2. Apply heat to the component lead on the wiring side of the board, and allow the solder to run down the lead to the hole and land pattern. Use just enough solder and heat to fill the hole and to make a good electrical connection. If heat is applied equally to the component lead and the land pattern, the land pattern may be damaged before the component lead is hot enough to solder.

3. Wash the general area of repair using a typewriter cleaning brush and IBM cleaning fluid (P/N 450608); wipe the area with a clean piece of cloth or tissue.

Card Inspection

1. Visually inspect resistors, inductors, and capacitors for signs of physical damage, discolored value bands, melted wax, and other signs of overheating.

2. Inspect for damaged printed circuit card contacts and leading edge of card.

3. Inspect for solder splashes and short circuited printed wiring.

4. Check for improperly soldered components on the printed circuit board.

Transistor Measurement

WARNING: Always use the X100 scale of the ohmmeter to protect transistors from excessive current.

A good-bad test to indicate open or shorted transistor junctions may be performed on a transistor without removing it from the printed circuit card. For the test, transistors are considered as two back-to-back diodes, arranged in NPN or PNP configuration. Check forward and reverse resistance of each diode with an ohmmeter adjusted to the X100 ohm scale (Figure 24). If the resistance is high in both directions the transistor is open. If the resistance is low in both directions, the transistor is shorted.

NOTE: Before removing and discarding the transistor as a result of this test, check the printed card to establish that an apparently shorted transistor junction is not the result of its being shunted by a low resistance component.

Circuit Measurements

Pulses

These measurements require an oscilloscope with a calibrated sweep time base and a frequency response high and low enough to pass all frequencies in the pulse spectrum to be measured. A high impedance (10:1 attenuating) probe is usually used in this type of measurement to avoid distorting the pulse. This type of probe must be calibrated to the oscilloscope used.

Pulse Rise Time is the time required for the leading edge of a pulse to complete 80 percent of its change in level as measured between the 10 percent and 90 percent points. Calibrate the oscilloscope sweep time for a slightly greater time than the rise time to be measured. The pulse rise time (Figure 25) can be read directly from the oscilloscope.

Pulse Duration is the time between a 50 percent point on the pulse rise time and 50 percent point on the pulse decay time (Figure 26). This quantity can be measured using the same techniques as for measuring pulse rise time.

Pulse Decay Time is the same as pulse rise time, except that it occurs on the trailing edge of the pulse.

Pulse Droop and Pulse Overshoot are measured as a percentage of total pulse amplitude (Figure 27).

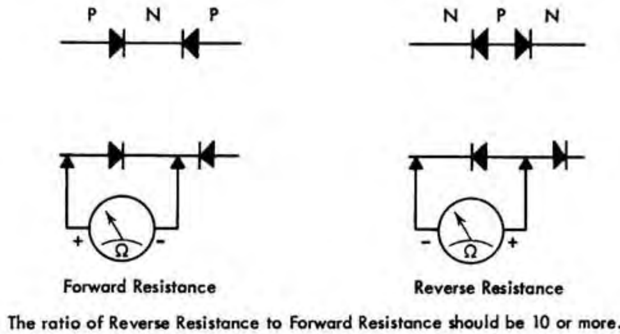

Figure 24. Transistor Measurements

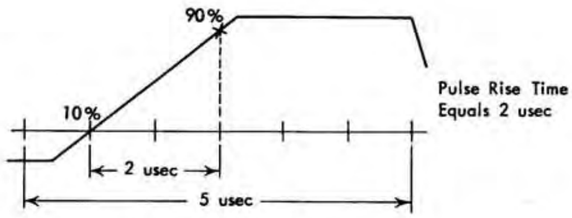

Figure 25. Pulse Rise Time Measurement

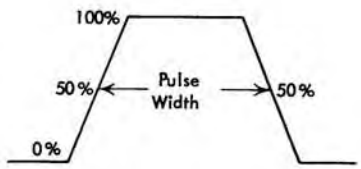

Figure 26. Pulse Duration Measurement

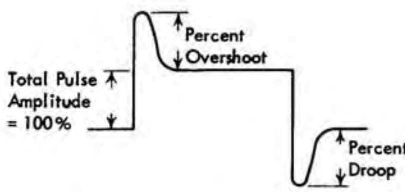

Figure 27. Pulse Droop and Overshoot

Signal Level Measurement

Use the oscilloscope for point-to-point P and N line measurements. A grease pencil line may be used to mark line levels and tolerance limits on the scope face (Figure 28). Note that oscilloscope calibration varies with the type of probe, plug-in-amplifier, and oscilloscope used.

Phase Shift and Time Delay Measurement

Phase shift is a time delay of less than one cycle of the fundamental frequency of the measured waveform. It is expressed in cycle degrees. Time delay is a delay of