

## 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



<b>ELECTRICAL SPECIFICATIONS</b> ( $T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Collector to emitter breakdown voltage	$V_{(BR)CES}$	$V_{GE} = 0\text{ V}, I_C = 250\text{ }\mu\text{A}$	600	-	-	V
Emitter to collector breakdown voltage	$V_{(BR)ECS}$	$V_{GE} = 0\text{ V}, I_C = 1.0\text{ A}$ Pulse width $\leq 80\text{ }\mu\text{s}$ ; duty factor $\leq 0.1$	18	-	-	
Temperature coeff. of breakdown	$\Delta V_{(BR)CES}/\Delta T_J$	$V_{GE} = 0\text{ V}, I_C = 10\text{ mA}$	-	0.38	-	V/ $^\circ\text{C}$
Collector to emitter saturation voltage	$V_{CE(on)}$	$I_C = 100\text{ A}$	-	1.60	1.9	V
		$I_C = 200\text{ A}$				
		$I_C = 100\text{ A}, T_J = 150\text{ }^\circ\text{C}$				
		$V_{GE} = 15\text{ V}$ See fig. 2, 5				
Gate threshold voltage	$V_{GE(th)}$	$V_{CE} = V_{GE}, I_C = 250\text{ }\mu\text{A}$	3.0	-	6.0	
Temperature coeff. of threshold voltage	$\Delta V_{GE(th)}/\Delta T_J$	$V_{CE} = V_{GE}, I_C = 2.0\text{ mA}$	-	- 11	-	mV/ $^\circ\text{C}$
Forward transconductance	$g_{fe}$	$V_{CE} = 100\text{ V}, I_C = 100\text{ A}$ Pulse width $5.0\text{ }\mu\text{s}$ , single shot	79	-	-	S
Zero gate voltage collector current	$I_{CES}$	$V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}$	-	-	1.0	mA
		$V_{GE} = 0\text{ V}, V_{CE} = 600\text{ V}, T_J = 150\text{ }^\circ\text{C}$	-	-	10	
Gate to emitter leakage current	$I_{GES}$	$V_{GE} = \pm 20\text{ V}$	-	-	$\pm 250$	nA

<b>SWITCHING CHARACTERISTICS</b> ( $T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Total gate charge (turn-on)	$Q_g$	$I_C = 100\text{ A}$ $V_{CC} = 400\text{ V}$ $V_{GE} = 15\text{ V}$ ; See fig. 8	-	770	1200	nC
Gate-emitter charge (turn-on)	$Q_{ge}$		-	100	150	
Gate-collector charge (turn-on)	$Q_{gc}$		-	260	380	
Turn-on delay time	$t_{d(on)}$	$T_J = 25\text{ }^\circ\text{C}$ $I_C = 100\text{ A}$ $V_{CC} = 480\text{ V}$ $V_{GE} = 15\text{ V}$ $R_g = 2.0\text{ }\Omega$ Energy losses include "tail" See fig. 9, 10, 14	-	54	-	ns
Rise time	$t_r$		-	79	-	
Turn-off delay time	$t_{d(off)}$		-	130	200	
Fall time	$t_f$		-	300	450	
Turn-on switching loss	$E_{on}$		-	0.98	-	
Turn-off switching loss	$E_{off}$	-	3.48	-		
Total switching loss	$E_{ts}$	-	4.46	7.6		
Turn-on delay time	$t_{d(on)}$	$T_J = 150\text{ }^\circ\text{C}$ $I_C = 100\text{ A}, V_{CC} = 480\text{ V}$ $V_{GE} = 15\text{ V}, R_g = 2.0\text{ }\Omega$ Energy losses include "tail" See fig. 10, 11, 14	-	56	-	ns
Rise time	$t_r$		-	75	-	
Turn-off delay time	$t_{d(off)}$		-	160	-	
Fall time	$t_f$		-	460	-	
Total switching loss	$E_{ts}$		-	7.24	-	
Internal emitter inductance	$L_E$	Measured 5 mm from package	-	5.0	-	nH
Input capacitance	$C_{ies}$	$V_{GE} = 0\text{ V}$ $V_{CC} = 30\text{ V}$ $f = 1.0\text{ MHz}$ ; See fig. 7	-	16 500	-	pF
Output capacitance	$C_{oes}$		-	1000	-	
Reverse transfer capacitance	$C_{res}$		-	200	-	

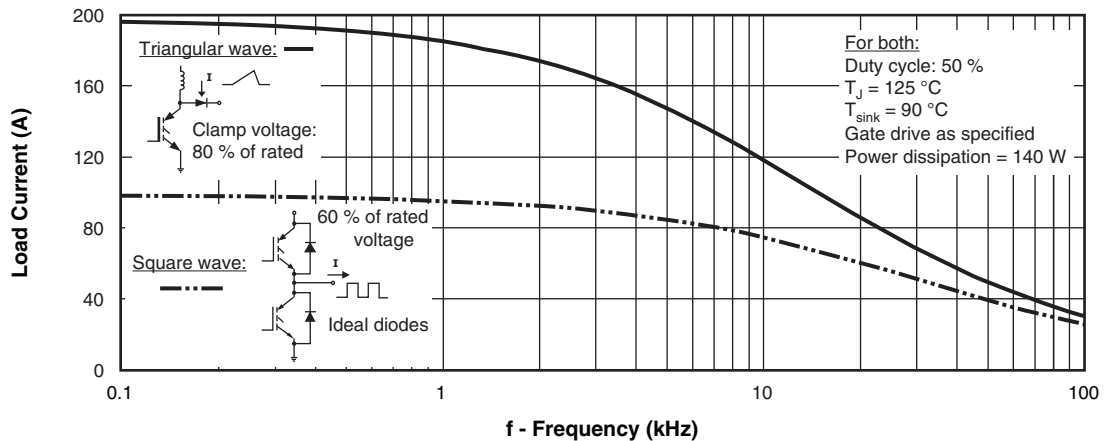


Fig. 1 - Typical Load Current vs. Frequency  
(Load Current =  $I_{RMS}$  of Fundamental)

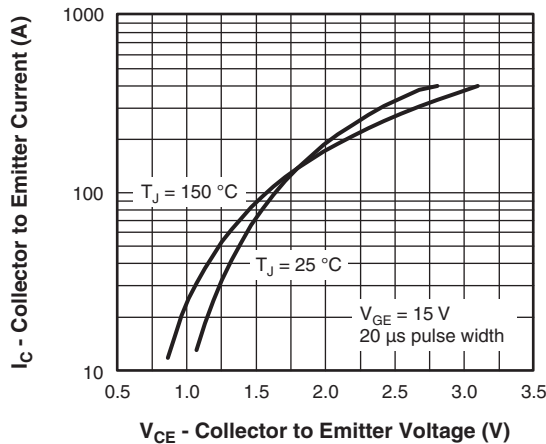


Fig. 2 - Typical Output Characteristics

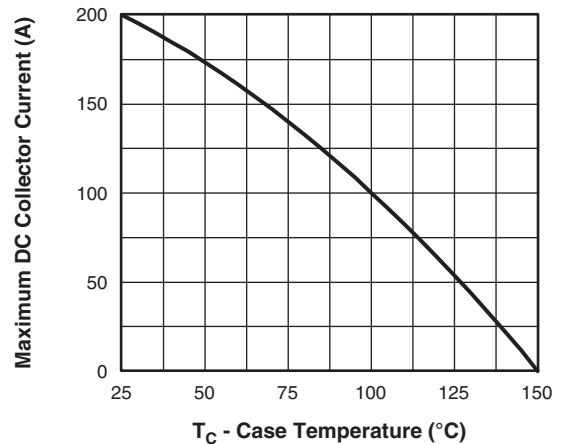


Fig. 4 - Maximum Collector Current vs. Case Temperature

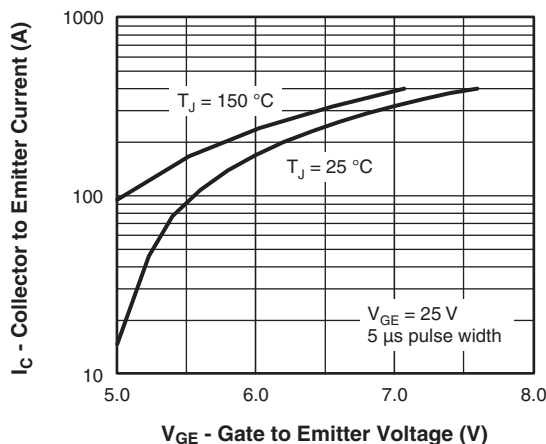


Fig. 3 - Typical Transfer Characteristics

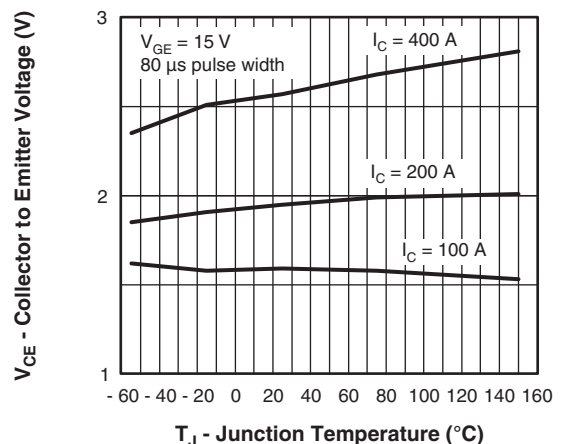


Fig. 5 - Typical Collector to Emitter Voltage vs. Junction Temperature

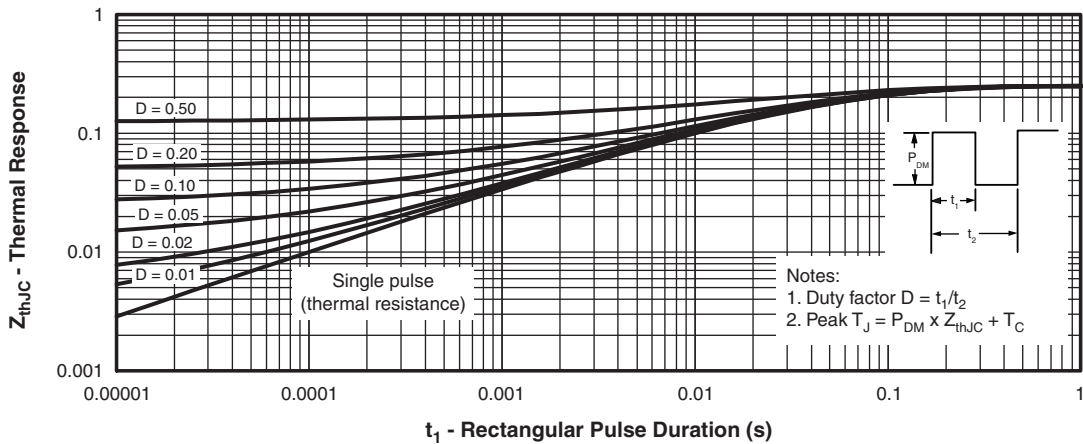


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction to Case

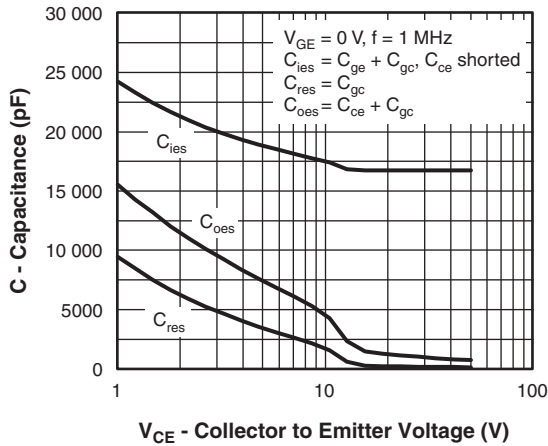


Fig. 7 - Typical Capacitance vs. Collector to Emitter Voltage

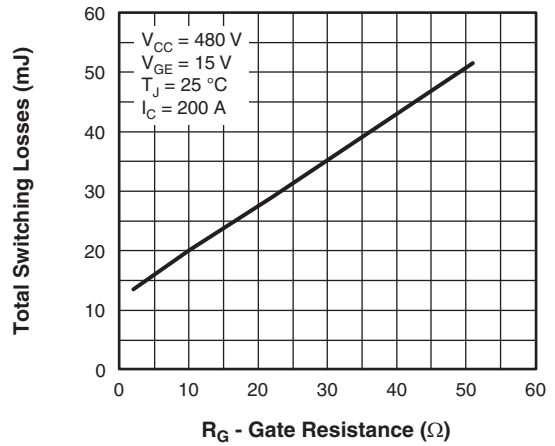


Fig. 9 - Typical Switching Losses vs. Gate Resistance

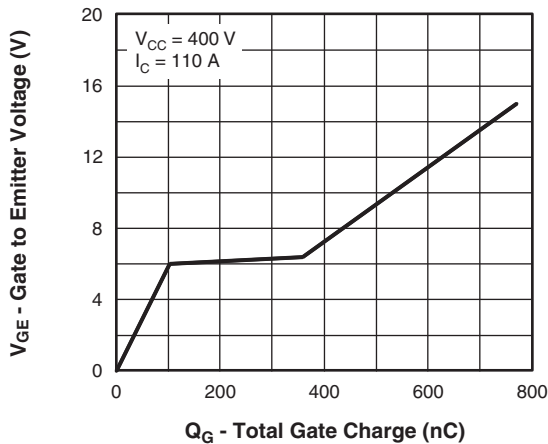


Fig. 8 - Typical Gate Charge vs. Gate to Emitter Voltage

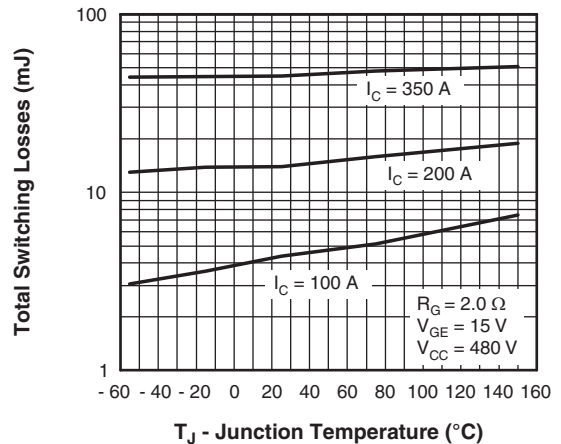


Fig. 10 - Typical Switching Losses vs. Junction Temperature

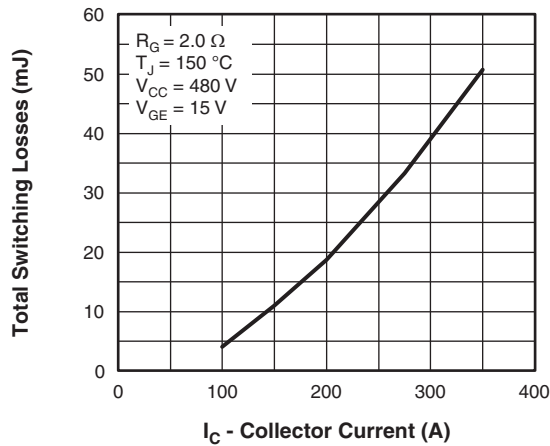


Fig. 11 - Typical Switching Losses vs. Collector Current

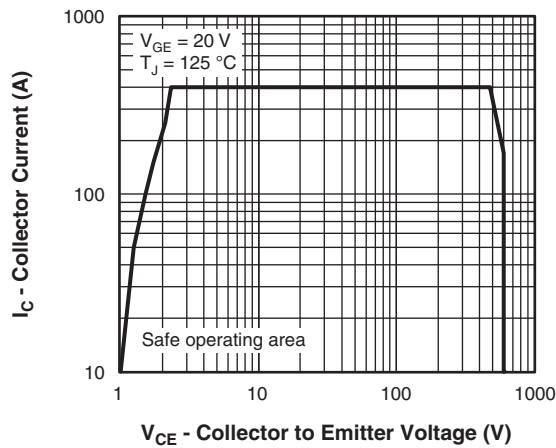
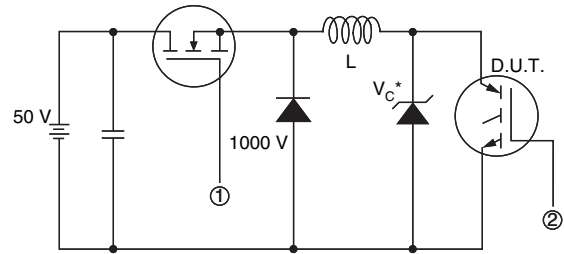


Fig. 12 - Turn-Off SOA



\* 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

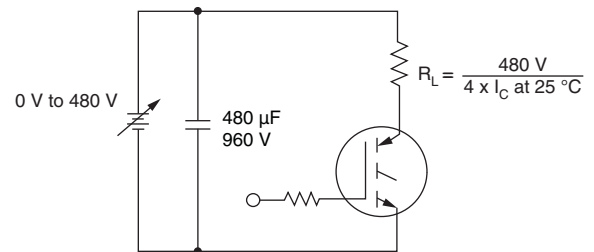
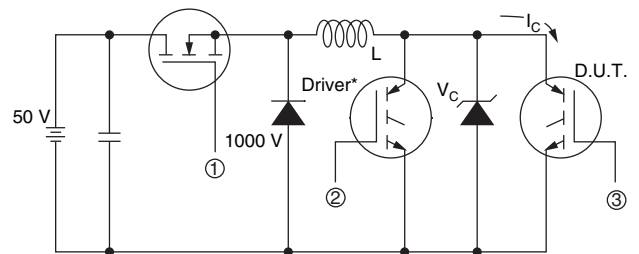


Fig. 13b - Pulsed Collector Current Test Circuit



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

Fig. 14a - Switching Loss Test Circuit

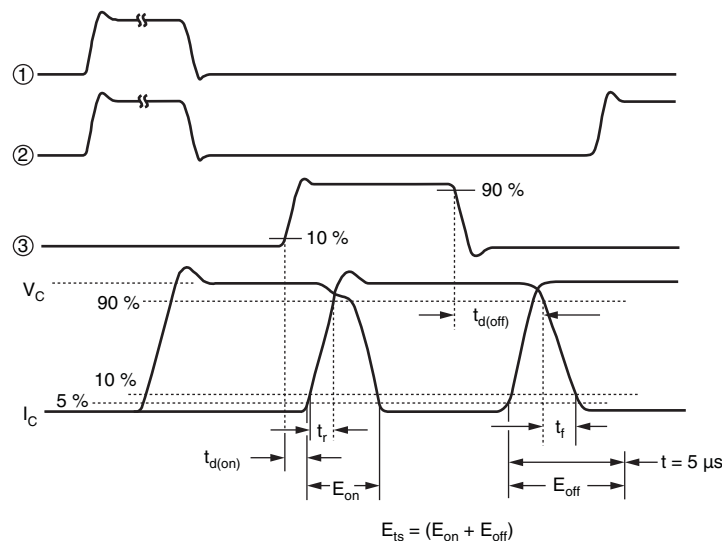
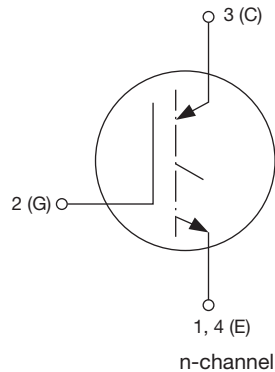


Fig. 14b - Switching Loss Waveforms

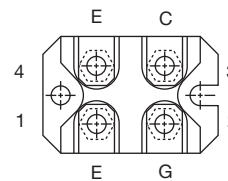
**ORDERING INFORMATION TABLE**

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

- 1** - Insulated Gate Bipolar Transistor (IGBT)
- 2** - Generation 4, IGBT silicon, DBC construction
- 3** - Current rating (200 = 200 A)
- 4** - Single switch, no diode
- 5** - SOT-227
- 6** - Voltage rating (60 = 600 V)
- 7** - Speed/type (U = Ultrafast)
- 8** -
  - None = Standard production
  - P = Lead (Pb)-free

**CIRCUIT CONFIGURATION**


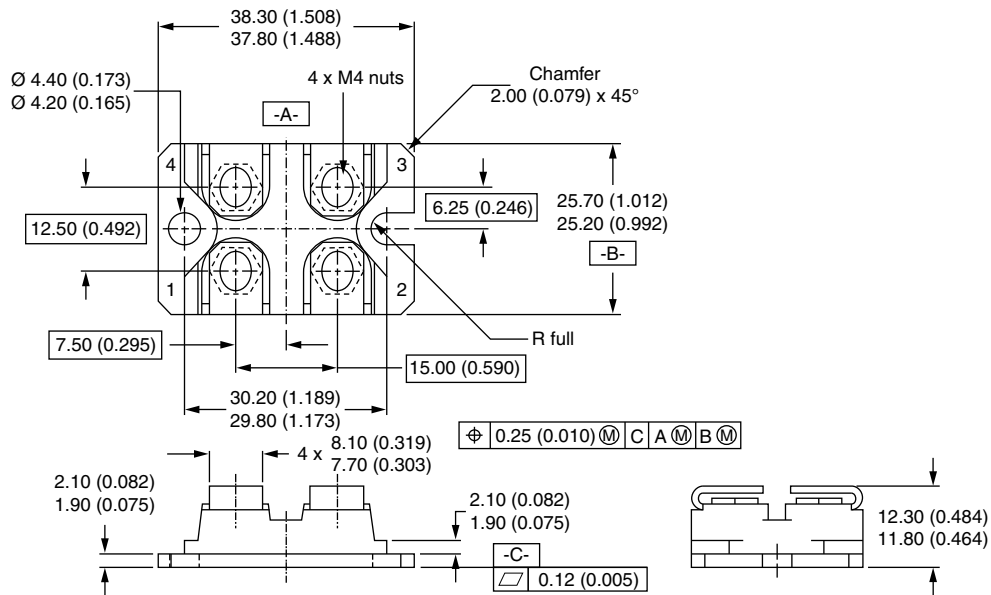
Lead assignment



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



## Disclaimer

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