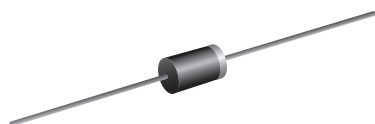


# TRANSZORB® Transient Voltage Suppressors



DO-15 (DO-204AC)



**RoHS**  
COMPLIANT

## FEATURES

- Glass passivated chip junction
- Available in unidirectional and bidirectional
- 500 W peak pulse power capability with a 10/1000  $\mu$ s waveform, repetitive rate (duty cycle): 0.01 %
- Excellent clamping capability
- Very fast response time
- Low incremental surge resistance
- Solder dip 275 °C max. 10 s, per JESD 22-B106
- AEC-Q101 qualified
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

## TYPICAL APPLICATIONS

Use in sensitive electronics protection against voltage transients induced by inductive load switching and lighting on ICs, MOSFET, signal lines of sensor units for consumer, computer, industrial, and telecommunication.

## MECHANICAL DATA

**Case:** DO-15 (DO-204AC)

Molded epoxy over passivated chip

Molding compound meets UL 94 V-0 flammability rating  
Base P/N-E3 - RoHS compliant, commercial grade  
Base P/NHE3 - RoHS compliant, AEC-Q101 qualified

**Terminals:** matte tin plated leads, solderable per J-STD-002 and JESD 22-B102

E3 suffix meets JESD 201 class 1A whisker test, HE3 suffix meets JESD 201 class 2 whisker test

**Polarity:** for unidirectional types the color band denotes cathode end, no marking on bidirectional types

## PRIMARY CHARACTERISTICS

|                                 |                               |
|---------------------------------|-------------------------------|
| $V_{WM}$                        | 5.0 V to 170 V                |
| $V_{BR}$ (unidirectional)       | 6.4 V to 209 V                |
| $V_{BR}$ (bidirectional)        | 6.4 V to 209 V                |
| $P_{PPM}$                       | 500 W                         |
| $P_D$                           | 3.0 W                         |
| $I_{FSM}$ (unidirectional only) | 70 A                          |
| $T_J$ max.                      | 175 °C                        |
| Polarity                        | Unidirectional, bidirectional |
| Package                         | DO-15 (DO-204AC)              |

## DEVICES FOR BIDIRECTION APPLICATIONS

For bidirectional types, use CA suffix (e.g. SA5.0CA, SA170CA).

Electrical characteristics apply in both directions.

## MAXIMUM RATINGS ( $T_A = 25$ °C unless otherwise noted)

| PARAMETER                                                                             | SYMBOL         | VALUE          | UNIT |
|---------------------------------------------------------------------------------------|----------------|----------------|------|
| Peak pulse power dissipation with a 10/1000 $\mu$ s waveform <sup>(1)</sup> (fig. 1)  | $P_{PPM}$      | 500            | W    |
| Peak pulse current with a 10/1000 $\mu$ s waveform <sup>(1)</sup>                     | $I_{PPM}$      | See next table | A    |
| Power dissipation on infinite heatsink at $T_L = 75$ °C (fig. 5)                      | $P_D$          | 3.0            | W    |
| Peak forward surge current 10 ms single half sine-wave unidirectional only            | $I_{FSM}$      | 70             | A    |
| Maximum instantaneous forward voltage at 100 A for unidirectional only <sup>(3)</sup> | $V_F$          | 3.5            | V    |
| Operating junction and storage temperature range                                      | $T_J, T_{STG}$ | -55 to +175    | °C   |

### Notes

<sup>(1)</sup> Non-repetitive current pulse, per fig. 3 and derated above  $T_A = 25$  °C per fig. 2

<sup>(2)</sup> 8.3 ms single half sine-wave or equivalent square wave, duty cycle = 4 pulses per minute maximum

**ELECTRICAL CHARACTERISTICS** ( $T_A = 25\text{ }^{\circ}\text{C}$  unless otherwise noted)

| DEVICE TYPE           | BREAKDOWN VOLTAGE<br>$V_{BR}$ AT $I_T$ <sup>(1)</sup><br>(V) |      | TEST CURRENT<br>$I_T$<br>(mA) | STAND-OFF VOLTAGE<br>$V_{WM}$<br>(V) | MAXIMUM REVERSE LEAKAGE<br>AT $V_{WM}$ <sup>(3)</sup><br>$I_D$ ( $\mu\text{A}$ ) | MAXIMUM PEAK PULSE CURRENT<br>$I_{PPM}$ <sup>(2)</sup><br>(A) | MAXIMUM CLAMPING VOLTAGE<br>AT $I_{PPM}$<br>$V_C$ (V) | MAXIMUM TEMPERATURE COEFFICIENT<br>AT $V_{BR}$<br>(mV/ $^{\circ}\text{C}$ ) |
|-----------------------|--------------------------------------------------------------|------|-------------------------------|--------------------------------------|----------------------------------------------------------------------------------|---------------------------------------------------------------|-------------------------------------------------------|-----------------------------------------------------------------------------|
|                       | MIN.                                                         | MAX. |                               |                                      |                                                                                  |                                                               |                                                       |                                                                             |
| SA5.0A <sup>(4)</sup> | 6.40                                                         | 7.07 | 10                            | 5.0                                  | 600                                                                              | 54.3                                                          | 9.2                                                   | 5                                                                           |
| SA6.0A                | 6.67                                                         | 7.37 | 10                            | 6.0                                  | 600                                                                              | 48.5                                                          | 10.3                                                  | 5                                                                           |
| SA6.5A                | 7.22                                                         | 7.98 | 10                            | 6.5                                  | 400                                                                              | 44.7                                                          | 11.2                                                  | 5                                                                           |
| SA7.0A                | 7.78                                                         | 8.60 | 10                            | 7.0                                  | 150                                                                              | 41.7                                                          | 12.0                                                  | 6                                                                           |
| SA7.5A                | 8.33                                                         | 9.21 | 1.0                           | 7.5                                  | 50                                                                               | 38.8                                                          | 12.9                                                  | 7                                                                           |
| SA8.0A                | 8.89                                                         | 9.83 | 1.0                           | 8.0                                  | 25                                                                               | 36.8                                                          | 13.6                                                  | 7                                                                           |
| SA8.5A                | 9.44                                                         | 10.4 | 1.0                           | 8.5                                  | 10                                                                               | 34.7                                                          | 14.4                                                  | 8                                                                           |
| SA9.0A                | 10.0                                                         | 11.1 | 1.0                           | 9.0                                  | 5.0                                                                              | 32.5                                                          | 15.4                                                  | 9                                                                           |
| SA10A                 | 11.1                                                         | 12.3 | 1.0                           | 10                                   | 1.0                                                                              | 29.4                                                          | 17.0                                                  | 10                                                                          |
| SA11A                 | 12.2                                                         | 13.5 | 1.0                           | 11                                   | 1.0                                                                              | 27.5                                                          | 18.2                                                  | 11                                                                          |
| SA12A                 | 13.3                                                         | 14.7 | 1.0                           | 12                                   | 1.0                                                                              | 25.1                                                          | 19.9                                                  | 12                                                                          |
| SA13A                 | 14.4                                                         | 15.9 | 1.0                           | 13                                   | 1.0                                                                              | 23.3                                                          | 21.5                                                  | 13                                                                          |
| SA14A                 | 15.6                                                         | 17.2 | 1.0                           | 14                                   | 1.0                                                                              | 21.6                                                          | 23.2                                                  | 14                                                                          |
| SA15A                 | 16.7                                                         | 18.5 | 1.0                           | 15                                   | 1.0                                                                              | 20.5                                                          | 24.4                                                  | 16                                                                          |
| SA16A                 | 17.8                                                         | 19.7 | 1.0                           | 16                                   | 1.0                                                                              | 19.2                                                          | 26.0                                                  | 17                                                                          |
| SA17A                 | 18.9                                                         | 20.9 | 1.0                           | 17                                   | 1.0                                                                              | 18.1                                                          | 27.6                                                  | 19                                                                          |
| SA18A                 | 20.0                                                         | 22.1 | 1.0                           | 18                                   | 1.0                                                                              | 17.1                                                          | 29.2                                                  | 20                                                                          |
| SA20A                 | 22.2                                                         | 24.5 | 1.0                           | 20                                   | 1.0                                                                              | 15.4                                                          | 32.4                                                  | 23                                                                          |
| SA22A                 | 24.4                                                         | 26.9 | 1.0                           | 22                                   | 1.0                                                                              | 14.1                                                          | 35.5                                                  | 25                                                                          |
| SA24A                 | 26.7                                                         | 29.5 | 1.0                           | 24                                   | 1.0                                                                              | 12.9                                                          | 38.9                                                  | 28                                                                          |
| SA26A                 | 28.9                                                         | 31.9 | 1.0                           | 26                                   | 1.0                                                                              | 11.9                                                          | 42.1                                                  | 30                                                                          |
| SA28A                 | 31.1                                                         | 34.4 | 1.0                           | 28                                   | 1.0                                                                              | 11                                                            | 45.4                                                  | 31                                                                          |
| SA30A                 | 33.3                                                         | 36.8 | 1.0                           | 30                                   | 1.0                                                                              | 10                                                            | 48.4                                                  | 36                                                                          |
| SA33A                 | 36.7                                                         | 40.6 | 1.0                           | 33                                   | 1.0                                                                              | 9.4                                                           | 53.3                                                  | 39                                                                          |
| SA36A                 | 40.0                                                         | 44.2 | 1.0                           | 36                                   | 1.0                                                                              | 8.6                                                           | 58.1                                                  | 41                                                                          |
| SA40A                 | 44.4                                                         | 49.1 | 1.0                           | 40                                   | 1.0                                                                              | 7.8                                                           | 64.5                                                  | 46                                                                          |
| SA43A                 | 47.8                                                         | 52.8 | 1.0                           | 43                                   | 1.0                                                                              | 7.2                                                           | 69.4                                                  | 50                                                                          |
| SA45A                 | 50.0                                                         | 55.3 | 1.0                           | 45                                   | 1.0                                                                              | 6.9                                                           | 72.7                                                  | 52                                                                          |
| SA48A                 | 53.3                                                         | 58.9 | 1.0                           | 48                                   | 1.0                                                                              | 6.5                                                           | 77.4                                                  | 56                                                                          |
| SA51A                 | 56.7                                                         | 62.7 | 1.0                           | 51                                   | 1.0                                                                              | 6.1                                                           | 82.4                                                  | 61                                                                          |
| SA54A                 | 60.0                                                         | 66.3 | 1.0                           | 54                                   | 1.0                                                                              | 5.7                                                           | 87.1                                                  | 65                                                                          |
| SA58A                 | 64.4                                                         | 71.2 | 1.0                           | 58                                   | 1.0                                                                              | 5.3                                                           | 93.6                                                  | 70                                                                          |
| SA60A                 | 66.7                                                         | 73.7 | 1.0                           | 60                                   | 1.0                                                                              | 5.2                                                           | 96.8                                                  | 71                                                                          |
| SA64A                 | 71.1                                                         | 78.6 | 1.0                           | 64                                   | 1.0                                                                              | 4.9                                                           | 103                                                   | 76                                                                          |
| SA70A                 | 77.8                                                         | 86.0 | 1.0                           | 70                                   | 1.0                                                                              | 4.4                                                           | 113                                                   | 85                                                                          |
| SA75A                 | 83.3                                                         | 92.1 | 1.0                           | 75                                   | 1.0                                                                              | 4.1                                                           | 121                                                   | 91                                                                          |
| SA78A                 | 86.7                                                         | 95.8 | 1.0                           | 78                                   | 1.0                                                                              | 4                                                             | 126                                                   | 95                                                                          |
| SA85A                 | 94.4                                                         | 104  | 1.0                           | 85                                   | 1.0                                                                              | 3.6                                                           | 137                                                   | 103                                                                         |
| SA90A                 | 100                                                          | 111  | 1.0                           | 90                                   | 1.0                                                                              | 3.4                                                           | 146                                                   | 110                                                                         |
| SA100A                | 111                                                          | 123  | 1.0                           | 100                                  | 1.0                                                                              | 3.1                                                           | 162                                                   | 123                                                                         |
| SA110A                | 122                                                          | 135  | 1.0                           | 110                                  | 1.0                                                                              | 2.8                                                           | 177                                                   | 133                                                                         |
| SA120A                | 133                                                          | 147  | 1.0                           | 120                                  | 1.0                                                                              | 2.6                                                           | 193                                                   | 146                                                                         |
| SA130A                | 144                                                          | 159  | 1.0                           | 130                                  | 1.0                                                                              | 2.4                                                           | 209                                                   | 158                                                                         |
| SA150A                | 167                                                          | 185  | 1.0                           | 150                                  | 1.0                                                                              | 2.1                                                           | 243                                                   | 184                                                                         |
| SA160A                | 178                                                          | 197  | 1.0                           | 160                                  | 1.0                                                                              | 1.9                                                           | 259                                                   | 196                                                                         |
| SA170A                | 189                                                          | 209  | 1.0                           | 170                                  | 1.0                                                                              | 1.8                                                           | 275                                                   | 208                                                                         |

**Notes**(1) Pulse test:  $t_p \leq 50\text{ ms}$ 

(2) Surge current waveform per fig. 3 and derate per fig. 2

(3) For bidirectional types with  $V_{WM}$  of 10 V and less the  $I_D$  limit is doubled(4) For the bidirectional SA5.0CA, the maximum  $V_{BR}$  is 7.25 V

(5) All terms and symbols are consistent with ANSI/IEEE CA62.35



**ORDERING INFORMATION** (Example)

| PREFERRED PIN               | UNIT WEIGHT (g) | PREFERRED PACKAGE CODE | BASE QUANTITY | DELIVERY MODE                    |
|-----------------------------|-----------------|------------------------|---------------|----------------------------------|
| SA5.0A-E3/54                | 0.432           | 54                     | 4000          | 13" diameter paper tape and reel |
| SA5.0AHE3/54 <sup>(1)</sup> | 0.432           | 54                     | 4000          | 13" diameter paper tape and reel |

**Note**

<sup>(1)</sup> AEC-Q101 qualified

**RATINGS AND CHARACTERISTICS CURVES** ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

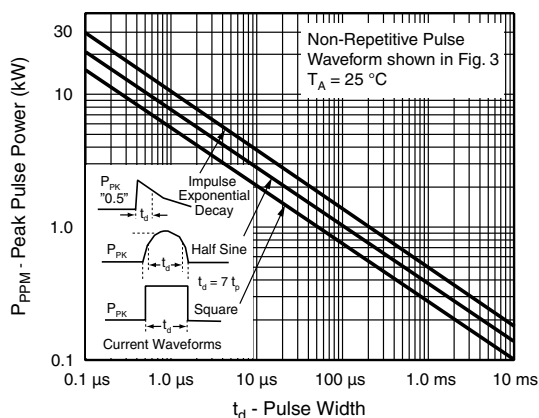


Fig. 1 - Peak Pulse Power Rating Curve

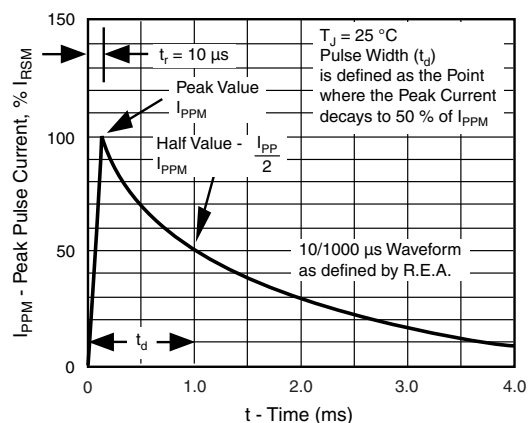


Fig. 3 - Pulse Waveform

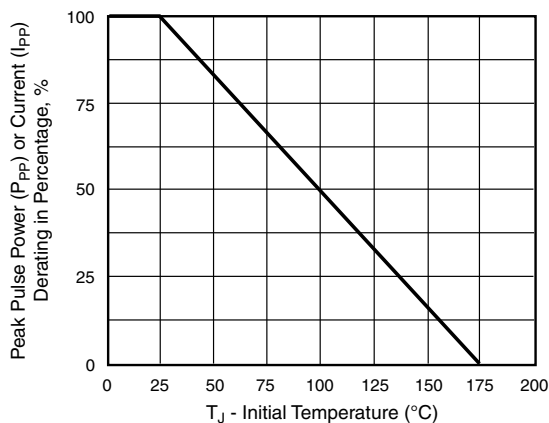


Fig. 2 - Pulse Derating Curve

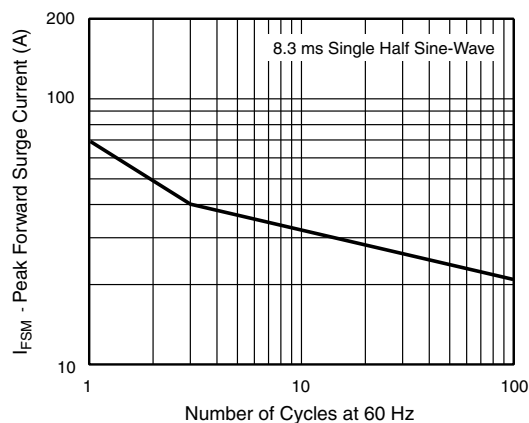


Fig. 4 - Maximum Non-Repetitive Forward Surge Current Unidirectional Only

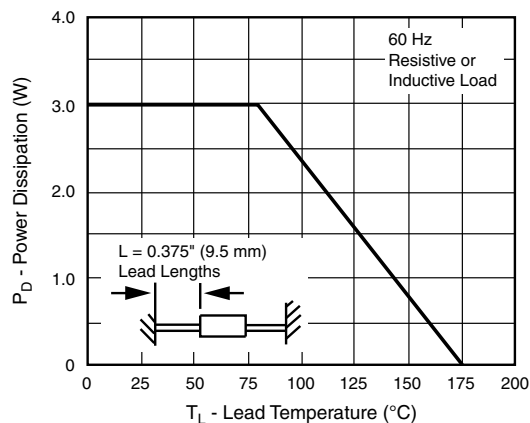


Fig. 5 - Steady State Power Derating Curve

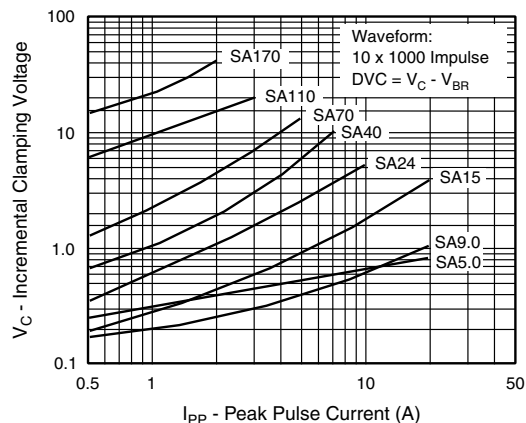


Fig. 8 - Incremental Clamping Voltage Curve Uni-Directional

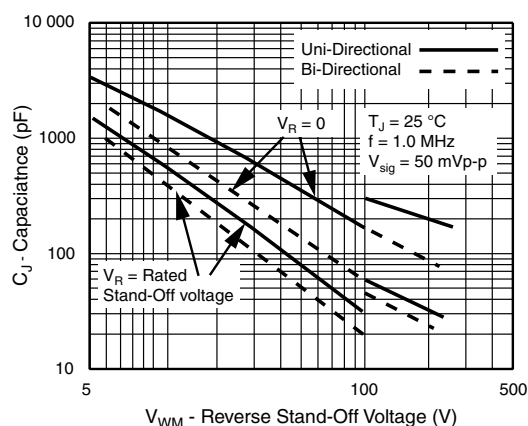


Fig. 6 - Capacitance

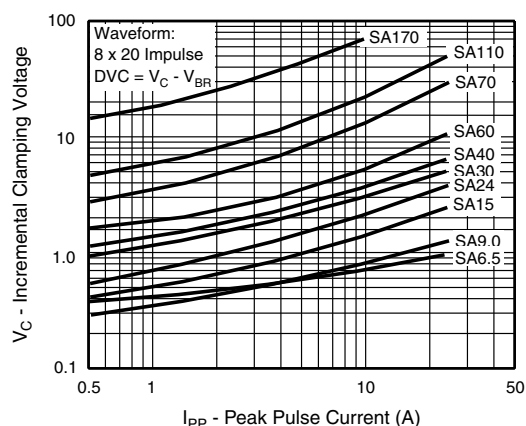


Fig. 9 - Incremental Clamping Voltage Curve Bidirectional

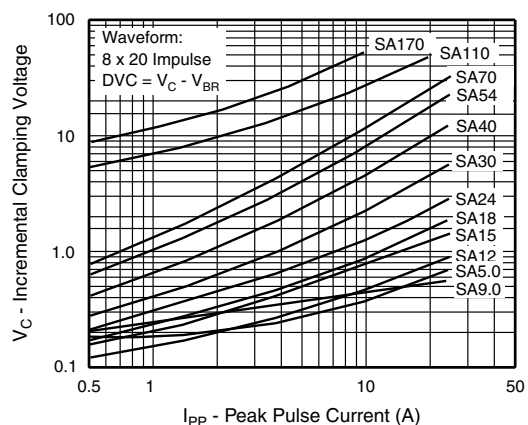


Fig. 7 - Incremental Clamping Voltage Curve Unidirectional

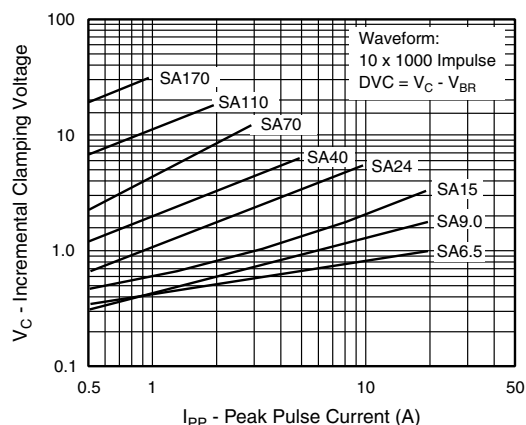


Fig. 10 - Incremental Clamping Voltage Curve Bidirectional

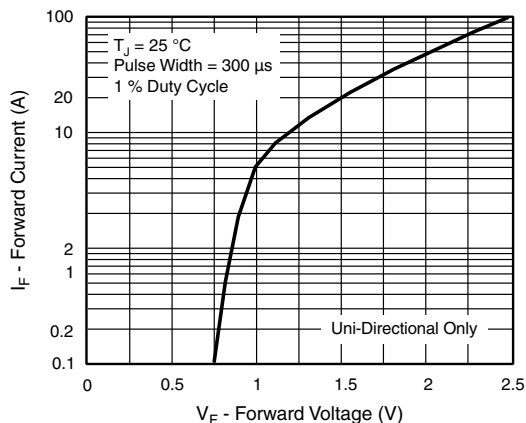


Fig. 11 - Typical Instantaneous Forward Voltage

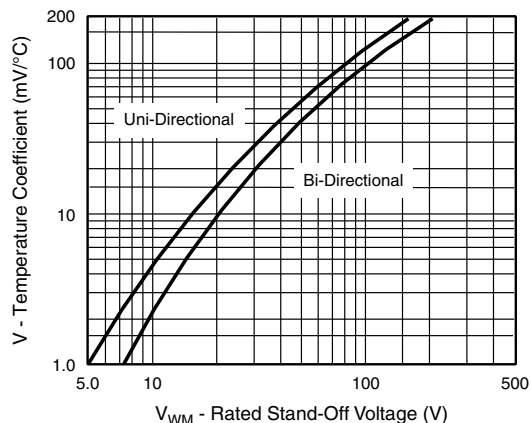
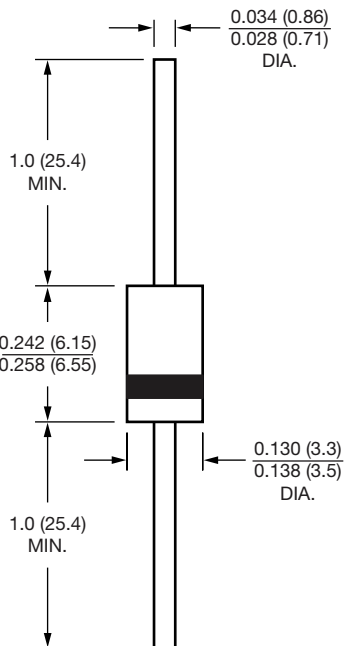


Fig. 12 - Breakdown Voltage Temperature Coefficient Curve

**PACKAGE OUTLINE DIMENSIONS** in inches (millimeters)

**DO-15 (DO-204AC)**

**Note**

- Dimensions of mold length and diameter do not include mold flash and gate burr, mold flash shall not exceed 0.015 inch per side. These dimensions are measured at the outermost extreme of the plastic body



## 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.

Hyperlinks included in this datasheet may direct users to third-party websites. These links are provided as a convenience and for informational purposes only. Inclusion of these hyperlinks does not constitute an endorsement or an approval by Vishay of any of the products, services or opinions of the corporation, organization or individual associated with the third-party website. Vishay disclaims any and all liability and bears no responsibility for the accuracy, legality or content of the third-party website or for that of subsequent links.

Vishay products are not designed for use in life-saving or life-sustaining applications or any application in which the failure of the Vishay product could result in personal injury or death unless specifically qualified in writing by Vishay. 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.