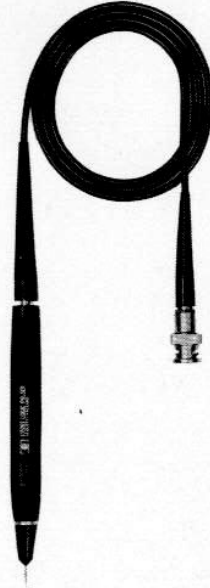


LOGIC PULSER

10526T



HEWLETT
PACKARD

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.

MANUAL DESCRIPTION

INSTRUMENT: 10526T LOGIC PULSER
SERIAL PREFIX: 1220A
DATE PRINTED: MARCH 1974
HP PART NO: 10526-90008
MICROFICHE NO: 10526-90009

CHANGE DATE: December 14, 1979

(This change supersedes all earlier dated changes)

- Make all changes listed as ERRATA.
- Check the following table for your instrument's serial prefix or serial number and make listed change(s) to manual.

IF YOUR INSTRUMENT HAS SERIES NUMBER	MAKE THE FOLLOWING CHANGES TO YOUR MANUAL	IF YOUR INSTRUMENT HAS SERIES NUMBER	MAKE THE FOLLOWING CHANGES TO YOUR MANUAL
▶ Series 1932	1		

▶ **NEW OR REVISED ITEM**

▶ **ERRATA**

▶ Page 1, Figure 2, Logic Pulser Options:
Delete all of Figure 2.

▶ Page 3, Table 1, Specifications:
Delete all of "Options Available".

► **ERRATA (Cont'd)**

- Page 23, Table 2, Parts List:
Change "Description" of C4 to 47 pF, 50V.
Change "HP Part No." for C4 from 0160-3876 to 0160-4546.
- Page 24, Table 2, Parts List (Continued):
Change MP7 part number from 10526-20002 to 10526-40001.
- Page 27, Figure 14, Pulser Schematic Diagram:
Change R4 value to 2700 ohms.
- **CHANGE 1 (Series 1932)**
- Page 23, Table 2, Parts List:
Change "HP Part No." for C2 and C3 from 0160-3878 to 0160-2327.

10526T

LOGIC PULSER

SERIES 1220A

Copyright HEWLETT-PACKARD COMPANY 1973
5301 STEVENS CREEK BLVD., SANTA CLARA, CALIF. 95050

Printed: **MARCH 1974**

Manual Part No. 10526-90008
Microfiche No. 10526-90009

PRINTED IN U.S.A.



**HEWLETT
PACKARD**

Figure 1. 10526T Logic Pulser and Provided Accessories

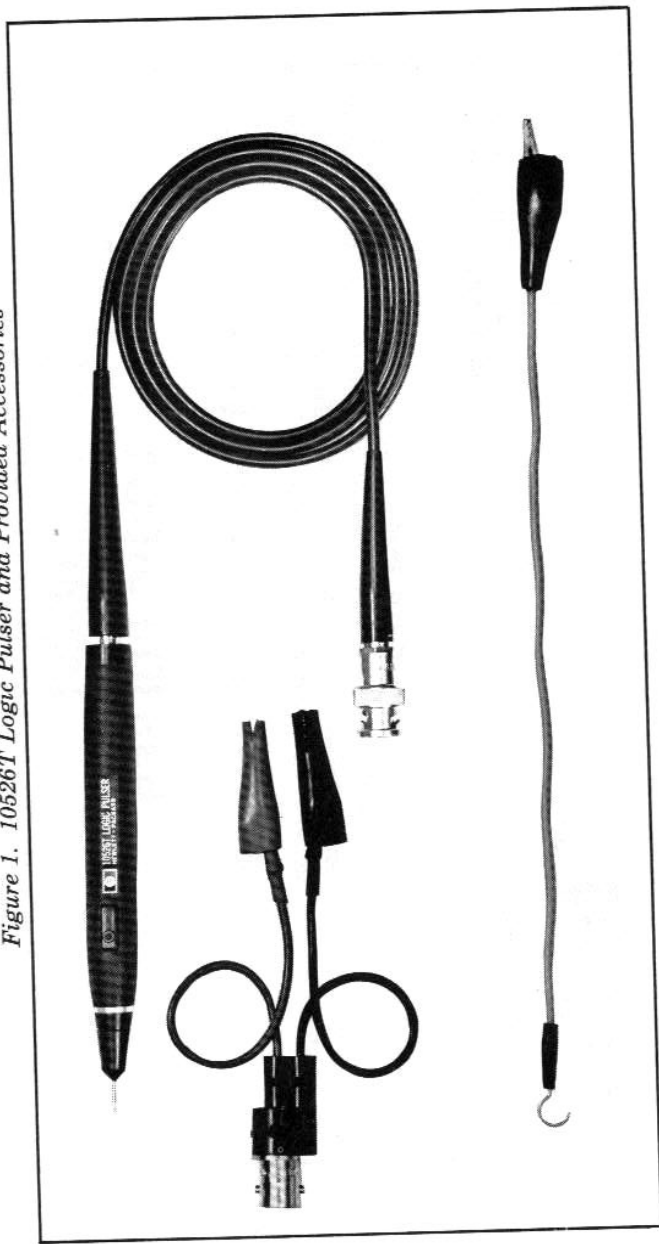
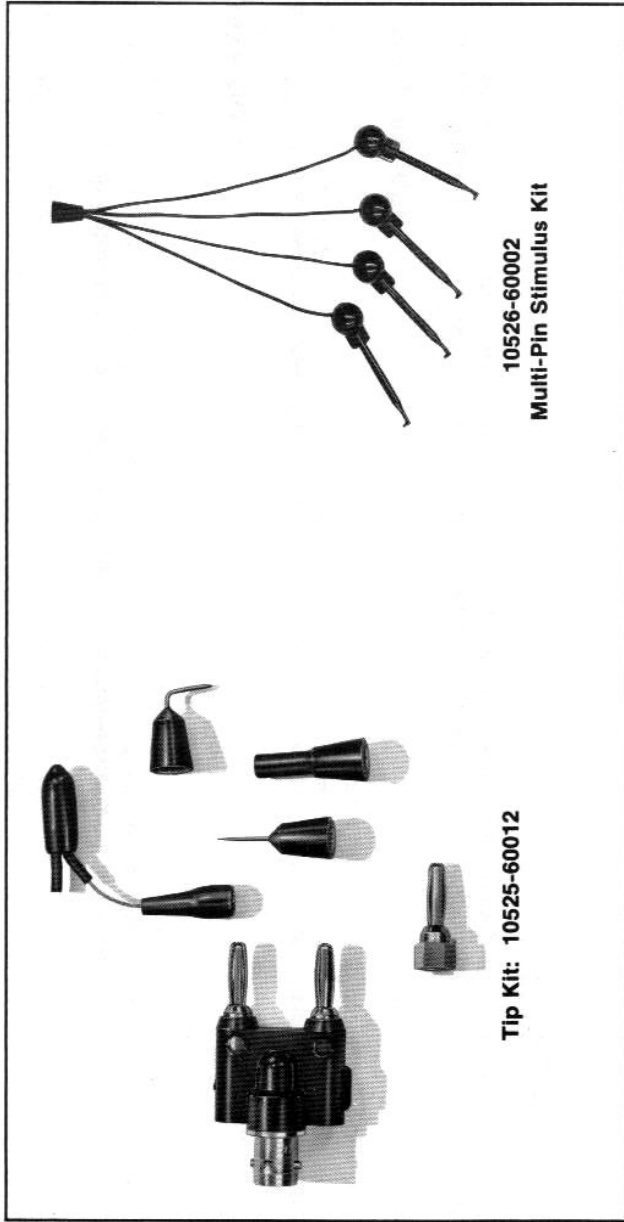


Figure 2. 10526T Logic Pulser Options



GENERAL INFORMATION

INTRODUCTION

The 10526T Logic Pulser is a single-shot pulse generator designed to stimulate TTL and DTL logic circuitry. Included in this manual is operating, application, and servicing information. See Table 1 for Logic Pulser specifications.

DATE CODE

The Logic Pulser's year and week of manufacture are stamped on the circuit board. Example: 4-24 would indicate 24th week of 1974.

SERIES NUMBER

The Logic Pulser does not have a serial number. It does, however, have a series number, which is stamped on the printed circuit board. Refer to this number in any correspondence that pertains to maintenance.

Pulse Voltage, HIGH Output: 2 volts at .65 Ampere (1A typical at $V_{ps} = 5V, 25^{\circ}C$)
Pulse Voltage, LOW Output: 0.8 volt at .65 Ampere (1A typical at $V_{ps} = 5V, 25^{\circ}C$)
Output Impedance, Active State: 2 Ohms
Output Impedance, Off State: >1 Megohm
Pulse Width: 0.3 microsecond nominal
Input Overload Protection: ± 50 volts continuous
Power Supply Input Protection: ± 7 volts (includes power lead reversal protection)
Power Required: 5 volts $\pm 10\%$ at 25 milliamperes
Temperature: 0° to 55° Celsius

Accessories Supplied (Figure 1):

Power Supply Connector Adapter: BNC-to-dual alligator clips
Common Return Clip: Clip lead for probe-to-alligator clip

Options Available:

Opt. 004 — Multi-pin Stimulus Kit (Pulser tip to four clip leads), 10526-60002
Opt. 005 — HP Tip-Kit, part number 10525-60012, includes one of each of the following parts:
Probe Tip (Wire Wrap Terminal 0.1")
Probe Tip (Banana)
Probe Tip (Bent 90° Std.)
Probe Tip (Flexible Lead-Pin (.025") Terminal Receptacle)
BNC-to-Dual Banana Plug
Probe Tip (Straight)

UNPACKING

If the shipping package is damaged, ask that the carrier's agent be present when package is opened. Inspect the Logic Pulsar for obvious physical damage (dents, scratches, etc.). If the Logic Pulsar 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 Pulsar without waiting for claim against carrier to be settled.

PULSER POWER

If possible, use the +5 volts ($\pm 10\%$) of the instrument being tested. A BNC-to-alligator clip adaptor is supplied with the Pulsar. An external supply may be used in place of the instrument's supply. In this case, connect the common return of the power supply to that of the instrument under test.

Common Return Clip

When maximum current output is required, use the common return clip supplied with the Pulsar to make the common return path as short as possible. Current pulses from and to the Pulsar can be as high as one Ampere. The common return connector reduces the IR drop.

PULSER OPERATION

The Hewlett-Packard Model 10526T Logic Pulser (Figure 1) generates one LOW pulse and one HIGH pulse each time the fingertip pulse switch is pressed. The user need not be concerned with the state of the test node: Pressing the switch automatically drives a TTL or DTL logic output or input from LOW to HIGH or from HIGH to LOW. The high source and sink current capability of the Pulser can override integrated circuit output points, originally in either the HIGH or LOW state. The output pulse width of 0.3 μ s, however, limits the amount of energy delivered to the device under test, thereby eliminating the possibility of destruction.

The Pulser's output is tri-state. In the off state, the probe's high output impedance ensures that circuit operation is unaffected by probing until the Pulse switch is pressed. Pulses can be injected while the circuit is operating and no disconnections are needed. The multi-pin stimulus kit (Option 004) is useful for stimulating up to four inputs of a gate at the same time or four different circuit nodes.

APPLICATIONS WITH COMPLEMENTARY INSTRUMENTS

INTRODUCTION

Hewlett-Packard makes several instruments which assist the troubleshooter in testing logic circuitry with the Logic Pulser. The Model 10525T Logic Probe, Model 10529A Logic Comparator, and the Model 10528A Logic Clip are three. Examples of their applications are given in the following descriptions.

LOGIC GATE TESTING

A logic gate may be tested by pulsing the gate's input, while monitoring the output with a Logic Probe (see Figure 3). The Logic Pulser generates a pulse opposite to the state of the input line and can change the output's state. This assumes the output of the gate is not clamped in its state by another input, e.g., a HIGH on the other input of an OR gate.

If the pulse is not detected at the output, pulse the output line (see Figure 4). If the output is not shorted to Vcc or common return, the Logic Probe should indicate a pulse opposite to its original indication. If not, check for external shorts (solder bridges, etc.) before removing the integrated circuit.

Figure 3. Logic Gate Testing

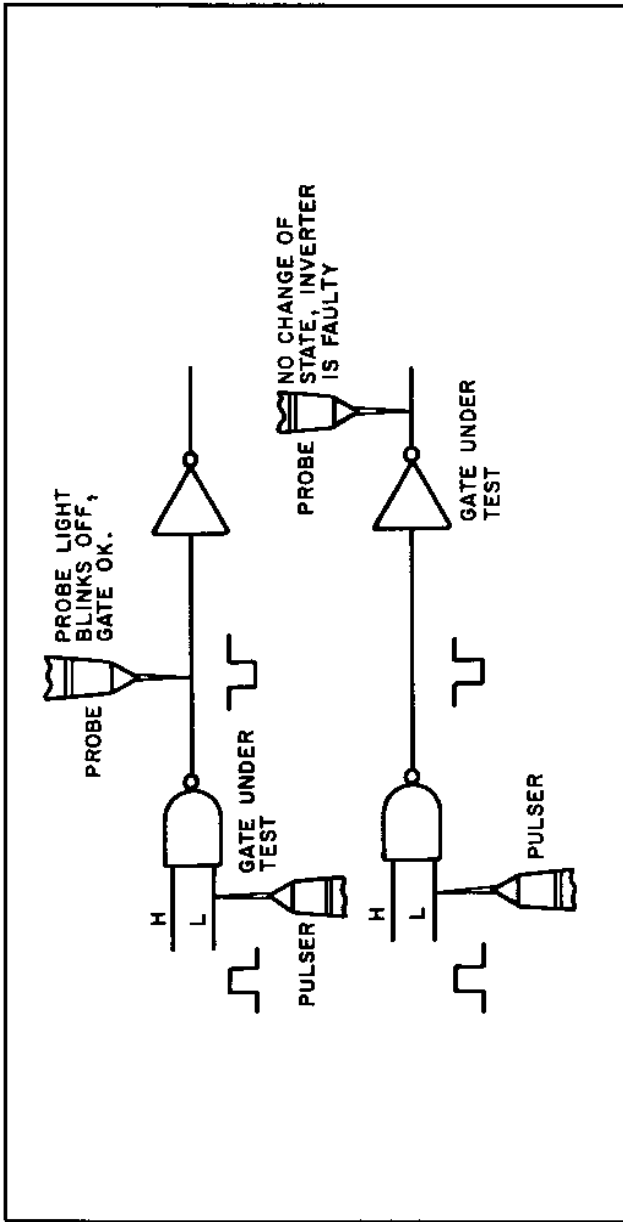
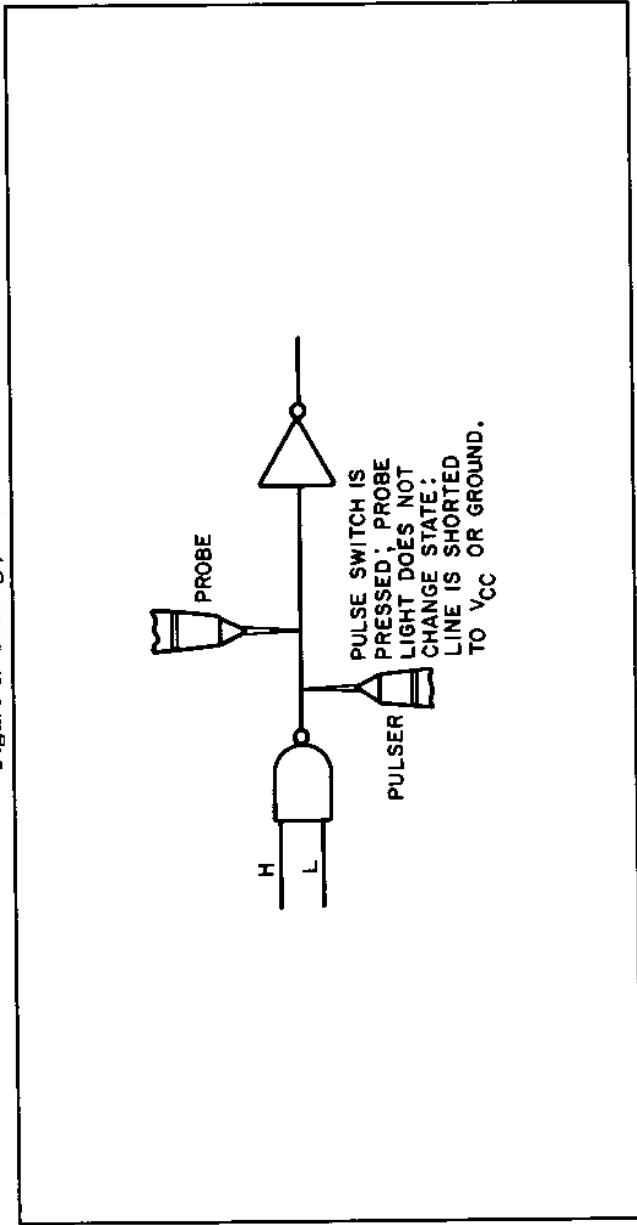


Figure 4. Testing for Shorts



COUNTER, SHIFT REGISTER, AND FLIP-FLOP TESTING

MSI IC's, such as shift registers and counters, typically have several output pins where data must be monitored when testing. The Logic Pulser, used as a manually controlled clock, allows the Logic Clip to simultaneously examine all output data at rates convenient for viewing.

When the Logic Clip is placed on an IC, the LED's on the clip indicate the logic state of each pin (see Figure 5). As the Pulser clocks the input, the indications on the Clip can be compared to a truth table.

LOGIC COMPARATOR

The 10529A Logic Comparator (Figure 6) is an IC troubleshooting tool that electrically compares a reference IC to an IC under test. The reference IC shares the power and input signals with the test IC. When comparing the outputs of the two IC's, any level difference existing for 0.2 μ s or more will light an LED on the comparator, thereby indicating a fault.

The Logic Pulser allows in-circuit stimulation, so test pulses may be introduced at circuit nodes. Thus, reset or synchronizing pulses may be injected to reset the comparator's IC to the same initial state as the test IC. This allows the reference IC and the test IC to begin operation from the same reference point.

Figure 5. Multi-pin Testing with Logic Clip

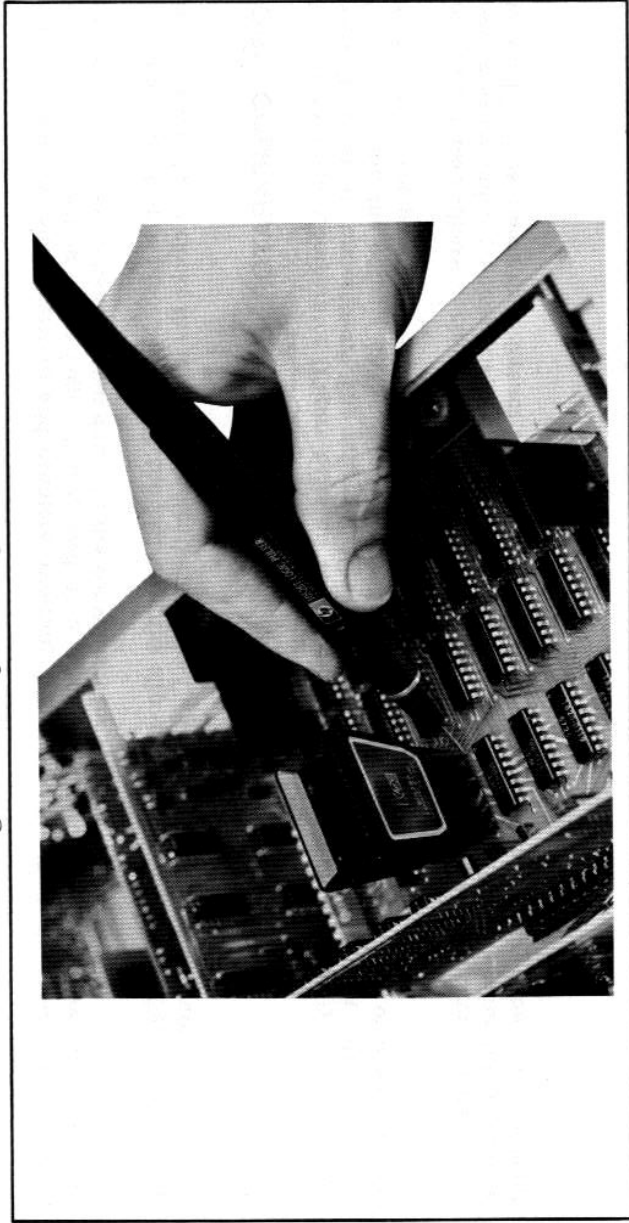
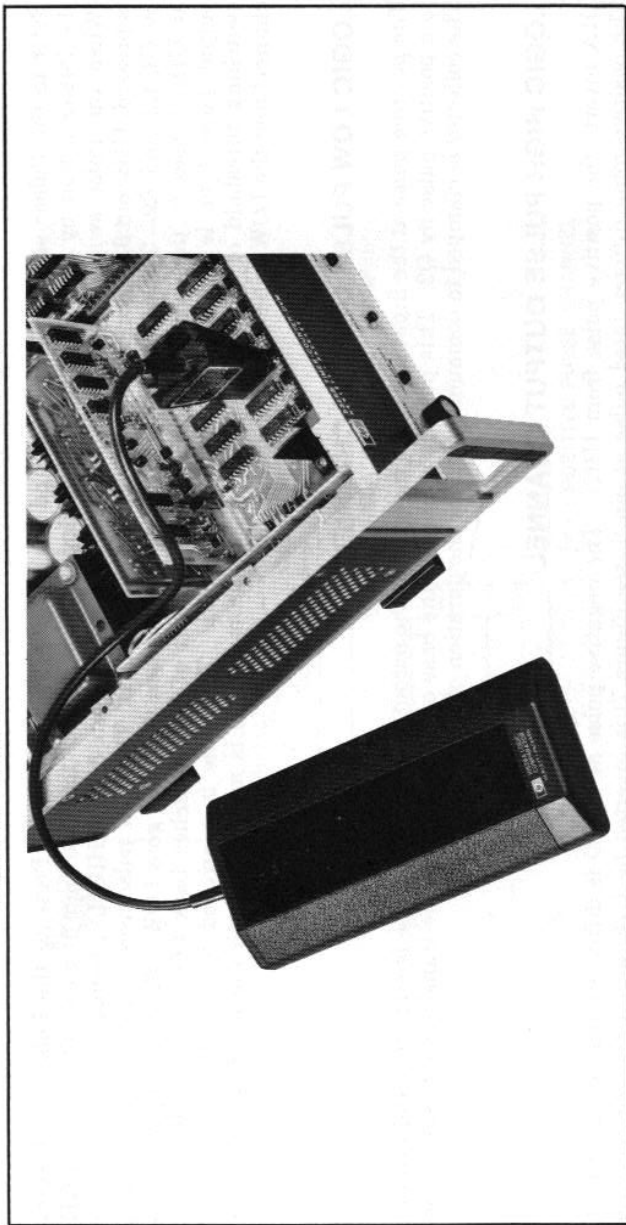


Figure 6. Multi-pin Testing with Logic Comparator



THEORY OF OPERATION

Refer to the Pulser schematic diagram and timing diagram (Figure 7). Pressing the Pulse switch starts the Pulser action by resetting the R-S flip-flop. The F-F "out" terminal (pin 8) goes LOW from HIGH. (When the Pulse switch is released, the flip-flop sets and pin 8 goes HIGH.) Before the Pulse button is pressed, U1B (pin 3) is normally at 2.9 volts (a logic HIGH). The LOW pulse from UID(8) is differentiated by C3, R2, and R9. The output of U1B(2) goes HIGH when the input goes LOW. When the input voltage at U1B(3) rises to the switching threshold, the output of U1B switches back LOW. The U1B positive output pulse time is approximately 0.3 microsecond. This time is controlled by C3, R2, R9, and the switching threshold of U1B. The positive pulse from U1B(2) is applied to both the HIGH pulse output channel and the LOW pulse output channel.

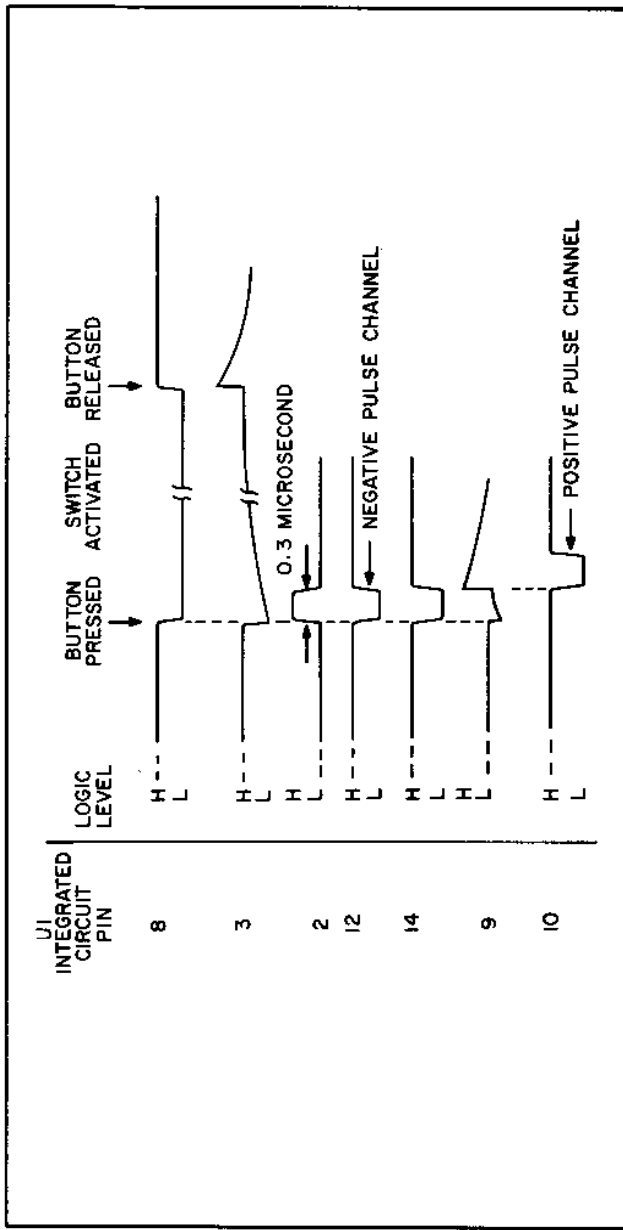
LOGIC LOW PULSE OUTPUT CHANNEL

The positive pulse at the input of U1F is inverted at the output (pin 12). The pulse is amplified and inverted to a positive pulse by Q2. This pulse is applied to the base of Q4 and drives the transistor into saturation. The collector is clamped to common return for the duration of the pulse.

LOGIC HIGH PULSE OUTPUT CHANNEL

U1A inverts the positive pulse from U1(2). The negative pulse at U1(14) is differentiated by C2 and R1. The positive-going differentiated pulse at pin 9 (see Figure 7) is inverted by U1E, and a delayed, negative

Figure 7. 10526T Logic Pulser Timing Diagram



pulse is produced at the output of U1E(10). This pulse starts when the original U1(2) pulse stops. The negative pulse from U1(10) switches Q1 on for the pulse time, producing a positive pulse at the collector of Q1. The positive pulse from the collector of Q1 switches Q3 on and produces the positive output pulse. Capacitor C5 supplies current for the HIGH pulses. Capacitor C6 provides a low impedance path for the output pulse and protects the Pulser from d.c. voltages that may inadvertently be applied to the Pulser's output (probe tip). R8 supplies a discharge path for C6.

INPUT PROTECTION

CR1, DS1, and C1 prevent power supply voltages above 5V from damaging the Pulser. With +7V applied to the Pulser power input, zener diode CR1 breaks down to clamp Vcc to about 6.5V. The remainder of the input voltage (+0.5V) is dropped across DS1. When the polarity of the supply is reversed, -7V is applied to the power input (an incorrect condition). CR1 conducts and limits Vcc applied to U1 to -0.7V. The remainder is dropped across DS1. C1 filters spikes or perturbations found on the supply line. R7 protects the output channels from damage due to overvoltage or reverse connections of power supply.

WAVEFORMS OF OUTPUT PULSE

The three waveform photographs in Figure 8 show the performance of the Logic Pulser in simple circuits. These illustrate the Pulser's automatic pulse selection. Waveform A shows the output voltage when the 10526T is pulsed into a +4-volt point. The node is pulled below 0.8 volt. Waveform B shows a 1-volt point pulsed. The node is driven HIGH for 0.3 microsecond. Waveform C shows a +2.5-volt point pulsed. The node is first clamped LOW and then driven HIGH. Each time the pulse button is pressed, the output is clamped low for 0.3 microsecond and then drives high for 0.3 microsecond.

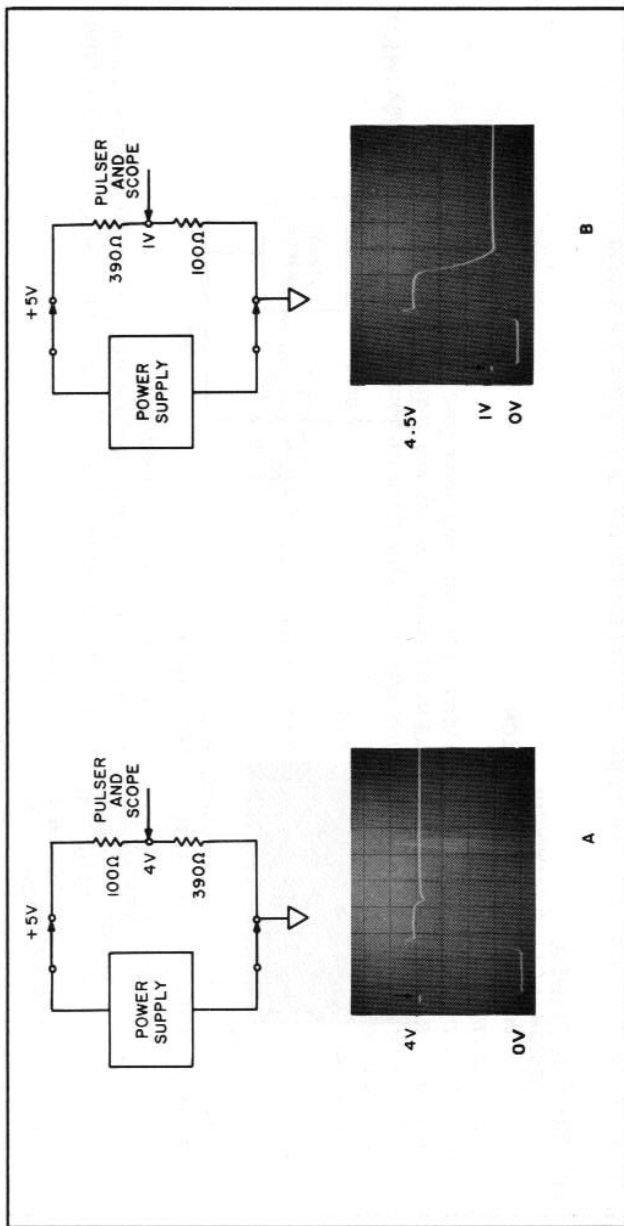
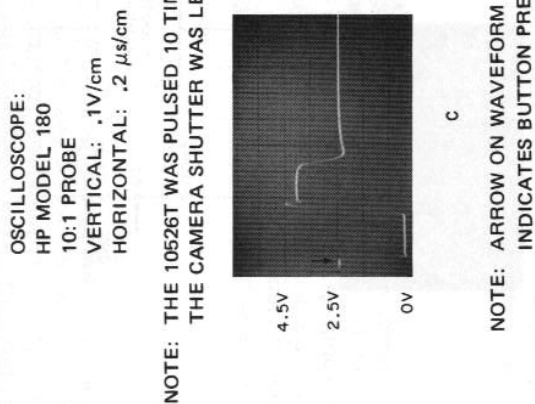
Figure 8. *Pulsar Waveforms*

Figure 8. *Pulser Waveforms (Continued)*

MAINTENANCE

PARTS REPLACEMENT

All parts of the Pulser can be replaced. Be careful when replacing any parts on the Pulser's printed circuit board, since too much heat can ruin the board. Use the smallest and lowest temperature soldering iron available to replace parts. A 30-watt soldering iron is recommended.

PULSER DISASSEMBLY

Figure 12 shows the Pulser parts. To disassemble the Pulser, perform the following steps:

1. With fingers, unscrew probe tip (MP1).
2. Slide black collar (MP2) off tip stud.
3. Use probe tip point to remove front collar (MP3). Gently push tip point between collar and body (MP7).
4. Gently push tip point between top and bottom probe body halves near tip stud.
5. Gently push tip point under rear of tip stud. The body will come free.
6. Separate circuit board and body.

PULSER ASSEMBLY

Reverse disassembly procedure. Keep "hp" on label toward tip. Note cutout for switch.

TEST PROCEDURE

There are no adjustments or preventive maintenance procedures for the Logic Pulser. The operational tests, given below, may be performed to ensure the Pulser is operating properly.

RECOMMENDED TEST EQUIPMENT

HP 6214A	0-10V 0-1A Power Supply
HP 412A	DC Volt-Ohm-Ammeter 1% Accuracy
HP 180C	100 MHz Bandwidth
HP 1801C	5 mV/div sensitivity
HP 1820C	10 ns/div sweep, time base
HP 5300A	Measuring System
HP 5302A	50 MHz Universal Counter
10 μ FD	10 V Capacitor
50 Ω	Feedthrough load
3.0 Ω	Resistor
6.2 Ω	Resistor
10525T	Logic Probe

OPERATIONAL TESTS

Test A

With the test setup as shown in Figure 9, set power supply A to $+5V \pm 10\%$. Press the Pulser pushbutton and observe a positive-going pulse, $.3 \mu s$ wide and $>2.0V$ in amplitude, each time button is pressed. See Figure 9.

The 10525T Logic Probe should flash each time Pulser pushbutton is pressed.

Test B

Arrange the test setup as shown in Figure 10. Set power supply A to $+5V \pm 10\%$, set power supply B to $+5.0V$. Press the Pulser button and observe that the Pulser clamps the node below 0.8 volt. See Figure 10.

The 10525T Logic Probe should flash off each time the Pulser pushbutton is pressed.

Test C

Connect circuit as shown in Figure 11. Set power supply A to $+5V \pm 10\%$. Set counter trigger level to $+1.4V$. Set the counter in TOTALIZE mode. Each time Pulser pushbutton is pressed, the counter should register one additional count.

Figure 9. Test A Setup

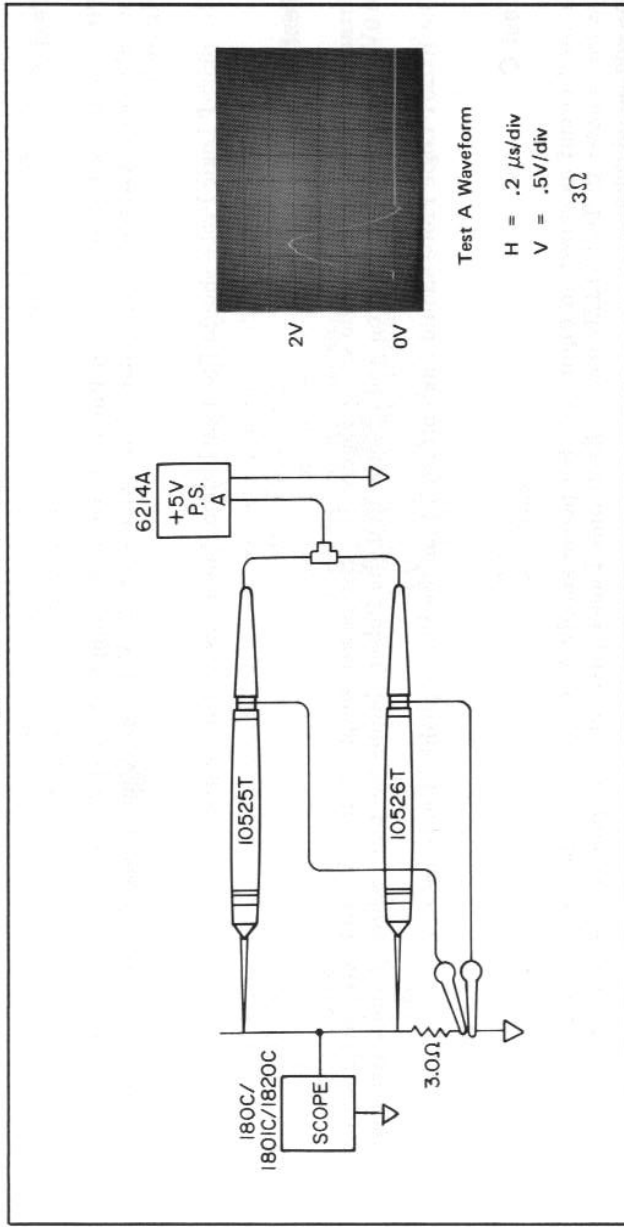


Figure 10. Test B setup

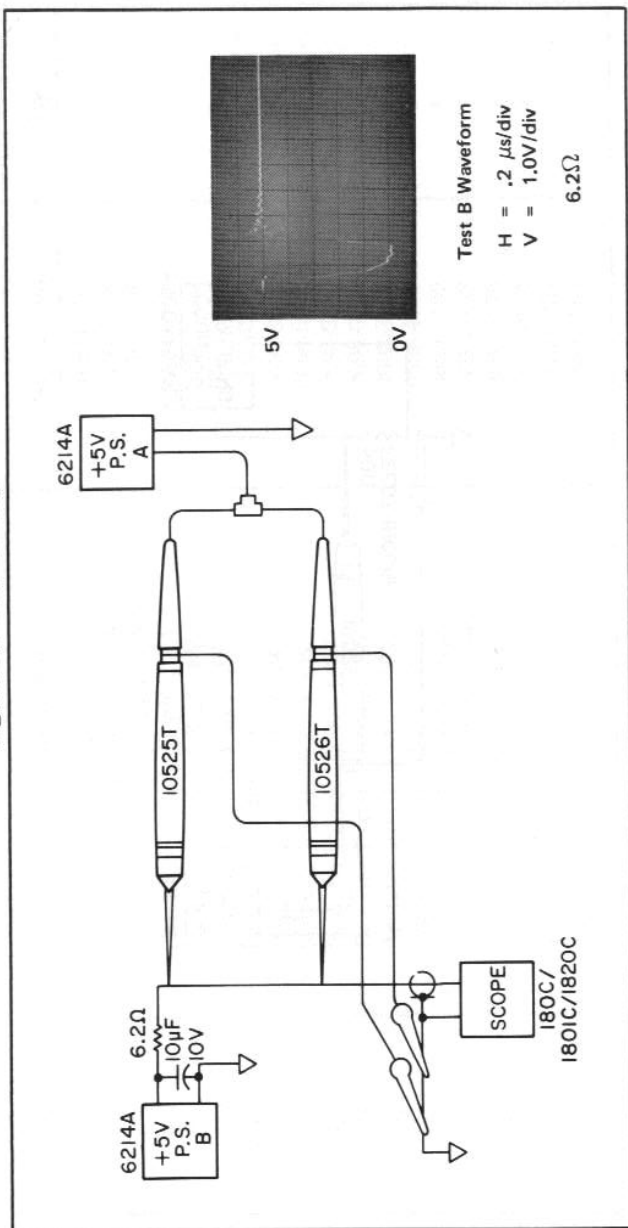


Figure 11. Test C Setup

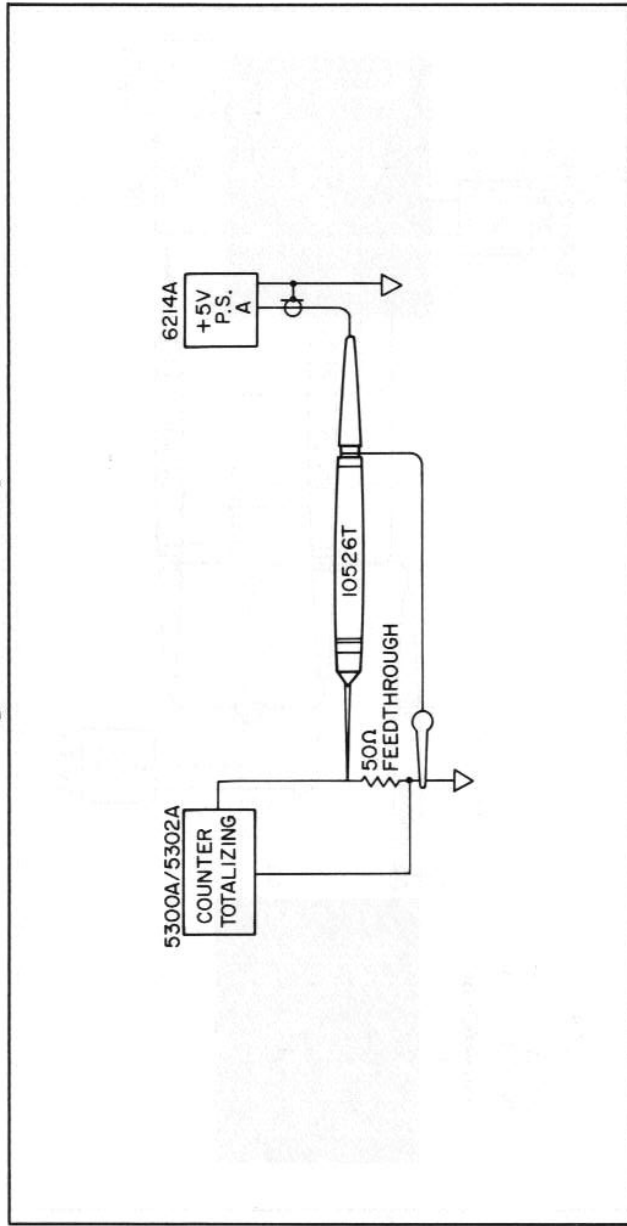


Table 2. Parts List

Ref. Desig.	Description	HP Part No.	Qty.
C1	Capacitor Fixed, 3.3 μ F, 15V	0180-0210	1
C2	Capacitor Fixed, .001 μ F, 100V	0160-3878	1
C3	Capacitor Fixed, .001 μ F, 100V	0160-3878	1
C4	Capacitor Fixed, 47 pF, 200V	0160-3876	1
C5	Capacitor Fixed, 6.8 μ F, 6V	0180-2550	1
C6	Capacitor Fixed, 1 μ F, 50V	0160-3490	1
CR1	Diode Breakdown, 6.49V	1902-0057	1
R1	Resistor Fixed, 390 Ω , 1/8W	0698-6649	1
R2	Resistor Fixed, 750 Ω , 1/8W	0698-6241	1
R3	Resistor Fixed, 2000 Ω , 1/8W	0698-5180	1
R4	Resistor Fixed, 2700 Ω , 1/8W	0698-6000	1
R5	Resistor Fixed, 300 Ω , 1/10W	0698-3114	1
R6	Resistor Fixed, 62 Ω , 1/8W	0698-4132	1
R7	Resistor Fixed, 5100 Ω , 1/8W	0698-7102	1
R8	Resistor Fixed, 20,000 Ω , 1/8W	0698-6123	1
R9	Resistor Fixed, 510 Ω , 1/8W	0698-5176	1
Q1	Transistor	1853-0831	1
Q2	Transistor	1853-0831	1
Q3	Transistor	1854-0568	1

Table 2. Parts List (Continued)

Ref. Desig.	Description	HP Part No.	Qty.
Q4	Transistor	1854-0568	1
S1	Switch	3101-1757	1
U1	Hex Inverter SN7404W	1820-1004	1
DS1	Lamp	2140-0094	1
MP1	Pin Tip Assembly	5060-0418	1
MP2	Collar, Black	10526-20003	1
MP3	Collar, Front Alu	10525-20003	1
MP4	Stud, Tip	10525-20002	1
MP5	Collar, Rear	10525-20008	1
MP6	Probe Body Bottom	10525-40003	1
MP7	Probe Body Top	10526-20002	1
MP8	Cable Assembly	10525-60004	1
	Common Return Clip	10004-61301	1
	Cable Assembly BNC	8120-1292	1

Figure 12. *Pulser Parts Locations*

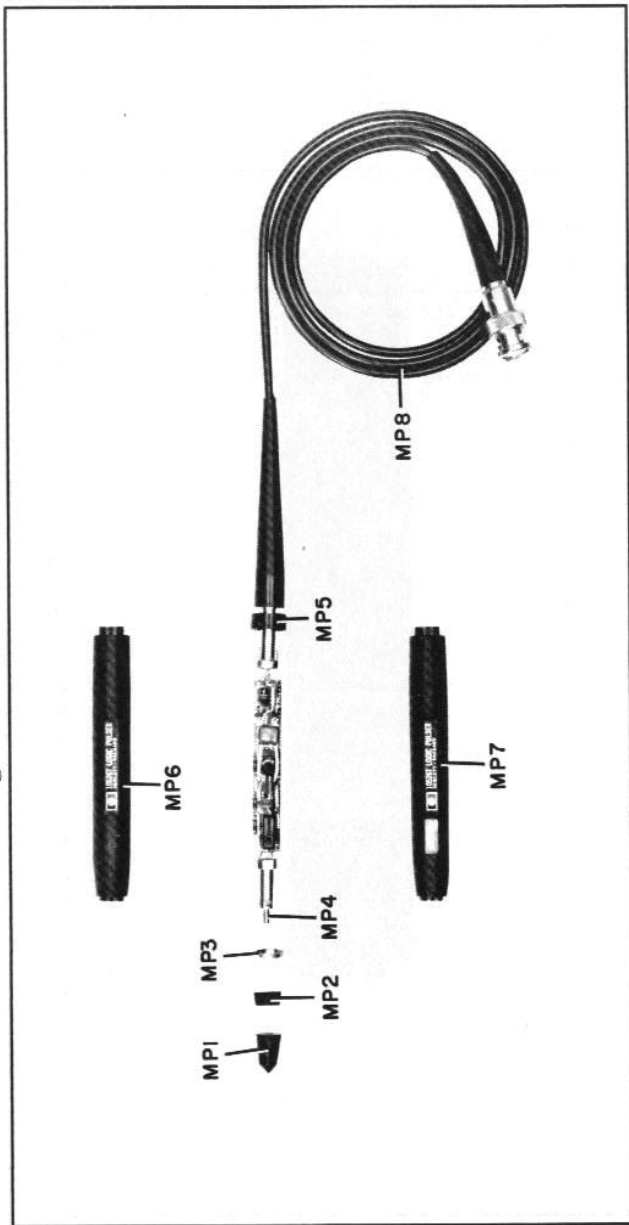


Figure 13. *Pulser Component Locator*

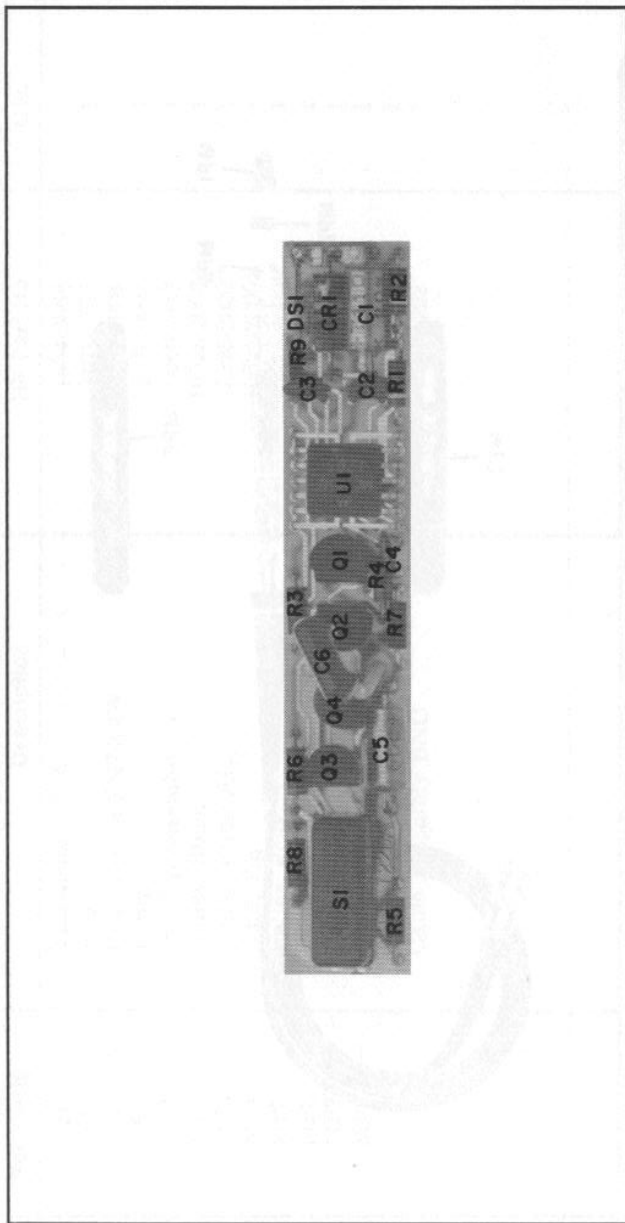
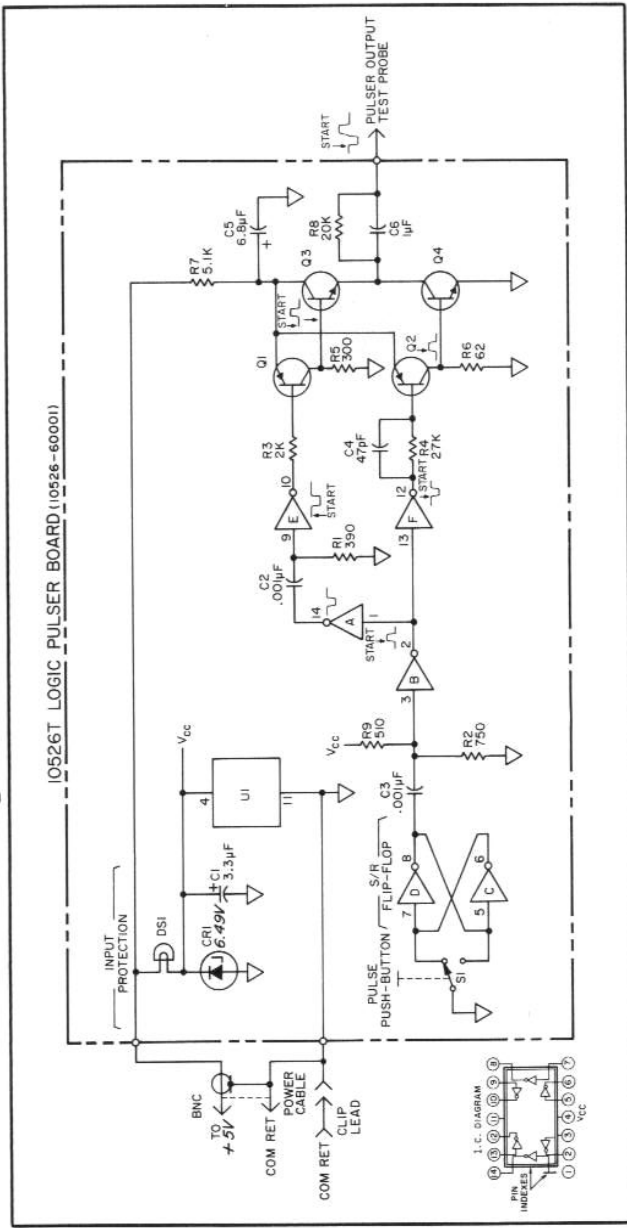


Figure 14. Pulser Schematic Diagram



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 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 CANADA:

QUEBEC

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

IN CENTRAL AND SOUTH AMERICA:

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

10526-90008



HEWLETT
PACKARD

PRINTED IN U.S.A.