

Terminology

Term	Symbol	Definition
Rated AC Voltage	V_{rms}	Maximum continuous sinusoidal AC voltage (<5% total harmonic distortion) which may be applied to the component under continuous operation conditions at 25 °C
Rated DC Voltage	V_{dc}	Maximum continuous DC voltage (<5% ripple) which may be applied to the component under continuous operating conditions at 25 °C
Supply Voltage	V	The voltage by which the system is designated and to which certain operating characteristics of the system are referred; $V_{rms} = 1,1 \times V$
Leakage Current	I_{dc}	The current passing through the varistor at V_{dc} and at 25 °C or at any other specified temperature
Varistor Voltage	V_n	Voltage across the varistor measured at a given reference current I_n
Reference Current	I_n	Reference current = 1 mA DC
Clamping Voltage Protection Level	V_c	The peak voltage developed across the varistor under standard atmospheric conditions, when passing an 8/20 μ s class current pulse
Class Current	I_c	A peak value of current which is 1/10 of the maximum peak current for 100 pulses at two per minute for the 8/20 μ s pulse
Voltage Clamping Ratio	V_c/V_{app}	A figure of merit measure of the varistor clamping effectiveness as defined by the symbols V_c/V_{app} , where ($V_{app} = V_{rms}$ or V_{dc})
Jump Start Transient	V_{jump}	The jump start transient results from the temporary application of an overvoltage in excess of the rated battery voltage. The circuit power supply may be subjected to a temporary overvoltage condition due to the voltage regulation failing or it may be deliberately generated when it becomes necessary to boost start the car.
Rated Single Pulse Transient Energy	W_{max}	Energy which may be dissipated for a single 10/1000 μ s pulse of a maximum rated current, with rated AC voltage or rated DC voltage also applied, without causing device failure
Load Dump Transient	WLD	Load Dump is a transient which occurs in automotive environment. It is an exponentially decaying positive voltage which occurs in the event of a battery disconnect while the alternator is still generating charging current with other loads remaining on the alternator circuit at the time of battery disconnect.
Rated Peak Single Pulse Transient Current	I_{max}	Maximum peak current which may be applied for a single 8/20 μ s pulse, with, rated line voltage also applies, without causing device failure
Rated Transient Average Power Dissipation	P	Maximum average power which may be dissipated due to a group of pulses occurring within a specified isolated time period, without causing device failure at 25 °C
Capacitance	C	Capacitance between two terminals of the varistor measured at @ 1 kHz
Non-linearity Exponent	α	A measure of varistor nonlinearity between two given operating currents, I_n and I_1 as described by $I = k V \exp(a)$, where: - k is a device constant, - $I_1 < I < I_n$ and - $a = \log(I/I_n) / \log(V/V_n) = 1 / \log(V/V_n)$, where: - I_n is reference current (1 mA) and V_n is varistor voltage - $I_1 = 10 I_n$, V_1 is the voltage measured at I_1
Response Time	tr	The time lag between application of a surge and varistor's "turn-on" conduction action
Varistor Voltage Temperature Coefficient	TC	$(V_n \text{ at } 85^\circ\text{C} - V_n \text{ at } 25^\circ\text{C}) / (V_n \text{ at } 25^\circ\text{C}) \times 60^\circ\text{C} \times 100$
Insulation Resistance	IR	Minimum resistance between shorted terminals and varistor surface
Isolation Voltage		The maximum peak voltage which may be applied under continuous operating conditions between the varistor terminations and any conducting mounting surface
Operating Temperature		the range of ambient temperature for which the varistor is designed to operate continuously as defined by the temperature limits of its climatic category
Climatic Category	LCT/UCT/DHD	UCT = Upper Category Temperature - the maximum ambient temperature for which a varistor has been designed to operate continuously, LCT = Lower Category Temperature - the minimum ambient temperature at which a varistor has been designed to operate continuously DHD = Dump Heat Test Duration
Storage Temperature		Storage temperature range without voltage applied
Current/Energy Derating		Derating of maximum values when operated above UCT (85 °C for PV and 125 °C for DV)

SQUARE SHAPED HIGH ENERGY VARISTORS-ZOV SERIES

Description


The ZOV series is a series of high-energy varistors. There are two groups of varistors. The first group consists of standard sized surge shaped varistors while the second group consists of full custom parameter designed varistors. With the second ZOV series group, the customer is offered the opportunity to design their own optimum varistor to suit their specific application, within the dimensions that are possible. Parameters free to be chosen are: non-standard DC/AC operating voltage, leakage current, clamping voltage, maximum surge current, energy absorption level, maximum dissipation power as well as shape, the dimensions being the function of required electrical parameters and vice-versa.

Both of these groups are offered in two versions: epoxy coated with rigid terminals and metalized varistor blocks. The first are designed to provide secondary surge protection in an outdoor and service entrance environment (distribution panels), in computers and also in industrial applications for motor controls and power supplies in oil-drilling, mining and transportation fields. The second are intended for applications with special contact or installation requirements. The electrode finish of devices is solderable and can also be used with pressure contacts for stacking applications.



Features

Standard Varistor Types

- Operating voltage range V_{rms} 60 V to 680 V.
- Operating voltage range V_{dc} 85 V to 900 V.
- 5 model sizes available 23, 25, 32, 40 and 60 mm.
- Broad range of current and energy handling capabilities.
- Low limiting voltage @ $I_{max}/2$.
- +85 °C continuous operating temperature.
- Available either as epoxy coated varistors with rigid terminals or as metalized varistor blocks.
-  UL 1449, 3rd edition & CSA C22.2 file E326499 Section 1. For Type 1 SPD appl.
- In house testing according to VDE 0675.
- Lead free components.
- In the case that a ZOV varistor is used as a metalized block without leads and coating, device ratings and characteristics are only valid for professionally soldered and coated components. Improper soldering and further manufacturing steps

can lead to: a change of characteristics such as reduced long term stability, a reduced surge current and energy absorption capability, reduced adhesive strength of electrodes and low climatic strength. In the case that a dipping soldering method is chosen, KEKO VARICON can minimize this problem by the passivation of varistor block edges.

Full Custom Parameter Designed Varistors

- Operating voltage range V_{rms} 60 V to 680 V.
- Operating voltage range V_{dc} 85 V to 900 V.
- Indefinite number of sizes of both square and rectangular shapes, the maximum being 45 x 90 mm.
- Broad range of current and energy handling capabilities.
- +85 °C continuous operating temperature.
- Electrical parameters free to be chosen are AC/DC operating voltage, leakage current, clamping voltage, maximum surge current, energy absorption level, maximum dissipation power and threshold voltage temperature coefficient.
- Available either as epoxy coated varistors with rigid terminals or as metalized varistor blocks.

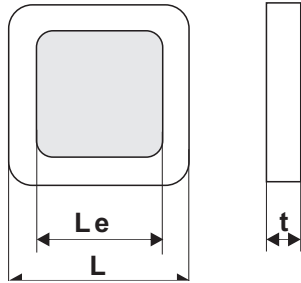
Absolute Maximum Ratings

Continuous:	Standard Types	Units	Custom Designed Types	Units
Steady State Applied Voltage:				
DC Voltage Range (V_{dc})	85 to 900	V	85 to 900	V
AC Voltage Range (V_{rms})	60 to 680	V	60 to 680	V
Transient:				
Peak Single Pulse Surge Current, 8/20 μ s Waveform, (I_{max})	18000 to 80000	A	> 5500	A/cm ²
Single Pulse Surge Energy, 10/1000 μ s Waveform (W_{max})	90 to 4140	J	> 400	J/cm ³
Operating Ambient Temperature	-40 to +85	°C	-40 to +85	°C
Storage Temperature Range	-40 to +125	°C	-40 to +125	°C
Threshold Voltage Temperature Coefficient	< +0,05	%/°C	< +0,05	%/°C
Insulation Resistance*	> 1	G Ω	> 1	G Ω
Isolation Voltage Capability*	> 2,5	kV	> 2,5	kV
Response Time	< 25	ns	< 25	ns
Climatic Category*	40 / 85 / 56		40 / 85 / 56	

* valid in case of epoxy coated components

Device Ratings and Characteristics

Standard High Energy Varistor Types



**Metalized
Varistor
Block**

Size Parameters

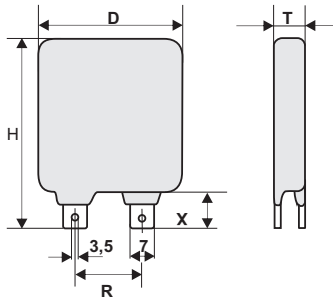
Size	L _{max} mm	Le _{max} mm
23	23	18
25	23	20
32	30	28
40	34	31
60	43	39

ZOV 60 K 23 ZOV 275 K 60

Type	V _{rms} V	V _{dc} V	V _n @ 1 mA V	V _c @ I _c V	I _c A	W _{max} 10/1000 μs J	P max W	I _{max} 8/20 μs A	C @ 1 kHz pF	t max mm	T max mm
ZOV 60 K 23	60	85	100	165	100	90	1,0	18000	3850	1,0	7,7
ZOV 60 K 25	60	85	100	165	150	125	1,0	20000	4850	1,0	7,7
ZOV 60 K 32	60	85	100	165	200	250	1,2	30000	9700	1,0	7,7
ZOV 60 K 40	60	85	100	165	300	300	1,4	45000	12000	1,0	7,7
ZOV 75 K 23	75	100	120	200	100	100	1,0	18000	3500	1,1	7,9
ZOV 75 K 25	75	100	120	200	150	145	1,0	20000	4500	1,1	7,9
ZOV 75 K 32	75	100	120	200	200	280	1,2	30000	9800	1,1	7,9
ZOV 75 K 40	75	100	120	200	300	340	1,4	45000	11000	1,1	7,9
ZOV 95 K 23	95	125	150	250	100	135	1,0	18000	2950	1,3	8,1
ZOV 95 K 25	95	125	150	250	150	190	1,0	20000	3680	1,3	8,1
ZOV 95 K 32	95	125	150	250	200	380	1,2	30000	7470	1,3	8,1
ZOV 95 K 40	95	125	150	250	300	450	1,4	45000	9200	1,3	8,1
ZOV 130 K 23	130	170	205	340	100	180	1,0	18000	2310	1,5	8,1
ZOV 130 K 25	130	170	205	340	150	250	1,0	20000	2900	1,5	8,1
ZOV 130 K 32	130	170	205	340	200	500	1,2	30000	5780	1,5	8,1
ZOV 130 K 40	130	170	205	340	300	600	1,4	45000	7200	1,5	8,1
ZOV 130 K 60	130	170	205	340	500	960	1,6	80000	11520	1,5	8,1
ZOV 150 K 23	150	200	240	395	100	215	1,0	18000	1990	1,7	8,3
ZOV 150 K 25	150	200	240	395	150	300	1,0	20000	2480	1,7	8,3
ZOV 150 K 32	150	200	240	395	200	600	1,2	30000	4960	1,7	8,3
ZOV 150 K 40	150	200	240	395	300	720	1,4	45000	6100	1,7	8,3
ZOV 150 K 60	150	200	240	395	500	1150	1,6	80000	9760	1,7	8,3
ZOV 230 K 23	230	300	360	595	100	320	1,0	18000	1320	2,4	9,0
ZOV 230 K 25	230	300	360	595	150	450	1,0	20000	1650	2,4	9,0
ZOV 230 K 32	230	300	360	595	200	900	1,2	30000	3300	2,4	9,0
ZOV 230 K 40	230	300	360	595	300	1080	1,4	45000	4060	2,4	9,0
ZOV 230 K 60	230	300	360	595	500	1730	1,6	80000	6490	2,4	9,0
ZOV 250 K 23	250	320	390	650	100	350	1,0	18000	1220	2,6	9,2
ZOV 250 K 25	250	320	390	650	150	490	1,0	20000	1530	2,6	9,2
ZOV 250 K 32	250	320	390	650	200	970	1,2	30000	3050	2,6	9,2
ZOV 250 K 40	250	320	390	650	300	1160	1,4	45000	3760	2,6	9,2
ZOV 250 K 60	250	320	390	650	500	1860	1,6	80000	6050	2,6	9,2
ZOV 275 K 23	275	350	430	710	100	380	1,0	18000	1100	2,8	9,4
ZOV 275 K 25	275	350	430	710	150	530	1,0	20000	1380	2,8	9,4
ZOV 275 K 32	275	350	430	710	200	1060	1,2	30000	2770	2,8	9,4
ZOV 275 K 40	275	350	430	710	300	1280	1,4	45000	3400	2,8	9,4
ZOV 275 K 60	275	350	430	710	500	2050	1,6	80000	5440	2,8	9,4

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Device Ratings and Characteristics



**Epoxy Coated
Varistor Block**

Size Parameters

Size	D _{max} mm	R ± 1 mm	H _{max} mm
23	25	18,5	43
25	25	18,5	43
32	35	25,4	53
40	36,5	25,4	56
60	48	25,4	66

ZOV 300 K 23 ZOV 680 K 60

Type	V _{rms} V	V _{dc} V	V _n @ 1 mA V	V _c @ I _c V	I _c A	W _{max} 10/1000 μs J	P max W	I _{max} 8/20 μs A	C @ 1 kHz pF	t max mm	T max mm
ZOV 300 K 23	300	385	470	775	100	440	1,0	18000	1010	3,1	9,7
ZOV 300 K 25	300	385	470	775	150	615	1,0	20000	1270	3,1	9,7
ZOV 300 K 32	300	385	470	775	200	1225	1,2	30000	2540	3,1	9,7
ZOV 300 K 40	300	385	470	775	300	1470	1,4	45000	3130	3,1	9,7
ZOV 300 K 60	300	385	470	775	500	2350	1,6	80000	5000	3,1	9,7
ZOV 320 K 23	320	420	510	840	100	480	1,0	18000	990	3,2	9,9
ZOV 320 K 25	320	420	510	840	150	680	1,0	20000	1240	3,2	9,9
ZOV 320 K 32	320	420	510	840	200	1350	1,2	30000	2470	3,2	9,9
ZOV 320 K 40	320	420	510	840	300	1620	1,4	45000	3050	3,2	9,9
ZOV 320 K 60	320	420	510	840	500	2600	1,6	80000	4880	3,2	9,9
ZOV 385 K 23	385	505	620	1025	100	500	1,0	18000	810	3,8	10,6
ZOV 385 K 25	385	505	620	1025	100	690	1,0	20000	1020	3,8	10,6
ZOV 385 K 32	385	505	620	1025	100	1390	1,2	30000	2040	3,8	10,6
ZOV 385 K 40	385	505	620	1025	100	1660	1,4	45000	2500	3,8	10,6
ZOV 385 K 60	385	505	620	1025	100	2660	1,6	80000	400	3,8	10,6
ZOV 420 K 23	420	560	680	1120	100	530	1,0	18000	740	4,4	10,9
ZOV 420 K 25	420	560	680	1120	150	740	1,0	20000	930	4,4	10,9
ZOV 420 K 32	420	560	680	1120	200	1480	1,2	30000	1850	4,4	10,9
ZOV 420 K 40	420	560	680	1120	300	1780	1,4	45000	2280	4,4	10,9
ZOV 420 K 60	420	560	680	1120	500	2850	1,6	80000	3650	4,4	10,9
ZOV 460 K 23	460	615	750	1240	100	580	1,0	18000	670	4,8	11,4
ZOV 460 K 25	460	615	750	1240	150	810	1,0	20000	840	4,8	11,4
ZOV 460 K 32	460	615	750	1240	200	1610	1,2	30000	1680	4,8	11,4
ZOV 460 K 40	460	615	750	1240	300	1930	1,4	45000	2060	4,8	11,4
ZOV 460 K 60	460	615	750	1240	500	3090	1,6	80000	3300	4,8	11,4
ZOV 510 K 23	510	670	820	1355	100	600	1,0	18000	610	5,2	11,8
ZOV 510 K 25	510	670	820	1355	150	840	1,0	20000	770	5,2	11,8
ZOV 510 K 32	510	670	820	1355	200	1680	1,2	30000	1530	5,2	11,8
ZOV 510 K 40	510	670	820	1355	300	2010	1,4	45000	1900	5,2	11,8
ZOV 510 K 60	510	670	820	1355	500	3220	1,6	80000	3040	5,2	11,8
ZOV 550 K 23	550	745	910	1500	100	650	1,0	18000	550	5,9	12,5
ZOV 550 K 25	550	745	910	1500	150	900	1,0	20000	690	5,9	12,5
ZOV 550 K 32	550	745	910	1500	200	1810	1,2	30000	1380	5,9	12,5
ZOV 550 K 40	550	745	910	1500	300	2170	1,4	45000	1700	5,9	12,5
ZOV 550 K 60	550	745	910	1500	500	3470	1,6	80000	2720	5,9	12,5
ZOV 680 K 23	680	895	1100	1815	100	770	1,0	18000	460	6,9	13,5
ZOV 680 K 25	680	895	1100	1815	150	1080	1,0	20000	570	6,9	13,5
ZOV 680 K 32	680	895	1100	1815	200	2160	1,2	30000	1150	6,9	13,5
ZOV 680 K 40	680	895	1100	1815	300	4140	1,4	45000	1400	6,9	13,5
ZOV 680 K 60	680	895	1100	1815	500	2050	1,6	80000	2240	6,9	13,5

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Device Ratings and Characteristics

Full Custom Parameter Designed High Energy Varistors

The ZOV series group of full custom parameter designed varistors consists of square or rectangular shaped varistors, available as epoxy coated or as metalized varistor blocks. Other versions such as metalized blocks with rigid terminals, etc. or other coatings are also available.

The customer can specify the varistor electrical properties and set the limits of size parameters in accordance with the General Technical Data, as provided below. The customer can also choose to have standard electrical parameters in a non-standard varistor shape and size to best suit the available housing. The customer has our full engineering support in realizing his specific protection requirement.

In the case that a ZOV varistor is used as a metalized block without leads and coating, device ratings and characteristics are only valid for professionally soldered and coated components. Improper soldering and further manufacturing steps can lead to: a change of characteristics such as reduced long term stability, a reduced surge current and energy absorption capability, reduced adhesive strength of electrodes and low climatic strength. In the case that a dipping soldering method is chosen, KEKO VARICON can minimize this problem by the passivation of varistor block edges.

General Technical Data

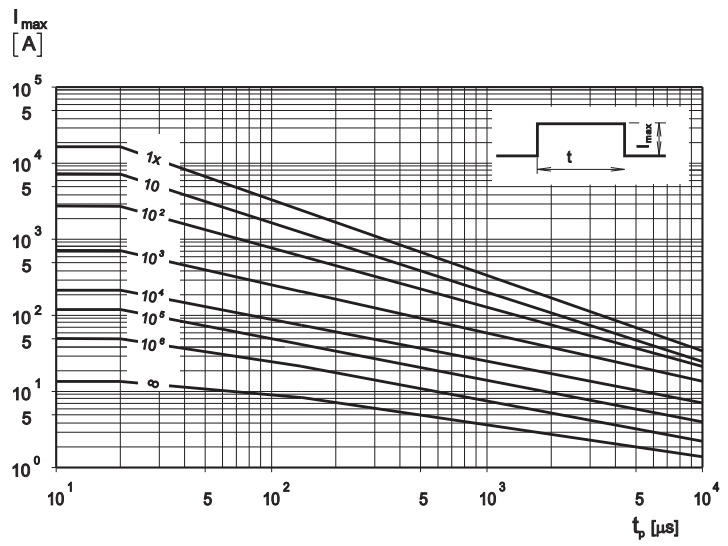
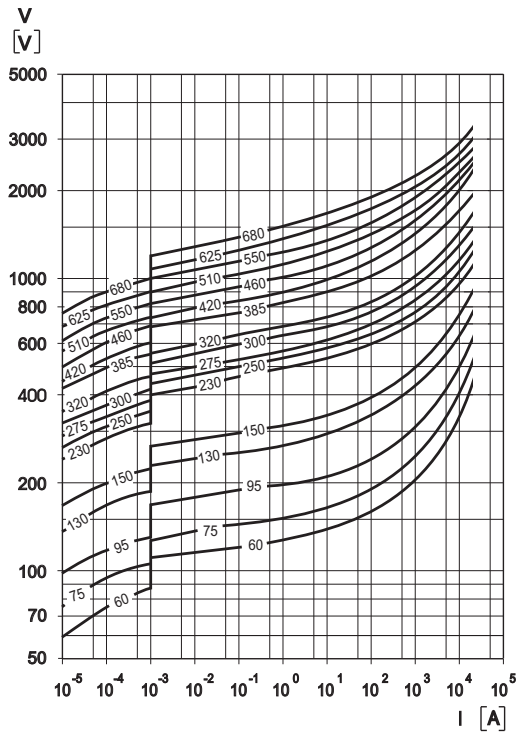
Electrical Parameters		Value	Units
Varistor Threshold Voltage (V_n) Range at 1 mA		100 to 1100	V
Continuous:			
Steady State Applied Voltage:			
DC Voltage Range (V_{dc})		85 to 900	V
AC Voltage Range (V_{rms})		60 to 680	V
Transient:			
Peak Single Pulse Surge Current, 8/20 μ s Waveform, (I_{max})		>5500	A/cm ²
Single Pulse Surge Energy, 10/1000 μ s Waveform (W_{max})		>400	J/cm ³
Protective Level			
Clamping Voltage		<1,9 x V_{dc}	V
Coefficient of nonlinearity α	minimum	45	
	typical	60	
Leakage Current Level	at 25 °C	0,5	μ A/cm ²
	at 85 °C	10	μ A/cm ²
Temperature behavior			
Operating Ambient Temperature		-40 to +85	°C
Storage Temperature Range		-40 to +125	°C
Minimum Threshold Voltage Temperature Coefficient		+0,05	%/°C
Design			
Epoxy coated with rigid Terminals			
Metallized Block with solderable electrode finish			
Physical Parameters			
Maximum Size L x W		Custom design	
Shape		Square, rectangular	

Protection Level

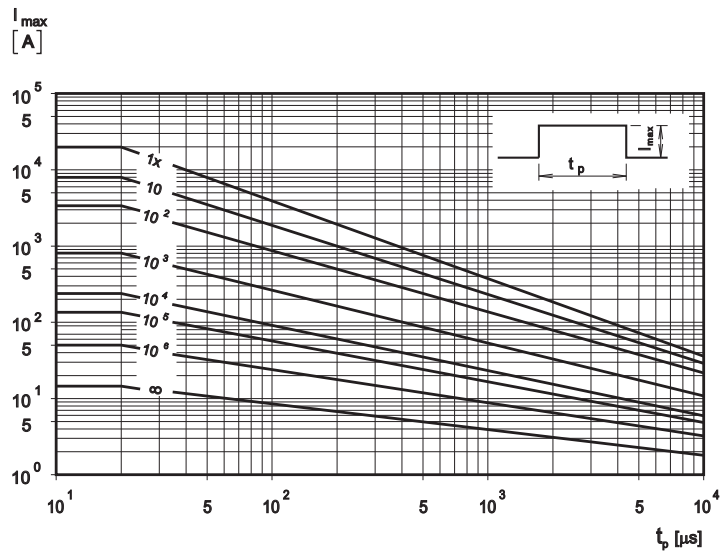
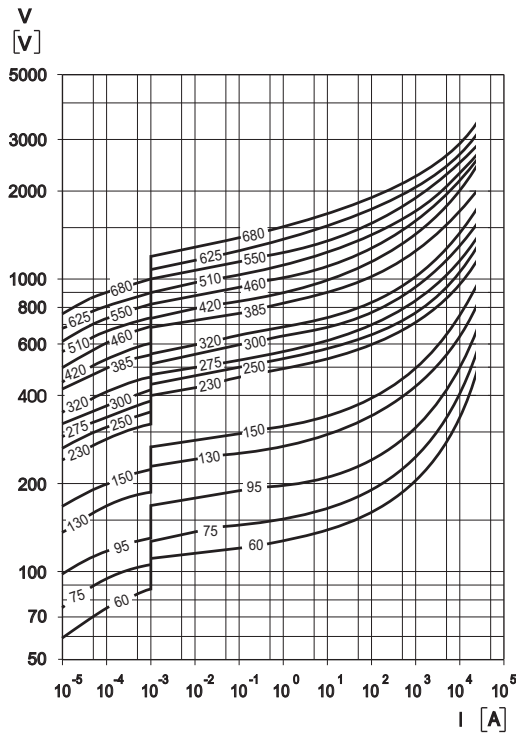
Pulse Rating Curves

*In the most demanding conditions as per the tolerance region

Model Size 23
ZOV 60...680



Model Size 25
ZOV 60...680



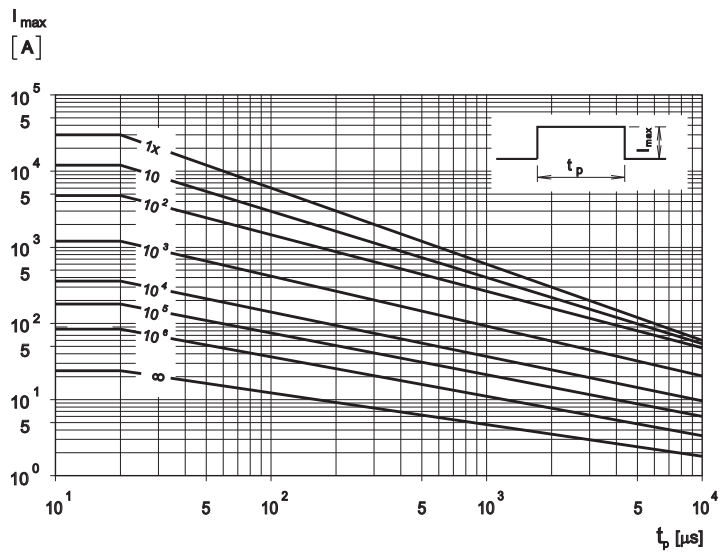
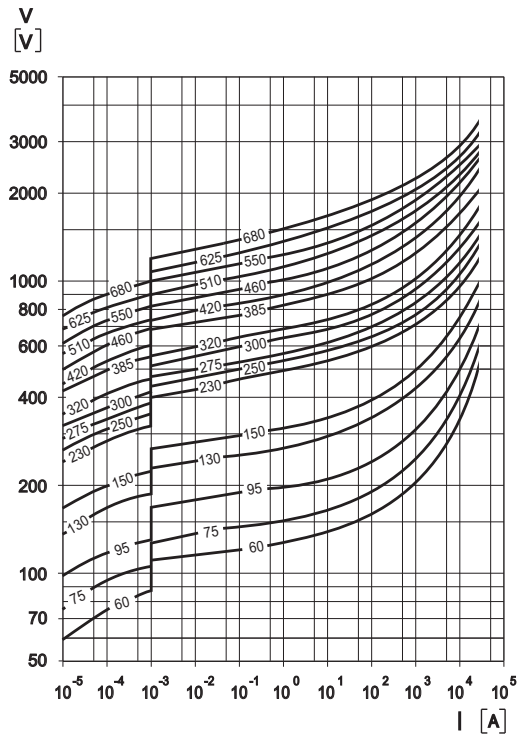
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Protection Level

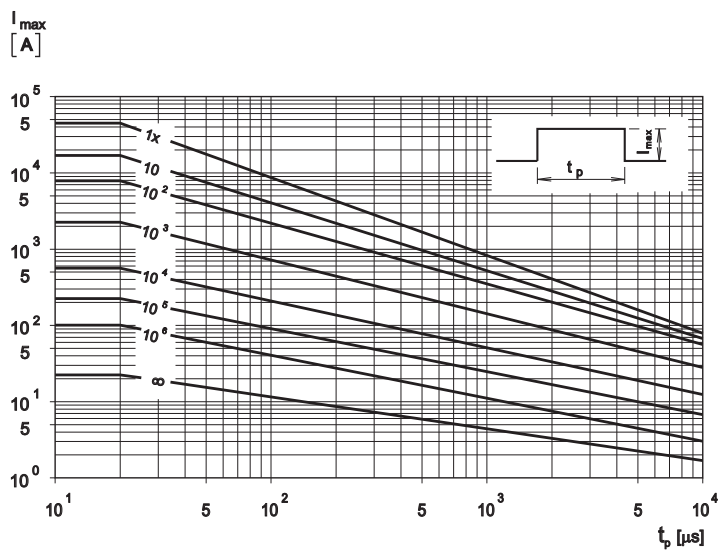
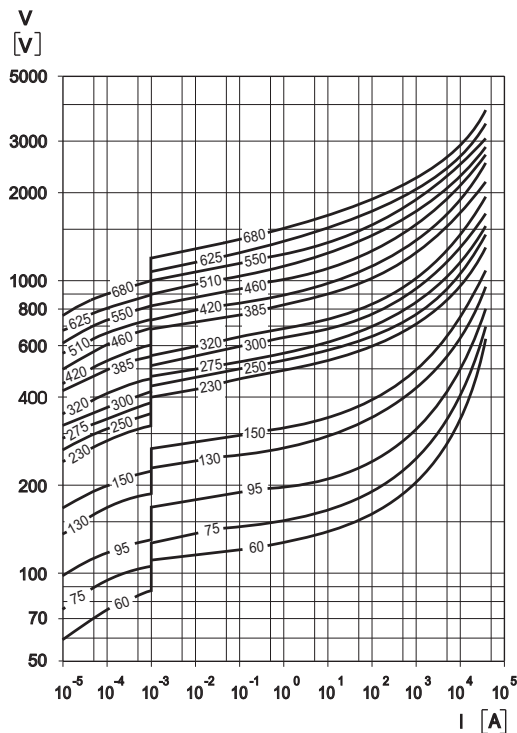
Pulse Rating Curves

*In the most demanding conditions as per the tolerance region

Model Size 32
ZOV 60...680



Model Size 40
ZOV 60...680



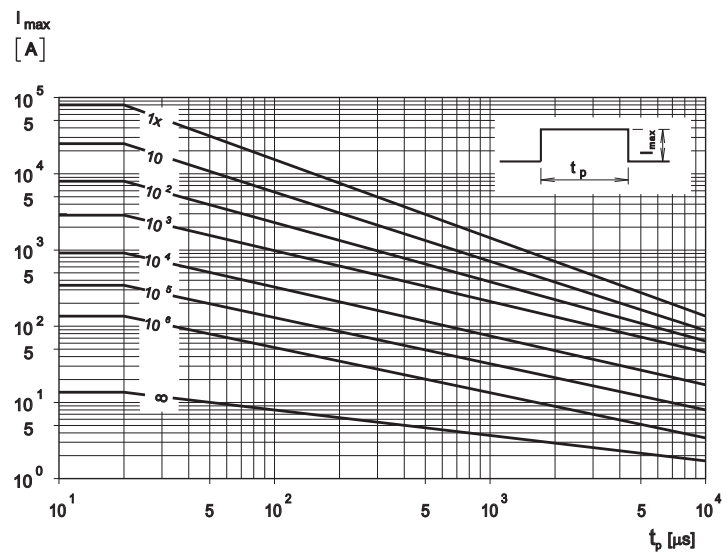
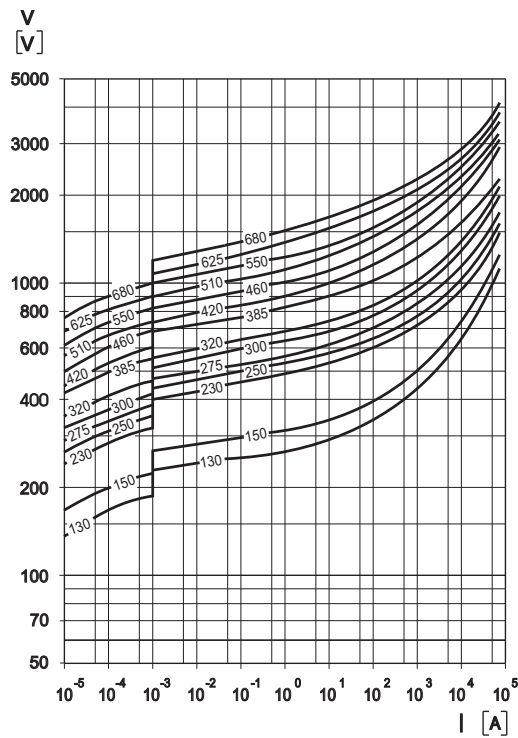
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Protection Level

*In the most demanding conditions as per the tolerance region

Pulse Rating Curves

Model Size 60
ZOV 60...680



ROUND SHAPED HIGH ENERGY VARISTORS – ZOVR SERIES

Description


The ZOVR series is a series of round shaped high energy varistors. This series consists of three nominal model sizes – 25, 32 and 40. These varistors are available as either epoxy coated varistors with rigid terminals or as metallized varistor discs. The first are designed to provide secondary surge protection in an outdoor and service entrance environment (distribution panels), in computers, telecommunications and also in industrial applications for motor controls and power supplies in oil-drilling, mining and transportation fields. The second are intended for applications with special contact or installation requirements. The electrode finish of these devices is solderable and can also be used with pressure contacts for stacking applications.



Features

Standard Varistor Types

- Operating voltage range V_{rms} 60 V to 680 V.
- Operating voltage range V_{dc} 85 V to 900 V.
- 3 model sizes available 25, 32 and 40 mm.
- Broad range of current and energy handling capabilities.
- Low limiting voltages @ $I_{max}/2$.
- +85 °C continuous operating temperature.
- Available either as epoxy coated varistors with rigid terminals or as metallized varistor blocks.
- In-house testing according to VDE 0675.

-  UL 1449, 3rd edition & CSA C22.2, file E326499 Section 2. For Type 1 SPD applications.
- Lead free components.
- In the case that a ZOV varistor is used as a metallized block without leads and coating, device ratings and characteristics are only valid for professionally soldered and coated components. Improper soldering and further manufacturing steps can lead to: a change of characteristics such as reduced long term stability, a reduced surge current and energy absorption capability, reduced adhesive strength of electrodes and low climatic strength. In the case that a dipping soldering method is chosen, KEKO VARICON can minimize this problem by the passivation of varistor block edges.

Absolute Maximum Ratings

Continuous:

Steady State Applied Voltage:

	Units	Value
DC Voltage Range (V_{dc})	V	85 to 900
AC Voltage Range (V_{rms})	V	60 to 680

Transient:

Peak Single Pulse Surge Current, 8/20 μ s Waveform, (I_{max})	A	18000 to 40000
Single Pulse Surge Energy, 10/1000 μ s Waveform (W_{max})	J	90 to 2590

Operating Ambient Temperature

Storage Temperature Range	°C	-40 to +125
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Minimum Threshold Voltage Temperature Coefficient

Insulation Resistance *	G Ω	> 1
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Isolation Voltage Capability *

Response Time	ns	< 25
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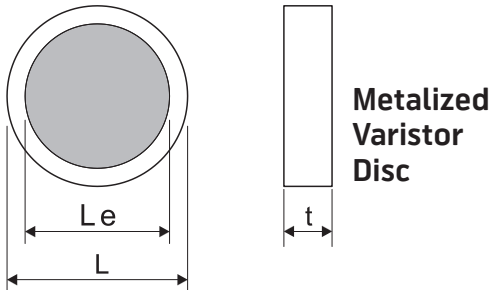
Climatic Category *

		40 / 85 / 56
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* valid in case of epoxy coated components

Device Ratings and Characteristics

Standard Round-shaped High Energy Varistor Types



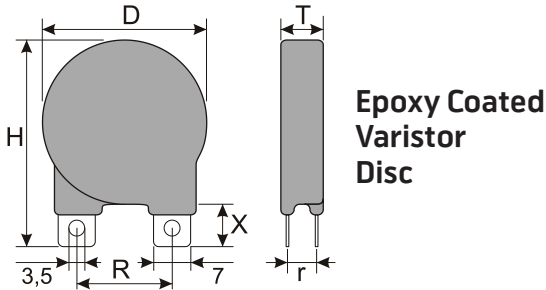
Size Parameters

Size	L_{max} mm	L_{emax} mm
25	22	18
32	33	28
40	39	34

ZOVR 60 K 25 ZOVR 275 K 40

Type	V_{rms} V	V_{dc} V	V_n @ 1 mA V	V_c V	I_c A	W_{max} 10/1000 μ s J	P max W	I_{max} 8/20 μ s A	C @ 1 kHz pF	t max mm	T max mm	r max mm
ZOVR 60 K 25	60	85	100	165	150	90	1,0	18000	3850	1,0	7,7	1,4
ZOVR 60 K 32	60	85	100	165	200	250	1,2	30000	9700	1,0	7,7	1,4
ZOVR 60 K 40	60	85	100	165	300	300	1,4	40000	12000	1,0	7,7	1,4
ZOVR 75 K 25	75	100	120	200	150	100	1,0	18000	3500	1,2	7,9	1,6
ZOVR 75 K 32	75	100	120	200	200	280	1,2	30000	8900	1,2	7,9	1,6
ZOVR 75 K 40	75	100	120	200	300	340	1,4	40000	11000	1,2	7,9	1,6
ZOVR 95 K 25	95	125	150	250	150	135	1,0	18000	2950	1,4	8,1	1,8
ZOVR 95 K 32	95	125	150	250	200	380	1,2	30000	7470	1,4	8,1	1,8
ZOVR 95 K 40	95	125	150	250	300	450	1,4	40000	9200	1,4	8,1	1,8
ZOVR 130 K 25	130	170	205	340	150	180	1,0	18000	2310	1,5	8,1	1,9
ZOVR 130 K 32	130	170	205	340	200	500	1,2	30000	5780	1,5	8,1	1,9
ZOVR 130 K 40	130	170	205	340	300	600	1,4	40000	7200	1,5	8,1	1,9
ZOVR 150 K 25	150	200	240	395	150	215	1,0	18000	1990	1,7	8,3	2,1
ZOVR 150 K 32	150	200	240	395	200	600	1,2	30000	4960	1,7	8,3	2,1
ZOVR 150 K 40	150	200	240	395	300	720	1,4	40000	6100	1,7	8,3	2,1
ZOVR 230 K 25	230	300	360	595	150	320	1,0	18000	1320	2,4	9,0	2,8
ZOVR 230 K 32	230	300	360	595	200	900	1,2	30000	3300	2,4	9,0	2,8
ZOVR 230 K 40	230	300	360	595	300	1080	1,4	40000	4060	2,4	9,0	2,8
ZOVR 250 K 25	250	320	390	650	150	350	1,0	18000	1220	2,6	9,2	3,0
ZOVR 250 K 32	250	320	390	650	200	970	1,2	30000	3050	2,6	9,2	3,0
ZOVR 250 K 40	250	320	390	650	300	1160	1,4	40000	3760	2,6	9,2	3,0
ZOVR 275 K 25	275	350	430	710	150	380	1,0	18000	1100	2,8	9,4	3,2
ZOVR 275 K 32	275	350	430	710	200	1060	1,2	30000	2770	2,8	9,4	3,2
ZOVR 275 K 40	275	350	430	710	300	1280	1,4	40000	3400	2,8	9,4	3,2

Device Ratings and Characteristics



Size Parameters

Size	D _{max} mm	R _{max} mm	H _{max} mm	X _{max} mm
25	25	19	43	18
32	37	25	55	18
40	44	25	62	18

ZOVR 300 K 25 ZOVR 680 K 40

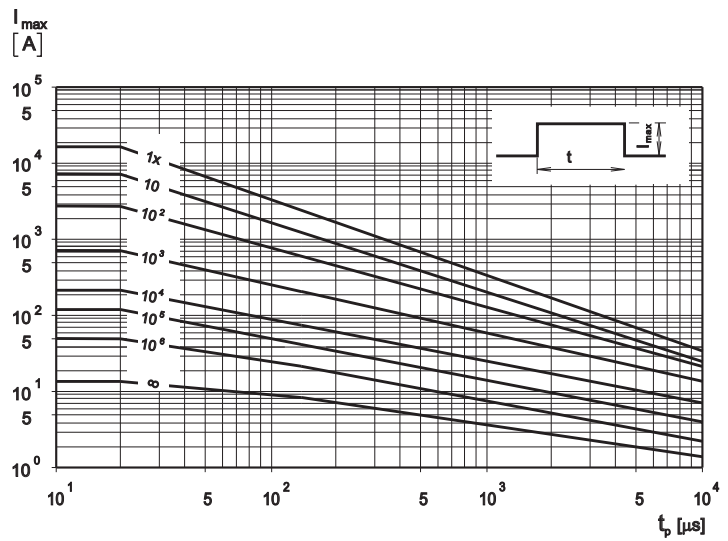
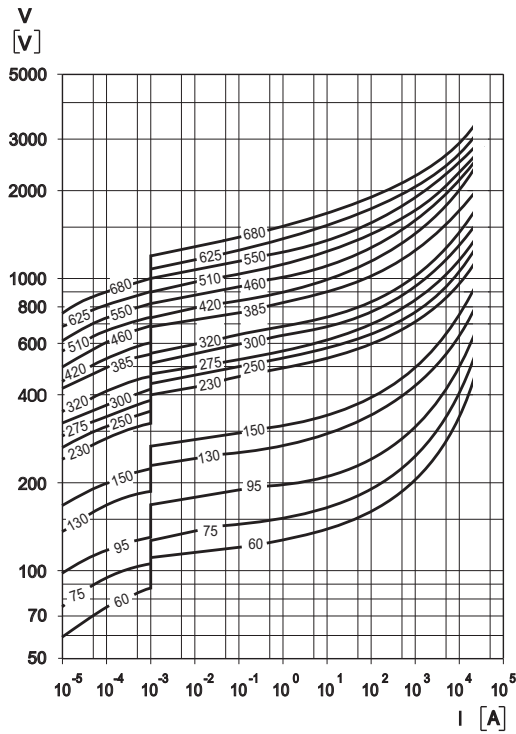
Type	V _{rms} V	V _{dc} V	V _n @ 1 mA V	V _c V	I _c A	W _{max} 10/1000 μs J	P _{max} W	I _{max} 8/20 μs A	C @ 1 kHz pF	t max mm	T max mm	r max mm
ZOVR 300 K 25	300	385	470	775	150	440	1,0	15000	1010	3,1	9,7	3,5
ZOVR 300 K 32	300	385	470	775	200	1225	1,0	30000	2540	3,1	9,7	3,5
ZOVR 300 K 40	300	385	470	775	300	1470	1,2	40000	3130	3,1	9,7	3,5
ZOVR 320 K 25	320	420	510	840	150	480	1,0	15000	990	3,2	9,9	3,6
ZOVR 320 K 32	320	420	510	840	200	1350	1,0	30000	2470	3,2	9,9	3,6
ZOVR 320 K 40	320	420	510	840	300	1620	1,2	40000	3050	3,2	9,9	3,6
ZOVR 385 K 25	385	505	620	1025	150	500	1,0	15000	810	3,8	10,6	4,2
ZOVR 385 K 32	385	505	620	1025	200	1390	1,0	30000	2040	3,8	10,6	4,2
ZOVR 385 K 40	385	505	620	1025	300	1660	1,2	40000	2500	3,8	10,6	4,2
ZOVR 420 K 25	420	560	680	1120	150	530	1,0	15000	740	4,4	10,9	4,8
ZOVR 420 K 32	420	560	680	1120	200	1480	1,0	30000	1850	4,4	10,9	4,8
ZOVR 420 K 40	420	560	680	1120	300	1780	1,2	40000	2280	4,4	10,9	4,8
ZOVR 460 K 25	460	615	750	1240	150	580	1,0	15000	670	4,8	11,4	5,2
ZOVR 460 K 32	460	615	750	1240	200	1610	1,0	30000	1680	4,8	11,4	5,2
ZOVR 460 K 40	460	615	750	1240	300	1930	1,2	40000	2060	4,8	11,4	5,2
ZOVR 510 K 25	510	670	820	1355	150	600	1,0	15000	610	5,2	11,8	5,6
ZOVR 510 K 32	510	670	820	1355	200	1680	1,0	30000	1530	5,2	11,8	5,6
ZOVR 510 K 40	510	670	820	1355	300	2010	1,2	40000	1900	5,2	11,8	5,6
ZOVR 550 K 25	550	745	910	1500	150	650	1,0	15000	550	5,9	12,5	6,3
ZOVR 550 K 32	550	745	910	1500	200	1810	1,0	30000	1380	5,9	12,5	6,3
ZOVR 550 K 40	550	745	910	1500	300	2170	1,2	40000	1700	5,9	12,5	6,3
ZOVR 680 K 25	680	895	1100	1815	150	770	1,0	15000	460	6,9	13,5	7,3
ZOVR 680 K 32	680	895	1100	1815	200	2160	1,0	30000	1150	6,9	13,5	7,3
ZOVR 680 K 40	680	895	1100	1815	300	2590	1,2	40000	1400	6,9	13,5	7,3

Protection Level

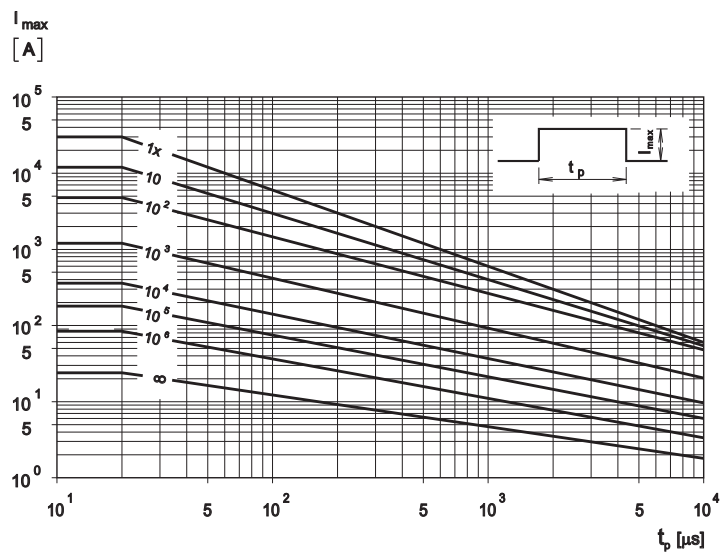
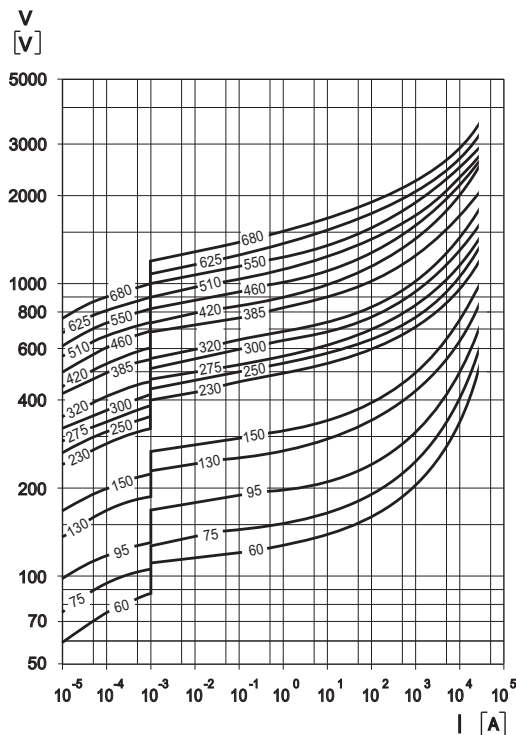
Pulse Rating Curves

*In the most demanding conditions as per the tolerance region

Model Size 25
ZOVR 60...680



Model Size 32
ZOVR 60...680



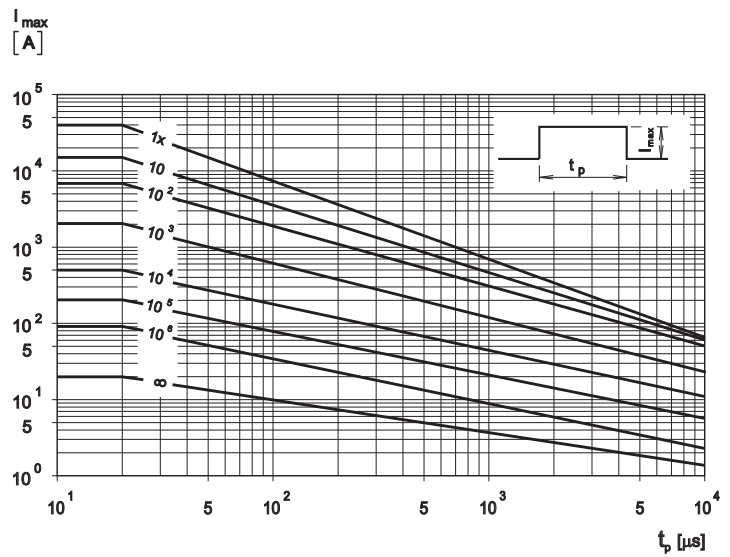
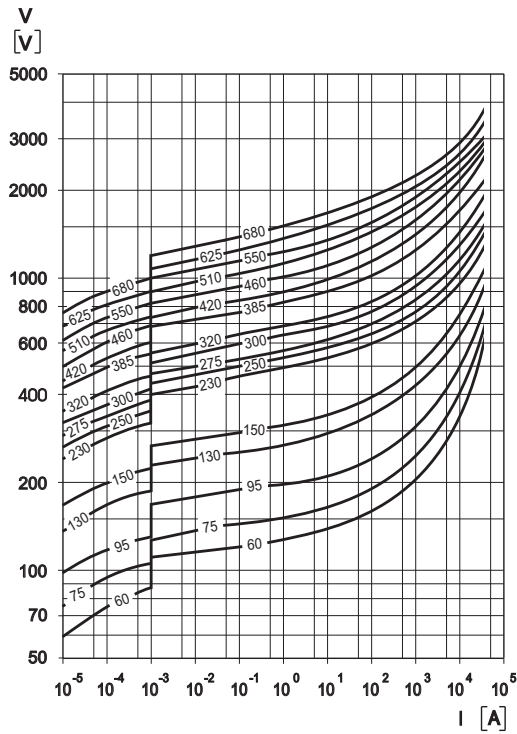
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Protection Level

Pulse Rating Curves

*In the most demanding conditions as per the tolerance region

Model Size 40
ZOVR 60...680



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SQUARE SHAPED HIGH ENERGY VARISTORS – ZOV SERIES


Description

A stacked high energy varistor is formed to improve the capability of standard ZOV or ZOVR high energy varistors. Such varistors provide a much higher maximum pulse current and absorption energy capability in a much smaller space in comparison to standard single ZOV of ZOVR varistors.

Stacked varistors are designed to provide secondary surge protection in an outdoor and service entrance environment. They provide high current (pulse shape 8/20 μ s) as well as high energy (current pulse shape 10/350 μ s) handling capabilities according to IEC 61643-11, class I, II and III tests.



Features

- Operating voltage range V_{rms} 150 V to 440 V.
- Different model sizes available.
- Broad range of current (pulse shape 8/20 μ s) and energy (current pulse shape 10/350 μ s) handling capabilities.
- Low limiting voltages @ $I_{max}/2$.
- +85 °C continuous operating temperature; higher operating temperatures are available upon request.
- In-house testing according to VDE 0675.
- Available in various versions and custom designed terminals.
-  UL 1449, 3rd edition & CSA C22.2, file E326499 Section 1. For Type I SPD applications.

ZOVS Series

Size – number of discs	I_{imp} (10/350 μ s) capability
Single disc – 40	4 kA
Double disc – 40 D2	8 kA

ZOVH Series

Size – number of discs	I_{imp} (10/350 μ s) capability
Single disc – 40	6,5 kA
Double disc – 40 D2	12,5 kA
Quadruple disc – 40 D4	25 kA

ZOVS series

Type	V_{rms} V	V_{dc} V	V_n @ 1 mA V	V_c @ I_c V	I_c A	W_{max} 10/1000 μ s J	P max W	I_{max} 8/20 μ s A	I_n 8/20 μ s A	I_{imp} 10/350 μ s A	C @ 1 kHz pF	t max mm	T max mm
ZOVS 275 K 40	275	350	430	710	300	1280	1,4	40000	20000	4000	3400	4,0	8,0
ZOVS 320 K 40	320	420	510	840	300	1620	1,4	40000	20000	4000	3050	4,4	8,4
ZOVS 385 K 40	385	505	620	1025	300	1660	1,4	40000	20000	4000	2500	5,6	9,6
ZOVS 420 K 40	420	560	680	1120	300	1780	1,4	40000	20000	4000	2280	6,2	10,2
ZOVS 440 K 40	440	585	715	1180	300	1860	1,4	40000	20000	4000	2100	6,9	10,9

ZOVA series

Type	V_{rms} V	V_{dc} V	V_n @ 1 mA V	V_c @ I_c V	I_c A	W_{max} 10/1000 μ s J	P max W	I_{max} 8/20 μ s A	I_n 8/20 μ s A	I_{imp} 10/350 μ s A	C @ 1 kHz pF	t max mm	T max mm
ZOVA 275 K 40	275	350	430	710	300	1920	1,4	40000	20000	5000	3150	4,3	8,3
ZOVA 320 K 40	320	420	510	840	300	2430	1,4	40000	20000	5000	2800	4,7	8,7
ZOVA 385 K 40	385	505	620	1025	300	2490	1,4	40000	20000	5000	2250	5,9	9,9
ZOVA 420 K 40	420	560	680	1120	300	2670	1,4	40000	20000	5000	2050	6,5	10,5
ZOVA 440 K 40	440	585	715	1180	300	2790	1,4	40000	20000	5000	1950	7,2	11,2

ZOVH series

Type	V_{rms} V	V_{dc} V	V_n @ 1 mA V	V_c @ I_c V	I_c A	W_{max} 10/1000 μ s J	P max W	I_{max} 8/20 μ s A	I_n 8/20 μ s A	I_{imp} 10/350 μ s A	C @ 1 kHz pF	t max mm	T max mm
ZOVH 275 K 40	275	350	430	710	300	2580	1,4	40000	15000	6500	2900	4,6	8,6
ZOVH 320 K 40	320	420	510	840	300	3060	1,4	40000	15000	6500	2400	5,0	9,0
ZOVH 385 K 40	385	505	620	1025	300	3720	1,4	40000	15000	6500	2000	6,2	10,2
ZOVH 420 K 40	420	560	680	1120	300	4080	1,4	40000	15000	6500	1900	6,8	10,8
ZOVH 440 K 40	440	585	715	1180	300	4290	1,4	40000	15000	6500	1800	7,5	11,5

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Ordering Information

Standard Types

ZOV 680 K 40 E yy

- ZOV** - Series Name: ZOV, ZOVR, ZOVs, ZOVH
- 680** - Maximum Continuous Operating Voltage – V_{rms}
- K** - V_n Tolerance: J = $\pm 5\%$, K = $\pm 10\%$, S = special
- 40** - Size: 23, 25, 32, 40, 60, 80,...
- E** - Design: E = epoxy coated varistor with rigid terminals
M = metalized varistor block
ME = uncoated block with rigid terminals
MP = metalized varistor block with passivation
- yy** - Special Requirements

Custom Designed Types

ZOV 250 K 503 E yy

- ZOV** - Series Name: ZOV, ZOVs, ZOVR, ZOVH
- 250** - Maximum Continuous Operating Voltage – V_{rms}
- K** - V_n Tolerance: J = $\pm 5\%$, K = $\pm 10\%$, S = special
- 503** - Surge Current Code: 503 = 50,000 A, 8/20 μs
- E** - Design: E = epoxy coated varistor with rigid terminals
M = metalized varistor block
ME = uncoated block with rigid terminals
- yy** - Special Requirements

Varistor Marking for coated types only

Standard Types

ZOV 680 K 40 KEKO XX

- KEKO** - Trade name
- ZOV** - Series Name
- 680** - V_{rms}
- K** - V_n Tolerance
- 40** - Size
- xx** - Approval

Custom Designed Types

ZOV 275 K 503 KEKO XX

- KEKO** - Trade name
- ZOV** - Series name
- 680** - V_{rms}
- K** - V_n Tolerance
- 503** - Surge Current Code: 503 : 50000 A, 8/20 μs

SPECIAL MEDIUM VOLTAGE VARISTORS - SV SERIES

Description

The SV series is a series of lead style epoxy coated square or rectangular shaped varistors with an AC operating voltage ranging from 60 V to 550 V. There are two groups of these varistors.

The first consists of square shaped varistors with extremely high current and energy capabilities and a low clamping voltage, providing an increased level of protection necessary for the transients expected in telecommunication and AC power networks. Compared to electrically equivalent disc varistors, SV varistors come in smaller nominal dimensions.

With the second SV series group, the customer is offered the opportunity to design their own optimum varistor to suit their specific application, within the dimensions that are possible. Parameters free to be chosen are: non-standard DC/AC operating voltage, leakage current, clamping voltage, maximum surge current, energy absorption level, maximum dissipation power as well as shape, the dimensions being the function of required electrical parameters and vice-versa.



Features

- Operating voltage range V_{rms} 60 V to 550 V.
- Operating voltage range V_{dc} 85 V to 745 V.
- 6 model sizes equivalent to standard disc varistors: 5 mm, 7 mm, 10 mm, 14 mm, 20 mm, 23 mm.
- Smaller nominal dimensions.
- Broad range of current and energy handling capabilities.
- +85 °C continuous operating temperature.
- Low clamping voltage.
- Available with straight and crimped leads.
- Available in tape and reel for automatic pick and place.
-  UL 1449, 3rd edition & CSA C22.2, File E326499 Section 4.
- Lead free components.

Full Custom Parameter Designed Varistors

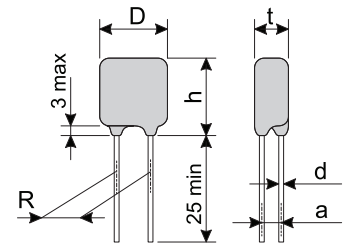
- Operating voltage range V_{rms} 60 V to 1000 V.
- Operating voltage range V_{dc} 85 V to 1300 V.
- Indefinite number of sizes of both square and rectangular shape, the maximum being 23 x 23 mm.
- Broad range of current and energy handling capabilities.
- +125 °C continuous operating temperature.
- Electrical parameters free to be chosen are AC/DC operating voltage, leakage current, clamping voltage, maximum surge current, energy absorption level, maximum dissipation power and threshold voltage temperature coefficient.
- Available in tape and reel for automatic pick and place.
- SV...K 20 with $I_{max} = 1 \times 15 \text{ kA} @ 8/20 \mu\text{s}$ is available upon request.
- SV...K 23 with $I_{max} = 1 \times 20 \text{ kA} @ 8/20 \mu\text{s}$ is available upon request.

Absolute Maximum Ratings

Continuous:	Standard Types	Units	Custom Designed Types	Units
Steady State Applied Voltage:				
DC Voltage Range (V_{dc})	85 to 745	V	85 to 1300	V
AC Voltage Range (V_{rms})	60 to 550	V	60 to 1000	V
Transient:				
Peak Single Pulse Surge Current, 8/20 μs Waveform, (I_{max})	600 to 15.000	A	>5500	A/cm ²
Single Pulse Surge Energy, 10/1000 μs Waveform (W_{max})	4 to 815	J	>400	J/cm ²
Operating Ambient Temperature	-40 to +85	°C	-40 to +125	°C
Storage Temperature Range	-40 to +125	°C	-40 to +125	°C
Threshold Voltage Temperature Coefficient	< +0,05	%/°C	< +0,05	%/°C
Insulation Resistance	> 1	G Ω	> 1	G Ω
Isolation Voltage Capability	> 2,5	kV	> 2,5	kV
Response Time	< 25	ns	< 2,5	μs
Climatic Category	40 / 85 / 56		40 / 125 / 56	

* valid in case of epoxy coated components

Device Ratings and Characteristics



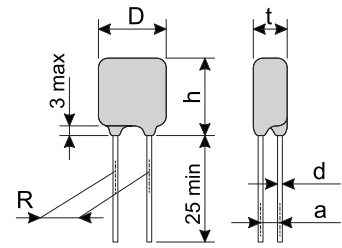
SV 60 K 5.....SV 230 K 23

Type	V _{rms} V	V _{dc} V	V _n @ 1 mA V	V _c V	I _c A	W _{max} 10/1000 μs J	P max W	I _{max} * 8/20 μs A	C typ. @ 1 kHz pF	D max mm	t max mm	R mm	d mm	h max mm
SV 60 K 5	60	85	100	155v	5	4	0,1	600	370	7	2,5	5	0,6	9,5
SV 60 K 7	60	85	100	155	10	9	0,25	1750	900	9	3,5	5	0,6	11,5
SV 60 K 10	60	85	100	155	25	20	0,4	3500	1380	12	4,1	7,5	0,8	15
SV 60 K 14	60	85	100	155	50	42	0,6	8000	2300	16	4,2	7,5	0,8	19
SV 60 K 20	60	85	100	155	100	89	1	12000	3400	22,5	4,5	10	0,8	26
SV 75 K 5	75	100	120	190	5	5	0,1	600	300	7	3,6	5	0,6	9,5
SV 75 K 7	75	100	120	190	10	11	0,25	1750	720	9	3,6	5	0,6	11,5
SV 75 K 10	75	100	120	190	25	26	0,4	3500	1080	12	4,2	7,5	0,8	15
SV 75 K 14	75	100	120	190	50	51	0,6	8000	1850	16	4,2	7,5	0,8	19
SV 75 K 20	75	100	120	190	100	101	1	12000	3100	22,5	4,6	10	0,8	26
SV 95 K 5	95	125	150	240	5	7	0,1	600	240	7	3,8	5	0,6	9,5
SV 95 K 7	95	125	150	240	10	14	0,25	1750	580	9	3,8	5	0,6	11,5
SV 95 K 10	95	125	150	240	25	31	0,4	3500	870	12	4,3	7,5	0,8	15
SV 95 K 14	95	125	150	240	50	64	0,6	8000	1480	16	4,3	7,5	0,8	19
SV 95 K 20	95	125	150	240	100	133	1	12000	2700	22,5	4,6	10	0,8	26
SV 115 K 5	115	150	180	290	5	8	0,1	600	200	7	4,0	5	0,6	9,5
SV 115 K 7	115	150	180	290	10	16	0,25	1750	480	9	4,0	5	0,6	11,5
SV 115 K 10	115	150	180	290	25	37	0,4	3500	750	12	4,3	7,5	0,8	15
SV 115 K 14	115	150	180	290	50	78	0,6	8000	1230	16	4,4	7,5	0,8	19
SV 115 K 20	115	150	180	290	100	147	1	12000	2200	22,5	4,8	10	0,8	26
SV 130 K 5	130	170	205	320	5	9	0,1	600	180	7	4,0	5	0,6	9,5
SV 130 K 7	130	170	205	320	10	19	0,25	1750	430	9	4,0	5	0,6	11,5
SV 130 K 10	130	170	205	320	25	42	0,4	3500	670	12	4,5	7,5	0,8	15
SV 130 K 14	130	170	205	320	50	85	0,6	8000	1100	16	4,6	7,5	0,8	19
SV 130 K 20	130	170	205	320	100	177	1	12000	2150	22,5	5,0	10	1	26
SV 130 K 23	130	170	205	320	100	222	1	15000	3390	25	5,0	10	1	27
SV 140 K 5	140	180	220	340	5	9	0,1	600	170	7	4,1	5	0,6	9,5
SV 140 K 7	140	180	220	340	10	22	0,25	1750	400	9	4,1	5	0,6	11,5
SV 140 K 10	140	180	220	340	25	46	0,4	3500	620	12	4,6	7,5	0,8	15
SV 140 K 14	140	180	220	340	50	94	0,6	8000	1020	16	4,7	7,5	0,8	19
SV 140 K 20	140	180	220	340	100	196	1	12000	1900	22,5	5,4	10	1	26
SV 140 K 23	140	180	220	340	100	247	1	15000	3340	25	5,4	10	1	27
SV 150 K 5	150	200	240	360	5	11	0,1	600	160	7	4,3	5	0,6	9,5
SV 150 K 7	150	200	240	360	10	23	0,25	1750	380	9	4,3	5	0,6	11,5
SV 150 K 10	150	200	240	360	25	51	0,4	3500	590	12	4,8	7,5	0,8	15
SV 150 K 14	150	200	240	360	50	101	0,6	8000	690	16	4,8	7,5	0,8	19
SV 150 K 20	150	200	240	360	100	213	1	12000	1740	22,5	5,6	10	1	26
SV 150 K 23	150	200	240	360	100	270	1	15000	3050	25	5,6	10	1	27
SV 175 K 5	175	225	270	420	5	11	0,1	600	140	7	4,8	5	0,6	9,5
SV 175 K 7	175	225	270	420	10	26	0,25	1750	330	9	4,8	5	0,6	11,5
SV 175 K 10	175	225	270	420	25	58	0,4	3500	500	12	5,0	7,5	0,8	15
SV 175 K 14	175	225	270	420	50	119	0,6	8000	830	16	5,0	7,5	0,8	19
SV 175 K 20	175	225	270	420	100	241	1	12000	1630	22,5	5,8	10	1	26
SV 175 K 23	175	225	270	420	100	305	1	15000	2870	25	5,8	10	1	27
SV 230 K 5	230	300	360	550	5	16	0,1	600	110	7	4,8	5	0,6	9,5
SV 230 K 7	230	300	360	550	10	35	0,25	1750	250	9	4,8	5	0,6	11,5
SV 230 K 10	230	300	360	550	25	78	0,4	3500	400	12	5,4	7,5	0,8	15
SV 230 K 14	230	300	360	550	50	157	0,6	8000	650	16	5,5	7,5	0,8	19
SV 230 K 20	230	300	360	550	100	322	1	12000	1220	22,5	5,9	10	1	26
SV 230 K 23	230	300	360	550	100	407	1	15000	2020	25	5,9	10	1	27

Type SV.....K 20 with I_{max} = 1 x 15 kA @ 8/20 μs available upon request

Type SV.....K 23 with I_{max} = 1 x 20 kA @ 8/20 μs available upon request

Device Ratings and Characteristics



SV 250 K 5.....SV 550 K 23

Type	V _{rms} V	V _{dc} V	V _n @ 1 mA V	V _c V	I _c A	W _{max} 10/1000 μs J	P max W	I _{max} * 8/20 μs A	C typ. @ 1 kHz pF	D max mm	t max mm	R mm	d mm	h max mm
SV 250 K 5	250	320	390	590	5	17	0,1	600	100	7	5,0	5	0,6	9,5
SV 250 K 7	250	320	390	590	10	38	0,25	1750	240	9	5,0	5	0,6	11,5
SV 250 K 10	250	320	390	590	25	85	0,4	3500	370	12	5,6	7,5	0,8	15
SV 250 K 14	250	320	390	590	50	169	0,6	8000	600	16	5,7	7,5	0,8	19
SV 250 K 20	250	320	390	590	100	345	1	12000	1130	22,5	6,1	10	1	26
SV 250 K 23	250	320	390	590	100	437	1	15000	1980	25	6,1	10	1	27
SV 275 K 5	275	350	430	680	5	20	0,1	600	90	7	5,6	5	0,6	9,5
SV 275 K 7	275	350	430	680	10	44	0,25	1750	220	9	5,6	5	0,6	11,5
SV 275 K 10	275	350	430	680	25	97	0,4	3500	350	12	6,0	7,5	0,8	15
SV 275 K 14	275	350	430	680	50	187	0,6	8000	550	16	6,0	7,5	0,8	19
SV 275 K 20	275	350	430	680	100	380	1	12000	1030	22,5	6,3	10	1	26
SV 275 K 23	275	350	430	680	100	481	1	15000	1800	25	6,3	10	1	27
SV 300 K 7	300	385	470	700	10	46	0,25	1750	200	9	5,8	5	0,6	11,5
SV 300 K 10	300	385	470	700	25	102	0,4	3500	320	12	6,1	7,5	0,8	15
SV 300 K 14	300	385	470	700	50	211	0,6	8000	510	16	6,1	7,5	0,8	19
SV 300 K 20	300	385	470	700	100	437	1	12000	940	22,5	6,6	10	1	27
SV 300 K 23	300	385	470	700	100	554	1	15000	1650	25	6,6	10	1	29
SV 320 K 10	320	420	510	760	25	144	0,4	3500	300	12	6,5	7,5	0,8	15
SV 320 K 14	320	420	510	760	50	230	0,6	8000	480	16	6,8	7,5	0,8	19
SV 320 K 20	320	420	510	760	100	485	1	12000	860	22,5	6,8	10	1	27
SV 320 K 23	320	420	510	760	100	611	1	15000	1520	25	6,8	10	1	29
SV 385 K 10	385	505	620	900	25	116	0,4	3500	270	12	6,9	7,5	0,8	15
SV 385 K 14	385	505	620	900	50	241	0,6	8000	410	16	6,9	7,5	0,8	19
SV 385 K 20	385	505	620	900	100	495	1	12000	710	22,5	7,5	10	1	27
SV 385 K 23	385	505	620	900	100	624	1	15000	1250	25	7,5	10	1	29
SV 420 K 10	420	560	680	980	25	121	0,4	3500	240	12	7,3	7,5	0,8	15
SV 420 K 14	420	560	680	980	50	253	0,6	8000	380	16	7,4	7,5	0,8	19
SV 420 K 20	420	560	680	980	100	523	1	12000	680	22,5	7,8	10	1	27
SV 420 K 23	420	560	680	980	100	670	1	15000	1200	25	7,8	10	1	29
SV 460 K 10	460	615	750	1080	25	132	0,4	3500	230	12	7,8	7,5	0,8	15
SV 460 K 14	460	615	750	1080	50	275	0,6	8000	350	16	7,8	7,5	0,8	19
SV 460 K 20	460	615	750	1080	100	572	1	12000	620	22,5	8,2	10	1	27
SV 460 K 23	460	615	750	1080	100	728	1	15000	1080	25	8,2	10	1	29
SV 510 K 10	510	670	820	1200	25	144	0,4	3500	210	12	8,2	7,5	0,8	15
SV 510 K 14	510	670	820	1200	50	284	0,6	8000	330	16	8,2	7,5	0,8	19
SV 510 K 20	510	670	820	1200	100	598	1	12000	570	22,5	8,7	10	1	27
SV 510 K 23	510	670	820	1200	100	750	1	15000	1000	25	8,7	10	1	29
SV 550 K 10	550	745	910	1350	25	168	0,4	3500	200	12	8,8	7,5	0,8	15
SV 550 K 14	550	745	910	1350	50	330	0,6	8000	310	16	8,8	7,5	0,8	19
SV 550 K 20	550	745	910	1350	100	644	1	12000	510	22,5	9,2	10	1	27
SV 550 K 23	550	745	910	1350	100	815	1	15000	900	25	9,2	10	1	29

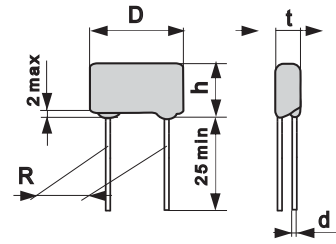
Type SV....K 20 with I_{max} = 1 x 15 kA @ 8/20 μs available upon request

Type SV....K 23 with I_{max} = 1 x 20 kA @ 8/20 μs available upon request

Full Custom Parameter Designed Medium Voltage Varistors

The SV series group of full custom parameter designed varistors consists of square and rectangular shaped varistors, available either as epoxy coated lead style components or as metalized pellets.

The customer can specify the varistor electrical properties and set the limits of size parameters in accordance with the General Technical Data, as provided below. The customer can also choose to have standard electrical parameters in a non-standard varistor shape and size to best fit the available housing. The customer has our full engineering support in realizing his specific protection requirement.



General Technical Data

Electrical Parameters		Value	Units
Varistor Threshold Voltage (V_n) Range at 1 mA		100 to 910	V
Continuous:			
Steady State Applied Voltage:			
DC Voltage Range (V_{dc})		85 to 745	V
AC Voltage Range (V_{rms})		60 to 550	V
Transient:			
Peak Single Pulse Surge Current, 8/20 μ s Waveform (I_{max})		> 5500	A/cm ²
Single Pulse Surge Energy, 10/1000 μ s Waveform (W_{max})		> 400	J/cm ³
Protective Level			
Clamping Voltage		< 1,9 x V_{dc}	V
Coefficient of non-linearity a	minimum	45	
	typical	60	
Leakage Current Level	at 25 °C	0.5	μ A/cm ²
	at 85 °C	10	μ A/cm ²
Temperature behavior			
Operating Ambient Temperature		-40 to +85	°C
Storage Temperature Range		-40 to +125	°C
Minimum Threshold Voltage Temperature Coefficient		-0,001	%/°C
Design			
Leaded	- coating	epoxy resin	
	- lead style	straight or crimped	
Pallet		solderable electrode finish	
Size Parameters			
Minimum Size		3 x 3	mm
Maximum Size		23 x 23	mm
Shape		square, rectangular	
Lead Spacing R		2,5, 5,0, 7,5, 10	mm
Wire Diameter d		0,6, 0,8, 1,0	mm
Packaging		bulk, tape and reel	

Ordering Information

SV 250 K 20 B L1 YY

SV	- Series Name
250	- Maximum Continuous Operating Voltage V_{rms}
K	- V_n Tolerance: J = \pm 5 %, K = \pm 10 %, S = special
20	- Model Size: 10, 14, 20, 23
B	- Package: R = Reel, A = Ammo pack, B = Bulk
L1	- Lead Style: 1 = straight, 5 = crimped, M = met....
YY	- Other parameters are either specified separately or are the function of electrical and/or size parameters

Varistor Marking

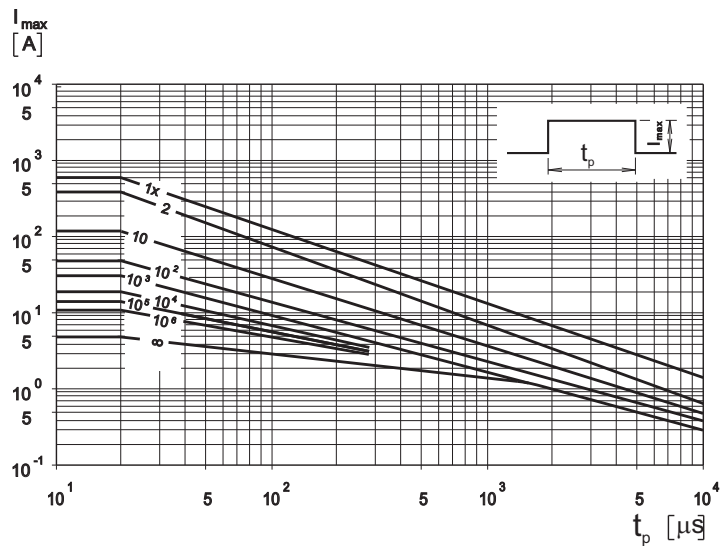
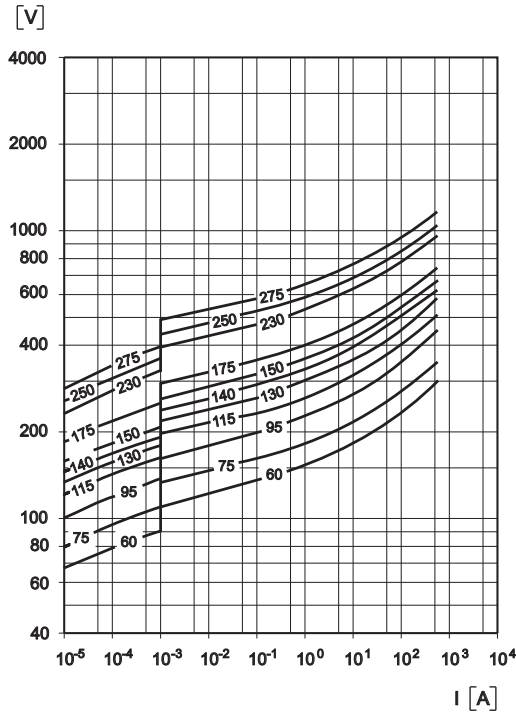
KEKO	- Trade name
SV 250	- Series Name
K 802	- V_{rms}
K	- V_n Tolerance
802	- Surge Current Code

Protection Level

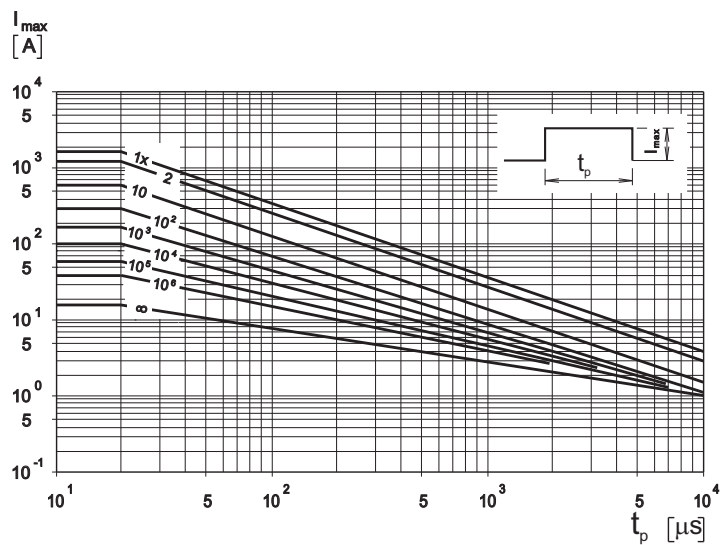
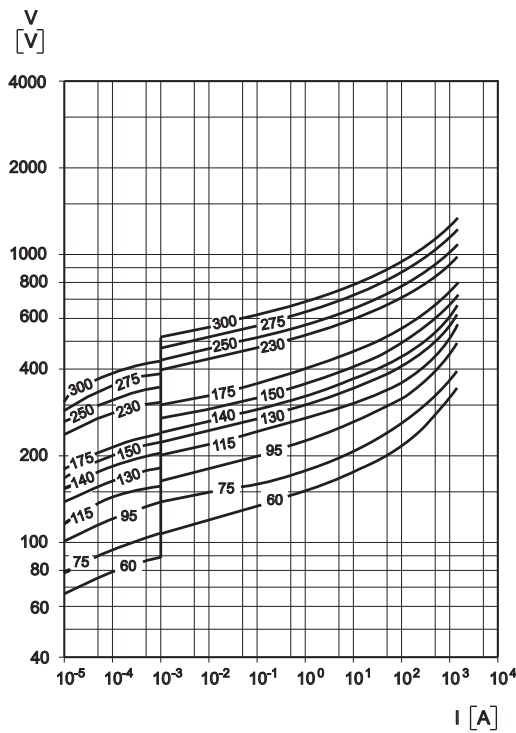
Pulse Rating Curves

* With the worst-case condition in the tolerance region

Model Size 5
SV 60...275



Model Size 7
SV 60...300



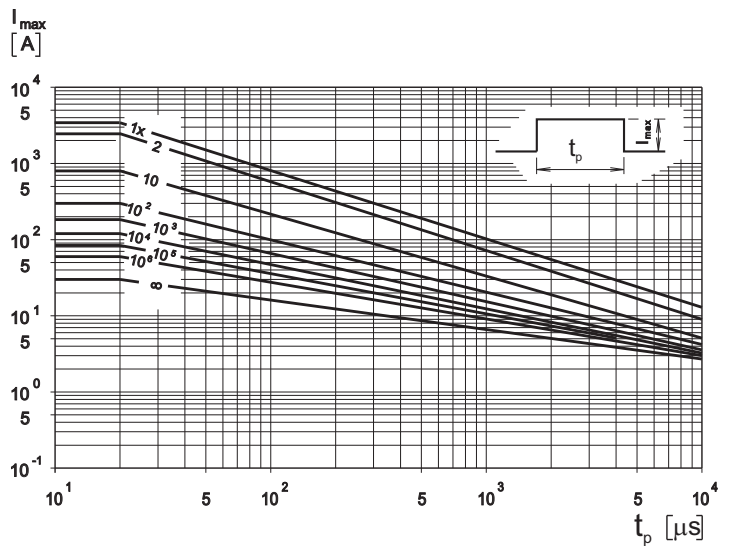
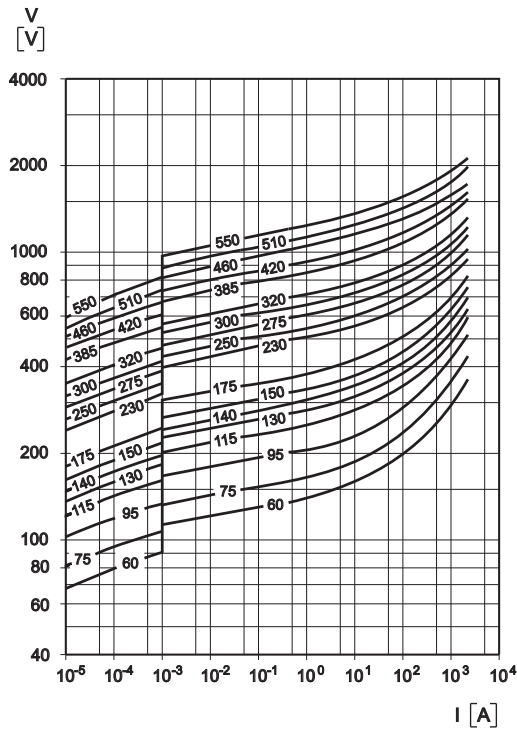
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Protection Level

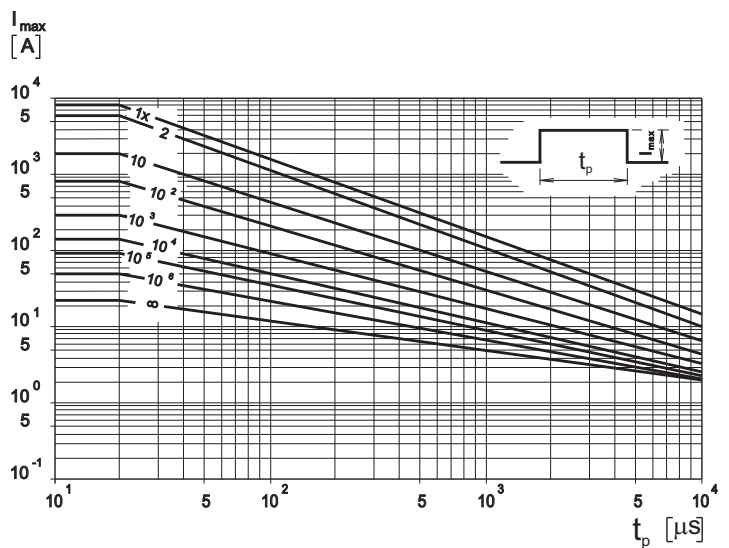
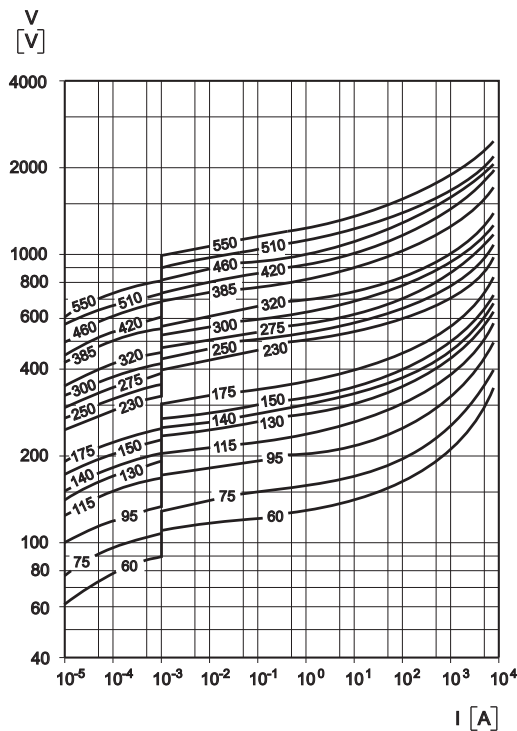
Pulse Rating Curves

* With the worst-case condition in the tolerance region

Model Size 10
SV 60...550



Model Size 14
SV 60...550



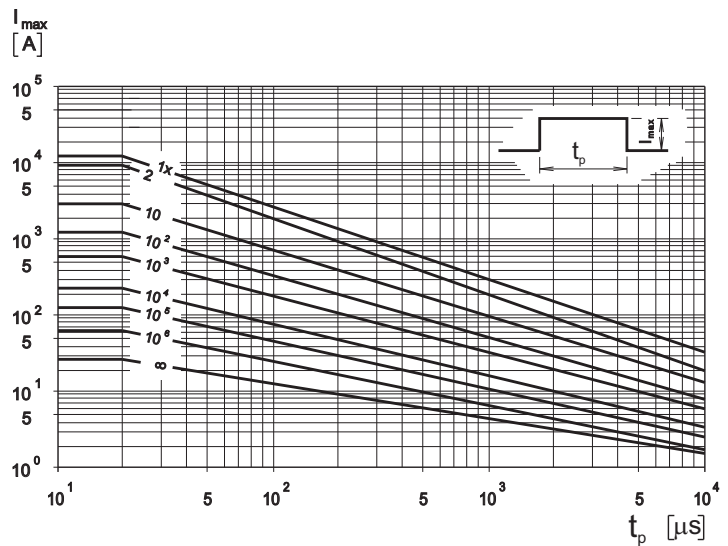
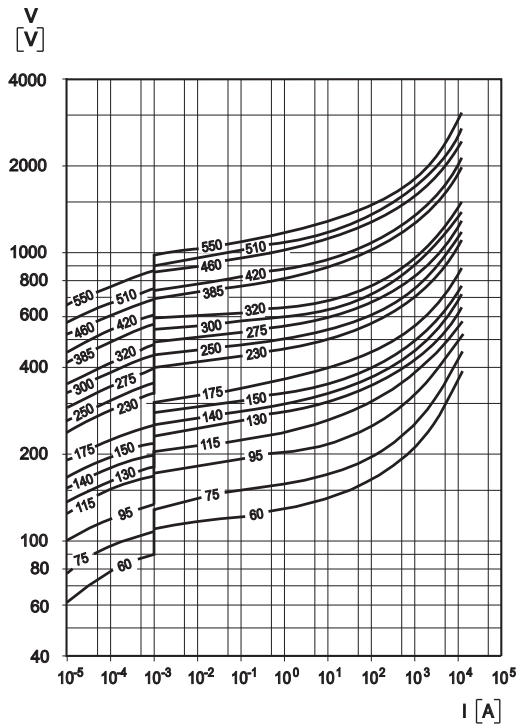
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Protection Level

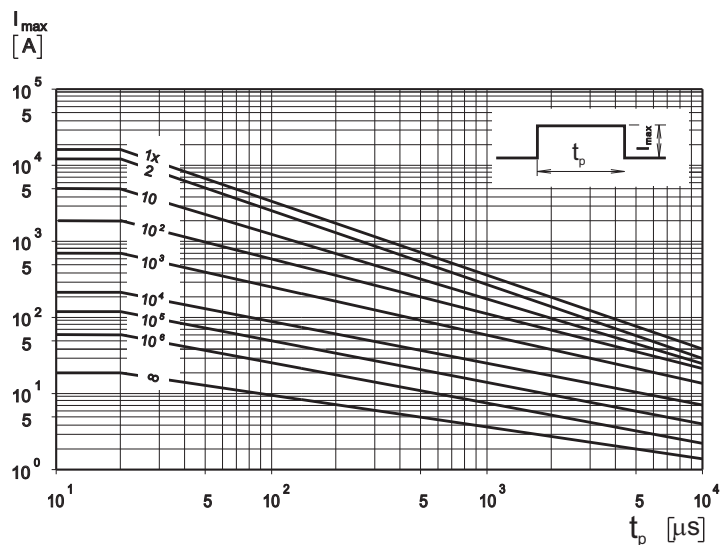
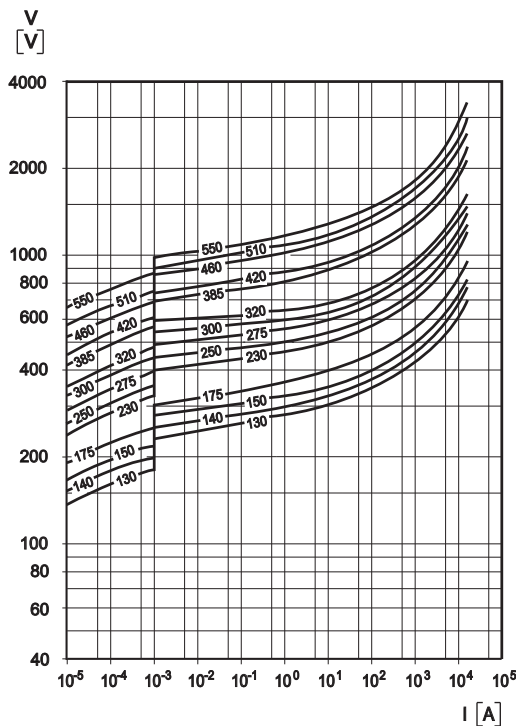
Pulse Rating Curves

* With the worst-case condition in the tolerance region

Model Size 20
SV 60...550



Model Size 23
SV 130...550



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Extended MEDIUM VOLTAGE DISC VARISTORS - CV+ SERIES

Description

The CV+ series of transient surge suppressors is the extended version of CV disc shaped varistors. The CV+ series consists of 7 mm, 10 mm, 14 mm, 20 mm and 23mm sized varistors of extremely high current and energy capabilities. They provide an increased level of protection necessary for the transients expected in telecommunication and AC power networks. The AC operating voltage of these varistors ranges from 60 V to 550 V.



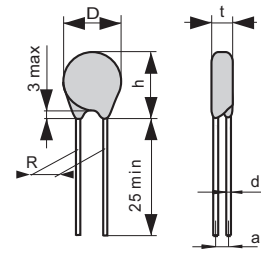
Features

- Operating voltage range V_{rms} 60 V to 550 V.
- Operating voltage range V_{dc} 85 V to 745 V.
- 5 model sizes available 7 mm, 10 mm, 14 mm, 20 mm, 23 mm.
- Broad current handling capability I_{max} 1750 A to 15000 A (8/20 μ s).
- Broad energy absorption capability W_{max}9 J to 627 J (10/1000 μ s).
- +85 °C continuous operating temperature.
- Sizes 7, 10, 14 and 20 mm available in tape and reel for automatic pick and place.
- **cULus** UL 1449, 3rd edition & CSA C22.2. File E326499 Section 6.
- Lead free components.
- Higher operating voltages are available upon request (*).
- Higher I_{max} and W_{max} are available upon request (**).

Absolute Maximum Ratings

Continuous:	Units	Value
Steady State Applied Voltage:		
DC Voltage Range (V_{dc})	V	85 to 745
AC Voltage Range (V_{rms})	V	60 to 550
Transient:		
Peak Single Pulse Surge Current, 8/20 μ s Waveform (I_{max})	A	1750 to 15000
Single Pulse Surge Energy, 10/1000 μ s Waveform (W_{max})	J	9 to 627
Operating Ambient Temperature	°C	-40 to +85
Storage Temperature	°C	-40 to +125
Threshold Voltage Temperature Coefficient	%/°C	< + 0,05
Insulation Resistance	G Ω	> 1
Isolation Voltage Capability	kV	> 2,5
Response Time	ns	< 25
Climatic Category		40 / 85 / 56

Device Ratings and Characteristics

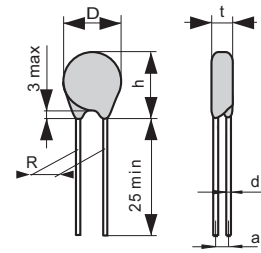


CV+ 60 K 7.....CV+ 300 K 23

Type	V_{rms} V	V_{dc} V	V_n @ 1 mA V	V_c V	I_c A	W_{max} 10/1000 μ s J	P max W	I_{max} 8/20 μ s A	C @ 1 kHz pF	D max mm	t max mm	R mm	d mm	h max mm
CV+ 60 K 7	60	85	100	165	10	9	0,25	1750	680	9	3,5	5	0,6	11,5
CV+ 60 K 10	60	85	100	165	25	18	0,4	3500	1200	12,5	4,1	7,5	0,8	15
CV+ 60 K 14	60	85	100	165	50	38	0,6	6000	2200	16,5	4,2	7,5	0,8	20
CV+ 60 K 20	60	85	100	165	100	77	1	12000	4100	22,5	4,6	10	1	26
CV+ 75 K 7	75	100	120	200	10	11	0,25	1750	550	9	3,6	5	0,6	11,5
CV+ 75 K 10	75	100	120	200	25	24	0,4	3500	950	12,5	4,2	7,5	0,8	15
CV+ 75 K 14	75	100	120	200	50	46	0,6	6000	1800	16,5	4,2	7,5	0,8	20
CV+ 75 K 20	75	100	120	200	100	88	1	12000	3300	22,5	4,6	10	1	26
CV+ 95 K 7	95	125	150	250	10	14	0,25	1750	440	9	3,8	5	0,6	11,5
CV+ 95 K 10	95	125	150	250	25	28	0,4	3500	750	12	4,3	7,5	0,8	15
CV+ 95 K 14	95	125	150	250	50	58	0,6	6000	1400	16	4,3	7,5	0,8	20
CV+ 95 K 20	95	125	150	250	100	116	1	12000	2600	22,5	4,6	10	1	26
CV+ 115 K 7	115	150	180	300	10	16	0,25	1750	360	9	4,0	5	0,6	11,5
CV+ 115 K 10	115	150	180	300	25	34	0,4	3500	650	12,5	4,3	7,5	0,8	15
CV+ 115 K 14	115	150	180	300	50	71	0,6	6000	1200	16,5	4,4	7,5	0,8	20
CV+ 115 K 20	115	150	180	300	100	128	1	12000	2100	22,5	4,8	10	1	26
CV+ 130 K 7	130	170	205	340	10	19	0,25	1750	360	9	4,0	5	0,6	11,5
CV+ 130 K 10	130	170	205	340	25	38	0,4	3500	580	12,5	4,5	7,5	0,8	15
CV+ 130 K 14	130	170	205	340	50	77	0,6	6000	1050	16,5	4,6	7,5	0,8	20
CV+ 130 K 20	130	170	205	340	100	154	1	12000	1900	22,5	5,0	10	1	26
CV+ 130 K 23	130	170	205	340	100	172	1	15000	3500	25	5,0	10	1	27
CV+ 140 K 7	140	180	220	360	10	22	0,25	1750	300	9	4,1	5	0,6	11,5
CV+ 140 K 10	140	180	220	360	25	42	0,4	3500	540	12,5	4,6	7,5	0,8	15
CV+ 140 K 14	140	180	220	360	50	85	0,6	6000	980	16,5	4,7	7,5	0,8	20
CV+ 140 K 20	140	180	220	360	100	170	1	12000	1800	22,5	5,1	10	1	26
CV+ 140 K 23	140	180	220	360	100	190	1	15000	3200	25	5,1	10	1	27
CV+ 150 K 7	150	200	240	395	10	23	0,25	1750	280	9	4,3	5	0,6	11,5
CV+ 150 K 10	150	200	240	395	25	46	0,4	3500	510	12,5	4,6	7,5	0,8	15
CV+ 150 K 14	150	200	240	395	50	92	0,6	6000	900	16,5	4,8	7,5	0,8	20
CV+ 150 K 20	150	200	240	395	100	185	1	12000	1600	22,5	5,2	10	1	26
CV+ 150 K 23	150	200	240	395	100	207	1	15000	2900	25	5,2	10	1	27
CV+ 175 K 7	175	225	270	455	10	26	0,25	1750	250	9	4,8	5	0,6	11,5
CV+ 175 K 10	175	225	270	455	25	53	0,4	3500	440	12,5	4,9	7,5	0,8	15
CV+ 175 K 14	175	225	270	455	50	108	0,6	6000	800	16,5	4,9	7,5	0,8	20
CV+ 175 K 20	175	225	270	455	100	210	1	12000	1400	22,5	5,3	10	1	26
CV+ 175 K 23	175	225	270	455	100	235	1	15000	2500	25	5,3	10	1	27
CV+ 230 K 7	230	300	360	595	10	35	0,25	1750	190	9	4,8	5	0,6	11,5
CV+ 230 K 10	230	300	360	595	25	71	0,4	3500	350	12,5	5,4	7,5	0,8	15
CV+ 230 K 14	230	300	360	595	50	143	0,6	6000	620	16,5	5,5	7,5	0,8	20
CV+ 230 K 20	230	300	360	595	100	280	1	12000	1100	22,5	5,9	10	1	26
CV+ 230 K 23	230	300	360	595	100	313	1	15000	2200	25	5,9	10	1	27
CV+ 250 K 7	250	320	390	650	10	38	0,25	1750	180	9	5,0	5	0,6	11,5
CV+ 250 K 10	250	320	390	650	25	77	0,4	3500	320	12,5	5,6	7,5	0,8	15
CV+ 250 K 14	250	320	390	650	50	154	0,6	6000	580	16,5	5,7	7,5	0,8	20
CV+ 250 K 20	250	320	390	650	100	300	1	12000	1000	22,5	6,1	10	1	26
CV+ 250 K 23	250	320	390	650	100	336	1	15000	1900	25	6,1	10	1	27
CV+ 275 K 7	275	350	430	710	10	44	0,25	1750	160	9	5,6	5	0,6	11,5
CV+ 275 K 10	275	350	430	710	25	88	0,4	3500	300	12,5	5,8	7,5	0,8	15
CV+ 275 K 14	275	350	430	710	50	170	0,6	6000	530	16,5	5,9	7,5	0,8	20
CV+ 275 K 20	275	350	430	710	100	330	1	12000	900	22,5	6,3	10	1	26
CV+ 275 K 23	275	350	430	710	100	370	1	15000	1600	25	6,3	10	1	27
CV+ 300 K 7	300	385	470	775	10	46	0,25	1750	150	9	5,8	5	0,6	11,5
CV+ 300 K 10	300	385	470	775	25	93	0,4	3500	280	12,5	6,1	7,5	0,8	15
CV+ 300 K 14	300	385	470	775	50	192	0,6	6000	490	16,5	6,1	7,5	0,8	20
CV+ 300 K 20	300	385	470	775	100	380	1	12000	850	22,5	6,0	10	1	27
CV+ 300 K 23	300	385	470	775	100	426	1	15000	1300	25	6,6	10	1	29

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Device Ratings and Characteristics



CV+ 320 K 10.....CV+ 550 K 23

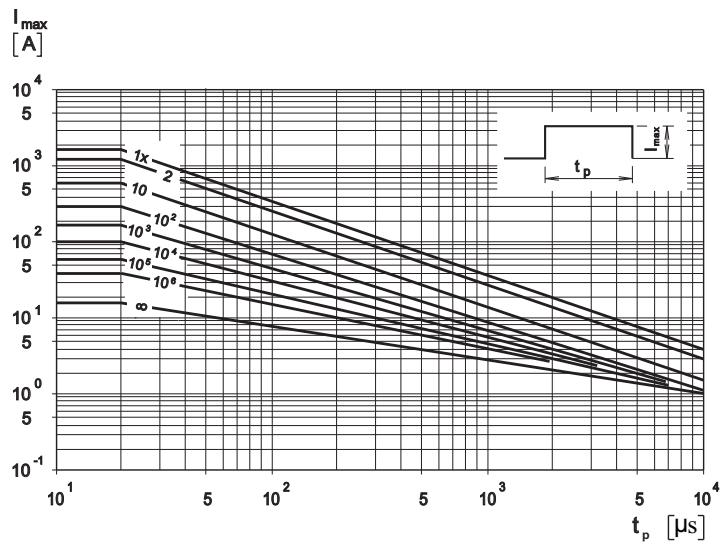
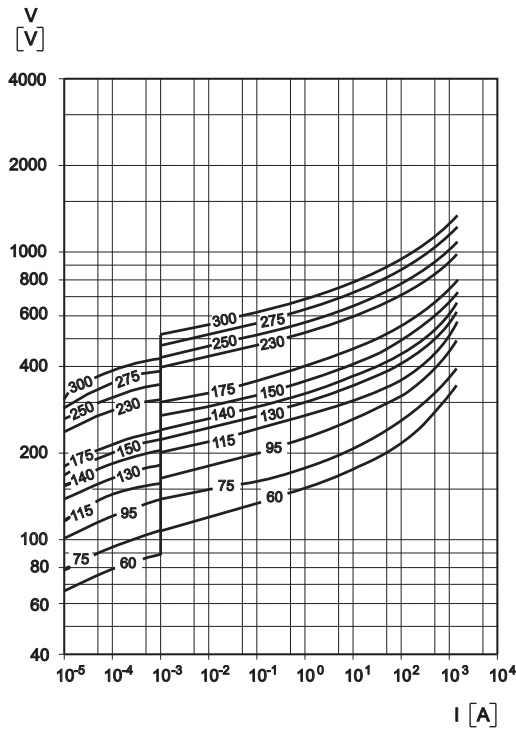
Type	V_{rms} V	V_{dc} V	V_n @ 1 mA V	V_c V	I_c A	W_{max} 10/1000 μ s J	P max W	I_{max} 8/20 μ s A	C @ 1 kHz pF	D max mm	t max mm	R mm	d mm	h max mm
CV+ 320 K 10	320	420	510	840	25	104	0,4	3500	260	12,5	5,9	7,5	0,8	16
CV+ 320 K 14	320	420	510	840	50	209	0,6	6000	460	16,5	6,5	7,5	0,8	21
CV+ 320 K 20	320	420	510	840	100	420	1	12000	800	22,5	6,8	10	1	27
CV+ 320 K 23	320	420	510	840	100	470	1	15000	1100	25	6,8	10	1	29
CV+ 385 K 10	385	505	620	1025	25	106	0,4	3500	230	12,5	6,4	7,5	0,8	16
CV+ 385 K 14	385	505	620	1025	50	219	0,6	6000	390	16,5	6,9	7,5	0,8	21
CV+ 385 K 20	385	505	620	1025	100	430	1	12000	650	22,5	7,5	10	1	27
CV+ 385 K 23	385	505	620	1025	100	480	1	15000	1000	25	7,5	10	1	29
CV+ 420 K 10	420	560	680	1120	25	110	0,4	3500	210	12,5	7,3	7,5	0,8	16
CV+ 420 K 14	420	560	680	1120	50	230	0,6	6000	370	16,5	7,4	7,5	0,8	21
CV+ 420 K 20	420	560	680	1120	100	460	1	12000	620	22,5	7,8	10	1	27
CV+ 420 K 23	420	560	680	1120	100	515	1	15000	950	25	7,8	10	1	29
CV+ 460 K 10	460	615	750	1240	25	120	0,4	3500	200	12,5	7,8	7,5	0,8	16
CV+ 460 K 14	460	615	750	1240	50	250	0,6	6000	340	16,5	7,8	7,5	0,8	21
CV+ 460 K 20	460	615	750	1240	100	500	1	12000	560	22,5	8,2	10	1	27
CV+ 460 K 23	460	615	750	1240	100	560	1	15000	900	25	8,2	10	1	29
CV+ 510 K 10	510	670	820	1355	25	131	0,4	3500	180	12,5	8,2	7,5	0,8	16
CV+ 510 K 14	510	670	820	1355	50	258	0,6	6000	310	16,5	8,2	7,5	0,8	21
CV+ 510 K 20	510	670	820	1355	100	520	1	12000	510	22,5	8,7	10	1	27
CV+ 510 K 23	510	670	820	1355	100	582	1	15000	650	25	8,7	10	1	29
CV+ 550 K 10	550	745	910	1500	25	153	0,4	3500	170	12,5	8,8	7,5	0,8	16
CV+ 550 K 14	550	745	910	1500	50	300	0,6	6000	290	16,5	8,8	7,5	0,8	21
CV+ 550 K 20	550	745	910	1500	100	560	1	12000	480	22,5	9,2	10	1	27
CV+ 550 K 23	550	745	910	1500	100	627	1	15000	800	25	9,2	10	1	29

Protection Level

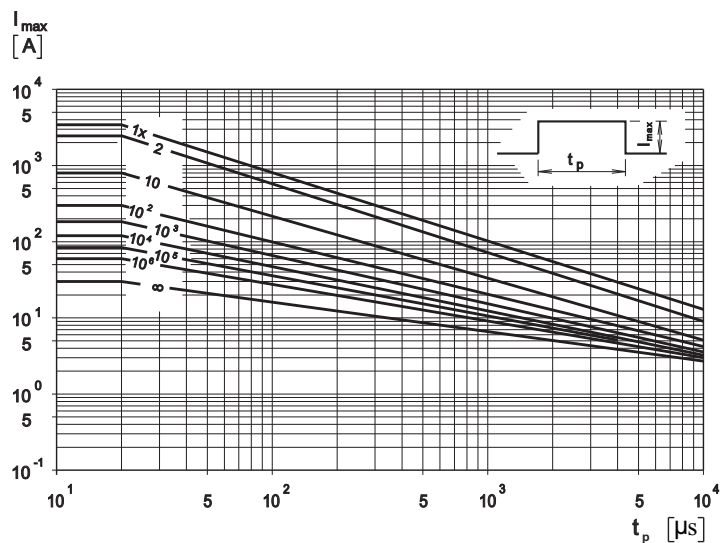
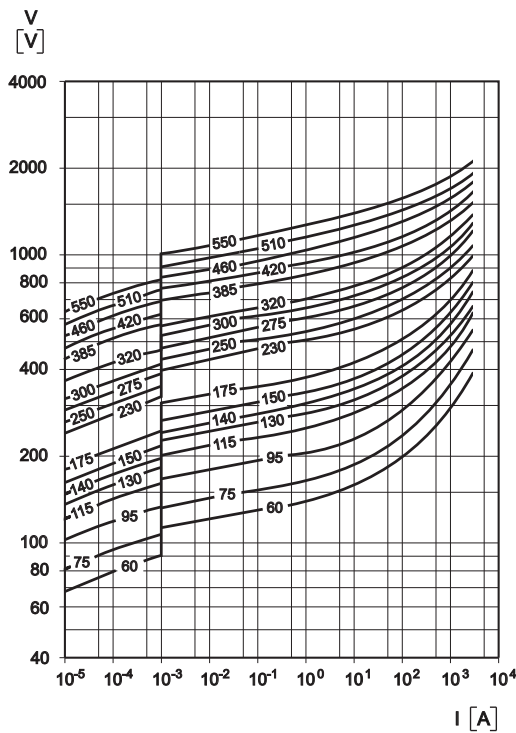
Pulse Rating Curves

* With the worst-case condition in the tolerance region

Model Size 7
CV+ 60...300



Model Size 10
CV+ 60...550



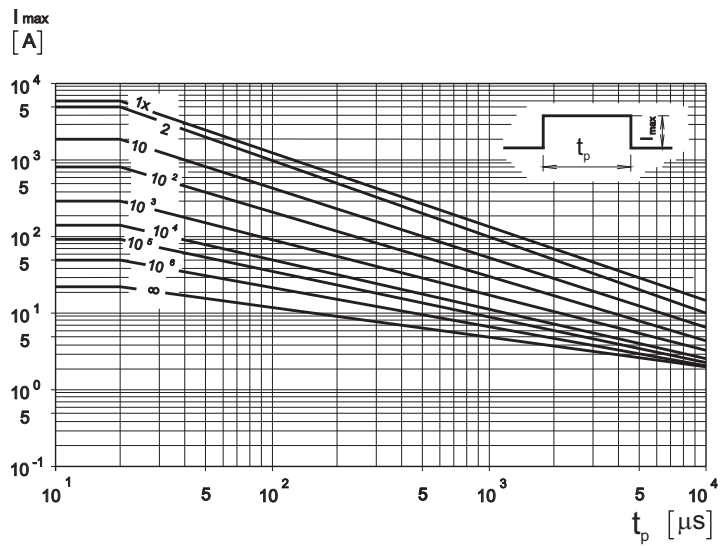
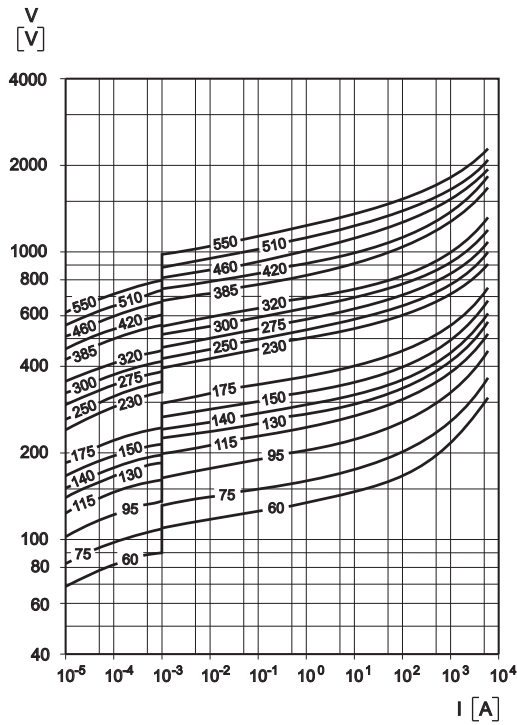
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Protection Level

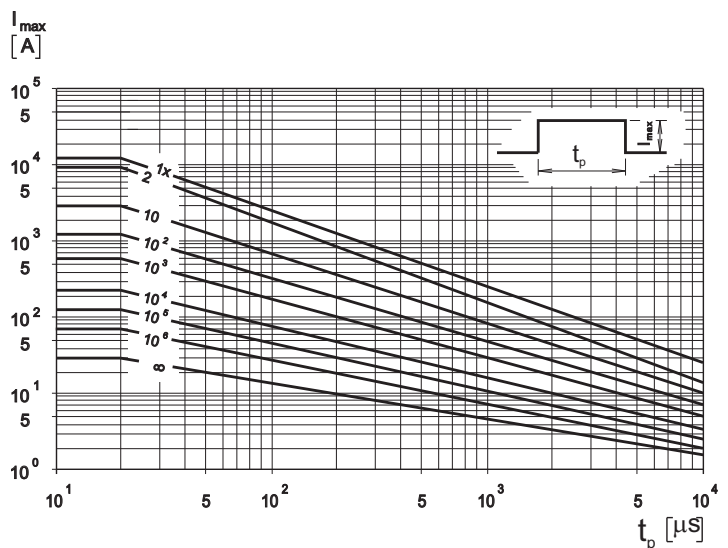
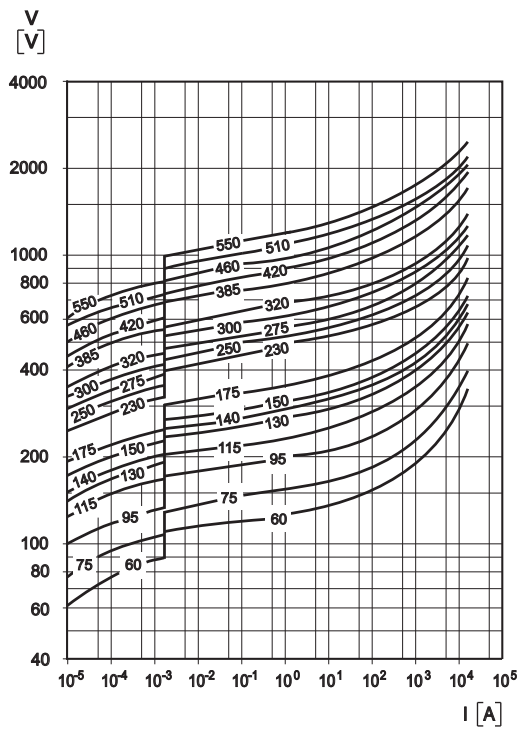
Pulse Rating Curves

* With the worst-case condition in the tolerance region

Model Size 14
CV+ 60...550



Model Size 20
CV+ 60...550



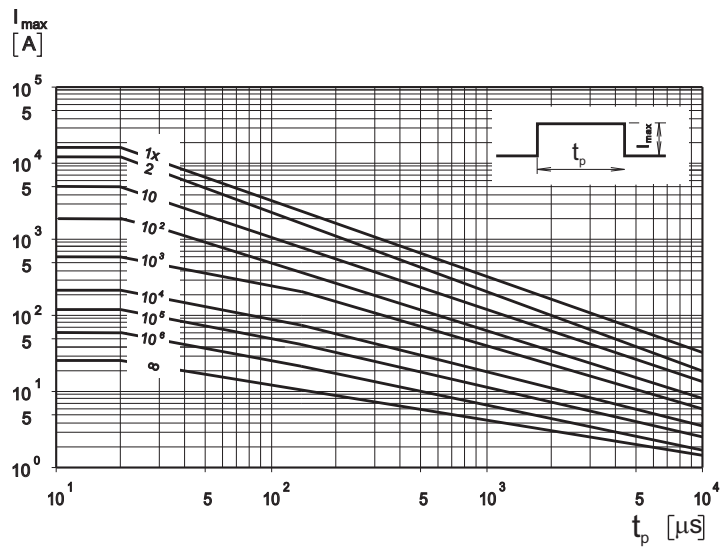
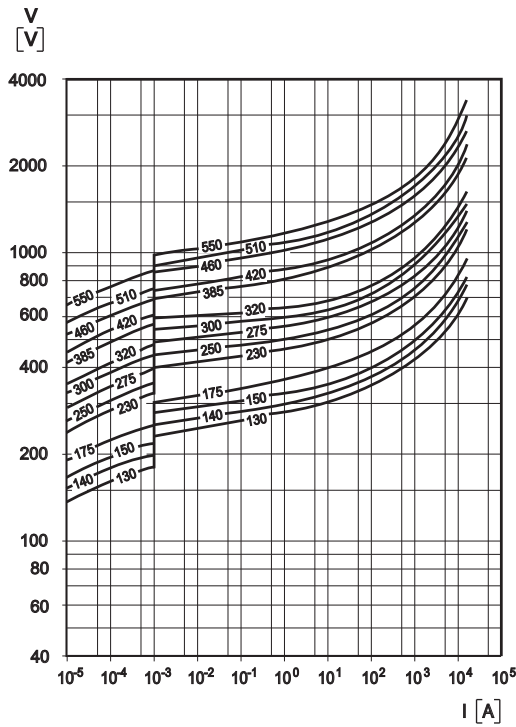
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Protection Level

Pulse Rating Curves

* With the worst-case condition in the tolerance region

Model Size 23
CV+ 60...550



MEDIUM VOLTAGE DISC VARISTORS - CV SERIES


Description

The CV series of transient surge suppressors are disc shaped varistors that can be operated continuously in low and medium voltage circuits of electronic systems as well as across AC power lines.

Due to their radial lead construction, these components require very little mounting space. They are available in five model sizes: 5mm, 7mm, 10 mm, 14 mm and 20 mm and feature a wide AC operating voltage ranging from 50 V to 680 V.



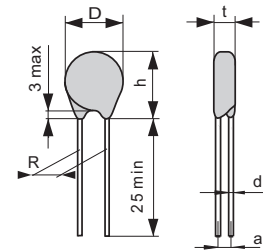
Features

- Operating voltage range V_{rms} 50 V to 680 V; higher voltages available upon request.
- Operating voltage range V_{dc} 65 V to 895 V.
- 5 model sizes available5 mm, 7 mm, 10 mm, 14 mm, 20 mm.
- Broad current handling capability I_{max} 400 to 6500 A (8/20 μ s).
- Broad energy absorption capability W_{max}2,7 to 620 J (10/1000 μ s).
- +85 °C continuous operating temperature.
- Available in tape and reel for automatic pick and place.
-  UL 1449 & CSA C22.2 File E163318, Across-The-Line Components Section 1. UL 1449, 3rd edition & CSA C22.2. File E326499 Section 5.
- VDE Reg. Nr. 10144-CECC 42200 and IEC 61051, Approval No. 010144
- Lead free components.
- For RMS voltages below 50V see ZV Leaded series.

Absolute Maximum Ratings

Continuous:	Units	Value
Steady State Applied Voltage:		
DC Voltage Range (V_{dc})	V	65 to 895
AC Voltage Range (V_{rms})	V	50 to 680
Transient:		
Peak Single Pulse Surge Current, 8/20 μ s Waveform (I_{max})	A	400 to 6500
Single Pulse Surge Energy, 10/1000 μ s Waveform (W_{max})	J	2,7 to 620
Operating Ambient Temperature	°C	-40 to +85
Storage Temperature	°C	-40 to +125
Threshold Voltage Temperature Coefficient	%/°C	< + 0,05
Insulation Resistance	G Ω	> 1
Isolation Voltage Capability	kV	> 2,5
Response Time	ns	< 25
Climatic Category		40 / 85 / 56

Device Ratings and Characteristics

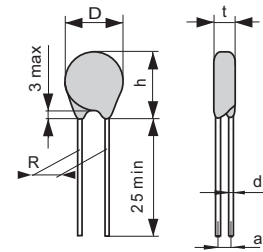


CV 50 K 5.....CV 175 K 20

Type	V _{rms} V	V _{dc} V	V _n @ 1 mA V	V _c V	I _c A	W _{max} 10/1000 μs J	P max W	I _{max} 8/20 μs A	C typ. @ 1 kHz pF	D max mm	t max mm	R mm	d mm	h max mm
CV 50 K 5	50	65	82	135	5	2,7	0,1	400	350	7	3,5	5	0,6	9,5
CV 50 K 7	50	65	82	135	10	6,8	0,25	1200	820	9	3,5	5	0,6	11,5
CV 50 K 10	50	65	82	135	25	17	0,4	2500	1400	12,5	4,1	7,5	0,8	15
CV 50 K 14	50	65	82	135	50	35	0,6	4500	2600	16,5	4,1	7,5	0,8	20
CV 50 K 20	50	65	82	135	100	75	1	6500	5000	22,5	4,5	10	1	26
CV 60 K 5	60	85	100	165	5	3	0,1	400	300	7	3,5	5	0,6	9,5
CV 60 K 7	60	85	100	165	10	7	0,25	1200	680	9	3,5	5	0,6	11,5
CV 60 K 10	60	85	100	165	25	16	0,4	2500	1200	12,5	4,1	7,5	0,8	15
CV 60 K 14	60	85	100	165	50	34	0,6	4500	2200	16,5	4,2	7,5	0,8	20
CV 60 K 20	60	85	100	165	100	71	1	6500	4100	22,5	4,6	10	1	26
CV 75 K 5	75	100	120	200	5	4	0,1	400	250	7	3,6	5	0,6	9,5
CV 75 K 7	75	100	120	200	10	9	0,25	1200	550	9	3,6	5	0,6	11,5
CV 75 K 10	75	100	120	200	25	21	0,4	2500	950	12,5	4,2	7,5	0,8	15
CV 75 K 14	75	100	120	200	50	41	0,6	4500	1800	16,5	4,2	7,5	0,8	20
CV 75 K 20	75	100	120	200	100	81	1	6500	3300	22,5	4,6	10	1	26
CV 95 K 5	95	125	150	250	5	6	0,1	400	200	7	3,8	5	0,6	9,5
CV 95 K 7	95	125	150	250	10	11	0,25	1200	440	9	3,8	5	0,6	11,5
CV 95 K 10	95	125	150	250	25	25	0,4	2500	750	12,5	4,3	7,5	0,8	15
CV 95 K 14	95	125	150	250	50	51	0,6	4500	1400	16,5	4,3	7,5	0,8	20
CV 95 K 20	95	125	150	250	100	106	1	6500	2600	22,5	4,6	10	1	26
CV 115 K 5	115	150	180	300	5	6	0,1	400	170	7	4,0	5	0,6	9,5
CV 115 K 7	115	150	180	300	10	13	0,25	1200	360	9	4,0	5	0,6	11,5
CV 115 K 10	115	150	180	300	25	30	0,4	2500	650	12,5	4,3	7,5	0,8	15
CV 115 K 14	115	150	180	300	50	62	0,6	4500	1200	16,5	4,4	7,5	0,8	20
CV 115 K 20	115	150	180	300	100	118	1	6500	2100	22,5	4,8	10	1	26
CV 130 K 5	130	170	205	340	5	7	0,1	400	150	7	4,0	5	0,6	9,5
CV 130 K 7	130	170	205	340	10	15	0,25	1200	320	9	4,0	5	0,6	11,5
CV 130 K 10	130	170	205	340	25	34	0,4	2500	580	12,5	4,5	7,5	0,8	15
CV 130 K 14	130	170	205	340	50	68	0,6	4500	1050	16,5	4,6	7,5	0,8	20
CV 130 K 20	130	170	205	340	100	142	1	6500	1900	22,5	5,0	10	1	26
CV 140 K 5	140	180	220	360	5	7	0,1	400	140	7	4,1	5	0,6	9,5
CV 140 K 7	140	180	220	360	10	18	0,25	1200	1200	9	4,1	5	0,6	11,5
CV 140 K 10	140	180	220	360	25	37	0,4	2500	2500	12,5	4,6	7,5	0,8	15
CV 140 K 14	140	180	220	360	50	75	0,6	4500	4500	16,5	4,7	7,5	0,8	20
CV 140 K 20	140	180	220	360	100	157	1	6500	6500	22,5	5,1	10	1	26
CV 150 K 5	150	200	240	395	5	9	0,1	400	130	7	4,3	5	0,6	9,5
CV 150 K 7	150	200	240	395	10	18	0,25	1200	280	9	4,3	5	0,6	11,5
CV 150 K 10	150	200	240	395	25	41	0,4	2500	510	12,5	4,6	7,5	0,8	15
CV 150 K 14	150	200	240	395	50	81	0,6	4500	900	16,5	4,8	7,5	0,8	20
CV 150 K 20	150	200	240	395	100	170	1	6500	1550	22,5	5,2	10	1	26
CV 175 K 5	175	225	270	455	5	9,5	0,1	400	120	7	4,8	5	0,6	9,5
CV 175 K 7	175	225	270	455	10	21	0,25	1200	250	9	4,8	5	0,6	11,5
CV 175 K 10	175	225	270	455	25	46	0,4	2500	440	12,5	4,9	7,5	0,8	15
CV 175 K 14	175	225	270	455	50	95	0,6	4500	800	16,5	4,9	7,5	0,8	20
CV 175 K 20	175	225	270	455	100	193	1	6500	1400	22,5	5,3	10	1	26

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Device Ratings and Characteristics



CV 230 K 5 CV 680 K 20

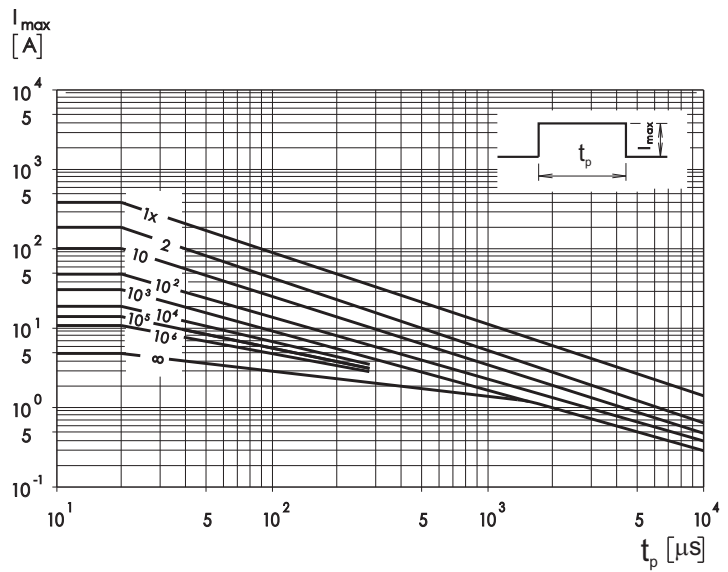
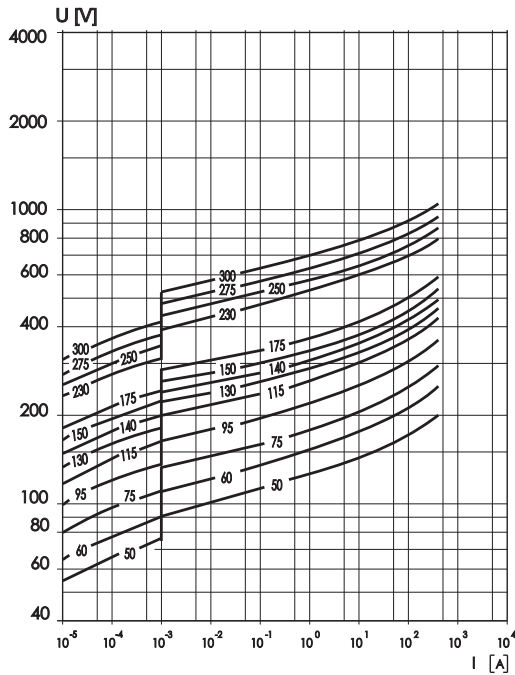
Type	V_{rms} V	V_{dc} V	V_n @ 1 mA V	V_c V	I_c A	W_{max} 10/1000 μ s J	P max W	I_{max} 8/20 μ s A	C typ. @ 1 kHz pF	D max mm	t max mm	R mm	d mm	h max mm
CV 230 K 5	230	300	360	595	5	13	0,1	400	90	7	4,8	5	0,6	9,5
CV 230 K 7	230	300	360	595	10	28	0,25	1200	190	9	4,8	5	0,6	11,5
CV 230 K 10	230	300	360	595	25	62	0,4	2500	350	12,5	5,4	7,5	0,8	15
CV 230 K 14	230	300	360	595	50	126	0,6	4500	650	16,5	5,5	7,5	0,8	20
CV 230 K 20	230	300	360	595	100	258	1	6500	1200	22,5	5,9	10	1	26
CV 250 K 5	250	320	390	650	5	14	0,1	400	80	7	5,0	5	0,6	9,5
CV 250 K 7	250	320	390	650	10	30	0,25	1200	180	9	5,0	5	0,6	11,5
CV 250 K 10	250	320	390	650	25	68	0,4	2500	320	12,5	5,6	7,5	0,8	15
CV 250 K 14	250	320	390	650	50	135	0,6	4500	580	16,5	5,7	7,5	0,8	20
CV 250 K 20	250	320	390	650	100	276	1	6500	1000	22,5	6,1	10	1	26
CV 275 K 5	275	350	430	710	5	16	0,1	400	70	7	5,6	5	0,6	9,5
CV 275 K 7	275	350	430	710	10	35	0,25	1200	160	9	5,6	5	0,6	11,5
CV 275 K 10	275	350	430	710	25	78	0,4	2500	300	12,5	6,0	7,5	0,8	15
CV 275 K 14	275	350	430	710	50	150	0,6	4500	530	16,5	6,0	7,5	0,8	20
CV 275 K 20	275	350	430	710	100	304	1	6500	900	22,5	6,3	10	1	26
CV 300 K 5	300	385	470	775	5	21	0,1	400	65	7	5,8	5	0,6	9,5
CV 300 K 7	300	385	470	775	10	37	0,25	1200	150	9	5,8	5	0,6	11,5
CV 300 K 10	300	385	470	775	25	82	0,4	2500	280	12,5	6,1	7,5	0,8	15
CV 300 K 14	300	385	470	775	50	169	0,6	4500	490	16,5	6,1	7,5	0,8	20
CV 300 K 20	300	385	470	775	100	350	1	6500	850	22,5	6,6	10	1	26
CV 320 K 10	320	420	510	840	25	91	0,4	2500	260	12,5	6,8	7,5	0,8	16
CV 320 K 14	320	420	510	840	50	184	0,6	4500	460	16,5	6,8	7,5	0,8	21
CV 320 K 20	320	420	510	840	100	388	1	6500	800	22,5	6,8	10	1	27
CV 385 K 10	385	505	620	1025	25	93	0,4	2500	240	12,5	7,4	7,5	0,8	16
CV 385 K 14	385	505	620	1025	50	193	0,6	4500	400	16,5	7,4	7,5	0,8	21
CV 385 K 20	385	505	620	1025	100	396	1	6500	700	22,5	7,5	10	1	27
CV 420 K 10	420	560	680	1120	25	97	0,4	2500	220	12,5	7,3	7,5	0,8	16
CV 420 K 14	420	560	680	1120	50	202	0,6	4500	350	16,5	7,4	7,5	0,8	21
CV 420 K 20	420	560	680	1120	100	418	1	6500	650	22,5	7,8	10	1	27
CV 460 K 10	460	615	750	1240	25	106	0,4	2500	200	12,5	7,8	7,5	0,8	16
CV 460 K 14	460	615	750	1240	50	220	0,6	4500	330	16,5	7,8	7,5	0,8	21
CV 460 K 20	460	615	750	1240	100	460	1	6500	550	22,5	8,2	10	1	27
CV 510 K 10	510	670	820	1355	25	115	0,4	2500	180	12,5	8,2	7,5	0,8	16
CV 510 K 14	510	670	820	1355	50	227	0,6	4500	310	16,5	8,2	7,5	0,8	21
CV 510 K 20	510	670	820	1355	100	478	1	6500	500	22,5	8,7	10	1	27
CV 550 K 10	550	745	910	1500	25	134	0,4	2500	170	12,5	8,8	7,5	0,8	16
CV 550 K 14	550	745	910	1500	50	264	0,6	4500	290	16,5	8,8	7,5	0,8	21
CV 550 K 20	550	745	910	1500	100	515	1	6500	450	22,5	9,2	10	1	27
CV 625 K 10	625	825	1000	1650	25	140	0,4	2500	160	12,5	9,1	7,5	0,8	16
CV 625 K 14	625	825	1000	1650	50	280	0,6	4500	270	16,5	9,2	7,5	0,8	21
CV 625 K 20	625	825	1000	1650	100	565	1	6500	400	22,5	9,7	10	1	27
CV 680 K 10	680	895	1100	1815	25	155	0,4	2500	150	12,5	9,7	7,5	0,8	16
CV 680 K 14	680	895	1100	1815	50	310	0,6	4500	250	16,5	9,8	7,5	0,8	21
CV 680 K 20	680	895	1100	1815	100	620	1	6500	350	22,5	10,2	10	1	27

Protection Level

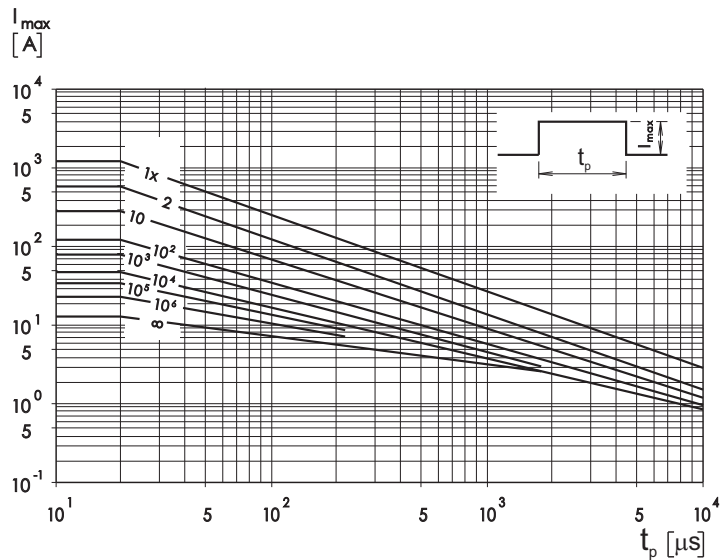
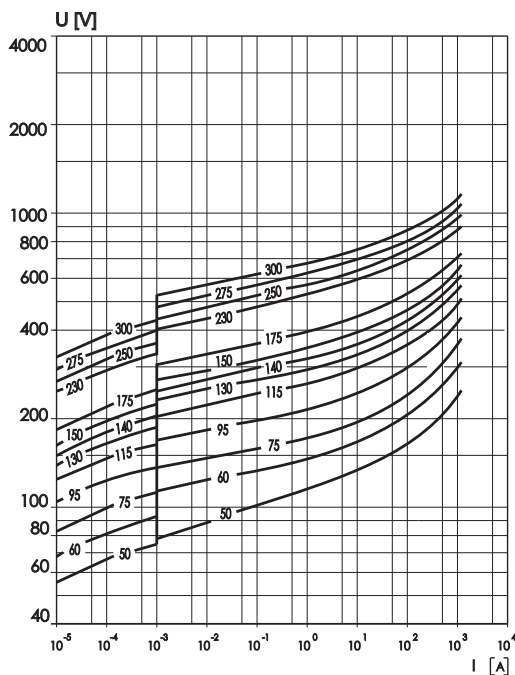
Pulse Rating Curves

* With the worst-case condition in the tolerance region

Model Size 5
CV 50...275



Model Size 7
CV 50...300



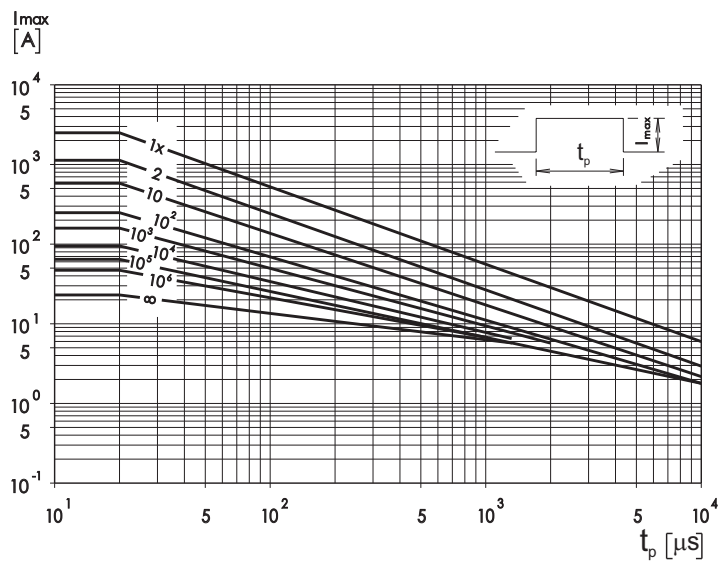
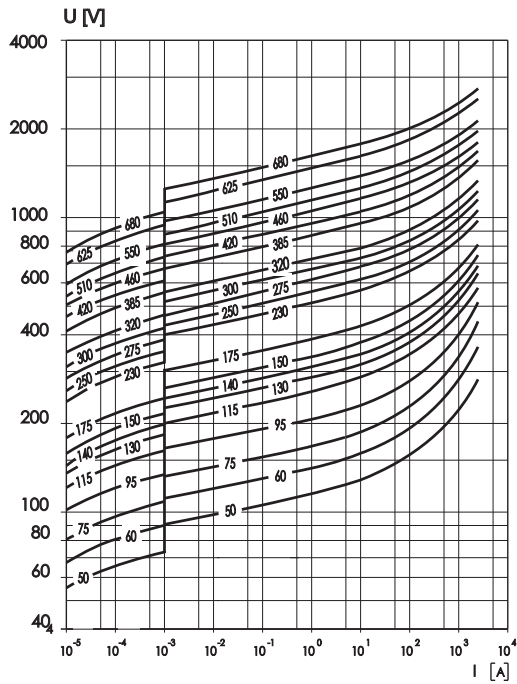
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Protection Level

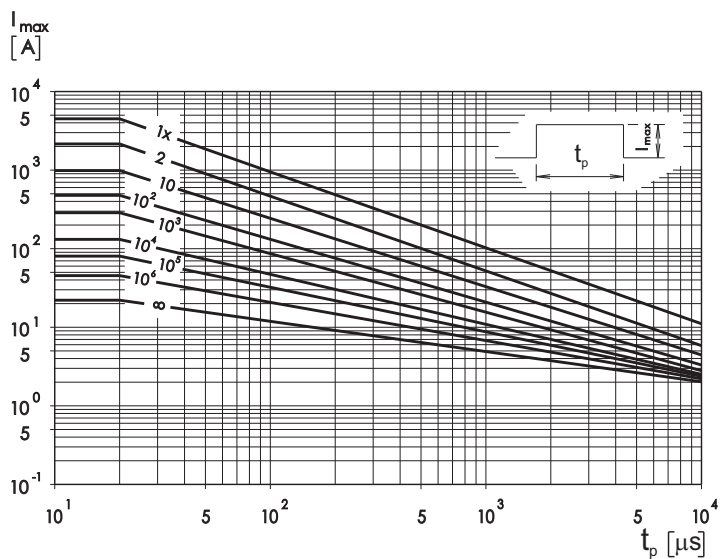
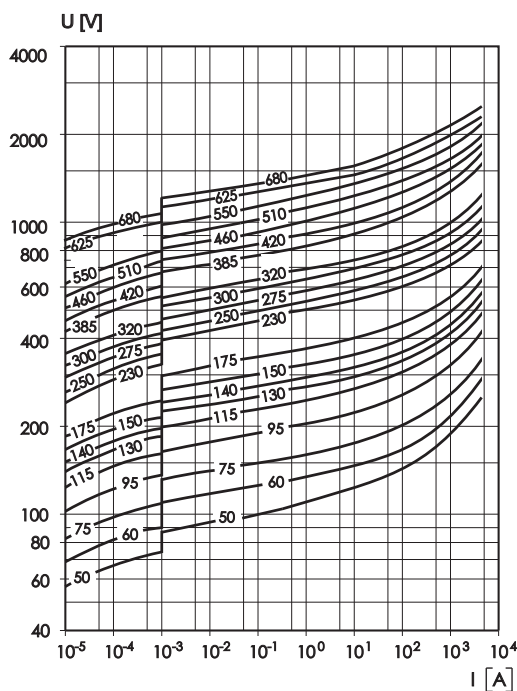
Pulse Rating Curves

* With the worst-case condition in the tolerance region

Model Size 10
CV 50...680



Model Size 14
CV 50...680



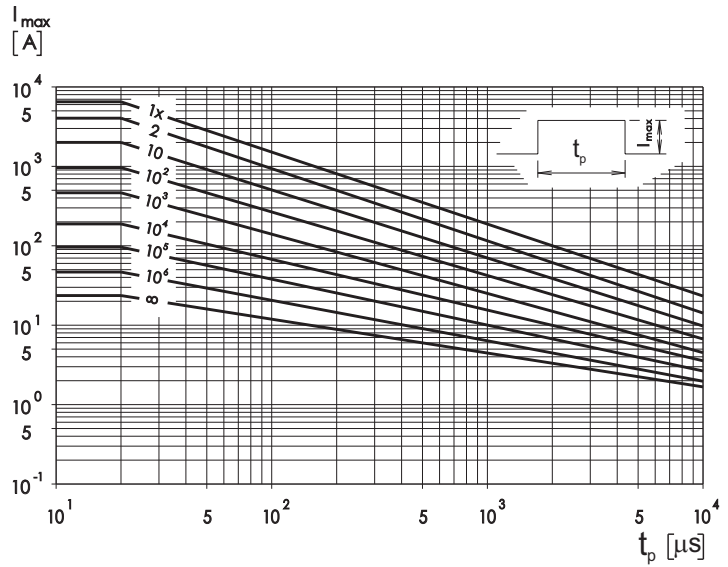
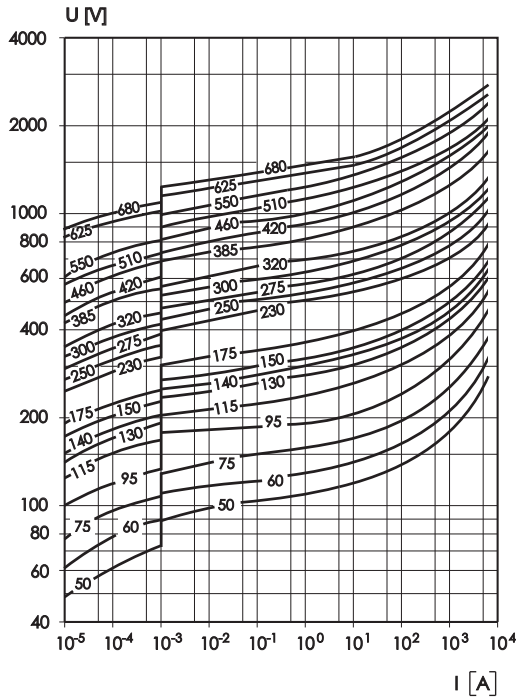
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Protection Level

Pulse Rating Curves

* With the worst-case condition in the tolerance region

Model Size 20
CV 50...680



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AUTOMOTIVE VARISTORS - AV SERIES

Description

Almost all electronic systems in an automobile, e.g. anti-lock brake system, direct ignition system, airbag control system, wiper motors, etc. are susceptible to damage from destructive voltage transients.

The AV series of leaded automotive varistors includes multilayer TH varistors. Automotive Varistors are intended for WLD applications typically requiring up to 50 J of energy, and disc automotive varistors for WLD applications requiring more than 50 J of energy.

Automotive varistors offer excellent transient energy absorption due to improved internal energy distribution. Compared to equivalent disc automotive varistors they offer better electrical characteristics realized in a much smaller size.



Features

- Supply voltage12 V, 24 V and 42 V.
- Broad range of current and energy handling capabilities realized with either type of construction (leaded multilayer and disc automotive varistors).
- +125 °C continuous operating temperature.
- +150 °C continuous operating temperature is available upon request.
- In-line leads in case of leaded varistors.
- Available in tape and reel for automatic insertion equipment.
- Lead free components.
- AEC-Q200 Grade 1 qualified.

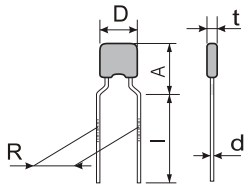
Absolute Maximum Ratings

	Units	Value
Continuous:		
Steady State Applied Voltage:		
DC Voltage Range (V_{dc})	V	18 to 56 *
Transient:		
Load Dump Energy, (WLD)	J	3 to 25 **
Jump Start Capability (5 minutes), (V_{jump})	V	24,5 to 65
Peak Single Pulse Surge Current, 8/20 μ s Waveform, (I_{max})	A	400 to 2000
Single Pulse Surge Energy, 10/1000 μ s Waveform (W_{max})	J	1,6 to 76
Operating Ambient Temperature	°C	-55 to +125
Storage Temperature Range	°C	-55 to +150
Threshold Voltage Temperature Coefficient	%/°C	< + 0,05
Insulation Resistance	G Ω	> 1
Isolation Voltage Capability	kV	> 1,25
Response Time	ns	< 25
Climatic Category		55 / 125 / 56

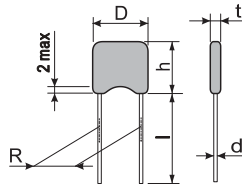
* Higher operating voltages are available upon request.

** Automotive varistors with WLD = 50 J and 100 J in the form of leaded multilayer or single layer disc varistors are available upon request.

Device Ratings and Characteristics



Size 602
WLD Code 003



Size 802, 902, 1103
WLD Code 006, 012, 025, 050

Dimensions

Size mm	D max mm	R mm	d mm	h/A max mm
602	7,0	5,0	0,6	7
802	8,0	5,0	0,6	9
902	9,0	5,0	0,6	12
1103	11,0	7,5	0,6	12

Dimensions "t" is in the table below.

AV 14 K 602 003...AV 40 K 902 025

Type	V _{rms} V	V _{dc} V	V _n @ 1 mA V	V _{jump} 5 min V	V _c V	I _c A	I _{max} 8/20 μs A	W _{max} 10/1000 μs J	WLD 10 x J	P max W	C typ. @ 1 kHz nF	t max mm
12 V Power Supply												
AV 14 K 602 003	14	16	24	24,5	40	2,5	400	1,6	3	0,010	2,5	4,5
AV 14 K 802 006	14	16	24	24,5	40	5	800	2,4	6	0,015	4,6	4,5
AV 14 K 902 012	14	16	24	24,5	40	5	1200	4,4	12	0,030	10,5	4,5
AV 14 K 902 025	14	16	24	24,5	40	10	2000	6,0	25	0,080	22,0	5,5
AV 14 K 1103 050	14	16	24	24,5	40	10	2000	13,2	50	0,100	29,0	6,5
AV 17 K 602 003	17	20	27	30	44	2,5	400	1,8	3	0,010	2,0	4,5
AV 17 K 802 006	17	20	27	30	44	5	800	2,9	6	0,015	4,0	4,5
AV 17 K 902 025	17	20	27	30	44	10	2000	7,2	25	0,080	18,0	5,5
AV 17 K 1103 050	17	20	27	30	44	10	2000	15,8	50	0,100	24,0	6,5
24 V Power Supply												
AV 20 K 602 003	20	26	33	30	54	2,5	400	1,9	3	0,010	1,8	4,5
AV 20 K 802 006	20	26	33	30	54	5	800	3,0	6	0,015	3,5	4,5
AV 20 K 902 025	20	26	33	30	54	10	2000	9,0	25	0,080	13,0	4,5
AV 20 K 1103 050	20	26	33	30	54	10	2000	17,0	50	0,100	18,0	6,5
AV 30 K 602 003	30	34	47	50	77	2,5	400	2,3	3	0,010	1,3	4,5
AV 30 K 802 006	30	34	47	50	77	5	800	3,8	6	0,015	2,0	4,5
AV 30 K 902 025	30	34	47	50	77	10	2000	18,0	25	0,080	12,0	4,5
42 V Power Supply												
AV 40 K 602 003	40	56	68	65	110	2,5	400	2,6	3	0,010	1,1	4,5
AV 40 K 802 006	40	56	68	65	110	5	800	4,8	6	0,015	1,8	4,5
AV 40 K 902 025	40	56	68	65	110	10	2000	18,0	25	0,080	6,6	4,5

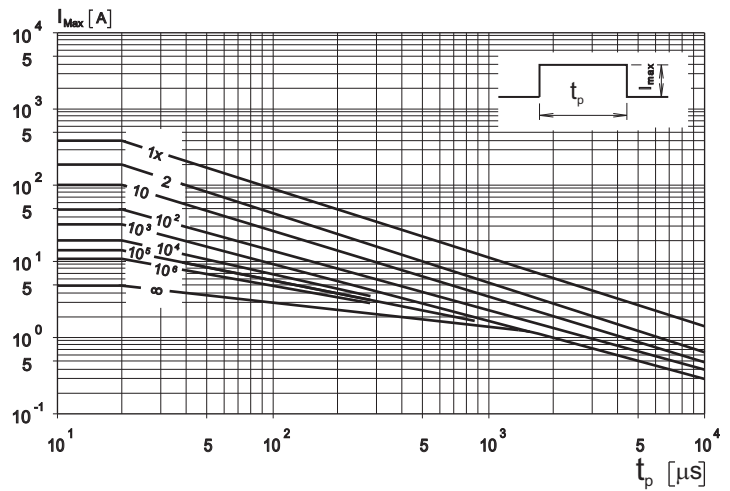
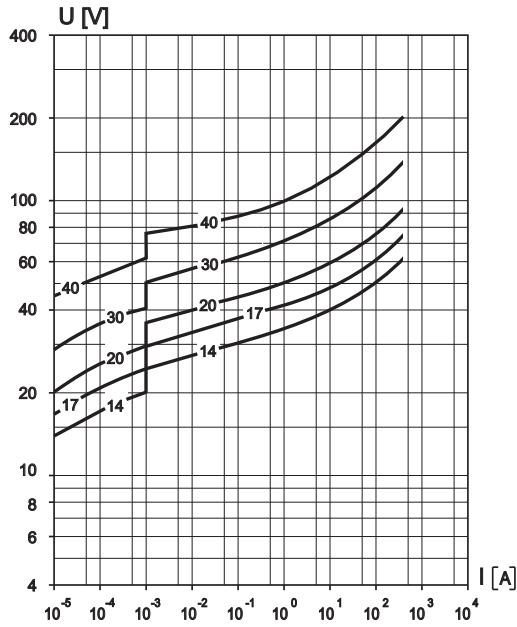
* - Types AV 35 are available upon request.

Protection Level

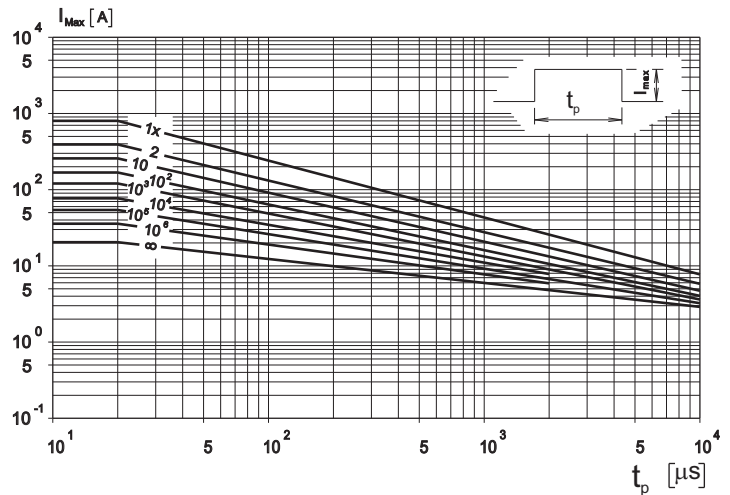
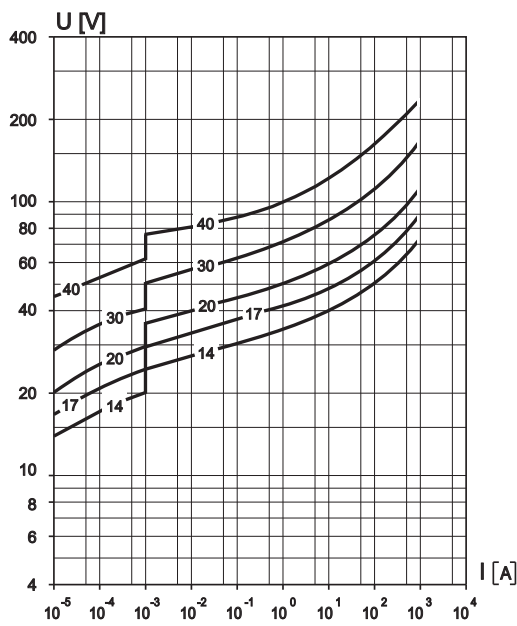
Pulse Rating Curves

* With the worst-case condition in the tolerance region

Model Size 60
AV 14...40 K...003



Model Size 80
AV 14...40 K...006



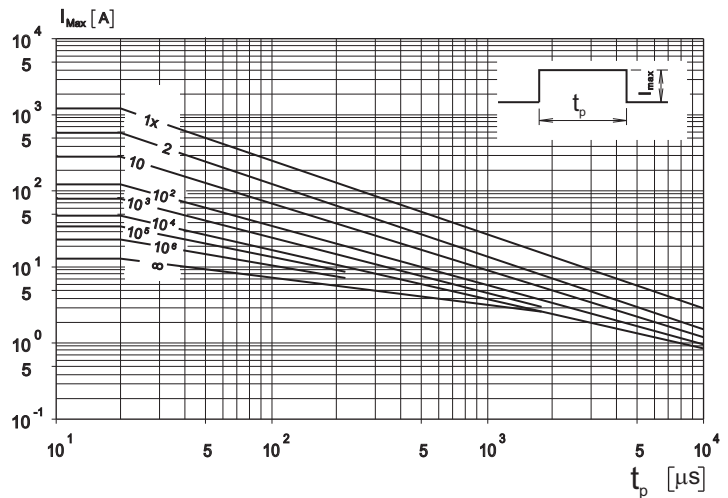
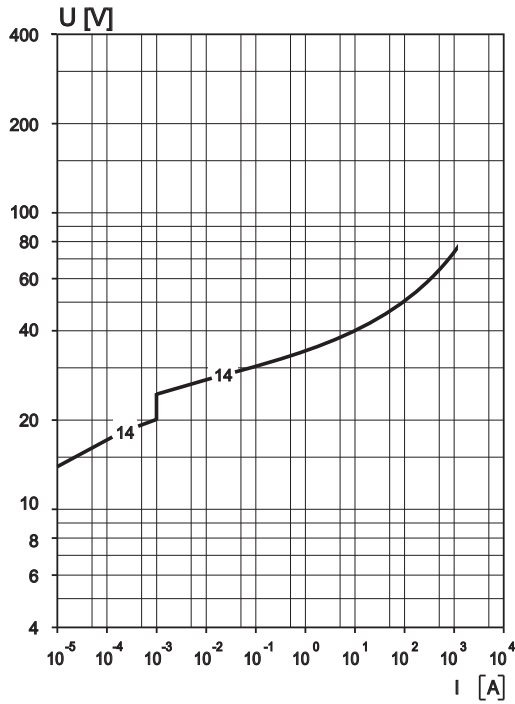
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Protection Level

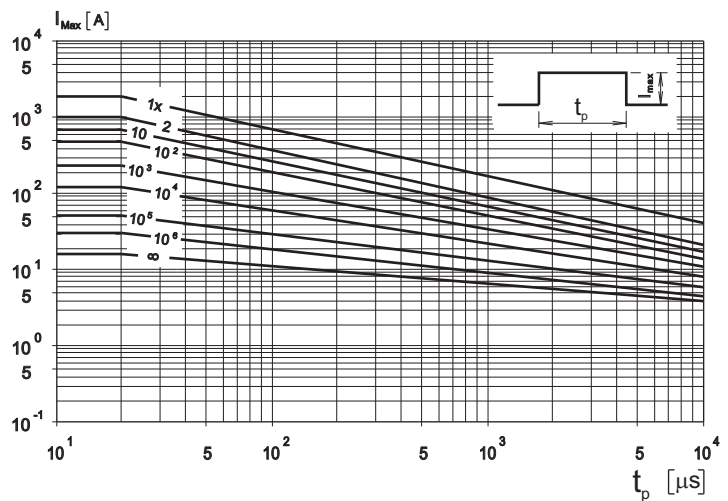
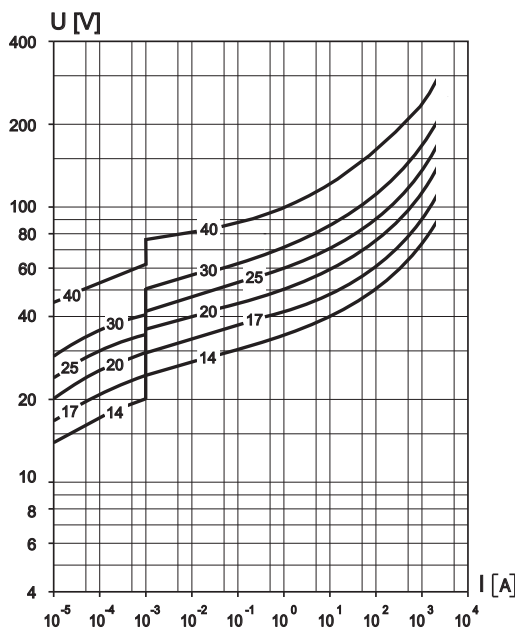
Pulse Rating Curves

* With the worst-case condition in the tolerance region

Model Size 90
AV 14 K 902 012



Model Size 90, 110
AV 14 ... 20 K ... 025...50
AV 25...40 K...050...100



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LOW VOLTAGE LEADED STYLE VARISTORS - ZV SERIES

Description


The ZV series of low voltage varistors is designed to protect sensitive electronic devices against high voltage and current surges in the low voltage region.

They offer excellent transient energy absorption due to improved energy volume distribution and power dissipation.

Low voltage varistors cover a wide DC operating voltage range from 3 V to 56 V.



Features

- Operating voltage range V_{dc}3 V to 56 V.
- 5 Model sizes available5, 7, 10, 14, 20.
- Low clamping voltage.
- Broad range of current and energy handling capabilities.
- + 125 °C continuous operating temperature
- Dimensional and weight savings on the board.
- Available in tape and reel for automatic insertion
- Lead free components.
- AEC-Q200 qualified Grade 3.
-  UL 1449, 3rd edition & CSA C22.2. File E326499 Section 7.

Applications

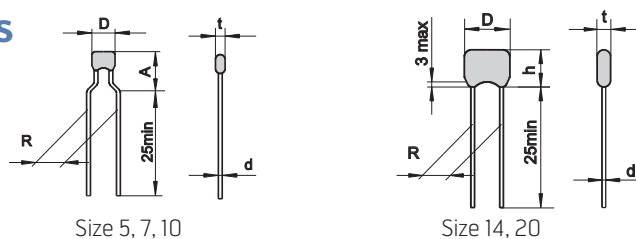
- Suppression of inductive switching or other transient events such as surge voltage at the circuit board level.
- Provides on-board transient voltage protection for ICs and transistors.
- Helps to achieve electromagnetic compliance of end products.
- Replaces larger TVS Zener diodes in many applications.

Absolute Maximum Ratings

Continuous:	Units	Value
Steady State Applied Voltage:		
DC Voltage Range (V_{dc})	V	3 to 56 *
AC Voltage Range (V_{rms})	V	2 to 40 *
Transient:		
Peak Single Pulse Surge Current, 8/20 μ s Waveform (I_{max})	A	100 to 2000
Single Pulse Surge Energy, 10/1000 μ s Waveform (W_{max})	J	0,1 to 37,8
Operating Ambient Temperature	°C	-55 to +125
Storage Temperature	°C	-55 to +150
Threshold Voltage Temperature Coefficient	%/°C	< + 0,05
Insulation Resistance	G Ω	> 1
Isolation Voltage Capability	kV	> 1,25
Response Time	ns	< 25
Climatic Category		55 / 125 / 56

* Higher operating voltages are available upon request.

Device Ratings and Characteristics



ZV 2 M 5.....ZV 40 K 20

Type	V _{rms} V	V _{dc} V	V _n @ 1 mA V	V _c V	I _c A	W _{max} 10/1000 μs J	P max W	I _{max} 8/20 μs A	C typ. @ 1 kHz pF	D max mm	t max mm	R mm	d mm	h max mm
ZV 2 M 5	2	3	4	10	1	0,1	0,005	100	1300	6	3,5	5	0,6	7
ZV 2 M 7	2	3	4	10	2,5	0,2	0,008	200	5000	7	3,5	5	0,6	8
ZV 4 M 5	4	5,5	8	14	1	0,1	0,005	100	1066	6	3,5	5	0,6	7
ZV 4 M 7	4	5,5	8	14	2,5	0,3	0,008	200	3720	7	3,5	5	0,6	8
ZV 4 M 10	4	5,5	8	14	5	0,4	0,010	300	5000	7	3,5	5	0,6	9
ZV 4 M 14	4	5,5	8	14	10	0,8	0,015	500	10000	8	3,5	5	0,6	12
ZV 4 M 20	4	5,5	8	14	20	1,5	0,020	1000	17000	9	3,5	5	0,6	12
ZV 6 M 5	6	8	11	21	1	0,2	0,005	100	1066	6	3,5	5	0,6	7
ZV 6 M 7	6	8	11	21	2,5	0,5	0,008	200	3720	7	3,5	5	0,6	8
ZV 6 M 10	6	8	11	21	5	0,8	0,010	300	5000	7	3,5	5	0,6	9
ZV 6 M 14	6	8	11	21	10	1	0,015	500	10000	8	3,5	5	0,6	12
ZV 6 M 20	6	8	11	21	20	3,8	0,020	1000	17000	9	3,5	5	0,6	12
ZV 8 L 5	8	11	15	25	1	0,2	0,005	100	650	6	3,5	5	0,6	7
ZV 8 L 7	8	11	15	25	2,5	0,6	0,008	250	2020	7	3,5	5	0,6	8
ZV 8 L 10	8	11	15	25	5	1,1	0,010	500	3200	7	3,5	5	0,6	9
ZV 8 L 14	8	11	15	25	10	1,9	0,015	800	6260	8	3,5	5	0,6	12
ZV 8 L 20	8	11	15	25	20	4,3	0,020	1500	11070	9	3,5	5	0,6	12
ZV 11 K 5	11	14	18	33	1	0,3	0,005	100	480	6	3,5	5	0,6	7
ZV 11 K 7	11	14	18	33	2,5	0,8	0,008	250	1400	7	3,5	5	0,6	8
ZV 11 K 10	11	14	18	33	5	1,7	0,010	500	2420	7	3,5	5	0,6	9
ZV 11 K 14	11	14	18	33	10	3,3	0,015	1000	5000	8	3,5	5	0,6	12
ZV 11 K 20	11	14	18	33	20	10,5	0,020	2000	9270	9	3,5	5	0,6	12
ZV 14 K 5	14	18	22	38	1	0,4	0,005	100	377	6	3,5	5	0,6	7
ZV 14 K 7	14	18	22	38	2,5	0,9	0,008	250	1050	7	3,5	5	0,6	8
ZV 14 K 10	14	18	22	38	5	2,2	0,010	500	1770	7	3,5	5	0,6	9
ZV 14 K 14	14	18	22	38	10	4,2	0,015	1000	3850	8	3,5	5	0,6	12
ZV 14 K 20	14	18	22	38	20	12	0,020	2000	7670	9	3,5	5	0,6	12
ZV 17 K 5	17	22	27	44	1	0,5	0,005	100	335	6	3,5	5	0,6	7
ZV 17 K 7	17	22	27	44	2,5	1,2	0,008	250	850	7	3,5	5	0,6	8
ZV 17 K 10	17	22	27	44	5	2,6	0,010	500	1370	7	3,5	5	0,6	9
ZV 17 K 14	17	22	27	44	10	5,2	0,015	1000	3050	8	3,5	5	0,6	12
ZV 17 K 20	17	22	27	44	20	14,2	0,020	2000	6600	9	3,5	5	0,6	12
ZV 20 K 5	20	26	33	54	1	0,6	0,005	100	325	6	4,5	5	0,6	7
ZV 20 K 7	20	26	33	54	2,5	1,4	0,008	250	790	7	4,5	5	0,6	8
ZV 20 K 10	20	26	33	54	5	3,2	0,010	500	1090	7	4,5	5	0,6	9
ZV 20 K 14	20	26	33	54	10	6,4	0,015	1000	2490	8	4,5	5	0,6	12
ZV 20 K 20	20	26	33	54	20	18,2	0,020	2000	5670	9	4,5	5	0,6	12
ZV 25 K 5	25	31	39	65	1	0,7	0,005	100	315	6	4,5	5	0,6	7
ZV 25 K 7	25	31	39	65	2,5	1,6	0,008	250	790	7	4,5	5	0,6	8
ZV 25 K 10	25	31	39	65	5	3,8	0,010	500	870	7	4,5	5	0,6	9
ZV 25 K 14	25	31	39	65	10	7,2	0,015	1000	1890	8	4,5	5	0,6	12
ZV 25 K 20	25	31	39	65	20	22,4	0,020	2000	4670	9	4,5	5	0,6	12
ZV 30 K 5	30	38	47	77	1	0,9	0,005	100	315	6	4,5	5	0,6	7
ZV 30 K 7	30	38	47	77	2,5	2,2	0,008	250	790	7	4,5	5	0,6	8
ZV 30 K 10	30	38	47	77	5	4,4	0,010	500	770	7	4,5	5	0,6	9
ZV 30 K 14	30	38	47	77	10	9,4	0,015	1000	1530	8	4,5	5	0,6	12
ZV 30 K 20	30	38	47	77	20	25,8	0,020	2000	3870	9	4,5	5	0,6	12
ZV 35 K 5	35	45	56	90	1	1,2	0,005	100	315	6	4,5	5	0,6	7
ZV 35 K 7	35	45	56	90	2,5	2,6	0,008	250	790	7	4,5	5	0,6	8
ZV 35 K 10	35	45	56	90	5	5,4	0,010	500	680	7	4,5	5	0,6	9
ZV 35 K 14	35	45	56	90	10	10,2	0,015	1000	1260	8	4,5	5	0,6	12
ZV 35 K 20	35	45	56	90	20	33,4	0,020	2000	3470	9	4,5	5	0,6	12
ZV 40 K 5	40	56	68	110	1	1,4	0,005	100	315	6	4,5	5	0,6	7
ZV 40 K 7	40	56	68	110	2,5	3,2	0,008	250	790	7	4,5	5	0,6	8
ZV 40 K 10	40	56	68	110	5	6,4	0,010	500	660	7	4,5	5	0,6	9
ZV 40 K 14	40	56	68	110	10	13,4	0,015	1000	1070	8	4,5	5	0,6	12
ZV 40 K 20	40	56	68	110	20	37,8	0,020	2000	3130	9	4,5	5	0,6	12

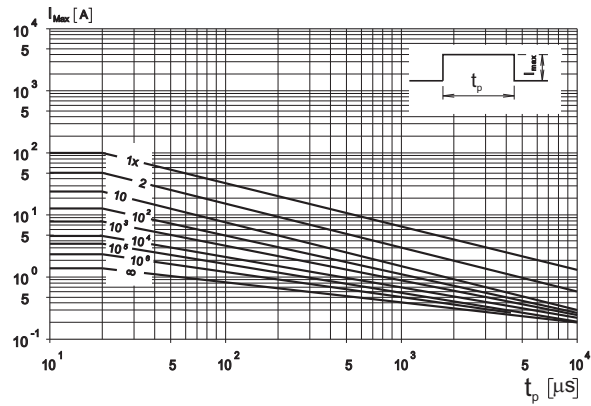
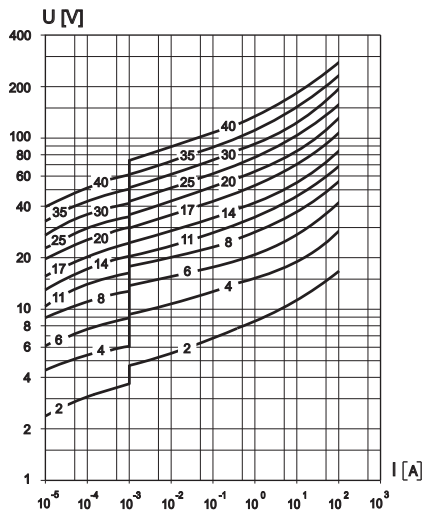
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Protection Level

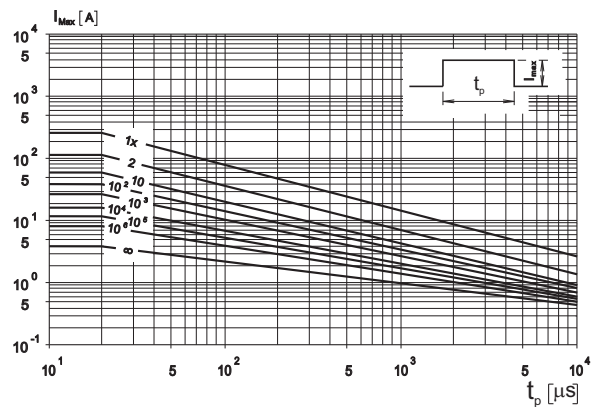
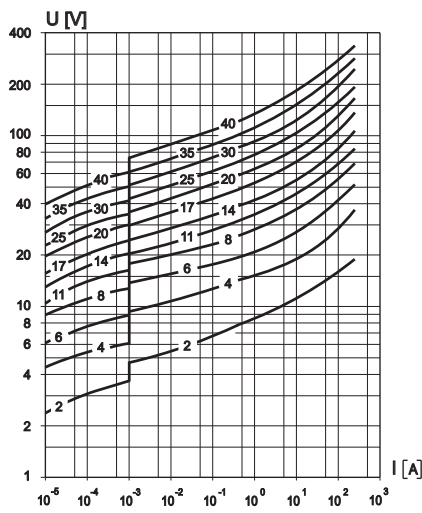
Pulse Rating Curves

* With the worst-case condition in the tolerance region

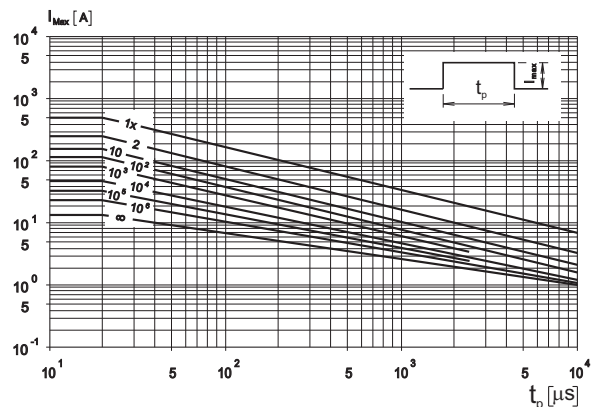
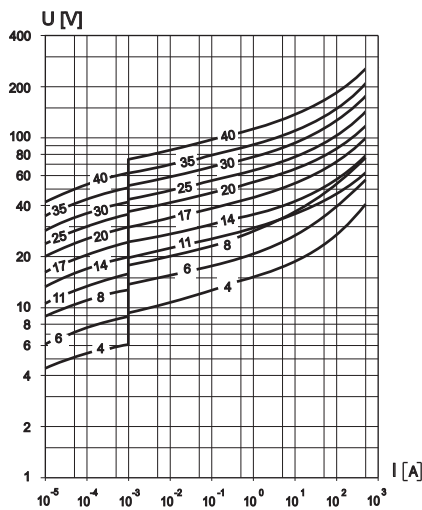
Model Size 5
ZV 2...40



Model Size 7
ZV 2...40



Model Size 10
ZV 4...40



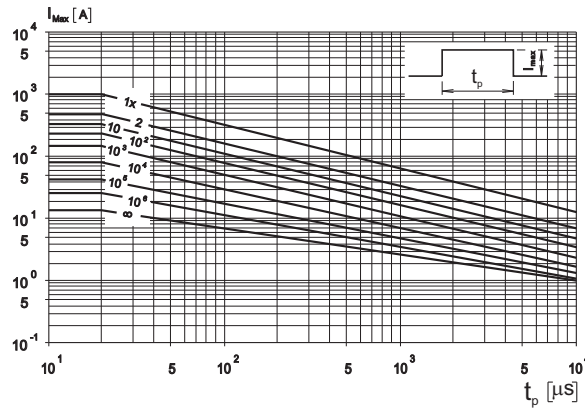
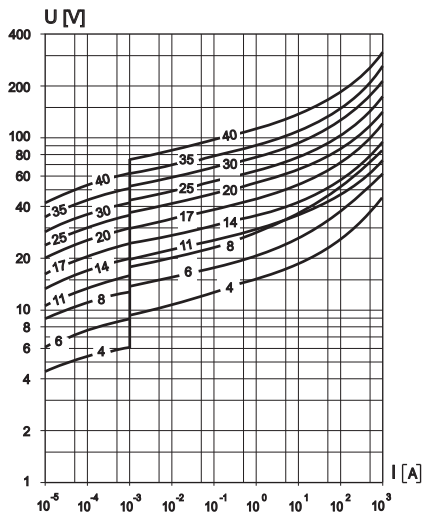
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Protection Level

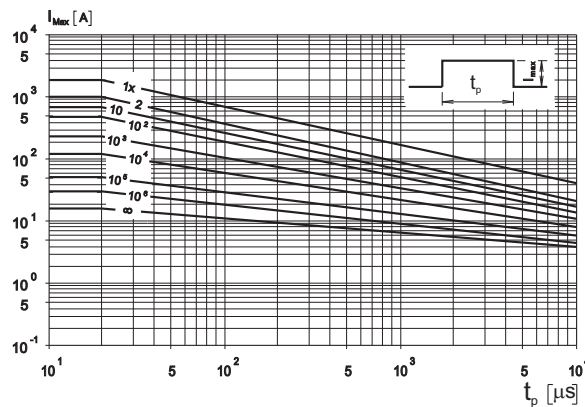
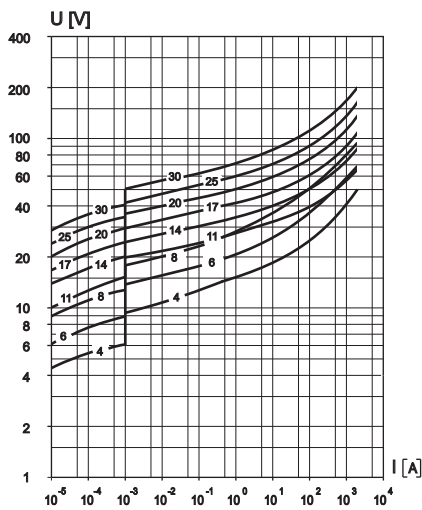
Pulse Rating Curves

* With the worst-case condition in the tolerance region

Model Size 14
ZV 4...40



Model Size 20
ZV 4...40



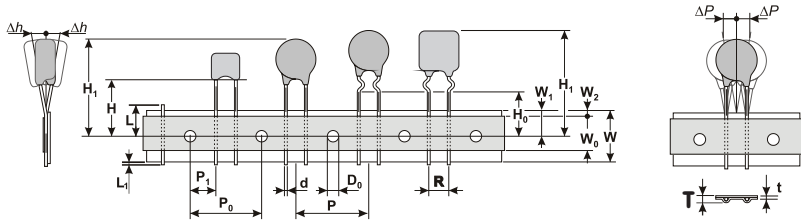
Lead Styles

Type	R (mm)	h_{max} (mm)	A_{max} (mm)	Version 1	Version 5
ZV 2...40 K 5 ZV 2...40 K 7 ZV 2...40 K 10 AV 14...40 K 602 003	5 5 5 5		7 8 9 7		
ZV 4...40 K14 AV 14...40 K 802 006	5 5	9 9	12 9		
ZV 4...40 K 20 AV 14...40 K 902 012...025 AV 14...20 K 1103 050	5 5 7,5		12 12 12		
CV 50...300 K 5 CV 50...300 K 7 CV+ 60...275 K 7	5 5 5	9,5 11,5 11,5	12,5 14,5 14,5		
CV 50...680 K 10 CV 50...680 K 14 CV 50...680 K 20 CV+ 60...550 K 10 CV+ 60...550 K 14 CV+ 60...550 K 20 CV+ 130...550 K 23	7,5 7,5 10 7,5 7,5 10 10	15 20 26 15 20 26 27			
SV 60...300 K 5 SV 60...300 K 7	5 5	9,5 11,5	12,5 14,5		
SV 60...550 K 10 SV 60...550 K 14 SV 60...550 K 20 SV 130...550 K 23	7,5 7,5 10 10	15 19 26 27			

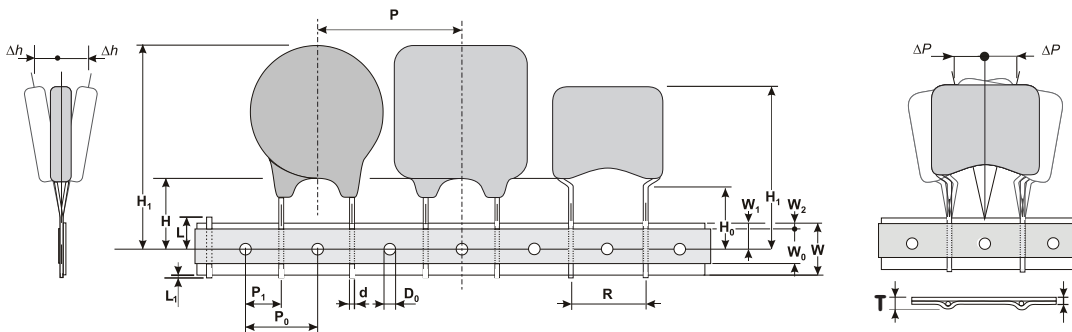
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Protection Level

Customs to IES Publication 286-2 Ed.3: 2008-03



R = 5 mm



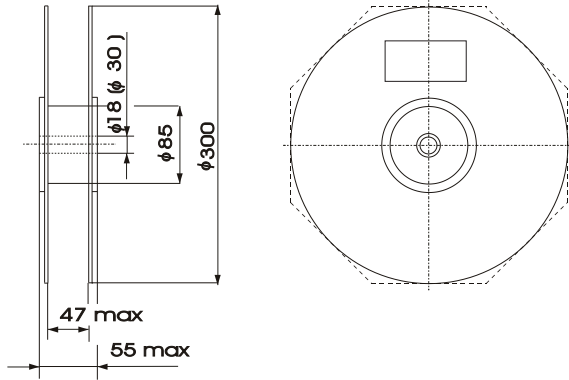
R = 7,5 mm, 10 mm

Symbol	Parameter	Model Size				
		Φ 5	Φ 7	Φ 10	Φ 14	Φ 20
		602 / 802 / 902		1103		
Dimension (mm)						
W	Carrier tape with	18 +1,0/-0,5	18 +1,0/-0,5	18 +1,0/-0,5	18 +1,0/-0,5	18 +1,0/-0,5
W0	Hold down tape width	5 min	5 min	5 min	5 min	5 min
W1	Sprocket hole position	9 +0,75/-0,5	9 +0,75/-0,5	9 +0,75/-0,5	9 +0,75/-0,5	9 +0,75/-0,5
W2	Distance between the upper edges of the carrier tape and hold-down tape	3 max	3 max	3 max	3 max	3 max
T	Total tape thickness	1,5 max	1,5 max	1,7 max	1,7 max	1,9 max
t	Tape thickness	0,9 max	0,9 max	0,9 max	0,9 max	0,9 max
P	Pitch of component	12,7 ± 1,0	12,7 ± 1,0	12,7 ± 1,0	25,4 ± 1,0	25,4 ± 1,0
P0	Feed hole pitch	12,7 ± 0,3	12,7 ± 0,3	12,7 ± 0,3	12,7 ± 0,3	12,7 ± 0,3
P1	Feed hole center to pitch	3,85 ± 0,7	3,85 ± 0,7	8,95 ± 0,7	8,95 ± 0,7	7,7 ± 0,7
R	Lead Spacing	5 +0,5/-0,2	5 +0,5/-0,2	7,5 +0,5/-0,2	7,5 +0,5/-0,2	10 +0,5/-0,2
ΔP	Component alignment	± 1,3 max	± 1,3 max	± 1,3 max	± 1,3 max	± 1,3 max
Δh	Component alignment	± 2 max	± 2 max	± 2 max	± 2 max	± 2 max
d	Wire diameter	0,6 max	0,6 max	0,8 max	0,8 max	1 max
D0	Feed hole diameter	4 ± 0,2	4 ± 0,2	4 ± 0,2	4 ± 0,2	4 ± 0,2
H	Height from tape center to comp. base	18 +2,0/-0,0	18 +2,0/-0,0	18 +2,0/-0,0	18 +2,0/-0,0	18 +2,0/-0,0
Ho	Seating plane height	16 ± 0,5	16 ± 0,5	16 ± 0,5	16 ± 0,5	16 ± 0,5
H1	Component height	32,2 max	32,2 max	46,5 max	46,5 max	46,5 max
L	Protrusion - cut out	11 max	11 max	11 max	11 max	11 max
L1	Protrusion - cut off	0,5 max	0,5 max	0,5 max	0,5 max	0,5 max

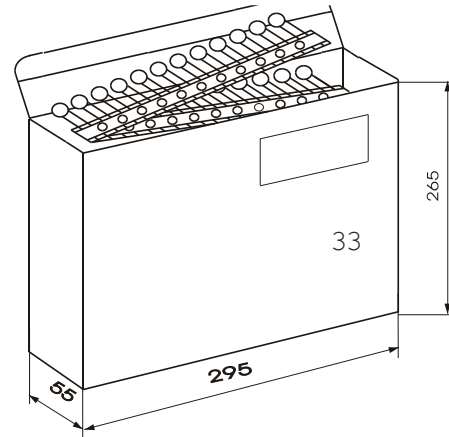
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Packaging

Reel



Ammo pack



Package units

Bulk

V	5			7				10				14			20				23					
	ZV	AV/602	SV	CV/CV+	ZV	AV/802	SV	CV/CV+	ZV	AV/902	SV	CV/CV+	ZV	AV/1103	SV	CV/CV+	ZV	AV 20	AV 40	SV	CV/CV+	SV	CV/CV+	
2	1500				1500				1500				1000				1000							
4	1500				1500				1500				1000				1000							
6	1500				1500				1500				1000				1000							
8	1500				1500				1500				1000				1000							
11	1500			1500	1500			1500	1500				1000				1000							
14	1500	1500		1500	1500	1500		1500	1500	1000		600	1000	800			1000							
17	1500	1500		1500	1500	1500		1500	1500	1000		600	1000	800			1000							
20	1500	1500		1500	1500	1500		1500	1500	1000		600	1000	800			1000							
25	1500	1500		1500	1500	1500		1500	1500	1000		600	1000				1000	300	300					
30	1500	1500		1500	1500	1500		1500	1500	1000		600	1000				1000	300	300					
35	1500	1500		1500	1500	1500		1500	1500	1000		600	1000				1000	300	300					
40	1500	1500		1500	1500	1500		1500	1500	1000		600	1000				1000	300	300					
50				1500				1500				600				400						300		
60			1300	1500			1000	1500			500	600			400	400				250	300			
75			1300	1500			1000	1500			500	600			400	400				250	300			
95			1300	1500			900	1000			500	600			400	400				250	300			
115			1300	1500			900	1000			400	500			400	400				250	300			
130			1300	1500			900	1000			400	500			400	400				250	300	150	250	
140			1300	1500			900	1000			400	500			400	400				250	300	150	250	
150			1300	1500			900	1000			400	500			400	400				250	300	150	250	
175			1300	1500			900	1000			400	500			400	400				250	300	150	250	
230			900	1000			900	1000			400	500			250	300				250	200	150	150	
250			900	1000			900	1000			400	500			250	300				250	200	150	150	
275			900	1000			900	1000			400	500			250	300				250	200	150	150	
300				1000			900	1000			400	500			250	300				150	200	100	150	
320											400	500			250	300				150	200	100	150	
385											300	400			250	300				150	200	100	150	
420											300	400			250	300				150	200	100	150	
460											300	400			250	300				150	200	100	150	
510											300	400			250	300				150	200	100	150	
550*											300	400			250	300				150	200	100	150	

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Packaging

Reel

V	5				7				10				14				20				23			
	ZV	AV/602	SV	CV/CV+	ZV	AV/802	SV	CV/CV+	ZV	AV/902	SV	CV/CV+	ZV	AV/1103	SV	CV/CV+	ZV	AV 20	AV 40	SV	CV/CV+	SV	CV/CV+	
2	1500				1500				1500				1500				1500							
4	1500				1500				1500				1500				1500							
6	1500				1500				1500				1500				1500							
8	1500				1500				1500				1500				1500							
11	1500			1800	1500			1500	1500			1500				1500								
14	1500	1500		1800	1500	1500		1500	1500	1500		1300	1500	1300			1500							
17	1500	1500		1800	1500	1500		1500	1500	1300		1300	1500	1300			1500							
20	1500	1500		1500	1500	1500		1500	1500	1300		1300	1500	1300			1500							
25	1500	1300		1500	1500	1300		1500	1500	1300		1300	1500				1500	500	400					
30	1500	1300		1500	1500	1300		1500	1500	1300		1300	1500				1500	500	400					
35	1500	1300		1500	1500	1300		1500	1500	1300		1300	1500				1500	500	400					
40	1500	1300		1500	1500	1300		1500	1500	1300		1300	1500				1500	500	400					
50				1500				1500				1300				700						600		
60			1500	1500				1500	1500			1300	1300			600	700				600	600		
75			1300	1500				1300	1500			1300	1300			600	700				600	600		
95			1300	1500				1300	1000			1200	1300			600	600				500	600		
115			1300	1300				1300	1000			1200	1000			500	600				500	500		
130			1300	1300				1300	1000			1200	1000			500	600				500	500	150	250
140			1300	1200				1300	1000			1200	1000			500	600				500	500	150	250
150			1200	1200				1200	1000			1000	1000			500	600				500	500	150	250
175			1200	1200				1200	1000			1000	1000			500	500				500	500	150	250
230			1000	1000				1000	1000			1000	1000			500	500				500	400	150	150
250			1000	1000				1000	1000			900	800			400	400				400	400	150	150
275			1000	1000				1000	1000			900	800			400	400				400	400	150	150
300				900				900	1000			800	800			400	400				400	400	100	150
320												800	800			400	400				300	400	100	150
385												700	700			300	400				300	300	100	150
420												700	700			300	300				300	300	100	150
460												600	600			300	300				300	300	100	150
510												600	600			300	300				300	300	100	150
550*												600	600			300	300				300	300	100	150

* For voltages to 680 - same as for 550.

Ammo

V	5				7				10				14				20				23			
	ZV	AV/602	SV	CV/CV+	ZV	AV/802	SV	CV/CV+	ZV	AV/902	SV	CV/CV+	ZV	AV/1103	SV	CV/CV+	ZV	AV 20	AV 40	SV	CV/CV+	SV	CV/CV+	
2	2000				2000				2000				2000				2000							
4	2000				2000				2000				2000				2000							
6	2000				2000				2000				2000				2000							
8	2000				2000				2000				2000				2000							
11	2000			2000	2000			2000	2000			2000	2000			2000								
14	2000	2000		2000	2000	2000		2000	2000	1800		1800	2000	1500			2000							
17	2000	2000		2000	2000	2000		2000	2000	1800		1800	2000	1800			2000							
20	1800	2000		2000	1800	2000		2000	1800	1800		1800	1800	1800			1800							
25	1800	1800		2000	1800	1800		2000	1800	1800		1800	1800				1800	600	400					
30	1800	1800		2000	1800	1800		2000	1800	1800		1500	1800				1800	600	400					
35	1800	1800		2000	1800	1800		2000	1800	1800		1500	1800				1800	600	400					
40	1800	1800		1800	1800	1800		1800	1800	1800		1500	1800				1800	600	400					
50				2000				2000				1800				800						700		
60			1800	2000				1800	2000			1600	1600			800	800				700	700		
75			1800	2000				1800	2000			1600	1600			800	800				700	700		
95			1600	1800				1600	1800			1500	1600			700	700				700	700		
115			1600	1600				1600	1600			1300	1500			700	700				600	600		
130			1600	1600				1600	1600			1300	1300			700	700				600	600	150	250
140			1600	1600				1600	1600			1300	1300			700	700				600	600	150	250
150			1500	1500				1500	1500			1300	1300			700	700				600	600	150	250
175			1500	1500				1500	1500			1300	1300			600	600				600	600	150	250
230			1200	1200				1200	1200			1200	1200			600	600				500	500	150	150
250			1200	1200				1200	1200			1000	1000			500	500				500	500	150	150
275			1200	1200				1200	1200			1000	1000			500	500				500	500	150	150
300				1000				1000	1000			1000	1000			500	500				500	500	100	150
320												1000	1000			500	500				400	400	100	150
385												900	900			400	400				400	400	100	150
420												900	800			400	400				400	400	100	150
460												800	800			400	400				400	400	100	150
510												800	800			400	400				300	400	100	150
550*												700	700			300	400				300	400	100	150

* For voltages to 680 - same as for 550.

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Ordering Information

ZV Series

ZV 40 K 20 R L1 YY

- ZV** - Series Name
40 - Maximum Continuous Working Voltage - V_{rms}
K V_n Tolerance: K = $\pm 10\%$,
 L = $\pm 15\%$, M = $\pm 20\%$
20 - Size: 5, 7, 10, 14, 20
R - Packaging: R = Reel,
 A = Ammo Pack, B = Bulk
L1 - Lead Style; 1 = straight,
 5 = crimped
YY - Special requirements

AV Series

AV 20 K 802 006 R L1 YY

- AV** - Series Name
20 - Maximum Continuous Working Voltage - V_{rms}
K - V_n Tolerance: K = $\pm 10\%$,
 S = special
80 - Size: 60, 80, 90, 110; 80 = 8 mm
2 - Leas spacing Code:
 2 = 5 mm, 3 = 7,5 mm
006 - WLD - Load Dump Energy Code:
 006 = 6 J
R - Packaging: R = Reel,
 A = Ammo Pack, B = Bulk
L1 - Lead Style; 1 = straight,
 5 = crimped
YY - Special requirements

CV / CV+ / SV Series

CV 130 K 14 R L1 YY

- CV** - Series Name
130 - Maximum Continuous Working Voltage - V_{rms}
K - V_n Tolerance: K = $\pm 10\%$,
 J = $\pm 5\%$, S = special
14 - Size: 5, 7, 10, 14, 20, 23
R - Packaging: R = Reel,
 A = Ammo Pack, B = Bulk
L1 - Lead Style; 1 = straight,
 5 = crimped
YY - Speciaa requirements

Varistor Marking for ZV / AV / CV / CV+ / SV Series

For Model Size 5, 7

14Z5

- 14** - V_{rms}
Z - the first letter of Series Name ZV
5 - Model Size: 5, 7

For Model Size 602

20A003

- 20** - V_{rms}
A - the first letter of Series Name AV
003 - WLD Code: 003

For Model Size 5

CV130K5

- 130** - V_{rms}
CV - Series Name
K - V_n Tolerance
5 - Model Size: 5

For Model Size 10, 14

ZV 40 K10

- 40** - V_{rms}
K - V_n Tolerance
10 - Model Size: 10, 14

For Model Size 802

AV 17 K 006

- AV** - Series Name
17 - V_{rms}
K - V_n Tolerance
006 - WLD Code: 006

For Model Size 7, 10, 14, 20, 23

KEKO CV 300 K 20

- XX**
KEKO - Tradename
CV - Series Name: Cv, Cv+, SV
300 - V_{rms}
K - V_n Tolerance
20 - Model Size: 7, 10, 14, 20, 23
xx - Approvals

For Model Size 20

KEKO ZV 11 K20

- KEKO** - Tradename
ZV - Series Name
11 - V_{rms}
K - V_n Tolerance
20 - Model Size: 20

For Model Size 902, 1103

KEKO AV 30 K 100

- KEKO** - Tradename
AV - Series Name
30 - V_{rms}
K - V_n Tolerance
100 - WLD Code: 012, 025, 050, 100

LOW & MEDIUM VOLTAGE PLASTICS-ENCAPSULATED VARISTORS - PV SERIES


Description

The PV series of low & medium voltage plastic-encapsulated varistors is designed to protect electronic equipment against high voltage surges in the low & medium voltage region. They offer direct SMD equivalents to leaded disc varistors of 5 and 7 mm sizes. The thermoplastic encapsulation is non-flammable according to the standard UL 94 V-0. Contacts are made of tinned copper sheet.

PV varistors are designed for surface mounting and are available in two model sizes. These transient voltage suppressors cover an operating voltage V_{rms} from 11 V to 300 V, featuring maximum surge currents from 100 A to 1200 A.



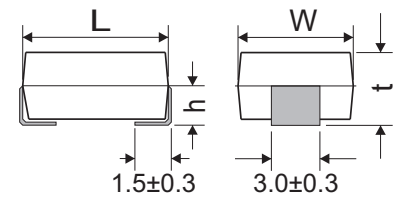
Features

- Fully lead-free component
- Operating voltage range V_{dc}14 V to 385 V
- Operating voltage V_{rms}11 V to 300 V
- 2 model sizes available3255 and 4032
- + 85 °C continuous operating temperature
- Dimensional and weight savings on board
- Easy solderable tinned copper sheet
- Non-flammable thermoplastic encapsulation according to the standard UL 94 V-0
- Available in tape and reel for automatic pick and place
-  UL 1449, 3rd edition & CSA C22.2. File E326499 Section 3.

Absolute Maximum Ratings

Continuous:	Units	Value
Steady State Applied Voltage:		
DC Voltage Range (V_{dc})	V	14 to 385
AC Voltage Range (V_{rms})	V	11 to 300
Transient:		
Non-Repetitive Surge Current, 8/20 μ s Waveform (I_{max})	A	100 to 1200
Non-Repetitive Surge Energy, 10/1000 μ s Waveform (W_{max})	J	0,6 to 30
Operating Ambient Temperature	°C	-40 to +85
Storage Temperature	°C	-40 to +125
Threshold Voltage Temperature Coefficient	%/°C	< + 0,05
Response Time	ns	< 5
Climatic Category		40 / 85 / 56

Device Ratings and Characteristics



PV 11 K 3225.....PV 300 K 4032

Type	V _{rms} V	V _{dc} V	V _n @ 1 mA V	V _c V	I _c A	W _{max} 10/1000 μs J	P max W	I _{max} 8/20 μs A	C typ. @ 1 kHz pF	h ±0,3 mm	L ±0,5 mm	W ±0,4 mm	t ±0,3 mm
PV 11 K 3225	11	14	18	36	2,5	0,6	0,01	100	1600	1,7	8,0	6,3	3,4
PV 11 K 4032	11	14	18	36	5	1,1	0,02	250	3100	2,3	10,0	8,0	4,7
PV 14 K 3225	14	18	22	43	2,5	0,7	0,01	100	1300	1,7	8,0	6,3	3,4
PV 14 K 4032	14	18	22	43	5	1,3	0,02	250	2500	2,3	10,0	8,0	4,7
PV 17 K 3225	17	22	27	53	2,5	0,9	0,01	100	1050	1,7	8,0	6,3	3,4
PV 17 K 4032	17	22	27	53	5	1,6	0,02	250	1900	2,3	10,0	8,0	4,7
PV 20 K 3225	20	26	33	65	2,5	1,1	0,01	100	750	1,7	8,0	6,3	3,4
PV 20 K 4032	20	26	33	65	5	2,0	0,02	250	1500	2,3	10,0	8,0	4,7
PV 25 K 3225	25	31	39	77	2,5	1,2	0,01	100	660	1,7	8,0	6,3	3,4
PV 25 K 4032	25	31	39	77	5	2,4	0,02	250	1260	2,3	10,0	8,0	4,7
PV 30 K 3225	30	38	47	93	2,5	1,5	0,01	100	580	1,7	8,0	6,3	3,4
PV 30 K 4032	30	38	47	93	5	2,8	0,02	250	1050	2,3	10,0	8,0	4,7
PV 35 K 3225	35	45	56	110	2,5	1,8	0,01	100	460	1,7	8,0	6,3	3,4
PV 35 K 4032	35	45	56	110	5	3,4	0,02	250	850	2,3	10,0	8,0	4,7
PV 40 K 3225	40	56	68	135	2,5	2,2	0,01	100	400	1,7	8,0	6,3	3,4
PV 40 K 4032	40	56	68	135	5	4,1	0,02	250	720	2,3	10,0	8,0	4,7
PV 50 K 3225	50	65	82	135	5	2,5	0,10	400	390	1,7	8,0	6,3	3,4
PV 50 K 4032	50	65	82	135	10	6,5	0,25	1200	820	2,3	10,0	8,0	4,7
PV 60 K 3225	60	85	100	165	5	3,0	0,10	400	330	1,7	8,0	6,3	3,4
PV 60 K 4032	60	85	100	165	10	7,0	0,25	1200	680	2,3	10,0	8,0	4,7
PV 75 K 3225	75	100	120	200	5	4,0	0,10	400	270	1,7	8,0	6,3	3,4
PV 75 K 4032	75	100	120	200	10	9,0	0,25	1200	550	2,3	10,0	8,0	4,7
PV 95 K 3225	95	125	150	250	5	6,0	0,10	400	220	1,7	8,0	6,3	3,4
PV 95 K 4032	95	125	150	250	10	11,0	0,25	1200	440	2,3	10,0	8,0	4,7
PV 115 K 3225	115	150	180	300	5	6,5	0,10	400	180	1,7	8,0	6,3	3,4
PV 115 K 4032	115	150	180	300	10	13,0	0,25	1200	360	2,3	10,0	8,0	4,7
PV 130 K 3225	130	170	205	340	5	7,0	0,10	400	160	1,7	8,0	6,3	3,4
PV 130 K 4032	130	170	205	340	10	15,0	0,25	1200	320	2,3	10,0	8,0	4,7
PV 140 K 3225	140	180	220	360	5	7,5	0,10	400	150	1,7	8,0	6,3	3,4
PV 140 K 4032	140	180	220	360	10	18,0	0,25	1200	300	2,3	10,0	8,0	4,7
PV 150 K 3225	150	200	240	395	5	9,0	0,10	400	140	1,7	8,0	6,3	3,4
PV 150 K 4032	150	200	240	395	10	18,5	0,25	1200	280	2,3	10,0	8,0	4,7
PV 175 K 3225	175	225	270	455	5	9,5	0,10	400	120	2,3	8,0	6,3	4,7
PV 175 K 4032	175	225	270	455	10	21,0	0,25	1200	250	2,3	10,0	8,0	4,7
PV 230 K 3225	230	300	360	595	5	10,0	0,10	400	95	2,3	8,0	6,3	4,7
PV 230 K 4032	230	300	360	595	10	23,0	0,25	1200	190	2,3	10,0	8,0	4,7
PV 250 K 3225	250	320	390	650	5	11,0	0,10	400	80	2,3	8,0	6,3	4,7
PV 250 K 4032	250	320	390	650	10	25,0	0,25	1200	180	2,3	10,0	8,0	4,7
PV 275 K 3225	275	350	430	710	5	13,0	0,10	400	75	2,3	8,0	6,3	4,7
PV 275 K 4032	275	350	430	710	10	29,0	0,25	1200	160	2,3	10,0	8,0	4,7
PV 300 K 3225	300	385	470	775	5	15,0	0,10	400	70	2,3	8,0	6,3	4,7
PV 300 K 4032	300	385	470	775	10	30,0	0,25	1200	150	2,3	10,0	8,0	4,7

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MEDIUM VOLTAGE VARISTORS - DV SERIES


Description

The DV series of medium voltage varistors is designed to protect electronic equipment against high voltage surges in the medium voltage region. They offer excellent transient energy absorption due to improved energy volume distribution and power dissipation. Compared to other medium voltage SMD varistors, DV varistors have a very low profile.

DV varistors are designed for surface mounting and are available in two model sizes - 3225 and 4032 (the 2220 size is also available upon request). These transient voltage suppressors cover an operating voltage V_{rms} from 11 to 300 V, featuring maximum surge currents from 100 A to 1200 A.



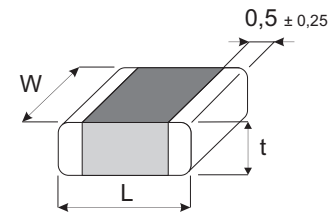
Features

- Fully lead-free component
- Operating voltage range V_{dc}14 V to 385 V
- Operating voltage V_{rms}11 V to 300 V
- 3 model sizes available2220, 3255 and 4032
- Broad range of current and energy handling capabilities
- Leadless chip form – zero inductance guaranteeing the fastest response time to transient surges
- + 125 °C continuous operating temperature
- Insensitive to water cleaning procedures and to humidity corresponding to a climatic category 55/125/56
- Dimensional and weight savings on the board – low profile medium voltage SMD varistor
- Non-packing improves the flammability rating
- Available in tape and reel for automatic pick and place
-  UL 1449, 3rd edition & CSA C22.2. File E326499.

Absolute Maximum Ratings

Continuous:	Units	Value
Steady State Applied Voltage:		
DC Voltage Range (V_{dc})	V	14 to 385
AC Voltage Range (V_{rms})	V	11 to 300
Transient:		
Non-Repetitive Surge Current, 8/20 μ s Waveform (I_{max})	A	100 to 1200
Non-Repetitive Surge Energy, 10/1000 μ s Waveform (W_{max})	J	0,6 to 30
Operating Ambient Temperature	°C	-55 to +125
Storage Temperature	°C	-55 to +150
Threshold Voltage Temperature Coefficient	%/°C	< + 0,05
Response Time	ns	< 5
Climatic Category		55 / 125 / 56

Device Ratings and Characteristics



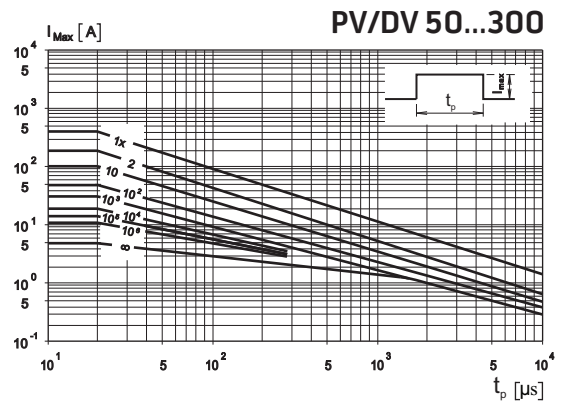
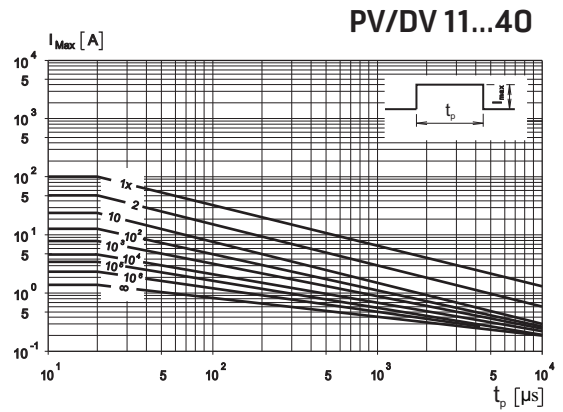
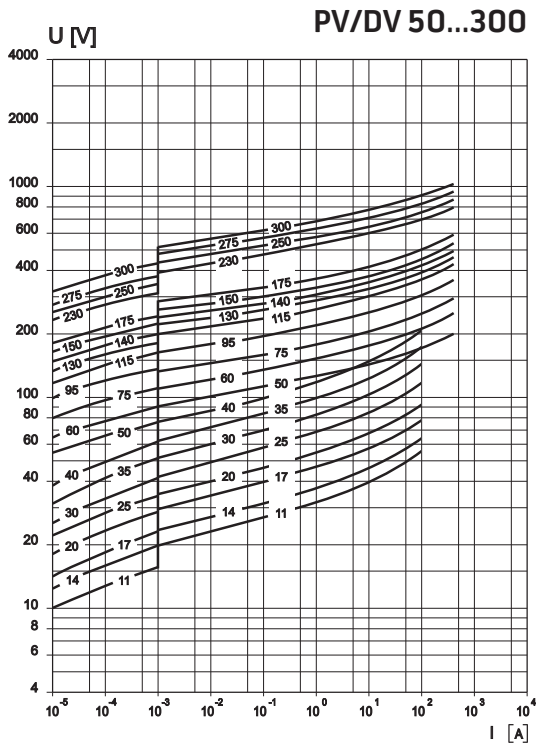
DV 11 K 3225.....DV 300 K 4032

Type	V_{rms} V	V_{dc} V	V_n @ 1 mA V	V_c V	I_c A	W_{max} 10/1000 μ s J	P max W	I_{max} 8/20 μ s A	C typ. @ 1 kHz pF	L $\pm 0,5$ mm	W $\pm 0,4$ mm	t max mm
DV 11 K 3225	11	14	18	36	2,5	0,6	0,01	100	2500	8,0	6,3	1,4
DV 11 K 4032	11	14	18	36	5	1,1	0,02	250	4300	10,0	8,0	1,4
DV 14 K 3225	14	18	22	43	2,5	0,7	0,01	100	2200	8,0	6,3	1,6
DV 14 K 4032	14	18	22	43	5	1,3	0,02	250	3500	10,0	8,0	1,6
DV 17 K 3225	17	22	27	53	2,5	0,9	0,01	100	1750	8,0	6,3	1,8
DV 17 K 4032	17	22	27	53	5	1,6	0,02	250	3000	10,0	8,0	1,8
DV 20 K 3225	20	26	33	65	2,5	1,1	0,01	100	1650	8,0	6,3	1,8
DV 20 K 4032	20	26	33	65	5	2,0	0,02	250	2300	10,0	8,0	1,8
DV 25 K 3225	25	31	39	77	2,5	1,2	0,01	100	1500	8,0	6,3	2,0
DV 25 K 4032	25	31	39	77	5	2,4	0,02	250	1900	10,0	8,0	2,0
DV 30 K 3225	30	38	47	93	2,5	1,5	0,01	100	1000	8,0	6,3	2,0
DV 30 K 4032	30	38	47	93	5	2,8	0,02	250	1600	10,0	8,0	2,0
DV 35 K 3225	35	45	56	110	2,5	1,8	0,01	100	800	8,0	6,3	2,0
DV 35 K 4032	35	45	56	110	5	3,4	0,02	250	1400	10,0	8,0	2,0
DV 40 K 3225	40	56	68	135	2,5	2,2	0,01	100	700	8,0	6,3	2,0
DV 40 K 4032	40	56	68	135	5	4,1	0,02	250	1200	10,0	8,0	2,0
DV 50 K 3225	50	65	82	135	5	2,5	0,10	400	400	8,0	6,3	2,0
DV 50 K 4032	50	65	82	135	10	6,5	0,25	1200	580	10,0	8,0	2,0
DV 60 K 3225	60	85	100	165	5	3,0	0,10	400	300	8,0	6,3	2,0
DV 60 K 4032	60	85	100	165	10	7,0	0,25	1200	530	10,0	8,0	2,0
DV 75 K 3225	75	100	120	200	5	4,0	0,10	400	240	8,0	6,3	2,0
DV 75 K 4032	75	100	120	200	10	9,0	0,25	1200	480	10,0	8,0	2,0
DV 95 K 3225	95	125	150	250	5	6,0	0,10	400	210	8,0	6,3	2,0
DV 95 K 4032	95	125	150	250	10	11,0	0,25	1200	310	10,0	8,0	2,0
DV 115 K 3225	115	150	180	300	5	6,5	0,10	400	200	8,0	6,3	2,0
DV 115 K 4032	115	150	180	300	10	13,0	0,25	1200	270	10,0	8,0	2,0
DV 130 K 3225	130	170	205	340	5	7,0	0,10	400	150	8,0	6,3	2,0
DV 130 K 4032	130	170	205	340	10	15,0	0,25	1200	250	10,0	8,0	2,0
DV 140 K 3225	140	180	220	360	5	7,5	0,10	400	180	8,0	6,3	2,0
DV 140 K 4032	140	180	220	360	10	18,0	0,25	1200	240	10,0	8,0	2,0
DV 150 K 3225	150	200	240	395	5	9,0	0,10	400	150	8,0	6,3	2,0
DV 150 K 4032	150	200	240	395	10	18,5	0,25	1200	220	10,0	8,0	2,0
DV 175 K 3225	175	225	270	455	5	9,5	0,10	400	130	8,0	6,3	2,0
DV 175 K 4032	175	225	270	455	10	21,0	0,25	1200	200	10,0	8,0	2,0
DV 230 K 3225	230	300	360	595	5	10,0	0,10	400	110	8,0	6,3	2,0
DV 230 K 4032	230	300	360	595	10	23,0	0,25	1200	170	10,0	8,0	2,0
DV 250 K 3225	250	320	390	650	5	11,0	0,10	400	100	8,0	6,3	2,0
DV 250 K 4032	250	320	390	650	10	25,0	0,25	1200	160	10,0	8,0	2,0
DV 275 K 3225	275	350	430	710	5	13,0	0,10	400	90	8,0	6,3	2,0
DV 275 K 4032	275	350	430	710	10	29,0	0,25	1200	150	10,0	8,0	2,0
DV 300 K 3225	300	385	470	775	5	15,0	0,10	400	85	8,0	6,3	2,0
DV 300 K 4032	300	385	470	775	10	30,0	0,25	1200	140	10,0	8,0	2,0

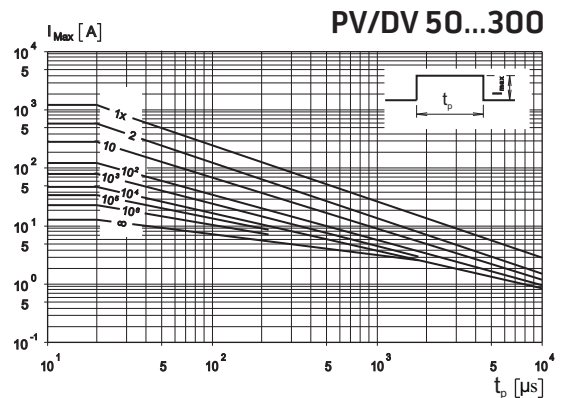
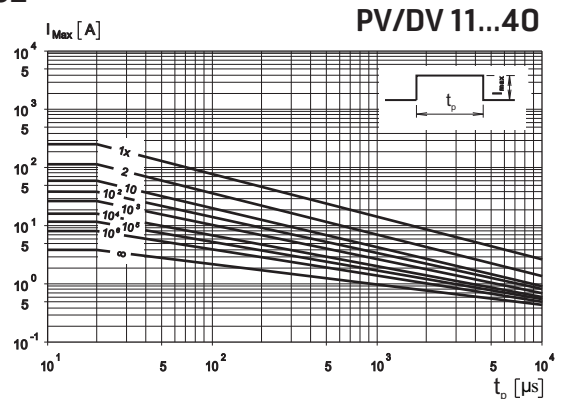
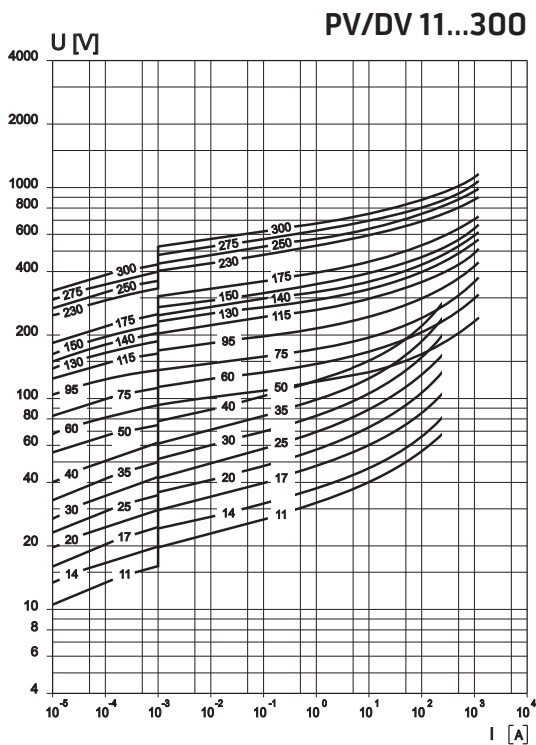
Protection Level

Pulse Rating Curves

Model Size 3225



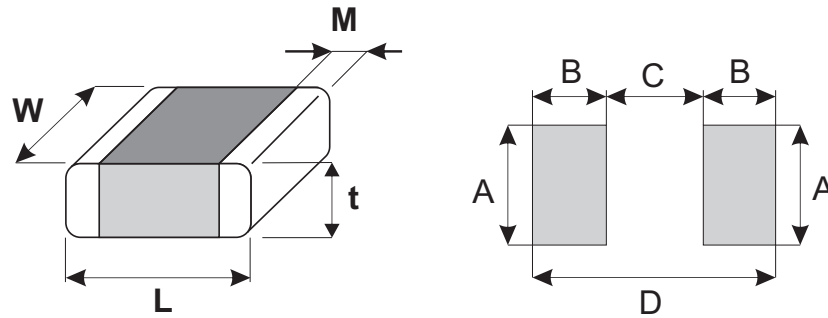
Model Size 4032



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Soldering Pad Configuration

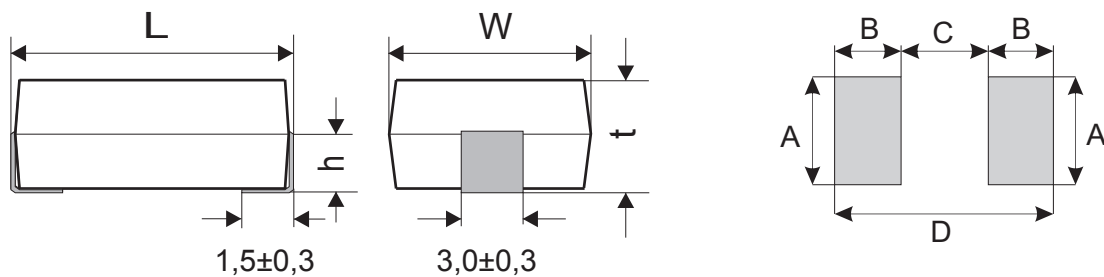
DV Series



Size	Voltage range (V)	L ± 0,5 (mm)	W ± 0,4 (mm)	M ± 0,25 (mm)	t _{max} (mm)	A (mm)	B (mm)	C (mm)	D (mm)
3225	11 to 300	8,0	6,3	0,5	2,0	6,8	1,5	6,5	9,5
4032	11 to 300	10,0	8,3	0,5	2,0	6,8	1,5	8,7	11,7

* size 2220 available upon request

PV Series

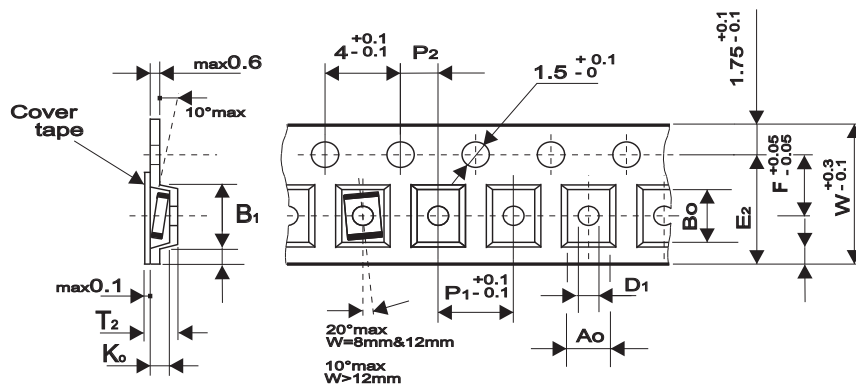


Size	Voltage range (V)	L ± 0,5 (mm)	W ± 0,4 (mm)	h ± 0,3 (mm)	t ± 0,3 (mm)	A (mm)	B (mm)	C (mm)	D (mm)
3225	11 to 150	8,0	6,3	1,7	3,4	3,5	2,9	4,5	10,3
3225	175 to 300	8,0	6,3	2,3	4,7	3,5	2,9	4,5	10,3
4032	11 to 300	10,0	8,3	2,3	4,7	3,5	2,9	6,5	12,3

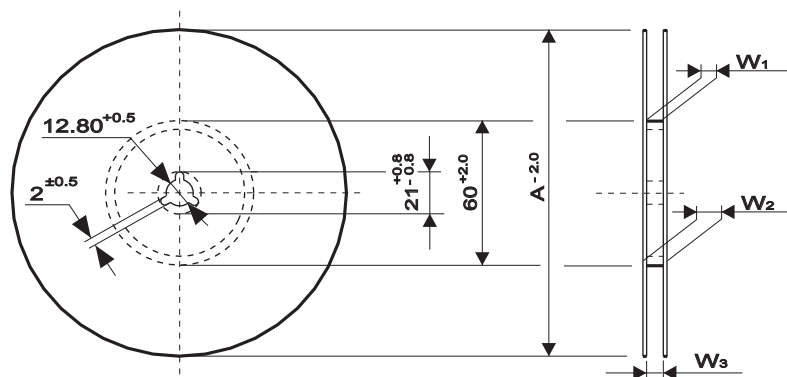
Device Ratings and Characteristics

Conforms to IEC Publication 286 - 3 Ed.4: 2007-06

Tape



Reel



Variable dimensions

Tape Size		16mm	
Size	Units	3225	4032
Size	(mm)	7	8,6
Ao	(mm)	7,8	10,8
Bo	(mm)	3,7	3,7
Ko max	(mm)	12,1	12,1
B1 max	(mm)	1,5	1,5
D1 max	(mm)	14,25	14,25
e2	(mm)	12	12
P1	(mm)	7,5	7,5
F	(mm)	16,0	16,0
W	(mm)	9,5	9,5
T2 max	(mm)	16,4+2	16,4+2
W1	(mm)	22,4	22,4
W2 max	(mm)	15,9...19,4	15,9...19,4
A	(mm)	330	330

Package units

Series	Chip Size	
	3225	4032
DV	2000	2000
PV < 175	1500	1000
PV > 175	1000	1000

Ordering Information

PV 20 K 3225 R2 yy

- PV** - Series Name
- 20** - V_{rms}
- K** - V_n Tolerance: K = \pm 10 %
- 3225** - Model Size: 3225, 4032
- R2** - Packaging: R2 = Reel 330 mm
- yy** - Special requirements

DV 20 K 3225 R2 yy

- DV** - Series Name
- 20** - V_{rms}
- K** - V_n Tolerance: K = \pm 10 %
- 3225** - Model Size: 3225, 4032
- R2** - Packaging: R2 = Reel 330 mm
- yy** - Special requirements

Varistor Marking for PV Series

PV 20 K 3225

- KEKO** - Tradename
- PV** - Series Name
- 20** - V_{rms}
- K** - V_n Tolerance
- 3225** - Model Size
- ww/yy** - Date code on request

AUTOMOTIVE DUAL FUNCTION VARICON - OV SERIES

Description

The VARICON OV series is a series of dual function protective devices that protect against voltage surges in an automotive voltage region and against radio frequency noise. This component replaces two components – a low voltage varistor and a capacitor.

OV series varicons incorporate a varistor function in automotive applications in a voltage region (12 V, 24 V, 42 V) and a function of a radio-frequency filtering capacitor in a high capacitance range from 0,47 to 1,5 μ F (higher values are available upon request), making them ideal for protection in automobile electronics applications.

OV Varicons are square shaped components with in-line leads, which require very little mounting space, at least 30% less the two components they replace. Dual function varicons are also available in SMD versions upon request – compliant with Pb-free soldering.



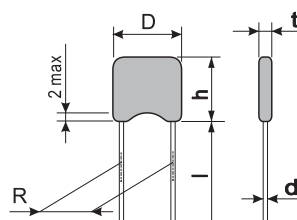
Features

- Supply voltage12 V, 24 V and 42 V.
- Operating voltage V_{dc}16, 20, 26, 38 and 56 V.
- Capacitance range C (pF).....0,47 to 1,5 μ F (higher values are available upon request).
- Capacitor temperature characteristics.
- Protects against voltage transients and suppresses radio-frequency interference.
- Dimensional and weight saves on board
- 2 standard model sizes available7,5 x 9,0 and 8 x 12 mm (smaller model size is available upon request).
- THD and SMD components.
- Available in tape and reel for automatic insertion equipment.
- RoHS, GADSL, REACH.
- AEC-Q200 qualified Grade 1.

Absolute Maximum Ratings

	Units	Value
Continuous:		
Steady State Applied Voltage:		
DC Voltage Range (V_{dc})	V	16 to 56
AC Voltage Range (V_{rms})	V	14 to 40
Transient:		
Load Dump Energy (WDL)	J	6 to 12
Jump Start Capability (5 minutes), (V_{jump})	V	24 to 65
Non-Repetitive Surge Current, 8/20 μ s Waveform (I_{max})	A	800 to 1200
Non-Repetitive Surge Energy, 10/1000 μ s Waveform (W_{max})	J	2,4 to 10,5
Capacitance Range	nF	470 to 4700
Capacitor Temperature Characteristics		X7R
Operating Ambient Temperature	$^{\circ}$ C	-40 to +125
Storage Temperature Range	$^{\circ}$ C	-40 to +150
Threshold Voltage Temperature Coefficient	%/ $^{\circ}$ C	< + 0,05
Insulation Resistance	G Ω	> 1
Isolation Voltage Capability	kV	> 1,25
Response Time	ns	< 25
Climatic Category		40 / 125 / 56

Device Ratings and Characteristics



OV 14 K 474 MX 801 ... OV 40 K 155 MX 122

Type	V _{rms} V	V _{dc} V	V _n @ 1 mA V	V _{jump} 5 min V	V _c V	I _c A	W _{max} 10/1000 μs J	WLD 10 x J	P max W	I _{max} 8/20 μs A	C @ 1 kHz μF	D max mm	h/A max mm	R mm	d mm	t max mm
12 V Supply Voltage																
OV 14 K 474 MX 801	14	16	24	24,5	40	5	2,4	6	0,015	800	0,47	7,5	9	5	0,6	5,5
OV 14 K 105 MX 801	14	16	24	24,5	40	5	2,4	6	0,015	800	1,00	7,5	9	5	0,6	5,5
OV 14 K 155 MX 801	14	16	24	24,5	40	5	2,4	6	0,015	800	1,50	7,5	9	5	0,6	5,5
OV 14 K 474 MX 122	14	16	24	24,5	40	10	5,8	12	0,030	1200	0,47	8,0	12	5	0,6	5,5
OV 14 K 105 MX 122	14	16	24	24,5	40	10	5,8	12	0,030	1200	1,00	8,0	12	5	0,6	5,5
OV 14 K 155 MX 122	14	16	24	24,5	40	10	5,8	12	0,030	1200	1,50	8,0	12	5	0,6	5,5
OV 17 K 474 MX 801	17	20	27	30	44	5	2,8	6	0,015	800	0,47	7,5	9	5	0,6	5,5
OV 17 K 105 MX 801	17	20	27	30	44	5	2,8	6	0,015	800	1,00	7,5	9	5	0,6	5,5
OV 17 K 155 MX 801	17	20	27	30	44	5	2,8	6	0,015	800	1,50	7,5	9	5	0,6	5,5
OV 17 K 474 MX 122	17	20	27	30	44	10	7,4	12	0,030	1200	0,47	8,0	12	5	0,6	5,5
OV 17 K 105 MX 122	17	20	27	30	44	10	7,4	12	0,030	1200	1,00	8,0	12	5	0,6	5,5
OV 17 K 155 MX 122	17	20	27	30	44	10	7,4	12	0,030	1200	1,50	8,0	12	5	0,6	5,5
24 V Supply Voltage																
OV 20 K 474 MX 801	20	26	33	36	54	5	3,2	6	0,015	800	0,47	7,5	9	5	0,6	5,5
OV 20 K 105 MX 801	20	26	33	36	54	5	3,2	6	0,015	800	1,00	7,5	9	5	0,6	5,5
OV 20 K 155 MX 801	20	26	33	36	54	5	3,2	6	0,015	800	1,50	7,5	9	5	0,6	5,5
OV 20 K 474 MX 122	20	26	33	36	54	10	7,8	12	0,030	1200	0,47	8,0	12	5	0,6	5,5
OV 20 K 105 MX 122	20	26	33	36	54	10	7,8	12	0,030	1200	1,00	8,0	12	5	0,6	5,5
OV 20 K 155 MX 122	20	26	33	36	54	10	7,8	12	0,030	1200	1,50	8,0	12	5	0,6	5,5
OV 30 K 474 MX 801	30	38	47	50	77	5	4,5	6	0,015	800	0,47	7,5	9	5	0,6	5,5
OV 30 K 105 MX 801	30	38	47	50	77	5	4,5	6	0,015	800	1,00	7,5	9	5	0,6	5,5
OV 30 K 155 MX 801	30	38	47	50	77	5	4,5	6	0,015	800	1,50	7,5	9	5	0,6	5,5
OV 30 K 474 MX 122	30	38	47	50	77	10	10	12	0,030	1200	0,47	8,0	12	5	0,6	5,5
OV 30 K 105 MX 122	30	38	47	50	77	10	10	12	0,030	1200	1,00	8,0	12	5	0,6	5,5
OV 30 K 155 MX 122	30	38	47	50	77	10	10	12	0,030	1200	1,50	8,0	12	5	0,6	5,5
42 V Supply Voltage																
OV 40 K 474 MX 801	40	56	68	65	110	5	4,8	6	0,015	800	0,47	7,5	9	5	0,6	5,5
OV 40 K 105 MX 801	40	56	68	65	110	5	4,8	6	0,015	800	1,00	7,5	9	5	0,6	5,5
OV 40 K 155 MX 801	40	56	68	65	110	5	4,8	6	0,015	800	1,50	7,5	9	5	0,6	5,5
OV 40 K 474 MX 122	40	56	68	65	110	10	10,5	12	0,030	1200	0,47	8,0	12	5	0,6	5,5
OV 40 K 105 MX 122	40	56	68	65	110	10	10,5	12	0,030	1200	1,00	8,0	12	5	0,6	5,5
OV 40 K 155 MX 122	40	56	68	65	110	10	10,5	12	0,030	1200	1,50	8,0	12	5	0,6	5,5

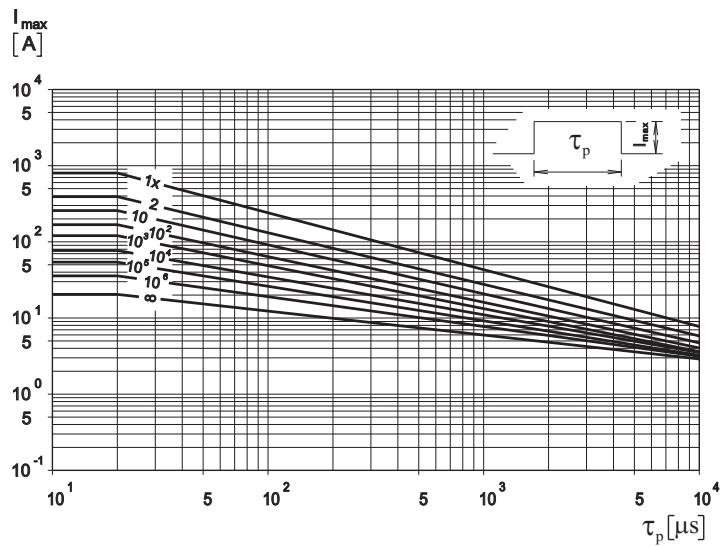
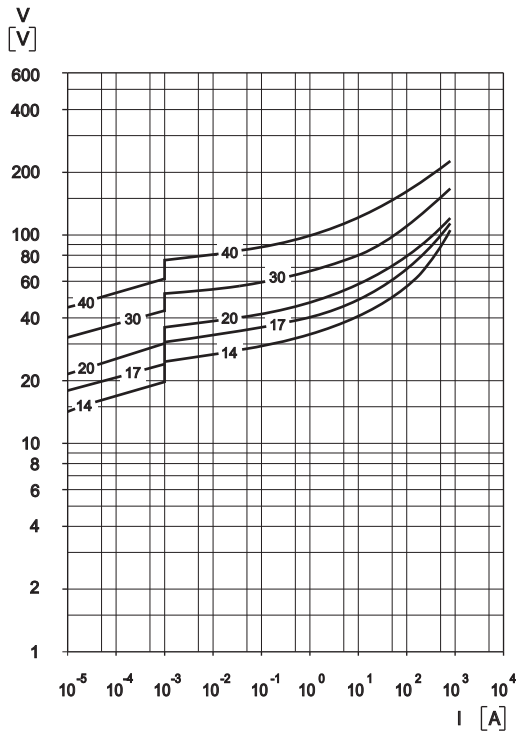
* X stands for X7R temperature characteristics; Other capacitance values are also available

Protection Level

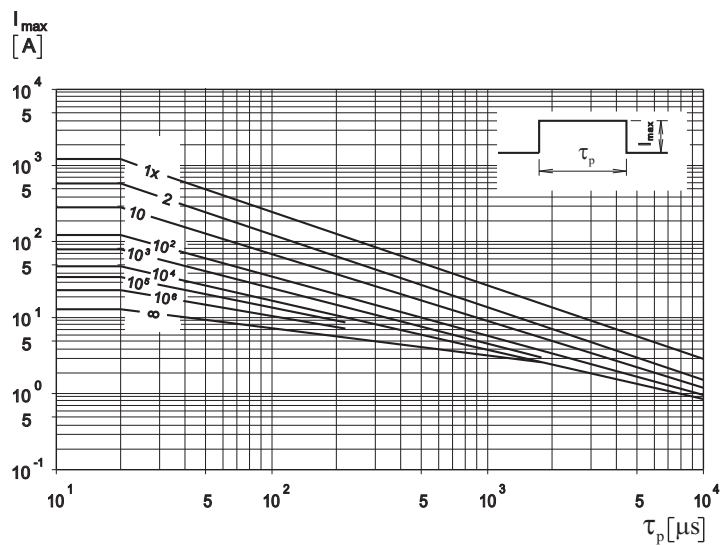
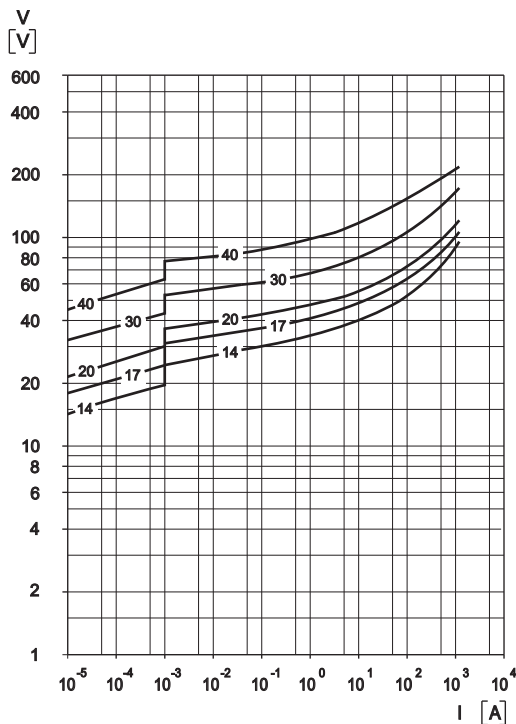
Pulse Rating Curves

* In the most demanding conditions as per the tolerance region

OV 14...40 K ... 801

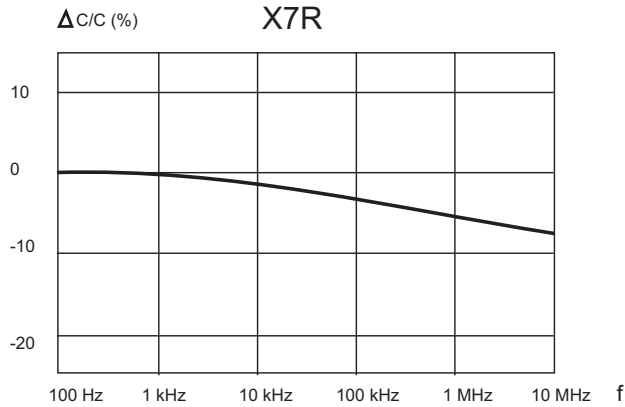


OV 14...40 K ... 122

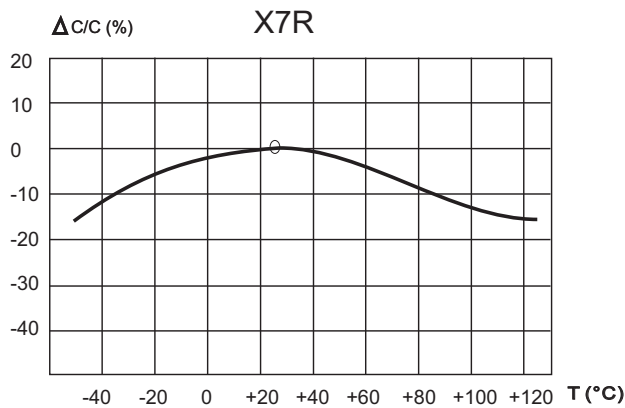


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Capacitance - Frequency Characteristics

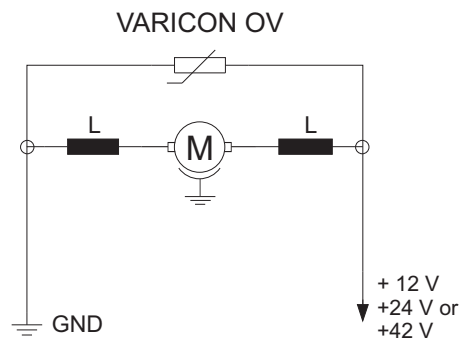


Capacitance - Temperature Characteristics



Application

Application Circuit



Provides for the elimination of transients and EMI noise in automotive electronics such as engine control, exhaust gas control, safety systems, etc. against disturbances caused by small motors used in automobiles. Most frequently, small motors in an automobile are those used for windscreen wipers, window mechanisms, seat adjustments and automatic door locking.

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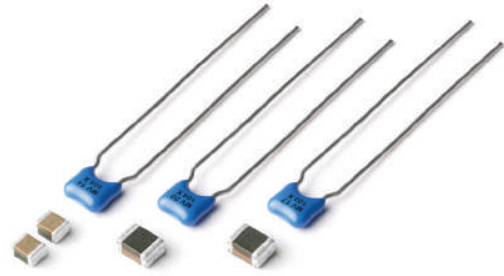
LOW VOLTAGE DUAL FUNCTION VARICON - MV SERIES

Description

The VARICON MV series is series of dual function protective devices that protect against voltage surges in a low voltage region and against high frequency noise, replacing two components, those being a low voltage varistor and a capacitor.

MV series varicons incorporate a varistor function in the DC voltage range from 3 to 125 V (up to 170 V upon request) and function as high frequency by-pass capacitors operating in the capacitance range from 10 nF to 1 μ F. Lower capacitance values are also available. They are intended for protection of all sensitive electronic devices experiencing both voltage transients and high frequency noise produced by electromechanical devices, such as buzzers, relays, etc.

MV Varicons are square shaped components with in-line leads, which require very little mounting space, at least 30% less than the two components they replace. Dual function VARICONs are also available in SMD versions upon request – compliant with Pb-free soldering.



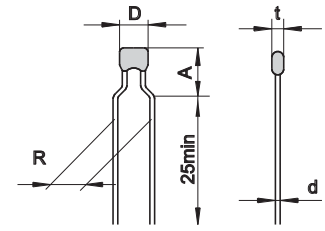
Features

- Operating voltage range V_{dc} 3 to 125 V (up to 170 V upon request).
- Operating voltage range V_{rms} 2 to 95 V (up to 130 V upon request).
- Capacitance range C (@ 1 kHz)10 nF to 1 μ F (lower capacitance values are also available upon request).
- Capacitor temperature characteristicsX7R.
- Protects against voltage transients and suppresses high frequency interference.
- Dimensional and weight saves on board.
- One standard model size available 6 x 9 mm.
- THD and SMD components.
- Available in tape and reel for automatic pick and place.
- Lead free components.
- AEC-Q200 qualified Grade 1

Absolute Maximum Ratings

Continuous:	Units	Value
Steady State Applied Voltage:		
DC Voltage Range (V_{dc})	V	3 to 170
AC Voltage Range (V_{rms})	V	2 to 130
Transient:		
Non-Repetitive Surge Current, 8/20 μ s Waveform (I_{max})	A	150
Non-Repetitive Surge Energy, 10/1000 μ s Waveform (W_{max})	J	0,1 to 2,5
Capacitance Range	nF	10 to 1000
Capacitor Temperature Characteristics		X7R
Operating Ambient Temperature	$^{\circ}$ C	- 40 to + 125
Storage Temperature Range	$^{\circ}$ C	- 40 to +150
Threshold Voltage Temperature Coefficient	%/ $^{\circ}$ C	< + 0,05
Insulation Resistance	G Ω	> 1
Isolation Voltage Capability	kV	> 1,25
Response Time	ns	< 25
Climatic Category		40 / 125 / 56

Device Ratings and Characteristics



MV 2 M 103 MX MV 95 K 105 MX

Type	V_{rms} V	V_{dc} V	V_n @ 1 mA V	V_c @ 1 A V	W_{max} 10/1000 μ s J	P max W	I_{max} 8/20 μ s A	C @ 1 kHz nF	D max mm	A max mm	R mm	d mm	t max mm
MV 2 M 103 MX	2	3	4	10	0,1	0,01	150	10	6	9	5	0,6	5,5
MV 2 M 104 MX	2	3	4	10	0,1	0,01	150	100	6	9	5	0,6	5,5
MV 2 M 105 MX	2	3	4	10	0,1	0,01	150	1000	6	9	5	0,6	5,5
MV 4 M 103 MX	4	5,5	8	14	0,2	0,01	150	10	6	9	5	0,6	5,5
MV 4 M 104 MX	4	5,5	8	14	0,2	0,01	150	100	6	9	5	0,6	5,5
MV 4 M 105 MX	4	5,5	8	14	0,2	0,01	150	1000	6	9	5	0,6	5,5
MV 6 M 103 MX	6	8	11	21	0,2	0,01	150	10	6	9	5	0,6	5,5
MV 6 M 104 MX	6	8	11	21	0,2	0,01	150	100	6	9	5	0,6	5,5
MV 6 M 105 MX	6	8	11	21	0,2	0,01	150	1000	6	9	5	0,6	5,5
MV 8 L 103 MX	8	11	15	25	0,3	0,01	150	10	6	9	5	0,6	5,5
MV 8 L 104 MX	8	11	15	25	0,3	0,01	150	100	6	9	5	0,6	5,5
MV 8 L 105 MX	8	11	15	25	0,3	0,01	150	1000	6	9	5	0,6	5,5
MV 11 K 103 MX	11	14	18	35	0,8	0,01	150	10	6	9	5	0,6	5,5
MV 11 K 104 MX	11	14	18	35	0,8	0,01	150	100	6	9	5	0,6	5,5
MV 11 K 105 MX	11	14	18	35	0,8	0,01	150	1000	6	9	5	0,6	5,5
MV 14 K 103 MX	14	18	22	38	0,9	0,01	150	10	6	9	5	0,6	5,5
MV 14 K 104 MX	14	18	22	38	0,9	0,01	150	100	6	9	5	0,6	5,5
MV 14 K 105 MX	14	18	22	38	0,9	0,01	150	1000	6	9	5	0,6	5,5
MV 17 K 103 MX	17	22	27	49	1,1	0,01	150	10	6	9	5	0,6	5,5
MV 17 K 104 MX	17	22	27	49	1,1	0,01	150	100	6	9	5	0,6	5,5
MV 17 K 105 MX	17	22	27	49	1,1	0,01	150	1000	6	9	5	0,6	5,5
MV 20 K 103 MX	20	26	33	54	1,3	0,01	150	10	6	9	5	0,6	5,5
MV 20 K 104 MX	20	26	33	54	1,3	0,01	150	100	6	9	5	0,6	5,5
MV 20 K 105 MX	20	26	33	54	1,3	0,01	150	1000	6	9	5	0,6	5,5
MV 25 K 103 MX	25	31	39	65	1,7	0,01	150	10	6	9	5	0,6	5,5
MV 25 K 104 MX	25	31	39	65	1,7	0,01	150	100	6	9	5	0,6	5,5
MV 25 K 105 MX	25	31	39	65	1,7	0,01	150	1000	6	9	5	0,6	5,5
MV 30 K 103 MX	30	38	47	77	2,0	0,01	150	10	6	9	5	0,6	5,5
MV 30 K 104 MX	30	38	47	77	2,0	0,01	150	100	6	9	5	0,6	5,5
MV 30 K 105 MX	30	38	47	77	2,0	0,01	150	1000	6	9	5	0,6	5,5
MV 35 K 103 MX	35	45	56	90	2,2	0,01	150	10	6	9	5	0,6	5,5
MV 35 K 104 MX	35	45	56	90	2,2	0,01	150	100	6	9	5	0,6	5,5
MV 35 K 105 MX	35	45	56	90	2,2	0,01	150	1000	6	9	5	0,6	5,5
MV 40 K 103 MX	40	56	68	110	2,3	0,01	150	10	6	9	5	0,6	5,5
MV 40 K 104 MX	40	56	68	110	2,3	0,01	150	100	6	9	5	0,6	5,5
MV 40 K 105 MX	40	56	68	110	2,3	0,01	150	1000	6	9	5	0,6	5,5
MV 50 K 103 MX	50	65	82	135	2,3	0,01	150	10	6	9	5	0,6	5,5
MV 50 K 104 MX	50	65	82	135	2,3	0,01	150	100	6	9	5	0,6	5,5
MV 50 K 105 MX	50	65	82	135	2,3	0,01	150	1000	6	9	5	0,6	5,5
MV 60 K 103 MX	60	85	100	165	2,3	0,01	150	10	6	9	5	0,6	5,5
MV 60 K 104 MX	60	85	100	165	2,3	0,01	150	100	6	9	5	0,6	5,5
MV 60 K 105 MX	60	85	100	165	2,3	0,01	150	1000	6	9	5	0,6	5,5
MV 95 K 103 MX	95	125	150	250	2,5	0,01	150	10	6	9	5	0,6	5,5
MV 95 K 104 MX	95	125	150	250	2,5	0,01	150	100	6	9	5	0,6	5,5
MV 95 K 105 MX	95	125	150	250	2,5	0,01	150	1000	6	9	5	0,6	5,5

* X stand for X7R temperature characteristic.

Other capacitance values and voltages are also available upon request.

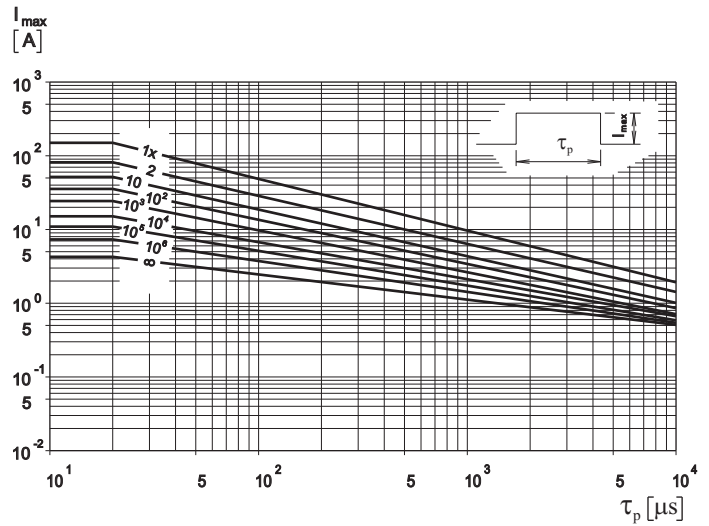
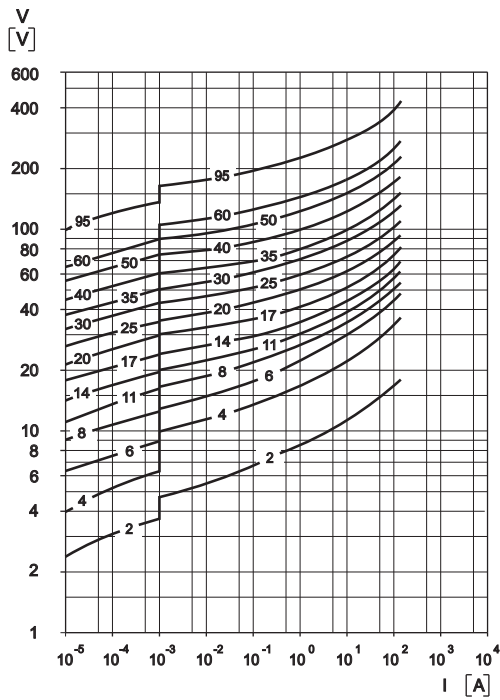
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Protection Level

Pulse Rating Curves

* With the worst-case condition in the tolerance region

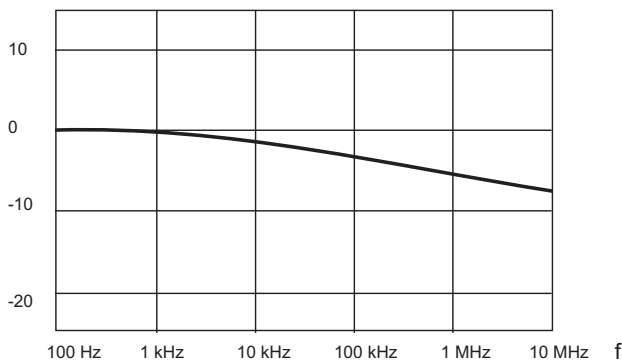
MV 2 M...95 K



Capacitance - Frequency Characteristics

$\Delta C/C$ (%)

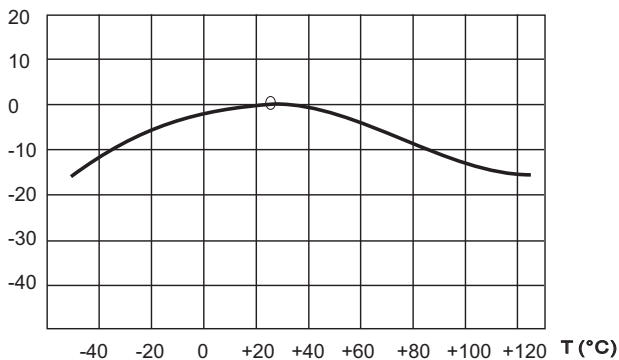
X7R



Capacitance - Temperature Characteristics

$\Delta C/C$ (%)

X7R



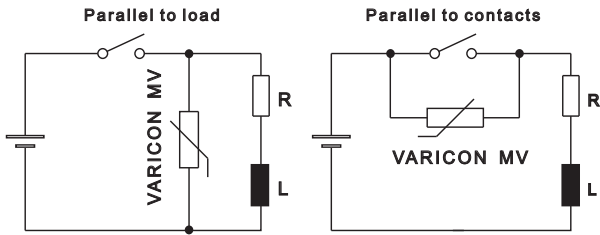
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Application

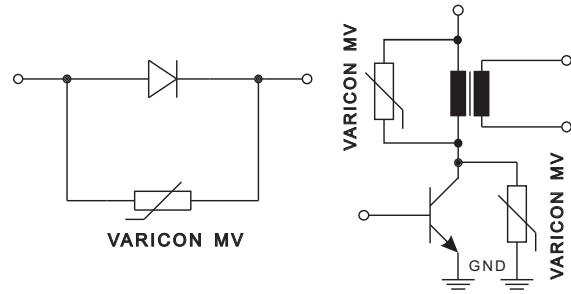
- Electrostatic Surge Absorption
- Relay Surge Suppression Effect and Relay reset Time
- Piezoelectric Buzzer Shock Noise Absorption

Application Circuits

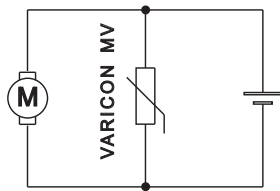
(a) Eliminating sparks from relay circuits
(there is no delay in operating time)



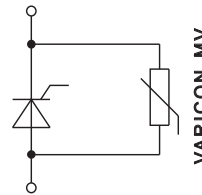
(b) Eliminating noise from micro motors



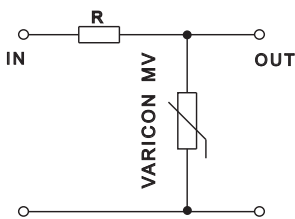
(c) Stabilizing voltages and absorbing line surges



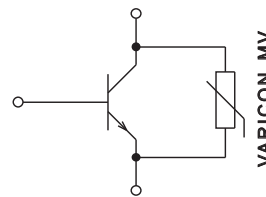
(d) Absorbing shock noise of piezoelectric alarms



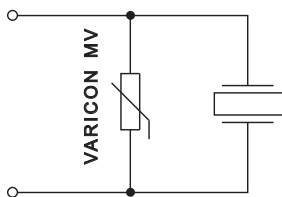
(e) Protecting semi conductive components including transistors and diodes



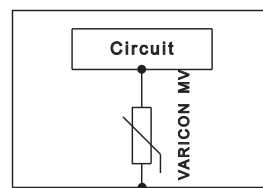
(f) Improved thyristor configuration
Eliminating vibration better than conventional circuits



(g) Elimination of over-shooting from transistors

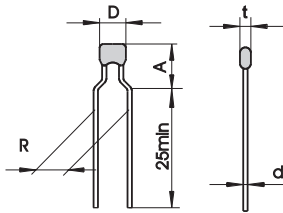
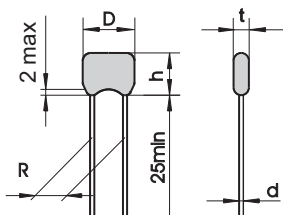
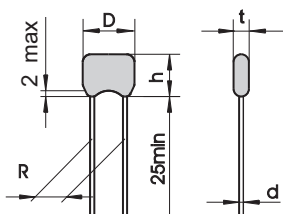


(h) Elimination of static electricity from circuits

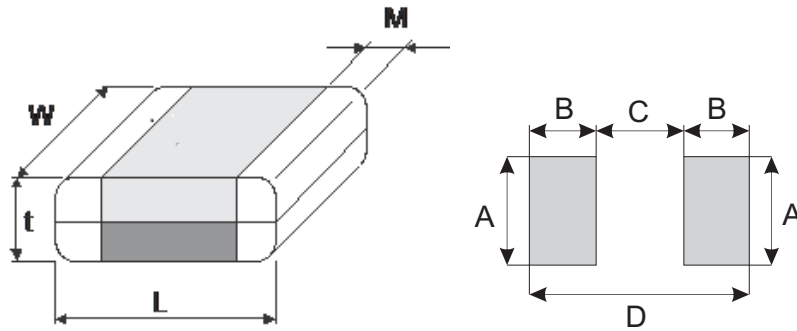


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Lead Styles

Type	R (mm)	h (mm)	A (mm)	Version 1	Version 5
MV 2 M...95 K 103...105 MX	5		9		
OV 14...40 K 474...155 MX 801	5	9			
OV 14...40 K 474...155 MX 122	5	12			

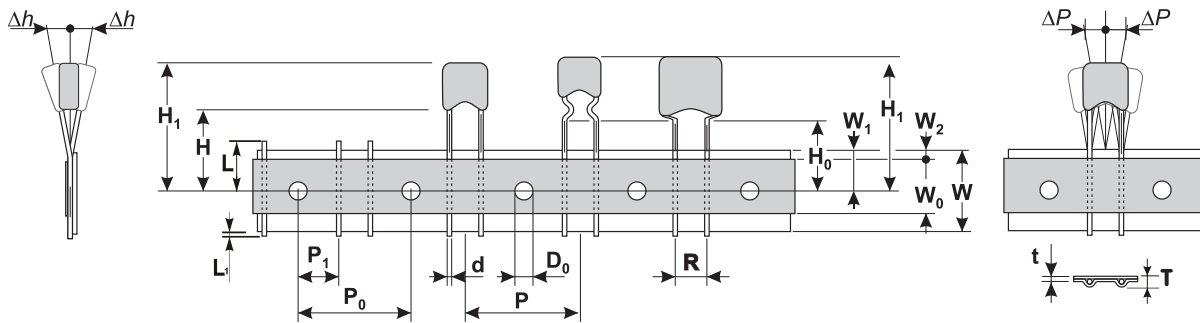
Soldering Pad Configuration



Size	L (mm)	W (mm)	M (mm)	t _{max} (mm)	A (mm)	B (mm)	C (mm)	D (mm)
1210	3,2 ± 0,30	2,50 ± 0,25	0,5 ± 0,25	2,5	2,8	1,2	2,1	4,5
1812	4,7 ± 0,40	3,20 ± 0,30	0,5 ± 0,25	3,0	3,6	1,5	3,2	6,2
2220	5,7 ± 0,50	5,00 ± 0,40	0,5 ± 0,25	3,0	5,5	1,5	4,2	7,2

Tape and Reel Specification

Conforms to IEC Publication 286-2 Ed.3: 2008-03



Symbol	Parameter	Dimension (mm)
W	Carrier tape with	18 +1,0/-0,5
W ₀	Hold down tape width	5 min
W ₁	Sprocket hole position	9 +0,75/-0,5
W ₂	Distance between the upper edges of the carrier tape and hold-down tape	3 max
T	Total tape thickness	1,5 max
t	Tape thickness	0,9 max
P	Pitch of component	12,7 ± 1,0
P ₀	Feed hole pitch	12,7 ± 0,3
P ₁	Feed hole center to pitch	3,85 ± 0,7
R	Lead Spacing	5 +0,5/-0,2
ΔP	Component alignment	± 1,3 max
Δh	Component alignment	± 2 max
d	Wire diameter	0,6 max
D ₀	Feed hole diameter	4 ± 0,2
H	Height from tape center to comp. base	18 +2,0/-0,0
H ₀	Seating plane height	16 ± 0,5
H ₁	Component height	32,2 max
L	Protrusion - cut out	11 max
L ₁	Protrusion - cut off	0,5 max

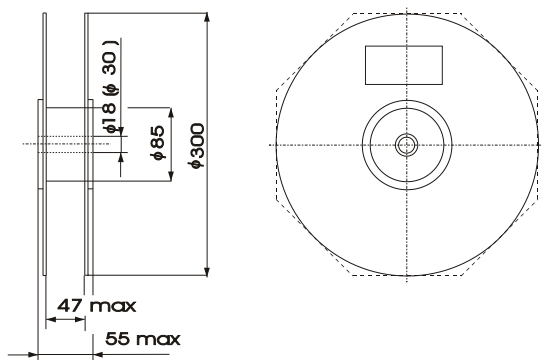
* - given tabel is only for products with R=5mm, for other Lead Spacing dimensions please contact the factory for data.

Unit Package

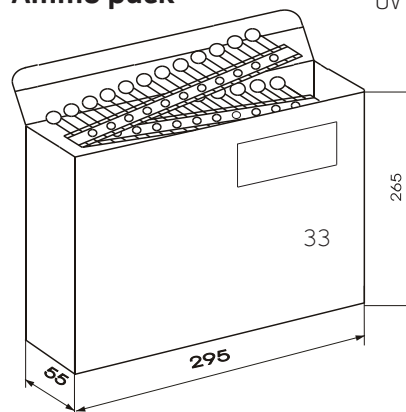
Series	B	R	A
MV	1500	1500	1500
OV	1000	1000	1000

Packaging

Reel



Ammo pack

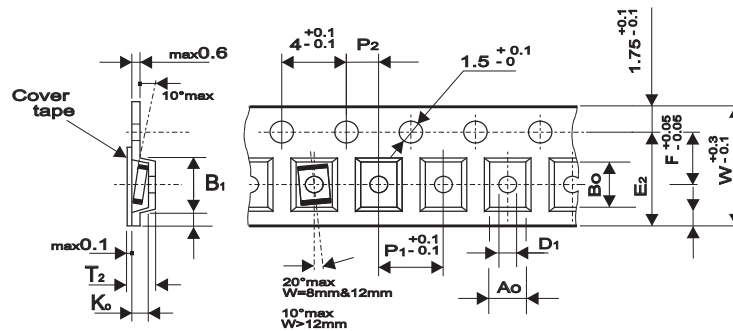


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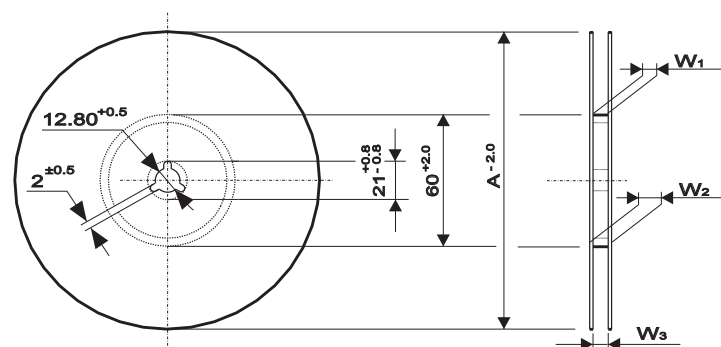
Tape and Reel Specification

Conforms to IEC Publication 286 - 3 Ed.4: 2007-06

Tape



Reel



Variable dimensions

Tape Size		8 mm		12 mm	
Size	Units	1210	1812	2220	
Ao	(mm)	2,9	3,7	5,6	
Bo	(mm)	3,7	5	6,25	
Ko max	(mm)	*	*	*	
B1 max	(mm)	4,35	8,2	8,2	
D1 min	(mm)	0,3	1,5	1,5	
E2 min	(mm)	6,25	10,25	10,25	
P1	(mm)	4	8	8,	
F	(mm)	3,5	5,5	5,5	
W	(mm)	8,0	12,0	12,0	
T2 max	(mm)	**	**	**	
W1	(mm)	8,4+1,5	12,4+2	12,4+2	
W2 max	(mm)	14,4	18,4	18,4	
W3	(mm)	7,9...10,9	11,9...15,4	11,9...15,4	
A	(mm)	180/330	180/330	180/330	

*,** - the values for this parameter are depended on capacitance values. For detail information and technical data please contact the factory.

Package units

Series	Voltage range (V)	Chip Size					
		1210		1812		2220	
		Reel size		Reel size		Reel size	
		180	330	180	330	180	330
OV	all	***	***	***	***	***	***
MV	all	***	***	***	***	***	***

*** - the values are depended on varicons dimensions (parameter Ko and T2). For detail information and technical data please contact the factory.

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Ordering Information

OV 20 K 474 MX 801 R L1 yy

- OV** - Series Name: MV, OV
- 20** - Maximum Continuous Operating Voltage - V_{rms}
- K** - V_n Tolerance: K = $\pm 10\%$, L = $\pm 15\%$, M = $\pm 20\%$
- 474** - Capacitance Code in pF: 474 = 470 nF
- M** - Capacitance Tolerance: K = $\pm 10\%$, M = $\pm 20\%$
- X** - Dielectric Type: X = X7R
- 1812** - Dimensions, only for SMD component
- 801** - Surge Current Code in A: 801 = 800 A
- N** - Barrier type, only for SMD component
- R** - Packaging: B = Bulk, R = reel, A = ammo
- L1** - Lead Style: 1 = straight, only for Leaded component
- yy** - Special requirements

Varicon Marking

For OV Series

OV 20 K 474 MX 122

- OV** - Series Name
- 20** - V_{rms}
- K** - V_n Tolerance
- 474** - Capacitance Code
- M** - Capacitance Tolerance
- X** - Dielectric Ceramics Code
- 122** - Surge Current Code - does not exist for current code 801

For MV Series

MV 14 103 X

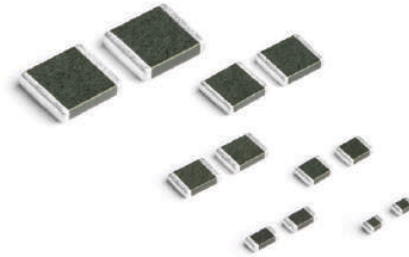
- MV** - Series Name
- 14** - V_{rms}
- K** - V_n Tolerance
- 103** - Capacitance Code
- X** - Dielectric Ceramics Code

AUTOMOTIVE VARISTORS - AV & AV HT SERIES

Description

Almost all-electronic systems in an automobile, e.g. anti-lock brake system, direct ignition system, airbag control system, wiper motors, etc. are susceptible to damage from destructive voltage transients. AV varistors are transient suppressors with temperature independent suppression characteristics enabling protection from -55 °C to 150 °C.

AV varistors offer excellent transient energy distribution. AV varistors require significantly less space and pad area than silicon TVS diodes, offering greater circuit board layout flexibility for the designer.



Features

- Supply voltage.....12 V, 24 V and 42 V
- Operating voltage range V_{dc}3 V to 170 V higher operating voltages available upon request.
- Load Dump Energy up to 50 J available upon request.
- + 125 °C continuous operating temperature for AV Series
- + 150 °C continuous operating temperature for AV HT Series
- Automotive varistors with a lower or higher capacitance, as well as varistors with a 100 % controlled capacitance value, are available upon request.
- 6 model sizes available ...0805, 1206, 1812, 2220, 3225.
- Leadless chip form near zero inductance guaranteeing the fastest speed of response to transient surges.
- Broad range of current and energy handling capabilities.
- Low clamping voltage – Uc.
- Absence of plastic coating guarantees better flammability rating.
- Non-sensitive to mildly activated fluxes (see Soldering Recommendations, page 25).
- End termination: Ni/Sn or AgPd or type suitable for Pb-free soldering process – barrier type end terminations solderable with Pb-free solders according to JEDEC J-STD-020C and IEC 60068-2-58.
- RoHS 2 2011/65/EC, REACH, GADSL compliant.
- AEC-Q200 qualified Grade 1.

Absolute Maximum Ratings

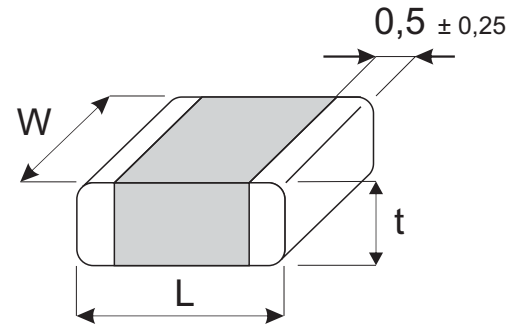
Continuous:	Units	Value
Steady State Applied Voltage:		
DC Voltage Range (V_{dc})	V	16 to 56
Transient:		
Load Dump Energy (WDL)	J	1 to 25 *
Jump Start Capability (5 minutes), (V_{jump})	V	24,5 to 65
Peak Single Pulse Surge Current, 8/20 μ s Waveform (I_{max})	A	120 to 2000
Single Pulse Surge Energy, 10/1000 μ s Waveform (W_{max})	J	0,3 to 30
Operating Ambient Temperature	°C	-55 to +125 for AV -55 to +150 for AVHT
Storage Temperature Range	°C	-55 to +150
Threshold Voltage Temperature Coefficient	%/°C	< + 0,05
Response Time	ns	< 2
Climatic Category		55 / 125 / 56

* Types for Maximum Load Dump Energy (WDL) of 50 J are available upon request.

Device Ratings and Characteristics

Dimensions

	L mm	W mm	t _{max} mm
0805	2,0 ± 0,25	1,25 ± 0,20	1,0
1206	3,2 ± 0,30	1,60 ± 0,20	1,2
1210	3,2 ± 0,30	2,50 ± 0,25	1,3
1812	4,7 ± 0,40	3,20 ± 0,30	1,3
2220	5,7 ± 0,50	5,00 ± 0,40	1,4
3225	8,0 ± 0,50	6,30 ± 0,40	1,5



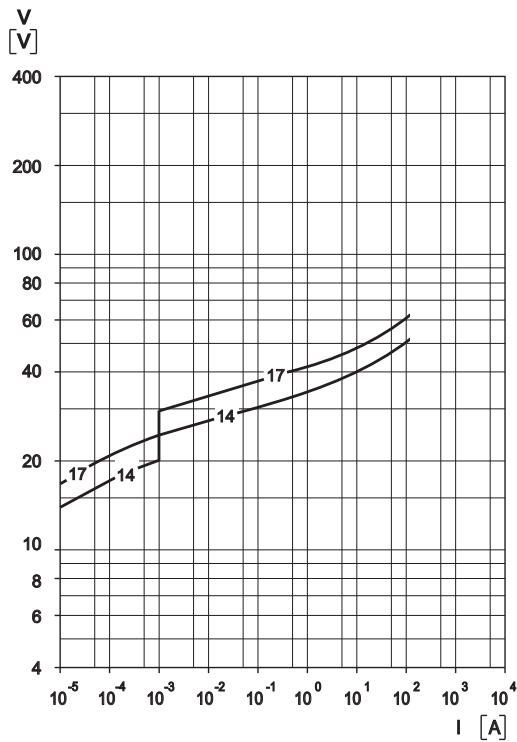
AV 14 K 0805 121...AV 40 K 3225 202

Type	V _{rms} V	V _{dc} V	V _n 1 mA V	V _{jump} 5 min V	V _c V	I _c 8/20 μs A	I _{max} 8/20 μs A	W _{max} 10/1000 μs J	WLD 10 x J	P max W	C _{typ} @ 1 kHz nF
12 V Power Supply											
AV 14 K 0805 121	14	16	24	24,5	40	1	120	0,3	1	0,008	0,44
AV 14 K 1206 201	14	16	24	24,5	40	1	200	0,6	1,5	0,008	1,00
AV 14 K 1210 401	14	16	24	24,5	40	2,5	400	1,6	3,	0,010	2,23
AV 14 K 1812 801	14	16	24	24,5	40	5	800	2,4	6	0,015	4,50
AV 14 K 2220 122	14	16	24	24,5	40	10	1200	5,8	12	0,030	10,00
AV 14 K 3225 202	14	16	24	24,5	40	20	2000	12,5	25	0,040	16,00
AV 17 K 0805 121	17	20	27	30	44	1	120	0,5	1	0,008	0,37
AV 17 K 1206 201	17	20	27	30	44	1	200	1,1	1,5	0,008	0,81
AV 17 K 1210 401	17	20	27	30	44	2,5	400	1,8	3	0,010	2,00
AV 17 K 1812 801	17	20	27	30	44	5	800	2,9	6	0,015	3,80
AV 17 K 2220 122	17	20	27	30	44	10	1200	7,2	12	0,030	8,00
AV 17 K 3225 202	17	20	27	30	44	20	2000	13,8	25	0,040	13,20
24 V Power Supply											
AV 20 K 1206 201	20	26	33	30	54	1	200	1,6	1,5	0,008	0,78
AV 20 K 1210 401	20	26	33	30	54	2,5	400	1,9	3	0,010	1,65
AV 20 K 1812 801	20	26	33	30	54	5	800	3,0	6	0,015	3,30
AV 20 K 2220 122	20	26	33	30	54	10	1200	8,0	12	0,030	7,00
AV 20 K 3225 202	20	26	33	30	54	20	2000	15,0	25	0,040	11,00
AV 30 K 1206 201	30	34	47	50	77	1	200	2,0	1,5	0,008	0,53
AV 30 K 1210 401	30	34	47	50	77	2,5	400	2,3	3	0,010	1,10
AV 30 K 1812 801	30	34	47	50	77	5	800	3,8	6	0,015	2,20
AV 30 K 2220 122	30	34	47	50	77	10	1200	10,0	12	0,030	6,50
AV 30 K 3225 202	30	34	47	50	77	20	2000	17,0	25	0,040	6,60
42 V Power Supply											
AV 40 K 1206 201	40	56	68	65	110	1	200	2,2	1,5	0,008	0,40
AV 40 K 1210 401	40	56	68	65	110	2,5	400	2,6	3	0,010	0,90
AV 40 K 1812 801	40	56	68	65	110	5	800	4,8	6	0,015	1,80
AV 40 K 2220 122	40	56	68	65	110	10	1200	10,5	12	0,030	5,50
AV 40 K 3225 202	40	56	68	65	110	20	2000	21	25	0,040	6,20

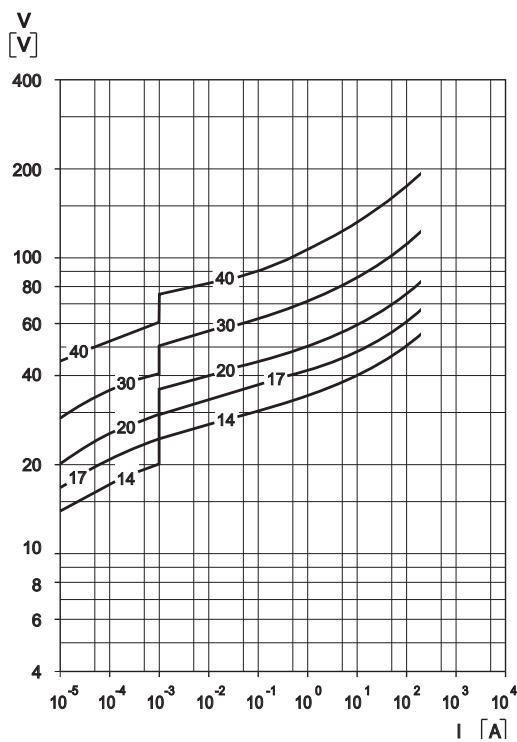
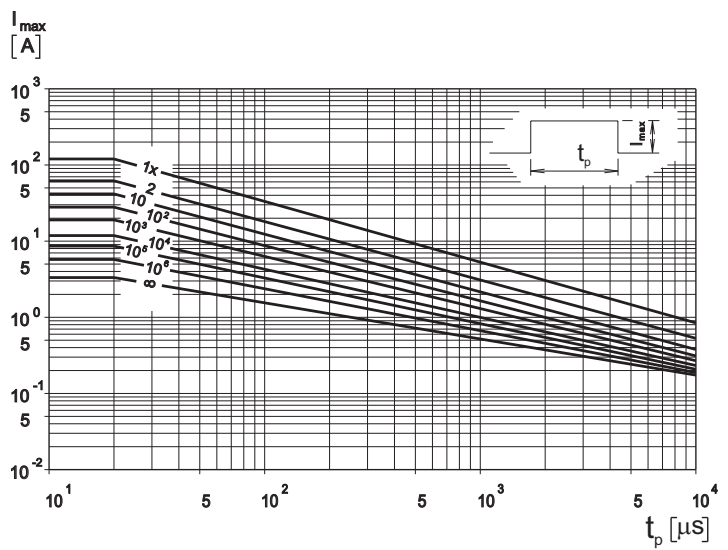
Protection Level

Pulse Rating Curves

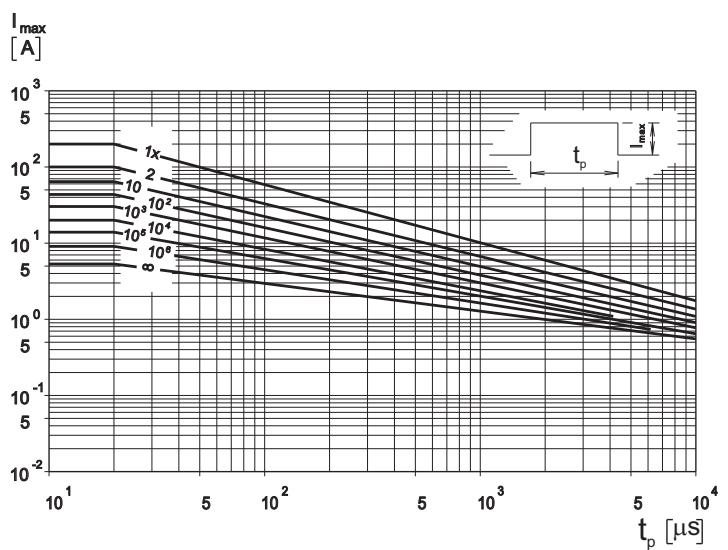
* In the most demanding conditions as per the tolerance region



Model Size 0805
AV 14...17 K 0805 121



Model Size 1206
AV 14...40 K 1206 201



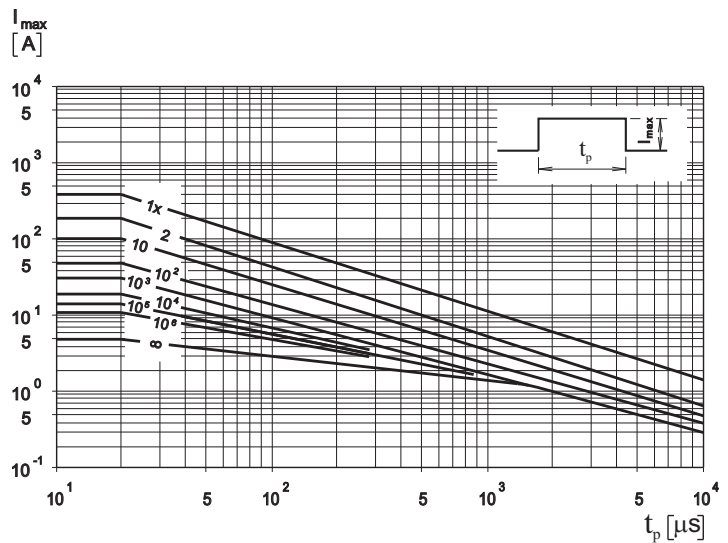
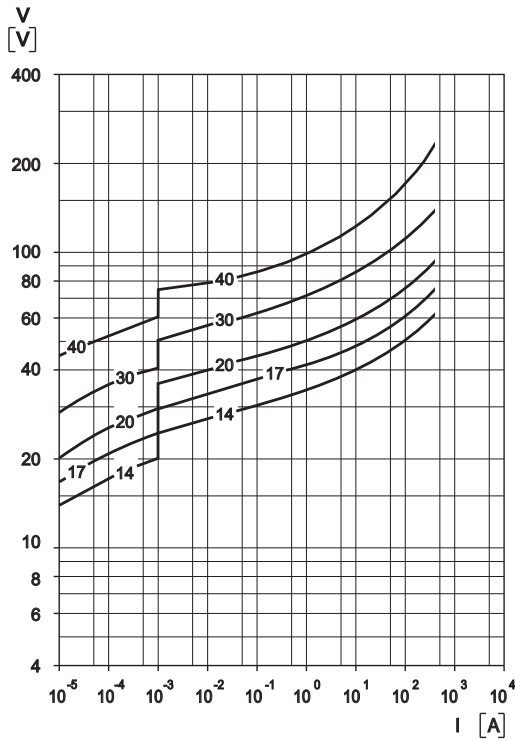
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Protection Level

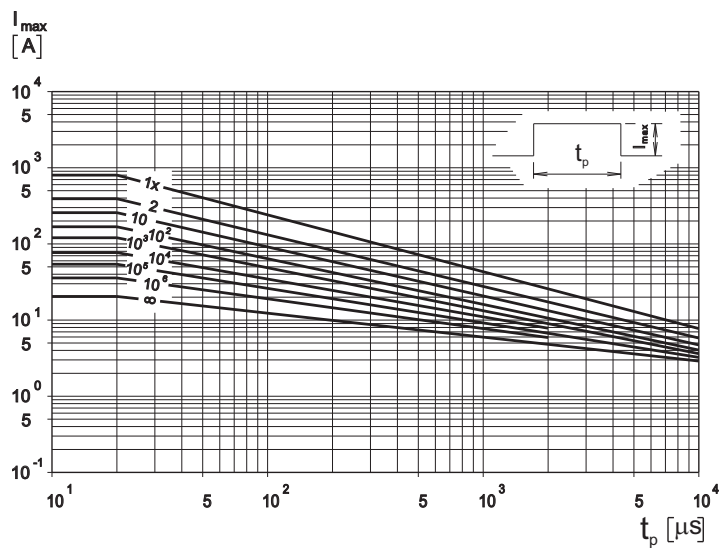
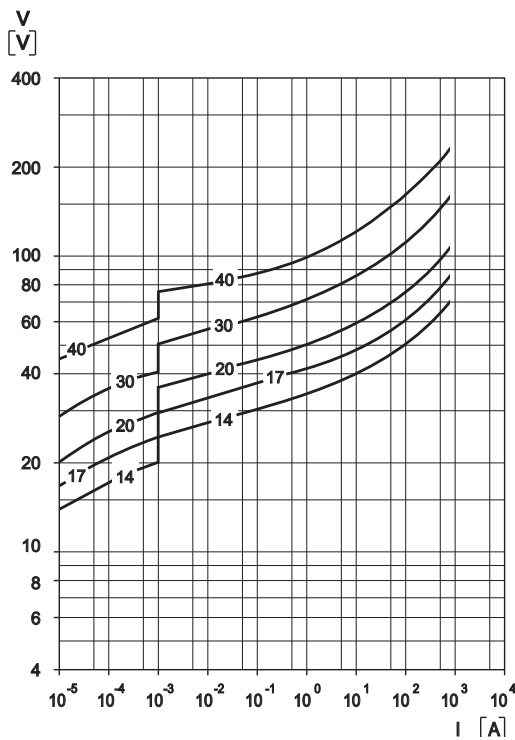
Pulse Rating Curves

* In the most demanding conditions as per the tolerance region

Model Size 1210
AV 14...40 K 1210 401



Model Size 1812
AV 14...40 K 1812 801

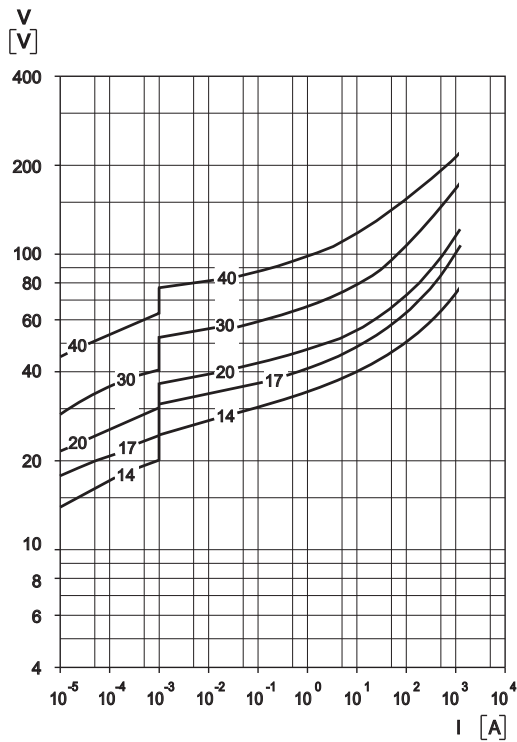


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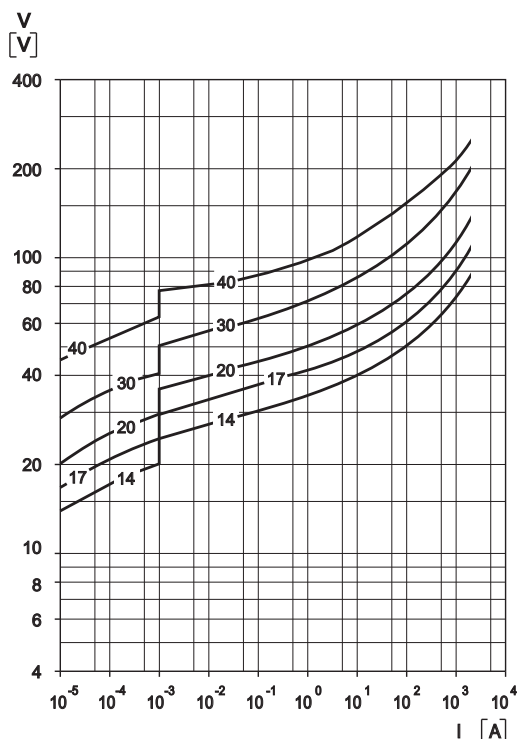
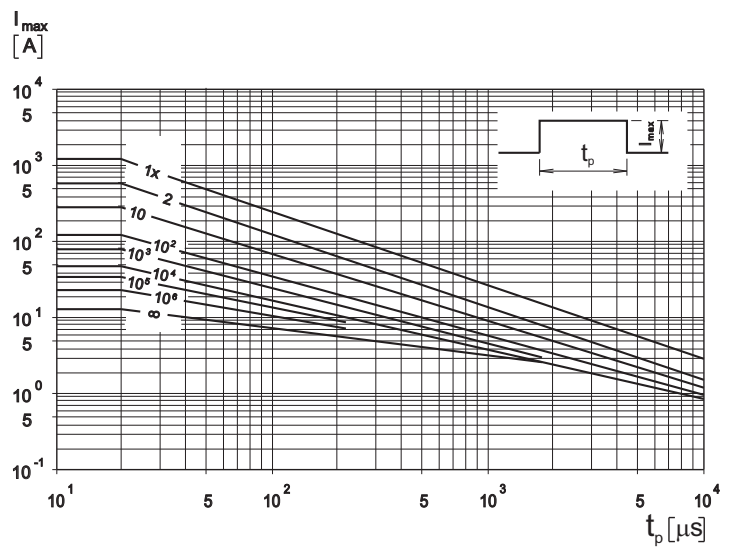
Protection Level

Pulse Rating Curves

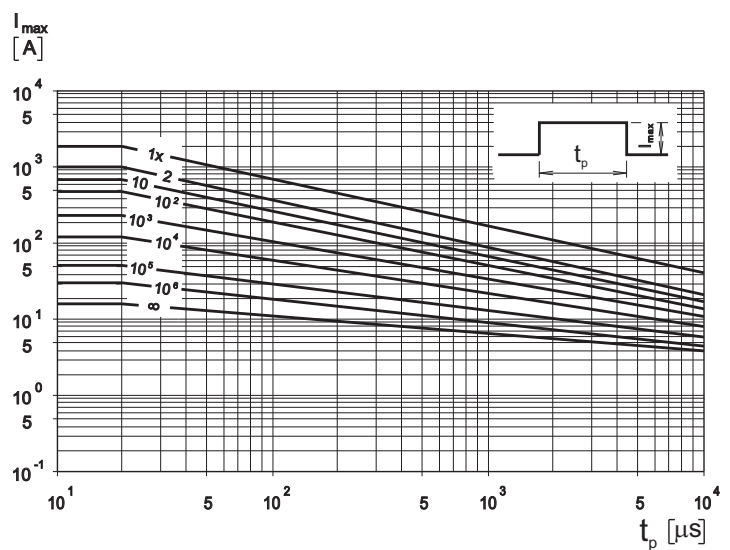
* In the most demanding conditions as per the tolerance region



Model Size 2220
AV 14...40 K 2220 122



Model Size 3225
AV 14...40 K 3225 202



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Reliability – Lifetime

In general, reliability is the ability of a component to perform and maintain its functions in routine circumstances, as well as hostile or unexpected circumstances.

The mean life of AV series components is a function of:

- Factor of Applied Voltage
- Ambient temperature.

Mean life is closely related to Failure rate (formula).

Mean life (ML) is the arithmetic mean (average) time to failure of a component.

Failure rate is the frequency with which an engineered system or component fails, expressed for example in failures per hour. Failure rate is usually time dependent, an intuitive corollary is that the rate changes over time versus the expected life cycle of a system.

Failure rate formula – calculation

$$\Lambda = \frac{10^9}{ML [h]} [\text{fit}]$$

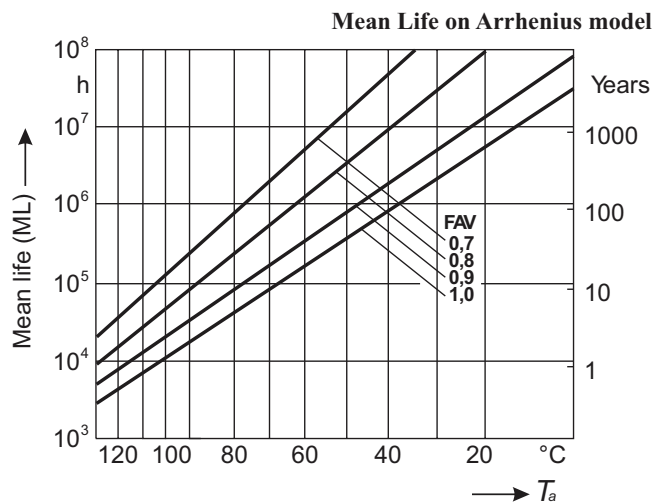
FAV – Factor of Applied Voltage

$$FAV = \frac{V_{\text{apl}}}{V_{\text{max}}}$$

V_{apl} ... applied voltage

V_{max} ... maximum operating voltage

AV 14 ... 40 Dimension 0805 ... 3225

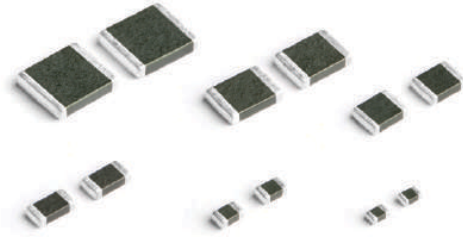


LOW VOLTAGE SMD VARISTORS - ZV & ZV HT SERIES

Description


The ZV series of low voltage varistors is designed to protect sensitive electronic devices against high voltage surges in the low voltage region. They offer excellent transient energy absorption due to improved energy volume distribution and power dissipation. Low voltage varistors cover a wide DC operating voltage range from 3 V to 170 V.

ZV varistors are typically applied to protect integrated circuits and other components at the circuit board level.



Features

- Operating voltage range V_{dc}3 V to 170 V higher operating voltages available upon request.
- +125 °C maximum continuous operating temperature for ZV Series +150 °C continuous operating temperature for AV HT Series
- Varistors with lower or higher capacitance, as well as varistors with a 100 % controlled capacitance value, are available upon request.
- 6 models sizes are available... 0603, 0805, 1206, 1210, 1812, 2220.
- Short response time.
- Broad range of current and energy handling capabilities
- Low clamping voltage – U_c .
- Non-sensitive to mildly activated fluxes (see Soldering Recommendations, page 25).
- End termination: Ni/Sn or AgPd suitable for Pb-free soldering process – barrier type and terminations solderable with Pb-free solders according to IEC 60068-2-58.

-  UL 1499, 3rd edition & CSA C22.2 File E326499 Section 8.
- RoHS 2 compliant components according to 2011/65/EC and 2003/11/EC.
- AEC-Q200 qualified Grade 1.

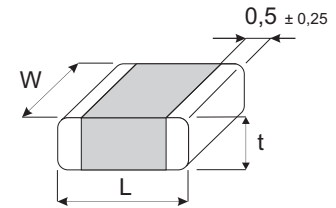
Applications

- Suppression of inductive switching or other transient events such as surge voltage at the circuit board level.
- ESD protection for components sensitive to IEC 1000-4-2, MIL-STD 883C Method 3015.7 and other industry spec.
- Replace larger surface mount TVS Zeners in many applications.
- Used to achieve electromagnetic compliance of end products.
- Provides on-board transient voltage protection of ICs and transistors.

Absolute Maximum Ratings

	Units	Value
Continuous:		
Steady State Applied Voltage:		
DC Voltage Range (V_{dc})	V	3 to 170
AC Voltage Range (V_{rms})	V	2 to 130
Transient:		
Peak Single Pulse Surge Current, 8/20 μ s Waveform (I_{max})	A	30 to 1200
Single Pulse Surge Energy, 10/1000 μ s Waveform (W_{max})	J	0,1 to 12,2
Operating Ambient Temperature	°C	-55 to +125 for ZV -55 to +150 for ZVHT
Storage Temperature Range	°C	-55 to +150
Threshold Voltage Temperature Coefficient	%/°C	< + 0,05
Response Time	ns	< 2
Climatic Category		55 / 125 / 56

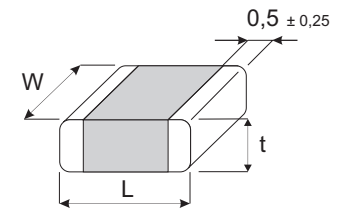
Device Ratings and Characteristics



ZV 2 M 0603 300...ZV 20 K 2220 122

Type	V _{rms} V	V _{dc} V	V _n 1mA V	V _c V	I _c 8/20 μs A	W _{max} 10/1000 μs J	P max W	I _{max} 8/20 μs A	C _{typ} @ 1 kHz pF	L _{typ} 100 mA/ns nH	L mm	W mm	t max mm
ZV 2 M 0603 300	2	3	4	10	1	0,1	0,003	30	360	1,0	1,6 ± 0,20	0,80 ± 0,10	0,95
ZV 2 M 0805 101	2	3	4	10	1	0,1	0,005	100	930	1,5	2,0 ± 0,25	1,25 ± 0,20	0,80
ZV 2 M 1206 151	2	3	4	10	1	0,2	0,008	150	4000	1,8	3,2 ± 0,30	1,60 ± 0,20	0,85
ZV 4 M 0603 300	4	5,5	8	14	1	0,1	0,003	30	295	1,0	1,6 ± 0,20	0,80 ± 0,10	0,95
ZV 4 M 0805 101	4	5,5	8	14	1	0,1	0,005	100	695	1,5	2,0 ± 0,25	1,25 ± 0,20	0,80
ZV 4 M 1206 151	4	5,5	8	14	1	0,3	0,008	150	3300	1,8	3,2 ± 0,30	1,60 ± 0,20	0,85
ZV 4 M 1210 251	4	5,5	8	14	3	0,4	0,010	250	5000	1,8	3,2 ± 0,30	2,50 ± 0,25	0,85
ZV 4 M 1812 501	4	5,5	8	14	5	0,8	0,015	500	10000	2,5	4,7 ± 0,40	3,20 ± 0,30	1,25
ZV 4 M 2220 102	4	5,5	8	14	10	1,5	0,020	1000	19500	3,0	5,7 ± 0,50	5,00 ± 0,40	1,25
ZV 6 M 0603 300	6	8	11	21	1	0,1	0,003	30	260	1,0	1,6 ± 0,20	0,80 ± 0,10	0,95
ZV 6 M 0805 101	6	8	11	21	1	0,2	0,005	100	560	1,5	2,0 ± 0,25	1,25 ± 0,20	0,80
ZV 6 M 1206 151	6	8	11	21	1	0,5	0,008	150	2600	1,8	3,2 ± 0,30	1,60 ± 0,20	0,85
ZV 6 M 1210 301	6	8	11	21	3	0,8	0,010	300	4100	1,8	3,2 ± 0,30	2,50 ± 0,25	0,85
ZV 6 M 1812 501	6	8	11	21	5	1,0	0,015	500	7500	2,5	4,7 ± 0,40	3,20 ± 0,30	1,25
ZV 6 M 2220 122	6	8	11	21	10	3,8	0,020	1200	17000	3,0	5,7 ± 0,50	5,00 ± 0,40	1,25
ZV 8 L 0603 300	8	11	15	25	1	0,1	0,003	30	240	1,0	1,6 ± 0,20	0,80 ± 0,10	0,95
ZV 8 L 0805 121	8	11	15	25	1	0,2	0,005	120	475	1,5	2,0 ± 0,25	1,25 ± 0,20	0,80
ZV 8 L 1206 201	8	11	15	25	1	0,6	0,008	200	2000	1,8	3,2 ± 0,30	1,60 ± 0,20	0,85
ZV 8 L 1210 401	8	11	15	25	3	1,1	0,010	400	3400	1,8	3,2 ± 0,30	2,50 ± 0,25	0,85
ZV 8 L 1812 501	8	11	15	25	5	1,9	0,015	500	6300	2,5	4,7 ± 0,40	3,20 ± 0,30	1,25
ZV 8 L 2220 122	8	11	15	25	10	4,3	0,020	1200	15000	3,0	5,7 ± 0,50	5,00 ± 0,40	1,25
ZV 11 K 0603 300	11	14	18	33	1	0,2	0,003	30	210	1,0	1,6 ± 0,20	0,80 ± 0,10	0,95
ZV 11 K 0805 121	11	14	18	33	1	0,3	0,005	120	400	1,5	2,0 ± 0,25	1,25 ± 0,20	0,80
ZV 11 K 1206 201	11	14	18	33	1	0,6	0,008	200	1300	1,8	3,2 ± 0,30	1,60 ± 0,20	0,85
ZV 11 K 1210 401	11	14	18	33	3	1,3	0,010	400	2600	1,8	3,2 ± 0,30	2,50 ± 0,25	0,85
ZV 11 K 1812 801	11	14	18	33	5	2,0	0,015	800	5100	2,5	4,7 ± 0,40	3,20 ± 0,30	1,25
ZV 11 K 2220 122	11	14	18	33	10	5,5	0,020	1200	12000	3,0	5,7 ± 0,50	5,00 ± 0,40	1,25
ZV 14 K 0603 300	14	18	22	38	1	0,3	0,003	30	195	1,0	1,6 ± 0,20	0,80 ± 0,10	0,95
ZV 14 K 0805 121	14	18	22	38	1	0,4	0,005	120	355	1,5	2,0 ± 0,25	1,25 ± 0,20	0,80
ZV 14 K 1206 201	14	18	22	38	1	0,6	0,008	200	950	1,8	3,2 ± 0,30	1,60 ± 0,20	0,85
ZV 14 K 1210 401	14	18	22	38	3	1,6	0,010	400	2000	1,8	3,2 ± 0,30	2,50 ± 0,25	0,85
ZV 14 K 1812 801	14	18	22	38	5	2,4	0,015	800	4200	2,5	4,7 ± 0,40	3,20 ± 0,30	1,25
ZV 14 K 2220 122	14	18	22	38	10	6,0	0,020	1200	9400	3,0	5,7 ± 0,50	5,00 ± 0,40	1,25
ZV 17 K 0603 300	17	22	27	44	1	0,3	0,003	30	185	1,0	1,6 ± 0,20	0,80 ± 0,10	0,95
ZV 17 K 0805 121	17	22	27	44	1	0,4	0,005	120	315	1,5	2,0 ± 0,25	1,25 ± 0,20	0,80
ZV 17 K 1206 201	17	22	27	44	1	0,7	0,008	200	740	1,8	3,2 ± 0,30	1,60 ± 0,20	0,85
ZV 17 K 1210 401	17	22	27	44	3	1,8	0,010	400	1700	1,8	3,2 ± 0,30	2,50 ± 0,25	0,85
ZV 17 K 1812 801	17	22	27	44	5	2,8	0,015	800	3500	2,5	4,7 ± 0,40	3,20 ± 0,30	1,25
ZV 17 K 2220 122	17	22	27	44	10	7,5	0,020	1200	7700	3,0	5,7 ± 0,50	5,00 ± 0,40	1,25
ZV 20 K 0603 300	20	26	33	54	1	0,3	0,003	30	175	1,0	1,6 ± 0,20	0,80 ± 0,10	0,95
ZV 20 K 0805 121	20	26	33	54	1	0,4	0,005	120	290	1,5	2,0 ± 0,25	1,25 ± 0,20	1,05
ZV 20 K 1206 201	20	26	33	54	1	0,8	0,008	200	620	1,8	3,2 ± 0,30	1,60 ± 0,20	1,25
ZV 20 K 1210 401	20	26	33	54	3	2,0	0,010	400	1400	1,8	3,2 ± 0,30	2,50 ± 0,25	1,35
ZV 20 K 1812 801	20	26	33	54	5	3,0	0,015	800	3000	2,5	4,7 ± 0,40	3,20 ± 0,30	1,55
ZV 20 K 2220 122	20	26	33	54	10	8,0	0,020	1200	6500	3,0	5,7 ± 0,50	5,00 ± 0,40	1,45

Device Ratings and Characteristics

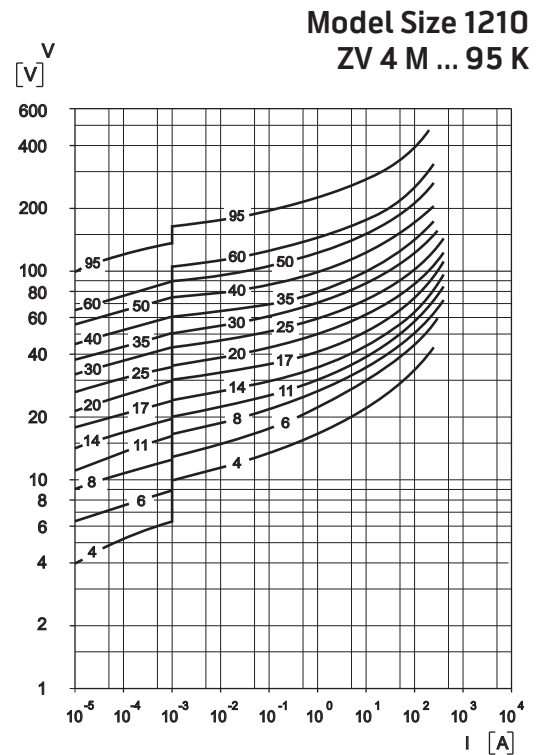
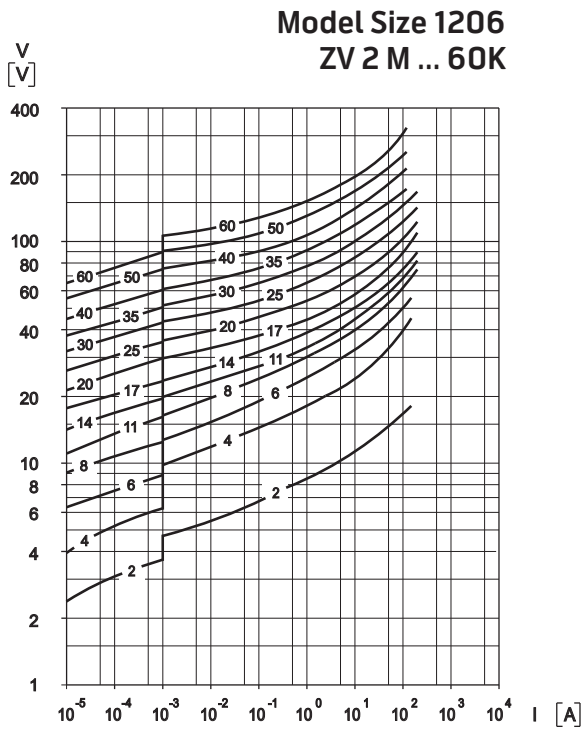
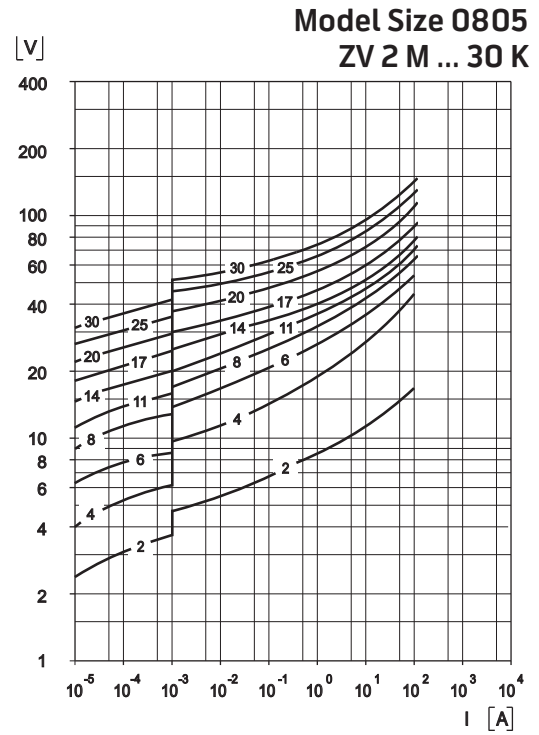
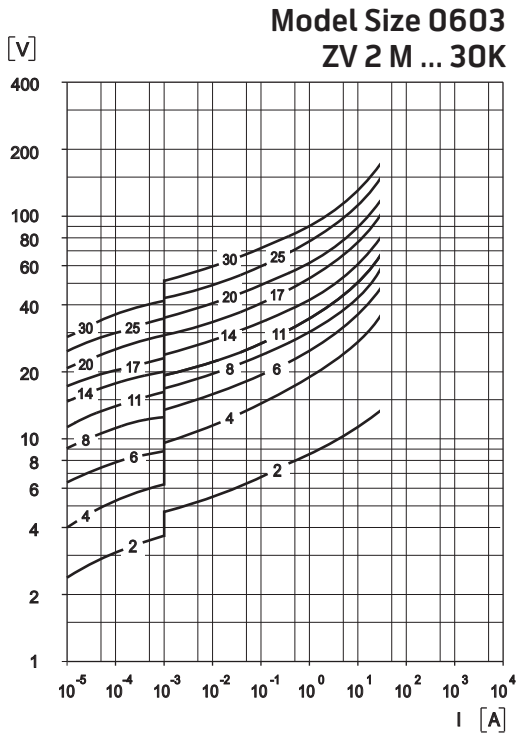


ZV 25 K 0603 300....ZV 130 K 2220 501

Type	V _{rms} V	V _{dc} V	V _n 1 mA V	V _c V	I _c 8/20 μs A	W _{max} 10/1000 μs J	P max W	I _{max} 8/20 μs A	C _{typ} @ 1 kHz pF	L _{typ} 100 mA/ns nH	L mm	W mm	t max mm
ZV 25 K 0603 300	25	31	39	65	1	0,1	0,003	30	165	1,0	1,6 ± 0,20	0,80 ± 0,10	0,95
ZV 25 K 0805 121	25	31	39	65	1	0,2	0,005	120	260	1,5	2,0 ± 0,25	1,25 ± 0,20	1,05
ZV 25 K 1206 201	25	31	39	65	1	1,0	0,008	200	510	1,8	3,2 ± 0,30	1,60 ± 0,20	1,25
ZV 25 K 1210 401	25	31	39	65	3	1,8	0,010	400	1060	1,8	3,2 ± 0,30	2,50 ± 0,25	1,45
ZV 25 K 1812 801	25	31	39	65	5	3,9	0,015	800	2300	2,5	4,7 ± 0,40	3,20 ± 0,30	1,55
ZV 25 K 2220 122	25	31	39	65	10	9,5	0,020	1200	5000	3,0	5,7 ± 0,50	5,00 ± 0,40	1,45
ZV 30 K 0603 300	30	38	47	77	1	0,1	0,003	30	160	1,0	1,6 ± 0,20	0,80 ± 0,10	0,95
ZV 30 K 0805 121	30	38	47	77	1	0,2	0,005	120	230	1,5	2,0 ± 0,25	1,25 ± 0,20	1,05
ZV 30 K 1206 201	30	38	47	77	1	1,2	0,008	200	450	1,8	3,2 ± 0,30	1,60 ± 0,20	1,25
ZV 30 K 1210 301	30	38	47	77	3	2,1	0,010	300	850	1,8	3,2 ± 0,30	2,50 ± 0,25	1,45
ZV 30 K 1812 801	30	38	47	77	5	4,4	0,015	800	1800	2,5	4,7 ± 0,40	3,20 ± 0,30	1,55
ZV 30 K 2220 122	30	38	47	77	10	12,2	0,020	1200	4000	3,0	5,7 ± 0,50	5,00 ± 0,40	1,45
ZV 35 K 1206 121	35	45	56	90	1	0,6	0,008	120	400	1,8	3,2 ± 0,30	1,60 ± 0,20	1,25
ZV 35 K 1210 251	35	45	56	90	3	2,2	0,010	250	670	1,8	3,2 ± 0,30	2,50 ± 0,25	1,45
ZV 35 K 1812 601	35	45	56	90	5	4,2	0,015	600	1340	2,5	4,7 ± 0,40	3,20 ± 0,30	1,55
ZV 35 K 2220 102	35	45	56	90	10	7,6	0,020	1000	3000	3,0	5,7 ± 0,50	5,00 ± 0,40	1,45
ZV 40 K 1206 121	40	56	68	110	1	0,8	0,008	120	370	1,8	3,2 ± 0,30	1,60 ± 0,20	1,25
ZV 40 K 1210 251	40	56	68	110	3	2,4	0,010	250	570	1,8	3,2 ± 0,30	2,50 ± 0,25	1,45
ZV 40 K 1812 601	40	56	68	110	5	4,8	0,015	600	1000	2,5	4,7 ± 0,40	3,20 ± 0,30	1,55
ZV 40 K 2220 102	40	56	68	110	10	9,2	0,020	1000	2200	3,0	5,7 ± 0,50	5,00 ± 0,40	1,45
ZV 50 K 1206 121	50	65	82	135	1	0,8	0,008	120	340	1,8	3,2 ± 0,30	1,60 ± 0,20	1,65
ZV 50 K 1210 251	50	65	82	135	3	1,7	0,010	250	470	1,8	3,2 ± 0,30	2,50 ± 0,25	1,75
ZV 50 K 1812 401	50	65	82	135	5	4,8	0,015	400	710	2,5	4,7 ± 0,40	3,20 ± 0,30	1,85
ZV 50 K 2220 801	50	65	82	135	10	5,8	0,020	800	1500	3,0	5,7 ± 0,50	5,00 ± 0,40	1,85
ZV 60 K 1206 121	60	85	100	165	1	0,9	0,008	120	330	1,8	3,2 ± 0,30	1,60 ± 0,20	1,65
ZV 60 K 1210 251	60	85	100	165	3	2,2	0,010	250	390	1,8	3,2 ± 0,30	2,50 ± 0,25	1,75
ZV 60 K 1812 401	60	85	100	165	5	5,8	0,015	400	580	2,5	4,7 ± 0,40	3,20 ± 0,30	1,85
ZV 60 K 2220 801	60	85	100	165	10	6,2	0,020	800	1000	3,0	5,7 ± 0,50	5,00 ± 0,40	1,85
ZV 75 K 1206 121	75	100	120	200	1	0,9	0,008	120	240	1,8	3,2 ± 0,30	1,60 ± 0,20	1,70
ZV 75 K 1210 251	75	100	120	200	3	2,2	0,010	250	330	1,8	3,2 ± 0,30	2,50 ± 0,25	1,80
ZV 75 K 1812 401	75	100	120	200	5	5,8	0,015	400	440	2,5	4,7 ± 0,40	3,20 ± 0,30	1,90
ZV 75 K 2220 801	75	100	120	200	10	6,2	0,020	800	700	3,0	5,7 ± 0,50	5,00 ± 0,40	1,90
ZV 95 K 1210 201	95	125	150	250	3	2,6	0,010	200	240	1,8	3,2 ± 0,30	2,50 ± 0,25	1,80
ZV 95 K 1812 301	95	125	150	250	5	5,2	0,015	300	340	2,5	4,7 ± 0,40	3,20 ± 0,30	1,90
ZV 95 K 2220 501	95	125	150	250	10	7,4	0,020	500	600	3,0	5,7 ± 0,50	5,00 ± 0,40	1,90
ZV 115 K 1210 201	115	150	180	300	3	2,6	0,010	200	200	1,8	3,2 ± 0,30	2,50 ± 0,25	1,80
ZV 115 K 1812 301	115	150	180	300	5	5,2	0,015	300	310	2,5	4,7 ± 0,40	3,20 ± 0,30	1,90
ZV 115 K 2220 501	115	150	180	300	10	7,4	0,020	500	560	3,0	5,7 ± 0,50	5,00 ± 0,40	1,90
ZV 130 K 1210 201	130	170	205	340	3	2,6	0,010	200	150	1,8	3,2 ± 0,30	2,50 ± 0,25	1,80
ZV 130 K 1812 301	130	170	205	340	5	5,2	0,015	300	240	2,5	4,7 ± 0,40	3,20 ± 0,30	1,90
ZV 130 K 2220 501	130	170	205	340	10	7,4	0,020	500	500	3,0	5,7 ± 0,50	5,00 ± 0,40	1,90

Protection Level

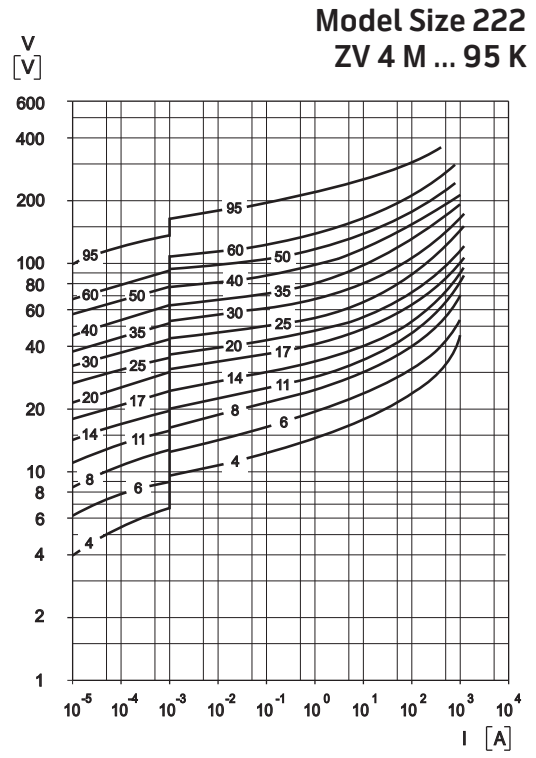
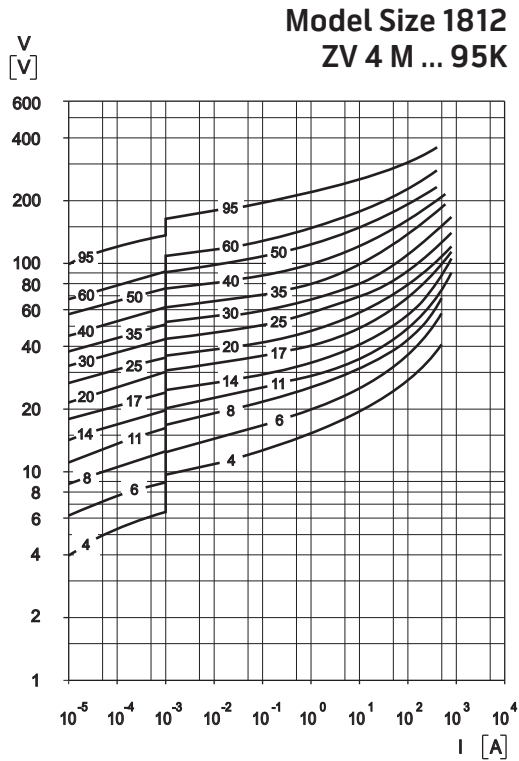
* With the worst-case condition in the tolerance region



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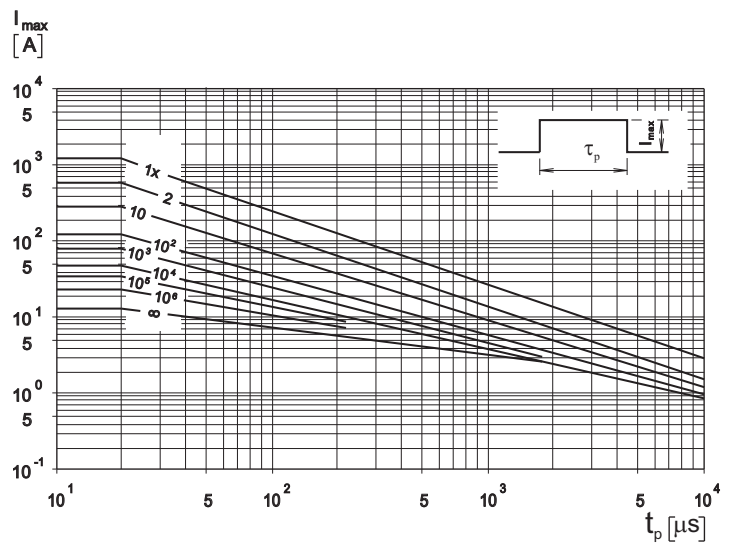
Protection Level

* With the worst-case condition in the tolerance region



Pulse Rating Curves

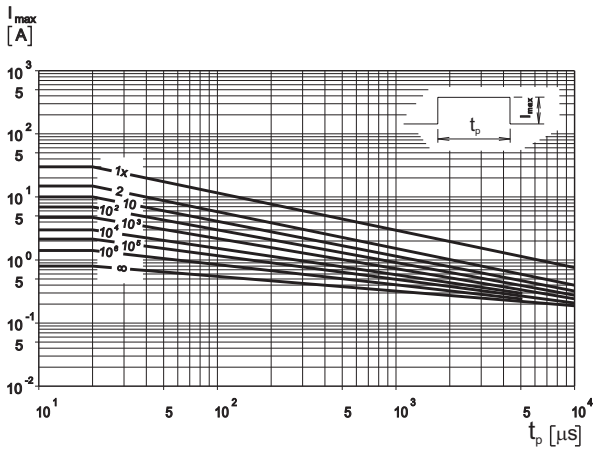
ZV 6 M ... 30 K 2220 122



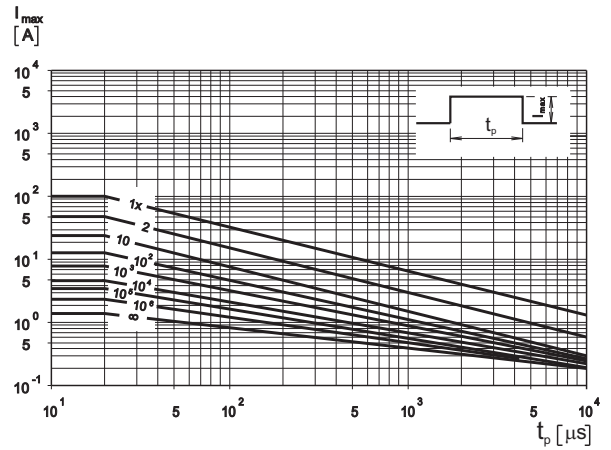
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Pulse Rating Curves

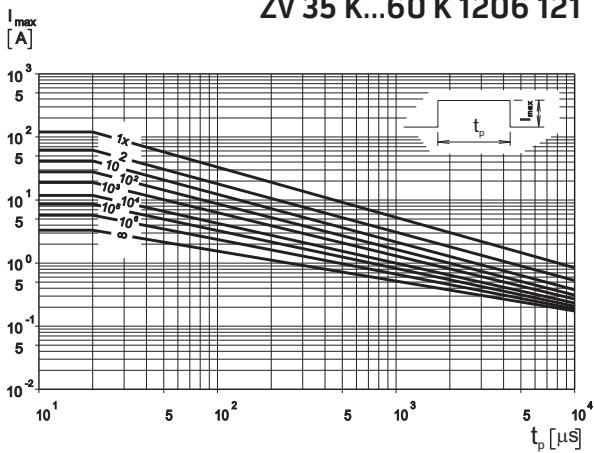
ZV 2 M...30 K 0603 300



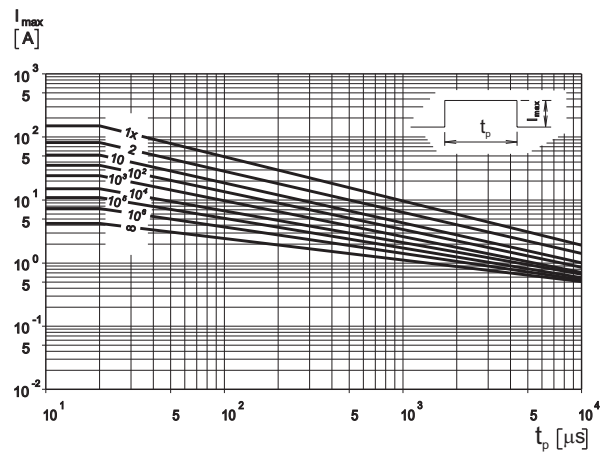
ZV 2 M...6 M 0805 101



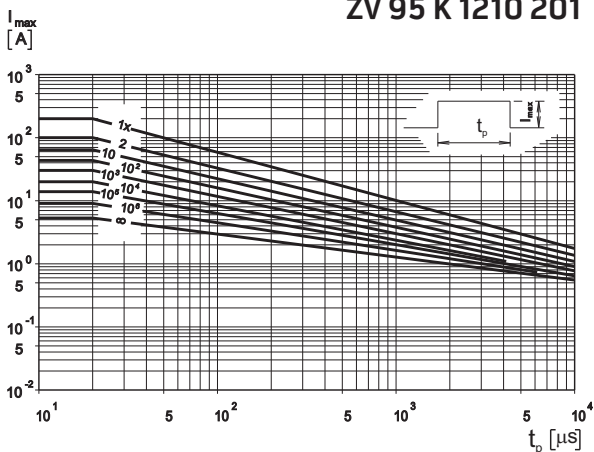
ZV 8 L...30 K 0805 121
ZV 35 K...60 K 1206 121



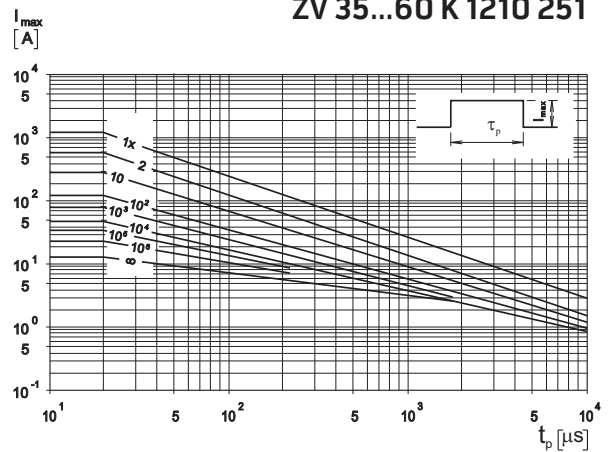
ZV 2 M...6 M 1206 151



ZV 8 L...30 1206 201
ZV 95 K 1210 201



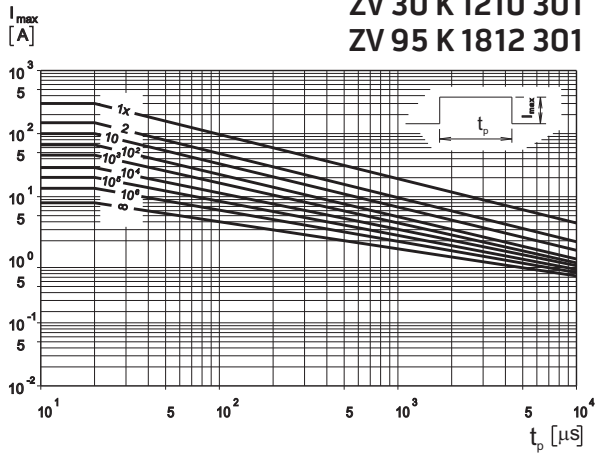
ZV 4 M 1210 251
ZV 35...60 K 1210 251



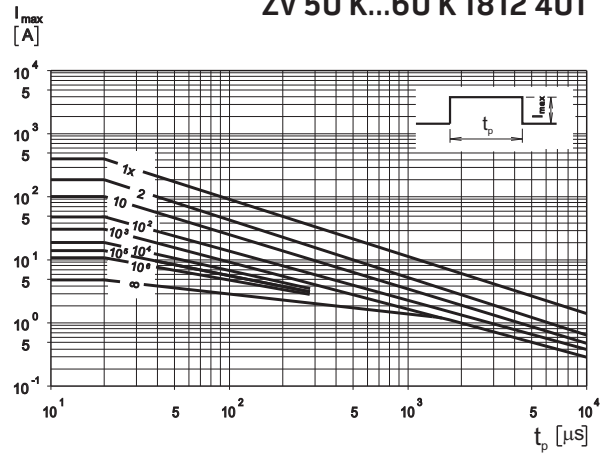
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Pulse Rating Curves

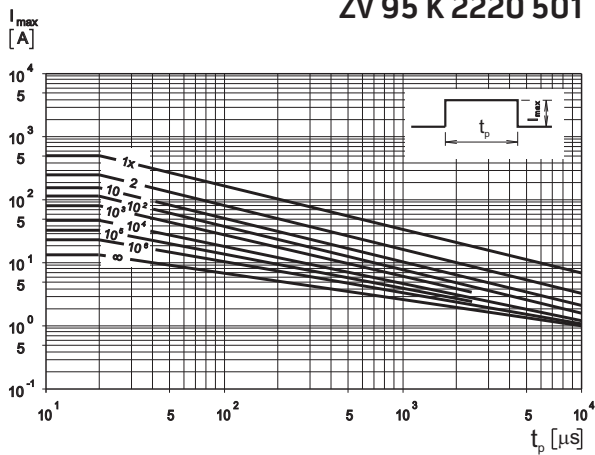
ZV 6 M 1210 301
ZV 30 K 1210 301
ZV 95 K 1812 301



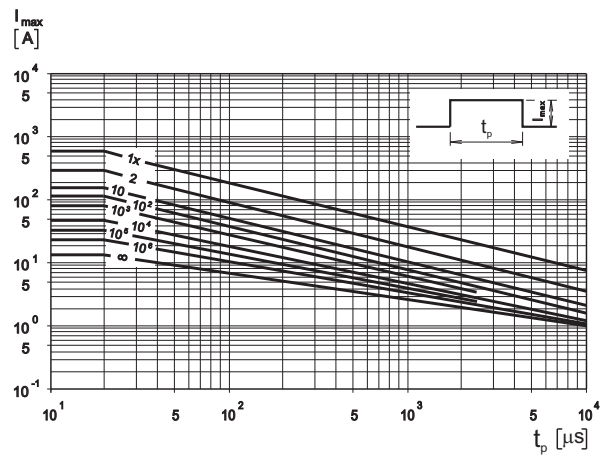
ZV 8 L...25 K 1210 401
ZV 50 K...60 K 1812 401



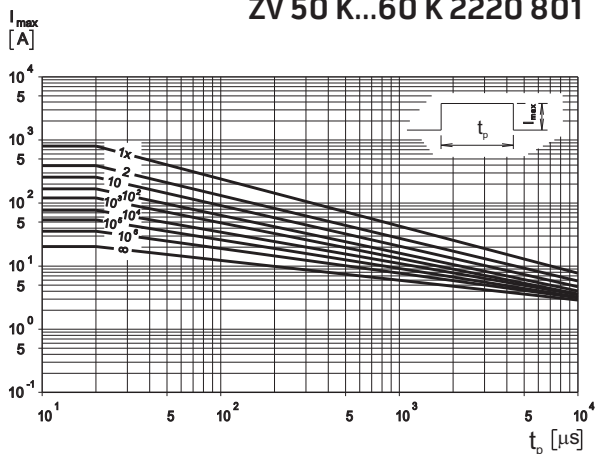
ZV 4 M...8 L 1812 501
ZV 95 K 2220 501



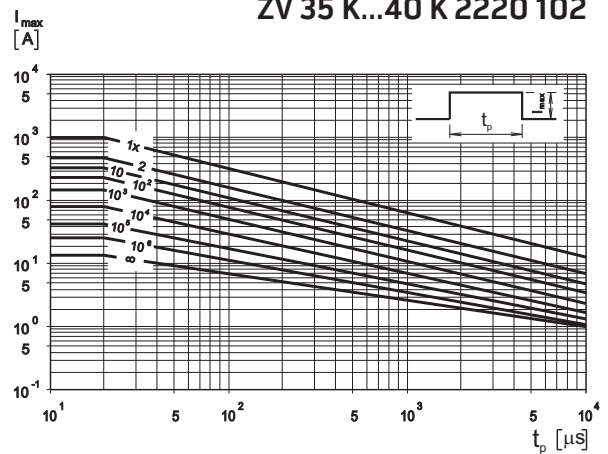
ZV 35 K...40 K 1812 601



ZV 11 K...30 K 1812 801
ZV 50 K...60 K 2220 801



ZV 4 M 2220 102
ZV 35 K...40 K 2220 102



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Reliability – Lifetime

In general, **reliability** is the ability of a component to perform and maintain its functions in routine circumstances, as well as in hostile or unexpected circumstances.

The Mean life of ZV series components is a function of:

- - Factor of Applied Voltage
- - Ambient temperature.

Mean life is closely related to Failure rate (formula).

Mean life (ML) is the arithmetic mean (average) time to failure of a component.

Failure rate is the frequency with which an engineered system or component fails, expressed for example in failures per hour. Failure rate is usually time dependent, and an intuitive corollary is that the rate changes over time versus the expected life cycle of a system.

Failure rate formula – calculation

$$\Lambda = \frac{10^9}{ML [h]} [\text{fit}]$$

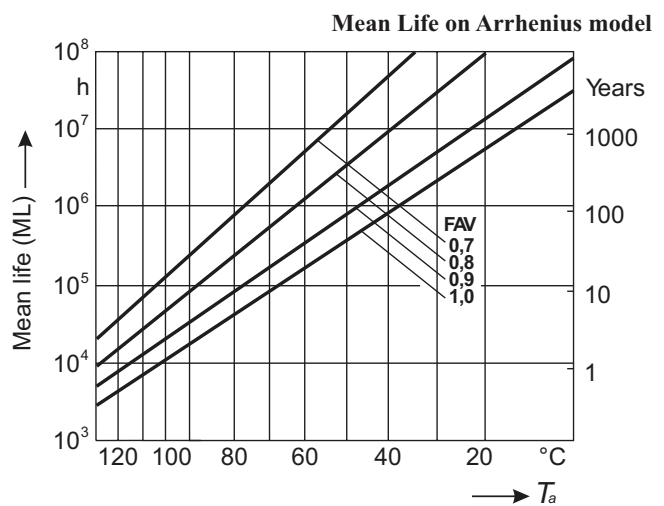
FAV – Factor of Applied Voltage

$$FAV = \frac{V_{\text{apl}}}{V_{\text{max}}}$$

V_{apl} ... applied voltage

V_{max} ... maximum operating voltage

ZV 2 ... 130 Dimension 0603 ... 2220



LOW CAPACITANCE & LOW ENERGY VARISTORS - ZVX SERIES

Description


The ZVX series are low-energy (0,1 J) varistor chips, designed specifically for the protection of I/O line drivers and other sensitive semiconductor gates from the damaging effects of high voltage, low energy transients such as ESD events. Unlike other competitive low-energy varistors, the ZVX series offers all the protecting features of standard varistor chips, and exceptionally low values of capacitance. In these applications, as the frequency of data transfer increases, lower capacitance is required to eliminate possible skewing of the data signals due to capacitive loading.

In most cases, the 1 KHz capacitance values of the ZVX series are less than one half of the competition. Furthermore, this series is offered in 0603, 0805 and 1206 sizes, with an extended range of voltages from 3V to 38 V_{dc}.



Features

- Operating voltage range V_{dc}.....3 V to 38 V.
- + 125 °C maximum continuous operating temperature
- 6 models sizes available... 0603, 0805, 1206.
- Exceptionally low capacitance ratings.
- Short response time.
- Inherent bi-directional clamping, low clamping voltages.
- Dimensional and weight savings on the board.
- Non-sensitive to mildly activated fluxes (see Soldering Recommendations, page 25).
- End termination: Ni / Sn or AgPd suitable for Pb-free soldering process solderable with Pb-free solders according to JEDEC J-STD-020E and IEC 60068-2-58.
- Non-plastic coating guarantees better flammability rating.

-  UL 1499, 3rd edition & CSA C22.2 File E326499 Section 8.
- RoHS 2 2011/65/EC, REACH, GADSL compliant.
- AEC-Q200 qualified Grade 1.

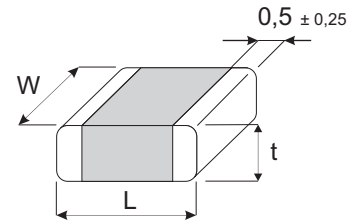
Applications

- Suppression of inductive switching or other transient events such as surge voltage at the circuit board level.
- Excellent for I/O line protection, operating at hi-speed data transfer rates, due to very low capacitance values.
- ESD protection for components sensitive to IEC 1000-4-2, MIL-STD 883C Method 3015.7, AEC-Q200-002 and other industry spec.
- Replace larger surface mount TVS Zeners in many applications.
- Used to achieve electromagnetic compliance of end products.
- Provides on-board transient voltage protection of ICs and transistors.

Absolute Maximum Ratings

	Units	Value
Continuous:		
Steady State Applied Voltage:		
DC Voltage Range (V _{dc})	V	3 to 38
AC Voltage Range (V _{rms})	V	2 to 30
Transient:		
Peak Single Pulse Surge Current, 8/20 μs Waveform (I _{max})	A	30 to 40
Single Pulse Surge Energy, 10/1000 μs Waveform (W _{max})	J	0,1
Operating Ambient Temperature	°C	-55 to +125
Storage Temperature Range	°C	-55 to +150
Threshold Voltage Temperature Coefficient	%/°C	< + 0,05
Response Time	ns	< 1
Climatic Category		55 / 125 / 56

Device Ratings and Characteristics



ZVX 2 S 0603 300....ZVX 30 S 1206 400

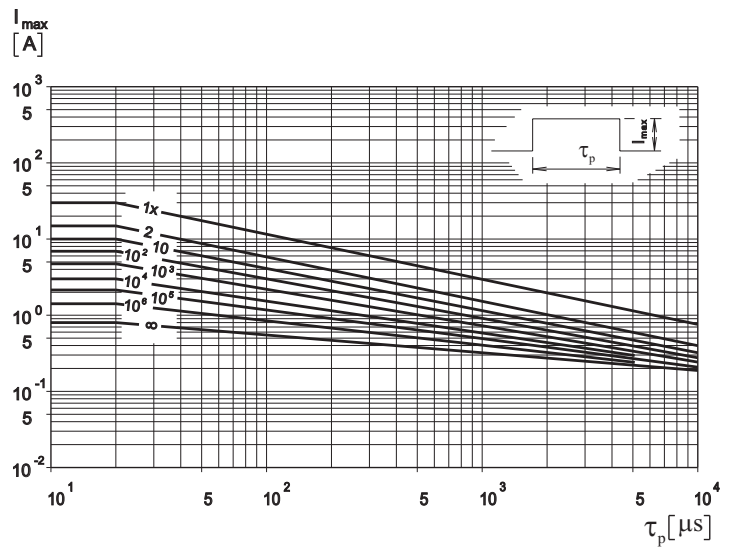
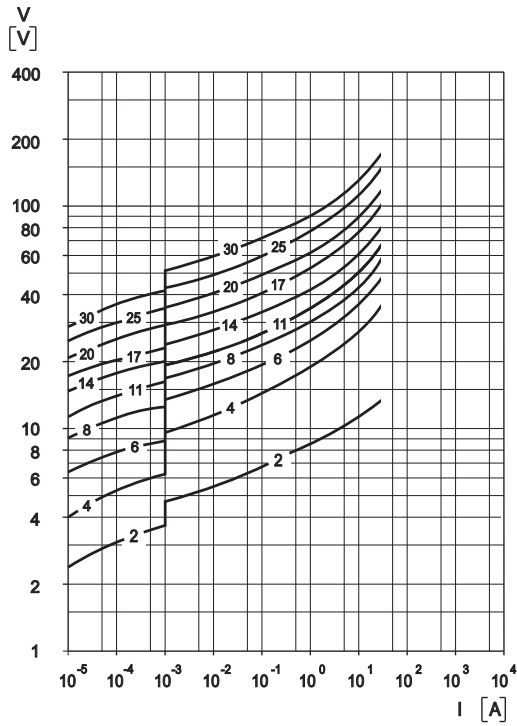
Type	V_{rms} V	V_{dc} V	V_n 1 mA V	V_c V	I_c 8/20 μ s A	W_{max} 10/1000 μ s J	P max W	I_{max} 8/20 μ s A	C_{typ} @ 1 kHz pF	L_{typ} 100 mA/ns nH	L mm	W mm	t max mm
ZVX 2 S 0603 300	2	3,3	4,1 - 6,0	10	1	0,1	0,003	30	200	1,0	1,6 ± 0,20	0,80 ± 0,10	0,9
ZVX 2 S 0805 400	2	3,3	4,1 - 6,0	10	1	0,1	0,005	40	500	1,5	2,0 ± 0,25	1,25 ± 0,20	1,0
ZVX 2 S 1206 400	2	3,3	4,1 - 6,0	10	1	0,1	0,008	40	840	1,8	3,2 ± 0,30	1,60 ± 0,20	1,0
ZVX 4 S 0603 300	4	5,6	7,6 - 9,3	15,5	1	0,1	0,003	30	165	1,0	1,6 ± 0,20	0,80 ± 0,10	0,9
ZVX 4 S 0805 400	4	5,6	7,6 - 9,3	15,5	1	0,1	0,005	40	340	1,5	2,0 ± 0,25	1,25 ± 0,20	1,0
ZVX 4 S 1206 400	4	5,6	7,6 - 9,3	15,5	1	0,1	0,008	40	720	1,8	3,2 ± 0,30	1,60 ± 0,20	1,0
ZVX 6 S 0603 300	6	9	11,0 - 14,0	20	1	0,1	0,003	30	145	1,0	1,6 ± 0,20	0,80 ± 0,10	0,9
ZVX 6 S 0805 400	6	9	11,0 - 14,0	20	1	0,1	0,005	40	290	1,5	2,0 ± 0,25	1,25 ± 0,20	1,0
ZVX 6 S 1206 400	6	9	11,0 - 14,0	20	1	0,1	0,008	40	620	1,8	3,2 ± 0,30	1,60 ± 0,20	1,0
ZVX 8 S 0603 300	8	12	14,0 - 18,3	25	1	0,1	0,003	30	135	1,0	1,6 ± 0,20	0,80 ± 0,10	0,9
ZVX 8 S 0805 400	8	12	14,0 - 18,3	25	1	0,1	0,005	40	275	1,5	2,0 ± 0,25	1,25 ± 0,20	1,0
ZVX 8 S 1206 400	8	12	14,0 - 18,3	25	1	0,1	0,008	40	540	1,8	3,2 ± 0,30	1,60 ± 0,20	1,0
ZVX 11 S 0603 300	11	14	16,5 - 20,3	30	1	0,1	0,003	30	120	1,0	1,6 ± 0,20	0,80 ± 0,10	0,9
ZVX 11 S 0805 400	11	14	16,5 - 20,3	30	1	0,1	0,005	40	200	1,5	2,0 ± 0,25	1,25 ± 0,20	1,0
ZVX 11 S 1206 400	11	14	16,5 - 20,3	30	1	0,1	0,008	40	500	1,8	3,2 ± 0,30	1,60 ± 0,20	1,0
ZVX 14 S 0603 300	14	18	22,9 - 28,0	40	1	0,1	0,003	30	110	1,0	1,6 ± 0,20	0,80 ± 0,10	0,9
ZVX 14 S 0805 400	14	18	22,9 - 28,0	40	1	0,1	0,005	40	165	1,5	2,0 ± 0,25	1,25 ± 0,20	1,0
ZVX 14 S 1206 400	14	18	22,9 - 28,0	40	1	0,1	0,008	40	250	1,8	3,2 ± 0,30	1,60 ± 0,20	1,0
ZVX 17 S 0603 300	17	22	25,2 - 31,3	48	1	0,1	0,003	30	100	1,0	1,6 ± 0,20	0,80 ± 0,10	0,9
ZVX 17 S 0805 400	17	22	25,2 - 31,3	48	1	0,1	0,005	40	145	1,5	2,0 ± 0,25	1,25 ± 0,20	1,0
ZVX 17 S 1206 400	17	22	25,2 - 31,3	48	1	0,1	0,008	40	210	1,8	3,2 ± 0,30	1,60 ± 0,20	1,0
ZVX 20 S 0603 300	20	26	31,0 - 38,0	58	1	0,1	0,003	30	100	1,0	1,6 ± 0,20	0,80 ± 0,10	0,9
ZVX 20 S 0805 400	20	26	31,0 - 38,0	58	1	0,1	0,005	40	140	1,5	2,0 ± 0,25	1,25 ± 0,20	1,0
ZVX 20 S 1206 400	20	26	31,0 - 38,0	58	1	0,1	0,008	40	200	1,8	3,2 ± 0,30	1,60 ± 0,20	1,0
ZVX 25 S 0603 300	25	30	37,0 - 46,9	65	1	0,1	0,003	30	100	1,0	1,6 ± 0,20	0,80 ± 0,10	0,9
ZVX 25 S 0805 400	25	30	37,0 - 46,9	65	1	0,1	0,005	40	140	1,5	2,0 ± 0,25	1,25 ± 0,20	1,0
ZVX 25 S 1206 400	25	30	37,0 - 46,9	65	1	0,1	0,008	40	200	1,8	3,2 ± 0,30	1,60 ± 0,20	1,0
ZVX 30 S 0603 300	30	38	42,3 - 51,7	77	1	0,1	0,003	30	80	1,0	1,6 ± 0,20	0,80 ± 0,10	0,9
ZVX 30 S 0805 400	30	38	42,3 - 51,7	77	1	0,1	0,005	40	100	1,5	2,0 ± 0,25	1,25 ± 0,20	1,0
ZVX 30 S 1206 400	30	38	42,3 - 51,7	77	1	0,1	0,008	40	165	1,8	3,2 ± 0,30	1,60 ± 0,20	1,0

Protection Level

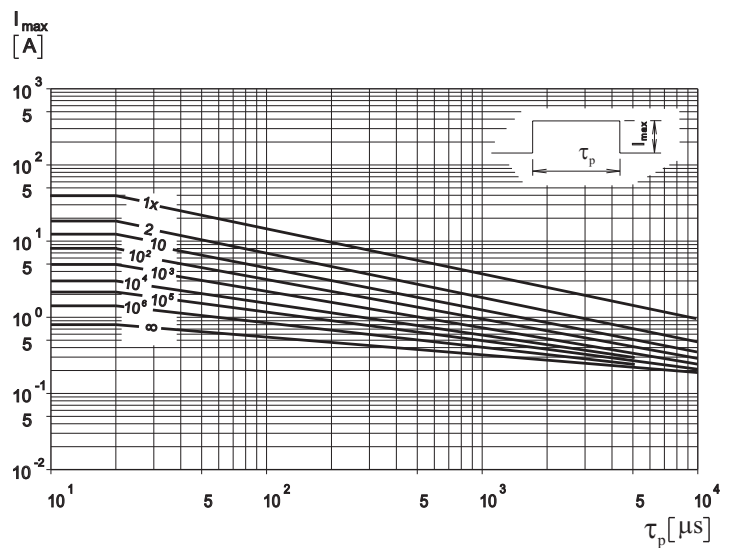
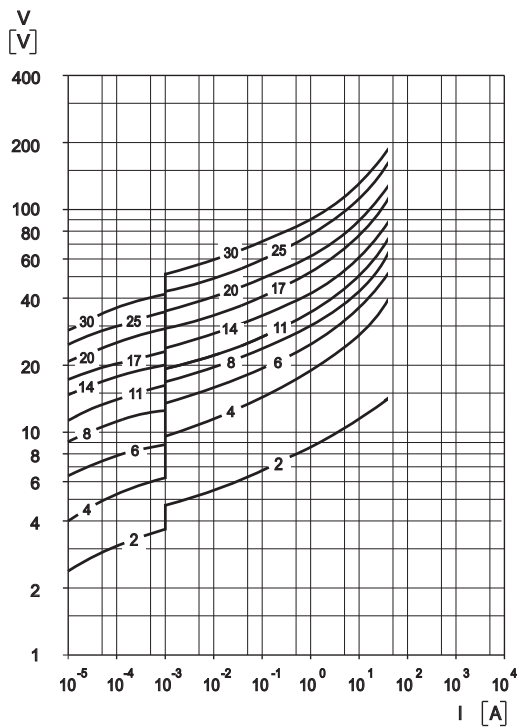
Pulse Rating Curves

* With the worst-case condition in the tolerance region

Model Size 0603
ZVX 2 ... 30 S



Model Size 0805
ZVX 2 ... 30 S



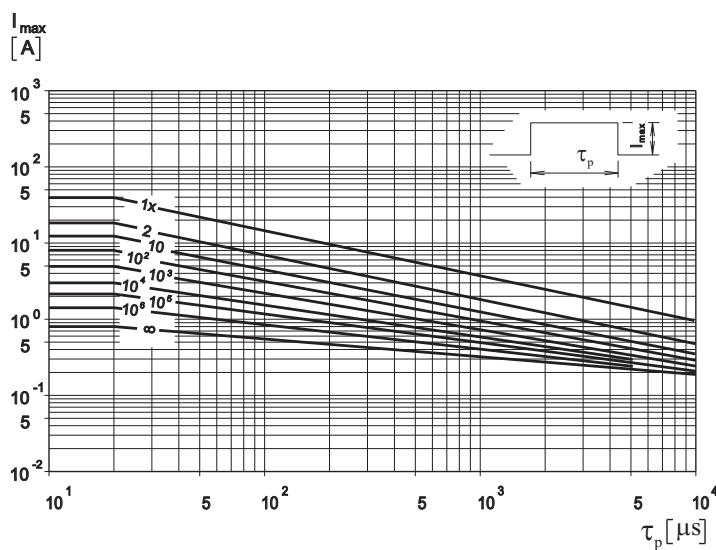
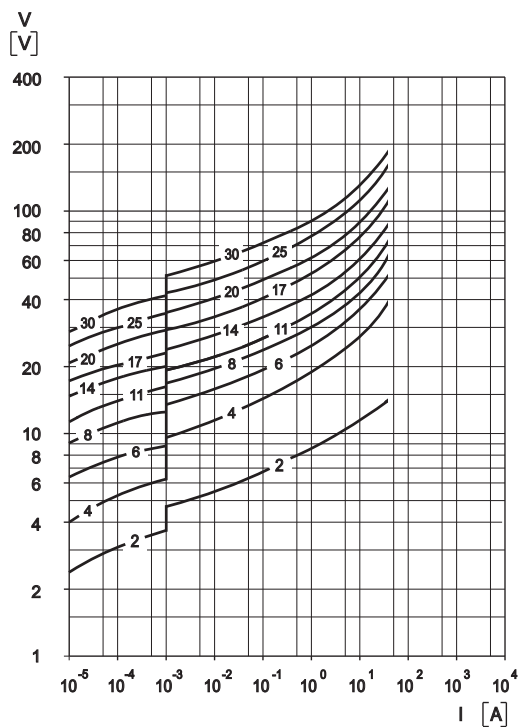
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Protection Level

Pulse Rating Curves

* With the worst-case condition in the tolerance region

Model Size 1206
ZVX 2 ... 30 S

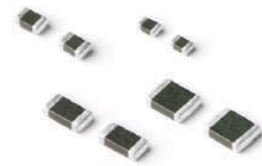


ESD SUPPRESSION VARISTORS - ZVE SERIES

Description


ZVE varistors are designed to suppress ESD events, including those specified in IEC 1000-4-2 or other standards used for Electromagnetic Compliance testing. The ZVE series is typically applied to protect integrated circuits and other components at the circuit board level operating at 18 VDC or less.

The fabrication method, design and materials of these devices result in capacitance characteristics suitable for high frequency attenuation / low-pass filter circuit functions, providing suppression and filtering in a single device.



Features

- Operating voltage range V_{dc} up to 18 V.
- +125 °C maximum continuous operating temperature
- 4 models sizes available... 0603, 0805, 1206, 1210.
- Short response time.
- Characterized for inductance and capacitance.
- Dimensional and weight savings on the board.
- Non-sensitive to mildly activated fluxes (see Soldering Recommendations, page 25).
- End termination: Ni / Sn or AgPd suitable for Pb-free soldering process – solderable with Pb-free solders according to JEDEC J-STD-020C and IEC60068-2-58.
- Non-plastic coating guarantees better flammability rating.
- Available in tape and reel for automatic pick and place.

-  UL 1499, 3rd edition & CSA C22.2 File E326499 Section 8.
- RoHS 2 compliant components according to 2002/95/EC and 2003/11/EC.
- AEC-Q200 qualified Grade 1.

Applications

- Protection of components and circuits sensitive to ESD transients occurring on power supply, control and signal lines.
- Suppression of ESD events as specified in IEC 1000-4-2, MIL-STD 883C, method 3015.7 or AEC-Q200-002 for Electromagnetic Compliance (EMC).
- Used in mobile communication, computer/EDP products, medical products, hand held / portable devices, industrial equipment, including diagnostic port protection and I/O interfaces.

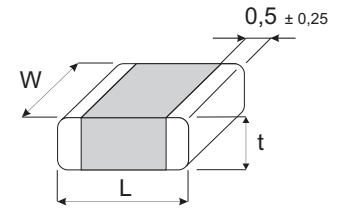
Absolute Maximum Ratings

Continuous:	Units	Value
Steady State Applied Voltage:		
DC Voltage Range (V_{dc})	V	≤ 18
AC Voltage Range (V_{rms})	V	2 to 30
Transient:		
Peak Single Pulse Surge Current, 8/20 μ s Waveform (I_{max})	A	20, 30
Single Pulse Surge Energy, 10/1000 μ s Waveform (W_{max})	J	0,05 to 0,1
Operating Ambient Temperature	°C	-55 to +125
Storage Temperature Range	°C	-55 to +150
Threshold Voltage Temperature Coefficient	%/°C	< + 0,05
Response Time	ns	< 1
Climatic Category		55 / 125 / 56

Device Ratings and Characteristics

Dimensions

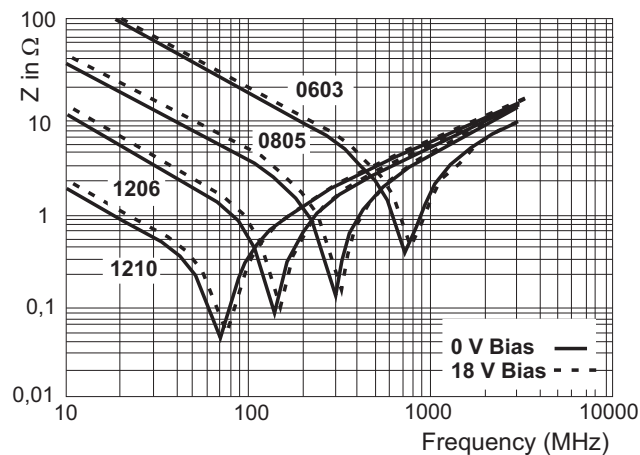
	L mm	W mm	t _{max} mm
ZVE 14 S 0603	1,6 ± 0,20	0,80 ± 0,10	0,95
ZVE 14 S 0805	2,0 ± 0,25	1,25 ± 0,20	0,95
ZVE 14 S 1206	3,2 ± 0,30	1,60 ± 0,20	1,20
ZVE 14 S 1210	3,2 ± 0,30	2,50 ± 0,25	1,30



ZVE 14 S 0603.....ZVE 14 S 1210

Type	V _{rms} V	V _{dc} V	V _n 1 mA V	V _c 8/20 μs V	I _c 8/20 μs A	W _{max} 10/1000 μs J	P max W	C _{max} 1 MHz pF	L _{typ} 100 mA/μs nH
ZVE 14 S 0603	14	18	22 - 28	50	2	0,05	0,003	75	< 1,0
ZVE 14 S 0805	14	18	22 - 28	50	2	0,10	0,004	100	< 1,5
ZVE 14 S 1206	14	18	22 - 28	50	2	0,10	0,004	200	< 1,8
ZVE 14 S 1210	14	18	22 - 28	50	2	0,10	0,004	400	< 3,5

Capacitance - Frequency Characteristics



Reliability – Lifetime

In general, **reliability** is the ability of a component to perform and maintain its functions in routine circumstances, as well as in hostile or unexpected circumstances.

The Mean life of ZVE/ZVX series components is a function of:

- Factor of Applied Voltage
- Ambient temperature.

Mean life is closely related to Failure rate (formula).

Mean life (ML) is the arithmetic mean (average) time to failure of a component.

Failure rate is the frequency with which an engineered system or component fails, expressed for example in failures per hour. Failure rate is usually time dependent, and an intuitive corollary is that the rate changes over time versus the expected life cycle of a system.

Failure rate formula – calculation

$$\Lambda = \frac{10^9}{ML [h]} [\text{fit}]$$

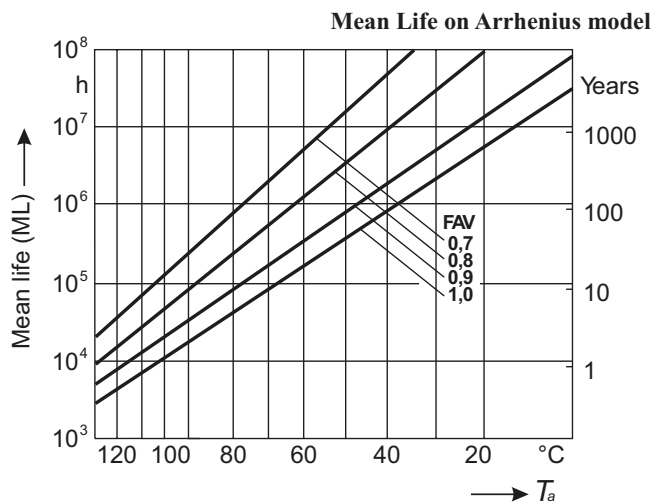
FAV – Factor of Applied Voltage

$$FAV = \frac{V_{apl}}{V_{max}}$$

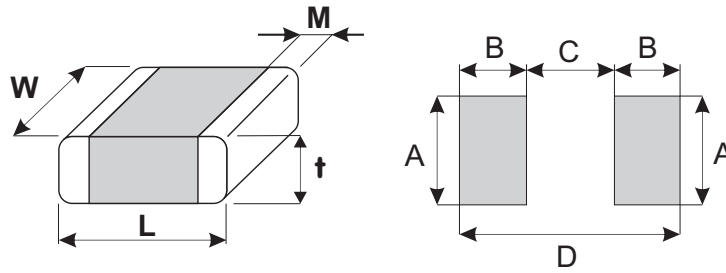
V_{apl} ... applied voltage

V_{max} ... maximum operating voltage

ZVE/ZVX 2 ... 40 Dimension 0603 ... 2220



Soldering Pad Configuration

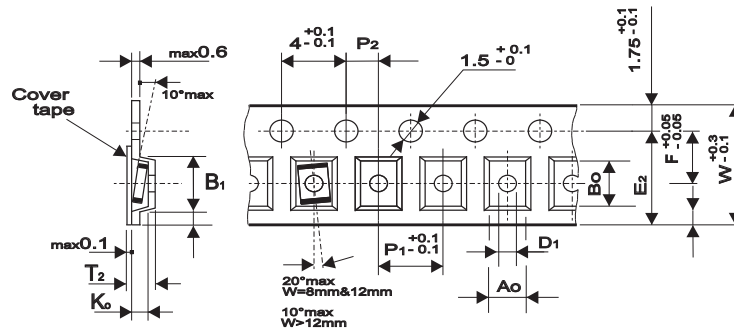


Size	L (mm)	W (mm)	M (mm)	t_{\max} (mm)	A (mm)	B (mm)	C (mm)	D (mm)
0603	1,6 ± 0,20	0,80 ± 0,10	0,5 ± 0,25	1,0	1,0	1,0	0,6	2,6
0805	2,0 ± 0,25	1,25 ± 0,20	0,5 ± 0,25	1,1	1,4	1,2	1,0	3,4
1206	3,2 ± 0,30	1,60 ± 0,20	0,5 ± 0,25	1,6	1,8	1,2	2,1	4,5
1210	3,2 ± 0,30	2,50 ± 0,25	0,5 ± 0,25	1,8	2,8	1,2	2,1	4,5
1812	4,7 ± 0,40	3,20 ± 0,30	0,5 ± 0,25	1,9	3,6	1,5	3,2	6,2
2220	5,7 ± 0,50	5,00 ± 0,40	0,5 ± 0,25	1,9	5,5	1,5	4,2	7,2
3225	8,0 ± 0,50	6,30 ± 0,40	0,5 ± 0,25	2,0	6,8	1,5	6,5	9,5

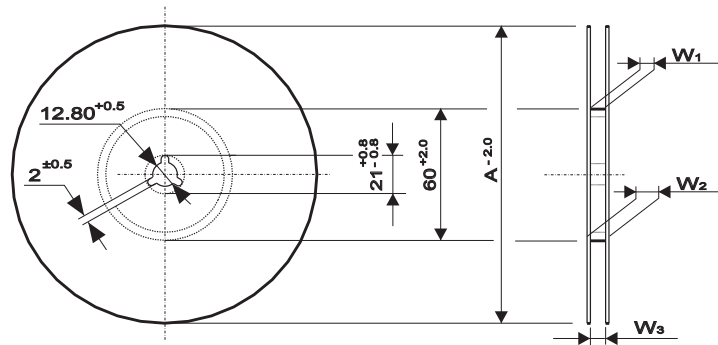
Tape and Reel Specification

Conforms to IEC Publication 286 - 3 Ed.4: 2007-06

Tape



Reel



Variable dimensions

Tape Size		8 mm				12 mm		16 mm	
Size	Units	0603	0805	1206	1210	1812	2220	3225	4032
Ao	(mm)	1,2	1,6	1,9	2,9	3,75	5,6	7	8,6
Bo	(mm)	1,9	2,4	3,75	3,7	5	6,25	8,7	10,8
Ko max	(mm)	1,1	1,1	1,8	2	2	2	3,7	3,7
B1 max	(mm)	4,35	4,35	4,35	4,35	8,2	8,2	12,1	12,1
D1 min	(mm)	0,3	0,3	0,3	0,3	1,5	1,5	1,5	1,5
E2 min	(mm)	6,25	6,25	6,25	6,25	10,25	10,25	14,25	14,25
P1	(mm)	4	4	4	4	8	8	12	12
F	(mm)	3,5	3,5	3,5	3,5	5,5	5,5	7,5	7,5
W	(mm)	8,0	8,0	8,0	8,0	12,0	12,0	16,0	16,0
T2 max	(mm)	3,5	3,5	3,5	3,5	6,5	6,5	9,5	9,5
W1	(mm)	8,4+1,5	8,4+1,5	8,4+1,5	8,4+1,5	12,4+2	12,4+2	16,4+2	16,4+2
W2 max	(mm)	14,4	14,4	14,4	14,4	18,4	18,4	22,4	22,4
W3	(mm)	7,9...10,9	7,9...10,9	7,9...10,9	7,9...10,9	11,9...15,4	11,9...15,4	15,9...19,4	15,9...19,4
A	(mm)	180/330	180/330	180/330	180/330	180/330	180/330	330	330

Package units

Series	Voltage range (V)	0603 Reel size		0805 Reel size		1206 Reel size		1210 Reel size		1812 Reel size		2220 Reel size		3225 Reel size	4032 Reel size
		180	330	180	330	180	330	180	330	180	330	180	330	330	330
ZVE	14	4000	15000	4000	15000	4000	15000	4000	15000						
ZV / ZVX	2 to 14	4000	15000	4000	15000	4000	15000	4000	15000	1500	6000	1500	5000		
	17	3500	14000	3500	14000	2500	14000	2500	14000	1500	6000	1500	5000		
	20 to 40	3500	14000	3500	14000	2500	10000	2500	9000	1000	4000	1000	4000		
	50 to 130					2000	8000	2000	8000	1000	4000	1000	4000		
AV	14			3500	15000	2500	15000	2500	15000	1000	6000	1000	4000	2500	2500
	17			3500	14000	2500	14000	2500	14000	1000	6000	1000	4000	2500	2500
	20 to 40				14000	2500	10000	2500	9000	1000	4000	1000	4000	2500	2500

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Ordering Information

AV 20 K 1210 401 N R1 yy

AV 20 K 1210 401 Ni R1 yy

- AV** - Series Name: AV, ZV, ZVE, ZVX
- 20** - Maximum Continuous Working Voltage - V_{rms}
- K** - V_n Tolerance: K = $\pm 10\%$, L = $\pm 15\%$, M = $\pm 20\%$
- 1210** - Chip Size: 0603, 0805, 1206, 1210, 1812, 2220, 3225
- 401** - Maximum Surge Current: 400 = 40 A; 401 = 400 A
- N** - Barrier type end terminations suitable for Pb-free reflow soldering
- (no letter) AgPd end terminations suitable for Pb reflow soldering
- Ni** - Ni Sn barrier type end terminations - suitable for Pb and Pb-Free reflow soldering
- R1** - Packaging: R1 = Reel 180 mm, R2 = Reel 330 mm, R3 = 180 mm-1000 pcs
- yy** - Special requirements: HT = operating temperature - 55 to + 150 °C

SOLDERING RECOMMENDATIONS

Popular soldering techniques used for surface mounted components are Wave and Infrared Reflow processes. Both processes can be performed with Pb-containing or Pb-free solders. The termination options available for these soldering techniques are AgPd and Barrier Type End Terminations.

End termination	Designation	Recommended and Suitable for	Component RoHS Compliant
Ag/Pd	Series (ZV, AV, DV, C, ...)..... R1	Pb-containing soldering	Yes
Barrier Type End Termination	Series (ZV, AV, DV, C, ...)..... N R1	Pb-containing and Pb-free soldering	Yes
Ni Sn End Termination	Series (ZV, AV, ...) ...Ni R1	Pb-containing and Pb-free soldering v	Yes

Wave Soldering – this process is generally associated with discrete components mounted on the underside of printed circuit boards, or for large top-side components with bottom-side mounting tabs to be attached, such as the frames of transformers, relays, connectors, etc. SMD varistors to be wave soldered are first glued to the circuit board, usually with an epoxy adhesive. When all components on the PCB have been positioned and an appropriate time is allowed for adhesive curing, the completed assembly is then placed on a conveyor and run through a single, double wave process.

Infrared Reflow Soldering – these reflow processes are typically associated with top-side component placement. This technique utilizes a mixture of adhesive and solder compounds (and sometimes fluxes) that are blended into a paste. The paste is then screened onto PCB soldering pads specifically designed to accept a particular sized SMD component. The recommended solder paste wet layer thickness is 100 to 300 µm. Once the circuit board is fully populated with MD components, it is placed in a reflow environment, where the paste is heated to slightly above its eutectic temperature. When the solder paste reflows, the SMD components are attached to the solder pads.

Solder Fluxes – solder fluxes are generally applied to populated circuit boards to lean oxides form forming during the heating process and to facilitate the flowing of the solder. Solder fluxes can be either a part of the solder paste compound or can be separate materials, usually fluids. Recommended fluxes are:

- non-activated (R) fluxes, whenever possible
- mildly activated (RMA) fluxes of class L3CN
- class ORLO

Activated (RA), water soluble or strong acidic fluxes with a chlorine content > 0.2 wt. % are NOT RECOMMENDED. The use of such fluxes could create high leakage current paths along the body of the varistor components.

When a flux is applied prior to wave soldering, it is important to completely dry any residual flux solvents prior to the soldering process.

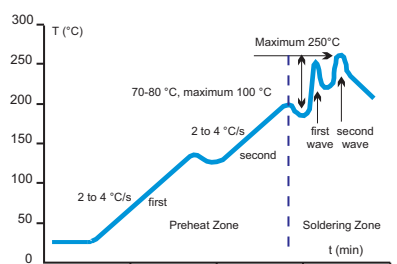


Fig. 1. Wave Soldering Temperature Profile for Pb-free and Pb-containing Soldering

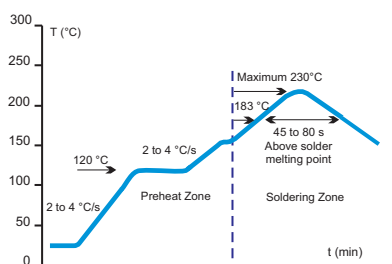


Fig. 2. Infrared Reflow Temperature Profile for Pb-containing Soldering

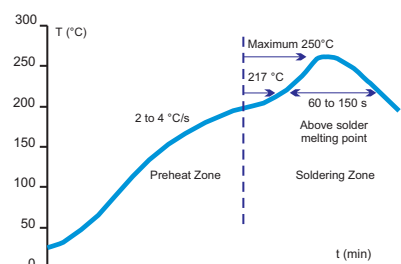


Fig. 3. Reflow Temperature Profile for Pb-free Soldering

Thermal Shock – to avoid the possibility of generating stresses in the varistor chip due to thermal shock, a preheat stage to within 100 °C of the peak soldering process temperature is recommended. Additionally, SMD varistors should not be subjected to a temperature gradient greater than 4 °C/sec., with an ideal gradient being 2 °C/sec. Peak temperatures should be controlled. Wave and Reflow soldering conditions for SMD varistors with Pb-containing solders are shown in Fig. 1 and 2 respectively, while Wave and Reflow soldering conditions for SMD varistors with Pb-free solders are shown in Fig. 1 and 3.

Whenever several different types of SMD components are being soldered, each having a specific soldering profile, the soldering profile with the least heat and the minimum amount of heating time is recommended. Once soldering has been completed, it is necessary to minimize the possibility of thermal shock by allowing the hot PCB to cool to less than 50 °C before cleaning.

Inspection Criteria – the inspection criteria to determine acceptable solder joints, when Wave or Infrared Reflow processes are used, will depend on several key variables, principally termination material process profiles.

Pb-containing Wave and IR Reflow Soldering – typical “before” and “after” soldering results for Silver/Palladium (AgPd) and Barrier Type End Terminations can be seen in Fig. 4. Both barrier type and silver/palladium terminated varistors form a reliable electrical contact and metallurgical bond between the end terminations and the solder pads. The bond between these two metallic surfaces is exceptionally strong and has been tested by both vertical pull and lateral (horizontal) push tests. The results, in both cases, exceed established industry standards for adhesion.

The solder joint appearance of a barrier type terminated versus a silver/palladium terminated varistor will be slightly different. Solder forms a metallurgical junction with the thin tin-alloy (over the barrier layer), and due to its small volume “climbs” the outer surface of the terminations, the meniscus will be slightly lower. This optical appearance difference should be taken into consideration when programming visual inspection of the PCB after soldering.

Silver Palladium (AgPd) End Terminations

Barrier Type End Terminations and Ni Sn End Terminations

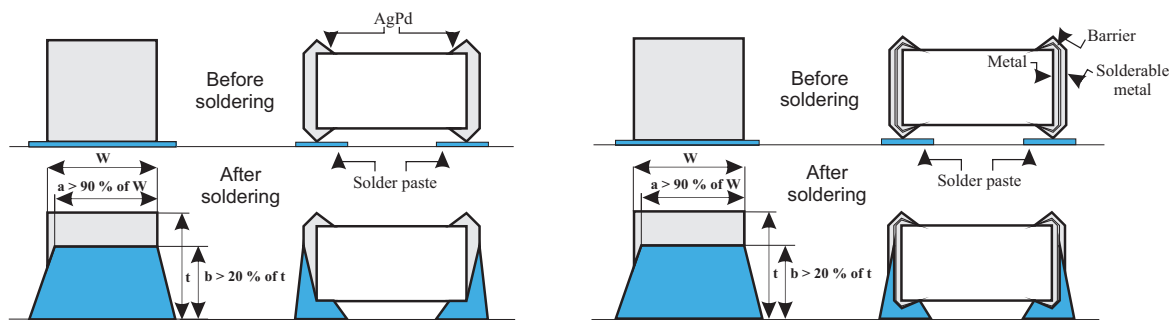


Fig. 4 Soldering Criterion in case of Wave and IR Reflow Pb-containing Soldering

Silver Palladium (AgPd) End Terminations

Barrier Type End Terminations and Ni Sn End Terminations

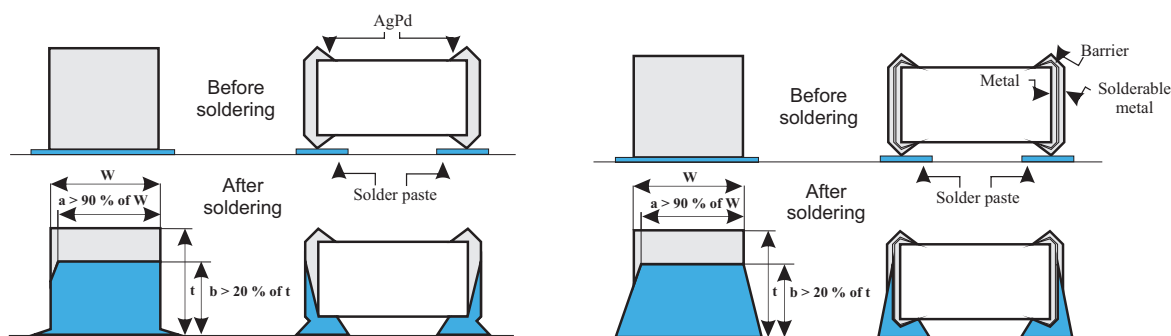


Fig. 5 Soldering Criterion in case of Wave and IR Reflow Pb-free Soldering

Pb-free Wave and IR Reflow Soldering – typical “before” and “after” soldering results for Silver/Palladium (AgPd) and Barrier Type End Terminations are given in A phenomenon known as “mirror” or “negative” meniscus results will appear in the case of Silver/Palladium terminated varistors. Solder forms a metallurgical junction with the entire volume of the end termination, i.e. it diffuses from pad to end termination across the inner side, forming a “mirror” or “negative meniscus. The height of the solder penetration can be clearly seen on the end termination and is always 30% higher than the chip height.

Since barrier type terminations on KEKO-VARICON chips do not require the use of problematic nickel and tin-alloy electroplating processes, these varistors are truly considered environmentally friendly.

Solder Test and Retained Samples – reflow soldering test based on J-STD-020D.1 and soldering test by dipping based on IEC 60068-2 for Pb-free solders are performed on each production lot as shown in the following chart. Test results and accompanying samples are retained for a minimum of two (2) years. The solderability of a specific lot can be checked at any time within this period should a customer require this information.

Test	Resistance to flux	Solderability	Static leaching (simulation of Reflow Soldering)	Dynamic leaching (simulation of Wave Soldering)
Parameter				
Soldering method	dipping	dipping	dipping	dipping with agitation
Flux	L3CN, ORLO	L3CN, ORLO, R	L3CN, ORLO, R	L3CN, ORLO, R
Pb Solder	62Sn / 36Pb / 2 Ag			
Pb Soldering temperature (°C)	235 ± 5	235 ± 5	260 ± 5	235 ± 5
Pb-FREE Solder	Sn96 / Cu0,4-0,8 / 3-4Ag			
Pb-FREE Soldering temperature (°C)	250 ± 5	250 ± 5	280 ± 5	250 ± 5
Soldering time (s)	2	210	10	> 15
Burn-in conditions	V_{dcmax} , 48 h	-	-	-
Acceptance criterion	$dV_n < 5\%$, i_{dc} must stay unchanged	> 95 % of end termination must be covered by solder	> 95 % of end termination must be intact and covered by solder	> 95 % of end termination must be intact and covered by solder

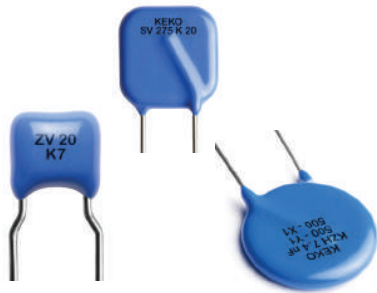
Rework Criteria Soldering Iron – unless absolutely necessary, the use of soldering irons is NOT recommended for reworking varistor chips. If no other means of rework is available, the following criteria must be strictly followed:

- Do not allow the tip of the iron to directly contact the top of the chip
- Do not exceed the following soldering iron specifications:
 - Output Power: 30 Watts maximum
 - Temperature of Soldering Iron Tip: 280 °C maximum
 - Soldering Time: 10 Seconds maximum

Storage Conditions – SMD varistors should be used within 1 year of purchase to avoid possible soldering problems caused by oxidized terminals. The storage environment should be controlled, with humidity less than 40% and temperature between -25 and 45 °C. Varistor chips should always be stored in their original packaged unit.

Where varistor chips have been in storage for more than 1 year, and where there is evidence of solderability difficulties, KEKO-VARICON can “refresh” the terminations to eliminate these problems.

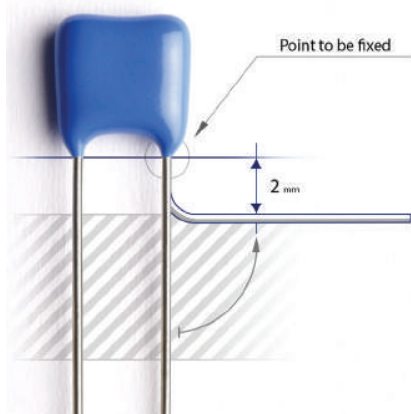
ASSEMBLY RECOMMENDATIONS FOR TH COMPONENTS



Very often before soldering through-hole components, their leads get bent. It is important not to damage the component during lead bending. Typical damage incurred during bending is cracks in epoxy parts, which can lead to increased humidity sensitivity of a component and consequentially to a shorter life time.

- In order to avoid epoxy parts damage it is necessary to:
 - fix the most sensitive point (epoxy parts) of a component body
 - bend the wire at least 2 mm below the end of epoxy parts

Other potential damage to a component which can lead to component failure or a shorter life time is thermal shock during manual soldering with a soldering iron. This can occur in the case when a soldering iron is placed too close to one point of the component body and most often it happens if the solder joint is too close to the varistor body.



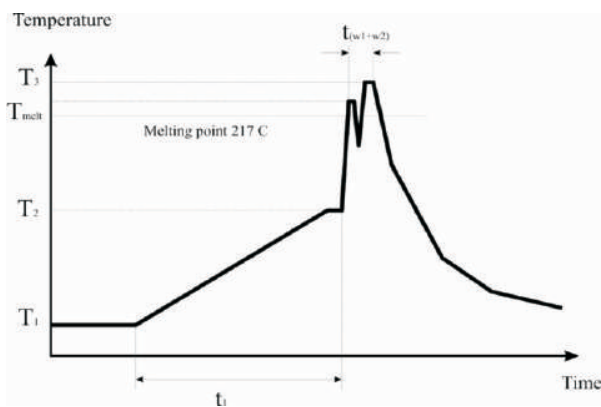
° Resistance to Soldering Heat

In the case of automatic wave soldering, it is important to provide sufficient resistance to soldering heat. In order to prevent any potential problems KEKO VARICON decided to introduce their own internal standard for testing the resistance to soldering heat of through-hole components: 300 °C, 10s.

° Pb-free Wave Soldering Profile Recommendations

Recommended soldering profiles for all above components are in accordance with JEDEC standard curves (J-STD-020D) and therefore compatible with the new Pb-free process.

° lead-fee Wave Soldering Profile



Pb-free wave soldering profile requirements for soldering heat resistance of components

Parameters	Symbol	Specification
preheating temperture gradient		4°C/s max.
Preheating time	t1	2 to 5 min
Min. preheating temperature	T1	130 °C
Max. preheating temperature	T2	180 °C
Melting temperature/point	T _{meltv}	217 °C
Time in wave soldering phase (w ₁ +w ₂)	t _{w1+w2}	10s
Max. wave temperature (w ₁ +w ₂)	T ₃	265 °C +0/-5 °C
Cooling teperature gradient		6° C/s max.
Tempearature jump form T ₂ to T ₃ (w ₁)	T _{3(w1)} - T ₂	120 °C max
Time from 25°C to T ₃ (wave temperature)		8 min max.

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Reliability Testing Procedures

Varistor testing procedures comply with CECC 42200, IEC 1051-1/2 and AEC-Q200.

Testing results are available upon customer request. Special tests can be performed upon customer request.

Reliability Parameter	Test	Tested according to	Condition to be satisfied after testing
AC/DC Bias Reliability	AC/DC Life Test	CECC 42200, Test 4.20 or IEC 1051-1, Test 4.20., AEC-Q200 Test8 - 1000 h at UCT	$ \delta_{Vn} (1 \text{ mA}) < 10 \%$
Pulse Current Capability	$I_{\text{max}} 8/20 \mu\text{s}$	CECC 42200, Test C 2.1 or IEC 1051-1, Test 4.5. 10 pulses in the same direction at 2 pulses per minute at maximum peak current for 10 pulses	$ \delta_{Vn} (1 \text{ mA}) < 10 \%$ no visible damage
Pulse Energy Capability	$W_{\text{max}} 10/1000 \mu\text{s}$	CECC 42200, Test C 2.1 or IEC 1051-1, Test 4.5. 10 pulses in the same direction at 1 pulses every 2 minutes at maximum peak current for 10 pulses	$ \delta_{Vn} (1 \text{ mA}) < 10 \%$ no visible damage
WLD Capability	WLD x 10	ISO 7637, Test pulse 5, 10 pulses at rate 1 per minute	$ \delta_{Vn} (1 \text{ mA}) < 15 \%$ no visible damage
V_{jump} Capability	V _{jump} 5 min	Increase of supply voltage to $V \geq V_{\text{jump}}$ for 1 minute	$ \delta_{Vn} (1 \text{ mA}) < 15 \%$ no visible damage
Environmental and Storage Reliability	Climatic Sequence	CECC 42200, Test 4.16 or IEC 1051-1, Test 4.17. a) Dry heat, 16h, UCT, Test Ba, IEC 68-2-2 b) Damp heat, cyclic, the first cycle: 55 °C, 93 % RH, 24 h, Test Db 68-2-4 c) Cold, LCT, 2 h, Test Aa, IEC 68-2-1 d) Damp heat cyclic, remaining 5 cycles: 55 °C, 93 % RH, 24 h/cycle, Test Bd, IEC 68-2-30	$ \delta_{Vn} (1 \text{ mA}) < 10 \%$
	Thermal Shock	CECC 42200, Test 4.12, Test Na, IEC 68-2-14, AEC-Q200 Test16, 5 cycles UCT/LCT, 30 minutes	$ \delta_{Vn} (1 \text{ mA}) < 10 \%$ no visible damage
	Steady State Damp Heat	CECC 42200, Test 4.17, Test Ca, IEC 68-2-3, AEC-Q200 Test 6, 56 days, 40 °C, 93% RH. AEC-Q200 Test7: Bias, Rh, T all at 85.	$ \delta_{Vn} (1 \text{ mA}) < 10 \%$
	Storage Test	IEC 68-2-2, Test Ba, AEC-Q200 Test 3, 1000 h at maximum storage temperature	$ \delta_{Vn} (1 \text{ mA}) < 5 \%$
Mechanical Reliability	Solderability	CECC 42200, Test 4.10.1, Test Ta, IEC 68-2-20 solder bath and reflow method	Solderable at shipment and after 2 year of storage, criteria > 95% must be covered by solder for reflow meniscus
	Resistance to Soldering Heat	CECC 42200, Test 4.10.2, Test Tb, IEC 68-2-20 solder bath nad reflow method	$ \delta_{Vn} (1 \text{ mA}) < 5 \%$
	Terminal Strength	JIS-C-6429, App. 1, 18N for 60 s - same for AEC-Q200 Test 22	no visual damage
	Board Flex	JIS-C-6429, App. 2, 2 mm min. AEC-Q200 test 21 - Board flex: 2 mm flex min.	$ \delta_{Vn} (1 \text{ mA}) < 2 \%$ no visible damage
	Vibration	CECC 42200, Test 4.15, Test Fc, IEC 68-2-6, AEC-Q200 Test 14. Frequency range 10 to 55 Hz (AEC: 10-2000Hz) Amplitude 0.75 m/s ² or 98 m/s ² (AEC: 5 g's for 20 minutes) Total duration 6 h (3x2h) (AEC: 12 cycles each of 3 directions) Waveshape - half sine	$ \delta_{Vn} (1 \text{ mA}) < 10 \%$ no visible damage
	Mechanical Shock	CECC 42200, Test 4.14, Test Ea, IEC 68-2-27, AEC-Q200 Test 13. Acceleration = 490 m/s ² (AEC: MIL-STD-202-Method 213), Pulse duration = 11 ms, Waveshape - half sine; Number of shocks = 3x6	$ \delta_{Vn} (1 \text{ mA}) < 10 \%$ no visible damage
Electrical Transient Conduction	ISO-7637-1 Pulses	AEC-Q200 Teat 30: Test pulses 1 to 3. Also other pulses - freestyle.	$ \delta_{Vn} (1 \text{ mA}) < 10 \%$ no visible damage

Reliability Testing Procedures

RFI Suppression and Safety RFI Suppression a Capacitor Testing according to EN 132 400 and IEC 60384 - 1.

Reliability Parameter	Test	Tested according to	Condition to be satisfied after testing
Voltage Proof	Vt	EN 132 400, Test 4.2.1. - the voltage shall be raised from near zero to the test voltage Vt at a rate not exceeding 150 V/s, Where for: Class X1 Capacitors $V_t = 2 \cdot V_{rms} + 1500 \text{ V-}$, 1 minute Class Y1 Capacitors $V_t = 4000 \text{ V-}$, 1 minute Class Y2 Capacitors $V_t = 2 \cdot V_{rms} + 1500 \text{ V-}$, 1 minute	no permanent breakdown of flash-overs during the test period
Impulse Voltage		EN 132 400, Test 4.13. - 24 impulses of the same polarity shall be applied to the capacitor. The time between impulses shall be no less than 10s, where for: Class X1 Capacitors $V_p = 4 \text{ kV}$ Class Y1 Capacitors $V_p = 8 \text{ kV}$ Class Y2 Capacitors $V_p = 5 \text{ kV}$	no self-healing breakdowns or flash-overs
AC/DC Bias Reliability	AC/DC Life Test	EN 132 400, Test 4.14, 1000 h at UCT, where: - for X Class Capacitors: at $V = 1,25 V_{rms}$ and once per hour the voltage shall be increased to 1000 V- for 0,1 s - for Y Class Capacitors: at $V = 1,7 V_{rms}$ and once per hour the voltage shall be increased to 1000 V- for 0,1 s	no visible damage $ \Delta C/C < 20 \%$ $\tan \delta < 0,008$ IR greater than 50 % of the applicable limits no permanent breakdown or flash-over during voltage proof
Charge and Discharge		EN 132 400, Test 4.15. - 10.000 cycles of charge and discharge at the rate of one operation per minute with the test voltage of $\text{SQRT}(2) \cdot V_{rms}$ discharge rate adjusted to 100 V/ μs	$ \Delta C/C < 10 \%$ $\tan \delta < 0,008$ IR greater than 50 % of the applicable limits
Radio - Frequency Characteristics		EN 132 400, test 4.16. - measurement of capacitor impedance over a range of frequencies	with specification
Capacitance - Temperature Characteristics		Measurement of capacitance and $\tan \delta$ in the temperature chamber at 20 °C and at UCT and LTC	with specification
Environmental and Storage Reliability	Climatic Sequence	EN 132 400, Test 4.11 a) Dry heat, 16 h, UCT, Test Ba, IEC 68-2-2 b) Damp heat, cyclic, the first cycle: 55 °C, 93 % RH, 24 H, test DB, IEC 68-2-1 c) Cold, LCT, 2 h, Test Aa, IEC 68-2-1 d) Damp heat cyclic, remaining 5 cycles: 55 °C, 93 % RH, 24 h/cycle, test Bd, IEC 68-2-30	no visible damage $ \Delta C/C < 20 \%$ $\tan \delta < 0,008$ IR greater than 50 % of the applicable limits no permanent breakdown or flash-over during voltage proof
	Thermal Shock	EN 132 400, Test 4.6, Test Na, IEC 68-2-14, 5 cycles UCT/LCT, 30 minutes	no visible damage
	Steady State Damp Heat	EN 132 400, Test 4.6, Test Na, IEC 68-2-14, 5 cycles UCT/LCT, 30 minutes	no visible damage $ \Delta C/C < 20 \%$ $\tan \delta < 0,008$ IR greater than 50 % of the applicable limits no permanent breakdown or flash-over during voltage proof
	Storage Test	IEC 68-2-2, Test Ba 1000 h at maximum storage temperature	no visible damage $ \Delta C/C < 20 \%$ $\tan \delta < 0,008$ IR greater than 50 % of the applicable limits no permanent breakdown or flash-over during voltage proof
Mechanical Reliability	Solderability	EN 132 400, Test 4.5., Test Ta, IEC 68-2-20, solder bath and reflow method	Solderable at shipment and after 2 years of storage - limits*
	Resistance to Soldering Heat	EN 132 400, Test 4.4., Test Tb, IEC 68-2-20, solder bath and reflow method	no visible damage $ \Delta C/C < 10 \%$
	Robustness of Termination	EN 132 400, Test 4.3., Test Ua, IEC 68-2-21	no visible damage
	Vibration	EN 131 400, Test 4.7., Test Fc, IEC 68-2-6, Frequency range 10 to 55 Hz; Amplitude 0.75 mm or 98 m/s ² Total duration 6 h (3 x 2 h); Waveshape - half sine	no visible damage
	Mechanical Shock	EN 132 400, Test 4.9, Test Ea, IEC 68-2-27 Acceleration = 490 m/s ² ; 100 g 6ms and 50 g 11 ms Waveshape - half sine; Number of shocks = 3 x 6	$ \Delta C/C < 10 \%$ $\tan \delta$ within specification no visible damage

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