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An ISO 9001:2008 Registered Company

HYBRID JUNCTION TO CASE

Some customers and users ask about thermal resistance values (junction to case) for different converters.

While Theta J-C values may give useful guidance for thermal design for packaged mono element power semiconductors, the use of a single thermal resistance figure is of little or misleading value for relatively complex DC-DC power converters. That is because the converter design comprises a variety of many semiconductor elements, all electrically stress derated and thermally managed by the internal design of the converter. The Theta JC value for any one such element could vary greatly with another; an average value could misrepresent the range. This is the reasoning why such values are not typically published.

Guidelines offered in the MDI Application Notes are meant to offer assistance during thermal design of converter interfaces, such as:

The converter base plate must be maintained at or below the published maximum rated operating temperature.

The mounting surface must be flat and smooth so as to prevent air gaps or voids that will inhibit heat conduction. The use of thermal pads held in compression to the manufacturer's recommendations is encouraged to take up differences.

The heat load or flux may be calculated by assuming all (100%) of the converter thermal dissipation is accounted for by conduction; no convective or radiated components should be assumed. This will prevent problems in thermal vacuum.

The power dissipated by the converter may be calculated knowing the converter's efficiency of operation

Converter efficiency will vary primarily with applied load. Curves demonstrating how efficiency varies as a function of load are available.

The heat sink should be capable of conducting the total power dissipated within the converter to insure safe semiconductor junction temperatures are maintained. Maximum power is dissipated when input voltage is at its minimum and output load is at its maximum. Typical power dissipation for a 30watt, 5VDC output converter at worst case, 68% efficiency, would be

30 Watts/. 68 = 44.12 watts of input power.
44.12 W input
-30.0 W output
14.12 Watts of power being dissipated

The heat sink required for this example would need to conduct 14.12 watts minimum away from the converter to prevent internal temperatures from rising above maximum operating junction temperatures over time.

Generally, MDI limits the internal rise of the highest thermal dissipating elements inside the converter to not more that 20C over base plate by virtue of excellent thermal design. The base plate reference is that of the converter, positioned approximately in the center. Applications guidelines (as above) should be carefully considered during thermal design of the host equipment to preclude hot spots, thermal runaway under vacuum and enhance reliability of the converter in its intended use.