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 |
| S1, S2 | S.p.s.t. momentary-action, normally-open push-button switch |
| S3 | S.p.s.t. slide switch |
| S4 | P.d.t. slide switch |
| SO1 | TO-5 transistor socket |
| Misc. | Double A.A battery holders (2), external test leads (3), banana plugs (2), 10 nylon cup washers for jct (4), wire, solder, hardware, etc. |

Optional—Metalphoto hard-anodized aluminum dialplate, available from Reed’s Photo Finishing, 627 N. 33rd St., Phoenix, Ariz. $7.00 in silver color for $2.75 in red, gold, or copper for $3.25, postpaid in U.S.A.; specify stock #TK-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.
configuration, 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.

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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 \( R_6 \) to the next smaller standard value if it does.

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 shortened output will cause no harm, but it could damage the output transistors if a large signal were applied.

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

NGW TRANSISTOR TESTER
(Continued from page 59)

Depress the \( SI-GE \) (\( SI \) for silicon and \( GE \) for germanium) switch (\( S_2 \)). 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 \( S_4 \) to \( PNP \) and the pointer should return to zero. If no deflection is observed in either position of \( S_4 \), the transistor is open.

With the \( NPN-PNP \) switch (\( S_4 \)) 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 \( S_1 \), and if the meter shows less than 1 mA, set \( S_3 \) to \( X100 \). Multiply the meter reading by the value indicated by the position of \( S_3 \). This is the d.c. current gain of the transistor. No meter indication means that the transistor has an interelement open.

With \( S_1 \) closed, depress \( S_2 \). 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 Collector jack (\( J_3 \)); the cathode goes to the Emitter jack (\( J_1 \)). When \( S_4 \) is then set to \( NPN \), the meter should deflect fully upscale. Now set \( S_4 \) to the \( PNP \) position; there should be no deflection. (Full-scale deflection is obtained in both positions of \( S_4 \) 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 \( S_4 \) is set to \( PNP \). The tester will NOT check tunnel diodes, trigger diodes, constant-current diodes, or four-layer diodes.