“High Side Chopper” IGBT SOT-227 (Ultrafast IGBT), 50 A

SOT-227

PRODUCT SUMMARY	
V_{CES}	1200 V
I_C DC	50 A at 92 °C
$V_{CE(on)}$ typical at 50 A, 25 °C	3.22 V
Speed	8 kHz to 30 kHz
Package	SOT-227
Circuit	High side switch

FEATURES

- NPT Gen 5 IGBT technology
- Square RBSOA
- HEXFRED® clamping diode
- Positive $V_{CE(on)}$ temperature coefficient
- Fully isolated package
- Very low internal inductance (≤ 5 nH typical)
- Industry standard outline
- UL approved file E78996
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

RoHS COMPLIANT

BENEFITS

- Designed for increased operating efficiency in power conversion: UPS, SMPS, welding, induction heating
- Easy to assemble and parallel
- Direct mounting on heatsink
- Plug-in compatible with other SOT-227 packages
- Low EMI, requires less snubbing

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
Collector to emitter voltage	V_{CES}		1200	V
Continuous collector current	I_C	T_C = 25 °C	84	A
		T_C = 80 °C	57	
Pulsed collector current	I_{CM}		150	
Clamped inductive load current	I_{LM}		150	
Diode continuous forward current	I_F	T_C = 25 °C	76	
		T_C = 80 °C	52	
Gate to emitter voltage	V_{GE}		± 20	V
Power dissipation, IGBT	P_D	T_C = 25 °C	431	W
		T_C = 80 °C	242	
Power dissipation, diode	P_D	T_C = 25 °C	278	
		T_C = 80 °C	156	
RMS isolation voltage	V_{ISOL}	Any terminal to case, t = 1 min	2500	V

ELECTRICAL SPECIFICATIONS (T_J = 25 °C unless otherwise specified)						
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**MIN.**	**TYP.**	**MAX.**	**UNITS**
Collector to emitter breakdown voltage	$V_{BR(CES)}$	V_{GE} = 0 V, I_C = 1 mA	1200	-	-	V
Collector to emitter voltage	$V_{CE(on)}$	V_{GE} = 15 V, I_C = 25 A	-	2.46	-	
		V_{GE} = 15 V, I_C = 50 A	-	3.22	2.80	
		V_{GE} = 15 V, I_C = 25 A, T_J = 125 °C	-	2.84	3.60	
		V_{GE} = 15 V, I_C = 50 A, T_J = 125 °C	-	3.78	3.0	
Gate threshold voltage	$V_{GE(th)}$	V_{CE} = V_{GE}, I_C = 500 μA	4	5	4	
Temperature coefficient of threshold voltage	$V_{GE(th)}/\Delta T_J$	V_{CE} = V_{GE}, I_C = 1 mA (25 °C to 125 °C)	-	-10	-	mV/°C
Collector to emitter leakage current	I_{CES}	V_{GE} = 0 V, V_{CE} = 1200 V	-	6	50	μA
		V_{GE} = 0 V, V_{CE} = 1200 V, T_J = 125 °C	-	0.7	2.0	mA
Diode reverse breakdown voltage	V_{BR}	I_R = 1 mA	1200	-	-	V
Diode forward voltage drop	V_{FM}	I_C = 25 A, V_{GE} = 0 V	-	1.99	2.42	V
		I_C = 50 A, V_{GE} = 0 V	-	2.53	3.00	
		I_C = 25 A, V_{GE} = 0 V, T_J = 125 °C	-	1.96	2.30	
		I_C = 50 A, V_{GE} = 0 V, T_J = 125 °C	-	2.66	3.08	
Diode reverse leakage current	I_{RM}	V_R = V_R rated	-	4	50	μA
		T_J = 125 °C, V_R = V_R rated	-	0.6	3	mA
Gate to emitter leakage current	I_{GES}	V_{GE} = ± 20 V	-	-	± 200	nA

SWITCHING CHARACTERISTICS (T_J = 25 °C unless otherwise specified)							
PARAMETER	**SYMBOL**	**TEST CONDITIONS**		**MIN.**	**TYP.**	**MAX.**	**UNITS**
Total gate charge (turn-on)	Q_g	I_C = 50 A, V_{CC} = 600 V, V_{GE} = 15 V		-	400	-	nC
Gate to emitter charge (turn-on)	Q_{ge}			-	43	-	
Gate to collector charge (turn-on)	Q_{gc}			-	187	-	
Turn-on switching loss	E_{on}	I_C = 50 A, V_{CC} = 600 V, V_{GE} = 15 V, R_g = 5 Ω, L = 500 μH, T_J = 25 °C	Energy losses include tail and diode recovery (see fig. 18)	-	2.72	-	mJ
Turn-off switching loss	E_{off}			-	1.11	-	
Total switching loss	E_{tot}			-	3.83	-	
Turn-on switching loss	E_{on}	I_C = 50 A, V_{CC} = 600 V, V_{GE} = 15 V, R_g = 5 Ω, L = 500 μH, T_J = 125 °C		-	3.94	-	
Turn-off switching loss	E_{off}			-	2.31	-	
Total switching loss	E_{tot}			-	6.25	-	
Turn-on delay time	$t_{d(on)}$			-	191	-	ns
Rise time	t_r			-	53	-	
Turn-off delay time	$t_{d(off)}$			-	223	-	
Fall time	t_f			-	143	-	
Reverse bias safe operating area	RBSOA	T_J = 150 °C, I_C = 150 A, R_g = 22 Ω, V_{GE} = 15 V to 0 V, V_{CC} = 900 V, V_P = 1200 V		Fullsquare			
Diode reverse recovery time	t_{rr}	I_F = 50 A, dI_F/dt = 200 A/μs, V_R = 200 V		-	129	161	ns
Diode peak reverse current	I_{rr}			-	11	14	A
Diode recovery charge	Q_{rr}			-	700	1046	nC
Diode reverse recovery time	t_{rr}	I_F = 50 A, dI_F/dt = 200 A/μs, V_R = 200 V, T_J = 125 °C		-	208	257	ns
Diode peak reverse current	I_{rr}			-	17	21	A
Diode recovery charge	Q_{rr}			-	1768	2698	nC

THERMAL AND MECHANICAL SPECIFICATIONS							
PARAMETER		**SYMBOL**		**MIN.**	**TYP.**	**MAX.**	**UNITS**
Junction and storage temperature range		T_J, T_{Stg}		-40	-	150	°C
Junction to case	IGBT	R_{thJC}		-	-	0.29	°C/W
	Diode			-	-	0.45	
Case to heatsink		R_{thCS}	Flat, greased surface	-	0.05	-	
Weight				-	30	-	g
Mounting torque				-	-	1.3	Nm
Case style		SOT-227					

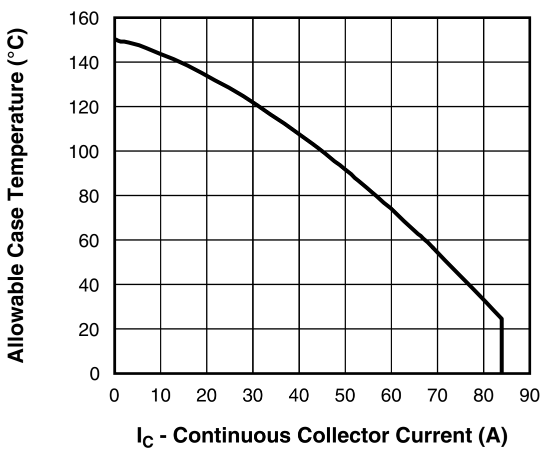


Fig. 1 - Maximum DC IGBT Collector Current vs. Case Temperature

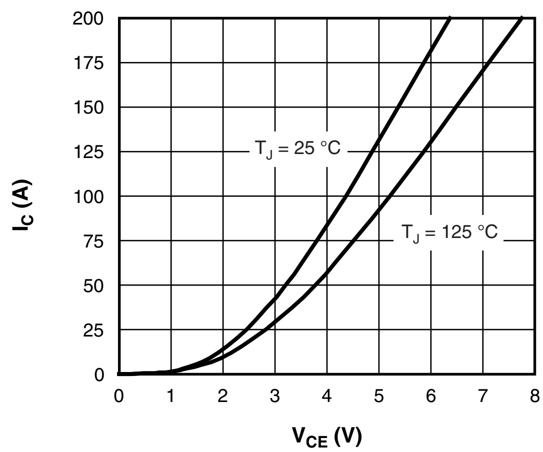


Fig. 3 - Typical IGBT Collector Current Characteristics

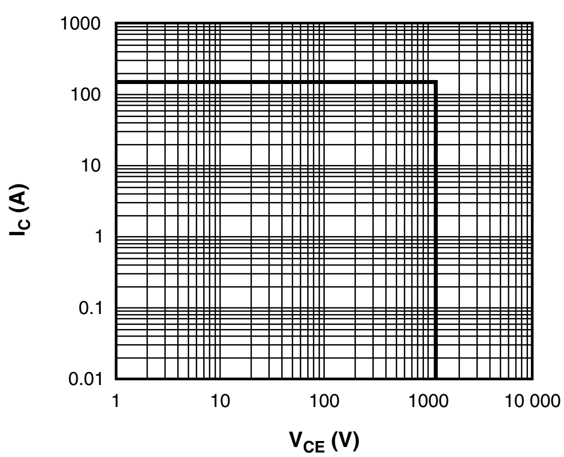


Fig. 2 - IGBT Reverse Bias SOA
T_J = 150 °C, V_{GE} = 15 V

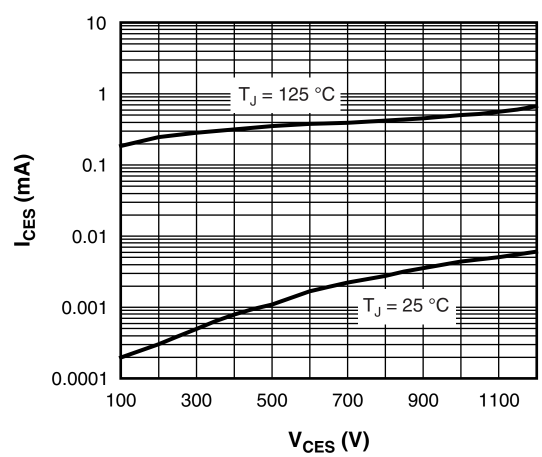


Fig. 4 - Typical IGBT Zero Gate Voltage Collector Current

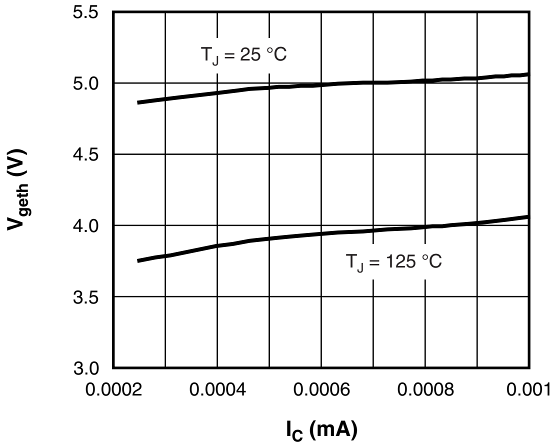


Fig. 5 - Typical IGBT Threshold Voltage

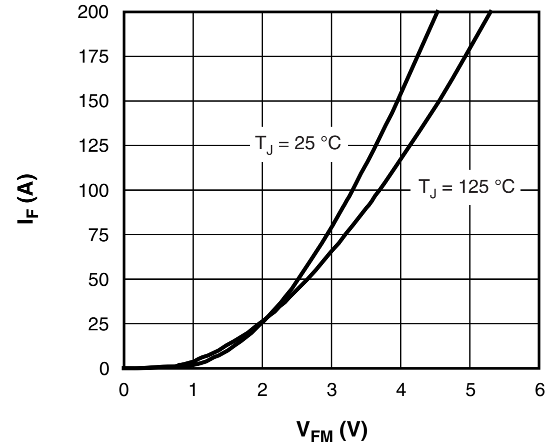


Fig. 8 - Typical Diode Forward Characteristics

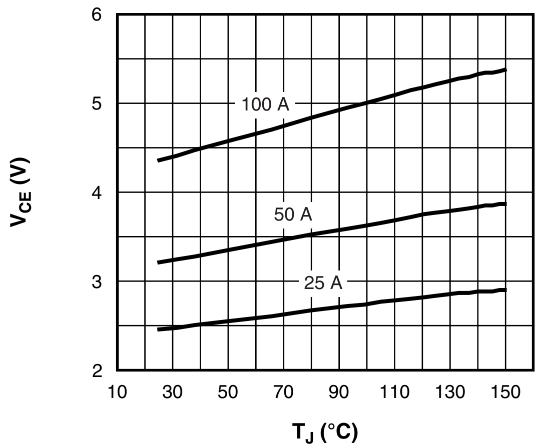


Fig. 6 - Typical IGBT Collector to Emitter Voltage vs. Junction Temperature, V_{GE} = 15 V

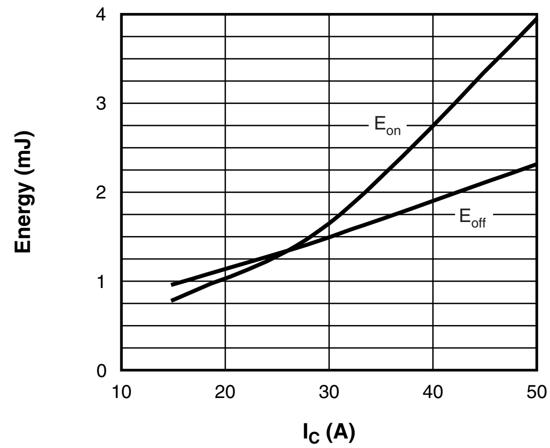


Fig. 9 - Typical IGBT Energy Loss vs. I_C
T_J = 125 °C, L = 500 µH, V_{CC} = 600 V,
R_g = 5 Ω, V_{GE} = 15 V

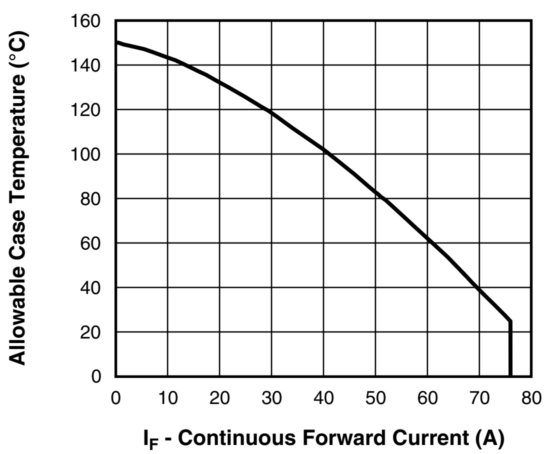


Fig. 7 - Maximum DC Forward Current vs. Case Temperature

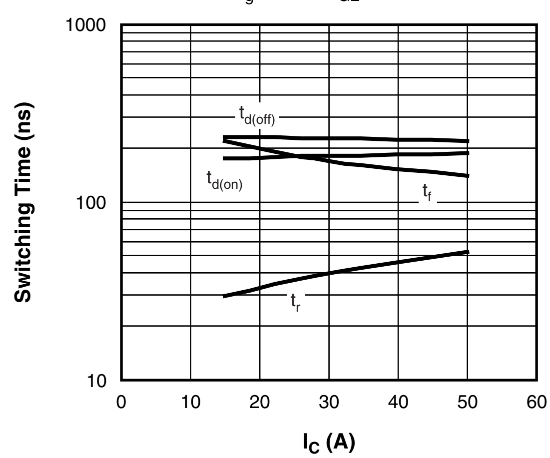


Fig. 10 - Typical IGBT Switching Time vs. I_C
T_J = 125 °C, L = 500 µH, V_{CC} = 600 V,
R_g = 5 Ω, V_{GE} = 15 V

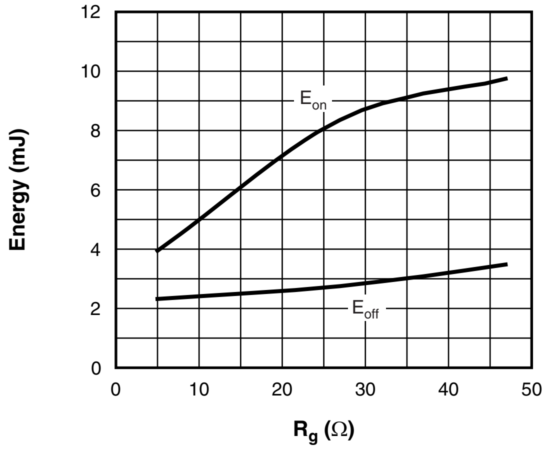


Fig. 11 - Typical IGBT Energy Loss vs. R_g
T_J = 125 °C, I_C = 50 A, L = 500 μH,
V_{CC} = 600 V, V_{GE} = 15 V

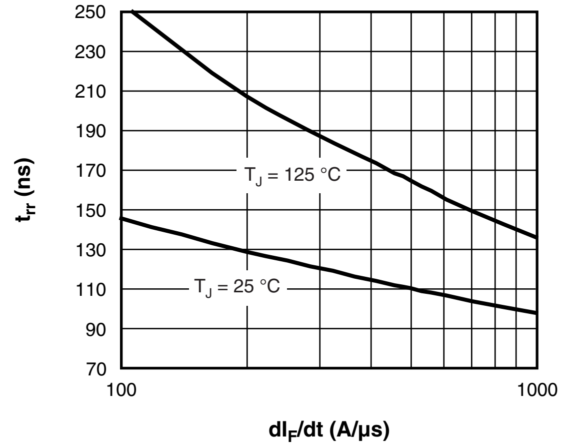


Fig. 13 - Typical t_{rr} Diode vs. dI_F/dt
V_R = 200 V, I_F = 50 A

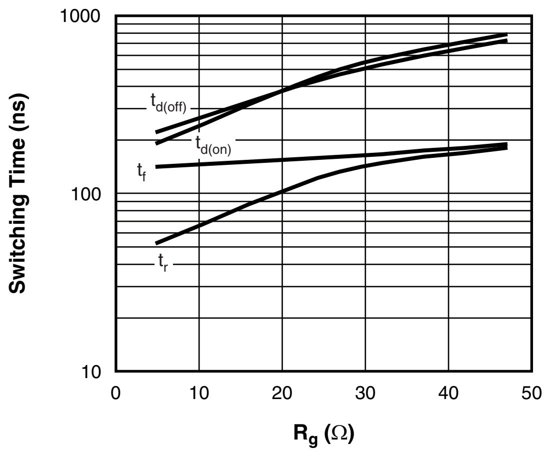


Fig. 12 - Typical IGBT Switching Time vs. R_g
T_J = 125 °C, L = 500 μH, V_{CC} = 600 V,
I_C = 50 A, V_{GE} = 15 V

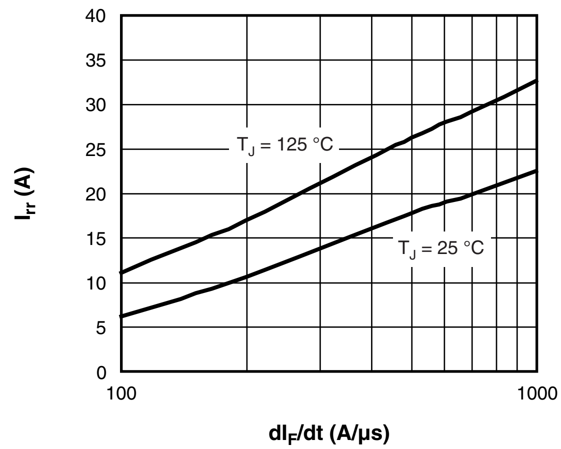


Fig. 14 - Typical I_{rr} Diode vs. dI_F/dt
V_R = 200 V, I_F = 50 A

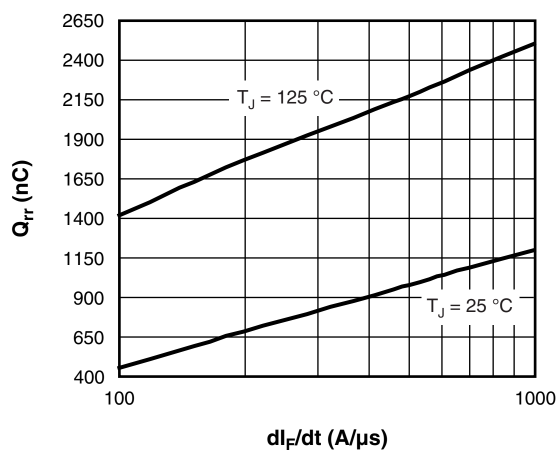


Fig. 15 - Typical Q_{rr} Diode vs. dI_F/dt, V_R = 200 V, I_F = 50 A

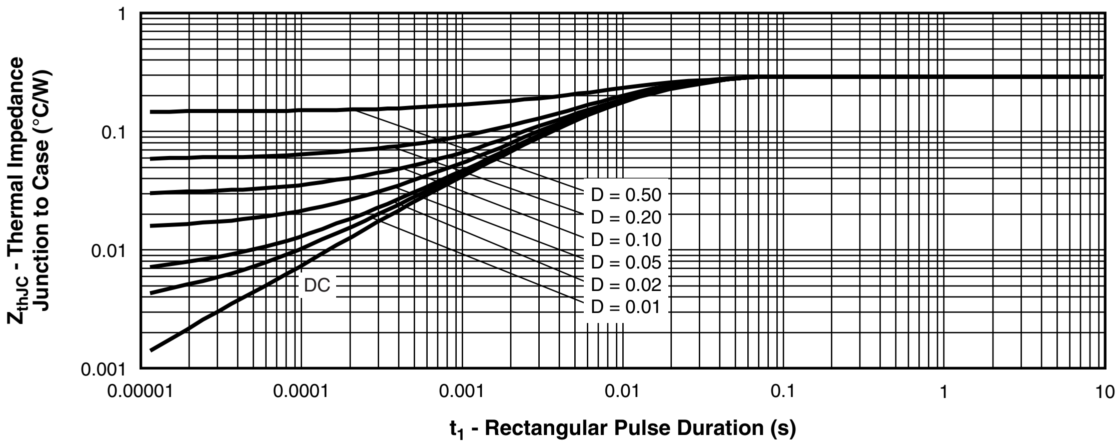


Fig. 16 - Maximum Thermal Impedance Z_{thJC} Characteristics (IGBT)

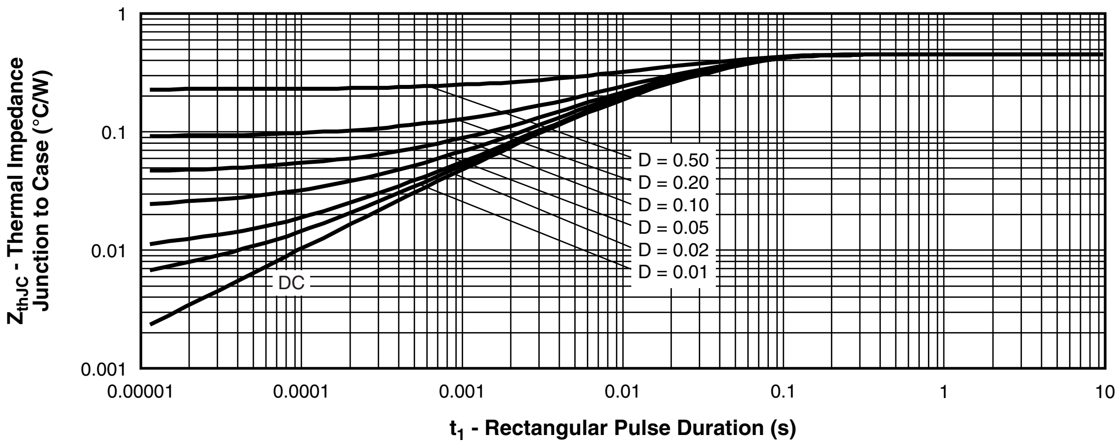


Fig. 17 - Maximum Thermal Impedance Z_{thJC} Characteristics (Diode)

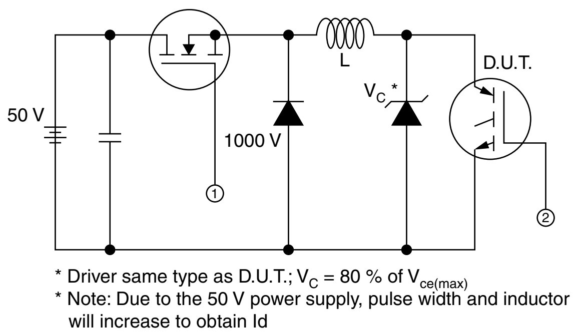


Fig. 18a - Clamped Inductive Load Test Circuit

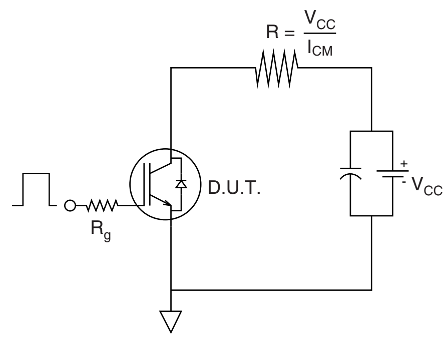


Fig. 18b - Pulsed Collector Current Test Circuit

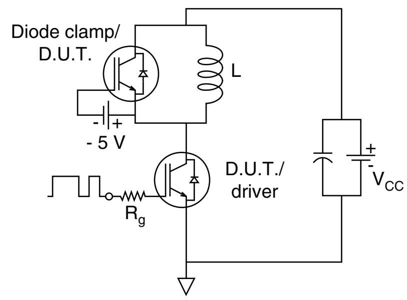


Fig. 19a - Switching Loss Test Circuit

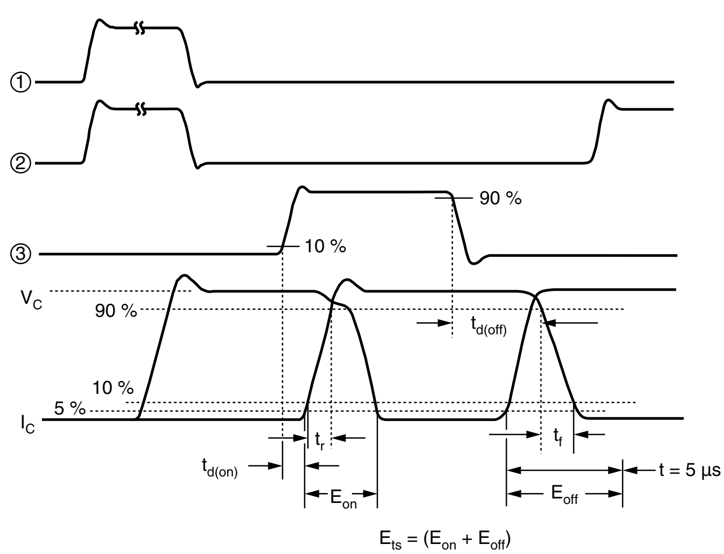


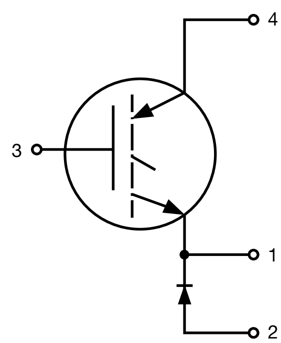
Fig. 19b - Switching Loss Waveforms Test Circuit

ORDERING INFORMATION TABLE

Device code	VS-	G	B	50	N	A	120	U	X
	1	2	3	4	5	6	7	8	9

1 - Vishay Semiconductors product
2 - Insulated Gate Bipolar Transistor (IGBT)
3 - B = IGBT Generation 5
4 - Current rating (50 = 50 A)
5 - Circuit configuration (N = High side chopper)
6 - Package indicator (A = SOT-227)
7 - Voltage rating (120 = 1200 V)
8 - Speed/type (U = Ultrafast IGBT)
9 - X = F/W HEXFRED® diode

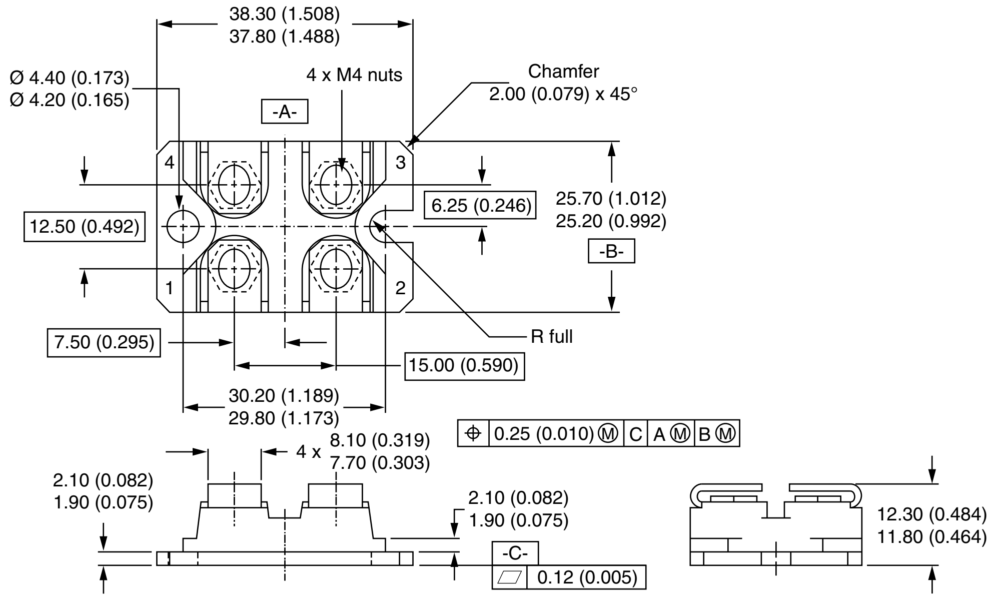
CIRCUIT CONFIGURATION



LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95036
Packaging information	www.vishay.com/doc?95037

SOT-227

DIMENSIONS in millimeters (inches)



Notes

- Dimensioning and tolerancing per ANSI Y14.5M-1982
- Controlling dimension: millimeter

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