Powerex, Inc., 173 Pavilion Lane, Youngwood, Pennsylvania 15697 (724) 925-7272
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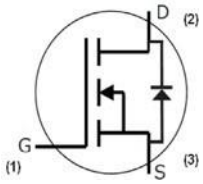
1700V 1000mΩ Silicon Carbide Power MOSFET

PMS1000170K

Circuit diagram



Package Type: TO-247-3L

HF

RoHS

Description

The Powerex 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.

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

Applications

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

Benefits

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

Product Specifications

Device	V_{DS}	I_D (25℃)	$R_{(DS)on}$	Marking
PMS1000170K	1700V	6.8A	1000mΩ	PMS1000170K

PMS1000170K
1700V 1000mΩ Silicon Carbide Power MOSFET

Contents

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Maximum Ratings (T_c = 25°C, 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	V_{GSmax}	-10/+25		$t_p \leq$ 0.5us, D < 0.001, T_C = 25℃
Gate-source voltage	V_{GSop}	-5/+20		Recommended operation values, T_C = 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 temperature	T_j	-55~175	℃	
Storage temperature	T_{stg}	-55~175	℃	
Soldering temperature	T_L	260	℃	1.6mm from case for 10s
Mounting torque	M	1	Nm	M3 screw

Thermal Resistances

Parameter	Symbol	Values			Unit	Test condition
		Min.	Typ.	Max.		
Thermal resistance from junction to case	$R_{th(j-c)}$	/	1.25	/	℃/W	
Thermal resistance from junction to ambient	$R_{th(j-a)}$	/	/	40	℃/W	

Static Electrical Characteristics (T_j = 25°C, 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	2.6	4		V_{DS} = V_{GS}, I_D = 0.5mA
		/	1.8	/		V_{DS} = V_{GS}, I_D = 0.5mA, T_j = 175ºC
Drain-source leakage current	I_{DSS}	/	1	100	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	/		V_{GS} = 20V, I_D = 2A, T_j = 175ºC
Transconductance	g_{fs}	/	1.0	/	S	V_{DS} = 20V, I_D = 2A
		/	1.2	/		V_{DS} = 20V, I_D = 2A, T_j = 175ºC
Internal gate resistance	$R_{g(int)}$	/	6	/	Ω	f = 1MHz, V_{AC} = 25mV
Avalanche energy	E_{AS}	/	150	/	mJ	L = 5mH, V_{DD} = 50V

Dynamic Electrical Characteristics (T_j = 25°C, 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	/		
Reverse transfer capacitance	C_{rss}	/	2	/		
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, I_D = 2A,I_{GS} = 1mA
Gate to drain charge	Q_{gd}	/	9.2	/		
Total gate charge	Q_g	/	16.7	/		

Switching Characteristics (T_j = 25°C, 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	/		
Turn-on delay time	$t_{d(on)}$	/	17	/	ns	V_{DD} = 1200V, V_{GS} = -5/+20V, I_D = 2A, $R_{G(ext)}$ = 12Ω, L = 1364μH, T_j = 175°C
Rise time	t_r	/	16	/		
Turn-off delay time	$t_{d(off)}$	/	29	/		
Fall time	t_f	/	84	/		
Turn-on switching energy	E_{on}	/	88	/	μJ	
Turn-off switching energy	E_{off}	/	29	/		

Reverse SiC Diode Characteristics (T_j = 25°C, 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°C
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	

Note: When using SiC Body Diode the maximum recommended V_{GS} = -5V

Electrical Characteristic Diagrams

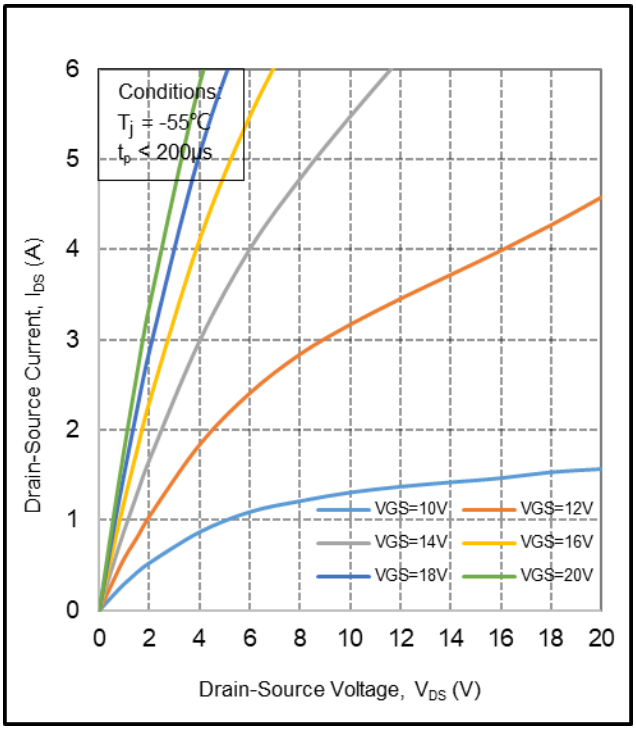

Figure 1. Output characteristics at T_j = -55℃

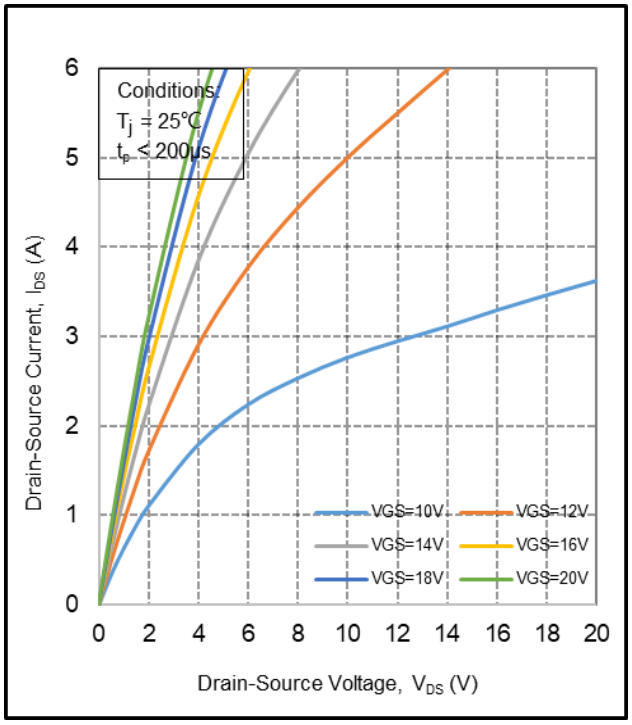

Figure 2. Output characteristics at T_j = 25℃

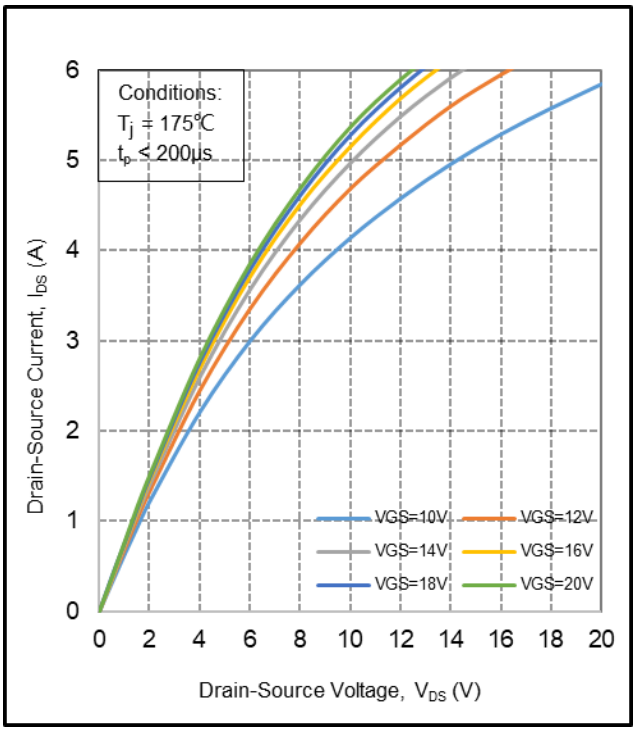

Figure 3. Output characteristics at T_j = 175℃

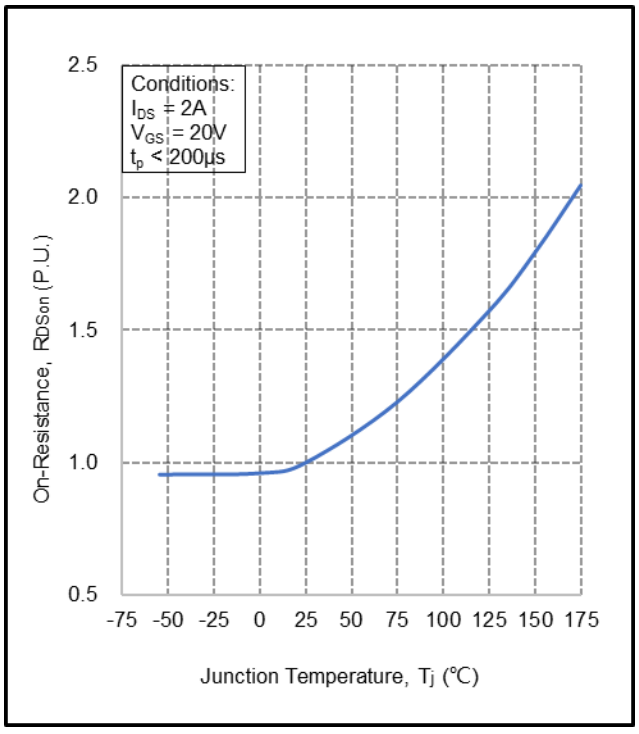

Figure 4. Normalized on-resistance vs. temperature

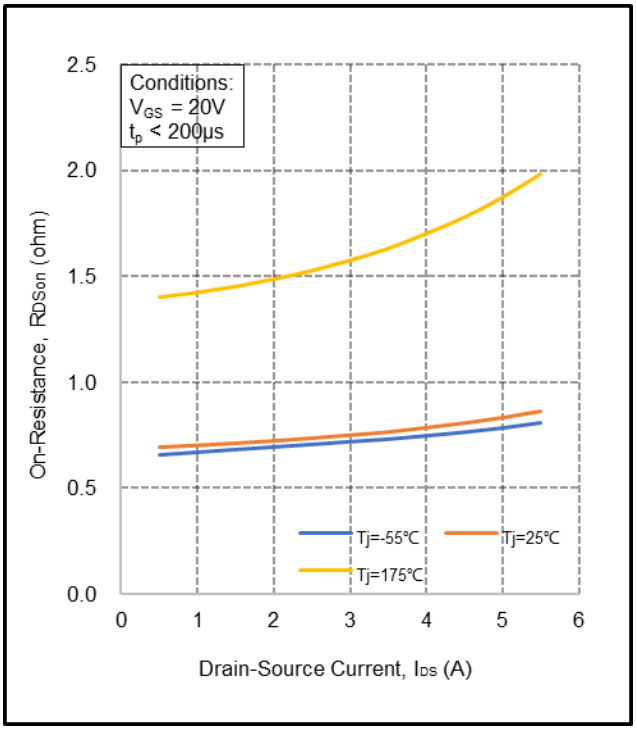

Figure 5. On-resistance vs. drain current for various temperatures

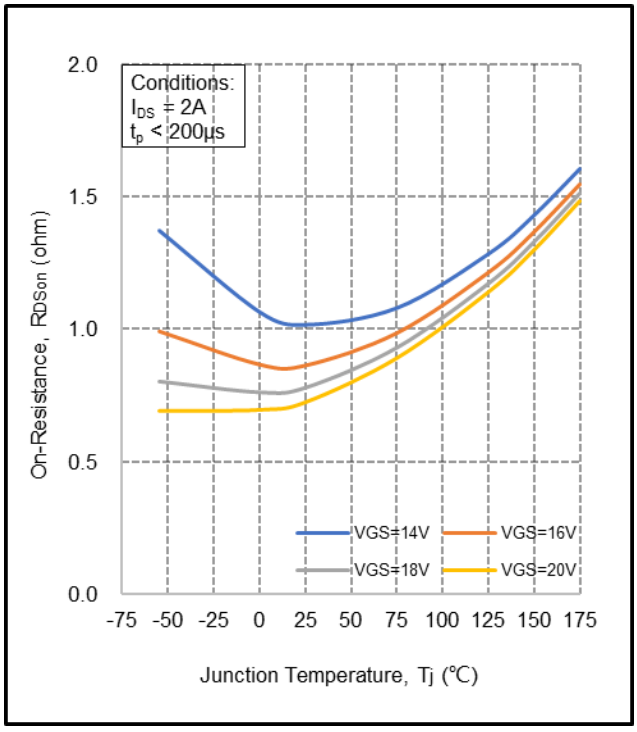

Figure 6. On-resistance vs. temperature for various gate voltages

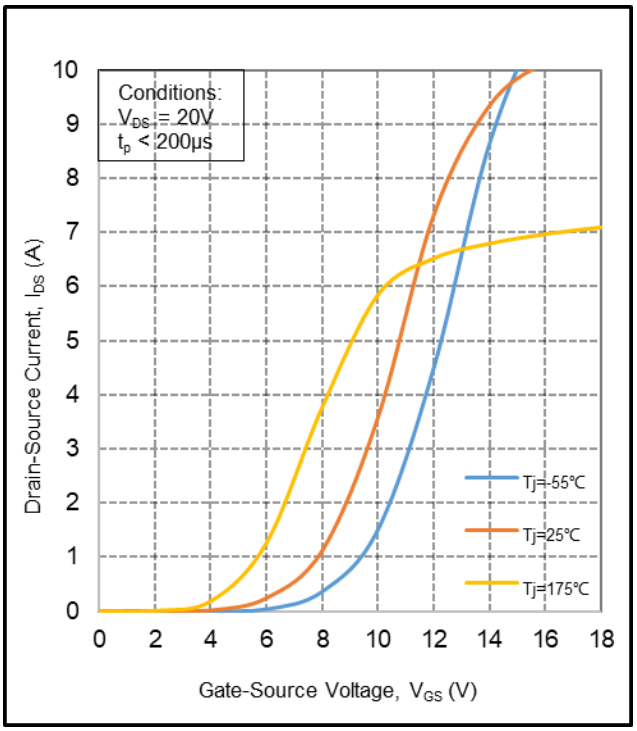

Figure 7. Transfer characteristic for various junction temperatures

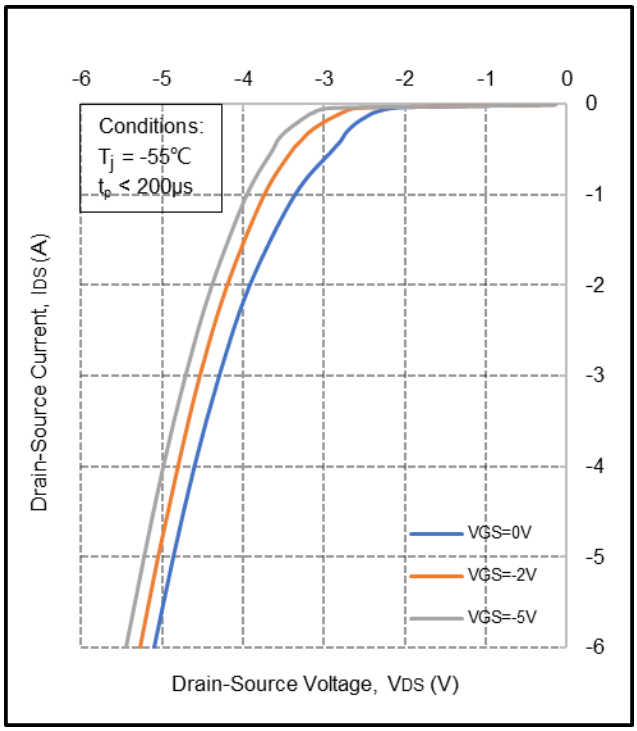

Figure 8. Body diode characteristic at T_j = -55°C

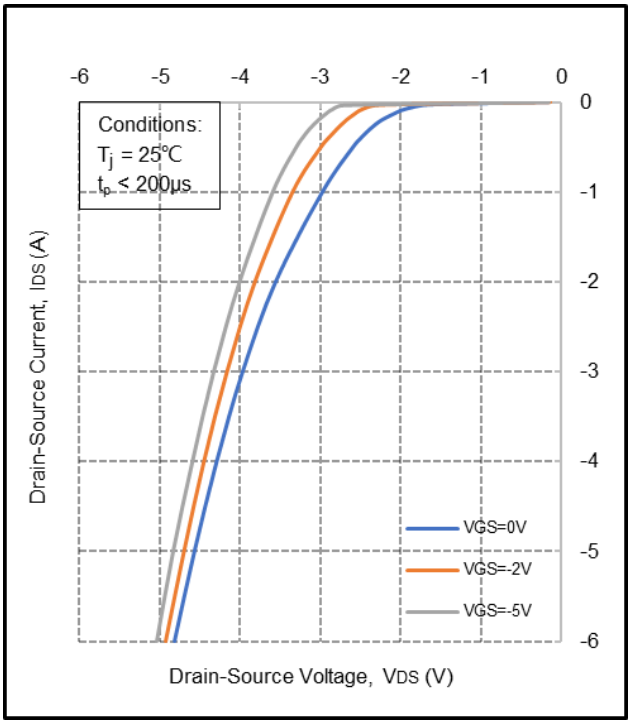

Figure 9. Body diode characteristic at T_j = 25℃

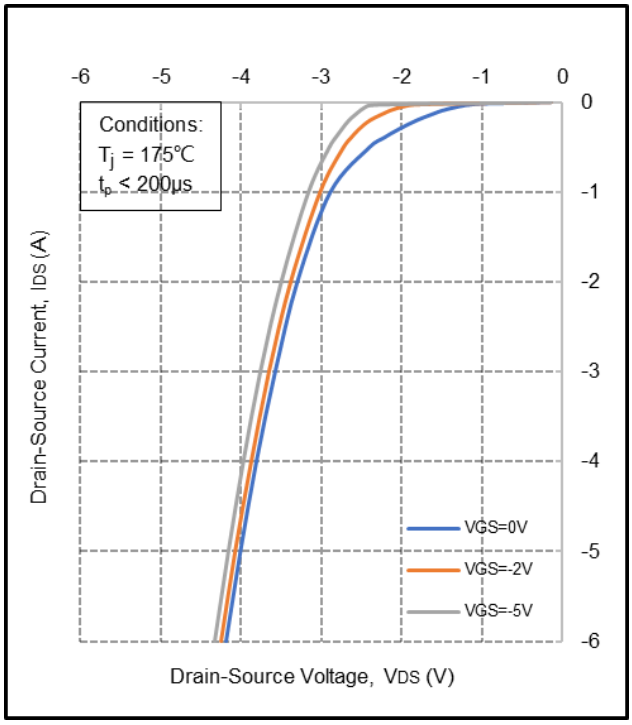

Figure 10. Body diode characteristic at T_j = 175℃

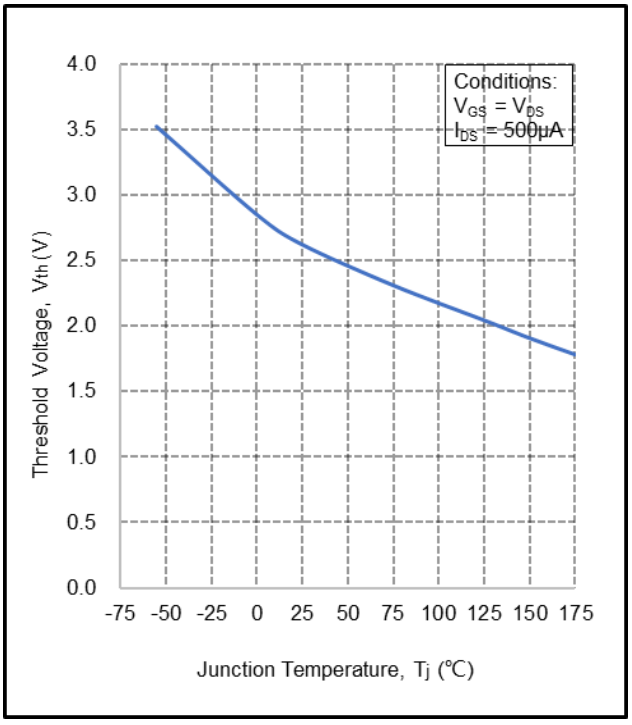

Figure 11. Threshold voltage vs. temperature

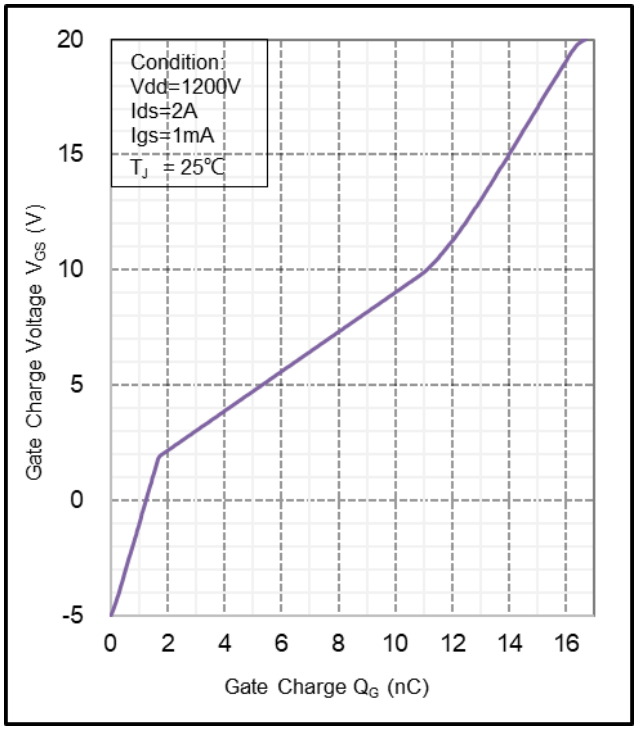

Figure 12. Gate Charge Characteristic

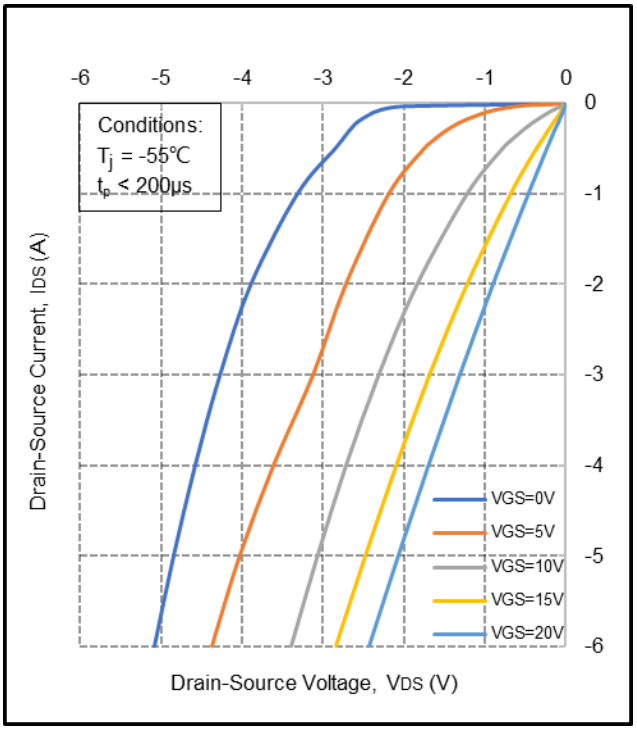

Figure 13. 3rd quadrant characteristic at T_j = -55℃

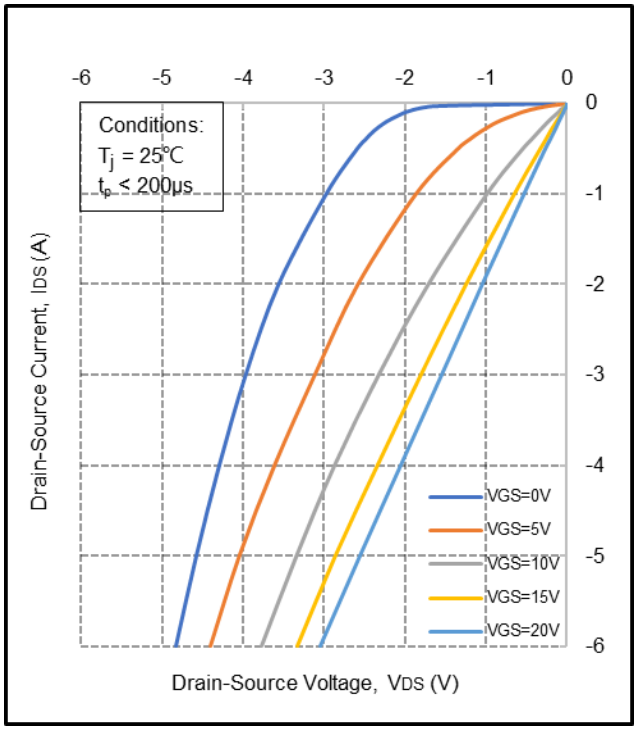

Figure 14. 3rd quadrant characteristic at T_j = 25℃

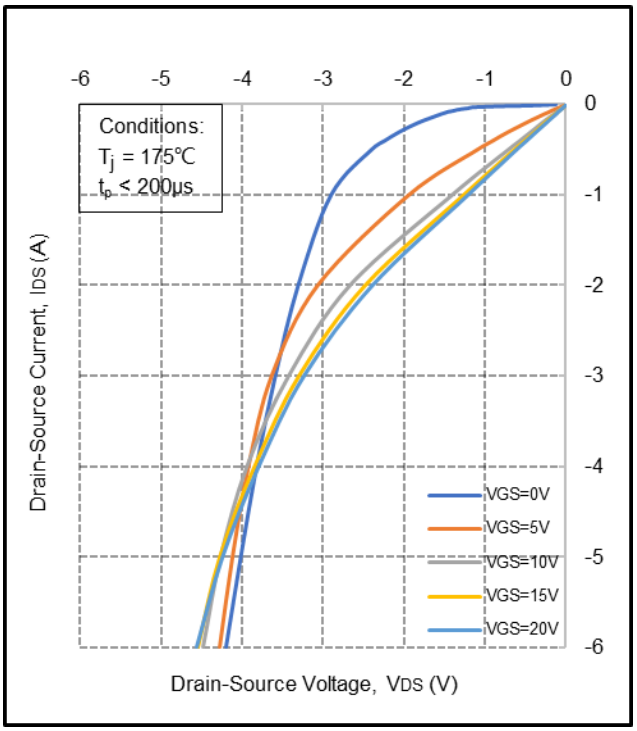

Figure 15. 3rd quadrant characteristic at T_j = 175℃

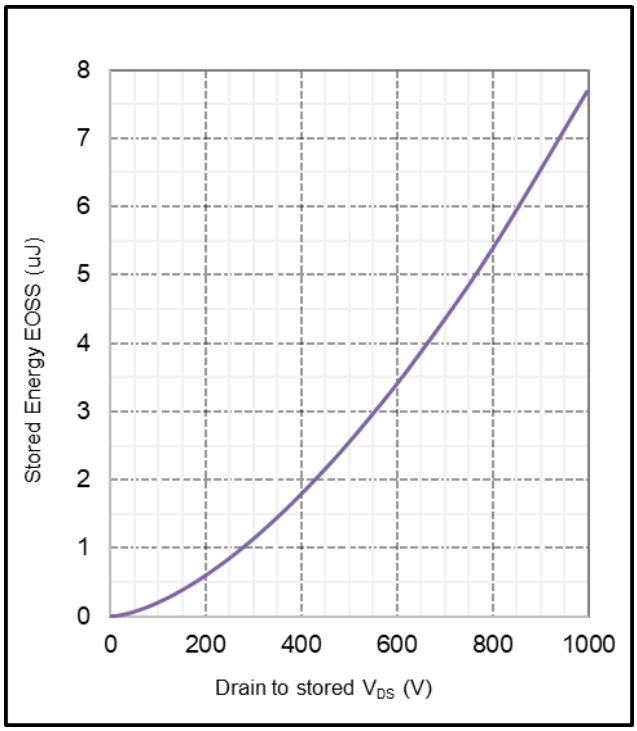

Figure 16. Output capacitor stored energy

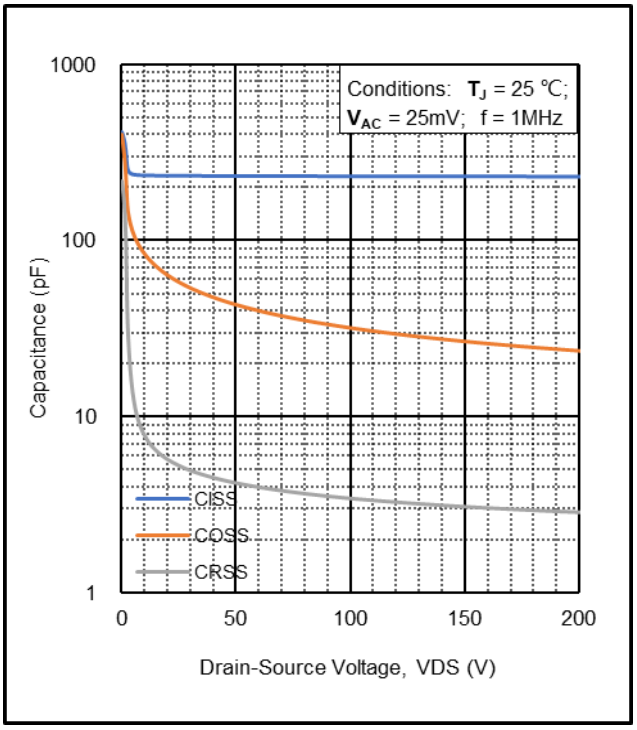

Figure 17. Capacitance vs. drain-source voltage (0 - 200V)

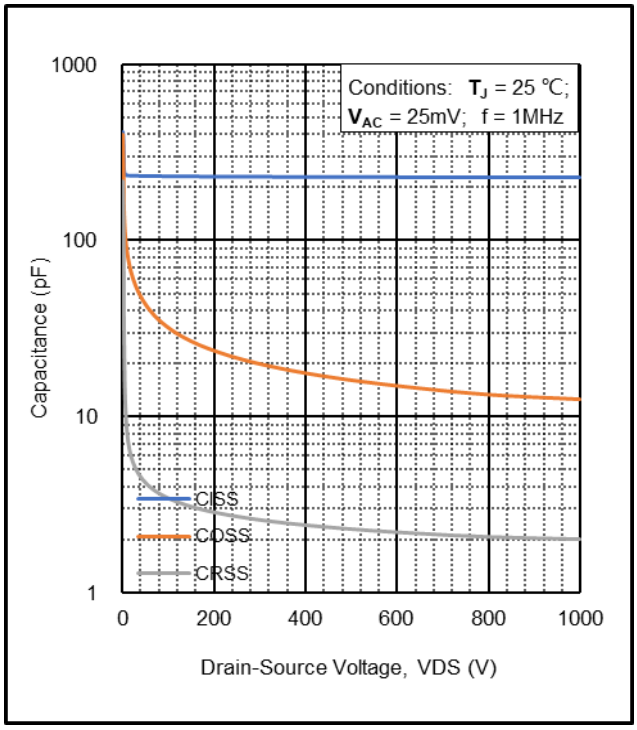

Figure 18. Capacitance vs. drain-source voltage (0 - 1000V)

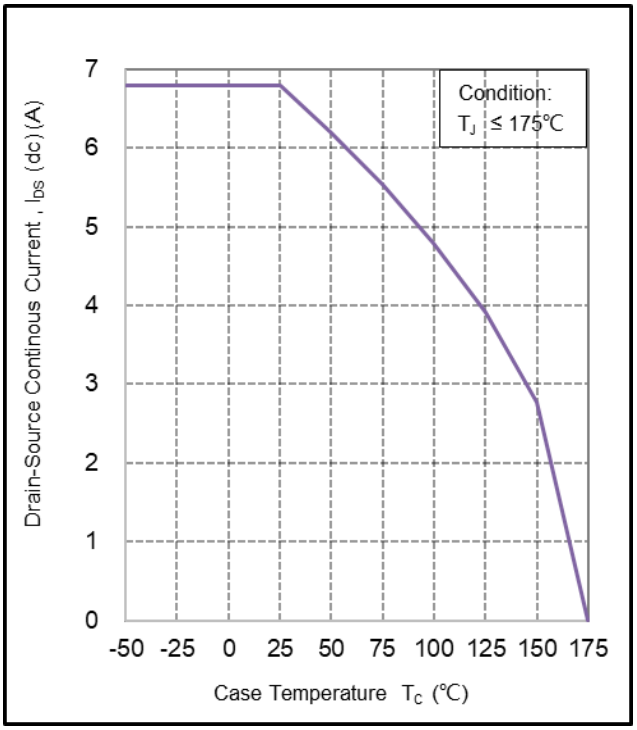

Figure 19. Continuous drain current derating vs. temperature

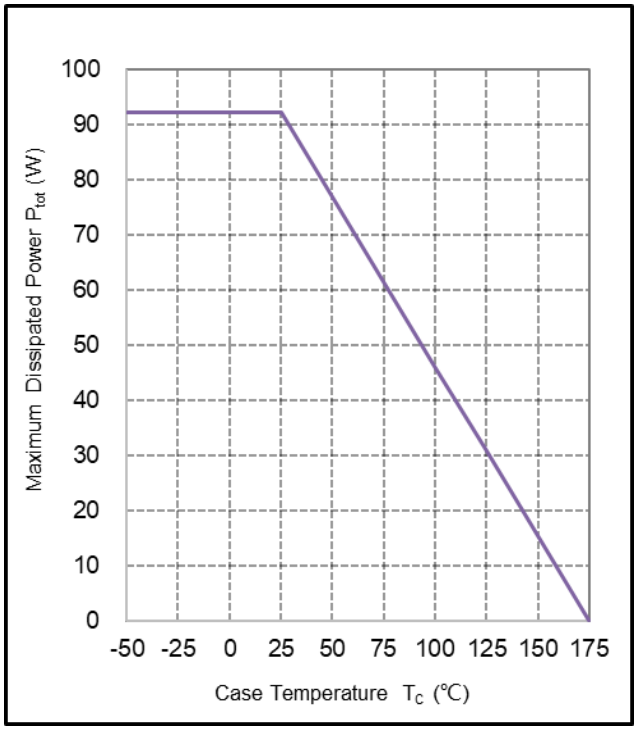

Figure 20. Maximum power dissipation derating vs. temperature

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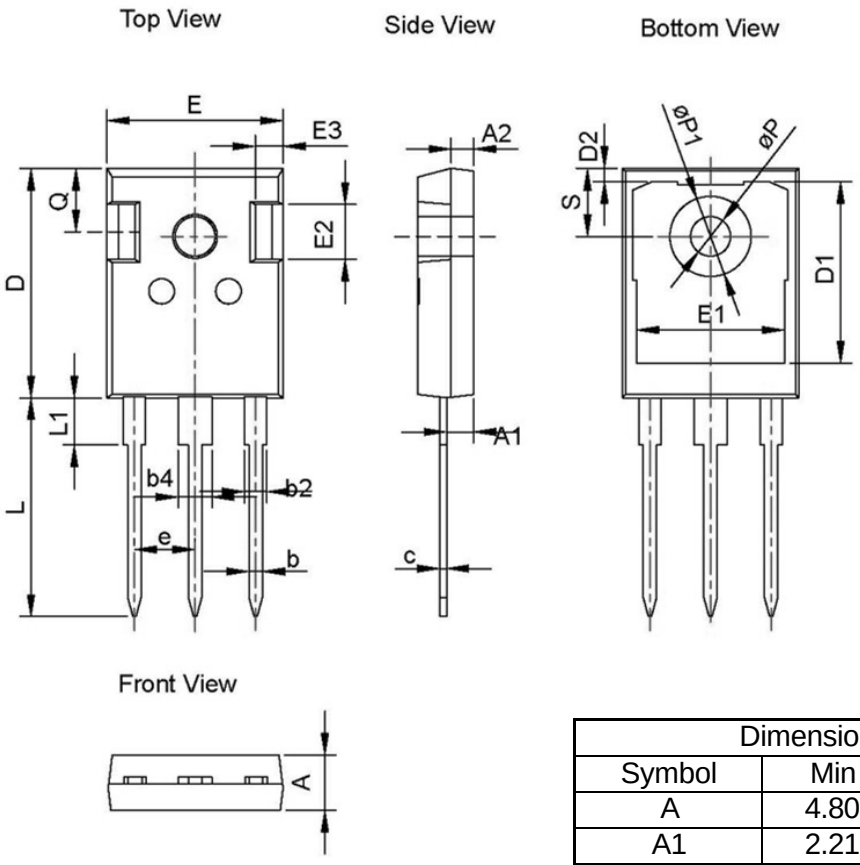
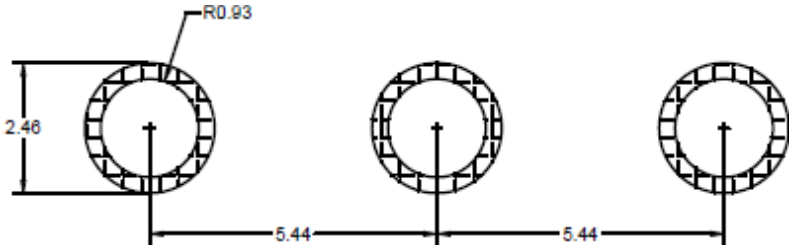
1700V 1000mΩ Silicon Carbide Power MOSFET

Package Information



Dimension unit: [mm]			
Symbol	Min	Nom	Max
A	4.80	5.00	5.20
A1	2.21	2.41	2.61
A2	1.85	2.00	2.15
b	1.11	1.21	1.36
b2	1.91	2.01	2.21
b4	2.91	3.01	3.21
c	0.51	0.60	0.75
D	20.70	21.00	21.30
D1	16.25	16.55	16.85
D2	1.00	1.20	1.35
E	15.50	15.80	16.10
E1	13.00	13.30	13.60
E2	4.80	5.00	5.20
E3	2.30	2.50	2.70
e		5.44 BSC	
L	19.62	19.92	20.22
L1	-	-	4.30
øP	3.40	3.60	3.80
øP1	-	-	7.30
Q	5.40	5.80	6.20
S		6.20 BSC	

Recommended Solder Pad Layout



TO-247-3L

Note: All dimensions are in mm