

COMMERCIALIZATION OF 3.3kV SILICON CARBIDE (SiC) MOSFETs & SBDs

Objectives: Proposed efforts would focus on commercialization of 3.3 kV SiC Schottky Barrier Diodes (SBD) and MOSFETs, including reliability assessments and production scale-up. Microsemi is also proposing to investigate technical feasibility of producing 6.5 kV SBDs through an open foundry for eventual higher yield and lower cost manufacturing

Major Milestones: 3.3 kV – Optimize design and process for commercialization, complete fundamental reliability tests, prove ruggedness by R-UIS, R-Surge. 6.5kV - develop advance technical info sheet, complete fab & testing of SBDs, understand market requirements for commercialization.

PROJECT METRICS / DELIVERABLES

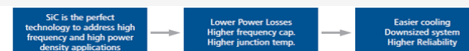
- 3.3kV SiC dies (100 SBDs, 100 MOSFET), 50 dies of 6.5kV SiC SBD

WBG TECHNOLOGY IMPACT

- 1. WBG Benefits:** Inherently faster switching operates at higher frequencies while generating lower power losses, for higher efficiency. High ruggedness provides pathway for WBG to enter mission-critical applications such as T&D and traction.
- 2. Markets:** Transmission & Distribution, High Power Traction, High Performance Industrial, Aerospace & Defense.
- 3. Commercialization:** 12 months.
- 4. Market Penetration:** SiC devices replacing current Si IGBT solutions require ≥ 2 kV for above markets. The HV market consisting primarily of the 3.3 kV-based solutions could make up 20% of the total market by 2021.

PROPOSED PB4

SiC Applications



| Markets | Applications | High Temperature | High Frequency | Small, Light System | Low Loss, Efficiency |
|---------------------------|---|------------------|----------------|---------------------|----------------------|
| Commercial Avionics | Actuation Air Conditioning Power Distribution | X | X | X | X |
| Defense Oil drilling | Motor Drives Aux. Power Supplies | X | X | X | X |
| Transportation Automotive | H/EV Powertrain EV Battery Charger DC/DC Converter Energy Recovery | X | | X | X |
| Solar Energy | PV inverter | | X | X | X |
| Wind turbine | Inverter | | X | X | |
| Industrial | Motor drives Welding UPS, SMPS Induction Heating | | X | X | X |
| Medical | MRI power supply X-Ray power supply | | X | X | X |

CONTACT

PoC: Dr. Avinash Kashyap
 avinash.kashyap@microsemi.com
 Phone: 541-280-6267

ADDITIONAL IMPACTS

- 1. Impact on Cost Effectiveness:** (a) Using 6" fab that shares several tools with a larger-volume Si line can drastically decrease cost per amp, (b) as market penetration increases, cost of substrates is expected to drop substantially, (c) a commercial foundry would reduce extrinsic defects, improving yield and cost, (d) R&D cycles can be reduced, which directly lowers costs.
- 2. Jobs:** 2 fulltime equivalents; potential of assembly and fab work benefits.
- 3. US Competitiveness:** Major players in SiC are based outside of the US, a potential risk that could affect mission-critical applications such as Aerospace and Defense. Semiconductor fabrication is also rapidly moving outside of the US and threatens to stall innovation. Microsemi is working towards keeping both the design and fabrication of WBG technology in the US.