Insulated Gate Bipolar Transistor (Ultrafast IGBT), 75 A

SOT-227

FEATURES

- NPT Generation V IGBT technology
- Square RBSOA
- HEXFRED® low Q_{rr}, low switching energy
- Positive $V_{CE(on)}$ temperature coefficient
- Fully isolated package
- Speed 8 kHz to 60 kHz
- 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

PRODUCT SUMMARY	
V_{CES}	1200 V
I_C DC	75 A at 95 °C
$V_{CE(on)}$ typical at 75 A, 25 °C	3.3 V
Package	SOT-227

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	131	A
		T_C = 80 °C	89	
Pulsed collector current	I_{CM}		200	
Clamped inductive load current	I_{LM}		200	
Diode continuous forward current	I_F	T_C = 25 °C	59	
		T_C = 80 °C	39	
Gate to emitter voltage	V_{GE}		± 20	V
Power dissipation, IGBT	P_D	T_C = 25 °C	658	W
		T_C = 80 °C	369	
Power dissipation, diode	P_D	T_C = 25 °C	240	
		T_C = 80 °C	135	
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 = 250 μA	1200	-	-	V
Collector to emitter voltage	$V_{CE(on)}$	V_{GE} = 15 V, I_C = 75 A	-	3.3	3.8	
		V_{GE} = 15 V, I_C = 75 A, T_J = 125 °C	-	3.6	3.9	
Gate threshold voltage	$V_{GE(th)}$	V_{CE} = V_{GE}, I_C = 250 μA	4	5	6	
Temperature coefficient of threshold voltage	$V_{GE(th)}/\Delta T_J$	V_{CE} = V_{GE}, I_C = 1 mA (25 °C to 125 °C)	-	- 12	-	mV/°C
Collector to emitter leakage current	I_{CES}	V_{GE} = 0 V, V_{CE} = 1200 V	-	3	250	μA
		V_{GE} = 0 V, V_{CE} = 1200 V, T_J = 150 °C	-	4	20	mA
Forward voltage drop	V_{FM}	I_C = 75 A, V_{GE} = 0 V	-	3.4	5.0	V
		I_C = 75 A, V_{GE} = 0 V, T_J = 125 °C	-	3.3	5.2	
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		-	690	-	nC
Gate to emitter charge (turn-on)	Q_{ge}			-	65	-	
Gate to collector charge (turn-on)	Q_{gc}			-	250	-	
Turn-on switching loss	E_{on}	I_C = 75 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)	-	1.53	-	mJ
Turn-off switching loss	E_{off}			-	1.76	-	
Total switching loss	E_{tot}			-	3.29	-	
Turn-on switching loss	E_{on}	I_C = 75 A, V_{CC} = 600 V, V_{GE} = 15 V, R_g = 5 Ω, L = 500 μH, T_J = 125 °C		-	2.49	-	
Turn-off switching loss	E_{off}			-	3.45	-	
Total switching loss	E_{tot}			-	5.94	-	
Turn-on delay time	$t_{d(on)}$			-	281	-	ns
Rise time	t_r			-	45	-	
Turn-off delay time	$t_{d(off)}$			-	300	-	
Fall time	t_f			-	126	-	
Reverse bias safe operating area	RBSOA	T_J = 150 °C, I_C = 200 A, R_g = 22 Ω, V_{GE} = 15 V to 0 V, V_{CC} = 900 V, V_P = 1200 V, L = 500 μH		Fullsquare			
Diode reverse recovery time	t_{rr}	I_F = 50 A, dI_F/dt = 200 A/μs, V_R = 200 V		-	142	210	ns
Diode peak reverse current	I_{rr}			-	13	16	A
Diode recovery charge	Q_{rr}			-	923	1680	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		-	202	260	ns
Diode peak reverse current	I_{rr}			-	18	22	A
Diode recovery charge	Q_{rr}			-	1818	2860	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}		-	-	0.19	°C/W
	Diode			-	-	0.52	
Case to heatsink		R_{thCS}	Flat, greased surface	-	0.05	-	
Weight				-	30	-	g
Mounting torque				-	-	1.3	Nm
Case style		SOT-227					

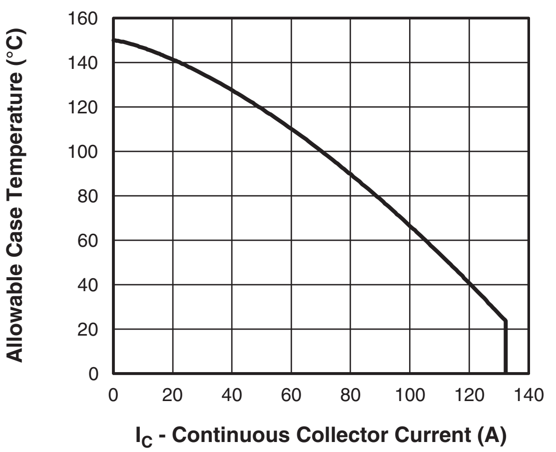


Fig. 1 - Maximum DC IGBT Collector Current vs. Case Temperature

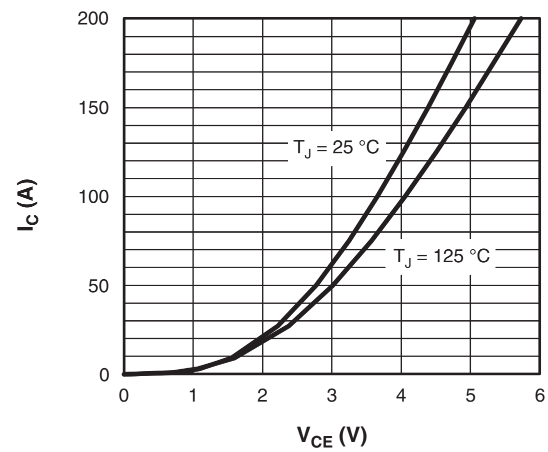


Fig. 3 - Typical IGBT Collector Current Characteristics

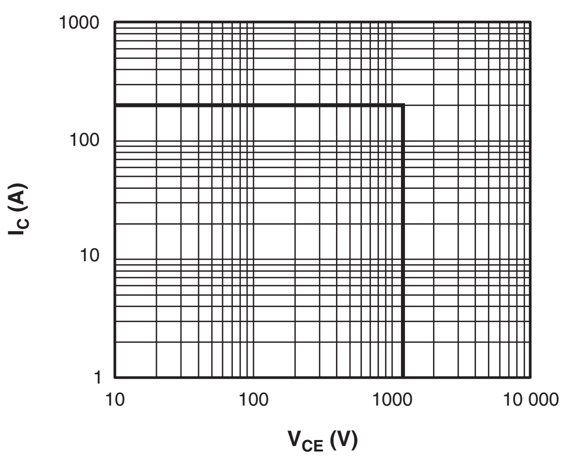


Fig. 2 - IGBT Reverse Bias SOA T_J = 150 °C, V_{GE} = 15 V

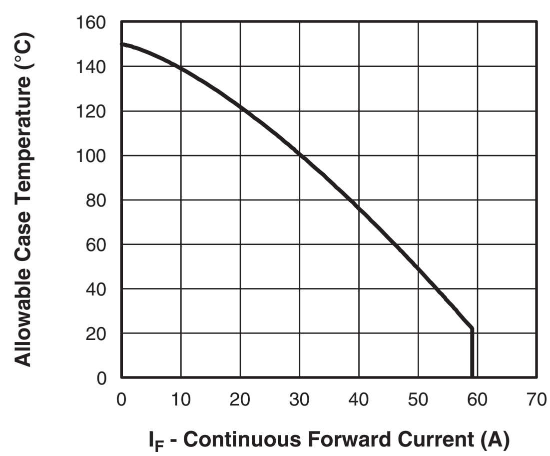


Fig. 4 - Maximum DC Forward Current vs. Case Temperature

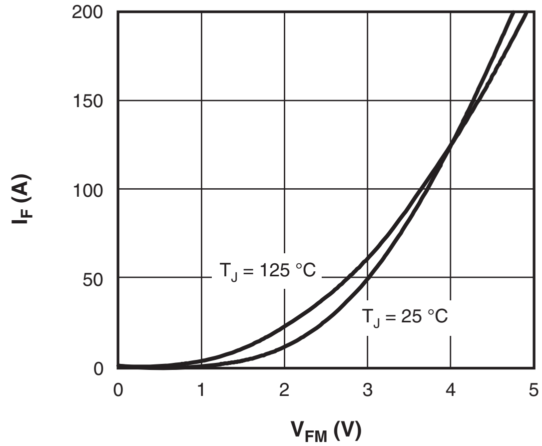


Fig. 5 - Typical Diode Forward Characteristics

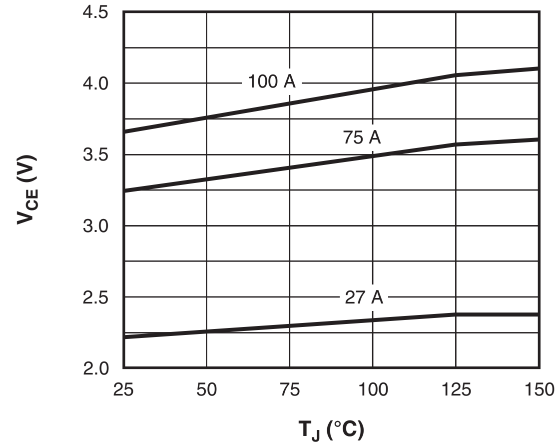


Fig. 8 - Typical IGBT Collector to Emitter Voltage vs. Junction Temperature, V_{GE} = 15 V

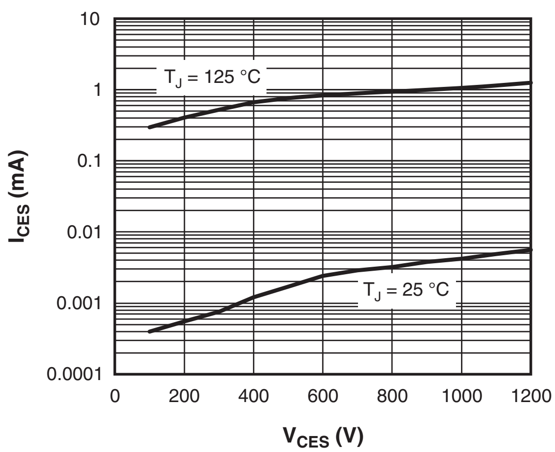


Fig. 6 - Typical IGBT Zero Gate Voltage Collector Current

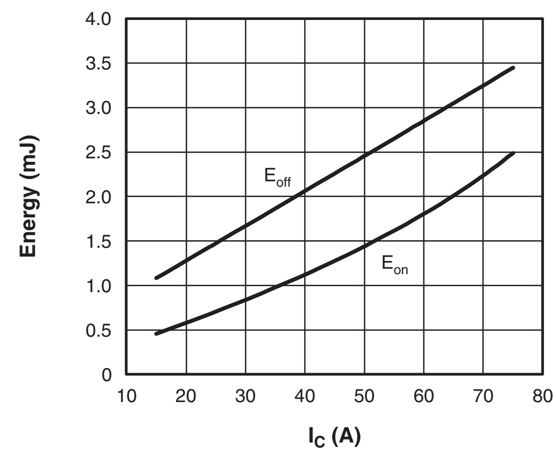


Fig. 9 - Typical IGBT Energy Loss vs. I_C
T_J = 125 °C, L = 500 µH, V_{CC} = 600 V,
R_g = 5 Ω, V_{GE} = 15 V

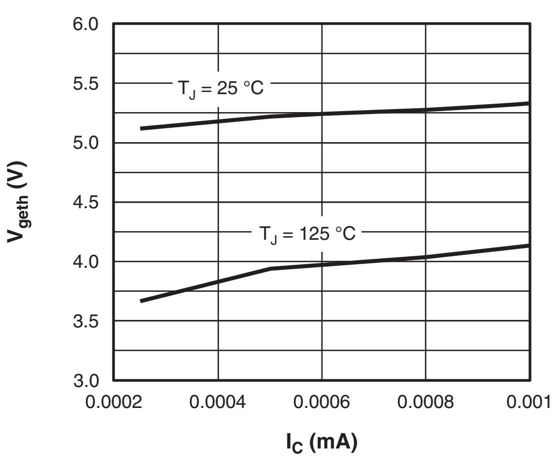


Fig. 7 - Typical IGBT Threshold Voltage

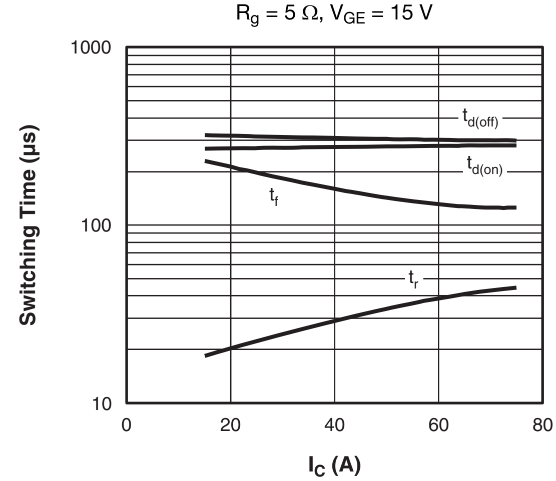


Fig. 10 - Typical IGBT Switching Time vs. I_C
T_J = 125 °C, L = 500 µH, V_{CC} = 600 V,
R_g = 5 Ω, V_{GE} = 15 V

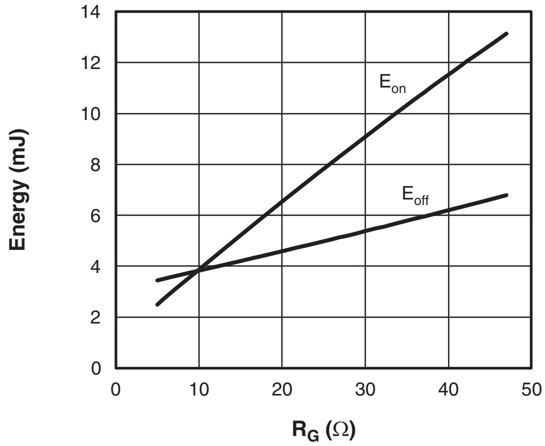


Fig. 11 - Typical IGBT Energy Loss vs. R_g
T_J = 125 °C, I_C = 75 A, L = 500 μH,
V_{CC} = 600 V, V_{GE} = 15 V

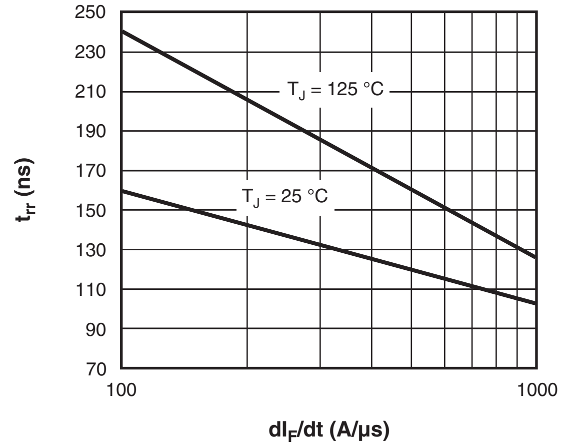


Fig. 13 - Typical t_{rr} diode vs. dI_F/dt
V_{RR} = 200 V, I_F = 50 A

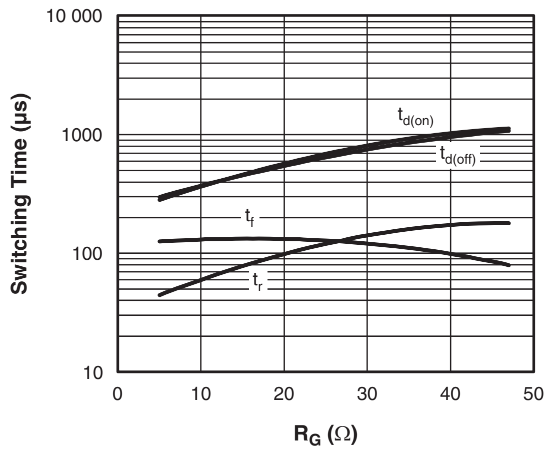


Fig. 12 - Typical IGBT Switching Time vs. R_g
T_J = 125 °C, L = 500 μH, V_{CC} = 600 V,
R_g = 5 Ω, V_{GE} = 15 V

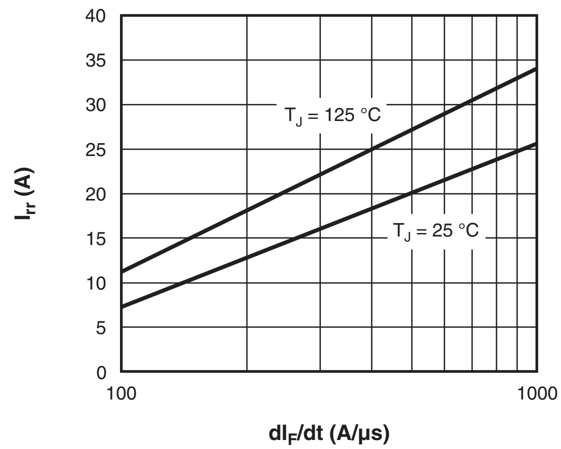


Fig. 14 - Typical I_{rr} diode vs. dI_F/dt
V_{RR} = 200 V, I_F = 50 A

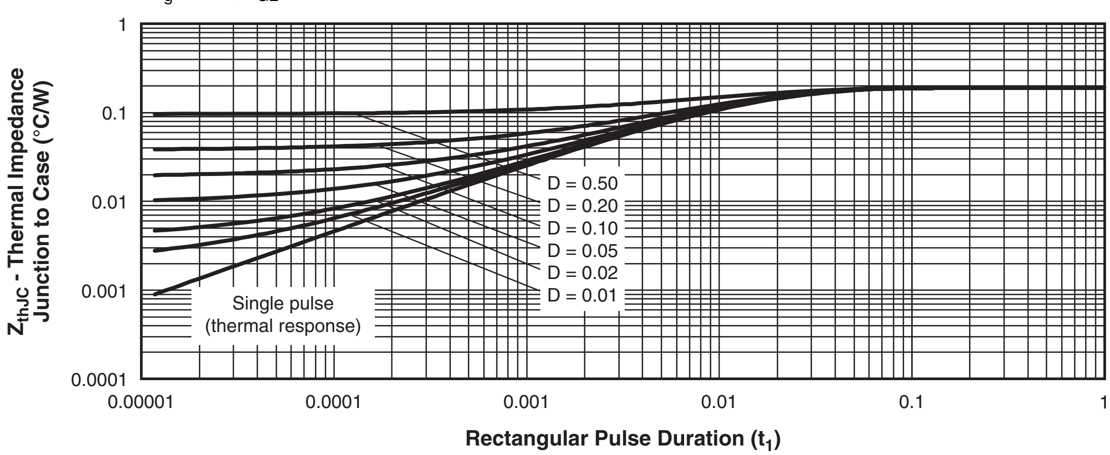


Fig. 15 - Maximum Thermal Impedance Z_{thJC} Characteristics (IGBT)

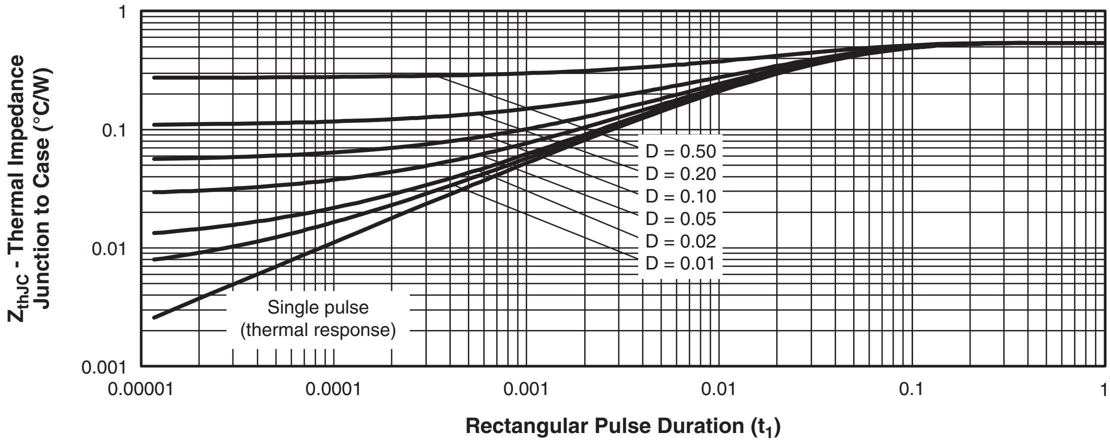


Fig. 16 - Maximum Thermal Impedance Z_{thJC} Characteristics (diode)

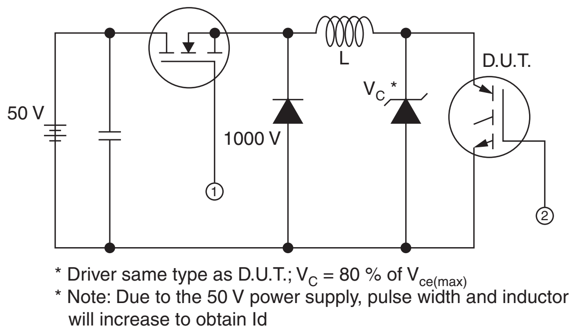


Fig. 17a - Clamped Inductive Load Test Circuit

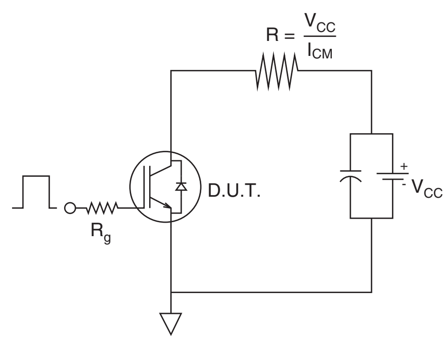


Fig. 17b - Pulsed Collector Current Test Circuit

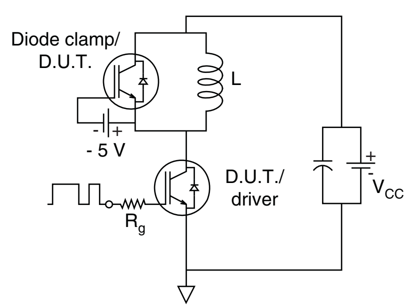


Fig. 18a - Switching Loss Test Circuit

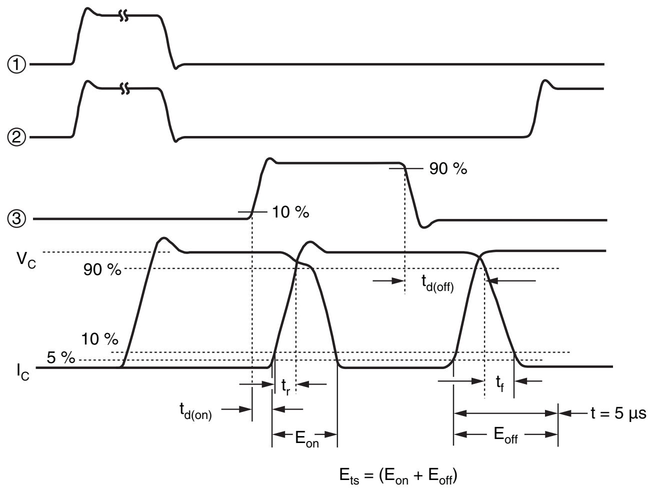


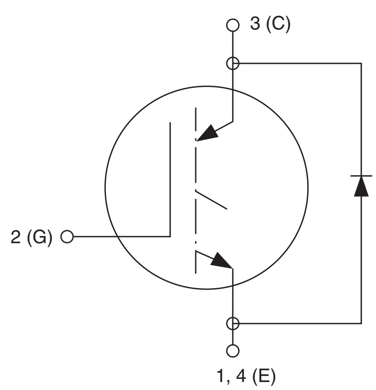
Fig. 18b - Switching Loss Waveforms Test Circuit

ORDERING INFORMATION TABLE

Device code	VS-	G	B	75	D	A	120	U	P
	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 (75 = 75 A)
5	-	Circuit configuration (D = Single switch with antiparallel diode)
6	-	Package indicator (A = SOT-227)
7	-	Voltage rating (120 = 1200 V)
8	-	Speed/type (U = Ultrafast IGBT)
9	-	Totally lead (Pb)-free

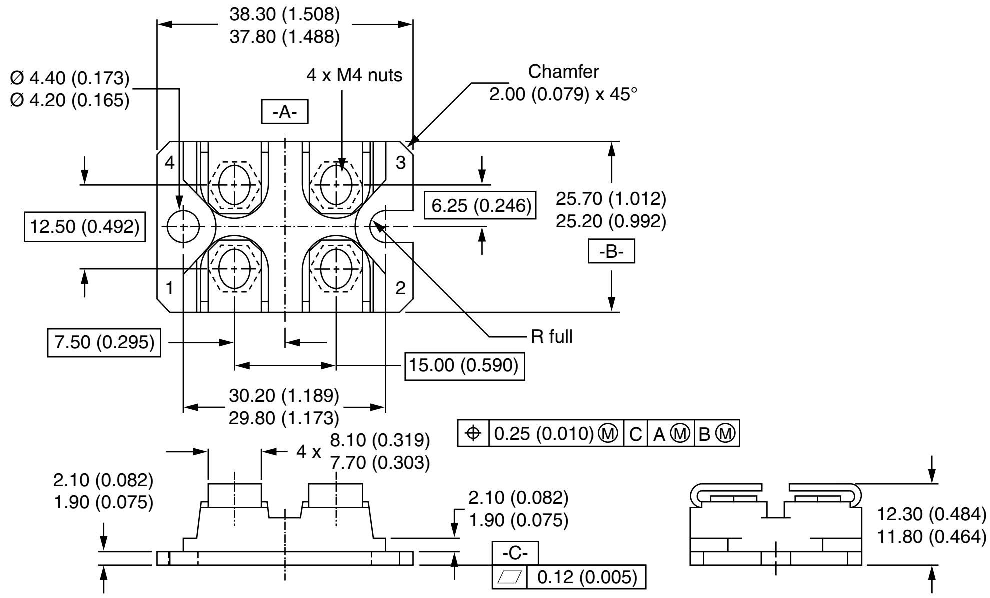
CIRCUIT CONFIGURATION



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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