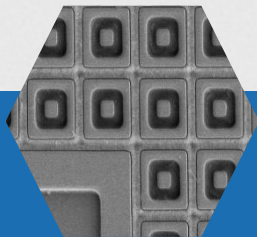


Automotive Power Module Packaging Technology and Cost Review

A cost-oriented review of power module packaging technologies for the automotive market.



The most recent market forecast by Yole Développement shows the global rise of power devices. The market for power module devices will follow that trend, with a 10.2% compound annual growth rate (CAGR) over the next five years. This will impact the power module packaging market, which will see a 9.5% CAGR, reaching a value of almost \$1.8B.

The progress of electric and hybrid electric vehicles (EV/HEVs) is imposing new standards in terms of electrical equipment, pushing electronic components to work in non-conventional environments for longer. That poses the electronics industry new challenges regarding both performance and reliability. To meet these requirements, electronic systems have to be improved at both design and industrialization levels.

Power modules have come a long way since the early stages of car electrification. They are now playing a key role in the power modulation through all EV/HEVs, from inverters to bi-directional converters. Packaging these modules has become critical due to several technical aspects. They must combine good thermal and electrical efficiency while keeping low mass and volume. Also, to remain competitive in an open market, power module makers must deliver high reliability while remaining cost efficient.

In this report we analysed the physical composition and cost of thirteen modules for automotive applications from five different manufacturers. We reviewed the different topologies and techniques used for the module packaging in such applications. We describe opening the modules, provide measurements and cross-sections, along with scanning electron microscope (SEM) and optical pictures. We analyse and simulate the cost of manufacturing and compare it to a summary panel.

This report includes comparison of the structures and costs of the different technological choices made by key manufacturers of the automotive industry.

COMPLETE TEARDOWN WITH

- Detailed photos
- Precise measurements
- Manufacturing process flow
- Manufacturing cost analysis
- Technological and cost comparison

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TABLE OF CONTENTS

Introduction

- Executive Summary
- Reverse Costing Methodology
- Glossary
- SiC Power Device Market

Company Profile

- Rohm
- Portfolio
- Supply Chain

Physical analysis

- Summary of the Physical Analysis
- 650V MOSFET: SCT3120AL
 - ✓ MOSFET die view and dimensions
 - ✓ MOSFET delayering and main blocks
 - ✓ MOSFET die process
 - ✓ MOSFET die cross-section
 - ✓ MOSFET die process characteristic
- 1200V MOSFET: BSM180D12P3C007
 - ✓ MOSFET Die View and Dimensions
 - ✓ MOSFET Delayering and Main Blocks
 - ✓ MOSFET Die Process
 - ✓ MOSFET Die Cross-Section
 - ✓ MOSFET Die Process Characteristic

Manufacturing Process

- MOSFET Die Front-End Process
- MOSFET Fabrication Unit
- Packaging Process and Fabrication Unit

Cost Analysis

- Summary of the Cost Analysis
- Yields Explanation and Hypotheses
- 650V MOSFETs : SCT3120AL
 - ✓ MOSFET Die Front-End Cost
 - ✓ MOSFET Die Probe Test, Thinning and Dicing
 - ✓ MOSFET Die Wafer Cost
 - ✓ MOSFET Die Cost
- Complete Device
 - ✓ Assembled Component Cost
 - ✓ Component Cost
 - 1200V MOSFETs : BSM180D12P3C007
 - ✓ Company profile
 - ✓ Molded DSC
- Module Comparison
- Cost Breakdown
- Cost by Power
- Cost by Switch

AUTHORS



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He's in charge of systems reverse cost analysis with a focus on embedded systems. He previously worked in the high-reliability packaging field. Farid holds a master degree in microelectronics and material from the University of Nantes.



Yvon Le Goff joined System Plus Consulting in 2011, in order to setup the labora-

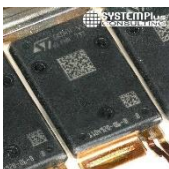
tory of System Plus Consulting. He previously worked during 25 years in Atmel Nantes Technological Analysis Laboratory as fab support in physical analysis, and 3 years at Hirex Engineering in Toulouse, in a DPA lab.



Véronique Le Troadec has joined System Plus Consulting as a laboratory engineer.

Coming from Atmel Nantes, she has extensive knowledge in failure analysis of components and in deprocessing of integrated circuits.

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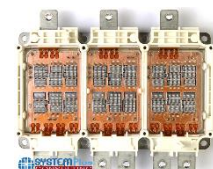
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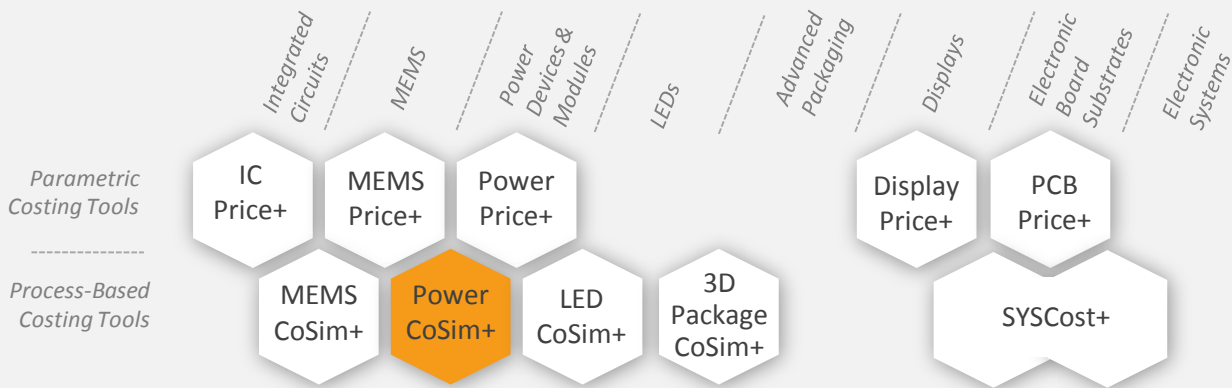
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