Insulated Gate Bipolar Transistor Ultralow $V_{CE(on)}$, 250 A

SOT-227

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
- Designed and qualified for industrial level
- UL approved file E78996
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912

Pb-free
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

PRODUCT SUMMARY	
V_{CES}	600 V
$V_{CE(on)}$ (typical) at 200 A, 25 °C	1.33 V
I_C at T_C = 90 °C [(1)]	250 A

Note

[(1)] Maximum collector current admitted 100 A to do not exceed the maximum temperature of terminals

ABSOLUTE MAXIMUM RATINGS				
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**MAX.**	**UNITS**
Collector to emitter voltage	V_{CES}		600	V
Continuous collector current	I_C [(1)]	T_C = 25 °C	400	A
		T_C = 90 °C	250	
Pulsed collector current	I_{CM}	Repetitive rating; V_{GE} = 20 V, pulse width limited by maximum junction temperature	400	
Clamped Inductive load current	I_{LM}	V_{CC} = 80 % (V_{CES}), V_{GE} = 20 V, L = 10 µH, R_g = 2.0 Ω,	400	
Gate to emitter voltage	V_{GE}		± 20	V
Power dissipation	P_D	T_C = 25 °C	961	W
		T_C = 90 °C	462	
Isolation voltage	V_{ISOL}	Any terminal to case, t = 1 minute	2500	V

Note

[(1)] Maximum collector current admitted 100 A to do not exceed the maximum temperature of terminals

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 thermal resistance	R_{thJC}	-	-	0.13	°C/W
Case to sink thermal resistance, flat, greased surface	R_{thCS}	-	0.1	-	
Mounting torque, on terminals and heatsink	T	-	-	1.3	Nm
Weight		-	30	-	g
Case style	SOT-227				

ELECTRICAL SPECIFICATIONS (T_J = 25 °C unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNITS
Collector to emitter breakdown voltage	$V_{(BR)CES}$	V_{GE} = 0 V, I_C = 1 mA		600	-	-	V
Emitter to collector breakdown voltage	$V_{(BR)ECS}$ [(1)]	V_{GE} = 0 V, I_C = 1.0 A		18	-	-	V
Collector to emitter voltage	$V_{CE(on)}$	I_C = 100 A	V_{GE} = 15 V	-	1.10	1.3	V
		I_C = 200 A		-	1.33	1.66	
		I_C = 100 A, T_J = 125 °C		-	1.02	-	
		I_C = 200 A, T_J = 125 °C		-	1.32	-	
		I_C = 100 A, T_J = 150 °C		-	1.02	-	
		I_C = 200 A, T_J = 150 °C		-	1.33	-	
Gate threshold voltage	$V_{GE(th)}$	V_{CE} = V_{GE}, I_C = 250 μA		3.0	4.5	6.0	
		V_{CE} = V_{GE}, I_C = 250 μA, T_J = 125 °C		-	3.1	-	
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		-	- 12	-	mV/°C
Collector to emitter leakage current	I_{CES}	V_{GE} = 0 V, V_{CE} = 600 V		-	20	1000	μA
		V_{GE} = 0 V, V_{CE} = 600 V, T_J = 125 °C		-	0.2	-	mA
		V_{GE} = 0 V, V_{CE} = 600 V, T_J = 150 °C		-	0.6	10	
Gate to emitter leakage current	I_{GES}	V_{GE} = ± 20 V		-	-	± 250	nA

Notes

(1) Pulse width ≤ 80 μs; duty factor ≤ 0.1 %

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} = 600 V, V_{GE} = 15 V		-	770	1200	nC
Gate-to-emitter charge (turn-on)	Q_{ge}			-	100	150	
Gate-to-collector charge (turn-on)	Q_{gc}			-	260	380	
Turn-on switching loss	E_{on}	T_J = 25 °C I_C = 100 A V_{CC} = 480 V V_{GE} = 15 V R_g = 5.0 Ω L = 500 μH	Energy losses include tail and diode recovery. Diode used 60APH06	-	0.55	-	mJ
Turn-off switching loss	E_{off}			-	25	-	
Total switching loss	E_{tot}			-	25.5	-	
Turn-on delay time	$t_{d(on)}$			-	267	-	ns
Rise time	t_r			-	42	-	
Turn-off delay time	$t_{d(off)}$			-	310	-	
Fall time	t_f			-	450	-	
Turn-on switching loss	E_{on}	T_J = 125 °C I_C = 100 A V_{CC} = 480 V V_{GE} = 15 V R_g = 5.0 Ω L = 500 μH		-	0.67	-	mJ
Turn-off switching loss	E_{off}			-	43.0	-	
Total switching loss	E_{tot}			-	43.7	-	
Turn-on delay time	$t_{d(on)}$			-	275	-	ns
Rise time	t_r			-	50	-	
Turn-off delay time	$t_{d(off)}$			-	350	-	
Fall time	t_f			-	700	-	
Internal emitter inductance	L_E	Between lead and center of die contact		-	5.0	-	nH
Input capacitance	C_{ies}	V_{GE} = 0 V , V_{CC} = 30 V, f = 1.0 MHz		-	16 250	-	pF
Output capacitance	C_{oes}			-	1040	-	
Reverse transfer capacitance	C_{res}			-	190	-	

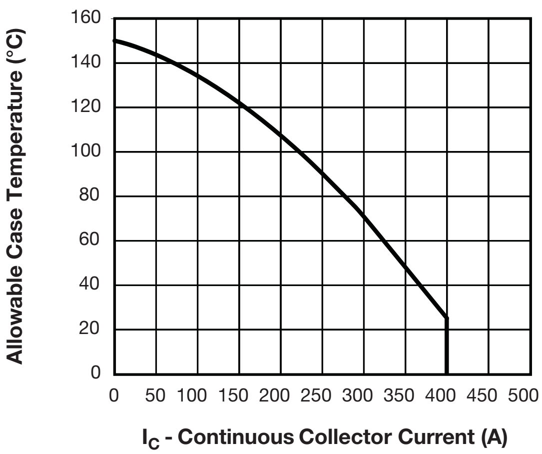


Fig. 1 - Maximum DC IGBT Collector Current vs. Case Temperature

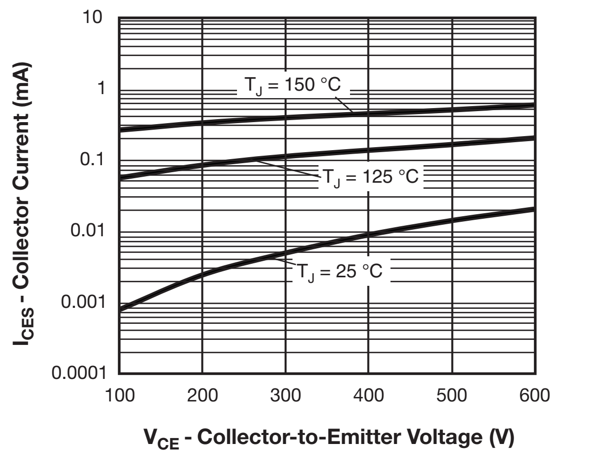


Fig. 4 - Typical IGBT Zero Gate Voltage Collector Current

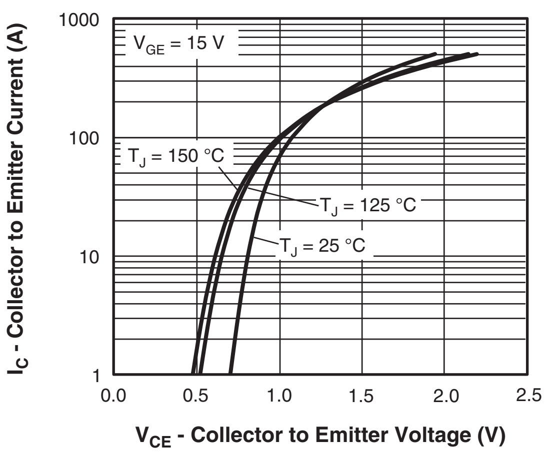


Fig. 2 - Typical Collector to Emitter Current Output Characteristics

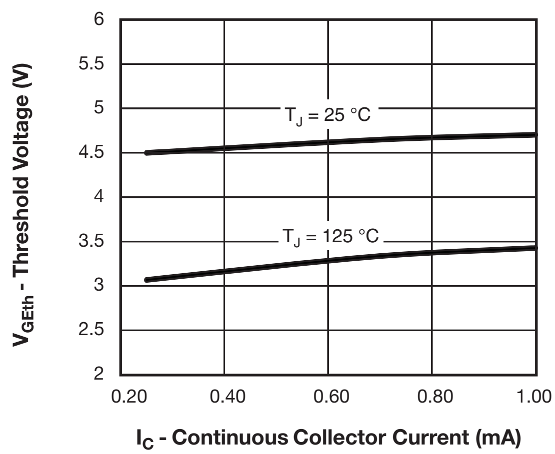


Fig. 5 - Typical IGBT Threshold Voltage

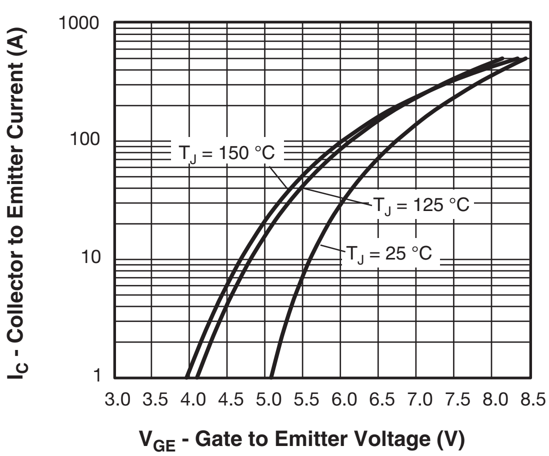


Fig. 3 - Typical IGBT Transfer Characteristics

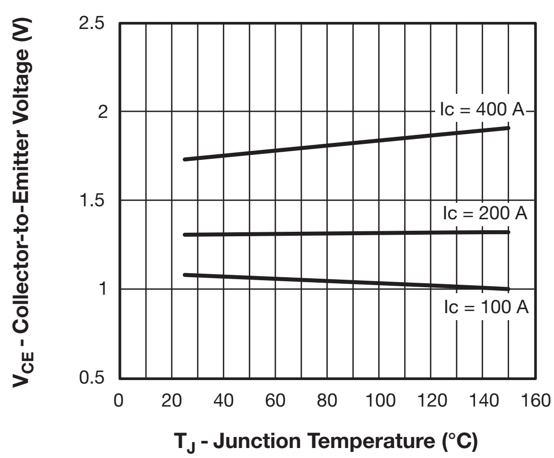


Fig. 6 - Typical IGBT Collector to Emitter Voltage vs. Junction Temperature, V_{GE} = 15 V

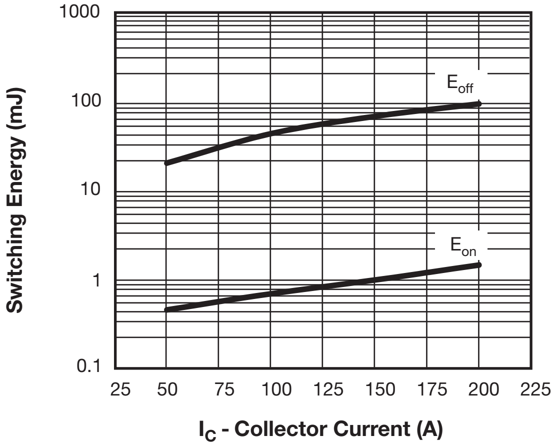


Fig. 7 - Typical IGBT Energy Losses vs. I_C, T_J = 125 °C, V_{CC} = 480 V, V_{GE} = 15 V, L = 500 μH, R_g = 5 Ω, Diode used: 60APH06

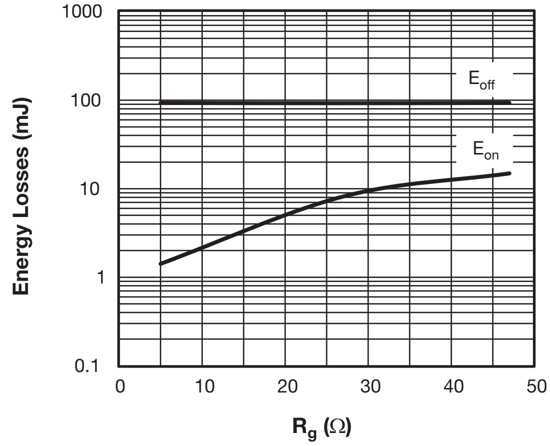


Fig. 9 - Typical IGBT Energy Losses vs. R_g, T_J = 125 °C, I_C = 200 A, V_{CC} = 480 V, V_{GE} = 15 V, L = 500 μH, Diode used: 60APH06

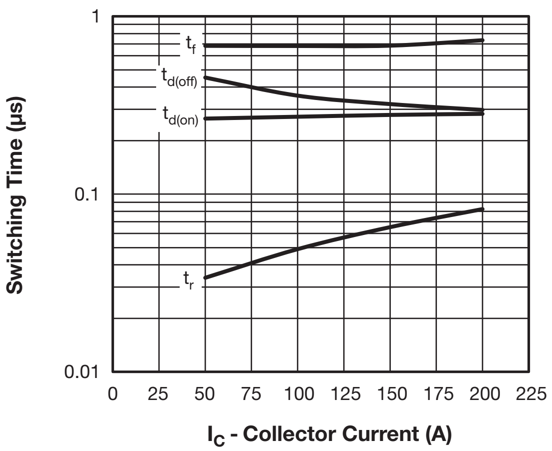


Fig. 8 - Typical IGBT Switching Time vs. I_C, T_J = 125 °C, V_{CC} = 480 V, V_{GE} = 15 V, L = 500 μH, R_g = 5 Ω, Diode used: 60APH06

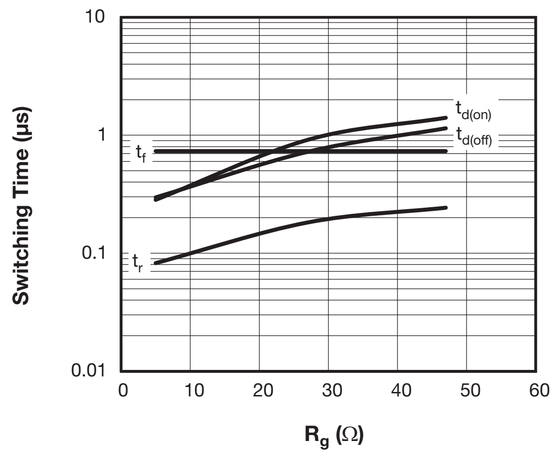


Fig. 10 - Typical IGBT Switching Time vs. R_g, T_J = 125 °C, I_C = 200 A, V_{CC} = 480 V, V_{GE} = 15 V, L = 500 μH, Diode used: 60APH06

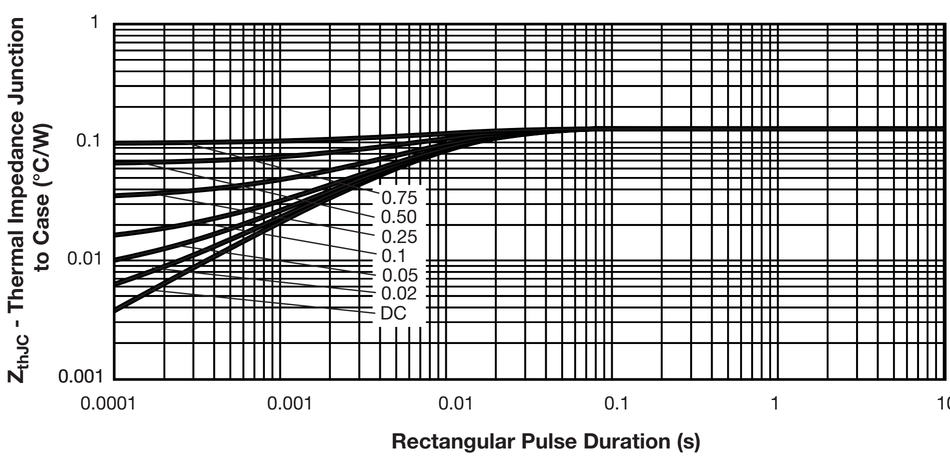


Fig. 11 - Maximum Thermal Impedance Z_{thJC} Characteristics

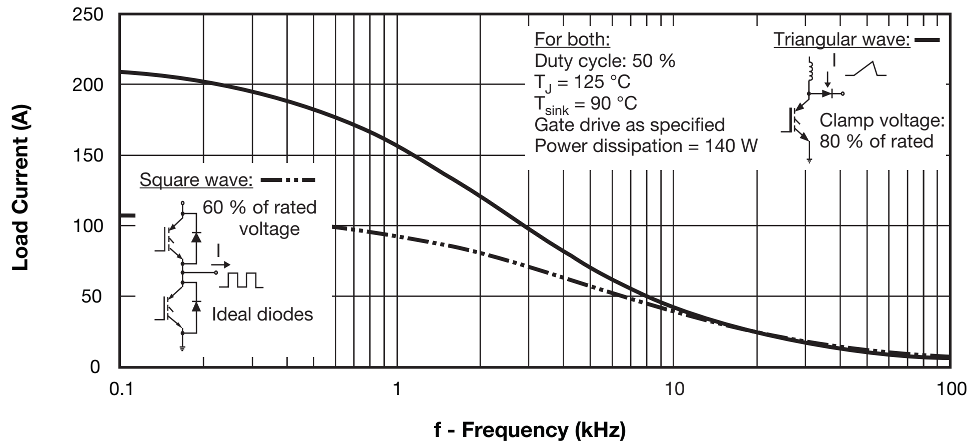


Fig. 12 - Typical Load Current vs. Frequency (Load Current = I_{RMS} of Fundamental)

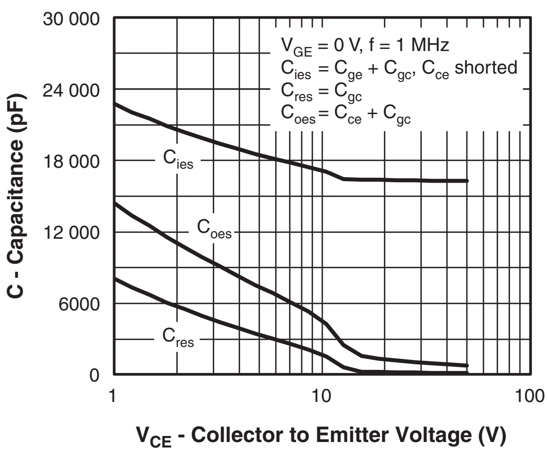


Fig. 13 - Typical Capacitance vs. Collector to Emitter Voltage

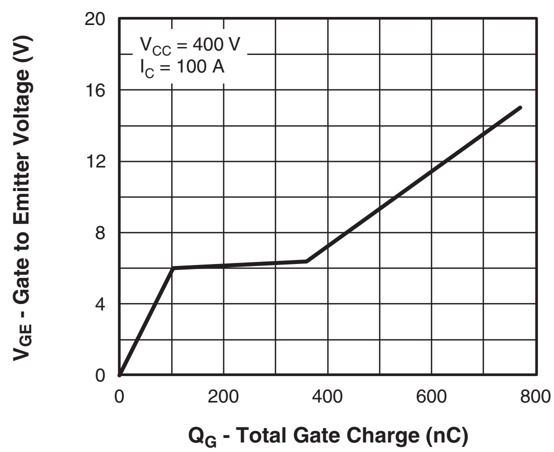


Fig. 14 - Typical Gate Charge vs. Gate to Emitter Voltage

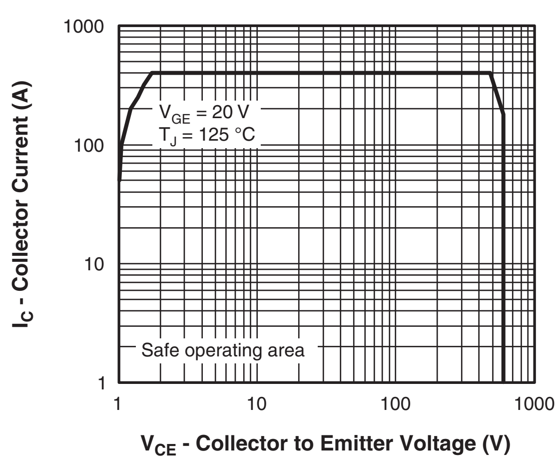


Fig. 15 - Turn-Off SOA

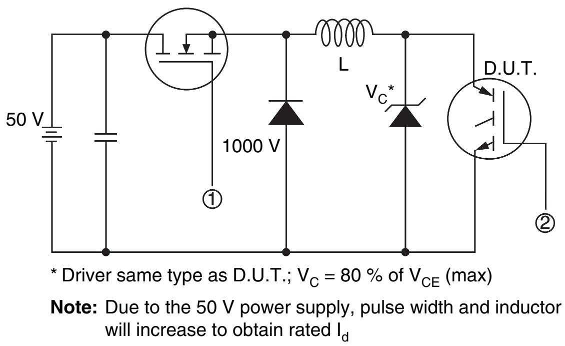


Fig. 16a - Clamped Inductive Load Test Circuit

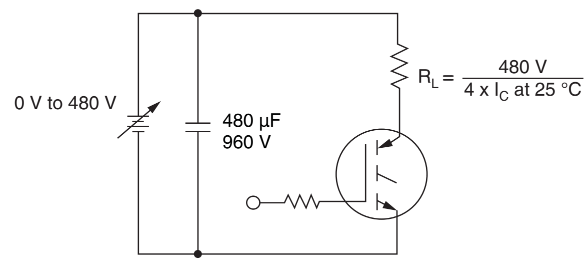
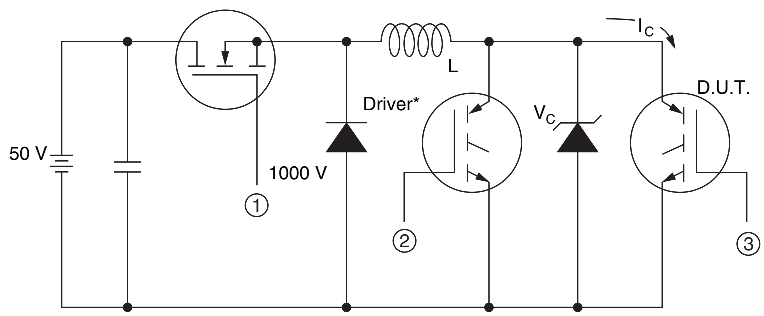


Fig. 16b - Pulsed Collector Current Test Circuit



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

Fig. 17a - Switching Lost Test Circuit

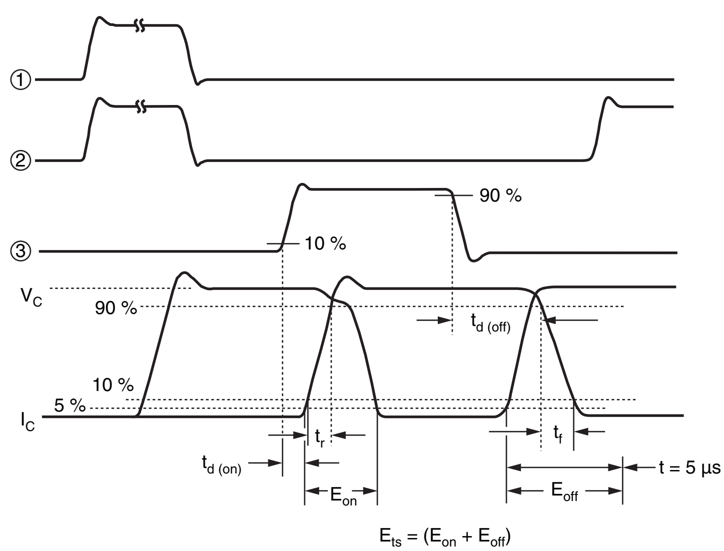
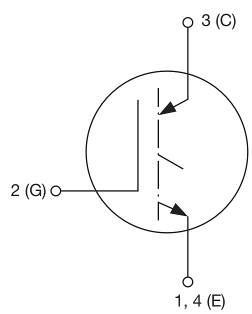
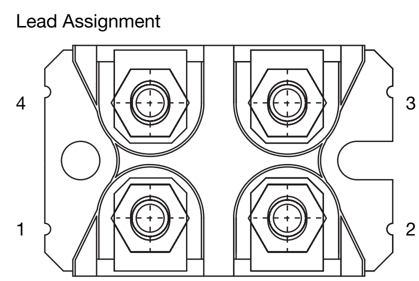


Fig. 17b - Switching Loss Waveforms

ORDERING INFORMATION TABLE

Device code	VS-	G	A	250	S	A	60	S
	1	2	3	4	5	6	7	8

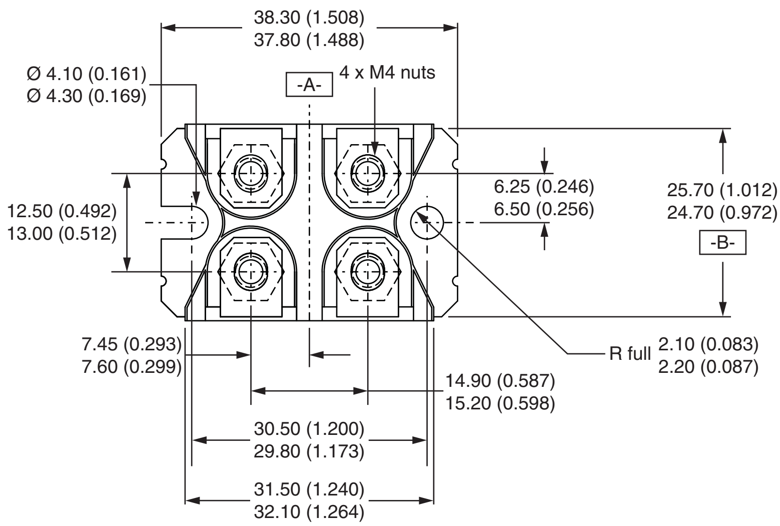
- **1** - Vishay Semiconductors product
- **2** - Insulated Gate Bipolar Transistor (IGBT)
- **3** - Generation 4, IGBT silicon
- **4** - Current rating (250 = 250 A)
- **5** - Circuit configuration (S = Single switch, without antiparallel diode)
- **6** - Package indicator (A = SOT-227)
- **7** - Voltage rating (60 = 600 V)
- **8** - Speed/type (S = Standard speed)

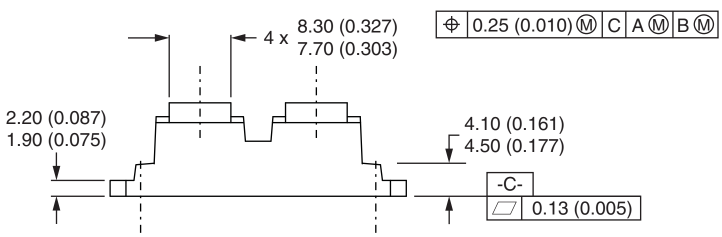
CIRCUIT CONFIGURATION		
CIRCUIT	**CIRCUIT CONFIGURATION CODE**	**CIRCUIT DRAWING**
Single switch, no antiparallel diode	S	 N-channel 

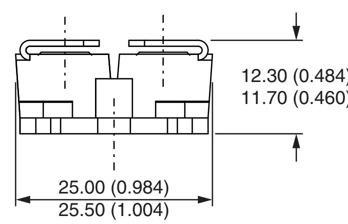
LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95423
Packaging information	www.vishay.com/doc?95425

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.

ООО «ЛайфЭлектроникс» "LifeElectronics" LLC

ИНН 7805602321 КПП 780501001 Р/С 40702810122510004610 ФАКБ "АБСОЛЮТ БАНК" (ЗАО) в г.Санкт-Петербурге К/С 30101810900000000703 БИК 044030703

Компания «Life Electronics» занимается поставками электронных компонентов импортного и отечественного производства от производителей и со складов крупных дистрибьюторов Европы, Америки и Азии.

С конца 2013 года компания активно расширяет линейку поставок компонентов по направлению коаксиальный кабель, кварцевые генераторы и конденсаторы (керамические, пленочные, электролитические), за счёт заключения дистрибьюторских договоров

Мы предлагаем:

- *Конкурентоспособные цены и скидки постоянным клиентам.*
- *Специальные условия для постоянных клиентов.*
- *Подбор аналогов.*
- *Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.*

- *Приемлемые сроки поставки, возможна ускоренная поставка.*
- *Доставку товара в любую точку России и стран СНГ.*
- *Комплексную поставку.*
- *Работу по проектам и поставку образцов.*
- *Формирование склада под заказчика.*

- *Сертификаты соответствия на поставляемую продукцию (по желанию клиента).*
- *Тестирование поставляемой продукции.*
- *Поставку компонентов, требующих военную и космическую приемку.*
- *Входной контроль качества.*
- *Наличие сертификата ISO.*

В составе нашей компании организован Конструкторский отдел, призванный помогать разработчикам, и инженерам.

Конструкторский отдел помогает осуществить:

- *Регистрацию проекта у производителя компонентов.*
- *Техническую поддержку проекта.*
- *Защиту от снятия компонента с производства.*
- *Оценку стоимости проекта по компонентам.*
- *Изготовление тестовой платы монтаж и пусконаладочные работы.*

Тел: +7 (812) 336 43 04 (многоканальный)
Email: org@lifeelectronics.ru

www.lifeelectronics.ru