SOT-227 Power Module
Single Switch - Power MOSFET, 220 A

SOT-227

FEATURES

- Enhanced body diode dV/dt and dI_F/dt capability
- Improved gate avalanche and dynamic dV/dt ruggedness
- Fully characterized capacitance and avalanche SOA
- Fully isolated package
- Easy to use and parallel
- Low on-resistance
- Simple drive requirements
- UL approved file E78996
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

RoHS COMPLIANT

APPLICATIONS

- High efficiency synchronous rectification SMPS
- Uninterruptible power supply
- High speed power switching
- Hard switched and high frequency circuits

DESCRIPTION

This generation of power MOSFETs from Vishay Semiconductors provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

The SOT-227 package is universally preferred for all commercial-industrial applications at power dissipation levels to approximately 400 W to 700 W. The low thermal resistance of the SOT-227 contribute to its wide acceptance throughout the industry.

PRODUCT SUMMARY	
V_{DSS}	200 V
$R_{DS(on)}$	0.0048 Ω
I_D	220 A
Type	Modules - MOSFET
Package	SOT-227

ABSOLUTE MAXIMUM RATINGS				
PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
MOSFET				
Drain to source voltage	V_{DSS}		200	V
Continuous drain current at V_{GS} 10 V	I_D (1)	T_C = 25 °C	220	A
		T_C = 100 °C	158	
Pulsed drain current	I_{DM} (2)		520	
Power dissipation	P_D	T_C = 25 °C	789	W
		T_C = 100 °C	395	
Gate to source voltage	V_{GS}		± 30	V
Single pulse avalanche energy	E_{AS} (3)		1200	mJ
Avalanche current	I_{AR} (4)		70	A
Repetitive avalanche energy	E_{AR} (4)		600	mJ
MODULE				
Operating junction temperature range	T_J		-55 to +175	°C
Operating storage temperature range	T_{Stg}		-55 to +175	
Insulation withstand voltage (AC-RMS)	V_{ISOL}		2.5	kV

Notes

(1) Maximum continuous drain current at V_{GS} 10 V must be limited to 100 A to do not exceed the maximum temperature of power terminals.

(2) Repetitive rating; pulse width limited by maximum junction temperature.

(3) Limited by T_J max., starting T_J = 25 °C, L = 0.23 mH, R_g = 25 Ω, I_{AS} = 102 A, V_{GS} = 10 V. Part not recommended for use above this value.

(4) Repetitive rating; pulse width limited by maximum junction temperature starting T_J = 25 °C, L = 0.23 mH, R_g = 25 Ω, V_{GS} = 10 V, duty cycle 1 %.

THERMAL - MECHANICAL SPECIFICATIONS						
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**MIN.**	**TYP.**	**MAX.**	**UNITS**
Junction and storage temperature range	T_J, T_{Stg}		-55	-	175	°C
Junction to case	R_{thJC}		-	-	0.19	°C/W
Case to heatsink	R_{thCS}	Flat, greased surface	-	0.05	-	
Weight			-	30	-	g
Mounting torque		Torque to terminal	-	-	1.1 (9.7)	Nm (lbf.in)
		Torque to heatsink	-	-	1.3 (11.5)	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 = 1.0 mA	200	-	-	V
Breakdown voltage temperature coefficient	$\Delta V_{(BR)DSS}/\Delta T_J$	Reference to 25 °C, I_D = 1.0 mA	-	0.21	-	V/°C
Static drain to source on-resistance	$R_{DS(on)}$ (1)	V_{GS} = 10 V, I_D = 150 A	-	4.8	7.0	mΩ
Gate threshold voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 500 µA	3	4	5.1	V
		V_{DS} = V_{GS}, I_D = 500 µA, T_J = 125 °C	-	2.5	-	
Forward transconductance	g_{fs}	V_{DS} = 20 V, I_D = 150 A	-	385	-	S
Gate resistance, internal	R_g		-	2	-	Ω
Drain to source leakage current	I_{DSS}	V_{DS} = 200 V, V_{GS} = 0 V	-	1	50	µA
		V_{DS} = 200 V, V_{GS} = 0 V, T_J = 125 °C	-	40	1000	
		V_{DS} = 200 V, V_{GS} = 0 V, T_J = 175 °C	-	2	10	mA
Gate to source forward leakage	I_{GSS}	V_{GS} = 20 V	-	-	250	nA
Gate to source reverse leakage		V_{GS} = -20 V	-	-	-250	
Total gate charge	Q_g	I_D = 150 A, V_{DS} = 100 V, V_{GS} = 10 V, see fig.15 and fig.19 (1)	-	350	-	nC
Gate to source charge	Q_{gs}		-	120	-	
Gate to drain ("Miller") charge	Q_{gd}		-	110	-	
Turn-on delay time	$t_{d(on)}$	V_{DD} = 120 V, I_D = 150 A, R_g = 5 Ω, L = 500 µH, diode used: 20CZU02	-	360	-	ns
Rise time	t_r		-	245	-	
Turn-off delay time	$t_{d(off)}$		-	205	-	
Fall time	t_f		-	220	-	
Turn-on delay time	$t_{d(on)}$	V_{DD} = 120 V, I_D = 150 A, R_g = 5 Ω, L = 500 µH, T_J = 125 °C, diode used: 20CZU02	-	350	-	ns
Rise time	t_r		-	243	-	
Turn-off delay time	$t_{d(off)}$		-	210	-	
Fall time	t_f		-	175	-	
Internal source inductance	L_S	Between lead, and center of die contact	-	5	-	nH
Input capacitance	C_{iss}	V_{GS} = 0 V, V_{DS} = 50 V, f = 1.0 MHz, see fig.14	-	21 000	-	pF
Output capacitance	C_{oss}		-	1600	-	
Reverse transfer capacitance	C_{rss}		-	320	-	
Drain to case capacitance	C_{d-cs}	V_{GS} = 0 V, (G-S shortened); f = 1 MHz	-	43	-	

SOURCE-DRAIN RATINGS AND CHARACTERISTICS (T_J = 25 °C unless otherwise specified)						
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**MIN.**	**TYP.**	**MAX.**	**UNITS**
Continuous source current (body diode)	I_S	MOSFET symbol showing the integral reverse p-n junction diode	-	-	220	A
Pulsed source current (body diode)	I_{SM} (1)		-	-	520	
Diode forward voltage	V_{SD} (2)	T_J = 25 °C, I_S = 150 A, V_{GS} = 0 V	-	0.87	1.0	V
		T_J = 125 °C, I_S = 150 A, V_{GS} = 0 V	-	0.75	-	
		T_J = 175 °C, I_S = 150 A, V_{GS} = 0 V	-	0.70	-	
Reverse recovery time	t_{rr}	T_J = 25 °C, I_F = 50 A, dI_F/dt = 100 A/µs, V_R = 100 V (2)	-	170	-	ns
Reverse recovery current	I_{rr}		-	12	-	A
Reverse recovery charge	Q_{rr}		-	1060	-	nC
Reverse recovery time	t_{rr}	T_J = 125 °C, I_F = 50 A, dI_F/dt = 100 A/µs, V_R = 100 V (2)	-	200	-	ns
Reverse recovery current	I_{rr}		-	15	-	A
Reverse recovery charge	Q_{rr}		-	1550	-	nC
Forward turn-on time	t_{on}	Intrinsic turn-on time is negligible (turn-on is dominated by LS + LD)				

Notes

(1) Repetitive rating; pulse width limited by maximum junction temperature.

(2) Pulse width ≤ 300 µs, duty cycle ≤ 2 %

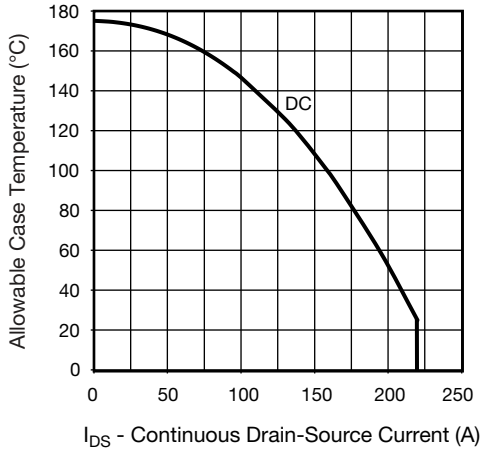


Fig. 1 - Maximum DC MOSFET Drain-Source Current vs. Case Temperature

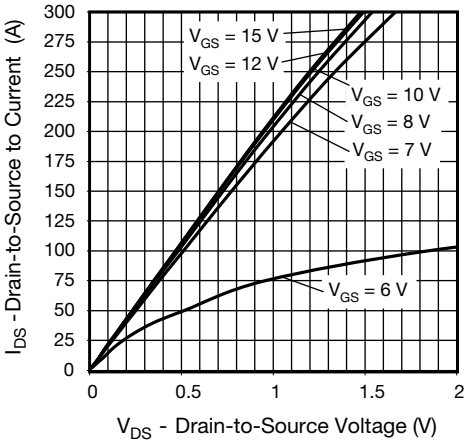


Fig. 3 - Typical Drain-to-Source Current Output Characteristics, at T_J = 25 °C

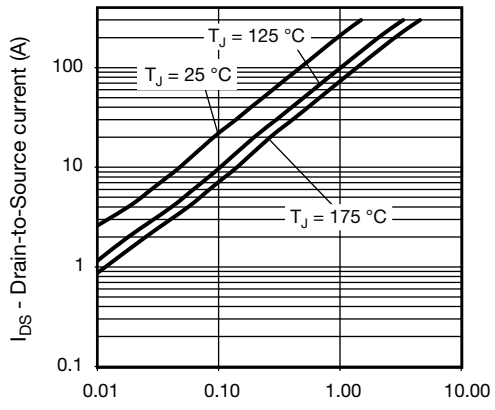


Fig. 2 - Typical Drain-to-Source Current Output Characteristics, V_{GS} = 10 V

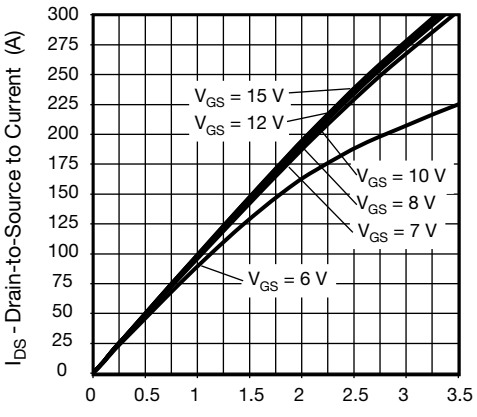


Fig. 4 - Typical Drain-to-Source Current Output Characteristics, at T_J = 125 °C

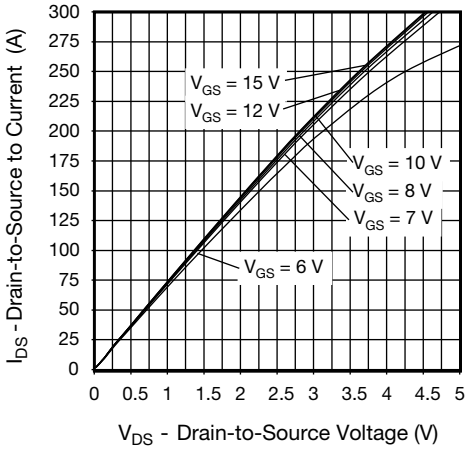


Fig. 5 - Typical Drain-to-Source Current Output Characteristics, at T_J = 175 °C

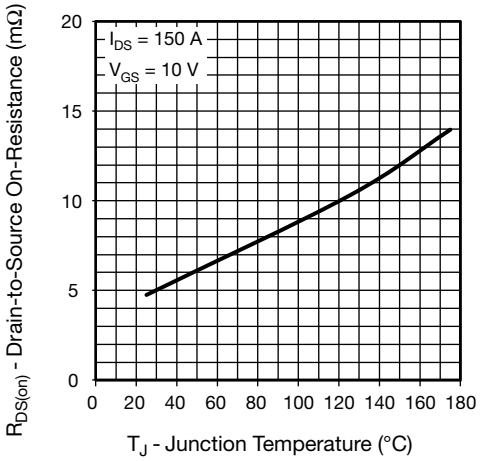


Fig. 6 - Typical Drain-to-Source On-Resistance vs. Temperature

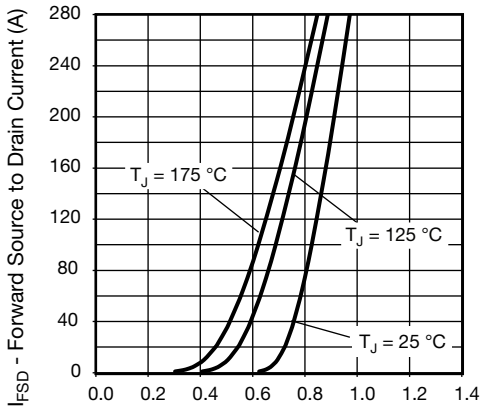


Fig. 7 - Typical Body Diode Forward Voltage Drop Characteristics

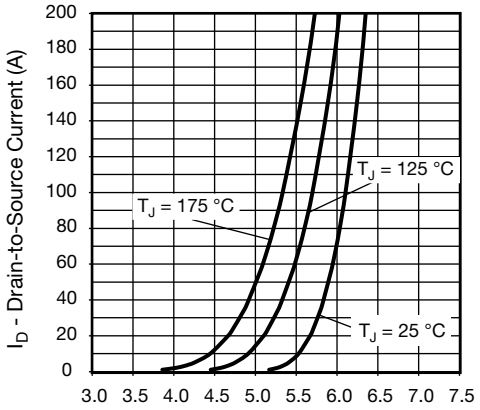


Fig. 8 - Typical MOSFET Transfer Characteristics

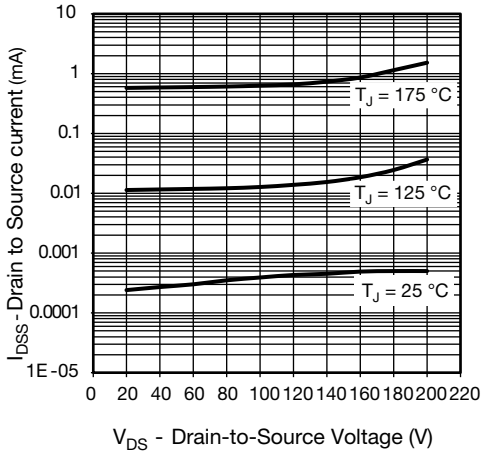


Fig. 9 - Typical MOSFET Zero Gate Voltage Drain Current

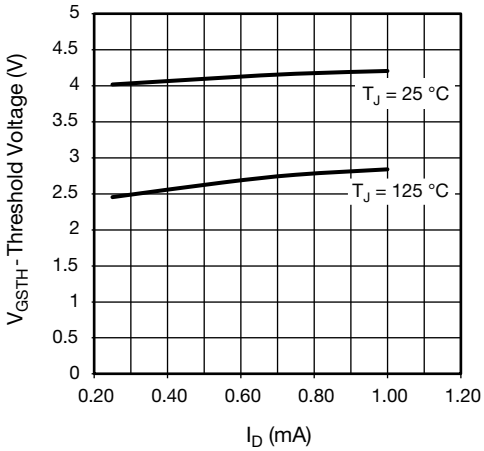


Fig. 10 - Typical MOSFET Threshold Voltage

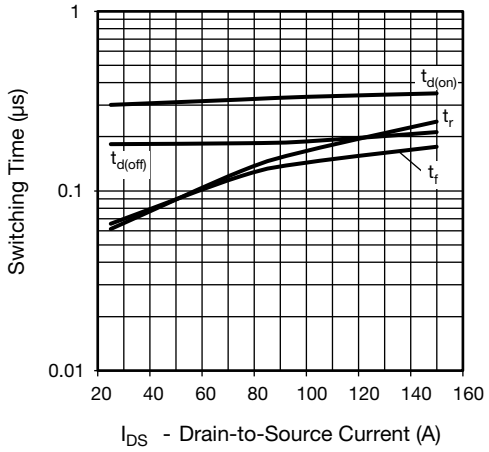


Fig. 11 - Typical MOSFET Switching Time vs. I_{DS},
T_J =125 °C, V_{DD} = 120 V, V_{GS} = 10 V, L = 500 µH, R_g = 5 Ω
Diode Used: 20CZU02

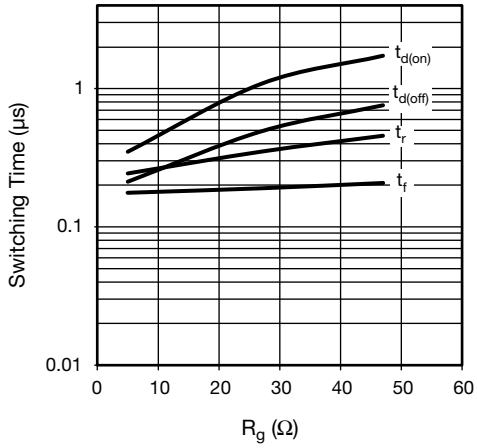


Fig. 12 - Typical MOSFET Switching Time vs. R_g,
T_J =125 °C, I_{DS} = 150 A, V_{DD} = 120 V, V_{GS} = 10 V, L = 500 µH
Diode Used: 20CZU02

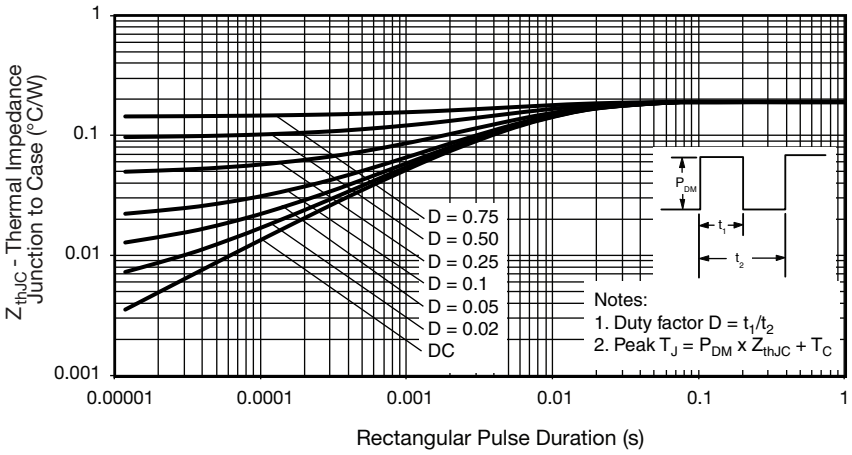


Fig. 13 - Maximum Thermal Impedance Z_{thJC} Characteristics, MOSFET

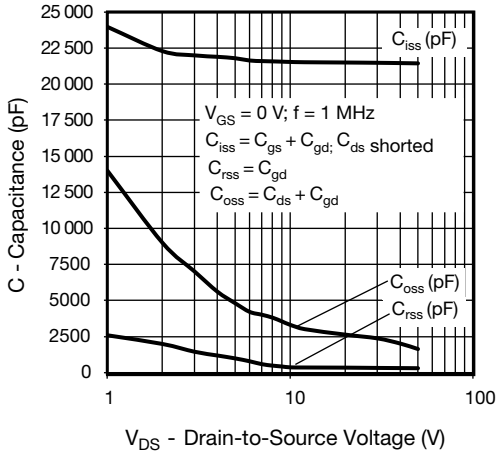


Fig. 14 - Typical Capacitance vs. Drain-to-Source Voltage

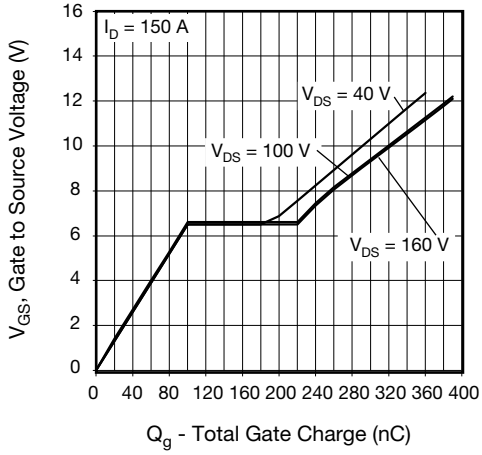


Fig. 15 - Typical Gate Charge vs. Gate-to-Source Voltage

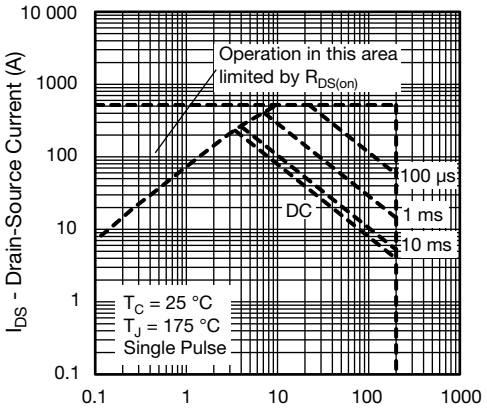


Fig. 16 - Maximum Safe Operating Area

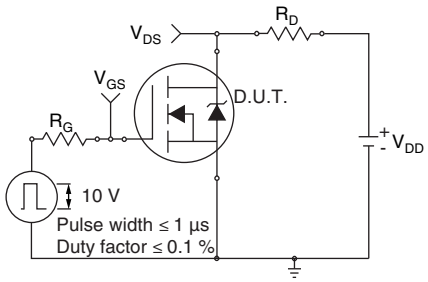


Fig. 17 a - Switching Time Test Circuit

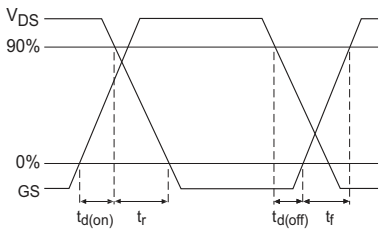
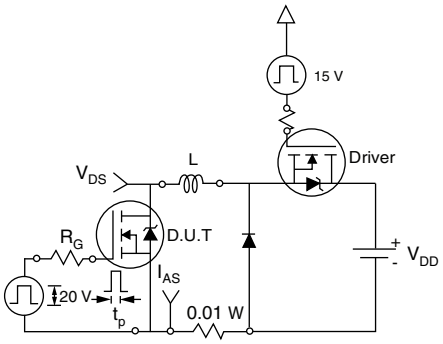


Fig. 17 b - Switching Time Waveform



18 a - Unclamped Inductive Test Circuit

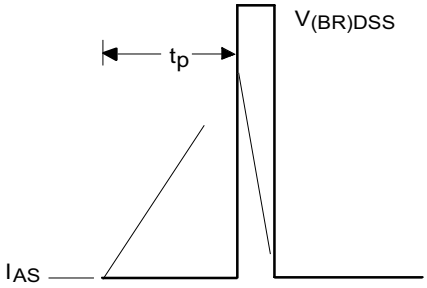


Fig. 18 b - Unclamped Inductive Waveform

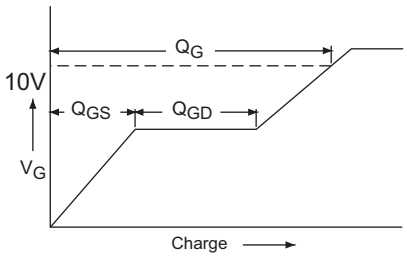


Fig. 19 a - Basic Gate Charge Waveform

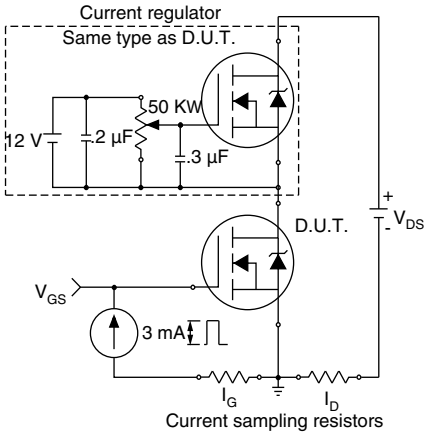


Fig. 19 b - Gate Charge Test Circuit

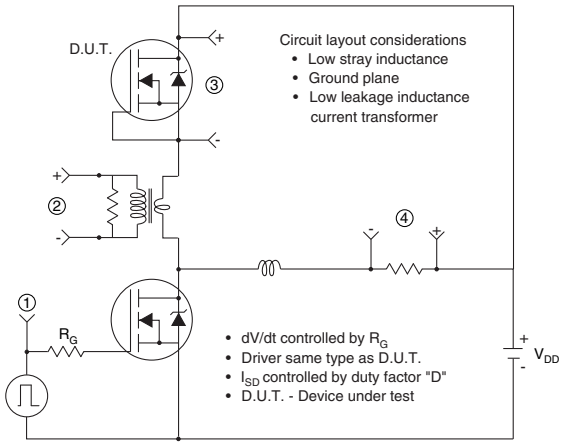
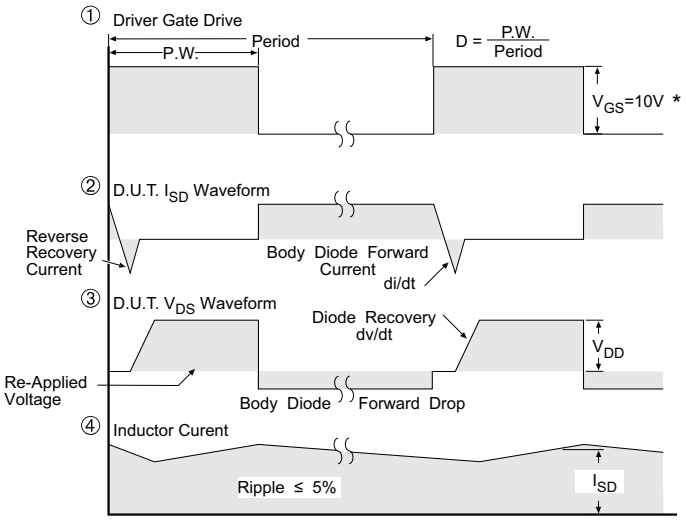


Fig. 19 c - Peak Diode Recovery dV/dt Test Circuit



* V_{GS} = 5V for Logic Level Devices

Fig. 20 - For N-Channel Power MOSFETs

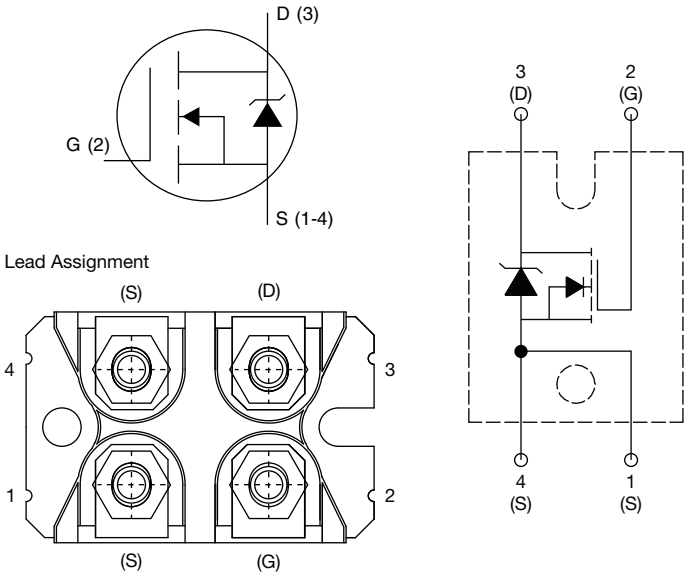
ORDERING INFORMATION TABLE

Device code

VS-	F	C	220	S	A	20
1	2	3	4	5	6	7

- 1 - Vishay Semiconductors product
- 2 - MOSFET module
- 3 - MOSFET die generation
- 4 - Current rating (220 = 220 A)
- 5 - S = single switch
- 6 - Package indicator SOT-227
- 7 - Voltage rating (20 = 200 V)

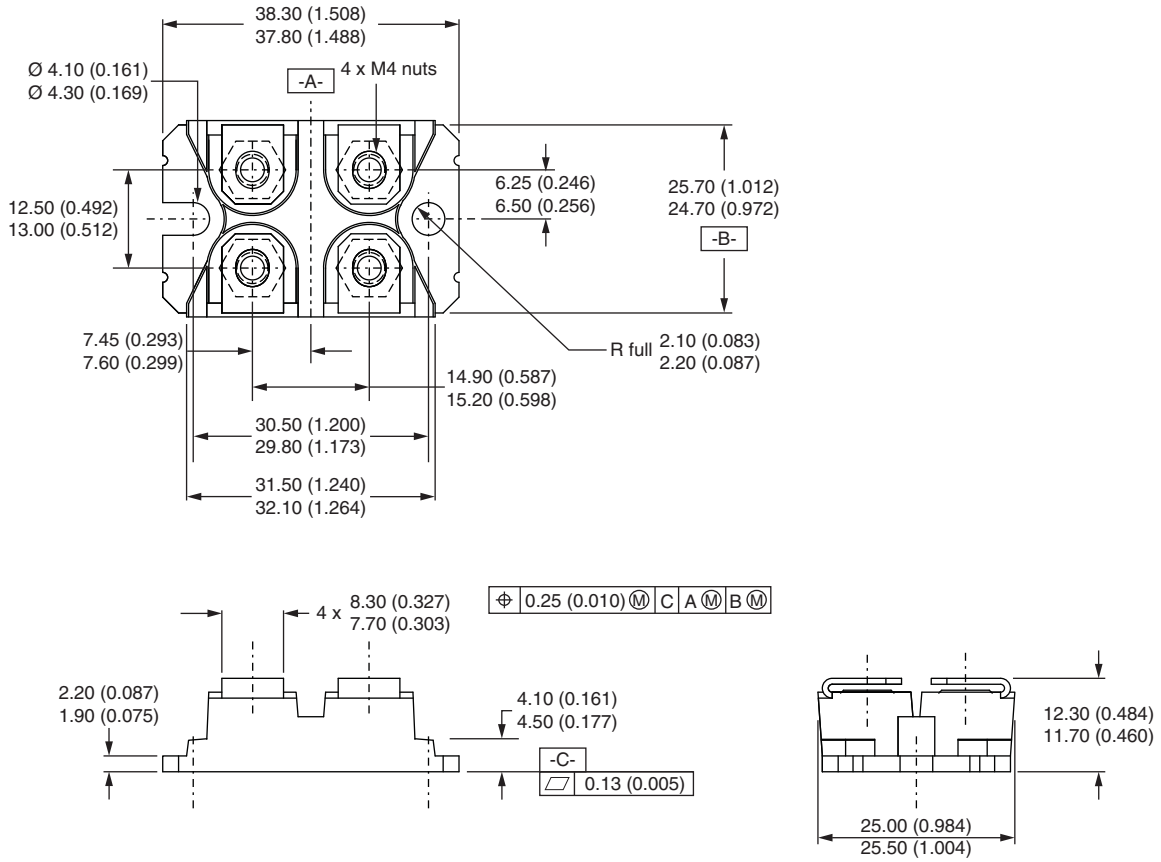
CIRCUIT CONFIGURATION

CIRCUIT	CIRCUIT CONFIGURATION CODE	CIRCUIT DRAWING
Single switch	S	

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

SOT-227 Generation II

DIMENSIONS in millimeters (inches)



Note

- Controlling dimension: millimeter

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