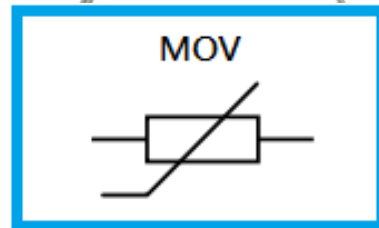


## PVR05D Series MOV Devices

### Features

- Wide operating voltages ranging from 10 V<sub>RMS</sub> to 460 V<sub>RMS</sub> (14 V<sub>DC</sub> to 615 V<sub>DC</sub>).
- Fast response time of less than 25 ns, instantly clamping the transient over voltage.
- High surge current handling capability.
- High energy absorption capability.
- Low clamping voltages, providing better surge protection.
- Low capacitance values, providing digital switching circuitry protection.
- High insulation resistance, preventing electric arcing to the adjacent devices or circuits.



### Applications

- Transistor, diode, IC, thyristor or triac semiconductor protection.
- Surge protection in consumer electronics.
- Surge protection in industrial electronics.
- Surge protection in electronic home appliances, gas and petroleum appliances.
- Relay and electromagnetic valve surge absorption.

### Agency Approval

- UL file no.: E474915
- VDE file no.: 40028836
- CQC file no.: 12001078540 and 19001211516

### General Characteristics Definition

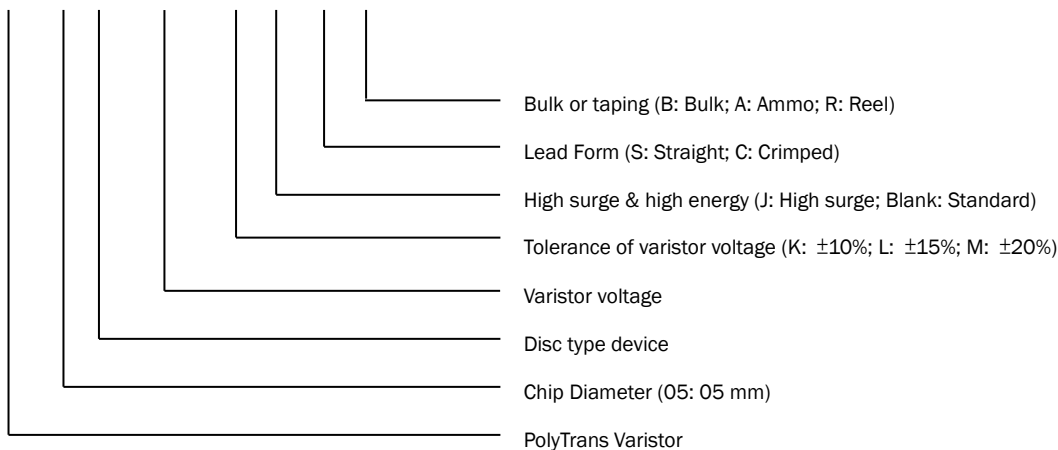
- Operating temperature: -40 ~ 125°C
- Storage temperature: -40 ~ 125°C
- Working surface temperature: 115°C
- Insulation resistance: >100 MΩ
- Coating (Epoxy resin): Flame-Retardant to UL 94 V-0

### Material

- Coating: Epoxy resin
- Lead wire: Tin plated copper
- Electrode: Silver solder
- Disk: Zinc oxide

### Part Number Code

PVR 05 D □□□ □ □- □ □



## PVR05D Series MOV Devices

### Electrical Characteristics (Standard Product)

Part Number	Max Allowable Voltage		Varistor Voltage $V_b$ @ 1 mA	Energy 10/1000 $\mu$ s (J)	Withstand Surge Current 8/20 $\mu$ s (A)	Rated Power (W)	Max Leakage Current @ $V_{DC}$ ( $\mu$ A)	Max Clamping Voltage		Typical Capacitance (pF)
	$V_{RMS}$	$V_{DC}$						V	I	
	(V)	(V)						(V)	(A)	
PVR05D180L	10	14	18	0.4	100	0.01	30	38	1.0	1400
PVR05D220K	14	18	22	0.6	100	0.01	30	43	1.0	1150
PVR05D270K	17	22	27	0.7	100	0.01	30	53	1.0	930
PVR05D330K	20	26	33	0.8	100	0.01	30	65	1.0	760
PVR05D390K	25	31	39	1.1	100	0.01	30	77	1.0	640
PVR05D470K	30	38	47	1.4	100	0.01	30	93	1.0	530
PVR05D560K	35	45	56	1.5	100	0.01	30	110	1.0	450
PVR05D680K	40	56	68	1.8	100	0.01	30	135	1.0	370
PVR05D820K	50	65	82	2.6	400	0.10	20	135	10.0	300
PVR05D101K	60	85	100	2.8	400	0.10	20	165	10.0	250
PVR05D121K	75	100	120	4.2	400	0.10	20	200	10.0	210
PVR05D151K	95	125	150	4.2	400	0.10	20	250	10.0	165
PVR05D181K	115	150	180	5.6	400	0.10	20	300	10.0	140
PVR05D201K	130	170	200	7.7	400	0.10	20	330	10.0	125
PVR05D221K	140	180	220	8.8	400	0.10	20	360	10.0	110
PVR05D241K	150	200	240	9.8	400	0.10	20	395	10.0	100
PVR05D271K	175	225	270	10.5	400	0.10	20	455	10.0	95
PVR05D301K	190	250	300	11.8	400	0.10	20	505	10.0	85
PVR05D331K	210	275	330	14.0	400	0.10	20	550	10.0	75
PVR05D361K	230	300	360	14.0	400	0.10	20	595	10.0	70
PVR05D391K	250	320	390	15.4	400	0.10	20	650	10.0	65
PVR05D431K	275	350	430	16.8	400	0.10	20	710	10.0	60
PVR05D471K	300	385	470	18.2	400	0.10	20	775	10.0	55
PVR05D511K	320	415	510	19.6	400	0.10	20	845	10.0	50
PVR05D561K	350	460	560	19.6	400	0.10	20	920	10.0	45
PVR05D621K	385	505	620	21.0	400	0.10	20	1025	10.0	40
PVR05D681K	420	560	680	21.0	400	0.10	20	1120	10.0	35
PVR05D751K	460	615	750	22.4	400	0.10	20	1240	10.0	30

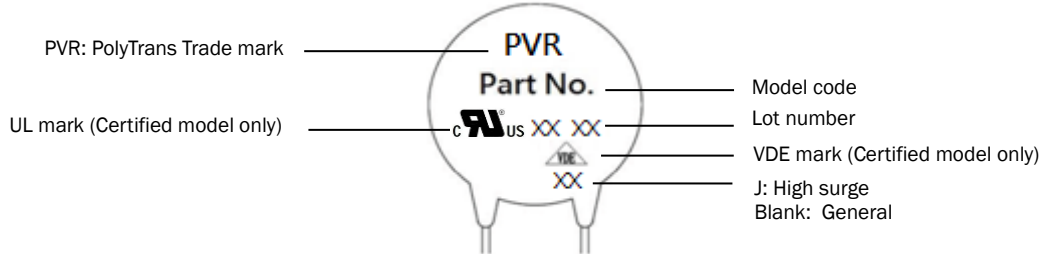
## PVR05D Series MOV Devices

### Electrical Characteristics (High Surge Product)

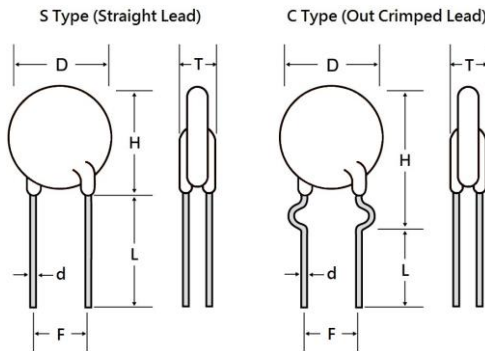
Part Number	Max Allowable Voltage		Varistor Voltage $V_b$ @ 1 mA	Energy 10/1000 $\mu$ s (J)	Withstand Surge Current 8/20 $\mu$ s (A)	Rated Power (W)	Max Leakage Current @ $V_{DC}$ ( $\mu$ A)	Max Clamping Voltage		Typical Capacitance (pF)
	$V_{RMS}$	$V_{DC}$						V	I	
	(V)	(V)						(V)	(A)	
PVR05D180LJ	10	14	18	0.6	250	0.01	30	38	1.0	1400
PVR05D220KJ	14	18	22	0.7	250	0.01	30	43	1.0	1150
PVR05D270KJ	17	22	27	0.9	250	0.01	30	53	1.0	930
PVR05D330KJ	20	26	33	1.1	250	0.01	30	65	1.0	760
PVR05D390KJ	25	31	39	1.2	250	0.01	30	77	1.0	640
PVR05D470KJ	30	38	47	1.5	250	0.01	30	93	1.0	530
PVR05D560KJ	35	45	56	1.8	250	0.01	30	110	1.0	450
PVR05D680KJ	40	56	68	2.2	250	0.01	30	135	1.0	370
PVR05D820KJ	50	65	82	3.8	800	0.10	20	135	10.0	300
PVR05D101KJ	60	85	100	4.0	800	0.10	20	165	10.0	250
PVR05D121KJ	75	100	120	5.0	800	0.10	20	200	10.0	210
PVR05D151KJ	95	125	150	7.0	800	0.10	20	250	10.0	165
PVR05D181KJ	115	150	180	8.0	800	0.10	20	300	10.0	140
PVR05D201KJ	130	170	200	8.7	800	0.10	20	330	10.0	125
PVR05D221KJ	140	180	220	9.0	800	0.10	20	360	10.0	110
PVR05D241KJ	150	200	240	11.0	800	0.10	20	395	10.0	100
PVR05D271KJ	175	225	270	13.0	800	0.10	20	455	10.0	95
PVR05D301KJ	190	250	300	14.0	800	0.10	20	505	10.0	85
PVR05D331KJ	210	275	330	14.5	800	0.10	20	550	10.0	75
PVR05D361KJ	230	300	360	16.0	800	0.10	20	595	10.0	70
PVR05D391KJ	250	320	390	17.0	800	0.10	20	650	10.0	65
PVR05D431KJ	275	350	430	20.0	800	0.10	20	710	10.0	60
PVR05D471KJ	300	385	470	20.8	800	0.10	20	775	10.0	55
PVR05D511KJ	320	415	510	21.0	800	0.10	20	845	10.0	50
PVR05D561KJ	350	460	560	23.0	800	0.10	20	920	10.0	45
PVR05D621KJ	385	505	620	25.0	800	0.10	20	1025	10.0	40
PVR05D681KJ	420	560	680	29.0	800	0.10	20	1120	10.0	35
PVR05D751KJ	460	615	750	32.0	800	0.10	20	1240	10.0	30

## PVR05D Series MOV Devices

### Marking Definitions



### Physical Dimensions



Symbol	Dimension	
	(mm)	
D	7.0 max.	
H	S type	10.0 max.
	C type	12.0 max.
L	15.0 min.	
F	5.0±0.8	
d	0.6±0.05	

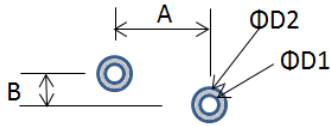
Part Number	T (Max)
	(mm)
PVR05D180L	3.8
PVR05D220K	3.8
PVR05D270K	3.9
PVR05D330K	3.9
PVR05D390K	4.1
PVR05D470K	4.1
PVR05D560K	4.5
PVR05D680K	4.5
PVR05D820K	4.1
PVR05D101K	4.3
PVR05D121K	4.5

Part Number	T (Max)
	(mm)
PVR05D151K	4.8
PVR05D181K	4.1
PVR05D201K	4.1
PVR05D221K	4.2
PVR05D241K	4.3
PVR05D271K	4.5
PVR05D301K	4.7
PVR05D331K	4.8
PVR05D361K	5.0
PVR05D391K	5.1
PVR05D431K	5.3

Part Number	T (Max)
	(mm)
PVR05D471K	5.6
PVR05D511K	5.8
PVR05D561K	6.2
PVR05D621K	6.4
PVR05D681K	6.4
PVR05D751K	6.5

## PVR05D Series MOV Devices

### Recommended Pad Layout



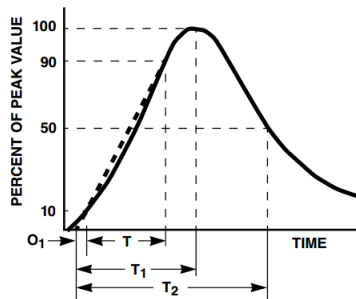
Symbol	Dimension (mm)
A	5.0 typ.
ΦD1	1.0 typ.
ΦD2	2.5 typ.

Part Number	B (Typ) (mm)
PVR05D180L	1.3
PVR05D220K	1.4
PVR05D270K	1.6
PVR05D330K	1.8
PVR05D390K	2.0
PVR05D470K	2.1
PVR05D560K	2.2
PVR05D680K	1.5
PVR05D820K	1.6
PVR05D101K	1.6
PVR05D121K	1.7

Part Number	B (Typ) (mm)
PVR05D151K	1.8
PVR05D181K	1.6
PVR05D201K	1.6
PVR05D221K	1.7
PVR05D241K	1.8
PVR05D271K	1.8
PVR05D301K	1.8
PVR05D331K	1.9
PVR05D361K	2.1
PVR05D391K	2.2
PVR05D431K	2.4

Part Number	B (Typ) (mm)
PVR05D471K	2.5
PVR05D511K	2.7
PVR05D561K	2.9
PVR05D621K	3.2
PVR05D681K	3.4
PVR05D751K	3.7

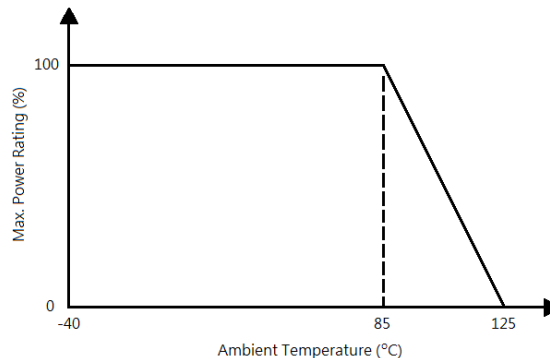
### Peak Pulse Current Test Waveform



$O_1$  = Virtual Origin of Wave  
 $T$  = Time from 10% to 90% of Peak  
 $T_1$  = Rise Time =  $1.25 \times T$   
 $T_2$  = Decay Time

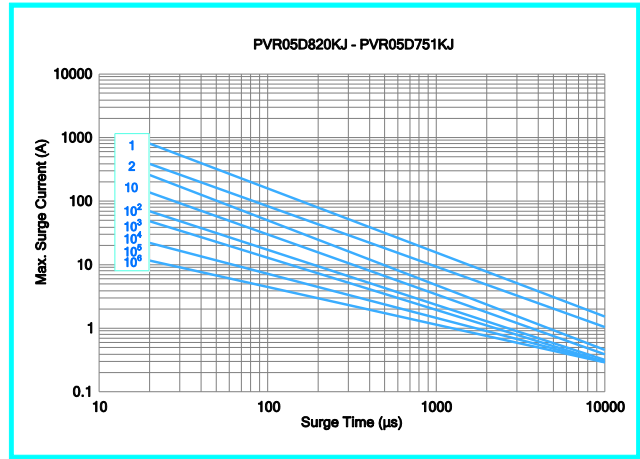
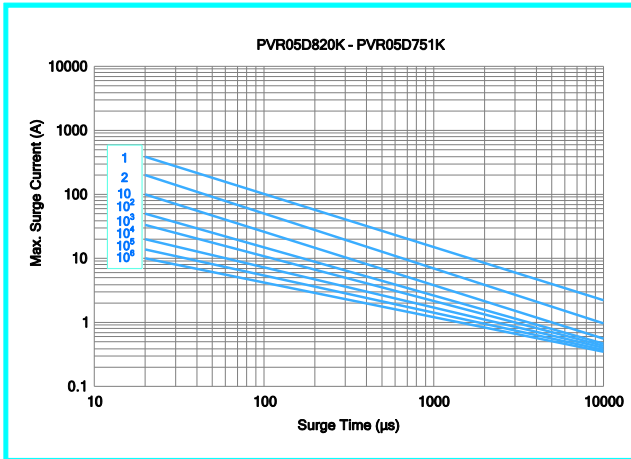
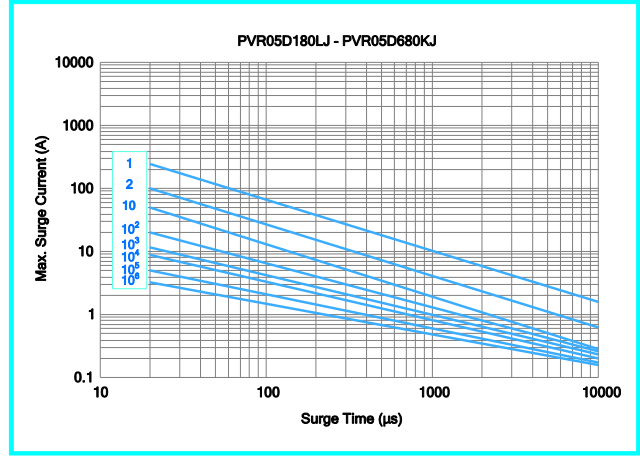
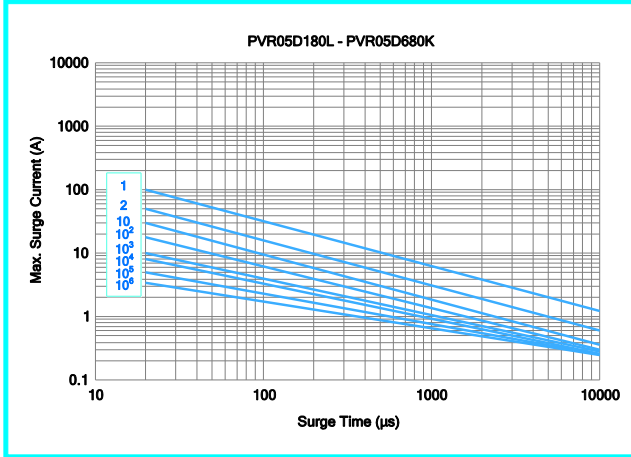
**Example** - For an 8/20  $\mu$ s current waveform  
 $8 \mu$ s =  $T_1$  = Rise Time  
 $20 \mu$ s =  $T_2$  = Decay Time

### Power Derating Curve



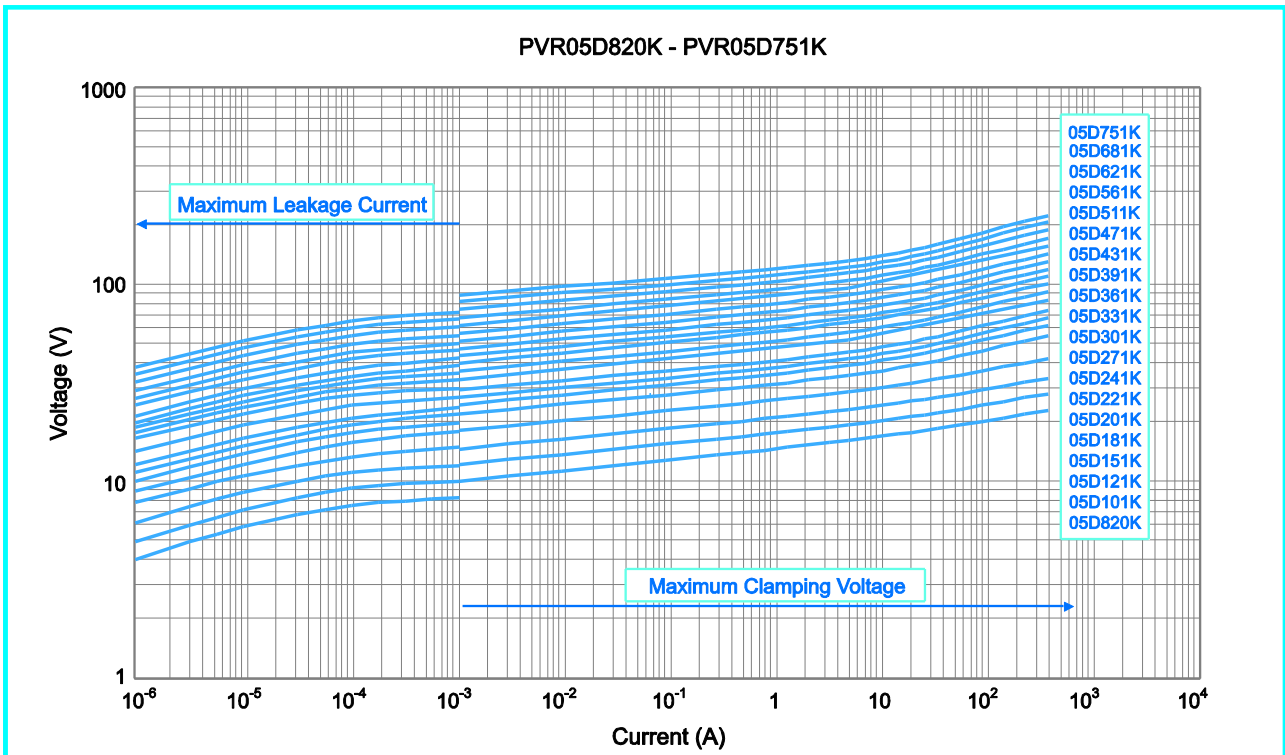
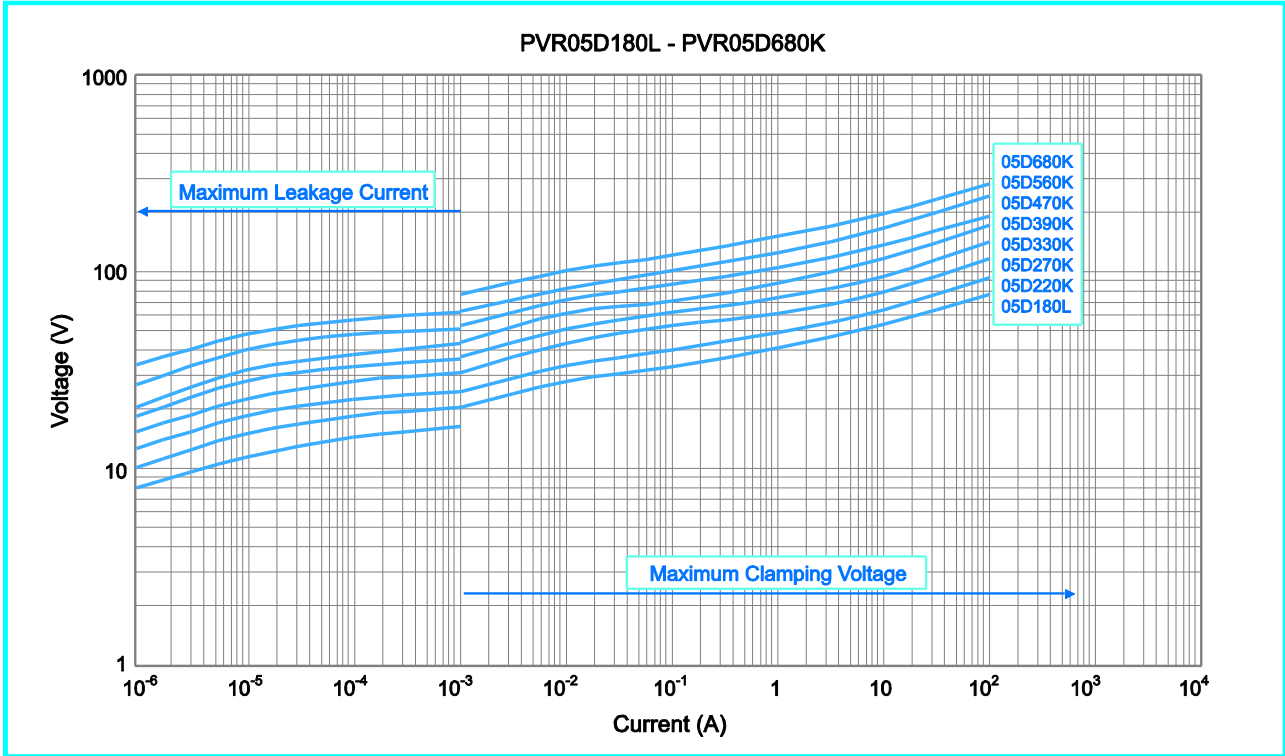
## PVR05D Series MOV Devices

### Pulse Rating Curves



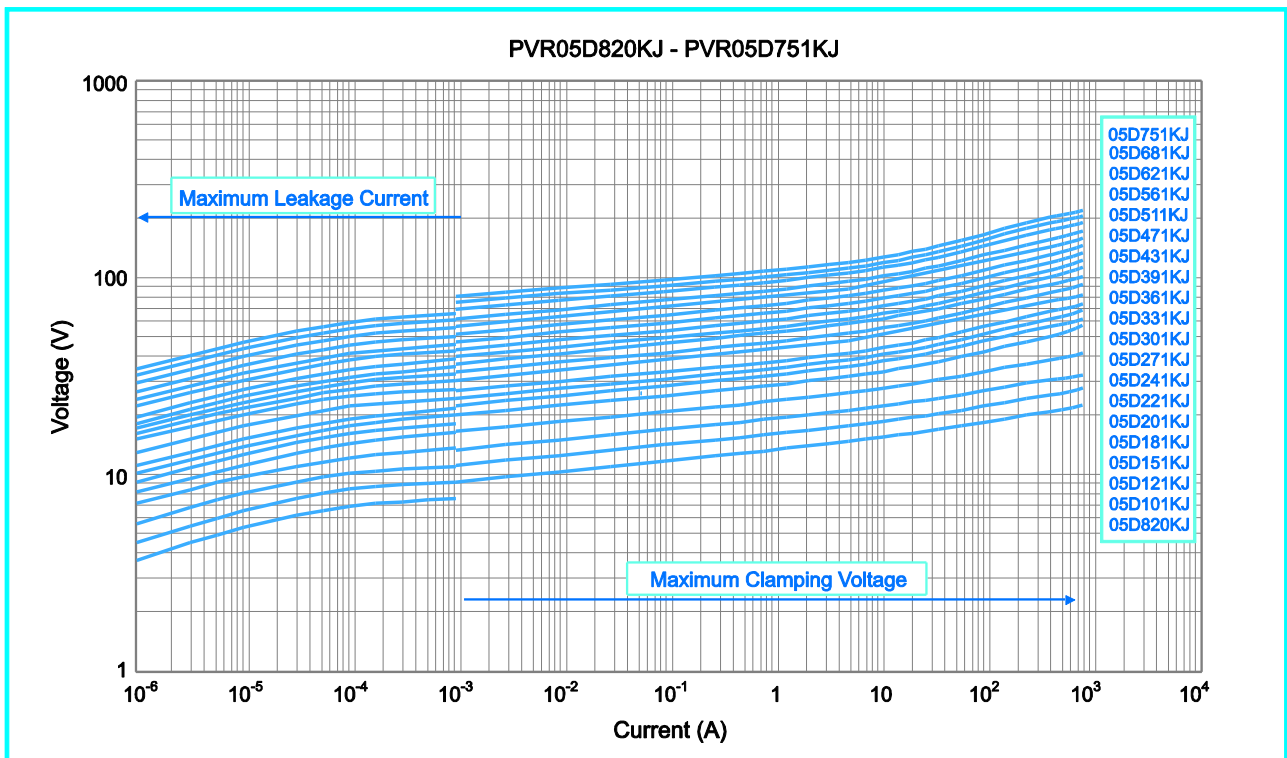
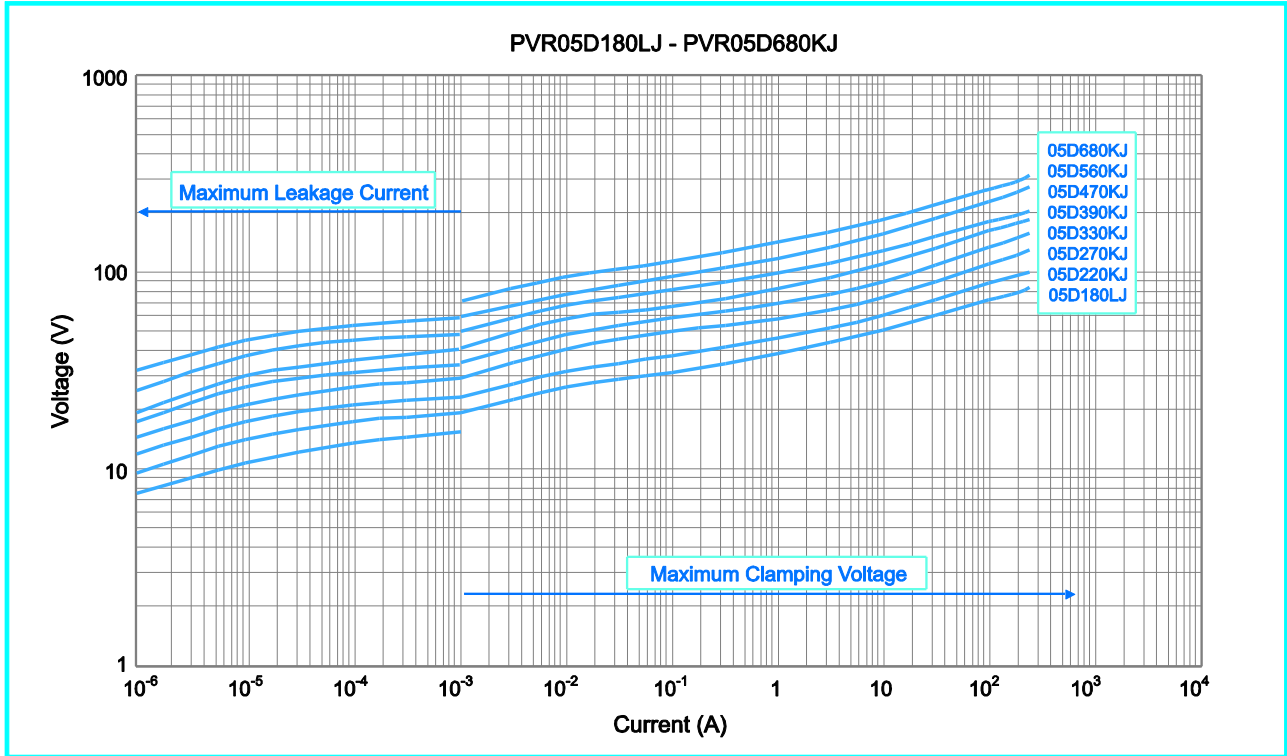
## PVR05D Series MOV Devices

### V-I Characteristics Curves



## PVR05D Series MOV Devices

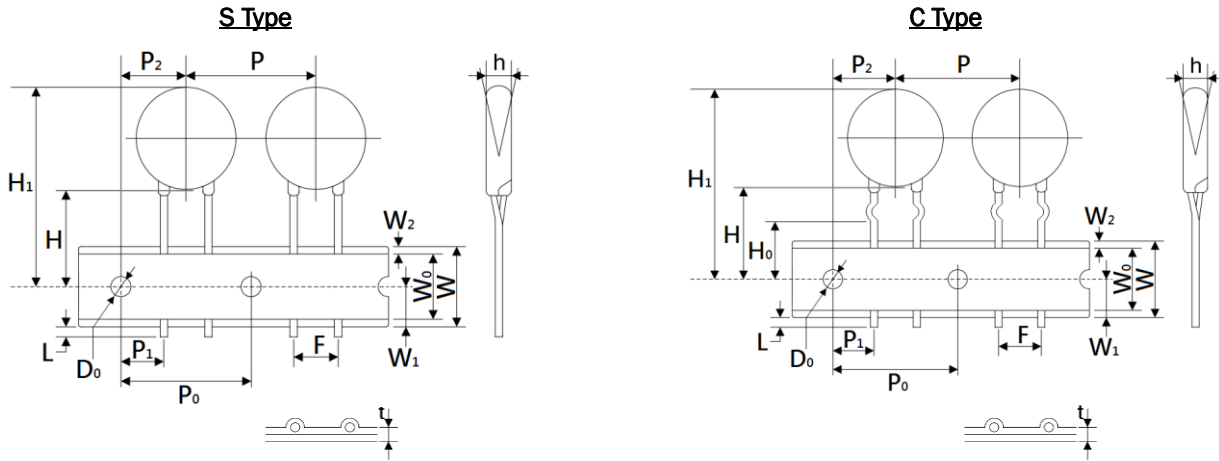
### V-I Characteristics Curves





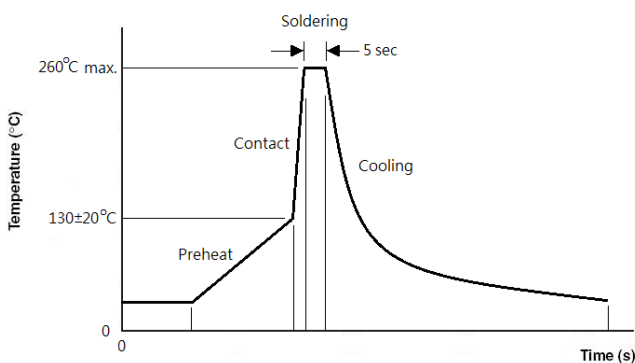
## PVR05D Series MOV Devices

### Taping Dimensions



Symbol	Dimension	Symbol	Dimension
	(mm)		(mm)
P	12.7±1.0	W <sub>2</sub>	3.0 max.
P <sub>0</sub>	12.7±0.3	H	20.0±2.0
P <sub>1</sub>	3.85±0.7	H <sub>0</sub>	16.0±1.0
P <sub>2</sub>	6.35±1.3	H <sub>1</sub>	29.0 max.
F	5.0±0.8	h	0±0.2
W	18.0±1.0	L	1.0 max.
W <sub>0</sub>	12.5 max.	D <sub>0</sub>	4.0±0.2
W <sub>1</sub>	9.0±0.5	t	0.6±0.3

### Lead Free Wave Soldering Recommendations

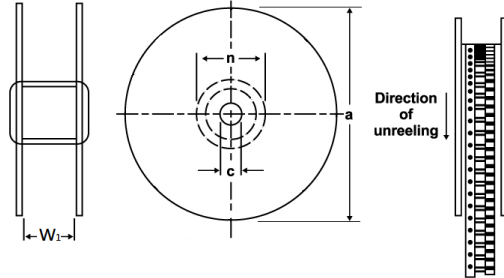


<b>Preheat</b>	
- Temperature Min (T <sub>s_min</sub> )	110°C
- Temperature Max (T <sub>s_max</sub> )	150°C
- Time (T <sub>s_min</sub> to T <sub>s_max</sub> )	30-90 seconds
- Average Ramp-Up Rate	1~3°C/second
<b>Peak Temperature</b>	260°C
<b>Max Time at Peak Temperature</b>	5 seconds
<b>Ramp-Down Rate</b>	5 °C /second max.

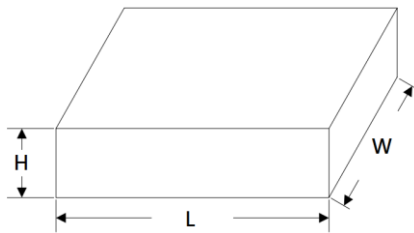
**Note:** If the wave soldering temperatures exceed the recommended profile, devices may not meet the performance requirements.

## PVR05D Series MOV Devices

### Reel and Ammo Packing Dimensions/Quantity



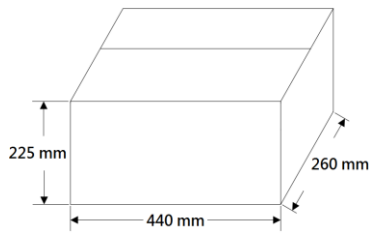
Symbol	Dimension (mm)
W <sub>1</sub>	46±1
a	340±10
c	31±1



Symbol	Dimension (mm)
W	348±5
L	185±5
H	60±5

Part Number	Reel pack		Ammo pack	
	Box	Carton	Box	Carton
180L - 241K	2000	20000	N/A	N/A
271K - 751K	1500	15000	N/A	N/A

### Bulk Packing Quantity



Part Number	Bulk pack			
	Type	Bag	Small Carton	Carton
180L - 751K	Long leg	1000	10000	20000
	Short leg	1000	15000	30000

## PVR05D Series MOV Devices

### Reliability Test

Mechanical Ratings										
Test Parameter	Test Condition / Description	Performance Requirements								
Terminal Pull Strength	<p>After gradually applying the load specified below and keeping the unit fixed for ten seconds, the terminal shall be visually examined for any damage.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">Diameter</td> <td style="text-align: center;">Loading</td> </tr> <tr> <td style="text-align: center;">0.6 mm</td> <td style="text-align: center;">1.0 kg</td> </tr> <tr> <td style="text-align: center;">0.8 mm</td> <td style="text-align: center;">1.0 kg</td> </tr> <tr> <td style="text-align: center;">1.0 mm</td> <td style="text-align: center;">2.0 kg</td> </tr> </table>	Diameter	Loading	0.6 mm	1.0 kg	0.8 mm	1.0 kg	1.0 mm	2.0 kg	No visible damage
Diameter	Loading									
0.6 mm	1.0 kg									
0.8 mm	1.0 kg									
1.0 mm	2.0 kg									
Terminal Bending Strength	<p>The unit shall be secured with its terminal kept vertical and the weight specified below be applied in axial direction. The terminal shall gradually be bent by 90° in one direction, then 90° in the opposite direction, and again back to the original position. The damage of the terminal shall be visually examined.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">Diameter</td> <td style="text-align: center;">Loading</td> </tr> <tr> <td style="text-align: center;">0.6 mm</td> <td style="text-align: center;">0.5 kg</td> </tr> <tr> <td style="text-align: center;">0.8 mm</td> <td style="text-align: center;">0.5 kg</td> </tr> <tr> <td style="text-align: center;">1.0 mm</td> <td style="text-align: center;">1.0 kg</td> </tr> </table>	Diameter	Loading	0.6 mm	0.5 kg	0.8 mm	0.5 kg	1.0 mm	1.0 kg	No visible damage
Diameter	Loading									
0.6 mm	0.5 kg									
0.8 mm	0.5 kg									
1.0 mm	1.0 kg									
Vibration	The specimen shall be vibrated by its lead wires with a total amplitude of 1.5 mm and a varying frequency of 10~55~10Hz (each minutes) for a period of 2 hours respectively in each X, Y and Z directions.	No Visible damage $\Delta V_b/V_b \leq 5\%$								
Solderability	After dipping the terminal the depth of approximately 3 mm from the specimen in a soldering bath of 260°C for 10±1 (D5: 5±1) seconds. Thereafter the terminal shall be visually examined.	Terminations shall be uniformly covered by solder								
Resistance to solder heat	After preheating the specimen, the specimen shall be completely immersed into a soldering bath having a temperature of 260±5°C for 10±1 (D5: 5±1) seconds or iron of 400±5°C for 3±0.5 seconds. Thereafter the change of $V_b$ and mechanical damage shall be examined.	No Visible damage $\Delta V_b/V_b \leq 5\%$								
Environmental Ratings										
Test Parameter	Test Condition / Description	Performance Requirements								
Dry Heat Loading	<p>The specimen shall be applied continuously the maximum allowable voltage at the specified conditions for specified period and then stored at room temperature and normal humidity over 2 hours. Thereafter, the change of <math>V_b</math> and mechanical damage shall be examined.</p> <p>Ambient temp: 125±2°C / Period: 1000±24hours</p>	$\Delta V_b/V_b \leq 10\%$								
High Temp Storage	<p>In a dry oven without load.</p> <p>Ambient temp: 125±2°C / Period: 1000±24hours</p>	$\Delta V_b/V_b \leq 5\%$								
Damp Heat Loading	<p>The specimen shall be applied continuously the maximum allowable voltage at the specified conditions for specified period and then stored at room temperature and normal humidity over 2 hours. Thereafter, the change of <math>V_b</math> and mechanical damage shall be examined.</p> <p>Ambient temp: 40±2°C, 90~95%RH / Period: 1000±24hours</p>	$\Delta V_b/V_b \leq 10\%$								
Temperature Cycle	<p>Condition the specimen to each temperature from step 1 to step 4 in this order for the period shown in the table of specifications. The change of <math>V_b</math> and mechanical damage shall be examined after 2 hours.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">Step 1</td> <td style="text-align: center;">-40±3°C / 30min.</td> </tr> <tr> <td style="text-align: center;">Step 2</td> <td style="text-align: center;">Room temp / 15min.</td> </tr> <tr> <td style="text-align: center;">Step 3</td> <td style="text-align: center;">85±2°C / 30min.</td> </tr> <tr> <td style="text-align: center;">Step 4</td> <td style="text-align: center;">Room temp / 15min.</td> </tr> </table>	Step 1	-40±3°C / 30min.	Step 2	Room temp / 15min.	Step 3	85±2°C / 30min.	Step 4	Room temp / 15min.	No Visible damage $\Delta V_b/V_b \leq 10\%$
Step 1	-40±3°C / 30min.									
Step 2	Room temp / 15min.									
Step 3	85±2°C / 30min.									
Step 4	Room temp / 15min.									
Surge Lifetime Rating	The change of $V_b$ shall be measured after the impulse listed below is applied 10,000 times continuously with the interval of ten seconds at room temperature.	No Visible damage $\Delta V_b/V_b \leq 10\%$								
Voltage Proof	Voltage: 2500 Vac / Leakage current $\leq 0.5$ mA / Time: 60 seconds	No Breakdown								