

SOT-227 Power Module

Single Switch - Super Junction Power MOSFET, 150 A


SOT-227

FEATURES

- Super junction power MOSFET
- Low $R_{DS(on)}$
- Low conduction losses and low switching losses
- Maximum 150 °C junction temperature
- UL approved file E78996 
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912


**RoHS
COMPLIANT**

PRIMARY CHARACTERISTICS

V_{DSS}	650 V
$R_{DS(on)}$ typical	14 mΩ
I_D	115 A at $T_C = 90\text{ °C}$
Type	Modules - MOSFET
Package	SOT-227

APPLICATIONS

- DC/DC converter
- DC/AC inverter
- UPS
- Charging stations
- Solar inverters

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
MOSFET				
Drain to source voltage	V _{DSS}		650	V
Continuous drain current, V _{GS} at 13 V	I _D	T _C = 25 °C	163	A
		T _C = 90 °C	115	
Pulsed drain current	I _{DM} ⁽¹⁾	T _C = 25 °C	365	
Power dissipation	P _D	T _C = 25 °C	1042	W
Gate to source voltage	V _{GS}		± 20	V
Single pulse avalanche energy ⁽²⁾	E _{AS}	T _C = 25 °C, L = 5 mH, V _{DS} = 75 V	474	mJ
Avalanche current	I _{AS}		13.8	A
MODULE				
Operating junction temperature range	T _J		-55 to +150	°C
Operating storage temperature range	T _{Stg}		-40 to +150	
Insulation voltage (RMS)	V _{ISOL}	Any terminal to case, t = 1 min	2500	V

Notes

⁽¹⁾ Limited at max. junction temperature

⁽²⁾ Duty cycle ≤ 1 %

**THERMAL - MECHANICAL SPECIFICATIONS**

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Operating junction temperature range	T_J		-55	-	150	°C
Operating storage temperature range	T_{Stg}		-40	-	150	
Junction to case MOSFET	R_{thJC}		-	-	0.12	°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 ($T_J = 25\text{ °C}$ unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Drain to source breakdown voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}$, $I_D = 0.75\text{ mA}$	650	-	-	V
Breakdown voltage temperature coefficient	$\Delta V_{(BR)DSS}/\Delta T_J$	$I_D = 0.75\text{ mA}$ (25 °C to 125 °C)	-	0.48	-	V/°C
Static drain to source on-resistance	$R_{DS(on)}$	$V_{GS} = 13\text{ V}$, $I_D = 150\text{ A}$	-	14.8	18.3	mΩ
		$V_{GS} = 13\text{ V}$, $I_D = 150\text{ A}$, $T_J = 125\text{ °C}$	-	30.6	-	
Gate threshold voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$, $I_D = 0.75\text{ mA}$	2.9	4.0	5.1	V
		$V_{DS} = V_{GS}$, $I_D = 0.75\text{ mA}$, $T_J = 125\text{ °C}$	-	2.9	-	
Temperature coefficient of threshold voltage	$\Delta V_{GS(th)}/\Delta T_J$	$V_{DS} = V_{GS}$, $I_D = 0.75\text{ mA}$ (25 °C to 125 °C)	-	-11.0	-	mV/°
Forward transconductance	g_{fs}	$V_{DS} = 20\text{ V}$, $I_D = 150\text{ A}$, $V_{GS} = 10\text{ V}$	-	125	-	S
Drain to source leakage current	I_{DSS}	$V_{DS} = 650\text{ V}$, $V_{GS} = 0\text{ V}$	-	0.3	5.0	μA
		$V_{DS} = 650\text{ V}$, $V_{GS} = 0\text{ V}$, $T_J = 125\text{ °C}$	-	86	-	
Gate to source leakage	I_{GSS}	$V_{GS} = \pm 20\text{ V}$	-	-	± 300	nA
Total gate charge	Q_g	$I_D = 46\text{ A}$, $V_{DS} = 480\text{ V}$, $V_{GS} = 0\text{ V} / 13\text{ V}$	-	508	-	nC
Gate to source charge	Q_{gs}		-	108	-	
Gate to drain ("Miller") charge	Q_{gd}		-	166	-	
Turn-on switching energy	E_{on}	$V_{DD} = 400\text{ V}$, $I_D = 150\text{ A}$, $R_{g(on)} = 1.0\text{ Ω}$, $V_{GS} = 13\text{ V}$, $T_J = 125\text{ °C}$	-	2.12	-	mJ
Turn-on delay time	$t_{d(on)}$	Used one diode of VS-U5FX150FA60 as free wheeling	-	86	-	ns
Rise time	t_r		-	72	-	
Turn-off switching energy	E_{off}	$V_{DD} = 400\text{ V}$, $I_D = 150\text{ A}$, $R_{g(off)} = 2.2\text{ Ω}$, $V_{GS} = 13\text{ V} / -10\text{ V}$, $T_J = 125\text{ °C}$	-	1.13	-	mJ
Turn-off delay time	$t_{d(off)}$	Used one diode of VS-U5FX150FA60 as free wheeling	-	122	-	ns
Fall time	t_f		-	9	-	
Input capacitance	C_{iss}	$V_{GS} = 0\text{ V}$, $V_{DS} = 400\text{ V}$, $f = 100\text{ kHz}$	-	19.95	-	nF
Output capacitance	C_{oss}		-	0.16	-	
Reverse transfer capacitance	C_{rss}		-	0.035	-	

SOURCE-DRAIN RATINGS AND CHARACTERISTICS ($T_J = 25\text{ °C}$ unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Pulsed source current (body diode)	I_{SM}	6 ms rectangular pulse	-	-	1368	A
Diode forward voltage	V_{SD}	$I_S = 150\text{ A}$, $V_{GS} = 0\text{ V}$	-	0.99	1.5	V
Reverse recovery time	t_{rr}	$T_J = 25\text{ °C}$, $I_F = I_S = 50\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_R = 100\text{ V}$	-	211	-	ns
Reverse recovery charge	Q_{rr}		-	1740	-	nC
Reverse recovery current	I_{RRM}		-	16.5	-	A

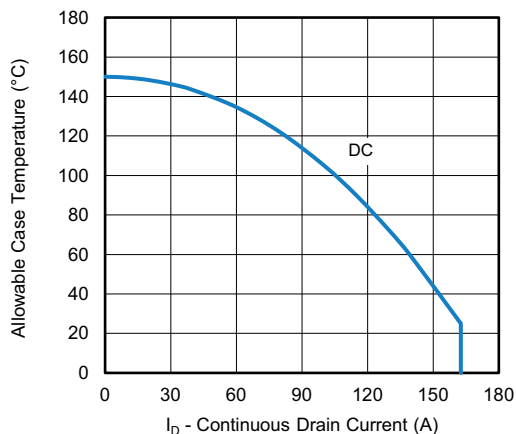


Fig. 1 - Maximum Continuous Drain Current vs. Case Temperature

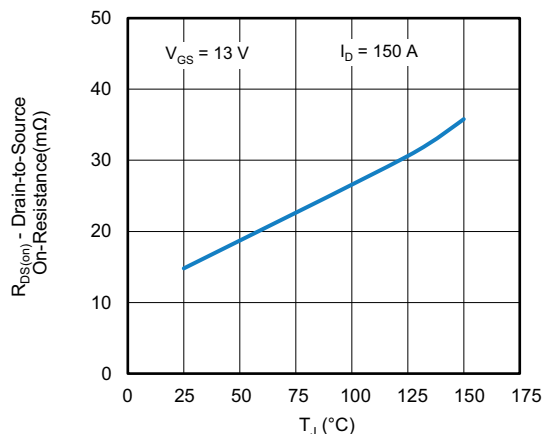


Fig. 4 - Typical Drain-to-Source On-Resistance vs. Temperature

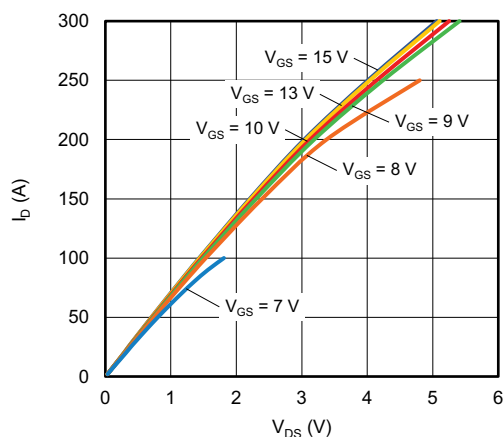
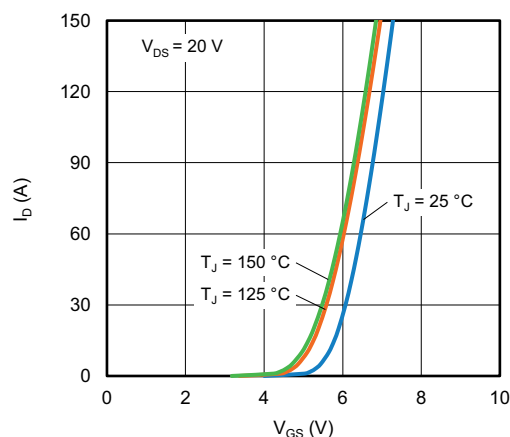

Fig. 2 - Typical Drain to Source Current Output Characteristics at $T_J = 25\text{ °C}$


Fig. 5 - Typical Transfer Characteristics

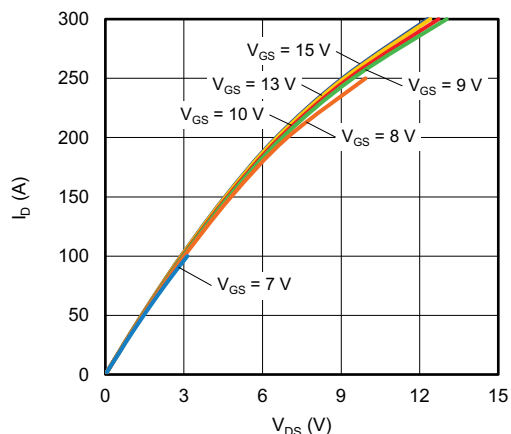
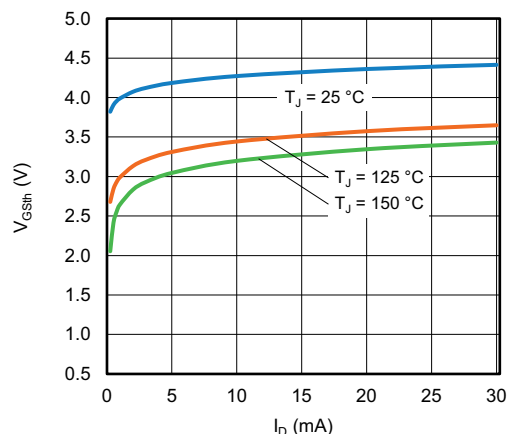

Fig. 3 - Typical Drain to Source Current Output Characteristics at $T_J = 125\text{ °C}$


Fig. 6 - Typical Gate Threshold Voltage Characteristics

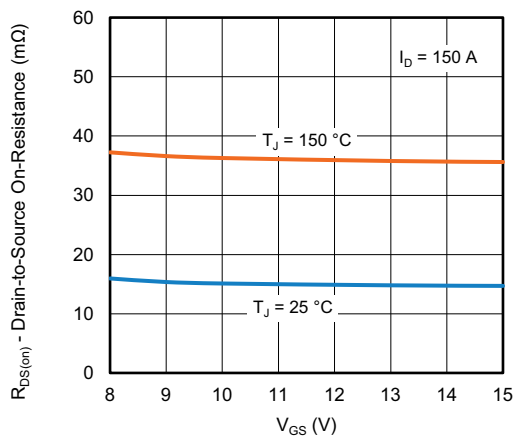


Fig. 7 - Typical Drain-to-Source On-Resistance vs. Gate to Source Voltage

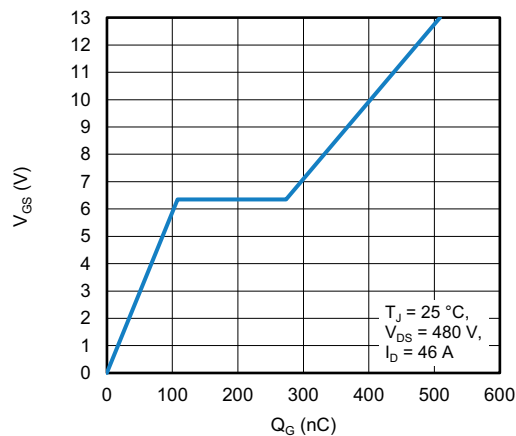


Fig. 10 - Typical Gate Charge vs. Gate to Source Voltage

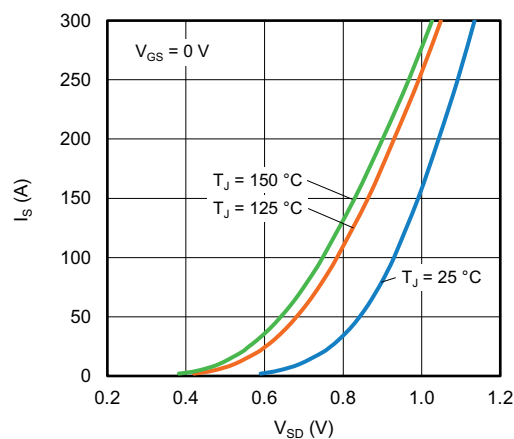


Fig. 8 - Typical Body Diode Source-to-Drain Current Characteristics

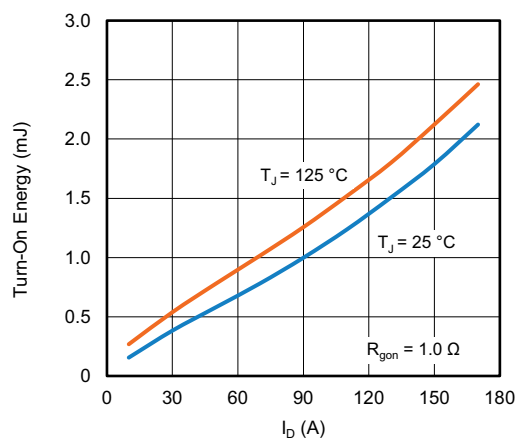


Fig. 11 - Typical Turn-On Energy Loss vs. I_D ($V_{GS} = 13\text{ V}$)

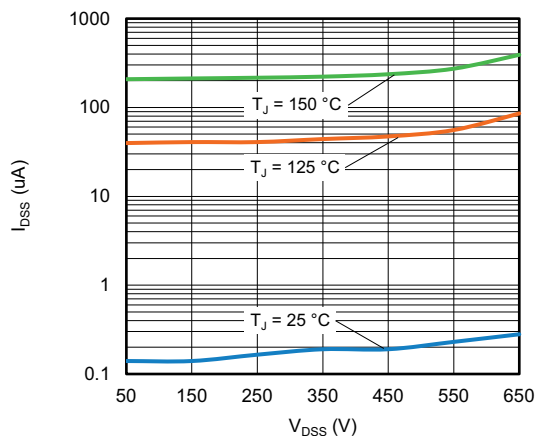


Fig. 9 - Typical Zero Gate Voltage Drain Current

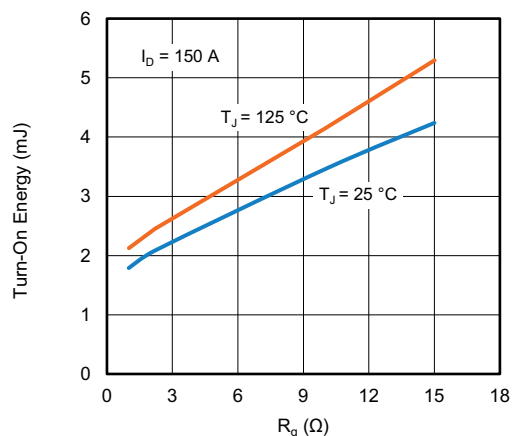


Fig. 12 - Typical Turn-On Energy Loss vs. R_g ($V_{GS} = 13\text{ V}$)

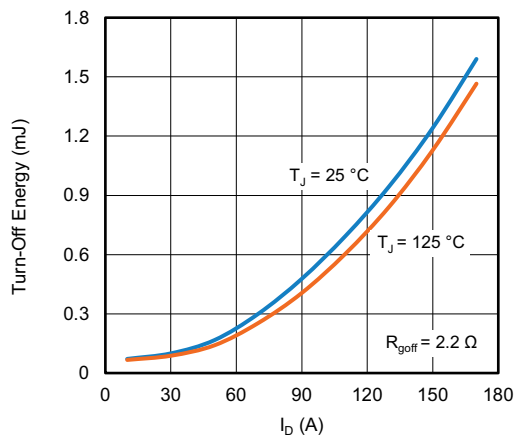


Fig. 13 - Typical Turn-Off Energy Loss vs. I_D
($V_{GS} = 13\text{ V} / -10\text{ V}$)

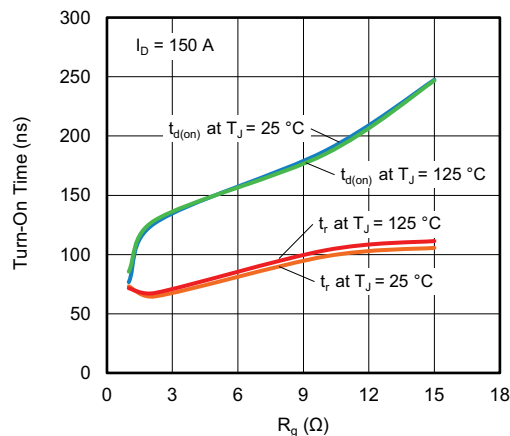


Fig. 16 - Typical Turn-On Switching Time vs. R_g
($V_{GS} = 13\text{ V}$)

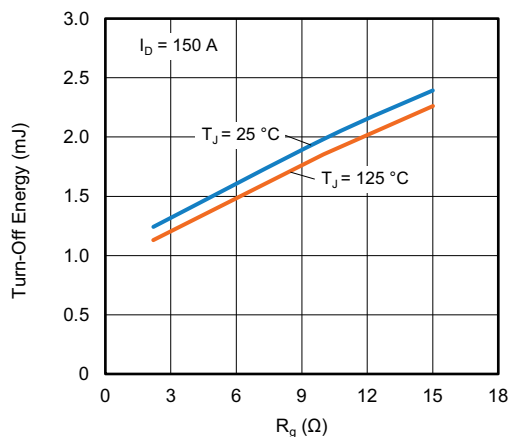


Fig. 14 - Typical Turn-Off Energy Loss vs. R_g
($V_{GS} = 13\text{ V} / -10\text{ V}$)

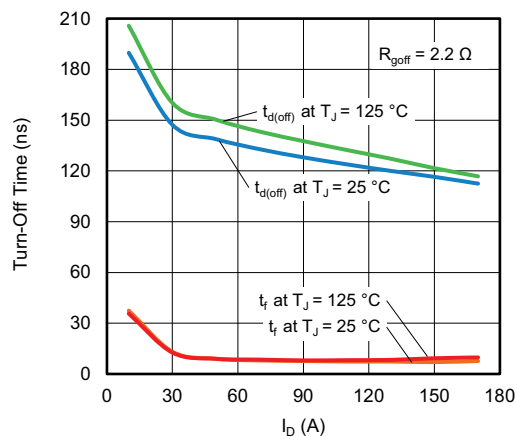


Fig. 17 - Typical Turn-Off Switching Time vs. I_D
($V_{GS} = 13\text{ V} / -10\text{ V}$)

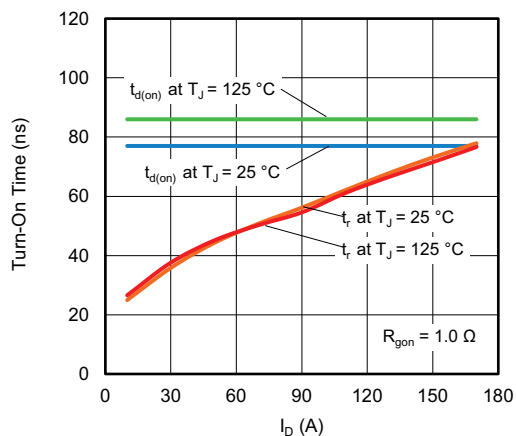


Fig. 15 - Typical Turn-On Switching Time vs. I_D
($V_{GS} = 13\text{ V}$)

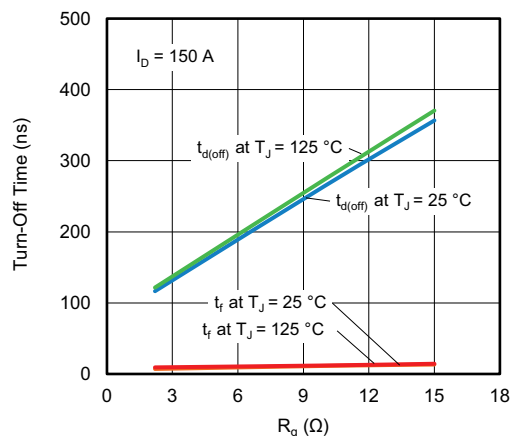


Fig. 18 - Typical Turn-Off Switching Time vs. R_g
($V_{GS} = 13\text{ V} / -10\text{ V}$)

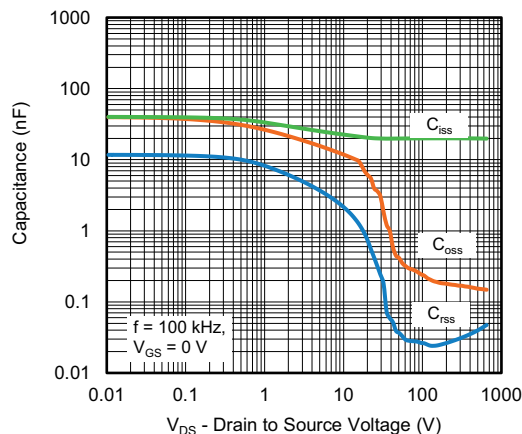


Fig. 19 - Typical Capacitance vs. Drain-to-Source Voltage

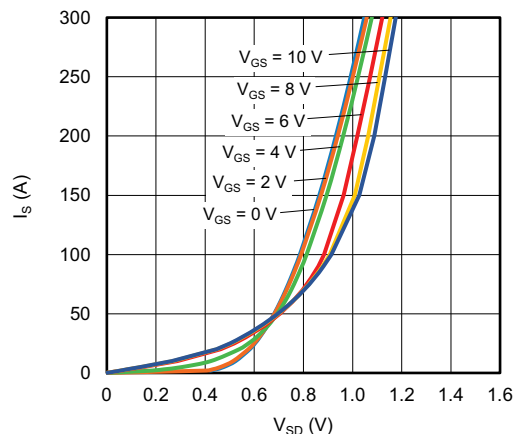
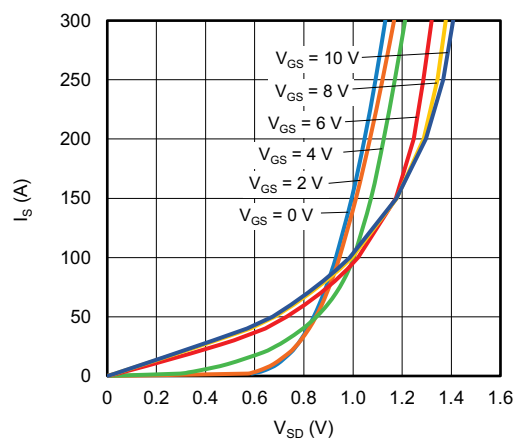
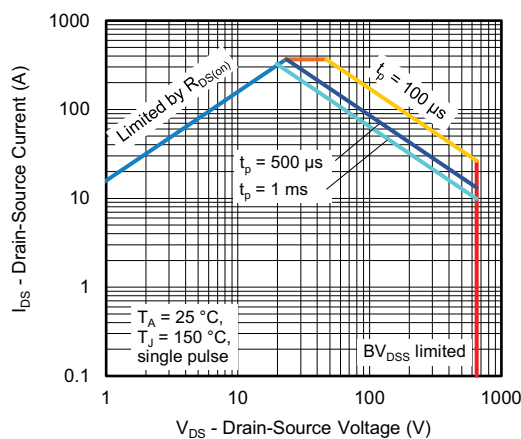

Fig. 21 - Typical Body Diode Source-to-Drain Current Characteristics $T_J = 125\text{ }^{\circ}\text{C}$

Fig. 20 - Typical Body Diode Source-to-Drain Current Characteristics $T_J = 25\text{ }^{\circ}\text{C}$


Fig. 22 - Safe Operating Area

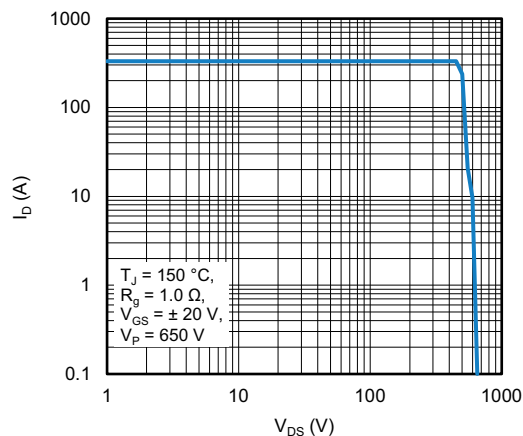


Fig. 23 - Reverse BIAS SOA

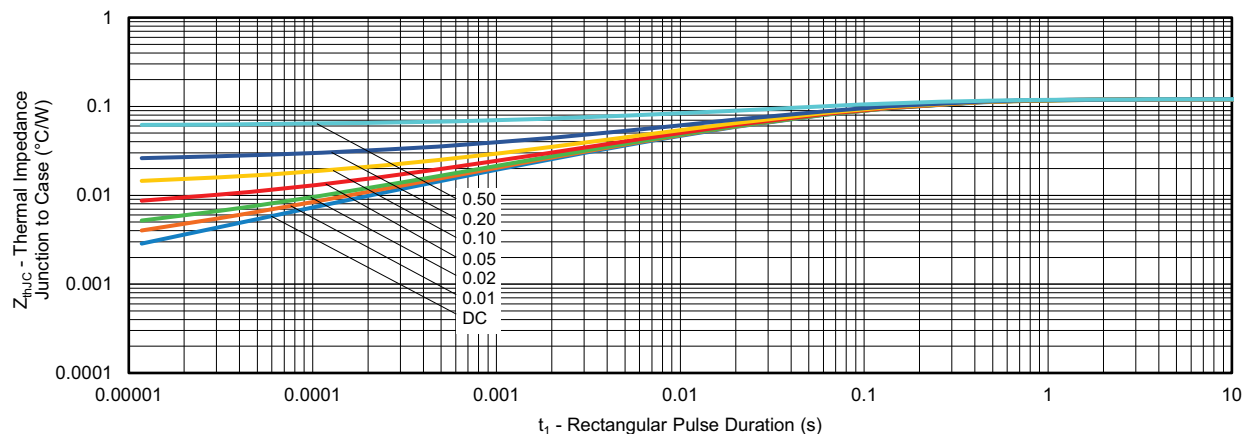


Fig. 24 - Maximum Thermal Impedance Z_{thJC} Characteristics

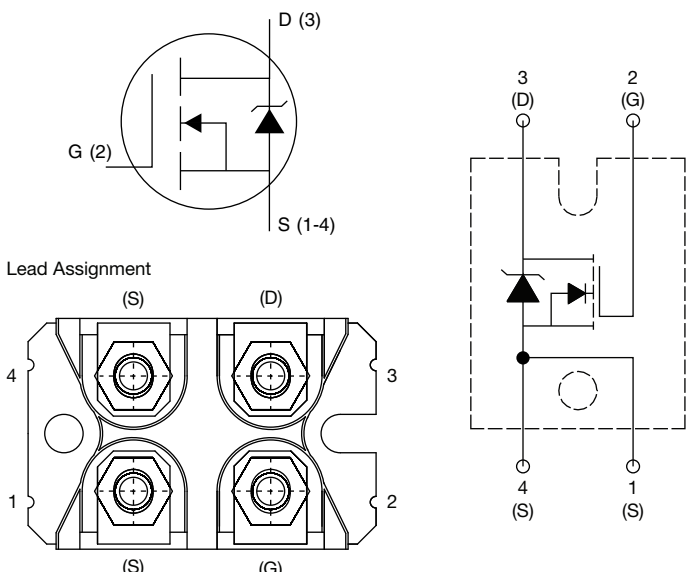
ORDERING INFORMATION TABLE

Device code

VS-	F	C	150	S	A	65
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① ② ③ ④ ⑤ ⑥ ⑦

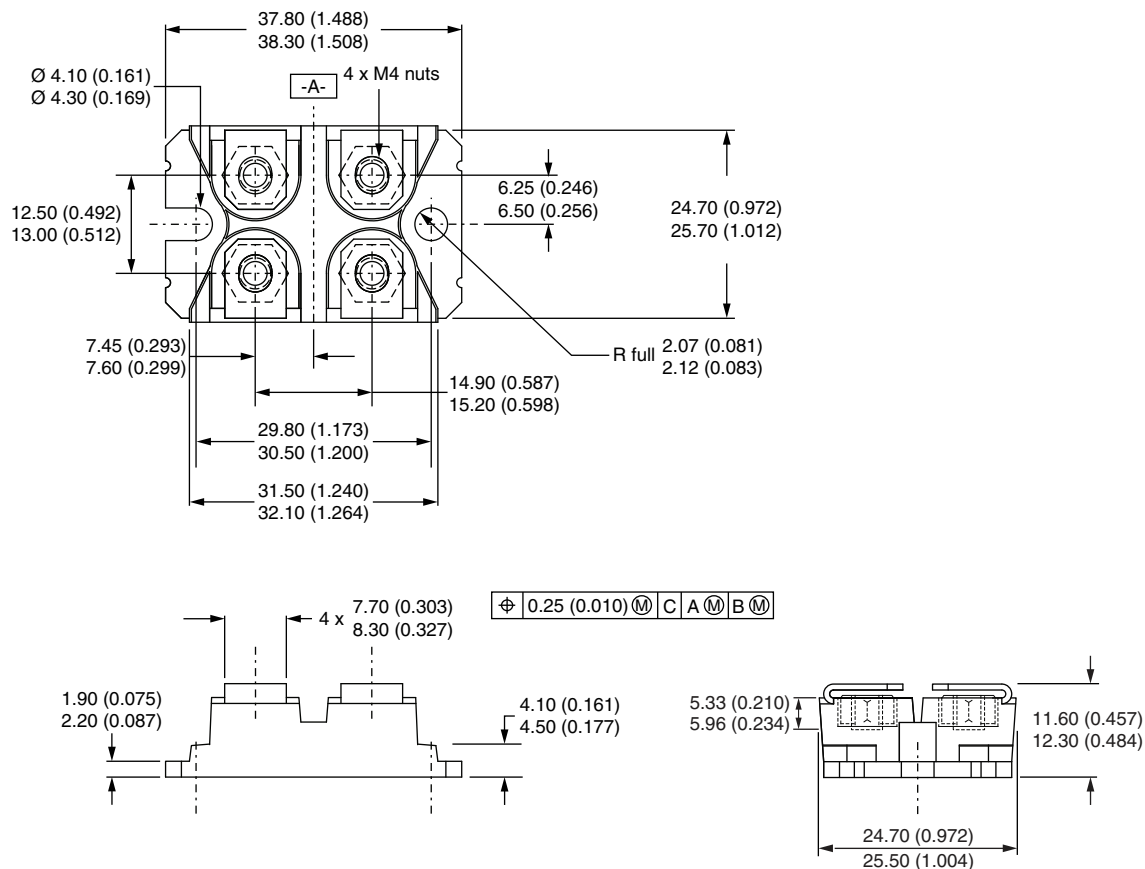
- 1** - Vishay Semiconductors product
- 2** - MOSFET module
- 3** - MOSFET die generation
- 4** - Current rating (150 = 150 A)
- 5** - Circuit configuration (S = single switch)
- 6** - Package indicator (SOT-227)
- 7** - Voltage rating (65 = 650 V)

CIRCUIT CONFIGURATION		
CIRCUIT	CIRCUIT CONFIGURATION CODE	CIRCUIT DRAWING
Single switch	S	 The circuit drawing for the Single switch (S) configuration includes three diagrams: a schematic symbol showing a diode and a switch in series, with terminals labeled D (3), G (2), and S (1-4); a lead assignment diagram showing the physical package with terminals labeled (S), (D), (S), and (G); and a physical package diagram showing the internal circuitry with terminals labeled 3 (D), 2 (G), 4 (S), and 1 (S).

LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95423
Packaging information	www.vishay.com/doc?95425

SOT-227 Generation 2

DIMENSIONS in millimeters (inches)



Note

- Controlling dimension: millimeter



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