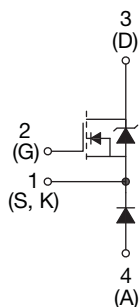


SOT-227 Power Module

High Side Chopper - Power MOSFET, 100 A



SOT-227



FEATURES

MOSFET

- 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


RoHS
COMPLIANT

CHOPPER DIODE

- Low forward voltage drop
- Ultrafast, soft reverse recovery, with high operating junction temperature (T_J max. = 175 °C)
- UL approved file E78996 
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

PRIMARY CHARACTERISTICS	
MOSFET	
V_{DSS}	200 V
$R_{DS(on)}$	9.6 mΩ
I_D at 97 °C	80 A
Type	Modules - MOSFET
Package	SOT-227
CHOPPER DIODE	
I_F at 90 °C	64 A
t_{rr}	33 ns

ABSOLUTE MAXIMUM RATINGS				
PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
MOSFET				
Drain to source voltage	V_{DSS}		200	V
Continuous drain current V_{GS} at 10 V	I_D	$T_C = 25\text{ °C}$	108	A
		$T_C = 90\text{ °C}$	83	
Pulsed drain current	$I_{DM}^{(1)}$		170	
Power dissipation	P_D	$T_C = 25\text{ °C}$	405	W
		$T_C = 90\text{ °C}$	229	
Gate to source voltage	V_{GS}		± 30	V
Single pulse avalanche energy	$E_{AS}^{(2)}$		600	mJ
Avalanche current	$I_{AR}^{(3)}$		50	A
Repetitive avalanche energy	$E_{AR}^{(3)}$		300	mJ
CHOPPER DIODE				
Cathode to anode voltage	V_R		200	V
Continuous forward current	I_F	$T_C = 25\text{ °C}$	92	A
		$T_C = 90\text{ °C}$	64	
Maximum peak one cycle non-repetitive surge current	I_{FSM}		280	A
Maximum power dissipation, chopper diode	P_D	$T_C = 90\text{ °C}$	79	W
MODULE				
Operating junction temperature range	T_J		-55 to +175	°C
Storage temperature range	T_{Stg}		-55 to +175	
RMS insulation voltage	V_{ISO}	Any terminal to case, $t = 1\text{ min}$	2500	V

Notes

- Repetitive rating; pulse width limited by maximum junction temperature starting $T_J = 25\text{ °C}$
- Limited by T_J max., starting $T_J = 25\text{ °C}$, $L = 0.23\text{ mH}$, $R_g = 25\text{ Ω}$, $I_{AS} = 72\text{ A}$, $V_{GS} = 10\text{ V}$. Part not recommended for use above this value
- Repetitive rating; pulse width limited by maximum junction temperature starting $T_J = 25\text{ °C}$, $L = 0.23\text{ mH}$, $R_g = 25\text{ Ω}$, $V_{GS} = 10\text{ V}$, duty cycle 1 %

**THERMAL - MECHANICAL SPECIFICATIONS**

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNITS
Junction to case thermal resistance	R_{thJC}	-	-	0.37	°C/W
MOSFET Chopper Diode		-	-	1.08	
Case to sink, flat greased surface (heatsink compound thermal conductivity = 1 W/mK)	R_{thCS}	-	0.10	-	
Mounting torque		Torque to terminal		1.1 (9.7)	Nm (lbf.in)
		Torque to heatsink		1.8 (15.9)	Nm (lbf.in)
Approximate module weight		-	30	-	g

ELECTRICAL CHARACTERISTICS ($T_J = 25\text{ °C}$ unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
MOSFET						
Drain-to-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 500\text{ }\mu\text{A}$	200	-	-	V
Breakdown voltage temperature coefficient	$\Delta V_{(BR)DSS}/\Delta T_J$	Reference to $25\text{ °C}, I_D = 1\text{ mA}$	-	0.21	-	V/°C
Static drain-to-source on-resistance	$R_{DS(on)}^{(1)}$	$V_{GS} = 10\text{ V}, I_D = 80\text{ A}$	-	9.6	14.0	mΩ
Gate threshold voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	2.7	4.1	5.5	V
		$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}, T_J = 125\text{ °C}$	-	2.6	-	
Forward transconductance	g_{fs}	$V_{DS} = 20\text{ V}, I_D = 80\text{ A}$	-	200	-	S
Drain-to-source leakage current	I_{DSS}	$V_{DS} = 200\text{ V}, V_{GS} = 0\text{ V}$	-	0.6	25	μA
		$V_{DS} = 200\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ °C}$	-	20	500	
		$V_{DS} = 200\text{ V}, V_{GS} = 0\text{ V}, T_J = 175\text{ °C}$	-	1	5	mA
Gate-to-source forward leakage	I_{GSS}	$V_{GS} = 20\text{ V}$	-	-	120	nA
Gate-to-source reverse leakage		$V_{GS} = -20\text{ V}$	-	-	-120	
Total gate charge	Q_g	$I_D = 80\text{ A}, V_{DS} = 100\text{ V}, V_{GS} = 10\text{ V},$ see fig. 15 and fig. 28 ⁽¹⁾	-	161	-	nC
Gate-to-source charge	Q_{gs}		-	54	-	
Gate-to-drain ("Miller") charge	Q_{gd}		-	52	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 100\text{ V}, I_D = 80\text{ A}, R_g = 2.5\text{ }\Omega,$ $L = 500\text{ }\mu\text{H}$	-	148	-	ns
Rise time	t_r		-	215	-	
Turn-off delay time	$t_{d(off)}$		-	114	-	
Fall time	t_f		-	125	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 100\text{ V}, I_D = 80\text{ A}, R_g = 2.5\text{ }\Omega,$ $L = 500\text{ }\mu\text{H}, T_J = 125\text{ °C}$	-	132	-	ns
Rise time	t_r		-	215	-	
Turn-off delay time	$t_{d(off)}$		-	124	-	
Fall time	t_f		-	108	-	
Internal source inductance	L_S	Between lead and center of die contact	-	3	-	nH
Input capacitance	C_{iss}	$V_{GS} = 0\text{ V}, V_{DS} = 50\text{ V}, f = 1.0\text{ MHz},$ see fig. 14	-	10 720	-	pF
	C_{oss}		-	810	-	
	C_{rss}		-	160	-	
Drain to Case Capacitance	C_{d-cs}	$V_{GS} = 0\text{ V}, (G-S \text{ shorted}); f = 1\text{ MHz}$	-	50	-	
CHOPPER DIODE						
Diode reverse breakdown voltage	V_{BR}	$I_R = 100\text{ }\mu\text{A}$	200	-	-	V
Forward voltage drop	V_{FM}	$I_F = 30\text{ A}$	-	0.94	1.08	
		$I_F = 30\text{ A}, T_J = 125\text{ °C}$	-	0.8	-	
		$I_F = 30\text{ A}, T_J = 175\text{ °C}$	-	0.74	-	
Reverse leakage current	I_{RM}	$V_R = V_R \text{ rated}$	-	1	50	μA
		$V_R = V_R \text{ rated}, T_J = 125\text{ °C}$	-	7	-	
		$V_R = V_R \text{ rated}, T_J = 175\text{ °C}$	-	0.15	1	mA
Junction capacitance	C_T	$V_R = 200\text{ V}$	-	119	-	pF

Note

⁽¹⁾ Pulse width $\leq 400\text{ }\mu\text{s}$, duty cycle $\leq 2\%$

SOURCE-DRAIN RATINGS AND CHARACTERISTICS ($T_J = 25\text{ }^{\circ}\text{C}$ unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
MOSFET						
Continuous source current (body diode)	I_S	MOSFET symbol showing the integral reverse p-n junction diode	-	-	108	A
Pulsed source current (body diode)	$I_{SM}^{(1)}$		-	-	170	
Body diode forward voltage	$V_{SD}^{(2)}$	$T_J = 25\text{ }^{\circ}\text{C}$, $I_S = 80\text{ A}$, $V_{GS} = 0\text{ V}$	-	0.88	1.02	V
		$T_J = 125\text{ }^{\circ}\text{C}$, $I_S = 80\text{ A}$, $V_{GS} = 0\text{ V}$	-	0.76	-	
		$T_J = 175\text{ }^{\circ}\text{C}$, $I_S = 80\text{ A}$, $V_{GS} = 0\text{ V}$	-	0.70	-	
Reverse recovery time	t_{rr}	$T_J = 25\text{ }^{\circ}\text{C}$, $I_F = 30\text{ A}$, $dI_F/dt = 100\text{ A}/\mu\text{s}$, $V_R = 100\text{ V}^{(2)}$	-	145	-	ns
Reverse recovery current	I_{rr}		-	11	-	A
Reverse recovery charge	Q_{rr}		-	790	-	nC
Reverse recovery time	t_{rr}	$T_J = 125\text{ }^{\circ}\text{C}$, $I_F = 30\text{ A}$, $dI_F/dt = 100\text{ A}/\mu\text{s}$, $V_R = 100\text{ V}^{(2)}$	-	170	-	ns
Reverse recovery current	I_{rr}		-	13.5	-	A
Reverse recovery charge	Q_{rr}		-	1140	-	nC
Forward turn-on time	t_{on}	Intrinsic turn-on time is negligible (turn-on is dominated by LS + LD)				

DYNAMIC RECOVERY CHARACTERISTICS ($T_J = 25\text{ }^{\circ}\text{C}$ unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
CHOPPER DIODE						
Reverse recovery time	t_{rr}	$T_J = 25\text{ }^{\circ}\text{C}$, $I_F = 30\text{ A}$, $dI_F/dt = 200\text{ A}/\mu\text{s}$, $V_R = 100\text{ V}^{(2)}$	-	33	-	ns
Reverse recovery current	I_{rr}		-	3.5	-	A
Reverse recovery charge	Q_{rr}		-	59	-	nC
Reverse recovery time	t_{rr}	$T_J = 25\text{ }^{\circ}\text{C}$, $I_F = 30\text{ A}$, $dI_F/dt = 200\text{ A}/\mu\text{s}$, $V_R = 100\text{ V}^{(2)}$	-	59	-	ns
Reverse recovery current	I_{rr}		-	8.3	-	A
Reverse recovery charge	Q_{rr}		-	238	-	nC

Notes

- (1) Repetitive rating, pulse width limited by maximum junction temperature (see fig. 27)
(2) Pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$

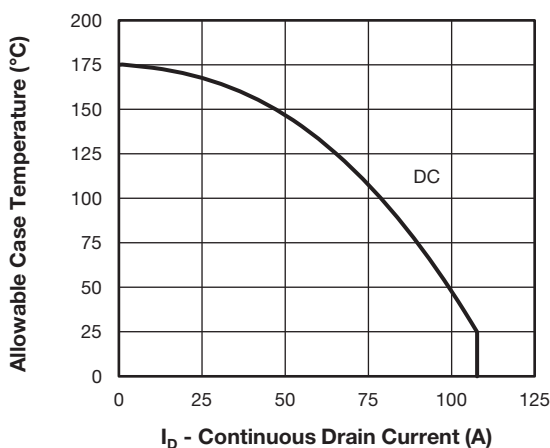


Fig. 1 - Maximum MOSFET Drain-Source Current vs. Case Temperature

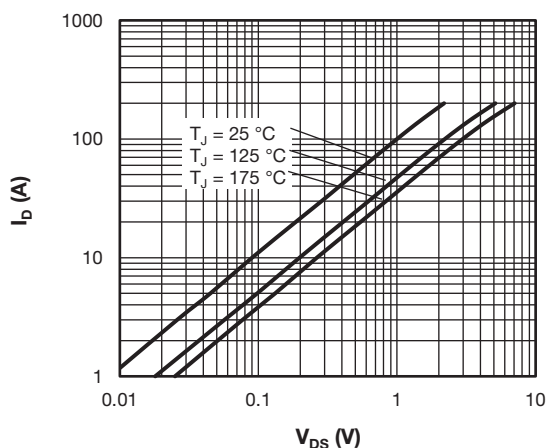


Fig. 2 - Typical MOSFET Output Characteristics, $V_{GS} = 10\text{ V}$

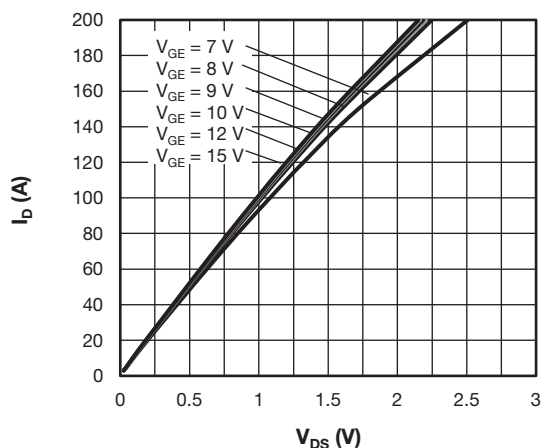


Fig. 3 - Typical MOSFET Output Characteristics,
at $T_J = 25\text{ }^{\circ}\text{C}$

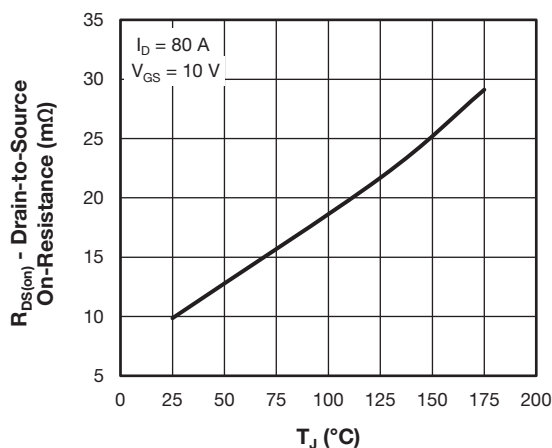


Fig. 6 - Typical Drain to Source On-Resistance vs. Temperature

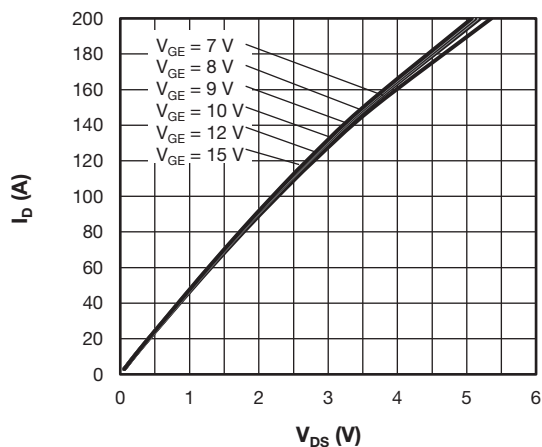


Fig. 4 - Typical MOSFET Output Characteristics,
at $T_J = 125\text{ }^{\circ}\text{C}$

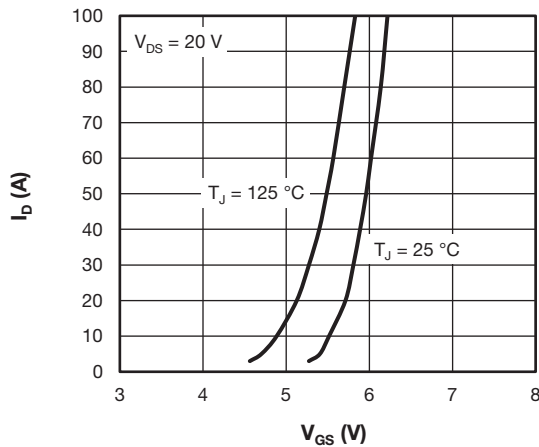


Fig. 7 - Typical MOSFET Transfer Characteristics

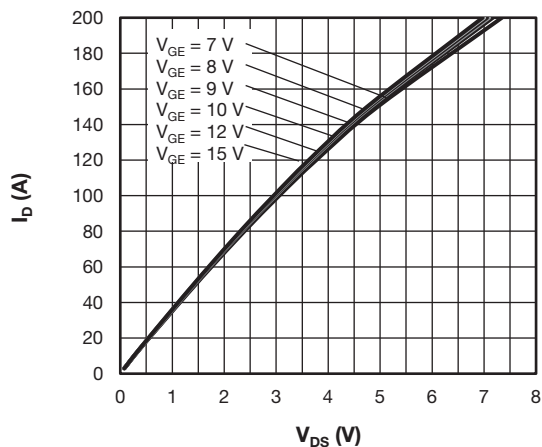


Fig. 5 - Typical MOSFET Output Characteristics,
at $T_J = 175\text{ }^{\circ}\text{C}$

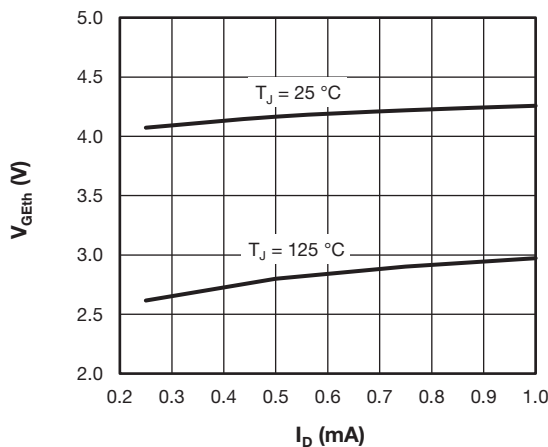


Fig. 8 - Typical MOSFET Gate Threshold Voltage

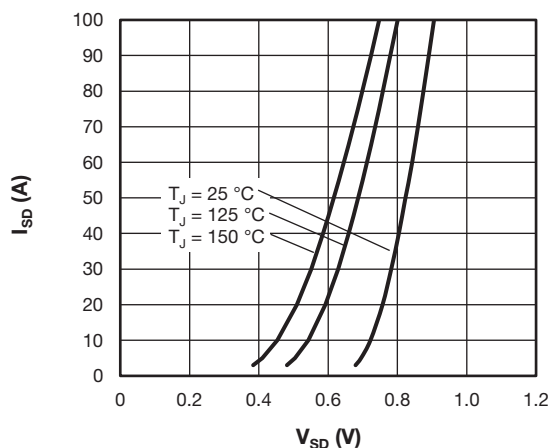


Fig. 9 - Typical MOSFET Body Diode Forward Current Characteristics

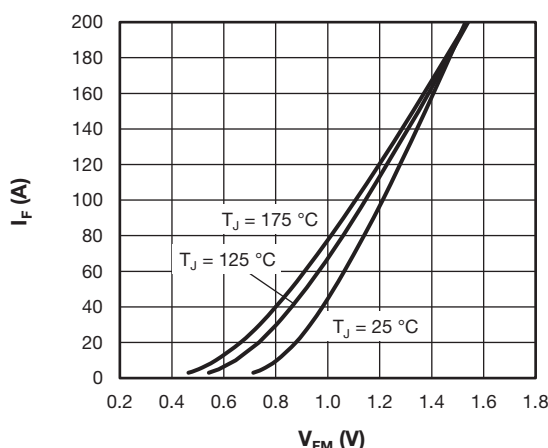


Fig. 12 - Typical Chopper Diode Forward Characteristics

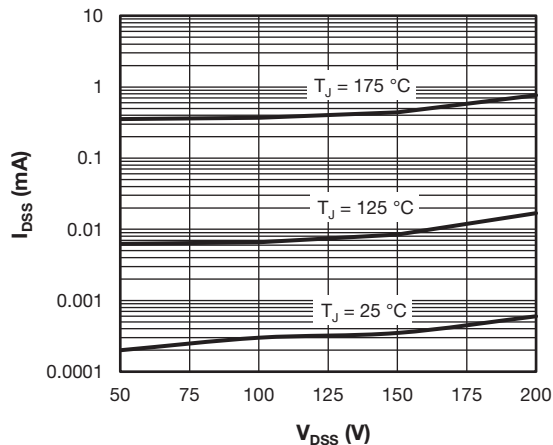


Fig. 10 - Typical MOSFET Zero Gate Voltage Drain Current

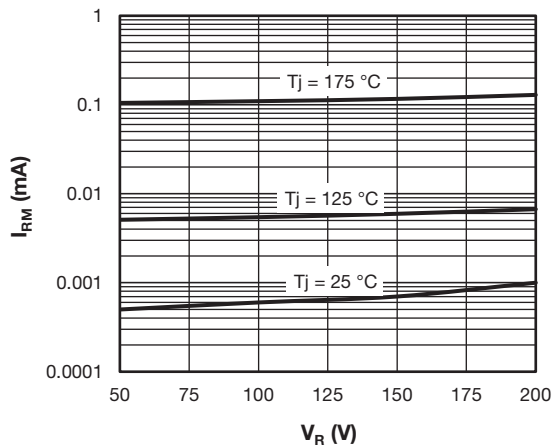


Fig. 13 - Typical Chopper Diode Reverse Leakage Current

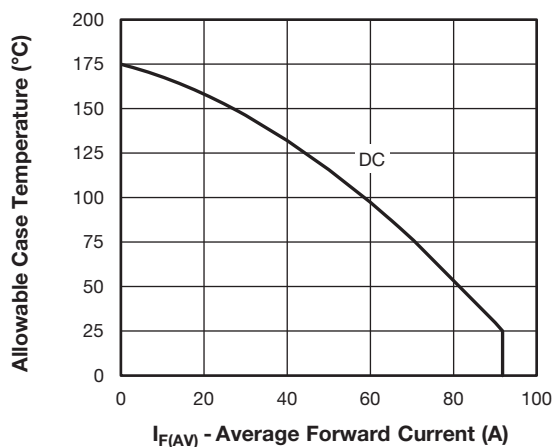
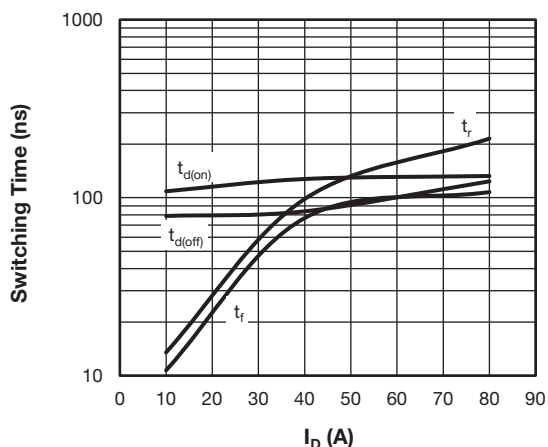


Fig. 11 - Maximum Allowable Forward Current vs. Case Temperature


Fig. 14 - Typical MOSFET Switching Time vs. I_D
 $T_J = 125\text{ }^{\circ}\text{C}$, $V_{DD} = 100\text{ V}$, $R_g = 2.5\text{ }\Omega$, $V_{GS} = 10\text{ V}$, $L = 500\text{ }\mu\text{H}$

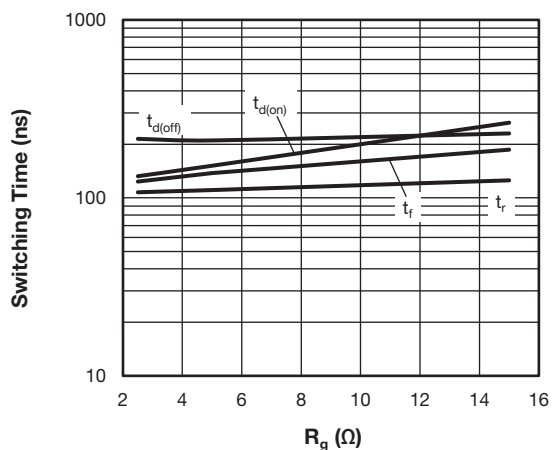


Fig. 15 - Typical MOSFET Switching Time vs. R_g
 $T_J = 125^\circ\text{C}$, $V_{DD} = 100\text{ V}$, $I_D = 80\text{ A}$, $L = 500\text{ }\mu\text{H}$

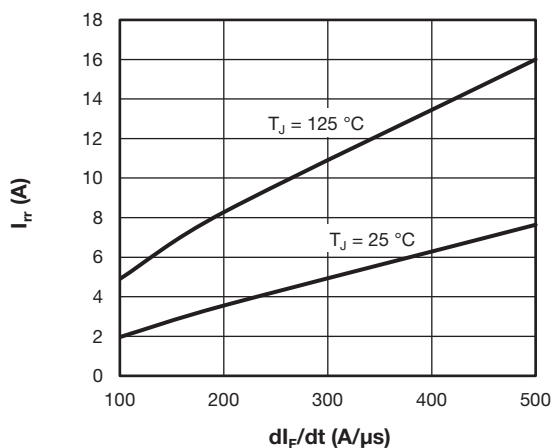


Fig. 17 - Typical Chopper Diode Reverse Recovery Current vs. di_F/dt
 $V_{rr} = 100\text{ V}$, $I_F = 30\text{ A}$

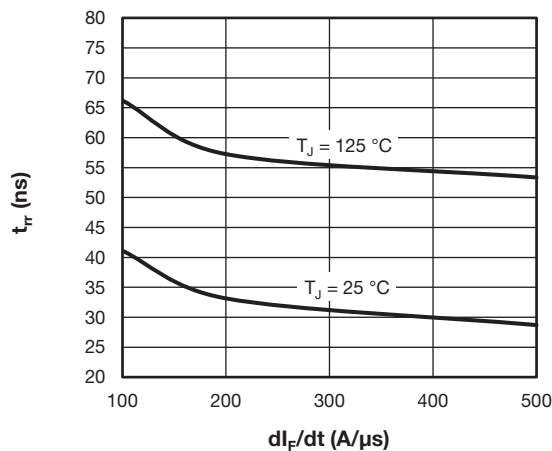


Fig. 16 - Typical Chopper Diode Reverse Recovery Time vs. di_F/dt
 $V_{rr} = 100\text{ V}$, $I_F = 30\text{ A}$

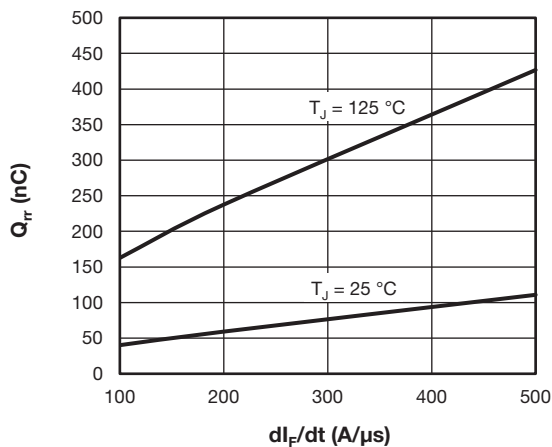


Fig. 18 - Typical Chopper Diode Reverse Recovery Charge vs. di_F/dt
 $V_{rr} = 100\text{ V}$, $I_F = 30\text{ A}$

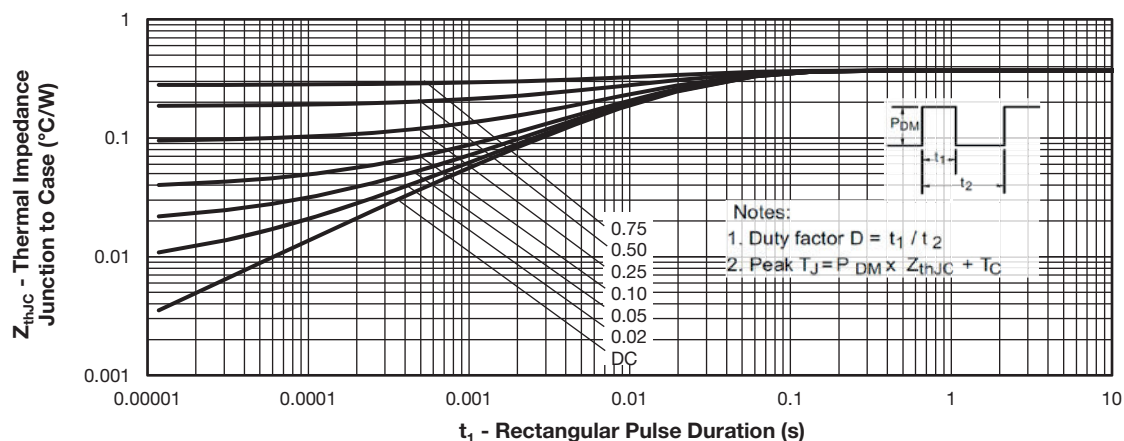


Fig. 19 - Maximum Thermal Impedance Z_{thJC} Characteristics - (MOSFET)

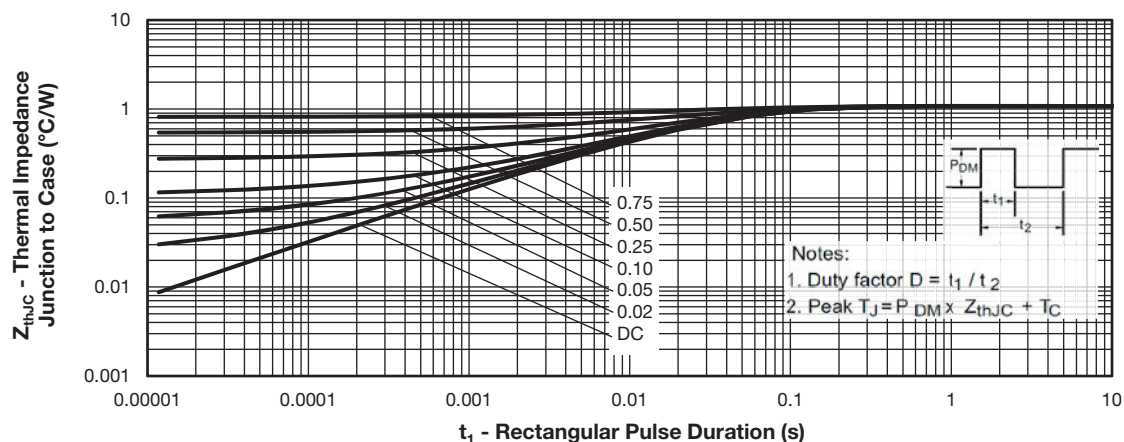
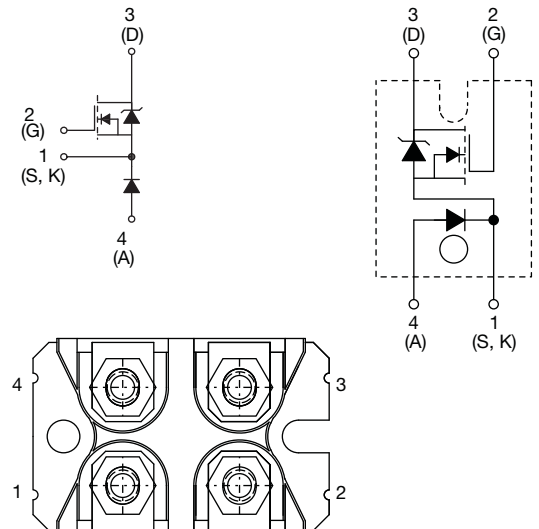


Fig. 20 - Maximum Thermal Impedance Characteristics (Chopper Diode)

CIRCUIT CONFIGURATION		
CIRCUIT	CIRCUIT CONFIGURATION CODE	CIRCUIT DRAWING
High side chopper	N	



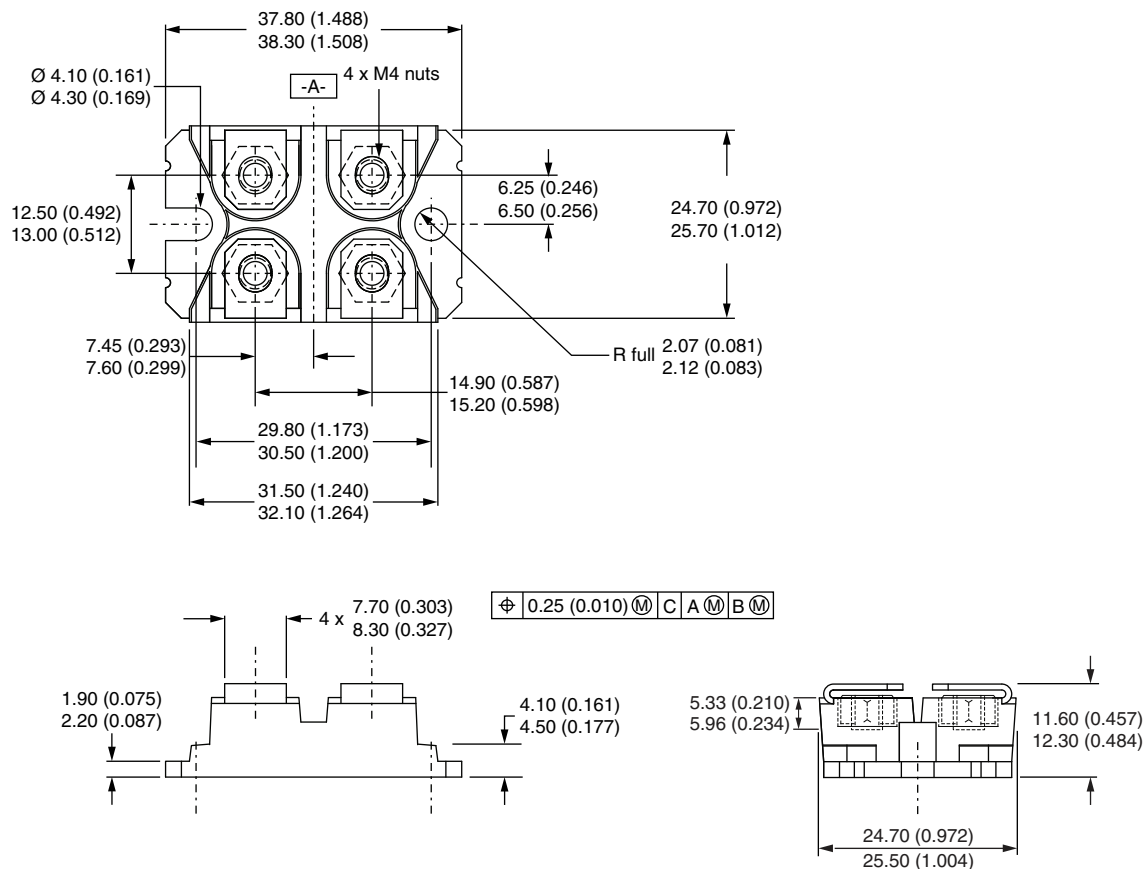
ORDERING INFORMATION TABLE

Device code	VS-	F	C	80	N	A	20
	1	2	3	4	5	6	7
1	- Vishay Semiconductors product						
2	- MOSFET module						
3	- MOSFET die generation						
4	- Current rating (80 = 80 A)						
5	- N = high side chopper						
6	- Package indicator SOT-227						
7	- Voltage rating (20 = 200 V)						

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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