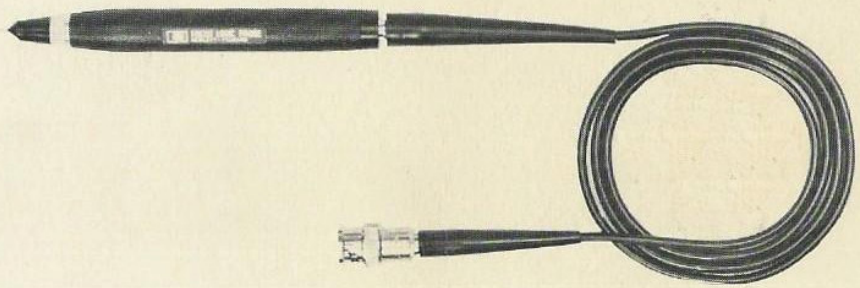
OPERATING AND SERVICE MANUAL

LOGIC PROBE

10525T



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CERTIFICATION

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.

WARRANTY AND ASSISTANCE

This Hewlett-Packard product is warranted against defects in materials and workmanship. This warranty applies for one year from the date of delivery, or, in the case of certain major components listed in the manual, for the specified period. We will repair or replace products which prove to be defective during the warranty period provided they are returned to Hewlett-Packard. No other warranty is expressed or implied. We are not liable for consequential damages.

Service contracts or customer assistance agreements are available for Hewlett-Packard products that require maintenance and repair on-site.

For any assistance, contact your nearest Hewlett-Packard Sales and Service Office.

10525T
LOGIC PROBE

SERIES 1344A

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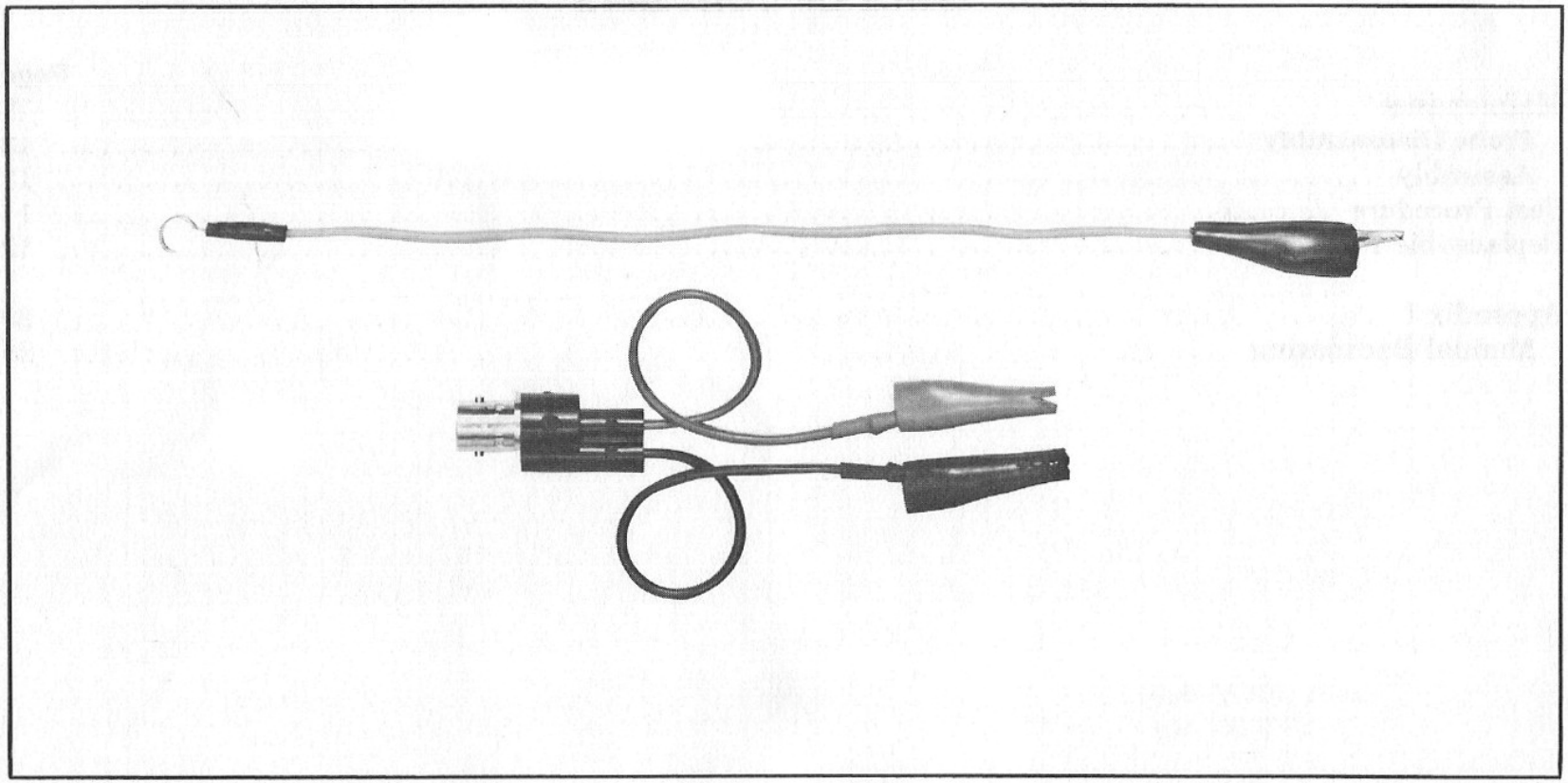
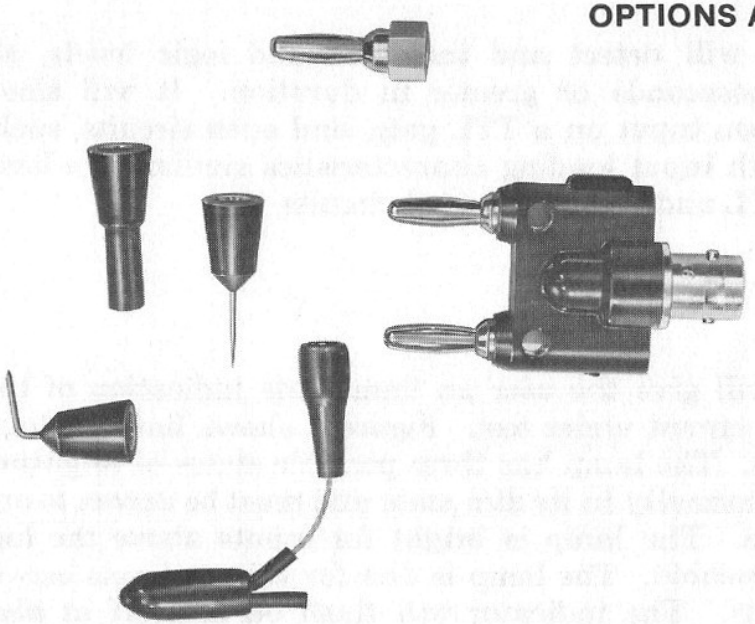
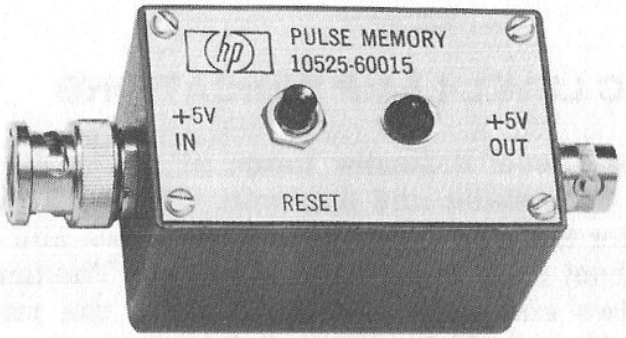


Figure 1. Model 10525T Logic Probe Accessories (Continued)

OPTIONS AVAILABLE



Kit: 10525-60012
OPTION 005



OPTION 006

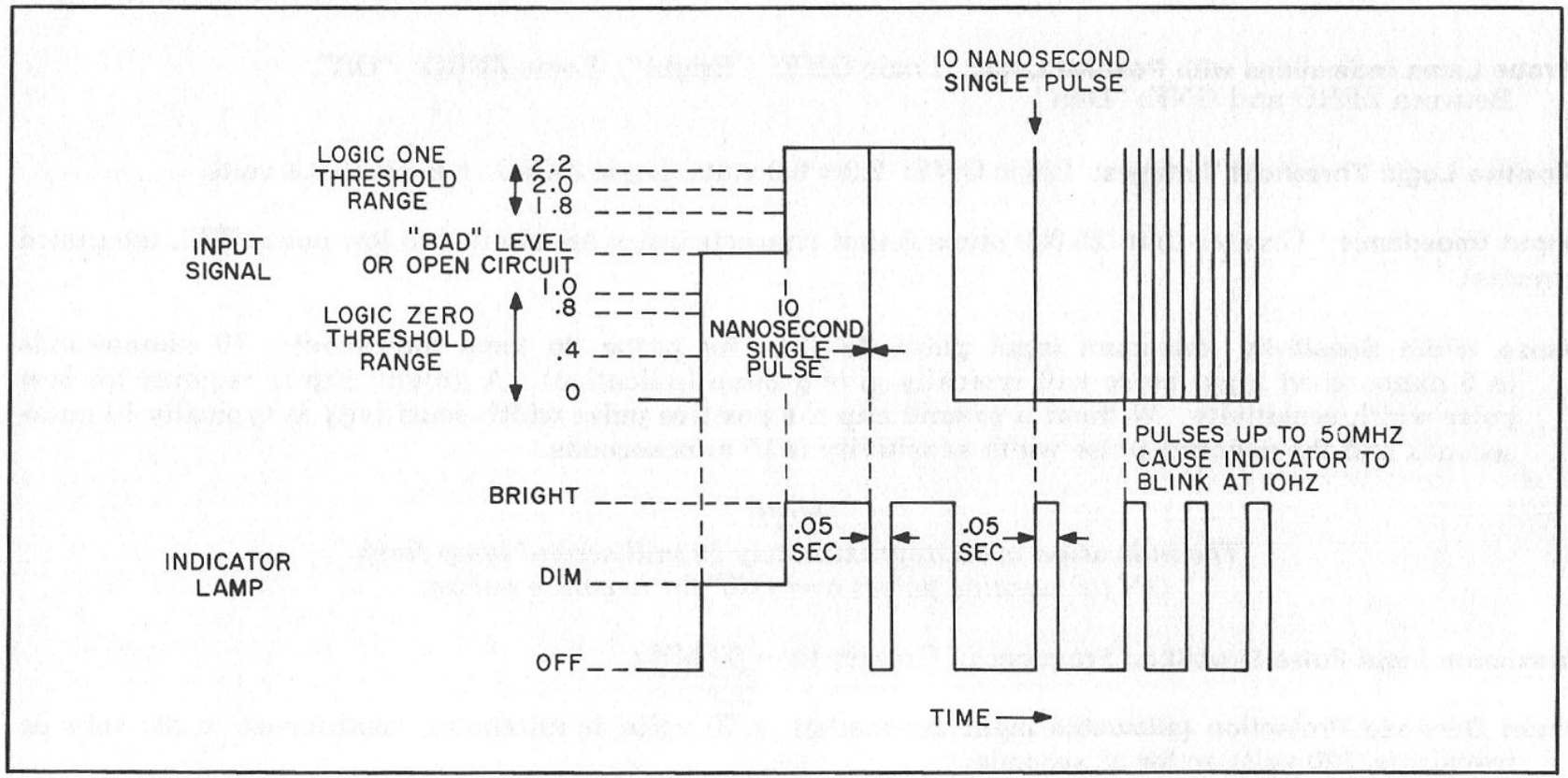
INTRODUCTION

The Hewlett-Packard Model 10525T Logic Probe will detect and indicate valid logic levels, and the presence and polarity of single pulses of 10 nanoseconds or greater in duration. It will also detect intermediate (or "BAD") logic levels, such as an open input on a TTL gate, and open circuits, such as an open collector output without pull-up resistors. With input loading characteristics similar to a low power TTL gate input, it is compatible with virtually all TTL and DTL integrated circuits.

LOGIC LEVEL LAMP INDICATIONS

The logic level indicator lamp, at the probe tip, will give the user an immediate indication of the logic states, both static and dynamic, which exist in the circuit under test. Figure 2 shows how the logic level indicator lamp responds to voltage levels and pulses. The lamp has three possible states of brightness; off, dim (about half brilliance) and bright. The lamp is normally in its dim state and must be driven to one of its other two states by voltage levels at the probe tip. The lamp is bright for inputs above the logic one threshold and off for inputs below the logic zero threshold. The lamp is dim for voltage levels between the logic one and zero thresholds and for open circuits. The indicator will flash on and off at about ten times per second for pulse train inputs greater than about 10 Hz.

Figure 2. Logic Level Lamp Indications with Probe Input Voltage Levels



10525T LOGIC PROBE SPECIFICATIONS

Probe Lamp Indications with Positive Logic: Logic ONE: "Bright". Logic ZERO: "Off". Between ZERO and ONE: "Dim".

Positive Logic Threshold Voltages: Logic ONE: 2.0 ± 0.2 volts, Logic ZERO: 0.8 + 0.2 – 0.4 volts.

Input Impedance: Greater than 25,000 ohms (input characteristics are similar to low power TTL integrated circuits).

Pulse Width Sensitivity (minimum input pulse duration for probe tip lamp indication): 10 nanoseconds (a 5 nanosecond input pulse will typically give a lamp indication). A ground clip is required for best pulse width sensitivity. Without a ground clip the positive pulse width sensitivity is typically 10 nanoseconds and the negative pulse width sensitivity is 15 nanoseconds.

NOTE
The indication is an approximately 50 millisecond lamp flash.
ON for positive pulses and OFF for negative pulses.

Maximum Input Pulse Repetition Frequencs: Greater than 50 MHz.

Input Overload Protection (allowable input overloads): ± 70 volts dc maximum continuous; ± 200 volts dc transients; 120 volts ac for 30 seconds.

10525T LOGIC PROBE SPECIFICATIONS

Power Requirements: +5 volts dc ±5% at 60 milliamperes (the probe is protected against supply voltages between +7 and -15 at the power input connector).

VOLTAGE CAUTION

Probe DAMAGE will occur with power supply potentials more positive than +7 volts or more negative than -15 volts.

Operating Environment: 0°C to 55°C.

Weight: 2½ ounces.

Size: Probe body, 6 inches; Cable, 3.5 feet.

Accessories Provided: Ground clip and BNC-to-alligator adapter.

Options Available: *Option 005: Tip Kit (10525-60012)* — Straight Tip, Hooked Tip, Spring Tip, Banana Tip Back Plane Adapter, Dual Banana-to-BNC Adapter. *Option 006: Pulse Memory (10525-60015)* — A small box connected between the Probe and the +5 volt power source. The Pulse Memory stores the occurrence of a transient pulse.

DATE CODE

The year and week of manufacture are stamped on the circuit board. Example: "4-24" would indicate 24th week of 1974. There is no serial number.

SERIES CODE

A four-digit series number is also stamped on the circuit board. This number should match the series number on the title page of this manual. If the board series number differs from the manual series number there are other differences between the manual and the board. Lower series numbers are explained in Appendix A, and higher series numbers are covered by MANUAL CHANGES sheets included with the manual. The MANUAL CHANGES sheet should have a series number matching the board. If it does not, ask your Hewlett-Packard representative for a MANUAL CHANGES sheet with the matching series number.

UNPACKING

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.

MATCHING INSTRUMENTS

Hewlett-Packard makes several instruments that can be used with the Logic Probe to help you do a quicker and better job. Three examples are the Model 10526T Logic Pulser, Model 10528A Logic Clip, and Model 10529A Logic Comparator. The 10526T Logic Pulser can be used to stimulate the input of a logic element while the Logic Probe is touching the output to sense the activity of the element.

USING THE LOGIC PROBE

Probe Power

The Probe can be powered from the +5 volt supply used by the circuit under test (a BNC-to-clip lead adaptor is provided) or from a +5 volt DC laboratory supply. If a separate power supply is used, the power supply and circuit-under-test grounds must be connected together.

A ground clip (provided with the Probe) may be connected just behind the Probe body. The ground clip is a convenient means for connecting grounds when using external laboratory supplies. It also improves pulse width sensitivity and noise immunity. However, its use is optional. It is not required for most applications.

Pulse Detection

The Logic Probe is ideal for detecting short duration pulses and low repetition rate pulses that would be very difficult to observe on an oscilloscope. Positive pulses to ten nanoseconds or greater in width trigger the lamp indicator on for 50 milliseconds or greater. Negative pulses cause the lamp to momentarily go off.

Troubleshooting

The bad level feature of the 10525T Logic Probe is useful for testing tri-state logic outputs. The logic high and logic low states are detected as described above and the third state (i.e., high impedance output) is detected as an open circuit (or bad level) condition, which leaves the lamp indicator dim. It is also useful for detecting floating, or unconnected TTL gate inputs which look like a bad level.

Several logic circuit analysis techniques lend themselves for use with logic probes. One technique is to run the circuit under test at its normal clock rate while monitoring for various circuit control signals, such as reset, start, stop, shift, transfer, or clock signals. Questions, such as "is the counter operating?" are easily resolved by noting if the probe indicator is flashing on and off, which indicates that pulse train activity is present.

Another useful technique is to replace the normal clock signal with a very slow clock signal from a pulse generator or to single step the clock input with a pulse generator similar to the HP Model 10526T Logic Pulser. The changes in logic signals should now occur at a rate slow enough so that they can be observed

on a real time basis. This real time analysis technique coupled with the ability to inject logic level pulses anywhere in the circuit with the Logic Pulser and the ability to detect logic state changes with the Logic Probe contribute to rapid troubleshooting and fault finding in digital circuits.

Logic Level Indication Hysteresis

The logic lamp indication changes from OFF to DIM to BRIGHT and reverse are controlled by circuits with some hysteresis. This avoids lamp flickering caused by voltage levels near the logic ONE and logic ZERO thresholds.

LOGIC PROBE THEORY OF OPERATION

The following Logic Probe theory of operation should be referenced to the schematic diagram near the back of this book. Only the Logic One Channel is described since the Logic Zero Channel is the same after the threshold detector.

Logic System Used

In this section the positive-true logic convention is used, that is:

TRUE = ONE (1) = HIGH (more positive potential)
FALSE = ZERO (0) = LOW (more negative potential)

Input Circuit

At the probe input, resistor R1 and diodes CRA and CRB protect the probe from input overloads. At the power input connector, diodes CR1 and CR3 protect the probe from reversed power connections.

Threshold Level Detectors

All input signals are applied to the two parallel threshold detectors. Both detectors compare the input signal to internal reference voltages.

Logic One Channel

If the probe's input signal is more positive than the reference voltage of the logic ONE threshold detector, the detector's output will go High. Some hysteresis is provided to prevent instability, should the input voltage be equal to the reference voltage. The output of gate A is normally High (gate G output normally Low). The resultant Low from gate B sets the SR Flip-Flop, thereby placing a High on the output of gate C. Coincident with this, two things happen: (1) QA Lights the Logic Level Indicator Lamp. (2) The High outputs from gate C and the One Delay causes the output of gate E to go low. This disables gate F and prevents the indicator lamp from turning off, should the input signal drop to zero during this pulse-stretching time. This cross-coupled disabling characteristic is responsible for the 10 Hz flash rate when the input is a high-frequency pulse train.

Once the High from gate C propagates through the One Delay (approximately 50 ms), a Low on the R input of gate D attempts to reset the flip-flop. The flip-flop will reset only if the input voltage drops below the logic 1 threshold level.

Lamp Level Control

The indicator lamp turns on to full brilliance when gate C output goes High. This occurs when the probe's input level reaches the "1" threshold. When the probe's voltage is below the "0" threshold, the SR Flip-Flop in the Zero Channel is set High and prevents gate J from lighting the indicator lamp.

The High from the flip-flop and the High from the Zero Delay (for about 50 ms) prevents the One Flip-Flop from setting.

When the probe voltage is not positive enough to activate the One Channel or low enough to activate the Zero Channel, both flip-flop outputs are Low. Both Low outputs are connected to gate J, which turns QB and the lamp on. Diode CRC provides an added diode voltage drop in the emitter circuit and causes the lamp to glow at only half brightness.

Logic Levels and Pulses

If the probe input is continuously HIGH, the ONE channel F-F OUT point and the LOGIC LAMP will be HIGH (the lamp will be on) continuously. A single fast positive pulse, 5 to 10 nanoseconds or slower,

will actuate the ONE channel flip-flop and produce about a 50 millisecond bright LOGIC LAMP flash. The delay circuit stretches the pulse. A positive pulsating signal with a frequency even slightly greater than 50 MHz will cause the lamp to flash on for about 50 milliseconds, 10 times per second. The delay circuit stretches the pulses. Negative levels or pulses will cause the lamp to switch off for about 50 milliseconds.

MAINTENANCE

Be careful if you replace any parts on the probe circuit board. Excess heat can ruin the board. Use the smallest and lowest temperature soldering iron possible.

Probe Disassembly

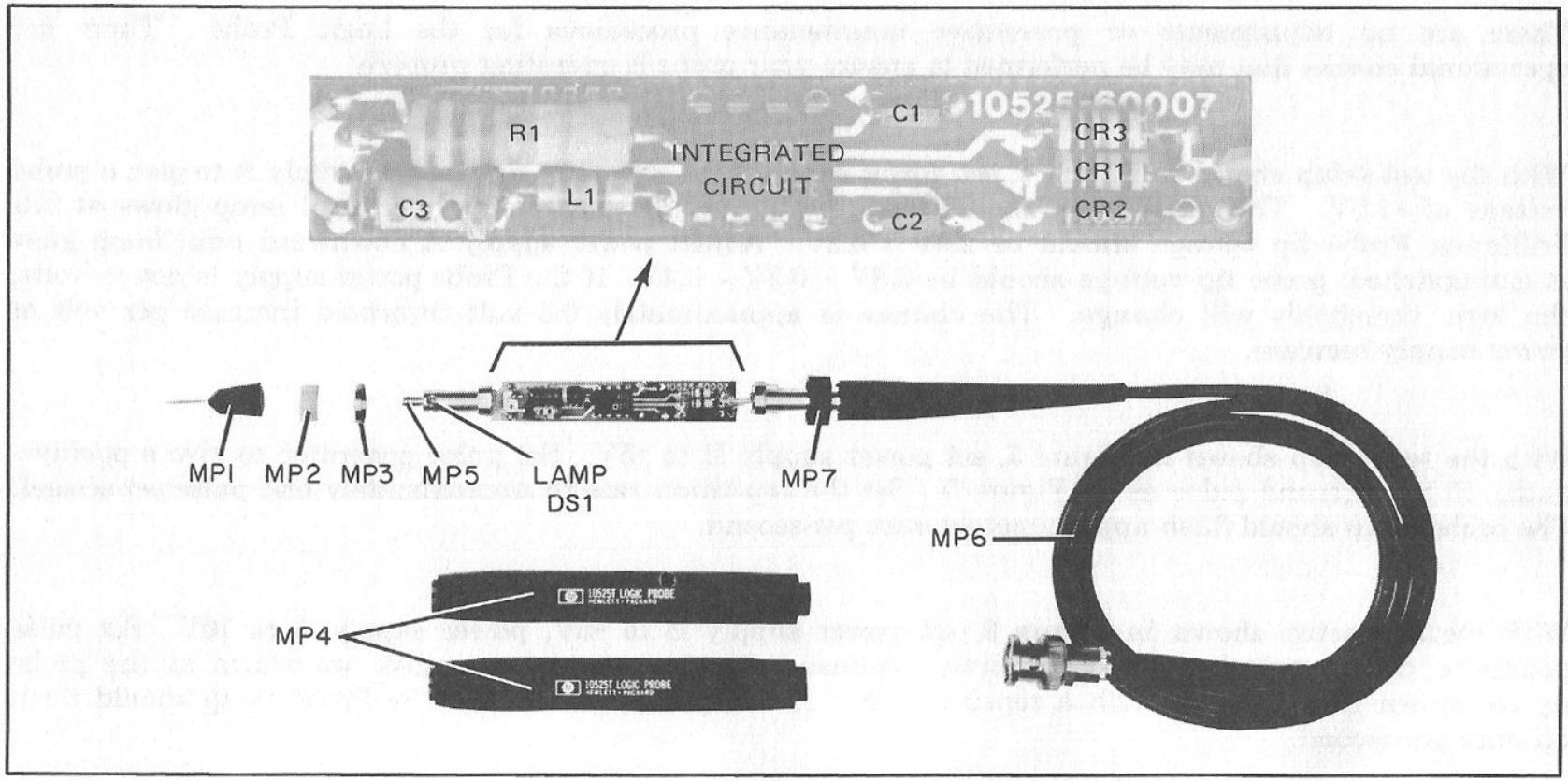
Figure 3 shows the probe parts. To take the probe apart follow these steps:

1. With fingers, unscrew the probe tip (MP1).
2. Slide light window (MP2) off probe tip end.
3. Use the probe tip point to remove the front collar (MP3). Gently push tip point between collar and probe body (MP4).
4. Gently push tip point between body shell halves at probe tip stud (MP5). One body shell will come off.
5. Gently push tip point under rear of tip stud. The other body shell will come free.
6. Separate circuit board and body shell.

Assembly

Reverse disassembly procedure keeping "hp" on label toward probe tip.

Figure 3. Parts Identification



TEST PROCEDURE

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

With the test setup shown in Figure 4, set power supply B to +5V ±10% and power supply A to give a probe voltage of +1.5V. The probe lamp should glow dimly. Adjust power supply A until lamp glows at full brilliance, Probe tip voltage should be 2.0V ± 0.2V. Adjust power supply A downward until lamp glow is extinguished, probe tip voltage should be 0.8V + 0.2V - 0.4V. If the Probe power supply is not +5 volts, the logic thresholds will change. The change is approximately 0.3 volt threshold increase per volt of power supply increase.

With the test setup shown in Figure 5, set power supply B to +5V. Set pulse generator to give a positive-going 10 nanosecond pulse as in Figure 5. Set the repetition rate to approximately one pulse-per-second. The probe lamp should flash approximately once per-second.

With the test setup shown in Figure 6, set power supply B to +5V, power supply A to 10V. Set pulse generator output polarity to (-) negative. Adjust the pulse generator to give waveform at the probe tip as shown in Figure 6. With a repetition rate of one pulse-per-second. The Probe lamp should flash off once per-second.

Figure 4. Logic Level Test Setup

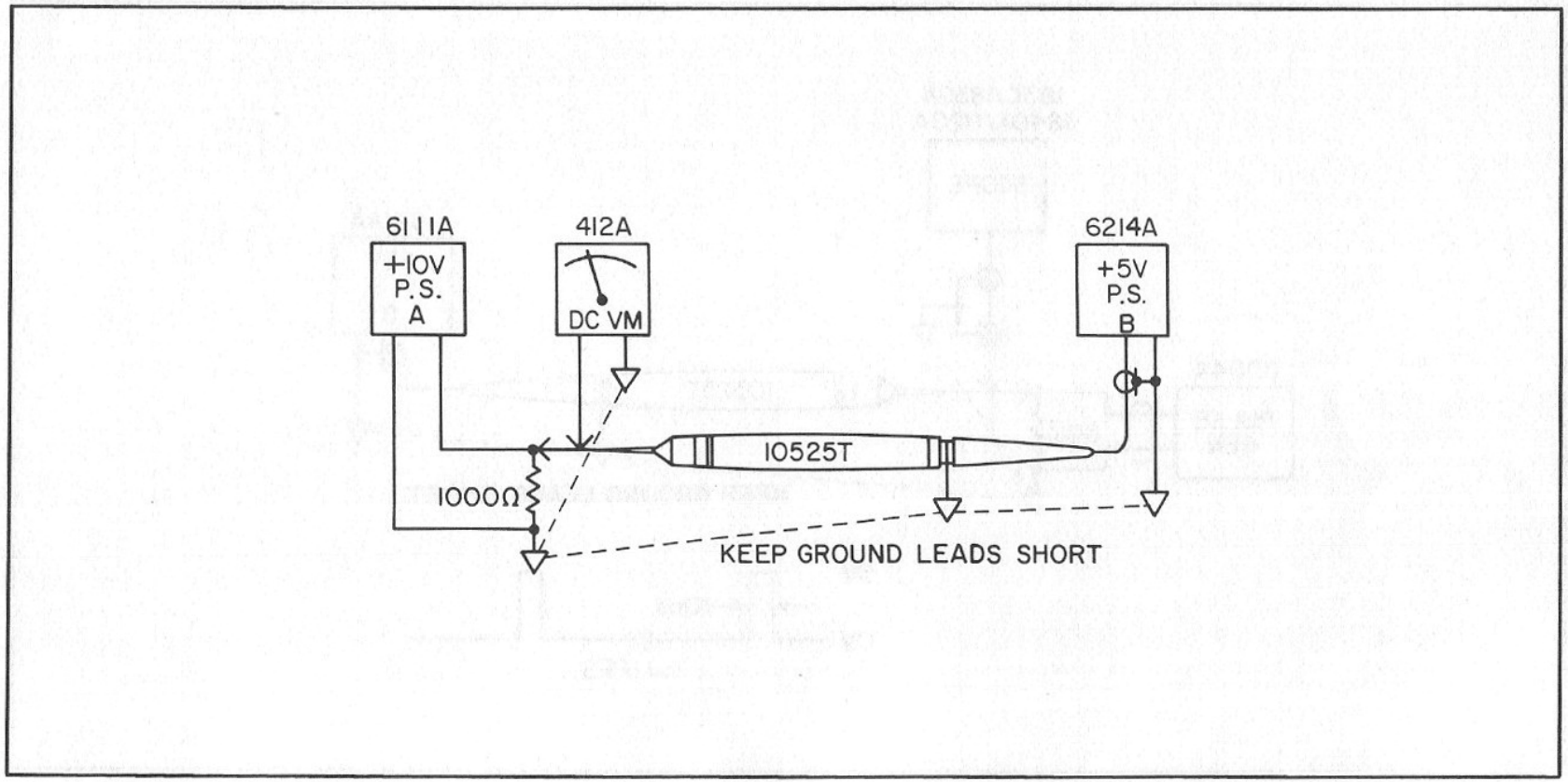


Figure 5. Positive Pulse Test Setup

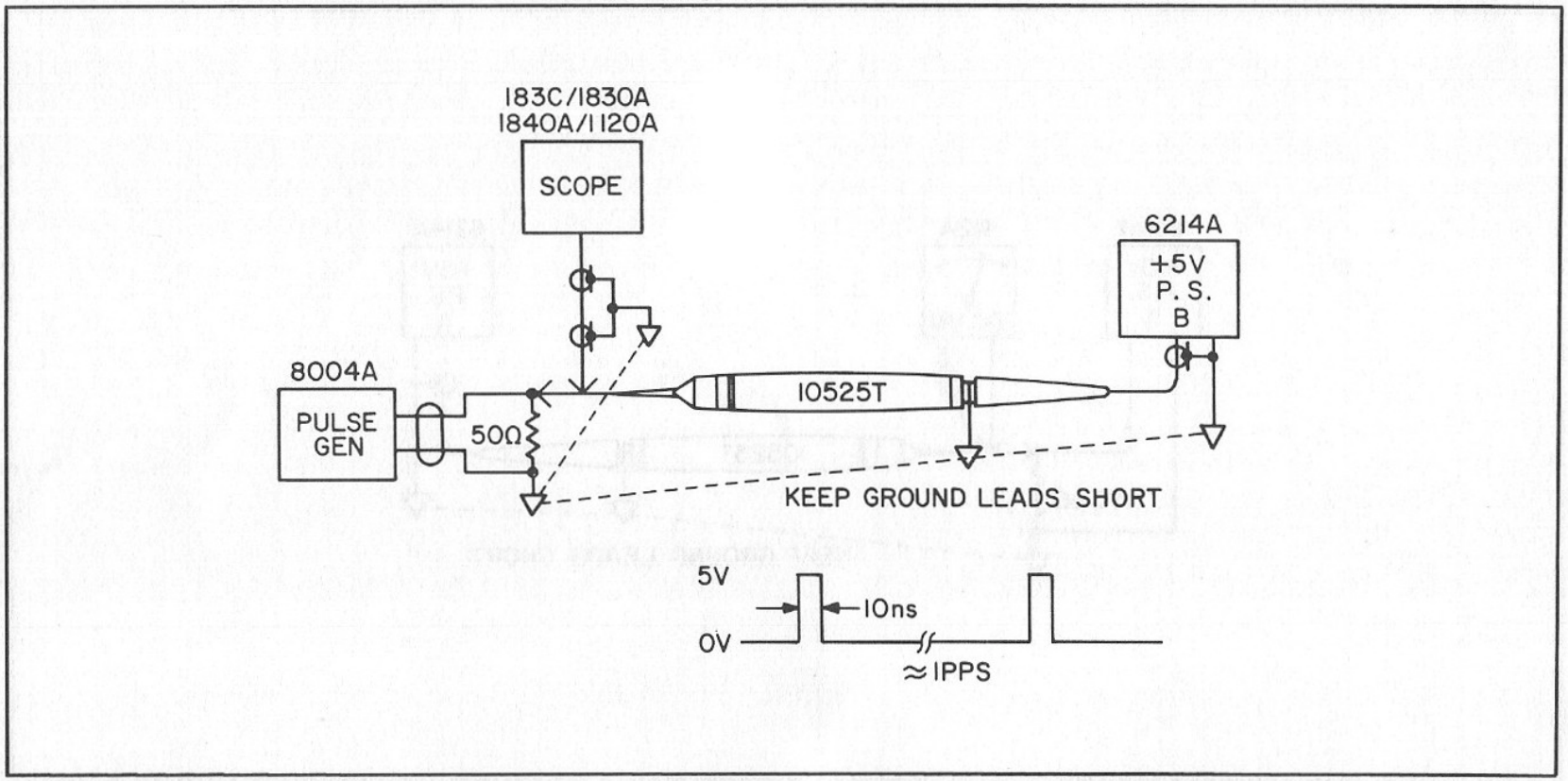


Figure 6. Negative Pulse Test Setup

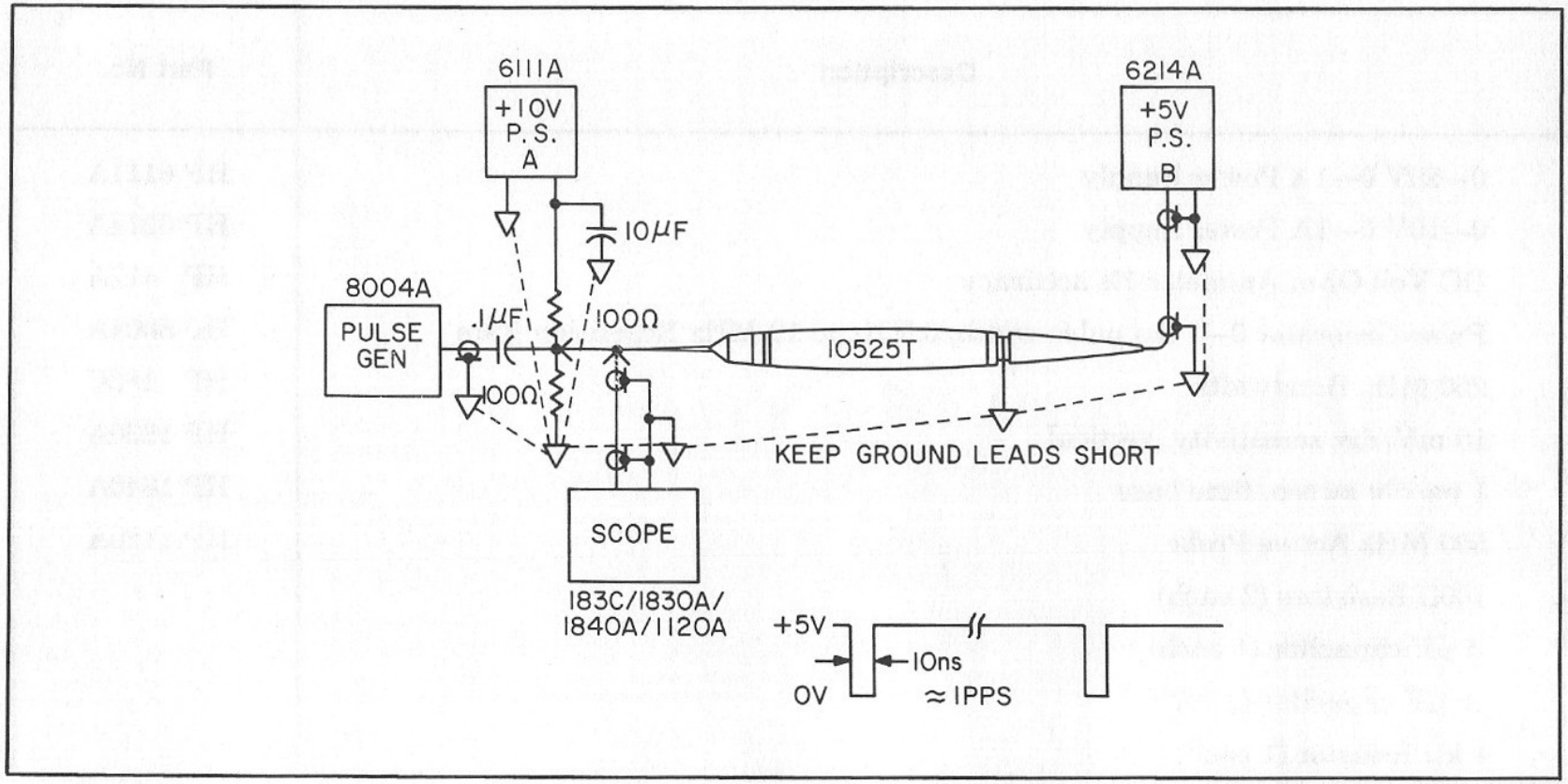


Table 1. Recommended Test Equipment

Description	Part No.
0—20V 0—1A Power Supply	HP 6111A
0—10V 0—1A Power Supply	HP 6214A
DC Volt-Ohm Ammeter 1% accuracy	HP 412A
Pulse Generator 0—1 ms pulse width, 0.3 Hz to 10 MHz Repetition Rate	HP 8004A
250 MHz Bandwidth	HP 183C
10 mV/div sensitivity, vertical	HP 1830A
1 ns/div sweep, time base	HP 1840A
500 MHz Active Probe	HP 1120A
100Ω Resistors (2 each)	
.1 μF capacitor (1 each)	
10 μF capacitor (2 each)	
1 kΩ Resistor (1 each)	

REPLACEABLE PARTS

Table 2 gives the replaceable parts for the Probe. You can get repair parts through your local Hewlett-Packard Sales and Service Office (see the list at the end of this book). Give the Hewlett-Packard part number and Probe model number.

Table 2. Replaceable Parts for Model 10525T Logic Probe

Ref. Desig.	Description	HP Part No.	Qty.
C1	Capacitor Fixed, Elect, 10 μF, 2V	0180-2513	1
C2	Capacitor Fixed, Elect, 10 μF, 2V	0180-2513	1
C3	Capacitor Fixed, 20 pF 500V	0160-2264	1
CR1	Diode, Germ., 100 ma.	1910-0030	1
CR2	Diode, Breakdown, 6.49V	1902-0057	1
CR3	Diode, Germ., 100 ma.	1910-0030	1
L1	Coil: 27 μH	9100-2269	1
R1	Resistor, Fixed, 5.1K, 1W	0761-0069	1

(continued)

Table 2. Replaceable Parts for Model 10525T Logic Probe (Continued)

Ref. Desig.	Description	HP Part No.	Qty.
DS1	Incandescent Lamp	2140-0378	1
	Circuit Board	10525-20007	1
MP1	Probe Tip	5060-0418	1
MP2	Light Window	10525-20006	1
MP3	Front Collar	10525-20003	1
MP4	Body Shell	10525-40003	2
MP5	Tip Stud	10525-20002	1
MP6	Cable Assembly Power	10525-60004	1
MP7	Rear Collar	10525-20008	1
MP8	Ground Clip	10004-61301	1
MP9	BNC-to-Alligator Clips	8120-1292	1
U1	Integrated Circuit	1820-1001	1

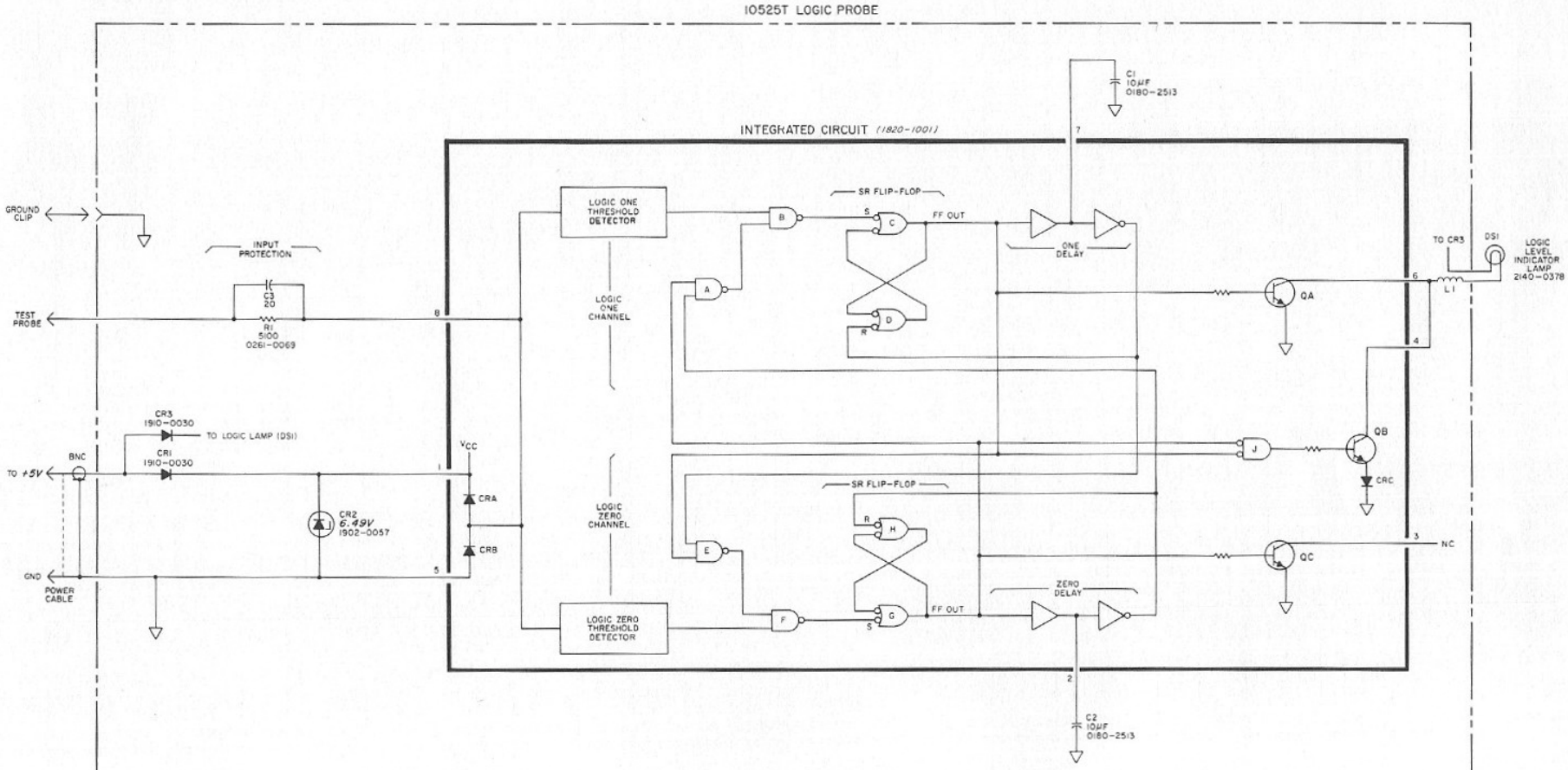


Figure 7. MODEL 10525T SCHEMATIC DIAGRAM

NOTE:
HEWLETT-PACKARD STOCK NUMBERS ARE GIVEN WITH REPLACEABLE PARTS.

APPENDIX I

MANUAL BACKDATING

This manual applies directly to Logic Probes having Series No. 1344A. For probes having Series No. 1220A, Change 1 and 2 should be made to the manual. For probes having Series No. 1332A Change 2 should be made to the manual.

CHANGE 1

Page 20, Table 2:
Change DS1 from 2140-0378 to 2140-0016.*

CHANGE 2

Page 20, Table 2:
Delete L1 9100-2269 COIL: 27 μH.*

Page 2, Figure 7:
Delete L1.

* Note
ALL probes should have DS1 changed to 2140-0378 and L1 added.
See Service Note 10525T-1 for recommended procedure.

HEWLETT-PACKARD SALES AND SERVICE OFFICES

To obtain servicing information and order replacement parts, contact the nearest Hewlett-Packard Sales and Service Office in HP Catalog, or contact the nearest regional office.

IN THE UNITED STATES:

CALIFORNIA
3939 Lankershim Blvd.
North Hollywood 91604

GEORGIA
P.O. Box 28234
450 Interstate North
Atlanta 30328

ILLINOIS
5500 Howard Street
Skokie 60076

NEW JERSEY
W. 120 Century Road
Paramus 07652

IN CANADA:

QUEBEC
Hewlett-Packard (Canada) Ltd.
275 Hymus Blvd.
Pointe Claire

IN EUROPE:

SWITZERLAND
Hewlett-Packard (Schweiz) AG
Rue du Bois-du-Lan 7
P.O. Box 85
CH-1217 Meyrin 2 Geneva

IN AFRICA, ASIA, AND AUSTRALIA:

Hewlett-Packard Intercontinental
3200 Hillview Ave.
Palo Alto, California 94304

IN CENTRAL AND SOUTH AMERICA:

Hewlett-Packard Intercontinental
3200 Hillview Ave.
Palo Alto, California 94304

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