

Insulated Gate Bipolar Transistor Ultralow $V_{CE(on)}$, 342 A


SOT-227


PRODUCT SUMMARY

V_{CES}	600 V
$V_{CE(on)}$ (typical) at 200 A, 25 °C	1.33 V
I_C at $T_C = 97\text{ °C}$ ⁽¹⁾	200 A

Note

⁽¹⁾ Maximum I_{RMS} current admitted 100 A to do not exceed the maximum temperature of terminals

FEATURES

- Standard: Optimized for minimum saturation voltage and low speed up to 5 kHz
- Lowest conduction losses available
- Fully isolated package (2500 V_{AC})
- 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

BENEFITS

- Designed for increased operating efficiency in power conversion: UPS, SMPS, TIG welding, induction heating
- Easy to assemble and parallel
- Direct mounting to heatsink
- 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 ⁽¹⁾	$T_C = 25\text{ °C}$	342	A
		$T_C = 97\text{ °C}$	200	
Pulsed collector current	I_{CM}	Repetitive rating; $V_{GE} = 20\text{ V}$, pulse width limited by maximum junction temperature See fig. 15	400	
Clamped Inductive load current	I_{LM}	$V_{CC} = 80\% (V_{CES})$, $V_{GE} = 20\text{ V}$, $L = 10\text{ }\mu\text{H}$, $R_g = 2.0\text{ }\Omega$, See fig. 14	400	
Gate to emitter voltage	V_{GE}		± 20	V
Reverse voltage avalanche energy	E_{ARV}	Repetitive rating; pulse width limited by maximum junction temperature	155	mJ
RMS isolation voltage	V_{ISOL}	Any terminal to case, $t = 1\text{ minute}$	2500	V
Maximum power dissipation	P_D	$T_C = 25\text{ °C}$	781	W
		$T_C = 100\text{ °C}$	312	
Operating junction and storage temperature range	T_J, T_{Stg}		- 55 to + 150	°C
Mounting torque		6-32 or M3 screw	12 (1.3)	lbf · in (N · m)

Note

⁽¹⁾ Maximum I_{RMS} current admitted 100 A to do not exceed the maximum temperature of terminals

THERMAL AND MECHANICAL SPECIFICATIONS

PARAMETER	SYMBOL	TYP.	MAX.	UNITS
Junction to case	R_{thJC}	-	0.16	°C/W
Case to sink, flat, greased surface	R_{thCS}	0.05	-	
Weight of module		30	-	g

ELECTRICAL SPECIFICATIONS ($T_J = 25\text{ }^{\circ}\text{C}$ unless otherwise noted)						
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	$V_{(BR)ECS}^{(1)}$	$V_{GE} = 0\text{ V}$, $I_C = 1.0\text{ A}$	18	-	-	
Temperature coeff. of breakdown voltage	$\Delta V_{(BR)CES}/\Delta T_J$	$V_{GE} = 0\text{ V}$, $I_C = 1.0\text{ mA}$	-	0.62	-	V/ $^{\circ}\text{C}$
Collector to emitter saturation voltage	$V_{CE(on)}$	$I_C = 100\text{ A}$	-	1.10	1.3	V
		$I_C = 200\text{ A}$	-	1.33	-	
		$I_C = 100\text{ A}$, $T_J = 150\text{ }^{\circ}\text{C}$	-	1.02	-	
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	$\Delta V_{GE(th)}/\Delta T_J$	$V_{CE} = V_{GE}$, $I_C = 2\text{ mA}$	-	- 10	-	mV/ $^{\circ}\text{C}$
Forward transconductance	$g_{fe}^{(2)}$	$V_{CE} = 100\text{ V}$, $I_C = 100\text{ A}$	90	150	-	S
Zero gate voltage collector current	I_{CES}	$V_{GE} = 0\text{ V}$, $V_{CE} = 600\text{ V}$	-	-	1.0	mA
		$V_{GE} = 0\text{ V}$, $V_{CE} = 10\text{ V}$, $T_J = 150\text{ }^{\circ}\text{C}$	-	-	10	
Gate to emitter leakage current	I_{GES}	$V_{GE} = \pm 20\text{ V}$	-	-	± 250	nA

Notes(1) Pulse width $\leq 80\text{ }\mu\text{s}$; duty factor $\leq 0.1\text{ }\%$ (2) Pulse width $5.0\text{ }\mu\text{s}$, single shot

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, 13	-	78	-	ns
Rise time	t_r		-	56	-	
Turn-off delay time	$t_{d(off)}$		-	890	1300	
Fall time	t_f		-	390	580	
Turn-on switching loss	E_{on}	Energy losses include "tail" See fig. 9, 10, 13	-	0.98	-	mJ
Turn-off switching loss	E_{off}		-	17.4	-	
Total switching loss	E_{ts}		-	18.4	25.5	
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, 13	-	72	-	ns
Rise time	t_r		-	60	-	
Turn-off delay time	$t_{d(off)}$		-	1500	-	
Fall time	t_f		-	660	-	
Total switching loss	E_{ts}		-	35.7	-	mJ
Internal emitter inductance	L_E	Between lead, and center of the die contact	-	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	-	16 250	-	pF
Output capacitance	C_{oes}		-	1040	-	
Reverse transfer capacitance	C_{res}		-	190	-	

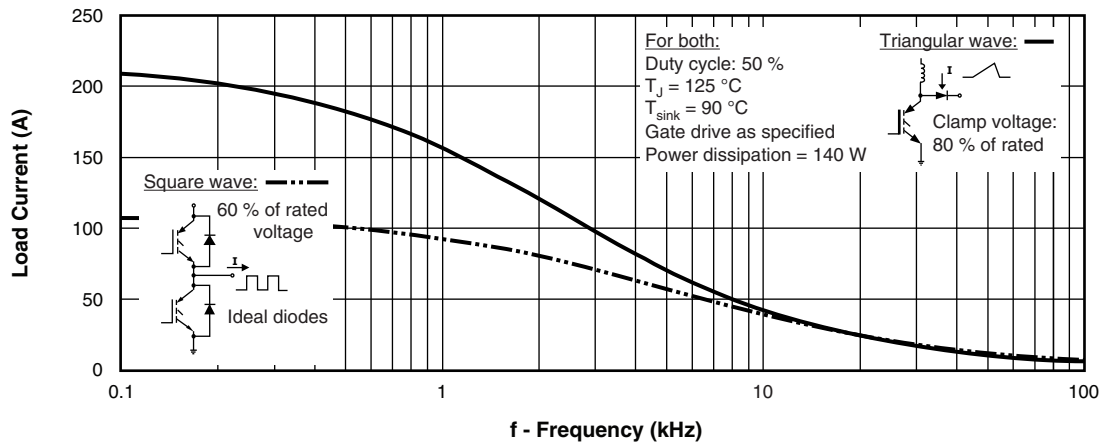


Fig. 1 - Typical Load Current vs. Frequency
(Load Current = I_{RMS} of Fundamental)

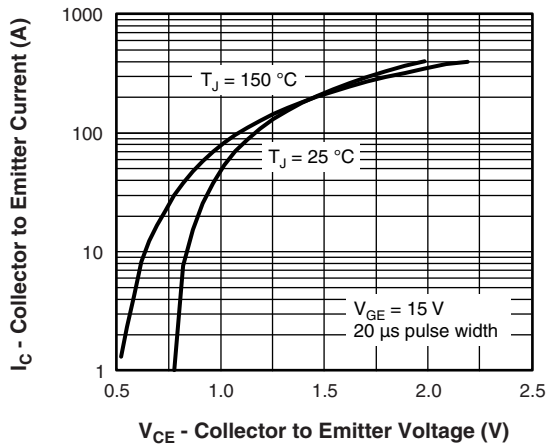


Fig. 2 - Typical Output Characteristics

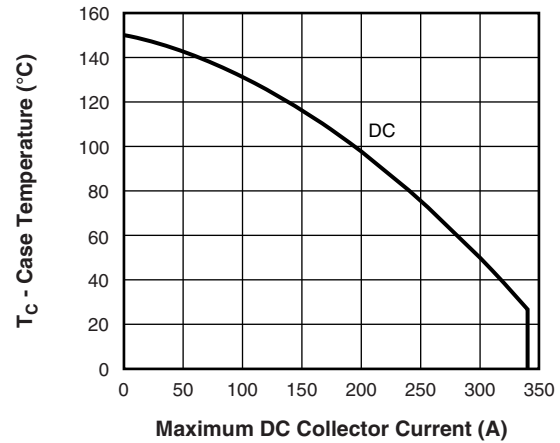


Fig. 4 - Maximum Collector Current vs. Case Temperature

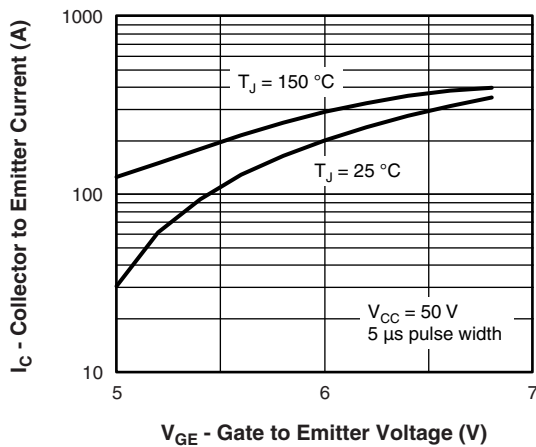


Fig. 3 - Typical Transfer Characteristics

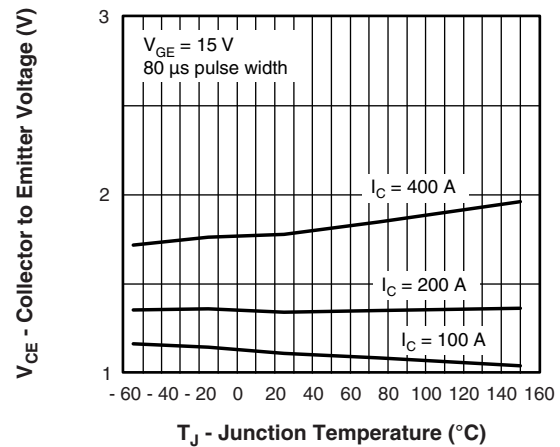


Fig. 5 - Typical Collector to Emitter Voltage vs. Junction Temperature

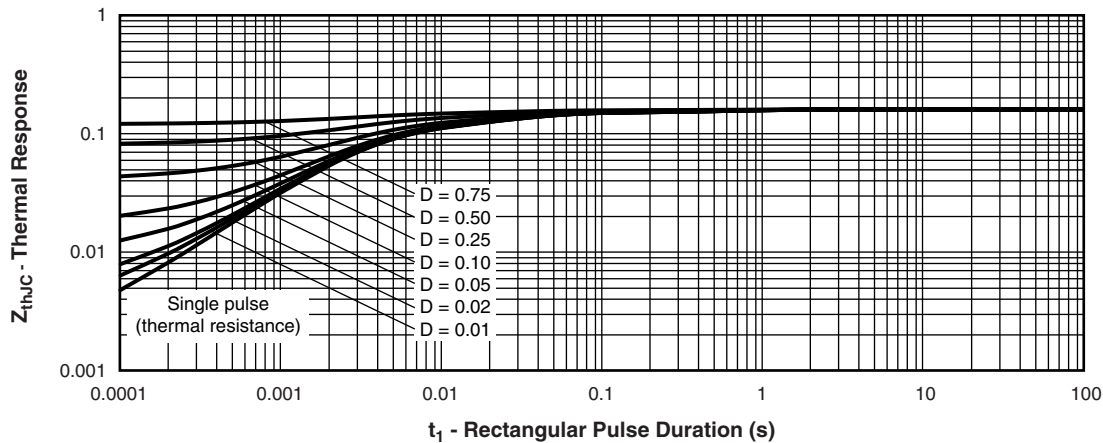


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction to Case

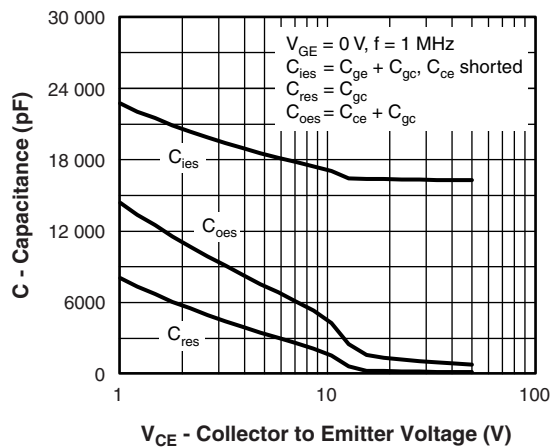


Fig. 7 - Typical Capacitance vs. Collector to Emitter Voltage

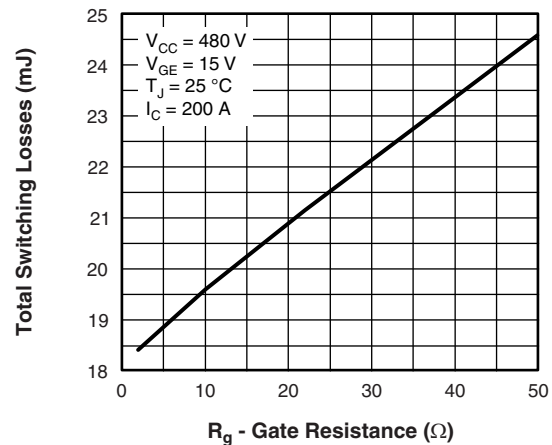


Fig. 9 - Typical Switching Losses vs. Gate Resistance

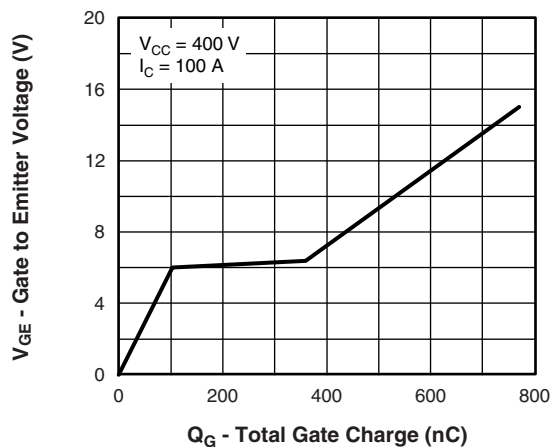


Fig. 8 - Typical Gate Charge vs. Gate to Emitter Voltage

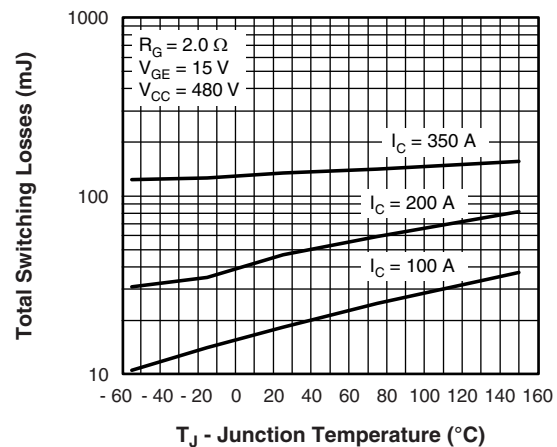


Fig. 10 - Typical Switching Losses vs. Junction Temperature

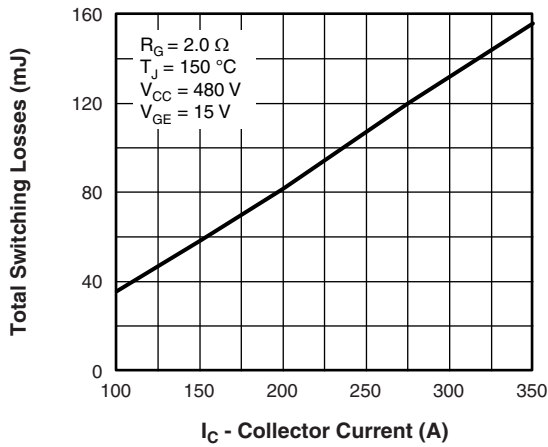
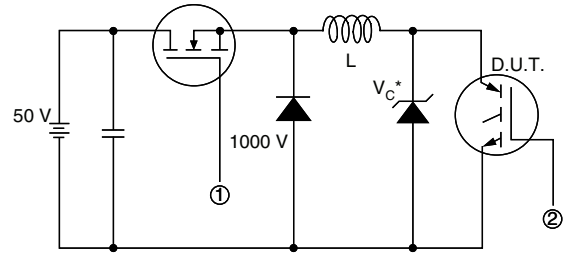


Fig. 11 - Typical Switching Losses vs. Collector Current



* 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

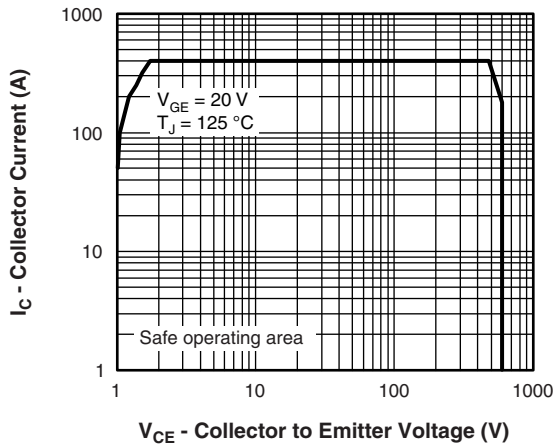


Fig. 12 - Turn-Off SOA

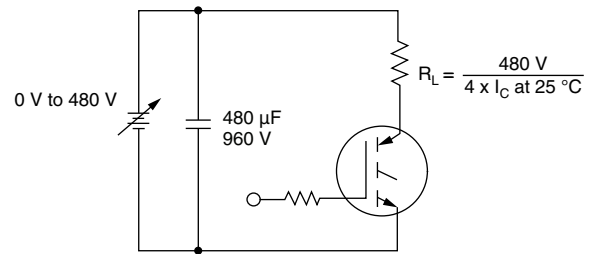
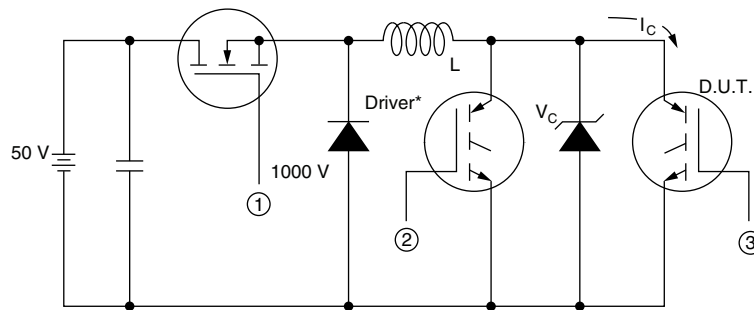


Fig. 13b - Pulsed Collector Current Test Circuit



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

Fig. 14a - Switching Lost Test Circuit

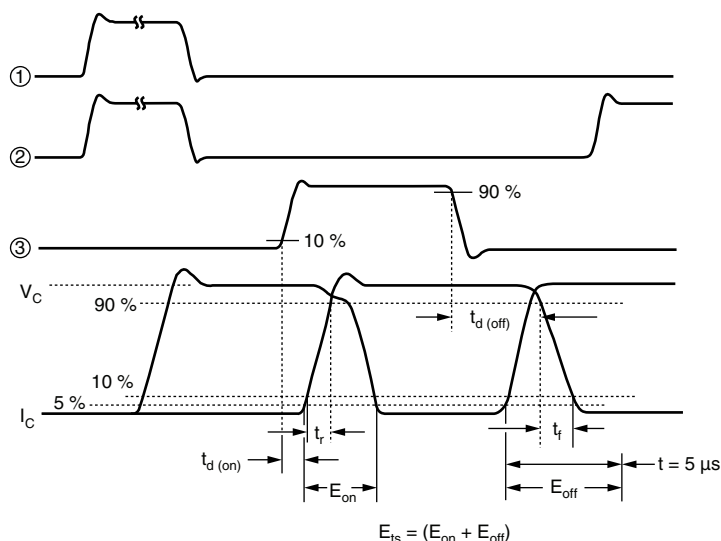
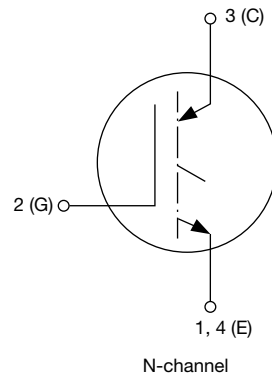


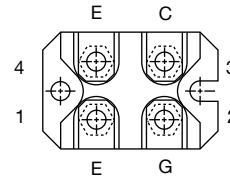
Fig. 14b - Switching Loss Waveforms

ORDERING INFORMATION TABLE

Device code	G	A	200	S	A	60	S	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 (S = Standard speed)						
⑧	-	• None = Standard production						
	-	• P = Lead (Pb)-free						

CIRCUIT CONFIGURATION


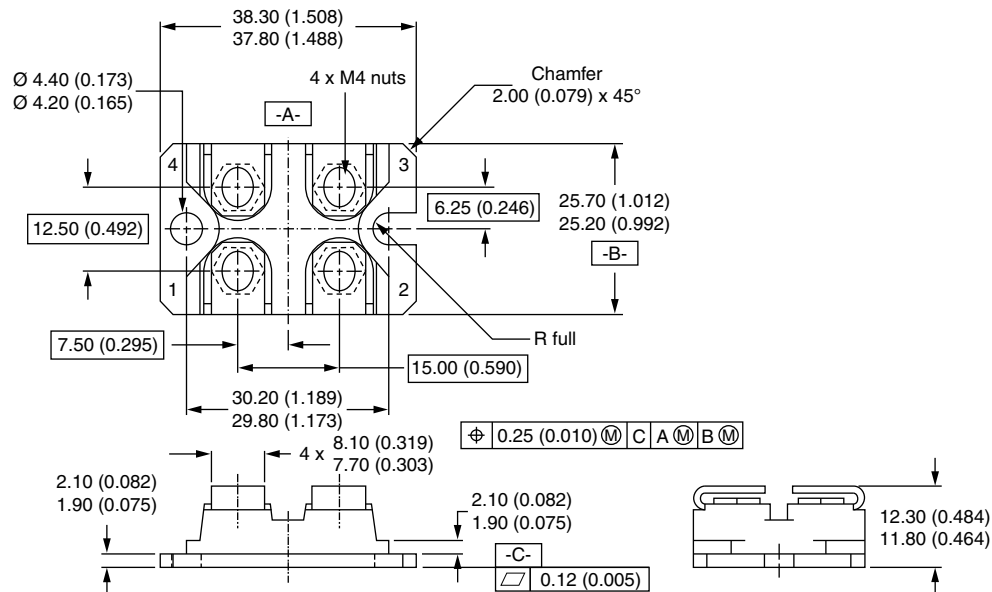
Lead assignment



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



Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and/or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk and agree to fully indemnify and hold Vishay and its distributors harmless from and against any and all claims, liabilities, expenses and damages arising or resulting in connection with such use or sale, including attorneys fees, even if such claim alleges that Vishay or its distributor was negligent regarding the design or manufacture of the part. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.

Material Category Policy

Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.

Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.