

Measurement of Capacitance in CDM Testing

Background

CDM (Charged Device Model) ESD testing is performed on a device to determine real world susceptibility of electronics to a sudden discharge of a device that has a surface charge and then touches a grounded or different potential, conductive surface. CDM simulators usually consist of a charge plate, which is connected to a high voltage power supply, and a grounded pin, that can be moved from pin to pin (known as the “pin under test” or PUT). The resulting current that flows into (or out of) the device depends on the innate capacitance of the device and, to a lesser extent, the ground plate. Knowing the value of the capacitance for each pin helps the designer to understand the difference between various passing values and the overall architecture of the device.

The Thermo Scientific Orion3 CDM simulator is the most popular and advanced CDM simulator in the market and offers, among many other features, the ability to measure the true capacitance of every pin on a device.

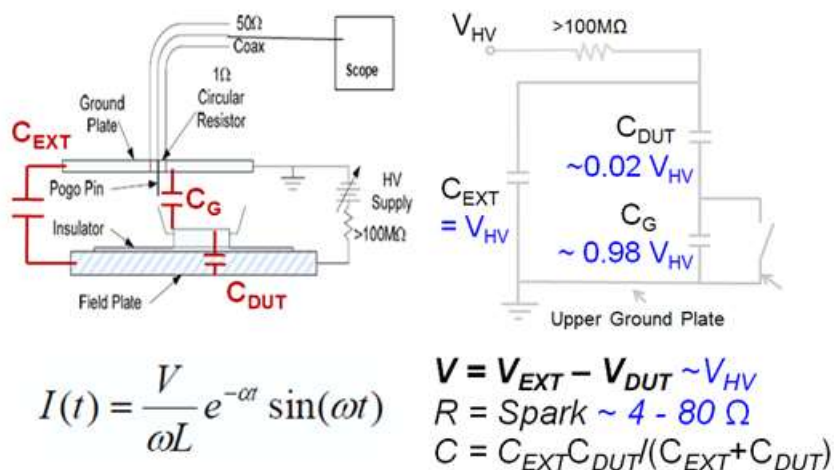


Figure 1: CDM model for a simulator

Measuring capacitance

The total current entering the device is proportional to the maximum charge that the device can hold (Figure 1, CDUT). In turn, the charge allows you to determine the capacitance, since capacitance is a function of voltage and charge:

$$C = \frac{Q}{V}$$

Where:

C= capacitance [Farads]

Q = Charge [Coulombs]

V = Voltage [Volts]

The measurement of the charge is performed using an oscilloscope and a current transducer. In CDM simulators, the most common current transducer is a 1 Ohm circular resistor located in the ground plane and attached to a coaxial cable that routes the signal to the oscilloscope. The resulting waveform is a double decaying exponential:

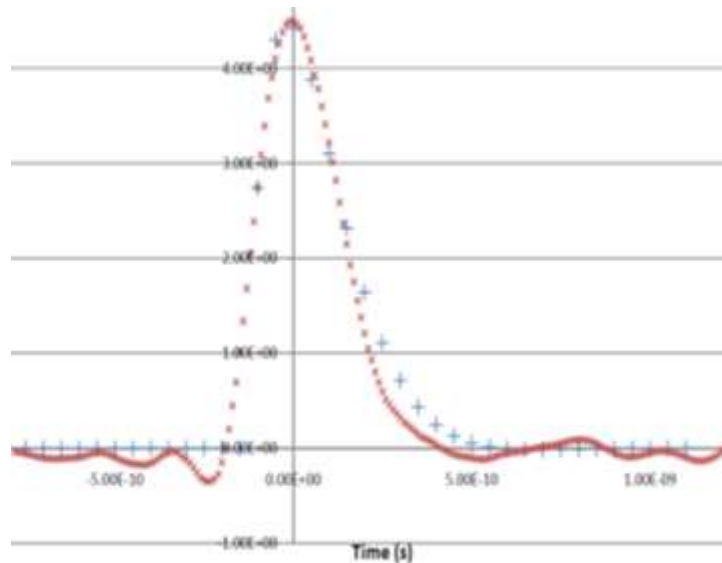


Figure 2: Typical CDM waveform

Since current is a measure of the change of charge with time, it is possible to calculate the total current, and therefore the capacitance of the pin under test with a captured waveform.

$$I = \frac{dQ}{dt}; \quad Q = \int_{t=0}^{t=t1} I dt$$

Conclusion

The Thermo Scientific Orion3 can accurately measure the true capacitance on every pin of a device. It is important to note that the capacitance of the pin under test is measured and not calculated. A calculation will provide you with a loose approximation of the actual value, but not the true value. The actual charge flowing into the device is contained in the waveform capture of the oscilloscope for a given pin. The capacitance of each pin allows an insight on how the current into the device is affected by pin location and package for a given DUT, allowing the user to understand possible differences in CDM performance.

Capacitance calculations are done automatically for every pin under test by selecting the waveform capture option. All the values of capacitance are included in the test results report. For more information, or a demonstration of the Orion3's capabilities, please contact your local sales representative.