component news

Dec. 19, 1979 COMPANY CONFIDENTIAL Issue 277

RCA 339 causes application problems

RCA, one of three suppliers of the high usage (50K/yr.) 156-0411-00 (339 comparator), has been found to have application problems here at Tek. Discrepancies exist between the performance of RCA parts and those of our other two approved sources, National and NEC.

Long delay times

There are applications in which RCA's 339 exhibits a longer delay than our other vendors. (The large-signal delay time is typically 300nS but delay times of up to 2.5μS were recorded.) In a test circuit the RCA parts were found to have a linear relationship between the amount of input underdrive applied before a positive transition, and the delay of the output after the positive transition, which didn't exist in other vendors' parts (see Figure 1).

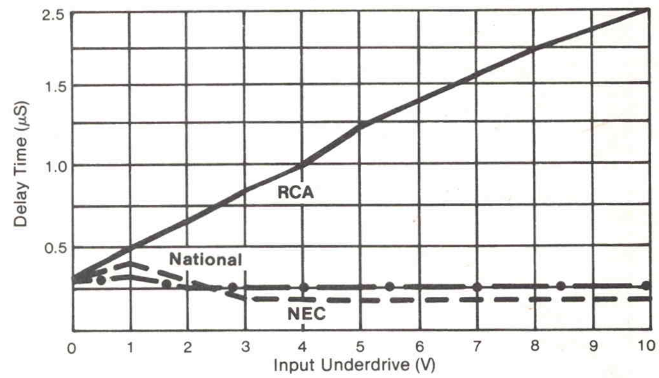
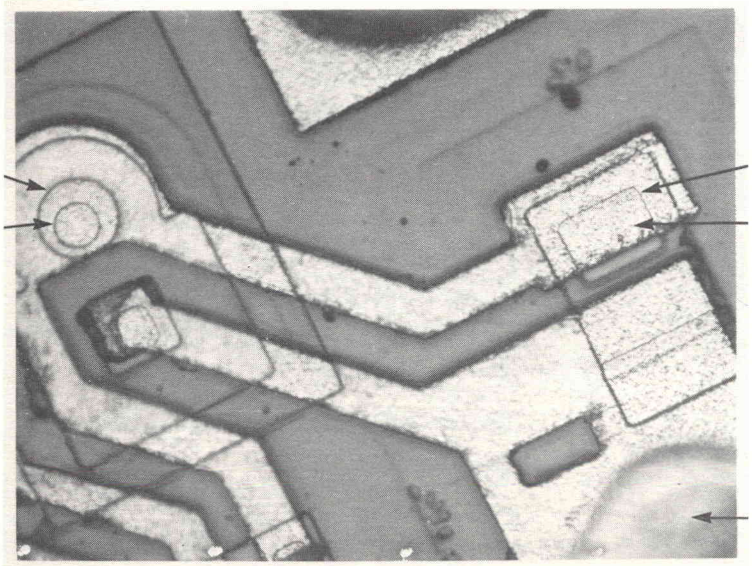


Figure 1



Oxide window omitted by RCA creates unusual delay characteristics

Capacitance creates delay

The constant slope $\left(\frac{dv}{dt}\right)$ of the graph hints that the delay time is being caused by a current source charging a parasitic capacitance.

continued on page 2

Also in this issue

In the schematic (Figure 2) Q2 and Q3 are lateral PNP transistors which have stray capacitance between base and substrate (ground), as shown in Figure 3.

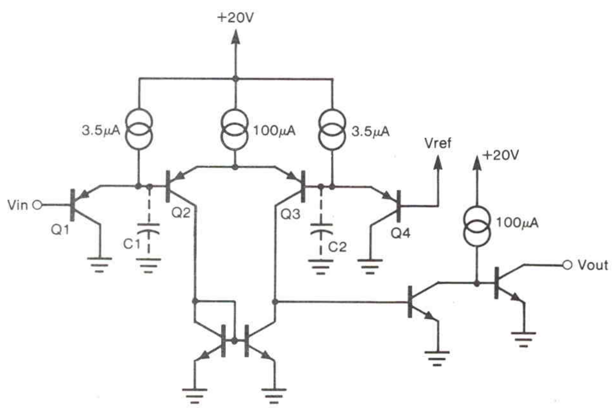


Figure 2 — RCA schematic.
Parasitic capacitors (C1 &C2) create delay.

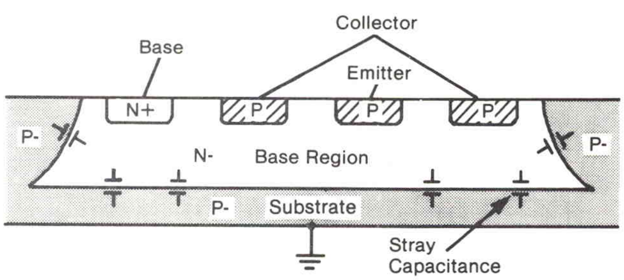


Figure 3 — Q2, Q3, lateral PNPs
The boundary between the base region (N-) and the substrate (P-) is a reverse-biased junction and has a large surface area, so it forms a significant capacitor (C1 & C2, Fig. 2).

These capacitors are in a critical location, as they must be charged by the (small) 3.5μA current sources as follows:

(1) Vin driven below Vref by an amount, Vu.d.
  (a) Q1's emitter follows, and its emitter current discharges C1, and turns Q2 on.
  (b) The output swings with minimal delay.

(2) Vin driven back above Vref.
  (a) Q1 shuts off.
  (b) C1 must be charged (through a ΔV equal to Vu.d.) by the 3.5μA current source and Q2's base current (≅10μA), before Q2 shuts off and the output swings.

this creates a delay of

$$\Delta t = \frac{C1}{I} \Delta V \cong \frac{C1}{13.5\mu A} Vu.d.$$

If the comparator is used in the inverting mode, the same delay problem exists, this time with the charging of C2.

Diodes eliminate delay in National part

In the National part (Figure 4), this delay problem is solved by adding input charging diodes (D1 and D2) to provide the charging current for C1 and C2. The data taken from the National part (Figure 1) shows that these diodes do prevent the delay.

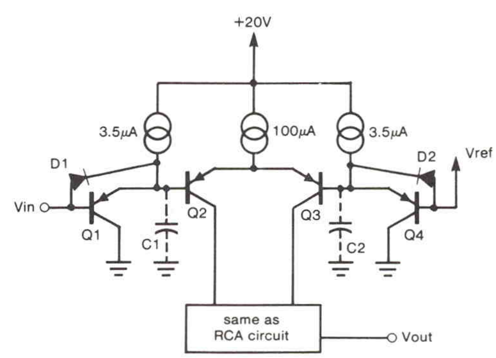


Figure 4 — National schematic.
D1 and D2 prevent delay in National part.

RCA has non-functional diodes

After the delay was pinned down as being a result of the lack of these input diodes, decapsulation of several RCA chips with different date codes and observation under the microscope showed that the input diodes **were** there, but that

continued on page 3

there were no windows in the oxide layer through which the metallization could contact them (see Photo 1). Microscopic observation showed that other vendors' parts had the diodes, and that they **did** have the oxide windows through which to make contact (see Photos 2 and 3).

Photo 1
RCA 339

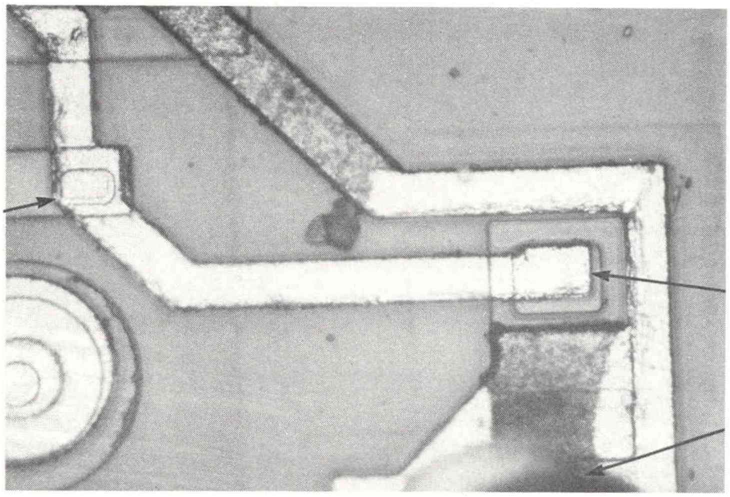


Photo 2
NEC 339

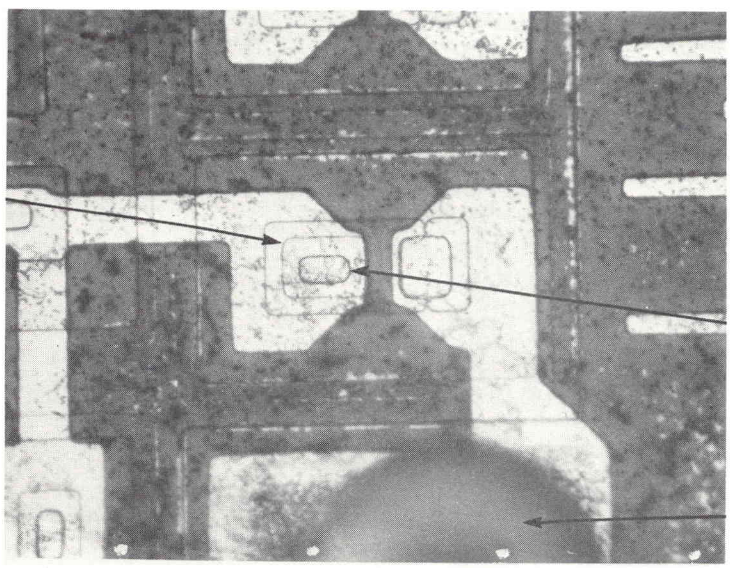
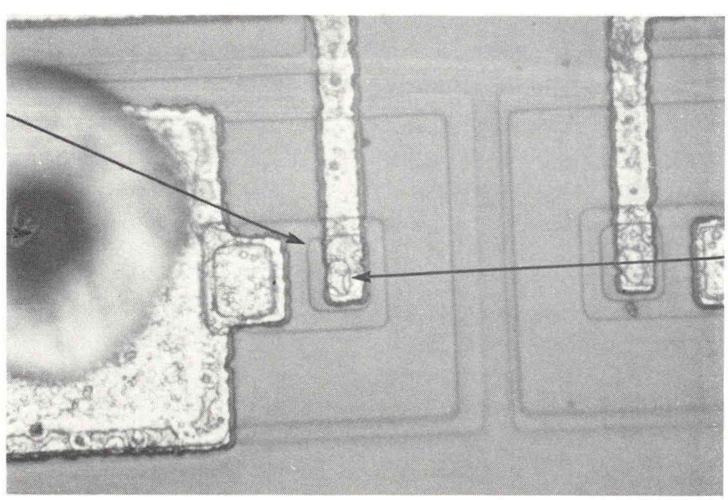


Photo 3
National 339



continued on page 4

Non-functional diodes confirmed

To verify that the diodes in the RCA part were not connected, two probes were placed down on the die, across D1 (one on the input pin and the other on the run connecting the cathode of D1 to the emitter of Q1, see Figure 5).

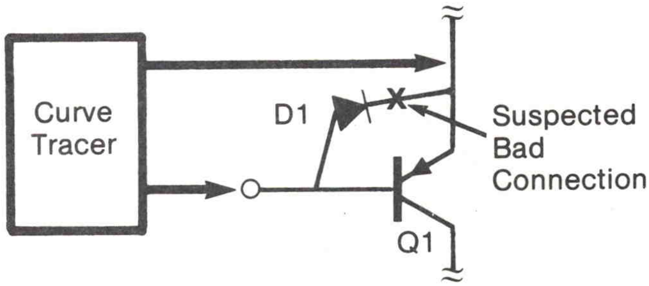


Figure 5

A curve tracer applied to the two probes showed the base-emitter junction of Q1 to be functional, but no current flowed through the diode in the forward direction. The voltage was increased and no current flowed until the 75V V_{be} reverse breakdown voltage of Q1 was reached. The same results were obtained for other inputs on the same chip and on other RCA chips as well. But when other vendors' parts were probed, their input diodes were found to be functional.

RCA notified

After experimental data pointed to missing (actually non-functional) diodes, and both microscopic observation and die-probing confirmed the suspicion, the RCA factory was called. The problem was described to both the applications engineer and the process engineer and neither knew about it. A week or so later they called back with the information that the oxide mask **was** changed to disconnect the diodes shortly after the device was first sent into production. When pressed for the reason the diodes were disconnected, they stated that the device had "objectionable input current characteristics when trying to meet Note 3 in the RCA electrical characteristics" (which states that the inputs may be raised to +30V without damage when V+ = 5V.)

RCA disqualified

This delay is grounds for disqualification, although it could be designed around by clamping the input so it can't go below Vref. Because of this situation, RCA has been disqualified until such time as their part's performance is brought into line with the other vendors'.

Assistance was offered in debugging the device if RCA would produce and send us some parts made from the original mask (disconnecting the diodes is not considered by Component Engineering to be an adequate solution to the objectionable input currents mentioned above). RCA declined to take advantage of this offer and is making no moves to correct this problem.

For more information

If you have any questions about the 339 comparator please contact me at 58-299, ext. 6700.

Willie Rempfer
Analog Component Engineering

Contact Finish Alternatives

With the rising costs of connectors spurred by the unstable gold market, the connector industry has been seeking alternative connector finishes. In introducing a discussion of connector finishes, one must first consider how a connector actually makes contact.

A detailed examination of a connector shows two mating halves of a separable electrical connector pressed together by a normal force. Even though the two mating surfaces appear smooth, on a microscopic level the surfaces have some characteristic roughness. Due to this roughness, the contacting surfaces have finite contact spots, or "A"-spots (see Figure 1).

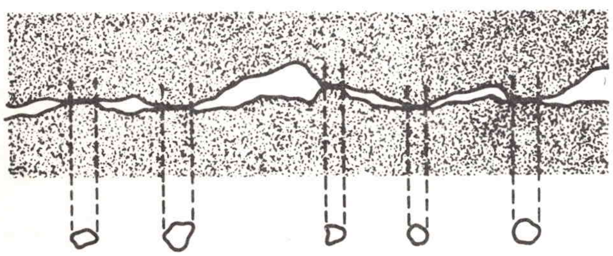


Figure 1 — Multiple contact regions at a typical contact surface ("A" spots)

In this situation we can define the true area of contact as being the spots in intimate contact. Current flowing through the connector must "neck down" or constrict, giving rise to contact resistance. It has been found that the **constriction resistance** of the connector is **highly dependent on the normal force** applied to the contact. Figure 2 depicts Rc for common connector materials.

The contact resistance and the number of contact spots is found to be largely independent over three orders of magnitude difference in the apparent area of the contact. The contact spots can be modeled as hemispheres increasing the true area of contact through elastic and plastic deformation as the normal force is applied. As a matter of fact, one of the ways to accurately determine the true area of contact is by measuring the contact resistance of two clean surfaces. Therefore, contact resistance is akin to other mechanical surface phenomena like friction, because of the strong dependence of normal force and independence of the apparent contact area.

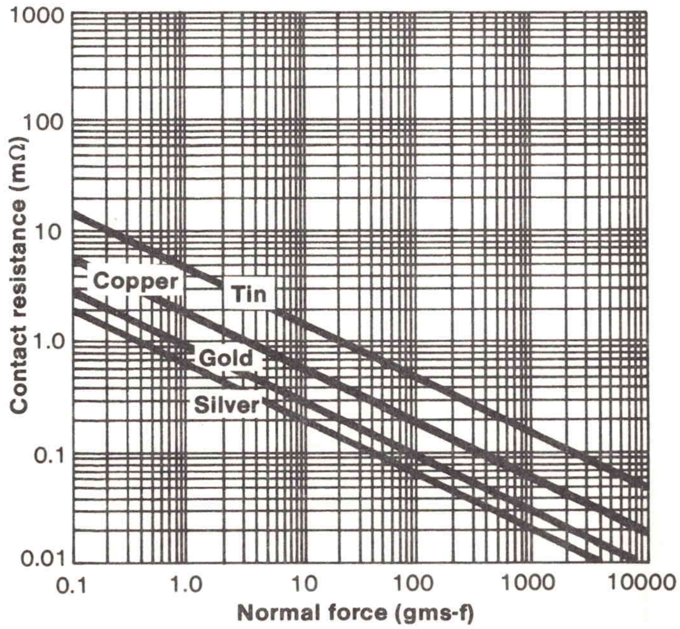


Figure 2 — Rc of chemically clean contacts vs. force

Selecting contact finishes

A secondary consideration in choosing a contact finish is the environmental conditions under which the connector operates. The contact resistance curves in Figure 2 apply to chemically clean contacts, but rarely do contacts occur chemically clean when exposed to the environment.

The atmosphere contains many contaminants harmful to contact materials, such as H_2S, SO_2, reactive chlorides (NO), moisture, and particulates such as dusts (see **Component News 274**, page 7). Humidity is a key ingredient in any contact corrosion, with 60-70% relative humidity being the key value above which corrosion reactions are rapidly accelerated. Very low amounts of contaminants (on the order of several parts per billion) are harmful to electrical contact materials. H_2S is characteristic of severe industrial environments,

continued on page 6

SO_2 is a by-product of paper manufacture (SO_2-processed paper outgasses this contaminant), and reactive chlorides can come from outgassing plastics such as vinyl chloride.

A certain amount of most of these contaminants is found in all atmospheres, even in office environments. These atmospheric contaminants form corrosion films on most contact materials and cause film resistance in addition to the constriction resistance previously mentioned.

Materials and failure modes

With the constriction and film resistances kept in mind, we can now proceed to contact materials, properties and failure modes. A chart of available contact materials for all applications is given in Figure 3 (page 7), showing general classifications. It may be appropriate to say here that materials with good corrosion resistance may be poor electrical contact finishes. Nickel and aluminum are corrosion-resistant materials which form passivating layers of film which prevent further corrosion of basis materials. The passivating layers are difficult to break down either electrically or mechanically. Electrical characteristics of the films can be classified as occuring by three mechanisms: tunnel conduction, dielectric breakdown, or a combination of both.

Class A materials (see Figure 3) such as gold generally form films on the order of 100Å thick. Film resistance is quite low and the tunnel resistivity results in a linear V vs. I curve. Class B and C materials start conduction in a linear V vs. I curve until a sufficient voltage gradient exists to cause dielectric breakdown. The two classes are differentiated primarily by the severity of dielectric breakdown. The Class D materials form films which are very thick and act as insulators until severe dielectric breakdown occurs. Special considerations must be made to ensure contact reliability when using these materials. Gold, silver and tin are the most commonly used contact finishes presently available on connectors.

An examination of the failure modes of these materials can help choose the proper material for a given application.

Gold — Because of its cost, gold has traditionally been plated in thin coatings. Any thin plating has tiny voids or pores in the finish. Platings thicker than 150-200 millionths of an inch are generally considered to be pore-free. However, any plating less than 150 microinches will have some intrinsic porosity. For instrumentation applications, 30 microinch gold plating is considered to be the absolute minimum required to achieve sufficient coverage and provide resistance to the environment. The plating pores appear at grain boundaries of the basis metal. Methods of reducing porosity include control of substrate roughness, pulse plating methods as well as the use of "leveling" underplates.

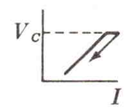
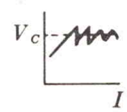
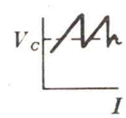
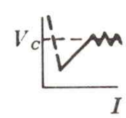
The primary failure mode of gold platings is through "pore corrosion." The material underneath the gold corrodes through the pores in the surface and may spread over the surface. Two different types of underplates are commonly used today: nickel and copper. Nickel forms extremely hard and non-conductive corrosion products. Nickel has been shown to drastically improve the wear characteristics of the surface plating as well as preventing the diffusion of zinc impurities and copper from the basis material in high temperature applications (greater the 100°C). Electroplated nickel has the tendency to form high stress deposits in thick coatings, that are prone to cracking when flexed. Nickel does not tend to spread or "creep" over the contact surface as much as copper does.

Copper generally forms a more apparent brownish corrosion product which does spread over the gold surface. The copper corrosion products are more easily broken down, both mechanically and electrically. Copper is sensitive to sulfide environments whereas nickel corrodes more in chloride environments. Let it suffice to say that which underplate is used depends on the application, voltages and currents, environments and whether visible corrosion is detrimental.

Silver — Silver has previously been used in a wide variety of connector applications. Silver was widely used as an underplate for gold until it was discovered that silver sulfide corrosion products

text continued on page 8

Figure 3. Contact Finish Classifications

Classification	Characteristics	Film Breakdown Voltage	Resistance Range Before Breakdown	Typical Voltage Current Char.
Class A: Best Gold Selected gold alloys	Gold, and a few of its alloys, is in a class by itself. It is clearly less prone to film growth than any other material. Pure gold is rather soft with tendencies to adhesion and wear. Low normal forces with thick gold finishes, or the addition of hardeners (i.e., cobalt and nickel) lessen adhesion and improve wear.	No dielectric breakdown. Tunnel conduction only.	Less than 1Ω	
Class B: Good Platinum Palladium Iridium Rhenium	These metals grow relatively little film. When exposed they will develop various films up to approximately 100 Å. Continuous cycling minimizes films to a few monolayers.	0.1 - 1V initially through tunnel conduction followed by dielectric breakdown.	Up to 10Ω	
Class C: Fair Rhodium Silver gold Silver Pd Silver Silver copper	This class becomes more film-prone as silver content increases, also gets worse as base metals (copper and nickel) are added. The main uses of these finishes are switch applications where continuous cycling "wipes" away films and keeps intimate contact surfaces film-free.	1 - 10V initially through tunnel conduction followed by more severe dielectric breakdown.	Up to 100Ω	
Class D: Poor Copper Nickel Tungsten Brass Nickel silver (Cu-Ni-Zn alloys) Phosphor bronze Beryllium copper Aluminum Tin	All of these metals develop thick and often strong films which require very high forces to break through. They should be avoided except in cases where high normal forces and other special design considerations are taken into account.	10 - 100V Severe dielectric breakdown of films.	Up to 10^6Ω	

continued on page 8

crept rapidly over the gold surface finish from surface defects. Under some conditions the "creep" was extreme enough to cover the surface in a matter of weeks.

Silver is now primarily used as a finish in RF connector applications, where the black discoloration of sulfide and oxide films are not objectionable. The corrosion films are relatively soft and easily broken down mechanically and electrically. Some ICs are currently being produced with silver coated lead frames. They are easily distinguished by the characteristic black tarnish films formed when packaged in paper containers. To prevent tarnish films, silver should be sealed in plastic bags with a tarnish-preventative chemical.

Tin — Tin has been classified as a poor contact finish because it forms relatively thick corrosion films which simply cannot be broken down in today's low voltage and current applications. High mechanical forces are required to assist in penetrating the films. In addition, tin has other detrimental characteristics to take into consideration when used in connector applications.

Pure electroplated tin has the tendency to form "whiskers" which can short adjacent circuits. Again, this is the result of stress from the electroplating process. Alloying lead into the tin minimizes whisker growth. Reflowing the tin by melting, and thus changing the grain structure, is an alternate method for relieving the stress level of the deposits. With high current circuits, these whiskers can be burned off with only temporary circuit disturbance.

The worst failure mode of tin is in "fretting" corrosion. Fretting corrosion occurs when a corrosion product in the intimate contact surface gets abrasively worn into the plating though contact motion. Eventually, with sufficient cycles of contact motion, the full thickness of plating to the base material is covered with the corrosion. The contact motion may be the result of differential thermal expansion of materials, vibration environment, as well as connect/disconnect cycles. All materials, except gold, are subject to some degree of fretting corrosion.

Tin is also soft, and the high normal forces required to break down the corrosion films and keep the intimate contact surfaces film-free negatively impact the wear characteristics. Tin-lead alloys, with near eutectic mixtures (like solder), have proven to be quite corrosion-resistant except in direct marine atmospheres. An application chart comparing tin and gold characteristics is given in Figure 4, page 9.

Conclusion

Despite the rising and unstable price of gold, this finish still holds as the best contact finish. The consensus of opinion at the 1979 Holm Electrical Contact Conference was that there is still no direct replacement for gold in electrical contacts. In most low-level circuit applications, gold is still the only contact finish that allows a sufficient margin of safety for reliable connections.

For more information about contact finishes, please contact **Peter Butler (58-299), ext. 5417.**

continued on page 9

Figure 4. Contact Finish Guidelines for Connectors In Instrumentation Applications

	Gold is Necessary	"Undefined Zone"	Tin is OK	No Plating
Contact Normal Force	0 - 150 gms	150 - 450 gms	450 gms up.	1 kgm up.
Engagement Wipe	None	Small	With Slide	With Slide
Insertion/ Withdrawal Cycles	100 - 1000 cycles	10 - 100 cycles	Less than 10 cycles	Less than 10 cycles
Open-Circuit Voltage	0 - 10V	10V - 30V	Greater Than 30V	Greater Than 30V
Current	0 - 1 amp	1 amp - 10 amps	Greater Than 10A	Greater Than 1A*

*Providing **all** conditions in that column are met.

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.
✓ **156-0949-00**	**MMI**	**Microprogram controller**	**Dale Coleman, 7607**

Monolithic Memories, Inc. has announced that production of their sole-sourced 67110 microprogram controller circuit has been discontinued. Any individuals or project leaders with long-term requirements for this part should contact Purchasing about a "last time" buy.

✓ **156-0986-00**	**Signetics**	**Microprocessor with 100% burn-in**	**Carl Teale, 7148**

The 2650A and its variations are single-sourced parts produced by Signetics. Due to our numerous development projects which utilize these microprocessors, we are becoming increasingly dependent on Signetics for consistent and timely deliveries.

Unfortunately, this manufacturer has a poor record for protecting their single-sourced customers. And, because Signetics is owned by one of Tek's competitors (Philips), we can hardly expect things to improve.

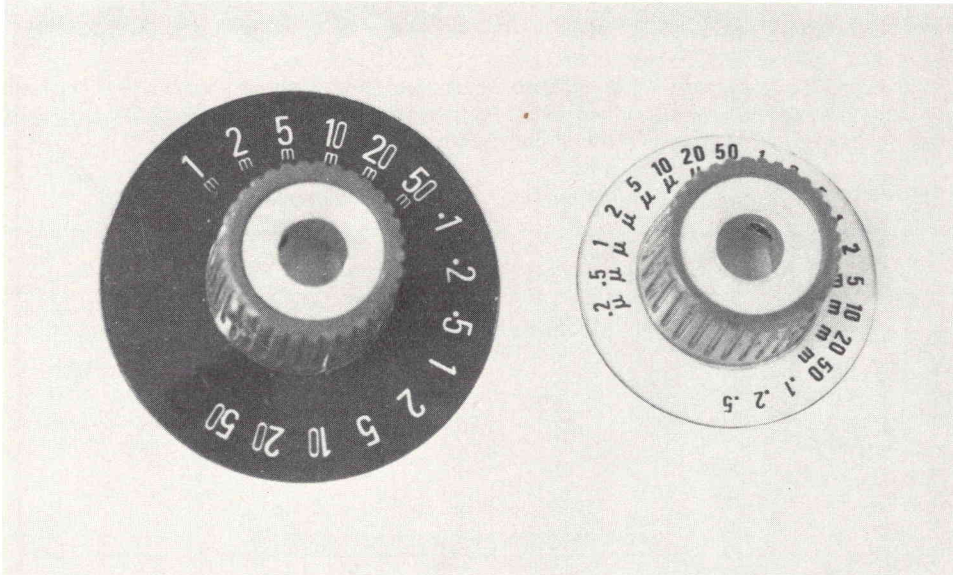
This part **cannot** be replaced by relaying out the boards as many other components can be. Therefore, we strongly recommend that you not use this, or any other, single-sourced microprocessor for new designs.

✓ **In process**	**Intel**	**Static RAM, 1K x 4 NMOS, 18-pin**	**Peter Reitmajer, 4663**

Intel's 2114AL will soon be part-numbered and will become prime source for SRAMs formerly supplied under Tek P/Ns 156-1028-xx, 156-1127-xx and 156-1281-xx.

The new part number has a faster access time, requires less power to operate, performs better under test conditions, and is less expensive than the older parts. A comparison is shown below:

Part Number	Bit Geometry	I_{CC}	Access Time (R/W)	Approx. Cost
New	1K x 4	40mA	200nS	$6.00
156-1028-xx	1K x 4	135mA	450nS	8.00
156-1127-xx	1K x 4	70mA	450nS	8.50
156-1281-xx	1K x 4	100mA	200nS	8.50



How about switching to clear background knob skirts?

Many manufacturing problems could be resolved, and money saved, by eliminating the solid background knob skirt (on left) in favor of the clear background type (on right).

Solid background knob skirts are a headache. They're difficult to manufacture, cost more and have very high reject rates.

For instance, annual labor costs to manufacture the solid skirt portion of the knob alone amount to $9,468 as opposed to $1,097 for the clear variety — a difference of over 800%. Annual labor costs to manufacture the entire knob assembly are $2,333 for solid as opposed to only $315 for clear — a 700% differential.

Additionally, the reject rate for solids in our skirt making area where silkscreening takes place averages 17% because of filled-in or distorted nomenclature and edge smearing. When these solid skirts reach knob assembly, an additional 35% are rejected for pinholes in the background and non-concentric lettering, etc. Then, when the knobs reach the instrument assembly areas another 40% are rejected for light leaks, pinholes, shipping damage and "black patches," a condition when pinhole patching is visually obvious.

In order to cut this high reject rate we in Plastics have tightened manufacturing controls and have begun using trays in which skirts and knob assemblies are kept separate to avoid shipping damage. However, these precautions are not the solution to the problem.

The only real solution is to change to clear background skirts exclusively. In order to do this we need input from all involved, especially instrument design areas. There are 31 Tek part numbers involved.

If we changed to clear skirts exclusively, some 1,443 hours of manufacturing time and lots of waste and frustration could be saved annually.

Jayant Ingle
Betty Bohall
(08-538), ext. 7214 (Vancouver)

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	No.	Description	When Available	P/N	Approx. Cost	Engineer to contact
		digital devices				
Rockwell, Synertek	6502	IC, 8-bit microprocessor, NMOS, 40-pin DIP	Now	156-1425-00	$ 7.00	Carl Teale, 7148
TI	75160	GPIB Data Bus XCVR	Now	156-1414-xx	5.00	Jim Howe, 6303
TI	75161	GPIB Control Bus XCVR	Now	156-1415-xx	5.00	Jim Howe, 6303
TI	75162	GPIB Control Bus XCVR	1st Qtr. '80	In process	5.00	Jim Howe, 6303
TI	9914	GPIB Protocol chip	Now	156-1444-xx	25.60	Jim Howe, 6303
		optoelectronic and passive devices				
Litronix	RL10	Lamp, LED, tombstone; rectangular with curved top	Now	No P/N	—	Betty Anderson, 6389
Dialight	555-4003	Lamp, LED, same as 150-1020-00 but 4-wide	Now	No P/N	2.20	Betty Anderson, 6389
Dialight	550-0406-004	Lamp, LED, 4-wide red lamps with black plastic "hatchback" mount, p.c. board mount, side looking	Now	No P/N	1.25	Betty Anderson, 6389
HP	HDSP-2010	Display, LED, same as HDSP-2000 with extended temp range, guaranteed leak rate, 4-digit, 5x7 dot, w/shift registers, drivers	Jan. 1	No P/N	—	Betty Anderson, 6389
Data Display	PCL-190R	Lamp, LED, red, side looking, hatchback plastic mount, p.c. board mount	Now	No P/N	—	Betty Anderson, 6389
Tec-Lite	—	Lamp, LED, panel mount, w/hardware, shielded, red, green	—	No P/N	—	Betty Anderson, 6389
Mallory	TCG	Capacitor, 440μF, 100V alum. elect., axial lead	Now	290-0915-00		Don Anderson, 5415
Mallory	TCG	Capacitor, 3200μF, 25V alum. elect., axial lead	Now	290-0913-00		Don Anderson, 5415
Mallory	TCG	Capacitor, 6200μF, 15V alum. elect., axial lead	Now	290-0914-00		Don Anderson, 5415
Panasonic	LS	Capacitor, 33μF, 35V single ended alum. elect.	Now	290-0920-00		Don Anderson, 5415
Panasonic	LS	Capacitor, 220μF, 50V alum. elect., axial lead	Now	290-0918-00		Don Anderson, 5415
Panasonic	LS	Capacitor, 330μF, 25V alum. elect., axial lead	Now	290-0917-00		Don Anderson, 5415
Panasonic	LS	Capacitor, 470μF, 35V single ended alum. elect.	Now	290-0919-00		Don Anderson, 5415
Sprague	715P	Capacitor, 0.0033μF, 1.2KVDC polypropylene, radial lead	Now	285-1208-00		Don Anderson, 5415
Sprague	674D	Capacitor, 300μF, 50V electrolytic, low ESR, 2.3 ARMS ripple current, single ended	Now	290-0912-00		Don Anderson, 5415
TRW		Capacitor, 0.47μF, 600WVDC metallized polyester, axial lead	Now	285-1210-00		Don Anderson, 5415

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)

Institute for Interconnecting and Packaging Electronic Circuits (IPC)

Monthly issues of the IPC Monthly Technical Review are available for perusal at 41-260. The October issue features an article on a high energy method for repairing gold contact fingers on circuit boards.

New Tek Standard

062-1709-00 Fabrication Standard-Checklist for Mold Designers and Mold Makers, Standard Mold Requirements

New publications available from Tek Standards

ANSI 132.1-1966 Office Lighting
ANSI B1.22-1978 Gages and Gaging Practice for "MJ" Series Metric Screw Thread
ANSI B5.51M-79 Preferred SI Units for Machine Tools
ANSI X4.11-1973 Operating Supply Voltage and Frequency for Office Machines
CSA Preliminary Standard. Continuous Flow Inhalation Anaesthetic. Apparatus (Anaesthetic Machines) for Medical Use
DIN German Standards. Katalog 1979
DIN Katalog — English Translation of German Standards 1979
DOD-C-24594 Cell, Storage, Silver-Zinc Alkaline Type (For Deep Submergence Applications) Metric
FED-Std-H28/1 Superseding NBS Handbook (1969) Part 1 Section 1
IEC-147-OE-1979 Essential Ratings and Characteristics of Semiconductor Devices and General Principles of Measuring Methods Part 0: General and Terminology, (Fifth Supplement of 147-0-1966)
IEEE 62 Guide for Field Testing Power Apparatus Insulation
MIL-HDBK-235-1A Electromagnetic (Radiated) Environment Considerations for Design and Procurement of Electrical and Electronic Equipment as Hub Systems
MIL-R83726A Amendment 2: Relays, Time Delay, Hybrid and Solid State
MIL-S-15291C Amendment 2: Switches, Rotary, Snap Action
MIL-S-28827A Switches, Thermostatic (Volatile Liquid), Hermetically Sealed
MIL-T18934A Test-Detecting Set, Cable AN/TSM-11
MIL-T-28800B Amendment 1: Test Equipment for Use with Electrical and Electronic Equipment
MIL-STD-22D Welded Joint Design
MIL-STD-1174B Associated Lists for Arradcom Engineering Drawings
MIL-STD-1364E Standard General Purpose Electronic Test Equipment, April 1979
MIL-STD-29175 Switch, Thermostatic, Low Voltage, Non, (Setback/Setup) and Setback/Setup. Temperature Limiting: Heating, Cooling, and Heating-Cooling
QQW-343D Federal Specification, Wire, Electrical
UL 20 Revision Pages to Eighth Edition
UL 544 Second Edition. Medical and Dental Equipment
UL 913 Third Edition. Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III Division I, Hazardous Location
UL 1244 Electrical and Electronic Measuring and Testing Equipment. First Edition. July 3, 1978
UL 1244 Revision Pages — First Edition Electrical and Electronic Measuring and Testing Equipment. August 9, 1979

Where are my ROMs?

This question is being asked more and more frequently within Tektronix. ROMs are getting more costly and harder to get. Why? Because all IC manufacturers are currently capacity-limited.

Due to the fact that masked ROMs (MROMs) are custom-made parts, manufacturers are unable to build inventories. The result — vendors are increasing minimum order quantities and lead times.

For example, Motorola has increased minimum order quantities to 1000, with Texas Instruments going to 500. Lead times are averaging more than twenty weeks. As a low volume user of MROMs, Tektronix will probably be constrained to working with low volume suppliers, and will probably see the overall cost of MROMs edging toward the cost of EPROMs.

What about using EPROMs? This will work in some cases, but not in all. Vendors are not supplying 64K EPROMs, and 32K EPROMs are difficult to secure. Plus, we estimate that the cost of EPROMs is three to five times that of MROMs. With a minimum order level of 1000 parts, on a low volume instrument (e.g. 250/yr.) the carrying cost of inventory will, in many instances, offset the higher cost of EPROMs. Also, over a four-year period you may have to face the cost of remasking, or the obsolescence of the original MROM.

What, then, is the answer? Presently there is no good answer. Nor does the MROM situation look like it will get any brighter. Minimum order quantities will probably continue to go higher, and the five month lead time will probably get even longer.

We, therefore, recommend that all new MROM orders be placed as soon as possible. Also, minimum order quantities should be checked, and care taken to ensure that resident software is correct.

For more information call **Don Van Beek, ext. 4663** (Memory and I/O Component Engineering), or **George Roussos, ext. 7927** (Purchasing).

92-701

RICHARD DUNIPACE

COMPONENT NEWS

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.