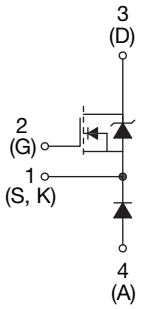
SOT-227 Power Module
High Side Chopper - Power MOSFET, 100 A

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

Pb-free

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 °C	108	A
		T_C = 90 °C	83	
Pulsed drain current	I_{DM} (1)		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} (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 °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	Tc = 90 °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 min	2500	V

Notes

(1) Repetitive rating; pulse width limited by maximum junction temperature starting T_J = 25 °C

(2) 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

(3) 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		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	-	-	1.8 (15.9)	Nm (lbf.in)
Approximate module weight				-	30	-	g

ELECTRICAL CHARACTERISTICS (T_J = 25 °C unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
MOSFET						
Drain-to-source breakdown voltage	$V_{(BR)DSS}$	V_{GS} = 0 V, I_D = 500 µA	200	-	-	V
Breakdown voltage temperature coefficient	$\Delta V_{(BR)DSS}/\Delta T_J$	Reference to 25 °C, I_D = 1 mA	-	0.21	-	V/°C
Static drain-to-source on-resistance	$R_{DS(on)}$ (1)	V_{GS} = 10 V, I_D = 80 A	-	9.6	14.0	mΩ
Gate threshold voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 µA	2.7	4.1	5.5	V
		V_{DS} = V_{GS}, I_D = 250 µA , T_J = 125 °C	-	2.6	-	
Forward transconductance	g_{fs}	V_{DS} = 20 V, I_D = 80 A	-	200	-	S
Drain-to-source leakage current	I_{DSS}	V_{DS} = 200 V, V_{GS} = 0 V	-	0.6	25	µA
		V_{DS} = 200 V, V_{GS} = 0 V, T_J = 125 °C	-	20	500	
		V_{DS} = 200 V, V_{GS} = 0 V, T_J = 175 °C	-	1	5	mA
Gate-to-source forward leakage	I_{GSS}	V_{GS} = 20 V	-	-	120	nA
Gate-to-source reverse leakage		V_{GS} = -20 V	-	-	-120	
Total gate charge	Q_g	I_D = 80 A, V_{DS} = 100 V, V_{GS} = 10 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 V, I_D = 80 A, R_g = 2.5 Ω, L = 500 µH	-	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 V, I_D = 80 A, R_g = 2.5 Ω, L = 500 µH, T_J = 125 °C	-	132	-	ns
Rise time	tr		-	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 V, V_{DS} = 50 V, f = 1.0 MHz, see fig. 14	-	10 720	-	pF
	C_{oss}		-	810	-	
	C_{rss}		-	160	-	
Drain to Case Capacitance	C_{d-cs}	V_{GS} = 0 V, (G-S shorted); f = 1 MHz	-	50	-	
CHOPPER DIODE						
Diode reverse breakdown voltage	V_{BR}	I_R = 100 µA	200	-	-	V
Forward voltage drop	V_{FM}	I_F = 30 A	-	0.94	1.08	
		I_F = 30 A, T_J = 125 °C	-	0.8	-	
		I_F = 30 A, T_J = 175 °C	-	0.74	-	
Reverse leakage current	I_{RM}	V_R = V_R rated	-	1	50	µA
		V_R = V_R rated, T_J = 125 °C	-	7	-	
		V_R = V_R rated, T_J = 175 °C	-	0.15	1	mA
Junction capacitance	C_T	V_R = 200 V	-	119	-	pF

Note

(1) Pulse width ≤ 400 µs, duty cycle ≤ 2 %

SOURCE-DRAIN RATINGS AND CHARACTERISTICS (T_J = 25 °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 °C, I_S = 80 A, V_{GS} = 0 V	-	0.88	1.02	V
		T_J = 125 °C, I_S = 80 A, V_{GS} = 0 V	-	0.76	-	
		T_J = 175 °C, I_S = 80 A, V_{GS} = 0 V	-	0.70	-	
Reverse recovery time	t_{rr}	T_J = 25 °C, I_F = 30 A, dI_F/dt = 100 A/µs, V_R = 100 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 °C, I_F = 30 A, dI_F/dt = 100 A/µs, V_R = 100 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 °C unless otherwise specified)						
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**MIN.**	**TYP.**	**MAX.**	**UNITS**
CHOPPER DIODE						
Reverse recovery time	t_{rr}	T_J = 25 °C, I_F = 30 A, dI_F/dt = 200 A/µs, V_R = 100 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 °C, I_F = 30 A, dI_F/dt = 200 A/µs, V_R = 100 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 ≤ 300 µs, duty cycle ≤ 2 %

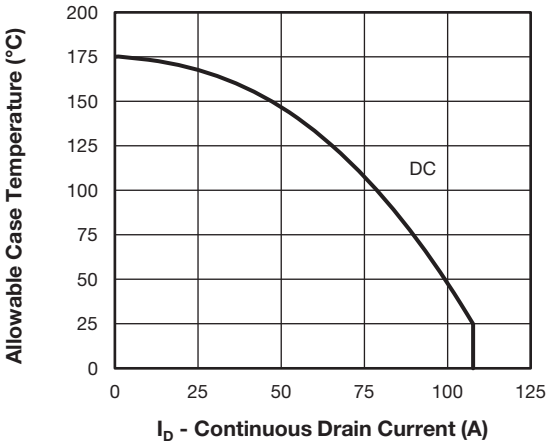


Fig. 1 - Maximum MOSFET Drain-Source Current vs. Case Temperature

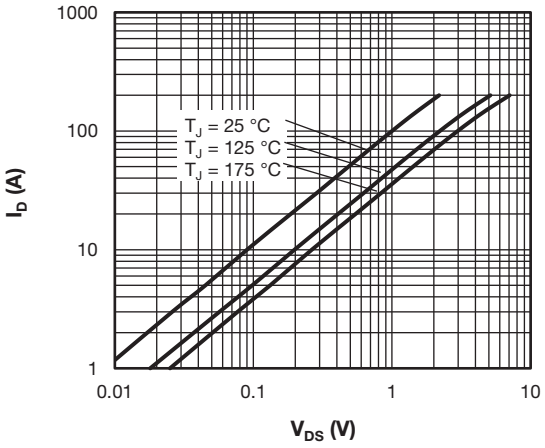


Fig. 2 - Typical MOSFET Output Characteristics, V_{GS} = 10 V

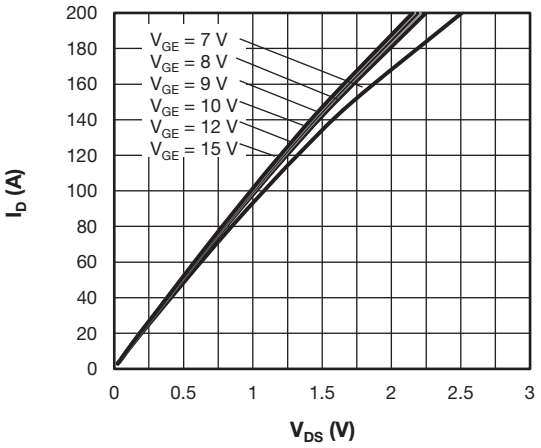


Fig. 3 - Typical MOSFET Output Characteristics, at T_J = 25 °C

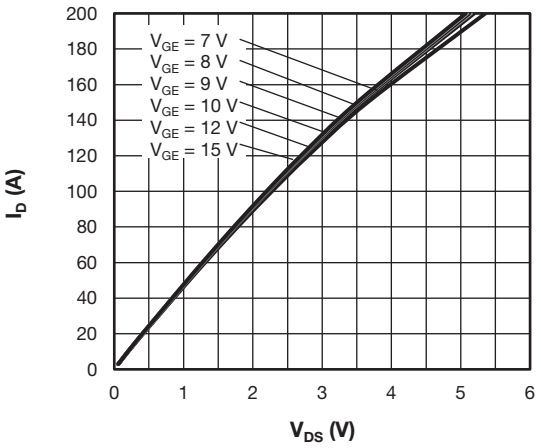


Fig. 4 - Typical MOSFET Output Characteristics, at T_J = 125 °C

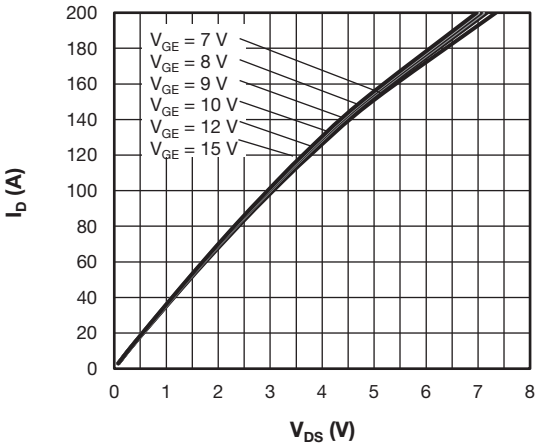


Fig. 5 - Typical MOSFET Output Characteristics, at T_J = 175 °C

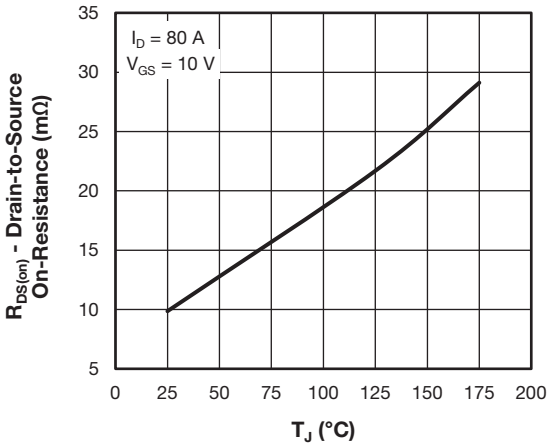


Fig. 6 - Typical Drain to Source On-Resistance vs. Temperature

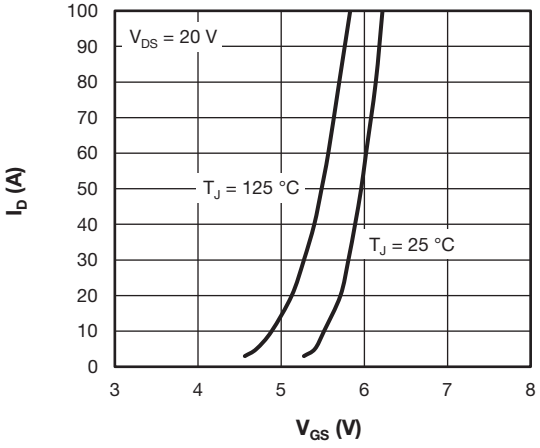


Fig. 7 - Typical MOSFET Transfer Characteristics

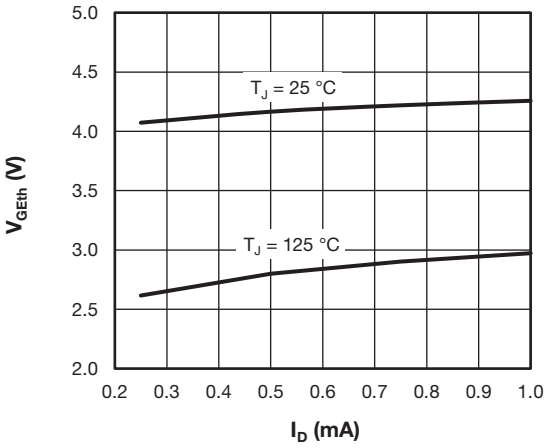


Fig. 8 - Typical MOSFET Gate Threshold Voltage

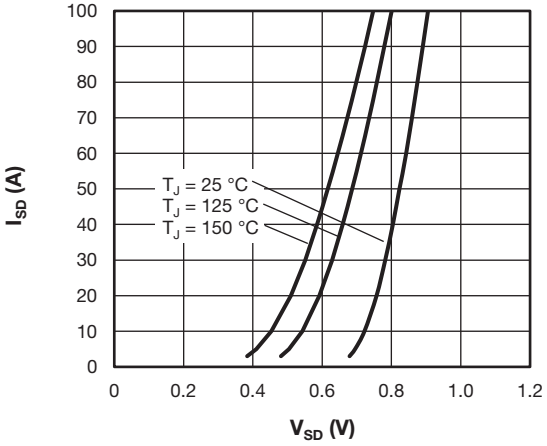


Fig. 9 - Typical MOSFET Body Diode Forward Current Characteristics

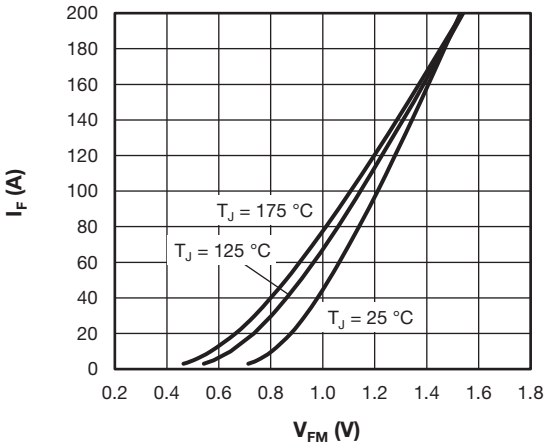


Fig. 12 - Typical Chopper Diode Forward Characteristics

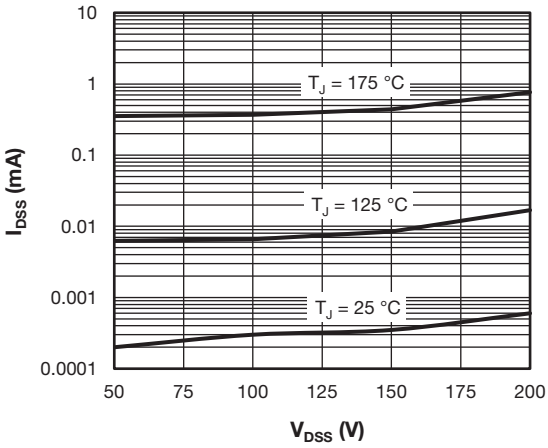


Fig. 10 - Typical MOSFET Zero Gate Voltage Drain Current

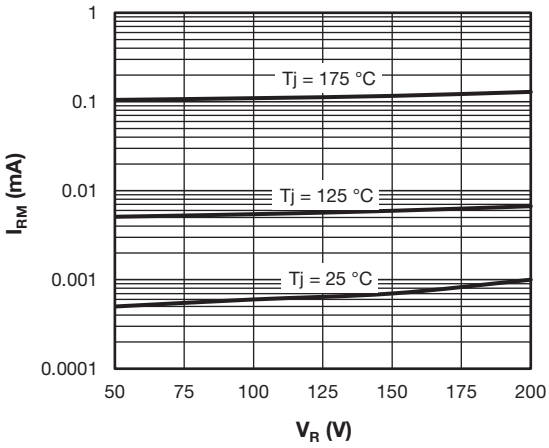


Fig. 13 - Typical Chopper Diode Reverse Leakage Current

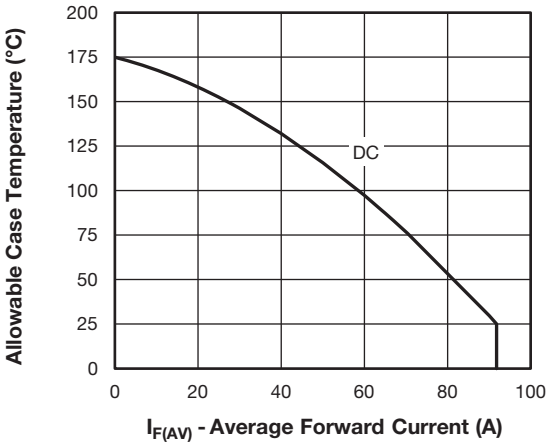


Fig. 11 - Maximum Allowable Forward Current vs. Case Temperature

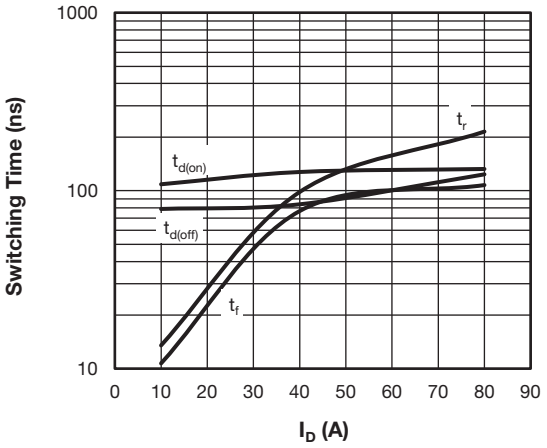


Fig. 14 - Typical MOSFET Switching Time vs. I_D
T_J = 125 °C, V_{DD} = 100 V, R_g = 2.5 Ω, V_{GS} = 10 V, L = 500 µH

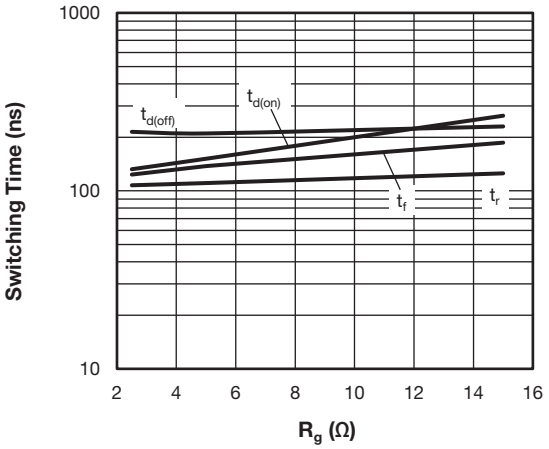


Fig. 15 - Typical MOSFET Switching Time vs. R_g
T_J = 125 °C, V_{DD} = 100 V, I_D = 80 A, L = 500 µH

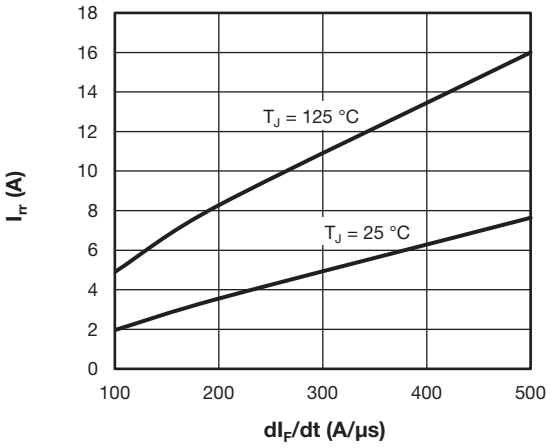


Fig. 17 - Typical Chopper Diode Reverse Recovery Current vs. dI_F/dt
V_{rr} = 100 V, I_F = 30 A

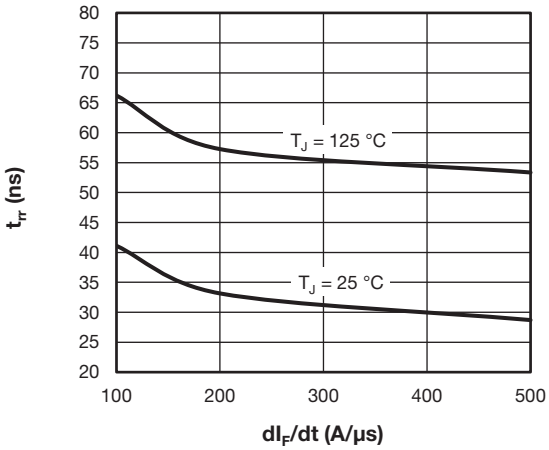


Fig. 16 - Typical Chopper Diode Reverse Recovery Time vs. dI_F/dt
V_{rr} = 100 V, I_F = 30 A

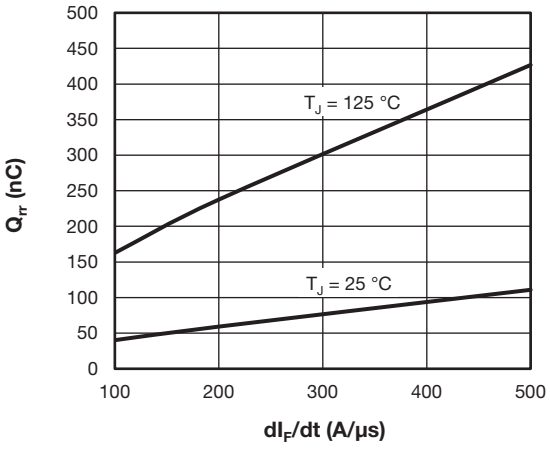


Fig. 18 - Typical Chopper Diode Reverse Recovery Charge vs. dI_F/dt
V_{rr} = 100 V, I_F = 30 A

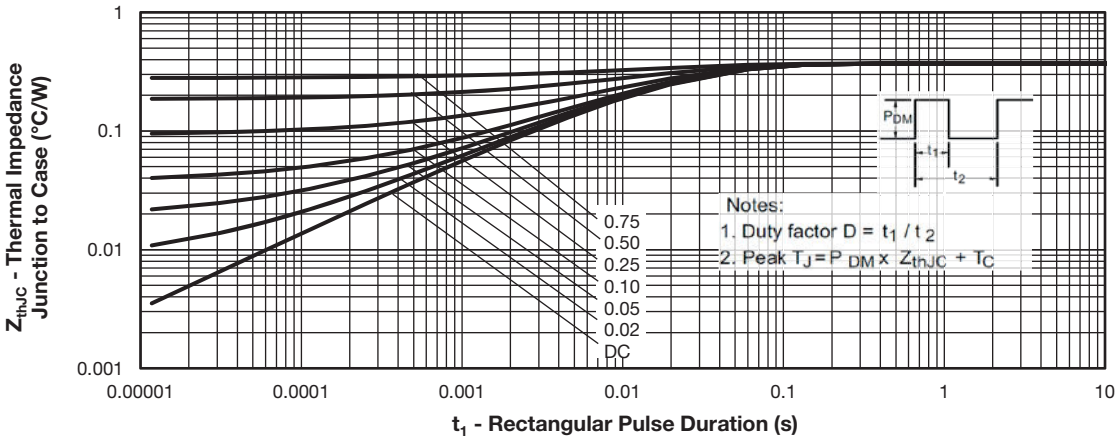


Fig. 19 - Maximum Thermal Impedance Z_{thJC} Characteristics - (MOSFET)

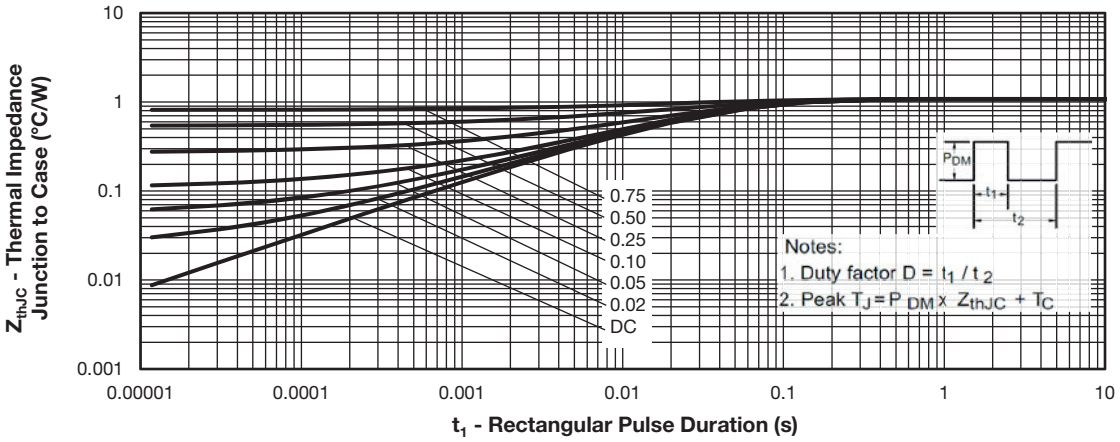
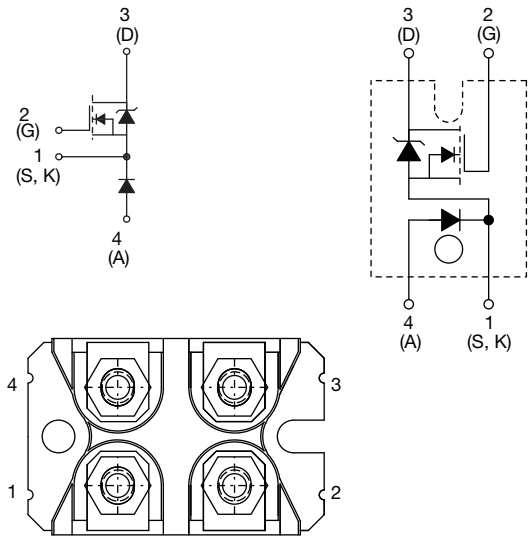
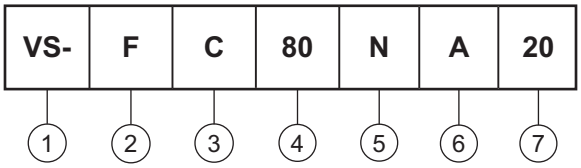


Fig. 20 - Maximum Thermal Impedance Characteristics (Chopper Diode)

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

ORDERING INFORMATION TABLE

Device code

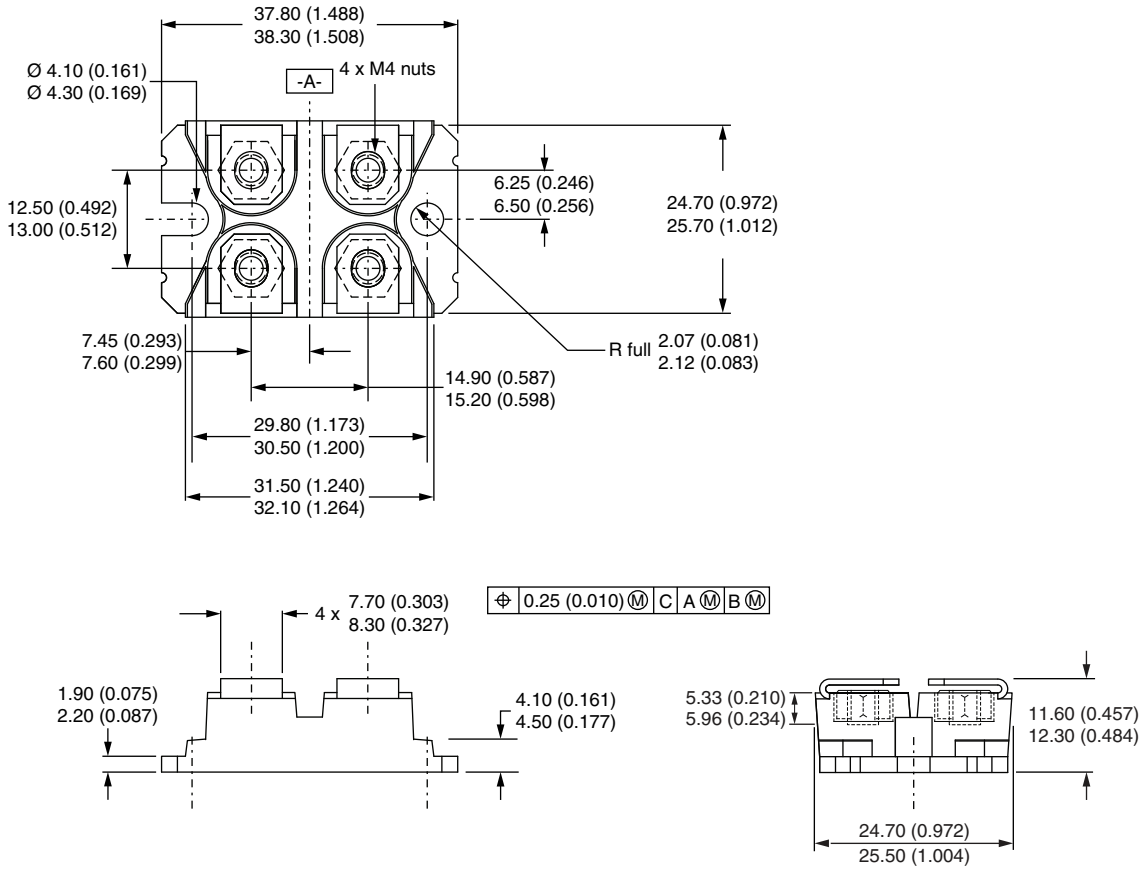


1	-	Vishay Semiconductors product
2	-	MOSFET module
3	-	MOSFET die generation
4	-	Current rating (80 = 80 A)
5	-	N = high side chopper
6	-	Package indicator SOT-227
7	-	Voltage rating (20 = 200 V)

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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