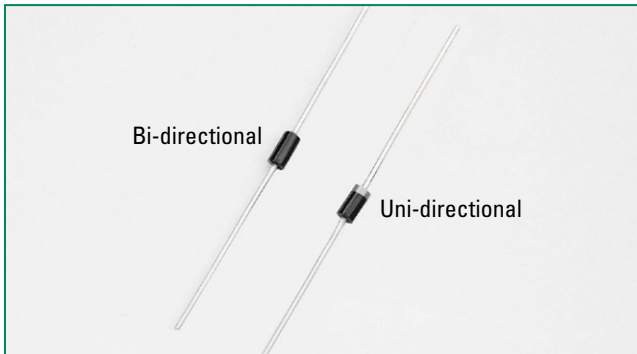



P4KE Series



Agency Approvals

| AGENCY | AGENCY FILE NUMBER |
|---|--------------------|
|  | E230531 |

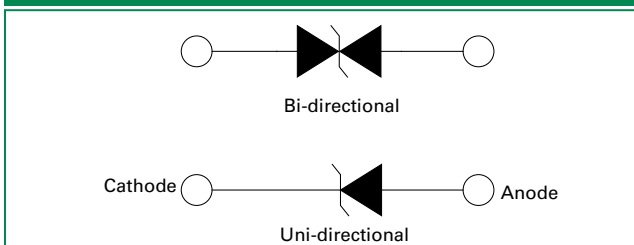
Maximum Ratings and Thermal Characteristics (T_A = 25°C unless otherwise noted)

| Parameter | Symbol | Value | Unit |
|--|-----------------------------------|------------|------|
| Peak Pulse Power Dissipation (Fig.2) by 10/1000µs Test Waveform (Fig.4) (Note 1), (Note 4) | P _{PPM} | 400 | W |
| Steady State Power Dissipation on Infinite Heat Sink at T _L = 75°C | P _D | 1.5 | W |
| Peak Forward Surge Current, 8.3ms Single Half Sine Wave Unidirectional Only (Note 2) | I _{FSM} | 60 | A |
| Maximum Instantaneous Forward Voltage at 25A for Unidirectional Only (Note 3) | V _F | 3.5/5.0 | V |
| Operating Junction and Storage Temperature Range | T _J , T _{STG} | -55 to 175 | °C |
| Typical Thermal Resistance Junction to Lead | R _{θJL} | 60 | °C/W |
| Typical Thermal Resistance Junction to Ambient | R _{θJA} | 100 | °C/W |

Notes:

1. Non-repetitive current pulse, per Fig. 4 and derated above T_J (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.
3. V_F < 3.5V for single die parts and V_F < 5.0V for stacked-die parts.
4. The P_{PPM} of stacked-die parts is 600W, please contact Littelfuse for the stacked-die component details.

Functional Diagram



Description

The P4KE Series is designed specifically to protect sensitive electronic equipment from EFTs, ESD, and induced lightning transients.

Features

- 400W peak pulse capability at 10/1000µs waveform, repetition rate (duty cycles): 0.01%
- Glass passivated chip junction in DO-41 Package
- Fast response time: typically less than 1.0ps from 0 Volts to V_{BR min}
- Excellent clamping capability
- Typical failure mode is a short circuit
- Whisker test is conducted per Table 4a/4c of JEDEC JESD201A
- IEC 61000-4-2 ESD 30kV(Air), 30kV (Contact)
- EFT protection of data lines in accordance with IEC 61000-4-4
- Low incremental surge resistance
- Typical IR ≤ 1 µA for VBR min > 12.6 V
- High temperature reflow soldering guaranteed: 260°C/40sec / 0.375"/(9.5mm) lead length, 5 lbs., (2.3kg) tension
- V_{BR} @ T_J = V_{BR} @ 25°C × (1 + α T × (T_J - 25)) (α T: Temperature Coefficient, typical value is 0.1%)
- UL Recognized compound meeting flammability rating V-0
- 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 components are ideal for the protection of I/O interfaces, V_{CC} bus and other vulnerable circuits used in telecom, computer, industrial ICT equipment and consumer electronic applications.

Additional Information



Datasheet




Resources



Samples


Electrical Characteristics (T_A=25°C unless otherwise noted)

| Part Number (Uni) | Part Number (Bi) | Reverse Stand off Voltage V _R (Volts) | Breakdown Voltage V _{BR} @ I _T (V) | | Test Current I _T (mA) | Maximum Clamping Voltage V _C @ I _{pp} (V) | Maximum Peak Pulse Current I _{pp} (A) | Maximum Reverse Leakage I _R @ V _R (μA) | Agency Approval  |
|-------------------|------------------|--|--|--------|----------------------------------|---|--|--|---|
| | | | MIN | MAX | | | | | |
| P4KE6.8A | P4KE6.8CA | 5.80 | 6.45 | 7.14 | 10 | 10.5 | 39.00 | 1000 | X |
| P4KE7.5A | P4KE7.5CA | 6.40 | 7.13 | 7.88 | 10 | 11.3 | 36.30 | 500 | X |
| P4KE8.2A | P4KE8.2CA | 7.02 | 7.79 | 8.61 | 10 | 12.1 | 33.90 | 200 | X |
| P4KE9.1A | P4KE9.1CA | 7.78 | 8.65 | 9.55 | 1 | 13.4 | 30.60 | 50 | X |
| P4KE10A | P4KE10CA | 8.55 | 9.50 | 10.50 | 1 | 14.5 | 28.30 | 10 | X |
| P4KE11A | P4KE11CA | 9.40 | 10.50 | 11.60 | 1 | 15.6 | 26.30 | 5 | X |
| P4KE12A | P4KE12CA | 10.20 | 11.40 | 12.60 | 1 | 16.7 | 24.60 | 5 | X |
| P4KE13A | P4KE13CA | 11.10 | 12.40 | 13.70 | 1 | 18.2 | 22.50 | 1 | X |
| P4KE15A | P4KE15CA | 12.80 | 14.30 | 15.80 | 1 | 21.2 | 19.30 | 1 | X |
| P4KE16A | P4KE16CA | 13.60 | 15.20 | 16.80 | 1 | 22.5 | 18.20 | 1 | X |
| P4KE18A | P4KE18CA | 15.30 | 17.10 | 18.90 | 1 | 25.5 | 16.10 | 1 | X |
| P4KE20A | P4KE20CA | 17.10 | 19.00 | 21.00 | 1 | 27.7 | 14.80 | 1 | X |
| P4KE22A | P4KE22CA | 18.80 | 20.90 | 23.10 | 1 | 30.6 | 13.40 | 1 | X |
| P4KE24A | P4KE24CA | 20.50 | 22.80 | 25.20 | 1 | 33.2 | 12.30 | 1 | X |
| P4KE27A | P4KE27CA | 23.10 | 25.70 | 28.40 | 1 | 37.5 | 10.90 | 1 | X |
| P4KE30A | P4KE30CA | 25.60 | 28.50 | 31.50 | 1 | 41.4 | 9.90 | 1 | X |
| P4KE33A | P4KE33CA | 28.20 | 31.40 | 34.70 | 1 | 45.7 | 9.00 | 1 | X |
| P4KE36A | P4KE36CA | 30.80 | 34.20 | 37.80 | 1 | 49.9 | 8.20 | 1 | X |
| P4KE39A | P4KE39CA | 33.30 | 37.10 | 41.00 | 1 | 53.9 | 7.60 | 1 | X |
| P4KE43A | P4KE43CA | 36.80 | 40.90 | 45.20 | 1 | 59.3 | 6.90 | 1 | X |
| P4KE47A | P4KE47CA | 40.20 | 44.70 | 49.40 | 1 | 64.8 | 6.30 | 1 | X |
| P4KE51A | P4KE51CA | 43.60 | 48.50 | 53.60 | 1 | 70.1 | 5.80 | 1 | X |
| P4KE56A | P4KE56CA | 47.80 | 53.20 | 58.80 | 1 | 77.0 | 5.30 | 1 | X |
| P4KE62A | P4KE62CA | 53.00 | 58.90 | 65.10 | 1 | 85.0 | 4.80 | 1 | X |
| P4KE68A | P4KE68CA | 58.10 | 64.60 | 71.40 | 1 | 92.0 | 4.50 | 1 | X |
| P4KE75A | P4KE75CA | 64.10 | 71.30 | 78.80 | 1 | 103.0 | 4.00 | 1 | X |
| P4KE82A | P4KE82CA | 70.10 | 77.90 | 86.10 | 1 | 113.0 | 3.60 | 1 | X |
| P4KE91A | P4KE91CA | 77.80 | 86.50 | 95.50 | 1 | 125.0 | 3.30 | 1 | X |
| P4KE100A | P4KE100CA | 85.50 | 95.00 | 105.00 | 1 | 137.0 | 3.00 | 1 | X |
| P4KE110A | - | 94.00 | 105.00 | 116.00 | 1 | 152.0 | 2.70 | 1 | X |
| - | P4KE110CA* | 94.00 | 105.00 | 116.00 | 1 | 152.0 | 4.00 | 1 | X |
| P4KE120A | - | 102.00 | 114.00 | 126.00 | 1 | 165.0 | 2.50 | 1 | X |
| - | P4KE120CA* | 102.00 | 114.00 | 126.00 | 1 | 165.0 | 3.70 | 1 | X |
| P4KE130A | - | 111.00 | 124.00 | 137.00 | 1 | 179.0 | 2.30 | 1 | X |
| - | P4KE130CA* | 111.00 | 124.00 | 137.00 | 1 | 179.0 | 3.40 | 1 | X |
| P4KE150A | - | 128.00 | 143.00 | 158.00 | 1 | 207.0 | 2.00 | 1 | X |
| - | P4KE150CA* | 128.00 | 143.00 | 158.00 | 1 | 207.0 | 2.90 | 1 | X |
| P4KE160A | - | 136.00 | 152.00 | 168.00 | 1 | 219.0 | 1.90 | 1 | X |
| - | P4KE160CA* | 136.00 | 152.00 | 168.00 | 1 | 219.0 | 2.80 | 1 | X |
| P4KE170A | - | 145.00 | 162.00 | 179.00 | 1 | 234.0 | 1.80 | 1 | X |
| - | P4KE170CA* | 145.00 | 162.00 | 179.00 | 1 | 234.0 | 2.60 | 1 | X |
| P4KE180A | - | 154.00 | 171.00 | 189.00 | 1 | 246.0 | 1.70 | 1 | X |
| - | P4KE180CA* | 154.00 | 171.00 | 189.00 | 1 | 246.0 | 2.50 | 1 | X |
| P4KE200A | - | 171.00 | 190.00 | 210.00 | 1 | 274.0 | 1.50 | 1 | X |
| - | P4KE200CA* | 171.00 | 190.00 | 210.00 | 1 | 274.0 | 2.20 | 1 | X |
| P4KE220A | - | 185.00 | 209.00 | 231.00 | 1 | 328.0 | 1.30 | 1 | - |
| - | P4KE220CA* | 185.00 | 209.00 | 231.00 | 1 | 328.0 | 1.90 | 1 | - |
| P4KE250A | - | 214.00 | 237.00 | 263.00 | 1 | 344.0 | 1.20 | 1 | - |
| - | P4KE250CA* | 214.00 | 237.00 | 263.00 | 1 | 344.0 | 1.80 | 1 | - |
| P4KE300A | - | 256.00 | 285.00 | 315.00 | 1 | 414.0 | 1.00 | 1 | - |
| - | P4KE300CA* | 256.00 | 285.00 | 315.00 | 1 | 414.0 | 1.50 | 1 | - |
| P4KE350A* | P4KE350CA* | 300.00 | 332.00 | 368.00 | 1 | 482.0 | 1.30 | 1 | - |
| P4KE400A* | P4KE400CA* | 342.00 | 380.00 | 420.00 | 1 | 548.0 | 1.10 | 1 | - |
| P4KE440A* | P4KE440CA* | 376.00 | 418.00 | 462.00 | 1 | 602.0 | 1.00 | 1 | - |

Transient Voltage Suppression (TVS) Diodes

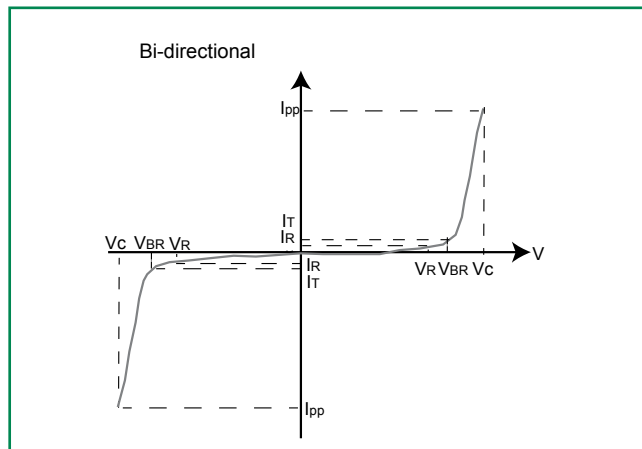
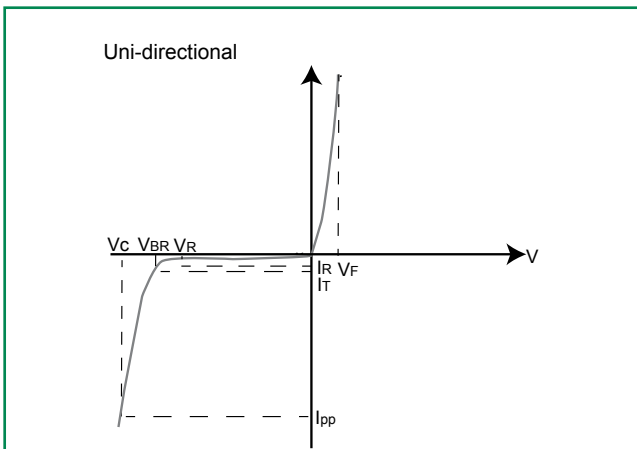
Axial Leaded – 400W > P4KE series

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 $V_{BR} @ I_T$ (V) | | Test Current I_T (mA) | Maximum Clamping Voltage $V_C @ I_{pp}$ (V) | Maximum Peak Pulse Current I_{pp} (A) | Maximum Reverse Leakage $I_R @ V_R$ (μA) | Agency Approval  |
|-------------------|------------------|---|--------------------------------------|--------|-------------------------|---|---|---|---|
| | | | MIN | MAX | | | | | |
| P4KE480A* | P4KE480CA* | 408.00 | 456.00 | 504.00 | 1 | 658.0 | 0.92 | 1 | - |
| P4KE510A* | P4KE510CA* | 434.00 | 485.00 | 535.00 | 1 | 698.0 | 0.86 | 1 | - |
| P4KE530A* | P4KE530CA* | 451.00 | 503.50 | 556.50 | 1 | 725.0 | 0.83 | 1 | - |
| P4KE540A* | P4KE540CA* | 460.00 | 513.00 | 567.00 | 1 | 740.0 | 0.82 | 1 | - |
| P4KE550A* | P4KE550CA* | 468.00 | 522.50 | 577.50 | 1 | 760.0 | 0.79 | 1 | - |

For bidirectional type having V_R of 10 volts and less, the I_R value is double.
For parts without A, the V_{BR} is $\pm 10\%$ and V_C is 5% higher than with A parts
For stack-die parts, use * to label the part number.

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 though 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

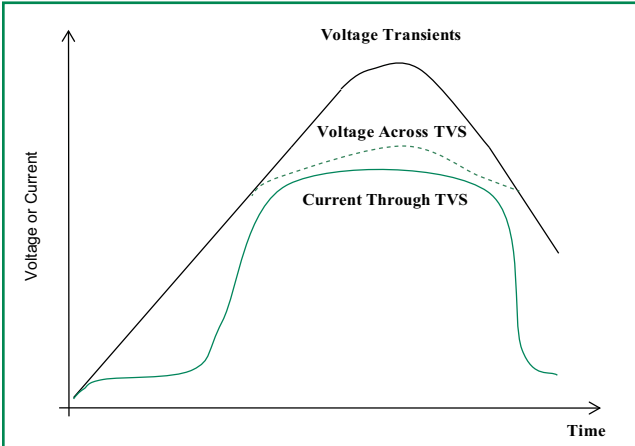
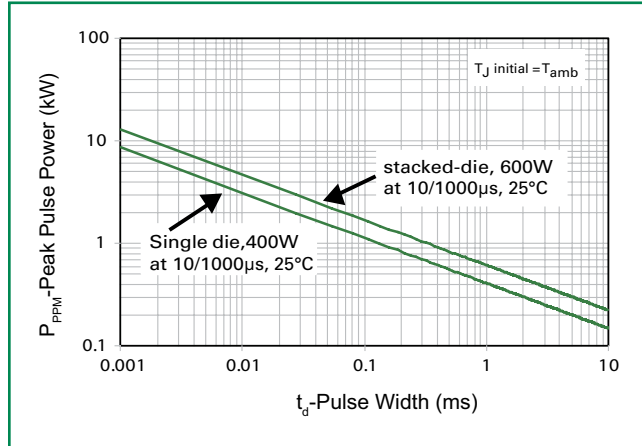


Figure 2 - Peak Pulse Power Rating Curve



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

Figure 3 - Peak Pulse Power Derating Curve

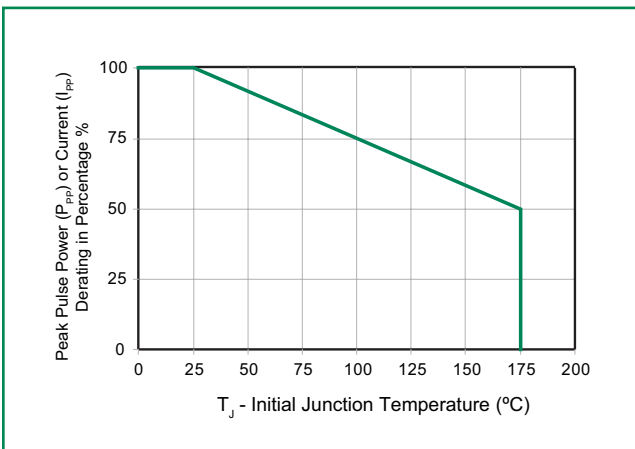


Figure 4 - Pulse Waveform

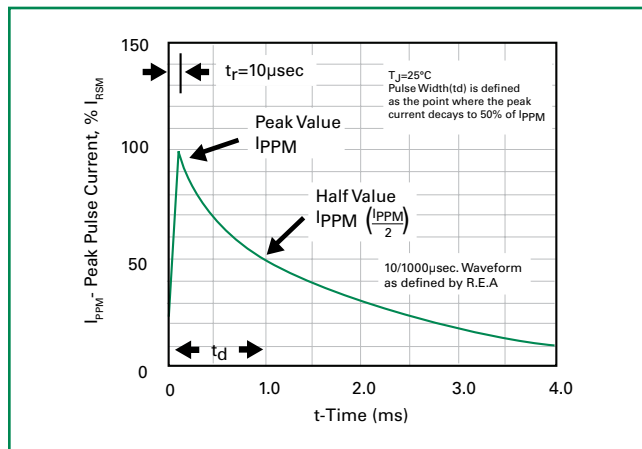


Figure 5 - Typical Junction Capacitance

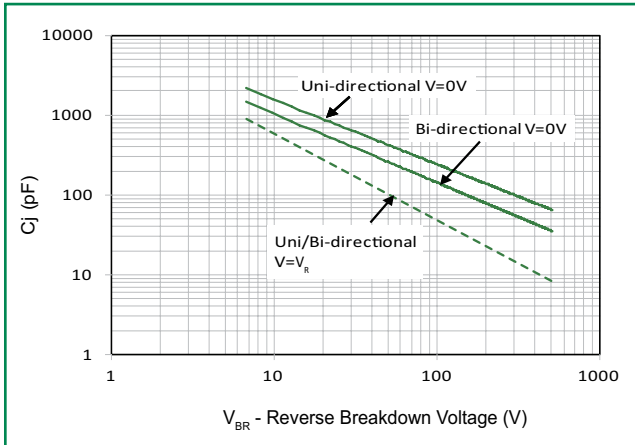


Figure 6 - Typical Transient Thermal Impedance

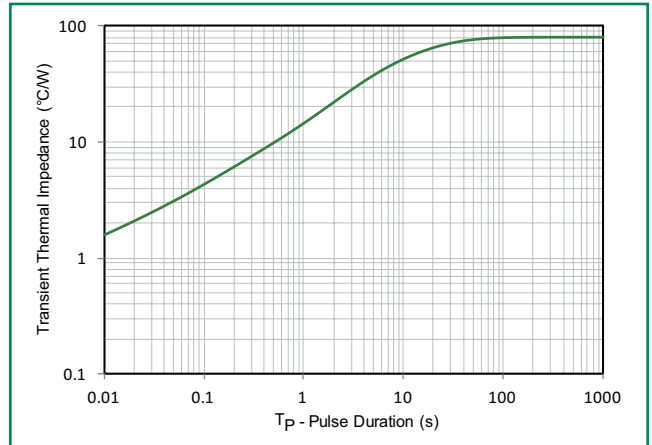


Figure 7 - Maximum Non-Repetitive Forward Surge Current Uni-Directional Only

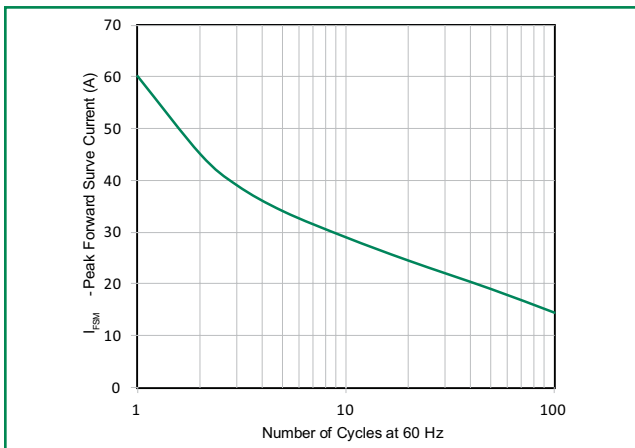
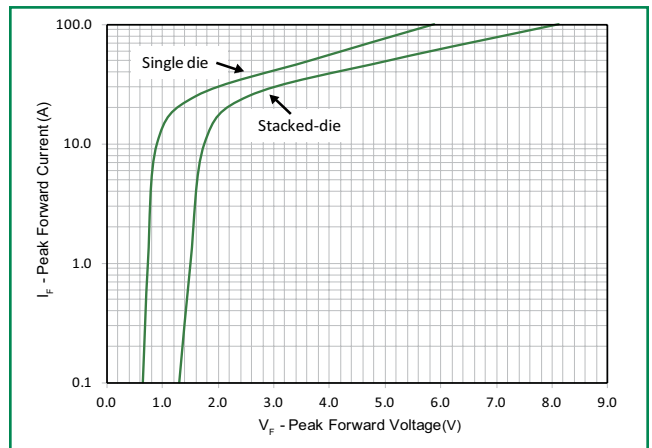
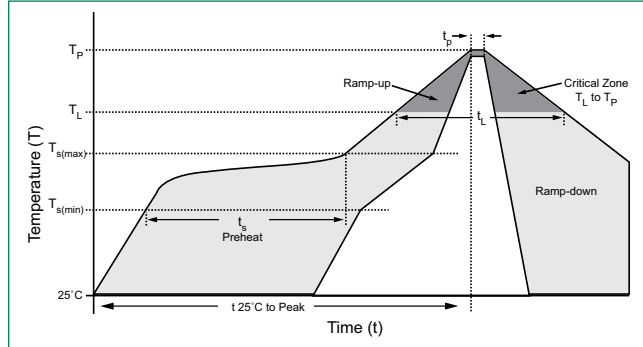


Figure 8 - Peak Forward Voltage Drop vs Peak Forward Current (Typical Values)



Soldering Parameters

| | | |
|--|------------------------------------|-------------------------|
| Reflow Condition | | Lead-free assembly |
| Pre Heat | - Temperature Min ($T_{s(min)}$) | 150°C |
| | - Temperature Max ($T_{s(max)}$) | 200°C |
| | - Time (min to max) (t_s) | 60 – 180 secs |
| Average ramp up rate (Liquidus Temp (T_A) to peak) | | 3°C/second max |
| $T_{s(max)}$ to T_A - Ramp-up Rate | | 3°C/second max |
| Reflow | - Temperature (T_A) (Liquidus) | 217°C |
| | - Time (min to max) (t_s) | 60 – 150 seconds |
| Peak Temperature (T_p) | | 260 ^{+0/-5} °C |
| Time within 5°C of actual peak Temperature (t_p) | | 20 – 40 seconds |
| Ramp-down Rate | | 6°C/second max |
| Time 25°C to peak Temperature (T_p) | | 8 minutes Max. |
| Do not exceed | | 260°C |



Flow/Wave Soldering (Solder Dipping)

| | |
|---------------------------|-----------|
| Peak Temperature : | 260°C |
| Dipping Time : | 5 seconds |
| Soldering : | 1 time |

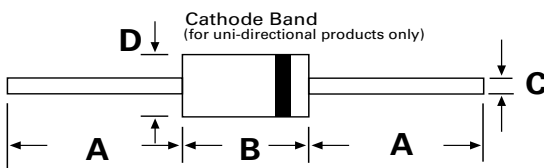
Physical Specifications

| | |
|-----------------|--|
| Weight | 0.012oz., 0.3g |
| Case | JEDEC DO-204AL (DO-41) molded plastic body over passivated junction. |
| Polarity | Colored band indicates unidirectional component's cathode end |
| Terminal | Matte Tin axial leads, solderable per JESD22-B102. |

Environmental Specifications

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

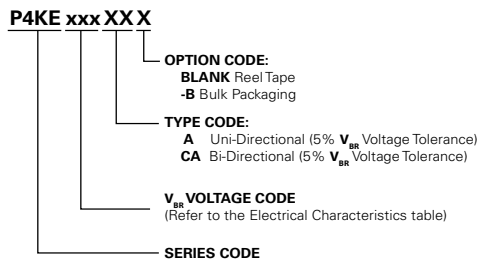
Dimensions



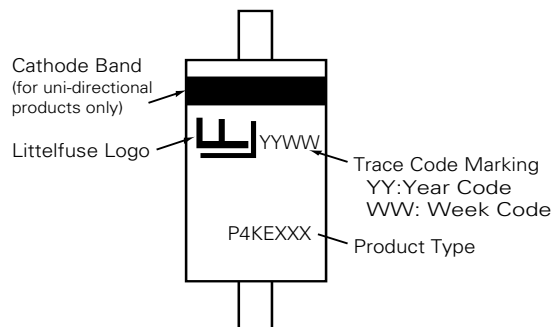
DO-204AL (DO-41)

| Dimensions | Inches | | Millimeters | |
|------------|--------|-------|-------------|------|
| | Min | Max | Min | Max |
| A | 1.000 | - | 25.40 | - |
| B | 0.160 | 0.205 | 4.10 | 5.20 |
| C | 0.028 | 0.034 | 0.71 | 0.86 |
| D | 0.080 | 0.107 | 2.00 | 2.70 |

Part Numbering System



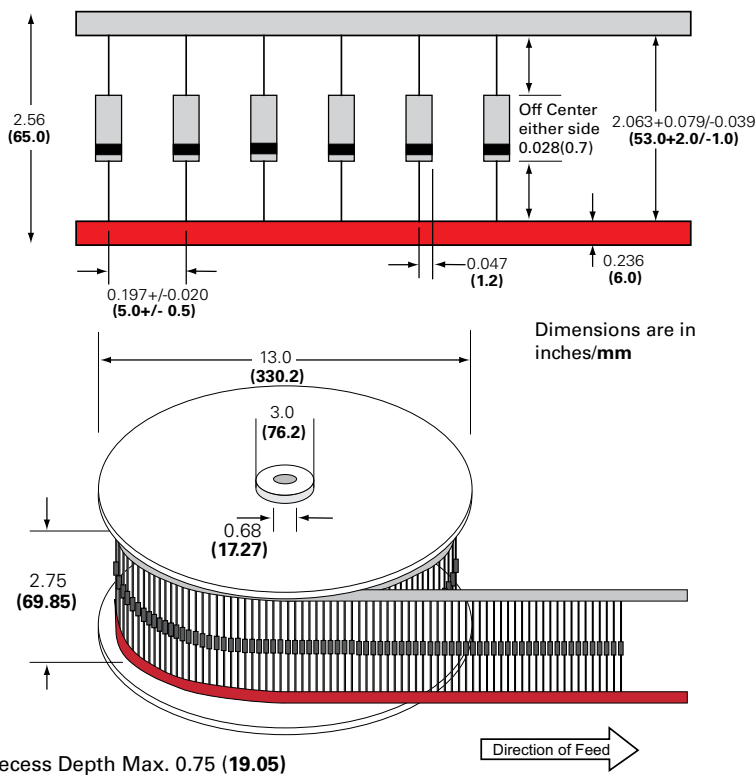
Part Marking System



Packaging

| Part Number | Component Package | Quantity | Packaging Option | Packaging Specification |
|-------------|-------------------|----------|------------------|-------------------------|
| P4KExxxXX | DO-204AL | 5000 | Tape & Reel | EIA STD RS-296 |
| P4KExxxXX-B | DO-204AL | 500 | BOX | Littelfuse Spec. |

Tape and Reel Specification



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