Cree, Inc.

John W. Palmour

Cree, Inc. Information

- Cree, Inc. is the world leader in SiC substrates and epitaxy.
- High quality substrates and high voltage epi are available for sale to all contractors
- Cree is the leading manufacturer of SiC power devices in the US.
- Demonstrated voltage and highest power SiC power devices to date

Area of Expertise

- Design and fabrication of high voltage, high power SiC diodes and switches
- SiC device modelling
- Electrical characterization of V_f drift and full reliability testing
- Material growth solutions for decreasing electrically active defects in SiC

Previous Relevant Accomplishments

- Developed low defect SiC epi process for reducing V_f degradation on PiN Diodes
- Demonstrated > 9 kV, 50 A PiN diode
- Demonstrated 67% yield for 10 kV diodes with <100 mV V_f drift
- Demonstrated 10 kV, 123 mΩ-cm^2 SiC DMOSFET

Contact Information

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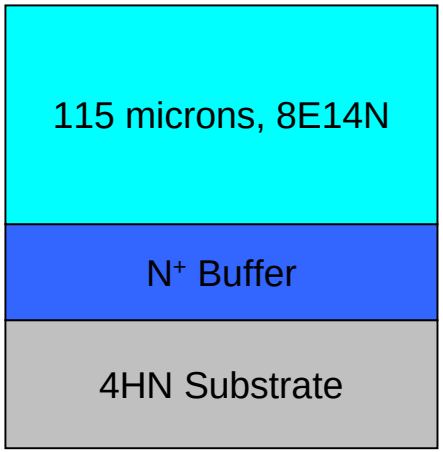
Pipes = 10

Pipe density = 0.22 cm^{-2}

3-inch

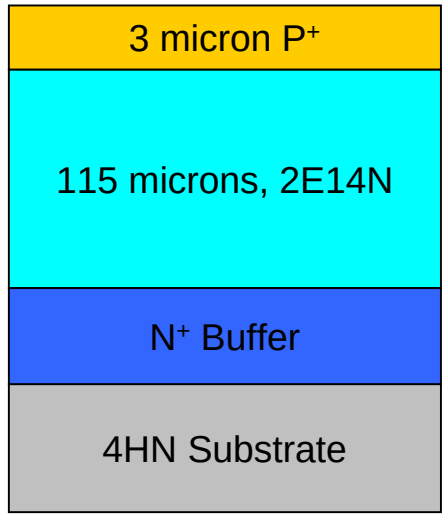
Cree's proposed DARPA standard low defect epitaxy offering

Generic 10 kV MOSFET epiwafer



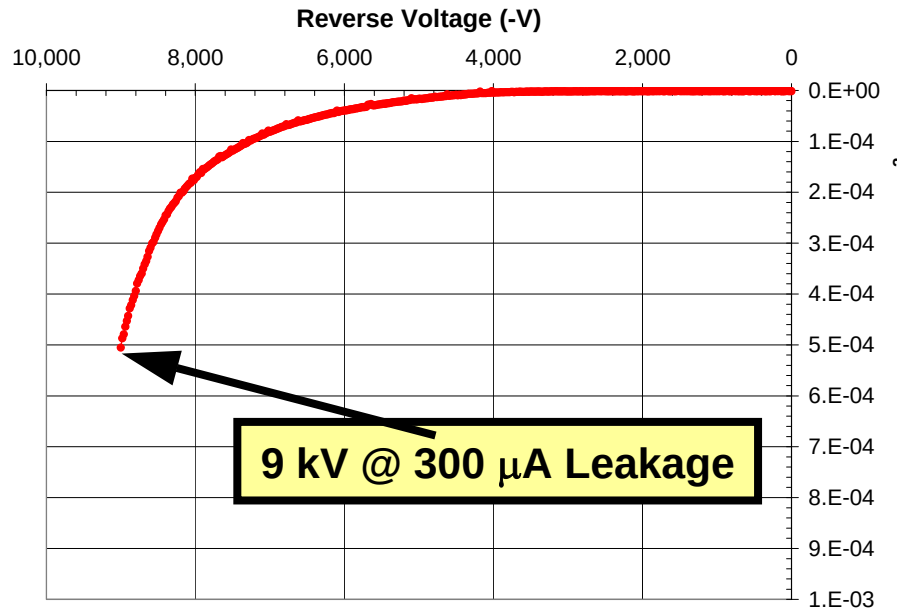
Median critical properties:
Catastrophic defect density* < 3 cm^{-2}
Epilayer thickness variation < 2.5 %
Epilayer doping variation < 10 %
**Carrot defect reduction process*

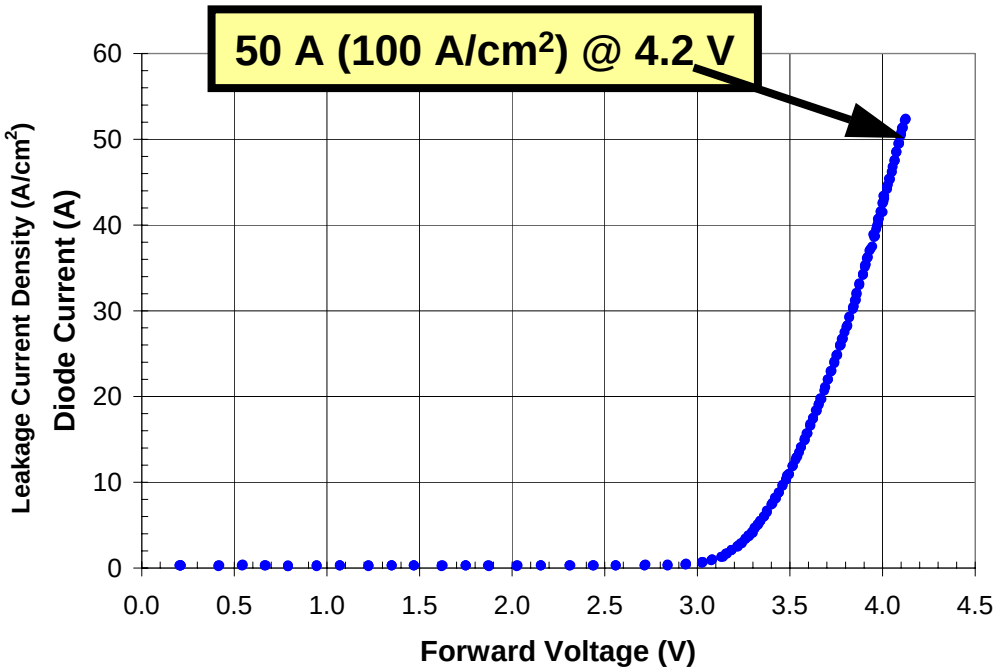
Generic 10 kV PiN diode epiwafer



Median critical properties:
Basal plane dislocation EPD* < 30 cm^{-2}
Epilayer thickness variation < 2.5 %
Epilayer doping variation < 10 %
**Carrot defect reduction process &*
Basal plane dislocation reduction process

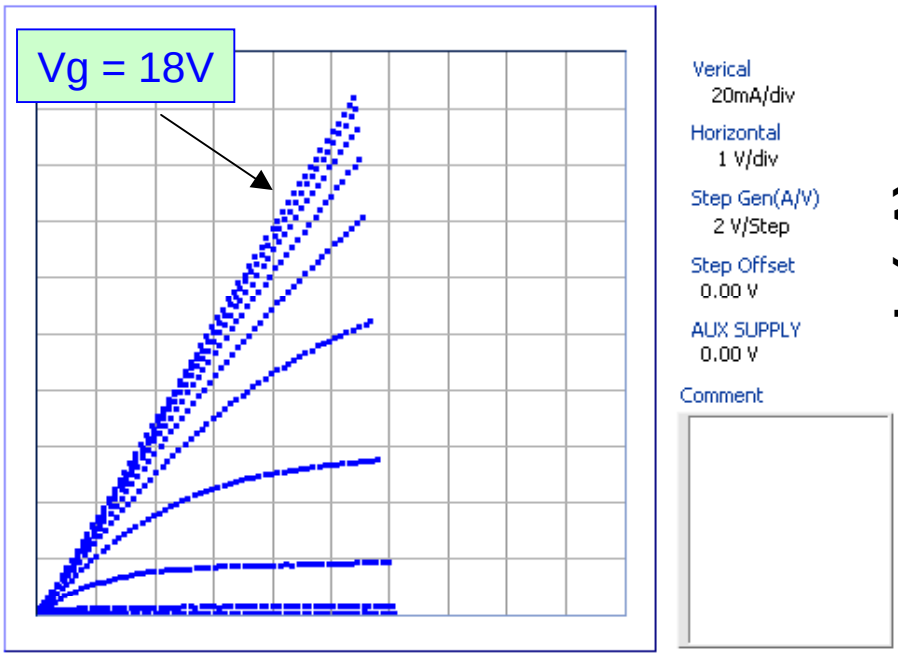
Forward and Reverse I-V on the Largest SiC Chip Made Yet!

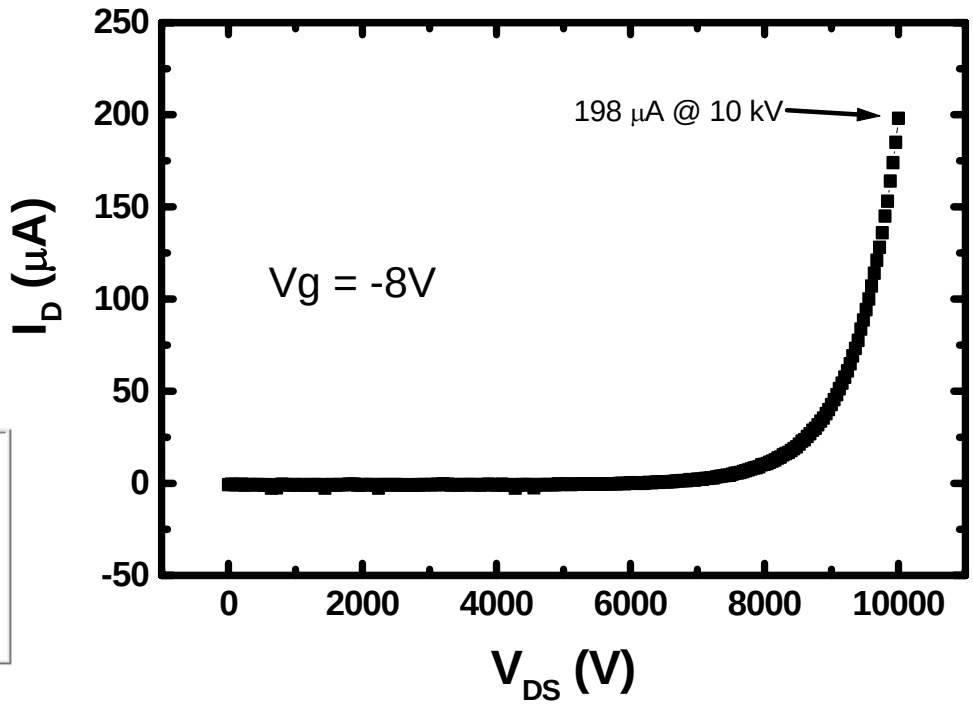




- Reverse blocking is current compliance limited
- 100 μm, Low BPD Epitaxy
- V_f drift < 100 mV after 100 hours
- 8.5 mm x 8.5 mm total chip area

SiC DMOSFET with Extremely Low On-Resistance





$R_{ds(on)}$ = 123 mΩ-cm²!!

Blocking Voltage = 10 kV
$J_{leakage}$ = 6.5 mA/cm²