

5KP Series



Agency Approvals

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

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

| Parameter | Symbol | Value | Unit |
|--|-----------------|------------|--------------------|
| Peak Pulse Power Dissipation by 10/1000 μs Test Waveform (Fig.2) (Note 1) | P_{PPM} | 5000 | W |
| Steady State Power Dissipation on Infinite Heat Sink at $T_L=75^\circ\text{C}$ | P_D | 8.0 | W |
| Peak Forward Surge Current, 8.3ms Single Half Sine Wave Unidirectional Only (Note 2) | I_{FSM} | 400 | A |
| Maximum Instantaneous Forward Voltage at 100A 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 | $^\circ\text{C}$ |
| Typical Thermal Resistance Junction to Lead | $R_{\theta JL}$ | 8.0 | $^\circ\text{C/W}$ |
| Typical Thermal Resistance Junction to Ambient | $R_{\theta JA}$ | 40 | $^\circ\text{C/W}$ |

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. $V_F < 3.5\text{V}$ for single die parts and $V_F < 5.0\text{V}$ for stacked-die parts.

Functional Diagram



Description

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

Features

- 5000W peak pulse capability at 10/1000 μs waveform, repetition rate (duty cycles):0.01 %
- Glass passivated chip junction in P600 package
- 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
- Typical I_R less than $2\mu\text{A}$ when V_{BR} min > 12V
- High temperature to reflow soldering guaranteed: $260^\circ\text{C}/40\text{sec}$ / 0.375", (9.5mm) lead length, 5 lbs., (2.3kg) tension
- $V_{BR} @ T_J = V_{BR} @ 25^\circ\text{C} \times (1 + \alpha T \times (T_J - 25))$ (α : 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-

Applications

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.

Additional Information



Datasheet



Resources



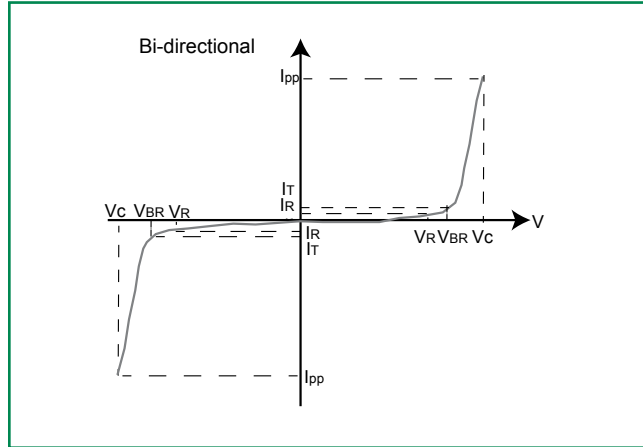
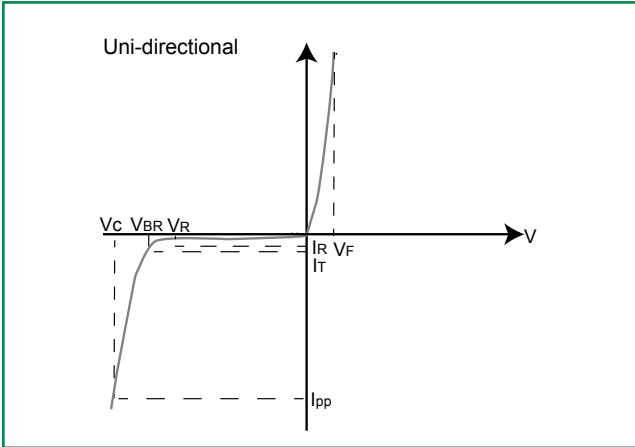
Samples

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} (Volts) @ I _T | | 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 | | | | | |
| 5KP5.0A | 5KP5.0CA | 5.0 | 6.40 | 7.00 | 50 | 9.2 | 554.3 | 5000 | X |
| 5KP6.0A | 5KP6.0CA | 6.0 | 6.67 | 7.37 | 50 | 10.3 | 495.1 | 5000 | X |
| 5KP6.5A | 5KP6.5CA | 6.5 | 7.22 | 7.98 | 50 | 11.2 | 455.4 | 2000 | X |
| 5KP7.0A | 5KP7.0CA | 7.0 | 7.78 | 8.60 | 50 | 12.0 | 425.0 | 1000 | X |
| 5KP7.5A | 5KP7.5CA | 7.5 | 8.33 | 9.21 | 5 | 12.9 | 395.3 | 250 | X |
| 5KP8.0A | 5KP8.0CA | 8.0 | 8.89 | 9.83 | 5 | 13.6 | 375.0 | 150 | X |
| 5KP8.5A | 5KP8.5CA | 8.5 | 9.44 | 10.40 | 5 | 14.4 | 354.2 | 50 | X |
| 5KP9.0A | 5KP9.0CA | 9.0 | 10.00 | 11.10 | 5 | 15.4 | 331.2 | 20 | X |
| 5KP10A | 5KP10CA | 10.0 | 11.10 | 12.30 | 5 | 17.0 | 300.0 | 15 | X |
| 5KP11A | 5KP11CA | 11.0 | 12.20 | 13.50 | 5 | 18.2 | 280.2 | 2 | X |
| 5KP12A | 5KP12CA | 12.0 | 13.30 | 14.70 | 5 | 19.9 | 256.3 | 2 | X |
| 5KP13A | 5KP13CA | 13.0 | 14.40 | 15.90 | 5 | 21.5 | 237.2 | 2 | X |
| 5KP14A | 5KP14CA | 14.0 | 15.60 | 17.20 | 5 | 23.2 | 219.8 | 2 | X |
| 5KP15A | 5KP15CA | 15.0 | 16.70 | 18.50 | 5 | 24.4 | 209.0 | 2 | X |
| 5KP16A | 5KP16CA | 16.0 | 17.80 | 19.70 | 5 | 26.0 | 196.2 | 2 | X |
| 5KP17A | 5KP17CA | 17.0 | 18.90 | 20.90 | 5 | 27.6 | 184.8 | 2 | X |
| 5KP18A | 5KP18CA | 18.0 | 20.00 | 22.10 | 5 | 29.2 | 174.7 | 2 | X |
| 5KP20A | 5KP20CA | 20.0 | 22.20 | 24.50 | 5 | 32.4 | 157.4 | 2 | X |
| 5KP22A | 5KP22CA | 22.0 | 24.00 | 26.90 | 5 | 35.5 | 143.7 | 2 | X |
| 5KP24A | 5KP24CA | 24.0 | 26.70 | 29.50 | 5 | 38.9 | 131.1 | 2 | X |
| 5KP26A | 5KP26CA | 26.0 | 28.90 | 31.90 | 5 | 42.1 | 121.1 | 2 | X |
| 5KP28A | 5KP28CA | 28.0 | 31.10 | 34.40 | 5 | 45.4 | 112.3 | 2 | X |
| 5KP30A | 5KP30CA | 30.0 | 33.30 | 36.80 | 5 | 48.4 | 105.4 | 2 | X |
| 5KP33A | 5KP33CA | 33.0 | 36.70 | 40.60 | 5 | 53.3 | 95.7 | 2 | X |
| 5KP36A | 5KP36CA | 36.0 | 40.00 | 44.20 | 5 | 58.1 | 87.8 | 2 | X |
| 5KP40A | 5KP40CA | 40.0 | 44.40 | 49.10 | 5 | 64.5 | 79.1 | 2 | X |
| 5KP43A | 5KP43CA | 43.0 | 47.80 | 52.80 | 5 | 69.4 | 73.5 | 2 | X |
| 5KP45A | 5KP45CA | 45.0 | 50.00 | 55.30 | 5 | 72.7 | 70.2 | 2 | X |
| 5KP48A | 5KP48CA | 48.0 | 53.30 | 58.90 | 5 | 77.4 | 65.9 | 2 | X |
| 5KP51A | 5KP51CA | 51.0 | 56.70 | 62.70 | 5 | 82.4 | 61.9 | 2 | X |
| 5KP54A | 5KP54CA | 54.0 | 60.00 | 66.30 | 5 | 87.1 | 58.6 | 2 | X |
| 5KP58A | 5KP58CA | 58.0 | 64.40 | 71.20 | 5 | 93.6 | 54.5 | 2 | X |
| 5KP60A | 5KP60CA | 60.0 | 66.70 | 73.70 | 5 | 96.8 | 52.7 | 2 | X |
| 5KP64A | 5KP64CA | 64.0 | 71.10 | 78.60 | 5 | 103.0 | 49.5 | 2 | X |
| 5KP70A | 5KP70CA | 70.0 | 77.80 | 86.00 | 5 | 113.0 | 45.1 | 2 | X |
| 5KP75A | 5KP75CA | 75.0 | 83.30 | 92.10 | 5 | 121.0 | 42.1 | 2 | X |
| 5KP78A | 5KP78CA | 78.0 | 86.70 | 95.80 | 5 | 126.0 | 40.5 | 2 | X |
| 5KP85A | 5KP85CA | 85.0 | 94.40 | 104.00 | 5 | 137.0 | 37.2 | 2 | X |
| 5KP90A | 5KP90CA | 90.0 | 100.00 | 111.00 | 5 | 146.0 | 34.9 | 2 | X |
| 5KP100A | 5KP100CA | 100.0 | 110.00 | 123.00 | 5 | 162.0 | 31.5 | 2 | X |
| 5KP110A | 5KP110CA | 110.0 | 122.00 | 135.00 | 5 | 177.0 | 28.8 | 2 | X |
| 5KP120A | 5KP120CA | 120.0 | 133.00 | 147.00 | 5 | 193.0 | 26.4 | 2 | X |
| 5KP130A | 5KP130CA | 130.0 | 144.00 | 159.00 | 5 | 209.0 | 24.4 | 2 | X |
| 5KP150A | 5KP150CA | 150.0 | 167.00 | 185.00 | 5 | 243.0 | 21.0 | 2 | X |
| 5KP160A | 5KP160CA | 160.0 | 178.00 | 197.00 | 5 | 259.0 | 19.7 | 2 | X |
| 5KP170A | 5KP170CA | 170.0 | 189.00 | 209.00 | 5 | 275.0 | 18.5 | 2 | X |
| 5KP180A | 5KP180CA | 180.0 | 200.00 | 221.00 | 5 | 292.0 | 17.5 | 2 | X |
| 5KP190A | 5KP190CA | 190.0 | 211.00 | 233.00 | 5 | 310.0 | 16.5 | 2 | X |
| 5KP200A | 5KP200CA | 200.0 | 222.00 | 246.00 | 5 | 329.2 | 15.5 | 2 | X |
| 5KP210A | 5KP210CA | 210.0 | 233.00 | 258.00 | 5 | 349.5 | 14.6 | 2 | X |
| 5KP220A | 5KP220CA | 220.0 | 244.00 | 270.00 | 5 | 371.1 | 13.7 | 2 | X |
| 5KP250A | 5KP250CA | 250.0 | 277.00 | 306.00 | 5 | 425.0 | 12.0 | 2 | X |

For bidirectional type having V_R of 10 volts and less, the I_R limit is double.
 For parts without A, the V_{BR} is ± 10% and V_C is 5% higher than with A parts

I-V Curve Characteristics



- P_{PPM} Peak Pulse 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_r)
- 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

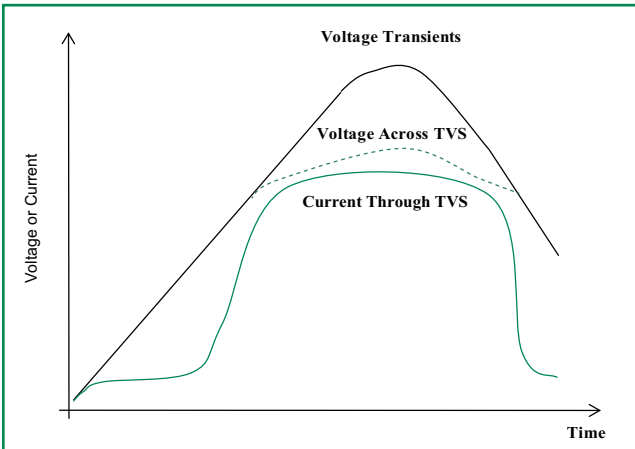
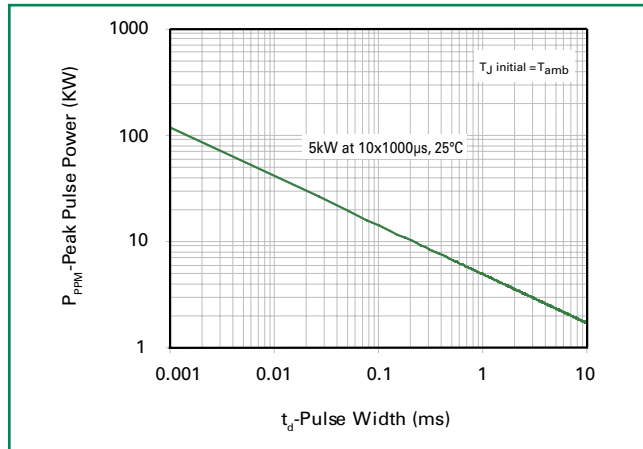


Figure 2 - Peak Pulse Power Rating Curve



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

Figure 3 - Peak Pulse Power Derating Curve

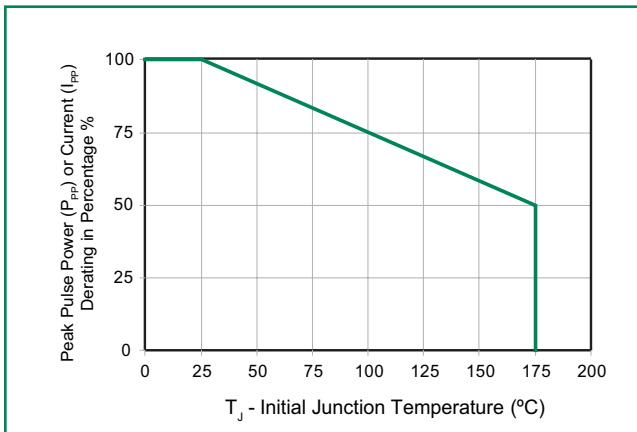


Figure 4 - Pulse Waveform

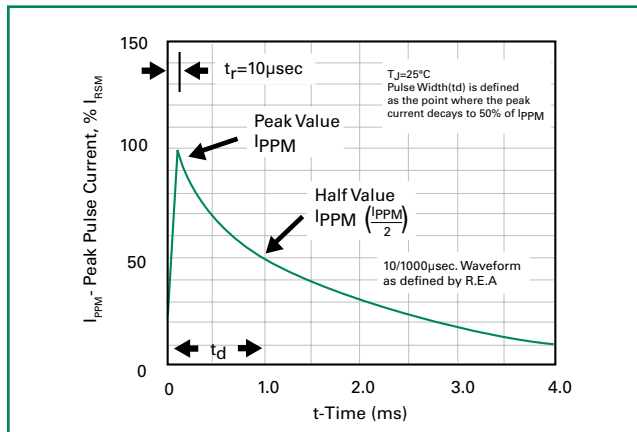


Figure 5 - Typical Junction Capacitance

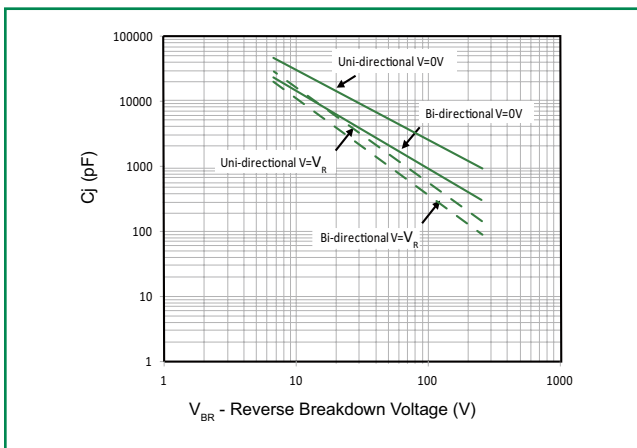


Figure 6 - Typical Transient Thermal Impedance

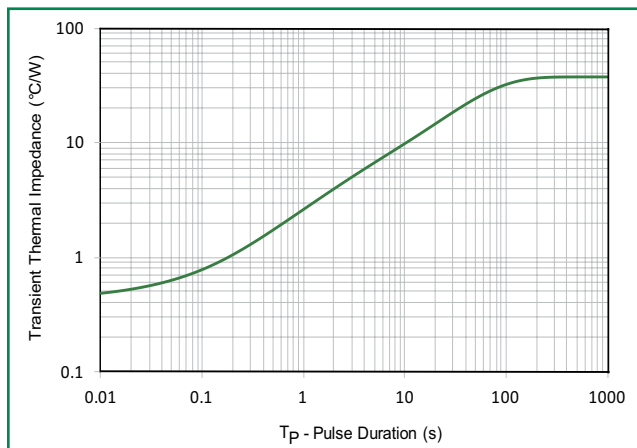


Figure 7 - Maximum Non-Repetitive Peak Forward Surge Current Uni-Directional Only

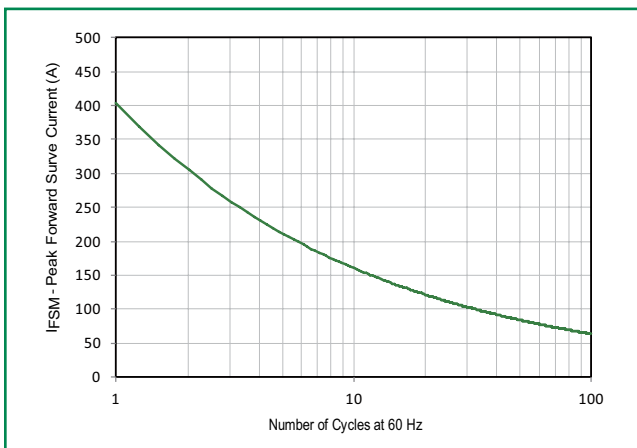
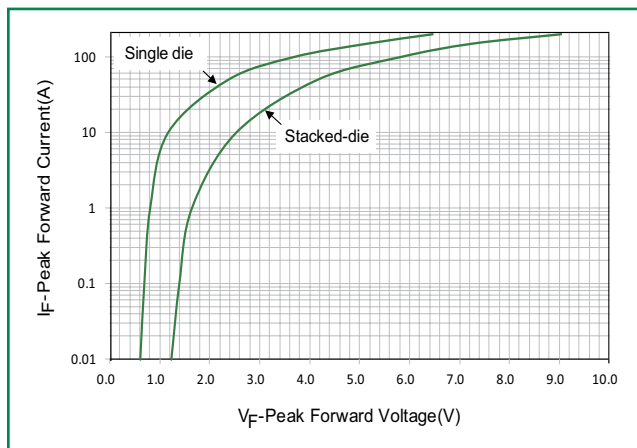
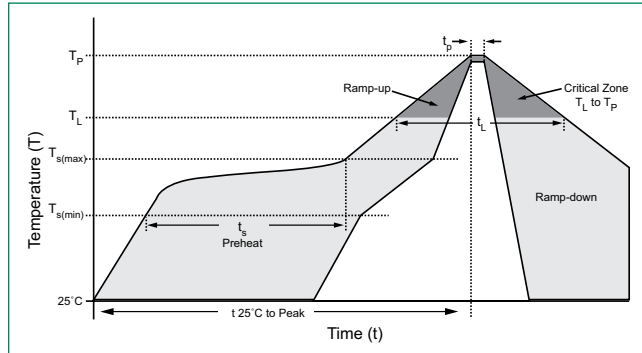


Figure 8 - Peak Forward Voltage Drop vs Peak Forward Current (Typical Values)



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 : | 265°C |
| Dipping Time : | 10 seconds |
| Soldering : | 1 time |

Physical Specifications

| | |
|-----------------|--|
| Weight | 0.07oz., 2.1g |
| Case | P600 molded plastic body over passivated junction. |
| Polarity | Color band denotes the cathode except Bipolar. |
| 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



| Dimensions | Inches | | Millimeters | |
|------------|--------|-------|-------------|------|
| | Min | Max | Min | Max |
| A | 1.000 | - | 25.40 | - |
| B | 0.340 | 0.360 | 8.60 | 9.10 |
| C | 0.048 | 0.052 | 1.22 | 1.32 |
| D | 0.340 | 0.360 | 8.60 | 9.10 |

Part Numbering System

5KPxxxXXX



Part Marking System



Packing Options

| Part Number | Component Package | Quantity | Packaging Option | Packaging Specification |
|-------------|-------------------|----------|------------------|-------------------------|
| 5KPxxxXX | P600 | 800 | Tape & Reel | EIA STD RS-296 |
| 5KPxxxXX-B | P600 | 100 | BULK | Littelfuse Spec. |

Tape and Reel Specification

