OPERATING AND SERVICE MANUAL

LOGIC PROBE

10525A

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The Hewlett-Packard Company certifies that this instrument was thoroughly tested and inspected and found to meet its published specifications when it was shipped from the factory. The Hewlett-Packard Company further certifies that its calibration measurements are traceable to the U.S. National Bureau of Standards to the extent allowed by the Bureau's calibration facility.

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LOGIC PROBE

10525A

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Printed: JAN 1971

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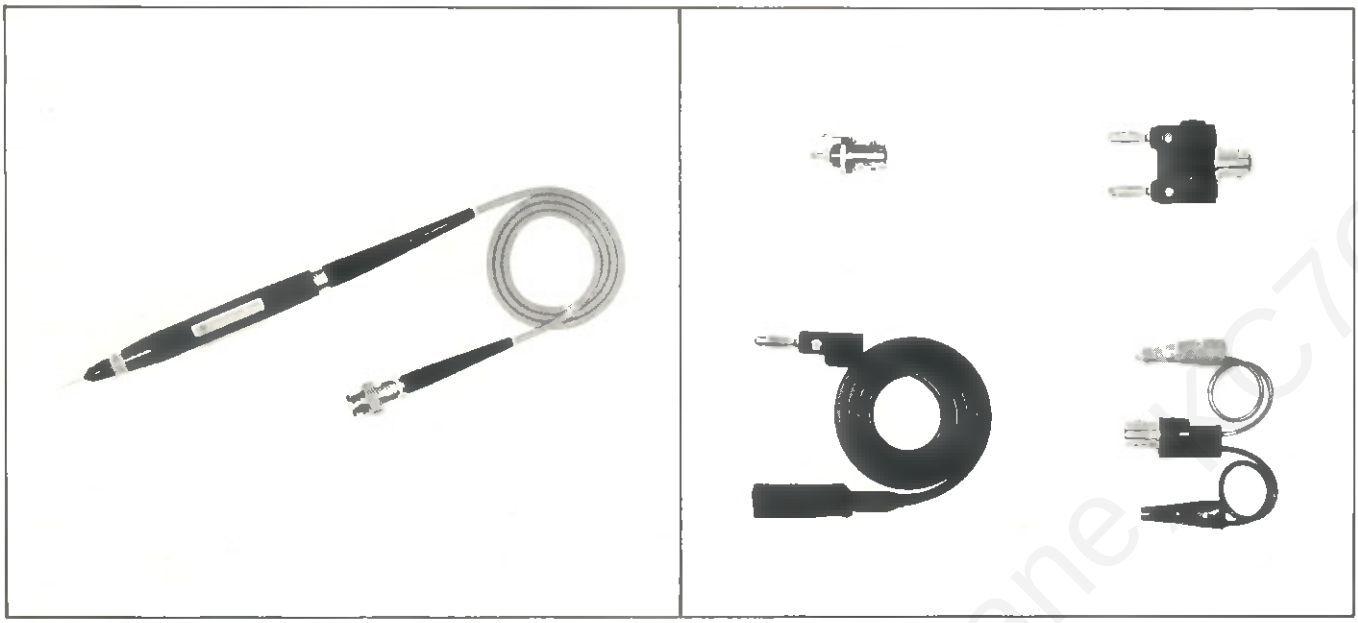
Figure 1. Model 10525A and Accessories



SPECIFICATIONS

Input Impedance: 10K ohm nominal.

Triggering Threshold: +1.4V nominal.

Pulse Width Sensitivity: Better than 30 nanoseconds for 2.0 volt positive or negative pulses referenced symmetrically about +1.4V.

Environment: 0° to +55°C.

Power Requirements: +5 volts ± 10%, 75 mA.

Input Overload Protection: -50V to +200V continuous
-200V to +200V transients
120VAC for 10 seconds

Power Supply Input Protection:
Probe is protected against forward and reverse supply voltages to 7 volts, but can withstand higher voltages if the power source is current-limited to 150 mA.

1. GENERAL INFORMATION

2. The Hewlett-Packard Model 10525A Logic Probe (Figure 1) will detect and indicate logic levels, and the presence and polarity of single pulses 30 nanoseconds or greater in duration. With 10K input impedance and +1.4V triggering threshold, it is compatible with most DTL and TTL Integrated Circuits. Accessories supplied with the Probe are shown in Figure 1.

3. The indicator lamp, which is part of the Probe, will give the user an immediate indication of the conditions existing in the circuit under test. Lamp indications are discussed in Paragraph 11, Applications.

4. IDENTIFICATION

5. A three-digit number on each Logic Probe printed circuit board is a series number used for documentation purposes. The series number identifies a group of instruments and is not unique for any given Logic Probe within the series.

6. INITIAL INSPECTION

7. If the shipping package is damaged, ask that the carrier's agent be present when package is opened. Inspect the Logic Probe for obvious physical damage (dents, scratches, etc.). If the Logic Probe is damaged or fails to meet specifications, notify carrier and nearest Hewlett-Packard Sales and Service office immediately. (Sales and Service offices are listed at the back of this manual.) Retain shipping package and packaging material for carrier's inspection. The Sales and Service office will arrange for replacement of your Logic Probe without waiting for claim against carrier to be settled.

8. ENVIRONMENTAL

9. Conditions during operation should be limited as follows:

a. Minimum temperature: 0°C (+32°F)

b. Maximum temperature: +55°C (+131°F).

10. Conditions during storage and shipment should be limited as follows:

a. Minimum temperature: -40°C (-40°F).

b. Maximum temperature: +75°C (+167°F).

11. APPLICATION

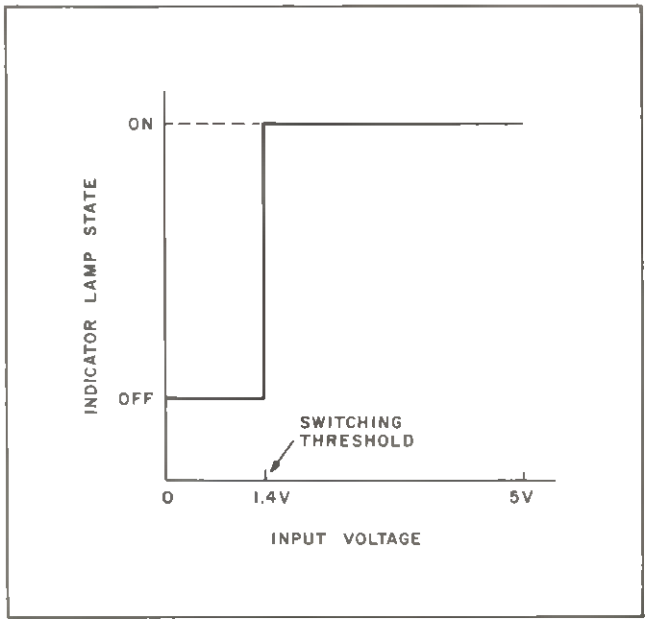
12. The Logic Probe is designed for pulse and level tracing in Integrated Circuit networks using TTL (transistor transistor logic), DTL (diode transistor logic), or any logic where the levels fall in the operating range of the Probe.

13. Power requirements are +5V ± 10%, 75 mA applied through the Probe cable from the unit under test or an external power supply. When an external power supply is used, the ground jumper should be kept short to minimize noise pick-up, which could produce false triggering.

CAUTION

Keep dc voltage less than ±7V, unless power supply is current-limited to 150 mA.

Figure 2. Level Detection



14. When the Logic Probe is used to detect logic levels, the indicator lamp will be on when the input is "High" and off when the input is "LOW", giving an indication of a Logical "1" or "0" (Figure 2). With power applied and no connection to a circuit, the probe lamp will normally be "ON".

15. The Logic Probe is ideal for detecting pulses of short duration and low repetition rates that would normally be very difficult to observe on an oscilloscope. Positive pulses 30 nanoseconds or greater in width are stretched and cause the indicator to flash on for 100 ms. This is shown in Figure 3. Negative pulses similarly cause the indicator lamp to momentarily extinguish. High frequency pulse trains, too fast for the eye to follow, are indicated by partial illumination of the indicator.

16. The indicator on-time vs. input pulse width is shown in Figure 4 and it can be seen that the minimum "on" (or off time, for negative pulses) is 1/10 second. The maximum time is dependent on input pulse width.

17. Several logic circuit analysis techniques lend themselves for use with Logic Probes. One technique

Figure 3. Pulse Detection and Stretching Action

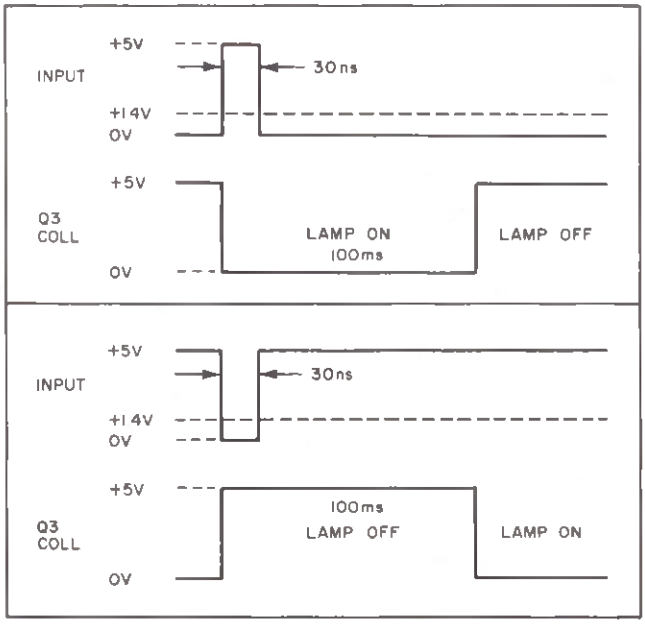
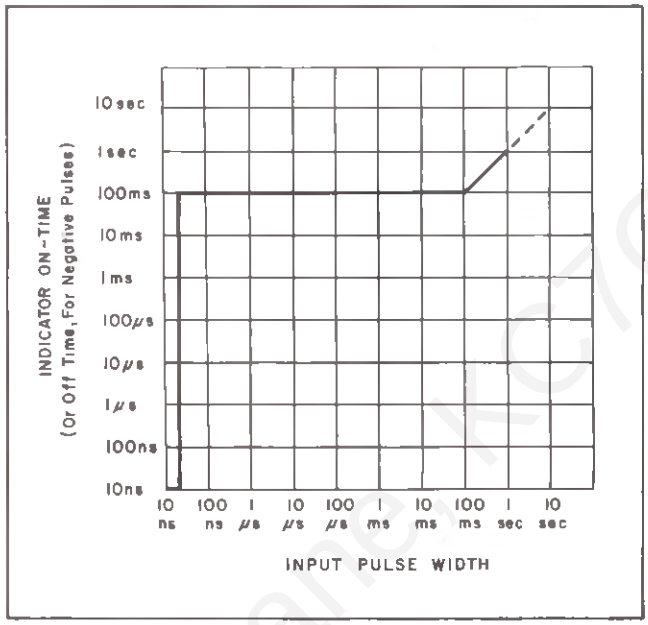


Figure 4. Indicator On/Off Time vs Input Pulse Width



is to run the circuit under test at its normal clock rate, while checking for "key" logic pulses such as reset, start, shift, transfer, or clock. Questions such as "is a particular decade counting?" are easily resolved by noting if the probe's indicator is partially lit, which only occurs when fast repetition pulse trains are monitored.

18. Another analysis technique consists of replacing the normal fast clock signal with a very slow clock signal from a pulse generator, for example, the HP Model 8003A. The logic changes in the circuit under test will occur at a rate sufficiently slow that individual level changes and timely pulse occurrences can be observed on a real time basis. This real-time analysis coupled with the probe's features of automatic triggering and tip-mounted indicator contribute to efficient circuit diagnosis and defective IC identification.

19. THEORY OF OPERATION

20. The block diagram is shown in Figure 5 and the schematic in Figure 6. The input amplifier is protected against over-voltage by CR1, CR2, and R1. The amplifier raises the input impedance and sets the

Figure 5. Block Diagram

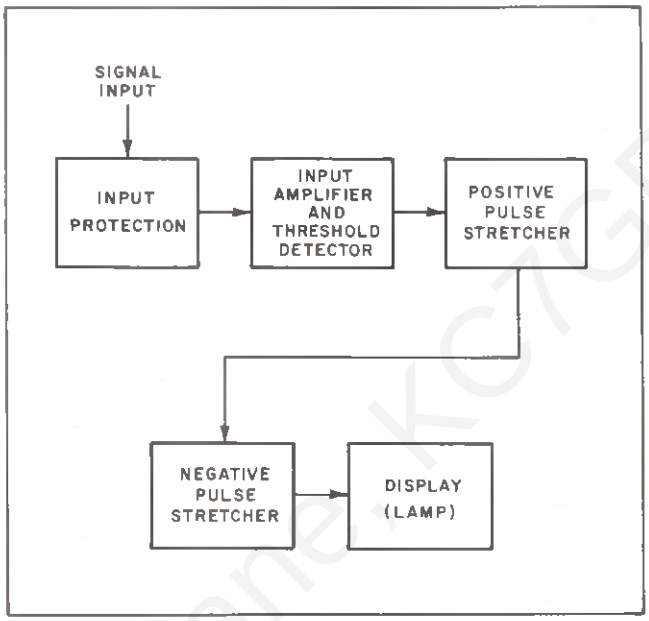
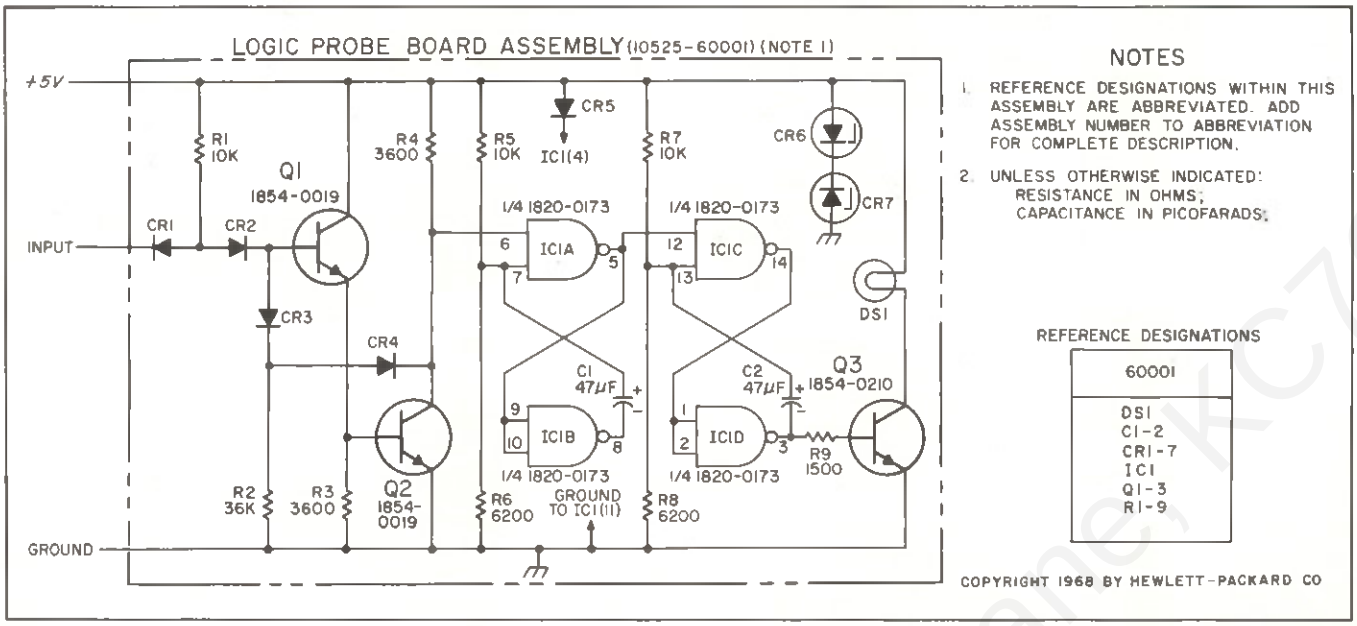


Figure 6. Logic Probe Schematic Diagram



input threshold to +1.4V. The amplifier includes emitter follower Q1, common emitter amplifier Q2, and associated components. Negative non-linear feedback around both amplifier stages via CR3 and CR4 prevents saturation to enhance the speed.

21. The input amplifier is followed by two pulse stretchers; one of the two triggers automatically on each incoming pulse, depending on the pulse's polarity. Each stretcher consists of a monostable multivibrator, or "one-shot", formed by cross-connecting two gates. When one "one-shot" is stretching, the other is acting as an inverting amplifier. The output of the second stretcher drives the indicator lamp via switch Q3.

22. PERFORMANCE CHECKS

23. There are no adjustments or preventive maintenance procedures for the Logic Probe. However, there are some operational checks that may be performed to ensure your probe is operating properly.

24. With the test setup shown in Figure 7-A, connect the Probe to Power Supply "A" and adjust the output to +5V. Set the output of Power Supply "B" for +1.8V and touch the probe to the positive side of the load resistor shown. The probe lamp should remain on. With the probe still connected, adjust the output of Power Supply "B" for +1.0V. The light should go off.

25. With the test setup shown in Figure 7B, connect the Probe to Power Supply and adjust for a +5V output. Set up the Pulse Generator so that the waveforms shown are present at the output. The repetition rate of the Pulse Generator should be set to 1 Hz, or manual, to initiate a pulse every second. With waveform (A), the lamp should be off and come on for about 1/10 second every second. With waveform (B), the lamp should be on and go off for about 1/10 second every second.

26. MAINTENANCE

27. Extreme care should be used in replacing or removing parts on the printed circuit board. Excessive heat will damage the board and some components on it. A low temperature soldering iron should be used. For warranty repair and replacement information, refer to WARRANTY AND ASSISTANCE statement inside manual front cover.

28. PARTS REPLACEMENT

29. All parts in the Logic Probe can be replaced in the field. Table 1 lists all parts and their HP Part Number. Figures 8 shows physical location of all components.

Figure 7A. Performance Test Setup

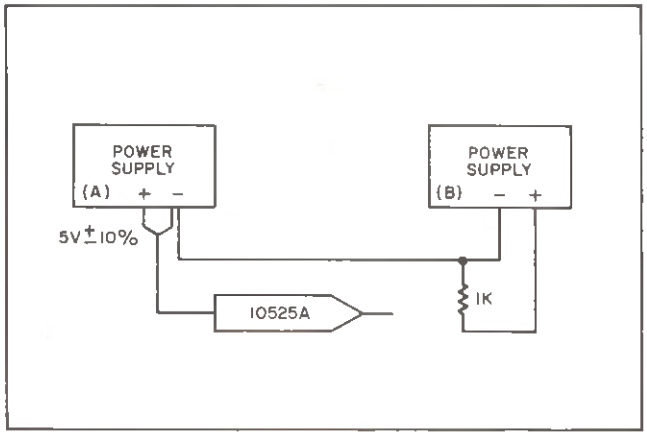


Figure 7B. Performance Test Setup

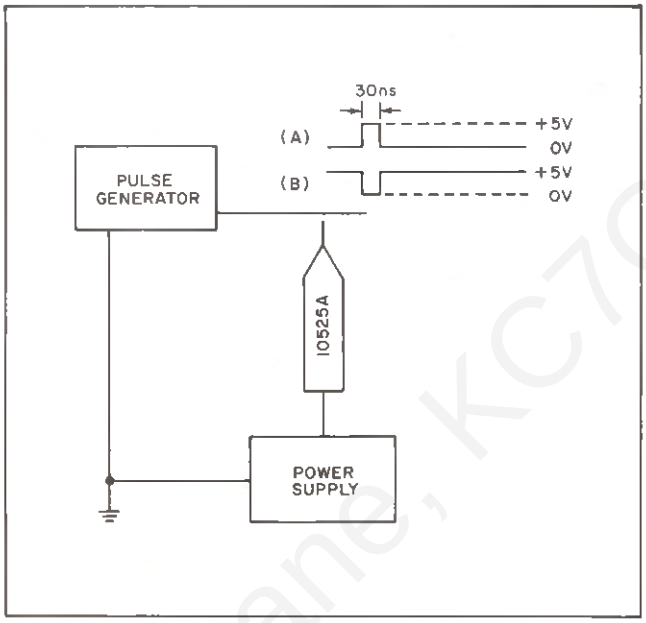


Figure 8. Logic Probe Assembly Breakdown and Component Placement

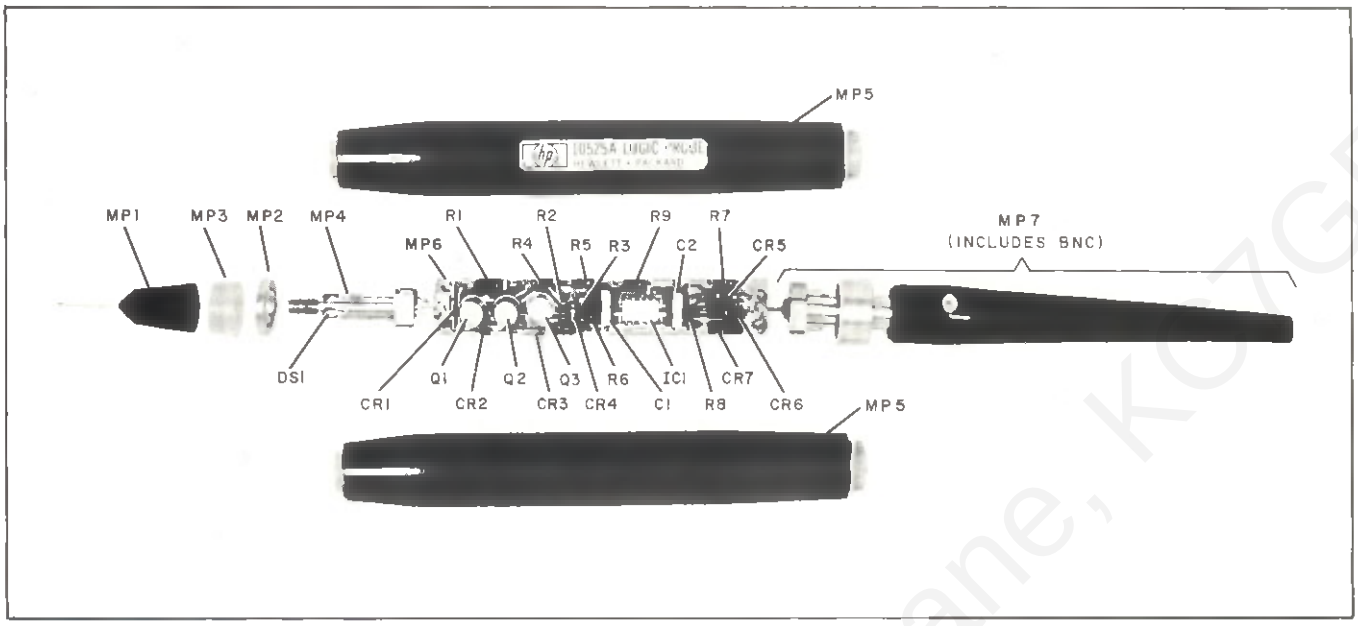


Table 1. Parts List

Ref.	Description	HP Part No.	Qty	Ref.	Description	HP Part No.	Qty
	Logic Probe Board Assy	10525-60001	1	R6, R8	R: fxd, car, 6.2K 5%, 1/8W	0698-5184	2
C1, C2	C: fxd, tant elec, 47 μF, 4V	0180-2235	2	R9	R: fxd, car, 1.5K 5%, 1/8W	0698-5178	1
CR1, 2	Diode: Si, 200 PIV	1901-0519	2		Board, Blank	10525-20001	1
CR3	Diode: Si	1901-0520	1				
CR4	Diode: Si, hot carrier	1901-0347	1	MP1	Probe tip: (Standard)	5060-0418	1
CR5	Diode: Ge	1910-0030	1	MP2	Front collar	10525-20003	1
CR6, 7	Diode: breakdown 6.19V, 5%	1902-0049	2	MP3	Light window	10525-20006	1
DS1	Lamp, incan. 5V, 60 mA	2140-0016	1	MP4	Stud, tip retaining	10525-20002	1
IC1	Integrated Circuit	1820-0173	1	MP5	Probe body	10525-40001	2
Q1, Q2	Transistor: Si, NPN	1854-0019	2	MP6	Probe Board Assy	10525-60001	1
	Insulator, TO-18	0340-0410	3	MP7	Cable Assy	10525-60002	1
Q3	Transistor: Si, NPN	1854-0210	1		Accessories:		
R1	R: fxd, flm, 10K 5%, 1/4W	0698-4278	1		BNC Bulkhead mtg con	1250-0083	1
R2	R: fxd, car, 36K 5%, 1/8W	0698-5568	1		BNC to Banana adapter	1251-2277	1
R3, R4	R: fxd, car, 3.6K 5%, 1/8W	0698-5181	2		BNC to Minigator adapter	8120-1292	1
R5, R7	R: fxd, car, 10K 5%, 1/8W	0698-5426	2		Ground Cable Assy	8120-1288	1
					Probe tip: Hooked	10525-80001	1

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