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NEW RELEASE

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SiC MOSFET(1200V) : Short-Circuit Robustness Survey-Benchmark Report (2025 Edition)

Report Overview

In 2020, LTEC published the world's first SiC MOSFET short-circuit robustness evaluation and comparison report (19G-0025), followed by an updated report (22G-1100) in 2023 covering third- and fourth-generation device technologies. Since the 2023 report, new advanced transistors and SiC MOSFETs from Chinese manufacturers have been evaluated, and new reports is proposed. The following transistors are included in this report:

No.	Manufacturer	Product type	Generation	Vdss [V]	RON [mΩ]
1	BYD Semiconductor (CHN)	BSK080S120	G1	1200	80
2	Basic Semiconductor (CHN)	B2M065120Z	G2	1200	65
3	INFINEON (GER)	IMZC120R078M2H	G2	1200	78
4	NAVITAS-GeneSiC （US)	G3F75MT12K	G3F	1200	75
5	NEXPERIA (NLD/CHN)	NSF080120L3A0	G1	1200	80

Additionally, this report includes data for ROHM G4 and Wolfspeed G3 SiC transistors for comparison/benchmarking purposes.

This report compiles evaluation and analysis data on transistor short-circuit robustness using actual short-circuit tests, transistor structural analysis, physical modeling, and simulation.

Analysis result summary

Short-Circuit Robustness Survey-Benchmark Report (2025 Edition) (71 pages)

(Refer to the next page for a detailed table of contents)

Short-Circuit Withstand Time (SCWT) Test Results

- Gate oxide leakage current during a short circuit (SC) is recognized and evaluated as a precursor mechanism for degradation.
- Furthermore, comparison of the time (t1) at which gate current begins to flow is evaluated as an indicator of technology robustness, quality, and protection circuit design margin.
- The SCWT and gate oxide quality of Chinese-made SiC MOSFETs are compared with products from world-class manufacturers.
- While few manufacturers specify SCWT, we clearly define the dependency and trade-off with on-resistance (Ron) and compare it across all the evaluated devices.

Report price

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

Detailed short circuit withstand capability investigation reports have also been released for each of the products No. 1 to No. 5.　Please contact LTEC for more information.

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Excerpt from Short-Circuit Robustness Survey-Benchmark Report (1)

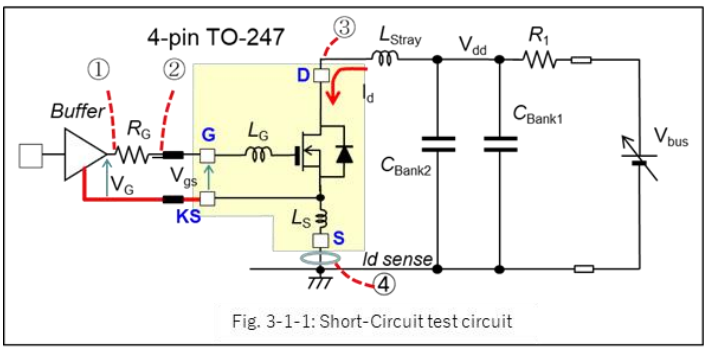

Fig. 3-1-1: Short-Circuit test circuit

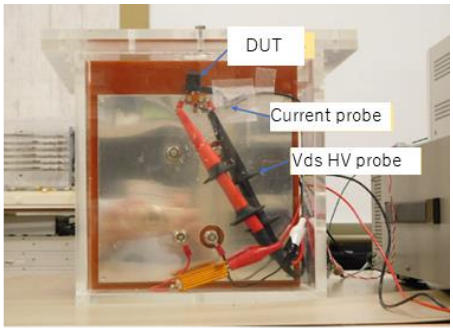

Fig. 3-1-4: Short-Circuit evaluation system

Table 4. Summary of short-circuit characteristics evaluation results for 1200V-rated SiC MOSFETs

			Units	ROHM (JPN)	WOLFSPEED (US)	INFINEON (GERM)	GenSiC (US)	NEXPERIA (オランダ/CHN)	BASiC (CHN)	BYD (CHN)
				SCT4062KR	C3M0075120D	IMZC120R078M2H	G3F075MT12K	NSF080120L3A0	B2M065120Z	BSK080S120
	1	Qualification Level		Industrial	Industrial	Industrial	Industrial	Industrial	Industrial	Industrial
	2	Package		4 TO-247	3, 4 TO-247	4 TO-247	4 TO-247	3-TO-247	4-TO-247	4-TO-247
Electrical Specs	3	Technology Generation/Prod year		G4/2021	G3/2016	G2/2024	G3/2024	2023	G2/2023	
	4	Rated Drain Voltage, Vdss	V	1200	1200	1200	1200	1200	1200	1200
	5	R_{ON}/ DC Id	mΩ/A	62 / 26	75 / 30	78 / 28	75 / 30	80 / 35	65 / 47	80 / 36
	6	Vth	V	3.8	2.5	4.2	2.9	2.3	2.8	3.0
	7	Gm/W	mS/mm							
	8	Ciss/A	pF/mm2							
	9	Gm/Ciss	1/ns							
	10	Chip Size	mm2							
	11	Specific ON resistance, RONxA	mΩ· mm2							
Short-Circuit Parameters	12	Peak SC Current, Isc,pk/W @ 600V	A/mm							
	13	SC Time (to failure), $t_{sc,f}$ @ 600V/800V	us	~						
	14	SC Critical Temperature, Tj,crit	°C	10						
	15	SC Critical Energy-to-Failure Esc,f/AA @ 600V/800V	mJ/mm2	1						
	16	SC Max Withstand Time, tscon @ 600V/800V	us							
	17	SC-induced Gate Current turn-on time, t1	us							
	18	Critical Energy at t=t_1, $E_{sc,t1}$ /AA 800V	mJ/mm2							
Device Structural Features	19	Transistor Array Active Area, AA	mm2							
	20	Transistor Configuration		Dou						
	21	Gate Oxide Thickness, Tox	nm							
	22	Transistor Cell Pitch, P	um							
	23	Die Photograph								

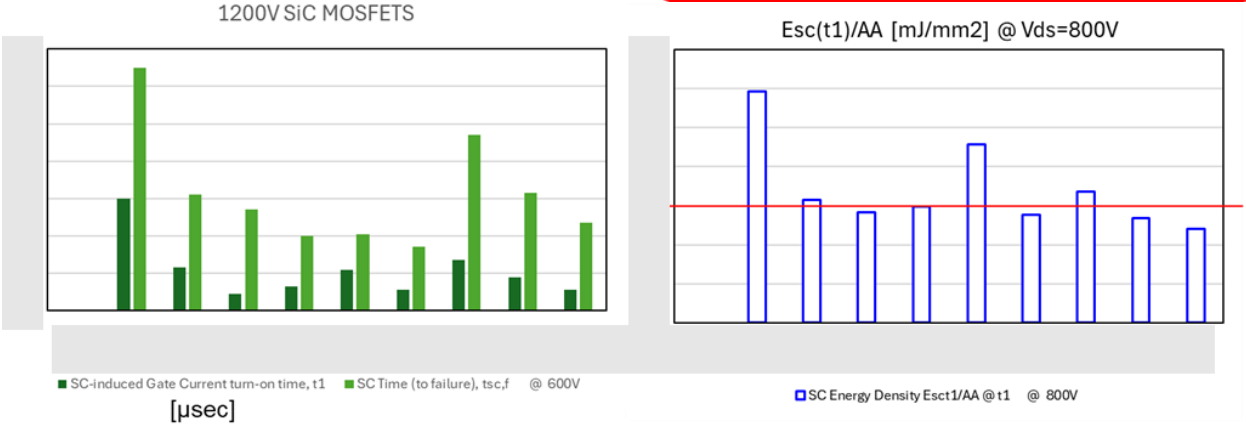

Fig. 3.1.1: Comparison of the short circuit capability and time to failure (SCWT @ Vds = 600 V) of the evaluated 1200V SiC MOSFET, and the dissipated energy Esc(t1) at the start time (t1) of gate leakage current.

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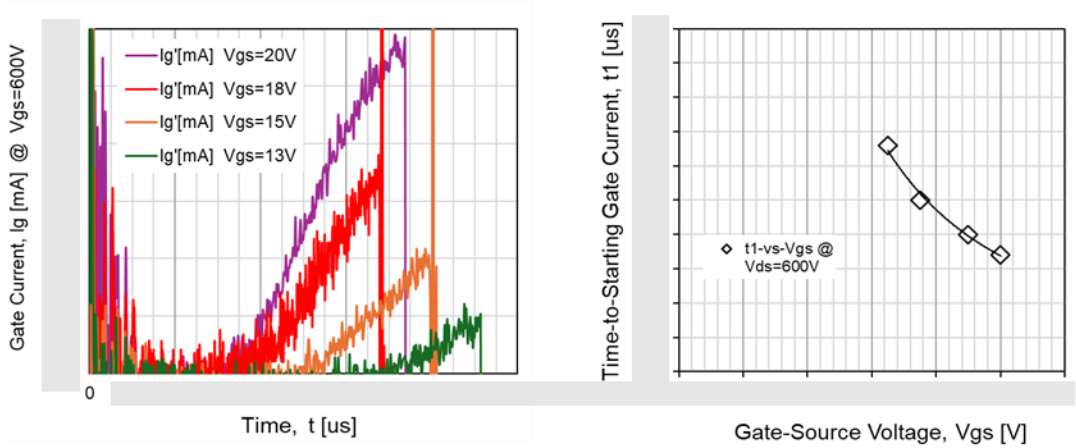

Fig. 3.2.10: Example 1 of the gate current (Ig) and gate-source voltage (Vgs) during a short-circuit transient at Vds = 600''

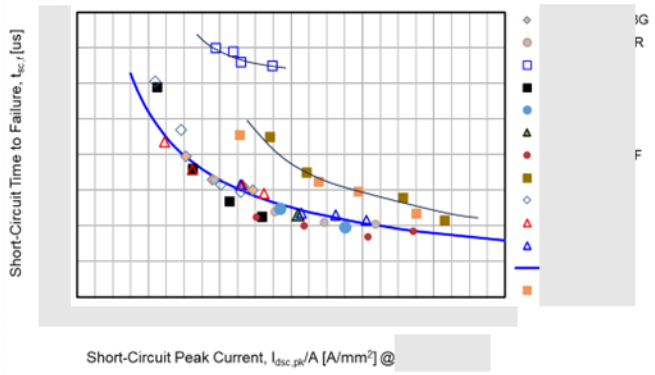

Fig. 3.3.4: Summary of the dependence of SC failure time (SCWT=tsc,f) on SC peak current density (Idsc,pk/A) for evaluated 1200V SiC MOSFETs from several manufacturers and technologies.

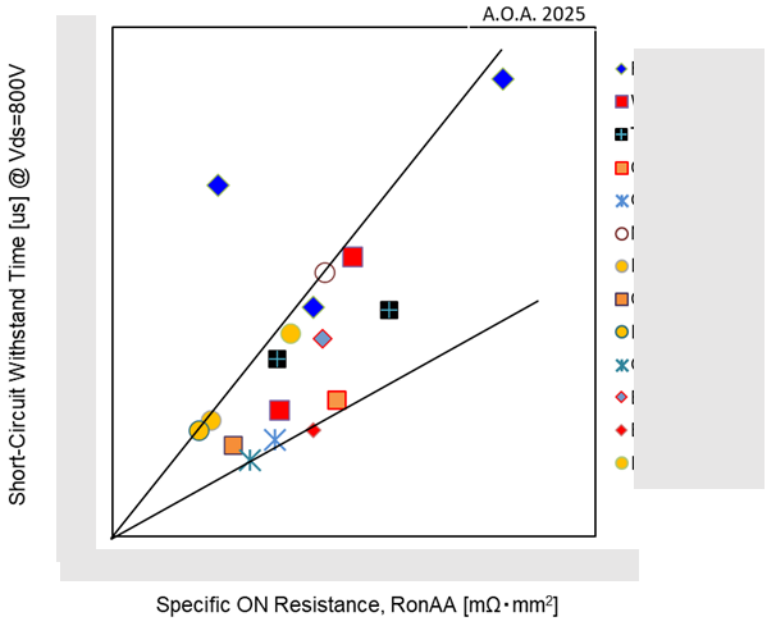

Fig.5.2.2: The trend of short circuit withstand capability (at Vds=800V) across devices from multiple manufacturers and technology generations shown as a function of the specific on-resistance (RonAA).

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