

Insulated Gate Bipolar Transistor (Ultrafast Speed IGBT), 100 A



SOT-227

FEATURES

- Ultrafast: Optimized for minimum saturation voltage and speed up to 40 kHz in hard switching, > 200 kHz in resonant mode
- Very low conduction and switching losses
- Fully isolate package (2500 V_{AC/RMS})
- 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**

PRODUCT SUMMARY	
V _{CES}	600 V
V _{CE(on)} (typical)	1.92 V
V _{GE}	15 V
I _C	100 A

BENEFITS

- Designed for increased operating efficiency in power conversion: UPS, SMPS, welding, induction heating
- Lower overall losses available at frequencies = 20 kHz
- Easy to assemble and parallel
- Direct mounting to heatsink
- Lower EMI, requires less snubbing
- 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	T _C = 25 °C	200	A
		T _C = 100 °C	100	
Pulsed collector current	I _{CM}		400	
Clamped inductive load current	I _{LM}	V _{CC} = 80 % (V _{CES}), V _{GE} = 20 V, L = 10 μH, R _G = 2.0 Ω, See fig. 13a	400	
Gate to emitter voltage	V _{GE}		± 20	V
Reverse voltage avalanche energy	E _{ARV}	Repetitive rating; pulse width limited by maximum junction temperature	160	mJ
RMS isolation voltage	V _{ISOL}	Any terminal to case, t = 1 minute	2500	V
Maximum power dissipation	P _D	T _C = 25 °C	500	W
		T _C = 100 °C	200	
Operating junction and storage temperature range	T _J , T _{Stg}		- 55 to + 150	°C
Mounting torque		6-32 or M3 screw	1.3 (12)	N · m (lbf · in)

THERMAL AND MECHANICAL SPECIFICATIONS				
PARAMETER	SYMBOL	TYP.	MAX.	UNITS
Junction to case	R _{thJC}	-	0.25	°C/W
Case to sink, flat, greased surface	R _{thCS}	0.05	-	
Weight of module		30	-	g



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	
Emitter to collector breakdown voltage	V _{(BR)ECS}	V _{GE} = 0 V, I _C = 1.0 A Pulse width ≤ 80 μs; duty factor ≤ 0.1	18	-	-		
Temperature coeff. of breakdown	ΔV _{(BR)CES} /ΔT _J	V _{GE} = 0 V, I _C = 10 mA	-	0.38	-	V/°C	
Collector to emitter saturation voltage	V _{CE(on)}	I _C = 100 A	V _{GE} = 15 V See fig. 2, 5	-	1.60	1.9	V
		I _C = 200 A		-	1.92	-	
		I _C = 100 A, T _J = 150 °C		-	1.54	-	
Gate threshold voltage	V _{GE(th)}	V _{CE} = V _{GE} , I _C = 250 μA	3.0	-	6.0		
Temperature coeff. of threshold voltage	ΔV _{GE(th)} /ΔT _J	V _{CE} = V _{GE} , I _C = 2.0 mA	-	- 11	-	mV/°C	
Forward transconductance	g _{fe}	V _{CE} = 100 V, I _C = 100 A Pulse width 5.0 μs, single shot	79	-	-	S	
Zero gate voltage collector current	I _{CES}	V _{GE} = 0 V, V _{CE} = 600 V	-	-	1.0	mA	
		V _{GE} = 0 V, V _{CE} = 600 V, T _J = 150 °C	-	-	10		
Gate to emitter leakage current	I _{GES}	V _{GE} = ± 20 V	-	-	± 250	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} = 400 V V _{GE} = 15 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 °C I _C = 100 A V _{CC} = 480 V V _{GE} = 15 V R _g = 2.0 Ω Energy losses include "tail" See fig. 9, 10, 14	-	54	-	ns
Rise time	t _r		-	79	-	
Turn-off delay time	t _{d(off)}		-	130	200	
Fall time	t _f		-	300	450	
Turn-on switching loss	E _{on}		-	0.98	-	
Turn-off switching loss	E _{off}	-	3.48	-		
Total switching loss	E _{ts}	-	4.46	7.6		
Turn-on delay time	t _{d(on)}	T _J = 150 °C I _C = 100 A, V _{CC} = 480 V V _{GE} = 15 V, R _g = 2.0 Ω Energy losses include "tail" See fig. 10, 11, 14	-	56	-	ns
Rise time	t _r		-	75	-	
Turn-off delay time	t _{d(off)}		-	160	-	
Fall time	t _f		-	460	-	
Total switching loss	E _{ts}		-	7.24	-	
Internal emitter inductance	L _E	Measured 5 mm from package	-	5.0	-	nH
Input capacitance	C _{ies}	V _{GE} = 0 V V _{CC} = 30 V f = 1.0 MHz; See fig. 7	-	16 500	-	pF
Output capacitance	C _{oes}		-	1000	-	
Reverse transfer capacitance	C _{res}		-	200	-	

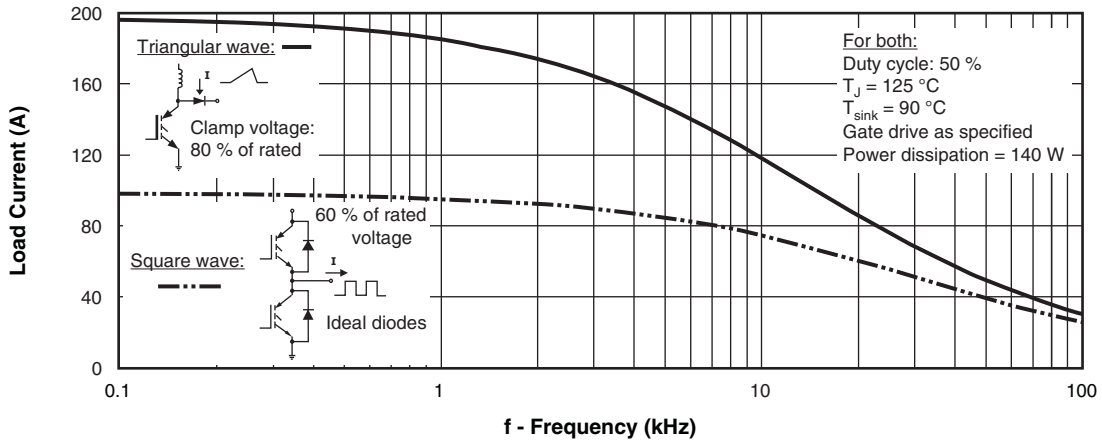


Fig. 1 - Typical Load Current vs. Frequency
(Load Current = I_{RMS} of Fundamental)

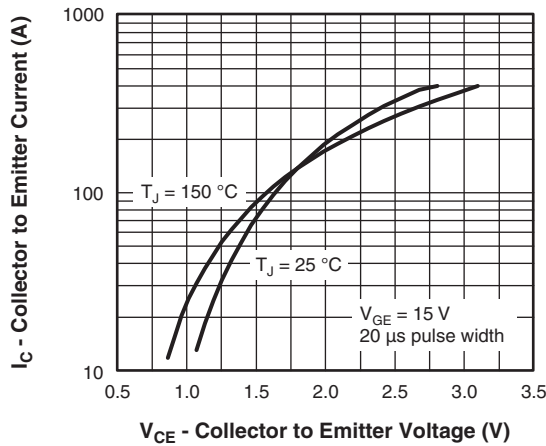


Fig. 2 - Typical Output Characteristics

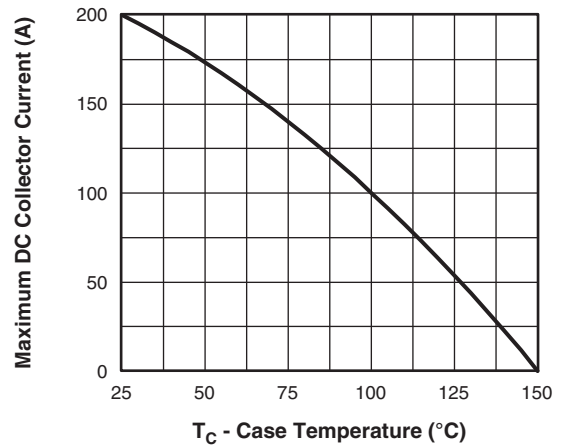


Fig. 4 - Maximum Collector Current vs. Case Temperature

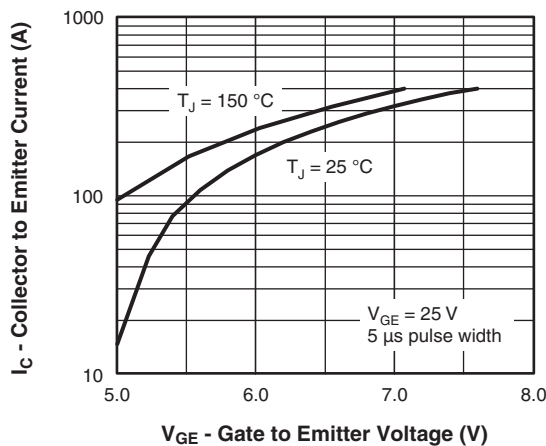


Fig. 3 - Typical Transfer Characteristics

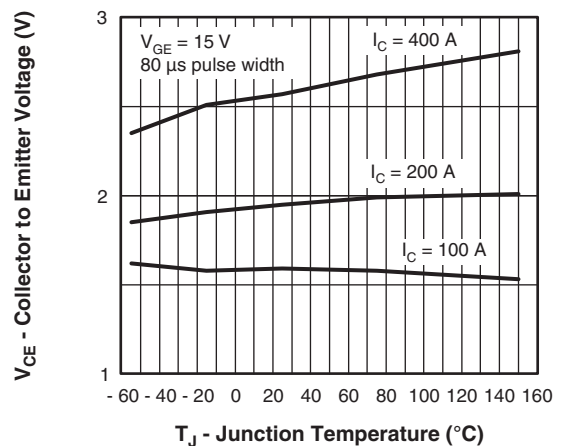


Fig. 5 - Typical Collector to Emitter Voltage vs. Junction Temperature

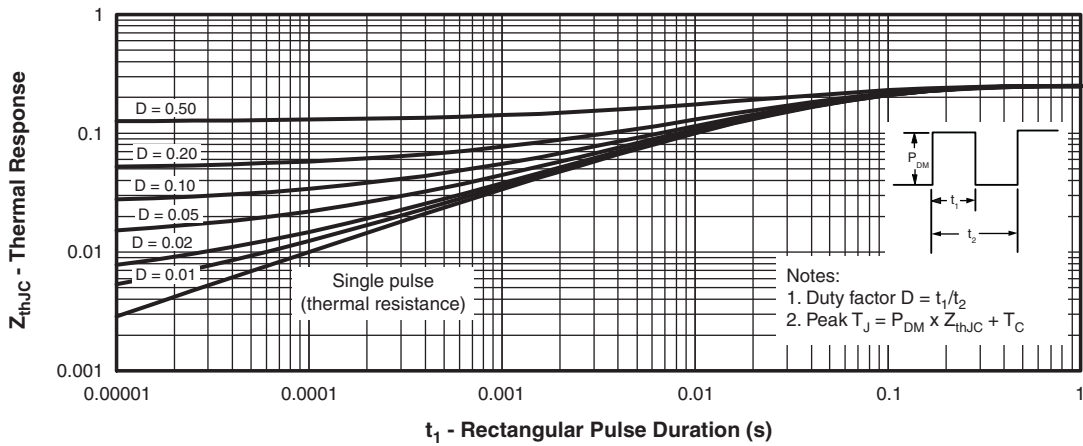


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction to Case

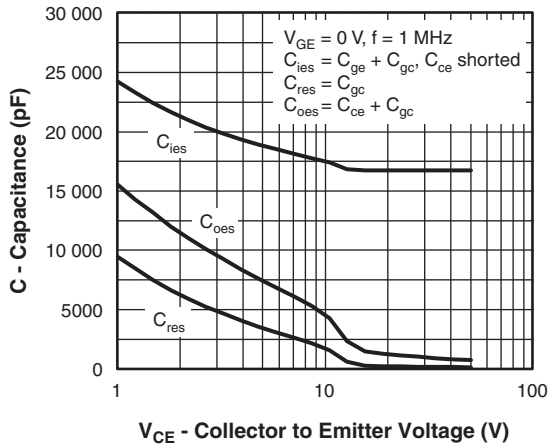


Fig. 7 - Typical Capacitance vs. Collector to Emitter Voltage

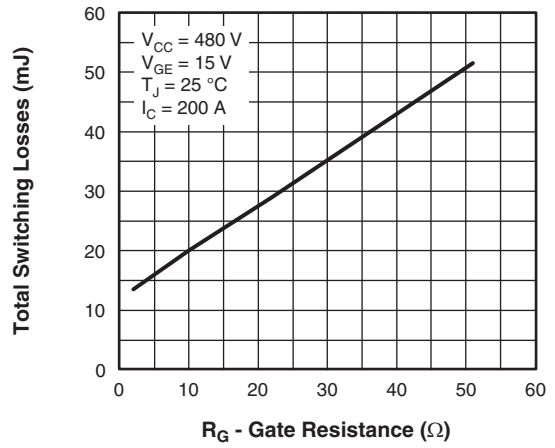


Fig. 9 - Typical Switching Losses vs. Gate Resistance

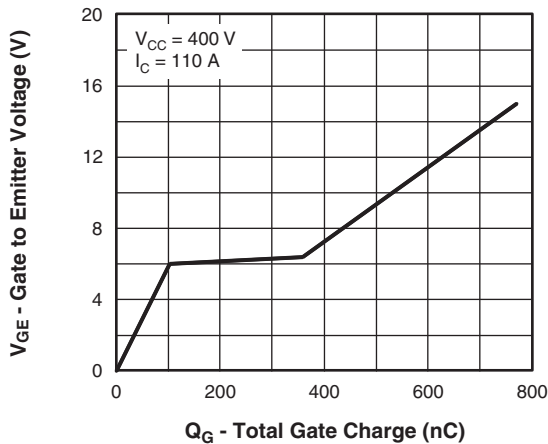


Fig. 8 - Typical Gate Charge vs. Gate to Emitter Voltage

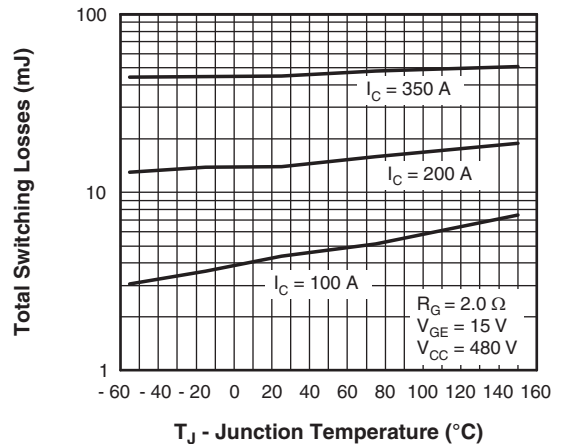


Fig. 10 - Typical Switching Losses vs. Junction Temperature

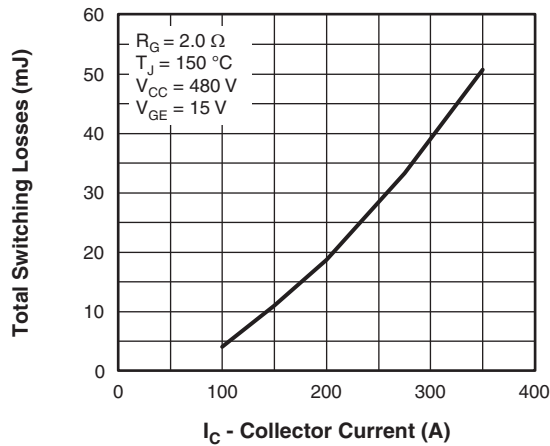


Fig. 11 - Typical Switching Losses vs. Collector Current

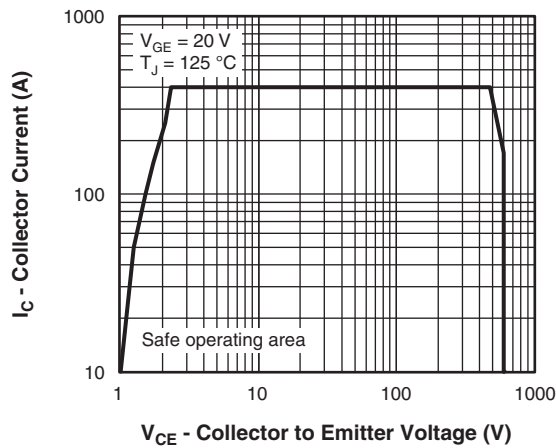
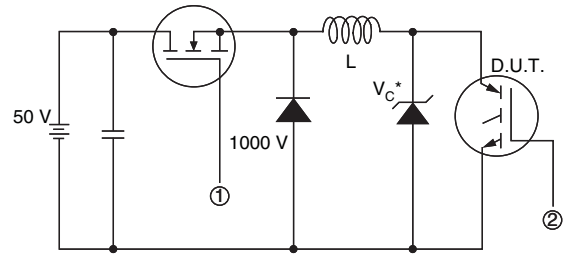


Fig. 12 - Turn-Off SOA



* Driver same type as D.U.T.; $V_C = 80\%$ of $V_{CE}(\text{max})$

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

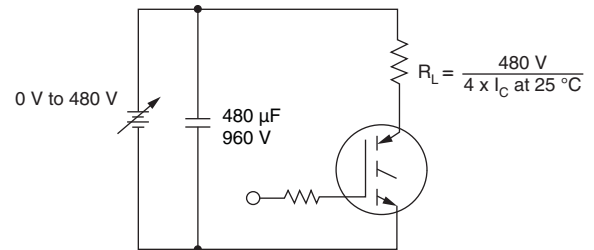
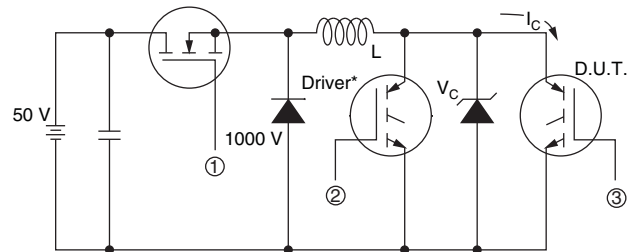


Fig. 13b - Pulsed Collector Current Test Circuit



* Driver same type as D.U.T., $V_C = 480 \text{ V}$

Fig. 14a - Switching Loss Test Circuit

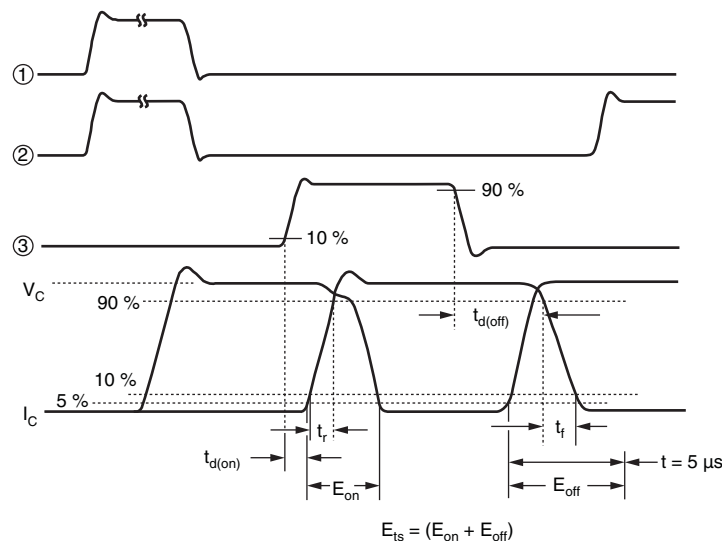
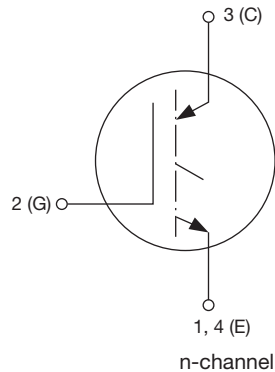


Fig. 14b - Switching Loss Waveforms

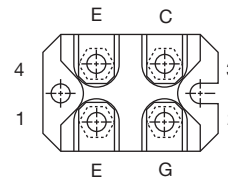
ORDERING INFORMATION TABLE

Device code	G	A	200	S	A	60	U	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 (U = Ultrafast)
- 8** -
 - None = Standard production
 - P = Lead (Pb)-free

CIRCUIT CONFIGURATION


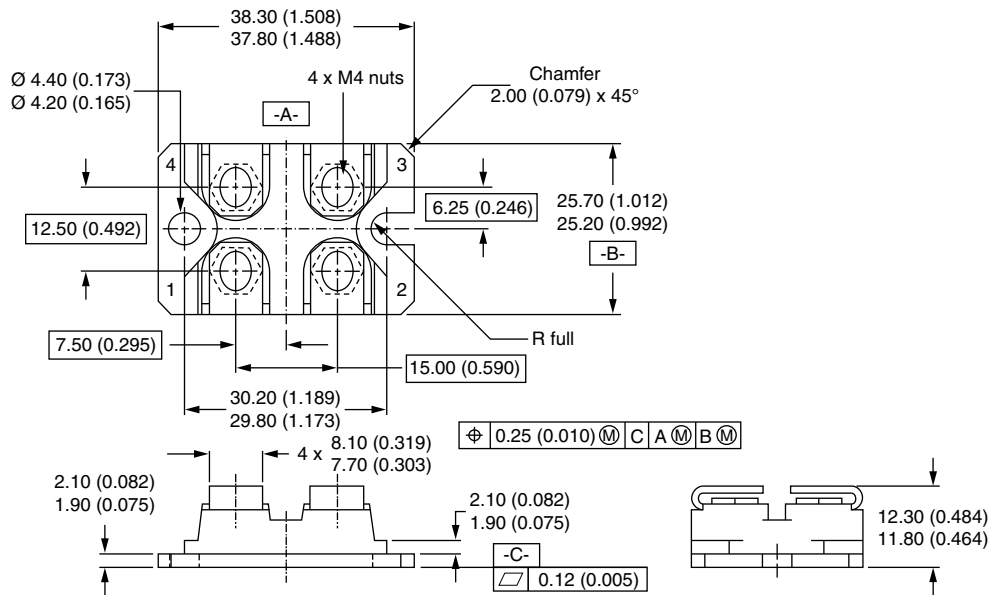
Lead assignment



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. 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.