**Thermal Modelling Project**

**Introduction:**

The aim of this project is to determine the maximum Junction temperature of 2 Silicon Carbide transistors within a microelectronics assembly (MCM - Multi Chip Module) during operation, at all temperature extremes. It will also be required to show the temperature distribution across the whole of the assembly.

**Multi Chip Module Details:**

This module is based on a High Temperature Co-Fired Ceramic (HTCC) package which is hermetically sealed. The photo below shows a typical HTCC package. The package used in this project will use the same technology, however dimensions, geometry and pin out will be different.

Bottom Kovar Seal Ring & Cavity



Top Kovar Seal Ring & Cavity

96% Alumina Substrate

The following outline drawings show the dimensions of the package to be modelled as part of this project.

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Bottom Cavity

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Top Cavity

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The above dual cavity package will have formed leads on all 4 sides as shown in this example

The main source of heat with in the package is the 2 SiC MOSFETs as shown in side 2 above, however other components will have some contribution to heat within the package.

* The module will be mounted to a multi-layer copper clad printed circuit board.
* The lead material is Kovar 0.813mm wide, 0.152mm thick, gold over nickel plated.
* The ambient air/cooling air will be -55oC minimum to +85oC maximum.
* Thermal transfer will be by conduction through the formed leads to the PCB and convection to the ambient cooling air.
* Current flow through the 2 MOSFETs will be 7.5 amps continuous.



Circuit Diagram

7.5 amps through this pair of MOSFETs

* The maximum on resistance of each MOSFET is 25 milliohms.
* The power dissipated in each MOSFET will be 1.4 watts (I2R)
* 96% Alumina substrate 2mm thickness
* Top and bottom conductor layer, tungsten, nickel and gold plated.
* 5 Inner tungsten conductor layers.
* All conductor layers approx. 30% of the total ceramic area
* Package leads on a 1.524mm pitch
* Assume leads mounted to an infinite heatsink
* Seal ring top, 3mm high
* Seal ring bottom, 1.5mm high
* All exposed metal surfaces 6um thickness nickel plated, followed by 0.2um gold plate.
* Alternative substrate material – AlN (Aluminium Nitride) – impact on thermal model.