New Release

LTEC Corporation

Your most experienced partner in IP protection

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 200mΩ·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 (≤10mΩ) 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

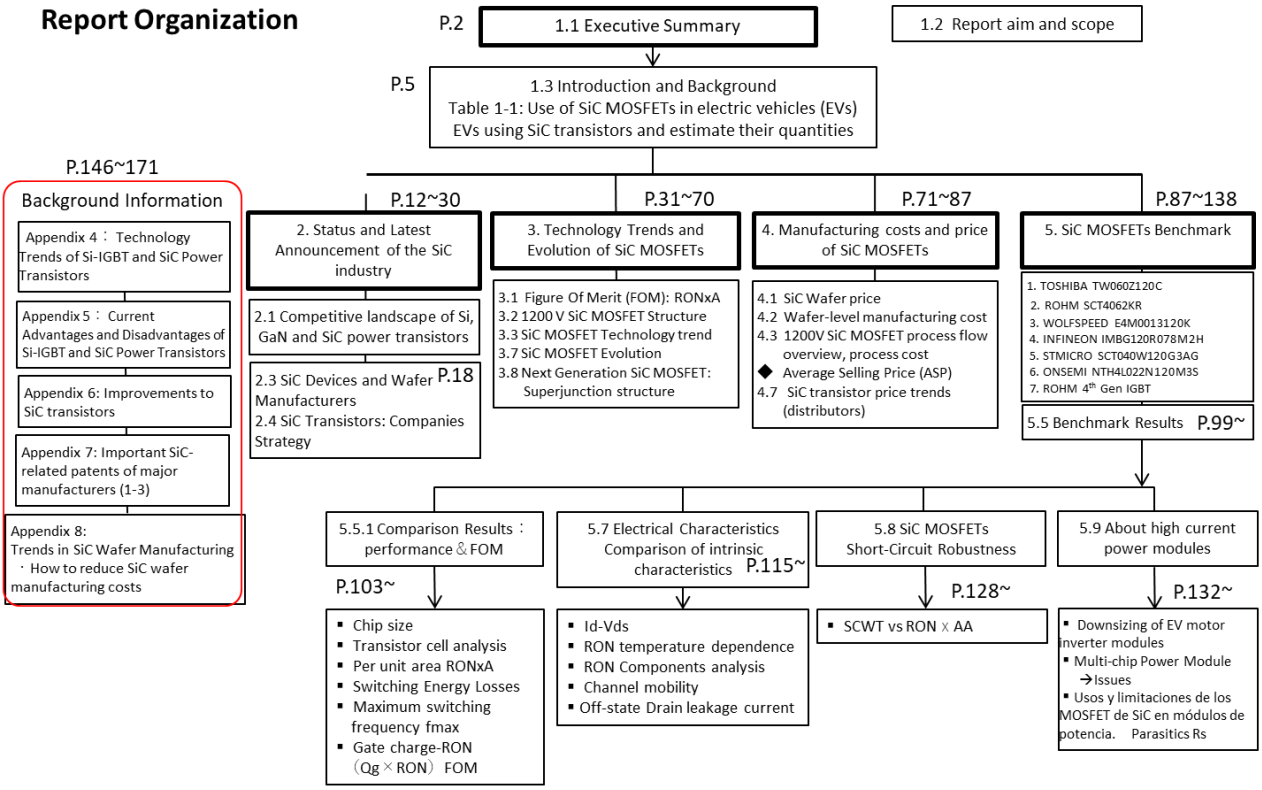
Delivered one week after order placement.

Please contact us for report pricing.

LTEC Corporation US Representative Office www.ltec-biz.com/en/
2310 Homestead Rd, C1 #231 Los Altos, CA 94024
Phone: +1-(650) 382-1181
Contact2@ltec.biz

Report No　: 24G-0876-1
Release day : 2025.02.19

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).

TABLE OF CONTENTS (1)

TABLE OF CONTENTS (2)

2 Prospects of SiC transistors

2.1 Competition between Si, GaN and SiC power transistors

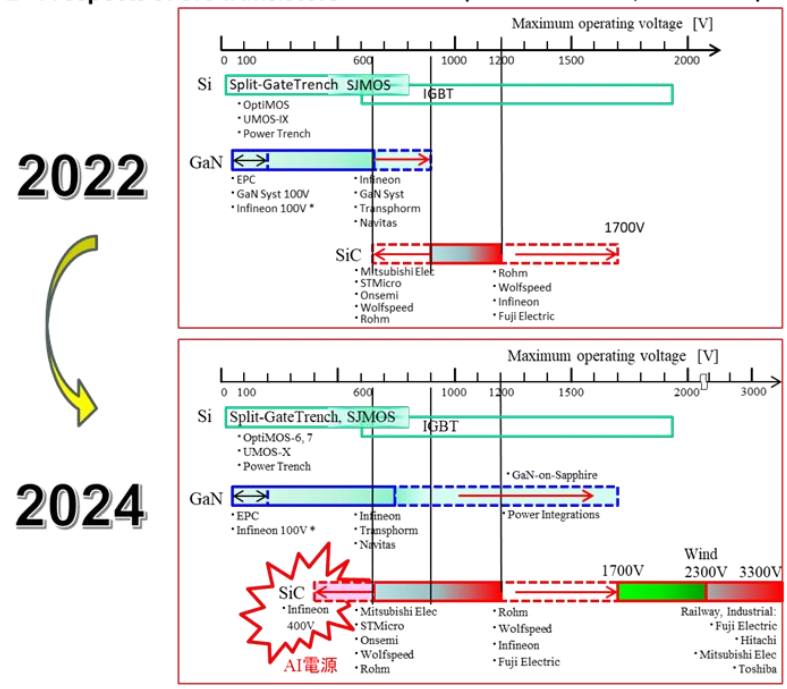


Fig.2.X Evolution of high power WBG transistors.

・GaN expanding to Vdss> 1200V, and

・SiC MOSFETs encroaching into Vdss~400V.

2 Prospects for SiC transistors

2.1 Competitive landscape of Si, GaN and SiC power transistors

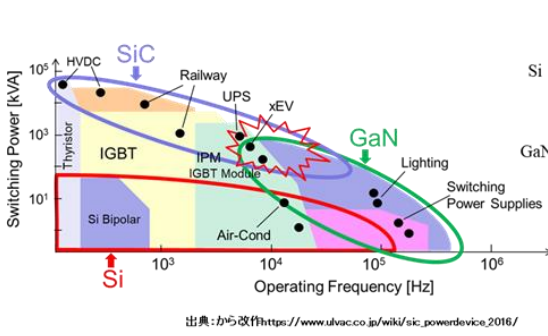


Fig.2.1: Competitive landscape of Si, GaN and SiC power transistors

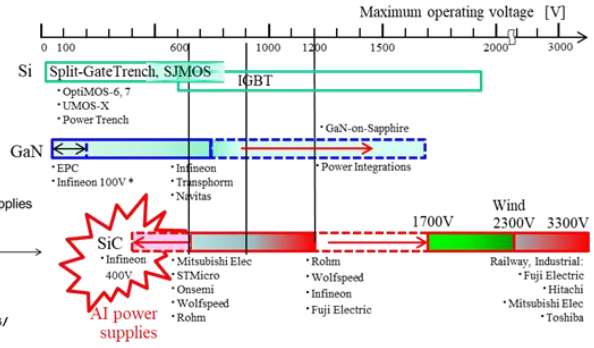


Fig.2.2: Current Voltage Application Areas for Si, GaN and SiC Power Transistors

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 Vdss>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								D
	72	Specific Effective ON Resistance, RONxA @ Tj= 150°C	mΩ・mm2							
	73	Specific Intrinsic ON Resistance, RONxAA @ Tj= 25°C	mΩ・mm2							
	74	Specific Intrinsic ON Resistance, RONxAA @ Tj= 150°	mΩ・mm2							
	75	Qg x RON @ Tj= Tjmax	nC・Ω							
	76	Ciss x RON @ Tj= Tjmax	pF・Ω							
	77	Crss x RON @ Tj= Tjmax	pF・Ω							
	78	Coss x RON @ Tj= Tjmax	pF・Ω							
	79	Turn-off Switching Energy, Eoff x RON @ Tj= Tjmax	mJ・mΩ							
	80	Turn-on Switching Energy, Eon x RON @ Tj= Tjmax	mJ・mΩ							
	81	Maximum Switching Frequency, fmax	kHz							
	82	Reverse Recovery Charge, Qrr x RON	nC・Ω							
Cost & Price										
	83	Average Selling Price, ASP (Retailer)	$/unit							
	84	ASP per Ampere (@ Tc=100℃)	$/A							
	85	ASPxRON	$・Ω							
		Processed Wafer Cost (Estimated, AVG)	$/wafer							

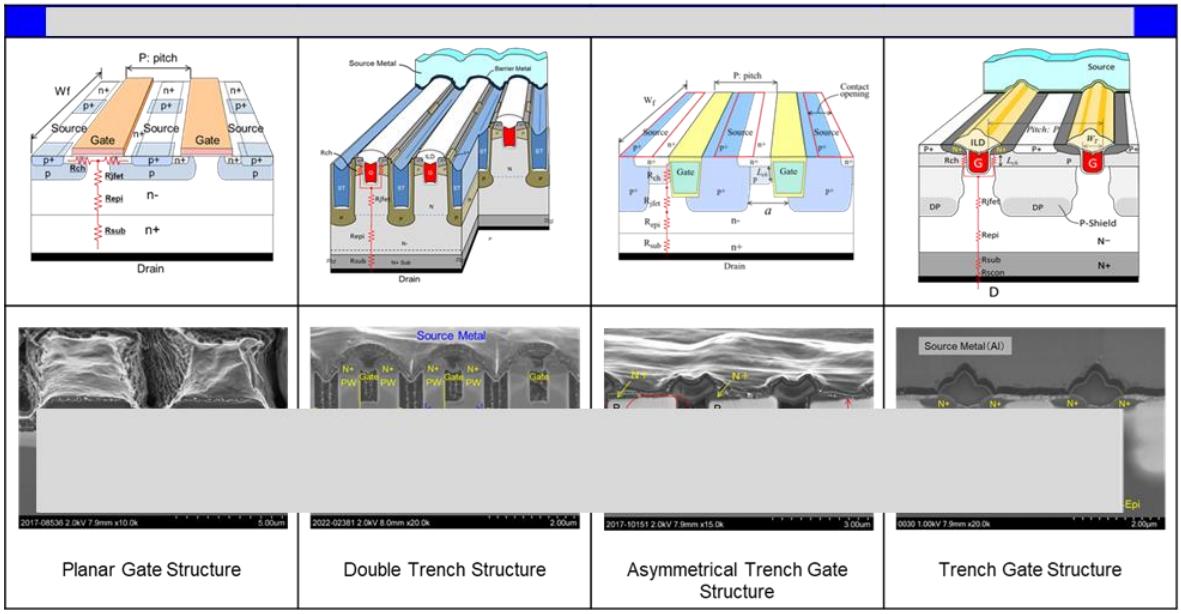
Table 2-1: Current status of SiC device and module manufacturers

#	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パワーカードで使用されている。
2	INFINEON (DE)		✔				
3	WOLFSPEED (US) (CREE)		✔				
4	ROHM (JPN)		✔				
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/IXYS (US)		✔				
13	United SiC Corp (Qorvo) (US)		✔				
14	X-Fab (US)						
15	SiCamore Semi (US, OR)						
16	Denso (JPN)		✔				
17	BOSCH (DE)		✔				
18	SUMITOMO Electric Ind. (JPN)						
19	RENESAS						

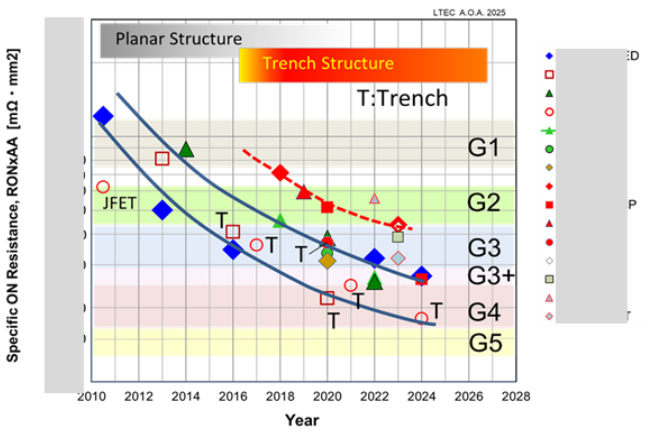
5.2 Table 5-1: 1200V SiC MOSFETs benchmark (2025)

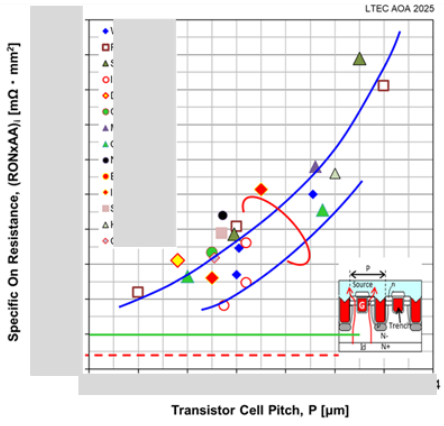
	Manufacturer Product	ROHM SCT4062KR	TOSHIBA TW060Z120C	WOLFSPEED E4M0013120K	INFINEON IMBG120R078M2H	ONSEMI NTH4L022N120M3S	STMICRO SCT040W120G3AG	INVENTCHIP IV3Q12013T4Z
	Manufacturer country	JPN	JPN	USA	GERM	USA	ITA	CHN
	Process Generation	4th	3rd	4th	2nd	3rd M3S	3rd	3rd
Electrical Specs & FOMs	Max Vdd [V]							
	Rated DC Id [A] (per transistor)							
	RON [mΩ]							
	Spec Operating Tjmax [°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]							
Structural Features	Chip Size, A [mm²]							
	Array Active Area, AA [mm²]							
	Current Density, Id/AA [A/mm²]							
	Specific ON resistance FOM: Effective RON x A [mΩ· mm²] @ Tj=25°C							
	Specific ON resistance FOM: Effective RON x A [mΩ· mm²] @ Tj=Tjmax							
	Transistor Configuration							
	Transistor Cell pitch, P [μm]							
	Die photograph							

5.3 Table 7：SiC MOSFETの構造 *） (2025)

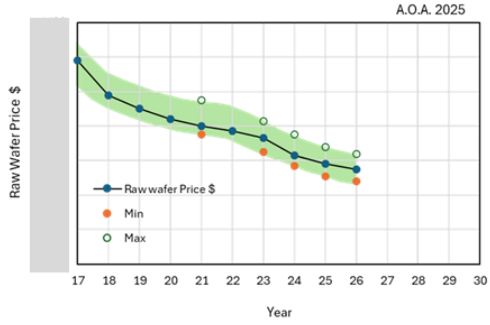


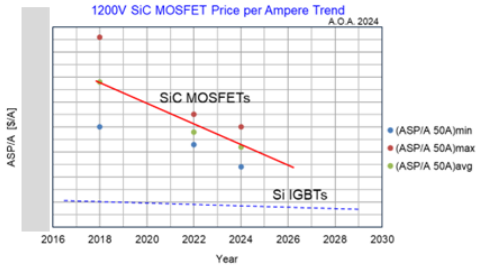
3.1 Technology Trends and Evolution of SiC MOSFETs（2025）
1200V SiC-MOSFET



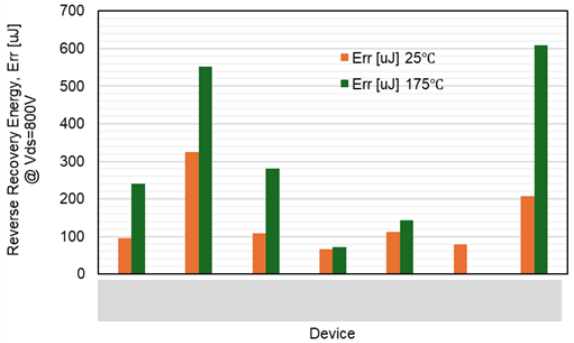


4.6 Average Selling Price per Amp





SiC MOSFET Performance Benchmarking



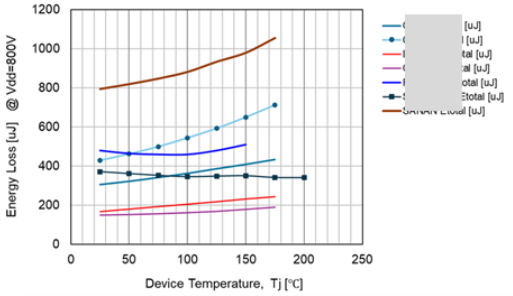


Fig.X-1 Body diode reverse recovery energy loss (Err @ 25°C, 800V) in 1200V, Ron~32-40mΩ SiC MOSFETs