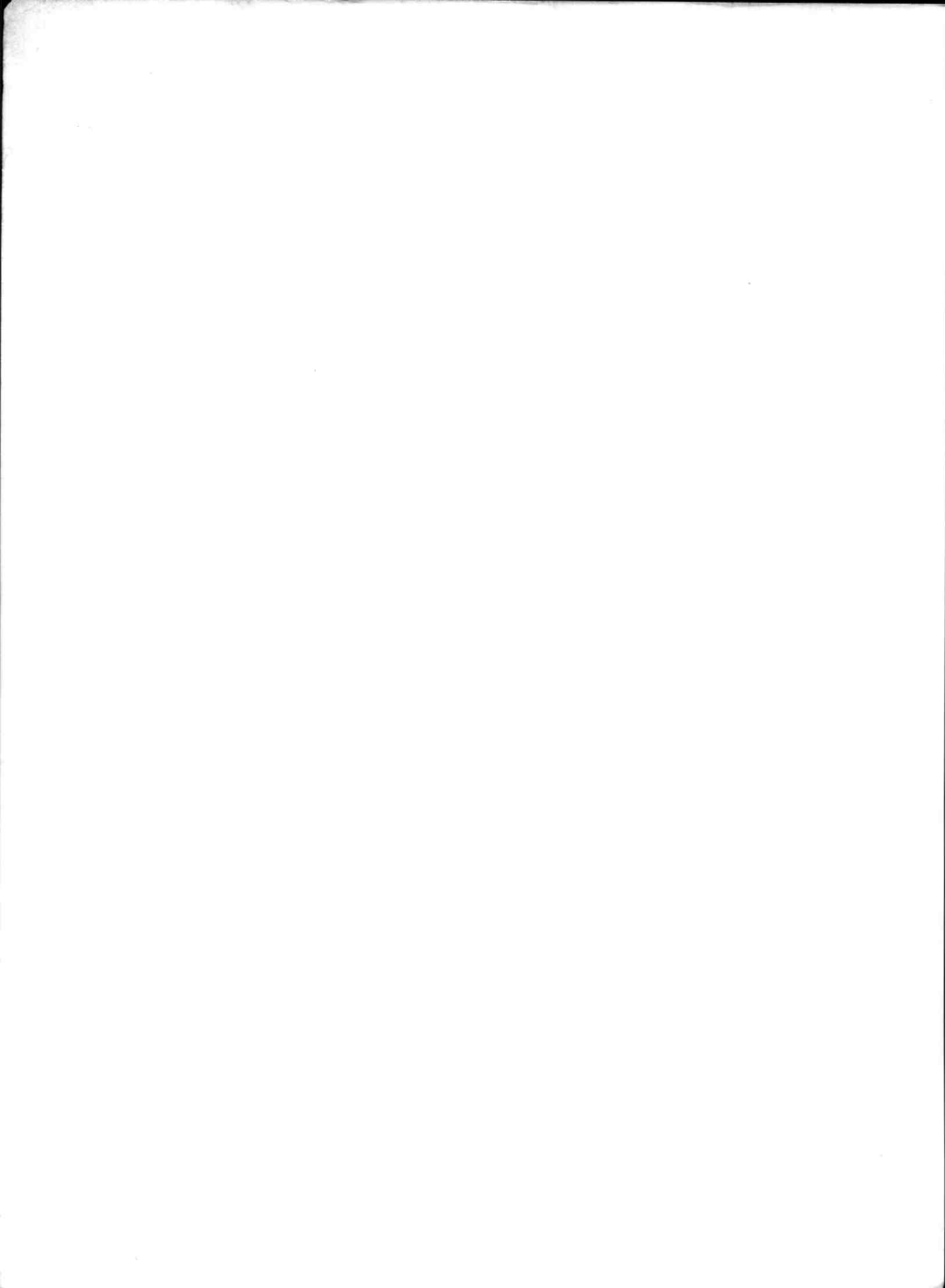


Master Selection Guide

and Catalog







MOTOROLA
Semiconductors

SELECTING THE BEST SEMICONDUCTOR

Selecting the best semiconductor for a given application can pose a significant challenge. To simplify the task in selecting a "best" transistor, diode or other device for new designs, this book's selection tables include all popular Motorola semiconductor devices and applications. These guides permit a quick comparison of the preferred devices, and a pre-selection of semiconductors that are most suitable.

The selection tables are arranged to highlight the prime selection criteria in easy-to-use order. Since the important characteristics depend on the type of device, the selection tables take different forms. In silicon rectifiers, for example, peak reverse voltage, and average forward current are the basic criteria, and the devices are listed in order of these ratings. For other devices, such as transistors, other important characteristics or suggested applications are specified in their particular section.

The selection tables include only basic specifications. For complete information contact your nearest Motorola sales office or franchised distributor.

Beam-Fired, BET, CHAINMAKER, C.Q., Deka-Pak, Designer's, Econocap, Epibase, Epicap, EXbug, EXORciser, EXORdisk, EXORTape, Glassivated, HANDY Lab®, HEP®, LocaLogic, Isothermal, Limelight, McMOS, Meg-A-Life II, MEGALOGIC, MDTL, MECL, MECL 10,000, MECL III, MHTL, Micro-T, MIDA, MIKbug, MINIbug, Miniode, Mini-T, MLED, MMOS, MRTL, mW MRTL, MNMOS, M TTL, Multi-Cell II, Multi-Pak, QUIL, RamRod, Red Head, Surtetic, SWITCHMODE, Thermopad, Thermowatt, Unibloc, Uniwatt, Zero-TC, are trademarks of Motorola Inc. k-Pak is a trade name of Motorola Inc.

Annular Semiconductors and Field Relief Electrode are patented by Motorola Inc.



and



are trademarks of Motorola Inc.

Information in this catalog is believed to be accurate and reliable. However, no responsibility is assumed by MOTOROLA for its use; nor for any infringement of patents or of other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of MOTOROLA with respect to such information.

©MOTOROLA INC., 1975
"All Rights Reserved"

INDEX

INTEGRATED CIRCUITS

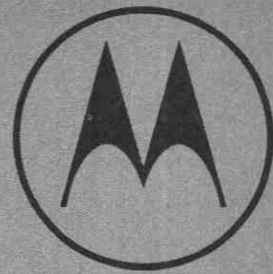
MOS INTEGRATED CIRCUITS	1-1
M6800 Microcomputer Family (including MCM6800's)	1-2
MOS RAM's (excluding MCM6800's)	1-5
MOS ROM's (excluding MCM6800's)	1-6
McMOS MC14000 and MC14500 Series	1-7
McMOS MC14400 Series	1-8
BIPOLAR DIGITAL INTEGRATED CIRCUITS	
MECL MC10,000 Series	2-2
MECL III MC1600 Series	2-4
MEGALOGIC LSI	2-5
Logic Products for Phase-Locked Loop Applications	2-6
MHTL MC660 Series	2-7
MDTL MC830/MC930 Series	2-8
(Includes MC1800/MC1900 Series Devices)	
MRTL MC700/MC800/MC900 Series	2-10
(Includes MC9700/MC9800 Series Devices)	
mW MRTL MC708/MC808/MC908 Series	2-11
(Includes MC9700/MC9800 Series Devices)	
MTTL Beam Lead Integrated Circuits (MCBC5400 Series)	2-12
MTTL Dielectrically Isolated Integrated Circuits	2-13
(MCE54H00/MCE74H00 Series, MCE5400/MCE7400 Series)	
MCE7000 Series Dielectrically Isolated Integrated Circuits	2-13
MDTL Dielectrically Isolated Integrated Circuits	2-14
(MCE930 Series)	
Special Bipolar Logic Products for Custom Applications	2-15
LINEAR INTEGRATED CIRCUITS	
Interface Circuits	3-2
Operational Amplifiers	3-14
High-Frequency Amplifiers	3-17
Regulators	3-19
Special-Purpose Circuits	3-21
Consumer Devices	3-22
Linear IC Packages	3-25

DISCRETE SEMICONDUCTORS

AMPLIFIERS	
Reference	4-81
CHIPS	4-113
Virtually every device manufactured by Motorola is available in chip form.	
Contact your Motorola representative for more information.	
DIODES	
4-Layer	4-105
Avalanche Regulator	4-77
Current Regulator	4-80
Dual	4-82
Epicap Tuning	4-66

Forward Reference	4-82
Hot-Carrier	4-72
Hyper-Abrupt Junction Tuning	4-70
PIN Switching	4-72
Plastic Hot-Carrier	4-72
Precision Reference	4-81
Temperature Compensated Zener Reference	4-82
Transient Suppressor	4-83
Tuning Diode	4-66
Voltage Regulator	4-81
Zener Diodes Device Options	4-76
Zener	4-77
Zener Reference	4-79
MICRO-T TRANSISTORS AND DIODES	4-47
OPTOELECTRONICS	
Couplers/Isolators	4-109
Detectors	4-111
Light-Emitting Diodes	4-110
RECTIFIERS	
Bridges	4-89
Fast Recovery	4-91
General-Purpose	4-86
High Current Multi-Cell Diodes	4-88
High Current Multi-Cell Circuits	4-90
Hot-Carrier Power	4-92
Special Purpose	4-93
RF MODULES	
Hybrid Amplifier	4-61
THYRISTORS	4-95
TRANSISTORS	
Field-Effect	4-29
Multiple and Darlington	4-35
Plastic Encapsulated Small-Signal	4-21
Small-Signal Hermetic	4-13
Silicon Power	4-2
Silicon RF	4-51
Silicon Power Voltage Regulator	4-10
Unijunctions	4-104
TRIGGERS	
4-Layer Diodes	4-105
Diacs	4-105
Silicon Bidirectional Switch	4-105
Silicon Unidirectional Switch	4-105
DEVICES FOR MILITARY APPLICATIONS	5-1
APPLICATION NOTE SELECTION GUIDE	6-1
ENGINEERING BULLETIN SELECTION GUIDE	6-4





MOS

INTEGRATED CIRCUITS

MOS INTEGRATED CIRCUITS

Motorola's MOS Lines range from standard SSI to MSI and LSI functions. Most devices are available in two temperature/voltage ranges, and in both plastic and ceramic packages. Over 200 different devices are offered.

The two major MOS lines include complementary MOS (McMOS) and NMOS Circuits.

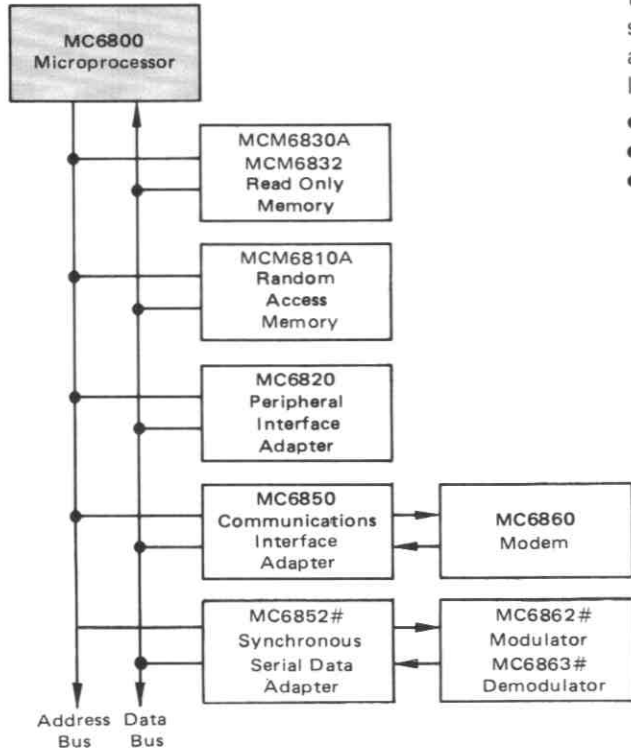
The McMOS family is available in a wide variety of basic and complex logic functions at medium speeds and very low power dissipation.

The NMOS products include the M6800 microcomputer components and an array of memory devices. RAMs, ROMs, Character generators, and unique micro-computer parts, such as Peripheral Interface Adapter (PIA), Asynchronous Communications Interface Adapter (ACIA), and MODEM are part of this series.

TABLE OF CONTENTS

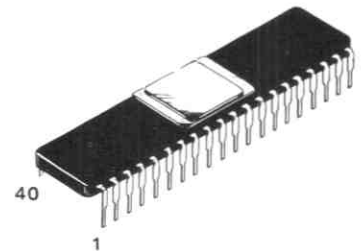
	Page
M6800 Microcomputer Family (Including MCM6800's)	1-2
MOS RAMs (Excluding MCM6800's).	1-5
MOS ROMs (Excluding MCM6800's).	1-6
McMOS MC14000 and MC14500 Series.	1-7
McMOS MC14400 Series.	1-8

**M6800 MICROCOMPUTER FAMILY
BLOCK DIAGRAM**

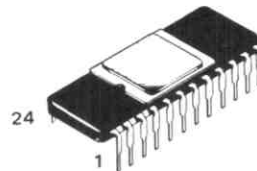


The M6800 family of parts has been designed to set the standard for microcomputer system architecture. The family provides total-system building functions, yet is designed with the flexibility to allow growth. Programmable logic is designed to replace hardwired logic and costly custom microcomputer functions.

- Minimum System Approach
- Powerful Instructions
- Comprehensive Support:
 - Systems Development Tools
 - Software
 - Documentation
 - Applications Aid



CERAMIC PACKAGE
CASE 699



CERAMIC PACKAGE
CASE 684

FUNCTIONS AND CHARACTERISTICS

Function	Type	Case	Comments
Microprocessor	MC6800L	699	Monolithic 8-bit MPU forming the central control function for the M6800 family. Bi-directional data bus, 8-bit parallel processing, 16-bit address bus capable of addressing 65K bytes of memory, 72 instructions, DMA and multiple processor capability.
Peripheral Interface Adapter	MC6820L	699	Interfaces MPU to peripherals through two 8-bit bi-directional peripheral data buses and four control lines. Programmed by the MPU during system initialization.
Asynchronous Communications Interface Adapter	MC6850L	684	Provides the data formatting and control to interface serial asynchronous data communications information to bus organized systems. Programmable control register provides variable word lengths, clock division ratios, transmit control, receive control, and interrupt control.
Synchronous Serial Data Adapter#	MC6852L#	684	Provides a bi-directional interface for simultaneously transmitting and receiving standard synchronous communications characters. Programmable control for variable word lengths, synchronization, and interrupt.
Digital Modem	MC6860L	684	Provides necessary modulation, demodulation and supervisory control to implement serial data communications link, over voice-grade channel, utilizing FSK at bit rates to 600 bps.
2400 bps Digital Modulator #	MC6862L #	684	Provides necessary modulation and control to implement serial data communications link, over voice-grade channel, utilizing DPSK at bit rates of 1200 or 2400 bps.
2400 bps Digital Demodulator#	MC6863L #	684	Provides necessary demodulation and control to implement serial data communications link, over voice-grade channel, utilizing DPSK at bit rates of 1200 or 2400 bps.

#To be announced.

THE M6800 MICROCOMPUTER FAMILY (continued)

Device No.	No. of Bits	Description	Organization	Access Time (ns max)	Power Supplies (V)	No. of Pins	Case
------------	-------------	-------------	--------------	----------------------	--------------------	-------------	------

RANDOM ACCESS MEMORIES (Silicon Gate NMOS)

MCM6810A	1024	Static	128 x 8	500	+5	24	684
MCM68111A#	1024	Static, Common I/O and Output Disable	256 x 4	450	+5	18	680, 707
MCM68112A#	1024	Static, Common I/O	256 x 4	450	+5	16	620, 648
MCM6815A#	4096	Dynamic	4096 x 1	300	+12, +5, -5	22	677, 708
MCM6815A2#	4096	Dynamic	4096 x 1	200	+12, +5, -5	22	677, 708

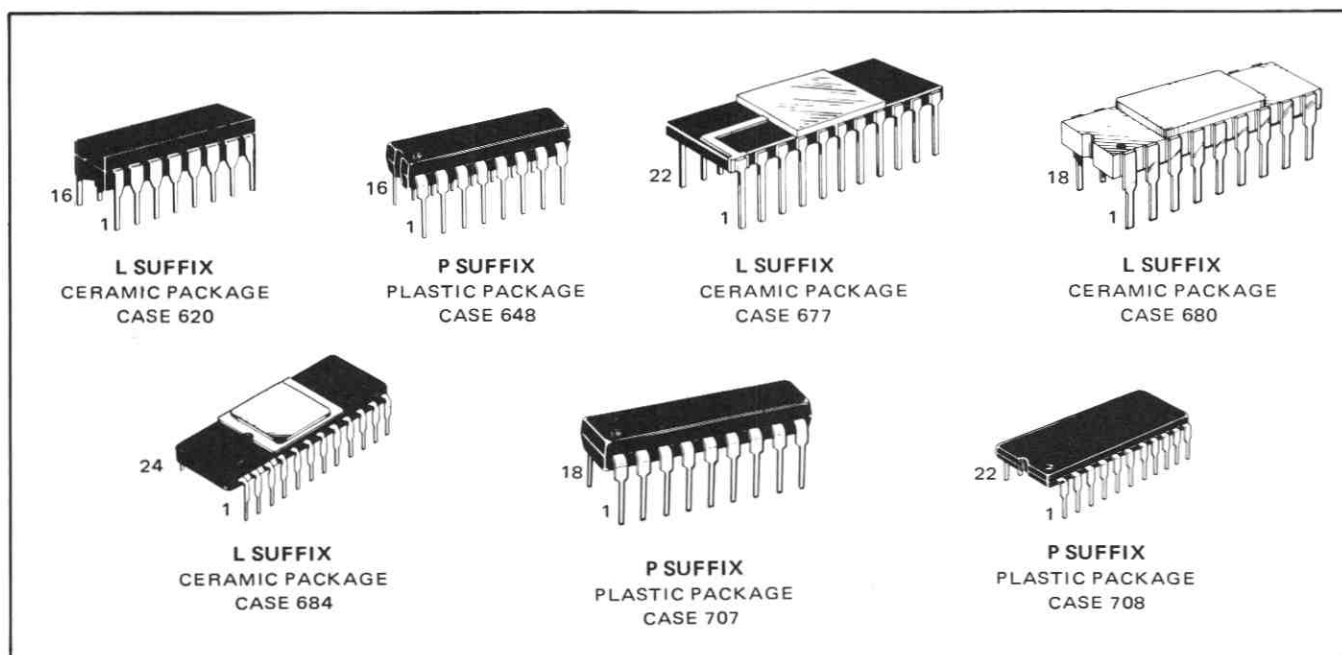
READ ONLY MEMORIES (Silicon Gate NMOS unless otherwise noted)

MCM6830A*	8192	Mask-Programmable	1024 x 8	500	+5	24	684
MCM68317*#	16384	Mask-Programmable	2048 x 8	500	+5	24	684
MCM6832*†	16384	Mask-Programmable	2048 x 8	550	+12, +5, -5	24	684
MCM68708#	8192	Alterable	1024 x 8	500	+12, +5, -5	24	TBA

*Mask-programmable ROMs are manufactured according to a bit-pattern supplied by the customer. A special device number (SCMxxxx) is assigned to each individual pattern.

#To be announced

† Metal Gate NMOS



M6800 SYSTEM SUPPORT

Numerous semiconductor devices are available to enhance the capabilities of the M6800 Family of integrated circuits. Among these, the following should be given special attention (characteristics are given in the indicated section of this Master Selection Guide):

NMOS Random Access Memories NMOS Read Only Memories	Various sizes and types of MOS memories are available to supplement those in the M6800 Family.
MEGALOGIC LSI	These computer-oriented products are a natural complement for MPU-based systems.
Linear Interface Circuits	A broad spectrum of interface circuits will be of particular interest to microcomputer system designers.
McMOS Integrated Circuits	Many of the newer McMOS devices are specialized functions which fit specific needs of microcomputer systems.
MPU Clock Buffer (Multiple Transistor)	The MPQ6842 provides the requirements of the clock buffer for $\phi 1$ and $\phi 2$ inputs of the MPU.

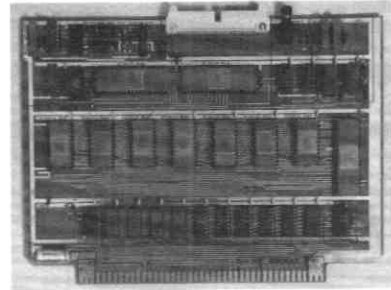
In addition to the categories listed, Two-Phase Clocks (MC6870A, MC6870B, and MC6871A) are available from Motorola Inc., Component Products Department, 2553 North Edgington, Franklin Park, Illinois 60131.

M6800 SUPPORT HARDWARE

EXORciser



Evaluation Module



EXORdisk



EXORTape

EXORciser	Ability to emulate a user's system makes the EXORciser an efficient and economical means for development of M6800 Microprocessor Systems. The optional modules can be arranged to represent the user's proposed system, optional Resident Software permits editing, assembling, and modification of programs.
Evaluation Module	This complete board has all of the M6800 Family devices for ease of parts evaluation. It can be used to run simple programs for familiarization with the system as well as evaluation prior to actual system development with the EXORciser.
EXORdisk	The EXORdisk (Motorola's floppy disk) speeds up microcomputer program development; it is many times faster than teletype or paper tape.
EXORTape	The EXORTape (Motorola's high-speed paper tape reader) provides high-speed reading of paper tape for efficient program loading, editing, and assembling.

M6800 SUPPORT SOFTWARE

Compatible software is available in a variety of forms:

Resident Software	Used with the EXORciser or Evaluation Module, this package consists of the Editor — for editing operations on lines or character strings — and the Assembler — which uses a two-pass operation to produce listing and object tape.
Commercial Timesharing	M6800 software is available on several commercial timesharing services. As circumstances indicate, others will be added.
Host Computer Software	Two software packages are available for host computers: 1. Standard package, normally supplied by vendors; 2. Full capability package, pre-tailored to customer.



Random Access Memories are useful wherever temporary storage is required. They find application in large mainframe memory systems, minicomputers, and conventional digital control circuits.

RAMs which are specifically intended for use with the M6800 Microcomputer Family are shown in another table.

Device No.	No. of Bits	Description	Organization	Access Time (ns max)	Power Supplies (V)	No. of Pins	Case
------------	-------------	-------------	--------------	----------------------	--------------------	-------------	------

SILICON GATE NMOS

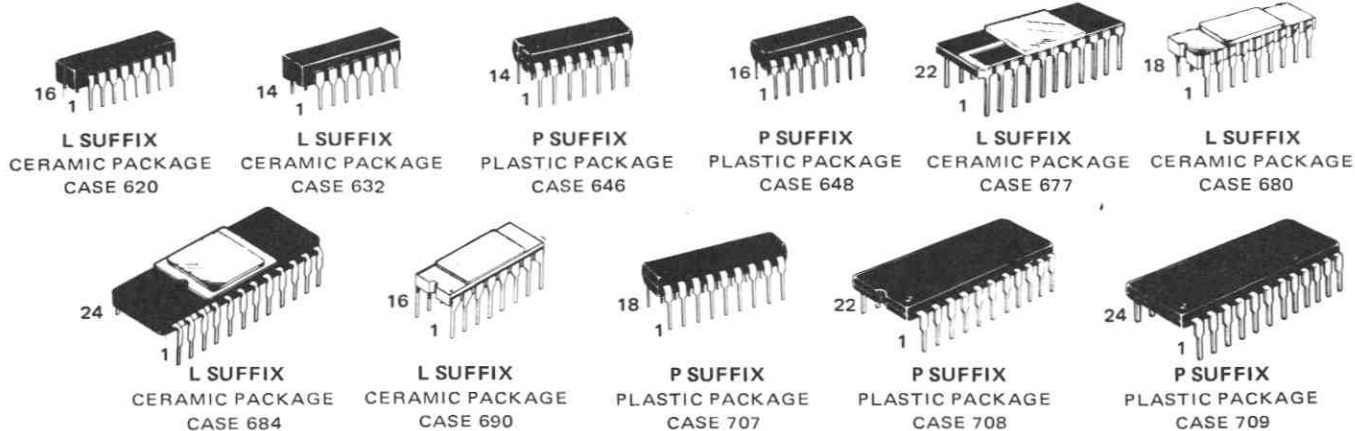
MCM2102*	1024	Static	1024 x 1	1000	+5	16	620, 648
MCM2102-1*	1024	Static, High Speed	1024 x 1	500	+5	16	620, 648
MCM2102-2*	1024	Static	1024 x 1	650	+5	16	620, 648
MCM2102A*	1024	Static, Very High Speed	1024 x 1	350	+5	16	620, 648
MCM2102A2*	1024	Static, Very High Speed	1024 x 1	250	+5	16	620, 648
MCM2102A4*	1024	Static, Very High Speed	1024 x 1	450	+5	16	620, 648
MCM2111A*	1024	Static, Common I/O and Output Disable	256 x 4	350	+5	18	680, 707
MCM2111A2*	1024	Static, Common I/O and Output Disable	256 x 4	250	+5	18	680, 707
MCM2111A4*	1024	Static, Common I/O and Output Disable	256 x 4	450	+5	18	680, 707
MCM2112A*	1024	Static, Common I/O	256 x 4	350	+5	16	620, 648
MCM2112A2*	1024	Static, Common I/O	256 x 4	250	+5	16	620, 648
MCM2112A4*	1024	Static, Common I/O	256 x 4	450	+5	16	620, 648
MCM6604	4096	Dynamic	4096 x 1	350	+12, +5, -5	16	690, 648
MCM6604-2	4096	Dynamic	4096 x 1	250	+12, +5, -5	16	690, 648
MCM6604-4	4096	Dynamic	4096 x 1	300	+12, +5, -5	16	690, 648
MCM6605A	4096	Dynamic	4096 x 1	300	+12, +5, -5	22	677, 708
MCM6605A1	4096	Dynamic	4096 x 1	150	+12, +5, -5	22	677, 708
MCM6605A2	4096	Dynamic	4096 x 1	200	+12, +5, -5	22	677, 708
MCM6616*	16384	Dynamic	16384 x 1	350	+12, +5, -5	16	TBA

METAL GATE CMOS

MCM14505A	64	Static, -55 to +125°C	64 x 1	550#	+3 to +18	14	632
MCM14505C	64	Static, -40 to +85°C	64 x 1	650#	+4.5 to +16	14	632, 646
MCM14537A	256	Static, -55 to +125°C	256 x 1	4000#	+3 to +18	16	690
MCM14537C	256	Static, -40 to +85°C	256 x 1	6000#	+4.5 to +16	16	690
MCM14552A	256	Static, -55 to +125°C	64 x 4	3000#	+3 to +18	24	684
MCM14552C	256	Static, -40 to +85°C	64 x 4	6000#	+4.5 to +16	24	684, 709

* To be announced

Measured with $V_{DD} = +5V$, $T_A = 25^\circ C$





Motorola's Read Only Memories include both pre-programmed memories and mask-programmable memories for custom applications.

The character generators are useful in CRT displays as well as in digital printers. Together with the code converters, which facilitate interface circuitry when going from one character standard to another, they provide a wide choice of devices for data display systems. ROMs are also available to provide the rhythm patterns for electronic organs.

ROMs which are specifically intended for use with the M6800 Microcomputer Family are shown in another table.

Device No.	No. of Bits	Description	Organization	Access Time (ns max)	Power Supplies (V)	No. of Pins	Case
------------	-------------	-------------	--------------	----------------------	--------------------	-------------	------

METAL GATE NMOS

MCM6550*	7168	Mask-Programmable, Static, Rhythm	16 Patterns of 24 or 32 Beats	$t_{cyc} = 1 \text{ ms}$	+15, +5, -3	40	699, 711
MCM6560*	8192	Mask-Programmable, Addressable	1024 x 8 or 2048 x 4	350	+12, +5, -3	24	684, 709
Pre-Programmed Standard Memories:							
MCM6561		Binary Code Converter	1024 x 8				
MCM6562		Binary Code Converter	1024 x 8				
MCM6570*	8192	Mask-Programmable 9 x 7 Character Generator, Horizontal Scan, Shift Capability	128c x (9 x 7)	500	+12, +5, -3	24	684, 709
Pre-Programmed Standard Memories:							
MCM6571		ASCII Characters and Greek, Shifted					
MCM6571A		ASCII Characters and Greek, Shifted					
MCM6572		ASCII and Greek, Not Shifted					
MCM6573		Japanese Characters, Not Shifted					
MCM6574		Math Symbols and Pictures, Shifted					
MCM6575		Alphanumeric Control Characters, Shifted					
MCM6576		British Standard Characters, Shifted					
MCM6577		German Standard Characters, Shifted					
MCM6578		French Standard Characters, Shifted					
MCM6579		General European Standard Characters, Shifted					
MCM6580*	8192	Mask-Programmable 7 x 9 Character Generator, Vertical Scan, Shift Capability	128c x (7 x 9)	400	+12, +5, -3	24	684, 709
Pre-Programmed Standard Memories:							
MCM6581		ASCII Characters and Greek, Shifted					
MCM6583		Japanese Characters, Not Shifted					
MCM6590*	16384	Mask-Programmable, Static	2048 x 8	800	+12, +5, -3	24	684
Pre-Programmed Standard Memory:							
MCM6591		Universal Code Converter					

METAL GATE CMOS

MCM14524A*	1024	Mask-Programmable, -55 to +125°C	256 x 4	2650#	+3 to +18	16	620
MCM14524C*	1024	Mask-Programmable, -40 to +85°C	256 x 4	3975#	+4.5 to +16	16	620, 648

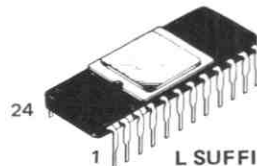
*Mask-programmable ROMs are manufactured according to a bit-pattern supplied by the customer. A special device number (SCMxxxx) is assigned to each individual pattern. #Measured with $V_{DD} = +5 \text{ V}$, $T_A = 25^\circ \text{C}$



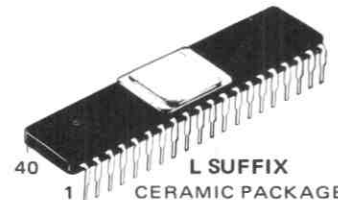
L SUFFIX
CERAMIC PACKAGE
CASE 620



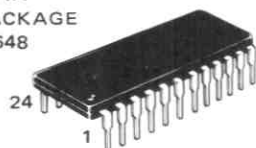
P SUFFIX
PLASTIC PACKAGE
CASE 648



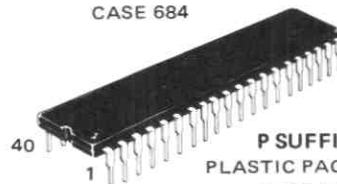
L SUFFIX
CERAMIC PACKAGE
CASE 684



L SUFFIX
CERAMIC PACKAGE
CASE 699



P SUFFIX
PLASTIC PACKAGE
CASE 709



P SUFFIX
PLASTIC PACKAGE
CASE 711

McMOS

MC14000 and MC14500 Series Complementary MOS

INTEGRATED CIRCUITS

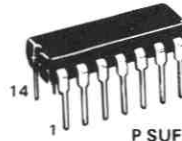
McMOS



L SUFFIX
CERAMIC PACKAGE
CASE 620



L SUFFIX
CERAMIC PACKAGE
CASE 632



P SUFFIX
PLASTIC PACKAGE
CASE 646



P SUFFIX
PLASTIC PACKAGE
CASE 648

The McMOS series of monolithic integrated logic circuits is designed to provide the system design engineer with a medium-speed integrated circuit family which approaches the ideal in performance. The low power dissipation and flexible power supply requirements of this family of devices greatly simplify power supply design, and the high noise immunity and large fanout capability reduce parts count and simplify printed circuit board layout.

All devices may also be obtained in chip form for the manufacturer of hybrid microcircuits.

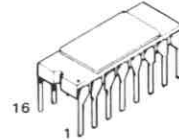
FEATURES

- Quiescent Power Dissipation = 10 nW/pkg typical for Gates
- High Noise Immunity = 45% of V_{DD} typical
- Single or Multiple Supply Operation – Positive or Negative
- Fan-out – > 50
- Output Logic Excursion Independent of Fan-out
- Diode Protection on All Inputs

$V_{DD} = 3.0 \text{ Vdc to } 18 \text{ Vdc}$, $T_A = -55^\circ\text{C to } +125^\circ\text{C}$ for AL Suffix
 $V_{DD} = 3.0 \text{ Vdc to } 16 \text{ Vdc}$, $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ for CL/CP Suffix



L SUFFIX
CERAMIC PACKAGE
CASE 684



L SUFFIX
CERAMIC PACKAGE
CASE 690



P SUFFIX
PLASTIC PACKAGE
CASE 709

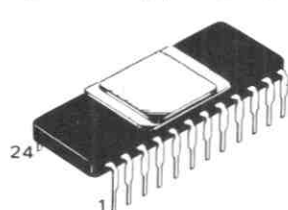
Function	Type	Case
Dual 3-Input NOR Gate plus Inverter	MC14000	632,646
Quad 2-Input NOR Gate	MC14001	632,646
Dual 4-Input NOR Gate	MC14002	632,646
18-Bit Static Shift Register	MC14006	632,646
Dual Complementary Pair Plus Inverter	MC14007	632,646
4-Bit Full Adder	MC14008	620,648
Quad 2-Input NAND Gate	MC14011	632,646
Dual 4-Input NAND Gate	MC14012	632,646
Dual Type D Flip-Flop	MC14013	632,646
8-Bit Static Shift Register	MC14014	620,648
Dual 4-Bit Static Shift Register	MC14015	620,648
Quad Analog Switch/Quad Multiplexer	MC14016	632,646
Decade Counter/Divider	MC14017	620,648
14-Bit Binary Counter	MC14020	620,648
8-Bit Static Shift Register	MC14021	620,648
Octal Counter/Divider	MC14022	620,648
Triple 3-Input NAND Gate	MC14023	632,646
Seven-Stage Ripple Counter	MC14024	632,646
Triple 3-Input NOR Gate	MC14025	632,646
Dual J-K Flip-Flop	MC14027	620,648
BCD-To-Decimal Decoder/ Binary-To-Octal Decoder	MC14028	620,648
Triple Serial Adder (Positive Logic)	MC14032	620,648
8 Bit Universal Bus Register	MC14034	684,709
4-Bit Parallel-In/Parallel-Out Shift Register	MC14035	620,648
Triple Serial Adder (Negative Logic)	MC14038	620,648
12 Bit Binary Counter	MC14040	620,648
Quad Latch	MC14042	620,648
Phase-Locked Loop	MC14046	620,648
Hex Inverter/Buffer	MC14049	620,648
Hex Buffer	MC14050	620,648
Quad 2-Input OR Gate	MC14071	632,646
Quad D-Type Register	MC14076	620,648
Quad 2-Input AND Gate	MC14081	632,646

Function	Type	Case
Triple Gate (Dual 4-Input NAND Gate and 2-Input NOR/OR Gate or 8-Input AND/NAND Gate)	MC14501	620,648
Strobed Hex Inverter/Buffer	MC14502	620,648
64 Bit Static Random Access Memory	MCM14505	632,646
Dual Expandable AND-OR-INVERT Gate	MC14506	620,648
Quad Exclusive OR Gate	MC14507	632,646
Dual 4-Bit Latch	MC14508	684,709
BCD Up/Down Counter	MC14510	620,648
BCD-To-Seven Segment Latch/Decoder/Driver	MC14511	620,648
8 Channel Data Selector	MC14512	620,648
4-Bit Latch/4 to 16 Line Decoder (High)	MC14514	684,709
4-Bit Latch/4 to 16 Line Decoder (Low)	MC14515	684,709
Binary Up/Down Counter	MC14516	620,648
Dual 64 Bit Static Shift Register	MC14517	620,648
Dual BCD Up Counter	MC14518	620,648
4-Bit AND/OR Selector (Quad 2-Channel Data Selector or Quad Exclusive NOR Gate)	MC14519	620,648
Dual Binary Up Counter	MC14520	620,648
24-State Frequency Divider	MC14521	620,648
Programmable Divide-By-N 4-Bit Counter (BCD)	MC14522	620,648
1024 Bit Read Only Memory	MCM14524	620,648
Programmable Divide-By-N 4-Bit Counter (Binary)	MC14526	620,648
BCD Rate Multiplier	MC14527	620,648
Dual Retriggerable/Resetttable Monostable Multivibrator	MC14528	620,648
Dual 4 Channel Analog Data Selector	MC14529	620,648
Dual 5-Input Majority Logic Gate	MC14530	620,648
12 Bit Parity Tree	MC14531	620,648
8-Bit Priority Encoder	MC14532	620,648
Real Time 5-Decade Counter	MC14534	684,709
Programmable Timer	MC14536	620,648
256 Bit Static Random Access Memory	MCM14537	690
Dual 4 Channel Data Selector/Multiplexer	MC14539	620,648
Programmable Oscillator/Timer	MC14541	632,646
BCD-to-Seven Segment Latch/Decoder/Driver	MC14543	620,648
Successive Approximation Register	MC14549	620,648
256-Bit Static Random Access Memory	MCM14552	684,709
Three-Digit BCD Counter	MC14553	620,648
2 x 2-Bit Parallel Binary Multiplier	MC14554	620,648
Dual Binary to 1 of 4 Decoder/Demultiplexer	MC14555	620,648
Dual Binary to 1 of 4 Decoder/Demultiplexer (Inverting)	MC14556	620,648
1-to-64 Bit Variable Length Shift Register	MC14557	620,648
BCD-to-Seven Segment Decoder	MC14558	620,648
Successive Approximation Register	MC14559	620,648
NBCD Adder	MC14560	620,648
9's Complementer	MC14561	632,646
128 Bit Static Shift Register	MC14562	632,646
Industrial Time Base Generator	MC14566	620,648
Hex Gate (Quad Inverter Plus 2-Input NOR Gate plus 2-Input NAND Gate)	MC14572	620,648
4 x 4 Multiport Register	MC14580	684,709
4 Bit Arithmetic Logic Unit	MC14581	684,709
Look Ahead Carry Block	MC14582	620,648
Dual Schmitt Trigger	MC14583	620,648
4-Bit Magnitude Comparator	MC14585	620,648

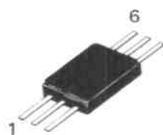
MC14400 Series Complementary MOS

The MC14400 Series contains devices whose designs and specifications are tailored towards specific subsystem applications. The MC14400 Series devices are manufactured with the same low power metal gate complementary MOS processing techniques as the MC14000 and MC14500 Series standard product family devices, and as such will exhibit the same inherent characteristics of the technology such as low power dissipation and high noise immunity. The specifications of these subsystem devices are, however, designed to maximize their efficiency in the applications for which they were intended and may not necessarily meet the more universal specifications required of and guaranteed by our standard MC14000 and MC14500 CMOS product family.

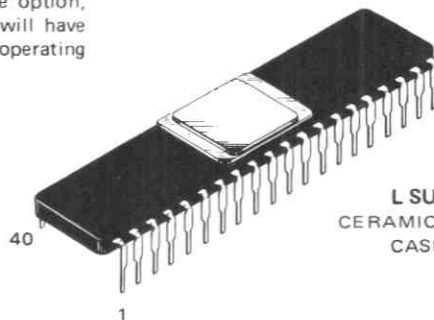
To differentiate the new specification policy, the MC14400 Series will have a new set of suffixes. Some devices will have only a package option, either plastic ("P" suffix) or ceramic ("L" suffix). Other devices will have options available for power supply range ("V" or "F" suffix) and operating temperature range ("E" suffix).



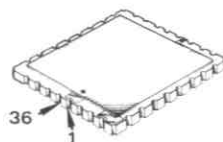
L SUFFIX
CERAMIC PACKAGE
CASE 684



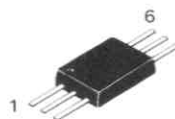
L SUFFIX
CERAMIC PACKAGE
CASE 688



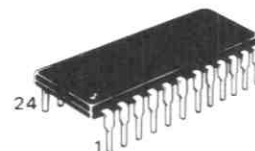
L SUFFIX
CERAMIC PACKAGE
CASE 699



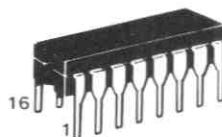
Z SUFFIX
LEADLESS CERAMIC PACKAGE
CASE 703



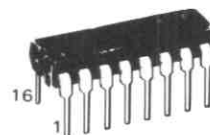
P SUFFIX
PLASTIC PACKAGE
CASE 704



P SUFFIX
PLASTIC PACKAGE
CASE 709



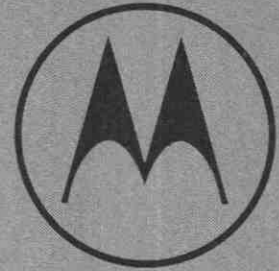
L SUFFIX
CERAMIC PACKAGE
CASE 620



P SUFFIX
PLASTIC PACKAGE
CASE 648

FUNCTIONS AND CHARACTERISTICS

Function	Type	V _{DD} Range Vdc	Temperature °C	Case
2-of-8 Tone Encoder	MC14410L,P	4.4 to 6.0	-40 to +85	620, 648
Bit Rate Generator	MC14411L,P	5.0	-40 to +85	684, 709
Universal Low Speed (0-600 bps) Modem	MC14412FL	4.75 to 15	-40 to +85	690
	MC14412VL	4.75 to 6.0	-40 to +85	690
Quad Precision Timer/Driver	MC14415EFL	3.0 to 18	-55 to +125	620
	MC14415FL,FP	3.0 to 16	-40 to +85	620, 648
	MC14415EVL	3.0 to 6.0	-55 to +125	620
	MC14415VL,VP	3.0 to 6.0	-40 to +85	620, 648
2-of-8 Keypad-to-Binary Encoder	MC14419L,P	3.0 to 6.0	-40 to +85	620, 648
3½ Digit A/D Logic Subsystem	MC14435EFL	3.0 to 18	-55 to +125	620
	MC14435FL,FP	3.0 to 16	-40 to +85	620, 648
	MC14435EVL	3.0 to 6.0	-55 to +125	620
	MC14435VL,VP	3.0 to 6.0	-40 to +85	620, 648
L. C. D. Watch/Clock Circuit	MC14440L,Z MCC14440	1.4 to 1.65	-10 to +60	699, 703 Chip
Oscillator/2 ¹⁶ Divider/Buffer	MC14450L,P	1.3 to 3.0	0 to +50	688, 704
	MCC14450			Chip
Oscillator/2 ¹¹ to 2 ¹⁹ Divider/Buffered Duty Cycle Control	MC14451L,P	1.3 to 3.0	-10 to +60	620,648
	MCC14451			Chip
Hex Contact Bounce Eliminator	MC14490EFL	3.0 to 18	-55 to +125	620
	MC14490FL,FP	3.0 to 16	-40 to +85	620, 648
	MC14490EVL	3.0 to 6.0	-55 to +125	620
	MC14490VL,VP	3.0 to 6.0	-40 to +85	620, 648



BIPOLAR DIGITAL INTEGRATED CIRCUITS

BIPOLAR DIGITAL INTEGRATED CIRCUITS

Motorola's Bipolar Integrated Circuits include elements of several logic families — MECL, MHTL, MDTL, MRTL and MTTL — from SSI to large scale functions.

Of particular interest is the MECL 10,000 high-speed logic family. This series features significantly lower power dissipation when compared to standard MECL devices. Technological advances have permitted new levels of circuit complexity. One such example is the MCM10149, 1024-Bit PROM.

While not family related, Phase-Locked Loop (PLL) and Megalogic encompass several design approaches to bipolar circuits.

Motorola offers the designer a choice of specifically designed integrated circuits for performing phase-locked loop functions, such as, phase detection, frequency division, filtering, and voltage-controlled signal generation.

Megalogic provides several design approaches to bipolar LSI. Motorola has developed LSI arrays of 160 and 400 gate complexities with typical speeds of 25 ns per gate. These gate arrays keep costly layout and engineering manpower to a minimum.

Motorola's extensive experience in high-reliability military and space programs has resulted in quality assurance for integrated circuits and participation in the MIL-M-385 10 Program. The dielectrically Isolated MDTL family and the Beam-Lead MTTL family are also used in highly reliable systems.

	Page
MECL MC10,000 Series	2-2
MECL III MC1600 Series	2-4
Megalogic LSI	2-5
Logic Products for Phase-Locked Loop Applications	2-6
MHTL MC660 Series	2-7
MDTL MC830/MC930 Series	2-8
(Includes MC1800/MC1900 Series Devices)	
MRTL MC700/MC800/MC900 Series	2-10
(Includes MC9700/MC9800 Series Devices)	
mW MRTL MC708/MC808/MC908 Series	2-11
(Includes MC9700/MC9800 Series Devices)	
MTTL Beam Lead Integrated Circuits	2-12
(MCBC5400 Series)	
MTTL Dielectrically Isolated Integrated Circuits	2-13
(MCE54H00/MCE74H00 Series, MCE5400/MCE7400 Series)	
MCE7000 Series Dielectrically Isolated Integrated Circuits	2-13
MDTL Dielectrically Isolated Integrated Circuits	2-14
(MCE930 Series)	
Special Bipolar Logic Products for Custom Applications	2-15

MECL

MECL 10,000 SERIES INTEGRATED CIRCUITS

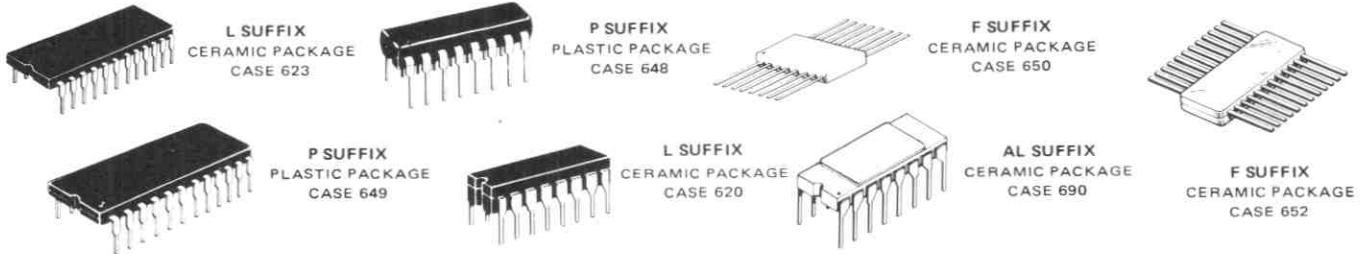
MECL

MC10,100/10,200 Series (-30 to +85°C)

MC10,500/10,600 Series (-55 to +125°C)

MECL 10,000 has an excellent speed-power product, has relatively slow rise and fall times, and transmission-line drive capability. The combination of versatile logic functions and the 2.0 ns propagation delay make MECL 10,000 a versatile family for data handling and processing systems.

Circuit design with MECL 10,000 is unusually convenient. The differential amplifier input and emitter-follower output permit high fanout, the wired-OR option, and complementary outputs. MECL III is directly compatible with MECL 10,000, and can be used to extend the speed capability of the MECL 10,000 series.



FUNCTIONS AND CHARACTERISTICS ($V_{CC} = 0$, $V_{EE} = -5.2$ V, $T_A = 25^\circ\text{C}$)

Function	Type ①		Propagation Delay ns typ	Power Dissipation mW typ/pkg*	Case
	-30 to +85°C	-55 to +125°C			
Quad 2-Input NOR Gate With Strobe	MC10100	—	2.0	100	620
Quad OR/NOR Gate	MC10101	MC10501	2.0	100	620,648,650
Quad 2-Input NOR Gate	MC10102	MC10502	2.0	100	620,648,650
Quad 2-Input OR Gate	MC10103	—	2.0	100	620
Quad 2-Input AND Gate	MC10104	MC10504	2.7	140	620,648,650
Triple 2-3-2-Input OR/NOR Gate	MC10105	MC10505	2.0	90	620,648,650
Triple 4-3-3-Input NOR Gate	MC10106	MC10506	2.0	90	620,648,650
Triple 2-Input Exclusive OR/Exclusive NOR	MC10107	MC10507	2.5	110	620,648,650
Dual 4-5-Input OR/NOR Gate	MC10109	MC10509	2.0	60	620,648,650
Dual 3-Input 3-Output OR Gate	MC10110	—	2.4	160	620,648
Dual 3-Input 3-Output NOR Gate	MC10111	—	2.4	160	620,648
Quad Exclusive OR Gate	MC10113	—	2.5	175	620,648
Triple Line Receiver	MC10114	MC10514	2.4	145	620,648,650
Quad Line Receiver	MC10115	MC10515	2.0	110	620,648,650
Triple Line Receiver	MC10116	MC10516	2.0	85	620,648,650
Dual 2-Wide 2-3-Input OR-AND/OR-AND-INVERT Gate	MC10117	MC10517	2.3	100	620,648,650
Dual 2-Wide 3-Input OR-AND Gate	MC10118	MC10518	2.3	100	620,648,650
4-Wide 4-3-3-Input OR-AND Gate	MC10119	MC10519	2.3	100	620,648,650
4-Wide OR-AND/OR-AND-INVERT Gate	MC10121	MC10521	2.3	100	620,648,650
Triple 4-3-3-Input Bus Driver	MC10123	—	3.0	310	620
Quad MTTL to MECL Translator	MC10124	MC10524	3.5	380	620,648,650
Quad MECL to MTTL Translator	MC10125	MC10525	4.5	380	620,648,650
Bus Driver	MC10128	—	12.0	700	620
Quad Bus Receiver	MC10129	—	10.0	750	620
Dual Latch	MC10130	MC10530	2.5	155	620,648,650
Dual Type D Master-Slave Flip-Flop	MC10131	MC10531	f = 160 MHz	235	620,648,650
Dual Multiplexer With Latch and Common Reset	MC10132	—	3.0	225	620,648
Quad Latch	MC10133	MC10533	4.0	310	620,648,650
Multiplexer with Latch	MC10134	—	3.0	225	620,648
Dual J-K Master-Slave Flip-Flop	MC10135	MC10535	f = 140 MHz	280	620,648,650
Universal Hexadecimal Counter	MC10136	MC10536	f = 150 MHz	625	620,648,650

(continued)

① L suffix denotes Dual In-Line Ceramic Package, P suffix denotes Dual In-Line Plastic Package, F suffix denotes flat package (i.e., MC10100L = Ceramic Dual In-Line Package, MC10100P = Plastic Dual In-Line Package and MC10500F = Ceramic Flat Package.)

*External Load Power not included.

FUNCTIONS AND CHARACTERISTICS (continued)

Function	Type ①		Propagation Delay ns typ	Power Dissipation mW typ/pkg*	Case
	-30 to +85°C	-55 to +125°C			
Universal Decade Counter	MC10137	MC10537	f = 150 MHz	625	620,648,650
Bi-Quinary Counter	MC10138	—	f = 150 MHz	370	620,648
64-Bit Random Access Memory (90 Ω)	MCM10140	—	t _{Access} = 15 (max)	420	620,690
Four-Bit Universal Shift Register	MC10141	MC10541	f = 200 MHz	425	620,648,650
64-Bit Random Access Memory (50 Ω)	MCM10142	—	t _{Access} = 10 (max)	420	620
8 x 2 Multiport Register File (RAM)	MCM10143	—	t _{Access} = 10	610	623
256-Bit Random Access Memory	MCM10144	—	t _{Access} = 30 (max)	420	620,690
64-Bit Register File (RAM)	MCM10145	—	t _{Access} = 10	625	620
128-Bit Random Access Memory	MCM10147	—	t _{Access} = 12 (max)	420	620
64-Bit Random Access Memory (50 Ω)	MCM10148	—	t _{Access} = 15 (max)	420	620
1024-Bit Programmable Read-Only Memory	MCM10149	—	t _{Access} = 25 (max)	—	690
Quad Latch	MC10153	—	4.0	310	620
Quad 2-Input Multiplexer (Non-Inverting)	MC10158	—	2.5	197	620
Quad 2-Input Multiplexer (Inverting)	MC10159	—	2.5	218	620
12-Bit Parity Generator-Checker	MC10160	MC10560	5.0	320	620,648,650
Binary to 1-8 Decoder (Low)	MC10161	MC10561	4.0	315	620,648,650
Binary to 1-8 Decoder (High)	MC10162	MC10562	4.0	315	620,648,650
Error Detection-Correction Circuit	MC10163	—	5.0	520	620
8-Line Multiplexer	MC10164	MC10564	3.0	310	620,648,650
8-Input Priority Encoder	MC10165	—	7.0	545	620,648
5-Bit Magnitude Comparator	MC10166	—	6.0	440	620
Quad Latch	MC10168	—	3.0	310	620
9 + 2 Bit Parity Generator-Checker	MC10170	—	4.0	300	620
Dual Binary to 1-4 Decoder (Low)	MC10171	MC10571	4.0	325	620,648,650
Dual Binary to 1-4 Decoder (High)	MC10172	MC10572	4.0	325	620,648,650
Quad 2-Input Multiplexer/Latch	MC10173	—	2.5	275	620,648
Dual 4 to 1 Multiplexer	MC10174	MC10574	3.5	305	620,648,650
Quint Latch	MC10175	MC10575	2.5	400	620,648
Hex "D" Master-Slave Flip-Flop	MC10176	MC10576	f = 150 MHz	460	620,648,650
Triple MECL to NMOS Translator	MC10177	—	—	1.0 W	620
Binary Counter	MC10178	—	f = 150 MHz	370	620,648
Look-Ahead Carry Block	MC10179	MC10579	3.0 (C _n ,P) 4.0 (G)	300	620,648,650
Dual High Speed Adder/Subtractor	MC10180	MC10580	4.5	360	620,648,650
4-Bit Arithmetic Logic Unit/Function Generator	MC10181	MC10581	See Logic Diag.	600	623,649,652
2-Bit Arithmetic Logic Unit/Function Generator	MC10182	—	See Logic Diag.	575	620
4 x 2 Multiplier	MC10183	—	50	760	623
Hex "D" Master Slave Flip-Flop/with Reset	MC10186	—	f = 150 MHz	460	620
Quad MST to MECL 10,000 Translator	MC10190	—	2.5	215	620
Hex MECL 10,000 to MST Translator	MC10191	—	2.2	145	620
Error Detection-Correction Circuit	MC10193	—	7.5	520	620
Dual Simultaneous Bus Transceiver	MC10194	—	2.5	405	620
Hex Inverter/Buffer	MC10195	—	2.0	200	620
Hex "AND" Gate	MC10197	—	2.8	200	620
High-Speed Dual 3-Input 3-Output OR Gate	MC10210	—	1.5	160	620,648
High-Speed Dual 3-Input 3-Output NOR Gate	MC10211	—	1.5	160	620,648
High-Speed Dual 3-Input 3-Output OR/NOR Gate	MC10212	—	1.5	160	620
High-Speed Triple Line Receiver	MC10216	MC10616	1.8	100	620,648,650
High-Speed Dual Type D Master-Slave Flip-Flop	MC10231	MC10631	f = 225 MHz	270	620,648,650
High Speed 2 x 1 Bit Array Multiplier Block	MC10287	—	—	400	620

① L suffix denotes Dual In-Line Ceramic Package, P suffix denotes Dual In-Line Plastic Package, F suffix denotes flat package (i.e., MC10100L = Ceramic Dual In-Line Package, MC10100P = Plastic Dual In-Line Package and MC10500F = Ceramic Flat Package.)

* Load Power not included

MECL III

INTEGRATED CIRCUITS

MECL III

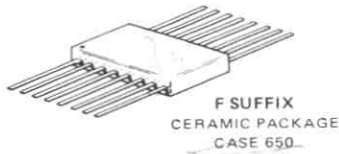
MC1600 Series (-30°C to +85°C)

The requirement for digital systems with ever higher performance has increased the need for high-speed integrated circuits. The industry has recognized that the only economical way to obtain high operating system speed is through the use of emitter-coupled logic. Motorola offers a state-of-the-art, emitter-coupled logic family with subnanosecond propagation delays — MECL III.

MECL III circuit design is similar to that used in the popular MECL 10,000 family. In the MECL III line, as well as MECL 10,000, advanced processing techniques are employed and the capability for driving low-impedance terminated lines is provided. MECL III is recommended for new designs.

GENERAL FEATURES

- Gate Switching Speeds of 1.0 ns typical
- Capability of Driving Terminated Lines with Impedance as Low as 50 Ohms
- Flip-Flop Toggle Rate Greater Than 500 MHz
- Operation with Unused Inputs Left Open
- Compatibility with MECL 10,000 Series
- Counting Speeds to above 1 GHz



FUNCTIONS AND CHARACTERISTICS (V_{CC} = 0, V_{EE} = -5.2 V, T_A = 25°C unless otherwise noted.)

Function	Type ① -30° to +85°C	Loading Factor # Each Output	Propagation Delay 50-ohm Load ns typ	Power Dissipation (No Load) mW typ/pkg	Case
High Bandwidth Quad 2-Input OR/NOR Gate	MC1601	—	0.75	600	650
High Bandwidth Triple 2-2-3 Input OR/NOR Gate	MC1602	—	0.75	460	650
High Bandwidth 4-5-Input OR/NOR Gate	MC1603	—	0.75	320	650
High Bandwidth Triple Line Receiver	MC1604	—	0.75	460	650
Dual Type D Master-Slave Flip-Flop	MC1605	—	500 MHz typ	525	650
Voltage Controlled Oscillator	MC1648	—	*225 MHz typ	150	607,632,646
Dual A/D Comparator	MC1650	70	3.5	275	620,650
Dual A/D Comparator	MC1651	70	3.0	275	620,650
Binary Counter	MC1654	70	*325 MHz typ	750 \lll	620
Voltage-Controlled Multivibrator	MC1658	70	*150 MHz typ	125	620,648,650
Dual 4-Input OR/NOR Gate	MC1660	70	1.1	120	620,650
Quad 2-Input NOR Gate	MC1662	70	1.1	240	620,650
Quad 2-Input OR Gate	MC1664	70	1.1	240	620,650
Dual Clocked R-S Flip-Flop	MC1666	70	1.8	220	620,650
Dual Clocked Latch	MC1668	70	1.8	220	620,650
Master-Slave Type D Flip-Flop	MC1670	70	*350 MHz typ	220	620,650
Triple 2-Input Exclusive OR Gate	MC1672	70	1.3	220	620,650
Triple 2-Input Exclusive NOR Gate	MC1674	70	1.3	220	620,650
Bi-Quinary Counter	MC1678	70	*350 MHz typ	750 \lll	620
Dual 4-5-Input OR/NOR Gate	MC1688	70	0.8	125	650
UHF Prescaler Type D Flip-Flop	MC1690	70	*500 MHz min	200	620,650
Quad Line Receiver	MC1692	70	1.1	220	620,650
4-Bit Shift Register	MC1694	70	*325 MHz typ	750 \lll	620
1 GHz Divide-By-Ten Counter	MC1696	—	*1 GHz min	650	650
Divide-By-Four Gigahertz Counter	MC1699	—	*1.2 GHz typ	650	650

① L suffix denotes Dual In-Line Ceramic Package, F suffix denotes Ceramic Flat Package, P suffix denotes Dual In-Line Plastic Package. (i.e., MC1600L = Ceramic Dual In-Line Package, MC1600F = Ceramic Flat Package, MC1600P = Plastic Dual In-Line Package).

\lll Requires Heat Sink — IERC-LIC-214A2WCB or equivalent.

*Toggle Frequency

#DC Loading Factors are based on:

1. Full load output current, I_L = -25 mAdc max
2. Maximum input current, I_{IN} = 350 μAdc

MEGALOGIC LSI

MEGALOGIC is a bipolar LSI family of low-cost products directed to the computer, industrial, and consumer markets, for both MPU and non-MPU applications. The family will include technologies such as TRL and I²L, plus others that may be applicable. Design techniques will encompass the production-proven gate array technique plus other design approaches to provide the flexibility

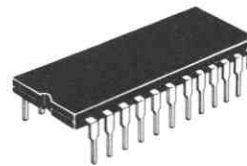
required for cost-effective, standard bipolar LSI functions. Designers can now implement highly complex systems with only a few basic off-the-shelf LSI components. Benefits include lower system costs, off-the-shelf availability, improved reliability, lower system power drain, fewer parts to assemble and inspect, and more compact system architecture.

BIPOLAR LSI GATE ARRAYS

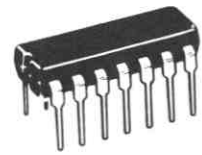
Megalogic encompasses several design approaches to Bipolar LSI. One approach is the basic gate array. The basic arrays with the addition of custom metalization, can be connected quickly and economically into high-density functions of equivalent complexity.

Characteristic	XC160	XC400
Number of Gates	160	400
Number of Bonding Pads	48	74
Fan-In	3	3
Fan-Out (Internal)	5	5
Propagation Delay	25 ns	25 ns
Power Dissipation (Chip)	480 mW	1200 mW
Logic "0" Level*	0.5 V	0.5 V
Logic "1" Level*	2.4 V	2.4 V
Die Size (Mils)	74 x 103	123 x 125

*External, at specified load.



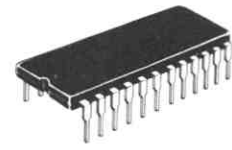
L SUFFIX
CERAMIC PACKAGE
CASE 623



P SUFFIX
PLASTIC PACKAGE
CASE 646



P SUFFIX
PLASTIC PACKAGE
CASE 648



P SUFFIX
PLASTIC PACKAGE
CASE 649

STANDARD PRODUCT LINE

The following standard Bipolar LSI parts have been defined, and are available.

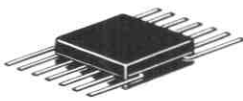
Device	Function	Case	Applications
MC8500	CRCC Generator	649	Magnetic tape drive controllers using NRZI recording; 7 or 9 channels.
MC8501	Error Pattern Register	648	
MC8502	LRCC/Data Register	649	
MC8503	Universal Polynomial Generator (16-Bit)	646	Cassette, floppy disc, data communications
MC8504	Universal Presettable Polynomial Generator (4-Bit, Cascadable)	648	High-speed disc controllers, digital filtering
MC8505	MOS Dynamic Memory Refresh Logic Circuit	648	Add-on memory, memory applications
MC8506	Polynomial Generator (16-Bit)	648	Floppy disc, SDLC terminals
MC8520	Deskew/Queue Register	623	Magnetic tape drive controllers, phase encoded
MC8521*	Data Recovery	TBA	
MC8522*	2-of-8 Tone Decoder (Low Frequency)	TBA	Digital communications, touch tone receivers, telephone networks, mobile radio systems.
MC8523*	2-of-8 Tone Decoder (High Frequency)	TBA	
MC8524*	2-of-8 Tone Decoder Timing and Control	TBA	

*To be announced.

LOGIC PRODUCTS

for

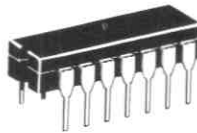
PHASE-LOCKED LOOP APPLICATIONS



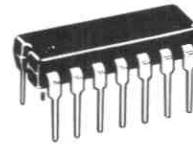
F SUFFIX
CERAMIC PACKAGE
CASE 607



L SUFFIX
CERAMIC PACKAGE
CASE 620



L SUFFIX
CERAMIC PACKAGE
CASE 632



P SUFFIX
PLASTIC PACKAGE
CASE 646



P SUFFIX
PLASTIC PACKAGE
CASE 648

Motorola offers the designer a choice of specially designed integrated circuits for performing phase-locked loop functions: phase detection, frequency division, filtering, and voltage-controlled signal generation. In addition, the choice of circuits permits the designer to select TTL circuits where speed is not critical (<25 MHz), or ECL circuits where high speed is required. The MC12000 series circuits will operate at either +5.0 V or -5.2 V, and translators are included where needed so that all functions are compatible.

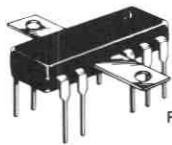
FUNCTIONS AND CHARACTERISTICS

Function	Type				Family	Frequency MHz typ	Power Dissipation mW typ/pkg
	-55 to +125°C	Case	0 to +75°C	Case			
Emitter-Coupled Oscillator	—	—	MC1648	607,632,646	MECL	225	150
Voltage-Controlled Multivibrator	—	—	MC1658	620,648	MECL	150	125
Dual Voltage-Controlled Multivibrator	MC4324	607,632	MC4024	607,632,646	MTTL	30	150
Phase-Frequency Detector	MC4344	607,632	MC4044	607,632,646	MTTL	8.0	85
Digital Mixer/Translator	—	—	MC12000	632	MECL	250	470
Two-Modulus Prescaler	—	—	MC12012	620	MECL	200	500
Two-Modulus Prescaler	MC12513	620	MC12013	620,648	MECL	600	—
Counter Control Logic	—	—	MC12014	620	MTTL	25	25
Offset Control	MC12520	632	MC12020	632,646	MECL	—	—
Offset Programmer	MC12521	620	MC12021	620,648	MECL	—	—
Phase-Frequency Detector	MC12540	632	MC12040	632,648	MECL	70	425
Crystal Oscillator	MC12560	620	MC12060	620,648	MTTL	0.1 to 2.0	175
Crystal Oscillator	MC12561	620	MC12061	620,648	MTTL	2.0 to 20	210
Programmable Modulo-N Decade Counter (÷0 thru 9)	MC4316 (MC54416)	620	MC4016 (MC74416)	620,648	MTTL	8.0	250
Programmable Modulo-N Counter (÷0, 1 and ÷0 thru 4)	MC4317 (MC54417)	620	MC4017 (MC74417)	620,648	MTTL	8.0	250
Programmable Modulo-N Hexadecimal Counter (÷0 thru 15)	MC4318 (MC54418)	620	MC4018 (MC74418)	620,648	MTTL	8.0	250
Programmable Modulo-N Counter (÷0 thru 3 and ÷0 thru 3)	MC4319 (MC54419)	620	MC4019 (MC74419)	620,648	MTTL	8.0	250

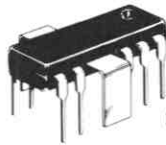
*MC660 Series (-30 to +75°C)

Motorola's MHTL integrated circuits are especially designed to meet the requirements of industrial applications because of the outstanding noise immunity. MHTL circuits provide error-free operation in high noise environments far beyond the tolerance of other integrated circuit families. Multifunction packages and broad operating temperature range further tailor this device family to the industrial designer's requirements.

*MHTL ceramic dual in-line devices are available with specification over the -55°C to +125°C temperature range and/or with hi-rel processing on special order. See your Motorola representative for pricing.



P SUFFIX
PLASTIC PACKAGE
CASE 675



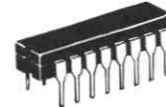
PC SUFFIX
PLASTIC PACKAGE
CASE 676



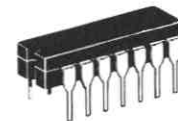
P SUFFIX
PLASTIC PACKAGE
CASE 646



P SUFFIX
PLASTIC PACKAGE
CASE 648



L SUFFIX
CERAMIC PACKAGE
CASE 620



L SUFFIX
CERAMIC PACKAGE
CASE 632

FUNCTIONS AND CHARACTERISTICS ($V_{CC} = 15 V \pm 1.0 V_{dc}$, $T_A = 25^\circ C$)

Function	Type ① -30 to +75°C	Loading Factor Each Output	Propagation Delay ns typ	Power Dissipation mW typ/pkg	Case
Expandable Dual 4-Input NAND Gate (active pullup)	MC660	10	110	88/26 ②	632,646
Expandable Dual 4-Input NAND Gate (passive pullup)	MC661	10	125	88/26 ②	632,646
Expandable Dual 4-Input Line Driver (NAND)	MC662	30	140	180/26 ②	632,646
Dual J-K Flip-Flop	MC663	9	3.0 MHz ③	200	632,646
Master-Slave R-S Flip-Flop	MC664	8	3.0 MHz ③	160	632,646
Triple Level Translator	MC665	MDTL = 8 MTTL III = 5.5 MRTL = 5	40	83 (MDTL) 104 (MRTL)	632,646
Triple Level Translator	MC666	10	75	105	632,646
Dual Monostable Multivibrator	MC667	10	140	240	632,646
Quad 2-Input NAND Gate (passive pullup)	MC668	10	125	176/52 ②	632,646
Dual 4-Input Expander	MC669	—	—	—	632,646
Triple 3-Input NAND Gate (passive pullup)	MC670	10	125	132/39 ②	632,646
Triple 3-Input NAND Gate (active pullup)	MC671	10	110	132/39 ②	632,646
Quad 2-Input NAND Gate (active pullup)	MC672	10	110	176/52 ②	632,646
Dual 2-Input AND-OR-INVERT Gate (active pullup)	MC673	10	110	160/50 ②	632,646
Dual 2-Input AND-OR-INVERT Gate (passive pullup)	MC674	10	125	160/50 ②	632,646
Dual Pulse Stretcher	MC675	10	150 (pins 1,6) 110 (pins 5,6)	180	632,646
BCD-To-Decimal Decoder-Driver	MC676	—	—	380	620,648
Hex Inverter With Strobe (active pullup)	MC677	10	110	246/96 ②	620,648
Hex Inverter With Strobe (without output resistors)	MC678	10	125	192/96 ②	620,648
Dual Lamp/Line Driver	MC679,B	125	0.5 μs typ	250/30 ②	632,646
Hex Inverter (active pullup)	MC680	10	110	246/96 ②	632,646
Hex Inverter (open collector)	MC681	10	125	192/96 ②	632,646
Quad Latch	MC682	10	250	375	620,648
Quad 2-Input Exclusive OR Gate	MC683	10	—	380	632,646
Decade Counter	MC684	10	0.5 MHz ③	480	620,648
Binary Counter	MC685	10	0.5 MHz ③	480	620,648
4-Bit Shift Register	MC686	10	0.5 MHz ③	480	620,648
Dual J-K Flip-Flop	MC688	10	2.5 MHz ③	375	620,648
Hex Inverter (high voltage)	MC689	10	150	173/55 ②	632,646
Hex Inverter (active pullup)	MC690	10	150	173/55 ②	632,646
Hex Inverter/Interface Element	MC691	10	300 (t-+) 150 (t+-)	500/150 ②	632,646
Dual Interface Element, Line Driver/Receiver	MC696	10 @ 10 V V_{CC} 15 @ 25 V V_{CC}	750	225/60 ②	620,648
Dual Power AND Gate	MC699	10	650 (pins 1,6) 350 (pins 1,3)	650/350 ②	675,676 ④

① L suffix denotes Dual In-Line Ceramic Package, P denotes Dual In-Line Plastic Package (i.e., MC660L = Dual In-Line Ceramic, MC660P = Dual In-Line Plastic Package)

② Inputs High/Input Low

③ f_{Tog}

④ Case 676 available on special order only.

MC830 Series (0 to +75°C)

MC930 Series (-55 to +125°C)

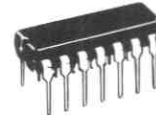
MAXIMUM RATINGS

Rating	Value	Unit
Supply Voltage –		Vdc
Operating	4.5 to 5.5	
Continuous	8.0	
Pulsed, < 1 second	12	
Output Current (Into Outputs with Outputs Low)		mAdc
Buffers, Power Gates – Continuous	100	
Pulsed, < 30 ms	300	
All other types – Continuous	30	
Pulsed, < 30 ms	90	
Input Forward Current –		mAdc
Continuous	-10	
Pulsed, < 30 ms	-30	
or		
Negative Voltage at Input –		Vdc
Continuous	-0.5	
Pulsed, < 30 ms	-1.5	
Input Reverse Current	1.0	mAdc
or		
Positive Voltage at Diode Input	5.5	Vdc
Operating Temperature Range		°C
MC930 Series	-55 to +125	
MC830 Series	0 to +75	
Storage Temperature Range		°C
Metal Can, Ceramic Package	-65 to +150	
Plastic Package	-55 to +125	
Maximum Junction Temperature		°C
MC930 Series	175	
MC830 Series	150	

MDTL integrated circuits provide an excellent balance of speed, power dissipation, and noise immunity for general purpose digital applications. The line includes many multifunction types. Additional logic power is provided by the "wired OR" capability of the basic MDTL gate.



G SUFFIX
METAL PACKAGE
CASE 603-02
TO-100



P SUFFIX
PLASTIC PACKAGE
CASE 646



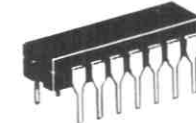
F SUFFIX
CERAMIC PACKAGE
CASE 607



P SUFFIX
PLASTIC PACKAGE
CASE 648



L SUFFIX
CERAMIC PACKAGE
CASE 620



L SUFFIX
CERAMIC PACKAGE
CASE 632
TO-116

FUNCTIONS AND CHARACTERISTICS (V_{CC} = 5.0 Vdc, T_A = 25°C)

Function	Type ① 0 to +75°C	Case	Type ① -55 to +125°C	Case	Loading Factor Each Output	Propaga- tion Delay ns typ	Power Dissipation mW typ/pkg
Expandable Dual 4 Input NAND Gate	MC830	607,632,646	MC930	607,632	8	30	22
Expandable Dual 3 2 Input NAND Gate	MC830	603	MC930	603	8	30	22
Clocked Flip-Flop	MC831	603,607,632,646	MC931	603,607,632	7	40	55
Expandable Dual 4 Input Buffer	MC832	607,632,646	MC932	607,632	25	35	85
Expandable Dual 3 2 Input Buffer	MC832	603	MC932	603	25	35	85
Dual 4-Input Expander	MC833	607,632,646	MC933	607,632	–	–	–
Dual 4 3 Input Expander	MC833	603	MC933	603	–	–	–
Hex Inverter	MC834	607,632,646	MC934	607,632	8	30	66
Hex Inverter (without output resistors)	MC835	607,632,646	MC935	607,632	8	30	42
Hex Inverter	MC836	607,632,646	MC936	607,632	8	30	66
Hex Inverter	MC837	607,632,646	MC937	607,632	7	25	90
Decade Counter	MC838	607,632,646	MC938	607,632	8	30 MHz ③	150
Divide by Sixteen Counter	MC839	607,632,646	MC939	607,632	8	30 MHz ③	150
Hex Inverter (without input diodes)	MC840	607,632,646	MC940	607,632	8	30	66
Hex Inverter (without output resistors and input diodes)	MC841	607,632,646	MC941	607,632	8	30	42
4-Input AND Driver with NOR Strobe	MC843	603	MC943	603	250 mA	80	50
Expandable Dual 4 Input Power Gate	MC844	607,632,646	MC944	607,632	27	30	65
Expandable Dual 3 2 Input Power Gate	MC844	603	MC944	603	27	30	65
Clocked Flip-Flop	MC845	603,607,632,646	MC945	603,607,632	12/10 ②	40	60
Quad 2-Input NAND Gate	MC846	607,632,646	MC946	607,632	8	30	44
Quad Inverter	MC846	603	MC946	603	8	30	44
Quad 2-Input Gate Expander	MC847	607,632,646	MC947	607,632	–	–	–
Clocked Flip-Flop	MC848	603,607,632,646	MC948	603,607,632	11/9 ②	40	70
Quad 2-Input NAND Gate (2 k pullup resistor)	MC849	607,632,646	MC949	607,632	7	25	66
Quad Inverter (2 k pullup resistor)	MC849	603	MC949	603	7	25	60

① F suffix denotes Ceramic Flat Package, G suffix denotes Metal Can, L suffix denotes Dual In-Line Ceramic Package, P suffix denotes Dual In-Line Plastic Package. (i.e., MC830G = Metal Can, MC830F = Flat Package, MC830L = Dual In-Line Ceramic Package.)

② Fan-out for MC830 series type/Fan-out for MC930 series type.

③ Maximum counting frequency.

(continued)

MDTL Integrated Circuits (continued)

FUNCTIONS AND CHARACTERISTICS ($V_{CC} = 5.0$ Vdc, $T_A = 25^\circ\text{C}$) (continued)

Function	Type ① 0 to $+75^\circ\text{C}$	Case	Type ① -55 to $+125^\circ\text{C}$	Case	Loading Factor Each Output	Propaga- tion Delay ns typ	Power Dissipation mW typ/pkg
Pulse Triggered Binary Monostable Multivibrator	MC850	603,607,632,646	MC950	603,607,632	10/8 ②	15	50
Dual J-K Flip-Flop (common clock and C_D , separate S_D)	MC851	603,607,632,646	MC951	603,607,632	10	40	30
Dual J-K Flip-Flop (separate clock and S_D , no C_D)	MC852	607,632,646	MC952	607,632	12/10 ②	40	120
Dual J-K Flip-Flop (common clock and C_D , separate S_D , 2 k pullup resistor)	MC855	607,632,646	MC955	607,632	11/9 ②	40	140
Dual J-K Flip-Flop (separate clock and S_D , no C_D , 2 k pullup resistor)	MC856	607,632,646	MC956	607,632	11/9 ②	40	140
Quad 2-Input Buffer	MC857	607,632,646	MC957	607,632	25	35	170
Quad 2-Input NAND Power Gate	MC858	607,632,646	MC958	607,632	27	30	130
Expandable Dual 4-Input NAND Gate (2 k pullup resistor)	MC861	607,632,646	MC961	607,632	7	25	33
Expandable Dual 3-2 Input NAND Gate (2 k pullup resistor)	MC861	603	MC961	603	7	25	33
Triple 3-Input NAND Gate	MC862	607,646	MC962	607,632	8	30	33
Dual 2-Input NAND Gate plus Inverter	MC862	603	MC962	603	8	30	30
Triple 3-Input NAND Gate (2 k pullup resistor)	MC863	607,646	MC963	607,632	7	25	50
Dual 2-Input NAND Gate plus Inverter (2 k pullup resistor)	MC863	603	MC963	603	7	25	45
Dual 6-Input NAND Gate	MC1800	607,632,646	MC1900	607,632	8	30	22
Dual 5-Input NAND Gate (2 k pullup resistor)	MC1801	607,632,646	MC1901	607,632	7	25	33
Expandable 8-Input NAND Gate	MC1802	607,632,646	MC1902	607,632	8	30	11
Expandable 8-Input NAND Gate (2 k pullup resistor)	MC1803	607,632,646	MC1903	607,632	7	25	16.5
10-Input NAND Gate	MC1804	607,632,646	MC1904	607,632	8	30	11
10-Input NAND Gate (2 k pullup resistor)	MC1805	607,632,646	MC1905	607,632	7	25	16.5
Quad 2-Input AND Gate	MC1806	607,632,646	MC1906	607,632	8	35	72
Quad 2-Input AND Gate (2 k pullup resistor)	MC1807	607,632,646	MC1907	607,632	7	30	85
Quad 2-Input OR Gate	MC1808	607,632,646	MC1908	607,632	8	35	97
Quad 2-Input OR Gate (2 k pullup resistor)	MC1809	607,632,646	MC1909	607,632	7	30	115
Quad 2-Input NOR Gate	MC1810	607,632,646	MC1910	607,632	8	30	60
Quad 2-Input NOR Gate (2 k pullup resistor)	MC1811	607,632,646	MC1911	607,632	7	25	72
Quad 2-Input Exclusive OR Gate	MC1812	607,632,646	MC1912	607,632	8	40	120
Quad Latch	MC1813	620,648	MC1913	620	7	35	220
Quad Latch	MC1814	607,632,646	MC1914	607,632	7	35	220
Parallel Gated Clocked Flip-Flop	MC1815	607,632,646	MC1915	607,632	12/10 ②	40	65
Parallel Gated Clocked Flip-Flop	MC1816	607,632,646	MC1916	607,632	11/9 ②	40	75
Quad 2-Input NAND Gate (without output resistor)	MC1818	607,632,646	MC1918	607,632	8	30	32
High Voltage Hex Inverter	MC1820	632,646	-	-	7	40	42

① F suffix denotes Ceramic Flat Package, G suffix denotes Metal Can, L suffix denotes Dual In-Line Ceramic Package, P suffix denotes Dual In-Line Plastic Package. (i.e., MC830G = Metal Can, MC830F = Flat Package, MC830L = Dual In-Line Ceramic Package.)

② Fan-out for MC830 series type/Fan-out for MC930 series type.

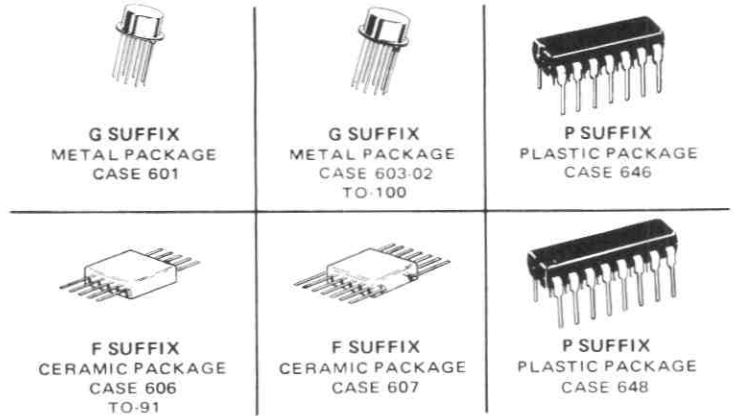
③ Maximum counting frequency.

MC700 series (+15 to +55°C)

MC800 series (0 to +75 and 0 to +100°C)

MC900 series (-55 to +125°C)

Medium-power MRTL integrated circuits provide a broad line of low-cost, multi-function, digital circuits. Typical gate speed is 12 ns, with power dissipation averages of 19 mW (input high) and 5.0 mW (inputs low) per logic node. Devices from the MC700 Series have loading factors normalized for compatibility with the low-power mW MRTL devices for ease in mixing the two power levels in a system.



FUNCTIONS AND CHARACTERISTICS

($V_{CC} = 3.0 V \pm 10\%$ for MC900 Series and MC800F, G Series; $3.6 V \pm 10\%$ for MC800P Series and MC700 Series, $T_A = 25^\circ C$)

Function	Type ① MC700 Series +15 to +55°C	Case	Type ① MC800 Series 0 to +75°C	Case	Type ① MC800 Series 0 to +100°C	Case	Type ① MC900 Series -55 to +125°C	Case	Loading Factor Each Output		tp ns typ	Power Dissipation mW typ/pkg	
									With mW MRTL	With MRTL		MC700 and MC800P Series	MC800F,G and MC900 Series
Buffer	MC700	601,606			MC800	601,606	MC900	601,606	80	25	20	25/50 ②	16/45 ②
Counter Adapter	MC701	601			MC801	601	MC901	601	16	5	22	80	55
R-S Flip-Flop	MC702	601			MC802	601	MC902	601	13	4	14	32	22
3-Input NOR Gate	MC703	601,606			MC803	601,606	MC903	601,606	16	5	12	28/7.5 ②	19/5.0 ②
Half Adder	MC704	601,606			MC804	601,606	MC904	601,606	16	5	14	65	45
Half-Shift Register	MC705	601,606			MC805	601,606	MC905	601,606	13	4	22	75	53
Half-Shift Register (w/o inverter)	MC706	601,606			MC806	601,606	MC906	601,606	13	4	22	52	36
4-Input NOR Gate	MC707	601,606			MC807	601,606	MC907	601,606	16	5	12	30/7.5 ②	19/5.0 ②
Dual 2-Input NOR Gate	MC714	601,606			MC814	601,606	MC914	601,606	16	5	12	50/15 ②	38/10 ②
Dual 3-Input NOR Gate	MC715	603,606,646	MC815	646	MC815	603,606	MC915	603,606	16	5	12	55/15 ③	38/10 ②
J-K Flip-Flop			MC816	646	MC816	601,606	MC916	601,606	-	3	30	91/79 ③	62/54 ③
J-K Flip-Flop	MC723	601,606,646							10	-	30	91/79 ③	-
Quad 2-Input NOR Gate	MC724,A	607,646	MC824,A	646	MC824	607	MC924	607	16	5	12	100/30 ②	76/20 ②
Dual 4-Input NOR Gate	MC725	607,646	MC825	646	MC825	607	MC925	607	16	5	12	60/15 ②	38/10 ②
J-K Flip-Flop	MC726	603,606,646	MC826	646	MC826	603,606	MC926	603,606	16	5	35	100/86 ③	130/65 ③
Quad Inverter	MC727	603,606			MC827	603,606	MC927	603,606	16	5	12	87/30 ②	76/20 ②
5-Input NOR Gate	MC729	601,606			MC829	603,606	MC929	601,606	16	5	12	33/7.5 ②	19/5.0 ②
Quad Exclusive OR Gate	MC771	607,646	MC871	646	MC871	607	MC971	607	16	5	12	28	72
J-K Flip-Flop	MC774	601			MC874	601	MC974	601	16	5	35	100/86 ③	130/65 ③
Dual Half-Adder	MC775	607,646	MC875	646	MC875	607	MC975	607	16	5	20	120	90
Binary Up Counter	MC777	646	MC877	646					10	3	-	180	-
1 J-K Flip-Flop, 1 Expander, 2 Buffers	MC779	646	MC879	646					-	-	-	141/124 ④	-
Decade Up Counter	MC780	646	MC880	646					10	3	-	250	-
Dual Half-Shift Register	MC783	607,646	MC883	646	MC883	607	MC983	607	13	4	22	140	110
Dual Half-Shift Register (w/inverter)	MC784	607,646	MC884	646	MC884	607	MC984	607	13	4	22	100	75
Quad 2-Input Expander	MC785,A	607,646	MC885,A	646	MC885	607	MC985	607	-	-	12	20/- ②	17/- ②
Dual 4-Input Expander	MC786	607,646	MC886	646	MC886	607	MC986	607	-	-	12	20/- ②	17/- ②
1 J-K Flip-Flop, 1 Inverter, 2 Buffers	MC787	646	MC887	646					-	-	-	138/132 ④	-
Dual 3-Input Buffer, non-inverting	MC788	607,646	MC888	646	MC888	607	MC988	607	80	25	24	145/56 ②	128/42 ②
Hex Inverter	MC789,A	607,646	MC889,A	646	MC889	607	MC989	607	16	5	12	130/15 ②	76/20 ②
Dual J-K Flip-Flop	MC790	607,646	MC890	646	MC890	607	MC990	607	10	3	35	182/158 ③	124/108 ③
Dual J-K Flip-Flop	MC791	607,646	MC891	646	MC891	607	MC991	607	16	5	40	190/160 ③	155/130 ③
Triple 3-Input NOR Gate	MC792	607,646	MC892	646	MC892	607	MC992	607	16	5	12	82/24 ②	57/15 ②
Serial-Parallel Shift Register	MC794	646	MC894	646					16	5	55	225	-
Dual Full Adder	MC796	607,646	MC896	646	MC896	607	MC996	607	16	5	60	225	190
Dual Full Subtractor	MC797	607,646	MC897	646	MC897	607	MC997	607	16	5	60	225	190
Dual Buffer	MC799	603,606,646	MC899	646	MC899	603,606	MC999	603,606	80	25	15	50/90 ②	32/90 ②
Dual 4-Channel Data Selector	MC9701	648	MC9801	648					16	5	25	100	-
Dual J-K Flip-Flop	MC9702	646	MC9802	646					10	3	35	182/158 ③	-
4-Bit Parallel Full Adder	MC9704	648	MC9804	648					6	2	125	265	-
Dual 4-Channel Data Distributor	MC9707	648	MC9807	648					16	5	25	150	-
Quad Schmitt Trigger	MC9709	646	MC9809	646					16	5	30	95	-
Quad 2-Input AND Gate	MC9713	646	MC9813	646					16	5	28	100	-
Quad 2-Input NAND Gate	MC9714	646	MC9814	646					16	5	14	145	-
Quad 2-Input OR Gate	MC9715	646	MC9815	646					16	5	14 ⑤	28/100 ②	-
Hex Expander	MC9719,A	646	MC9819,A	646					-	-	12	13/- ②	-

"A" suffix devices have insured capability to drive at least one MTTL load or two MDTL loads.

① G Suffix denotes Metal Can, F suffix denotes Flat Package, P suffix denotes Plastic Package.

② Inputs High/Inputs Low

③ Only Clock Inputs High/Inputs Low

④ Only Clock Input high on flip-flop, other element Inputs High/Inputs Low

⑤ Operating Frequency (MHz)

MC708 series (+15 to +55°C)

MC808 series (0 to +75°C)

MC908 series (-55 to +125°C)

Low-power mW MRTL integrated circuits are designed for use where minimal system power consumption is desired. Typical gate speed is 27 ns, with typical power dissipation of 6.5 mW (input high) and 0.5 mW (inputs low) per logic node. Devices from the MC708 Series can be mixed with devices from the medium-power MC700 Series which has loading factors normalized for compatibility.



G SUFFIX
METAL PACKAGE
CASE 601



G SUFFIX
METAL PACKAGE
CASE 603
TO-100



P SUFFIX
PLASTIC PACKAGE
CASE 646



F SUFFIX
CERAMIC PACKAGE
CASE 606
TO-91



F SUFFIX
CERAMIC PACKAGE
CASE 607



P SUFFIX
PLASTIC PACKAGE
CASE 648

FUNCTIONS AND CHARACTERISTICS

(V_{CC} = 3.0 V ± 10% for MC908 Series, 3.6 V ± 10% for MC808 Series and MC708 Series; T_A = 25°C)

Function	Type ① MC708 Series +15 to +55°C	Type ① MC808 Series 0 to +75°C	Case	Type ① MC908 Series -55 to +125°C	Case	Loading Factor Each Output All Series	tp ns typ	Power Dissipation mW typ/pkg	
								MC708 Series & MC808 Series	MC908 Series
Half Adder	MC708	MC808	601,606	MC908	601,606	4	60	19/12.5 ②	14/8.5 ②
2-Input Buffer	MC709	MC809	601,606	MC909	601,606	30	57	7.0/23 ②	5.5/16 ②
Dual 2-Input NOR Gate	MC710	MC810	601,606	MC910	601,606	4	27	10/2.5 ②	8.0/1.0 ②
4-Input OR/NOR Gate	MC711	MC811	601,606	MC911	601,606	4	60	8.0/5.5 ②	6.0/3.5 ②
Half Adder	MC712	MC812	601,606	MC912	601,606	4	66	15.5/10.5 ②	11.5/5.5 ②
Type D Flip-Flop	MC713	MC813	601,606	MC913	601,606	3	75	24/17.5 ③	17.5/13 ③
Quad 2-Input NOR Gate	MC717	MC817	607,646	MC917	607	4	27	20/5.0 ②	16/2.5 ②
Dual 3-Input NOR Gate	MC718	MC818	603,606,646	MC918	603,606	4	27	12/2.5 ②	9.5/1.0 ②
Dual 4-Input NOR Gate	MC719	MC819	607,646	MC919	607	4	27	13/2.5 ②	11/1.0 ②
J-K Flip-Flop	MC720	MC820	601,606	MC920	601,606	2	50	20.5/14.5 ④	15.5/10 ④
Dual 2-Input Gate Expander	MC721	MC821	601,606	MC921	601,606	—	27	3.0/— ②	3.0/— ②
J-K Flip-Flop	MC722	MC822	603,606,646	MC922	603,606	4	70	24/20 ④	17.5/13 ④
5-Input NOR Gate	MC728	MC828	601,606	MC928	601,606	4	27	7.5/1.0 ②	6.5/0.5 ②
Dual Exclusive OR/NOR Gate	MC764	MC864	646	—	—	4	—	25	—
Quad Latch	MC767,A	MC867,A	648	—	—	9	50	110	—
BCD-To-Decimal Decoder	MC770	MC870	648	—	—	7	36	100/— ②	—
Dual J-K Flip-Flop	MC776	MC876	607,646	MC976	607	2	50	41/29 ④	31/20 ④
Dual Type D Flip-Flop	MC778	MC878	607,646	MC978	607	3	60	48/35 ③	35/26 ③
Dual Buffer	MC781	MC881	601	MC981	601	30	57	14/46 ②	11/32 ②
J-K Flip-Flop	MC782	MC882	601	MC982	601	2	80	23/21 ④	15/13 ④
Triple 3-Input NOR Gate	MC793	MC893	607,646	MC993	607	4	27	18/3.5 ②	14/2.0 ②
Dual 2-Input Buffer	MC798	MC898	607,646	MC998	607	30	57	14/46 ②	11/32 ②
Hex Inverter	MC9718	MC9818	646	—	—	4	27	7.0/3.0 ②	—
Hex Expander	MC9720	MC9820	646	—	—	—	12	30/— ②	—
Quad 2-Input Expander	MC9721	MC9821	646	—	—	—	27	20/— ②	—
Dual J-K Flip-Flop	MC9722	MC9822	646	—	—	4	75	24/— ④	—
Quad 2-Input AND Gate	MC9723	MC9823	646	—	—	4	50	12 ⑤	—
Quad 2-Input NAND Gate	MC9724	MC9824	646	—	—	4	50	20/5.0 ②	—
Quad 2-Input OR Gate	MC9725	MC9825	646	—	—	4	50	-/7.0 ②	—

"A" suffix devices have insured capability to drive at least one M TTL load or two M DTL loads.

① G suffix denotes Metal Can, F suffix denotes Flat Package, P suffix denotes Plastic Package.

② Inputs High/Inputs Low unless otherwise noted.

③ Direct Set and Direct Clear Low, All other Inputs High/All Inputs Low.

④ Only Clock Input High/All Inputs Low.

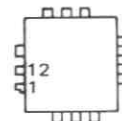
⑤ One Input High/One Input Low.

MCBC5400 Series (-55 to +125°C)

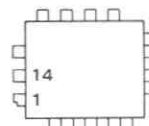


MCBC5400 series integrated circuits comprise a family of transistor-transistor logic designed for general purpose digital applications. The family has a medium operating speed (15-30 MHz clock rate), good external noise immunity, high fan out, and the capability of driving capacitive loads of up to 600 pF.

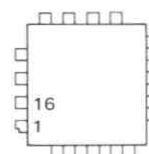
This series is produced using beam lead sealed junction technology. These devices are particularly useful in highly reliable systems using hybrid beam lead assembly techniques.



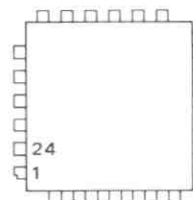
BEAM LEAD CHIP
(12 Lead)
(Geometry Side Down)



BEAM LEAD CHIP
(14 Lead)
(Geometry Side Down)



BEAM LEAD CHIP
(16 Lead)
(Geometry Side Down)



BEAM LEAD CHIP
(24 Lead)
(Geometry Side Down)

MAXIMUM RATINGS

Rating	Value	Unit
Power Supply Voltage	7.0	Vdc
Input Voltage	5.5	Vdc
Operating Temperature Range	-55 to +125	°C
Storage Temperature Range	-65 to +150	°C

FUNCTIONS AND CHARACTERISTICS (V_{CC} = 5.0 V, T_A = 25°C)

Function	Type	Loading Factor Each Output	Propagation Delay ns typ	Power Dissipation mW typ/pkg	Number of Beams
	Chip -55°C to +125°C				
Quad 2-Input NAND Gate	MCBC5400	10	10	40	14
Quad 2-Input NAND Gate (Open Collector Output)	MCBC5401	10	35	40	14
Quad 2-Input NOR Gate	MCBC5402	10	10	48	16
Hex Inverter	MCBC5404	10	13	60	16
Hex Inverter (Open Collector)	MCBC5405	10	35	60	16
Triple 3-Input NAND Gate	MCBC5410	10	10	30	14
Dual 4-Input NAND Gate	MCBC5420	10	10	20	12
8-Input NAND Gate	MCBC5430	10	10	10	12
Dual 4-Input NAND Buffer	MCBC5440	30	13	50	14
Expandable Dual 2-Wide 2-Input AND-OR-INVERT Gate	MCBC5450	10	13	28	14
Dual 2-Wide 2-Input AND-OR-INVERT Gate	MCBC5451	10	13	28	14
Expandable 4-Wide 2-Input AND-OR-Invert Gate	MCBC5453 MCBC5454	10	13	22	14
4-Wide 2-Input AND-OR-Invert Gate	MCBC5454	10	13	22	14
Dual 4-Input Expander for AND-OR-INVERT Gate	MCBC5460	—	5.0	8.0	14
J-K Flip-Flop	MCBC5472	10	30	40	16
Dual J-K Flip-Flop	MCBC5473	10	30	80	24
Dual Type D Flip-Flop	MCBC5479	10	16	84	24

MTTL

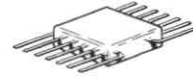
Dielectrically Isolated INTEGRATED CIRCUITS

MTTL

MCE54H00 Series, MCE5400 Series (-55 to +125°C)
MCE74H00 Series, MCE7400 Series (0 to +70°C)



The Dielectrically Isolated Integrated Circuit (DIIC) MTTL family is designed specifically for use in military and space applications that require a high degree of reliability under severe radiation environments and post irradiation operation. The MTTL DIIC family utilizes nichrome resistors, post metalization passivation, monometallic interconnections, and very small high frequency transistor structures to enhance the radiation resistant qualities of this line.



F SUFFIX
CERAMIC PACKAGE
CASE 607

FUNCTIONS AND CHARACTERISTICS (V_{CC} = 5.0 V, T_A = 25°C)

Function	MCE54H00/74H00 Series Type		Loading Factor Each Output	Propa- gation Delay ns typ	Power Dissipation m/W typ/pkg
	-55 to +125°C	0 to +70°C			
Quad 2-Input NAND Gate	MCE54H00	MCE74H00	10	6.0	80
Quad 2-Input NAND Gate (Open Collector Output)	MCE54H01	MCE74H01	10	8.0	80
Hex Inverter	MCE54H04	MCE74H04	10	6.0	120
Triple 3-Input NAND Gate	MCE54H10	MCE74H10	10	6.0	60
Dual 4-Input NAND Gate	MCE54H20	MCE74H20	10	6.0	40
11-Input NAND Gate	MCE54H31	MCE74H31	10	9.0	20
Dual 4-Input NAND Power Gate	MCE54H40	MCE74H40	30	6.0	80
Dual 2-Wide 2-Input AND-OR-INVERT Gate	MCE54H51	MCE74H51	10	6.0	58
4-Wide 2-Input AND-OR-INVERT Gate	MCE54H54A	MCE74H54A	10	6.0	40
Dual 2-Wide 2-3-Input AND-OR-INVERT Gate	MCE54H56	MCE74H56	10	6.0	58
4-Wide 3-3-2-3-Input AND-OR-INVERT Gate	MCE54H57	MCE74H57	10	6.0	40
Dual Type D Flip-Flop	MCE54H79	MCE74H79	10	16	140
Binary To One-Of-Eight Line Decoder	MCE54H146	MCE74H146	10	—	130
	MCE5400/7400 Series Type				
	-55 to +125°C	0 to +70°C			
Dual J-K Flip-Flop	MCE54103	MCE74103	10	8.0	100

NETWORKS

Dielectrically Isolated INTEGRATED CIRCUITS

NETWORKS

MCE7000 SERIES (0° to +100°C)

The MCE7000 series uses a dielectric isolation instead of the usual junction isolation to combat the effects of gamma radiation. Each component is isolated by a high resistance (10¹⁰ ohms) layer of SiO₂. Dielectric isolation also lowers inter-component capacitance and improves efficiency.



F SUFFIX
CERAMIC PACKAGE
CASE 606
TO-91



F SUFFIX
CERAMIC PACKAGE
CASE 607

Function	Type	Power Dissipation mW typ/pkg	Case
Seven-Diode Array	MCE7003	—	607
Diode-Resistor Network	MCE7005	20*	606
Sixteen-Diode Array	MCE7006	—	606
Twelve-Resistor Network	MCE7007	97	607

* 100 Ω resistor.

MCE930 Series (-55 to +125°)

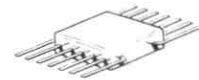
The Dielectrically Isolated MDTL family is intended for use in military and space applications that require a high degree of reliability under severe radiation environments. In addition to dielectric isolation, this family of devices utilizes nichrome resistors throughout. A post-metalization passivation process further enhances the radiation resistance qualities of the family and very small high frequency tran-

sistor structures are used throughout.

Dielectrically Isolated MDTL has the same electrical specifications as the MC930 family and may be used interchangeably with it. This eliminates the need for redesigning existing equipment to gain radiation-resistance and allows the design engineer to utilize a familiar logic type for new systems.

MAXIMUM RATINGS

Rating	Value	Unit
Supply Voltage – Continuous	8.0	Vdc
Pulsed, < 1 second	12	
Output Current (into outputs) – Buffers, Power Gates – Continuous	150	mAdc
Pulsed, < 30 ms	300	
All other types	30	
Input Forward Current	-10	mAdc
Input Reverse Current – Buffers, Power Gates	5.0	mAdc
All other types	1.0	
Operating Temperature Range – MCE930 Series	-55 to +125	°C
Storage Temperature Range	-65 to +150	°C



F SUFFIX
CERAMIC PACKAGE
CASE 607
TO-86

FUNCTIONS AND CHARACTERISTICS (V_{CC} = 5.0 Vdc, T_A = 25°C)

Function	Type Case 607 -55 to +125°C	Loading Factor Each Output	Power Dissipation mW typ/pkg
Expandable Dual 4-Input NAND Gate	MCE930	8.0	22
Expandable Dual 4-Input Buffer	MCE932	25	85
Dual 4-Input Expander	MCE933	—	—
Hex Inverter	MCE936	8	66
Expandable Dual 4-Input NAND Power Gate	MCE944	27	65
Clocked Flip-Flop	MCE945	10	60
Quad 2-Input NAND Gate	MCE946	8	44
Clocked Flip-Flop	MCE948	9.0	70
Triple 3-Input NAND Gate	MCE962	8.0	33

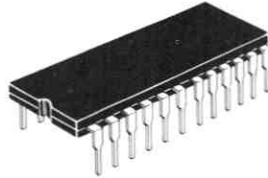
SPECIAL BIPOLAR LOGIC PRODUCTS for *CUSTOM* APPLICATIONS



F SUFFIX
CERAMIC PACKAGE
CASE 607



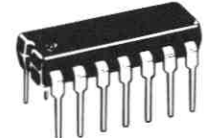
L SUFFIX
CERAMIC PACKAGE
CASE 620



L SUFFIX
CERAMIC PACKAGE
CASE 623



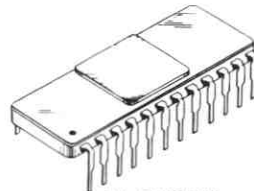
L SUFFIX
CERAMIC PACKAGE
CASE 632



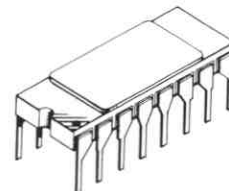
P SUFFIX
PLASTIC PACKAGE
CASE 646



P SUFFIX
PLASTIC PACKAGE
CASE 648



AL SUFFIX
CERAMIC PACKAGE
CASE 684

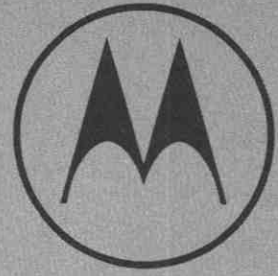


AL SUFFIX
CERAMIC PACKAGE
CASE 690

(Additional mask-programmable memories are in the MOS device listing.)

Function	Type	Temperature	Case	Comments
128-Bit Read Only Memory (Formerly XC170,171)	MCM4000L,P	0 to +75°C	620,648	Bipolar read only memory organized as 16 eight-bit words. Compatible with MDTL and all MTTL lines. Open collectors or 2.0 kilohm pullup resistors at buffered output bit lines. Truth table and output option specified by user.
	MCM4300L	-55 to +125°C	620	
256-Bit Read Only Memory	MCM4002L,P	0 to +75°C	620,648	Bipolar read only memory organized as 32 eight-bit words. Compatible with MDTL and all MTTL lines. Open collectors or 2.0 kilohm pullup resistors at buffered output bit lines. Truth table and output option specified by user.
	MCM4302L	-55 to +125°C	620	
512-Bit Read Only Memory	MCM4003AL,L	0 to +75°C	684,623	Bipolar read only memory organized as 64 eight-bit words. Compatible with MDTL and all MTTL lines. Open collectors or 2.0 kilohm pullup resistors at buffered output bit lines. Truth table and output option specified by user.
	MCM4303AL,L	-55 to +125°C	684,623	
1024-Bit Read Only Memory*	MCM4004AL,L	0 to +70°C	690,620	Bipolar read only memory organized as 256 four-bit words. Input loading of -0.25 mA maximum. Typical address time of 50 ns, typical chip select time of 25 ns. Open collectors or 2.0 kilohm pullup resistors at output bit lines. Truth table and output option specified by user.
	MCM4304AL,L	-55 to +125°C	690,620	
512-Bit Programmable Read Only Memory	MCM5003AL,L	0 to +70°C	684,623	Bipolar programmable read only memory organized as 64 eight-bit words. Field programmable by "blowing" appropriate nichrome resistors to break metalization links. Ninth bit available for circuit testing. Open collector outputs.
	MCM5303AL,L	-55 to +125°C	684,623	
512-Bit Programmable Read Only Memory	MCM5004AL,L	0 to +70°C	684,623	Same as MCM5003AL except 2.0 kilohm pullup resistors on the collector outputs.
	MCM5304AL,L	-55 to +125°C	684,623	
25 Gate Array	XC177	-55 to +125°C	607,632	Twenty-five gates with two custom layers of metalization required to complete the circuit and obtain the desired function. Compatible with MDTL and all MTTL lines.
		0 to +75°C	646,632, 646,648	

*Standard options of the MCM4004 are available as MCM4067 and MCM4068 Binary-to-BCD Number Converters and MCM4069 and MCM4070 Hollerith-to-ASCII Converters.



LINEAR INTEGRATED CIRCUITS

LINEAR INTEGRATED CIRCUITS

Linear products include circuits used in consumer, industrial and interface applications. These products are available in a variety of package styles and in chip form. **Consumer devices** designed principally for entertainment use, i.e., television, audio, radio, automotive, and organ applications.

Industrial products fill important roles in process control, instrumentation, and signal processing functions.

Interface components span the gap between analog information and digital processing. This category is highlighted at Motorola by the number of new monolithic D/A and A/D converters.

TABLE OF CONTENTS

	Page
Interface Circuits	3-2
Operational Amplifiers (Including Chips)	3-14
High-Frequency Amplifiers	3-17
Regulators (Including Chips)	3-19
Special-Purpose Circuits (Including Chips)	3-21
Consumer Devices	3-22
Linear IC Packages.	3-25

Chips listed are stock chips. For availability of chips for other products, contact your Motorola sales representative.

INTERFACE CIRCUITS

Interface is the generic term applied to a wide variety of circuit functions which do not conveniently fit into either the Linear (analog) or Digital realms. Often these devices possess both Linear and Digital circuitry and performance parameters. The following pages include applications for Linear Interface Integrated Circuits.

MEMORY INTERFACE

- NMOS Memory Interface 3-3
 High capacitance drivers for the ADDRESS, CLOCK or CHIP ENABLE inputs and the sense amplifiers required to configure advanced NMOS memories into effective systems.
- Magnetic Memory Interface 3-5
 Drivers and sense amplifiers for core and plated wire memory systems.

BUS INTERFACE

- Computer, Minicomputer, Microprocessor, Instrumentation Bus Interface 3-6
 Drivers, receivers and transceivers for bus-oriented data systems. Specific devices for IBM computer, popular minicomputer, M6800 microprocessor, and the IEEE instrumentation bus (HP-IB) requirements.

INSTRUMENTATION INTERFACE

- Numeric Display Interface. 3-8
 Driver devices for mating either light-emitting diode (LED) or Gas-Discharge type numeric displays to MOS or Bipolar IC's.
- A/D-D/A Conversion 3-9
 Low-cost building block approach IC's pioneered by Motorola. D/A's to 8 bits and two methods of A/D conversion including a simple two chip DVM with a CMOS logic section.

COMMUNICATIONS INTERFACE

- Communications Interface 3-10
 Highlighting a unique monolithic 4 x 4 balanced crosspoint switch which replaces electromechanical devices in PABX or other communications equipment.

COMPUTER AND TERMINAL INTERFACE

- Line Drivers/Receivers 3-10
 Useful in transmitting digital data over long lengths of cable without error or noise problems. Devices meeting the requirements of EIA specifications RS232C, 422 and 423, as well as differential current mode and open collector peripheral drivers are covered.
- Comparators. 3-12
 A broad line from popular single supply quads to family of quad comparators with Three-State Outputs.

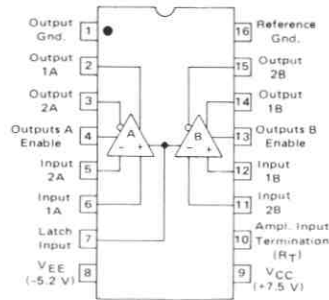
MEMORY INTERFACE

Both NMOS and magnetic memory systems require interface functions.

NMOS Memory

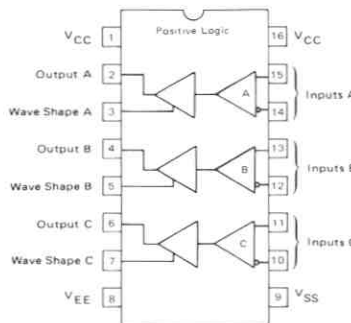
Probably nowhere else has semiconductor technology achieved greater complexities and higher circuit densities in practical, real-world products than in today's advanced NMOS memories. These devices permit greater memory capacity per unit volume and lower costs per bit than imaginable only a few years ago.

However, these memory ICs do not function alone. As an approximate rule of thumb, for each three memory packages in a typical system, one package of support interface circuitry is required. Some memory ICs require only low-voltage ADDRESS and CONTROL line drivers and higher-voltage CLOCK drivers. Other types require a sense amplifier in addition to the drivers.



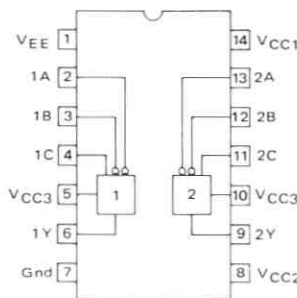
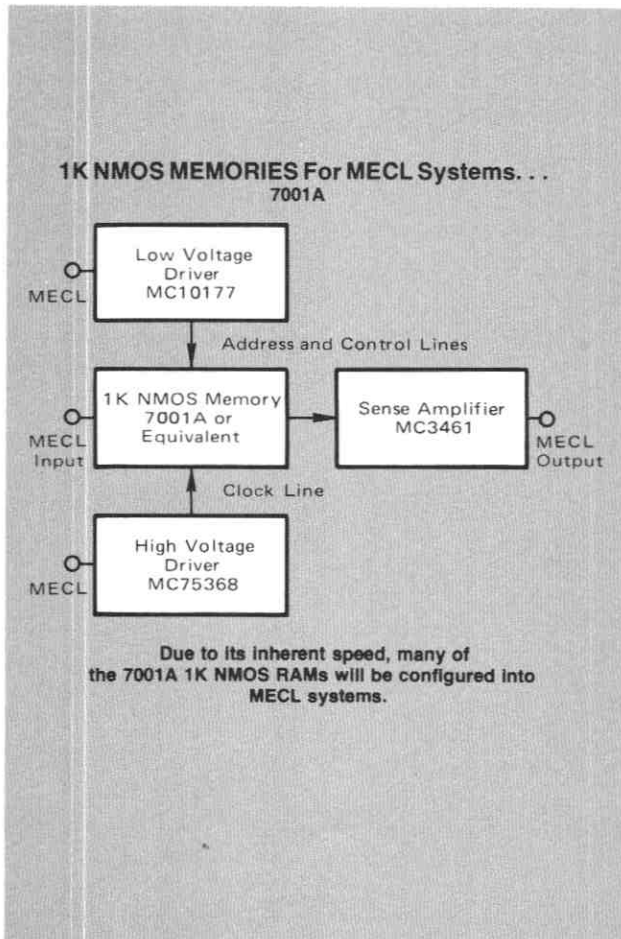
MC3461
0 to 70°C
L Suffix — Case 620
Dual 7001 to MECL
10,000 Sense Amplifier
with latches. No external
components required.

I_{TH} μA Max	t_{PD} (Amplifier) ns Max	t_{PD} (Enable) ns Max
± 200	10	5.0



MC10177
-30 to 85°C
L Suffix — Case 620
Triple MECL input
Address Line Driver for
1K or 4K RAMs.

V_{OH} @ $I_{OH} = -15$ mA Volts Min	V_{OL} @ $I_{OL} = 1.0$ mA Volts Max	$t_{DLH/DHL}$ @ $C_L = 350$ pF ns Typ
4.0	0.5	6.0

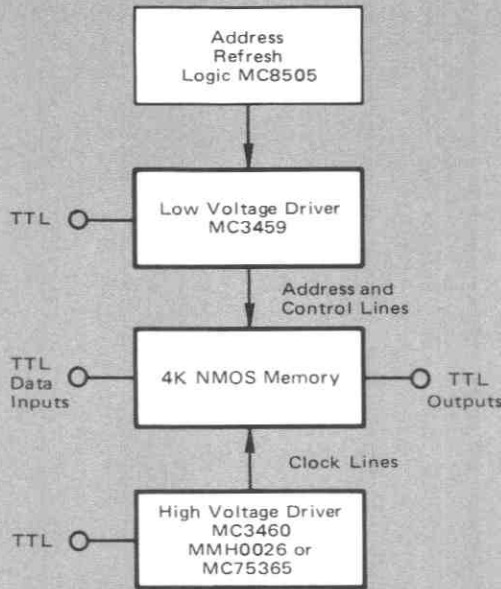


MC75368 **MC75358**
0 to 70°C
L Suffix — Case 632
P Suffix — Case 646
CHIP Enable driver with MECL
compatible inputs.
Maximum Supply Voltage = 18V Maximum Supply Voltage = 22 V

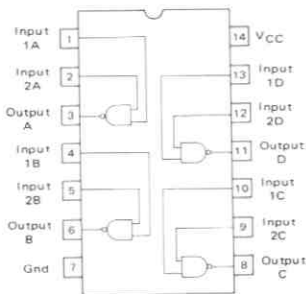
V_{OH} @ $I_{OH} = -100$ μA Volts Min	V_{OL} @ $I_{OL} = 10$ mA Volts Max	t_{DLH} @ $C_L = 390$ pF ns Max
$V_{CC} - 3.0$	0.2	24

INTERFACE (continued)

4K NMOS MEMORIES For TTL Systems . . .



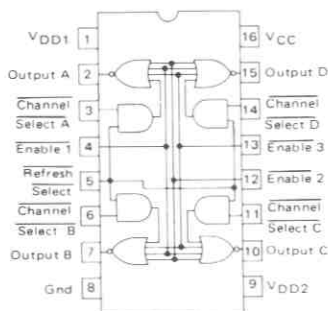
Today's 4K NMOS RAMs provide economical mass storage in popular TTL logic systems.



MC3459
0 to 70°C
L Suffix — Case 632
P Suffix — Case 646

Low Voltage (+5 V) Address Line Driver on popular 1K and 4K NMOS RAMs

V_{OH} @ $I_{OH} = -2.0 \text{ mA}$ Volts Min	V_{OL} @ $I_{OL} = 80 \text{ mA}$ Volts Max	t_{PLH} @ $C_L = 360 \text{ pF}$ ns Max
2.4	0.7	26

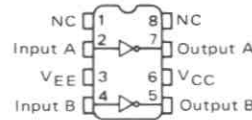


MC3460
Higher voltage (+12 V) CHIP Enable Driver incorporates REFRESH function for 4K RAMs.

MC3466
CHIP Enable Driver specifically guaranteed for 7001 1K RAMs.

0 to 70°C
L Suffix — Case 620
P Suffix — Case 648

V_{OH} @ $I_{OH} = -2.0 \text{ mA}$ Volts Min	V_{OL} @ $I_{OL} = 40 \text{ mA}$ Volts Max	t_{DLH} @ $C_L = 480 \text{ pF}$ ns Max
$V_{DD} - 1.0$	0.55	23



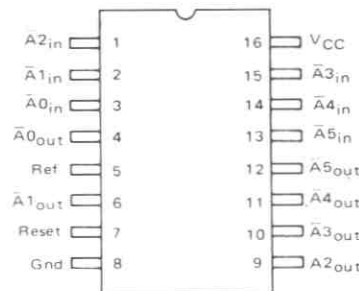
MMH0026
-55 to 125°C
G Suffix — Case 601
L Suffix — Case 632

MMH0026C
0 to 85°C
L Suffix — Case 632
G Suffix — Case 601
P1 Suffix — Case 626

Pin Connections for P1 Package

Drivers for extremely heavy capacitive loading (to 1000 pF).

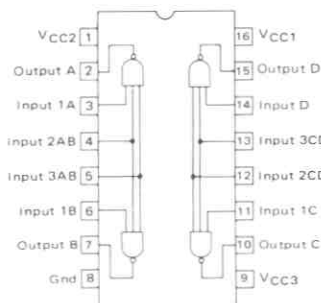
V_{OL} @ $V_i - V_{EE} = 0.4 \text{ V}$ Volts Min	V_{OL} @ $V_i - V_{EE} = 2.5 \text{ V}$ Volts Max	t_{PHL} @ $C_L = 1000 \text{ pF}$ ns Max
$V_{CC} - 1.0$	$V_{EE} + 0.5 \text{ V}$	12



MC8505
0 to 70°C
L Suffix — Case 620
P Suffix — Case 648

LSI Refresh logic circuit for 4K dynamic RAMs

V_{OH} @ $I_{O} = -300 \mu\text{A}$ Volts Min	V_{OL} @ $I_{O} = 3.2 \text{ mA}$ Volts Max	$t_{PD} \text{ (ADDRESS)}$ ns Max	$t_{PD} \text{ (REFRESH)}$ ns Max
2.4	0.5	80	145



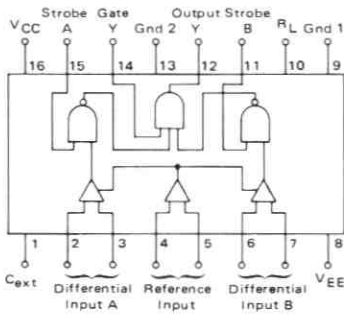
MC75365
0 to 70°C
L Suffix — Case 620
P Suffix — Case 648

CHIP Enable driver for either 4K or 1K RAMs. Differs from MC3460 by not providing REFRESH Input.

V_{OH} @ $I_{OH} = -100 \mu\text{A}$ Volts Min	V_{OL} @ $I_{OL} = 10 \text{ mA}$ Volts Max	t_{DLH} @ $C_L = 200 \text{ pF}$ ns Max
$V_{CC} - 0.3$	0.3	20

Magnetic Memory

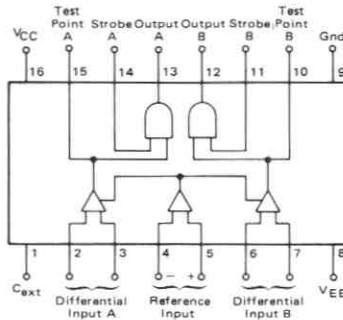
Sense Amplifiers



MC5522
MC5523
-55 to 125°C
L Suffix — Case 620

MC7522
MC7523
0 to 70°C
L Suffix — Case 620

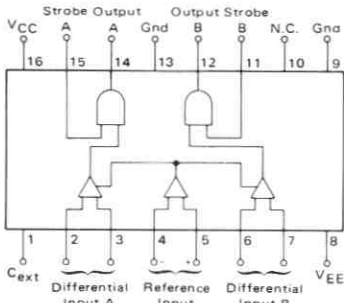
Dual channel with open-collector output, high sink current capability



MC5538
MC5539
-55 to 125°C
L Suffix — Case 620

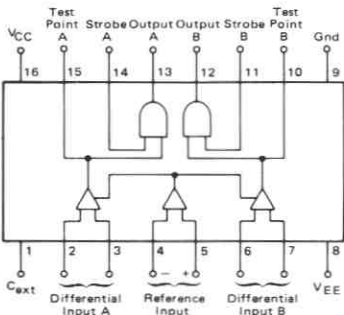
MC7538
MC7539
0 to 70°C
L Suffix — Case 620
P Suffix — Case 648

Same as MC7528, 29 except NAND outputs



MC5524
MC5525
-55 to 125°C
L Suffix — Case 620

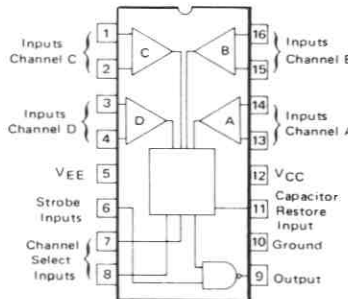
MC7524
MC7525
0 to 70°C
Dual with Independent Strobing
L Suffix — Case 620
P Suffix — Case 648



MC5528
MC5529
-55 to 125°C
L Suffix — Case 620

MC7528
MC7529
0 to 70°C
L Suffix — Case 620
P Suffix — Case 648
Same as MC7524, 25 except amplifier test points included

	MC5522 MC5524 MC5528 MC5534 MC5538	MC5523 MC5525 MC5529 MC5535 MC5539	MC7522 MC7524 MC7528 MC7534 MC7538	MC7523 MC7525 MC7529 MC7535 MC7539
$V_{TH} @ V_{REF} = 15 \text{ mV} =$	10 to 20 mV	8 to 22 mV	11 to 19 mV	8 to 22 mV
$V_{TH} @ V_{REF} = 40 \text{ mV} =$	35 to 45 mV	33 to 47 mV	36 to 44 mV	33 to 47 mV
Max $I_{IB} =$	100 μA	100 μA	75 μA	75 μA
Max $t_{PLH} @ C_L = 15 \text{ pF} =$	40 ns	40 ns	40 ns	40 ns



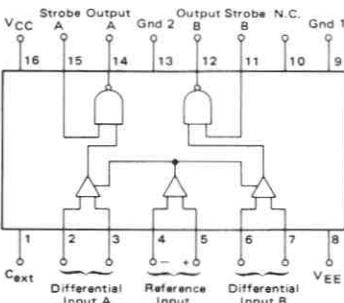
MC1544
-55 to 125°C
L Suffix — Case 620
F Suffix — Case 650

MC1444
0 to 70°C
L Suffix — Case 620

AC-coupled, decoded input channel selection, wired-OR output strobe capability, +5.0 V, -6.0 V power supply.

Device Number	V_{TH} mV	V_{OH} @ $I_{OH} = -400 \mu\text{A}$ Volts Min	V_{OL} @ $I_{OL} = 10 \text{ mA}$ Volts Max	t_{PD} ns Max
MC1544	0.5 to 1.5	2.4	0.5	25
MC1444	0.3 to 2.3	2.4	0.5	25

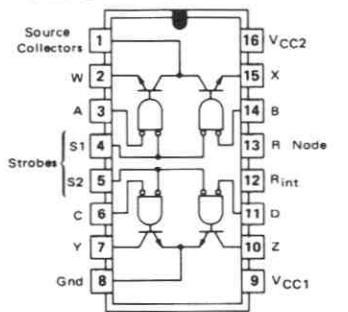
Core Driver



MC5534
MC5535
-55 to 125°C
L Suffix — Case 620

MC7534
MC7535
0 to 70°C
L Suffix — Case 620
P Suffix — Case 648

Same as MC7524, 25 except NAND outputs



MC55325
-55 to 125°C
L Suffix — Case 620
F Suffix — Case 650

MC75325
0 to 70°C
L Suffix — Case 620
P Suffix — Case 648

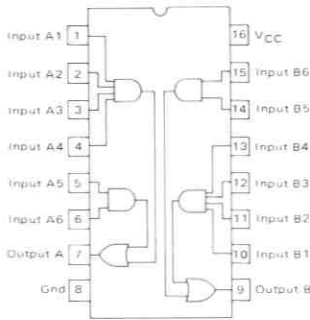
Dual Memory Driver with logic inputs, 24-Volt output capability.

Device Number	V_{sat} @ I_{sink} or $I_{source} = 600 \text{ mA}$ Volts Max	I_{OH} @ $V_{CC2} = 24 \text{ V}$ μA Max	t_{PLH} (Source) ns Max	t_{PLH} (Sink) ns Max
MC55325	0.70	150	50	45
MC75325	0.75	200	50	45

BUS INTERFACE

Several popular bus formats have been established to allow compatibility of equipment regardless of manufacturer.

Computer Bus

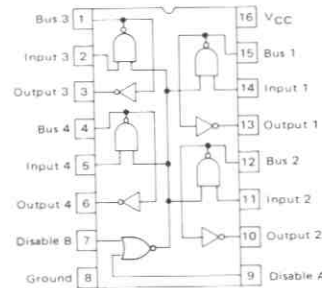


MC8T13
0 to 75°C
L Suffix — Case 620
P Suffix — Case 648
MC8T13 is a dual open emitter driver. Specified for general TTL systems.

MC8T23
0 to 75°C
L Suffix — Case 620
P Suffix — Case 648
MC8T23 is a dual open emitter driver. Specified to meet IBM System requirements.

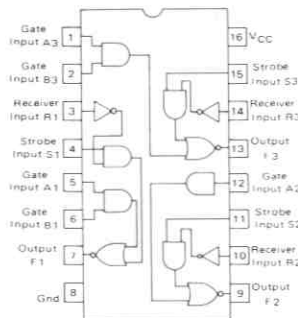
Device Number	V_{OH} @ $I_{OH} = -75 \text{ mA}$ @ $I_{OH} = -59.3 \text{ mA}^*$ Volts Max	I_{OS} @ $V_O = 0$ mA Max	t_{PLH} @ $C_L = 15 \text{ pF}$ ns Max
MC8T13	2.4	-30	20
MC8T23	3.11*	-30	20

Minicomputer Bus



MC3438
0 to 70°C
L Suffix — Case 620
P Suffix — Case 648
Quad Transceivers with hysteresis-equipped receivers and open-collector driver outputs which permit wire-OR connection (DM8838 equivalent).

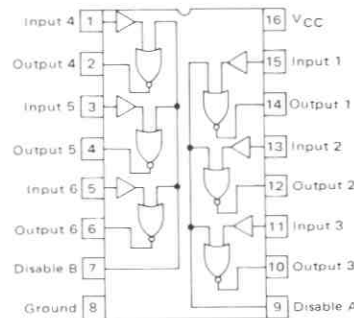
Receiver Hysteresis Volts Min	$V_{L(BUS)}$ @ $I_{BUS} = 50 \text{ mA}$ Volts Max	I_{BUS} @ $V_{H(BUS)} = 4.0 \text{ V}$ μA Max	t_{PLHDI} @ $C_L = 15 \text{ pF}$ ns Max	t_{PLHRI} @ $C_L = 15 \text{ pF}$ ns Max
0.25	0.7	100	25	30



MC8T14
0 to 70°C
L Suffix — Case 620
P Suffix — Case 648
MC8T14 is a triple-hysteresis-equipped receiver. Specified for general TTL Systems.

MC8T24
0 to 70°C
L Suffix — Case 620
P Suffix — Case 648
MC8T24 is a triple-hysteresis-equipped receiver specified to meet IBM System requirements.

Device Number	$V_{H(R)}$ Volts Min	$I_{H(R)}$ @ $V_{H(R)} = 3.8 \text{ V}$ @ $V_{H(R)} = 3.11 \text{ V}^*$ mA Max	$t_{PLH(R)}$ @ $C_L = 15 \text{ pF}$ ns Max
MC8T14	0.3	0.17	30
MC8T24	0.2	0.17*	30

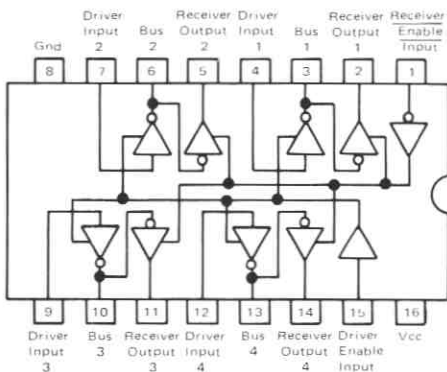


MC3437
0 to 70°C
L Suffix — Case 620
P Suffix — Case 648
Hex Receivers with Hysteresis for improved noise immunity (DM8837 equivalent)

$I_{H(R)}$ @ $V_{H(R)} = 4.0 \text{ V}$ μA Max	Hysteresis Volts Min	$t_{PLH(R)}$ @ $C_L = 15 \text{ pF}$ ns Max
50	0.5	30

Microprocessor Bus

The revolutionary "Computer on a Chip" is another bus organized system. The requirements on the microprocessor bus are especially stringent. Generally, microprocessors (MPUs) are fabricated utilizing MOS technology with its attendant high circuit density characteristics. However, MOS structures become unduly large when it is necessary to conduct large amounts of current. Therefore it is necessary that each of the elements attached to the MPU bus require minimal load current. Most MPU systems can tolerate a total loading equal to only about one conventional TTL load.

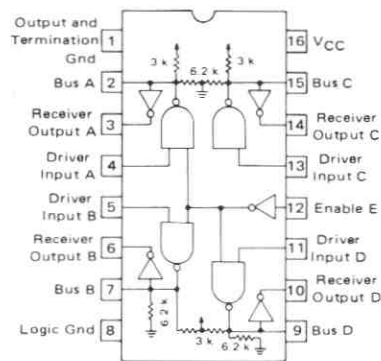


MC8T26/MC6880
0 to +75°C
L Suffix — Case 620
P Suffix — Case 648
Quad three-state bus transceiver

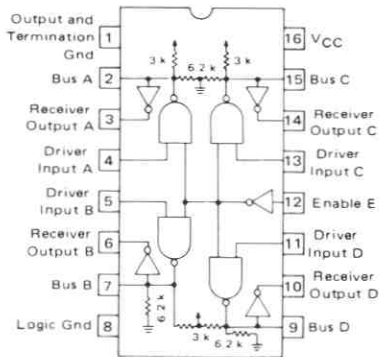
I_{IH} and I_{IL} Input Current (Either Logic State) μA	I_{OHL} Output Disabled Leakage Current — High Logic State Max μA	t_{PLH} , t_{PHL} Propagation Delay Time — High to Low or Low to High ns Max
200	100	17

Instrumentation Bus

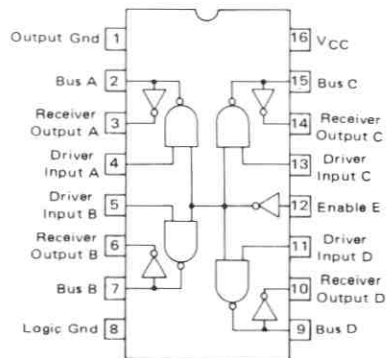
Steps toward standardization of the instrumentation interface bus have been made by the International Electrotechnical Commission (IEC) and the IEEE with Standard 488-1975. Acceptance of these standards will permit interconnection of many types of measurement apparatus, manufactured by numerous firms, into complex systems simply by plugging in connecting cables.



MC3440
0 to 70°C
P Suffix — Case 648
Quad Transistors with 3 Drivers
Sharing a Common Enable Input
R1 = 3.0 k (to V_{CC})
R2 = 6.2 k (to Gnd)



MC3441
0 to 70°C
P Suffix — Case 648
Quad Transceivers with all four
drivers controlled by a
Common-Enable Input
R1 = 3.0 k (to V_{CC})
R2 = 6.2 k (to Gnd)



MC3443
0 to 70°C
P Suffix — Case 648
Quad Transistors without
termination resistors. Functional
equivalent to 75138

Device Number	Receiver Input Hysteresis mV Min	Drive Output Voltage @ $I_{OL} = 48$ mA; Volts Max	Bus Divider Voltage Volts	t_{PHL} (Driver or Receiver) ns Max
MC3440	400	0.4	2.6 to 3.75	30
MC3441	400	0.4	2.6 to 3.75	30
MC3443	400	0.4	—	25(D) 22(R)

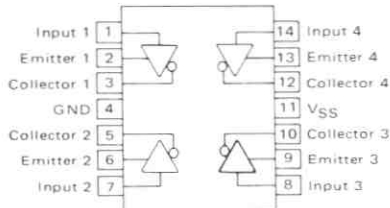
INSTRUMENTATION INTERFACE

Digital techniques are rapidly invading instrumentation systems.

Numeric Display Interface

MC75491
0 to 70°C
L Suffix — Case 632
P Suffix — Case 646

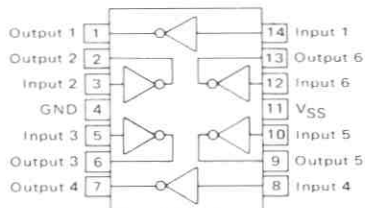
Quad LED Segment Driver for common-cathode displays. MOS compatible inputs.



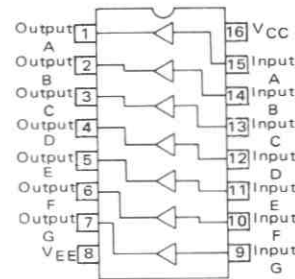
I_i @ $V_i = 10\text{ V}$ mA Max	V_{CE} @ $I_{CE} = 50\text{ mA}$ Volts Max	V_{SS} Volts Max
3.3	1.2	10

MC75492
0 to 70°C
L Suffix — Case 632
P Suffix — Case 646

Hex LED Digit Driver for common-cathode displays. MOS compatible inputs.

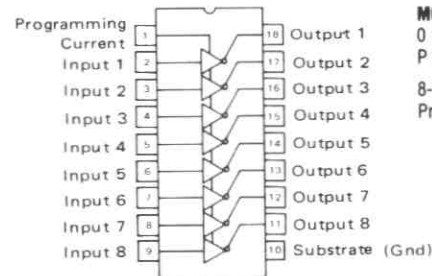


I_i @ $V_i = 10\text{ V}$ mA Max	V_{OL} @ $I_{OL} = 250\text{ mA}$ Volts Max	V_{SS} Volts Max
3.3	1.2	10



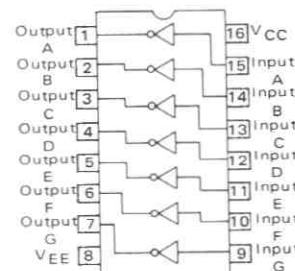
MC3490
0 to 70°C
P Suffix — Case 648
7-Digit Anode Driver with High Logic Level Input Required for Activation

Breakdown Voltage Volts Min	Input Voltage (OFF-State) Volts Min	Input Voltage (ON-State) Volts Max	Input Current μA Max
48	-5.0	-2.0	450



MC3491
0 to 70°C
P Suffix — Case 701
8-Segment Cathode Driver with Programmable Current

Breakdown Voltage Volts Min	Current Deviation (All 8 Outputs) % Max	Output Current Compliance Voltage Volts Range
80	10	5.0 to 50

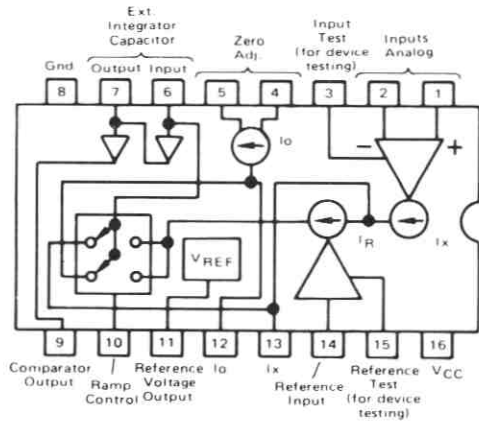


MC3494
0 to 70°C
P Suffix — Case 648
7-Digit Anode Driver with Low Logic Level Input Required for Activation

Breakdown Voltage Volts Min	Input Voltage (OFF-State) Volts Max	Input Voltage (ON-State) Volts Min	Input Current μA Max
48	-2.0	-5.0	-350

INTERFACE (continued)

A/D-D/A Conversion

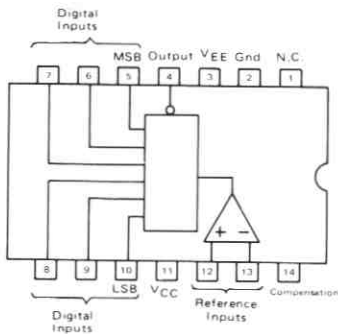


MC1505
-55 to 135°C
L Suffix — Case 620

MC1405
0 to 70°C
L Suffix — Case 620

A dual ramp subsystem which can provide accuracies to 4½ BCD digits or 13 binary bits. May be used with McMOS or MTTL logic systems. Mates with MC14435 for complete 3½ BCD Converter function.

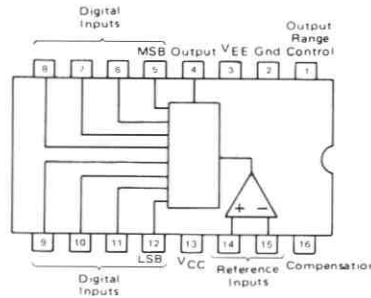
Linearity Error % Max	Voltage Reference Volts	Temperature Coefficient of Reference %/°C	I _{CC} @ V _{CC} = 5.0 V mA Max
±0.05	1.15 to 1.35	0.005	12



MC1506
-55 to 125°C
L Suffix — Case 632

MC1406
0 to 70°C
L Suffix — Case 632

6-Bit Multiplying Digital-to-Analog Converters



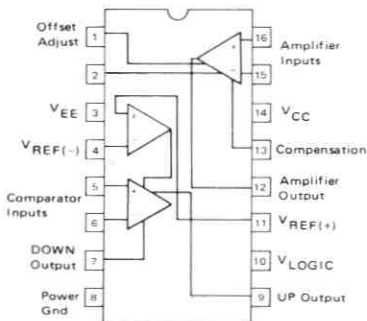
MC1508L
-55 to 125°C
L Suffix — Case 620

MC1408L
MC1408L7
MC1408L6
0 to 70°C
L Suffix — Case 620

8-Bit Multiplying Digital-to-Analog Converters

Accuracy % Min	t _{PHL} , t _{PLH} ns Max	Output Current @ V _{EE} = -5.0 V mA Range	P _D @ V _{EE} = -5.0 V mW Max
±0.78	50	0 to 2.1	1.2

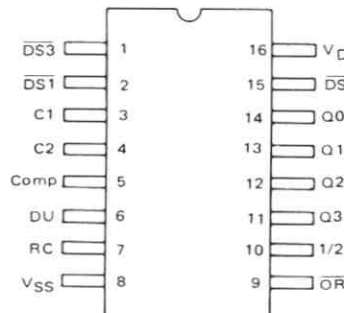
Device Number	Accuracy % Min	Output Current @ V _{REF} = 2.0 V mA Range	P _D @ V _{EE} = -5.0 V mW Max
MC1508L8	±0.19	1.9 to 2.1	170
MC1408L8	±0.19	1.9 to 2.1	170
MC1408L7	±0.39	1.9 to 2.1	170
MC1408L6	±0.78	1.9 to 2.1	170



MC1507
-55 to 125°C
L Suffix — Case 620

MC1407
0 to 70°C
L Suffix — Case 620

MC1507/MC1407 — Tracking or Successive Approximation A/D Subsystem consisting of a high slew rate operational amplifier and an adjustable dual threshold comparator.



MC14435
-55 to 125°C
MC14435EFL — L-Suffix Case 620
MC14435EVL — L-Suffix Case 620
-40 to 85°C
MC14435FL — L-Suffix Case 620
MC14435FP — P-Suffix Case 648
MC14435VL — L-Suffix Case 620
MC14435VP — P-Suffix Case 648
3½ Digit BCD Subsystem for Mating with the MC1505

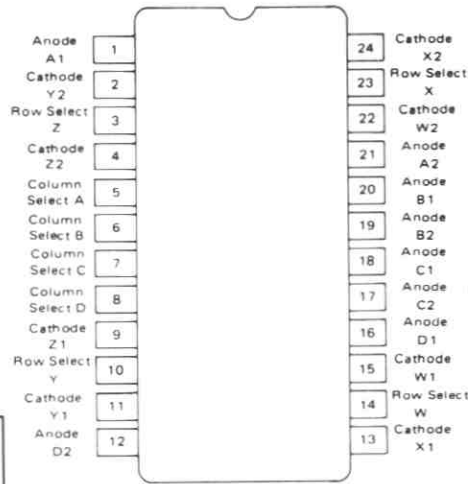
Device Number	V _{DO} Amplifier mV Max	I _{IB} Amplifier μA Max	Comparator V _{TH} @ V _{REF} = 40 mV mV Range	Comparator V _{IR} mV Range	Comparator I _{SINK} mA Min
MC1507	2.0	1.5	±36 to ±44	-150 to +320	3.2
MC1407	6.0	2.5	±30 to ±50	-150 to +320	3.2

P _D (quiescent) @ V _{DD} = 5.0 V mW Max	I _{OL} @ V _{DD} = 5.0 V (Digit Selects) mA Min	I _{OL} @ V _{DD} = 5.0 V (BCD Outputs) mA Min	I _{OL} @ V _{DD} = 5.0 V (All Outputs) mA Min
1.75	1.6	1.6	-0.2

COMMUNICATION INTERFACE

Low-cost solid-state crosspoint switches offer important advantages in modern telephone exchanges.

r_{off} @ $V_{AK} = 10$ V M Ω Min	r_{on} @ $I_{AK} = 20$ mA Ohms Max	BV_{AK} BV_{KA} Volts Min	V_{AK} @ $I_{AK} = 20$ mA Volts Max
100	10	25	1.1

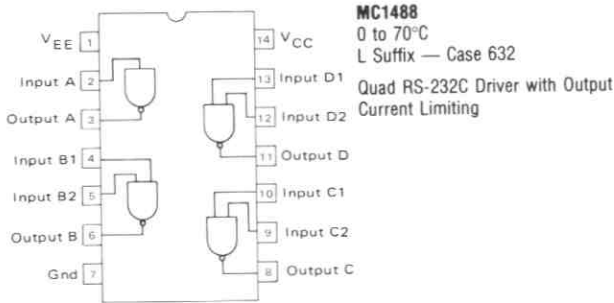


MC3416
0 to 70°C
P Suffix — Case 649
L Suffix — Case 623
4 x 4 two-wire monolithic Crosspoint Switch for PABX applications. Select inputs are both CMOS and TTL compatible.

COMPUTER AND TERMINAL INTERFACE

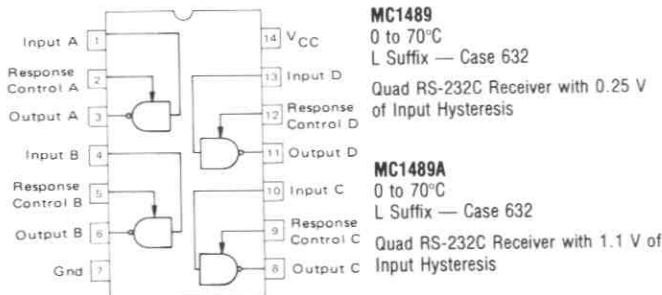
Important interfaces are present in computers and computer terminals.

Drivers and Receivers



MC1488
0 to 70°C
L Suffix — Case 632
Quad RS-232C Driver with Output Current Limiting

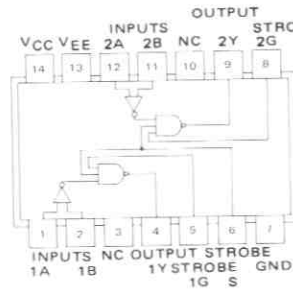
V_{OH} @ $V_{CC}/V_{EE} = \pm 9.0$ V Volts Min	V_{OL} @ $V_{CC}/V_{EE} = \pm 9.0$ V Volts Max	I_{OS} mA Range	t_{PHL} @ $C_L = 15$ pF ns Max
6.0	-6.0	± 6.0 to 12	175



MC1489
0 to 70°C
L Suffix — Case 632
Quad RS-232C Receiver with 0.25 V of Input Hysteresis

MC1489A
0 to 70°C
L Suffix — Case 632
Quad RS-232C Receiver with 1.1 V of Input Hysteresis

Device Number	Input V_{IH} Volts Range	Input V_{IL} Volts Range	t_{PHL} @ $R_L = 390\Omega$ ns Max
MC1489 MC1489A	1.0 to 1.5 1.75 to 2.25	0.75 to 1.25 0.75 to 1.25	50 50



MC55107
-55 to 125°C
L Suffix — Case 632

MC75107
0 to 70°C
L Suffix — Case 632
P Suffix — Case 646

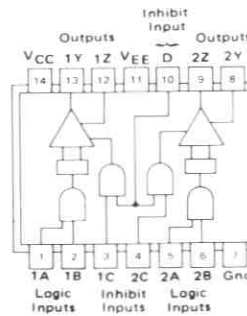
Dual Differential Input Receivers with Active Pull-up TTL Outputs

MC55108
-55 to 125°C
L Suffix — Case 632

MC75108
0 to 70°C
L Suffix — Case 632
P Suffix — Case 646

Dual Differential Input Receivers with Open-Collector Outputs

Input V_{TH} mV Max	I_{IH} @ $V_{ID} = 0.5$ V μ A Max	I_{IL} @ $V_{ID} = -2.0$ V μ A Max	t_{PHL} ns Max
± 25	75	-10	25



MC75109
0 to 70°C
L Suffix — Case 632
P Suffix — Case 646

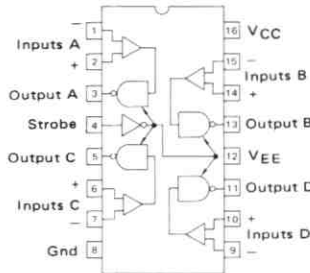
MC75110
0 to 70°C
L Suffix — Case 632
P Suffix — Case 646

Dual Current-Mode Drivers with Inhibit Inputs
Sink Current ≈ 6.0 mA
Sink Current ≈ 12 mA

Device Number	I_{ON} (ON) mA Max	I_{OFF} (OFF) μ A Max	t_{PHL} ns Max
MC75109 MC75110	3.5 6.5	100 100	15 15

INTERFACE (continued)

DRIVERS AND RECEIVERS (continued)

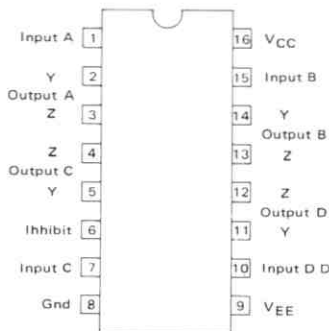


MC3450
0 to 70°C
L Suffix — Case 620
P Suffix — Case 648

MC3452
0 to 70°C
L Suffix — Case 620
P Suffix — Case 648

Quad Differential-Input Receivers
Common Three-State Enable Open Collector Outputs

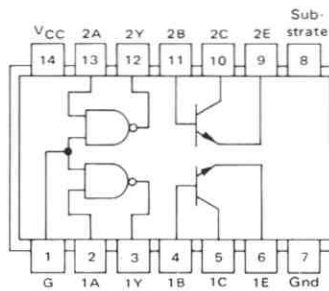
Input V_{TH} mV Max	I_{IH} @ $V_{ID} = 0.5$ V μ A Max	I_{IL} @ $V_{IL} = -2.0$ V μ A Max	t_{PLH} ns Max
± 25	75	-10	25



MC3453
0 to 70°C
L Suffix — Case 620
P Suffix — Case 648

Quad Current-Mode Driver with Common Inhibit Input. Current Sink is Approximately 12 mA

Input V_{TH} mV Max	I_{IH} @ $V_{ID} = 0.5$ V μ A Max	I_{IL} @ $V_{IL} = -2.0$ V μ A Max	t_{PLH} ns Max
± 25	75	-10	25



MC75450
0 to 70°C
L Suffix — Case 632
P Suffix — Case 646

Dual Peripheral Positive AND Driver, plus two non-committed NPN output transistors.

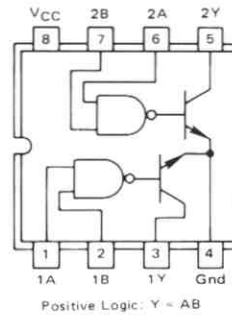
Positive Logic: Y = $\overline{A}\overline{B}$ (gate only)
C = $\overline{A}\overline{B}$ (gate and transistor)

GATE

V_{OH} @ $I_{OH} = -400$ μ A Volts Max	V_{OL} @ $I_{OL} = 16$ mA Volts Max	t_{PLH} @ $C_L = 15$ pF ns Max
2.4	0.4	14

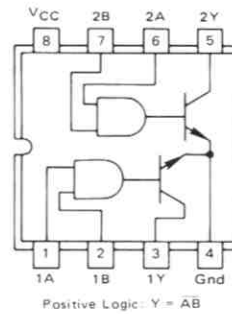
TRANSISTOR

BV_{CEO} Volts Min	BV_{EBO} Volts Min	h_{FE} @ $V_{CE} = 3.0$ V, $I_C = 300$ mA Min
35	5.0	30



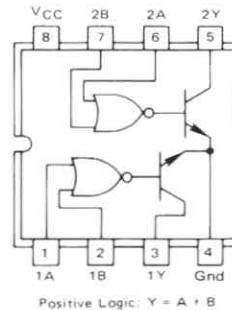
MC75451
MC75461
0 to 70°C
P Suffix — Case 626
U Suffix — Case 693

Dual Peripheral Positive AND Driver with Logic Gate Outputs Internally Connected to NPN output transistors.
 V_O (max) = 30 V — MC75451
= 35 V — MC75461



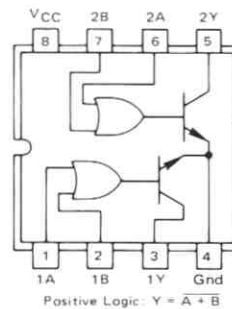
MC75452
MC75462
0 to 70°C
P Suffix — Case 626
U Suffix — Case 693

Dual Positive NAND driver with Logic Gate Outputs Internally Connected to NPN Output Transistors.
 V_O (max) = 30 V — MC75452
= 35 V — MC75462



MC75453
MC75463
0 to 70°C
P Suffix — Case 626
U Suffix — Case 693

Dual Positive OR Driver With Logic Gate Outputs Internally Connected to NPN Output Transistors.
 V_O (max) = 30 V — MC75453
= 35 V — MC75463



MC75454
MC75464
0 to 70°C
P Suffix — Case 626
U Suffix — Case 693

Dual Positive NOR Driver with Logic Gate Output Internally Connected to NPN Output Transistors
 V_O (max) = 30 V — MC75454
= 35 V — MC75464

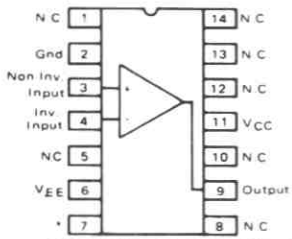
MC75451, MC75452, MC75453, MC75454

I_{OH} @ $V_{OH} = 30$ V μ A Max	V_{OL} @ $I_{OL} = 300$ mA Volts Max	I_{IH} @ $V_{IH} = 2.4$ V μ A Max	I_{IL} @ $V_{IL} = 0.4$ V mA Max
100	0.7	40	-1.6

MC75461, MC75462, MC75463, MC75464

I_{OH} @ $V_{OH} = 35$ V μ A Max	V_{OH} (After Switching) @ $V_{CC} = 35$ V, $I_O = 300$ mA mV Max
100	-10

Comparators



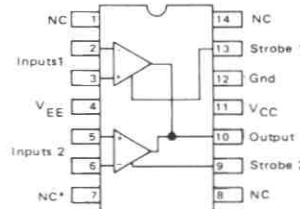
MC1710C
0 to 70°C
G Suffix — Case 601
F Suffix — Case 606
L Suffix — Case 632
P Suffix — Case 646

MC1710
-55 to 125°C
G Suffix — Case 601
F Suffix — Case 606
L Suffix — Case 632

Single Comparators

*Connected to pin 6 via the substrate on some plastic units

Device Number	V _{IO} mV Max	I _{IB} μA Max	A _{VOL} V/V Min
MC1710C	5.0	25	1000
MC1710	2.0	20	1250



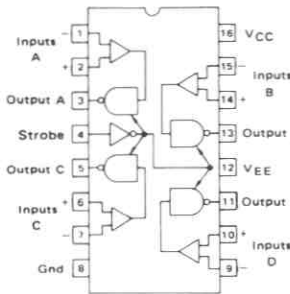
MC1711C
0 to 70°C
G Suffix — Case 603
F Suffix — Case 606
L Suffix — Case 632
P Suffix — Case 646

MC1711
0 to 70°C
G Suffix — Case 603
F Suffix — Case 606
L Suffix — Case 632

Dual Comparators with Strobes, Wire-ORed Outputs

*Connected to pin 4 via the substrate on some plastic units.

Device Number	V _{IO} mV Max	I _{IB} μA Max	A _{VOL} V/V Min
MC1711C	5.0	100	700
MC1711	3.5	75	700



MC3430
0 to 70°C
L Suffix — Case 620
P Suffix — Case 648

MC3431
0 to 70°C
L Suffix — Case 620
P Suffix — Case 648

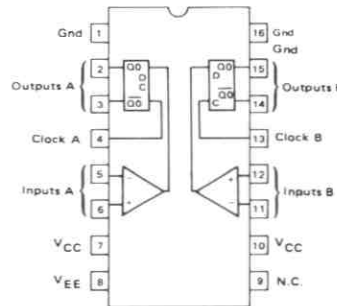
MC3432
0 to 70°C
L Suffix — Case 620
P Suffix — Case 648

MC3433
0 to 70°C
L Suffix — Case 620
P Suffix — Case 648

Quad High-Speed Comparators with Three-State Enable Common to All Four Devices

Quad Comparators with Open Collector Outputs, Common Strobe Input

Device Number	V _{IS} mV Max	I _{IB} μA Max	t _{PHL} ns Max
MC3430	±6.0	20	45
MC3431	±10	20	45
MC3432	±6.0	20	50
MC3433	±10	20	50



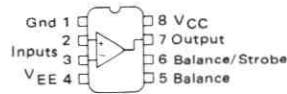
MC1650
-30 to 85°C
L Suffix — Case 620
F Suffix — Case 650

MC1651
-30 to 85°C
L Suffix — Case 620
F Suffix — Case 650

Ultra-High Speed Dual Comparators with Latches

Device Number	V _{TH} mV Min	Common-Mode Range Volts Min	t _{PD} (Differential Inputs) ns Max	t _{PD} (Clock) ns Max
MC1650	±20	-2.5 to 3.0	5.0	4.7
MC1651	±20	-3.0 to 2.5	5.0	4.7

COMPARATORS (continued)



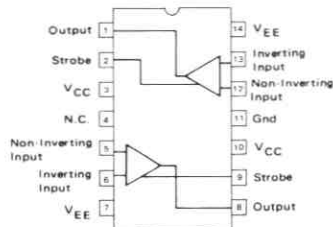
MLM111
 -55 to 125°C
 G Suffix — Case 601
 F Suffix — Case 606
 L Suffix — Case 632

MLM211
 -25 to 85°C
 G Suffix — Case 601
 F Suffix — Case 606
 L Suffix — Case 632

MLM311
 0 to 70°C
 G Suffix — Case 601
 F Suffix — Case 606
 L Suffix — Case 632
 P1 Suffix — Case 626

High-Gain, High Input Impedance Comparators. May be used with single power supply. Strobe and balance inputs provided.

Device Number	V _{IO} mV Max	I _{IB} nA Max	V _{OL} @ I _{OL} = 50 mA Volts Max
MLM111	3.0	100	1.5
MLM211	3.0	100	1.5
MLM311	7.5	250	1.5

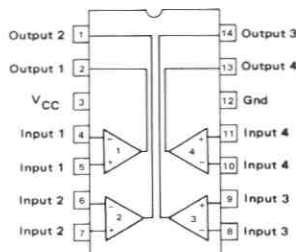


MC1514
 -55 to 125°C
 F Suffix — Case 607
 L Suffix — Case 632

MC1414
 0 to 70°C
 F Suffix — Case 607
 L Suffix — Case 632
 P Suffix — Case 646

Dual Comparators with Strobes

Device Number	V _{IO} mV Max	I _{IB} μA Max	A _{VOL} V/V Min
MC1514	2.0	20	1250
MC1414	5.0	25	1000



MLM139
MLM139A
 -55 to 125°C
 L Suffix — Case 632

MC3302
MLM239
MLM239A
 -40 to 85°C
 L Suffix — Case 632
 P Suffix — Case 646

MLM339
MLM339A
 0 to 70°C
 L Suffix — Case 632
 P Suffix — Case 646

Quad Single Supply Voltage Comparators

Device Number	V _{IO} @ 25°C mV Max	I _{IB} @ 25°C nA Max	I _{SINK} @ V _{OL} = 500 mV mA Min	V _{OL} @ I _{OL} = 2.0 mA* @ I _{OL} = 4.0 mA mV Max
MC3302	20	1000	—	400*
MLM139	5.0	100	6.0	500
MLM139A	2.0	100	6.0	500
MLM239	5.0	250	6.0	500
MLM239A	2.0	250	6.0	500
MLM339	5.0	250	6.0	500
MLM339A	2.0	250	6.0	500

Motorola offers a broad line of operational amplifiers to meet a wide range of usages. From low-cost, industry standard types to high precision circuits the span encompasses a large range of performance capabilities.

These linear integrated circuits are available as single, dual, and quad monolithic devices in a variety of package

styles as well as standard and beam-lead chips. The following guide is designed to highlight those Motorola operational amplifiers which are recommended for new designs due to their excellent performance, lower relative cost and ready availability.

NON COMPENSATED — Gain and Frequency-Response characteristics may be optimized for specific applications through the selective addition of external compensating capacitors and resistors.

AN INDUSTRY STANDARD — MC1709

<p>This design was among the first high-performance types on the market and still is one of the most popular. Its long history has made it among the most widely sourced unit in the industry, and the most universally available amplifier. In the largest selection of packages, at the lowest cost.</p>	<p>Available Variations:</p> <p>Prime Device — MC1709 $T_A = -55$ to $+125^\circ\text{C}$</p> <p>Relaxed Spec. — MC1709C $T_A = 0$ to $+70^\circ\text{C}$</p> <p>Military Processed Devices Available — MC1709A</p> <p>Beam Lead — MCB1709</p> <p>Duals — Prime Device — MC1537 Relaxed Spec. — MC1437</p>	<p>Chips:</p> <p>Standard — MCC1709 MCC1709C</p> <p>Beam Lead — MCBC1709</p> <p>Flip-Chip — MCCF1709 MCCF1709C</p>
--	--	---

FOR HIGHER PERFORMANCE GENERAL-PURPOSE APPLICATIONS

<p>MC1748</p> <p>Improved version of MC1709, available at a slightly higher price. Has greater gain and slew rate, better input and output impedances and somewhat lower power dissipation.</p>	<p>Available Variations:</p> <p>Prime Device — MC1748 $T_A = -55$ to $+125^\circ\text{C}$</p> <p>Relaxed Spec. — MC1748C $T_A = 0$ to $+75^\circ\text{C}$</p>	<p>Chips:</p> <p>Standard — MCC1748 MCC1748C</p> <p>Beam Lead — MCBC1748</p>
<p>MC1539</p> <p>High slew rate amplifier. Also offers substantial improvement in offset current and voltage, and in frequency response. Recommended for high-performance applications at low cost.</p>	<p>Available Variations:</p> <p>Prime Device — MC1539 $T_A = -55$ to $+125^\circ\text{C}$</p> <p>Relaxed Spec. — MC1439 $T_A = 0$ to $+75^\circ\text{C}$</p>	<p>Chips:</p> <p>Standard — MCC1539 MCC1439</p>

FOR SPECIAL APPLICATIONS

<p>MC1520 — Differential Output</p> <p>Wide-Band Amplifier, recommended primarily for those applications where differential output is an essential circuit requirement.</p>	<p>Available Variations:</p> <p>Prime Device — MC1520 $T_A = -55$ to $+125^\circ\text{C}$</p>	<p>Relaxed Spec. — MC1420 $T_A = 0$ to $+75^\circ\text{C}$</p>
<p>MLM101A — Low Bias Current</p> <p>High-performance amplifier, featuring exceptionally low input bias and offset currents. Limited temperature version (MLM301A) is particularly attractive as general-purpose amplifier due to low cost.</p>	<p>Available Variations:</p> <p>Prime Device — MLM101A $T_A = -55$ to $+125^\circ\text{C}$</p> <p>Intermediate Spec. — MLM201A $T_A = -25$ to $+85^\circ\text{C}$</p>	<p>Relaxed Spec. — MLM301A $T_A = 0$ to $+75^\circ\text{C}$</p> <p>Military Qualification or Process Devices Available — MLM101A</p>

ELECTRICAL SPECIFICATIONS — (Prime Devices)

Device Type	I_B	V_{IO}	I_{IO}	A_{vol}	f_c	BW_p	SR	Case
	μA Max	mV Max	nA Max	V/V Min Typ	MHz Typ	kHz Typ	V/ μs Typ	
MC1709	0.5	5.0	200	25 k	0.5	4.0	0.25	601, 606, 632, 693
MC1748	0.5	5.0	200	50 k	1.0	10	0.8	601, 606
MC1539	0.5	3.0	60	50 k	2.0	50	4.2	601, 632, 693
MC1520	2.0	10	100	1 k	10	150	5.0	602A, 606
MLM101A	0.075	2.0	10	50 k	1.0	10	0.5	601, 693

OPERATIONAL AMPLIFIERS (continued)

COMPENSATED — Internal frequency compensation adjusts roll-off to provide stable operation regardless of amount of feedback employed.

FOR GENERAL-PURPOSE APPLICATIONS

<p>MC1741 — An Industry Standard</p> <p>High-performance amplifier whose wide availability and low-cost (relaxed specification MC1741C) have made it a popular device for general-purpose amplifier applications.</p> <p>Available Variations:</p> <p>Prime Device — MC1741 $T_A = -55$ to $+125^\circ\text{C}$</p> <p>Relaxed Spec. — MC1741C $T_A = 0$ to $+75^\circ\text{C}$</p> <p>Military Qualification or Process Devices Available — MC1741</p> <p>Duals — Prime Device — MC1747 MC1558 Intermediate Spec. — MC1458 Relaxed Spec. — MC1747C MC1458C</p>		<p>MC1741S — High Slew Rate</p> <p>Performance similar to MC1741 except with slew rate and power bandwidth to 20 times higher. Low cost "C" version is ideal for applications where restricted temperature range is suitable.</p> <p>Available Variations:</p> <p>Prime Device — MC1741S $T_A = -55$ to $+125^\circ\text{C}$</p> <p>Relaxed Spec. — MC1741SC $T_A = 0$ to $+75^\circ\text{C}$</p>	
<p>Chips:</p> <p>Standard MCC1741 MCC1741C</p> <p>Beam Lead MCBC1741 MCCF1741</p> <p>Flip-Chip MCCF1741C MCCF1558 MCCF1458</p>			

<p>MLM107 — Low Input Current</p> <p>Designed for applications such as sample-and-hold circuits and long interval integrators, where improved input characteristics are needed.</p> <p>Available Variations:</p> <p>Prime Device — MLM107 $T_A = -55$ to $+125^\circ\text{C}$</p> <p>Intermediate Spec. — MLM207 $T_A = -25$ to $+85^\circ\text{C}$</p> <p>Relaxed Spec. — MLM307 $T_A = 0$ to $+70^\circ\text{C}$</p>	<p>MC1556 — High Input Impedance</p> <p>High performance amplifier featuring extremely high input impedance, high gain and a general upgrading of all other characteristics that make this device particularly suited for the most demanding overall amplifier needs.</p> <p>Available Variations:</p> <p>Prime Device — MC1556 $T_A = -55$ to $+125^\circ\text{C}$</p> <p>Relaxed Spec. — MC1456 $T_A = 0$ to $+70^\circ\text{C}$</p>	<p>MC1776 — Micropower Programmable</p> <p>Programmable, by means of external resistor, to optimize current, voltage and noise characteristics. Operates over ± 1.2 to ± 18 Volt power supply range, with microwatt power dissipation at the lower supply voltages.</p> <p>Available Variations:</p> <p>Prime Device — MC1776 $T_A = -55$ to $+125^\circ\text{C}$</p> <p>Relaxed Spec. — MC1776C $T_A = 0$ to $+70^\circ\text{C}$</p> <p>Low Cost Version — MC3476 $T_A = 0$ to $+70^\circ\text{C}$</p>
---	--	--

SPECIAL FEATURES AMPLIFIERS

<p>MLM110 — Unity Gain Follower</p> <p>For voltage follower purposes in highly critical instrumentation applications.</p> <p>Available Variations:</p> <p>Prime Device — MLM110 $T_A = -55$ to $+125^\circ\text{C}$</p> <p>Intermediate Spec. — MLM210 $T_A = -25$ to $+85^\circ\text{C}$</p> <p>Relaxed Spec. — MLM310 $T_A = 0$ to $+70^\circ\text{C}$</p>	<p>MC1536 — High Output Voltage</p> <p>High gain amplifier with maximum supply voltage to ± 40 volts, for extremely wide output voltage swing.</p> <p>Available Variations:</p> <p>Prime Device — MC1536 $T_A = -55$ to $+125^\circ\text{C}$</p> <p>Relaxed Spec. — MC1436 $T_A = 0$ to $+75^\circ\text{C}$</p> <p>Chips:</p> <p>Standard — MCC1536 MCC1436</p>	<p>MC1538 — Power Booster</p> <p>Designed as high current gain amplifiers, with unity voltage gain. Can deliver load currents to ± 300 mA, for driving low impedance loads.</p> <p>Available Variations:</p> <p>Prime Device — MC1538 $T_A = -55$ to $+125^\circ\text{C}$</p> <p>Relaxed Spec. — MC1438 $T_A = 0$ to $+75^\circ\text{C}$</p>
---	--	---

ELECTRICAL SPECIFICATIONS — (Prime Devices)

Device Type	I_{IB}	V_{IO}	I_{IO}	A_{vol}	f_c	BW_p	SR	Case
	μA	mV	nA	V/V	MHz	kHz	V/ μs	
	Max	Max	Max	Min	Typ	Typ	Typ	
MC1741	0.5	5.0	200	50 k	1.0	10	0.8	601, 606, 632, 693
MC1741S	0.5	5.0	200	50 k	1.0	200	15	601, 693
MLM107	0.075	2.0	10	50 k	1.0	10	0.5	601
MC1556	0.015	4.0	2.0	100 k	1.0	40	2.5	601, 632, 693
MC1776	0.0075	5.0	3.0	200 k	0.2	1.5	0.1	601
MLM110	0.003	4.0	—	Unity	20	300	30	601, 693
MC1536	0.02	5.0	3.0	100 k	1.0	23	2.0	601, 693
MC1538	200	—	—	900	—	1500	75	614

MULTIPLE OPERATIONAL AMPLIFIERS

Dual and Quad operational amplifiers for space and cost savings in applications requiring more than one amplifier.

DUAL OPERATIONAL AMPLIFIERS

<p>MC1537 – NON COMPENSATED Dual equivalent of the highly popular MC1709. Available Variations: Prime Device – MC1537 $T_A = -55$ to $+125^\circ\text{C}$ Relaxed Spec. – MC1437 $T_A = 0$ to $+75^\circ\text{C}$</p>	<p>MC1558, MC1747 – COMPENSATED Dual equivalents of the highly popular MC1741. The two devices and their "variations" differ principally in pin configurations. Available Variations: Prime Device – MC1558 $T_A = -55$ to $+125^\circ\text{C}$ Relaxed Spec. – MC1458 $T_A = 0$ to $+75^\circ\text{C}$ MC1458C Chips: Standard – MCC1558 MCC1458 Flip-Chip – MCCF1558 MCCF1458</p>	<p>Available Variations: Prime Device – MC1747 $T_A = -55$ to $+125^\circ\text{C}$ Relaxed Spec. – MC1747C $T_A = 0$ to $+75^\circ\text{C}$ Military Qualification or Process Devices Available – MC1747</p>
---	--	---

ELECTRICAL SPECIFICATIONS – (Prime Devices)

Device Type	I_{IB} μA Max	V_{IO} mV Max	I_{IO} nA Max	A_{vol} V/V Min	f_c MHz Typ	BW_p kHz Typ	SR V/ μs Typ	Case
MC1537	0.5	5.0	200	25 k	1.0	3.0	0.25	632
MC1558	0.5	5.0	200	50 k	1.1	14	0.8	601, 632, 693
MC1747	0.5	5.0	200	50 k	1.0	10	0.5	601, 603, 607, 646

QUAD OPERATIONAL AMPLIFIERS

<p>MC3503 High performance, compensated quad operational amplifier with specifications similar to MC1741, but with lower power requirements. Operates with single or split power supplies. Available Variations: Prime Device – MC3503 $T_A = -55$ to $+125^\circ\text{C}$ Relaxed Spec. – MC3403 $T_A = 0$ to $+70^\circ\text{C}$</p>	<p>MC3401 Low cost amplifier with four independent circuits ideal for active filters, multi-channel amplifiers and similar applications. $T_A = 0$ to $+75^\circ\text{C}$</p>	<p>MC3301 Similar to MC3401, except with much greater temperature range suitable for wide under hood temperature variations in automotive applications. $T_A = -40$ to $+85^\circ\text{C}$</p>
--	--	---

ELECTRICAL SPECIFICATIONS

Device Type	I_{IB} μA Max	V_{IO} mV Max	I_{IO} nA Max	A_{vol} V/V Min	f_c MHz Typ	BW_p kHz Typ	SR V/ μs Typ	Case
MC3301	0.3	—	—	1 k	4.0	20	0.6	646
MC3401	0.3	—	—	1 k	5.0	20	0.6	646
MC3403	0.5	8.0	200	20 k	1.0	9.0	0.6	632, 646
MC3503	0.5	5.0	200	50 k	1.0	9.0	0.6	632

OTHER OPERATIONAL AMPLIFIERS

The following operational amplifier types are also manufactured by Motorola. These device types are recommended for exact replacement only.

MC1430 MC1431 MC1433 MC1435	MC1530 MC1531 MC1533 MC1535	MC1712 MC1712C
--------------------------------------	--------------------------------------	-------------------

A variety of high-frequency circuits with features ranging from low-cost simplicity to multi-function versatility marks Motorola's line of integrated RF/IF amplifiers. Devices described here are intended for industrial and communica-

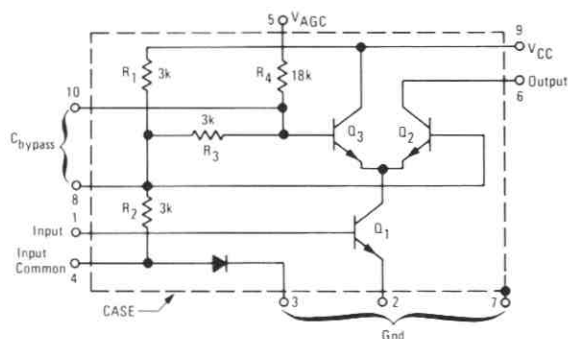
tions applications. For devices especially dedicated to consumer products, i.e., TV and entertainment radio, see Consumer Applications Selector Guide.

AGC AMPLIFIERS

MC1550 – Low Cost Building Block

Single-stage cascade connected amplifier with delayed AGC characteristics, for operation at frequencies to 100 MHz. Has typical power gain of 25 dB @ 60 MHz. See Application Notes AN-215A, AN-247A and AN-299 for design details.

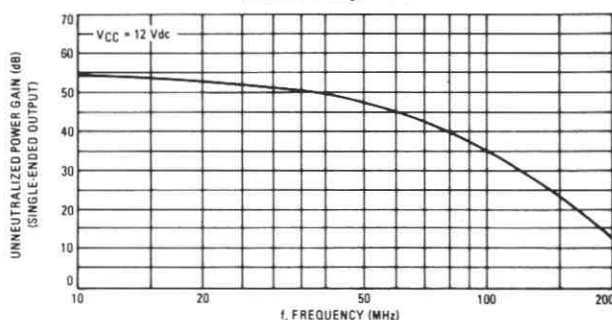
CIRCUIT SCHEMATIC



MC1590 – Wide-Band General Purpose

Has differential inputs and outputs with unneutralized power gain as high as 35 dB typical at 100 MHz in tuned amplifier service. Effective AGC voltage range from 5 to 7 volts for a 30 dB gain reduction. See Application Note AN-513 for design details.

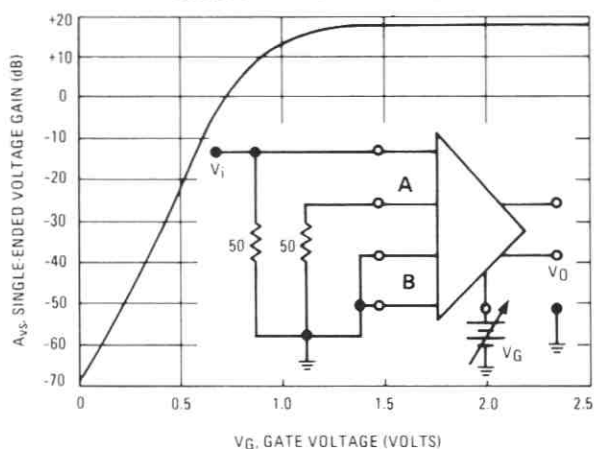
UNNEUTRALIZED POWER GAIN versus FREQUENCY (Tuned Amplifier)



MC1545/MC1445 – Gated 2-Channel Input

Differential input and output amplifier with gated 2-channel input for a wide variety of switching purposes. Typical 75 MHz bandwidth makes it suitable for high-frequency applications such as video switching, FSK circuits, multiplexers, etc.. Gating circuit is useful for AGC control. See Application Notes AN-475 and AN-491 for design details.

GATE CHARACTERISTICS



AGC AMPLIFIERS ELECTRICAL SPECIFICATIONS

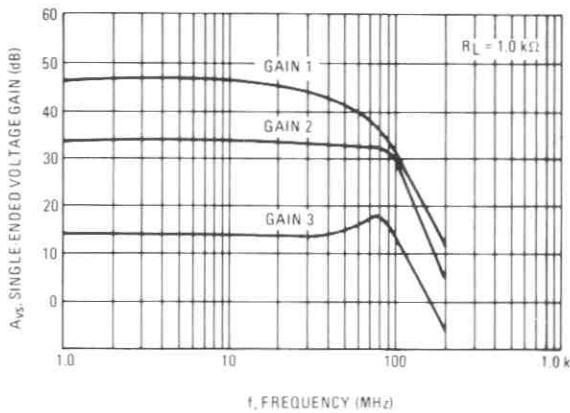
Operating Temperature Range		A _V dB	Bandwidth MHz	V _{CC} /V _{EE} Vdc	Case	Special Features
-55 to +125°C	0 to +75°C					
MC1550	—	22 Min	22	+6/-	602B,606	Low-Cost
MC1590	—	44 Typ @ 4 Typ @	10 100	+12/-	601	Characterized as Video Amplifier and as High Frequency Tuned Amplifier
MC1545	MC1445	19 Typ @	75	+5/-5	602A,607,632	Gate Controlled 2-Channel Input

NON-AGC AMPLIFIERS

MC1733/MC1733C – Utility Amplifier

Differential input and output amplifier provides three fixed gain options with bandwidth to 120 MHz. External resistor permits any gain setting from 10 to 400 V/V. Extremely fast rise time (2.5 ns typ) and propagation delay time (3.6 ns typ) makes this unit particularly useful as pulse amplifier in tape, drum, or disc memory read applications.

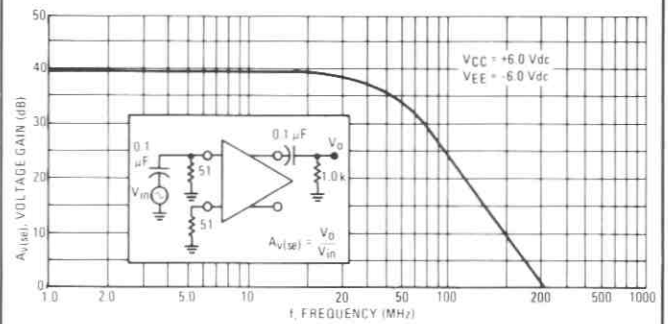
GAIN versus FREQUENCY



MC1510/MC1410 – General-Purpose Amplifier

Differential amplifier with flat response to 40 MHz. Provides excellent performance and simple design for most video and communications purposes.

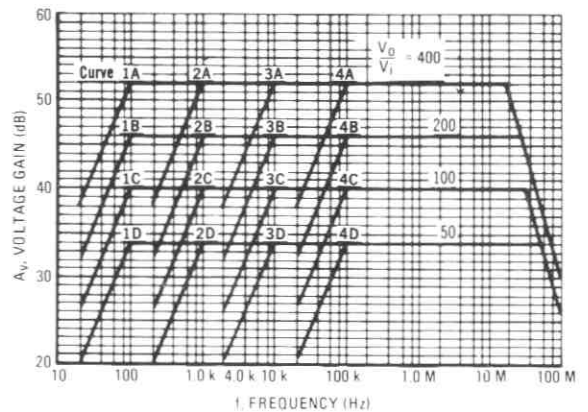
VOLTAGE GAIN versus FREQUENCY



MC1552/MC1553 – Low Distortion Amplifier

Extremely high performance amplifier with internal series feedback for stable voltage gain and low distortion. Temperature compensation stabilizes operating point. Has selectable gain option and well characterized data that permits accurate response shaping (see graph). Useful for critical applications such as wideband linear amplifiers or fast-rise pulse amplifiers.

FREQUENCY RESPONSE



NON AGC AMPLIFIERS ELECTRICAL SPECIFICATIONS

Operating Temperature Range		Av dB	Bandwidth MHz	VCC/VEE Vdc	Case	Special Features
-55 to +125°C	0 to +75°C					
MC1733	MC1733C	52 40 20	@ 40 90 120	+6/-6	603,632	3-Fixed Gain Options, Fast Rise Time and Propagation
MC1510	MC1410	40	40	+6/-6	601	
MC1553	—	46 52	@ 35 15	+6/-6	602B	High and Low Gain Versions of precision amplifier with distortion as low as 0.2% at 200 kHz.
MC1552	—	34 40	@ 40 35	+6/-6	602B	

FIXED OUTPUT VOLTAGE REGULATORS

Low cost, dedicated, monolithic circuits for positive and/or negative regulation requirements from 100 mA to 1.5 A. Most are available in plastic and metal packages. Consult the data sheets for more detailed specifications.



CASE 199-04
(P Suffix)

CASE 11
(K Suffix)

POSITIVE 1.5 A – MC7800 Series
Family Characteristics:
0 to +125°C Junction Temperature
 I_O – 1.5 A (Max)
 V_O – ±5% of nominal voltage for all line and load condition limits

Nominal V_O	V_I (dc)		Device Type
	Min	Max	
5 V	7 V	35 V	MC7805C
6 V	8 V	35 V	MC7806C
8 V	10.5 V	35 V	MC7808C
12 V	14.5 V	35 V	MC7812C
15 V	17.5 V	35 V	MC7815C
18 V	21 V	35 V	MC7818C
24 V	27 V	40 V	MC7824C

*Also available as the:
MLM109 (-55 to +150°C)
MLM209 (-25 to +125°C)
MLM309 (0 to +125°C)




CASE 199-04
(P Suffix)

CASE 79-02
TO-39
(G Suffix)

POSITIVE, 500 mA – MC78M00 Series
Family Characteristics:
0 to +125°C Junction Temperature
 I_O – 500 mA (Max)
 V_O – ±5% of nominal voltage for all line and load condition limits.

Nominal V_O	V_I (dc)		Device Type
	Min	Max	
5 V	7 V	35 V	MC78M05C
6 V	8 V	35 V	MC78M06C
8 V	10.5 V	35 V	MC78M08C
12 V	14.5 V	35 V	MC78M12C
15 V	17.5 V	35 V	MC78M15C
18 V	21 V	35 V	MC78M18C
24 V	27 V	40 V	MC78M24C



CASE 199-04
(P Suffix)

CASE 11
(K Suffix)


NEGATIVE, 1.5 A – MC7900 Series
Family Characteristics:
0 to +125°C Junction Temperature
 I_O – 1.5 A (Max)
 V_O – ±5% of nominal voltage for all line and load condition limits.

Nominal V_O	V_I (dc)		Device Type
	Min	Max	
2 V	7.2 V	35 V	MC7902C
5 V	7 V	35 V	MC7905C
5.2 V	7 V	35 V	MC7905.2C
6 V	8 V	35 V	MC7906C
8 V	10.5 V	35 V	MC7908C
12 V	14.5 V	35 V	MC7912C
15 V	17.5 V	35 V	MC7915C
18 V	21 V	35 V	MC7918C
24 V	27 V	40 V	MC7924C

POSITIVE, 750 mA – MC7700 Series

Family Characteristics:
0 to +125°C Junction Temperature
 I_O – 750 mA (Max)
 V_O – ±5% of nominal voltage for all line and load condition limits.

Nominal V_O	V_I (dc)		Device Type
	Min	Max	
5 V	7 V	35 V	MC7705C
6 V	8 V	35 V	MC7706C
8 V	10.5 V	35 V	MC7708C
12 V	14.5 V	35 V	MC7712C
15 V	17.5 V	35 V	MC7715C
18 V	21 V	35 V	MC7718C
20 V	23 V	40 V	MC7720C
24 V	27 V	40 V	MC7724C




CASE 199-04
(P Suffix)

CASE 79-02
TO-39
(G Suffix)

POSITIVE, 100 mA – MC78L00 Series

Family Characteristics:
0 to +125°C Junction Temperature
 I_O – 100 mA (Max)
 V_O – ±10% of nominal voltage for all line and load condition limits.

Nominal V_O	V_I (dc)		Device Type
	Min	Max	
5 V	7 V	30 V	MC78L05C
8.1 V	10.5 V	30 V	MC78L08C
12 V	10.5 V	35 V	MC78L12C
15 V	17.5 V	35 V	MC78L15C
18 V	21 V	35 V	MC78L18C
24 V	27 V	40 V	MC78L24C



CASE 29-02
TO-92
(P Suffix)

CASE 79-02
TO-39
(G Suffix)

NEGATIVE, 100 mA – MC79L00 Series

Family Characteristics:
0 to +125°C Junction Temperature
 I_O – 100 mA (Max)
 V_O – ±10% of nominal voltage for all line and load condition limits.

Nominal V_O	V_I (dc)		Device Type
	Min	Max	
3 V	5 V	30 V	MC79L03C
5 V	7 V	30 V	MC79L05C
12 V	14.5 V	35 V	MC79L12C
15 V	17.5 V	35 V	MC79L15C
18 V	21 V	35 V	MC79L18C
24 V	27 V	40 V	MC79L24C




CASE 29-02
TO-92
(P Suffix)

CASE 79-02
TO-39
(G Suffix)

DUAL (±15 V Output) 100 mA REGULATOR

The MC1568 features an output balance of ±1% maximum (±2% for MC1468), current limit control and provisions for remote sensing. The ceramic package (L Suffix) has a balance control pin for critical balance requirements. The preset V_O of ±15 V can be varied from ±8 to ±20 V at the sacrifice of performance over temperature.

	MC1568	MC1468
Temp. Range	-55 to +125	0 to 75
I_O (Max)	100 mA	100 mA
V_O	±15 V, ±2.5%	±15 V, ±6%
V_I (Min/Max)	±17.2/±30	±17.5/±30
Reg _{line}	0.006	0.01
% V_O/V_I (Max)		
Reg _{load} (%/ V_O Max)	0.07	0.07



CASE 603
(G Suffix)

CASE 614
(R Suffix)

CASE 632
(L Suffix)

VARIABLE OUTPUT VOLTAGE REGULATORS

When an adjustable or tailored voltage is required, the following regulators should be used. Voltage is set by varying the value of an external resistor or resistors. More complete data on individual devices can be found on the data sheets.



CASE 614 500 mA
(R Suffix)



CASE 602A 200 mA
(G Suffix)



CASE 603
(G Suffix)



CASE 646
(P Suffix)



CASE 632
(L Suffix)

POSITIVE, 500 mA – 2.5 to 37 V

The MC1569 is a high performance regulator designed for either stand-alone operation or with a current boost transistor. It has an electrical complement, the MC1563 for dual supply applications requiring positive and negative outputs. Ripple rejection is typically 0.002%/V. An electronic shutdown control and remote sensing are also provided.

Operating Temperature (Junction)	-55 to +125°C
I_O Max	500 mA
V_O Range	2.5 to 37 V
V_I (Min/Max)	8.5 to 40 V
Reg _{line} Max	0.015%/V _O
Reg _{load} Max	0.05%

Variations:

The MC1469 is a relaxed specification lower cost version of the MC1569 and operates over a 0 to +70°C Junction Temperature Range.

MC1569/MC1469 also available as non-encapsulated chip, use MCC prefix.

MC1561 is the same as the MC1569 but has a much higher transient response. It is also available as the MC1560 which has a reduced V_O range and slightly relaxed specifications. The MC1461 and MC1460 are also available for 0 to +70°C operation.

POSITIVE, 150 mA – 2 to 37 V

The MC1723 is a very popular, lower current regulator for either stand-alone use or in conjunction with a current boost transistor. Three package variations are available: Metal (G Suffix), dual-in-line ceramic (L Suffix), or Plastic (P Suffix).

Operating Temperature (Ambient)	-55 to +125°C
I_O Max	150 mA
V_O Range	2 to 37 V
V_I (Min/Max)	9.5 to 40 V
Reg _{line} Max	0.2% V_O
Reg _{load} Max	0.15% V_O

Variations:

The MC1723C is a lower cost relaxed specification of the MC1723 for operation over the temperature range of 0 to +75°C (ambient).

The MC1723/MC1723C also available as nonencapsulated chip, use MCC prefix. MC1723 also available as nonencapsulated beam-lead device; use MCBC prefix, use MCB prefix for device in ceramic flat package.

MC1723 – High reliability processed versions offered.

POSITIVE, 20 mA – 4.5 to 40 V

The MLM105 is also available for low current applications. Line regulation is 0.01%/V and load regulation (no load to full load) 1 mV. Operating temperature is -55 to +125°C ambient.

The MLM205 relaxed specification:
-25 to +85°C

The MLM305 relaxed specification:
0 to +70°C

NEGATIVE, 500 mA – 3.6 to 37 V

The MC1563 is an electrical complement to the MC1569 for construction of positive and negative output regulator systems. In the power package (R Suffix), the case is ground for both types allowing direct mounting on a common heat sink.

Variations:

The MC1463 is a relaxed specification lower cost version of the MC1563 and operates over a 0 to +70°C Junction Temperature Range.

MC1563/MC1463 also available as non-encapsulated chip, use MCC prefix.

Operating Temperature (Junction)	-55 to +125°C
I_O Max	500 mA
V_O Range	3.6 to 37 V
V_I (Min/Max)	8.5 to 40 V
Reg _{line}	0.015%/V _O Max
Reg _{load}	0.05% Max

NEGATIVE, 20 mA – 0.015 to 40 V

The MLM104 is also available for low current applications. Line regulation is 0.01%/V and load regulation (no load to full load) 1 mV. Operating Temperature is -55 to +125°C (ambient).

The MLM204 relaxed specification:
-25 to +85°C

The MLM304 relaxed specification:
0 to +70°C

LABORATORY SUPPLY, VOLTAGE AND CURRENT REGULATOR

The MC1566 is a floating regulator designed for use with an external series pass NPN transistor. The voltage and current capabilities are limited only by the characteristics of the series element. Some of the more important features include:

- Automatic cross-over between voltage and current regulation
- Adjustable to zero volts or current
- Short circuit protection
- Remote Sensing

Operating Temperature (Ambient)	-55 to +125°C
Reg _{line} & Reg _{load}	0.01% + 1 mV
Reg _{current}	0.1% + 1 mA

Variations:

The MC1466 is a lower cost relaxed specification version of the MC1566 for operation from 0 to +75°C (ambient)



CASE 603
(G Suffix)



CASE 602A
(G Suffix)



CASE 614 500 mA
(R Suffix)



CASE 603
(G Suffix)



CASE 632
Suffix L

SPECIAL-PURPOSE CIRCUITS

The linear-integrated-circuits listed in this section were developed by Motorola for the system design engineer to fill special-purpose requirements as indicated

by the subheadings. Temperature ranges and package availability are also tailored to provide versatility.

MULTIPLIERS

Function	Linearity Error typ	Input Voltage Range Vdc min	Case	Type	
				-55 to +125°C	0 to +70°C
A four-quadrant multiplier designed to operate with ±15-volt supplies; has internal level-shift circuitry and voltage regulator.	±0.3%	±10	620	MC1594	—
	±0.5%	±10	620	—	MC1494
Applications include multiply, divide, square root, mean square, phase detector, frequency doubler, balanced modulator/demodulator, electronic gain control.	X Input = 0.5% Y Input = 1.0%	±10	632	MC1595*	—
	X Input = 1.0% Y Input = 2.0%	±10	632	—	MC1495*

*Also available as a nonencapsulated chip. use MCC prefix.

BALANCED MODULATOR/DEMODULATOR

Function	Carrier Suppression dB @ f typ MHz		Common-Mode Rejection dB typ	Case	Type	
	-55 to +125°C	0 to +75°C				
Balanced modulator/demodulator designed for use where the output voltage is a product of an input voltage (signal) and a switching function (carrier).	65	0.5	85	602A, 632 602A, 632, 646	MC1596	MC1496
	50	10				

LOW-FREQUENCY CIRCUITS

Function	Output Power W typ	Voltage Gain - typ V/V typ	Total Harmonic Distortion % typ	Case	Type	
					-55 to +125°C	0 to +70°C
A power amplifier device capable of single or split supply operation.	1.0	10, 18, 36	0.4	602B	MC1554	MC1454

TIMING CIRCUITS

Function	Supply Voltage V _{CC} Vdc - max	Initial Timing Error V _{CC} = 5 & 15 V, C = 0.1 μF %-typ	V _{OL} V _{CC} = 15 V I _{sink} = 50 mA Vdc - max	V _{OH} V _{CC} = 15 V I _{source} = 100 mA Vdc - min	Case	Type	
						-55 to +125°C	0 to +75°C
Wide range adjustable timers	16	1.0	0.75	12.75	601, 626, 693	—	MC1455
	18	0.5	0.5	13	601, 693	MC1555	—
Dual Adjustable Timers	16	2.25	0.75	12.75	632, 646	—	MC3456
	18	1.5	0.5	13	632	MC3556	—

...reflecting Motorola's continuing commitment to semiconductor products necessary for consumer system designs. The tabulation contains data for a large number of components designed principally for entertainment

product applications. It is arranged to simplify first-order of linear integrated circuit device lineups to satisfy primary functions for Television, Audio, Radio, Automotive and Organ applications.

TELEVISION CIRCUITS

SOUND

Function	Features	Case	Type
Sound IF, Detector, Limiter, Audio Preamp	80 μ V, 3 dB Limiting Sensitivity, 3.5 V(RMS) Output, Sufficient for Single Transistor Output Stage	646,647	MC1351
Sound IF Detector	Interchangeable with ULN2111A	646,647	MC1357
Sound IF Detector, DC Volume Control, Preamp	Excellent AMR, Interchangeable with CA3065	646,647	MC1358

VIDEO

1st and 2nd Video IF Amplifier	IF Gain @ 45 MHz - 60 dB typ AGC Range - 70 dB min	626	MC1349
	IF Gain @ 45 MHz - 46 dB typ, AGC Range - 60 dB min	626	MC1350
1st and 2nd Video IF, AGC Keyer and Amplifier	IF Gain @ 45 MHz - 53 dB typ, AGC Range - 65 dB min, "Forward AGC" Provided for Tuner	646,647	MC1352
	Same as MC1352, with Opposite AGC for Tuner	646,647	MC1353
3rd IF and Video Detector	Low-Level Detection, Low Harmonic Generation, Reduced Circuit Cost and Complexity, Reduced Shielding	626	MC1330
3rd IF, Video Detector, Sound IF Detector, and Sync Separator	Low-Level Detection, Separate Sound Detector, Differential Inputs	646	MC1331
AGC Keyer, AGC Amplifier, Noise Gate, Sync Separator	High-Quality Noise Gate, One IF AGC Output and Two Tuner AGC Outputs, Adjustable AGC Delay	646	MC1344
Automatic Fine Tuning	High Gain AFT System, Interchangeable with CA3064	646 686	MC1364

CHROMA

Chroma IF Amplifier and Subcarrier System	Includes Complete Chroma IF, AGC, dc Gain and Tint Controls, Injection Locked Oscillator, Low Peripheral Parts Count	646	MC1398
Chroma Subcarrier System	Interchangeable with CA3070, APC Chroma Reference System	648	MC1370
Chroma IF Amplifier	Interchangeable with CA3071, Automatic and Manual Gain Control	646	MC1371
Dual Chroma Demodulators	Industry Standard Demodulator, Low Differential Output dc Drift	603 646, 647	MC1328
	Same as MC1328 with short-circuit protected outputs, and improved dc tracking and temperature coefficients on outputs.	646	MC1329
	Similar to MC1328 but with Luminance and Blanking Inputs, Internal Matrix Provides RGB Outputs	646,647	MC1326
	Same as MC1326 with short-circuit protected outputs, and improved dc tracking and temperature coefficients on outputs.	646	MC1324
	Dual Doubly Balanced Demodulator with RGB Output Matrix and PAL Switch	646,647	MC1327
Triple Chroma Demodulator	Triple Doubly Balanced Demodulator with Adjustable Output Matrix, Contains Three Independent Demodulators.	648	MC1323

DEFLECTION

Horizontal Processor	Includes Phase-Detector, Oscillator and Pre-driver; Linear Balanced Phase Detector; Adjustable dc Loop Gain	626	MC1391
Horizontal Processor	Same as MC1391 except designed to accept negative sawtooth sync pulse.	626	MC1394
Color Processing Circuit	Includes chroma IF amplifier with ACC, color killer, linear dc chroma control, phase locked loop subcarrier regenerator with dc hue control.	648	XC1399

AUDIO CIRCUITS

PREAMPLIFIERS

Function	V _{CC} V _{dC} – max	A _{vol} dB min	THD % typ	z _o Ohms typ	Case	Type
Dual Preamplifier	±15	80	0.1	100	632	MC1303

DRIVERS

Function	V _{CC} V _{dC} – max	Drive Current mA	A _{vol} dB	Case	Type
Class B Audio Drivers	60	–	90 typ	646	XC1387
	25	50 max	–	646	MC1385

POWER AMPLIFIERS

Function	P _O Watts	V _{CC} V _{dC} max	e _{in} @ rated P _O mV (RMS) typ	P _D mA – max	R _L Ohms	Case	Type
Audio Power Amplifiers	0.5	12	3.0	4.0	8.0	626	MC1306
	0.25	12	3.0	3.5	16	626	MC3360P

RADIO CIRCUITS

IF AMPLIFIERS

Function	Gain @ 10.7 MHz dB – typ	3 dB Limiting @ 10.7 MHz mV (RMS) typ (μV(RMS))*	AMR dB – typ min*	Recovered Audio Output Δf = 75 kHz mV(RMS)	Power Supply Volts – max	Case	Type
IF Amplifier	58	0.175	60	690	18	626	MC1350
Limiting FM-IF Amplifier	–	0.600	45	480	18	646,647	MC1355
Limiting IF Ampl/Quadrature Detector	53	0.4	–	–	16	646,647	MC1357
IF Amplifier	42	60	50	500	18	626	MC3310P
IF Amplifier, Limiter, Detector, Audio Preamplifier	21	–	–	–	16	646	MC1375
IF Amplifier Quad Detector, AF pre- Amplifier, AFC, AGC, Muting and Tuning Meter Circuits	–	18*	60*	300	16	648	XC1389
Limiting IF Ampl/Quadrature Detector with Built-In Regulator	← Similar to MC1357 →					646,647	MC1356

DECODERS

Function	Channel Separation dB – typ	THD % – typ	Stereo – Indicator Lamp Driver mA – max	Features	Case	Type
FM Multiplex Stereo Decoders	45	0.5	40	Audio Muting	646	MC1304
	45	0.5	40	Audio Muting	646	MC1305
	40	0.5	40	–	646	MC1307
	40	0.3	75	Coilless Operation	646	MC1310
	40	0.5	100	Coilless Operation, Emitter Follower Outputs, and Unity Gain	648	MC1311●
Four-Channel SQ* Decoders	45	0.1	–	V _{CC} = 20 V _{dC} nom	646	MC1312
Four Channel SQ* Gain and Balance Control	–	–	–	Master Volume Control and LF/RF, LB/RB, E/B Balance Control	646	MC1314
Four Channel SQ* Logic Circuit	–	–	–	Interface with MC1314 and MC1312 to increase F/B Separation and Supply Gain and Balance Control to MC1314.	646	MC1315

*Trademark of Columbia Broadcasting System, Inc.

SPECIAL FUNCTIONS

Function	Toggle Frequency kHz Typ	Power Supply Volts Max	Case	Type
Emitter-Coupled Astable Multivibrator	100	10	626	MC3380

● To be introduced

AUTOMOTIVE CIRCUITS

OPERATIONAL AMPLIFIER

Function	V _{CC} Range Vdc	A _{vol} V/mV – typ	I _{IB} μA – max	Unity Gain Bandwidth MHz – typ	R _{in} MΩ typ	Case	Type
Quad Operational Amplifier	4.0 to 28	2.0	0.3	4.0	1.0	646	MC3301

COMPARATOR

Function	V _{CC} Range Vdc	V _{IDR} Vdc	I _{IB} μA-max	Output Leakage Current μA-max	Sink Current	Case	Type
Quad Comparator	2.0 to 28	±V _{CC}	0.5	1.0	6.0	646	MC3302
Quad Comparator (Single/Dual Supply)	2.0 to 36 ↓	36 ↓	100 250 250 100 250 250	0.1 ↓	6.0 ↓	646/ 632 ↓	MLM139 MLM239 MLM339 MLM139A MLM239A MLM339A

ORGAN CIRCUITS

FREQUENCY DIVIDERS

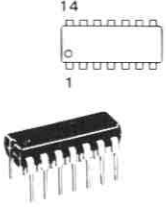
Function	V _{CC} Range Vdc	f _{Tog} MHz – typ	V _{OH} Vdc – min	Case	Type
7-Stage Divider	6.0 to 16	3.0	15.5	646	XC1302 ●

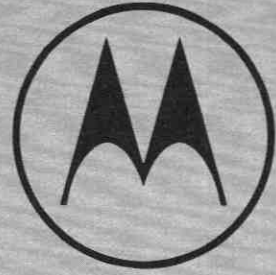
ATTENUATOR

Function	V _{CC} Range Vdc	THD % – typ	A _v dB – typ	Attenuation Range dB – typ	Case	Type
Electronic Attenuator	9.0 to 18	0.6	13	90	626	MC3340P

● To be announced.

LINEAR IC PACKAGES

 <p>CASE 11 (TO-3) Suffix K after type number</p>	 <p>CASE 29-02 TO-92 Suffix P after type number</p>	 <p>CASE 79-02 (TO-39) Suffix G after type number</p>	 <p>CASE 199-04 Suffix P after type number</p>	 <p>CASE 206A No Suffix</p>
 <p>CASE 601 Suffix G after type number</p>	 <p>CASE 602A Suffix G after type number</p>	 <p>CASE 602B Suffix G after type number</p>	 <p>CASE 603 (TO-100) Suffix G after type number</p>	 <p>CASE 606 (TO-91) Suffix F after type number</p>
 <p>CASE 607 Suffix F after type number</p>	 <p>CASE 614 Suffix R after type number</p>	 <p>CASE 620 Suffix L after type number</p>	 <p>CASE 623 Suffix L after type number</p>	 <p>CASE 626 Suffix P or PL after type number</p>
 <p>CASE 632 (TO-116) Suffix L after type number</p>	 <p>CASE 646 Suffix P after type number</p>	 <p>CASE 647 Suffix PQ after type number</p>	 <p>CASE 648 Suffix P after type number</p>	 <p>CASE 649 Suffix P after type number</p>
 <p>CASE 650 Suffix F after type number</p>	 <p>CASE 686 Suffix G after type number</p>	 <p>CASE 693 Suffix U after type number</p>	 <p>CASE 701 Suffix P after type number</p>	



SILICON POWER TRANSISTORS

This Selector Guide is to help the designer choose the best silicon power transistor for his new equipment and find suitable replacements for devices used in older designs. It is a comprehensive listing of the industry's most complete line of PNP and NPN silicon power transistors, and the devices are rated at currents between 100 mA and 60 amperes, and at voltages up to 1500 volts.

Motorola has the production capability and flexibility to supply devices especially tailored to specific application needs. Where suitable power transistors cannot be selected from this guide, contact your nearest Motorola sales representative or distributor.

TABLE OF CONTENTS

	PAGE
General-Purpose Silicon Power Transistors	
Representing over 200 "best value" selected devices for new designs	4-3
Power Darlington Transistors	
High current gain Darlington devices for use in a variety of applications	4-8
Power Switchmode Transistors	
Designed for high-voltage, high-speed, power switching in inductive circuits where fall time is critical.	4-7
High Voltage Transistors	
Devices intended for industrial, commercial and military equipment	4-9
High Frequency Transistors	
Designed for a wide variety of power amplifier and high-speed saturated switching applications. . .	4-11
Motorola Replacements for the Popular TIP Series	4-12

SILICON POWER TRANSISTORS (Continued)

The following index reflects the devices characterized in this section. To locate the exact page number, see Catalog Index (Page 7-1).

INDEX

2N3054A	2N5875	2N6277	2N6499	MJE41
2N3055	2N5876	2N6282	2N6542	MJE41A
2N3439	2N5877	2N6283	2N6543	MJE41B
2N3440	2N5878	2N6284	2N6544	MJE41C
2N3583	2N5879	2N6285	2N6545	MJE42
2N3584	2N5880	2N6286	2N6546	MJE42A
2N3585	2N5881	2N6287	2N6547	MJE42B
2N3715	2N5882	2N6294	2N6569	MJE42C
2N3716	2N5883	2N6295	2N6576	MJE47
2N3738	2N5884	2N6296	2N6577	MJE48
2N3739	2N5885	2N6297	2N6578	MJE49
2N3740	2N5886	2N6298	BU108	MJE51
2N3741	2N5986	2N6299	BU126	MJE52
2N3791	2N5987	2N6300	BU205	MJE53
2N3792	2N5988	2N6301	BU208	MJE200
2N3867	2N5989	2N6303	MJ205	MJE210
2N3868	2N5990	2N6306	MJ413	MJE340
2N3902	2N5991	2N6307	MJ423	MJE340K
2N4231A	2N6029	2N6308	MJ425	MJE350
2N4232A	2N6030	2N6312	MJ802	MJE520
2N4233A	2N6031	2N6313	MJ804	MJE700
2N4234	2N6034	2N6314	MJ900	MJE800
2N4240	2N6035	2N6338	MJ1000	MJE1100
2N4398	2N6037	2N6339	MJ2253	MJE2160
2N4399	2N6038	2N6340	MJ2254	MJE2955
2N4918	2N6039	2N6341	MJ2955	MJE2955K
2N4919	2N6040	2N6377	MJ3760	MJE3055
2N4920	2N6041	2N6378	MJ3761	MJE3055K
2N4921	2N6042	2N6379	MJ4502	MJE3300
2N4922	2N6043	2N6383	MJ5415	MJE3301
2N4923	2N6044	2N6384	MJ5416	MJE3302
2N5190	2N6045	2N6385	MJ7160	MJE3310
2N5191	2N6049	2N6406	MJ7161	MJE3311
2N5192	2N6050	2N6407	MJ7260	MJE3312
2N5193	2N6051	2N6408	MJ7261	MJE3439
2N5194	2N6052	2N6409	MJE29	MJE3440
2N5195	2N6053	2N6410	MJE29A	MJE5190
2N5301	2N6054	2N6411	MJE29B	MJE5191
2N5302	2N6055	2N6412	MJE29C	MJE5192
2N5303	2N6056	2N6413	MJE30	MJE5293
2N5304	2N6057	2N6414	MJE30A	MJE5194
2N5629	2N6058	2N6415	MJE30B	MJE5195
2N5630	2N6059	2N6416	MJE30C	MJE5655
2N5631	2N6226	2N6417	MJE31	MJE5656
2N5632	2N6227	2N6418	MJE31A	MJE5657
2N5633	2N6228	2N6419	MJE31B	MJE5974
2N5634	2N6229	2N6420	MJE31C	MJE5975
2N5655	2N6230	2N6421	MJE32	MJE5976
2N5656	2N6231	2N6422	MJE32A	MJE5977
2N5657	2N6233	2N6423	MJE32B	MJE5978
2N5683	2N6234	2N6424	MJE32C	MJE5979
2N5684	2N6235	2N6425	MJE33	MJE5980
2N5685	2N6249	2N6436	MJE33A	MJE5981
2N5686	2N6250	2N6437	MJE33B	MJE5982
2N5745	2N6251	2N6438	MJE33C	MJE5983
2N5758	2N6274	2N6495	MJE34	MJE5984
2N5759	2N6275	2N6497	MJE34A	MJE5985
2N5760	2N6276	2N6498	MJE34B	MPC900
			MJE34C	MPC1000

General-Purpose Silicon Power Transistors

From over 1400 power device types available from Motorola, the following represent over 200 "best value", selected devices for new designs. These devices are rated primarily on performance, price and availability. It is recommended that these standard device types be given first consideration for new design.

The device types are listed in increasing order of I_C continuous and V_{CEO} ratings. Other basic data is provided to enable the designer to have a wider field of choice — be it polarity, parameter, case style, process type, or complementary device types. Contact your nearest Motorola sales office for assistance in additional device selection and complete technical data.

Device and Polarity		V_{CEO}	h_{FE}	I_C	$V_{CE(sat)}$	I_C	f_r	P_D	Case
NPN	PNP	Volts Max	Min/Max	@ Amp	Volts Max	@ Amp	MHz Min	Watts Max	
0.3 Amp									
MJE3440		250	40/160	0.02	0.5	0.05	15	15	77
MJE3439		350	40/160	0.02	0.5	0.05	15	15	77
0.5 Amp									
2N5655		250	30/250	0.1	1.0	0.1	10	20	77
MJE5655		250	30/250	0.1	1.0	0.1	10	30	199
2N5656		300	30/250	0.1	1.0	0.1	10	20	77
MJE5656		300	30/250	0.1	1.0	0.1	10	30	199
MJE340K		300	30/240	0.05				30	199
	MJE350	300	30/240	0.05				20	77
MJE340		300	30/240	0.05				20.8	77
MJE5657		350	30/250	0.1	1.0	0.1	10	30	199
2N5657		350	30/250	0.1	1.0	0.1	10	20	77
1.0 Amp									
MJE29	MJE30	40	40/-	0.2	0.7	1.0	3.0	30	77
MJE29A	MJE30A	60	40/-	0.2	0.7	1.0	3.0	30	77
MJE29B	MJE30B	80	40/-	0.2	0.7	1.0	3.0	30	77
MJE29C	MJE30C	100	40/-	0.2	0.7	1.0	3.0	30	77
	MJ5415	200	30/150	0.05	2.5	0.05	15	10	79
2N3738	2N6424	225	40/200	0.1	2.5	0.25	10	20	80
2N3440		250	40/160	0.02	0.5	0.05	15	5.0	79
	MJ5416	300	30/120	0.05	2.5	0.05	15	10	79
2N3739	2N6425	300	40/200	0.1	2.5	0.25	10	20	80
2N3439		350	40/160	0.02	0.5	0.05	15	5.0	31
1.5 Amp									
MJE47		250	30/250	0.3	1.0	1.0	5.0	50	199
MJE2160		300	30/240	0.5	3.5	0.5		50	199
MJE48		300	30/250	0.3	1.0	1.0	5.0	50	199
MJE49		350	30/250	0.3	1.0	1.0	5.0	50	199
2.0 Amp									
2N6408	2N6406	60	50/250	0.1	2.0	2.0	50	12.5	77
2N6409	2N6407	80	50/250	0.1	2.0	2.0	50	12.5	77
2N3583	2N6420	175	40/200	0.5	5.0	1.0	10	35	80
2N3584	2N6421	250	8/80	1.0	0.75	1.0	10	35	80
2N3585	2N6422	300	8/80	1.0	0.75	1.0	10	35	80
2N4240	2N6423	300	10/100	0.75	1.0	0.75	15	35	80

SILICON POWER TRANSISTORS (Continued)

PREFERRED SILICON POWER TRANSISTORS (continued)

Device and Polarity		V _{CE0} Volts Max	h _{FE}		I _C Amp	V _{CE (sat)} Volts		f _T MHz Min	P _D Watts Max	Case
NPN	PNP		Min/Max	@		Max	@			
0.3 Amp										
	MJ205	750	2/-		2.5	5.0		7.5	10	11
	BU205	750	2/-		2.5	5.0		7.5	10	11
3.0 Amp										
	MJE520	30	25/-		1.0				25	77
	MJE31	40	25/-		1.0	1.2	3.0	3.0	40	77
	2N4921	40	20/100		0.5	0.6	1.0	3.0	30	77
		40	2N3867		1.5	0.75	1.5	60	6.0	31
		60	2N3868		1.5	0.75	1.5	60	6.0	31
	2N4922	60	2N4919		0.5	0.6	1.0	3.0	30	77
		60	MJ2253		0.25	0.3	0.5	3.0	25	80
	MJE31A	60	MJE32A		1.0	1.2	3.0	3.0	40	77
	MJE31B	80	MJE32B		1.0	1.2	3.0	3.0	40	77
		80	MJ2254		0.25	0.3	0.5	3.0	25	80
	2N6416	90	2N6418		0.2	3.0	3.0	40	15	77
	2N4923	80	2N4920		0.5	0.6	1.0	3.0	30	77
	2N6417	100	2N6419		0.2	3.0	3.0	40	15	77
	MJE31C	100	MJE32C		1.0	1.2	3.0	3.0	40	77
3.5 Amp										
	2N3902	400	30/90		1.0	0.8	1.0	2.8	100	11
4.0 Amp										
	2N6410	25	2N6411		2.0	0.8	2.0	50	15	77
	2N6412	40	2N6414		0.2	2.5	4.0	50	15	77
	2N5190	40	2N5193		1.5	0.6	1.5	2.0	40	77
	MJE5190	40	MJE5193		1.5	0.6	1.5	2.0	60	199
	2N6037	40	2N6034		2.0	2.0	2.0	25	40	77
	MJE3300	40	MJE3310		1.0	1.5	1.5	20	15	77
	2N3054A	55	2N6049		0.5	1.0	0.5	3.0	75	80
	2N6413	60	2N6415		0.2	2.5	4.0	50	15	77
	2N5191	60	2N5194		1.5	0.6	1.5	2.0	40	77
	MJE5191	60	MJE5194		1.5	0.6	1.5	2.0	60	199
		60	2N3740		0.25	0.6	1.0	4.0	25	80
	2N6294	60	2N6296		2.0	2.0	2.0	4.0	50	80
	2N6038	60	2N6035		2.0	2.0	2.0	25	40	77
	MJE3301	60	MJE3311		1.0	1.5	1.5	20	15	77
	MJE800	60	MJE700		1.5	2.5	1.5	40	40	77
	MJE3302	80	MJE3312		1.0	1.5	1.5	20	15	77
	2N5192	80	2N5195		1.5	0.6	1.5	2.0	40	77
	MJE5192	80	MJE5195		1.5	0.6	1.5	2.0	60	199
		80	2N3741		0.25	0.6	1.0	4.0	25	80
	2N6295	80	2N6297		2.0	2.0	2.0	4.0	50	80
	2N6039	80	2N6036		2.0	2.0	2.0	25	40	77

SILICON POWER TRANSISTORS (Continued)

PREFERRED SILICON POWER TRANSISTORS (continued)

Device and Polarity		V _{CEO} Volts Max	h _{FE}		I _C Amp	V _{CE(sat)}		f _T MHz Min	P _D Watts Max	Case
NPN	PNP		Min/Max	@		Volts Max	@				I_{C} Amp
5.0 Amp										
MJE200	MJE210	25	45/180		2.0	0.75	2.0	65	15	77
2N4231A	2N6312	40	25/100		1.5	0.7	1.5	4.0	75	80
MJE5977	MJE5974	40	20/120		2.5	0.6	2.5	2.0	75	199
2N4232A	2N6313	60	25/100		1.5	0.7	1.5	4.0	75	80
MJE5978	MJE5975	60	20/120		2.5	0.6	2.5	2.0	75	199
2N4233A	2N6314	60	20/120		1.5	0.7	1.5	4.0	75	199
MJE1100	MJE1090	60	750/-		3.0	2.5	3.0	70	70	90
MJE5979	MJE5976	80	20/120		2.5	0.6	2.5	2.0	75	199
2N6233		225	25/125		1.0	1.0	1.0	20	50	80
2N6497		250	10/75		2.5	1.5	2.5	5.0	80	199
MJE51		250	5.0/-		5.0	2.0	5.0	2.5	80	199
2N6234		275	25/125		1.0	0.5	1.0	20	50	80
2N6542		300	7/35		3.0	1.0	3.0	6.0	100	11
2N6498		300	10/75		2.5	1.5	2.5	5.0	80	199
MJE52		300	5.0/-		5.0	2.0	5.0	2.5	80	199
2N6235		325	25/125		1.0	0.5	1.0	20	50	80
2N6499		350	10/75		2.5	1.5	2.5	5.0	80	199
MJE53		350	5.0/-		5.0	2.0	5.0	2.5	80	199
MJ425		400	30/90		1.0	0.8	1.0	2.5	100	11
2N6543		400	7/35		3.0	1.0	3.0	6.0	100	11
BU108		750				5.0	4.5	7.5	56	11
MJ804		800	2.2/-		3.5			1.5	100	11
6.0 Amp										
MJE41	MJE42	40	30/-		0.3	1.5	6.0	2.0	65	199
MJE41A	MJE42A	60	30/-		0.3	1.5	6.0	2.0	65	199
MJE41B	MJE42B	80	30/-		0.3	1.5	6.0	2.0	65	199
MJE41C	MJE42C	100	30/-		0.3	1.5	6.0	2.0	65	199
2N5758	2N6226	100	25/100		3.0	1.0	3.0	1.0	150	11
2N5759	2N6227	120	20/80		3.0	1.0	3.0	1.0	150	11
2N5760	2N6228	140	15/60		3.0	1.0	3.0	1.0	150	11
MJ3760		550				5.0	6.0	7.5	80	11
8.0 Amp										
MJE5983	MJE5980	40	20/120		4.0	0.6	4.0	2.0	90	199
MJE5984	MJE5981	60	20/120		4.0	0.6	4.0	2.0	90	199
2N6300	2N6298	60	750/18k		4.0	2.0	4.0	4.0	75	80
2N6055	2N6053	60	750/18k		4.0	2.0	4.0	4.0	100	11
2N6043	2N6040	60	1k/20k		4.0	2.0	4.0	4.0	75	199
MJ1000	MJ900	60	1k/-		3.0	2.0	3.0	3.0	90	11
MJE5985	MJE5982	80	20/120		4.0	0.6	4.0	2.0	90	199
2N6301	2N6299	80	750/18k		4.0	2.0	4.0	4.0	75	80
2N6056	2N6054	80	750/18k		4.0	2.0	4.0	4.0	100	11
2N6044	2N6041	80	1k/20k		4.0	2.0	4.0	4.0	75	199
2N6045	2N6042	100	1k/20k		3.0	2.0	4.0	4.0	75	199
2N6306		250	15/75		3.0	0.8	3.0	5.0	125	11
2N6307		300	15/75		3.0	1.0	3.0	5.0	125	11
MJ7160		300	25/100		3.0	1.0	3.0	30	140	11
2N6544		300	7/35		5.0	1.5	5.0	6.0	125	11
2N6308		350	12/60		3.0	5.0	1.5	3.0	125	11
MJ7161		400	25/100		3.0	1.0	3.0	30	140	11
2N6545		400	7/35		5.0	1.5	5.0	6.0	125	11
MJ3761		550				5.0	8.0	7.5	80	11

SILICON POWER TRANSISTORS (Continued)

PREFERRED SILICON POWER TRANSISTORS (continued)

Device and Polarity		V _{CE0} Volts Max	h _{FE}		I _C Amp	V _{CE (sat)} Volts		f _T MHz Min	P _D Watts Max	Case
NPN	PNP		Min/Max	@		Max	@			
10 Amp										
2N5304		40	30/120	2.0	0.4	2.0	100	25	9	
MJE33	MJE34	40	40/-	1.0	1.0	3.0	2.0	80	199	
2N6383		40	1k/20k	5.0	2.0	5.0	20	100	11	
2N6384		60	1k/20k	5.0	2.0	5.0	20	100	11	
MJE3055	MJE2955	60	20/70	4.0	1.1	4.0	2.0	90	90	
MJE3055K	MJE2955K	60	20/70	4.0	1.1	4.0	2.0	90	199	
2N5877	2N5875	60	20/100	4.0	1.0	5.0	4.0	150	11	
2N3715	2N3791	60	50/150	1.0	0.8	5.0	4.0	150	11	
MJE33A	MJE34A	60	40/-	1.0	1.0	3.0	2.0	80	199	
2N5878	2N5876	80	20/100	4.0	1.0	5.0	4.0	150	11	
2N6385		80	1k/20k	5.0	2.0	5.0	20	100	11	
2N3716	2N3792	80	50/150	1.0	0.8	5.0	4.0	150	11	
MJE33B	MJE34B	80	40/-	1.0	1.0	3.0	2.0	80	199	
MJE33C	MJE34C	100	40/-	1.0	1.0	3.0	2.0	80	199	
2N5632	2N6229	100	25/100	5.0	1.0	7.5	1.0	150	11	
2N5633	2N6230	120	20/80	5.0	1.0	7.5	1.0	150	11	
2N5634	2N6231	140	15/60	5.0	1.0	7.5	1.0	150	11	
MJ413		325	20/80	0.5	0.8	0.5	2.5	125	11	
MJ423		325	30/90	1.0	0.8	1.0	2.5	125	11	
12 Amp										
2N6569		40	15/200	4.0	1.5	4.0	1.5	100	11	
2N5989	2N5986	40	20/120	6.0	0.7	6.0	2.0	100	90	
2N5990	2N5987	60	20/120	6.0	0.7	6.0	2.0	100	90	
2N6057	2N6050	60	750/18k	6.0	2.0	6.0	4.0	150	11	
2N5991	2N5988	80	20/120	6.0	0.7	6.0	2.0	100	90	
2N6058	2N6051	80	750/18k	6.0	2.0	6.0	4.0	150	11	
2N6059	2N6052	100	750/18k	6.0	2.0	6.0	4.0	150	11	
15 Amp										
2N3055		60	20/70	4.0	1.1	4.0	2.5	115	11	
	MJ2955	60	20/70	4.0	1.1	4.0	4.0	150	11	
2N5881	2N5879	60	20/100	6.0	1.0	7.0	4.0	160	11	
2N6576		60	500/5k	10	4.0	15		120	11	
2N5882	2N5880	80	20/100	6.0	1.0	7.0	4.0	160	11	
2N6577		90	500/5k	10	4.0	15		120	11	
2N6578		120	500/5k	10	4.0	15		120	11	
2N6249		200	10/50	10	1.5	10	2.5	175	11	
2N6250		275	8.0/50	10	1.5	10	2.5	175	11	
MJ7260		300	25/100	5.0	1.0	5.0	30	175	11	
2N6546		300	6/35	10	1.5	10	6.0	175	11	
2N6251		350	6.0/50	10	1.5	10	2.5	175	11	
MJ7261		400	25/100	5.0	1.0	5.0	30	175	11	
2N6547		400	6/35	10	1.5	10	6.0	175	11	
16 Amp										
2N5629	2N6029	100	25/100	8.0	1.0	10	1.0	200	11	
2N5630	2N6030	120	20/80	8.0	1.0	10	1.0	200	11	
2N5631	2N6031	140	15/60	8.0	1.0	10	1.0	200	11	
20 Amp										
2N6282	2N6285	60	750/18k	10	2.0	10	4.0	160	11	
2N5303	2N5745	80	15/60	10	1.0	10	2.0	200	12	
2N6283	2N6286	80	750/18k	10	2.0	10	4.0	160	11	
2N6284	2N6287	100	750/18k	10	2.0	10	4.0	160	11	

SILICON POWER TRANSISTORS (Continued)

PREFERRED SILICON POWER TRANSISTORS (continued)

Device and Polarity		V _{CE0} Volts Max	h _{FE} Min/Max	I _C Amp	V _{CE (sat)} Volts		f _r MHz Min	P _D Watts Max	Case
NPN	PNP				Max	@ I _C Amp			
25 Amp									
2N5885	2N5883	60	20/100	10	1.0	15	4.0	200	11
	2N6436	80	20/80	10	1.0	10	40	200	11
2N5886	2N5884	80	20/100	10	1.0	15	4.0	200	11
	2N6437	100	20/80	10	1.0	10	40	200	11
2N6338		100	30/120	10	1.0	10	40	200	11
	2N6438	120	20/80	10	1.0	10	40	200	11
2N6339		120	30/120	10	1.0	10	40	200	11
2N6340		140	30/120	10	1.0	10	40	200	11
2N6341		150	30/120	10	1.0	10	40	200	11
30 Amp									
2N5301	2N4398	40	15/60	15	3.0	0.75	10	200	12
2N5302	2N4399	60	15/60	15	2.0	0.75	10	200	12
MJ802	MJ4502	90	25/100	7.5	0.8	7.5	2.0	200	12
50 Amp									
2N5685	2N5683	60	15/60	25	1.0	25	2.0	300	197
2N5686	2N5684	80	15/60	25	1.0	25	2.0	300	197
	2N6377	80	30/120	20	1.2	20	30	250	197
	2N6378	100	30/120	20	1.2	20	30	250	197
2N6274		100	30/120	20	1.0	20	30	250	197
	2N6379	120	30/120	20	1.2	20	30	250	197
2N6275		120	30/120	20	1.0	20	30	250	197
2N6276		140	30/120	20	1.0	20	30	250	197
2N6277		150	30/120	20	1.0	20	30	250	197

Power SWITCHMODE Transistors

The Designers data sheets for switchmode silicon power devices provide detailed information for operating conditions as well as safety limits. Voltage, current, switching, temperature and secondary breakdown requirements are specified in detail.

The 2N6542 thru 2N6547 transistors are designed for high-voltage, high-speed, power switching in inductive circuits where fall time is critical. They are particularly suited for 115 and 220 volt line operated switch-mode applications such as:

- Switching Regulators
- PWM Inverters and Motor Controls
- Solenoid and Relay Drivers
- Deflection Circuits

Specification Features —

High Temperature Performance Specified for:
 Reversed Biased SOA with Inductive Loads
 Switching Times with Inductive Loads
 Saturation Voltages
 Leakage Currents

The device types are listed in increasing order of I_C continuous and V_{CEV} rating.

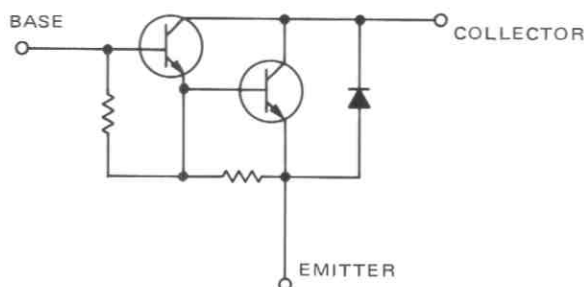
Device	I _C Amp Max	V _{CEV} Volts Max	V _{CEX (sat)} @ 100°C Volts Min	V _{CE (sat)} @ 100°C Volt Max	@ I _C Amp	t _r @ 100°C ns Max	@ I _C Amp
NPN							
2N6542	5.0	650	350	2.0	3.0	800	3.0
2N6543	5.0	850	450	2.0	3.0	800	3.0
2N6544	8.0	650	350	2.5	5.0	900	5.0
2N6545	8.0	850	450	2.5	5.0	900	5.0
2N6546	15	650	350	2.5	10	1500	10
2N6547	15	850	450	2.5	10	1500	10

Power Darlington Transistors

Monolithic power Darlington devices have found wide design usage in a variety of different applications. This power technology promises an even brighter future in advancing the state of the art — high voltage and very high current devices are on the horizon and will soon become a viable alternative to Thyristor devices on the designer's specification list. Darlington devices are not only a very high gain alternative; other significant advantages include:

- integrated circuit compatibility
- high input impedance
- high current gain
- reduced component count
- space savings

The following devices are listed in increasing order of I_C continuous and V_{CE0} rating.



Device and Polarity		I_C Amp Max	V_{CE0} Volts Max	h_{FE}		I_C Amp	$V_{CE(sat)}$ Volts Max		f_T MHz Min	P_D Watts Max	Case
NPN	PNP			Min/Max	@		@	@			
2N6037	2N6034	4.0	40	750/15k	2.0	2.0	2.0	25	40	77	
2N6294	2N6296	4.0	60	750/18k	2.0	2.0	2.0	4.0	50	80	
2N6038	2N6035	4.0	60	750/15k	2.0	2.0	2.0	25	40	77	
MJE800	MJE700	4.0	60	750/-	1.5	2.5	1.5	40	40	77	
2N6295	2N6297	4.0	80	750/18k	2.0	2.0	2.0	4.0	50	80	
2N6039	2N6036	4.0	80	750/15k	2.0	2.0	2.0	25	40	77	
MJE3300	MJE3310	4.0	40	1k/-	1.0	1.5	1.5	20	15	77	
MJE3301	MJE3311	4.0	60	1k/-	1.0	1.5	1.5	20	15	77	
MJE3302	MJE3312	4.0	80	1k/-	1.0	1.5	1.5	20	15	77	
MJE1100	MJE1090	5.0	60	750/-	3.0	2.5	3.0	1.0	70	90	
MJ1000	MJ900	8.0	60	1k/-	3.0	2.0	3.0	90	90	11	
2N6300	2N6298	8.0	60	750/18k	4.0	2.0	4.0	4.0	75	80	
2N6055	2N6053	8.0	60	750/18k	4.0	2.0	4.0	4.0	100	11	
2N6043	2N6040	8.0	60	1k/20k	4.0	2.0	4.0	4.0	75	199	
2N6301	2N6299	8.0	80	750/18k	4.0	2.0	4.0	4.0	75	80	
2N6056	2N6054	8.0	80	750/18k	4.0	2.0	4.0	4.0	100	11	
2N6044	2N6041	8.0	80	1k/20k	4.0	2.0	4.0	4.0	75	199	
2N6045	2N6042	8.0	100	1k/20k	3.0	2.0	4.0	4.0	75	199	
2N6057	2N6050	12	60	750/18k	6.0	2.0	6.0	4.0	150	11	
2N6058	2N6051	12	80	750/18k	6.0	2.0	6.0	4.0	150	11	
2N6059	2N6052	12	100	750/18k	6.0	2.0	6.0	4.0	150	11	
2N6576		15	60	500/5k	10	2.8	10	4.0	120	11	
2N6577		15	90	500/5k	10	2.8	10	4.0	120	11	
2N6578		15	120	500/5k	10	2.8	10	4.0	120	11	
2N6282	2N6285	20	60	750/18k	10	2.0	10	4.0	160	11	
2N6283	2N6286	20	80	750/18k	10	2.0	10	4.0	160	11	
2N6284	2N6287	20	100	750/18k	10	2.0	10	4.0	160	11	

High Voltage Transistors

The high-voltage devices are intended for industrial, commercial and military equipment. Typical applications include high-voltage differential and operational amplifiers, high-voltage inverters, low and medium current switching and series regulators. The devices are listed in decreasing order of V_{CE0} and I_C continuous.

Device and Polarity		I_C Amp Max	h_{FE}		I_C Amp	$V_{CE}^{(sat)}$ Volts Max		f_T MHz Min	P_D Watts Max	Case
NPN	PNP		Min/Max	@		@	@			
800 Volts										
	MJ804	5.0	2.2/ -		3.5			1.5	100	11
750 Volts										
	BU108	5.0				5.0	4.5	7.5	56	11
	BU208	5.0				5.0	4.5	7.5	56	11
	MJ205	2.5	2/ -		2.5	5.0	2.5	7.5	10	11
	BU205	2.5	2/ -		2.5	5.0	2.5	7.5	10	11
550 Volts										
	MJ3760	8.0				5.0	8.0	7.5	80	11
	MJ3761	6.0				5.0	8.0	7.5	80	11
400 Volts										
	MJ7261	15	25/ 100		5.0	1.0	5.0	30	175	11
	2N6547	15	6/ 35		10	1.5	10	6.0	175	11
	MJ7161	8.0	25/ 100		3.0	1.0	3.0	30	140	11
	2N6545	8.0	7/ 35		5.0	1.5	5.0	6.0	125	11
	2N6543	5.0	7/ 35		3.0	1.0	3.0	6.0	100	11
	MJ425	5.0	30/ 90		1.0	0.8	1.0	2.5	100	11
	2N3902	3.5	30/ 90		1.0	0.8	1.0	2.8	100	11
350 Volts										
	2N6251	15	6.0/ 50		10	1.5	10	2.5	175	11
	2N6308	8.0	12/ 60		3.0	5.0	1.5	3.0	125	11
	2N6499	5.0	10/ 75		2.5	1.5	2.5	5.0	80	199
	MJE53	5.0	30/ -		0.3	2.0	5.0	2.5	80	199
	MJE49	1.5	30/ 250		0.3	1.0	1.0	5.0	50	199
	2N3439	1.0	40/ 160		0.02	0.5	0.05	15	5.0	79
	MJE5657	0.5	30/ 250		0.1	1.0	0.1	10	30	199
	2N5657	0.5	30/ 250		0.1	1.0	0.1	10	20	77
	MJE3439	0.3	40/ 160		0.02	0.5	0.05	15	15	77
325 Volts										
	MJ423	10	30/ 90		1.0	0.8	1.0	2.5	125	11
	MJ413	10	20/ 80		0.5	0.8	0.5	2.5	125	11
	2N6235	5.0	25/ 125		1.0	0.5	1.0	20	50	80
300 Volts										
	MJ7260	15	25/ 100		5.0	1.0	5.0	30	175	11
	2N6546	15	6/ 35		10	1.5	10	6.0	175	11
	2N6307	8.0	15/ 75		3.0	1.0	3.0	5.0	125	11
	MJ7160	8.0	25/ 100		3.0	1.0	3.0	30	140	11
	2N6544	8.0	7/ 35		5.0	1.5	5.0	6.0	125	11
	MJE52	5.0	30/ -		0.3	2.0	5.0	2.5	80	199
	2N6542	5.0	7/ 35		3.0	1.0	3.0	6.0	100	11
	2N6498	5.0	10/ 75		2.5	1.5	2.5	5.0	80	199
	2N3585	2.0	8/ 80		1.0	0.75	1.0	10	35	80
	2N4240	2.0	10/ 100		0.75	1.0	0.75	15	35	80
	MJE48	1.5	30/ 250		0.3	1.0	1.0	5.0	50	199
	MJE2160	1.5	30/ 240		0.5	3.5	0.5	50	50	199
	2N3739	1.0	40/ 200		0.1	2.5	0.25	10	20	80
		1.0	30/ 120		0.05	2.5	0.05	15	10	79
	2N5656	0.5	30/ 250		0.1	1.0	0.1	10	20	77
	MJE5656	0.5	30/ 250		0.1	1.0	0.1	10	30	199
	MJE340K	0.5	30/ 240		0.05			30	30	199
	MJE340	0.5	30/ 240		0.05			20	20	77

SILICON POWER TRANSISTORS (Continued)

HIGH VOLTAGE TRANSISTORS (continued)

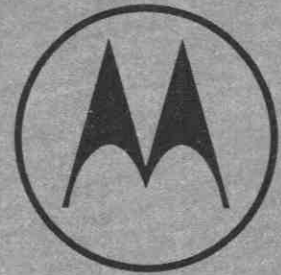
Device and Polarity		I _C Amp Max	h _{FE} Min/Max	@ I _C Amp	V _{CE (sat)} Volts Max	@ I _C Amp	f _T MHz Min	P _O Watts Max	Case
NPN	PNP								
275 Volts									
		15	8.0/ 50	10	1.5	10	2.5	175	11
		5.0	25/ 125	1.0	0.5	1.0	20	50	80
250 Volts									
		8.0	15/ 75	3.0	0.8	3.0	5.0	125	11
		5.0	10/ 75	2.5	1.5	2.5	5.0	80	199
		5.0	30/ -	0.3	2.0	5.0	2.5	80	199
	2N6421	2.0	8.0/ 80	1.0	0.75	1.0	10	35	80
		1.5	30/ 250	0.3	1.0	1.0	5.0	50	199
		1.0	40/ 160	0.02	0.5	0.05	15	5.0	79
		0.5	30/ 250	0.1	1.0	0.1	10	20	77
		0.5	30/ 250	0.1	1.0	0.1	10	30	199
		0.3	40/ 160	0.02	0.5	0.05	15	15	77
225 Volts									
		5.0	25/ 125	1.0	1.0	1.0	20	50	80
	2N6424	1.0	40/ 200	0.1	2.5	0.25	10	20	80
200 Volts									
		15	10/ 50	10	1.5	10	2.5	175	11
	MJ5415	1.0	30/ 150	0.05	2.5	0.05	15	10	79

High Power Voltage Regulators

The MPC1000 and MPC900 are complete solid state hybrid regulators in a metal hermetic package. Specifications and performance of the MPC1000 positive voltage regulator and the MPC900 negative voltage regulator are nearly identical.

For systems requiring both a positive and a negative power supply, these devices are excellent for use as complementary regulators and offer the advantage of operation with a common ground. The devices are designed to deliver load current to 10 Adc. Output current capability can be increased further through use of one or more external pass transistors. They are specified for operation over the junction temperature range (-55 to +175°C).

Device and Polarity		V _O Volts		I _L A	V _{in1} - V _O Volts		V _{in} Volts		I _B mA	Reg _{in} % V _O /V _{in}	Reg _L % V _O	P _O Watts	Case
NPN	PNP	Min	Max	Max	Min	Max	Min	Max	Max	Max	Max	Max	
MPC1000		2.0	35	10	3.0	60	9.5	40	5.0	0.5	0.6	100	662-01
	MPC900	-4.0	-30	10	2.5	30	-9.0	35	20	0.5	0.6	100	662-01



SMALL-SIGNAL METAL TRANSISTORS

Silicon Small-Signal Transistors

500 AND GROWING! That phrase aptly describes the number of different classifications in Motorola's line of small-signal transistors. And with this many device type numbers covering the small-signal transistor spectrum, it is apparent that the actual differences between some devices becomes quite small. Even when the line is divided into its two natural categories — plastic for lowest cost, and metal for hermeticity — the sheer number of devices in each category makes selection by spec-for-spec comparison a significant task. This selector guide, therefore, ignores the large bulk of general-purpose, small-signal type numbers and concentrates on those transistors that have emerged as the best values in various applications categories.

Since the devices highlighted here are the most popular in each category, it follows that they are among the most widely available, at the lowest cost. They are particularly well-suited for new designs where a continuous, off-the-shelf supply of product is required.

The reader is reminded, however, that semiconductors are manufactured by "batch" processes, and that each "batch" may yield devices with widely varying parameters. This creates device "families". While the various specifications limits assigned to "family members" have been selected on the basis of demonstrated industry need, modern testing methods have made the selection of devices with special characteristics simple and inexpensive. Where the specified characteristics of the "preferred" devices listed in the following selector guides do not meet a particular design requirement, the designer is requested to contact his nearest Motorola sales representative for price quotations on special devices to fit his needs.

TABLE OF CONTENTS

	Page
Small-Signal Metal Transistors	
Switching Transistors	
... for use in general-purpose amplifiers and switching applications	4-15
High-Gain Low-Noise Transistors	
... for low-noise, low-level amplifier applications	4-17
High-Voltage Amplifiers	
... for use in general-purpose, high voltage applications	4-17
High-Frequency Amplifier/Oscillators	
... high-frequency power oscillators, multipliers and driver applications	4-18
General-Purpose Amplifiers	
... for use in general purpose amplifier and switching applications	4-19

SMALL-SIGNAL METAL TRANSISTORS (Continued)

The following index reflects the devices characterized in this section. To locate the exact page number, see Catalog Index (Page 7-1).

INDEX

Switching Transistors

NPN

2N2206
2N2319
2N2368
2N2369
2N2369A
2N2539
2N2540
2N2845
2N3011
2N3227
2N3252S
2N3253S
2N3444S
2N3506
2N3507
2N3508
2N3509
2N3647
2N3648
2N3724
2N3725
2N3734
2N3735
2N3736
2N3737
2N4013
2N4014
2N5859
2N5861
MM3220
MM3734
MM3736
MM3737
MM5189
MM5262

PNP

2N869A
2N3012
2N3244S
2N3245S
2N3249
2N3468S
2N3546
2N3634S
2N3635S
2N3636S
2N3762S
2N3763S
2N4208
2N4209
2N4404
2N4405
2N4406
2N4407
2N4890
2N4929S
MM3726
MM4001
MM4005
MM4006
MM4007
MM4030
MM4031
MM4032
MM4033
MM4036
MM4037
MM4257
MM4258

High-Gain Low-Noise

NPN

2N929
2N930
2N930A
2N2483
2N2484
MM2484

Darlington

NPN

MM6427

PNP

2N3798
2N3799

High Voltage Amplifiers

NPN

2N657S
2N1190S
2N3114S
2N3498S
2N3499S
2N3500S
2N3501S
2N3712S
2N3742S
2N4924S
2N4926
2N4927
2N5058S
2N5059S
MM2258
MM2259
MM3000
MM3001
MM3002
MM3003
MM3005
MM3006
MM3007
MM3008
MM3009

PNP

2N3494S
2N3495S
2N3496
2N3497
2N3634S
2N3635S
2N3637S
2N3743S
2N4404
2N4405
2N4890
2N4928
2N4929S
2N4930
2N4931S
MM4000
MM4001
MM4002
MM4003
MM4009
MM4010
MM4036
MM4037
MM5005
MM5006
MM5007

High-Frequency Amplifiers/Oscillators

NPN

2N917
2N918
2N3544
MM1941

PNP

2N3307
2N3308
2N4260
2N4261

General-Purpose Amplifiers

NPN

2N656
2N697S
2N699
2N717
2N718
2N843
2N915
2N916
2N956
2N1613S
2N1613AS
2N1711S
2N1711AS
2N1890S
2N1893S
2N2102S
2N2193AS
2N2218S
2N2218AS
22219S
2N2219AS
2N2221
2N2221A
2N2222
2N2222A
2N2270S
2N2297S
2N2789S
2N2951S
2N2959S
2N3019S
2N3020S
2N3053S
2N3053AS
2N3110S
2N3299S
2N3300S
2N3301
2N3302
2N3946
2N3947
2N4450
2N5581
2N5582
MM3019
MM3020
MM3053
MM3903
MM3904

PNP

2N1131S
2N1131AS
2N1132
2N1132A

2N1991S
2N2800S
2N2904S
2N2904AS
2N2905S
2N2905AS
2N2906
2N2906A
2N2907
2N2907A
2N3073
2N3133S
2N3135
2N3250
2N3250A
2N3251
2N3251A
2N3485
2N3485A
2N3486
2N3486A
2N3673
MM3905
MM3906
MM4008

Switching Transistors

The transistors listed below detail Motorola's Silicon Transistors. Prime devices are shown in Bold Face Type. Devices are listed in order of decreasing turn-on time (t_{on}).

Package	Family	Device Type	t_{on} ns Max	& t_{off} ns Max	@ I_c mA	V_{CE0} Volts Min	I_c mA Max	h_{FE} @ I_c mA Min	Volts @ $V_{CE(sat)}$ Max	I_c mA	I_b mA	f_T MHz Min	@ I_c mA	
NPN														
TO-18	5	2N2845	40	40	150	30	—	30	0.4	150	15	250	50	
		2N2540	40	40	150	30	—	100	0.45	150	15	250	20	
		2N2539	40	40	150	30	—	50	0.45	150	15	250	20	
TO-5	22	2N3507S	45	90	1500	50	3000	30	1.0	1500	150	60	100	
		2N3506S	45	90	1500	40	3000	40	1.0	1500	150	60	100	
TO-52	27	2N3444S	50	70	500	50	—	20	0.6	500	50	175	50	
		2N3253S	50	70	500	40	—	25	0.6	500	50	175	50	
		2N3252S	45	70	500	30	—	30	0.5	500	50	200	50	
TO-39		2N3725	35	60	500	50	2000	35	0.52	500	50	300	50	
		2N3724	35	60	500	30	2000	35	0.42	500	50	300	50	
		2N3735	48	60	1000	75	1500	20	0.5	500	50	250	50	
		2N3734	48	60	1000	50	1500	30	0.5	500	50	250	50	
		MM5189	40	70	—	40	2000	20	1.0	1000	100	350 (typ)	50	
		2N5859	35	60	1000	40	2000	15	0.4	500	50	250	50	
		MM3734	35	60	1000	30	1500	25	0.5	500	50	200	50	
		MM5262	30	60	1000	50	2000	25	0.8	1000	100	350 (typ)	50	
		2N5861	25	60	500	50	2000	25	0.5	500	50	200	50	
		TO-18		2N4014	35	60	500	50	1000	35	0.52	500	50	300	50
		2N4013	35	60	500	30	1000	35	0.42	500	50	300	50	
TO-18	73	2N3011	15	20	30	12	200	25	0.25	30	3.0	400	20	
		2N3227	12	18	100	20	500	30	0.25	10	1.0	500	10	
		2N2369	12	18	100	15	500	20	0.25	10	1.0	500	10	
		2N2369A	12	18	10	15	200	40	0.2	10	1.0	500	10	
		2N2368	12	15	10	15	—	20	0.25	10	1.0	400	10	
		2N2319	60	50	20	15	200	40	0.35	20	1.0	300	10	
		2N2206	40	75	10	12	200	40	0.220	10	1.0	200	10	
2N3508	12	18	10	20	500	40	0.25	10	1.0	500	10			
2N3509	12	18	10	20	500	100	0.25	10	1.0	500	10			
TO-46	81	2N3647	20	25	150	10	500	25	0.4	150	15	350	15	
		2N3648	16	18	150	15	500	30	0.4	150	15	450	15	
TO-46	99	2N3737	48	60	1000	50	1500	20	0.5	500	50	250	50	
		2N3736	48	60	1000	30	1500	30	0.5	500	50	250	50	
		MM3737	45	65	1000	50	1500	20	0.5	500	50	200	50	
		MM3736	45	65	1000	30	1500	30	0.5	500	50	200	50	

SMALL-SIGNAL METAL TRANSISTORS (Continued)

Switching Transistors (Continued)

Package	Family	Device Type	t_{on} & t_{off}		I_C	V_{CE0}	I_C	h_{FE}	I_C	$V_{CE(sat)}$			f_T	
			ns	ns						Volts	@ I_C	& I_B	MHz	@ I_C
			Max	Max	mA	Min	Max	Min	mA	Max	mA	mA	Min	mA
PNP														
TO-18	44	2N3249	90	100	10	12	—	100	10	0.125	10	1.0	300	20
		2N869A	50	80	30	18	200	40	30	0.2	30	3.0	400	10
		2N2894	60	90	30	12	200	40	30	0.2	30	3.0	400	30
		2N3012	60	75	30	12	200	30	30	0.2	30	3.0	400	30
TO-18	45	2N3546	40	30	50	12	—	25	50	0.25	50	5.0	700	10
TO-39	50	2N4890S	100	270	150	40	500	50	150	1.4	150	15	100	50
		MM4036	75	175	150	65	1000	40	150	0.65	150	15	60	50
		MM4037	75	175	150	40	1000	50	150	1.4	150	15	60	50
		2N4405	40	210	500	80	1000	25	500	0.5	500	50	200	50
		2N4404	40	210	500	80	1000	15	500	0.5	500	50	200	50
TO-39	56	MM4031	100	240 (typ)	500	80	1000	25	500	0.5	500	50	100	50
		MM4033	100	240 (typ)	500	80	1000	70	500	0.5	500	50	150	50
		MM4032	100	240 (typ)	500	60	1000	70	500	0.5	500	50	150	50
		MM4030	100	240 (typ)	500	60	1000	25	500	0.5	500	50	100	50
		2N4407	75	225	1000	80	2000	15	1000	0.7	1000	100	150	50
		2N4406	75	225	1000	80	2000	10	1000	0.7	1000	100	150	50
		MM4007	—	—	—	100	1000	50	150	0.1 (typ)	150	15	50	50
		MM4006	—	—	—	80	1000	50	150	0.1 (typ)	150	15	50	50
		MM4005	—	—	—	60	1000	50	150	0.1 (typ)	150	15	50	50
TO-39	60	2N3763S	43	115	1000	60	1500	20	1000	0.9	1000	100	150	50
		2N3762S	43	115	1000	40	1500	30	1000	0.9	1000	100	180	50
TO-39	337	2N3245S	55	165	500	50	1000	30	500	0.6	500	50	150	50
		2N3244S	50	185	500	40	1000	50	500	0.5	500	50	175	50
		2N3468S	40	90	500	50	1000	25	500	0.6	500	50	150	50
		2N3467S	40	90	500	40	100	40	500	0.5	500	50	175	50
		MM3726	35	60	1000	50	1500	15	1000	1.2	1000	100	200	50
TO-18	345	2N4209	15	20	10	15	200	50	10	0.18	10	1.0	850	10
		2N4208	15	20	10	12	200	30	10	0.15	10	1.0	700	10
		MM4258	15	20	10	12	80	30	10	0.15	10	1.0	700	10
		MM4257	15	15	10	6.0	80	30	10	0.15	10	1.0	500	10
TO-39	454	2N3636S	400	600	50	175	1000	50	50	0.5	50	5.0	150	30
		2N3635S	400	600	50	140	1000	100	50	0.5	50	5.0	200	30
		2N3634S	400	600	50	140	1000	50	50	0.5	50	5.0	150	30
		2N4929S	—	—	—	150	500	25	10	0.5	10	1.0	100	20
		MM4001	—	—	—	150	500	20	10	0.6	10	1.0	—	—

High-Gain Low-Noise Transistors

The transistors are characterized for high-gain and low-noise applications. Devices are listed in decreasing order of NF.

Package	Family	Device Type	NF Wideband Typ* Max dB	BV _{CEO} Volts Min	I _C mA Max	h _{FE}		I _C μA mA*	f _T MHz	
						Min	Max		@	I _C mA
NPN										
TO-18	18	2N2483	8.0*	60	50	40	120	10	12	0.05
		2N2484	8.0*	60	50	100	500	10	15	0.05
		2N929	4.0	45	30	40	120	10	30	0.5
		2N930A	3.0	45	30	100	300	10	45	0.5
		2N930	3.0	45	30	100	300	10	30	0.5
NPN DARLINGTON										
TO-18	914	MM6427	—	40	300	5000	—	10*	125	100
PNP										
TO-18	55	2N3798	3.5	60	50	150	450	500	30	0.5
		2N3799	2.5	60	50	300	900	500	30	0.5

High-Voltage Amplifiers

The following table lists Motorola standard devices that have high Collector-Emitter Breakdown Voltage. Prime devices are shown in Bold Face Type. Devices are listed in decreasing order of BV_{CEO}.

Package	Family	Device Type	BV _{CEO} Volts Min	I _C mA Max	h _{FE}		V _{CE(sat)} Volts Max	I _C mA	I _B mA	f _T MHz	
					Min	@ I _C mA				@	I _C mA
NPN											
TO-39	6	MM3009	180	400	40	10	—	—	—	50	20
		MM3008	120	400	40	10	—	—	—	50	20
TO-39	26R	MM2259	175	300	35	10	0.4	25	2.5	150	20
		2N3501S	150	300	100	150	0.4	150	15	150	20
		2N3500S	150	300	40	150	0.4	150	15	150	20
		2N3114S	150	200	30	30	1.0	50	5.0	40	30
		2N3712S	150	200	30	30	2.0	50	5.0	40	30
		MM3001	150	200	20	10	—	—	—	150	10
		MM2258	120	500	50	10	0.4	25	2.5	150	20
		2N3499S	100	500	100	150	0.6	300	30	150	20
		2N3498S	100	500	40	150	0.6	300	30	150	20
		2N4924S	100	200	40	150	0.4	50	5.0	100	20
		2N657S	100	—	30	200	4.0	200	40	—	—
2N1990S	—	1000	20	30	0.5	2.0	0.2	—	—		
TO-39	88	MM3007	100	2500	50	250	0.35	150	15	50	50
		MM3006	80	2500	50	200	0.35	150	15	50	50
		MM3005	60	2500	50	150	0.35	150	15	50	50
TO-39	210R	2N5058S	300	150	35	30	1.0	30	3.0	30	10
		2N3742S	300	50	20	30	1.0	30	3.0	30	10
		2N5059S	250	150	30	30	1.0	30	3.0	30	10
		2N4927	250	50	20	30	2.0	30	3.0	30	10
		MM3003	250	50	20	10	—	—	—	150	10
		2N4926	200	50	20	30	2.0	30	3.0	30	10
		MM3002	200	50	20	10	—	—	—	150	10

SMALL-SIGNAL METAL TRANSISTORS (Continued)

High-Voltage Amplifiers (Continued)

Package	Family	Device Type	V_{CE0} Volts Min	I_C mA Max	h_{FE} Min	@ I_C mA	$V_{CE(sat)}$ Volts Max	@ I_C mA	I_S mA	f_T MHz Min	@ I_C mA
PNP											
TO-39	46	2N3495S	120	100	40	10	0.35	10	1.0	150	20
		2N4928S	100	100	25	10	0.5	10	1.0	100	20
		MM4000	100	100	20	10	0.6	10	1.0	—	—
		2N3494S	80	100	40	10	0.3	10	1.0	200	20
TO-18	47	2N3497	120	100	40	10	0.35	10	1.0	150	20
		2N3496	80	100	40	10	0.3	10	1.0	200	20
TO-39	49	MM4010	100	500	75	10	0.2 (typ)	10	1.0	150 (typ)	20
		MM5007	100	2000	50	250	0.5	150	15	30	50
		MM4009	80	500	75	10	0.2 (typ)	10	1.0	150 (typ)	20
		MM5006	80	2000	50	200	0.5	150	15	30	50
		MM5005	60	2000	50	150	0.5	150	15	30	50
TO-39	50	2N4405	80	1000	100	150	0.2	150	15	200	50
		2N4404	80	1000	40	150	0.2	150	15	200	50
		MM4036	65	1000	20	150	0.65	150	15	60	50
		MM4037	40	1000	50	150	1.4	150	15	60	50
		2N4890S	40	500	50	150	1.4	150	15	100	50
TO-39	452R	2N3743S	300	50	25	30	8.0	30	3.0	30	10
		2N4931S	250	500	20	20	5.0	10	1.0	20	20
		MM4003	250	500	20	10	5.0	10	1.0	—	—
		2N4930S	200	500	20	20	5.0	10	1.0	20	20
		MM4002	200	500	20	10	5.0	10	1.0	—	—
TO-39	454R	2N3637S	175	1000	100	50	0.5	50	5.0	200	30
		2N3636S	175	1000	50	50	0.5	50	5.0	150	30
		2N4929S	150	500	25	10	0.5	10	1.0	100	20
		MM4001	150	500	20	10	0.6	10	1.0	—	—
		2N3635S	140	1000	100	50	0.5	50	5.0	200	30
		2N3634S	140	1000	50	50	0.5	50	5.0	150	30

High-Frequency Amplifiers/ Oscillators

The transistors shown are designed for use as both oscillators and amplifiers at UHF and VHF frequencies. Devices are listed in decreasing order of V_{CE0} .

Package	Family	Device Type	V_{CE0} Volts Min	h_{FE} Min	@ I_C mA	G_{ps} dB Min	NF dB Max	@ f MHz	f_T MHz Min	@ I_C mA	C_{ob} pF Max
NPN											
TO-72	72	2N917	15	20	3.0	9.0	6.0	60	500	4.0	1.7
		2N918	15	20	3.0	15	6.0	60	600	4.0	1.7
TO-38	75	2N3544	25	25	10	—	—	—	600	10	2.5
		MM1941	20	25	10	7.0	—	—	600	10	2.5
PNP											
TO-18	63	2N3307	35	40	2.0	17	4.5	200	300	2.0	1.3
		2N3308	25	25	2.0	17	6.0	200	300	2.0	1.6
TO-72	65	2N4261	15	30	10	—	—	—	1600	10	2.5
		2N4260	15	30	10	—	—	—	2000	10	2.5

General-Purpose Amplifiers

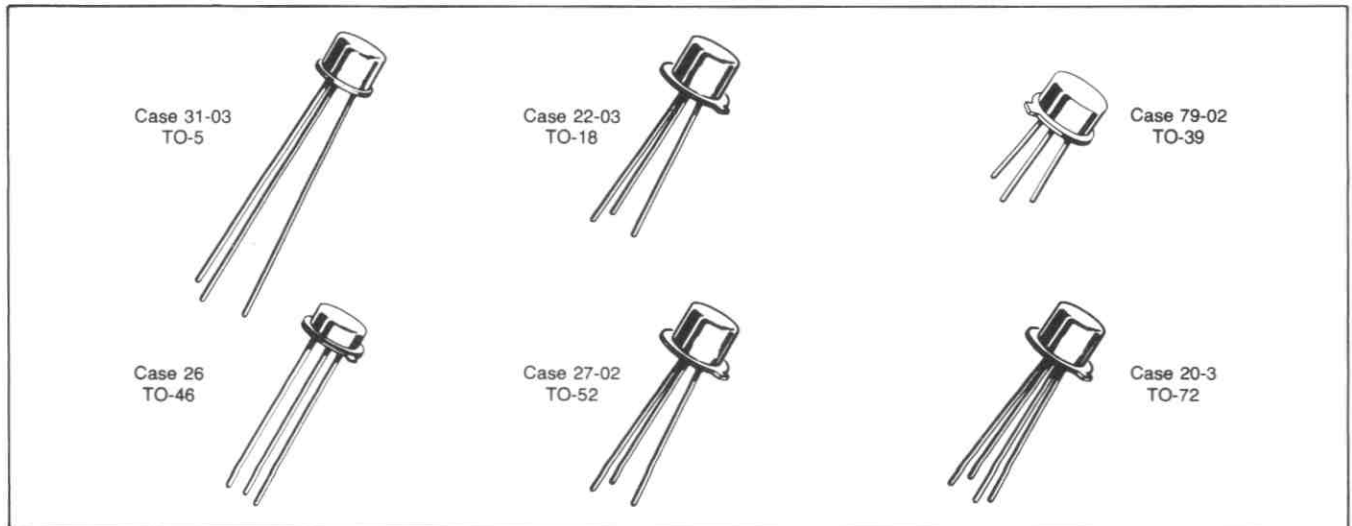
These transistors are designed for high speed switching circuits, dc to VHF amplifier applications and complementary circuitry. Prime devices are shown in Bold Face Type. Devices are listed in decreasing order of BV_{CEO} .

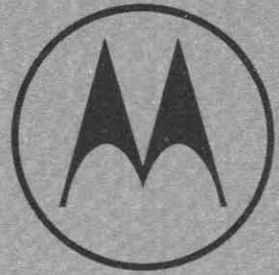
Package	Family	Device Type	BV_{CEO} Volts Min	f_r MHz Min	@ I_c mA	I_c mA Max	h_{FE}		@ I_c mA		
							Min	Max			
NPN											
TO-39	2R	2N2959S	60	250	20	600	100	300	150		
		2N2951S	60	200	10	250	20	150	10		
		2N1711S	80	70	50	—	100	300	150		
		2N1613S	50	60	50	500	40	120	150		
		2N2219AS	40	300	20	800	100	300	150		
		2N2218AS	40	250	20	800	40	120	150		
		2N697S	40	50	50	—	40	120	150		
		2N2789S	35	250	20	800	100	300	150		
		2N3299S	30	250	50	500	40	120	150		
		2N3300S	30	250	50	500	100	300	150		
		2N2218S	30	250	20	800	40	120	150		
		2N2219S	30	250	20	800	100	300	150		
		TO-46	2S	2N5582	40	300	20	800	100	300	150
				2N5581	40	250	20	800	40	120	150
2N4450	30			250	50	500	100	300	150		
TO-18	3	2N956	50	70	50	—	40	120	150		
		2N843	45	40	10	800	45	150	10		
		2N2222A	40	300	20	800	100	300	150		
		2N2221A	40	250	20	800	40	120	150		
		2N718	40	50	50	—	40	120	150		
		2N717	40	40	50	500	20	60	150		
		2N3301	30	250	50	500	40	120	150		
		2N3302	30	250	50	500	100	300	150		
		2N2221	30	250	20	800	40	120	150		
		2N2222	30	250	20	800	100	300	150		
		TO-39	14R	2N3019S	80	100	50	1000	100	300	150
2N3020S	80			80	50	1000	40	120	150		
2N699	80			50	50	—	40	120	150		
2N1893S	80			50	50	500	40	120	150		
2N2102S	65			60	50	1000	40	120	150		
2N3053AS	60			100	50	700	50	250	150		
2N1890S	60			60	50	500	100	300	150		
2N656S	60			—	—	—	30	90	200		
MM3053	50			100	50	1000	40	300	150		
2N2193AS	50			50	50	1000	40	120	150		
2N2270S	45			100	50	1000	50	200	150		
2N3110S	40			600	10	1000	40	120	150		
2N3053S	40			100	50	700	50	250	150		
2N2297S	35			60	50	1000	40	120	150		
TO-18	23			2N915	50	250	10	—	50	200	10
		2N3946	40	300	10	200	50	150	10		
		2N3947	40	300	10	200	100	300	10		
		2N916	25	300	10	—	50	200	10		
TO-52	221	MM3904	40	300	10	200	100	300	10		
		MM3903	40	250	10	200	50	150	10		

SMALL-SIGNAL METAL TRANSISTORS (Continued)

General - Purpose Amplifiers (Continued)

Package	Family	Device Type	BV _{CEO} Volts Min	f _r MHz Min	@ I _c mA	I _c mA Max	h _{FE}		@ I _c mA		
							Min	Max			
PNP											
TO-18	35	2N3251A	60	300	10	200	100	300	10		
		2N3250A	60	250	10	200	50	150	10		
		2N3251	40	300	10	200	100	300	10		
		2N3250	40	250	10	200	50	150	10		
TO-46	48	2N3485A	60	200	50	600	40	120	150		
		2N3486A	60	200	50	600	100	300	150		
		2N3673	50	200	50	600	75	225	150		
		2N3486	40	200	50	600	100	300	150		
TO-18	333	2N2906A	60	200	50	600	40	120	150		
		2N2907A	60	200	50	600	100	300	150		
		2N3073	60	130	50	500	30	130	50		
		2N3135	50	200	50	600	40	120	150		
		2N2906	40	200	50	600	40	120	150		
		2N2907	40	200	50	600	100	300	150		
		TO-39		2N2904AS	60	200	50	600	40	120	150
				2N2905AS	60	200	50	600	100	300	150
				MM4008	60	325 (typ)	20	500	75	—	10
				2N3133S	50	200	50	600	40	120	150
2N2904S	40			200	50	600	40	120	150		
2N2905S	40			200	50	600	100	300	150		
2N1132AS	40			60	50	600	30	90	150		
2N1131AS	40			50	50	600	30	90	150		
2N2800S	35			120	50	800	30	90	150		
2N1132S	35			60	50	600	30	90	150		
2N1131S	35	50	50	600	30	90	150				
2N1991S	20	40	50	600	15	60	150				
TO-52	271	MM3906	40	250	10	200	100	300	10		
		MM3905	40	200	10	200	50	150	10		





SMALL-SIGNAL PLASTIC-ENCAPSULATED TRANSISTORS

Plastic-Encapsulated Small-Signal Transistors for Industrial and Consumer applications

The Small-Signal Plastic Transistors represent Motorola's broadest product line. From RF/VHF/UHF amplifiers, mixers, oscillators and switches to general-purpose amplifiers and switches, all are available as standard product or custom specials. Specialty devices for the industrial, computer or consumer market as well as specialty packages — Duowatt and Uniwatt — are all available for unique high technology applications. The following list demonstrates the many applications possible with plastic transistors. If specific applications are not listed, consult your factory representative for assistance.

TABLE OF CONTENTS

	Page
General-Purpose Amplifiers and Switches	
... a quick reference guide of the most popular NPN and PNP general purpose devices	4-24
RF/UHF/VHF Amplifiers and CATV Transistors	
... for high frequency applications	4-25
High-Speed Saturated Switching Transistors	
... for high-speed saturated switching applications	4-25
General-Purpose Transistors	
... for general purpose amplifiers and switches	4-26
Low-Noise Amplifier Transistors	
... for low-noise audio amplifiers	4-27
High-Voltage Transistors	
... for high-voltage amplifier and driver applications	4-27
Medium-Power (Uniwatt and Duowatt) Transistors	
... for high voltage and high current amplifiers and switches	4-28

PLASTIC ENCAPSULATED SMALL-SIGNAL TRANSISTORS (Continued)

The following index reflects the devices characterized in this section. To locate the exact page number, see Catalog Index (Page 7-1).

INDEX

2N3903	MPS2222	MPS-D01
2N3904	MPS2369	MPS-D02
2N3905	MPS2907	MPS-D03
2N3906	MPS3639	MPS-D05
2N4123	MPS3640	MPS-D06
2N4124	MPS3646	MPS-D51
2N4125	MPS3702	MPS-D52
2N4126	MPS3704	MPS-D53
2N4264	MPS6507	MPS-D55
2N4265	MPS6511	MPS-D56
2N4400	MPS6514	MPS-H02
2N4401	MPS6515	MPS-H04
2N4402	MPS6518	MPS-H05
2N4403	MPS6519	MPS-H07
2N5086	MPS6520	MPS-H08
2N5087	MPS6521	MPS-H10
2N5088	MPS6522	MPS-H11
2N5089	MPS6523	MPS-H17
2N5209	MPS6531	MPS-H20
2N5210	MPS6534	MPS-H24
2N5220	MPS6535	MPS-H30
2N5221	MPS6541	MPS-H31
2N5225	MPS6543	MPS-H32
2N5226	MPS6546	MPS-H34
2N5400	MPS6547	MPS-H37
2N5401	MPS6566	MPS-H54
2N5402	MPS6568	MPS-H55
2N5403	MPS6569	MPS-H81
2N5500	MPS6570	MPS-H83
2N5551	MPS6571	MPS-H85
2N6548	MPS8097	MPS-L01
2N6549	MPS8098	MPS-L51
2N6515	MPS8099	MPS-U01
2N6516	MPS8500	MPS-U01A
2N6517	MPS8598	MPS-U03
2N6518	MPS-A05	MPS-U04
2N6519	MPS-A06	MPS-U05
2N6520	MPS-A09	MPS-U06
2N6551	MPS-A17	MPS-U07
2N6552	MPS-A18	MPS-U10
2N6553	MPS-A19	MPS-U45
2N6554	MPS-A20	MPS-U51
2N6555	MPS-A42	MPS-U51A
2N6556	MPS-A43	MPS-U52
2N6557	MPS-A55	MPS-U55
2N6558	MPS-A56	MPS-U56
2N6559	MPS-A70	MPS-U57
MPS706,A	MPS-A92	MPS-U60
MPS834	MPS-A93	MPS-U95
MPS835		

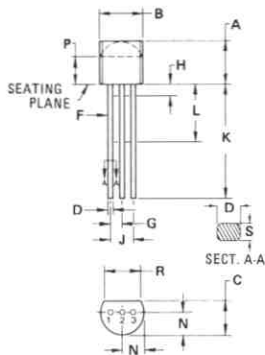
PLASTIC ENCAPSULATED SMALL-SIGNAL TRANSISTORS (Continued)

This Selector Guide is designed to help you select the right silicon plastic transistor for your applications. A wide range of device types in three basic package configurations are listed in this Selector Guide.

The TO-92 — is the most popular, high-volume plastic package and will meet most of your high-performance, low-cost requirements.

The Uniwatt/Duowatt Package — is designed for applications requiring greater power dissipation than available with the TO-92 package.

MOTOROLA PLASTIC PACKAGE OUTLINES



Case 29-02
TO-92

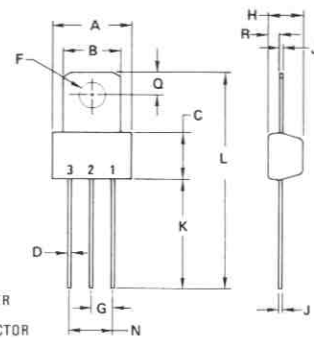
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.32	5.33	0.170	0.210
B	4.44	5.21	0.175	0.205
C	3.18	4.19	0.125	0.165
D	0.41	0.56	0.016	0.022
F	0.41	0.48	0.016	0.019
G	1.14	1.40	0.045	0.055
H	—	2.54	—	0.100
J	2.41	2.67	0.095	0.105
K	12.70	—	0.500	—
L	6.35	—	0.250	—
N	2.03	2.92	0.080	0.115
P	2.92	—	0.115	—
R	3.43	—	0.135	—
S	0.36	0.41	0.014	0.016

All JEDEC dimensions and notes apply.



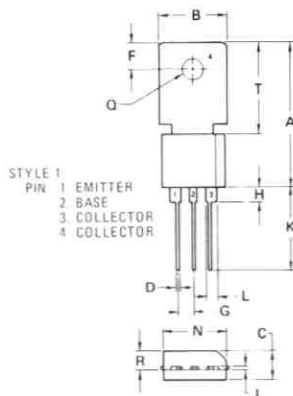
STYLE 1:
PIN 1. EMITTER
2. BASE
3. COLLECTOR

Uniwatt
Case 152-02

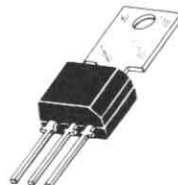


DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.14	9.53	0.360	0.375
B	6.60	7.24	0.260	0.285
C	5.41	5.66	0.213	0.223
D	0.38	0.53	0.015	0.021
F	3.18	3.33	0.125	0.131
G	2.54 BSC	—	0.100 BSC	—
H	3.94	4.19	0.155	0.165
J	0.36	0.41	0.014	0.016
K	12.07	12.70	0.475	0.500
L	25.02	25.53	0.985	1.005
N	—	5.08 BSC	—	0.200 BSC
Q	2.39	2.69	0.094	0.106
R	1.14	1.40	0.045	0.055

NOTE:
1. LEADS WITHIN 0.15 mm (0.006)
TOTAL OF TRUE POSITION
AT CASE, AT MAXIMUM
MATERIAL CONDITION.



STYLE 1:
PIN 1. EMITTER
2. BASE
3. COLLECTOR
4. COLLECTOR



Duowatt
Case 306-02

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	21.84	22.35	0.860	0.880
B	9.91	10.41	0.390	0.410
C	4.19	4.44	0.165	0.175
D	0.61	0.71	0.024	0.028
F	3.68	3.94	0.145	0.155
G	2.41	2.67	0.095	0.105
H	1.70	1.96	0.067	0.077
J	0.48	0.66	0.019	0.026
K	12.70	—	0.500	—
L	1.78	2.03	0.070	0.080
N	9.91	10.16	0.390	0.400
Q	3.56	3.81	0.140	0.150
R	2.41	2.67	0.095	0.105
T	13.21	13.97	0.520	0.550

General Purpose Amplifiers and Switches —TO-92 Package

Silicon transistors designed for use in complementary amplifier circuits. The transistors are listed in order of decreasing breakdown voltage (BV_{CE0}).

The following devices are the most popular consumer amplifier transistors:

Device and Polarity		BV_{CE0} Volts Min	f_T @ $I_C = 10$ mA MHz Min Typ*		I_C mA Max	h_{FE}		@	I_C mA
NPN	PNP		Min	Max		Min	Max		
MPS8098	MPS8598	60	200	500	100	300	10	10	
2N3903	2N3905	40	270*	200	50	150	10	10	
2N3904	2N3906	40	250	200	100	300	10	10	
MPS3903	MPS3905	40	150	200	50	150	10	10	
MPS3904	MPS3906	40	200	200	100	300	10	10	
2N4123	2N4125	30	250	200	50	150	2.0	2.0	
2N4124	2N4126	25	300	200	120	360	2.0	2.0	
MPS6515	MPS6519	25	100	—	250	500	2.0	2.0	

The following devices are the most popular consumer low-noise transistors:

Device and Polarity		BV_{CE0} Volts Min	f_T @ $I_C = 500$ μ A MHz Min		I_C mA Max	h_{FE}		@	I_C μ A	NF dB Typ
NPN	PNP		Min	Max		Min	Max			
MPS-A18		45	100	200	500	1500	10	4.0		
2N5088	2N5086	30	40	50	150	500	100	3.0		
2N5089	2N5087	25	40	50	250	800	100	2.0		

The following are the most popular industrial high-voltage and high current transistors:

Device and Polarity		BV_{CE0} Volts Min	f_T MHz Typ* @		I_C mA Max	h_{FE} @ $I_C = 10$ mA	
NPN	PNP		Min	I_C mA		Min	Max
2N5551	2N5401	160	100	10	600	80	250
2N5550	2N5400	140	100	10	—	40	180
MPS-A06	MPS-A56	80	100	100	500	50	—
MPS-A05	MPS-A55	60	100	100	500	50	—
2N4400	2N4402	40	200	20	—	40	—
2N4401	2N4403	40	250	20	—	40	—
MPS6531	MPS6534	40	390*	50	—	60	120

RF / UHF / VHF Amplifiers and CATV Transistors

The transistors listed below are the high performance, high frequency standard transistors available in the TO-92 plastic package. The transistors are listed in order of decreasing breakdown voltage (BV_{CE0}).

Device Type	BV_{CE0} Volts Min	h_{FE} Min	I_C mA	G_{dB} Typ# Min	NF dB	f MHz	V_{AGC} Typ* Min	Gain Reduction dB	f_T MHz Min	I_C mA	C_{cb} pF Max	
												@
NPN												
MPS-H04	80	30	1.5	—	2.0	1.0	—	—	80	1.5	1.6	
MPS-H05	80	30	1.5	—	2.0	1.0	—	—	80	1.5	1.6	
MPS-H34	45	15	20	—	—	—	—	—	500	15	0.32	
MPS-H37	40	25	5.0	—	—	—	—	—	300	5.0	100	
MPS-H07	30	20	3.0	18*	3.2	100	5.0*	30	400	3.0	0.3*	
MPS-H08	30	20	3.0	14*	3.5	200	5.0*	30	500	3.0	0.3*	
MPS-H20	30	25	4.0	—	—	—	—	—	400	4.0	0.65	
MPS-H24	30	30	8.0	—	—	—	—	—	400	8.0	0.36	
MPS-H32	30	27	4.0	22.5	3.3*	45	5.5#	30	300	4.0	0.22	
MPS-H10	25	60	4.0	—	—	—	—	—	650	4.0	0.7	
MPS-H11	25	60	4.0	—	—	—	—	—	650	4.0	0.7	
MPS-H19	25	45	4.0	—	—	—	—	—	300	4.0	0.65	
MPS-H02	20	20	4.0	20	3.3	200	4.0	30	375	4.0	0.5	
MPS-H30	20	20	4.0	22.5	6.0	45	4.4	30	300	4.0	0.65	
MPS-H31	20	20	4.0	22.5	6.0	45	5.2	30	300	4.0	0.65	
MPS-H17	15	25	5.0	24#	6.0	200	—	—	800	5.0	0.9	

PNP												
Device Type	BV_{CE0} Volts Min	h_{FE} Min	I_C mA	G_{dB} Typ# Min	NF dB	f MHz	V_{AGC} Typ* Min	Gain Reduction dB	f_T MHz Min	I_C mA	C_{cb} pF Max	
MPS-H54	80	30	1.5	—	2.0	1.0	—	—	80	1.5	1.6	
MPS-H55	80	30	1.5	—	2.0	1.0	—	—	80	1.5	1.6	
MPS-H83	30	20	2.5	10*	6.5	850	4.5*	30	600	2.5	0.3*	
MPS-H85	30	20	2.5	14*	6.5	200	—	—	350	2.5	0.2*	
MPS6543	25	25	4.0	—	—	—	—	—	750	4.0	—	
MPS6546	25	20	2.0	—	—	—	—	—	600	2.0	0.45*	
MPS6547	25	20	2.0	20	—	100	—	—	600	2.0	0.35*	
MPS6568	20	20	4.0	20	3.3	200	4.0	30	375	4.0	0.5	
MPS6569	20	20	4.0	20	6.0	45	4.4	30	300	4.0	0.5	
MPS6570	20	20	4.0	20	6.0	4.5	5.2	30	300	4.0	0.5	
MPS6507	20	25	2.0	—	—	—	—	—	700	10	—	
MPS6511	20	25	10	30	—	4.5	—	—	—	—	—	
MPS6541	20	25	4.0	—	—	—	—	—	—	—	—	

High-Speed Saturated Switching Transistors

The transistors listed in this table are specially optimized for high-speed saturated switches. They are heavily gold doped and processed to provide very short switching times and low output capacitance (below 6 pF). The transistors are listed in order of decreasing turn-on time (t_{on}).

Device Type	t_{on} ns Max	t_{off} ns Max	I_C mA	BV_{CE0} Volts Min	h_{FE} Min	I_C mA	$V_{CE(sat)}$ Volts @ I_C & I_B			f_T MHz Min	I_C mA
							Max	mA	mA		
NPN											
MPS706,A	40	75	10	15	20	10	0.6	10	1.0	200	10
2N4264	25	35	10	15	40	10	0.22	10	1.0	300	10
2N4265	25	35	10	12	100	10	0.22	10	1.0	300	10
MPS835	20	35	10	—	20	10	0.3	10	1.0	300	10
MPS3646	18	28	300	15	30	30	0.2	30	3.0	350	30
MPS834	16	30	10	—	25	10	0.25	10	1.0	350	10
MPS2369	12	18	10	15	40	10	0.25	10	1.0	500	10
PNP											
MPS3640	25	35	50	12	30	10	0.2	10	1.0	500	10
MPS3639	25	25	50	6.0	30	10	0.16	10	1.0	—	—

General-Purpose Transistors

These general-purpose transistors are designed for small-signal amplification from dc to low radio frequencies. They are also useful as oscillators and general-purpose switches. The transistors are listed in order of decreasing breakdown voltage (BV_{CEO}).

Device and Polarity		BV_{CEO} Volts Min	f_r MHz Min	@ I_C mA	I_C mA Max	h_{FE}		@ I_C mA
NPN	PNP					Min	Max	
MPS8099	MPS8599	80	150	10	200	100	300	1.0
MPS-A06	MPS-A56	80	100	10	500	50	—	100
MPS8098	MPS8598	60	150	10	200	100	300	1.0
MPS-A05	MPS-A55	60	100	10	500	50	—	100
2N3904	2N3906	40	300	10	200	100	300	10
2N4401	2N4403	40	250	20	600	100	300	150
2N3903	2N3905	40	250	10	200	50	150	10
2N4400	2N4402	40	200	20	600	50	150	150
MPS-A20	MPS-A70	40	125	5.0	100	40	400	5000
MPS6531	MPS6534	40	—	50	600	100	300	150
MPS2222	MPS2907	30	250	20	600	100	300	150
2N4123	2N4125	30	250	10	200	50	150	2.0
MPS3704	MPS3702	30	100	50	600	100	300	50
2N4124	2N4126	25	300	10	300	120	360	2.0
MPS-D06	MPS-D56	25	100	10	50	50	—	10
MPS-D05	MPD-D55	25	100	50	500	80	—	100
2N5225	2N5226	25	50	20	200	30	600	50
MPS6514	MPS6518	25	200	10	200	50	300	10
2N5220	2N5221	15	100	20	500	30	600	50

PLASTIC ENCAPSULATED SMALL-SIGNAL TRANSISTORS (Continued)

Low-Noise Amplifier Transistors

The small-signal transistors listed in this table are characterized for low-noise amplification at low frequencies. The transistors are listed in decreasing order of noise figure (NF).

Device Type	NF dB Typ	@ f kHz* Hz	BV _{CEO} Volts Min	h _{FE} Min	@ I _C mA	f _T MHz Min	@ I _C mA
NPN							
2N4123	6.0	Audio	30	50	2.0	250	10
2N3903	6.0	Audio	40	50	10	250	10
2N4124	5.0	Audio	25	120	2.0	300	10
2N3904	5.0	Audio	40	100	10	300	10
MPS6565	4.0	Audio	45	40	10	—	—
MPS6566	4.0	Audio	45	100	10	—	—
2N5209	3.0	Audio	50	150	10	30	500
2N5088	3.0	Audio	30	100	300	50	500
MPS6520	3.0	Audio	25	200	2.0	390	2.0
MPS6521	3.0	Audio	25	300	2.0	390	2.0
2N5210	2.0	Audio	5.0	250	10	30	500
MPS8097	2.0	100	40	250	0.1	200	10
2N5089	2.0	Audio	25	400	10	50	500
MPS-A18	1.5	Audio	45	500	10	100	1.0
MPS-A09	1.4	1.0*	50	100	0.1	30	0.5
MPS6571	1.2	100	20	250	100	50	500
PNP							
2N4125	5.0	Audio	30	50	2.0	200	10
2N3905	5.0	Audio	40	50	10	200	10
2N3906	4.0	Audio	40	100	10	250	10
2N4126	4.0	Audio	25	120	2.0	250	10
2N5086	3.0	Audio	50	100	150	40	500
MPS6522	3.0	Audio	25	200	2.0	340	2.0
MPS6523	3.0	Audio	25	300	2.0	340	2.0
2N5087	2.0	Audio	50	250	10	40	500

Audio = 10 Hz to 15.7 kHz.

High-Voltage Transistors

These high-voltage transistors are designed for driving neon bulbs and Nixie® indicator tubes, for direct line operation, and for other applications requiring high-voltage capability at relatively low collector current. These devices are listed in order of decreasing breakdown voltage (BV_{CEO}).

Device Type	BV _{CEO} Volts Min	I _C Amp Max	h _{FE} Min	@ I _C mA	V _{CE(sat)} Volts Max	@ I _C mA	& I _B mA	f _T MHz Min	@ I _C mA
NPN									
2N6517	350	0.5	40	30	0.30	10	1.0	40	10
2N6516	300	0.5	45	30	0.30	10	1.0	40	10
MPS-A42	300	0.5	40	10	0.5	20	2.0	50	10
2N6515	250	0.5	50	30	0.30	10	1.0	40	10
MPS-A43	200	0.5	40	10	0.4	20	2.0	50	10
MPS-D01	200	0.1	20	30	—	—	—	40	10
2N5551	160	0.6	80	10	0.15	10	1.0	100	10
2N5550	140	0.6	60	10	0.15	10	1.0	100	10
MPSD-02	140	0.05	20	30	—	—	—	40	10
MPS-D03	100	0.05	50	10	0.2	10	1.0	60	10
MPS-L01	100	0.05	20	30	—	—	—	40	10
PNP									
2N6520	350	0.5	30	30	0.30	10	1.0	40	10
2N6519	300	0.5	45	30	0.30	10	1.0	40	10
MPS-A92	300	0.5	40	10	0.8	20	2.0	50	10
2N6518	250	0.5	50	30	0.30	10	1.0	40	10
MPS-A93	200	0.5	40	10	0.7	20	2.0	50	10
MPS-D51	200	0.1	20	30	—	—	—	40	10
2N5401	150	0.6	60	10	0.2	10	1.0	100	10
MPS-D52	140	0.05	20	30	—	—	—	40	10
2N5400	120	0.6	40	10	0.2	10	1.0	100	10
MPS-D53	100	0.05	20	30	—	—	—	40	10
MPS-L51	100	0.6	40	50	0.25	10	1.0	60	10

* Registered Trademark of Burroughs Corporation.

Medium-Power (Uniwatt and Duowatt) Transistors

For applications requiring higher power dissipation than that of the standard Unibloc package, Motorola has developed the Uniwatt and Duowatt packages. These plastic packages are slightly larger than the TO-92 case. Without a heat sink the Uniwatt package can dissipate 1 Watt @ $T_A = 25^\circ\text{C}$; the Duowatt can dissipate 2 Watts @ $T_A = 25^\circ\text{C}$.

The transistors are listed in order of increasing collector current (I_C).

Uniwatt Transistors ($P_D = 1.0 \text{ Watt @ } T_A = 25^\circ\text{C}$)

Device Type	I_C A dc Max	BV_{CE0} Volts Min	h_{FE} Min @ I_C mA	$V_{CE(sat)}$ Volts Max @ I_C mA & I_B mA	f_T MHz Min @ I_C mA
NPN					
MPS-U10	0.5	300	40	0.75	60
MPS-U02	0.8	40	50	0.4	15
MPS-U03	1.0	120	40	0.5	100
MPS-U04	1.0	180	40	0.5	100
MPS-U01	2.0	30	60	0.5	50
MPS-U01A	2.0	40	60	0.5	50
MPS-U45	2.0	40	15 k	1.5	100
MPS-U05	2.0	60	60	0.4	50
MPS-U06	2.0	80	60	0.4	50
MPS-U07	2.0	180	30	0.4	50

PNP

MPS-U60	0.5	300	30	0.75	60
MPS-U52	0.8	40	50	0.4	150
MPS-U51	2.0	30	60	0.7	50
MPS-U51A	2.0	40	60	0.7	50
MPS-U95	2.0	40	15 k	1.5	500
MPS-U55	2.0	60	50	0.5	50
MPS-U56	2.0	80	50	0.5	50
MPS-U57	2.0	100	30	0.5	50

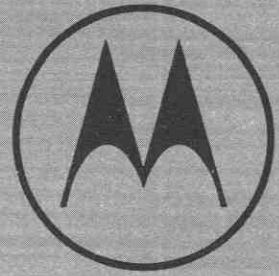
Duowatt Transistors ($P_D = 2.0 \text{ Watt @ } T_A = 25^\circ\text{C}$)

Device Type	I_C A dc Max	BV_{CE0} Volts Min	h_{FE} Min @ I_C mA	$V_{CE(sat)}$ Volts Max @ I_C mA & I_B mA	f_T MHz Min @ I_C mA
NPN					
2N6557	0.5	250	40	0.6	45
2N6558	0.5	300	40	0.6	45
2N5669	0.5	350	40	0.6	45
2N6551	1.0	60	80	0.5	75
2N6552	1.0	80	80	0.5	75
2N6553	1.0	100	80	0.5	75
2N6548	2.0	40	25 k	1.5	75
2N6549	2.0	40	15 k	1.5	75

PNP

2N6554	1.0	60	80	0.5	75
2N6555	1.0	80	80	0.5	75
2N6556	1.0	100	80	0.5	75

FIELD-EFFECT TRANSISTORS



Motorola offers a line of field-effect transistors that encompasses the latest technology and covers the full range of FET applications. Included is a wide variety of junction FETs and MOSFETs, with N- or P-channel polarity with both single and dual gates. These FETs include devices developed for operation across the frequency range from dc to UHF in switching and amplifying applications. Package options from low cost plastic to metal TO-72 packages are available.

The selector guides on the following pages are designed to emphasize those FET families and device types that, by virtue of widespread industry use, ease of manufacture and, consequently, low relative cost, merit first consideration for new equipment design.

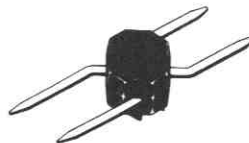
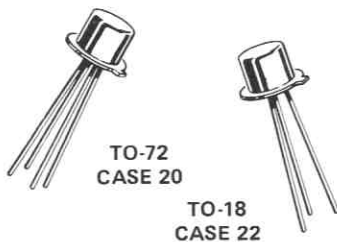
TABLE OF CONTENTS

	Page
General-Purpose Devices	4-30
Designed for use in general-purpose amplifier and switching applications.	
General-Purpose Amplifiers	4-31
Transistors designed for amplification in the audio-frequency range.	
Choppers and Switches	4-32
Devices designed for chopper and high-speed switching applications.	
RF Amplifiers	4-33
Devices characterized for operation at frequencies as high as 900 MHz.	

The following index reflects the devices characterized in this section. To locate the exact page number, see Catalog Index (Page 7-1).

INDEX				
2N3330	2N4221A	2N5460	2N5639	MFE 132
2N3365	2N4222	2N5461	2N5640	MFE 140
2N3366	2N4222A	2N5462	2N5716	MFE 590
2N3367	2N4351	2N5474	2N5717	MFE 591
2N3796	2N4352	2N5475	2N5718	MFE 823
2N3797	2N4416	2N5476	2N5797	MFE 824
2N3823	2N4416A	2N5484	2N5798	MFE 3001
2N3993	2N4856	2N5485	2N5799	MFE 3002
2N3994	2N4857	2N5486	2N5800	MFE 3003
2N3994A	2N4858	2N5556	3N209	MPF 102
2N4220	2N5457	2N5557	3N223	MPF 256
2N4220A	2N5458	2N5558	MFE 130	MPF 970
2N4221	2N5459	2N5638	MFE 131	MPF 971

THE TO-18 AND TO-72 — are designed for applications requiring hermeticity as well as greater power dissipation than available with the TO-92 package.



THE MICRO-H CASE 262 — four leaded plastic stripline package.

THE TO-76 is the EIA standard part for matched dual transistors.



THE TO-92 — is the most popular, high-volume plastic package and will meet most of your high-performance, low-cost requirements.



General-Purpose Devices

Using the same transistor for both switching and amplifier applications can reduce inventories and increase purchase quantities to take advantage of quantity price reductions. Transistors listed here represent good, all-around amplifiers in the audio frequency range, and provide satisfactory medium-speed switching capabilities. MOSFETs listed are characterized primarily as switches but can be used as satisfactory general-purpose amplifiers.

JFETs – N-CHANNEL

Package	Family	Preferred Types	Features	Y_{fs} mmhos Min/Max	I_{DSS} mA Min/Max	$V_{(BR)GSS}$ $V_{(BR)DSS}^*$ Volts Min	$V_{GS(off)}$ $V_{GS(TH)}^*$ Volts Min/Max	NF dB nV/\sqrt{Hz}^*
TO-92	131	Standard Family Limits		0.5/6.5	0.5/24	to -50	-0.2/-8.0	to 2.5
		2N5457	Good overall performance. Low Cost.	1.0/5.0	1.0/5.0	-25	-0.5/-6.0	—
		2N5458		1.5/5.5	2.0/9.0	-25	-1.0/-7.0	—
2N5459	2.0/6.0	4.0/16		-25	-2.0/-8.0	—		
TO-72	130	2N4220	Somewhat improved specifications; slightly higher cost.	1.0/4.0	0.5/3.0	-30	-/-4.0	2.5
		2N4221		2.0/5.0	2.0/6.0	-30	-/-6.0	2.5
		2N4222		2.5/6.0	5.0/15	-30	-/-8.0	2.5
	130	2N3823		3.5/6.5	4.0/20	-30	-/-8.0	2.5
		2N3824		—	—	-50	—	—

JFETs – P-CHANNEL

TO-92	125	Standard Family Limits		0.8/8.0	0.3/30	to 60	-0.2/9.0	115*
		2N5460	Good performance, low cost.	1.0/4.0	1.0/5.0	40	0.75/6.0	115*
		2N5461		1.5/5.0	2.0/9.0	40	1.0/7.5	115*
		2N5462		2.0/6.0	4.0/16	40	1.8/9.0	115*

MOSFET – N-CHANNEL (Enhancement)

TO-72	122	Standard Family Limits		1.0/-	10/-	25*	0.5/5.0*	—
		2N4351	Relatively low-cost, complement to 2N4352	1.0/-	10/-	25*	0.5/5.0*	—

MOSFET – P-CHANNEL (Enhancement)

TO-72	123	Standard Family Limits		1.0/4.0	-1.0/-10	to -50*	-1.0/-5.0*	—
		2N4352	Relatively low-cost, complement to 2N4351	1.0/-	-10/-	-25*	-1.0/-5.0*	—

General-Purpose Amplifiers

The following transistors are designed for amplification in the audio-frequency range. The devices characterized represent the best values and should receive primary consideration. Other family members are also indicated, together with any specific features they may have.

J FET – N-CHANNEL

Package	Family	Preferred Types	Features	Y_{fs} mmhos Min/Max	I_{DSS} mA Min/Max	$V_{(BR)GSS}$ $V_{(BR)DSS}^*$ V Min	$V_{GS(off)}$ V Min/Max	NF dB nV/ \sqrt{Hz}^*
TO-92	131	Standard Family Limits		0.5/6.5	0.5/24	to -50	-0.2/-0.8	to 75*
		2N5457	Lowest Cost Family.	1.0/5.0	1.0/5.0	-25	-0.5/-6.0	—
		2N5458	General-purpose application.	1.5/5.5	2.0/9.0	-25	-1.0/-7.0	—
		2N5459		2.0/6.0	4.0/16	-25	-2.0/-8.0	—
TO-72		2N4220A	Similar to above series, but with specified NF and slightly improved specifications. Somewhat higher cost.	1.0/4.0	0.5/3.0	-30	-/-4.0	2.5
		2N4221A		2.0/5.0	2.0/6.0	-30	-/-6.0	2.5
		2N4222A		2.5/6.0	5.0/15	-30	-/-8.0	2.5
		2N5556	Very low noise.	1.5/6.5	0.5/2.5	-30	-0.2/-4.0	20*
		2N5557		1.5/6.5	2.0/5.0	-30	-0.8/-5.0	20*
2N5558	1.5/6.5	4.0/10		-30	-1.5/-6.0	20*		
TO-92	124	Standard Family Limits		-1.0/2.0	0.05/9.0	to -50	-0.2/-12	75*
		2N5716	For low-power applications, as in battery operated equipment. Good performance at low cost.	0.2/1.0	0.05/0.25	-40	-0.2/-3.0	75*
		2N5717		0.4/1.6	0.2/1.0	-40	-0.5/5.0	75*
		2N5718		0.5/2.0	0.8/4.0	-40	-1.0/-8.0	75*
TO-18		2N3367	Similar to above series, but higher cost due to metal package.	0.1/1.0	0.5/0.25	-40	-/-2.5	75*
		2N3366		0.25/1.0	0.2/1.0	-40	-/-7.0	75*
		2N3365		0.4/2.0	0.8/4.0	-40	-/-12	75*

Other Family Members

TO-18	124	(All comparisons are referenced to similarly packaged preferred device types in the tables above.)	
TO-72	131	MFE2093, 4, 5 – Higher $V_{(BR)GSS}$, higher cost.	
TO-92	131	2N3822, 3 – Higher $V_{(BR)GSS}$, higher cost.	
		2N5358, 59, 60, 61, 62, 63, 64 – Tighter specifications, higher cost.	
TO-92	131	MPF109, MPF111 – Lowest Cost. Loose specifications.	

JFET – P-CHANNEL

TO-92	125	Standard Family Limits		0.8/8.0	0.3/30	to 60	0.2/9.0	to 3.0
		2N5460	Good performance, Low cost.	1.0/4.0	1.0/5.0	40	0.75/6.0	2.5
		2N5461		1.5/5.0	2.0/9.0	40	1.0/7.5	2.5
		2N5462		2.0/6.0	4.0/16	40	1.8/9.0	2.5
TO-72		2N3330	Tighter specifications, metal package, higher cost.	1.5/3.0	2.0/6.0	20	-/6.0	3.0
TO-92	127	Standard Family Limits		0.06/0.7	0.02/2.0	45	0.5/9.0	110*
		2N5797	For low-power applications, as in battery-operated equipment. Good performance at low cost.	0.06/0.225	0.02/0.1	40	0.5/4.0	115*
		2N5798		0.1/0.4	0.08/0.4	40	0.8/6.0	115*
		2N5799		0.16/0.5	0.25/1.0	40	1.2/8.0	115*
		2N5800		0.25/0.7	0.7/2.0	40	2.0/9.0	115*
TO-72		2N5474	Similar to above series, higher cost due to metal package.	0.16/0.4	0.2/0.5	40	1.2/7.0	115*
		2N5475		0.2/0.5	0.4/1.0	40	1.5/8.0	115*
		2N5476		0.26/0.65	0.8/2.0	40	2.0/9.0	115*
Other Family Members								
(All comparisons are referenced to similarly packaged preferred device types in tables above.)								
TO-72	127	2N5471, 72, 73 – Lower Y_{fs} , lower I_{DSS} , higher cost.						
	125	2N3909,A 2N5265, 66, 67, 68, 69, 70 – Very tight specifications. Higher cost. MFE4007, 08, 09, 10, 11, 12 –						
TO-92	125	2N5463, 64, 65 – Higher $V_{(BR)GSS}$. Higher cost.						
		2N4342, MPF161 – Low cost.						
		2N4360 – Lowest cost. Very loose specifications.						

FIELD-EFFECT TRANSISTORS (continued)

General-Purpose Amplifiers (Continued)

Package	Family	Preferred Types	Features	Y_{fs} mmhos Min/Max	I_{DSS} mA Min/Max	$V_{(BR)GSS}$ $V_{(BR)DSS}^*$ V Min	$V_{GS(off)}$ V Min/Max	NF dB nV/ \sqrt{Hz}^*
MOSFET – N-CHANNEL (Depletion-Enhancement) – TABLE II (continued)								
TO-18	110	Standard Family Limits		0.7/4.0	0.5/15	to 25*	$V_{GS(TH)}$ -/-8.0	to 3.8
		MFE824	Especially suited for smoke detector applications.	1.0/-	1.0/15	20*	-/-6.0	-
TO-72	MFE3001 2N3796 2N3797	$I_{GSS} = \pm 1.0 \mu A_{dc} \text{ Max}$		0.7/3.5	0.5/6.0	20*	-/-8.0	-
		0.9/1.8	0.5/3.0	25	-/-4.0	3.8 Typ		
		1.5/3.0	2.0/6.0	20	-/-7.0	3.8 Typ		
MOSFET – P-CHANNEL (Enhancement)								
TO-18	123A	MFE823	Especially suited for smoke detector applications. $I_{GSS} = \pm 1.0 \mu A_{dc} \text{ Max}$	1.0/-	-/-20	-25*	-2.0/-6.0	-

Choppers and Switches

FETs have no offset voltages and low "on" resistance. As a result they are especially well suited for chopper/switch applications. The following characterized devices represent the best values and should receive primary consideration.

JFETs – N CHANNEL

Package	Family	Preferred Types	Features	$r_{ds(on)}$ Ohms Max	$I_{D(off)}$ I_{DSS}^* nA Max	C_{rss} pF Max	$V_{(BR)GSS}$ $V_{(BR)DSS}^*$ V Min	$V_{GS(off)}$ $V_{GS(TH)}^*$ V Min/Max
TO-92	140	Standard Family Limits		25 to 100	0.25 to 1	3.5 to 8.0	to -40	-0.5/-10
		2N5638	Good Performance, low-cost.	30	1.0	4.0	-30	-
		2N5639		60	1.0	4.0	-30	-
		2N5640		100	1.0	4.0	-30	-
TO-18	2N4856 2N4857 2N4858	Somewhat improved specifications. Metal Package.		25	0.25	8.0	-40	-4.0/-10
		Higher cost.		40	0.25	8.0	-40	-2.0/-6.0
				60	0.25	8.0	-40	-0.8/-4.0
Other Family Members								
TO-92	140	MPF4391, 2, 3 – Similar to 2N5638 Series, slightly higher cost.						
TO-18		2N4091, 2, 3 – Slower than 2N4856 Series, slightly lower cost. 2N4391, 2, 3 – Slightly improved performance, but higher cost. 2N4859, 60, 61 – Same as 2N4856, 57, 58 except for -30 V $V_{(BR)GSS}$. 2N4856A, 57A, 58A, 59A, 60A, 61A – Tighter C_{rss} than non-A version. 2N3970, 71, 72 – MFE2004, 5, 6.						
Other Family Members								
TO-72	136	MFE2010, 1, 2 – Lower $r_{ds(on)}$, significantly higher cost.						

JFETs – P-CHANNEL

TO-92	128	Standard Family Limits		100 to 250	10	5.0	30	1.0/12
		MPF970	Good Performance, low cost.	100	10	5.0	30	5.0/12
		MPF971		250	10	5.0	30	1.0/7.0
TO-72	129	Standard Family Limits		150 to 300	1.2	3.5 to 5.0	25	1.0/9.5
		2N3993	Higher cost than above plastic series.	150	1.2	4.5	25	4.0/9.5
		2N3994		300	1.2	5.0	25	1.0/5.5
		2N3994A		300	1.2	3.5	25	1.0/5.5

MOSFET – N-CHANNEL (Enhancement)

TO-72	122	Standard Family Limits		100 to 300	10*	1.3	25*	0.5/5.0*
		2N4351	Relatively low cost. Complementary with 2N4352 P-Channel device.	300	10*	1.3	25*	1.0/5.0*
	114	MFE3002	Somewhat higher cost.	100	10*	1.0	15*	-/3.0*
Other Family Members								
TO-72	122	3N169, 170, 171 – Tighter $V_{GS(TH)}$, higher cost.						

MOSFET – P-CHANNEL (Enhancement)

TO-72	Standard Family Limits			200 to 600	0.25 to 10*	to 1.3	to -50*	-1.0/-5.0*
	123	2N4352	Relatively Low cost	600	-10*	1.3	25*	-1.0/-5.0*
	115	MFE3003	Slightly Higher cost	200	-10*	1.0	15*	-/-4.0*
Other Family Members								
TO-72	123	3N155, 55A, 56, 56A, 57, 57A, 58, 58A – Tighter parameter limits, higher costs.						

RF Amplifiers

Devices listed here are characterized for operation at frequencies as high as 900 MHz. Both amplifier and mixer devices are included. In general, amplifier transistors have a small-signal power gain (G_{ps}) specification and a noise figure, while mixer devices are characterized by a conversion gain (G_c) specification and may or may not have an assigned noise figure.

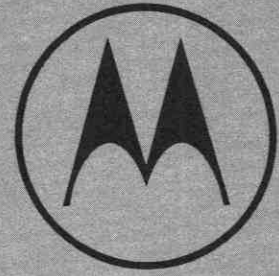
A comparison of specifications indicates that MOSFETs, in general, have a considerably lower reverse transfer capacitance (C_{rss}) than JFETs. This makes them suitable for operation over wide frequency ranges, as required for many TV applications. Moreover, all MOSFETs listed are dual-gate devices that often simplify circuit designs. The JFET lines are often preferred for communications circuits where only narrow bandwidths are required.

JFET – N-CHANNEL

Package	Family	Preferred Types	Features	Test Frequency MHz	G_{ps} G_c^* dB Min/Max	Y_{fs} mmhos Min/Max	C_{rss} pF Min/Max	NF dB Max	$V_{(BR)DSS}$ $V_{(BR)GSS}^*$ V Min
TO-92	130	Standard Family Limits		to 200	10/20	2.0/7.5	-/3.0	4.0	to 25
		MPF102	Very low cost. Limited specifications.	100	—	2.0/7.5	-/3.0	—	25*
	146	Standard Family Limits		to 400	10/30	3.0/8.0	1.0/3.0	—	to 30
		2N5484	Moderate cost. Low noise figure.	100	16/25	3.0/6.0	-/3.0	3.0	25*
		MPF256	Slightly higher cost. Improved performance.	400	12/-	6.0/-	1.2 Typ	4.0	25*
		2N5485 2N5486	Somewhat higher cost.	400 400	10/20 10/20	3.5/7.0 4.0/8.0	-/1.0 -/1.0	4.0 4.0	25* 25*
TO-72	2N4416 2N4416A	Best value in metal As above, but higher break-down voltage and tighter $V_{GS(off)}$	400	10/-	4.5/7.5	-/0.8	4.0	30*	
	Other Family Members (All comparisons are referenced to similarly packaged preferred device types in the table above.)								
TO-92	130	2N5668, 69, 70 – Somewhat improved specifications. Higher cost. MPF108, MPF112 – Lowest cost. Very limited specifications.							
TO-72		2N4223, 24; 2N3823							
	146	MFE2000, 1							
	120	3N124, 25, 26 – This family is tetrode connected, and is tested at 100 MHz. Has higher breakdown voltage (50 V) and higher cost than other metal packaged devices.							

MOSFET – N-CHANNEL

AMPLIFIERS									
TO-72	875	Standard Family Limits		to 500	10/28	8.0/20	-/-0.05	6.0	to 25
		MFE130	VHF amplifiers listed in order of increasing test frequency.	105	17/-	8.0/20	-/0.05	5.0	25
		MFE131 3N209	Cost variations are relatively small.	200 500	17/- 10/20	8.0/20 10/20	-/0.05 -/0.05	5.0 6.0	25 25
	890	Standard Family Limits		to 900	10/-	8.0/20	-/0.025	8.0	25
		MFE590	VHF/UHF amplifiers characterized to 900 MHz. Moderate cost.	900	10.5/-	8.0/20	-/0.025	8.0	25
		MFE591		900	10.5/-	10/20	-/0.02	6.0	25
MIXERS									
TO-72	Standard Family Limits		to 500	10/28	8.0/20	-/0.05	6.0	to 25	
	875	MFE132	Good performance.	200	12/-*	8.0/20	-/0.05	—	25
	880	3N223	Improved specifications. Moderately higher cost.	200	21/28*	17/40	-/0.05	—	25
Other Family Members									
262	875	MPF130 – Amplifier MPF131 – Amplifier 3N210 – Amplifier MPF132 – Mixer							
	880	3N224 – Mixer							
TO-72	112	MFE3004, 5 – Amplifier 3N128 – Amplifier							
	816	3N140 – Amplifier/Mixer							



MULTIPLE DEVICES

SMALL-SIGNAL MULTIPLE TRANSISTORS AND DARLINGTON TRANSISTORS

The trend in electronic system design is toward the use of integrated circuits — to reduce component cost, assembly cost, and equipment cost. But ICs still aren't all things to all people, and for those circuit designs where ICs are not available, there is a noticeable swing towards the use of multiple devices.*

Motorola is reacting to this expanding market requirement by making available a very large selection of Quad, Dual and Darlington transistors for off-the-shelf delivery. The chips used in the Quad and Dual transistors are those that have emerged as the most popular ones for discrete transistor applications. But even beyond that, Motorola offers its entire vast repertoire of discrete small-signal transistors for multiple-device packaging. For special applications where the devices listed may not quite fit the design requirements, special configurations can be supplied with quick turnaround time and low premiums.

**Multiple devices, as described here, encompass two or more transistor chips in a single package. Included in this definition are the Darlington transistors which consist of two interconnected devices functioning as a single-stage amplifier.*

TABLE OF CONTENTS

	Page
Quad Transistors	4-37
General-Purpose Amplifier and Switching Transistors	
Low-Noise, High-Gain Amplifier Transistors	
Low-Current Switching Transistors	
RF Amplifiers and Oscillators, High-Voltage Drivers, and J-FET-Bipolar Transistors	
Dual Transistors	4-41
General-Purpose Amplifier and Switching Amplifiers	
Low-Noise, High-Gain Amplifier Transistors	
High-Current Switching and Core Driver Transistors	
RF Amplifiers and Oscillators	
Darlington Transistors	4-45
Power and Small-Signal Darlington Amplifier Transistors	
MPU Clock Buffer	4-40

MULTIPLE TRANSISTORS (continued)

The following index reflects the devices characterized in this section. To locate the exact page number, see Catalog Index (Page 7-1).

INDEX

QUAD TRANSISTORS

2N5146
2N6501
MHQ918
MHQ2221
MHQ2222
MHQ2369
MHQ2483
MHQ2484
MHQ2906
MHQ2907
MHQ3467
MHQ3798
MHQ3799
MHQ4001A
MHQ4002A
MHQ4013
MHQ4014
MHQ6001
MHQ6002
MHQ6100
MHQ6100A
MPQ918
MPQ1000
MPQ1050
MPQ2001
MPQ2221
MPQ2222
MPQ2369
MPQ2483
MPQ2484
MPQ2906
MPQ2907
MPQ3303
MPQ3467
MPQ3546
MPQ3725
MPQ3725A
MPQ3762
MPQ3798
MPQ3799
MPQ3904
MPQ3906
MPQ4003
MPQ4004
MPQ6501
MPQ6502
MPQ6600
MPQ6600A
MPQ6700
MPQ6842
MPQ7041
MPQ7042
MPQ7043
MPQ7051
MPQ7052
MPQ7053
MPQ7091
MPQ7092

MPQ7093
MQ918
MQ930
MQ982
MQ1120
MQ1129
MQ2218,A
MQ2219,A
MQ2369
MQ2484
MQ2904
MQ2905A
MQ3251
MQ3467
MQ3725
MQ3762
MQ3798
MQ3799A
MQ7001
MQ7003
MQ7004
MQ7005
MQ7007

DUAL TRANSISTORS

2N2060
2N2060A
2N2223,A
2N2453,A
2N2480,A
2N2639
2N2644
2N2652,A
2N2720
2N2721
2N2722
2N2903,A
2N2913
thru
2N2920
2N3043
thru
2N3048
2N3425
2N3806
thru
2N3811
2N3811A
2N3812
thru
2N3817
2N3817A
2N3838
2N4015
2N4016
2N4854
2N4855
2N4937

2N4938
2N4939
2N4940
2N4941
2N4942
2N5973
2N5794
2N5795
2N5796
2N6428
thru
2N6435
2N6441
thru
2N6448
2N6502
2N6503
MD708,A,B
MD708F,AF,BF
MD918,A,B
MD918AF,BF
MD982
MD982F
MD984
MD985
MD985F
MD986
MD986F
MD1120
MD1120F
MD1121,F
MD1122,F
MD1123,F
MD1129
MD1129F
MD1130F
MD1131,F
MD1132,F
MD2060,F
MD2218,A
MD2218F,AF
MD2219,A
MD2219F,AF
MD2369,A,B
MD2369AF,BF
MD2904,A
MD2904F,AF
MD2905,A
MD2905F,AF
MD3250,A
MD3250F,AF
MD3251A
MD3251F,AF
MD3409
MD3410
MD3425
MD3467
MD3467F

MD3725
MD3725F
MD3762,F
MD5000,A,B
MD6001,F
MD6002,F
MD6003,F
MD6100,F []
MD7000
MD7001,F
MD7002,A,B
MD7003,A,B
MD7003F,AF
MD7004,F
MD7005,F
MD7007,A,B
MD7007F,BF
MD7021,F
MD8001
MD8002
MD8003

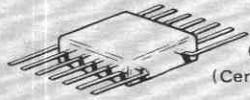
DARLINGTON TRANSISTORS

2N998
2N2723
2N2785
2N6034
2N6035
2N6036
2N6037
2N6038
2N6039
2N6294
2N6295
2N6296
2N6297
2N6426
2N6427
MJE 700
MJE 702
MJE 800
MJE 802
MM6427
MPS-A 12
MPS-A 13
MPS-A 14
MPS-A 65
MPS-A 66
MPS-D04
MPS-D54

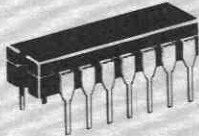
QUAD TRANSISTORS

GENERAL-PURPOSE AMPLIFIER AND SWITCHING TRANSISTORS

The multiple transistors included in this category have been implemented with discrete transistor chips that have proved to be the most popular for high all around performance at low cost. The line is characterized by a relatively high-current gain over an extremely wide range of dc collector current, a high-frequency response and medium-speed switching capability.



CASE 607-04
(Ceramic Flat Package)
MQ Devices



CASE 632
TO-116
(Ceramic Package)
MHQ Devices



CASE 646
(Plastic Package)
MPQ Devices

	NPN TYPES			PNP TYPES			
Prime Devices	MPQ2222 MHQ2222 MQ2219A <i>(Basic Device Design – 2N2222)</i>		MPQ3904 <i>(Basic Device Design 2N3904)</i>	MPQ2907 MHQ2907 MQ2905A <i>(Basic Device Design – 2N2907)</i>		MPQ3906 <i>(Basic Device Design 2N3906)</i>	
Design Parameters Specified h_{FE} Range f_T (Typ) t_{on} (Typ) t_{off} (Typ)	To 60 Vdc 100 μ A to 500 mA 300 MHz @ 20 mA 25 ns @ 150 mA		To 40 Vdc 100 μ A to 100 mA 300 MHz @ 10 mA 40 ns @ 10 mA 136 ns @ 10 mA	To 60 Vdc 100 μ A to 500 mA 350 MHz @ 50 mA 30 ns @ 150 mA		To 40 Vdc 100 μ A to 100 mA 350 MHz @ 10 mA 43 ns @ 10 mA 155 ns @ 10 mA	
Derivatives From Prime Devices (In decreasing order of price)	Ceramic Package	Plastic Package	Ceramic Flat Package	—	Ceramic Package	Plastic Package	Ceramic Flat Package
	MHQ2221	MPQ2221 MPQ1000	<i>MQ2218,A</i> <i>MQ2219</i> MQ1120 MQ1129	—	MHQ2906	MPQ2906 MPQ1500	<i>MQ2904</i> MQ7001 MQ982 MQ3251 (1) MQ7007 (1) (1) See 2N3250 data sheet for basic design parameters.
Complementary Pairs (2 Pairs Per Package)	Ceramic Package	Plastic Package	Ceramic Flat Package	Description			
	MHQ6002 } MHQ6001 }	MPQ6002 } MPQ6001 } MPQ6502 } MPQ6501 } <i>MPQ6700</i> }	MQ6002 } MQ6001 }	Two Chips from Basic Device Design 2N2222 and 2N2907. Devices differ principally in h_{FE} . Same as above, but with a different pin arrangement. Two Chips from Basic Device Design 2N3904 and 2N3906.			

Numbers in italic type denote data sheet that shows design curves.

LOW-NOISE; HIGH-GAIN AMPLIFIER TRANSISTORS

NPN TYPES			PNP TYPES			
MQ2484 MPQ2484 MHQ2484 <i>(Basic Device Design - 2N2484)</i>			MQ3799A (Matched) MPQ3799 MHQ3799 <i>(Basic Device Design - 2N3799)</i>			Prime Devices
To 60 Vdc 100 μ A to 10 mA 90 MHz @ 500 μ A 2.0 dB @ 10 μ A			To 60 Vdc 10 μ A to 10 mA 140 MHz @ 1.0 mA 1.5 dB @ 100 μ A			Design Parameters BV _{CEO} Specified h _{FE} Range f _T (Typ) NF (Typ)
Ceramic Package	Plastic Package	Ceramic Flat Package	Ceramic Package	Plastic Package	Ceramic Flat Package	Derivatives From Prime Devices (In decreasing order of price)
MHQ2483	MPQ2483	MQ930	MHQ3798	MPQ3798	MQ3799 MQ3798 MQ7003	
Ceramic Package	Plastic Package	Ceramic Flat Package	Description			Complementary Pairs
MHQ6100,A	MPQ6100,A MPQ6600,A	MQ6100 MQ7021	Two Chips from Basic Device Design 2N2484 and 2N3799. The A version has higher gain.			

HIGH-CURRENT SWITCHING AND CORE DRIVER TRANSISTORS

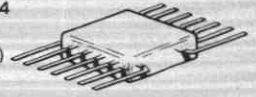
NPN TYPES			PNP TYPES				
MPQ3725A <i>(Basic Device Design - 2N3725)</i>	MHQ4014 <i>(Basic Device Design - 2N4014)</i>	MPQ3303 <i>(Basic Device Design - 2N3303)</i>	MPQ3762 2N5146 <i>(Basic Device Design - 2N3762)</i>			Prime Devices	
To 50 Vdc 100 mA to 500 mA 300 MHz @ 50 mA 20 ns @ 500 mA 50 ns	To 45 Vdc 10 mA to 1.0 A 300 MHz @ 50 mA 20 ns @ 500 mA 50 ns	To 12 Vdc 100 mA to 1.0 A 500 MHz @ 100 mA 12 ns @ 1.0 A 20 ns	To 40 Vdc 100 mA to 1.0 A 200 MHz @ 50 mA 30 ns @ 500 mA 75 ns			Design Parameters BV _{CEO} Specified h _{FE} Range f _T (Typ) t _{on} (Typ) t _{off} (Typ)	
Plastic Package	Ceramic Package	Ceramic Flat Package	-	Ceramic Package	Plastic Package	Ceramic Flat Package	
MPQ3725 MPQ4004 MPQ4003 MPQ1050	MHQ4013 MHQ4002A MHQ4001A	MQ3725 2N6501		MHQ3467	MPQ3467	MQ3467 MQ3762	Derivatives From Prime Devices (In decreasing order of price)

Numbers in italic type denote data sheet that shows design curves.

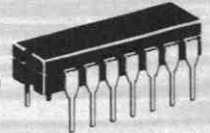
LOW-CURRENT SWITCHING TRANSISTORS

	NPN TYPES	PNP TYPES
Prime Devices	MPQ2369 MQ2369 MHQ2369 <i>(Basic Device Design – 2N2369)</i>	MPQ3546 MHQ3546 <i>(Basic Device Design – 2N3546)</i>
Design Parameters BV _{CEO} Specified h _{FE} Range f _T (Typ) t _{on} (Typ) t _{off} (Typ)	To 15 Vdc 10 mA to 100 mA 650 MHz @ 10 mA 9.0 ns @ 10 mA 15 ns	To 12 Vdc 10 mA to 100 mA 850 MHz @ 10 mA 15 ns @ 50 mA 25 ns
Derivative From Prime Devices	Flat Package MQ7004	—

CASE 607-04
(Ceramic Flat Package)
MQ Devices



CASE 632
TO-116
(Ceramic Package)
MHQ Devices



CASE 646
(Plastic Package)
MPQ Devices



RF AMPLIFIERS AND OSCILLATORS, HIGH-VOLTAGE (HV) DRIVERS, AND J-FET-BIPOLAR QUAD TRANSISTORS

	RF NPN TYPES	HV NPN TYPES	HV PNP TYPES
Prime Devices	MPQ918 MQ918 MHQ918 <i>(Basic Device Design – 2N918)</i>	MPQ7043 <i>(Basic Device Design – 2N6515)</i>	MPQ7093 <i>(Basic Device Design – 2N6518)</i>
Design Parameters BV _{CEO} Specified h _{FE} Range f _T (Typ) NF (Typ)	To 15 Vdc 100 μA to 10 mA 850 MHz @ 4.0 mA 4.0 dB @ 1.0 mA	To 400 Vdc** 1.0 mA to 30 mA 70 MHz @ 10 mA	To 400 Vdc** 1.0 mA to 30 mA 70 MHz @ 10 mA
Derivatives From Prime Devices (In decreasing order of price)	Ceramic Flat Package MQ7005	Plastic Package MPQ7042 MPQ7041	Plastic Package MPQ7092 MPQ7091
Complementary Pairs (2 Pairs Per Package)	—	Plastic Package MPQ7051 MPQ7052 MPQ7053	Description Two Chips from Basic Device Design 2N6515 and 2N6518. Devices differ principally in BV _{CEO} .
NPN-Bipolar, N-Channel, J-FET Quad Transistor Combination	—	MPQ2001	Two Chips from Basic Device Design 2N2222 & 2N5358 (J-FET) lines. BV _{GSS} to 25 Vdc, I _{DSS} from 2.0 mA-16 mA

**Supplied as Specials.


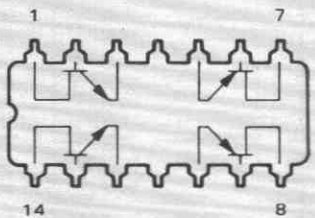
Numbers in italic type denote data sheet that shows design curves.

MPU CLOCK BUFFER

MPQ6842

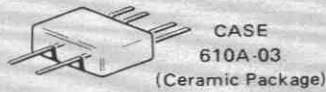
Quad dual in-line silicon annular complementary pair transistors.

The MPQ6842 is designed to provide the switching speed and saturation voltages necessary to design the clock circuit to meet the MPU clock requirements.

	Design Parameters	Limits
 <p>CASE 646 Plastic</p>	BV_{CEO}	To 40 Vdc
 <p>CONNECTION DIAGRAM</p>	Specified h_{FE} Range	100 μ A to 100 mA
	f_T (Typ)	300 MHz @ 10 mA
	t_{on} (Typ)	45 ns @ 10 mA
	t_{off} (Typ)	150 ns @ 10 mA

DUAL TRANSISTORS

LOW-NOISE, HIGH-GAIN AMPLIFIER TRANSISTORS



	NPN TYPE		PNP TYPE	
Prime Devices	2N2920 <i>(Basic Device Design – 2N2484)</i>		2N3811A <i>(Basic Device Design – 2N3799)</i>	
Design Parameters Specified h_{FE} Range V_{CE0} f_T (Typ) NF (Typ) h_{FE} Matching Avail.	To 60 Vdc 10 μ A to 10 mA 90 MHz @ 500 μ A 2.0 dB @ 10 μ A		To 60 Vdc 1.0 μ A to 10 mA 140 MHz @ 1.0 mA 1.5 dB @ 100 μ A	
Derivatives From Prime Devices (In decreasing order of price)	Metal Package	Ceramic Package	Metal Package	Ceramic Package
	2N2543,A 2N2639 thru 2N2644 2N2722 2N2903,A 2N2913 thru 2N2919 MD7002,A,B MD8001 MD8003	2N3043 thru 2N3048	2N3806 thru 2N3811 MD7003,A,B	2N3812 thru 2N3817A MD7003F,AF
Complementary Pairs (Basic Device Design 2N2484 and 2N3799)	Metal Package		Ceramic Package	
	MD6100 MD7021		MD6100F MD7021F	
Matched Pairs (Monolithic Devices)	Metal Package		Description	
	2N6441 thru 2N6448		Devices differ principally in gain and matching characteristics.	

Numbers in italic type denote data sheet that shows design curves.

GENERAL-PURPOSE AMPLIFIER AND SWITCHING AMPLIFIERS

The multiple transistors included in this category have been implemented with discrete transistor chips that have proved to be the most popular for high all around performance at low cost. The line is characterized by a relatively high-current gain over an extremely wide range of dc collector current, a high-frequency response and medium-speed switching capability.



NPN TYPE		PNP TYPE		
MD2219A,AF <i>(Basic Device Design - 2N2222)</i>		MD2905A,AF <i>(Basic Device Design - 2N2907)</i>		Prime Devices
To 60 Vdc 10 μ A to 500 mA 300 MHz @ 20 mA 40 ns @ 150 mA 110 ns		To 60 Vdc 100 μ A to 500 mA 350 MHz @ 50 mA 30 ns @ 150 mA 100 ns		Design Parameters BV _{CEO} Specified h _{FE} Range f _T (Typ) t _{on} (Typ) t _{off} (Typ) h _{FE} Matching Avail.
Metal Package	Ceramic Package	Metal Package	Ceramic Package	Derivatives From Prime Devices (In decreasing order of price)
2N2060,A <i>MD2218,A</i>	<i>MD2218F,AF</i>	2N4015	<i>MD2904F,AF</i>	
2N2223,A <i>MD2219</i>	<i>MD2219F</i>	2N4016	<i>MD2905F</i>	
2N2480,A MD3409	MD1120F	2N5795	MD7001F	
2N2652,A MD3410	MD1129F	2N5796	MD982F	
MD1120		<i>MD2904,A</i>		
2N2720 MD1121		<i>MD2905</i>		
2N2721 MD1122		MD7001		
2N5793 MD1129		MD982		
2N5794 MD7000				
Metal Package		Ceramic Flat Package		Complementary Pairs (Basic Device Design 2N2222 and 2N2907)
2N4854	MD6001	2N3838		
2N4855	MD6002	MD985F		
MD985	MD6003	MD6001F		
		MD6002F		
		MD6003F		

Numbers in italic type denote data sheet that shows design curves.

RF AMPLIFIERS AND OSCILLATORS



	NPN TYPE		PNP TYPE	
Prime Devices	MD918A MD918AF <i>(Basic Device Design – 2N918)</i>		MD5000A <i>(Basic Device Design – 2N3307)</i>	
Design Parameters Specified h_{FE} Range f_T (Typ) NF (Typ) G_{pe} h_{FE} Matching Avail.	To 15 Vdc 100 μ A to 10 mA 850 MHz @ 4.0 mA 4.0 dB @ 1.0 mA 15 dB @ 4.0 mA		To 15 Vdc 100 μ A to 10 mA 900 MHz @ 4.0 mA 3.0 dB @ 1.0 mA 18 dB @ 4.0 mA	
Derivatives From Prime Devices (In decreasing order of price)	Metal Package	Ceramic Package	Metal Package	—
	<i>MD918,B</i> MD1131 MD1132 MD7005	<i>MD918F,BF</i> MD1131F MD1132F MD7005F	MD5000 MD5000B	

NEW INTRODUCTIONS

- MD4260 PNP silicon transistors designed for use as wideband or high-frequency differential amplifiers and dual RF amplifiers.
- MD4261
- MD6900 NPN/PNP silicon transistor designed for use as complementary wideband RF amplifiers.

TO BE INTRODUCED

- MD5500,F 450 MHz NPN Amplifier

Numbers in italic type denote data sheet that shows design curves.

HIGH-CURRENT SWITCHING AND CORE DRIVER TRANSISTORS

NPN TYPE		PNP TYPE		Prime Devices
MD3725,F <i>(Basic Device Design - 2N3725)</i>		MD3762,F <i>(Basic Device Design - 2N3762)</i>			Design Parameters BV_{CEO} Specified h_{FE} Range f_{T} (Typ) t_{on} (Typ) t_{off} (Typ) h_{FE} Matching Avail.
To 45 Vdc 10 mA to 1.0 A 300 MHz @ 50 mA 20 ns @ 500 mA 25 ns		To 40 Vdc 100 mA to 1.0 A 200 MHz @ 50 mA 30 ns @ 500 mA 75 ns		
Metal Package	Ceramic Package	Metal Package	Ceramic Package	Derivatives From Prime Devices
2N6502	2N6503	<i>MD3467</i>	MD3467F	

LOW-CURRENT SWITCHING TRANSISTORS

NPN TYPE		PNP TYPE		Prime Devices
MD2369A,AF <i>(Basic Device Design - 2N2369)</i>		MD3251A,AF <i>(Basic Device Design - 2N3250)</i>			Design Parameters BV_{CEO} Specified h_{FE} Range f_{T} (Typ) t_{on} (Typ) t_{off} (Typ) h_{FE} Matching Avail.
To 15 Vdc 10 mA to 100 mA 650 MHz @ 10 mA 15 ns @ 10 mA 15 ns		To 40 Vdc 10 μA to 50 mA 300 MHz @ 10 mA 50 ns @ 10 mA 200 ns		
Metal Package	Ceramic Package	Metal Package	Ceramic Package	Derivatives From Prime Devices (In decreasing order of price)
2N3425 MD708,A,B <i>MD2369,B</i> MD7004	MD708,AF,BF,F MD2369F,BF MD7004F	2N4937 2N4938 2N4939 <i>MD3250,A</i> <i>MD3251,A</i> MD1123 MD1130 MD7007,A,B MD984	2N4940 2N4941 2N4942 <i>MD3250F,AF</i> <i>MD3251F,AF</i> MD1130F MD7007F,BF	
Metal Package		Ceramic Package		Complementary Pairs (Basic Device Design 2N2369 and 2N3250)
MD986		MD986F		







Numbers in italic type denote data sheet that shows design curves.

DARLINGTON TRANSISTORS

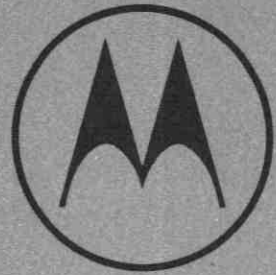
POWER AND SMALL-SIGNAL DARLINGTON AMPLIFIER TRANSISTORS

Darlington amplifiers are cascade transistors used in applications requiring very high-current gain and input impedance. The plastic transistors have monolithic construction and the metal package transistors are two chip construction. The transistors are listed in order of increasing breakdown voltage (V_{CE0}).

V_{CE0}^* $V_{CE0(sat)}^{\#}$ V_{CE0} Volts Min	I_C mA* Amp Max	h_{FE} @ I_C			$V_{CE(sat)}$ @ I_C		P_D Watts	f_T MHz Min	NF dB Typ	Device Type	
		Min	Max	mA* Amp	Volts Max	mA* Amp				NPN	PNP
20*	500*	20,000	—	10*	1.0	10*	0.625	0.035	—	<i>MPS-A12</i>	—
25*	300*	1000	—	10*	1.0	0.1	0.625	100	—	<i>MPS-D04</i>	MPS-D54
30*	500*	5000	—	10*	1.5	0.1	0.625	125	2.0	<i>MPS-A13</i>	—
30*	500*	10,000	—	10*	1.5	0.1	0.625	125	2.0	<i>MPS-A14</i>	—
30*	300*	50,000	—	10*	1.5	0.1	0.625	100	2.0	—	<i>MPS-A65</i>
30*	300*	75,000	—	10*	1.5	0.1	0.625	100	2.0	—	<i>MPS-A66</i>
40	200*	1200	—	10*	1.0	15*	0.5	10	—	2N2785	—
40	300*	5000	—	10*	1.5	0.1	0.375	—	—	MM6427	—
40	500*	5000	—	10*	1.5	0.1	0.75	—	—	MPQ6426	—
40	1.0	10,000	25,000	150*	—	—	—	175	6.0	—	2N6521
40	500*	10,000	200,000	10*	1.2	50*	0.625	—	3.0	2N6427	—
40	1.0	20,000	50,000	150*	—	—	—	175	6.0	—	2N6522
40	500*	20,000	200,000	10*	1.2	50*	0.625	—	3.0	2N6426	—
40	4.0	750	15,000	2.0	2.0	2.0	1.5	—	—	2N6037	2N6034
60#	500*	1600	8,000	10*	—	—	0.5	—	6.0	2N998	—
60	40*	2000	10,000	10*	1.0	10*	0.5	100	10	2N2723	—
60	4.0	750	—	1.5	2.5	1.5	40	—	—	MJE 800	MJE 700
60	4.0	750	15,000	2.0	2.0	2.0	1.5	25	—	2N6038	2N6035
60	4.0	750	18,000	2.0	2.0	2.0	50	4.0	—	2N6294	2N6296
80	4.0	750	—	1.5	2.5	1.5	40	—	—	MJE 802	MJE 702
80	4.0	750	15,000	2.0	2.0	2.0	1.5	2.5	—	2N6039	2N6036
80	4.0	750	18,000	2.0	2.0	2.0	50	4.0	—	2N6295	2N6297

 Case 20 TO-72	 Case 22-03 TO-18	 Case 29-02 TO-92	 Case 34A	 Case 77-03	 Case 646
2N998 2N2723 2N2785	MM6427	2N6426 2N6427 MPS-A12 MPS-A13 MPS-A14 MPS-A65 MPS-A66 MPS-D04 MPS-D54	2N6521 2N6522	2N6034 2N6035 2N6036 2N6037 2N6038 2N6039 2N6294 2N6295 2N6296 2N6297 MJE 700 MJE 702 MJE 800	MPQ6426 MPQ6427

Numbers in italic type denote data sheet that shows design curves.



MICRO-T TRANSISTORS

and DIODES

Micro-T devices combine high performance with extremely small physical size. The type numbers listed below are available from stock, but all other Motorola small-signal transistors may be obtained in Micro-T packages on special order.

TABLE OF CONTENTS

	Page
RF Amplifier Transistors	4-48
For high-frequency amplifier and switching applications	
General Purpose Transistors	4-48
Most popular discrete amplifiers in Micro-T package	
Low Noise Amplifier Transistors	4-49
Low noise audio and high gain amplifiers	
Low Current Switching Transistors	4-49
High speed switching transistors	
Switching Diodes	4-50
Single and dual diodes with common anode or cathode	
Micro-T Field-Effect Transistors	4-50
J-FET and MOS FET	

The following index reflects the devices characterized in this section. To locate the exact page number, see Catalog Index (Page 7-1).

INDEX

MMCM930	MMD6100	MMT2907
MMCM2221	MMD6150	MMT3014
MMCM2222	MMD7000	MMT3546
MMCM2369	MMD7001	MMT3798
MMCM2484	MMT70	MMT3799
MMCM2907	MMT71	MMT3823
MMCM3798	MMT72	MMT3903
MMCM3799	MMT75	MMT3904
MMCM3903	MMT76	MMT3905
MMCM3904	MMT930	MMT3906
MMCM3905	MMT2222	MMT3960
MMCM3906	MMT2369	MMT4261
MMD70	MMT2484	MMT8015
MMD6050	MMT2857	

RF AMPLIFIER/HIGH SPEED SWITCHING TRANSISTORS

Standard metal packaged RF devices, in Micro-T packages are designed for applications where limited space is critical. This package is particularly attractive from a pre-testing and cost point of view as the RF parameters can be 100% tested for high performance. For complete design data, consult the prime device data sheet. For other RF devices not listed, contact your nearest Motorola sales representative or distributor. Ceramic packages with a cold sealing process will also be available in quantity orders in the future.

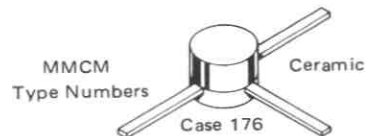
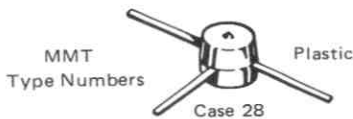


Prime Devices	NPN Types			PNP Types	
	MMT2857	MMT8015	MMT3960	MMT918	MMT4261
Design Parameters	To 20 V	To 15 V	To 15 V	To 15 V	To 20 V
BV _{CEO}	1.0 to 20 mA	1.0 to 10 mA	1.0 to 30 mA	3.0 mA	10 mA
Operating h _{FE} Range	1400 MHz @ 5.0 mA	2000 MHz @ 6.0 mA	1600 MHz @ 10 mA	600 MHz @ 4.0 mA	1000 MHz @ 10 mA
f _T (Typ)	4.0 dB @ 1.5 mA	3.5 dB @ 1.0 mA	—	6.0 dB @ 1.0 mA	—
NF (Typ)	15 dB @ 450 MHz	7.0 dB @ 1.0 GHz	—	15 dB @ 200 MHz	—
G _{pe} (Typ)	—	—	3.0 ns @ 10 mA	—	—
t _{on} (Typ)	—	—	—	—	—

MMT4049 PNP RF Amplifier — to be introduced.

GENERAL-PURPOSE AND SWITCHING TRANSISTORS

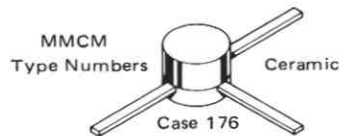
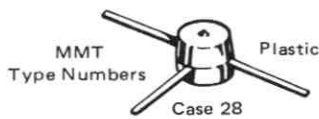
For general-purpose applications and for designs requiring fast switching, the Micro-T packaged transistors are available in either economy plastic or hermetically sealed ceramic. Complete designer data sheets are available for prime devices; equivalent data sheets may be obtained when the same die is used in other 2N — standard devices. For devices not listed, contact your nearest Motorola representative or distributor.



Prime Devices	NPN Types		PNP Types	
	MMT2222 MMCM2222	MMT3904 MMCM3904	MMT2907 MMCM2907	MMT3906 MMCM3906
Design Parameters	To 60 V	To 40 V	To 60 V	To 40 V
BV _{CEO}	100 μA to 500 mA	100 μA to 100 mA	100 μA to 500 mA	100 μA to 100 mA
Operating h _{FE} Range	300 MHz @ 20 mA	300 MHz @ 10 mA	350 MHz @ 50 mA	350 MHz @ 10 mA
f _T (Typ)	25 ns	40 ns	30 ns	45 ns
t _{on} (Typ)	@ 150 mA	@ 10 mA	@ 150 mA	@ 10 mA
t _{off} (Typ)	250 ns	140 ns	100 ns	160 ns
Derivatives from Prime Devices	Ceramic Package	Plastic Package		Plastic Package
	MMCM2221	MMT3903 MMT76 Ceramic Package MMCM3903		MMT3905 MMT75 Ceramic Package MMCM3905

LOW NOISE/HIGH GAIN AMPLIFIER TRANSISTORS

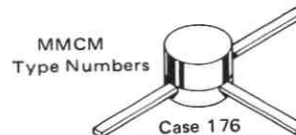
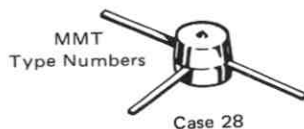
Two types of specialty transistors complement Motorola's micro-transistor amplifier selection. The combination of high-gain and low-noise have made these standards popular for many years. The Micro-T package coupled with performance permits space premium designs to become a reality. Other high voltage and Darlington transistors are also available as specials.



	NPN Types		PNP Types	
Prime Devices	MMT2484 MMCM2484		MMT3799 MMCM3799	
Design Parameters BV _{CEO} Operating h _{FE} Range f _T (Typ) NF (Typ)	To 60 V 100 μA to 10 mA 90 MHz @ 500 μA 2.0 dB @ 10 μA		To 60 V 10 μA to 10 mA 140 MHz @ 1.0 mA 1.5 dB @ 100 μA	
Derivatives from Prime Devices	Ceramic Package MMCM930	Plastic Package MMT930 MMT70	Ceramic Package MMCM3798	Plastic Package MMT3798 MMT71

LOW CURRENT SWITCHING TRANSISTORS

To complement the Micro-T amplifiers, these high speed switching transistors can be used in circuits where space limitations are critical. For design data, consult prime device data sheet or the 2N JEDEC equivalent. For devices not listed, consult your nearest Motorola sales representative or distributor.



	NPN Types		PNP Types
Prime Devices	MMT2369 MMCM2369	MMT3014	MMT3546
Design Parameters BV _{CEO} Operating h _{FE} Range f _T (Typ) t _{on} (Typ) t _{off} (Typ)	To 15 V 10 mA to 100 mA 650 MHz @ 10 mA 2.0 ns @ 10 mA 15 ns	To 20 V 10 mA to 100 mA 400 MHz @ 30 mA 12 ns @ 300 mA 13 ns	To 12 V 10 mA to 100 mA 850 MHz @ 10 mA 15 ns @ 50 mA 25 ns
Derivatives from Prime Devices		Plastic Package MMT72	

SWITCHING DIODES

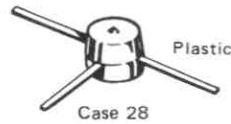
The Micro-T product line includes single and double diodes for voltage doubling or bias control functions. Zener diodes are also available as specials. For lead times and availability, contact your nearest distributor or Motorola's sales representative.



	Single	Common Cathode	Common Anode	Series
Prime Devices	MMD6050	MMD6100	MMD6150	MMD7000
Design Parameters	To 100 V 10 mA 0.6 V @ 1.0 mA 10 ns	To 100 V 10 mA 0.6 V @ 1.0 mA 20 ns	To 100 V 10 mA 0.6 V @ 1.0 mA 20 ns	To 100 V 10 mA 0.6 V @ 1.0 mA 20 ns
Derivatives from Prime Devices	MMD70			MMD7001

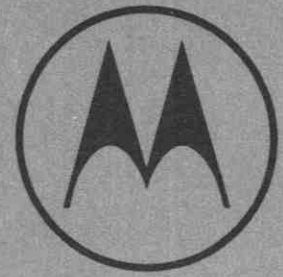
MICRO-T FIELD-EFFECT TRANSISTORS

Technologies other than bipolar transistors are available in the Micro-T package. One example is the popular J-FET. Also available are other J-FET and MOSFET devices requiring up to four leads and having a chip size less than 25 mils per side. For lead time and availability, contact your nearest Motorola sales representative.



	N-Channel J-FET
Prime Device	MMT3823
Design Parameters	To 35 V 5.0 mA to 20 mA 4.0 pF 2.0 dB @ 100 MHz, $R_S = 1000 \text{ Ohms}$

Note: Other FETs are available as specials. Standard FET devices to be introduced.



RF TRANSISTORS

and MODULES

This selection guide contains the preferred registered and non-registered RF parts available. From more than 500 total individual available devices, Motorola has selected 17 transistor/module chains from 1.5 to 600 W (PEP) output. All devices are designed, tested and optimized for frequency ranges from 2 to 900 MHz. These devices are designed for your advanced RF engineering concepts.

TABLE OF CONTENTS

	Page
High Frequency, Low-Voltage Amplifier Transistors/Modules cover the spectrum from 2 to 947 MHz (7.5 to 13.6 Volts)	4-53
High Frequency, High Voltage, Power Amplifier Transistors cover the spectrum from 2 to 400 MHz (28 to 50 Volts)	4-57
Power Varactor Multipliers	4-59
15 Watts at 450 MHz to 2.0 Watts at 6 GHz	
UHF and Microwave Oscillators	4-59
400 MHz to 2.0 GHz	
Low-Noise Transistors	4-59
Noise Figure versus Frequency	
General-Purpose Transistors	4-60
f_T versus I_C	
CATV, MATV, and Class A Linear Transistors	4-60
f_T and Noise Figure	
Hybrid Amplifier Modules	4-61
CATV Hybrid Modules cover the spectrum from 40 to 512 MHz	

The following index reflects the devices characterized in this section. To locate the exact page number, see Catalog Index(Page 7-1).

INDEX

Device Type	Package	Device Type	Package	Device Type	Package	Device Type	Package
1N4387	44	2N5841	TO-72	MRF208	145A-07	MRF453A	145A-04
1N4388	44	2N5847	145A-07	MRF209	145A-07	MRF454	211-10
1N5149	47	2N5848	145A-07	MRF212	145A-07	MRF454A	145A-04
1N5150	47	2N5849	145A-08	MRF215	278-06	MRF501	TO-72
1N5150A	47	2N5941	211-07	MRF216	278-06	MRF502	TO-72
1N5153	47	2N5942	211-10	MRF221	211-07	MRF509	207A-01
1N5153A	47	2N5943	TO-39	MRF222	211-07	MRF511	144D-05
1N5155	46	2N5944	244-04	MRF223	211-07	MRF515	TO-39
1N5155A	46	2N5945	244-04	MRF224	211-07	MRF517	TO-39
2N2857	TO-72	2N5946	244-04	MRF225	TO-39	MRF519	TO-39
2N3553	TO-39	2N6080	145A-07	MRF226	145A-07	MRF531	TO-39
2N3632	TO-60	2N6081	145A-07	MRF227	TO-39	MRF532	TO-39
2N3839	TO-72	2N6082	145A-07	MRF230	TO-39	MRF601	297-01
2N3948	TO-39	2N6083	145A-07	MRF231	145A-07	MRF602	297-01
2N3960	TO-18	2N6084	145A-07	MRF232	145A-07	MRF604	TO-46
2N4073	TO-39	2N6166	211-10	MRF233	145A-07	MRF607	TO-39
2N4427	TO-39	2N6255	TO-39	MRF234	145A-07	MRF618	278-06
2N4428	TO-39	2N6256	249-05	MRF235	145A-07	MRF626	305-01
2N4957	TO-72	2N6304	TO-72	MRF237	TO-39	MRF627	305A-01
2N4958	TO-72	2N6305	TO-72	MRF238	145A-07	MRF628	249-05
2N4959	TO-72	2N6367	211-07	MRF243	278-06	MRF629	TO-39
2N5031	TO-72	2N6368	211-10	MRF244	278-06	MRF644	278-06
2N5032	TO-72	2N6370	211-07	MRF245	278-06	MRF646	278-06
2N5070	TO-60	BFR90	302A-01	MRF304	278-06	MRF816	249-05
2N5108	TO-39	BFR91	302A-01	MRF305	278-06	MRF817	244-04
2N5109	TO-39	BFR96	302A-01	MRF306	278-06	MRF818	244-04
2N5160	TO-39	BFY90	TO-72	MRF313	305-01	MRF823	278-05
2N5179	TO-72	BFX89	TO-72	MRF313A	305A-01	MRF824	278-05
2N5583	TO-39	MHW401	301-01	MRF401	145A-01	MRF825	278-05
2N5589	144B-04	MHW559	270-02	MRF402	TO-39	MRF835	278-05
2N5590	145A-07	MHW562	270-02	MRF406	211-07	MRF901	302-01
2N5591	145A-07	MHW570	270A-01	MRF420	211-10	MRF904	TO-72
2N5635	144B-04	MHW572	270A-01	MRF421	211-08	MRF961	302-01
2N5636	144B-04	MHW580	714	MRF422	211-08	MRF5174	244-04
2N5637	145A-07	MHW601	297-01	MRF425	145A-08	MRF5175	244-04
2N5641	144B-04	MHW602	297-01	MRF427	145A-08	MRF5176	244-04
2N5642	145A-07	MHW709	700-01	MRF428	307-01	MRF5177	215-01
2N5643	145A-07	MHW710	700-01	MRF432	211-07	MRF5177A	145A-07
2N5644	145A-07	MM4019	TO-39	MRF433	211-07	MRF8004	TO-39
2N5829	TO-72	MM4049	TO-72	MRF449	211-07	MV1805C	47
2N5835	TO-72	MM8001	TO-39	MRF449A	145A-07	MV1805J	44
2N5836	TO-46	MM8009	TO-39	MRF450	211-07	MV1807J1	44
2N5837	TO-46	MRF207	TO-39	MRF450A	145A-07	MV1809C1	47
				MRF453	211-10		

High Frequency, Low Voltage Amplifier Transistors/ Modules

The transistors listed in this table are specified for operation in RF Power amplifiers and are listed by specific application at a given test frequency. Arrangement within each application group is in the order of increasing output power. Modulation type is given in each application heading.

Device Type	P_{out} Output Power Watts	G_{PE} Power Gain dB Min	V_{CC} Supply Voltage Volts	Package
2-30 MHz, SSB TRANSISTORS				
2N6367	9.0 PEP	14	12.5	211-07
MRF432*	12.5 PEP	20	12.5	211-07
MRF433*	12.5 PEP	20	12.5	211-07
MRF406	20 PEP	12	12.5	211-07
MRF425	30 PEP	12	12.5	145A-08
2N6368	40 PEP	10	12.5	211-10
MRF420	75 PEP	10	12.5	211-10
MRF421	100 PEP	10	12.5	211-04
<p>*PNP/NPN Complements for Complementary Symmetry Driver, See EB-32. For Matched Pairs Order MK433.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>Chain 1 — 12.5 V, 2-30 MHz Off-road vehicles / Oil tankers / Fishing fleets</p> </div> <div style="text-align: center;"> </div> </div>				
14-30 MHz, CB/AMATEUR TRANSISTORS				
MRF8004	3.5	10	12.5	TO-39
MRF449	30	10	13.6	211-07
MRF449A	30	10	13.6	145A-07
MRF450	50	11	13.6	211-07
MRF450A	50	11	13.6	145A-07
MRF453	60	11	13.6	211-10
MRF453A	60	11	13.6	145A-04
MRF454	80	11	13.6	211-10
MRF454A	80	11	13.6	145-04
27-50 MHz, LOW-BAND FM TRANSISTORS				
MRF402	1.0	10	12.5	TO-39
2N5847	8.0	10	12.5	145A-07
2N5848	20	8.0	12.5	145A-07
2N5849	40	7.5	12.5	145A-08

RF TRANSISTORS AND MODULES (continued)

Device Type	P _{out} Output Power Watts	G _{PE} Power Gain dB Min	V _{CC} Supply Voltage Volts	Package
40-100 MHz, MIDBAND FM TRANSISTORS				
MRF230	1.5	10	12.5	TO-39
MRF231	3.5	10	12.5	145A-07
MRF232	7.5	9.0	12.5	145A-07
MRF233	15	9.5	12.5	145A-07
MRF234	25	10	12.5	145A-07
MRF235	50	8.0	12.5	145A-07

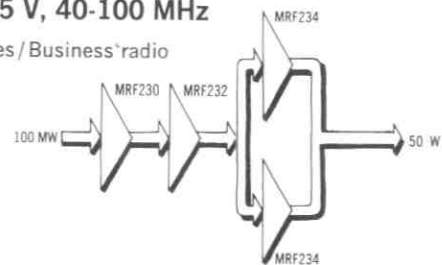
Chain 2 — 12.5 V, 40-100 MHz

European taxis/Off-shore oil rigs



Chain 3 — 12.5 V, 40-100 MHz

European buses/Business radio



156-162 MHz, VHF MARINE RADIO FM TRANSISTORS				
MRF237**	4.0	12	12.5	TO-39
MRF238	30	9.0	12.5	145A-07

**Grounded emitter TO-39 package. See EB-29

Chain 4 — 13.6 V, 160 MHz
Marine radio/Pleasure craft/Fishing boats/2 meter "ham band"

130-175 MHz, HIGH BAND/VHF FM TRANSISTORS				
MRF604	1.0	10	12.5	TO-46
2N4427	1.0	10	12	TO-39
MRF607	1.75	12.5	12.5	TO-39
2N6255	3.0	7.8	12.5	TO-39
2N5589	3.0	8.2	13.6	144B-06
MRF237**	4.0	12	12.5	TO-39
2N6080	4.0	12	12.5	145A-07
2N5590	10	5.2	13.6	145A-07
MRF212	10	9.0	12.5	145A-07

**Grounded emitter TO-39 package. See EB-29

RF TRANSISTORS AND MODULES (continued)

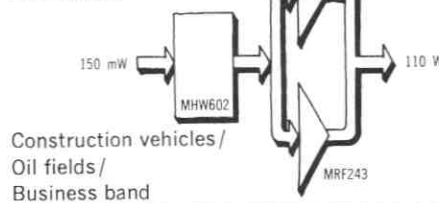
Device Type	P _{out} Output Power Watts	G _{FE} Power Gain dB Min	V _{CC} Supply Voltage Volts	Package
130-175 MHz, HIGH BAND/VHF FM TRANSISTORS				
2N6081	15	6.3	12.5	145A-07
MRF221	15	6.3	12.5	211-07
MRF215*	20	8.2	12.5	278-06
2N5591	25	4.4	13.6	145A-07
2N6082	25	6.2	12.5	145A-07
MRF222	25	6.2	12.5	211-07
2N6083	30	5.7	12.5	145A-07
MRF223	30	5.7	12.5	211-07
2N6084	40	4.5	12.5	145A-07
MRF224	40	4.5	12.5	211-07
MRF216*	40	6.7	12.5	278-06
MRF243*	60	7.0	12.5	278-06
MRF244*	70	6.6	12.5	278-06
MRF245*	80	6.4	12.5	278-06

*Controlled "Q" transistor. See EB-19

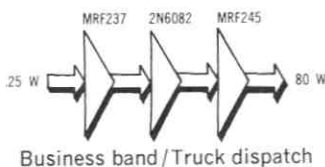
146-175 MHz, HIGH BAND/VHF FM MODULES				
MHW601	13	21	12.5	297-01
MHW602	20	21	12.5	297-01

See EB-23 for applications information

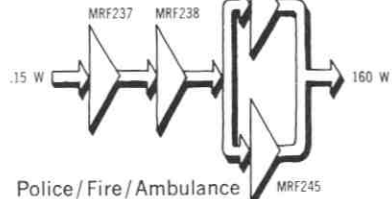
Chain 5 — 12.5 V, 175 MHz



Chain 6 — 12.5 V, 175 MHz



Chain 7 — 12.5 V, 175 MHz



220 MHz, CITIZENS BAND FM TRANSISTORS

MRF207	1.0	8.2	12.5	TO-39
MRF225	1.5	9.0	12.5	TO-39
MRF227*	3.0	13.5	12.5	TO-39
MRF208	10	10	12.5	145A-07
MRF226	13	9.0	12.5	145A-07
MRF209	25	4.4	12.5	145A-07

*Grounded emitter TO-39 package. See EB-29

Chain 8 — 12.5 V, 225 MHz

1¼ meter "ham band"/225 MHz class E/Communicator class



407-512 MHz, UHF FM TRANSISTORS

2N6256	0.5	10	12.5	249.05
MRF626	0.5	10	12.5	305-01
MRF627	0.5	10	12.5	305A-01
MRF628	0.5	10	12.5	249.05
MRF515	0.75	8.0	12.5	TO-39
2N3948	1.0	6.0	13.6	TO-39
2N5644	1.0	7.0	12.5	145A-07
MRF629**	2.0	8.0	12.5	TO-39
2N5944	2.0	9.0	12.5	244-04
2N5945	4.0	8.0	12.5	244-04
2N5946	10	6.0	12.5	244-04
MRF618*	15	6.0	12.5	278-06
MRF644*	25	6.2	12.5	278-06
MRF646*	40	4.9	12.5	278-06

*Controlled "Q" transistor. See EB-19.

**Grounded emitter TO-39 package.

RF TRANSISTORS AND MODULES (continued)

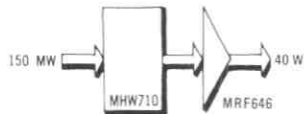
AMPLIFIER MODULES

MODULE	P _{out} Output Power Watts	f MHz	G _{PE} Power Gain dB Min	V _{DC} Supply Voltage	Package
407-512 MHz, UHF FM MODULES					
MHW401-1	1.5	400-440	15	7.5	301-01
MHW401-2	1.5	440-470	15	7.5	301-01
MHW401-3	1.5	470-512	15	7.5	301-01
MHW709-1	7.5	400-440	18.8	12.5	700-01
MHW709-2	7.5	440-470	18.8	12.5	700-01
MHW709-3	7.5	470-512	18.8	12.5	700-01
MHW710-1	13	400-440	19.4	12.5	700-01
MHW710-2	13	440-470	19.4	12.5	700-01
MHW710-3	13	470-512	19.4	12.5	700-01

See EB-8 for applications information

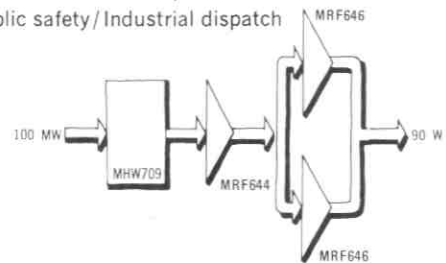
Chain 9 — 12.5 V, 512 MHz

Agricultural communications / Base stations / Repeaters



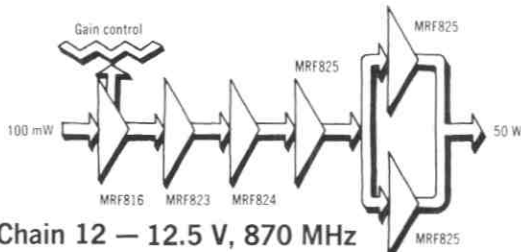
Chain 10 — 12.5 V, 470 MHz

Public safety / Industrial dispatch

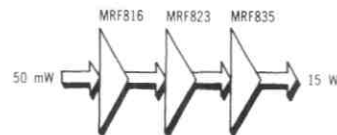


Device Type	P _{out} Output Power Watts	G _{PE} Power Gain dB Min	V _{CC} Supply Voltage Volts	Package
806-947 MHz, UHF FM TRANSISTORS				
MRF816	0.75	10	12.5	249-05
MRF817	2.5	6.2	13.6	244-04
MRF823*	5.0	8.0	12.5	278-05
MRF818	8.0	5.05	13.6	244-04
MRF824*	12	4.8	12.5	278-05
MRF835**	15	7 (G _{PE})	12.5	278-05
MRF825*	25	4.5	12.5	278-05

*Controlled "Q" transistor. See EB-19 **Gold metallization, controlled "Q" transistor. See EB-26, EB-19



Chain 12 — 12.5 V, 870 MHz
Base station / Industrial dispatch



Chain 11 — 12.5 V, 850 MHz
Cellular radio telephone

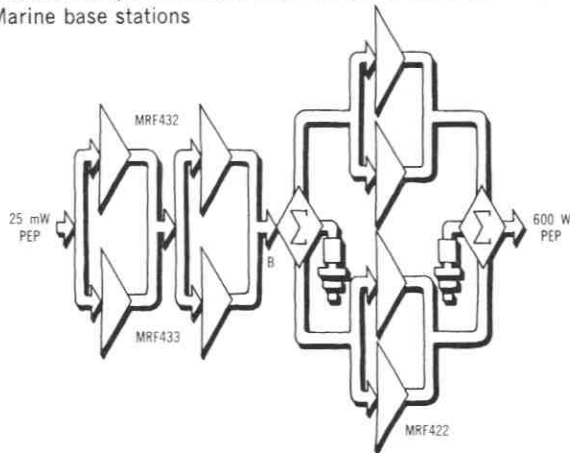
High Frequency, High Voltage, Power Amplifier Transistors

The transistors listed in this table are specified for operation in RF Power amplifiers and are listed by specific application at a given test frequency. Arrangement within each application group is in the order of increasing output power. Modulation type is given in each application heading.

Device Type	P_{out} Output Power Watts	G_{PE} Power Gain dB Min	V_{CC} Supply Voltage Volts	Package
2-30 MHz, SSB TRANSISTORS				
2N6370	10 PEP	12	28	211-07
MRF432	12.5 PEP	20	12.5	211-07
MRF433	12.5 PEP	20	12.5	211-07
2N5070	25 PEP	13	28	TO-60
MRF401	25 PEP	13	28	145A-07
MRF427	25 PEP	12	50	145A-08
2N5941	40 PEP	13	28	211-07
2N5942	80 PEP	10	28	211-04
MRF422	150 PEP	10	28	211-04
MRF428	150 PEP	13	50	307-01

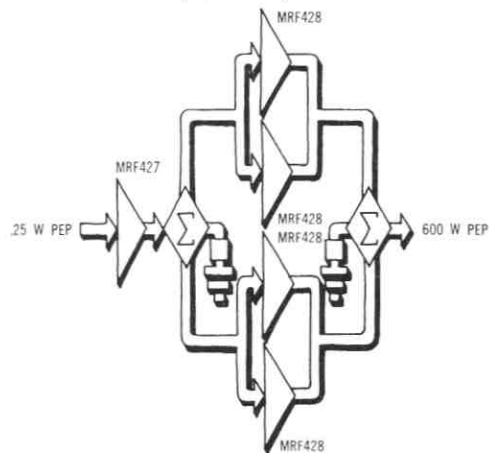
Chain 13 — 28 V, 2-30 MHz

Merchant ships/Land-base stations/Government vehicles/
Marine base stations



Chain 14 — 50 V, 2-30 MHz

Commercial ships/Military base stations

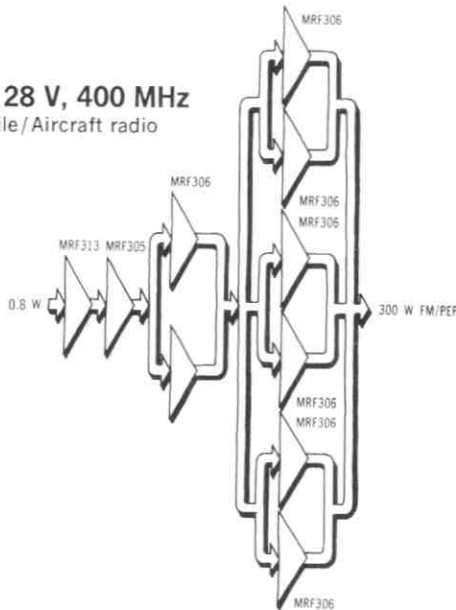


RF TRANSISTORS AND MODULES (continued)

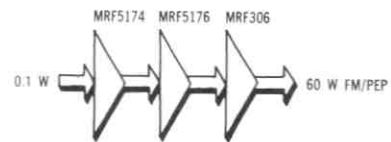
Device Type	P _{out} Output Power Watts	G _{PE} Power Gain dB Min	V _{CC} Supply Voltage Volts	Package
106-175 MHz, VHF AM TRANSISTORS				
2N3866	1.0	10	28	TO-39
2N3553	2.5	10	28	TO-39
2N5641	7.0	8.4	28	144B-04
2N5642	20	8.2	28	145A-07
2N5643	40	7.6	28	145A-07
2N6166	100	6.0	28	211-10
225-400 MHz, UHF AM TRANSISTORS				
MRF509	1.0	10	28	207A-01
2N3866	1.0	10	28	TO-39
MRF313	1.0	16 (Typ)	28	305-01
MRF313A	1.0	16 (Typ)	28	305A-01
MRF5174	2.0	12	28	244-04
2N5635	2.5	6.2	28	144B-04
MRF5175	5.0	11	28	244-04
2N5636	7.5	5.7	28	144B-04
MRF304*	10	9.0	28	278-06
MRF5176	15	10	28	244-04
2N5637	20	4.6	28	145A-07
MRF5177	30	6.0	28	215-01
MRF5177A	30	6.0	28	145A-07
MRF305*	30	8.0	28	278-06
MRF306**	60	8.0	28	278-06

*Controlled "Q" transistor. See EB-19 **Gold metallization, double matched controlled "Q" transistor. See EB-26, EB-19

Chain 15 — 28 V, 400 MHz
Fixed/Mobile/Aircraft radio



Chain 16 — 28 V, 400 MHz
Aircraft radio



Power Varactor Multipliers

Motorola's line of step-recovery multipliers represents a selection of frequency doublers and triplers. Output capabilities range from 15 watts at 450 MHz to 2 watts at 6 GHz. The table is arranged in order of decreasing output frequency.

Device Type	f_{out} GHz	P_{out} Min Watts	f_{in} GHz	P_{in} Watts	Package
1N5155A	6.0	2.0	2.0	5.0	46
1N5155	6.0	2.0	2.0	5.0	46
MV1809C1	2.0	14.5	1.0	25	47
1N5153	2.0	6.0	1.0	12	47
1N5153A	2.0	7.2	1.0	12	47
1N5150A	1.0	25	0.5	37	47
MV1807J1	1.0	25	0.5	37	44
1N5150	1.0	24	0.5	37	47
1N5149	1.0	11	0.5	20	47
1N4388	1.0	11	0.5	20	44
MV1805C	0.75	26	0.25	40	47
MV1805J	0.75	26	0.25	40	44
1N4387	0.45	15	0.15	30	44

UHF and Microwave Oscillators

The transistors listed below are for UHF and microwave oscillator applications as initial signal sources or as output stages of limited range transmitters. Devices are listed in order of increasing test frequency.

Device Type	Test Conditions		P_{out} mW Typ* Min	f_r MHz Typ* Min	Package
	f MHz	V_{CC} Volts			
2N3866	400	15	1000	500	TO-39
2N5179	500	10	20	900	TO-72
2N2857	500	10	30	1000	TO-72
2N3839	500	6.0	30	1000	TO-72
MM8009	1680	20	200	1000	TO-39
2N5108	1680	20	300	1200	TO-39
MRF905	1680	20	500*	2200*	TO-46

Low-Noise Transistors

The low-noise devices listed are produced with carefully controlled r_b' and f_t to optimize device noise performance. Devices listed in the matrix are classified according to noise figure performance versus frequency.

NF dB	FREQUENCY MHz						Polarity
	60	100	200	450	1000	2000	
1.5	2N5829 2N5031	2N5829 2N5031	MRF904				PNP NPN
2.0	2N4957 2N5032	2N4957 2N5032	2N5829 2N5031	MRF904	MRF901		PNP NPN
2.5	2N4958 2N5032	2N4958 2N5032	2N4957 2N5032	2N5829 2N5031	MRF901		PNP NPN
3.0	2N4959 2N2857	2N4959 2N2857	2N4958 2N5032	2N4957 2N5032	2N5829 MRF901	MRF901	PNP NPN
3.5	2N4959 2N5179	2N4959 2N5179	2N4959 2N2857	2N4958 2N5032	2N4957 2N5031		PNP NPN
4.0	2N4959 2N5179	2N4959 2N5179	2N4959 2N5179	2N4959 2N2857	2N4958 2N5031		PNP NPN
4.5	2N4959 2N5179	2N4959 2N5179	2N4959 2N5179	2N4959 2N2857	2N4959 2N5032		PNP NPN

General-Purpose Amplifier Transistors

The behavior of f_T as a function of I_C is critical in most Class A amplifier applications. The devices listed in the matrix form below are classified according to f_T versus I_C .

f_T GHz Min	COLLECTOR CURRENT mA							Polarity
	2.0	5.0	10	20	50	100	200	
5.0				MRF911	MRF691			NPN
4.5				MM4049 MRF901				PNP NPN
4.0			MM4049 MRF901	MM4049 MRF901	MRF961			PNP NPN
3.5		MM4049 MRF901	MM4049 MRF901	MM4049 MRF901	MRF961			PNP NPN
2.5	MRF901	MRF901	2N5835	2N5835	2N5836			PNP NPN
2.0		2N5031	2N5841	2N5841	2N5836	2N5837	2N5837	PNP NPN
1.5	2N5031	2N4957 2N3960	2N6304	2N6304	2N5583 2N5943	2N5583 2N5109	2N5837	PNP NPN
1.2	2N4957	2N4959 2N2857	2N6305	2N6305	2N5583 2N5943	2N5583 2N5109	2N5583	PNP NPN
1.0	2N5179	2N5179	2N2857	2N5583 2N5943	2N5160 MM8001	2N5160 2N5108	2N5583	PNP NPN
0.8	MRF502	MRF502	MRF502	2N5160 2N3866	2N5160 2N3866	2N5160 2N4428	2N5583	PNP NPN
0.6	MRF501	MRF501	MRF501	2N3866	2N4073	MM4019 2N3553	MM4019 2N3553	PNP NPN
0.5				MRF532* MRF531**	MRF532* MRF531**			PNP NPN

* $V_{CE0} = 80$ Vdc ** $V_{CE0} = 100$ Vdc

CATV, MATV, and Class A Linear Transistors

The devices listed below are excellent for Class A linear CATV/MATV applications. The new MRF511 is gaining wide industry acceptance. The devices are listed according to increasing Current-Gain (f_T). More information concerning the device for your specific linear design needs can be obtained through your local Motorola Sales Office or Motorola distributor.

Device Type	Nominal Test Conditions V_{CE}/I_C Volts/mA	f_T MHz Min Typ*	Noise Figure		Distortion Specifications				Package
			Max or Typ*	Freq. MHz	2nd Order IMD	3rd Order IMD	12 ch. Cross-Mod.	Output Level dBmV	
MRF501	6/2-5	600	4.5°/200						TO72
MRF502	6/2-5	800	4.0°/200						TO72
2N5179	6/1.5-2	900	4.5/200						TO72
BFY90	5/2	1000	5.0/500						TO72
2N6305	5/2-10	1200	5.5/450						TO72
BFX89	—	1200	6.5/500						TO72
2N5109	15/10-50	1200	3.0°/200						TO39
2N5943	15/30-50	1200	6.8°/200	-50		-42	+50		TO39
2N6304	5/2-10	1400	4.5/450						TO72
MRF511	20/50-80	1500	7.3°/200	-50	-65	-57	+50		144D-04
MRF517	15/25-60	2200	7.5/300	-60	-72	-57	+45		TO39
MRF519	20/50-80	2200	8.0/300	-50	-68	-57	+50		TO39(1)
BFR90	10/14	5000°	2.4°/500						302
BFR91	5/35	5000°	1.9°/500						302
BFR96	10/50	5000°	3.3°/500						302

(1) Grounded Emitter TO39 (Case 79-05)

Hybrid Amplifier Modules

The Hybrid Modules listed are specified for amplifier applications in CATV distribution equipment but are applicable wherever broadband (HF/VHF) low distortion, low-noise amplification is required. These devices can also be used for Broadband Medium Power (0.5 W) Driver Amplifiers.

CATV HYBRID MODULES

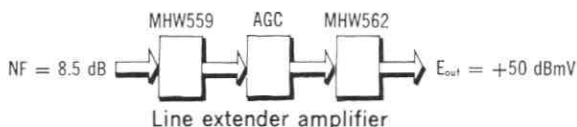
Device Type	Gain 40-300 MHz Min/Typ	Maximum Distortion Specifications				Noise Figure
		Output Level Note 1 dBmV	2nd Order Test Note 2 dB / Frequency MHz	3rd Order Test Note 2 dB / Frequency MHz	Cross-Modulation dB / No. of Channels	@ 300 MHz dB
MHW559	15.5/16	+50	-64/chs (2+13) @ ch R	-70/chs (4+5+A) @ ch R	-54/21	8.5
MHW562	15.5/16	+50	-69/chs (2+13) @ ch R	-78/chs (4+5+A) @ ch R	-57/21	10
MHW570	16/16.7	+50	-64/chs (2+13) @ ch R	-76/chs (4+5+A) @ ch R	-54/30	7.5
MHW572	16/16.7	+50	-70/chs (2+13) @ ch R	-79/chs (4+5+A) @ ch R	-57/30	9.0
MHW580	33/34	+48	-65/chs (3+M) @ ch W	-72/chs (U+V+W) @ ch W	-57/35	7.0

Notes:

- 1.0 Millivolt Referenced to 75 Ohms.
- Channel Frequency
 ch 2 = 55 MHz, ch 3 = 61 MHz, ch 4 = 67 MHz, ch 5 = 77 MHz, ch A = 121 MHz,
 ch 13 = 211 MHz, ch M = 325 MHz, ch R = 265 MHz, ch U = 283 MHz,
 ch V = 289 MHz, ch W = 295 MHz.

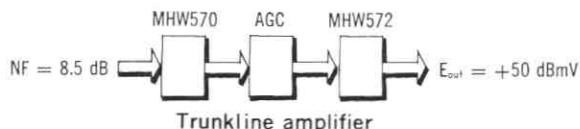
Chain 17 — CATV

GAIN ~ 30 dB (40-300 MHz)



Chain 18 — CATV

GAIN ~ 32 dB (40-300 MHz)



ENGINEERING BULLETIN ABSTRACTS

EB-8 — "HOW TO APPLY THE MHW709 AND MHW710 UMF POWER MODULES"

Discusses gain control, decoupling, source and load impedance, load mismatch and other operating conditions important to the effective use of the MHW709/710 series modules.

EB-9 — "BUILD THESE CLASS E CITIZENS BAND AMPLIFIERS"

Sufficient information is provided to build an amplifier/low pass filter using the MRF207/208 chain and providing 10 W at 225 MHz at the filter output. Use of the MRF225/226 chain in this circuit will provide 13 W.

EB-17 — "SIMPLE VHF BROADBAND DESIGN USES CQ TRANSISTOR LINEUP"

The fixed-tuned amplifier for the 132-175 MHz band described provides 40 W at 12.5 V from a 1.0 W input using the MRF216/MRF221 transistor chain.

EB-18 — "CQ MODULAR TECHNIQUES MAKE 45 WATT UHF AMPLIFIER PRACTICAL"

Provides construction information for a practical 45 W, 12.5 V UHF amplifier which uses a power module/transistor lineup. Line-ups for outputs of 25 W and 35 W are also specified.

EB-19 — "CONTROLLED-Q RF TECHNOLOGY — WHAT IT MEANS, HOW IT'S DONE"

How high frequency energy is efficiently transferred from a signal source to the control element in Motorola's Controlled-Q transistors is explained.

EB-23 — "HOW TO APPLY THE MHW601/602 VHF POWER MODULES"

Discusses operation and testing considerations that should be followed to use the MHW601/602 VHF power modules to the best advantage. Gain control, decoupling, source and load impedances and load mismatch are treated and instructions for building a test fixture are also provided.

EB-25 — "FOUR BUILDING BLOCK AMPLIFIERS FOR 900 MHz COMMUNICATIONS"

Describes the use of a family of four 50 ohm amplifiers for the 900 MHz band to build amplifier chains with up to 50 W output from as little as 50 mW input.

EB-26 — "A METALLIZATION SYSTEM FOR UHF AND MICROWAVE POWER TRANSISTORS"

The metallization system described overcomes the limitations of aluminum under high current density conditions. Justification of the choice of metals for the system is provided in the discussion.

EB-27 — "GET 300 WATTS PEP LINEAR ACROSS 2 TO 30 MHz FROM THIS PUSH-PULL AMPLIFIER"

Provides information sufficient to build a push-pull linear amplifier with 300 watts of PEP or CW output power across the 2 to 30 MHz band. MRF422, a new high power transistor developed for single sideband applications, is used in the design.

EB-29 — "THE COMMON EMITTER TO-39 AND ITS ADVANTAGES"

Motorola's small signal package innovation — the common emitter TO-39 — offers designers significant improvements in gain and thermal performance. EB-29 explains how.

EB-31 — "PERFORMANCE OF THE MHW560 SERIES OF CATV AMPLIFIER MODULES IN 50 OHM SYSTEMS"

The high gain, wideband linear characteristics of the MHW560 series of CATV amplifier modules suit them for use as low-level drivers in communications applications. EB-31 provides typical 50 ohm data and describes the test circuit with which the characterizations were derived.

EB-32 — "A COMPLEMENTARY SYMMETRY AMPLIFIER FOR 2 TO 30 MHz WITH SSB DRIVER APPLICATIONS"

The complementary symmetry amplifier discussed combines push-pull design with single ended impedance matching and high gain from Motorola's MRF432/433 transistors to provide up to 25 W PEP for 2 to 30 MHz SSB driver applications. Adequate information for constructing the circuit is included.

EB-37 — "AMPLIFIER GAINS 10 dB OVER NINE OCTAVES"

Discusses an amplifier, based on the MRF901 transistor, which exhibits a nominal gain of 10 dB over nine octaves of bandwidth. Sufficient information to build the amplifier is provided.

EB-38 — "MEASURING THE INTERMODULATION DISTORTION OF LINEAR AMPLIFIERS"

The two standard methods of measuring the intermodulation distortion of linear amplifiers and three systems for generating the required two-tone test signal are discussed.

EB-46 — "A SINGLE-DEVICE, 80-WATT, 50-OHM VHF AMPLIFIER"

EB-46 describes the design and construction of an amplifier using a single, MRF245, internally-matched transistor and providing 80 Watts with 9.5 gain across the 143 to 156 MHz band from just 8 W drive. Modifications of the basic amplifier for operation across wider bands are also discussed.

EB-53 — "TWO VHF HIGHBAND GAIN BLOCKS FORM 20 dB, 30-WATT AMPLIFIER CHAIN"

EB-53 describes an amplifier chain designed for use in a communications radio for the VHF marine band that can be adapted to both amateur and low-cost commercial usage. Built from MRF237, a 4 Watt common-emitter TO-39 transistor and MRD238, a 3030 Watt device, the amplifier chain provides 20 dB of gain over any 10 MHz portion of the VHF Marine/Amateur/Commercial band.

APPLICATION NOTE ABSTRACTS

AN-555 — "MOUNTING STRIPLINE-OPPOSED-EMITTER (SOE) TRANSISTORS"

The basic construction of the Stripline-Opposed-Emitter package used for many RF power transistors is described. Methods of mounting and heat-sinking both stud and flange type packages are described.

AN-593 — "BROADBAND LINEAR POWER AMPLIFIERS USING PUSH-PULL TRANSISTORS"

Two solid-state linear power amplifiers are discussed. One provides 160 watts while operating from a 28 volt supply and the other provides 80 watts from a 12.5 volt supply.

AN-595 — "25 WATT AND 10 WATT VHF MARINE BAND TRANSMITTERS"

Design, performance and construction information are provided for two power amplifiers suitable for VHF marine band (156-162 MHz) applications. Rated power output levels are 25 watts and 10 watts.

AN-704 — "BROADBAND NETWORK DESIGN FOR UHF AMPLIFIERS"

A practical method to synthesize breadboard matching networks for UHF power amplifier using only a set of filter design tables and a standard Smith chart is developed.

AN-721 — "IMPEDANCE MATCHING NETWORKS APPLIED TO RF POWER TRANSISTORS"

This note covers the basics of interstage and output impedance matching of RF power transistors. Graphical and numerical methods of solution are clearly described, along with sample problems. Photos, schematics and charts are generously provided throughout.

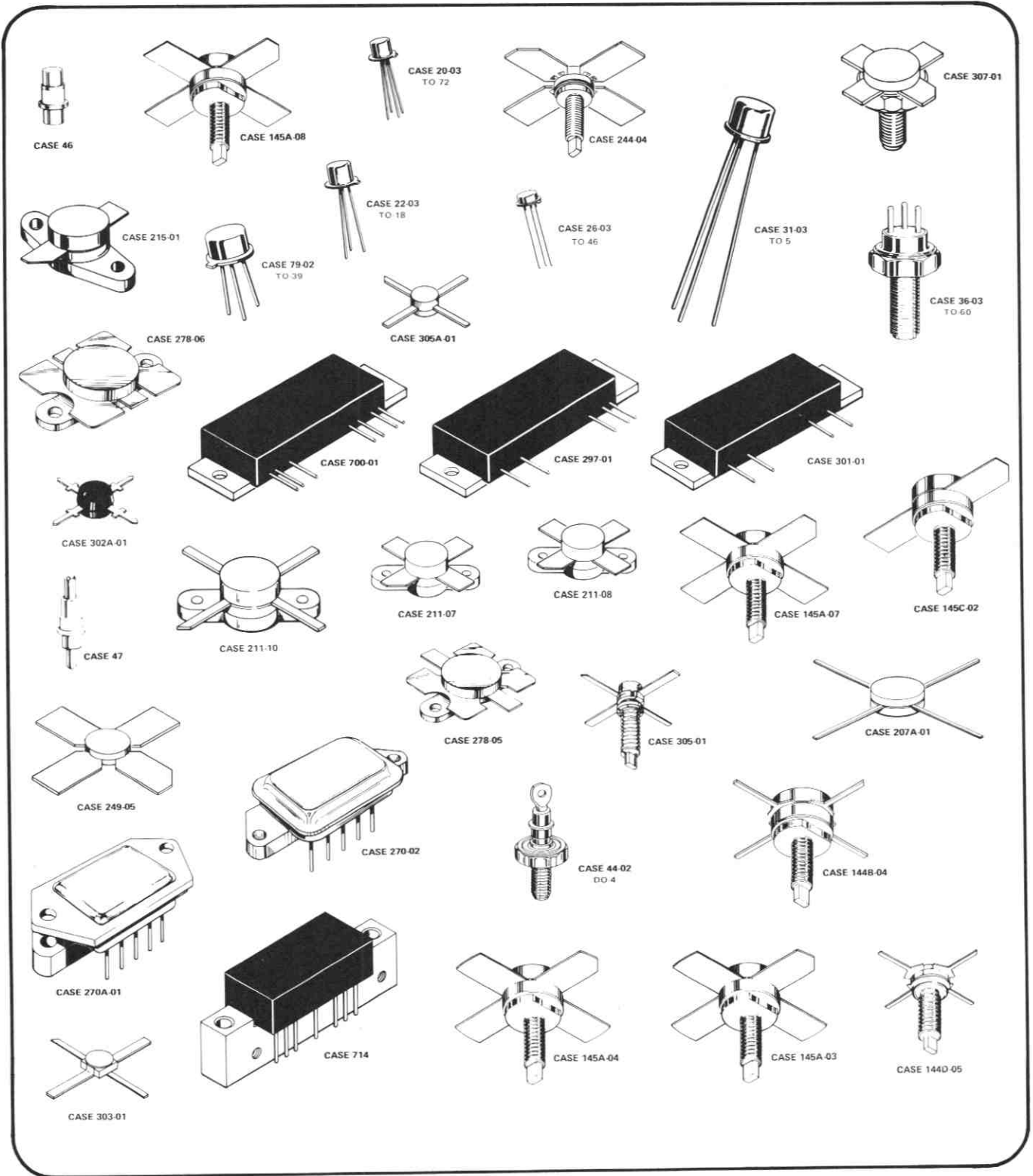
AN-728 — "13 WATT MICROSTRIP AMPLIFIER FOR 220-225 MHz OPERATION"

Design, performance and construction information are provided for a 12.5 volt, FM transmitter power amplifier and low pass filter. MRF225 and MRF226 RF power transistors are utilized in the two-stage amplifier to achieve 13 watts of power output to the filter from approximately 125 mW of drive at 225 MHz. Economical dipped-mica capacitors, microstrip lines and eyelet construction have been employed.

AN-749 — "BROADBAND TRANSFORMERS AND POWER COMBINING TECHNIQUES FOR RF"

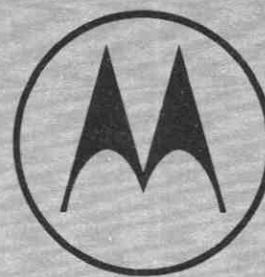
This Application Note discusses broadband transformers for RF power applications. Practical examples are given with performance data and power combining techniques are discussed in detail.

RF TRANSISTORS AND MODULES (continued)



PACKAGE INFORMATION

Silicon High Frequency products are available in a variety of packages for many applications. Information on devices in non-standard packaging may be obtained through your local Motorola Sales Office or Motorola distributor.



TUNING DIODES

... and Other VHF/UHF Devices

The age of electronic tuning and frequency control is here! Mechanical tuning systems are being outdated by the following advantages of electronic tuning systems:

- Mechanical linkage and contacts are eliminated.
- Channel or station changes can easily be made by push button, continuous tuning, signal search or sweep methods.
- Faster response time
- Remote tuning is simplified
- Tuning components are much smaller than mechanical components
- The designer is released from the mechanical and size restrictions dictated by mechanical tuning methods

Three parameters are of prime consideration in choosing the proper tuning diode.

C_T – Nominal capacitance – Measure of the capacitance at one specified voltage

C_R – Capacitance ratio – Ratio of the capacitance at two separate voltages usually at the operating ends of the CV curve. Measure of the magnitude of capacitance change as the reverse voltage is varied across the operating range.

Q – Figure of Merit – The same figure of merit that is widely used for capacitance and coils and is an indicator of how "good" a capacitor the tuning diode is.

These parameters are highlighted in the following selector guide and organized by package style to permit selection of the required specifications and package.

TABLE OF CONTENTS

Page

Epicap Tuning Diodes . . . designed for electronic tuning and control applications	4-66
PIN Switching Diodes . . . designed for VHF band switching and general-purpose switching . . .	4-72
Hot-Carrier Diodes . . . ideal for VHF and UHF mixer and detector applications as well as . . .	4-72
	many higher microwave frequency applications





The following index reflects the devices characterized in this section. To locate the exact page number, see Catalog Index (Page 7-1).

INDEX

1N5139,A	1N5462A	MB1-101	MV1622	MV1863D	MV2113
1N5140,A	1N5463A	MPI-3401	MV1624	MV1864D	MV2114
1N5141,A	1N5464A	MPN3401	MV1626	MV1865D	MV2115
1N5142,A	1N5465A	MPN3402	MV1628	MV1866	MV3102
1N5143,A	1N5466A	MPN3411	MV1630	MV1866D	MV3103
1N5144,A	1N5467A	MPN3412	MV1632	MV1868	MV3104
1N5145,A	1N5468A	MV104	MV1634	MV1868D	MV3105
1N5146,A	1N5469A	MV104G	MV1636	MV1870	MV3106
1N5147,A	1N5470A	MV109	MV1638	MV1870D	MV3107
1N5148,A	1N5471A	MV209	MV1640	MV1871	MV3140
1N5441A	1N5472A	MV830	MV1642	MV1872	MV3141
1N5442A	1N5473A	MV831	MV1644	MV1874	MV3142
1N5443A	1N5475A	MV832	MV1646	MV1876	MVAM-1
1N5444A	1N5476A	MV833	MV1648	MV1877	MVAM-2
1N5445A	BB105A	MV834	MV1650	MV1878	MVI-2097
1N5446A	BB105B	MV835	MV1652	MV2101	MVI-2098
1N5447A	BB105G	MV836	MV1654	MV2102	MVI-2099
1N5448A	MBD101	MV837	MV1656	MV2103	MVI-2100
1N5449A	MBD102	MV838	MV1658	MV2104	MVI-2101
1N5450A	MBD103	MV839	MV1660	MV2105	MVI-2102
1N5451A	MBD201	MV840	MV1662	MV2107	MVI-2103
1N5452A	MBD301	MV1401	MV1664	MV2108	MVI-2104
1N5453A	MBD501	MV1403	MV1666	MV2109	MVI-2105
1N5455A	MBD502	MV1404	MV1858D	MV2110	MVI-2106
1N5456A	MBD701	MV1405	MV1860D	MV2111	MVI-2107
1N5461A	MBD702	MV1620	MV1862D	MV2112	MVI-2108
					MVI-2109

EPICAP TUNING DIODES

LINE HIGHLIGHTS

<ul style="list-style-type: none"> • LOW CAPACITANCE • MICROWAVE OPERATION • MICROWAVE PACKAGE • HIGH Q 													<ul style="list-style-type: none"> • HIGH Q • CAPACITANCE TOLERANCE 10% and 5.0% 			<ul style="list-style-type: none"> • HIGH Q GUARANTEED @ 4.0 V • CONTROLLED TR 			<ul style="list-style-type: none"> • THE PREMIUM GLASS LINE • VERY HIGH Q • GUARANTEED HIGH TR • CAPACITANCE TOLERANCE 10%,5.0% and 2.0% 		
MAXIMUM WORKING VOLTAGE													60 VOLTS								
 Case 45				 Case 51 DO-7			 Case 51 DO-7			 Case 51 DO-7											
Cap Ratio 4-60 V Min	Q @ 4.0 V 100 MHz Min	Device Type	Cap Ratio 4-60 V Min	Q @ 4.0 V 50 MHz Min	(1) Device Type	Cap Ratio 4-60 V Min	Q @ 4.0 V 50 MHz Min	Device Type	Cap Ratio 2-30 V Min	Q @ 4.0 V 50 MHz Min	(2) Device Type										
1.0	2.1	350	MV 1858D																		
2.2	2.5	350	MC1860D																		
3.3	2.6	300	MC1862D																		
4.7	2.6	300	MV 1863D																		
6.8	2.7	300	MV 1864D	2.7	350	1N5139,A ⁽³⁾			2.7	600	1N5461A										
8.2	2.7	300	MV 1865D						2.8	600	1N5462A										
10	2.8	250	MV 1866D	2.8	300	1N5140,A	3.0	500	MV 1866	2.8	550	1N5463A									
10																					
10																					
12	2.8	200	MV 1868D	2.8	300	1N5141,A	3.0	500	MV 1868	2.8	550	1N5464A									
15	2.8	200	MV 1870D	2.8	250	1N5142,A	3.0	400	MV 1870	2.8	550	1N5465A									
18				2.8	250	1N5143,A	3.0	400	MV 1871	2.9	500	1N5466A									
20									2.9	500	1N5467A										
22				3.2	200	1N5144,A	3.2	400	MV 1872	2.9	500	1N5468A									
22																					
27				3.2	200	1N5145,A	3.2	300	MV 1874	2.9	500	1N5469A									
33				3.2	200	1N5146,A	3.2	300	MV 1876	2.9	500	1N5470A									
39				3.2	200	1N5147,A	3.2	300	MV 1877	2.9	450	1N5471A									
47				3.2	200	1N5148,A	3.2	300	MV 1878	2.9	400	1N5472A									
56									2.9	300	1N5473A										
68									2.9	250	1N5474A										
82									2.9	225	1N5475A										
100									2.9	200	1N5476A										
120																					
150																					
180																					
200																					
220																					
250																					
270																					
330																					

C_T
 NOMINAL
 CAPACITANCE
 pF
 $\pm 10\%$
 @
 $V_R = 4.0 V$
 $= 3.0 V^*$
 $f = 1.0 MHz$

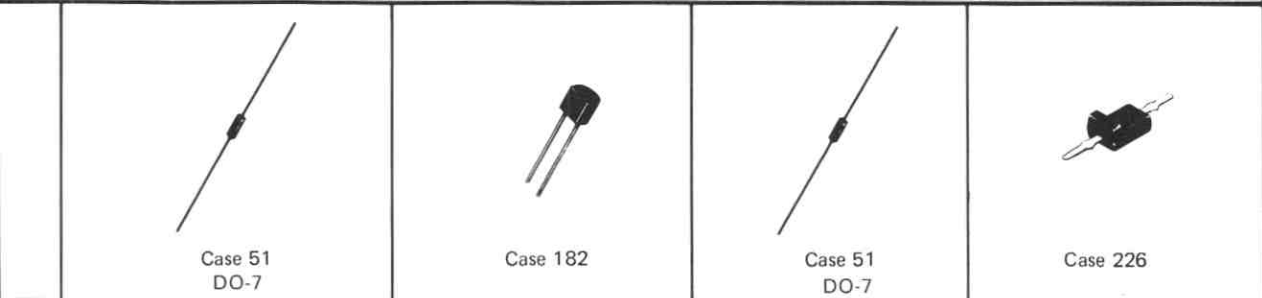
(1) Add Suffix "A" for $\pm 5.0\%$ C_T tolerance

(2) Substitute "B" Suffix for $\pm 5.0\%$ C_T , "C" Suffix for 2.0% C_T

(3) A versions of 1N5139 – 1N5148 series have tighter capacitance min/max windows.

<ul style="list-style-type: none"> • HIGH Q • CAPACITANCE TOLERANCE 10%, 5.0% and 2.0% • CONTROLLED 	<ul style="list-style-type: none"> • PLASTIC PACKAGE • LOW-COST, HIGH VOLUME 	<ul style="list-style-type: none"> • GENERAL PURPOSE 	<ul style="list-style-type: none"> • LOW INDUCTANCE • MINI-L PACKAGE
--	--	---	--

30 VOLTS



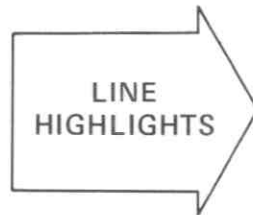
Cap. Ratio 2-30 V Min	Q @ 4.0 V 50 MHz Min	Device Type	Cap. Ratio 2-30 V Min	Q @ 4.0 V 50 MHz Min	Device Type	Cap. Ratio 4-25 V Min	Q @ 4.0 V 50 MHz Min	Device Type	Cap. Ratio 3-25 V Min	Q @ 3.0 V 50 MHz Min	Device Type
-----------------------------	-------------------------------	----------------	-----------------------------	-------------------------------	----------------	-----------------------------	-------------------------------	----------------	-----------------------------	-------------------------------	----------------



												1.0
												2.2
												3.3
												4.7
2.5	450	1N5441A	2.5	450	MV2101							6.8
2.5	450	1N5442A	2.5	450	MV2102							8.2
2.6	400	1N5443A	2.5	400	MV2103				4.5	150	MV3140*	10
									4.0	150	MV3141*	10
									3.5	50	MV3142*	10
2.6	400	1N5444A	2.5	400	MV2104							12
2.6	400	1N5445A	2.5	400	MV2105	1.8	30	MV830				15
2.6	350	1N5446A	2.5	350	MV2106	1.8	25	MV831				18
2.6	350	1N5447A										20
2.6	350	1N5448A	2.5	350	MV2107	1.8	25	MV832	4.5	300	MV3102*	22
									4.0	200	MV3103*	22
2.6	350	1N5449A	2.5	300	MV2108	1.8	25	MV833				27
2.6	350	1N5450A	2.5	200	MV2109	1.9	20	MV834				33
2.6	300	1N5451A	2.5	150	MV2110	1.9	20	MV835				39
2.6	250	1N5452A	2.5	150	MV2111	1.9	15	MV836				47
2.6	200	1N5453A	2.6	150	MV2112	1.9	15	MV837				56
2.7	175	1N5454A	2.6	150	MV2113	2.0	15	MV838				68
2.7	175	1N5455A	2.6	100	MV2114	2.0	10	MV839				82
2.7	175	1N5456A	2.6	100	MV2115	2.0	10	MV840				100

C_T
 NOMINAL
 CAPACITANCE
 pF
 $\pm 10\%$
 @
 $V_R = 4.0 V$
 $= 3.0 V^*$
 $f = 1.0 MHz$

* Hyper Abrupt

EPICAP TUNING DIODES (continued)



<ul style="list-style-type: none"> • HIGH Q • IDEAL FOR RF AND MICROWAVE APPLICATIONS 			<ul style="list-style-type: none"> • CONTROLLED AND UNIFORM TUNING RATIO • CAPACITANCE TOLERANCE 10% • MICRO-MINIATURE PACKAGE 		
MAXIMUM WORKING VOLTAGE			30 VOLTS		
 <p>Case 226</p>			 <p>Case 166-02</p>		
Cap Ratio 2-30 V Min	Q @ 4.0 V 100 MHz Min	Device Type	Cap Ratio 2-30 V Min	Q @ 4.0 V 100 MHz Min	Device Type

<p>C_T NOMINAL CAPACITANCE pF ±10% @ $V_R = 4.0\text{ V}$ $= 2.0\text{ V}^\ddagger$ $= 1.0\text{ V}^\bullet$ $f = 1.0\text{ MHz}$</p>	1.0				2.0	325	MVI-2097
	2.2				2.0	325	MVI-2908
	3.3				2.2	300	MVI-2909
	4.7				2.4	300	MVI-2100
	6.8	2.7	225	MV3501	2.7	275	MVI-2101
	8.2	2.8	225	MV3502	2.8	275	MVI-2102
	10	2.8	200	MV3503	2.8	275	MVI-2103
	12	2.8	200	MV3504	2.8	275	MVI-2104
	15	2.9	200	MV3505	2.9	275	MVI-2105
	18	2.9	175	MV3506	2.9	250	MVI-2106
	20						
	22	2.9	175	MV3507	2.9	200	MVI-2107
	27				2.7	200	MVI-2108
	33				2.7	200	MVI-2109
	39						
	47						
	56						
	68						
	82						
	100						
	120						
150							
180							
200							
220							
250							
270							
330							
550							

* Motorola has capability to supply a variety of families in the Micro-I. If the device desired is not listed — please contact your nearest distributor or Motorola Sales Representative.

• GENERAL PURPOSE	• HIGH CAPACITANCE • GENERAL PURPOSE	• HYPER ABRUPT • GLASS DIODES
-------------------	---	----------------------------------

20 VOLTS	12 VOLTS
----------	----------

Case 51 DO-7	Case 146 DO-14	Case 51 DO-7

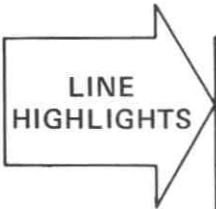
Cap Ratio 2-20 V Min	Q @ 4.0 V 50 MHz Min	Device Type	Cap Ratio 2-20 V Min	Q @ 4.0 V 20 MHz Min	Device Type	Cap Ratio 2-10 V #1-10 V Min	Q @ 2.0 V 1.0 MHz Min	Device Type
----------------------------	-------------------------------	----------------	----------------------------	-------------------------------	----------------	---------------------------------------	--------------------------------	----------------



									1.0
									2.2
									3.3
									4.7
2.0	300	MV 1620							6.8
2.0	300	MV 1622							8.2
2.0	300	MV 1624							10
2.0	300	MV 1626							12
2.0	250	MV 1628							15
2.0	250	MV 1630							18
2.0	250	MV 1632							20
2.0	250	MV 1634							22
2.0	200	MV 1636							27
2.0	200	MV 1638							33
2.0	200	MV 1640							39
2.0	200	MV 1642							47
2.0	150	MV 1644							56
2.0	150	MV 1646							68
2.0	150	MV 1648							82
2.0	150	MV 1650							100
			2.6	250	MV 1652	10	200	MV 1404‡	120
			2.6	250	MV 1654	10	200	MV 1403‡	150
			2.6	200	MV 1656				180
			2.6	200	MV 1658				200
			2.6	150	MV 1660				220
			2.3	150	MV 1662(3)	10	200	MV 1405‡	250
			2.3	100	MV 1664(3)				270
			2.3	100	MV 1666(3)				330
						14	200	#MV 1401‡	550

C_T
 NOMINAL
 CAPACITANCE
 pF
 ±10%
 @
 $V_R = 4.0 V$
 $= 2.0 V‡$
 $= 1.0 V$
 $f = 1.0 MHz$

FM Radio and TV Hyper-Abrupt Tuning Diodes

... designed for use in VHF and UHF tuners and FM radio, providing solid-state reliability in replacement of mechanical tuning methods.



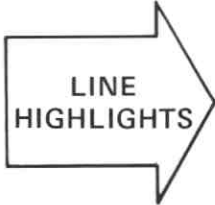
<ul style="list-style-type: none"> • HIGH Q • GUARANTEED CAPACITANCE RANGE 			<ul style="list-style-type: none"> • LOW INDUCTANCE • MINI-L PACKAGE 			<ul style="list-style-type: none"> • GUARANTEED MINIMUM Q • LOW INDUCTANCE • MINI-L PACKAGE 			<ul style="list-style-type: none"> • HIGH Q • CONTROLLED TR • LOW INDUCTANCE • MINI-L PACKAGE 			<ul style="list-style-type: none"> • HIGH Q • CONTROLLED TR • LOW INDUCTANCE • MINI-L PACKAGE 		
MAXIMUM WORKING VOLTAGE 32 VOLTS						30 VOLTS								
 Case 29-02 TO-92						 Case 226								
Cap Ratio 3-30 V Min	Q @ 3.0 V 100 MHz Min	Device Type	Cap Ratio 3-25 V Min	Q @ 3.0 V 100 MHz Min	Device Type	Cap Ratio 3-25 V Min	Q @ 3.0 V 100 MHz Min	Device Type	Cap Ratio 3-25 V Min	Q @ 3.0 V 50 MHz Min	Device Type	Cap Ratio 3-25 V Min	Q @ 3.0 V 50 MHz Min	Device Type
2.2*			4.5	225	BB105B									
2.3*			4.0	150	BB105G									
2.6*			4.0	225	BB105A									
10						4.5	150	MV3140						
10						4.0	150	MV3141						
10						3.5	50	MV3142						
22									4.5	300	MV3102			
22									4.0	200	MV3103			
29												5.0	280	MV109
29												5.0	200	MV209
36	2.5	100	MV104G											
40	2.5	100	MV104											

C_T
 NOMINAL
 CAPACITANCE
 pF
 $\pm 10\%$
 $V_R = 3.0 \text{ Vdc}$
 $f = 1.0 \text{ MHz}$

* $V_R = 25 \text{ V}$ for C_T

AM Tuning Diodes

... designed for electronic tuning of AM radios, receivers, and general AM frequency control.



<ul style="list-style-type: none"> • HIGH CAPACITANCE RATIO • GUARANTEED DIODE CAPACITANCE 	<ul style="list-style-type: none"> • HIGH CAPACITANCE RATIO • GUARANTEED DIODE CAPACITANCE
--	--

MAXIMUM WORKING VOLTAGE 28 VOLTS



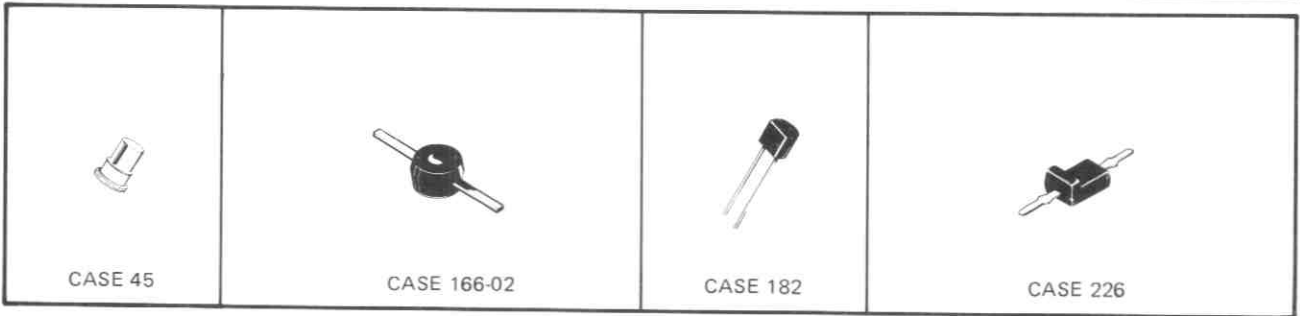
Cap Ratio 1-25 V Min	Q @ 1.0 V 1.0 MHz Min	Device Type	Cap Ratio 1-25 V Min	Q @ 1.0 V 1.0 MHz Min	Device Type
----------------------	-----------------------	-------------	----------------------	-----------------------	-------------

C _T NOMINAL CAPACITANCE pF ±10% V _R = 1.0 V f = 1.0 MHz	330	15	150	MVAM-2 (Dual AM Diode)		
	450				15	150	MVAM-1 (Triple AM Diode)

Hot-Carrier Diodes

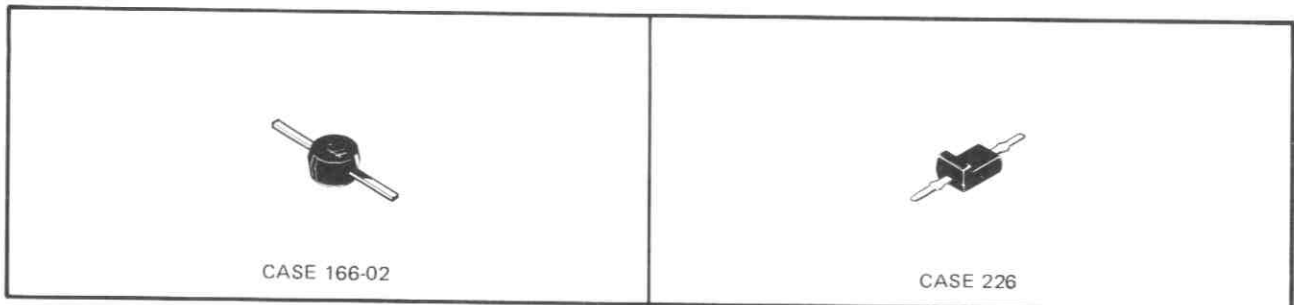
Hot-Carrier diodes are ideal for VHF and UHF mixer and detector applications as well as many higher microwave frequency applications. They provide stable electrical characteristics by eliminating the point-contact diode presently used in many applications. Motorola has the capability of supplying these devices in a variety of packages.

$V_{(BR)R}$ $I_R = 10 A$ Volts Min	C_T $V_R = 0 V, f = 1.0 MHz (1)$ $V_R = 15 V, f = 1.0 MHz (2)$ $V_R = 20 V, f = 1.0 MHz (3)$ pF Max	V_F $I_F = 10 mA$ Volts Max	I_R $V_R = 3.0 V (4)$ $V_R = 15 V (5)$ $V_R = 25 V (6)$ $V_R = 35 V (7)$ μA Max	NF dB Max	Device Type	Case
4.0	1.0 (1)	0.6	0.25 (4)	7.0	MBD101	182-02
4.0	1.0 (1)	0.6	0.25 (4)	7.0	MBD102	226
4.0	1.0 (1)	0.6	0.25 (4)	7.0	MBD103	45-01
20	1.5 (2)	0.6	200 (5)		MBD201	182-03
30	1.5 (2)	0.6	200 (6)		MBD301	182-03
50	1.0 (3)	1.2	200 (6)		MBD501	182-02
50	1.0 (3)	1.2	200 (6)		MBD502	226
70	1.0 (3)	1.2	200 (7)		MBD701	182-02
70	1.0 (3)	1.2	200 (7)		MBD702	226
4.0	1.0 (1)	0.6	0.25 (4)	7.0	MBI-101	166-02



Pin Switching Diodes

... designed for VHF band switching and general purpose switching.



$V_{(BR)R}$ $I_R = 10 \mu A$ Volts Min	R_S $I_F = 10 mA$ Ohms Min	C_T $V_R = 20 V$ $f = 1.0 MHz$ $f = 100 MHz^*$ pF Max	L_S $f = 250 MHz$ nH Typ	C_C $f = 1.0 MHz$ pF Typ	Device Type	Case
35	0.7	1.0	3.0	0.15	MPI-3401	166-02
35	0.7	1.0	3.0	0.1	MPN3401	226
35	0.6	2.0	3.0	0.1	MPN3402	226
25	10	0.45*	3.0	0.1	MPN3411	226
25	15	0.45*	3.0	0.1	MPN3412	226



ZENER DIODES

Voltage Regulator and Reference Devices

In every language under the sun, the name most commonly associated with solid-state regulator and reference devices is Motorola. A pioneer in Zener diodes development, Motorola has consistently led the industry in parameter improvements, packaging proliferation and specifications innovation. Today, Motorola serves the industry with an incomparable line of zener and avalanche regulator diodes, temperature compensated reference devices, and a host of integrated circuits designed to provide the exact degree of regulation required, at the point in the circuit or system where it can be used most conveniently at the lowest cost.

TABLE OF CONTENTS

	Page
Zener and Avalanche Regulator Diodes	
Silicon-oxide to provide low leakage, sharp breakover "knee" and long-term stability.	4-77
Zener Reference Devices (Temperature Compensated)	
Consist of forward-biased silicon diode junctions in series with zener-breakdown diode to provide precise degree of temperature compensation. Though not specified, voltage-time stability normally better than 100 parts per million change per 1000 hours of operation.	4-79
Special Devices	
<u>Precision Reference Diodes</u>	
Ultra precision voltage standards with certified voltage-time variations as low as 5 ppm per 1000 hours of operation.	4-80
<u>Amplifying Regulator Diodes</u>	
Designed for use in regulated power supplies as a combination voltage reference element and error voltage amplifier, providing temperature compensation for excellent reference voltage stability.	4-80
<u>Field-Effect Current Regulator Diodes</u>	
Provide constant-current output over wider range of terminal voltage. Used in instrumentation (ramp and stair-step generators), over-current protection and other applications requiring a constant current between 0.22 and 4 mA (nom).	4-80
<u>Voltage Regulators</u>	
High-conductance silicon diodes designed as a stable forward reference source for biasing transistor amplifiers and similar applications.	4-81
<u>Current Limited Reference Devices (Temperature Compensated)</u>	
Designed specifically for precision instrumentation applications, this series of devices offers a 6-35 volt (nominal) output over a wide range of input voltages and temperature.	4-81
<u>Tuning Regulator Diodes</u>	
For use in television and FM radios that use variable capacitance diode tuners.	4-81
<u>Dual Diodes</u>	
Designed for use in low cost biasing, steering and voltage doubler applications.	4-81
<u>Transient Suppressors</u>	
For applications requiring protection of voltage sensitive equipment against high-energy voltage pulses.	4-82

ZENER DIODES (continued)

The following index reflects the devices characterized in this section. To locate the exact page number, see Catalog Index (Page 7-1).

INDEX

.4M.64FR10	1N945B,J,TX	1N2808&R	1N3015&R	1N3334&R	1N4074	1N4060&R	1N4749
.4M1.36FR5	1N957	1N2809&R	1N3016	1N3335&R	1N4074A	1N4561&R	1N4750
.4M1.36FR2	1N958	1N2810&R	1N3017	1N3336&R	1N4075	1N4562&R	1N4751
.4M2.04FR5	1N959	1N2811&R	1N3018	1N3337&R	1N4075A	1N4563&R	1N4752
.4M2.04FR2	1N960	1N2813&R	1N3019	1N3338&R	1N4076	1N4564&R	1N4753
1M110ZS10	1N961	1N2814&R	1N3020	1N3339&R	1N4076A	1N4565	1N4754
1M120ZS10	1N962	1N2816&R	1N3021	1N3340&R	1N4077	1N4565A	1N4755
1M130ZS10	1N963	1N2818&R	1N3022	1N3342&R	1N4077A	1N4566	1N4756
1M140ZS10	1N964	1N2819&R	1N3023	1N3343&R	1N4078	1N4566A	1N4757
1M160ZS10	1N965	1N2820&R	1N3024	1N3346&R	1N4078A	1N4567	1N4758
1M180ZS10	1N966	1N2822&R	1N3025	1N3347&R	1N4079	1N4567A	1N4759
1M200ZS10	1N967	1N2823&R	1N3026	1N3349&R	1N4079A	1N4568	1N4760
1N429	1N968	1N2824&R	1N3027	1N3350&R	1N4080	1N4568A	1N4761
1N746	1N969	1N2825&R	1N3028	1N3503	1N4080A	1N4569	1N4762
1N747	1N970	1N2826&R	1N3029	1N3504	1N4081	1N4569A	1N4763
1N748	1N971	1N2827&R	1N3030	1N3821	1N4081A	1N4570	1N4764
1N749	1N972	1N2829&R	1N3031	1N3822	1N4082	1N4570A	1N4775
1N750	1N973	1N2831&R	1N3032	1N3823	1N4082A	1N4571	1N4775A
1N751	1N974	1N2832&R	1N3033	1N3824	1N4083	1N4571A	1N4776
1N752	1N975	1N2833&R	1N3034	1N3825	1N4083A	1N4572	1N4776A
1N753	1N976	1N2834&R	1N3035	1N3826	1N4084	1N4572A	1N4777
1N754	1N977	1N2835&R	1N3036	1N3827	1N4084A	1N4573	1N4777A
1N755	1N978	1N2836&R	1N3037	1N3828	1N4085	1N4573A	1N4778
1N756	1N979	1N2837&R	1N3038	1N3829	1N4085A	1N4574	1N4778A
1N757	1N980	1N2838&R	1N3039	1N3830	1N4099	1N4574A	1N4779
1N758	1N981	1N2840&R	1N3040	1N3993&R	1N4100	1N4575	1N4779A
1N759	1N982	1N2841&R	1N3041	1N3994&R	1N4101	1N4575A	1N4780
1N816	1N983	1N2842&R	1N3042	1N3995&R	1N4103	1N4576	1N4780A
1N821,J,TX	1N984	1N2843&R	1N3043	1N3996&R	1N4104	1N4576A	1N4781
1N821A	1N985	1N2844&R	1N3044	1N3997&R	1N4105	1N4577	1N4781A
1N823,J,TX	1N986	1N2845&R	1N3045	1N3998&R	1N4106	1N4577A	1N4782
1N823A	1N987	1N2846&R	1N3046	1N3999&R	1N4107	1N4578	1N4782A
1N825,J,TX	1N988	1N2970&R	1N3047	1N4000&R	1N4109	1N4578A	1N4783
1N825A	1N989	1N2971&R	1N3048	1N4057	1N4110	1N4579	1N4783A
1N827,J,TX	1N990	1N2972&R	1N3049	1N4057A	1N4112	1N4579A	1N4784
1N827	1N991	1N2973&R	1N3050	1N4058	1N4114	1N4580	1N4784A
1N829,J,TX	1N992	1N2974&R	1N3051	1N4058A	1N4115	1N4580A	1N4892
1N829A	1N1530	1N2975&R	1N3154,J,TX	1N4059	1N4116	1N4581A	1N4892A
1N935	1N1530A	1N2976&R	1N3154A	1N4059A	1N4118	1N4581	1N4893
1N935A	1N1735	1N2977&R	1N3155,J,TX	1N4060	1N4120	1N4582	1N4893A
1N935B,J,TX	1N1736	1N2979&R	1N3155A	1N4060A	1N4121	1N4582A	1N4894
1N936	1N1736A	1N2980&R	1N3156,J,TX	1N4061	1N4122	1N4583	1N4894A
1N936A	1N1737	1N2982&R	1N3156A	1N4061A	1N4123	1N4583A	1N4895
1N936B	1N1737A	1N2984&R	1N3157,J,TX	1N4062	1N4124	1N4584	1N4895A
1N937	1N1738	1N2985&R	1N3157A	1N4062A	1N4125	1N4584A	1N4896
1N937A	1N1738A	1N2986&R	1N3305&R	1N4063	1N4126	1N4728	1N4896A
1N937B,J,TX	1N1739	1N2988&R	1N3306&R	1N4063A	1N4127	1N4729	1N4897
1N938	1N1739A	1N2989&R	1N3307&R	1N4064	1N4129	1N4730	1N4897A
1N938A	1N1740	1N2990&R	1N3308&R	1N4064A	1N4130	1N4731	1N4898
1N938B,J,TX	1N1740A	1N2991&R	1N3309&R	1N4065	1N4131	1N4732	1N4898A
1N939	1N1741	1N2992&R	1N3310&R	1N4065A	1N4132	1N4733	1N4899
1N939A	1N1741A	1N2993&R	1N3311&R	1N4066	1N4134	1N4734	1N4899A
1N939B,J,TX	1N1742	1N2996&R	1N3312&R	1N4066A	1N4135	1N4735	1N4900
1N941	1N1742A	1N2997&R	1N3314&R	1N4067	1N4370	1N4736	1N4900A
1N941A	1N2163,A	1N2999&R	1N3315&R	1N4067A	1N4371	1N4737	1N4901
1N941,B,J,TX	1N2164,A	1N3000&R	1N3317&R	1N4068	1N4372	1N4549&R	1N4901A
1N942	1N2165,A	1N3001&R	1N3319&R	1N4068A	1N4550&R	1N4551&R	1N4902
1N942A	1N2166,A	1N3002&R	1N3320&R	1N4069	1N4551&R	1N4740	1N4903
1N942B	1N2167,A	1N3003&R	1N3321&R	1N4069A	1N4552&R	1N4741	1N4903A
1N943	1N2168,A	1N3004&R	1N3322&R	1N4070	1N4552&R	1N4742	1N4904
1N943A	1N2169,A	1N3005&R	1N3324&R	1N4070A	1N4553&R	1N4743	1N4904A
1N943B,J,TX	1N2170,A	1N3007&R	1N3325&R	1N4071	1N4554&R	1N4744	1N4905
1N944	1N2171,A	1N3008&R	1N3326&R	1N4071A	1N4555&R	1N4745	1N4905A
1N944A	1N2804&R	1N3009&R	1N3327&R	1N4072	1N4556&R	1N4746	1N4906
1N944B,J,TX	1N2805&R	1N3011&R	1N3328&R	1N4072A	1N4557&R	1N4747	1N4906A
1N945	1N2806&R	1N3012&R	1N3330&R	1N4073	1N4558&R	1N4748	1N4907
1N945A	1N2807&R	1N3014&R	1N3332&R	1N4073A	1N4559&R	1N4748	1N4907

ZENER DIODES (continued)

INDEX (continued)

1N4907A	1N5242	1N5337	1N5844A	1N5937	MCA1912	MZ4622	MZC6.8B10
1N4908	1N5243	1N5338	1N5845A	1N5938	MCA1913	MZ4623	MZC7.5B10
1N4908A	1N5245	1N5339	1N5846A	1N5939	MCA1914	MZ4624	MZC8.2B10
1N4909	1N5246	1N5341	1N5847A	1N5940	MCA1921	MZ4625	MZC9.1B10
1N4909A	1N5248	1N5342	1N5848A	1N5941	MCA1922	MZ4626	MZC10B10
1N4910	1N5250	1N5343	1N5850A	1N5942	MCA1923	MZ4627	MZC11B10
1N4910A	1N5251	1N5344	1N5851A	1N5943	MCA1924	MZC2.4A10	MZC12B10
1N4911	1N5252	1N5346	1N5852A	1N5944	MCA1931	MZC2.7A10	MZC13B10
1N4911A	1N5254	1N5347	1N5853A	1N5945	MCA1932	MZC3.0A10	MZC15B10
1N4912	1N5256	1N5348	1N5855A	1N5946	MCA1933	MZC3.3A10	MZC16B10
1N4912A	1N5257	1N5350	1N5856A	1N5947	MCA1934	MZC3.6A10	MZC18B10
1N4913	1N5258	1N5352	1N5857A	1N5948	MCA2011	MZC3.9A10	MZC20B10
1N4913A	1N5259	1N5353	1N5858A	1N5949	MCA2012	MZC4.3A10	MZC22B10
1N4914	1N5260	1N5355	1N5859A	1N5950	MCA2013	MZC4.7A10	MZC24B10
1N4914A	1N5261	1N5357	1N5861A	1N5951	MCA2014	MZC5.1A10	MZC27B10
1N4915	1N5262	1N5358	1N5862A	1N5952	MCA2021	MZC5.6A10	MZC30B10
1N4915A	1N5263	1N5359	1N5864A	1N5953	MCA2022	MZC6.2A10	MZC33B10
1N4916	1N5265	1N5361	1N5866A	1N5954	MCA2023	MZC6.8A10	MZC36B10
1N4916A	1N5266	1N5363	1N5867A	1N5955	MCA2024	MZC7.5A10	MZC39B10
1N4917	1N5267	1N5364	1N5868A	1N5956	MCA2031	MZC8.2A10	MZC43B10
1N4917A	1N5268	1N5365	1N5870A	1N5985	MCA2132	MZC9.1A10	MZC47B10
1N4918	1N5270	1N5366	1N5872A	1N5986	MCA2133	MZC10A10	MZC51B10
1N4918A	1N5271	1N5367	1N5873A	1N5987	MCA2134	MZC11A10	MZC56B10
1N4919	1N5272	1N5368	1N5874A	1N5988	MCA2211	MZC12A10	MZC62B10
1N4919A	1N5273	1N5369	1N5875A	1N5989	MCA2212	MZC13A10	MZC68B10
1N4920	1N5274	1N5370	1N5876A	1N5990	MCA2213	MZC15A10	MZC75B10
1N4920A	1N5275	1N5372	1N5877A	1N5991	MCA2214	MZC16A10	MZC82B10
1N4921	1N5276	1N5373	1N5878A	1N5992	MCA2221	MZC18A10	MZC91B10
1N4921A	1N5277	1N5374	1N5879A	1N5993	MCA2222	MZC20A10	MZC100B10
1N4922	1N5278	1N5375	1N5881A	1N5994	MCA2223	MZC22A10	MZC110B10
1N4922A	1N5279	1N5377	1N5882A	1N5995	MCA2224	MZC24A10	MZC120B10
1N4923	1N5281	1N5378	1N5883A	1N5996	MCA2231	MZC27A10	MZC130B10
1N4923A	1N5283	1N5379	1N5884A	1N5997	MCA2232	MZC29A10	MZC140B10
1N4924	1N5284	1N5380	1N5886A	1N5998	MCA2233	MZC30A10	MZC140B10
1N4924A	1N5285	1N5381	1N5887A	1N5999	MCA2234	MZC33A10	MZC150B10
1N4925	1N5286	1N5383	1N5888A	1N6000	MCL1300	MZC36A10	MZC160B10
1N4925A	1N5287	1N5384	1N5889A	1N6001	MCL1301	MZC39A10	MZC170B10
1N4926	1N5288	1N5386	1N5890A	1N6002	MCL1302	MZC43A10	MZC180B10
1N4926A	1N5289	1N5388	1N5891A	1N6003	MCL1303	MZC47A10	
1N4927	1N5290	1N5518	1N5892A	1N6004	MCL1304	MZC51A10	
1N4927A	1N5291	1N5519	1N5893A	1N6005	MCLTC6010	MZC56A10	
1N4928	1N5292	1N5520	1N5894A	1N6006	MCLTC6025	MZC62A10	
1N4928A	1N5293	1N5521	1N5895A	1N6007	MCLTC6050	MZC68A10	
1N4929	1N5294	1N5522	1N5897A	1N6008	MCLTC6100	MZC75A10	
1N4929A	1N5295	1N5523	1N5913	1N6009	MSD6100	MZC82A10	
1N4930	1N5296	1N5524	1N5914	1N6010	MSD6101	MZC91A10	
1N4930A	1N5297	1N5525	1N5915	1N6011	MSD6102	MZC100A10	
1N4931	1N5298	1N5526	1N5916	1N6012	MSD6150	MZC110A10	
1N4931A	1N5299	1N5527	1N5917	1N6013	MSD7000	MZC120A10	
1N4932	1N5300	1N5528	1N5918	1N6014	MVS460	MZC130A10	
1N4932A	1N5301	1N5529	1N5919	1N6015	MZ605	MZC140A10	
1N5221	1N5302	1N5530	1N5920	1N6016	MZ610	MZC150A10	
1N5223	1N5303	1N5531	1N5921	1N6017	MZ620	MZC160A10	
1N5225	1N5304	1N5532	1N5922	1N6018	MZ640	MZC170A10	
1N5226	1N5305	1N5533	1N5923	1N6019	MZ805	MZC180A10	
1N5227	1N5306	1N5535	1N5924	1N6020	MZ810	MZC200A10	
1N5228	1N5307	1N5536	1N5925	1N6021	MZ820	MZC1.8B10	
1N5229	1N5308	1N5538	1N5926	1N6022	MZ840	MCZ2.0B10	
1N5230	1N5309	1N5540	1N5927	1N6023	MZ2360	MCZ2.2B10	
1N5231	1N5310	1N5541	1N5928	1N6024	MZ2361	MCZ2.4B10	
1N5232	1N5311	1N5542	1N5929	1N6025	MZ2362	MCZ2.7B10	
1N5233	1N5312	1N5545	1N5930	1N6026	MZ4614	MCZ3.0B10	
1N5234	1N5313	1N5546	1N5931	1N6027	MZ4615	MZC3.3B10	
1N5235	1N5314	1N5837A	1N5932	1N6028	MZ4616	MZC3.6B10	
1N5236	1N5314	1N5839A	1N5933	1N6029	MZ4617	MZC3.9B10	
1N5237	1N5333	1N5841A	1N5934	1N6030	MZ4618	MZC4.3B10	
1N5239	1N5334	1N5842A	1N5935	1N6031	MZ4619	MZC4.7B10	
1N5240	1N5335	1N5843A	1N5936	MCA1911	MZ4620	MZC5.1B10	
1N5241	1N5336	1N5843A	1N5936		MZ4621	MZC5.6B10	
						MZC6.2B10	

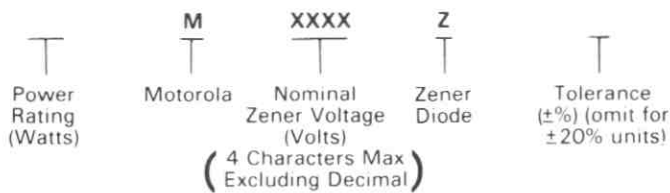
DEVICE OPTIONS

Motorola manufactures a complete line of zener diodes. In cases where a non-standard set of specifications is required, the appropriate device can be selected and ordered from the following device options.

NON-STANDARD ZENER DIODES SPECIAL VOLTAGE AND TOLERANCE RATINGS

JEDEC "IN" type numbers denote a specific Zener voltage, power rating, and tolerance. For example, JEDEC type 1N4728 is a standard 1 watt diode, rated at 3.3 volts $\pm 10\%$. A suffix "A" on this type number indicates a $\pm 5\%$ voltage tolerance.

Special Motorola devices, with a choice of voltages and tolerances, are also available. The following diagram explains the Motorola coding system:



For example, the code for a special 10 watt Zener diode with a voltage of 41 volts and a tolerance of $\pm 1\%$ would be: 10M41Z1.

Following is a list of other standard Motorola symbols for special Zener device orders (X's indicate nominal Zener voltage):

BASIC MOTOROLA TYPE	DEVICE DESCRIPTION
1/4MXXXAZ5	250 mW Alloy Glass, $\pm 5\%$
1/4MXXXZ5	250 mW Glass, $\pm 5\%$
4MXXXAZ5	400 mW Alloy Glass, $\pm 5\%$
4MXXXZ10	400 mW Glass, $\pm 10\%$
5MXXXZS10	500 mW Surmetic, $\pm 10\%$
1MXXXZ5	1 Watt Flangeless, $\pm 5\%$
1MXXXAZ10	1 Watt Alloy Flangeless, $\pm 10\%$
1MXXXZ10	1 Watt Flangeless, $\pm 10\%$
1MXXXZS5	1 Watt Surmetic, $\pm 5\%$
1 5MXXXZ	1 5 Watt, $\pm 20\%$
5MXXXZS5	5 Watt Surmetic, $\pm 5\%$
10MXXXAZ5	10 Watt Alloy Stud, $\pm 5\%$
10MXXXZ10	10 Watt Stud, $\pm 10\%$
50MXXXAZ10	50 Watt Alloy TO-3, $\pm 10\%$
50MXXXASZ5	50 Watt Alloy Stud, $\pm 5\%$
50MXXXZ	50 Watt TO-3, $\pm 20\%$
50MXXXSZ5	50 Watt Stud, $\pm 5\%$

For reverse polarities (10 W and 50 W), insert "R" before tolerance, i.e., 50M110SZR5.

1N5518 thru 1N5546 — This series may be ordered in $\pm 2\%$ and $\pm 1\%$ tolerance by adding the following suffix:

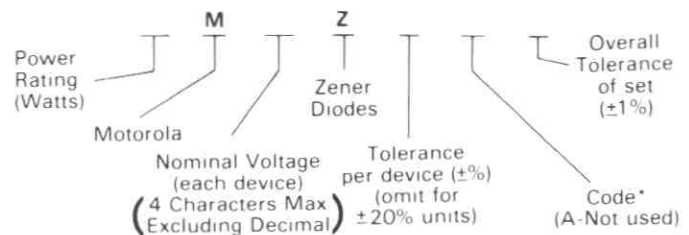
C = $\pm 2\%$ D = $\pm 1\%$

For example the 1N5518D would be the same as the 1N5518B except $V_Z = 3.3 \pm 1\%$.

ZENER TYPES BETWEEN NOMINAL VOLTAGES MATCHED SETS OF ZENER DIODES

Zener diodes can also be obtained in sets consisting of two or more matched devices. The method for specifying such matched sets is similar to the one described for specifying units with a special voltage and/or tolerance except that two extra suffixes are added to the code number described above.

These units are marked with code letters to identify the matched sets and in addition, each unit in a set is marked with the same serial number which is different for each set being ordered.

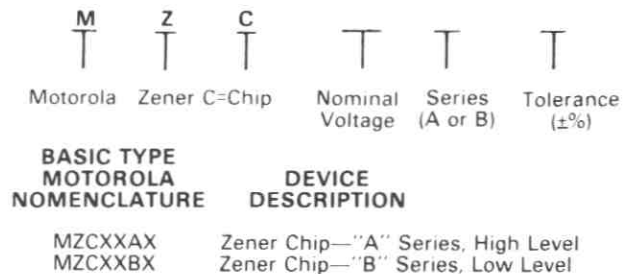


*Code

- B — Two devices in series
 - C — Three devices in series
 - D — Four devices in series
 - E — Five devices in series
 - F — Six devices in series
 - G — Seven devices in series
 - H — Eight devices in series
 - P — Two devices in parallel (not recommended)
 - X — Two devices, one standard polarity, the other reverse polarity. (10 and 50 watts only)
- i.e., 10M51Z5B1 is for two 10 watt zeners, each of 51 volts, $\pm 5\%$, matched to a total voltage of 102 volts $\pm 1\%$.

ZENER CHIPS (MZC)

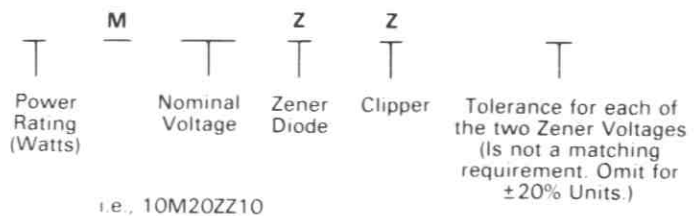
1. The nomenclature for Zener Chips is as follows:



2. Chips are sold in increments of ten (10) only.
3. The pricing formula for between nominal voltages and tight tolerance zeners shall apply.
4. Chips are **not** sold as matched sets or clippers.
5. A "-1" suffix will cause all chips ordered to be supplied in Deka-Pak.

ZENER CLIPPERS

Special clipper diodes with opposing Zener junctions built into the device are available by using the following nomenclature:



This nomenclature is applicable to all packages and power ratings as restricted in the above paragraphs.

ORDERING INFORMATION








Order using the above nomenclature or else specify the device type, nominal voltage and tolerance required.

ZENER and AVALANCHE REGULATOR DIODES

The devices depicted in the accompanying matrix represent a basic profile of the largest inventoried zener-diode line in the industry. Check the following features for application to your specific requirements.

Wide selection of package materials and styles:


- Plastic (surmetic), for lowest cost
- Glass for highest reliability
- Metal for highest power
- Unencapsulated (chips), for hybrid circuit applications

Nominal Zener Voltage (Note 6)	CHIPS (25 Mils Square) Cathode = Bottom Surface		250 MILLIWATT (400 mW Package) Cathode = Polarity Mark	400 MILLIWATT Cathode = Polarity Mark		500 MILLIWATT Cathode = Polarity Mark		
	 MZC	Actual Size	 Glass Case 51 (DO-7)	 Case 299 DO-35	 Case 51 DO-7	 Surmetic Case 182 (TO-92)	 Surmetic Case 51 (DO-7)	 Glass Case 299-01 (DO-35)
1.8		MZC1.8B10	MZ4614					
2.0		MZC2.0B10	MZ4615					
2.2		MCZ2.2B10	MZ4616					
2.4	MZC2.4A10	MCZ2.4B10	MZ4617	1N4370		1N5837A	1N5221	1N5985
2.7	MZC2.7A10	MCZ2.7B10	MZ4618	1N4371		1N5839A	1N5223	1N5986
3.0	MZC3.0A10	MCZ3.0B10	MZ4619	1N4372		1N5841A	1N5225	1N5987
3.3	MZC3.3A10	MZC3.3B10	MZ4620	1N746	1N5518	1N5842A	1N5226	1N5988
3.6	MZC3.6A10	MZC3.6B10	MZ4621	1N747	1N5519	1N5843A	1N5227	1N5989
3.9	MZC3.9A10	MZC3.9B10	MZ4622	1N748	1N5520	1N5844A	1N5228	1N5990
4.3	MZC4.3A10	MZC4.3B10	MZ4623	1N749	1N5521	1N5845A	1N5229	1N5991
4.7	MZC4.7A10	MZC4.7B10	MZ4624	1N750	1N5522	1N5846A	1N5230	1N5992
5.1	MZC5.1A10	MZC5.1B10	MZ4625	1N751	1N5523	1N5847A	1N5231	1N5993
5.6	MZC5.6A10	MZC5.6B10	MZ4626	1N752	1N5524	1N5848A	1N5232	1N5994
6.2	MZC6.2A10	MZC6.2B10	MZ4627	1N753	1N5525	1N5850A	1N5234	1N5995
6.8	MZC6.8A10	MZC6.8B10	1N4099	1N754 1N957	1N5526	1N5851A	1N5235	1N5996
7.5	MZC7.5A10	MZC7.5B10	1N4100	1N755 1N958	1N5527	1N5852A	1N5236	1N5997
8.2	MZC8.2A10	MZC8.2B10	1N4101	1N756 1N959	1N5528	1N5853A	1N5237	1N5998
9.1	MZC9.1A10	MZC9.1B10	1N4103	1N757 1N960	1N5529	1N5855A	1N5239	1N5999
10	MZC10A10	MZC10B10	1N4104	1N758 1N961	1N5530	1N5856A	1N5240	1N6000
11	MZC11A10	MZC11B10	1N4105	1N962	1N5531	1N5857A	1N5241	1N6001
12	MZC12A10	MZC12B10	1N4106	1N759 1N963	1N5532	1N5858A	1N5242	1N6002
13	MZC13A10	MZC13B10	1N4107	1N964	1N5533	1N5859A	1N5243	1N6003
15	MZC15A10	MZC15B10	1N4109	1N965	1N5535	1N5861A	1N5245	1N6004
16	MZC16A10	MZC16B10	1N4110	1N966	1N5536	1N5862A	1N5246	1N6005
18	MZC18A10	MZC18B10	1N4112	1N967	1N5538	1N5864A	1N5248	1N6006
20	MZC20A10	MZC20B10	1N4114	1N968	1N5540	1N5866A	1N5250	1N6007
22	MZC22A10	MZC22B10	1N4115	1N969	1N5541	1N5867A	1N5251	1N6008
24	MZC24A10	MZC24B10	1N4116	1N970	1N5542	1N5868A	1N5252	1N6009
27	MZC27A10	MZC27B10	1N4118	1N971		1N5870A	1N5254	1N6010
30	MZC30A10	MZC30B10	1N4120	1N972	1N5545	1N5872A	1N5256	1N6011
33	MZC33A10	MZC33B10	1N4121	1N973	1N5546	1N5873A	1N5257	1N6012
36	MZC36A10	MZC36B10	1N4122	1N974		1N5874A	1N5258	1N6013
39	MZC39A10	MZC39B10	1N4123	1N975		1N5875A	1N5259	1N6014
43	MZC43A10	MZC43B10	1N4124	1N976		1N5876A	1N5260	1N6015
47	MZC47A10	MZC47B10	1N4125	1N977		1N5877A	1N5261	1N6016
51	MZC51A10	MZC51B10	1N4126	1N978		1N5878A	1N5262	1N6017
56	MZC56A10	MZC56B10	1N4127	1N979		1N5879A	1N5263	1N6018
62	MZC62A10	MZC62B10	1N4129	1N980		1N5881A	1N5265	1N6019
68	MZC68A10	MZC68B10	1N4130	1N981		1N5882A	1N5266	1N6020
75	MZC75A10	MZC75B10	1N4131	1N982		1N5883A	1N5267	1N6021
82	MZC82A10	MZC82B10	1N4132	1N983		1N5884A	1N5268	1N6022
91	MZC91A10	MZC91B10	1N4134	1N984		1N5886A	1N5270	1N6023
100	MZC100A10	MZC100B10	1N4135	1N985		1N5887A	1N5271	1N6024
110	MZC110A10	MZC110B10		1N986		1N5888A	1N5272	1N6025
120	MZC120A10	MZC120B10		1N987		1N5889A	1N5273	1N6026
130	MZC130A10	MZC130B10		1N988		1N5890A	1N5274	1N6027
140	MZC140A10	MZC140B10		1N989		1N5891A	1N5275	
150	MZC150A10	MZC150B10		1N990		1N5892A	1N5276	1N6028
160	MZC160A10	MZC160B10		1N991		1N5893A	1N5277	1N6029
170	MZC170A10	MZC170B10		1N992		1N5894A	1N5278	
180	MZC180A10	MZC180B10				1N5895A	1N5279	1N6030
200	MZC200A10	MZC200B10				1N5897A	1N5281	1N6031


Chips:









A denotes I_{ZT} in mA range

B denotes I_{ZT} in 250 μ A

 JAN/JANTX available \pm 5% only

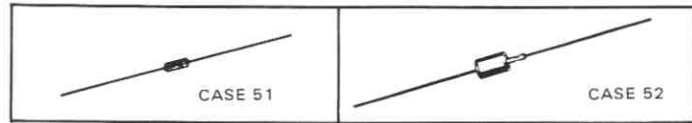
ZENER AND AVALANCHE REGULATOR DIODES (continued)

- Power ratings from 1.4 to 50 Watts
- Breakover tolerances from 1.8 to 200 V in approximately 10% steps
- Available tolerances from 20% (low cost) to as tight as 1% (critical applications) with off-the-shelf-delivery
- Special selection of electrical characteristics available at low cost due to high-volume lines (check your Motorola sales representative for special quotations)
- JAN/JANTX (V) availability 

Nominal Zener Voltage	1 WATT	1 WATT	1 WATT	5 WATT	10 WATT	50 WATT		
	Cathode Polarity Mark 	Cathode to Case 	Cathode Polarity Mark 	Cathode Polarity Mark 	Cathode Polarity Mark 	Cathode to Case = 1N3993 Series Anode to Case = 1N2970 Series 	Anode to Case  	
	Surmetic 30 Case 59 (DO-41)	Metal Case 52 (DO-13)	Glass Case 59 (DO-41)	Surmetic 40 Case 17	Metal Case 56 (DO-4)	Metal Case 54 (TO-3)	Metal Case 58 (DO-5)	
1.8								
2.0								
2.2								
2.4								
2.7								
3.0								
3.3	1N4728	1N3821	1N5913	1N5333				
3.6	1N4729	1N3822	1N5914	1N5334				
3.9	1N4730	1N3823	1N5915	1N5335	1N3993&R	1N4557&R	1N4549&R	
4.3	1N4731	1N3824	1N5916	1N5336	1N3994&R	1N4558&R	1N4550&R	
4.7	1N4732	1N3825	1N5917	1N5337	1N3995&R	1N4559&R	1N4551&R	
5.1	1N4733	1N3826	1N5918	1N5338	1N3996&R	1N4560&R	1N4552&R	
5.6	1N4734	1N3827	1N5919	1N5339	1N3997&R	1N4561&R	1N4553&R	
6.2	1N4735	1N3828	1N5920	1N5341	1N3998&R	1N4562&R	1N4554&R	
6.8	1N4736	1N3829	1N5921	1N5342	1N3999&R	1N4563&R	1N4555&R	
		1N3016			1N2970&R	1N2804&R	1N3305&R	
7.5	1N4737	1N3830	1N5922	1N5343	1N4000&R	1N4564&R	1N4556&R	
		1N3017			1N2971&R	1N2805&R	1N3306&R	
8.2	1N4738	1N3018	1N5923	1N5344	1N2972&R	1N2806&R	1N3307&R	
9.1	1N4739	1N3019	1N5924	1N5346	1N2973&R	1N2807&R	1N3308&R	
10	1N4740	1N3020	1N5925	1N5347	1N2974&R	1N2808&R	1N3309&R	
11	1N4741	1N3021	1N5926	1N5348	1N2975&R	1N2809&R	1N3310&R	
12	1N4742	1N3022	1N5927	1N5349	1N2976&R	1N2810&R	1N3311&R	
13	1N4743	1N3023	1N5928	1N5350	1N2977&R	1N2811&R	1N3312&R	
15	1N4744	1N3024	1N5929	1N5352	1N2979&R	1N2813&R	1N3314&R	
16	1N4745	1N3025	1N5930	1N5353	1N2980&R	1N2814&R	1N3315&R	
18	1N4746	1N3026	1N5931	1N5355	1N2982&R	1N2816&R	1N3317&R	
20	1N4747	1N3027	1N5932	1N5357	1N2984&R	1N2818&R	1N3319&R	
22	1N4748	1N3028	1N5933	1N5358	1N2985&R	1N2819&R	1N3320&R	
24	1N4749	1N3029	1N5934	1N5359	1N2986&R	1N2820&R	1N3321&R	
27	1N4750	1N3030	1N5935	1N5361	1N2988&R	1N2822&R	1N3322&R	
30	1N4751	1N3031	1N5936	1N5363	1N2989&R	1N2823&R	1N3324&R	
33	1N4752	1N3032	1N5937	1N5364	1N2990&R	1N2824&R	1N3325&R	
36	1N4753	1N3033	1N5938	1N5365	1N2991&R	1N2825&R	1N3326&R	
39	1N4754	1N3034	1N5939	1N5366	1N2992&R	1N2826&R	1N3327&R	
43	1N4755	1N3035	1N5940	1N5367	1N2993&R	1N2827&R	1N3328&R	
47	1N4756	1N3036	1N5941	1N5368	1N2996&R	1N2829&R	1N3330&R	
51	1N4757	1N3037	1N5942	1N5369	1N2997&R	1N2831&R	1N3332&R	
56	1N4758	1N3038	1N5943	1N5370	1N2999&R	1N2832&R	1N3334&R	
62	1N4759	1N3039	1N5944	1N5372	1N3000&R	1N2833&R	1N3335&R	
68	1N4760	1N3040	1N5945	1N5373	1N3001&R	1N2834&R	1N3336&R	
75	1N4761	1N3041	1N5946	1N5374	1N3002&R	1N2835&R	1N3337&R	
82	1N4762	1N3042	1N5947	1N5375	1N3003&R	1N2836&R	1N3338&R	
91	1N4763	1N3043	1N5948	1N5377	1N3004&R	1N2837&R	1N3339&R	
100	1N4764	1N3044	1N5949	1N5378	1N3005&R	1N2838&R	1N3340&R	
110	1M110ZS10	1N3045	1N5950	1N5379	1N3007&R	1N2840&R	1N3342&R	
120	1M120ZS10	1N3046	1N5951	1N5380	1N3008&R	1N2841&R	1N3343&R	
130	1M130ZS10	1N3047	1N5952	1N5381	1N3009&R	1N2842&R	1N3343&R	
150	1M140ZS10	1N3048	1N5953	1N5383	1N3011&R	1N2843&R	1N3346&R	
160	1M160ZS10	1N3049	1N5954	1N5384	1N3012&R	1N2844&R	1N3347&R	
180	1M180ZS10	1N3050	1N5955	1N5386	1N3014&R	1N2845&R	1N3349&R	
200	1M200ZS10	1N3051	1N5956	1N5388	1N3015&R	1N2846&R	1N3350&R	

R, RA, & RB = Reverse Polarity Types Available

ZENER REFERENCE DEVICES



For applications where output voltage must remain within narrow limits during changes in input voltage, load resistance and temperature. Motorola guarantees all Reference Devices to fall within the specified maximum voltage variations, ΔV_Z , at the specifically indicated test temperatures and test current (JEDEC Standard #5). Temperature Coefficient is also specified but should be

considered as a reference only – not a maximum rating.

The low voltage devices are hermetically sealed, all-glass structure. Includes JAN; JANTX and radiation hardened device types. These temperature compensated Zener Reference Diodes have low dynamic impedance and silicon-oxide-passivated junctions for long term stability.

V _Z Volts	Test Current mA _{dc}	Test Temp Points	AVERAGE TEMPERATURE COEFFICIENT OVER THE OPERATING RANGE									
			0.01 %/°C		0.005 %/°C		0.002 %/°C		0.001 %/°C		0.0005 %/°C	
			Device Type	V _Z Max Volts	Device Type	V _Z Max Volts	Device Type	V _Z Max Volts	Device Type	V _Z Max Volts	Device Type	V _Z Max Volts
6.2 Δ	7.5	A	*1N821, J,TX	0.096	*1N823, J,TX	0.048	*1N825, J,TX	0.019	*1N827, J,TX	0.009	*1N829, J,TX	0.005
6.2 Δ	7.5	A	*1N821A	0.096	*1N823A	0.048	*1N825A	0.019	*1N827A	0.009	*1N829A	0.005
6.4	0.5	B	1N4565	0.018	1N4566	0.024	1N4567	0.010	1N4568	0.005	1N4569	0.002
	0.5	A	1N4565A	0.099	1N4566A	0.050	1N4567A	0.020	1N4568A	0.010	1N4569A	0.005
	1.0	B	1N4570	0.048	1N4571	0.024	1N4572	0.010	1N4573	0.005	1N4574	0.002
	1.0	A	1N4570A	0.099	1N4571A	0.050	1N4572A	0.020	1N4573A	0.010	1N4574A	0.005
	2.0	B	1N4575	0.048	1N4576	0.024	1N4577	0.010	1N4578	0.005	1N4579	0.002
	2.0	A	1N4575A	0.099	1N4576A	0.025	1N4577A	0.020	1N4578A	0.010	1N4579A	0.005
	4.0	B	1N4580	0.048	1N4581	0.024	1N4582	0.010	1N4583	0.005	1N4584	0.002
	4.0	A	1N4580A	0.099	1N4581A	0.050	1N4582A	0.020	1N4583A	0.010	1N4584A	0.005
8.4	10	A	*1N3154, J,TX	0.130	*1N3155, J,TX	0.065	*1N3156, J,TX	0.026	*1N3157, J,TX	0.013		
	10	C	*1N3154A	0.072	*1N3155A	0.085	*1N3156A	0.034	*1N3157A	0.017		
8.5	0.5	B	1N4775	0.064	1N4776	0.032	1N4777	0.013	1N4778	0.006	1N4779	0.003
	0.5	A	1N4775A	0.132	1N4776A	0.066	1N4777A	0.026	1N4778A	0.013	1N4779A	0.007
	1.0	B	1N4780	0.064	1N4781	0.032	1N4782	0.013	1N4783	0.006	1N4784	0.003
	1.0	A	1N4780A	0.132	1N4781A	0.066	1N4782A	0.026	1N4783A	0.013	1N4784A	0.007
9.0	7.5	B	*1N935	0.067	*1N936	0.033	*1N937	0.013	*1N938	0.006	*1N939	0.003
	7.5	A	*1N935A	0.139	*1N936A	0.069	*1N937A	0.027	*1N938A	0.013	*1N939A	0.007
	7.5	C	*1N935B, J,TX	0.184	*1N936B	0.092	*1N937B, J,TX	0.037	*1N938B, J,TX	0.018	*1N939B, J,TX	0.009
9.4 \pm 0.4 (Suffix "A" +0.2 V)	10	D			1N2163,A	0.033			1N2166,A	0.007	1N2169,A	0.004
		E			1N2164,A	0.086			1N2167,A	0.017	1N2170,A	0.009
		F			1N2165,A	0.110			1N2168,A	0.023	1N2171,A	0.012
11.7	7.5	B	*1N941	0.088	*1N942	0.044	*1N943	0.018	*1N944	0.009	*1N945	0.004
	7.5	A	*1N941A	0.081	*1N942A	0.090	*1N943A	0.036	*1N944A	0.018	*1N945A	0.009
	7.5	C	*1N941B, J,TX	0.239	*1N942B	0.120	*1N943B, J,TX	0.047	*1N944B, J,TX	0.024	*1N945B, J,TX	0.012
12.8	0.5	G	1N4896	0.086	1N4897	0.048	1N4898	0.019	1N4899	0.010		
	0.5	A	1N4896A	0.198	1N4897A	0.099	1N4898A	0.040	1N4899A	0.020		
	1.0	G	1N4900	0.096	1N4901	0.048	1N4902	0.019	1N4903	0.010		
	1.0	A	1N4900A	0.198	1N4901A	0.099	1N4902A	0.040	1N4903A	0.020		
	2.0	G	1N4904	0.096	1N4905	0.048	1N4906	0.019	1N4907	0.010		
	2.0	A	1N4904A	0.198	1N4905A	0.099	1N4906A	0.040	1N4907A	0.020		
	4.0	G	1N4908	0.096	1N4909	0.048	1N4910	0.019	1N4911	0.010		
	4.0	A	1N4908A	0.198	1N4909A	0.099	1N4910A	0.040	1N4911A	0.020		
	7.5	G	1N4912	0.096	1N4913	0.048	1N4914	0.019	1N4915	0.010		
7.5	A	1N4912A	0.198	1N4913A	0.099	1N4914A	0.040	1N4915A	0.020			
1.9	0.5	G	1N4916	0.144	1N4917	0.072	1N4918	0.029				
	0.5	A	1N4916A	0.298	1N4917A	0.149	1N4918A	0.060				
	1.0	G	1N4919	0.144	1N4920	0.072	1N4921	0.029				
	1.0	A	1N4919A	0.298	1N4920A	0.149	1N4921A	0.060				
	2.0	G	1N4922	0.144	1N4923	0.072	1N4924	0.029				
	2.0	A	1N4922A	0.298	1N4923A	0.149	1N4924A	0.060				
	4.0	G	1N4925	0.144	1N4926	0.072	1N4927	0.029	1N4928	0.014		
	4.0	A	1N4925A	0.298	1N4926A	0.149	1N4927A	0.060	1N4928A	0.030		
	7.5	G	1N4929	0.144	1N4930	0.072	1N4931	0.029	1N4932	0.014		
	7.5	A	1N4929A	0.298	1N4930A	0.149	1N4931A	0.060	1N4932A	0.030		

Test Temperature Points	
A	-55, 0, +25, +175, +100
B	0, +25, +75
C	-55, 0, +25, +75, +100, +150
D	0, +25, +70
E	-55, 0, +125, +75, +125
F	-55, 0, +75, +125, +185
G	+25, +75, +100

Δ Non-suffix – Z_{TT} = 15, "A" Suffix – Z_{TT} = 10
 * Radiation Resistant Devices Available; to order, specify MZ821, A or B in lieu of "1N" prefix.
 Not applicable to J or TX devices.

SPECIAL DEVICES (continued)



High-Voltage Devices consist of hermetically sealed discrete glass-packaged devices, properly interconnected to yield higher voltages and encapsulated in a transfer-molded plastic package. Includes JAN devices. All devices encapsulated in Case 41, exceptions shown.

CASE 41 – EXCEPT AS NOTED

Reference Voltage V _Z Volts	Test Current I _{ZT} mA	Max Voltage Change V _Z (Volts) @ Test Temperatures -55 to +25°C +25 to 100°C		Average Temp. Coeff. %°C	Device Type
6.2	7.5	0.050 (1) 0.050 (1)		0.01 0.01	1N429 (2) 1N1735
8.4	10	0.014 (1) 0.007		0.002 0.001	♦1N1530 ♦1N1530A (2)
12.4	7.5	0.100 (1) 0.050		0.01 0.005	1N1736 1N1736A
12.4	10	0.050	0.047	0.005	1N4057
		0.020	0.010	0.002	1N4057A
14.6		0.058	0.055	0.005	1N4058
		0.023	0.022	0.002	1N4058A
16.8		0.067	0.063	0.005	1N4059
		0.027	0.025	0.002	1N4059A
18.5		0.074	0.069	0.005	1N4060
		0.030	0.028	0.002	1N4060A
18.6	7.5	0.150 (1) 0.075		0.01 0.005	1N1737 1N1737A
21	10	0.084	0.079	0.005	1N4061
		0.034	0.032	0.002	1N4061A
23	10	0.092	0.086	0.005	1N4062
		0.037	0.035	0.002	1N4062A
24.8	7.5	0.200 (1) 0.100		0.01 0.005	1N1738 1N1738A
27	10	0.108	0.101	0.005	1N4063
		0.043	0.041	0.002	1N4063A
30	10	0.120	0.113	0.005	1N4064
		0.048	0.045	0.002	1N4064A
31.0	7.5	0.250 (1) 0.125		0.01 0.005	1N1739 1N1739A
33	10	0.132	0.124	0.005	1N4065
		0.053	0.050	0.002	1N4065A
37	7.5	0.148	0.139	0.005	1N4066
		0.059	0.056	0.002	1N4066A
37.2		0.300 (1) 0.150		0.01 0.005	1N1740 1N1740A
43		0.172	0.161	0.005	1N4067
		0.069	0.065	0.002	1N4067A
43.4		0.350 (1) 0.175		0.01 0.005	1N1741A 1N1741A

Reference Voltage V _Z Volts	Test Current I _{ZT} mA	Max Voltage Change V _Z (Volts) @ Test Temperatures -55 to +25°C +25 to 100°C		Average Temp. Coeff. %°C	Device Type
47	7.5	0.188	0.176	0.005	1N4068
		0.075	0.071	0.002	1N4068A
49.6		0.400 1 0.200		0.01 0.005	1N1742 1N1742A
51		0.204	0.191	0.005	1N4069
		0.082	0.077	0.002	1N4069A
56		0.224	0.210	0.005	1N4070
		0.090	0.084	0.002	1N4070A
62		0.248	0.232	0.005	1N4071
		0.099	0.093	0.002	1N4071A
68	5.0	0.272	0.255	0.005	1N4072
		0.109	0.102	0.002	1N4072A
75		0.300	0.281	0.005	1N4073
		0.120	0.113	0.002	1N4073A
82		0.328	0.307	0.005	1N4074
		0.131	0.123	0.062	1N4074A
87		0.348	0.326	0.005	1N4075
		0.139	0.131	0.002	1N4075A
91		0.364	0.341	0.005	1N4076
		0.146	0.137	0.002	1N4076A
100		0.400	0.375	0.005	1N4077
		0.160	0.150	0.002	1N4077A
105	2.5	0.420	0.394	0.005	1N4078
		0.168	0.158	0.002	1N4078A
110		0.440	0.413	0.005	1N4079
		0.176	0.165	0.002	1N4079A
120		0.480	0.450	0.005	1N4080
		0.192	0.180	0.002	1N4080A
130		0.520	0.488	0.005	1N4081
		0.208	0.195	0.002	1N4081A
140		0.560	0.525	0.005	1N4082
		0.224	0.210	0.002	1N4082A
150		0.600	0.563	0.005	1N4083
		0.240	0.225	0.002	1N4083A
175		0.700	0.656	0.005	1N4084
		0.280	0.263	0.002	1N4084A
200		0.800	0.750	0.005	1N4085
		0.320	0.300	0.002	1N4085A

(1) These devices are tested at the following temperatures: -55°, +25°, and +100°C.
 (2) Available as JAN devices.

SPECIAL DEVICES

Precision Reference Diodes. Designed, manufactured and tested for ultra-high stability of voltage with time and temperature change. Use of special measurement equipment and voltage standards provide calibration directly traceable to the National Bureau of Standards.



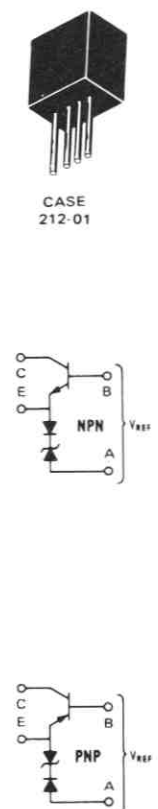
CASE 51

Reference Voltage Volts	Test Current mA	Temperature Stability		CERTIFIED VOLTAGE TIME STABILITY OVER 1000 HOURS OF OPERATION (Parts/Million Change)									
				<5 PPM/1000 HR		<10 PPM/1000 HR		<20 PPM/1000 HR		<40 PPM/1000 HR		<100 PPM/1000 HR	
		ΔV_Z (mV)	OP Temp Range °C	Device Type	Change μV Max	Device Type	Change μV Max	Device Type	Change μV Max	Device Type	Change μV Max	Device Type	Change μV Max
6.2 ± 5%	7.5	2.5	25, 75, 100	MZ605	30	MZ610	60	MZ620	120	MZ640	240		
8.4 ± 5%	10	3.5	25, 75, 100	MZ805	45	MZ810	90	MZ820	180	MZ840	360		
6.35 ± 5%	7.5	2.5	25 to 100			1N4895	64	1N4893	127			1N4891*	318
6.35 ± 5%	7.5	5.0	-55 to 100			1N4895A	64	1N4893A	127			1N4891A*	318
6.35 ± 5%	7.5	5.0	25 to 100			1N4894	64	1N4892	127			1N4890*	318
6.35 ± 5%	7.5	10	-55 to 100			1N4894A	64	1N4892A	127			1N4890A*	318
6.2 - 6.5	7.5	3.0	25 to 100									1N3502	636
6.2 - 6.5	7.5	6.0	25 to 100					1N3504	127	1N3503	318	1N3501	636

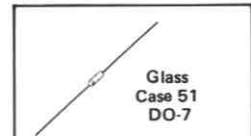
* < 50 PPM time stability on these devices.

Amplifying Regulator Diodes. Designed for use in regulated power supplies as a combination voltage reference element and error voltage amplifier, providing temperature compensation for excellent reference voltage stability. Available with either PNP or NPN transistors by adding either P or N Suffix to part number.

ELECTRICAL CHARACTERISTICS ($I_{ZT} = 5.0 \text{ mA}$, $V_{CE0} = 30 \text{ V}$)

	V_{REF} Volts	Tolerance ±%	Test Temperature °C	V_{REF} Volts	Device Type
	NPN	6.8	10	0, +25, +75	0.051	MCA1911
0.025					MCA1912
0.010					MCA1913
0.005					MCA1914
NPN	6.8	5.0	-55, 0, +25, -55, +100	0.105	MCA1921
				0.052	MCA1922
				0.020	MCA1923
				0.010	MCA1924
NPN	6.8	5.0	-55, 0, +25, +75, +100, +150	0.139	MCA1931
				0.069	MCA1932
				0.026	MCA1933
				0.013	MCA1934
NPN	8.6	10	0, +25, +75	0.060	MCA2011
				0.030	MCA2012
				0.012	MCA2014
				0.006	MCA2014
NPN	8.6	5.0	-55, 0, +25, +75, +100	0.124	MCA2021
				0.062	MCA2022
				0.024	MCA2023
				0.012	MCA2024
NPN	8.6	5.0	-55, 0, +25, +75, +100, +150	0.164	MCA2031
				0.082	MCA2032
				0.032	MCA2033
				0.016	MCA2034
NPN	9.5	10	0, +25, +75	0.071	MCA2111
				0.035	MCA2112
				0.014	MCA2113
				0.007	MCA2114
NPN	9.5	5.0	-55, 0, +25, -75, +100	0.147	MCA2121
				0.073	MCA2122
				0.028	MCA2123
				0.014	MCA2124
NPN	9.5	5.0	-55, 0, +25, +75, -100, +150	0.194	MCA2131
				0.097	MCA2132
				0.038	MCA2133
				0.019	MCA2134
PNP	11	10	0, +25, +75	0.082	MCA2211
				0.041	MCA2212
				0.016	MCA2213
				0.008	MCA2214
PNP	11	5.0	-55, 0, +25, +75, +100	0.170	MCA2221
				0.085	MCA2222
				0.034	MCA2223
				0.017	MCA2224
PNP	11	5.0	-55, 0, +25, +75, +100, +150	0.225	MCA2231
				0.112	MCA2232
				0.044	MCA2233
				0.022	MCA2234

Field-Effect Current Regulator Diodes. High impedance diodes providing a constant current output over a wide range of applied voltages. For applications in instrumentation and protective circuitry.

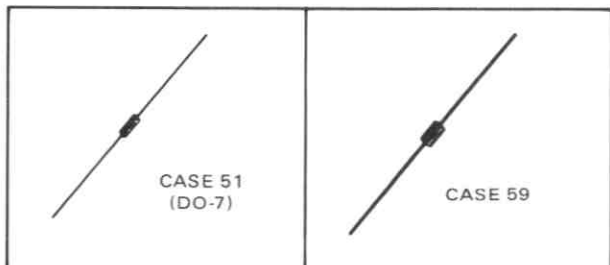


Reg. Current I_p @ $V_T = 25 \text{ V}$ mA Nom	Device Type	Knee Imp Z_K @ $V_K = 6.0 \text{ V}$ M Ω Max	Limiting Voltage @ $I_L = 0.8 I_p$ Volts Max
0.22	1N5283	2.75	1.00
0.24	1N5284	2.35	1.00
0.27	1N5285	1.95	1.00
0.30	1N5286	1.60	1.00
0.33	1N5287	1.35	1.00
0.39	1N5288	1.00	1.05
0.43	1N5289	0.870	1.05
0.47	1N5290	0.750	1.05
0.56	1N5291	0.560	1.10
0.62	1N5292	0.470	1.13
0.68	1N5293	0.400	1.15
0.75	1N5294	0.335	1.20
0.82	1N5295	0.290	1.25
0.91	1N5296	0.240	1.29
1.00	1N5297	0.205	1.35
1.10	1N5298	0.180	1.40
1.20	1N5299	0.155	1.45
1.30	1N5300	0.135	1.50
1.40	1N5301	0.115	1.55
1.50	1N5302	0.105	1.60
1.60	1N5303	0.092	1.65
1.80	1N5304	0.074	1.75
2.00	1N5305	0.061	1.85
2.20	1N5306	0.052	1.95
2.40	1N5307	0.044	2.00
2.70	1N5308	0.035	2.15
3.00	1N5309	0.029	2.25
3.30	1N5310	0.024	3.35
3.60	1N5311	0.020	2.50
3.90	1N5312	0.017	2.60
4.30	1N5313	0.014	2.75
4.70	1N5314	0.012	2.90
0.5 ± 0.3	MCL1300	0.500	1.00
1.0 ± 0.6	MCL1301	0.200	1.50
2.0 ± 0.6	MCL1302	0.100	2.00
3.0 ± 0.6	MCL1303	0.050	2.00
4.0 ± 0.6	MCL1304	0.025	2.50

SPECIAL DEVICES (continued)

Low Voltage Regulators

High-conductance silicon diodes designed as stable forward-reference sources for transistor amplifier biasing and similar applications. Available in high reliability glass construction or economic plastic packaging.



ELECTRICAL CHARACTERISTICS

($T_A = 25^{\circ}\text{C}$ unless otherwise noted).

Forward Reference Voltage		Test Current I_F mA	Leakage Current $I_R @ V_R$ μA Volts		Device Type	Case
Min	Max					
0.63	0.71	10	10	5.0	MZ2360	59 Surmetic
1.24	1.38	10	10	5.0	MZ2361	51 Surmetic
1.90	2.10	10	10	5.0	MZ2362	51 Glass
0.58	0.70	1.0	0.1	4.0	.4M.64FR10	
1.29	1.43	10			.4M1.36FR5	
1.33	1.39	10			.4M1.36FR2	
1.94	2.14	10			.4M2.04FR5	
2.00	2.08	10			.4M2.04FR2	
0.58	0.70	1.0			1N816	

Current Limited Temperature Compensated Voltage Reference Diodes

Voltage reference element with inherent temperature compensation and current regulation resulting in excellent reference stability over temperature excursions and wide variations of input voltage.

Specifications in the following table are given for an input of 31 volts. Devices differ specifically in temperature as shown in ΔV_{REF} .

V_{REF} @ $V_{in} = 31$ Volts		V_{in} Volts		I_{in} @ $V_{in} = 31$ Volts		Input Impedance $M\Omega$ Min	Z_{REF} @ $I_{in} = 4.0$ mA Ohms Max	ΔV_{REF} @ $V_{in} = 31$ Volts $-55^{\circ}\text{C}, +25^{\circ}\text{C}, +100^{\circ}\text{C}$	
Min	Max	Min	Max	Min	Max			Volts Max	Device Type
6.08	6.72	12	75	3.2	4.8	0.2	50	0.010	MCLTC6010
6.08	6.72	12	75	3.2	4.8	0.2	50	0.025	MCLTC6025
6.08	6.72	12	75	3.2	4.8	0.2	50	0.050	MCLTC6050
6.08	6.72	12	75	3.2	4.8	0.2	50	0.100	MCLTC6100



CASE 181-02

Tuning Diode Regulator

Highly reliable temperature compensated monolithic integrated circuit voltage stabilizer designed for use in television and FM radios that use variable capacitance diode tuners.

V_Z Volts Min/Max	I_Z mA	$\frac{\Delta V_Z}{\Delta T}$ Mv/ $^{\circ}\text{C}$ Min/Max	Z_Z Ohms Max	P_D mW	Device Type
31/35	18	-31/+1.55	25	625	MVS460



CASE 182-01

Dual Diodes

Dual diodes designed for use in low cost biasing, steering and voltage doubler applications including series, common cathode and common anode diodes.

$V_{(BR)} @ I_{(BR)}$ Volts Min		$I_R @ V_R$ μA Max	$V_F @$ Volts Min/Max	I_F mA	$C_{VR} = 0$ pF Max	t_{rr} ns Max	Device Type	Description	
	μA								
100	100	0.1	50	0.67/0.82	10	1.5	4.0	MSD6100	Switching Discriminator Common Cathode Common Cathode Series
50	100	0.1	40	0.67/0.82	10	2.0	10	MSD6101	
70	100	0.1	50	0.67/1.0	10	3.0	100	MSD6102	
70	100	0.1	50	-/1.0	10	8.0	100	MSD6150	
100	100	0.2	50	0.67/0.82	10	1.5	15	MSD7000	

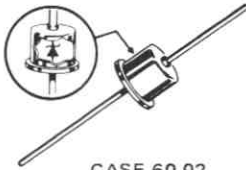


CASE 29
(TO-92)

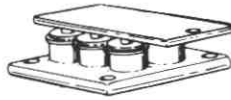
TRANSIENT SUPPRESSORS

POWER TRANSIENT SUPPRESSORS

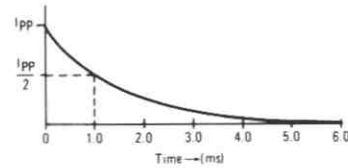
Transient suppressors designed for applications requiring protection of voltage sensitive electronic devices in danger of destruction by high energy voltage transients. Select from standard factory available types or design the suppressor to meet specific needs by paralleling cells. For specific options, i.e., non-standard voltages, higher power capacity, and package configurations, consult factory.



CASE 60-02




CASE 119



V_R Operating Voltage		I_R Reverse Current μA	V_Z Breakdown Voltage @		V_Z Clamping Voltage @		V_F Forward Voltage @		Device Type	Case
Nom Vdc	V(RMS)		Min Volts	I_{ZT} mA	Max Volts	I_{pp} Amp	Volts	I_F Amp		
14	10	50	16	0.4	1.25	32	1.5	10	MPZ5-16A MPZ5-16B MPZ5-32A MPZ5-32B MPZ5-32C MPZ5-180A MPZ5-180B MPZ5-180C	119
14	10		16	0.4	1.25					
28	20		32	0.2	1.25					
28	20		32	0.2	1.25					
28	20		32	0.2	1.25					
28	20		32	0.2	1.25					
165	117	5.0	180	0.03	1.14	24	2.0	100	MZ5555 MZ5556 MZ5557 MZ5558	60-02
165	117		180	0.03	1.14					
165	117		180	0.03	1.14					
30.5	21.5	5.0	33	1.0	47.5	19	2.8	↓	↓	↓
40.3	28.5		43.7	↓	63.5					
49	34.5		54	↓	78.5					
175	124		191	↓	265					

Power Rectifier/Power Surge Suppressor

... designed for applications requiring a low voltage rectifier with reverse avalanche characteristics or for use as a reverse power transient suppressor. Developed to suppress transients in the automotive system, this device operates in the forward mode as a standard rectifier or reverse mode as a power zener diode and will protect expensive mobile transceivers, radios and tape decks from over-voltage conditions.

	B_V Breakdown Voltage @ $I_R = 100$ mA Volts	I_R Reverse Current @ $V_R = 20$ V Max μA	V_F Instantaneous Forward Voltage @ $i_F = 79$ A Volts	$I_{(RMS)}$ Forward Current Max Amp	Device Type
		32	50	1.1	94	MR2525,R

CASE 296-03

Polarity: Standard polarity is cathode to case - MR2525
Reverse polarity is anode to case and is designated by an "R" suffix - MR2525R



RECTIFIERS

From tiny, lead-mounted, low-current rectifiers to powerful multi-cell units with near-thousand-amp capacity; from single-phase, half-wave devices to three-phase circuits; from conventional diode junctions to special-purpose units for specific applications, Motorola's extensive line of rectifiers satisfies every possible requirement for electronic equipment. Moreover, volume production unmatched in the industry offers low-cost selection potential.

TABLE OF CONTENTS

	Page
General Purpose Rectifiers	
<u>Low and Medium Current</u>	4-87
Single-cell rectifiers with forward current ranging from 1A to 50A and reverse voltage ratings up to 1000 volts.	
<u>High Current</u>	4-88
Multi-cell devices with up to 700 A/600 V off-the-shelf ratings and even greater current and voltage capability on a custom basis.	
Rectifier Bridges and Circuits	
<u>Low-to-Medium Current</u>	4-89
A variety of packaging methods yields current ratings up to 30 A and reverse-voltage ratings to 1000 V.	
<u>High Current</u>	4-90
Single-phase and three-phase bridges and circuits with current ratings up to 650 A.	
Special Purpose Rectifiers	
<u>Fast Recovery Devices</u>	4-91
For circuit applications requiring switching times from 200 to 1000 nano-seconds. Current rating up to 50 A.	
<u>Hot Carrier Devices</u>	4-92
For high-frequency power supplies demanding switching times of less than 10 nano-seconds.	

The following index reflects the devices characterized in this section. To locate the exact page number, see Catalog Index (Page 7-1).

INDEX

1N248B	1N5830	MR 752
1N249B	1N5832	MR 754
1N250B	1N5833	MR 756
1N1183	BYW60	MR800
1N1183A	BYW61	MR801
1N1184	BYW62	MR802
1N1184A	BYW64	MR804
1N1186	BYW66	MR806
1N1186A	BYW68	MR810
1N1188		MR811
1N1188A	MBR1520	MR812
1N1190	MBR2520	MR814
1N1190A	MBR2530	MR816
1N1191	MBR4020PF	MR817
1N1192	MBR4030	MR818
1N1194	MBR4030PF	MR820
1N1196A	MDA100	MR821
1N1198A	MDA101	MR822
1N1199,A	MDA102	MR824
1N1200,A	MDA104	MR826
1N1204,A	MDA106	MR830
1N1206,A	MDA108	MR831
1N3208	MDA110	MR832
1N3209	MDA800	MR834
1N3210	MDA801	MR836
1N3212	MDA802	MR850
1N3214	MDA804	MR851
1N3491	MDA806	MR852
1N3492	MDA920A2	MR854
1N3493	MDA920A3	MR856
1N3495	MDA920A4	MR860
1N3659	MDA920A6	MR861
1N3660	MDA920A7	MR862
1N3661	MDA922-2	MR864
1N3663	MDA922-3	MR866
1N3879	MDA922-4	MR870
1N3880	MDA922-6	MR871
1N3881	MDA922-7	MR872
1N3883	MDA922-8	MR874
1N3889	MDA922-9	MR876
1N3890,JAN,JTX	MDA942-1	MR 1-1000
1N3891,JAN,JTX	MDA942-2	MR 1-1200
1N3893,JAN,JTX	MDA942-3	MR 1-1400
1N3899	MDA942-5	MR 1-1600
1N3900	MDA942-6	MR 1120
1N3901	MDA970-1	MR 1121
1N3903	MDA970-2	MR 1122
1N3909	MDA970-3	MR 1124
1N3910,JAN,JTX	MDA970-5	MR 1126
1N3911,JAN,JTX	MDA980-1	MR 1128
1N3913,JAN,JTX	MDA980-2	MR 1130
1N3988	MDA980-3	MR 1366
1N3990	MDA980-5	MR 1376
1N4001	MDA980-6	MR 1386
1N4002	MDA990-1	MR 1396
1N4003	MDA990-2	MR 2000S
1N4004	MDA990-3	MR 2001S
1N4005	MDA990-5	MR 2002S
1N4006	MDA990-6	MR 2004S
1N4007	MDA1200	MR 2006S
1N4719	MDA1201	MR 2008S
1N4720	MDA1202	MR 2010S
1N4721	MDA1204	MR 2500
1N4722	MDA6693	MR 2500S
1N4723	MDA1206	MR 2501
1N4724	MDA3500	MR 2501S
1N4725	MDA3501	MR 2502
1N4933	MDA3502	MR 2502S
1N4934	MDA3504	MR 2504
1N4935	MDA3506	MR 2504S
1N4936	MDA3508	MR 2506
1N4937	MDA3510	MR 2506S
1N4997	MDA6693	MR 2508
1N4998	MR250-1	MR 2508S
1N4999	MR250-2	MR 2510
1N5000	MR250-3	MR 2510S
1N5001	MR250-4	MR 2525
1N5002	MR250-5	MR 2525R
1N5003	MR328	MR 5005
1N5817	MR330	MR 5010
1N5818	MR331	MR 5020
1N5820	MR500	MR 5040
1N5821	MR501	MRA133
1N5822	MR502	MRA133B
1N5823	MR504	MRA333
1N5824	MR506	MRA333B
1N5826	MR508	MRA163
1N5827	MR510	MRA163B
1N5829	MR750	MRA363
	MR751	MRA363B












Case	1.0	3.0		6.0	
	59-04 Plastic	60 Metal	70 Metal	267 Plastic	194 Plastic
V_{RRM} Volts					
50	1N4001‡	1N4719	1N4997	MR500	MR750
100	1N4002‡	1N4720	1N4998	MR501	MR751
200	1N4003‡	1N4721	1N4999	MR502	MR752
400	1N4004‡	1N4722	1N5000	MR504	MR754
600	1N4005‡	1N4723	1N5001	MR506	MR756
800	1N4006‡	1N4724	1N5002	MR508	
1000	1N4007‡	1N4725	1N5003	MR510	
I_{FSM} (Amps)	30	300	300	100	400
T_A @ Rated I_O (°C)	75	75	75	95	60
T_C @ Rated I_O (°C)					
T_J (Max) (°C)	175	175	175	175	175

‡ Package Size: 0.120" Max Diameter by 0.260" Max. Length

GENERAL PURPOSE RECTIFIERS

Low and Medium Current







Wide variety of low-cost devices to fit any mounting requirements.
 These lines are also available with anode-to-case connection by adding "R"
 suffix to the standard part number.

I _O AVERAGE RECTIFIED FORWARD CURRENT (Amperes)										
12	15	20		25			30	35	40	50
245 (DO-4) Metal	42A (DO-5) Metal	42A (DO-5) Metal	283-01 (DO-4) Low-Cost Plastic	283-01 (DO-4) Low-Cost Plastic	193-03 Low-Cost Plastic	43 (DO-21) Pressfit	43 (DO-21) Metal	42A (DO-5) Metal	42A (DO-5) Metal	43-04 Metal
										
MR1120 1N1199,A	1N3208	1N248B 1N1191	MR2000S	MR2500S	MR2500	1N3491	1N3659	1N1183	1N1183A	MR5005
MR1121 1N1200,A	1N3209	1N249B 1N1192	MR2001S	MR2501S	MR2501	1N3492	1N3660	1N1184	1N1184A	MR5010
MR1122 1N1202,A	1N3210	1N250B 1N1194	MR2002A	MR2502S	MR2502	1N3493	1N3661	1N1186	1N1186A	MR5020
MR1124 1N1204,A	1N3212	1N1196 1N1196A	MR2004S	MR2504S	MR2504	1N3495	1N3663	1N1188	1N1188A	MR5040
MR1126 1N1206A	1N3214	1N1198A 1N3214	MR2006S	MR2506S	MR2506	MR328		1N1190	1N1190A	
MR1128 1N3988			MR2008S	MR2508S	MR2508	MR330				
MR1130 1N3990			MR2010S	MR2510S	MR2510	MR331				
300	250	350	400	600	400	30	400	400	800	600
150	150	150	150	150	150	130	100	140	150	150
190	175					175	175	190	190	195

▲ Request Data Sheet for Mounting Information

High-Current Multi-Cell Rectifier Diodes











Multi-Cell construction, with matched cells, for excellent thermal management and highest reliability. Normally available with cathode connected to case. Add "R" suffix to type number for reverse polarity.

	I _O , AVERAGE RECTIFIED FORWARD CURRENT				
	50A	100A		450A	700A
				 Case 128 	
V _{RRM} (Volts)	Case 100	Case 167	Case 189	Case 135	Case 136
300	MR1205FL	MR1215FL	MR1815SL	MR1245SL,FL	MR1265FL
600	MR1209FL	MR1219SL	MR1819SL	MR1249SL,FL	MR1269FL
I _{FSM} (Amp)	800	2000	2000	8000	1200
T _C @ Rated I _O (°C)	150	135	135	150	150
T _J (Max) (°C)	190	190	190	190	190

RECTIFIER BRIDGES and CIRCUITS

Low - To-Medium Current

Single-phase rectifier bridges with a wide variety of packaging options. Standard devices are made with general-purpose rectifiers, but similar configurations can be made with special rectifier-cells (i.e., fast recovery cells) on special order.

		I _O , DC OUTPUT CURRENT (Amperes)									
		1.0	1.0	2.0	4.0	8.0	12	30	35		
V _{RRM} Volts	Case	109 (1)	312-01 (1)	312-01	117 (1)	298-01 (2)	117	298-01 (2)	179-01 (1)	179-02 (1)	309
											
50	MDA920A2	MDA100A	MDA200	MDA970-1	MDA800	MDA970-1	MDA1200	MDA980-1	MDA990-1	MDA3500 BYW60	
100	MDA920A3	MDA101A	MDA201	MDA970-2	MDA801	MDA970-2	MDA1201	MDA980-2	MDA990-2	MDA3501 BYW61	
200	MDA920A4	MDA102A	MDA202	MDA970-3	MDA802	MDA970-3	MDA1202	MDA980-3	MDA990-3	MDA3502 BYW62	
400	MDA920A6	MDA104A	MDA204	MDA970-5	MDA804	MDA970-5	MDA1204	MDA980-5	MDA990-5	MDA3504 BYW64	
600	MDA920A7	MDA106A	MDA206		MDA806		MDA1206	MDA980-6	MDA990-6	MDA3506 BYW66	
800		MDA108A	MDA208							MDA3508 BYW68	
1000		MDA110A	MDA210							MDA3510	
I _{FSM} Amp	32	45	60	100	300	100	300	300	300	400	
T _A @ Rated I _O (°C)	75	55	55	25							
T _C @ Rated I _O (°C)					100	55	100	55	55	55	
T _J (Max) (°C)	175	150	175	150	175	150	175	175	175	175	

(1) Lead Frame Assembly

(2) Discrete Diode Assembly Utilizing Metal Cased Rectifiers









High-Current Multi-Cell Rectifier Circuits

Multi-cell full-wave rectifier circuits and bridges with up to 650 A current carrying capacity.

I _O AVERAGE RECTIFIER FORWARD CURRENT (Forced Convection at 1500 LFM)								
Circuit	300 A				600 A		650 A	
	Single-Phase Full-Wave Center Tap	Single-Phase Full-Wave Bridge	Three-Phase Full-Wave Center Tap	Three-Phase Full-Wave Bridge	Single-Phase Full-Wave Center Tap	Single-Phase Full-Wave Bridge	Three-Phase Full-Wave Center Tap	Three-Phase Full-Wave Bridge
Waveforms								
Case	154A	155A	154	155	156A	157A	156	157
V _{RRM} (Volts)								
300	MRA133	MRA133B	MRA333	MRA333B	MRA163	MRA163B	MRA363	MRA363B
I _{FSM} (Amps)	3000	3000	2000	2000	6000	6000	5000	5000
I _O Free Convection (Amps)	75	75	75	75	125	125	150	150
T _A @ Rated I _O (1500 FLM or Free Convection) (°C)	75	75	75	75	75	75	75	75
T _J (Max) (°C)	150	150	150	150	150	150	150	150

Fast Recovery Rectifiers








... available for designs requiring a power rectifier having maximum switching times ranging from 200 ns to 750 ns. These devices are offered in current ranges of 1.0 to 50 amperes and in voltages to 600 volts. Higher voltages are available upon request, but a necessary trade-off against switching speeds results. Reverse polarity (anode to case) obtained by adding an "R" suffix.

I _O , AVERAGE RECTIFIED FORWARD CURRENT (Amperes)																	
Case	1.0		3.0		5.0		6.0		12		20		30		40		
	59-04 Plastic	60 Metal	70 Metal	267-01 Plastic	194 Plastic	56-02 (DO-4) Metal	257 (DO-5) Metal	42A (DO-5) Metal									
V _{RRM} (Volts)																	
50	1N4933‡	MR810	MR830	MR800	MR850	MR910	MR820	1N3879	1N3889	1N3899	1N3909	MR860	MR870				
100	1N4934‡	MR811	MR831	MR801	MR851	MR911	MR821	1N3880	1N3890 JAN,JTX	1N3900	1N3910, JAN,JTX	MR861	MR871				
200	1N4935‡	MR812	MR832	MR802	MR852	MR912	MR822	1N3881	1N3891 JAN,JTX	1N3901	1N3911, JAN,JTX	MR862	MR872				
400	1N4936‡	MR814	MR834	MR804	MR854	MR914	MR824	1N3883	1N3893, JAN,JTX	1N3903	1N3913, JAN,JTX	MR864	MR874				
600	1N4937‡	MR816	MR836	MR806	MR856	MR916	MR826	MR1366	MR1376	MR1386	MR1396	MR866	MR876				
800		MR817				MR917											
1000		MR818				MR918											
I _{FSM} (Amps)	30	30	100	100	100	100	300	150	200	250	300	350	400				
T _A @Rated I _O (°C)	75	75			90*	90*	55*										
T _C @Rated I _O (°C)			100	100				100	100	100	100	100	100				
T _J (Max) (°C)	150	150	150	150	175	175	175	150	150	150	150	160	160				
t _{rr} (μs)	0.2	0.75	0.2	0.2	0.2	0.75	0.2	0.2	0.2	0.2	0.2	0.2	0.2				

*Must be derated for reverse power dissipation. See Data Sheet.
‡Package Size: 0.120" Max Diameter by 0.260" Max Length.

Hot Carrier Rectifiers


... Schottky barrier devices, ideal for use in low voltage, high frequency power supplies and as free-wheeling diodes. These units feature very low forward voltages and switching times estimated at less than 10 ns. They are offered in current ranges of 0.5 to 5.0 amperes and in voltages to 30. Reverse polarity (anode to case) is not available.

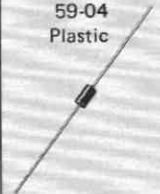
		I _O , AVERAGE RECTIFIED FORWARD CURRENT (Amperes)											
Case	V _{RRM} (Volts)	0.5	1.0	3.0	3.0	5.0	15		25		40		
		51-02 Glass 	59-04 Plastic 	267 Plastic 	60 Metal 			245 (DO-4) Metal 		257 (DO-5) Metal 		430-2 (DO-21) Metal 	
20		MBR020	1N5817	1N5820	MBR320M	1N5823	1N5826	MBR1520	1N5829	MBR2520	1N5832	MBR4020	MBR4020PF
30		MBR030	1N5818	1N5821	MBR330M	1N5824	1N5827	MBR12530	1N5830	MBR2530	1N5833	MBR4030	MBR4030PF
I _{FSM} (Amps)		5.0	100		500	500	500	500	800	800	800	800	800
*T _C @Rated I _O (°C)							85	80	85	80	75	70	50
T _A = 75°C PC Board Mount		125											
*T _L @Rated I _O (°C)			90	95	90	80							
T _J (Max) (°C)			125	125	125	125	125	125	125	125	125	125	125
*Max V _F @ I _{FM} = I _O		0.50	0.55	0.50	45 @ 5 A	0.37	0.47	0.55	0.46	0.55	0.55	0.63	0.63

*Values are for the 30 Volt units. The lower voltage parts provide lower limits.
 †Must be derated for reverse power dissipation. See Data Sheet.

High Voltage Diodes and Stacks

... low-current, high-voltage diodes and stacks in current ranges of 250 mA to 1.0 ampere and in voltages from 1000 to 5000 volts.


250 mA High Voltage Diodes	
Case	169-02 Plastic
V_{RRM} (Volts)	
1000	MR250-1
2000	MR250-2
3000	MR250-3
4000	MR250-4
5000	MR250-5
I_{FSM} (Amps)	15
T_A @ Rated I_O (°C)	75
T_J (Max) (°C)	150

1.0 Ampere Television Damper Diode	
Case	59-04 Plastic
V_{RRM} (Volts)	
1000	MR1-1000
1200	MR1-1200
1400	MR1-1400
1600	MR1-1600
I_{FSM} (Amps)	30
T_A @ Rated I_O (°C)	75*
T_J (Max) (°C)	175
t_{rr} (μ s)	25
*Must be derated for reverse power dissipation. See Data Sheet.	

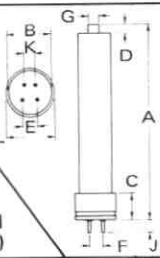
Low Voltage Rectifiers

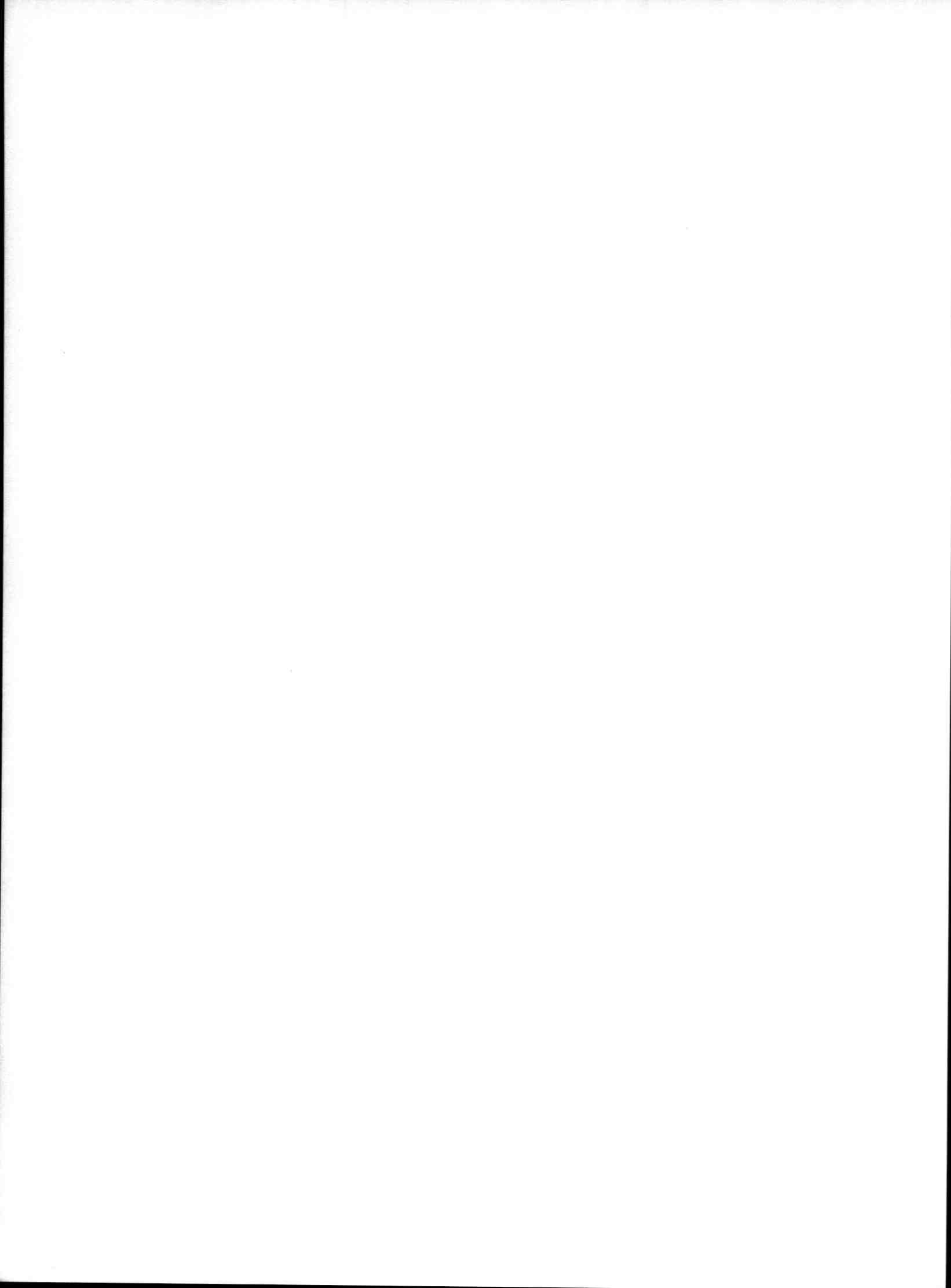
... for low voltage applications to suppress reverse power transients.

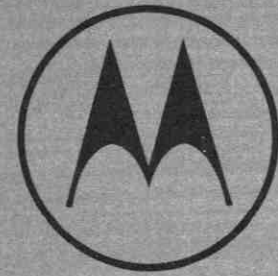
Avalanche Rectifiers

Case	269-03
V_{RRM} (Volts)	
23	MR2525
23	MR2525R
BV (Volts)	24-32
I_{FSM} (Amps)	600
T_C @ Rated I_O (°C)	150
T_J (Max) (°C)	175

Solid-State Mercury Vapor Tube Replacements

Case	286-03		INCHES	
			DIM	MIN MAX
V_{RRM} (Volts)			A	10.505 10.625
			B	2.185 2.225
			C	1.405 1.470
			D	0.490 0.510
			E	0.750 BSC
			F	0.744 BSC
			G	0.559 0.569
			J	0.658 0.698
			K	0.562 BSC
			L	2.480 2.520
	30,000		MDA6693	
	I_O (Amps)		5.0	
	I_{FSM} (Amps)		400	
	T_A @ Rated I_O (°C)		75	
	T_J (Max) (°C)		175	
	v_F @ $i_F = 20$ A (Volts) (Pulse Width 10 ms, < 1% Duty Cycle)		38	
MDA872A, MDA575A, Mercury Vapor Tube Replacements Available. Consult Factory.				





THYRISTERS

and TRIGGERS

SILICON CONTROLLED RECTIFIERS (SCRs) AND
TRIACs
(0.8 to 80 Amperes; 15 to 800 Volts)

Motorola's extensive line of thyristors consists of two generic component categories — SCRs and Triacs. Within each of these categories are two basic packaging divisions, plastic and metal — plastic for lowest cost and metal hermetically sealed packages for applications requiring highest reliability. Combined, these divisions include a large number of individual devices covering a forward-current range from 0.8 to 80 Amperes and a blocking voltage range from 15 to 800 Volts.

But the availability of devices for a wide range of current and voltage requirements doesn't begin to tell the whole story. For within the large selection of different series numbers are device families with characteristics designed for specifically designated applications. Here are some examples of preferred device families for the more high-volume applications, and for special unique purposes.

TABLE OF CONTENTS

	Page
THYRISTOR DEVICES	
SCRs in Plastic Packages (0.8 — 16 Amp)	4-98
Triacs in Plastic Packages (0.45 — 12 Amp)	4-99
SCRs in Metal Packages (1.6 — 35 Amp)	4-100
Triacs in Metal Packages (15 — 40 Amp)	4-101
Pulse Modulators in Metal Packages (80 Amp)	4-103
TRIGGER DEVICES	
Unijunction Transistors	4-104
Programmable Unijunction Transistors	4-105
Diac (3-Layer Diodes)	4-105
Silicon Bidirectional Switch	4-105
4-Layer Diodes	4-105
Silicon Unidirectional Switch	4-105

The following index reflects the devices characterized in this section. To locate the exact page number, see Catalog Index(Page 7-1).

INDEX

1N5159	2N2577	2N5061	2N6169
1N5160	2N2578	2N5062	2N6170
1N5758,A	2N2579	2N5063	2N6171
1N5759,A	2N2646	2N5064	2N6172
1N5760,A	2N2647	2N5164	2N6173
1N5761,A	2N2687	2N5165	2N6174
1N5762,A	2N2688	2N5166	2N6236
1N5779	2N2689	2N5167	2N6237
1N5780	2N2690	2N5168	2N6238
1N5781	2N3870	2N5169	2N6239
1N5782	2N3871	2N5170	2N6240
1N5783	2N3872	2N5171	2N6241
1N5784	2N3873	2N5431,JAN	2N6342,A
1N5785	2N3896	2N5441	2N6343,A
1N5786	2N3897	2N5442	2N6344,A
1N5787	2N3898	2N5443	2N6345,A
1N5788	2N3899	2N5444	2N6346,A
1N5789	2N3980	2N5445	2N6347,A
1N5790	2N4167	2N5446	2N6348,A
1N5791	2N4168	2N5567	2N6349,A
1N5792	2N4169	2N5568	2N6394
1N5793	2N4170	2N5569	2N6395
2N681	2N4171	2N5570	2N6396
2N682	2N4172	2N5571	2N6397
2N683	2N4173	2N5572	2N6398
2N684	2N4174	2N5573	2N6399
2N685	2N4183	2N5574	2N6400
2N686	2N4184	2N6027	2N6401
2N687	2N4185	2N6028	2N6402
2N688	2N4166	2N6068,A,B	2N6403
2N689	2N4187	2N6069,A,B	2N6404
2N690	2N4188	2N6070,A,B	2N6405
2N691	2N4189	2N6071,A,B	MAC10-1
2N692	2N4190	2N6072,A,B	MAC10-2
2N1595	2N4199,JAN	2N6073,A,B	MAC10-3
2N1596	2N4200,JAN	2N6074,A,B	MAC10-4
2N1597	2N4201,JAN	2N6075,A,B	MAC10-5
2N1598	2N4202,JAN	2N6116	MAC10-6
2N1599	2N4203,JAN	2N6117	MAC10-7
2N1842,A	2N4204,JAN	2N6118	MAC10-8
2N1843,A	2N4212	2N6145	MAC11-1
2N1844,A	2N4213	2N6146	MAC11-2
2N1845,A	2N4214	2N6147	MAC11-3
2N1846,A	2N4215	2N6151	MAC11-4
2N1847,A	2N4216	2N6152	MAC11-5
2N1848,A	2N4217	2N6153	MAC11-6
2N1849,A	2N4218	2N6154	MAC11-7
2N1850,A	2N4219	2N6155	MAC11-8
2N2322	2N4441	2N6156	MAC35-1
2N2323	2N4442	2N6157	MAC35-2
2N2324	2N4443	2N6158	MAC35-3
2N2325	2N4444	2N6159	MAC35-4
2N2326	2N4851	2N6160	MAC35-5
2N2327	2N4852	2N6161	MAC35-6
2N2328	2N4853	2N6162	MAC35-7
2N2329	2N4870	2N6163	MAC35-8
2N2573	2N4871	2N6164	MAC35-10
2N2574	2N4948	2N6165	MAC36-1
2N2575	2N4949	2N6167	MAC36-2
2N2576	2N5060	2N6168	MAC36-3






THYRISTOR DEVICES (continued)

MAC36-4	MAC5442	MCR107-2	MCR2305-8
MAC36-5	MAC5443	MCR107-3	MCR2305-10
MAC36-6	MAC5444	MCR107-4	MCR2604L-1
MAC36-7	MAC5445	MCR107-5	MCR2604L-2
MAC36-8	MAC5446	MCR107-6	MCR2604L-3
MAC36-10	MAC6400-80	MCR107-7	MCR2604L-4
MAC37-1	MAC6410-80	MCR107-8	MCR2604L-5
MAC37-2	MAC6420-80	MCR115	MCR2604L-6
MAC37-3	MBS4991	MCR120	MCR2604L-8
MAC37-4	MBS4992	MCR201	MCR2604L-10
MAC37-5	MCR80-5	MCR220-5	MCR3000-1
MAC37-6	MCR80-10	MCR220-7	MCR3000-2
MAC37-7	MCR80-20	MCR220-9	MCR3000-3
MAC37-8	MCR80-30	MCR221-5	MCR3000-4
MAC37-10	MCR80-40	MCR221-7	MCR3000-5
MAC38-1	MCR80-50	MCR221-9	MCR3000-6
MAC38-2	MCR80-60	MCR406-1	MCR3000-7
MAC38-3	MCR80-70	MCR406-2	MCR3000-8
MAC38-4	MCR80-80	MCR406-3	MCR3000-9
MAC38-5	MCR81-5	MCR406-4	MCR3000-10
MAC38-6	MCR81-10	MCR407-1	MCR3818-1
MAC38-7	MCR81-20	MCR407-2	MCR3818-3
MAC38-8	MCR81-30	MCR407-3	MCR3818-5
MAC38-10	MCR81-40	MCR407-4	MCR3818-7
MAC92-1	MCR81-50	MCR649AP-1	MCR3818-10
MAC92-2	MCR81-60	MCR649AP-2	MCR3918-1
MAC92-3	MCR81-70	MCR649AP-3	MCR3918-3
MAC92-4	MCR81-80	MCR649AP-4	MCR3918-5
MAC92-5	MCR82-5	MCR649AP-5	MCR3918-7
MAC92-6	MCR82-10	MCR649AP-6	MCR3918-10
MAC92A-1	MCR82-20	MCR649AP-7	MCR3835-1
MAC92A-2	MCR82-30	MCR649-8	MCR3835-2
MAC92A-3	MCR82-40	MCR649AP-8	MCR3835-5
MAC92A-4	MCR82-50	MCR649-9	MCR3835-7
MAC92A-5	MCR82-60	MCR649AP-9	MCR3835-8
MAC92A-6	MCR82-70	MCR649-10	MCR3835-9
MAC220-2	MCR82-80	MCR649AP-10	MCR3835-10
MAC220-3	MCR83-5	MCR729-5	MCR3935-1
MAC220-5	MCR83-10	MCR729-6	MCR3935-2
MAC220-7	MCR83-20	MCR729-7	MCR3935-5
MAC220-9	MCR83-30	MCR729-8	MCR3935-7
MAC221-2	MCR83-40	MCR729-9	MCR3935-8
MAC221-3	MCR83-50	MCR729-10	MCR3935-9
MAC221-5	MCR83-60	MCR846-1	MCR3935-10
MAC221-7	MCR83-70	MCR846-2	MPT20
MAC221-9	MCR83-80	MCR846-3	MPT28
MAC40688	MCR101	MCR846-4	MPT32
MAC40689	MCR102	MCR1718-5	MPU131
MAC40690	MCR103	MCR1718-6	MPU132
MAC40795	MCR104	MCR1718-7	MPU133
MAC40796	MCR106-1	MCR1718-8	MPU6027
MAC40797	MCR106-2	MCR1906-1	MPU6028
MAC40798	MCR106-3	MCR1906-2	MU10
MAC40799	MCR106-4	MCR1906-3	MU20
MAC40800	MCR106-5	MCR1906-4	MU2646
MAC40801	MCR106-6	MCR2305-1	MU4891
MAC4688	MCR106-7	MCR2305-2	MU4892
MAC4689	MCR106-8	MCR2305-3	MU4893
MAC4690	MCR106-9	MCR2305-4	MU4894
MAC5441	MCR106-10	MCR2305-5	MUS4987
	MCR107-1	MCR2305-6	MUS4988

THYRISTORS in PLASTIC PACKAGES






Excellent reliability and low cost make Motorola plastic-packaged thyristors the preferred devices for high-volume, low and medium current applications. Batch-processed, high-impact plastic provides outstanding mechanical ruggedness while oxide or glass surface passivation protects each die against impurity contamination and moisture penetration for long-term electrical stability.

SCRs

ON-STATE (RMS) CURRENT										
0.8 AMP	4.0 AMP				8.0 AMP	12 AMP	16 AMP			
										
Case 29-02 TO-92 Style 10	Case 77-03 Style 2				Case 90-05 Style 1		Case 90-05 Style 1	Case 221-02 TO-220 AB Style 1		

V _{DRM} V _{RRM} Blocking Voltage (DC or peak) Volts	15 V	MCR101	—	—	—	—	—	—	—	—
	25 V	—	—	—	—	—	—	—	MCR3000-1	—
30 V	MCR102 2N5060	2N6236	MCR106-1	MCR107-1	MCR406-1	MCR407-1	—	—	—	—
50 V	—	2N6237	—	—	—	—	—	2N4441 MCR3000-2	2N6394	2N6400
60 V	MCR103 2N5061	—	MCR106-2	MCR107-2	MCR406-2	MCR407-2	—	—	—	—
100 V	MCR104 2N5062	2N6238	MCR106-3	MCR107-3	MCR406-3	MCR407-3	MCR3000-3	2N6395	2N6401	—
150 V	MCR115 2N5063	—	—	—	—	—	—	—	—	—
200 V	MCR120 2N5064	2N6239	MCR106-4	MCR107-4	MCR406-4	MCR407-4	2N4442 MCR3000-4	2N6396	2N6402	—
300 V	—	—	MCR106-5	MCR107-5	—	—	MCR3000-5	MCR220-5	MCR221-5	—
400 V	—	2N6240	MCR106-6	MCR107-6	—	—	2N4443 MCR3000-6	2N6397	2N6403	—
500 V	—	—	MCR106-7	MCR107-7	—	—	MCR3000-7	MCR220-7	MCR221-7	—
600 V	—	2N6241	MCR106-8	MCR107-8	—	—	2N4444 MCR3000-8	2N6398	2N6404	—
700 V	—	—	MCR106-9	—	—	—	MCR3000-9	MCR220-9	MCR221-9	—
800 V	—	—	MCR106-10	—	—	—	MCR3000-10	2N6399	2N6405	—
ELECTRICAL CHARACTERISTICS	I _{TSM} (Amp)	6.0	25	25	25	30	20	80	100	160
	I _{GT} @ 25°C (mA) Max	0.2	0.2	0.2	20	0.2	0.5	30	30	30
	V _{GT} @ 25°C (V) Max	0.8	0.8	1.0	1.5	0.8	1.0	1.5	1.5	1.5
	I _H @ 25°C (mA) Max	5.0	3.0	5.0	20	3.0	5.0	40	40	40

TRIACS

ON-STATE (RMS) CURRENT									
0.45 AMP	4.0 AMP			8.0 AMP	10 AMP		12 AMP		
									
Case 29-02 TO-92 Style 12	Case 77-03 Style 5			Case 221-02 TO-220 AB Style 2	Case 90-05 Style 4		Case 221-02 TO-220 AB Style 2		









V _{DRM} Blocking Voltage (DC or Peak) Volts	25 V	—	2N6068	2N6068A	2N6068B	—	MAC11-1	MAC10-1	—	—	
	30 V	MAC92-1 MAC92A-1*	—	—	—	—	—	—	—	—	—
	50 V	—	2N6069	2N6069A	2N6069B	MAC220-2 MAC221-2	MAC11-2	MAC10-2	—	—	
	60 V	MAC92-2 MAC92A-2*	—	—	—	—	—	—	—	—	
	100 V	MAC92-3 MAC92A-3*	2N6070	2N6070A	2N6070B	MAC220-3 MAC221-3	MAC11-3	MAC10-3	—	—	
	200 V	MAC92-4 MAC92A-4*	2N6071	2N6071A	2N6071B	2N6342 2N6346	2N6154 MAC11-4	2N6151 MAC10-4	2N6342A	2N6346A	
	300 V	MAC92-5 MAC92A-5*	2N6072	2N6072A	2N6072B	MAC220-5 MAC221-5	MAC11-5	MAC10-5	—	—	
	400 V	MAC92-6 MAC92A-6*	2N6073	2N6073A	2N6073B	2N6343 2N6347	2N6155 MAC11-6	2N6152 MAC10-6	2N6343A	2N6347A	
	500 V	—	2N6074	2N6074A	2N6074B	MAC220-7 MAC221-7	MAC11-7	MAC10-7	—	—	
	600 V	—	2N6075	2N6075A	2N6075B	2N6344 2N6348	2N6156 MAC11-8	2N6153 MAC10-8	2N6344A	2N6348A	
	700 V	—	—	—	—	MAC220-9 MAC221-9	—	—	—	—	
800 V	—	—	—	—	2N6345 2N6349	—	—	2N6345A	2N6349A		
ELECTRICAL CHARACTERISTICS	I _{GT} @ 25°C (mA)										
	MT2(+),G(+)	5.0	30	5.0	3.0	50	50	50	50	50	
	MT2(+),G(-)	15*	—	5.0	3.0	75#	—	75	—	75	
	MT2(-),G(-)	5.0	30	5.0	3.0	50	50	50	50	50	
	MT2(-),G(+)	15*	—	10	5.0	75#	—	75	—	75	
V _{GT} @ 25°C (V)											
MT2(+),G(+)	2.0	@ -40°C	2.5	2.5	2.5	2.5	2.0	2.0	2.0	2.0	
MT2(+),G(-)	2.0*	—	2.5	2.5	2.5#	—	2.5	—	2.5		
MT2(-),G(-)	2.0	2.5	2.5	2.5	2.5	2.0	2.0	2.0	2.0		
MT2(-),G(+)	2.0*	—	2.5	2.5	2.5#	—	2.5	—	2.5		
I _{TSM} (Amp)	6.0	30	30	30	100	100	100	120	120		

* Denotes A Version

Denotes 2N6346 thru 2N6349 and MAC221 Series only.

SCRs in METAL PACKAGES

For current handling requirements up to 80 Amperes, with up to 800-Volt blocking potential, Motorola metal packaged SCRs combine highest reliability with the design flexibility offered by a wide variety of package options. Pulse modulator SCRs provide pulse current capacity to 1000 Amperes for radar and similar applications.

		ON-STATE (RMS) CURRENT											
		0.5 AMP		1.6 AMP			8.0 AMP		16 AMP	20 AMP			
													
Case 22-03 TO-18 Style 6	Case 79-02 TO-39 Style 3			Case 86 Style 1	Case 87L Style 1	Case 263-03 Style 1	Case 310-01 Style 1	Case 263-03 Style 1	Case 311-01 Style 1				
V _{DRM} V _{RRM} Blocking Voltage (DC or Peak) Volts	15 V	MCR201	—	—	—	—	—	—	—	—	—	—	—
	25 V	—	—	2N2322	2N4212	MCR1906-1	2N4167 MCR2305-1	2N4183 MCR2604L-1	2N1842 2N1842A	MCR3818-1	MCR3918-1	—	—
	30 V	2N2687	—	—	—	—	—	—	—	—	—	—	—
	50 V	—	2N1595	2N2323	2N4213	MCR1906-2	2N4168 MCR2305-2	2N4184 MCR2604L-2	2N1843 2N1843A	2N5164	2N5168	—	—
	60 V	2N2688	—	—	—	—	—	—	—	—	—	—	—
	100 V	2N2689	2N1596	2N2324	2N4214	MCR1906-3	2N4169 MCR2305-3	2N4185 MCR2604L-3	2N1844 2N1844A	MCR3818-3	MCR3918-3	2N6167	—
	150 V	—	—	2N2325	2N4215	—	—	—	2N1845 2N1845A	—	—	—	—
	200 V	2N2690	2N1597	2N2326	2N4216	MCR1906-4	2N4170 MCR2305-4	2N4186 MCR2604L-4	2N1846 2N1846A	2N5165	2N5169	2N6168	—
	250 V	—	—	2N2327	2N4217	—	—	—	2N1847 2N1847A	—	—	—	—
	300 V	—	2N1598	2N2328	2N4218	—	2N4171 MCR2305-5	2N4187 MCR2604L-5	2N1848 2N1848A	MCR3818-5	MCR3918-5	—	—
	400 V	—	2N1599	2N2329	2N4219	—	2N4172 MCR2305-6	2N4188 MCR2604L-6	2N1849 2N1849A	2N5166	2N5170	2N6169	—
	500 V	—	—	—	—	—	2N4173	2N4189	2N1850 2N1850A	MCR3818-7	MCR3918-7	—	—
	600 V	—	—	—	—	—	2N4174 MCR2305-8	2N4190 MCR2604L-8	—	2N5167	2N5171	2N6170	—
700 V	—	—	—	—	—	—	—	—	—	—	—	—	
800 V	—	—	—	—	—	MCR2305-10	MCR2604L-10	—	MCR3818-10	MCR3918-10	—	—	
ELECTRICAL CHARACTERISTICS	I _{TSM} (Amp)	6.0	15	15	15	15	← 100 →		125	← 240 →			
	I _{GT} @ 25°C (mA) Max	0.2	10	0.2	0.1	1.0	← 30 →		80	← 40 →			
	V _{GT} @ 25°C (V) Max	1.0	3.0	0.8	0.8	1.0	← 1.5 →		2.0	← 1.5 →			
	I _H @ 25°C (mA) Max	2.0	5.0 Typ	2.0	3.0	5.0	← 30 →		—	← 50 →			

HIGH CURRENT SCRs in METAL PACKAGES

SCRs in METAL PACKAGES (continued)

ON-STATE (RMS) CURRENT					
25 AMP			35 AMP		
Case 54 Style 2	Case 61 TO-41 Style 1	Case 263-03 Style 1	Case 310-01 Style 1	Case 263-03 Style 1	Case 311-01 Style 1
—	—	—	—	—	—
MCR649AP-1	2N2573	2N681	MCR3835-1	MCR3935-1	—
—	—	—	—	—	—
MCR649AP-2	2N2574	2N682	MCR3835-2	MCR3935-2	—
—	—	—	—	—	—
MCR649AP-3	2N2575	2N683	2N3870	2N3896	2N6171
—	—	2N684	—	—	—
MCR649AP-4	2N2576	2N685	2N3871	2N3897	2N6172
—	—	2N686	—	—	—
MCR649AP-5	2N2577	2N687	MCR3835-5	MCR3935-5	—
MCR649AP-6	2N2578	2N688	2N3872	2N3898	2N6173
MCR649AP-7	2N2579	2N689	MCR3835-7	MCR3935-7	—
MCR649AP-8	MCR649-8	2N690	2N3873 MCR3835-8	2N3899 MCR3935-8	2N6174
MCR649AP-9	MCR649-9	2N691	MCR3835-9	MCR3935-9	—
MCR649AP-10	MCR649-10	2N692	MCR3835-10	MCR3935-10	—
260	260	200	←————— 350 —————→		
40	40	25	←————— 40 —————→		
3.5	3.5	3.0	←————— 1.6 —————→		
20 Typ	20 Typ	20 Typ	←————— 50 —————→		

ON-STATE RMS CURRENT			
80 AMP			
Case 287-01 Style 1	Case 288-01 Style 1	Case 291-01 Style 1	Case 285-01 Style 1

V _{DRM} V _{RRM} Blocking Voltage (Volts)	25 V	—	—	—	—
	50 V	MCR80-5	MCR81-5	MCR82-5	MCR83-5
	100 V	MCR80-10	MCR81-10	MCR82-10	MCR83-10
	200 V	MCR80-20	MCR81-20	MCR82-20	MCR83-20
	300 V	MCR80-30	MCR81-30	MCR82-30	MCR83-30
	400 V	MCR80-40	MCR81-40	MCR82-40	MCR83-40
	500 V	MCR80-50	MCR81-50	MCR82-50	MCR83-50
	600 V	MCR80-60	MCR81-60	MCR82-60	MCR83-60
	700 V	MCR80-70	MCR81-70	MCR82-70	MCR83-70
	800 V	MCR80-80	MCR81-80	MCR82-80	MCR83-80
ELECTRICAL CHARACTERISTICS	I _{TSM} (Amp)	1000	1000	1000	1000
	I _{GT} @ 25°C (mA) Max	70	70	70	70
	V _{GT} @ 25°C (V) Max	3.0	3.0	3.0	3.0
	I _H @ 25°C (mA) Max	70	70	70	70
	t _{gt} (μs) Typ	70	70	70	70
dv/dt (V/μs) Typ	100	100	100	100	

TRIACs in METAL PACKAGES





Hermetically sealed for highest reliability in control applications to 40 Amperes and voltage to 800 Volts. Wide variety of package options simplifies mechanical design.



		ON-STATE (RMS) CURRENT												
		10 AMP			15 AMP			25 AMP			30 AMP			
		Case 174-03 Style 3	Case 175-02 Style 3	Case 235-02 Style 2	Case 174-03 Style 3	Case 175-02 Style 3	Case 235-02 Style 2	Case 174-03 Style 3	Case 175-02 Style 3	Case 174-03 Style 3	Case 175-02 Style 3	Case 174-03 Style 3	Case 175-02 Style 3	
V _{DRM} Blocking Voltage (DC or Peak) Volts	25 V	-	-	-	-	-	-	MAC35-1	MAC37-1	MAC36-1	MAC38-1	-	-	
	50 V	-	-	-	-	-	-	MAC35-2	MAC37-2	MAC36-2	MAC38-2	-	-	
	100 V	-	-	-	-	-	-	MAC35-3	MAC37-3	MAC36-3	MAC38-3	-	-	
	200 V	2N5567	2N5569	MAC40799	2N5571	2N5573	2N6145	MAC35-4	MAC37-4	MAC36-4	MAC38-4	2N6157	2N6160	
	300 V	-	-	-	-	-	-	MAC35-5	MAC37-5	MAC36-5	MAC38-5	-	-	
	400 V	2N5568	2N5570	MAC40800	2N5572	2N5574	2N6146	MAC35-6	MAC37-6	MAC36-6	MAC38-6	2N6158	2N6161	
	500 V	-	-	-	-	-	-	MAC35-7	MAC37-7	MAC36-7	MAC38-7	-	-	
	600 V	MAC40795	MAC40796	MAC40801	MAC40797	MAC40798	2N6147	MAC35-8	MAC37-8	MAC36-8	MAC38-8	2N6159	2N6162	
	800 V	-	-	-	-	-	-	MAC35-10	MAC37-10	MAC36-10	MAC38-10	-	-	
ELECTRICAL CHARACTERISTICS	Maximum	I _{GT} @25°C (mA)												
		MT2(+),G(+)	25	25	25	50	50	50	75	75	75	75	60	60
		MT2(+),G(-)	40	40	40	80	80	80	100	-	100	-	70	70
		MT2(-),G(-)	25	25	25	50	50	50	75	75	75	75	70	70
		MT2(-),G(+)	40	40	40	80	80	80	100	-	100	-	100	100
	Maximum	V _{GT} @25°C (V)												
		MT2(+),G(+)	2.5	2.5	2.5	2.5	2.5	2.5	3.0	3.0	3.0	3.0	2.0	2.0
		MT2(+),G(-)	2.5	2.5	2.5	2.5	2.5	2.5	3.0	-	3.0	-	2.1	2.1
		MT2(-),G(-)	2.5	2.5	2.5	2.5	2.5	2.5	3.0	3.0	3.0	3.0	2.1	2.1
		MT2(-),G(+)	2.5	2.5	2.5	2.5	2.5	2.5	3.0	-	3.0	-	2.5	2.5
	I _{TSM} (Amp)	100	100	100	100	100	100	225	225	225	225	250	250	

PULSE MODULATOR SCRs

These devices are especially designed for pulse modulator applications in radar and similar equipment.

TRIACS IN METAL PACKAGES (continued)

ON-STATE (RMS) CURRENT			
30 AMP		40 AMP	
			
Isolated			Isolated
Case 311-01 Style 1	Case 310-01 Style 1	Case 263-03 Style 1	Case 311-01 Style 1
-	-	-	-
-	-	-	-
-	-	-	-
2N6163	2N5441 MAC5441	2N5444 MAC5444	MAC40688 MAC4688
-	-	-	-
2N6164	2N5442 MAC5442	2N5445 MAC5445	MAC40689 MAC4689
-	-	-	-
2N6165	2N5443 MAC5443	2N5446 MAC5446	MAC40690 MAC4690
-	MAC6400 80	MAC6410-80	MAC6420 80
60	70	70	70
70	70	70	70
70	70	70	70
100	100	100	100
2.0	2.0	2.0	2.0
2.1	2.0	2.0	2.0
2.1	2.0	2.0	2.0
2.5	2.5	2.5	2.5
250	300-2N5441 Ser. 200-MAC Ser.	300-2N5444 S. 200-MAC S.	300-MAC4068 Ser. 200-Rest

ON-STATE PULSE CURRENT				
100 AMP		1000 AMP		
				
Case 63-03 Style 1 TO-64		Case 263-03 Style 1		
V _{DRM} V _{RRM} Blocking Voltage (Volts)	25 V	-	MCR846-1	-
	50 V	-	MCR846-2	-
	100 V	-	MCR846-3	-
	200 V	-	MCR846-4	-
	300 V	2N4199 2N4199JAN	MCR729-5	MCR1718-5
	400 V	2N4200 2N4200JAN	MCR729-6	MCR1718-6
	500 V	2N4201 2N4201JAN	MCR729-7	MCR1718-7
	600 V	2N4202 2N4202JAN	MCR729-8	MCR1718-8
	700 V	2N4203 2N4203JAN	MCR729-9	-
	800 V	2N4204 2N4204JAN	MCR729-10	-
ELECTRICAL CHARACTERISTICS	I _{GT} @ 25°C (mA) Max	50	50	50
	V _{GT} @ 25°C (V) Max	1.5	1.5	1.5
	I _H @ 25°C (mA) Min Typ*	3.0	25*	15*
	t _{gt} (μs) Max Typ*	0.4*	0.5* 0.4†	-
	t _{off} (μs) Max Typ*	20	6* 15*†	20*
	dv/dt (V/μs) Max Typ*	250	50	100*

† Applies to MCR729 Series only.

TRIGGER DEVICES



UJT



PUT



SBS



SUS



DIAC



4-LAYER

Trigger devices come under a variety of different classifications, with somewhat differing characteristics –

- Unijunction Transistors
- Unidirectional Switches
- Bidirectional Switches
- Bilateral Triggers
- 4-Layer Diodes

the principal function of all of these is to act as trigger devices for SCR and Triac circuits.



Motorola makes them all, and with sufficient breadth of specifications to meet any circuit requirement.

The variety of different trigger devices available complicates device selection. No specific type of trigger has a clear-cut advantage over all others. Hence, trigger selection is often very subjective, based on the designer's experience and familiarity. Nevertheless, some basic comparisons can be drawn that might simplify the job of trigger selection for designers who have not already formed specific preferences.

UNIUNCTION TRANSISTORS – UJT

Highly stable devices for general-purpose trigger applications and as pulse generators (oscillators) and timing circuits. Useful at frequencies ranging (generally) from 1 Hz to 1 MHz. Available in low-cost plastic package (TO-92) and in hermetically sealed metal package (Case 22A).

UNIUNCTION TRANSISTORS – (UJT)



Package	Device Type	η		I_P μA Max	I_{EB20} μA Max	I_V mA Min
		Min	Max			
Plastic Case 29-02 (TO-92) 	MU10	0.50	0.85	5.0	1.0	1.0
	2N4870	0.56	0.75	5.0	1.0	2.0
	2N4871	0.70	0.85	5.0	1.0	4.0
	MU2646	0.56	0.75	5.0	12	4.0
	MU4891	0.55	0.82	5.0	0.01	2.0
	MU4892	0.51	0.69	2.0		
	MU4893	0.55	0.82	2.0		
MU4894	0.74	0.86	1.0			
Metal Case 22A-01 	MU20	0.56	0.85	2.0	0.2	1.0
	2N2646	0.56	0.75	5.0	12	4.0
	2N2647	0.68	0.82	2.0	0.2	8.0
	2N3980	0.68	0.82	2.0	0.01	1.0
	2N4851	0.56	0.75	2.0	0.1	2.0
	2N4852	0.70	0.85	2.0	0.1	4.0
	2N4853	0.70	0.85	0.4	0.05	6.0
	2N4948*	0.55	0.82	2.0	0.01	2.0
	2N4949*	0.74	0.86	1.0	0.01	2.0
	2N5431*	0.72	0.80	0.4	0.01	2.0

*Also available as JAN and JANTX devices

THYRISTOR DEVICES (continued)

TRIGGER DEVICES (Continued)

PROGRAMMABLE UNIJUNCTION TRANSISTORS – (PUT)

Package	Device Type	I _p		I _{GAO} @40 V	I _v	
		R _G = 10 kΩ	R _G = 1.0 MΩ		R _G = 10 kΩ	R _G = 1.0 MΩ
		μA Max	nA Max		μA Min	μA Max
Plastic Case 29-02 TO-92 	2N6027	5.0	2.0	10	70	50
	2N6028	1.0	0.15	↓	25	25
	MPU6027	5.0	2.0	↓	70	50
	MPU6028	1.0	0.15	↓	25	25
	MPU131	5.0	2.0	5.0	70	50
	MPU132	2.0	0.3	5.0	50	50
	MPU133	1.0	0.15	5.0	50	25
Metal Case 22 03 TO-18 	2N6116*	5.0	2.0	5.0	70	50
	2N6117*	2.0	0.3	5.0	50	50
	2N6118*	1.0	0.15	5.0	50	25


*Also available as JAN and JANTX devices

PROGRAMMABLE UNIJUNCTION TRANSISTORS – PUT


Similar to UJTs, except that I_v, I_p and intrinsic standoff voltage are programmable (adjustable) by means of external voltage divider. This stabilizes circuit performance for variations in device parameters. General operating frequency range is from 0.01 Hz to 10 kHz, making them suitable for long-duration timer circuits. Two-package availability provides cost option.

Package	Device Type	V _S Volts Nom*		I _S μA Max	I _H mA Max
		Min	Max		


BILATERAL TRIGGERS – (DIACs)

Plastic Case 182-02 TO-92 	1N5758/MPT20	20 ± 4.0*	100	
	1N5759	24 ± 4.0*	100	
	1N5760/MPT28	28 ± 4.0*	100	
	1N5761/MPT32	32 ± 4.0*	100	
	1N5762	36 ± 4.0*	100	
	1N5758A	20 ± 2.0*	25	
	1N5759A	24 ± 2.0*	25	
	1N5760A	28 ± 2.0*	25	
	1N5761A	32 ± 2.0*	25	
	1N5762A	36 ± 2.0*	25	


SILICON BIDIRECTIONAL SWITCH – (SBS)

Plastic Case 29-02 TO-92 	MBS4991	6.0	10	500	1.5
	MBS4992	7.5	9.0	120	0.5

4-LAYER DIODES (I_F = 150 mAdc Max)

Glass Case 51 DO-7 Glass 	1N5159	9.0	11	50	20
	1N5160	10	12	↓	↓
	1N5779	11	13	↓	↓
	1N5780	12	14	↓	↓
	1N5781	13	15	↓	↓
	1N5782	8.0	10	100	50
	1N5783	9.0	11	↓	↓
	1N5784	10	12	↓	↓
	1N5785	11	13	↓	↓
	1N5786	12	14	↓	↓
	1N5787	13	15	↓	↓
	1N5788	8.0	10	↓	2.0
	1N5789	9.0	11	↓	↓
	1N5790	10	12	↓	↓
	1N5791	11	13	↓	↓
	1N5792	12	14	↓	↓
	1N5793	13	15	↓	↓

SILICON UNIDIRECTIONAL SWITCH – (SUS)

Plastic Case 29-02 TO-92 	MUS4987	6.0	10	500	1.5
	MUS4988	7.5	9.0	150	0.5

BILATERAL TRIGGERS – DIACs

Specifically designed as low-cost bidirectional triggers in line-operated Triac control circuits such as light dimmers, motor controls and temperature controls.

SILICON BIDIRECTIONAL SWITCH – SBS

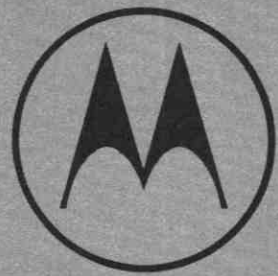
Applications similar to Diac, but has gate electrode that permits synchronization.

4-LAYER DIODES

Small, axial-lead devices with stable, repeatable characteristics required for critical SCR trigger and pulse generator applications.

SILICON UNIDIRECTIONAL SWITCH – SUS

Similar to 4-Layer Diodes, but has gate electrode that permits synchronization.



OPTOELECTRONICS

Optoelectronic devices are designed for use in computer, industrial and consumer equipment. Motorola's standard line of optoelectronic products include optical couplers, light emitters and light detectors. Compactness, reliability and compatibility with integrated circuits keynote light-emitting diode advantages — as well as perfect spectral matching in infrared (IR) units to silicon detectors. They emit infrared or visible light when forward biased. Motorola offers a variety of red and infrared, fast switching types for flexibility in package, performance and price.

TABLE OF CONTENTS

OPTICAL COUPLERS/ISOLATORS

	Page
Transistor Output Popular form of isolator that offers moderate speed (approximately 300 kHz), sensitivity and economy	4-109
Darlington Output Designed for use when high transfer ratios and increased output current capability are required. The speed, approximately 30 kHz, is slower than the transistor type but the transfer ratio can be as much as twenty times as high as the single transistor type	4-109
High-Speed Logic Coupler Gallium Arsenide LED optically coupled to a high-speed integrated detector intended for use as a digital inverter.	4-109

LIGHT-EMITTING DIODES

Light-Emitting Diodes Wide variety of styles accommodate differing needs in color, viewing angle, package size, light-sensitivity and off-on contrast.	4-110
Infrared-Emitting Diodes Gallium Arsenide devices emitting in the 900 nM (9000 Å) region. This wavelength is matched to the peak sensitivity of silicon detectors	4-111

SILICON PHOTO DETECTORS

Phototransistors One of the most popular detectors offers moderate sensitivity and medium speed (approximately 2.0 μs response time).	4-112
Photodiodes Ideal for detection systems where response times on the order of 1.0 ns are required. Although output levels are low, they can easily be amplified to provide working signal levels.	4-112
Darlington These devices provide a higher degree of sensitivity for those areas that demand the extreme in this parameter.	4-112

OPTOELECTRONICS (Continued)

The following index reflects the devices characterized in this section. To locate the exact page number, see Catalog Index (Page 7-1).

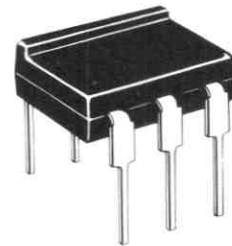
DEVICE INDEX

1N5909	4N38A	MOC5001
1N5910	MLED50	MOC8030
1N5911	MLED55	MOC8050
1N5912	MLED60	MRD14B
2N5777	MLED90	MRD120
2N5778	MLED92	MRD121
2N5779	MLED440	MRD150
2N5780	MLED445	MRD300
4N25	MLED500	MRD310
4N25A	MLED600	MRD360
4N26	MLED640	MRD370
4N27	MLED655	MRD450
4N28	MLED660	MRD500
4N29	MLED900	MRD510
4N29A	MLED910	MRD601
4N30	MLED930	MRD602
4N31	MOC119	MRD603
4N32	MOC1005	MRD604
4N32A	MOC1006	MRD810
4N33	MOC3000	MRD3050
4N35	MOC3001	MRD3051
4N36	MOC3002	MRD3055
4N37	MOC3003	MRD3056
4N38	MOC5000	

OPTICAL COUPLERS/ISOLATORS

Couplers are designed to provide isolation protection from high-voltage transients, surge voltage or low level noise that would otherwise damage the input or generate erroneous information. They allow interfacing systems of different logic levels, different grounds, etc., that would otherwise be incompatible. Motorola offers a variety of standard isolation voltages from transients protection of 500 to 5000 Volts minimum.

Motorola also offers a wide array of standard devices that have a wide range of specifications (including the first series of DIP transistors and darlington couplers to achieve JEDEC registration: transistors — 4N25 thru 4N28/darlington — 4N29 thru 4N33).

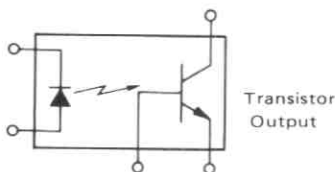


CASE 673-04



The **Transistor Coupler** is probably the most popular form of isolator since it offers moderate speed (approximately 300 kHz), sensitivity and economy. In addition, the collector-base junction can be used as a photo diode to achieve higher speeds. The output in the diode mode is lower, requiring amplification for more usable output levels.

For High Speed, Moderate Efficiency



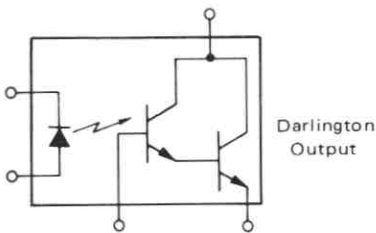
Device Type	Isolation* Voltage Volts Min	DC Current Transfer Ratio % Min	BV _{CEO} Volts Min	Collector Output Current @I _F = 10 mA Typ mA
4N28	500	10	30	2.0
4N26	1500	20	30	3.5
4N27	1500	10	30	2.0
4N38	1500	20	80	3.5
4N37	1500	100	30	2.0
4N36	2500	100	30	2.0
4N25	2500	20	30	3.5
4N25A**	2500	20	30	3.5
4N38A**	2500	20	80	3.5
4N35	3550	100	30	2.0
MOC1005	5000	20	30	5.0
MOC1006	5000	10	30	3.0

*AC peak voltage — one full sine wave 60 Hz.

**Underwriter Laboratory Recognition

The **Darlington Transistor Coupler** is used when high transfer ratios and increased output current capability are needed. The speed, approximately 30 kHz, is slower than the transistor type but the transfer ratio can be as much as twenty times as high as the single transistor type.

For High Efficiency, Moderate Speed

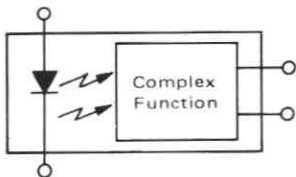


Device Type	Isolation* Voltage Volts Min	DC Current Transfer Ratio % Min	BV _{CEO} Volts Min	Collector Output Current @I _F = 10 mA Typ mA
4N30 (MOC1200)	1500	100		30
4N31	1500	50	30	10
4N33	1500	500	30	60
MOC119	1500	300	30	45
MOC8030	1500	300	80	45
MOC8050	1500	500	80	60
4N29	2500	100	30	30
4N29A**	2500	100	30	30
4N32	2500	500	30	60
4N32A**	2500	500	30	60

* AC peak voltage – one full sine wave 60 Hz.
 ** Underwriter Laboratory Recognition.

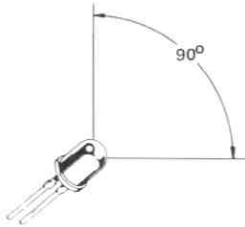
Complex Functions

As the areas of application for couplers grow, more complicated output functions will be required. Higher speeds, lower drive, more current output devices are already beginning to make their appearance on the marketplace. (Motorola now offers a high-speed function and is developing a new TRIAC Driver/Bilateral Switch function). These new functions will offer the designer even more flexibility and opportunities for creative design.



Device Type	Isolation Voltage Volts Min	Switching Times		Off Output Current μA Max
		t _{on} ns Typ	t _{off} ns Typ	
Hi-Speed				
MOC5001	500	300	650	100
MOC5000	1500	250	400	100
Triac Driver/ Bilateral Switch		LED Trigger Current I _{F(TH)} Typ mA		Output Saturation Current I _(sat) Typ mA
MOC3000	5000	5.0		80
MOC3001	5000	5.0		45
MOC3002	5000	5.0		80
MOC3003	5000	5.0		45













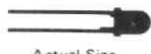
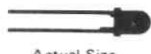




VISIBLE LIGHT-EMITTING DIODES



Motorola visible emitters are available for use in panel and circuit condition indicators, light modulators, and film annotation.

Peak Emission Wavelength = 660 nm (Typ)
 Forward Voltage @ 20 mA = 1.6 V (Typ) (Except as noted)

Viewing Angle – Angle at which intensity is 50% of maximum on axis intensity.

Package	Device Type (Lens Type)	Viewing Angle α	Instantaneous Axial Luminous Intensity Typ mcd	Mounting	
				Panel	Circuit Board
 Case 279-01 Plastic	 Actual Size 1N5911 (Note 1,2,3) (Formerly MLED750) (Diffusing Green)	90°	0.3 @ 25 mA	x	
	 Actual Size 1N5912 (Note 1,2,4) (Formerly MLED850) (Visible Yellow)	90°	0.3 @ 25 mA	x	
 Case 171(2) Plastic	 Actual Size MLED600 (Clear Red)	30°	3.0 @ 20 mA	x	x
 Case 234-02 Plastic	 Actual Size MLED50 (Clear) MLED55 (Diffusing Red)	70°	1.0 @ 20 mA	x	x
		100°	0.6 @ 20 mA	x	x
 Case 279-01 Plastic	 Actual Size MLED640 (Milky White)	90°	2.0 @ 20 mA	x	
	 Actual Size MLED655 (Diffusing Red) General Purpose	90°	2.0 @ 20 mA	x	
	 Actual Size MLED660 (Diffusing Red) High Current	90°	1.5 @ 20 mA	x	
 Case 292-01 Plastic	 Actual Size MLED440 (Visible Red) MLED445 (Clear)	90°	0.3 @ 20 mA	x	
		40°	0.8 @ 20 mA	x	
	 Actual Size 1N5909 (Formerly MLED455) (Diffusing Red)	75°	1.2 @ 20 mA	x	
 Case 279-01 Plastic	 Actual Size 1N5910 (Formerly MLED650) (Diffusing Red) Wide Viewing	140°	0.8 @ 20 mA	X	
 Case 29-02 Plastic	 Actual Size MLED500 (Diffusing Red)	110°	0.3 @ 20 mA		x

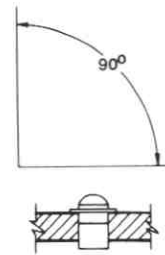
- Notes: 1. Indicates JEDEC Registered Data
 2. Forward Voltage @ 25 mA = 2.1 mA (Typ)
 3. Peak Emission Wavelength = 560 nm (Typ)
 4. Peak Emission Wavelength = 575 nm (Typ)

INFRARED-EMITTING DIODES











Infrared (900 nm) gallium arsenide emitters are available from Motorola for use in light modulators, shaft or position encoders, punched card and tape readers, optical switching and logic circuits. They are spectrally matched for use with silicon detectors.

Peak Emission Wavelength = 900 nm (Typ)

Forward Voltage @ 50 mA = 1.2 (Typ)



Emission Angle — Angle at which I_R emission is 50% of maximum intensity.







Package	Device Type	Emission Angle α	Instantaneous Power Output Typ μ W	Mounting	
				Panel	Circuit Board
 Case 81A-01 Metal Actual Size 	MLED910	30°	150 @ 50 mA		x
 Case 209-01 Metal Actual Size 	MLED930	30°	650 @ 100 mA	x	
 Case 171 (2) Plastic Actual Size 	MLED900	30°	550 @ 50 mA	x	x
 Case 234-02 Clear Plastic Actual Size 	MLED60 MLED90	65° 65°	550 @ 50 mA 350 @ 50 mA	x x	x x
 Case 29-02 Plastic Actual Size 	MLED92	110°	650 @ 100 mA	x	x

PHOTODETECTORS









A variety of silicon photodetectors are available for a wide range of light detecting applications. Devices are available in packages offering choices of viewing angle and size in either low cost, economical, plastic cases or rugged, hermetic, metal cans. Advantages over phototubes are high sensitivity, good temperature stability, and proven silicon reliability. Applications include card and tape readers, pattern and character recognition, shaft encoders, position sensors, counters, and others. Maximum sensitivity occurs at approximately 800 nm.

Phototransistors

Phototransistors are used where moderate sensitivity and medium speed (2.0 μ s) are required.





Package	Type Number	Light Current @ H		BV_{CEO} Volts Min	Dark Current @ V_{CC}	
		Typ mA	mW/cm^2		nA Max	Volts
 Case 210-01 Metal Actual Size 	MRD810	4.0	5.0	35	50	20
 Case 81A-01 Metal Actual Size 	MRD604 MRD603 MRD602 MRD601	8.5 6.0 3.5 1.5	20 20 20 20	50 50 50 50	25 25 25 25	30 30 30 30
 Case 82-01 Metal Actual Size 	MRD310 MRD300	2.5 7.5	5.0 5.0	50 50	25 25	20 20

Phototransistors (continued)

Package	Type Number	Light Current @ H		BV _{CEO} Volts Min	Dark Current @ V _{CC}	
		Typ mA	mW/cm ²		nA Max	Volts
 Case 82-01 Metal 	MRD3054	1.2	5.0	30	100	20
	MRD3056	2.5	5.0	30	100	20
	MRD3055	1.8	5.0	30	100	20
	MRD3051	0.2	5.0	30	100	20
	MRD3050	0.2	5.0	30	100	20
	MRD3052	0.25	5.0	30	100	20
	MRD3053	0.5	5.0	30	100	20
 Case 279-01 Plastic 	MRD120	0.7	1.0	40	100	20
	MRD121	0.25	1.0	40	100	20
 Case 173 Clear Plastic 	MRD150	0.45	5.0	40	100	20
 Case 171-01 Plastic 	MRD450	4.0	5.0	40	100	20





Photodiodes

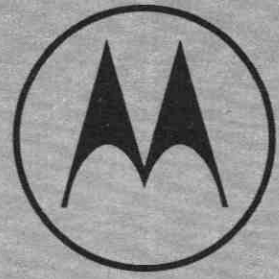
Photodiodes are used where high speed is required (1.0 ns).

Package	Type Number	Light Current @ H		BVR Volts Min	Dark Current @ Volts	
		Typ μ A	mW/cm ²		nA Max	Volts
 Case 209-01 Metal Convex Lens 	MRD500	9.0	5.0	100	2.0	20
 Case 210-01 Metal Flat Lens 	MRD510	2.0	5.0	100	2.0	20

Photodarlington

Photodarlington are used where maximum sensitivity is required with typical rise and fall times of 50 μ s.

Package	Type Number	Light Current @ H		BV _{CEO} Volts Min	Dark Current @ Volts	
		Typ mA	mW/cm ²		nA Max	Volts
 Case 82-01 Metal 	MRD360	20	0.5	40	100	10
	MRD370	10	0.5	40	100	10
 Case 29-01 Plastic 	2N5780	8.0	2.0	40	100	12
	2N5779	8.0	2.0	25	100	12
	2N5778	4.0	2.0	40	100	12
	2N5777	4.0	2.0	25	100	12
	MRD14B	2.0	2.0	12	100	12



CHIPS

Motorola has made available to the hybrid circuit manufacturer, in chip form, virtually all of the thousands of discrete and integrated circuit devices in its standard product catalog. For more detailed information on these chips, including testing, visual inspection, packaging, size, geometry, and metallization, contact your nearest Motorola representative or distributor.

DEVICES FOR MILITARY



APPLICATIONS

The following tables list devices that appear in QPL-19500 (Qualified Products List) as of 16 September 1975 and are available in the JAN, JANTX, and JANTXV versions as specified. Check with your local Motorola sales office or franchised distributor for current qualification status and availability.

1N...Device Numbers ASSEMBLIES DIODES

Reference
Zener
Current Regulator
Voltage Regulator

RECTIFIERS

SILICON ZENER DIODES ±5% SERIES

MIL-S-19500/127

1N746A JAN,JTX,JTXV thru 1N759A JAN,JTX,JTXV

MIL-S-19500/117

1N962B JAN,JTX,JTXV thru 1N992B JAN,JTX,JTXV

*MIL-S-19500/114

1N2804B JAN,JTX thru 1N2811B JAN,JTX
1N2813B JAN,JTX
1N2814B JAN,JTX
1N2816B JAN,JTX
1N2818B JAN,JTX thru 1N2820B JAN,JTX
1N2822B JAN,JTX thru 1N2827B JAN,JTX
1N2829B JAN,JTX
1N2831B JAN,JTX thru 1N2838B JAN,JTX
1N2840B JAN,JTX thru 1N2846 JAN,JTX

*MIL-S-19500/124

1N2970B JAN,JTX thru 1N2977B JAN,JTX
1N2979B JAN,JTX
1N2980B JAN,JTX
1N2982B JAN,JTX
1N2984B JAN,JTX thru 1N2986B JAN,JTX
1N2988B JAN,JTX thru 1N2993B JAN,JTX
1N2995B JAN,JTX
1N2997B JAN,JTX
1N2999B JAN,JTX thru 1N3005B JAN,JTX
1N3007B JAN,JTX thru 1N3009B JAN,JTX
1N3011B JAN,JTX
1N3012B JAN,JTX
1N3014B JAN,JTX
1N3015B JAN,JTX

MIL-S-19500/115

1N3016B JAN,JTX,JTXV thru 1N3051B JAN,JTX,JTXV

SILICON ZENER DIODES ±5% SERIES (continued)

*MIL-S-19500/358

1N3305B JAN,JTX thru 1N3312B JAN,JTX
1N3314B JAN,JTX
1N3315B JAN,JTX
1N3317B JAN,JTX
1N3319B JAN,JTX thru 1N3321B JAN,JTX
1N3323B JAN,JTX thru 1N3328B JAN,JTX
1N3330B JAN,JTX
1N3332B JAN,JTX
1N3334B JAN,JTX thru 1N3340B JAN,JTX
1N3342B JAN,JTX thru 1N3344B JAN,JTX
1N3346B JAN,JTX
1N3347B JAN,JTX
1N3349B JAN,JTX
1N3350B JAN,JTX

MIL-S-19500/115

1N3821A JAN,JTX,JTXV thru 1N3828A JAN,JTX,JTXV

**MIL-S-19500/272

1N3993A JAN,JTX thru 1N4000A JAN,JTX

MIL-S-19500/435

1N4099 JAN,JTX,JTXV thru 1N4135 JAN,JTX,JTXV

MIL-S-19500/127

1N4370A JAN,JTX,JTXV thru 1N4372A JAN,JTX,JTXV

*MIL-S-19500/358

1N4549B JAN,JTX thru 1N4554B JAN,JTX

MIL-S-19500/435

1N4614 JAN,JTX,JTXV thru 1N4627 JAN,JTX,JTXV

MIL-S-19500/73

1N4557B RB,JAN,JTX thru 1N4562B JAN,JTX

VOLTAGE REGULATORS

MIL-S-19500/437

1N5519B JAN,JANTX thru 1N5545B JAN,JANTX

DEVICES FOR MILITARY APPLICATIONS (continued)

1N. . . DEVICE NUMBERS (continued)

CURRENT REGULATORS

MIL-S-19500/463	
1N5285 JAN,JTX,JTXV	1N5300 JAN,JTX,JTXV
1N5286 JAN,JTX,JTXV	1N5301 JAN,JTX,JTXV
1N5287 JAN,JTX,JTXV	1N5302 JAN,JTX,JTXV
1N5288 JAN,JTX,JTXV	1N5303 JAN,JTX,JTXV
1N5289 JAN,JTX,JTXV	1N5304 JAN,JTX,JTXV
1N5290 JAN,JTX,JTXV	1N5305 JAN,JTX,JTXV
1N5291 JAN,JTX,JTXV	1N5306 JAN,JTX,JTXV
1N5292 JAN,JTX,JTXV	1N5307 JAN,JTX,JTXV
1N5293 JAN,JTX,JTXV	1N5308 JAN,JTX,JTXV
1N5294 JAN,JTX,JTXV	1N5309 JAN,JTX,JTXV
1N5295 JAN,JTX,JTXV	1N5310 JAN,JTX,JTXV
1N5296 JAN,JTX,JTXV	1N5311 JAN,JTX,JTXV
1N5297 JAN,JTX,JTXV	1N5312 JAN,JTX,JTXV
1N5298 JAN,JTX,JTXV	1N5313 JAN,JTX,JTXV
1N5299 JAN,JTX,JTXV	1N5314 JAN,JTX,JTXV

TC REFERENCE DIODES

MIL-S-19500	
1N429 JAN	/299
1N821 JAN,JTX,JTXV	/159
1N823 JAN,JTX,JTXV	/159
1N825 JAN,JTX,JTXV	/159
1N827 JAN,JTX,JTXV	/159
1N829 JAN,JTX,JTXV	/159
1N935B JAN,JTX,JTXV	/156
1N937B JAN,JTX,JTXV	/156
1N938B JAN,JTX,JTXV	/156
1N939B JAN,JTX,JTXV	/156
1N941B JAN,JTX	/157
1N943B JAN,JTX	/157
1N944B JAN,JTX	/157
1N945B JAN,JTX	/157
1N3154 JAN,JTX	/158
1N3155 JAN,JTX	/158
1N3156 JAN,JTX	/158
1N3157 JAN,JTX	/158
1N4565A JAN,JTX,JTXV thru	/452
1N4574A JAN,JTX,JTXV	

DIODE ASSEMBLIES

MIL-S-19500	
1N1530A JAN	/320
1N1742A JAN	/298

RECTIFIERS

MIL-S-19500/304	
1N3890 JAN,JTX,JTXV	
1N3890R JAN,JTX,JTXV	
1N3891 JAN,JTX,JTXV	
1N3891R JAN,JTX,JTXV	
1N3893 JAN,JTX,JTXV	
1N3893R JAN,JTX,JTXV	
MIL-S-19500/308	
1N3910R JAN,JTX	
1N3911R JAN,JTX	
1N3912R JAN,JTX	
1N3913R JAN,JTX	

DEVICES FOR MILITARY APPLICATIONS (continued)

2N... Device Numbers

TRANSISTORS

Field Effect, High Frequency,
Multiple Device, Power, RF Power,
Switching and Unijunction

THYRISTORS

The following tables list devices that appear in QPL-19500 (Qualified Products List) as of 16 September 1975 and are available in the JAN, JANTX, and JANTXV versions as specified. Check with your local Motorola sales office or franchised distributor for current qualification status and availability.

SWITCHING AND HIGH FREQUENCY TRANSISTORS

MIL-S-19500

2N499 JAN	/72	2N3250A JAN,JTX,JTXV	/323
2N499A JAN	/72	2N3251A JAN,JTX,JTXV	/323
2N502A JAN	/112	2N3253 JAN	/347
2N502B JAN	/112	2N3253S JAN	/347
2N703 JAN	/153	2N3444 JAN	/347
2N705 JAN	/86	2N3444S JAN	/347
2N706 JAN	/120	2N3449 JAN	/338
2N708 JAN,JTX	/312	2N3467 JAN,JTX,JTXV	/348
2N718A JAN,JTX,JTXV	/181	2N3468 JAN,JTX,JTXV	/348
2N869A JAN,JTX	/283	2N3485A JAN,JTX	/392
2N914 JAN,JTX	/373	2N3486A JAN,JTX	/392
2N916 JAN	/271	2N3498 JAN,JTX,JTXV	/366
2N929 JAN,JTX	/253	2N3499 JAN,JTX,JTXV	/366
2N930 JAN,JTX	/253	2N3500 JAN,JTX,JTXV	/366
2N962 JAN	/258	2N3501 JAN,JTX,JTXV	/366
2N964 JAN	/258	2N3506 JAN,JTX,JTXV	/349
2N1132 JAN	/177	2N3507 JAN,JTX,JTXV	/349
2N1613 JAN,JTX,JTXV	/181	2N3634 JAN,JTX,JTXV	/357
2N2218 JAN,JTX,JTXV	/251	2N3635 JAN,JTX,JTXV	/357
2N2218A JAN,JTX,JTXV	/251	2N3636 JAN,JTX,JTXV	/357
2N2219 JAN,JTX,JTXV	/251	2N3637 JAN,JTX,JTXV	/357
2N2219A JAN,JTX,JTXV	/251	2N3743 JAN,JTX,JTXV	/397
2N2221 JAN,JTX,JTXV	/255	2N3762 JAN,JTX,JTXV	/396
2N2221A JAN,JTX,JTXV	/255	2N3763 JAN,JTX,JTXV	/396
2N2222 JAN,JTX,JTXV	/255	2N3764 JAN,JTX,JTXV	/396
2N2222A JAN,JTX,JTXV	/255	2N3765 JAN,JTX,JTXV	/396
2N2369A JAN,JTX,JTXV	/317	2N3959 JAN,JTX	/399
2N2481 JAN,JTX	/268	2N3960 JAN,JTX	/399
2N2857 JAN,JTX,JTXV	/343	2N4405 JAN,JTX	/448
2N2905 JAN,JTX,JTXV	/290	2N4449 JAN,JTX,JTXV	/317
2N2905A JAN,JTX,JTXV	/290	2N4453 JAN,JTX	/283
2N2906 JAN,JTX,JTXV	/291	2N4930 JAN,JTX,JTXV	/397
2N2906A JAN,JTX,JTXV	/291	2N4931 JAN,JTX,JTXV	/397
2N2907 JAN,JTX,JTXV	/291	2N5581 JAN,JTX	/423
2N2907A JAN,JTX,JTXV	/291	2N5582 JAN,JTX	/423
2N3013 JAN,JTX	/287	2N6365 JAN	/471
		2N6365A JAN	/471

POWER TRANSISTORS

MIL-S-19500

2N3715 JAN,JTX,JTXV	/408	2N3868 JAN,JTX,JTXV	/350
2N3716 JAN,JTX,JTXV	/408	2N3902 JAN,JTX	/371
2N3739 JAN,JTX	/402	2N4399 JAN,JTX,JTXV	/433
2N3740 JAN,JTX,JTXV	/441	2N5302 JAN,JTX	/456
2N3741 JAN,JTX,JTXV	/441	2N5303 JAN,JTX	/456
2N3791 JAN,JTX,JTXV	/379	2N5685 JAN,JTX,JTXV	/464
2N3792 JAN,JTX,JTXV	/379	2N5686 JAN,JTX,JTXV	/464
2N3867 JAN,JTX,JTXV	/350	2N5745 JAN,JTX,JTXV	/433

DEVICES FOR MILITARY APPLICATIONS (continued)

2N... DEVICE NUMBERS (continued)

SILICON CONTROLLED RECTIFIERS

MIL-S-19500		
2N4199 JAN	.....	/372
2N4200 JAN	.....	/372
2N4201 JAN	.....	/372
2N4202 JAN	.....	/372
2N4203 JAN	.....	/372
2N4204 JAN	.....	/372

MULTIPLE DEVICES

MIL-S-19500		
2N2060 JAN,JTX,JTXV	.....	/270
2N3810 JAN,JTX,JTXV	.....	/336
2N3811 JAN,JTX,JTXV	.....	/336
2N4854 JAN,JTX,JTXV	.....	/421
2N5793,94 JAN,JTX	.....	/495

UNIUNCTION

MIL-S-19500		
2N4948 JAN,JTX	.....	/388
2N4949 JAN,JTX	.....	/388
2N5431 JAN,JTX	.....	/425
2N6116 JAN,JTX	.....	/493
2N6117 JAN,JTX	.....	/493
2N6118 JAN,JTX	.....	/493

FIELD-EFFECT TRANSISTORS

MIL-S-19500		
2N3330 JAN,JTX	.....	/378
2N3821 JAN,JTX	.....	/375
2N3822 JAN,JTX	.....	/375
2N3823 JAN,JTX	.....	/375
2N4856,59 JAN,JTX	.....	/385

RF POWER TRANSISTORS

MIL-S-19500		
2N918 JAN,JTX,JTXV	.....	/301
2N1142 JAN	.....	/87
2N1195 JAN	.....	/71
2N2273 JAN	.....	/244
2N3127 JAN	.....	/346
2N3375 JAN,JTX,JTXV	.....	/341
2N3553 JAN,JTX,JTXV	.....	/341
2N3866 JAN,JTX,JTXV	.....	/398
2N3866A JAN,JTX,JTXV	.....	/398

The following tables list devices which are in the process of qualification for listing in QPL-19500 as of 16 September 1975. Check with your local Motorola sales office or franchised distributor for current qualification status and availability.

POWER TRANSISTORS

MIL-S-19500		
2N3439,40 JAN,JTX	.....	/368
2N5664,65 JAN,JTX,JTXV	.....	/455
2N5683,84 JAN,JTX	.....	/466
2N6051,52 JAN,JTX,JTXV	.....	/501
2N6058,59 JAN,JTX,JTXV	.....	/503
2N6306,08 JAN,JTX	.....	/498

SWITCHING AND HIGH FREQUENCY TRANSISTORS

MIL-S-19500		
2N3019 JAN,JTX	.....	/391
2N3700 JAN,JTX	.....	/391
2N3735,37 JAN,JTX,JTXV	.....	/395
2N4957 JAN,JTX	.....	/426
2N5109 JAN,JTX	.....	/453

MULTIPLE DEVICES

MIL-S-19500		
2N5795,96 JAN,JTX,JTXV	.....	/496

FIELD-EFFECT TRANSISTORS

MIL-S-19500		
2N4092 JAN,JTX	.....	/431
2N4093 JAN,JTX	.....	/431
2N4416A JAN,JTX,JTXV	.....	/428
2N4857,58,60,61 JAN,JTX	.....	/385

INTEGRATED CIRCUITS

A typical military part number consists of the JAN prefix, the general specification number, the detail specification number, and a coded part number.

PART NUMBER DESCRIPTION

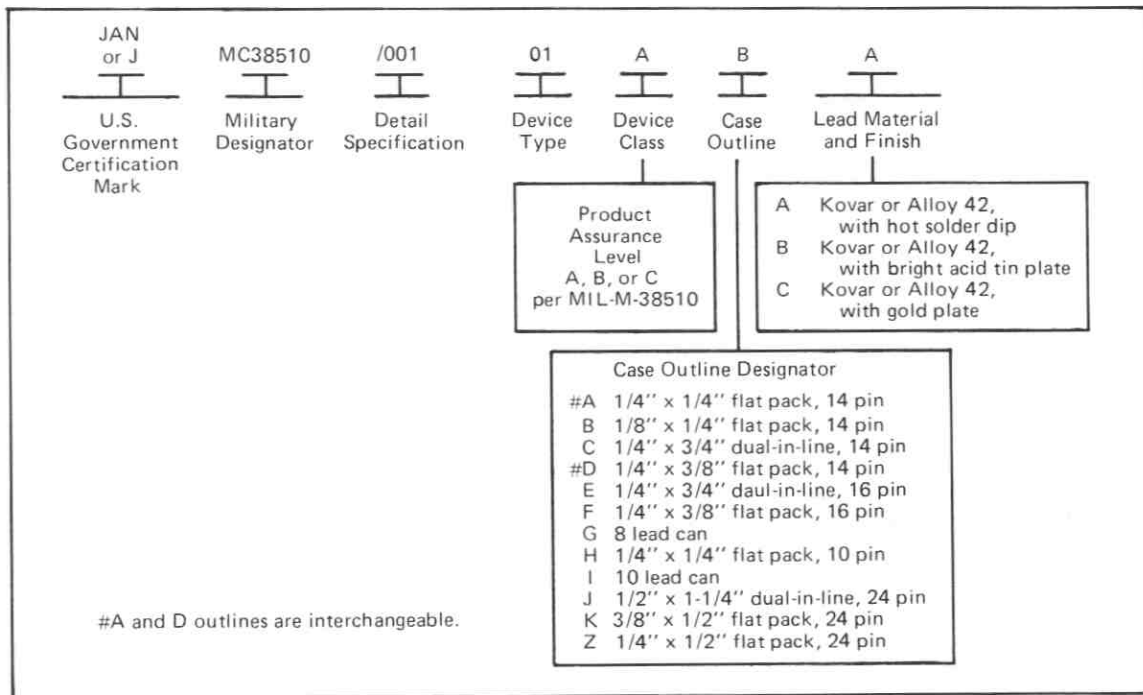


TABLE I - JAN PART NUMBER TO MOTOROLA PART NUMBER CROSS REFERENCE

Contact your local Motorola sales office or franchised distributor for current qualification status and availability.

MTTL INTEGRATED CIRCUITS							
JAN Part No.**	Motorola Standard Part No.	JAN Part No.**	Motorola Standard Part No.	JAN Part No.**	Motorola Standard Part No.	JAN Part No.**	Motorola Standard Part No.
MIL-M-38510/001 NAND Gates		MIL-M-38510/003 NAND Buffers		MIL-M-38510/006 Binary Full Adders		MIL-M-38510/009 Shift Registers	
01	MC5430	01	MC5440	01	MC15482	01	MC5495
02	MC5420	02	MC5437	02	MC5483	02	MC5496
03	MC5410	03	MC5438	03	MC9304	03	MC54164A
04	MC5400	MIL-M-38510/004 NOR Gates		MIL-M-38510/007 Exclusive OR Gate		04	MC54165
05	MC5404	01	MC5402	01	MC5486	05	MC54194
06	MC5412	02	MC5423	MIL-M-38510/008 Hex Buffers/Drivers		06	MC54195
07	MC5401	03	MC5425	01	MC5406	MIL-M-38510/010 Decoders	
08	MC5405	04	MC5427	02	MC5416	01	MC5442
09	MC5403	MIL-M-38510/005 AND-OR-INVERT Gates		03	MC5407	02	MC5443
MIL-M-38510/002 Flip-Flops		01	MC5450	04	MC5417	03	MC5444
01	MC5472	02	MC5451	05	MC5426	04	MC5445
02	MC5473	03	MC5453			05	MC54145
03	MC54107	04	MC5454			06	MC5446
04	MC5476					07	MC5447
05	MC5474					08	MC5448
06	MC5470					09	MC5449
07	MC5479						

**JAN type number must be completed as shown in the Part Number Description.

TABLE I – JAN PART NUMBER TO MOTOROLA PART NUMBER
CROSS REFERENCE (continued)

MTTL INTEGRATED CIRCUITS (continued)							
JAN Part No.**	Motorola Standard Part No.		JAN Part No.**	Motorola Standard Part No.		JAN Part No.**	Motorola Standard Part No.
MIL-M-38510/011 Arithmetic Logic Unit			MIL-M-38510/015 Bistable Latches			MIL-M-38510/022 High-Speed Flip-Flops	
01	MC54181		01	MC5475		01	MC54H72
02	MC54182		02	MC5477		02	MC54H73
MIL-M-38510/012 Monostable Multivibrators			03	MC9308		03	MC54H74A
01	MC54121		04	MC9314		04	MC54H76
02	MC54122		MIL-M-38510/016 AND Gates			05	MC54H101
03	MC54123		01	MC5408		06	MC54H103
MIL-M-38510/013 Counters			02	MC5409		MIL-M-38510/023 High-Speed NAND Gates	
01	MC5492		MIL-M-38510/017 Low-Power Flip-Flops			01	MC54H30
02	MC5493		01	MC54174		02	MC54H20
03	MC54160		02	MC54175		03	MC54H10
04	MC54163		MIL-M-38510/019 Parity Generators/Checkers			04	MC54H00
05	MC54162		01	MC54180		05	MC54H04
06	MC54161		MIL-M-38510/020 Low-Power NAND Gates			06	MC54H01
07	MC5490		01	MC54L30*		07	MC54H22
08	MC54192		02	MC54L20*		MIL-M-38510/024 High-Speed NAND Buffer	
09	MC54193		03	MC54L10*		01	MC54H40
MIL-M-38510/014 Data Selectors/Multiplexers			04	MC54L00*		MIL-M-38510/025 Counters	
01	MC54150		05	MC54L04*		01	MC54L90*
02	MC9312		06	MC54L03*		02	MC54L93*
03	MC54153		MIL-M-38510/021 Low-Power Flip-Flops			MIL-M-38510/026 Low-Power Exclusive OR Gate	
04	MC9309		01	MC54L71*		01	MC54L86*
05	MC9322		02	MC54L72*		MIL-M-38510/040 High-Speed AND-OR-INVERT Gates	
06	MC54151		03	MC54L73*		01	MC54H50
			04	MC54L78*		02	MC54H51
			05	MC54L74*		03	MC54H53
						04	MC54H54
						05	MC54H55
						MIL-M-38510/041 Low-Power AND-OR-INVERT Gates	
						01	MC54L51*
						02	MC54L54*
						03	MC54L55*
						MIL-M-38510/151 Schmitt-Triggers	
						01	MC5413
						02	MC5414
						03	MC54132

MDTL INTEGRATED CIRCUITS							
JAN Part No.**	Motorola Standard Part No.		JAN Part No.**	Motorola Standard Part No.		JAN Part No.**	Motorola Standard Part No.
MIL-M-38510/030 NAND Gates			MIL-M-38510/031 NAND Buffer/Expander			MIL-M-38510/032 Monostable Multivibrator	
01	MC930		01	MC932		01	MC951
02	MC935		02	MC944		MIL-M-38510/033 Flip-Flops	
03	MC936		03	MC957		01	MC945
04	MC946		04	MC958		02	MC948
05	MC962		05	MC933		03	MC950
						04	MC9093**

*Not presently being manufactured or planned for immediate introduction.

**JAN type number must be completed as shown in the Part Number Description.

DEVICES FOR MILITARY APPLICATIONS (continued)

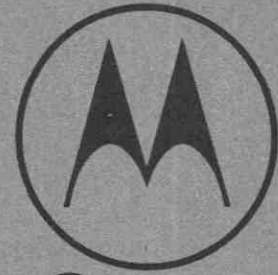
TABLE I — JAN PART NUMBER TO MOTOROLA PART NUMBER CROSS REFERENCE (continued)

McMOS INTEGRATED CIRCUITS										
JAN Part No.**	Motorola Standard Part No.		JAN Part No.**	Motorola Standard Part No.		JAN Part No.**	Motorola Standard Part No.		JAN Part No.**	Motorola Standard Part No.
MIL-M-38510/050 NAND Gates			MIL-M-38510/052 NOR Gates			MIL-M-38510/055 Buffers/Converters			MIL-M-38510/057 Static Shift Registers	
01	MC14011A		01	MC14000A		01	MC1409A		01	MC14006A
02	MC14012A		02	MC14001A		02	MC14010A		02	MC14014A*
03	MC14023A		03	MC14002A		03	MC14049A		03	MC14015A
MIL-M-38510/051 Flip-Flops			04	MC14025A		04	MC14050A		04	MC14021A
01	MC14013A		MIL-M-38510/053 AND-OR-INVERT Gates			05	MC14041A*		05	MC14031A*
02	MC14027A		01	MC14007A		MIL-M-38510/056 Counters/Dividers			MIL-M-38510/058 Quad Analog Switch	
			02	MC14019A*		01	MC14017A		01	MC14016A
			03	MC14030A*		02	MC14018A*			
			MIL-M-38510/054 4-Bit Full Adder			03	MC14020A			
			01	MC14008A		04	MC14022A			
						05	MC14024A			
MECL 10,000 INTEGRATED CIRCUITS										
JAN Part No.**	Motorola Standard Part No.									
MIL-M-38510/060# Multiple Gates										
01	MC10501									
02	MC10502									
03	MC10505									
04	MC10506									
05	MC10507									
06	MC10509									
07	MC10504									
LINEAR INTEGRATED CIRCUITS										
JAN Part No.**	Motorola Standard Part No.		JAN Part No.**	Motorola Standard Part No.		JAN Part No.**	Motorola Standard Part No.		JAN Part No.**	Motorola Standard Part No.
MIL-M-38510/101 Operational Amplifiers			MIL-M-38510/102 Voltage Regulator			MIL-M-38510/104 Line Drivers and Receivers			MIL-M-38510/106 Voltage Follower Operational Amplifiers	
01	MC1741		01	MC1723		01	MC55107		01	MLM102*
02	MC1747		MIL-M-38510/103 Voltage Comparators			02	MC55108		02	MLM110
03	MLM101A		01	MC1710		03	MC9614*		MIL-M-38510/107 Voltage Regulator	
04	MLM108A		02	MC1711		04	MC9615*		01	MLM109
05	MLH2101A*		03	MLM106*		05	MC55113*			
06	MLH2108A*		04	MLM111*						
07	MLM118*									
MEMORIES										
JAN Part No.**	Motorola Standard Part No.									
MIL-M-38510/201 Programmable Read Only Memories										
01	MCM5303									
02	MCM5304									

*Not presently being manufactured or planned for immediate introduction.

**JAN type number must be completed as shown in the Part Number Description.

#A draft of MIL-M-38510/060 has been issued. A series of MIL-M-38510 specifications has been reserved for the complete line of MECL devices including flip-flops, decoders, and arithmetic units.



APPLICATION NOTES

The Application Notes listed have been prepared to acquaint the circuits and systems engineer with the broad line of Motorola Semiconductor Products and their applications.

To obtain copies of these notes, simply list the AN number or numbers and send your request on your company letterhead to: Technical Information Center, Motorola Semiconductor Products Inc., P. O. Box 20912, Phoenix, Arizona 85036.

APPLICATION NOTE NUMBER TITLE

AN-139A Understanding Transistor Response Parameters
AN-178A Epicap Tuning Diode Theory and Applications
AN-182 A Method of Predicting Thermal Stability
AN-189 Solid-State Pulse Width Modulation DC Motor Control
AN-204A The MC1530, MC1531 Integrated Operational Amplifiers
AN-210 FM Modulation Capabilities of Epicap VV C's
AN-211A Field-Effect Transistors in Theory and Practice
AN-215A RF Small-Signal Design Using 2-Port Parameters
AN-219 The Field-Effect Transistor in Digital Applications
AN-220 FET's in Chopper and Analog Switching Circuits
AN-221 4-Layer and Current-Limiter Diodes Reduce Circuit Cost and Complexity
AN-222 The ABC's of Solid-State DC to AC Inverters
AN-238 Transistor Mixer Design Using 2-Port Parameters
AN-240 SCR Power Control Fundamentals
AN-245A An Integrated Core Memory Sense Amplifier
AN-247A An Integrated Circuit RF-IF Amplifier
AN-248 The MC1533 Monolithic Operational Amplifier
AN-249 Designing Around the Tuning Diode Inductance
AN-261A Transistor Logarithmic Conversion Using An Operational Amplifier
AN-267 Matching Network Designs with Computer Solutions
AN-268 Pulse Triggering of Radar Modulator SCR's
AN-270 Nanosecond Pulse Handling Techniques In IC Interconnections
AN-273A More Value Out of Integrated Operational Amplifier Data Sheets
AN-282A Systemizing RF Power Amplifier Design
AN-290B Mounting Procedure for, and Thermal Aspects of, Thermopad Plastic Power Devices
AN-293 Theory and Characteristics of the Unijunction Transistor
AN-294 Unijunction Transistor Timers and Oscillators
AN-295 Suppressing RFI in Thyristor Circuits

APPLICATION NOTE NUMBER TITLE

AN-298 Noise Immunity With High Threshold Logic
AN-299 An IC Wideband Video Amplifier With AGC
AN-401 The MC1554 One-Watt Monolithic Integrated Circuit Power Amplifier
AN-403 Single Power Supply Operation of IC Op Amps
AN-404 A Wideband Monolithic Video Amplifier
AN-407 A General Purpose IC Differential Output Operational Amplifier
AN-411 The MC1535 Monolithic Dual Op-Amp
AN-413 Unijunction Trigger Circuits for Gated Thyristors
AN-414 Operation and Application of MHTL IC Flip-Flops
AN-415A Avoiding Second Breakdown
AN-416 One-Step High Order Frequency Multipliers
AN-417A IC Crystal Controlled Oscillators
AN-418 High Speed Monostable Multivibrator Design With MECL Integrated Circuits
AN-419 UHF Amplifier Design Using Data Sheet Design Curves
AN-421 Semiconductor Noise Figure Considerations
AN-423 Field-Effect Transistor RF Amplifier Design Techniques
AN-426A Low-Power Audio Amplifiers Using Complementary Plastic Transistors
AN-436 Conventional and Self-Start Dimming of Incandescent Lights
AN-437B Design Considerations and Performance of Motorola Temperature-Compensated Zener Reference Diodes
AN-439 MC1539 Op-Amp and its Applications
AN-440 Theory and Characteristics of Phototransistors
AN-442 Designing DC-DC Converters for Capacitor Charging With Batteries
AN-443 Directional and Speed Control for Series, Universal and Shunt Motors
AN-445 Pulse-Width Modulation for DC-Motor Speed Control
AN-447 Fast Charging Systems for Ni-Cd Batteries
AN-455 Using the FET Designer Data Sheet for Worst Case Amplifier Circuit Design

APPLICATION NOTE
NUMBER TITLE

AN-459	A Simple Technique for Extending Op-Amp Power Bandwidth
AN-460	Using Transient Response to Determine Operational Amplifier Stability
AN-461	Transient Suppression With a Power Zener Diode
AN-462	FET Current Regulators — Circuits and Diodes
AN-464	MTTL Designer's Note — The MC4004/MC4005, A 16-Bit Random Access Memory
AN-465	MTTL Designer's Note — The MC4006/MC4007 Decoders
AN-466	Circuit Applications for the Triac
AN-467	Using Motorola High Threshold Logic
AN-469	Line Operated 15-kHz Inverter
AN-470	Bipolar Chopper Transistors and Circuits
AN-471	Analog-to-Digital Conversion Techniques
AN-472	Mounting and Heat Sinking Uniwatt Plastic Transistors
AN-473	A Monolithic High-Power Series Voltage Regulator
AN-474	The MC1541 — A Gated Dual-Channel Sense Amplifier for Core Memories
AN-475	Using the MC1545 — A Monolithic, Gated-Video Amplifier
AN-478A	Small-Signal RF Design With Dual-Gate MOSFETs
AN-481	A Broadband 4-Watt Aircraft Transmitter
AN-482	Electronic Speed Control of Appliance Motors
AN-483B	20 and 30 Watt Power Amplifiers Using Darlington Output Transistors
AN-484A	Medium-Power Audio Amplifiers
AN-485	High-Power Audio Amplifiers With Short-Circuit Protection
AN-488	High-Speed Addition Using Lookahead Carry Techniques
AN-489	Analysis and Basic Operation of the MC1595
AN-491	Gated Video Amplifier Applications, the MC1545
AN-493	The MC3000/MC3100 Series Transistor-Transistor Logic Flip-Flops
AN-496A	Error Detection and Correction Using Exclusive-OR Gates and Parity Trees
AN-498	Voltage and Current Boost Techniques Using the MC1560-61
AN-499	Shutdown Techniques for the MC1560-61/69 Monolithic Voltage Regulators
AN-500	Development, Analysis, and Basic Operation of the MC1560-61 Monolithic Voltage Regulators
AN-504	The MC1600 Series MECL III Gates
AN-505	The MC4012, A MTTTL 4-Bit Shift Register
AN-506	Code Conversion With Semiconductor Read Only Memories
AN-507	A 13-Watt Broadband AM Aircraft Transmitter
AN-508	Applications of Phototransistors in Electro-Optic Systems
AN-509	True RMS Voltage Regulators
AN-511	Low Frequency Applications of Field-Effect Transistors
AN-512	Applications of Fast-Recovery Rectifiers
AN-513	A High Gain Integrated Circuit RF-IF Amplifier With Wide Range AGC

APPLICATION NOTE
NUMBER TITLE

AN-517	Improving the Efficiency of Low-Voltage, High-Current Rectification
AN-518	Constant-Speed Motor Control Using Tachometer Feedback
AN-519	Using MDTL Logic Blocks
AN-521	Using Balanced Emitter Transistors in RF Applications
AN-522	The MC1556 Operational Amplifier and its Applications
AN-524	Converting Relay Control Systems to Digital ICs
AN-526	Theory, Characteristics and Applications of Silicon Unilateral and Bilateral Switches
AN-527	Theory, Characteristics and Applications of the Programmable Unijunction Transistor
AN-529	Regulated Line Operated Inverter Uses High Voltage Power Transistors and Hot-Carrier Rectifiers
AN-530A	The MC7491A Eight-Bit Serial Shift Register and the MC7495 Four-Bit Shift Register
AN-531	MC1596 Balanced Modulator
AN-532A	MTTL and MECL Avionics Digital Frequency Synthesizer
AN-533	Semiconductors for Plated-Wire Memories
AN-535	Phase-Locked Loop Design Fundamentals
AN-536	Micro-T Packaged Transistors for High-Speed Logic Systems
AN-540	A Synchronously Gated N-Decade Sweep Oscillator
AN-541	Medium Scale Integration in the Numerical Control Field
AN-543	Integrated Circuit IF Amplifiers for AM/FM and FM Radios
AN-544A	Printed Circuit VHF TV Tuners Using Tuning Diodes
AN-545	Television Video IF Amplifier Using Integrated Circuits
AN-546	Solid-State Linear Power Amplifier Design
AN-547	A High-Speed Dual Differential Comparator, the MC1514
AN-548A	Microstrip Design Techniques for UHF Amplifiers
AN-549	A Vertical Deflection Circuit Using Complementary Transistors
AN-550	Programming the MCM5003/5004 Programmable Read Only Memory
AN-551	Tuning Diode Design Techniques
AN-552	The Control Engineer's Guide to IC Applications
AN-553	A New Generation of Integrated Avionic Synthesizers
AN-555	Mounting Stripline-Opposed-Emitter (SOE) Transistors
AN-556	Interconnection Techniques for Motorola's MECL 10,000 Series Emitter Coupled Logic
AN-557	Analog-to-Digital Cyclic Converter
AN-559	Simple RAMP A/D Converter
AN-560	Designing Tuned Lines for UHF TV Tuners
AN-561	How to Use Photosensors and Light Sources
AN-563	Hybrid Gain Modules for Use in CATV Trunk and Line Extender Amplifiers
AN-564	An ADF Frequency Synthesizer Utilizing Phase-Locked Looped Integrated Circuits
AN-565	Using Shift Registers as Pulse Delay Networks
AN-566	High-Speed Binary Multiplication Using the MC10181
AN-567	MECL Positive and Negative Logic
AN-568	A Fuse-Thyristor Coordination Primer

APPLICATION NOTE
NUMBER TITLE

AN-569 Transient Thermal Resistance — General Data and Its Use

AN-571 Isolation Techniques Using Optical Couplers

AN-574 CMOS: A New Logic Type for Control Systems

AN-575A Variable Speed Control System for Induction Motors

AN-576 The Logical Design of Shift Counters

AN-577 Design Techniques for an 80-Watt, 175 MHz Transmitter for 12.5 Volt Operation

AN-578 UHF Microstrip Amplifiers Utilizing G-10 Epoxy-Glass Laminate

AN-579 Testing MECL 10,000 Integrated Logic Circuits

AN-580 Thermal Runaway in High Power Thyristors

AN-581 An MSI 1500-MHz Frequency Counter Using MECL and M TTL

AN-583 A MECL 10,000 Main-Frame Memory System Employing Dynamic MOS RAMs

AN-584 Programmable Counters Using the MC10136 and MC10137 MECL 10,000 Universal Counters

AN-585 VHF Power Amplifiers Using Paralleled Output Transistors

AN-586 Measure Frequency and Propagation Delay With High-Speed MECL Circuits

AN-587 Analysis and Design of the Op-Amp Current Source

AN-588 A 20 kHz, 1 kW Line Operated Inverter

AN-589 Generate Custom Waveforms Digitally

AN-590 Servo Motor Drive Amplifiers

AN-592 AC Noise Immunity of MECL 10,000 Integrated Circuits

AN-593 Broadband Linear Power Amplifiers Using Push-Pull Transistors

AN-594 A Frequency Synthesizer for Aircraft Automatic Direction Finding Systems

AN-595 25-Watt and 10-Watt VHF Marine Band Transmitters

AN-596 A Class D Citizen's Band Transmitter Using Low-Cost Plastic Transistors

AN-597 Power Control Using the Zero Voltage Switch

AN-598A Four Terminal, Optically Isolated Zero Crossing AC Relay

AN-599 Mounting Techniques for Metal Packaged Power Semiconductors

AN-700 Simulate MECL System Interconnections With A Computer Program

AN-701 Understanding MECL 10,000 DC and AC Data Sheet Specifications

AN-702 High-Speed Digital-To-Analog and Analog-To-Digital Techniques

AN-703 Designing Digitally-Controlled Power Supplies

AN-704 Broadband Network Design for UHF Amplifiers

AN-705 Pulse Width Modulation for Small DC Motor Control

AN-706 A CRT Display System Using NMOS Memories

AN-707 Noise Immunity Comparison of CMOS Versus Popular Bipolar Logic Families

AN-708 Line Driver and Receiver Considerations

AN-709 MECL 10,000 Arithmetic Elements MC10179, MC10180, MC10181

APPLICATION NOTE
NUMBER TITLE

AN-710 Communication System Transmission Losses

AN-711 The Recovery of Recorded Digital Information in Drum, Disk and Tape Systems

AN-712A Interface Techniques Between Industrial Logic and Power Devices

AN-713 Binary D/S Converters can Provide BCD-Coded Conversion

AN-714 A Personalized Heart-Rate Monitor With Digital Readout

AN-715 Introduction to CMOS IC's With 3-State Outputs

AN-716 Successive Approximation A/D Conversion

AN-717 Battery Powered 5-MHz Frequency Counter

AN-718A Industrial Clock/Timer Featuring Back-Up Power Supply Operation

AN-719 A New Approach to Switching Regulators

AN-720 Interfacing With MECL 10,000

AN-721 Impedance Matching Networks Applied to RF Power Transistors

AN-312 (European)

AN-722 Replacing Sequential Logic With ROMs

AN-724 Operational Aspects of Motorola's Data Terminal

AN-725 A Low-Cost 80 V-1.5 A Color TV Power Supply

AN-726 Bussing With MECL 10,000 Integrated Circuits

AN-727 Television Horizontal APC/AFC Loops: The Last 10 Percent

AN-728 13-Watt Microstrip Amplifier for 220-225 MHz Operation

AN-729 A Medium Cost PLL Varactor Tuning System Utilizing Off-the-Shelf Logic

AN-730 A High-Speed FIFO Memory Using the MECL MC10143 Register File

AN-731 Low-Speed Modem Fundamentals

AN-732 A Non-Volatile Microprocessor Memory Using 4K N-Channel MOS RAMs

AN-733 A ROM-Digital Approach to PWM-Type Speed Control of ac Motors

AN-734 SCR Controller for a Series Field dc Motor

AN-735 Solid-State Gas/Smoke Detector System

AN-736 Lead Forming Tool for Plastic Micro-T Devices

AN-737 Switched Mode Power Supplies — Highlighting a 5-V, 40-A Inverter Design

AN-738 NBCD Sign and Magnitude Adder/Subtractor

AN-739 A Synthetic Spectrum Tuning System for TV

AN-740 The Designing on N-Channel 16 x 16-Bit Memory System for the PDP-11

AN-741 Interface Considerations for Numeric Display Systems

AN-742 A 200 MHz Autoranging MECL-McMOS Frequency Counter

AN-743 Five-Digit Accumulator/Elapsed Time Indicator

AN-744 A Phase-Locked Loop Tuning System for Television

AN-746 A 3½-Digit DVM Using An Integrated Circuit Dual Ramp System

AN-747 Low-Speed Modem System Design Using the MC6860

AN-748 Applications of MC1405/MC14435 in Digital Meters

AN-749 Broadband Transformers and Power Combining Techniques for RF

AN-750 A Self-Regulating Horizontal Scan System

APPLICATION NOTE
NUMBER TITLE

AN-751	A Disassociated Intercarrier Television Video IF Amplifier
AN-752	An 80-Watt Switching Regulator for CATV and Industrial Applications
AN-753	Scanning Logic for RF Scanner-Receivers Using CMOS Integrated Circuits
AN-754	Device Operation and System Implementation of the Asynchronous Communications Interface Adapter (MC6850)

APPLICATION NOTE
NUMBER TITLE

AN-755	Solid-State Relays for AC Power Control
*AN-756	Crystal Switching Methods for MC12060/MC12061 Oscillators
*AN-757	Analog-to-Digital Conversion Techniques With the M6800 Microprocessor System

*Available Soon.

ENGINEERING BULLETINS SELECTION GUIDE

The Engineering Bulletins listed below have been prepared to acquaint the systems engineer with the broad line of Semiconductor Products and their applications.

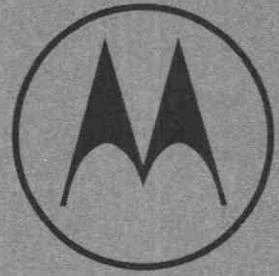
To obtain copies of these bulletins, simply list the EB number or numbers and send your request on your company letterhead to: Technical Information Center, Motorola Semiconductor Products Inc., P. O. Box 20912, Phoenix, Arizona 85036.

ENGINEERING BULLETIN
NUMBER TITLE

EB-1	Sensitive Gate Triacs Form IC Alliance — Operate Loads to 4 A — 600 V
EB-4	We Sense A Change in You, Friend . . .
EB-5	Get the Drift, Men . . .
EB-7	Madam! Your Circuit Scheme Shows Symptoms of Triac Inadequacy
EB-8	How to Apply the MHW709/710 UHF Power Modules
EB-10	Scope's Vertical Amplified by New Circuit
EB-11	Scope Sweep is Quick on the Trigger
EB-12	Clock/Timer Controls Time-Dependent Industrial Systems
EB-13	Switching Regulators Head 'Em Off at the Series Pass
EB-14	Simple Linear Voltage Sweep Uses the MC1555 Timer
EB-15	Power Darlington Design Tips
EB-17	Simple VHF Broadband Design Uses CQ Transistor Lineup
EB-18	CQ, Modular Techniques Make 45 Watt UHF Amplifier Practical
EB-19	Controlled-Q RF Technology — What It Means, How it's Done
EB-20	Multiplier/Op-Amp Circuit Detects True RMS
EB-21	DAC Key to Inexpensive 2 2/3 Digit Voltmeter
EB-22	Economical 225 MHz Receiver Front End Employs FETs
EB-23	How to Apply the MHW601/602 VHF Power Modules
EB-24	Input Buffer Circuits for the MC1505 Dual Ramp A-to-D Converter Subsystem
EB-25	Four Building Block Amplifiers for 900 MHz Communications
EB-26	A Metallization System for UHF and Microwave Power Transistors
EB-27	Get 300 Watts PEP Linear Across 2 to 30 MHz From This Push-Pull Amplifier
EB-28	Low-Cost, Easy-to-Build Exciter/Multiplier for 225 MHz FM Transmitters
EB-29	The Common Emitter TO-39 and its Advantages
EB-30	Sensitive Gate SCRs — Don't Forget the Gate Cathode Resistor
EB-31	Performance of the MHW560 Series of CATV Amplifier Modules in 50 Ohm Systems
EB-32	A Complementary Symmetry Amplifier for 2 to 30 MHz SSB Driver Applications

ENGINEERING BULLETIN
NUMBER TITLE

EB-33	Solid-State Gas/Smoke Detector Systems
EB-34	A Low-Cost 18.75 MHz Oscillator-Buffer for FM Transmitters
EB-35	Autopolarity Circuits for the MC1405 Dual-Slope A/D Converter System
EB-36	4 1/2 Digit DVM System Using the MC1505 Dual-Slope Converter
EB-37	Amplifier Gains 10 dB Over Nine Octaves
EB-38	Measuring the Intermodulation Distortion of Linear Amplifiers
EB-39	80-Watt CATV Switching Regulator Useful in Industrial Amplifiers
EB-40	Three CMOS BCD-to-Seven Segment Decoders
EB-41	The LED Circular Timepiece
EB-42	Motorola Field-Effect Liquid Crystal Displays — A Light Look
EB-43	A 9 1/2 Digit Gas Discharge Display System With Leading Zero Suppression
EB-44	An Isolated, Picket-Fence Firing Circuit for High Current SCRs
EB-46	A Single-Device, 80-Watt, 50-Ohm VHF Amplifier
EB-47	Event Counter and Storage Latches for High Frequency High Resolution Counters
EB-48	A Time Base and Control Logic Subsystem for High Frequencies, High Resolution Counters
EB-49	Application Performance of the MC6860 Modem
EB-50	Build This Simple, Battery-Powered 3 1/2 Digit DVM From Standard Parts
EB-51	Successive Approximation BCD A/D Converter
EB-52	Control Your Switching Regulator With the MC3380 Astable Multivibrator
EB-53	Two VHF Highband Gain Blocks Form 20 dB, 30-Watt Amplifier Chain
EB-54	A Simple Line Phase-Reversal Detection Circuit
EB-55	Battery-Powered 3 1/2 Digit Multimeter
EB-56	A Cordless, CMOS Liquid Crystal Display Clock
EB-57	An Economical FM Transmitter Voice Processor from a Single IC
EB-58	Analog Data Acquisition Network for Digital Processing Using the MC1405-MC14435 A/D System



CATALOG INDEX

CATALOG INDEX

A complete index of type numbers in alphanumerical order for instant device identification. Many of the devices are referred by section and page number to more comprehensive tables in this book. Device types that are not referenced are, nevertheless, manufactured and inventoried by Motorola, but are suggested principally for replacement purposes.

CATALOG INDEX (continued)

DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE
DIODES		1/4M22Z5		DIODES		1N703A-4		1N728	
Zener		1/4M22Z10		Reference		1N703A-5		1N728A	
1/4M2.4AZ		1/4M24Z		4M1.36FR2	4-82	1N703A-6		1N729	
1/4M2.4AZ5		1/4M24Z5		4M1.36FR5	4-82	1N704		1N729A	
1/4M2.4AZ10		1/4M24Z10		4M2.04FR2	4-82	1N704A		1N730	
1/4M2.7AZ		1/4M25Z		4M2.04FR5	4-82	1N704A-0		1N730A	
1/4M2.7AZ5		1/4M25Z5				1N704A-1		1N731	
1/4M2.7AZ10		1/4M25Z10		Zener		1N704A-2		1N731A	
1/4M3.0AZ		1/4M27Z		1M110ZS5		1N704A-3		1N732	
1/4M3.0AZ5		1/4M27Z5		1M110ZS10	4-78	1N704A-4		1N732A	
1/4M3.0AZ10		1/4M27Z10		1M120ZS5		1N704A-5		1N733	
1/4M3.3AZ		1/4M30Z		1M120ZS10	4-78	1N705		1N733A	
1/4M3.3AZ5		1/4M30Z5		1M130ZS5		1N705A		1N734	
1/4M3.3AZ10		1/4M30Z10		1M130ZS10	4-78	1N705A-0		1N734A	
1/4M3.6AZ		1/4M33Z		1M140ZS5		1N705A-1		1N735	
1/4M3.6AZ5		1/4M33Z5		1M140ZS10	4-78	1N705A-2		1N735A	
1/4M3.6AZ10		1/4M33Z10		1M150ZS5		1N705A-3		1N736	
1/4M3.9AZ		1/4M36Z		1M150ZS10	4-78	1N705A-4		1N736A	
1/4M3.9AZ5		1/4M36Z5		1M160ZS10	4-78	1N705A-5		1N737	
1/4M3.9AZ10		1/4M36Z10		1M175ZS5		1N705A-6		1N737A	
1/4M4.3AZ		1/4M39Z		1M175ZS10		1N705A-7		1N738	
1/4M4.3AZ5		1/4M39Z5		1M180ZS10	4-78	1N705A-8		1N738A	
1/4M4.3AZ10		1/4M39Z10		1M200ZS5		1N706		1N739	
1/4M4.7AZ		1/4M43Z		1M200ZS10	4-78	1N706A		1N739A	
1/4M4.7AZ5		1/4M43Z5		RECTIFIERS		1N706A-0		1N740	
1/4M4.7AZ10		1/4M43Z10		1N248B	4-87	1N706A-1		1N740A	
1/4M5.1AZ		1/4M45Z		1N248C		1N706A-2		1N741	
1/4M5.1AZ5		1/4M45Z5		1N249B	4-87	1N706A-3		1N741A	
1/4M5.1AZ10		1/4M45Z10		1N249C		1N706A-4		1N742	
1/4M5.6AZ		1/4M47Z		1N250B	4-87	1N706A-5		1N742A	
1/4M5.6AZ5		1/4M47Z5		1N250C		1N706A-6		1N743	
1/4M5.6AZ10		1/4M47Z10		DIODES		1N706A-7		1N743A	
1/4M6.2AZ		1/4M50Z		TC		1N706A-8		1N744	
1/4M6.2AZ5		1/4M50Z5		1N429	4-80	1N706A-9		1N744A	
1/4M6.2AZ10		1/4M50Z10		1N429JAN		1N707		1N745	
1/4M6.8AZ		1/4M52Z		RECTIFIERS		1N707A		1N745A	
1/4M6.8AZ5		1/4M52Z5		1N550		1N707A-0		1N746	4-77
1/4M6.8AZ10		1/4M52Z10		1N551		1N707A-1		1N746A	
1/4M6.8Z		1/4M56Z		1N552		1N707A-2		1N746AJAN	
1/4M6.8Z5		1/4M56Z5		1N553		1N707A-3		1N746AJTX	
1/4M6.8Z10		1/4M56Z10		1N554		1N707A-4		1N746AJTXV	
1/4M7.5Z		1/4M62Z		1N555		1N707A-5		1N747	4-77
1/4M7.5Z5		1/4M62Z5		1N556		1N707A-6		1N747A	
1/4M7.5Z10		1/4M62Z10		1N562		1N707A-7		1N747AJAN	
1/4M8.2Z		1/4M68Z		1N563		1N708		1N747AJTX	
1/4M8.2Z5		1/4M68Z5		1N607.R		1N708A		1N747AJTXV	
1/4M8.2Z10		1/4M68Z10		1N607A.RA		1N709		1N748	4-77
1/4M9.1Z		1/4M75Z		1N608.R		1N709A		1N748A	
1/4M9.1Z5		1/4M75Z5		1N608A.RA		1N710		1N748AJAN	
1/4M9.1Z10		1/4M75Z10		1N609.R		1N710A		1N748AJTX	
1/4M10Z		1/4M82Z		1N609A.RA		1N711		1N748AJTXV	
1/4M10Z5		1/4M82Z5		1N610.R		1N711A		1N749	4-77
1/4M10Z10		1/4M82Z10		1N610A.RA		1N712		1N749A	
1/4M11Z		1/4M91Z		1N611.R		1N712A		1N749AJAN	
1/4M11Z5		1/4M91Z5		1N611A.RA		1N713		1N749AJTX	
1/4M11Z10		1/4M91Z10		1N612.R		1N713A		1N749AJTXV	
1/4M12Z		1/4M100Z		1N612A.RA		1N714		1N750	4-77
1/4M12Z5		1/4M100Z5		1N613.R		1N714A		1N750A	
1/4M12Z10		1/4M100Z10		1N613A.RA		1N715		1N750AJAN	
1/4M13Z		1/4M105Z		1N614.R		1N715A		1N750AJTX	
1/4M13Z5		1/4M105Z5		1N614A.RA		1N716		1N750AJTXV	
1/4M13Z10		1/4M105Z10		DIODES		1N716A		1N751	4-77
1/4M14Z		1/4M110Z		Zener		1N717		1N751A	
1/4M14Z5		1/4M110Z5		1N702		1N717A		1N751AJAN	
1/4M14Z10		1/4M110Z10		1N702A-0		1N718		1N751AJTX	
1/4M15Z		1/4M120Z		1N702A-1		1N718A		1N751AJTXV	
1/4M15Z5		1/4M120Z5		1N702A-2		1N719		1N752	4-77
1/4M15Z10		1/4M120Z10		1N702A-3		1N719A		1N752A	
1/4M16Z		1/4M130Z		1N702A-4		1N720		1N752AJAN	
1/4M16Z5		1/4M130Z5		1N702A-5		1N720A		1N752AJTX	
1/4M16Z10		1/4M130Z10		1N702A-6		1N721		1N752AJTXV	
1/4M17Z		1/4M140Z		1N702A-7		1N721A		1N753	4-77
1/4M17Z5		1/4M140Z5		1N702A-8		1N722		1N753A	
1/4M17Z10		1/4M140Z10		1N702A-9		1N722A		1N753AJAN	
1/4M18Z		1/4M150Z		1N703		1N723		1N753AJTX	
1/4M18Z5		1/4M150Z5		1N703A-0		1N723A		1N753AJTXV	
1/4M18Z10		1/4M150Z10		1N703A-1		1N724		1N754	4-77
1/4M19Z		1/4M175Z		1N703A-2		1N724A		1N754A	
1/4M19Z5		1/4M175Z5		1N703A-3		1N725		1N754AJAN	
1/4M19Z10		1/4M175Z10				1N725A		1N754AJTX	
1/4M20Z		1/4M200Z				1N726		1N754AJTXV	
1/4M20Z5		1/4M200Z5				1N726A		1N755	4-77
1/4M20Z10		1/4M200Z10				1N727		1N755A	
1/4M22Z						1N727A		1N755AJAN	

Reference
1N816

TC
1N821 4-79
1N821A 4-79
1N821JAN
1N821JTX 4-79
1N821JTXV
1N823 4-79
1N823A 4-79
1N823JAN
1N823JTX 4-79
1N823JTXV
1N825 4-79
1N825A 4-79
1N825JAN

CATALOG INDEX (continued)

DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE
1N825JTX	4-79	1N962A		1N976A		1N990A		1N1318		1N1368A,AR	
1N825JTXV		1N962B		1N976B		1N990B		1N1318A		1N1369.R	
1N827	4-79	1N962BJAN		1N976BJAN		1N990BJAN		1N1319		1N1369A,AR	
1N827A	4-79	1N962BJTX		1N976BJTX		1N990BJTX		1N1319A		1N1370.R	
1N827JAN		1N962BJTXV		1N976BJTXV		1N990BJTXV		1N1320		1N1370A,AR	
1N827JTX	4-79	1N963	4-77	1N977	4-77	1N991		1N1320A		1N1371.R	
1N827JTXV		1N963A		1N977A		1N991A		1N1321		1N1371A,AR	
1N829	4-79	1N963B		1N977B		1N991B		1N1321A		1N1372.R	
1N829A	4-79	1N963BJAN		1N977BJAN		1N991BJAN		1N1322		1N1372A,AR	
1N829JAN		1N963BJTX		1N977BJTX		1N991BJTX		1N1322A		1N1373.R	
1N829JTX	4-79	1N963BJTXV		1N977BJTXV		1N991BJTXV		1N1323		1N1373A,AR	
1N829JTXV		1N964	4-77	1N978	4-77	1N992		1N1323A		1N1374.R	
1N935	4-79	1N964A		1N978A		1N992A		1N1324		1N1374A,AR	
1N935A	4-79	1N964B		1N978B		1N992B		1N1324A		1N1375.R	
1N935B	4-79	1N964BJAN		1N978BJAN		1N992BJAN		1N1325		1N1375A,AR	
1N935BJAN	4-79	1N964BJTX		1N978BJTX		1N992BJTX		1N1325A		1N1507	
1N935JTX	4-79	1N964BJTXV		1N978BJTXV		1N992BJTXV		1N1326		1N1507A	
1N935BJTXV	4-79	1N965	4-77	1N979	4-77			1N1326A		1N1508	
1N936	4-79	1N965A		1N979A		RECTIFIERS		1N1327		1N1508A	
1N936A	4-79	1N965B		1N979B		1N1115.R		1N1327A		1N1509	
1N936B	4-79	1N965BJAN		1N979BJAN		1N1116.R				1N1509A	
1N937	4-79	1N965BJTX		1N979BJTX		1N1117.R		RECTIFIERS		1N1510	
1N937A	4-79	1N965BJTXV		1N979BJTXV		1N1118.R		1N1341.R		1N1510A	
1N937B	4-79	1N966	4-77	1N980	4-77	1N1119.R		1N1341A,RA		1N1511	
1N937BJAN	4-79	1N966A		1N980A		1N1120.R		1N1341B,RB		1N1511A	
1N937BJTX	4-79	1N966B		1N980B		1N1124.R		1N1342.R		1N1512	
1N937BJTXV	4-79	1N966BJAN		1N980BJAN		1N1124A,RA		1N1342A,RA		1N1512A	
1N938	4-79	1N966BJTX		1N980BJTX		1N1125.R		1N1342B,RB		1N1513	
1N938A	4-79	1N966BJTXV		1N980BJTXV		1N1125A,RA		1N1343.R		1N1513A	
1N938B	4-79	1N967	4-77	1N981	4-77	1N1126.R		1N1343A,RA		1N1514	
1N938BJAN	4-79	1N967A		1N981A		1N1126A,RA		1N1343B,RB		1N1514A	
1N938BJTX	4-79	1N967B		1N981B		1N1127.R		1N1344.R		1N1515	
1N938BJTXV	4-79	1N967BJAN		1N981BJAN		1N1127A,RA		1N1344A,RA		1N1515A	
1N939	4-79	1N967BJTX		1N981BJTX		1N1128.R		1N1344B,RB		1N1516	
1N939A	4-79	1N967BJTXV		1N981BJTXV		1N1128A,RA		1N1345.R		1N1516A	
1N939B	4-79	1N968	4-77	1N982	4-77	1N1183	4-87	1N1345A,RA		1N1517	
1N939BJAN	4-79	1N968A		1N982A		1N1183A	4-87	1N1345B,RB		1N1517A	
1N939BJTX	4-79	1N968B		1N982B		1N1184	4-87	1N1346.R		1N1518	
1N939BJTXV	4-79	1N968BJAN		1N982BJAN		1N1184A	4-87	1N1346A,RA		1N1518A	
1N940		1N968BJTX		1N982BJTX		1N1185		1N1346B,RB		1N1519	
1N940A		1N968BJTXV		1N982BJTXV		1N1185A		1N1347.R		1N1519A	
1N941	4-79	1N969	4-77	1N983	4-77	1N1186	4-87	1N1347A,RA		1N1520	
1N941A	4-79	1N969A		1N983A		1N1186A	4-87	1N1347B,RB		1N1520A	
1N941B	4-79	1N969B		1N983B		1N1187		1N1348.R		1N1521	
1N941BJAN	4-79	1N969BJAN		1N983BJAN		1N1187A		1N1348A,RA		1N1521A	
1N941BJTX	4-79	1N969BJTX		1N983BJTX		1N1188	4-87	1N1348B,RB		1N1522	
1N942	4-79	1N969BJTXV		1N983BJTXV		1N1188A	4-87			1N1522A	
1N942A	4-79	1N970	4-77	1N984	4-77	1N1189		DIODES		1N1523	
1N942B	4-79	1N970A		1N984A		1N1189A		Zener		1N1523A	
1N943	4-79	1N970B		1N984B		1N1190	4-87	1N1351.R		1N1524	
1N943A	4-79	1N970BJAN		1N984BJAN		1N1190A	4-87	1N1351A,AR		1N1524A	
1N943B	4-79	1N970BJTX		1N984BJTX		1N1191	4-87	1N1352.R		1N1525	
1N943BJAN	4-79	1N970BJTXV		1N984BJTXV		1N1192	4-87	1N1352A,AR		1N1525A	
1N943BJTX	4-79	1N971	4-77	1N985	4-77	1N1193	4-87	1N1353.R		1N1526	
1N944	4-79	1N971A		1N985A		1N1194	4-87	1N1353A,AR		1N1526A	
1N944A	4-79	1N971B		1N985B		1N1195		1N1354.R		1N1527	
1N944B	4-79	1N971BJAN		1N985BJAN		1N1195A		1N1354A,AR		1N1527A	
1N944BJTX	4-79	1N971BJTX		1N985BJTX		1N1196	4-87	1N1355.R		1N1528	
1N944BJTXV	4-79	1N971BJTXV		1N985BJTXV		1N1196A	4-87	1N1355A,AR		1N1528A	
1N945	4-79	1N972	4-77	1N986	4-77	1N1197		1N1356.R			
1N945A	4-79	1N972A		1N986A		1N1197A		1N1356A,AR		TC	
1N945B	4-79	1N972B		1N986B		1N1198		1N1357.R		1N1530	4-80
1N945BJAN	4-79	1N972BJAN		1N986BJAN		1N1198A		1N1357A,AR		1N1530A	4-80
1N945BJTX	4-79	1N972BJTX		1N986BJTX		1N1199A	4-87	1N1358.R		1N1530AJAN	
		1N972BJTXV		1N986BJTXV		1N1200A	4-87	1N1358A,AR			
		1N973	4-77	1N987	4-77	1N1201A		1N1359.R		RECTIFIERS	
		1N973A		1N987A		1N1202A	4-87	1N1359A,AR		1N1537	
		1N973B		1N987B		1N1203A		1N1360.R		1N1538	
		1N973BJAN		1N987BJAN		1N1204A	4-87	1N1360A,AR		1N1539	
		1N973BJTX		1N987BJTX		1N1205A		1N1361.R		1N1540	
		1N973BJTXV		1N987BJTXV		1N1206A	4-87	1N1361A,AR		1N1541	
		1N974	4-77	1N988	4-77			1N1362.R		1N1542	
		1N974A		1N988A		DIODES		1N1362A,AR		1N1543	
		1N974B		1N988B		Zener		1N1363.R		1N1544	
		1N974BJAN		1N988BJAN		1N1313		1N1363A,AR			
		1N974BJTX		1N988BJTX		1N1313A		1N1364.R		DIODES	
		1N974BJTXV		1N988BJTXV		1N1314		1N1364A,AR		Zener	
		1N975	4-77	1N989	4-77	1N1314A		1N1365.R		1N1588	
		1N975A		1N989A		1N1315		1N1365A,AR		1N1588A	
		1N975B		1N989B		1N1315A		1N1366.R		1N1589	
		1N975BJAN		1N989BJAN		1N1316		1N1366A,AR		1N1589A	
		1N975BJTX		1N989BJTX		1N1316A		1N1367.R		1N1590	
		1N975BJTXV		1N989BJTXV		1N1317		1N1367A,AR		1N1590A	
		1N976	4-77	1N990	4-77	1N1317A		1N1368.R		1N1591	

CATALOG INDEX (continued)

DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE
1N2828B		1N2972BJAN		1N2991R	4-78	1N3009B,R		1N3025B,R		1N3039B,R	
1N2829R	4-78	1N2972BJTX		1N2991A,R		1N3009BJAN		1N3025BJAN		1N3039BJAN	
1N2829A,R		1N2973	4-78	1N2991B,R		1N3010		1N3025BJTX		1N3039BJTX	
1N2829B,R		1N2973A,R		1N2991BJAN,R		1N3010A		1N3025BJTXV		1N3039BJTXV	4-78
1N2829BJAN		1N2973B,R		1N2991BJTX,R		1N3010B		1N3026	4-78	1N3040	4-78
1N2830		1N2973BJAN		1N2992R	4-78	1N3011R	4-78	1N3026A,R		1N3040A,R	
1N2830A		1N2973BJTX		1N2992A,R		1N3011A,R		1N3026B,R		1N3040B,R	
1N2830B		1N2974	4-78	1N2992B,R		1N3011B,R		1N3026BJAN		1N3040BJAN	
1N2831R	4-78	1N2974A,R		1N2992BJAN		1N3011BJAN,R		1N3026BJTX		1N3040BJTX	
1N2831A,R		1N2974B,R		1N2992BJTX		1N3011BJTX,R		1N3026BJTXV		1N3040BJTXV	4-78
1N2831B,R		1N2974BJAN		1N2993R	4-78	1N3012R	4-78	1N3027	4-78	1N3041	4-78
1N2831BJAN		1N2974BJTX		1N2993A,R		1N3012A,R		1N3027A,R		1N3041A,R	
1N2832R	4-78	1N2975	4-78	1N2993B,R		1N3012B,R		1N3027B,R		1N3041B,R	
1N2832A,R		1N2975A,R		1N2993BJAN		1N3012BJAN		1N3027BJAN		1N3041BJAN	
1N2832B,R		1N2975B,R		1N2993BJTX		1N3012BJTX		1N3027BJTX		1N3041BJTX	
1N2832BJAN		1N2975BJAN		1N2994		1N3013		1N3027BJTXV		1N3041BJTXV	4-78
1N2833R	4-78	1N2975BJTX		1N2994A,R		1N3013A,R		1N3028	4-78	1N3042	4-78
1N2833A,R		1N2976	4-78	1N2994B,R		1N3013B,R		1N3028A,R		1N3042A,R	
1N2833B,R		1N2976A,R		1N2995		1N3014R	4-78	1N3028B,R		1N3042B,R	
1N2833BJAN		1N2976B,R		1N2995A,R		1N3014A,R		1N3028BJAN		1N3042BJAN	
1N2834R	4-78	1N2976BJAN		1N2995B,R		1N3014B,R		1N3028BJTX		1N3042BJTX	
1N2834A,R		1N2976BJTX		1N2995BJAN		1N3014BJAN		1N3028BJTXV		1N3042BJTXV	4-78
1N2834B,R		1N2977	4-78	1N2995BJTX		1N3014BJTX		1N3029	4-78	1N3043	4-78
1N2834BJAN		1N2977A,R		1N2996R	4-78	1N3015R	4-78	1N3029A,R		1N3043A,R	
1N2835R	4-78	1N2977B,R		1N2996A,R		1N3015A,R		1N3029B,R		1N3043B,R	
1N2835A,R		1N2977BJAN		1N2996B,R		1N3015B,R		1N3029BJAN		1N3043BJAN	
1N2835B,R		1N2977BJTX		1N2997R	4-78	1N3015BJAN		1N3029BJTX		1N3043BJTX	
1N2835BJAN		1N2978		1N2997A,R		1N3015BJTX		1N3029BJTXV		1N3043BJTXV	4-78
1N2836R	4-78	1N2978A,R		1N2997B,R		1N3016		1N3030	4-78	1N3044	4-78
1N2836A,R		1N2978B,R		1N2997BJAN		1N3016A		1N3030A,R		1N3044A,R	
1N2836B,R		1N2979R	4-78	1N2997BJTX		1N3016B		1N3030B,R		1N3044B,R	
1N2836BJAN		1N2979A,R		1N2998		1N3016BJAN		1N3030BJAN		1N3044BJAN	
1N2837R	4-78	1N2979B,R		1N2998A,R		1N3016BJTX		1N3030BJTX		1N3044BJTX	
1N2837A,R		1N2979BJAN		1N2998B,R		1N3016BJTXV		1N3030BJTXV		1N3044BJTXV	4-78
1N2837B,R		1N2979BJTX		1N2999R	4-78	1N3017	4-78	1N3031	4-78	1N3045	4-78
1N2837BJAN		1N2980R	4-78	1N2999A,R		1N3017A,R		1N3031A,R		1N3045A,R	
1N2838R	4-78	1N2980A,R		1N2999B,R		1N3017B,R		1N3031B,R		1N3045B,R	
1N2838A,R		1N2980B,R		1N2999BJAN		1N3017BJAN		1N3031BJAN		1N3045BJAN	
1N2838B,R		1N2980BJAN		1N2999BJTX		1N3017BJTX		1N3031BJTX		1N3045BJTX	
1N2838BJAN		1N2980BJTX		1N3000R	4-78	1N3017BJTXV		1N3031BJTXV		1N3045BJTXV	4-78
1N2839R	4-78	1N2981		1N3000A,R		1N3018	4-78	1N3032	4-78	1N3046	4-78
1N2839A,R		1N2981A,R		1N3000B,R		1N3018A,R		1N3032A,R		1N3046A,R	
1N2839B,R		1N2981B,R		1N3000BJAN		1N3018B,R		1N3032B,R		1N3046B,R	
1N2840R	4-78	1N2982R	4-78	1N3000BJTX		1N3018BJAN		1N3032BJAN		1N3046BJAN	
1N2840A,R		1N2982A,R		1N3001R	4-78	1N3018BJTX		1N3032BJTX		1N3046BJTX	
1N2840B,R		1N2982B,R		1N3001A,R		1N3018BJTXV		1N3032BJTXV		1N3046BJTXV	4-78
1N2840BJAN		1N2982BJAN		1N3001B,R		1N3019	4-78	1N3033	4-78	1N3047	4-78
1N2841R	4-78	1N2982BJTX		1N3001BJAN		1N3019A,R		1N3033A,R		1N3047A,R	
1N2841A,R		1N2983,R		1N3001BJTX		1N3019B,R		1N3033B,R		1N3047B,R	
1N2841B,R		1N2983A,R		1N3002R	4-78	1N3019BJAN		1N3033BJAN		1N3047BJAN	
1N2841BJAN		1N2983B		1N3002A,R		1N3019BJTX		1N3033BJTX		1N3047BJTX	
1N2842R	4-78	1N2984R	4-78	1N3002B,R		1N3019BJTXV		1N3033BJTXV		1N3047BJTXV	4-78
1N2842A,R		1N2984A,R		1N3002BJAN		1N3020	4-78	1N3034	4-78	1N3048	4-78
1N2842B,R		1N2984B,R		1N3002BJTX		1N3020A,R		1N3034A,R		1N3048A,R	
1N2842BJAN		1N2984BJAN		1N3003R	4-78	1N3020B,R		1N3034B,R		1N3048B,R	
1N2843R	4-78	1N2984BJTX		1N3003A,R		1N3020BJAN		1N3034BJAN		1N3048BJAN	
1N2843A,R		1N2985R	4-78	1N3003B,R		1N3020BJTX		1N3034BJTX		1N3048BJTX	
1N2843B,R		1N2985A,R		1N3003BJAN		1N3020BJTXV		1N3034BJTXV		1N3048BJTXV	4-78
1N2843BJAN		1N2985B,R		1N3003BJTX		1N3021	4-78	1N3035	4-78	1N3049	4-78
1N2844R	4-78	1N2985BJAN		1N3004R	4-78	1N3021A,R		1N3035A,R		1N3049A,R	
1N2844A,R		1N2985BJTX		1N3004A,R		1N3021B,R		1N3035B,R		1N3049B,R	
1N2844B,R		1N2986R	4-78	1N3004B,R		1N3021BJAN		1N3035BJAN		1N3049BJAN	
1N2844BJAN		1N2986A,R		1N3004BJAN		1N3021BJTX		1N3035BJTX		1N3049BJTX	
1N2845R	4-78	1N2986B,R		1N3004BJTX		1N3021BJTXV		1N3035BJTXV		1N3049BJTXV	4-78
1N2845A,R		1N2986BJAN		1N3005R	4-78	1N3022	4-78	1N3036	4-78	1N3050	4-78
1N2845B,R		1N2986BJTX		1N3005A,R		1N3022A,R		1N3036A,R		1N3050A,R	
1N2845BJAN		1N2987		1N3005B,R		1N3022B,R		1N3036B,R		1N3050B,R	
1N2846R	4-78	1N2987A,R		1N3005BJAN		1N3022BJAN		1N3036BJAN		1N3050BJAN	
1N2846A,R		1N2987B,R		1N3005BJTX		1N3022BJTX		1N3036BJTX		1N3050BJTX	
1N2846B,R		1N2988R	4-78	1N3006R		1N3022BJTXV		1N3036BJTXV		1N3050BJTXV	4-78
1N2846BJAN		1N2988A,R		1N3006A,R		1N3023	4-78	1N3037	4-78	1N3051	4-78
1N2970R	4-78	1N2988B,R		1N3006B,R		1N3023A,R		1N3037A,R		1N3051A,R	
1N2970A,R		1N2988BJAN		1N3007R	4-78	1N3023B,R		1N3037B,R		1N3051B,R	
1N2970B,R		1N2988BJTX		1N3007A,R		1N3023BJAN		1N3037BJAN		1N3051BJAN	
1N2970BJAN		1N2989R	4-78	1N3007B,R		1N3023BJTX		1N3037BJTX		1N3051BJTX	
1N2970BJTX		1N2989A,R		1N3007BJAN		1N3023BJTXV		1N3037BJTXV		1N3051BJTXV	4-78
1N2971	4-78	1N2989B,R		1N3007BJTX		1N3024	4-78	1N3038	4-78	TC	
1N2971A,R		1N2989BJAN		1N3008R	4-78	1N3024A,R		1N3038A,R		1N3154	4-78
1N2971B,R		1N2989BJTX		1N3008A,R		1N3024B,R		1N3038B,R		1N3154A	4-78
1N2971BJAN		1N2990R	4-78	1N3008B,R		1N3024BJAN		1N3038BJAN		1N3154AJAN	4-78
1N2971BJTX		1N2990A,R		1N3008BJAN		1N3024BJTX		1N3038BJTX		1N3154JTX	4-78
1N2972	4-78	1N2990B,R		1N3008BJTX		1N3024BJTXV		1N3038BJTXV		1N3155	4-78
1N2972A,R		1N2990BJAN		1N3009R	4-78	1N3025	4-78	1N3039	4-78	1N3155A	4-78
1N2972B,R		1N2990BJTX		1N3009A,R		1N3025A,R		1N3039A,R			

CATALOG INDEX (continued)

DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE
1N3155JAN	4-78	1N3320B,R		1N3342BJAN		1N3650		1N3698B		1N3807B	
1N3155JTX	4-78	1N3320BJAN		1N3343&R	4-78	1N3659	4-87	1N3699		1N3808	
1N3156	4-78	1N3321&R	4-78	1N3343A,R		1N3660	4-87	1N3699A		1N3808A	
1N3156A	4-78	1N3321A,R		1N3343B,R		1N3661	4-87	1N3699B		1N3808B	
1N3156JAN	4-78	1N3321B,R		1N3343BJAN		1N3662		1N3700		1N3809	
1N3156JTX	4-78	1N3321BJAN		1N3344		1N3663	4-87	1N3700A		1N3809A	
1N3157	4-78	1N3322&R	4-78	1N3344A,R		1N3670,A		1N3700B		1N3809B	
1N3157A	4-78	1N3322A,R		1N3344B,R		1N3671,A		1N3701		1N3810	
1N3157JAN	4-78	1N3322B,R		1N3344BJAN		1N3672,A		1N3701A		1N3810A	
1N3157JTX	4-78	1N3323		1N3345		1N3673,A		1N3701B		1N3810B	
VVC		1N3323A,R		1N3345A,R				1N3702		1N3811	
1N3182		1N3323B,R		1N3345B,R		DIODES		1N3702A		1N3811A	
RECTIFIERS		1N3323BJAN		1N3346&R	4-78	Zener		1N3702B		1N3811B	
1N3208	4-87	1N3324&R	4-78	1N3346A,R		1N3675		1N3703		1N3812	
1N3209	4-87	1N3324A,R		1N3346B,R		1N3675A		1N3703A		1N3812A	
1N3210	4-87	1N3324B,R		1N3346BJAN		1N3675B		1N3703B		1N3812B	
1N3211		1N3324BJAN		1N3347&R	4-78	1N3676		1N3703		1N3813	
1N3212	4-87	1N3325&R	4-78	1N3347A,R		1N3676A		1N3704		1N3813A	
1N3213		1N3325A,R		1N3347B,R		1N3676B		1N3705		1N3813B	
1N3214	4-87	1N3325B,R		1N3347BJAN		1N3677		1N3706		1N3814	
		1N3325BJAN		1N3348		1N3677A		1N3707		1N3814A	
		1N3326&R	4-78	1N3348A,R		1N3677B		1N3708		1N3814B	
		1N3326A,R		1N3348B,R		1N3678		1N3709		1N3815	
		1N3326B,R		1N3349&R	4-78	1N3678A		1N3710		1N3815A	
		1N3326BJAN		1N3349A,R		1N3678B		1N3711		1N3815B	
		1N3327&R	4-78	1N3349B,R		1N3679		1N3712		1N3816	
		1N3327A,R		1N3349BJAN		1N3679A		1N3713		1N3816A	
		1N3327B,R		1N3350&R	4-78	1N3679B		1N3714		1N3816B	
		1N3327BJAN		1N3350A,R		1N3680		1N3715		1N3817	
		1N3328&R	4-78	1N3350B,R		1N3680A		1N3716		1N3817A	
		1N3328A,R		1N3350BJAN		1N3680B		1N3717		1N3817B	
		1N3328B,R		RECTIFIERS		1N3681		1N3718		1N3818	
		1N3328BJAN		1N3491	4-87	1N3681A		1N3719		1N3818A	
		1N3329&R	4-78	1N3492	4-87	1N3681B		1N3720		1N3818B	
		1N3329A,R		1N3493	4-87	1N3682		1N3721		1N3819	
		1N3329B,R		1N3494		1N3682A		1N3722		1N3819A	
		1N3330&R	4-78	1N3495	4-87	1N3682B		1N3723		1N3819B	
		1N3330A,R				1N3683		1N3724		1N3820	
		1N3330B,R				1N3683A		1N3725		1N3820A	
		1N3330BJAN				1N3683B		1N3726		1N3820B	
		1N3331				1N3684		1N3727		1N3821	4-78
		1N3331A,R				1N3684A		1N3728		1N3821A	
		1N3331B,R				1N3684B		1N3729		1N3821A JAN	
		1N3332&R	4-78			1N3685		1N3730		1N3821AJTX	
		1N3332A,R				1N3685A		1N3731		1N3821AJTXV	
		1N3332B,R				1N3685B		1N3732		1N3822	4-78
		1N3332BJAN				1N3686		1N3733		1N3822A	
		1N3333				1N3686A		1N3734		1N3822AJAN	
		1N3333A,R				1N3686B		1N3735		1N3822AJTX	
		1N3333B,R				1N3687		1N3736		1N3822AJTXV	
		1N3334&R	4-78			1N3687A		1N3737		1N3823	4-78
		1N3334A,R				1N3687B		1N3738		1N3823A	
		1N3334B,R				1N3688		1N3739		1N3823AJAN	
		1N3334BJAN				1N3688A		1N3740		1N3823AJTX	
		1N3335&R	4-78			1N3688B		1N3741		1N3823AJTXV	
		1N3335A,R				1N3689		1N3742		1N3824	4-78
		1N3335B,R				1N3689A		1N3743		1N3824A	
		1N3335BJAN				1N3689B		1N3744		1N3824AJAN	
		1N3336&R	4-78			1N3690		1N3745		1N3824AJTX	
		1N3336A,R				1N3690A		1N3746		1N3824AJTXV	
		1N3336B,R				1N3690B		1N3747		1N3825	4-78
		1N3336BJAN				1N3691		1N3748		1N3825A	
		1N3337&R	4-78			1N3691A		1N3749		1N3825AJAN	
		1N3337A,R				1N3691B		1N3750		1N3825AJTX	
		1N3337B,R				1N3692		1N3751		1N3825AJTXV	
		1N3337BJAN				1N3692A		1N3752		1N3826	4-78
		1N3338&R	4-78			1N3692B		1N3753		1N3826A	
		1N3338A,R				1N3693		1N3754		1N3826AJAN	
		1N3338B,R				1N3693A		1N3755		1N3826AJTX	
		1N3338BJAN				1N3693B		1N3756		1N3826AJTXV	
		1N3339&R	4-78			1N3694		1N3757		1N3827	4-78
		1N3339A,R				1N3694A		1N3758		1N3827A	
		1N3339B,R				1N3694B		1N3759		1N3827AJAN	
		1N3339BJAN				1N3695		1N3760		1N3827AJTX	
		1N3340				1N3695A		1N3761		1N3827AJTXV	
		1N3340A,R				1N3695B		1N3762		1N3828	4-78
		1N3340B,R				1N3696		1N3763		1N3828A	
		1N3340BJAN				1N3696A		1N3764		1N3828AJAN	
		1N3341				1N3696B		1N3765		1N3828AJTX	
		1N3341A,R				1N3697		1N3766		1N3828AJTXV	
		1N3341B,R				1N3697A		1N3767		1N3829	4-78
		1N3342&R	4-78			1N3697B		1N3768		1N3830	4-78
		1N3342A,R				1N3698		1N3769		1N3830A	
		1N3342B,R				1N3698A		1N3770			

CATALOG INDEX (continued)

DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE
RECTIFIERS											
1N3879	4-91	1N4063	4-80	1N4108		1N4129	4-77	1N4558&R	4-78	1N4580A	4-79
1N3880	4-91	1N4063A	4-80	1N4108JAN		1N4129JAN		1N4558A,R		1N4581	4-79
1N3881	4-91	1N4064	4-80	1N4108JTX		1N4129JTX		1N4558B,R		1N4581A	4-79
1N3882		1N4064A	4-80	1N4108JTXV		1N4129JTXV		1N4559&R	4-78	1N4582	4-79
1N3883	4-91	1N4065	4-80	1N4109	4-77	1N4130	4-77	1N4559A,R		1N4582A	4-79
1N3889	4-91	1N4065A	4-80	1N4109JAN		1N4130JAN		1N4559B,R		1N4583	4-79
1N3890	4-91	1N4066	4-80	1N4109JTX		1N4130JTX		1N4560&R	4-78	1N4583A	4-79
1N3890JAN	4-91	1N4066A	4-80	1N4109JTXV		1N4130JTXV		1N4560A,R		1N4584	4-79
1N3890JTX	4-91	1N4067	4-80	1N4110	4-77	1N4131	4-77	1N4560B,R		1N4584A	4-79
1N3891	4-91	1N4067A	4-80	1N4110JAN		1N4131JAN		1N4561&R	4-78		
1N3891JAN	4-91	1N4068	4-80	1N4110JTX		1N4131JTX		1N4561A,R		Zener	
1N3891JTX	4-91	1N4068A	4-80	1N4110JTXV		1N4131JTXV		1N4561B,R		1N4614JAN	
1N3891JTXV		1N4069	4-80	1N4111		1N4132	4-77	1N4562&R	4-78	thru	
1N3892		1N4069A	4-80	1N4111JAN		1N4132JAN		1N4562A,R		1N4627JAN	
1N3893	4-91	1N4070	4-80	1N4111JTX		1N4132JTX		1N4562B,R		1N4614JTX	
1N3893JAN	4-91	1N4070A	4-80	1N4111JTXV		1N4132JTXV		1N4563&R	4-78	thru	
1N3893JTX	4-91	1N4071	4-80	1N4112	4-77	1N4133		1N4563A,R		1N4627JTX	
1N3893JTXV		1N4071A	4-80	1N4112JAN		1N4133JAN		1N4563B,R		1N4614JTXV	
1N3899	4-91	1N4072	4-80	1N4112JTX		1N4133JTX		1N4564&R	4-78	thru	
1N3900	4-91	1N4072A	4-80	1N4112JTXV		1N4133JTXV		1N4564A,R		1N4627JTXV	
1N3901	4-91	1N4073	4-80	1N4113		1N4134	4-77	1N4564B,R			
1N3902		1N4073A	4-80	1N4113JAN		1N4134JAN		TC			
1N3903	4-91	1N4074	4-80	1N4113JTX		1N4134JTX		1N4565	4-79	1N4719	4-86
1N3909	4-91	1N4074A	4-80	1N4113JTXV		1N4134JTXV		1N4565A	4-79	1N4720	4-86
1N3910	4-91	1N4075	4-80	1N4114	4-77	1N4135	4-77	1N4565AJAN		1N4721	4-86
1N3910JAN	4-91	1N4075A	4-80	1N4114JAN		1N4135JAN		1N4565AJTX		1N4722	4-86
1N3910JTX	4-91	1N4076	4-80	1N4114JTX		1N4135JTX		1N4565AJTXV		1N4723	4-86
1N3911	4-91	1N4076A	4-80	1N4114JTXV		1N4135JTXV		1N4566	4-79	1N4724	4-86
1N3911JAN	4-91	1N4077	4-80	1N4115	4-77	1N4370	4-77	1N4566A	4-79	1N4725	4-86
1N3911JTX	4-91	1N4077A	4-80	1N4115JAN		1N4370A		1N4566AJAN			
1N3912		1N4078	4-80	1N4115JTX		1N4370AJAN		1N4566AJTX		DIODES	
1N3913JAN	4-91	1N4078A	4-80	1N4116	4-77	1N4370AJTX		1N4566AJTXV		Zener	
1N3913JTX		1N4079	4-80	1N4116JAN		1N4371	4-77	1N4567	4-79	1N4728	4-78
1N3917		1N4079A	4-80	1N4116JTX		1N4371A		1N4567A	4-79	1N4729A	
1N3918		1N4080	4-80	1N4116JTXV		1N4371AJAN		1N4567AJAN		1N4729	4-78
1N3923JAN	4-91	1N4080A	4-80	1N4117		1N4371AJTX		1N4567AJTX		1N4729A	4-78
1N3923JTX		1N4081	4-80	1N4117JAN		1N4371AJTXV		1N4567AJTXV		1N4730	4-78
1N3987		1N4081A	4-80	1N4117JTX		1N4372	4-77	1N4568	4-79	1N4731	4-78
1N3988		1N4082	4-80	1N4117JTXV		1N4372A		1N4568A	4-79	1N4731A	
1N3989		1N4082A	4-80	1N4118	4-77	1N4372AJAN		1N4568AJAN		1N4732	4-78
1N3990		1N4083	4-80	1N4118JAN		1N4372AJTX		1N4568AJTX		1N4732A	
		1N4083A	4-80	1N4118JTX		1N4372AJTXV		1N4568AJTXV		1N4733	4-78
		1N4084	4-80	1N4118JTXV		Varactor Multiplier					
		1N4084A	4-80	1N4119		1N4386		1N4569AJAN		1N4733A	
		1N4085	4-80	1N4119JAN		1N4387	4-59	1N4569AJTX		1N4734	4-78
		1N4085A	4-80	1N4119JTX		1N4388	4-59	1N4569AJTXV		1N4734A	
				1N4120	4-77			1N4570		1N4735	4-78
				1N4120JAN				1N4570A	4-79	1N4735A	
				1N4120JTX				1N4570AJAN		1N4736	4-78
				1N4120JTXV				1N4570AJTX		1N4736A	
				1N4121	4-77			1N4570AJTXV		1N4737	4-78
				1N4121JAN				1N4571	4-79	1N4737A	
				1N4121JTX				1N4571A	4-79	1N4738	4-78
				1N4121JTXV				1N4571AJAN		1N4738A	
				1N4122	4-77			1N4571AJTX		1N4739	4-78
				1N4122JAN				1N4571AJTXV		1N4739A	
				1N4122JTX				1N4572	4-79	1N4740	4-78
				1N4122JTXV				1N4572A	4-79	1N4740A	
				1N4123	4-77			1N4572AJAN		1N4741	4-78
				1N4123JAN				1N4572AJTX		1N4741A	
				1N4123JTX				1N4572AJTXV		1N4742	4-78
				1N4123JTXV				1N4573	4-79	1N4742A	
				1N4124	4-77			1N4573A	4-79	1N4743	4-78
				1N4124JAN				1N4573AJAN		1N4743A	
				1N4124JTX				1N4573AJTX		1N4744	4-78
				1N4124JTXV				1N4573AJTXV		1N4744A	
				1N4125	4-77			1N4574	4-79	1N4745	4-78
				1N4125JAN				1N4574A	4-79	1N4745A	
				1N4125JTX				1N4574AJAN		1N4746	4-78
				1N4125JTXV				1N4574AJTX		1N4746A	
				1N4126	4-77			1N4574AJTXV		1N4747	4-78
				1N4126JAN				1N4575	4-79	1N4747A	
				1N4126JTX				1N4575A	4-79	1N4748	4-78
				1N4126JTXV				1N4576	4-79	1N4748A	
				1N4127	4-77			1N4576A	4-79	1N4749	4-78
				1N4127JAN				1N4577	4-79	1N4749A	
				1N4127JTX				1N4577A	4-79	1N4750	4-78
				1N4127JTXV				1N4578	4-79	1N4750A	
				1N4128				1N4578A	4-79	1N4751	4-78
				1N4128JAN				1N4579	4-79	1N4751A	
				1N4128JTX				1N4579A	4-79	1N4752	4-78
				1N4128JTXV				1N4580	4-79	1N4752A	
										1N4753	4-78
										1N4753A	

CATALOG INDEX (continued)

DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE
1N5311JTX		1N5355B		1N5383B		1N5533A		1N5820		1N5926	
1N5311JTXV		1N5356A		1N5384A	4-78	1N5533B		1N5821		1N5926A	
1N5312		1N5356B		1N5384B		1N5534		1N5822		1N5926B	
1N5312JAN		1N5357	4-78	1N5385		1N5534A		1N5824		1N5927	
1N5312JTX		1N5357A		1N5385A		1N5534B		1N5825		1N5927A	
1N5312JTXV		1N5357B		1N5385B		1N5535	4-77	1N5826		1N5927B	
1N5313		1N5358	4-78	1N5386	4-78	1N5535A		1N5827		1N5928	
1N5313JAN		1N5358A		1N5386A		1N5535B		1N5828		1N5928A	
1N5313JTX		1N5358B		1N5387		1N5536	4-77	1N5829		1N5928B	
1N5313JTXV		1N5359	4-78	1N5387A		1N5536A		1N5830		1N5929	
1N5314		1N5359A		1N5387B		1N5536B		1N5831		1N5929A	
1N5314JAN		1N5359B		1N5388	4-78	1N5537		1N5832		1N5929B	
1N5314JTX		1N5360		1N5388A		1N5537A		1N5833		1N5930	
1N5314JTXV		1N5360A		1N5388B		1N5537B		1N5834		1N5930A	
Zener		1N5360B		VVC		1N5538	4-77	DIODES		1N5930B	
1N5333	4-78	1N5361	4-78	1N5441A	4-67	1N5538A		Zener		1N5931	
1N5333A		1N5361A		thru		1N5538B		1N5837A	4-77	1N5931A	
1N5333B		1N5361B		1N5456A	4-67	1N5539		thru		1N5931B	
1N5334	4-78	1N5362		1N5441B		1N5539A		1N5873A	4-77	1N5932	
1N5334A		1N5362A		thru		1N5539B		1N5837B		1N5932A	
1N5334B		1N5362B		1N5456B		1N5540	4-77	thru		1N5932B	
1N5335	4-78	1N5363	4-78	1N5441C		1N5540A		1N5873B		1N5933	
1N5335A		1N5363A		thru		1N5540B		1N5874A	4-77	1N5933A	
1N5335B		1N5363B		1N5456C		1N5541	4-77	thru		1N5933B	
1N5336	4-78	1N5364	4-78	1N5461A	4-66	1N5541A		1N5886A	4-77	1N5934	
1N5336A		1N5364A		thru		1N5541B		1N5874B		1N5934A	
1N5336B		1N5364B		1N5476A	4-66	1N5542	4-77	thru		1N5934B	
1N5337	4-78	1N5365	4-78	1N5461B		1N5542A		1N5886B		1N5935	
1N5337A		1N5365A		thru		1N5542B		1N5887A	4-77	1N5935A	
1N5337B		1N5365B		1N5476B		1N5543		thru		1N5935B	
1N5338	4-78	1N5366	4-78	1N5461C		1N5543A		1N5897A	4-77	1N5936	
1N5338A		1N5366A		thru		1N5543B		1N5887B		1N5936A	
1N5338B		1N5366B		1N5476C		1N5544	4-77	thru		1N5936B	
1N5339	4-78	1N5367	4-78	Avalanche		1N5544A		1N5897B		1N5937	
1N5339A		1N5367A		1N5518	4-77	1N5544B		OPTOELECTRONICS		1N5937A	
1N5339B		1N5367B		1N5518A		1N5545	4-77	LED		1N5937B	
1N5340		1N5368	4-78	1N5518B		1N5545A		1N5909	4-110	1N5938	
1N5340A		1N5368A		1N5519	4-77	1N5545B		1N5910	4-110	1N5938A	
1N5340B		1N5368B		1N5519A		1N5546A		1N5911	4-110	1N5938B	
1N5341	4-78	1N5369	4-78	1N5519B		1N5546B		1N5912	4-110	1N5939	
1N5341A		1N5369A		1N5519C		TRANSISTORS				1N5939A	
1N5341B		1N5369B		1N5520	4-77	Photo				1N5939B	
1N5342	4-78	1N5370	4-78	1N5520A		1N5722		DIODES		1N5940	
1N5342A		1N5370A		1N5520B		1N5723		Zener		1N5940A	
1N5342B		1N5370B		1N5521	4-77	1N5724		1N5913		1N5940B	
1N5343	4-78	1N5371		1N5521A		1N5725		1N5913A		1N5941	
1N5343A		1N5371A		1N5521B		THYRISTORS		1N5913B		1N5941A	
1N5343B		1N5371B		1N5522	4-77	Bilateral		1N5914		1N5941B	
1N5344	4-78	1N5372	4-78	1N5522A		Triggers		1N5914A		1N5942	
1N5344A		1N5372A		1N5522B		1N5758		1N5914B		1N5942A	
1N5344B		1N5372B		1N5523	4-77	1N5758A		1N5915		1N5942B	
1N5345		1N5373	4-78	1N5523A		1N5759		1N5915A		1N5943	
1N5345A		1N5373A		1N5523B		1N5759A		1N5915B		1N5943A	
1N5345B		1N5373B		1N5524	4-77	1N5760		1N5916		1N5943B	
1N5346	4-78	1N5374	4-78	1N5524A		1N5760A		1N5916A		1N5944	
1N5346A		1N5374A		1N5524B		1N5761		1N5916B		1N5944A	
1N5346B		1N5374B		1N5525	4-77	1N5761A		1N5917		1N5944B	
1N5347	4-78	1N5375	4-78	1N5525A		1N5762		1N5917A		1N5945	
1N5347A		1N5375A		1N5525B		1N5762A		1N5917B		1N5945A	
1N5347B		1N5375B		1N5526	4-77	4-Layer Diodes		1N5918		1N5945B	
1N5348	4-78	1N5376	4-78	1N5526A				1N5918A		1N5946	
1N5348A		1N5376A		1N5526B				1N5918B		1N5946A	
1N5348B		1N5376B		1N5527	4-77			1N5919		1N5946B	
1N5349	4-78	1N5377	4-78	1N5527A				1N5919A		1N5947	
1N5349A		1N5377A		1N5527B				1N5919B		1N5947A	
1N5349B		1N5377B		1N5528	4-77			1N5920		1N5947B	
1N5350	4-78	1N5378	4-78	1N5528A				1N5920A		1N5948	
1N5350A		1N5378A		1N5528B				1N5920B		1N5948A	
1N5350B		1N5378B		1N5529	4-77			1N5921		1N5948B	
1N5351		1N5379	4-78	1N5529A				1N5921A		1N5949	
1N5351A		1N5379A		1N5529B				1N5921B		1N5949A	
1N5351B		1N5379B		1N5530	4-77			1N5922		1N5949B	
1N5352	4-78	1N5380	4-78	1N5530A				1N5922A		1N5950	
1N5352A		1N5380A		1N5530B				1N5922B		1N5950A	
1N5352B		1N5380B		1N5531	4-77			1N5923		1N5950B	
1N5353	4-78	1N5381	4-78	1N5531A				1N5923A		1N5951	
1N5353A		1N5381A		1N5531B				1N5923B		1N5951A	
1N5353B		1N5381B		1N5532	4-77			1N5924		1N5951B	
1N5354	4-78	1N5382	4-78	1N5532A				1N5924A		1N5952	
1N5354A		1N5382A		1N5532B				1N5924B		1N5952A	
1N5354B		1N5382B		1N5533	4-77			1N5925		1N5952B	
1N5355		1N5383	4-78	RECTIFIERS				1N5925A		1N5953	
1N5355A		1N5383A		Schottky				1N5925B		1N5953A	
										1N5953B	

CATALOG INDEX (continued)

DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE
1N5954		1N6010	4-77	2N691	4-101	2N1523		2N2218AJTX2		THYRISTORS	
1N5954A		1N6010A		2N692	4-101	2N1529		2N2219s	4-15	Unijunction	
1N5954B		1N6010B				2N1530		2N2219JAN1		2N2646	4-104
1N5955		1N6011	4-77	TRANSISTORS		2N1531		2N2219JAN2		2N2647	4-104
1N5955A		1N6011A		SS Metal		2N1532		2N2219JTX1		TRANSISTORS	
1N5955B		1N6011B				2N1533		2N2219JTX2		Metal Dual	
1N5956		1N6012	4-77	2N697	4-15	2N1534		2N2219As	4-15	2N2652	4-42
1N5956A		1N6012A		2N699	4-19	2N1535		2N2219AJAN1		2N2652A	4-42
1N5956B		1N6012B		2N703		2N1536		2N2219AJAN2		THYRISTORS	
1N5985	4-77	1N6013	4-77	2N706		2N1537		2N2219AJTX1		2N2687	4-100
1N5985A		1N6013A		2N706JAN		2N1538		2N2219AJTX2		2N2688	4-100
1N5985B		1N6013B		2N706A		2N1539		2N2221JAN	4-19	2N2689	4-100
1N5986	4-77	1N6014	4-77	2N706B		2N1540		2N2221JTX		2N2690	4-100
1N5986A		1N6014A		2N708		2N1541		2N2221A	4-19	TRANSISTORS	
1N5986B		1N6014B		2N708JAN		2N1542		2N2221AJAN		Metal Dual	
1N5987	4-77	1N6015	4-77	2N708JTX				2N2221AJTX		2N2720	4-42
1N5987A		1N6015A		2N717	4-19	THYRISTORS		2N2222	4-19	2N2721	4-42
1N5987B		1N6015B		2N718	4-19	SCR		2N2222JAN		2N2722	4-41
1N5988	4-77	1N6016	4-77	2N718A		2N1595	4-100	2N2222JTX		2N2723	4-45
1N5988A		1N6016A		2N718AJAN		2N1596	4-100	2N2222AJAN	4-19	2N2785	4-45
1N5988B		1N6016B		2N718AJTX		2N1597	4-100	2N2222AJTX		2N2789s	4-15
1N5989	4-77	1N6017	4-77	2N720A		2N1598	4-100	2N2223	4-42	2N2800s	4-16
1N5989A		1N6017A		2N736		2N1599	4-100	2N2223A	4-42	2N2845	4-15
1N5989B		1N6017B		2N740		TRANSISTORS		2N2257		RF	
1N5990	4-77	1N6018	4-77	2N744		SS Metal		2N2270	4-19	2N2857	4-59
1N5990A		1N6018A		2N753		2N1613	4-19	2N2270s	4-19	2N2857JAN	
1N5990B		1N6018B		2N828A		2N1613AS		2N2297s	4-19	2N2857JTX	
1N5991	4-77	1N6019	4-77	2N843	4-19	2N1613s	4-15	2N2319		2N2857JTXV	
1N5991A		1N6019A		2N869A	4-16	2N1613JAN1		THYRISTORS		SS Metal	
1N5991B		1N6019B		2N869AJAN		2N1613JAN2		SCR		2N2894	4-16
1N5992	4-77	1N6020	4-77	2N869AJTX		2N1613JTX1		2N2322	4-100	2N2895	
1N5992A		1N6020A		2N910		2N1613JTX2		2N2322A	4-100	2N2896	
1N5992B		1N6020B		2N914		2N1711AS		2N2322s	4-100	2N2897	
1N5993	4-77	1N6021	4-77	2N914JAN		2N1711As	4-15	2N2325	4-100	2N2897	4-41
1N5993A		1N6021A		2N914JTX		THYRISTORS		2N2326	4-100	2N2903A	4-41
1N5993B		1N6021B		2N915	4-15	SCR		2N2326A	4-100	2N2904s	4-16
1N5994	4-77	1N6022	4-77	2N916	4-15	2N1842	4-100	2N2327	4-100	2N2904As	4-16
1N5994A		1N6022A		2N916JAN		2N1842A	4-100	2N2327s	4-100	2N2905s	4-16
1N5994B		1N6022B		2N917	4-18	2N1843	4-100	2N2328	4-100	2N2905JAN1	
1N5995	4-77	1N6023	4-77	2N918	4-18	2N1843A	4-100	2N2329	4-100	2N2905JAN2	
1N5995A		1N6023A		2N918AJAN		2N1844	4-100	TRANSISTORS		2N2905JTX1	
1N5995B		1N6023B		2N918JTX		2N1844A	4-100	SS Metal		2N2905JTX2	
1N5996	4-77	1N6024	4-77	2N929	4-17	2N1845	4-100	2N2330	4-15	2N2905As	4-16
1N5996A		1N6024A		2N929AJAN		2N1845A	4-100	2N2331		2N2906AJAN	
1N5996B		1N6024B		2N930	4-17	2N1846	4-100	2N2368	4-15	2N2906AJTX	
1N5997	4-77	1N6025	4-77	2N930AJAN		2N1846A	4-100	2N2369	4-15	2N2906AJTXV	
1N5997A		1N6025A		2N930JTX		2N1847	4-100	2N2369A	4-15	2N2906AJTXV	
1N5997B		1N6025B		2N956		2N1847A	4-100	2N2382		2N2906As	4-16
1N5998	4-77	1N6026	4-77	2N998	4-45	2N1848	4-100	2N2405s	4-15	2N2906JAN	
1N5998A		1N6026A		2N1131	4-16	2N1848A	4-100	2N2453		2N2906A	4-16
1N5998B		1N6026B		2N1131A	4-16	2N1849	4-100	2N2453A		2N2906AJAN	
1N5999	4-77	1N6027	4-77	2N1131S	4-20	2N1849A	4-100	2N2480	4-42	2N2906AJTX	
1N5999A		1N6027A		2N1131AS	4-20	2N1850	4-100	2N2480A	4-42	2N2906AJTXV	
1N5999B		1N6027B		2N1131JAN		2N1850A	4-100	2N2481		2N2907	4-16
1N6000	4-77	1N6028	4-77	2N1132	4-16	TRANSISTORS		2N2481JAN		2N2907JAN	
1N6000A		1N6028A		2N1132A	4-16	SS Metal		2N2481JTX		2N2907JTX	
1N6000B		1N6028B		2N1132S	4-20	2N1890		2N2483	4-17	2N2906ATXV	
1N6001	4-77	1N6029	4-77	2N1132AS	4-20	2N1893s	4-19	2N2484	4-17	2N2907	
1N6001A		1N6029A		2N1132AJAN		2N1990s	4-17	2N2501		2N2907JAN	
1N6001B		1N6029B				2N1991s	4-16	2N2539	4-15	2N2907JTX	
1N6002	4-77	1N6030	4-77	Pwr		Met Dual		2N2540	4-15	2N2907A	4-16
1N6002A		1N6030A		2N1162		2N2060	4-42	2N2543A	4-41	2N2907AJAN	
1N6002B		1N6030B		2N1163		2N2060A	4-42	THYRISTORS		2N2907AJTX	
1N6003	4-77	1N6031	4-77	2N1164		2N2060JAN		SCR		2N2907ATXV	
1N6003A		1N6031A		2N1165		2N2060JTX		2N2573	4-101	2N2913	4-41
1N6003B		1N6031B		2N1166		2N2060JTXV		2N2574	4-101	2N2914	4-41
1N6004	4-77	TRANSISTORS		2N1167				2N2575	4-101	2N2915	4-41
1N6004A		SS Metal		2N1190s				2N2576	4-101	2N2916	4-41
1N6004B				2N1191				2N2577	4-101	2N2917	4-41
1N6005	4-77	2N656s	4-19	2N1192				2N2578	4-101	2N2918	4-41
1N6005A		2N657s	4-17	2N1193				2N2579	4-101	2N2919	4-41
1N6005B		THYRISTORS		2N1194				TRANSISTORS		2N2920	4-41
1N6006	4-77	SCR		2N1358				Metal Dual		2N2944	
1N6006A		2N681	4-101	2N1359				2N2639	4-41	2N2945	
1N6006B		2N682	4-101	2N1360				2N2640	4-41	2N2945A	
1N6007A		2N683	4-101	2N1362				2N2641	4-41	2N2946	
1N6007B		2N684	4-101	2N1363				2N2642	4-41	2N2946A	
1N6008	4-77	2N684A	4-101	2N1364				2N2643	4-41		
1N6008A		2N685	4-101	2N1365				2N2644	4-41		
1N6008B		2N686	4-101	2N1518							
1N6009	4-77	2N687	4-101	2N1519							
1N6009A		2N688	4-101	2N1520							
1N6009B		2N689	4-101	2N1521							
		2N690	4-101	2N1522							

CATALOG INDEX (continued)

DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE
2N4216	4-100	THYRISTORS SCR	2N4441 4-98 2N4442 4-98 2N4443 4-98 2N4444 4-98	SS Metal	2N4924s 4-17 2N4925s 2N4926 4-17 2N4927 4-17 2N4928s 4-18 2N4929s 4-16 2N4930s 4-18	RF	2N5090 2N5108 4-59 2N5109 4-60	2N5336 2N5337 2N5338 2N5339 2N5344 2N5345 2N5346 2N5347 2N5348 2N5349	THYRISTORS Triac	2N5567 4-102 2N5568 4-102 2N5569 4-102 2N5570 4-102 2N5571 4-102 2N5572 4-102 2N5573 4-102 2N5574 4-102	
2N4217	4-100										
2N4218	4-100										
2N4219	4-100										
TRANSISTORS Fet											TRANSISTORS SS Metal
2N4220	4-30	2N4455	4-15	2N4931s 4-18		2N5155		2N5400 4-24			
2N4220A	4-31	THYRISTORS Unijunction	2N4449 2N4449JAN 2N4449JTX 2N4450 4-15 2N4453	THYRISTORS Unijunction	2N4930JAN 2N4930JTX 2N4930TXV 2N4931s 4-18 2N4931JAN 2N4931JTX 2N4931TXV 2N4937 2N4938 2N4939 2N4940 2N4941 2N4942	RF	2N5160 4-60 2N5161 2N5162	2N5358 4-31 2N5359 4-31 2N5360 4-31 2N5361 4-31 2N5362 4-31 2N5363 4-31 2N5364 4-31	SS Metal	2N5581 4-15 2N5581JAN 2N5581JTX 2N5582 4-15 2N5582JAN 2N5582JTX	
2N4221	4-30										
2N4221A	4-31										
2N4222	4-30										
2N4222A	4-31										
2N4223	4-33	2N4851 4-104		2N4948 4-104		2N5164 4-100		2N5401 4-24			
2N4224	4-33	2N4852 4-104		2N4948JAN 4-104		2N5165 4-100		Pwr Metal			
Pwr Metal		2N4853 4-104		2N4948JTX 4-104		2N5166 4-100		2N5427			
2N4231A	4-5	TRANSISTORS SS Metal	2N4854 4-42 2N4854JAN 2N4854JTX 2N4854JTXV 2N4855 4-42	THYRISTORS Bidirectional Switch	2N4949 4-104 2N4949JAN 2N4949JTX	RF	2N5167 4-100	2N5428	SS Plastic	2N5583 4-60 2N5589 4-54 2N5590 4-54 2N5591 4-55	
2N4232A	4-5										
2N4233A	4-5										
2N4234s											
2N4235s											
2N4236s		2N4856 4-32		2N4957 4-59		2N5168 4-100		2N5429			
2N4237s		2N4856A 4-32		2N4957JAN 4-4		2N5169 4-100		2N5430			
2N4238s		2N4856JAN 4-32		2N4957JTX 4-4		2N5170 4-100		THYRISTORS Unijunction			
2N4239s		2N4856JTX 4-32		2N4957JTXV 4-4		2N5171 4-100		2N5431 4-104			
2N4240	4-3	2N4857A 4-32		2N4958 4-59		TRANSISTORS RF		2N5431JAN			
SS Metal		2N4858 4-32		2N4959 4-59		2N5179 4-59		2N5431JANTX			
2N4260	4-18	2N4858A 4-32		THYRISTORS RF		Pwr Plastic		TRANSISTORS Pwr			
2N4261	4-18	2N4859 4-32		2N4993		2N5190 4-4		2N5435			
2N4264	4-25	2N4859A 4-32		TRANSISTORS RF		2N5191 4-4		2N5436			
2N4265	4-25	2N4859JAN 4-32		2N5016 4-59		2N5192 4-4		2N5437			
Pwr		2N4859JTX 4-32		2N5031 4-59		2N5193 4-4		2N5438			
2N4276		2N4860 4-32		2N5032 4-59		2N5194 4-4		2N5439			
2N4277		2N4860A 4-32		Pwr Metal		2N5195 4-4		2N5440			
2N4278		2N4861 4-32		2N5050		SS Plastic		THYRISTORS Triac			
2N4279		2N4861A 4-32		2N5051		2N5208		2N5441			
2N4280		THYRISTORS Unijunction		2N5052		2N5209 4-27		2N5442			
2N4281		2N4870 4-104		SS Metal		2N5210 4-27		2N5443			
2N4282		2N4871 4-104		2N5058s 4-17		2N5219		2N5444			
2N4283		TRANSISTORS Pwr Metal		2N5059s 4-17		2N5220 4-26		2N5445			
Fet		2N4877		THYRISTORS SCR		2N5221 4-26		2N5446			
2N4342	4-31	2N4877		2N5060		2N5222 4-26		TRANSISTORS Fet			
Pwr Metal		THYRISTORS Unijunction		2N5061		2N5223 4-26		2N5457 4-30			
2N4348		2N4870 4-104		2N5062		2N5224 4-26		2N5458 4-30			
Fet		2N4871 4-104		2N5063		2N5225 4-26		2N5459 4-30			
2N4351	4-30	TRANSISTORS SS Metal		2N5064		2N5226 4-26		2N5460 4-30			
2N4352	4-30	2N4890 4-16		THYRISTORS SCR		2N5227 4-26		2N5461 4-30			
2N4360	4-31	Pwr Metal		2N5067		2N5228 4-26		2N5462 4-30			
2N4391	4-32	2N4898		2N5068		2N5229 4-26		2N5463 4-31			
2N4392	4-32	2N4899		2N5069		2N5230 4-26		2N5464 4-31			
2N4393	4-32	2N4900		THYRISTORS RF		2N5231 4-26		2N5465 4-31			
Pwr Metal		2N4901		2N5070 4-57		Pwr Metal		2N5466 4-31			
2N4398	4-7	2N4902		2N5071		2N5241		2N5467 4-31			
2N4398HS		2N4903		THYRISTORS SCR		Fet		2N5468 4-31			
2N4399	4-7	2N4904		2N5071		2N5265 4-31		2N5469 4-31			
2N4399HS		2N4905		TRANSISTORS Pwr Metal		2N5266 4-31		2N5470 4-31			
2N4399JAN		2N4906		2N5067		2N5267 4-31		2N5471 4-31			
2N4399JTX		2N4907		2N5068		2N5268 4-31		2N5472 4-31			
2N4399JTXV		2N4908		2N5069		2N5269 4-31		2N5473 4-31			
SS Plastic		2N4909		RF		2N5270 4-31		2N5474 4-31			
2N4400	4-24	2N4910		2N5070 4-57		2N5271		2N5475 4-31			
2N4401	4-24	2N4911		2N5071		Pwr Metal		2N5476 4-31			
2N4402	4-24	2N4912		SS Plastic		2N5301 4-7		2N5477 4-31			
2N4403	4-24	2N4913		2N5086 4-24		2N5302H 4-7		2N5478 4-33			
2N4404	4-16	2N4914		2N5087 4-24		2N5302JAN 4-6		2N5479 4-33			
2N4405	4-16	2N4915		2N5088 4-24		2N5302JTX 4-6		2N5480 4-33			
2N4406	4-16	2N4916		2N5089 4-24		2N5303 4-6		2N5481 4-33			
2N4407	4-16	2N4917		RF		2N5303H 4-6		2N5482 4-33			
2N4409		2N4918 4-4		2N5070 4-57		2N5303JAN 4-6		2N5483 4-33			
2N4410		2N4919 4-4		2N5071		2N5303JTX 4-6		2N5484 4-33			
2N4416	4-33	2N4920 4-4		SS Plastic		2N5304 4-6		2N5485 4-33			
2N4416A	4-33	2N4921 4-4		2N5086 4-24		2N5324		2N5486 4-33			
RF		2N4922 4-4		2N5087 4-24		2N5325		SS Plastic			
2N4427	4-54	2N4923 4-4		2N5088 4-24		TRANSISTORS Triac		2N5550 4-24			
2N4428	4-60			2N5089 4-24		2N5551 4-24		2N5555 4-31			
2N4440						2N5556 4-31		2N5557 4-31			

CATALOG INDEX (continued)

DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE
MRTL		MC1310	3-33	MC1535	4-16	MC1803	2-9	MC3108		MC4017	2-6
MC924	2-10	MC1311	3-33	MC1536	3-15	MC1804	2-9	MC3109		MC4018	2-6
MC925	2-10	MC1312	3-33	MC1537	3-16	MC1805	2-9	MC3110		MC4019	2-6
MC926	2-10	MC1314	3-33	MC1538	3-15	MC1806	2-9	MC3111		MC4021	
MC927	2-10	MC1315	3-33	MC1539	3-14	MC1807	2-9	MC3112		MC4022	
mW MRTL		MC1323	3-22	MC1540		MC1808	2-9	MC3115		MC4023	
MC928	2-11	MC1324	3-22	MC1541		MC1809	2-9	MC3116		MC4024	2-6
MRTL		MC1326	3-22	MC1543		MC1810	2-9	MC3118		MC4027	
MC929	2-10	MC1327	3-22	MC1544	3-5	MC1811	2-9	MC3119		MC4028	
MDTL		MC1328	3-22	MC1545	3-17	MC1812	2-9	MC3120		MC4029	
MC930	2-8	MC1329	3-22	MC1550	3-17	MC1813	2-9	MC3121		MC4030	
MC931	2-8	MC1330	3-22	MC1552	3-18	MC1814	2-9	MC3122		MC4031	
MC932	2-8	MC1331	3-22	MC1553	3-18	MC1815	2-9	MC3123		MC4032	
MC933	2-8	MC1344	3-22	MC1554	3-21	MC1816	2-9	MC3124		MC4033	
MC934	2-8	MC1349	3-22	MC1555	3-21	MC1818	2-9	MC3125		MC4037	
MC935	2-8	MC1350	3-22	MC1556	3-15	MC1820	2-9	MC3126		MC4038	
MC936	2-8	MC1351	3-22	MC1558	3-16	MC1900	2-9	MC3128		MC4040	
MC937	2-8	MC1352	3-22	MC1560		MC1901	2-9	MC3129		MC4041	
MC938	2-8	MC1353	3-22	MC1561		MC1902	2-9	MC3130		MC4042	
MC939	2-8	MC1355	3-23	MC1563		MC1903	2-9	MC3131		MC4043	
MC940	2-8	MC1356	3-23	MC1566		MC1904	2-9	MC3132		MC4044	2-6
MC941	2-8	MC1357	3-23	MC1568		MC1905	2-9	MC3133		MC4048	
MC942	2-8	MC1358	3-23	MC1569		MC1906	2-9	MC3134		MC4050	
MC943	2-8	MC1364	3-23	MC1585		MC1907	2-9	MC3150		MC4051	
MC944	2-8	MC1370	3-23	MC1590	3-17	MC1908	2-9	MC3151		MC4062	
MC945	2-8	MC1371	3-23	MC1594	3-21	MC1909	2-9	MC3152		MC4300	
MC946	2-8	MC1375	3-23	MC1595	3-21	MC1910	2-9	MC3153		MC4304	
MC947	2-8	MC1385	3-23	MC1596	3-21	MC1911	2-9	MC3154		MC4305	
MC948	2-8	MC1391	3-23	MECL		MC1912	2-9	MC3155		MC4306	
MC949	2-8	MC1394	3-23	MC1601	2-4	MC1914	2-9	MC3160		MC4307	
MC950	2-9	MC1398	3-23	MC1602	2-4	MC1915	2-9	MC3161		MC4308	
MC951	2-9	MC1405	3-9	MC1603	2-4	MC1916	2-9	MC3162		MC4310	
MC952	2-9	MC1406	3-9	MC1604	2-4	MC1918	2-9	MC3163		MC4316	2-6
MC953	2-9	MC1407	3-9	MC1605	2-4	MTTL		LINEAR		MC4317	2-6
MC954	2-9	MC1408L6	3-9	MC1648	2-4	MC3000		MC3301	3-24	MC4318	2-6
MC955	2-9	MC1408L7	3-9	MC1650	2-4	MC3001		MC3302	3-24	MC4319	2-6
MC956	2-9	MC1408L8	3-9	MC1651	2-4	MC3002		MC3303	3-16	MC4324	2-6
MC957	2-9	MC1410	3-18	MC1654	2-4	MC3003		MC3310P	3-23	MC4326	
MC958	2-9	MC1414	3-13	MC1658	2-4	MC3004		MC3330		MC4327	
MC959	2-9	MC1420	3-14	MC1660	2-4	MC3005		MC3340P	3-24	MC4328	
MC960	2-9	MC1430	3-16	MC1662	2-4	MC3006		MC3360P	3-23	MC4329	
MC961	2-9	MC1431	3-16	MC1664	2-4	MC3007		MC3370		MC4330	
MC962	2-9	MC1433	3-16	MC1666	2-4	MC3008		MC3380		MC4331	
MC963	2-9	MC1435	3-16	MC1668	2-4	MC3009		MC3401	3-16	MC4332	
MRTL		MC1436	3-15	MC1670	2-4	MC3010		MC3403	3-16	MC4335	
MC971	2-10	MC1436C	3-15	MC1672	2-4	MC3011		MC3416	3-10	MC4337	
MC974	2-10	MC1437	3-16	MC1674	2-4	MC3012		MC3430	3-12	MC4344	2-6
MC975	2-10	MC1438		MC1678	2-4	MC3015		MC3431	3-12	MC4350	
mW MRTL		MC1439		MC1688	2-4	MC3016		MC3432	3-12	MC5400	
MC976	2-11	MC1440		MC1690	2-4	MC3018		MC3433	3-12	MC5401	
MC977	2-11	MC1441		MC1692	2-4	MC3019		MC3437	3-6	MC5402	
MC978	2-11	MC1444	3-5	MC1694	2-4	MC3020		MC3438	3-6	MC5403	
MC981	2-11	MC1445	3-17	MC1696	2-4	MC3021		MC3440	3-7	MC5404	
MC982	2-11	MC1446L		MC1699	2-4	MC3022		MC3441	3-7	MC5405	
MRTL		MC1454	3-21	LINEAR		MC3023		MC3443	3-7	MC5406	
MC983	2-10	MC1455	3-21	MC1709	3-14	MC3024		MC3444	3-7	MC5407	
MC984	2-10	MC1456	3-15	MC1709A	3-14	MC3025		MC3450	3-11	MC5408	
MC985	2-10	MC1456C	3-15	MC1709C	3-14	MC3026		MC3452	3-11	MC5409	
MC986	2-10	MC1458	3-15	MC1710	3-12	MC3028		MC3453	3-11	MC5410	
MC988	2-10	MC1458C	3-15	MC1710C	3-12	MC3029		MC3456	3-21	MC5416	
MC989	2-10	MC1460		MC1711	3-12	MC3030		MC3459	3-4	MC5417	
MC990	2-10	MC1461		MC1711C	3-12	MC3031		MC3460	3-4	MC5420	
MC991	2-10	MC1463		MC1712	3-16	MC3032		MC3461	3-3	MC5426	
MC992	2-10	MC1466		MC1712C	3-16	MC3033		MC3466	3-4	MC5430	
mW MRTL		MC1468		MC1723		MC3034		MC3476	3-15	MC5437	
MC993	2-11	MC1469		MC1723C		MC3050		MC3490	3-8	MC5438	
MRTL		MC1488	3-10	MC1733	3-18	MC3051		MC3491	3-8	MC5440	
MC996	2-10	MC1488L	3-10	MC1733C	3-18	MC3052		MC3494	3-8	MC5442	
MC997	2-10	MC1489	3-10	MC1741	3-15	MC3053		MC3503	3-16	MC5443	
mW MRTL		MC1489A	3-10	MC1741C	3-15	MC3054		MC3556	3-21	MC5444	
MC998	2-11	MC1494	3-21	MC1741S	3-15	MC3055		MTTL		MC5445	
MRTL		MC1495	3-21	MC1741SC	3-15	MC3060		MC4000		MC5447	
MC999	2-10	MC1496	3-21	MC1747	3-16	MC3061		MC4001		MC5448	
LINEAR		MC1505	3-9	MC1747C	3-16	MC3062		MC4002		MC5449	
MC1303	3-33	MC1506	3-9	MC1748	3-14	MC3063		MC4004		MC5450	
MC1304	3-33	MC1507	3-9	MC1748C	3-14	MC3100		MC4005		MC5451	
MC1305	3-33	MC1508		MC1776	3-15	MC3101		MC4006		MC5453	
MC1306	3-33	MC1508L8	3-9	MC1776C	3-15	MC3102		MC4007		MC5454	
MC1307	3-33	MC1510	3-18	MDTL		MC3103		MC4008		MC5460	
		MC1514	3-13	MC1800	2-9	MC3104		MC4010		MC5470	
		MC1520	3-14	MC1801	2-9	MC3105		MC4012		MC5472	
		MC1530	4-16	MC1802	2-9	MC3106		MC4015		MC5473	
		MC1531	4-16			MC3107		MC4016	2-6	MC5475	
		MC1533	4-16								

CATALOG INDEX (continued)

DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE
MC5477		MC7266		MC74H71		MC8322		mW MRTL		MC10168	2-3
MC5479		MC7267		MC74H72		MC8324		MC9718	2-11	MC10170	2-3
MC5480		MC7270		MC74H73		MC8328				MC10171	2-3
MC5483		MC7271		MC74H74A		MC8300		MRTL		MC10172	2-3
MC5484		MC7280		MC74H79		MC8301		MC9719A		MC10173	2-3
MC5486		MC7281		MC74H86		MC8304				MC10174	2-3
MC5490		MC7400		MC74H89		MC8306		mW MRTL		MC10175	2-3
MC5491A		MC7401		MC74H115		MC8307		MC9720	2-11	MC10176	2-3
MC5492		MC7402		MC74H116		MC8308		MC9721	2-11	MC10177	2-3
MC5493		MC7404		MC74H117		MC8309		MC9722	2-11	MC10178	2-3
MC5494		MC7405		MC74H118		MC8310		MC9723	2-11	MC10179	2-3
MC5495		MC7406		MC74H119		MC8311		MC9724	2-11	MC10180	2-3
MC5496		MC7407		MC74H120		MC8312		MC9725	2-11	MC10181	2-3
MC54H00		MC7408				MC8314				MC10182	2-3
MC54H01		MC7409		LINEAR		MC8316		MRTL		MC10183	2-3
MC54H02		MC7410		MC7522	3-5	MC8318		MC9801	2-10	MC10186	2-3
MC54H04		MC7416		MC7523	3-5	MC8322		MC9802	2-10	MC10190	2-3
MC54H05		MC7417		MC7524	3-5	MC8324		MC9804	2-10	MC10191	2-3
MC54H08		MC7420		MC7525	3-5	MC8328		MC9807	2-10	MC10193	2-3
MC54H10		MC7426		MC7528	3-5	MC8375		MC9809	2-10	MC10194	2-3
MC54H11		MC7430		MC7529	3-5	MC8377		MC9813	2-10	MC10195	2-3
MC54H12		MC7437		MC7534	3-5	MC8383		MC9814	2-10	MC10197	2-3
MC54H20		MC7438		MC7535	3-5			MC9815	2-10	MC10210	2-3
MC54H21		MC7440		MC7538	3-5	LSI				MC10211	2-3
MC54H22		MC7441A		MC7539	3-5	MC8500	2-5	mW MRTL		MC10212	2-3
MC54H28		MC7442		MC7705C	3-19	MC8501	2-5	MC9818	2-11	MC10216	2-3
MC54H29		MC7443		MC7706C	3-19	MC8502	2-5			MC10231	2-3
MC54H30		MC7444		MC7708C	3-19	MC8503	2-5	MRTL		MC10287	2-3
MC54H31		MC7445		MC7712C	3-19	MC8504	2-5	MC9819A	2-10	MC10501	2-2
MC54H32		MC7446		MC7715C	3-19	MC8505	2-5			MC10502	2-2
MC54H36		MC7447		MC7718C	3-19	MC8506	2-5	mW MRTL		MC10504	2-2
MC54H39		MC7448		MC7720C	3-19	MC8520	2-5	MC9820	2-11	MC10505	2-2
MC54H40		MC7449		MC7724C	3-19	MC8521	2-5	MC9821	2-11	MC10506	2-2
MC54H50		MC7450		MC7805C	3-19	MC8522	2-5	MC9822	2-11	MC10507	2-2
MC54H51		MC7451		MC7806C	3-19	MC8523	2-5	MC9823	2-11	MC10509	2-2
MC54H52		MC7453		MC7808C	3-19	MC8524	2-5	MC9824	2-11	MC10514	2-2
MC54H53		MC7454		MC7812C	3-19			MC9825	2-11	MC10515	2-2
MC54H54		MC7460		MC7815C	3-19	MTTL				MC10516	2-2
MC54H55		MC7470		MC7818C	3-19	MC8601		MECL		MC10517	2-2
MC54H60		MC7472		MC7824C	3-19	MC8602		MC10100	2-2	MC10518	2-2
MC54H61		MC7473		MC7902C	3-19	MC8603		MC10101	2-2	MC10519	2-2
MC54H62		MC7475		MC7905C	3-19			MC10102	2-2	MC10521	2-2
MC54H71		MC7476		MC7905.2C	3-19	LINEAR		MC10103	2-2	MC10524	2-2
MC54H72		MC7477		MC7906C	3-19	MC8T13		MC10104	2-2	MC10525	2-2
MC54H73		MC7479		MC7908C	3-19	MC8T14		MC10105	2-2	MC10530	2-2
MC54H74A		MC7480		MC7912C	3-19	MC8T23		MC10106	2-2	MC10531	2-2
MC54H79		MC7483		MC7915C	3-19	MC8T24		MC10107	2-2	MC10533	2-2
MC54H86		MC7484		MC7918C	3-19	MC8T26		MC10109	2-2	MC10535	2-2
MC54H89		MC7486		MC7924C	3-19			MC10110	2-2	MC10536	2-2
MC54H115		MC7490		MC78M05	3-19	MTTL		MC10111	2-2	MC10537	2-3
MC54H116		MC7491A		MC78M06	3-19	MC9300		MC10112	2-2	MC10541	2-3
MC54H117		MC7492		MC78M08	3-19	MC9301		MC10113	2-2	MC10560	2-3
MC54H118		MC7493		MC78M12	3-19	MC9304		MC10114	2-2	MC10561	2-3
MC54H119		MC7495		MC78M15	3-19	MC9306		MC10115	2-2	MC10562	2-3
MC54H120		MC7496		MC78M18	3-19	MC9307		MC10116	2-2	MC10564	2-3
		MC74H00		MC78M20	3-19	MC9308		MC10117	2-2	MC10571	2-3
LINEAR		MC74H01		MC78M24	3-19	MC9309		MC10118	2-2	MC10572	2-3
MC5522	3-5	MC74H02		MTTL		MC9310		MC10119	2-2	MC10574	2-3
MC5523	3-5	MC74H04		MC8241		MC9311		MC10121	2-2	MC10575	2-3
MC5524	3-5	MC74H05		MC8242		MC9312		MC10123	2-2	MC10576	2-3
MC5525	3-5	MC74H08		MC8250		MC9314		MC10124	2-2	MC10580	2-3
MC5528	3-5	MC74H10		MC8251		MC9316		MC10125	2-2	MC10581	2-3
MC5529	3-5	MC74H11		MC8260		MC9318		MC10128	2-2	MC10616	2-3
MC5534	3-5	MC74H12		MC8261		MC9322		MC10129	2-2	MC10631	2-3
MC5535	3-5	MC74H20		MC8266		MC9324		MC10130	2-2		
MC5538	3-5	MC74H21		MC8267		MC9328		MC10131	2-2	PLL	
MC5539	3-5	MC74H22		MC8270		MC9375		MC10132	2-2	MC12000	2-6
		MC74H28		MC8271		MC9377		MC10133	2-2	MC12012	2-6
MOS		MC74H29		MC8271		MC9383		MC10134	2-2	MC12013	2-6
MC6800		MC74H30		MC8280		MC9601		MC10135	2-2	MC12014	2-6
MC6802		MC74H31		MC8281		MC9602		MC10136	2-2	MC12020	2-6
MC6850		MC74H32		MC8300		MC9603		MC10137	2-2	MC12021	2-6
MC6852		MC74H36		MC8301				MC10138	2-3	MC12040	2-6
MC6860		MC74H39		MC8304		MRTL		MC10141	2-3	MC12060	2-6
MC6862		MC74H40		MC8306		MC9701	2-10	MC10153	2-3	MC12061	2-6
MC6863		MC74H50		MC8307		MC9702	2-10	MC10158	2-3	MC12513	2-6
		MC74H51		MC8308		MC9704	2-10	MC10159	2-3	MC12520	2-6
MTTL		MC74H52		MC8309		MC9707	2-10	MC10160	2-3	MC12521	2-6
MC7241		MC74H53		MC8310		MC9709	2-10	MC10161	2-3	MC12540	2-6
MC7242		MC74H54		MC8311		MC9713	2-10	MC10162	2-3	MC12560	2-6
MC7250		MC74H55		MC8312		MC9714	2-10	MC10163	2-3	MC12561	2-6
MC7251		MC74H60		MC8314		MC9715	2-10	MC10164	2-3		
MC7260		MC74H61		MC8316				MC10165	2-3	LINEAR	
MC7261		MC74H62		MC8318				MC10166	2-3	MC13120	

CATALOG INDEX (continued)

DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE
MOS		MC14554	1-7	MC74416	2-6	MCA2214	4-81	MCE936	2-14	MCM5004AL.L	2-15
MC14000	1-7	MC14555	1-7	MC74417	2-6	MCA2221	4-81	MCE944	2-14	MCM5303AL.L	2-15
MC14001	1-7	MC14556	1-7	MC74418	2-6	MCA2222	4-81	MCE945	2-14	MCM5304AL.L	2-15
MC14002	1-7	MC14557	1-7	MC74419	2-6	MCA2223	4-81	MCE946	2-14		
MC14006	1-7	MC14558	1-7	MC74450		MCA2224	4-81	MCE948	2-14	MOS	
MC14007	1-7	MC14559	1-7	MC74452		MCA2231	4-81	MCE962	2-14	MCM6550	1-6
MC14008	1-7	MC14560	1-7	MC74453		MCA2232	4-81	MCE54H00	2-13	MCM6560	1-6
MC14011	1-7	MC14561	1-7	MC74454		MCA2233	4-81	MCE54H01	2-13	MCM6561	1-6
MC14012	1-7	MC14562	1-7	MC74455		MCA2234	4-81	MCE54H04	2-13	MCM6562	1-6
MC14013	1-7	MC14566	1-7	MC74456				MCE54H10	2-13	MCM6570	1-6
MC14014	1-7	MC14572	1-7	MC74460		LINEAR		MCE54H20	2-13	MCM6571A	1-6
MC14015	1-7	MC14580	1-7	MC74468		MCB1709	3-14	MCE54H31	2-13	MCM6572	1-6
MC14016	1-7	MC14581	1-7			MCB1710		MCE54H40	2-13	MCM6573	1-6
MC14017	1-7	MC14582	1-7	LINEAR		MCB1723		MCE54H51	2-13	MCM6574	1-6
MC14020	1-7	MC14583	1-7	MC75107	3-10	MCB1741		MCE54H54	2-13	MCM6575	1-6
MC14021	1-7	MC14585	1-7	MC75108	3-10	MCB1748		MCE54H56	2-13	MCM6576	1-6
MC14022	1-7			MC75109	3-10	MCBC1709	3-14	MCE54H57	2-13	MCM6577	1-6
MC14023	1-7	MTTL		MC75110	3-10	MCBC1710		MCE54H72	2-13	MCM6578	1-6
MC14024	1-7	MC15482		MC75140		MCBC1723		MCE54H73	2-13	MCM6579	1-6
MC14025	1-7	MC17482		MC75325	3-5	MCBC1741	3-15	MCE54H79	2-13	MCM6580	1-6
MC14027	1-7	MC25482		MC75358	3-3	MCBC1748	3-14	MCE54H146	2-13	MCM6581	1-6
MC14028	1-7	MC27482		MC75365	3-4			MCE54I03	2-13	MCM6583	1-6
MC14032	1-7	MC54100		MC75368	3-3	MTTL		MCE7003F	2-13	MCM6590	1-6
MC14033	1-7	MC54107		MC75450	3-11	MCBC5400	2-12	MCE7005F	2-13	MCM6591	1-6
MC14034	1-7	MC54121		MC75451	3-11	MCBC5401	2-12	MCE7006F	2-13	MCM6604	1-5
MC14035	1-7	MC54145		MC75452	3-11	MCBC5402	2-12	MCE7007F	2-13	MCM6604-2	1-5
MC14038	1-7	MC54150		MC75453	3-11	MCBC5404	2-12	MCE74H00	2-13	MCM6604-4	1-5
MC14040	1-7	MC54151		MC75454	3-11	MCBC5405	2-12	MCE74H01	2-13	MCM6605A	1-5
MC14042	1-7	MC54152		MC75461	3-11	MCBC5410	2-12	MCE74H04	2-13	MCM6605A1	1-5
MC14046	1-7	MC54153		MC75462	3-11	MCBC5420	2-12	MCE74H10	2-13	MCM6616	1-5
MC14049	1-7	MC54155		MC75463	3-11	MCBC5430	2-12	MCE74H20	2-13	MCM6810	
MC14050	1-7	MC54156		MC75464	3-11	MCBC5440	2-12	MCE74H31	2-13	MCM6815	
MC14071	1-7	MC54157		MC75491	3-8	MCBC5450	2-12	MCE74H40	2-13	MCM6830	
MC14076	1-7	MC54164A		MC75492	3-8	MCBC5451	2-12	MCE74H51	2-13	MCM6832	
MC14081	1-7	MC54165				MCBC5453	2-12	MCE74H54	2-13		
MC14410L.P	1-8	MC54176		MTTL		MCBC5454	2-12	MCE74H56	2-13	MECL	
MC14411L.P	1-8	MC54177		MC83151		MCBC5460	2-12	MCE74H57	2-13	MCM10140	2-3
MC14412FL	1-8	MC54180		MC83152		MCBC5472	2-12	MCE74H59	2-13	MCM10142	2-3
MC14412VL	1-8	MC54181		MC83153		MCBC5473	2-12	MCE74H146	2-13	MCM10143	2-3
MC14415EFL	1-8	MC54182		MC93151		MCBC5479	2-12	MCE74I03	2-13	MCM10144	2-3
MC14415FL.FP	1-8	MC54192		MC93152						MCM10145	2-3
MC14415VL.VP	1-8	MC54193		MC93153		LINEAR		DIODES		MCM10147	2-3
MC14419L.P	1-8	MC54195				MCC1436	3-15	Current Limiting		MCM10148	2-3
MC14435EFL	1-8	MC54408		DIODES		MCC1439	3-14	MCL1300	4-82	MCM10149	2-3
MC14435FL.FP	1-8	MC54417	2-6	Reference		MCC1458		MCL1301	4-82		
MC14435EVL	1-8	MC54418	2-6	MCA1911	4-81	MCC1463		MCL1302	4-82	MOS	
MC14435VL.VP	1-8	MC54419	2-6	MCA1912	4-81	MCC1469		MCL1303	4-82	MCM14505	1-7
MC14440L.P	1-8	MC54419	2-6	MCA1913	4-81	MCC1495		MCL1304	4-82	MCM14505A	1-5
MC14450L.P	1-8	MC54452		MCA1914	4-81	MCC1536	3-15			MCM14505C	1-5
MC14451L.P	1-8	MC54453		MCA1915	4-81	MCC1539	3-14	Zener		MCM14524	1-7
MC14490EFL	1-8	MC54454		MCA1922	4-81	MCC1558		MCLTC6010	4-82	MCM14524A	1-6
MC14490FL.FP	1-8	MC54455		MCA1923	4-81	MCC1563		MCLTC6025	4-82	MCM14524C	1-6
MC14490EVL	1-8	MC54456		MCA1924	4-81	MCC1569		MCLTC6050	4-82	MCM14537	1-5
MC14490VL.VP	1-8	MC54460		MCA1931	4-81	MCC1595		MCLTC6100	4-82	MCM14537A	1-5
MC14501	1-7	MC54468		MCA1932	4-81	MCC1709	3-14			MCM14537C	1-5
MC14502	1-7			MCA1933	4-81	MCC1709C	3-14	MOS		MCM14552	1-7
MC14506	1-7	LINEAR		MCA1934	4-81	MCC1710		MCM2102	1-5	MCM14552A	1-5
MC14507	1-7	MC55107	3-10	MCA2011	4-81	MCC1711C		MCM2102-1	1-5	MCM14552C	1-5
MC14508	1-7	MC55108	3-10	MCA2012	4-81	MCC1711C		MCM2102-2	1-5	MCM68111A	
MC14510	1-7	MC55325	3-5	MCA2013	4-81	MCC1723		MCM2102A	1-5	MCM68112A	
MC14511	1-7			MCA2014	4-81	MCC1723C		MCM2102A4	1-5	MCM68707	
MC14512	1-7	MTTL		MCA2021	4-81	MCC1741	3-15	MCM2111A	1-5		
MC14514	1-7	MC74100		MCA2022	4-81	MCC1741C	3-15	MCM2111A2	1-5	THYRISTORS	
MC14515	1-7	MC74107		MCA2023	4-81	MCC1748	3-14	MCM2112A	1-5	SCR	
MC14516	1-7	MC74121		MCA2024	4-81	MCC1748C	3-14	MCM2112A2	1-5	MCR80-05	4-102
MC14517	1-7	MC74145		MCA2031	4-81			MCM2112A4	1-5	MCR80-10	4-102
MC14518	1-7	MC74150		MCA2032	4-81	MOS CHIPS				MCR80-20	4-102
MC14519	1-7	MC74151		MCA2033	4-81	MCC14440	1-8	MTTL		MCR80-30	4-102
MC14520	1-7	MC74152		MCA2034	4-81	MCC14450	1-8	MCM4000L.P	2-15	MCR80-40	4-102
MC14521	1-7	MC74153		MCA2111	4-81	MCC14451	1-8	MCM4002L.P	2-15	MCR80-50	4-102
MC14522	1-7	MC74155		MCA2112	4-81			MCM4003AL.L	2-15	MCR80-60	4-102
MC14526	1-7	MC74156		MCA2113	4-81	LINEAR		MCM4004AL.L	2-15	MCR80-70	4-102
MC14527	1-7	MC74157		MCA2114	4-81	MCCF1458	3-15			MCR80-80	4-102
MC14528	1-7	MC74157A		MCA2121	4-81	MCCF1558	3-15	MCM4064		MCR81-05	4-102
MC14529	1-7	MC74166A		MCA2122	4-81	MCCF1709	3-14	MCM4067		MCR81-10	4-102
MC14530	1-7	MC74165		MCA2123	4-81	MCCF1709C	3-14	MCM4068		MCR81-20	4-102
MC14531	1-7	MC74176		MCA2124	4-81	MCCF1741	3-15	MCM4069		MCR81-30	4-102
MC14532	1-7	MC74177		MCA2131	4-81	MCCF1741C	3-15	MCM4070		MCR81-40	4-102
MC14533	1-7	MC74180		MCA2132	4-81			MCM4300L	2-15	MCR81-50	4-102
MC14534	1-7	MC74181		MCA2133	4-81	MDTL		MCM4302L	2-15	MCR81-60	4-102
MC14536	1-7	MC74182		MCA2134	4-81	MCE930	2-14	MCM4303AL.L	2-15	MCR81-70	4-102
MC14539	1-7	MC74192		MCA2211	4-81	MCE932	2-14	MCM4304AL.L	2-15	MCR81-80	4-102
MC14541	1-7	MC74193		MCA2212	4-81	MCE933	2-14	MCM5003AL.L	2-15		
MC14543	1-7	MC74195		MCA2213	4-81						
MC14549	1-7	MC74408									
MC14553	1-7										

CATALOG INDEX (continued)

DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE
MHW570	4-61	MJ3260		MJE103		MJE2020		MK15B		LINEAR	
MHW572	4-61	MJ3430		MJE104		MJE2021		MK20	3-14	MLM101A	
MHW580	4-61	MJ3480		MJE105		MJE2050		MK20B		MLM104	
MHW601	4-55	MJ3701		MJE105K		MJE2055		MK25		MLM105	
MHW602	4-55	MJ3702		MJE170		MJE2090		MK25B	3-15	MLM107	
MHW709-1	4-56	MJ3703		MJE171		MJE2091		MK30		MLM109	
MHW709-2	4-56	MJ3704		MJE172		MJE2092		MK30B	3-15	MLM110	
MHW709-3	4-56	MJ3760	4-5	MJE180		MJE2093		MK35	3-13	MLM111	
MHW710-1	4-56	MJ3761	4-5	MJE181		MJE2100		MK35B		MLM124	
MHW710-2	4-56	MJ3771		MJE182		MJE2101		MK77-1	3-24	MLM139	
MHW710-3	4-56	MJ3772		MJE200	4-5	MJE2102		MK77-1B	3-24	MLM139A	
		MJ3773		MJE201		MJE2103		MK77-2		MLM201A	
Pwr Metal		MJ4031		MJE202		MJE2150		MK77-2B		MLM204	
MJ205	4-4	MJ4032		MJE203		MJE2160	4-3	MK77-3B		MLM205	
MJ400		MJ4033		MJE204		MJE2360		MK90-1		MLM207	3-15
MJ410		MJ4034		MJE205		MJE2361		MK90-1B		MLM209	
MJ411		MJ4035		MJE205K		MJE2370		MK90-2	3-15	MLM210	
MJ413	4-9	MJ4200		MJE210	4-5	MJE2480		MK90-2B		MLM211	3-13
MJ420		MJ4201		MJE220		MJE2481		MK90-3		MLM224	
MJ420s		MJ4210		MJE221		MJE2482		MK90-3B	3-24	MLM239	
MJ421		MJ4211		MJE222		MJE2483		MK90-4	3-24	MLM239A	
MJ421s		MJ4502	4-7	MJE223		MJE2490		MK90-4B		MLM301A	3-14
MJ423	4-9	MJ4645		MJE224		MJE2491		MK90-5		MLM304	
MJ424		MJ4646		MJE225		MJE2520		MK90-5B		MLM305	
MJ425	4-5	MJ4647		MJE230		MJE2801		MK90-6	3-15	MLM307	
MJ430s		MJ4648		MJE231		MJE2801K		MK90-6B		MLM309	
MJ431		MJ5038		MJE232		MJE2901		MK90-7	3-15	MLM310	
MJ440s		MJ5039		MJE233		MJE2901K		MK90-7B	3-13	MLM311	
MJ450		MJ5415	4-3	MJE234		MJE2955		MK90-8		MLM324	
MJ480		MJ5416	4-3	MJE235		MJE2955K		MK90-8B		MLM339	3-24
MJ481		MJ6302		MJE240		MJE3055		MK90-9	3-24	MLM339A	
MJ490		MJ6700		MJE241		MJE3055K		MK90-9B			
MJ491		MJ6701		MJE242		MJE3300	4-4	MK90-10B		TRANSISTORS	
MJ701		MJ7000		MJE243		MJE3301	4-4	MK100		SS Metal	
MJ702		MJ7160	4-5	MJE244		MJE3302	4-4	MK100B		MM1500	
MJ704		MJ7161	4-5	MJE250		MJE3310	4-4	MK126		MM1500A	
MJ721		MJ7260	4-9	MJE251		MJE3311	4-4	MK126B		MM1501	
MJ723		MJ7261	4-9	MJE252		MJE3312	4-4	MK167		MM1505	
MJ802	4-7	MJ8020		MJE253		MJE3370		MK167B		MM1553	
MJ804	4-5	MJ8100		MJE254		MJE3371		MK189		MM1748	
MJ900	4-8	MJ8101		MJE340	4-3	MJE3439	4-3	MK189B		MM1748A	
MJ901		MJ9000		MJE340K	4-3	MJE3440	4-3	MK199-1		MM1941	4-18
MJ920				MJE341		MJE3520		MK199-1B		MM2005-2	
MJ921		Pwr Plastic		MJE341K		MJE3521		MK199-2		MM2258	4-17
MJ1000	4-8	MJE29	4-3	MJE344		MJE3738		MK199-2B		MM2259	4-17
MJ1001		MJE29A	4-3	MJE344K		MJE3739		MK199-3		MM2260	
MJ1200		MJE29B	4-3	MJE345		MJE4918		MK199-3B		MM2484	
MJ1201		MJE29C	4-3	MJE350	4-3	MJE4919		MK199-4		MM3000	
MJ1800		MJE30	4-3	MJE370		MJE4920		MK199-4B		MM3001	4-17
MJ2249		MJE30A	4-3	MJE370K		MJE4921		MK199-5		MM3002	4-17
MJ2250		MJE30B	4-3	MJE371		MJE4922		MK199-5B		MM3003	4-17
MJ2251		MJE30C	4-3	MJE371K		MJE4923		MK199-6B		MM3005	4-17
MJ2252		MJE31	4-4	MJE520	4-4	MJE5190	4-4	MK221-1		MM3006	4-17
MJ2253	4-4	MJE31A	4-4	MJE520K		MJE5191	4-4	MK221-1B		MM3007	4-17
MJ2254		MJE31B	4-4	MJE521		MJE5192	4-4	MK221-2		MM3008	4-17
MJ2267		MJE31C	4-4	MJE521K		MJE5193	4-4	MK221-2B		MM3009	4-17
MJ2268		MJE32	4-4	MJE700	4-4	MJE5194	4-4			MM3019	
MJ2500		MJE32A	4-4	MJE701		MJE5195	4-4			MM3020	
MJ2501		MJE32B	4-4	MJE702	4-44	MJE5655	4-3	LIQUID CRYSTAL		MM3053	4-19
MJ2801		MJE32C	4-4	MJE703		MJE5656	4-3	DISPLAY		MM3220	
MJ2802		MJE33		MJE710		MJE5657	4-3	MLC400		MM3226	4-16
MJ2840		MJE33A		MJE711		MJE5974	4-5	MLC500		MM3734	4-15
MJ2841		MJE33B		MJE712		MJE5975	4-5	MLC501		MM3735	
MJ2901		MJE33C		MJE720		MJE5976	4-5			MM3736	4-15
MJ2940		MJE34		MJE721		MJE5977	4-5	OPTOS		MM3737	4-15
MJ2941		MJE34A		MJE722		MJE5978	4-5	LED		MM3903	4-15
MJ2955		MJE34B		MJE800	4-4	MJE5979	4-5	MLED50	4-110	MM3904	4-15
MJ3000		MJE34C		MJE801		MJE5980	4-5	MLED55	4-110	MM3905	4-16
MJ3001		MJE41	4-5	MJE802	4-44	MJE5981	4-5	MLED60	4-111	MM3906	4-16
MJ3010		MJE41A	4-5	MJE803		MJE5982	4-5	MLED90	4-111	MM3907	4-16
MJ3011		MJE41B	4-5	MJE1090	4-5	MJE5983	4-5	MLED92	4-111	MM4000	4-18
MJ3026		MJE41C	4-5	MJE1091		MJE5984	4-5	MLED440	4-110	MM4001	4-16
MJ3027		MJE42	4-5	MJE1092		MJE5985	4-5	MLED445		MM4002	4-18
MJ3028		MJE42A	4-5	MJE1093		MJE5985	4-5	MLED500		MM4003	4-18
MJ3029		MJE42B	4-5	MJE1100	4-5	MJE6040		MLED600	4-110	MM4005	4-16
MJ3030		MJE42C	4-5	MJE1101		MJE6041		MLED610		MM4006	4-16
MJ3030		MJE47	4-3	MJE1102		MJE6042		MLED640	4-110	MM4007	4-16
MJ3040		MJE48	4-9	MJE1103		MJE6043		MLED655	4-110	MM4008	4-20
MJ3041		MJE49	4-9	MJE1290		MJE6044		MLED660	4-110	MM4009	4-18
MJ3042		MJE51	4-5	MJE1291		MJE6045		MLED900	4-111	MM4010	4-18
MJ3055		MJE52	4-5	MJE1660				MLED910	4-111		
MJ3101		MJE53	4-5	MJE1661		MTG HDWR KITS		MLED930	4-111	RF	
MJ3201		MJE101		MJE2010		MK10				MM4018	
MJ3202		MJE102		MJE2011		MK10B				MM4019	
						MK15					

CATALOG INDEX (continued)

DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE
MR250-1	4-92	MR1130	4-87	MRD810	4-111	MRF817	4-56	MV1660	4-69	MZ805	
MR250-2	4-92	MR1205FL	4-88	MRD3050	4-112	MRF818	4-56	MV1662	4-69	MZ810	4-81
MR250-3	4-92	MR1209FL	4-88	MRD3051	4-112	MRF823	4-56	MV1664	4-69	MZ820	4-81
MR250-4	4-92	MR1215FL	4-88	MRD3054	4-112	MRF824	4-56	MV1666	4-69	MZ840	4-81
MR250-5	4-92	MR1215SL	4-88	MRD3055	4-112	MRF825	4-56			MZ821	
MR327		MR1219FL	4-88	MRD3056	4-112	MRF835	4-56			MZ821A	
MR328		MR1219SL	4-88			MRF901	4-59	Pwr Varactors		MZ823	
MR330		MR1245FL	4-88			MRF905	4-59	MV1805C,J	4-59	MZ823A	
MR331		MR1249FL	4-88			MRF5174		MV1809C1	4-59	MZ825	
MR500	4-86	MR1245SL	4-88			MRF5175	4-58			MZ825A	
MR501	4-86	MR1249SL	4-88	TRANSISTORS		MRF5176	4-58			MZ827	
MR502	4-86	MR1262FL		RF		MRF5177	4-58	Tuning		MZ827A	
MR504	4-86	MR1265FL	4-88	MRF207	4-55	MRF5177A	4-58	MV1858A		MZ935	
MR506	4-86	MR1269FL	4-88	MRF208	4-55	MRF8004	4-53	MV1858D	4-66	MZ935A	
MR508	4-86	MR1366	4-91	MRF209	4-55			MV1860A		MZ935B	
MR510	4-86	MR1376	4-91	MRF212	4-54			MV1860D	4-66	MZ936	
MR750	4-86	MR1386	4-91	MRF215	4-55			MV1862A		MZ936A	
MR751	4-86	MR1396	4-91	MRF216	4-55			MV1862D	4-66	MZ936B	
MR752	4-86	MR1815SL	4-88	MRF221	4-55			MV1863A		MZ937	
MR754	4-86	MR1819SL	4-88	MRF222	4-55			MV1863D	4-66	MZ937A	
MR756	4-86	MR2000S	4-87	MRF223	4-55			MV1864A		MZ937B	
MR800	4-91	MR2001S	4-87	MRF224	4-55			MV1864D	4-66	MZ938	
MR801	4-91	MR2002S	4-87	MRF225	4-55			MV1865A		MZ938A	
MR802	4-91	MR2004S	4-87	MRF226	4-55			MV1865D	4-66	MZ938B	
MR804	4-91	MR2006S	4-87	MRF230	4-54	DIODES		MV1866	4-66	MZ941	
MR806	4-91	MR2008S	4-87	MRF231	4-54	SS Plastic		MV1866A		MZ941A	
MR810	4-91	MR2010S	4-87	MRF232	4-54	MSD6100	4-82	MV1866D	4-66	MZ941B	
MR811	4-91	MR2083HA		MRF233	4-54	MSD6101	4-82	MV1868A		MZ942A	
MR812	4-91	MR2266		MRF234	4-54	MSD6102	4-82	MV1868B	4-66	MZ942B	
MR813		MR2271		MRF235	4-54	MSD7000	4-82	MV1870	4-66	MZ943	
MR814	4-91	MR2272		MRF237	4-54	MSS1000		MV1870A		MZ943A	
MR816	4-91	MR2273		MRF243	4-55	MSS1001		MV1870D	4-66	MZ943B	
MR817	4-91	MR2500	4-87	MRF244	4-55	MSS1002				MZ944	
MR818	4-91	MR2501	4-87	MRF245	4-55			DIODES		MZ944A	
MR820	4-91	MR2502	4-87	MRF304		THYRISTORS		VVC		MZ944B	
MR821	4-91	MR2502	4-87	MRF305	4-58	Unijunction		MV1871	4-66	MZ3154	
MR822	4-91	MR2504	4-87	MRF306	4-58	MU10	4-104	MV1872	4-66	MZ3154A	
MR824	4-91	MR2506	4-87	MRF313	4-58	MU20	4-104	MV1874	4-66	MZ3155	
MR826	4-91	MR2508	4-87	MRF401	4-57	MU2646	4-104	MV1876	4-66	MZ3155A	
MR830	4-91	MR2510	4-87	MRF402	4-57	MU2646M		MV1877	4-66	MZ3156	
MR831	4-91	MR2500S	4-87	MRF404	4-53	MU4891	4-104	MV1878	4-66	MZ3156A	
MR832	4-91	MR2501S	4-87	MRF404	4-53	MU4892	4-104	MV2101	4-67	MZ2360	4-82
MR834	4-91	MR2502S	4-87	MRF406	4-53	MU4893	4-104	thru		MZ2361	4-82
MR836	4-91	MR2504S	4-87	MRF418		MU4894	4-104	MV2115	4-67	MZ2362	4-82
MR840		MR2506S	4-87	MRF419				MV2201			
MR841		MR2508S	4-87	MRF420	4-53	Unidirectional		MV2203		Zener	
MR842		MR2510S	4-87	MRF421	4-53	MUS4987	4-105	MV2205		MZ4614	4-77
MR844		MR2525	4-83	MRF422	4-57	MUS4988	4-105	MV2209		MZ4615	4-77
MR846		MR2525R	4-83	MRF425	4-53			MV2301		MZ4616	4-77
MR846		MR4933		MRF427	4-57	DIODES		MV3102		MZ4617	4-77
MR850	4-91	MR4934		MRF428	4-57	VVC		MV3103	4-67	MZ4618	4-77
MR851	4-91	MR4935		MRF432	4-53	MV104	4-70	MV3140	4-67	MZ4619	4-77
MR852	4-91	MR4936		MRF433	4-53	MV104G	4-70	MV3141	4-67	MZ4620	4-77
MR854	4-91	MR4937		MRF449	4-53	MV109	4-70	MV3142	4-67	MZ4621	4-77
MR856	4-91	MR5005	4-87	MRF449A	4-53	MV205		MV3501	4-68	MZ4622	4-77
MR860	4-91	MR5010		MRF450	4-53	MV206		MV3502	4-68	MZ4623	4-77
MR861	4-91	MR5020		MRF450A	4-53	MV209	4-70	MV3503	4-68	MZ4624	4-77
MR862	4-91	MR5030		MRF452		MV830	4-66	MV3504	4-68	MZ4625	4-77
MR864	4-91	MR5040	4-87	MRF452A		thru		MV3505	4-68	MZ4626	4-77
MR866	4-91	MRA133	4-90	MRF454	5-53	MV840	4-66	MV3506	4-68	MZ4627	4-77
MR870	4-91	MRA133B	4-90	MRF454A	5-53	MV1401	4-69	MV3507	4-68	MZ4678	
MR871	4-91	MRA163	4-90	MRF501	5-60	MV1403	4-69			MZ4679	
MR872	4-91	MRA163B	4-90	MRF502	5-60	MV1404	4-69	Tuning		MZ4680	
MR874	4-91	MRA333	4-90	MRF509	4-58	MV1405	4-69	MVAM-1	4-71	MZ4681	
MR876	4-91	MRA333B	4-90	MRF511	4-60	MV1620	4-69	MVAM2	4-71	MZ4682	
MR890		MRA363		MRF515	4-54	MV1622	4-69	MV12097	4-68	MZ4683	
MR891		MRA363B		MRF517	4-60	MV1624	4-69	thru		MZ4684	
MR892				MRF519	4-60	MV1626	4-69	MV12109	4-68	MZ4685	
MR894		OPTOS		MRF531	4-60	MV1628	4-69	MVS460	4-82	MZ4686	
MR896		Photodetectors		MRF532	4-60	MV1630	4-69			MZ4687	
MR910	4-91	MRD14B	4-112	MRF603		MV1632	4-69	DIODES		MZ4688	
MR911	4-91	MRD120	4-112	MRF604	4-54	MV1634	4-69	Zener		MZ4689	
MR912	4-91	MRD121	4-112	MRF606		MV1636	4-69	MZ500-1		MZ4690	
MR914	4-91	MRD150	4-112	MRF607	4-54	MV1638	4-69	thru		MZ4691	
MR916	4-91	MRD300	4-111	MRF618	4-55	MV1640	4-69	MZ500-40		MZ4692	
MR917	4-91	MRD310	4-111	MRF619		MV1642	4-69	MZ1000-1		MZ4693	
MR918	4-91	MRD360	4-112	MRF620		MV1644	4-69	thru		MZ4694	
MR1120	4-87	MRD370	4-112	MRF621		MV1646	4-69	MZ1000-37		MZ4695	
MR1121	4-87	MRD450	4-112	MRF626	4-55	MV1648	4-69			MZ4696	
MR1122	4-87	MRD500	4-112	MRF627		MV1650	4-69	TC		MZ4697	
MR1123	4-87	MRD510	4-112	MRF628		MV1652	4-69	MZ605		MZ4698	
MR1124	4-87	MRD601	4-111	MRF629	4-55	MV1654	4-69	MZ610	4-81	MZ4699	
MR1125	4-87	MRD602	4-111	MRF644	4-55	MV1656	4-69	MZ620	4-81	MZ4700	
MR1126	4-87	MRD603	4-111	MRF646	4-55	MV1658	4-69				
MR1128	4-87	MRD604	4-111	MRF816	4-56						

CATALOG INDEX (continued)

DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE	DEVICE	PAGE
		Zener Chips		MZC20A10	4-77	MZC160A10	4-77	MZC11B10	4-77	MZC100B10	4-77
MZ4701		MAC2.4A10	4-77	MZC22A10	4-77	MZC170A10	4-77	MZC12B10	4-77	MZC110B10	4-77
MZ4702		MZC2.7A10	4-77	MZC24A10	4-77	MZC180A10	4-77	MZC13B10	4-77	MZC120B10	4-77
MZ4703		MZC3.0A10	4-77	MZC27A10	4-77	MZC200A10	4-77	MZC15B10	4-77	MZC130B10	4-77
MZ4704		MZC3.3A10	4-77	MZC30A10	4-77	MZC1.8B10	4-77	MZC16B10	4-77	MZC140B10	4-77
MZ4705		MZC3.6A10	4-77	MZC33A10	4-77	MZC2.0B10	4-77	MZC18B10	4-77	MZC150B10	4-77
MZ4706		MZC3.9A10	4-77	MZC36A10	4-77	MZC2.2B10	4-77	MZC20B10	4-77	MZC160B10	4-77
MZ4707		MZC4.3A10	4-77	MZC39A10	4-77	MZC2.4B10	4-77	MZC22B10	4-77	MZC170B10	4-77
MZ4708		MZC4.7A10	4-77	MZC43A10	4-77	MZC2.7B10	4-77	MZC24B10	4-77	MZC180B10	4-77
MZ4709		MZC5.1A10	4-77	MZC47A10	4-77	MZC3.0B10	4-77	MZC27B10	4-77		
MZ4710		MZC5.6A10	4-77	MZC51A10	4-77	MZC3.3B10	4-77	MZC30B10	4-77	4-Layer	
MZ4711		MZC6.2A10	4-77	MZC56A10	4-77	MZC3.6B10	4-77	MZC33B10	4-77	M4L3052	
MZ4712		MZC6.8A10	4-77	MZC62A10	4-77	MZC3.9B10	4-77	MZC36B10	4-77	M4L3053	
MZ4713		MZC7.5A10	4-77	MZC68A10	4-77	MZC4.3B10	4-77	MZC39B10	4-77	M4L3054	
MZ4714		MZC8.2A10	4-77	MZC75A10	4-77	MZC4.7B10	4-77	MZC43B10	4-77	MTTL	
MZ4715		MZC9.1A10	4-77	MZC82A10	4-77	MZC5.1B10	4-77	MZC47B10	4-77	XC117	2-15
MZ4716		MZC10A10	4-77	MZC91A10	4-77	MZC5.6B10	4-77	MZC51B10	4-77		
MZ4717		MZC11A10	4-77	MZC100A10	4-77	MZC6.2B10	4-77	MZC56B10	4-77	LINEAR	
MZ5555	4-83	MZC12A10	4-77	MZC110A10	4-77	MZC6.8B10	4-77	MZC62B10	4-77	XC1302	3-24
MZ5556	4-83	MZC13A10	4-77	MZC120A10	4-77	MZC7.5B10	4-77	MZC68B10	4-77	XC1387	3-23
MZ5557	4-83	MZC15A10	4-77	MZC130A10	4-77	MZC8.2B10	4-77	MZC75B10	4-77	XC1389	3-23
MZ5558	4-83	MZC16A10	4-77	MZC140A10	4-77	MZC9.1B10	4-77	MZC82B10	4-77	XC1393	
		MZC18A10	4-77	MZC150A10	4-77	MZC10B10	4-77	MZC91B10	4-77	XC1399	3-22

