

SOT-227 Power Module

Single Switch - Super Junction Power MOSFET, 50 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

APPLICATIONS

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

PRIMARY CHARACTERISTICS

V_{DSS}	650 V
$R_{DS(on)}$ typical	44 mΩ
I_D	51 A at $T_C = 90\text{ °C}$
Type	Modules - MOSFET
Package	SOT-227

ABSOLUTE MAXIMUM RATINGS

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	68	A
		T _C = 90 °C	51	
Pulsed drain current	I _{DM} ⁽¹⁾	T _C = 25 °C	140	
Power dissipation	P _D	T _C = 25 °C	625	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	663	mJ
Avalanche current	I _{AS}		16.3	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 %



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 = 0.25 mA	650	-	-	V
Breakdown voltage temperature coefficient	ΔV _{(BR)DSS} /ΔT _J	I _D = 0.25 mA (25 °C to 125 °C)	-	0.41	-	V/°C
Static drain to source on-resistance	R _{DS(on)}	V _{GS} = 13 V, I _D = 50 A	-	44	54	mΩ
		V _{GS} = 13 V, I _D = 50 A, T _J = 125 °C	-	91	-	
Gate threshold voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 0.25 mA	2.9	4.0	5.1	V
		V _{DS} = V _{GS} , I _{DS} = 0.25 mA, T _J = 125 °C	-	3.0	-	
Temperature coefficient of threshold voltage	ΔV _{GS(th)} /ΔT _J	V _{DS} = V _{GS} , I _D = 0.25 mA (25 °C to 125 °C)	-	-10.0	-	mV/°C
Forward transconductance	g _{fs}	V _{DS} = 20 V, I _D = 50 A, V _{GS} = 10 V	-	44	-	S
Drain to source leakage current	I _{DSS}	V _{DS} = 650 V, V _{GS} = 0 V	-	0.23	3.0	μA
		V _{DS} = 650 V, V _{GS} = 0 V, T _J = 125 °C	-	24.6	-	
Gate to source leakage	I _{GSS}	V _{GS} = ± 20 V	-	-	± 100	nA
Total gate charge	Q _g	I _D = 46 A, V _{DS} = 480 V, V _{GS} = 0 V / 13 V	-	167	-	nC
Gate to source charge	Q _{gs}		-	40	-	
Gate to drain ("Miller") charge	Q _{gd}		-	60	-	
Turn-on switching energy	E _{on}	V _{DD} = 400 V, I _D = 50 A, R _{g(on)} = 1.0 Ω, V _{GS} = 13 V, T _J = 125 °C	-	0.94	-	mJ
Turn-on delay time	t _{d(on)}	Used one diode of VS-U5FX150FA60 as free wheeling	-	16	-	ns
Rise time	t _r		-	52	-	
Turn-on/off switching energy	E _{off}	V _{DD} = 400 V, I _D = 50 A, R _{g(off)} = 4.7 Ω, V _{GS} = 13 V / -10 V, T _J = 125 °C	-	0.1	-	mJ
Turn-off delay time	t _{d(off)}	Used one diode of VS-U5FX150FA60 as free wheeling	-	55	-	
Fall time	t _f		-	5	-	
Input capacitance	C _{iss}	V _{GS} = 0 V, V _{DS} = 400 V, f = 100 kHz	-	6.2	-	nF
Output capacitance	C _{oss}		-	0.058	-	
Reverse transfer capacitance	C _{rss}		-	0.013	-	

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}	6 ms rectangular pulse	-	-	648	A
Diode forward voltage	V _{SD}	I _S = 50 A, V _{GS} = 0 V	-	1.0	1.45	V
Reverse recovery time	t _{rr}	T _J = 25 °C, I _F = I _S = 50 A, di/dt = 100 A/μs, V _R = 100 V	-	150	-	ns
Reverse recovery charge	Q _{rr}		-	885	-	nC
Reverse recovery current	I _{RRM}		-	11.8	-	A

THERMAL AND 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}		-	-	0.2	°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			

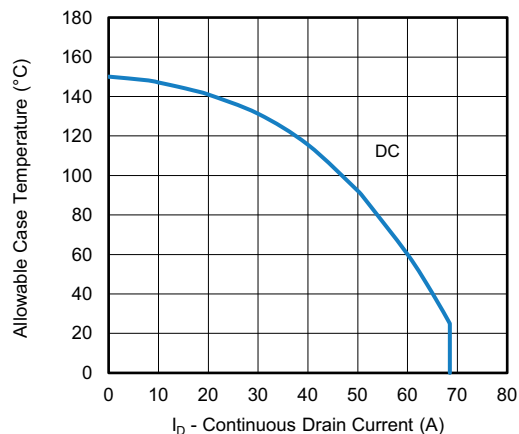


Fig. 1 - Maximum Continuous Drain Current vs. Case Temperature

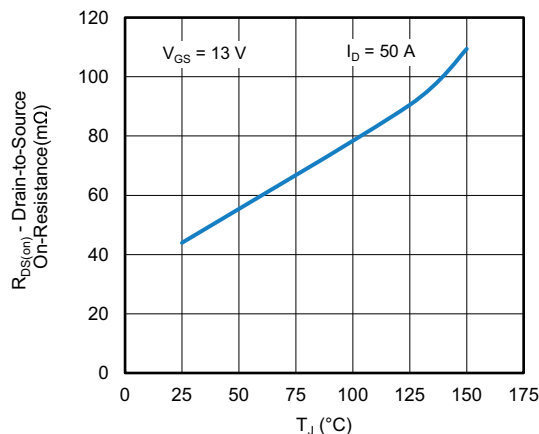


Fig. 4 - Typical Drain-to-Source On-Resistance vs. Temperature

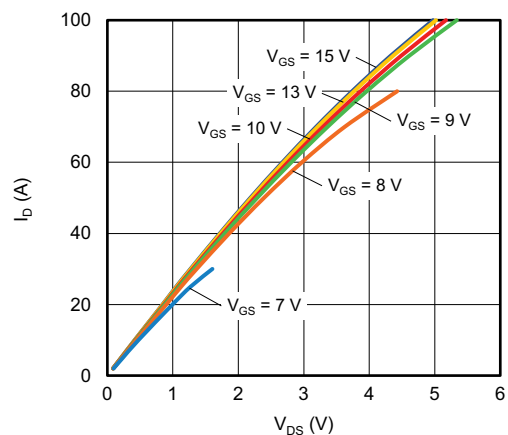
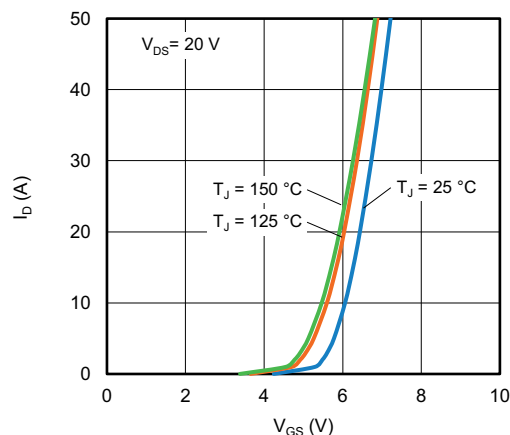

Fig. 2 - Typical Drain to Source Current Output Characteristics at $T_J = 25\text{ }^{\circ}\text{C}$


Fig. 5 - Typical Transfer Characteristics

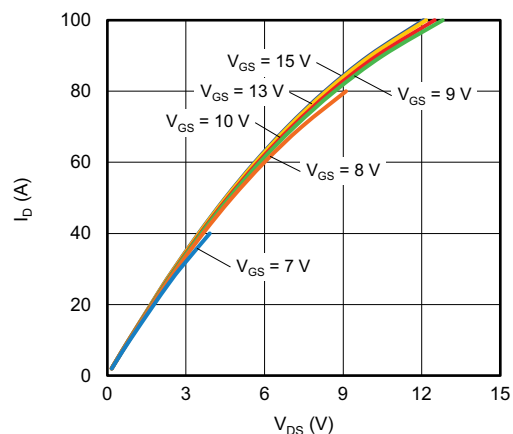
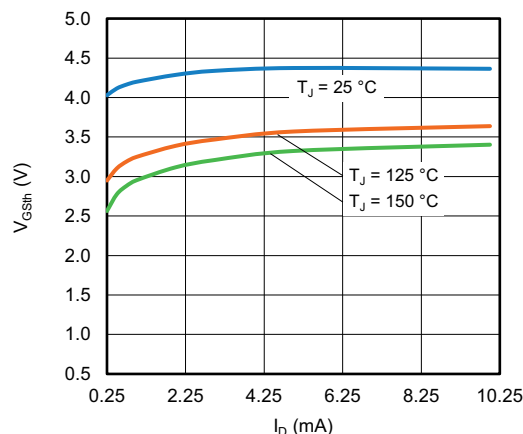

Fig. 3 - Typical Drain to Source Current Output Characteristics at $T_J = 125\text{ }^{\circ}\text{C}$


Fig. 6 - Typical Gate Threshold Voltage Characteristics

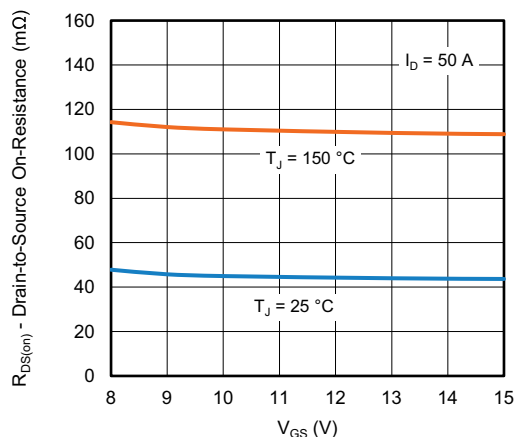


Fig. 7 - Typical Drain-to-Source On-Resistance vs. Gate to Source Voltage

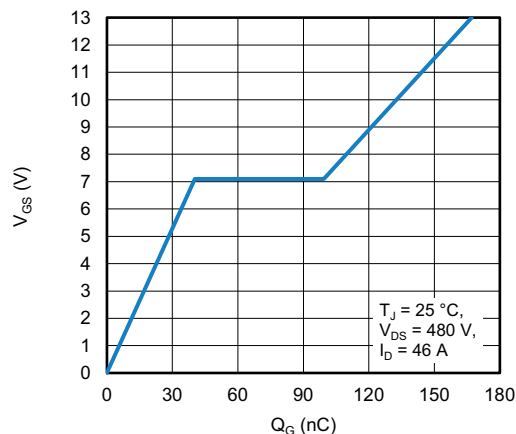


Fig. 10 - Typical Gate Charge vs. Gate to Source Voltage

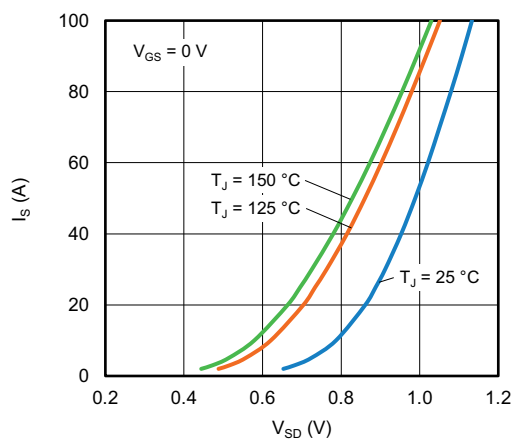


Fig. 8 - Typical Body Diode Source-to-Drain Current Characteristics

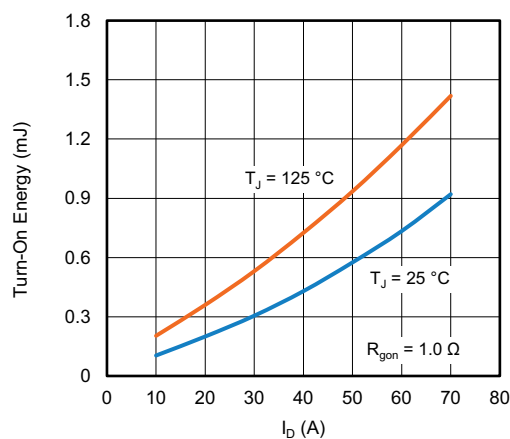


Fig. 11 - Typical Turn-On Energy Loss vs. I_D ($V_{GS} = 13\text{ V}$)

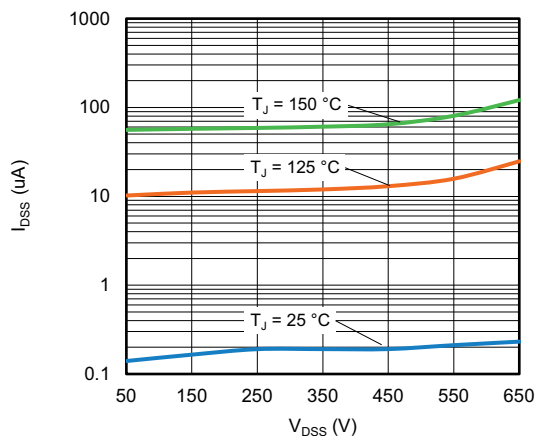


Fig. 9 - Typical Zero Gate Voltage Drain Current

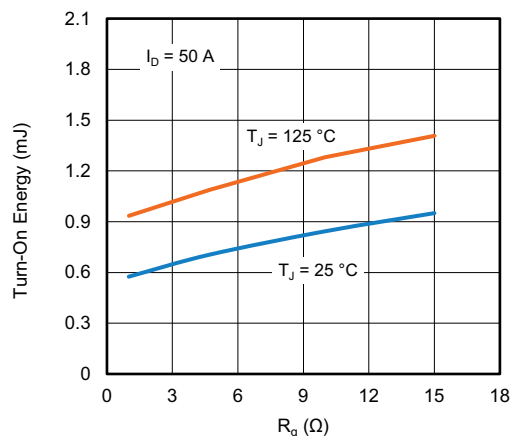


Fig. 12 - Typical Turn-On Energy Loss vs. R_g ($V_{GS} = 13\text{ V}$)

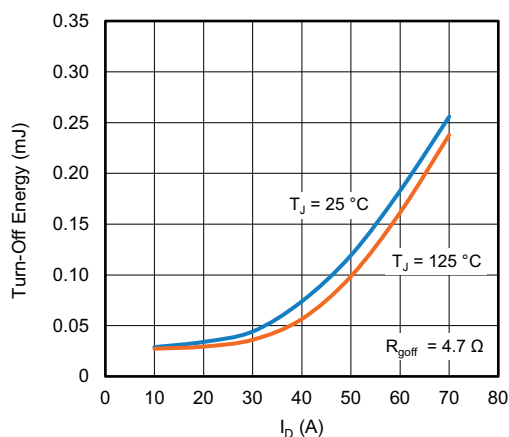


Fig. 13 - Typical Turn-Off Energy Loss vs. I_D
($V_{GS} = 13\text{ V} / -10\text{ V}$)

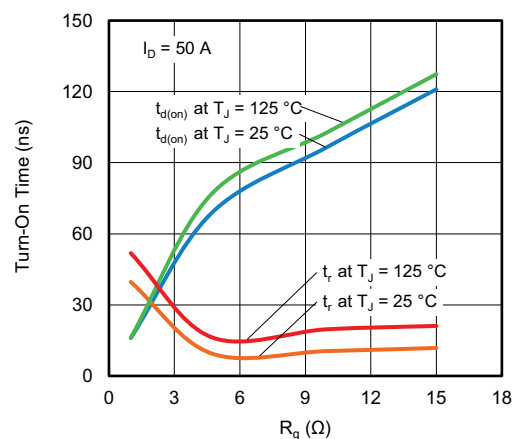


Fig. 16 - Typical Turn-On Switching Time vs. R_g
($V_{GS} = 13\text{ V}$)

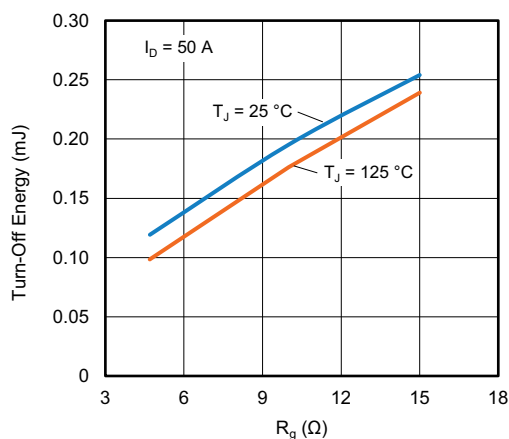


Fig. 14 - Typical Turn-Off Energy Loss vs. R_g
($V_{GS} = 13\text{ V} / -10\text{ V}$)

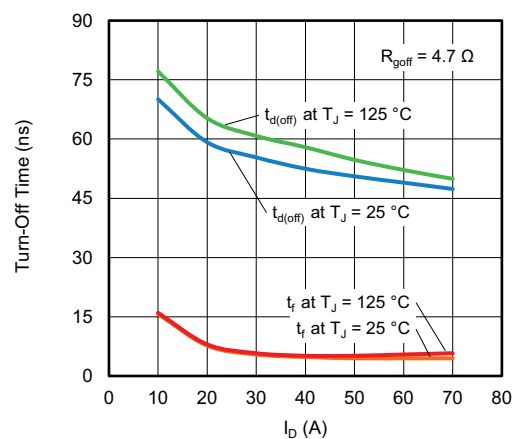


Fig. 17 - Typical Turn-Off Switching Time vs. I_D
($V_{GS} = 13\text{ V} / -10\text{ V}$)

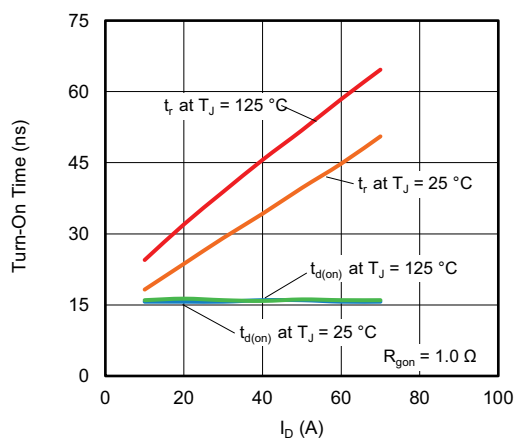


Fig. 15 - Typical Turn-On Switching Time vs. I_D
($V_{GS} = 13\text{ V}$)

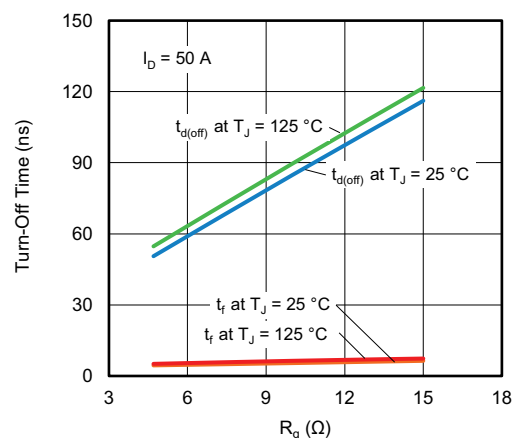


Fig. 18 - Typical Turn-Off Switching Time vs. R_g
($V_{GS} = 13\text{ V} / -10\text{ V}$)

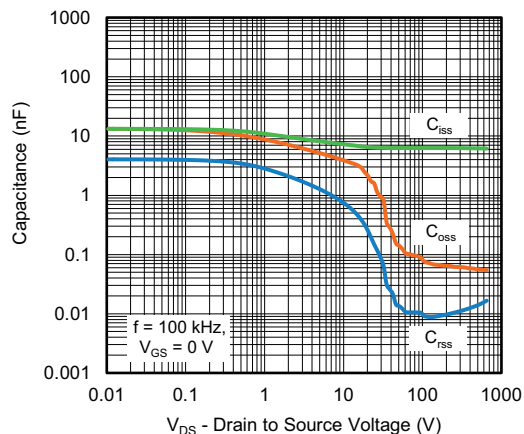


Fig. 19 - Typical Capacitance vs. Drain-to-Source Voltage

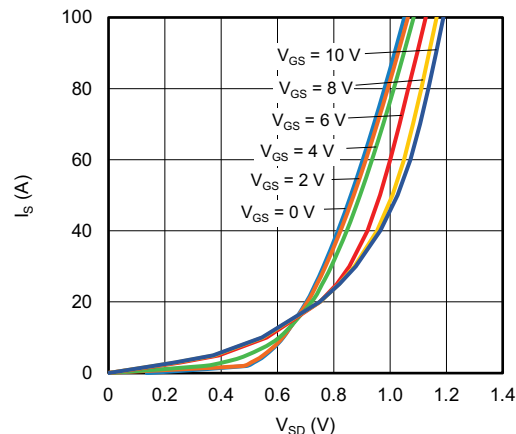
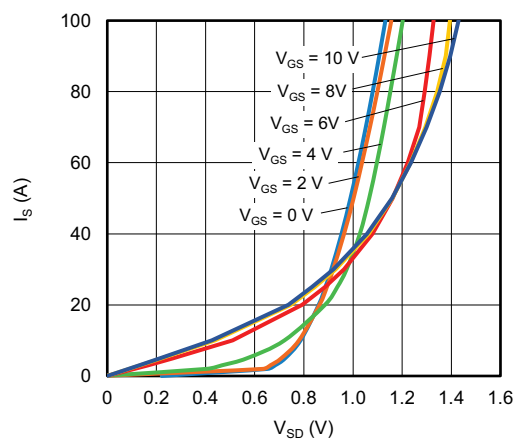
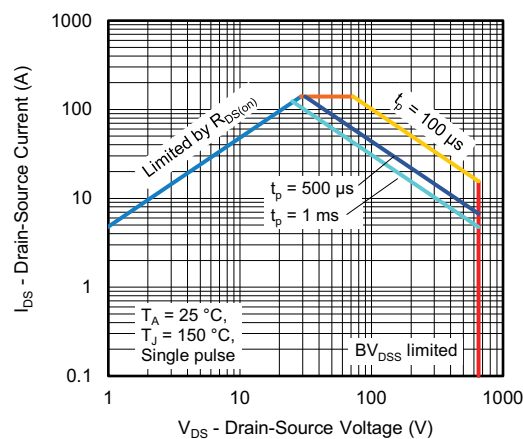

Fig. 21 - Typical Body Diode Source-to-Drain Current Characteristics $T_J = 125\text{ }^{\circ}\text{C}$

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


Fig. 22 - Safe Operating Area

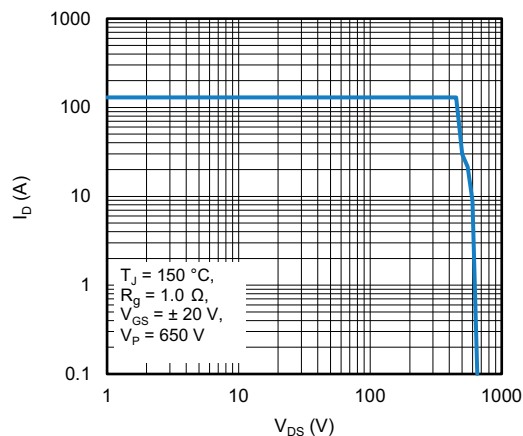


Fig. 23 - Reverse BIAS SOA

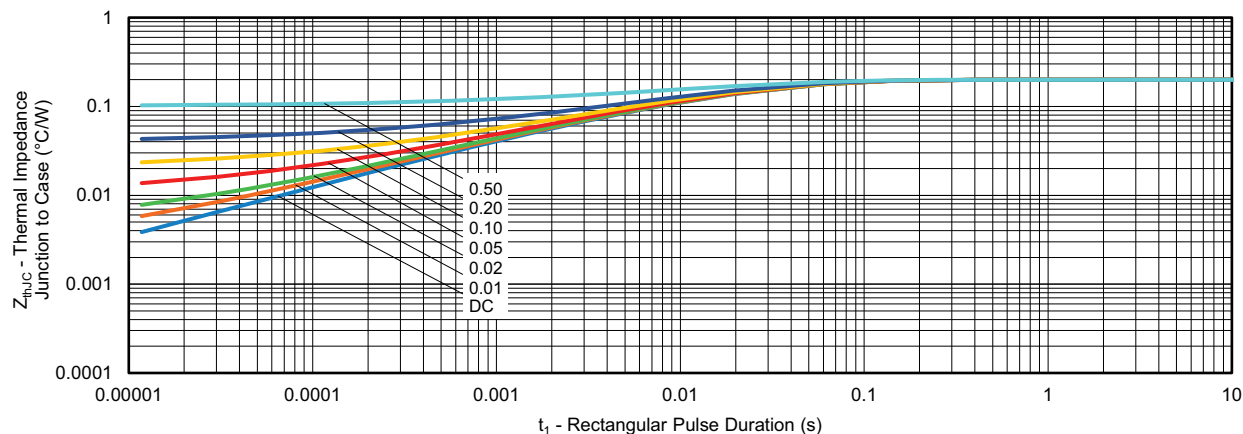


Fig. 24 - Maximum Thermal Impedance Z_{thJC} Characteristics

ORDERING INFORMATION TABLE

Device code

VS-	F	C	50	S	A	65
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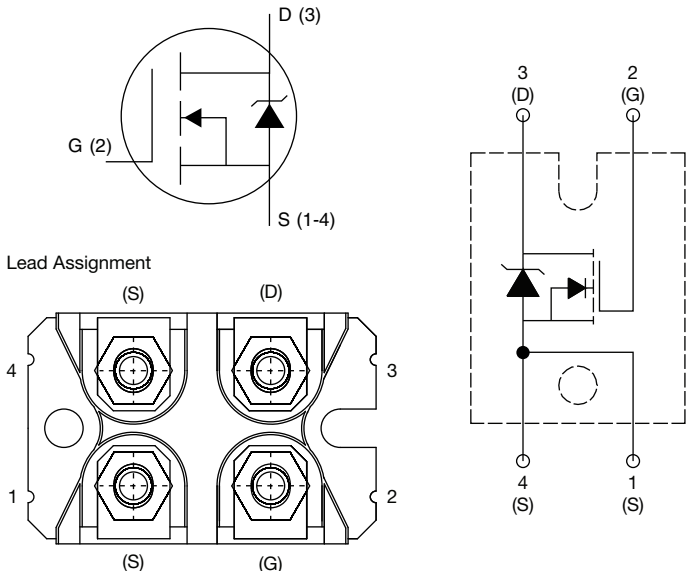
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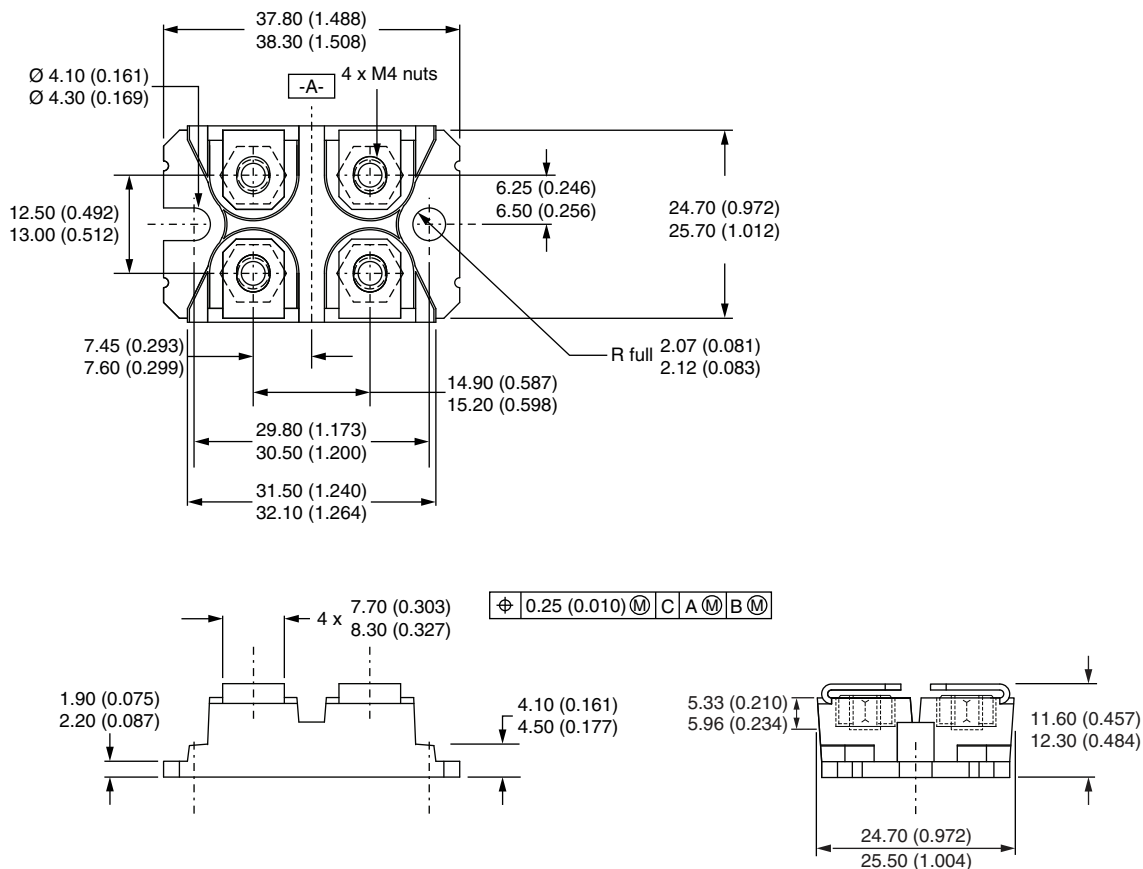
- 1** - Vishay Semiconductors product
- 2** - MOSFET module
- 3** - MOSFET die generation
- 4** - Current rating (50 = 50 A)
- 5** - Circuit configuration (S = single switch)
- 6** - Package indicator (SOT-227)
- 7** - Voltage rating (65 = 650 V)

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 switch controlled by a diode, a lead assignment diagram showing the physical package with leads labeled (S), (D), (G), and (S), and a detailed schematic of the internal circuitry showing the diode and switch components connected to the leads.

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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