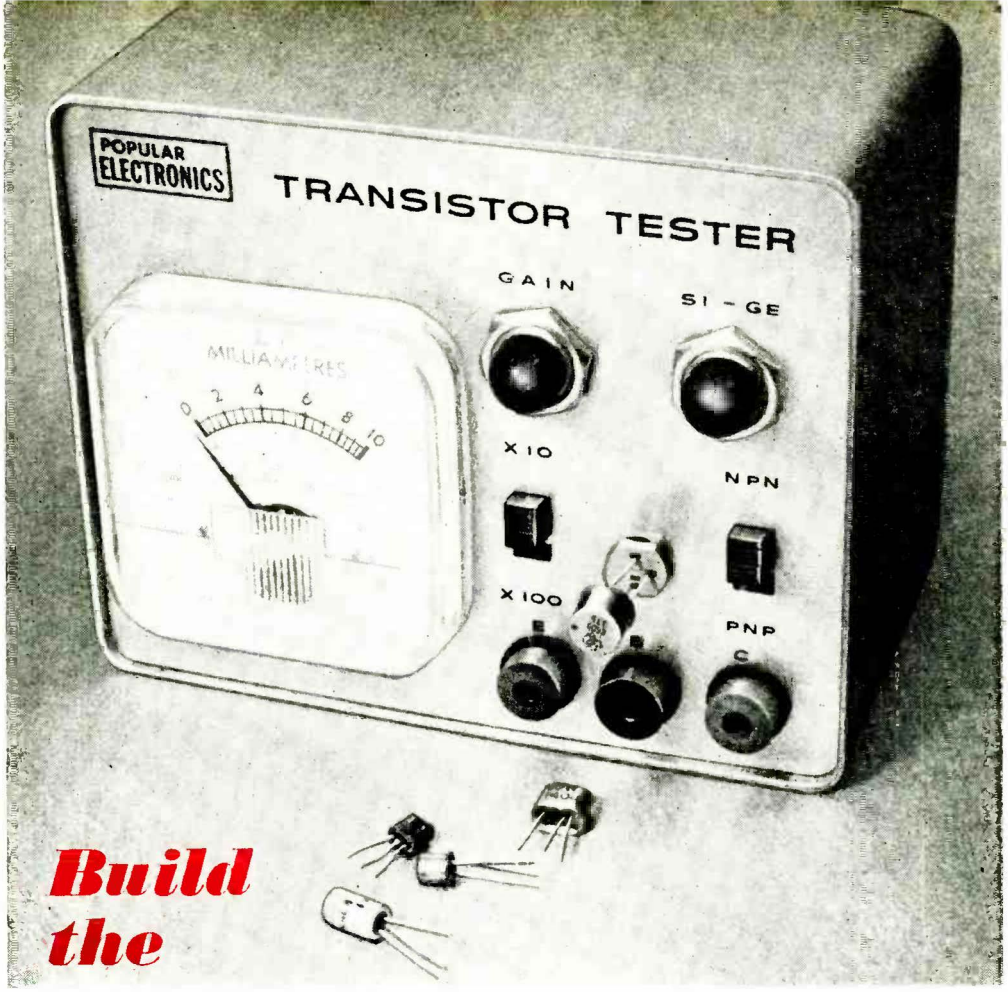


Build the NGW Transistor Tester

STOP WONDERING—
THE "NO-GUESS-WORK"
TESTER CHECKS FOR
SILICON-GERMANIUM
AND NPN OR PNP

BY DON LANCASTER

HAVE YOU been tempted to buy a package of those transistor assortments that are being offered for only pennies-per-transistor? Perhaps you have some unmarked transistors (or transistors with production numbers that are meaningless to you) collecting dust in your spare parts box. How can you tell what types of transistors you have and what condition they are in? The answer is simple: build the transistor tester described on the following pages.

This transistor tester is a simple instrument that you can construct for $10 or less. It will check just about any transistor or semiconductor diode for interelement shorts, opens and leakage, and will check transistors for gain. The tester will tell you if a transistor under

test is *npn* or *pnp* and whether it is silicon or germanium.

Construction. The transistor tester's circuitry can be housed in any convenient size metal or plastic case, and since the parts arrangement is not critical, almost any type of chassis construction can be used. The photo on page 59 shows the method used in the prototype.

Since most transistors you are likely to test will have a TO-5 type case con-

HOW IT WORKS

When a small amount of base current controls a large amount of collector current in a transistor, amplification takes place. In most modern transistors, d.c. current gain is essentially equal to the small-signal a.c. current gain all the way up to the low MHz region. This tester measures d.c. current gain by applying a known amount of base current to the test transistor, and then displays the collector current gain on meter *M1*. (When the collector current is divided by the base current, the result will be the d.c. gain of the transistor under test, and this is the figure that will be indicated on the meter.)

All transistors are tested under 1 to 10 mA collector current conditions—about the operating range of most small-signal transistors. Gain for power transistors will be lower than for small-signal types since the power transistor's gain curve peaks somewhere between 100 and 1000 mA. Resistor *R1* serves as a collector load—or current limiter—for all transistors under test, and *R2* and *R3* (when *S3* is set to *X100*) control base current.

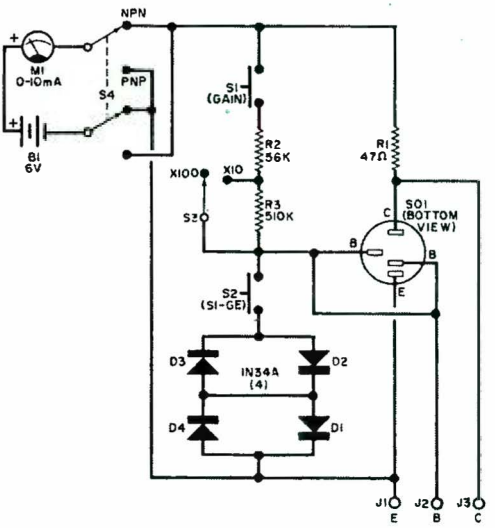
Switch *S2* and diodes *D1* through *D4* form the *SI-GE* test circuit. For normal bias, the base voltage of a silicon transistor will be 0.6 volt and base voltage of a germanium transistor will be 0.2 volt. Two germanium diodes connected in series (*D1* through *D4* are germanium types) require 0.4 volt to conduct—a potential halfway between *GE* and *SI* base voltages. To eliminate complex switching, two germanium diodes are operated in each direction, providing *npn* and *pnp* testing capability.

Diodes are tested on a go/no-go basis when they are connected to the tester as described in "Testing Diodes" (see text).

PARTS LIST

B1—Four 1.5-volt "AA" penlight cells
D1, D2, D3, D4—1N34A germanium diode
J1, J2, J3—Banana jack (one red, one blue, one green)
*M1—0-10-mA d.c. milliammeter**
*R1—47-ohm, ½-watt resistor**
R2—56,000-ohm, ½-watt resistor
R3—510,000-ohm, ½-watt resistor
S1, S2—S.p.s.t. momentary-action, normally-open push-button switch
S3—S.p.s.t. slide switch
S4—D.p.d.t. slide switch
SO1—TO-5 transistor socket
1—3" x 4" x 5" aluminum box—see text
Misc.—Double AA battery holders (2), external test leads (3), banana plugs (3), #10 nylon cup washers for feet (4), wire, solder, hardware, etc.
Optional—Metalphoto hard-anodized aluminum dialplate, available from Reill's Photo Finishing, 4627 N. 11th St., Phoenix, Ariz. 85014, in silver color for $2.75, in red, gold, or copper for $3.25, postpaid in U.S.A.; specify stock #TRT-1

*The combined resistance of *R1* and *M1* should lie between 200 and 300 ohms.

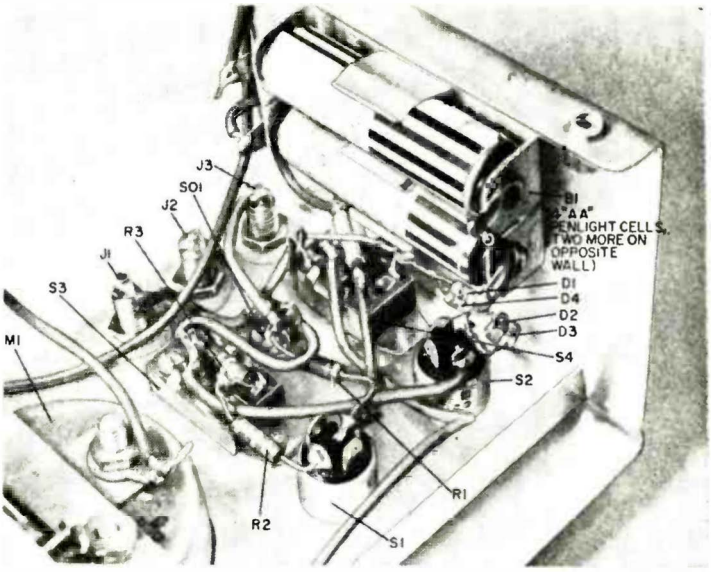


Note that there are two base contacts on SO1 to accommodate both the TO-5 triangular lead configuration and the older in-line arrangement.

TESTING TRANSISTORS

1 Set multiplier switch to X100 and identity switch to NPN. Insert transistor into socket or connect transistor to appropriate leads
2 Meter should not deflect—if meter does deflect, discard transistor; it is shorted.
3 Depress SI-GE push button. If meter deflects, transistor is PNP. If meter does not deflect, transistor is NPN. If there is no meter reading in either position of identity switch, transistor can be discarded; it is open.
4 Change identity switch to proper position for type of transistor and note meter reading—it should be very low. Silicon transistors produce a zero reading; germanium transistors (non-power) will read less than 1 mA.
5 Depress GAIN push button and adjust multiple switch for less than full-scale reading. This reading is d.c. current gain of transistor (scale times multiplier).
6 Verify silicon/germanium transistors by depressing both GAIN and identity push buttons. If meter reading remains the same or drops slightly, transistor is germanium. Drop of meter reading to zero indicates silicon.

If you wish, you can cut out this convenient chart and paste it on the case of the transistor tester.



Internal layout of the author's model showing location of all parts. This layout is recommended for best duplication.

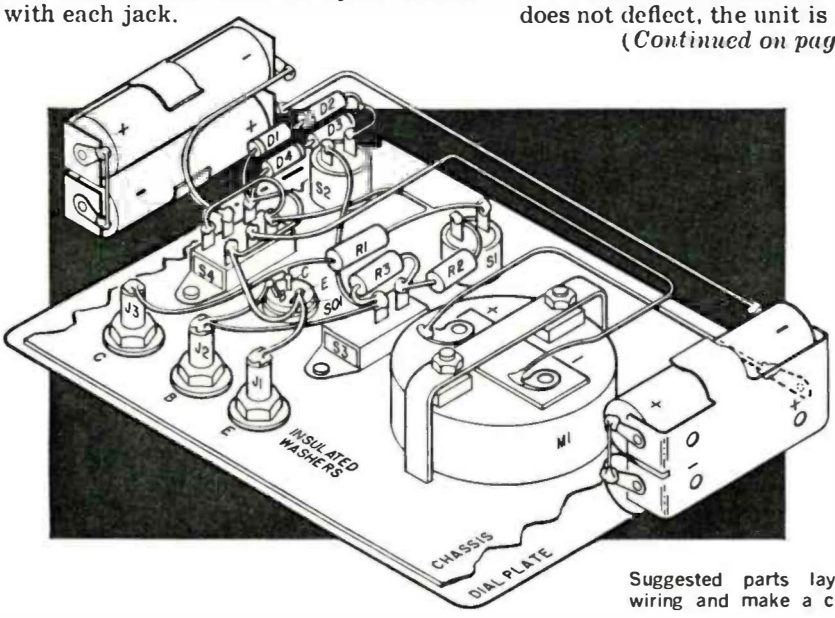
figuration, you should mount a TO-5 transistor socket in a convenient and accessible location on the front panel of the instrument (see photo on page 57). For transistors with other than a TO-5 case configuration, three banana jacks are mounted at the bottom of the front panel to make the proper connections via short test cables.

The banana jacks (*J1* through *J3* in the schematic diagram) must be insulated from the chassis, using one shoulder and one flat fiber or nylon washer with each jack.

Testing Transistors. The approach to testing a given transistor is simple and straightforward. The procedure need not take more than a minute, and with practice, you can cut the testing time down to a few seconds.

First set switches *S3* and *S4* to the *X100* and *NPN* positions, respectively, and connect the transistor to be tested via the external test cables or plug it into the transistor socket. If the pointer of meter *M1* should swing fully up-scale, the transistor is shorted; if the pointer does not deflect, the unit is okay.

(*Continued on page* 98)

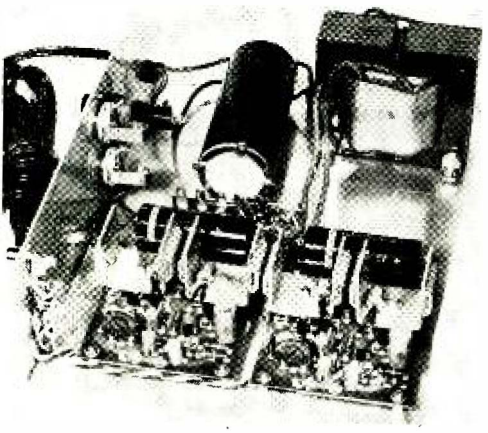


Suggested parts layout to simplify wiring and make a clean-looking unit.

L'IL TIGER

(*Continued from page* 33)

Just set the 500-ohm potentiometer for minimum resistance, apply voltage to the circuit, then reset the potentiometer for a current reading of about 5 mA. Measure the resistance of the potentiometer and install a fixed resistor of the next largest standard value in place of it. Make sure that this new resistor does not cause the idle current to increase above 10 mA; reduce the value of the resistor used for *R6* to the next smaller standard value if it does.



A pair of "L'il Tiger" amplifiers and common power supply can be mounted in a chassis for stereo use.

The "L'il Tiger" can be used with almost any transistor preamplifier, but the 5000-ohm input impedance is too low for many tube preamps.

Caution: Be careful not to short the heat sinks to each other while you are working on the amplifier with the protective cover removed. Remember that the heat sinks are connected directly to supply voltage and ground, respectively. Shorting them together will not harm the circuit, but will blow the fuse. Conventional microphone jacks have been used as output connectors to minimize chances of shorting the output of the amplifier. With no signal applied, a shorted output will cause no harm, but it could damage the output transistors if a large signal were applied. -30-

NGW TRANSISTOR TESTER

(*Continued from page* 59)

Depress the *S1-GE* (*S1* for silicon and *GE* for germanium) switch (*S2*). If the meter pointer goes to full-scale deflection, the transistor is a *pnp* unit; if no deflection is observed, it is an *npn* unit. If the meter deflects, move switch *S4* to *PNP* and the pointer should return to zero. If no deflection is observed in either position of *S4*, the transistor is open.

With the *NPN-PNP* switch (*S4*) in the proper position, as determined above, read the transistor's leakage current. Leakage for a germanium transistor should generally be less than 1 mA, zero for silicon transistors. (Consult a transistor manual if you observe excessive leakage for germanium power transistors. Leakage in excess of 1 mA for some germanium transistors can be normal.)

Depress *GAIN* switch *S1*, and if the meter shows less than 1 mA, set *S3* to *X100*. Multiply the meter reading by the value indicated by the position of *S3*. This is the d.c. current gain of the transistor. No meter indication means that the transistor has an interelement open.

With *S1* closed, depress *S2*. If the meter pointer deflection remains the same or drops slightly, the transistor is a germanium unit. If the indication should drop to zero, the transistor is silicon. A simplified step-by-step testing procedure that can be pasted on the tester appears on page 58.

Testing Diodes. Connect the anode of the diode to be tested to the *C*ollector jack (*J3*); the cathode goes to the *E*mitter jack (*J1*). When *S4* is then set to *NPN*, the meter should deflect fully upscale. Now set *S4* to the *PNP* position; there should be no deflection. (Full-scale deflection is obtained in both positions of *S4* when the diode under test is shorted; there is no deflection when the diode is open.)

Zener diodes with less than 6 volts breakover potential (E_{bo}) will normally produce a slight meter indication when *S4* is set to *PNP*. The tester will *NOT* check tunnel diodes, trigger diodes, constant-current diodes, or four-layer diodes. -30-