Insulated Gate Bipolar Transistor (Trench IGBT), 100 A

SOT-227

FEATURES

- Trench IGBT technology with positive temperature coefficient
- Square RBSOA
- 10 μs short circuit capability
- HEXFRED® antiparallel diodes with ultrasoft reverse recovery
- T_J maximum = 150 °C
- Fully isolated package
- Very low internal inductance (≤ 5 nH typical)
- Industry standard outline
- UL approved file E78996
- Compliant to RoHS directive 2002/95/EC

RoHS COMPLIANT

PRODUCT SUMMARY	
V_{CES}	1200 V
I_C DC	100 A at 119 °C
$V_{CE(on)}$ typical at 100 A, 25 °C	1.73 V

BENEFITS

- Designed for increased operating efficiency in power conversion: UPS, SMPS, welding, induction heating
- Easy to assemble and parallel
- Direct mounting to heatsink
- Plug-in compatible with other SOT-227 packages
- Speed 4 kHz to 30 kHz
- Very low $V_{CE(on)}$
- 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 (1)	T_C = 25 °C	258	A
		T_C = 80 °C	174	
Pulsed collector current	I_{CM}		450	
Clamped inductive load current	I_{LM}		450	
Diode continuous forward current	I_F	T_C = 25 °C	50	
		T_C = 80 °C	34	
Peak diode forward current	I_{FSM}		180	
Gate to emitter voltage	V_{GE}		± 20	V
Power dissipation, IGBT	P_D	T_C = 25 °C	893	W
		T_C = 119 °C	221	
Power dissipation, diode	P_D	T_C = 25 °C	176	
		T_C = 119 °C	44	
Isolation voltage	V_{ISOL}	Any terminal to case, t = 1 min	2500	V

Note

(1) Maximum continuous collector current must be limited to 100 A to do not exceed the maximum temperature of terminals

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 = 250 μA	1200	-	-	V
Collector to emitter voltage	$V_{CE(on)}$	V_{GE} = 15 V, I_C = 100 A	-	1.73	2.1	
		V_{GE} = 15 V, I_C = 100 A, T_J = 125 °C	-	1.98	2.2	
Gate threshold voltage	$V_{GE(th)}$	V_{CE} = V_{GE}, I_C = 7.5 mA	4.9	5.9	7.9	
Temperature coefficient of threshold voltage	$\Delta V_{GE(th)}/\Delta T_J$	V_{CE} = V_{GE}, I_C = 1 mA (25 °C to 125 °C)	-	- 17.6	-	mV/°C
Collector to emitter leakage current	I_{CES}	V_{GE} = 0 V, V_{CE} = 1200 V	-	0.6	100	μA
		V_{GE} = 0 V, V_{CE} = 1200 V, T_J = 125 °C	-	0.6	10	mA
Forward voltage drop	V_{FM}	I_F = 40 A, V_{GE} = 0 V	-	2.81	3.3	V
		I_F = 40 A, V_{GE} = 0 V, T_J = 125 °C	-	3.07	3.4	
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**
Turn-on switching loss	E_{on}	I_C = 100 A, V_{CC} = 720 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. 20)	-	5.2	-	mJ
Turn-off switching loss	E_{off}			-	7.1	-	
Total switching loss	E_{tot}			-	12.3	-	
Turn-on switching loss	E_{on}	I_C = 100 A, V_{CC} = 720 V, V_{GE} = 15 V, R_g = 5 Ω, L = 500 μH, T_J = 125 °C		-	6.1	-	
Turn-off switching loss	E_{off}			-	9.8	-	
Total switching loss	E_{tot}			-	15.9	-	
Turn-on delay time	$t_{d(on)}$			-	350	-	ns
Rise time	t_r			-	75	-	
Turn-off delay time	$t_{d(off)}$			-	374	-	
Fall time	t_f			-	493	-	
Reverse bias safe operating area	RBSOA	T_J = 150 °C, I_C = 450 A, R_g = 22 Ω, V_{GE} = 15 V to 0 V, V_{CC} = 900 V, V_P = 1200 V, L = 500 μH		Fullsquare			
Diode reverse recovery time	t_{rr}	I_F = 50 A, dI_F/dt = 200 A/μs, V_{rr} = 400 V		-	164	194	ns
Diode peak reverse current	I_{rr}			-	12	15	A
Diode recovery charge	Q_{rr}			-	994	1455	nC
Diode reverse recovery time	t_{rr}	I_F = 50 A, dI_F/dt = 200 A/μs, V_{rr} = 400 V, T_J = 125 °C		-	230	273	ns
Diode peak reverse current	I_{rr}			-	16.5	20	A
Diode recovery charge	Q_{rr}			-	1864	2730	nC
Short circuit safe operating area	SCSOA	T_J = 150 °C, R_g = 22 Ω, V_{GE} = 15 V to 0 V, V_{CC} = 900 V, V_p = 1200 V		10			μs

Insulated Gate Bipolar Transistor (Trench IGBT), 100 A

THERMAL AND MECHANICAL SPECIFICATIONS						
PARAMETER		SYMBOL	MIN.	TYP.	MAX.	UNITS
Maximum junction and storage temperature range		T_J, T_{Stg}	- 40	-	150	°C
Junction to case	IGBT	R_{thJC}	-	-	0.14	°C/W
	Diode		-	-	0.71	
Case to sink per module		R_{thCS}	-	0.1	-	
Mounting torque, 6-32 or M3 screw			-	-	1.3	Nm
Weight			-	30	-	g

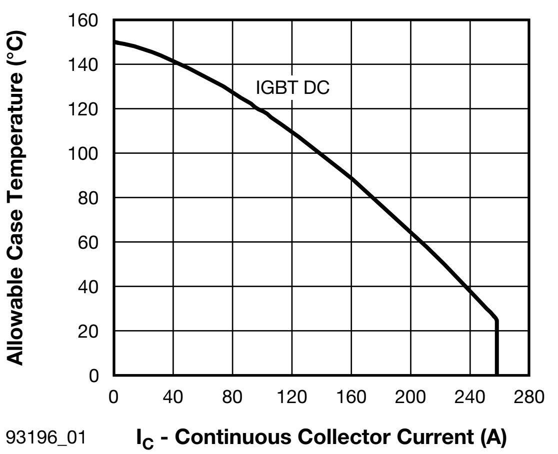


Fig. 1 - Maximum DC IGBT Collector Current vs. Case Temperature

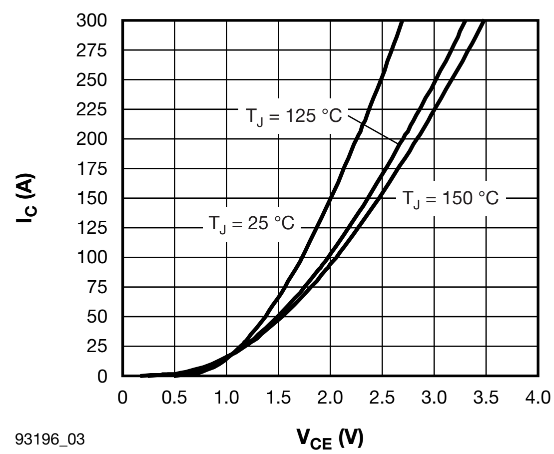


Fig. 3 - Typical IGBT Collector Current Characteristics V_{GE} = 15 V

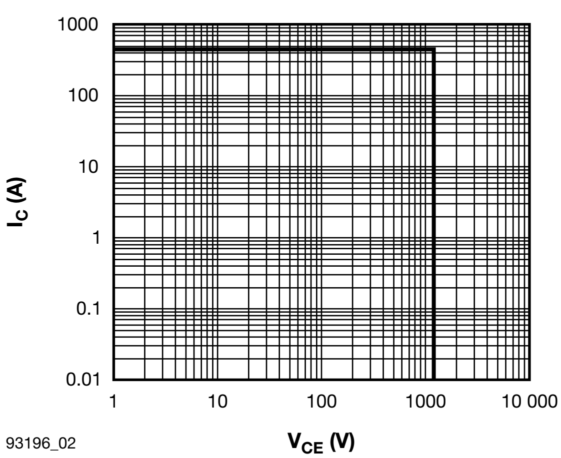


Fig. 2 - IGBT Reverse Bias SOA T_J = 150 °C, V_{GE} = 15 V

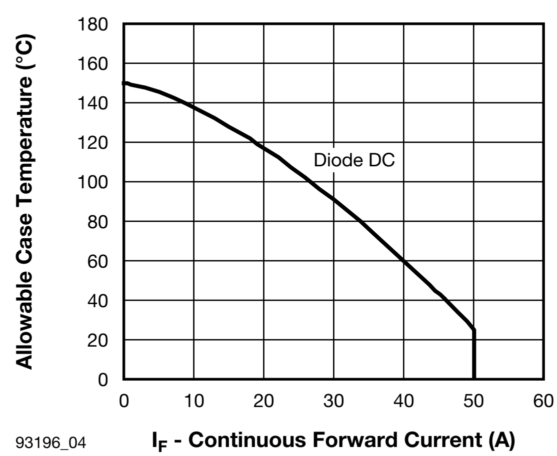


Fig. 4 - Maximum DC Forward Current vs. Case Temperature

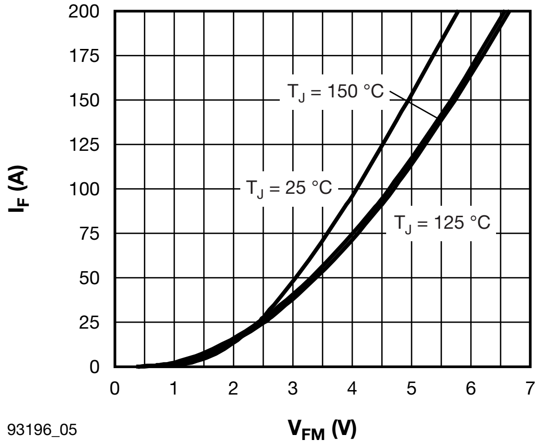


Fig. 5 - Typical Diode Forward Characteristics

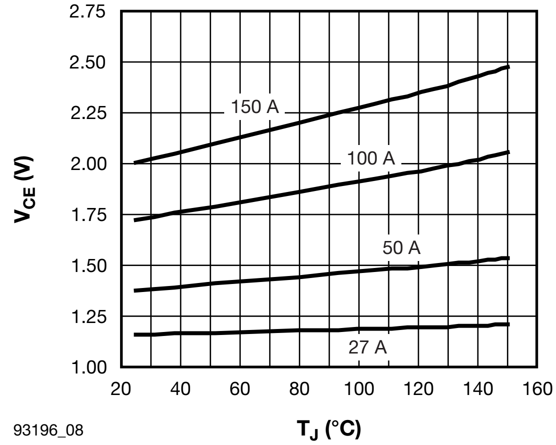


Fig. 8 - Typical IGBT Collector to Emitter Voltage vs. Junction Temperature, V_{GE} = 15 V

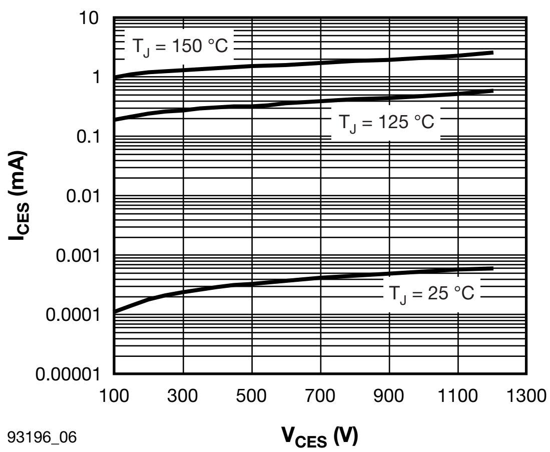


Fig. 6 - Typical IGBT Zero Gate Voltage Collector Current

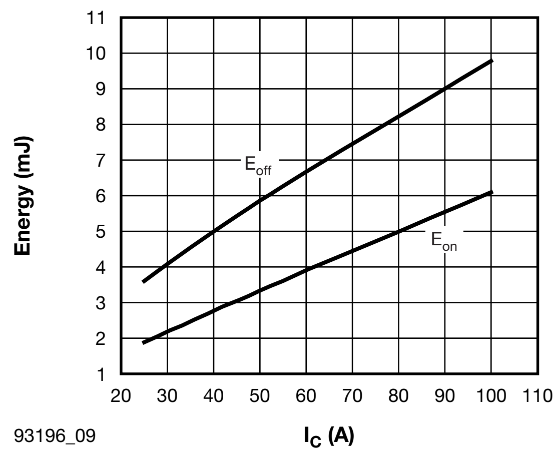


Fig. 9 - Typical IGBT Energy Loss vs. I_C
T_J = 125 °C, L = 500 µH, V_{CC} = 720 V,
R_g = 5 Ω, V_{GE} = 15 V

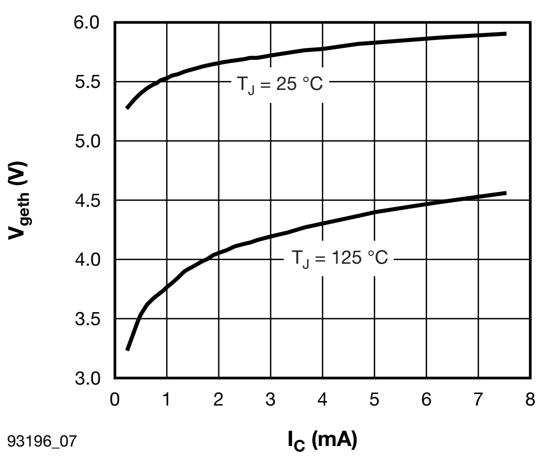


Fig. 7 - Typical IGBT Threshold Voltage

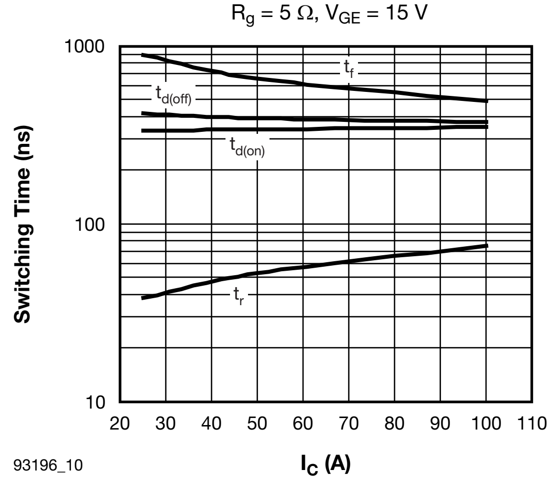


Fig. 10 - Typical IGBT Switching Time vs. I_C
T_J = 125 °C, L = 500 µH, V_{CC} = 720 V,
R_g = 5 Ω, V_{GE} = 15 V

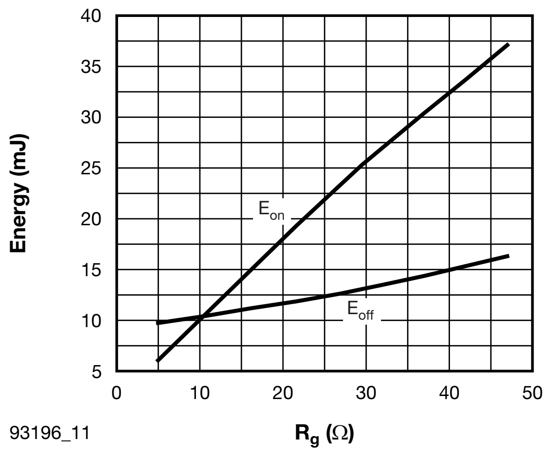


Fig. 11 - Typical IGBT Energy Loss vs. R_g
T_J = 125 °C, I_C = 100 A, L = 500 µH,
V_{CC} = 720 V, V_{GE} = 15 V

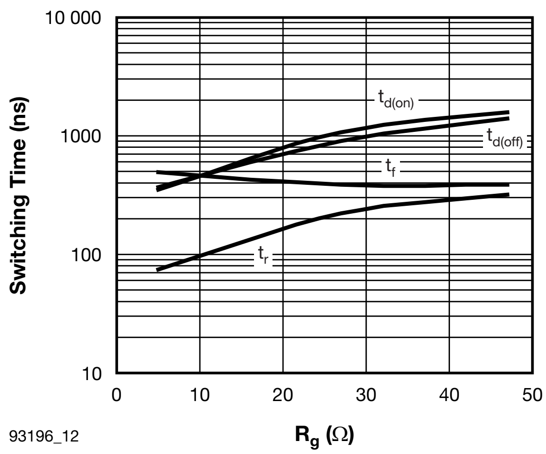


Fig. 12 - Typical IGBT Switching Time vs. R_g
T_J = 125 °C, L = 500 µH, V_{CC} = 720 V,
I_C = 100 A, V_{GE} = 15 V

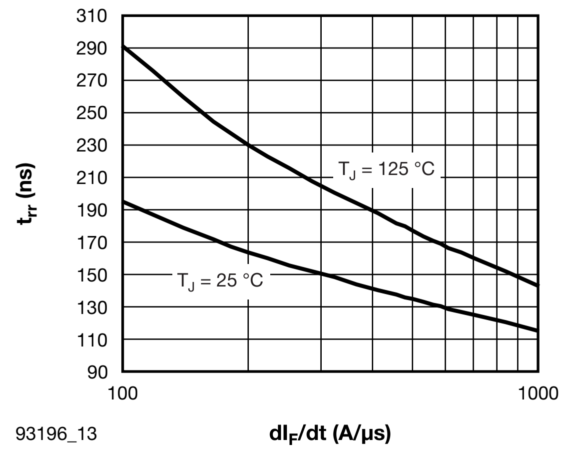


Fig. 13 - Typical t_{rr} Diode vs. dI_F/dt
V_{rr} = 400 V, I_F = 50 A

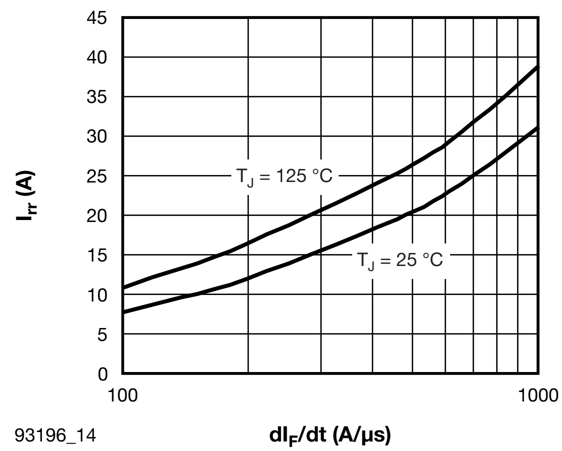


Fig. 14 - Typical I_{rr} Diode vs. dI_F/dt
V_{rr} = 400 V, I_F = 50 A

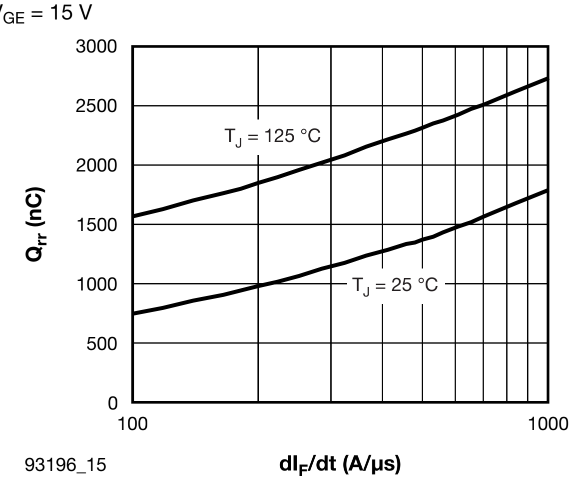


Fig. 15 - Typical Q_{rr} Diode vs. dI_F/dt
V_{rr} = 400 V, I_F = 50 A

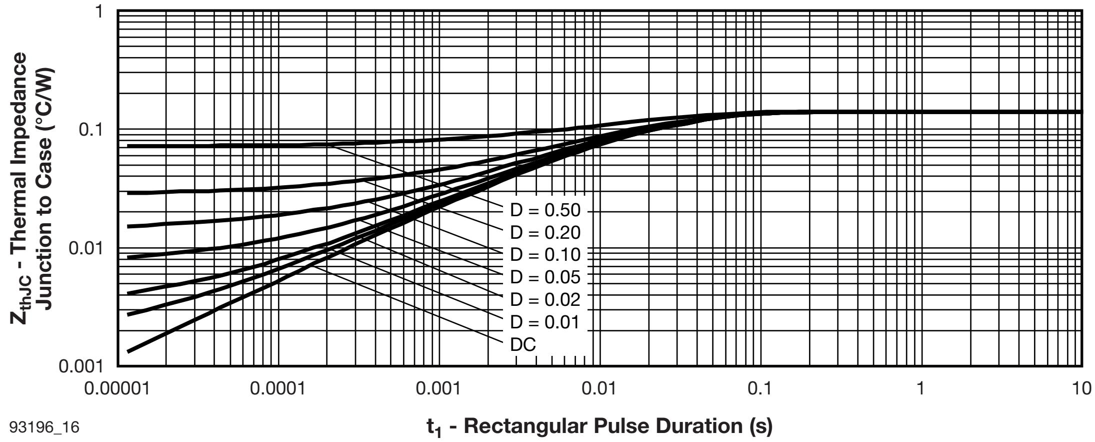


Fig. 16 - Maximum Thermal Impedance Z_{thJC} Characteristics (IGBT)

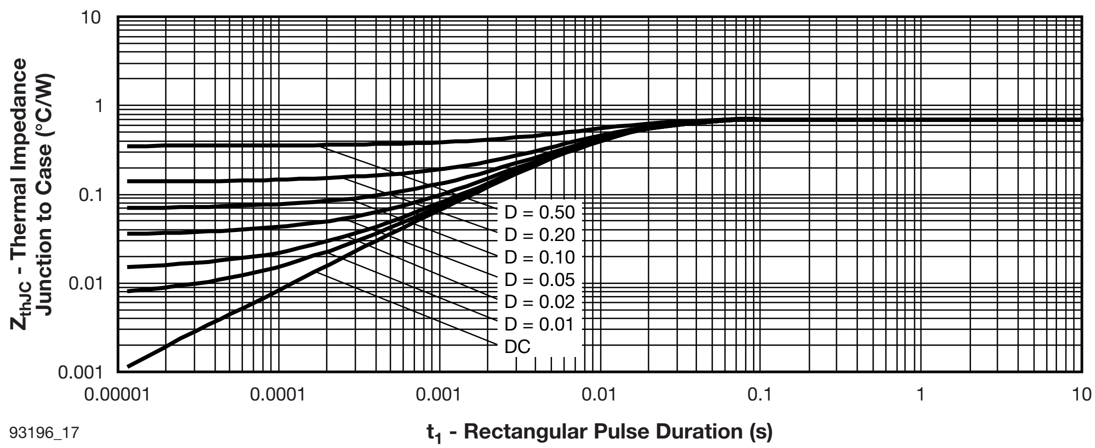
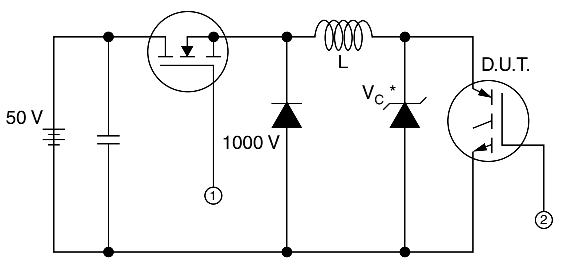


Fig. 17 - Maximum Thermal Impedance Z_{thJC} Characteristics (Diode)



* 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

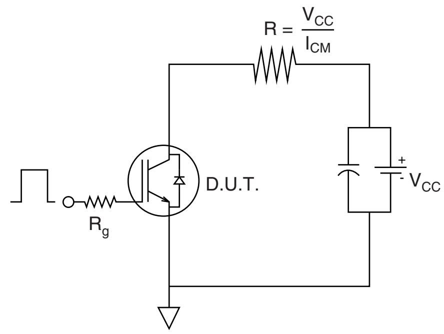


Fig. 18b - Pulsed Collector Current Test Circuit

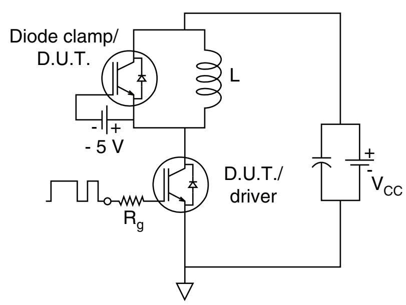


Fig. 19a - Switching Loss Test Circuit

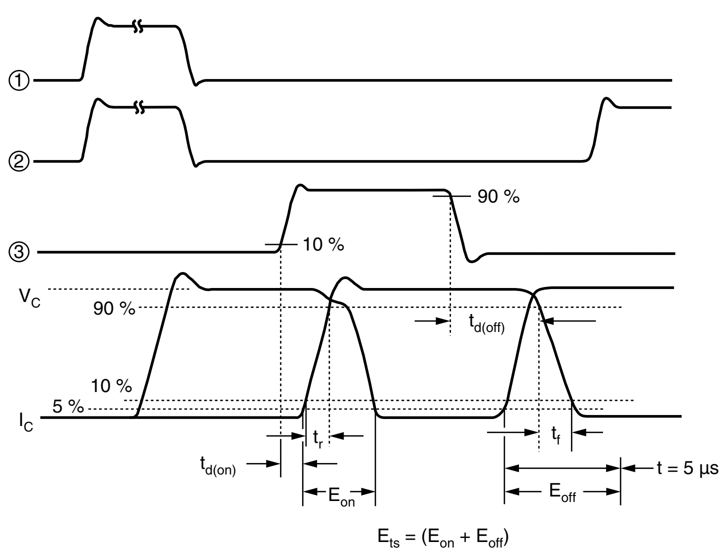


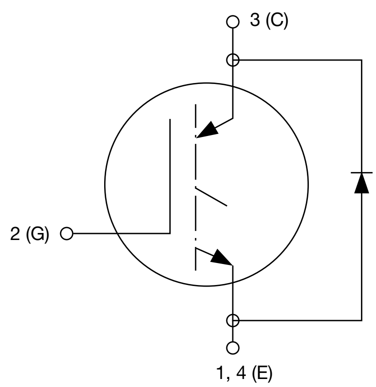
Fig. 19b - Switching Loss Waveforms Test Circuit

ORDERING INFORMATION TABLE

Device code	G	T	100	D	A	120	U
	1	2	3	4	5	6	7

1 - Insulated Gate Bipolar Transistor (IGBT)
2 - T = Trench IGBT technology
3 - Current rating (100 = 100 A)
4 - Circuit configuration (D = Single switch with antiparallel diode)
5 - Package indicator (A = SOT-227)
6 - Voltage rating (120 = 1200 V)
7 - Speed/type (U = Ultrafast)

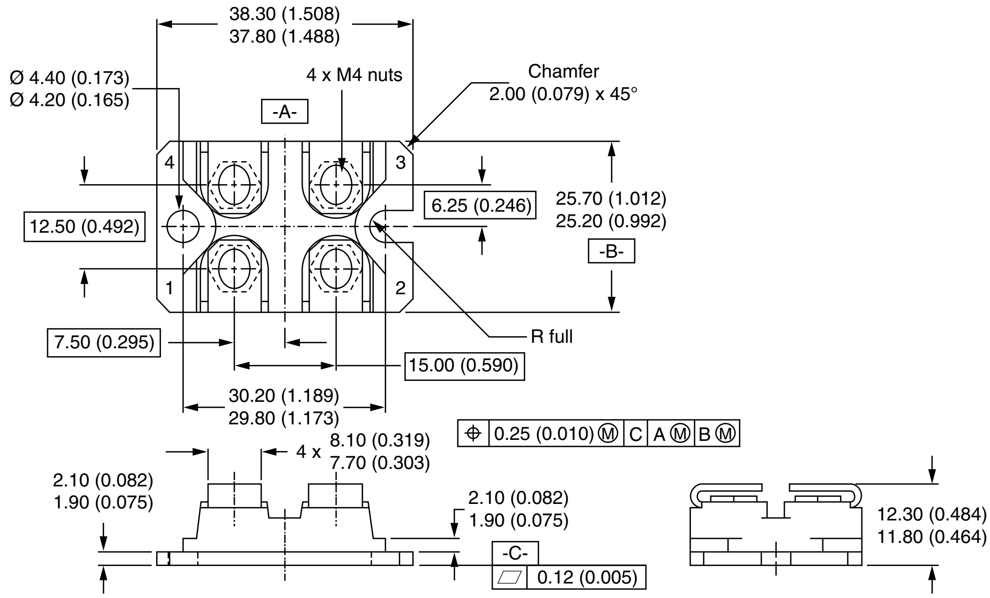
CIRCUIT CONFIGURATION



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 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.