

## MCM & Hybrid Derating

Unlike traditionally packaged electronic components, the Hybrid or MCM thermal environment for each application must be considered separately on its own merit. Package density/mounting determines the thermal rise peculiar to the individual package design. Failure rates, an exponential function of temperature for all electronic components, makes an accurate thermal analysis the essential element to the integrity of predicted reliability figures. Recommend that derating of MCMs and hybrid devices are accomplished by considering the most reliability-limiting element contained within the packaged device. All passive and active devices need to be considered separately. Recommend the user refer to the individual part chapters in this manual when attempting to derate a MCM or hybrid device, as shown in Table 1.

When passive structures are used in microwave applications, properly designed transmission lines and other passive microwave components should not require power derating. In cases of poor design or fabrication, transmission lines can fail as a result of electrical over stress (EOS), resulting in an open circuit. Poor design can also limit the reliability of other passive structures; however, normally it is the active device elements, which pose the primary reliability threat for microwave structures.

Part Type	Maximum Allowable Rating
Thick Film Resistor	Current/Voltage – 80% Power – 50% (See Notes 1 and 4 below).
Film Chip Resistor	See Resistors Derating Section
Ceramic Chip Capacitor	See Capacitor Derating Section (See Note 2)
Tantalum Chip Capacitor	See Capacitor Derating Section (See Note 2)
Chip Inductor	See Magnetic Devices Derating Section
General Purpose Diode	See Discrete Semiconductor Derating Section (See Note 3)
Microwave Diode	See Discrete Semiconductor Derating Section (See Note 3)
Bipolar Transistor	See Discrete Semiconductor Derating Section (See Note 3)
Field Effect Transistor (FET)	See Discrete Semiconductor Derating Section (See Note 3)
Microcircuits	See Microcircuit Derating Section (See Note 3)

Table 1. Recommended Derating Guidelines for Hybrid and MCM Devices

NOTES:

1. For repetitive pulse applications, the average power is determined by dividing pulse duration by duty cycle, and multiplying the result by the peak power.
2. Voltages must never be applied in reverse of the normal polarization of a polarized capacitor.
3. Maximum junction temperature ratings for all semiconductors and integrated circuits are assumed greater than or equal to the maximum operating temperature required of the device.
4. Derating values for thick film resistors is taken from IPC-MC-790, "Guidelines for Multichip Module Technology Utilization"; August 1992.