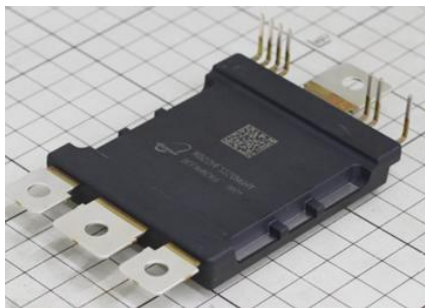
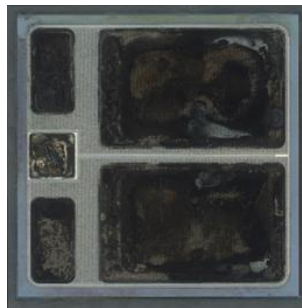


## SiC power Module (1200V) : StarPower MD22HFS120N6HY Module, SiC MOSFET Analysis Reports



Module



SiC MOSFET Die

### Report Overview

June 2024, Chinese company StarPower Semiconductor announced a SiC power module for 800V EV drive. This module features extremely low on-resistance using 1200V SiC MOSFETs, making it usable even in 800V onboard power supply environments.

Its molded, single-sided cooling structure, solid copper base plate with PINFIN structure, and AMB (Si<sub>3</sub>N<sub>4</sub>) substrate demonstrate the company's commitment to current trends and reliability.

This report clarifies the features of this product through an analysis of the module's structure, an overview of the SiC MOSFETs mounted, and a structural analysis.

### Product Features

Product type: MD22HFS120N6HY  $V_{DS}=1200V$ 、 $I_D=648A$ 、 $R_{DS(ON)}=2.12m\Omega$   
Released data: June 2024

[Datasheet : https://www.powersemi.com/Upload/Products/202407//pdf/MD22HFS120N6HY.pdf](https://www.powersemi.com/Upload/Products/202407//pdf/MD22HFS120N6HY.pdf)

- Half-bridge module 2 in 1-package
- Applications: Hybrid and electric vehicles, motor drive inverters

### Analysis result summary

#### ① Module Structure Analysis Report (44 pages)

- Cu pad is formed on the source bonding area of SiC MOSFET.
- Ag sinter is used to connect SiC MOSFET to AMB substrate and aforementioned pad.

#### ② SiC MOSFET Overview Analysis Report (15 pages)

- The Ron x AA of this product is comparable to STMicroelectronics' 3rd-generation SiC MOSFETs.

#### ③ SiC MOSFET Structure Analysis Report (53 pages)

- The gate oxide film is thinner than that of a typical planar SiC MOSFET.

### Report price

Delivered one week after order placement. Please contact us for report pricing.

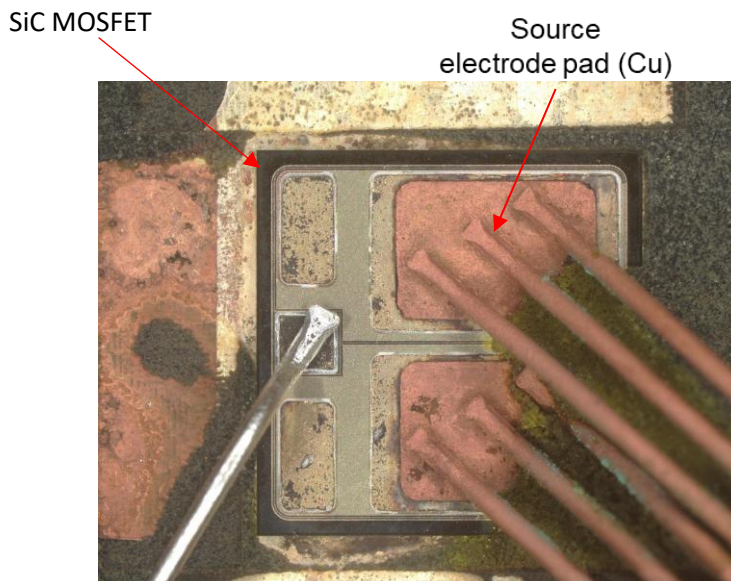
## ① Module Structure Analysis Report Table of Contents

【Table of contents】		Page
1	Device Summary	
	Table1-1 : Device Summary	• • • 3
1-1.	Summary of analysis results	• • • 4
	Table1-2 : Module Structure Overview	• • • 5
2	Module Analysis	
2-1.	Product appearance	• • • 7
2-2.	Internal layout observation	• • • 13
2-3.	Module mounted die observation	• • • 19
2-4.	Module Cross-section observation	• • • 20

## ① Excerpt from Module Structure Analysis Report



Module Cross-section OM image



Internal Module Observation

## ② SiC MOSFET Overview Analysis Report Table of Contents

【Table of contents】		Page
1	Device Summary	
	Table1-1:Device Summary	• • • 3
1-1.	Summary of analysis results	• • • 4
	Table1-2: Device Structure : SiC MOSFET	
	Table1-3: Device Structure : Layer materials and thickness	• • • 5
2	Module Analysis	
2-1.	Product appearance	• • • 7
3	SiC MOSFET Die Overview Analysis	
3-1.	Plan-view Analysis(OM) (Die Observation)	• • • 11
3-2.	Cell array cross-sectional Analysis (Epi layer thickness and cell pitch confirmation)	• • • 12
3-3.	Die outer perimeter cross-sectional Analysis (confirmation of edge termination structure)	• • • 13
4	Comparison with other manufacturers	• • • 15

## ② Excerpt from SiC MOSFET Overview Analysis Report

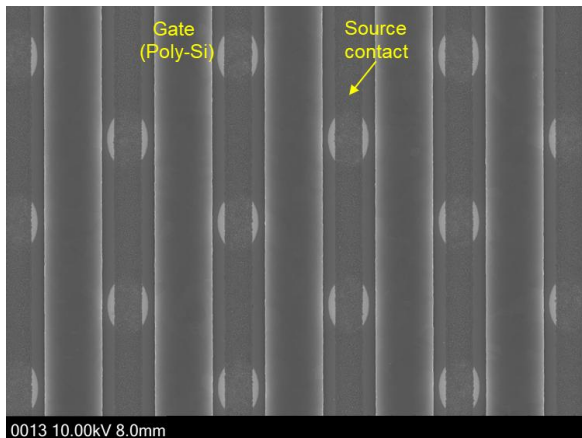
Table : Device structure

	StarPower MD22HFS120N6HY	StarPower DM400S12TDRB	Silan SCDP120R013N2P4B	STMicro SCT040W120G3AG
Die size A (mm x mm = mm <sup>2</sup> )				
Transistor area AA (mm <sup>2</sup> )				
Ron (mΩ / Vgs(V))				
Ron x AA (mΩ · mm <sup>2</sup> )				
Transistor cell configuration				
Cell pitch P (μm)				
Gate oxide film				

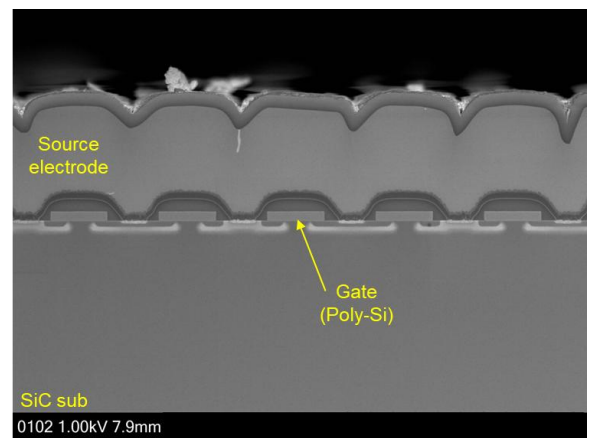
### ③ SiC MOSFET Structure Analysis Report Table of Contents

【Table of contents】		Page
1	Device Summary	
	Table1-1:Device Summary	• • • 3
1-1.	Summary of analysis results	• • • 4
	Table1-2: Device Structure : SiC MOSFET	• • • 5
	Table1-3: Device Structure : Layer materials and thickness	• • • 6
2	Module Analysis	
2-1.	Product appearance	• • • 8
2-2.	Internal layout observation	• • • 11
3	SiC MOSFET Die Structure Analysis	
3-1.	Plan-view analysis (OM)	• • • 14
3-2.	Plan-view analysis (SEM)	• • • 28
3-3.	Cell array cross-sectional Analysis	• • • 34
3-4.	Die outer perimeter cross-sectional Analysis	• • • 42
4	SiC MOSFET Die back surface structure (Annealing marks)	• • • 50
5	Comparison with other manufacturers	• • • 53

### ③ Excerpt from SiC MOSFET Structure Analysis Report



Cell array plane SEM image (Poly-Si layer)



Cell array cross-section SEM image