

GOX 2023

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Heterogeneous Material Integration

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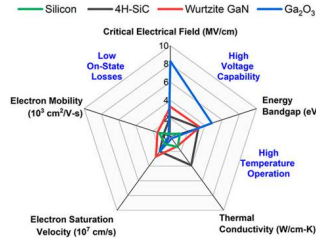


Table 1 : Radiation Effects between Ga2O3 and Si MOSFETs

Radiation Type	Si MOSFET	Ga ₂ O ₃ MOSFET
Total Ionizing Dose	Atomic change in lattice: • Carrier concentration altered	Strong bond, reinjection of carriers from Al ₂ O ₃ /AlN _x interface • Carrier concentration in 2DEG less affected
Displacement Damage	Metal Oxide layer traps charge: • Threshold voltage changes	Field Effect Transistor: • No oxide layer to trap charge
Single Event Effects	SE Gate Rupture (SEGR) • Catastrophic failure SE Burn Out (SEB) • Catastrophic failure	SE Gate Rupture (SEGR) • No Catastrophic failure observed SE Burn Out (SEB) • Catastrophic failure
Conclusion	Bulkier die to meet tolerance levels Very susceptible to radiation High FOM: low performance	Almost no die change, mainly packaging Very tolerant to radiation Low FOM: good performance

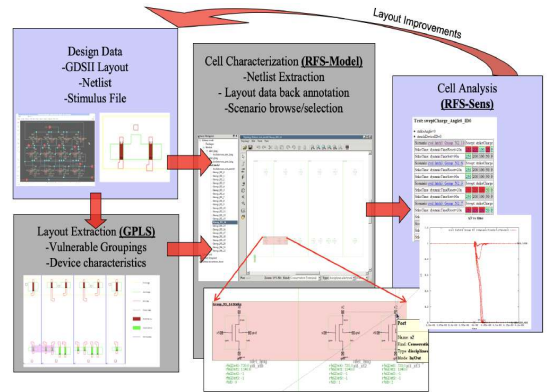


Figure 4: Design Analysis Approach

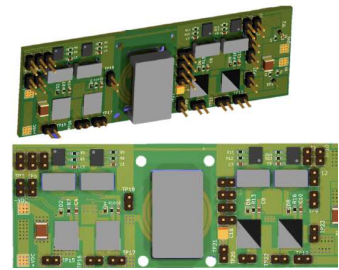


Figure 5: Proposed design

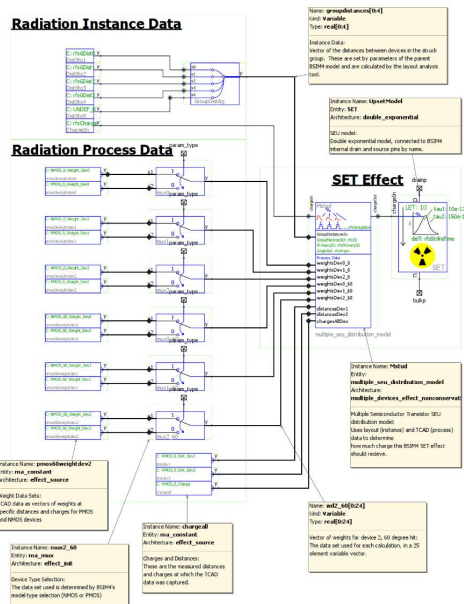


Figure 2: Radiation Modelling

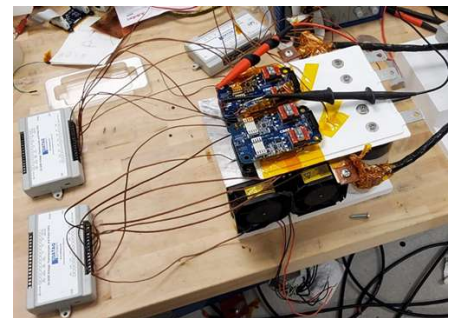


Figure 6: PEBB Experimental Setup for Steady State Thermal Characterization

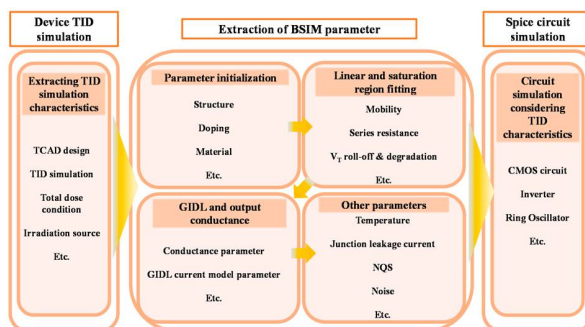


Figure 3: Flow chart of the simulations for TID

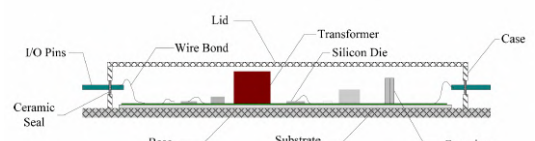
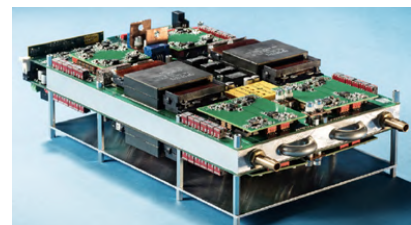


Figure 7: Package for DC-DC converter