

SEMI G24-89

TEST METHOD FOR MEASURING THE LEAD-TO-LEAD AND LOADING CAPACITANCE OF PACKAGE LEADS¹

1 Purpose

This document defines the equipment, materials, and procedures used to measure the lead-to-lead and loading capacitance of package leads. Semiconductor packages are shown as examples; however, other packaging elements can be measured by this method.

2 Equipment and Materials

2.1 Capacitance meter which uses a two probe plus guard method with two coax cables, or a meter which utilizes a four probe plus guard method. The four probe method requires four cables to be modified to connect to two probes at the probe end of the cables. Both methods require an 18 awg. or larger insulated wire for the guard connection. Keep cables at minimum length (1 meter) unless specified by individual equipment. Coaxial cables must be used to connect the probes to the meter. Meter accuracy $\pm 2\%$. The probe shields must be connected together. This connection should be short, approximately one to two inches.

2.2 Probe station with two coax probes and one regular probe. Recommendation: Micromanipulator, two (2) each coax probe model 44-FPC-6000 with #5 collet, and one each OON-FPC-6000 with #3 collet, or equivalent.

3 Procedure: Lead-to-Lead Capacitance(See Figure 1)

3.1 Set the instrument to measure at 1 Mhz. If the equipment has a cable length selection switch, adjust the switch to the appropriate coax cable length.

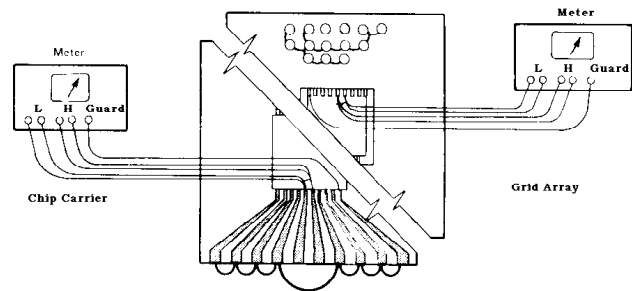


Figure 1
Lead-to-Lead Capacitance

3.2 Connect together all the pins in close proximity to those being measured, for multi-layer ceramic package pins should be chosen to connect all traces adjacent to traces being measured. Example: Eight surrounding pins are connected for the 68 lead pin grid; twelve surrounding pins are connected together for the 124 pin grid; eight surrounding pins are connected together for all flat packs (see Figure 1). If there are power planes and/or large power buses in the package, their pins must be connected together with the eight or 12 surrounding pins discussed above.

3.3 Place the guard probe down on the cavity side of any one of the eight or 12 leads discussed in Section 3.2, to ensure that they will not affect the measurement.

3.4 Place one coaxial probe approximately 1/8 inch above the cavity side of one of the leads to be measured.

3.5 Place the other coaxial probe approximately 1/8 inch above the cavity side of the other lead to be measured.

3.6 *Nulling Procedure* — If using an instrument that auto-zeros, such as the H.P.4275A, follow the instrument instructions for capacitance measurement. If this type of instrument is not being used, take the reading on the instrument at this point.

¹ This test method applies to measurements in the range of 1 to 100 pico farads.

3.7 Place the probes down on the leads to be measured. This should be a vertical movement only.

3.8 Take the capacitance reading. If using auto-zeroing equipment, this capacitance measurement will be used. If not, take the reading from 3.6 and subtract it from the reading in 3.8 to derive the capacitance measurement of interest. (See Table 1.)

Table 1 Capacitance Nulling Procedure for Non-Zeroing Equipment

Pins to be Measured	Capacitance Reading at 3.6	Capacitance Reading at 3.8	Subtraction Step to Derive Desired Capacitance at 3.9
1 & 2	C_1	C_2	$C_2 - C_1 = C_3$
3 & 4	0.050 pf	2.130 pf	$2.130 - 0.050 = 2.080$ pf

For Auto-Zeroing Equipment:

Pins to be Measured	Capacitance Reading at 3.6	Capacitance Reading at 3.8	Subtraction Step to Derive Desired Capacitance at 3.9
5 & 6	C_1	C_2	$C_2 - C_1 = C_3$
7 & 8	0.00 pf*	2.08 pf	$2.080 - 0.000 = 2.080$ pf

*Follow instrument instructions to read 0.00 pf

3.9 Repeat the procedure as required.

4 Procedure: Loading Capacitance (See Figure 2)

4.1 Omit guard terminal. Connect together all the pins in close proximity to the one to be measured. Example: Eight surrounding pins are connected together for the 68 pin grid; twelve surrounding pins are connected together for the 124 pin grid; eight surrounding pins are connected together for all flat packs (see Figure 2). If there are power planes and/or large power buses in the package, their pins must be connected together with the eight or 12 surrounding pins discussed above.

4.2 Place one coaxial probe approximately 1/8 inch above the cavity side of any one of the eight or 12 leads discussed in Section 4.1.

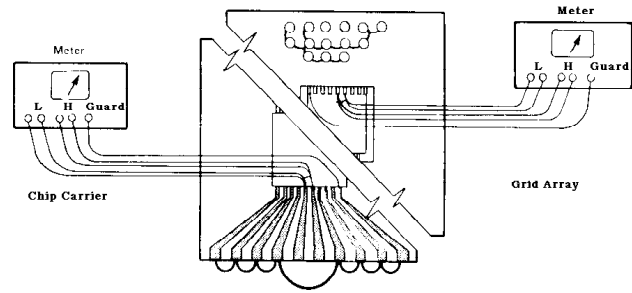


Figure 2 Loading Capacitance

4.3 Place the other coaxial probe approximately 1/8 inch above the cavity side of the lead to be measured.

4.4 Continue as in Steps 3.6 to 3.9.

4.5 Overall accuracy with this method is $\pm 5\%$.

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