




Insulated Gate Bipolar Transistor (Warp 2 Speed IGBT), 100 A



SOT-227

PRODUCT SUMMARY	
V_{CES}	600 V
I_C DC	100 A at 61 °C
$V_{CE(on)}$ typical at 100 A, 25 °C	2.4 V
I_F DC	100 A at 85 °C
Package	SOT-227
Circuit	Single Switch Diode

FEATURES

- NPT warp 2 speed IGBT technology with positive temperature coefficient
- Square RBSOA
- HEXFRED® antiparallel diodes with ultrasoft reverse recovery
- 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 to heatsink
- Plug-in compatible with other SOT-227 packages
- Higher switching frequency up to 150 kHz
- Lower conduction losses and switching losses
- Low EMI, requires less snubbing

ABSOLUTE MAXIMUM RATINGS				
PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
Collector to emitter voltage	V_{CES}		600	V
Continuous collector current	I_C	$T_C = 25\text{ °C}$	125	A
		$T_C = 80\text{ °C}$	85	
Pulsed collector current	I_{CM}		300	
Clamped inductive load current	I_{LM}		300	
Diode continuous forward current	I_F	$T_C = 25\text{ °C}$	160	
		$T_C = 80\text{ °C}$	105	
Peak diode forward current	I_{FM}		200	
Gate to emitter voltage	V_{GE}		± 20	V
Power dissipation, IGBT	P_D	$T_C = 25\text{ °C}$	447	W
		$T_C = 80\text{ °C}$	250	
Power dissipation, diode	P_D	$T_C = 25\text{ °C}$	313	
		$T_C = 80\text{ °C}$	175	
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	600	-	-	V
Collector to emitter voltage	V _{CE(on)}	V _{GE} = 15 V, I _C = 100 A	-	2.4	2.8	
		V _{GE} = 15 V, I _C = 100 A, T _J = 125 °C	-	3	3.4	
Gate threshold voltage	V _{GE(th)}	V _{CE} = V _{GE} , I _C = 250 μA	3	3.9	5	
Temperature coefficient of threshold voltage	ΔV _{GE(th)} /ΔT _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} = 600 V	-	7	100	μA
		V _{GE} = 0 V, V _{CE} = 600 V, T _J = 150 °C	-	4	10	mA
Forward voltage drop	V _{FM}	I _C = 100 A, V _{GE} = 0 V	-	1.6	2.1	V
		I _C = 100 A, V _{GE} = 0 V, T _J = 125 °C	-	1.7	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 = 100 A, V _{CC} = 480 V, V _{GE} = 15 V		-	460	690	nC	
Gate to emitter charge (turn-on)	Q _{ge}			-	160	250		
Gate to collector charge (turn-on)	Q _{gc}			-	70	130		
Turn-on switching loss	E _{on}	I _C = 100 A, V _{CC} = 360 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)	-	0.36	-	mJ	
Turn-off switching loss	E _{off}			-	1.42	-		
Total switching loss	E _{tot}			-	1.78	-		
Turn-on switching loss	E _{on}	I _C = 100 A, V _{CC} = 360 V, V _{GE} = 15 V, R _g = 5 Ω, L = 500 μH, T _J = 125 °C		-	0.52	-	ns	
Turn-off switching loss	E _{off}			-	1.6	-		
Total switching loss	E _{tot}			-	2.12	-		
Turn-on delay time	t _{d(on)}			-	264	-	ns	
Rise time	t _r			-	54	-		
Turn-off delay time	t _{d(off)}			-	257	-		
Fall time	t _f			-	80	-		
Reverse bias safe operating area	RBSOA	T _J = 150 °C, I _C = 300 A, R _g = 22 Ω, V _{GE} = 15 V to 0 V, V _{CC} = 400 V, V _P = 600 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		-	95	120	ns	
Diode peak reverse current	I _{rr}			-	10	13	A	
Diode recovery charge	Q _{rr}			-	480	780	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		-	144	185	ns	
Diode peak reverse current	I _{rr}			-	16	19	A	
Diode recovery charge	Q _{rr}			-	1136	1758	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}	-	-	0.28	°C/W
	Diode		-	-	0.4	
Case to heatsink	R_{thCS}	Flat, greased surface	-	0.05	-	
Weight			-	30	-	g
Mounting torque			-	-	1.3	Nm
Case style	SOT-227					

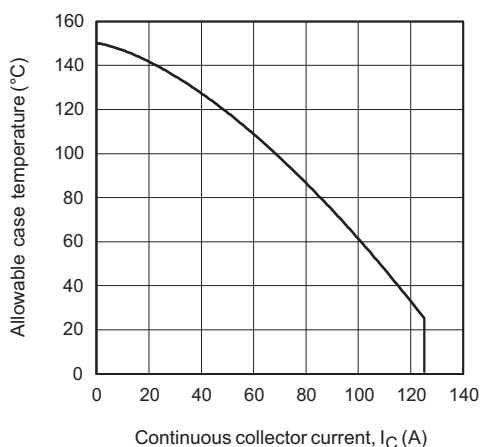


Fig. 1 - Maximum DC IGBT Collector Current vs. Case Temperature

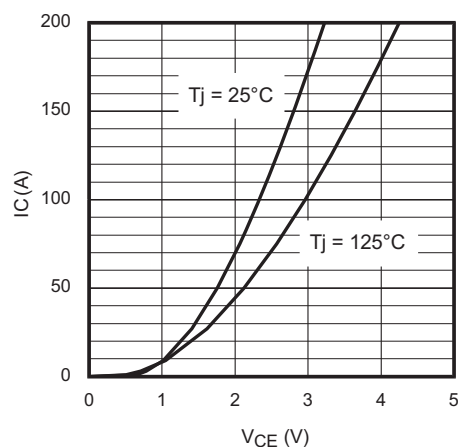


Fig. 3 - Typical IGBT Collector Current Characteristics

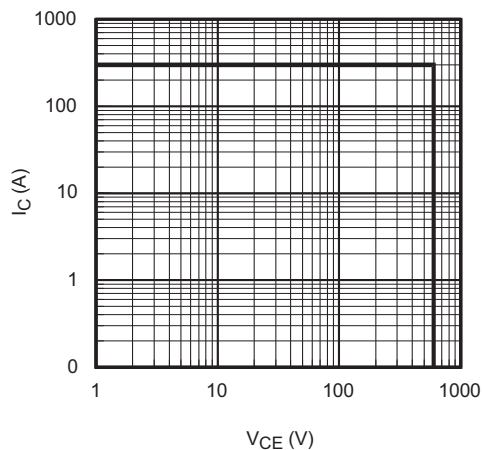


Fig. 2 - IGBT Reverse Bias SOA
 $T_J = 150^\circ\text{C}, V_{GE} = 15\text{ V}$

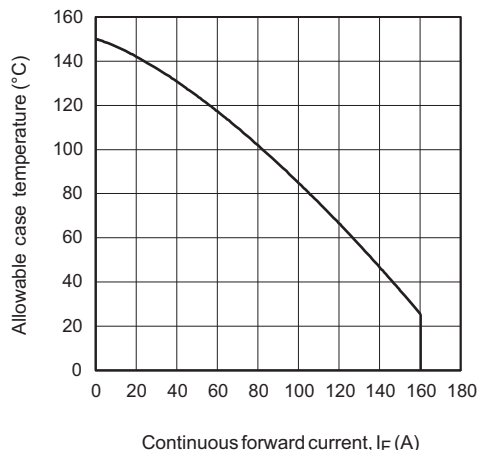


Fig. 4 - Maximum DC Forward Current vs. Case Temperature

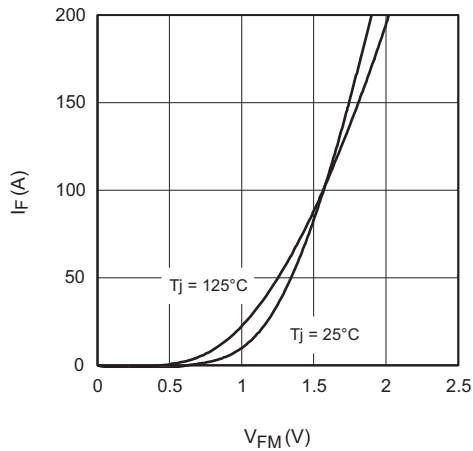


Fig. 5 - Typical Diode Forward Characteristics

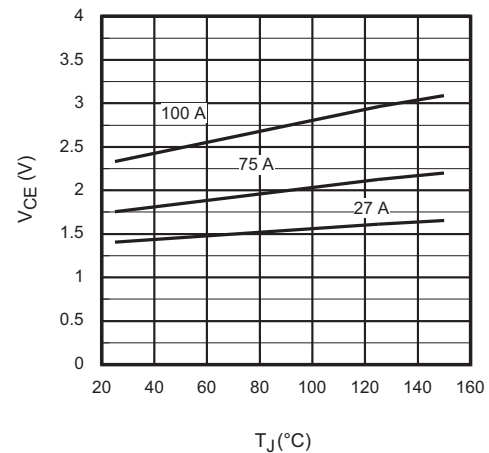


Fig. 8 - Typical IGBT Collector to Emitter Voltage vs. Junction Temperature, $V_{GE} = 15\text{ V}$

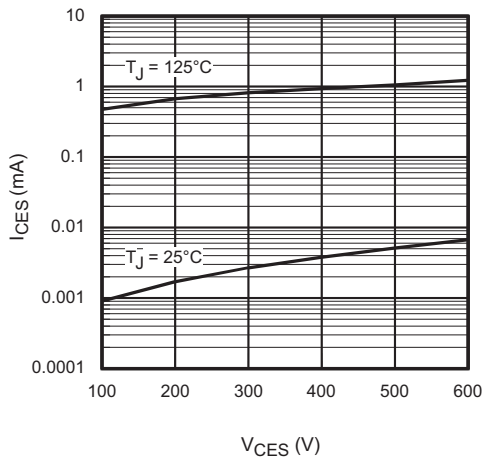


Fig. 6 - Typical IGBT Zero Gate Voltage Collector Current

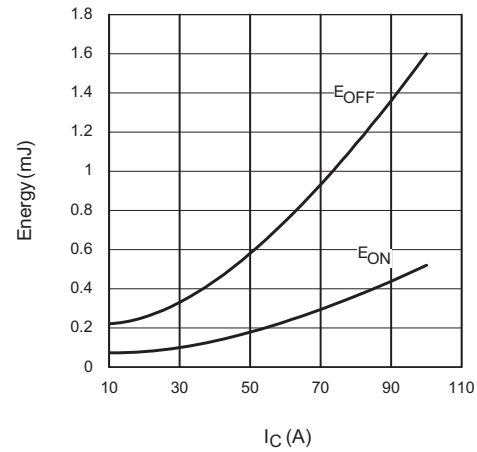


Fig. 9 - Typical IGBT Energy Loss vs. I_C
 $T_J = 125\text{ }^\circ\text{C}$, $L = 500\text{ }\mu\text{H}$, $V_{CC} = 360\text{ V}$,
 $R_g = 5\text{ }\Omega$, $V_{GE} = 15\text{ V}$

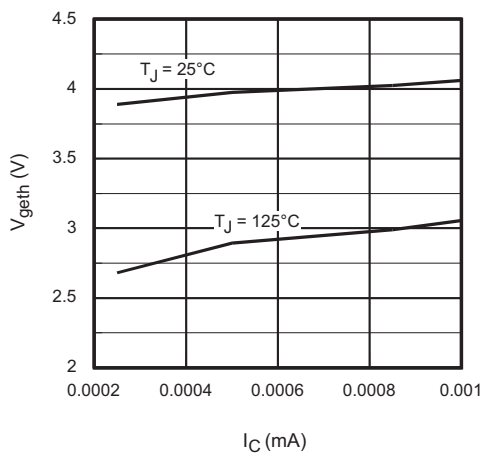


Fig. 7 - Typical IGBT Threshold Voltage

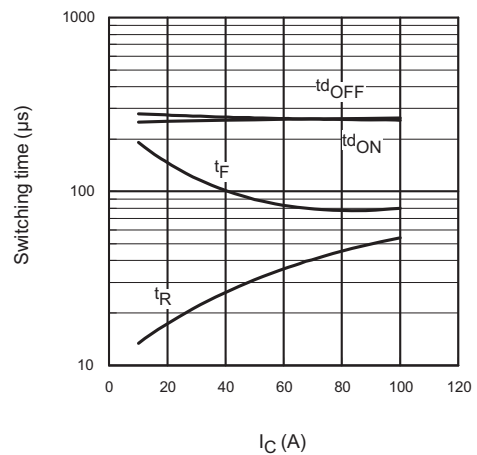


Fig. 10 - Typical IGBT Switching Time vs. I_C
 $T_J = 125\text{ }^\circ\text{C}$, $L = 500\text{ }\mu\text{H}$, $V_{CC} = 360\text{ V}$,
 $R_g = 5\text{ }\Omega$, $V_{GE} = 15\text{ V}$

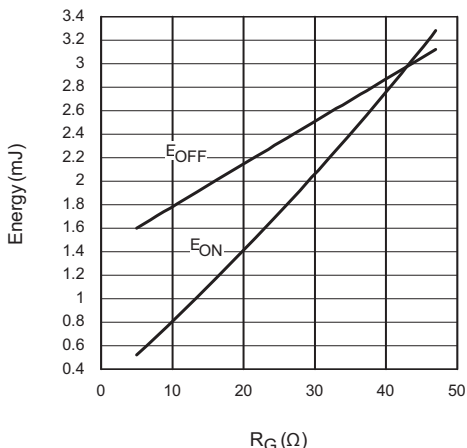


Fig. 11 - Typical IGBT Energy Loss vs. R_g
 $T_J = 125^\circ\text{C}$, $I_C = 100\text{ A}$, $L = 500\ \mu\text{H}$,
 $V_{CC} = 360\text{ V}$, $V_{GE} = 15\text{ V}$

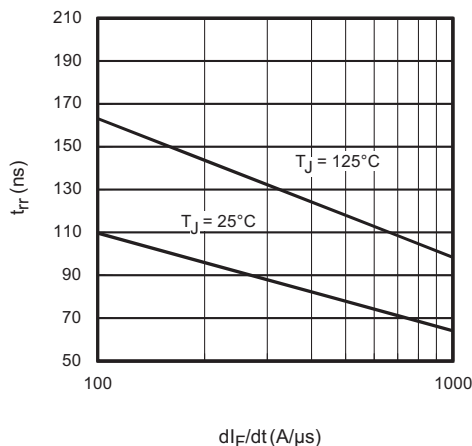


Fig. 13 - Typical t_{rr} diode vs. dI_F/dt
 $V_{RR} = 200\text{ V}$, $I_F = 50\text{ A}$

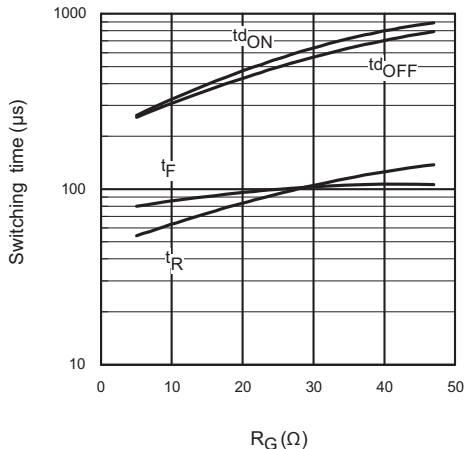


Fig. 12 - Typical IGBT Switching Time vs. R_g
 $T_J = 125^\circ\text{C}$, $L = 500\ \mu\text{H}$, $V_{CC} = 360\text{ V}$,
 $I_C = 100\text{ A}$, $V_{GE} = 15\text{ V}$

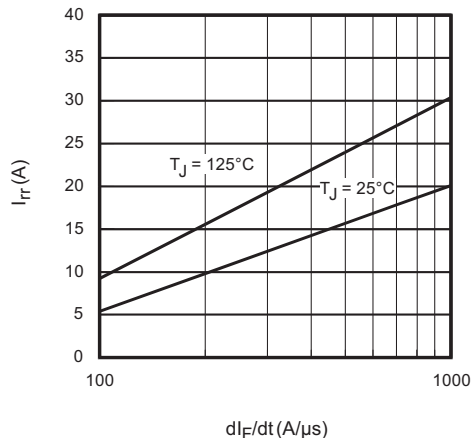


Fig. 14 - Typical I_{rr} diode vs. dI_F/dt
 $V_{RR} = 200\text{ V}$, $I_F = 50\text{ A}$

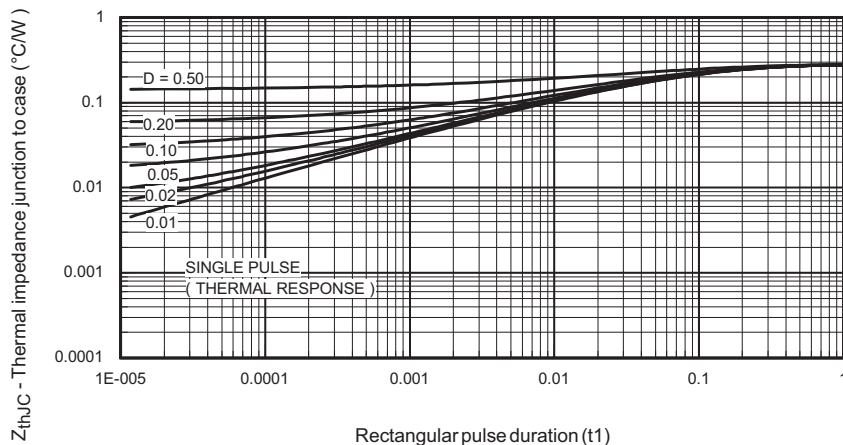


Fig. 15 - Maximum Thermal Impedance Z_{thJC} Characteristics (IGBT)

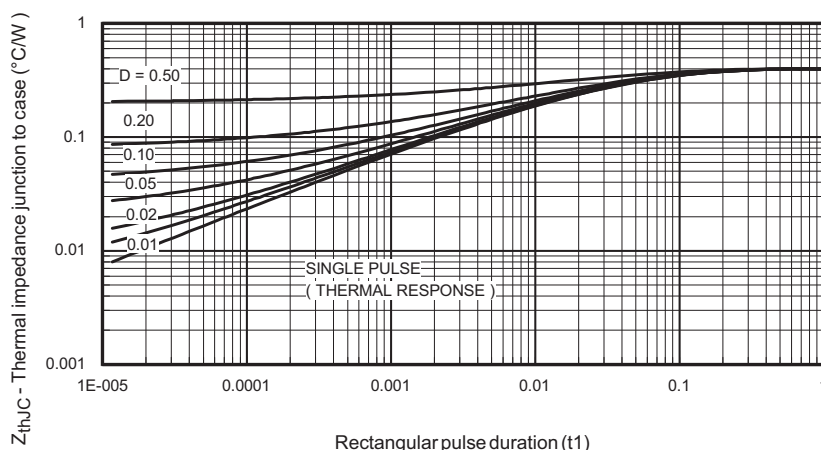
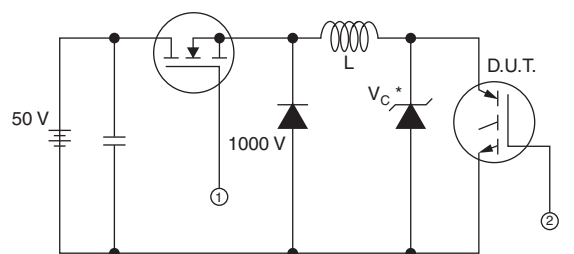


Fig. 16 - Maximum Thermal Impedance Z_{thJC} Characteristics (diode)



* Driver same type as D.U.T.; $V_C = 80\%$ of $V_{ce(max)}$
 * Note: Due to the 50 V power supply, pulse width and inductor will increase to obtain I_d

Fig. 17a - Clamped Inductive Load Test Circuit

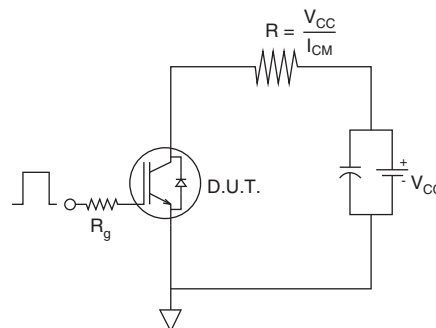


Fig. 17b - Pulsed Collector Current Test Circuit

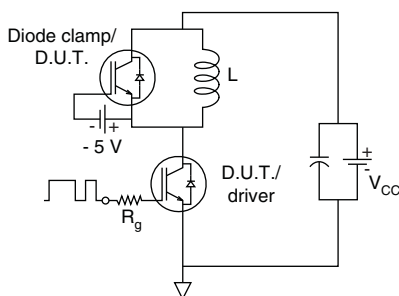


Fig. 18a - Switching Loss Test Circuit

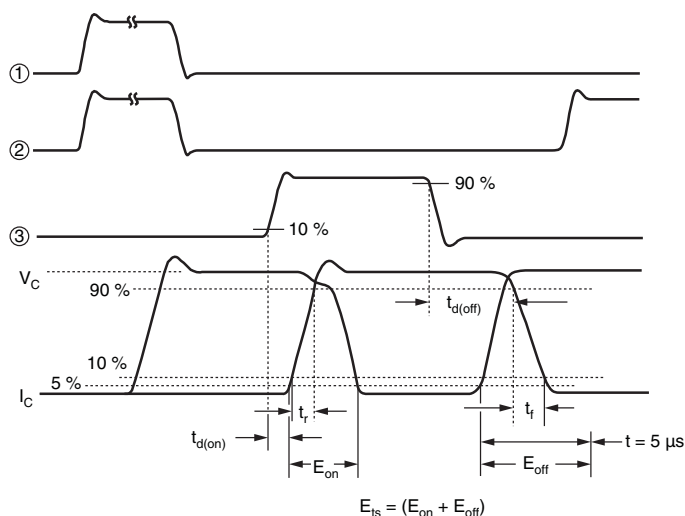


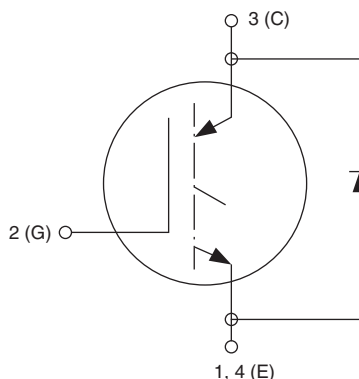
Fig. 18b - Switching Loss Waveforms Test Circuit

ORDERING INFORMATION TABLE

Device code	VS-	G	B	100	D	A	60	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 (100 = 100 A)
- 5** - Circuit configuration (D = Single switch with antiparallel diode)
- 6** - Package indicator (A = SOT-227)
- 7** - Voltage rating (60 = 600 V)
- 8** - Speed/type (U = Ultrafast IGBT)
- 9** - Totally lead (Pb)-free

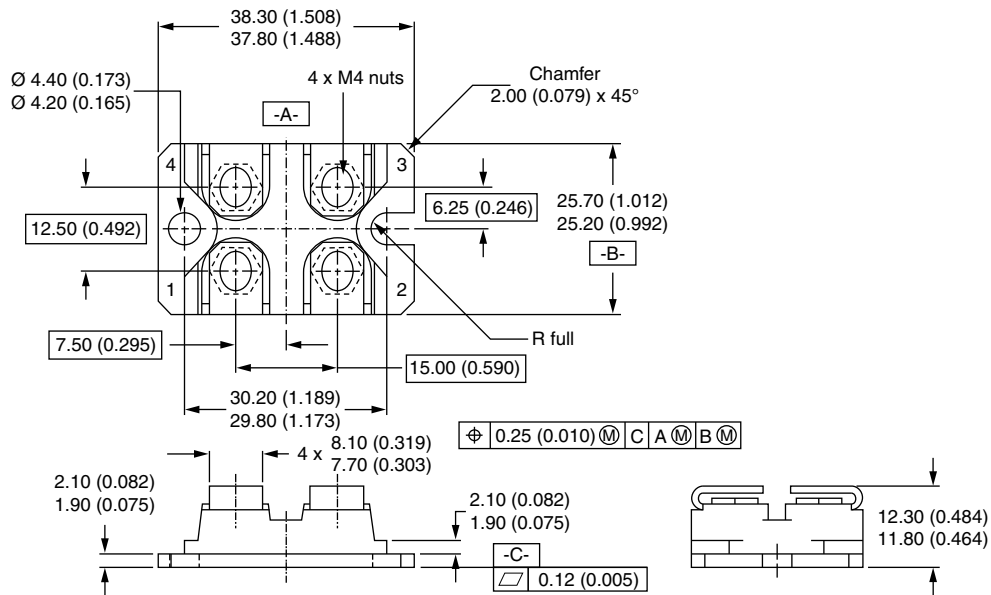
CIRCUIT CONFIGURATION



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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