

IF YOU OWN A NEW, OR OLD, FREQUENCY COUNTER THAT will operate up to 50 MHz, but not 650 MHz, then here's a project for you! For under \$50.00 in parts, which includes two IC's, you can add a battery-operated, amplifying 650-MHz Prescaler Probe to your existing frequency counter. Now, compare that to purchasing 500-MHz counters in the \$200 to \$250 price range, and 650-MHz counters in the \$400, and better, price range.

Further, the 650-MHz Prescaler Probe isn't just a prescaler IC with about 800-mV of sensitivity. No way! Our probe uses a Plessey SL952 wide-bandwidth RF amplifier that's usable to 1 GHz, providing a typical sensitivity around 4 to 20 mV,

fronting an old-reliable Fairchild divide-by-10, 650-MHz 11C90 chip to get the job done.

How the Circuit Works

The 650-MHz Prescaler Probe's input is terminated by resistor R1 (Fig. 1) and is fed through C1 to the diode limiter composed of D1 through D4. Those diodes are forward-biased by the +5-volt supply for small-input signals and, in turn, feed the signal to U1. However, for larger input signals, diodes D1 through D4 will start to turn off, passing less of the signal, and, thus, attenuating it. But even in a full-off state, the FH1100-type diodes will always pass a small part of the

650-MHZ AMPLIFYING



PRESCALER PROBE

By D.E. Patrick

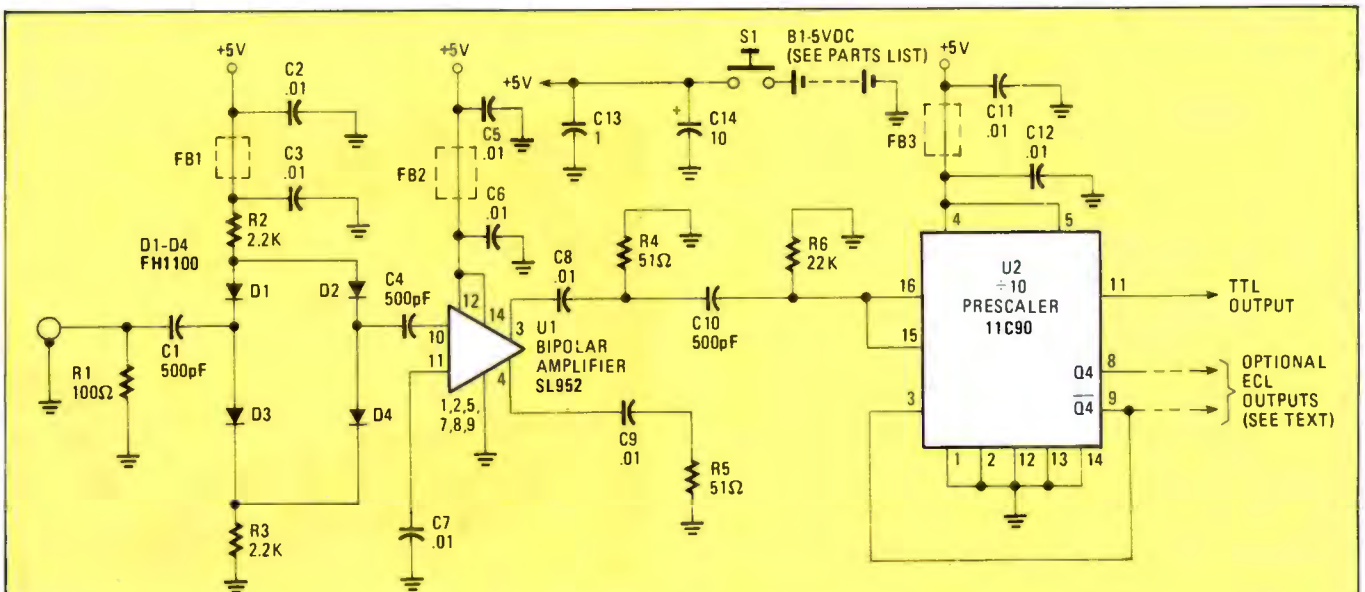


FIG. 1—IT TAKES more space to draw the probe's diagram than it does to lay it out on a perf-board.

input to U1 because of capacitive leakage within the diodes.

Integrated circuit U1, a Plessey SL952 bipolar amplifier, capable of 1-GHz operation, provides 20 to 30 dB of gain. The input signal is supplied to pin 10. U1 with the other input (pin 11) bypassed to ground. The output signal is taken at pin 3 and pin 4, with pin 3 loaded by R4 and pin 4 by R5.

Integrated circuit 11C90, U2, is a high-speed prescaler capable of 650-MHz operation configured for a divide-by-10 format. A reference voltage internally generated appears at pin 15 and is tied to pin 16, the clock input. That centers the capacitive-coupled input voltage from U1 around the switching threshold-voltage level. An ECL-to-TTL converter in U1 provides level conversion to drive TTL input counters by tying pin 13 low. Therefore, no external ECL to TTL converter is required at the pin-11 output.

On the other hand, ECL outputs are available at U2, pin 8 (Q4) and at pin 9 (Q4), if desired. In that circuit configuration, pin 13 is left open, and U2 will use less power.

Construction Hints

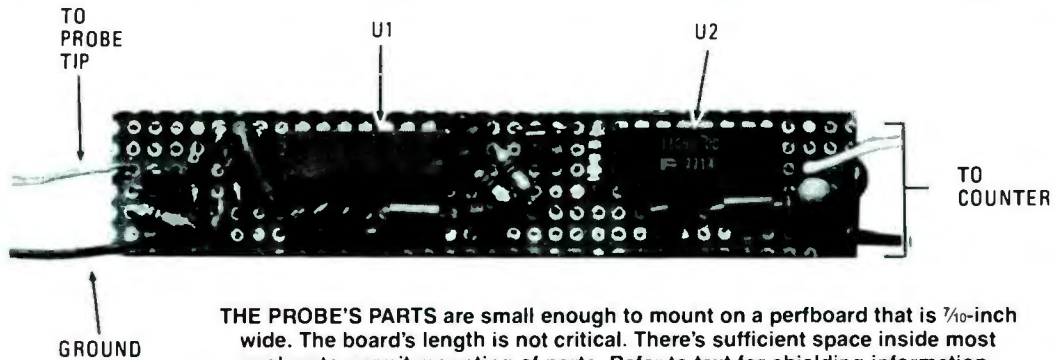
Layout and shielding at proper points are critical, because of the high gain and small size of the probe. To eliminate

problems, use the parts layout provided. Further, a shield should be placed between U1 and U2, and the entire probe circuitry encapsulated in a metal inner-case, albeit a plastic outer-case may be used to prevent any possible shock.

Some final notes

It should be pointed out that at frequencies from 50 MHz to 650 MHz, frequency counters and prescaler front-ends are much more sensitive to misuse. For example, you might get away with coupling a transmitter into the front end of a 10- to 50-MHz counter with a high-impedance front end having protection diodes going to ground, although even that's pushing things. But trying the same thing with the typical bridge used in this project will lead to disaster. If you need to couple the counter to a transmitter, try loosely coupling it with a coil of wire.

And a good rule of thumb at such high frequencies is not to push more than a volt, or so, at most high-frequency counters or scope-sampling units. For example, you can blow some 1- to 10-GHz scope samplers costing over \$3000 by just overdriving the beasts with 1 volt; the same thing applies here and with most prescalers and counters. ■



THE PROBE'S PARTS are small enough to mount on a perfbboard that is 7/10-inch wide. The board's length is not critical. There's sufficient space inside most probes to permit mounting of parts. Refer to text for shielding information.



PARTS LIST FOR 650-MHz AMPLIFYING PRESCALER PROBE

SEMICONDUCTORS

D1-D4—FH1100 diodes
U1—SL952, Plessey bipolar-amplifier integrated circuit
U2—11C90 Fairchild prescaler integrated circuit

RESISTORS

(All fixed resistors are 1/4-watt, 5% carbon-film types, or equivalent)
R1—100-ohm
R2, R3—2200-ohm
R4, R5—51-ohm
R6—22,000-ohm

CAPACITORS

(All capacitors are monolithic, or small disc types except when indicated otherwise)

C1, C4, C10—500-pF
C2, C3, C5-C9, C11, C12—.1- μ F to .01 μ F
C13—1- μ F
C14—10- μ F, 10-WVDC tantalum

ADDITIONAL PARTS AND MATERIALS

FB1, FB2, FB3—ferrite beads (ETC FBS100, or equivalent)
S1—Momentary pushbutton switch
B1—5-volt mercury or lithium battery
Printed-circuit board or perfbboard, probe with internal shield, wire, solder, mounting hardware, etc.

A complete set of parts is available from Electronic Technical Consultants (ETC), P.O. Box 29278, Denver, CO 80229 for \$50.00 plus \$10.00 for postage and handling.