COMPONENT NEWS

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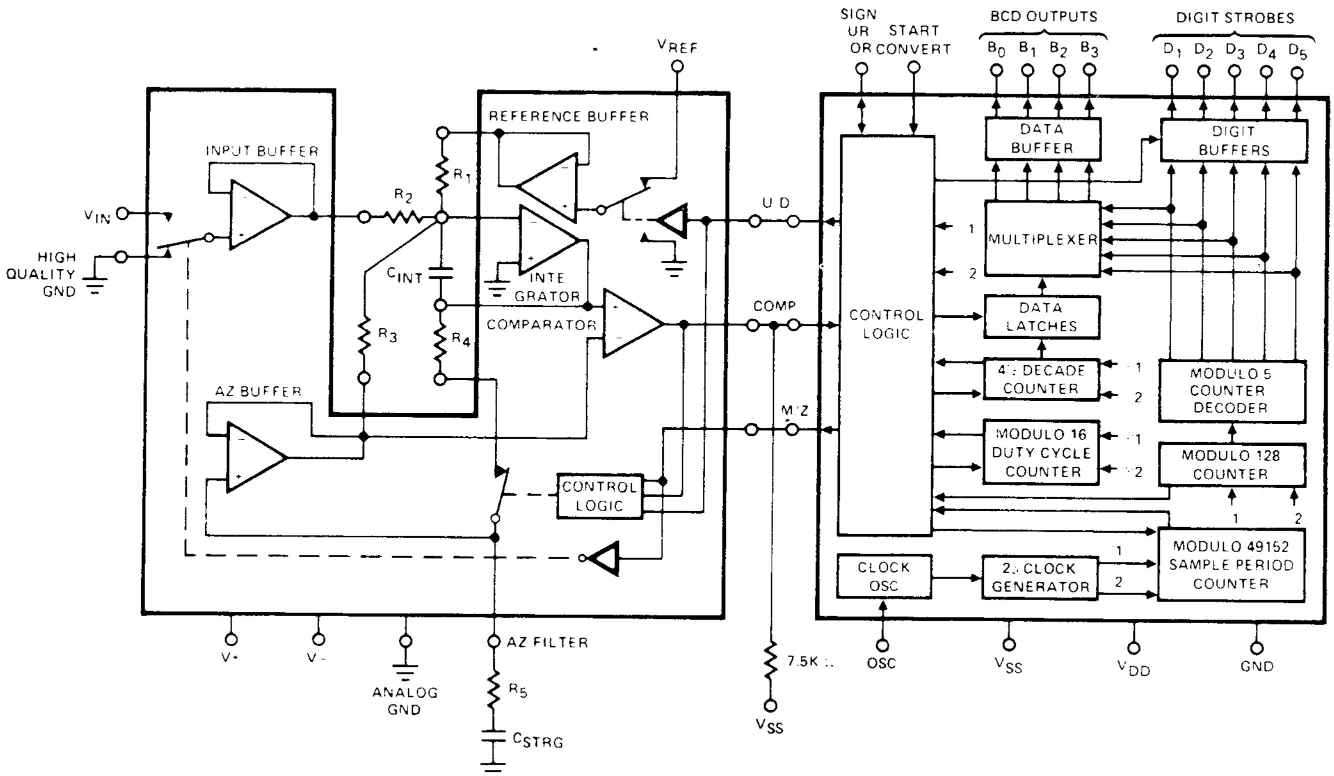
4½ digit A/D converter

Siliconix, Inc. has developed a 4½ digit DVM system for low-cost, high-performance applications. The set consists of a monolithic PMOS synchronous 18-pin digital processor (LD 121) and a monolithic bipolar-PMOS 16-pin analog processor (LD 120).

The two-chip system uses a charge-balancing technique for A/D conversion called "quantized feedback." The conversion technique balances the charge supplied by a current proportional to the input voltage, over a measured interval, with an accumulation of quantized charges equal to a BCD count. The units of quantized charge are provided through pulsewidth modulation of a reference current.

Figure 1 illustrates the functional block diagram of the A/D converter with external components required for proper circuit connection.

continued on page 2



LD120 **Connection Diagram** LD121

Figure 1

also in this issue

4½ digit A/D converter *continued from page 1*

system operation

The LD 120/LD 121 system performs a ratiometric A/D conversion which may be used over a **full-scale** range from 1.9999 volts or 199.99 millivolts. The 199.99 mV range is capable of 10 μV resolution.

The following output information is available: two overrange signals, underrange, sign and 4½ digits of multiplexed BCD data. All outputs are TTL compatible. Overrange is also indicated by blinking digit strobes above 20,000 counts. An input is provided to inhibit this feature at user option.

The system does require three supply voltages (12 V, -12 V, 5 V) and a stable reference voltage. An internal oscillator can be used to generate a clock frequency but is not recommended for design. For improved CMRR, an external clock source is recommended.

system performance

Discussions with Siliconix are currently under way to obtain 200 mV range specifications. Specifications at this range are not yet available in data books. Up-to-date comprehensive specs for the LD 120 and LD121 are shown in Table 1. The following discussion covers what each system performance specification means, and how it compares to typical measured values.

linearity and noise

Linearity error is determined by measuring the maximum deviation of the output reading from a straight line drawn between the value of the converter's zero offset and the full-scale value. **Noise error** is defined as internal noise generated within the chip and is measured as the amount of fluctuation of the output reading. Linearity and noise errors are difficult to separate, thus an error measurement will constitute a composite of linearity error and noise error.

Samples of the LD 120/LD 121 tested at Tektronix showed that the typical count deviation at 25°C was -1 to +2 counts for the 200 mV scale. Maximum error due to linearity and noise for the 200 mV scale at 25°C is ±4 counts.

zero drift

Zero drift is the amount of counts the output will drift over temperature with zero input signal. The limits of zero drift for samples tested was ±2 counts. Siliconix specifies maximum zero drift as ±5 counts and typical zero drift as ±1 count for the 2 V and 200 mV scales.

gain temperature coefficient

Gain error is the departure of the actual output reading from expected output reading for a full-scale input voltage. At a particular temperature, gain error is nulled by the application of a gain adjustment.

The **gain temperature coefficient** is the amount the output reading will vary per change in temperature for a full-scale input voltage. Figure 2 illustrates the observed gain errors associated with temperature changes. Siliconix specifies that the output reading will vary a maximum of 15 ppm/△°C and typically 5 ppm/△°C for the 2 V and 200 mV ranges.

accuracy

The term **accuracy** describes the overall performance of a converter. It measures how closely the output of the actual A/D converter approaches the output of an ideal model.

Accuracy includes all error sources, principally, linearity error, noise error, zero offset error, temperature coefficients and power supply changes. Since the LD 120/LD121 converter has fairly high resolution, circuit board layout becomes a critical factor for maximizing accuracy. Contact me in Component Engineering for board layout considerations.

conclusion

The LD 120/LD121 converter set will cost approximately $15.00 in 1000 lot quantities, and should be considered for applications involving 4½ digit DVM systems. Samples tested show that the LD 120/LD 121 can be successfully used on the 200 mV scale with proper design considerations.

For more information about the LD 120/LD 121, please contact Chris Martinez on ext. 7709.

(See Table 1 on pages 3 and 4, and Figure 2 on page 5)

4½ digit A/D converter

Table 1: Electrical Characteristics

		CHARACTERISTIC		MIN	TYP	MAX	UNITS	TEST CONDITIONS V+ = 12 V; V−, V_{DD} = −12 V, RANGE	TEMP.
SYSTEM (Notes 2 & 3)			Linearity	−1	±¼	+1	Counts	2 V	25°C
				−2	±½	+2		200 mV	
			Stability (noise)		±1/3	±1	Counts	2 V	25°C
					±½	±2		200 mV	
			Linearity + Stability*		-2 to +1		Counts	200 mV	0°C
					-1 to +2				25°C
					-2 to +1				50°C
					-1 to +3				70°C
			Zero drift		±2*	±5	Counts	2 V, 200 mV	25°C to 75°C
			Gain T.C.		see fig. 2	15	PPM/°C	2 V, 200 mV	0°C to 70°C
		NMRR			40			dB	25°C
		PSRR			80				25°C
LD121CJ DIGITAL	POWER	V_{SS}		4	5	6	V	V_{SS} = 5 V, T_A = 25°C	
		V_{DD}		−9	−12	−15			
		I_{SS}	(Note 4)		12	15	mA		
	INPUTS	V_{INH}	Comparator Input	3.5			V	Guaranteed Input Threshold Voltages	
		V_{INL}				3			
		V_{INH}	Sign/Or/Ur (Note 5)	3.5					
		V_{INL}	Blink Inhibit			0.5			
		V_{INH}	Start	3.5					
		V_{INL}				0.5			
		V_{INH}	Oscillator IN	3.5					
		V_{INL}				−3			
		I_{INH}	Sign/OR/UR (Note 5)			170	µA	V_{IN} = 0 V	
		I_{INL}	Start			−170		V_{IN} = 5 V	
		I_{INL}	Oscillator			1.4	mA	V_{IN} = −3.5 V	
	OUTPUTS	V_{OH}	Bit Lines, Sign/OR/UR Digit Strobes	2.4			V	I_{OH} = −10 µA	
		V_{OL}				0.5		I_{OL} = 1.6 mA	
		V_{OH}	M/Z	4.0				I_{OH} = −150 µA	
		V_{OL}				0.5		I_{OL} = 0.8 mA	
		V_{OH}		4.0				I_{OH} = −0.5 mA	
		V_{OL}				0.5		I_{OL} = 0.8 mA	
	DYNAMIC	t_p	Start Convert (Note 6)	20			µs		
		f_{OSC}		50		250	kHz	50% Duty Cycle	
			Rep Rate	78		470	Hz	f_{OSC} ÷ 640	
			Duty Cycle		15		%		
			Interdigit Blanking		25				

* Typical values measured at Tektronix

		CHARACTERISTIC		MIN	TYP	MAX	UNITS	TEST CONDITIONS $V+ = 12$ V; $V-$, $V_{DD} = -12$ V, $V_{SS} = 5$ V, $T_A = 25°C$
LD120CJ LINEAR	POWER	V+		9	12	15	V	
		V−		−9	−12	−15		
		I+				3.5	mA	
		I−				−3		
		I_{GND}		0		−2	mA	M/Z, U/D = 2.4 V
	INPUT BUFF	I_{SOURCE}		−50	−100		μA	$V_{IN} = 2$ V, Buff Out = 0 V
		I_{SINK}		400	800			$V_{IN} = -2$ V, Buff Out = 0 V
		I_{IN}			2		pA	$V_{IN} = \pm 2.8$ V
		I_{IN}			40			$T_A = 70°C$, $V_{IN} = \pm 2.8$ V
		CMRR			−72		dB	
		V_{IN}	(Note 7)	−5		5	V	
	AZ BUFF	I_{SOURCE}			−100		μA	
		I_{SINK}			800			
		I_{STRG}			100		pA	$T_A = 70°C$
		V_{OFFSET}		−50		50	mV	$V_{OUT} = 0$ V
			Switch Resistance (on) (Note 8)		6	20	kΩ	$V_{STRG} = -4$ V, $I_{DS} = 30$ μA
	REF BUFF	I_{SOURCE}		−400	−800		μA	V_{IL} (U/D IN) = 0.8 V, $V_O = 0$ V
		I_{SINK}			100			V_{IH} (U/D IN) = 2.0 V, $V_O = 2$ V
	INT	I_{SOURCE}	(Note 9)	−50	−100		μA	V_{IN} (Int. IN) = −100 mV, $V_O = 0$ V
		I_{SINK}		400	800			V_{IN} (Int. IN) = 100 mV, $V_O = 0$ V
			Output Swing	−10		10	V	
	COMP	V_{OUT}		−5			V	$R_L = 10$k to +5 V, AZ FILTER IN = 100 mV
		V_{OFFSET}			±5		mV	INTEGRATOR OUT = 0 V
		I_{IH}	M/Z, U/D Inputs			50	nA	$V_{IH} = 2.0$ V
		I_{IL}				−100	μA	$V_{IL} = 0.8$ V

Typical values are for Design Aid Only, not guaranteed and not subject to production testing. **LD120-CMAM1-A LD121-IPDC V**

NOTES:

1. Bit width over which reading is stable 95% of the time.
2. System Parameters are not directly tested.
3. $f_{OSC} = 163.84$ kHz, $V_{REF} = 6.8$ V.
4. All outputs disconnected.
5. Pin characteristic only during D_4 strobe time.
6. Minimum positive going pulse width to initiate a conversion.
7. Maximum voltage for V_{INPUT} (pin 1) or hi-quality GND (pin 2) for which linearity can be guaranteed.
8. V_{STRG} must be more positive than −4 volts.
9. Reference Source Impedance must be less than 10K Ω.

4½ digit A/D converter

Refer to text on page 2

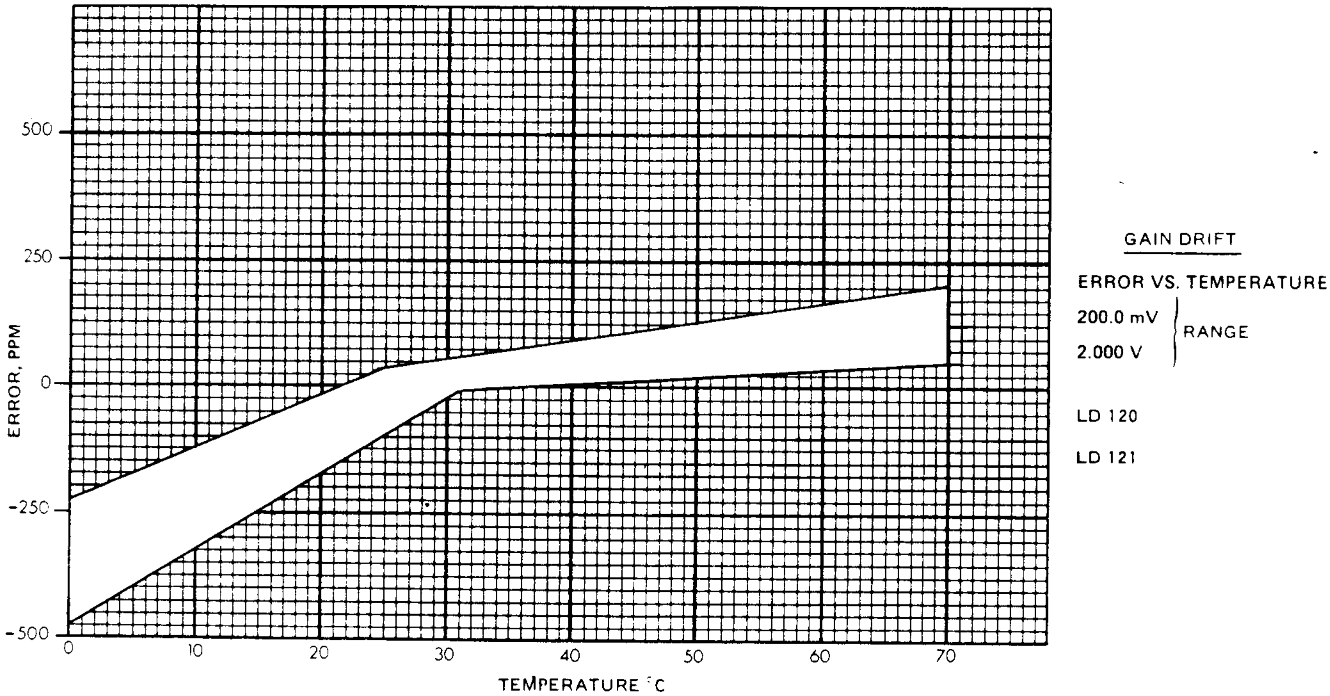


Figure 2

Second edition of sourcebook available

The second edition of the Engineering Sourcebook (Who, What, When, Where, How) is now available from Technical Communications.

The sourcebook is a general reference and resource guide for Tek engineers and support personnel. The book outlines the services provided by various design, evaluation and engineering support groups within the company. Specifically, **who** to contact, **what** is the function, **when** and **how** to make contact and **where** groups are located.

In addition to reorganizing and updating the information in the sourcebook, this edition incorporates divider tabs, an index and page numbers for easier reference.

If you would like a copy of the sourcebook, fill in the coupon below and return to delivery station 58-299.

I want to receive a copy of the Engineering Sourcebook

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Component applications review described

The primary function of Component Applications Engineering is to conduct component application reviews of new instruments. Two to four weeks before DC is the best time to begin the reviews. Reviews before PR and again before ER can be helpful, but changes are more difficult to implement.

When one of the product introduction milestones (DC, PR or ER) is approaching, you may request a component applications review of your instrument. We will need a set of diagrams, a parts list, and an EIS (Engineering Instrument Specification) if there is one. To best evaluate mechanical component applications, we need an instrument for about a half day.

While designers regularly seek assistance from component engineers for new components, they may be unaware of some application problems with previously part-numbered components. Component Applications Engineering can warn you of probable availability problems, recommend less expensive, more reliable or better performing parts, and give some helpful tips on protecting sensitive devices. Now and then we can put you in touch with another designer who has already solved a problem similar to the one you're facing.

In addition, we have a library of applications notes which are available for reading and copying. The app notes are grouped by function – power supplies, audio, reliability, etc.

The NPI Guidebook briefly describes the component applications activities. Refer to Section II, 2.16; II, 3.21; and II, 4.25 in the guidebook.

To schedule a component applications review, or for other application assistance, contact Virg Tomlin (ext. 5302) or Jim Howe (ext. 5698).

Programmed memory devices assigned "160" P/N

To alleviate problems with programmed memory devices the following plan is being put into effect.

All programmed memory devices (ROM, PROM, EPROM, EAROM, PAL, FPLA) will be given a newly designated Tek part number which is 160-xxxx-xx.

What does this mean to the engineer trying to part number a device for an instrument? It will require a certain amount of additional effort on the designer's part. The procedure will be as follows.

1. A PPIF will be submitted in the usual manner and a part number assigned.

2. Approximately one week prior to FER (Field Engineering Release) the engineer will furnish a device and a binary paper tape to Component Engineering, both containing the bit pattern. Component Engineering will verify that the contents of the two are identical and return the part to the engineer. The paper tape will then be sent to archiving for permanent storage.

3. The component engineer will sign off the spec indicating he/she has verified the contents.

4. The question may be asked: Why are we doing this? There are cases where instruments have been shipped and parts have failed in the field, but field personnel were unable to secure parts because the bit pattern was never documented except in the engineer's desk drawer. We wish to correct this situation.

We would also request that devices part numbered under the old 156-xxxx-xx **not** be changed to the new system. It would cause mass confusion.

Also, unprogrammed parts (EPROM, EAROM, PROM, etc.) will still have the 156-xxxx-xx. **The 160-xxxx-xx is reserved for programmed versions only.**

Any questions concerning MOS devices should be directed to Bob Goetz, ext. 6302, and for bipolar devices to Dave Sutherland, ext. 6301.

Call Dorothy Peterson, ext. 6336 for more details on the 160-xxxx-xx system.

Ceramic capacitor markings

It's important to remember that different manufacturers use different marking methods for identifying ceramic capacitors. Where one vendor might mark a 0.1µF ± 20% capacitor "104M," another manufacturer might mark an identical capacitor ".1M."

When the capacitance is expressed in picofarads (pF), the value is usually identified by a three digit number, with the first two digits representing the first two significant figures, and the last digit indicating the number of zeros (i.e. "104" is 100,000 pF). If the value is less than 10 pF, the letter "R" is often used to indicate the decimal point. For example, "7R5" is 7.5 pF. Another method uses the number "9" to move the decimal point one place to the left, i.e. "759" is 7.5 pF.

When the tolerance is marked, a **letter** will be used after the value to indicate the tolerance. "103K" or ".01K" thus becomes 0.01µF ± 10% (see table below).

The temperature characteristic is usually shown as a group of three characters written below the capacitance value. For example, $\frac{.02P}{Z5P}$ is 0.2µF -0—+100%, with a temperature range of +10°C to +85°C, and a maximum capacitance change of ±10%.

The following tables list the most commonly used tolerance and temperature characteristic codes. For more information on capacitor markings contact Harry Ford (58-299), ext. 6520.

Temp. range	code
+10 – +85	Z5
-30—+85	Y5
-55—+85	X5
-55—+125	X7
	W5
-55—+150	V5

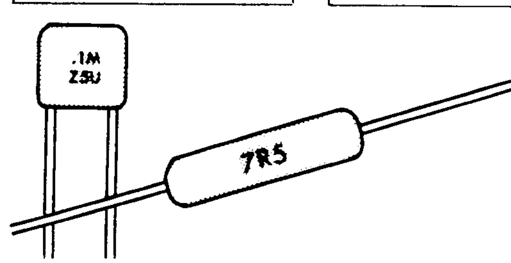
Single letter code for temp. char.	
ΔC over temp. (%)	code
7.5	B
+22—-33	C
+22—-56	E
ppm/°C 0 ± 30	A

Cap tolerance (%)	code
±1	F
±2	G
±3	H
±5	J
±10	K
±20	M
-20 – +80	Z
-0 – +100	P
+22 – -90	W
Special	G

Max. cap Δ (%)	code
±1	A
±1.5	B
±2.2	C
±3.3	D
±4.7	E
±7.5	F
±10	P
±15	R
±22	S
+22—-33	T
+22—-56	U
+22—-82	V

Temperature Coefficient	
PPM	code
Stearlite	A8
P120	A7
P100	M7
P030	B6
NPO (0)	C0
N030	B1
N080	U1
N150	P2
N220	R2
N300	B2
N330	S2
N470	T2
N500	D2
N650	E2
N750	U2
N1400	F3
N1500	P3
N2200	R3
N3300	S3
N4200	G3
N4700	T3
N5600	H3
P400	W2

Temp. Coeff. Tolerance	
PPM/°C	code
+10	R
+15	F
+20	Z
+30	G
+60	H
+100	W
+120	J
+150	S
+250	K
+400	A
+500	L
+650	B
+860	C
+900	D
+1000	M
+2500	N
Not specified	O
See appl. spec.	P



Capacitors: insulation resistance clarified

The insulation resistance of a capacitor can be quite critical in circuitry where current leakage through the capacitor can cause malfunction or undesirable results to occur. Examples of these applications are coupling and timing circuits.

Insulation resistance is often confused with the inherent "series resistance" of a capacitor. However, insulation resistance (IR) is a measure of leakage current and is referred to as the "parallel" or "shunt" resistance of the capacitor (see Figure).

Leakage current is composed of electrons that make their way through the dielectric itself, around the edges and across the surfaces of the dielectric, and between the leads.

In general, if we double the dielectric area, we also double the paths for electrons to flow through the dielectric, resulting in double the leakage current (one-half the insulation resistance). This inverse ratio between capacitance and insulation resistance for any given dielectric makes it possible for a capacitor manufacturer to specify a given IR for all capacitance values in a product line.

This is done by multiplying the insulation resistance (ohms) times the capacitance (farads) to arrive at a constant value of ohms x farads. Manufacturers commonly specify IR as meg $\Omega\mu$F. For example,

$$50{,}000 \text{ meg } \Omega\mu F = 500 \text{ meg } \Omega \times 100\ \mu F$$
$$\text{or} = 5{,}000 \text{ meg } \Omega \times 10\ \mu F$$
etc.

To find the IR for a capacitor, divide "meg $\Omega\mu$F" value by "μF." For example, if the manufacturer specifies 1000 meg $\Omega\mu$F and you have a 0.47 μF capacitor then the IR limit will be:

$$\frac{1000 \text{ meg } \Omega\mu F}{0.47\ \mu F} = 2127 \text{ meg } \Omega$$

For a 0.015 μF capacitor, the IR limit would be:

$$\frac{1000 \text{ meg } \Omega\mu F}{0.015\ \mu F} = 66{,}666 \text{ meg } \Omega$$

Sometimes the use of a limiting value along with the IR constant causes some confusion. This became necessary with the advent of plastic film capacitors because their high inherent IR and very small capacitance ratings required instruments that could measure in the millions of megohm range.

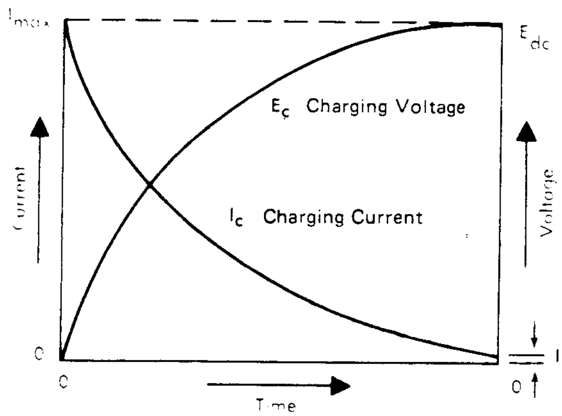
So, manufacturers also specify a maximum IR limit. For example, though a 0.005 μF capacitor would have an IR of 200,000 meg Ω (if specified at 1000 meg $\Omega\mu$F), manufacturer's specifications typically state "need not exceed 100,000 meg Ω."

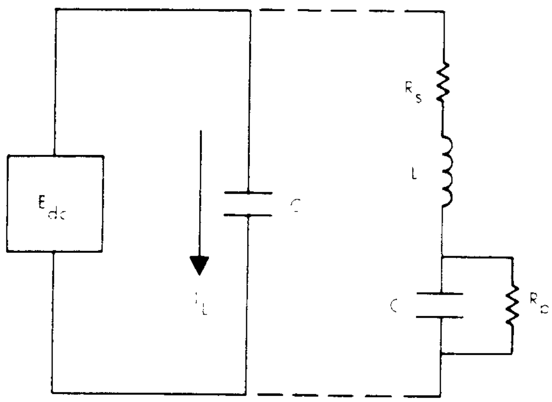
As noted earlier, each dielectric material has its own inherent insulation resistance which depends on the chemical and molecular structure composition of the material.

Ceramic dielectrics have two classes of matrial – Type 1 and II. Type 1 ceramic (includes COG dielectric) is the best, being 100K meg Ω maximum or 1000 meg Ω x μF, whichever is less. X7R, a stable material, is typically the same even though it's Type II. However, Z5U is typically 10K meg Ω maximum or 500 meg Ω x μF, whichever is less.

Since manufacturers' specified IR values differ, we recommend that you check the specification for the particular capacitor you are going to use.

For more details, call Harry Ford, Component Engineering (58-299), ext. 6520.





(Steady state condition)

Where: Edc = Charging voltage (volts)
I_L = Leakage current (amperes)
Rp = Parallel Resistance (Ohms)
C = Capacitance (Farads)
L = Inductance (Henries)
Rs = Series Resistance

Freon contaminates electrolytic capacitors

It has been observed, both here at Tektronix and elsewhere, that Freon® contamination of aluminum electrolytic capacitors results in early component failure.

While we haven't established what reactions take place, or exactly which of the components — Freon, electrolyte, aluminum foil, aluminum oxide — are involved, we have established some criteria for differentiating Freon-caused failures from other failure mechanisms.

electrical potential must be present

Freon is a particularly stable compound, and under normal conditions, is completely inert. The halogen atoms are tightly bound to the Freon molecule and without adding energy to the system, no reaction will take place.

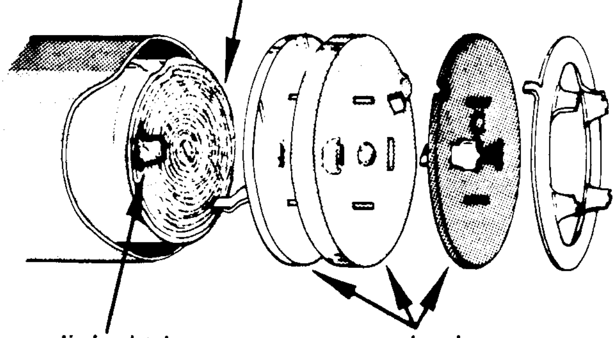
When a dc voltage is impressed across the capacitor, however, the Freon molecule is torn apart. The resulting free ions then migrate toward the anodic foil and attack it.

what to look for

The technician will observe an intermittant or open circuit in a capacitor that is suffering from Freon damage. Because there is no reaction without applied voltage, Freon contamination cannot be detected on parts from stock or on boards in production. But, parts in instruments which have gone through precalibration and cycling (40–50 hours of operation) should give indications of Freon damage.

what we find

In Freon-damaged capacitors we observe large pitted areas, or holes, in the anodic foil. In addition, a dark grey residue is present, usually around the anodic lead tab in paste or crystalline powder depending on whether or not there's any electrolyte left.



Cutaway view of Freon-damaged capacitor.

In an undamaged electrolytic capacitor, the paper spacer between the anodic and cathodic foils is not bound to the foil in any way. Therefore, the spacer and foil are easily separated when the capacitor is unwound. When there is corrosion from Freon damage, the paper sticks to the foil as if glued.

The longer the part has been in use, the easier it is to recognize the effects of Freon damage. For this reason, for parts that have seen only a few days of operation, it's particularly helpful to know how the part was mounted on the equipment. Most of the electrolyte, and therefore the Freon, will pool towards the bottom of the capacitor. This is where we can most likely expect to find damage.

In summary, the following procedure should be followed:

1. Be sure the capacitor has been operating for at least two days.

2. If possible, determine the position that the capacitor was in during operation.

3. Any capacitor suspected of being damaged by Freon should be replaced and returned to Component Reliability Engineering.

If you are going to be taking the capacitor apart yourself:

1. Open it and inspect for pitting of the anodic foil, concentrating on the suspect area.

2. Look for a dark grey paste or crystalline deposit.

3. Look for areas where the paper spacer sticks to the anodic foil.

For further help, please contact Larry Meneghin, Component Reliability Engineering, at delivery station 58-176, or call ext. 7268.

Correction

Issue 254 of **Component News** incorrectly reported a part number for a redesigned, Tek-made knob (see page 5). The part number listed as 366-1619-03 should be **366-1519-03.**

Contact Harvey Gjesdal (ext. 7791) for more details.

New Series 73 ModPot proposed

Allen-Bradley ModPots® are a versatile family of front panel controls which have become widely used in Tek products in recent years. The original Series 70 version used a machined bushing and faceplate, making it a fairly expensive component. In an effort to lower cost A-B introduced two additional versions.

The Series 72 is an all-plastic one- or two-section component especially attractive for certain high voltage applications. Because it is very limited as to shaft and switch combinations, we've assigned only four or five new part numbers. In this case, substitution of molded plastic parts for machined parts and screws decreases cost by about 20%.

The second version, Series 73, uses a machined metal bushing and mounting surface, insert-molded into a plastic faceplate. Because the machined part is smaller and requires no secondary operations, a cost savings of 5 to 15% is realized, even though metal shafts (including concentric) are available. We've begun using these devices in substantial quantities, in both new and existing part numbers.

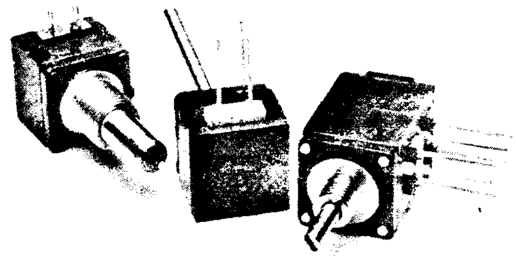
Series 73 pots for bushing mounting are limited to single and dual assemblies by the strength of the two-piece bushing/faceplate (we use some 73 triples, but they are ECB mounted). To meet the need for a low-cost design sufficiently strong for triples and quads, A-B proposes use of a die-cast zinc alloy bushing plate. Parts which are one and two sections long will use a cast alloy rear plate, with studs which are swaged over as they emerge through the small holes in the bushing plate. Triples and quads will use the conventional plastic rear cover, and screws. Alloy material is Zamac 3; plating is dull nickel. Samples passed the 10-day humidity exposure with corrosion confined to the swaged areas.

There is some concern that the large area of metal, appearing where previously there were only plastic and four small screw heads, could cause problems. The possibility exists that new UL requirements would be more difficult to meet with the new parts.

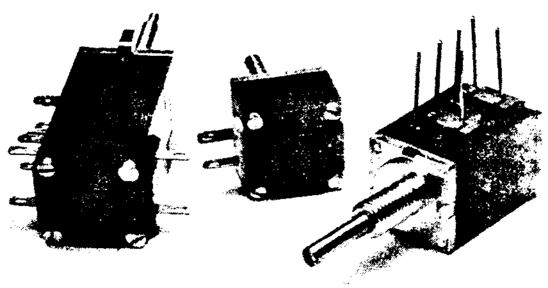
I'm asking that all staff engineers whose products use ModPots examine the effects of the modifications just discussed. Please let me know your conclusions.

If you wish, I can supply a few samples for your inspection, but samples in your particular part number will take six to eight weeks. Your concerns will be discussed with the vendor—especially those involving safety.

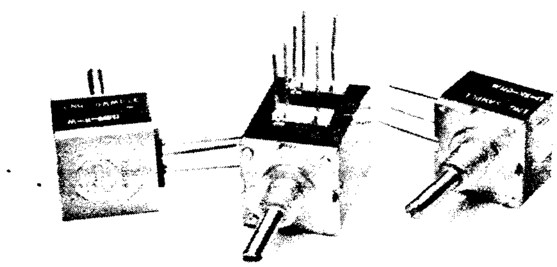
Gene Single
Component Engineering (ext. 5302)



Present Series 73 ModPots. Single-section controls use swaged-over plastic prongs to hold the parts together; duals use screws. Note faceplate construction.



Series 70 ModPots. All use machined bushing/faceplate and four, #1-64 screws.



Proposed Series 73 ModPots. Both singles and duals will use swaged-over metal prongs; triples and quads will look like the Series 70 (screws and plastic rear cover) except for the die-cast bushing plate.

Microprocessor Crystals

The following is a list of microprocessor crystals, some of which are part numbered at Tektronix. These crystals feature a low start-up resistance and are ideal for use with microprocessors. For more information, contact Byron Witt in Component Engineering, ext. 5417.

Frequency (MHz)	μP vendor	Microprocessor	Tek P/N
1.000	Motorola	6800	158-0025-00
	AMI	S6800	158-0025-00
	National	SC/MP	
	RCA	COP1800/1802	
1.025	Signetics	2650	
1.8432	Motorola	MC14410 Baud Rate Generator	
2.000	Fairchild	F-8/CPU 3850	158-0070-00
2.012		Special for MPU's	
2.097152	Mostek	MM5378/5379	
2.4576	Fairchild	34702 Bit Rate Generator	158-0124-00
2.50	Intersil	IM6100	
3.000	TI	TMS9900	158-0126-00
3.2768	Intersil	ICM7205	
3.33	Intersil	IM6102	
3.579545		Special for MPU's	158-0105-00
3.595325		Special for MPU's	
3.93216		Special for MPU's	
4.000	Intel	4040/4004/4201	158-0056-00
	Harris	HM6100	
	National	Pace IPC16	
	Intersil	IM6100, IM6102	
4.434	Signetics	2650	158-0075-00
4.44		Special for MPU's	
4.55	Intel	4040/4004/4201	
4.75	Intel	4040/4004/4201	
4.9152		Special for MPU's	158-0072-00
4.9562	Intel	4040/4004/4201	
5.000	TI	TMS, Special for MPU's	158-0084-00
5.0688	SMC	Com 5016/5016T Dual Baud Rate Generator	
5.185	Intel	4040/4004/4201	
5.333		Special for MPU's	
5.585	Intel	4040/4004/4201	
5.587	Intel	4040/4004/4201	
5.7143	National	Pace	
6.000	GI	CP1600	
	Intel	8748	
6.144	Intel	8085	
6.5536	Intersil	ICM7045	
6.666		Special for MPU's	
8.000	GI	CP1600	
	Intersil	IM6100	
8.448		Special for MPU's	
9.8304		Special for MPU's	
10.000	GI	CP1600A, Special for MPU's	158-0031-01
11.430		Special for MPU's	
12.000		Special for MPU's	
13.5168	Intel	8080/8008/8224	
14.31818	Intel	8080/8008/8224	
15.000	Intel	8080/8008/8224	
16.58880		Special for MPU's	
18.000	Intel	8080/8008/8224	

continued on page 12

Frequency (MHz)	μP vendor	Microprocessor	Tek P/N
18.432	Intel	8080/8008/8224	158-0136-00
19.354	Intel	8080/8008/8224	
19.6608	Intel	8080/8008/8224	
20.000		Special for MPU's	158-0154-00
22.032		Special for MPU's	
22.1184	Intel	8080/A	
23.400	Intel	8080/8008/8224	
23.684	Intel	8080/8008/8224	
24.576	Intel	8080/8008/8224	
25.000	Intel	3000	158-0077-00
27.000	Intel	8080/8008/8224	
28.1250		Special for MPU's	
32.000	Intel	8080/8008/8224	
36.000	AMD	Special for MPU's	
48.000	TI	TMS9900	158-0152-00
100.00	Fairchild	Special for MPU's	158-0106-00

Typical Specifications:

Frequencies vary from 1.0 MHz to 100 MHz, frequency tolerance at 25°C is ±0.005%, drive level is 1 MW. Temperature tolerance is ±0.01% from 0 to 70°C. Series resistance varies with frequency. Shunt capacitance is 32 pF.

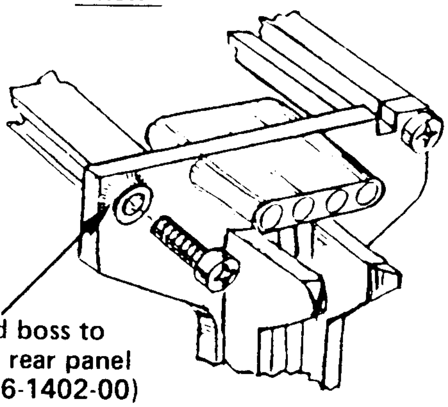
Rear panel design modified

The upper right-hand screw on the rear panel previously needed an aluminum spacer mounted under it to allow the screw head to protrude and make contact with a ground clip. This spacer (P/N 361-0326-00, 3¢ each, annual usage 50,000+) has been eliminated in the modified rear plastic panel (P/N 386-1402-00) by having a boss molded into the plastic to extend the screw head. The screw itself remains the same and all old stock is being used up first.

Double-wide plug-ins are not affected and will continue to use the spacer.

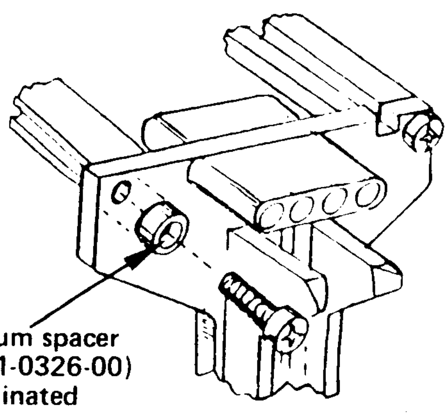
For more information, please contact Harvey Gjesdal, Lab Oscilloscope Products Evaluation, ext. 7791.

new



added boss to molded rear panel (P/N 386-1402-00)

old



aluminum spacer (P/N 361-0326-00) eliminated

High-frequency dual FET part numbered

A monolithic matched dual DMOS FET transistor has been part numbered at Tek: 151-1117-00. This DMOS part is now our highest frequency dual FET.

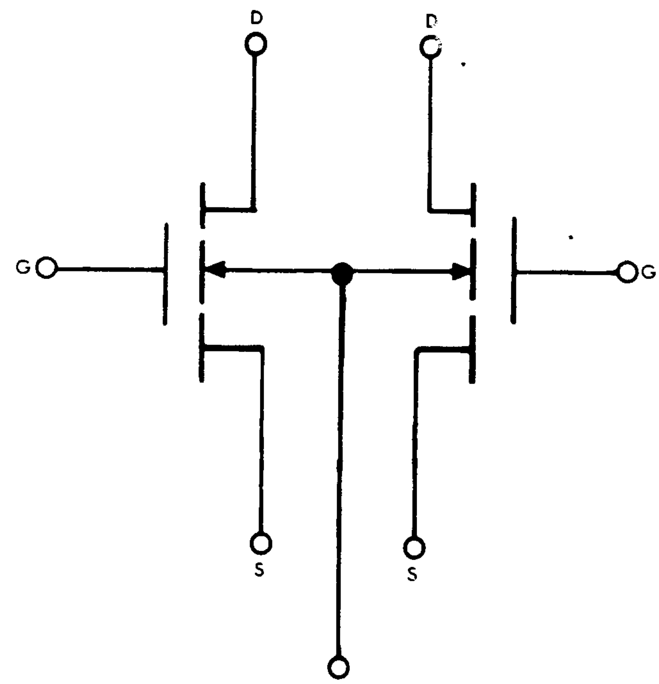
Typical parameter values (measured at 15V, 10 mA) are: g_m = 16 mmho, C_{GS} = 3.6 pF, C_{DG} = 1.07 pF. The device is specified for an offset voltage of 25 mV maximum, and 25 μV/°C drift.

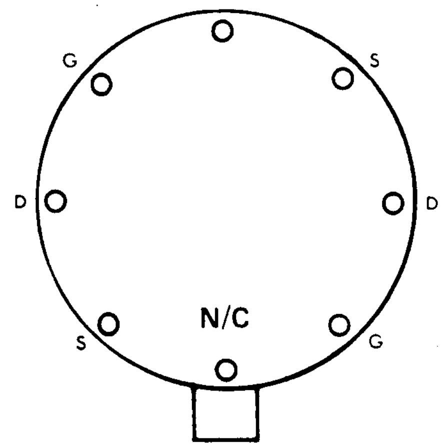
Zero TC occurs at about 5 mA where the g_m is still nearly 10 mmhos. Drain currents of up to 70 mA per side can be produced, with the g_m maximizing at about 65 mA.

The f_T is 500 MHz at 5 mA, rising to 790 MHz at 60 mA.

The part is an N-channel, enhancement mode device in a TO-99 case with the pin-out as shown below. Note that the common substrate does not allow totem-pole operation.

For more details, contact Jerry Willard, Analog Component Engineering, ext. 7461.





Note that the pinout is the same as other dual FETs, and that the gates are not zener protected.

DMAC samples here

Two samples of MC6844 Direct Memory Access Controller (DMAC) are available in Component Engineering for product-related development projects.

For more information, please contact Jim Howe, ext. 5698.

New product information

The UCN-4401A and UCN-4801A latch/drivers are a combination of four or eight CMOS latches with a bipolar Darlington transistor driver for each latch. These are new products from Sprague.

The open collector drivers can sink up to 500mA each, or can sustain at least 50 volts in the off state.

Bob Voll, ext. 7148

Moisture-vapor barrier reduces condensation

It was recently brought to our attention in Packaging Design, that 100% of a particular product line being shipped to points in Texas and Florida arrived with water condensation damage.

We determined that the problem was caused by temperature changes encountered while being trucked over the mountains. Products shipped by air suffered no such damage. Clearly, the thin polyethylene bag then being used did not provide sufficient moisture protection.

Subsequent testing indicates that Champion "Foil-Rap 2175" (which conforms to military specification MIL-B-131, Class 1) would provide an acceptable vapor barrier for. packaging Tek products at a fairly low cost. A 24" x 36" bag made from this material costs $1.18 in quantities of 1000.

For heavier items, another material with similar properties (conforming to military specification MIL-C-9959) is available. Sold as complete package assemblies, these units are initially very expensive, but they are re-usable, so that their cost could be spread out over a number of instruments.

Dessicant (a moisture absorbing material) is used inside these moisture-vapor barriers to absorb the small amount of moisture that does penetrate the barrier. The amount, and therefore the cost, of the dessicant needed depends on the size of the instrument and what is packed in the barrier bag along with the instrument. The dessicant used for the USM 425 costs approximately 65¢.

For more information on moisture-vapor barriers please contact Paul Phelps, ext. 7615.

2102 reliability tests

Reliability testing on a 2102 1K x 1 RAM (Tek P/N 156-0291-00) has been completed for two vendors: Intel and Signetics.

Fifty parts from each vendor were tested for 96 hours. The ambient temperature was 125°C and the power supply was set at nominal value. Alternating ones and zeros were read from and written into each cell.

The life test results were as follows:

	No. of failures at			
Vendor	0 hrs.	16 hrs.	36 hrs.	96 hrs.
Signetics	2	0	0	0
Intel	0	0	0	1

Based on the result of the life test, we do not feel that burn-in is necessary with this part. We do recommend, however, 100% electrical testing before use (use the 156-0291-01, 100% tested version).

For more details, contact Steve Hui in Component Reliability Engineering, ext. 6511.

DIP caps feature 0.3" lead spacing

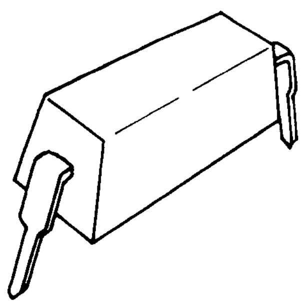
AVX has introduced a series of DIP capacitors featuring 0.3" lead spacing. These epoxy cased caps offer several advantages over the more conventional, axial-leaded packages.

The new package design makes the capacitors easily hand-insertable, with the capability of being machine-inserted. Pre-formed leads eliminates lead-cutting and bending.

The parts are mechanically superior to glass, axial leaded caps. In addition, the AVX design helps remove the dips and bumps in the path of the air flow across the board.

The following versions of this capacitor are Tek part numbered:

	value	temp. char.	Tek P/N
AVX ceramic	0.22 µF, 50V	Z5U	283-0423-00
AVX ceramic	0.047 µF, 50V	Z5U	283-0422-00
AVX ceramic	0.10 µF, 50V	Z5U	283-0421-00



For more information, contact Harry Ford (58-299), ext. 6520.

Reliability report: Plastic vs. metal can transistors

Several design engineers have requested information on the relative reliability of plastic encapsulated versus metal can transistors. We have calculated projected failure rates for a T0-92 (151-0190-00) versus an equivalent T0-18 part (151-0190-06 or 151-0460-00) for several different power levels.

This calculation shows that the metal can parts should exhibit a somewhat lower failure rate than the plastic parts (based on failure rate projection concepts presented in **Component News** No. 255). See table below.

Metal Can vs. Plastic Comparison

Assumptions:

5% Freaks

30°C ambient, 20°C internal rise in instrument

$\theta_{JA} \approx$ 230°C/watt for plastic

300°C/watt for metal can

	Plastic 151-0190-00			Metal can 151-0190-06		
Power level	**50mW**	**100mW**	**200mW**	**50mW**	**100mW**	**200mW**
ΔT_j, °C	11	23	46	15	30	60
T_j, actual, °C	61	73	96	65	80	110
Failure rate W/F*, %/1000 hrs.	0.08	0.3	3	<0.01	0.06	0.8
Failure rate W/OF**	<0.01	<0.01	0.3	≪0.01	<0.01	<0.01

* with freaks (raw parts, electrically tested)

** without freaks, i.e., freaks removed by burn-in followed by electrical test

The thermal resistance (junction to ambient) is slightly lower for the plastic cased unit, leading to lower junction temperatures for a given power dissipation. However, projected failure rates for the plastic parts are higher because they have a shorter freak and main population life when both are referenced to the same temperature.

Also shown in the table is the effect of a 100% burn-in on the projected failure rate.

For more information contact Ron Schwartz, ext. 6511.

Sample tests or 100% burn-in for transistors

The article on transistor burn-in in **Component News** No. 255 described two approaches being pursued by Component Reliability Engineering for transistor reliability enhancement.

Reliability sample test requirements are being applied to most high-usage bipolar transistor specifications to establish minimum levels of reliability for vendor qualification and new part lot acceptance criteria. These requirements are designed to assure a maximum failure rate of 0.1%/1000 hours at 70°C junction temperature for plastic encapsulated parts.

If failure rates of much lower than 0.1%/1000 hours are necessary to meet instrument reliability goals, 100% burn-in is necessary. By removing freaks with a high temperature burn-in, failure rates of 0.01%/1000 hours or lower can be achieved.

For more details, contact Ron Schwartz, ext. 6511.

APPENDIX A:
Reprinted from Component News 255, p. 19 (with additions)

Part Number	Vendor	Qualified?	Freak%
151-0103-00	Motorola	yes	8
	Fairchild	yes	20
	T.I.		12
151-0126-00	Motorola	Q	<4
	National	Q	<4
	Fairchild	Q	<4
	Teledyne	no	<4
	Raytheon	yes	<4
151-0127-00	Motorola	Q	<2
	Fairchild	yes	<2
151-0150-00	Motorola	yes	(10)
	Fairchild	yes	(10)
	RCA	yes	40
151-0188-00	Motorola	yes	(20)
	T.I.	yes	(10)
	National	yes	(7)
151-0190-00	Motorola	yes	<2
	Sprague	Q	8
	T.I.	yes	(25)
151-0190-06	Motorola	Q	<4*
(151-0460-00)	T.I.	yes	<2
151-0195-00	Motorola	yes	<4
151-0199-00	Motorola	yes	15
151-0216-00	Motorola	yes	<2
	T.I.	yes	<2
151-0220-00	Fairchild	yes	(12)
151-0225-00	Teledyne	yes**	100
	National	yes	12
151-0228-00	Fairchild	yes	25
151-0250-00	Fairchild	yes	12
151-0254-00	G.E.	yes	89
	National	Q	4
151-0259-00	Fairchild	yes	4
151-0260-00	Motorola	yes	4
	T.I.	yes	4
	SSS	no	20
151-0270-00	Fairchild	yes	6
	T.I.	yes	10

Part Number	Vendor	Qualified?	Freak%
151-0279-00/01	Fairchild	yes	(25)
	Motorola	yes	(25)
	National	yes	(12)
	T.I.	yes	(25)
151-0289-00	Motorola	yes	25
151-0333-00	Motorola	yes	<4
151-0341-00	National	yes	<4
151-0342-00	National	yes	<4
	Fairchild	yes	4
151-0347-00	Motorola	yes	6
	Fairchild	yes	12
	National	yes	50
	NPC	Q	<3
	Sprague	Q	11
151-0350-00	T.I.	yes**	62
	Fairchild	yes	10
151-0358-00	G.E.	yes	5
151-0423-00	Fairchild	yes	<2
	T.I.	no	45
151-0425-00	Motorola	yes	8
151-0426-00	G.E.	yes	<2
151-0427-00	National	yes	11
151-0435-00	Motorola	yes	(15)
	Fairchild	no	100
151-0443-00	Motorola	yes	(15)
151-0451-00	RCA	yes	19
	SSS		15
151-0462-00	T.I.	no	40
	RCA	yes	20
	Motorola	Q	<5
	Fairchild		5
	National	Q	<5
151-0478-00	T.I.	yes	15
	RCA	yes	<5
	Motorola		<5

(x) indicates freak % somewhat dependent on stress level.
Q in qualification process
* metal can version of -0190

**CRE has recommended disqualification on this part/vendor

Errata from Component News 255

Page 13 E_A = activation energy in eV (1.0 eV is used in our calculations)

Page 15 (bottom) 80°C ∿ **1430**

Page 21 with burn-in <0.1%

with burn-in <0.01%

TECHNICAL STANDARDS

new and revised standards that may be seen at technical standards and ordered

ANSI Z210.1-1976 Metric Practice Guide This ANSI Standard includes both ASTM E380-76 and IEEE Standard 268-1976 which are nearly identical except the IEEE version uses the "er" (meter) spelling and the ASTM Standard uses the "re" (metre) spelling ($4)

ASTM F85-76 Standard Recommended Practice for Nomenclature for Wire Leads Used as Conductors in Electron Tubes

DOD-STD-1476 (Aug 1977) Metric System, Application in New Design

EIA RS-380 Small Contact Standard for Electrical Connectors (reaffirmed Feb 1977) ($1)

ISO 2955 (1977) Information Processing – Representations of Si and Other Units for Use in Systems with Limited Character Sets

MIL-D-29173(YD) (July 1977) Documentation, Technical: Civil Engineering Equipment

MIL-P-82646(OS) (Mar 1976) Plastic Film, Conductive, Heat-Sealable, Flexible

MIL-R-24563(SH) (Nov 1977) Relay, Alternating Current, Power-Sensing

MIL-STD-1595 (July 1977) Aerospace Welder Performance Qualification (Supplement to ASME Boiler and Pressure Vessel Code, Section IX, 1974)

NFPA No. 70-1978 National Electrical Code ($5.50) (have a few copies on hand)

QSTAG 229 Quadripartite Standardization Agreement 229, Abbreviations for Use on Drawings, Amendment No. 1 (1973)

QQ-S-781H (Sep 1974) Strapping, Steel, and Seals

Have available a few copies of **Metric Laws and Practices in International Trade, A Handbook for U.S. Exporters** (Sept 1976), U.S. Department of Commerce

new magazine

Engineering Graphics has been replaced by **Drafting and Repro Digest.** Subscriptions may be obtained from: Circulation Manager, Drafting and Repro Digest, 6 East 43rd St., New York, NY 10017

new product design standard available

Environmental Test, Electrostatic Discharge, is available from Reprographics (ext. 5577) by part number 062-2862-00.

errata

The part number for Product Design Standard, Environmental Test, Atmospheric, is **062-2847-00.** This was incorrectly listed as 062-2842-00.

For information on the above publications call Carol Schober, ext. 7976.

personnel and assignments in technical standards

We welcome **Roy Eckelman** and **Carol Jones** to our group. Roy is replacing Leon Lingel and will work on standards for cables, drafting, fabrication, occupational safety, and product safety. Roy can be reached at ext. 7451.

Carol's assignments include cables, color, documentation, finish, and test methods. She will also be involved with circuit boards and some product design standards. Her extension is 6224.

Dwain Hall is primarily involved with circuit board and product design standards, ext. 6823.

Carol Schober should be contacted for information on Tektronix standards and external standards such as industry, military, and international. She can be reached at ext. 7976.

Pauline Whitmore will provide information on component mounting details and the Standards Directory, ext. 5136.

Chuck Sullivan
Technical Standards manager

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
156-0877-00	Intel	8251 USART	Bill Pfeifer, 6303

The specs on the 156-0877-00 are being changed to describe the 8251A instead of the 8251. The A version is compatible with the original 8251 and has several design bugs corrected. For a copy of the data sheet call me at ext. 6303 or stop by 58-299.

156-1017-00	Intel	2716 EPROM	Bob Goetz, 6302

Because of availability problems, we request that once you are finished using 156-1017-00 EPROMs, please return them to stock, so that other designers need not experience unnecessary delays in obtaining these devices.

156-1088-00	Intel	8085A microprocessor	Bob Voll, 7148

A problem has been discovered in the most recent version of the Intel 8085 microprocessor. The trap flag of the 8085A remains high after a power on reset. This causes an immediate interrupt of the processor following the reset signal. The processor will start program execution at the TRAP address instead of at address zero.

The problem can be avoided by following the power on reset with a second reset pulse. The reset input works correctly once the trap flag has been cleared.

Intel hopes to have a new version of the 8085A ready in March. Production quantities should be available in June.

no P/N	all vendors	Data I/O PROM programmer	Bob Goetz, 6302

If you have a data I/O PROM programmer, you may be interested in two field bulletins updating the units. Call Bob, ext. 6302 to receive copies.

(see list)	all vendors	ceramic capacitors, axial lead	Harry Ford, 6520

Specifications for the capacitors listed below are being revised to change lead length to 0.150 min., 0.190 max. (dia. 0.090 ± 0.01). We will have to live with mixed stock until all vendors start delivering parts with the shorter lead lengths. This change will result in a cost savings.

281-0757-00	281-0765-00	281-0786-00	281-0799-00
281-0758-00	281-0767-00	281-0788-00	281-0809-00
281-0759-00	281-0768-00	281-0791-00	281-0812-00
281-0762-00	281-0769-00	281-0792-00	281-0814-00
281-0763-00	281-0770-00	281-0797-00	
281-0764-00	281-0785-00	281-0798-00	

ComponentNewsNewComponents

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	Tek P/N	Approx. cost	Engineer to contact
		analog devices				
TI	TL072CP	Op amp, dual, JFET-input	now	156-1191-00	$ .71	John Hereford, 6700
TI	TL074CN	Op amp, quad, JFET-input	now	156-1200-00	1.25	John Hereford, 6700
Fairchild	FT317A	Power transistor, NPN 120V, V_{CEO}(sus), I_C = 4A, 40W, TO-220 pkg, fT = 20 MHz (complement to 151-0647-00)	Mar.	151-0674-00	.85	Jim Williamson, 5345
Motorola	MJE13005	Power transistor, 400V, V_{CEO}(sus), I_C = 4A, PD = 75W, TO-220 pkg, fT = 4 MHz "switchmode"	Mar.	——	.74	Jim Williamson, 5345
		digital devices				
TI, Mot.	74LS122	Retriggerable one-shot	soon	no P/N yet	——	Wilton Hart, 7607
Nippon	SM8550	Floppy disk controller	now	no P/N yet	——	Wilton Hart, 7607
MMI, AMD	74S240	Octal buffer	now	no P/N yet	1.75	Dave Sutherland, 6301
MMI, AMD	74S241	Octal buffer	now	156-1179-00	1.75	Dave Sutherland, 6301
MMI, AMD	74S244	Octal buffer	now	no P/N yet	1.75	Dave Sutherland, 6301
Signetics	82S185	2K x 4 PROM	now	156-1182-00	——	Dave Sutherland, 6301
TI	74S197	Binary counter	now	156-1183-00	——	Dave Sutherland, 6301
TI	74S189	16 x 4 RAM	now	156-1189-00	1.25	Dave Sutherland, 6301
TI	74S138	3 to 8 line decoder	now	156-1194-00	——	Dave Sutherland, 6301
AMD	26S02	Dual monostable multivibrator	now	156-1195-00	——	Dave Sutherland, 6301
TI	74S181	Arithmetic logic unit	now	156-1196-00	——	Dave Sutherland, 6301
TI	74S299	8-bit shift register	now	156-1197-00	——	Dave Sutherland, 6301
TI	74S163	Synchronous 4-bit counter	now	156-1198-00	——	Dave Sutherland, 6301
		electromechanical devices				
TI		Hall effect switch on 17.5 mm film	1 yr.	——	.40	Joe Joncas, 6365
TI		Hall effect switch on 17.5 T0-226AA	now	——	.35	Joe Joncas, 6365
——		Machine screw 2-56 x 0.156L, PNH, SST, POZ	now	211-0264-00	.01	Rod Christiansen, 5953
——		Washer, Teflon, 0.45 I.D. x 1.1 O.D. x .01 TK.	now	210-1284-00	.20	Rod Christiansen, 5953
——		Washer, split lock #10, 0.048 Tk Cd. plated steel	now	210-0081-00	.05	Rod Christiansen, 5953
——		Cap screw, 5-40 x 0.5 skt hd, Cd. plated	now	211-0270-00	.05	Rod Christiansen, 5953
——		Cap screw, 2-56 x 0.125 skt hd SST	now	211-0266-00	.04	Rod Christiansen, 5953
——		Cap screw, 2-56 x 0.375 skt hd, SST	now	211-0265-00	.05	Rod Christiansen, 5953
——		Cap screw, 2-56 x 0.75 skt hd, SST	now	211-0263-00	.09	Rod Christiansen, 5953
——		Thread forming screw, 8-32 x 0.312 fl hd, TT, Cd plated steel, Posidriv	now	213-0801-00	.02	Rod Christiansen, 5953
——		Set screw, 4-40 x 0.5 hex skt, SST, cup pt	now	213-0791-00	.10	Rod Christiansen, 5953
——		Set screw, 4-40 x 0.25 hex skt, Cd plated steel	now	213-0800-00	.02	Rod Christiansen, 5953
——		Set screw, 2-56 x 0.188 hex skt, SST	now	213-0799-00	.03	Rod Christiansen, 5953
Compulite	857-01A	Indicator light, white sq. cap	now	136-0697-00	—	Pete Butler, 5953

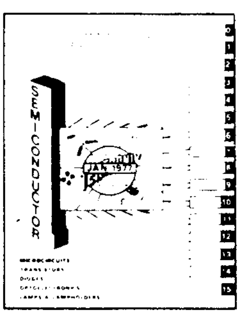
continued on page 20

continued from page 19

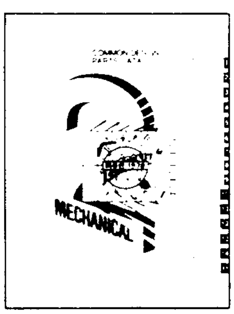
Vendor	No.	Description	When available	Tek P/N	Approx. cost	Engineer to contact
resistor, capacitor, optoelectronic devices						
capacitor, fixed						
Mallory,Sprague		10μF ± 5%, 20V solid tant., herm. sealed	now	290-0830-00	.21	Merle Hendricks, 5415
United Chem.,Sprague, Matsushita, Nichicon		1μF, 250V aluminum axial lead	now	290-0763-00	.09	Merle Hendricks, 5415
United Chem.,Nichicon, Matsushita		Min-aluminum single ended	now	290-0831-00	—	Merle Hendricks, 5415
Electrocube,TRW Electronic Concepts		0.047μF, 600V metallized mylar	now	285-1170-00	—	Merle Hendricks, 5415
resistor, fixed						
A-B	BB1005	10Ω ± 5% 1/8 W	Feb.	317-0100-03	.08	Ray Powell, 6520
A-B	BB1015	100Ω ± 5% 1/8W	Feb.	317-0101-01	.08	Ray Powell, 6520
A-B	BB2005	20Ω ± 5% 1/8W	Feb.	317-0200-03	.08	Ray Powell, 6520
A-B	BB2205	22Ω ± 5% 1/8W	Feb.	317-0230-03	.08	Ray Powell, 6520
A-B	BB2705	27Ω ± 5% 1/8W	Feb.	317-0270-03	.08	Ray Powell, 6520
A-B	BB3005	30Ω ± 5% 1/8W	Feb.	317-0300-03	.08	Ray Powell, 6520
A-B	BB3605	36Ω ± 5% 1/8W	Feb.	317-0360-03	.08	Ray Powell, 6520
A-B	BB4305	43Ω ± 5% 1/8W	Feb.	317-0430-03	.08	Ray Powell, 6520
A-B	BB4315	430Ω ± 5% 1/8 W	Feb.	317-0431-03	.08	Ray Powell, 6520
A-B	BB4705	47Ω ± 5% 1/8W	Feb.	317-0470-03	.08	Ray Powell, 6520
A-B	BB4715	470Ω ± 5% 1/8W	Feb.	317-0471-03	.08	Ray Powell, 6520
A-B	BB5105	51Ω ± 5% 1/8W	Feb.	317-0510-03	.08	Ray Powell, 6520
A-B	BB5605	56Ω ± 5% 1/8W	Feb.	317-0560-03	.08	Ray Powell, 6520
A-B	BB6205	62Ω ± 5% 1/8W	Feb.	317-0620-03	.08	Ray Powell, 6520
A-B	BB6805	68Ω ± 5% 1/8W	Feb.	317-0680-03	.08	Ray Powell, 6520
A-B	BB7505	75Ω ± 5% 1/8W	Feb.	317-0750-03	.08	Ray Powell, 6520
A-B	BB9105	91Ω ± 5% 1/8W	Feb.	317-0910-03	.08	Ray Powell, 6520
Dale,Mepco,Electra		1.96MΩ ± 1% T0 1/8W	Mar.	321-0509-00	.08	Ray Powell, 6520
Dale,RCL,Kelvin		2Ω ± 5% 5W	Mar.	308-0119-00	.15	Ray Powell, 6520
Dale,RCL	NS1015000	1.5K ± 2% non-inductive, 10W	Feb.	308-0809-00	.40	Ray Powell, 6520
Dale,IRC	MFF1816G	1.21MΩ ± 1% 1/8W	Feb.	321-0489-00	.05	Ray Powell, 6520
Dale,Mepco	MFF1226G	255Ω ± 1% 1/2W	Feb.	323-0136-00	.04	Ray Powell, 6520
Corning	———	1.5K ± 10% 3W	Feb.	307-0616-00	.14	Ray Powell, 6520
A-B	GB3305	33Ω ± 5% 1W	Feb.	307-0330-00	.08	Ray Powell, 6520

PARTS CATALOG NOTICE

The following Common Design Parts Catalogs are currently available from the Catalogs group:

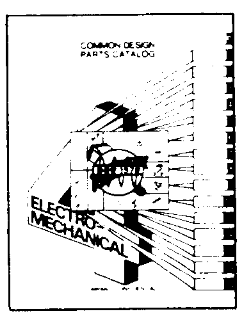


Semiconductor
October 1977

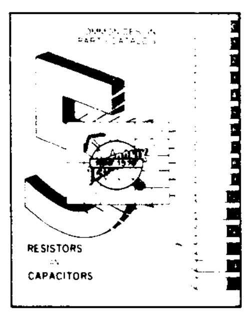


Mechanical
February 1978

Materials
June 1977



Electro-mechanical
November 1976



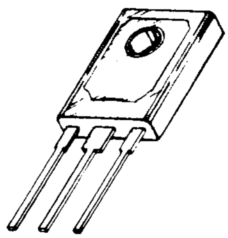
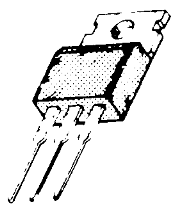
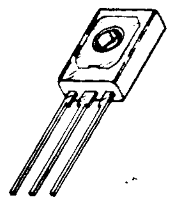
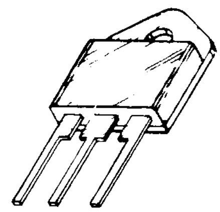
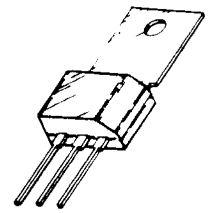
Resistor/Capacitor
November 1977

Contact Fred Schade (58-276), ext. 7974, to receive any of these catalogs.

Plastic transistor mounting survey

In an effort to standardize transistor mounting techniques, we are asking people who use power transistors to complete the following questionnaire. Please send the completed form to Jim Williamson (58-299).

1. Which transistor plastic package styles do you use?

				
TO-127	TO-220	TO-126	T.I. plastic TO-3 "X-86"	TO-202
☐ Always	☐ Always	☐ Always	☐ Always	☐ Always
☐ Usually	☐ Usually	☐ Usually	☐ Usually	☐ Usually
☐ Sometimes	☐ Sometimes	☐ Sometimes	☐ Sometimes	☐ Sometimes
☐ Never	☐ Never	☐ Never	☐ Never	☐ Never

2. Which insulating materials do you use?

mica ☐

Kapton/thermal film (orange plastic) ☐

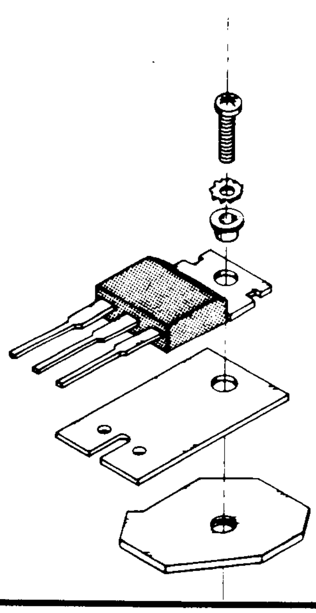
Silicon Rubber ☐

Beryllium Oxide (BeO) ☐

Annodized Aluminum ☐

Other (specify)

3. Which transistor mounting techniques do you use?

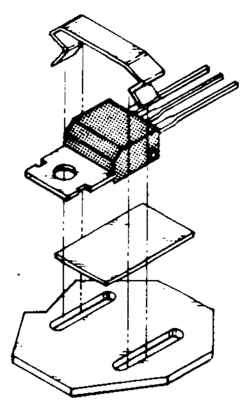


TO-127
☐ Always
☐ Usually
☐ Sometimes
☐ Never

TO-220
☐ Always
☐ Usually
☐ Sometimes
☐ Never

TO-126
☐ Always
☐ Usually
☐ Sometimes
☐ Never

T.I. plastic TO-3 "X-86"
☐ Always
☐ Usually
☐ Sometimes
☐ Never

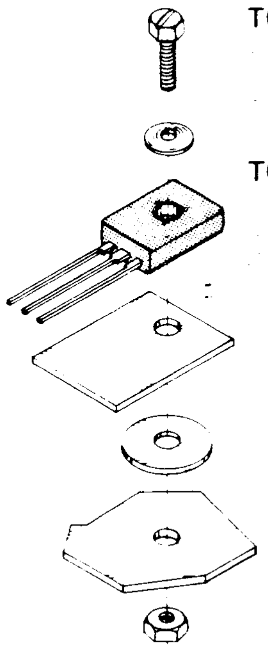


TO-127
☐ Always
☐ Usually
☐ Sometimes
☐ Never

TO-220
☐ Always
☐ Usually
☐ Sometimes
☐ Never

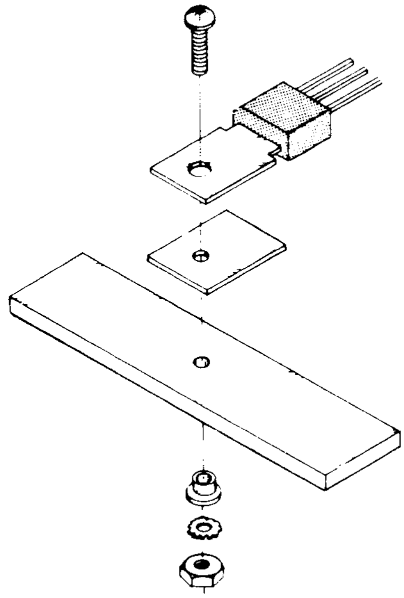
TO-126
☐ Always
☐ Usually
☐ Sometimes
☐ Never

T.I. plastic TO-3 "X-86"
☐ Always
☐ Usually
☐ Sometimes
☐ Never



TO-126
Always
Usually
Sometimes
Never

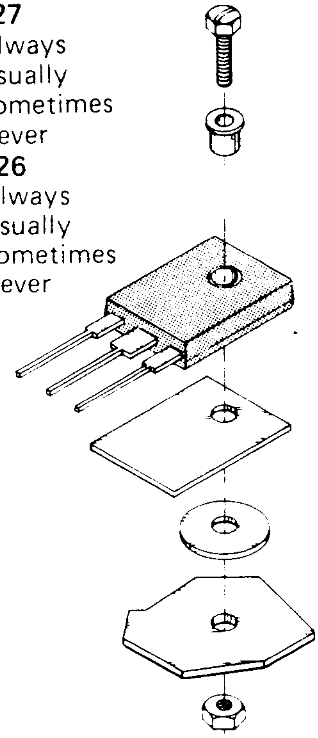
TO-127
Always
Usually
Sometimes
Never

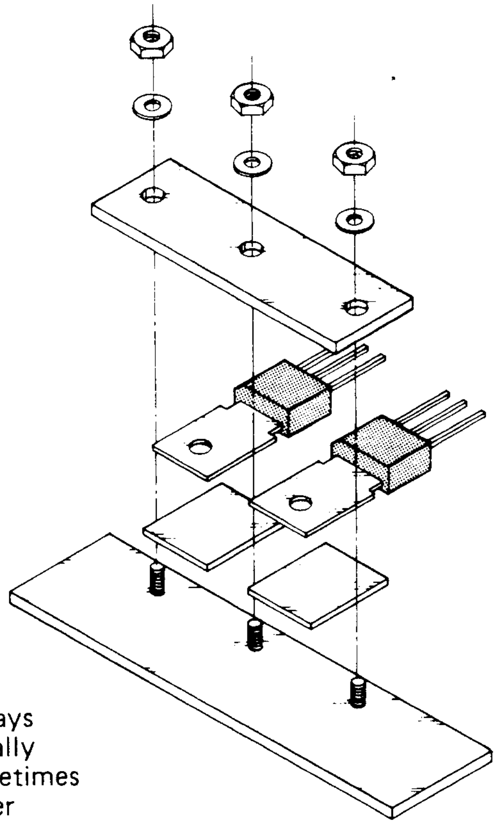


TO-202
□ Always
□ Usually
□ Sometimes
□ Never

TO-127
Always
Usually
Sometimes
Never

TO-126
Always
Usually
Sometimes
Never





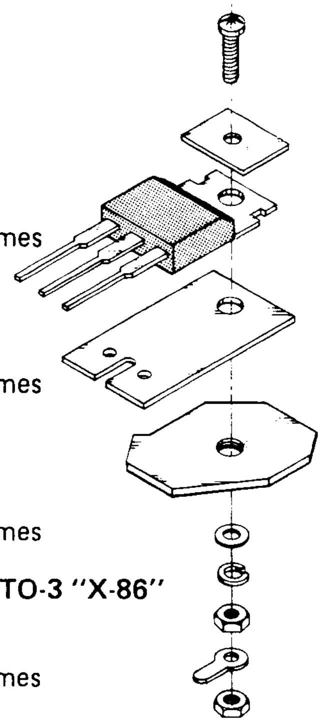
TO-202
□ Always
□ Usually
□ Sometimes
□ Never

TO-127
Always
Usually
Sometimes
Never

TO-126
Always
Usually
Sometimes
Never

TO-220
Always
Usually
Sometimes
Never

T.I. plastic TO-3 "X-86"
Always
Usually
Sometimes
Never



TO-127
□ Always
□ Usually
□ Sometimes
□ Never

TO-220
□ Always
□ Usually
□ Sometimes
□ Never

TO-126
□ Always
□ Usually
□ Sometimes
□ Never

T.I. plastic TO-3 "X-86"
□ Always
□ Usually
□ Sometimes
□ Never

PRODUCT SAFETY NOTE NO. 31A

18 January 1978

Subject: Primary-wire breakage.

In Item 2 of Product Safety Note No. 31, we referred to breakage of internal primary wires at the points of connection.

Product Safety Note No. 31 mentions two ways of dealing with wire breakage--a clamp as close as practicable to the conductor ends, and alternatively, cable lacing that terminates as close as practicable to the conductor ends.

Actually, there are probably many ways of handling this problem. A third means that has been brought to our attention consists of placing sleeving over the primary-circuit wires, extending as close as practicable to the conductor ends.

The subject of protecting against primary-wire breakage arose from interpretations, in some regions, of IEC documents. We view this subject as a basic safety matter.

Pete Perkins

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Eddie Richmond

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Product Safety Engineer
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