component news

Nov. 15, 1979 COMPANY CONFIDENTIAL Issue 276

How fast is FAST?

FAST is an acronym for Fairchild Advanced Schottky TTL. FAST circuits are made with Fairchild's isoplanar process; the same process used for the 100K ECL logic family. This process produces transistors with extremely small parasitic capacitances and f_T in excess of 5GHz, providing the speed/power product shown in Figure 1.

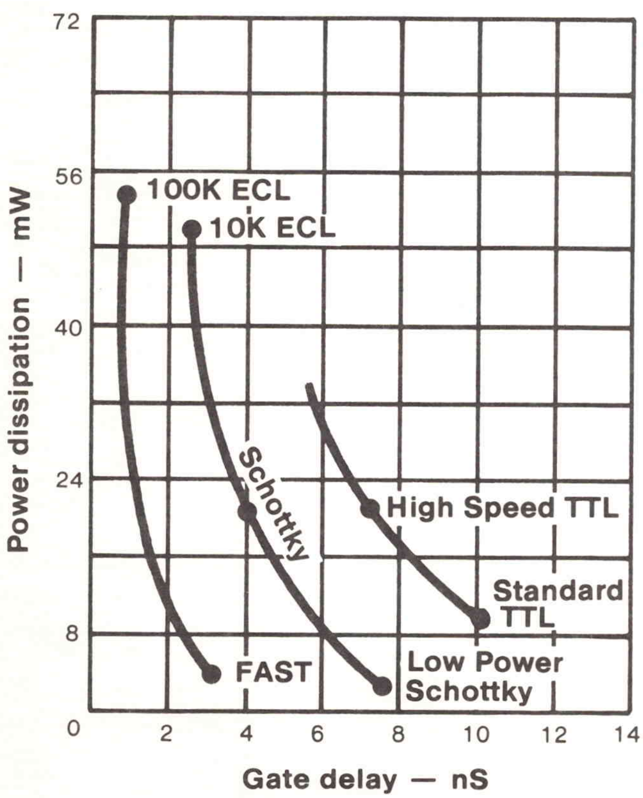

Figure 1

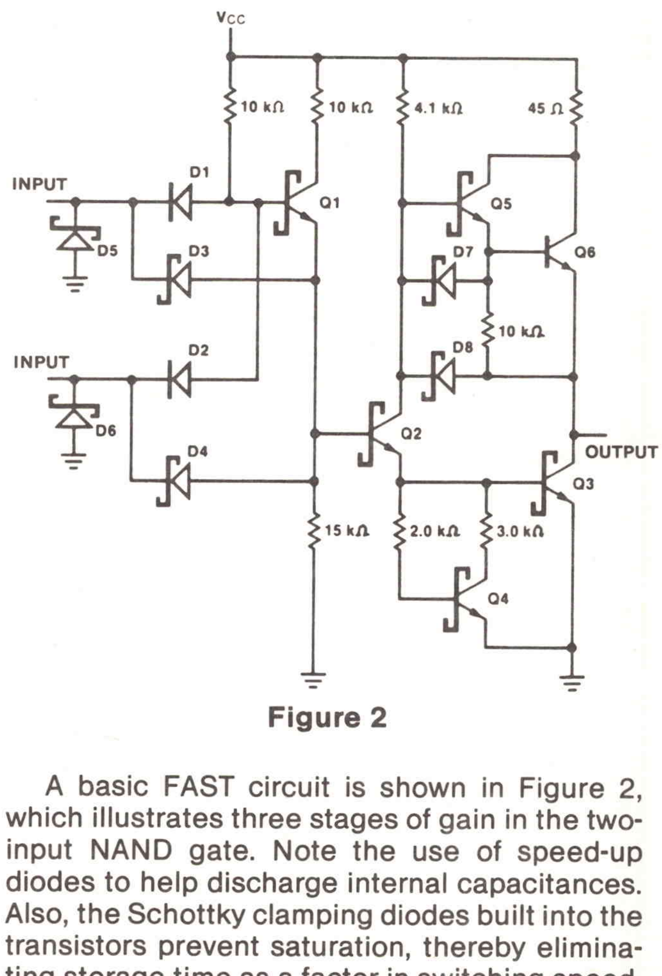

Figure 2

A basic FAST circuit is shown in Figure 2, which illustrates three stages of gain in the two-input NAND gate. Note the use of speed-up diodes to help discharge internal capacitances. Also, the Schottky clamping diodes built into the transistors prevent saturation, thereby eliminating storage time as a factor in switching speed. High gain is an advantage because it raises the input threshold voltage while keeping high drive capabilities.

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Also in this issue

Voltage transfer functions were measured at −55°C and 25°C. These plots showed an input-output transfer point centered between 0.8 volts and 2.0 volts giving a good balance between the high- and low-state noise margins.

Figure 3 shows the effects of load capacitance on propagation delay and transition time. Figure 4 shows I_{CC} on pin 7 of 74F04 as a function of temperature. Note the peak of I_{CC} at 0°C.

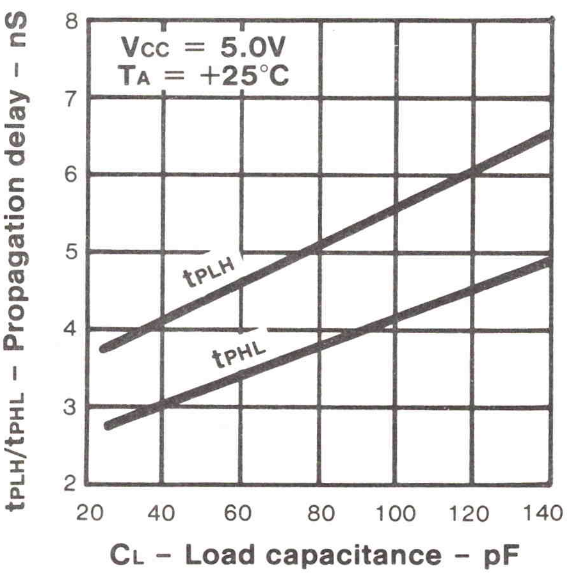

Figure 3

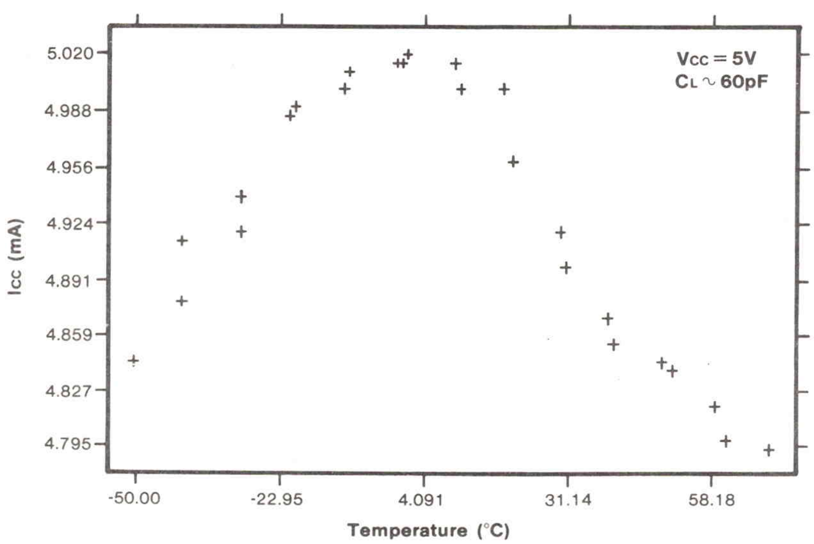

Figure 4

Figures 5 - 7 (page 3) show rise times of TTL, LSTTL and STTL respectively. Note variations in the slope of the waveforms. TTL has a slight over-shoot while LS has a long rise time in the last 10%. The Schottky part has about the "cleanest" waveform of the three. The curve is smooth and reaches its final value directly.

Now, compare these figures to Figure 8. Note the slight knee at about the 55% point. Also, the long rise time for the last 10% of the waveform. The following parts possess this waveform: 74F02, 74F04, 74F08 and 74F32. However, Fairchild did remedy the problem in all later parts.

Figure 9 shows the fall time of 74F04. Note that it is very "clean" with just a little over-shoot.

The FAST series devices scheduled for production are listed in Figure 10. FAST provides a good compromise between speed and power. Due to pin-for-pin compatibility with standard 74TTL series parts, FAST can be used to speed-up circuits using standard or LSTTL devices. Also, it can decrease power consumption of a Schottky-designed circuit.

Some of the parts listed in Figure 10 (page 4) show that many devices now have octal grouping. Some new functions have also been added to the family (74F521, 74F531, etc.). This new family of TTL parts should provide a much-needed speed/power improvement.

For more information about the FAST series, contact Dale Coleman (58-125) ext. 7607.

Editor's note: This article was compiled by Don Van Beek while working in the Digital Component Engineering group. Don now works in Memory and I/O Component Engineering. If you'd like to review his test results or receive a more detailed report, stop by 58-121, or call ext. 4663.

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7404

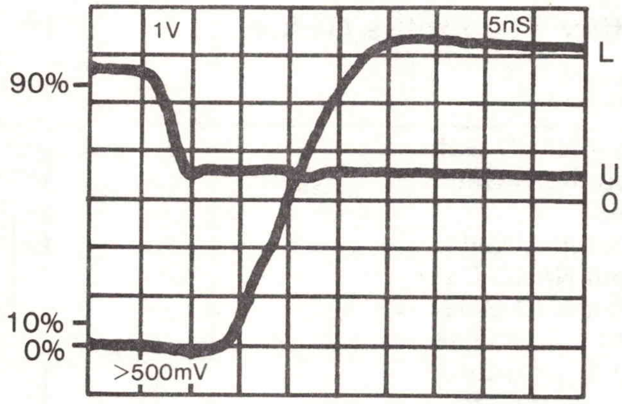


Figure 5 — TTL

Rise and Fall Times

Load was ~10pF
Frequency = 3mHz
Vcc = 5.0VDC
Temperature = Room temperature

Rise and fall time from
10% - 90% of final value

U = Input from PG502 pulse generator
L = Output from device
0 = Zero volts

74LS04

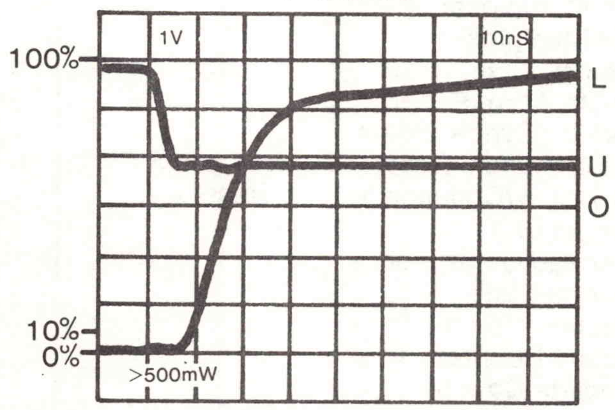


Figure 6 — LSTTL

74F04

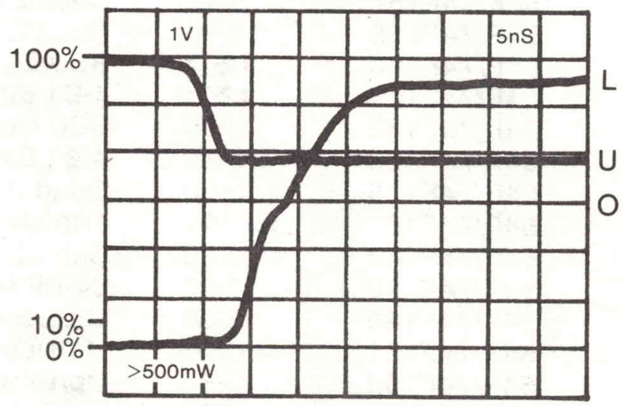


Figure 8 — FTTL

74S04

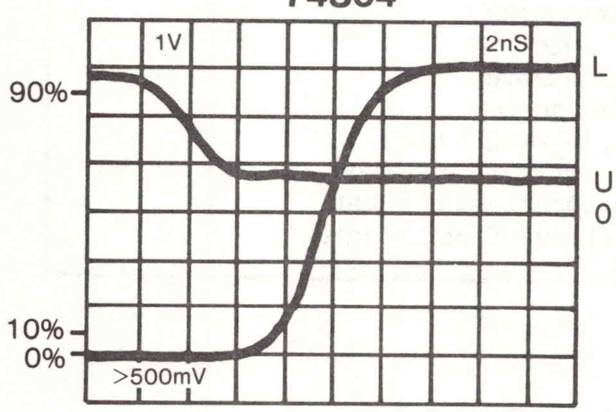


Figure 7 — STTL

74F04

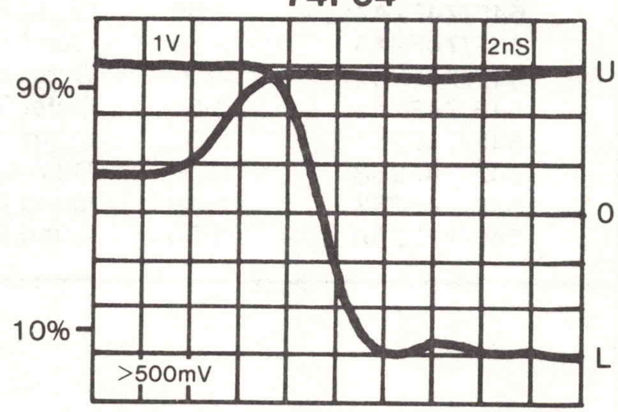


Figure 9 — FTTL

continued on page 4

Figure 10

Fairchild Advanced Schottky TTL Status Guide

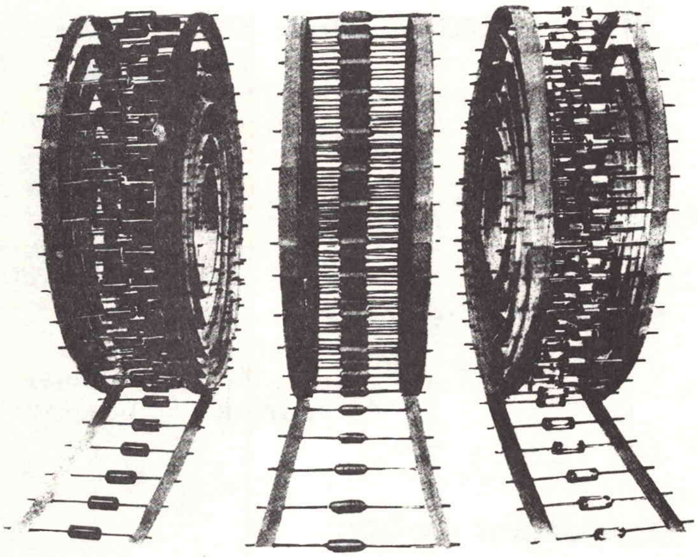
Device	Availability	Description
54F/74F00	Now	Quad 2-Input NAND Gate
54F/74F02	Now	Quad 2-Input NOR Gate
54F/74F04	Now	Hex Inverter
54F/74F08	Now	Quad 2-Input AND Gate
54F/74F10	Now	Triple 3-Input NAND Gate
54F/74F11	12-79	Triple 3-Input AND Gate
54F/74F20	12-79	Dual 4-Input NAND Gate
54F/74F32	Now	Quad 2-Input OR Gate
54F/74F64	6-80	AND/OR – Invert Gate
54F/74F74	Now	Dual D-Type Flip-Flop
54F/74F109	12-79	Dual JK Flip-Flop
54F/74F151	3-80	8-Input Multiplexer
54F/74F153	Now	Dual 4-Input Multiplexer
54F/74F157	Now	Quad 2-Input Multiplexer
54F/74F158	3-80	Quad 2-Input Multiplexer
54F/74F160	12-79	BCD Decade Ctr. Asyn. Reset
54F/74F161	12-79	4-Bit Binary Ctr. Asyn. Reset
54F/74F162	3-80	BCD Decade Ctr. Synch. Reset
54F/74F163	3-80	4-Bit Binary Ctr. Synch. Reset
54F/74F175	3-80	Quad D Flip-Flop w/Common Master Reset
54F/74F181	Now	Arithmetic Logic Unit
54F/74F182	3-80	Carry Look-Ahead Generator
54F/74F189	3-80	64-Bit Memory 3-State
54F/74F190	3-80	Up/Down Decade Counter
54F/74F191	12-79	Up/Down Binary Counter
54F/74F192	3-80	Up/Down Decade Counter
54F/74F193	3-80	Up/Down Binary Counter
54F/74F194	Now	4-Bit Bidirectional Universal Shift Register
54F/74F195	Obsolete	4-Bit Parallel Access Shift Register
54F/74F240	12-79	Octal Inv. Bus/Line Driver
54F/74F241	12-79	Octal Bus/Line Driver
54F/74F242	3-80	Quad Bus Transceiver
54F/74F243	3-80	Quad Bus Transceiver
54F/74F244	12-79	Octal Bus/Line Driver
54F/74F245	3-80	Octal Bus Transceiver
54F/74F251	3-80	8-Input Multiplexer 3-State
54F/74F253	12-79	Dual 4-Input Multiplexer 3-State
54F/74F257	Now	Quad 2-Input Multiplexer 3-State
54F/74F258	3-80	Quad 2-Input Multiplexer 3-State

Axial-leaded caps for auto insertion

Sprague Electric's type 292C monolythic ceramic capacitor has been accepted for 30 part numbers. For persons interested in applying these parts, a summary of the test results follows.

Two groups of parts were tested; a 0.01μF, ±10%, 50V group (similar to 281-0773-00), and a 0.10μF, ±20%, 50V group (similar to 281-0775-00).

Insulation resistance after life tests of 1000 hours at 200% rated voltage at 85°C showed the mean was over 100GΩ. The specification on Z5U parts is 5GΩ. The mean dissipation factor after life tests was 1.55%; the spec is 3%. Insulation resistance averaged over 150GΩ after humidity for ten days per MIL-STD-202MTD106. The spec allows 50GΩ insulation resistance.



Dielectric withstand voltage was tested at 250% of rated voltage applied from one to five seconds at 25°C. All parts tested passed without shorting. All parts also passed terminal strength tests (51 lbs. applied axially to MIL-STD-202 MTD211, test A).

The following temperature characteristics are available:

X7R — Changes less than 15% capacitance from −15°C to +125°C.
Z5U — Changes less than +22%, −56% capacitance from +10°C to +85°C.
NPO — Changes less than ±0.3% capacitance from −55°C to +125°C.

For complete test results, reference Test Report No. 15 in Optoelectronic & Passive Component Engineering, or contact **Ray Powell (58-299), ext. 6520.**

Preventing CMOS latch-up

Recent CMOS gates have shown an increased susceptibility to SCR-type latch-up. This latch-up occurs when the input or output of a CMOS gate is driven above the V_{DD} supply. When the part does latch-up, a low resistance path is formed from V_{DD} to V_{SS} and if the power supply can supply 1 amp or more, the device will be destroyed. The condition of an input or output of a CMOS gate going above V_{DD} can happen if certain sections of an instrument are powered up before others.

Some recent Motorola 14001 parts were observed to latch-up at input/output currents of about 10mA. This was observed by supplying input or output current from an independent supply; then turning on the V_{DD} supply to the CMOS device. Therefore, to avoid latch-up, limit the input or output current to 5mA or less in cases where the input or output can possibly go above V_{DD}.

Electrostatic discharges from persons can also cause this latch-up (but only when the discharge occurs while the CMOS device has power applied). Persons charged to as little as 1500 volts touching a CMOS input or output with a metallic intervening object (such as a screwdriver) can induce latch-up. With bare fingers, the voltage required was about 4KV. Thus, static handling precautions should be observed when servicing instruments containing CMOS, especially with the power on.

Ron Schwartz
92-336, ext. 1991

Lithium Battery Warning

We have received the following report about an accident involving an instrument which was powered by lithium batteries:

> "Apparently, an instrument which contained a 72-cell lithium battery power supply in a pressure case was stored in an inactive status in a crate in a warehouse. After the device had been in storage for months, it suddenly exploded. The end cap smashed through the crate and sheared off the leg of a person some distance away, while the rest of the case rocketed in an opposite direction through a building wall with great violence and some flames.
>
> There may have been a detonation of the lithium battery through some internal process, or because of a reaction from leaking gasses with plastic materials inside the instrument."

This report, which is part of the GIDEP "Safe-Alert" program, is only one of many similar accidents which have occurred with lithium batteries. We therefore do not recommend any applications using these batteries.

Byron Witt
58-299, ext. 5417

Memory Selection Guides

In a joint effort with the Parts Cataloging group, Memory and I/O Component Engineering is publishing and maintaining four Memory Selection Guides. This issue of **Component News** contains three of these guides: Static RAMs, Dynamic RAMs, and Field and Factory Programmable ROMs. The Mass Storage Selection Guide will be published at a later date.

Your comments would be helpful as we update and improve these guides.

Paul Gray, manager
Memory & I/O Comp. Eng. (ext. 4663)

Fred Schade, manager
Parts Cataloging (ext. 7976)

Persons claiming to be representatives of Supra Products, a Salem, Oregon firm, have called or approached members of the Component Engineering team saying they are associated with our group in a private project or endeavor. The representatives have requested help with component problems. Unfortunately, it appears that no such association between our two companies exists.

It is suggested that all outside telephone calls of this nature be carefully checked out before supplying any information.

New component engineer

Dale Coleman has joined the Digital Component Engineering group, with responsibility for ECL, Schottky and bit-slice components. Dale previously worked for Burroughs Corporation as a component engineer, and he has a BSEE degree from the Massachusetts Institute of Technology.

Dale can be reached at 58-125, ext. 7607.

Steve Pataki, manager
Component Engineering

Important Notice:

It has come to our attention that people are changing ROM "160-xxxx-xx" part numbers to the "062-xxxx-xx" number when issuing Bills of Material and other internal paperwork. **This should not be done.**

The "062" number is only a technical sheet used to inform our vendors of the Tek specification. It does not replace the "160" part number. The "062" is only required on the PPIF to alert specification personnel as to the class of ROM required.

Please direct any questions about these part numbers for ROMs to **Don VanBeek, ext. 4663.**

TECHNICAL STANDARDS

The function of Technical Standards is to identify, describe and document standard processes, procedures, and practices within the Tektronix complex, and to ensure these standards are consistent with established national and international standards. Technical Standards also provides a central repository for standards and specifications required at Tektronix.
Chuck Sullivan, manager (41-260)

DIN (German Standards Institute)

English translations of DIN standards are now available from Heyden & Son, Inc., Philadelphia, and can be ordered through Technical Standards. These DIN standards are in a 'high state-of-the-art' condition and have much value to American industry, including Tektronix. Further information is available from Technical Standards, ext. 241, Town Center.

new publications available from Technical Standards

ANSI B47.1A-1978 Gage Blanks (Metric Translation of ANSI B47.1-1974)
ANSI H35.2(M)-1978 Dimensional Tolerances for Aluminum Mill Products
ANSI X3.17-1977 Character Set and Print Quality for Optical Character Recognition
ANSI X3.25-1976 Character Structure and Character Parity Sense for Parallel-by-bit Data Communication in the American National Standard Code for Information Interchange
ANSI X3.32-1973 Graphic Representation of the Control Characters of American National Standard Code for Information Interchange
ANSI X3.4-1977 Code for Information Interchange
ANSI X3.5-1970 Flowchart Symbols and Their Usage in Information Processing
ANSI X3.50-1976 Representations for U.S. Customary, S1, and Other Units to be Used in Systems with Limited Character Sets
ANSI X3.57-1977 Structure for Formatting Message Headings for Information Interchange using the American National Standard Code for Information Interchange for Data Communication System Control
ANSI X3.60-1978 For Minimal BASIC
ANSI X3.62-1979 For paper used in Optical Character Recognition Systems
ANSI X3.66-1979 For Advanced Data Communication Control Procedures (ADCCP)
ANSI X3.9-1978 Programming Language FORTRAN
ANSI X4.6-1979 American National Standard for 10-Key Keyboard for Adding and Calculating Machines
ANSI Y14.2M-1979 Line Conventions and Lettering
ANSI Y32.10-1967 Graphic Symbols for Fluid Power Diagrams
ANSI Z53.1-1979 Safety Color Code for Marking Physical Hazards
EIA-RS-186-E Standard Test Methods for Passive Electronic Component Parts
EIA-RS-380-A Small Contact Standard for Electrical Connectors
EIA-RS-404 Standard for Start-Stop Signal Quality Between Data Terminal Equipment and Non-Synchronous Data Communication Equipment
EIA-RS-431 Electrical Interface Between Numerical Control and Machine Tools
EIA-RS-437.3 Subminiature Sensitive Switches
EIA-RS-437.4 Sub-Subminiature Sensitive Switches
EIA-RS-444 Dimensional and Electrical Characteristics Defining Dual In-Line Lead Socket Panels
EIA-RS-451 Resistor Networks — Fixed Film
EIA-RS-452 Fixed Film Resistors — High Resistance/High Voltage

continued on next page

more Technical Standards

IEC 191-3B-1978 Mechanical Standardization of Semiconductor Devices, Part 3, General rules for the preparation of outline drawings of integrated circuits
IEC 191-2H-1978 Same — Dimensions
IEC 282-1A-1978 High Voltage Fuses
IEC 304-1978 Standard Colors for PVC insulation for low-frequency cables and wires
IEC 344-1971 Amendment 1978, Guide to Calculation of Resistance of plain and tinned copper conductors and low-frequency cables and wires
IEC 384-1-1972 Fixed Capacitors for Use in Electronic Equipment, Terminology and Methods of Test (w/supplements)
IEEE STD-675-1979 Multiple Controllers in a CAMAC Crate
IPC-A-600C Acceptability of Printed Boards
IPC-AM-372 Electroless Copper Film for Additive Printed Boards
IPC-D-310A Artwork Generation and Measurement Techniques
IPC-D-320 Printed Board, Rigid, Single- and Double-Sided, End Product Specification
IPC-D-350B Printed Board Description in Digital Form
IPC-SM-840 Qualification and Performance of Permanent Polymer Coating (Solder Mask) for Printed Boards
UL 844, May 1978 Electric Lighting Fixtures (for use in hazardous locations)

For information on these publications, please call Technical Standards, Town Center, ext. 241.

ComponentNews NewComponents

This column is designed to provide timely information regarding new components, vendors, availability and price. "New Components" can also be used as an informal update to the Common Design Parts Catalogs. Samples may or may not be available in Engineering Stock.

Vendor	No.	Description	When Available	P/N	Approx. Cost	Engineer to contact
		analog devices				
Intersil	ICL7107	A/D Converter, 3½ digit	now	156-1435-00	$7.40	Chris Martinez, 7709
Motorola	MC1403AU	V. Reference, 2.5V ± 1%, 25ppm, 8 pin DIP	now	156-1439-00	1.54	Gary Sargeant, 5345
Motorola	MC1404AU5	V. Reference, 5.0V ± 1%, Trimmable, 25ppm, 8 pin DIP	now	156-1437-00	2.20	Gary Sargeant, 5345
Motorola	MC1404AU6	V. Reference, 6.25V ± 1%, Trimmable, 25ppm, 8 pin DIP	now	156-1436-00	2.20	Gary Sargeant, 5345
TRW	TVP1505A	Transient Suppressor, 13V, for 12V power supplies, 1.5 Joule, 82 Amp surge for 1 mS	now	in process	1.74	Gary Sargeant, 5345
		optoelectronic and passive devices				
E. F. Johnson	186-xxxx-xxx	Capacitor, variable, air dielectric, very small	now	no P/Ns	.95	Alan LaValle, 5415
Allen Bradley	208B01	Resistor network, fixed film, 4, 100Ω, 2%, 0.3W each	week 1	307-0717-00	.35	Ray Powell, 6520
Allen Bradley	210A152F	Resistor network, fixed film, 9, 1.5KΩ, 1% 0.15W each	week 1	307-0719-00	.35	Ray Powell, 6520
Allen Bradley	210A680	Resistor network, fixed film, 5, 68Ω, 2%, 0.3W each	week 1	no P/N	.35	Ray Powell, 6520
Bourns	4308R-101 682	Resistor network, fixed film, 7, 6.8KΩ, 2%, 1.0W (CS-CR)	now	307-0597-00	.25	Ray Powell, 6520
Dale	MSP10A01-501F	Resistor network, fixed film, 9, 500Ω, 1%, 0.15W each	week 1	307-0720-00	.35	Ray Powell, 6520
Dale	RS2B-B330-ROF	Resistor WW, fixed, 330Ω, 1%, 2.5W, (CS-CR)	now	308-0443-00	.19	Ray Powell, 6520
Stackpole	9-8-5-R680Ω	Resistor network, fixed film, 8, 680Ω, 5% 0.19W each	week 1	307-0718-00	.35	Ray Powell, 6520

Memory Selection Guide

Factory Programmable ROMs (XROMs)

Function	Process	Technology	Bit Geometry (bits)	Bit Geometry (organization)	Part Number	Vendor	Vendor No.	Pins	Supply (V)	Power (mW) Active	Power (mW) Standby	Read Access Time (nS)
MROM	BIPOLAR	TTL	256	32 x 8	062-xxxx-xx	Nat. Semi.	DM8598NA	16	+5	350		30
MROM	BIPOLAR	TTL	256	32 x 8	062-xxxx-xx	T. I.	SN7488AJ	16	+5	400		35
MROM	BIPOLAR	TTL	4096	512 x 8	062-xxxx-xx	Signetics	N8205N	24	+5	850		75
MROM	BIPOLAR	TTL	16384	2K x 8	062-4176-xx	Signetics	82S291FN	24	+5	900		100
MROM	MOS	NMOS	2048	256 x 8	062-xxxx-xx	Nat. Semi.	MM5243	24	−12,+5	1000		1000
MROM	MOS	NMOS	2240	64 x 5 x 7	062-4181-xx	G. I.	RO-3-2513	24	+5	175		450
MROM	MOS	NMOS	8064	128 x 7 x 9	062-4180-xx	Motorola	MCM66700	24	+5	525		350
MROM	MOS	NMOS	8192	1K x 8	062-4173-xx	Motorola	MCM68A308L	24	+5	650		500
MROM	MOS	NMOS	8192	1K x 8	062-4175-xx	AMD	AM9208DC	24	Not recommended for new design			
MROM	MOS	NMOS	8192	1K x 8	062-4178-xx	Signetics	2607FN	24	+5	525		450
MROM	MOS	NMOS	8192	1K x 8	062-xxxx-xx	EA	P8308A	24	+5	525		500
MROM	MOS	NMOS	16384	2K x 8	062-4171-xx	AMI	6831B	24	+5	300		450
MROM	MOS	NMOS	16384	2K x 8	062-4174-xx	Motorola	MCM68A316E	24	+5	650		500
MROM	MOS	NMOS	16384	2K x 8	062-4177-xx	Motorola	MCM6832L	24	±5	700		750
MROM	MOS	NMOS	16384	2K x 8	062-4179-xx	Signetics	N2616N	24	+5	1000		450
MROM	MOS	NMOS	16384	2K x 8	062-xxxx-xx	Motorola	MCM6509L	24	Not recommended for new design			
MROM	MOS	NMOS	16384	2K x 8	062-xxxx-xx	Motorola	MCM6831E/L	24	+5	650		500
MROM	MOS	NMOS	16384	2K x 8	062-xxxx-xx	G. I.	8316A	24	+5	200		850
MROM	MOS	NMOS	16384	2K x 8	062-xxxx-xx	Intel	C8316A	24	+5	1000		1000
MROM	MOS	NMOS	32768	4K x 8	062-4170-xx	Synertek	SYC2332	24	+5	750		480
MROM	MOS	NMOS	32768	4K x 8	062-4172-xx	Signetics	2632FN	24	+5	400		450
MROM	MOS	NMOS	32768	4K x 8	062-4182-xx	T. I.	TMS4732	24	+5	400		450
MROM	MOS	NMOS	32768	4K x 8	062-4504-xx	Motorola	MCM68A332	24	+5	400		350
MROM	MOS	NMOS	65536	8K x 8	062-4325-xx	Mostek	36000P-4	24	+5	220	35	250
MROM	MOS	NMOS	65536	8K x 8	062-4503-xx	Mostek	36000P-5	24	+5	220	35	300
MROM	MOS	PMOS	2048	256 x 8	062-xxxx-xx	Nat. Semi.	MM5213	24	−12,+5	640		450
MROM	MOS	PMOS	4032	64 x 7 x 9	062-xxxx-xx	EA	EA4001	24	Not recommended for new design			
MROM	MOS	PMOS	4096	512 x 8	062-xxxx-xx	Signetics	N2530	24	Not recommended for new design			
MROM	MOS	PMOS	4096	512 x 8	062-xxxx-xx	Nat. Semi.	MM5214	24	−12,+5	700		1000
MROM	MOS	PMOS	5120	512 x 10	062-4497-xx	EA	EA43356	24	Not recommended for new design			
MROM	MOS	PMOS	5120	512 x 10	062-4497-xx	EA	EA43357	24	Not recommended for new design			
MROM	MOS	PMOS	5120	512 x 10	062-4497-xx	EA	EA4000	24	Not recommended for new design			
MROM	MOS	VMOS	16384	2K x 8	062-4502-xx	AMI	S4216		Not recommended for new design			
MROM	MOS	VMOS	65536	8K x 8	062-4499-xx	AMI	S4264		Not recommended for new design			
ROM	BIPOLAR	TTL	4032	64 x 7 x 9	156-1170-xx	Nat. Semi.	DM8678CABJ	16	+5	775		55
ROM	MOS	NMOS	1024	1K x 1	156-0236-xx	AMS	C01841	40	Not recommended for new design			
ROM	MOS	NMOS	1024	1K x 1	156-0237-xx	AMS	C01839	40	Not recommended for new design			
ROM	MOS	NMOS	2240	64 x 5 x 7	156-0337-xx	MMI	6055	18	Not recommended for new design			
ROM	MOS	NMOS	2240	32 x 7 x 10	156-0102-xx	T. I.	TMS4100		Not recommended for new design			
ROM	MOS	NMOS	2240	32 x 7 x 10	156-0103-xx	T. I.	TMS4100		Not recommended for new design			
ROM	MOS	NMOS	2240	32 x 7 x 10	156-0104-xx	T. I.	TMS4100		Not recommended for new design			
ROM	MOS	NMOS	2304	256 x 9	156-0209-xx	EA	EA3021	24	Not recommended for new design			
ROM	MOS	NMOS	2376	264 x 9	156-0894-xx	Mostek	MCS1020	16	Not recommended for new design			
ROM	MOS	NMOS	4032	64 x 7 x 9	156-0363-xx	Fairchild	3258DDC	16	Not recommended for new design			
ROM	MOS	NMOS	4096	512 x 8	156-0214-xx	EA	EA3304	24	Not recommended for new design			
ROM	MOS	NMOS	8064	128 x 7 x 9	156-0950-xx	Motorola	MCM6575	24	+5	440		350
ROM	MOS	NMOS	8064	128 x 7 x 9	156-0952-xx	Motorola	MCM6581/L	24	−3, +5	800		400
ROM	MOS	NMOS	8064	128 x 7 x 9	156-1168-xx	Motorola	MCM6571A	10	−3 +5	800		500
ROM	MOS	PMOS	2048	256 x 9	156-0244-xx	Intel	1301-0044	24	−9, +5	2000		1000
ROM	MOS	PMOS	3072	64 x 6 x 8	156-0871-xx	Signetics	N2516		Not recommended for new design			

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Memory Selection Guide

Field Programmable ROMs (XROMs)

Process	Bit Geometry (Bits)	Bit Geometry (Organization)	Part Number	Vendor	Vendor No.	Pins	Supply (V)	Power (mW) Active	Power (mW) Standby	Read Access Time (nS)
PROM / Bipolar / ECL	256	32 x 8	156-1037-xx	Signetics	10139	16	−5.2	580		15
PROM / Bipolar / STTL	256	32 x 8	156-0305-xx	AMD	27S18	16	+5	450		40
			156-0785-xx	Intersil	IM5610CDE	16	+5	550		40
				Nat. Semi.	DM8578N	16	+5	550		40
			156-1151-xx	Nat. Semi.	DM74S288J	16	+5	550		30
			156-1325-xx	T. I.	SN74S188J	16	+5	400		25
	1024	256 x 4	156-0737-xx	Nat. Semi.	DM8574	16	+5	400		60
			156-0905-xx	Fairchild	93427DC	16	+5	550		40
			156-1343-xx	Signetics	N82S129J	16	+5	600		50
	4096	512 x 8	156-0769-xx	Signetics	N82S115F	24	+5	925		90
			156-0903-xx	Intel	D3624-4	24	+5	850		60
			156-0971-xx	Intel	P/D3604L-6	24	+5	700	225	90
			156-1372-xx	T. I.	SN74S472J	16	+5	675		75
			156-1392-xx	MMI	6349-1J	20	+5	775		70
	4096	1K x 4	156-1213-xx	MMI	6353-1J	18	+5	875		60
	8192	1K x 8	156-0960-xx	Nat. Semi.	74S471J	20	+5	750		75
				T. I.	SN74S471J	20	+5	950		75
			156-0969-xx	Intel	D3608	24	+5	950		80
			156-0973-xx	Signetics	N82S2708E	24	+5	925		70
			156-0976-xx	Signetics	N82S181F	24	+5	800		70
	8192	2K x 4	156-1182-xx	Signetics	N82S185F	18	+5	600		100
	16384	2K x 8	156-1354-xx	Signetics	N82S191	24	+5	875		80
PROM / Bipolar / TTL	2048	512 x 4	156-0859-xx	MMI	6306-1J	16	+5	650		60
			156-1146-xx	Intersil	5604	16	+5	700		70
PROM / MOS / PMOS	2040	256 x 8	156-0133-xx	Intel	1601	24	Not recommended for new design			
			156-0346-xx	Intel	1602A	24	−9,+5	2000		1000
EPROM / MOS / NMOS	2048	256 x 8	156-0380-xx	Intel	1702A	24	Not recommended for new design			
			156-0463-00	Nat. Semi.	MM5203Q	24	−12,+5	730		625
	4096	512 x 8	156-0528-xx	Nat. Semi.	MM5204N	24	Not recommended for new design			
			156-0689-xx	Intel	C2704	24	Not recommended for new design			
	8192	1K x 8	156-0708-xx	Motorola	MCM2708L	24	±5,+12	800		450
				Intel	C2708	24	±5,+12	800		450
				Nat. Semi.	MM2708Q	24	±5,+12	800		450
	16384	2K x 8	156-1017-xx	Intel	B2716	24	+5	525	132	450
			156-1101-xx	T. I.	TMS2716JL	24	±5,+12	500		450
	32768	4096 x 8	156-1403-xx	Intel	2732	24	+5	750	150	450

Memory Selection Guide
Static RAMs (SRAMs)

Process	Type	Bits	Bit Geometry	Part Number	Vendor	Vendor No.	Pins	Supply (V)	I_{CC} (mA) Active	I_{CC} (mA) Standby	Cycle Time (nS) Read (Max)	Cycle Time (nS) Write (Min)
BIPOLAR	ECL	64	16 x 4	156-0847-xx	Motorola	MCM10145LDS	16	Not recommended for new design				
				156-0881-xx	Fairchild	95400DC	16	Not recommended for new design				
		128	128 x 1	156-1035-xx	Motorola	MCM10147L	16	Not recommended for new design				
					Fairchild	10405DC	16	Not recommended for new design				
		256	256 x 1	156-0657-xx	Motorola	MCM10144L	16	−5.2	−135		26	29
					Fairchild	10410DC	16	−5.2			30	35
					NEC-AM	UPB10144D	16	−5.2				
		1024	256 x 4	156-1297-xx	Fujitsu-Am	MB7072N	22	−5.2	−120		15	15
			1K x 1	156-0761-xx	Fairchild	10415A	16	−5.2	−150		20	22
					Motorola	MCM10146L	16	−5.2	−150		29	35
		4096	4K x 1	156-1227-xx	Fairchild	F10470DC	18	−5.2	−200		35	35
	TTL	64	16 x 4	156-0192-xx	T. I.	SN7489N	16	Not recommended for new design				
				156-0199-xx	Signetics	N82S25N/F	16	+5.	105		50.	40.
				156-0339-xx	Nat. Semi.	DM8599N	16	+5.	120		50.	45.
				156-0599-xx	Nat. Semi.	DM74LS189	16	+5.	25		80.	130.
				156-1189-xx	T. I.	SN74S189J4	16	+5.				
		256	256 x 1	156-0984-xx	Signetics	N82S116F	16	+5.	115		40.	25.
				156-1357-xx	AMD	AM29721DC/DCB2	16	+5.	70		45.	50.
		576	64 x 9	156-1171-xx	Signetics	N82S09-I	28	+5.	190		45.	45.
		1024	256 x 4	156-1223-xx	Fairchild	93422	22	+5.	155		45.	40.
				156-1293-xx	Fairchild	93L422	22	+5.	80		60.	55.
				156-1360-xx	Fairchild	93422DC/PC	22	+5.	155		45.	40.
MOS	CMOS	1024	256 x 4	156-0887-xx	Harris	HMI-6562-9	16	+5.	2.5	1μA	400	400.
		4096	1K x 4	156-1301-xx	Harris	HMI-6514-9	18	Not currently recommended				
				156-1359-xx	Harris	HMI-6514-5	18	Not currently recommended				
				156-1429-xx	NEC-μC	UPD444	18	+5.	40	50μA	450.	450.
	NMOS	256	256 x 1	156-0135-xx	Intel	P1101A	16	Not recommended for new design				
		320	80 x 4	156-0797-xx	Intel	P4002-2	16	Not recommended for new design				
		1024	128 x 8	156-0716-xx	Motorola	MCM6810	24	+5.	80		450.	450.
					AMI	S6810A	24	+5.	70		450.	450.
			256 x 4	156-0695-xx	Signetics	2606B-1	16	Not recommended for new design				
				156-0698-xx	Intel	B2101A-1	22	Not recommended for new design				
				156-1051-xx	Intel	B2101A-2	22	Not recommended for new design				
					Signetics	2101-2N	22	Not recommended for new design				
					DEC	2112323-00		Not recommended for new design				
				156-1052-xx	Intel	B2101A-4	22	Not recommended for new design				
					Signetics	2101-1N	22	Not recommended for new design				
					DEC	2112323		Not recommended for new design				
				156-1188-xx	Intel	D2111A-2	18	Not recommended for new design				
				156-1298-xx	Synertek	SY21H01-2	22	Not recommended for new design				
			1K x 1	156-0291-xx	Intel	2102	16	Not recommended for new design				
					Signetics	2102B	16	Not recommended for new design				
				156-0893-xx	Fairchild	2102FDC/PC	16	Not recommended for new design				
					Signetics	N21F02B	16	Not recommended for new design				
				156-1278-xx	Intel	CD2115A	16	+5.	125		45.	40.
		4096	1K x 4	156-0873-xx	AMD	AM9130APC/DC	22	Not recommended for new design				
				156-0943-xx	EMM-Semi	4804A	18	Not recommended for new design				
				156-1028-xx	Intel	2114	18	+5.	135		450.	450.
				156-1042-xx	AMD	AM9130BDC	22	Not recommended for new design				
				156-1127-xx	Intel	2114L	18	+5.	70		450.	450.
				156-1281-xx	Intel	P2114-2	18	+5.	100		200.	200.
				156-1323-xx	AMD	AM91L24CDC	18	+5.	50		300.	300.
			4K x 1	156-0987-xx	AMD	9140BDC	22	Not recommended for new design				
				156-1228-xx	Intel	CD2147	18	+5.	160	20	70.	70.
		8092	1K x 8	156-1382-xx	Mostek	4118-4	24	+5.	60	80	250.	250.
				156-1383-xx	Mostek	4118-2	24	+5.	60	80	150.	150.

Memory Selection Guide

Dynamic RAMs (DRAMs)

Function	Process	Bit Geometry	Part Number	Vendor	Vendor No.	Pins	Supply (V)	Power (mW) Active	Power (mW) Standby	CycTime (nS) Read (Max)	CycTime (nS) Write (Min)
DRAM	MOS PMOS	1024 x 1	156-0179-xx	Mostek	MK4006P	Not recommended for new design					
DRAM	MOS NMOS	4096 x 1	156-0862-xx	Motorola	MCM6604L	16	±5+12	600		350	500
				Mostek	MK4096K-11	16	±5+12	1W		350	500
			156-0924-xx	T. I.	TMS4051L	Not recommended for new design					
			156-0972-xx	Mostek	MK4027-4	16	±5+12	462		250	375
			156-1000-xx	Nat. Semi.	MM5280D	Not recommended for new design					
			156-1027-xx	Mostek	MK4027P-3	16	±5+12	1W		200	375
			156-1112-xx	Mostek	MK4027P-2	16	±5+12	1W		150	320
			156-1185-xx	Intel	2104A-1	16	±5+12	1W		150	320
DRAM	MOS NMOS	16384 x 1	156-0968-xx	Mostek	MK4116P-3	16	±5+12	462		200	375
				Nippon	416-2	16	±5+12	462		200	375
				ITT	4116-3J	16	±5+12	462		200	375
			156-1353-xx	Mostek	MK4116-2	16	±5+12	462		150	320
				Nippon	μPD416D-3	16	±5+12	462		150	320

COMPONENT NEWS

RICHARD DUNIPACE

92-701

component news

Published by Technical Communications
58-299, ext. 6867

Jacquie Calame, Editor
Birdie Dalrymple, Illustrator
Lola Janes, Writer

To submit an article, call Jacquie on ext. 6867, or stop by 58-299.
For mailing list changes, contact Kelly Turner at 19-123, ext. 5502.