Insulated Gate Bipolar Transistor (Warp 2 Speed IGBT), 90 A

SOT-227

FEATURES

Pb-free RoHS COMPLIANT

- NPT warp 2 speed IGBT technology with positive temperature coefficient
- Square RBSOA
- HEXFRED® antiparallel diodes with ultrasoft reverse recovery
- Fully isolated package
- Very low internal inductance (≤ 5 nH typical)
- Industry standard outline
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912

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
- Higher switching frequency up to 150 kHz
- Lower conduction losses and switching losses
- Low EMI, requires less snubbing

PRODUCT SUMMARY	
V_{CES}	600 V
I_C DC	90 A at 90 °C
$V_{CE(on)}$ typical at 100 A, 25 °C	2.40 V
I_F DC	108 A at 90 °C

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
Collector to emitter voltage	V_{CES}		600	V
Continuous collector current	I_C	T_C = 25 °C	147	A
		T_C = 90 °C	90	
Pulsed collector current	I_{CM}		300	
Clamped inductive load current	I_{LM}		300	
Diode continuous forward current	I_F	T_C = 25 °C	180	
		T_C = 90 °C	108	
Gate-to-emitter voltage	V_{GE}		± 20	V
Power dissipation, IGBT	P_D	T_C = 25 °C	625	W
		T_C = 90 °C	300	
Power dissipation, diode	P_D	T_C = 25 °C	379	
		T_C = 90 °C	182	
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 = 250 µA	600	-	-	V
Collector to emitter voltage	$V_{CE(on)}$	V_{GE} = 15 V, I_C = 100 A	-	2.4	2.8	
		V_{GE} = 15 V, I_C = 100 A, T_J = 125 °C	-	3	3.4	
		V_{GE} = 15 V, I_C = 100 A, T_J = 150°C	-	3.3	-	
Gate threshold voltage	$V_{GE(th)}$	V_{CE} = V_{GE}, I_C = 250 µA	3	3.9	5.0	
		V_{CE} = V_{GE}, I_C = 250 µA, T_J = 125 °C	-	2.5	-	
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)	-	- 10	-	mV/°C
Collector to emitter leakage current	I_{CES}	V_{GE} = 0 V, V_{CE} = 600 V	-	7	100	µA
		V_{GE} = 0 V, V_{CE} = 600 V, T_J = 125 °C	-	1.5	6.0	mA
		V_{GE} = 0 V, V_{CE} = 600 V, T_J = 150 °C	-	6	10	
Forward voltage drop, diode	V_{FM}	I_C = 100 A, V_{GE} = 0 V	-	1.6	2.1	V
		I_C = 100 A, V_{GE} = 0 V, T_J = 125 °C	-	1.56	2.0	
		I_C = 100 A, V_{GE} = 0 V, T_J = 150 °C	-	1.53	-	
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 = 100 A, V_{CC} = 480 V, V_{GE} = 15 V		-	460	690	nC
Gate to emitter charge (turn-on)	Q_{ge}			-	160	250	
Gate to collector charge (turn-on)	Q_{gc}			-	70	130	
Turn-on switching loss	E_{on}	I_C = 100 A, V_{CC} = 360 V, V_{GE} = 15 V, R_g = 5 Ω, L = 500 µH, T_J = 25 °C	Energy losses include tail and diode recovery. Diode used 60APH06	-	0.39	-	mJ
Turn-off switching loss	E_{off}			-	1.10	-	
Total switching loss	E_{tot}			-	1.49	-	
Turn-on delay time	$t_{d(on)}$			-	245	-	ns
Rise time	t_r			-	53	-	
Turn-off delay time	$t_{d(off)}$			-	240	-	
Fall time	t_f			-	63	-	
Turn-on switching loss	E_{on}	I_C = 100 A, V_{CC} = 360 V, V_{GE} = 15 V, R_g = 5 Ω, L = 500 µH, T_J = 125 °C		-	0.52	-	mJ
Turn-off switching loss	E_{off}			-	1.24	-	
Total switching loss	E_{tot}			-	1.76	-	
Turn-on delay time	$t_{d(on)}$			-	240	-	ns
Rise time	t_r			-	54	-	
Turn-off delay time	$t_{d(off)}$			-	250	-	
Fall time	t_f			-	80	-	
Reverse bias safe operating area	RBSOA	T_J = 150 °C, I_C = 300 A, R_g = 22 Ω, V_{GE} = 15 V to 0 V, V_{CC} = 400 V, V_P = 600 V, L = 500 µH		Fullsquare			
Diode reverse recovery time	t_{rr}	I_F = 50 A, dI_F/dt = 200 A/µs, V_R = 200 V		-	95	-	ns
Diode peak reverse current	I_{rr}			-	10	-	A
Diode recovery charge	Q_{rr}			-	480	-	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		-	144	-	ns
Diode peak reverse current	I_{rr}			-	16	-	A
Diode recovery charge	Q_{rr}			-	1136	-	nC

THERMAL AND MECHANICAL SPECIFICATIONS							
PARAMETER		SYMBOL	MIN.	TYP.	MAX.	UNITS
Maximum junction and storage temperature		T_J, T_{Stg}	- 40	-	150	°C
Junction to case	IGBT	R_{thJC}	-	-	0.20	°C/W
	Diode		-	-	0.33	
Case to sink thermal resistance, flat greased surface		R_{thCS}	-	0.1	-	
Mounting torque, on termianls and heatsink		T	-	-	1.3	Nm
Weight			-	30	-	g
Case style			SOT-227			

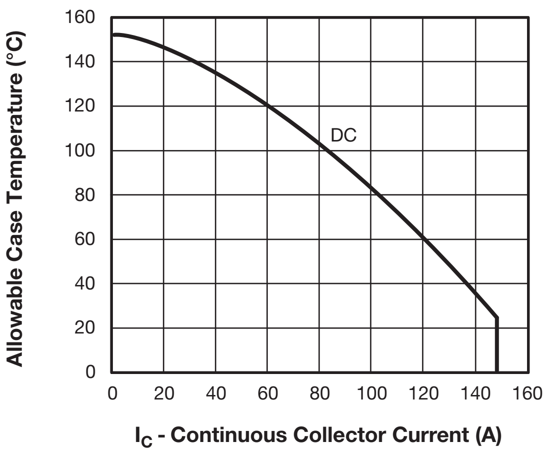


Fig. 1 - Maximum DC IGBT Collector Current vs. Case Temperature

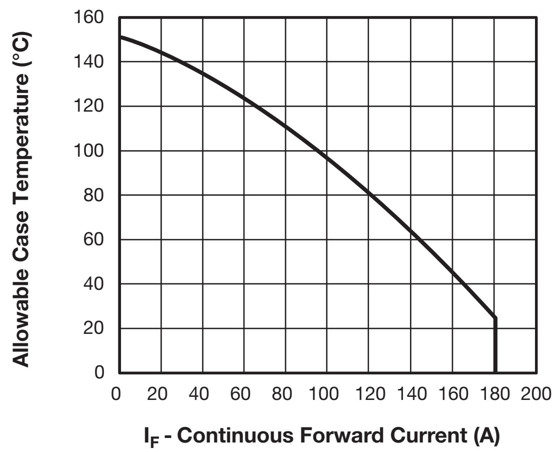


Fig. 3 - Maximum Allowable Forward Current vs. Case Temperature, Diode Leg

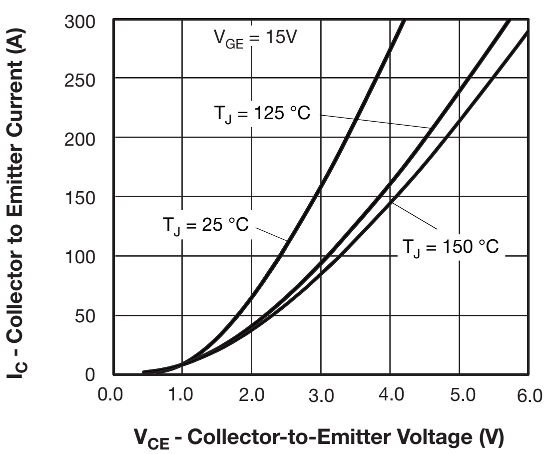


Fig. 2 - Typical Collector to Emitter Voltage (V)

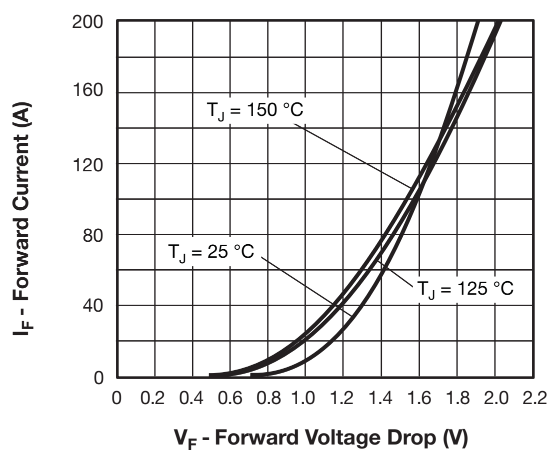


Fig. 4 - Typical Forward Voltage Drop Characteristics

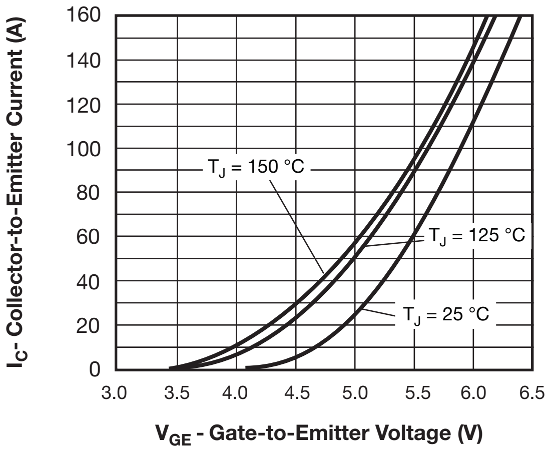


Fig. 5 - Typical IGBT Transfer Characteristics

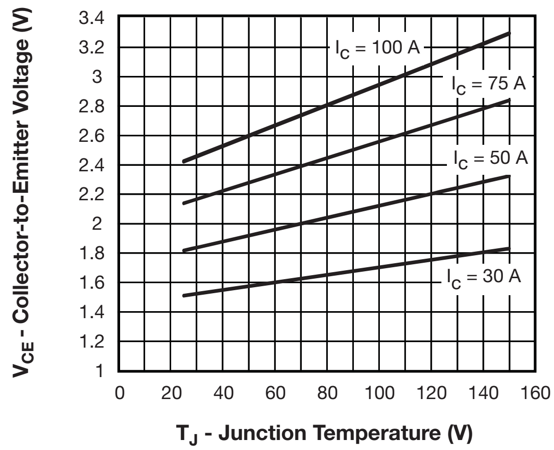


Fig. 8 - Typical IGBT Collector to Emitter Voltage vs. Junction Temperature, V_{GE} = 15 V

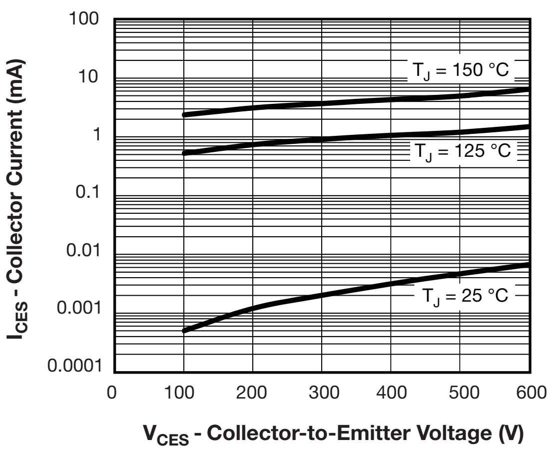


Fig. 6 - Typical IGBT Zero Gate Voltage Collector Current

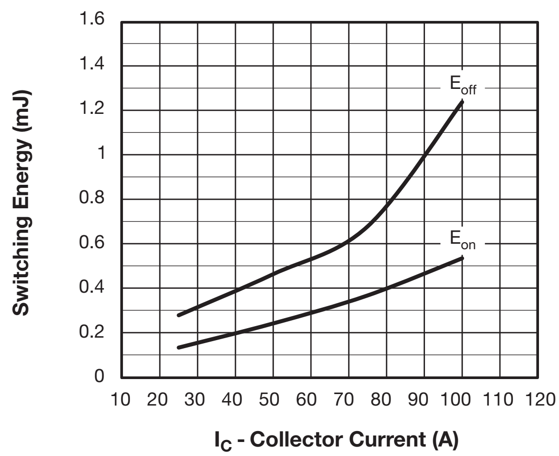


Fig. 9 - Typical IGBT Energy Losses vs. I_C
T_J = 125 °C, L = 500 μH, V_{CC} = 360 V,
R_g = 5 Ω, V_{GE} = 15 V, Diode used: 60APH06

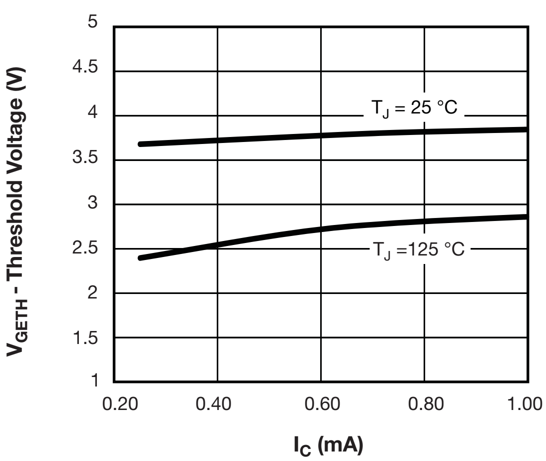


Fig. 7 - Typical IGBT Threshold Voltage

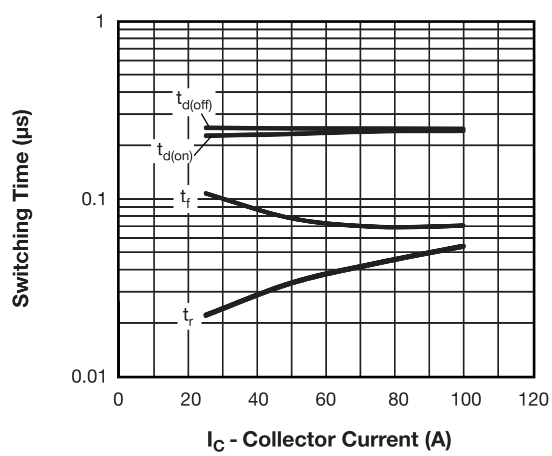


Fig. 10 - Typical IGBT Switching Time vs. I_C
T_J = 125 °C, L = 500 μH, V_{CC} = 360 V,
R_g = 5 Ω, V_{GE} = 15 V, Diode used: 60APH06

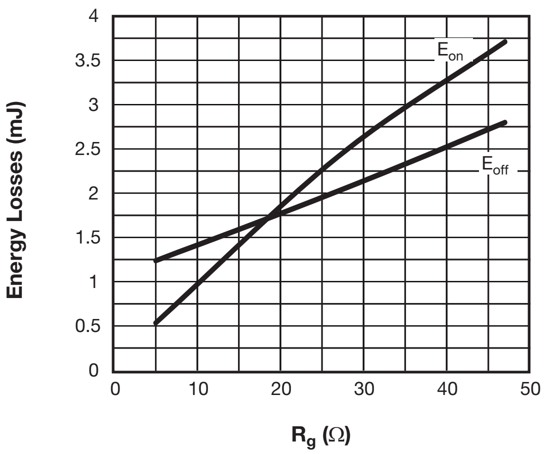


Fig. 11 - Typical IGBT Energy Loss vs. R_g
T_J = 125 °C, I_C = 100 A, L = 500 µH,
V_{CC} = 360 V, V_{GE} = 15 V, Diode used: 60APH06

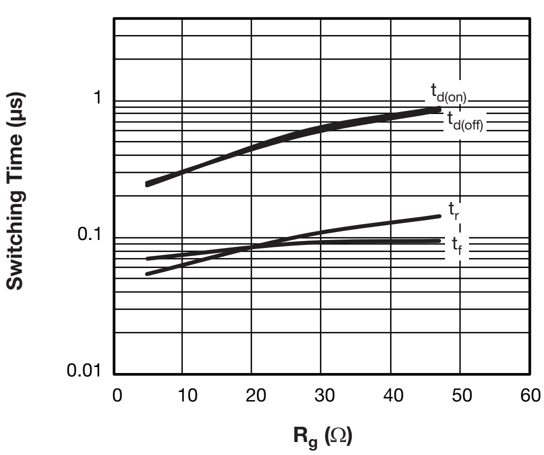


Fig. 12 - Typical IGBT Switching Time vs. R_g
T_J = 125 °C, L = 500 µH, V_{CC} = 360 V,
I_C = 100 A, V_{GE} = 15 V, Diode used: 60APH06

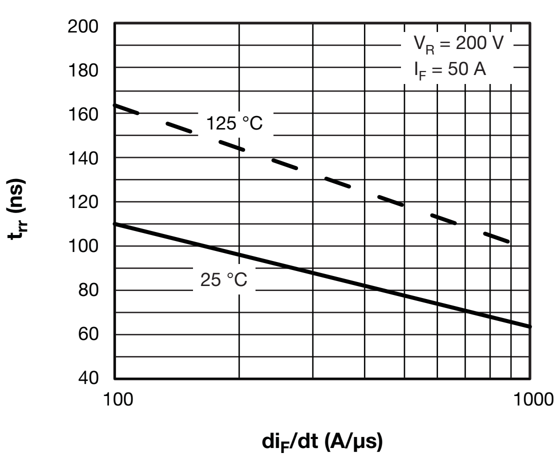


Fig. 13 - Typical Reverse RecoveryTime vs. dI_F/dt, of Diode

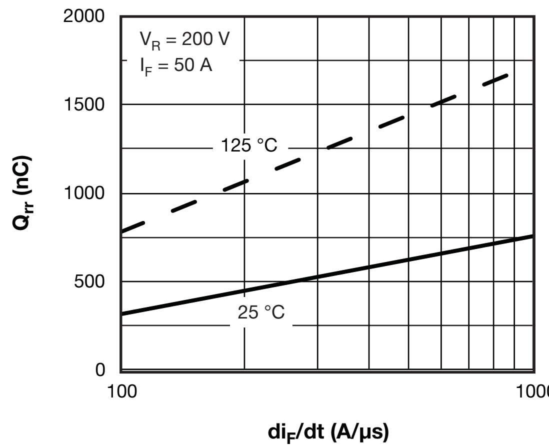


Fig. 14 - Typical Stored Charge vs. dI_F/dt of Diode

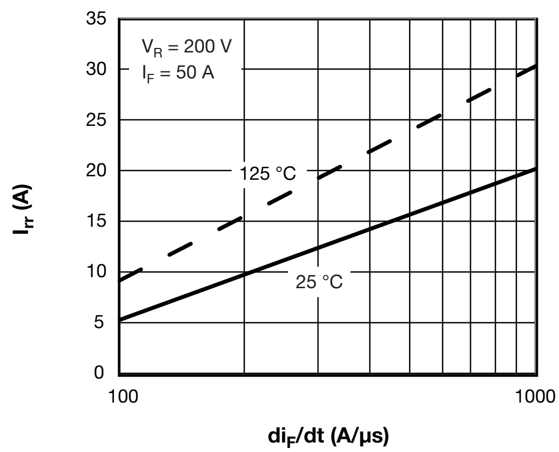


Fig. 15 - Typical Reverse Recovery Current vs. dI_F/dt of Diode

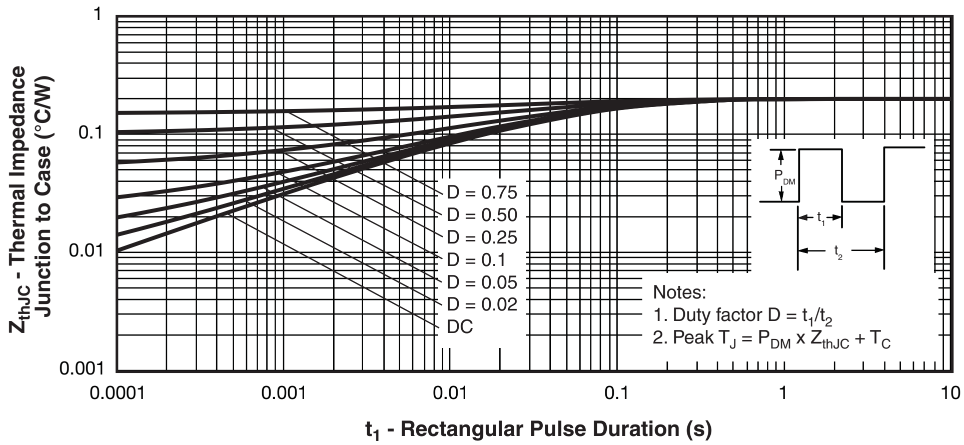


Fig. 16 - Maximum Thermal Impedance Z_{thJC} Characteristics, IGBT

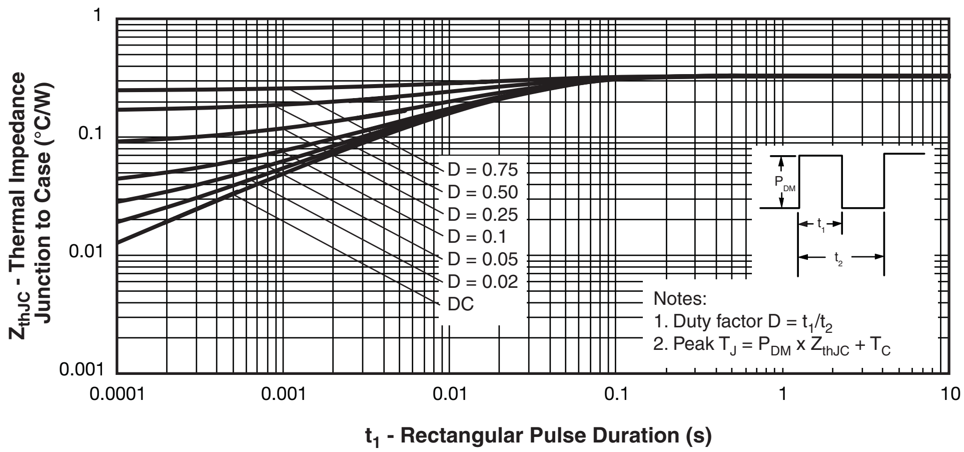


Fig. 17 - Maximum Thermal Impedance Z_{thJC} Characteristics, Diode

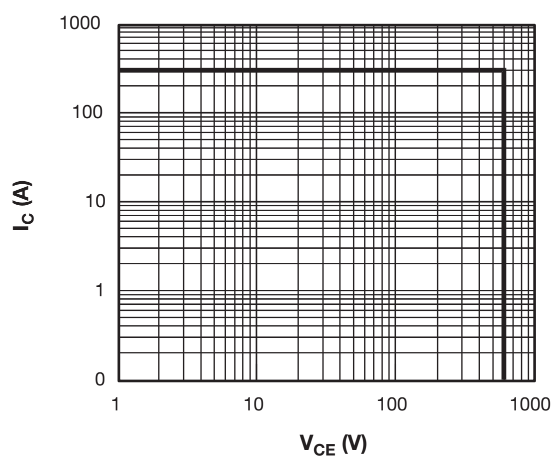
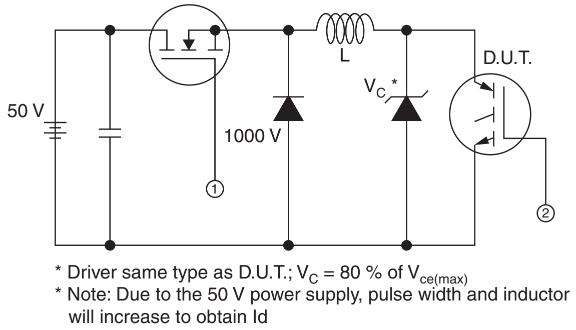
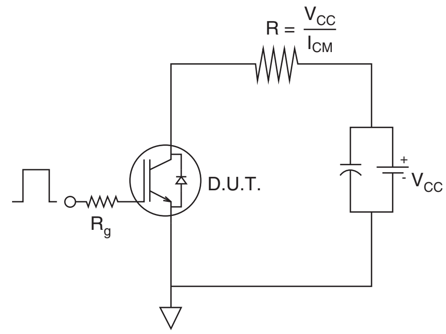


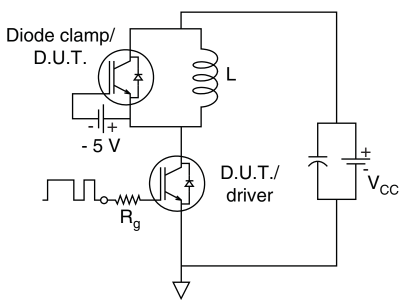
Fig. 18 - IGBT Reverse BIAS SOA, $T_J = 150$ °C, $V_{GE} = 15$ V



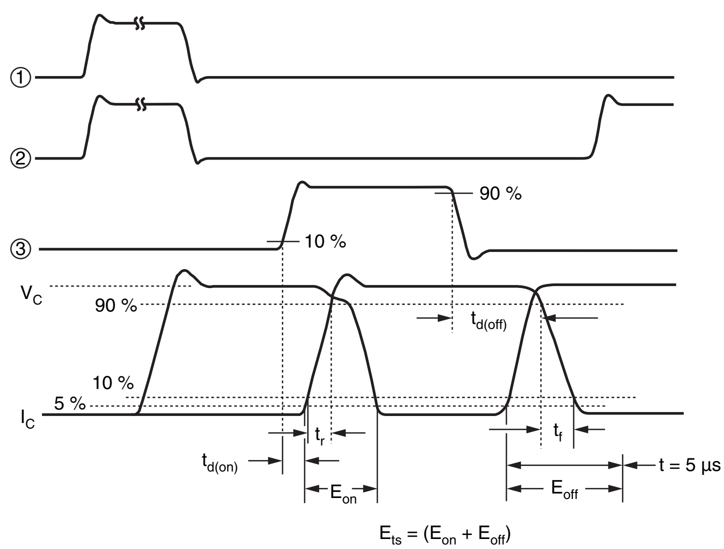
19a - Clamped Inductive Load Test Circuit



19b - Pulsed Collector Current Test Circuit



20a - Switching Loss Test Circuit

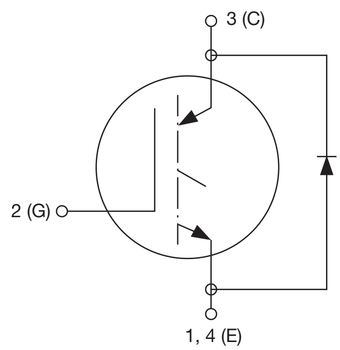
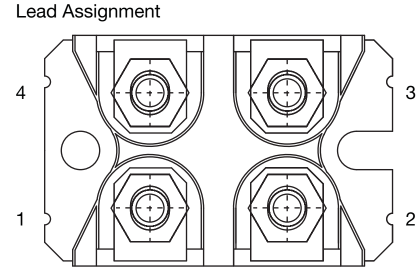


20b - Switching Loss Waveforms Test Circuit

ORDERING INFORMATION TABLE

Device code	VS-	G	B	90	D	A	60	U
	1	2	3	4	5	6	7	8

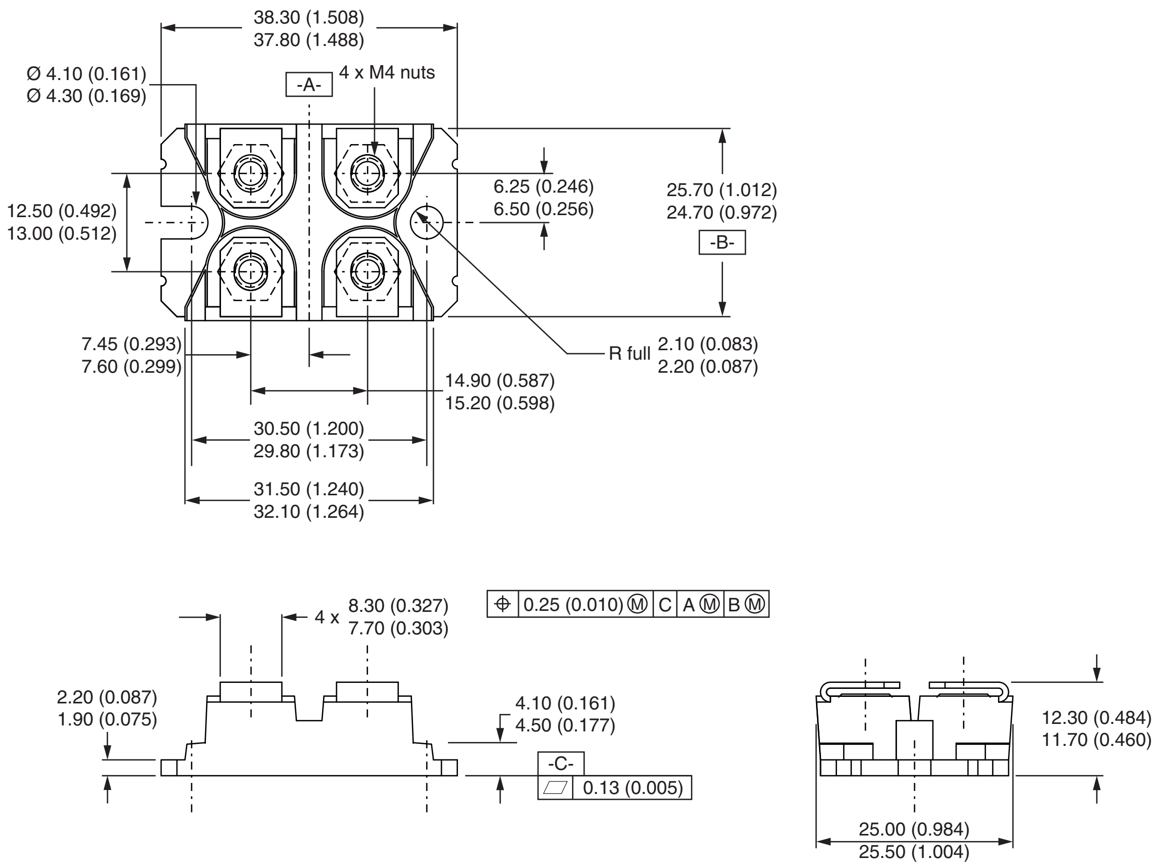
- **1** - Vishay Semiconductors product
- **2** - Insulated Gate Bipolar Transistor (IGBT)
- **3** - B = IGBT Generation 5
- **4** - Current rating (90 = 90 A)
- **5** - Circuit configuration (D = Single switch with antiparallel diode)
- **6** - Package indicator (A = SOT-227)
- **7** - Voltage rating (60 = 600 V)
- **8** - Speed/type (U = Ultrafast IGBT)

CIRCUIT CONFIGURATION		
CIRCUIT	**CIRCUIT CONFIGURATION CODE**	**CIRCUIT DRAWING**
2 separate diodes, parallel pin-out	D	 Lead Assignment 

LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95423
Packaging information	www.vishay.com/doc?95425

SOT-227 Generation II

DIMENSIONS in millimeters (inches)



Note

- 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.

Стандарт
Электрон
Связь

Мы молодая и активно развивающаяся компания в области поставок электронных компонентов. Мы поставляем электронные компоненты отечественного и импортного производства напрямую от производителей и с крупнейших складов мира.

Благодаря сотрудничеству с мировыми поставщиками мы осуществляем комплексные и плановые поставки широчайшего спектра электронных компонентов.

Собственная эффективная логистика и склад в обеспечивает надежную поставку продукции в точно указанные сроки по всей России.

Мы осуществляем техническую поддержку нашим клиентам и предпродажную проверку качества продукции. На все поставляемые продукты мы предоставляем гарантию .

Осуществляем поставки продукции под контролем ВП МО РФ на предприятия военно-промышленного комплекса России , а также работаем в рамках 275 ФЗ с открытием отдельных счетов в уполномоченном банке. Система менеджмента качества компании соответствует требованиям ГОСТ ISO 9001.

Минимальные сроки поставки, гибкие цены, неограниченный ассортимент и индивидуальный подход к клиентам являются основой для выстраивания долгосрочного и эффективного сотрудничества с предприятиями радиоэлектронной промышленности, предприятиями ВПК и научно-исследовательскими институтами России.

С нами вы становитесь еще успешнее!

Наши контакты:

Телефон: +7 812 627 14 35

Электронная почта: sales@st-electron.ru

Адрес: 198099, Санкт-Петербург,
Промышленная ул, дом № 19, литера Н,
помещение 100-Н Офис 331