Ion Implantation and Applications for Power Devices

Outline

Introduction

Silicon carbide doping challenges

- Implant Species and Source Operation
- High Temperature Implant for Implant Damage Control

Silicon Carbide Structure and Implant Solutions

- High Energy Implant for SiC Trench MOSFET
- Purion XEmax High Energy System

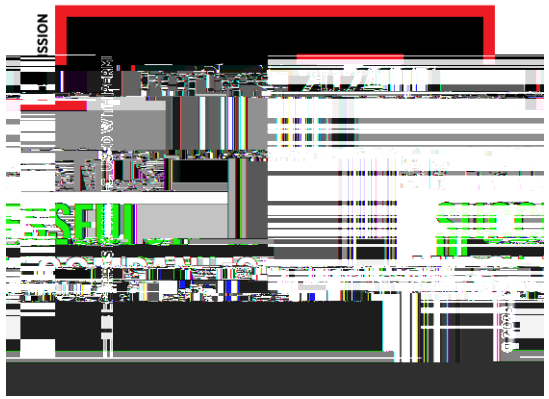
Summary

Axcelis at a Glance

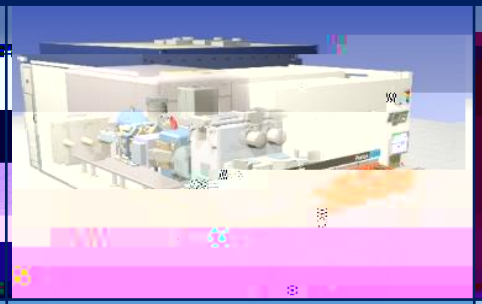
Global leader in technology development and manufacturing of ion implant systems and services for the semiconductor industry for 45 years

- Serving the ~$2.7B ion implant systems market
- Based in Beverly, MA with headcount greater than 1700 worldwide
- Global customer support infrastructure
- Growing installed base of greater than 3000 tools
- Strong IP portfolio

Supplier of record to leading semiconductor CAPEX spenders in all market segments including DRAM, NAND, Foundry, Logic, Power and Image Sensor



Product Overview - Common Purion Platform

				
	Purion H Purion Dragon	Purion H200	Purion M	Purion XE/EXE/VXE Purion XEmax
™		Purion H200 SiC	Purion M SiC	Purion XE/EXE SiC
	Adv DRAM/NAND & Logic Material Modification	Power Device Mature Technologies	Power Device RF Mature Technologies Adv DRAM/NAND	Power Device Image Sensor Mature Technologies Adv DRAM/NAND

Silicon Carbide Doping Challenges

Aluminium: P-type dopant

- Solid source vaporizer like, AlI

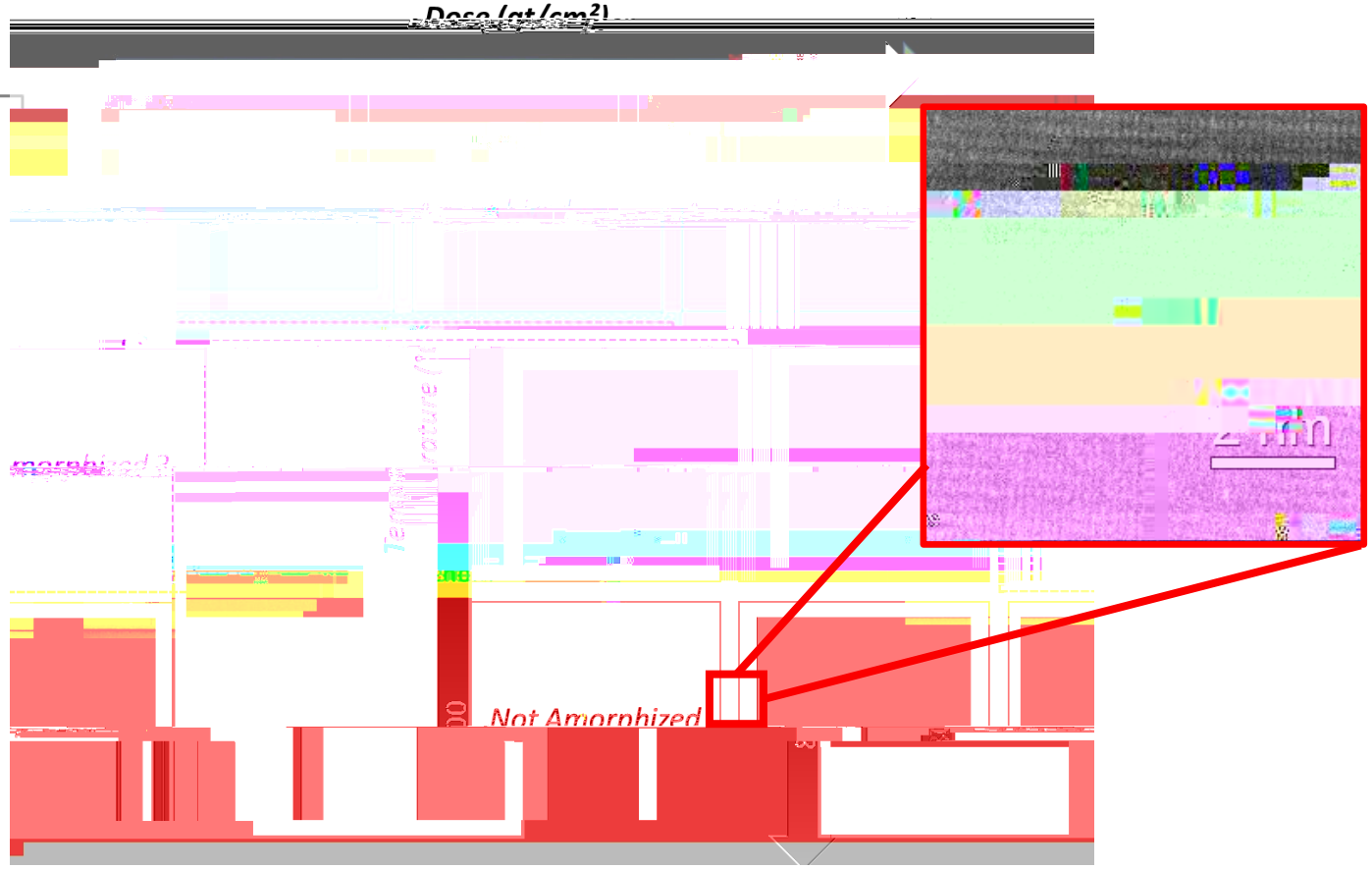
Implant and Annealing Strategy

Advanced ion implantation
Control & Minimize defect level

Avoid capping layer process and to reduce manufacturing costs

Laser annealing to combine high temperature activation efficiency with no high thermal budget-induced extending defects

Hot Implant and Annealing Control to Implant Damages



[1] Y. Negoro et al. (2004).

- High Temperature Implant for SiC Implant Defect Control
- “Warm” or Room Temperature Implants at Lower Lose for Productivity Consideration

Axcelis High Energy Implant Systems

Purion XE/EXE/VXE
Purion XEmax

Purion XE/EXE SiC

Power Device
Image Sensor
Mature Technologies
Adv DRAM/NAND

Linear acceleration (LINAC) technology

- Market leader
- High productivity
- Reliable and cost effective

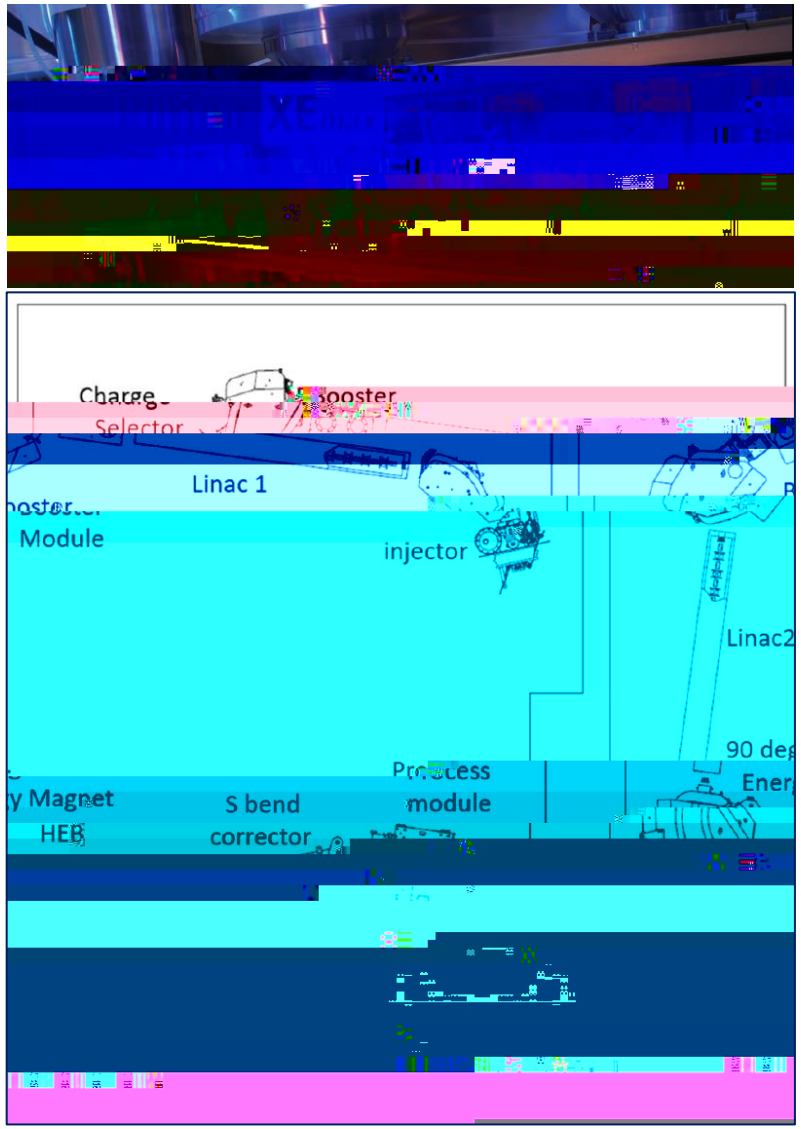
High temperature implant for SiC

- Purion XE
- Purion EXE

New developed systems:

- Purion XEmax
  - —Ultra high energy system (15MeV)
  - —To satisfy implant roadmap requirement

Purion XEmax High Energy System



Designed to achieve high energy implant capability

- Higher extraction current
- Longer source life

Booster module acceleration

- Select higher charge state ion after booster
- Eliminate energetic contaminants generated from ion source

S bend corrector magnet

- Provide accurate ion beam angle control

Purion XEmax, Axcelis ultra-high energy implanter with Boost™ technology, Shu Satoh, IIT 2022

Axcelis Purion Power Series for SiC
Highest Productivity Solution for ALL Implants in SiC HVM

Summary

Axcelis makes critical R&D investments to fuel continued innovation that further differentiates our products

Axcelis tools provide a variety of competitive advantages across all customer segments

Axcelis provides SiC implantation solutions

- Medium energy with high current implant capability
- Provide high temperature implant capability with high productivity
- Provide high energy system for profile optimization/engineering