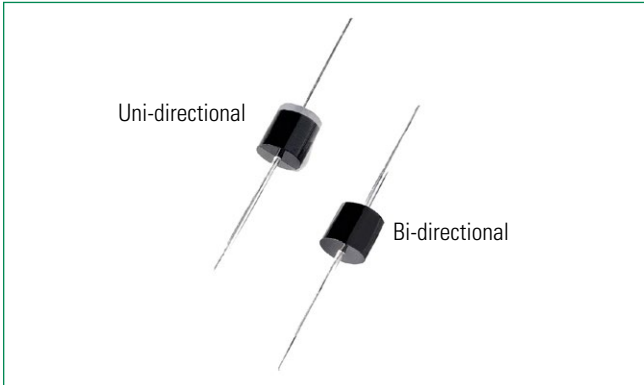


**5KP-HR Series**



**Agency Approvals**

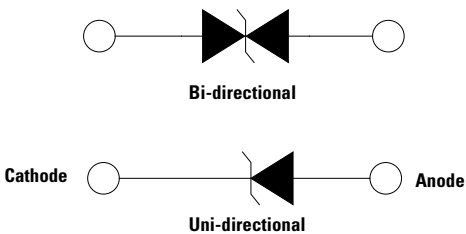
Agency	Agency File Number
	E230531

**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>	5	kW
Steady State Power Dissipation on Infinite Heat Sink at T <sub>J</sub> = 75°C	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
Maximum Instantaneous Forward Voltage at 100A for Unidirectional Only (Note 3)	V <sub>F</sub>	3.5/5.0	V
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.
  3. V<sub>F</sub> < 3.5V for single die parts and V<sub>F</sub> < 5.0V for stacked-die parts.

**Functional Diagram**



**Description**

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


**Features**

- 5 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 > 12V
- 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<sub>A</sub>=25°C unless otherwise noted)

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

**Note:**

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

### Screen Process

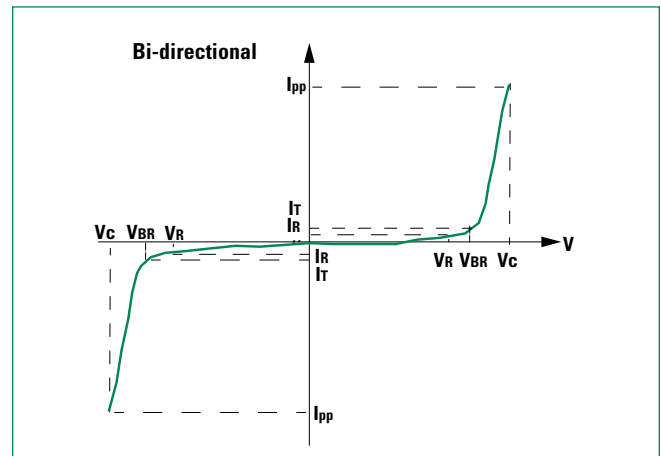
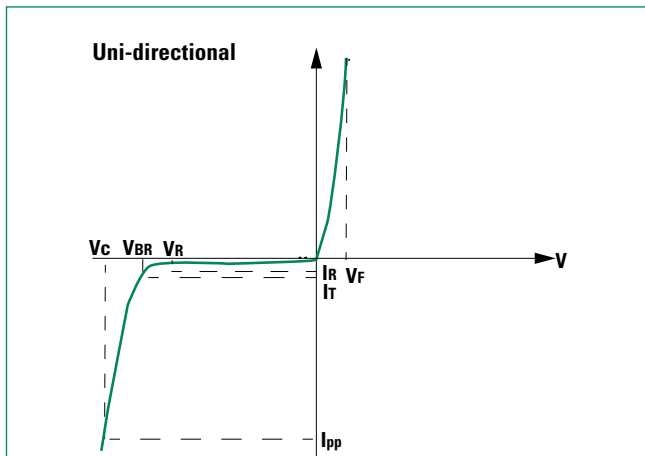
<b>100% Vision Inspection</b>	MIL-STD-750 method 2074
<b>100% High Temperature Storage Life (168hrs,175°C)</b>	MIL-STD-750 method 1031
<b>100% Temperature Cycle Test (-55 to150°C, 20 cycles, dwell time 15 min)</b>	MIL-STD-750 method 1051
<b>100% Surge Test (2x)</b>	MIL-STD-750 method 4066
<b>100% HTRB 150°C Bias=VR(80% breakdown voltage, 96hrs, and each direction 96hrs for Bi-directional products)</b>	MIL-STD-750 method 1038
<b>Final Electrical Test( 100% 3 sigma limit, 100% dynamic test and PAT limit)</b>	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 Accept 0 failures
Burn - In (HTRB)	MIL -STD-750, Method 1038.5	Applied voltage 100% $V_R$ @150°C	Sample size 45 340 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 Accept 0 failures

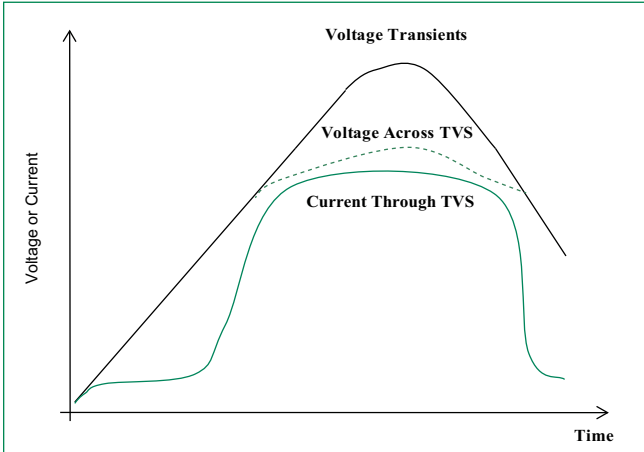
### I-V Curve Characteristics



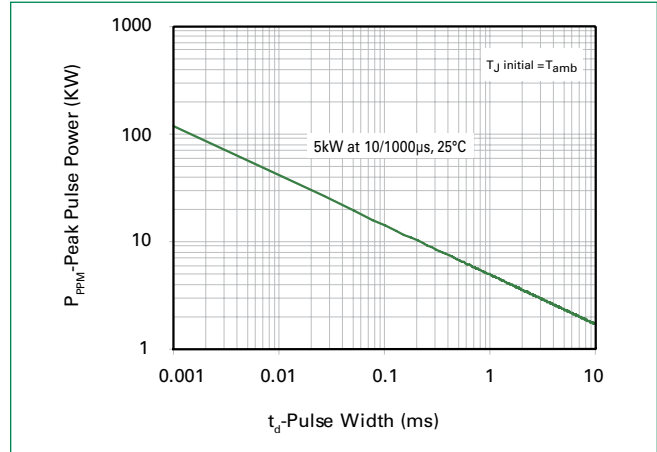
- $P_{PPM}$  **Peak Pulse Power Dissipation** – Max power dissipation
- $V_R$  **Stand-off Voltage** – Maximum voltage that can be applied to the TVS without operation
- $V_{BR}$  **Breakdown Voltage** – Maximum voltage that flows through the TVS at a specified test current ( $I_T$ )
- $V_C$  **Clamping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

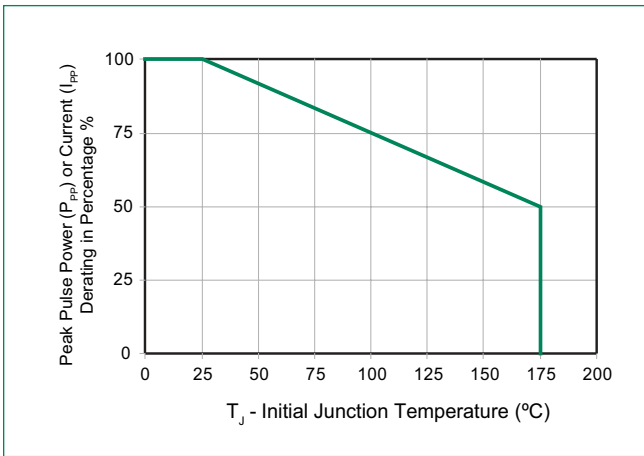
**Figure 1 - TVS Transients Clamping Waveform**



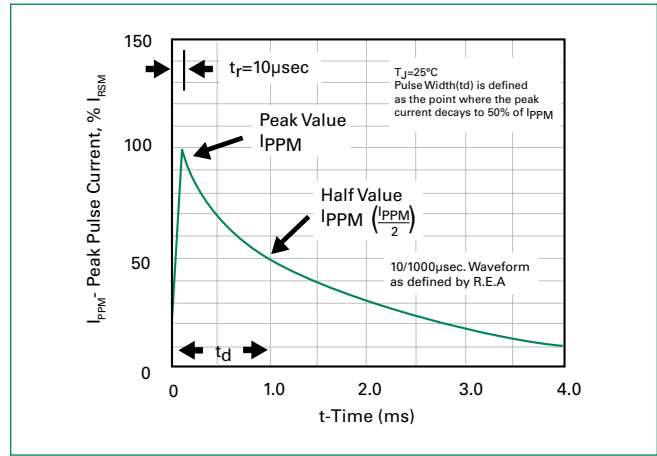
**Figure 2 - Peak Pulse Power Rating Curve**



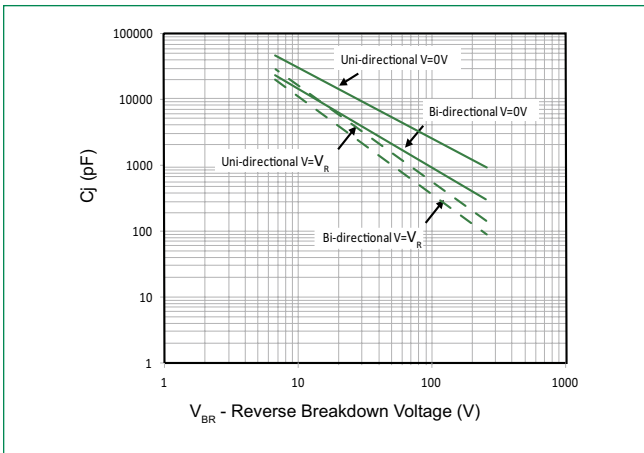
**Figure 3 - Peak Pulse Power Derating Curve**



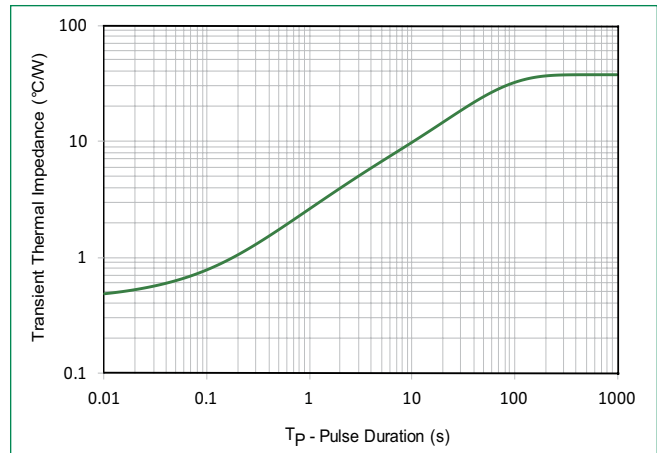
**Figure 4 - Pulse Waveform**



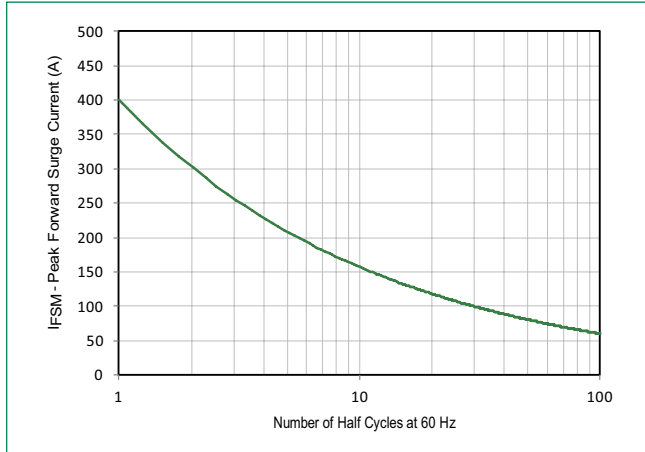
**Figure 5 - Typical Junction Capacitance**



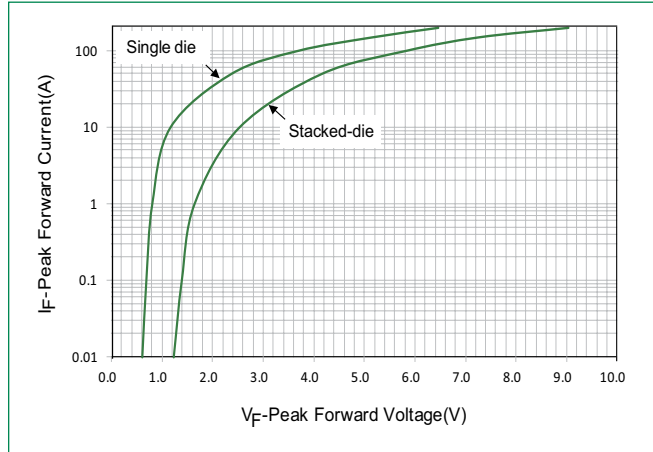
**Figure 6 - Typical Transient Thermal Impedance**



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



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



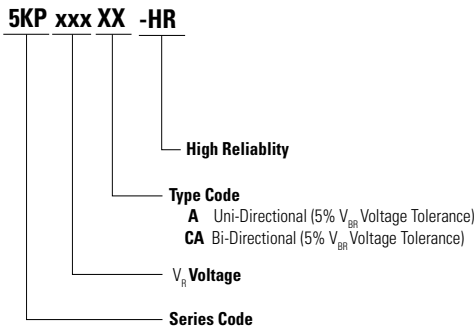
**Physical Specifications**

<b>Weight</b>	0.07oz., 2.1g
<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.

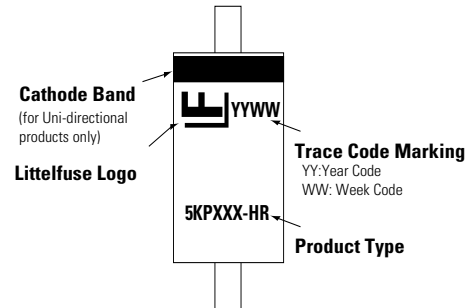
**Environmental Specifications**

<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

**Part Numbering System**



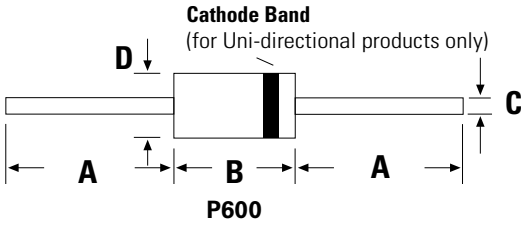
**Part Marking System**



**Packing Options**

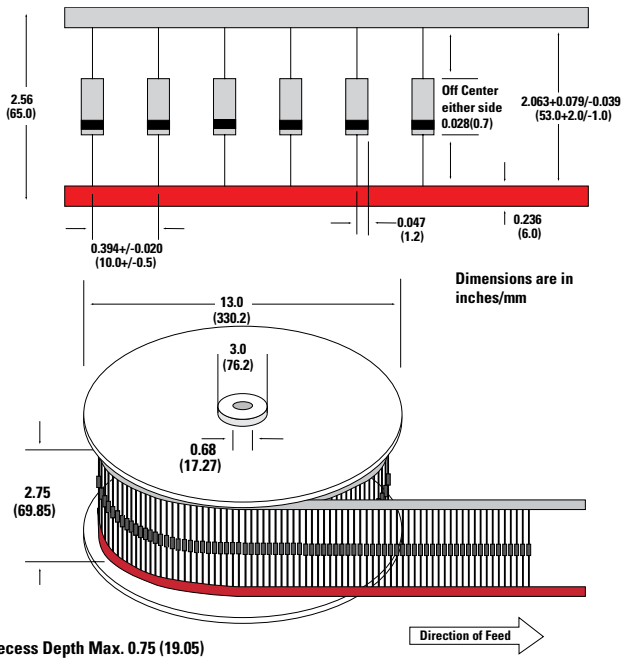
Part Number	Component Package	Quantity	Packaging Option	Packaging Specification
5KPxxxXX-HR	P600	800	Tape & Reel	EIA STD RS-296

**Dimensions**

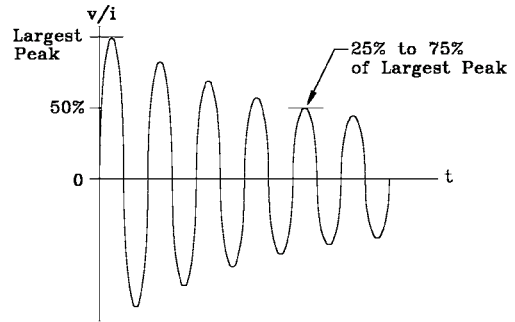


Dimensions	Inches		Millimeters	
	Min	Max	Min	Max
<b>A</b>	1.000	-	25.40	-
<b>B</b>	0.340	0.360	8.60	9.10
<b>C</b>	0.048	0.054	1.22	1.36
<b>D</b>	0.340	0.360	8.60	9.10

**Tape and Reel Specification**

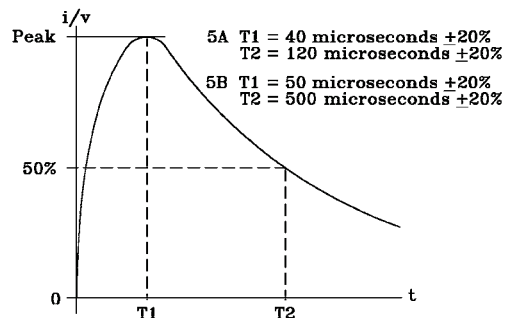
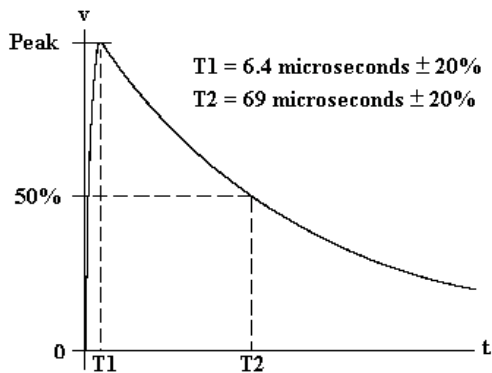


**RTCA/DO-160G Wave 3**



- Notes:
1. Voltage and current are not required to be in phase.
  2. The waveshape may have either a damped sine or cosine waveshape.

**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 3	Wave 4 (6.4/69us)				Wave 5a (40/120us)				Wave 3	Wave 4 (6.4/69us)			Wave 5a (40/120us)		Wave 3	Wave 4 (6.4/69us)			Wave 5a (40/120us)	
		L5	L3	L4	L5	L3	L4	L5	L5	L3	L4	L5	L3	L4	L5	L3	L4	L5	L3	L4		
		128A	60A	150A	320A	300A	750A	1600A	128A	60A	150A	320A	300A	750A	128A	60A	150A	320A	300A	750A		
5KP5.0A-HR	5KP5.0CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP6.0A-HR	5KP6.0CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP6.5A-HR	5KP6.5CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP7.0A-HR	5KP7.0CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP7.5A-HR	5KP7.5CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP8.0A-HR	5KP8.0CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP8.5A-HR	5KP8.5CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP9.0A-HR	5KP9.0CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP10A-HR	5KP10CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP11A-HR	5KP11CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP12A-HR	5KP12CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP13A-HR	5KP13CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP14A-HR	5KP14CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP15A-HR	5KP15CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP16A-HR	5KP16CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP17A-HR	5KP17CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP18A-HR	5KP18CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP20A-HR	5KP20CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP22A-HR	5KP22CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP24A-HR	5KP24CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
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5KP33A-HR	5KP33CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP36A-HR	5KP36CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP40A-HR	5KP40CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP43A-HR	5KP43CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP45A-HR	5KP45CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP48A-HR	5KP48CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP51A-HR	5KP51CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP54A-HR	5KP54CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP58A-HR	5KP58CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP60A-HR	5KP60CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP64A-HR	5KP64CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP70A-HR	5KP70CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP75A-HR	5KP75CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP78A-HR	5KP78CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP85A-HR	5KP85CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP90A-HR	5KP90CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP100A-HR	5KP100CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP110A-HR	5KP110CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP120A-HR	5KP120CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP130A-HR	5KP130CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP150A-HR	5KP150CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP160A-HR	5KP160CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP170A-HR	5KP170CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP180A-HR	5KP180CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP190A-HR	5KP190CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP200A-HR	5KP200CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP210A-HR	5KP210CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		
5KP220A-HR	5KP220CA-HR	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass		

**Note:**

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