ECPE Lighthouse SiC & GaN: next gen WBG power packaging (2018)

Project

The target is to build a **msPEBB**:
modular scalable Power Electronics Building Block
Funding: direct industrial R&D project

Performed tasks

- Concept development
- Acquisition of the project funding

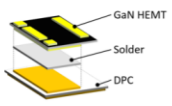
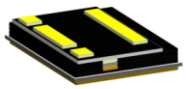
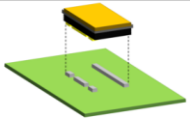
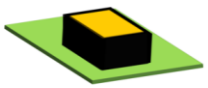
Non-Isolated single chip package – Prepackage

- As Prepackage or Power CSP - the most simple version of a semiconductor package
- It provides robust thermo-mechanical interface for further production steps and adds nearly no thermal impedance and no inductance
- Such solution can be used as intermediate packaging step for:
  - power discrete, like in the case with GaN (s. below)
  - PCB Embedded power modules
  - Mold power modules
  - Case power modules
- Result: higher manufacturing yield for multichip power modules, easier and faster development

Isolated single chip package – new power discrete reference for GaN

- Adding of additional ceramic on the bottom for single chip or multiple chips simplifies the inverter level integration
- Significantly improved cooling allows better semiconductor utilization
- Critical switching cell and gate loop inductances are not limiting fast GaN switching any more

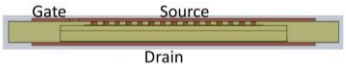
Isolated GaN power package

Step 1 – Soldering	Step 2 – Underfilling	Step 3 – Soldering	Step 4 – Underfilling
			
Soldering the GaN semiconductor on the DPC	Underfilling around the GaN semicon-ductor	Reflow soldering of the insulated GaN packages as SMD devices on the inverter PCB	Underfilling of the soldered insulated GaN packages on the PCB

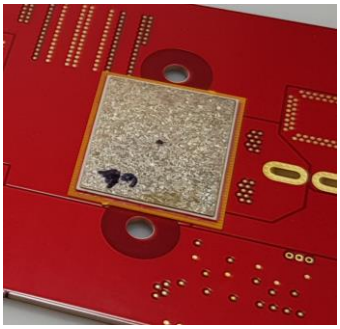
Prepackage



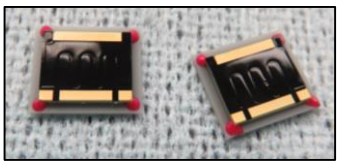
Structure of the Prepackage



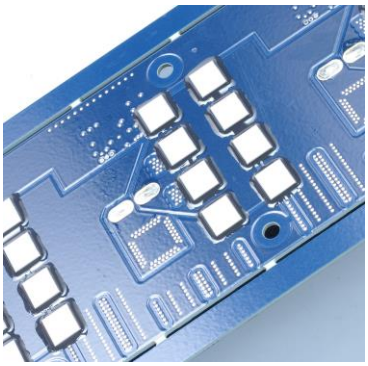
Integration for SiC



Chip soldering on DPC



Integration for GaN



Figures source: E.Hoene, Packaging as Enabler for Next Generation Power Electronics, 24.03.2021