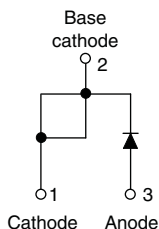


## Fast Soft Recovery Rectifier Diode, 10 A



TO-220AC



### FEATURES/DESCRIPTION

The 10ETF...PbF 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.

This product series has been designed and qualified for industrial level and lead (Pb)-free.



RoHS\*  
COMPLIANT

### PRODUCT SUMMARY

|               |                |
|---------------|----------------|
| $V_{RRM}$     | 1000 to 1200 V |
| $V_F$ at 10 A | < 1.33 V       |
| $t_{rr}$      | 80 ns          |

### APPLICATIONS

- Output rectification and freewheeling in inverters, choppers and converters
- Input rectifications where severe restrictions on conducted EMI should be met

### MAJOR RATINGS AND CHARACTERISTICS

| SYMBOL      | CHARACTERISTICS                | VALUES       | UNITS            |
|-------------|--------------------------------|--------------|------------------|
| $V_{RRM}$   |                                | 1000 to 1200 | V                |
| $I_{F(AV)}$ | Sinusoidal waveform            | 10           | A                |
| $I_{FSM}$   |                                | 160          |                  |
| $t_{rr}$    | 1 A, 100 A/ $\mu$ s            | 80           | ns               |
| $V_F$       | 10 A, $T_J = 25^\circ\text{C}$ | 1.33         | V                |
| $T_J$       |                                | - 40 to 150  | $^\circ\text{C}$ |

### VOLTAGE RATINGS

| PART NUMBER | $V_{RRM}$ , MAXIMUM PEAK REVERSE VOLTAGE<br>V | $V_{RSM}$ , MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE<br>V | $I_{RRM}$<br>AT 150 $^\circ\text{C}$<br>mA |
|-------------|-----------------------------------------------|--------------------------------------------------------------|--------------------------------------------|
| 10ETF10     | 1000                                          | 1100                                                         | 4                                          |
| 10ETF12     | 1200                                          | 1200                                                         |                                            |

### ABSOLUTE MAXIMUM RATINGS

| PARAMETER                                           | SYMBOL        | TEST CONDITIONS                                                    | VALUES | UNITS                       |
|-----------------------------------------------------|---------------|--------------------------------------------------------------------|--------|-----------------------------|
| Maximum average forward current                     | $I_{F(AV)}$   | $T_C = 125^\circ\text{C}$ , 180 $^\circ$ conduction half sine wave | 10     | A                           |
| Maximum peak one cycle non-repetitive surge current | $I_{FSM}$     | 10 ms sine pulse, rated $V_{RRM}$ applied                          | 160    |                             |
|                                                     |               | 10 ms sine pulse, no voltage reapplied                             | 185    |                             |
| Maximum $I^2t$ for fusing                           | $I^2t$        | 10 ms sine pulse, rated $V_{RRM}$ applied                          | 128    | $\text{A}^2\text{s}$        |
|                                                     |               | 10 ms sine pulse, no voltage reapplied                             | 180    |                             |
| Maximum $I^2\sqrt{t}$ for fusing                    | $I^2\sqrt{t}$ | $t = 0.1$ to 10 ms, no voltage reapplied                           | 1800   | $\text{A}^2\sqrt{\text{s}}$ |

\* Pb containing terminations are not RoHS compliant, exemptions may apply

# 10ETF...PbF Soft Recovery Series

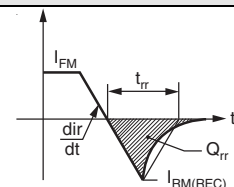
Vishay High Power Products

Fast Soft Recovery  
Rectifier Diode, 10 A



| ELECTRICAL SPECIFICATIONS       |                    |                              |                                         |        |       |
|---------------------------------|--------------------|------------------------------|-----------------------------------------|--------|-------|
| PARAMETER                       | SYMBOL             | TEST CONDITIONS              |                                         | VALUES | UNITS |
| Maximum forward voltage drop    | V <sub>FM</sub>    | 10 A, T <sub>J</sub> = 25 °C |                                         | 1.33   | V     |
| Forward slope resistance        | r <sub>t</sub>     | T <sub>J</sub> = 150 °C      |                                         | 22.9   | mΩ    |
| Threshold voltage               | V <sub>F(TO)</sub> |                              |                                         | 0.96   | V     |
| Maximum reverse leakage current | I <sub>RM</sub>    | T <sub>J</sub> = 25 °C       | V <sub>R</sub> = Rated V <sub>RRM</sub> | 0.1    | mA    |
|                                 |                    | T <sub>J</sub> = 150 °C      |                                         | 4      |       |

| RECOVERY CHARACTERISTICS |          |                                                                 |        |               |
|--------------------------|----------|-----------------------------------------------------------------|--------|---------------|
| PARAMETER                | SYMBOL   | TEST CONDITIONS                                                 | VALUES | UNITS         |
| Reverse recovery time    | $t_{rr}$ | $I_F$ at 10 Apk<br>25 A/ $\mu\text{s}$<br>25 $^{\circ}\text{C}$ | 310    | ns            |
| Reverse recovery current | $I_{rr}$ |                                                                 | 4.7    | A             |
| Reverse recovery charge  | $Q_{rr}$ |                                                                 | 1.05   | $\mu\text{C}$ |
| Typical snap factor      | S        |                                                                 | 0.6    |               |



| THERMAL - MECHANICAL SPECIFICATIONS            |                                   |                                      |             |                        |
|------------------------------------------------|-----------------------------------|--------------------------------------|-------------|------------------------|
| PARAMETER                                      | SYMBOL                            | TEST CONDITIONS                      | VALUES      | UNITS                  |
| Maximum junction and storage temperature range | T <sub>J</sub> , T <sub>Stg</sub> |                                      | - 40 to 150 | °C                     |
| Maximum thermal resistance junction to case    | R <sub>thJC</sub>                 | DC operation                         | 1.5         | °C/W                   |
| Maximum thermal resistance junction to ambient | R <sub>thJA</sub>                 |                                      | 62          |                        |
| Typical thermal resistance, case to heatsink   | R <sub>thCS</sub>                 | Mounting surface, smooth and greased | 0.5         |                        |
| Approximate weight                             |                                   |                                      | 2           | g                      |
|                                                |                                   |                                      | 0.07        | oz.                    |
| Mounting torque                                | minimum                           |                                      | 6 (5)       | kgf · cm<br>(lbf · in) |
|                                                | maximum                           |                                      | 12 (10)     |                        |
| Marking device                                 |                                   | Case style TO-220AC (JEDEC)          | 10ETF12     |                        |



# 10ETF...PbF Soft Recovery Series

Fast Soft Recovery  
Rectifier Diode, 10 A

Vishay High Power Products

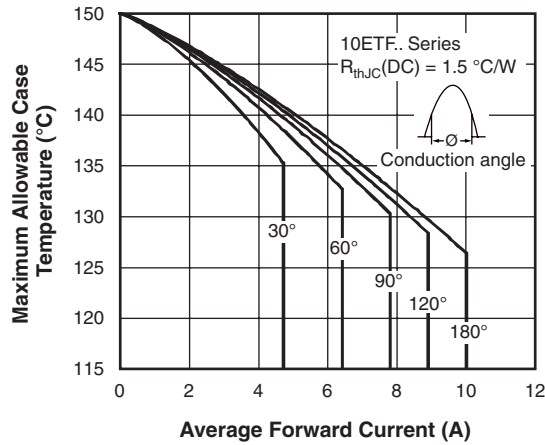


Fig. 1 - Current Rating Characteristics

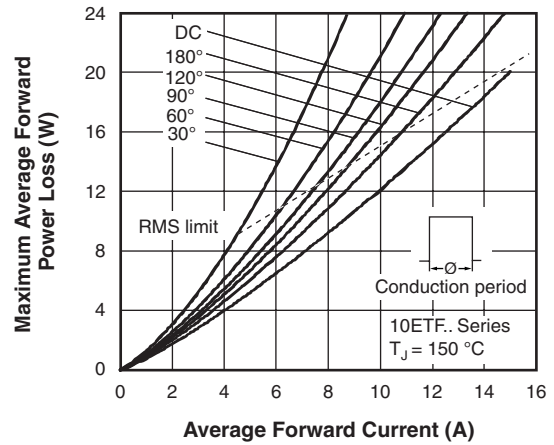


Fig. 4 - Forward Power Loss Characteristics

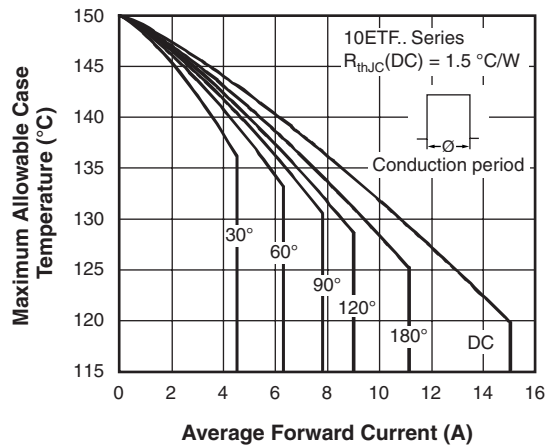


Fig. 2 - Current Rating Characteristics

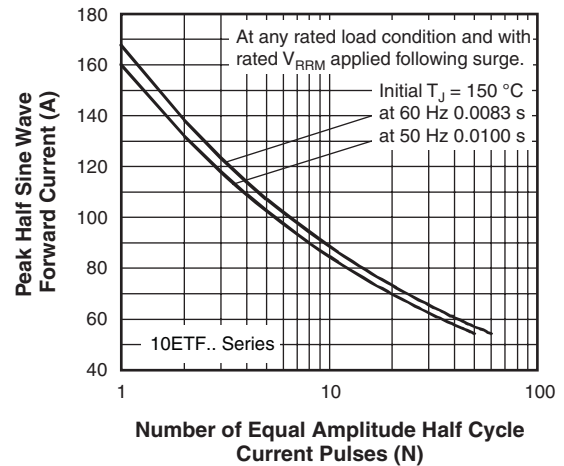


Fig. 5 - Maximum Non-Repetitive Surge Current

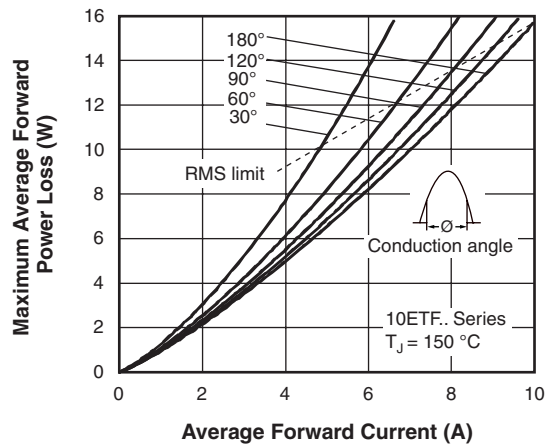


Fig. 3 - Forward Power Loss Characteristics

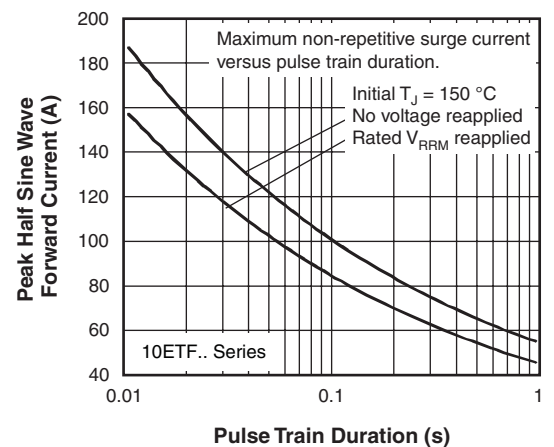


Fig. 6 - Maximum Non-Repetitive Surge Current

# 10ETF...PbF Soft Recovery Series

Vishay High Power Products

Fast Soft Recovery  
Rectifier Diode, 10 A

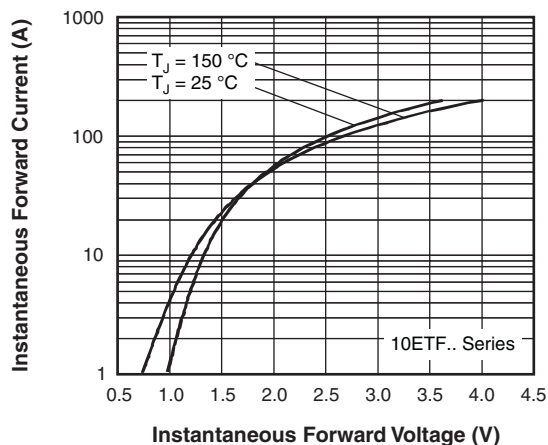


Fig. 7 - Forward Voltage Drop Characteristics

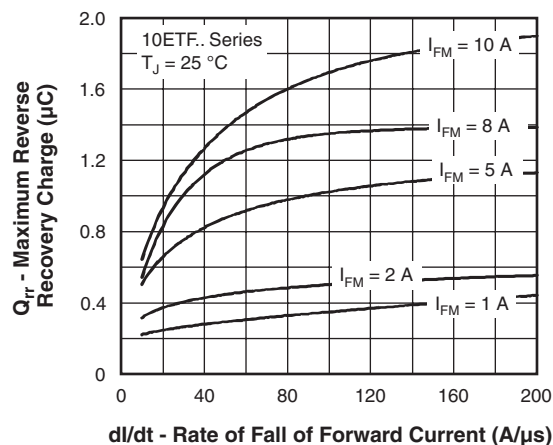


Fig. 10 - Recovery Charge Characteristics,  $T_J = 25\text{ }^{\circ}\text{C}$

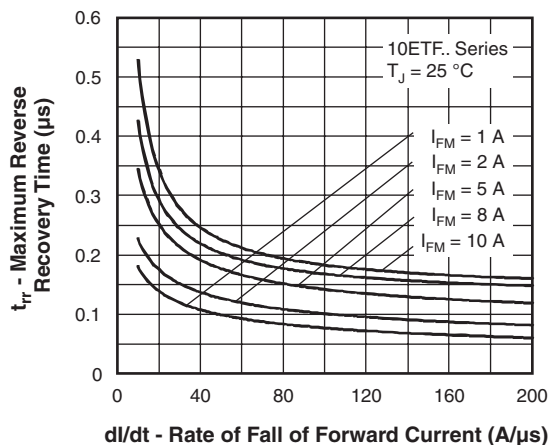


Fig. 8 - Recovery Time Characteristics,  $T_J = 25\text{ }^{\circ}\text{C}$

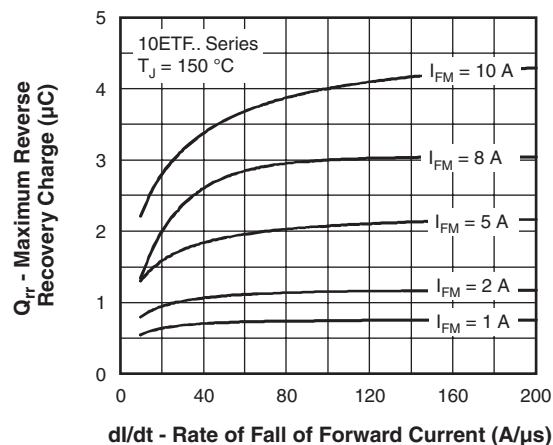


Fig. 11 - Recovery Charge Characteristics,  $T_J = 150\text{ }^{\circ}\text{C}$

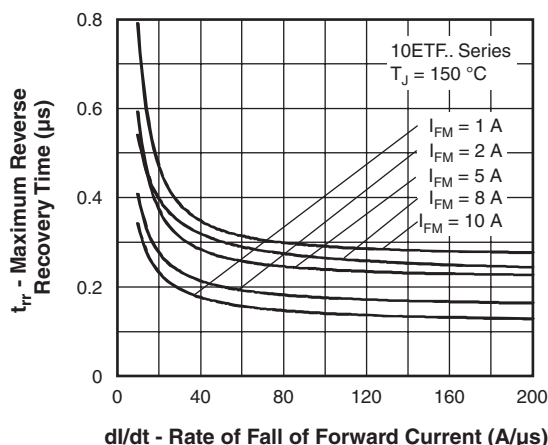


Fig. 9 - Recovery Time Characteristics,  $T_J = 150\text{ }^{\circ}\text{C}$

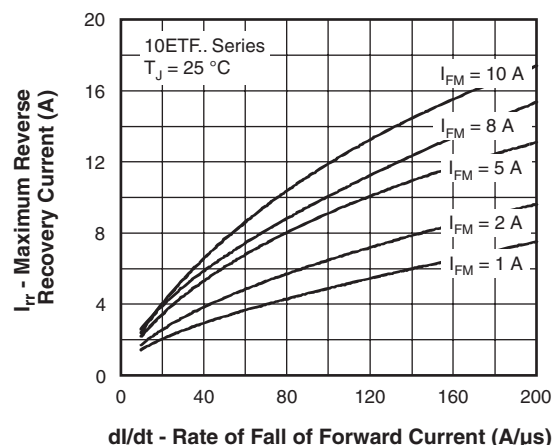


Fig. 12 - Recovery Current Characteristics,  $T_J = 25\text{ }^{\circ}\text{C}$



## 10ETF...PbF Soft Recovery Series

Fast Soft Recovery  
Rectifier Diode, 10 A

Vishay High Power Products

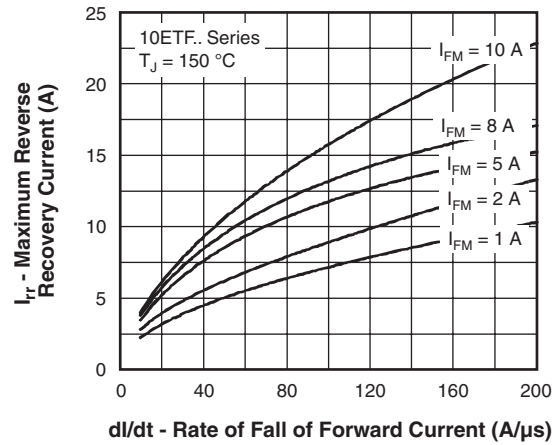


Fig. 13 - Recovery Current Characteristics,  $T_J = 150\text{ }^{\circ}\text{C}$

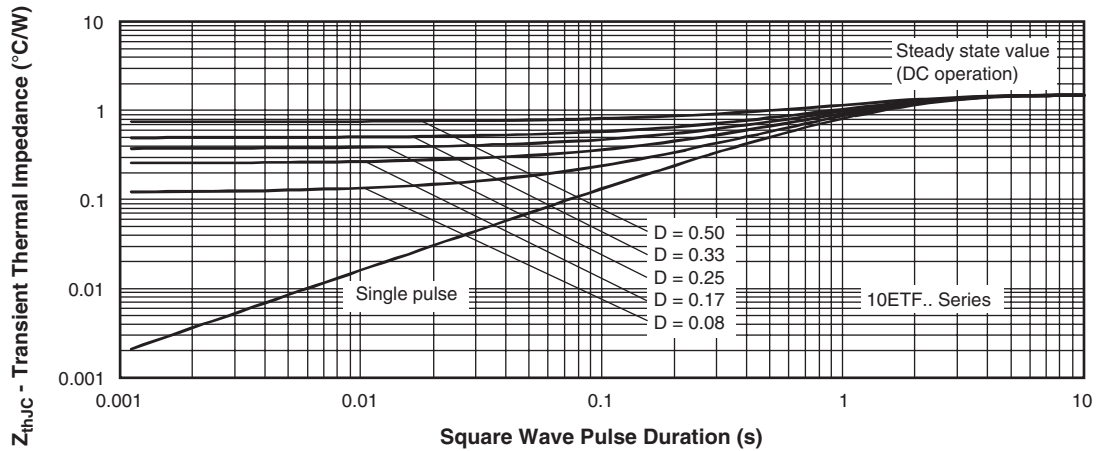


Fig. 14 - Thermal Impedance  $Z_{thJC}$  Characteristics



## ORDERING INFORMATION TABLE

|             |    |   |   |   |    |     |
|-------------|----|---|---|---|----|-----|
| Device code | 10 | E | T | F | 12 | PbF |
|             | 1  | 2 | 3 | 4 | 5  | 6   |

- 1 - Current rating ( $10 = 10\text{ A}$ )
- 2 - Circuit configuration:  
E = Single diode
- 3 - Package:  
T = TO-220AC
- 4 - Type of silicon:  
F = Fast soft recovery rectifier
- 5 - Voltage code  $\times 100 = V_{\text{RRM}}$
- 6 -
  - None = Standard production
  - PbF = Lead (Pb)-free

|             |
|-------------|
| 10 = 1000 V |
| 12 = 1200 V |

| LINKS TO RELATED DOCUMENTS |                                                                               |
|----------------------------|-------------------------------------------------------------------------------|
| Dimensions                 | <a href="http://www.vishay.com/doc?95221">http://www.vishay.com/doc?95221</a> |
| Part marking information   | <a href="http://www.vishay.com/doc?95224">http://www.vishay.com/doc?95224</a> |

### 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 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.