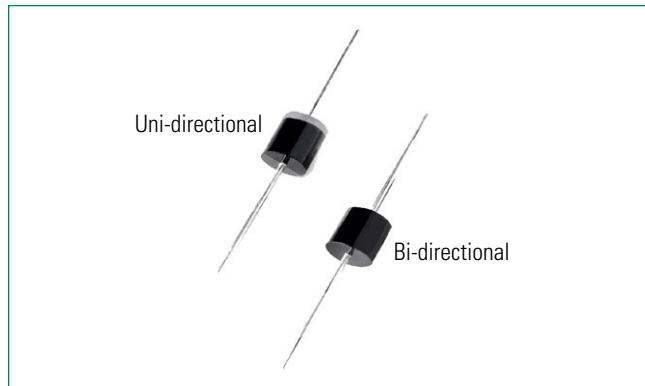


## 15KPA-HR Series



### Agency Approvals

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

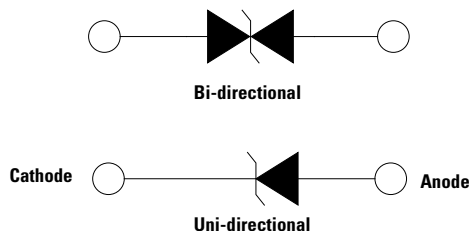
### Maximum Ratings and Thermal Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

| Parameter                                                                             | Symbol                            | Value      | Unit |
|---------------------------------------------------------------------------------------|-----------------------------------|------------|------|
| Peak Pulse Power Dissipation by 10/1000µs Test Waveform (Fig.2)(Note 1)               | P <sub>PPM</sub>                  | 15         | kW   |
| Steady State Power Dissipation on Infinite Heat Sink at T <sub>A</sub> =75°C (Fig. 6) | P <sub>D</sub>                    | 8.0        | W    |
| Peak Forward Surge Current, 8.3ms Single Half Sine Wave Unidirectional Only (Note 2)  | I <sub>FSM</sub>                  | 400        | A    |
| Operating Junction and Storage Temperature Range                                      | T <sub>J</sub> , T <sub>STG</sub> | -55 to 175 | °C   |
| Typical Thermal Resistance Junction to Lead                                           | R <sub>θJL</sub>                  | 8.0        | °C/W |
| Typical Thermal Resistance Junction to Ambient                                        | R <sub>θJA</sub>                  | 40         | °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



### Descriptions

The 15KPA-HR High Reliability Series is designed specifically to protect sensitive electronic equipment from voltage transients induced by lightning and other transient voltage events.

### Features

- 15 kW peak pulse capability at 10/1000µs 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 V<sub>BR</sub> 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)
- EFT protection of data lines in accordance with IEC 61000-4-4
- Low incremental surge resistance
- Typical I<sub>R</sub> less than 2µA when V<sub>BR</sub> min>36V
- High temperature soldering guaranteed: 260C/10 seconds / 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+ α T x (T<sub>J</sub> - 25)) (α T: Temperature Coefficient, typical value is 0.1 %)
- UL Recognized compound meeting flammability rating V-0
- Lead-free matte tin plated package
- 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<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 Peak Pulse Current $I_{PP}$ (A) | Maximum Reverse Leakage $I_R$ @ $V_R$ ( $\mu\text{A}$ ) | Maximum Clamping Voltage $V_C$ @ $I_{PP}$ (V) | Agency Recognition  |
|-------------------|------------------|-----------------------------------------|--------------------------------------------|-------|-------------------------|-----------------------------------------|---------------------------------------------------------|-----------------------------------------------|--------------------------------------------------------------------------------------------------------|
|                   |                  |                                         | MIN                                        | MAX   |                         |                                         |                                                         |                                               |                                                                                                        |
| 15KPA17A-HR       | 15KPA17CA-HR     | 17                                      | 18.99                                      | 20.79 | 50                      | 515.4                                   | 5000                                                    | 29.3                                          | X                                                                                                      |
| 15KPA18A-HR       | 15KPA18CA-HR     | 18                                      | 20.11                                      | 22.01 | 50                      | 488.7                                   | 5000                                                    | 30.9                                          | X                                                                                                      |
| 15KPA20A-HR       | 15KPA20CA-HR     | 20                                      | 22.34                                      | 24.46 | 20                      | 440.2                                   | 1500                                                    | 34.3                                          | X                                                                                                      |
| 15KPA22A-HR       | 15KPA22CA-HR     | 22                                      | 24.57                                      | 26.91 | 10                      | 407.0                                   | 500                                                     | 37.1                                          | X                                                                                                      |
| 15KPA24A-HR       | 15KPA24CA-HR     | 24                                      | 26.81                                      | 29.35 | 5                       | 371.0                                   | 150                                                     | 40.7                                          | X                                                                                                      |
| 15KPA26A-HR       | 15KPA26CA-HR     | 26                                      | 29.04                                      | 31.80 | 5                       | 343.2                                   | 50                                                      | 44.0                                          | X                                                                                                      |
| 15KPA28A-HR       | 15KPA28CA-HR     | 28                                      | 31.28                                      | 34.24 | 5                       | 317.9                                   | 25                                                      | 47.5                                          | X                                                                                                      |
| 15KPA30A-HR       | 15KPA30CA-HR     | 30                                      | 33.51                                      | 36.7  | 5                       | 297.8                                   | 15                                                      | 50.7                                          | X                                                                                                      |
| 15KPA33A-HR       | 15KPA33CA-HR     | 33                                      | 36.9                                       | 40.4  | 5                       | 276.1                                   | 2                                                       | 54.7                                          | X                                                                                                      |
| 15KPA36A-HR       | 15KPA36CA-HR     | 36                                      | 40.2                                       | 44.0  | 5                       | 252.5                                   | 2                                                       | 59.8                                          | X                                                                                                      |
| 15KPA40A-HR       | 15KPA40CA-HR     | 40                                      | 44.7                                       | 48.9  | 5                       | 229.5                                   | 2                                                       | 65.8                                          | X                                                                                                      |
| 15KPA43A-HR       | 15KPA43CA-HR     | 43                                      | 48.0                                       | 52.6  | 5                       | 216.3                                   | 2                                                       | 69.8                                          | X                                                                                                      |
| 15KPA45A-HR       | 15KPA45CA-HR     | 45                                      | 50.3                                       | 55.0  | 5                       | 207.4                                   | 2                                                       | 72.8                                          | X                                                                                                      |
| 15KPA48A-HR       | 15KPA48CA-HR     | 48                                      | 53.6                                       | 58.7  | 5                       | 194.3                                   | 2                                                       | 77.7                                          | X                                                                                                      |
| 15KPA51A-HR       | 15KPA51CA-HR     | 51                                      | 57.0                                       | 62.4  | 5                       | 182.1                                   | 2                                                       | 82.9                                          | X                                                                                                      |
| 15KPA54A-HR       | 15KPA54CA-HR     | 54                                      | 60.3                                       | 66.0  | 5                       | 172.2                                   | 2                                                       | 87.7                                          | X                                                                                                      |
| 15KPA58A-HR       | 15KPA58CA-HR     | 58                                      | 64.8                                       | 70.9  | 5                       | 161.0                                   | 2                                                       | 93.8                                          | X                                                                                                      |
| 15KPA60A-HR       | 15KPA60CA-HR     | 60                                      | 67.0                                       | 73.4  | 5                       | 155.0                                   | 2                                                       | 97.4                                          | X                                                                                                      |
| 15KPA64A-HR       | 15KPA64CA-HR     | 64                                      | 71.5                                       | 78.3  | 5                       | 144.9                                   | 2                                                       | 104.2                                         | X                                                                                                      |
| 15KPA70A-HR       | 15KPA70CA-HR     | 70                                      | 78.2                                       | 85.6  | 5                       | 132.9                                   | 2                                                       | 113.6                                         | X                                                                                                      |
| 15KPA75A-HR       | 15KPA75CA-HR     | 75                                      | 83.8                                       | 91.7  | 5                       | 123.8                                   | 2                                                       | 122.0                                         | X                                                                                                      |
| 15KPA78A-HR       | 15KPA78CA-HR     | 78                                      | 87.1                                       | 95.4  | 5                       | 119.7                                   | 2                                                       | 126.1                                         | X                                                                                                      |
| 15KPA85A-HR       | 15KPA85CA-HR     | 85                                      | 94.9                                       | 104.0 | 5                       | 109.7                                   | 2                                                       | 137.6                                         | X                                                                                                      |
| 15KPA90A-HR       | 15KPA90CA-HR     | 90                                      | 100.5                                      | 110.1 | 5                       | 103.7                                   | 2                                                       | 145.6                                         | X                                                                                                      |
| 15KPA100A-HR      | 15KPA100CA-HR    | 100                                     | 111.7                                      | 122.3 | 5                       | 93.6                                    | 2                                                       | 161.3                                         | X                                                                                                      |
| 15KPA110A-HR      | 15KPA110CA-HR    | 110                                     | 122.9                                      | 134.5 | 5                       | 84.5                                    | 2                                                       | 178.6                                         | X                                                                                                      |
| 15KPA120A-HR      | 15KPA120CA-HR    | 120                                     | 134.0                                      | 146.8 | 5                       | 78.5                                    | 2                                                       | 192.3                                         | X                                                                                                      |
| 15KPA130A-HR      | 15KPA130CA-HR    | 130                                     | 145.2                                      | 159.0 | 5                       | 72.5                                    | 2                                                       | 208.3                                         | X                                                                                                      |
| 15KPA150A-HR      | 15KPA150CA-HR    | 150                                     | 167.6                                      | 183.5 | 5                       | 62.4                                    | 2                                                       | 241.9                                         | X                                                                                                      |
| 15KPA160A-HR      | 15KPA160CA-HR    | 160                                     | 178.7                                      | 195.7 | 5                       | 58.4                                    | 2                                                       | 258.6                                         | X                                                                                                      |
| 15KPA170A-HR      | 15KPA170CA-HR    | 170                                     | 189.9                                      | 207.9 | 5                       | 55.4                                    | 2                                                       | 272.7                                         | X                                                                                                      |
| 15KPA180A-HR      | 15KPA180CA-HR    | 180                                     | 201.1                                      | 220.1 | 5                       | 52.3                                    | 2                                                       | 288.5                                         | X                                                                                                      |
| 15KPA200A-HR      | 15KPA200CA-HR    | 200                                     | 223.4                                      | 244.6 | 5                       | 47.3                                    | 2                                                       | 319.1                                         | X                                                                                                      |
| 15KPA220A-HR      | 15KPA220CA-HR    | 220                                     | 245.7                                      | 269.1 | 5                       | 42.4                                    | 2                                                       | 356.0                                         | X                                                                                                      |
| 15KPA240A-HR      | 15KPA240CA-HR    | 240                                     | 268.1                                      | 293.5 | 5                       | 39.3                                    | 2                                                       | 384.6                                         | X                                                                                                      |
| 15KPA260A-HR      | 15KPA260CA-HR    | 260                                     | 290.4                                      | 318.0 | 5                       | 36.2                                    | 2                                                       | 416.7                                         | X                                                                                                      |
| 15KPA280A-HR      | 15KPA280CA-HR    | 280                                     | 312.8                                      | 342.4 | 5                       | 33.2                                    | 2                                                       | 454.5                                         | X                                                                                                      |

**Note:**

2. Each lot of parts will pass group B test requirement.

### Screen Process

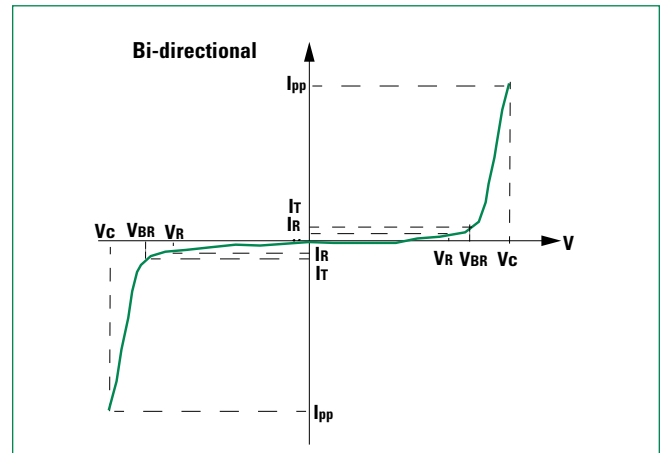
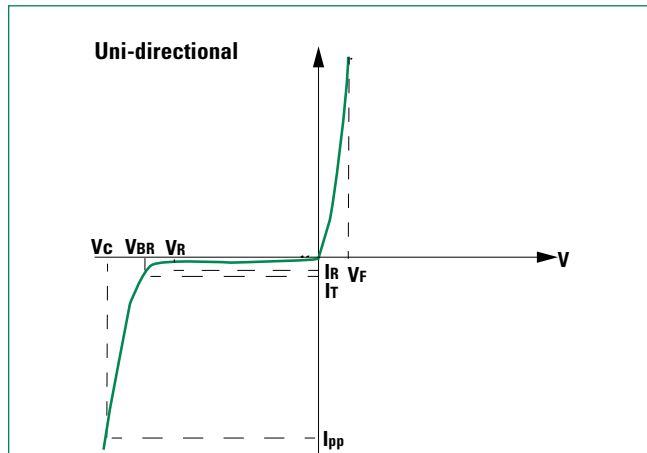
|                                                                                                             |                                   |
|-------------------------------------------------------------------------------------------------------------|-----------------------------------|
| 100% Vision Inspection                                                                                      | MIL-STD-750 method 2074           |
| 100% High Temperature Storage Life (168hrs,175°C)                                                           | MIL-STD-750 method 1031           |
| 100% Temperature Cycle Test (-55 to150°C, 20 cycles, dwell time 15 min)                                     | MIL-STD-750 method 1051           |
| 100% Surge Test (2x)                                                                                        | MIL-STD-750 method 4066           |
| 100% HTRB 150°C Bias=VR(80% breakdown voltage, 96hrs, and each direction 96hrs for Bi-directional products) | MIL-STD-750 method 1038           |
| Final Electrical Test( 100% 3 sigma limit, 100% dynamic test and PAT limit)                                 | MIL-STD-750 method 4016.4021.4011 |

**Note:** Up-screen program can be specified by customer's request via contacting Littelfuse service

### Group B Test Requirement

| Screen           | Method                              | Condition                                                            | Requirement                                                                                                   |
|------------------|-------------------------------------|----------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
| Surge test       | 10/1000 $\mu$ s Peak Pulse Waveform | Maximum clamping Voltage ( $V_C$ ) @ Peak Pulse Current ( $I_{PP}$ ) | Sample Size 45 perform 10x<br>Accept 0 failures                                                               |
| Burn - In (HTRB) | MIL -STD-750, Method 1038.5         | Applied voltage, 100% $V_R$ @150°C                                   | Sample size 45<br>340 hours (680 hours for bi-direction products, each direction 340 hours) Accept 0 failures |
| Electrical test  | —                                   | $I_R$ @ $V_R$ , $V_{(BR)}$ @ $I_T$                                   | Sample size 45<br>Accept 0 failures                                                                           |

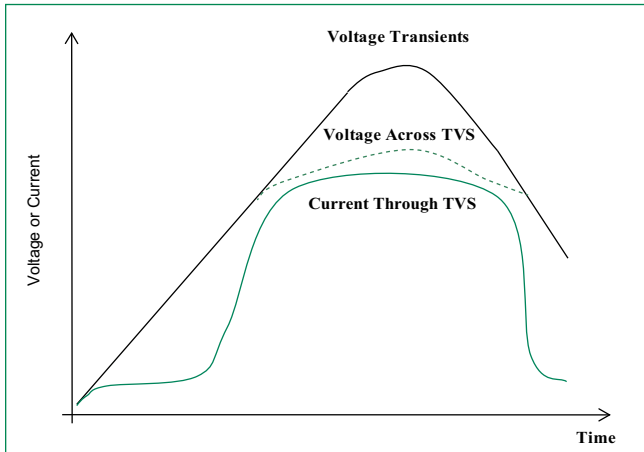
### I-V Curve Characteristics



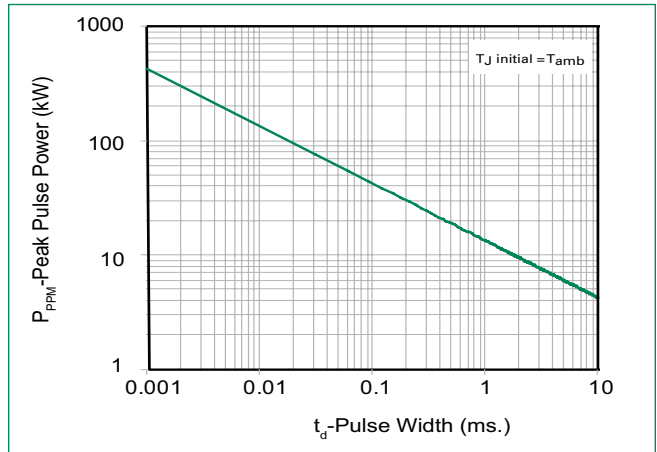
**$P_{PPM}$  Peak Pulse Power Dissipation** -- Max power dissipation  
 **$V_R$  Stand-off Voltage** -- Maximum voltage that can be applied to the TVS without operation  
 **$V_{BR}$  Breakdown Voltage** -- Maximum voltage that flows though the TVS at a specified test current ( $I_T$ )  
 **$V_C$  Clamping 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)

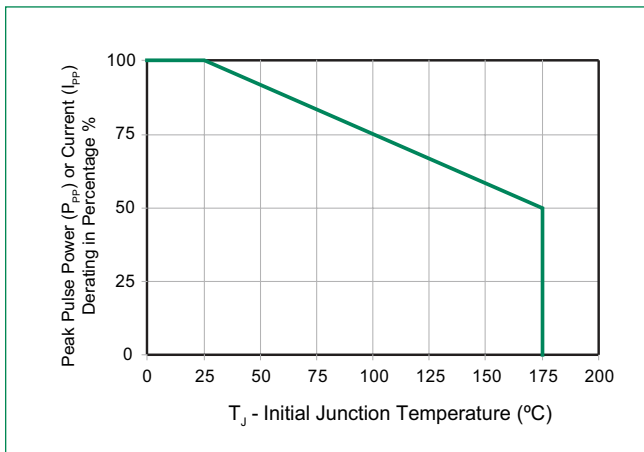
**Figure 1 - TVS Transients Clamping Waveform**



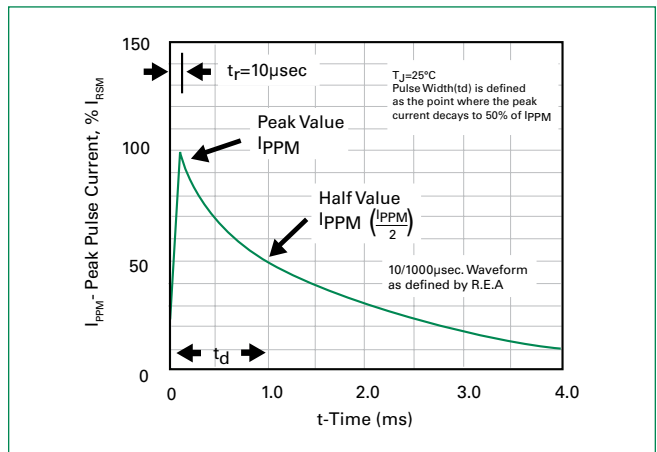
**Figure 2 - Peak Pulse Power Rating Curve**



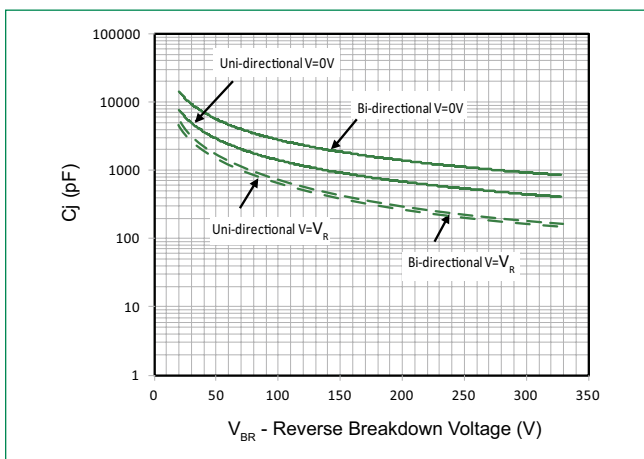
**Figure 3 - Peak Pulse Power Derating Curve**



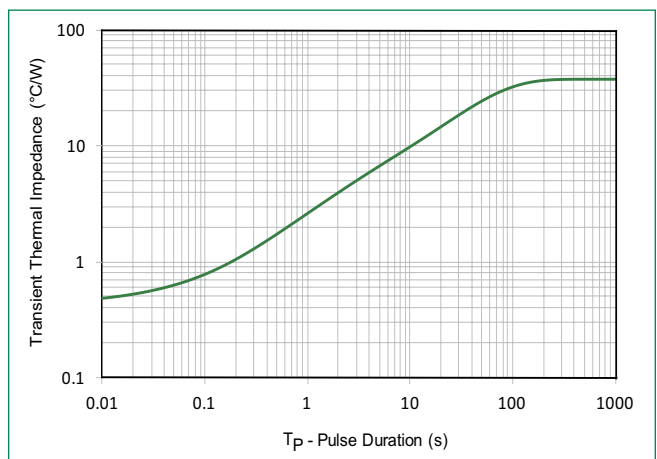
**Figure 4 - Test Pulse Waveform**



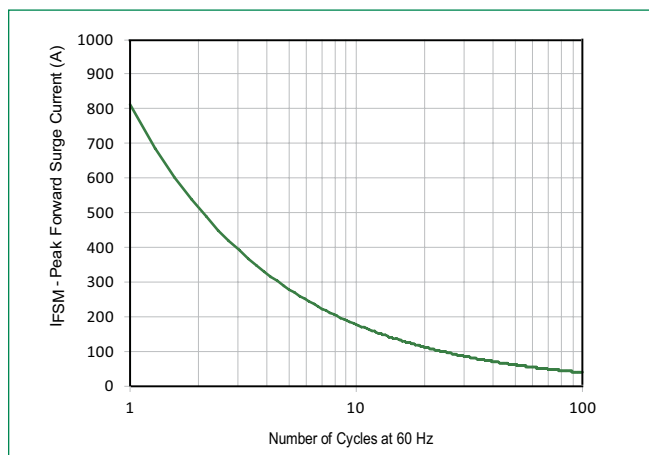
**Figure 5 - Typical Junction Capacitance**



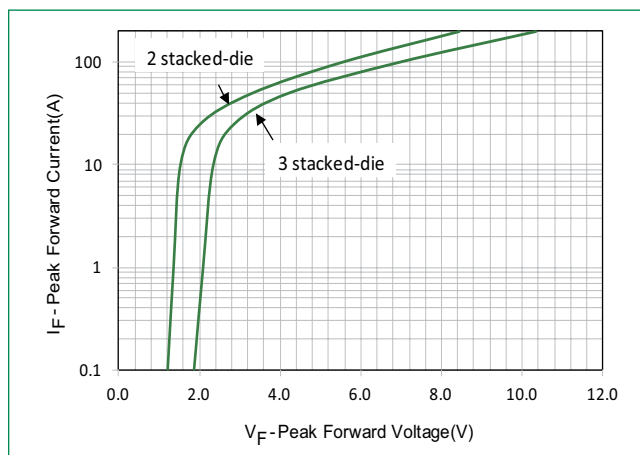
**Figure 6 - Typical Transient Thermal Impedance**



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



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



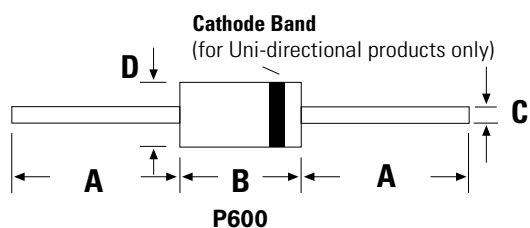
### Physical Specifications

|                 |                                                    |
|-----------------|----------------------------------------------------|
| <b>Weight</b>   | 0.07oz., 2.5g                                      |
| <b>Case</b>     | P600 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

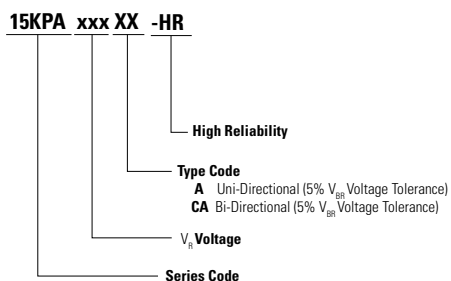


| Dimensions | Inches |       | Millimeters |      |
|------------|--------|-------|-------------|------|
|            | Min    | Max   | Min         | Max  |
| <b>A</b>   | 1.000  | -     | 25.40       | -    |
| <b>B</b>   | 0.340  | 0.360 | 8.60        | 9.10 |
| <b>C</b>   | 0.048  | 0.054 | 1.22        | 1.36 |
| <b>D</b>   | 0.340  | 0.360 | 8.60        | 9.10 |

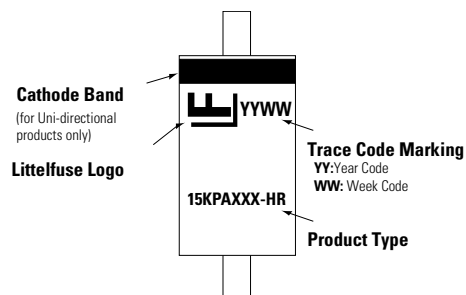
### Packing Options

| Part Number   | Component Package | Quantity | Packaging Option | Packaging Specification |
|---------------|-------------------|----------|------------------|-------------------------|
| 15KPAxxxXX-HR | P600              | 800      | Tape & Reel      | EIA STD RS-296          |

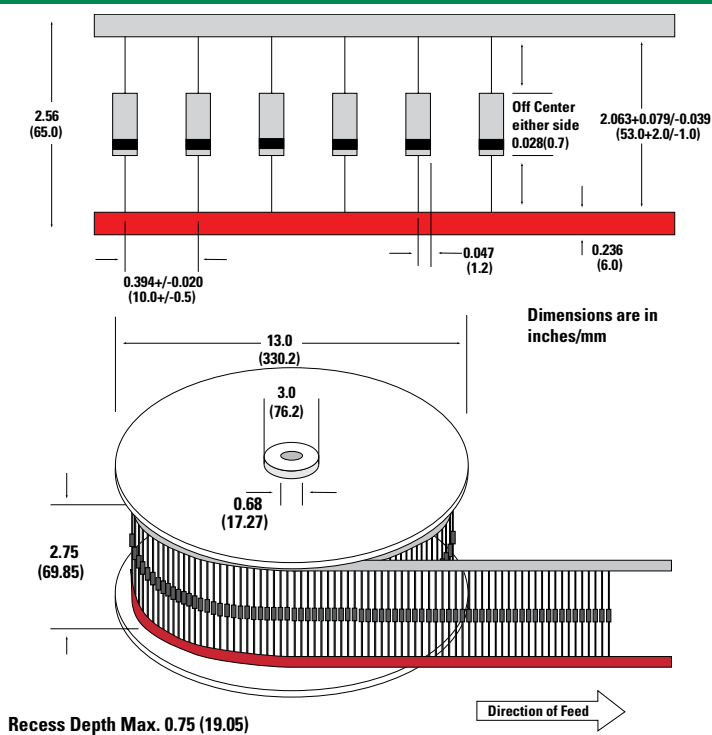
### Part Numbering System



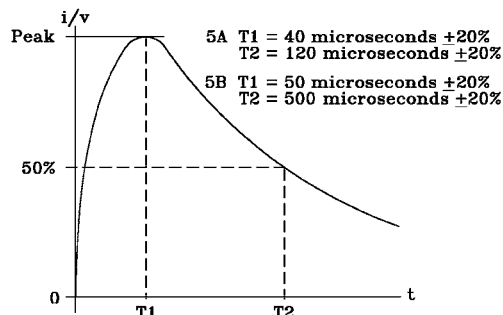
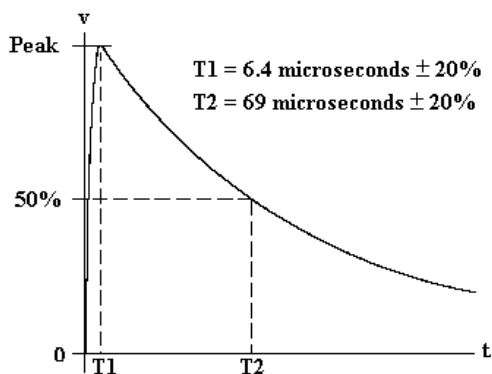
### Part Marking System



### Tape and Reel Specification



### RTCA/DO-160G Wave 4 and Wave 5



### Pin Injection Protection Per RTCA/DO-160G

| Part Number (Uni) | Part Number (Bi) | 25C               |      |      |                    |      |      | 70C               |      |      |                    |      |      | 120C              |      |      |                    |      |      |
|-------------------|------------------|-------------------|------|------|--------------------|------|------|-------------------|------|------|--------------------|------|------|-------------------|------|------|--------------------|------|------|
|                   |                  | Wave 4 (6.4/69us) |      |      | Wave 5a (40/120us) |      |      | Wave 4 (6.4/69us) |      |      | Wave 5a (40/120us) |      |      | Wave 4 (6.4/69us) |      |      | Wave 5a (40/120us) |      |      |
|                   |                  | L3                | L4   | L5   | L3                 | L4   | L5   | L3                | L4   | L5   | L3                 | L4   | L5   | L3                | L4   | L5   | L3                 | L4   | L5   |
|                   |                  | 60A               | 150A | 320A | 300A               | 750A | 60A  | 150A              | 320A | 300A | 750A               | 60A  | 150A | 320A              | 300A | 750A | 60A                | 150A | 320A |
| 15KPA17A-HR       | 15KPA17CA-HR     | pass              | pass | pass | pass               | pass | pass | pass              | pass | pass | pass               | pass | pass | pass              | pass | pass | pass               | pass | pass |
| 15KPA18A-HR       | 15KPA18CA-HR     | pass              | pass | pass | pass               | pass | pass | pass              | pass | pass | pass               | pass | pass | pass              | pass | pass | pass               | pass | pass |
| 15KPA20A-HR       | 15KPA20CA-HR     | pass              | pass | pass | pass               | pass | pass | pass              | pass | pass | pass               | pass | pass | pass              | pass | pass | pass               | pass | pass |
| 15KPA22A-HR       | 15KPA22CA-HR     | pass              | pass | pass | pass               | pass | pass | pass              | pass | pass | pass               | pass | pass | pass              | pass | pass | pass               | pass | pass |
| 15KPA24A-HR       | 15KPA24CA-HR     | pass              | pass | pass | pass               | pass | pass | pass              | pass | pass | pass               | pass | pass | pass              | pass | pass | pass               | pass | -    |
| 15KPA26A-HR       | 15KPA26CA-HR     | pass              | pass | pass | pass               | pass | pass | pass              | pass | pass | pass               | pass | pass | pass              | pass | pass | pass               | pass | -    |
| 15KPA28A-HR       | 15KPA28CA-HR     | pass              | pass | pass | pass               | pass | pass | pass              | pass | pass | pass               | pass | pass | pass              | pass | pass | pass               | pass | -    |
| 15KPA30A-HR       | 15KPA30CA-HR     | pass              | pass | pass | pass               | pass | pass | pass              | pass | pass | pass               | pass | pass | pass              | pass | pass | pass               | pass | -    |
| 15KPA33A-HR       | 15KPA33CA-HR     | pass              | pass | pass | pass               | pass | pass | pass              | pass | pass | pass               | pass | pass | pass              | pass | pass | pass               | pass | -    |
| 15KPA36A-HR       | 15KPA36CA-HR     | pass              | pass | pass | pass               | pass | pass | pass              | pass | pass | pass               | pass | pass | pass              | pass | pass | pass               | pass | -    |
| 15KPA40A-HR       | 15KPA40CA-HR     | pass              | pass | pass | pass               | pass | pass | pass              | pass | pass | pass               | pass | pass | pass              | pass | pass | pass               | pass | -    |
| 15KPA43A-HR       | 15KPA43CA-HR     | pass              | pass | pass | pass               | pass | pass | pass              | pass | pass | pass               | pass | pass | pass              | pass | pass | pass               | pass | -    |
| 15KPA45A-HR       | 15KPA45CA-HR     | pass              | pass | pass | pass               | pass | pass | pass              | pass | pass | pass               | pass | pass | pass              | pass | pass | pass               | pass | -    |
| 15KPA48A-HR       | 15KPA48CA-HR     | pass              | pass | pass | pass               | -    | pass | pass              | pass | pass | pass               | -    | pass | pass              | pass | pass | pass               | pass | -    |
| 15KPA51A-HR       | 15KPA51CA-HR     | pass              | pass | pass | pass               | -    | pass | pass              | pass | pass | pass               | -    | pass | pass              | pass | pass | pass               | pass | -    |
| 15KPA54A-HR       | 15KPA54CA-HR     | pass              | pass | pass | pass               | -    | pass | pass              | pass | pass | pass               | -    | pass | pass              | pass | pass | pass               | pass | -    |
| 15KPA58A-HR       | 15KPA58CA-HR     | pass              | pass | pass | pass               | -    | pass | pass              | pass | pass | pass               | -    | pass | pass              | pass | pass | pass               | pass | -    |
| 15KPA60A-HR       | 15KPA60CA-HR     | pass              | pass | pass | pass               | -    | pass | pass              | pass | -    | -                  | pass | pass | pass              | -    | -    | pass               | pass | -    |
| 15KPA64A-HR       | 15KPA64CA-HR     | pass              | pass | pass | pass               | -    | pass | pass              | pass | -    | -                  | pass | pass | pass              | -    | -    | pass               | pass | -    |
| 15KPA70A-HR       | 15KPA70CA-HR     | pass              | pass | pass | pass               | -    | pass | pass              | pass | -    | -                  | pass | pass | pass              | -    | -    | pass               | pass | -    |
| 15KPA75A-HR       | 15KPA75CA-HR     | pass              | pass | pass | pass               | -    | pass | pass              | pass | -    | -                  | pass | pass | pass              | -    | -    | pass               | pass | -    |
| 15KPA78A-HR       | 15KPA78CA-HR     | pass              | pass | pass | pass               | -    | pass | pass              | pass | -    | -                  | pass | pass | pass              | -    | -    | pass               | pass | -    |
| 15KPA85A-HR       | 15KPA85CA-HR     | pass              | pass | pass | pass               | -    | pass | pass              | pass | -    | -                  | pass | pass | pass              | -    | -    | pass               | pass | -    |
| 15KPA90A-HR       | 15KPA90CA-HR     | pass              | pass | pass | pass               | -    | pass | pass              | pass | -    | -                  | pass | pass | pass              | -    | -    | pass               | pass | -    |
| 15KPA100A-HR      | 15KPA100CA-HR    | pass              | pass | pass | -                  | -    | pass | pass              | pass | -    | -                  | pass | pass | pass              | -    | -    | pass               | pass | -    |
| 15KPA110A-HR      | 15KPA110CA-HR    | pass              | pass | pass | -                  | -    | pass | pass              | pass | -    | -                  | pass | pass | pass              | -    | -    | pass               | pass | -    |
| 15KPA120A-HR      | 15KPA120CA-HR    | pass              | pass | pass | -                  | -    | pass | pass              | pass | -    | -                  | pass | pass | pass              | -    | -    | pass               | pass | -    |
| 15KPA130A-HR      | 15KPA130CA-HR    | pass              | pass | pass | -                  | -    | pass | pass              | pass | -    | -                  | pass | pass | -                 | -    | -    | pass               | pass | -    |
| 15KPA150A-HR      | 15KPA150CA-HR    | pass              | pass | pass | -                  | -    | pass | pass              | pass | -    | -                  | pass | pass | -                 | -    | -    | pass               | pass | -    |
| 15KPA160A-HR      | 15KPA160CA-HR    | pass              | pass | pass | -                  | -    | pass | pass              | -    | -    | -                  | pass | pass | -                 | -    | -    | pass               | pass | -    |
| 15KPA170A-HR      | 15KPA170CA-HR    | pass              | pass | pass | -                  | -    | pass | pass              | -    | -    | -                  | pass | pass | -                 | -    | -    | pass               | pass | -    |
| 15KPA180A-HR      | 15KPA180CA-HR    | pass              | pass | pass | -                  | -    | pass | pass              | -    | -    | -                  | pass | -    | -                 | -    | -    | pass               | -    | -    |
| 15KPA200A-HR      | 15KPA200CA-HR    | pass              | pass | pass | -                  | -    | pass | pass              | -    | -    | -                  | pass | -    | -                 | -    | -    | pass               | -    | -    |
| 15KPA220A-HR      | 15KPA220CA-HR    | pass              | pass | pass | -                  | -    | pass | -                 | -    | -    | -                  | pass | -    | -                 | -    | -    | pass               | -    | -    |
| 15KPA240A-HR      | 15KPA240CA-HR    | pass              | pass | pass | -                  | -    | pass | -                 | -    | -    | -                  | pass | -    | -                 | -    | -    | pass               | -    | -    |
| 15KPA260A-HR      | 15KPA260CA-HR    | pass              | pass | -    | -                  | -    | pass | -                 | -    | -    | -                  | pass | -    | -                 | -    | -    | pass               | -    | -    |
| 15KPA280A-HR      | 15KPA280CA-HR    | pass              | pass | -    | -                  | -    | pass | -                 | -    | -    | -                  | pass | -    | -                 | -    | -    | pass               | -    | -    |

**Note:**

1. L1 = Level 1, L2 = Level 2, L3 = Level 3, L4 = Level 4, L5 = Level 5