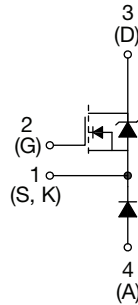


SOT-227 Power Module High Side Chopper - Power MOSFET, 100 A



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

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


**RoHS
COMPLIANT**

PRODUCT SUMMARY	
MOSFET	
V_{DSS}	200 V
$R_{DS(on)}$	0.0096 Ω
I_D at 97 °C	80 A
Type	Modules - MOSFET
Package	SOT-227
CHOPPER DIODE	
I_F at 90 °C	64 ns
t_{rr}	33 ns

MAJOR RATINGS AND CHARACTERISTICS				
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 (1)	$T_C = 25$ °C	108	A
		$T_C = 90$ °C	83	
Pulsed drain current	I_{DM} (2)		170	
Power dissipation	P_D	$T_C = 25$ °C	405	W
		$T_C = 90$ °C	229	
Gate to source voltage	V_{GS}		± 30	V
Single pulse avalanche energy	E_{AS} (3)		600	mJ
Avalanche current	I_{AR} (4)		50	A
Repetitive avalanche energy	E_{AR} (4)		300	mJ
CHOPPER DIODE				
Cathode to anode voltage	V_R		200	V
Continuous forward current	I_F	$T_C = 25$ °C	92	A
		$T_C = 90$ °C	64	
Maximum peak one cycle non-repetitive surge current	I_{FSM}		280	A
Maximum power dissipation, chopper diode	P_D	$T_C = 90$ °C	79	W

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 starting $T_J = 25$ °C
- (3) Limited by T_J max., starting $T_J = 25$ °C, $L = 0.23$ mH, $R_g = 25$ Ω , $I_{AS} = 72$ 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 %



MAJOR RATINGS AND CHARACTERISTICS				
PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
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 min	2500	V

THERMAL - MECHANICAL SPECIFICATIONS							
PARAMETER	SYMBOL		MIN.	TYP.	MAX.	UNITS	
Junction to case thermal resistance	MOSFET	R_{thJC}	-	-	0.37	°C/W	
	Chopper Diode		-	-	1.08		
Case to sink, flat greased surface (heatsink compound thermal conductivity = 1 W/mK)	Module	R_{thCS}	-	0.10	-		
Mounting torque		Torque to terminal	-	-	1.1 (9.7)	Nm (lbf.in)	
		Torque to heatsink	-	-	1.3 (11.5)	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 °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	-		



ELECTRICAL CHARACTERISTICS ($T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
CHOPPER DIODE						
Diode reverse breakdown voltage	V_{BR}	$I_R = 100\ \mu\text{A}$	200	-	-	V
Forward voltage drop	V_{FM}	$I_F = 30\ \text{A}$	-	0.94	1.08	
		$I_F = 30\ \text{A}, T_J = 125\text{ }^\circ\text{C}$	-	0.8	-	
		$I_F = 30\ \text{A}, T_J = 175\text{ }^\circ\text{C}$	-	0.74	-	
Reverse leakage current	I_{RM}	$V_R = V_R\ \text{rated}$	-	1	50	μA
		$V_R = V_R\ \text{rated}, T_J = 125\text{ }^\circ\text{C}$	-	7	-	mA
		$V_R = V_R\ \text{rated}, T_J = 175\text{ }^\circ\text{C}$	-	0.15	1	
Junction capacitance	C_T	$V_R = 200\ \text{V}$	-	119	-	pF

Note(1) Pulse width $\leq 400\ \mu\text{s}$, 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 $\leq 300\ \mu\text{s}$, duty cycle $\leq 2\%$

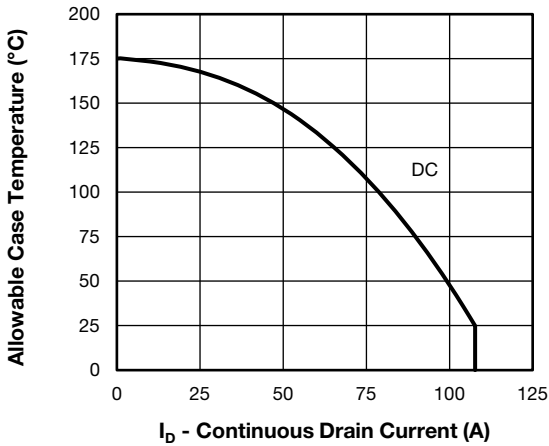


Fig. 1 - Maximum MOSFET Drain-Source Current vs. Case Temperature

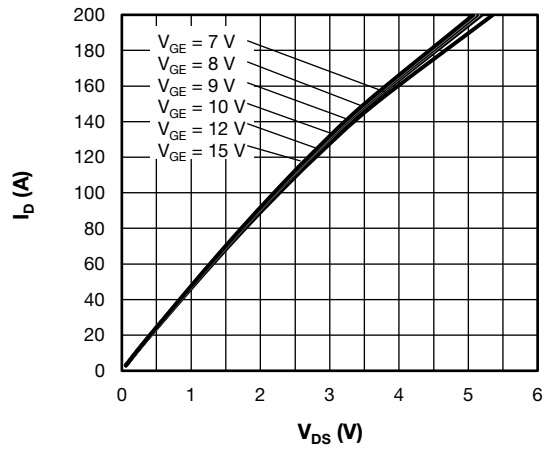


Fig. 4 - Typical MOSFET Output Characteristics, at $T_J = 125\text{ }^\circ\text{C}$

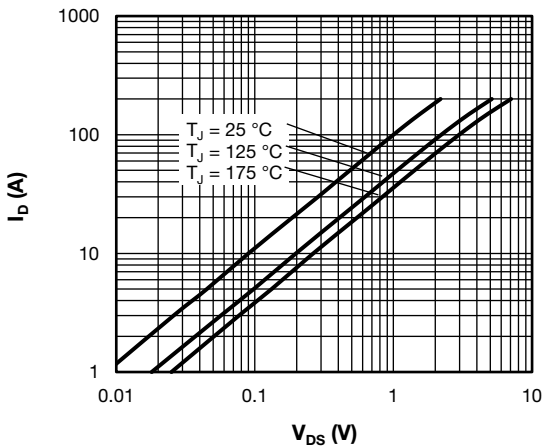


Fig. 2 - Typical MOSFET Output Characteristics, $V_{GS} = 10\text{ V}$

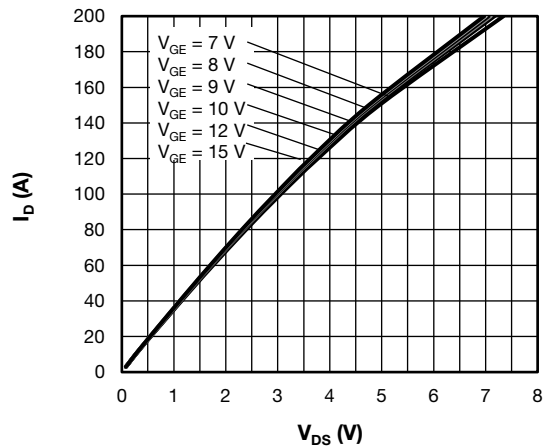


Fig. 5 - Typical MOSFET Output Characteristics, at $T_J = 175\text{ }^\circ\text{C}$

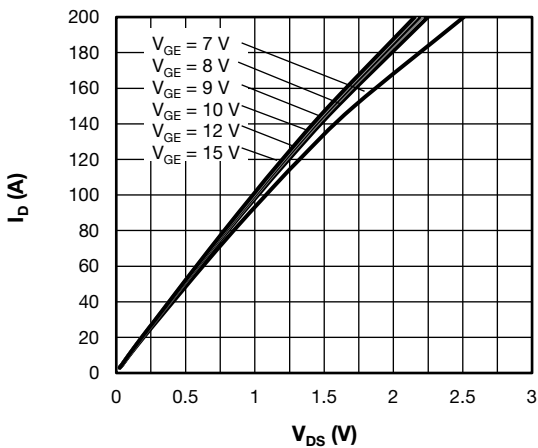


Fig. 3 - Typical MOSFET Output Characteristics, at $T_J = 25\text{ }^\circ\text{C}$

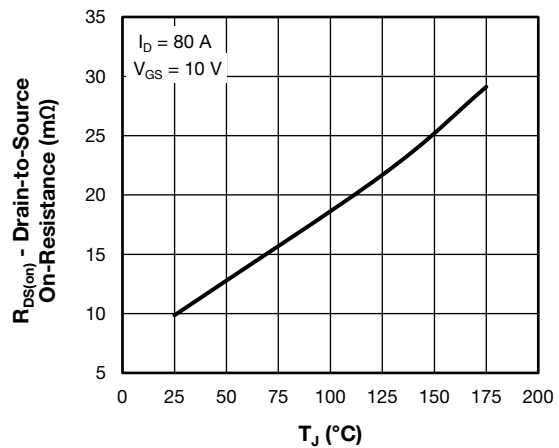


Fig. 6 - Typical Drain to Source On-Resistance vs. Temperature

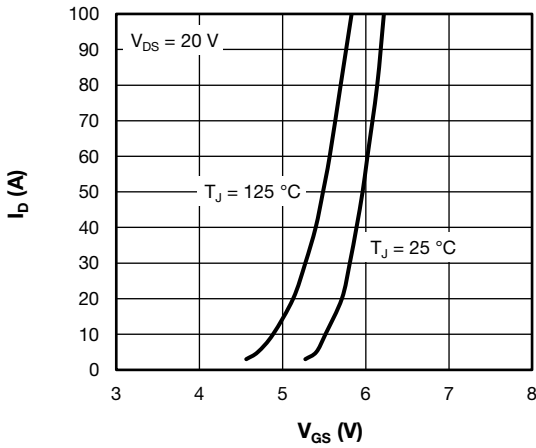


Fig. 7 - Typical MOSFET Transfer Characteristics

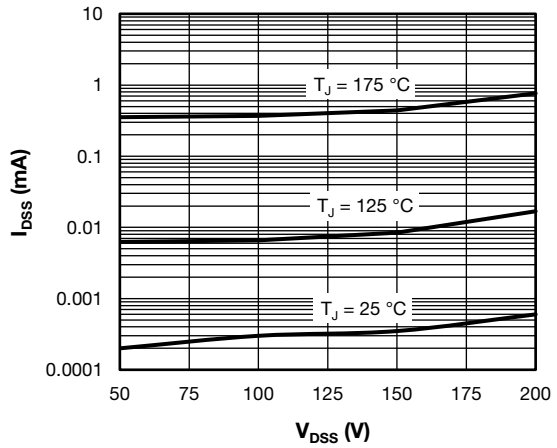


Fig. 10 - Typical MOSFET Zero Gate Voltage Drain Current

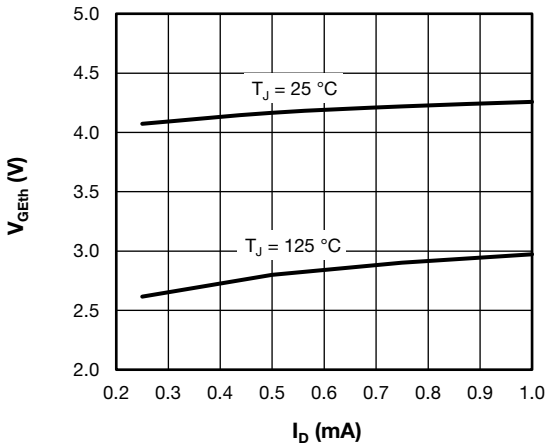


Fig. 8 - Typical MOSFET Gate Threshold Voltage

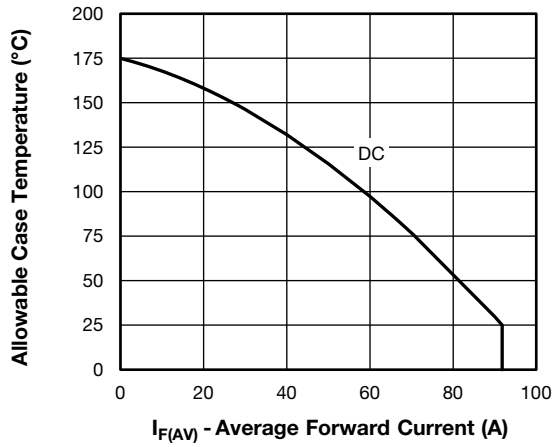


Fig. 11 - Maximum Allowable Forward Current vs. Case Temperature

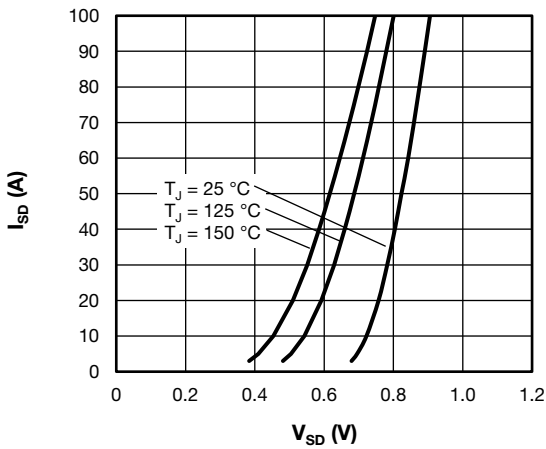


Fig. 9 - Typical MOSFET Body Diode Forward Current Characteristics

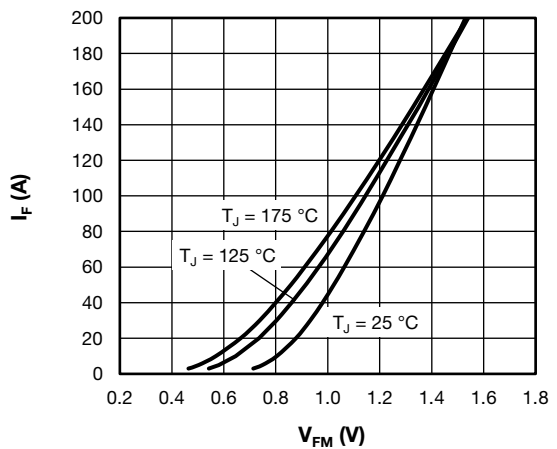


Fig. 12 - Typical Chopper Diode Forward Characteristics

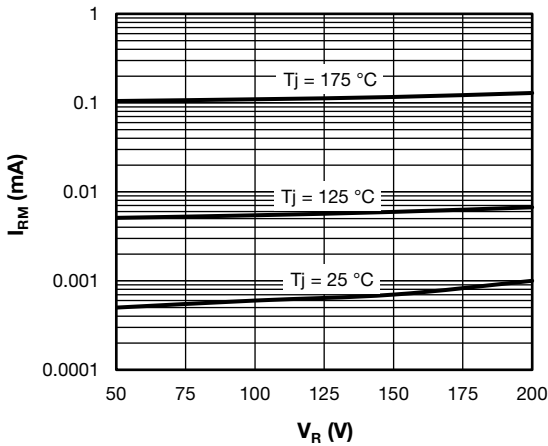


Fig. 13 - Typical Chopper Diode Reverse Leakage Current

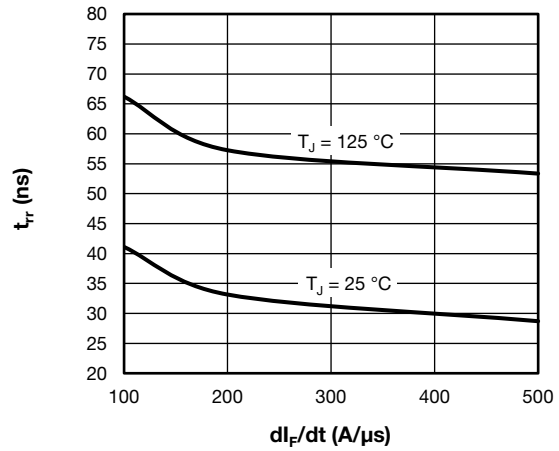


Fig. 16 - Typical Chopper Diode Reverse Recovery Time vs. di_F/dt
 $V_{rr} = 100\text{ V}$, $I_F = 30\text{ A}$

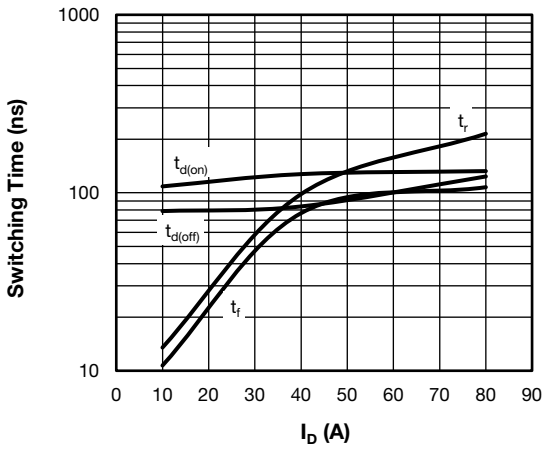


Fig. 14 - Typical MOSFET Switching Time vs. I_D
 $T_J = 125\text{ °C}$, $V_{DD} = 100\text{ V}$, $R_g = 2.5\text{ }\Omega$, $V_{GS} = 10\text{ V}$, $L = 500\text{ }\mu\text{H}$

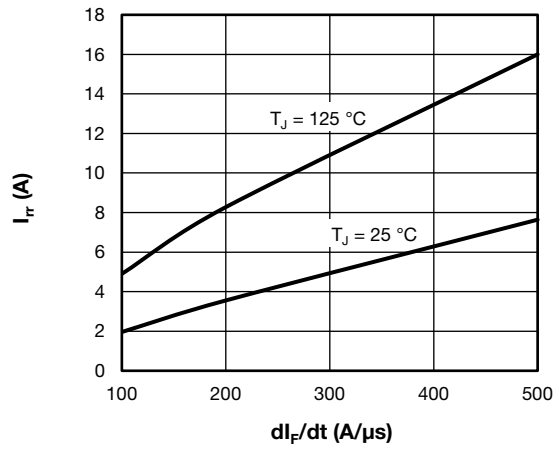


Fig. 17 - Typical Chopper Diode Reverse Recovery Current vs. di_F/dt
 $V_{rr} = 100\text{ V}$, $I_F = 30\text{ A}$

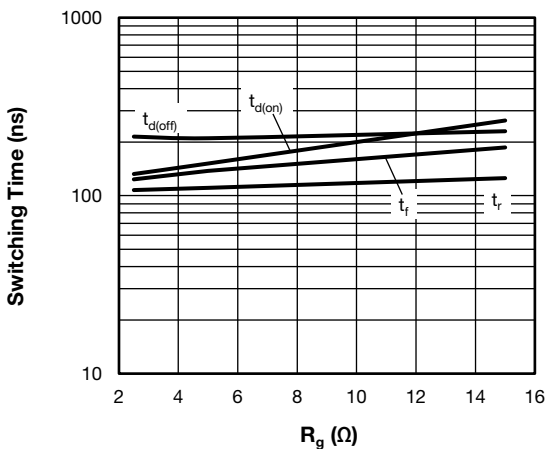


Fig. 15 - Typical MOSFET Switching Time vs. R_g
 $T_J = 125\text{ °C}$, $V_{DD} = 100\text{ V}$, $I_D = 80\text{ A}$, $L = 500\text{ }\mu\text{H}$

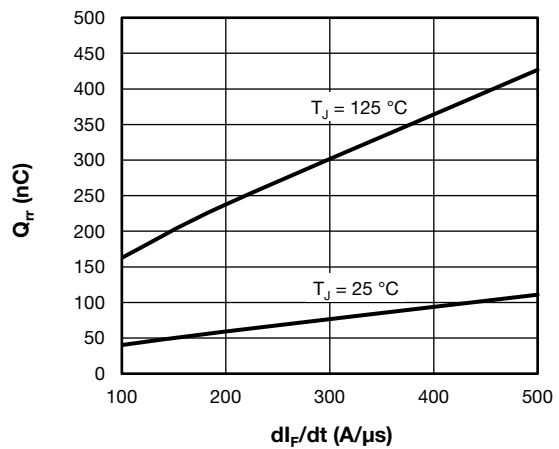


Fig. 18 - Typical Chopper Diode Reverse Recovery Charge vs. di_F/dt
 $V_{rr} = 100\text{ V}$, $I_F = 30\text{ A}$

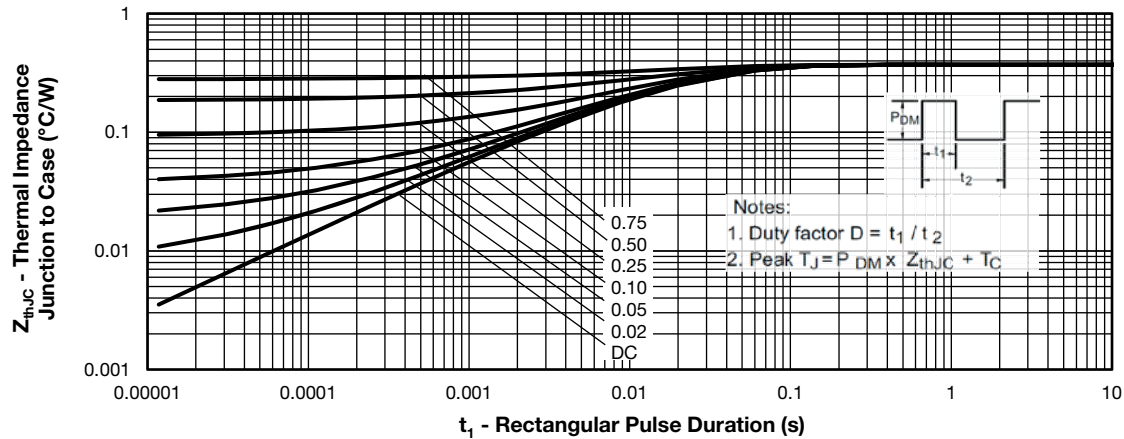


Fig. 19 - Maximum Thermal Impedance Z_{thJC} Characteristics - (MOSFET)

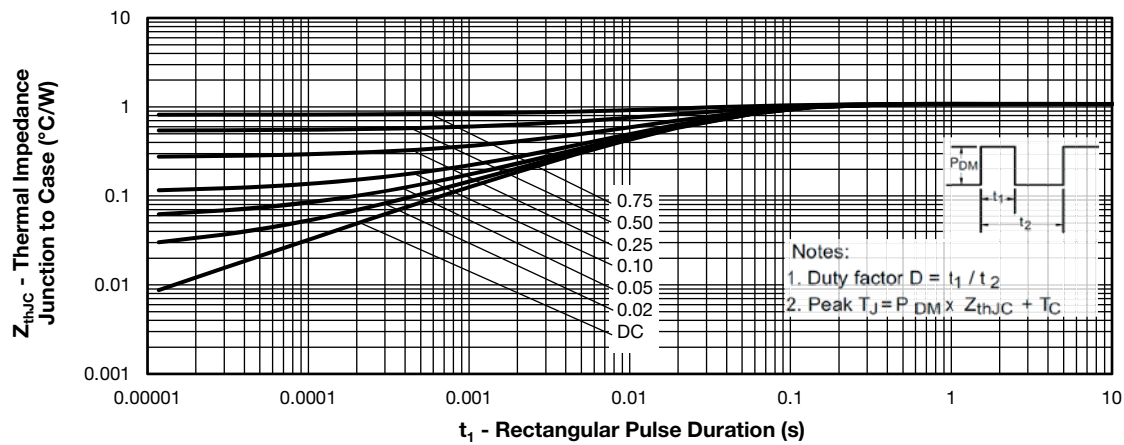


Fig. 20 - Maximum Thermal Impedance Characteristics (Chopper Diode)

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		2		3		4
		5		6		7	

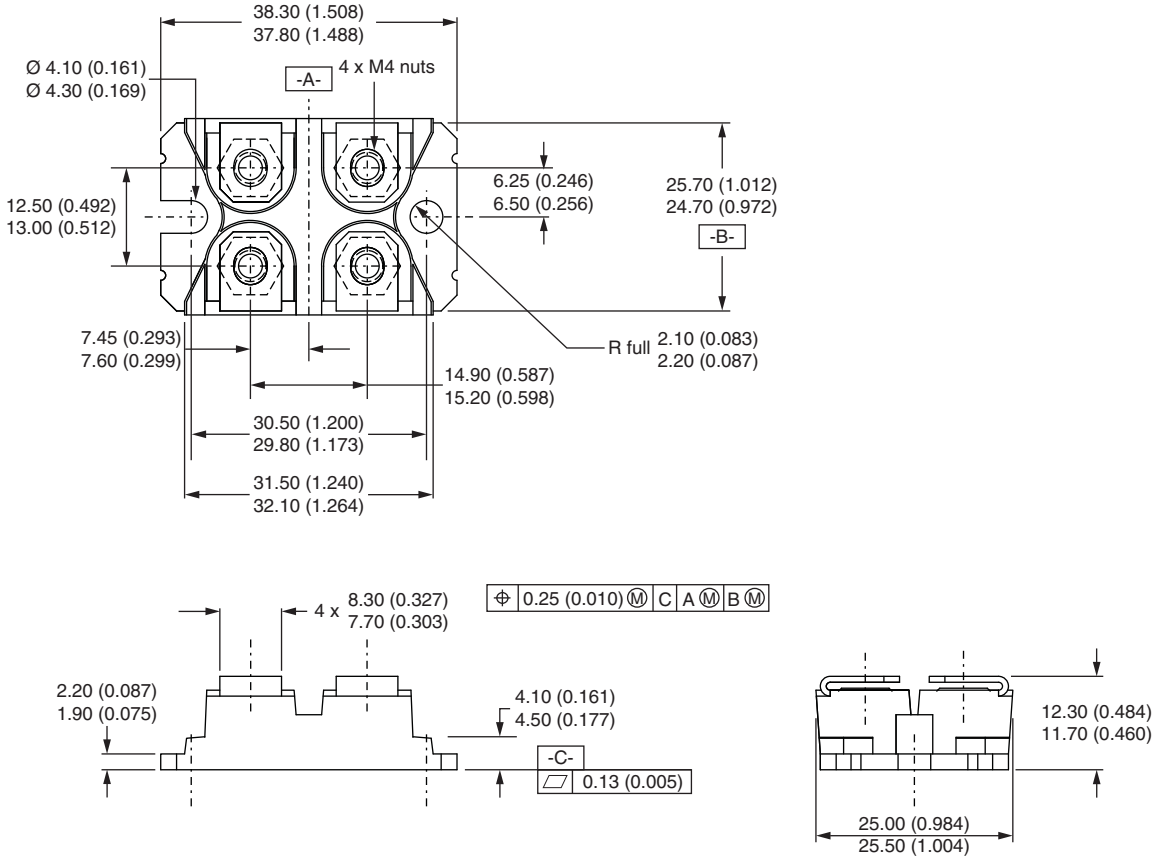
- 1** - Vishay Semiconductors product
- 2** - MOSFET module
- 3** - MOSFET die generation
- 4** - Current rating (80 = 80 A)
- 5** - N = high side chopper
- 6** - Package indicator SOT-227
- 7** - Voltage rating (20 = 200 V)

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



SOT-227 Generation II

DIMENSIONS in millimeters (inches)



Note

- Controlling dimension: millimeter



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