

EURIPIDES² PRAGUE FORUM | 2014

SiCRATES

SiC Rectifier bridge and smart switch Assembly for aeronautics compatible with high Temperature harsh Environments



CONTEXT

More aircraft electrification

New power & environmental strategies

Electrical systems replace hydraulic systems

Power electronics close to the actuators

Reduce weight & volume. Compactness & integration

Lifetime & reliability increase

Need to withstand high T° environment ($> 200^\circ\text{C}$)

Power Electronics key enabling technology

Wide band gap materials (SiC, GaN...)

Power packaging

OBJECTIVES

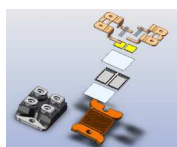
New and inter-consistent assembly processes for SiC components

Compatible with

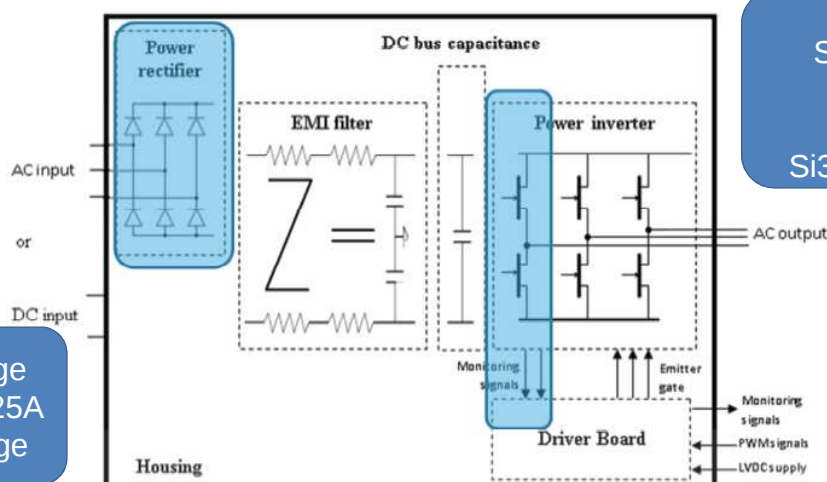
high temperatures ($T_j=300^\circ\text{C}$ / $T_a=200^\circ\text{C}$) and large ΔT (-65°C to 250°C) environments

Towards solutions for high T° SiC applications for Aeronautics & Automotive & Industrial

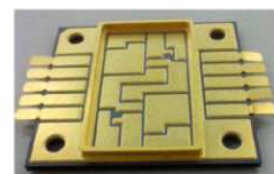
DEMONSTRATORS



Power Rectifier Bridge
SiC Diodes 1200V – 25A
Compact HT $^\circ$ package



Smart Switch
SiC JFET Normally ON
1200V – 25A
SOI driver
Si3N4 based HT $^\circ$ package



MAJOR TECHNOLOGICAL CHALLENGES

High temperature capability

Improved reliability & lifetime

Non hermetic Corrosion free @ 200°C

Low & High T° ageing compatibility

Improved thermal extraction

SiC & assembly technologies compatibility

SIC DIE ATTACHMENT

Thin SiC die processing

SiC die backside metallization

Diffusion soldering

Ag sintering

ENCAPSULATION

Materials evaluation

(PI, Silicone, Epoxy, ...)

New materials development

Processes evaluation

SIC DIE INTERCONNECTION

SiC bond pads metallization

Cu clips assembly

Al or Al/Cu Ribbon bonding

Ag sintering for dual ceramic

PACKAGE CONSTRUCTION & PROCESSES INTEGRATION

Process bricks full integration

& materials compatibility

SiC compatibility

Project Coordinator

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