SOT-227 Power Module
Single Switch - Silicon Carbide Power MOSFET 200 A

SOT-227

FEATURES

- High blocking voltage with low on-resistance
- High speed switching with low capacitance
- Soft body diode with low reverse recovery
- Maximum 175 °C junction temperature
- UL approved file E78996
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

RoHS COMPLIANT

APPLICATIONS

- EV chargers
- Server and telecom PSU
- UPS
- Solar Inverters
- SMPS
- DC/DC converters

PRIMARY CHARACTERISTICS	
V_{DSS}	1200 V
$R_{DS(on)}$ at 200 A	12.1 mΩ
I_D	127 A at 90 °C
Type	SiC MOSFET Modules
Package	SOT-227

DESCRIPTION

This is an high performance silicon carbide MOSFET. The high blocking voltage with low on-resistance, high speed switching with low capacitance make this MOSFET ideal for high frequency switching application including solar inverters and EV chargers.

ABSOLUTE MAXIMUM RATINGS				
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**MAX.**	**UNITS**
MOSFET				
Drain to source voltage	V_{DSS}		1200	V
Continuous drain current, V_{GS} at 15 V	I_D	T_C = 25 °C	163	A
		T_C = 90 °C	127	
Pulsed drain current	I_{DM} (1)		380	
Power dissipation	P_D	T_C = 25 °C	750	W
Gate to source voltage	V_{GS}		-8 / +19	V
MODULE				
Operating junction temperature range	T_J		-55 to +175	°C
Operating storage temperature range	T_{Stg}		-40 to +150	
Insulation voltage (RMS)	V_{ISOL}	any terminal to case, t = 1 min	2500	V

Note

(1) Limited at max. junction temperature

RECOMMENDED OPERATING CONDITIONS			
PARAMETER	**SYMBOL**	**RATING**	**UNITS**
Recommended operating gate - source voltage	$V_{GS(op)}$	-4 / +15	V

THERMAL AND MECHANICAL SPECIFICATIONS							
PARAMETER		SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Operating junction temperature range		T_J		-55	-	175	°C
Operating storage temperature range		T_{Stg}		-40	-	150	
Junction to case	MOSFET	R_{thJC}		-	-	0.2	°C/W
Case to heatsink	Module	R_{thCS}	Flat, greased surface	-	0.1	-	
Weight				-	30	-	g
Mounting torque			Torque to terminal	-	-	1.1 (9.7)	Nm (lbf. in)
			Torque to heatsink	-	-	1.8 (15.9)	Nm (lbf. in)
Case style				SOT-227			

ELECTRICAL CHARACTERISTICS (T_J = 25 °C unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Drain to source breakdown voltage	$V_{(BR)DSS}$	V_{GS} = 0 V, I_D = 400 µA	1200	-	-	V
Breakdown voltage temperature coefficient	$\Delta V_{(BR)DSS}/\Delta T_J$	I_D = 400 µA (25 °C to 125 °C)	-	0.45	-	mV/°C
Static drain to source on-resistance	$R_{DS(on)}$	V_{GS} = 15 V, I_D = 200 A	-	12.1	17.25	mΩ
		V_{GS} = 15 V, I_D = 200 A, T_J = 175 °C	-	2.2	-	
Gate threshold voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 28.44 mA	1.7	2.6	3.7	V
		V_{DS} = V_{GS}, I_D = 28.44 mA, T_J = 150 °C	-	2.5	-	
Temperature coefficient of threshold voltage	$\Delta V_{GS(th)}/\Delta T_J$	V_{DS} = V_{GS}, I_D = 28.44 mA (25 °C to 125 °C)	-	-2.6	-	mV/°C
Forward transconductance	g_{fs}	V_{DS} = 20 V, I_D = 200 A	-	111	-	S
Drain to source leakage current	I_{DSS}	V_{DS} = 1200 V, V_{GS} = 0 V	-	0.4	200	µA
		V_{DS} = 1200 V, V_{GS} = 0 V, T_J = 150 °C	-	1.8	-	
Gate to source leakage	I_{GSS}	V_{GS} = 15 V	-	-	250	nA
Total gate charge	Q_g	I_D = 100 A, V_{DS} = 800 V, V_{GS} = -4 V / +15 V	-	331	-	nC
Gate to source charge	Q_{gs}		-	70	-	
Gate to drain ("Miller") charge	Q_{gd}		-	107	-	
Turn-on switching energy	E_{on}	V_{DD} = 800 V, I_D = 200 A, R_g = 2.2 Ω, V_{GS} = -4 V / +15 V	-	3.291	-	mJ
Turn-off switching energy	E_{off}		-	3.205	-	
Turn-on delay time	$t_{d(on)}$		-	28.32	-	ns
Rise time	t_r		-	49.6	-	
Turn-off delay time	$t_{d(off)}$		-	52.48	-	
Fall time	t_f		-	14.08	-	
Turn-on switching energy	E_{on}	V_{DD} = 800 V, I_D = 200 A, R_g = 2.2 Ω, V_{GS} = -4 V / +15 V, T_J = 125 °C	-	2.096	-	mJ
Turn-off switching energy	E_{off}		-	3.24	-	
Turn-on delay time	$t_{d(on)}$		-	27.68	-	ns
Rise time	t_r		-	36.32	-	
Turn-off delay time	$t_{d(off)}$		-	58.24	-	
Fall time	t_f		-	14.08	-	
Input capacitance	C_{iss}	V_{GS} = 0 V, V_{DS} = 1000 V, f = 100 kHz	-	9123	-	pF
Output capacitance	C_{oss}		-	143	-	
Reverse transfer capacitance	C_{rss}		-	33	-	

SOURCE-DRAIN RATINGS AND CHARACTERISTICS (T_J = 25 °C unless otherwise specified)						
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**MIN.**	**TYP.**	**MAX.**	**UNITS**
Pulsed source current (body diode)	I_{SM}	10 ms sine or 6 ms rectangular pulse, T_J = 175 °C	-	-	441	A
Diode forward voltage	V_{SD}	I_S = 200 A, V_{GS} = 0 V	-	5.71	6.0	V
Reverse recovery time	t_{rr}	T_J = 25 °C, I_F = I_S = 200 A, dI/dt = 12 240 A/µs, V_R = 800 V	-	17.28	-	ns
Reverse recovery charge	Q_{rr}		-	388	-	nC
Reverse recovery current	I_{RRM}		-	81	-	A

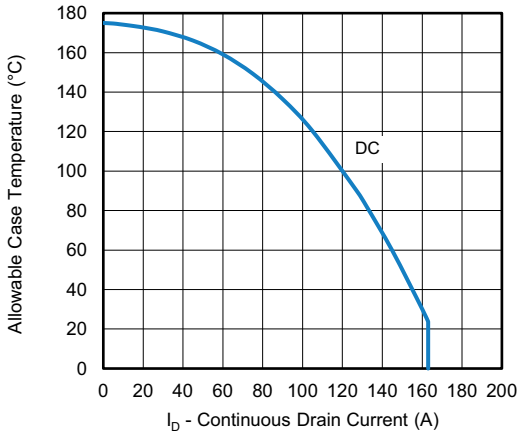


Fig. 1 - Max. Continuous Drain Current vs. Case Temperature

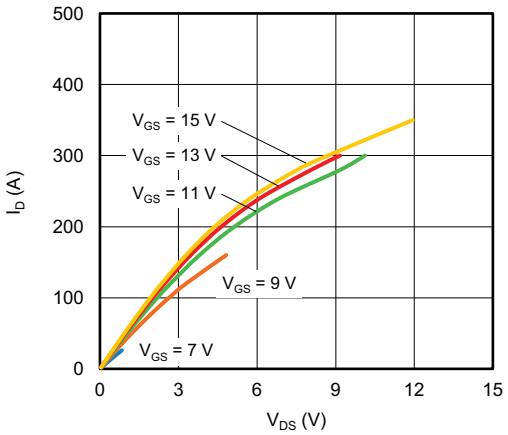


Fig. 3 - Typical Drain to Source Current Output Characteristics at T_J = 150 °C

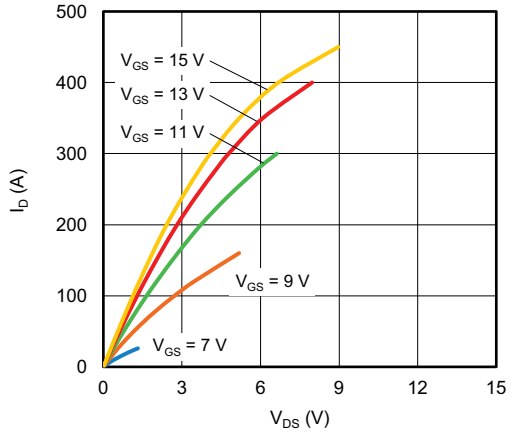


Fig. 2 - Typical Drain to Source Current Output Characteristics at T_J = 25 °C

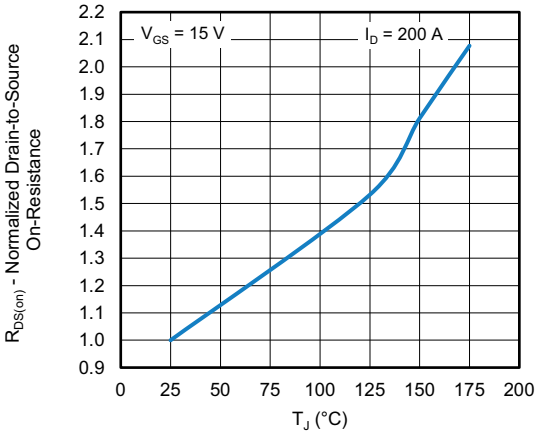


Fig. 4 - Normalized Drain-to-Source On-Resistance vs. Temperature

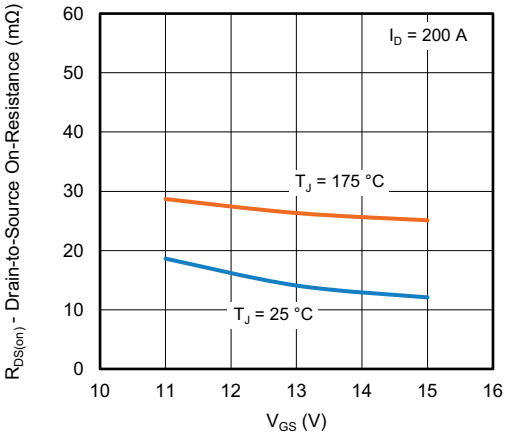


Fig. 5 - Typical Drain-to-Source On-Resistance vs. Gate to Source Voltage

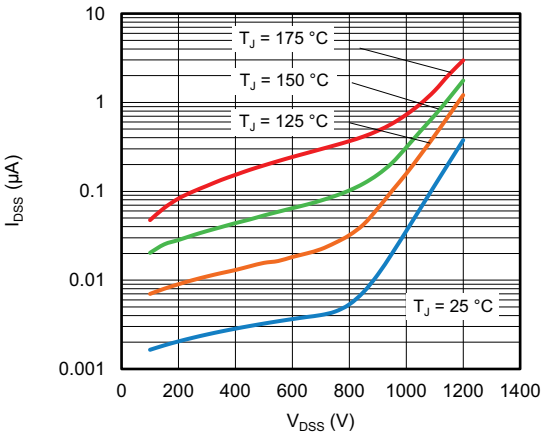


Fig. 8 - Typical Zero Gate Voltage Drain Current

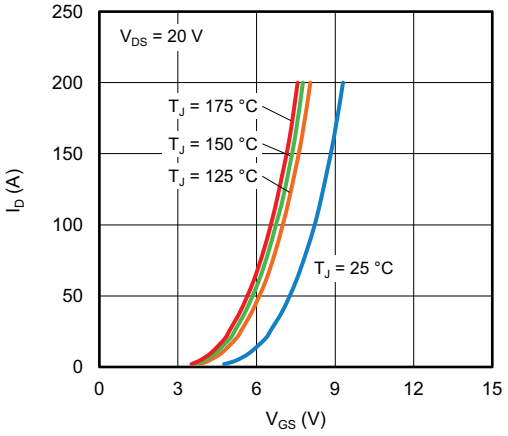


Fig. 6 - Typical Transfer Characteristics

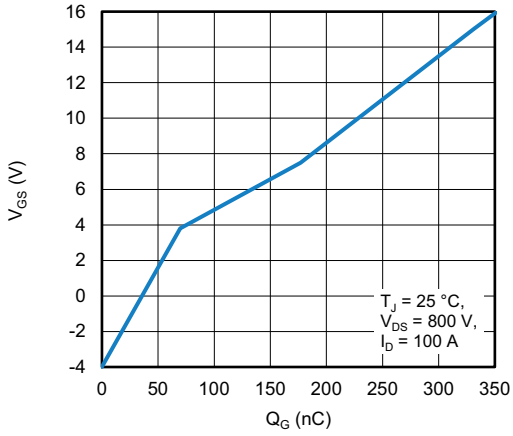


Fig. 9 - Typical Gate Charge vs. Gate to Source Voltage

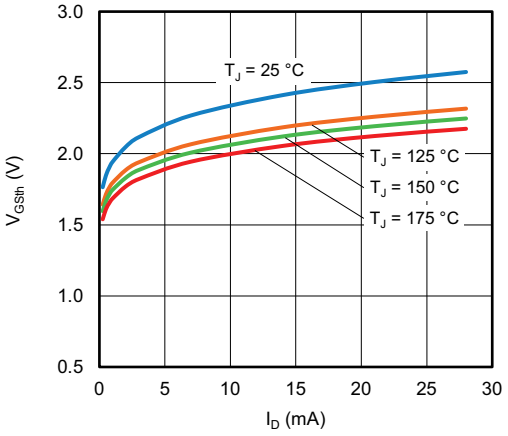


Fig. 7 - Typical Gate Threshold Voltage Characteristics

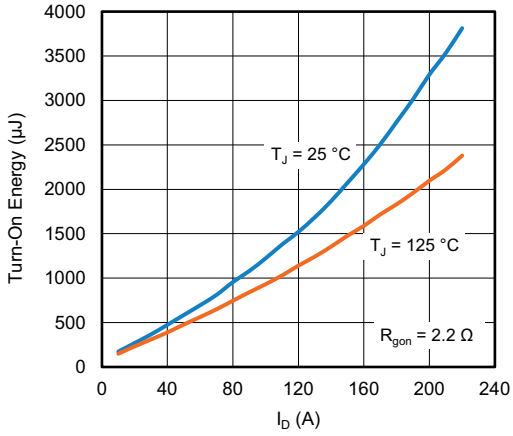


Fig. 10 - Typical Turn-On Energy Loss vs. I_D

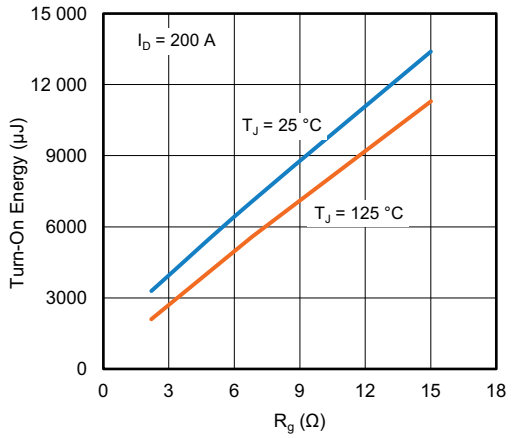


Fig. 11 - Typical Turn-On Energy Loss vs. R_g

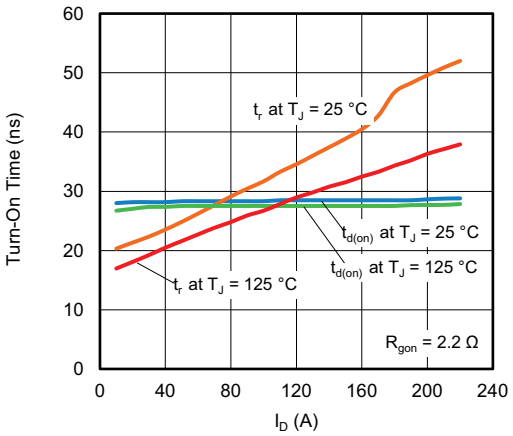


Fig. 14 - Typical Turn-On Switching Time vs. I_D

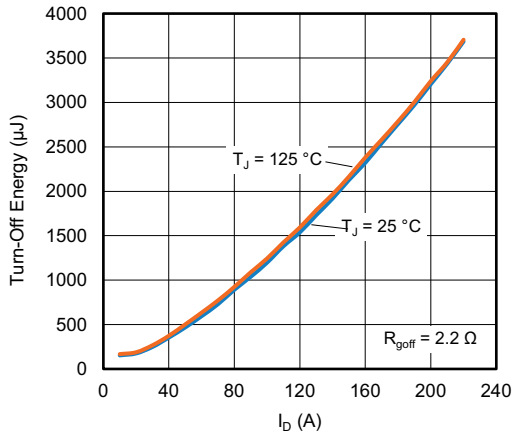


Fig. 12 - Typical Turn-Off Energy Loss vs. I_D

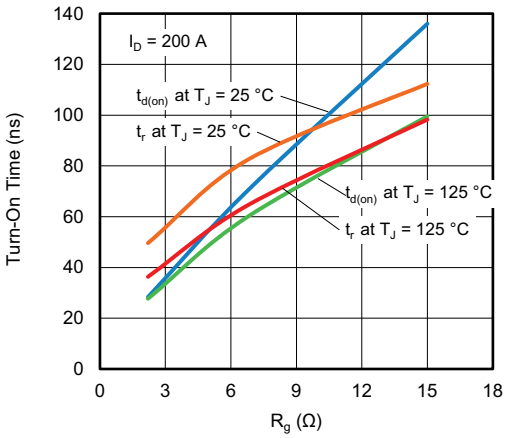


Fig. 15 - Typical Turn-On Switching Time vs. R_g

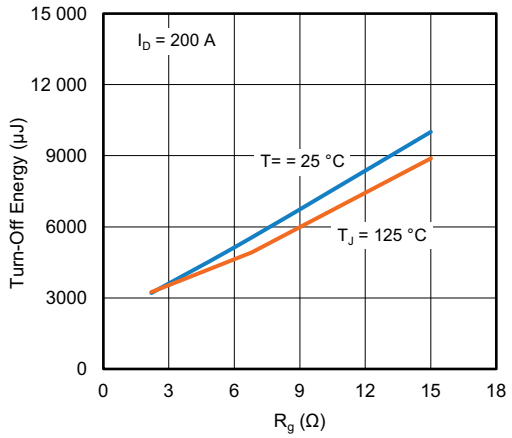


Fig. 13 - Typical Turn-Off Energy Loss vs. R_g

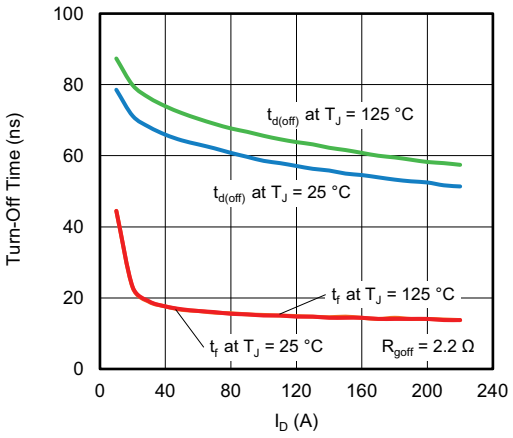


Fig. 16 - Typical Turn-Off Switching Time vs. I_D

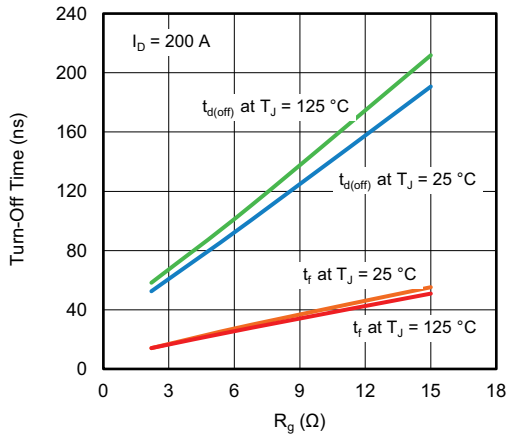


Fig. 17 - Typical Turn-Off Switching Time vs. R_g

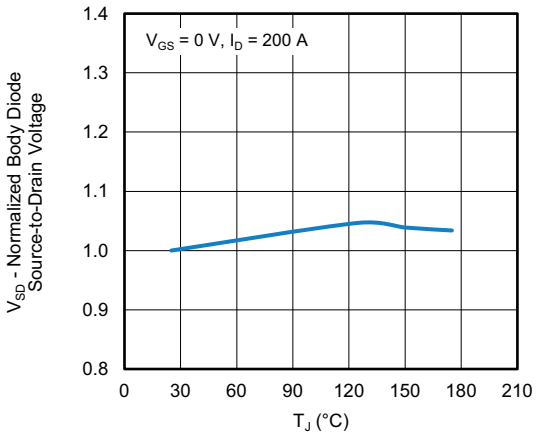


Fig. 20 - Normalized Body Diode Source-to-Drain vs. Temperature

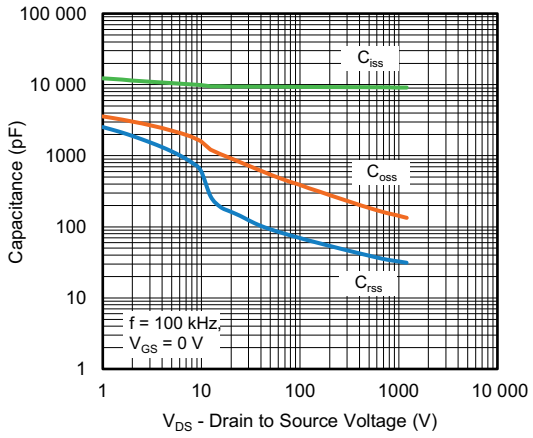


Fig. 18 - Capacitance vs. Drain-to-Source Voltage

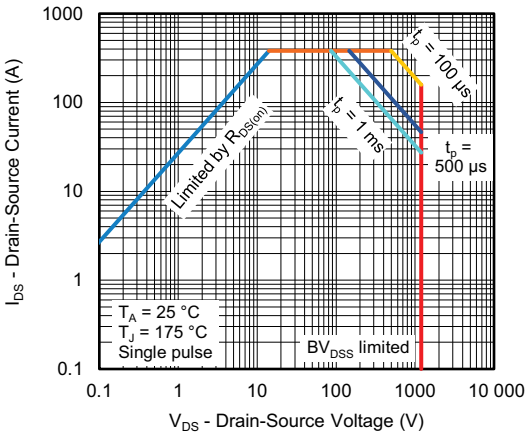


Fig. 21 - Safe Operating Area

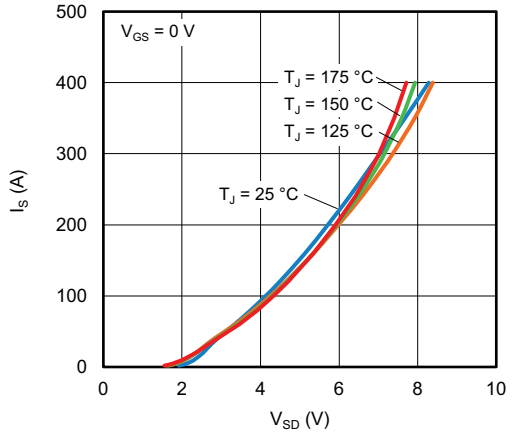


Fig. 19 - Typical Body Diode Source-to-Drain Current Characteristics

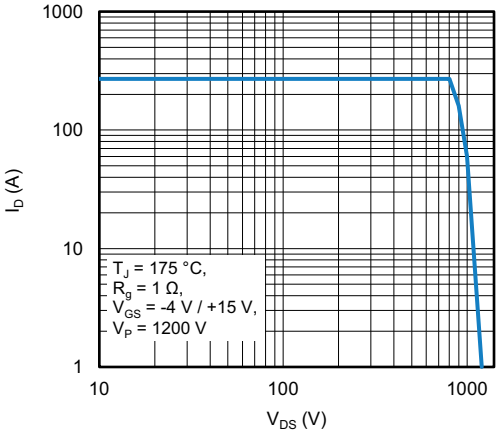


Fig. 22 - Reverse BIAS Safe Operating Area

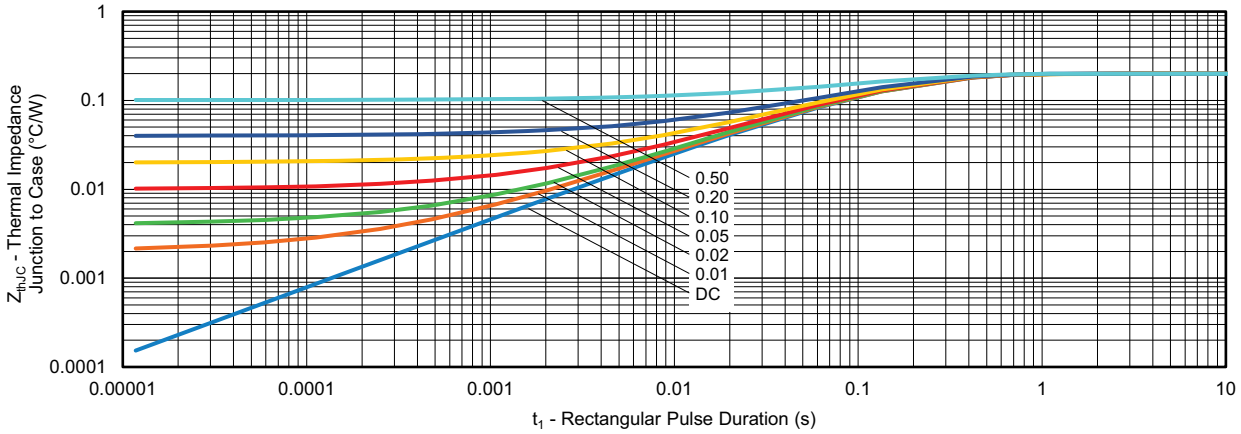


Fig. 23 - Maximum Thermal Impedance Z_{thJC} Characteristics

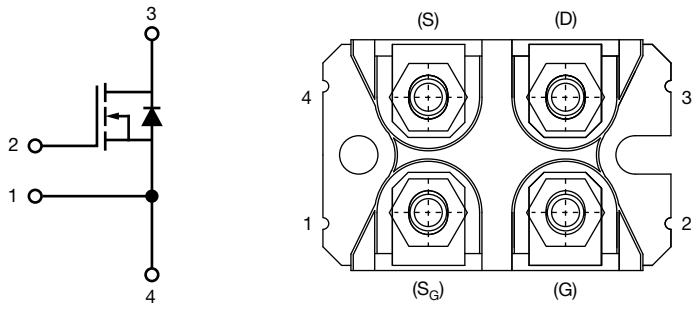
ORDERING INFORMATION TABLE

Device code

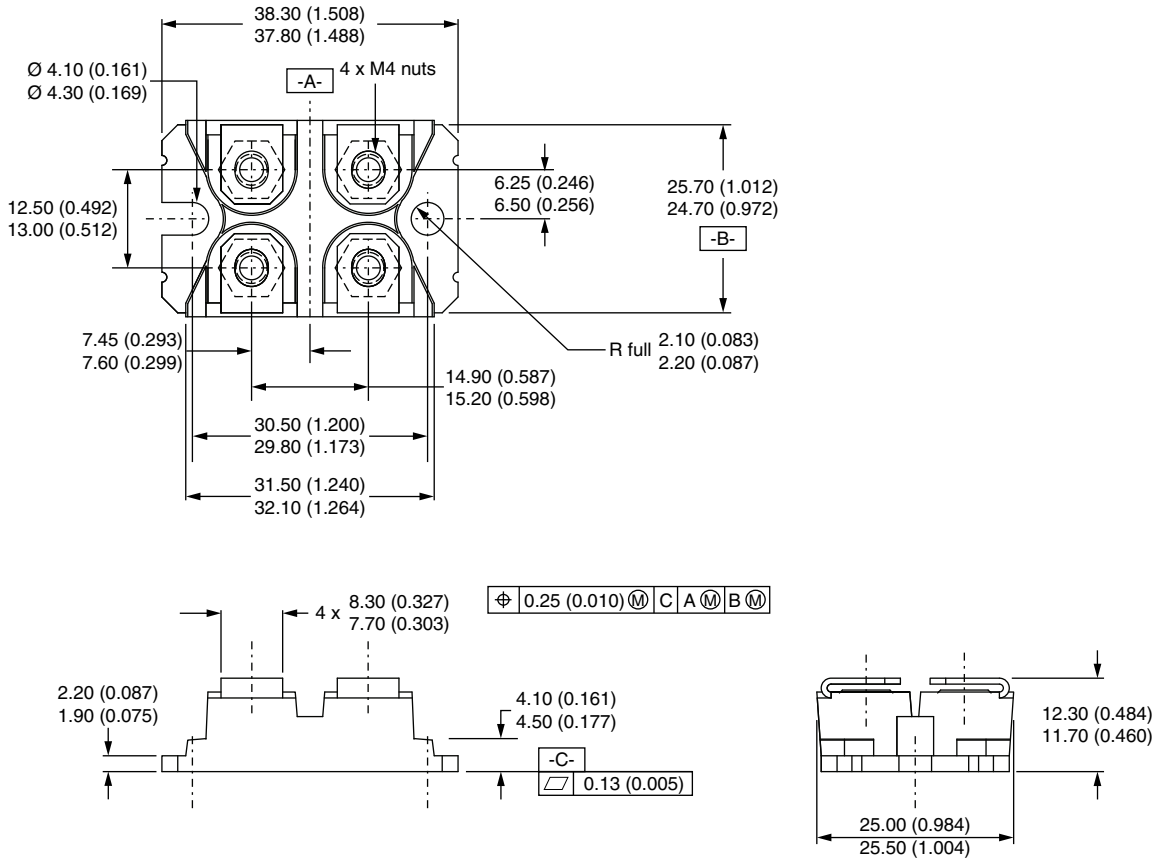
VS-	SF	200	S	A	120
1	2	3	4	5	6

- 1 - Vishay Semiconductors product
- 2 - SF = SiC MOSFET module
- 3 - Current rating (200 = 200 A)
- 4 - Circuit configuration (S = single switch)
- 5 - Package indicator (SOT-227)
- 6 - Voltage rating (120 = 1200 V)

CIRCUIT CONDIGURATION

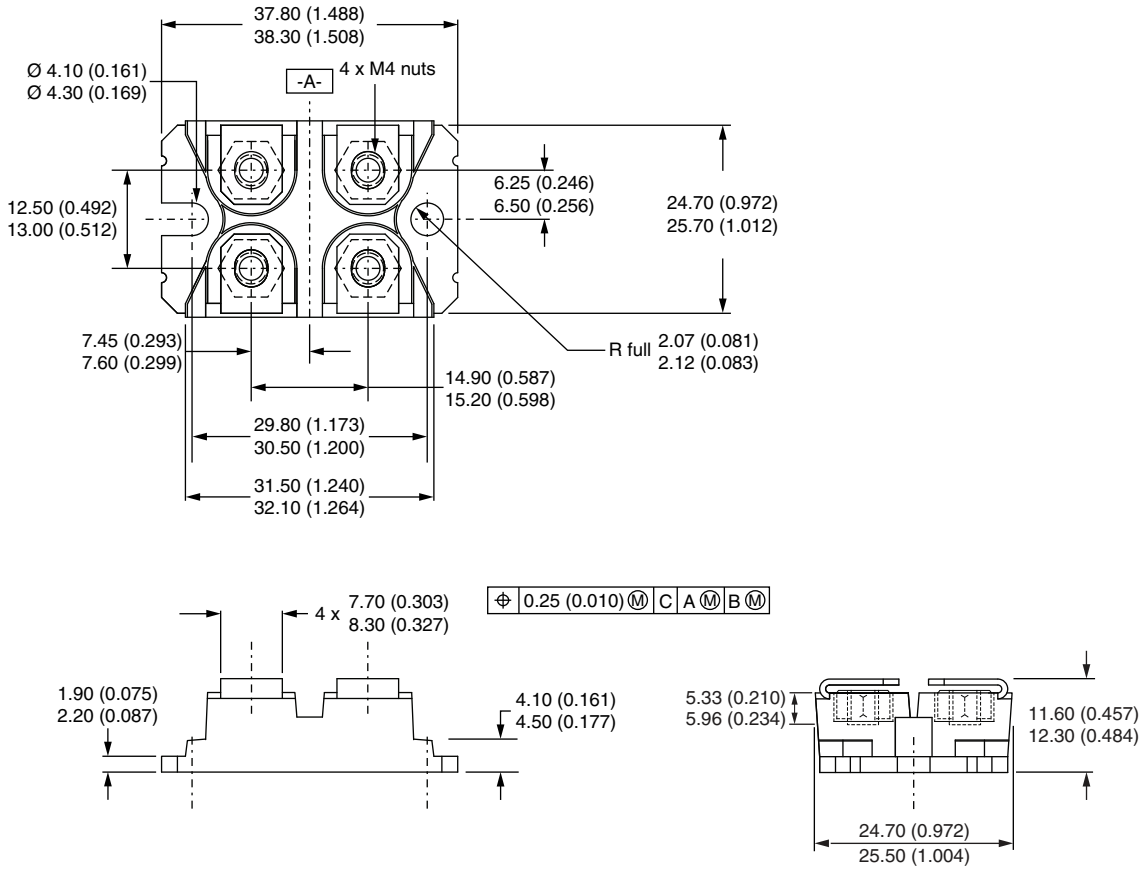
CIRCUIT	CIRCUIT CONFIGURATION CODE	CIRCUIT DRAWING
Single switch	S	

DIMENSIONS in millimeters



SOT-227 Generation 2

DIMENSIONS in millimeters (inches)



Note

- Controlling dimension: millimeter

Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, “Vishay”), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Hyperlinks included in this datasheet may direct users to third-party websites. These links are provided as a convenience and for informational purposes only. Inclusion of these hyperlinks does not constitute an endorsement or an approval by Vishay of any of the products, services or opinions of the corporation, organization or individual associated with the third-party website. Vishay disclaims any and all liability and bears no responsibility for the accuracy, legality or content of the third-party website or for that of subsequent links.

Vishay products are not designed for use in life-saving or life-sustaining applications or any application in which the failure of the Vishay product could result in personal injury or death unless specifically qualified in writing by Vishay. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.