

# Project Special

A collection of small projects for the experienced constructor.

## COMPONENT CURVE TRACER JOE TRIES

This is a simple circuit that checks the voltage versus current characteristic of a particular component. It works in conjunction with any oscilloscope that can work in the X-Y mode (as opposed to the sweep mode; the vertical amplifier becomes the input and the sweep circuit (or other vertical amplifier) becomes the other). Standard, easy-to-obtain components are used for the construction.

The peak voltage across the test probes is rated at approximately 17VAC. A peak current of 1.7mA will flow through the probes when they are shorted together. These parameters are safe and useful for testing many components.

### How It Works

The tracer circuit uses the oscilloscope X-axis to display the voltage (17Vp-p) and the scope Y-axis to display the current (1.7mA p-p). With this in mind, an open circuit on the probe will be displayed as a straight horizontal line. A short circuit will be seen as straight vertical line.

With a 10k resistor connected across the probes, a straight line at 45° will be displayed. Differing resistors can be related to the 10k resistor by observing the angle that they make on the oscilloscope screen.

Reactive components (*ie*, capacitors and chokes) will provide an elliptical trace. Experimentation with good, known component types and values will establish what an acceptable trace is.

Switch S1 can be closed to permit a full-wave signal to be applied to the probes; this means that both a positive- and negative-going voltage will be applied across the tested component. Thus, the

forward and reverse current that results can be observed.

With SW1 open, diode D1 is placed in series with the circuit; this provides a positive half-wave signal to the probes (they are polarized by color-coding for this purpose). In this way, polarized components (*eg* electrolytic capacitors) can be tested for charging, leakage or breakdown voltage.

An ideal diode will display a short when forward-biased and an open when reverse-biased. Real diodes can be distinguished as being silicon or germanium by the voltage drop across them during forward-bias (0.7V for silicon and 0.3V for germanium). A zener diode's breakdown voltage can be obtained when the screen is read for the knee voltage (the point where the zener begins to conduct current when forward-biased; the actual voltage

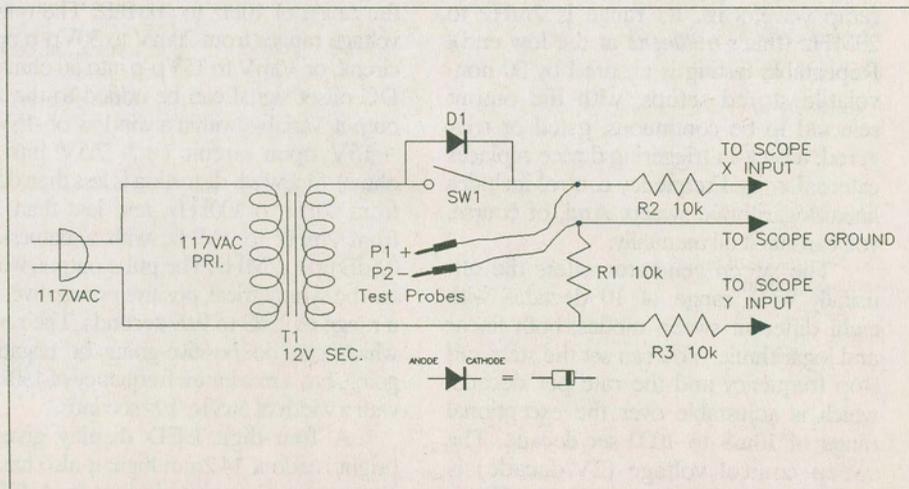
depends on the type number).

An appropriate interface must be made between this circuit and the oscilloscope. The scope's input connectors may be banana or BNC; use whatever connectors are required.

Resistors R2 and R3 are used to prevent damage to the transformer in the event of an accidental short between connectors P1, P2 or P3.

### PARTS LIST

R1-3 10k, .25W, D1 1N4001 or 1N4148, T1 power transformer with 117VAC primary and 12VAC secondary, current rating 50mA or more, with power cord, SW1 SPST slide or toggle, P1, P2 red (+) and black (-) test probes, plus suitable connectors for scope inputs, suitable case, perfboard, etc.



The circuit diagram for the Component Curve Tracer. Because of its simplicity, no PCB is shown.