

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_{AC/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 _{CES}	600 V
V _{CE(on)} (typical)	1.92 V
V _{GE}	15 V
I _C	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 _{CES}		600	V
Continuous collector current	I _C	T _C = 25 °C	200	A
		T _C = 100 °C	100	
Pulsed collector current	I _{CM}		400	
Clamped inductive load current	I _{LM}	V _{CC} = 80 % (V _{CES}), V _{GE} = 20 V, L = 10 μH, R _G = 2.0 Ω, See fig. 13a	400	
Gate to emitter voltage	V _{GE}		± 20	V
Reverse voltage avalanche energy	E _{ARV}	Repetitive rating; pulse width limited by maximum junction temperature	160	mJ
RMS isolation voltage	V _{ISOL}	Any terminal to case, t = 1 minute	2500	V
Maximum power dissipation	P _D	T _C = 25 °C	500	W
		T _C = 100 °C	200	
Operating junction and storage temperature range	T _J , T _{Stg}		- 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 _{thJC}	-	0.25	°C/W
Case to sink, flat, greased surface	R _{thCS}	0.05	-	
Weight of module		30	-	g

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

ELECTRICAL SPECIFICATIONS ($T_J = 25\text{ }^\circ\text{C}$ 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 ≤ 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	
		$I_C = 200\text{ A}$		-	1.92		-
		$I_C = 100\text{ A}$, $T_J = 150\text{ }^\circ\text{C}$		-	1.54		-
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}	$V_{GE} = \pm 20\text{ V}$	-	-	± 250	nA	

SWITCHING CHARACTERISTICS ($T_J = 25\text{ }^\circ\text{C}$ 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	-	

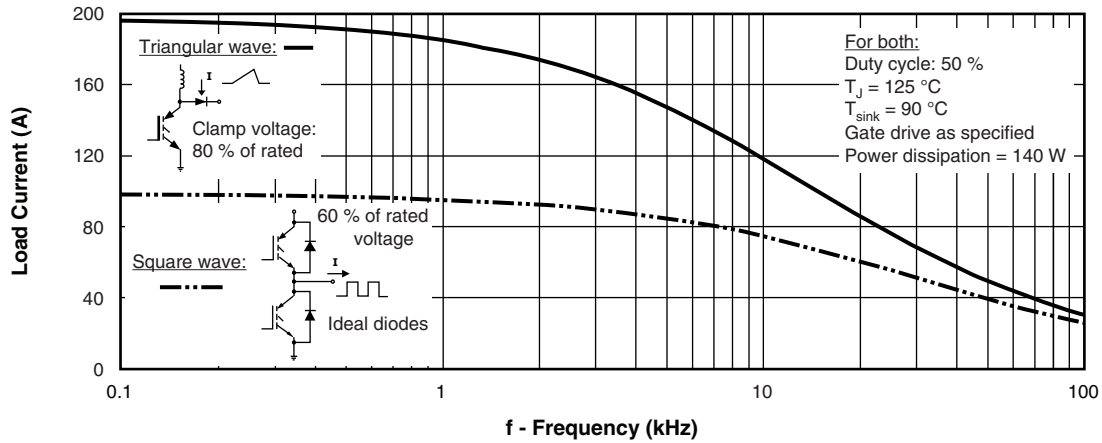
Insulated Gate Bipolar Transistor (Ultrafast Speed IGBT), 100 A Vishay Semiconductors


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

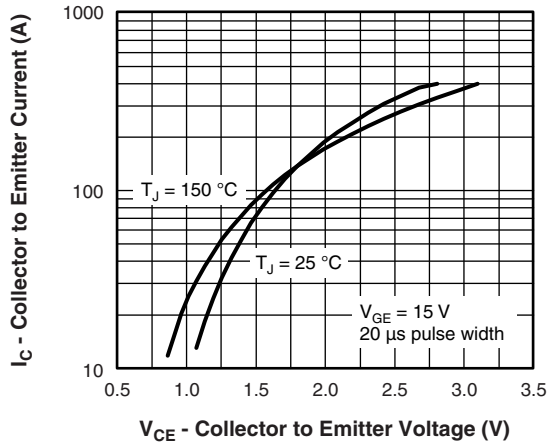


Fig. 2 - Typical Output Characteristics

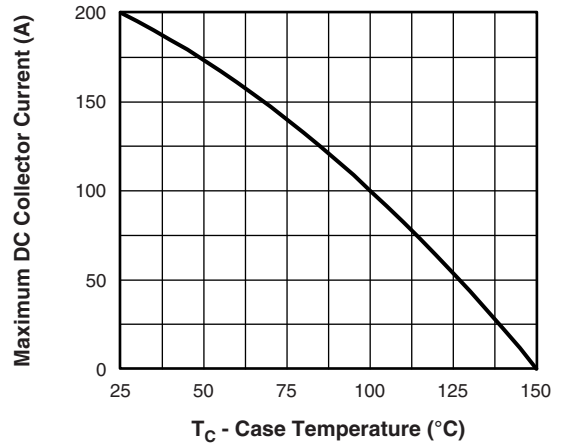


Fig. 4 - Maximum Collector Current vs. Case Temperature

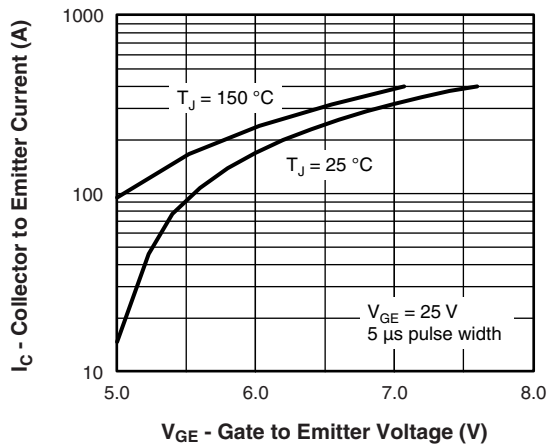


Fig. 3 - Typical Transfer Characteristics

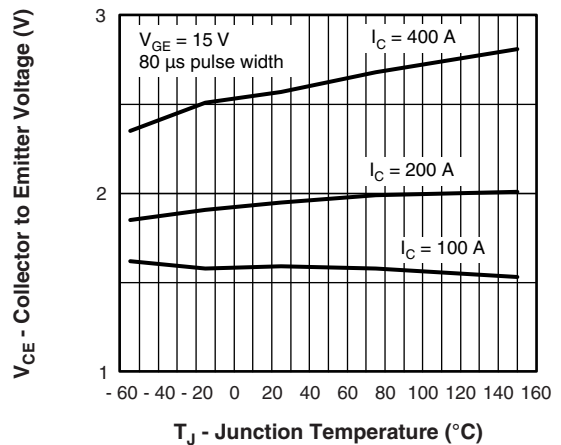


Fig. 5 - Typical Collector to Emitter Voltage vs. Junction Temperature

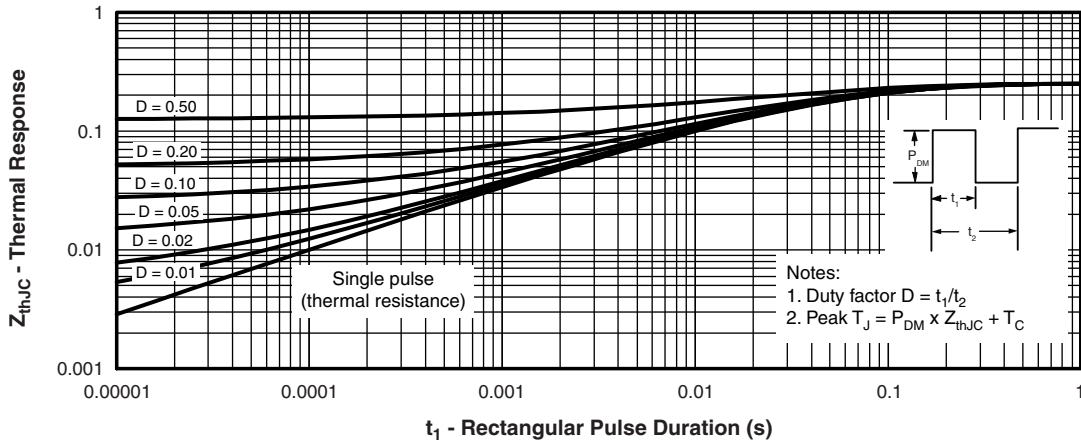


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction to Case

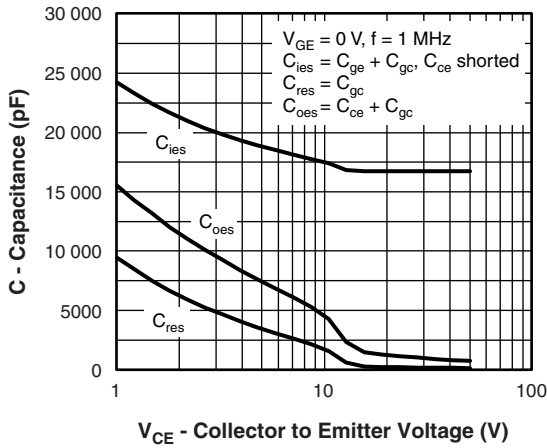


Fig. 7 - Typical Capacitance vs. Collector to Emitter Voltage

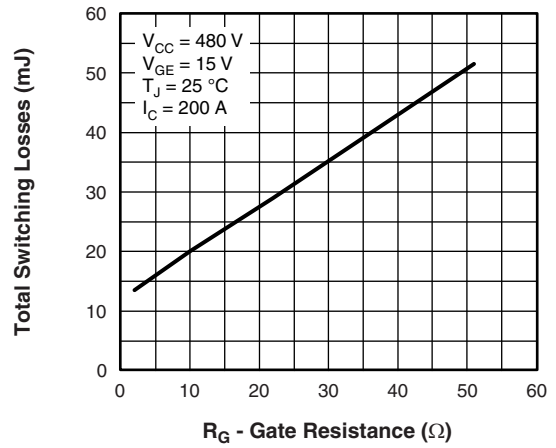


Fig. 9 - Typical Switching Losses vs. Gate Resistance

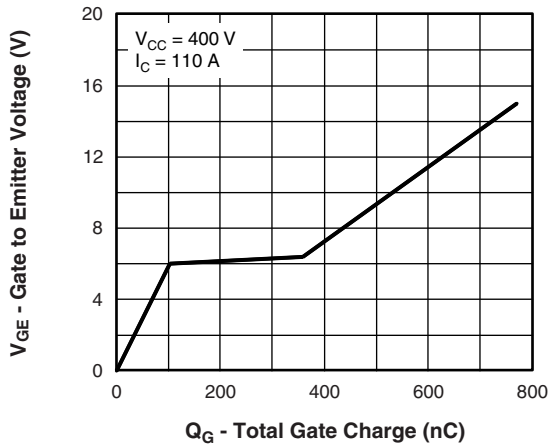


Fig. 8 - Typical Gate Charge vs. Gate to Emitter Voltage

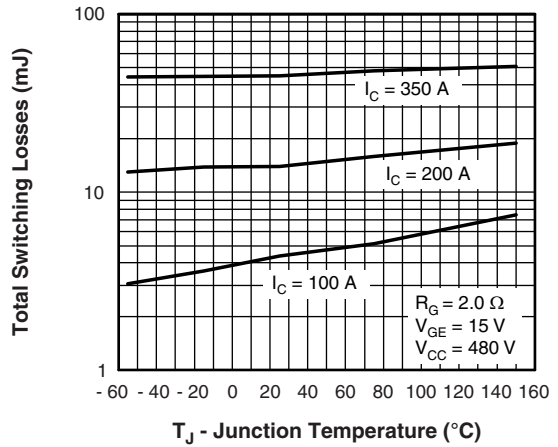


Fig. 10 - Typical Switching Losses vs. Junction Temperature

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

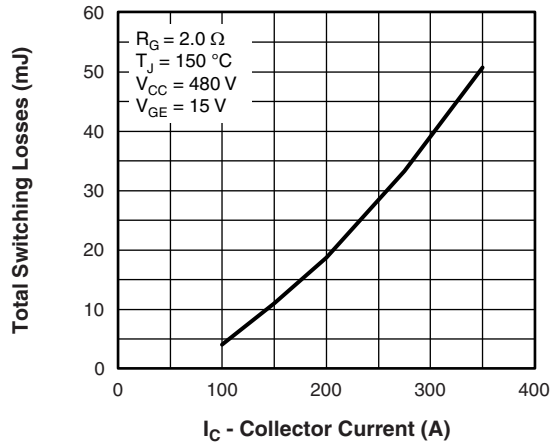


Fig. 11 - Typical Switching Losses vs. Collector Current

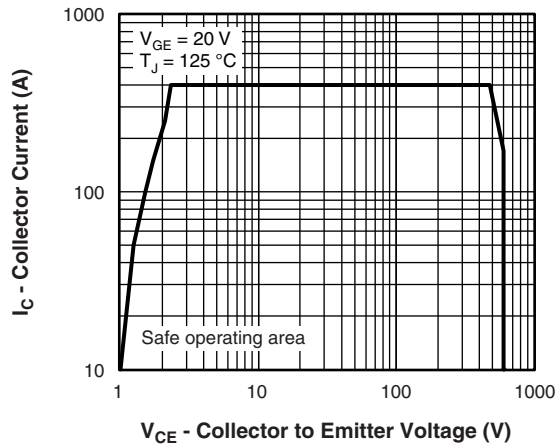
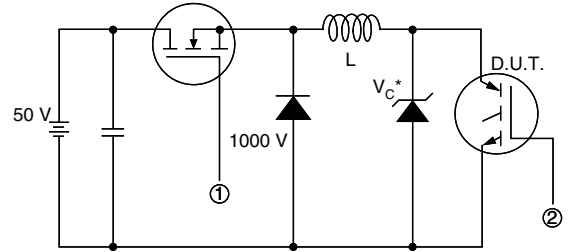


Fig. 12 - Turn-Off SOA



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

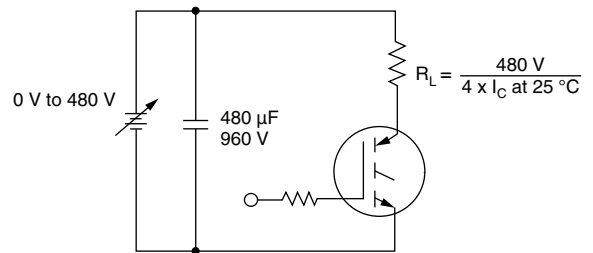
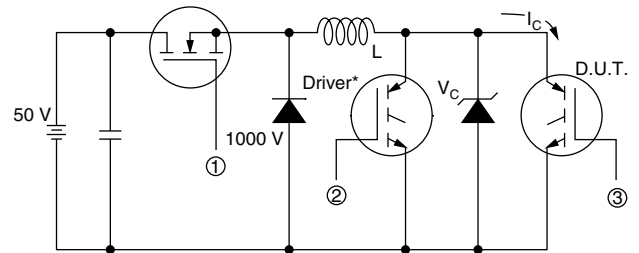
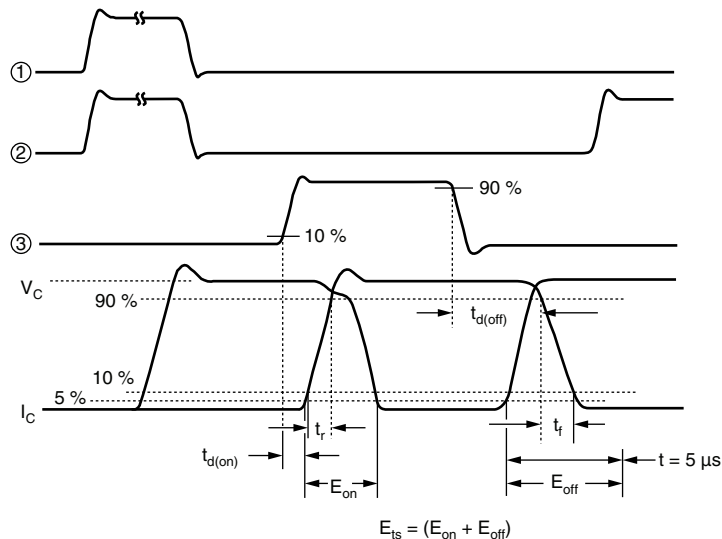


Fig. 13b - Pulsed Collector Current Test Circuit



* Driver same type as D.U.T., $V_C = 480$ V

Fig. 14a - Switching Loss Test Circuit



$$E_{ts} = (E_{on} + E_{off})$$

Fig. 14b - Switching Loss Waveforms

GA200SA60UP



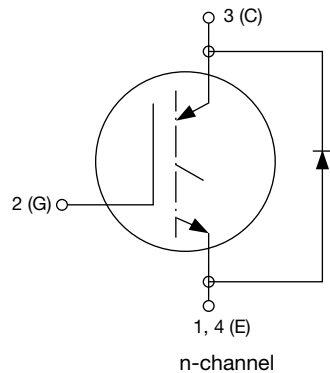
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ORDERING INFORMATION TABLE

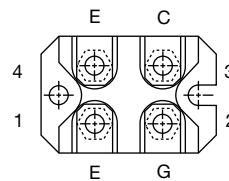
Device code	G	A	200	S	A	60	U	P
	①	②	③	④	⑤	⑥	⑦	⑧

- 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

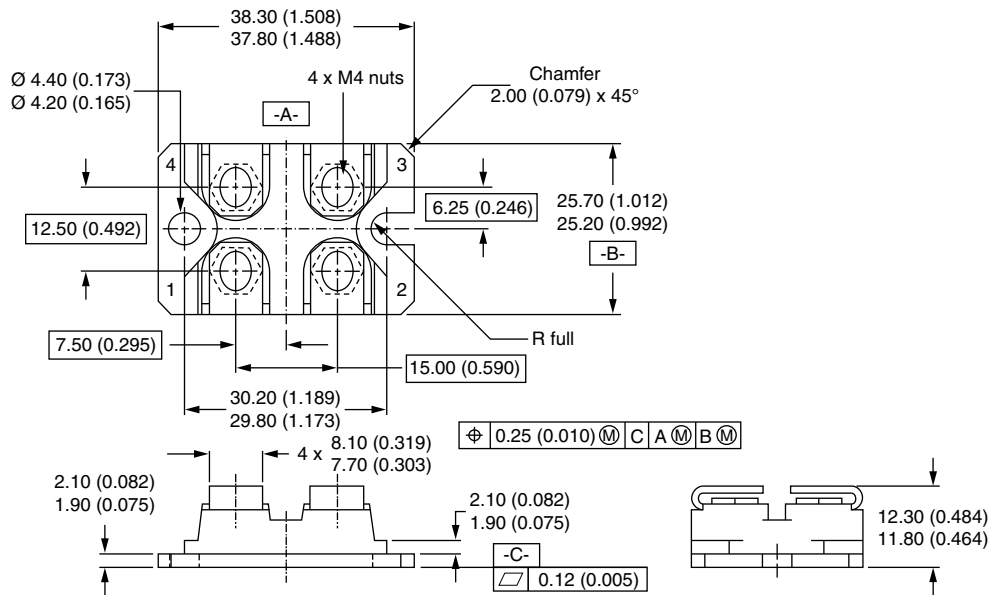


LINKS TO RELATED DOCUMENTS

Dimensions	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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