"High Side Chopper" IGBT SOT-227 (Ultrafast IGBT), 50 A

SOT-227

FEATURES

- NPT Generation V IGBT technology
- Square RBSOA
- HEXFRED® clamping diode
- Positive $V_{CE(on)}$ temperature coefficient
- Fully isolated package
- Speed 8 kHz to 60 kHz
- 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

Pb-free
RoHS COMPLIANT

PRODUCT SUMMARY	
V_{CES}	1200 V
I_C DC	50 A at 92 °C
$V_{CE(on)}$ typical at 50 A, 25 °C	3.22 V
Package	SOT-227
Circuit	High side switch

BENEFITS

- Designed for increased operating efficiency in power conversion: UPS, SMPS, welding, induction heating
- Easy to assemble and parallel
- Direct mounting on heatsink
- Plug-in compatible with other SOT-227 packages
- Low EMI, requires less snubbing

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
Collector to emitter voltage	V_{CES}		1200	V
Continuous collector current	I_C	T_C = 25 °C	84	A
		T_C = 80 °C	57	
Pulsed collector current	I_{CM}		150	
Clamped inductive load current	I_{LM}		150	
Diode continuous forward current	I_F	T_C = 25 °C	76	
		T_C = 80 °C	52	
Gate to emitter voltage	V_{GE}		± 20	V
Power dissipation, IGBT	P_D	T_C = 25 °C	431	W
		T_C = 80 °C	242	
Power dissipation, diode	P_D	T_C = 25 °C	278	
		T_C = 80 °C	156	
RMS 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 = 1 mA	1200	-	-	V
Collector to emitter voltage	$V_{CE(on)}$	V_{GE} = 15 V, I_C = 25 A	-	2.46	-	
		V_{GE} = 15 V, I_C = 50 A	-	3.22	2.80	
		V_{GE} = 15 V, I_C = 25 A, T_J = 125 °C	-	2.84	3.60	
		V_{GE} = 15 V, I_C = 50 A, T_J = 125 °C	-	3.78	3.0	
Gate threshold voltage	$V_{GE(th)}$	V_{CE} = V_{GE}, I_C = 500 µA	4	5	4	
Temperature coefficient of threshold voltage	$V_{GE(th)}/\Delta T_J$	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} = 1200 V	-	6	50	µA
		V_{GE} = 0 V, V_{CE} = 1200 V, T_J = 125 °C	-	0.7	2.0	mA
Diode reverse breakdown voltage	V_{BR}	I_R = 1 mA	1200	-	-	V
Diode forward voltage drop	V_{FM}	I_C = 25 A, V_{GE} = 0 V	-	1.99	2.42	V
		I_C = 50 A, V_{GE} = 0 V	-	2.53	3.00	
		I_C = 25 A, V_{GE} = 0 V, T_J = 125 °C	-	1.96	2.30	
		I_C = 50 A, V_{GE} = 0 V, T_J = 125 °C	-	2.66	3.08	
Diode reverse leakage current	I_{RM}	V_R = V_R rated	-	4	50	µA
		T_J = 125 °C, V_R = V_R rated	-	0.6	3	mA
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 = 50 A, V_{CC} = 600 V, V_{GE} = 15 V		-	400	-	nC
Gate to emitter charge (turn-on)	Q_{ge}			-	43	-	
Gate to collector charge (turn-on)	Q_{gc}			-	187	-	
Turn-on switching loss	E_{on}	I_C = 50 A, V_{CC} = 600 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)	-	2.72	-	mJ
Turn-off switching loss	E_{off}			-	1.11	-	
Total switching loss	E_{tot}			-	3.83	-	
Turn-on switching loss	E_{on}	I_C = 50 A, V_{CC} = 600 V, V_{GE} = 15 V, R_g = 5 Ω, L = 500 µH, T_J = 125 °C		-	3.94	-	
Turn-off switching loss	E_{off}			-	2.31	-	
Total switching loss	E_{tot}			-	6.25	-	
Turn-on delay time	$t_{d(on)}$			-	191	-	ns
Rise time	t_r			-	53	-	
Turn-off delay time	$t_{d(off)}$			-	223	-	
Fall time	t_f			-	143	-	
Reverse bias safe operating area	RBSOA	T_J = 150 °C, I_C = 150 A, R_g = 22 Ω, V_{GE} = 15 V to 0 V, V_{CC} = 900 V, V_P = 1200 V		Fullsquare			
Diode reverse recovery time	t_{rr}	I_F = 50 A, dI_F/dt = 200 A/µs, V_R = 200 V		-	129	161	ns
Diode peak reverse current	I_{rr}			-	11	14	A
Diode recovery charge	Q_{rr}			-	700	1046	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		-	208	257	ns
Diode peak reverse current	I_{rr}			-	17	21	A
Diode recovery charge	Q_{rr}			-	1768	2698	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}		-	-	0.29	°C/W
	Diode			-	-	0.45	
Case to heatsink		R_{thCS}	Flat, greased surface	-	0.05	-	
Weight				-	30	-	g
Mounting torque				-	-	1.3	Nm
Case style		SOT-227					

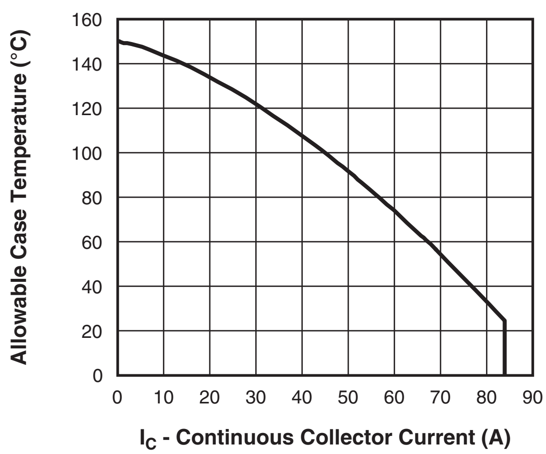


Fig. 1 - Maximum DC IGBT Collector Current vs. Case Temperature

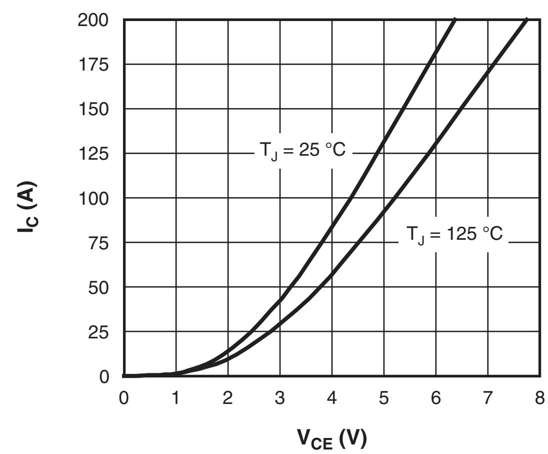


Fig. 3 - Typical IGBT Collector Current Characteristics

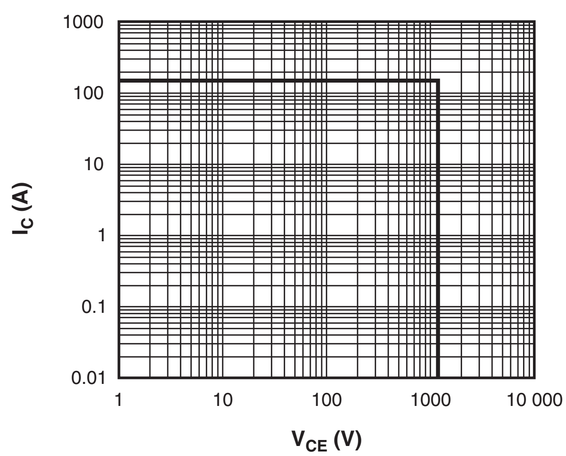


Fig. 2 - IGBT Reverse Bias SOA
T_J = 150 °C, V_{GE} = 15 V

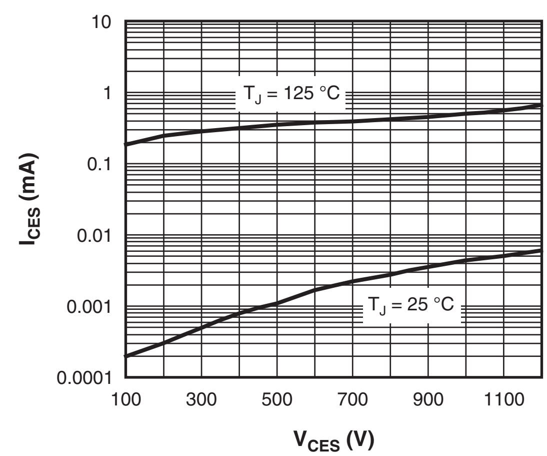


Fig. 4 - Typical IGBT Zero Gate Voltage Collector Current

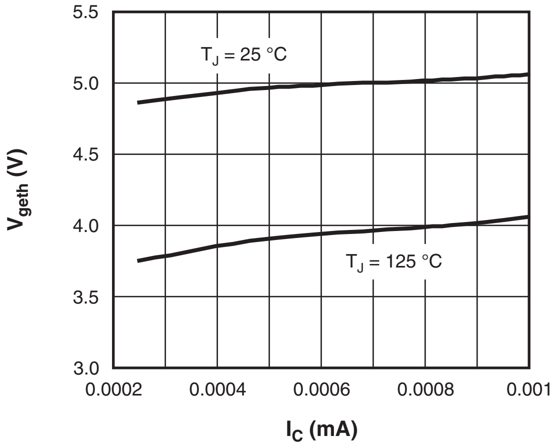


Fig. 5 - Typical IGBT Threshold Voltage

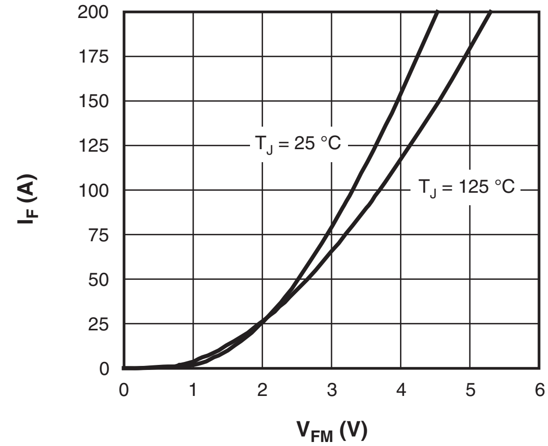


Fig. 8 - Typical Diode Forward Characteristics

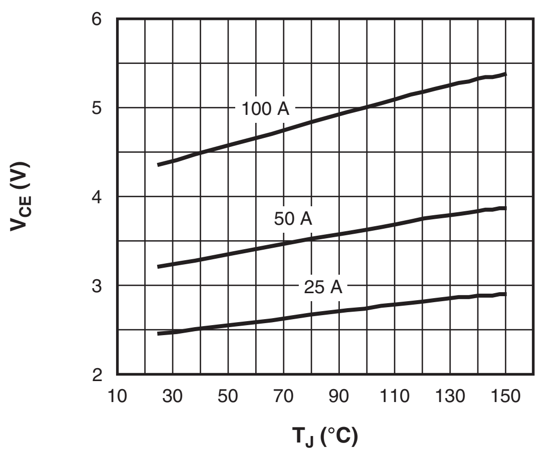


Fig. 6 - Typical IGBT Collector to Emitter Voltage vs. Junction Temperature, V_{GE} = 15 V

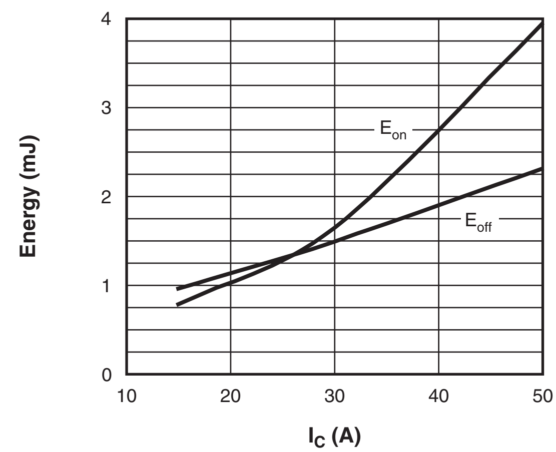


Fig. 9 - Typical IGBT Energy Loss vs. I_C
T_J = 125 °C, L = 500 µH, V_{CC} = 600 V,
R_g = 5 Ω, V_{GE} = 15 V

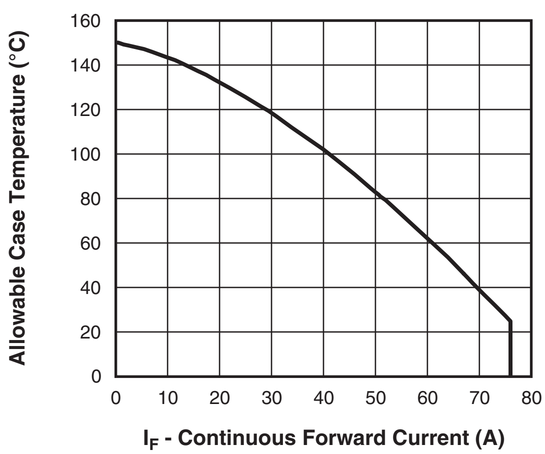


Fig. 7 - Maximum DC Forward Current vs. Case Temperature

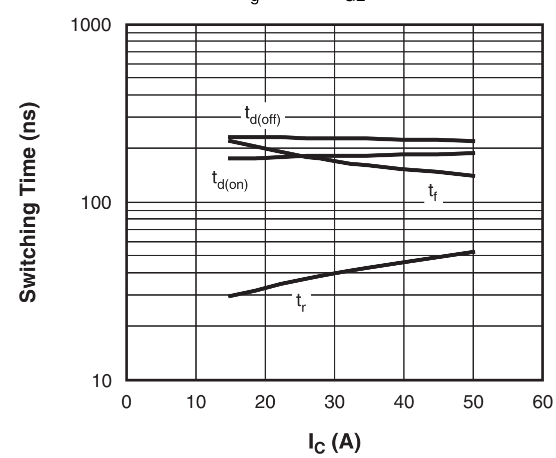


Fig. 10 - Typical IGBT Switching Time vs. I_C
T_J = 125 °C, L = 500 µH, V_{CC} = 600 V,
R_g = 5 Ω, V_{GE} = 15 V

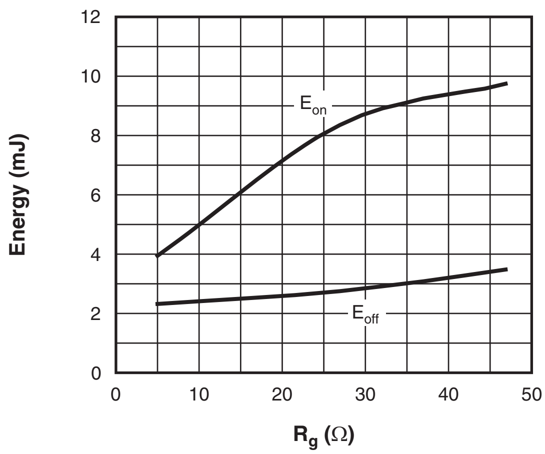


Fig. 11 - Typical IGBT Energy Loss vs. R_g
T_J = 125 °C, I_C = 50 A, L = 500 μH,
V_{CC} = 600 V, V_{GE} = 15 V

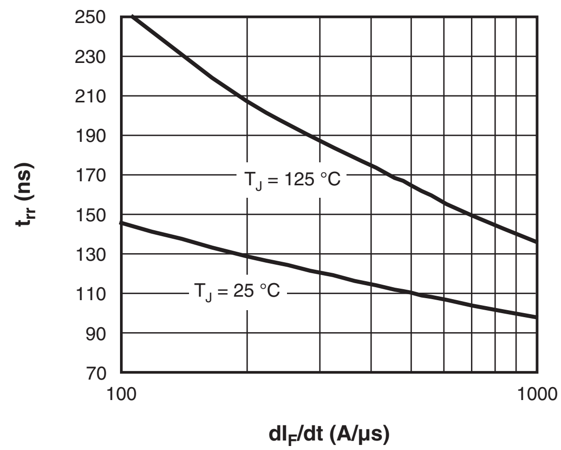


Fig. 13 - Typical t_{rr} Diode vs. dI_F/dt
V_R = 200 V, I_F = 50 A

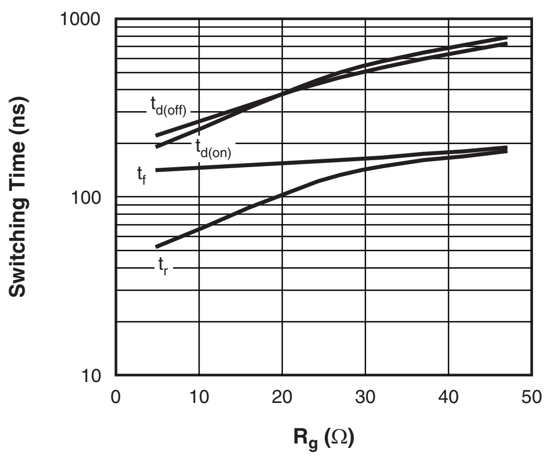


Fig. 12 - Typical IGBT Switching Time vs. R_g
T_J = 125 °C, L = 500 μH, V_{CC} = 600 V,
I_C = 50 A, V_{GE} = 15 V

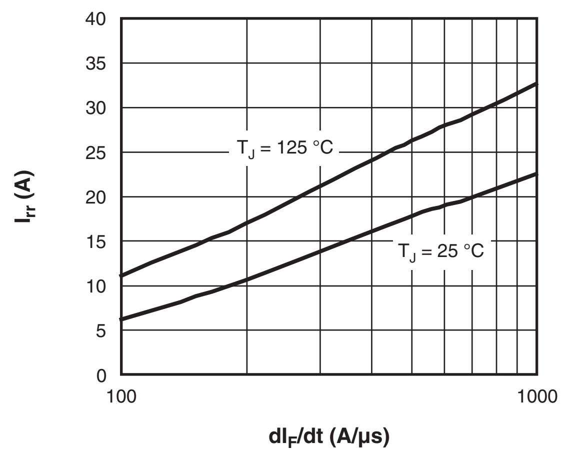


Fig. 14 - Typical I_{rr} Diode vs. dI_F/dt
V_R = 200 V, I_F = 50 A

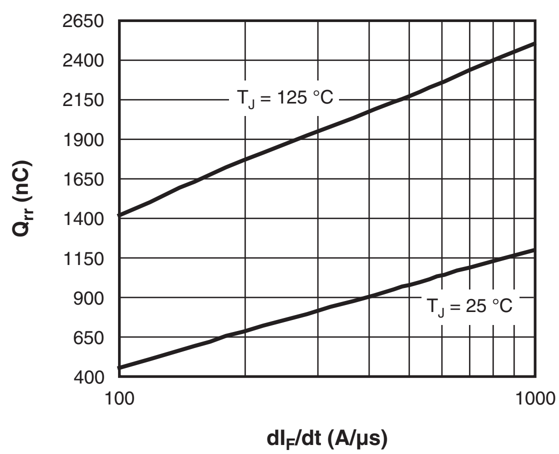


Fig. 15 - Typical Q_{rr} Diode vs. dI_F/dt, V_R = 200 V, I_F = 50 A

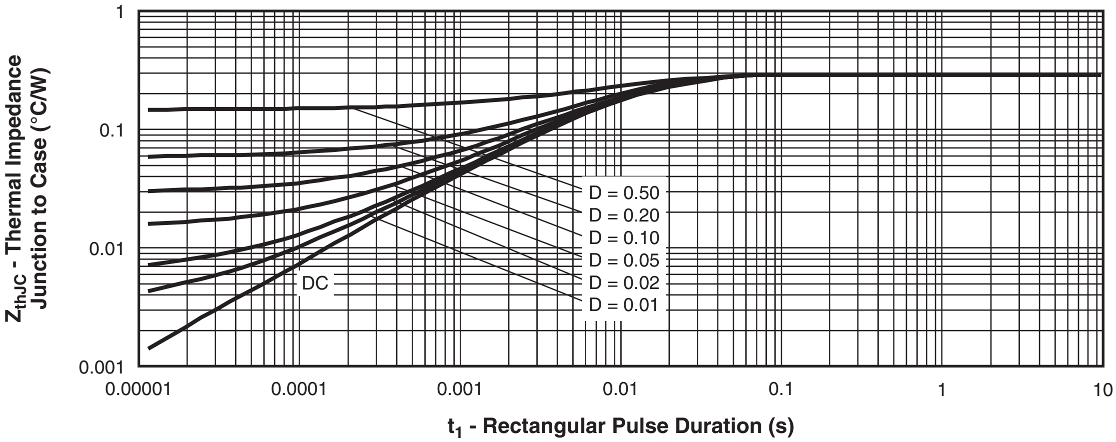


Fig. 16 - Maximum Thermal Impedance Z_{thJC} Characteristics (IGBT)

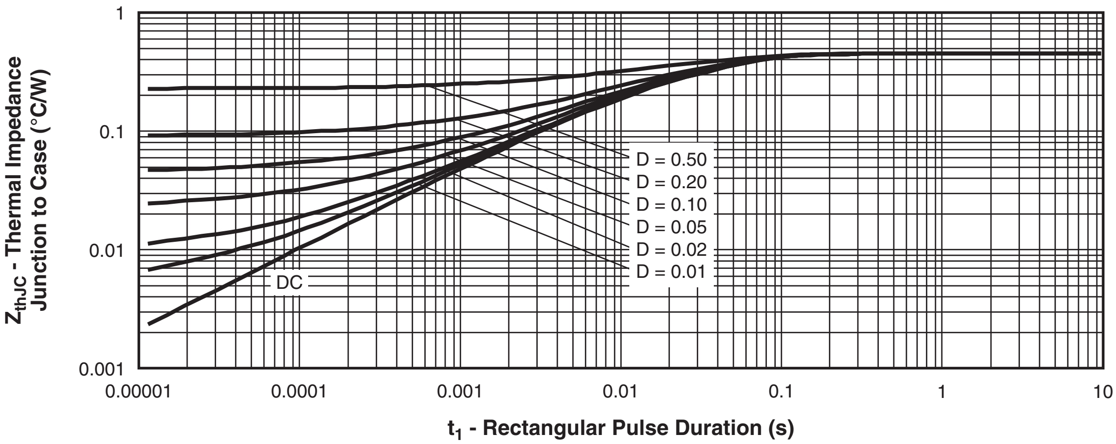
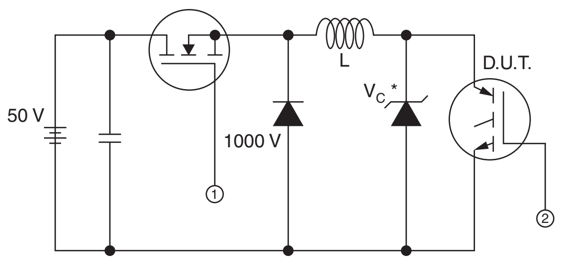


Fig. 17 - Maximum Thermal Impedance Z_{thJC} Characteristics (Diode)



* 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 Id

Fig. 18a - Clamped Inductive Load Test Circuit

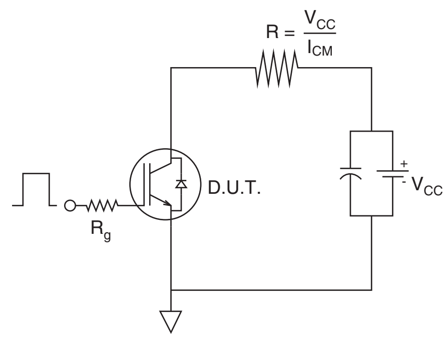


Fig. 18b - Pulsed Collector Current Test Circuit

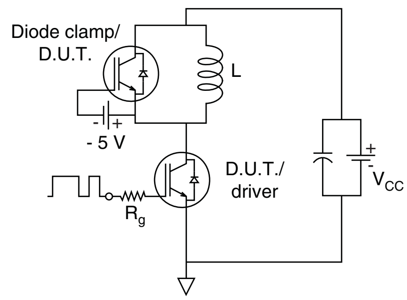


Fig. 19a - Switching Loss Test Circuit

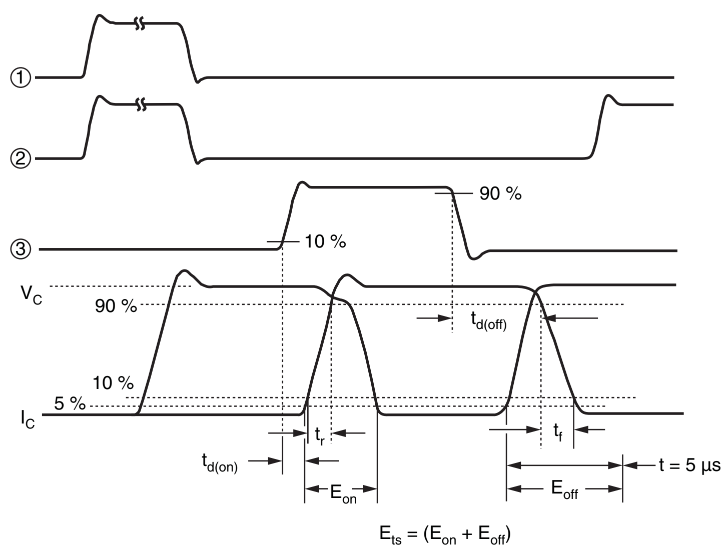


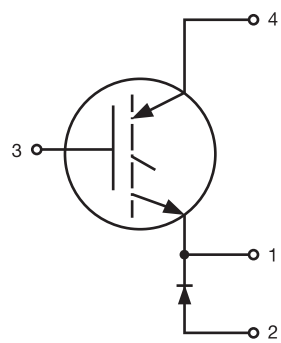
Fig. 19b - Switching Loss Waveforms Test Circuit

ORDERING INFORMATION TABLE

Device code	VS-	G	B	50	N	A	120	U	X
	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 (50 = 50 A)
5 - Circuit configuration (N = High side chopper)
6 - Package indicator (A = SOT-227)
7 - Voltage rating (120 = 1200 V)
8 - Speed/type (U = Ultrafast IGBT)
9 - X = F/W HEXFRED® diode

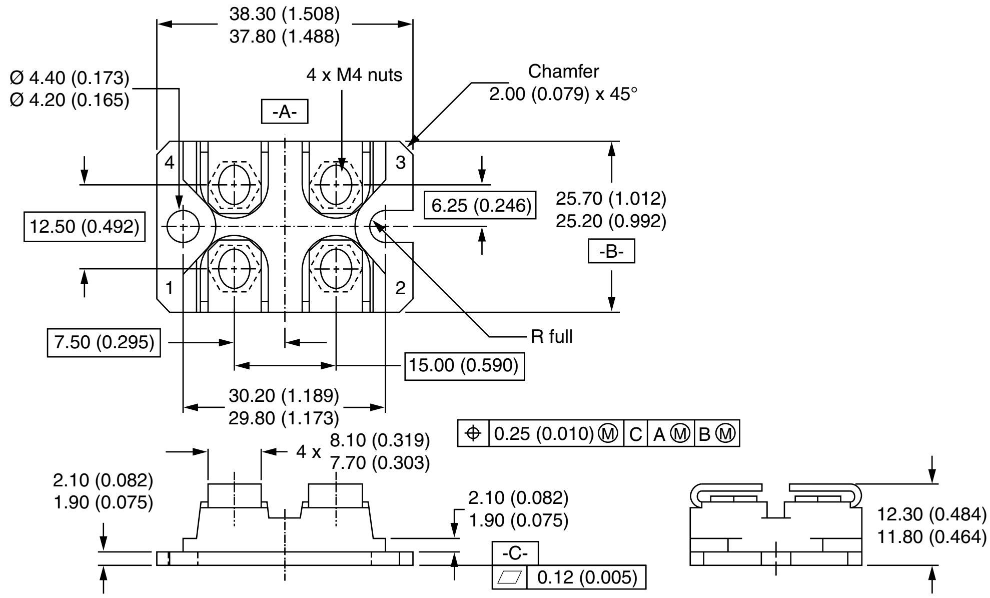
CIRCUIT CONFIGURATION



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

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. 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.

Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.