VOL. 30 NO. 1
JANUARY 1971

CHILTON'S

THE ELECTRONIC ENGINEER

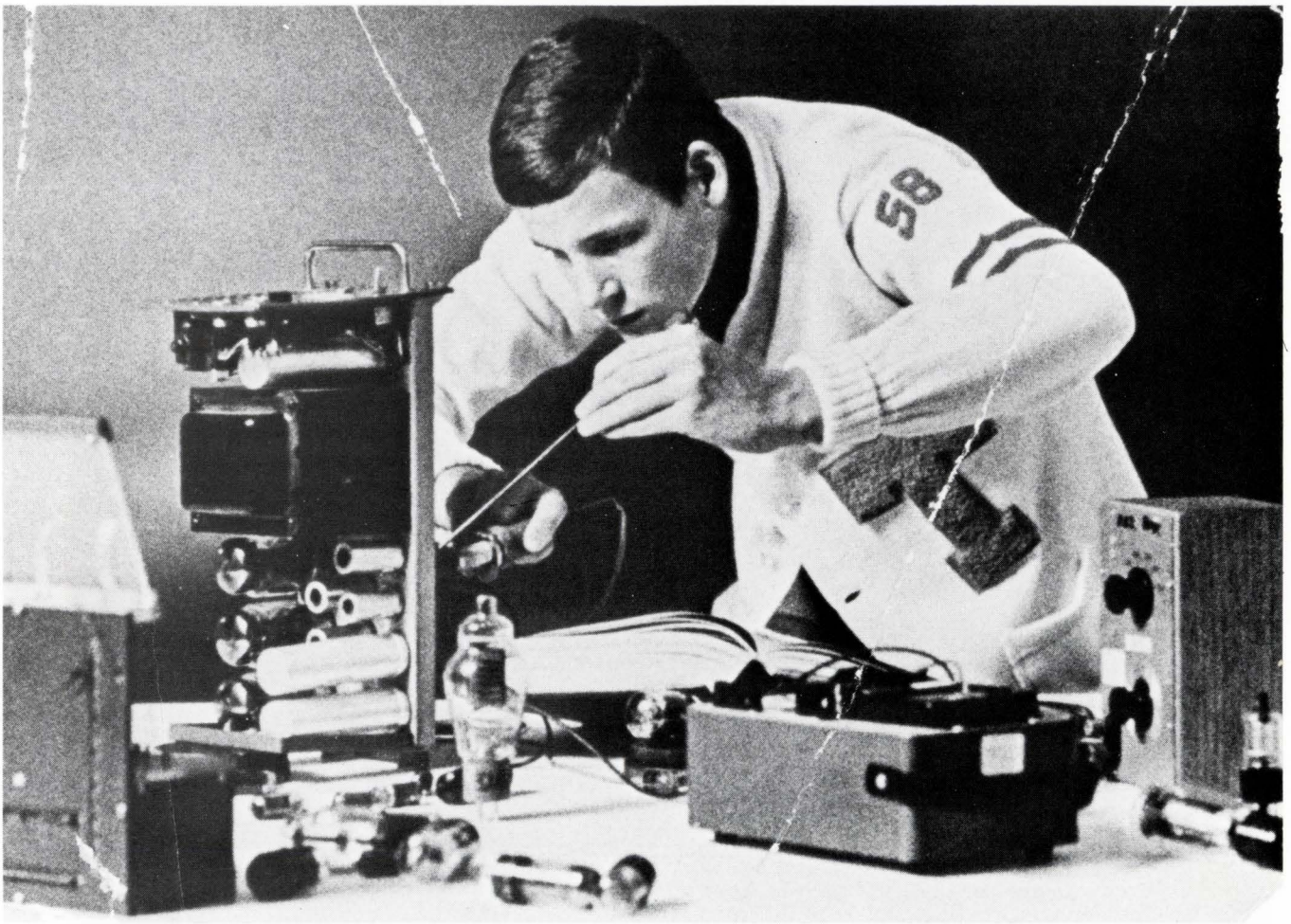
Hard hit by military cutbacks, our industry must switch to new markets, p. 21

The year of conversion

Optoelectronics course exam

What's available in MSI?

The 12 best IC ideas



Are you still using the same scope you used in college?

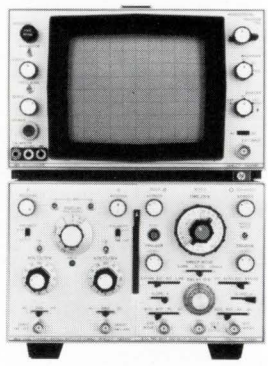
If so, you've been missing out on the greatest achievements in scope technology. During the last five years, Hewlett-Packard has quietly but firmly assumed technological leadership in the oscilloscope industry with the revolutionary HP 180 Scope System.

HP's innovations in general-purpose lab scopes include: the first scope with a real-time bandwidth of 250 MHz; the first 18 GHz sampling scope; the first 100 MHz variable-persistence storage scope; the first calibrated TDR scope with 35 ps rise time; and the first and only high-frequency (100 MHz) scope with a "big picture" CRT (8 x 10 div, 1.3 cm/div). And all these have a broad range of compatible plug-ins.

And, as these "for instances" illustrate, HP's innovations are *functional* improvements that increase your scope's usefulness. No "bells and whistles" that add little to performance and a lot to the price.

This functional approach has been applied to our lower-priced field-service scopes, too. No frills. Just function. With HP, you get the most favorable price/performance ratio of any scopes on the market. And all HP scopes are backed by comprehensive training and service organizations to optimize your scope investment.

It's amazing how many engineers have clung to the "old school traditions" while scope technology has progressed in quantum leaps. Call an HP Field Engineer and find out what the state-of-the-art is today. He'll be glad to give you a side-by-side demonstration with your "old school scope." Or write Hewlett-Packard, Palo Alto, California 94304. In Europe: 1217 Meyrin-Geneva, Switzerland.



Scopes are changing. Are you?

081/3

HEWLETT hp PACKARD

Circle Reader Service #**9.**

URGENTLY NEEDED: RELIABILITY

Accidental Electrocutions Claim 1200 Patients a Year

Fairchild News Service

At least three patients in United States hospitals are accidentally electrocuted each day.

The total number of electrocutions annually is about 1200.

According to Dr. Paul W. Wiltpd, a surgeon at Irtpy Boirt Kelhlin Hospital, Bythm, who supplied the figures, most of

condition but were undergoing "routine diagnostic tests," or "routine treatment."

Dr. Wiltpd's figu dental electrocution quoted last week a Symposium held in ing at a session o Medical Instrumer

search Council, Canada, said:

"Internal electric shock is a subtle hazard that has often es- recognition. As a result, were attrib-

patients a year are electrocuted during hospital treatment in the U.S.A."

In a telephone interview last week, Dr. Wiltpd said he received the figures from an actuary for a na- United States insurance com- a computer study

Reproduced from: Electronic News

NEWS

The tiny flaws in medical design can kill

Errant currents from faulty electronic equipment are reported imperiling patients in certain cases

Ronald Gechman
West Coast Editor

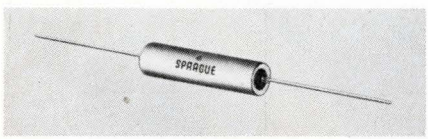
aware that small electr applied to the

Reproduced from: Electronic Design

FROM SPRAGUE: RELIABLE CAPACITORS

Sprague Electric has long been aware of the crucial importance of reliability . . . particularly in medical electronics, where failure can be fatal. The capacitors shown on this page are designed for utmost reliability . . . not merely to meet existing standards, but to be as failure-free as the present state of the art will permit.

HYREL® Capacitors



Manufactured under climate- and dust-controlled conditions in factory space used solely for high reliability production. 100% tested for optimum quality control. Exceed military and industrial standards for shock, vibration, moisture resistance, life. Reliability documented by extensive test data. Applications now include cardiac pacers and coronary care units. One 4-year user reports *no* failures. Available in following types:

Type 350D HYREL® ST Solid Tantalum
6 to 75 WVDC, .0047 to 330 μF

Type 351D Non-Polar HYREL® ST Solid Tantalum
6 to 50 WVDC, .0023 to 160 μF

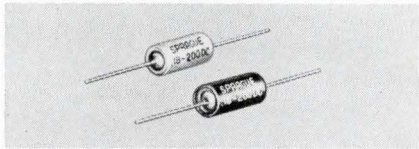
Type 309D HYREL® GT Sintered-Anode Tantalum
6 to 150 WVDC, 1.7 to 1200 μF

Type 330D HYREL® GT Sintered-Anode Tantalum
4 to 100 WVDC, 1.7 to 1200 μF

Type 195P HYREL® Q Subminiature Paper
200 to 600 WVDC, .001 to 1.0 μF

Type 168P HYREL® PQ Subminiature Paper
50 WVDC, .001 to 1.0 μF

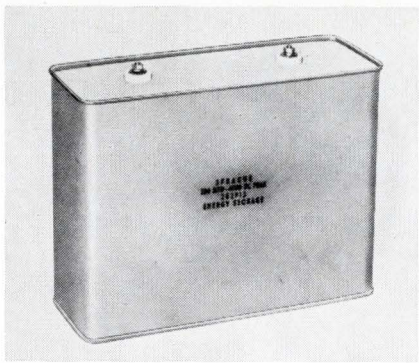
Type 118P Subminiature DIFILM® Metallized Capacitors



Unmatched for reliability at 125C by any other metallized paper capacitor. Higher insulation resistance than that of any other metallized paper design. Unique dielectric combines metallized paper and polyester film impregnated with special high temperature mineral wax. Hermetically sealed.

200 to 1000 WVDC, .001 to 12.0 μF

Heart Defibrillator Capacitors



True energy-storage capacitors expressly developed for heart defibrillators. Charged in milliseconds and discharged in a fraction of a millisecond.

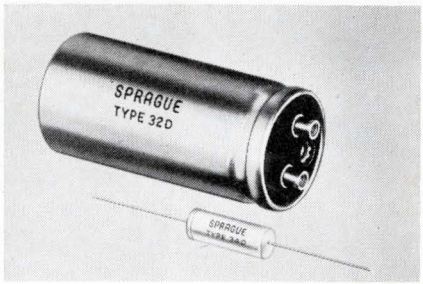
Three case sizes available.
Each rated 16 μF, 7500 WVDC.

Type 260P METFILM® 'K' Film Capacitors

Exceptional versatility and superior electrical characteristics in small physical size. Metallized polycarbonate-film dielectric provides high insulation resistance, high capacitance stability, low dielectric absorption, low dissipation factor. Hermetically sealed.

200 to 600 WVDC, .01 to 10.0 μF

COMPULYTIC® Aluminum Electrolytic Capacitors



Power supply filter capacitors with low leakage currents, low ESR, long shelf life. Feature the most reliable seal yet developed for aluminum electrolytics.

Type 32D—Cylindrical with tapped terminal inserts or solder lug terminals
2.5 to 450 WVDC, 35 to 200,000 μF

Type 34D—Tubular with axial leads
2.5 to 450 WVDC, 1 to 13,000 μF

4SC-0119

For technical literature on any of these capacitors, or engineering assistance without obligation, write or call Mr. John Moynihan, Sprague Electric Company, 233 Marshall Street, North Adams, Mass. 01247. Telephone (413) 664-4411

THE BROAD-LINE PRODUCER OF ELECTRONIC PARTS

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THE MARK OF RELIABILITY

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about the rectifiers we promised to introduce this month . . .

THEY ARE NOT JUST "HI-REL". THEY ARE

Centralab PRIME′ Microglass Rectifiers

1N3611 thru 1N3613

1N4001 thru 1N4005

1N4245 thru 1N4247

1N5185 thru 1N5190

1N5185A thru 1N5190A

HFR-5 thru HFR-20

Briefly, here's what the PRIME′ "label" means:

We've initiated a new Program for Reliability, Integrity, and Manufacturing Efficiency for all of our products. Now all Centralab Semiconductor products — incorporating improved designs — are manufactured to JAN quality levels for inherent reliability.

Special conditioning and selection provides products at four levels of reliability — at realistic prices to fit individual needs.

One of our PRIME′ grades will meet any OEM requirement.

PRIME′ grades are:

PRIME′ 1–For critical applications requiring maximum reliability and where repair or replacement is impossible. 100% conditioning, testing and data profiling — in excess of JAN-TX quality provisions.

PRIME′ 2–For military and industrial applications requiring JAN-TX or equivalent parts.

PRIME′ 3–For applications requiring JAN parts.

PRIME′ 4–For commercial and industrial electronics requiring JEDEC or equivalent parts.

CENTRALAB SEMICONDUCTOR
Division • GLOBE-UNION INC.
4501 NORTH ARDEN DRIVE
EL MONTE, CALIFORNIA 91734

PRIME′ is proving itself. Compare the "A" versions of our newly-registered PRIME′ fast-recovery rectifiers against those previously available:

JEDEC Type Number	Case Type	Electrical Specifications @ 25°C						Maximum Ratings	
		Peak Reverse Voltage PRV	Maximum Forward Voltage Drop @ $I_F = I_O$ V_F	Maximum Reverse Current I_r @ PRV		Maximum Reverse Recovery Time t_{rr}	Maximum Junction Capacitance @ $V_R = 0$ Volts	Average Rectified Current I_O @ 25°C	Surge Current I_{FM}
				25°C	100°C				
		Volts	Volts	μA	μA	pf	n sec	Amps	Amps
1N5185	20	50	1.1	5	100	600	250	3	80
1N5186	20	100	1.1	5	100	400	250	3	80
1N5187	20	200	1.1	5	100	320	250	3	80
1N5188	20	400	1.1	5	100	240	300	3	80
1N5189	20	500	1.1	5	100	200	350	3	80
1N5190	20	600	1.1	5	100	160	400	3	80
1N5185A	20	50	1.1	2	80	400	250	4	80
1N5186A	20	100	1.1	2	80	300	250	4	80
1N5187A	20	200	1.1	2	80	250	250	4	80
1N5188A	20	400	1.1	2	80	200	250	4	80
1N5189A	20	500	1.1	2	80	160	250	4	80
1N5190A	20	600	1.1	2	80	120	300	4	80

Contact us now for a comprehensive data package describing the program in detail.

THE ELECTRONIC ENGINEER

January 1971 Vol. 30 No. 1

Cover: Swords into plowshares—an old idea that may have vital importance in the '70s as more and more electronic engineers take their talents and experience into the civil sector. In this issue, our staff analyzes just a few of the areas that have tremendous growth potential, such as, the handling of files, data terminals for department store sales, microwave communications links, video recording and playback for homes, and some of the growing number of electronic applications in automobile design.

THE ELECTRONIC ENGINEER

January 1971
Vol. 30 No. 1

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Monthly publication of Chilton Company, Chestnut & 56th Sts., Phila., Pa. 19139. (Area Code 215) SHerwood 8-2000. Controlled circulation postage paid at Philadelphia, Pa. $1 a copy. Subscription rates U. S. and U. S. Possessions: 1 yr. $12.00; 2 yrs. $20.00. Canada 1 year $14.00; 2 yrs. $25.00. All other countries 1 yr. $20.00; 2 yrs. $35.00.

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Medical Electronic News
Electronic Components News

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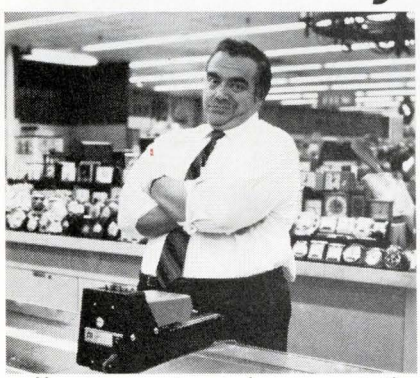
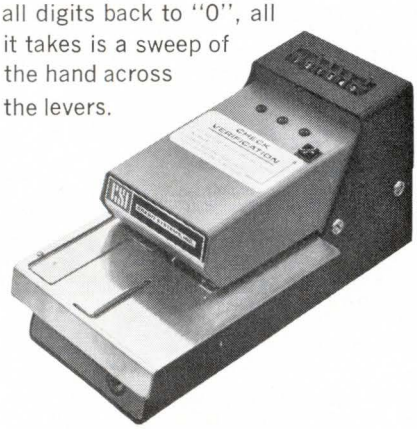
Somebody Out There Likes Me.



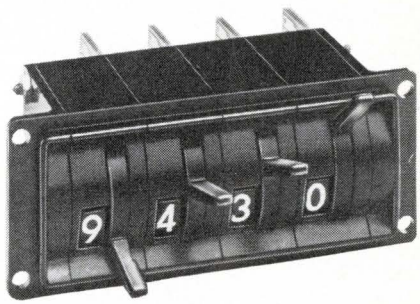
I'm a counter salesman at the branch of a large department store chain. When people give me a credit card or a check, I instantly check their credit on this fast little terminal unit. It's easy. I can verify a check against a drivers license number in a second just by flipping this MINILEVER™ switch. Of course, I have to flip this switch all day long. But I don't mind. "Credit-Chek", produced by Credit Systems Inc., of Colmar, Pennsylvania, was obviously designed by engineers with compassion. They know that if some poor soul has to flip a row of switches all day long, it should be easy and comfortable. Comfort produces accuracy.

MINILEVER is an accurate, easy to use switch. Nice large characters, .200 inches high, that "click" into position by the flip of a lever. The MINILEVER gives you up to 12 positions per module. The modules are on ½" centers, with as many in a row as you require. When you wish to reset all digits back to "0", all it takes is a sweep of the hand across the levers.



So, be compassionate, think of the other guy and buy MINILEVER. After all, you'd want him to do the same for you.

Send for our new data sheet.



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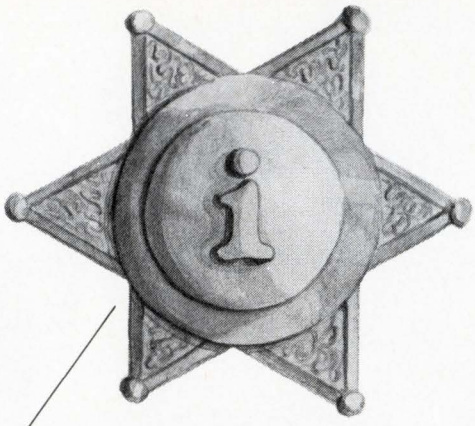

Don't get held up by a masked ROM.

Let Intersil guard you from masking costs and delays with an electrically programable ROM. All you need to code it is a few seconds and a simple program box. No masks. No eight weeks for delivery.

It's the IM5600, our 256-bit 40-ns T²L ROM packaged in a 16-pin DIP or flatpack. A pin-for-pin replacement for the 9034 and its second sources, only faster. And it's off-the-shelf from our distributors.

TWX-a-Code or Code-a-Card.

For super-fast service, TWX your code to us or your nearest Intersil distributor. We'll program up to 100 ROMs directly off the wire and have them in the mail to you right away.

Another time saver. Order quantities of blank ROMs, mount them on your own PC cards and stock them. When you need it, program a complete card at a time, plug it in and go!

Penny a bit, anyone?

Price for the IM5600 (0 to +75° C version) is $25.70 in 100-piece lots. But if you're interested in really large quantities we can bring the price down to a fraction of that. Any takers?

See your friendly Intersil fellow.

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Intersil

EDITORIAL

Thank you, but the work is only starting

The endorsement is clear, as the cards continue to pour in. So far, about 8000 readers have sent to this magazine the coupon we included in our October issue, endorsing our effort to promote jobs for electronic engineers. In this issue we have outlined how we think jobs can best be promoted, and where the thrust of our effort is to promote them.

Many readers have asked if we are going to Washington to propose "make work" projects for engineers. Nothing could be further from our mind. Our effort is based on the conviction (based, in turn, on our analysis of technological developments for the early '70s) that there will be plenty of opportunities available. These opportunities hold the promise of jobs for electronic engineers. However, while the opportunities are available, it does not follow that they will fully develop, or that American electronic manufacturers will capture them.

For example, the Federal Communications Commission, which is considering applications by over 30 companies to build more than 1700 communications links in the country, has already authorized Microwave Communications Inc. (MCI) to build one of them, between Chicago and St. Louis. The sooner the FCC authorizes these links and resolves the major policy issues* involved in some of these applications, the better for our industry and for our readers. In addition, the availability of an expanded communications network in the country will foster the new applications of data processing equipment and data terminals, which also employ the skills of electronic engineers. (See the article, "The year of conversion," on page 21 of this issue.)

However, if we want American manufacturers to develop both data communications and terminal equipment competitively, we feel they need and deserve help from *our* government, since the foreign manufacturers who will try to sell that kind of equipment in the United States have the aid and support of *their* governments. Such help would be nothing new for our government. For example, the Department of Commerce already does an excellent job in helping American manufacturers of data processing equipment and of instruments to sell their products abroad. However, as good as this kind of help is, it is directed at products which exist today, and are already in production. A similar effort is mandatory, we submit, to help our manufacturers produce the equipment that will be needed tomorrow.

For these reasons, this editor has been indicating these areas of opportunity to industry groups and, after receiving your heartening endorsement, we are also outlining them to our government, along with our proposals for official action. In this issue, we are starting to outline them to you, since their success depends on the success of the equipment our readers will design.

We have your endorsement. While you work in developing the equipment of the '70s, we will continue to press for help to make it competitive. The work is only starting.

Alberto Socolovsky
Editor

*See "The hour of decision at the FCC." **The Electronic Engineer,** Nov. 1970, pp. 22-29.

UP-TO-DATE

Making the top ten . . . For the second consecutive year, Lockheed topped the list of the 10 contractors awarded the biggest dollar volume in Department of Defense prime contracts. Lockheed received $1.84 billion in fiscal year 1970, down $192 million from the preceding year. They were also first in R&D contracts, with $526.3 million. Despite this, the company had to ask the Pentagon in March for $600 million in interim financing for DoD projects.

Borrow a memory . . . Corning Glass Works is encouraging memory systems designers to borrow glass memory modules to study their memory requirements. To overcome the initial price hurdle engineers face when buying fully assembled glass memory modules, Corning is lending memories for up to two months to selected design engineers with memory requirements.

Government recognition . . . The American Institute of Aeronautics and Astronautics (AIAA) has enlarged its program to help unemployed engineers and scientists find professional jobs. In addition to the five original locations, workshops will be established in 29 areas. The program will be financed with $129,000, the Department of Labor furnishing $109,000 and NASA, the remainder. Also for unemployed engineers, the Department of Labor has established a national registry, a central file of engineering job openings and job applicants. Set up with the cooperation of the California Department of Human Resources and the National Society of Professional Engineers, the program is funded with $125,000. Although located in Sacramento, the registry will provide nationwide employment assistance to engineers and prospective employers.

A very slight increase . . . Business opportunities for electronic and aerospace companies will increase 1 to 3% in government markets, predicts the Electronic Industries Association. EIA concludes that DoD and NASA can no longer be considered growth markets for electronic manufacturers. Total DoD and NASA electronic-related spending is expected to be about $15.5 billion in 1979, compared with 1969's $12.6 billion—a 25% increase, but probably only enough to offset inflation. Agencies with programs of most potential for electronics will be the Federal Aviation Administration, Urban Mass Transportation Agency, Department of Housing and Urban Development, Office of Education, and the Law Enforcement Assistance Administration.

Low-noise audio ICs . . . Toshiba has developed a new process for manufacturing low-noise transistors and ICs. The "perfect crystal technology" (PCT) process insures crystal perfection throughout all manufacturing steps, with a dislocation-free epitaxial layer grown on a dislocation-free silicon substrate. Noise level of ICs at 100 Hz can be reduced to 1/5, and at 10 Hz to 1/20, that of circuits produced by other methods. The circuits will be used for audio frequency amplification.

Military R&D budget . . . David Packard, Undersecretary of Defense warned about the danger of reducing the military R&D budget. Speaking at the annual show and Convention of the Instrument Society of America (ISA) in Philadelphia, Mr. Packard indicated the many developments, such as glass reinforced PC boards, aluminum and titanium for commercial airplanes, etc., that came about thanks to military R&D. He expressed the hope that Congress would accept the budget for R&D requested by DoD, although the request has already been cut back by the House.

Bits of information . . . **Sylvania Electronic Systems** has started an electronics school in Waltham, Mass., to train men and women for various careers. The school offers vocational training in radio and TV, communications, and computer electronics . . . **Control Data Corp.** has been awarded two contracts, valued at $15.2 million, by the U.S. Navy. The company will install three CDC 6000 Series and six CDC 1700 computer systems at the Naval Weapons Lab., Dahlgren, Va., and the Naval Ship Research and Development Ctr., Carderock, Md. . . . **Burlington Northern** has awarded a $1.2 million contract to Stromberg-Carlson to merge and enlarge the rail's phone systems into an integrated network.

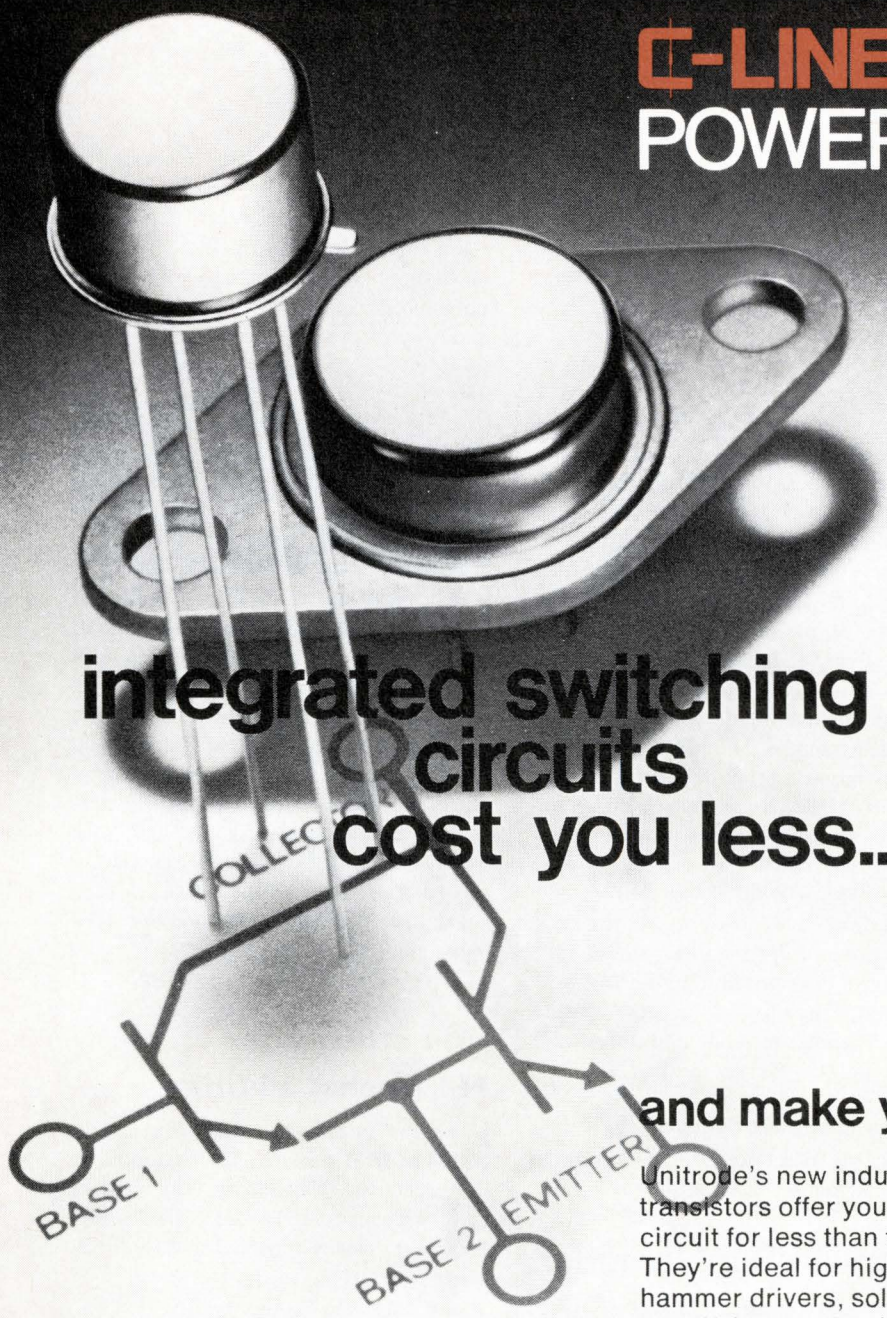
Toshiba of Japan now has a black and white TV that is equipped for both regular broadcast reception and closed circuit TV monitoring of up to four locations within the home . . . **RCA** has announced the development of a low-noise avalanche diode oscillator with a noise level 10 times lower than that previously reported for such devices . . .

Zenith Radio Corp. is introducing an advanced acousto-optic intensity modulation system for the economical application of laser beams in such fields as data processing, communications, and video recording . . . **Optel** claims it has the first commercial electronic device using liquid crystal or cathodochromic screens to display data. The unit is a display terminal . . . **Despite the $1 billion** investment in Cape Kennedy, NASA is examining other sites for the $6 billion reusable space shuttle program.

The U.S. supplies an estimated 75% of the $25-million IC market in Great Britain . . . **The microwave oven market** may jump from 75,000 units/yr to 200,000 units/yr by the end of 1971 . . . **The European MOS market** is expected to grow from $42 to $500 million by 1975 . . . **Color TV** picture tube exports were up 143% as of August last year, although total output was down 22%. . . Monochrome exports were down 54% and output 25% . . . **Fairchild** lost $10 million in the third quarter last year while employment dropped from 23,000 to 16,000 in six months.

Varadyne Inc. has developed a new MOS process called VMOS which is said to be as fast as current sinking logic and as inexpensive as standard MOS . . . **Air pollution instrument sales** are expected to rise from $12 million to $35 million by 1975 . . . **U.S. unemployment** averaged 5.1% in August 1970 (vs 3.5% in 1969), while unemployment in California hit 6.5% (vs 4.6% in 1969).

¢-LINE POWER DARLINGTONS



integrated switching circuits cost you less...

and make your work a lot easier.

Unitrode's new industrial 10 Amp silicon planar NPN Darlington transistors offer you the advantages of a monolithic two transistor circuit for less than the price of comparable discrete devices. They're ideal for high gain switching applications such as print hammer drivers, solenoid, servo and lamp drivers and for amplifying applications such as motor controls and linear amplifiers. They're available in two hermetically sealed metal packages — a lead-mounted TO-33 (U2T101) and a chassis-mounted TO-66 (U2T201). Both utilize overlay (multiple emitter) techniques on driver and output transistors. Saturation voltage is 1.5V max. @ 5A and current gain is 2000 min @ 5A. Collector-Emitter voltage ratings are available up to 150 volts. U2T201 has a power dissipation rating of 25W @ a case temperature of 100°C. For whatever Darlington application you have, Unitrode ¢-Line Darlingtons are more efficient and less expensive than any other method of performing the function. Why not make us prove it? (U2T101 is $2.75 ea. in lots of 100.)

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Unitrode Corporation,
Dept. 1D , 580 Pleasant St., Watertown, Mass. 02172

Free samples on request.

UNITRODE quality takes the worry out of paying less.

Circle Reader Service #**5.**

A "reel" packaging breakthrough

The traditional IC packaging bottleneck appears to have been broken by two new methods for automatically mass producing and packaging ICs. General Electric's multibond™ is a process to automate the assembly of the IC chip to its package while miniMod™ is the name they give to their new packaging concept.

Both the multibond process and the miniMod package use a polyimide film strip. This very stable, but still flexible, plastic film is made in continuous lengths perforated with indexing holes for mechanized processing and testing. Other holes in the strip will accept the silicon pellet and will provide access to copper leads so that you can attach your substrate. A 1-oz. copper ribbon is laminated to this strip. Through a photolithographic process a lead frame is etched into the copper ribbon at each index point of the strip. Following this, the lead frames are tinned in preparation for pellet attachment.

Each copper lead is etched down to a 4-mil wide finger at the point at which it is to be bonded to a gold bump on the silicon pellet. The finger is cantilevered over the hole which receives the pellet. Away from the pellet, the copper leads are widened to become the package leads.

The pellet itself has been specially processed for use with this lead frame. A standard monolithic IC is fabricated, complete with its aluminum metalization, and then a glass overcoat is deposited over the entire circuit except for the bonding pad areas. Gold bumps are plated into the exposed bonding areas. The pellet is attached to the lead frame by aligning it under the cantilevered fingers and applying heat and pressure to all fingers, simultaneously forming a gold-tin eutectic bond that can withstand temperatures of over 280°C.

Direct connection of the copper leads to the bonding pads by this process eliminates the conventional gold wires used between a pellet and its lead frame.

The company also announced the availability of two products that are being offered in the new package.

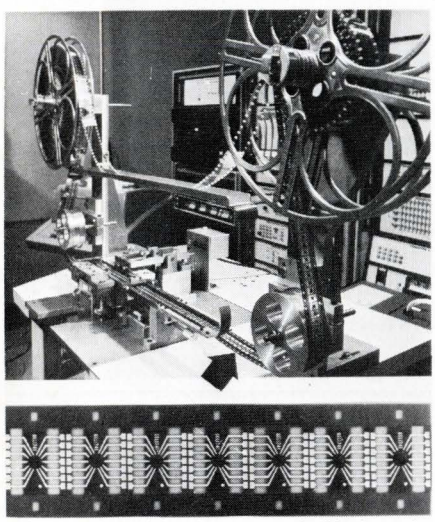
The PA 1494 AccuSwitch™ is a monolithic threshold detector with controlled hysteresis. Intended for applications requiring the logic function of a Schmitt trigger, it has a sensitivity below 50 nA and its own voltage reference.

Circle Reader Service #**280.**

The GEL 1741 features short-circuit protection at both the input and output, low power consumption, and offset voltage null capability. It accepts a wide range of common mode and differential mode input voltages and it will not "latch up."

Circle Reader Service #**281.**

General Electric Co., IC products Dept., Syracuse, N.Y. 13201.



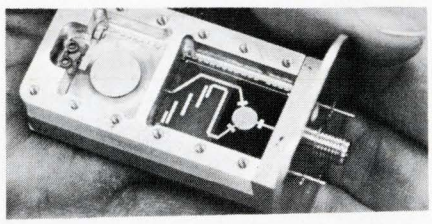
ICs packaged in the new miniMod packaging concept can be automatically tested. The film strip approach as a carrier for these products and the reel-to-reel handling approach enable GE to test these new ICs (The GEL 1741 op amp is shown) easily and automatically.

Compact Doppler radar

Entering the consumer applications field for the first time, Hewlett-Packard Co. has a microwave Doppler radar transmitter-receiver module for many consumer and industrial purposes. A completely solid-state module, it is built with hybrid thin-film microcircuits.

The power from a Gunn diode producing 50 mW of power at 10.525 GHz is coupled to the output port through a circulator. Some of the energy from the diode is shunted through a 10-dB coupler to a hot carrier diode mixer. This serves as the reference signal.

The returning rf signal, shifted in frequency as a result of its reflection from a moving object, passes back through the circulator. The circulator isolates incoming and outgoing signals, even though they pass through the same port to and from an antenna. Coming in from the circulator, the received signal moves through a bandpass filter to remove spurious responses. It then moves on to the mixer where the incoming and outgoing signals subtract to generate an audio signal proportional to velocity.



All that's needed to form a complete microwave Doppler radar is the module, an antenna, a display, and a power source. Possibilities for consumer uses include automobiles, private airplanes, and pleasure boats. The radar will be used in industrial applications such as intrusion alarms, automatic traffic controls, railroad speed controllers, and automatic aircraft landing systems.

Modules will sell, in quantities of 1000, for less than $150 and, in very large quantities, for less than $100.

Circle Reader Service #**282.**

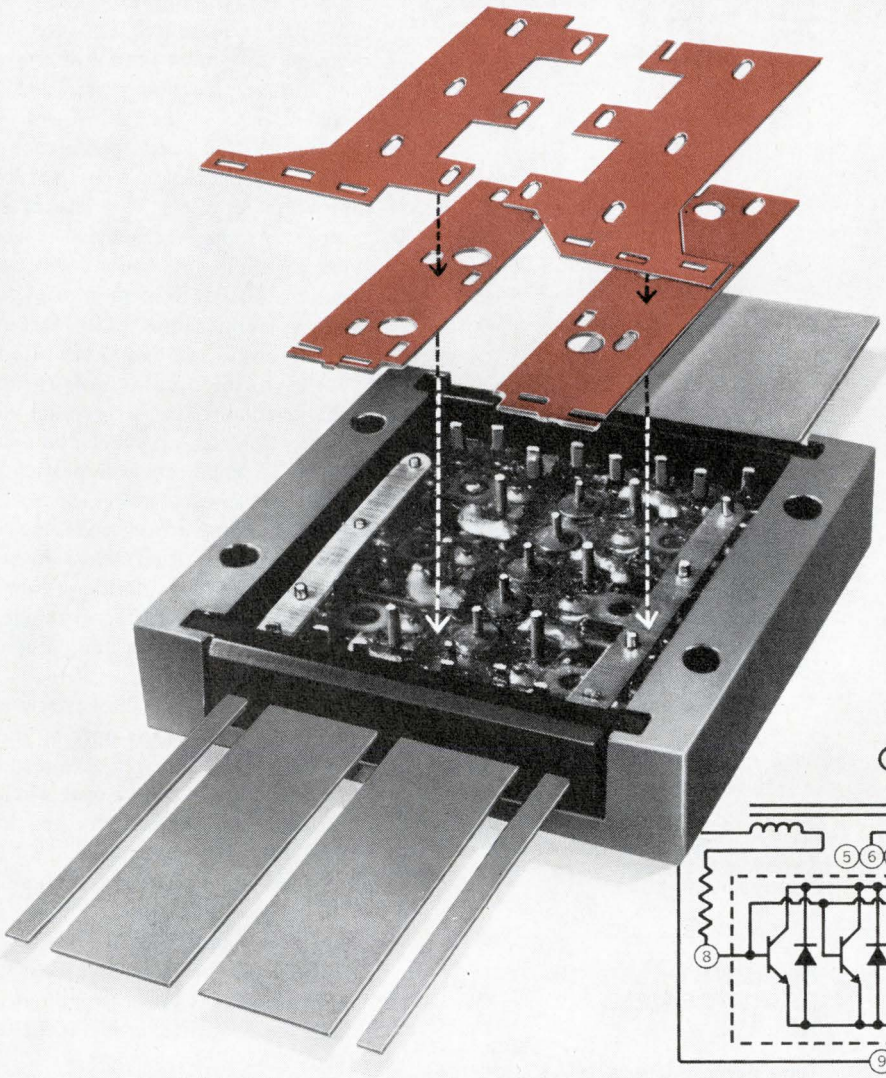
FET reaches 14 GHz

Using ion impantation techniques, scientists at IBM's Research Division have developed an experimental FET with a cutoff frequency of 14 GHz. This is the highest frequency reported to date for a silicon transistor.

The substrate is high-resistivity (100 Ω-cm) p-type silicon. Both source and drain are diffused n^+ with phosphorus. The area between the source and drain is then implanted with boron to produce a higher conductivity (1 Ω-cm) p-type material. After the metal electrodes and gate are formed, the device receives a heavy implantation of phosphorus ions to extend the source and drain to the exact edges of the gate.

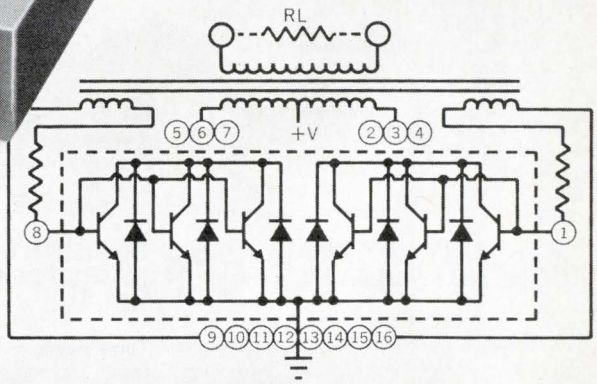
Experiments to date indicate that the transistor produces high gains in the 5-10 GHz range. In addition, switching speeds of less than 500 ps have been measured. Although the 500-ps value was the resolution limit of the measurement setup, IBM expects the actual switching speed of the unloaded transistor to be less than 100 ps.

Introducing... A New Modular Concept in RCA Hybrid Power Circuits



Module shown actual size

Exploded view shows one of the standard interconnections of the RCA hybrid power module as used in a common-emitter inverter. That portion within the dotted lines in the circuit schematic represents the RCA module.



Take RCA transistor chips with current capabilities up to 80 A, rectifiers with peak currents to 80 A, and resistors to 10 watts. Interconnect them — in any number of ways. What do you get? A power capability up to 800 W, current capability up to 300 A!

Right now, RCA is mass-assembling a variety of thick-film hybrid high-power arrays that are ideal for switching and amplifier applications in military and industrial equipment. Modules are also available in unconnected versions, if you prefer to create your own design.

These hybrid power circuits offer obvious power circuit advantages, including: compactness, light weight, fewer parts, minimum assembly costs, factory-selected and matched components, and efficient built-in heat dissipation.

Look over the inverter example illustrated. Then call your local RCA Representative or your RCA Distributor for more information on the modular concept. For RCA's new, detailed brochure, "High-Power Arrays" (HPA-100), write: RCA, Commercial Engineering, Section 59A/UC2R, Harrison, N. J. 07029. International, RCA, 2-4 rue du Lièvre, 1227 Geneva, Switzerland, or P.O. Box 112, Hong Kong.

RCA

ISSCC 71

Electronics brings the world closer together in this year's IEEE International Solid-State Circuits Conference. The annual meeting, which is scheduled for Feb. 17-19, will again be held at the University of Pennsylvania (afternoon sessions) and the Philadelphia's Sheraton Hotel (evening discussions). Of the 200 papers submitted, 75 were selected, representing more than a dozen nations in Europe, the Far East, and South America.

Just as this year's conference represents a variety of nations, so does the program represent a variety of current topics. Among the subjects covered in the 15 afternoon sessions will be computer-aided design, memories, digital circuit applications of IC technology, linear circuitry, avalanche diode circuits, biomedical electronics, and charge-coupled carrier-domain devices. Topics for the 12 panel discussions in which 75 engineers will participate include microwave power sources, low-noise microwave front ends, high-power If techniques, microwave broadband transistor power amplifiers, biomedical sensors, silicon-diode array image tubes, the impact of LSI on computer design, and A-D/D-A.

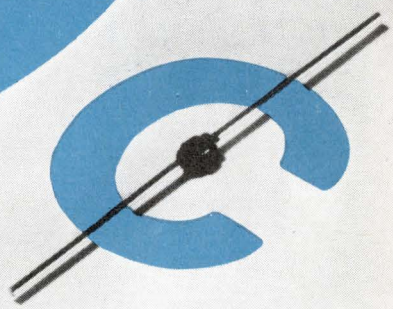
Be sure to attend the keynote address by D. W. Hill on the opening day. Hill is from the Research Department of Anaesthetics at the Royal College of Surgeons of England, located in London. He'll be speaking on the "Impact of Solid-State Circuitry Technology on Biomedical Electronics." Also at this time the IEEE Mervin J. Kelly Prize award will be presented, as well as ISSCC plaques for outstanding contributed papers delivered at the 1970 meeting.

You'll find the Digest of Technical papers more than just a souvenir to return home with. It's filled with 200 pages of information and includes condensed versions of all invited, contributed, and keynote papers. They'll be distributed to all who register at the meeting, but you'll have to pay for them after that.

Registration before the conference is $20 for IEEE members, $25 for nonmembers. At the door, it's $30 and $35 respectively. If you'd like programs or registrations forms, address your requests to Lewis Winner, 152 W. 42nd St., New York, N.Y. 10036.

PIN diodes

Low series resistance
(typically 0.3Ω at 100mA)
Available off-the-shelf



The new UM4000 Series is available in a variety of packages in voltages from 100v to 600v at the lowest prices in the industry. (as low as 89c in 10K lots.) Such features as low losses, low thermal impedances, low parasitics, low distortion and high reliability make them ideal for applications from LF to S band. They're especially suited for switches, duplexers, TR switches, receiver protectors, digital phase shifters, attenuator circuits and AGC loops. For fast action, call Steve Nannis collect at (617) 926-0404.
Unitrode Corporation, 580 Pleasant Street, Watertown, Mass. 02172.

UNITRODE quality takes the worry out of paying less.

Circle Reader Service #**8.**

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Inquiry Processing Dept.1 D , 63 Atlantic Ave., Boston, Mass. 02110

☐ Please send me free UM4001 sample as well as Application Bulletin and complete specs.

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ADDRESS_____

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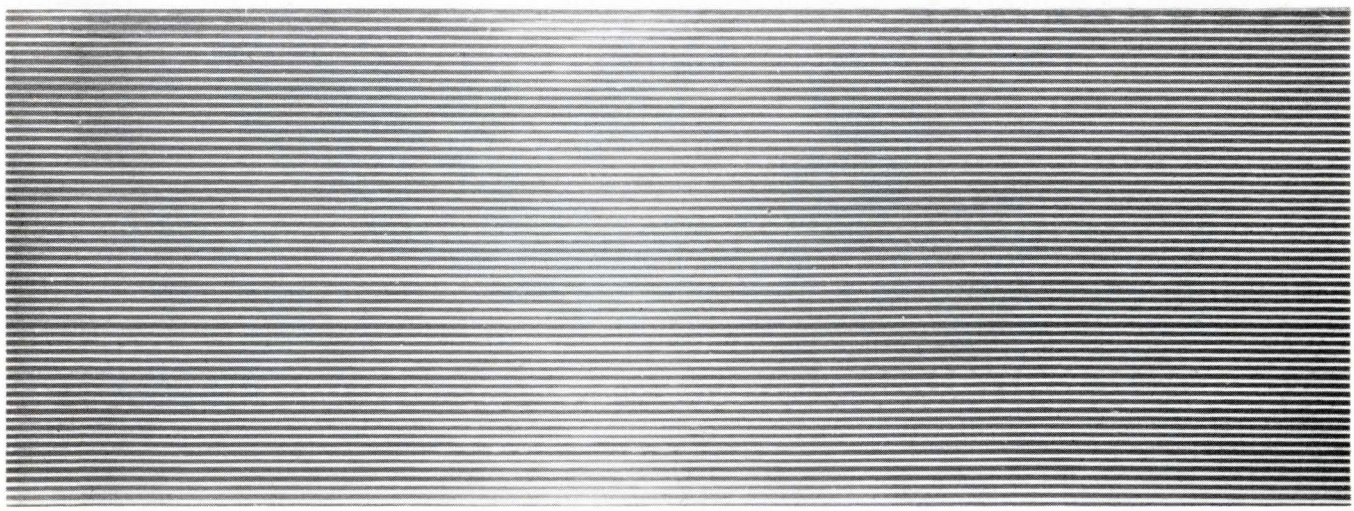
this is a coaxial cable . . .



It doesn't look like coaxial cable, but it acts like it. It has the same propagation velocity and controlled cross talk characteristics, as well as matched impedance. It's a piece of Ansley Signaflo® transmission cable. But because it doesn't have the traditional coax form, some people are hesitant to use it . . . even though it's stronger, lighter, and requires less space in packaging. Ansley Signaflo will even flex and follow complex contours.

Unlike coaxial cable, the biggest benefits are found in the final assembly. Each cable assembly provides exactly the same controlled electrical characteristics. Misassembly errors are eliminated. Total installed cost, a big factor to consider with coax, can be as much as 50% less.

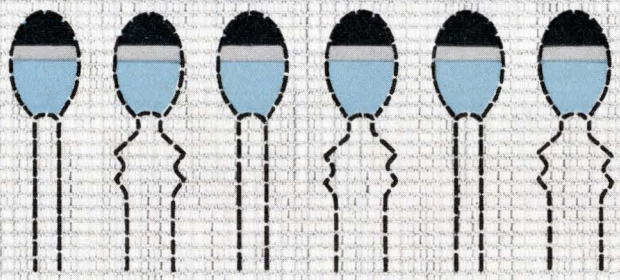
Ansley Signaflo transmission cable is manufactured in a wide range of sizes, configurations and insulating structures available from stock.

Also available is Ansley Flex-Strip® electrical conductor cable. In addition to the standard stocked cables, Ansley will produce any flat cable or terminated cable assembly to suit your specific requirements.

With over ten years of experience in the manufacture of flat cable and custom-engineered flat cable assemblies, we are anxious to prove our capabilities. We have coaxial cable like you've never seen before. Ansley Corporation, a subsidiary of Thomas & Betts Corporation, Doylestown, Pa. 18901 and Los Angeles, Cal. 90065. In Europe, Ansley Elektronik, GmbH, 8766 Grossheubach.

Ansley

Now ITT can save you something on capacitors too!



Get a free sample of ITT's competence in capacitors! Learn how you can use miniature resin-dipped solid tantalum devices to cut costs without sacrificing performance. In some areas – impedance, for example – you can even expect performance improvement.

ITT has 31 popular models in stock, and some 25 others available on very short notice. In the combinations shown below, you may select capacitance from 0.1 to 100 μF and voltage ratings from 3 to 35 VDC.

Temperature range is −55 to +85°C, and you may choose either flexible or preformed leads. Normal capacitance tolerance is +50% to −20%, but special orders for ±20% or ±10% devices can be filled.

Find out how ITT can save you something on your next capacitor procurement. Use this coupon to get a free tantalum capacitor sample and a price quotation.

☐ Please send me a free capacitor with the voltage/capacitance characteristics circled at right.

☐ Please quote on _____ pieces with the voltage/capacitance characteristics circled at right.

☐ Please send me detailed specification on your capacitor line.

☐ Please have a salesman call.

SAMPLE VOLTAGE/CAPACITANCE COMBINATIONS AVAILABLE FROM STOCK

Voltage	Capacitance (μF)					
35	0.1	0.15	0.22	0.33	0.47	0.68
	1	1.5	2.2	3.3	4.7	6.8
	10					
20	3.3	4.7	6.8	15		
16	2.2	10.0	22			
10	4.7	10.0	15.0	33		
6.3	6.8	15.0	22.0	47.0		
3	33.0	68.0	100.0			

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

semiconductors ITT

ITT Semiconductors is a division of International Telephone and Telegraph Corporation, 500 Broadway, Lawrence, Mass. 08142. Phone 617-688-1881. Factories in Florida • Massachusetts • England • France • Germany • Portugal • Australia

"Many CPUs are in a terrible jam," the Sanders man noted thickly. "Incoming orders are stealing much precious time."

"Let's put MAC 16 on it posthaste," urged his assistant urgently. "With its phenomenal hardware interrupts, Lockheed's mighty mini is the ideal computer for our proposed curative, the Sanders Order Entry System!"

"Interesting," mused the older man, "but what of devices? Can a mini computer control stations enough?"

"An incredible 256 devices!" shrieked the lad. "Plus mass storage and blinding speed!"

"Hmmm. I suppose we could link MAC 16 with our justly renowned Sanders 720 Display Stations..."

"Of course! Two per office—the second one for verification. Why, on-line or off-line, our system will be so foolproof even *girls* can operate it!" the youngster giggled triumphantly.

"My boy, your enthusiasm is contagious. Consider it done!"

"Our fortunes are made!" his assistant exulted, foaming slightly.

Verily, an apt prophecy it was.

Moral: Fame and fortune await. Merely tell Central you want (213) 722-6810, collect, and become the next clever MAC 16 applicator.

Lockheed Electronics

Data Products Division / Los Angeles (213) 722-6810
A Division of Lockheed Aircraft Corporation

MAC AND THE ELECTRIC ORDER RECORDER

or

Saving the Day for CPUs

CALENDAR

JANUARY						
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

Jan. 19-21: Computer Designer's Conference & Exhibition, Anaheim, California. Addtl. Info.—Milton S. Kiver, President, Industrial & Scientific Conference Management, Inc., 222 W. Adams St., Chicago, Ill. 60606.

Jan. 21-22: Magnetic Recording, Barbizon Plaza Hotel, New York, N.Y. Addtl. Info.—L. R. Neville, Rear Admiral USN (Ret.), Associate Executive Director, The New York Academy of Sciences, 2 E. 63rd St., N.Y. 10021.

FEBRUARY						
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28						

Feb. 9-11: 12th Annual Winter Convention on Aerospace and Electronic Systems (WINCON) Biltmore Hotel, Los Angeles, Calif. Addtl. Info.—Wm. H. Herrman, P.R. Chairman, Wincon '71, 3600 Wilshire Blvd., Los Angeles, Calif. 90005.

Feb. 17-19: IEEE International Solid State Circuits Conference, Sheraton Hotel, University of Pennsylvania, Philadelphia, Pa. Addtl. Info.—R. W. Webster, Texas Instruments, POB 5012, Dallas, Texas 75222.

Feb. 22-27: Electronic Components Exhibition, U.S. Trade Ctr. for Scandinavia, Stockholm, Sweden. Addtl. Info.—A. J. Beiring, Project Officier, Scandinavia and Benelux Section, Commercial Exhibitions Program, U.S. Dept. of Commerce, Washington, D.C. 20230.

'70 & '71 Conference Highlights

IEEE—International Convention & Exhibition, March 22-25; New York, N. Y.

WESCON—Western Electronic Show & Convention, Aug. 24-27; San Francisco, Calif.

Call for Papers

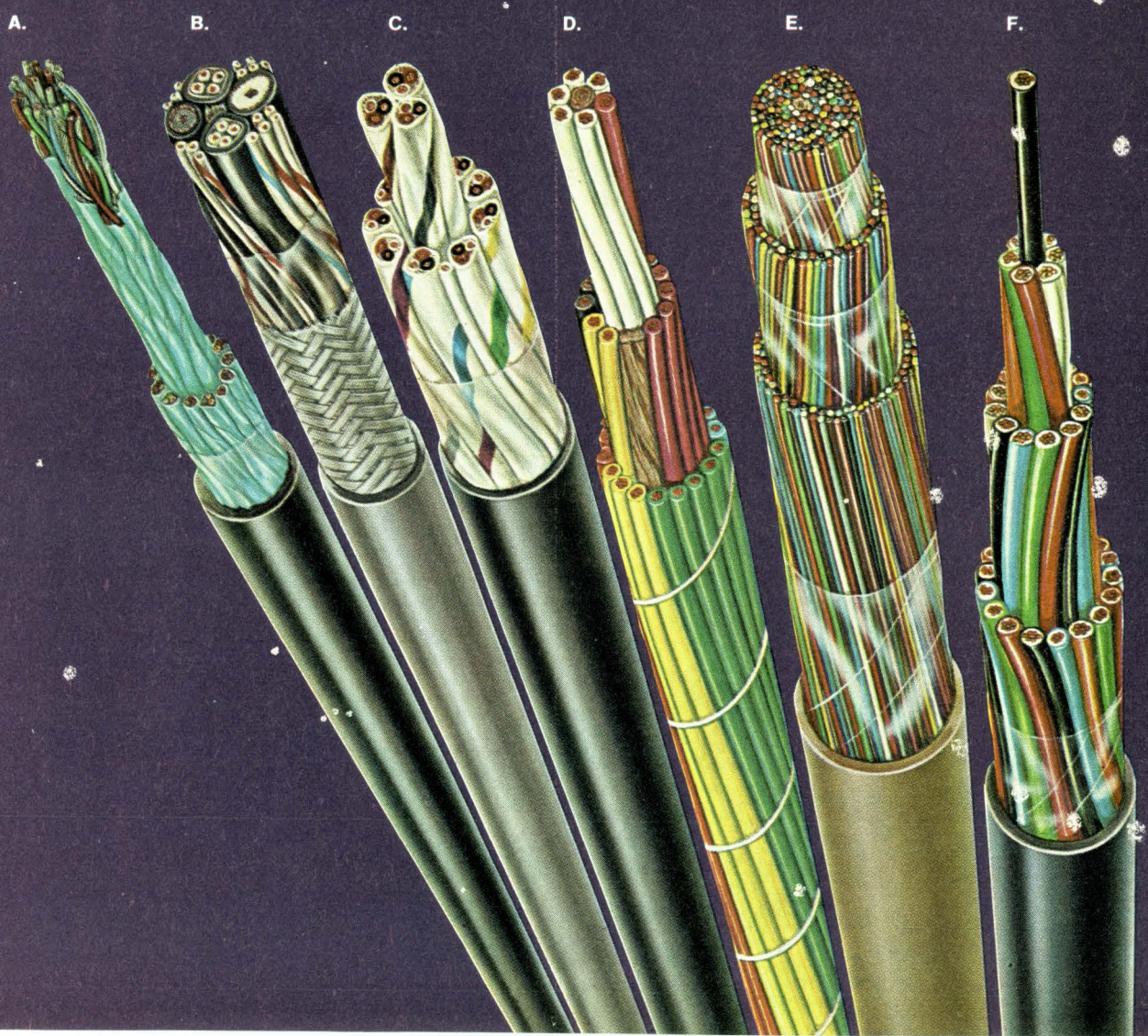
Oct. 20-21: Fourth Annual Connector Symposium, Cherry Hill, N.J. Submit four copies of a 200-400 word abstract by March 1 to Program Chairman, ELECTRONIC CONNECTOR STUDY GROUP, P.O. Box 3104, Philadelphia, Pa. 19150.

Circle Reader Service #**14**→

Custom(er) Cable Constructions by Chester

Behind every foot of multi-conductor cable produced by our Chester Cable Operations, are the vast resources, technical skills and virtually unlimited facilities of Cities Service. From the basic copper ore to the finished product, every care is exercised in strict quality control to assure you of dependable and practical cable construction to fulfill your most exacting requirements.

The samples of Plasticote® multi-conductor cables shown on these pages are but a few of the thousands of "specials" produced for our many customers. No matter what your needs in conductors, insulations or jackets, check first with Chester . . . we know you'll be more than pleased with the results.



A. RECORDING STUDIO: Audio sound cable: 25 shielded pairs, stranded copper conductors, low loss insulation, twisted with uninsulated drain wire, isolated aluminum tape shields, cabled, PVC jacket.

B. TV CAMERA MFR.: Camera control cable for Audio and Video signals: a composite of PVC and polyethylene insulated conductors, cabled, overall braid shield, PVC jacket.

C. AIRCRAFT SIMULATOR MFR.: Control cable: 12 triples shielded jacketed, stranded copper conductors, PVC insulated, individual shield jacket color coded, cabled overall PVC jacket.

D. ELEVATOR MFR.: Control cable: 35 conductors, stranded copper, PVC insulated, conductors coded by colors and printed numbers, cabled with open binder; individual conductors U/L listed.

E. INTERCOM EQUIPMENT MFR.: 250 conductor inter-office communication and signaling cable: solid bare copper, PVC insulation, paired, cabled, PVC jacket; U/L listed.

F. ELECTRIC UTILITY CO.: Station control cable for general use: 37 conductors, stranded, polyethylene and PVC insulated, color coded, cabled, overall tough PVC jacket; per NEMA/IPCEA Specifications.

G. LARGE CITY: Communication cable: 50 pairs, polyethylene insulated, cabled, continuous layer of copper shielding tape, PVC jacket; per spec. IMSA-19-2, 600 volts.

H. LEADING SHIPBUILDER: shipboard cable: stranded conductors, nylon-jacketed PVC insulation, pairs shielded and jacketed, cabled, PVC jacket, and aluminum braid armor overall; per spec. MIL-C-915.

I. U. S. GOVERNMENT: Coaxial cable: type RG-218/U, solid copper conductor, polyethylene insulated, copper braid shield, PVC jacket; per spec. MIL-C-17/79.

J. BROADCASTING COMPANY: Remote control broadcasting cable: stranded conductors, polyethylene insulation, pairs & triples shielded and jacketed, cabled, PVC jacket overall.

K. COMPUTER MFR.: Computer control cable: 55 conductors, stranded copper conductors, PVC insulated, formed into 7 groups of 7 conductors, cabled, PVC jacket; U/L listed.

L. MACHINERY MFR.: Bus drop cable: 3 PVC insulated stranded conductors, with split uninsulated grounding conductor, cabled, overall PVC jacket; U/L listed; per NEC.

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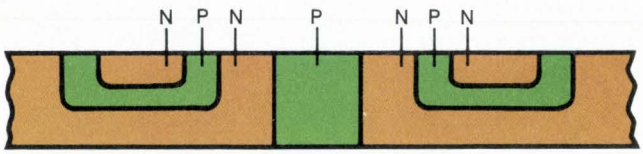
The first monolithic dual J-FET: A standard 2N package with the right answer to $\frac{\Delta(V_{GS1}-V_{GS2})}{\Delta T}$

The trouble with most dual J-FETS is that they're actually two J-FETS. Or two J-FETS with an extra P channel tossed in to provide isolation.

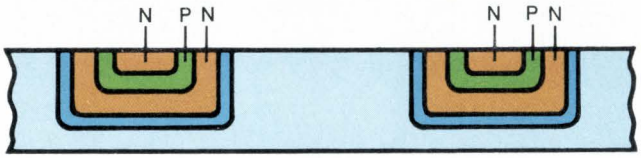
The one practically assures you of poor thermal tracking. The other means you can't get the dual J-FET in a standard 6-lead 2N package. (The lead from that extra P channel has to go somewhere. Where? That's your problem, not the J-FET-makers.)

Because the NPNPNPN construction uses up a lot of silicon real estate, good thermal tracking is hard to come by there, too.

Enter our monolithic dual J-FET, the first monolithic dual J-FET.



Them.



Us.

As you can see, we build it differently.

We lay down SiO_2 boats in the chip and build our J-FETS in there: for the first time, you get a dual J-FET with dielectric isolation. No P channel. No seventh lead.

Higher isolation. Lower cross talk. Lower noise.

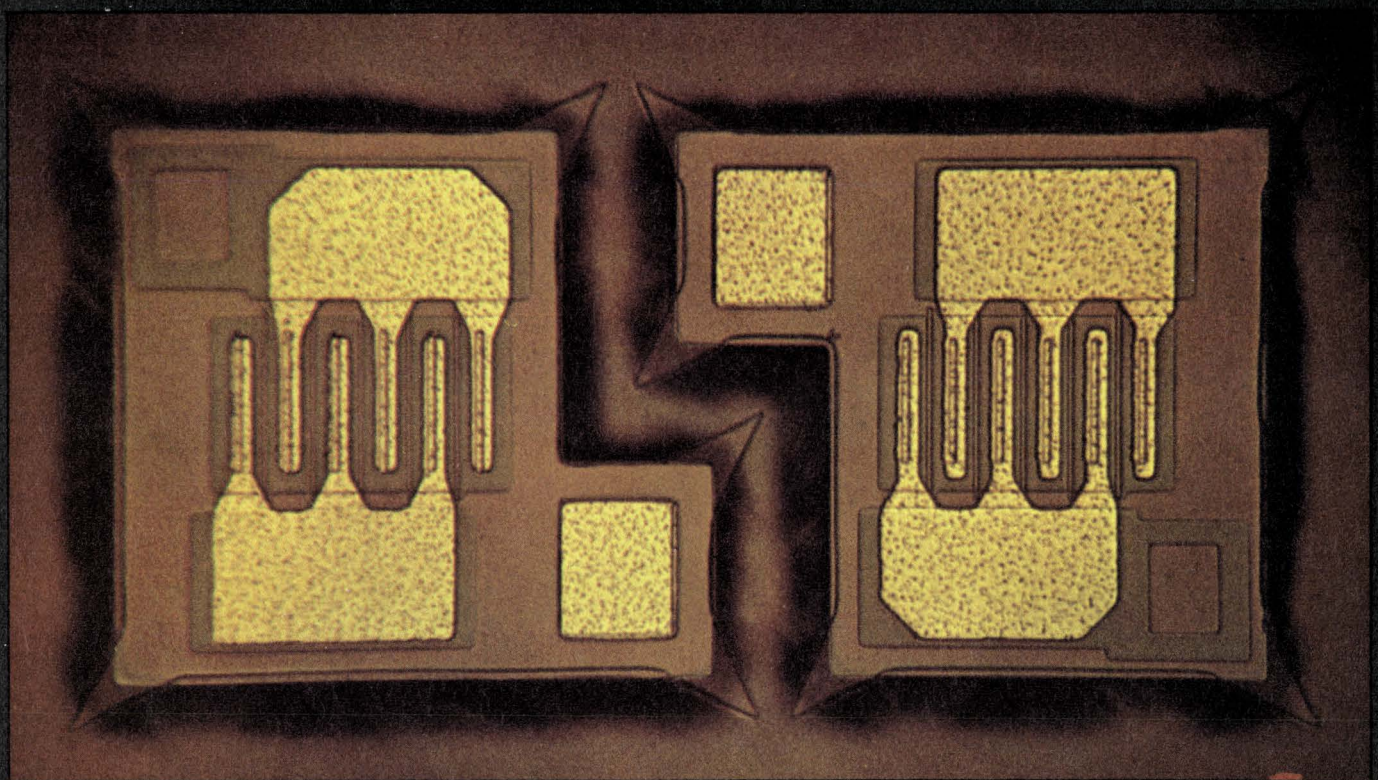
And, because we use less chip to build in, you get thermal tracking values of 5 μV/°C or better, without fuss.

If all this sounds like the answer to a differential amplifier problem or two, it's because we planned our dual J-FET that way.

We have other J-FET answers to any problems you might be facing with AC, DC, high frequency, or low noise amplifiers; analog or digital switching; or high-voltage hangups. All in our new J-FET spec sheet. Write, and we'll have one in the next mail.

Can't wait that long? Call (215) 355-5000 and ask for Marty Kiousis. Unisem Corporation, P.O. Box 11569, Philadelphia, Pennsylvania 19116.

Another Unisem first: the dielectrically isolated monolithic dual J-FET.



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1971: the year of conversion

Technology transfer to consumer needs means the dawning of a new age of electronics—promising real growth in a host of new markets.

Yes, it's about time. It's about time to take note of the writing on the wall and really look at its message. And that message tells us to look around, brother, because the days of the big defense money are gone.

And it's time to make a turnaround just as quickly as we can, before the manufacturing headquaters for the new markets—as has already happened with calculators and color TV—succumb to the lure of travel and take up residence in pleasant climes outside of our United States.

You've probably noticed this past year that **The Electronic Engineer** has put more and more emphasis on those ideas which will help shape our industry (our CHALLENGE series and editorials, for example). In doing the research necessary to write such material, the editorial staff has been able to identify a host of new markets which, in this decade, will assume tremendous proportions. A number of them, such as data terminals, communications, video recording, and process control, will grow regardless of what the U.S. electronics industry does about them. So to retain them here in this country, we must start immediately to control their development.

Other markets—notably air traffic control, urban transit, medical electronics, education, pollution control—will need government-directed specifications. But we, as a united industry, must take the government by the hand, and tell it what it needs. We must not drop this responsibility into the laps of the politicians, for if we do, we will surely help to create another monster such as the defense industry *was*.

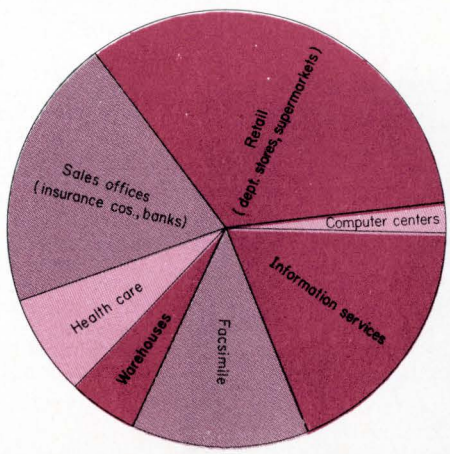
Information storage with Videofile™

Ten years ago, government work accounted for about 50% of Ampex Corp's total business. Today, government business is only about 14% of the corporation's volume, because Ampex, located in Redwood City, Calif., took pains to make sure that its non-government business grew. As a result, Ampex is moving into markets it has never served before. And an outstanding example of one shift towards consumer electronics is the company's Videofile Information System.

Videofile uses video tape for the storage and retrieval, via digital addresses, of documents and other graphic images. Such a system does with documents what computer systems do with alphanumeric information. The user can permanently store his records, or edit them in any way he wishes. Because the storage is electronic in nature, the user can move information from place to place in his files, remotely display it, and so forth.

Since Videofile handles a class of files which does not lend itself to storage in digital form, it is not competing with computer or microfilm systems. Instead, Videofile fills a vast market need that exists between those two areas. And its users typically have huge files that need constant updating: dynamic files with many inputs and outputs. The law enforcement community is thus a major market for the system, as is the insurance industry, the medical records field, and the transportation industry.

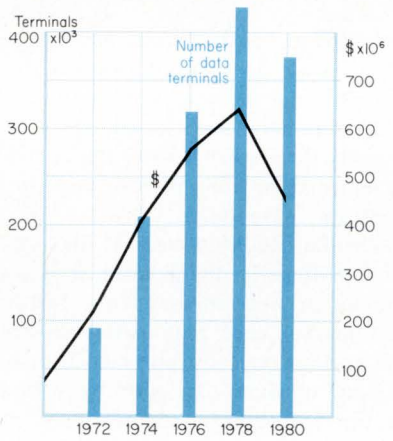
Videofile is a blend of three technologies which, over the years, have grown at Ampex: video recording (for the



By 1980, most electronic data terminals will be bought and used by people with no electronics background. The chart shows the percentage of terminal points (not units) by end user. Note the importance of retail establishments such as department stores, "fast-food" chains, and supermarkets. (Information courtesy of Datran.)

broadcast industry); computer tape (for the computer industry); and instrumentation recording (which was primarily government oriented). Bear in mind, too, that this technology transfer implies personnel transfer as well. After all, the 500 people at the Videofile division came not only from within Ampex, but also from companies such as Philco-Ford's Western Development Labs., Lockheed, Sylvania, and so on. These people, who formerly worked in government and aerospace fields, now work on heavily commercially oriented projects.

But these people are the lucky ones. Evan Ragland, president of American Regitel in San Carlos, Calif., comments on the contributions of aerospace to technology, and the transfer of technology to consumer needs. He feels that the private sectors of our industry should accept and use both the contributions of aerospace and the people who made them to solve problems wherever electronics can help to do so. And he stresses the fact that his people do have aerospace backgrounds. Further, their experience is not only applicable, but also important. "A power supply is a power supply, and we use the same MOS ROMs that we see in all other types of equipment." He adds that "large manufacturers are generally not too anxious to innovate, and thus possibly obsolete their investments. The large companies are moving too slowly toward those problem solutions which will make our lives a little easier and a bit more pleasant. Perhaps we have waited too long for the giants—the IBMs, RCAs, GEs—to solve our problems."



Number of and dollars for data terminals estimated to be sold in this decade. These estimates are for terminals that either have a communications capability, or that will be connected to a communications terminal, to exchange information with a computer. There will be many other terminals which will not need that capability, such as those for small library systems or production line control.

Ampex's Videofile™ Information System is just what the doctor ordered for the handling of massive, dynamic document files. This installation is at a hospital complex. Doctors and nurses throughout its 23 clinics, with the help of Videofile, have rapid access to the medical record of any patient, either as a TV picture or as hard copy.

Cash in on point-of-sale systems

The cashier at Bullock's, a department store in Los Angeles, looked hesitantly at the lighted display reading HOW PAY on her new cash register. She pushed the CHRG button on the keyboard, and the display prompted her to insert the sales slip and enter the customer's credit card number. The register printed it, seemingly without hesitation, although it had already had time to ask its backup Nova minicomputer to check the customer's credit on an NCR 315 computer.

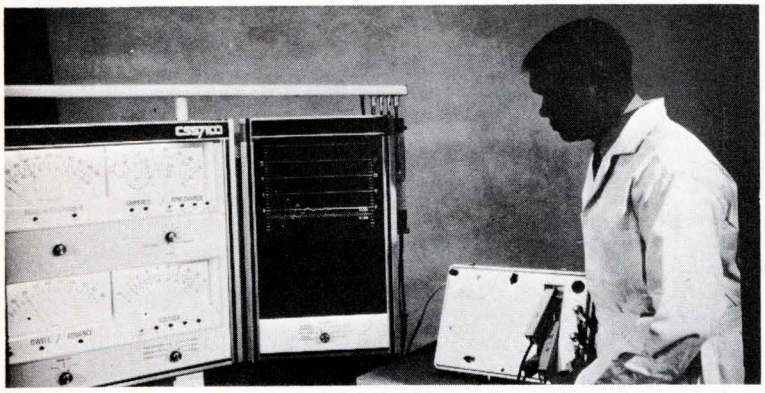
This illustrates only one example of the many applications for the new point-of-sale terminals which will become popular in the 1970s, and American Regitel is the electronics company supplying the terminals being tested at Bullock's. Ragland states that he could not have designed these terminals without the help of electronic engineers experienced in modern digital design with complex integrated circuits.

While the application to department stores will be very important, point-of-sale systems will be needed in libraries, "fast-food" chains such as Gino's, MacDonald's, or Hot Shoppes and, ultimately, in supermarkets. While the technology required to design terminals for these diverse applications is basically the same, and well-mastered by electronic engineers, they must be designed specifically with the user in mind—a user who, in general, does not have an electronics background.

Data terminals and communications

Together with other equipment such as facsimile, teletypewriters, remote health monitors, and bank teller registers, point-of-sale terminals are examples of *data* terminals, peripheral units which provide remote access to or retrieval from a computer, or from electronically stored information (usually called the data base). Since many of these terminals will be far away from their computers or electronic data bases, the increased applications for terminals will demand an expansion and improvement in the communications lines required to connect them. With the exception of oil companies and railroads, which have their own right-of-ways and have installed their own microwave communications systems, most users of data terminals must use the telephone network for their data communications. And, as of this writing, there are before the Federal Communications Commission applications by 30 companies to build over 1700 microwave stations in the country. One of these companies, Microwave Communications Inc., has already been approved to build a microwave link between Chicago and St. Louis. (See the article "Hour of decision at the FCC," **The Electronic Engineer,** Nov. 1970, pp. 22-29.) Another applicant, Datran (a subsidiary of University Computing Corp.) has applied for a network engineered and devoted exclusively to digital transmission. It's based on time-division multiplexing (TDM), unlike the telephone network which is based on frequency-division multiplexing.

With the possible exception of the TDM switching exchanges, which Martin Co. in Orlando is designing under a



Clayton's dynamometer includes electronic instrumentation amplifiers for the panel meters. The electronic circuitry is packaged in rugged modules to withstand the service shop environment and to simplify service.

contract from Datran, most of the equipment required for these vast communications networks of the 1970s can be designed with the technology and the components developed in the 1960s—a technology well-mastered by electronic engineers. Therefore, the successful designs for microwave transmitters, for power supplies, and for switching and carrier equipment will not be those that push the state-of-the-art at the expense of price, but rather those that implement modern technology and reliability at the lowest cost.

TV reruns you'd like to see

In the 1970s consumer electronics will be geared towards the individual consumer as well as towards the consumer industry. The next generation for electronics in the home will be the era of canned TV. Call it what you will—video cassettes, cartridge TV, or prerecorded programming—video recording for the individual consumer is on its way in. And if you listen to the optimists in the industry, its impact on the public is going to be revolutionary.

The whole field of video recording is still up for grabs. About two dozen companies are looking at the hardware aspects with varying shades of enthusiasm. Among them, the companies have come up with five distinct approaches to video recording, but only one approach—magnetic tape—offers a record-it-yourself capability to the user. Not too surprisingly, the largest number of companies are looking in the direction of mag tape right now.

While the mag tape advocates have numerical superiority, the two big guns in the home entertainment market—CBS and RCA—are busy developing two entirely different systems. First to hit the street (with deliveries already underway to Equitable Life Assurance Society) is EVR (electron video recording) from CBS. With EVR, an electron beam writes video information onto photographic film in much the same way that a similar gun creates an image on the face of a CRT. The audio portion of the program is recorded with conventional techniques onto magnetic stripes running along the edge of the film. The playback equipment, manufactured by Motorola, reconverts the information on the file into electrical form and feeds it to the antenna terminals of the TV receiver.

RCA, the other big name in the field, is not nearly as far along as CBS. The RCA system (dubbed SelectaVision) is, technically, a much more complicated process. Its great advantage, however, is that the recording medium is inexpensive vinyl tape. The actual program information, in the form of a holographic pattern, is embossed on the vinyl tape by means of a nickel master.

While CBS and RCA are looking at playback-only systems, a number of companies see more promise in the playback-plus-record capability of magnetic tape. To date the list includes Avco, Ampex, Arvin, Sony, North American Philips, and Panasonic. To further complicate the picture, A.E.G.-Telefunken and Teldec (Telefunken-British Decca) have jointly demonstrated a working system which uses plastic discs resembling phonograph records. At least one company, NordMende of Germany, has a working system that uses Super 8-mm film.

Looking over the pack right now, there is no apparent leader. All of the systems are presently priced too high for the general public and a good many of them are still in the prototype stage, if that far. But judging by the number of companies involved, it's apparent that a lot of people believe "there's gold in them thar hills!"

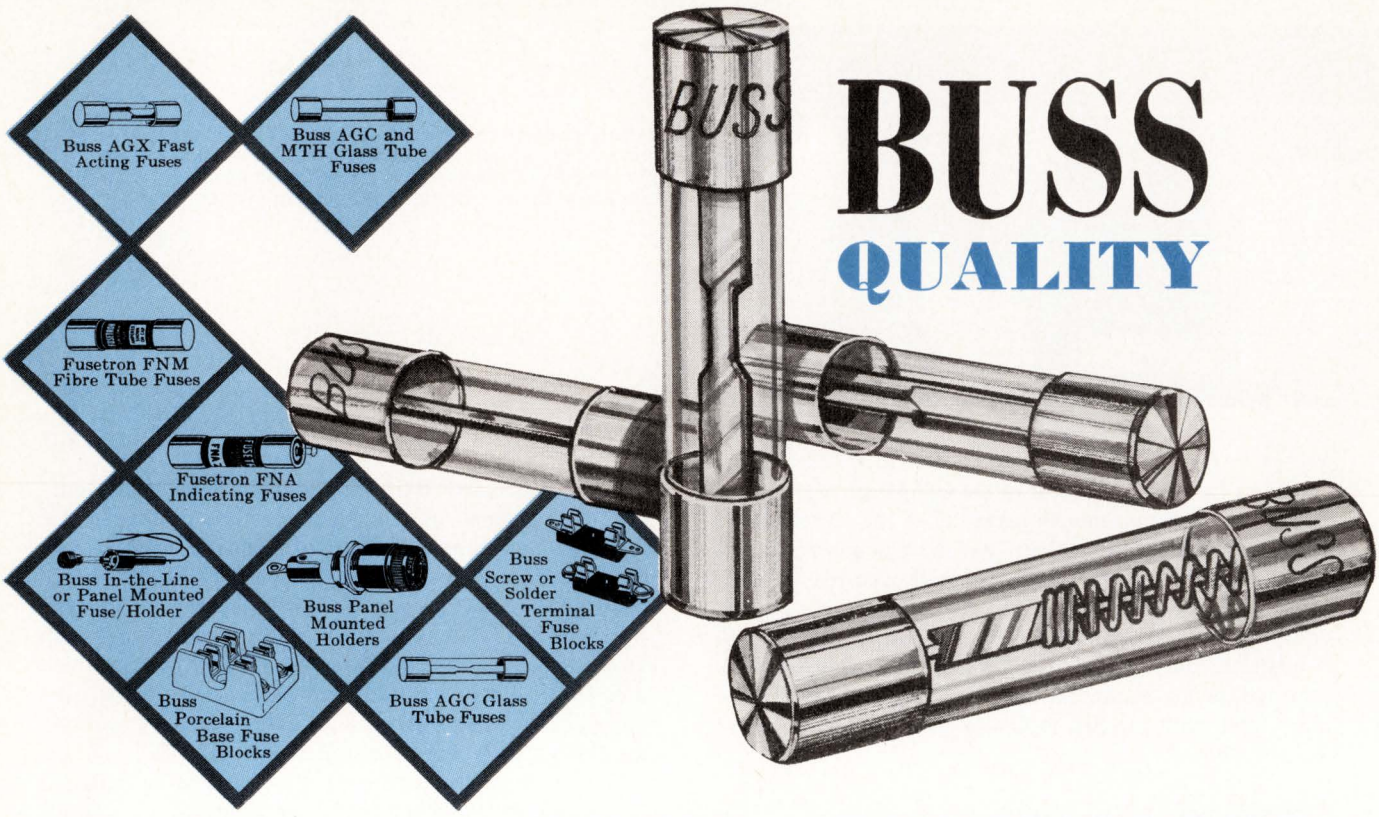
Electronics in the driver's seat

Skidding on a wet pavement—one of the driving mishaps most dreaded by drivers—may be a thing of the past thanks to electronic anti-skid devices. Ford, for example, is testing one designed by Kelsey-Hayes in 1968 which uses an IC computing box by Texas Instruments. For tailgaters, Hewlett-Packard has designed an automatic braking unit which is triggered by a radar sensor.

While these electronic driving aids are still too expensive to be incorporated into any but top-of-the-line autos, all car manufacturers expect to add them to most of their models when prices go down—around 1976—and only electronic engineers can design them, at low cost. In the meantime, the skills of electronic engineers are starting to be applied to repair, rather than to make, automobiles. Two EEs designed an electronic control board for the CSS 7100, a dynamometer manufactured by Clayton Mfg. Co. of El Monte, Calif. While the control board is a very simple combination of instrumentation amplifiers, it had to be designed to withstand the environment of a service shop, and to minimize the downtime produced by any possible failure of an electronic component. Other electronic analyzers made by companies such as Sun Electric, Auto-Scan, and Allen are becoming increasingly popular among service stations, but represent only an early sample of the type of equipment electronic engineers can and will design, at low cost, in the 1970s.

INFORMATION RETRIEVAL

Computers & peripherals, Industrial, Communications



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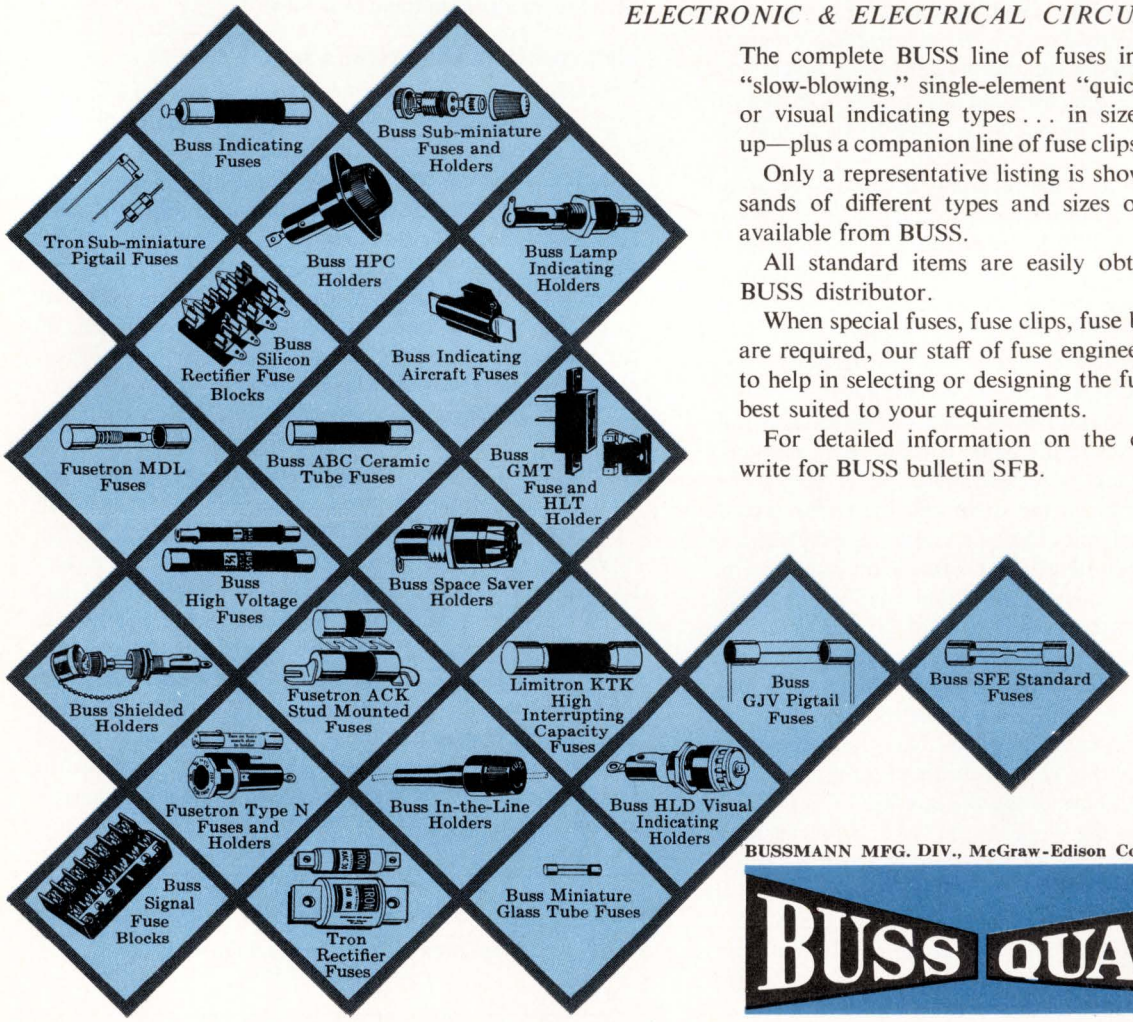

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BUSS QUALITY

What's available in MSI?

Here's a list of bipolar MSI circuits to ease the pain of matching the right device to your particular application.

By Larry Beck and Walter Richard

Computer Control Div., Honeywell Inc., Framingham, Mass.

The table on the following pages lists the bipolar digital MSI circuits available today or in the near future. The list is intended as an aid to design engineers in selecting devices and also to keep them informed of the rapid advances in this field.

The organization of the table groups circuits according to function. (The list does not include memory devices or MOS circuits.) When the information was available, we have also included the operating voltage, typical power dissipation and typical propagation delays for each circuit.

The manufacturers listed in the table can be identified according to the following key. If you want more information on a particular manufacturer's circuits, please use the reader service number indicated.

KEY TO MANUFACTURERS

Company	Key	RSN
Fairchild	Fch	201
International Tel. and Tel.	ITT	202
Motorola	Mot	203
National	Nat	204
Philco-Ford	Phl	205
Raytheon	Ray	206
Signetics	Sig	207
Sprague	Spr	208
Stewart Warner	Swn	209
Sylvania*	Syl	
Texas Instrument	TI	210
Transitron	Tns	211

**Sylvania has dropped out of the IC Manufacturing business. These circuits are included because they are still available from some distributors. There is also a good chance that another manufacturer will buy the line and continue to manufacture the circuits.*

REGISTERS

Function	Operating Voltage	Typical Power (mw)	Typical Speed (ns)	Manufacturers
Shift register, 8-bit	5	175	27	7491A (TI, Nat, Spr, ITT Syl, Phl, Tns, Fch, Mot, Sig)
	5	17.5	100	74L91A (TI)
	5	175	30	8270 (Nat)
	5	175	30	8290 (Nat)
	5	175	30	8276 (Sig)
Shift register, 4-bit, parallel-in/serial out	5	175	25	7494 (TI, Spr, ITT, Tns, Fch, Mot, Phl)
Shift register, 4-bit, shift rt/lft	5	250	26	7495 (TI, Spr, ITT, Fch, Mot, Tns, Phl)
	5	19	125	74L95 (TI)
	5	250	26	8580 (Nat)
	5	120	22	SM113 (Syl)
Shift register, 5-bit, parallel in/out or serial in/out	5	240	25	7496 (TI, Nat, Spr, ITT, Fch, Mot, Tns, Phl)
Shift register, 8-bit, bidirectional	5	360	18	74198 (TI)

REGISTERS

Function	Operating Voltage	Typical Power (mw)	Typical Speed (ns)	Manufacturers
Shift register, universal	5	360	18	74199 (TI)
	5	180	25	4012 (Mot)
	5	19	—	74L99 (TI)
Data selector/storage register, 4-bit	5	25	—	74L98 (TI)
Shift register, 8-bit, serial-in; parallel or serial out	5	180	23	74164 (TI)
	5	180	30	8570 (Nat)
Shift register, 8-bit, parallel or serial in; serial out	5	230	17	74165 (TI)
	5	200	35	8590 (Nat)
Shift register, 4-bit	5	300	25 MHz	8300 (Ray, Mot) 9300 (ITT, Fch, Mot, Phl)
	5	300	—	8600 (Nat)
	5	150	30	TSR 2516, TSR 2526, TSR 2518 TSR 2528, TSR 2512E, TSR 2514E TSR 2522E, TSR 2524E; (Tns)
	5	75	10 MHz	9200 (Fch)
	5	180	20 MHz	9302 (Fch)
	5	180	20	7270, 7271 (Mot)
	5	180	22/bit	4012 (Mot)
	5	175	25	7494 (Mot)
	5	250	25	7495 (Mot)
Storage register, 4-bit	5	80	16	RL62, RL63, (Ray)
	5	80	22	TR62, TR63 (Tns)
	5	120	20	SM63, SM73 (Syl); 9655, 9656 (Phl); TR72, TR73 (Tns)
	5	120	16	RL72, RL73 (Ray)
Shift register, dual, 8-bit	5	85	10 MHz	9228 (Fch)
	5	300	22	9328 (Fch, Mot, Phl)
Buffer register, dual, 5-bit	5	400	30	8200, 8201 (Sig)
Buffer register, 10-bit	5	400	30	8202, 8203 (Sig)
Shift register, 4-bit, parallel entry	5	180	20	8270, 8271 (Mot, Sig)
Shift register, 4-bit, resettable	5	150	25	TR 742526 (Tns)
Register, 4x4 file	5	480	45	74170 (TI)
Shift register, 5-bit	5	240	25	7496 (Mot)
Shift register, serial parallel	3.6	225	55	794. 894 (Mot)

DECODERS

Function	Operating Voltage	Typical Power (mw)	Typical Speed (ns)	Manufacturers
Decoder, 24-bit carry	5	150	8	RL 3202 (Ray)
Fast carry extender	5	95	14	8261 (Sig)
Decoder/driver, BCD to decimal	5, 55	105	250	7441 (Fch, ITT, Mot, Tns, Spr, Nat, Phl)
	5, 55	75	—	7441 (Sig)
	5, 30	215	50	7445 (TI, Tns, Spr, Mot, ITT, Phl)
	5. 15	215	50	74145 (TI, Tns, Spr, Nat, Mot)

DECODERS

Function	Operating Voltage	Typical Power (mw)	Typical Speed (ns)	Manufacturers
Decoder/driver, BCD to seven segment	5–30	265	100	7446 (TI, Tns, Spr, Nat, Mot, ITT, Fch)
	5–15	265	100	7447 (TI, Tns, Spr, Nat, Mot, ITT, Fch)
	5	265	100	7448 (TI, Tns, Spr, ITT)
	5	165	100	7448 (Mot); 7449 (TI, Tns, Mot)
	5	165	250	8307 (Mot)
	5	260	100	DM 8848 (Nat)
Decoder, BCD to decimal	5	140	23	7442 (TI, Tns, Spr, Nat, Mot, ITT, Phl)
	5	180	15	SM 240 (Syl)
	5	55	—	74141 (TI)
	5	95	20	7251 (Mot); 8251 (Mot, Sig)
	5	125	22	8301, 9301 (Mot)
	3.6	100	36	770, 870 (Mot)
Decoder, excess-3 to decimal	5	140	23	7443 (TI, Tns, Spr, ITT, Mot)
	5	180	15	SM250 (Syl)
Decoder, excess-3 Gray to decimal	5	140	23	7444 (TI, Tns, Mot, Spr, ITT)
	5	180	15	SM290 (Syl)
Decoder, one of sixteen	5	175	23	9311 (Fch, Mot) 8311 (Mot)
	5	40	47	9211 (Fch)
Decoder, seven segment	5	165	250	9307 (Fch, Mot)
	—	—	—	8T04 (Sig)
Decoder/driver, one of ten	5–55	100	250	9315 (Fch)
	5	145	23	9301 (Fch, Mot, ITT)
	5–68	60	—	8T01B (Sig)
Decoder/driver, seven segment	5–30	260	200	9317 (Fch)
	5	—	250	8317, 9317 (Mot)
	5	110	250	9327 (Fch)
Decoder, (dual), one of four	5	150	22	9321 (Fch)
	5	125	14	4007 (Mot)
	5.2	245	6.5	1042 (Mot)
Carry decoder	5	25	4	9658 (Phl); SM42 (Syl)
	5	20	4	4032, 4332 (Mot)
	5	20	25	RL42, RL43 (Ray)
Decoder, binary to one of 8-line	5	100	14	4006 (Mot)
	5	85	20	7250, 8250 (Mot)
	−5.2	210	6/11	1043, 1243 (Mot)
Decoder, (dual), binary to one of 4-line	5	125	14	4007 (Mot)
	5	40	48	9221 (Fch)
Decoder, binary to one of 8-line, inverting/non-inverting	5	240	<45	4038 (Mot)
Decoder, binary to 2 of 8-line	5	200	45	4040 (Mot)
Decoder, one in eight	5	180	15	SM233 (Syl)
Decoder, one of ten	5	50	62	9201 (Fch)
Translator, BCD to 7 segment	5	280	85	SM200 (Syl)
Converter, 8-bit serial to parallel	5	180	20 MHz	9303 (Fch)
Converter, binary to BCD	5	240	40	74185 (TI)
Decoder, 40-bit carry	5	300	12	RL3302 (Ray)

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Circle Reader Service #**16.**

COUNTERS

Function	Operating Voltage	Typical Power (mw)	Typical Speed (ns)	Manufacturers
Counter, decade	5	160	60	7490 (TI, Sig, Mot, Fch, Tns, ITT, Spr, Nat, Ray, Phl)
	5	150	30 MHz	838, 938 (Mot)
	5	170	10 MHz	9210 (Fch)
	5	180	35	TRC2516, TRC2518, (Tns)
	5	300	20 MHz	SM270 (Syl)
Counter, sync, up/down decade	5	375	20	74190 (TI)
	5	325	27	74192 (TI, Fch, Nat)
	5	325	14–35	74192 (Mot)
	5	315	20	8285 (Sig, Mot)
Counter, decade, ripple	5	160	18 MHz	9350 (Fch)
Counter, divide-by-twelve	5	155	60	7492 (TI, Sig, Mot, Fch, Tns, ITT, Spr, Nat)
	5	140	15	8288 (Sig)
Counter, 4-bit, binary	5	160	75	7493 (TI, Sig, Mot, Phl, Fch, Tns, Syl, ITT, Nat, Spr)
	5	16	280	74L93 (TI, Nat)
	5	300	20	8316 (Fch) 9316 (ITT)
	5	300	14–35	8316, 9316 (Mot)
	5	300	20 MHz	SM260 (Syl)
	5	150	27	SM163 (Syl)
Counter, sync, binary	5	325	14	74161 (TI)
	5	325	14	74163 (TI)
Counter, decade, presettable	5	300	14–35	8310, 9310 (Mot)
Counter, sync up/down, 4-bit binary	5	375	20	74191 (TI)
	5	325	27	74193 (TI, Mot, Nat)
Counter, binary ripple	5	160	18 MHz	9356 (Fch)
Counter, high-speed, presettable, binary	5	190	—	74197 (TI, Spr)
	5	190	25	8291 (Sig)
	5	130	20 MHz	7281, 8281 (Mot)
Counter, low-power, presettable, decade	5	45	80	8292 (Sig)
Counter, low-power, presettable, binary	5	45	80	8293 (Sig)
Counter, BCD decade/storage element	5	130	—	8280 (Sig, Mot, Tns, Nat) US748280 (Spr)
Counter, 4-bit binary/storage element	5	130	—	8281 (Sig, Mot, Tns, Nat) US748281 (Spr)
Counter, binary hexidecimal, sync, up/down	5	315	20	8284 (Sig, Mot)
	5	360	20	9326 (Fch)
Counter, decade, programmable, cascadeable	5	250	10 MHz	4016 (Mot)
Counter, binary, programmable, cascadeable	5	250	10 MHz	4018 (Mot)
Counter, presettable, decade up/down	5	350	20	8306, 9306 (Mot)
Counter, BCD, up/down	5	350	40	8306 (Fch)
	5	150	27	SM173 (Syl)
	5	225	30	SM 193 (Syl)
Counter, decade, up/down	5	315	30 MHz	7285 (Mot)
	5	250	25 MHz	9360 (Fch)
	—	—	—	RL3602 (Ray)
Counter, binary, up/down	5	225	30	SM183 (Syl)
	5	250	25 MHz	9366 (Fch)
	5	315	30 MHz	7284 (Mot)
	—	—	—	RL3402 (Ray)

COUNTERS

Function	Operating Voltage	Typical Power (mw)	Typical Speed (ns)	Manufacturers
Counter, hexidecimal	5	70	10 MHz	9216 (Fch)
Counter, BCD, decade up/down	5	360	20	9320 (Fch)
	5	320	23	9330 (Fch)
	5	315	30 MHz	8285 (Mot)
Counter, universal	5	195	25 MHz	9305 (Fch)
Counter, hexidecimal, up/down	5	320	23	9336 (Fch)
	5	200	16/bit	4023 (Mot)
Counter, 4-bit, binary presettable	5	150	35 MHz	TC742512 (Tns)
	5	180	35	TRC2512, TRC2514 (Tns)
Counter, sync, decade	5	325	14	74160, 74162 (TI)
Counter, divide-by-twelve/ storage element	5	130	40	DM8688 (Nat)
Counter, programmable modulo-N decade	5	250	10 MHz	4316 (Mot)
Counter, programmable modulo-N hexidecimal	5	250	10 MHz	4318 (Mot)
Counter, binary up	3.6	180	4 MHz	777, 877 (Mot)
Counter, decade up	3.6	250	4 MHz	780, 880 (Mot)
Counter, divide-by-16	5	150	30 MHz	839, 939 (Mot)

ADDERS AND SUBTRACTORS

Function	Operating Voltage	Typical Power (mw)	Typical Speed (ns)	Manufacturers
Adder, full, gated	5	105	—	7480 (TI, Mot, Fch, Tns, Sig, ITT, Spr)
	5	110	35	8286 (Sig)
Adder, full, 2-bit	5	175	—	7482 (TI, Fch, Phl, ITT, Spr, Tns)
	5	165	15/12	15482, 17482, 25482, 27482 (Mot)
Adder, full, 4-bit binary	5	390	—	7483 (TI, Mot, Fch, Tns, ITT, Spr, Nat, Phl)
	—	—	—	RX4753 (Ray)
Adder, dual, carry-save	5	220	11	744183 (TI)
Adder, independent, fast-carry	5	125	25/13	4630, 4031, 4330, 4331 (Mot)
	—	—	—	TA32, TA33 (Tns)
	5	125	25	SM32, SM33 (Syl)
Adder, dependent, fast-carry	5	125	25/13	4028, 4029, 4328, 4329 (Mot)
	—	—	—	TA22, TA23 (Tns)
	5	125	25	SM22, SM23 (Syl); 9652 (Phl) RL22, RL23 (Ray)
Adder, full	5	90	25/13	4026, 4027, 4326, 4327 (Mot)
	—	—	—	TA12, TA13 (Tns)
	5	90	24	SM12, SM13 (Syl)
	5	90	25	RL12, RL13 (Ray)
	−5.2	145	3/8	1019, 1219 (Mot)
Adder, dual, full	3.6	225	60	796, 896 (Mot)
	5	150	28	8304 (Fch, Phl)
	3	190	60	996 (Mot)
	5	110	8–28	8304, 9304 (Mot)
Adder, 4-bit	5	350	18	RL3102 (Ray)
Adder/subtractor, 4-bit, anticipated carry	5	300	25	SM310 (Syl)

MULTIPLIERS & DIVIDERS

Function	Operating Voltage	Typical Power (mw)	Typical Speed (ns)	Manufacturers
Subtractor, full	−5.2	145	4/11	1021, 1221 (Mot)
Subtractor, full, dual	3.6	225	60	797, 897 (Mot)
Multiplier, decade	5 5	125 85	27 28	SM92 (Syl) SM93 (Syl)
Multiplier, sync, 6-bit programmable binary rate	5	300	—	7497 (TI)
Divider, programmable frequency	5	125	34	SM143, SM153 (Syl)
Divider, modulo	5	250	—	8520 (Nat)

MULTIPLEXERS & DEMULTIPLEXERS

Function	Operating Voltage	Typical Power (mw)	Typical Speed (ns)	Manufacturers
Multiplexers, dual 4 to 1 line selectors	5 5	170 170	22 22	74 153 (TI) 8212 (Nat)
Multiplexers, 4 to 16 line decoders	5	170	20	74154 (TI) 8213 (Nat)
Multiplexers, dual 2 to 4 line decoders	5 5	125 125	21 23	74155 (TI) 74156 (TI)
Multiplexers, dual 4-bit	5 5	150 130	24 18	9309 (ITT, Fch, Mot, Ray) SM213 (Syl)
Multiplexers, 8-input	5 5 5 5 5 5 5	135 150 160 160 40 40 —	25 20 20 20 80 80 —	9312 (ITT, Fch, Mot, Ray) 8230 (Sig) 8231 (Sig) 8232 (Sig) 9212 (Fch) 8211 (Nat) R x 4361 (Ray)
Multiplexers, 3-input, 4-bit digital	5 5	325 350	25 25	8263 (Sig) 8264 (Sig)
Multiplexers, 2-input, 4-bit digital	5 5 5 5 5 5 5	200 200 200 200 200 125 45	27 27 15 20 20 19 44	8266 (Sig, Mot) 8267 (Sig, Mot) 8233 (Sig) 8234 (Sig) 8235 (Sig) 9322 (Fch) 9222 (Fch)
Multiplexers, 4-bit digital, low-power	5	40	47	9209 (Fch)
Demultiplexer	5	225	15	SM221 (Syl)

DRIVERS & RECEIVERS

Function	Operating Voltage	Typical Power (mw)	Typical Speed (ns)	Manufacturers
Line driver, dual, 3-input NAND terminated, 3-output	5	44	6	3029 (Mot)
Line driver, dual	5	200	—	8T13 (Sig)
	+5, −5	140	20	1582 (Mot)
	+5, −5	180	16	75109 (TI)
	+5, −5	375	16	75110 (TI)
	5–30	320	50	9644 (Fch)
	5–12	320	80	9621 (Fch)
	5	60	16	TNG5212 (Tns)
	5	60	16	TNG5214 (Tns)
	5	60	16	TNG5222 (Tns)
	5	25	30	TG132, TG133 (Tns)
	5	170	25–50	RG132, RG133 (Ray)
	5	30	25	SG132, SG133 (Syl)
Line driver, quad	−9, +9	333	30/250	1488 (Mot)
	5	120	16	TNG5512
	5	120	16	TNG5514 (Tns)
	5	120	18	TG745512 (Tns)
	5	120	16	RG7510 (Ray)
	5, 12	180	10	SS341 (Syl)
Predriver, quad	5	120	15	4042 (Mot)
Line driver, party	—	—	—	8831 (Nat)
Line driver, dual differential	5	110	10	9614 (Fch)
	5	55	18	8830 (Nat)
Buss driver, triple 2-input	5	15	15	TG162, 163 (Tns)
	5	140	30–70	RG162, 163 (Ray)
	5	60	35	SG163 (Syl)
Lamp driver, quad 2-input	5	120	16	TNG5612 (Tns)
	5	120	16	RG7520 (Ray)
Driver, dual 3-input NAND	6	45	—	RM210G (Ray)
	6	45	—	RM220G (Ray)
Lamp driver, dual 4-input	5	60	16	RG7540 (Ray)
Driver, dual interface	5	60	12	75450 (TI)
Line driver, dual 3-input and terminated 3-output	5	56	9	3028 (Mot)
Line receiver, dual	+5, −5	135	17	75107 (TI)
	+5, −5	135	19	75108 (TI)
	—	—	—	75120 (TI)
	5, 12	370	100	RM4441 (Ray)
	5	30	40	8820 (Nat)
	+5, −5	140	40	1583 (Mot)
	+5, −5	170	37	1584 (Mot)
	5–12	320	38	9622 (Fch)
Line receiver, dual differential	5	100	20	9615 (Fch)
	5–12	320	35	9620 (Fch)
	+5, −5, +12	280	75	SS337 (Syl)
Line receiver, EIA	—	—	—	8822 (Nat)
	—	—	—	8823 (Nat)
Line receiver, triple	5	315	30	8T14 (Sig)
Line receiver, quad	5	100	60	1489 (Mot)
Receiver, quad, high logic level	5, 12	180	20	SS345 (Syl)

LATCHES

Function	Operating Voltage	Typical Power (mw)	Typical Speed (ns)	Manufacturers
Latch, 4-bit bistable	5	160	24	7475 (TI, Fch, Tns, Phl, Syl, ITT, Nat, Ray)
	5	160	30	7475 (Mot)
	5	175	16	7475 (Sig)
	5	160	100	7475 (Spr)
	5	160	16	7477 (TI, Sig, Fch)
	5	175	24	8275 (Sig)
	5	175	20	9314 (Fch)
	5	150	25	4037, 4337 (Mot)
	5	50	60	9214 (Fch)
	5	320	16	74100 (TI)
Latch, dual 4-bit	5	325	25	8308, 9308 (Mot)
	5	325	22	9308 (Fch)
	5	90	45	9208 (Fch)
Latch, 8-bit addressable	5	250	17	9334 (Fch)
Quad D for party line app.	—	—	—	8551 (Nat)
Quad latch, open collector	5	140	25	4035, 4335 (Mot)
Latch, quad	3.6	110	50	767, 867 (Mot)
	−5.2	250	8	1040, 1070, 1240, 1270 (Mot)
	5	220	35	1813, 1814, 1914 (Mot)

DATA SELECTORS AND DISTRIBUTORS

Function	Operating Voltage	Typical Power (mw)	Typical Speed (ns)	Manufacturers
Data selector, dual, 4-channel	5	150	11	4000 (Mot)
	−5.2	170	5	1028, 1228 (Mot)
	5	150	9–24	8309, 9309 (Mot)
Data selector, 16-bit	5	200	35	74150 (TI, Mot)
Data selector, 8-bit	5	145	35	74151 (TI, Mot, Phl)
	−5.2	150	7/18	1038, 1238 (Mot)
	5	130	35	74152 (TI)
Data distributor, dual	5	175	10	4002 (Mot)
Data flow, gate	—	—	—	8230 (Nat)
Digital switch, 8-channel	5	100	19	8210 (Nat)
Position scaler, 8-bit	5	300	30	8243 (Sig)
Data selector, 4-bit	5	180	10	7266, 8266 (Mot)
Data selector, 4-bit, open collector	5	180	10	7267, 8267 (Mot)
Data distributor	−5.2	160	4	1029, 1229 (Mot)

MULTIVIBRATORS

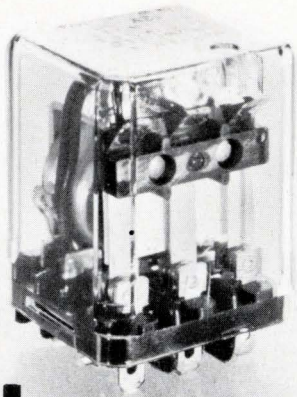
Function	Operating Voltage	Typical Power (mw)	Typical Speed (ns)	Manufacturers
Monostable multivibrator	5	90	25	9601 (Swn, ITT, Fch, Ray) 8850 (Nat)
	5	75	25	8601, 9601 (Mot)
	5	115	25	74121 (Spr, Nat, TI, Tns, Mot, Phl)
		65 (Tns)	30 (Tns)	
		90 (Mot)		
	5	65	35	8162 (Sig)
	5	100	20	74122 (TI)
	5	125	25	RX4360 (Ray)

Function	Operating Voltage	Typical Power (mw)	Typical Speed (ns)	Manufacturers
Monostable multivibrator, dual	5 5	100 175	20 25	74123 (TI) 9602 (Fch)
Monostable multivibrator, dual, voltage controlled	5	150	30 MHz	4024, 4324 (Mot)
Multivibrator	5	125	25	9600 (Fch)

MISCELLANEOUS

Function	Operating Voltage	Typical Power (mw)	Typical Speed (ns)	Manufacturers
Comparator, dual, 4-bit	5 5 5	175 120 250	40 40 —	8200 (Nat) SM133 (Syl) 9661 (Phl) 4022, 4322 (Mot)
Comparator, 4-bit	5 5 5 5	175 170 180 280	20 18 15 32	US747200 (Spr) 8242 (Sig) SM300 (Syl) 74H85 (TI)
Comparator, 5-bit, expandable	5	210	25	9324, 9224 (Fch)
Comparator, quad-1	5	150	15	7486 (TI, Phl)
True/complement zero/one element	5	270	14	74H87 (TI)
Function generator, dual, 2 variable	5	375	20	4610 (Fch)
Parity generator	5 5	270 —	33 —	9348 (Fch) RX4359 (Ray)
Parity generator/checker	5 −5.2 5 5 5 5	250 205 170 125 200 100	18 13/14 36 30 20 36	RL3002 (Ray) 1046, 1246 (Mot) 74180 (TI) SM123 (Syl) 9660 (Phl) 8262 (Sig) 8220 (Nat)
Parity tree, 8-bit	5	150	30	4008 (Mot)
Parity tree, dual, 4-bit	5	125	22	4010 (Mot)
Character generator, seven segment	5	240	45	4039 (Mot)
Arithmetic logic unit and function generator	5	450	42	9341 (Fch)
Arithmetic logic unit	5 5 5 5 5	400 95 400 400 450	42 60 20 12 35	9340 (Fch) 9240 (Fch) 8260 (Sig) 7260, 8260 (Mot) 74181 (TI)
High-speed, carry look ahead	5	180	13	74182 (TI) 9342 (Fch)
Single-error hamming code detector and generator	5	250	45	4041 (Mot)
Line selector, dual	5	70	20	4043 (Mot)
Level translator, quad	−5.2	200	12	1039, 1239 (Mot)

INFORMATION RETRIEVAL
Digital design Integrated circuits



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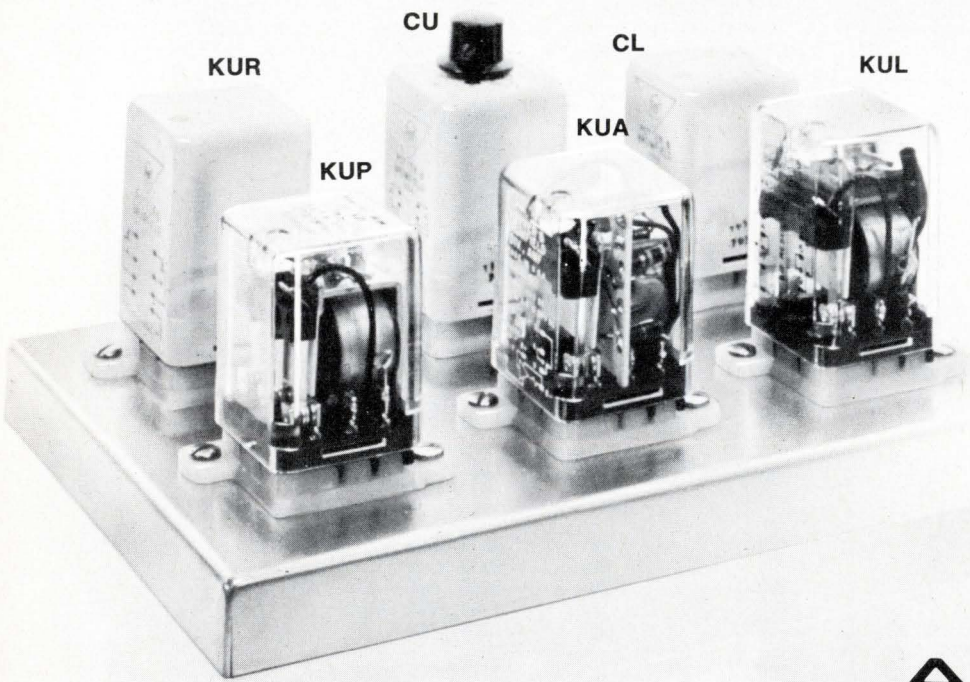

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IC IDEAS

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It is time once again to vote for the best IC Idea of the year. The twelve circuits you will find on the following pages were chosen as monthly winners between April 1969 and April 1970. Now, look at the circuits again and select the winningest winner. The lucky author receives an oscilloscope as his prize.

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941 Sweep circuit has triggered, free-run modes

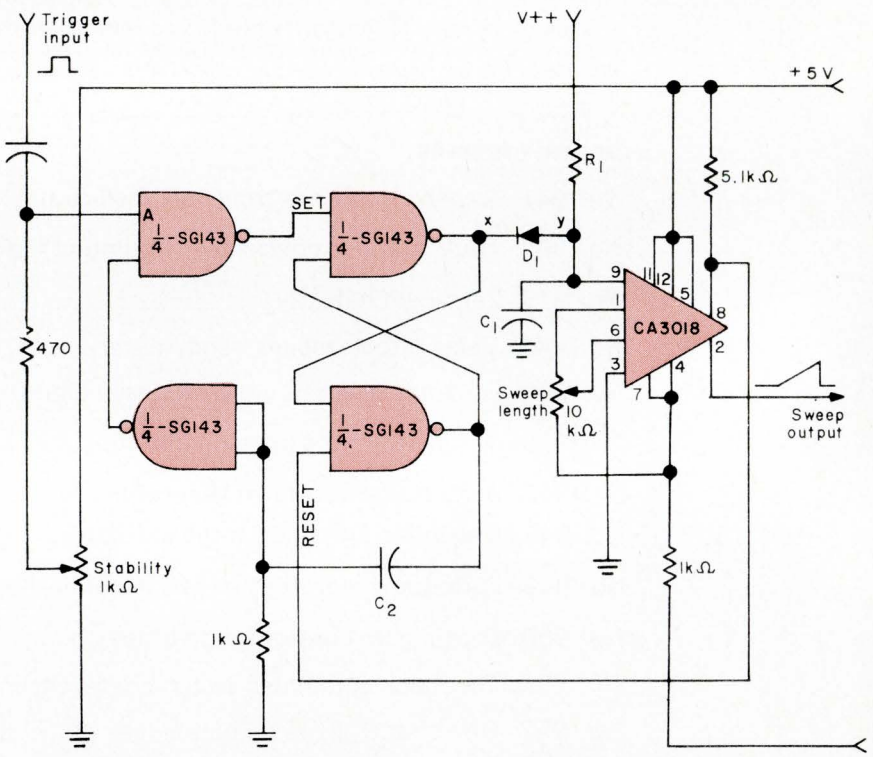
Chuck Ulrick
Collins Radio, Cedar Rapids, Iowa

This linear sweep circuit has many of the features of sweeps used in lab-type scopes. It consists of a control flip-flop, a capacitor charging circuit, a voltage comparator, and a hold-off multivibrator that prevents triggering of the sweep during its recovery time.

Half of the Sylvania SG143 is wired as a set-reset control flip-flop. During standby, it holds the cathode of the clamp diode (D_1) near ground, preventing C_1 from charging through R_1. The RCA CA3018 operates as a Darlington buffer and differential comparator. During standby, it sends a HIGH RESET input to the flip-flop.

If you set the stability control so that input A of the first NAND gate is just below threshold, then positive triggers cause it to set the flip-flop, releasing the clamp. C_1 then charges through R_1. When the comparator sees that this sweep voltage is at the desired amplitude (set by the sweep length control), it resets the flip-flop. C_1 discharges through D_1, forming the retrace.

At the same time, the reset action of the flip-flop sends a positive pulse through C_2 to the hold-off circuit. This gives a LOW output until C_2 discharges through the 1 kΩ resistor. Thus, trigger pulses are not effective during this interval, and each sweep starts only when the circuit is fully recovered.



If you set the stability control so that input A is above the gate threshold, the circuit free-runs. It gives you a continuous train of sweep pulses, each with a period equal to the sweep time plus the hold-off interval.

C_1 and R_1 determine the sweep rate, and, in general, $C_2 = 0.1C_1$. For very long sweeps that need a large C_1, replace D_1 with a pnp transistor emitter-follower. You will have to do this when the gate cannot discharge the timing capacitor in the desired time. Connect the transistor's base to point x, its emitter to y, and ground the collector.

Sweep linearity depends on the values of V++ and R_1, both of which can be very high. The IC's see only the charging current (produced by V++ and R_1), never the high V++.

942 Fault monitor checks for circulating logic bit

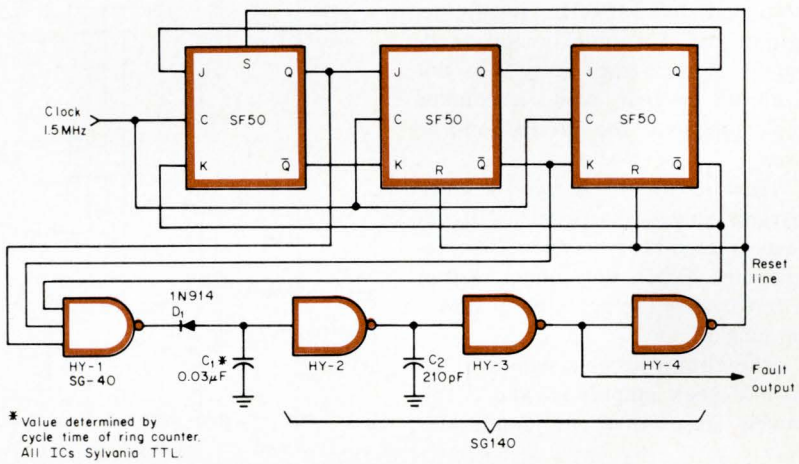
Robert Serody
Raytheon, Bedford, Mass.

This circuit monitors the operation of a ring counter to determine that only one bit is circulating. When this condition does not occur, the monitor sends a reset pulse to correct the counter and register a fault condition.

Previously, you had to use separate test/monitoring circuits to sense the presence of the circulating logic bit. A typical way would be to sum every state of the counter with a summing amplifier, and compare that output with two comparators that define the acceptable voltage range. If the counter states fall outside this range, the monitor resets the counter. Such a method needs a circuit with precision components, usually mounted on a separate module, with several power supplies necessary to operate it.

The new ring counter/fault monitor combines the counter and monitor into one circuit that checks periodically for proper operation. This is possible because the monitor checks for the presence of only one state of the ring counter.

As an example, consider the 3-state counter/monitor shown here. A NAND gate, HY-1, monitors the first state. (One input to HY-1 is a Q output; the other inputs are $\overline{Q}$.) The absence of this state shows that either all outputs of the counter are *0*, or that more than one logic *1* is circulating. In either case, the output of HY-1 stays HIGH, and C_1 charges to the supply voltage via HY-2's pull-up resistor.



When the voltage across C_1 reaches the logic threshold level, HY-2 sends a logic *0* through HY-3 and HY-4 to reset the counter. This, in turn, forces HY-1's output to drop to a *0* and discharge C_1 through D_1. The input to HY-2 thus drops below threshold, removing the reset pulse.

A time lag set by C_2 ensures that the reset pulse does not disappear before the flip-flops can reset. Gates HY-3 and HY-4 decrease the transition times of the reset pulse. Diode D_1 isolates C_1 from HY-1 during the recharge interval.

The circuit doesn't need precision components because the time constant set by C_1 and the pull-up resistor in HY-2 need be only long enough to prevent C_1 from reaching the threshold voltage between discharge times. The time between each discharge is the period of the ring counter. The fault monitor will reset the counter at turn-on, or when any extra bits are generated by noise spikes, or when the counter becomes defective.

You can use the monitor in a timing system by connecting the fault output of HY-3 to a register which is reset periodically. Connecting the register to trigger an alarm warns you if too many faults occur in a given time.

The ring counter may have any number of states. But the fault monitor always retains its basic simplicity of design because it need monitor only one of the states. In general, you can use the monitor to check the operation of many other circuits which involve a change of state in their operation.

C IDEAS

943 Zero-beat detector

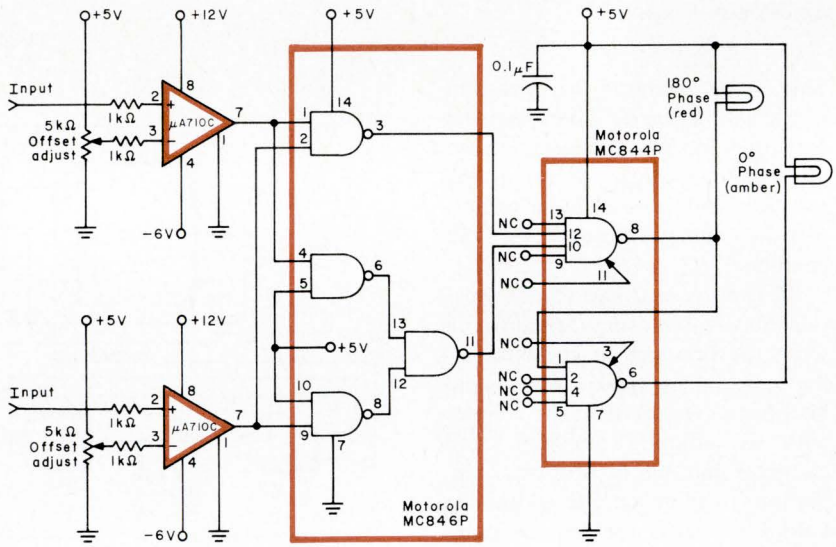
Tim K. Aaltonen
ARZ Assoc., New Rochelle, N. Y.

Keep this circuit in mind if you have to adjust two frequencies to within several cycles of each other.

The particular problem was to zero-beat two 15-kHz signals to within ±5 Hz, quickly and accurately. A dual-trace scope was not accurate enough, while a counter took too long for production-line use.

How to do it? A two-bit comparator solved the problem. It detects a zero-beat between two frequencies. When they match within a few cycles, the lights blink slowly on and off.

The circuit accepts signals of up to 5-V peak amplitude, and is relatively insensitive to amplitude.



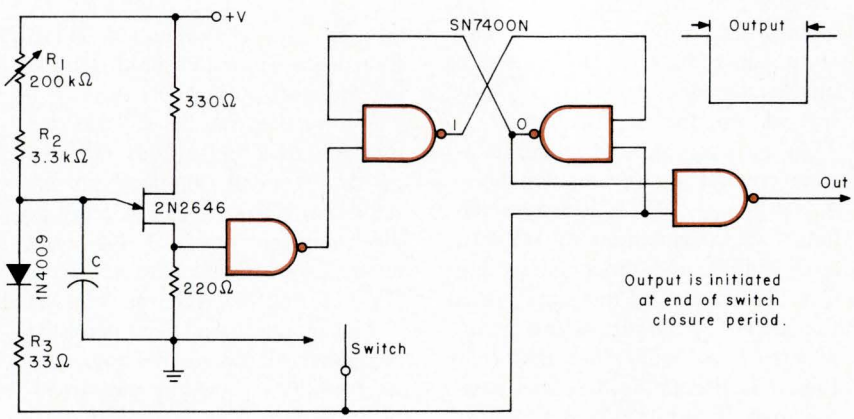
944 Delay circuit makes handy timer

G. Detlof
Tel. AB L.M. Ericsson
Stockholm, Sweden

With a unijunction transistor and an RS flip-flop, you can build a circuit useful in timing and control applications.

Closing the momentary-contact switch RESETS the flip-flop, and simultaneously discharges the capacitor through the diode. (Resistor R_3 limits the diode's current.) When the switch opens, the capacitor starts to charge through R_1 and R_2, and the output goes LOW.

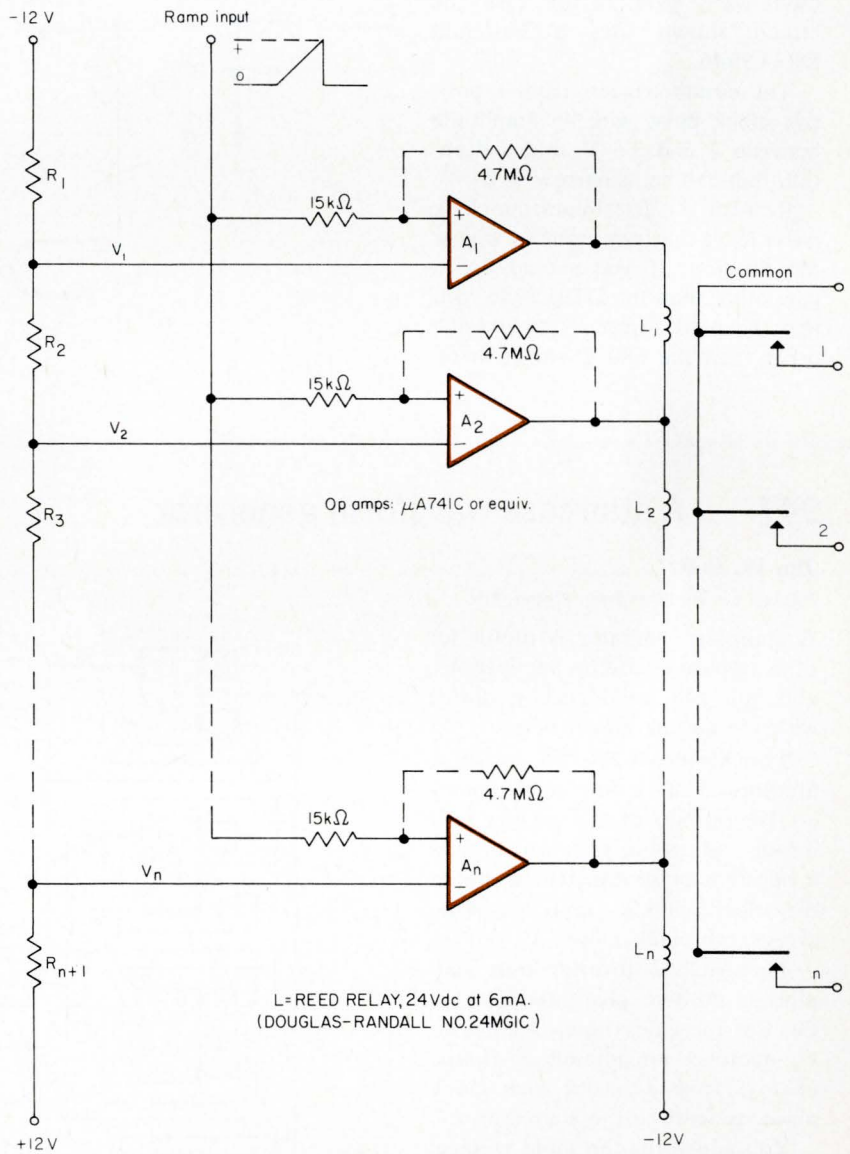
The output stays LOW until the capacitor reaches the UJT's peak-point voltage. When the UJT fires it puts a positive signal into the first gate which, in turn, SETS the flip-flop with a negative signal. The output is again HIGH.



The values of R_1, R_2, and C set the output pulse width, which can be several minutes long.

945 Op amps give mutually-exclusive digital sequencing

Maxwell Strange
NASA, Goddard Space Flight Center, Greenbelt, Md.



Here's a way to generate any number of sequential, mutually-exclusive outputs to isolated loads such as reed relays, miniature lamps, and so forth. The circuit is self-decoding, simple, and lower in cost than the usual digital approach that uses a clocked ring counter or a decoded ripple counter.

At the start of the input ramp, the outputs of all threshold detectors A_1 through A_n are negative, and the relays are not energized. When the ramp crosses level V_1, A_1's output goes to positive saturation, driving L_1 ON. As the ramp increases, it crosses level V_2, switches L_2 ON and, since A_1's output stays positive, simultaneously switches L_1 OFF. As the ramp reaches each successive threshold, the next relay is driven ON and the previous one switched OFF.

You can individually adjust the output pulse widths with threshold divider resistors R_1 through R_{n+1}. The ramp can come from a simple *RC* network or an operational integrator. For very slow ramps, 4.7 MΩ feedback resistors across the op amps provide hysteresis to prevent threshold chatter.

The variable-dwell feature makes this circuit useful as an event programmer. Or, as a data commutator, you can vary the sampling time to suit the data rate and give efficient synchronization. Further, the last output pulse can reset the ramp for continuous cycling or, by incorporating a simple SET-RESET flip-flop, return it to a standby mode until another START command appears to begin a new cycle.

C IDEAS

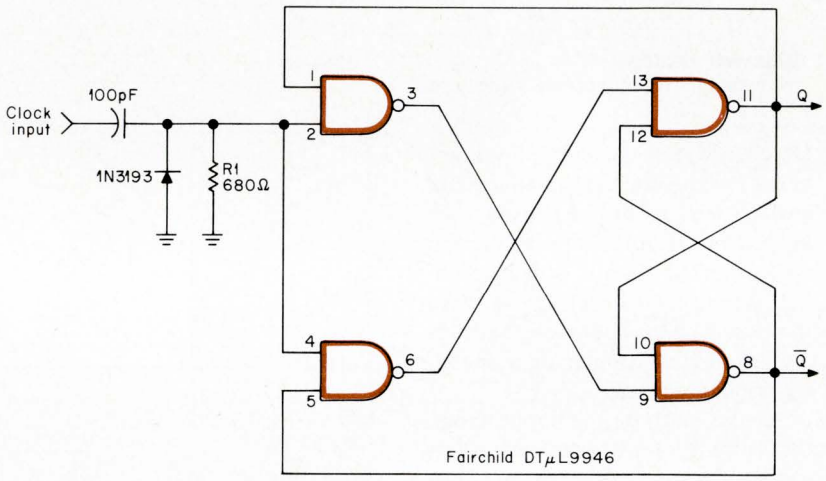
946 Simple-to-make toggling flip-flop

Thomas P. Benzie
U. S. Steel Corp., Monroeville, Pa.

Here is a toggle-mode flip-flop that you can make simply and economically from a single, quad 2-input NAND gate. In this case, the circuit shown uses a Fairchild DTμL9946.

The circuit triggers from a positive clock pulse with an amplitude between 2 and 3.5 V, and a duration that can be as narrow as 25 ns.

Resistor R_1 determines the clock pulse level that you need to trigger the flip-flop. If you should use a gate other than the DTμL9946, you may have to adjust R_1 to a value other than the 680 Ω shown here.



947 A staircase waveform generator

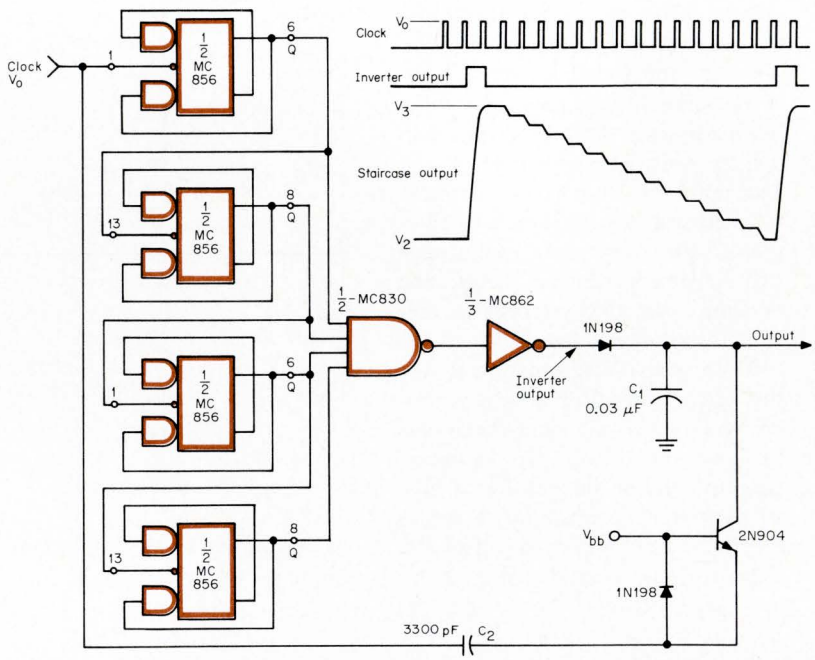
Jim W. Foltz
Motorola Semiconductor Prod., Phoenix, Ariz.

A staircase generator is useful for time-amplitude coding applications, and you can build such a device with the circuit shown here.

Two Motorola MC856, dual J-K flip-flops form a four-stage counter. The outputs of this counter feed a four-input NAND gate, which gives a negative pulse equal in width to the clock period, and occurring every 16th clock pulse.

The MC862 inverter thus supplies a positive charging pulse to C_1. But the clock input, applied to C_2, removes an amount of charge (C_2V_0) from C_1 with each clock pulse, generating the staircase.

You adjust the threshold voltage, V_2, and the step amplitude by varying the ratio C_1/C_2. The number of counter stages determines the number of steps in the waveform.



948 One video amplifier: three oscillators

Michael English
Fairchild Semiconductor, Mountain View, Calif.

The three oscillators shown here use an IC video amplifier as their active element. Oscillation frequencies range from several Hz to more than 10 MHz, and the output signals can directly drive DTL or TTL circuits. Output rise times and fall-times are less than 10 ns.

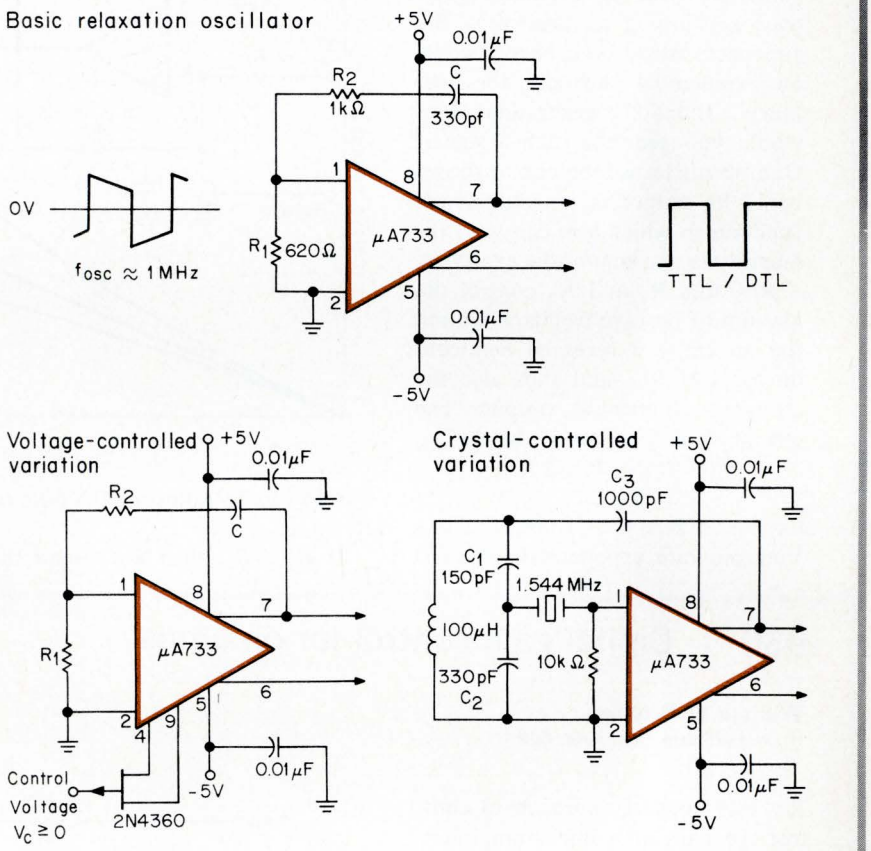
The Fairchild μA733 has differential inputs and outputs, and a 120-MHz, 3-dB bandwidth when operated at 20-dB voltage gain. It needs no external frequency-compensation. Gain-adjustment terminals let you continuously vary the IC's gain from 10 to 400 with an external resistor; without external components, you can still select fixed gains of 10, 100, or 400.

The basic oscillator is an *RC* relaxation circuit, with the other two being variations upon it. In this basic circuit, capacitor C and the voltage divider formed by R_1 and R_2 supply positive feedback. The period of oscillation, T, is

$$T \approx 2C\,(R_1 + R_2) \cdot \ln\,[A_v R_1/(R_1 + R_2)] \geq 2.$$

The approximation is due to the fact that the IC draws input bias current when the input signal is positive, but none when the input is negative. This means that the duty factor of the oscillation differs slightly from the ideal value of 50%, and thus the coefficient of the equation is not exactly two.

A voltage gain (A_v) of ten holds the division ratio R_1/R_2 to values between 0.2 and 0.4. The equation for T sets the lower limit, because the inequality $A_v R_1/(R_1 + R_2) \geq 2$ must hold for practical solutions. The single-ended output swing, and the input range of the device (±1 V), set the upper limit.



You can control the oscillation frequency in two ways, both of which give rise to the voltage-control variant of the basic circuit. In one method, you shunt an FET across R_1, and vary the FET's drain resistance by its gate voltage. Take care that you still satisfy the division ratio restrictions for the combination of R_1, R_2, and the FET.

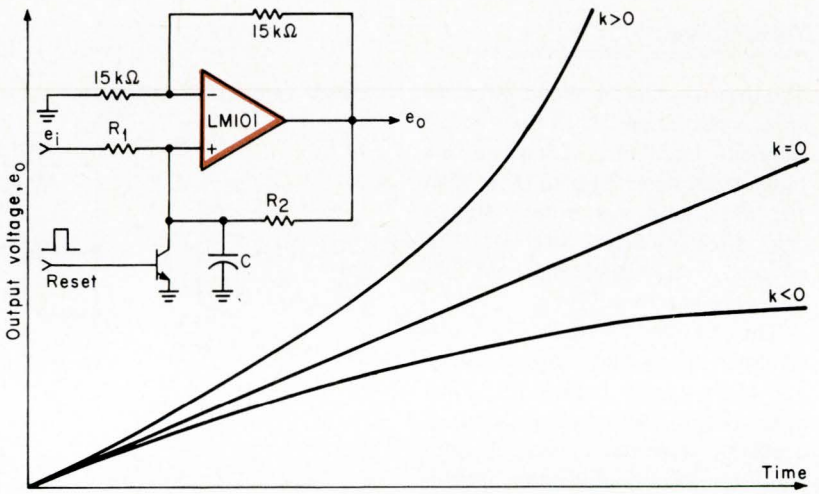
A second method of frequency control uses the fact that the period, T, is proportional to the natural log of the gain. So, to control the gain, connect an FET across the gain-adjustment terminals of the device, as shown. A junction FET as the gain control element gives about a 3:1 frequency variation: the higher the gain, the lower the oscillation frequency.

Another variant of the basic relaxation circuit comes about because, in principle, you can replace capacitor C with a crystal of the desired frequency. To prevent excitation of the crystal's overtone modes, put a tuned circuit in the feedback loop. This tank favors oscillations at its own resonant frequency, but suppresses other, spurious modes. To sustain oscillations, the voltage division ratio, C_1/C_2, must be greater than the reciprocal of the amplifier gain.

949 Function generator has variable polarity exponents

William Neeland
Kaiser Aerospace and Electronics, Palo Alto, Calif.

You can generate a linear sawtooth waveform in many ways (as, for example, with a constant-current source charging a capacitor). But suppose, instead, you have need of an exponential sawtooth for nonlinear function generation—how would you generate such a signal? One way is to use the circuit shown here: its output is an exponential function in which you can vary the magnitude and sign of the exponent.



Resistors R_1 and R_2 control the amount of positive feedback around the op amp—a National Semiconductor LM101—and thus also the circuit's exponential output. The output is of the form ϵ^{kt} where

$$k = (R_1 - R_2)/R_1 R_2,$$

and $e_o = 2e_i(\epsilon^{\frac{kt}{C}} - 1)/kR_1$.

You generate exponentials of various powers by adjusting the ratio of R_1 to R_2.

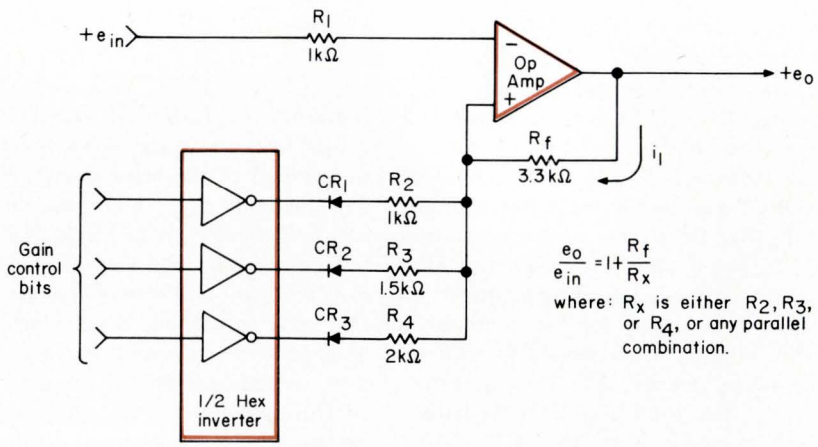
If $R_1 = R_2$, then $k = 0$ and the equation for e_o reduces (by l'Hospital's rule) to that of a linear sawtooth waveform: $e_o = 2e_it/CR_1$.

950 Digital gain control for op amps

William E. Peterson
ITL Research Corp., Northridge, Calif.

Try this unusual approach to control the gain of a linear amplifier; it solves many a problem in computer-controlled, analog systems.

The circuit uses an op amp in a non-inverting connection, so that its voltage gain is $1 + R_f/R_x$, where R_x is the resistance between the non-inverting input terminal and ground. If you restrict e_{in} to analog signals that are positive with respect to ground, then feedback current i_1 will always flow in the direction shown.



In the circuit diagram, R_x of the gain equation is replaced by R_2, R_3, and R_4. The hex inverter connects these resistors to ground either singly or in any combination, according to the drive supplied to it, and thus sets the circuit's gain.

If any inverter output is a logic 1 (about 5 or 6 V), then the diode in series with that output is reverse biased, and the associated resistor is not in the gain control loop.

The illustration shows eight (2^3) digital gain settings, but you can extend this number to whatever you need, simply by adding more inverters. And you can use any op amp or inverter that's handy.

951 Feedback eliminates switch contact transients

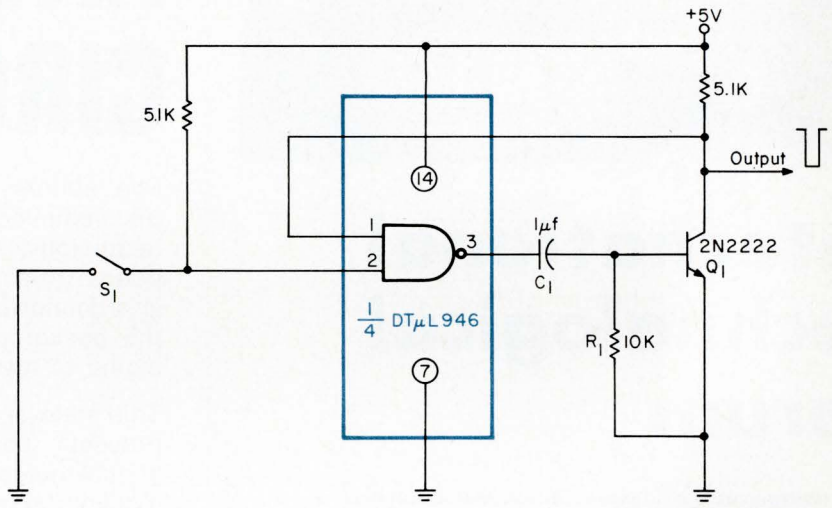
Veikko O. Jaakola

Teledyne Systems Co., El Segundo, Calif.

This monostable circuit lets you use a pushbutton or toggle switch to generate a single pulse without worrying about transients.

When S_1 is closed, it causes the output of the Fairchild DTμL 946 gate to go to +5 V turning on transistor Q_1. The feedback to the input of the gate keeps its output high for as long as Q_1 is on, despite any transients in the switch. You can even open the switch and still get the output pulse.

The pulse width is determined by the R_1C_1 time constant and you can get pulses from 1.5 ms to several seconds with this circuit.



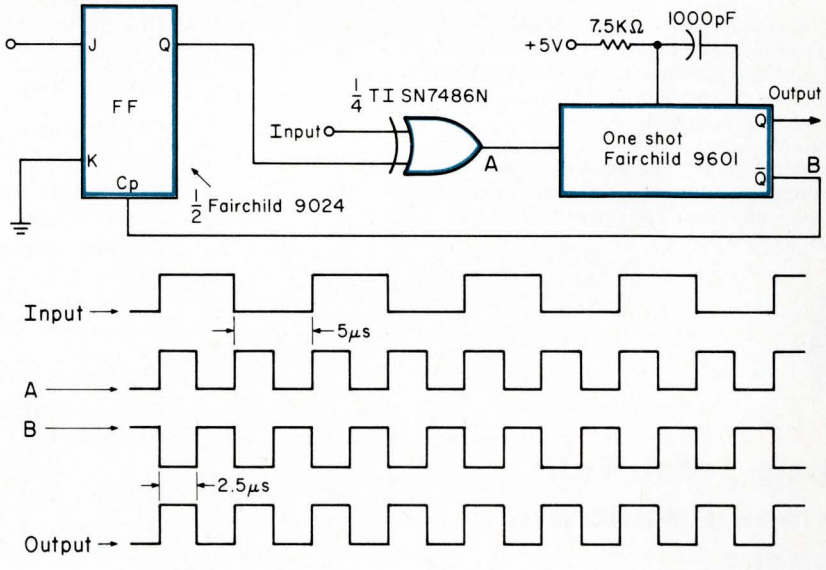
952 One-shot triggers on both edges of input

Ken Erickson

Interstate Electronics Corp., Anaheim, Calif.

This circuit gives you a pulse of the desired width whenever the input changes logic states. If the input is a symmetrical square-wave you can use it as a frequency doubler. Another application is as a detector to monitor changes in digital data.

If the Q output of the flip-flop is initially at logic 0, when the input changes state, the output of the exclusive OR gate goes to a 1 level and triggers the one-shot. When the one-shot times out, the output goes low and the inverted output goes high thus toggling the flip-flop to the logic 1 state. This causes the output of the gate to go low and removes the input to the one-shot. With each half cycle of the input square wave this sequence is repeated.



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The Electronic Engineer
One Decker Square
Bala-Cynwyd, Pa. 19004

Don't forget to fill in your name and address at the end of this exam.

1.
The widest application of optoelectronics devices is
(a) sensing. (b) character recognition.
(c) counting. (d) readout.
a. ☐ b. ☐ c. ☐ d. ☐

2.
The visible spectrum is closest to
(a) 0.28 to 0.73 μ. (b) 0.33 to 0.65 μ.
(c) 0.33 to 0.76 μ. (d) 0.39 to 0.71 μ.
a. ☐ b. ☐ c. ☐ d. ☐

3.
One angstrom is equal to
(a) 10^{-9} meters. (b) 10^{-3} microns.
(c) 10^{-10} meters. (d) 10^{4} microns.
a. ☐ b. ☐ c. ☐ d. ☐

4.
Basically, leakage current in an optoelectronic device is referred to as the device's
(a) color temperature. (b) light current.
(c) black body. (d) dark current.
a. ☐ b. ☐ c. ☐ d. ☐

5.
The most common compounds for light emitters are
(a) III-V compounds. (b) II-VI compounds.
(c) II-V compounds. (d) III-VI compounds.
a. ☐ b. ☐ c. ☐ d. ☐

6.
"LED" stands for
(a) large emitter devices. (b) light energized dice. (c) low emitter devices. (d) light emitting diodes.
a. ☐ b. ☐ c. ☐ d. ☐

7.
Which of the following is not correct? a. ☐
(a) optical lenses increases gain. (b) light b. ☐
must focus on device's active area. (c) c. ☐
lenses can be plastic. (d) intense light can d. ☐
saturate devices.

8.
The defining factor for the photometric a. ☐
system spectral response curve is b. ☐
(a) unit response for all wavelengths. c. ☐
(b) that of a standard observer. (c) a light d. ☐
bulb. (d) radiant energy from a standard
resistor.

9.
Efficiency of a light emitting device is a. ☐
(a) based upon lumens radiated. (b) b. ☐
emitted flux density. (c) light output pow- c. ☐
er divided by total input power. (d) power d. ☐
consumed in heat divided by input power.

10.
The human eye peaks around a. ☐
(a) blue. (b) red. (c) violet. (d) green. b. ☐
c. ☐
d. ☐

11.
DC electrical properties normally speci- a. ☐
fied for discrete LEDs are b. ☐
(a) forward voltage drop and the break- c. ☐
down voltage. (b) current and power con- d. ☐
sumption.
(c) light current and dark current.
(d) breakdown current and maximum
voltage.

12.
For monolithic numeric displays, how a. ☐
many segments are commonly used? b. ☐
(Don't include decimal point.) c. ☐
(a) 6. (b) 7. (c) 8. (d) 9. d. ☐

13.
What is the most common visible color a. ☐
emitted from today's LEDs? b. ☐
(a) green. (b) blue. (c) red. (d) orange. c. ☐
d. ☐

14.
In a phototransistor the a. ☐
(a) base-emitter junction is very large. b. ☐
(b) lens is mandatory. (c) collector-base c. ☐
juntion and photodiode junction are iden- d. ☐
tical. (d) photoresistive element must be
as large as possible.

15.
Photoconductive devices are used for a. ☐
(a) fast response. (b) large light-to-dark- b. ☐
ratios. (c) high gain. (d) broad spectrum c. ☐
response. d. ☐

16.
Coupled pairs are popular because of a. ☐
their b. ☐
(a) high isolation capabilities. (b) speed c. ☐
of response. (c) environmental capabil- d. ☐
ities. (d) none of the above.

17.
Light intensity, *H*, is normally given in a. ☐
(a) lumens/distance. (b) Å/cm². b. ☐
(c) watts/distance. (d) mW/cm². c. ☐
d. ☐

18.
A photovoltaic component a. ☐
(a) generates a voltage when light is ab- b. ☐
sorbed. (b) primarily senses far infrared. c. ☐
(c) has an output directly proportional to d. ☐
the square of applied voltage. (d) gener-
ates light with an applied voltage.

19.
Placing a lense over a light detector will a. ☐
(a) give 360° of light detection. (b) reduce b. ☐
internal light reflections. (c) greatly im- c. ☐
prove speed of response. (d) none of the d. ☐
above.

20.
What is the prime advantage of a photo- a. ☐
transistor over a photodiode? b. ☐
(a) better parameters. (b) better isola- c. ☐
tion. (c) amplification. (d) wider spectrum d. ☐
response.

Don't forget to fill in your name and address and enclose $1.00 to cover costs.

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No. 1: The 24-Second Q Meter

Think back to the last time you used a Q Meter. It was probably an ancient-looking monster that you couldn't operate without studying a manual. A lot of cumbersome controls took strength and patience to manipulate. Once you got the hang of it, you still had to spend about a minute to get a reading... and then, you had to multiply that reading by another to get the answer you were looking for.

No more. Now, there's HP's 4342A—the Q Meter that lets you take readings in 24 seconds or less, start-to-finish. A single indicator gives you Q directly, over a range from 5 to 1000; there's no Q-multiplier to contend with. Fingertip controls let you choose any frequency from 22 kHz to 70 MHz—a wider range than ever before. Likewise, you can select L, C, or △C scales effortlessly, in seconds.

The 4342A is just one of HP's family of "Useables"—easy-to-use instruments for testing components. For further information on the 4342A, or on any of the "Useables," contact your local HP field engineer. Or write Hewlett-Packard, Palo Alto, California 94304. In Europe: 1217 Meyrin-Geneva, Switzerland.

HEWLETT hp PACKARD

091/8

COMPONENT-TESTING INSTRUMENTS YOU CAN USE

The Useables:

No. 1: 4342A Q Meter, No. 2: 4270A Automatic Capacitance Bridge, No. 3: 4328A Milliohmmeter, No. 4: 4329A High Resistance Meter, No. 5: 4260A Universal Bridge, No. 6: 4470A Transistor Noise Analyzer.

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Cornell-Dubilier filters are designed to control potential electromagnetic interface susceptibility and emission problems, insuring system compatibility with commercial power inter-facing. Computer system filters require close liaison between supplier and user, to achieve compliance to international electromagnetic interference spcifications. It is not enough to buy and install a filter; its effect must be proven. Cornell-Dubilier specializes in pre- and and post-design assistance to systems manufacturers. Cornell-Dubilier's track record for efficiency and reliability can help you set performance records, too.

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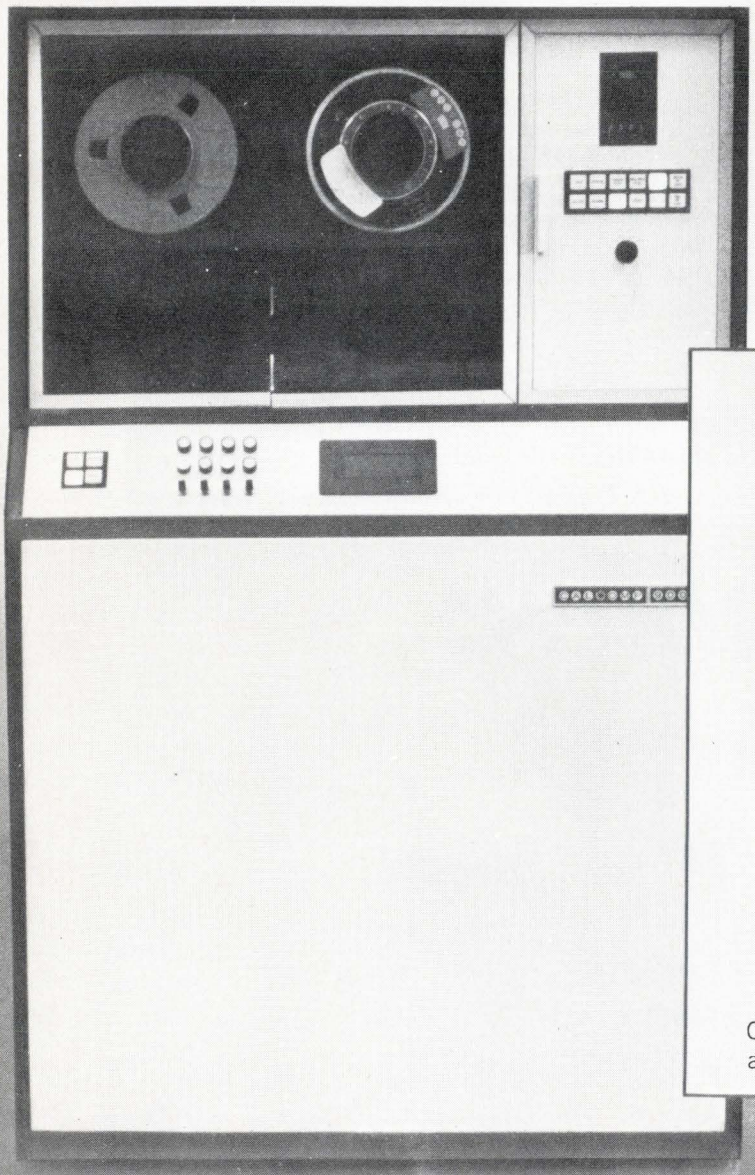

CDE Computer System Filters are designed to comply with applicable UL, Military, and European specifications.

ATTENTION: Computer Designers

The first nation-wide Computer Designer's Conference devoted exclusively to the interests of design engineers, not users, who build and test computer systems will be held this month (Jan. 19-21) at the Anaheim Convention Center in Anaheim, Calif.

Current innovations in the design of computer systems will be spotlighted in 12 technical sessions. More than 60 papers are scheduled for these morning sessions.

Complementing the technical program will be a 200-250 booth exhibition—the largest ever held in this field—featuring the latest components, subsystems, and test instruments for the design and construction of analog, digital, and hybrid computers.

Engineers will find an opportunity to exchange ideas with other engineers representing all fields of design during the five evening audience participation seminars. Both the technical sessions and the seminars are oriented towards providing solutions to the many design problems facing today's engineers. Attention is directed to the design of peripheral equipment as well.

To give you an idea of what to expect at the discussion seminars, here's a brief look at Session C, "Selecting Main Frame Memories." An introductory talk by the chairman precedes brief commentaries by each panelist in his area of expertise. Following this will be questions from the chair or floor directed to the panel.

An impressive panel of manufacturers and users will assemble for Session C. Participating will be: Ralph Gabai, Lockheed Electronics; Philip A. Harding, Electronic Memories; Linder C. Hobbs, Hobbs Associates; Cloyd E. Marvin, Four-Phase Systems; and Robert N. Noyce of Intel. Leading the session as chairman will be our Western Editor in Los Angeles, Steve Thompson.

Steve's introductory talk, "A Way of Looking at Memories," will introduce a method of relating currently available main frame memories in terms of cost, performance, technology, and size, all in a single graphic presentation.

Further discussion by the panelists will cover such areas as: cost-performance tradeoffs, the interrelationship of memory choice with system design and software, and the availability of memories. Be sure to bring your main frame memory problems and your design questions along.

The entire conference offers you an excellent opportunity to get up-to-date information from a well-qualified group. **The Electronic Engineer** is an associate sponsor of the Computer Designer's Conference. Be sure to look for us at our booth. In the meantime, for more information, contact Industrial & Scientific Conference Management Inc., 222 W. Adams St., Chicago, Ill. 60606.

Computer Designer's Conference & Exhibition

Time	Tuesday, Jan. 19	Wednesday, Jan. 20	Thursday, Jan. 21
8:00 A.M.	**Registration**	**Registration**	**Registration**
8:30 A.M. to 11:45 A.M.	**Technical Sessions** 1) Design of Computer-Controlled Communication Systems 2) Minicomputer Architecture and Design 3) Automated Digital Design for the 70's 4) Techniques for Domain Data Conversion	**Technical Sessions** 5) Design of Computer-Controlled Hybrid Systems 6) Design and Application of Digital Building Blocks 7) Arrays/Hybrids—Capabilities and Application 8) Electro-Optical Input/Output Systems	**Technical Sessions** 9) Advanced Memories 10) Firmware—Its Impact and Application 11) Hardware/Software Computer Diagnostics 12) Control of Noise Within Digital Systems
11:30 A.M. to 6:00 P.M.	**Exhibits**	**Exhibits**	**Exhibits**
6:30 P.M. to 8:30 P.M.	**Discussion Seminars** A) Implementation of Multiprocessors B) Aerospace Computer Requirements and Developments	**Discussion Seminars** C) Selecting Main Frame Memories D) Redundant Design Techniques for Achieving Long-Term Digital Systems Reliability E) Effective Selection of Communications I/O Functional Modules for Computer Systems	**Cassette tapes of this session will be available for a nominal fee. If you are interested in these cassettes, please circle No. 500.**

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NEW PRODUCTS

Data communications system has a heart of MOS

At least one company, Larse Corp., of Palo Alto, Calif., is applying MOS/LSI technology to products other than computers, peripherals or calculators. They are now using their own MOS/LSI chips in Data Communicator™ modules that form a complete digital data transmission and receiving system.

The transmitter, which scans 16 parallel data channels (time-division multiplexing) and encodes the data into a serial stream of binary-coded pulses, is called a Sen™. The receiver, which decodes and demultiplexes the data, is called a Rede™.

Communication between the Sen and Rede units can be over any type of link. It may be a simple twisted pair (19-gauge wire will take your data 10 miles); a voice-grade line; or you may choose to use a radio link, with the Sen modulating, say, a vhf transmitter.

Transmission reliability

These modules use a special "Larse" code for data transmission. The Sen's data work output comprises 16 data bits (one per input channel), plus sync pulses that result from one scan of the input circuits. A complete word uses 34 bits—16 data bits, 16 clock pulses, and two sync pulses.

The high ratio of data bits to the total number of bits transmitted is a feature of the code. The code also combines the advantages of synchronous and stop-start codes. And, its self-clocking feature means that there are predictable transitions that allow rigorous checking of the data receiver by the Rede unit.

The Rede unit actually performs 144 code-element checks, and 44 word checks.

Modes and rates

Sen and Rede units are available for communications via fsk tone, a-m tone, EIA RS-232-B, line switch, or line relay. (The mode determines the model number.) Communication rates are a function of the transmission mode. Standard rates vary from 60 to 1440 bps.

You can set up Sen/Rede systems for simplex operation (one-way only); half-duplex (two-way, same frequency, but time-phased); or duplex operation (two-way, same time, but different frequencies).

Further, you can choose from among eight transmission modes. Built-in address coding gives you even more flexibility.

Interfacing

You can interface the Rede module with both visual and audible alarms. Its 16 data outputs will each sink 15 mA from 24 Vdc.

For interfacing with other gear, both the Sen and the Rede provide for 5- and 12-V logic, and are compatible with DTL, TTL, HNIL, and MHTL circuits.

List prices for the various Sen models hover at about $600, while those for the Rede models are about $700. Larse Corp., 1070 E. Meadow Circle, Palo Alto, Calif. 94303. (415) 493-0700.

Circle Reader Service #**215.**

D to A is the name, but multiplication is the game

Here are a couple of devices that may seem a bit bizarre if you are accustomed to working with conventional (or fixed reference) D/A converters. These units, called multiplying D/A converters, are marked by their ability to handle variable, and even ac, references.

Manufacturers of conventional D/A's carefully design their devices so that the analog output is a function of just one variable—the digital input. The analog output from a multiplying D/A however, depends on two variables, the digital input and the varying analog input. The multiplying D/A does in fact perform full four-quadrant multiplication of the digital input with the instantaneous value of the analog input.

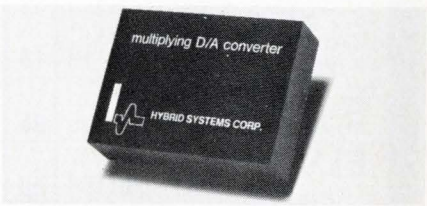
Among the applications for the devices are CRT displays. With the converter output controlling the beam position, the digital input can, in conjunction with a ramp on the analog input, be used to generate segments and patterns. Other applications include digitally controlled audio attenuators and hybrid (digital plus analog) computation systems, to name a few.

Two companies have recently jumped into the multiplying D/A field. One of these is Analog Devices Inc., with their DAC-M series of converters. These units come in 8- and 12-bit versions and will accept analog inputs in the dc-100 kHz range. Input and output full scale ranges are ±5 or ±10 V. The prices are $195 (8-bits) and $295 (12-bits).

Hybrid Systems Inc. also has a new line of multiplying D/A converters. Carrying part numbers 315-10, 315-11 and 315-12, they offer 10-, 11- and 12-bit resolution respectively. Bandwidth of the analog input is dc-400 kHz and full scale output is ±10 V. Prices are $125, $150, and $175 for the three resolutions.

Analog Devices, Inc., Pastoriza Div. 221 Fifth St., Cambridge, Mass. 02142 (617) 492-6000.

Circle Reader Service #**216.**



Hybrid Systems Corp., 95 Terrace Hall Ave., Burlington, Mass. 01803. (617) 273-1522.

Circle Reader Service #**217.**

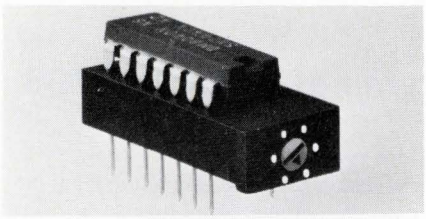
It's a switch

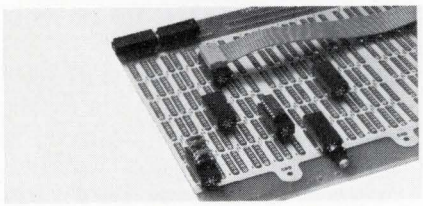
Here's a switch that's 100% IC compatible, that has a "piggyback" feature to let you plug any standard 14-pin device into it, and that you can couple in "tandem" for design versatility. Only 0.230 in. high, the switch lets you stack PC cards in ¼-in. increments.

Unlike prior DIP-adaptable switches, the Dipswitch is designed so that a cam lifts a moveable contact arm, giving a definite wiping action. This ensures a clean contact surface and low contact resistance.

Closure and opening of contact pairs is precisely controlled by individual cams having hexagonal shafts and cam bores. This means that the cams can be oriented to any of six different positions. Thus, the company can, through the use of only a few basic shapes, build almost any desired program into the switch without any special tooling and assembly costs.

A total of six pairs of contacts can be programmed to open or close in any desired sequence by simply rotating a screwdriver slot provided in the front of the switch.





The Dipswitch, which can be wave soldered onto a PC card, is impervious to attack by normal cleaning solutions.

It is rated at 115 Vac or 28 Vdc at 125 mA. Contact resistance is 10 mΩ max., dielectric strength 500 Vac, dc insulation resistance 10,000 MΩ, life expectancy 100,000 detent operations minimum, and operating temperature range −65° to +185°F.

Daven Division, McGraw-Edison Co., Manchester, N.H. 03101. (603) 669-0940.

Circle Reader Service #**218.**

CASETTE RECORDER

Model 400T incremental magnetic tape recorder is for data communications and time share applications. It has selectable read/write baud rates of 110, 150 and 300. You can stop and start on a character in the read mode without losing a character. Because of this feature it becomes a convenient replacement for paper tape devices. Storage capacity is greater than half a million data bits on a single 300 ft. cassette of ⅛ in.-wide tape. Mobark Instruments Corp., 1038 W. Evelyn Ave., Sunnyvale, Calif. 94086.

Circle Reader Service #**219.**

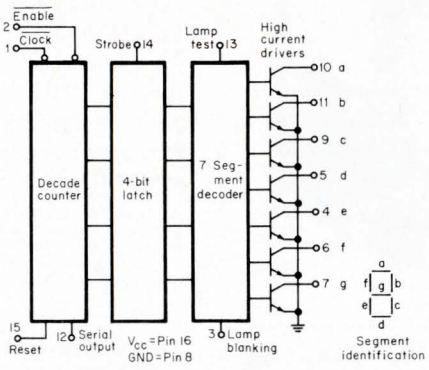
LED display and decoder/driver

Motorola has announced a pair of new products, including its first light emitting diode display.

The decoder

The MC4050 counter-latch-decoder combines the functions of an NBCD (Natural Binary Coded Decimal) counter, four-bit latch, and LED decoder/driver. This monolithic MSI package replaces three others, costing $14.80 (in 100 quantity), with a $9.00 package. It comes in a 16-pin DIP ceramic or plastic version.

There are two types of LED seven-segment displays: hybrid and monolithic. The MC4050 is designed to drive the hybrids (which have individual diodes mounted on a substrate and require current-sinking because their segment anodes are tied to a positive supply). The MC4051 (to be announced) will be a current-sourcing driver for the cathodes in a monolithic display (which are all diffused into a common substrate). With additional circuitry, the MC4050 could drive monolithic LEDs. If output current is supplemented, it can also drive incandescent displays.



MC4050 Counter-Latch-Decoder. Resetting the input suppresses the leading zeroes in a display. The lamp blanking input allows control of display brightness through control of the duty cycle, and a lamp test input permits verification of all diode integrity.

Power dissipation in the 4050 is 450 mW/package and toggle frequency is 35 MHz. It will sink 40 mAdc/segment at 0.4 V or 20 mAdc/segment at 1.6 V.

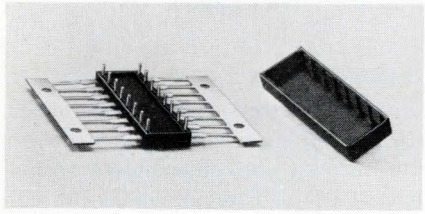
Monolithic display

The MOR 33 seven-segment monolithic display has a 0.125 in. character height. Even though monolithic LED displays are small, the human eye responds to them as if they were about twice their size. The MOR 33 is a pn Gallium Arsenide Phosphide 350 mW display that emits in the visible red (6600 Å). Designed for digital displays, brightness is typically 200 ft. L/segment at 10 mA. $7.50 (in quan.). Motorola Semiconductor, 5005 E. McDowell Rd., Phoenix, Ariz. 85036.

Circle Reader Service #**285.**

DUAL IN-LINE PACKAGES

New 14 and 16-lead DIPs feature headers with extended terminals for solderless wrap or bonded terminations.



Also, the lead frame is rugged enough so that the extended terminals may be bent over an inserted substrate for direct solder connections. Header and case in 24 set prototype kits cost $25.00/kit. Aura Mfg. Co., 50 McDermott Rd., North Haven, Conn. 06473. (203) 777-2541.

Circle Reader Service #**286.**

POWER TRANSISTORS

Operating range of these transistors is from 175 MHz in the vhf band through the L and S bands to 2 GHz. They can produce up to 10 W of output power with a min. of 6 dB gain at 1 GHz. The line features the 2N5108A npn "overlay," ultra-low leakage transistor, which can produce a min. of 1 Wac output power when operated at 1 GHz with a gain of 5 dB. Raytheon Co., Lexington, Mass. 02173. (617) 862-6600.

Circle Reader Service #**287.**

COMPUTER SYSTEM

The GE-PAC ™3010 offers full process control capability for small or less-complex applications. Developed around the GE-PAC 30 process minicomputer, it delivers full process I/O capability and includes interfacing for a broad range of process sensors and transducers. General Electric Co., Process Computer Dept., 2255 West Desert Cove Rd., Phoenix, Ariz. 85029.

Circle Reader Service #**288.**

FLAMEPROOF RESISTORS

These glass tin-oxide resistors are for use in TV sets, test equipment containing CRT readouts, and laser power supplies. Resistance ranges up to 100 MΩ and voltage performance to 10 kV. Designated HV½, HV1, HV1½, and HV2, they have a TC of −2000 ±500 ppm over a temp. range of 25° to 100°C. Electronic Products Div., Corning Glass Works, Corning, N.Y. 14830.

Circle Reader Service #**289.**

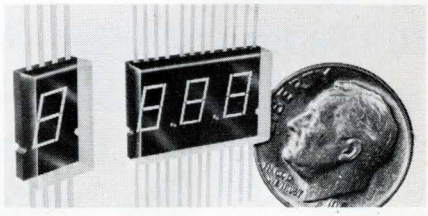
PRECISION FILM RESISTOR

Model ML103 resistor is 0.110 x 0.045 in. with a resistance range from 10Ω to 250 kΩ; power rating: 0.06 W at 125°C; TC: ±50 ppm/°C; and molded epoxy case with gold plated Dumet leads. Caddock Electronics, 3127 Chicago Ave., Riverside, Calif. 92507.

Circle Reader Service #**290.**

DISPLAY NUMERALS

New R7M-111 and R7M-191 gallium arsenide phosphide display numerals are 0.110 and 0.190 in. high, and come in a



flatpack configuration, making them well suited for PC mounting. The display emits light in the 6450 A (red) region at an output illumination of 100 fL/segment at 10 mA. Bowmar Canada Ltd., 1257 Algoma Rd., Ottawa, Ont., Canada. (613) 746-3100.

Circle Reader Service #**291.**

MODULAR POWER SUPPLIES

New line of current stabilized supplies offers programmable current with adjustable voltage limiting. A fast recovery current control circuit allows the output to stabilize in as little as 2 μs/V of compliance. Six current ranges are available in the CCP modules: 0-0.2 A to 0-2 A with loading from 0-100 V to 0-7 V. Source and load effects are below 0.0005% and 0.005% respectively. $150.00. Kepco, Inc., 131-38 Sanford Ave., Flushing, N.Y. 11352. (212) 461-7000.

Circle Reader Service #**292.**

MICROWORLD

COMPLEX FUNCTION CIRCUITS

These four devices are derived from the XC-170 128-bit read-only memory and are electrically compatible with all other MTTL lines. The devices are the MC4038P and MC4040P gated decoders, the MC4041P Hamming code detector and generator, and the MC4039P 7-segment character generator. Characteristics shared by the circuits are a total power dissipation of 200 to 240 mW/package, < 7.0 pF output capacitance and outputs capable of sinking 20 mAdc. The 1000-4999 prices are $5.10 ea. for any device. Technical Information Center, Motorola Semiconductor Products Inc., Box 20924, Phoenix, Ariz. 85036. (602) 273-3589.

Circle Reader Service #**225.**

DECODER/DRIVER CIRCUITS

This series includes three types of BCD to 7-segment decoder/drivers that operate the manufacturer's MAN-1 discrete and MAN-3 monolithic 7-segment displays. Both the MSD 101 and MSD 102, are active high devices specifically designed for the MAN-3 display. Both have binary-coded decimal inputs that are DTL/TTL compatible. The MSD 101 is recommended for individually addressing the MAN-3, while the MSD 102 is for multiplexing up to eight displays. The MSD 047, a monolithic active-low decoder/driver, is recommended for the MAN-1 7-segment light-emitting diode display. Prices start at $9.50 ea. (1-9 quan.) Monsanto Electronic Special Products, 10131 Bubb Rd., Cupertino, Calif. 95014.

Circle Reader Service #**226.**

HYBRID VOLTAGE REGULATORS

Both of these regulators, the C-216 single positive-voltage regulator, and the C-226 dual-voltage regulator, can drive external pass transistors to increase current output to several amperes. The C-216 has a 0.001%/°C temp. coefficient; adjustable resistor-programmed current limits; 0.005% line regulation; 0.01% load regulation; and a 200 mA output current capability. The model C-226 offers a ±15 V output with a ±100 mA output current capability. Features include external adjustable output voltages of from 12 to 37 V, load regulation of 0.005% and line regulation of 0.01%. Bell & Howell, Control Products Div., 706 Bostwick Ave., Bridgeport, Conn. 06605. (203) 368-6751.

Circle Reader Service #**227.**

HYBRID INTERFACE CIRCUITS

These three quad peripheral drivers are for interface applications calling for high-current, high-voltage, and low standby power consumption. The HIC040 has a high-current capability and fast switching speed that makes it useful as a systems master clock driver. The HIC067 performs especially well in lamp and relay drivers. The HIC068, with a 180 V breakdown voltage, is especially suited as a driver for high-voltage tubes and displays. Prices (1000 pc. quan.) are $12.70 for the HIC040; $12.90 for the HIC067; $11.65 for the HIC068. Texas Instruments Incorporated, Inquiry Answering Service Box 5012, M/S 308, Dallas, Tex. 75222. (214) 238-3741.

Circle Reader Service #**228.**

FAST SLEWING OP AMP

The 531 has a large-signal response that is nearly identical to its small-signal performance. Typical slew rate at unity gain is 40 V/μs. Small-signal bandwidth is 1 MHz, and large-signal bandwidth is 500 kHz. Supply voltage can range from ± 6 to ± 18 V. Signetics Corp., 611 E. Arques Ave., Sunnyvale, Calif. 94086. (408) 739-7700.

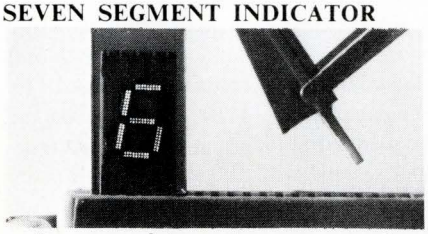
Circle Reader Service #**229.**

BIPOLAR ROM

The MM5200 features an access time of 30 ns and a power dissipation of 0.35 mW/bit. The chip stores 1024 bits in a 256-word by 4-bit format. It also has full address decoding on the chip and is directly DTL/TTL compatible. The 0 to +75°C version is $50.00 ea. in 100-999 quantities. Monolithic Memories, Inc., 1165E. Arques Ave., Sunnyvale, Calif. 94086.

Circle Reader Service #**230.**

SEVEN SEGMENT INDICATOR



Because of its unique construction, the Data-Lit 3 can be plugged into a PC board edge card connector for a vertical display. Since it requires only 1.7 V/segment you can power the display from the same supply as the logic card. $9.85 ea. (1000 quan.). Litronix, 10440 N. Tantau Ave., Cupertino, Calif. 95014. (415) 329-0810.

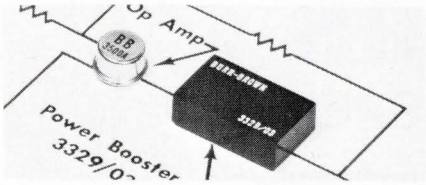
Circle Reader Service #**231.**

EXPANDED C-MOS LINE

The new devices include a 16-bit programmable ROM (SCL-5510); a one-of-eight strobed decoder (SCL-5206); a high-speed 64-bit shift register family (SCL-51300 series); a presetable 8-bit program counter (SCL-5401); an 8-bit data and/or address register (SCL-5402); a high-speed 256-bit read/write memory (SCL-5553); an 8-bit synchronous binary counter (SCL-5404); and a quad exclusive-OR (parity detector) (SCL-5201). Solid State Scientific Montgomeryville, Pa. 18936.

Circle Reader Service #**232.**

POWER BOOSTER



You can use the Model 3329/03 in cascade with all general purpose op amps. It functions as a high current output stage and is used inside the feedback loop as though it were an integral part of the op amp. Unit price is $20.00. Burr-Brown Research Corp., International Airport Industrial Park, Tucson, Ariz. 85706. (602) 294-1431.

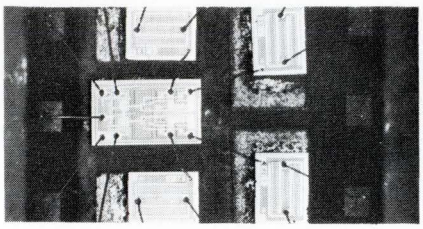
Circle Reader Service #**233.**

MULTIPLEXER

The MP4108 8-channel MUXPAC™ offers 2000 MΩ input impedance and −80 dB crosstalk in applications to 200 kHz. It functions in single-ended or differential mode, and includes buffered feedback for positive switch control. $130.00 ea. Analogic Corp., Audubon Rd., Wakefield, Mass. 01880.

Circle Reader Service #**234.**

FET SWITCH/DRIVERS



This line includes the DG151A series (military) and DG151B series (industrial) of 2-channel, SPST and DPST switch/drivers. Also being offered are the DG161A (military) and DG161B (industrial) single channel, SPDT and DPDT switch/drivers. Silconix Inc., 2201 Laurelwood Rd., Santa Clara, Calif. 95054. (408) 246-8000.

Circle Reader Service #**235.**

LOW POWER MSI DEVICES

The 93L01 and 93L28 offer one-fourth the power consumption at 40% the speed of the original 9301 and 9328 devices. The 93L01 is a BCD to decimal decoder, while the 93L28 is a high-speed, dual 8-bit shift register. Advanced Micro Devices Inc., 901 Thompson Pl., Sunnyvale, Calif. 94086.

Circle Reader Service #**236.**

TEN BIT D/A CONVERTER

Each DAC-49 is a complete converter and requires no external components for operation. You can select unipolar or bipolar outputs by externally programming the units. Full scale output can be either 0 to +10 V or ± 5 V at 5 mA. Output settling time to $\pm 0.1\%$ is 25 μs. Varadyne Systems, 1020 Turnpike St., Canton, Mass. 02021. (617) 828-6395.

Circle Reader Service #**237.**

CORE MEMORY SENSE AMP

The μA761 is a two-channel core memory sense amplifier with a 25 ns response time and a typical threshold accuracy of ± 2 mV. Independent strobe inputs on each channel enable the amplifier during core peaking times. You can combine the device with the MSI 9314 quad latch to provide a complete memory data register. Fairchild Semiconductor, 464 Ellis St., Mountain View, Calif. 94040. (415) 962-3563.

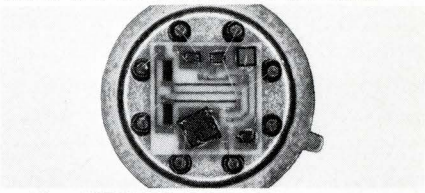
Circle Reader Service #**238.**

MOS 1024-BIT DYNAMIC SR

This four-phase register operates up to 1.0 MHz with a 25 pF load. The register interfaces with standard MOS input and output levels, and can be serially coupled to form higher orders. Operating range is −55 to 125°C and the arrays come in 14-lead flatpack or DIP. Price $20.00 (100 quan.). Collins Radio Co., MOS Marketing Dept. 600, Newport Beach, Calif. 92663.

Circle Reader Service #**239.**

LOW INPUT CURRENT OP AMP

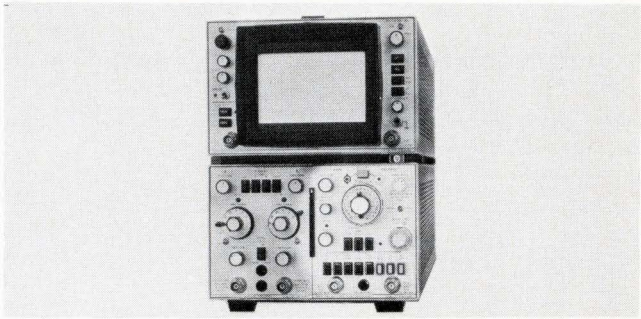


The ICH8500/ICH8500A includes a monolithic op amp, a pair of MOS FETs, a junction FET constant current source and a thin-film resistor network. The ICH8500A has a max. input current of 0.01 pA from −25 to 85°C while the ICH8500 features 0.1 pA over the same range. $28.25 ea. for the ICH8500 (100 pcs) and $29.77 ea. for the ICH8500A. Intersil, 10900 N. Tantau Ave., Cupertino, Calif. 95014. (405) 257-5450.

Circle Reader Service #**240.**

LAB INSTRUMENTS

DELAYED SWEEP PLUG-IN



This oscilloscope time-base plug-in has a delayed sweep that gives 1 ns/cm sweep time. Designed for use with HP's 183 series oscilloscopes, the Model 1841A plug-in has 21 sweep times ranging from 10 ns/cm to 0.1 s/cm. Delay time is selected by a 10-turn control working across the time range selected by the sweep time switch. The X10 magnifier in the main frame gives 1 ns/cm sweep time on the fastest range, a practical sweep time in view of the 183A/B's fast writing speed of 4 cm/ns. Price, $1150.00 with delivery time 8 wks. Inquiries Manager, Hewlett-Packard Co., 1601 California Ave., Palo Alto, Calif. 94304.

Circle Reader Service #**241.**

DIGITAL PLOTTER

The Auto-Pro 3500 accepts serial data from a time-share computer or parallel data in dedicated computer applications. Designed expressly to process time share data from scientific instruments, you can use it as both an incremental digital plotter and a 10 in. analog strip chart recorder. Because of its high and low speed input capability, (110 or 300 baud) the plotter/recorder can be used with modern high speed data terminals. It offers an input sensitivity of 100 mV full scale when used as an analog recorder. Technical Information Section, Automation Products Activity, Beckman Instruments, Inc., 2500 Harbor Blvd., Fullerton, Calif. 92634. (714) 871-4848.

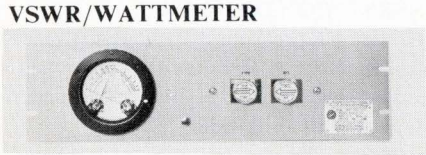
Circle Reader Service #**242.**

FOUR DIGIT DVM

Model 8110A has a dc accuracy of ±(0.01% of input +0.01% of range) for 90 days and is within ±(0.01% of input +0.02% of range) after six months. Six month ac and resistance accuracies are ±0.3% and ±0.02% with higher accuracies for shorter periods. The ac and dc ranges are 1, 10, 100, and 1000 V with 20% overranging on all ranges. Resistance ranges are 1, 10, 100, 1000 kΩ and 10 MΩ with 20% overranging. A rechargeable battery pack which can be installed in either the factory or field is priced at $100. $850.00. John Fluke Mfg. Co., Inc., Box 7428, Seattle, Wash. 98133.

Circle Reader Service #**243.**

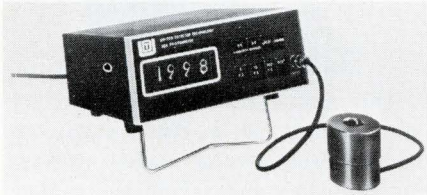
VSWR/WATTMETER



The THRULINE Model 3122 displays supplied power, reflected power and VSWR simultaneously on a single meter face. Forward and reflected power are shown by individual pointers and VSWR is monitored on a third scale from the intersection of the two power pointers. Bird Electronic Corp., 30303 Aurora Rd., Cleveland (Solon) Ohio 44139. (216) 248-1200.

Circle Reader Service #**244.**

PHOTOMETER/RADIOMETER



The Model 10A uses feedback techniques for short and long term stability and linearity. The instrument measures from 10^{-3} to 10^{5} ft. candles and ft. L or 10^{-9} W to 10^{-1} W within a spectral range from 2200 to 11,500 Å. You can also get a 10B telephotometer/microphotometer lensing system and fiber optics probes as accessories. United Detector Technology, 1732 21st St., Santa Monica, Calif. 90404.

Circle Reader Service #**245.**

FREQUENCY COUNTER

The Model 325B is a dc to 32 MHz frequency counter with five digits of stored display. Pushbutton selection of gate times provides resolution from 0.1 Hz to 1 kHz in decade steps. A 1 MHz crystal oscillator provides accuracies of 1 PPM over a 30 day period. Eldorado Electrodata Corp., 601 Chalomar Rd., Concord, Calif. 94520. (415) 686-4200.

Circle Reader Service #**246.**

LINEAR IC TESTER

You can use the Model 735 to test op amps, regulators and comparators with up to 14 individual tests. Test time is typically under 1 s. The tester has a master pass-fail indicator, individual lights for each parameter and a digital reading of all parameters. Prices start at $7850.00. Microdyne Instruments, 203 Middlesex Tpk, Burlington, Mass. 01803. (617) 272-5691.

Circle Reader Service #**247.**

FAST-SETTLING FET OP AMP

Model 1025 FET input op amp settles to 0.01% of final value in 300 ns. Designed for inverting applications, it also offers a wideband positive input with a ±2 V common mode range. Gain BW product is 50 MHz and open-loop gain is 100,000. Output is ±50 mA at ±10 V, with a slew rate of 500/μs over a temp. range of −25 to +85°C. $75.00 (1-9). Teledyne Philbrick Nexus, Allied Dr. at Rte 128, Dedham, Mass. 02026. (617) 329-1600.

Circle Reader Service #**248.**

SCR CAPACITORS

This family of SCR capacitors provides the low inductance and low effective series resistance (ESR) needed for commutating, or turning off, SCR circuits. Made with extended foil and other modifications, they can handle the high rep. rates and high peak currents found in commutating SCR circuits. Aerovox Corp., New Bedford, Mass. 02741. (617) 994-9661.

Circle Reader Service #**249.**

SOLDERING MATERIALS

These materials were designed to solve critical joining and cleaning problems found in microelectronic circuit manufacturing. Line includes microcreams, micropastes, microelectronic grade Vaculoy® solder, conductive inks, microfluxes, microdryer. Alpha Metals, Inc., 56 Water St., Jersey City, N.J. (201) HE 4-6778.

Circle Reader Service #**250.**

SS DISPLAY

MAN 1001, a GaAsP red SS readout comes in a 14-pin DIP. The new polarity and overflow unit features long operating life, compatibility with lv logic drive circuits, a 2-D display surface and a wide viewing angle. When used with the MAN 1, MAN 2 or MAN 3 readouts, it will display a plus or minus sign or a ±1. $15.75 ea. (1-9), $13.50 ea. (10 to 99) and $11.50 ea. (100 to 999). Monsanto Electronic Special Products, 10131 Bubb Rd., Cupertino, Calif. 95014. (408) 257-2140.

Circle Reader Service #**251.**

PHOTOTRANSISTORS

New CLT 2100 line of high gain phototransistors provides light currents to 12 mA at 5 V and 5 mW/cm. Dark currents are 25 nA at 10 V with collector-to-emitter breakdown voltages to 50 V. From $1.15 to $1.38 (500 quan.). Clairex Electronics, 560 S. Third Ave., Mt. Vernon, N.Y. 10550.

Circle Reader Service #**252.**

HF TUNING CAPACITORS

Capacitance of these precision capacitors can be adjusted with linearities as low as 0.3%. A patented contacting mechanism provides long life with > 100,000 tuning cycles. $3.00 to $7.75. Johanson Mfg. Corp., 400 Rockaway Valley Rd., Boonton, N.J. 07005. (201) 334-2676.

Circle Reader Service #**253.**

SS LIGHT PEN

Model LP 200 light pen is for symbol sensing and editing functions in modern high data rate CRT displays. It features 3 μs response time, < 2 fL sensitivity, interchangeable optics and a touch actuated switch. Information Control Corp., 9610 Bellanca Ave., Los Angeles, Calif. 90045. (213) 641-8520.

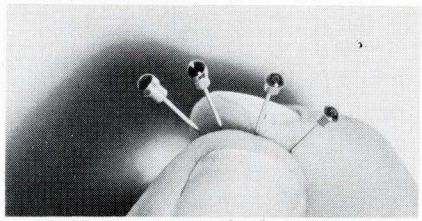
Circle Reader Service #**254.**

GaP CRYSTALS

These gallium phosphide single crystals are for production use in light emitting devices. Available in both ingot and polished wafer form, they may eventually replace many filament-type lamps. Imanco, 40 Robert Pitt Dr., Monsey, N.Y. 10952. (914) 356-3331.

Circle Reader Service #**255.**

SOLID STATE LAMPS



Solid-Lite red light-emitting lamps use GaP electroluminescence for brighter light at lower current. Compatible with IC output, they produce 2 mcd luminous intensity at only 15 mA drive current. OSL-1 provides wide-angle viewing with good visibility over 180°; OSL-2 features higher luminous intensity with a narrower viewing angle. OPCOA Inc., 330 Talmadge Rd., Edison, N.J. 08817.

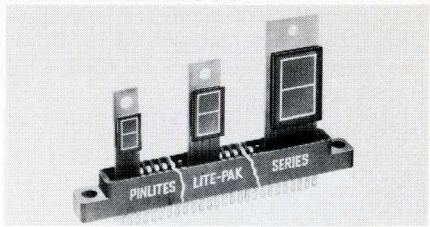
Circle Reader Service #**256.**

SERVO CONTROLLER

Here's a precision "Bang Bang" controller that can translate the analog signal of any transducer into a controller function. The Model 551 Voltsensor controller has an input Z >50 kΩ and input overload capability of ±200 V. $68.00 ea. fob factory. ($47.60 ea. at 100 pcs.). California Electronic Mfg. Co., Inc., Box 555, Alamo, Calif. 94507. (415) 932-3911.

Circle Reader Service #**257.**

DIGITAL READOUT



This digital readout plugs directly into a std. 0.050 in. center edge connector solving existing readout packaging problems and saving space. The Lite-Pak display also features low voltage (3 to 5 V), low current (as low as 8 mA), and long life (100,000 h). It is readable in direct sunlight and has distortion-free viewing. Pinlites Inc., 1275 Bloomfield Ave., Fairfield, N.J. 07007. (201) 226-7724.

Circle Reader Service #**258.**

DIFFERENTIAL AMPLIFIER

Open loop gain of 2 x 10^3 and freq. response to 5 mHz are features of the Ampac™ MP215 ±10 V inverting amp. It slews at 30 V/μs and settles to 0.01% in 1.5 μs. The TC is 20 μV/°C. Input $\not\equiv$ is 10^{11} Ω, input bias current only 50 pA and noise only 15 μV rms. Output is ±10 V at 20 mA, short-circuit-proof to ground. $80.00 ea. Analogic Corporation, Audubon Rd., Wakefield, Mass. 01880. (617) 246-0300.

Circle Reader Service #**259.**

WIDEBAND OP AMP

Model 9491A op amp has a guaranteed 6 dB/octave roll-off rate typically beginning at 1.5 MHz and crossing unit gain at 1 GHz min. Closed loop BW in excess of dc to 300 MHz are practical just by using a feedback resistor and an input resistor. Open loop gain is 60 dB min., and min. slewing rate is ±1000 V/μs. $60.00 (1-2), $54.00 (3-9) and $49.00 ea. (10-29). Optical Electronics, Inc., Box 11140, Tucson, Ariz. 85706. (602) 624-8358.

Circle Reader Service #**260.**

MODULAR POWER SUPLIES

LW series supplies perform at >50% efficiency at current ratings to 200 A and voltage ranges to 48 Vdc. Self-restoring current limiting and a self-resetting thermostat provide full protection. Features include remote sensing, remote programming, and complete serviceability. Lambda Electronics Corp., 515 Broad Hollow Rd., Melville, N.Y. 11746. (516) 694-4200.

Circle Reader Service #**261.**

CLEAR CASTING RESIN

After cure, Stycast 1269-A epoxy casting resin becomes so crystal-clear that it can be used in optical applications such as windows, and lenses. Thus, shatterproof lenses and windows are possible, and lenses can be cast to exact size and shape eliminating costly grinding. An interesting, recently developed application is the encapsulation of LEDs. The two part system cures in 16 hrs at 210°F. $2.35/lb. (16 lb. kit). Emerson & Cuming, Inc., Canton, Mass. 02021. (617) 828-3300.

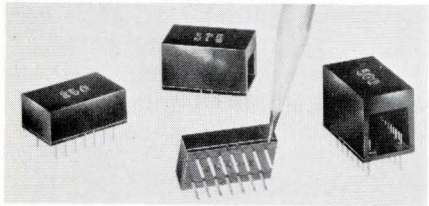
Circle Reader Service #**262.**

VC XTAL OSCILLATORS

Model 6668 WA, a 20 MHz VCXO, (voltage controlled crystal oscillator) can be modulated at rates up to 75 kHz with a resulting fm distortion of <3%. Frequency deviation is ±0.1% (±20 kHz pk). Other models in the 5 to 35 MHz range are available with deviation and modulation capabilities varying in proportion to center freq. Damon Corp., 115 Fourth Ave., Needham Heights, Mass. 02194. (617) 449-0800.

Circle Reader Service #**263.**

HEADERS WITH CAPS

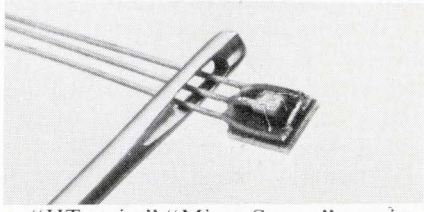


These 14-pin headers, with caps, have gold plated pins laid out in the std. 0.100 x 0.300 in. DIL grid. U-shaped openings in the tops of the pins accept component leads to wire size 24. Soldering is the normal means of component attachment. $0.75 to $1.20 ea. (< 100 pcs.). Design & Production Associates, 1600 N. Arrowhead Ave., San Bernardino, Calif. 92405. (714) 886-8612.

Circle Reader Service #**264.**

NEW PRODUCTS

SMALLEST PHOTOSENSOR?



"HT-series" "Micro Sensor" consists of either a photo transistor or a photo-darlington sensor bonded to a ceramic substrate with three leads attached (emitter, base, and collector). HT-700 series offers low cost and fast switching speeds; HT-800 series has high gain and high sensitivity. The HT-700 is $1.51 and the HT-800 is $1.86 ea. in 100 lot quan. HEI, Inc., Jonathan Industrial Ctr., Chaska, Minn. 55318. (612) 448-3510.

Circle Reader Service #**265.**

DIP TRIMMERS

Two new DIP model pots are for machine insertion and production soldering on PCBs. Series 2600 (wire-wound element) dissipates 1 W at 40°C. It comes in a range from 10Ω to 50 kΩ with std. tol. of ±10%. Series 8600 (film element) dissipates ¾ W at 25°C in a range from 10Ω to 2 MΩ. Intermediate values (100Ω through 500 kΩ) are available with ±10% tol. All other values have ±20%. Dale Electronics, Inc., Dept. 860, Box 609, Columbus, Nebr. 68601.

Circle Reader Service #**266.**

ILLUMINATED ROCKER SWITCH

This switch, which features front access for easy lamp replacement, mounts in a 0.655 x 0.730 in. panel cutout. Rocker switch units come in three circuit configurations, with a DPDT design. Contact rating is 5 A at 125 Vac; contact resistance, 10 mΩ Max. (at 2-4 Vdc, 1 A); and ins. res., 1000 MΩ at 500 Vdc. Shelly Associates, 111 Eucalyptus, El Segundo, Calif. 90245. (213) 322-2374.

Circle Reader Service #**267.**

VDR FOR COLOR TV TUBES

The AZ 9501 voltage dependent resistor used with the appropriate line transformer and high voltage cascade, produces the focus voltage for color picture tubes. It has a solder fuse which assures greater protection for the color receiver against increases in VDR current. $1.30 ea. Siemens Corp., 186 Wood Ave. So., Iselin, N.J. 08830. (201) 494-1000.

Circle Reader Service #**268.**

INDUSTRIAL SCR'S

ID100-104 series devices feature hermetically sealed TO-18 JEDEC metal can packaging at prices competitive with plastic devices. They are for lv, low-current sensing applications. Prices start at $0.45 ea. in 1000 lots. Unitrode Corp., 580 Pleasant St., Watertown, Mass. 02172. (617) 926-0404.

Circle Reader Service #**269.**

CHIP CAPACITORS

Type MB multilayer chip capacitors are for use in hybrid circuits. Range is 10.0 pF to 1.0 μF. They are available in four proposed std. EIA sizes and std. capacitance values. Temperature range is −55° to +125°C. Standard ratings are 50, 100, and 200 Vdc. Allen Bradley Co., 1201 S. 2nd St., Milwaukee, Wisc. 53204.

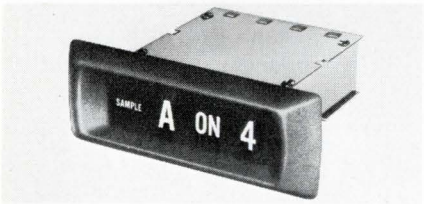
Circle Reader Service #**270.**

ONE COMPONENT EPOXY

This family of fast cure, one component epoxies is useful for end sealing capacitors, potting electronic components, heat sink bonding, lead bonding and PCB coating. Polymer Products Div., Amicon Corp., 21 Hartwell Ave., Lexington, Mass. 02173. (617) 862-7050.

Circle Reader Service #**271.**

MINIATURE READOUT



Series 0400 display features 0.50 in. message, viewable at 10 ft.; 60 fL brightness using 6 V lamps; front panel access; 0.752 in. center-to-center spacing, and a total weight of only 3 oz. Input is straight decimal (1 lamp/input terminal); or BCD with IEE driver/decoder. Industrial Electronic Engineers, Inc., 7720-40 Lemona Ave., Van Nuys, Calif. 91405. (213) 787-0311.

Circle Reader Service #**272.**

CHIP RESISTOR

Model 110 semiconductive glass resistors span a range from 10^8 to 10^{11} Ω. Chip size is 0.050 x 0.100 x 0.012 in. Operating temp. is −270° to +200°C with a TCR of −0.3%/°C max. $2.00 ea. (1000 pcs.). Eltec Instruments Inc., Box 46, Lancaster, N.Y. 14086. (716) 683-8421.

Circle Reader Service #**273.**

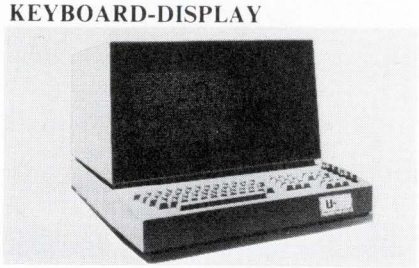
SYSTEMS

MODULAR A/D CONVERTERS

These converter modules are available in 8 (ADC-8H) and 10 bit (ADC-10H) resolutions and accuracies. The ADC-8H is $195.00 (1-9) and the ADC-10H is $225.00 (1-9). Features include: small size (2 x 4 x 0.4 in.); 5 input voltage options; binary, offset binary, 2's complement and BCD codings; speed (18 μs, max. for 10 bits); parallel and serial output standard; and various ext. connections for complete system compatibility. Analog Devices, Pastoriza Div., 221 Fifth St., Cambridge, Mass. 02142. (617) 492-6000.

Circle Reader Service #274.

KEYBOARD-DISPLAY



Model 522 keyboard-display is a complete stand-alone system that can be substituted directly for teletype equipment. It contains keyboard, CRT display, memory, power supply and communications interface. It has selectable transmission rates to serve low and medium speed time-sharing as well as high-speed communications. Uni-Comp Incorporated 18219 Parthenia St., Northbridge, Calif. 91324. (213) 886-7722.

Circle Reader Service #275.

4800 BPS MODEM

Modem 4500/48 is for users who require dedicated full duplex service. It calls for Type 3002, C-2 lines. The data set automatically equalizes, (without special programming) and then adaptively tracks any changes in the amplitude or delay distortion characteristics of the line. International Communications Corp., 7620 N.W. 36th Ave., Miami, Fla. 33147. (305) 691-1220.

Circle Reader Service #276.

VIDEO SWITCH

Model VS50P can switch video by inserting unit directly in 50 or 93 Ω line. It operates in 70 ns. Isolation is 70 dB, insertion loss 0.4 dB, and video BW 20 MHz. The built-in switch driver is compatible with micrologic. $195.00. Analog Research, Box 22023, Dallas, Tex. 75222. (214) 521-7056.

Circle Reader Service #277.

ABSTRACTS

Published information is vital to your job. To save time in finding this information, we have abstracted the important technical features from eight electronic engineering publications. Should any of these articles interest you, contact the magazine. Reprints of articles with an asterisk are available free. Save this section for future reference.

Charts and Nomographs

Find insertion loss at a glance, F. Calandra and H. Hausman, Cutler-Hammer, "Electronic Design," Vol. 18, No. 23, Nov. 8, 1970, pp. 78-79. A chart is presented for finding the midband insertion loss for Butterworth bandpass filters from the first through the tenth orders, as a function of the ratio of loaded Q to unloaded Q.

Versatile table simplifies convolution, C. W. Carlock, General Dynamics Corp., "Electronic Design," Vol. 18, No. 22, Oct. 25, 1970, pp. 66-67. You're provided with a table that gives the results of the convolution of several pairs of exponential functions. Two examples are worked.

Circuit Design

DC motor control is easy with transistors, Fred W. Kear, Sparton Southwest, "EDN," Vol. 15, No. 20, Oct. 15, 1970, pp. 41-43. Mr. Kear briefly describes five simple circuits to control dc motors. The circuits are specifically identified for use in motor starting and stopping, constant speed control, overload and overspeed protection, and speed sensing.

Want a bandpass filter?, Bud Broeker, Motorola Semiconductor Products Inc., "Electronic Design," Vol. 18, No. 22, Oct. 25, 1970, pp. 76-78. Commutating filters operate over a wide frequency range, are small, can vary resonant frequency, and provide easy bandwidth adjustment. Use of commutating filters to build simple low-pass filters is discussed.

Sensitivity—key to analog active filters, EDN Staff, "EDN," Vol. 15, No. 21, Nov. 1, 1970, pp. 17-25. This report describes the state-variable method for the design of active filters. Sensitivity—the percent change in a filter's characteristics caused by percent changes in the filter's components—receives special emphasis. There is also a brief discussion of programmable filters.

One adjustment controls many regulators, Robert C. Dobkin, National Semiconductor, "EDN," Vol. 15, No. 21, Nov. 1, 1970, pp. 33-35. Mr. Dobkin points out that the internal reference voltage of IC voltage regulators may vary as much as 10% from unit to unit. In power supply systems with more than one voltage, it is often technically and economically desirable to adjust all supplies from a single potentiometer. He shows how to do this in light of the reference-voltage variations, and gives application examples of positive-negative, multiregulator supplies.

Designing sampling phaselock loops, Dieter Lohrmann, U.S. Army Electronics Command, "Electronic Design," Vol. 18, No. 23, Nov. 8, 1970, pp. 74-76. Sampling phaselock loops make it very easy to lock the VCO to a high-order harmonic of the reference signal, and produce very little spurious output. They are difficult to design because their stability is complicated. An approximate stability criterion is suggested that applies over a wide range of disturbance frequencies.

Communications

Information: Its measure and communication, Richard D. Brugger, Elgin Electronics Inc., "Computer Design," Vol. 9, No. 11, Nov. 1970, pp. 115-120. Discrete message transmission systems are brought into perspective through a discussion of pertinent aspects. In this article the author contends that the nature of information is often obscured by hardware that "information" brought about. His discussion contains the basis for a description of information, channel capacity, and entropy.

Digital Design

Data-programming modules for matrix-board control systems, Herb Martin, Interswitch, "Computer Design," Vol. 9, No. 11, Nov. 1970, pp. 123-126. The data-programming module offers you an important solution to panel-programming problems. The author discusses the "hows" and "whys."

Frequency comparator performs double duty, Reginald C. E. Thomas, Sunstrand Aviation, "EDN," Vol. 15, No. 21, Nov. 1, 1970, pp. 29-32. Mr. Thomas states that only a few phase-comparison circuits are capable of producing a correct-polarity error signal when frequency errors are large. Such applications must use either a dual-mode phase comparator, or a phase and frequency comparator. The author describes three new circuits which transfer from frequency to phase comparison when the input frequencies are equal, and give definitive responses for simultaneously-occurring input pulses. The circuits each use several IC packages, but are amenable to construction on a single, silicon chip.

Three-level logic eliminates inverters, Edmond Vinarub, Reflectone, Inc., "Electronic Design," Vol. 18, No. 24, Nov. 22, 1970, pp. 56-57. Gate count can be reduced by using 3-level NAND logic. The penalty is increased propagation time through the network. Three examples are worked.

What truth tables don't tell you, Ron Treadway, Motorola Semiconductor Products, Inc., "Electronic Design," Vol. 18, No. 23, Nov. 8, 1970, pp. 68-72. Timing and loading considerations for using flip-flops are not listed in truth tables. This article examines the problems of flip-flops in a system, and gives a set of design criteria that overcome them. Edge clocking is used to eliminate some of them.

Integrated Circuits

***What's available in MSI?,** Larry Beck and Walter Richard, Honeywell Inc., Framingham, Mass., "The Electronic Engineer," Vol. 30, No. 1, Jan. 1971, pp. 25-35. Here's a tabular listing of commercially available bipolar digital MSI circuits. The table groups the circuits by function and includes a listing of the manufacturers for each circuit.

Miscellaneous

***1971: the year of conversion,** Staff Report, "The Electronic Engineer," Vol. 30, No. 1, Jan. 1971, pp. 21-23. This is the year when a host of new markets will reveal their potential for growth. Video recording, data terminals, point-of-sale systems, information storage systems, and automotive electronics are among the markets promising to lead the industry in this decade.

The employment problem: Can IEEE help?, John V. N. Granger, President, IEEE, "IEEE Spectrum," Vol. 7, No. 11, Nov. 1970, pp. 32-33. Ex-president Granger of the IEEE presents the results of an IEEE Board of Directors meeting which considered the possibility of a change in organizational direction. The results are disappointing for those searching for a new outlook. The only change from the traditional role is an increased emphasis on specialized retraining, while IRS rules prevent the IEEE from being more of an activist society.

Test and Measurement

The latest word in leak detection, Irving Litant, NASA, "EDN," Vol. 15, No. 20, Oct. 15, 1970, pp. 35-38. Many of us work with hermetically-sealed products such as transistors, ICs, relays, and so forth. According to Mr. Litant, there are many ways to detect leaks in such packages, but only a few can accurately determine the leak rate, and still fewer can pinpoint the leak site itself. The author supplies a brief discussion of gross and fine leak test procedures, and tells of the shortcomings of present methods. Mr. Litant then concludes with a description of a new leakage test developed at NASA.

LITERATURE

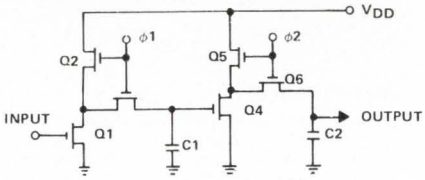
TTL Family catalog

Here are 112 pages (plus a fold-out chart) of solid product information describing probably the most complete line of TTL circuits available today. These logic, memory, and interface functions are standard, off-the-shelf building blocks that interface directly with each other. Because the line is extensive, you can choose almost any speed/power combination that you may need. Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif. 94040.

Circle Reader Service #**361.**

MOS/LSI catalog

Filled with circuit diagrams, this 212-page catalog clearly illustrates and describes 34 standard MOS/LSI circuits. You'll find complete specs for 15 shift registers (from a dual 16-bit to a dual 512-bit), eight read-only memories/character generators, programmable logic arrays (and how to program these logic circuits), a 128-bit content-addressable memory, a digital differential



Basic cell for a dynamic shift register

analyzer, and a six-stage frequency divider. In addition you're provided with information on MOS/LSI system compatibility, packaging, custom MOS/LSI, and interfacing MOS/LSI with TTL/DTL logic families. This comprehensive catalog is offered to you by Texas Instruments Inc., Box 5012, M/S 308, Dallas, Tex. 75222.

Circle Reader Service #**362.**

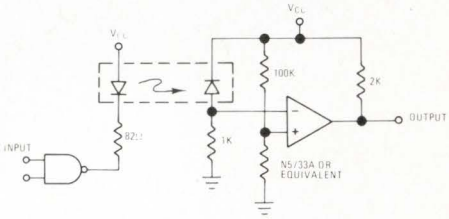
1971 component catalog

Fixed, variable, and step attenuators and rf components are detailed in this 1971 catalog. Application and design data is featured in a special 20-page section. This includes information on power dividers, terminations, mismatches, and connectors as well as attenuators. The 80-page catalog also provides illustrations of featured products and detailed drawings of the interface dimensions of various connectors. This comprehensive catalog represents Weinschel Engineering, Gaithersburg, Md.

Circle Reader Service #**363.**

D/A converter

An entire D/A converter is incorporated into a single hybrid IC package. This 12-page application note discusses the use of this technology in the Model 845 D/A converter. Its construc-



Buffered, inverting DAC

tion is described in detail, while photos and block diagrams supplement the information given for the 8-bit thick film unit. Helipot Div., Beckman Instruments Inc., 2500 Harbor Blvd., Fullerton, Calif. 92634.

Circle Reader Service #**364.**

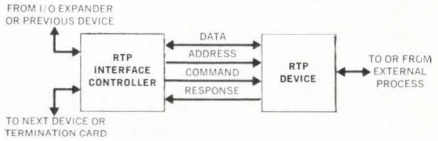
Fast settling amps

The basic types of fast settling amp responses plus the amps performance under various operating conditions are discussed in an application note. Phase shift and amplitude error introduced by stray capacitance are also covered. Formulas, charts, and tables pertaining to fast settling systems are included too. DDC, 100 Tec St., Hicksville, N.Y. 11801.

Circle Reader Service #**365.**

Peripheral devices

A series of peripheral devices that offer a new concept in computer-controlled, real-time system implementation is discussed in a 16-pager. The line is comprised of analog and digital input and output units that operate under the control of any modern, general-purpose digital



computer with the use of the universal I/O expander. Included in the series are high and low level analog input systems, D/A output systems, sample and hold D/A output systems, and various types of digital input/output systems. Computer Products, Box 23849, Ft. Lauderdale, Fla. 33307.

Circle Reader Service #**366.**

Semiconductor price list

More than 23,000 types of electron tubes and semiconductors are covered in this 60-page price list catalog. Within the 40 sections, you'll find data on industrial CRTs, microwave diodes, solid state tube replacements, transistors and SCRs, diodes and rectifiers, and ICs. You'll find the products of the best known manufacturers in this catalog brought to you by JSH Electronics Inc., Subs. of Varadyne Inc., Box 2898, Dept. NR, Culver City, Calif. 90230.

Circle Reader Service #**367.**

Transformer core laminations

Here's a 152-page loose-leaf notebook filled with information about transformer core laminations. Each page illustrates and describes a lamination shape and the variety of magnetic materials available for that particular shape. You'll also find information on tolerances, surface insulation, testing, packaging, design formulae, and applications. Magnetic Metals Co., Hayes Ave. at 21st St., Camden, N.J. 08101.

Circle Reader Service #**368.**

IC sockets and systems

Integrated circuit sockets, systems, and accessories are the subject of this 38-page catalog. You're given detailed information on dual-in-line, flat pak, and TO-5 IC products, as well as burn-in, breadboard, and wire wrapping systems for test and production. Photos accompany each product description, and charts provide necessary specs. Robinson-Nugent Inc., 800 E. Eighth St., New Albany, Ind. 47150.

Circle Reader Service #**369.**

MOS/LSI calculator circuits

Six chips make a calculator. Well, you still need a readout (or printer), a power supply, a cabinet, and a keyboard. But the six circuits described in this 12-page brochure provide all the logic required to implement an eight-digit, desk-top calculator. The brochure not only describes the circuit on each of the six chips (and provides a schematic for each), but also diagrams the interconnections necessary to make a calculator. Electronic Arrays Inc., 501 Ellis St., Mountain View, Calif. 94040.

Circle Reader Service #**370.**

Instrumentation rental

Hundreds of items by hundreds of manufacturers are featured in this 108-page instrumentation rental catalog. There's information and complete specs for transducers, oscillographs, tape recorders, oscilloscopes, amplifiers, digital systems, and computers, and many more. Products are indexed by manufacturer and model number so you're sure to find just what you're looking for. Datacraft Inc., 13714 S. Normandie Ave., Gardena, Calif. 90249.

Circle Reader Service #**371.**

Instant circuit boards

Here's a 16-page catalog that shows you how to go from schematic drawings to card cage systems in one step. A new packaging system, a complete family of circuit sub-elements and circuit materials, allows you to combine all types of circuit-element configurations on the same board. This time-saving idea is brought to you by Circuit-Stik Inc., 1518 W. 132nd St., Gardena, Calif. 90249.

Circle Reader Service #**372.**

LITERATURE

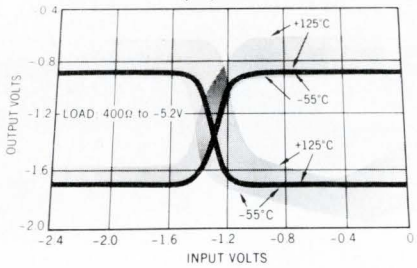
Circuit modules

A condensed product guide gives you 48 pages of material on functional circuit modules. With the designer in mind, the catalog serves as a reference manual for selection guidelines, application tips, and operating techniques for analog instrumentation. You're given complete product performance characteristics for analog computing components, op amps, nonlinear function modules, test instrumentation, and related equipment. Teledyne Philbrick Nexus, Allied Dr. at Rte. 128, Dedham, Mass. 02026.

Circle Reader Service #**373.**

ECL system applications

This 24-page booklet describes the manufacturer's 9500 ECL family, its system applications, and wiring rules. This series has 2- to 3-ns propagation delays, and is temperature-compensated for easy use in low-cost equipments. Besides describing the family members, the booklet goes into detail on wiring rules, microstrip, noise considerations, and special clock circuits to 100 MHz. Application Brief 157. Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif. 94040.



Circle Reader Service #**374.**

Computing counter applications

Sixteen new application notes have been added to H-P's Computing Counter Applications Library. The notes cover such topics as peak-peak phase deviation of a phase modulated signal, process control of thin film resistor deposits, limit testing, accumulative phase noise of a transmitter/receiver, and Doppler range errors. The applications are specifically designated for H-P's Computing Counter, an instrument with both computing and time measurement abilities. Hewlett-Packard Co., 1601 California Ave., Palo Alto, Calif. 94304.

Circle Reader Service #**375.**

Optical components

A 36-page brochure devotes itself to optical components and accessories. Featured are the company's optical interference filters with the humidity resistance required for general use outside a controlled laboratory environment. Also listed are exciter and barrier filters, a new low-cost line of neutral density filters with flat transmittance curves (from about 4,000 Å to 2.5 μm), and a series of laser line filters with peak transmittances up to 90%. Available from the System Components Div., Baird-Atomic Inc., 125 Middlesex Turnpike, Bedford, Mass. 01730.

Circle Reader Service #**376.**

Light-emitting diodes

A complete selector chart for GaAs light-emitting diodes provides data on wavelengths, brightness, power output, I_f, and V_f. The chart will help you to select the correct LED for such applications as card readers, tape readers, computer peripherals, optical logic drives, and panel indicating lights. And when you ask for the chart, you'll also receive a copy of "Semiconductor Report," news of the latest in technology, products, prices, and economics of the semiconductor industry. Semiconductor Specialists Inc., Box 66125, O'Hare International Airport, Chicago, Ill. 60666.

Circle Reader Service #**377.**

Creating social progress

A very readable 32-page brochure devotes itself to specific instances of aerospace-generated technology being applied to the solutions of domestic problems. Improving man's relationship to his environment, the major challenge of this decade, is discussed as related to such areas as air, water and land pollution, urban transportation, teaching methods and job training, crime control, and inadequate housing. The booklet offers solutions to the problems and explains that through the technology and techniques of the aerospace programs hopeful means are now possible. Available from the Publications Office, Aerospace Industries Association, 1725 DeSales St., N.W., Washington, D.C. 20036.

Circle Reader Service #**378.**

Data communication

Descriptions and specs for 11 ICC modems are provided in this 8-page catalog. The modems operate at speeds from 300 b/s up to 1 million b/s. Also included is information on multiplexers, transmission test equipment, and specialized modems for OEM users. For those interested in computer communication, this booklet is available from International Communications Corp., 7620 N. W. 36th Ave., Miami, Fla. 33147.

Circle Reader Service #**379.**

Surveillance antennas

A wide variety of broadband antennas is described in this 29-page guide. The antennas—loops, log periodics, omnidirectionals, dish and feed, and horns and spirals—span the frequency spectrum from 2 MHz to 18 GHz. Technical descriptions include gain and VSWR vs frequency, E- and H-plane radiation patterns, dimensions and weights, and so forth. Watkins-Johnson, 3333 Hillview Ave., Stanford Industrial Park, Palo Alto, Calif. 94304.

Circle Reader Service #**380.**

Oscillograph recording systems

Oscillograph recording of dynamic variables is covered in bulletin G-3. The 12-pager describes the components used in oscillograph systems and includes specs and prices for each. B&F Instruments Inc., Cornwells Heights, Pa. 19020.

Circle Reader Service #**381.**

Time sharing systems

Members of Honeywell's new series H1640 family of time-sharing systems are discussed in a most informative brochure. The systems, which are dedicated, conversational, and problem solving, are based on the first time-sharing system ever built by a computer manufacturer. The catalog provides complete descriptions for each member of the family, discusses the languages available, includes salient features of using such systems, and covers applications and peripheral options. Available from Honeywell, Computer Control Div., Old Connecticut Path, Framingham, Mass.

Circle Reader Service #**382.**

Electromagnetic indicators

Catalog P68-0570 describes five basic indicator types and explains how they may be used as single elements or as stacked assemblies operable from a variety of digital computer signals. Details relating to input codes, connections, electrical and mechanical characteristics, and construction are provided, as are schematics and a polarity excitation table. Singer-General Precision Inc., Kearfott Div., 1150 McBride Ave., Little Falls, N.J. 07424.

Circle Reader Service #**383.**

Programmable data terminal

An operator's manual for the company's 711 programmable data terminal includes complete keyboard operating instructions. The 28-page booklet details how to get on-line and off-line, discusses installation, storage and protection of the integral tape cassette cartridges, and provides simple maintenance and adjustment directions. Available from Daedalus Computer Products Inc., Box 248, N. Syracuse, N.Y.

Circle Reader Service #**384.**

LITERATURE

A/D-D/A converters

Detailed electrical and mechanical data for a line of ultra-mini A/D and D/A converters, in addition to accessory sample and holds, multiplexers, and mini PC power supplies, are contained in a comprehensive 28-page catalog. Various models of 10 series are described; the hardware discussed forms the basic building blocks for data acquisition, data analysis, data reproducing, and graphic display equipment. Varadyne Systems, 1020 Turnpike St., Canton, Mass. 02021.

Circle Reader Service #**385.**

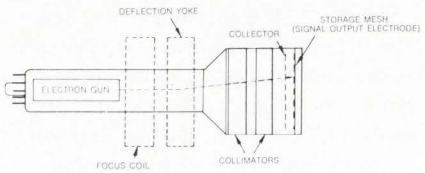
MOS clock driver

"A High Performance MOS Clock Driver" is an 8-page application note suggesting various uses of MOS clock line drivers. It discusses general considerations of clock line driving and details a complete four-phase system utilizing the Cermetek CH1033. Cermetek Inc., 660 National Ave., Mountain View, Calif. 94040.

Circle Reader Service #**386.**

Scan converter tubes

Do you know what it means to prime a storage tube? It's to charge the storage surface of a tube to determine a reference voltage for erasure. This and other terms you can find in the glossary included in this interesting booklet on scan converter tubes. Actually, the main feature of this booklet is a very clear explanation of the often misunderstood



Single-ended scan converter

principles of storage in converter tubes. Most of its 16 pages are packed with technical, yet clearly explained information, and it provides, as well, diagrams, characteristic tables and graphs, and fields for applications. Hughes Aircraft Co., Industrial Products Div., 2020 Oceanside Blvd., Oceanside, Calif. 92054.

Circle Reader Service #**387.**

Precision switches and assemblies

Hermetically sealed and high temperature switches are covered in catalog 72-2. The 15-pager contains operating characteristics, definitions, dimensional data, and schematics for the series, as well as suggested applications. Haydon Switch and Instrument, Inc., 1500 Meriden Rd., Waterbury, Conn. 06720.

Circle Reader Service #**388.**

Connector design guide

Plate connector and molded connector products are described in this 36-page design guide. It explains the design and construction of components for wire-wrapped plate systems, and illustrates numerous plate connectors and PC components. A variety of standard and special configurations are illustrated for center-to-center terminal spacings of 0.050 to 0.200 in. National Connector Div., Fabri-Tek Inc., 9210 Science Center Dr., Minneapolis, Minn. 55428.

Circle Reader Service #**389.**

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WELCOME

Talk about technology

First the fixings—new facilities and the right equipment—and then the people, and as of May 1, Unisem, formerly the Electronic Components Division of United Aircraft, was on its own. Finding operations uncomfortable with ECD's ground rules, United Aircraft decided to spin it off as a separate corporation. Other personnel came from Union Carbide's recently sold semiconductor division, including the new company's president, Jim Paris.

Mr. Mauri Morin, director of marketing, describes his company's capability in MOS/LSI as "a technology that is unique to the industry. We are the only people today that can consistently manufacture MOS/LSI integrated circuits that are completely bi-polar compatible, both in input and output, without any external components at all." Unisem attributes this capability to a simple engineering process that their engineers came across, and it works repeatedly.

In the area of hybrids, Unisem boasts of the capability of putting down ten layers of metal on a ceramic substrate prior to placing the components. The repeatable process allows 30 IC chips to be completely interconnected regardless of the number of layers required to cover all functions.

As for JFETs, Unisem is pushing monolithic dual JFETs, "because they are truly state-of-the-art and because of their leadership position in technology." Although their products are not oriented towards distribution, Unisem believes "the JFETs represent a good market for distribution and provide a good base from which to work into the hybrid market."

Rf power transistors constitute an area less state-of-the-art than the other areas the company is working with, but Unisem believes it will find more attention in the near future.

Located in Trevose, Pa., the company now employs approximately 275 people. Believing that they are in a market that is very flexible and that requires a fast response to growth and change, the founders structured their organization vertically. "The man responsible for MOS knows that his job begins with the engineering and continues until the product exits out the back door." Unisem believes this flexibility is a necessity in the ever-changing electronics market of today.

Circle Reader Service #**495.**

Great 'Standards' by the Power Professionals

We set out to engineer standardized power modules with some pretty high standards to meet. Yours. We had two things going for us. Nearly four decades of *custom* power experience . . . and, the determination to make an off-the-shelf line that was not merely good . . . but great! It paid off.

North's standard power units offer you real cost economy plus the utmost in reliability. May we suggest you look over our catalog . . . then take your *own measure* with a test unit.

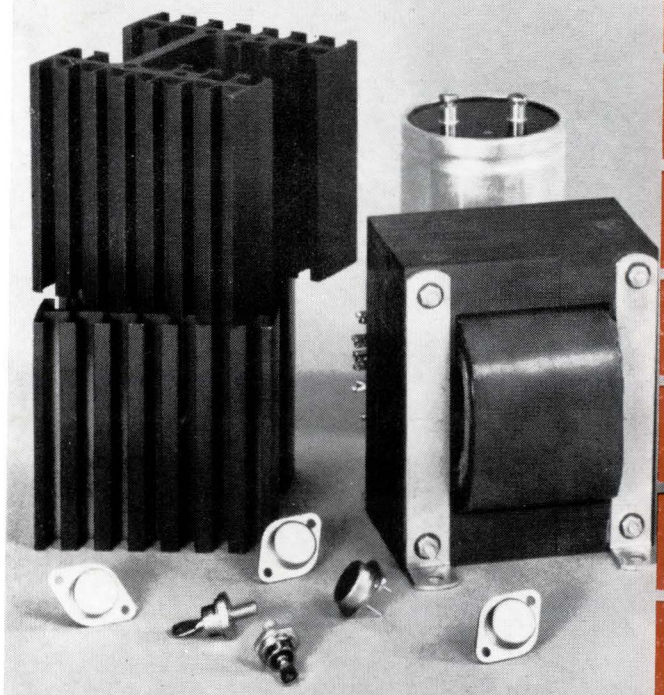
Call 419/468-8244 or TWX 419/468-4860.

North Electric Company • Electronetics Division / Galion, Ohio • A subsidiary of United Utilities, Incorporated

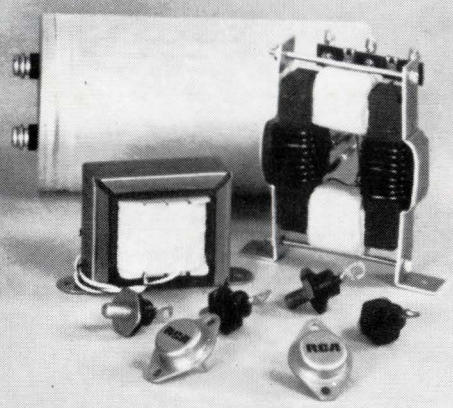
NORTH ELECTRIC

NSP-8

Cut the Size of Your Power Supply in Half with Fast, High-Voltage Transistors from RCA.



Conventional 5 V, 25 A Supply



New 5 V, 50 A Supply

RCA

For details and application note, write: RCA, Commercial Engineering, Section 59A/UT14, Harrison, N.J. 07029

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