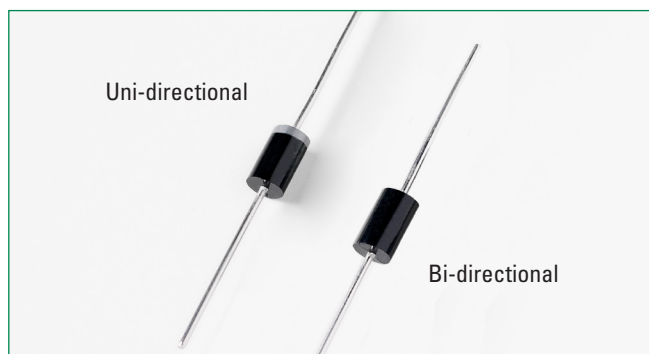


### TP1.5KE Series



#### Agency Approvals

| Agency                                                                            | Agency File Number |
|-----------------------------------------------------------------------------------|--------------------|
|  | E230531            |

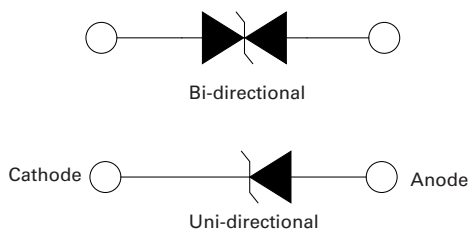
#### Maximum Ratings and Thermal Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

| Parameter                                                                            | Symbol           | Value      | Unit |
|--------------------------------------------------------------------------------------|------------------|------------|------|
| Peak Pulse Power Dissipation by 10/1000µs Test Waveform (Fig.2)(Note 1)              | P <sub>PPM</sub> | 1500       | W    |
| Steady State Power Dissipation on Infinite Heat Sink at T <sub>L</sub> =75°C         | P <sub>D</sub>   | 6.5        | W    |
| Peak Forward Surge Current, 8.3ms Single Half Sine Wave Unidirectional Only (Note 2) | I <sub>FSM</sub> | 200        | A    |
| Maximum Instantaneous Forward Voltage at 100A for Unidirectional Only (Note 3)       | V <sub>F</sub>   | 3.5        | V    |
| Operating Junction Temperature Range                                                 | T <sub>J</sub>   | -55 to 150 | °C   |
| Storage Temperature Range                                                            | T <sub>STG</sub> | -55 to 175 | °C   |
| Typical Thermal Resistance Junction to Lead                                          | R <sub>θJL</sub> | 15         | °C/W |
| Typical Thermal Resistance Junction to Ambient                                       | R <sub>θJA</sub> | 75         | °C/W |

#### Notes:

1. Non-repetitive current pulse, per Fig. 4 and derated above T<sub>J</sub> (initial) = 25°C per Fig. 3.
2. Measured on 8.3ms single half sine wave or equivalent square wave, duty cycle=4 per minute maximum.

#### Functional Diagram



#### Description

The TP1.5KE Series is designed specifically to protect sensitive electronic equipment from voltage transients induced by lightning and other transient voltage events.

#### Features

- High reliability application and automotive grade AEC-Q101 rev D qualified
- Glass passivated chip junction in DO-201 Package
- 1500W peak pulse capability at 10/1000µs waveform, repetition rate (duty cycles):0.01 %
- Fast response time: typically less than 1.0ps from 0 Volts to BV min
- Excellent clamping capability
- Typical failure mode is short from over-specified voltage or current
- Whisker test is conducted based on JEDEC JESD201A per its table 4a and 4c
- IEC 61000-4-2 ESD 30kV(Air), 30kV (Contact)
- ESD protection of data lines in accordance with IEC 61000-4-2
- EFT protection of data lines in accordance with IEC 61000-4-4
- Low incremental surge resistance
- High temperature to reflow soldering guaranteed: 260°C/10sec / 0.375"(9.5mm) lead length, 5 lbs., (2.3kg) tension
- V<sub>BR</sub> @ T<sub>J</sub> = V<sub>BR</sub> @ 25°C x (1 + αT x (T<sub>J</sub> - 25)) (αT: Temperature Coefficient, typical value is 0.1%)
- Plastic package is flammability rated V-0 per Underwriters Laboratories
- Matte tin lead-free plated
- Halogen free and RoHS compliant
- Pb-free E3 means 2nd level interconnect is Pb-free and the terminal finish material is tin(Sn) (IPC/JEDEC J-STD-609A.01)

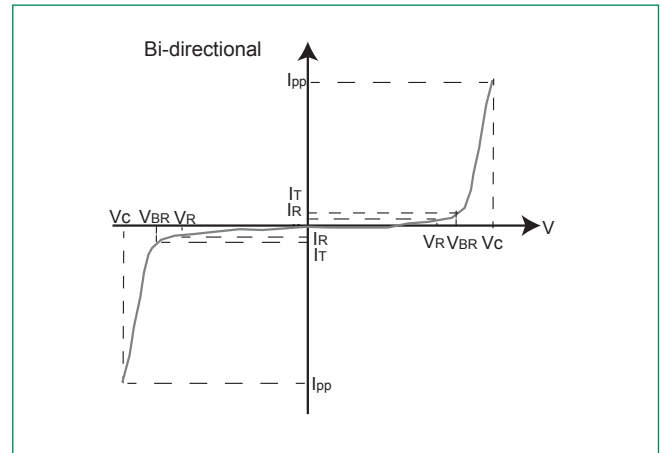
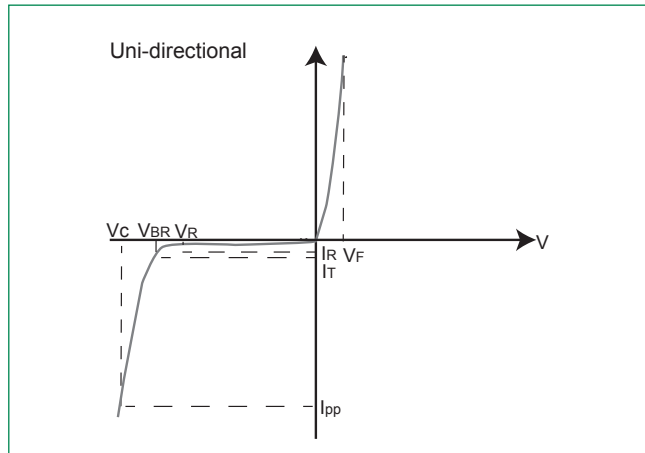
#### Applications

TVS devices are ideal for the protection of I/O interfaces, V<sub>CC</sub> bus and other vulnerable circuits used in telecom, computer, industrial and consumer electronic applications.

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

| Part Number (Uni) | Part Number (Bi) | Reverse Stand off Voltage $V_R$ (Volts) | Breakdown Voltage $V_{BR}$ (Volts) @ $I_T$ |       | Test Current $I_T$ (mA) | Maximum Clamping Voltage $V_C$ @ $I_{pp}$ (Volts) | Maximum Peak Pulse Current $I_{pp}$ (A) | Maximum Reverse Leakage $I_R$ @ $V_R$ ( $\mu\text{A}$ ) | Agency Approval  |
|-------------------|------------------|-----------------------------------------|--------------------------------------------|-------|-------------------------|---------------------------------------------------|-----------------------------------------|---------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
|                   |                  |                                         | MIN                                        | MAX   |                         |                                                   |                                         |                                                         |                                                                                                     |
| TP1.5KE12A        | TP1.5KE12CA      | 10.20                                   | 11.40                                      | 12.60 | 1                       | 16.7                                              | 91.0                                    | 5                                                       | X                                                                                                   |
| TP1.5KE13A        | TP1.5KE13CA      | 11.10                                   | 12.40                                      | 13.70 | 1                       | 18.2                                              | 83.5                                    | 1                                                       | X                                                                                                   |
| TP1.5KE15A        | TP1.5KE15CA      | 12.80                                   | 14.30                                      | 15.80 | 1                       | 21.2                                              | 71.7                                    | 1                                                       | X                                                                                                   |
| TP1.5KE16A        | TP1.5KE16CA      | 13.60                                   | 15.20                                      | 16.80 | 1                       | 22.5                                              | 67.6                                    | 1                                                       | X                                                                                                   |
| TP1.5KE18A        | TP1.5KE18CA      | 15.30                                   | 17.10                                      | 18.90 | 1                       | 25.2                                              | 60.3                                    | 1                                                       | X                                                                                                   |
| TP1.5KE20A        | TP1.5KE20CA      | 17.10                                   | 19.00                                      | 21.00 | 1                       | 27.7                                              | 54.9                                    | 1                                                       | X                                                                                                   |
| TP1.5KE22A        | TP1.5KE22CA      | 18.80                                   | 20.90                                      | 23.10 | 1                       | 30.6                                              | 49.7                                    | 1                                                       | X                                                                                                   |
| TP1.5KE24A        | TP1.5KE24CA      | 20.50                                   | 22.80                                      | 25.20 | 1                       | 33.2                                              | 45.8                                    | 1                                                       | X                                                                                                   |
| TP1.5KE27A        | TP1.5KE27CA      | 23.10                                   | 25.70                                      | 28.40 | 1                       | 37.5                                              | 40.5                                    | 1                                                       | X                                                                                                   |
| TP1.5KE30A        | TP1.5KE30CA      | 25.60                                   | 28.50                                      | 31.50 | 1                       | 41.4                                              | 36.7                                    | 1                                                       | X                                                                                                   |
| TP1.5KE33A        | TP1.5KE33CA      | 28.20                                   | 31.40                                      | 34.70 | 1                       | 45.7                                              | 33.3                                    | 1                                                       | X                                                                                                   |
| TP1.5KE36A        | TP1.5KE36CA      | 30.80                                   | 34.20                                      | 37.80 | 1                       | 49.9                                              | 30.5                                    | 1                                                       | X                                                                                                   |
| TP1.5KE39A        | TP1.5KE39CA      | 33.30                                   | 37.10                                      | 41.00 | 1                       | 53.9                                              | 28.2                                    | 1                                                       | X                                                                                                   |
| TP1.5KE43A        | TP1.5KE43CA      | 36.80                                   | 40.90                                      | 45.20 | 1                       | 59.3                                              | 25.6                                    | 1                                                       | X                                                                                                   |
| TP1.5KE47A        | TP1.5KE47CA      | 40.20                                   | 44.70                                      | 49.40 | 1                       | 64.8                                              | 23.5                                    | 1                                                       | X                                                                                                   |

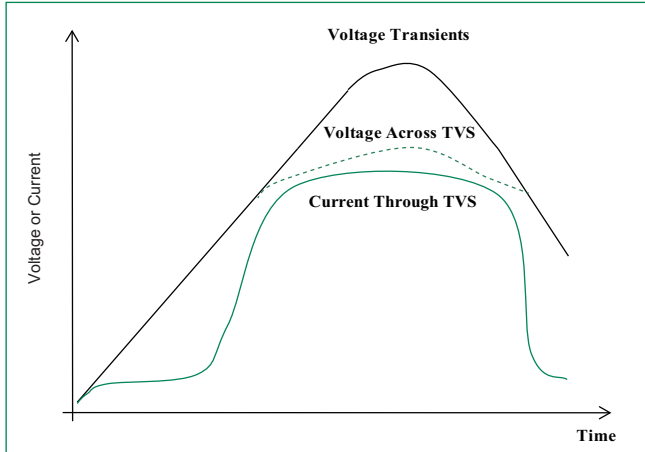
### I-V Curve Characteristics



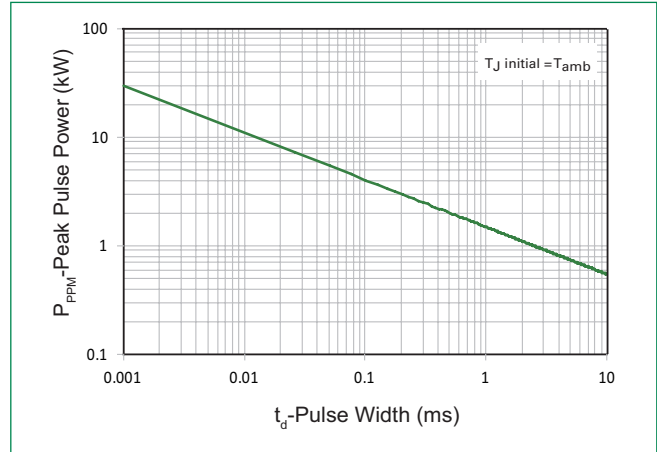
- $P_{PPM}$  Peak Pulse Power Dissipation** -- Max power dissipation  
 **$V_R$  Stand-off Voltage** -- Maximum voltage that can be applied to the TVS without operation  
 **$V_{BR}$  Breakdown Voltage** -- Maximum voltage that flows through the TVS at a specified test current ( $I_T$ )  
 **$V_C$  Clamping Voltage** -- Peak voltage measured across the TVS at a specified  $I_{ppm}$  (peak impulse current)  
 **$I_R$  Reverse Leakage Current** -- Current measured at  $V_R$   
 **$V_F$  Forward Voltage Drop for Uni-directional**

**Ratings and Characteristic Curves** ( $T_A=25^\circ\text{C}$  unless otherwise noted)

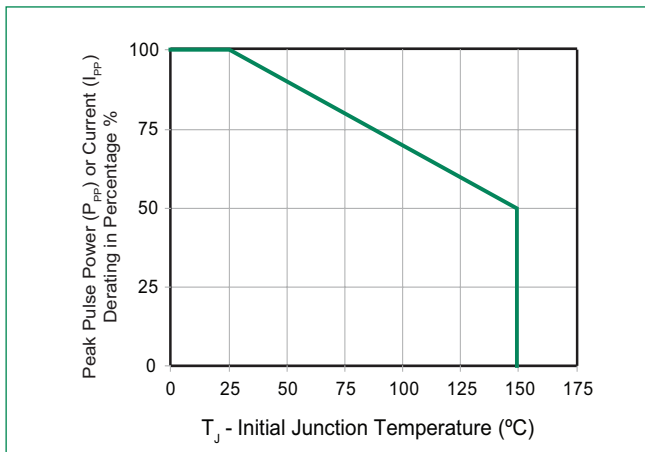
**Figure 1 - TVS Transients Clamping Waveform**



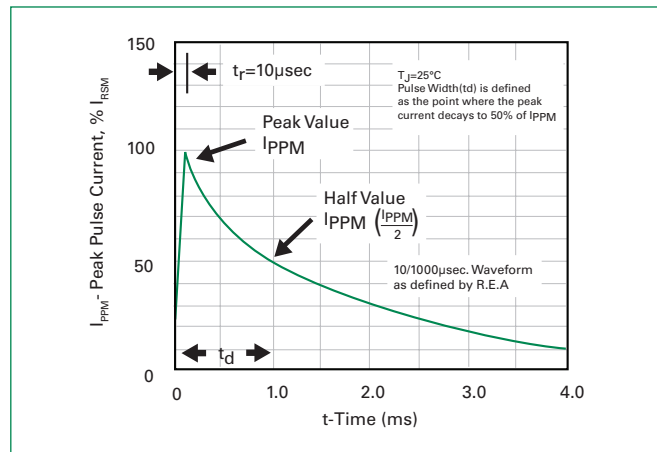
**Figure 2 - Peak Pulse Power Rating**



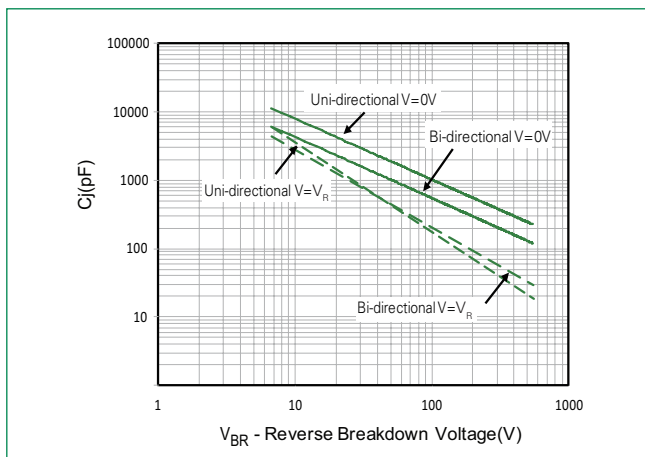
**Figure 3 - Peak Pulse Power Derating Curve**



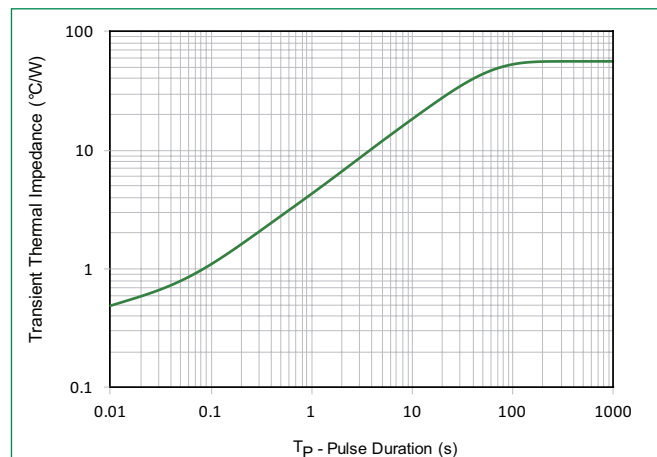
**Figure 4 - Pulse Waveform**



**Figure 5 - Typical Junction Capacitance**

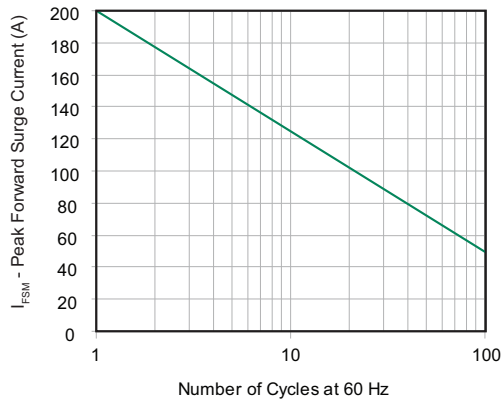


**Figure 6 - Typical Transient Thermal Impedance**

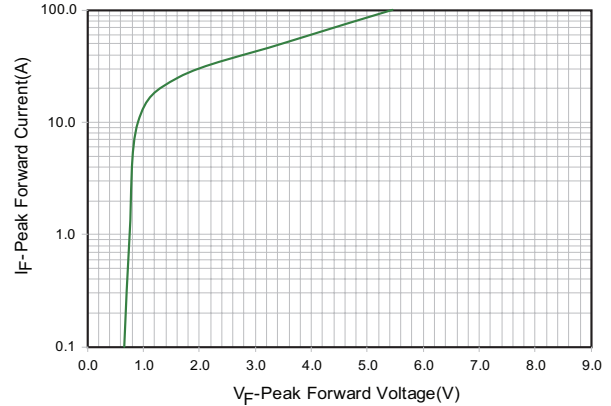


**Ratings and Characteristic Curves** ( $T_A=25^\circ\text{C}$  unless otherwise noted) (Continued)

**Figure 7 - Maximum Non-Repetitive Peak Forward Surge Current Uni-Directional Only**

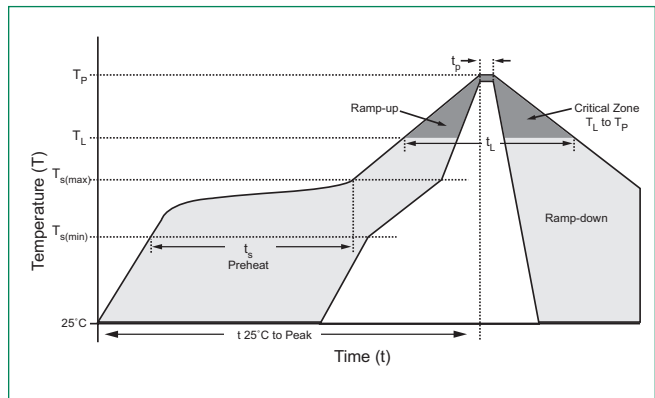


**Figure 8 - Peak Forward Voltage Drop vs Peak Forward Current (Typical Values)**



**Soldering Parameters**

|                                                                        |                                    |                    |
|------------------------------------------------------------------------|------------------------------------|--------------------|
| <b>Reflow Condition</b>                                                |                                    | Lead-free assembly |
| <b>Pre Heat</b>                                                        | - Temperature Min ( $T_{s(min)}$ ) | 150°C              |
|                                                                        | - Temperature Max ( $T_{s(max)}$ ) | 200°C              |
|                                                                        | - Time (min to max) ( $t_s$ )      | 60 – 120 secs      |
| <b>Average ramp up rate (Liquidus Temp (<math>T_L</math>) to peak)</b> |                                    | 3°C/second max     |
| <b><math>T_{s(max)}</math> to <math>T_L</math> - Ramp-up Rate</b>      |                                    | 3°C/second max     |
| <b>Reflow</b>                                                          | - Temperature ( $T_L$ ) (Liquidus) | 217°C              |
|                                                                        | - Time (min to max) ( $t_L$ )      | 60 – 150 seconds   |
| <b>Peak Temperature (<math>T_p</math>)</b>                             |                                    | 260 $^{+0/-5}$ °C  |
| <b>Time within 5°C of actual peak Temperature (<math>t_p</math>)</b>   |                                    | 30 seconds max     |
| <b>Ramp-down Rate</b>                                                  |                                    | 6°C/second max     |
| <b>Time 25°C to peak Temperature (<math>T_p</math>)</b>                |                                    | 8 minutes max.     |
| <b>Do not exceed</b>                                                   |                                    | 260°C              |



**Flow/Wave Soldering (Solder Dipping)**

|                           |            |
|---------------------------|------------|
| <b>Peak Temperature :</b> | 265°C      |
| <b>Dipping Time :</b>     | 10 seconds |
| <b>Soldering :</b>        | 1 time     |

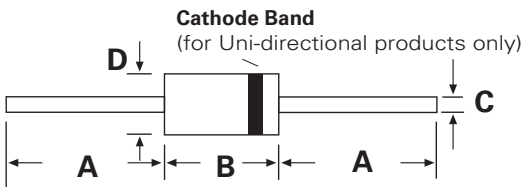
**Physical Specifications**

|                 |                                                            |
|-----------------|------------------------------------------------------------|
| <b>Weight</b>   | 0.045oz., 1.2g                                             |
| <b>Case</b>     | JEDEC DO-201 molded plastic body over passivated junction. |
| <b>Polarity</b> | Color band denotes the cathode except Bipolar.             |
| <b>Terminal</b> | Matte Tin axial leads, solderable per JESD22-B102.         |

**Environmental Specifications**

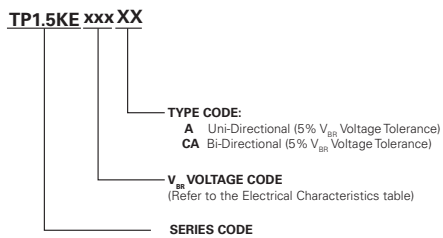
|                            |             |
|----------------------------|-------------|
| <b>High Temp. Storage</b>  | JESD22-A103 |
| <b>HTRB</b>                | JESD22-A108 |
| <b>Temperature Cycling</b> | JESD22-A104 |
| <b>H3TRB</b>               | JESD22-A101 |
| <b>RSH</b>                 | JESD22-B106 |

### Dimensions

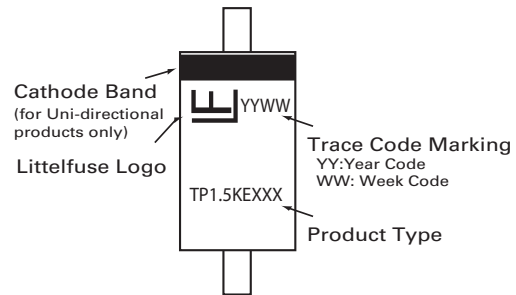


| Dimensions | Inches |       | Millimeters |      |
|------------|--------|-------|-------------|------|
|            | Min    | Max   | Min         | Max  |
| <b>A</b>   | 1.000  | -     | 25.40       | -    |
| <b>B</b>   | 0.285  | 0.375 | 7.20        | 9.50 |
| <b>C</b>   | 0.038  | 0.042 | 0.96        | 1.07 |
| <b>D</b>   | 0.190  | 0.210 | 4.80        | 5.30 |

### Part Numbering System



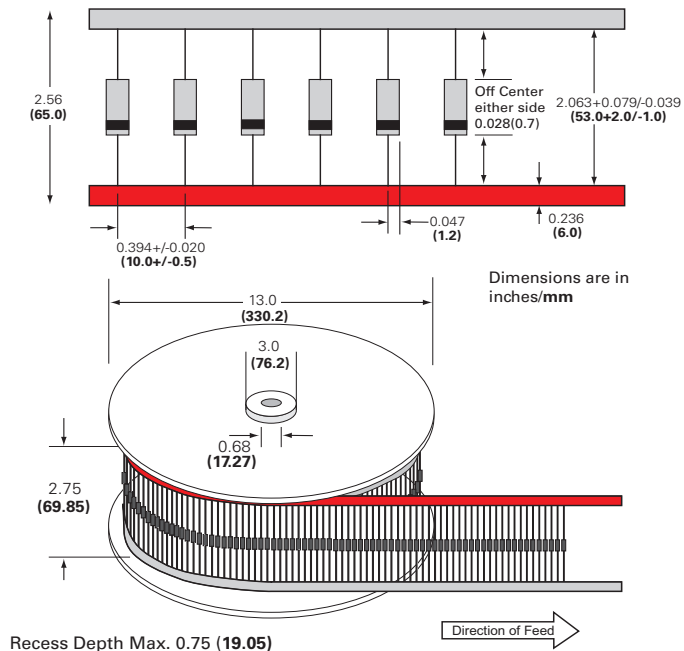
### Part Marking System



### Packaging

| Part Number  | Component Package | Quantity | Packaging Option | Packaging Specification |
|--------------|-------------------|----------|------------------|-------------------------|
| TP1.5KExxxXX | DO-201            | 1200     | Tape & Reel      | EIA STD RS-296          |

### Tape and Reel Specification



# Mouser Electronics

Authorized Distributor

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## Littelfuse:

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[TP1.5KE27CA](#) [TP1.5KE27A](#) [TP1.5KE15A](#) [TP1.5KE39CA](#) [TP1.5KE30A](#) [TP1.5KE43CA](#) [TP1.5KE30CA](#) [TP1.5KE33A](#)  
[TP1.5KE12A](#) [TP1.5KE47A](#) [TP1.5KE20A](#) [TP1.5KE33CA](#) [TP1.5KE36A](#) [TP1.5KE39A](#) [TP1.5KE36CA](#) [TP1.5KE18A](#)  
[TP1.5KE24A](#) [TP1.5KE12CA](#) [TP1.5KE16CA](#) [TP1.5KE22A](#) [TP1.5KE13CA](#) [TP1.5KE18CA](#) [TP1.5KE15CA](#)