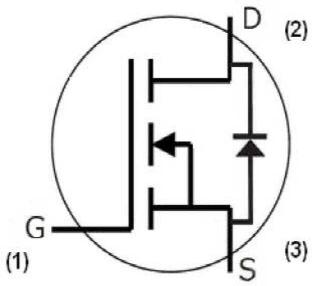
1700V 1000mΩ Silicon Carbide Power MOSFET

Features

- High blocking voltage with low on-resistance
- High switching speed with low capacitance
- Very fast and robust intrinsic body diode with low reverse recovery
- Very low switching losses
- Excellent avalanche ruggedness
- RoHS compliant



Benefits

- Greater system efficiency
- Reduced cooling requirements
- Increased power density
- Increased system switching frequency
- Easy to parallel and simple to drive

Die Size(mm)
1.61*1.61 mm^2

Potential Applications

- Solar inverters
- Uninterrupted power supplies
- Switch mode power supplies
- Motor drives

HF RoHS

Description

The Sanan Semiconductor 1700V/1000mΩ silicon carbide power MOSFET uses advanced SiC MOSFET technology with low on-resistance, low switching losses, and a high operation temperature of 175℃. It is suitable for use in high frequency circuits and provides a reduction in overall system size, increased efficiency and increased switching frequency. It has been widely used in applications including solar inverters, uninterrupted power supplies, switch mode power supplies, and motor drives. Using RoHS compliant components, it is qualified for use in industrial application.

Product Specifications

Device	V_{DS}	I_D (25℃)	$R_{(DS)on}$	Qrr
SMS1701000B	1700V	6.8A	1000mΩ	0.08μC

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Table 1. Maximum Ratings

(T_C = 25℃, unless otherwise specified)

Parameter	Symbol	Value	Unit	Test conditions
Drain-source voltage	V_{DSmax}	1700	V	V_{GS} = 0V, I_D = 100μA, T_C = 25℃
Gate-source voltage, max. transient voltage	V_{GSmax}	-10/+27	V	t_p ≤ 0.5us, D < 1%, Tc = 25℃
Gate-source voltage, max. static voltage	V_{GSmax}	-8/+24	V	Tc = 25℃
Gate-source voltage	V_{GSop}	-5/+20	V	Recommended operation values, Tc = 25℃
Continuous drain current	I_D	6.8	A	V_{GS} = 20V, T_C = 25℃
		4.8		V_{GS} = 20V, T_C = 100℃
Pulsed drain current	$I_{D(pulse)}$	21	A	T_C = 25℃, t_p = 10μs, half Sine Wave D = 0.1
Power dissipation	P_{tot}	92	W	T_C = 25℃
Operating junction and Storage temperature	T_j, T_{stg}	-55~175	℃	

Table 2. Static Electrical Characteristics

(T_j = 25℃, unless otherwise specified)

Parameter	Symbol	Values			Unit	Test conditions
		Min.	Typ.	Max.		
Drain-source breakdown voltage	$V_{(BR)DSS}$	1700	/	/	V	V_{GS} = 0V, I_D = 100μA
Gate threshold voltage	$V_{GS(th)}$	2	2.8	4	V	V_{DS} = V_{GS}, I_D = 0.5mA
		/	1.8	/	V	V_{DS} = V_{GS}, I_D = 0.5mA, T_j = 175℃
Drain-source leakage current	I_{DSS}	/	0.01	1	μA	V_{DS} = 1700V, V_{GS} = 0V
Gate-source leakage current	I_{GSS}	/	1	250	nA	V_{GS} = 20V, V_{DS} = 0V
Drain-source on-state resistance	$R_{DS(on)}$	/	0.7	1.2	Ω	V_{GS} = 20V, I_D = 2A
		/	1.5	/	Ω	V_{GS} = 20V, I_D = 2A, T_j = 175℃
Drain-source on-state resistance	$R_{DS(on)}$	/	0.75	1.3	Ω	V_{GS} = 18V, I_D = 2A
		/	1.6	/	Ω	V_{GS} = 18V, I_D = 2A, T_j = 175℃
Transconductance	g_{fs}	/	1.0	/	S	V_{DS} = 20V, I_D = 2A
		/	1.2	/	S	V_{DS} = 20V, I_D = 2A, T_j = 175℃
Internal gate resistance	$R_{g(int)}$	/	6	/	Ω	f = 1MHz, V_{AC} = 25mV

Table 3. Dynamic Electrical Characteristics

(T_j = 25℃, unless otherwise specified)

Parameter	Symbol	Values			Unit	Test conditions
		Min.	Typ.	Max.		
Input capacitance	C_{iss}	/	227	/	pF	V_{GS} = 0V, V_{DS} = 1000V, f = 1MHz, V_{AC} = 25mV
Output capacitance	C_{oss}	/	12.5	/	pF	
Reverse transfer capacitance	C_{rss}	/	2	/	pF	
C_{oss} stored energy	E_{oss}	/	7.7	/	μJ	
Gate to source charge	Q_{gs}	/	1.67	/	nC	V_{DD} = 1200V,V_{GS} = -5/+20V,

Gate to drain charge	Q_{gd}	/	9.2	/		I_D = 2A, I_{GS} = 1mA
Total gate charge	Q_g	/	16.7	/		

Table 4. Switching Characteristics

(T_j = 25℃, unless otherwise specified)

Parameter	Symbol	Values			Unit	Test conditions
		Min.	Typ.	Max.		
Turn-on delay time	$t_{d(on)}$	/	18	/	ns	V_{DD} = 1200V, V_{GS} = -5/+20V, I_D = 2A, $R_{G(ext)}$ = 12Ω, L = 1364μH
Rise time	t_r	/	16	/		
Turn-off delay time	$t_{d(off)}$	/	24	/		
Fall time	t_f	/	79	/		
Turn-on switching energy	E_{on}	/	63	/	μJ	
Turn-off switching energy	E_{off}	/	29	/		

* Switching Characteristics are collected in TO247-3L

Table 5. Reverse SiC Diode Characteristics

(T_j = 25℃, unless otherwise specified)

Parameter	Symbol	Values			Unit	Test conditions
		Min.	Typ.	Max.		
Diode forward voltage	V_{SD}	/	3.60	/	V	V_{GS} = -5V, I_{SD} = 1A
		/	3.20	/		V_{GS} = -5V, I_{SD} = 1A, T_j = 175°C
Continuous diode forward current	I_S	/	/	5	A	T_C = 25℃
Reverse recovery time	t_{rr}	/	34	/	ns	V_{GS} = -5V, I_{SD} = 2A, V_R = 1200V, di_f/dt = 0.19kA/μs
Reverse recovery charge	Q_{rr}	/	0.04	/	uC	
Peak reverse recovery current	I_{rrm}	/	1.85	/	A	
Reverse recovery time	t_{rr}	/	39	/	ns	V_{GS} = -5V, I_{SD} = 2A, V_R = 1200V, T_j = 175°C, di_f/dt = 0.19kA/μs
Reverse recovery charge	Q_{rr}	/	0.08	/	uC	
Peak reverse recovery current	I_{rrm}	/	3.57	/	A	

Electrical Characteristic Diagrams：

All the graphs are based on the TO-247-3L (which has higher thermal resistance than most packages used with topside sinter/solder)

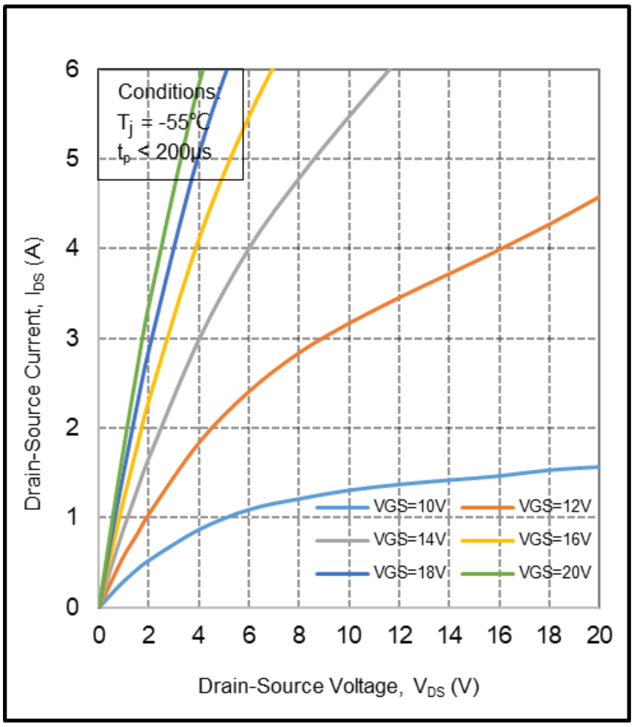


Figure 1. Output characteristics at T_j = -55℃

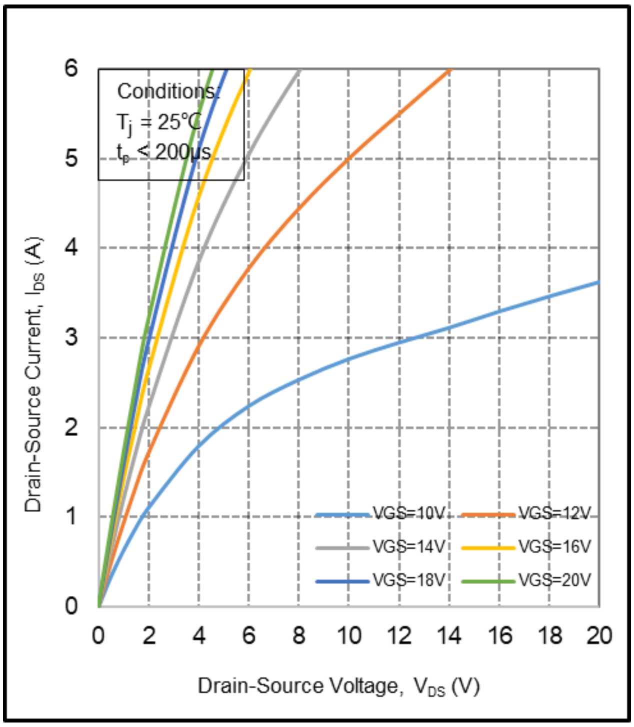


Figure 2. Output characteristics at T_j = 25℃

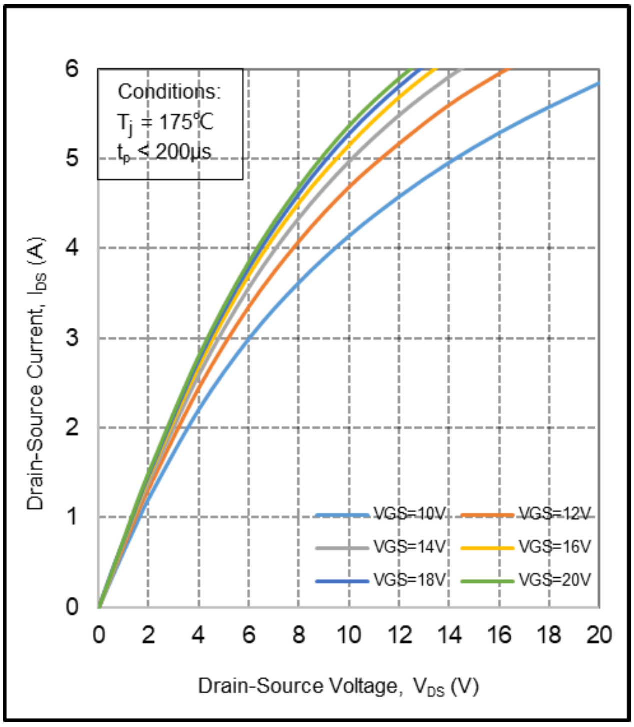


Figure 3. Output characteristics at T_j = 175℃

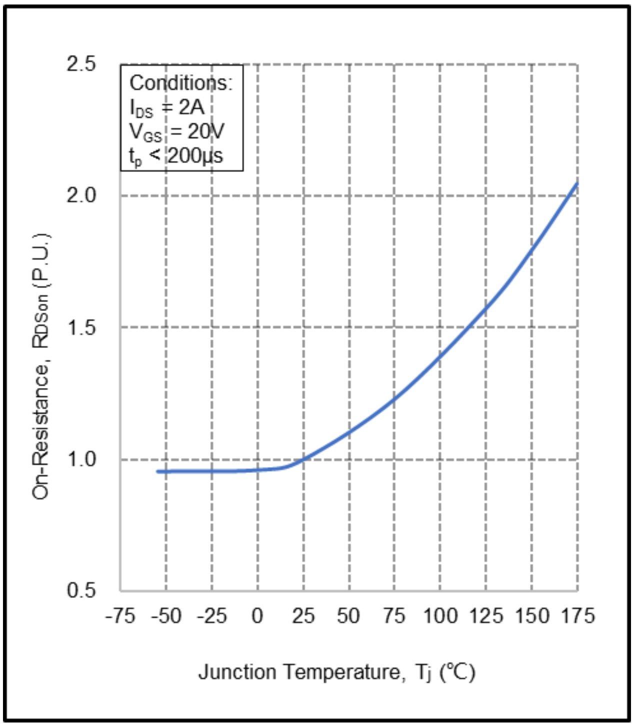


Figure 4. Normalized on-resistance vs. temperature

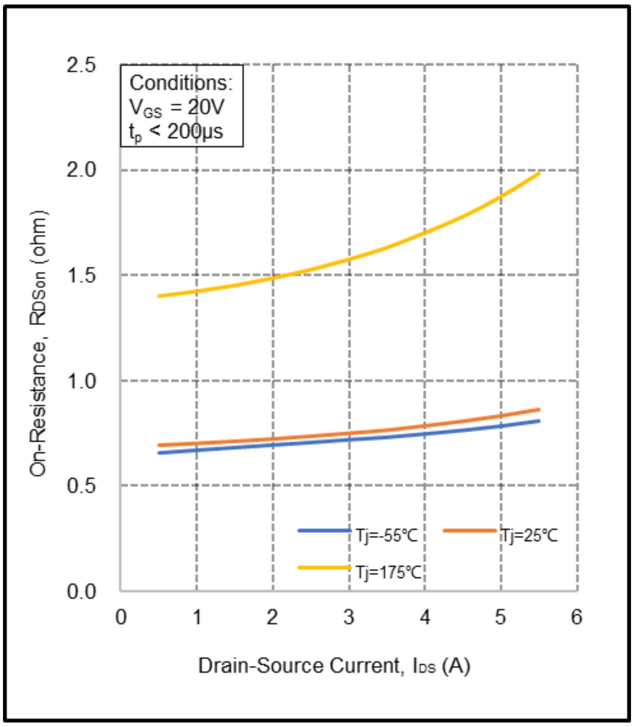


Figure 5. On-resistance vs. drain current for various temperatures

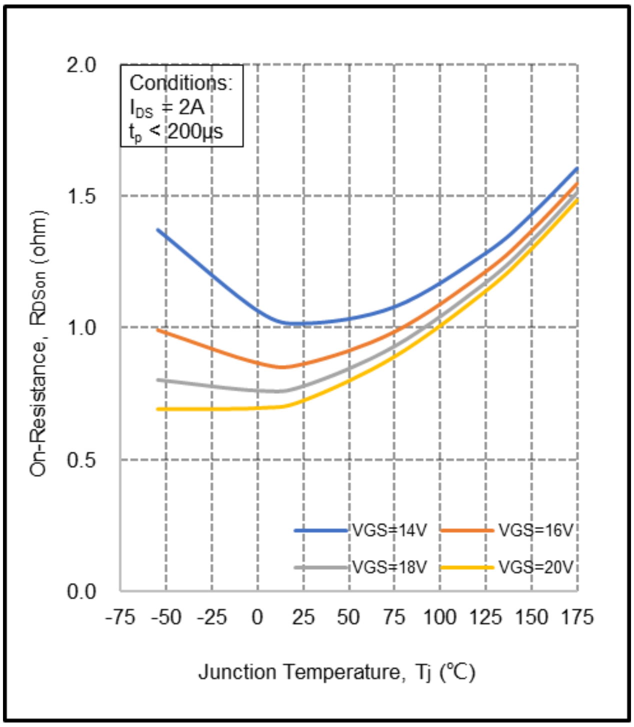


Figure 6. On-resistance vs. temperature for various gate voltages

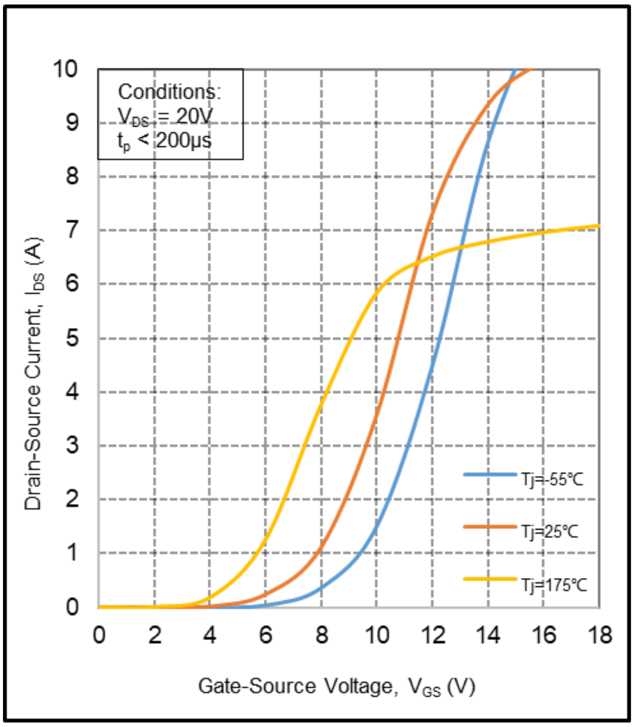


Figure 7. Transfer characteristic for various junction temperatures

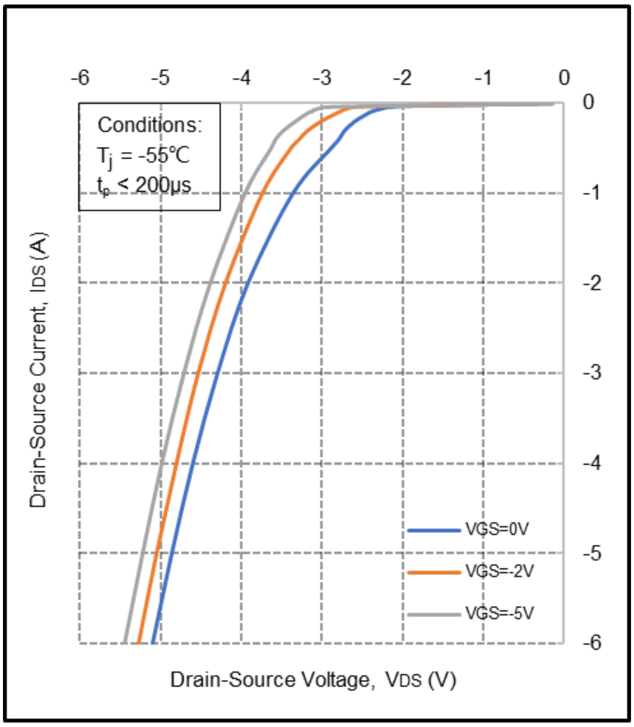


Figure 8. Body diode characteristic at T_j = -55℃

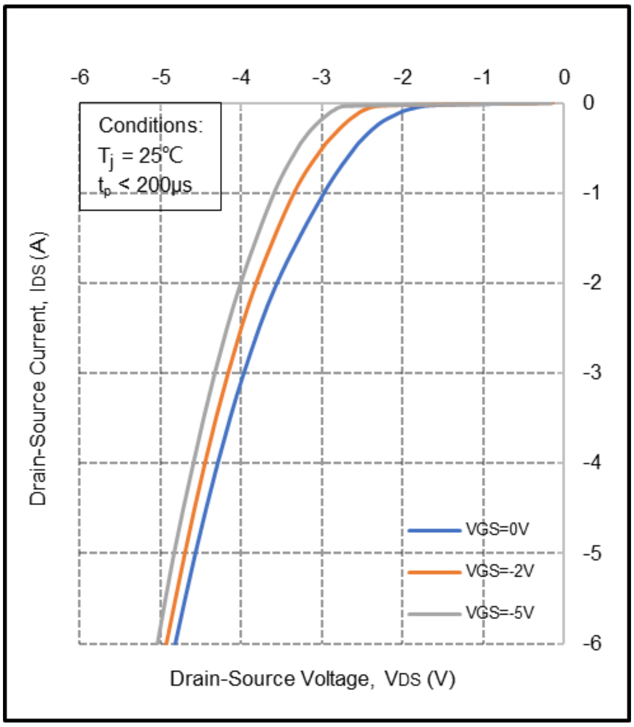


Figure 9. Body diode characteristic at T_j = 25℃

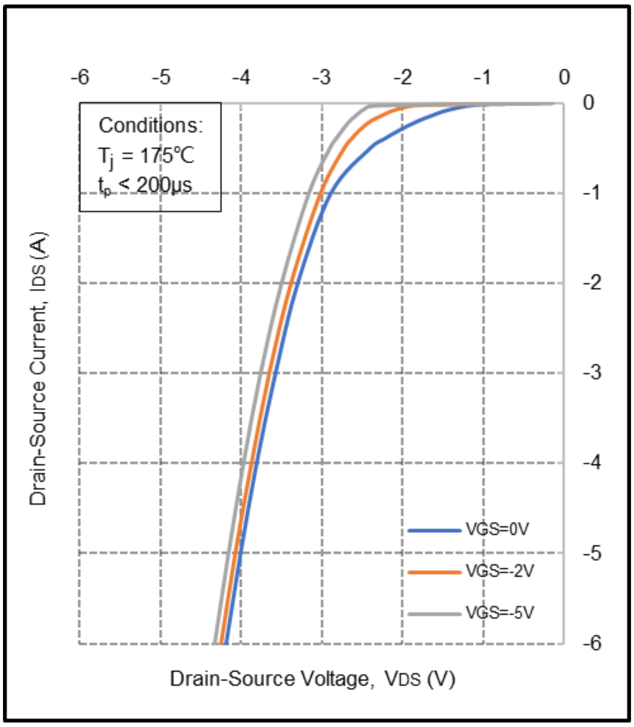


Figure 10. Body diode characteristic at T_j = 175℃

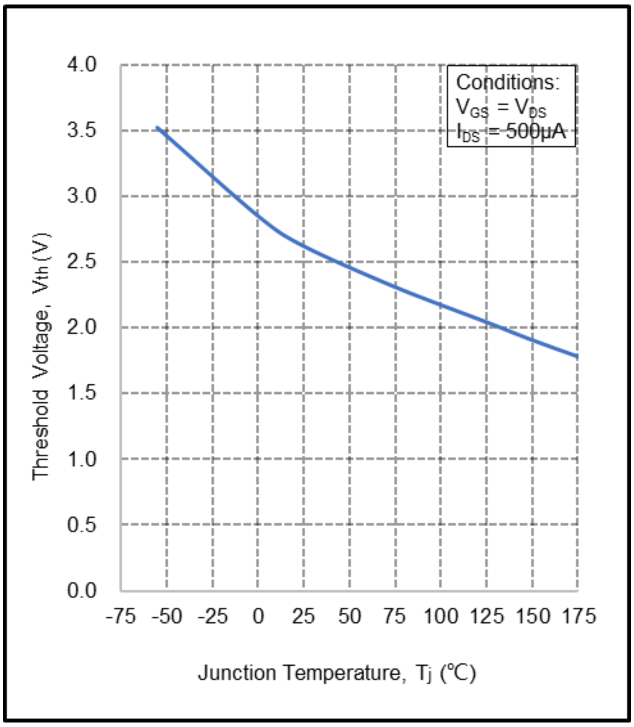


Figure 11. Threshold voltage vs. temperature

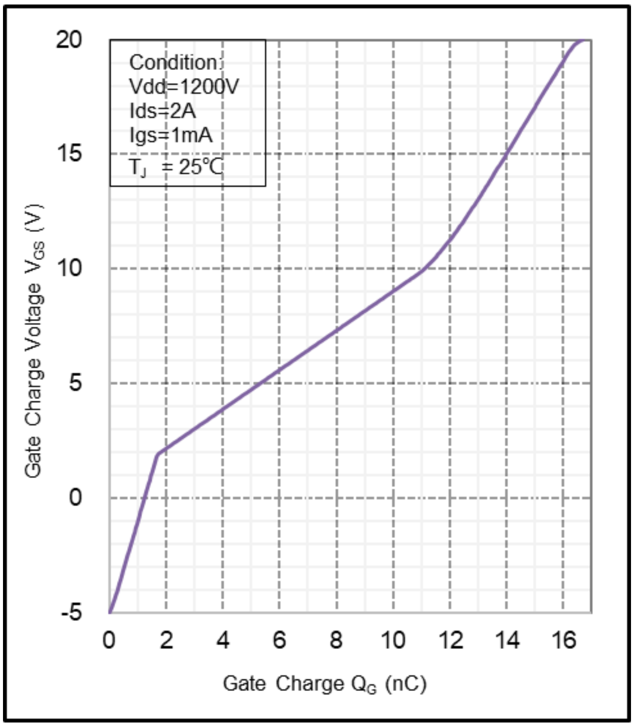


Figure 12. Gate Charge Characteristic

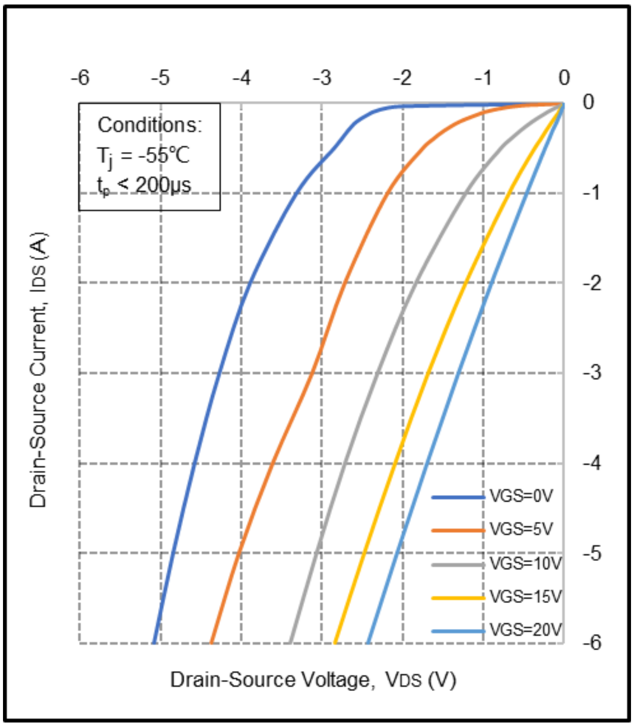


Figure 13. 3rd quadrant characteristic
at T_j = -55℃

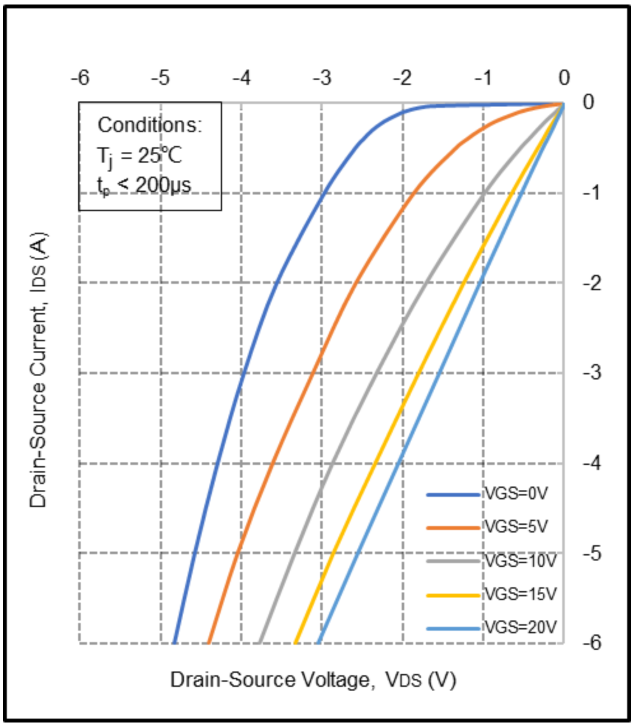


Figure 14. 3rd quadrant characteristic
at T_j = 25℃

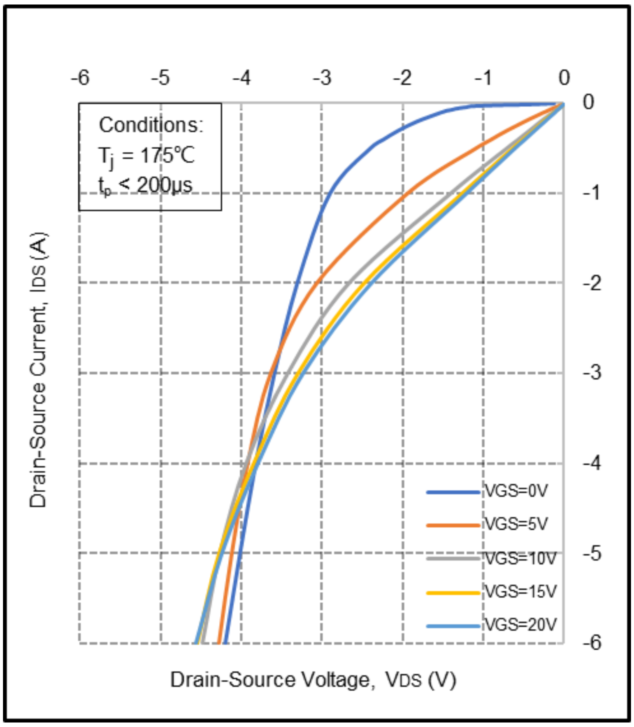


Figure 15. 3rd quadrant characteristic
at T_j = 175℃

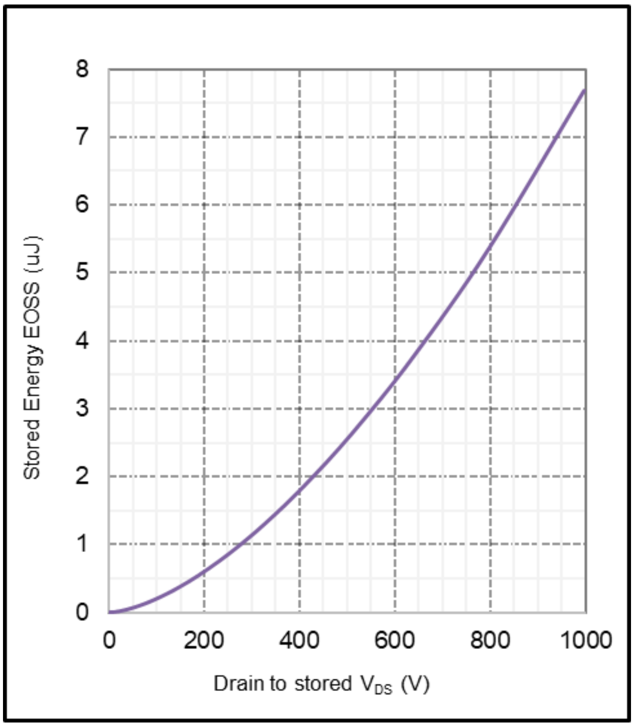


Figure 16. Output capacitor stored energy

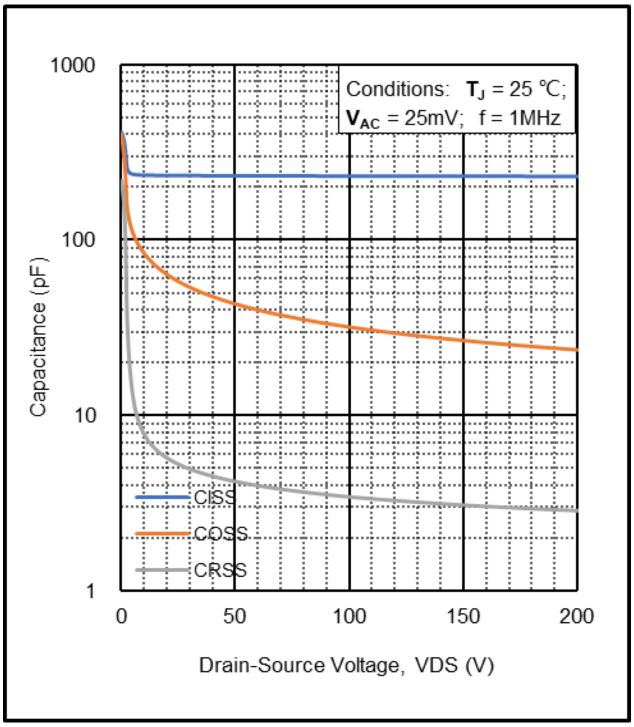


Figure 17. Capacitance vs. drain-source voltage (0 - 200V)

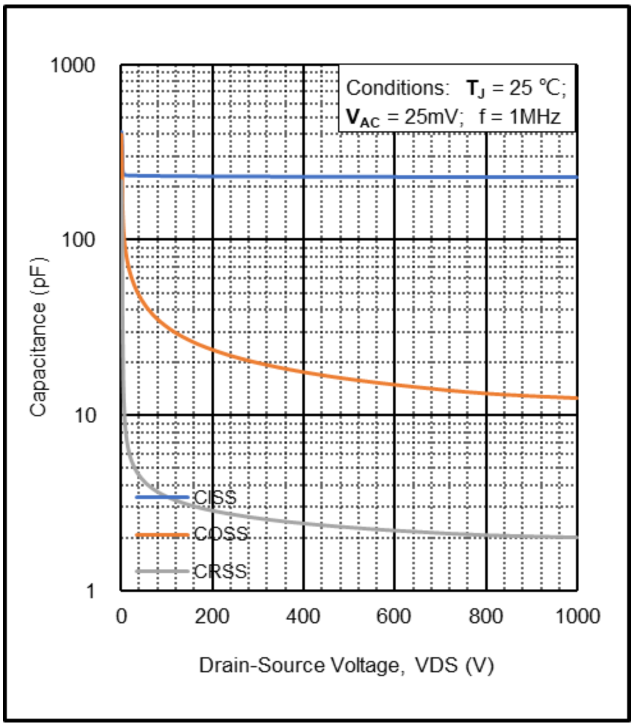


Figure 18. Capacitance vs. drain-source voltage (0 - 1000V)

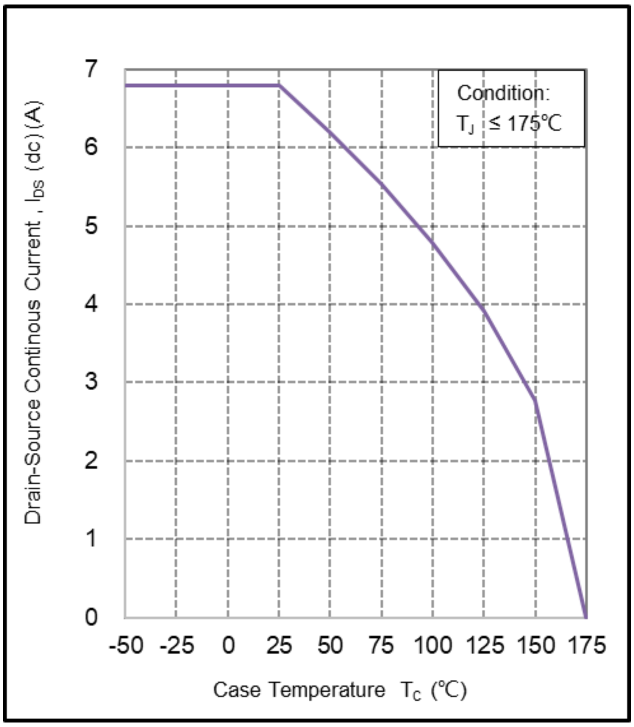


Figure 19. Continuous drain current derating vs. temperature

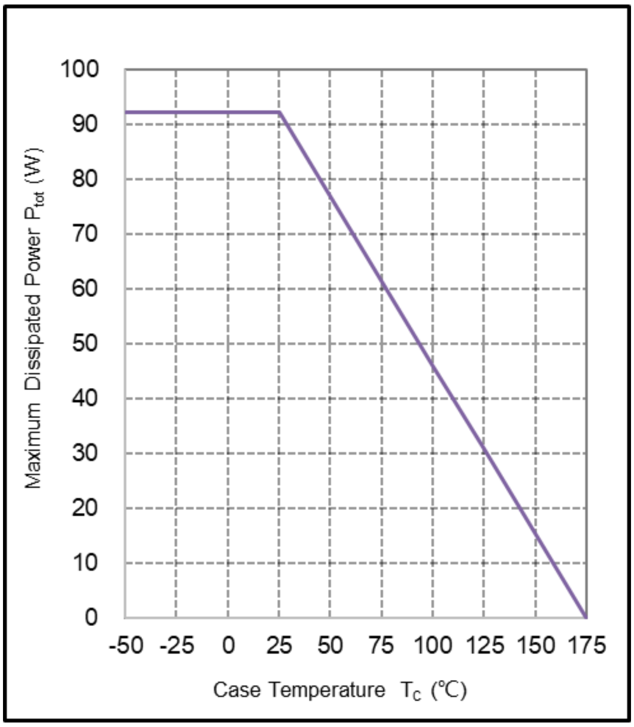
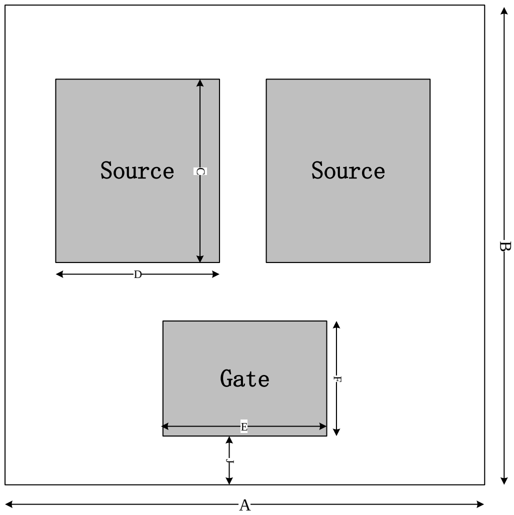


Figure 20. Maximum power dissipation derating vs. temperature

Chip Dimensions



Symbol	Dimensions	
	mm	inch
A	1.61	0.063
B	1.61	0.063
C	0.55	0.022
D	0.45	0.018
E	0.46	0.018
F	0.33	0.013
J	0.29	0.011

Mechanical Parameters

Parameter	Typical Value	Unit
Die Dimensions(L*W)	1.61*1.61	mm
Exposed Source Pad Metal Dimensions(L*W) Each	0.45*0.55	mm
Gate Pad Dimensions(L*W)	0.46*0.33	mm
Die Thickness	150	μm
Top Side Source Metallization(Ti:Al)	0.1/4	μm
Top Side Gate Metallization(Ti:Al)	0.1/4	μm
Bottom Drain metallization(Ti:Ni:Ag)	0.3/0.4/1.2	μm

Ordering Information

Part number	SMS1701000B
Package	Bare Die
Package Method	Wafer
RoHS	Yes

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