Catalogue - PROTECTIVE DEVICES - Edition 2015

KEKOVARICON

Varistors

SMD, THD, High Energy

Varicons

Multilayer SMD and THD

Dual Function Varicons

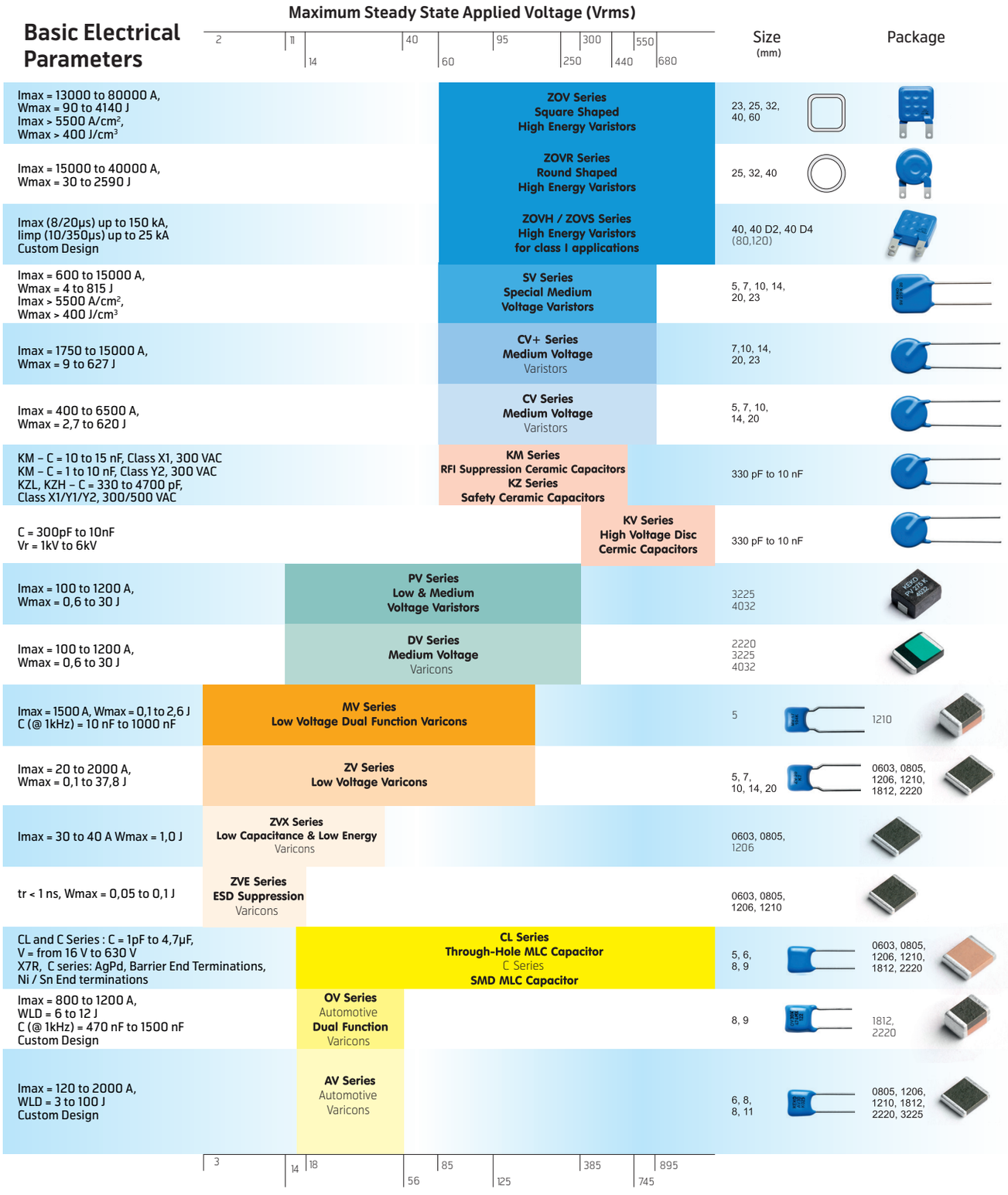
Capacitors

Safety class X and Y disc capacitors

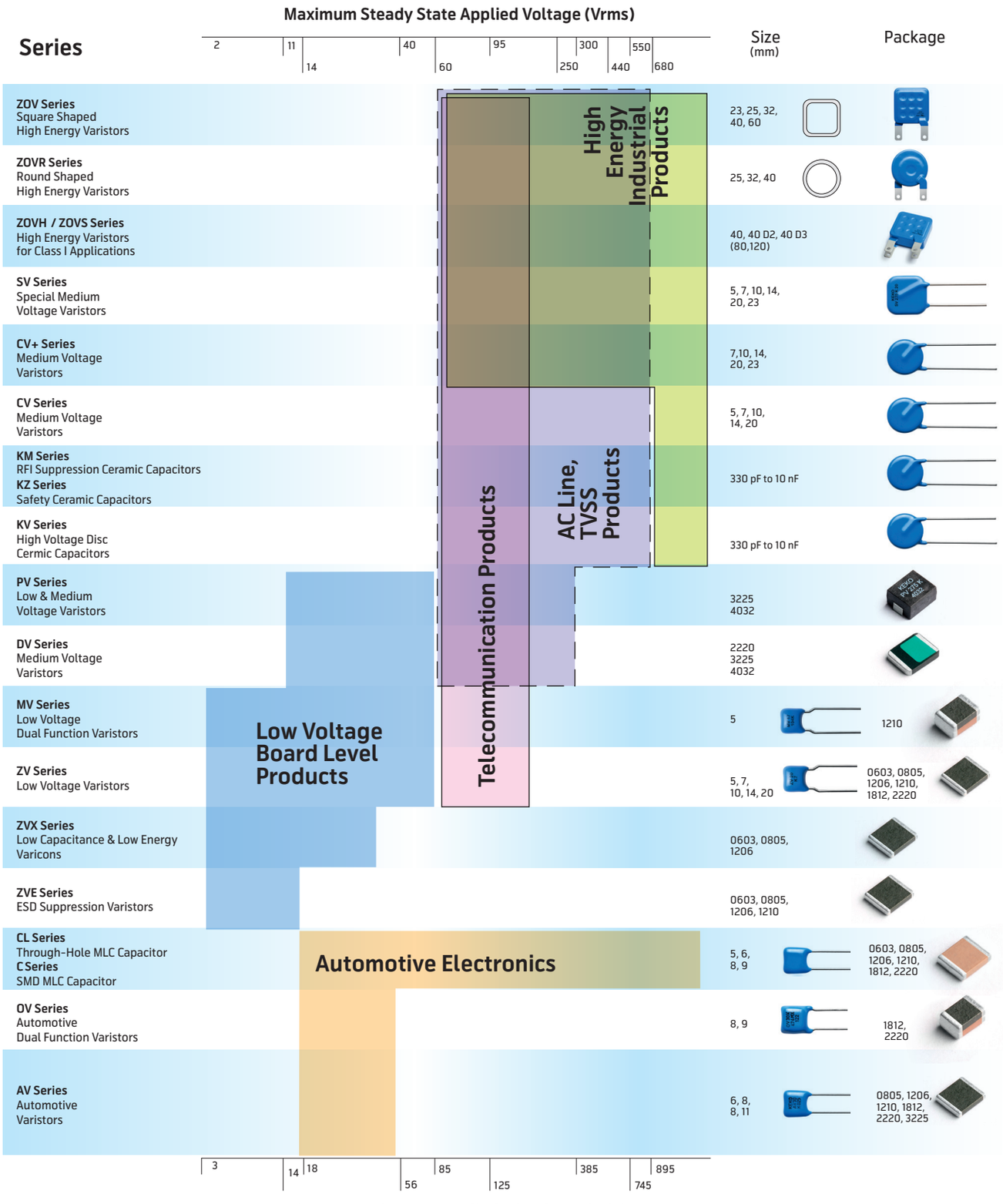
High voltage disc capacitors

www.keko-varicon.si

OVERVIEW OF PROTECTIVE DEVICES



APPLICATION FIELDS



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 Varsitor 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 variostors with rigid terminals or as metalized varistor blocks.
- c UL us 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.

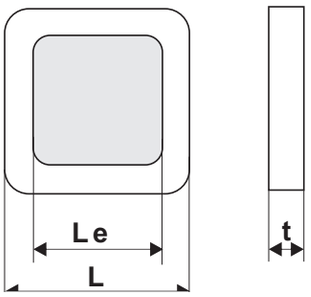
Absolute Maximum Ratings

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 µs Waveform, (I_{max})	18000 to 80000	A	> 5500	A/cm^2
Single Pulse Surge Energy, 10/1000 µs 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	GΩ	> 1	GΩ
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

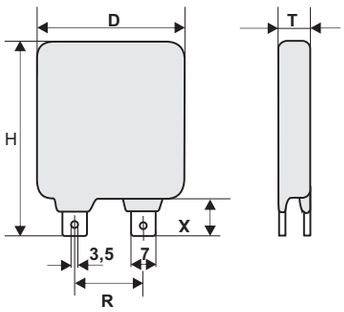
Size Parameters

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

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

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

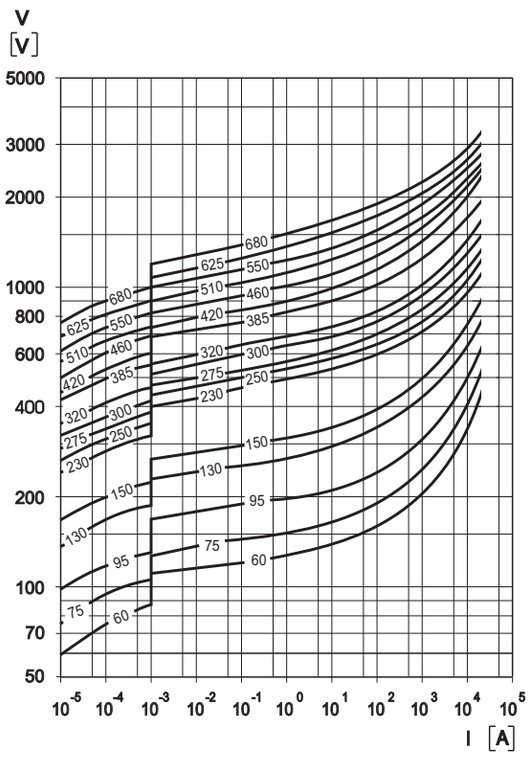
Electrical Parameters		**Value**	**Units**
Varistor Threshold Voltage (V_n) Range at 1 mA		100 to 1100	V
Continuous:			
Steady State Applied Voltage:			
DC Voltage Range (V_{dc})		85 to 900	V
AC Voltage Range (V_{rms})		60 to 680	V
Transient:			
Peak Single Pulse Surge Current, 8/20 µs Waveform, (I_{max})		>5500	A/cm^2
Single Pulse Surge Energy, 10/1000 µs 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	µA/cm^2
	at 85 °C	10	µA/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	

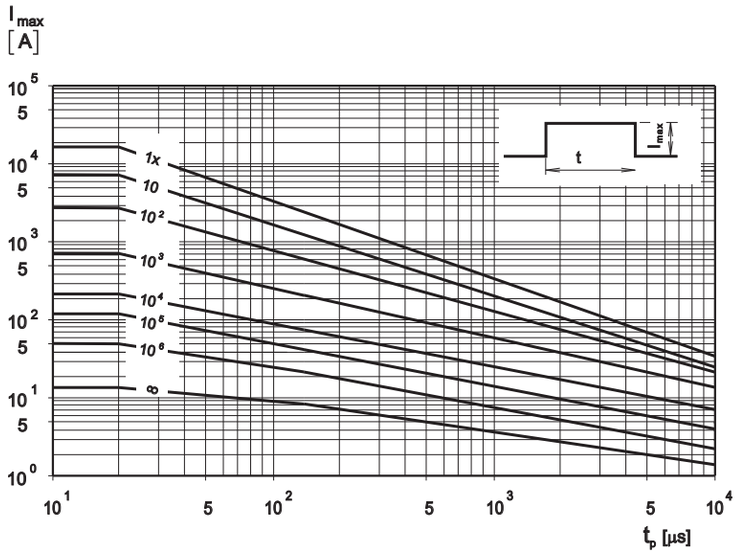
Protection Level

*In the most demanding conditions as per the tolerance region

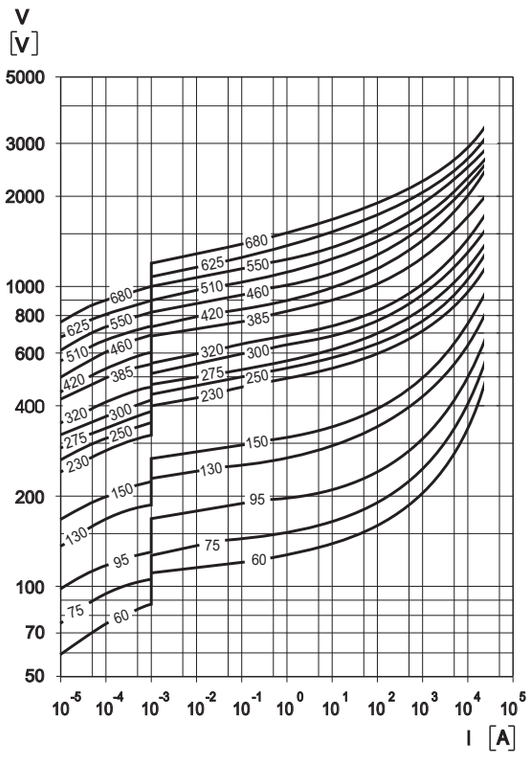
Pulse Rating Curves

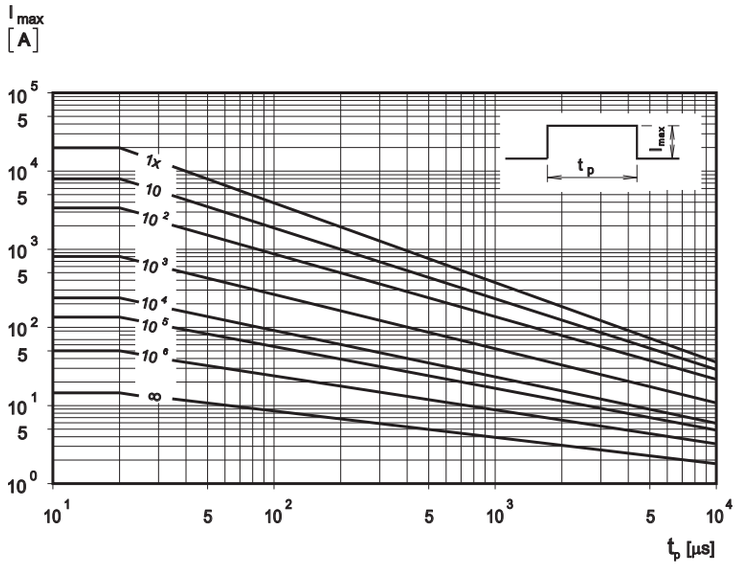
Model Size 23
ZOV 60...680





Model Size 25
ZOV 60...680



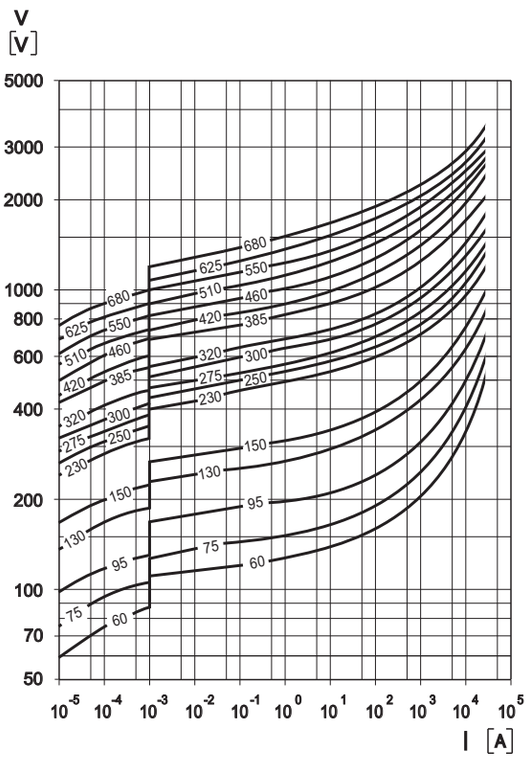


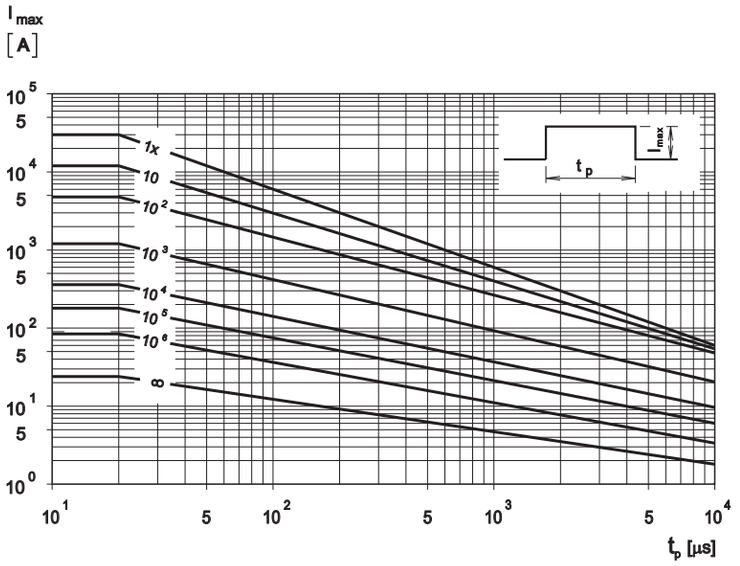
Protection Level

*In the most demanding conditions as per the tolerance region

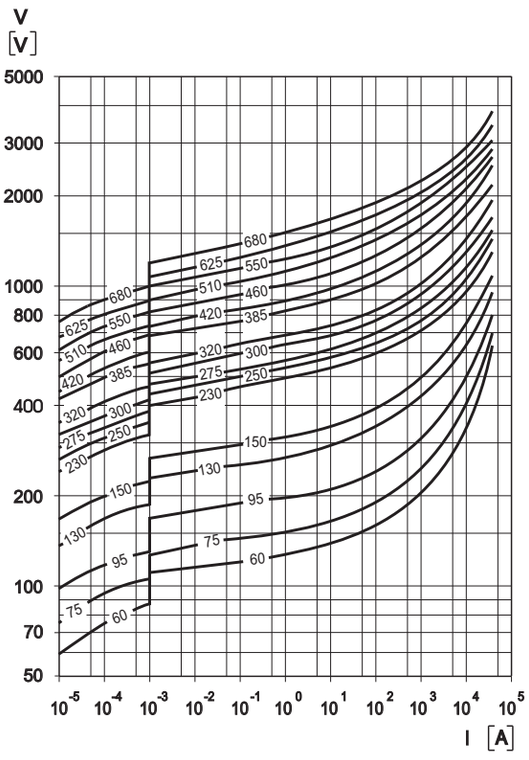
Pulse Rating Curves

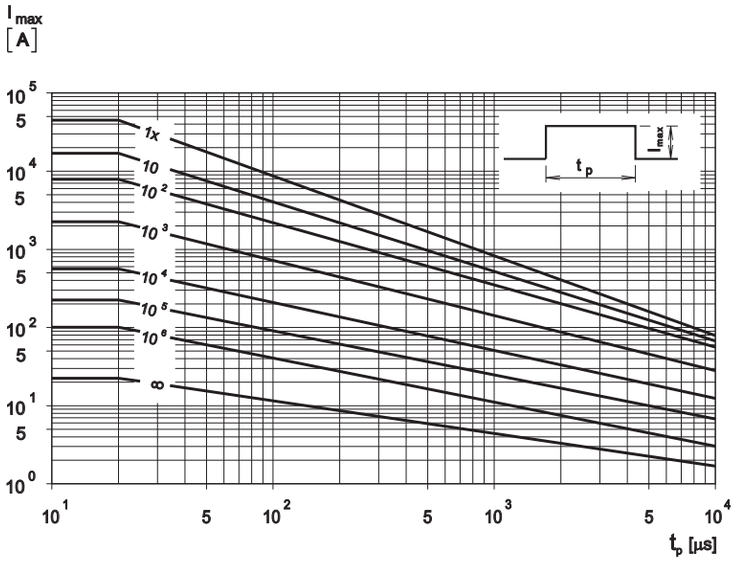
Model Size 32
ZOV 60...680





Model Size 40
ZOV 60...680



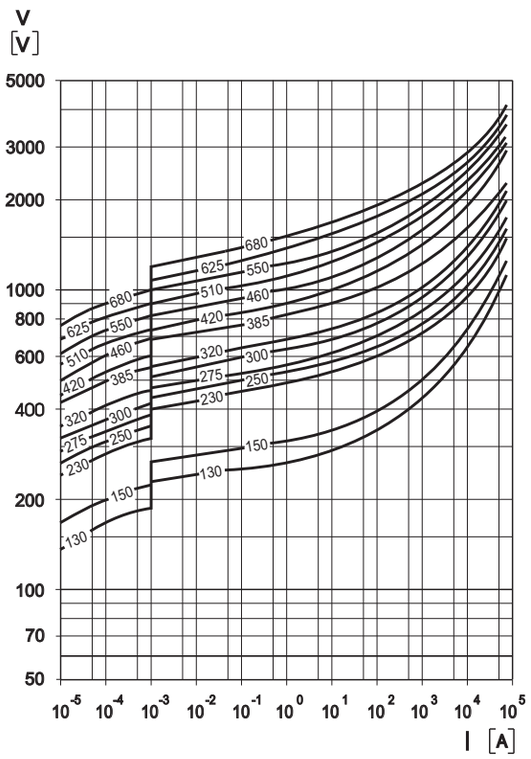


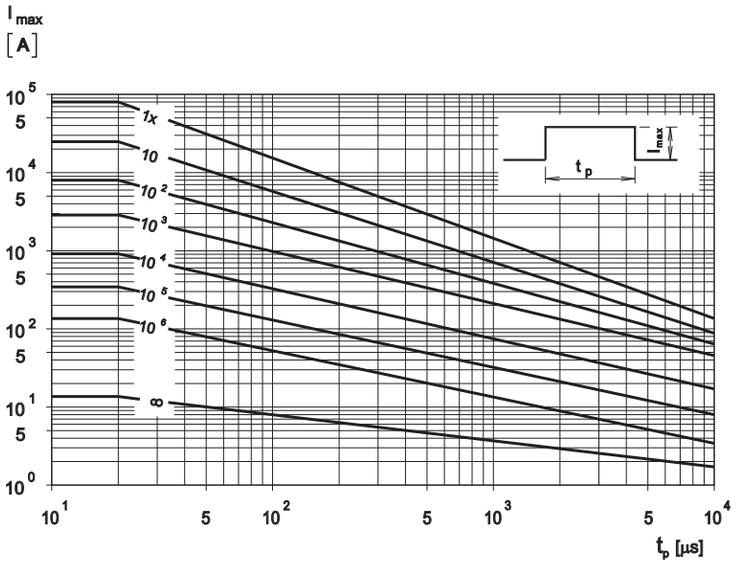
Protection Level

*In the most demanding conditions as per the tolerance region

Pulse Rating Curves

Model Size 60
ZOV 60...680





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 x 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 In
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 µs 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 µs 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/ Vapp, 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 µs pulse of a miaximum 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 disconect while the alternator is still generating charging current with other loads remaining on the alternator circuit at the time of battery disconect.
Rated Peak Single Pulse Transient Current	I_{max}	Maximum peak current which may be applied for a single 8/20 µs 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 0 log (I_1/I_n)/log(V_1/V_n) = 1/log(V1/V_n), where: - I_n is reference current (1 mA) and V_n is varistor voltage - I_1 = 10 In, 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 at 85 °C - V_n at 25 °C) / (V_n at 25 °C) x 60 °C) x 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 varistro 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)

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