

onsemi
Intelligent Technology. Better Future

**Dr. Mrinal K. Das, Senior Director of Technical Marketing
Power Solutions Group**

Global Driving Forces

Power is the Future of Electrification

90%

of industrial heating is made
by burning fossil fuels



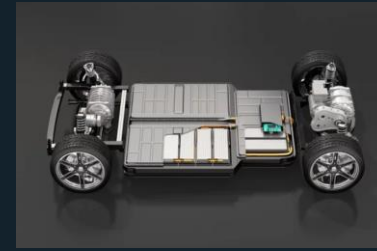
1000 TWh

of electricity consumed by
Data Centers by 2026



1150 TWh

of electricity consumed by
global EV fleet in 2030



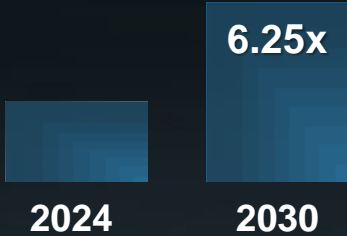
Transition away from fossil fuels and increased demand for artificial intelligence and EVs will exponentially increase energy consumption this decade

The Profound Impact of 1%



Electric Vehicles

EV Miles Driven



Data Centers

Power Consumption

460 TWh
= ~42M homes



Industrial Automation

Industrial Motor

50% of the
World's
Electricity

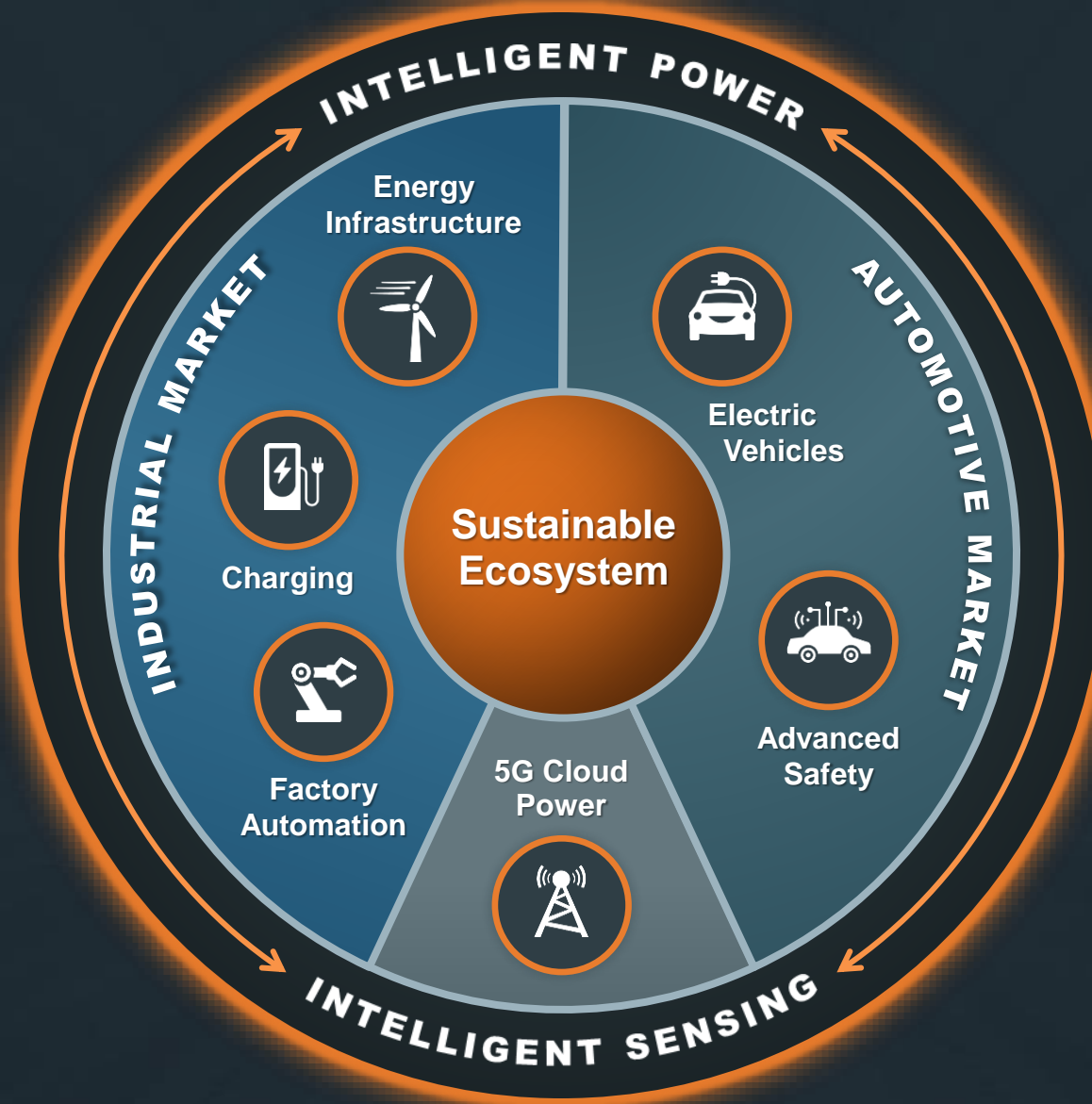
1% Efficiency Improvement

>4B/year
more EV miles driven WW

>\$653M/year
electricity cost savings WW

>\$25B/year
electricity cost savings WW

onsemi supports a sustainable ecosystem



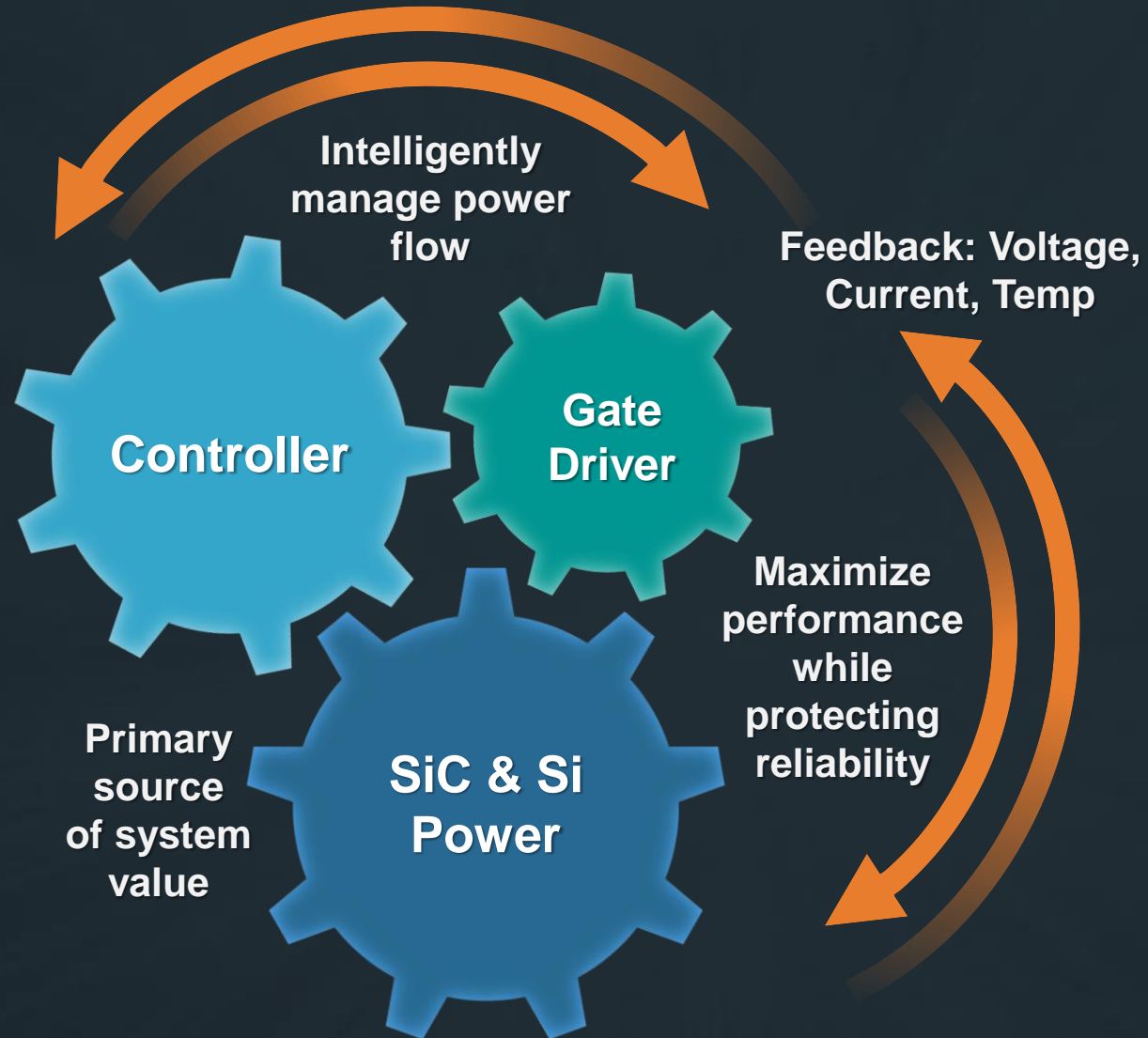


#2 Global Position

25% SiC Market Share

2x Market SiC Rev Growth

The Power of the Portfolio



onsemi delivers

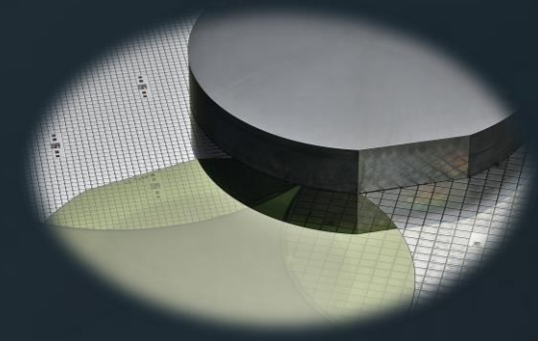
- ↑ **Efficiency (1-2%)**
- ↑ **Reliability**
- ↑ **Ease of Design**
- ↓ **System Cost**

The EliteSiC Advantage

Silicon Carbide – Powering the Future of Innovation

What is silicon carbide and why it matters

Silicon carbide is a next-gen semiconductor base material that consists of alternating planes of silicon and carbon.



Material Properties (Si vs. SiC)

10x Higher Dielectric Breakdown Field Strength

3x Higher Thermal Conductivity

2x Higher Electron Saturation Velocity

Reduced Leakage Currents

Application Benefits

Effect on Device

High Voltage
Low R_{SP}

Low Conduction
Losses

Effect on
System

High f_{SW} +
Small Passives

Cost Effective
Thermal Management

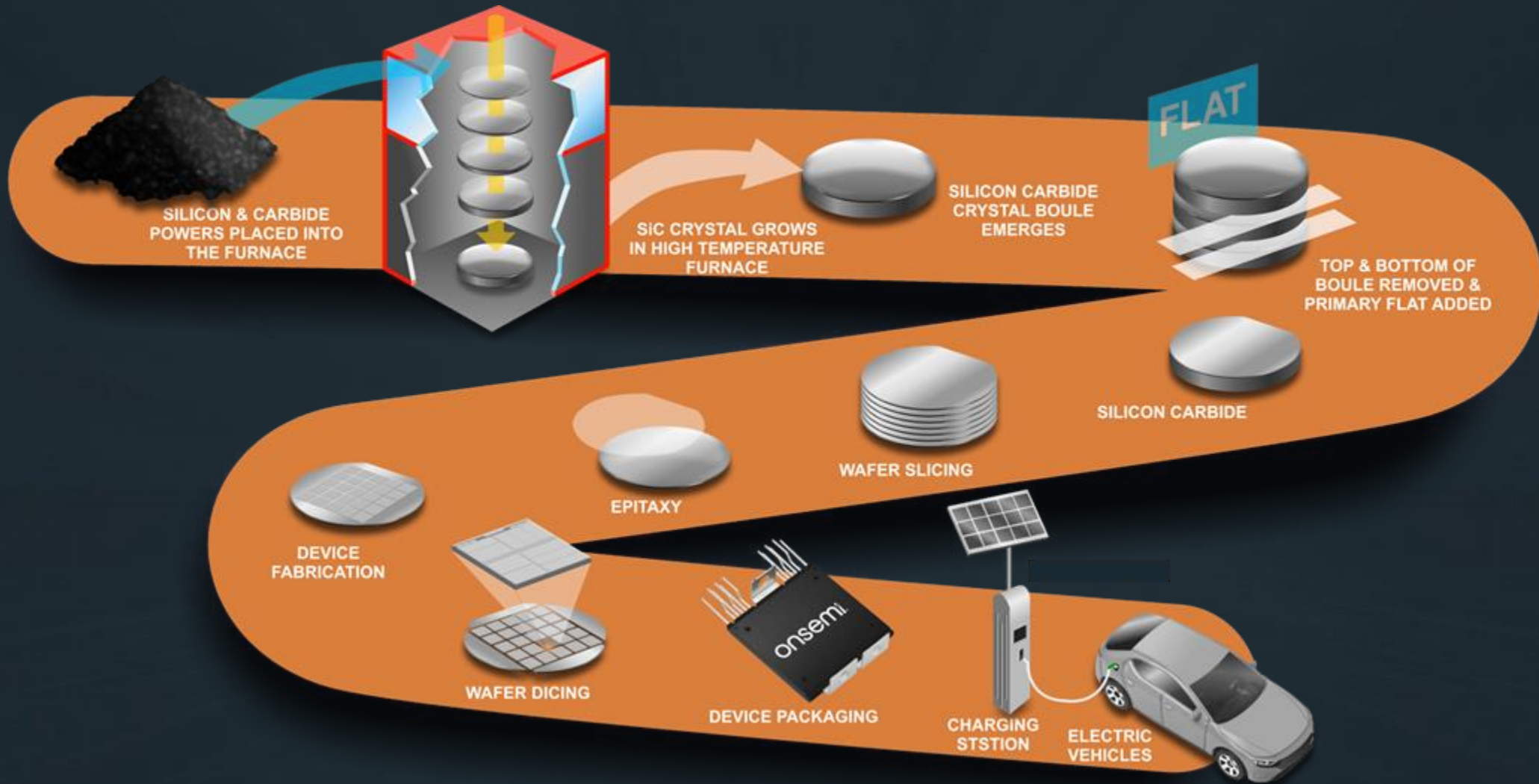
Effect on
End Application

System with

- Smaller Size
- Light Weight
- High Efficiency
- Cost Benefits

Silicon Carbide – Powering the Future of Innovation

Vertical Integration Drives Innovation

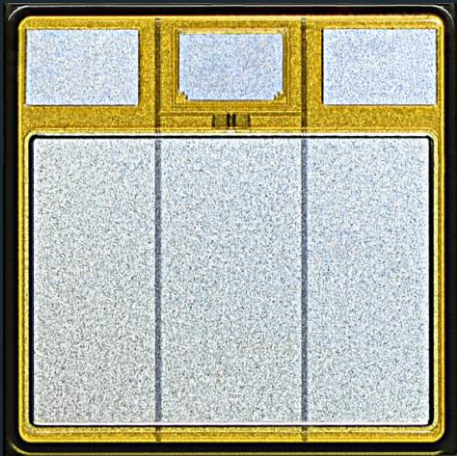


Launching M3e Technology Platform

Launching Today

EliteSiC M3e Platform

Influencing the Adoption and Effectiveness of Next-Gen Electrification Initiatives



**1200 V, 11 mΩ EliteSiC M3e
MOSFET Bare Die**

Performance: Industry-leading Figure of Merit

- Operates at higher switching frequencies and voltages
- Field-proven “Planar Topology” to deliver the confidence of quality and reliability for the ultra-conservative power electronics industry
- Achieves a reduction in both conduction by 30% and switching losses up to 50%
- Offer the industry’s lowest specific on-resistance (R_{SP}) with short-circuit capability for the traction inverter market

Cost Benefits:

- Improves performance and reliability of next-gen electrical systems at lower cost per kW
- Reduces passive component and thermal management costs

M3e Powering Tomorrow, Today

Vehicle Electrification

- Traction Inverter
- On Board Charger
- HV DC-DC
- HV Aux



Green Energy

- Solar Solutions
- Energy Storage
- Fast DC Chargers
- Solid State Transformers



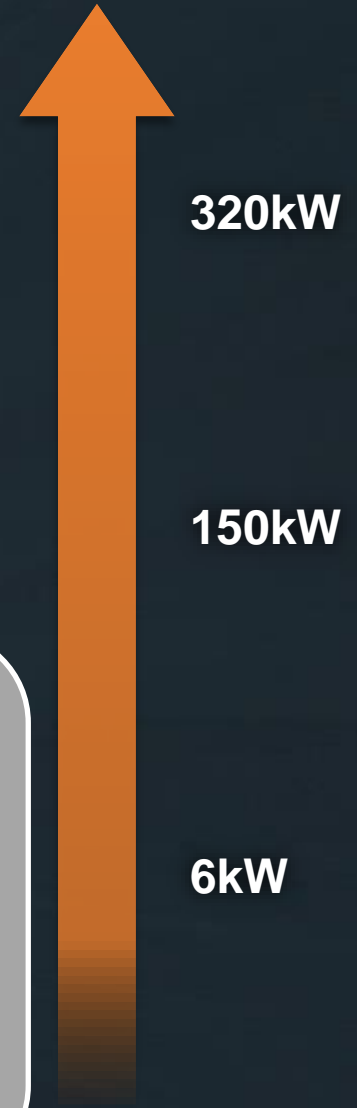
Motion Control

- Servo Motor
- Industrial HVAC
- Pumps
- Fans



AI & Data Centers

- Power Supplies
- Cooling Systems
- Uninterruptible Power Supplies



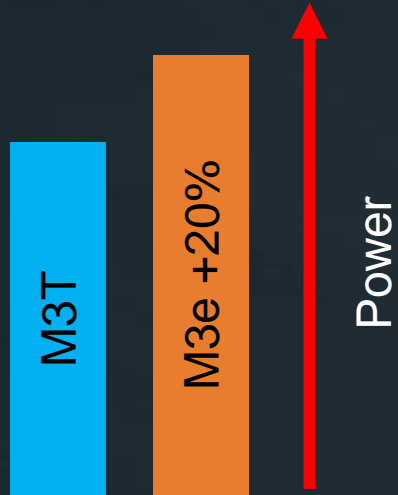
320kW

150kW

6kW

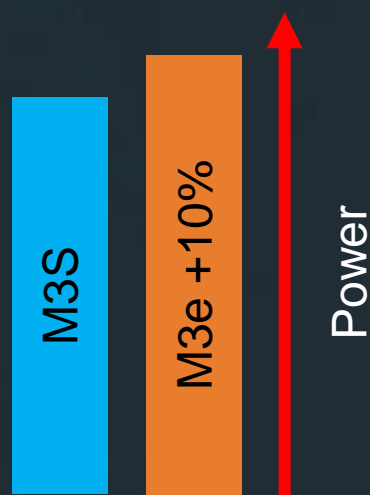
M3e Delivers More Power with Proven Quality

Traction Inverter



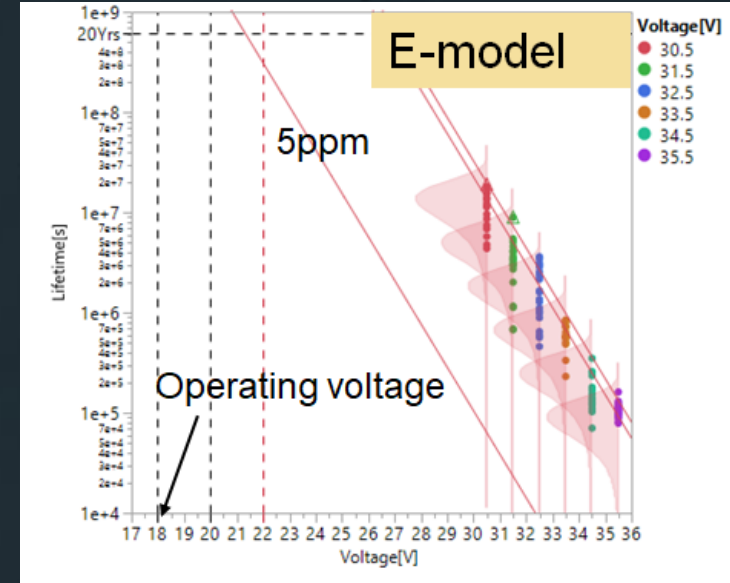
Equal Die Area

Charger/PSU

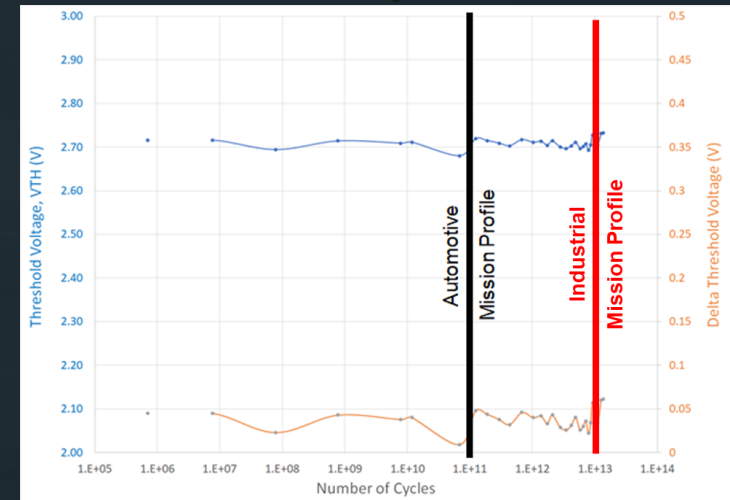


Equal Die Area

Sub-PPM Gate Failures after 20 years life

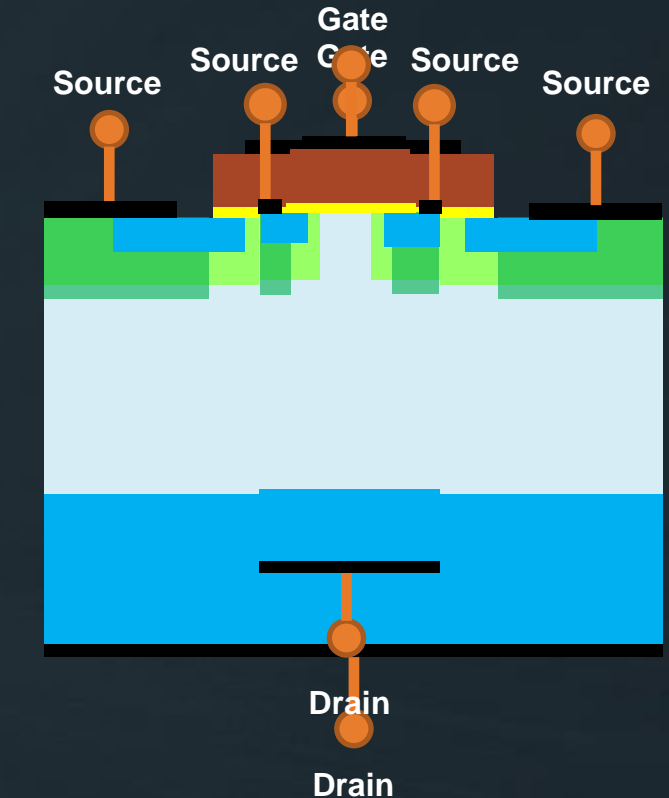


Stable Operation



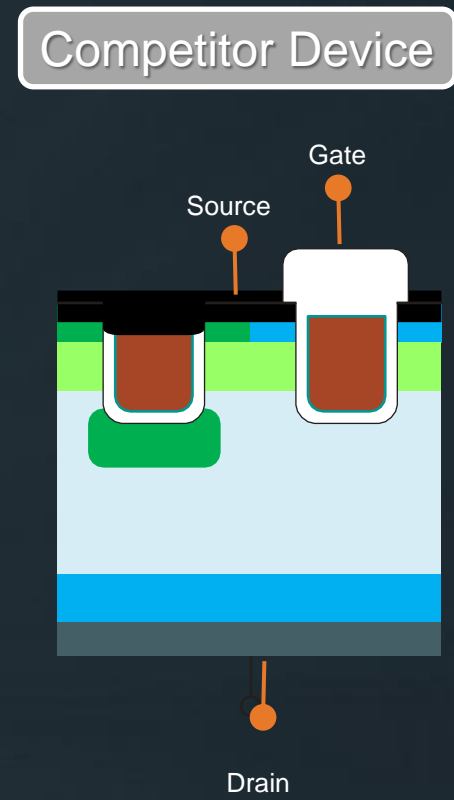
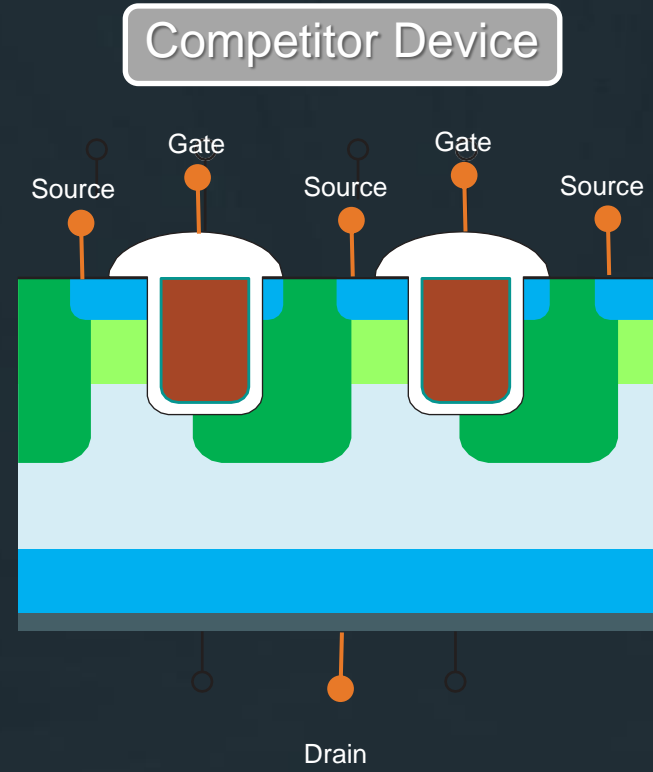
1200V EliteSiC M3e Delivers Industry's Lowest Losses for Traction Inverters

Supplier	Technology*	Conduction Loss 175°C R_{SP} (Normalized)	Switching Loss 175°C $E_{SW,SP}$ (Normalized)
Supplier A	Planar	1.05	1.95
Supplier B	Planar	1.38	1.68
Supplier C	Trench	1.07	1.35
Supplier D	Trench	1.31	1.70
onsemi	Planar M3e	1.0	1.0



*Latest SiC MOSFET generations benchmarked, including 2024 releases

M3e Performance Extends the Life of SiC Planar MOSFETs



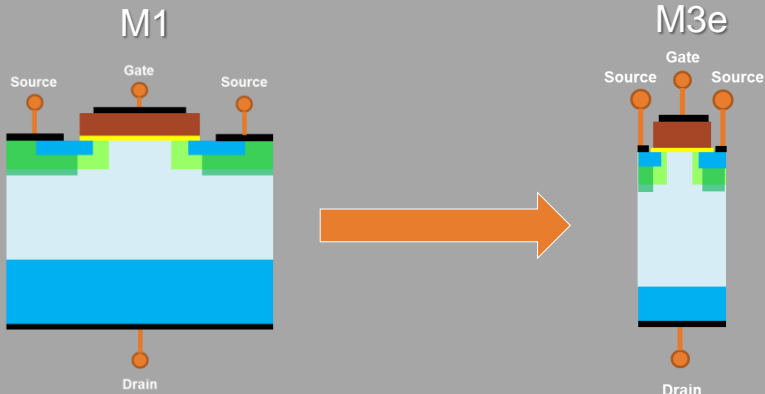
Released SiC trench MOSFETs are not yet FULL trench structures and hence do not out-perform the best SiC planar MOSFET (M3e)

*Unit cell defined as basic length that is repeated and includes two conducting channels

The Journey Ahead

Shrinking Unit Cells Lead to Increased Power Density

More Power, Smaller Package



62.5% reduction in unit cell length



onsemi Delivers

- Sustained industry leading performance
- Innovative Cell Structure
- Channel and materials engineering

Lead with Die Performance...

Differentiate with Package Innovation

Customer Needs

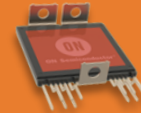
- ↑ Range – Efficiency
- ↑ Flexibility – Scalability
- ↑ Reliability – Ruggedness

Transfer Molded

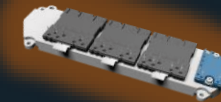
Half Bridge



Dual Side Cooled



Full Bridge with Cooling Channel

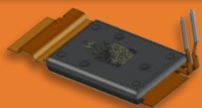


Embedded



Discrete

Single Switch



Next Gen Switch



Gel-filled

Case Module



Case Module+

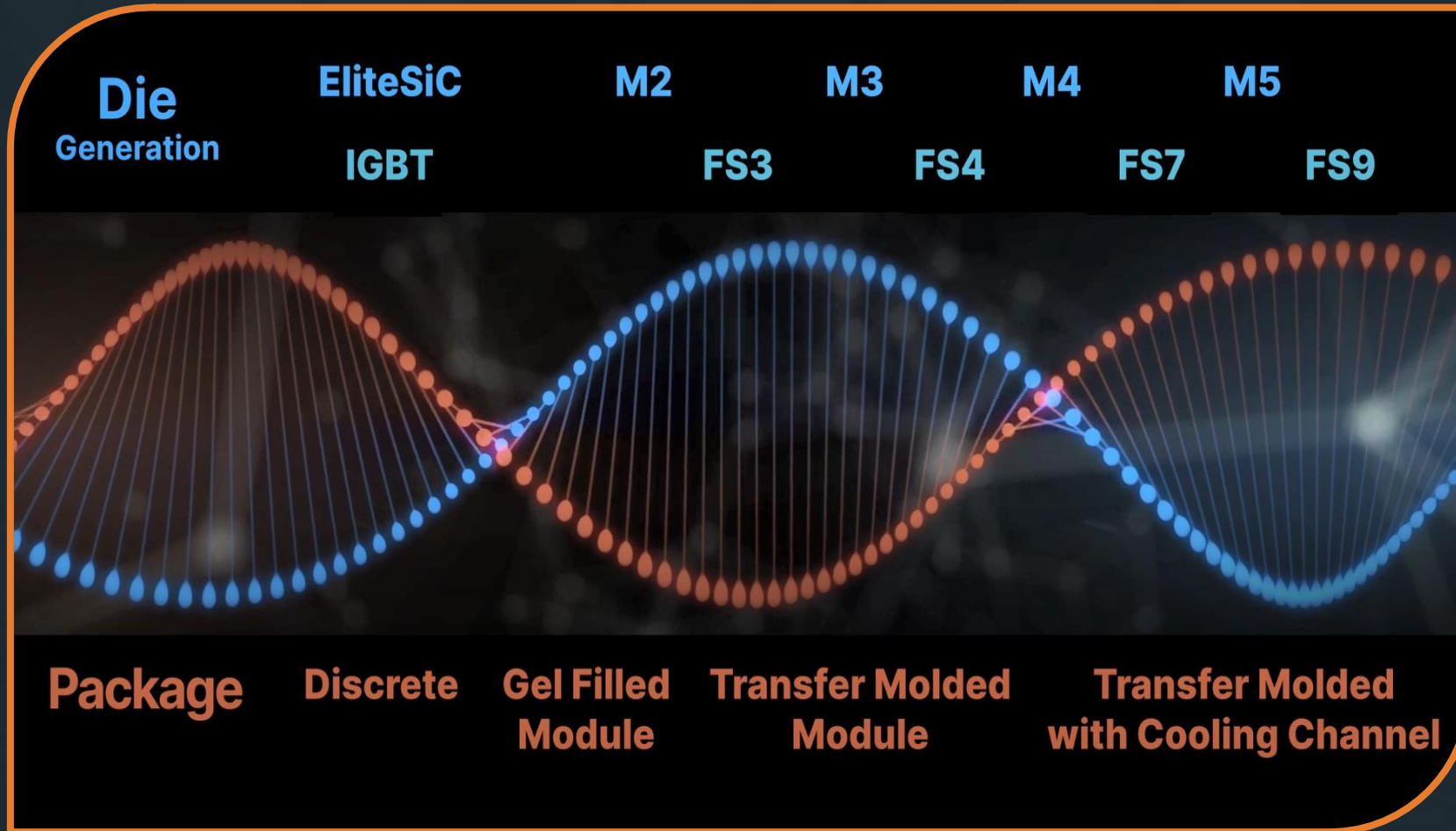


Innovation

onsemi Delivers

- Advanced packaging materials
- World class thermal performance
- Low electrical parasitics
- Simulations at Die, Package and System

Optimized Solutions are our DNA



Concurrent development of die and package leads to **optimized** solutions

onsemi™

Intelligent Technology. Better Future.

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Q&A
