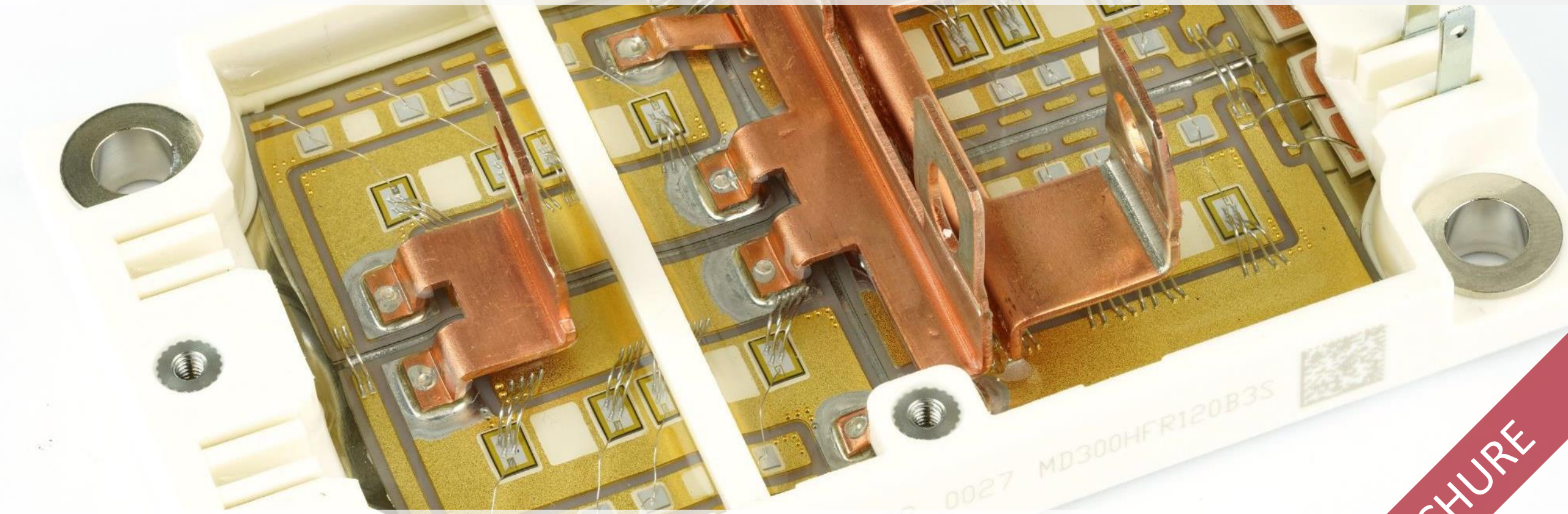


StarPower 1200V SiC MOSFET Power Module

SiC MOSFET Power Module With Sintered Chips For Industrial Applications (MD300HFR120B3S).

Power Electronics

PRODUCT BROCHURE

SPR22679

Summary

Contact us for more information

Full report pages: 114

PRODUCT BROCHURE

Biographies of the Authors

Amine Allouche, Technology & Cost Analyst

Amine Allouche serves as a Technology & Cost Analyst, Power Electronics.

With strong expertise in the field of power electronics, Amine produces reverse engineering & costing analyses while also working on custom projects. He collaborates closely with the laboratory team, defining objectives of the analyses and determine the methodologies necessary to reveal the structure of a device.

Amine holds a master's degree in Micro & Nanotechnologies with a focus on integrated systems from Grenoble's Polytechnic Institute (France). He also graduated from the Ecole Polytechnique Fédérale de Lausanne (EPFL) (Lausanne, Switzerland) and the Politecnico di Torino (Italy).

Tom Hervé, Laboratory Analyst

Tom Herve has joined System Plus Consulting as a Microelectronic Laboratory Technician in order to strengthen the laboratory team. In 2020, Tom was graduated from the University of Blois where he obtained a Technical degree (DUT) in Physical Measurements. He previously worked on different subject among which precipitation of zinc oxide.

Executive Summary

The market outlook for SiC devices is promising. According to Yole Développement's CS Monitor (Q4-2021), it is expected to grow from $1B to $3.46B for the period 2021 - 2026. Nevertheless, the technical panorama of SiC devices is still diverse, and every manufacturer has its own solutions to die design and packaging integration. This leads to strong competition, which will accelerate technical innovation and lower prices. Moreover, SiC business models are still very different. We are seeing (and will continue to see) a restructuring of the supply chain driven by the main cost factors.

Since the commercialization of the first SiC device in 2001, the performance of SiC devices and the value that they add have been gradually proven. Their price has also become increasingly acceptable to end-users. StarPower, a leading power module supplier in China, provides a complete range of industry-leading power modules to customers – including SiC power modules. In this context, System Plus Consulting provides a full reverse costing study of StarPower's 1200V SiC MOSFET Module "MD300HFR120B3S", which targets industrial applications. This module uses sintering technology for die attach and integrates a flat baseplate.

Supported by a full teardown of the module, this report reveals StarPower's technology choices for its assembled module as well as the designs of the different dies inside it. This report also provides insights into technology data, manufacturing cost, and the module's selling price, as well as an estimated manufacturing cost of all the device's parts and a selling price analysis. Included too is a physical comparison between two 1200V SiC power modules: StarPower's MD300HFR120B3S and Rohm's BSM180D12P3C007.

Methodolgy & Key Features

Teardown analysis

Package is analyzed and measured.
The dies are extracted in order to get overall data: dimensions, main blocks, pad number and pin out, die marking.
Setup of the manufacturing process

Costing analysis

Setup of the manufacturing environment
Cost simulation of the process steps

Selling price analysis

Supply chain analysis
Analysis of the selling price

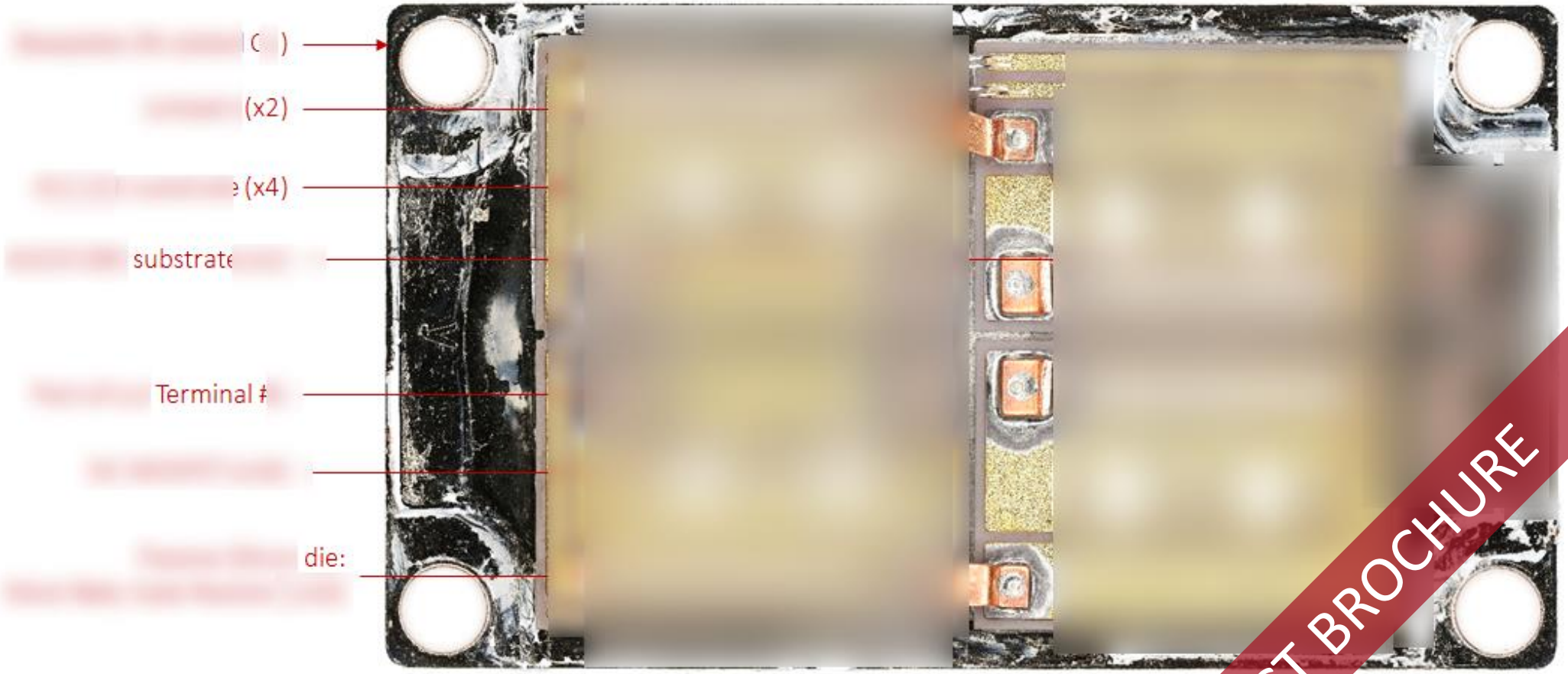
REPORT'S KEY FEATURES

- Detailed optical and SEM photos
- Precise measurements
- Manufacturing process flow
- Supply chain evaluation
- Manufacturing cost analysis
- Estimated selling price
- Physical comparison between 1200V SiC power modules from StarPower and Rohm

PRODUCT BROCHURE

Package Opening

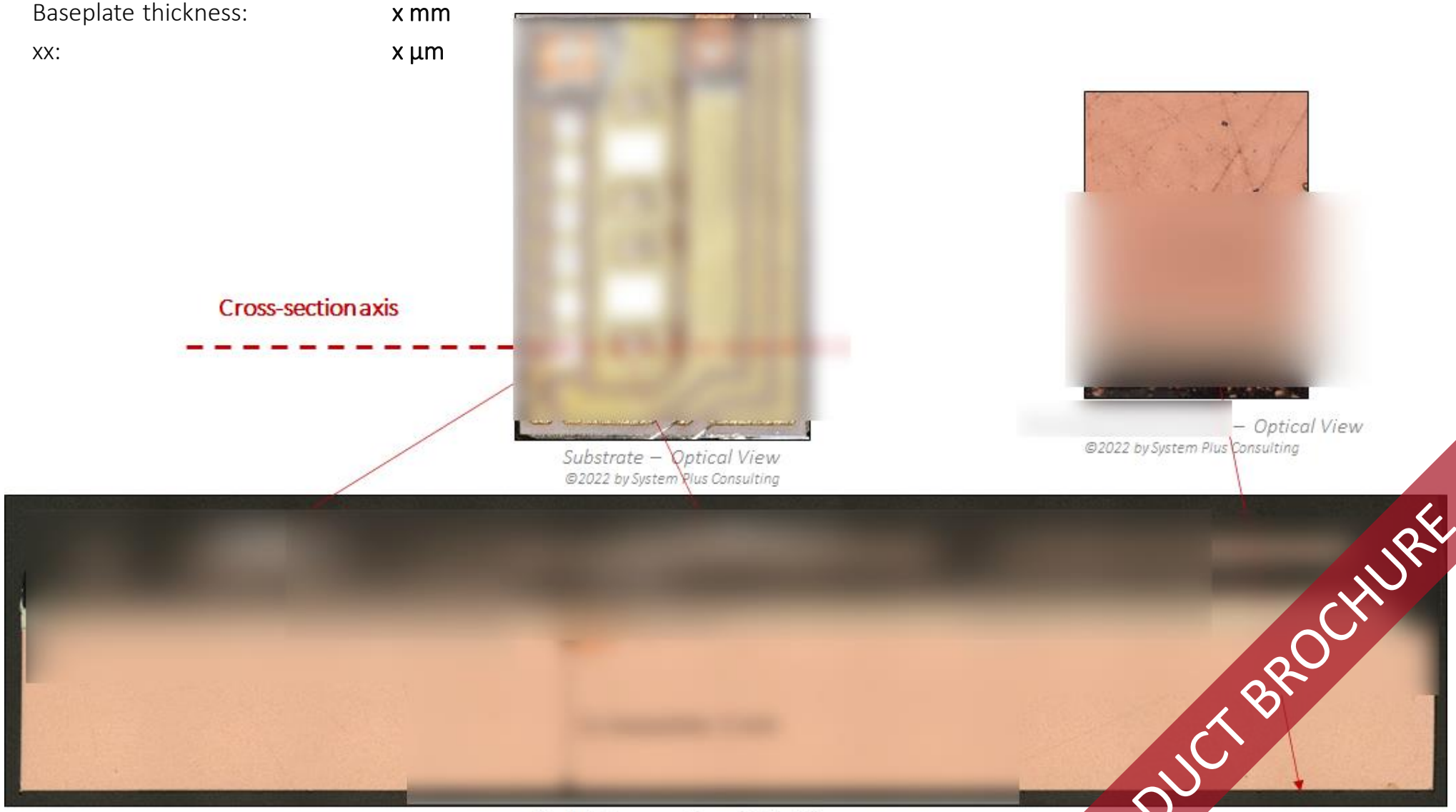
- The xxxx



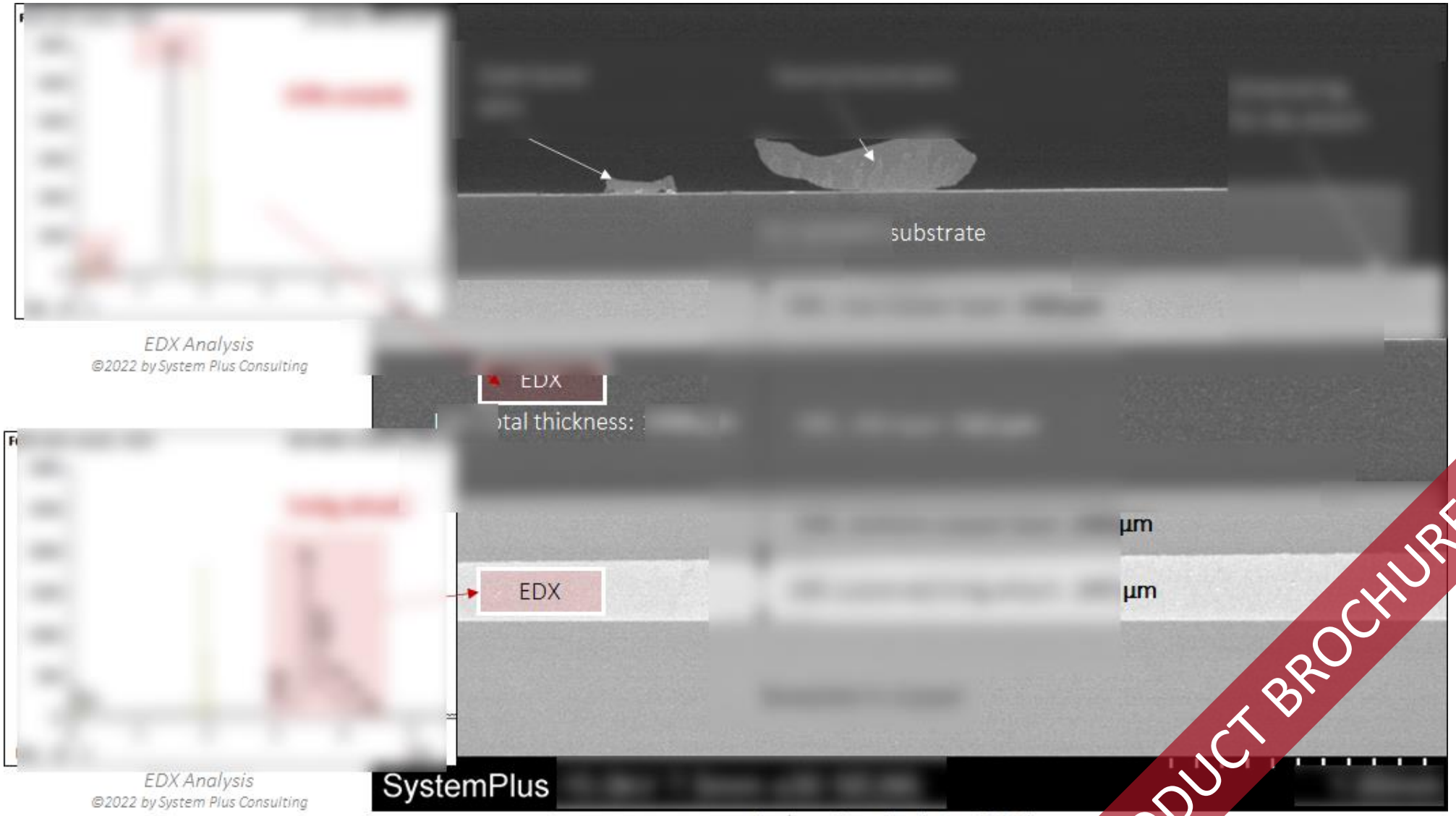
Package Opening – Optical View

Package Cross-Section – x

- Baseplate thickness: x mm
- xx: x µm



Package Cross-Section – xxx Substrate



EDX Analysis
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EDX Analysis
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Package Cross-Section – SEM View
©2022 by System Plus Consulting

PRODUCT BROCHURE

Die Process – Termination

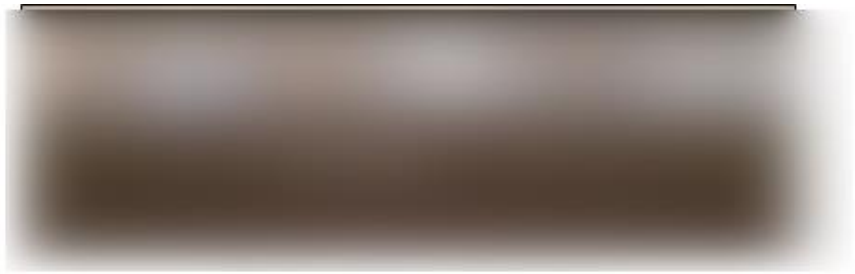
Die Delayering – Optical View

Termination:

- Dimension: x µm

Die Delayering – Cross View

Die Cross-Section



Die Cross-Section – Optical View
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Die Cross-Section – SEM View
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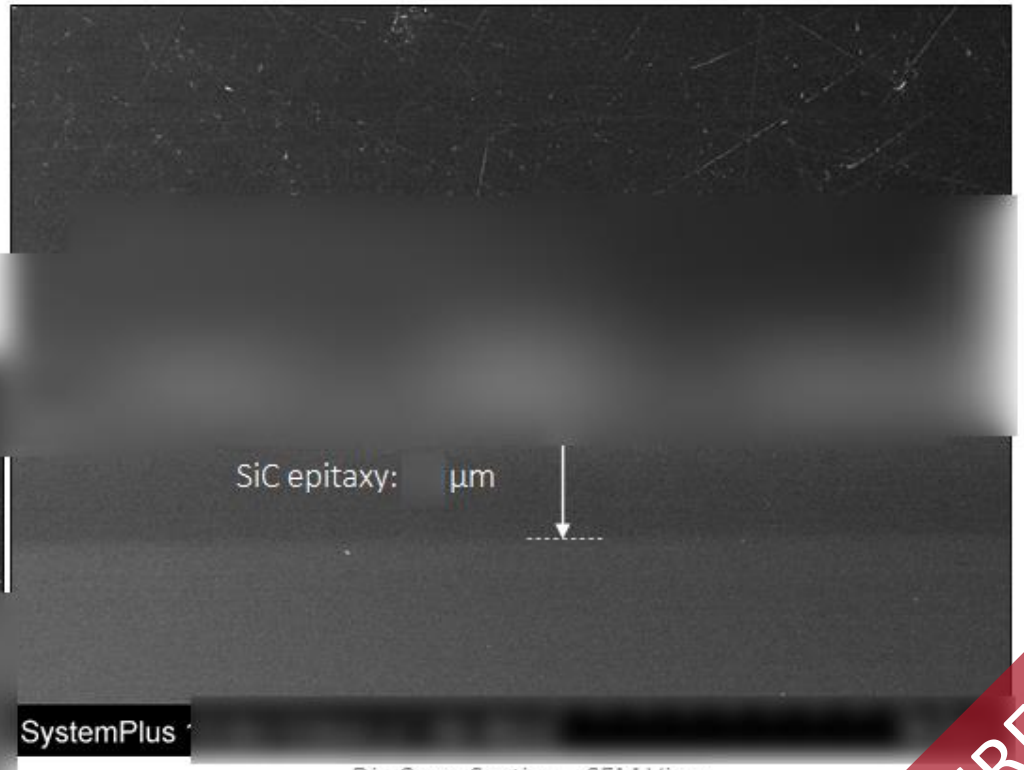


Die Cross-Section – SEM View
©2022 by System Plus Consulting

- SiC epitaxy:
- Polyimide:

StarPower vs Rohm 1200V SiC Power Modules – Comparison

Power module	StarPower MD300HFR120B3S 1200V	Rohm BSM180D12P3C007 1200V
Package		
Baseplate		
Current (A)		
Substrate		
SiC MOSFET		
Inverse Diode		
Die attach		

StarPower 1200V Power module– Optical View

Rohm 1200V Power module BSM180D12P3C007 – Optical View

Xxx SiC MOSFET – Process Flow (1/4)

SiC MOSFET Front-End Cost

Front-End Cost	Low Yield		Medium Yield		High Yield	
	Cost	Breakdown	Cost	Breakdown	Cost	Breakdown
Epi-wafer Cost						
Equipment Cost						
Clean Room Cost						
Labor Cost						
Consumable Cost						
FE Yield losses Cost						
Wafer Front-End Cost						
FE : Manufacturing yield						

Wafer Front-End Cost Breakdown (Medium Yield)

The front-end cost ranges from [redacted]1 to [redacted]

Module Cost – Assembly Cost

Module Assembly Step Cost	Low Yield		Medium Yield		High Yield	
	Cost	Breakdown	Cost	Breakdown	Cost	Breakdown
DBC						
Module Assembly Cost						

Final Module Cost

Module Cost	Low Yield		Medium Yield		High Yield	
	Cost	Breakdown	Cost	Breakdown	Cost	Breakdown
Packagin						
Packagin						
Packagin						
Module Assembly Cost						
Module Cost						

The module cost ranges from [redacted] yield variations.

RELATED ANALYSES

PRODUCT BROCHURE

Related Analyses

RELATED REPORTS

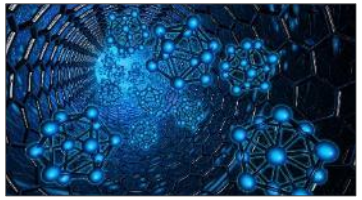
System Plus Consulting

- DENSO SiC Power Module in the Toyota Mirai II
- SiC Transistor Comparison 2021
- GeneSiC 1200V Gen3 and 3300V Gen2 SiC MOSFETs
- Wolfspeed All-SiC Module CAB450M12XM3
- Industrial Power Module Packaging Comparison 2020

Yole Développement

- Status of the Power Module Packaging Industry 2021
- Power SiC: Materials, Devices and Applications 2020

RELATED MONITORS



Yole Développement

- Compound Semiconductor Quarterly Market Monitor

Contact us
for more information

PRODUCT BROCHURE

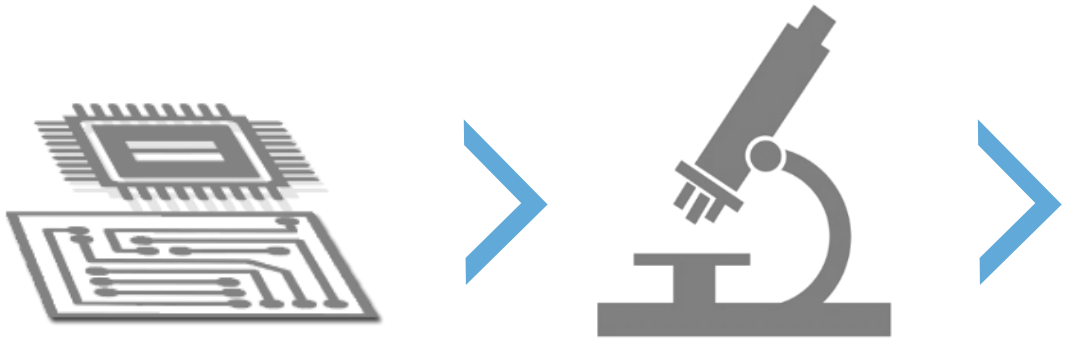
COMPANY SERVICES

PRODUCT BROCHURE

Our Core Activity : Reverse Costing®

A Structure, Process and Cost Analysis

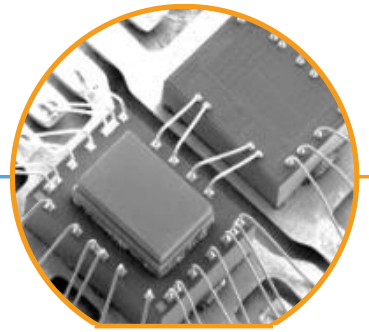
Reverse Costing® consists of disassembling a device or a system in order to identify its technology and discern its manufacturing processes and then using in-house models and tools to determine its cost.



Fields Of Expertise

Electronic System

- Automotive
  - ADAS
  - Electrification
  - Infotainment
  - Telematics
  - Other ECUs
- Consumer
  - Phone
  - Smart Home
  - Wearable
  - Tablet, Computing & Gaming



Semiconductor Device

- Battery
- Compound Semiconductor
- Computing and Software
- Display
- Emerging Technologies
- Imaging
- Memory
- Photonics and Lighting
- Power Electronics
- Radio Frequency
- Semiconductor Manufacturing
- Semiconductor Packaging
- Sensing and Actuating

Our offer

Terms and Conditions of Sales

1.INTRODUCTION

The present terms and conditions apply to the offers, sales and deliveries of services managed by System Plus Consulting except in the case of a particular written agreement.
Buyer must note that placing an order means an agreement without any restriction with these terms and conditions.

2.PRICES

Prices of the purchased services are those which are in force on the date the order is placed. Prices are in Euros and worked out without taxes. Consequently, the taxes and possible added costs agreed when the order is placed will be charged on these initial prices.
System Plus Consulting may change its prices whenever the company thinks it necessary. However, the company commits itself in invoicing at the prices in force on the date the order is placed.

3.REBATES and DISCOUNTS

The quoted prices already include the rebates and discounts that System Plus Consulting could have granted according to the number of orders placed by the Buyer, or other specific conditions. No discount is granted in case of early payment.

4.TERMS OF PAYMENT

System Plus Consulting delivered services are to be paid within 30 days end of month by bank transfer except in the case of a particular written agreement.
If the payment does not reach System Plus Consulting on the deadline, the Buyer has to pay System Plus Consulting a penalty for late payment the amount of which is three times the legal interest rate. The legal interest rate is the current one on the delivery date. This penalty is worked out on the unpaid invoice amount, starting from the invoice deadline. This penalty is sent without previous notice.
When payment terms are over 30 days end of month, the Buyer has to pay a deposit which amount is 10% of the total invoice amount when placing his order.

5. OWNERSHIP

System Plus Consulting remains sole owner of the delivered services until total payment of the invoice.

6.DELIVERIES

The delivery schedule on the purchase order is given for information only and cannot be strictly guaranteed. Consequently any reasonable delay in the delivery of services will not allow the buyer to claim for damages or to cancel the order.

7.ENTRUSTED GOODS SHIPMENT

The transport costs and risks are fully born by the Buyer. Should the customer wish to ensure the goods against lost or damage on the base of their real value, he must imperatively point it out to System Plus Consulting when the shipment takes place. Without any specific requirement, insurance terms for the return of goods will be the carrier current ones (reimbursement based on good weight instead of the real value).

8.FORCE MAJEURE

System Plus Consulting responsibility will not be involved in non execution or late delivery of one of its duties described in the current terms and conditions if these are the result of a force majeure case. Therefore, the force majeure includes all external event unpredictable and irresistible as defined by the article 1148 of the French Code Civil?

9.CONFIDENTIALITY

As a rule, all information handed by customers to system Plus Consulting are considered as strictly confidential.
A non-disclosure agreement can be signed on demand.

10.RESPONSABILITY LIMITATION

The Buyer is responsible for the use and interpretations he makes of the reports delivered by System Plus Consulting. Consequently, System Plus Consulting responsibility can in no case be called into question for any direct or indirect damage, financial or otherwise, that may result from the use of the results of our analysis or results obtained using one of our costing tools.

11.APPLICABLE LAW

Any dispute that may arise about the interpretation or execution of the current terms and conditions shall be resolved applying the French law.
It the dispute cannot be settled out-of-court, the competent Court will be the Tribunal de Commerce de Nantes.

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