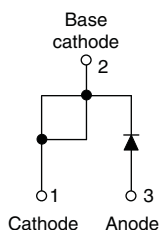




Fast Soft Recovery Rectifier Diode, 20 A



TO-220AC



FEATURES

- 150 °C max operating junction temperature
- Low forward voltage drop and short reverse recovery time
- Designed and qualified according to JEDEC-JESD47
- Material categorization:
For definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE

APPLICATIONS

These devices are intended for use in output rectification and freewheeling in inverters, choppers and converters as well as in input rectification where severe restrictions on conducted EMI should be met.

DESCRIPTION

The VS-20ETF0... fast soft recovery rectifier series has been optimized for combined short reverse recovery time and low forward voltage drop.

The glass passivation ensures stable reliable operation in the most severe temperature and power cycling conditions.

PRODUCT SUMMARY

Package	TO-220AC
$I_{F(AV)}$	20 A
V_R	200 V, 400 V, 600 V
V_F at I_F	1.3 V
I_{FSM}	300 A
t_{rr}	60 ns
T_J max.	150 °C
Diode variation	Single die
Snap factor	0.6

MAJOR RATINGS AND CHARACTERISTICS

SYMBOL	CHARACTERISTICS	VALUES	UNITS
V_{RRM}	Range	200 to 600	V
$I_{F(AV)}$	Sinusoidal waveform	20	A
I_{FSM}		300	
t_{rr}	1 A, 100 A/ μ s	60	ns
V_F	10 A, $T_J = 25$ °C	1.2	V
T_J	Range	- 40 to 150	°C

VOLTAGE RATINGS

PART NUMBER	V_{RRM} , MAXIMUM PEAK REVERSE VOLTAGE V	V_{RSM} , MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE V	I_{RRM} AT 150 °C mA
VS-20ETF02PbF, VS-20ETF02-M3	200	300	5
VS-20ETF04PbF, VS-20ETF04-M3	400	500	
VS-20ETF06PbF, VS-20ETF06-M3	600	700	

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum average forward current	$I_{F(AV)}$	$T_C = 97$ °C, 180° conduction half sine wave	20	A
Maximum peak one cycle non-repetitive surge current	I_{FSM}	10 ms sine pulse, rated V_{RRM} applied	250	
		10 ms sine pulse, no voltage reapplied	300	
Maximum I^2t for fusing	I^2t	10 ms sine pulse, rated V_{RRM} applied	316	A ² s
		10 ms sine pulse, no voltage reapplied	442	
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	$t = 0.1$ to 10 ms, no voltage reapplied	4420	A ² $\sqrt{s}$



ELECTRICAL SPECIFICATIONS

PARAMETER	SYMBOL	TEST CONDITIONS		VALUES	UNITS
Maximum forward voltage drop	V_{FM}	20 A, $T_J = 25\text{ }^{\circ}\text{C}$		1.3	V
Forward slope resistance	r_t	$T_J = 150\text{ }^{\circ}\text{C}$		12.5	m Ω
Threshold voltage	$V_{F(TO)}$			0.9	V
Maximum reverse leakage current	I_{RM}	$T_J = 25\text{ }^{\circ}\text{C}$	$V_R = \text{Rated } V_{RRM}$	0.1	mA
		$T_J = 150\text{ }^{\circ}\text{C}$		5.0	

RECOVERY CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS	
Reverse recovery time	t_{rr}	I_F at 20 Apk 100 A/ μ s 25 $^{\circ}\text{C}$	160	ns	
Reverse recovery current	I_{rr}		10	A	
Reverse recovery charge	Q_{rr}		1.25	μ C	
Snap factor	S	Typical	0.6		

THERMAL - MECHANICAL SPECIFICATIONS

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum junction and storage temperature range	T _J , T _{Stg}		- 40 to 150	°C
Maximum thermal resistance, junction to case	R _{thJC}	DC operation	0.9	°C/W
Maximum thermal resistance, junction to ambient	R _{thJA}		62	
Typical thermal resistance, case to heatsink	R _{thCS}	Mounting surface, smooth and greased	0.5	
Approximate weight			2	g
			0.07	oz.
Mounting torque	minimum		6 (5)	kgf · cm (lbf · in)
	maximum		12 (10)	
Marking device		Case style TO-220AC	20ETF02 20ETF04 20ETF06	

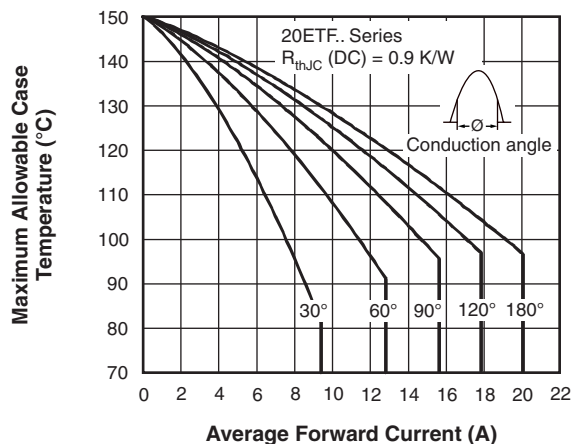


Fig. 1 - Current Rating Characteristics

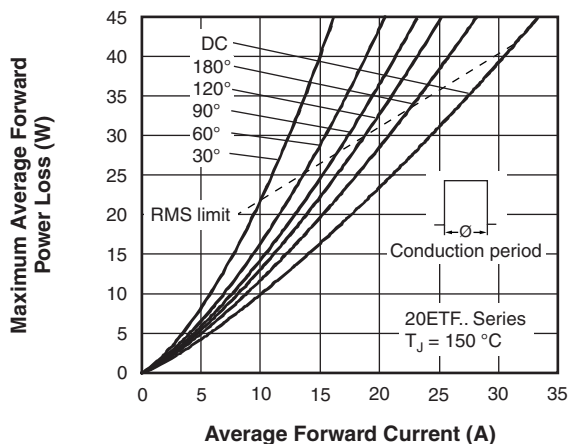


Fig. 4 - Forward Power Loss Characteristics

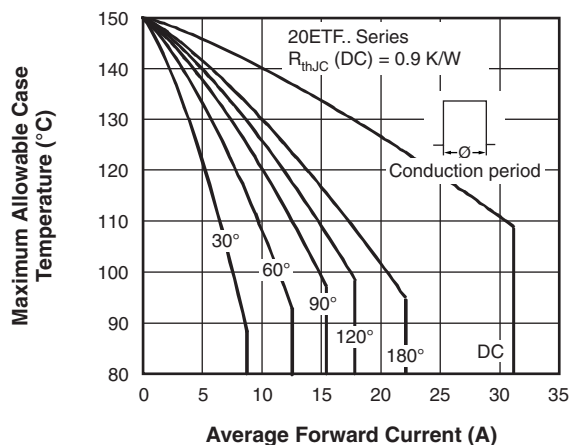


Fig. 2 - Current Rating Characteristics

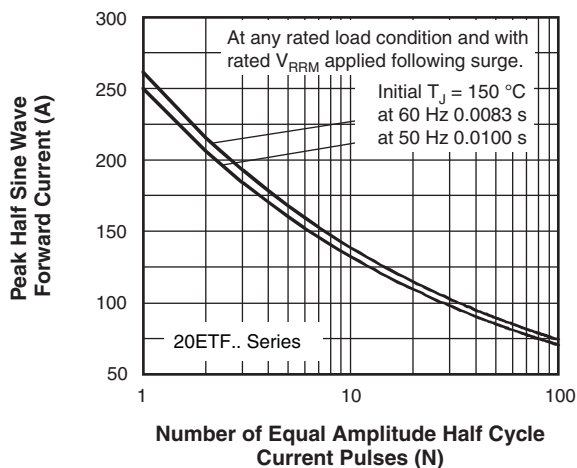


Fig. 5 - Maximum Non-Repetitive Surge Current

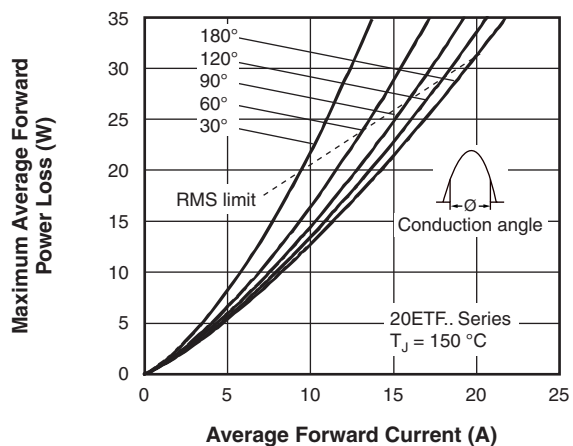


Fig. 3 - Forward Power Loss Characteristics

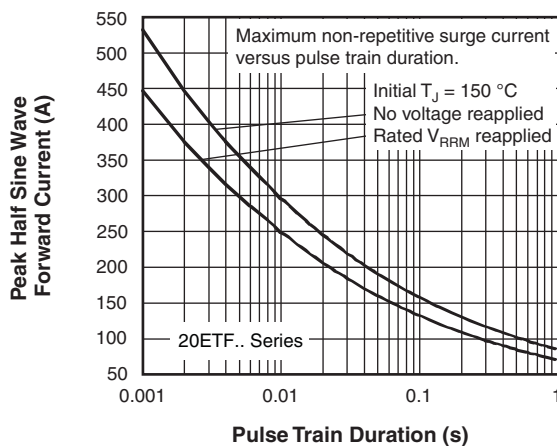


Fig. 6 - Maximum Non-Repetitive Surge Current

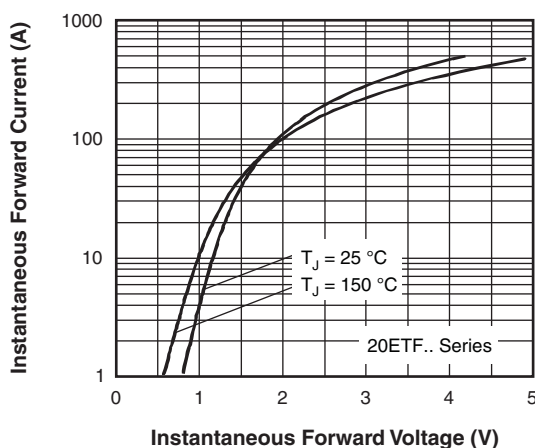


Fig. 7 - Forward Voltage Drop Characteristics

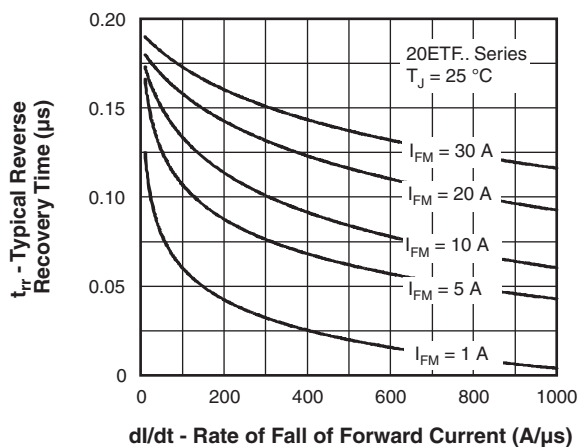


Fig. 8 - Recovery Time Characteristics, $T_J = 25\text{ }^{\circ}\text{C}$

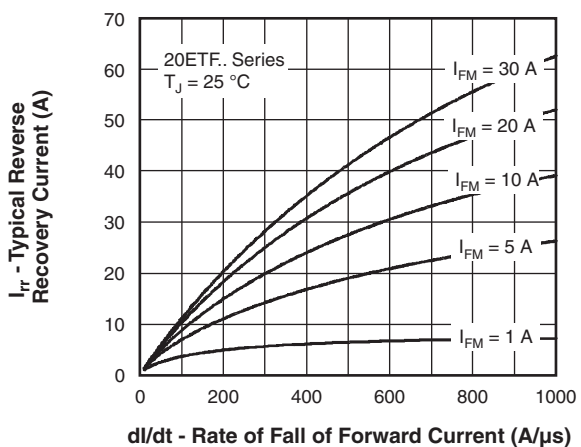


Fig. 10 - Recovery Charge Characteristics, $T_J = 25\text{ }^{\circ}\text{C}$

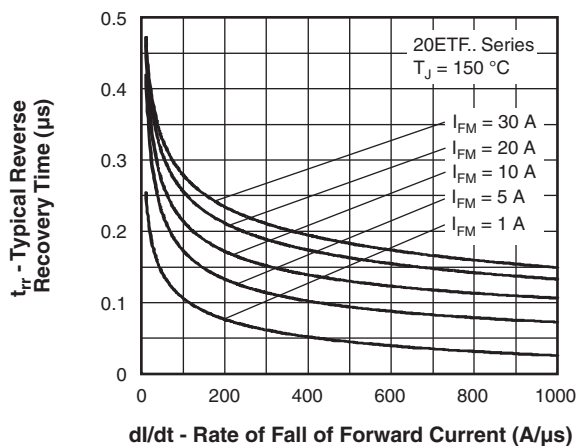


Fig. 9 - Recovery Time Characteristics, $T_J = 150\text{ }^{\circ}\text{C}$

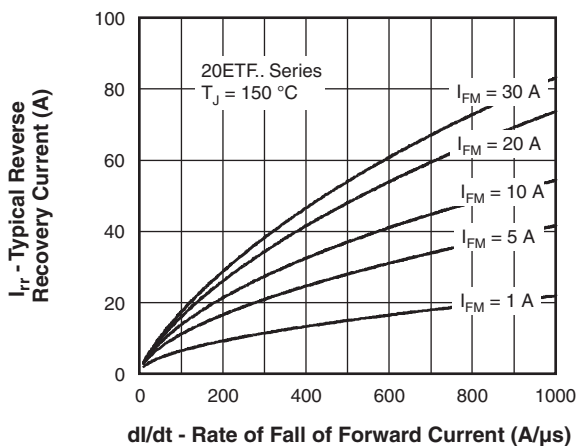


Fig. 11 - Recovery Charge Characteristics, $T_J = 150\text{ }^{\circ}\text{C}$

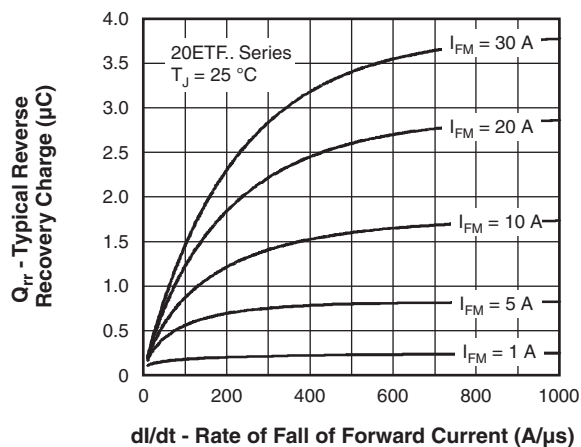


Fig. 12 - Recovery Current Characteristics, $T_J = 25\text{ }^{\circ}\text{C}$

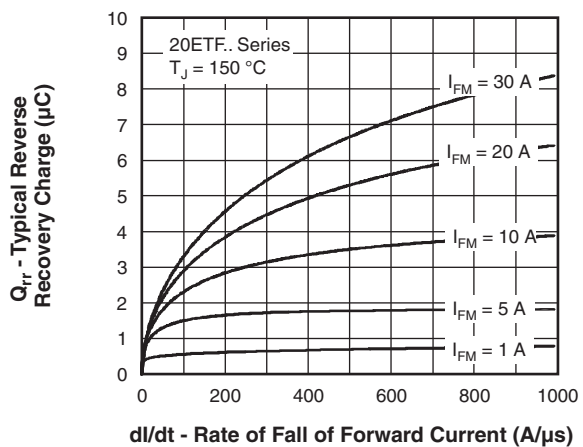


Fig. 13 - Recovery Current Characteristics, $T_J = 150\text{ }^{\circ}\text{C}$

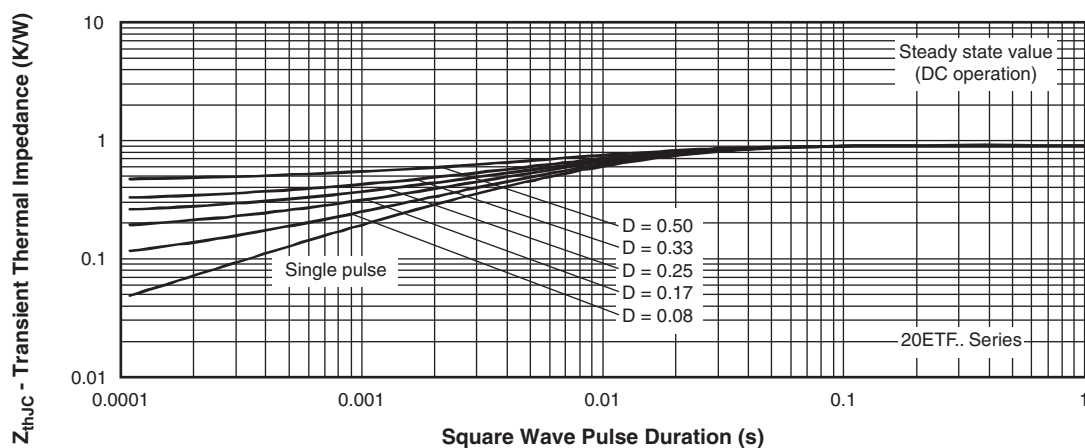


Fig. 14 - Thermal Impedance Z_{thJC} Characteristics



ORDERING INFORMATION TABLE

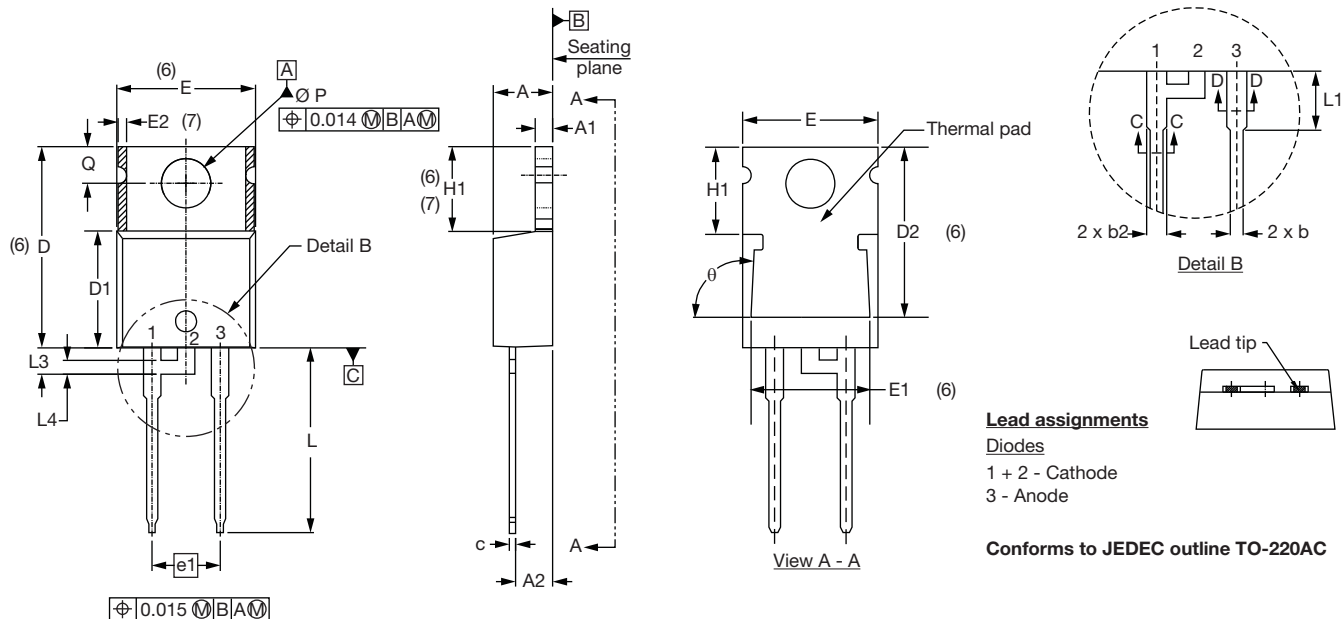
Device code	VS-	20	E	T	F	06	PbF
	1	2	3	4	5	6	7
1	- Vishay Semiconductors product						
2	- Current rating (20 = 20 A)						
3	- Circuit configuration: E = Single diode						
4	- Package: T = TO-220AC						
5	- Type of silicon: F = Fast soft recovery rectifier						
6	- Voltage code x 100 = V_{RRM}						
7	- Environmental digit						
	• PbF = Lead (Pb)-free and RoHS compliant						
	• -M3 = Halogen-free, RoHS compliant, and terminations lead (Pb)-free						

ORDERING INFORMATION (Example)			
PREFERRED P/N	QUANTITY PER T/R	MINIMUM ORDER QUANTITY	PACKAGING DESCRIPTION
VS-20ETF02PbF	50	1000	Antistatic plastic tube
VS-20ETF02-M3	50	1000	Antistatic plastic tube
VS-20ETF04PbF	50	1000	Antistatic plastic tube
VS-20ETF04-M3	50	1000	Antistatic plastic tube
VS-20ETF06PbF	50	1000	Antistatic plastic tube
VS-20ETF06-M3	50	1000	Antistatic plastic tube

LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95221
Part marking information	TO-220AC PbF www.vishay.com/doc?95224
	TO-220AC -M3 www.vishay.com/doc?95068

TO-220AC

DIMENSIONS in millimeters and inches



SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	4.25	4.65	0.167	0.183	
A1	1.14	1.40	0.045	0.055	
A2	2.56	2.92	0.101	0.115	
b	0.69	1.01	0.027	0.040	
b1	0.38	0.97	0.015	0.038	4
b2	1.20	1.73	0.047	0.068	
b3	1.14	1.73	0.045	0.068	4
c	0.36	0.61	0.014	0.024	
c1	0.36	0.56	0.014	0.022	4
D	14.85	15.25	0.585	0.600	3
D1	8.38	9.02	0.330	0.355	
D2	11.68	12.88	0.460	0.507	6
E	10.11	10.51	0.398	0.414	3, 6

SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
E1	6.86	8.89	0.270	0.350	6
E2	-	0.76	-	0.030	7
e	2.41	2.67	0.095	0.105	
e1	4.88	5.28	0.192	0.208	
H1	6.09	6.48	0.240	0.255	6, 7
L	13.52	14.02	0.532	0.552	
L1	3.32	3.82	0.131	0.150	2
L3	1.78	2.13	0.070	0.084	
L4	0.76	1.27	0.030	0.050	2
Ø P	3.54	3.73	0.139	0.147	
Q	2.60	3.00	0.102	0.118	
θ	90° to 93°		90° to 93°		

Notes

- (1) Dimensioning and tolerancing as per ASME Y14.5M-1994
- (2) Lead dimension and finish uncontrolled in L1
- (3) Dimension D, D1 and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outermost extremes of the plastic body
- (4) Dimension b1, b3 and c1 apply to base metal only
- (5) Controlling dimension: inches
- (6) Thermal pad contour optional within dimensions E, H1, D2 and E1
- (7) Dimension E2 x H1 define a zone where stamping and singulation irregularities are allowed
- (8) Outline conforms to JEDEC TO-220, D2 (minimum) where dimensions are derived from the actual package outline



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.