TVS Diodes
Axial Leaded – 600W > TP6KE series

TP6KE Series

Description
TVS devices are ideal for the protection of I/O interfaces, \( V_{CC} \) bus and other vulnerable circuits used in telecom, computer, industrial and consumer electronic applications.

Features
- Hi reliability application and automotive grade AEC-Q101 qualified
- Glass passivated chip junction in DO-15 Package
- 600W peak pulse capability at 10/1000\( \mu \)s 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 soldering guaranteed: 260°C+5/°C/ 10s ±1sec / 0.375”(9.5mm) lead length, 5 lbs., (2.3kg) tension
- \( V_{BR} \) @ \( T_J = V_{BR} \) @25°C x (1 + \( \alpha \) T x (\( T_J \) - 25)) (\( \alpha \) T:Temperature Coefficient, typical value is 0.1%)
- Plastic package is flammability rated V-0 per Underwriters Laboratories
- Lead-free matte tin plated package
- Halogen free and RoHS compliant
- Pb-free E3 means 2nd level interconnect is Pbfree and the terminal finish material is tin(Sn) (IPC/JEDEC J-STD-609A.01)

Maximum Ratings and Thermal Characteristics (\( T_A=25^\circ \)C unless otherwise noted)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Pulse Power Dissipation by 10/1000( \mu )s Test Waveform (Fig.2) (Note 1)</td>
<td>( P_{PPM} )</td>
<td>600</td>
<td>W</td>
</tr>
<tr>
<td>Steady State Power Dissipation on Infinite Heat Sink at ( T_S =75^\circ )C (Fig. 6)</td>
<td>( P_D )</td>
<td>5.0</td>
<td>W</td>
</tr>
<tr>
<td>Peak Forward Surge Current, 8.3ms Single Half Sine Wave Unidirectional Only (Note 2)</td>
<td>( I_{FSM} )</td>
<td>100</td>
<td>A</td>
</tr>
<tr>
<td>Maximum Instantaneous Forward Voltage at 50A for Unidirectional Only</td>
<td>( V_F )</td>
<td>3.5</td>
<td>V</td>
</tr>
<tr>
<td>Operating Junction and Storage Temperature Range</td>
<td>( T_J, T_{STG} )</td>
<td>-55 to 175</td>
<td>°C</td>
</tr>
<tr>
<td>Typical Thermal Resistance Junction to Lead</td>
<td>( R_{uJL} )</td>
<td>20</td>
<td>°C/W</td>
</tr>
<tr>
<td>Typical Thermal Resistance Junction to Ambient</td>
<td>( R_{uJA} )</td>
<td>75</td>
<td>°C/W</td>
</tr>
</tbody>
</table>

Notes:
1. Non-repetitive current pulse, per Fig. 4 and derated above \( T_J \) init(9) = 25°C per Fig. 3.
2. Measured on 8.3ms single half sine wave or equivalent square wave, duty cycle=4 per minute maximum.
### Electrical Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

<table>
<thead>
<tr>
<th>Part Number (Uni)</th>
<th>Part Number (Bi)</th>
<th>Reverse Stand off Voltage V&lt;sub&gt;R&lt;/sub&gt; (Volts)</th>
<th>Breakdown Voltage V&lt;sub&gt;BR&lt;/sub&gt; (Volts) @ I&lt;sub&gt;T&lt;/sub&gt;</th>
<th>Test Current I&lt;sub&gt;T&lt;/sub&gt; (mA)</th>
<th>Maximum Clamping Voltage V&lt;sub&gt;C&lt;/sub&gt; @ I&lt;sub&gt;ppm&lt;/sub&gt; (V)</th>
<th>Maximum Peak Pulse Current I&lt;sub&gt;pp&lt;/sub&gt; (A)</th>
<th>Maximum Reverse Leakage I&lt;sub&gt;R&lt;/sub&gt; @ V&lt;sub&gt;R&lt;/sub&gt; (µA)</th>
<th>Agency Approval</th>
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<tr>
<td>TP6KE13A</td>
<td>TP6KE13CA</td>
<td>11.10</td>
<td>12.40</td>
<td>1.18</td>
<td>33.5</td>
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<td>1X</td>
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<tr>
<td>TP6KE15A</td>
<td>TP6KE15CA</td>
<td>12.80</td>
<td>14.30</td>
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<td>TP6KE16A</td>
<td>TP6KE16CA</td>
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<td>15.20</td>
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<td>TP6KE18CA</td>
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<td>17.10</td>
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<td>TP6KE20CA</td>
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<td>19.00</td>
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<tr>
<td>TP6KE22A</td>
<td>TP6KE22CA</td>
<td>18.80</td>
<td>20.90</td>
<td>1.30</td>
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<td>TP6KE24A</td>
<td>TP6KE24CA</td>
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<td>22.80</td>
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<td>TP6KE27A</td>
<td>TP6KE27CA</td>
<td>23.10</td>
<td>25.70</td>
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<td>TP6KE30A</td>
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<td>TP6KE33CA</td>
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<td>TP6KE39A</td>
<td>TP6KE39CA</td>
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<td>37.10</td>
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<td>TP6KE51A</td>
<td>TP6KE51CA</td>
<td>43.60</td>
<td>48.50</td>
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<td>TP6KE62A</td>
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<td>53.00</td>
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<td>TP6KE68A</td>
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<td>58.10</td>
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<td>TP6KE75A</td>
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<td>64.10</td>
<td>71.30</td>
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<td>TP6KE82A</td>
<td>TP6KE82CA</td>
<td>70.10</td>
<td>77.90</td>
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<td>TP6KE91A</td>
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<td>77.80</td>
<td>86.50</td>
<td>1.125</td>
<td>4.9</td>
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</table>

### I-V Curve Characteristics

**P<sub>ppm</sub>** Peak Pulse Power Dissipation – Max power dissipation  
**V<sub>R</sub>** Stand-off Voltage – Maximum voltage that can be applied to the TVS without operation  
**V<sub>BR</sub>** Breakdown Voltage – Maximum voltage that flows through the TVS at a specified test current (I<sub>T</sub>)  
**V<sub>C</sub>** Clamping Voltage – Peak voltage measured across the TVS at a specified I<sub>ppm</sub> (peak impulse current)  
**I<sub>R</sub>** Reverse Leakage Current – Current measured at V<sub>R</sub>  
**V<sub>F</sub>** Forward Voltage Drop for Uni-directional
Ratings and Characteristic Curves \((T_A=25°C\text{ unless otherwise noted})\)

**Figure 1 - TVS Transients Clamping Waveform**

- Voltage Transients
- Voltage Across TVS
- Current Through TVS

**Figure 2 - Peak Pulse Power Rating**

- Peak Pulse Power (kW)
- Pulse Width (ms)

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

- Peak Pulse Power (PPP) or Current (IPP)
- Derating in Percentage %

**Figure 4 - Pulse Waveform**

- Pulse Width (ms)
- Half Value

**Figure 5 - Typical Junction Capacitance**

- Junction Capacitance (pF)
- Reverse Breakdown Voltage (V)

**Figure 6 - TypicalTransient Thermal Impedance**

- Transient Thermal Impedance (°C/W)
- Pulse Duration (s)

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Revised: 09/10/16
Axial Leaded – 600W > TP6KE series

**Physical Specifications**

- **Weight**: 0.015oz., 0.4g
- **Case**: JEDEC DO-204AC (DO-15) molded plastic body over passivated junction.
- **Polarity**: Color band denotes the cathode except Bipolar.
- **Terminal**: Matte Tin axial leads, solderable per JESD22-B102.

**Dimensions**

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Inches</th>
<th>Millimeters</th>
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<tbody>
<tr>
<td>A</td>
<td>1.000</td>
<td>25.40</td>
</tr>
<tr>
<td>B</td>
<td>0.230 - 0.300</td>
<td>5.80 - 7.60</td>
</tr>
<tr>
<td>C</td>
<td>0.028 - 0.034</td>
<td>0.71 - 0.86</td>
</tr>
<tr>
<td>D</td>
<td>0.104 - 0.140</td>
<td>2.60 - 3.60</td>
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</tbody>
</table>

**Environmental Specifications**

- **High Temp. Storage**: JESD22-A103
- **HTRB**: JESD22-A108
- **Temperature Cycling**: JESD22-A104
- **H3TRB**: JESD22-A101
- **RSH**: JESD22-B106

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

- **Peak Temperature**: 260°C ± 5/0°C
- **Dipping Time**: 10s ± 1 seconds
- **Soldering**: 1 time

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

![Graph showing the relationship between the number of cycles and the peak forward surge current.](image)
Part Numbering System

TP6KE xxxXXX

OPTION CODE:
BLANK Real Tape
-B Bulk Packaging

TYPE CODE:
A Uni-Directional (5% $V_{BR}$ Voltage Tolerance)
CA Bi-Directional (5% $V_{BR}$ Voltage Tolerance)

$V_{BR}$ VOLTAGE CODE
(Refer to the Electrical Characteristics table)

SERIES CODE

Packaging

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Component Package</th>
<th>Quantity</th>
<th>Packaging Option</th>
<th>Packaging Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>TP6KExxxXX</td>
<td>DO-204AC</td>
<td>4000</td>
<td>Tape &amp; Reel</td>
<td>EIA STD RS-296</td>
</tr>
<tr>
<td>TP6KExxxXX-B</td>
<td>DO-204AC</td>
<td>1000</td>
<td>BULK</td>
<td>Littelfuse Spec.</td>
</tr>
</tbody>
</table>

Part Marking System

Cathode Band
(for Uni-directional products only)

Trace Code Marking
YY: Year Code
WW: Week Code

TP6KEXXX

Product Type

Littelfuse Logo

Part Marking System

OPTION CODE:
BLANK Real Tape
-B Bulk Packaging

TYPE CODE:
A Uni-Directional (5% $V_{BR}$ Voltage Tolerance)
CA Bi-Directional (5% $V_{BR}$ Voltage Tolerance)

$V_{BR}$ VOLTAGE CODE
(Refer to the Electrical Characteristics table)

Trace Code Marking
YY: Year Code
WW: Week Code

Dimensions are in inches/mm

Rear Depth Max. 0.75 (19.05)

Tape and Reel Specification

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