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Application Note

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Subject: TRANSIENT: WHAT IS IT?

Transients are brief overvoltage pulses, whose energy can be coupled into voltage sensitive equipment via wires. Transients can be either in repeatable fashion or as random impulses. The effects of transient overvoltages vary greatly and depend on their source, intensity and frequency of occurrence. There are three types of transients

LIGHTNING TRANSIENTS:

A nearby lightning strike to objects on the ground produces electromagnetic fields that can induce voltages on the conductors of primary and secondary power lines. These electromagnetic fields have a great effect on antennas and transmission lines too. Direct strikes on high tension power lines inject high current into primary circuits producing voltage surges by either flowing through ground resistance and causing a ground potential change or flowing through the primary power circuits.

SWITCHING TRANSIENTS

Man made switching transient overvoltages commonly occur when current flowing in an inductor is interrupted. As the magnetic field of the inductor collapses, the stored energy is released, causing a voltage surge. Such events occur on the power distribution system when load shedding, capacitor bank switching or line fault (short circuits) interruptions occur. Similar transients, although of a much lower energy, are generated locally by relay, solenoid or transformer switching in nearby appliances.

STATIC ELECTRICITY (ESD)

Static electricity results from the triboelectric effect when two dissimilar insulating materials rub together. Electric charges of opposite polarity accumulate on the materials when separated. When a charged body touches or closely approaches an object at a lower potential an electrostatic discharge takes place. Although containing little energy, the very fast rise time discharges can damage or degrade silicon chips.

High winds, especially under conditions of very low humidity, can cause static in much the same manner as does walking across the carpet. Blowing powder snow and sand may also cause static build-up on exposed metal surfaces.

The following table shows some of the characteristics of transient sources.

	<u>VOLTAGE</u>	<u>CURRENT</u>	<u>RISE TIME</u>	<u>DURATION</u>
Lightning	a) 25kV/M b) 6kV	20kA 1kA	<1.5 microsec <10 microsec	40 microsec 1 millisec
Switching	a) <2500V b) <600V	200A >500A	<10 microsec <50 microsec	>1 millisec >10 Millisec
EMP	a) 100kV/M b) 1kV	10kA >10A	10 nanosec 20 nanosec	150 nanosec 1 microsec
ESD	a) 40kV b) 5-1kV	80A > 10A	1-5 nanosec 10 nanosec	<100 nanosec >100 nanosec

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