component news

Sept. 15, 1980 COMPANY CONFIDENTIAL Issue 283

2118 DRAM meets 5-volt-only challenge

The Intel 2118 is the first 16K dynamic RAM on the market that appears to have met the challenge of requiring a single 5-volt power supply.

To produce the 2118, Intel uses a variation of their standard HMOS process which uses two levels of polysilicon rather than just one. The first poly together with a very thin silicon dioxide dielectric form the cell capacitors. The second poly forms the MOS transistor gates. The area of the individual cells was found to be relatively large, indicating that alpha particle immunity was a primary design objective. The entire design approach appears very conservative and directed at producing a solid 16K DRAM rather than just a test vehicle for the 64K DRAM design.

The consequences of 5 volts only

The most obvious consequence of using only a single 5-volt power supply, and probably the most agonizing to dynamic RAM designers, is the fact that there will be less charge stored in the cells. Because each cell is nothing more than a very small capacior for which

$$dQ = C\ dV,$$

it's not hard to see that a smaller voltage swing means less charge and therefore a reduced noise margin. Because the noise margin in existing 12-volt dynamic RAMs is already painfully small, this problem represents a major obstacle to be overcome with both process technology and circuit innovation.

A second consequence of using only a single power supply is being faced with the decision of generating substrate bias on chip or connecting the substrate directly to ground. Good substrate bias generators are difficult to design and consume large amounts of chip real estate and power. On the other hand, leaving the substrate at ground potential will nearly double the capacitance associated with N^+ diffusions, increase the sensitivity of transistor threshold voltages to changes in source to substrate voltage and reduce transistor punch-through voltages. A negative substrate voltage also provides the device with protection against negative undershoots on its input pins. The input pins are connected directly to an N^+ diffusion so if the input voltage becomes negative with respect to the substrate the diode becomes forward biased and large numbers of electrons will be injected into the substrate.

The process

Intel's HMOS process is characterized by very shallow arsenic doped source and drain regions, channel lengths as short as 2.5μm and a gate oxide thickness of about 700Å for enhancement transistors and 600Å for depletion transistors. The result is smaller transistors with higher gain and reduced parasitic capacitance. No less than

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two threshold adjusting implants are used to create four different threshold voltages. The four transistor types which result are:

1. A standard enhancement device with a threshold voltage of about 0.6 volts.
2. An intrinsic device which uses no adjusting implant and has a threshold voltage of about zero volts.
3. A shallow depletion mode transistor with a threshold voltage of approximately -1.5 volts.
4. A deep depletion mode transistor with a threshold voltage around -2.0 volts.

Because the 2118 has an on-chip substrate bias generator that provides a bias of about -3 volts, the transistor threshold voltages will all increase in the positive direction several tenths of a volt. The finite time required to pump the substrate down to this voltage is the cause of the current surge that occurs during power up. Without the bias applied the threshold voltages are too low, resulting in large transistor currents.

The HMOS process also uses three different diffusions; one for the source and drain regions that uses arsenic and is about 0.5 microns deep, one for the buried contacts which uses phosphorous and is 1.2 microns deep, and finally, a 1.6 micron deep phosphorous diffusion for the metal contacts. Figure 1 is a cross-sectional view of an HMOS transistor.

As mentioned earlier, the cell capacitors are formed by the first polysilicon layer and a very thin SiO_2 dielectric. The measured oxide thickness was between 400Å and 450Å resulting in a surprisingly large cell capacitance of about 0.1pF. Intel is the only vendor that we know of that has been able to use an oxide this thin in a production process. (HMOS II transistors have a 400Å to 450Å gate oxide thickness. The process has been in production mode for over six months.) The first poly, often referred to as the cell plate, is tied to V_{DD} through a depletion mode decoupling transistor. The series transistor between the cell plate and the V_{DD} provides some decoupling from power supply noise. Having the cell plate at V_{DD} potential means that the semiconductor surface will be inverted for semiconductor surface potentials as high as V_{DD}. This means that a one can be written into a cell to a full V_{DD} level with no implant under the cell plate.

The other technique used is to tie the cell plate to ground because the ground line usually has less noise on it. But this requires an implanted N^+ channel under the cell plate which may be undesirable for processing reasons.

The addition of the first poly to the standard HMOS process requires only one additional mask and four extra steps:

1. Grow the capacitor oxide.
2. Deposit polysilicon.
3. Deposit SiO_2 to separate poly I and poly II.
4. Define and etch poly I.
5. Continue with standard HMOS process.

Figure 2 shows a cross-sectional view of a cell, it's access transistor and the associated diffused bit line.

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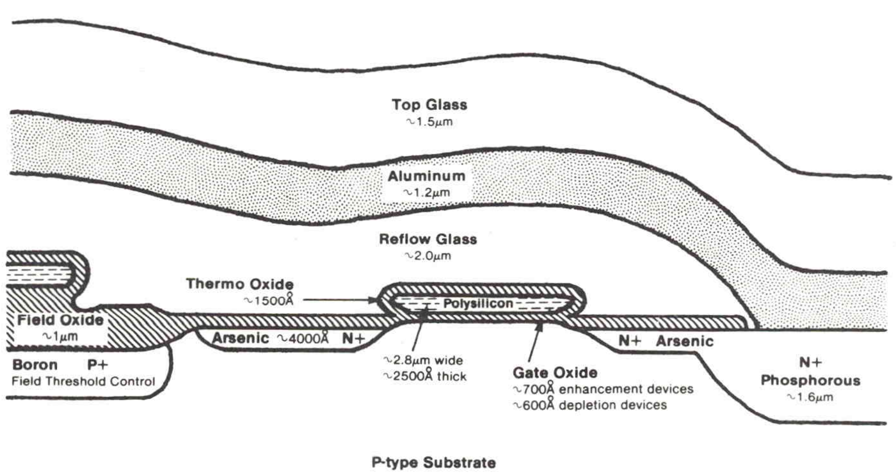

Figure 1 — Cross-section of HMOS transistor

Cell capacitance and one and zero margins

As mentioned before, 2118 cell capacitance is about 0.1pF. If a voltage level of 2.5 volts is used to distinguish between a one and a zero the associated critical charge stored on the capacitor is

$$Q = CV = 2.5 \text{ X } 10^{-13} \text{ coulombs}$$

or

$$N = \frac{Q}{A} = 1.6 \text{ million electrons}$$

Obviously there is not much extra charge to play around with, and this points out why a dynamic RAM must be so carefully designed and how something like an alpha particle can induce soft errors. Naturally occurring alpha particles exist with energies as high as 9 Mev. However, those emitted by trace elements in the packages of dynamic RAMs range in energy from 0 to about 5 Mev. A 5 Mev. alpha particle will generate about 1.4 million electron-hole pairs in silicon. Fortunately though, even a good collector at the semiconductor surface will collect only about 60 percent of the electrons generated. For the case of a 5 Mev. particle, then, about 840 thousand electrons could be collected. To more accurately determine the critical charge or voltage required to induce a soft error the sensing circuitry must be analyzed.

Figure 3 shows a schematic representation of the sensing circuitry. Just before sensing, the access transistor turns on allowing charge sharing to occur between the bit line and the cell (dummy cell). The bit lines are precharged to V_{dd} and have a capacitance of about 0.63pF. The dummy cell is precharged to ground potential and has a capacitance of one half the cell capacitance with a tolerance of about 5%. With this information the voltage levels present on the bit line for sensing can now be found. For a stored zero in the cell and V_{DD} at 4.5 volts,

$$V_{zero} = V_{DD} \frac{C_{Bit}}{C_{Bit} + C_{Cell}} = 3.88 \text{ volts}$$

For a stored one the cell voltage equals the bit line voltage and the bit line voltage does not change. This assumes no charge loss due to leakage into the cell, which is a reasonable assumption for a 2mS refresh cycle.

$$V_{one} = V_{DD}$$

The bit line connected to the dummy cell will assume a voltage in the range

$$V_{dummy} = V_{DD} \frac{C_{bit}}{C_{bit} + (\frac{1}{2}C_{cell} \pm 5\%)} = 4.17 \pm 0.03$$

The sense amplifier may also have as much as a ±30mV offset due to imbalance in the circuit components. Combining the above information the one and zero margins can now be calculated.

$$\Delta V_{zero} =$$

$$(4.17 - 0.06) - 3.88 = 0.22 \text{ volts}$$

$$\Delta V_{one} =$$

$$4.5 - (4.17 + 0.06) = 0.27 \text{ volts}$$

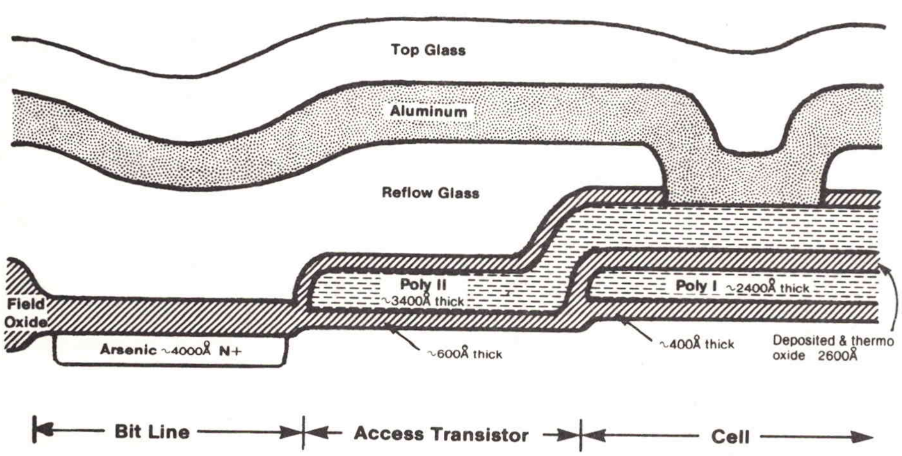

Figure 2 — Cross-section of 2118 cell and access transistor

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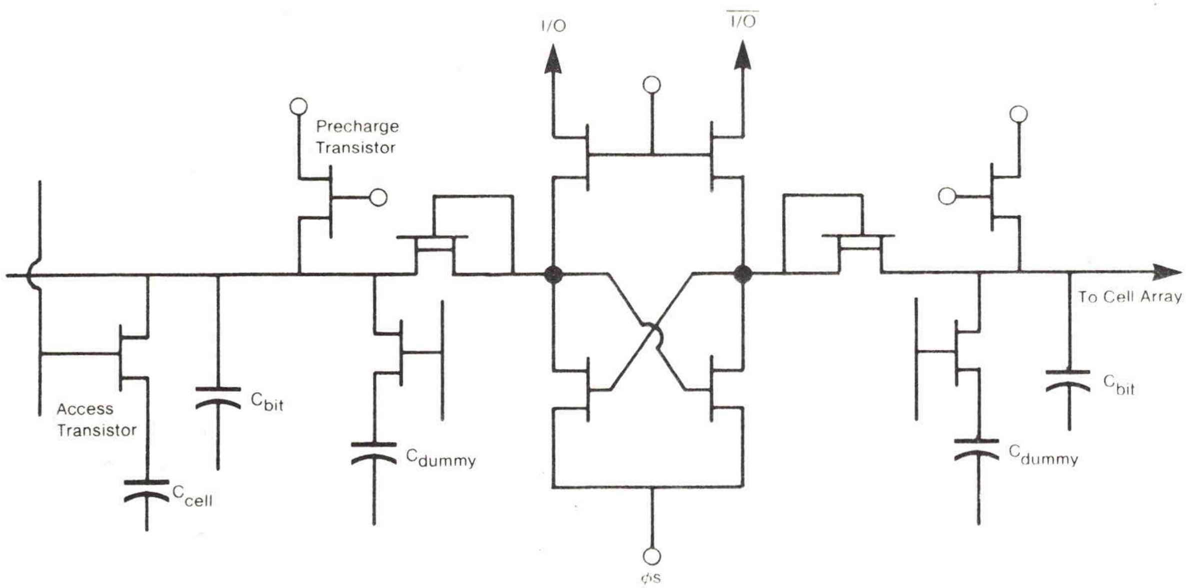

Figure 3 — 2118 sense amplifier

Looking back at the alpha particle problem the critical charge can be found. For a zero,

$$Q_{zero} = \Delta V_{zero}(C_{Bit} + C_{Dummy}) = 1.5 \times 10^{-13} \text{ coulombs.}$$

$$n_{zero} = 0.93\text{M electrons}$$

$$Q_{one} = \Delta_{one}(C_{Bit} + C_{Cell}) = 20 \times 10^{-13} \text{coulombs}$$

$$n_{one} = 1.2 \text{ M electrons}$$

Both of these charge values are safely above the 84K electrons that could be collected after an alpha particle hit. Theoretically then the Intel 2118 **should be alpha immune.**

A factor not accounted for in this analysis is noise on the V_{DD} line. As was mentioned earlier the cell plate is connected to V_{DD} through a series transistor which gives it a slow response to level shifts in the V_{DD} supply. Figure 4 shows the cell plate response to a 1 volt square wave superimposed on a 5 volt DC level. As a result it is possible to shift the level of the stored data with respect to the sense circuitry by as much as 1 volt. (The difference between the power supply maximum and minimum limits.) Now instead of using 4.5 volts in the charge sharing equations, 3.5 volts must be used which reduces the voltage swings by 22%. The sequence of level shifts that the power supply must go through to create this situation is unlikely in any real system, but it does point out the need for well regulated supply lines.

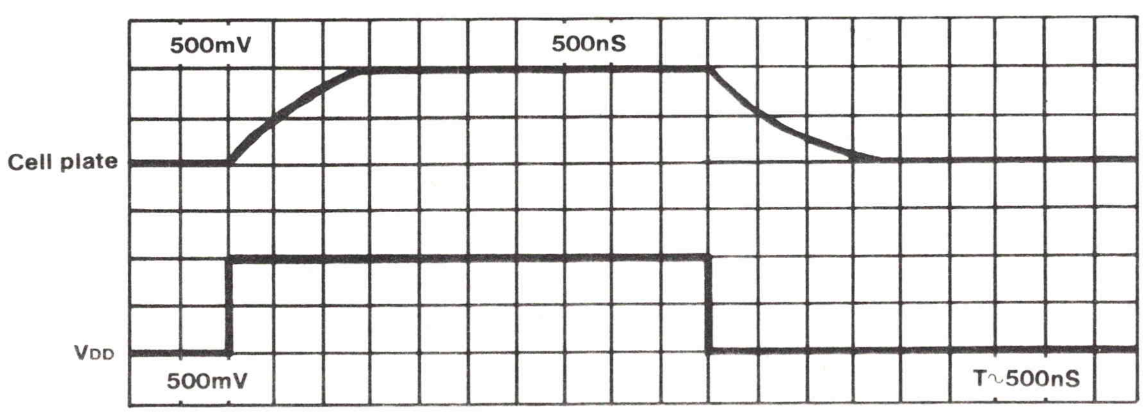

Figure 4 — Cell plate response to V_{DD}

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Conclusions

1. The Intel 2118 is produced using standard Intel processing steps, HMOS and HMOS II. This instills some confidence that it will be an easy part to produce and that large yield glitches will not occur.

2. The cell area is large and the silicon dioxide dielectric is thin, resulting in a large cell capacitance. Larger cell capacitance means larger voltage margins when sensing and reduced sensitivity to minority carrier charge in the substrate, whether from a forward biased diode, impact ionization in transistor channels or an alpha particle. The 2118, theoretically, is immune to alpha particles. Whether it really is or not remains to be seen, but regardless, soft error rates will be very low.

3. There will be a large current surge during power up that is caused by the finite pump down time of the substrate bias generator. The system power supply must be large enough to handle this surge. Intel's application notes provide the necessary design information.

If you have any questions, or for more information, please contact me at 78-557, ext. DR-2541.

John Carlson
Memory & I/O Component Engineering

EPROM identification labels available

The two identification labels shown below may be of interest to areas using UV-erasable PROMs or other programmable devices in 24-pin DIPs.

P/N 334-4016-00 part number identification marker is a typeable label with pressure-sensitive adhesive sized to fit on either the top or bottom of a 24-pin DIP. This allows the user to affix a part number to the device.

334-4016-00

P/N 334-4046-00 copyright identification marker is a label designed to be affixed over the window of a UV-erasable PROM to prevent customers from altering the contents of the device. No space is left on this label for adding part number information.

334-4046-00

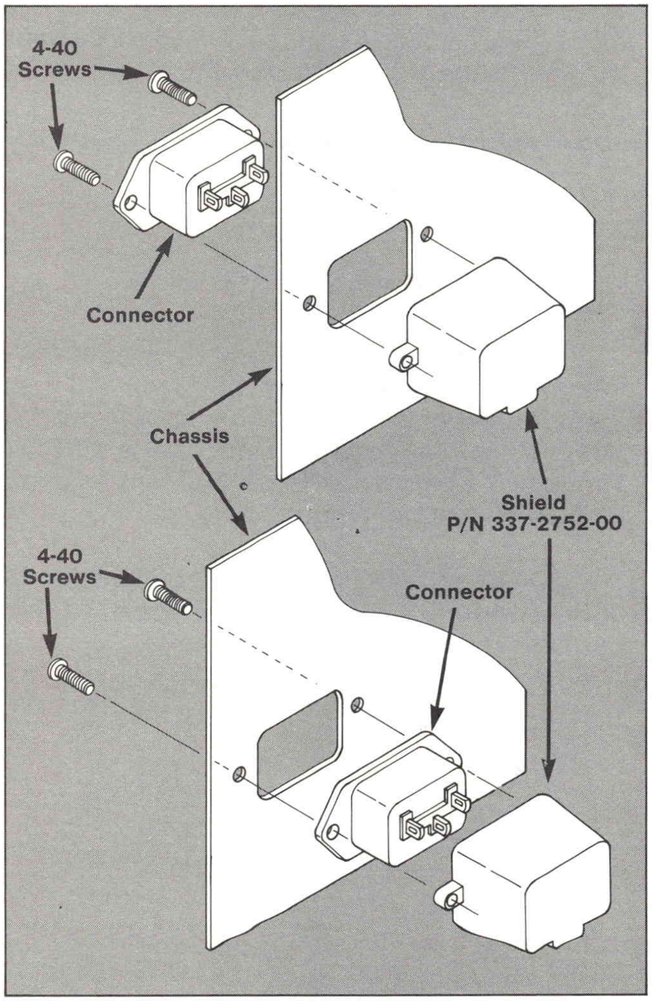
Both labels are made from a paper which is destroyed if an attempt is made to remove them. If a part number is required, you can use the 334-4016-00 on the bottom side of the EPROM. These two labels were developed for use on the 834 Data Communications Analyzer.

If you need more information, please contact **John Tilden (92-623), ext. WR-1883, or Mike Lancaster (92-623), ext. WR-1886.**

Primary wiring shield simplifies assembly

A molded plastic primary wiring shield has been designed to shield the back half of the EIA line voltage connector commonly used at Tek for removeable line cords (such as P/N 131-1084-00).

This shield, electrical receptacle P/N 337-2752-00, has two 4-40 threaded inserts to simplify assembly and can be assembled with the chassis between the connector and the shield, or with both shield and connector on the inside of the chassis (see illustration).



This shield is designed to pass UL inspection and is in production on the 834 Data Communication Analyzer.

For more information, please contact **John Tilden (92-623), ext. WR-1883, or Mike Lancaster (92-623), ext. WR-1886.**

Error Detection/Correction Chips

With the size of memories increasing and with the corresponding decrease in cell geometries, memory error will undoubtedly increase. To improve system reliability, error detection and correction schemes may need to be considered within the new product design. Memory and I/O Component Engineering is interested in your plans to incorporate these schemes into the Tek product and is currently investigating the following detection/correction chips:

Manufacturer	P/N	Data word size	Availability
AMD	AM2960	16 Bit	October, 1980
Fijitsu	MB1412A	8 Bit	now
Intel	---------------	16 Bit	1981
Motorola	MC68540	8 & 16 Bit	3rd Q, 1980
TI	74LS360	16 Bit	now
TI	74LS361	16 Bit	now

To share more detailed information, call **Jim McKay, Memory and I/O Component Engineering, ext. DR-2557.**

16K static RAMs now available

Looks like Japan did it again — Hitachi's 6116 (2K X 8) is now available in larger quantities at about $25 (slower speeds — 20nS access time). Toshiba's 2016 and 5516 (both 2K X 8) are also available in larger quantities. The 6116 and 5516 are CMOS-type, the 2016 is NMOS. For specification sheets and more information contact me on ext. DR-2555.

Peter Reitmajer
Memory & I/O Comp. Eng.

Improved reliability/service information available

The Reliability Information Services group in Component Services has, in the past year, enhanced its ability to provide field reliability and service information. An on-line warranty failure data base, various forms of graphic information and improved information retrieval of all failure data are just some of the enhancements. This information is available to engineering, manufacturing and support groups throughout Tektronix.

The reliability data is contained on the Computer Science Center (CSC) CYBER 73 computer. The information is handled through System 2000, a data base management system. Persons wishing to utilize the system have two options — either request the information from anyone in the Reliability Information group (ext. MR-8004), or access it yourself through the CYBER 73. Reports requested from the reliability group are generally available on a same-day basis. However, if you plan to access the data yourself, you should first attend a short course taught by Reliability Information Services.

Two sources of information are currently available, the Warranty Failure System and the total Field Failure System. Both sources are based upon information contained in the Service Record. This record is completed by the Tektronix technician at the customer's location or at various Service Centers across the U.S.

Warranty Failure System

This data is kept on-line for immediate access on the CYBER 73. Information contained on the data base is limited to warranty and demo instrument failures that have occurred within the last running year (e.g., AP005-AP104).

The Warranty System contains 20 different items taken from Service Records. They are:

	Example
Instrument Name (Product Type)	7104
Business Division	LID
Product Group	7000 Series
Tracked Instrument Indicator	1 = Tracked Instrument
Instrument Serial Number	B010203
Instrument Sale Date (DOS)	8002 (Year-Week)
Service Center	144262 (Houston)
Warranty Service or Warranty Failure Flag	F = Warranty Failure
Type of Failure (Warranty or Demo)	2 = Warranty
Instrument Failure Date	8/12/1980
Tek Accounting Period (of Instrument Failure	103
Date Service Record was Entered	Week 35
Time to Failure (TTF)	25 Weeks
Comment of Customer Problem	Bright Spot Defect
Comment of Repair Work Done	Replaced CRT & Realign
Component Failure Number (Part Number)	154078300
Exchange Board Number	N/A
Assembly Number of Failure	N/A
Circuit Symbol of Failure	V1850
Failure Code of Component	286

Information can be presented in a multitude of ways, ranging from listings of each failure to summarized information. A standard engineering report has been formatted (see Figure 1) which

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Figure 1

MEDICAL MOD SEARCH FOR SANDBERG 64
80/05/07.

INST.	FIELD	SERIAL	DOS	AD	FAIL DATE	TTF	PART NO.	CKT SYM	COD	PROBLEM DESC.	ACTION TAKEN
413	143818	B041694	7947	2	02/01/1980	10	900930000	R1505	910	REPAIR	HIGH RATE LIMIT NO A DJUSTABLE WIRE NOT C ONN TO ARM R1505
413	145361	B041641	7934	2	10/18/1979	8	900900000		911	SUPPLIES DOWN 6A TEMP INOP -	REPLACED C1011 SHOTE D ON DVM FOUND BAD S OLDER JNT A INPUT
413	143858	B010148	7951	2	01/24/1980	5	900900000		912	DOA	FOUND DVM BOARD TO B E LOOSE
413	143565	B031035	7942	2	11/01/1979	2	900900000		912	DVM READS 400 IN ECG CONT	DVM BD LOOSE ADDED P AD TO RETAINER
413	143540	B031413	7927	2	07/26/1979	3	900900000		912	INACCURATE HE ART RATE	P402 OFF ITS PINS

contains key information most commonly requested. Graphic information can also be obtained on request as shown in Figure 2 (Reliability Growth Curve) and Figure 3 (Instrument Profile).

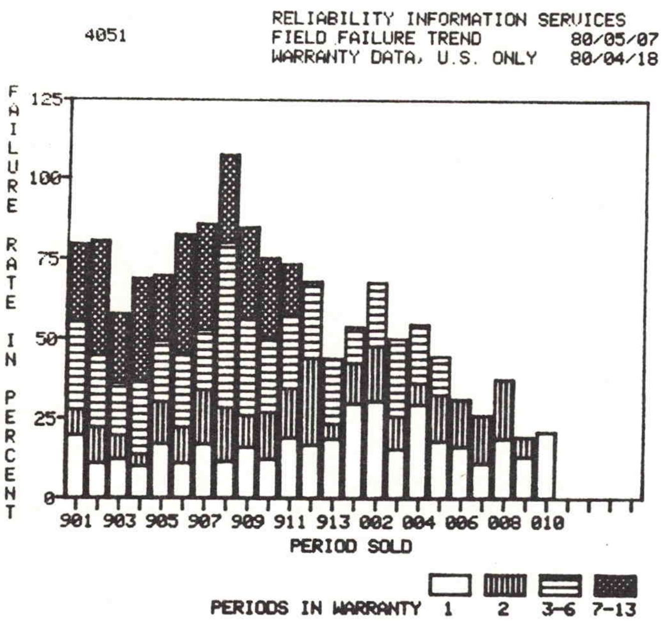


Figure 2

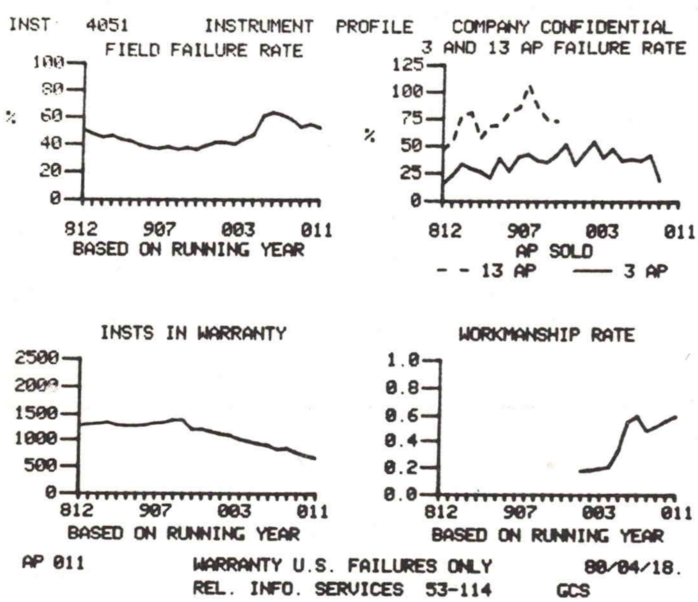


Figure 3

Field Failure System

Additional information not contained in the Warranty Failure System resides in the Field Failure System. Currently, some 135,000 Service Records are available through this system, and contain all known repairs occurring within the past year.

This data generally falls into the following categories:

Type of Repair (Warranty, Billables, Contracts, etc.)
Cost Information (Labor, Parts, etc.)
Systems Information
Down Time, Response Time, Turnaround Time, Repair Time, etc. for Instruments
Board Repair Information
Quote, Clean, Repair, Calibration and QA Times per Instrument
Maintenance Contract Information
Preventative Maintenance and Installation
Other

This information is available for all types of Service Records by request through the Reliability Information Services group. Reports can also be generated on a regular schedule. If computer costs are excessive, costs will be negotiated with the requesting department. The group can also assist in formatting your request for the most efficient and meaningful information.

Reliability Information Report Manual

A manual is available showing what information can be obtained with the two systems. Also, a users manual is available for persons interested in utilizing the Warranty Failure System information. Request either of these manuals by calling ext. MR-8004.

Wayne Bridges
53-114, ext. MR-8007

Current carrying capacity of wires and cables

Current carrying capacity (ampacity) is defined as the current a conductor can carry before its temperature rise exceeds a permissible value. It is a function of many variables, some of which are:

1. *The copper area of the conductor.* The ampacity varies with cross-sectional area. The larger the diameter, the greater the current carrying capacity. (Stranded and solid conductors of the same gauge will have slightly different current carrying capacities owing to differences in their circular mil area.)

2. *The ambient temperature.* This is defined as the temperature of the surrounding air. With a higher ambient temperature, less heat will be required to reach the maximum temperature rating of the insulation; therefore, the ampacity rating will be lower.

3. *The type of insulation.* The degree to which heat is conducted through the insulation varies with the material. The conductor temperature should never be permitted to exceed the maximum temperature rating of the insulation. Where room temperature is within 10° C of the rated temperature, use of a higher rated insulation is recommended.

4. *Ventilation around the cable.* Ventilation is the amount of air flow. This affects heat dissipation by convection or radiation.

5. *Number of conductors in the cable.* Single conductors have a higher ampacity rating than equivalent size conductors in a multiconductor cable. Heat dissipation is more limited in cables because each conductor is not completely exposed to air.

6. *Amperage.* Heat rise varies as the square of the applied current. Therefore, the more current, the greater the amount of generated heat.

It is obvious that no single chart of ampacities can be constructed when these and other possible variables are considered. The assignment of an ampacity rating to a conductor is a rather inexact procedure. In addition to all the factors discussed above, the design engineer is concerned with the equipment's service life. Thus, he or she may choose to derate the values shown to provide an even greater margin of safety.

The following table should be used as a guide but not as a firm statement of acceptable amperage values. It should be noted that these values are computed for an ambient air temperature of 25°C. The ambient temperature inside an instrument may be considerably higher.

Current Carrying Capacity for Two or Three Conductor Cables

AWG Size	O.D. (Inches)	Ohms/ 1000 ft.	Max Current in Amperes	
			Insulation Rating 60°C	Insulation Rating 105°
28	.0126	67.3	.398	0.63
26	.0159	42.4	.635	1.02
24	.0201	26.7	1.01	1.62
22	.0254	16.8	1.61	2.57
20	.0320	10.5	2.55	4.09
18	.0403	6.65	4.05	6.48
16	.0508	4.17	6.45	10.32

Based on ambient temperature of 25 ° C. (All values listed apply to each single conductor)

Correction factors to above table for other multiple-conductor cables:

No. of Conductors	1 Wire	4-5 Wires	6-15 Wires	16-30 Wires
Rating factor	1.6	0.8	0.7	0.5

For further information, contact **Elizabeth Doolittle (78-552), ext. DR-2309.**

More on TI's 92K bubble memory

In our continuing evaluation of bubble memories (see **Component News 280,** pages 3-7), Memory and I/O Component Engineering has successfully completed the first step in evaluating the Texas Instruments TIB0203S 92K bit bubble — an interface to the MICE M6809 Memory Evaluation Test Fixture. This interfacing was done on a wire wrap board, using TI's support chip set, with the exception of the coil driver (SN75382). The support chips include the controller (TMS9916), function timing generator (TIB0951), sense amp (TIB0833), function driver (SN75381), thermistor (SP102G) and diode array (VSB53).

Thus far, the TI coil driver does not function properly. A spike on the negative supply will cause the chip to short circuit internally and literally explode. Instead of the TI part, discrete coil drivers were designed and substituted. TI has admitted to having problems with these drivers and claim they have now solved the problem. We will continue to evaluate the coil driver chip.

There are also several problems associated with the controller. They include:

1. BDET from the controller is not used. It must be generated externally. Also, BXIN must be delayed one field cycle. Both of these fixes are due to the controller being set up for the earlier TIB0103, T-bar version of the 92K bubble.

2. Due to a design fault, the transfer in pulse remains on too long when accessing page 640. A software fix will prevent this occurrence.

3. Again due to a design fault, Loop #0 of the bubble must be good. The controller will ignore the redundancy logic for this loop.

4. The interrupt and multipage modes were not originally designed into the controller, but added at the last minute. Consequently, there are problems associated with using these modes, such as interrupts occurring at the wrong time.

Our continuing evaluation results on the TI 92K bit bubble will be reported in future issues. For more information, or help in clearing a contaminated bubble, call **Dick Green (ext. DR-2541)** or **Jim McKay (ext. DR-2557).**

Upcoming catalog change

The Digital Integrated Circuits section of the Semiconductor Parts Catalog is undergoing a change.

Because one of the goals of CE is to provide the most useful data possible, we are soliciting inputs from catalog users before implementing this change.

Digital integrated circuit listings by function will contain footnotes, the purpose of which will be to identify the general nature of problems associated with each component. The proposed list of footnotes follows.

Suggested new-design codes for Tek part numbers:

1. Preferred
2. Acceptable
3. Not recommended
4. Do not use
5. Blank — no recommendation

Qualifying phrases to be used, alone or grouped, as applicable:

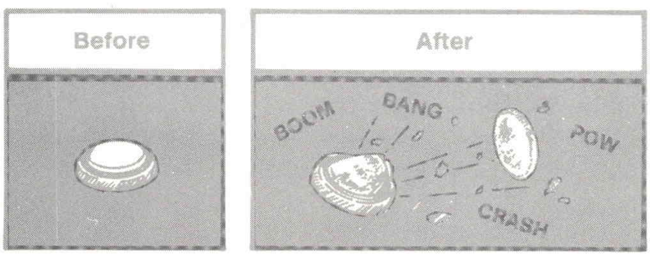
a) Obsolete
b) Availability problem
c) Function fulfilled better elsewhere
d) Known electrical problem
e) Part evaluated by CE
f) Part not evaluated by CE
g) Part not presently supported by CE

Reliability and cost data will not be handled in this footnoting system, as they appear elsewhere in the catalog.

Send your inputs to **Yvonne Brinck, Digital Component Engineering, 78-573.**

CAUTION: Calculator batteries can explode

Recently, the owner of a "Slim Jim" calculator, one of those 1/8" thick things, handed me a silver oxide battery that had blown up in his desk drawer. He had replaced the cells (there were two operated in series) when the "low battery" indicator came on, and then put them in his desk. Later he opened the drawer to find one of them had exploded!



When **two** or **more** cells are operated in **series** and one of the cells runs down and goes to zero volts, it "sees" a reversed polarity at its terminals and begins to charge up with reversed polarity. *The only thing that happens is that gas is generated.* Carried on long enough, the cell blows up. This is true of silver oxide, mercury and lithium cells.

When your low voltage indicator comes on in your thin calculator or watch where two or more cells are used to power it, replace them and dispose of the cells immediately. In addition, if a cell such as this blows up in an instrument, it will vent potassium hydroxide throughout, and ruin the instrument.

Byron Witt
78-552, ext. DR-2479

Vendor component data books

The responsibility for acquisition and distribution of the free vendor data books for engineering has recently been assigned to the Parts Cataloging Group, 78-567, ext. DR-2585.

Our staff is very small. For the present, we are limited as to the level of personal service we can provide.

As we have time, we are correlating past requests with new data book arrivals and mailing them. We are generally able to do this within a week.

Primarily we stock and request data books for semiconductors (microcircuits, transistors and diodes). We do keep a stock of as many of these data books as we can get our hands on. They are located in our area and engineers are welcome to drop by and select as needed.

This service and these books are strictly for new design engineering use at Tek and are not intended to support personal needs. Again, we are located at 78-567 ext. DR-2585.

Mike Boer named CE manager

Mike Boer is the new Component Engineering manager within the Component Services Group.

Managers reporting to Mike will be Jack George, Analog Component Engineering; Paul Curley, Optoelectronic and Passive Component Engineering; Bob Aguirre, Electromechanical Component Engineering; Phil Brothers, Digital Component Engineering; Paul Gray, Memory and I/O Component Engineering; and Virg Tomlin, Component Application Engineering.

Mike joins the group from SID where he was Digital Accessories Design manager. He will report to me.

Mike Probstfield
Component Services manager

Line Voltage Standard to be updated

A committee representing the various business units was recently formed to update Tek's Line Voltage Standard. The Line Voltage Standard, first published in 1966, needs to be brought up to date for several reasons:

1. To achieve uniformity among our products, both in performance and panel markings.
2. To reduce costs, by not designing our products to performance levels beyond actual international line voltage requirements.
3. To bring about agreement between product markings and manual ratings.
4. To reflect new line voltage selection devices introduced to the marketplace since 1966.

Members of the Line Voltage Standard Committee (listed below) will be meeting weekly to gain input and recommendations from business units and the engineering staff at Tek. Their objective is to write an electrical performance and panel marking standard. If you have any comments, contact the appropriate committee member for your business unit. After the new standard has been compiled, each business unit will be asked to vote for adoption of the standard.

The committee members are:

Dick Bailey	IDD	63-212
Larry Shorthill	IDD	63-356
Dave Leatherwood	Power Supply Design	58-733
Al Schamel	T&M500	92-815
Ed Wesel	Product Safety	41-400
Richard Nute	Product Safety	41-400
Don Roberts	Accessories	19-092

Dick Griffin, Product Safety
41-400, ext. TC-253

Notice to all mechanical engineers:

The flame retardant polypropylenes, which were commonly used in mini and maxi harmonica connectors, have been discontinued by Eastman Chemical Co. and are no longer available for new or existing plastic component designs.

The Tek P/Ns affected appear on page 1-23 of the blue Materials Catalog (March 1980 edition). They are 255-0461-01 Tenite 423R, black; and 255-0568-00 Tenite 423R, natural.

The existing parts made of these two materials are in the process of being modified to other materials. If the lack of these materials poses any inconvenience or design problems contact me on ext. V-7296.

In addition, the silicone rubber (Tek P/N 255-0520-00) listed on page 1-31 of the Materials Catalog should be listed more correctly as a *modified* silicone rubber. In addition to the General Electric SE436U silicone rubber, this compound contains 15% Carbon Black, 10% GE SE30 FR silicone rubber.

Bert Hippe
08-538, ext. V-7296

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)

New standards available

MIL-T-1072B	**Tin Plating:** Electrodeposited or Hot-Dipped, for Ferrous and Nonferrous Metals
FED-SPEC-MMM-A-250C	**Adhesive,** Water-Resistant (for closure of fiberboard boxes)
IEEE STD 389	IEEE Recommended Practice for **Testing Electronic Transformers and Inductors**
IEEE STD 748	IEEE Standard for **Spectrum Analyzers**
FED-SPEC-QQ-S-571E	**Solder,** Tin Alloy: Tin-Lead Alloy; and Lead Alloy
MIL-C-39012B	**Connectors,** Coaxial, Radiofrequency; General Specs for
MIL-M-63320	Microcircuit, Digital **CMOS** (Initial Logic)
MIL-R-63319	Resistor Network, Fixed, Film (Externally Trimmable)
MIL-STD-1654A	Power **Cable Assemblies**
ANSI/ANS-10.5	American Nuclear Society Guidelines for Considering User Needs in **Computer Program Development**
EIA-RS-463	Fixed **Aluminum Electrolytic Capacitors** for Alternating Current Motor Starting, Heavy Duty (type 1), and Light Duty (type 2)
MIL-STD-1395A	**Filters and Networks,** Selection and Use of
NBS	Special Publication 400-14 **Semiconductor Measurement Technology:** Thermal Resistance Measurements on Power Transistors
NBS	Special Publication 400-48 **Semiconductor Measurement Technology:** Spreading Resistance Analysis for Silicon Layers with Nonuniform Resistivity
ICEA Pub. No. S-19-81 (6th Edition) NEMA Pub. No. WC 3-1980	ICEA/NEMA Standards Publication. Rubber-insulated **Wire and Cable** for the Transmission and Distribution of Electrical Energy

IPC technical papers

IPC-TP-313	The Reduction of Gold Thickness from 60 Millionths to <15 Millionths
IPC-TP-316	Printed Wiring Board End Product Dimensioning and Tolerancing — Part II
IPC-TP-317	Warpage Reduction During Wave Soldering
IPC-TP-318	Improved Leaded Chip Carrier Performance
IPC-TP-320	Improved Quality Control of Printed Circuit Board B-Stage Epoxy Resins
IPC-TP-321	A New Method of Building a Multilayer Printed Circuit Board
IPC-TP-323	A Comparison of Direct Surface Analysis Techniques with Solvent Extraction/Contaminant Profiling Techniques for

062-3762-00 Circuit Board Standard: Switch Design

The purpose of this standard is to define the specific circuit board hole and contact pattern requirements for mounting Tektronix-made switches. This includes hole location patterns, location of contact patterns, tolerances, and other special requirements. The standard applies to circuit board design parameters and switch mounting requirements for commonly used types of circuit board, mounted switches manufactured by Tektronix for use in Tektronix products. The standard will be updated as new switches become available.

You may obtain a copy of this standard by calling Technical Standards, ext. TC-241, or by sending a request to delivery station 41-260.

COMPONENT CHECKLIST

The "Component Checklist" is intended to draw attention to problems or changes that affect circuit design. This listing includes: catalog and spec changes or discrepancies; availability and price changes; production problems; design recommendations; and notification of when and how problems were solved. For those problems of a continuing nature, periodic reminders with additional details will be included as needed.

Tek P/N	Vendor	Description of part	Who to contact, ext.
156-1189-00	**TI**	**16 X 4 Schottky RAM (74S189)**	**Peter Reitmajer, DR-2555**

This part was originally single sourced to Texas Instruments, and there were no problems until about six months ago when TI indicated that they were having engineering problems and couldn't meet our specs. A hunt for second sources is underway. Although TI, National, AMD, Signetics and Fairchild still make the part, at this time AMD is the only source who makes the part in a ceramic package. Fairchild plans to make their fast Schottky version (74F189) in ceramic packages, but all other vendors will produce only the plastic version (due to small profit potential).

Due to the high popularity of this part, AMD is booked and may not have the quantities needed by Tek. Also TI didn't give us the chance to make a last time buy. To help relieve the strain, **I would appreciate feedback from any and all users of the 74S189** who can either use the 74LS189 or the plastic version (some applications require ceramic packages and others do not).

Tek P/N	Vendor	Description of part	Who to contact, ext.
156-1382-00 **156-1383-00**	**Mostek**	**Static RAM (4118)**	**Peter Reitmajer, DR-2555**

Recently, Mostek indicated that it plans to remove the L input from their 4118 static RAM. When a new process (Poly 5) is implemented for this device, the latch input will be internally connected to V_{DD} (V_{CC}). This change was made because Mostek wants to make this device compatible with their byte wide line of memories.

Anyone using the latch on this device should contact me so that I can make arrangements with Mostek for supply of components with the latch input. The vendor indicated that no one has utilized the latch input, so they need any information indicating otherwise.

Tek P/N	Vendor	Description of part	Who to contact, ext.
156-1257-00	**Intel**	**8291 GPIB chip**	**Jim Howe, WI-3583**

Steve Coan and John Burgess of the Automated Instrument Compatibility Evaluation (AICE) group have discovered a problem in the redesigned C-step version of the 8291 GPIB chip. The problem is with the SR function of the device.

In the C-step 8291, the 'SPAS' interrupt is set in SPAS if 'rsv' is true when DAV is sent true. The same condition clears the 'rsv' message. The normal response of the user is to enable new requests for service on receipt of 'SPAS'.

If the user writes 'rsv' true after receiving the 'SPAS' interrupt but prior to exit from SPAS, the chip enters a hung state from which it will not ever make SRQ true.

The only ways out of this hung state are as follows:

1. The user writes 'rsv' false when true while the interface is not in SPAS.
2. The GPIB controller happens to conduct another serial poll of the interface.

Intel has been informed of these findings.

Component Engineers

Call the appropriate engineer listed below for information on purchased components. Delivery stations are: Analog CE – 78-557, Digital CE – 78-573, Electromechanical CE – 78-552, Memory & I/O CE – 78-557, Optoelectronic & Passive CE – 78-552. Extensions are all Beaverton DanRay.

Component		Engineer	Extension
ATTENUATORS		Byron Witt	2479
BATTERIES		Byron Witt	2479
BULBS		Halsey Royden	2314
CABLE ASSEMBLIES		Elizabeth Doolittle	2309/
		Phillip Lee	2461
CAPACITORS			
	ceramic	Ray Powell	2550
	electrolytic, film	Don Anderson	2545
	variable, mica	Dave Hayes	2317
COILS		Harry Ford	2310
CONNECTORS		Peter Butler	2474
CORES, ferrite		Byron Witt	2479
CRYSTALS & SAW		Byron Witt	2479
DELAY LINES		Byron Witt	2479
DIODES			
	visible LEDs	Alan LaValle	2317
	IR emitter, laser diode	Louis Mahn	2549
	high frequency	Eric Etheridge	2399
	all others	Gary Sargeant	2540
DISPLAYS		Alan LaValle	2317
ELECTROMECHANICAL PRINTERS		Jim Deer	2484
FANS		Bill Stadelman	2466
FETs		Jerry Willard	2539
FIBER OPTICS, cables, emitters, detectors		Louis Mahn	2549
FILTERS			
	air	Bill Stadelman	2466
	crystal	Byron Witt	2479
	light	Louis Mahn	2549
	line	Dennis Johnson 2471/Herb Zajac	7887
FUSES, FUSEHOLDERS		Dennis Johnson	2471
GASKETS		Bella Geotina	2315
GENERATORS		Bill Stadelman	2466
GPIB		Bill Pfeifer	2566
HARDWARE, miscellaneous		Eleanor Olson	2498
HEAT SINKS		Jim Williamson	2552
INDUCTORS		Harry Ford	2310
INTEGRATED CIRCUITS		see microcircuits	
JOYSTICKS		Jim Deer	2484
KEYBOARDS		Halsey Royden	2314
KNOBS		Halsey Royden	2314
LAMPS, LAMP SOCKETS		Halsey Royden	2314
LIGHT-EMITTING DIODES		Alan LaValle	2317
MAGNETIC TAPE HEADS		Bill Stadelman	2466
METERS			
	digital panels	Chris Martinez	2312
	general	Dennis Johnson	2471
MICROCIRCUITS			
	advanced Schottky TTL	Dale Coleman	2573
	A/D converters	Chris Martinez	2312
	analog switches	Eric Etheridge	2399
	bubble memory devices	Brad Benson	2557
	CCD/analog	Willie Rempfer	2308
	CMOS devices	Wilton Hart	2572
	communications circuits, analog	Matt Porter	2311
	comparators	Willie Rempfer	2308
	data communications, digital	Bill Pfeifer	2566
	D/A converters	Don Gladden	2551
	EAPROMs	Don Van Beek	2546
	EPROMs, PROMs	Don Van Beek	2546
	ECL devices	Dale Coleman	2573
	FPLAs, PALs	Dale Coleman	2573
MICROCIRCUITS, continued			
	linear devices	Don Gladden	2551
	high speed logic	Dale Coleman	2573
	low-power Schottky TTL	Bruce Brown	2571
	MOS (general)	Bill Pfeifer	2566
	operational amplifiers	Willie Rempfer	2308
	regulators, linear	Chris Martinez	2312
	regulators, switching	Jim Williamson	2552
	RAMs, dynamic	Bob Goetz	2543
	RAMs, static	Pete Reitmajer	2555
	ROMs	Don Van Beek	2546
	Schottky TTL	Dale Coleman	2573
	TTL devices	Bruce Brown	2571
MICROPROCESSORS			
	bit-slice microprocessors	Dale Coleman	2573
	peripherals and interface	Bill Pfeifer	2566
	F8, 6800, 6802	Carl Teale	2567
	Z80, Z8000, 8080, 8085, 8086	Wilton Hart	2572
	8035, 8048	Ken Smith	2319
	6801, 68701	John Higley	2316
MICROWAVE components		Byron Witt	2479
MONITORS		Harry Ford	2310
MOTORS		Bill Stadelman	2466
MULTIPLIERS, high-voltage		Gary Sargeant	2540
OEM		Jim Deer	2484
OSCILLATORS		Byron Witt	2479
PHOTOCOUPLERS		Louis Mahn	2549
POTENTIOMETERS		Gene Single	2544
POWER CORDS/receptacles/plugs		Dennis Johnson	2471
RAW MATERIALS, metals, plastics		Bella Geotina	2315
READOUT DEVICES		Alan LaValle	2317
RELAYS, mechanical & solid state		Paul Johnson	2473
RESISTORS			
	fixed	Ray Powell	2550
	variable	Gene Single	2544
SCRs, SCSs		Paul Johnson	2473
SHIELDS		Harry Ford	2310
SPARK GAPS		Paul Johnson	2473
SLEEVES, insulating		Bella Geotina	2315
SPEECH, input/output		Jim Deer	2484
SOCKETS			
	crystal	Byron Witt	2479
	all others	Peter Butler	2474
SWITCHES			
	general, solid state	Dennis Johnson	2471
	reed	Paul Johnson	2473
TERMINAL PINS		Joe Reshey	2313
TERMINATIONS		Byron Witt	2479
THERMISTORS		Ray Powell	2550
TRANSDUCERS		Byron Witt	2479
TRANSFORMERS		Byron Witt	2479
	power	Bill Stadelman	2466
TRANSISTORS			
	field-effect	Jerry Willard	2539
	phototransistors	Louis Mahn	2549
	power	Jim Williamson	2552
	small signal, arrays	Matt Porter	2311
	triacs, unijunctions	Paul Johnson	2473
TUBING, metal		Bella Geotina	2315
WIRES & CABLES		Phillip Lee	2461
WIRE & CABLES (Vancouver)		Elizabeth Doolittle	2309

Revised September 1, 1980

Component News New Components

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	Number	Description	When Available	Tek P/N	Engineer to contact, ext.
		memory and I/O devices			
Intel	2118	DRAM, 16K x 1, 5V Dynamic RAM, (120nS)	now	156-1552-00	B. Goetz, DR-2543
Hitachi	HM6147	SRAM, second source for 2147	now	156-1228-00	P. Reitmajer, DR-2555
Motorola	MCM2147C70	SRAM, second source for 2147	now		↓
Toshiba	TMM2147	SRAM, second source for 2147	now		↓
NEC-μC	D21470-2	SRAM, second source for 2147	now		↓
AMD	AM74S189	SRAM, second source for 745189	now	156-1189-00	↓
		optoelectronic and passive devices			
Clarostat A-B	CM41773 Type W	Panel Control, 50 KΩ Lin, PCP, w/case grounding lug, flatted shaft	—	311-2135-00	G. Single, DR-2544
Clarostat	—	Panel Control, 5MΩ Lin, w/6KV HV Standoff, w/case grounding lug	11/15/80	311-2138-00	↓
Clarostat	—	Panel Control, 2MΩ Lin, w/6KV HV Standoff, w/case grounding lug	11/15/80	311-2139-00	↓
Beckman Bourns Spectrol	7286 3540 534	Precision WW Pot, 2KΩ, Bushing ⅜ x ⅜, shaft ¼ x 0.812, 10T	11/15/80	311-2140-00	↓
Clarostat	—	Panel Control, 10KΩ Lin, w/⅞" metal spacer	11/15/80	311-2141-00	↓
Bourns Spectrol	3540 534	Precision WW Pot, 10KΩ, Bushing ¼ x 0.312 FMS, Shaft ⅛ x 0.812 FMS, w/Loc Lug, 10T	10/15/80	311-2142-00	↓
TRW	BW20F	Resistor, 0.20Ω±5%, 1W Fusible	9/1/80	308-0832-00	R.Powell, DR-2550
TRW	BWF	Resistor, 0.22Ω±5%, 2W	9/1/80	308-0827-00	R.Powell, DR-2550
TRW	BWF	Resistor, 1.0Ω±5%, 2W Fusible	10/1/80	308-0831-00	R.Powell, DR-2550
TRW	TRW-35	Capacitor, 1.33μF, 200V metallized polypropylene, 2.8 ARMS ripple current at 30KHz, +65°C	now	285-1217-00	D. Anderson, DR-2545
Electrocube	230D	Capacitor, 0.27μF, 400V metallized mylar	now	285-1218-00	↓
Electrocube	230D	Capacitor, 1.0μF, 400V metallized mylar	now	285-1219-00	↓
Electrocube	910D	Capacitor, 1200pF, 200V metallized polypropylene	now	285-1220-00	↓
TRW	X463UW	Capacitor, 0.1μF ± 2%, 100V metallized polycarbonate	now	285-1221-00	↓
RIFA	PME271	Capacitor, line-to-line interference suppressor, 0.068μF, 250VAC, 60Hz	now	285-1222-00	↓
Electrocube	910D	Capacitor, 3300pF ± 1%, 200V metallized polypropylene	now	285-1224-00	↓

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