

## TRANSZORB® Transient Voltage Suppressors



Case Style 1.5KE

### FEATURES

- Glass passivated chip junction
- Available in uni-directional and bi-directional
- 1500 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
- AEC-Q101 qualified
- Solder dip 275 °C max. 10 s, per JESD 22-B106
- Material categorization: For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



### PRIMARY CHARACTERISTICS

|                                  |                                 |
|----------------------------------|---------------------------------|
| $V_{BR}$ uni-directional         | 6.8 V to 540 V                  |
| $V_{BR}$ bi-directional          | 6.8 V to 440 V                  |
| $V_{WM}$ uni-directional         | 5.8 V to 459 V                  |
| $V_{WM}$ bi-directional          | 5.8 V to 376 V                  |
| $P_{PPM}$                        | 1500 W                          |
| $P_D$                            | 6.5 W                           |
| $I_{FSM}$ (uni-directional only) | 200 A                           |
| $T_J$ max.                       | 175 °C                          |
| Polarity                         | Uni-directional, bi-directional |
| Package                          | 1.5KE                           |

### 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, automotive, and telecommunication.

### MECHANICAL DATA

**Case:** Molded epoxy body over passivated junction  
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

#### Note

- 1.5KE250A to 1.5KE540A and 1.5KE250CA to 1.5KE440CA for commercial grade only

**Polarity:** For uni-directional types the color band denotes cathode end, no marking on bi-directional types

### DEVICES FOR BI-DIRECTION APPLICATIONS

For bi-directional types, use CA suffix (e.g. 1.5KE440CA)  
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)        | $P_{PPM}$      | 1500           | 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)                            | $P_D$          | 6.5            | W    |
| Peak forward surge current 8.3 ms single half sine-wave uni-directional only <sup>(2)</sup> | $I_{FSM}$      | 200            | A    |
| Maximum instantaneous forward voltage at 100 A for uni-directional only <sup>(3)</sup>      | $V_F$          | 3.5/5.0        | 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> Measured on 8.3 ms single half sine-wave or equivalent square wave, duty cycle = 4 pulses per minute maximum  
<sup>(3)</sup>  $V_F = 3.5$  V for 1.5KE220A and below;  $V_F = 5.0$  V for 1.5KE250A and above



# 1.5KE6.8A thru 1.5KE540A, 1N6267A thru 1N6303A

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Vishay General Semiconductor

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

| JEDEC®<br>TYPE<br>NUMBER | GENERAL<br>SEMICONDUCTOR<br>PART NUMBER | BREAKDOWN<br>VOLTAGE<br>$V_{BR}$ AT $I_T$ <sup>(1)</sup><br>(V) |      | TEST<br>CURRENT<br>$I_T$<br>(mA) | STAND-OFF<br>VOLTAGE<br>$V_{WM}$<br>(V) | MAXIMUM<br>REVERSE<br>LEAKAGE<br>AT $V_{WM}$<br>$I_D$ <sup>(4)</sup><br>( $\mu\text{A}$ ) | MAXIMUM<br>PEAK<br>PULSE<br>CURRENT<br>$I_{PPM}$ <sup>(2)</sup><br>(A) | MAXIMUM<br>CLAMPING<br>VOLTAGE<br>AT $I_{PPM}$<br>$V_C$ (V) | MAXIMUM<br>TEMPERATURE<br>COEFFICIENT<br>OF $V_{BR}$<br>(%/°C) |
|--------------------------|-----------------------------------------|-----------------------------------------------------------------|------|----------------------------------|-----------------------------------------|-------------------------------------------------------------------------------------------|------------------------------------------------------------------------|-------------------------------------------------------------|----------------------------------------------------------------|
|                          |                                         | MIN.                                                            | MAX. |                                  |                                         |                                                                                           |                                                                        |                                                             |                                                                |
| 1N6267A                  | (+).1.5KE6.8A                           | 6.45                                                            | 7.14 | 10                               | 5.80                                    | 1000                                                                                      | 143                                                                    | 10.5                                                        | 0.057                                                          |
| 1N6268A                  | (+).1.5KE7.5A                           | 7.13                                                            | 7.88 | 10                               | 6.40                                    | 500                                                                                       | 133                                                                    | 11.3                                                        | 0.061                                                          |
| 1N6269A                  | (+).1.5KE8.2A                           | 7.79                                                            | 8.61 | 10                               | 7.02                                    | 200                                                                                       | 124                                                                    | 12.1                                                        | 0.065                                                          |
| 1N6270A                  | (+).1.5KE9.1A                           | 8.65                                                            | 9.55 | 1.0                              | 7.78                                    | 50                                                                                        | 112                                                                    | 13.4                                                        | 0.068                                                          |
| 1N6271A                  | (+).1.5KE10A                            | 9.50                                                            | 10.5 | 1.0                              | 8.55                                    | 10                                                                                        | 103                                                                    | 14.5                                                        | 0.073                                                          |
| 1N6272A                  | (+).1.5KE11A                            | 10.5                                                            | 11.6 | 1.0                              | 9.40                                    | 5.0                                                                                       | 96.2                                                                   | 15.6                                                        | 0.075                                                          |
| 1N6273A                  | (+).1.5KE12A                            | 11.4                                                            | 12.6 | 1.0                              | 10.2                                    | 5.0                                                                                       | 89.8                                                                   | 16.7                                                        | 0.078                                                          |
| 1N6274A                  | (+).1.5KE13A                            | 12.4                                                            | 13.7 | 1.0                              | 11.1                                    | 5.0                                                                                       | 82.4                                                                   | 18.2                                                        | 0.081                                                          |
| 1N6275A                  | (+).1.5KE15A                            | 14.3                                                            | 15.8 | 1.0                              | 12.8                                    | 1.0                                                                                       | 70.8                                                                   | 21.2                                                        | 0.084                                                          |
| 1N6276A                  | (+).1.5KE16A                            | 15.2                                                            | 16.8 | 1.0                              | 13.6                                    | 1.0                                                                                       | 66.7                                                                   | 22.5                                                        | 0.086                                                          |
| 1N6277A                  | (+).1.5KE18A                            | 17.1                                                            | 18.9 | 1.0                              | 15.3                                    | 1.0                                                                                       | 59.5                                                                   | 25.2                                                        | 0.089                                                          |
| 1N6278A                  | (+).1.5KE20A                            | 19.0                                                            | 21.0 | 1.0                              | 17.1                                    | 1.0                                                                                       | 54.2                                                                   | 27.7                                                        | 0.09                                                           |
| 1N6279A                  | (+).1.5KE22A                            | 20.9                                                            | 23.1 | 1.0                              | 18.8                                    | 1.0                                                                                       | 49.0                                                                   | 30.6                                                        | 0.092                                                          |
| 1N6280A                  | (+).1.5KE24A                            | 22.8                                                            | 25.2 | 1.0                              | 20.5                                    | 1.0                                                                                       | 45.2                                                                   | 33.2                                                        | 0.094                                                          |
| 1N6281A                  | (+).1.5KE27A                            | 25.7                                                            | 28.4 | 1.0                              | 23.1                                    | 1.0                                                                                       | 40.0                                                                   | 37.5                                                        | 0.096                                                          |
| 1N6282A                  | (+).1.5KE30A                            | 28.5                                                            | 31.5 | 1.0                              | 25.6                                    | 1.0                                                                                       | 36.2                                                                   | 41.4                                                        | 0.097                                                          |
| 1N6283A                  | (+).1.5KE33A                            | 31.4                                                            | 34.7 | 1.0                              | 28.2                                    | 1.0                                                                                       | 32.8                                                                   | 45.7                                                        | 0.098                                                          |
| 1N6284A                  | (+).1.5KE36A                            | 34.2                                                            | 37.8 | 1.0                              | 30.8                                    | 1.0                                                                                       | 30.1                                                                   | 49.9                                                        | 0.099                                                          |
| 1N6285A                  | (+).1.5KE39A                            | 37.1                                                            | 41.0 | 1.0                              | 33.3                                    | 1.0                                                                                       | 27.8                                                                   | 53.9                                                        | 0.1                                                            |
| 1N6286A                  | (+).1.5KE43A                            | 40.9                                                            | 45.2 | 1.0                              | 36.8                                    | 1.0                                                                                       | 25.3                                                                   | 59.3                                                        | 0.101                                                          |
| 1N6287A                  | (+).1.5KE47A                            | 44.7                                                            | 49.4 | 1.0                              | 40.2                                    | 1.0                                                                                       | 23.1                                                                   | 64.8                                                        | 0.101                                                          |
| 1N6288A                  | (+).1.5KE51A                            | 48.5                                                            | 53.6 | 1.0                              | 43.6                                    | 1.0                                                                                       | 21.4                                                                   | 70.1                                                        | 0.102                                                          |
| 1N6289A                  | (+).1.5KE56A                            | 53.2                                                            | 58.8 | 1.0                              | 47.8                                    | 1.0                                                                                       | 19.5                                                                   | 77.0                                                        | 0.103                                                          |
| 1N6290A                  | (+).1.5KE62A                            | 58.9                                                            | 65.1 | 1.0                              | 53.0                                    | 1.0                                                                                       | 17.6                                                                   | 85.0                                                        | 0.104                                                          |
| 1N6291A                  | (+).1.5KE68A                            | 64.6                                                            | 71.4 | 1.0                              | 58.1                                    | 1.0                                                                                       | 16.3                                                                   | 92.0                                                        | 0.104                                                          |
| 1N6292A                  | (+).1.5KE75A                            | 71.3                                                            | 78.8 | 1.0                              | 64.1                                    | 1.0                                                                                       | 14.6                                                                   | 104                                                         | 0.105                                                          |
| 1N6293A                  | (+).1.5KE82A                            | 77.9                                                            | 86.1 | 1.0                              | 70.1                                    | 1.0                                                                                       | 13.3                                                                   | 113                                                         | 0.105                                                          |
| 1N6294A                  | (+).1.5KE91A                            | 86.5                                                            | 95.5 | 1.0                              | 77.8                                    | 1.0                                                                                       | 12.0                                                                   | 125                                                         | 0.106                                                          |
| 1N6295A                  | (+).1.5KE100A                           | 95.0                                                            | 105  | 1.0                              | 85.5                                    | 1.0                                                                                       | 10.9                                                                   | 137                                                         | 0.106                                                          |
| 1N6296A                  | (+).1.5KE 110A                          | 105                                                             | 116  | 1.0                              | 94.0                                    | 1.0                                                                                       | 9.9                                                                    | 152                                                         | 0.107                                                          |
| 1N6297A                  | (+).1.5KE120A                           | 114                                                             | 126  | 1.0                              | 102                                     | 1.0                                                                                       | 9.1                                                                    | 165                                                         | 0.107                                                          |
| 1N6298A                  | (+).1.5KE130A                           | 124                                                             | 137  | 1.0                              | 111                                     | 1.0                                                                                       | 8.4                                                                    | 179                                                         | 0.107                                                          |
| 1N6299A                  | (+).1.5KE150A                           | 143                                                             | 158  | 1.0                              | 128                                     | 1.0                                                                                       | 7.2                                                                    | 207                                                         | 0.106                                                          |
| 1N6300A                  | (+).1.5KE160A                           | 152                                                             | 168  | 1.0                              | 136                                     | 1.0                                                                                       | 6.8                                                                    | 219                                                         | 0.108                                                          |
| 1N6301A                  | (+).1.5KE170A                           | 162                                                             | 179  | 1.0                              | 145                                     | 1.0                                                                                       | 6.4                                                                    | 234                                                         | 0.108                                                          |
| 1N6302A                  | 1.5KE180A                               | 171                                                             | 189  | 1.0                              | 154                                     | 1.0                                                                                       | 6.1                                                                    | 246                                                         | 0.108                                                          |
| 1N6303A                  | 1.5KE200A*                              | 190                                                             | 210  | 1.0                              | 171                                     | 1.0                                                                                       | 5.5                                                                    | 274                                                         | 0.108                                                          |
| -                        | 1.5KE220A*                              | 209                                                             | 231  | 1.0                              | 185                                     | 1.0                                                                                       | 4.6                                                                    | 328                                                         | 0.108                                                          |
| -                        | 1.5KE250A                               | 237                                                             | 263  | 1.0                              | 214                                     | 1.0                                                                                       | 4.4                                                                    | 344                                                         | 0.110                                                          |
| -                        | 1.5KE300A                               | 285                                                             | 315  | 1.0                              | 256                                     | 1.0                                                                                       | 3.6                                                                    | 414                                                         | 0.110                                                          |
| -                        | 1.5KE350A                               | 333                                                             | 368  | 1.0                              | 300                                     | 1.0                                                                                       | 3.1                                                                    | 482                                                         | 0.110                                                          |
| -                        | 1.5KE400A                               | 380                                                             | 420  | 1.0                              | 342                                     | 1.0                                                                                       | 2.7                                                                    | 548                                                         | 0.110                                                          |
| -                        | 1.5KE440A                               | 418                                                             | 462  | 1.0                              | 376                                     | 1.0                                                                                       | 2.5                                                                    | 602                                                         | 0.110                                                          |
| -                        | 1.5KE480A                               | 456                                                             | 504  | 1.0                              | 408                                     | 1.0                                                                                       | 2.28                                                                   | 658                                                         | 0.110                                                          |
| -                        | 1.5KE510A                               | 485                                                             | 535  | 1.0                              | 434                                     | 1.0                                                                                       | 2.15                                                                   | 698                                                         | 0.110                                                          |
| -                        | 1.5KE540A                               | 513                                                             | 567  | 1.0                              | 459                                     | 1.0                                                                                       | 2.03                                                                   | 740                                                         | 0.110                                                          |

### Notes

(1) Pulse test:  $t_p \leq 50$  ms

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

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

(4) For bi-directional types with  $V_R$  10 V and less the  $I_D$  limit is doubled

\* Bi-directional versions are UL approved under component across the line protection, ULV1414 file number E108274 (1.5KE200CA, 1.5KE220CA)

(+) Underwriters laboratory recognition for the classification of protectors (QVGQ2) under the UL standard for safety 497B and file number E136766 for both uni-directional and bi-directional devices



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

| PARAMETER                                       | SYMBOL          | VALUE | UNIT                      |
|-------------------------------------------------|-----------------|-------|---------------------------|
| Typical thermal resistance, junction to ambient | $R_{\theta JA}$ | 75    |                           |
| Typical thermal resistance, junction to lead    | $R_{\theta JL}$ | 15.4  | $^\circ\text{C}/\text{W}$ |

## ORDERING INFORMATION (Example)

| PREFERRED PIN                  | UNIT WEIGHT (g) | PREFERRED PACKAGE CODE | BASE QUANTITY | DELIVERY MODE                    |
|--------------------------------|-----------------|------------------------|---------------|----------------------------------|
| 1.5KE6.8A-E3/54                | 0.968           | 54                     | 1400          | 13" diameter paper tape and reel |
| 1.5KE6.8AHE3/54 <sup>(1)</sup> | 0.968           | 54                     | 1400          | 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

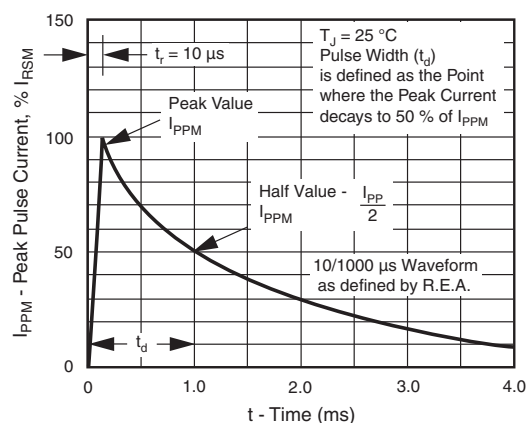


Fig. 3 - Pulse Waveform



Fig. 2 - Pulse Power or Current vs. Initial Junction Temperature



Fig. 4 - Typical Junction Capacitance



Fig. 5 - Power Derating Curve



Fig. 8 - Incremental Clamping Voltage Curve (Uni-directional)

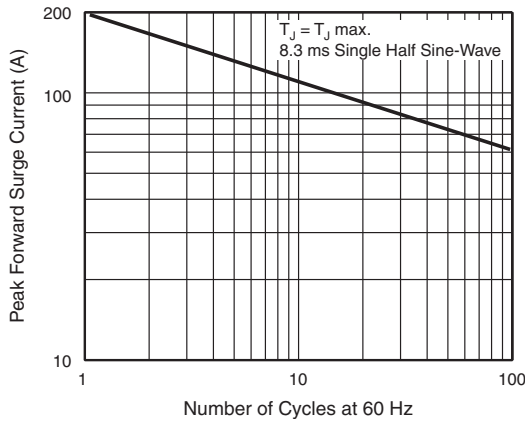


Fig. 6 - Maximum Non-Repetitive Forward Surge Current  
Uni-Directional only

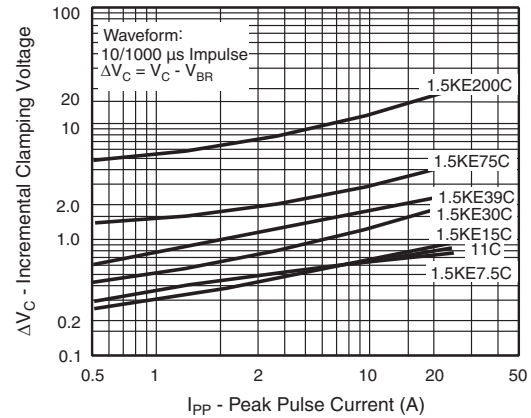


Fig. 9 - Incremental Clamping Voltage Curve (Bi-directional)

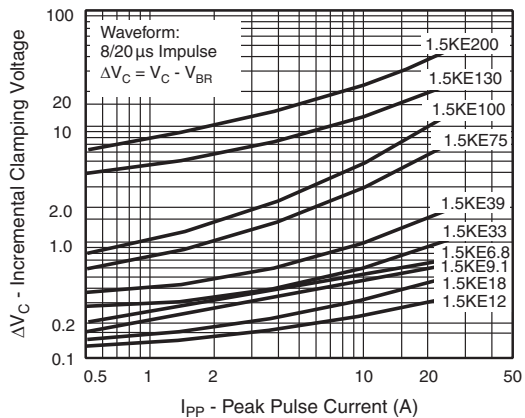


Fig. 7 - Incremental Clamping Voltage Curve (Uni-Directional)

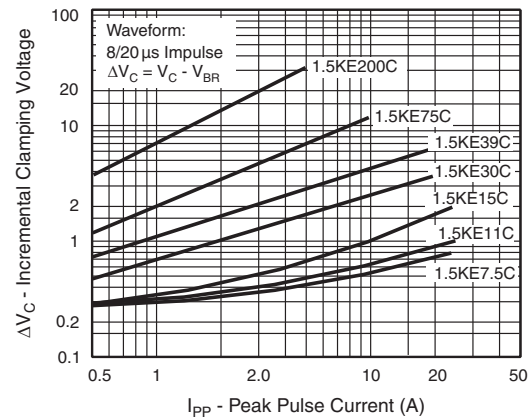


Fig. 10 - Incremental Clamping Voltage Curve (Bi-Directional)

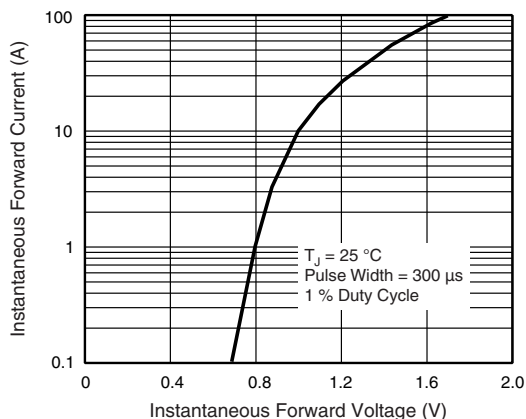


Fig. 11 - Instantaneous Forward Voltage Characteristics Curve

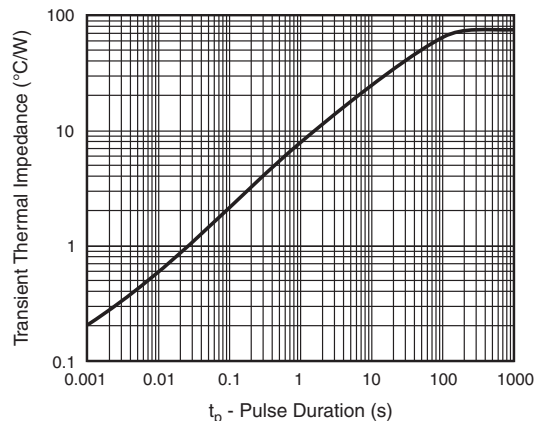
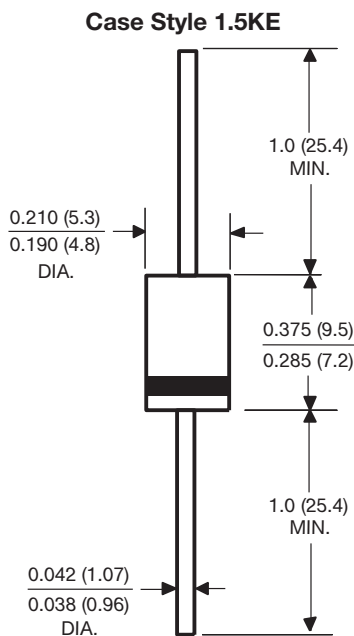


Fig. 12 - Typical Transient Thermal Impedance

## PACKAGE OUTLINE DIMENSIONS in inches (millimeters)



## APPLICATION NOTES

- This series of Silicon Transient Suppressors is used in applications where large voltage transients can permanently damage voltage-sensitive components.
- The TVS diode can be used in applications where induced lightning on rural or remote transmission lines presents a hazard to electronic circuitry (ref: R.E.A. specification P.E. 60).
- This Transient Voltage Suppressor diode has a pulse power rating of 1500 W for 1 ms. The response time of TVS diode clamping action is effectively instantaneous ( $1 \times 10^{-9}$  s bi-directional); therefore, they can protect integrated circuits, MOS devices, hybrids, and other voltage sensitive semiconductors and components. TVS diodes can also be used in series or parallel to increase the peak power ratings.



## Disclaimer

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## 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.**

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