

## Insulated Gate Bipolar Transistor (Ultrafast Speed IGBT), 100 A



SOT-227

**FEATURES**

- Ultrafast: Optimized for minimum saturation voltage and speed up to 40 kHz in hard switching, > 200 kHz in resonant mode
- Very low conduction and switching losses
- Fully isolate package (2500 V<sub>AC</sub>/RMS)
- Very low internal inductance (≤ 5 nH typical)
- Industry standard outline
- UL approved file E78996
- Compliant to RoHS Directive 2002/95/EC
- Designed and qualified for industrial level


**RoHS  
COMPLIANT**

PRODUCT SUMMARY	
V <sub>CES</sub>	600 V
V <sub>CE(on)</sub> (typical)	1.92 V
V <sub>GE</sub>	15 V
I <sub>C</sub>	100 A

**BENEFITS**

- Designed for increased operating efficiency in power conversion: UPS, SMPS, welding, induction heating
- Lower overall losses available at frequencies = 20 kHz
- Easy to assemble and parallel
- Direct mounting to heatsink
- Lower EMI, requires less snubbing
- Plug-in compatible with other SOT-227 packages

ABSOLUTE MAXIMUM RATINGS				
PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
Collector to emitter breakdown voltage	V <sub>CES</sub>		600	V
Continuous collector current	I <sub>C</sub>	T <sub>C</sub> = 25 °C	200	A
		T <sub>C</sub> = 100 °C	100	
Pulsed collector current	I <sub>CM</sub>		400	
Clamped inductive load current	I <sub>LM</sub>	V <sub>CC</sub> = 80 % (V <sub>CES</sub> ), V <sub>GE</sub> = 20 V, L = 10 μH, R <sub>G</sub> = 2.0 Ω, See fig. 13a	400	
Gate to emitter voltage	V <sub>GE</sub>		± 20	V
Reverse voltage avalanche energy	E <sub>ARV</sub>	Repetitive rating; pulse width limited by maximum junction temperature	160	mJ
RMS isolation voltage	V <sub>ISOL</sub>	Any terminal to case, t = 1 minute	2500	V
Maximum power dissipation	P <sub>D</sub>	T <sub>C</sub> = 25 °C	500	W
		T <sub>C</sub> = 100 °C	200	
Operating junction and storage temperature range	T <sub>J</sub> , T <sub>Stg</sub>		- 55 to + 150	°C
Mounting torque		6-32 or M3 screw	1.3 (12)	N · m (lbf · in)

THERMAL AND MECHANICAL SPECIFICATIONS				
PARAMETER	SYMBOL	TYP.	MAX.	UNITS
Junction to case	R <sub>thJC</sub>	-	0.25	°C/W
Case to sink, flat, greased surface	R <sub>thCS</sub>	0.05	-	
Weight of module		30	-	g



ELECTRICAL SPECIFICATIONS (T <sub>J</sub> = 25 °C unless otherwise specified)							
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS	
Collector to emitter breakdown voltage	V <sub>(BR)CES</sub>	V <sub>GE</sub> = 0 V, I <sub>C</sub> = 250 μA	600	-	-	V	
Emitter to collector breakdown voltage	V <sub>(BR)ECS</sub>	V <sub>GE</sub> = 0 V, I <sub>C</sub> = 1.0 A Pulse width ≤ 80 μs; duty factor ≤ 0.1	18	-	-		
Temperature coeff. of breakdown	ΔV <sub>(BR)CES</sub> /ΔT <sub>J</sub>	V <sub>GE</sub> = 0 V, I <sub>C</sub> = 10 mA	-	0.38	-	V/°C	
Collector to emitter saturation voltage	V <sub>CE(on)</sub>	I <sub>C</sub> = 100 A	V <sub>GE</sub> = 15 V See fig. 2, 5	-	1.60	1.9	V
		I <sub>C</sub> = 200 A		-	1.92	-	
		I <sub>C</sub> = 100 A, T <sub>J</sub> = 150 °C		-	1.54	-	
Gate threshold voltage	V <sub>GE(th)</sub>	V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 250 μA	3.0	-	6.0		
Temperature coeff. of threshold voltage	ΔV <sub>GE(th)</sub> /ΔT <sub>J</sub>	V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 2.0 mA	-	- 11	-	mV/°C	
Forward transconductance	g <sub>fe</sub>	V <sub>CE</sub> = 100 V, I <sub>C</sub> = 100 A Pulse width 5.0 μs, single shot	79	-	-	S	
Zero gate voltage collector current	I <sub>CES</sub>	V <sub>GE</sub> = 0 V, V <sub>CE</sub> = 600 V	-	-	1.0	mA	
		V <sub>GE</sub> = 0 V, V <sub>CE</sub> = 600 V, T <sub>J</sub> = 150 °C	-	-	10		
Gate to emitter leakage current	I <sub>GES</sub>	V <sub>GE</sub> = ± 20 V	-	-	± 250	nA	

SWITCHING CHARACTERISTICS (T <sub>J</sub> = 25 °C unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Total gate charge (turn-on)	Q <sub>g</sub>	I <sub>C</sub> = 100 A V <sub>CC</sub> = 400 V V <sub>GE</sub> = 15 V; See fig. 8	-	770	1200	nC
Gate-emitter charge (turn-on)	Q <sub>ge</sub>		-	100	150	
Gate-collector charge (turn-on)	Q <sub>gc</sub>		-	260	380	
Turn-on delay time	t <sub>d(on)</sub>	T <sub>J</sub> = 25 °C I <sub>C</sub> = 100 A V <sub>CC</sub> = 480 V V <sub>GE</sub> = 15 V R <sub>g</sub> = 2.0 Ω Energy losses include "tail" See fig. 9, 10, 14	-	54	-	ns
Rise time	t <sub>r</sub>		-	79	-	
Turn-off delay time	t <sub>d(off)</sub>		-	130	200	
Fall time	t <sub>f</sub>		-	300	450	
Turn-on switching loss	E <sub>on</sub>		-	0.98	-	
Turn-off switching loss	E <sub>off</sub>	-	3.48	-		
Total switching loss	E <sub>ts</sub>	-	4.46	7.6		
Turn-on delay time	t <sub>d(on)</sub>	T <sub>J</sub> = 150 °C I <sub>C</sub> = 100 A, V <sub>CC</sub> = 480 V V <sub>GE</sub> = 15 V, R <sub>g</sub> = 2.0 Ω Energy losses include "tail" See fig. 10, 11, 14	-	56	-	ns
Rise time	t <sub>r</sub>		-	75	-	
Turn-off delay time	t <sub>d(off)</sub>		-	160	-	
Fall time	t <sub>f</sub>		-	460	-	
Total switching loss	E <sub>ts</sub>		-	7.24	-	
Internal emitter inductance	L <sub>E</sub>	Measured 5 mm from package	-	5.0	-	nH
Input capacitance	C <sub>ies</sub>	V <sub>GE</sub> = 0 V V <sub>CC</sub> = 30 V f = 1.0 MHz; See fig. 7	-	16 500	-	pF
Output capacitance	C <sub>oes</sub>		-	1000	-	
Reverse transfer capacitance	C <sub>res</sub>		-	200	-	

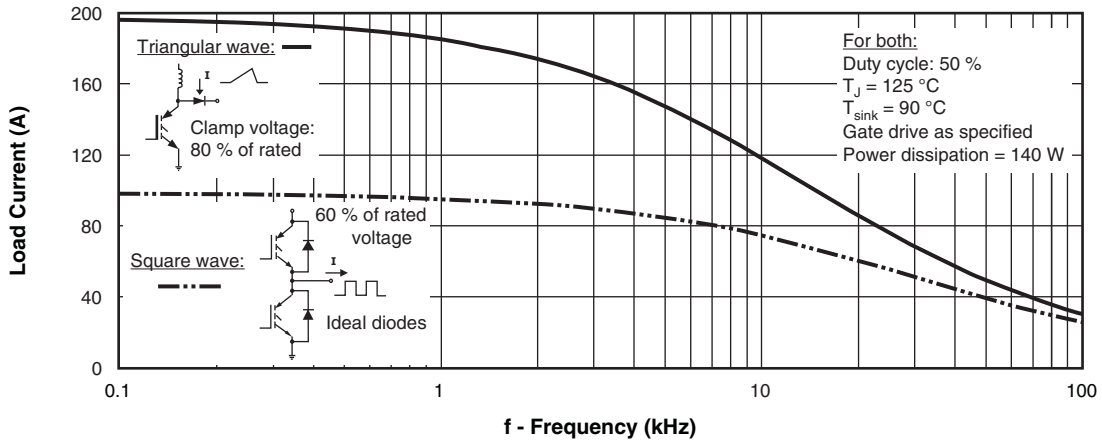


Fig. 1 - Typical Load Current vs. Frequency  
(Load Current =  $I_{RMS}$  of Fundamental)

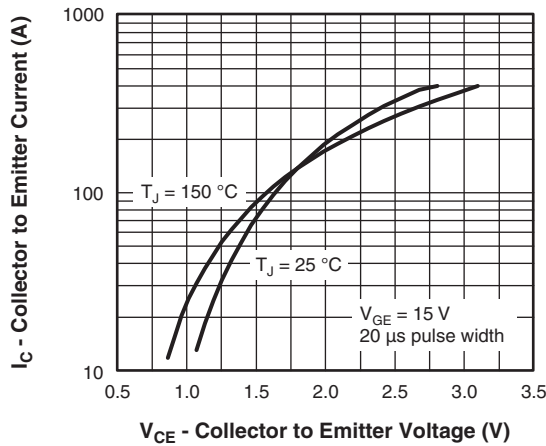


Fig. 2 - Typical Output Characteristics

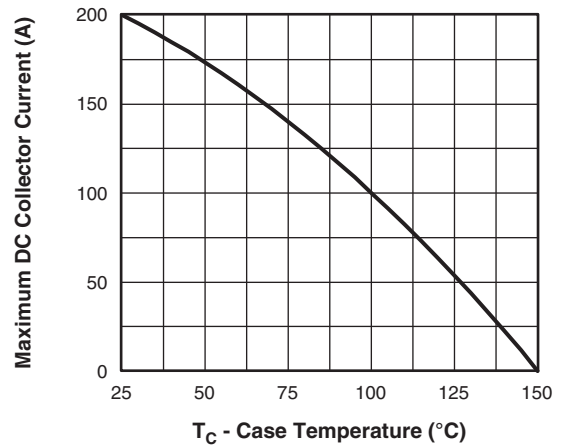


Fig. 4 - Maximum Collector Current vs. Case Temperature

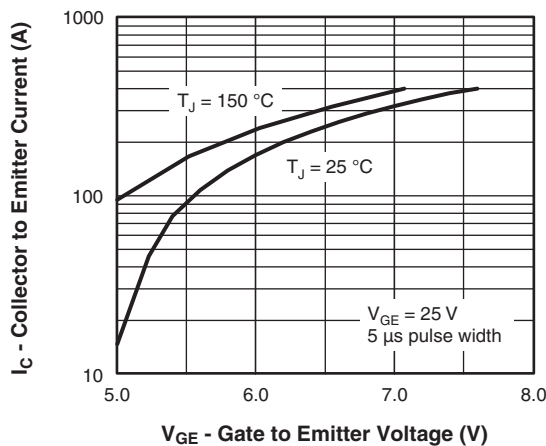


Fig. 3 - Typical Transfer Characteristics

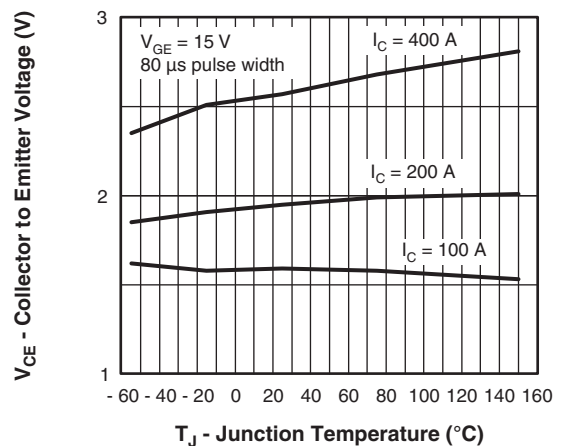


Fig. 5 - Typical Collector to Emitter Voltage vs. Junction Temperature

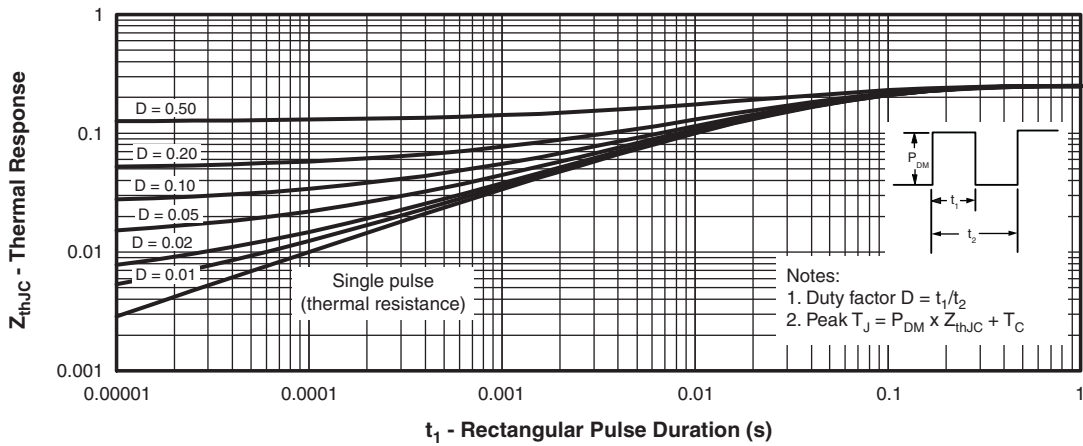


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction to Case

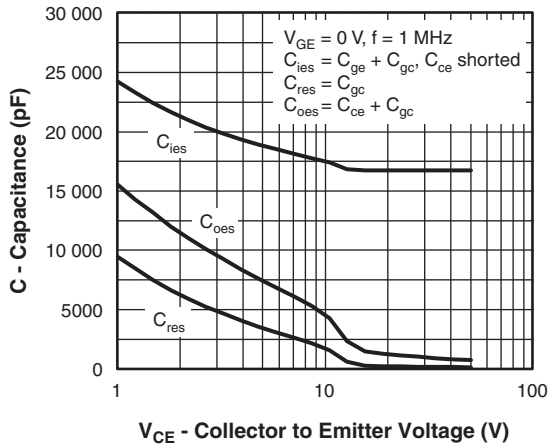


Fig. 7 - Typical Capacitance vs. Collector to Emitter Voltage

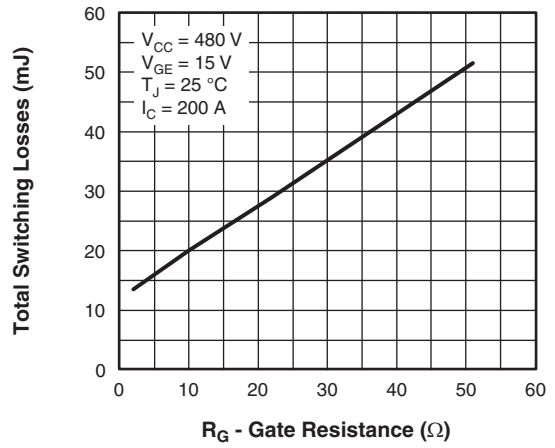


Fig. 9 - Typical Switching Losses vs. Gate Resistance

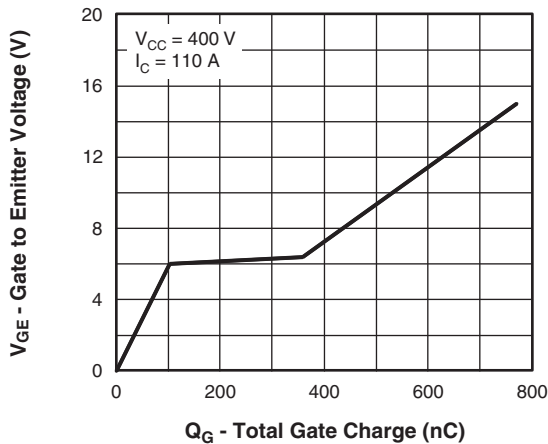


Fig. 8 - Typical Gate Charge vs. Gate to Emitter Voltage

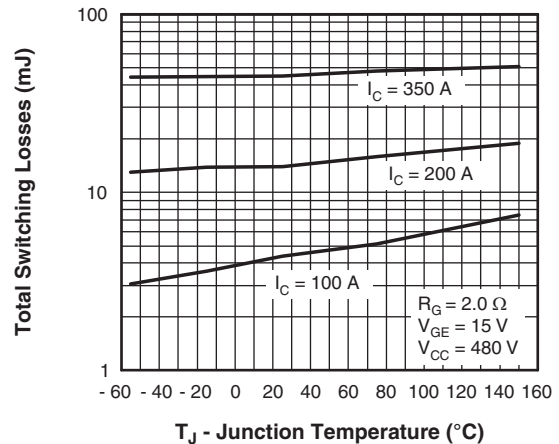


Fig. 10 - Typical Switching Losses vs. Junction Temperature

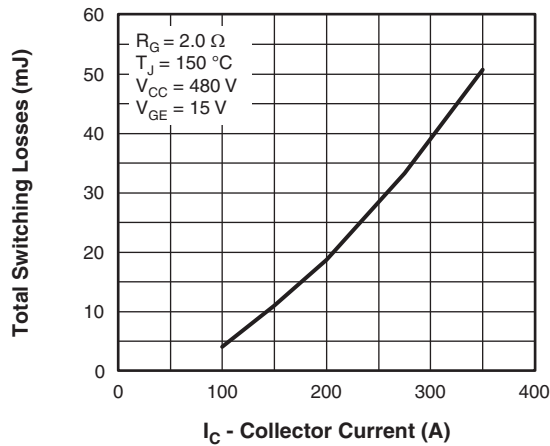


Fig. 11 - Typical Switching Losses vs. Collector Current

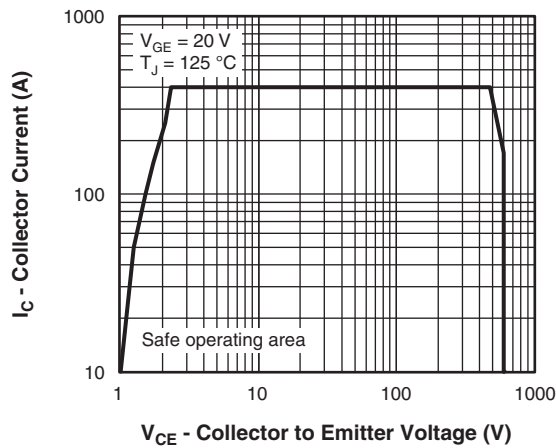
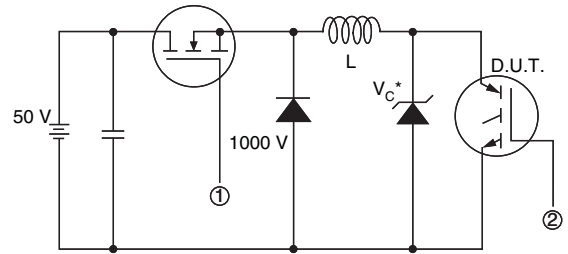


Fig. 12 - Turn-Off SOA



\* Driver same type as D.U.T.;  $V_C = 80\%$  of  $V_{CE}(\text{max})$

**Note:** Due to the 50 V power supply, pulse width and inductor will increase to obtain rated  $I_d$

Fig. 13a - Clamped Inductive Load Test Circuit

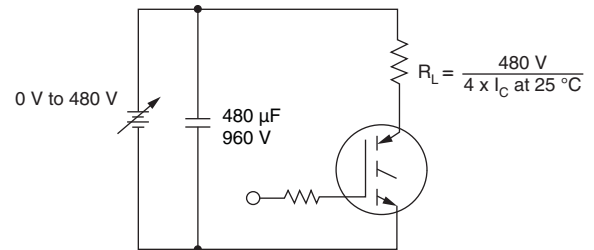
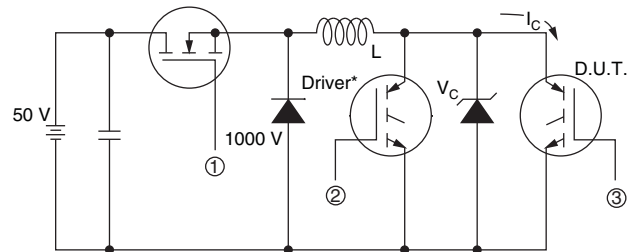


Fig. 13b - Pulsed Collector Current Test Circuit



\* Driver same type as D.U.T.,  $V_C = 480 \text{ V}$

Fig. 14a - Switching Loss Test Circuit

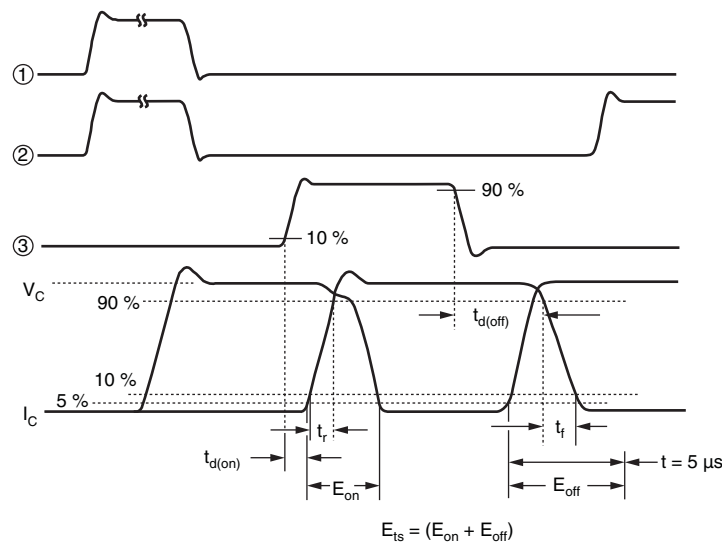
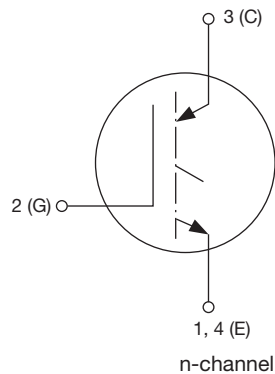


Fig. 14b - Switching Loss Waveforms

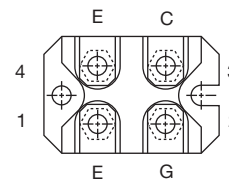
**ORDERING INFORMATION TABLE**

Device code	<b>G</b>	<b>A</b>	<b>200</b>	<b>S</b>	<b>A</b>	<b>60</b>	<b>U</b>	<b>P</b>
	1	2	3	4	5	6	7	8

- |          |  |
|----------|--|
| <b>1</b> | - Insulated Gate Bipolar Transistor (IGBT)   |
| <b>2</b> | - Generation 4, IGBT silicon, DBC construction   |
| <b>3</b> | - Current rating (200 = 200 A)   |
| <b>4</b> | - Single switch, no diode  |
| <b>5</b> | - SOT-227  |
| <b>6</b> | - Voltage rating (60 = 600 V)  |
| <b>7</b> | - Speed/type (U = Ultrafast)   |
| <b>8</b> | - <ul style="list-style-type: none"> <li>• None = Standard production</li> <li>• P = Lead (Pb)-free</li> </ul> |

**CIRCUIT CONFIGURATION**


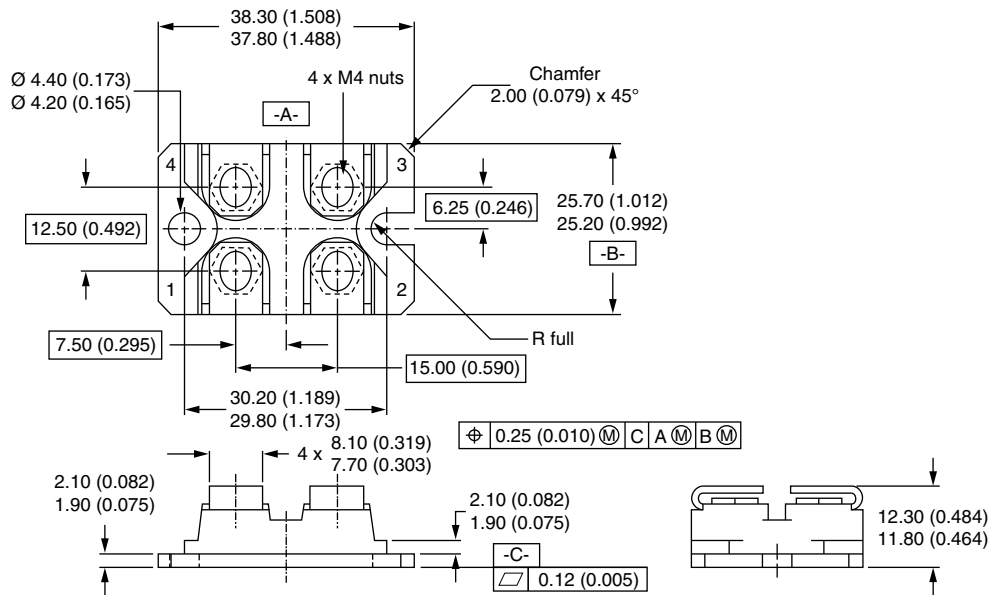
Lead assignment



LINKS TO RELATED DOCUMENTS	
Dimensions	<a href="http://www.vishay.com/doc?95036">www.vishay.com/doc?95036</a>
Packaging information	<a href="http://www.vishay.com/doc?95037">www.vishay.com/doc?95037</a>

## SOT-227

**DIMENSIONS** in millimeters (inches)



### Notes

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



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- Техническая поддержка проекта;
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