Modeling of a High-Temperature Ultra-Wide Bandgap Gallium Oxide Power Module

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TABLE I - MODELING METHODLOGIES

Method	*Benefit(s)*	*Limitation(s)*
ANSYS Workbench	Quick solve time/ability to model convection coefficient	No electron scattering/no micro or nano scale device structures
Silvaco TCAD 2D	Accurate electro-thermal interactions	Potential 2D-3D heat spreading differences/no convection model
Silvaco TCAD 3D	Accurate electro-thermal interactions	Very long solve time/no convection model
2D TCAD → 3D ANSYS	Quick solve time/accurate device level electro-thermal interactions	Static junction temperature

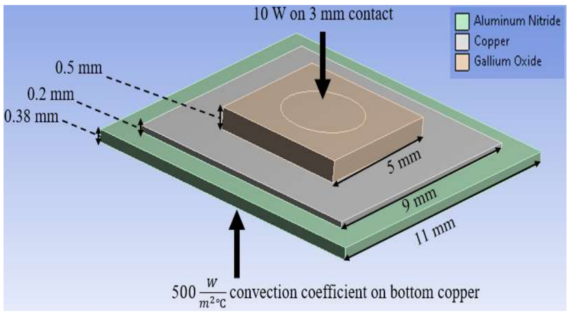
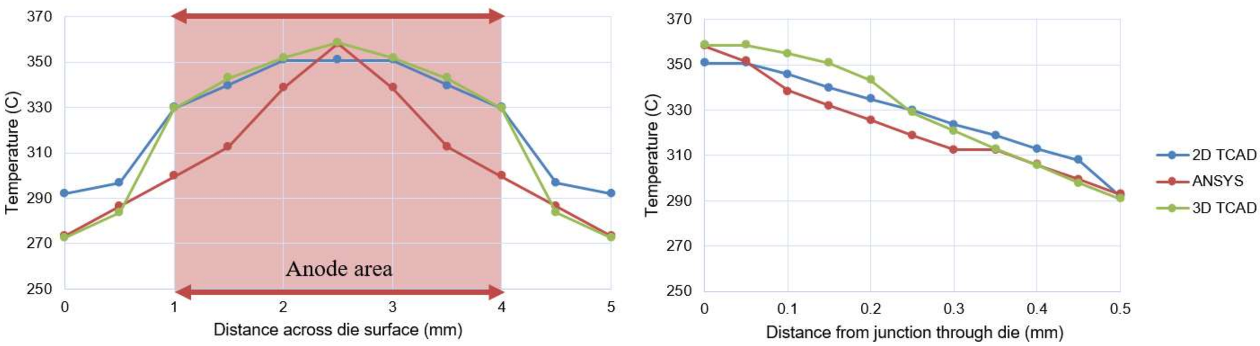


Figure 1: Model dimensions, load conditions, and boundary conditions used in all simulations.



(a) (b)

Figure 2: Temperature distribution for each model (a) across the anode surface and (b) through the die.

TABLE II - COMPARISON OF BOTTOM-SIDE COOLED DIODE MODELS

Method	*Solve Time*	*Peak Temperature*	*ΔT Across Device Surface*	*ΔT Through Device*
ANSYS Workbench	~2 minutes	358 °C	85 °C	65 °C
Silvaco TCAD 2D	~7 minutes	351 °C	59 °C	59 °C
Silvaco TCAD 3D	~13 minutes	358 °C	85 °C	68 °C