component news

Aug. 1, 1979 COMPANY CONFIDENTIAL Issue 272

Fast op amp evaluated

Our evaluation of the HA5195 op amp from Harris shows it to be the fastest monolithic op amp (with full ±12 volt swing*) available today. The amplifier features:

- Dielectric isolation processing (see inset, page 4);
- a slew rate of 190V/μS;
- settling time of 90nS to 0.1%;
- a gain-baindwidth product of 150MHz (gain of 5);
- and a full power bandwidth of 6.5MHz.

A schematic of the HA5195 design is shown in figure 1a, with a simplified diagram showing the AC signal path in figure 1b. The output stage (represented by the voltage follower) consists of two NPN emitter followers. The compensation network is C_1, C_2, C_3, and R_{29}. This network makes the amplifier system appear as second-order, critically damped.

The open-loop gain exhibits a classic 20dB/decade rolloff (down to a gain of 4) over most of its frequency range, and smooth output waveforms are generated.

* The Signetics NE5539 is faster (800V/μS, 1.2GHz gain-bandwidth product at gain of 7), than the Harris part but is low voltage (±3V output), and has a very low gain (320V/V). It is essentially without any second gain stage and uses emitter follower design.

continued on page 2

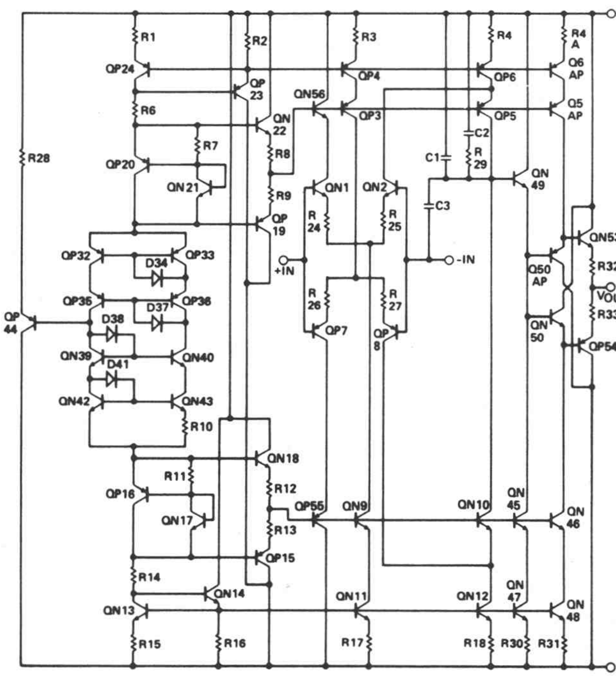

Figure 1a

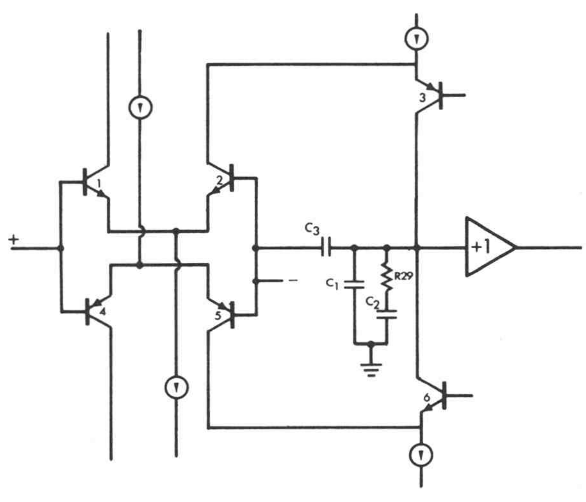

Figure 1b

Also in this issue

Input stage

The op amp was designed with speed as the highest priority, and open-loop input impedance (which is fairly low) was one parameter that was sacrificed to this end (see table 1). Closed-loop input resistance is approximated by the differential input resistance multiplied by the loop gain. However, the closed-loop differential input resistance is limited to the level of the common mode input resistance. The common-mode input capacitance, as measured, is mainly due to the package. The capacitance at the chip is about 0.5-1.0pF.

Table 1

Differential and Common-mode Input Impedance

	Z_{diff}	C_{diff}	Z_{cm}	C_{cm}
f = 25 Hz	6 KΩ	—	6.2 M	
	18 KΩ	—	8.0 M	1 nF
f = 1 MHz	1.5 K	8 pF	68 K	2.0 pF
		14 pF	78 K	

The input impedance is such that the closed loop performance (both AC and DC) will depend on both the feedback component ratio and the actual impedance presented to each amplifier input.

The input current of the HA5195 is high, with a maximum rating of 15μA at 25°C. The average drifts were measured at 10 to 90 nA/°C. The input offset voltage is average for a bipolar part at 6mV maximum. Its average drift measured between 2-25μV/°C (typically 15μV/°C. Using an external offset adjust will increase this drift.

Output capability

Output current drive is very good. It sources about 48mA and sinks about 38mA. It's rated on the preliminary data sheet at 25mA minimum at 25°C.

Output short-circuit current limiting was another feature that was sacrificed for the sake of speed. The HA5195 will withstand a short-circuit to ground for less than 30 seconds, but connection to either supply means instant death for the op amp. Current-limiting resistors in the supply leads may improve its life expectancy in this respect.

Power dissipation

For high speed, assuming a fixed capacitance, there must be higher charging current available because

$$\frac{dV}{dt} = \frac{I}{C}$$

The HA5195 is rated at 25mA maximum supply current and was typically at 15mA in our evaluation. Due to this high power dissipation in addition to the large output drive capability, the chip was encapsulated in a 14-pin ceramic package. However, it is still compatible with a standard 8-pin op amp. During normal operation, the package temperature rose as much as 30°C over ambient. This heating effect, or the fact that there is no short-circuit limiting, was probably the reason for two or three devices being destroyed during testing.

Other parameters

Other typical parameters of the HA5195, measured with ±15V supplies, are: 95dB of common-mode rejection ratio over a ±5V input; 90dB of power supply rejection ratio; and an input noise voltage of $15nV/\sqrt{Hz}$ at a frequency of 1KHz.

Application hints

The feedback resistance is best kept at or below 1KΩ and should not be greater than 5KΩ due to the low differential input resistance. Keeping the feedback resistance low causes a problem in that the input impedance as seen by the signal source, is low. Of course, external input FETs can be added to raise input impedance and reduce input bias currents. This method reduces the slew rates down to 130V/μS.

continued on page 3

The op amp is compensated for gains down to +5 or −4, but can be operated at unity gain without adding external capacitance. Compensation schemes use the amplifier's differential input impedance to reduce both the input and feedback signals, thereby raising the effective noise gain approximately 14dB to a stable point on the frequency response curve.

Resistor-only compensation methods, though, produce as much as 15% overshoot in the invert ing configurations and 40% in the non-inverting modes. Capacitance can be added to reduce the overshoot and smooth the frequency response.

The inputs of the devices evaluated could be operated within about 6 volts of the power supply rails. Harris, however, specifies a minimum common-mode range of ±5V with ±15V supplies. This means, to insure operation the inputs cannot be less than 10V from the rail.

The samples we evaluated did not perform as well as Harris claims; the speed response was a little slow (see table 2). Harris agreed with our findings and have since modified the chip to repair it.

Table 2

Conditions $V_{out} = \pm 5$ V		Slew Rate (V/μS)
$A_V = +1$	no load	160 to 190
$A_V = -1$	no load	190 to 220
$A_V = -5$	no load	160 to 200
$A_V = -5$	200Ω, 10.5 pF load	140 to 180

The problem stemmed from the fact that the polysilicon substrate apparently acts as a sort of ground plane. Polysilicon has a rather high sheet resistance. Originally the substrate was connected to -V (an AC ground) from only one point on the chip. Areas remote from the bond point were essentially floating.

By making several connections to the substrate the slew rate was increased by as much as 20% and the settling time reduced by about 400nS (see table 3). The response has changed from being slightly overcompensated to slightly undercompensated.

Table 3

Settling Time (nS)

	10 V Step	5 V Step		2.5 V Step		1 V Step	
	$A_v=-5$	$A_v=-5$	$A_v=-1$	$A_v=-5$	$A_v=-1$	$A_v=-5$	$A_v=-1$
1.00% (min)	55	30	45	25	35	20	30
(max)	60	45	50	40	45	35	65
0.10% (min)	90	75	110	70	95	60	90
(max)	150	140	160	140	170	140	160
0.01% (min)	200	250	300	250	350	250	300
(max)	700	700	1000	700	900	700	700

A 200Ω, 10.5 pF load increased the settling time by about 20%

DI process affects cost

The price of the op amp to Tektronix is $7.50 each in 100s, dropping to about $6 each in quantities of 5000. Considering that the device is newly introduced and monolithic, the price should drop, but not substantially. The DI process uses extra processing steps and it is difficult to perform the lapping operation with the precision that is required. The size of the chip is also relatively large for an op amp (50 mils X 84 mils).

Intersil and Dionics are the only other companies that are actively pursuing the DI process. Intersil is second-sourcing Harris' 2500 and 2600 op amp lines with fairly good results on the 2625, though they are presently not a qualified source at Tek.

For more information

This article was written by John Hereford, Analog Component Engineering, who recently left Tektronix. John's job is now in the hands of Willie Rempfer, ext. 6700. Contact Willie if you have any questions about these op amps.

Editor's note: Thanks to Jerry Willard, also from Analog CE, for his assistance in compiling and editing this article.

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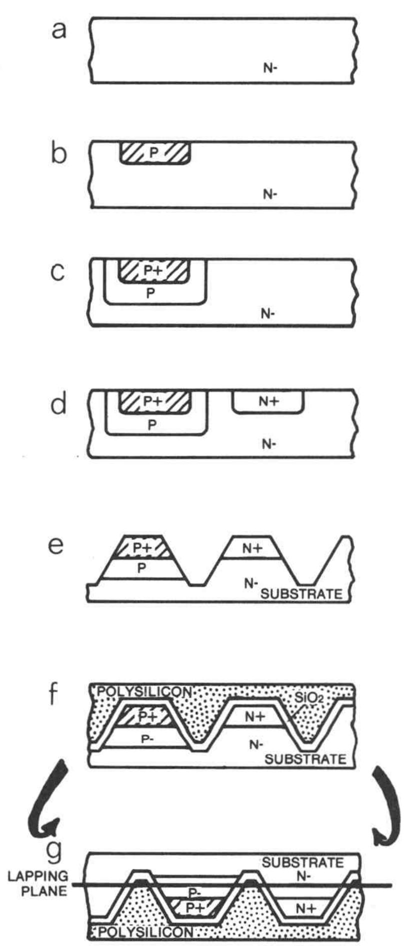
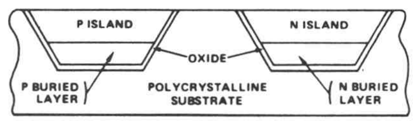
Dielectric Isolation Process

Conventional ICs use P-N junctions to isolate active components, one from another. Oxidized silicon (SiO_2 or glass) can also be used, but it is much more difficult to fabricate into all areas where isolation is required.

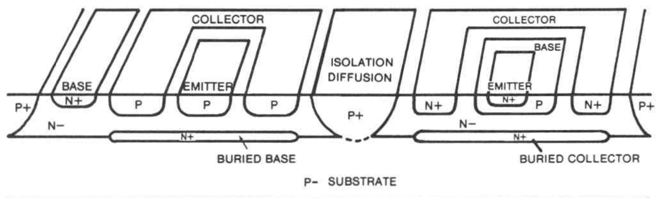
However, it can be done, and while relatively expensive, it is superior in three ways:
1) the oxide is usually thicker than the depletion region of P-N junctions normally used,
2) the dielectric permittivity of SiO_2 is ⅓ that of silicon, and
3) vertical PNP transistors can be fabricated with characteristics similar to the NPNs commonly used in linear ICs.

Points 1 and 2 result in much smaller parasitic capacitances between circuit elements. Point 3 is even more significant - PNP f_T's are raised from 2 or 3 MHz found in the usual lateral PNP to over 300 MHz.





DI substrate - ready for NPN and PNP processing



Conventional junction-isolated IC

Starting substrates are optimum for either NPN or PNP transistors - but not both. NPNs are much more common in most circuit designs so substrates with N− epitaxial layers are used. What is the collector layer for all of the NPNs must be the base of a PNP. To arrange a collector and emitter requires a *lateral* orientation.

This results in the base width being determined by lateral spacing which is difficult to control to small dimensions. Thus, the base width of a lateral transistor is always much larger than vertically-oriented devices where the base thickness is determined by the difference between two diffusions, and can be very thin.

There are other detrimental results of lateral orientation, but most significantly, wide bases mean long transit delays which mean low f_Ts.

Vacuum fluorescent display characterized

A vacuum fluorescent display was recently evaluated and characterized by CE. This particular display is an ITRON (Noritake) DC169A2, a sixteen-character, 5 X 7 dot matrix, alphanumeric display with 9mm-high characters.

Fluorescent displays consist of a filament (cathode) which acts as a source of electrons, and a 5 X 7 dot matrix of phosphorized anodes for each digit. A control grid, one per digit, controls the flow of electrons to the anodes by means of an applied voltage (see figure 1). A positive bias will accelerate electrons toward the anode, whereas cutoff is achieved with a slight negative voltage. Those anodes which have a positive voltage applied attract electrons, exciting the phosphors, and emitting light.

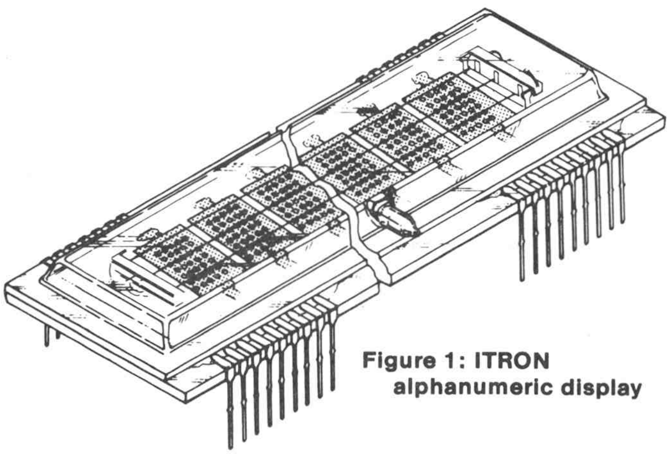


Figure 1: ITRON alphanumeric display

The ITRON display is designed to be multiplexed. Corresponding dots of each digit are connected. The anodes are selected to create the symbol, and the grids are used to select the digit. The display's pinout consists of 35 anodes, 16 grids and 2 filaments. This display operates with 35V on selected grids and anodes, and −5V on unselected grids and anodes to insure cutoff. The filament is typically powered with a 4 or 5 volts RMS.

The characteristic curves for this device are shown in figure 2. The g_m was between 200 and $600\mu\mho$ at an anode potential of 35 volts. Brightness measurements were made vs. grid voltage, anode voltage and temperatures. With the grid pulsed at 35V and a 5% duty cycle, the dots were visible even with zero volts on the anode (although brightness was too low to measure). With the anode pulsed at 35V, brightness was measurable with V-grid at zero volts. Maximum brightness was measured at about 20 V-grid at higher than 20V on the grid.

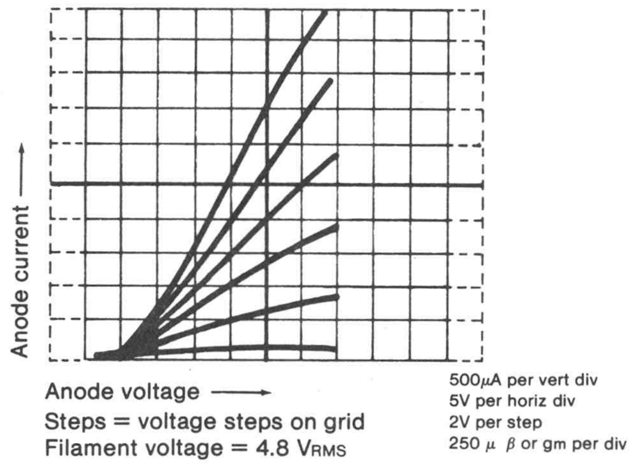


Figure 2: Characteristic curves

environmental & mechanical tests

With both grid and anode pulsed together, brightness decreased slightly with temperature. The manufacturer specifies maximum operating temperature at +55°C, where brightness degrades to 60% of that at room temperature, operating above this point will supposedly not degrade the display. Grid current also increased slightly with temperature.

The following mechanical tests were also run: vibration, shock, lead bend, lead pull, humidity, temperature cycling, static discharge and EMC.

One part had an anode open up after vibration and shock. These tests were repeated with no additional failures. In humidity tests (10 days per MIL-STD-202E), the epoxy used to attach the lead absorbed some water, causing some leakage between pins. This caused digits adjacent to the selected digit to light faintly. After the display "dried out," this condition disappeared.

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The Environmental Labs also pointed out that, while the display passed static and EMC tests, the device could act as an antenna and reradiate energy from inside the instrument. Care should be taken to prevent RF from getting into the device. The display passed all other tests.

advantages & disadvantages

Fluorescent displays are attractive because of good reliability, high brightness, low power and general nice appearance. They are usually blue-green, filterable from blue to yellow, and are becoming available in red and white phosphors. If properly filtered, they can be read in direct sunlight, though not as well as liquid crystals (LCDs).

The manufacturer rates this display at 61.4mW per digit, about 10% of the power required for a comparable LED. An LCD, on the other hand, requires less than 20μW per digit. It should be noted that LCDs cannot withstand environments as severe as fluorescent displays can.

The major disadvantage of fluorescents is that at least two power supplies are required. The filament is operated on 4-5 V_{RMS}, and the grid and anode are operated DC or multiplexed at 10-40 volts, depending on the display.

Other disadvantages are that the display is bulkier than LEDs or LCDs and, so far, are all manufactured by companies outside the US.

The cost per digit decreases as the number of digits increases for fluorescents. As a price comparison, the display we evaluated costs about $2.07 per digit, the Monsanto 5 X 7 LED matrix MAN2A is about $5.50 a digit, and crystaloid 8-digit 5 X 7 matrix S X 147 is about $1.00 per digit.

for more information

For more information, please contact Betty Lise Anderson (58-299), ext.6389.

ROMS now assigned 062 part numbers

The procedure for part numbering and controlling programmable memory devices has been modified to handle ROMs. On generic ROM types, we cannot issue 156-xxxx-xx part numbers because our documentation system will not accept these "zero usage" parts. Therefore, for us to provide specifications on these devices *we are assigning ROMs 062-xxxx-xx part numbers.*

This change will dramatically reduce our paperwork and allow Tek users to have and reference ROM specifications. We are asking everyone to use the 062 number on all PPIFs for ROMs.

The following list of 062 part numbers describes the ROMs which now have specifications. Other numbers will appear in **Component News** as they are added.

If you have any questions about ROM devices which are not on this list, please contact Bob Goetz in Memory and I/O Component Engineering, ext. 6302.

Part Number	Vendor Number	Manufacturer	Description
062-4170-00	SY2332	Synertek	S,T: M/C, DGTL; 2048 X 8 ROM, NMOS, 24-pin DIP. (CM)
062-4171-00	S6831B	AMI	S,T: M/C, DGTL; 2048 X 8 ROM, NMOS, 24-pin DIP. (CM)
062-4172-00	2632FN	Signetics	S,T: M/C, DGTL; 4096 X 8 ROM, NMOS, 24-pin DIP. (CM)
062-4173-00	MCM68A308	Motorola	S,T: M/C, DGTL; 1024 X 8 ROM, NMOS, 24-pin DIP. (CM)
062-4174-00	MCM68A316E	Motorola	S,T: M/C, DGTL; 2048 X 8 ROM, NMOS, 24-pin DIP. (CM)
062-4175-00	AM9208DC	AMD	S,T: M/C, DGTL; 1024 X 8 ROM, NMOS, 24-pin DIP. (CM)
062-4176-00	82S291FN	Signetics	S,T: M/C, DGTL; 2048 X 8 ROM, BIP, 24-pin DIP. (CM)
062-4177-00	MCM6832L	Motorola	S,T: M/C, DGTL; 2048 X 8 ROM, NMOS, 24-pin DIP. (CM)
062-4178-00	2607FN	Signetics	S,T: M/C, DGTL; 1024 X 8 ROM, NMOS, 24-pin DIP. (CM)
062-4179-00	2616FN	Signetics	S,T: M/C, DGTL, 2048 X 8 ROM, NMOS, 24-pin DIP. (CM)
062-4180-00	MCM66700	Motorola	S,T: M/C, DGTL; 8192 ROM, Char. Gen., 128-char., 7 X 9 matrix, NMOS, 24-pin DIP. (CM)
062-4181-00	RO-3-2513	GI	S,T: M/C, DGTL; 2560 ROM, Char. Gen., 64 char., 7 X 5 matrix, NMOS, 24-pin DIP. (CM)
062-4325-00	36000P-4	Mostek	S,T: M/C, DGTL; 8192 X 8 ROM, NMOS, 24-pin DIP. (CM)

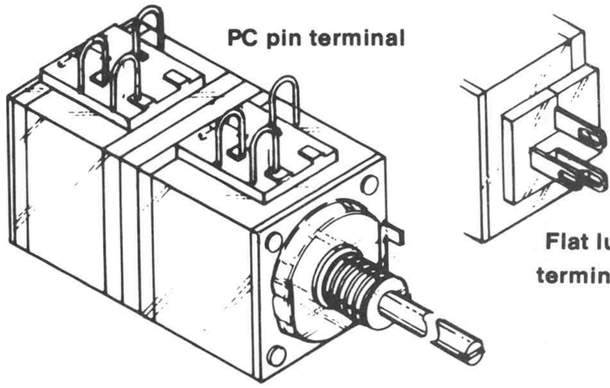
Bourns ⅝" square panel control changes

In a cost-cutting move, Bourns is discontinuing the flat lug terminal on their Model 80 pot (which is similar to the Allen-Bradley ModPot™). They will use the PC pin module instead, with the wire terminals bent into a "J" hook shape to form a solder terminal. The "J" terminal has been used for years on another style of pot, and should be satisfactory for our needs.

However, the PC pin module is longer than the lug terminal module, making finished assemblies somewhat longer. This increase will vary from 0.031" to 0.056". The table below compares maximum length behind the panel for the more common configurations.

Pot Type	Maximum length behind the panel (in.)	
	Discontinued flat lug terminal module	New "J" terminal module
Single section	0.610	0.641
Single w/rot. sw.	1.016	1.047
Dual, 1 shaft	1.016	1.072
Dual, concentric	1.116	1.172
Dual, w/rot. sw. on 2nd. sect.	1.491	1.547

Staff engineers and designers are advised to review all *non*-PC pin, ⅝" square panel control applications to make sure the longer parts will fit. (Do not include those with push-pull or push-momentary switches, because Bourns doesn't make that type of switch).

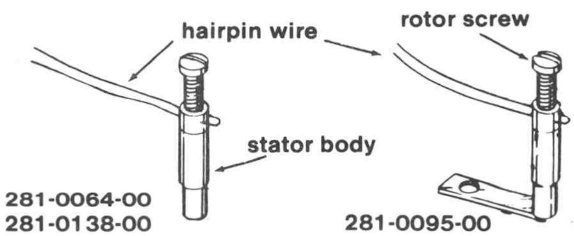


If the shorter assembly is necessary, please let me know at once. The old style will be available for those cases, although the cost will eventually be higher.

Gene Single
58-299, ext. 5302

Can grasshopper trimmers be silver plated?

Grasshopper trimmers are small, variable capacitors with very good characteristics; high Q, voltage rating, I-R, resolution, reliability and, until recently, low cost. The grasshoppers Tek uses are gold plated, and increasing gold prices are drastically affecting the cost of these parts.



Because we buy over 300,000 grasshoppers each year, we might consider offsetting these costs by having the stator body silver plated instead. The rotor screw and hairpin wire should probably remain gold plated.

One manufacturer has been producing silver plated grasshopper trimmers for many years and has supplied Tek with data to compare silver and gold plating. We've found no significant difference between the two. Some parameters of particular interest in this comparison are C_{min}, C_{max} and Q. The average difference in these parameters between silver and gold plated parts are $\Delta C_{min} = -0.77\%$; $\Delta C_{max} = +1.8\%$; and $\Delta Q = +61\%$.

Three styles of grasshoppers have Tek part numbers; the 281-0064-00 is used in the greatest quantity, but the 281-0095-00 and 281-0138-00 would also be affected if the plating material is changed.

The decision to make this plating change is pending your feedback. So, if you are using this style trimmer and feel you must have gold plating, please let me know.

Alan LaValle
58-299, ext. 5415

400V PNP transistor available soon

With the advent of off-line inverter/converter power supplies, many power transistors (both bipolar and MOSFET) have been made available with outstanding speed, voltage capability and packaging. What have been lacking, however, are decent price-comparable PNP complements to the NPNs already being utilized.

In half-bridge and full-bridge inverter configurations using NPNs only, some means of isolating the base drives for the output stage is required, this usually being a transformer. But, with a NPN-PNP output stage, this would not be needed. This technique eliminates the base drive transformer, saving space, cost and improving performance.

Until now, 400 volt power PNP transistors were extremely costly and of poor performance relative to their NPN counterparts. New devices just being introduced by Motorola and SGS-Ates may provide the complementary devices long desired at an affordable price. The construction of these PNPs is doubled-diffused, multiple epitaxial mesa - the only practical method of building a high-voltage PNP. Triple diffused processing, possible with NPN transistors, is virtually impossible with PNPs due to the inability of P-diffusants to penetrate deeply enough.

Initially, these new transistors are in TO-3 metal cans and are essentially complements of the 151-0368-00 in performance ratings, with I_c(max) of 8 amperes, $V_{CEO(SUS)}$ of 400 volts and $V_{CE(SAT)}$ of 1.5 V at $I_c = 4A$, $I_B = 1A$. Motorola's part designation is MJ6503, SGS-Ates' is BUW23. Motorola's list pricing is $4.85 in 100-piece quantity, but Tek's price would be somewhat less. SGS-Ates' price is $4.20 in 100-piece quantity, decreasing to $2.60 in 5K-quantities. These prices are very close to the price of the 151-0368-00.

The Motorola device is described in one of their excellent "Designer's Data Sheets." Full Tek characterization of both devices will be reported in an upcoming **Component News.**

for more information

Contact Jim Williamson, ext. 5345 for more information.

Vendor data book libraries

Due to an increasing demand for vendor supplied data books in the Walker Road and Wilsonville plants, two new branch libraries have been established.

To use the vendor data book reference library at Walker Road, contact **Ann Jacko (92-525, ext. 1744).** In Wilsonville, the data books have been placed in the existing library at **61-231,** with librarian **Cheri Eckholt (ext. 2986)** in charge.

In Beaverton, **Loretta Clark (58-299, ext. 6512),** has recently accepted responsibility for data book orders and distribution. If you have any questions please contact her. Lola Janes will continue with publications support for our group.

Carolyn Schloetel
Technical Communications

Electrical Standards has 5101A tapes

The Electrical Standards Lab maintains a master file on programs used on the 5101A cassettes. If you write a 5101A calibration tape, please let us have it long enough to copy.

We can then furnish you another if yours is lost or destroyed. In addition, we can furnish programmed tapes to others, saving them the time of developing their own and helping to standardize calibrations throughout Tektronix.

Bob Cram
58-188, ext. 5397

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)

The move of Technical Standards to Town Center presents our group with both a problem and an opportunity. The problem lies in the larger cost and complexity of operating from a distance; the opportunity arises from the challenge of doing better than "business as usual" in our new location.

For standards help, call Carol Whitmore, ext. 241, or send interplant mail to 41-260. The Directory of Standards and the computer index of reference standards located at all Library branches will provide quick information on available documents.

Extension numbers are: Roy Eckelman, ext. 244; Dwain Hall, ext. 245; Carol A. Jones, ext. 243; Pauline Whitmore, ext. 248.

The Component Standard: Reel Packaging of Axial Lead Components for Automatic Insertion, 062-3751-00, is available by calling ext. 241 (Town Center). This standard covers the lead taping requirements of axial lead components, specifically: resistors, diodes, capacitors, indicators and wire jumpers. However, it may be expanded to cover lead taping of components with axial leads not specifically mentioned, provided these components can be taped in accordance with the requirements in this standard. The standard replaces the previous documents 062-1688-00 and 062-1686-01.

The Laser Use Standard, 062-4194-00, is now available. It describes laser classification, operating environment, monitoring and recordkeeping requirements, personal protective equipment and compliance dates. This standard applies to all Tektronix operations where employees may be exposed to laser radiation at any time during the use of laser equipment or in the testing of a laser product.

new standards available

ANSI X3.60 - 1978 American National Standard for minimal BASIC
Australian Std. 2211 - 1978 Laser Safety
Aluminum Stds. & Data, 1978 Metric S1, The Aluminum Association
ISO Std. 724, ISO Metric Screw Threads, Basic Dimensions
ANSI/ASQC A3 - 1978, Quality Systems Terminology
UL Recognized Component Directory, March 1979
ISO Standards Handbook 2, 1979, Units of Measurement
IEEE Std. 4 - 1978, Standard Techniques for High Voltage Testing
CIE, Pub. No. 38 (TC-2.3) 1977, Radiometric and Photometric Characteristics of Materials and Their Measurement
ANSI/NEMA Standards Publication No. MW1000 - 1977 Magnet Wire
MIL-STD-1553B, Aircraft Internal Time Division Comand/Response Multiplex Data Bus. Replaces MIL-STD-1553A
American Die Casting Institute, 1965, Metric Version, 1979
MIL-G-49193 (CR), 1978, Signal Generator, SG-1171/U
MIL-B-49194 (CR), 1979, Impedance Bridge ZM-78/U
MIL-STD-13100, Shipboard Bonding, Grounding, and other Techniques for Electromagnetic Compatibility and Safety

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more TECHNICAL STANDARDS

IEC Standard 348: The Second Edition of IEC 348, Safety Requirements for Electronic Measuring Apparatus, has been published. The new issue can be ordered direct from: Central Office of the IEC (Sales Department), 1, rue de Varembe', 1211 Geneva 20, Switzerland. It may also be ordered from Technical Standards, 41-260, ext. 241.

requests for standards action

Technical Standards maintains forms for requesting development of a new Tektronix standard, and for requesting revision to an existing standard. These forms are available from Technical Standards, and will be provided to Library branches where there is a computer index to reference documents. Anyone who sees a need for either a new standard or a revision should fill out one of these forms and send it to 41-260. It is desirable that the requestor be able to provide detailed information and also be prepared to assist with whatever action is triggered by their request.

Charles D. Sullivan, manager

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				
Motorola, TI	74LS166	Shift register; 8-bit, parallel/serial input serial output	now	156-1313-00	$ 2.55	Ernesto Estrada, 7148
TI, Fairchild, National	74S30	Microcircuit; digital screened, 8-in., TTL, 14 DIP	now	156-0148-	.20	Don Van Beek, 5414
		electromechanical devices				
PSI	501063F	Clutch; magnetic, 12 V DC, CW rotation	1/1/80	105-0520-01	10.00	Bill Stadelman, 7711
		optoelectronic devices				
Litronix	RL4480-1	LED; discrete, red, TI, with distinct flange for panel mount with Tek-made grommets	9/1/79	no P/N	.21	Betty Anderson, 6389
IEE	LLT-201R-235R	LED; same as above	9/1/79	no P/N	.21	Betty Anderson, 6389
HP	HCMP1502	LED; discrete, green, TI, high intensity	9/1/79	no P/N	.55	Betty Anderson, 6389
Stanley	SP63431	LED; same as above	9/1/79	no P/N	.55	Betty Anderson, 6389
HP	5082-7610	LED; display, orange, 7 seg., CA, 635 nm, same pinout as 150-1037-00	9/1/79	no P/N	1.85	Betty Anderson, 6389
Monsanto	ME-61	LED; infrared emitter, radial leads	now	no P/N	.60	Louis Mahn, 6389
Mepco/Electro	5033R	Resistor; fixed metal film, 17.145 KΩ, 0.1% T9, 1/8W	now	321-1721-07	.22	Ray Powell, 6520
Mepco/Electro	5033R	Resistor; fixed metal film, 6.81 KΩ, 0.5%, T2, 1/8W	now	321-0670-00	.07	Ray Powell, 6520
Mepco/Electro	5053R	Resistor; fixed metal film, 23.2 KΩ, 1%, T0, 1/2W	now	323-0324-00	.05	Ray Powell, 6520

CRTC application note available

Timur Slamet, a recent student intern in the Digital Component Engineering group, completed a hardware and software design for a simple CRT terminal using National's DP8350 CRTC.

The hardware is implemented on a board for the Board Bucket and consists of the 8350, 4K bytes of RAM for video refresh, and circuitry to arbitrate between processor and CRTC accesses to refresh RAM.

The software consists of routines to put characters into the appropriate place in refresh RAM, manage the cursor position, and handle scrolling when necessary.

The software has been linked to a version of DDT, so the Board Bucket, together with the CRTC board, a keyboard, and a Motorola or Ball Brothers monitor, is also a stand-alone terminal.

The hardware on the board is normally configured to be write-only; the Refresh RAM is addressed at $E000 to $EFFF, and the CRTC registers are addresses at $F000 to $FFFF. There is no conflict because the processor reads program code from ROM in these areas and writes refresh data and cursor and screen management data to the CRTC board in these areas. Therefore, the refresh RAM does not occupy any otherwise usable space.

For testing of refresh RAM, the board may be restrapped to become read/write at a different location.

A complete report on this design, written by Timur Slamet, is available from me in Digital Component Engineering (58-125).

Jim Howe

More on the TI 9914

A memo describing the changes anticipated in the TI 9914 is available from me in Component Engineering. Most of the changes are to eliminate various bugs (see **Component News 271**, pages 9-12), but some are intended to enhance the device's flexibility.

I am able to functionally test 9914 devices. Any device obtained through me has been tested but devices obtained through Engineering Purchasing have not been tested in-house. Send me your 9914s and I will test them for you.

I would like to request the return of 9914 samples from groups which have recently received shipments of the parts from TI. It is much easier to provide a sample to groups which only require single quantities than to try to purchase single quantities. If you are able, please return your sample 9914s to me so I can distribute them elsewhere.

Jim Howe
Digital Component Engineering (58-125)

74S138 parts shortage

Texas Instruments is having problems meeting our needs for the 74S138. In order to keep all lines in production, we are taking delivery from Signetics on about 10,000 of their CD2108s. The CD2108 is the same as the 74S138, with the exception of the t_{PLH} on the Binary Select to any output path. This time for a standard part is currently 7nS and will be changed to 9nS for the CD2108 parts.

If you have any questions or foresee any problems, please contact **Don VanBeek (58-125), ext. 5414.**

New manager in Memory & I/O CE

Paul Gray is the new manager of Memory and I/O Component Engineering. Before coming to Tek, Paul headed the Electrical Engineering Department at PSU. Prior to this he was chairperson of the EE Department at North Carolina Agricultural and Technical State University.

Paul has a wide range of publications and writing experience, plus an interest in technical educations techniques. He has BS and MS degrees from Virginia Polytechnic Institute, and a PhD from Kansas State University.

Paul can be reached at 58-299, ext. 6302.

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RICHARD DUNIPACE

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