3		I_F = 10mA	25mA	100	30	45	250	1.0	320
H22B4		I_F = 10mA	7.5mA	100	55	45	250	1.0	320
H22B5		I_F = 10mA	14mA	100	55	45	250	1.0	320
H22B6		I_F = 10mA	25mA	100	55	45	250	1.0	320
CNY29		I_F = 20mA	2.5mA	100	25	150	150	1.2	319

Type # +	Description	Turn On I_F (ON) Max	Hysteresis I_F (OFF)/I_F(ON) Ratio Min	Hysteresis I_F (OFF)/I_F(ON) Ratio Max	Output Voltage Vol. Max	Operating Voltage Voltage Min	Operating Voltage Voltage Max	Package*
H21L1	Schmitt Trigger Output	30mA	0.5	0.9	0.4V	4V	15V	323
H21L2		15mA	0.5	0.9	0.4V	4V	15V	323
H22L1		30mA	0.5	0.9	0.4V	4V	15V	322
H22L2		15mA	0.5	0.9	0.4V	4V	15V	322

+ H21 and H22 interrupters: replace older less efficient designs significantly improve performance.
-Incorporate integral lenses.
-Feature a strengthened housing with slot aperture to improve resolution.
-Block up to 55 volts.
-Minimize high detector-supply-voltage problems.

* See Package Section

Functional Diagram Included In This Section

Functional Diagrams

Optoisolators/Optocouplers

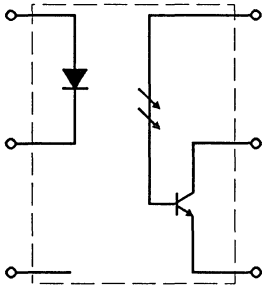
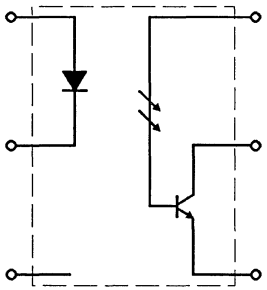
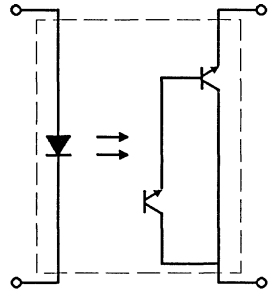


Photo-Transistor Output



High-Voltage Photo Transistor Output



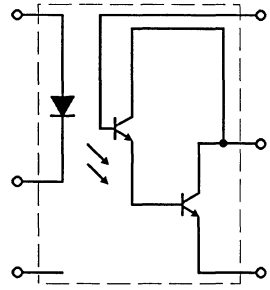
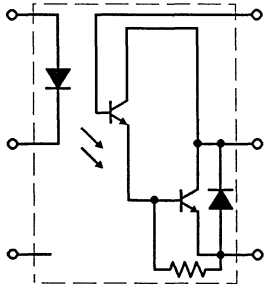
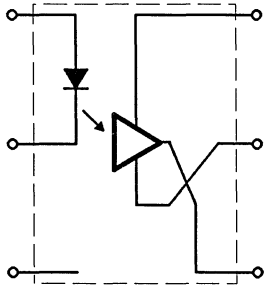


Photo Darlington Output



High-Voltage Photo Darlington Output



Video/Wideband Linear Isolator

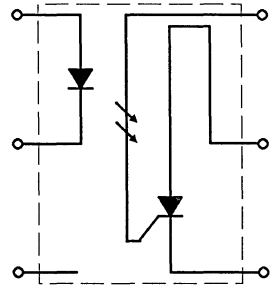
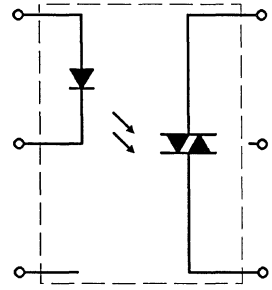
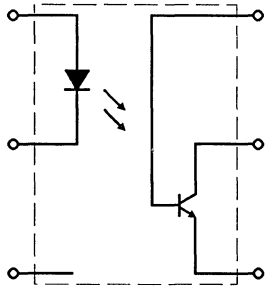


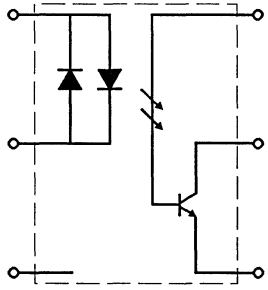
Photo SCR Output



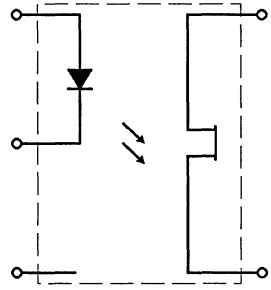
Triac Driver Output



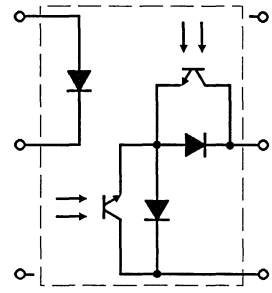
Programmable Threshold Isolator



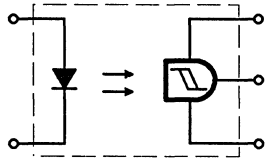
AC Input Isolator



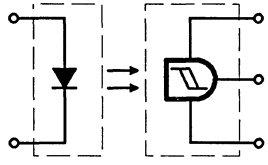
Bilateral Output Analog FET



Darlington



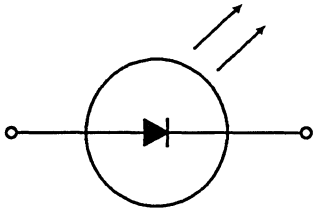
Schmitt Trigger Output



Schmitt Trigger Output

Functional Diagrams (Continued)

Infrared Emitters



Dectors

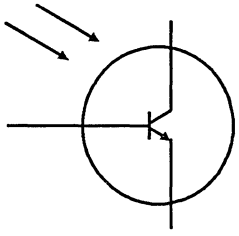


Photo Transistors

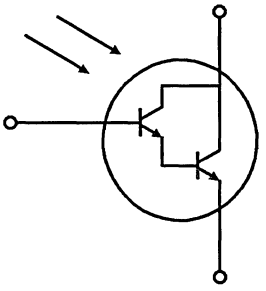


Photo Darlingtons

Matched Emitter-Detector Pairs

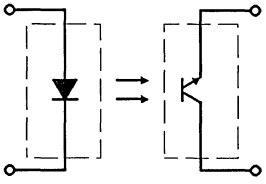


Photo Transistor Output

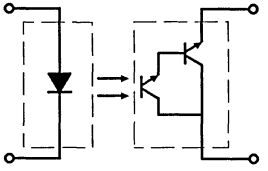
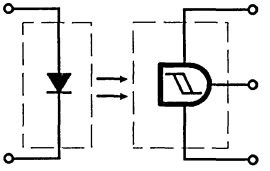


Photo Darlington Output



Schmitt Trigger Output

Photon-Coupled Interrupter Modules

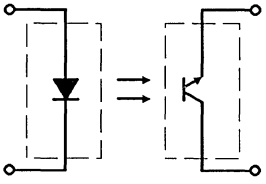


Photo Transistor Output

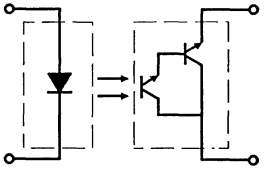


Photo Darlington Output

JAN Qualified-Parts Listing and MIL-M-38510 Detail Specifications (Slash Sheets)

Detail Specification	Type	Available JAN Devices S	B	1×10^5 Rad Si	1×10^6 Rad Si
MIL-M-38510/05001	CD4011A		X		
02	CD4012A		X		
03	CD4023A		X		
51	CD4011B	X	X	X	X
52	CD4012B	X	X	X	X
53	CD4023B	X	X	X	X
MIL-M-38510/05101	CD4013A		X		
02	CD4027A		X		
03	CD4043A				
51	CD4013B	X	X	X	X
52	CD4027B	X	X	X	X
53	CD4043B				
MIL-M-38510/05201	CD4000A		X		
02	CD4001A		X		
03	CD4002A		X		
04	CD4025A		X		
51	CD4000B				
52	CD4001B	X	X	X	X
53	CD4002B	X	X	X	
54	CD4025B	X	X	X	X
MIL-M-38510/05301	CD4007A		X		
02	CD4019A		X		
03	CD4030A				
04	CD4048A				
51	CD4007UB	X	X	X	X
52	CD4019B	X	X	X	X
53	CD4030B	X	X	X	X
54	CD4048B				
MIL-M-38510/05401	CD4008A				
51	CD4008B	X	X	X	
MIL-M-38510/05501	CD4009A				
02	CD4010A				
03	CD4049A		X		
04	CD4050A		X		
05	CD4041A				
51	CD4009UB				
52	CD4010B				
53	CD4049UB	X	X	X	X
54	CD4050B	X	X	X	X
55	CD4041UB	X	X	X	
MIL-M-38510/05601	CD4017A		X		
02	CD4018A				
03	CD4020A		X		
04	CD4022A		X		
05	CD4024A		X		
51	CD4017B	X	X	X	
52	CD4018B	X	X	X	X
53	CD4020B	X	X	X	X
54	CD4022B	X	X	X	X
55	CD4024B	X	X	X	X

Detail Specification	Type	Available JAN Devices S	B	1×10^5 Rad Si	1×10^6 Rad Si
MIL-M-38510/05701	CD4006A		X		
02	CD4014A		X		
03	CD4015A		X		
04	CD4021A		X		
05	CD4031A		X		
06	CD4034A				
51	CD4006B				
52	CD4014B	X	X	X	X
53	CD4015B	X	X	X	X
54	CD4021B	X	X	X	X
55	CD4031B				
56	CD4034B				
MIL-M-38510/05801	CD4016A				
02	CD4066A				
51	CD4016B				
52	CD4066B	X	X	X	X
MIL-M-38510/05901	CD4028A				
51	CD4028B	X	X	X	
MIL-M-38510/17001	CD4081B	X	X	X	X
02	CD4082B		X	X	
03	CD4073B		X	X	
MIL-M-38510/17101	CD4071B	X	X	X	X
02	CD4072B		X	X	
03	CD4075B	X	X	X	X
MIL-M-38510/17201	CD4085B	X	X	X	X
02	CD4086B	X	X	X	X
03	CD4070B	X	X	X	X
04	CD4077B		X	X	
MIL-M-38510/17301	CD4514B				
02	CD4515B				
03	CD4532B				
04	CD4555B				
05	CD4556B				
MIL-M-38510/17401	CD4069UB	X	X	X	X
02	CD40107B				
03	CD4502B	X	X	X	
04	CD40109B				
MIL-M-38510/17501	CD4076B				
02	CD4095B				
03	CD4096B				
04	CD4098B		X	X	
05	CD40174B				
MIL-M-38510/17601	CD4099B		X	X	
02	CD4508B				
MIL-M-38510/17701	CD4093B				
02	CD40106B				
MIL-M-38510/17801	CD4067B				
02	CD4097B				
03	CD40257B				

For current availability, call your Harris Semiconductor authorized distributor or nearest sales office.
Available in DIL (cerdip) packages and flat packs.

TYPE	DESCRIPTION	CLASS B				CLASS S			
		Mil-Std-883		Mil-M-38510		Mil-Std-883		Mil-M-38510	
		Non-Compliant	Compliant	Stan-dard	Rad Hard	Stan-dard	Rad Hard	Stan-dard	Rad Hard
CD4000A	Dual 3 Input NOR Gate plus Inverter	X		X		X	X		
CD4000B	Dual 3 Input NOR Gate plus Inverter	X	X			X	X		
CD4000UB	Dual 3 Input NOR Gate plus Inverter	X	X						
CD4001A	Quad 2 Input NOR Gate	X		X					
CD4001B	Quad 2 Input NOR Gate	X	X	X	X	X	X	X	X
CD4001UB	Quad 2 Input NOR Gate	X	X			X	X		
CD4002A	Dual 4 Input NOR Gate	X		X					
CD4002B	Dual 4 Input NOR Gate	X	X	X	X	X	X	X	X
CD4002UB	Dual 4 Input NOR Gate	X	X			X	X		
CD4006A	18 Stage static shift register	X		X					
CD4006B	18 Stage static shift register	X	X			X	X		
CD4007A	Dual Complementary pair plus Inverter	X		X					
CD4007UB	Dual Complementary pair plus Inverter	X	X		X	X	X	X	X
CD4008B	4 Bit full adder with parallel carry out.	X	X	X	X	X	X	X	X
CD4009UB	Hex buffer/converter (inverting)	X	X			X	X		
CD4010B	Hex buffer/converter (Non Inverting)	X	X			X	X		
CD4011A	Quad 2 - input NAND Gate	X		X					
CD4011B	Quad 2 - input NAND Gate	X	X	X	X	X	X	X	X
CD4011UB	Quad 2 - input NAND Gate	X	X			X	X		
CD4012A	Dual 4 - input NAND Gate	X		X					

High-Reliability CD4000 Slash-Series Types

TYPE	DESCRIPTION	CLASS B				CLASS S			
		Mil-Std-883		Mil-M-38510		Mil-Std-883		Mil-M-38510	
		Non-Compliant	Compliant	Stan-dard	Rad Hard	Stan-dard	Rad Hard	Stan-dard	Rad Hard
CD4012B	Dual 4 - input NAND Gate	X	X	X	X	X	X	X	X
CD4012UB	Dual 4 - input NAND Gate	X	X			X	X		
CD4013A	Dual "D" flip-flops with set/reset capability	X		X					
CD4013B	Dual "D" flip-flops with set/reset capability	X	X	X	X	X	X	X	X
CD4014A	8-Stage static shift register	X		X					
CD4014B	8-Stage static shift register	X	X	X	X	X	X	X	X
CD4015A	Dual 4 stage static shift register	X		X					
CD4015B	Dual 4 stage static shift register	X	X	X	X	X	X	X	X
CD4016A	Quad bilateral switch	X							
CD4016B	Quad bilateral switch	X	X			X	X		
CD4017B	Decode Counter/divider	X	X	X	X	X	X	X	X
CD4018A	Presettable divide by "N" counter	X							
CD4018B	Presettable divide by "N" counter	X	X	X	X	X	X	X	X
CD4019A	Quad AND/OR select Gate	X		X					
CD4019B	Quad AND/OR select Gate	X	X	X	X	X	X	X	X
CD4020A	14-Stage binary ripple counter	X		X					
CD4020B	14-Stage binary ripple counter	X	X	X	X	X	X	X	X
CD4021A	8-Stage static shift register	X		X					
CD4021B	8-Stage static shift register	X	X	X	X	X	X	X	X
CD4022A	Divide-by-8 counter/divider	X		X					
CD4022B	Divide-by-8 counter/divider	X	X	X	X	X	X	X	X
CD4023A	Triple 3-input NAND Gate	X		X	X				
CD4023B	Triple 3-input NAND Gate	X	X	X		X	X	X	X
CD4023UB	Triple 3-input NAND Gate	X	X			X	X		
CD4024A	7-Stage binary ripple counter	X		X					
CD4024B	7-Stage binary ripple counter	X	X	X	X	X	X	X	X
CD4025A	Triple 3-input NOR Gate	X		X					
CD4025B	Triple 3-iNput NOR Gate	X	X	X	X	X	X	X	X
CD4025UB	Triple 3-input NOR Gate	X	X			X	X		
CD4026A	Decade Counter/Divider	X							
CD4026B	Decade counter/divider	X	X			X	X		
CD4027A	Dual "J-K" flip-flop with set/reset capability	X		X					
CD4027B	Dual "J-K" flip-flop with set/reset capability	X	X	X	X	X	X	X	X
CD4028A	BCD-to-decimal decoder	X							
CD4028B	BCD-to-decimal decoder	X	X	X	X	X	X	X	X
CD4029A	Presettable up/down counter	X							
CD4029B	Presettable up/down counter	X	X			X	X		
CD4030A	Quad Exclusive-OR Gate	X							
CD4030B	Quad Exclusive-OR Gate	X	X	X	X	X	X	X	X
CD4031A	64-stage static shift register	X		X					
CD4031B	64-Stage static shift register	X	X			X	X		
CD4033B	Decade counter/divider	X	X			X	X		
CD4034B	8-Stage static shift register	X	X			X	X		
CD4035B	4-Stage parallel in/parallel out shift register	X	X			X	X		
CD4040A	12-Stage binary ripple counter	X							
CD4040B	12-Stage binary ripple counter	X	X			X	X		
CD4041A	Quad True/complement buffer	X							
CD4041UB	Quad True/complement buffer	X	X	X	X	X	X	X	X
CD4042A	Quad Clocked "D" latch	X							
CD4042B	Quad Clocked "D" latch	X	X			X	X		
CD4043A	Quad NOR R/S latch (3-state outputs)	X							
CD4043B	Quad NOR R/S latch (3-state outputs)	X	X			X	X		
CD4044A	Quad NAND R/S latch (3-state outputs)	X							
CD4044B	Quad NAND R/S latch (3-state outputs)	X	X			X	X		
CD4046A	Micropower phase-locked loop	X							

High-Reliability CD4000 Slash-Series Types

TYPE	DESCRIPTION	CLASS B				CLASS S			
		Mil-Std-883		Mil-M-38510		Mil-Std-883		Mil-M-38510	
		Non-Compliant	Compliant	Stan-dard	Rad Hard	Stan-dard	Rad Hard	Stan-dard	Rad Hard
CD4046B	Micropower phase locked loop	X	X			X	X		
CD4047B	Monostable/A-stable multivibrator	X	X			X	X		
CD4048A	Multifunctional expandable 8-input Gate	X							
CD4048B	Multifunctional expandable 8-input Gate	X	X			X	X		
CD4049A	Hex buffer/converter (inverting)	X		X					
CD4049UB	Hex buffer/converter (inverting)	X	X	X	X	X	X	X	X
CD4050A	Hex buffer/converter (non-inverting)	X		X					
CD4050B	Hex buffer/converter (non-inverting)	X	X	X	X	X	X	X	X
CD4051B	8-Channel analog multiplexer/ demultiplexer	X	X			X	X		
CD4052B	4-Channel analog multiplexer/ demultiplexer	X	X			X	X		
CD4053B	Triple 2-channel analog multiplexer demultiplexer	X	X			X	X		
CD4054B	4-Segment display driver		X			X	X		
CD4055B	BCD-to-7-segment decoder/driver with "display frequency" output		X			X	X		
CD4056B	BCD-to-7-segment decoder driver with strobed-latch function		X			X	X		
CD4059A	Programmable divide-by- "N" counter	X							
CD4060A	14-Stage binary ripple counter/divider and oscillator	X							
CD4060B	14-Stage binary ripple counter/divider and oscillator	X	X			X	X		
CD4063B	4-Bit magnitude comparator	X	X			X	X		
CD4066B	Quad bilateral switch	X	X	X	X	X	X	X	X
CD4067B	16-channel analog multiplexers/ demultiplexers	X	X			X	X		
CD4068B	8-Input NAND/AND gate	X	X			X	X		
CD4069UB	Hex inverter	X	X	X	X	X	X	X	X
CD4070B	Quad exclusive-OR gate	X	X	X	X	X	X	X	X
CD4071B	Quad 2-input OR gate	X	X	X	X	X	X	X	X
CD4072B	Dual 4-input OR gate	X	X	X		X	X		
CD4073B	Triple 3-input AND gate	X	X	X		X	X		
CD4075B	Triple 3-input OR gate	X	X	X		X	X		
CD4076B	4-Bit "D" flip-flop (3-state outputs)	X	X			X	X		
CD4077B	Quad exclusive-NOR gate	X	X	X		X	X		
CD4078B	8-Bit NOR/OR gate					X	X		
CD4081B	Quad 2-input AND gate	X	X	X	X	X	X		
CD4082B	Dual 4-input AND gate	X	X	X		X	X	X	X
CD4085B	Dual 2-wide, 2-input AND/OR/ INVERT (AOI) gate	X	X	X	X	X	X	X	X
CD4086B	Expandable 4-wide, 2-input AND/OR INVERT (AOI) gate	X	X	X	X	X	X	X	X
CD4089B	Binary rate multiplier	X	X			X	X		
CD4093B	Quad 2-input NAND Schmitt Trigger	X	X			X	X		
CD4094B	8-Stage shift-and-store bus register	X	X			X	X		
CD4095B	Gated "J-K" flip-flop (non-inverting)	X	X			X	X		
CD4096B	Gated "J-K" flip-flop (inverting and non-inverting)	X	X			X	X		
CD4097B	8-Channel analog multiplexer/ demultiplexer	X	X			X	X		
CD4098B	Dual monostable multivibrator	X	X	X		X	X		
CD4099B	8-Bit addressable latch	X	X	X		X	X		
CD4502B	Strobed hex inverter/buffer	X	X	X	X	X	X	X	X
CD4503B	Hex buffer (non-inverting)	X	X			X	X		
CD4508B	Dual 4-bit latch	X	X			X	X		

High-Reliability CD4000 Slash-Series Types

		CLASS B				CLASS S			
		Mil-Std-883		Mil-M-38510		Mil-Std-883		Mil-M-38510	
TYPE	DESCRIPTION	Non-Compliant	Compliant	Stan-dard	Rad Hard	Stan-dard	Rad Hard	Stan-dard	Rad Hard
CD4510B	Presettable 4-bit BCD up/down counter	X	X			X	X		
CD4511B	BCD-to-7-segment latch decoder/driver	X	X			X	X		
CD4512B	8-Channel data selector (3-state output)	X	X			X	X		
CD4514B	4-Bit latch/4-to-16-line decoder (outputs low)	X	X			X	X		
CD4515B	4-Bit latch/4-to-16-line decoder (outputs low)	X	X			X	X		
CD4516B	Presettable 4-bit binary up/down counter	X	X			X	X		
CD4517B	Dual 64-bit shift register	X	X			X	X		
CD4518B	Dual BCD up counter	X	X			X	X		
CD4520B	Dual binary up counter	X	X			X	X		
CD4527B	BCD rate multiplier	X	X			X	X		
CD4532B	8-Input priority encoder	X	X			X	X		
CD4536B	Programmable timer	X	X			X	X		
CD14538B	Dual precision monostable multivibrator		X			X	X		
CD4541B	CMOS programmable timer		X			X	X		
CD4543B	CMOS BCD-to-seven-segment latch/ decoder/driver for liquid-crystal displays		X			X	X		
CD4555B	Dual 1-of-4 decoder/demultiplexer (outputs high)		X			X	X		
CD4556B	Dual 1-of-4 decoder/demultiplexer (outputs low)	X	X			X	X		
CD4585B	4-Bit magnitude comparator		X			X	X		
CD4724B	8-Bit addressable latch		X			X	X		
CD40100B	32-bit left/right shift register	X	X			X	X		
CD40101B	9-Bit parity generator/checker	X	X			X	X		
CD40102B	Presettable 2-decade BCD down counter	X	X			X	X		
CD40103B	Presettable 8-bit binary down counter	X	X			X	X		
CD40104B	4-Bit bidirectional universal shift register	X	X			X	X		
CD40105B	4-Bit x 16 word FiFo buffer register	X	X			X	X		
CD40106B	Hex Schmitt Trigger	X	X			X	X		
CD40107B	Dual 2-input NAND buffer/driver	X	X			X	X		
CD40108B	4 x 4 Multiport register	X	X			X	X		
CD40109B	Quad low-to-high voltage interface	X	X			X	X		
CD40110B	Decade up-down counter/decoder/ latch/display driver	X	X			X	X		
CD40116B	CMOS high-speed 8-bit bidirectional CMOS/TTL interface level converter	X				X	X		
CD40147B	10-Line to 4-line BCD priority encoder	X	X			X	X		
CD40160B	Decade counter with asynchronous clear	X	X			X	X		
CD40161B	Binary counter with asynchronous clear	X	X			X	X		
CD40162B	Decade counter with synchronous clear	X	X			X	X		
CD40163B	Binary counter with synchronous clear	X	X			X	X		
CD40174B	Hex "D" flip-flop	X	X			X	X		
CD40175B	CMOS Quad 'D'-type flip-flop	X	X			X	X		
CD40181B	4-Bit arithmetic logic unit	X	X			X	X		
CD40182B	Look-ahead-carry block	X	X			X	X		
CD40192B	Presettable 4-Bit BCD up/down counter	X	X			X	X		
CD40193B	Presettalbe 4-Bit binary up/down counter	X	X			X	X		
CD40194B	4-Bit bidirectional universal shift register	X	X			X	X		
CD40208B	4 x 4 Multiport register	X	X			X	X		
CD40257B	Quad 2-line-to-1-line data selector	X	X			X	X		

CMOS Logic	DESCRIPTION	CLASS B			CLASS S
		Mil-Std 883C (Note 1)	SMD/ DESC (Note 2)	Mil-M 38510 (Note 3)	Mil-Std-883 Non-Compliant Rad Hard
CD54HC237	3-to-8 Line Decoder	X			
CD54HC238	3-to-8 Line Decoder/Demultiplexer	X	X		
CD54HC240	Octal Buffer/Line Driver, 3-State, Inverting	X	X		
CD54HC241	Octal Buffer/Line Driver, 3-State	X			
CD54HC242	Quad Bus Transceiver, 3-State, Inverting	X			
CD54HC243	Quad Bus Transceiver, 3-State	X	X		
CD54HC244	Octal Buffer/Line Driver, 3-State	X	X	X	X
CD54HC245	Octal Bus Transceiver, 3-State	X	X		X
CD54HC251	8-Input Multiplexer, 3-State	X	X		
CD54HC253	Dual 4-Input Multiplexer, 3-State	X			
CD54HC257	Quad 2-Input Multiplexer, 3-State	X	X		
CD54HC258	Quad 2-Line-to-4 Line Data Selector	X			
CD54HC259	8-Bit Addressable Latch	X	X		
CD54HC273	Octal D-Type Flip-Flop w/RESET	X	X		X
CD54HC280	9-Bit Odd/Even Parity Generator/Checker	X	X		
CD54HC283	4-Bit Full Adder w/Fast Carry	X			
CD54HC297	Digital Phase-Locked-Loop Filter	X			
CD54HC299	8-Bit Universal Shift Register, 3-State	X	X		
CD54HC354	8-Input Multiplexer/Register, 3-State	X			
CD54HC356	8-Input Multiplexer/Register, 3-State	X			
CD54HC365	Hex Buffer/Line Driver, 3-State	X	X		
CD54HC366	Hex Buffer/Line Driver, 3-State, Inverting	X	X		
CD54HC367	Hex Buffer/Line Driver, 3-State	X	X		
CD54HC368	Hex Buffer/Line Driver, 3-State, Inverting	X	X		
CD54HC373	Octal Transparent Latch, 3-State	X	X	X	X
CD54HC374	Octal D-Type Flip-Flop, 3-State	X	X		
CD54HC377	Octal D-Type Flip-Flop with Data Enable	X	X		
CD54HC390	Dual Decade Ripple Counter	X	X		
CD54HC393	Dual 4-Bit Binary Ripple Counter	X	X		
CD54HC423	Dual Retriggerable Monostable Multivibrator with Reset	X			
CD54HC533	Octal Transparent Latch, 3-State, Inverting	X	X		
CD54HC534	Octal D-Type Flip-Flop, 3-State, Inverting	X	X		
CD54HC540	Octal Buffer/Line Driver, 3-State, Inverting	X			
CD54HC541	Octal Buffer/Line Driver, 3-State	X			
CD54HC563	Octal Transparent Latch, 3-State, Inverting	X	X		
CD54HC564	Octal D-Type Flip-Flop, 3-State, Inverting	X	X		
CD54HC573	Octal Transparent Latch, 3-State	X	X		
CD54HC574	Octal D-Type Flip-Flop, 3-State	X			
CD54HC583	4-Bit Full Adder w/Fast Carry	X			
CD54HC597	8-Bit Shift Register with I/P Latch	X			
CD54HC640	Octal Bus Transceiver, 3-State Inverting	X	X		
CD54HC643	Octal Bus Transceiver, 3-State, True/Inverting	X			
CD54HC646	Octal Bus Transceiver/Register, 3-State	X	X		
CD54HC648	Octal Bus Transceiver/Register, 3-State, Inverting	X			
CD54HC670	4 x 4 Register File, 3-State	X			
CD54HC688	8-Bit Magnitude Comparator	X	X		
CD54HC4002	Dual 4-Input NOR Gate	X	X		
CD54HC4015	Dual 4-Bit Serial-In/Parallel-Out Shift Register	X			
CD54HC4016	Quad Bilateral Switch	X			
CD54HC4017	Johnson Decade Counter w/10 Decoded Outputs	X	X		
CD54HC4020	14-Stage Binary Ripple Counter	X	X		
CD54HC4024	7-Stage Binary Ripple Counter	X	X		
CD54HC4040	12-Bit Binary Ripple Counter	X	X		
CD54HC4046	Phase-Locked Loop with VCO	X			
CD54HC4049	Hex Inverting HIGH-to-LOW Level Shifter	X	X		
CD54HC4050	Hex HIGH-to-LOW Level Shifter	X	X		
CD54HC4051	8-Channel Analog Multiplexer/Demultiplexer	X			
CD54HC4052	Dual 4-Channel Analog Multiplexer/Demultiplexer	X	X		
CD54HC4053	Triple 2-Channel Analog Multiplexer/Demultiplexer	X	X		
CD54HC4059	Programmable Divided-by-"N" Counter	X	X		

NOTE 1 — 3A is 883 Revision C full compliant, Para 1.2.1
NOTE 2 — 3A devices are dual marked with the SMD/DESC drawing or standard military drawing.
NOTE 3 — B is JAN38510 Class B Device

CMOS Logic	DESCRIPTION	CLASS B			CLASS S
		Mil-Std 883C (Note 1)	SMD/ DESC (Note 2)	Mil-M 38510 (Note 3)	Mil-Std-883 Non-Compliant Rad Hard
CD54HC00	Quad 2-Input NAND Gate	X	X	X	X
CD54HC02	Quad 2-Input NOR Gate	X	X	X	X
CD54HC03	Quad 2-Input NAND Gate with Open Collector	X	X		
CD54HC04	Hex Inverter	X	X	X	X
CD54HC08	Quad 2-Input AND Gate	X	X	X	
CD54HC10	Triple 3-Input NAND Gate	X	X	X	X
CD54HC11	Triple 3-Input AND Gate	X	X		
CD54HC14	Hex Inverting Schmitt Trigger	X	X		
CD54HC20	Dual 4-Input NAND Gate	X	X		
CD54HC21	Dual 4-Input AND Gate	X	X		
CD54HC27	Triple 3-Input NOR Gate	X	X		
CD54HC30	8-Input NAND Gate	X	X		
CD54HC32	Quad 2-Input OR Gate	X	X	X	
CD54HC42	BCD-to-Decimal Decoder (1-to-10)	X	X		
CD54HC73	Dual J-K Flip-Flop w/RESET	X	X		
CD54HC74	Dual D Flip-Flop w/SET and RESET	X	X	X	X
CD54HC75	Quad Bistable Transparent Latch	X	X		
CD54HC85	4-Bit Magnitude Comparator	X	X		
CD54HC86	Quad 2-Input EXCLUSIVE-OR Gate	X	X		
CD54HC93	4-Bit Binary Ripple Counter	X			
CD54HC107	Dual J-K Flip-Flop w/RESET	X	X		
CD54HC109	Dual J-K Flip-Flop w/SET and RESET	X	X		
CD54HC112	Dual J-K Flip-Flop w/SET and RESET	X	X		
CD54HC123	Dual Retriggerable Monostable Multivibrator w/RESET	X	X		
CD54HC125	Quad 3-State Buffer	X	X		
CD54HC126	Quad 3-State Buffer	X	X		
CD54HC132	Quad 2-input NAND Schmitt Trigger	X	X		
CD54HC137	3-to-8-Line Decoder w/Latch, Inverting	X			
CD54HC138	3-to-8-Line Decoder/Demultiplexer, Inverting	X	X		X
CD54HC139	Dual 2-of-4-Line Decoder/Demultiplexer	X	X		
CD54HC147	10-to-4-Line Priority Encoder	X	X		
CD54HC151	8-Input Multiplexer	X	X		
CD54HC153	Dual 4-Input Multiplexer	X	X		
CD54HC154	4-to-16-Line Decoder/Demultiplexer	X	X		
CD54HC157	Quad 2-Input Multiplexer	X	X		
CD54HC158	Quad 2-Input Multiplexer, Inverting	X	X		
CD54HC160	Synchronous BCD Decade Counter, Asynchronous Reset	X	X		
CD54HC161	Synchronous 4-Bit Binary Counter, Asynchronous Reset	X	X		
CD54HC162	Synchronous BCD Decade Counter, Synchronous Reset	X	X		
CD54HC163	Synchronous 4-Bit Binary Counter, Synchronous Reset	X	X		
CD54HC164	8-Bit Serial-In Parallel-Out Shift Register	X	X		
CD54HC165	8-Bit Parallel-In Serial-Out Shift Register	X	X		
CD54HC166	8-Bit Parallel-In Serial-Out Shift Register	X			
CD54HC173	Quad D-Type Flip-Flop, 3-State	X	X		
CD54HC174	Hex D-Type Flip-Flop w/RESET	X	X		
CD54HC175	Quad D-Type Flip-Flop w/RESET	X	X		
CD54HC181	ALU	X			
CD54HC182	Carry Generator	X			
CD54HC190	Presettable Synchronous BCD Decade Up/Down Counter	X			X
CD54HC191	Synchronous 4-Bit Binary Up/Down Counter	X	X		
CD54HC192	Synchronous BCD Decade Up/Down Counter	X	X		
CD54HC193	Synchronous 4-Bit Binary Up/Down Counter	X	X		
CD54HC194	4-Bit Bidirectional Universal Shift Register	X	X		
CD54HC195	4-Bit Parallel Access Shift Register	X	X		
CD54HC221	Dual Monostable Multivibrator w/RESET	X	X		

NOTE 1 — 3A is 883 Revision C full compliant, Para 1.2.1
NOTE 2 — 3A devices are dual marked with the SMD/DESC drawing or standard military drawing.
NOTE 3 — B is JAN38510 Class B Device

High-Reliability CD54HC-Series Types

CMOS Logic	DESCRIPTION	CLASS B			CLASS S
		Mil-Std 883C (Note 1)	SMD/ DESC (Note 2)	Mil-M 38510 (Note 3)	Mil-Std-883 Non-Compliant Rad Hard
CD54HC4060	14-Stage Binary Ripple Counter w/Oscillator	X	X		
CD54HC4066	Quad Bilateral Switch	X			
CD54HC4067	16-Channel Analog Multiplexer/Demultiplexer	X			
CD54HC4075	Triple 3-Input OR Gate	X	X		
CD54HC4094	8-Stage Shift-and-Store Bus Register	X			
CD54HC4316	Quad Analog Switch	X			
CD54HC4351	Analog Multiplexer w/Latch	X			
CD54HC4352	Analog Multiplexer w/Latch	X			
CD54HC4353	Analog Multiplexer w/Latch	X			
CD54HC4510	Up/Down Counter, BCD	X			
CD54HC4511	BCD-to-7-Segment Latch/Decoder/Driver	X	X		
CD54HC4514	4-to-16-Line Decoder/Demultiplexer w/Input Latches	X			
CD54HC4515	4-to-16-Line Decoder with Input Latches	X			
CD54HC4516	Up/Down Counter, Binary	X			
CD54HC4518	Dual Synchronous BCD Counter	X			
CD54HC4520	Dual 4-Bit Synchronous Binary Counter	X			
CD54HC4538	Dual Precision Monostable Multivibrator	X	X		
CD54HC4543	BCD-to-7-Segment Latch/Decoder/Driver for LCDs	X			
CD54HC7046	Phase-Locked Loop with In-Lock Detection	X			
CD54HC7266	Quad Exclusive NOR	X	X		
CD54HC40102	8-Bit Synchronous BCD Down Counter	X			
CD54HC40103	8-Bit Binary Down Counter	X			
CD54HC40104	4-Bit Bidirectional Universal Shift Register, 3-State	X			
CD54HC40105	4 Bits x 16 Words FIFO Register	X			
CD54HCU04	Hex Inverter (Unbuffered)	X	X		

High-Reliability CD54HCT-Series Types

CMOS Logic	DESCRIPTION	CLASS B			CLASS S
		Mil-Std 883C (Note 1)	SMD/ DESC (Note 2)	Mil-M 38510 (Note 3)	Mil-Std-883 Non-Compliant Rad Hard
CD54HCT00	Quad 2-Input NAND Gate	X	X		X
CD54HCT02	Quad 2-Input NOR Gate	X			X
CD54HCT03	Quad 2-Input NAND Gate with Open Collector	X			
CD54HCT04	Hex Inverter	X			X
CD54HCT08	Quad 2-Input AND Gate	X	X		X
CD54HCT10	Triple 3-Input NAND Gate	X			X
CD54HCT11	Triple 3-Input AND Gate	X	X		X
CD54HCT14	Hex Inverting Schmitt Trigger	X	X		X
CD54HCT20	Dual 4-Input NAND Gate	X			X
CD54HCT21	Dual 4-Input AND Gate	X			X
CD54HCT27	Triple 3-Input NOR Gate	X			X
CD54HCT30	8-Input NAND Gate	X			
CD54HCT32	Quad 2-Input OR Gate	X	X		X
CD54HCT42	BCD-to-Decimal Decoder (1-to-10)	X			
CD54HCT73	Dual J-K Flip-Flop w/RESET	X			
CD54HCT74	Dual D Flip-Flop w/SET and RESET	X	X		X
CD54HCT75	Quad Bistable Transparent Latch	X			X
CD54HCT85	4-Bit Magnitude Comparator	X	X		
CD54HCT86	Quad 2-Input EXCLUSIVE-OR Gate	X			X
CD54HCT93	4-Bit Binary Ripple Counter	X			X
CD54HCT107	Dual J-K Flip-Flop w/RESET	X			
CD54HCT109	Dual J-K Flip-Flop w/SET and RESET	X			X
CD54HCT112	Dual J-K Flip-Flop w/SET and RESET	X			X
CD54HCT123	Dual Retriggerable Monostable Multivibrator w/RESET	X			
CD54HCT125	Quad 3-State Buffer	X			

NOTE 1 — 3A is 883 Revision C full compliant, Para 1.2.1
NOTE 2 — 3A devices are dual marked with the SMD/DESC drawing or standard military drawing.
NOTE 3 — B is JAN38510 Class B Device

CMOS Logic	DESCRIPTION	CLASS B			CLASS S
		Mil-Std 883C (Note 1)	SMD/ DESC (Note 2)	Mil-M 38510 (Note 3)	Mil-Std-883 Non-Compliant Rad Hard
CD54HCT126	Quad 3-State Buffer	X			
CD54HCT132	Quad 2-input NAND Schmitt Trigger	X			X
CD54HCT137	3-to-8-Line Decoder w/Latch, Inverting	X			
CD54HCT138	3-to-8-Line Decoder/Demultiplexer, Inverting	X	X		X
CD54HCT139	Dual 2-of-4-Line Decoder/Demultiplexer	X			X
CD54HCT147	10-to-4-Line Priority Encoder	X			X
CD54HCT151	8-Input Multiplexer	X			
CD54HCT153	Dual 4-Input Multiplexer	X			X
CD54HCT154	4-to-16-Line Decoder/Demultiplexer	X	X		
CD54HCT157	Quad 2-Input Multiplexer	X			X
CD54HCT158	Quad 2-Input Multiplexer, Inverting	X			
CD54HCT160	Synchronous BCD Decade Counter, Asynchronous Reset	X			X
CD54HCT161	Synchronous 4-Bit Binary Counter, Asynchronous Reset	X	X		X
CD54HCT162	Synchronous BCD Decade Counter, Synchronous Reset	X			
CD54HCT163	Synchronous 4-Bit Binary Counter, Synchronous Reset	X			X
CD54HCT164	8-Bit Serial-In Parallel-Out Shift Register	X			
CD54HCT165	8-Bit Parallel-In Serial-Out Shift Register	X	X		
CD54HCT166	8-Bit Parallel-In Serial-Out Shift Register	X			
CD54HCT173	Quad D-Type Flip-Flop, 3-State	X			
CD54HCT174	Hex D-Type Flip-Flop w/RESET	X			
CD54HCT175	Quad D-Type Flip-Flop w/RESET	X			
CD54HCT181	ALU	X			
CD54HCT182	Carry Generator	X			
CD54HCT190	Presettable Synchronous BCD Decade Up/Down Counter	X			X
CD54HCT191	Synchronous 4-Bit Binary Up/Down Counter	X	X		X
CD54HCT192	Synchronous BCD Decade Up/Down Counter	X			
CD54HCT193	Synchronous 4-Bit Binary Up/Down Counter	X			X
CD54HCT194	4-Bit Bidirectional Universal Shift Register	X			
CD54HCT195	4-Bit Parallel Access Shift Register	X			
CD54HCT221	Dual Monostable Multivibrator w/RESET	X			
CD54HCT237	3-to-8 Line Decoder	X			
CD54HCT238	3-to-8 Line Decoder/Demultiplexer	X			
CD54HCT240	Octal Buffer/Line Driver, 3-State, Inverting	X	X		X
CD54HCT241	Octal Buffer/Line Driver, 3-State	X			
CD54HCT242	Quad Bus Transceiver, 3-State, Inverting	X			
CD54HCT243	Quad Bus Transceiver, 3-State	X			
CD54HCT244	Octal Buffer/Line Driver, 3-State	X	X	X	X
CD54HCT245	Octal Bus Transceiver, 3-State	X	X		X
CD54HCT251	8-Input Multiplexer, 3-State	X			
CD54HCT253	Dual 4-Input Multiplexer, 3-State	X			
CD54HCT257	Quad 2-Input Multiplexer, 3-State	X			
CD54HCT258	Quad 2-Line-to-4 Line Data Selector	X			
CD54HCT259	8-Bit Addressable Latch	X			
CD54HCT273	Octal D-Type Flip-Flop w/RESET	X	X		X
CD54HCT280	9-Bit Odd/Even Parity Generator/Checker	X			
CD54HCT283	4-Bit Full Adder w/Fast Carry	X			
CD54HCT297	Digital Phase-Locked-Loop Filter	X			
CD54HCT299	8-Bit Universal Shift Register, 3-State	X			X
CD54HCT354	8-Input Multiplexer/Register, 3-State	X			
CD54HCT356	8-Input Multiplexer/Register, 3-State	X			
CD54HCT365	Hex Buffer/Line Driver, 3-State	X			X
CD54HCT366	Hex Buffer/Line Driver, 3-State, Inverting	X			
CD54HCT367	Hex Buffer/Line Driver, 3-State	X			
CD54HCT368	Hex Buffer/Line Driver, 3-State, Inverting	X			
CD54HCT373	Octal Transparent Latch, 3-State	X	X		X

NOTE 1 — 3A is 883 Revision C full compliant, Para 1.2.1
NOTE 2 — 3A devices are dual marked with the SMD/DESC drawing or standard military drawing.
NOTE 3 — B is JAN38510 Class B Device

CMOS Logic	DESCRIPTION	CLASS B			CLASS S
		Mil-Std 883C (Note 1)	SMD/ DESC (Note 2)	Mil-M 38510 (Note 3)	Mil-Std-883 Non-Compliant Rad Hard
CD54HCT374	Octal D-Type Flip-Flop, 3-State	X	X		X
CD54HCT377	Octal D-Type Flip-Flop with Data Enable	X			
CD54HCT390	Dual Decade Ripple Counter	X			X
CD54HCT393	Dual 4-Bit Binary Ripple Counter	X			
CD54HCT423	Dual Retriggerable Monostable Multivibrator with Reset	X			
CD54HCT533	Octal Transparent Latch, 3-State, Inverting	X			
CD54HCT534	Octal D-Type Flip-Flop, 3-State, Inverting	X			
CD54HCT540	Octal Buffer/Line Driver, 3-State, Inverting	X			X
CD54HCT541	Octal Buffer/Line Driver, 3-State	X			
CD54HCT563	Octal Transparent Latch, 3-State, Inverting	X			
CD54HCT564	Octal D-Type Flip-Flop, 3-State, Inverting	X			
CD54HCT573	Octal Transparent Latch, 3-State	X	X		
CD54HCT574	Octal D-Type Flip-Flop, 3-State	X			X
CD54HCT583	4-Bit Full Adder w/Fast Carry	X			
CD54HCT597	8-Bit Shift Register with I/P Latch	X			
CD54HCT640	Octal Bus Transceiver, 3-State Inverting	X			
CD54HCT643	Octal Bus Transceiver, 3-State, True/Inverting	X			
CD54HCT646	Octal Bus Transceiver/Register, 3-State	X			X
CD54HCT648	Octal Bus Transceiver/Register, 3-State, Inverting	X			
CD54HCT670	4 x 4 Register File, 3-State	X			
CD54HCT688	8-Bit Magnitude Comparator	X	X		
CD54HCT4002	Dual 4-Input NOR Gate	X			X
CD54HCT4015	Dual 4-Bit Serial-In/Parallel-Out Shift Register	X			
CD54HCT4016	Quad Bilateral Switch	X			
CD54HCT4017	Johnson Decade Counter w/10 Decoded Outputs	X			
CD54HCT4020	14-Stage Binary Ripple Counter	X			
CD54HCT4024	7-Stage Binary Ripple Counter	X			
CD54HCT4040	12-Bit Binary Ripple Counter	X			
CD54HCT4046A	Phase-Locked Loop with VCO	X			
—	Hex Inverting HIGH-to-LOW Level Shifter	—			
—	Hex HIGH-to-LOW Level Shifter	—			
CD54HCT4051	8-Channel Analog Multiplexer/Demultiplexer	X			
CD54HCT4052	Dual 4-Channel Analog Multiplexer/Demultiplexer	X			
CD54HCT4053	Triple 2-Channel Analog Multiplexer/Demultiplexer	X			
CD54HCT4059	Programmable Divided-by-"N" Counter	X	X		
CD54HCT4060	14-Stage Binary Ripple Counter w/Oscillator	X			
CD54HCT4066	Quad Bilateral Switch	X			
CD54HCT4067	16-Channel Analog Multiplexer/Demultiplexer	X			
CD54HCT4075	Triple 3-Input OR Gate	X			
CD54HCT4094	8-Stage Shift-and-Store Bus Register	X			
CD54HCT4316	Quad Analog Switch	X			
CD54HCT4351	Analog Multiplexer w/Latch	X			
CD54HCT4352	Analog Multiplexer w/Latch	X			
CD54HCT4353	Analog Multiplexer w/Latch	X			
CD54HCT4510	Up/Down Counter, BCD	X			
CD54HCT4511	BCD-to-7-Segment Latch/Decoder/Driver	X			
CD54HCT4514	4-to-16-Line Decoder/Demultiplexer w/Input Latches	X			
CD54HCT4515	4-to-16-Line Decoder with Input Latches	X			
CD54HCT4516	Up/Down Counter, Binary	X			
CD54HCT4518	Dual Synchronous BCD Counter	X			
CD54HCT4520	Dual 4-Bit Synchronous Binary Counter	X			
CD54HCT4538	Dual Precision Monostable Multivibrator	X			
CD54HCT4543	BCD-to-7-Segment Latch/Decoder/Driver for LCDs	X			
CD54HCT7046A	Phase-Locked Loop with In-Lock Detection	X			
CD54HCT7266	Quad Exclusive NOR	X			X
CD54HCT40102	8-Bit Synchronous BCD Down Counter	X			
CD54HCT40103	8-Bit Binary Down Counter	X			
CD54HCT40104	4-Bit Bidirectional Universal Shift Register, 3-State	X			
CD54HCT40105	4 Bits x 16 Words FIFO Register	X			

NOTE 1 — 3A is 883 Revision C full compliant, Para 1.2.1
NOTE 2 — 3A devices are dual marked with the SMD/DESC drawing or standard military drawing.
NOTE 3 — B is JAN38510 Class B Device

High-Reliability High-Speed CMOS Logic/SMD/DESC Military Drawings Cross-Reference

DEVICE TYPE	SMD/DESC DWG NUMBER
CD54HC00F3A	8403701CX
CD54HCT00F3A	5962-8683101CX
CD54HC02F3A	8404101CX
CD54HC03F3A	5962-8764701CA
CD54HC04F3A	8409801CX
CD54HCU04F3A	8601001CX
CD54HC08F3A	8404701CX
CD54HCT05F3A	5962-868301CX
CD54HC10F3A	8403801CX
CD54HC11F3A	8404801CX
CD54HC14F3A	8409101CX
CD54HCT14F3A	5962-8689001EX
CD54HC20F3A	8403901CX
CD54HC21F3A	5962-8857601CX
CD54HC27F3A	8404201CX
CD54HC30F3A	8404001CX
CD54HC32F3A	8404501CX
CD54HCT32F3A	5962-8685201CX
CD54HC42F3A	5962-868210EX
CD54HC73F3A	5962-8515301CX
CD54HC74F3A	8405601CX
CD54HCT74F3A	5962-8685301CX
CD54HC75F3A	8407001EX
CD54HC85F3A	8601301EX
CD54HCT85F3A	5962-8867201EX
CD54HC86F3A	8404601CX
CD54HC107F3A	5962-8515401CX
CD54HC109F3A	8415001EX
CD54HC112F3A	8408801EX
CD54HC123F3A	5962-8684701EX
CD54HC125F3A	5962-8772101CA
CD54HC126F3A	5962-8684801CX
CD54HC138F3A	8406201EX
CD54HCT138F3A	8550401EX
CD54HC139F3A	8409201EX
CD54HC147F3A	8406401EX
CD54HC151F3A	8412801EX
CD54HC153F3A	8409301EX
CD54HC154F3A	5962-8682201JX
CD54HCT154F3A	5962-8670101JX
CD54HC157F3A	5962-8606101EX
CD54HC158F3A	5962-8682301EX
CD54HC160F3A	5962-8682401EX
CD54HC161F3A	8407501EX
CD54HCT161F3A	5962-8685401EX
CD54HC162F3A	8409401EX
CD54HC163F3A	8607601EX
CD54HC164F3A	8416201CX
CD54HC165F3A	8409501EX
CD54HCT165F3A	5962-8685501EX
CD54HC173F3A	5962-8682501EX
CD54HC174F3A	8407301EX
CD54HC175F3A	8408901EX
CD54HC191F3A	5962-8689101EX
CD54HCT191F3A	5962-8867101EA

DEVICE TYPE	SMD/DESC DWG NUMBER
CD54HC192F3A	5962-8772401EX
CD54HC193F3A	5962-8780801EX
CD54HC194F3A	5962-8682601EX
CD54HC195F3A	5962-8682701EX
CD54HC221F3A	5962-8780501EX
CD54HC237F3A	5962-8860601EA
CD54HC238F3A	5962-8688401EX
CD54HC240F3A	8407401RX
CD54HCT240F3A	8550501RX
CD54HC243F3A	8409001CX
CD54HC244F3A	8409601RX
CD54HCT244F3A	8513001RX
CD54HC245F3A	8408501RX
CD54HCT245F3A	8550601RX
CD54HC251F3A	8512501EX
CD54HC257F3A	8512401EX
CD54HC259F3A	8551901EX
CD54HC273F3A	8409901RX
CD54HCT273F3A	5962-8772501RX
CD54HC280F3A	8607701CX
CD54HC299F3A	5962-8780601RX
CD54HC365F3A	8500101EX
CD54HC366F3A	5962-8682801EX
CD54HC367F3A	8500201EX
CD54HC368F3A	5962-8681201EX
CD54HC373F3A	8407201RX
CD54HCT373F3A	5962-8686701RX
CD54HC374F3A	8407101RX
CD54HCT374F3A	8550701RX
CD54HC377F3A	5962-8780701RA
CD54HC390F3A	8600901EX
CD54HC393F3A	8410001CX
CD54HC533F3A	5962-8681301RX
CD54HC534F3A	5962-8681401RX
CD54HC563F3A	5962-8606201RX
CD54HC564F3A	5962-8681501RX
CD54HC573F3A	8512801RX
CD54HCT573F3A	5962-8685601RX
CD54HC640F3A	5962-8780901RX
CD54HC646F3A	5962-8688501JX
CD54HC688F3A	5962-8681801RX
CD54HCT688F3A	5962-8686701RX
CD54HC4002F3A	8404401CX
CD54HC4017F3A	8601101EX
CD54HC4020F3A	8500301EX
CD54HC4024F3A	8601201CX
CD54HC4040F3A	8500401EX
CD54HC4049F3A	5962-8681901EX
CD54HC4050F3A	5962-8682001EX
CD54HCT4059F3A	5962-8862401JX
CD54HC4060F3A	5962-8768001EX
CD54HC4075F3A	5962-8772201CX
CD54HC4538F3A	5962-8688601EX
CD54HC7266F3A	8404301CX

REFERENCE: Military Bulletin MIL-BUL-103
"LIST OF STANDARDIZED MILITARY DRAWINGS"

SMD/DESC Drawings/High-Reliability High-Speed CMOS Cross-Reference

SMD/DESC DWG NUMBER	DEVICE TYPE
5962-8515301CX	CD54HC73F3A
5962-8515401CX	CD54HC107F3A
5962-8606101EX	CD54HC157F3A
5962-8606201RX	CD54HC563F3A
5962-8670101JX	CD54HCT154F3A
5962-8681201EX	CD54HC368F3A
5962-8681301RX	CD54HC533F3A
5962-8681401RX	CD54HC5334F3A
5962-8681501RX	CD54HC564F3A
5962-8681801RX	CD54HC688F3A
5962-8681901EX	CD54HC4049F3A
5962-8682001EX	CD54HC4050F3A
5962-8682101EX	CD54HC42F3A
5962-8682201JX	CD54HC154F3A
5962-8682301EX	CD54HC158F3A
5962-8682401EX	CD54HC160F3A
5962-8682501EX	CD54HC173F3A
5962-8682601EX	CD54HC194F3A
5962-8682701EX	CD54HC195F3A
5962-8682801EX	CD54HC366F3A
5962-8683101CX	CD54HCT00F3A
5962-8684701EX	CD54HC123F3A
5962-8684801CX	CD54HC126F3A
5962-8685201CX	CD54HCT32F3A
5962-8685301CX	CD54HCT74F3A
5962-8685401EX	CD54HCT161F3A
5962-8685501EX	CD54HCT165F3A
5962-8685601RX	CD54HCT573F3A
5962-8685701RX	CD54HCT688F3A
5962-8686701RX	CD54HCT373F3A
5962-8688301CX	CD54HCT08F3A
5962-8688401EX	CD54HC238F3A
5962-8688501JX	CD54HC646F3A
5962-8688601EX	CD54HC4538F3A
5962-8689001CX	CD54HCT14F3A
5962-8689101EX	CD54HC191F3A
5962-8764701CX	CD54HC03F3A
5962-8768001EX	CD54HC4060F3A
5962-8772101CX	CD54HC125F3A
5962-8772201CX	CD54HC4075F3A
5962-8772401EX	CD54HC193F3A
5962-8772501RX	CD54HCT273F3A
5962-8780501EX	CD54HC221F3A
5962-8780601RX	CD54HC299F3A
5962-8780701RX	CD54HC377F3A
5962-8780801EX	CD54HC192F3A
5962-8780901RX	CD54HC640F3A
5962-8857601CX	CD54HCT21F3A
5962-8860601EA	CD54HC237F3A
5962-8862401JX	CD54HCT4059F3A
5962-8867101EX	CD54HCT191F3A
5962-8867201EX	CD54HCT85F3A
8403701CX	CD54HC00F3A
8403801CX	CD54HC10F3A
8403901CX	CD54HC20F3A

SMD/DESCDWG NUMBER	DEVICE TYPE
8404001CX	CD54HC30F3A
8404101CX	CD54HC02F3A
8404201CX	CD54HC27F3A
8404301CX	CD54HC7266F3A
8404401CX	CD54HC4002F3A
8404501CX	CD54HC32F3A
8404601CX	CD54HC86F3A
8404701CX	CD54HC08F3A
8404801CX	CD54HC11F3A
8405601CX	CD54HC74F3A
8406201EX	CD54HC138F3A
8406401EX	CD54HC147F3A
8407001EX	CD54HC75F3A
8407101RX	CD54HC374F3A
8407201RX	CD54HC373F3A
8407301EX	CD54HC174F3A
8407401RX	CD54HC240F3A
8407501EX	CD54HC161F3A
8408501RX	CD54HC245F3A
8408801EX	CD54HC112F3A
8408901EX	CD54HC175F3A
8409001CX	CD54HC243F3A
8409101CX	CD54HC14F3A
8409201EX	CD54HC139F3A
8409301EX	CD54HC153F3A
8409401EX	CD54HC162F3A
8409501EX	CD54HC165F3A
8409601RX	CD54HC244F3A
8409801CX	CD54HC04F3A
8409901RX	CD54HC273F3A
8410001CX	CD54HC393F3A
8412801EX	CD54HC151F3A
8415001EX	CD54HC109F3A
8416201CX	CD54HC164F3A
8500101EX	CD54HC365F3A
8500201EX	CD54HC367F3A
8500301EX	CD54HC4020F3A
8500401EX	CD54HC4040F3A
8512401EX	CD54HC357F3A
8512501EX	CD54HC251F3A
8512801RX	CD54HC573F3A
8513001RX	CD54HCT244F3A
8550401EX	CD54HCT138F3A
8550501RX	CD54HCT240F3A
8550601RX	CD54HCT245F3A
8550701RX	CD54HCT374F3A
8551901EX	CD54HC259F3A
8600901EX	CD54HC390F3A
8601001CX	CD54HCU04F3A
8601101EX	CD54HC4017F3A
8601201CX	CD54HC4024F3A
8601301EX	CD54HC85F3A
8607601EX	CD54HC163F3A
8607701CX	CD54HC280F3A

REFERENCE: Military Bulletin MIL-BUL-103
"LIST OF STANDARDIZED MILITARY DRAWINGS"

Type*	Description	Data Sheet File No.
HCS00MS	Quad 2 NAND (SSI)	2138
HCTS00MS	Quad 2 NAND (SSI)	2139
HCS02MS	Quad 2 NOR (SSI)	2137
HCTS02MS	Quad 2 NOR (SSI)	2137
HCTS04MS	Hex Inverter (SSI)	2140
HCTS08MS	Quad 2 AND (SSI)	2136
HCS10MS	Triple 3-Input NAND Gate (SSI)	—
HCTS10MS	Triple 3-Input NAND Gate (SSI)	—
HCTS11MS	Triple 3-Input AND Gate (SSI)	—
HCTS14MS	Hex Schmitt Trigger (SSI)	—
HCTS20MS	Dual 4 NAND (SSI)	—
HCTS21MS	Dual 4 AND (SSI)	—
HCTS27MS	Triple 3 NOR (SSI)	—
HCTS32MS	Quad 2-Input OR Gate	2248
HCTS74MS	Dual D FF (FF)	2142
HCS74MS	Dual D FF (FF)	2143
HCTS74MS	Dual D FF (FF)	2143
HCTS75MS	Dual 2-Bit Bistable Latch (FF)	—
HCTS86MS	Quad 2 EX-OR (SSI)	—
HCTS93MS	4-Bit Ripple Counter (MSI)	—
HCTS109MS	Dual JK FF (FF)	2141
HCTS112MS	Dual JK FF S/R (FF)	—
HCTS132MS	Quad 2-Input NAND Schmitt Trigger	—
HCTS138MS	3-to-8-Line Decoder (MSI)	—
HCS138MS	3-to-8-Line Decoder (MSI)	—
HCTS139MS	Dual 2-to-4 Decoder (MSI)	—
HCTS147MS	10-to-4 Line Priority Encoder	—
HCTS153MS	Dual 4-Input Multiplexer (MSI)	—

Type*	Description	Data Sheet File No.
HCTS157MS	Quad 2-Input Multiplexer	—
HCTS160MS	4-Bit BCD Decade Counter (MSI)	—
HCTS161MS	4-Bit Binary Counter (MSI)	2144
HCTS163MS	4-Bit Binary Counter (MSI)	—
HCTS190MS	4-Bit Binary U/D Counter (MSI)	—
HCS190MS	4-Bit Binary U/D Counter (MSI)	2251
HCTS191MS	4-Bit Binary U/D Counter (MSI)	—
HCTS193MS	Presettable Synchronous 4-Bit Up/Down Counter	—
HCTS240MS	Octal Buffer (MSI)	2105
HCS244MS†	Octal Buffer (MSI)	2132
HCTS244MS†	Octal Buffer (MSI)	2133
HCTS245MS†	Octal Bus Transceiver (MSI)	—
HCS245MS†	Octal Bus Transceiver (MSI)	—
HCS273MS†	Octal D F/F w/Reset (MSI)	—
HCTS273MS†	Octal D F/F w/Reset (MSI)	—
HCTS299MS	8-Bit Universal Shift Register, 3-State	—
HCTS365MS†	Hex Buffer (MSI)	—
HCTS373MS†	Octal Latch (MSI)	2131
HCS373MS†	Octal Latch (MSI)	2135
HCS374MS†	Octal D F/F (MSI)	2134
HCTS390MS	Dual Decade Ripple Counter	—
HCTS540MS†	Octal Buffer (MSI)	—
HCTS574MS†	Octal D F/F (MSI)	—
HCTS646MS†	Transceiver/Register (MSI)	—
HCTS4002MS	Dual 4 NOR (SSI)	—
HCTS7266MS	Quad 2 EX-NOR (SSI)	—

†Bus driver output stage.
*MS in the type designation indicates reliability screening to Class S flow charts.

High-Reliability CD54AC/ACT-Series ACL Types

TYPES	DESCRIPTION	883C CLASS B	SMD/ DESC
CD54AC/ACT00F	Quad 2-Input NAND Gate	X	X*
CD54AC/ACT02F	Quad 2-Input NOR Gate	X	
CD54AC/ACT04F	Hex Inverter/Buffer	X	X*
CD54AC/ACT05F	Hex Inverter/Buffer with Open-Drain Outputs	X	
CD54AC/ACT08F	Quad 2-Input AND Gate	X	X*
CD54AC/ACT10F	Triple 3-Input NAND Gate	X	
CD54AC/ACT14F	Hex Inverting Schmitt Trigger	X	
CD54AC/ACT20F	Dual 4-Input NAND Gate	X	
CD54AC/ACT32F	Quad 2-Input OR Gate	X	X**
CD54AC/ACT74F	Dual D Flip-Flop w/Set and Reset	X	
CD54AC/ACT86F	Quad 2-Input Exclusive-OR Gate	X	
CD54AC/ACT109F	Dual J-K Flip-Flop w/Set and Reset	X	
CD54AC/ACT112F	Dual J-K Flip-Flop w/Set and Reset	X	
CD54AC/ACT138F	3-to-8 Line Decoder/Demultiplexer, Inverting	X	X*
CD54AC/ACT139F	Dual 2-of-4 Line Decoder/Demultiplexer	X	
CD54AC/ACT151F	8-Input Multiplexer	X	
CD54AC/ACT153F	Dual 4-Input Multiplexer	X	
CD54AC/ACT157F	Quad 2-Input Multiplexer	X	
CD54AC/ACT158F	Quad 2-Input Multiplexer, Inverting	X	
CD54AC/ACT161F	Synchronous 4-Bit Binary Counter, Asynchronous Reset	X	
CD54AC/ACT163F	Synchronous 4-Bit Binary Counter, Synchronous Reset	X	
CD54AC/ACT164F	8-Bit Serial-In Parallel-Out Shift Register	X	
CD54AC/ACT174F	Hex D-Type Flip-Flop w/Reset	X	
CD54AC/ACT175F	Quad D-Type Flip-Flop w/Reset	X	
CD54AC/ACT191F	Synchronous 4-Bit Binary Up/Down Counter	X	
CD54AC/ACT193F	Synchronous 4-Bit Binary Up/Down Counter	X	
CD54AC/ACT238F	3-to-8 Line Decoder/Demultiplexer	X	
CD54AC/ACT240F	Octal Buffer Line Driver, 3-State, Inverting	X	
CD54AC/ACT241F	Octal Buffer Line Driver, 3-State	X	
CD54AC/ACT244F	Octal Buffer Line Driver, 3-State	X	
CD54AC/ACT245F	Octal-Bus Transceiver, 3-State	X	
CD54AC/ACT251F	8-Input Multiplexer, 3-State	X	
CD54AC/ACT253F	Dual 4-Input Multiplexer, 3-State	X	
CD54AC/ACT257F	Quad 2-Input Multiplexer, 3-State	X	
CD54AC/ACT258F	Quad 2-Line to 4-Line Data Selector	X	

*AC type only. **ACT type only.

High-Reliability CD54AC/ACT-Series ACL Types

TYPES	DESCRIPTION	883C CLASS B	SMD/ DESC
CD54AC/ACT273F	Octal D-Type Flip-Flop w/Reset	X	X*
CD54AC/ACT280F	8-Bit Odd/Even Parity Generator/Checker	X	
CD54AC/ACT283F	4-Bit Full Adder w/Fast Carry	X	
CD54AC/ACT299F	8-Bit Universal Shift Register, 3-State	X	
CD54AC/ACT323F	8-Bit Universal Shift Register, 3-State, (With Synchronous Reset)	X	
CD54AC/ACT373F	Octal D-Type Flip-Flop, 3-State	X	
CD54AC/ACT374F	Octal D Flip-Flop, 3-State	X	
CD54AC/ACT533F	Octal Transparent Latch, 3-State, Inverting	X	
CD54AC/ACT534F	Octal D Flip-Flop, 3-State, Inverting	X	
CD54AC/ACT540F	Octal Buffer Line Driver, 3-State, Inverting	X	
CD54AC/ACT541F	Octal Buffer Line Driver, 3-State	X	
CD54AC/ACT563F	Octal Inverting Transparent Latch, 3-State	X	
CD54AC/ACT564F	Octal D-Type Flip-Flop, 3-State, Inverting	X	
CD54AC/ACT573F	Octal Transparent Latch, 3-State	X	
CD54AC/ACT574F	Octal D-Type Flip-Flop, 3-State	X	
CD54AC/ACT623F	Octal Bus Transceiver 3-State	X	
CD54AC/ACT646F	Octal Bus Transceiver/Register, 3-State	X	
CD54AC/ACT647F	Octal Bus Transceiver/Register 3-State	X	
CD54AC/ACT648F	Octal Bus Transceiver/Register, 3-State, Inverting	X	
CD54AC/ACT649F	Octal Transceiver/Reg, 3-State, Inverting, open C	X	
CD54AC/ACT651F	Octal Transceiver/Reg, 3-State, Inverting, open C	X	
CD54AC/ACT652F	Octal Bus Transceiver/Reg, 3-State, open C		
CD54AC/ACT653F	Octal Transceiver/Reg, 3-State, open C	X	
CD54AC/ACT654F	Octal Transceiver/Reg, 3-State, open C	X	
CD54AC/ACT7060F	14 Stage Counter with Oscillator	X	
CD54AC/ACT7201F	512 x 9 Bit Parallel In-Out FIFO	X	
CD54AC/ACT7202F	1024 x 9 Bit Parallel Input FIFO	X	
CD54AC/ACT7623	Octal Bus Transceiver, 3 State, w/open Drain		

*AC type only

High-Reliability ACL, SMD/DESC Military Drawings Cross-Reference

DEVICE TYPE	SMD/DESC DWG NUMBER
CD54AC00F3A	5962-8754901CA
CD54ACT00F3A	5962-8769901CA
CD54AC04F3A	5962-8760901CA
CD54AC08F3A	5962-8761501CA
CA54AC32F3A	5962-8761401CA
CD54AC74F3A	5962-8852001CA
CD54ACT74F3A	5962-8752501CA
CD54AC138F3A	5962-8762201EA
CD54AC139F3A	5962-8762301EA
CD54ACT139F3A	5962-8755301EA
CD54AC174F3A	5962-8762601EA
CD54ACT174F3A	5962-8775701EA

DEVICE TYPE	SMD/DESC DWG NUMBER
CD54AC240F3A	5962-8755001RA
CD54ACT240F3A	5962-8775901RA
CD54AC241F3A	5962-8755101RA
CD54AC244F3A	5962-8755201RA
CD54ACT244F3A	5962-8776001RA
CD54AC245F3A	5962-8775801RA
CD54ACT245F3A	5962-8766301RA
CD54AC273F3A	5962-8755501RA
CD54ACT273F3A	5962-8755601RA
CD54AC374F3A	5962-8769401RA
CD54AC540F3A	5962-8769501RA

REFERENCE: Military Bulletin MIL-BUL-103
"LIST OF STANDARDIZED MILITARY DRAWINGS"

SMD/DESC Military Drawings, High-Reliability ACL Cross-Reference

SMD/DESC DWG NUMBER	DEVICE TYPE
5962-8752501CA	CD54ACT74F3A
5962-8754901CA	CD54AC00F3A
5962-8755001RA	CD54AC240F3A
5962-8755101RA	CD54AC241F3A
5962-8755201RA	CD54AC244F3A
5962-8755301EA	CD54ACT139F3A
5962-8755501RA	CD54AC273F3A
5962-8755601RA	CD54ACT273F3A
5962-8760901CA	CD54AC04F3A
5962-8761401CA	CA54AC32F3A
5962-8761501CA	CD54AC08F3A
5962-8762201EA	CD54AC138F3A

**Awaiting final DESC approval.

SMD/DESC DWG NUMBER	DEVICE TYPE
5962-8762301EA	CD54AC139F3A
5962-8762601EA	CD54AC174F3A
5962-8766301RA	CD54ACT245F3A
5962-8769401RA	CD54AC374F3A
5962-8769501RA	CD54AC540F3A
5962-8769901CA	CD54ACT00F3A
5962-8775701EA	CD54ACT174F3A
5962-8775801RA	CD54AC245F3A
5962-8775901RA	CD54ACT240F3A
5962-8776001RA	CD54ACT244F3A
5962-8852001CA	CD54AC74F3A

REFERENCE: Military Bulletin MIL-BUL-103
"LIST OF STANDARDIZED MILITARY DRAWINGS"

DEVICE TYPE	DESCRIPTION/FEATURES	PRODUCT GRADES				
		JAN	SMD/ DESC	/883	-8	-Q
CDP1802ACD3	8 Bit Microprocessor			X		
CDP1802AD3	8 Bit Microprocessor			X		
CDP1821CD3	1024 Word x 1 Bit SRAM			X		
CDP1822CD3	256 Word x 4 Bit SRAM			X		
CDP1823CD3	128 Word x 8 Bit SRAM			X		
CDP1824CD3	32 Word x 8 Bit SRAM			X		
CDP1824D3	32 Word x 8 Bit SRAM			X		
CDP1852CD3	I/O Port			X		
CDP1852D3	I/O Port			X		
CDP1853CD3	N Bit 1-of-8 Decoder			X		
CDP1853D3	N Bit 1-of-8 Decoder			X		
CDP1854ACD3	UART			X		
CDP1854AD3	UART			X		
CDP1831CD3	512 Word x 8 Bit ROM			X		
CDP1831D3	512 Word x 8 Bit ROM			X		
CDP1832CD3	512 Word x 8 Bit ROM			X		
CDP1832D3	512 Word x 8 Bit ROM			X		
CDP1833CD3	1024 Word x 8 Bit ROM			X		
CDP1833D3	1024 Word x 8 Bit ROM			X		
CDP1834CD3	1024 Word x 8 Bit ROM			X		
CDP1834D3	1024 Word x 8 Bit ROM			X		
CDP1857CD/3	4 Bit Bus Buffer/Separator			X		
CDP1857D/3	4 Bit Bus Buffer/Separator			X		
CDM5114CD3	1024 Word x 4 Bit SRAM			X		
CMM5114DIRZ	1024 Word x 4 Bit SRAM Rad Hard			X		
CMM5114JIRZ	1024 Word x 4 Bit SRAM Rad Hard			X		
CMM5114KIRZ	1024 Word x 4 Bit SRAM Rad Hard			X		
CDM5332CD3	4096 Word x 8 Bit ROM			X		
CDM6264CD3	8 K x 8 150/200ns SRAM			X		
CDM6264ACD3	8 K x 8 150ns SRAM			X		
CDM6264ACJ3	8K x 8 150ns SRAM			X		
CDM6264LCD3	8K x 8 100ns SRAM - Low power			X		
CDM62256CD3	32 K x 8 100/120ns SRAM			X		
CMM5104D/3	4096 Word x 1 Bit SRAM			X		
CMM5104J/3	4096 Word x 1 Bit SRAM			X		
CMM5104K/3	4096 Word x 1 Bit SRAM			X		
CMM5104DIRZ	4096 Word x 1 Bit SRAM Rad Hard			X		
CMM5104JIRZ	4096 Word x 1 Bit SRAM Rad Hard			X		
CMM5104KIRZ	4096 Word x 1 Bit SRAM Rad Hard			X		
CMM6167K/3	16 Word x 1 Bit SRAM			X		
CMM6167KIRZ	16 Word x 1 Bit SRAM			X		
GP511K/3	Voltage Level Converter			X		
GP511KIRZ	and Buffer Rad Hard			X		
GP001/3	General Processor			X		
GP001/IRZ	General Processor Rad Hard			X		
GP501/3	Emulating Controller			X		
GP501/RZ	Emulating Controller Rad Hard			X		
GP502/3	"2910" Type Controller			X		
GP502/IRZ	"2910" Type Controller Rad Hard			X		
GP503/3	Multiplier (8 x 8)			X		
GP503/IRZ	Multiplier (8 x 8) Rad Hard			X		
GP514/3	Double Address Select Unit			X		
GP514/IRZ	Double Address Select Unit Rad Hard			X		
GP515/3	Double Register Select Unit			X		
GP515/IRZ	Double Register Select Unit Rad Hard			X		
GP516/3	BUS Interface Unit			X		
GP516/IRZ	BUS Interface Unit Rad Hard			X		
GP517/3	Interrupt Control Unit			X		
GP517/IRZ	Interrupt Control Unit Rad Hard			X		
GP301/3	Mask-Programmable ROM (512 x 8)			X		
GP301/IRZ	Mask-Programmable ROM (512 x 8) Rad Hard			X		
GP302/3	Mask-Programmable ROM (256 x 16)			X		
GP302/IRZ	Mask-Programmable ROM (256 x 16) Rad Hard		X			
GP305/3	Mask-Programmable ROM			X		
GP305/IRZ	(512 x 16) with Pipeline Register Rad Hard			X		
HD-15530	Manchester Encoder-Decoder		X	X		
HD-15531	Manchester Encoder-Decoder			X		
HD-4702	Programmable Bit Rate Generator			X		
HD-6402	Universal Asynchronous Receiver Transmitter			X		

DEVICE TYPE	DESCRIPTION/FEATURES	PRODUCT GRADES				
		JAN	SMD/ DESC	/883	-8	-Q
HD-6406	Programmable Asynchronous Communication Interface					
HD-6409	Manchester Encoder-Decoder			X		
HM-6504	4K x 1 Synchronous RAM	X	X	X		
HM-6508	1K x 1 Synchronous RAM			X		
HM-6514	1K x 4 Synchronous RAM	X	X	X		
HM-6516	2K x 8 Synchronous RAM	X	X	X		
HM-65162	2K x 8 Asynchronous RAM	X	X	X		
HM-6518	1K x 1 Synchronous RAM			X		
HM-65262	16K x 1 Asynchronous RAM	X	X	X		
HM-6551	256 x 4 Synchronous RAM			X		
HM-6561	256 x 4 Synchronous RAM			X		
HM-6564	64K Synchronous RAM Module				X	
HM-65642	8K x 8 Asynchronous RAM	X				
HM-6617	2K x 8 Fuse Link PROM		X	X		
HM-6642	512 x 8 Fuse Link PROM		X	X		
HM-8808/08A	8K x 8 Asynchronous RAM Modules				X	
HM-8816H	16K x 8 Asynchronous RAM Module				X	
HM-8832	32K x 8 Asychronous RAM Module				X	
HM-92560	256K Synchronous RAM Module				X	
HM-92570	256K Buffered Synchronous RAM Module				X	
HM5-91MZ	1M-Bit Asynchronous RAM Module				X	
HS-3182	ARINC 429 Bus Interface Line Driver		X		X	
HS-3282	ARINC 429 Bus Interface		X		X	
HS-3447	Cypher-1™ Data Encryption				X	X
HS65643RH	64K x 1 SOS CMOS Rad Hard Static RAM				X	X
HS65647RH	8K x 8 SOS CMOS Rad Hard Static RAM				X	X
RTX2000-8	16-Bit Real Time Microcontroller			X		X
80C86	Static 16-Bit Microprocessor		X	X		
80C88	Static 8/16-Bit Microprocessor			X		
80C286	Static 16-Bit Microprocessor			X		
82C37A	High Performance Programmable DMA Controller			X		
82C52	Serial Controller Interface		X	X		
82C54	Programmable Interval Timer		X	X		
82C55A	Programmable Peripheral Interface		X	X		
82C59A	Priority Interrupt Controller		X	X		
82C82	Octal Latching Bus Driver		X	X		
82C83H	Octal Latching Inverting Bus Driver		X	X		
82C84A	Clock Generator Driver		X	X		
82C85	Static Clock Controller/Generator			X		
82C86H/87H	Octal Bus Transceivers		X	X		
82C88	Bus Controller		X	X		
82C89	Bus Arbiter		X	X		
82C284	Clock Driver			X		
82C288	Bus Controller			X		

SMD/DESC and /883 Microprocessor and Peripheral ICs Cross-Reference

Device Type	JAN	SMD/DESC Dwg. No.	/883 No.
ICM7170AMDG	—	—	ICM7170AMDG/883B
ICM7170MJG	—	—	ICM7170MJG/883B
IM6402-1MJL	—	—	IM6402-1MJL/883B
IM6402AMJL	—	—	IM6402AMJL/883B
IM6653AMJG	—	—	IM6653AMJG/883B
IM6653MJG	—	—	IM6653MJG/883B
IM6654AMJG	—	—	IM6654AMJG/883B
IM6654MJG	—	—	IM6654MJG/883B
MG80C286-12	—	—	MG80C286-12/883
MG80C286-10	—	—	MG80C286-10/833
MD82C284-12	—	—	MD82C284-12/883
MD82C284-10	—	—	MD82C284-10/883
MD82C288-12	—	—	MD82C288-12/883
MD82C288-10	—	—	MD82C288-10/883
MD80C86	—	8405201QA	MD80C86/883
MR80C86	—	8405201XA	MR80C86/883
MD80C86-2	—	8405202QA	MD80C86-2/883
MR80C86-2	—	8405202XA	MR80C86-2/883
MD80C88	—	—	MD80C88/883
MR80C88	—	—	MR80C88/883
MD80C88-2	—	—	MD80C88-2/833
MR80C88-2	—	—	MR80C88-2/883
MD82C37A	—	—	MD82C37A/883
MR82C37A	—	—	MR82C37A/883
MD82C37A-5	—	—	MD82C37A-5/883
MR82C37A-5	—	—	MR82C37A-5/883
MD82C52	—	8501501XA	MD82C52/883
MR82C52	—	85015013A	MR82C52/883
MD82C54	—	8406501JA	MD82C54/883
MR82C54	—	84065013A	MR82C54/883
MD82C55A	—	8406602QA	MD82C55A/883
MR82C55A	—	8406602XA	MR82C55A/883
MD82C55A-5	—	8406601QA	MD82C55A-5/883
MR82C55A-5	—	8406601XA	MR82C55A-5/883
MD82C59A	—	5962-8501602YA	MD82C59A/883
MR82C59A	—	5962-85016023A	MR82C59A/883
MD82C59A-5	—	5962-8501601YA	MD82C59A-5/883
MR82C59A-5	—	5962-85016013A	MR82C59A/883
MD82C82	—	8406701RA	MD82C82/883
MR82C82	—	84067012A	MR82C82/883
MD82C83H	—	8406702RA	MD82C83H/883
MR82C83H	—	84067022A	MR82C83H/883
MD82C84A	—	8406801VA	MD82C84A/883
MR82C84A	—	84068012A	MR82C84A/883
MD82C85	—	—	MD82C85/883
MR82C85	—	—	MR82C85/883
MD82C86H-5	—	5962-8757701RA	MD82C86H-5/883
MR82C86H-5	—	5962-87577012A	MR82C86H-5/883
MD82C87H-5	—	5962-8757702RA	MD82C87H-5/883
MR82C87H-5	—	5962-87577022A	MR82C87H-5/883
MD82C88	—	8406901RA	MD82C88/883
MR82C88	—	84069012A	MR82C88/883
MD82C89	—	5962-8552801RA	MD82C89/883
MR82C89	—	5962-85528012A	MR82C89/883
RTX2000-8	—	—	RTX2000-8/883

BS9000 (UK) Microprocessor and Peripheral ICs

Device Type	BS Detail Specification No.
MD80C86	BS9490F8166
MD80C86-2	BS9490F8166
MD82C52	BS9490F8167
MD82C54	BS9490F8168
MD82C55A	BS9490F8169
MD82C59A	BS9490F8170
MD82C59A-5	BS9490F8170
MD82C82	BS9490F8171
MD82C83H	BS9490F8172
MD82C84A	BS9490F8173
MD82C86H-5	BS9490F8174
MD82C87H-5	BS9490F8175
MD82C88	BS9490F8176
MD82C89	BS9490F8177

/883 1K Static RAMS

Device Type	JAN	SMD/DESC Dwg. No.	/883 No.
HM1-6508	—	—	HM1-6508/883
HM1-6508B	—	—	HM1-6508B/883
HM1-6518	—	—	HM1-6518/883
HM1-6518B	—	—	HM1-6518B/883
HM1-6551	—	—	HM1-651/883
HM1-6551B	—	—	HM1-6551B/883
HM1-6561	—	—	HM1-6561/883
HM1-6561B	—	—	HM1-6561B/883

JAN, SMD/DESC, and /883 4K Static RAMS

HM1-6504	—	8102405VA	HM1-6504/883
HM1-6504B	—	8102403VA	HM1-6504B/883
HS1-6504RH	M38510R24503SVC	—	HS1-6504RH/883
HM1-6504S	M38510/24501BVA	8102401VA	HM1-6504S/883
HS9-6504RH	M38510R24503SKC	—	HS9-6504RH/883
HM1-6514	—	8102406VA	HM1-6514/883
HM1-6514B	—	8102404VA	HM1-6514B/883
HS1-6514RH	M38510R24-504SVC	—	HS1-6514RH/883
HM1-6514S	M38510/24502BVA	8102402VA	HM1-6514S/883
HS9-6514RH	M38510R24504SKC	—	HS9-6514RH/883

JAN/SMD/DESC, and /883 16K Synchronous Static RAMS

HM1-6516	M38510/29102BJA	8403601JA	HM1-6516/883
HM4-6516	M38510/29102BXA	8403601ZA	HM4-6516/883
HM1-6516B	—	8403607JA	HM1-6516B/883
HM4-6516B	—	8403607ZA	HM4-6516B/883

JAN, SMD/DESC, and /883 16K Asynchronous Static RAMS

HM1-65162	M38510/29104BJA	8403602JA	HM1-65162/883
HM4-65162	M38510/29104BXA	8403602ZA	HM4-65162/883
HM1-65162B	M38510/29110BJA	8403606JA	HM1-65162B/883
HM4-65162B	M38510/29110BXA	8403606ZA	HM4-65162B/883
HM1-65162C	—	8403603JA	HM1-65162C/883
HM4-65162C	—	8403603ZA	HM4-65162C/883
HM1-65262	M38510/29103BRA	8413201RA	HM1-65262/883
HM4-65262	M38510/29103BYA	8413201YA	HM4-65262/883
HM1-65262B	M38510/29109BRA	8413203RA	HM1-65262C/883
HM4-65262B	M38510/29109BYA	8413203YA	HM4-65262B/883

JAN and /883 64K Static RAMS

HM1-65642	—	8552514XA	HM1-65642/883
HM4-65642	—	8552514YA	HM4-65642/883
HM1-65642B	M38510/29205BXA	—	HM1-65642B/883
HM4-65642B	M38510/29205BYA	—	HM4-65642B/883
HM1-65642C	—	—	HM1-65642C/883
HM4-65642C	—	—	HM4-65642C/883

/883 Fuse Link PROMS

HM1-6617	—	8954001JA	HM1-6617/883
HM4-6617	—	8954001XA	HM4-6617/883
HM6-6617	—	8954001LA	HM6-6617/883
HM1-6617B	—	'8954002JA	HM1-6617B/883
HM4-6617B	—	8954002XA	HM4-6617B/883
HM6-6617B	—	8954002LA	HM6-6617B/883
HS1-6617RH	—	—	HS1-6617RH/883S
HS9-6617RH	—	—	HS9-6617RH/883S
HM1-6642	—	8869001JA	HM1-6642/883
HM4-6642	—	8869001XA	HM4-6642-883
HM6-6642	—	8869001LA	HM6-6642/883
HM1-6642B	—	8869002JA	HM1-6642B/883
HM4-6642B	—	88690023A	HM4-6642B/883
HM6-6642B	—	8869002LA	HM6-6642B/883

Static RAM Modules

Device Type	JAN	SMD/DESC Dwg. No.	/883 No.
HM5-6564 HM5-8808 HM5-8808B HM5-8808S HM5-8808A HM5-8808AB HM5-8808AS HM5-8816H HM5-8832 HM5-8832B HM-91MZ HM5-92560 HM5-92570 HS5-6564RH	CMOS Static RAM Modules are available for military and high-reliability applications processed to our high-reliability DASH 8 program flow. This includes burn-in and value-added processing (temperature cycling, SEM inspection, etc.). Please contact your Harris sales office or representative for information.		

SMD and /883 Data Communication Products

HD1-6409	—	—	HD1-6409/883
HD1-15530	—	7802901JA	HD1-15530/883
HD4-15530	—	78029013A	HD4-15530/883
HD1-15531	—	—	HD1-15531/883
HD1-15531B	—	—	HD1-15531B/883
HD1-4702	—	—	HD1-4702/883
HD1-6402	—	—	HD1-6402/883

High-Reliability JAN, SMD/DESC CMOS LSI IC Cross-Reference

JAN	Device Type
M38150/24501BVA	HM1-6504S
M38510/24502BVA	HM1-6514S
M38510/29102BJA	HM1-6516
M38510/29102BXA	HM4-6516
M38510/29103BRA	HM1-65262
M38510/29103BYA	HM4-65262
M38510/29104BJA	HM1-65162
M38510/29104BXA	HM4-65162
M38510/29109BRA	HM1-65262B

JAN	Device Type
M38510/29109BYA	HM4-65262B
M38510/29110BJA	HM1-65162B
M38510/29110BXA	HM4-65162B
M38510/29205BXA	HM1-65642B
M38510/29205BYA	HM4-65642B
M38150R245035VC	HS1-6504RH
M38150R24503SKC	HS9-6504RH
M38150R24504SVC	HS1-6514RH
M38150R24504SKC	HS9-6514RH

SMD/DESC Dwg No.	Device Type
5962-85016013A	MR82C59A-5
5962-8501601YA	MD82C59A-5
5962-85016023A	MR82C59A
5962-8501602YA	MD82C59A
5962-85528012A	MR82C89
5962-8552801RA	MD82C89
5962-86879013A	HS4-3182
5962-8687901EA	HS1-3182
5962-868801QA	HS1-3282
5962-868801XA	HS4-3282
5962-87577012A	MR82C86H-5
5962-8757701RA	MD82C86H-5
5962-87577022A	MR82C87H-5
5962-8757702RA	MD82C87H-5
5962-8756301JA	ICM7170MDG
5962-8756301JC	ICM7170MDG
78029013A	HD4-15530
7802901JA	HD1-15530
8102403VA	HM1-6504B
8102404VA	HM1-6514B
8102405VA	HM1-6504
8102406VA	HM1-6514

SMD/DESC Dwg No.	Device Type
8403603JA	HM1-65162C
8403603ZA	HM4-65162C
8403607JA	HM1-6516B
8403607ZA	HM4-6516B
8405201QA	MD80C86
8405201XA	MR80C86
84065013A	MR82C54
8406501JA	MD82C54
8406601QA	MD82C55A-5
8406601XA	MR82C55A-5
8406602QA	MD82C55A
8406602XA	MR82C55A
84067012A	MR82C82
8406701RA	MD82C82
84067022A	MR82C83H
8406702RA	MD82C83H
84068012A	MR82C84A
8406801VA	MD82C84A
84069012A	MR82C88
8406901RA	MD82C88
85015013A	MR82C52
8501501XA	MD82C52

Device Type	JAN	SMD/ DESC	/883	-8	-Q
HS-3374RH				X	X
HS-54C138RH				X	X
HS-80C85RH				X	X
HS-81C55RH				X	X
HS-81C56RH				X	X
HS-82C08RH				X	X
HS-82C12RH				X	X
HS-83C55RH				X	—
HS-80C86RH				X	X
HS-80C86RRH				X	X
HS-82C37ARH				X	X
HS-82C52RH				X	X
HS-82C54RH				X	X
HS-82C55ARH				X	X
HS-82C59ARH				X	X
HS-82C85RH				X	X
HS-15530RH				X	X
HS-245RH				X	X
HS-246RH				X	X
HS-248RH				X	X
HS-249RH				X	X
HS-3282		X		X	X
HS-6504RH				X	X

Device Type	JAN	SMD/ DESC	/883	-8	-Q
HS-6504RRH	X			X	X
HS-6508RH				X	X
HS-6514RH	X			X	X
HS-6514RRH				X	X
HS-6551RH				X	X
HS-65641RH				X	X
HS-65643RH			X	—	—
HS-65644RH			X	X	X
HS-65645RH			X	X	X
HS-65646RH			X	X	X
HS-65647RH			X	—	—
HS-65648RH			X	X	X
HS-6564RH			X	X	X
HS-65C162RH			X	X	X
HS-65C162RRH				X	X
HS-65C262RH				X	X
HS-65C262RRH				X	X
HS-65T162RH			X	X	X
HS-65T162RRH			X	X	X
HS-65T262RH				X	X
HS-65T262RRH				X	X
HS-6617RH			X	X	X

FAMILY	DESCRIPTION/FEATURES	PART NUMBER	PRODUCT GRADES					DIE GRADES	
			-8	/883	SMD/ DESC	JAN	CLASS S/-Q	B5856	-3
AMPLIFIERS									
HFA-0001 NEW!	Ultra High Speed Op Amp • High Slew Rate • Unity Gain Stable	1-0001 2-0001		Q4 Q4					
HFA-0002 NEW!	Wideband Op Amp • Wide Gain Bandwidth • High Open Loop Gain • Low Power	2-0002 7-0002		Q4 Q4					
HFA-0005 NEW!	High Speed Op Amp • High Slew Rate • Wide Gain Bandwidth • Unity Gain Stable	2-0005 7-0005		Q4 Q4					
HA-2400	4 Channel Programmable Amp • High Slew Rate • Wide Gain Bandwidth SMD:	0-2400 1-2400 4-2400 0-2405 8778301EA 87783012A	X	X X	X X			X	X
HA-2500	Precision High Slew Rate Amp • High Slew Rate • Low Offset Current • Fast Settling Time JAN:	2-2500 7-2500 0-2502 2-2502 4-2502 7-2502 0-2505 12204BGC	X X X X	X X X X X		X	X	X	X
HA-2510	High Slew Rate Amp • Wide Bandwidth • Fast Settling Time • High Input Impedence JAN:	2-2510 7-2510 0-2512 2-2512 4-2512 7-2512 0-2515 12205BGC	X X X X	X X X X X		X	X	X	X
HA-2520	High Slew Rate (Uncomp) Amp • High Slew Rate • Fast Settling Time • High Power Bandwidth JAN:	2-2520 7-2520 0-2522 2-2522 4-2522 7-2522 0-2525 12206BGC	X X X X	X X X X X		X	X	X	X
HA-2529	High Output Cur (Uncomp) Amp • High Slew Rate • Wide Gain Bandwidth SMD:	0-2529 2-2529 4-2529 7-2529 8972101GA 8972101PA 89721012A		X X X	X X X			X	X
HA-2539	High Slew Rate Wideband Amp • Very High Slew Rate • Open Loop Gain SMD:	0-2539 1-2359 4-2539 8778701CA 87787012A	X X	X X	X X			X	X
HA-2540	Wideband Fast Settling Amp • Fast Settling Time • Wide Gain Bandwidth • High Slew Rate SMD:	0-2540 1-2540 4-2540 8964801CA 89648012A	X X	X X	X X			X	X
HA-2541	Wideband Unity Gain Stable Amp • Unity Gain Bandwidth SMD:	1-2541 2-2541 8778501XA	X X	X	X				

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FAMILY	DESCRIPTION/FEATURES	PART NUMBER	PRODUCT GRADES -8	/883	SMD/ DESC	JAN	CLASS S/-Q	DIE GRADES B5856	-3
AMPLIFIERS - Continued									
HA-2542	Wideband High Output Cur Amp	1-2542	X						
	• High Output Current	2-2542	X	X					
	• Gain Bandwidth								
	SMD:	8964301XA			X				
HA-2544	Video Operational Amp	0-2544						X	
	• Unity Gain Bandwidth	2-2544		X					
	• Low Supply Current	4-2544		X					
	• Unity Gain Bandwidth	7-2544		X					
	SMD:	8950201GA			X				
		8950201PA			X				
		89502012A			X				
HA-2546 NEW!	2 Quadrant Video Multiplier	1-2546		Q2					
	• Video Bandwidth	4-2546		Q2					
HA-2547 NEW!	Video Multiplier	1-2547		Q2					
	• High Current Output	4-2547		Q2					
HA-2548 NEW!	High Slew Rate Wideband Amp	2-2548		Q2					
	• Wide Gain Bandwidth	4-2548		Q2					
	• Unity Gain	7-2548		Q2					
HA-2600	Wideband High Impedence Amp	2-2600	X	X			X		
	• Low Input Bias Current	7-2600	X	X					
	• Low Input Offset Current	0-2602							X
	• High Gain	2-2602	X	X					
		4-2602		X					
		7-2602	X	X					
		0-2605						X	
	JAN:	12202BGC				X			
HA-2620	Wideband (Uncomp) Amp	2-2620	X	X			X		
	• High Input Impedence	7-2620	X	X					
	• High Slew Rate	0-2622							X
	• Gain Bandwidth Product	2-2622	X	X					
		4-2622		X					
		7-2622	X	X					
		0-2625						X	
	JAN:	12203BGC				X			
HA-2640	High Voltage Amp	2-2640	X	X					
	• Output Voltage Swing	4-2640							
	• Supply Voltage	7-2640	X	X					
	• Offset Current	0-2645						X	
	DESC:	7800302GC			X				
HA-2650	Dual High Performance Amp	2-2650	X						
	• High Slew Rate	4-2650	X						
	• Exceptional DC	7-2650	X						
HA-4741	Quad Operational Amp	0-4741						X	X
	• Slew Rate	1-4741	X	X			X		
	• Bandwidth	4-4741		X					
HA-4900	Precision Quad Comparator	1-4900	X	Q2					
	• Fast Response Time	4-4900	X						
	• Low Offset Voltage	1-4902	X	X			X		
	• Low Offset Current	4-4902		X					
		0-4905						X	
	SMD:	8686001EA			X				
		86860012A			X				
HA-5002	Wideband High Slew Rate Amp	0-5002						X	X
	• Voltage Gain	2-5002	X	X					
	• High Slew Rate	4-5002		X					
	• Wide Bandwidth	7-5002	X	X					
	SMD: 5962-	8963601GA			X				
	5962-	8963601PA			X				
	5962-	89636012A			X				
HA-5004 NEW!	Video Buffer-Amplifier	1-5004		X					
	• High Speed	4-5004		Q2					

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FAMILY	DESCRIPTION/FEATURES	PART NUMBER	PRODUCT GRADES					DIE GRADES	
			-8	/883	SMD/ DESC	JAN	CLASS S/-Q	B5856	-3
AMPLIFIERS - Continued									
HA-5033	Video Buffer	0-5033						X	X
	• Differential Phase Error	2-5033	X	X					
	• Differential Gain Error								
	SMD:	8963301XA			X				
HA-5101	Single Low Noise Hi-Perf Amp	0-5101						X	X
	• Wide Bandwidth	2-5101		X					
	• Compensated	4-5101		X					
	• Low Noise	7-5101		X					
	SMD:	8963501GA			X				
		8963501PA			X				
		89635012A			X				
HA-5102	Dual Low Noise Hi-Perf Amp	0-5102						X	X
	• High Slew Rate	2-5102	X	X					
	• Low Noise	4-5102		X					
	• Low Offset Voltage	7-5102	X	X					
	• Compensated								
	SMD:	8954801GA			X				
		8954801PA			X				
		89548012A			X				
HA-5104	Quad Low Noise Hi-Perf Amp	0-5104						X	X
	• High Slew Rate	1-5104	X	X					
	• Low Noise	4-5104		X					
	• Compensated								
	SMD: 5962-	8850201CA			X				
	5962-	88502012A			X				
HA-5111	Single Low Noise Hi-Perf Amp	0-5111						X	X
	• Low Noise	2-5111		X					
	• Wide Bandwidth	4-5111		X					
	• Uncompensated	7-5111		X					
	SMD:	8963101GA			X				
		8963101PA			X				
		89631012A			X				
HA-5112	Dual Low Noise Hi-Perf Amp	0-5112						X	X
	• Low Noise	2-5112	X	X					
	• Wide Bandwidth	4-5112		X					
	• Uncompensated	7-5112	X	X					
	SMD:	8963201GA			X				
		8963201PA			X				
		89632012A			X				
HA-5114	Quad Low Noise Hi-Perf Amp	0-5114						X	X
	• Low Noise	1-5114	X	X					
	• Wide Bandwidth	4-5114	X	X					
	• Uncompensated								
	SMD:	8963401CA			X				
		89634012A			X				
HA-5127	Ultra-Low Noise Precision Amp	0-5127						X	X
	• Low Noise	2-5127		X					
	• High Speed	4-5127		X					
	• Low Offset Voltage	7-5127		X					
HA-5130	Precision Amp	2-5130	X						
	• Low Offset Voltage	7-5130	X						
	• Low Offset Voltage Drift	0-5135						X	
	• Open Loop Gain	2-5135	X	X					
		4-5135	X	X					
		7-5135	X	X					
HA-5134	Precision Quad Amp	0-5134						X	
	• High Channel Separation	1-5134		X					
	• Low Offset Voltage	4-5134		X					
HA-5137	Low Noise Precision Amp	0-5137						X	
	• High Speed	2-5137		X					
	• Wide Gain Bandwidth	4-5137		X					
	• Low Noise	7-5137		X					

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FAMILY	DESCRIPTION/FEATURES	PART NUMBER	PRODUCT GRADES					DIE GRADES	
			-8	/883	SMD/ DESC	JAN	CLASS S/-Q	B5856	-3
AMPLIFIERS - Continued									
HA-5141	Single Ultra Low Power Amp • Low Supply Current • Wide Supply Voltage Range • High Slew Rate	0-5141 2-5141 4-5141 7-5141	 X X X	 X X X				X	X
HA-5142	Dual Ultra Low Power Amp • Low Supply Current • Wide Supply Voltage Range • High Slew Rate	0-5142 2-5142 4-5142 7-5142	 X X X	 X X X				X	X
HA-5144	Quad Ultra Low Power Amp • Low Supply Current • Wide Supply Voltage Range	0-5144 1-5144 4-5144	 X X	 X X				X	X
HA-5147	Ultra Low Noise Wideband Amp • High Speed • Wide Gain Bandwidth • Low Noise • High CMRR	0-5147 2-5147 4-5147 7-5147		 X X X				X	
HA-5151	Single Low Power Amp • Low Supply Current • Dual Supply Voltage Range • High Slew Rate	0-5151 2-5151 4-5151 7-5151	 X X X	 X X X			 X	X	X
HA-5152	Dual Low Power Amp • Low Supply Current • Dual Supply Voltage Range • High Slew Rate	0-5152 2-5152 4-5152 7-5152	 X X X	 X X X			 X	X	X
HA-5154	Quad Low Power Amp • Low Supply Current • Dual Supply Voltage Range • High Slew Rate	0-5154 1-5154 4-5154	 X X	 X X			 X	X	X
HA-5160	Wideband J-FET Input Amp • Wide Gain Bandwidth • High Slew Rate	2-5160 0-5162	X	Q4				X	
HA-5170	Precision J-FET Input Amp • Low Offset Voltage • Low Offset Voltage Drift	0-5170 2-5170 4-5170 7-5170	 X X X	 Q4 Q4 Q4				X	
HA-5177	Ultra-Low Offset Voltage Amp • Low Offset Voltage • Low Offset Voltage Drift	0-5177 2-5177 4-5177 7-5177		 X X X				X	
HA-5180	Low Bias Current J-FET Amp • Ultra Low Bias Current • Low Power Supply Current	0-5180 2-5180 7-5180	 X X	 Q4 Q4				X	
HA-5190	Wideband Fast Settling Amp • Fast Settling Time • Very High Slew Rate • Wide Gain Bandwidth SMD:	0-5190 1-5190 2-5190 4-5190 0-5195 8778401CA 8778401XA 87784012A	 X X X	 X X X	 X X X		 X	 X	X
HA-5221	Single Wideband Amp • Unity Gain Bandwidth • Low Offset Voltage • Low Supply Current	2-5221 4-5221 7-5221		X X X					
HA-5222	Dual Wideband Amp • Unity Gain Bandwidth • Low Offset Voltage • Low Supply Current	4-5222 7-5222		X X					
HS-3516RH	Rad-Hard Hi Slew Rate Amp • Wide Bandwidth • Fast Settling Time • Low Power Supply Current	9-3516RH	X				X		

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FAMILY	DESCRIPTION/FEATURES	PART NUMBER	PRODUCT GRADES -8	/883	SMD/ DESC	JAN	CLASS S/-Q	DIE GRADES B5856	-3
AMPLIFIERS - Continued									
HS-3530RH	Rad-Hard Low Power Amp • Wide Range DC Programming • Wide Range AC Programming • Low Noise	2-3530RH	X				X		
HS-5104RH	Rad-Hard Quad Amp • High Slew Rate • Single 5V Supply Capability • Low Offset Voltage	1-5104RH	X				X		
SAMPLE AND HOLD									
HA-2420	Fast Sample and Hold • Fast Acquisition Time • Low Droop Rate • Gain Bandwidth Product SMD:	0-2420 1-2420 4-2420 8001601CA	 X X 	 X X 	 X	 	 X 	 	X
HA-5330	High Speed Sample and Hold • Fast Acquisition time	1-5330 4-5330	 	X X	 	 	 	 	
CMOS ANALOG SWITCHES									
HI-0200	Dual SPST • TTL/CMOS Input • Low R_{ON}	1-0200 2-0200	 	X X	 	 	 	 	
HI-0201	Quad SPST • TTL/CMOS Input • Low R_{ON} JAN: SMD:	1-0201 4-0201 12302BEA 7705301EX 77053012X	X 	X X 	 X X	 X 	 	 	
HI-0201HS	High Speed Quad SPST • Fast t_{ON}/t_{OFF} • TTL Input • Low R_{ON} SMD: 5962- 5962-	1-0201HS 4-0201HS 8671601EA 86716012A	X 	X X 	 X X	 	 	 	
HI-0222	Dual SPST • Video Bandwidth • High Isolation	1-0222 4-0222	 	X X	 	 	 	 	
HI-5040	Single SPST • Low R_{ON} • TTL/CMOS Input SMD:	 1-5040 8100609EA	 	 X 	 X	 	 	 	
HI-5041 HI-5048	Dual SPST • Low R_{ON} • TTL/CMOS Input SMD:	 1-50XX 8100610EA 8100619EA	 X 	 X 	 X X	 	 	 	
HI-5042 HI-5050	Single SPDT • Low R_{ON} • TTL/CMOS Input SMD:	 1-50XX 8100611EA 8100621EA	 	 X 	 X X	 	 	 	
HI-5043 HI-5051	Dual SPDT • Low R_{ON} • TTL/CMOS Input SMD:	 1-50XX 4-50XX 8100612EA 81006122A 8100622EA 81006222A	 X 	 X X 	 X X X X	 	 	 	
HI-5044	Single DPST • Low R_{ON} • TTL/CMOS Input SMD:	 1-5044 8100613EA	 	 X 	 X	 	 	 	

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FAMILY	DESCRIPTION/FEATURES	PART NUMBER	PRODUCT GRADES					DIE GRADES	
			-8	/883	SMD/ DESC	JAN	CLASS S/-Q	B5856	-3
CMOS ANALOG SWITCHES - Continued									
HI-5045 HI-5049	Dual DPST • Low R_{ON} • TTL/CMOS Input SMD:	 1-50XX 4-50XX 8100614EA 81006142A 8100620EA 81006202A		 X X	 X X X X				
HI-5046 HI-5046A	Single DPDT • Low R_{ON} • TTL/CMOS Input SMD:	 1-50XX 8100615EA 8100617EA		 X	 X X				
HI-5047 HI-5047A	DPDT • Low R_{ON} • TTL/CMOS Input SMD:	 1-50XX 8100616EA 8100618EA		 X	 X X				
HI-5048	Dual SPST • Low R_{ON} • TTL/CMOS Input SMD:	 1-5048 8100619EA		 X	 X				
HI-5049	Dual DPST • Low R_{ON} • TTL/CMOS Input SMD:	 1-5049 8100620EA		 X	 X				
HI-5050	SPDT • Low R_{ON} • TTL/CMOS Input SMD:	 1-5050 8100621EA		 X	 X				
HI-5051	Dual SPDT • Low R_{ON} • TTL/CMOS Input SMD:	 1-5051 4-5051 8100622EA 81006222A	X	 X X	 X X				
CMOS ANALOG MULTIPLEXERS									
HI-0506	16 Channel • Low R_{ON} • Low Cost	0-0506 1-0506 4-0506	 X	 X X	 	 X	 	X	X
HI-0507	8 Channel Differential • Low R_{ON} • Low Cost	0-0507 1-0507 4-0507	 X	 X X	 	 X	 	X	X
HI-0508	8 Channel • Low R_{ON} • Low Cost SMD:	0-0508 1-0508 4-0508 7705201EC 77052012A	 X	 X X	 X X	 X	 	X	X
HI-0509	4 Channel Differential • Low R_{ON} • Low Cost	0-0509 1-0509 4-0509	 X	 X X	 	 X	 	X	X
HI-0546	16 Channel • Input Overvoltage Protected • Matched R_{ON} SMD: 5962- 5962-	0-0546 1-0546 4-0546 8513101XA 85131013A	 	 X X	 X X	 X	 X	X	X
HI-0547	8 Channel Differential • Input Overvoltage Protected • Matched R_{ON} SMD: 5962- 5962-	0-0547 1-0547 4-0547 8513102XA 85131023A	 	 X X	 X X	 X	 X	X	X

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FAMILY	DESCRIPTION/FEATURES	PART NUMBER	PRODUCT GRADES					DIE GRADES	
			-8	/883	SMD/ DESC	JAN	CLASS S/-Q	B5856	-3
CMOS ANALOG MULTIPLEXERS - Continued									
HI-0548	8 Channel • Input Overvoltage Protected • Matched R_{ON} SMD:	0-0548 1-0548 4-0548 7705202EA 77052022A		 X X	 X X	 X	 X	X	X
HI-0549	4 Channel Differential • Input Overvoltage Protected • Matched R_{ON} SMD: 5962- 5962-	0-0549 1-0549 4-0549 8513103EA 85131032A		 X X	 X X	 X	 X	X	X
HI-1818A	8 Channel • Low Leakage • Low R_{ON}	0-1818A 1-1818A		 X				X	X
HI-1828A	4 Channel Differential • Low Leakage • Low R_{ON}	0-1828A 1-1828A		 X				X	X
A TO D CONVERTERS									
HI-574A (S,T)	12 Bit • 25 μsec Conversion	1-574A 4-574A		X X					
HI-674A (S,T)	12 Bit • 15 μsec Conversion	1-674A 4-674A		X X					
HI-774 (S,T)	12 Bit • 9 μsec Conversion	1-774		X					
D TO A CONVERTERS									
HI-565A (S,T)	12 Bit • Fast Settling	0-565A 1-565A		 X					
HI-DAC87V	2-Supply	1-DAC87V 4-DAC87V		X X					
RADIATION HARDENED PRODUCTS									
HS-508ARH	8-Channel Differential Analog Multiplexer • Gamma Dose -1x10^5 Rads (Si) • Input Overvoltage Protected	1-508ARH 9-508ARH	X X				X X		
HS-1840RH	16-Channel Analog Multiplexer • Gamma Dose -2x10^5 Rads (Si) • Hi-Z Analog Input Protection	1-1840RH 9-1840RH	X X				X X		
HS-302RH HS-303RH HS-306RH HS-307RH HS-384RH HS-390RH HS-3516RH HS-3530RH HS-5104RH	CMOS Analog Switches • Gamma Dose -1x10^5 Rads (Si) • Pin for Pin Compatible with Harris HI-3XX Series Analog Switches High Slew Rate OP Amp • Gamma Dose -1x10^6 Rads (Si) Low Power, Programmable OP Amp • Gamma Dose -1x10^2 Rads (Si) Quad High-Performance OP Amp • Gamma Dose -1x10^5 Rads (Si)	1-3XXRH	X X X X X X X X X				X X X X X X X X X		

X = Now Available; Date = Calendar Year; Blank = No current plans

High-Reliability JAN, SMD/DESC Military Drawings/ Device Types Cross-Reference

M38510 JAN PRODUCTS		
PART NUMBER	**DESCRIPTION**	**DEVICE TYPES**
12202BGC	OP AMP	HA2-2600
12203BGC	OP AMP	HA2-2620
12204BGC	OP AMP	HA2-2500
12205BGC	OP AMP	HA2-2510
12206BGC	OP AMP	HA2-2520
12302BEA	QUAD SWITCH	HI1-0201
19001BXA	16-CHANNEL MULTIPLEXER	HI1-0506
19002BXA	16-CHANNEL MULTIPLEXER	HI1-0546
19003BXA	DIFF. 8-CHANNEL MULTIPLEXER	HI1-0507
19004BXA	DIFF. 8-CHANNEL MULTIPLEXER	HI1-0547
19005BEA	8-CHANNEL MULTIPLEXER	HI1-0548
19006BEA	DIFF. 4-CHANNEL MULTIPLEXER	HI1-0549
19007BEA	8-CHANNEL MULTIPLEXER	HI1-0508
19008BEA	DIFF. 4-CHANNEL MULTIPLEXER	HI1-0509
SMD/DESC DRAWING NUMBER		
7705201EC	8 CHANNEL MULTIPLEXER	HI1-0508
7705202EA	8 CHANNEL MULTIPLEXER	HI1-0548
77052022A	8 CHANNEL MULTIPLEXER	HI4-0548
7705301EX	QUAD SWITCH	HI1-0201
77053012X	QUAD SWITCH	HI4-0201
7800302GC	HIGH-VOLTAGE OP AMP	HA2-2640
8001601CA	SAMPLE AND HOLD	HA1-2420
8100609EA	CMOS SWITCH	HI1-5040
8100610EA	CMOS SWITCH	HI1-5041
8100611EA	CMOS SWITCH	HI1-5042
8100612EA	CMOS SWITCH	HI1-5043
81006122A	CMOS SWITCH	HI4-5043
8100613EA	CMOS SWITCH	HI1-5044
8100614EA	CMOS SWITCH	HI1-5045
81006142A	CMOS SWITCH	HI4-5045
8100615EA	CMOS SWITCH	HI1-5046
8100616EA	CMOS SWITCH	HI1-5047
8100617EA	CMOS SWITCH	HI1-5046A
8100618EA	CMOS SWITCH	HI1-5047A
8100619EA	CMOS SWITCH	HI1-5048
8100620EA	CMOS SWITCH	HI1-5049
8100621EA	CMOS SWITCH	HI1-5050
8100622EA	CMOS SWITCH	HI1-5051
81006222A	CMOS SWITCH	HI4-5051
5962-8513101XA	16 CHANNEL MULTIPLEXER	HI1-0546
5962-85131013A	16 CHANNEL MULTIPLEXER	HI4-0546
5962-8513102XA	DIFF. 8 CHANNEL MULTIPLEXER	HI1-0547
5962-85131023A	DIFF. 8 CHANNEL MULTIPLEXER	HI4-0547
5962-8513103EA	DIFF. 4 CHANNEL MULTIPLEXER	HI1-0549
5962-85131032A	DIFF. 4 CHANNEL MULTIPLEXER	HI4-0549
5962-8671601EA	QUAD SWITCH	HI1-0201HS
5962-86716012A	QUAD SWITCH	HI4-0201HS

High-Reliability CA3000 Slash-Series Types

TYPE	DESCRIPTION	CLASS B Mil-Std-883 Non-Compliant	CLASS S (Modified) Mil-Std-883 Non-Compliant
CA0723T3	Voltage Regulator	X	
CA0741S3	Single Amplifier	X	
CA0741T1	Single Amplifier	X	
CA0741T3	Single Amplifier		X
CA0747T1	Dual Amplifier		X
CA0747T3	Dual Amplifier	X	
CA0748S1	Single Amplifier		X
CA0748S3	Single Amplifier	X	
CA0748T1	Single Amplifier		X
CA0748T3	Single Amplifier	X	
CA1558S3	Dual Amplifier	X	
CA1558T1	Dual Amplifier		X
CA1558T3	Dual Amplifier	X	
CA3001	DC Amplifier		X
CA3003	DC Amplifier	X	
CA30011	Wideband I/O Diff-Amp		X
CA30013	Wideband I/O Diff-Amp	X	
CA30021	IF Amplifier		X
CA30023	IF Amplifier	X	
CA30061	RF Amplifier		X
CA30063	RF Amplifier	X	
CA30153	Wideband Amplifier	X	
CA3015A1	Wideband Amplifier		X
CA3015A3	Wideband Amplifier	X	
CA3018A1	Transistor Array		X
CA3018A3	Transistor Array	X	
CA30191	Diode Array		X

TYPE	DESCRIPTION	CLASS B Mil-Std-883 Non-Compliant	CLASS S (Modified) Mil-Std-883 Non-Compliant
CA30193	Diode Array	X	
CA3020A1	Wideband Power Amplifier		X
CA3020A3	Wideband Power Amplifier	X	
CA30261	Differential Amplifier		X
CA30263	Differential Amplifier	X	
CA3028A3	Differential/Cascade Amplifer	X	
CA3028BS3	Differential/Cascade Amplifer	X	
CA3028B1	Differential/Cascade Amplifer		X
CA3028B3	Differential/Cascade Amplifer	X	
CA30391	Diode Array		X
CA30393	Diode Array	X	
CA3045F3	Transistor Array	X	
CA30451	Transistor Array		X
CA3049T1	Dual Hi-Freq Diff Amp		X
CA3049T3	Dual Hi-Freq Diff Amp	X	
CA30581	Zero Voltage Switch		X
CA30583	Zero Voltage Switch	X	
CA3080AS3	Single Transconductance Amp	X	
CA3080A1	Single Transconductance Amp		X

TYPE	DESCRIPTION	CLASS B Mil-Std-883 Non-Compliant	CLASS S (Modified) Mil-Std-883 Non-Compliant
CA3080A3	Single Transconductance Amp	X	
CA30801	Single Transconductance Amp		X
CA30803	Single Transconductance Amp	X	
CA3081F3	Transistor Common Emitter Array	X	
CA3082F3	Transistor Common Collector Array	X	
CA3083F3W	Transistor Array	X	
CA3085AS1	Positive Voltage Regulator		X
CA3085AS3	Positive Voltage Regulator	X	
CA3085A1	Positive Voltage Regulator		X
CA3085A3	Positive Voltage Regulator	X	
CA3085BS3	Positive Voltage Regulator	X	
CA3085BT3	Positive Voltage Regulator	X	
CA3085B1	Positive Voltage Regulator		X
CA30853	Positive Voltage Regulator	X	
CA3089F3W	FM IF System	X	
CA3089F	FM IF System		
CA3094AS3	Power Switch Amplifier	X	
CA3094AT1	Power Switch Amplifier		X
CA3094AT3	Power Switch Amplifier	X	
CA309453	Power Switch Amplifier	X	
CA3094T1	Power Switch Amplifier		X
CA3094T3	Power Switch Amplifier	X	
CA310053	Wideband Operational Amp	X	
CA3100T1	Wideband Operational Amp		X
CA3100T3	Wideband Operational Amp	X	
CA3130AS3	Wideband Operational Amp	X	
CA3130AT1	Wideband Operational Amp		X
CA3130AT3	Wideband Operational Amp	X	

TYPE	DESCRIPTION	CLASS B Mil-Std-883 Non-Compliant	CLASS S (Modified) Mil-Std-883 Non-Compliant
CA3130S3	Wideband Operational Amp	X	
CA3130T1	Wideband Operational Amp	X	
CA3130T3	Wideband Operational Amp	X	
CA3140AS3	Wideband Operational Amp	X	
CA3140AT1	Wideband Operational Amp		X
CA3140AT3	Wideband Operational Amp	X	
CA3140S1	Wideband Operational Amp		X
CA314053	Wideband Operational Amp	X	
CA3140T1	Wideband Operational Amp		X
CA3140T3	Wideband Operational Amp	X	
CA3160AS1	Wideband Operational Amp		X
CA3160AS3	Wideband Operational Amp	X	
CA3160AT1	Wideband Operational Amp		X
CA3160AT3	Wideband Operational Amp	X	
CA3160S1	Wideband Operational Amp		X
CA3160S3	Wideband Operational Amp	X	
CA3160T1	Wideband Operational Amp		X
CA3160T3	Wideband Operational Amp	X	
CA3260AT1	Wideband Dual Amp		X
CA3260AT3	Wideband Dual Amp	X	
CA3260T1	Wideband Dual Amp		X
CA3260T3	Wideband Dual Amp	X	
CA3280F3	Dual Variable Op. Amp	X	
CA3280AF3	Dual Variable Op. Amp.	X	
CA3290AT3	BiMOS Voltage Comparator	X	
CA6741T3	CA0741 & Popcorn Test	X	
HR3N0187	Dual Insulated Gate FET	X	
HR3N0200	Dual Insulated Gate FET	X	
HR3N0205	Dual Insulated Gate FET	X	

High-Reliability Standard Cells — HSC1000

The HSC1000 standard cell library is a series of high performance 1.5 micron dual level metal, silicon gate standard cells.

Features

- Supported on HARRIS FASTRACK™, Daisy™ and Mentor Graphics® Design Systems
- Low Power 1.5 Micron CMOS Process
- Dual Level Metal Interconnect
- 800 ps Typical 2-Input Nand Gate Delay with a Fanout = 2
- 150 MHz Maximum Toggle Frequency
- Supports Gate Counts to 25K
- Over 200 Primitive and Macrocell Functions
- RAM and ROM Module Compilers
- CMOS/TTL Compatible I/O's
- Commercial-Industrial-Military Temperature Ranges
- Proven Reliability and Manufacturable Process
- Extensive Packaging Options
- Screening and Qualification to Mil-Std-883C Method 5004/5005, Class B and Class S
- Function Compatible with the HSC1000RH Radiation Hardened Library

Macrocell Families*

- 29XX Series ALU Functions
- RTX Core Microcontroller
- ARINC 429
- Communication Functions
- Multiplier Functions
- Microprocessor Peripheral Functions

*Contact Harris for Availability

High-Reliability Gate Arrays — AGC 40K & TAGC40K Series

The AGC40K and TAGC40K series gate arrays are fabricated using Harris' high performance, double level metal, silicon gate 1.2 micron AVLSI2 process. The AGC40K series is ideal for military applications that require high-performance and low-power consumption. The TAGC40K series is ideal for military and space applications that require radiation hardened, high-performance and low-power consumption.

Features:

- Advanced 1.2 Micron (0.9 Micron Effective) VHSIC-Class Dual Level Metal CMOS Technology
- High Performance with 0.68ns typical delay for a 2-Input NAND Gate with Fanout of 2 (0.82 ns for TAGC40K)
- Extensive Library with Over 400 Elements Allows for a High Degree of Design Flexibility
- Available in 3 Sizes from 1750 to 13,500 Total Gates
- Latch Up Resistant
- Wide Military Package Selection
- Workstation Design Support for Mentor Graphics® and Valid™; Support for Harris FASTRACK™ and Daisy™ are Planned
- Proven Reliable and Manufacturable Process — Over 150,000 Parts Delivered
- Function and Mask Compatible with Radiation Hardened TAGC40K Series Gate Array
- CMOS/TTL Compatible I/Os
- Military Temperature Range
- Screening and Qualification to Mil-Std-883C Method 5004/5005, Class B and Class S
- All Design and Manufacturing Activities Performed in the United States
- Low Skew Clock Drivers — Maximum < 1 ns
- > 3500 Volt ESD Protection
- Designed for Easy Routing and High Gate Utilization
  - ▶ Up to 95% Cell Occupancy Demonstrated
- Boundary Scan I/Os and Scan Flip-Flops Allow for the Design of Highly Testable Circuits

TAGC40K Radiation Hardened

- ▶ Total Dose .....>1 x 10^6 Rads (Si)
- ▶ Survivability.....>1 x 10^{12} Rads (Si)/s
- ▶ Transient Upset.....>3.5 x 10^9 Rads (Si)/s
- ▶ Latchup .....None Measured
- ▶ Neutron Fluence.....>1 x 10^{14} Neutrons/cm^2
- ▶ SEU .....<1 x 10^{-8} Errors bit-day

High-Reliability Radiation Hardened SOS Gate Arrays — AUA Series

The AUA gate arrays are fabricated using the Harris' high performance, double level metal, silicon gate 1.2 micron CMOS/SOS process. The AUA series is ideal for military and space applications that require radiation hardened, high performance and low-power consumption.

Features

- Advanced 1.2 Micron (0.9 Micron Effective) VHSIC-Class Dual Level Metal CMOS/SOS Technology
- High Performance with 0.67 ns typical delay for a 2-Input NAND Gate with Fanout of 2
- Available in 2 Sizes: 10,000 and 20,000 Total Gates
- Wide Military Package Selection
- Workstation Design Support for Mentor Graphics® and Valid™; Support for Harris FASTRACK™ and Daisy™ are Planned
- 16 Dedicated Power Pins
- CMOS/TTL Compatible I/Os
- Military Temperature Range
- Screening and Qualification to Mil-Std-883C Method 5004/5005, Class B and Class S
- All Design and Manufacturing Activities Performed in the United States
- Programmable I/O Pins
  ▶Input, Output Bidirectional or Three-State

AUA Radiation Hardened

- ▶ Total Dose .....$>1 \times 10^6$ Rads (Si)
- ▶ Survivability.....$>1 \times 10^{12}$ Rads (Si)/s
- ▶ Transient Upset.....$>1 \times 10^{11}$ Rads (Si)/s
- ▶ Latchup .....None Measured
- ▶ Neutron Fluence .....$> 1 \times 10^{14}$ Neutrons/cm^2
- ▶ SEU .....$<1 \times 10^{-11}$ Errors/bit-day

High-Reliability Gate Arrays — AGC50K & TAGC50K* Series

The AGC50K and TAGC50K series gate arrays are fabricated using Harris' high performance, double level metal, silicon gate 1-micron AVLS12 CMOS process. A 3 level metal option will be available soon to effectively double the usable gate count. The process used to produce "T" series radiation hardened gate arrays is completely designer transparent in library and implementation, providing total dose radiation tolerance with only a minor reduction in speed.

Features

- Available in 4 sizes from 20,400 to 100,800 total gates
- Advance 1-micron VHSIC-class dual level metal CMOS technology with a third metal level option available in the future.
- Latch-up resistant
- High performance with 0.45 ns typical delay for a 2-input NAND gate with fanout of 2 (0.7 ns for TAGC50K)
- Extensive library with over 400 elements allows for a high degree of design flexibility.
- Wide military package selection
- Workstation design support for Mentor Graphics, Valid, Harris Fastrack and Daisy.
- Function and mask compatible with radiation hardened TAGC50K series gate array.
- Fully programmable I/O cells — input, output, bi-directional, tri-state, V_{DD}, V_{SS}.
- CMOS/TTL compatible I/O's with 2 to 16 mA programmable drive level.
- Military temperature range.
- Screening and qualification to MIL-STD-883C method 5004/5005, Class B and Class S..
- All design and manufacturing activities performed in the United States.
- Designed for easy routing and high gate utilization.
- Dedicated boundary scan I/O ring and scan flip-flops allow for the design of highly testable circuits.
- Enhanced power bus structure improves noise immunity.

TAGC50K Radiation Hardened

- ▶ Total Dose .....$>1 \times 10^6$ Rads (Si)
- ▶ Survivability.....$>1 \times 10^{12}$ Rads (Si)/s
- ▶ Transient Upset.....$>3.5 \times 10^9$ Rads (Si)/s
- ▶ Latchup .....None Measured
- ▶ Neutron Fluence .....$> 1 \times 10^{14}$ Neutrons/cm^2
- ▶ SEU .....$<2.5 \times 10^{-7}$ Errors/bit-day

*Advance Information

High-Reliability Ceramic Package Options for ASIC Devices

PACKAGE TYPE	NUMBER OF TERMINALS														
	14	16	18	20	22	24	28	32	40	42	44	48	64	120	132
Dual-In-Line Side-Braze FRIT	X X	X X	X X	* X	X X	X X	X X		X				X		
Flat/Quad Packs 50-Mil Centers 40-Mil Centers 25-Mil Centers	X	X		X		X	X			X			X		X X
Leadless Chip Carriers 50-Mil Centers 40-Mil Centers				X		 X	X	X X			X	 X	 X		
Pin Grid Arrays 100-Mil Centers														X	
Leaded Chip Carriers 40-Mil Centers									X						

*Qualification Pending

JAN and JANTX Bipolar Power Transistors

Types	MIL-S-19500/	Package	Polarity	P_T (W)	I_C (A)	V_{CEO} (V)	h_{FE} Min.	h_{FE} I_C (A)	f_T (MHz)
2N3439, 2N3440	368	TO-205AD/TO-39	N-P-N	0.8	1	350	40	0.02	15
2N3584, 2N3585	384	TO-213AA/TO-66	N-P-N	35	2	300	25	1	15
2N3879	526	TO-213AA/TO-66	N-P-N	35	7	75	20	4	40
2N5038, 2N5039	439*	TO-204AA/TO-3	N-P-N	140	20	90	20	12	60
2N5302, 2N5303	456*	TO-204AA/TO-3	N-P-N	200	30	80	15	15	2
2N5415S, 2N5416S	485	TO-205AD/TO-39	P-N-P	0.75	-1	-300	30	-0.05	15
2N5671, 2N5672	488*	TO-204AA/TO-3	N-P-N	140	30	120	20	20	50
2N6032, 2N6033	528*	TO-204AE/TO-3	N-P-N	140	50	120	10	50	50
2N6211-2N6213	461	TO-213AA/TO-66	P-N-P	35	-2	-350	30	-1	20
2N6283, 2N6284	504*	TO-204AA/TO-3	N-P-N	175	20	100	1250	10	8
2N6286, 2N6287	505*	TO-204AA/TO-3	P-N-P	175	-20	-100	1250	-10	8
2N6306, 2N6308	498*	TO-204AA/TO-3	N-P-N	125	8	350	15	3	5
2N6383-2N6385	523*	TO-204AA/TO-3	N-P-N	100	10	80	1000	5	20
2N6546, 2N6547	525*	TO-204AA/TO-3	N-P-N	175	15	300	12	5	60
2N6648-2N6650	527*	TO-204AA/TO-3	P-N-P	85	-10	-80	1000	-5	20
2N6671, 2N6673*	536*	TO-204AA/TO-3	N-P-N	150	10	400	10	5	15
2N6674, 2N6675*	537*	TO-204AA/TO-3	N-P-N	175	20	400	8	10	15
2N6676, 2N6678*	538*	TO-204AA/TO-3	N-P-N	175	20	400	8	10	15

*Available in JANTX form.

JANTXV Bipolar Power Transistors Now Available

The following bipolar types are now available in JANTXV form:

2N5038TXV	2N6284TXV	2N6385TXV	2N6671TXV
2N5039TXV	2N6286TXV	2N6546TXV	2N6673TXV
2N5302TXV	2N6287TXV	2N6547TXV	2N6674TXV
2N5303TXV	2N6306TXV	2N6648TXV	2N6675TXV
2N5671TXV	2N6308TXV	2N6649TXV	2N6676TXV
2N5672TXV	2N6383TXV	2N6650TXV	2N6678TXV
2N6283TXV	2N6384TXV		

Radiation-Hardened Bipolar Power Transistors

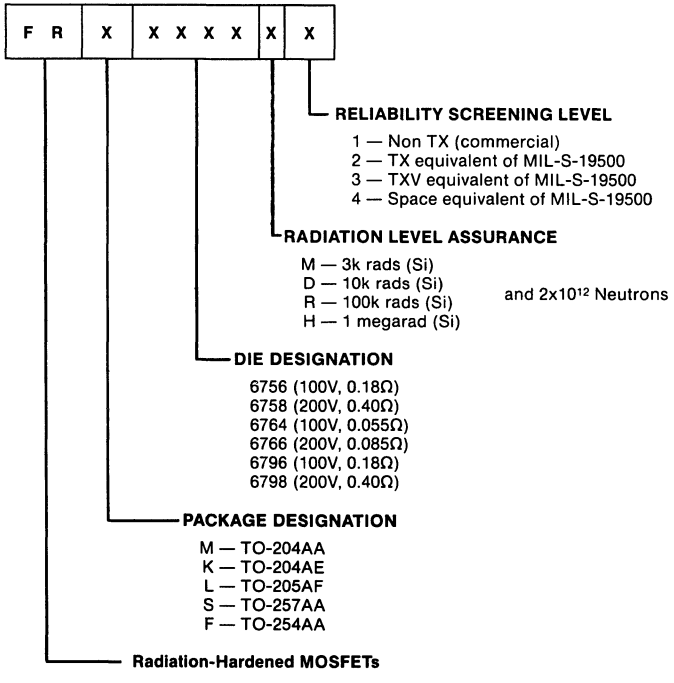
Types	Description	Package	Gamma Intensity (RAD(Si)/s)	Neutron Fluence (N/cm^2)
2N3879	75V/7A, N-P-N Hi-Speed	TO-213AA	1×10^7	5×10^{13}
2N5038	90V/20A, N-P-N Hi-Speed	TO-204AA	1×10^7	5×10^{13}
2N5320	75V/2A, N-P-N Small-Sig.	TO-205AD	1×10^7	5×10^{13}
2N5322	75V/2A, P-N-P Small-Sig.	TO-205AD	1×10^7	5×10^{13}
2N5672	120V/30A, N-P-N Hi-Speed	TO-204AA	1×10^7	5×10^{13}
2N6248	100V/10A, P-N-P EPI-Base	TO-204AA	1×10^7	5×10^{13}
2N6673	400V/8A, N-P-N Hi-Speed	TO-204AA	1×10^7	5×10^{13}
2N6688	200V/20A, N-P-N Hi-Speed	TO-204AA	1×10^7	5×10^{13}
2N7142*	60V/12A, N-P-N Hi-Speed	TO-204AA	1×10^8	1×10^{14}
2N7143*	80V/12A, N-P-N Hi-Speed	TO-204AA	1×10^8	1×10^{14}
2N7144*	60V/12A, N-P-N Hi-Speed	Radial	1×10^8	1×10^{14}
2N7145*	80V/12A, N-P-N Hi-Speed	Radial	1×10^8	1×10^{14}
2N7146*	60V/12A, N-P-N Hi-Speed	TO-257AA	1×10^8	1×10^{14}
2N7147*	80V/12A, N-P-N Hi-Speed	TO-257AA	1×10^8	1×10^{14}

*Formerly RCA Dev. type TA9107.

N-Channel Types	MIL-S-19500/	Package	Channel	P_T (W)	I_D (A)	V_{BR} (DSS) (V)	r_{DS} (on) Ω
2N6756	542A	TO-204AA	N	75	14	100	0.18
2N6758	542A	TO-204AA	N	75	9	200	0.4
2N6760	542A	TO-204AA	N	75	5.5	400	1
2N6762	542A	TO-204AA	N	75	4.5	500	1.5
2N6764	543A	TO-204AE	N	150	38	100	0.055
2N6766	543A	TO-204AE	N	150	30	200	0.085
2N6768	543A	TO-204AA	N	150	14	400	0.3
2N6770	543A	TO-204AA	N	150	12	500	0.4
2N6782	556	TO-205AF	N	15	3.5	100	0.6
2N6784	556	TO-205AF	N	15	2.25	200	1.5
2N6786	556	TO-205AF	N	15	1.25	400	3.6
2N6788	555	TO-205AF	N	20	6	100	0.3
2N6790	555	TO-205AF	N	20	3.5	200	0.8
2N6792	555	TO-205AF	N	20	2	400	1.8
2N6794	555	TO-205AF	N	20	1.5	500	3
2N6796	557	TO-205AF	N	25	8	100	0.18
2N6798	557	TO-205AF	N	25	5.5	100	0.4
2N6800	557	TO-205AF	N	25	3	400	1
2N6802	557	TO-205AF	N	25	2.5	500	1.5
P-Channel Types	**MIL-S-19500/**	**Package**	**Channel**	**P_T (W)**	**I_D (A)**	**V_{BR} (DSS) (V)**	**r_{DS} (on) Ω**
2N6849	563	TO-205AF	P	25	6.5	100	0.3
2N6851	563	TO-205AF	P	25	4	200	0.8
2N6895	565	TO-205AF	P	8.33	1.5	100	3.65
2N6896	565	TO-204AA	P	60	6	100	0.6
2N6897	565	TO-204AA	P	100	12	100	0.3
2N6898	565	TO-204AA	P	150	25	100	0.2
N-Channel Logic-Level Types	**MIL-S-19500/**	**Package**	**Channel**	**P_T (W)**	**I_D (A)**	**V_{BR} (DSS) (V)**	**r_{DS} (on) Ω**
2N6901	566	TO-205AF	N	8.33	1.5	100	1.4
2N6902	566	TO-204AA	N	75	-12	100	0.2
2N6903	566	TO-205AF	N	8.33	1.5	200	3.65
2N6904	566	TO-204AA	N	75	-8	200	0.65

Types	Pre-Rad Look Alike	Rating or Characteristic	Pre-Rad		Post-Radiation Electrical Characteristics								Units
					3K Rad(Si)[1]		10K Rad(Si)[2]		100K Rad(Si)[3]		1M Rad(Si)[4]		
			Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
FRM6756 FRS6756	2N6756 IRF130	I_D BV_{DSS} $R_{DS(ON)}$ V_{th}	14 100 2.0	 0.18 4.0	14 100 2.0	 0.18 4.0	14 100 1.5	 0.18 4.2	14 100 1.0	 0.20 4.5	8 100 0.5	 0.30 5.00	Amps Volts Ohms Volts
FRM6758 FRS6758	2N6758 IRF230	I_D BV_{DSS} $R_{DS(ON)}$ V_{th}	9 200 2.0	 0.4 4.0	9 180 2.0	 0.4 4.0	9 180 1.5	 0.4 4.2	8 180 1.0	 0.5 4.5	5 180 0.5	 0.75 5.0	Amps Volts Ohms Volts
FRK6764 FRF6764	2N6764 IRF150	I_D BV_{DSS} $R_{DS(ON)}$ V_{th}	38 100 2.0	 .055 4.0	38 100 2.0	 .055 4.0	38 100 1.5	 .055 4.2	38 100 1.0	 .060 4.5	16 100 0.5	 0.125 5.0	Amps Volts Ohms Volts
FRK6766 FRF6766	2N6766 IRF250	I_D BV_{DSS} $R_{DS(ON)}$ V_{th}	30 200 2.0	 .085 4.0	30 180 2.0	 .085 4.0	30 180 1.5	 0.100 4.2	25 180 1.0	 0.125 4.5	8 180 0.5	 0.250 5.00	Amps Volts Ohms Volts
FRL6796	2N6796 IRFF130	I_D BV_{DSS} $R_{DS(ON)}$ V_{th}	8 100 2.0	 0.18 4.0	8 100 2.0	 0.18 4.0	8 100 1.5	 0.18 4.2	8 100 1.0	 0.20 4.5	6 100 0.5	 0.30 5.00	Amps Volts Ohms Volts
FRL6798	2N6798 IRFF230	I_D BV_{DSS} $R_{DS(ON)}$ V_{th}	5.5 200 2.0	 0.4 4.0	5.5 180 2.0	 0.4 4.0	5.5 180 1.5	 0.4 4.2	5.5 180 1.0	 0.5 4.5	5 180 0.5	 0.75 5.00	Amps Volts Ohms Volts

Radiation-Hardened MOSFET Nomenclature Guide



Ultra Rad-Hard Power MOSFETs - Developmental Devices N-Channel Types

	Die Size - mils			
V_{DSS}	175 x 115 (HEX-III)	227 x 170 (HEX-IV)	257 x 257 (HEX-V)	325 x 325 (HEX-VI)
100V	TA17631XG	TA17641XG	TA17651XP	TA17661XP
	TA17631XW	TA17641XI	TA17651XI	TA17661XJ
	TA17631XI	TA17641XO	TA17651XJ	
	TA17631XO			
200V	TA17632XG	TA17642XG	TA17652XP	TA17662XP
	TA17632XW	TA17642XI	TA17652XI	TA17662XJ
	TA17632XI	TA17642XO	TA17652XJ	
	TA17632XO			
250V	TA17633XG	TA17643XG	TA17653XP	TA17663XP
	TA17633XW	TA17643XI	TA17653XI	TA17663XJ
	TA17633XI	TA17643XO	TA17653XJ	
	TA17633XO			
500V	TA17635XG	TA17645XG	TA17655XP	TA17665XP
	TA17635XW	TA17645XI	TA17655XI	TA17665XJ
	TA17635XI	TA17645XO	TA17655XJ	
	TA17635XO			

P-Channel Types

	Die Size - mils			
V_{DSS}	175 x 115 (HEX-III)	227 x 170 (HEX-IV)	257 x 257 (HEX-V)	325 x 325 (HEX-VI)
100V	TA17731XG	TA17741XG	TA17751XP	TA17761XP
	TA17731XW	TA17741XI	TA17751XI	TA17761XJ
	TA17731XI	TA17741XO	TA17751XJ	
	TA17731XO			
200V	TA17732XG	TA17742XG	TA17752XP	TA17762XP
	TA17732XW	TA17742XI	TA17752XI	TA17762XJ
	TA17732XI	TA17742XO	TA17752XJ	
	TA17732XO			
500V	TA17735XG	TA17745XG	TA17755XP	TA17765XP
	TA17735XW	TA17745XI	TA17755XI	TA17765XJ
	TA17735XI	TA17745XO	TA17755XJ	
	TA17735XO			

SUFFIX LETTER PACKAGE CODE:
G = TO-204AA
P = TO-204AE (60 MIL LEADS)
W = TO-205AF
I = TO-254AA
O = TO-257AA
J = TO-258AA

Available QPL Types

Type M83530/	Commercial No.	Size	Maximum Ratings (85°C)				Characteristics (25°C)					
			Continuous		Transient		Varistor @ 1mA DC Test Current			Maximum Clamping Voltage V_C @ Test Current (8/20μs)		Typical Capacitance
			RMS Voltage	DC Voltage	Energy (10/1000/μs)	Peak Current (8/20μs)						
			$V_{m(ac)}$	$V_{m(dc)}$	V_{tm}	I_{tm}	Min.	$V_{N(dc)}$	Max.	V_C	I_D	f = 1 MHz
			Volts	Volts	Joules	Amps	Volts	Volts	Volts	Volts	Amps	Picofarads
1-2000B	V130LA20B	20mm	130	175	50	6000	184	200	228	325	100	1900
1-2200D	V150LA20B	20mm	150	200	55	6000	212	240	243	360	100	1600
1-4300E	V275LA40B	20mm	275	369	100	6000	389	430	453	680	100	900
1-5100E	V320LA40B	20mm	320	420	120	6000	462	510	540	810	100	750

Available TX Model Types

TXV models are not listed within but can be made available upon request. Contact factory for specific requirements.

TX Model	Model Size	Device Mark	Catalog[1] Type	TX Model	Model Size	Device Mark	Catalog[1] Type
V8ZTX1	7 mm	8TX1	V8ZA1	**V130LTX2**	7 mm	130TX	V130LA2
V8ZTX2	10 mm	8TX2	V8ZA2	**V130LTX10A**	14 mm	130TX10	V130LA10A
				V130LTX20B	20 mm	130TX20	V130LA20A
V12ZTX1	7 mm	12TX1	V12ZA1				
V12ZTX2	10 mm	12TX2	V12ZA2	**V150LTX2**	7 mm	150TX	V150LA2
				V150LTX10A	14 mm	150TX10	V150LA10A
V22ZTX1	7 mm	22TX2	V22ZA1	**V150LTX20B**	20 mm	150TX20	V150LA20B
V22ZTX3	14 mm	22TX3	V22ZA3				
				V250LTX4	7 mm	250TX	V250LA4
V24ZTX50	20 mm	24TX50	V24ZA50	**V250LTX20A**	14 mm	250TX20	V250LA20A
				V250LTX40B	20 mm	250TX40	V250LA40B
V33ZTX1	7 mm	33TX1	V33ZA1				
V33ZTX5	14 mm	33TX5	V33ZA5	**V420LTX20A**	14 mm	420TX20	V420LA20A
V33ZTX70	20 mm	33TX70	V33ZA70	**V420LTX40B**	20 mm	420TX40	V420LA40B
V68ZTX2	7 mm	68TX2	V68ZA2	**V480LTX40A**	14 mm	480TX40	V480LA40A
V68ZTX10	14 mm	68TX10	V68ZA10	**V480LTX80B**	20 mm	480TX80	V480LA80B
V82ZTX2	7 mm	82TX2	V82ZA2	**V510LTX40A**	14 mm	510TX40	V510LA40A
V82ZTX12	14 mm	82TX12	V82ZA12	**V510LTX80B**	20 mm	510TX80	V510LA80B

NOTES: 1. Maximum ratings and characteristics shall be as specified per standard catalog tables.
2. Contact factory for TX models other than those listed above for custom types to meet your special requirements.
3. Minimum order may apply to certain model types.

SMD/DESC Drawing — Metal-Oxide Varistor (MOVs) Controlled Types

SMD/ DESC 87063/	Nearest Commercial No.	Size*	Maximum Ratings (85°C)				Characteristics (25°C)					
			Continuous		Transient		Varistor Voltage @ 1mA DC Test Current			Maximum Clamping Voltage V_C @ Test Current (8/20μs)		Typical Capacitance
			RMS Voltage	DC Voltage	Energy (10/ 1000μs)	Peak Current (8/20μs)	Min.	$V_{N(dc)}$	Max.	V_C	I_P	f = 1 MHz
			$V_{m(ac)}$	$V_{m(dc)}$	W_{tm}	I_{tm}						
			Volts	Volts	Joules	Amps	Volts	Volts	Volts	Volts	Amps	Picofarads
001	V22ZA05	1	14	18	0.2	35	18.7	22	26	51	2	400
002	V22ZA1	2	14	18	0.9	150	18.7	22	26	47	5	1600
003	V22ZA2	3	14	18	2.0	350	18.7	22	26	43	5	4000
004	V22ZA3	4	14	18	4.0	750	18.7	22	26	43	10	9000
005	V24ZA50	5	14	18	6.5	1500	19.2	24	26	43	20	18000
006	V27ZA05	1	17	22	0.25	35	23	27	31.1	59	2	300
007	V27ZA1	2	17	22	1.0	150	23	27	31.1	57	5	1300
008	V27ZA2	3	17	22	2.5	350	23	27	31.1	53	5	3000
009	V27ZA4	4	17	22	5.0	750	23	27	31.1	53	10	7000
010	V27ZA60	5	17	22	8.0	1500	23	27	31.1	50	20	15000
011	V33ZA05	1	20	26	0.3	35	29.5	33	38	67	2	250
012	V33ZA1	2	20	26	1.2	150	29.5	33	36.5	68	5	1100
013	V33ZA2	3	20	26	3.0	350	29.5	33	36.5	64	5	2700
014	V33ZA5	4	20	26	6.0	750	29.5	33	36.5	64	10	6000
015	V33ZA70	5	21	27	9.0	1500	29.5	33	36.5	58	20	13000
016	V36ZA80	5	23	31	10.0	1500	32	36	40	63	20	12000
017	V39ZA05	1	25	31	0.35	35	35	39	46	79	2	220
018	V39ZA1	2	25	31	1.5	150	35	39	43	79	5	900
019	V39ZA3	3	25	31	3.5	350	35	39	43	76	5	2200
020	V39ZA6	4	25	31	7.2	750	35	39	43	76	10	5000
021	V47ZA05	1	30	38	0.4	35	42	47	55	90	2	200
022	V47ZA1	2	30	38	1.8	150	42	47	52	92	5	800
023	V47ZA3	3	30	38	4.5	350	42	47	52	89	5	2000
024	V47ZA7	4	30	38	8.8	750	42	47	52	89	10	4500
025	V56ZA05	1	35	45	0.5	35	50	56	66	108	2	180
026	V56ZA2	2	35	45	2.3	150	50	56	62	107	5	700
027	V56ZA3	3	35	45	5.5	350	50	56	62	103	5	1800
028	V56ZA8	4	35	45	10.0	750	50	56	62	103	10	3900
029	V68ZA05	1	40	56	0.6	35	61	68	80	127	2	150
030	V68ZA2	2	40	56	3.0	150	61	68	75	127	5	600
031	V68ZA3	3	40	56	6.5	350	61	68	75	123	5	1500
032	V68ZA10	4	40	56	13.0	750	61	68	75	123	10	3300
033	V82ZA05	1	50	66	1.2	70	73	82	97	145	2	120
034	V82ZA2	2	50	66	3.5	300	73	82	91	135	10	500
035	V82ZA4	3	50	66	7.3	750	73	82	91	135	25	1100
036	V82ZA12	4	50	66	13.0	1500	73	82	91	145	50	2500
037	V100ZA05	1	60	81	1.5	70	90	100	117	175	2	90
038	V100ZA3	2	60	81	4.3	300	90	100	110	165	10	400
039	V100ZA4	3	60	81	8.9	750	90	100	110	165	25	900
040	V100ZA15	4	60	81	16.0	1500	90	100	110	175	50	2000
041	V120ZA05	1	75	102	1.8	100	108	120	138	205	2	70
042	V120ZA1	2	75	102	5.3	400	108	120	132	205	10	300
043	V120ZA4	3	75	102	11.0	1000	108	120	132	200	25	750
044	V120ZA6	4	75	102	19.0	2000	108	120	132	210	50	1700
045	V150ZA05	1	92	127	2.3	100	135	150	173	240	2	60
046	V150ZA1	2	95	127	6.5	400	135	150	165	250	10	250
047	V150ZA4	3	95	127	13.0	1000	135	150	165	250	25	600
048	V150ZA8	4	95	127	23.0	2000	135	150	165	255	50	1400
049	V180ZA05	1	95	127	2.7	150	162	180	207	290	2	50
050	V180ZA1	2	95	125	7.7	500	162	180	198	295	10	200
051	V180ZA5	3	115	153	16.0	1500	162	180	198	300	25	500
052	V180ZA10	4	115	153	27.0	3000	162	180	198	300	50	1100

*SIZE 1 - 5 mm, 2 - 7 mm, 3 - 10 mm, 4 - 14 mm, 5 - 20 mm

GaAs FET Products

Products and Services

Gallium Arsenide-based standard and custom products are available from Harris Microwave Semiconductor (HMS), located in Milpitas, CA.

Standard products include:

1. GaAs Field Effect Transistors (GaAs FETs) for RF and microwave applications.
2. GaAs Monolithic Microwave Integrated Circuits (MMICs) for broadband amplification of RF and microwave signals.

Custom design and foundry services are available whereby customers can design or specify specialized MMIC or FET products for manufacture at HMS. Analysis, testing, packaging, and screening options are available for all standard and custom products.

GaAs FET Products

Microwave GaAs FETs from Harris have been designed and built for performance, reliability and consistency using low defect gallium arsenide substrates, ion implantation, Ti/Pt/Au metallization, large cross-section "T" gate structure and integral dielectric scratch and short circuit protection.

Each wafer undergoes extensive reliability and performance qualification. Each die is DC tested and visually inspected prior to packaging and shipment. To accommodate specialized requirements, Harris can provide selections tailored to meet these needs. Custom screening and qualification testing are also available.

Gain Optimized FET Products

Device Type HMF-	MAG (dB) Min	MAG (dB) Typ	P_{MAG} (dBm)	G_{1dB} (dB)	P_{1dB} (dBm) Min	P_{1dB} (dBm) Typ	Freq. (GHz)	Bias V_{DS}, I_{DS}	Application/ Description
03100-100	5	7	14	4.5	—	15	18	6V, 50% I_{DSS}	2-20GHz Low Noise
03100-200	6	7	14	4.5	18	19	18	6V, 50% I_{DSS}	2.20GHz Gain/Drive
03100-300	6	7	14	4.5	20	21	18	6V, 50% I_{DSS}	2-20GHz Drive
0330	6	8	13.5	6	10	15	18	4V, 20mA	2-20GHz Low Noise, Low Current
06100-100	10	11	17	9	—	20	8	6V, 50% I_{DSS}	2-14GHz Power, High GM
06100-200	5	6	19.5	4.5	21.5	23.5	18	6V, 50% I_{DSS}	2-20GHz Power
1210	—	6	22	4	—	25	18	6V, 50% I_{DSS}	2-20GHz Power

Power Optimized FET Products

Device Type HMF-	G_{1dB} (dB)	P_{1dB} (dBm) Min	P_{1dB} (dBm) Typ	MAG (dB) Typ	P_{MAG} (dBm)	Freq (GHz)	Bias V_{DS}, I_{DS}	Application/ Description
0300	7.5	20.5	21.5	12	18	8	8V, 50% I_{DSS}	2-18GHZ, 125mW
0600	7	23.5	24.5	10.5	22	8	8V, 50% I_{DSS}	2-18GHz, 250mW
12000-100	6	25.5	26.5	9.5	25	8	8V, 50% I_{DSS}	2-16GHz, 500mW
12000-200	6	27	27.5	9.5	25	8	8V, 50% I_{DSS}	2-16GHz, 650mW
24000-100	4	28.5	29.5	7	28	8	8V, 50% I_{DSS}	2-14GHz, 800mW
24000-200	4.5	30	30.5	7	28	8	8V, 50% I_{DSS}	2-14GHz, 1.2W

HMM Series

Our half-micron (gate length) family of fully integrated MMIC amplifiers is intended for broadband applications where noise figure, gain or output power are key specifications in a system design.

HMM Product Family — Electrical Specifications

Model No	Frequency Band (GHz)	Small Signal Gain (dB) Typ	Gain Flatness (dB) Typ	1dB Gain Compression Output Power (dBm) Typ	Noise Figure (dB) Typ	VSWR Typ
HMM-10610	2-6	13	±.5	+19	6	1.7:1
HMM-10620 (Low Current)	2-6	11.5		+13	5.5	1.7:1
HMM-11810	6-18	6	±.75	+16	6.5	2:1
HMM-11820 (Low Current)	6-18	6		+12	5.5	1.7:1

Operating Conditions

HMR Series

For lower frequency application, specify the Harris HMR one-micron (gate length) MMIC family.

HMR Product Family — Electrical Specifications

Model No	Frequency Band (GHz)	Small Signal Gain (dB) Typ	Gain Flatness (dB) Typ	1dB Gain Compression Output Power (dBm) Typ	Noise Figure (dB) Typ	VSWR Typ
HMR-10504	0.5-3	11.0	±0.8	+10	7	1.7:1
HMR-10505	1-3	10.5	±0.8	+10	7	1.7:1
HMR-11000 Attenuator	DC-18	15 (Ins Loss) at 18	±0.5 at 10dB (Ins Loss)	+16	1.5 (Ins Loss)	1.3:1

V_{DD} = 8V, I_{DD} = 50 mA

Custom and Fabrication Services

Key Features

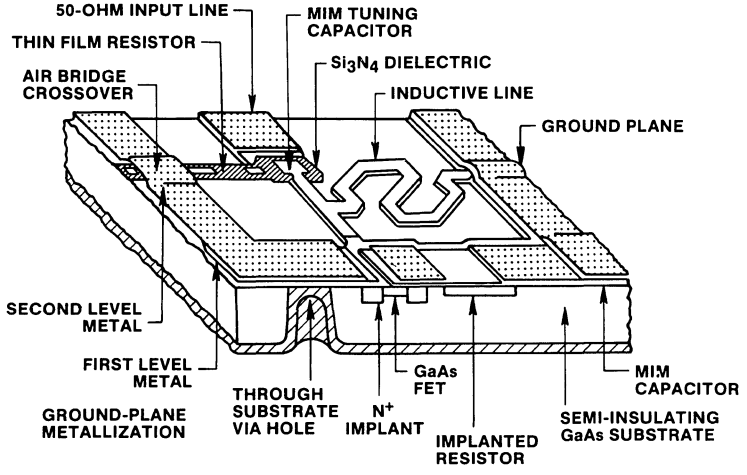
- Design rule book includes microwave and physical rules
- 0.5 micron plated "T"-gate technology
- Reliable Ti/Pt/Au metallization
- Ion implantation for uniformity, consistency
- Circuit elements
  - "n+" type (low sheet RHO) resistors
  - "n" type (high sheet RHO) resistors
  - Diodes
  - FETs
  - Dual gate FETs
  - Transmission lines
  - Inductors
  - Capacitors
  - Through substrate via holes

MMIC Program Options

- Gain, power or low current FET models and processing
- Circuit design from customer specs
- "Layout" from customer-supplied design
- Computer simulation of design
- Generation of digitized data from customer drawing
- RF screening of selected parts
- Special packaging/assembly
- Specialized DC testing
- High reliability screening

Processes for Custom MMICs

Process Type (Gate Length)	Practical Operating Frequencies	f_t	f_{max}	Process Options
0.5 Micron	0.5 to 20 GHz	18 GHz	40 GHz	High Gain, Low Current High Power
1 Micron	0.1 to 12 GHz	12 GHz	26 GHz	High Gain



Features of a typical MMIC chip

High-Reliability JAN, SMD/DESC Military Drawings/ Device Types Cross-Reference

M38510 JAN PRODUCTS

Specification	Description	Package	Device Type
	Analog Switches/Multiplexers		
10501BEA	SPST 75 Ohm High-Level CMOS Analog Switch	16-Pin Sidebraze	IH5040MDE
10502BEA	Dual SPST 75 Ohm High-Level CMOS Analog Switch	16-Pin Sidebraze	IH5041MDE
10503BEA	SPDT 75 Ohm High-Level CMOS Analog Switch	16-Pin Sidebraze	IH5042MDE
10504BEA	Dual SPDT 75 Ohm High-Level CMOS Analog Switch	16-Pin Sidebraze	IH5043MDE
10505BEA	DPST 75 Ohm High-Level CMOS Analog Switch	16-Pin Sidebraze	IH5044MDE
10506BEA	Dual DPST 75 Ohm High-Level CMOS Analog Switch	16-Pin Sidebraze	IH5045MDE
11101BAC	Dual SPST 30 Ohm High Speed Driver with JFET Switch	14-Pin Flatpack	DG181AL
11101BCA	Dual SPST 30 Ohm High-Speed Driver with JFET Switch	14-Pin Sidebraze	DG181AP
11101BIA	Dual SPST 30 Ohm High Speed Driver with JFET Switch	10-Pin Metal Can	DG181AA
11102BAC	Dual SPST 75 Ohm High Speed Driver with JFET Switch	14-Pin Flatback	DG182AL
11102BCA	Dual SPST 75 Ohm High Speed Driver with JFET Switch	14-Pin Sidebraze	DG182AP
11102BIA	Dual SPST 75 Ohn High Speed Driver with JFET Switch	10-Pin Metal Can	DG182AA
11103BAC	Dual DPST 30 Ohm High Speed Driver with JFET Switch	14-Pin Flatpack	DG184AL
11103BEA	Dual DPST 30 Ohm High Speed Driver with JFET Switch	16-Pin Sidebraze	DG184AP
11104BAC	Dual DPST 75 Ohm High Speed Driver with JFET Switch	14-Pin Flatpack	DG185AL
11104BEA	Dual DPST 75 Ohn High Speed Driver with JFET Switch	16-Pin Sidebraze	DG185AP
11105BAC	SPDT 30 Ohm High Speed Driver with JFET Switch	14-Pin Flatpack	DG187AL
11105BCA	SPDT 30 Ohm High Speed Driver with JFET Switch	14-Pin Sidebraze	DG187AP
11105BIA	SPDT 30 Ohm High Speed Driver with JFET Switch	10-Pin Metal Can	DG187AA
11106BAC	SPDT 75 Ohm High Speed Driver with JFET Switch	14-Pin Sidebraze	DG188AL
11106BCA	SPDT 75 Ohm High Speed Driver with JFET Switch	14-Pin Sidebraze	DG188AP
11106BIA	SPDT 75 Ohm High Speed Driver with JFET Switch	10-Pin Metal Can	DG188AA
11107BAC	Dual SPDT 30 Ohm High Speed Driver with JFET Switch	14-Pin Flatpack	DG190AL
11107BEA	Dual SPDT 30 Ohm High Speed Driver with JFET Switch	16-Pin Sidebraze	DG190AP
11108BAC	Dual SPDT 75 Ohm High Speed Driver with JFET Switch	14-Pin Flatpack	DG191AL
11108BEA	Dual SPDT 75 Ohm High Speed Driver with JFET Switch	16-Pin Side Braze	DG191AP
11601BCA	TTL Compatible CMOS Analog Switch	14-Pin Sidebraze	DG300AAP
11602BCA	TTL Compatible CMOS Analog Switch	14-Pin Sidebraze	DG301AAP
11603BCA	TTL Compatible CMOS Analog Switch	14-Pin Sidebraze	DG302AAP
11604BCA	TTL Compatible CMOS Analog Switch	14-Pin Sidebraze	DG303AAP
12302BEA	Quad SPST CMOS Analog Switch	16-Pin CERDIP	HI1-0201
12302BEA	Quad SPST CMOS Analog Switch	16-Pin Sidebraze	DG201AP
19007BEA	8-Channel CMOS Analog Multiplexer	16-Pin Sidebraze	IH6108MDE
19008BEA	4-Channel Differential CMOS Analog Multiplexer	16-Pin Sidebraze	IH6208MDE
	Amplifiers		
12202BGC	Wideband High Impedance Op Amp	TO-99 CAN	HA2-2600
12203BGC	Very Wideband Uncompensated Op Amp	TO-99 CAN	HA2-2620
12204BGC	Precision High Slew Rate Op Amp	TO-99 CAN	HA2-2500
12205BGC	High Slew Rate Op Amp	TO-99 CAN	HA2-2510
12206BGC	High Slew Rate Uncompensated Op Amp	TO-99 CAN	HA2-2520
	Data Acquisition		
12702BEA	CMOS Monolithic 10-Bit Multiplying D/A Converter	16-Pin Sidebraze	AD7520UD

SMD/DESC PRODUCTS

SMD/DESC Drwg No.	Description	Package	Device Type
	Analog/Linear		
7703901GA	Programmable Operational Amplifier	8-Pin CERDIP	LM4250H
7703901PA	Programmable Operational Amplifier	TO-99 CAN	LM4250J
7705201EA	8-Channel CMOS Analog Multiplexer	16-Pin CERDIP	IH6108MJE
7705201EC	8-Channel CMOS Analog Multiplexer	16-Pin CERDIP	HI1-0508
7705202EA	8-Channel CMOS Analog Multiplexer	16-Pin CERDIP	HI1-0548
7705203EA	8-Channel Fault-Protected CMOS Analog Multiplexer	16-Pin CERDIP	IH5108MJE
77052022A	8-Channel CMOS Analog Multiplexer	20-Pad CER LCC	HI4-0548
7705301EA	Quad SPST CMOS Analog Switch	16-Pin CERDIP	DG201AK
7800302GC	High-Voltage Operational Amplifier	TO-99 CAN	HA2-2640
7801401CA	Dual JFET Analog Switch	14-Pin CERDIP	DG129AK
7801401CC	Dual JFET Analog Switch	14-Pin CERDIP	DG129AP
8001601CA	Sample and Hold	14-Pin CERDIP	HA1-2420
8100601EA	SPST 75-ohm High-Level CMOS Analog Switch	16-Pin CERDIP	IH5040MJE
8100602EA	Dual SPST 75-ohm CMOS Analog Switch	16-Pin CERDIP	IH5041MJE
8100603EA	SPDT 75-ohm High-Level CMOS Analog Switch	16-Pin CERDIP	IH5042MJE
8100604EA	Dual SPDT 75-ohm High-Level CMOS Analog Switch	16-Pin CERDIP	IH5043MJE
8100605EA	DPST 75-ohm High-Level CMOS Analog Switch	16-Pin CERDIP	IH5044MJE
8100606EA	Dual DPST 75-ohm High-Level CMOS Analog Switch	16-Pin CERDIP	IH5045MJE
8100607EA	DPDT 57-ohm High-Level CMOS Analog Switch	16-Pin CERDIP	IH5046MJE
8100608EA	4PST 75-ohm High-Level CMOS Analog Switch	16-Pin CERDIP	IH5047MJE
8100609EA	SPST 75-ohm High-Level CMOS Analog Switch	16-Pin CERDIP	HI1-5040
8100609EA	SPST 75-ohm High-Level CMOS Analog Switch	16-Pin CERDIP	IH5140MJE
8100610EA	Dual SPST 75-ohm High-Level CMOS Analog Switch	16-Pin CERDIP	HI1-5041

High-Reliability JAN, SMD/DESC Military Drawings/ Device Types Cross-Reference

SMD/DESC PRODUCTS

SMD/DESC Drwg No.	Description	Package	Device Type
	Analog/Linear (continued)		
8100610EA	Dual SPST 75-ohm High-Level CMOS Analog Switch	16-Pin CERDIP	IH5141MJE
8100611EA	SPST 75-ohm High-Level CMOS Analog Switch	16-Pin CERDIP	HI1-5042
8100611EA	SPDT High-Level CMOS Analog Switch	16-Pin CERDIP	IH5142MJE
8100612EA	Dual SPDT 75-ohm High-Level CMOS Analog Swtich	16-Pin CERDIP	HI1-5043
81006122A	Dual SPDT 75-ohm High-Level CMOS Analog Switch	20-Pad CER LCC	HI4-5043
8100612EA	Dual SPDT High-Level CMOS Analog Switch	16-Pin CERDIP	IH5143MJE
8100613EA	DPST 75-ohm High-Level CMOS Analog Switch	16-Pin CERDIP	HI1-5044
8100613EA	DPST High-Level CMOS Analog Switch	16-Pin CERDIP	IH5144MJE
8100614EA	Dual DPST 75-ohm High-Level CMOS Analog Switch	16-Pin CERDIP	HI1-5045
8100614EA	Dual DPST 75-ohm High-Level CMOS Analog Switch	16-Pin CERDIP	IH5145MJE
81006142A	Dual DPST 75-ohm High-Level CMOS Analog Switch	20-Pad CER LCC	HI4-5045
8100615EA	DPDT 75-ohm High-Level CMOS Analog Switch	16-Pin CERDIP	HI1-5046
8100615EA	DPDT 75-ohm High-Level CMOS Analog Switch	16-Pin CERDIP	IH5046MJE
8100616EA	4PST 75-ohm High-Level CMOS Analog Switch	16-Pin CERDIP	HI1-5047
8100616EA	4PST 75-ohm High-Level CMOS Analog Switch	16-Pin CERDIP	IH5047MJE
8100617EA	DPDT 75-ohm High-Level CMOS Analog Switch	16-Pin CERDIP	HI1-5046A
8100617EA	DPDT 75-ohm High-Level CMOS Analog Switch	16-Pin CERDIP	IH5046MJE
8100618EA	4PST 75-ohm High-Level CMOS Analog Switch	16-Pin CERDIP	HI1-5047A
8100618EA	4PST 75-ohm High-Level CMOS Analog Switch	16-Pin CERDIP	IH5047MJE
8100619EA	Dual SPST 75-ohm High-Level CMOS Analog Switch	16-Pin CERDIP	HI1-5048
8100619EA	Dual SPST 75-ohm High-Level CMOS Analog Switch	16-Pin CERDIP	IH5148MJE
8100620EA	Dual SPST 75-ohm High-Level CMOS Analog Switch	16-Pin CERDIP	HI1-5049
8100620EA	Dual DPST 75-ohm High-Level CMOS Analog Switch	16-Pin CERDIP	IH5149MJE
8100621EA	SPDT 75-ohm High-Level CMOS Analog Switch	16-Pin CERDIP	HI1-5050
8100621EA	SPDT 75-ohm High-Level CMOS Analog Switch	16-Pin CERDIP	IH5150MJE
8100622EA	Dual SPDT 75-ohm High-Level CMOS Analog Switch	16-Pin CERDIP	HI1-5051
8100622EA	Dual SPDT 75-ohm High-Level CMOS Analog Switch	16-Pin CERDIP	IH5150MJE
81006222A	Dual SPDT 75-ohm High-Level CMOS Analog Switch	16-Pin CERDIP	HI4-5051
5962-8513101XA	Single 16/Diff. 8-Channel CMOS Analog Multiplexer	28-Pin CERDIP	HI1-0546
5962-85131013A	Single 16/Diff. 8-Channel CMOS Analog Multiplexer	28-Pad CER LCC	HI4-0546
5962-8513102XA	Single 16/Diff. 8-Channel CMOS Analog Multiplexer	28-Pin CERDIP	HI1-0547
5962-85131023A	Single 16/Diff. 8-Channel CMOS Analog Multiplexer	28-Pad CER LCC	HI4-0547
5962-8513103EA	Single 8/Diff. 4-Channel CMOS Analog Multiplexer	16-Pin CERDIP	HI1-0549
5962-85131032A	Single 8/Diff. 4-Channel CMOS Analog Multiplexer	20-Pad CER LCC	HI4-0549
5962-8513104XA	16-Channel Fault-Protected CMOS Analog Multiplexer	28-Pin CERDIP	IH5116MJI
5962-8513105XA	8-Channel Diff. Fault-Protected CMOS Analog Multiplexer	28-Pin CERDIP	IH5216MJI
5862-8513106EA	4-Channel Diff. Fault-Protected CMOS Analog Multiplexer	16-Pin CERDIP	IH5208MJE
5962-8671601EA	Quad SPST CMOS Analog Switch	16-Pin CERDIP	HI1-0201HS
5962-86716012A	Quad SPST CMOS Analog Switch	20-Pad CER LCC	HI4-0201HS
5962-8671801VA	4-Channel Wideband Multiplexer	18-Pin CERDIP	HI1-0524
5962-8766001GA	Dual Power MOSFET Driver	TO-99 CAN	ICL7667MTV
5962-8766001PA	Dual Power MOSFET Driver	8-Pin CERDIP	ICL7667MJA
5962-8869901XA	16/Diff. 8-Channel CMOS Analog Multiplexer	28-Pin CERDIP	HI1-0516
	Microperipheral/Memory		
5462-8756301JA	CMOS μp-Compatible Real-Time Clock	24-Pin CERDIP	ICM7170MDG
5462-8756301JA	CMOS μp-Compatible Real-Time Clock	24-Pin CERDIP	ICM7170MDG

Harris can provide devices that are in full compliance with MIL-STD-883B, Rev. C.

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Device Type	JAN No.	SMD/ DESC No.	Reference Publication
2N3439	MIL-S-19500/368		SSD-230C,
2N3440	MIL-S-19500/368		Vol. II•
2N3584	MIL-S-19500/384		
2N3585	MIL-S-19500/384		
2N3879	MIL-S-19500/526		
2N5038	MIL-S-19500/439		
2N5039	MIL-S-19500/439		
2N5302	MIL-S-19500/456		
2N5303	MIL-S-19500/456		
2N5320			
2N5322			
2N5415S	MIL-S-19500/485		
2N5416S	MIL-S-19500/485		
2N5671	MIL-S-19500/488		
2N5672	MIL-S-19500/488		
2N6032	MIL-S-19500/528		
2N6033	MIL-S-19500/528		
2N6211	MIL-S-19500/461		
2N6212	MIL-S-19500/461		
2N6213	MIL-S-19500/461		
2N6248			
2N6283	MIL-S-19500/504		
2N6284	MIL-S-19500/504		
2N6286	MIL-S-19500/505		
2N6287	MIL-S-19500/505		
2N6306	MIL-S-19500/498		
2N6308	MIL-S-19500/498		
2N6383	MIL-S-19500/523		
2N6384	MIL-S-19500/523		
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2N6546	MIL-S-19500/525		
2N6547	MIL-S-19500/525		
2N6648	MIL-S-19500/527		
2N6649	MIL-S-19500/527		
2N6650	MIL-S-19500/527		
2N6671	MIL-S-19500/536		
2N6673	MIL-S-19500/536		
2N6674	MIL-S-19500/537		
2N6675	MIL-S-19500/537		
2N6676	MIL-S-19500/538		
2N6678	MIL-S-19500/538		
2N6688			
2N6756	MIL-S-19500/542A		
2N6758	MIL-S-19500/542A		
2N6760	MIL-S-19500/542A		
2N6762	MIL-S-19500/542A		
2N6764	MIL-S-19500/543A		
2N6766	MIL-S-19500/543A		
2N6768	MIL-S-19500/543A		
2N6770	MIL-S-19500/543A		
2N6782	MIL-S-19500/556		
2N6784	MIL-S-19500/556		
2N6786	MIL-S-19500/556		
2N6788	MIL-S-19500/555		
2N6790	MIL-S-19500/555		
2N6792	MIL-S-19500/555		
2N6794	MIL-S-19500/555		
2N6796	MIL-S-19500/557		
2N6798	MIL-S-19500/557		
2N6800	MIL-S-19500/557		
2N6802	MIL-S-19500/557		•

Device Type	JAN No.	SMD/ DESC No.	Reference Publication
2N6849	MIL-S-19500/563		SSD-230C,
2N6851	MIL-S-19500/563		Vol. II•
2N6895	MIL-S-19500/565		
2N6896	MIL-S-19500/565		
2N6897	MIL-S-19500/565		
2N6898	MIL-S-19500/565		
2N6901	MIL-S-19500/566		
2N6902	MIL-S-19500/566		
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AGC50K			
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CA4000A	MIL-M-38510/05201		SSD-230C,
CD4000B	MIL-M-38510/05251		Vol. I■
CD4000UB			
CD4001A	MIL-M-38510/05202		
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CD4002A	MIL-M-38510/05203		
CD4002B	MIL-M-38510/05253		
CD4002UB			
CD4006A	MIL-M-38510/05701		
CD4006B	MIL-M-38510/05751		
CD4007A	MIL-M-38510/05301		
CD4007UB	MIL-M-38510/05351		
CD4008A	MIL-M-38510/05401		
CD4008B	MIL-M-38510/05451		
CD4009A	MIL-M-38510/05501		
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CD40100B			
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CD40102B			
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CD40106B	MIL-M-38510/17702		
CD40107B	MIL-M-38510/17402		
CD40108B			
CD40109B	MIL-M-38510/17404		
CD4010A	MIL-M-38510/05502		
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CD4011A	MIL-M-38510/05001		
CD4011B	MIL-M-38510/05051		
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CD4012A	MIL-M-38510/05002		
CD4012B	MIL-M-38510/05052		
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CD4013A	MIL-M-38510/05101		
CD4013B	MIL-M-38510/05151		
CD40147B			
CD4014A	MIL-M-38510/05702		
CD4014B	MIL-M-38510/05752		
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CD40160B			
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CD4016A	MIL-M-38510/05801		
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CD40174B	MIL-M-38510/17505		
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CD4017A	MIL-M-38510/05601		
CD4017B	MIL-M-38510/05651		
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CD4018A	MIL-M-38510/05602		
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CD40192B			
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Device Type	JAN No.	SMD/ DESC No.	Reference Publication
CD4019A	MIL-M-38510/05302		SSD-230C,
CD4019B	MIL-M-38510/05352		Vol. I■
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CD4020A	MIL-M-38510/05603		
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CD4023B	MIL-M-38510/05053		
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CD4024A	MIL-M-38510/05605		
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CD4030A	MIL-M-38510/05303		
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CD4066B	MIL-M-38510/05852		
CD4067B	MIL-M-38510/17801		
CD4068B			
CD4069UB	MIL-M-38510/17401		
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CD4071B	MIL-M-38510/17101		
CD4072B	MIL-M-38510/17102		
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CD4081B	MIL-M-38510/17001		
CD4082B	MIL-M-38510/17002		
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CD54HC04		8409801CX	
CD54HC08		8404701CX	
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CD54HC107		5962-8515401CX	
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CD54HC126		5962-8684801CX	
CD54HC132			
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CD54HC138		8406201EX	
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CD54HC151		8412801EX	
CD54HC153		8409301EX	
CD54HC154		5962-8682201JX	
CD54HC157		5962-860610EX	
CD54HC158		5962-8682301EX	
CD54HC160		5962-8682401EX	
CD54HC161		8407501EX	
CD54HC162		8409401EX	
CD54HC163		8607601EX	
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CD54HC237		5962-8860601EA	
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CD54HC243		8409001CX	
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CD54HC257		8512401EX	
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CD54HC27		8404201CX	
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CD54HC273		8409901RX	
CD54HC280		8607701CX	
CD54HC283			
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CD54HC30		8404001CX	
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CD54HC367		8500201EX	
CD54HC368		5962-8681201EX	
CD54HC373		8407201RX	
CD54HC374		8407101RX	
CD54HC377		5962-8780701RA	
CD54HC390		8600901EX	
CD54HC393		8410001CX	
CD54HC4002		8404401CX	
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CD54HC40105			
CD54HC4015			
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CD54HC4017		8601101EX	
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CD54HC4024		8601201CX	
CD54HC4040		8500401EX	
CD54HC4046			
CD54HC4049		5962-8681901EX	
CD54HC4050		5962-8682001EX	
CD54HC4051			
CD54HC4052			
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CD54HC4538		5962-8688601EX	
CD54HC4543			
CD54HC533		5962-8681301RX	
CD54HC534		5962-8681401RX	
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CD54HC648			
CD54HC670			
CD54HC688		5962-8681801RX	
CD54HC7046			
CD54HC7266		8404301CX	
CD54HC73		5962-8515301CX	
CD54HC74		8405601CX	
CD54HC75		8407001EX	
CD54HC85		8601301EX	
CD54HC86		8404601CX	
CD54HC93			
CD54HCT00		5962-8683101CX	
CD54HCT02			
CD54HCT03			
CD54HCT04			
CD54HCT05		5962-868301CX	
CD54HCT08			
CD54HCT10			
CD54HCT107			
CD54HCT109			
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CD54HCT123			
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CD54HCT126			
CD54HCT132			
CD54HCT137			
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CD54HCT14		5962-8689001EX	
CD54HCT14			
CD54HCT147			
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CD54HCT191		5962-8867101EA	
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CD54HCT237			SSD-230C,
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CD54HCT244		8513001RX	
CD54HCT245		8550601RX	
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CD54HCT273		5962-8772501RX	
CD54HCT280			
CD54HCT283			
CD54HCT297			
CD54HCT299			
CD54HCT30			
CD54HCT32		5962-8685201CX	
CD54HCT354			
CD54HCT356			
CD54HCT365			
CD54HCT366			
CD54HCT367			
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CD54HCT373		5962-8686701RX	
CD54HCT374		855701RX	
CD54HCT377			
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CD54HCT4002			
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CD54HCT4016			
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CD54HCT4020			
CD54HCT4024			
CD54HCT4040			
CD54HCT4046A			
CD54HCT4050		5962-8862401JX	
CD54HCT4051			
CD54HCT4052			
CD54HCT4053			
CD54HCT4059			
CD54HCT4060			
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CD54HCT4067			
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CD54HCT541			
CD54HCT563			
CD54HCT564			
CD54HCT573		5962-8685601RX	
CD54HCT574			
CD54HCT583			
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CD54HCT646			
CD54HCT648			
CD54HCT670			
CD54HCT688		5962-8685701RX	
CD54HCT7046A			
CD54HCT266			
CD54HCT73			
CD54HCT74		5962-8685301CX	
CD54HCT75			
CD54HCT85		5962-8867201EX	
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CD54HCT93			
CD54HCU04		8601001CX	
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CDP1854AC			SSD-230C,
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DG182AP	11102BCC		
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DG188AL	11106BAC		
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DG201AP	12302BEA		
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HA0-2420			
HA0-2502			
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HA0-5170			Analog★
HA05177			
HA0-5180			
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HA1-2400			
HA1-2420		8001601CA	
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HA1-5004			
HA1-5104			
HA1-5114			
HA1-5134			
HA1-5144			
HA1-5154			
HA1-5190			
HA1-5330			
HA2-2500	12204BGC		
HA2-2500			
HA2-2502			
HA2-2510	12205BGC		
HA2-2510			
HA2-2512			
HA2-2520	12206BGC		
HA2-2520			
HA2-2522			
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HA2-2541			
HA2-2542			
HA2-2544			
HA2-2548			
HA2-2600	12202BGC		
HA2-2600			
HA2-2602			
HA2-2620	12203BGC		
HA2-2620			
HA2-2622			
HA2-2640		7800302GC	
HA2-2640			
HA2-2650			
HA2-5002			
HA2-5033			
HA2-5101			
HA2-5102			
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HA2-5112			
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HA2-5147			Analog★
HA2-5151			
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HA2-5160			
HA2-5170			
HA2-5177			
HA2-5180			
HA2-5190			
HA2-5221			
HA4-2400			
HA4-2420			
HA4-2502			
HA4-2512			
HA4-2522			
HA4-2529			
HA4-2539			
HA4-2540			
HA4-2544			
HA4-2546			
HA4-2547			
HA4-2548			
HA4-2602			
HA4-2622			
HA4-2640			
HA4-2650			
HA4-4741			
HA4-4900			
HA4-4902			
HA4-5002			
HA4-5101			
HA4-5102			
HA4-5104			
HA4-5111			
HA4-5112			
HA4-5114			
HA4-5127			
HA4-5134			
HA4-5135			
HA4-5137			
HA4-5141			
HA4-5142			
HA4-5144			
HA4-5147			
HA4-5151			
HA4-5152			
HA4-5154			
HA4-5170			
HA4-5177			
HA4-5190			
HA4-5221			
HA4-5222			
HA4-5330			
HA7-2500			
HA7-2502			
HA7-2510			
HA7-2512			
HA7-2520			
HA7-2522			
HA7-2529			
HA7-2544			★

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HA7-2548			Analog★
HA7-2600			
HA7-2602			
HA7-2620			
HA7-2622			
HA7-2640			
HA7-2650			
HA7-5002			
HA7-5101			
HA7-5102			
HA7-5111			
HA7-5112			
HA7-5127			
HA7-5130			
HA7-5135			
HA7-5137			
HA7-5141			
HA7-5142			
HA7-5147			
HA7-5151			
HA7-5152			
HA7-5170			
HA7-5177			
HA7-5180			
HA7-5221			
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HCTS11			
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HCTS138			
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HCTS245			
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HCTS574			
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HCTS7266			
HCTS74			
HCTS75			
HCTS86			
HCTS93			■
HD1-15530		7802901JA	Digital#
HD1-15531			
HD1-4702			
HD4-15530		78029013A	
HD1-6402			
HD1-6409			#
HFA1-0001			Analog★
HFA2-0002			
HFA2-0005			
HFA4-0001			
HFA4-0002			
HFA4-0005			
HFA7-0002			
HFA7-0005			
HI0-0506			
HI0-0507			
HI0-0508			
HI0-0509			
HI0-0546			
HI0-0547			
HI0-0548			
HI0-0549			
HI0-1818A			
HI0-1828A			
HI1-0200			
HI1-0201	1230BEA	7705301EX	
HI1-0201HS		5962-8671601EA	
HI1-0201HS			
HI1-0222			
HI1-0506	19001BXA		
HI1-0507	19003BXA		
HI1-0508	19007BEA	7705201EC	
HI1-0509	19005BEA		
HI1-0546	19002BXA	5962-8513101XA	
HI1-0547	19004BXA	5962-8513102XA	
HI1-0548	19005BEA	7705202EA	
HI1-0549	19006BEA	5962-8513103EA	
HI1-1818A			
HI1-1828A			
HI1-5040		8100609EA	
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HI1-5042		8100611EA	Analog★
HI1-5043		8100612EA	
HI1-5044		8100613EA	
HI1-5045		8100614EA	
HI1-5046		8100615EA	
HI1-5046A		8100617EA	
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HI1-5048		8100619EA	
HI1-5049		8100620EA	
HI1-5050		8100621EA	
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HI1-565A			
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HI4-0201		77053012X	
HI4-0201HS		5962-86716012A	
HI4-0222			
HI4-0506			
HI4-0506			
HI4-0507			
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HI4-0509			
HI4-0546		5962-85131013A	
HI4-0547		5962-85131023A	
HI4-0547			
HI4-0548		77052022A	
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HI4-5043		81006122A	
HI4-5045		81006142A	
HI4-5051		81006222A	
HI4-574A			
HI4-674A			
HI4-DAC87V			★
HM-91MZ			Digital#
HM1-6504		8102405VA	
HM1-6504B		8102403VA	
HM1-6504S	M38510/24501BVA	8102401VA	
HM1-6508			
HM1-6514S	M38510/24502BVA	8102402VA	
HM1-6516	M38510/29102BJA	8403601JA	
HM1-65162	M38510/29104BJA	8403602JA	
HM1-65162B	M38510/29110BJA	8403606JA	
HM1-6518			
HM1-65262	M38510/29103BRA	8413201RA	
HM1-65262B	M38510/29109BRA	8413203RA	
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HM1-65642B	M38510/29205BXA		
HM1-6617		8954001JA	
HM1-6617B		8954002JA	
HM1-6642		8869001JA	
HM1-6642B		8869002JA	
HM4-6516	M38510/29102BXA	8403601ZA	
HM4-65161B	M38510/29110BXA	8403606ZA	
HM4-65162	M38510/29104BXA	8403602ZA	
HM4-65262	M38510/29103BYA	8413201YA	#

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HM4-65262B	M38510/29109BYA	8413203YA	Digital#
HM4-65642B	M38510/29205BYA		
HM4-6617		8954001XA	
HM4-6617B		8954002XA	
HM4-6642		88690013A	
HM5-6564			
HM5-8808			
HM5-8816H			
HM5-8832			
HM5-8832B			
HM5-92560			
HM5-92570			
HM6-6617		8954001LA	
HM6-6617B		8954002LA	
HM6-6642		8869001LA	
HM6-6642B		8869002LA	#
HMF-0300			GaAs†
HMF-03100-100			
HMF-03100-200			
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HMF-0330			
HMF-0600			
HMF-0610			
HMF-0620			
HMF-12000-100			
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HMF-24000-200			
HMM-10610			
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HMM-11810			
HMM-11820			
HMR-10504			
HMR-10505			†
HR3N0187			SSD-230C,
HR3N0200			Vol. I■
HR3N0205			■
HS-3447			Digital#
HS1-1840RH			
HS1-302RH			
HS1-303RH			
HS1-306RH			
HS1-307RH			
HS1-3182		8687901EA	
HS1-3282		8688001QA	
HS1-384RH			
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HS-65643RH			
HS-65647RH			
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HS9-390RH			
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HS9-6514RH			
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HSC1000			ASIC•
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ICL7667MTV		5962-8766000GA	ICDC-1987▶
ICL7667MJA		5962-8766001PA	
ICM7170MDG		5962-8765301JA	
ICM7170MDG		5962-8765301JC	
IH5040MDE	10501BEA		
IH5040MDE	10501BEC		
IH5040MJE		8100601EA	
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IH5041MDE	10502BEC		
IH5041MJE		8100602EA	
IH5042MDE	10503BEA		
IH5042MDE	10503BEC		
IH5042MJE		8100603EA	
IH5043MDE	10504BEA		
IH5043MDE	10504BEC		
IH5043MJE		8100604EA	
IH5044MDE	10505BEA		
IH5044MDE	10505BEC		
IH5044MJE		8100605EA	
IH5045MDE	10506BEA		
IH5045MDE	10506BEC		
IH5045MJE		8100606EA	
IH5046MJE		8100607EA	
IH5046MJE		8100615EA	
IH5047MJE		8100608EA	
IH5047MJE		8100616EA	
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IH5116MJI		5962-8513104XA	
IH5140MJE		8100609EA	
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IH5142MJE		8100611EA	
IH5143MJE		8100612EA	
IH5144MJE		8100613EA	
IH5145MJE		8100614EA	
IH5046MJE		8100617EA	
IH5047MJE		8100618EA	
IH5148MJE		8100619EA	
IH5149MJE		8100620EA	
IH5150MJE		8100621EA	
IH5151MJE		8100622EA	
IH5208MJE		5962-8513106EA	
IH5216MJI		5962-8513105XA	
IH6108MDE	19007BEA		
IH6108MDE	19007BEC		
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IH6208MDE	19008BEC		
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IM6653AMJG			ICDC-1987▶
IM6653MJG			
IM6654AMJG			
IM6654MJG			
LM4250J		7703901PA	
LM4250H		7703901GA	▶
MD80C86		8405201QA	Digital#
MD80C86-2		8405202QA	
MD80C88			
MD82C284			
MD82C37A			
MD82C52		8501501XA	
MD82C54		84065015JA	
MD82C55A		8406602QA	#
MD82C55A-5		8406601QA	Digital#
MD82C59A		5962-8501602YA	
MD82C59A-5		5962-8501601YA	
MD82C82		8406701RA	
MD82C83H		8406702RA	
MD82C84A		8406801VA	
MD82C86H-5		5962-8757701RA	
MD82C87H-5		5962-8757702RA	
MD82C85			
MD82C88		8406901RA	
MD82C89		5962-8552801RA	
MG80C286			
MR80C86		8405201XA	
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MR80C88			
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MR82C52		85015013A	
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MR82C55A		8406602XA	
MR82C55A-5		8406601XA	
MR82C59A		5962-85016023A	
MR82C59A-5		5962-85016013A	
MR82C82		84067012A	
MR82C83H		8406702RA	
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MR82C86H-5		5962-87577012A	
MR82C87H-5		5962-87577022A	
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V120ZA05		87063/041	
V120ZA1		87063/042	
V120ZA4		87063/043	
V120ZA6		87063/044	
V130LA10A			
V130LA2			
V130LA20A			
V130LA20B	M83530/1-2000B		
V150LA10A			
V150LA2			
V150LA20B			
V150LA20B	M83530/1-2200D		
V150ZA05		87063/045	
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V250LA20A			
V250LA4			
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V275LA40B	M83530/1-4300E		
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V27ZA1		87063/007	
V27ZA2		87063/008	
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V320LA40B	M83538/1-5100E		
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† Harris GaAs Products Data Sheets
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V47ZA05		87063/021	
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V480LA40A			
V480LA80B			
V510LA40A			
V510LA80B			
V56ZA05		87063/025	
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7703901GA	LM4250H	ICDC-1987▶
7703901PA	LM4250J	|
7705201EA	IH6108MJE	▶
7705201EC	HI1-0508	Analog★
7705202EA	HI1-0548	★
7705202EA	IH5108MJE	ICDC-1987▶
77052022A	HI4-0548	Analog★
7705301EA	DG201AK	ICDC-1987▶
7705301EX	HI1-0201	Analog★
7705301ZX	HI4-0201	|
7800302GC	HA2-2640	★
7801401CA	DG129AK	ICDC-1987▶
7801401CC	DG129AP	▶
7802901JA	HD1-15530	Digital#
78029013A	HD4-15530	#
8001601CA	HA1-2420	Analog★
8100601EA	IH5040MJE	ICDC-1987▶
8100602EA	IH5041MJE	|
8100603EA	IH5042MJE	|
8100604EA	IH5043MJE	|
8100605EA	IH5044MJE	|
8100606EA	IH5045MJE	|
8100607EA	IH5046MJE	|
8100608EA	IH5047MJE	|
8100609EA	IH5140MJE	▶
8100609EA	HI1-5040	Analog★
8100610EA	HI1-5041	★
8100610EA	IH5141MJE	ICDC-1987▶
8100611EA	HI1-5042	Analog★
8100611EA	IH5142MJE	ICDC-1987▶
81006122A	HI4-5043	Analog★
8100612EA	HI-5043	★
8100612EA	IH5143MJE	ICDC-1987▶
8100613EA	HI1-5044	Analog★
8100613EA	IH5144MJE	ICDC-1987▶
81006142A	HI4-5045	Analog★
8100614EA	HI1-5045	★
8100614EA	IH5145MJE	ICDC-1987▶
8100615EA	HI1-5046	Analog★
8100615EA	IH5046MJE	ICDC-1987▶
8100616EA	HI1-5047	Analog★
8100616EA	IH5047MJE	ICDC-1987▶
8100617EA	HI1-5046A	Analog★
8100617EA	IH5046MJE	ICDC-1987▶
8100618EA	HI1-5047A	Analog★
8100618EA	IH5047MJE	ICDC-1987▶
8100619EA	HI1-5048	Analog★
8100619EA	IH5148MJE	ICDC-1987▶
8100620EA	HI1-5049	Analog★
8100620EA	IH5149MJE	ICDC-1987▶
8100621EA	HI1-5050	Analog★
8100621EA	IH5150MJE	ICDC-1987▶
81006222A	HI4-5051	Analog★
8100622EA	HI1-5051	★
8100622EA	IH5151MJE	ICDC-1987▶
8102401VA	HM1-6504S	Digital#
8102402VA	HM1-6514S	|
8102403VA	HM1-6504B	|
8102404VA	HM1-6514B	|
8102405VA	HM1-6504	#

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8102406VA	HM1-6514	Digital#
8403601JA	HM1-6516	|
8403601ZA	HM4-6516	|
8403602JA	HM1-65162	|
8403602ZA	HM4-65162	|
8403603JA	HM1-65162C	|
8403603ZA	HM4-65162C	|
8403606JA	HM1-65162B	|
8403606ZA	HM4-65162B	|
8403607JA	HM1-6516B	|
8403607ZA	HM4-6516B	#
8403701CX	CD54HC00F3A	SSD-230C,
8403801CX	CD54HC10F3A	Vol. I■
8403901CX	CD54HC20F3A	|
8404001CX	CD54HC30F3A	|
8404101CX	CD54HC20F3A	|
8404201CX	CD54HC27F3A	|
8404301CX	CD54HC7266F3A	|
8404401CX	CD54HC4002F3A	|
8404501CX	CD54HC32F3A	|
8404601CX	CD54HC86F3A	|
8404701CX	CD54HC08F3A	|
8404801CX	CD54HC11F3A	■
8405201QA	MD80C86	Digital#
8405202QA	MD80C86-2	|
8405202XA	MR80C86-2	|
8405201XA	MR80C86	#
8405601CX	CD54HC74F3A	SSD-230C,
8406201EX	CD54HC138F3A	Vol. I■
8406401EX	CD54HC147F3A	■
84065013A	MR82C54	Digital#
8406501JA	MD82C54	|
8406601QA	MD82C55A-5	|
8406601XA	MR82C55A-5	|
8406602QA	MD82C55A	|
8406602XA	MR82C55A	|
84067012A	MR82C82	|
8406701RA	MD82C82	|
84067022A	MR82C83H	|
8406702RA	MD82C83H	|
84068012A	MR82C84A	|
8406801VA	MD82C84A	|
8406801VA	MD82C84A	|
84069012A	MR82C88	|
8406901RA	MD82C88	#
8407001EX	CD54HC75F3A	SSD-230C,
8407101RX	CD54HC374F3A	Vol. I■
8407201RX	CD54HC373F3A	|
8407301EX	CD54HC174F3A	|
8407401RX	CD54HC240F3A	|
8407501EX	CD54HC161F3A	|
8408501RX	CD54HC245F3A	|
8408801EX	CD54HC112F3A	|
8408901EX	CD54HC175F3A	|
8409001CX	CD54HC243F3A	|
8409101CX	CD54HC14F3A	|
8409201EX	CD54HC139F3A	|
8409301EX	CD54HC153F3A	|
8409401EX	CD54HC162F3A	|
8409501EX	CD54HC165F3A	■

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8409601RX	CD54HC244F3A	SSD-230C,
8409801CX	CD54HC04F3A	Vol. I■
8409901RX	CD54HC273F3A	
8410001CX	CD54HC393F3A	
8412801EX	CD54HC151F3A	
8415001EX	CD54HC109F3A	
8416201EX	CD54HC164F3A	
8500101EX	CD54HC365F3A	
8500201EX	CD54HC367F3A	
8500301EX	CD54HC4020F3A	
8500401EX	CD54HC4040F3A	■
85015013A	MR82C52	Digital#
8501501XA	MD82C52	
85016013A	MR82C59A-5	
8501601YA	MD82C59A-5	
85016023A	MR82C59A	
8501602YA	MD82C59A	#
8512401EX	CD54HC357F3A	SSD-230C,
8512501EX	CD54HC251F3A	Vol. I■
8512801RX	CD54HC357F3A	
8513001RX	CD54HC244F3A	■
5962-85131013A	HI4-0546	Analog★
5962-8513101XA	HI1-0546	
5962-85131023A	HI4-0547	
5962-8513102XA	HI1-0547	
5962-85131032A	HI4-0549	
5962-8513103EA	HI1-0549	★
5962-8513104XA	IH5116MJI	ICDC-1987▶
5962-8513105XA	IH5216MJI	
5962-8513106EA	IH5208MJE	▶
8550401EX	CD54HCT138F3A	SSD-230C,
8550501RX	CD54HCT240F3A	Vol. I■
8550601RX	CD54HCT245F3A	
8550701RX	CD54HCT374F3A	
8551901EX	CD54HC259F3A	■
8552514XA	HM1-65642	Digital#
8552514YA	HM4-65642	#
8600901EX	CD54HC390F3A	SSD-230C,
8601001CX	CD54HCU04F3A	Vol. I■
8601101EX	CD54HC4017F3A	
8601201CX	CD54HC4024F3A	
8601301EX	CD54HC85F3A	
8607601EX	CD54HC163F3A	
8607701CX	CD54HC280F3A	■
86879013A	HS4-3182	Digital#
8687901EA	HS1-3182	
8688001QA	HS1-3282	
8688001XA	HS4-3282	#
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87063/022	V47ZA1	
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87063/030	V68ZA2	
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87063/037	V100ZA05	
87063/038	V100ZA3	
87063/039	V100ZA4	
87063/040	V100ZA15	
87063/041	V120ZA05	
87063/042	V120ZA1	
87063/043	V120ZA4	
87063/044	V120ZA6	
87063/045	V150ZA05	
87063/046	V150ZA1	
87063/047	V150ZA4	
87063/048	V150ZA8	
87063/049	V180ZA05	
87063/050	V180ZA1	
87063/051	V180ZA5	
87063/052	V180ZA10	•
88690023A	HM4-6642	Digital#
8869001JA	HM1-6642	
8869001LA	HM6-6642	
88690023A	HM4-6642B	
8869002JA	HM1-6642B	
8869002LA	HM6-6642B	#
8869901XA	HI1-0516	Analog★
8954001JA	HM1-6617	Digital#
8954001LA	HM6-6617	
8954001XA	HM4-6617	
8954002JA	HM1-6617B	
5962-85016023A	MR82C59A	
5962-8501602YA	MD82C59A	
5962-85016013A	MR82C59A-5	
5962-8501601YA	MD82C59A-5	
5962-85016023A	MR82C59A	
5962-8501602YA	MD82C59A	#
5962-85131013A	HI4-0546	Analog★
5962-8513101XA	HI1-0546	
5962-85131023	HI4-0547	★

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5962-8513T02XA	HI1-0547	Analog★
5962-85131032A	HI4-0549	″
5962-8513103EA	HI1-0549	★
5962-8515301CX	CD54HC73F3A	SSD-230C,
5962-8515401CX	CD54HC107F3A	Vol. I■
5962-85528012A	MR82C89	Digital#
5962-8552801RA	MD82C89	#
5962-8606101EX	CD54HC157F3A	SSD-230C,
5962-8606201RX	CD54HC563F3A	Vol. I■
5962-8670101JX	CD54HCT154F3A	■
5962-86716012A	HI4-0201HS	Analog★
5962-8671601EA	HI1-0201HS	★
5962-8681201EX	CD54HC368F3A	SSD-230C,
5962-8681301RX	CD54HC533F3A	Vol. I■
5962-8681401RX	CD54HC534F3A	″
5962-8681501RX	CD54HC564F3A	″
5962-8681801RX	CD54HC688F3A	″
5962-8681901EX	CD54HC4049F3A	″
5962-8682001EX	CD54HC4050F3A	″
5962-8682101EX	CD54HC42F3A	″
5962-8682201JX	CD54HC154F3A	″
5962-8682301EX	CD54HC158F3A	″
5962-8682401EX	CD54HC160F3A	″
5962-8682501EX	CD54HC173F3A	″
5962-8682601EX	CD54HC194F3A	″
5962-8682701EX	CD54HC195F3A	″
5962-8682801EX	CD54HC366F3A	″
5962-8683101CX	CD54HCT00F3A	″
5962-8684701EX	CD54HC123F3A	″
5962-8684801CX	CD54HC126F3A	″
5962-8685201CX	CD54HCT32F3A	″
5962-8685301CX	CD54HCT74F3A	″
5962-8685401EX	CD54HCT161F3A	″
5962-8685501EX	CD54HCT165F3A	″
5962-8685601RX	CD54HCT573F3A	″
5962-8685701RX	CD54HCT688F3A	″
5962-8686701RX	CD54HCT373F3A	″
5962-8688301CX	CD54HCT08F3A	″
5962-8688401EX	CD54HCT238F3A	″
5962-8688501JX	CD54HC646F3A	″
5962-8688601EX	CD54HC453F3A	″
5962-8689001EX	CD54HCT14F3A	″
5962-8689101EX	CD54HC191F3A	″
5962-8752501CA	CD54ACT74F3A	″
5962-8754901CA	CD54AC00F3A	″
5962-8755001RA	CD54AC240F3A	″
5962-8755101RA	CD54AC241F3A	″
5962-8755201RA	CD54AC244F3A	″
5962-8755301EA	CD54ACT139F3A	″
5962-8755501RA	CD54AC273F3A	″
5962-8755601RA	CD54ACT273F3A	■
5962-87577012A	MR82C86H-5	Digital#
5962-8757701RA	MD82C86H-5	″
5962-87577022A	MR82C87H-5	″
5962-87577702RA	MD82C87H-5	#
5962-8760901CA	CD54AC04F3A	SSD-230C,
5962-8761401CA	CA54AC32F3A	Vol. I■
5962-8761501CA	CD54AC08F3A	″
5962-8762201EA	CD54AC138F3A	″
5962-8762301EA	CD54AC139F3A	■
5962-8762601EA	CD54AC174F3A	SSD-230C,
5962-8764701CA	CD54HC03F3A	Vol. I■
5962-8765301JA	ICM7170MDG	ICDC-1987▶
5962-8765301JC	ICM7170MDG	″
5962-8766000GA	ICL7667MTV	″
5962-8766001PA	ICL7667MJA	▶
5962-8766301RA	CD54ACT245F3A	SSD-230C,
5962-8768001EX	CD54HC4060F3A	Vol. I■
5962-8769401RA	CD54AC374F3A	″
5962-8769501RA	CD54AC540F3A	″
5962-8769901CA	CD54ACT00F3A	″
5962-8772101CA	CD54HC125F3A	″
5962-8772201CX	CD54HC4075F3A	″
5962-8772401EX	CD54HC193F3A	″
5962-8772501RX	CD54HCT273F3A	″
5962-8775701EA	CD54ACT174F3A	″
5962-8775801RA	CD54AC245F3A	″
5962-8775901RA	CD54ACT240F3A	″
5962-8776001RA	CD54ACT244F3A	″
5962-8780501EX	CD54HC221F3A	″
5962-8780601RX	CD54HC299F3A	″
5962-8780701RA	CD54HC377F3A	″
5962-8780801EX	CD54HC192F3A	″
5962-8780901RX	CD54HC640F3A	″
5962-8852001CA	CD54AC74F3A	″
5962-8857601CX	CD54HC21F3A	″
5962-8860601EA	CD54HC237F3A	″
5962-8862401JX	CD54HCT4059F3A	″
5962-8867101EA	CD54HCT191F3A	″
5962-8867201EX	CD54HCT85F3A	■
5962-8869901XA	HI1-0516	Analog★

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10501BEA	IH5040MDE	ICDC-1987▶
10501BEC	IH5040MDE	″
10502BEA	IH5041MDE	″
10502BEC	IH5041MDE	″
10503BEA	IH5042MDE	″
10503BEC	IH5042MDE	″
10504BEA	IH5043MDE	″
10504BEC	IH5043MDE	″
10505BEA	IH5044MDE	″
10505BEC	IH5044MDE	″
10506BEA	IH5045MDE	″
10506BEC	IH5045MDE	″
11101BAC	DG181AL	″
11101BCA	DG181AP	″
11101BCC	DG181AP	″
11101BIA	DG181AA	″
11102BAC	DG182AL	″
11102BCA	DG182AP	″
11102BCC	DG182AP	″
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11104BEA	DG185AP	ICDC-1987▶
11104BEC	DG185AP	
11105BAC	DG187AL	
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11105BCC	DG187AP	
11105BIA	DG187AA	
11106BAC	DG188AL	
11106BCA	DG188AP	
11106BCC	DG188AP	
11106BIA	DG188AA	
11106BIC	DG188AA	
11107BAC	DG190AL	
11107BEA	DG190AP	
11107BEC	DG190AP	
11108BAC	DG191AL	
11108BEA	DG191AP	
11108BEC	DG191AP	
11601BCA	DG300AAP	
11601BCC	DG300AAP	
11602BCA	DG301AAP	
11602BCC	DG301AAP	
11603BCA	DG302AAP	
11603BCC	DG302AAP	
11604BCA	DG303AAP	
11604BCC	DG303AAP	▶
12202BGC	HA2-2600	Analog★
12203BGC	HA2-2620	
12204BGC	HA2-2500	
12205BGC	HA2-2510	
12206BGC	HA2-2520	
12302BEA	HI1-0201	★
12702BEA	AD7502UD	ICDC-1987▶
12703BEA	AD7521UD	
12704BVC	AD7541TD	▶
19001BXA	HI1-0506	Analog★
19002BXA	HI1-0546	
19003BXA	HI1-0507	
19004BXA	HI1-0547	
19005BEA	HI1-0548	
19006BEA	HI1-0549	
19007BEA	HI1-0508	★
19007BEA	IH6108MDE	ICDC-1987▶
19007BEC	IH6108MDE	▶
19008BEA	HI1-0509	Analog★
19008BEA	IH6208MDE	ICDC-1987▶
19008BEC	IH6208MDE	▶
MIL-R-83530/1-2000B	V130LA20B	SSD-230C,
MIL-R-83530/1-2200D	V150LA20B	Vol. II•
MIL-R-83530/1-4300E	V275LA40B	
MIL-R-83530/1-5100E	V320LA40B	•
MIL-M-38510/17001	CD4081B	SSD-230C,
MIL-M-38510/17002	CD4082B	Vol. I■
MIL-M-38510/17003	CD4073B	
MIL-M-38510/17101	CD4071B	
MIL-M-38510/17102	CD4072B	
MIL-M-38510/17103	CD4075B	
MIL-M-38510/17201	CD4085B	
MIL-M-38510/17202	CD4086B	
MIL-M-38510/17203	CD4070B	
MIL-M-38510/17204	CD4077B	
MIL-M-38510/17301	CD4514V	■

JAN. No.	Device type	Reference Publication
MIL-M-38510/17302	CD4515B	SSD-230C,
MIL-M-38510/17303	CD4532B	Vol. II■
MIL-M-38510/17304	CD4555B	
MIL-M-38510/17305	CD4556B	
MIL-M-38510/17401	CD4609UB	
MIL-M-38510/17402	CD40107B	
MIL-M-38510/17403	CD4502B	
MIL-M-38510/17404	CD40109B	
MIL-M-38510/17501	CD4076B	
MIL-M-38510/17502	CD4095B	
MIL-M-38510/17503	CD4096B	
MIL-M-38510/17504	CD4098B	
MIL-M-38510/17505	CD40174B	
MIL-M-38510/17601	CD4099B	
MIL-M-38510/17602	CD4508B	
MIL-M-38510/17701	CD4093B	
MIL-M-38510/17702	CD40106B	
MIL-M-38510/17801	CD4067B	
MIL-M-38510/17802	CD4097B	
MIL-M-38510/17803	CD40257B	■
MIL-M-38510/24501BVA	HM1-6504S	Digital#
MIL-M-38510/24502BVA	HM1-6514S	
MIL-M-38510/29102BJA	HM1-6516	
MIL-M-38510/29102BXA	HM4-6516	
MIL-M-38510/29103BRA	HM1-65262	
MIL-M-38510/29103BYA	HM4-65262	
MIL-M-38510/29104BJA	HM1-65162	
MIL-M-38510/29104BXA	HM4-65162	
MIL-M-38510/29109BRA	HM1-65262B	
MIL-M-38510/29109BYA	HM4-65262B	
MIL-M-38510/29110BJA	HM1-65162B	
MIL-M-38510/29110BXA	HM4-65161B	
MIL-M-38510/29205BXA	HM1-65642B	
MIL-M-38510/29205BYA	HM4-65642B	#
MIL-M-38510/05001	CD4011A	SSD-230C,
MIL-M-38510/05002	CD4012A	Vol. I■
MIL-M-38510/05003	CD4023A	
MIL-M-38510/05051	CD4011A	
MIL-M-38510/05052	CD4012B	
MIL-M-38510/05053	CD4023B	
MIL-M-38510/05101	CD4013A	
MIL-M-38510/05102	CD4027A	
MIL-M-38510/05103	CD4043A	
MIL-M-38510/05151	CD4013B	
MIL-M-38510/05152	CD4027B	
MIL-M-38510/05153	CD4043B	
MIL-M-38510/05201	CD4000A	
MIL-M-38510/05202	CD4001A	
MIL-M-38510/05203	CD4002A	
MIL-M-38510/05204	CD4025A	
MIL-M-38510/05251	CD4000B	
MIL-M-38510/05252	CD4001B	
MIL-M-38510/05253	CD4002B	
MIL-M-38510/05254	CD4025B	
MIL-M-38510/05301	CD4007A	
MIL-M-38510/05302	CD4019A	
MIL-M-38510/05303	CD4030A	
MIL-M-38510/05304	CD4048A	
MIL-M-38510/05351	CD4007UB	
MIL-M-38510/05352	CD4019B	■

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★ Harris Analog Military Products Data Book
▶ Intersil's Component Data Catalog," No. 900301-003.

Hi-Rel Product JAN Number Index

JAN. No.	Device type	Reference Publication
MIL-M-38510/05353	CD4030B	SSD-230C,
MIL-M-38510/05354	CD4048B	Vol. I■
MIL-M-38510/05401	CD4008A	
MIL-M-38510/05451	CD4008B	
MIL-M-38510/05501	CD4009A	
MIL-M-38510/05502	CD4010A	
MIL-M-38510/05503	CD4049A	
MIL-M-38510/05504	CD4050A	
MIL-M-38510/05505	CD4041A	
MIL-M-38510/05551	CD4009UB	
MIL-M-38510/05552	CD4010B	
MIL-M-38510/05553	CD4049UB	
MIL-M-38510/05554	CD4050B	
MIL-M-38510/05555	CD4041UB	
MIL-M-38510/05601	CD4017A	
MIL-M-38510/05602	CD4018A	
MIL-M-38510/05603	CD4020A	
MIL-M-38510/05604	CD4022A	
MIL-M-38510/05605	CD4024A	
MIL-M-38510/05651	CD4017B	
MIL-M-38510/05652	CD4018B	
MIL-M-38510/05653	CD4020B	
MIL-M-38510/05654	CD4022B	
MIL-M-38510/05655	CD4024B	
MIL-M-38510/05701	CD4006A	
MIL-M-38510/05702	CD4014A	
MIL-M-38510/05703	CD4015A	
MIL-M-38510/05704	CD4021A	
MIL-M-38510/05705	CD4031A	
MIL-M-38510/05706	CD4034A	
MIL-M-38510/05751	CD4006B	
MIL-M-38510/05752	CD4014B	
MIL-M-38510/05753	CD4015B	
MIL-M-38510/05754	CD4021B	
MIL-M-38510/05755	CD4031B	
MIL-M-38510/05756	CD4034B	
MIL-M-38510/05801	CD4016A	
MIL-M-38510/05802	CD4066A	
MIL-M-38510/05851	CD4016B	
MIL-M-38510/05852	CD4066B	
MIL-M-38510/05901	CD4028A	
MIL-M-38510/05951	CD4028B	■
MIL-S-19500/368	2N3439	SSD-230C,
MIL-S-19500/368	2N3440	Vol. II•
MIL-S-19500/384	2N3584	
MIL-S-19500/384	2N3585	
MIL-S-19500/439	2N5038	
MIL-S-19500/439	2N5039	
MIL-S-19500/456	2N5302	
MIL-S-19500/456	2N5303	
MIL-S-19500/461	2N6211	
MIL-S-19500/461	2N6212	
MIL-S-19500/461	2N6213	
MIL-S-19500/485	2N5415S	
MIL-S-19500/485	2N5416S	
MIL-S-19500/488	2N5671	
MIL-S-19500/488	2N5672	
MIL-S-19500/498	2N6306	
MIL-S-19500/498	2N6308	
MIL-S-19500/504	2N6283	•

JAN. No.	Device type	Reference Publication
MIL-S-19500/504	2N6284	SSD-230C,
MIL-S-19500/505	2N6286	Vol. II•
MIL-S-19500/505	2N6287	
MIL-S-19500/523	2N6383	
MIL-S-19500/523	2N6384	
MIL-S-19500/523	2N6385	
MIL-S-19500/525	2N6546	
MIL-S-19500/525	2N6547	
MIL-S-19500/526	2N3879	
MIL-S-19500/527	2N6648	
MIL-S-19500/527	2N6649	
MIL-S-19500/527	2N6650	
MIL-S-19500/528	2N6032	
MIL-S-19500/528	2N6033	
MIL-S-19500/536	2N6671	
MIL-S-19500/536	2N6673	
MIL-S-19500/537	2N6674	
MIL-S-19500/537	2N6675	
MIL-S-19500/538	2N6676	
MIL-S-19500/538	2N6678	
MIL-S-19500/542	2N6756	
MIL-S-19500/542	2N6758	
MIL-S-19500/542	2N6760	
MIL-S-19500/542	2N6762	
MIL-S-19500/543	2N6764	
MIL-S-19500/543	2N6766	
MIL-S-19500/543	2N6768	
MIL-S-19500/543	2N6770	
MIL-S-19500/555	2N6788	
MIL-S-19500/555	2N6790	
MIL-S-19500/555	2N6792	
MIL-S-19500/555	2N6794	
MIL-S-19500/556	2N6782	
MIL-S-19500/556	2N6784	
MIL-S-19500/556	2N6786	
MIL-S-19500/557	2N6796	
MIL-S-19500/557	2N6798	
MIL-S-19500/557	2N6800	
MIL-S-19500/557	2N6802	
MIL-S-19500/563	2N6849	
MIL-S-19500/563	2N6851	
MIL-S-19500/564	2N6849	
MIL-S-19500/564	2N6851	
MIL-S-19500/565	2N6895	
MIL-S-19500/565	2N6896	
MIL-S-19500/565	2N6897	
MIL-S-19500/565	2N6898	
MIL-S-19500/566	2N6901	
MIL-S-19500/566	2N6902	
MIL-S-19500/566	2N6903	
MIL-S-19500/566	2N6904	•

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Packaging

The following tables explain the prefixes and suffixes used in the charts in the product sections.

Package Description	Suffix Letter(s)			
	CA Types	CD, CDM, CDP, MWS Types	LM Types	High-Reliability Types
STANDARD PRODUCT				
Dual-In-Line Side-Brazed Ceramic Package	D	D	–	D
Single-In-Line Plastic Package (SIP)	–	–	–	–
Dual-In-Line Plastic Package	E	E	N	E
Dual-In-Line Frit-Seal Ceramic Package	F	F	–	F
Modified Dual-In-Line Plastic Package with "Power Slab"	EM (Note 2)	–	–	–
Modified Quad-In-Line Plastic Package	QM (Note 2)	–	–	–
Quad-In-Line Plastic Package	Q	–	–	–
TO-5 Style Package with Dual-In-Line Formed Leads (DIL-CAN)	S	–	–	–
TO-5 Style Package with Straight Leads	T	T	H	T
TO-5 Style Package with Radial Formed Leads	V (Note 1)	–	–	–
TO-72 Style Package (Note 8)	–	–	–	–
TO-220 Style Package with Vertical-Mount Lead Form (Note 3)	M	–	–	–
Ceramic Flat Package	–	K	–	K
Small-Outline Package (SO)	M	M	–	–
Plastic Chip Carrier (Note 4)	Q	Q	–	–
Leadless Chip Carrier (Note 5)	J	J	–	J
Enhanced Product (Note 6)	X	X	–	–
Chip	H (Note 1)	H (Note 1)	–	H
Wafer	W	W	–	–
HIGH-RELIABILITY DEVICES				
Product Assurance Levels:				
(Availability of product according to these levels may vary from family to family).				
Class S Modified, Linear Devices	–	–	–	/I
Class S Modified, LSI Devices Radiation Hardened to 10^5 rads (Si)	–	–	–	/IRZ
Class B Modified to MIL-STD-883, Rev. C. Para 1.2.2	–	–	–	/3
Class B Compliant to MIL-STD-883, Rev. C. Para 1.2.1	–	–	–	/3A
Class S Compliant to MIL-STD-883, Rev. C. Para 1.2.1 (Note 7)	–	–	–	/MS
Same as /MS + Radiation Hardened to 10^6 rads (Si)	–	–	–	/MSH
Same as /MS + Radiation Hardened to 10^5 rads (Si)	–	–	–	/MSR
Chips:				
SEM inspection and Condition A Visual Inspection	–	–	–	H/S
Same as /S + Radiation Hardened to 10^5 rads (Si)	–	–	–	H/SR
Same as /S + Radiation Hardened to 10^6 rads (Si)	–	–	–	H/SH
Condition B Pre cap Visual Inspection	–	–	–	H/M

NOTES:

1. Some linear integrated circuits are provided in chip form to allow customer design of special and complex circuits to suit individual needs. Linear chips are electrically identical to and offer features of their counterparts, sealed in ceramic, TO-5 and plastic packages.
2. Some types may have an additional "M" suffix following the package designation suffix, i.e. CA3134EM. The additional "M" suffix simply indicates that the device is a mechanical variant of the basic package type.
3. TO-220 Style Package is also available with horizontal-mount lead form. Indicate "M" suffix for modified version, i.e., CA3169M.
4. Square plastic package having leads on all four sides. Formed for surface mounting, leads are bent underneath the package body to form the "J-Bend" configuration.
5. Hermetically sealed, square 3-layer ceramic package available with terminals spaced on 40-mil or 50-mil centers.
6. Burn-In and additional testing are added to the comprehensive real-time controls and test procedures carried out on standard product. (Optional for "D" and "E" package types.)
7. Conformance testing is optional and required for full compliance.
8. Package used in JEDEC 3N-Series DMOS and 40000-Series DMOS devices.

NOTE: JEDEC 3N-Series devices and 40000-Series DMOS devices are coded in numerical sequence only without regard for electrical or mechanical parameters.

Harris Device Family Prefixes

Description	Prefix Letter
Analog Devices Alternate Source	AD
National Semiconductor A/D Alternate Source	ADC
Driver/Level Transistor IC	D
Siliconix Analog Switch Alternate Source	DG
Monolithic DG Analog Switch Replacement	DGM
Siliconix Analog Gate Alternate Source	G
Linear IC	ICL
Microperipheral IC	ICM
Hybrid IC	ICH
Low Leakage Diodes	ID
Analog Switch Family	IH
Microcontroller IC	IM
Discrete Transistor	IT
Discrete Transistor	ITE
Discrete Transistor	J
National Semiconductor Hybrid Alternate Source	LH
National Semicondutor Alternate Source	LM
Discrete Transistor	M
High Voltage Analog Switch	MM
Signetics Alternate Source	NE
Discrete Transistor	NF
Discrete Transistor	P
Discrete Transistor	PN
Signetics Alternate Source	SE
Discrete Transistor	U
Discrete Transistor	VCR
Industry Standard Discrete Transitor	2N
Industry Standard Discrete Transitor	3N
Fairchild Linear Alternate Source	μa

NOTE:

JEDEC 2N- and 3N-series discrete devices are coded in numerical sequence only without regard for electrical or mechanical parameters.

Temperature-Range Designators

Temperature Range		Suffix Letter
Commercial:	0 to +70°C	C
Industrial:	-25°C to +85°C or -40°C to +85°C (Specified on Data Sheet)	I
Military:	-55°C to +125°C	M

Package-Type Designators

Package	Suffix Letter
TO-237	A
Small Outline, Plastic (SOIC)	B
TO-220	C
Ceramic, Side Brazed, Dual-In-Line	D
Small TO-8	E
Ceramic Flat Pack	F
Ceramic Pin-Grid Array	G
Hermetic, Hybrid DIP (16 pin, 0.6 x 0.7 pin spacing)	I
CERDIP, Dual-In-Line	J
TO-3	K
Leadless, Ceramic Quad-Pack	L
Plastic, Gullwing Quad-Pack	M
Plastic, J-Lead Quad-Pack	N
Plastic, Dual-In-Line	P
Plastic, Pin-Grid Array	R
TO-52	S
TO-5, TO-78, TO-99, TO-100	T
TO-18, TO-71, TO-72	U
TO-39	V
TO-92	Z
DICE (Chip)	/D
Wafer	/W
EXCEPTIONS TO PACKAGE-TYPE DESIGNATORS	
DG and DGM (Analog Switch) Series	
10-Pin Metal Can	A
14-Pin Flat Pack	L
Ceramic Dual-In-Line Package (Special Order Only)	P
CERDIP	K
AD (D/A Converter) Series	
TO-52	H
CERDIP Ceramic Dual-In-Line Package	D
Epoxy Dual-In-Line Package	N
TO-92	R

Pin-Count Designators

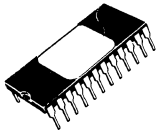
Number of Pins	Suffix Letter
8	A
10	B
12	C
14	D
16	E
22	F
24	G
42	H
28	I
32	J
35	K
40	L
48 (Not to be used on future products)	M
18	N
20	P
2	Q
3	R
4	S
6	T
7	U
8 (0.200" pin circle, isolated case)	V
10 (0.230" pin circle, isolated case)	W
8 (0.200" pin circle, case to pin 4)	Y
10 (0.230" pin circle, case to pin 5)	Z
NOTE: For all new products in packages that have more than 40 pins, the pin count designator will be a 2 or 3 digit number equal to the number of pins on the package.	
EXCEPTIONS TO PIN-COUNT DESIGNATORS	
DG and DGM (Analog Switch) Series	
10-Pin Metal Can	A
14-Pin Flat Pack	L
Ceramic Dual-In-Line Package (Special Order Only)	P
CERDIP	K
AD (D/A Converter) Series	
20, 18, 16 or 14	D
3-Pin	H

High-Reliability Device Designators

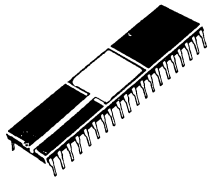
Package Description	Suffix Letter
MIL-STD-883B Rev. C Screened Devices	/883B
High-Reliability Device	/HR
Cost-Effective, High-Reliability Device	/BR
Burn-In Only Process Flow	/BI

IC Packages

D Suffix
Ceramic Dual-In-Line Packages

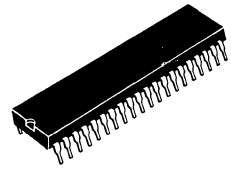


Welded-Seal 8, 14, 16, 18, 22, 24, 28, and 48 Lead Versions



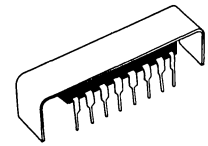
Side-Brazed 16, 18, 20, 22, 24, 28, 40, 48, and 64-Lead Versions

E Suffix
Dual-In-Line Plastic Package



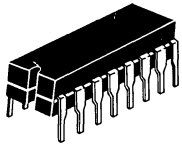
8, 14 16, 18, 20, 22, 24, 28, 40, and 42-Lead Versions

EM Suffix
Dual-In-Line Plastic Package with 'Power Slab'



Modified 16-Lead Package

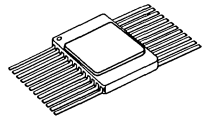
F Suffix
CERDIP (Frit-Seal) Dual-In-Line



14, 16, 18, 20, 22, 24, 28, and 40-Lead Versions

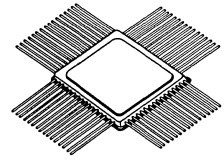
K Suffix
Ceramic Flat Pack

Standard



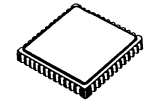
14, 16, 18, 24, 28, and 42-Lead Versions

Quad



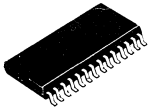
Available in 64 and 132-Lead Versions

J Suffix
Ceramic Leadless Chip Package

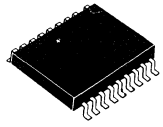


20, 24, 28, 32, 40, 44, 48, and 64 Terminals

M Suffix
Small-Outline Packages (SO)

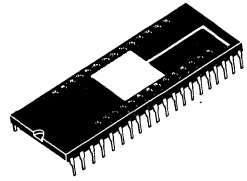


Narrow Body 8, 14, 16-Lead Versions



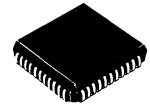
Wide Body 20, 24, and 28-Lead Versions

PB
Piggy Back Package



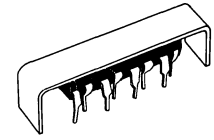
40 Lead

Q Suffix
Plastic Leadless Chip Package



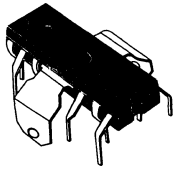
28, 44, 68, and 84 Terminals

QM Suffix
Quad-In-Line Plastic Package with 'Power Slab'



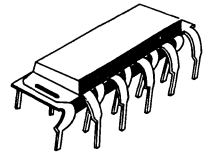
16-Lead Version

Q Suffix (QUIP)



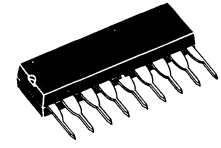
Modified 16-Lead Package

Quad-In-Line Plastic Package



Shielded 20-Lead

SIP
Single-In-Line Plastic Package

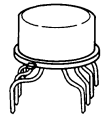


8, 9, 10, and 12-Lead Versions

IC Packages (Continued)

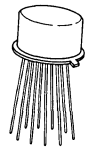
TO-5 Style Packages

S Suffix with Formed Leads (DIL-CAN)



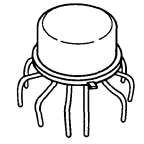
8-Lead Version

T Suffix with Straight Leads



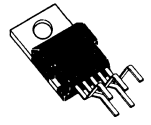
8, 10, and 12-Lead Versions

V1 Suffix with Radial Formed Leads



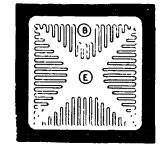
8, 10, and 12-Lead Versions

VERSA-V1 TO-220 Style Plastic Package with Vertical-Mount Lead Form



(Versions with Horizontal-Mount Lead Form are also Available.)

H Suffix Chip

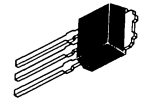


Discrete Semiconductor Packages

BR-4

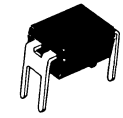
D-PAK

TO-252AA



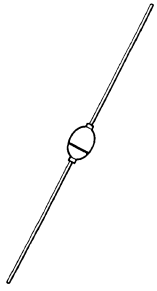
TO-251AA

DIP
Dual-In-Line Plastic Package

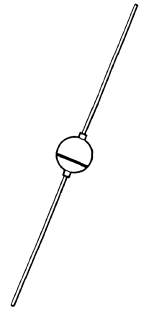


4-Lead Version

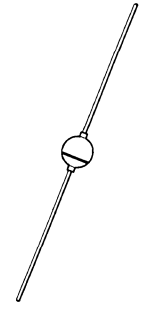
DO-204AP



GE-3

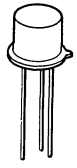


GE-4

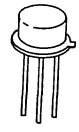


SOT-89

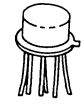
TO-18 (UR)



TO-52 (SQ, SR)

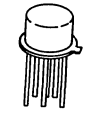


TO-71 (UT)



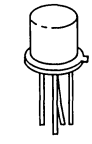
Low-Profile
6-Lead Version

TO-71 (ST)



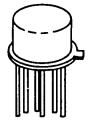
6-Lead Version

TO-72 (US)



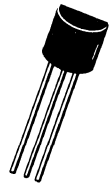
4-Lead Version

TO-78 (TT)

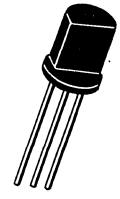


6-Lead Version

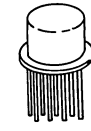
TO-92



TO-98



TO-99 (TV, TY, TZ)



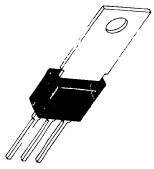
8-Lead Version

TO-100 (TW, TX)

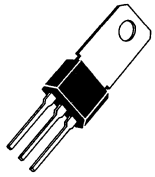
10-Lead Version

Discrete Semiconductor Packages (Continued)

TO-202



TO-202AB



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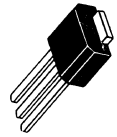

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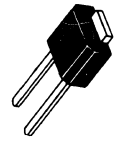
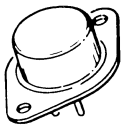


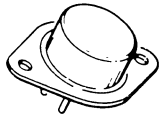
Press-Fit

VERSATAB

TO-204AA (TO-3)



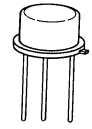
TO-204AE (TO-3)



(0.060 In.-Dia. Pins)

TO-205AA (TO-5)

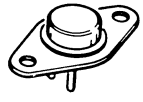
TO-205AD (TO-39)



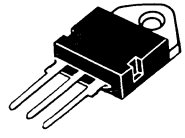
TO-205AF (TO-39)

Low-Profile

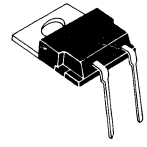
TO-213AA (TO-66)



TO-218AC

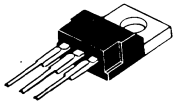


TO-220AA



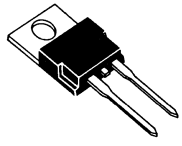
VERSAWATT

TO-220AB



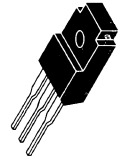
VERSAWATT

TO-220AC

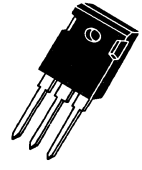


VERSAWATT

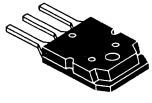
TO-220IS



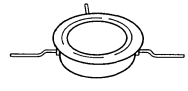
TO-247



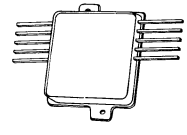
TO-247S



Radial



Metal Hermetic Package



Optoelectronic Devices

<table>
<tr><td colspan="4">TO-18 Style Hermetic Package</td></tr>
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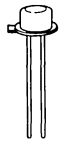
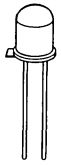
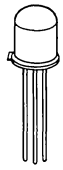
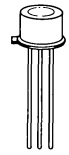
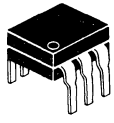
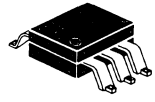
 
2-Lead with Flat Window</td><td>#54A
 
2-Lead with Lens</td><td>#55
 
3-Lead with Lens</td><td>#57
 
3-Lead with Flat Window</td></tr>
<tr><td colspan="3">6-Pin Dual-In-Line Plastic Package</td><td>Optoisolator</td></tr>
<tr><td>#295
 
Lead-Formed</td><td>#296
 
Standard Version</td><td>#298
 
Surface-Mount</td><td>#297
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<tr><td colspan="2">Flanged Optointerrupter Package</td><td colspan="2">Unflanged Optointerrupter Package</td></tr>
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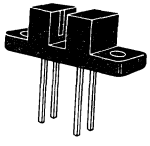
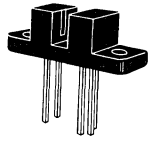
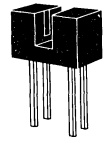
 
4-Lead</td><td>#323
 
5-Lead</td><td>#320
 
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 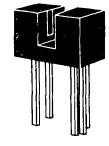
5-Lead</td></tr>
<tr><td colspan="4">Clear Plastic Package</td></tr>
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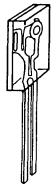
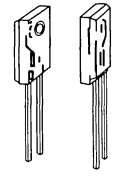
 
Emitter</td><td>#56A
 
Detector</td><td colspan="2">#321
 
Matched Emitter/Detector Pair</td></tr>
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- Rad-Hard ICs

Military/Aerospace Programs
- COMSEC Programs
- Strategic and Space Programs
- Military ASIC Programs

Signal Processing
- Linear
- Custom Linear
- Data Conversion
- Interface
- Analog Switches
- Multiplexers
- Filters
- DSP
- Telecom

Smart Power
- Power ICs
- Power ASICs
- Hybrid Programmable Switches
- Smart Power Modules
- Full-Custom High Voltage ICs

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