SG SEMICONDUCTOR

Power Electronics

Agency for Science, Technology and Research SINGAPORE

National Semiconductor Translation and Innovation Centre (Power Electronics) Technical Capabilities

SiC Device Design and Simulation	**Design and Simulation**	• Calibration and simulation of in-house models to match experimental results of a 1.2 kV rated Trench MOSFET • Development of models for device architectures such as: planar, trench, super-junction and SiC IGBT structures
Process Capabilities	**SiC Epitaxy**	• Max thickness: 74.2 µm ± 1.2% • Defect density: 0.2 /cm^2
	SiC Gate-Stack Formation	• Low Dit: ~10^{11} cm^{-2} eV^{-1} • Channel mobility: 61 cm^2/V·s
	Channeling Implant	• Energy: Up to 960 keV • Species: Al, B, P, N, Ar • Substrate temperature: 25 to 500 °C • Tilt angle: 0 to 60° • Twist angle: 0 to 270°
SiC Power Module Packaging	**Liquid Cooling**	• Thermal resistance: 0.1 °C/W
	Power Cycling	• Loop inductance: 10 nH • Power cycling time: 50 K cycles • Thermal cycling: 1 K cycles • High-temperature storage: 1000 hrs
Power Device Electrical Characterisation	**Wafer Level Test System**	• Max voltage: 10 kV • Max current: 600 A
	Cryogenic Measurement System	• Superconducting magnet max: 25.0 kOe (2.5 T) • Min temperature: 10 K
	Double-Pulse Test System	• Package type: TO-247 • Max voltage: 1.2 kV • Max current: 1000 A
	High-Temperature Reliability System	• Dynamic HTGB • Dynamic HTRB • Dynamic H3TRB
	Short Circuit Withstand Time Characterisation	• Max voltage: 1.2 kV • Max pulse current: 3000 A
	Unclamped Inductive Switching Characterisation	• Max voltage: 2.5 kV • Max current: 200 A

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Demonstrated Devices	**SiC Planar and Trench MOSFETs**	• Breakdown voltage: 1.2 kV • $R_{ON,SP}$: 1.6 mΩ·cm^2 • Channel mobility: 61 cm^2/V·s
	SiC Super-Junction MOSFETs	• Breakdown voltage: 1.7 kV • Super-junction depth: 14 µm
	SiC PIN Diodes	• Breakdown Voltage: 7.8 kV