

SiC MOSFETs (1200V): Survey and Benchmark Report (2025 Edition)

Background

In the past few years there have been significant announcements and activity in the SiC industry:

- Leading SiC device manufacturers have transitioned to Gen 4 technology, with specific on-resistance per unit area (RONxA) dropping below $200\text{m}\Omega\cdot\text{mm}^2$.
- As SiC wafer manufacturing expands and manufacturing yields improve, the price of SiC wafers has fallen significantly.
- Chinese SiC wafer manufacturers (e.g. Tankeblue, SICC, etc.) are actively attracting device manufacturers by offering high volume production and low-cost wafers (e.g. Tankeblue-Infineon, etc.).

Based on these circumstances and information, we are preparing to release the latest SiC MOSFET technology survey and benchmark report for 2025. The main purpose is to track the technological evolution of the **global SiC MOSFET industry** and its current status and prospects.

Report contents (174 pages) See Table of Contents on Page 2, 3, 4:

The technology trends and evolution analysis of SiC transistors is **based on data from close to 60 products analyzed by LTEC since 2014**, including data from the first generation to the latest fourth generation from major SiC device manufacturers.

STMicro, INFINEON, Wolfspeed, ROHM, TOSHIBA,
ONSEMI, NEXPERIA/Mitsubishi,
DENSO, BOSCH (Refer to P.6)

Questions addressed in this report:

- Top suppliers of SiC wafers and leading SiC transistor manufacturers
- Technology evolution and performance improvement trends in SiC transistors
 - Reducing transistor cell pitch size or improving transistor performance?
 - Technology trends and new announcements? (→ SuperJunction)
- ✓ New limits for very low RON ($\leq 10\text{m}\Omega$) transistors ★
- ✓ New SiC wafer (⇒ Bonded SiC, PolySiC substrate)
- ✓ Consideration of SiC raw wafer prices and SiC device processed wafer costs (PWC)
- ✓ Are SiC MOSFETs getting cheaper? Trend towards lower ASPs (average selling prices)?
- ✓ What is the cost/price ratio between SiC-based transistors and Si-based transistors?

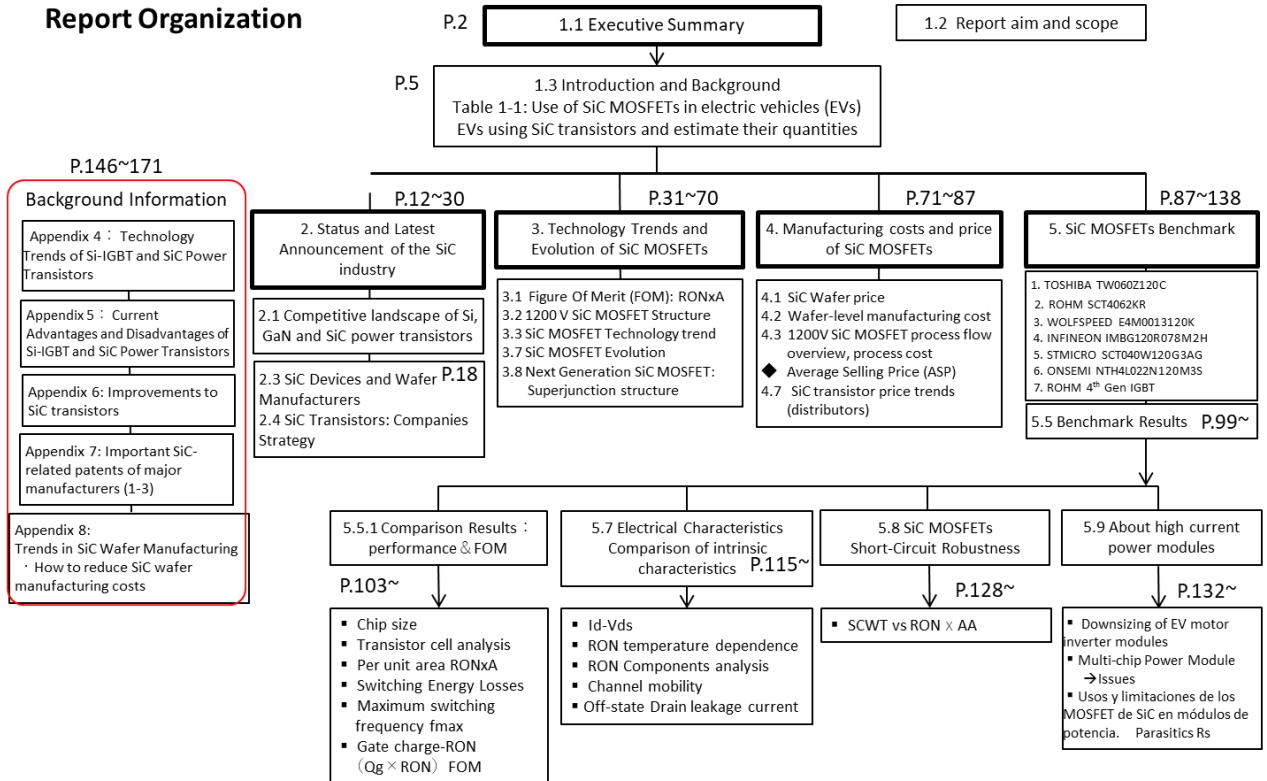
Has it changed between 2018, 2022 and 2024-25?

Report price

Delivered one week after order placement.

Please contact us for report pricing.

Report Organization



■ Introduction: Objective and Scope of this Report

The objective of this report is to investigate the main technological advances in power SiC MOSFETs, predict their trends, possible obstacles, track pricing trends for SiC wafer supplies and estimate manufacturing costs.

This report is not a market research report but rather summarizes current revenue forecasts and key manufacturers in the global SiC-based market based on publicly available information (sources are stated).

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2 Prospects of SiC transistors

2.1 Competition between Si, GaN and SiC power transistors

2022

2024

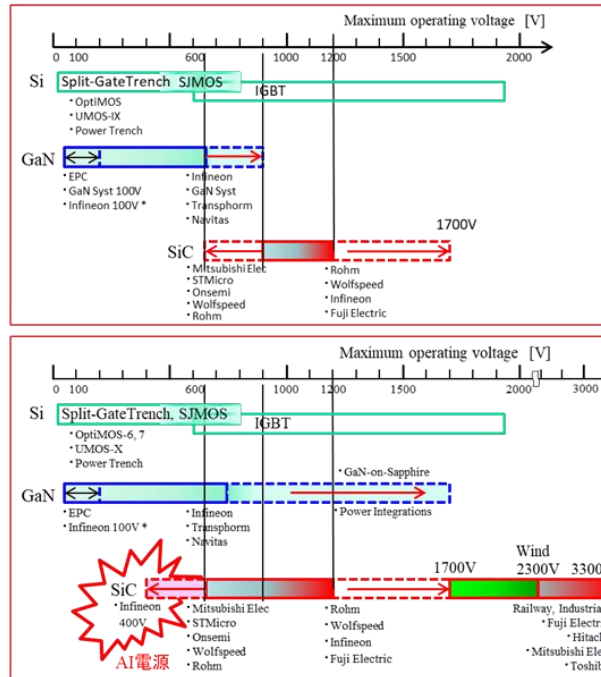


Fig.2.X Evolution of high power WBG transistors.

• GaN expanding to $V_{dss} > 1200V$, and
• SiC MOSFETs encroaching into $V_{dss} \sim 400V$.

2 Prospects for SiC transistors

2.1 Competitive landscape of Si, GaN and SiC power transistors

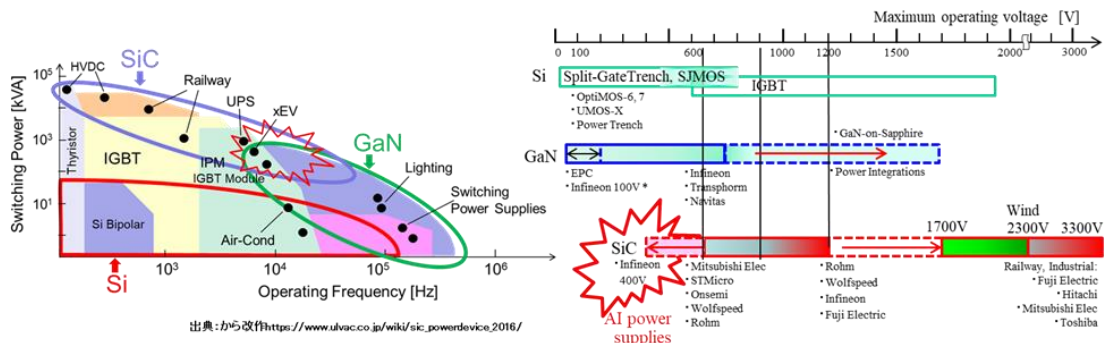


Fig.2.1: Competitive landscape of Si, GaN and SiC power transistors

Fig.2.2: Current Voltage Application Areas for Si, GaN and SiC Power Transistors

In 2017, Transphorm introduced the world's first GaN HEMT operating at 900V, which competes directly with SiC MOSFETs. In the 650V zone, major manufacturers are introducing SiC MOSFETs (STMicro for Tesla-3 motor inverters). Major manufacturers are also offering SiC transistors for 1700V applications.

• A major AC adapter manufacturer (Power Integrations, PI) introduced a flyback converter (InnoSwitch3-AQ 1700 Volt IC.) with AEC-Q100 qualified 1700V SiC MOSFETs as switching devices (February 2022).

• Furthermore, GaN company Navitas Semiconductor announced the acquisition of GeneSiC Semiconductor, a SiC pioneer with deep expertise in the design and process of SiC power devices. (August 16, 2022). Like PI, Navitas will incorporate SiC MOSFETs into its system designs. This is likely due to the limitations of GaN HEMTs for operation at $V_{dss} > 800V$ required for automotive systems.

• On May 28, 2024, INFINEON announced the expansion of GaN and SiC for AI (artificial intelligence) power supplies: New 400V CoolSiC MOSFET








Table.1 Outline of FOM and cost/price of evaluated devices

		TOSHIBA	ROHM	WOLFSPEED	INFINEON	STMICRO	ON-Semi	ROHM
FOM	Summary of Performance FOMs							
	Process Technology Generation							
	72 Specific Effective ON Resistance, RONx Δ @ Tj= 150°C							
	73 Specific Intrinsic ON Resistance, RONx $\Delta\Delta$ @ Tj= 25°C							
	74 Specific Intrinsic ON Resistance, RONx $\Delta\Delta$ @ Tj= 150°							
	75 Qg x RON @ Tj= Tjmax							
	76 Ciss x RON @ Tj= Tjmax							
	77 Crss x RON @ Tj= Tjmax							
	78 Coss x RON @ Tj= Tjmax							
	79 Turn-off Switching Energy, Eoff x RON @ Tj= Tjmax							
	80 Turn-on Switching Energy, Eon x RON @ Tj= Tjmax							
	81 Maximum Switching Frequency, fmax							
Cost & Price	82 Reverse Recovery Charge, Qrr x RON							
	83 Average Selling Price, ASP (Retailer)							
	84 ASP per Ampere (@ Tc=100°C)							
	85 ASPxRON							
	Processed Wafer Cost (Estimated, AVG)							

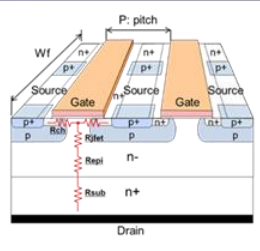
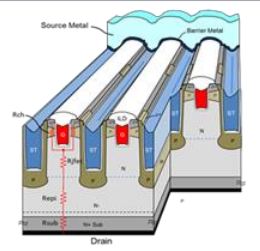
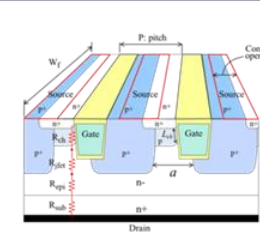
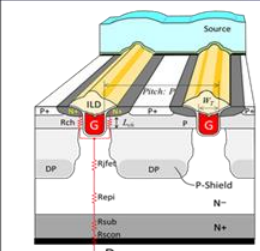
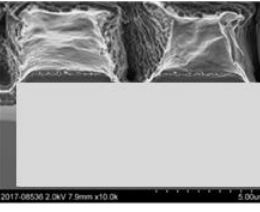
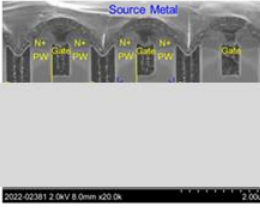
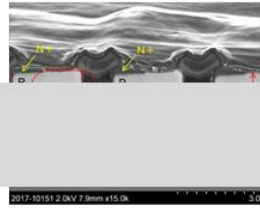
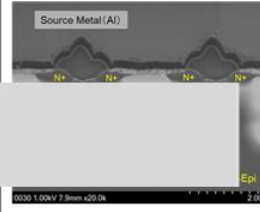
Table 2-1: Current status of SiC device and module manufacturers

#	Company	Market Share %	LTEC Report	Epi Wafer	Device Chip	Module	Latest activities
1	STMicro (IT)		✓	✓	✓		6インチウェハを使用。★STMicroの650VSiC-MOSFETは、TESLA-3のパワーカードで使用されている。
2	INFINEON (DE)		✓				
3	WOLFSPEED (US) (CREE)		✓				
4	ROHM (JPN)		✓				年4月)
5	ONSEMI (US)		✓				
6	mitsubishi Electric (JPN)		✓				
7	Fuji Electric (JPN)		✓				
8	Hitachi → Minebea PD (JPN)						
9	TOSHIBA (JPN)		✓				
10	MicroSemi/Microchip (US)		✓				
11	GeneSIC (US)		✓				
12	Littelfuse/DXYS (US)		✓				
13	United SiC Corp (Qorvo) (US)		✓				
14	X-Fab (US)						
15	SiCmore Semi (US, OR)						
16	Denso (JPN)		✓				
17	BOSCH (DE)		✓				0427
18	SUMITOMO Electric Ind. (JPN)						
19	RENESAS						

5.2 Table 5-1: 1200V SiC MOSFETs benchmark (2025)

	Manufacturer Product	ROHM SCT4062KR	TOSHIBA TW060Z120C	WOLFSPEED E4M0013120K	INFINEON IMBG120R078M2H	ONSEMI NTH4L022N120M3S	STMICRO SCT040W120G3AG	INVENTCHIP IV3Q12013T4Z
	Manufacturer country	JPN	JPN	USA	GERM	USA	ITA	CHN
	Process Generation	4 th	3 rd	4 th	2 nd	3 rd M3S	3 rd	3 rd
Electrical Specs & FOMs	Max V _{dd} [V]							
	Rated DC I _d [A] (per transistor)							
	RON [mΩ]							
	Spec Operating T _{jmax} [°C]							
	Gate Input capacitance CissxRON [pFxΩ]							
	Drain Output capacitance CossxRON [pFxΩ]							
	Reverse transfer capacitance CrssxRON [pFxΩ]							
	Total Switching Energy Loss EswxRON [mJ x mΩ]							
	Estimated Max Switching Frequency, fsw [kHz]							
	Chip Size, A [mm ²]							
Structural Features	Array Active Area, AA [mm ²]							
	Current Density, I _d /AA [A/mm ²]							
	Specific ON resistance FOM: Effective RON x A [mΩ · mm ²] @ T _j =25°C							
	Specific ON resistance FOM: Effective RON x A [mΩ · mm ²] @ T _j =T _{jmax}							
	Transistor Configuration							
	Transistor Cell pitch, P [μm]							
	Die photograph							

5.3 Table 7: SiC MOSFETの構造 *) (2025)

 <p>Planar Gate Structure</p>	 <p>Double Trench Structure</p>	 <p>Asymmetrical Trench Gate Structure</p>	 <p>Trench Gate Structure</p>
 <p>2017-08530 2.0kV 7.5mm x10.0k 5.00um</p>	 <p>2022-02381 2.0kV 8.0mm x20.0k 2.00um</p>	 <p>2017-10151 2.0kV 7.5mm x15.0k 3.00um</p>	 <p>0030 1.00kV 7.5mm x20.0k 2.00um</p>

3.1 Technology Trends and Evolution of SiC MOSFETs (2025)

1200V SiC-MOSFET

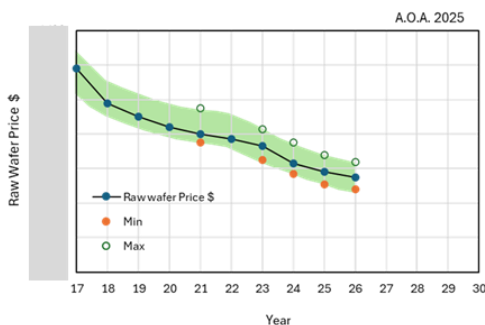
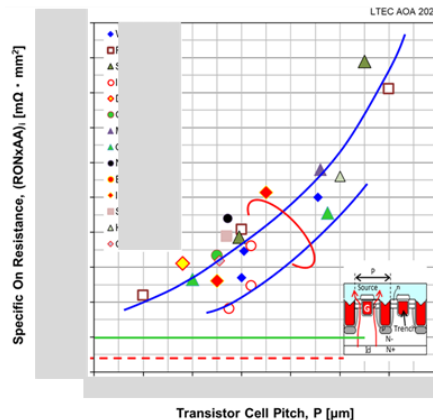
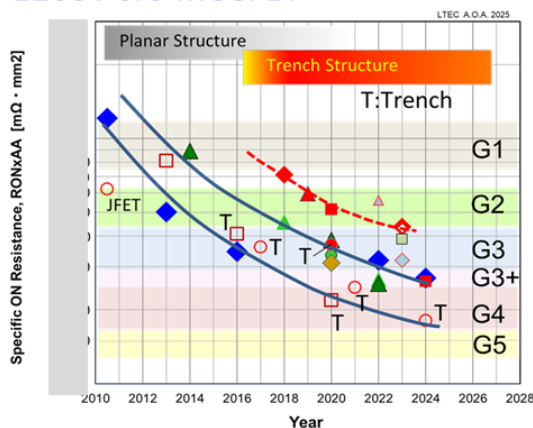
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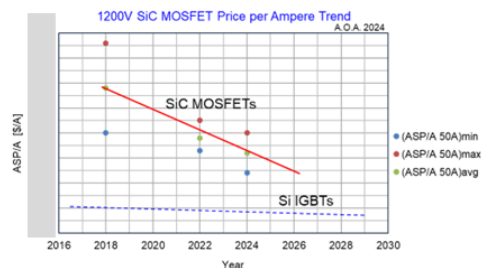
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3.1 Technology Trends and Evolution of SiC MOSFETs (2025)

1200V SiC-MOSFET



4.6 Average Selling Price per Amp



SiC MOSFET Performance Benchmarking

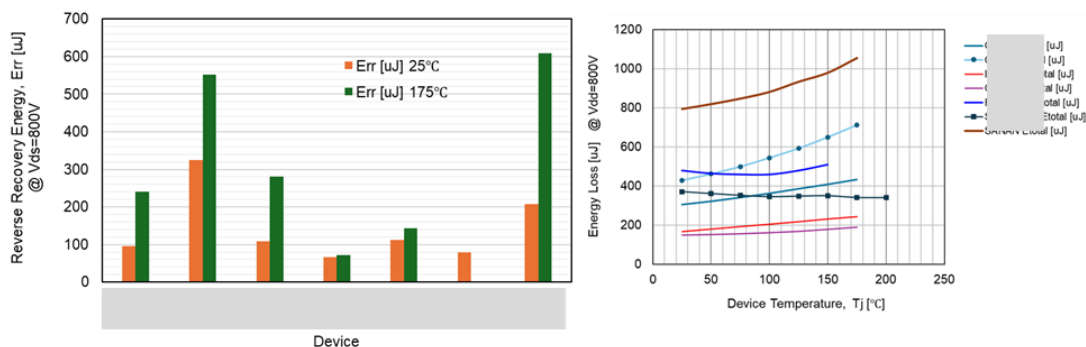


Fig.X-1 Body diode reverse recovery energy loss (Err @ 25°C, 800V) in 1200V, $R_{on} \sim 32-40 m\Omega$ SiC MOSFETs