



## varistor plus catalog

### Single Layer Varistor Technology

Surface Mount & Leaded Products



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# SEI ELECTRONICS / KEKO VARICON STRATEGIC ALLIANCE

## INTRODUCTION

SEI ELECTRONICS and KEKO VARICON have formed a strategic alliance to jointly promote the sale of transient voltage suppression components throughout North America under a program called Varistor Plus.

The Varistor Plus program combines a unique melding of leading-edge technological development, application engineering support and customer service designed to provide our customers with the best and broadest line of products and services in the industry.

The products offered in the Varistor Plus program include both multilayer and single layer varistors, packaged in EIA standard chip sizes and radial leaded configurations, which virtually cover every board level requirement for standard transient voltage protection. In addition, applications in market segments such as “Automotive,” “Telecom Switches (Line Cards),” “Industrial & Motor Controls” and “AC Power Networks” to name a few, are covered by specific product series designed for these unique transient voltage conditions.

## MULTILAYER PRODUCTS

Low voltage multilayer varistors span a DC voltage range of 3.0 to 125 V<sub>DC</sub>, with energy ratings from 0.05 to 37.8 joules. The wide range of EIA chip sizes, 0603 to 3225, accounts for the exceptionally broad product offering (one of the most extensive in the industry), and radial leaded MLVs are a new addition to the family of TVS protection components. The combination of these devices addresses all but the most extremely damaging transients to semiconductors and/or integrated circuits from: (1) ultra-high voltage, low-energy ESD events, (2) ultra-high voltage, high-energy near lightning strikes, (3) relatively low-to-medium voltage, high-energy inductive load disruptions, and all transient environments in between.

## SINGLE LAYER PRODUCTS

Low-to-medium voltage single layer (SLV) radial leaded discs, commonly known as MOVs, are designed primarily to operate in AC voltage applications. SEI's Varistor Plus products are offered in AC voltages from 11 V to 550 V, energy ratings from 0.6 to 815.0 joules and surge capabilities from 100 to 15,000 amps. Most applications are across AC power lines and protect against line surges generated from load switching, lightning and other forms of high-energy transient events. Please refer to the SEI/KEKO VARICON single layer catalog or contact SEI for any information related to SLV products.

## SPECIALTY PRODUCTS

The SEI Varistor Plus program embraces many specialty TVS products. Specific to the automotive industry, for example, the multilayer AV products offer exceptional electrical characteristics in much smaller packages and much higher levels of reliability than that achieved by typical automotive disc varistors. The multilayer OV (leaded) “dual function” component combines a low voltage varistor and capacitor into a single package for protection against voltage surges and RFI typically encountered in cars.

## KEKO VARICON HISTORY

KEKO VARICON, headquartered in Zuzemberk, Slovenia, has produced over-voltage protection devices for over 10 years. In the late 80s, the company was acquired by Zoran and Angela Zivic from the former ISKRA Group and was named KEKO VARICON (VARI from “VARIstor,” and CON from “CONdensator,” the old term for a capacitor). The ISKRA Group, started in the mid 50s, had previously manufactured both single layer and multilayer ceramic electronic components.

KEKO VARICON's General Manager, Zoran Zivic, has been actively involved in circuit protection developments in both active and passive components and material systems for more than 20 years. Mr. Zivic has written and published a wide variety of technical papers on electrical and electronic protection subjects and currently holds numerous product and material system patents. Considered one of the leading pioneers in developing surface mount protection devices, Zoran Zivic has earned and maintains the role as a technological leader in this industry.

## GENERAL NOTES

SEI's Varistor Plus / KEKO VARICON products have been tested and approved under the following standards:

UL1414, UL1449, CSA 22.2, IEC 1051.2 and CECC 42000.

## Table of Contents

### General Information

Varistor Glossary of Terms and Definitions . . . . . 1  
Overview of Protective Devices . . . . . 3

### Leaded Varistors

CV Series – Low & Medium Voltage Leaded Varistors . . . . . 4  
CV+ Series – Medium Voltage Leaded Varistors. . . . . 13  
SV Series – Special Medium Voltage Leaded Varistors . . . . . 20

### SMD Varistors

PV Series – Low & Medium Voltage Plastic Encapsulated SMD Varistors 28  
DV Series – Low & Medium Voltage SMD Varistors . . . . . 34

### High Energy Varistors

ZOV Series – High Energy Varistors . . . . . 40

### Packaging / Marking Information

Tape & Reel Specification – PV Series . . . . . 48  
Tape & Reel Specification – DV Series . . . . . 49  
Tape & Reel Specification – CV, CV+, SV Series . . . . . 50  
Lead Style (Version) / Lead Spacing – CV, CV+, SV Series. . . . . 51  
Varistor Marking – CV, CV+, SV, ZOV Series . . . . . 52

### Application Notes

Reliability Testing Procedures . . . . . 53  
SMD Soldering Recommendations. . . . . 54

**Varistor Glossary of Terms and Definitions**

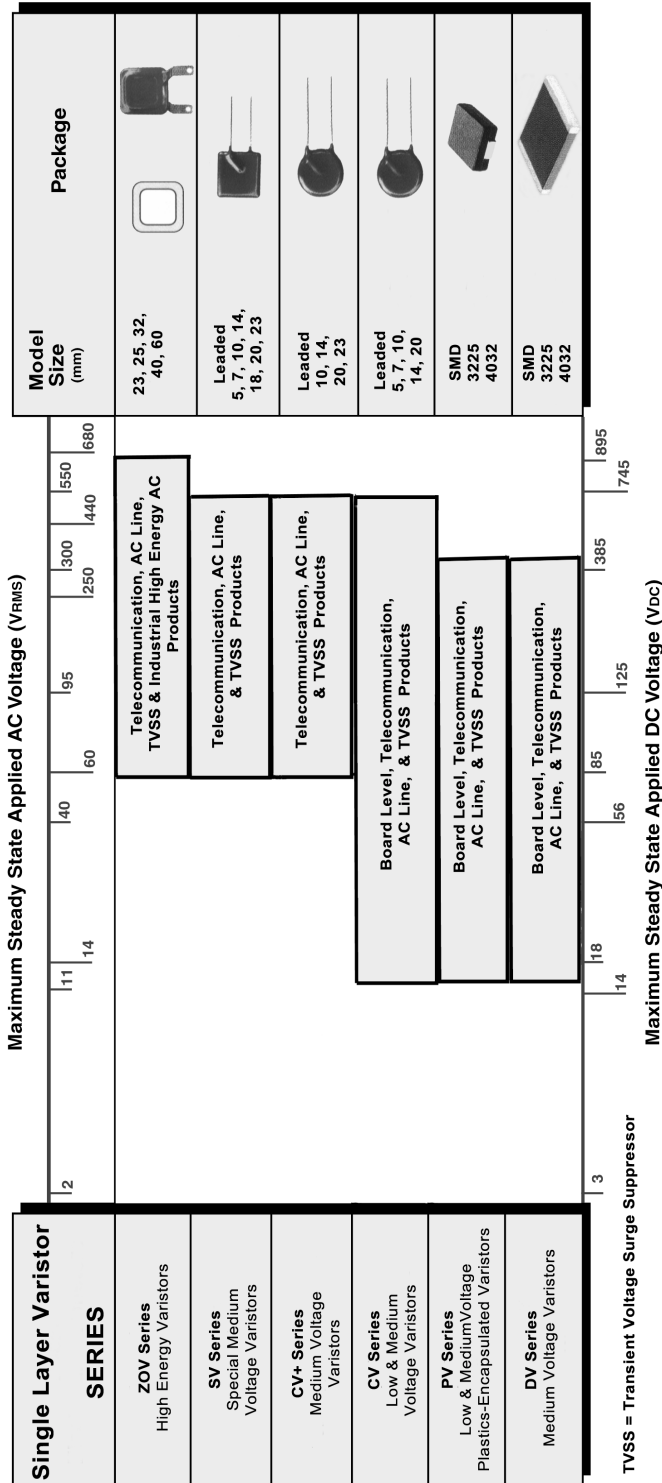
Term	Symbol	Definition
Rated AC Voltage	$V_{RMS}$	Maximum continuous sinusoidal AC voltage (< 5% total harmonic distortion) which may be applied to the varistor at 25°C.
Rated DC Voltage	$V_{DC}$	Maximum continuous DC voltage (< 5% ripple) which may be applied to the varistor at 25°C.
Leakage Current	$I_L$	Current passing through the varistor at rated DC voltage at 25°C or any other specified temperature.
Varistor Voltage	$V_N$	Voltage across the varistor measured at 1mA of DC current.
Clamping Voltage	$V_C$	Maximum peak voltage developed across the varistor when passing an 8/20 $\mu$ 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 an 8/20 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 $V_{DC}$ .
Single Pulse Transient Energy	$W_{MAX}$	Energy which may be dissipated for a single 10/1000 $\mu$ s pulse of a maximum rated current, with rated AC/DC voltage applied, without causing device failure.
Load Dump Transient	$W_{LD}$	Load Dump is a transient that occurs in an automotive environment. It is an exponentially decaying positive voltage that 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.
Single Pulse Peak Current	$I_P$	Maximum peak current that may be applied to the varistor for a single 8/20 $\mu$ s pulse, with line voltage applied, without causing device failure.
Average Power Dissipation	$P_{MAX}$	Maximum average dissipated power at 25°C resulting from a group of pulses occurring within a specified isolated time period, without causing device failure.
Capacitance	$C_{(TYP)}$	Capacitance between two terminals of the varistor measured at 1 kHz.
Inductance	$L$	Inductive component of the varistor when measured with a current edge rate (di/dt) of 100mA/ns. Values are typically measured in nanohenries (nH).
Jump Start Transient	$V_{JUMP}$	The jump start transient results from the temporary application of an over-voltage in excess of the rated battery voltage. The circuit power supply may be subjected to a temporary over-voltage condition due to the voltage regulation failing or it may be deliberately generated when it becomes necessary to boost start the car.
Response Time		The time lag between application of a surge and the varistor's "turn-on" conduction action.
Varistor Voltage Temperature Coefficient		$(V_N \text{ at } 85^\circ\text{C} - V_N \text{ at } 25^\circ\text{C}) / ((V_N \text{ at } 25^\circ\text{C}) \times 60^\circ\text{C}) \times 100$

## Varistor Glossary of Terms and Definitions

Insulation Resistance	IR	Minimum resistance between shorted terminals and varistor surface.
Isolation Voltage		The maximum peak voltage that 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.
Storage Temperature		Storage temperature range without voltage applied.
Current/Energy Derating		Derating of maximum values when operated above the varistor's rated continuous operating temperature.

Overview of Protective Devices (by Varistor Series)

Overview of Protective Devices



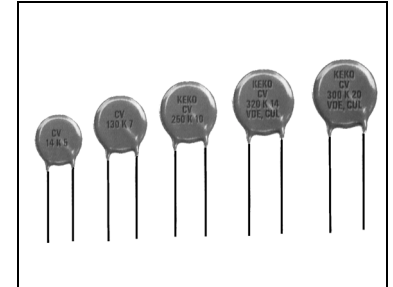
## Single Layer Technology

## Varistor Plus

### Description

The CV Series of transient surge suppressors are disc-shaped varistors that can be operated continuously in low and medium voltage electronic circuits, 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: 5 mm, 7 mm, 10 mm, 14 mm and 20 mm and feature a wide range of AC operating voltages from 11V to 550V.



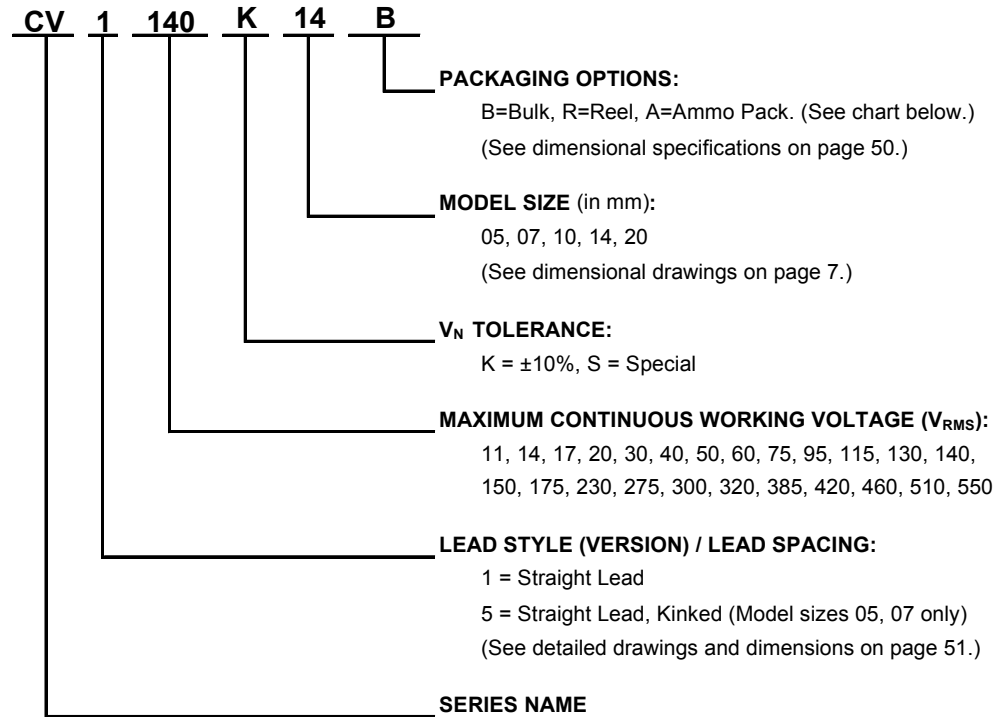
### Features

- Operating voltage range  $V_{RMS}$ .....11V to 550V
- Operating voltage range  $V_{DC}$ .....14V to 745V
- 5 model sizes available.....5 mm, 7 mm, 10 mm, 14 mm, 20 mm
- Broad range of current handling capability  $I_P$ .....100A to 6500A (8/20  $\mu$ s)
- Broad range of energy absorption capability  $W_{MAX}$ .....0.6J to 515J (10/1000  $\mu$ s)
- +85°C continuous operating temperature
- Available in tape and reel for automatic pick and place
- UL1414 & CSA C22.2, File E163318 (Across-The-Line-Components) for CV 130...300K 07...20
- UL1449, File E195529 (Transient Voltage Surge Suppressors) for CV 20...40K 5...10, CV 50...95K 5...20, CV 130...300K 07...20, CV 230...300K 5, CV 385...510K 10...20
- Reg. Nr. 10144 - CECC 42000/42200/42201, File 5883.11-4790-1001/A11 for CV 60,,300K 07...20
- UL1449 & CSA 22.2, file E221545 (Transient Viltant Surge Suppressors), for CV 20...550K 5...20

### Absolute Maximum Ratings

<b>Continuous:</b>	Value
Steady State Applied Voltage:	
DC Voltage Range ( $V_{DC}$ )	14V to 745V
AC Voltage Range ( $V_{RMS}$ )	11V to 550V
<b>Transient:</b>	
Peak Single Pulse Surge Current, 8/20 $\mu$ s Waveform ( $I_P$ )	100A to 6500A
Single Pulse Surge Energy, 10/1000 $\mu$ s Waveform ( $W_{MAX}$ )	0.6J to 515J
Operating Ambient Temperature	-40°C to +85°C
Storage Temperature Range	-40°C to +125°C
Threshold Voltage Temperature Coefficient	< - 0.05% / °C
Insulation Resistance	> 1G $\Omega$
Isolation Voltage Capability	>2.5kV
Response Time	< 25ns
Climatic Category	40/85/56

**HOW TO ORDER: CV SERIES (LOW & MEDIUM VOLTAGE LEADED VARISTORS)**



**Standard Packaging Options / Quantities**

Series	Voltage Range	Size	B	R	A
CV	11 to 150	5	2000	2000	2500
	175 to 230		2000	2000	2000
	250 to 275		1500	1500	1300
	11 to 230	7	1500	1500	2000
	250 to 300		1000	1000	1500
	14 to 115	10	1000	1500	2000
	130 to 230		800	1000	1500
	250 to 300		800	1000	1200
	320 to 550		500	300	
	40 to 115	14	700	800	900
	130 to 320		500	700	800
	385 to 550		300		
	40 to 75	20	500	700	800
	95 to 140		400	700	800
	150 to 420		300	500	600
	460 to 550		200		



Single Layer Technology

Varistor Plus

Device Ratings and Characteristics

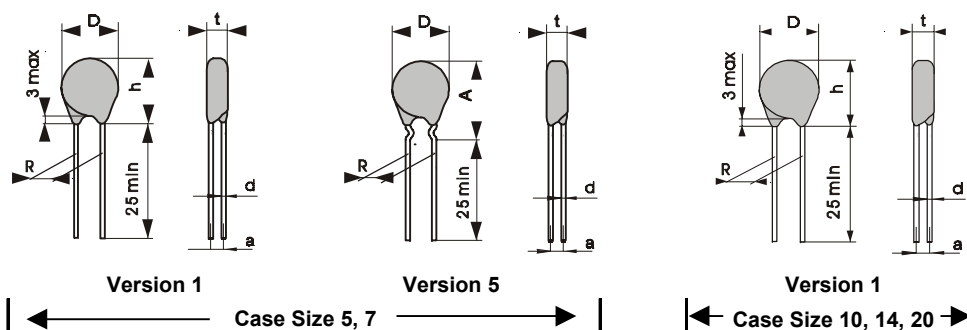
CV 11 K 05.....CV 300 K 07

Catalog Number	V <sub>RMS</sub>	V <sub>DC</sub>	V <sub>N</sub> @ 1 mA	V <sub>C</sub>	I <sub>C</sub>	W <sub>MAX</sub> 10/1000 μs	P <sub>MAX</sub>	I <sub>P</sub> 8/20 μs	C <sub>(TYP)</sub> 1kHz	D <sub>MAX</sub>	t <sub>MAX</sub>	R	d	h <sub>MAX</sub>
Unit of Measure	Volts	Volts	Volts	Volts	Amps	Joules	Watts	Amps	pF	mm	mm	mm	mm	mm
CV 11 K 05	11	14	18	36	1	0.6	0.01	100	1250	7	3.5	5	0.6	9.5
CV 14 K 05	14	18	22	43	1	0.7	0.01	100	980	7	3.6	5	0.6	9.5
CV 17 K 05	17	22	27	53	1	0.9	0.01	100	810	7	3.7	5	0.6	9.5
CV 20 K 05	20	26	33	65	1	1.1	0.01	100	690	7	3.9	5	0.6	9.5
CV 25 K 05	25	31	39	77	1	1.2	0.01	100	550	7	3.9	5	0.6	9.5
CV 30 K 05	30	38	47	93	1	1.5	0.01	100	460	7	3.8	5	0.6	9.5
CV 35 K 05	35	45	56	110	1	1.8	0.01	100	380	7	3.9	5	0.6	9.5
CV 40 K 05	40	56	68	135	1	2.2	0.01	100	350	7	4.1	5	0.6	9.5
CV 50 K 05	50	65	82	135	5	2.7	0.1	400	350	7	3.5	5	0.6	9.5
CV 60 K 05	60	85	100	165	5	3	0.1	400	300	7	3.5	5	0.6	9.5
CV 75 K 05	75	100	120	200	5	4	0.1	400	250	7	3.6	5	0.6	9.5
CV 95 K 05	95	125	150	250	5	6	0.1	400	200	7	3.8	5	0.6	9.5
CV 115 K 05	115	150	180	300	5	6	0.1	400	180	7	4	5	0.6	9.5
CV 130 K 05	130	170	205	340	5	7	0.1	400	160	7	4	5	0.6	9.5
CV 140 K 05	140	180	220	360	5	7	0.1	400	150	7	4.1	5	0.6	9.5
CV 150 K 05	150	200	240	395	5	9	0.1	400	140	7	4.3	5	0.6	9.5
CV 175 K 05	175	225	270	455	5	9.5	0.1	400	120	7	4.8	5	0.6	9.5
CV 230 K 05	230	300	360	595	5	13	0.1	400	95	7	4.8	5	0.6	9.5
CV 250 K 05	250	320	390	650	5	14	0.1	400	80	7	5	5	0.6	9.5
CV 275 K 05	275	350	430	710	5	16	0.1	400	75	7	5.6	5	0.6	9.5
CV 11 K 07	11	14	18	36	2.5	1.1	0.02	250	2900	9	3.5	5	0.6	11.5
CV 14 K 07	14	18	22	43	2.5	1.3	0.02	250	2250	9	3.6	5	0.6	11.5
CV 17 K 07	17	22	27	53	2.5	1.6	0.02	250	1850	9	3.7	5	0.6	11.5
CV 20 K 07	20	26	33	65	2.5	2	0.02	250	1600	9	3.9	5	0.6	11.5
CV 25 K 07	25	31	39	77	2.5	2.4	0.02	250	1300	9	3.9	5	0.6	11.5
CV 30 K 07	30	38	47	93	2.5	2.8	0.02	250	1100	9	3.8	5	0.6	11.5
CV 35 K 07	35	45	56	110	2.5	3.4	0.02	250	910	9	3.9	5	0.6	11.5
CV 40 K 07	40	56	68	135	2.5	4.1	0.02	250	800	9	4.1	5	0.6	11.5
CV 50 K 07	50	65	82	135	10	6.8	0.25	1200	820	9	3.5	5	0.6	11.5
CV 60 K 07	60	85	100	165	10	7	0.25	1200	680	9	3.5	5	0.6	11.5
CV 75 K 07	75	100	120	200	10	9	0.25	1200	550	9	3.6	5	0.6	11.5
CV 95 K 07	95	125	150	250	10	11	0.25	1200	440	9	3.8	5	0.6	11.5
CV 115 K 07	115	150	180	300	10	13	0.25	1200	360	9	4	5	0.6	11.5
CV 130 K 07	130	170	205	340	10	15	0.25	1200	320	9	4	5	0.6	11.5
CV 140 K 07	140	180	220	360	10	18	0.25	1200	300	9	4.1	5	0.6	11.5
CV 150 K 07	150	200	240	395	10	18	0.25	1200	280	9	4.3	5	0.6	11.5
CV 175 K 07	175	225	270	455	10	21	0.25	1200	250	9	4.8	5	0.6	11.5
CV 230 K 07	230	300	360	595	10	28	0.25	1200	190	9	4.8	5	0.6	11.5
CV 250 K 07	250	320	390	650	10	30	0.25	1200	180	9	5	5	0.6	11.5
CV 275 K 07	275	350	430	710	10	35	0.25	1200	160	9	5.6	5	0.6	11.5
CV 300 K 07	300	385	470	775	10	37	0.25	1200	150	9	5.8	5	0.6	11.5

Device Ratings and Characteristics

CV 14 K 10.....CV 550 K 10

Catalog Number	V <sub>RMS</sub>	V <sub>DC</sub>	V <sub>N</sub> @ 1 mA	V <sub>C</sub>	I <sub>C</sub>	W <sub>MAX</sub> 10/1000 μs	P <sub>MAX</sub>	I <sub>P</sub> 8/20 μs	C <sub>(TYP)</sub> 1kHz	D <sub>MAX</sub>	t <sub>MAX</sub>	R	d	h <sub>MAX</sub>
Unit of Measure	Volts	Volts	Volts	Volts	Amps	Joules	Watts	Amps	pF	mm	mm	mm	mm	mm
CV 14 K 10	14	18	22	43	5	3.2	0.05	500	5200	12.5	4.2	7.5	0.8	15
CV 17 K 10	17	22	27	53	5	3.9	0.05	500	4000	12.5	4.3	7.5	0.8	15
CV 20 K 10	20	26	33	65	5	4.8	0.05	500	3100	12.5	4.5	7.5	0.8	15
CV 25 K 10	25	31	39	77	5	5.6	0.05	500	2800	12.5	4.3	7.5	0.8	15
CV 30 K 10	30	38	47	93	5	6.8	0.05	500	2150	12.5	4.4	7.5	0.8	15
CV 35 K 10	35	45	56	110	5	8.1	0.05	500	1900	12.5	4.5	7.5	0.8	15
CV 0 K 10	40	56	68	135	5	9.8	0.05	500	1700	12.5	4.8	7.5	0.8	15
CV 50 K 10	50	65	82	135	25	17	0.4	2500	1400	12.5	4.1	7.5	0.8	15
CV 60 K 10	60	85	100	165	25	16	0.4	2500	1200	12.5	4.1	7.5	0.8	15
CV 75 K 10	75	100	120	200	25	21	0.4	2500	950	12.5	4.2	7.5	0.8	15
CV 95 K 10	95	125	150	250	25	25	0.4	2500	750	12.5	4.3	7.5	0.8	15
CV 115 K 10	115	150	180	300	25	30	0.4	2500	650	12.5	4.3	7.5	0.8	15
CV 130 K 10	130	170	205	340	25	34	0.4	2500	580	12.5	4.5	7.5	0.8	15
CV 140 K 10	140	180	220	360	25	37	0.4	2500	540	12.5	4.6	7.5	0.8	15
CV 150 K 10	150	200	240	395	25	41	0.4	2500	510	12.5	4.6	7.5	0.8	15
CV 175 K 10	175	225	270	455	25	46	0.4	2500	440	12.5	4.9	7.5	0.8	15
CV 230 K 10	230	300	360	595	25	62	0.4	2500	350	12.5	5.4	7.5	0.8	15
CV 250 K 10	250	320	390	650	25	68	0.4	2500	320	12.5	5.6	7.5	0.8	15
CV 275 K 10	275	350	430	710	25	78	0.4	2500	300	12.5	6	7.5	0.8	15
CV 300 K 10	300	385	470	775	25	82	0.4	2500	280	12.5	6.1	7.5	0.8	15
CV 320 K 10	320	420	510	840	25	91	0.4	2500	260	12.5	6.8	7.5	0.8	15
CV 385 K 10	385	505	620	1025	25	93	0.4	2500	230	12.5	7.4	7.5	0.8	16
CV 420 K 10	420	560	680	1120	25	97	0.4	2500	210	12.5	7.3	7.5	0.8	16
CV 460 K 10	460	615	750	1240	25	106	0.4	2500	200	12.5	7.8	7.5	0.8	16
CV 510 K 10	510	670	820	1355	25	115	0.4	2500	180	12.5	8.2	7.5	0.8	16
CV 550 K 10	550	745	910	1500	25	134	0.4	2500	170	12.5	8.8	7.5	0.8	16



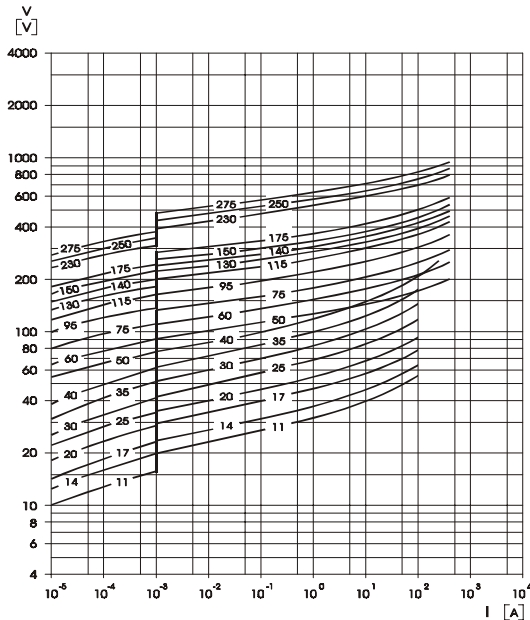
Device Ratings and Characteristics

CV 20 K 14.....CV 550 K 20

Catalog Number	V <sub>RMS</sub>	V <sub>DC</sub>	V <sub>N</sub> @ 1 mA	V <sub>C</sub>	I <sub>C</sub>	W <sub>MAX</sub> 10/1000 μs	P <sub>MAX</sub>	I <sub>P</sub> 8/20 μs	C <sub>(TYP)</sub> 1kHz	D <sub>MAX</sub>	t <sub>MAX</sub>	R	d	h <sub>MAX</sub>
Unit of Measure	Volts	Volts	Volts	Volts	Amps	Joules	Watts	Amps	pF	mm	mm	mm	mm	mm
CV 20 K 14	20	26	33	65	10	9.5	0.1	1000	5500	16.5	4.6	7.5	0.8	20
CV 25 K 14	25	31	39	77	10	11	0.1	1000	4600	16.5	4.4	7.5	0.8	20
CV 30 K 14	30	38	47	93	10	14	0.1	1000	3500	16.5	4.5	7.5	0.8	20
CV 35 K 14	35	45	56	110	10	16	0.1	1000	3100	16.5	4.7	7.5	0.8	20
CV 40 K 14	40	56	68	135	10	20	0.1	1000	2800	16.5	4.9	7.5	0.8	20
CV 50 K 14	50	65	82	135	50	35	0.6	4500	2600	16.5	4.1	7.5	0.8	20
CV 60 K 14	60	85	100	165	50	34	0.6	4500	2200	16.5	4.2	7.5	0.8	20
CV 75 K 14	75	100	120	200	50	41	0.6	4500	1800	16.5	4.2	7.5	0.8	20
CV 95 K 14	95	125	150	250	50	51	0.6	4500	1400	16.5	4.3	7.5	0.8	20
CV 115 K 14	115	150	180	300	50	62	0.6	4500	1200	16.5	4.4	7.5	0.8	20
CV 130 K 14	130	170	205	340	50	68	0.6	4500	1050	16.5	4.6	7.5	0.8	20
CV 140 K 14	140	180	220	360	50	75	0.6	4500	980	16.5	4.7	7.5	0.8	20
CV 150 K 14	150	200	240	395	50	81	0.6	4500	900	16.5	1.8	7.5	0.8	20
CV 175 K 14	175	225	270	455	50	95	0.6	4500	800	16.5	4.9	7.5	0.8	20
CV 230 K 14	230	300	360	595	50	126	0.6	4500	620	16.5	5.5	7.5	0.8	20
CV 250 K 14	250	320	390	650	50	135	0.6	4500	580	16.5	5.7	7.5	0.8	20
CV 275 K 14	275	350	430	710	50	150	0.6	4500	530	16.5	6	7.5	0.8	20
CV 300 K 14	300	385	470	775	50	169	0.6	4500	490	16.5	6.1	7.5	0.8	20
CV 320 K 14	320	420	510	840	50	184	0.6	4500	460	16.5	6.8	7.5	0.8	21
CV 385 K 14	385	505	620	1025	50	193	0.6	4500	390	16.5	7.4	7.5	0.8	21
CV 420 K 14	420	560	680	1120	50	202	0.6	4500	370	16.5	7.4	7.5	0.8	21
CV 460 K 14	460	615	750	1240	50	220	0.6	4500	340	16.5	7.8	7.5	0.8	21
CV 510 K 14	510	670	820	1355	50	227	0.6	4500	310	16.5	8.2	7.5	0.8	21
CV 550 K 14	550	745	910	1500	50	264	0.6	4500	290	16.5	8.8	7.5	0.8	21
CV 25 K 20	25	31	39	77	20	28	0.2	2000	8600	22.5	4.8	10	1	26
CV 30 K 20	30	38	47	93	20	34	0.2	2000	5600	22.5	5	10	1	26
CV 35 K 20	35	45	56	110	20	41	0.2	2000	6100	22.5	5.2	10	1	26
CV 40 K 20	40	56	68	135	20	49	0.2	2000	5300	22.5	5.4	10	1	26
CV 50 K 20	50	65	82	135	100	75	1	6500	5000	22.5	4.5	10	1	26
CV 60 K 20	60	85	100	165	100	71	1	6500	4100	22.5	4.6	10	1	26
CV 75 K 20	75	100	120	200	100	81	1	6500	3300	22.5	4.6	10	1	26
CV 95 K 20	95	125	150	250	100	106	1	6500	2600	22.5	4.6	10	1	26
CV 115 K 20	115	150	180	300	100	118	1	6500	2100	22.5	4.8	10	1	26
CV 130 K 20	130	170	205	340	100	142	1	6500	1900	22.5	5	10	1	26
CV 140 K 20	140	180	220	360	100	157	1	6500	1800	22.5	5.1	10	1	26
CV 150 K 20	150	200	240	395	100	170	1	6500	1600	22.5	5.2	10	1	26
CV 175 K 20	175	225	270	455	100	193	1	6500	1400	22.5	5.3	10	1	26
CV 230 K 20	230	300	360	595	100	258	1	6500	1100	22.5	5.9	10	1	26
CV 250 K 20	250	320	390	650	100	276	1	6500	1000	22.5	6.1	10	1	26
CV 275 K 20	275	350	430	710	100	304	1	6500	900	22.5	6.3	10	1	26
CV 300 K 20	300	385	470	775	100	350	1	6500	850	22.5	6.6	10	1	26
CV 320 K 20	320	420	510	840	100	388	1	6500	800	22.5	6.8	10	1	27
CV 385 K 20	385	505	620	1025	100	396	1	6500	650	22.5	7.5	10	1	27
CV 420 K 20	420	560	680	1120	100	418	1	6500	620	22.5	7.8	10	1	27
CV 460 K 20	460	615	750	1240	100	460	1	6500	560	22.5	8.2	10	1	27
CV 510 K 20	510	670	820	1355	100	478	1	6500	510	22.5	8.7	10	1	27
CV 550 K 20	550	745	910	1500	100	515	1	6500	480	22.5	9.2	10	1	27

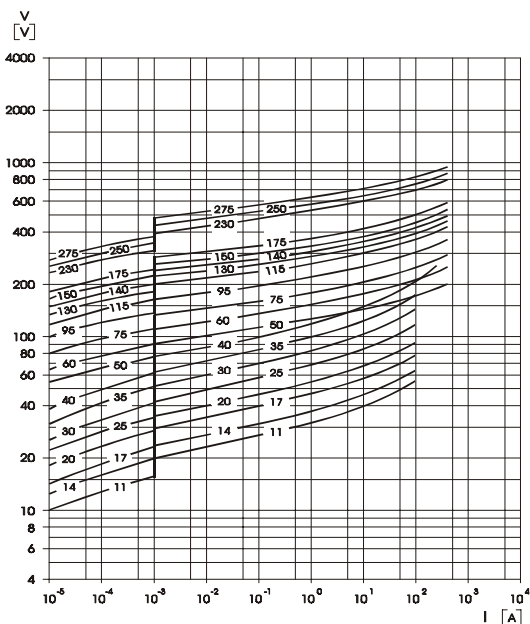
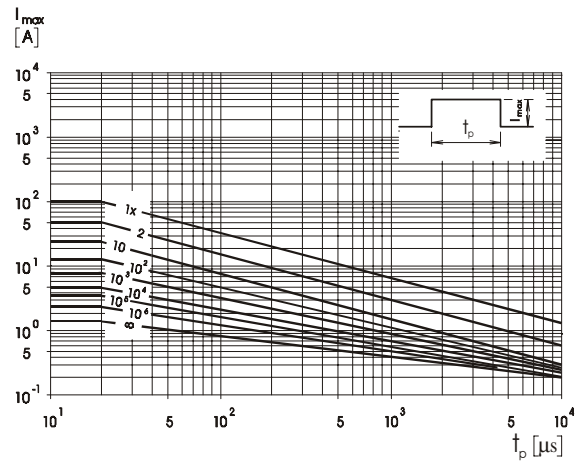
Performance Characteristics

Voltage/Current Curves

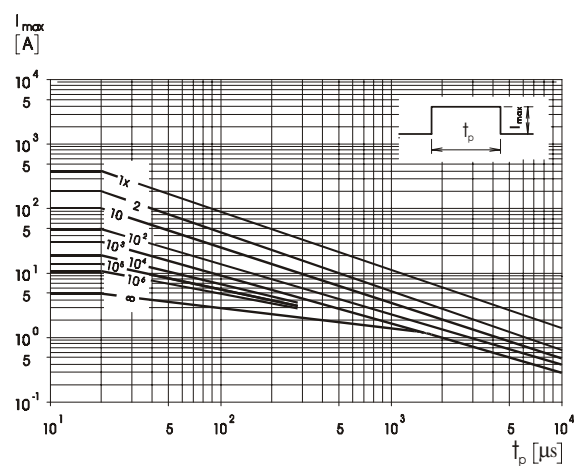


CV 11...40K 05

Pulse Rating Curves

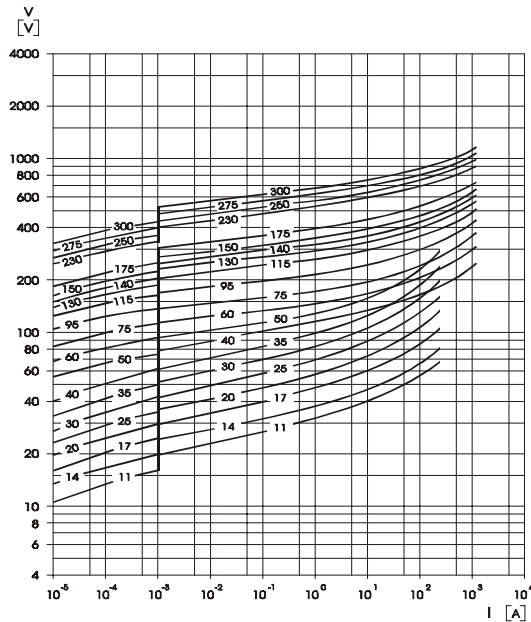


CV 50...275K 05



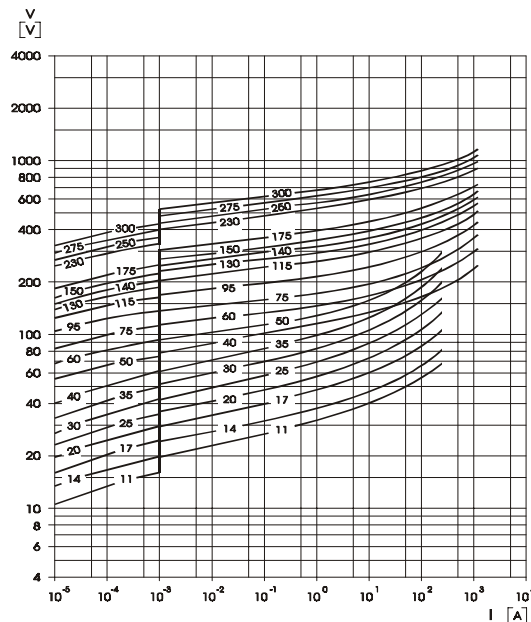
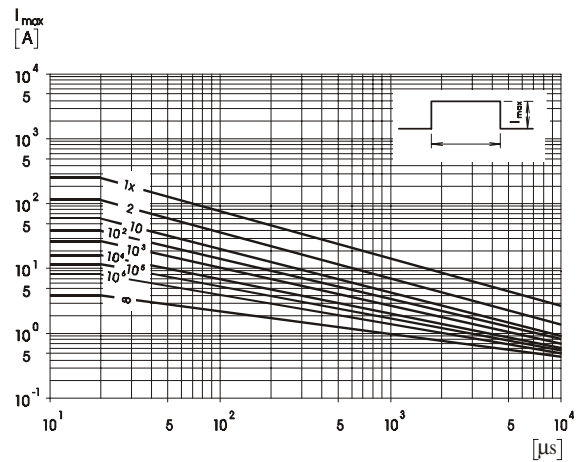
Performance Characteristics

Voltage/Current Curves

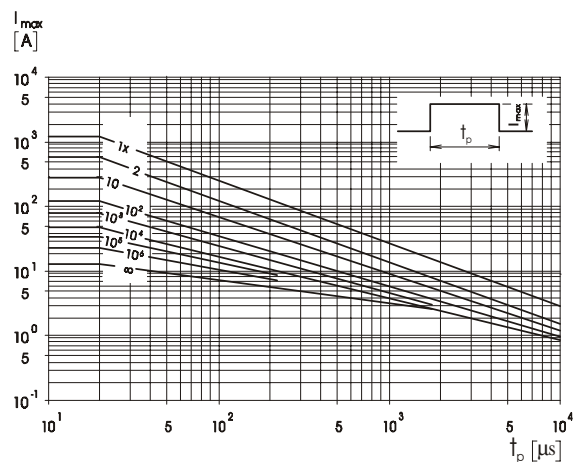


CV 11...40K 07

Pulse Rating Curves

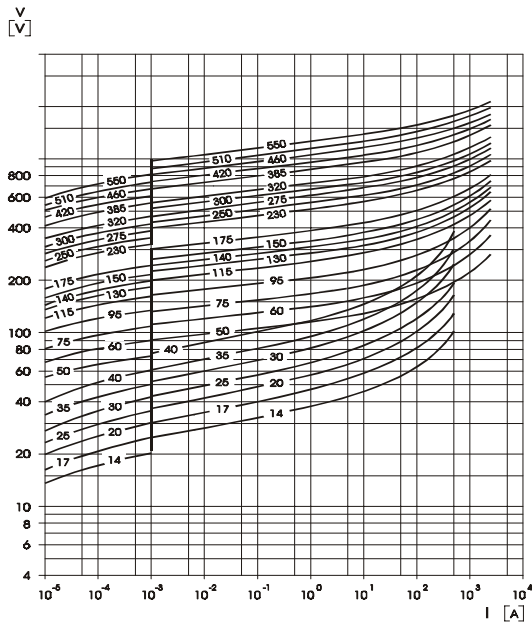


CV 50...300K 07



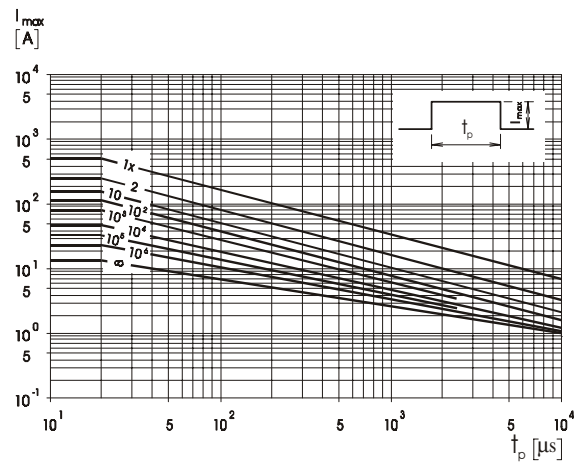
Performance Characteristics

Voltage/Current Curves

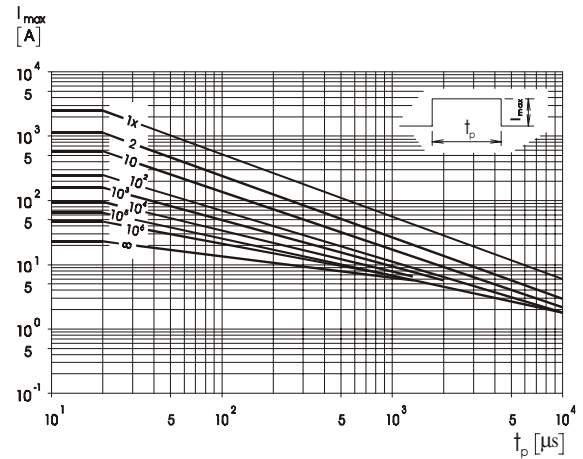
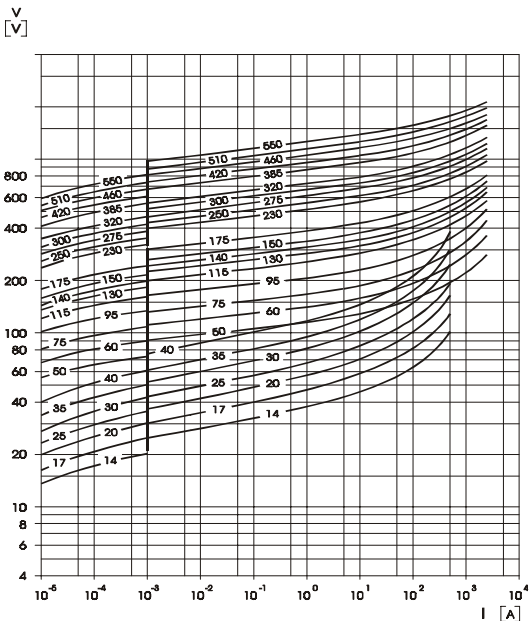


CV 14...40K 10

Pulse Rating Curves



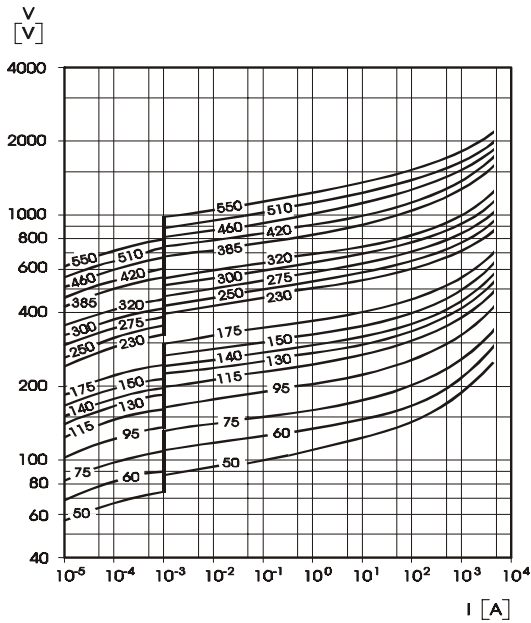
CV 50...550K 10



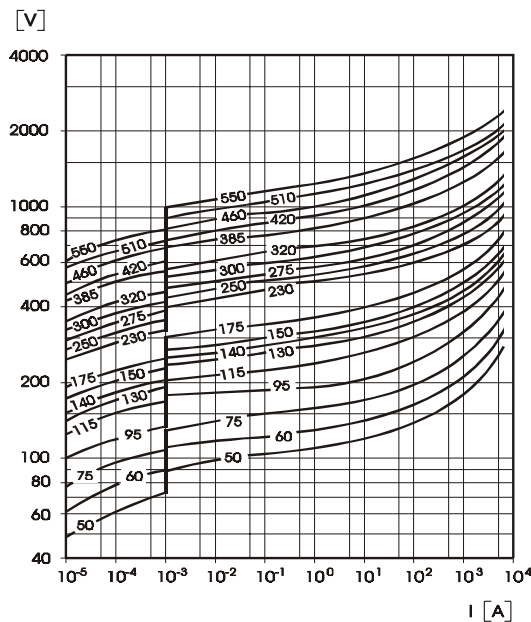
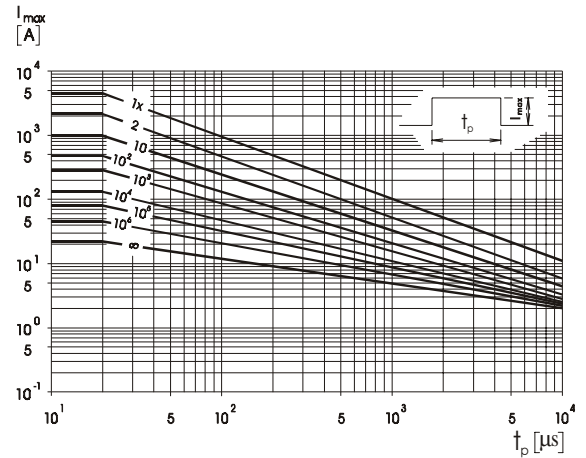
Performance Characteristics

Voltage/Current Curves

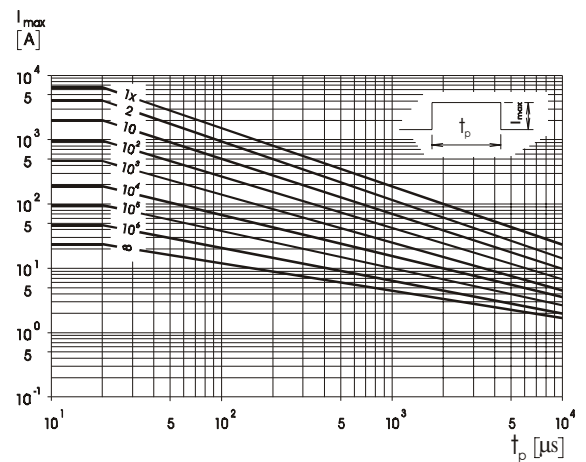
Pulse Rating Curves



CV 50...550K 14



CV 50...550K 20



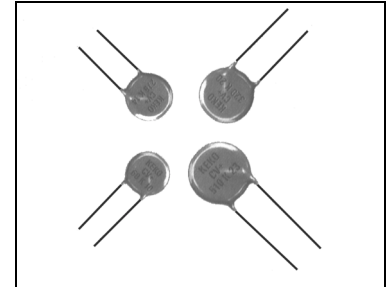
Single Layer Technology

Varistor Plus

**Description**

The CV+ Series of transient surge suppressors is an extended version of the CV Series of disc-shaped varistors. The CV+ Series consists of 7mm, 10 mm, 14 mm, 20 mm, and 23 mm sized varistors of extremely high current and energy capabilities.

They provide the increased level of protection necessary for the transients expected in telecommunication and AC power networks. AC operating voltage of these varistors ranges from 60V to 550V.



**Features**

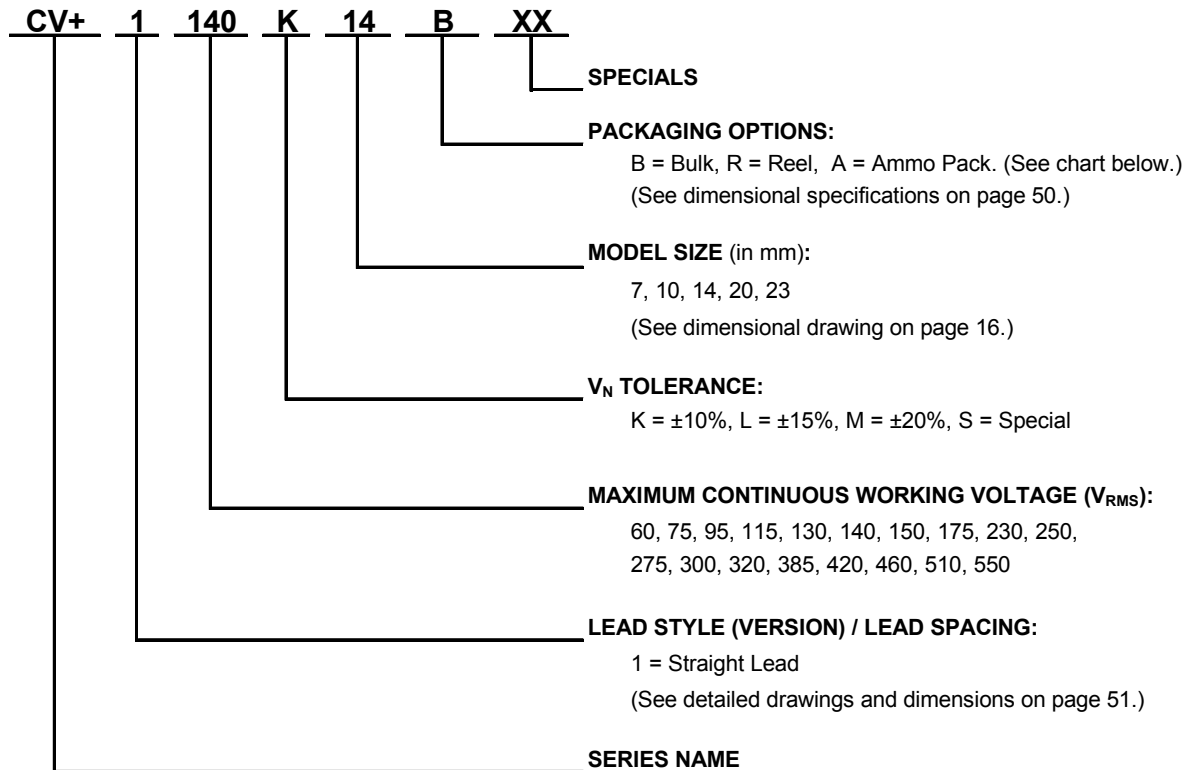
- Operating voltage range  $V_{RMS}$ .....60V to 550V
- Operating voltage range  $V_{DC}$ .....85V to 745V
- 5 model sizes available.....7mm, 10 mm, 14 mm, 20 mm, 23 mm
- Broad range current handling capability  $I_{MAX}$ .....1750A to 15000 A (8/20  $\mu$ s)
- Broad range energy absorption capability  $W_{MAX}$ .....9J to 627J (10/1000  $\mu$ s)
- +85°C continuous operating temperature
- Sizes 7mm,10mm, 14mm, 20mm available in tape and reel for automatic pick and place
- UL1449, File E195529 (Transient Voltage Surge Suppressors), for CV+ 130...300 K 10...20, CV+ 385...460 K 10...20
- UI1449 & CSA 22.2 (Transient Voltage Surge Suppressors), for CV+ 60...550 K 7...23 pending

**Absolute Maximum Ratings**

<b>Continuous:</b>	Value
Steady State Applied Voltage:	
DC Voltage Range ( $V_{DC}$ )	85V to 745V
AC Voltage Range ( $V_{RMS}$ )	60V to 550V
<b>Transient:</b>	
Peak Single Pulse Surge Current, 8/20 $\mu$ s Waveform ( $I_{MAX}$ )	1750A to 15000A
Single Pulse Surge Energy, 10/1000 $\mu$ s Waveform ( $W_{MAX}$ )	9J to 627J
Operating Ambient Temperature	-40°C to +85°C
Storage Temperature Range	-40°C to +125°C
Threshold Voltage Temperature Coefficient	< - 0.05% / °C
Insulation Resistance	> 1G $\Omega$
Isolation Voltage Capability	> 2.5kV
Response Time	< 25ns
Climatic Category	40/85/56



**HOW TO ORDER: CV+ SERIES (MEDIUM VOLTAGE LEADED VARISTORS)**



**Standard Packaging Options / Quantities**

Series	Voltage Range	Size	B	R	A
CV+	11 to 230	7	1500	1500	2000
	250 to 300		1000	1000	1500
	14 to 115	10	1000	1500	2000
	130 to 230		800	1000	1500
	250 to 300		800	1000	1200
	40 to 115	14	700	800	900
	130 to 320		500	700	800
	385 to 550		300		
	40 to 75	20	500	700	800
	95 to 140		400	700	800
	150 to 420		300	500	600
	460 to 550		200		
	130 to 275	23	150		
	300 to 420		100		
	460 to 550		100		

Single Layer Technology

Varistor Plus

Device Ratings and Characteristics

CV+ 60 K 07.....CV+ 550 K 14

Catalog Number	V <sub>RMS</sub>	V <sub>DC</sub>	V <sub>N</sub> @ 1 mA	V <sub>C</sub>	I <sub>C</sub>	W <sub>MAX</sub> 10/1000 μs	P <sub>MAX</sub>	I <sub>P</sub> 8/20 μs	C <sub>(TYP)</sub> 1kHz	D <sub>MAX</sub>	t <sub>MAX</sub>	R	d	h <sub>MAX</sub>
Unit of Measure	Volts	Volts	Volts	Volts	Amps	Joules	Watts	Amps	pF	mm	mm	mm	mm	mm
CV+ 60 K 07	60	85	100	165	10	9	0.25	1750	680	9	3.5	5	0.6	11.5
CV+ 75 K 07	75	100	120	200	10	11	0.25	1750	550	9	3.6	5	0.6	11.5
CV+ 95 K 07	95	125	150	250	10	14	0.25	1750	440	9	3.8	5	0.6	11.5
CV+ 115 K 07	115	150	180	300	10	16	0.25	1750	360	9	4.0	5	0.6	11.5
CV+ 130 K 07	130	170	205	340	10	19	0.25	1750	360	9	4.0	5	0.6	11.5
CV+ 140 K 07	140	180	220	360	10	22	0.25	1750	300	9	4.1	5	0.6	11.5
CV+ 150 K 07	150	200	240	395	10	23	0.25	1750	280	9	4.3	5	0.6	11.5
CV+ 175 K 07	175	225	270	455	10	26	0.25	1750	250	9	4.8	5	0.6	11.5
CV+ 230 K 07	230	300	360	595	10	35	0.25	1750	190	9	4.8	5	0.6	11.5
CV+ 250 K 07	250	320	390	650	10	38	0.25	1750	180	9	5.0	5	0.6	11.5
CV+ 275 K 07	275	350	430	710	10	44	0.25	1750	160	9	5.6	5	0.6	11.5
CV+ 300 K 07	300	385	470	775	10	46	0.25	1750	150	9	5.8	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	15.0
CV+ 75 K 10	75	100	120	200	25	24	0.4	3500	950	12.5	4.2	7.5	0.8	15.0
CV+ 95 K 10	95	125	150	250	25	28	0.4	3500	750	12.5	4.3	7.5	0.8	15.0
CV+ 115 K 10	115	150	180	300	25	34	0.4	3500	650	12.5	4.3	7.5	0.8	15.0
CV+ 130 K 10	130	170	205	340	25	38	0.4	3500	580	12.5	4.5	7.5	0.8	15.0
CV+ 140 K 10	140	180	220	360	25	42	0.4	3500	540	12.5	4.6	7.5	0.8	15.0
CV+ 150 K 10	150	200	240	395	25	46	0.4	3500	510	12.5	4.6	7.5	0.8	15.0
CV+ 175 K 10	175	225	270	455	25	53	0.4	3500	440	12.5	4.9	7.5	0.8	15.0
CV+ 230 K 10	230	300	360	595	25	71	0.4	3500	350	12.5	5.4	7.5	0.8	15.0
CV+ 250 K 10	250	320	390	650	25	77	0.4	3500	320	12.5	5.6	7.5	0.8	15.0
CV+ 275 K 10	275	350	430	710	25	88	0.4	3500	300	12.5	5.8	7.5	0.8	15.0
CV+ 300 K 10	300	385	470	775	25	93	0.4	3500	280	12.5	6.1	7.5	0.8	15.0
CV+ 320 K 10	320	420	510	840	25	104	0.4	3500	260	12.5	5.9	7.5	0.8	15.0
CV+ 385 K 10	385	505	620	1025	25	106	0.4	3500	230	12.5	6.4	7.5	0.8	15.0
CV+ 420 K 10	420	560	680	1120	25	110	0.4	3500	210	12.5	7.3	7.5	0.8	16.0
CV+ 460 K 10	460	615	750	1240	25	120	0.4	3500	200	12.5	7.8	7.5	0.8	16.0
CV+ 510 K 10	510	670	820	1355	25	131	0.4	3500	180	12.5	8.2	7.5	0.8	16.0
CV+ 550 K 10	550	745	910	1500	25	153	0.4	3500	170	12.5	8.8	7.5	0.8	16.0
CV+ 60 K 14	60	85	100	165	50	38	0.6	6000	2200	16.5	4.2	7.5	0.8	20.0
CV+ 75 K 14	75	100	120	200	50	46	0.6	6000	1800	16.5	4.2	7.5	0.8	20.0
CV+ 95 K 14	95	125	150	250	50	58	0.6	6000	1400	16.5	4.3	7.5	0.8	20.0
CV+ 115 K 14	115	150	180	300	50	71	0.6	6000	1200	16.5	4.4	7.5	0.8	20.0
CV+ 130 K 14	130	170	205	340	50	77	0.6	6000	1050	16.5	4.6	7.5	0.8	20.0
CV+ 140 K 14	140	180	220	360	50	85	0.6	6000	980	16.5	4.7	7.5	0.8	20.0
CV+ 150 K 14	150	200	240	395	50	92	0.6	6000	900	16.5	4.8	7.5	0.8	20.0
CV+ 175 K 14	175	225	270	455	50	108	0.6	6000	800	16.5	4.9	7.5	0.8	20.0
CV+ 230 K 14	230	300	360	595	50	143	0.6	6000	620	16.5	5.5	7.5	0.8	20.0
CV+ 250 K 14	250	320	390	650	50	154	0.6	6000	580	16.5	5.7	7.5	0.8	20.0
CV+ 275 K 14	275	350	430	710	50	170	0.6	6000	530	16.5	5.9	7.5	0.8	20.0
CV+ 300 K 14	300	385	470	775	50	192	0.6	6000	490	16.5	6.1	7.5	0.8	20.0
CV+ 320 K 14	320	420	510	840	50	209	0.6	6000	460	16.5	6.5	7.5	0.8	20.0
CV+ 385 K 14	385	505	620	1025	50	219	0.6	6000	390	16.5	6.9	7.5	0.8	20.0
CV+ 420 K 14	420	560	680	1120	50	230	0.6	6000	370	16.5	7.4	7.5	0.8	21.0
CV+ 460 K 14	460	615	750	1240	50	250	0.6	6000	340	16.5	7.8	7.5	0.8	21.0
CV+ 510 K 14	510	670	820	1355	50	258	0.6	6000	310	16.5	8.2	7.5	0.8	21.0
CV+ 550 K 14	550	745	910	1500	50	300	0.6	6000	290	16.5	8.8	7.5	0.8	21.0

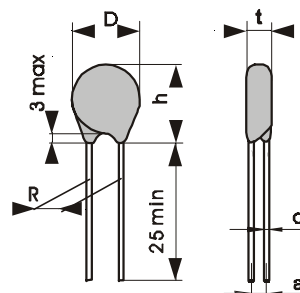
Single Layer Technology

Varistor Plus

Device Ratings and Characteristics

CV+ 60 K 20.....CV+ 550 K 23

Catalog Number	V <sub>RMS</sub>	V <sub>DC</sub>	V <sub>N</sub> @ 1 mA	V <sub>C</sub>	I <sub>C</sub>	W <sub>MAX</sub> 10/1000 μs	P <sub>MAX</sub>	I <sub>P</sub> 8/20 μs	C <sub>(TYP)</sub> 1kHz	D <sub>MAX</sub>	t <sub>MAX</sub>	R	d	h <sub>MAX</sub>
Unit of Measure	Volts	Volts	Volts	Volts	Amps	Joules	Watts	Amps	pF	mm	mm	mm	mm	mm
CV+ 60 K 20	60	85	100	165	100	77	1.0	12000	4100	22.5	4.6	10.0	1.0	26.0
CV+ 75 K 20	75	100	120	200	100	88	1.0	12000	3300	22.5	4.6	10.0	1.0	26.0
CV+ 95 K 20	95	125	150	250	100	116	1.0	12000	2600	22.5	4.6	10.0	1.0	26.0
CV+ 115 K 20	115	150	180	300	100	128	1.0	12000	2100	22.5	4.8	10.0	1.0	26.0
CV+ 130 K 20	130	170	205	340	100	154	1.0	12000	1900	22.5	5.0	10.0	1.0	26.0
CV+ 140 K 20	140	180	220	360	100	170	1.0	12000	1800	22.5	5.1	10.0	1.0	26.0
CV+ 150 K 20	150	200	240	395	100	185	1.0	12000	1600	22.5	5.2	10.0	1.0	26.0
CV+ 175 K 20	175	225	270	455	100	210	1.0	12000	1400	22.5	5.3	10.0	1.0	26.0
CV+ 230 K 20	230	300	360	595	100	280	1.0	12000	1100	22.5	5.9	10.0	1.0	26.0
CV+ 250 K 20	250	320	390	650	100	300	1.0	12000	1000	22.5	6.1	10.0	1.0	26.0
CV+ 275 K 20	275	350	430	710	100	330	1.0	12000	900	22.5	6.3	10.0	1.0	26.0
CV+ 300 K 20	300	385	470	775	100	380	1.0	12000	850	22.5	6.0	10.0	1.0	27.0
CV+ 320 K 20	320	420	510	840	100	420	1.0	12000	700	22.5	6.8	10.0	1.0	27.0
CV+ 385 K 20	385	505	620	1025	100	430	1.0	12000	650	22.5	7.5	10.0	1.0	27.0
CV+ 420 K 20	420	560	680	1120	100	460	1.0	12000	620	22.5	7.8	10.0	1.0	27.0
CV+ 460 K 20	460	615	750	1240	100	500	1.0	12000	560	22.5	8.2	10.0	1.0	27.0
CV+ 510 K 20	510	670	820	1355	100	520	1.0	12000	510	22.5	8.7	10.0	1.0	27.0
CV+ 550 K 20	550	745	910	1500	100	560	1.0	12000	480	22.5	9.2	10.0	1.0	27.0
CV+ 130 K 23	130	170	205	340	100	172	1.0	15000	3500	25.0	5.0	10.0	1.0	27.0
CV+ 140 K 23	140	180	220	360	100	190	1.0	15000	3200	25.0	5.1	10.0	1.0	27.0
CV+ 150 K 23	150	200	240	395	100	207	1.0	15000	2900	25.0	5.2	10.0	1.0	27.0
CV+ 175 K 23	175	225	270	455	100	235	1.0	15000	2500	25.0	5.3	10.0	1.0	27.0
CV+ 230 K 23	230	300	360	595	100	313	1.0	15000	2200	25.0	5.9	10.0	1.0	27.0
CV+ 250 K 23	250	320	390	650	100	336	1.0	15000	1900	25.0	6.1	10.0	1.0	27.0
CV+ 275 K 23	275	350	430	710	100	370	1.0	15000	1600	25.0	6.3	10.0	1.0	27.0
CV+ 300 K 23	300	385	470	775	100	426	1.0	15000	1300	25.0	6.6	10.0	1.0	29.0
CV+ 320 K 23	320	420	510	840	100	470	1.0	15000	1100	25.0	6.8	10.0	1.0	29.0
CV+ 385 K 23	385	505	620	1025	100	480	1.0	15000	1000	25.0	7.5	10.0	1.0	29.0
CV+ 420 K 23	420	560	680	1120	100	515	1.0	15000	950	25.0	7.8	10.0	1.0	29.0
CV+ 460 K 23	460	615	750	1240	100	560	1.0	15000	900	25.0	8.2	10.0	1.0	29.0
CV+ 510 K 23	510	670	820	1355	100	582	1.0	15000	650	25.0	8.7	10.0	1.0	29.0
CV+ 550 K 23	550	745	910	1500	100	627	1.0	15000	800	25.0	9.2	10.0	1.0	29.0

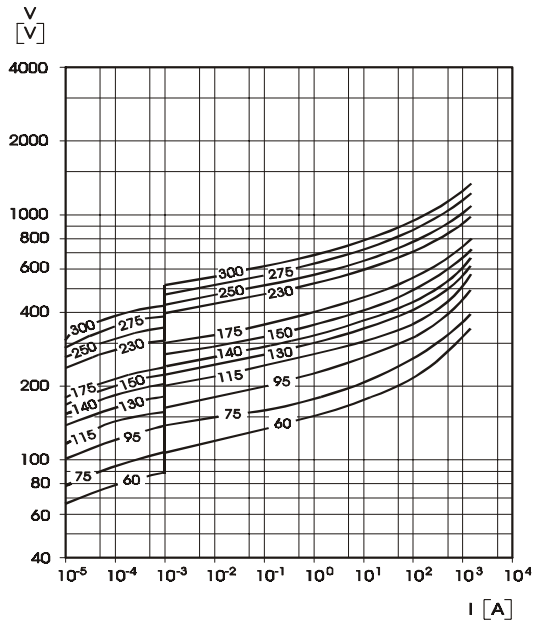


Version 1

| Case Size 7, 10, 14, 20, 23 |

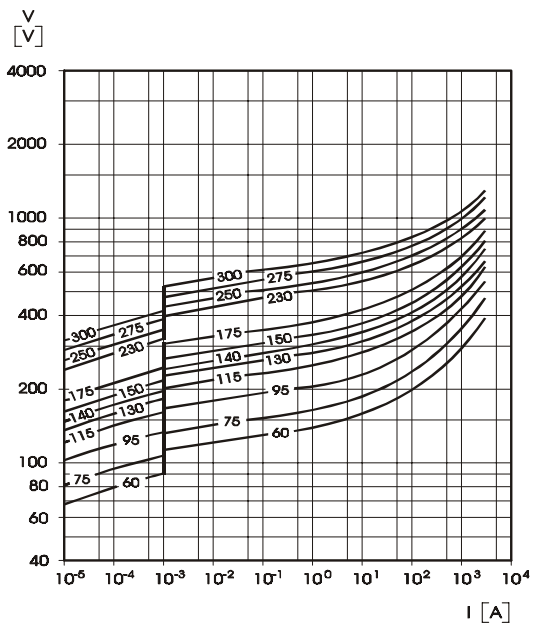
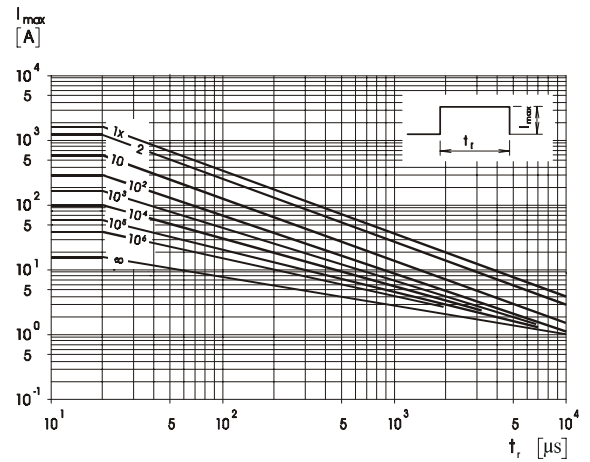
Performance Characteristics

Voltage/Current Curves

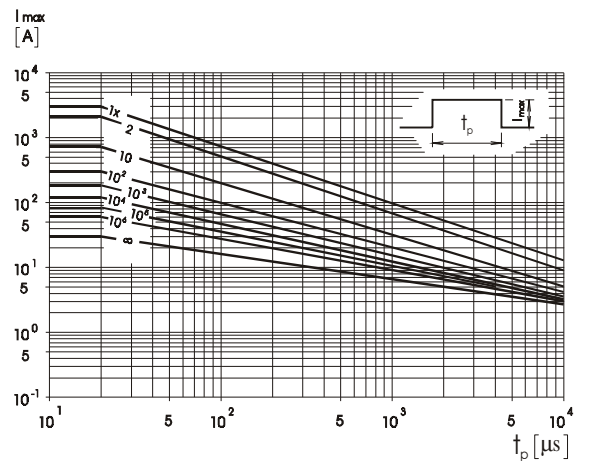


CV+ 60...300K 07

Pulse Rating Curves

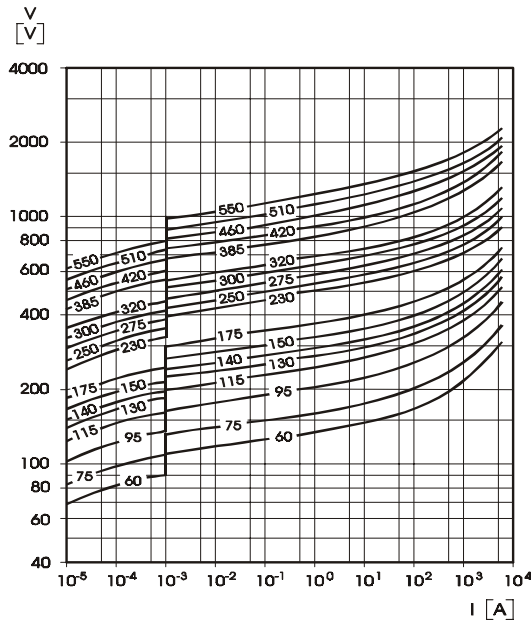


CV+ 60...550K 10



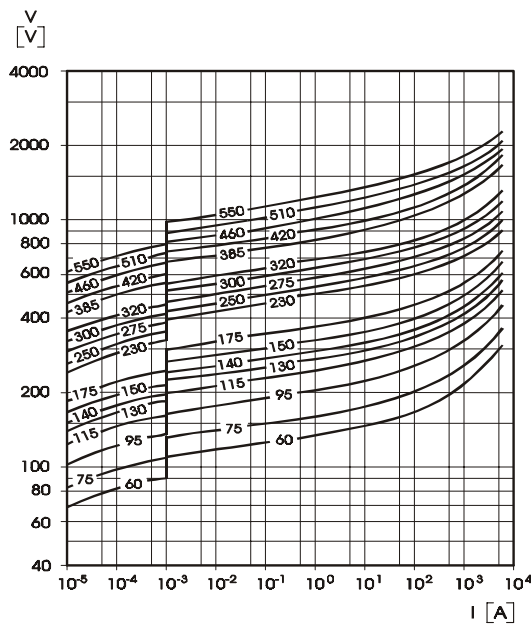
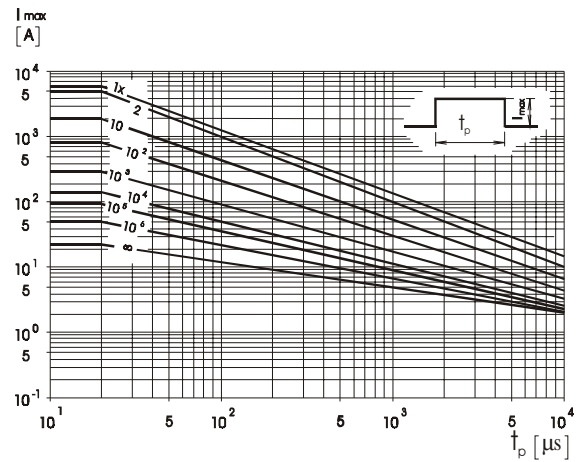
Performance Characteristics

Voltage/Current Curves

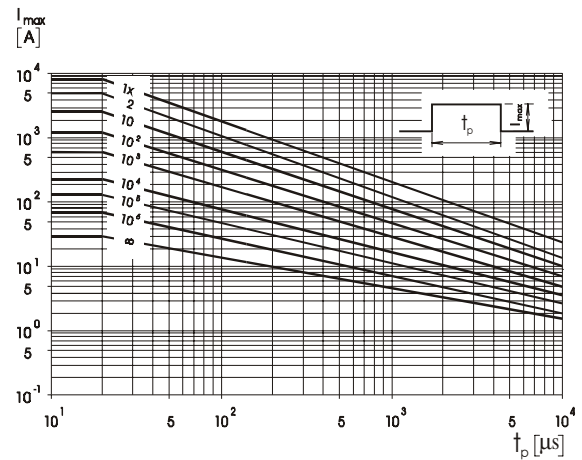


Pulse Rating Curves

CV+ 60..550K 14



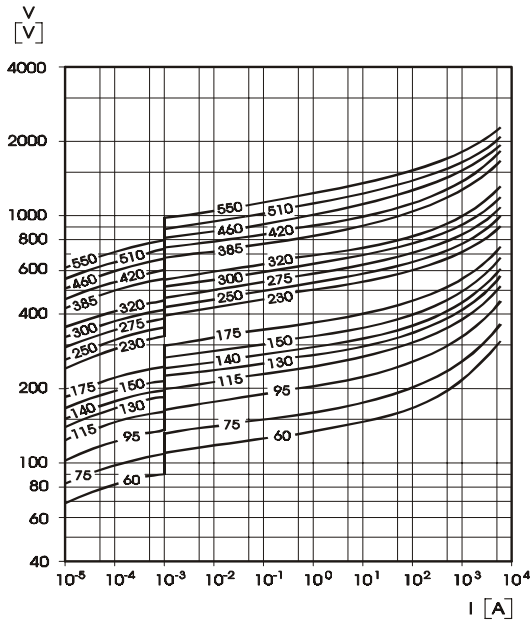
CV+ 60...550K 20



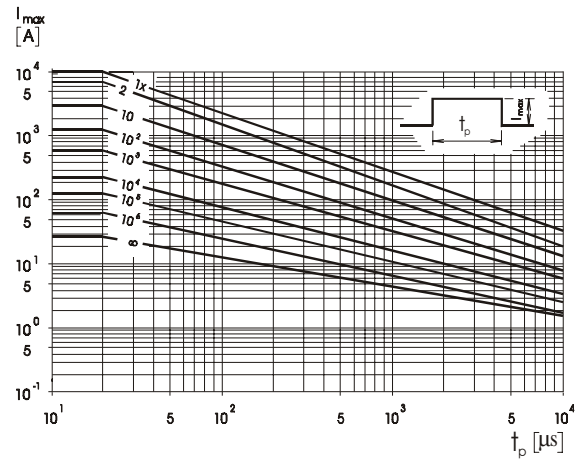
Performance Characteristics

Voltage/Current Curves

Pulse Rating Curves



CV+ 60..550K 23



## Single Layer Technology

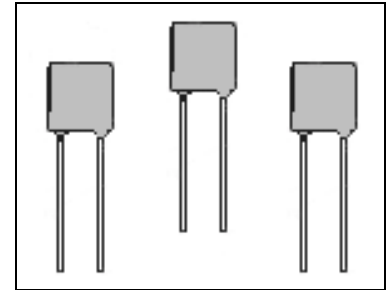
## Varistor Plus

### Description

The SV Series of transient voltage suppressors are epoxy-coated square or rectangular shaped leaded varistors with AC operating voltage ranging from 60V to 550V. There are two versions of these varistors.

The standard version of square varistors, featuring extremely high-current and high-energy capabilities and low clamping voltages, provides an increased level of protection necessary for the transients expected in telecommunications and AC power networks. Compared to standard disc varistors, SV series varistors realize electrical equivalent values in smaller nominal dimensions.

In the custom version of the SV Series, a customer can design (on their own or with our help) an optimum varistor with minimum dimensions to satisfy a specific application. A customer can choose from the following parameters: non-standard DC/AC operating voltage, leakage current, clamping voltage, maximum surge current, energy absorption level, maximum dissipation power, as well as shape (dimensions being the function of required electrical parameters and vice-versa.)



### Features

#### Standard Varistor Types

- Operating voltage range  $V_{RMS}$ .....60V to 550V
- Operating voltage range  $V_{DC}$ .....85V to 745V
- 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
- UL1449 & CSA 22.2, File E221545 (Transient Voltage Surge Suppressors), for SV 130....550K 20...23

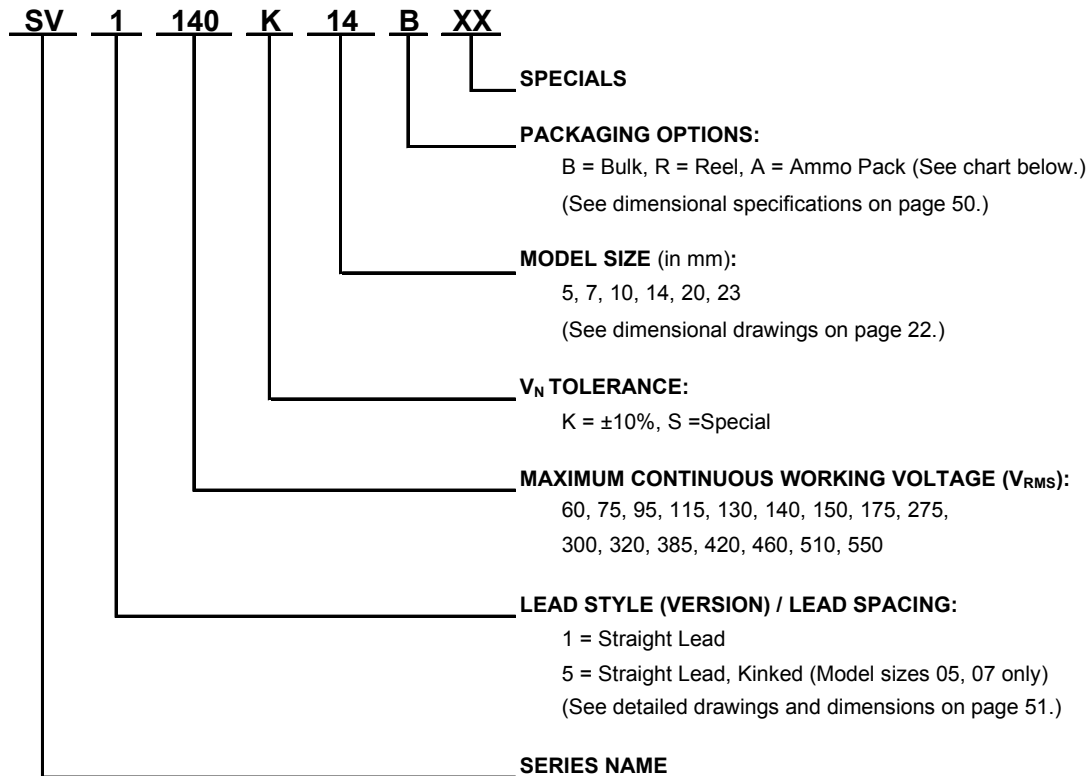
#### Full Custom Parameter Design Varistors

- Operating voltage range  $V_{RMS}$  .....60V to 550V
- Operating voltage range  $V_{DC}$  .....85V to 745V
- Indefinite number of both square and rectangular shape, the maximum one being 23 x 23 mm
- Broad range of current and energy handling capabilities
- +85°C continuous operating temperature
- Electrical parameters available for custom designs 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

### Absolute Maximum Ratings

	Standard Values	Custom Design Values
<b>Continuous:</b>		
Steady State Applied Voltage:		
DC Voltage Range ( $V_{DC}$ )	85V to 745V	85V to 745V
AC Voltage Range ( $V_{RMS}$ )	60V to 550V	60V to 550V
<b>Transient:</b>		
Peak Single Pulse Surge Current, 8/20 $\mu$ s Waveform ( $I_{MAX}$ )	600A to 15000A	> 5500 Acm <sup>3</sup>
Single Pulse Surge Energy, 10/1000 $\mu$ s Waveform ( $W_{MAX}$ )	4J to 815J	> 400 J/cm <sup>3</sup>
Operating Ambient Temperature	-40°C to +85°C	-40°C to +85°C
Storage Temperature Range	-40°C to +125°C	-40°C to +125°C
Threshold Voltage Temperature Coefficient	< - 0.05%/°C	< - 0.005%/°C
Insulation Resistance	> 1G $\Omega$	> 1G $\Omega$
Isolation Voltage Capability	> 2.5kV	> 2.5kV
Response Time	< 25ns	< 25ns
Climatic Category	40/85/56	40/85/56

**HOW TO ORDER: SV SERIES (SPECIAL MEDIUM VOLTAGE LEADED VARISTORS)**



**Standard Packaging Options / Quantities**

Series	Voltage Range	Size	B	R	A
SV	11 to 150	5	2000	2000	2500
	175 to 230		2000	2000	2000
	250 to 275		1500	1500	1300
	11 to 230	7	1500	1500	2000
	250 to 300		1000	1000	1500
	14 to 115	10	1000	1500	2000
	130 to 230		800	1000	1500
	250 to 300		800	1000	1200
	320 to 550		500	300	
	40 to 115	14	700	800	900
	130 to 320		500	700	800
	385 to 550		300		
	40 to 75	20	500	700	800
	95 to 140		400	700	800
	150 to 420		300	500	600
	460 to 550		200		
	130 to 275		150		
	300 to 420	23	100		
	460 to 550		100		



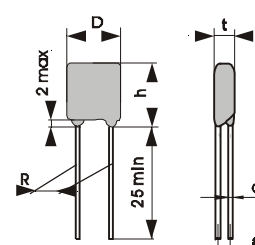
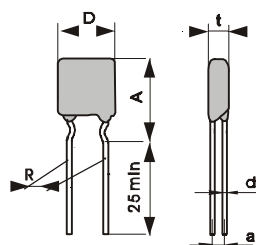
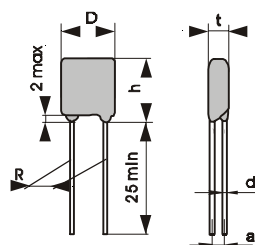
Single Layer Technology

Varistor Plus

Device Ratings and Characteristics

SV 60 K 05.....SV 300 K 07

Catalog Number	V <sub>RMS</sub>	V <sub>DC</sub>	V <sub>N</sub> @ 1 mA	V <sub>C</sub>	I <sub>C</sub>	W <sub>MAX</sub> 10/1000 μs	P <sub>MAX</sub>	I <sub>p</sub> 8/20 μs	C 1kHz	D <sub>MAX</sub>	t <sub>MAX</sub>	R	d	h <sub>MAX</sub>
Unit of Measure	Volts	Volts	Volts	Volts	Amps	Joules	Watts	Amps	pF	mm	mm	mm	mm	mm
SV 60 K 05	60	85	100	155	5	4.0	0.10	600	370	7.0	3.5	5.0	0.6	9.5
SV 75 K 05	75	100	120	190	5	5.0	0.10	600	300	7.0	3.6	5.0	0.6	9.5
SV 95 K 05	95	125	150	240	5	7.0	0.10	600	240	7.0	3.8	5.0	0.6	9.5
SV 115 K 05	115	150	180	290	5	8.0	0.10	600	200	7.0	4.0	5.0	0.6	9.5
SV 130 K 05	130	170	205	320	5	9.0	0.10	600	180	7.0	4.0	5.0	0.6	9.5
SV 140 K 05	140	180	220	340	5	9.0	0.10	600	170	7.0	4.1	5.0	0.6	9.5
SV 150 K 05	150	200	240	360	5	11.0	0.10	600	160	7.0	4.3	5.0	0.6	9.5
SV 175 K 05	175	225	270	420	5	11.0	0.10	600	140	7.0	4.8	5.0	0.6	9.5
SV 230 K 05	230	300	360	550	5	16.0	0.10	600	110	7.0	4.8	5.0	0.6	9.5
SV 250 K 05	250	320	390	590	5	17.0	0.10	600	100	7.0	5.0	5.0	0.6	9.5
SV 275 K 05	275	350	430	680	5	20.0	0.10	600	90	7.0	5.8	5.0	0.6	9.5
SV 60 K 07	60	85	100	155	10	9.0	0.25	1750	900	9.0	3.5	5.0	0.6	11.5
SV 75 K 07	75	100	120	190	10	11.0	0.25	1750	720	9.0	3.6	5.0	0.6	11.5
SV 95 K 07	95	125	150	240	10	14.0	0.25	1750	580	9.0	3.8	5.0	0.6	11.5
SV 115 K 07	115	150	180	290	10	16	0.25	1750	480	9.0	4.0	5.0	0.6	11.5
SV 130 K 07	130	170	205	320	10	19	0.25	1750	430	9.0	4.0	5.0	0.6	11.5
SV 140 K 07	140	180	220	340	10	22	0.25	1750	400	9.0	4.1	5.0	0.6	11.5
SV 150 K 07	150	200	240	360	10	23	0.25	1750	380	9.0	4.3	5.0	0.6	11.5
SV 175 K 07	175	225	270	420	10	26	0.25	1750	330	9.0	4.8	5.0	0.6	11.5
SV 230 K 07	230	300	360	550	10	35	0.25	1750	250	9.0	4.8	5.0	0.6	11.5
SV 250 K 07	250	320	390	590	10	38	0.25	1750	240	9.0	5.0	5.0	0.6	11.5
SV 275 K 07	275	350	430	680	10	44	0.25	1750	220	9.0	5.6	5.0	0.6	11.5
SV 300 K 07	300	385	470	700	10	46	0.25	1750	200	8.5	6.1	5.0	0.6	11.5



Version 1                      Version 5  
 ← Case Size 5, 7 →

Version 1  
 ← Case Size 10, 14, 20, 23 →

Single Layer Technology

Varistor Plus

Device Ratings and Characteristics

SV 60 K10.....SV 550 K 14

Catalog Number	V <sub>RMS</sub>	V <sub>DC</sub>	V <sub>N</sub> @ 1 mA	V <sub>C</sub>	I <sub>C</sub>	W <sub>MAX</sub> 10/1000 μs	P <sub>MAX</sub>	I <sub>P</sub> 8/20 μs	C 1kHz	D <sub>MAX</sub>	t <sub>MAX</sub>	R	d	h <sub>MAX</sub>
Unit of Measure	Volts	Volts	Volts	Volts	Amps	Joules	Watts	Amps	pF	mm	mm	mm	mm	mm
SV 60 K 10	60	85	100	155	25	20	0.40	3500	1380	12.0	4.1	7.5	0.8	15.0
SV 75 K 10	75	100	120	190	25	26	0.40	3500	1080	12.0	4.2	7.5	0.8	15.0
SV 95 K 10	95	125	150	240	25	31	0.40	3500	870	12.0	4.3	7.5	0.8	15.0
SV 115 K 10	115	150	180	290	25	37	0.40	3500	750	12.0	4.3	7.5	0.8	15.0
SV 130 K 10	130	170	205	320	25	42	0.40	3500	670	12.0	4.5	7.5	0.8	15.0
SV 140 K 10	140	180	220	340	25	46	0.40	3500	620	12.0	4.6	7.5	0.8	15.0
SV 150 K 10	150	200	240	360	25	51	0.40	3500	590	12.0	4.8	7.5	0.8	15.0
SV 175 K 10	175	225	270	420	25	58	0.40	3500	500	12.0	5.0	7.5	0.8	15.0
SV 230 K 10	230	300	360	550	25	78	0.40	3500	400	12.0	5.4	7.5	0.8	15.0
SV 250 K 10	250	320	390	590	25	85	0.40	3500	370	12.0	5.6	7.5	0.8	15.0
SV 275 K 10	275	350	430	680	25	97	0.40	3500	350	12.0	6.0	7.5	0.8	15.0
SV 300 K 10	300	385	470	700	25	102	0.40	3500	320	12.0	6.1	7.5	0.8	15.0
SV 320 K 10	320	420	510	760	25	144	0.40	3500	300	12.0	6.5	7.5	0.8	15.0
SV 385 K 10	385	505	620	900	25	116	0.40	3500	270	12.0	6.9	7.5	0.8	15.0
SV 420 K 10	420	560	680	980	25	121	0.40	3500	240	12.0	7.3	7.5	0.8	15.0
SV 460 K 10	460	615	750	1080	25	132	0.40	3500	230	12.0	7.8	7.5	0.8	15.0
SV 510 K 10	510	670	820	1200	25	144	0.40	3500	210	12.0	8.2	7.5	0.8	15.0
SV 550 K 10	550	745	910	1350	25	168	0.40	3500	200	12.0	8.8	7.5	0.8	15.0
SV 60 K 14	60	85	100	155	50	42	0.60	8000	2300	16.0	4.2	7.5	0.8	19.0
SV 75 K 14	75	100	120	190	50	51	0.60	8000	1850	16.0	4.2	7.5	0.8	19.0
SV 95 K 14	95	125	150	240	50	64	0.60	8000	1480	16.0	4.3	7.5	0.8	19.0
SV 115 K 14	115	150	180	290	50	78	0.60	8000	1230	16.0	4.4	7.5	0.8	19.0
SV 130 K 14	130	170	205	320	50	85	0.60	8000	1100	16.0	4.6	7.5	0.8	19.0
SV 140 K 14	140	180	220	340	50	94	0.60	8000	1020	16.0	4.7	7.5	0.8	19.0
SV 150 K 14	150	200	240	360	50	101	0.60	8000	690	16.0	4.8	7.5	0.8	19.0
SV 175 K 14	175	225	270	420	50	119	0.60	8000	830	16.0	5.0	7.5	0.8	19.0
SV 230 K 14	230	300	360	550	50	157	0.60	8000	650	16.0	5.5	7.5	0.8	19.0
SV 250 K 14	250	320	390	590	50	169	0.60	8000	600	16.0	5.7	7.5	0.8	19.0
SV 275 K 14	275	350	430	680	50	187	0.60	8000	550	16.0	6.0	7.5	0.8	19.0
SV 300 K 14	300	385	470	700	50	211	0.60	8000	510	16.0	6.1	7.5	0.8	19.0
SV 320 K 14	320	420	510	760	50	230	0.60	8000	480	16.0	6.8	7.5	0.8	19.0
SV 385 K 14	385	505	620	900	50	241	0.60	8000	410	16.0	6.9	7.5	0.8	19.0
SV 420 K 14	420	560	680	980	50	253	0.60	8000	380	16.0	7.4	7.5	0.8	19.0
SV 460 K 14	460	615	750	1080	50	275	0.60	8000	350	16.0	7.8	7.5	0.8	19.0
SV 510 K 14	510	670	820	1200	50	284	0.60	8000	330	16.0	8.2	7.5	0.8	19.0
SV 550 K 14	550	745	910	1350	50	330	0.60	8000	310	16.0	8.8	7.5	0.8	19.0

Single Layer Technology

Varistor Plus

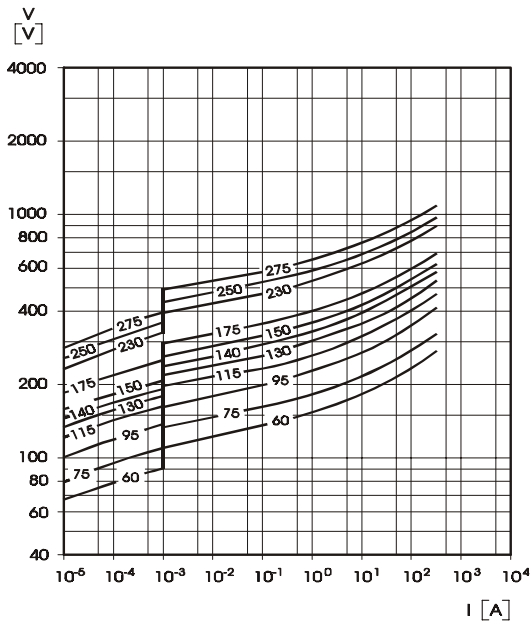
Device Ratings and Characteristics

SV 60 K 20.....SV 550 K 23

Catalog Number	V <sub>RMS</sub>	V <sub>DC</sub>	V <sub>N</sub> @ 1 mA	V <sub>C</sub>	I <sub>C</sub>	W <sub>MAX</sub> 10/1000 μs	P <sub>MAX</sub>	I <sub>P</sub> 8/20 μs	C 1kHz	D <sub>MAX</sub>	t <sub>MAX</sub>	R	d	h <sub>MAX</sub>
Unit of Measure	Volts	Volts	Volts	Volts	Amps	Joules	Watts	Amps	pF	mm	mm	mm	mm	mm
SV 60 K 20	60	85	100	155	100	89	1.0	12000	3400	22.5	4.6	10.0	0.8	26.0
SV 75 K 20	75	100	120	190	100	101	1.0	12000	3100	22.5	4.6	10.0	0.8	26.0
SV 95 K 20	95	125	150	240	100	133	1.0	12000	2700	22.5	4.9	10.0	0.8	26.0
SV 115 K 20	115	150	180	290	100	147	1.0	12000	2200	22.5	4.8	10.0	0.8	26.0
SV 130 K 20	130	170	205	320	100	177	1.0	12000	2150	22.5	5.0	10.0	1.0	26.0
SV 140 K 20	140	180	220	340	100	196	1.0	12000	1900	22.5	5.4	10.0	1.0	26.0
SV 150 K 20	150	200	240	360	100	213	1.0	12000	1740	22.5	5.6	10.0	1.0	26.0
SV 175 K 20	175	225	270	420	100	241	1.0	12000	1630	22.5	5.8	10.0	1.0	26.0
SV 230 K 20	230	300	360	550	100	322	1.0	12000	1220	22.5	5.9	10.0	1.0	26.0
SV 250 K 20	250	320	390	590	100	345	1.0	12000	1130	22.5	6.1	10.0	1.0	26.0
SV 275 K 20	275	350	430	680	100	380	1.0	12000	1030	22.5	6.3	10.0	1.0	26.0
SV 300 K 20	300	385	470	700	100	437	1.0	12000	940	22.5	6.6	10.0	1.0	26.0
SV 320 K 20	320	420	510	760	100	485	1.0	12000	860	22.5	6.8	10.0	1.0	27.0
SV 385 K 20	385	505	620	900	100	495	1.0	12000	710	22.5	7.5	10.0	1.0	27.0
SV 420 K 20	420	560	680	980	100	523	1.0	12000	680	22.5	7.8	10.0	1.0	26.0
SV 460 K 20	460	615	750	1080	100	572	1.0	12000	620	22.5	8.2	10.0	1.0	27.0
SV 510 K 20	510	670	820	1200	100	598	1.0	12000	570	22.5	8.7	10.0	1.0	27.0
SV 550 K 20	550	745	910	1350	100	644	1.0	12000	510	22.5	9.2	10.0	1.0	27.0
SV 130 K 23	130	170	205	320	100	222	1.0	15000	3390	25.0	5.0	10.0	1.0	27.0
SV 140 K 23	140	180	220	340	100	247	1.0	15000	3340	25.0	5.4	10.0	1.0	27.0
SV 150 K 23	150	200	240	360	100	270	1.0	15000	3050	25.0	5.6	10.0	1.0	27.0
SV 175 K 23	175	225	270	420	100	305	1.0	15000	2870	25.0	5.8	10.0	1.0	27.0
SV 230 K 23	230	300	360	550	100	407	1.0	15000	2020	25.0	5.9	10.0	1.0	27.0
SV 250 K 23	250	320	390	590	100	437	1.0	15000	1980	25.0	6.1	10.0	1.0	27.0
SV 275 K 23	275	350	430	680	100	481	1.0	15000	1800	25.0	6.3	10.0	1.0	27.0
SV 300 K 23	300	385	470	700	100	554	1.0	15000	1650	25.0	6.6	10.0	1.0	29.0
SV 320 K 23	320	420	510	760	100	611	1.0	15000	1520	25.0	6.8	10.0	1.0	29.0
SV 385 K 23	385	505	620	900	100	624	1.0	15000	1250	25.0	7.5	10.0	1.0	29.0
SV 420 K 23	420	560	680	980	100	670	1.0	15000	1200	25.0	7.8	10.0	1.0	29.0
SV 460 K 23	460	615	750	1080	100	728	1.0	15000	1080	25.0	8.2	10.0	1.0	29.0
SV 510 K 23	510	670	820	1200	100	750	1.0	15000	1000	25.0	8.7	10.0	1.0	29.0
SV 550 K 23	550	745	910	1350	100	815	1.0	15000	900	25.0	9.2	10.0	1.0	29.0

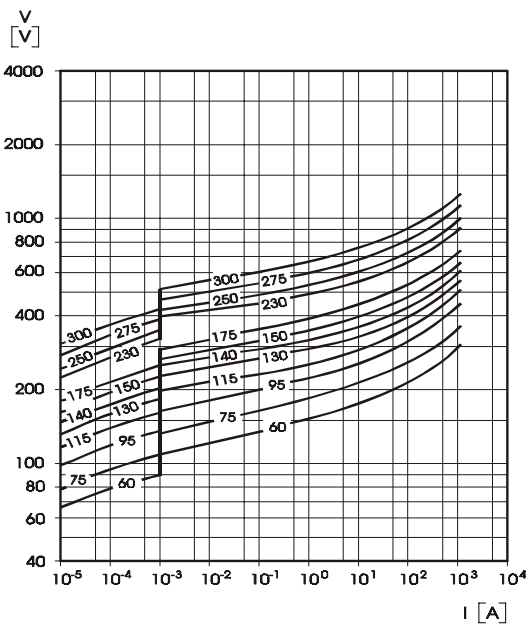
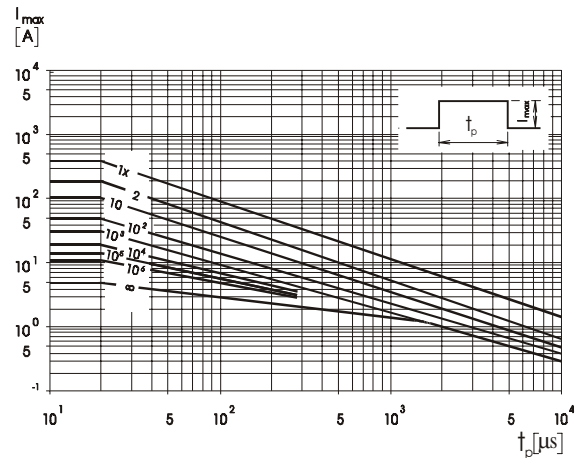
Performance Characteristics

Voltage/Current Curves

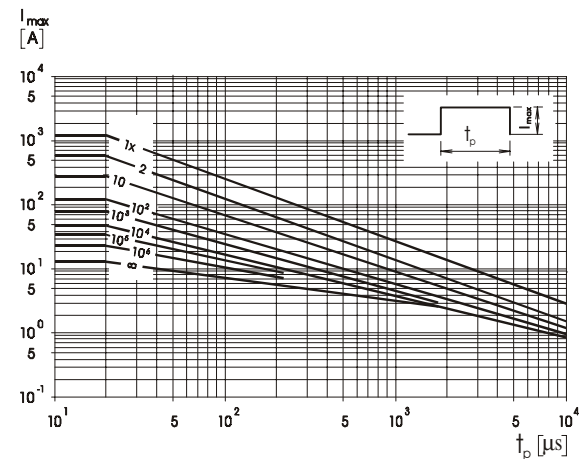


SV 60...275K 05

Pulse Rating Curves



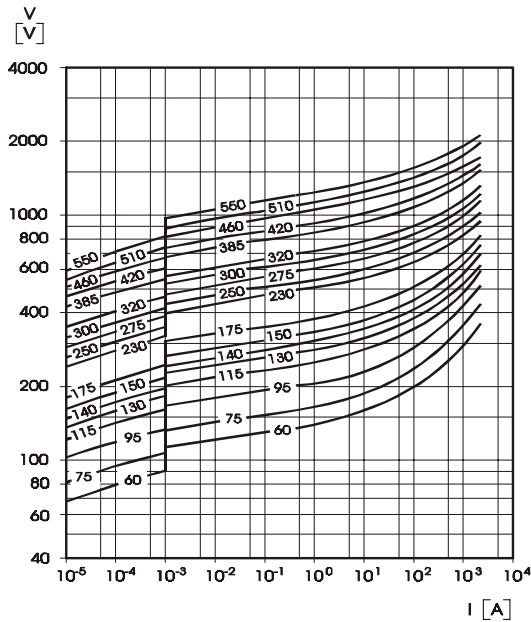
SV 60...300K 07



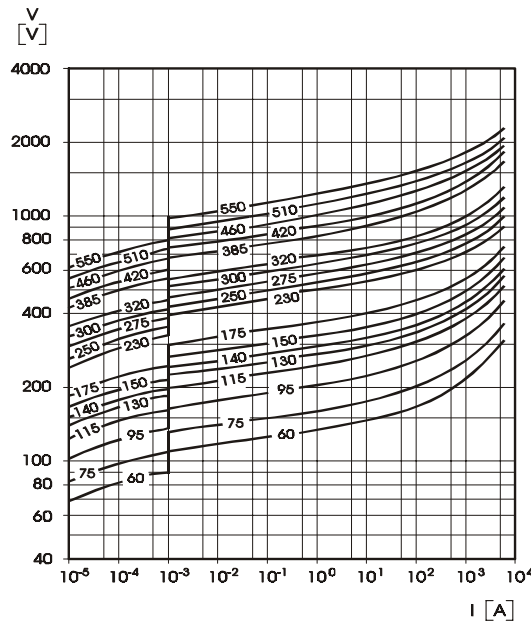
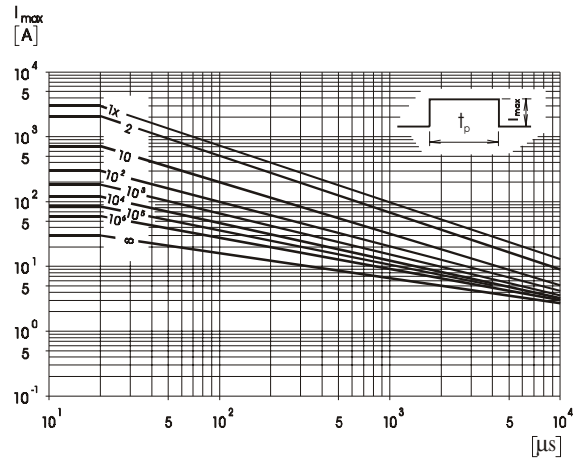
Performance Characteristics

Voltage/Current Curves

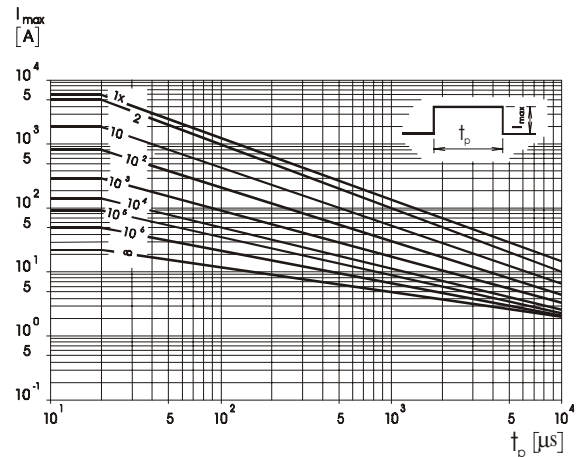
Pulse Rating Curves



SV 60...550K 10

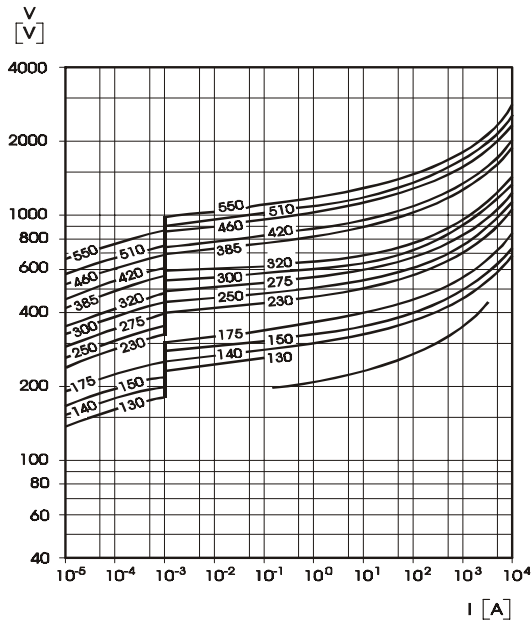


SV 60...550K 14



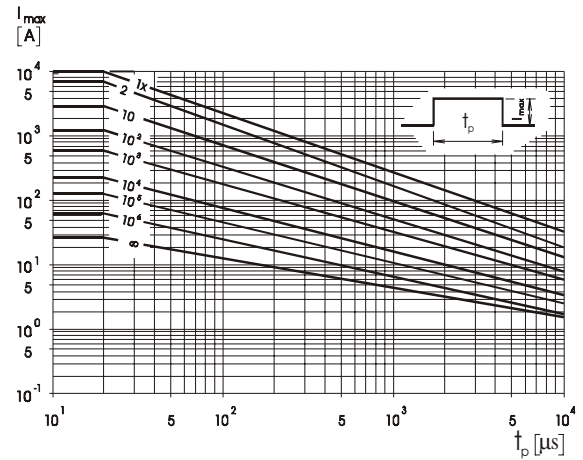
Performance Characteristics

Voltage/Current Curves

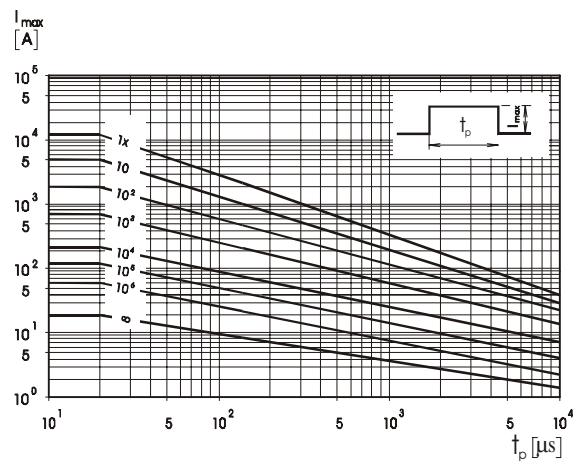
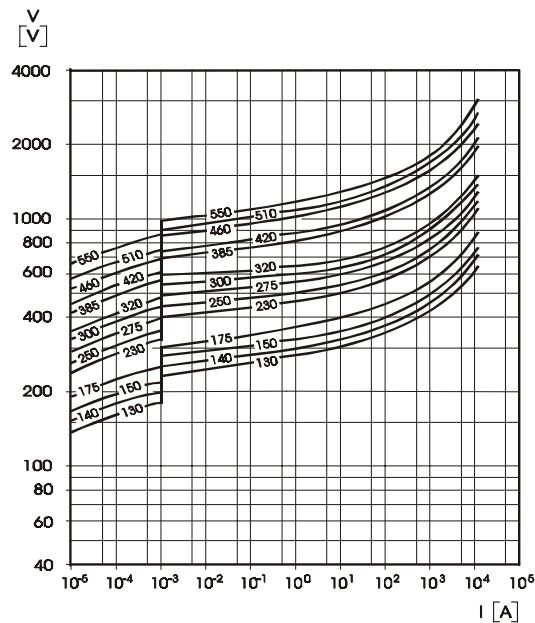


SV 60...550K 20

Pulse Rating Curves



SV 130...550K 23



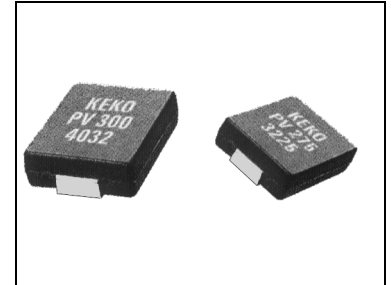
**Single Layer Technology**

**Varistor Plus**

**Description**

The PV Series is a line of surface mount plastic-encapsulated varistor designed to protect electronic equipment against high voltage surges in the low and medium voltage region. They offer direct SMD equivalents to 5mm and 7mm leaded disc varistors of size 5 and 7 mm. The thermoplastic encapsulation is non-flammable according to the standard defined by UL 94 V-0. Terminations are tinned copper sheet.

PV varistors are designed exclusively for surface mounting and are available in two model sizes. These transient voltage suppressors cover operating voltages ( $V_{RMS}$ ) from 11V to 300V, and feature maximum surge currents from 100A to 1200A.



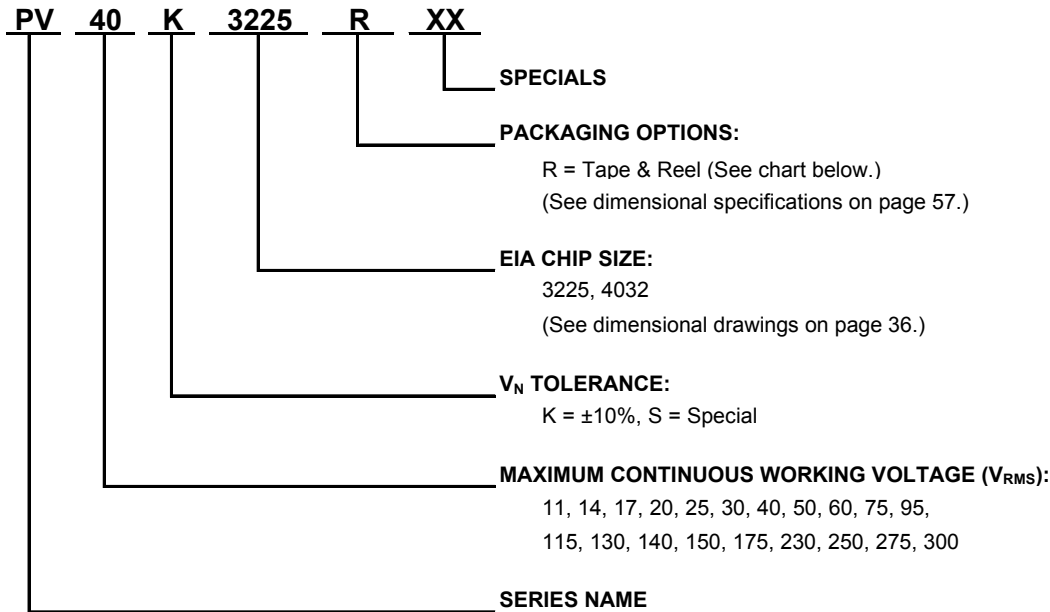
**Features**

- Lead-free component
- Operating voltage range  $V_{RMS}$ .....11V to 300V
- Operating voltage range  $V_{DC}$ .....14V to 385V
- 2 model sizes available.....3225 and 4032
- +85°C continuous operating temperature
- Dimensional and weight saves on board
- Easy solderable tinned copper terminations
- Non-flammable thermoplastic encapsulation case per according to standard UL 94 V-0
- Available in tape and reel for automatic pick and place
- UL1449 & CSA 22.2, file E 221545 (Transient Voltage Surge Suppression) for PV 60..300 K 3225/4032

**Absolute Maximum Ratings**

<b>Continuous:</b>	Value
Steady State Applied Voltage:	
AC Voltage Range ( $V_{RMS}$ )	11V to 300V
DC Voltage Range ( $V_{DC}$ )	14V to 385V
<b>Transient:</b>	
Single Pulse Peak Surge Current( $I_P$ ), 8/20 $\mu$ s Waveform	100A to 1200A
Single Pulse Energy Absorption ( $W_{MAX}$ ), 10/1000 $\mu$ s Waveform	0.6J to 30J
Operating Ambient Temperature	-40°C to +85°C
Storage Temperature Range	-40°C to +125°C
Threshold Voltage Temperature Coefficient	< - 0.05%/°C
Response Time	< 5ns
Climatic Category	55/125/56

**HOW TO ORDER: PV SERIES (LOW & MEDIUM VOLTAGE SMD VARISTORS)**



**Standard Packaging Options / Quantities**

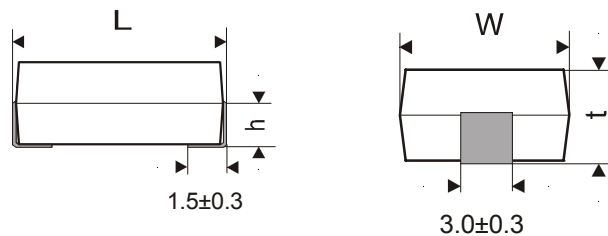
Series	Chip Size	
	3225	4032
PV	1500	1000



**Device Ratings and Characteristics**

**PV 11 K 3225.....PV 300 K 3225**

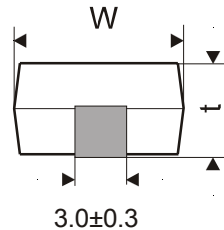
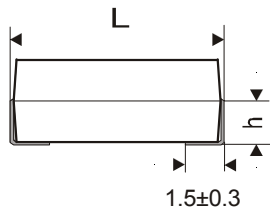
Catalog Number	V <sub>RMS</sub>	V <sub>DC</sub>	V <sub>N</sub> @ 1 mA	V <sub>C</sub>	I <sub>C</sub>	W <sub>MAX</sub> 10/1000 μs	P <sub>MAX</sub>	I <sub>P</sub> 8/20 μs	C <sub>TYP</sub> @ 1kHz	h ± 0.3	L ± 0.5	W ± 0.4	t ± 0.3
Unit of Measure	Volts	Volts	Volts	Volts	Amps	Joules	Watts	Amps	pF	mm	mm	mm	mm
PV 11 K 3225	11	14	18	36	1	0.6	0.01	100	1600	1.7	8.0	6.3	3.4
PV 14 K 3225	14	18	22	43	1	0.7	0.01	100	1300	1.7	8.0	6.3	3.4
PV 17 K 3225	17	22	27	53	1	0.9	0.01	100	1050	1.7	8.0	6.3	3.4
PV 20 K 3225	20	26	33	65	1	1.1	0.01	100	750	1.7	8.0	6.3	3.4
PV 25 K 3225	25	31	39	77	1	1.2	0.01	100	660	1.7	8.0	6.3	3.4
PV 30 K 3225	30	38	47	93	1	1.5	0.01	100	580	1.7	8.0	6.3	3.4
PV 35 K 3225	35	45	56	110	1	1.8	0.01	100	460	1.7	8.0	6.3	3.4
PV 40 K 3225	40	56	68	135	1	2.2	0.01	100	400	1.7	8.0	6.3	3.4
PV 50 K 3225	50	65	82	135	5	2.5	0.10	400	390	1.7	8.0	6.3	3.4
PV 60 K 3225	60	85	100	165	5	3.0	0.10	400	330	1.7	8.0	6.3	3.4
PV 75 K 3225	75	100	120	200	5	4.0	0.10	400	270	1.7	8.0	6.3	3.4
PV 95 K 3225	95	125	150	250	5	6.0	0.10	400	220	1.7	8.0	6.3	3.4
PV 115 K 3225	115	150	180	300	5	6.5	0.10	400	180	1.7	8.0	6.3	3.4
PV 130 K 3225	130	170	205	340	5	7.0	0.10	400	160	1.7	8.0	6.3	3.4
PV 140 K 3225	140	180	220	360	5	7.5	0.10	400	150	1.7	8.0	6.3	3.4
PV 150 K 3225	150	200	240	395	5	9.0	0.10	400	140	1.7	8.0	6.3	3.4
PV 175 K 3225	175	225	270	455	5	9.5	0.10	400	120	2.3	8.0	6.3	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 250 K 3225	250	320	390	650	5	11.0	0.10	400	80	2.3	8.0	6.3	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 300 K 3225	300	385	470	775	5	15.0	0.10	400	70	2.3	8.0	6.3	4.7



**Device Ratings and Characteristics**

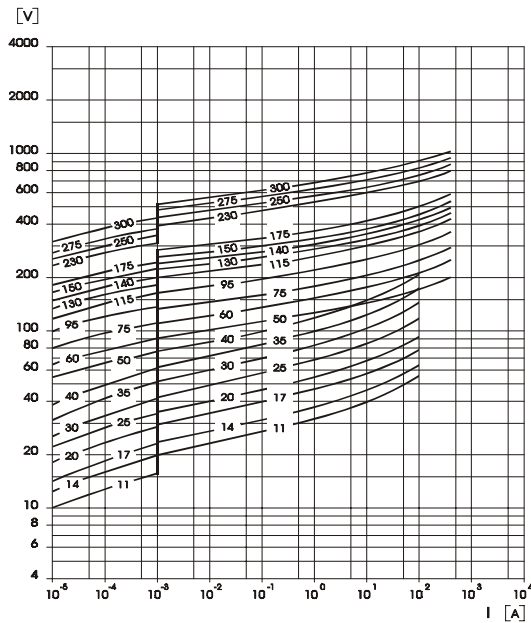
**PV 11 K 4032.....PV 300 K 4032**

Catalog Number	V <sub>RMS</sub>	V <sub>DC</sub>	V <sub>N</sub> @ 1 mA	V <sub>C</sub>	I <sub>C</sub>	W <sub>MAX</sub> 10/1000 μs	P <sub>MAX</sub>	I <sub>P</sub> 8/20 μs	C <sub>TYP</sub> @ 1kHz	h ± 0.3	L ± 0.5	W ± 0.4	t ± 0.3
Unit of Measure	Volts	Volts	Volts	Volts	Amps	Joules	Watts	Amps	pF	mm	mm	mm	mm
PV 11 K 4032	11	14	18	36	2.5	1.1	0.02	250	3100	2.3	10.0	8.0	4.7
PV 14 K 4032	14	18	22	43	2.5	1.3	0.02	250	2500	2.3	10.0	8.0	4.7
PV 17 K 4032	17	22	27	53	2.5	1.6	0.02	250	1900	2.3	10.0	8.0	4.7
PV 20 K 4032	20	26	33	65	2.5	2.0	0.02	250	1500	2.3	10.0	8.0	4.7
PV 25 K 4032	25	31	39	77	2.5	2.4	0.02	250	1260	2.3	10.0	8.0	4.7
PV 30 K 4032	30	38	47	93	2.5	2.8	0.02	250	1050	2.3	10.0	8.0	4.7
PV 35 K 4032	35	45	56	110	2.5	3.4	0.02	250	850	2.3	10.0	8.0	4.7
PV 40 K 4032	40	56	68	135	2.5	4.1	0.02	250	720	2.3	10.0	8.0	4.7
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 4032	60	85	100	165	10	7.0	0.25	1200	680	2.3	10.0	8.0	4.7
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 4032	95	125	150	250	10	11.0	0.25	1200	440	2.3	10.0	8.0	4.7
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 4032	130	170	205	340	10	15.0	0.25	1200	320	2.3	10.0	8.0	4.7
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 4032	150	200	240	395	10	18.5	0.25	1200	280	2.3	10.0	8.0	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 4032	230	300	360	595	10	23.0	0.25	1200	190	2.3	10.0	8.0	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 4032	275	350	430	710	10	29.0	0.25	1200	160	2.3	10.0	8.0	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



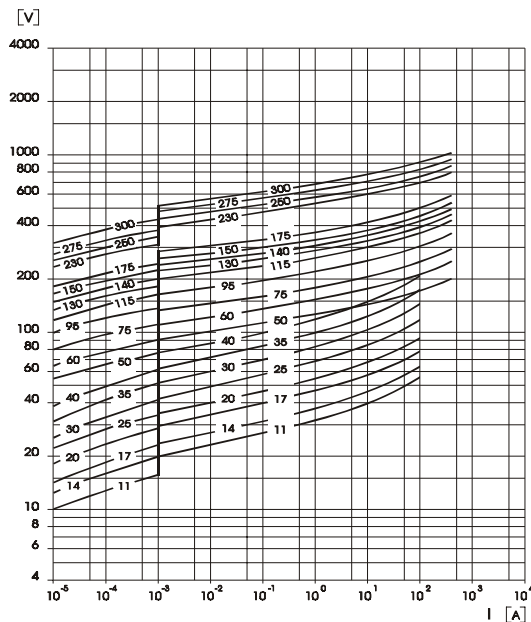
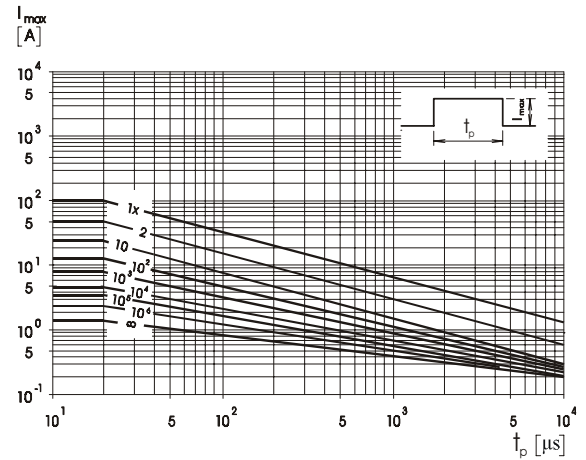
Performance Characteristics

Voltage/Current Curves

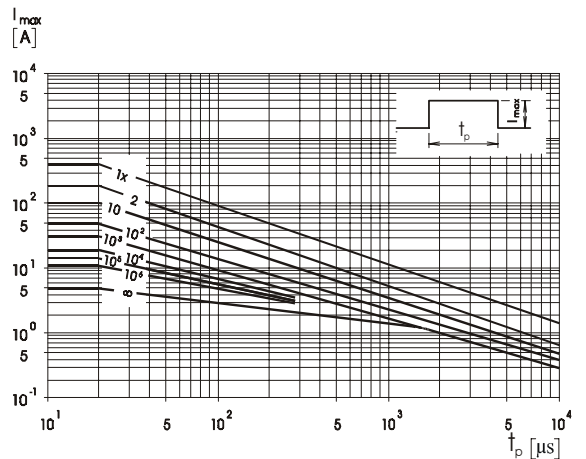


PV 11...40K 3225

Pulse Rating Curves



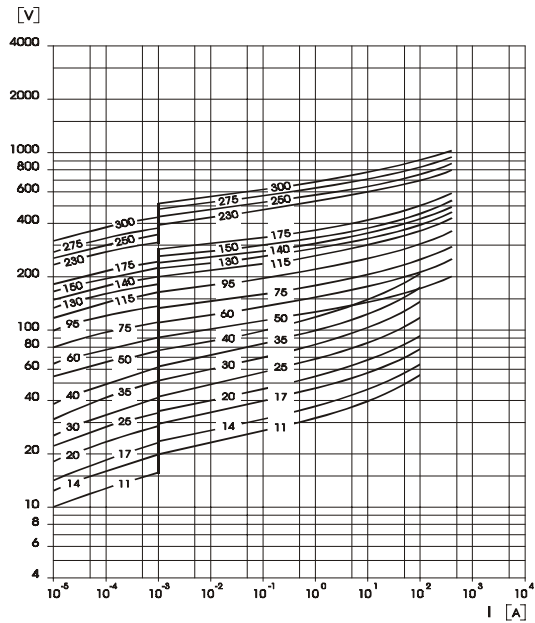
PV 50...300K 3225



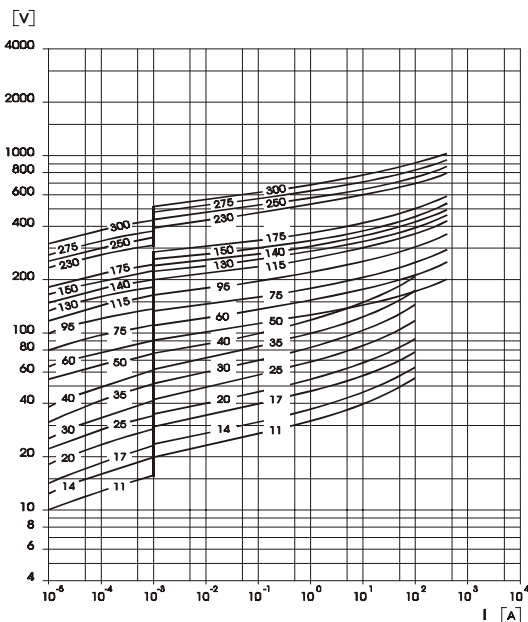
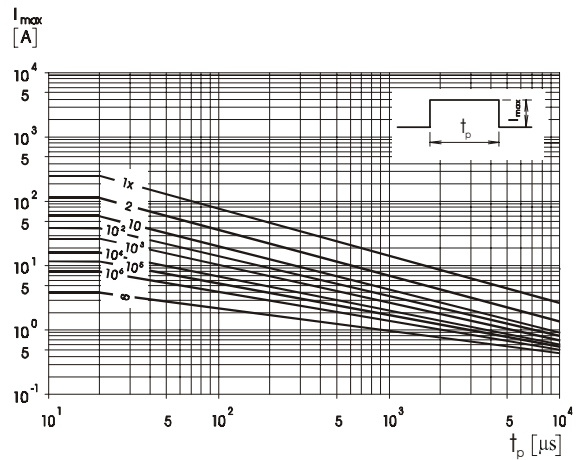
Performance Characteristics

Voltage/Current Curves

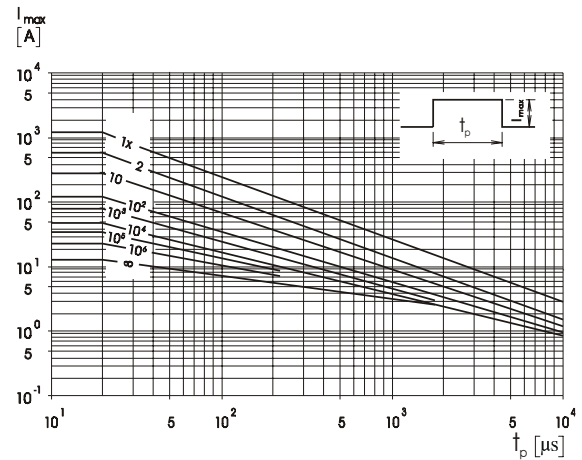
Pulse Rating Curves



PV 11...40K 4032



PV 50...300K 4032



Single Layer Technology

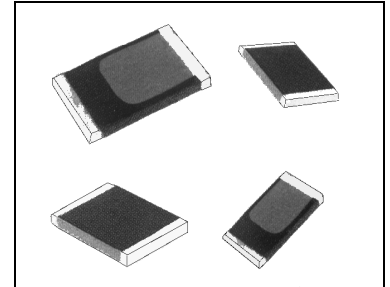
Varistor Plus

**Description**

The DV Series is a line of surface mount varistors chips 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 Series have a very low profile construction.

DV varistors are designed exclusively for surface mounting and are available in two model sizes. These transient voltage suppressors cover operating voltages from 11V to 300V<sub>RMS</sub> featuring maximum surge currents from 100A to 1200A.

Surface mount DV varistors are available in two model sizes. These transient voltage suppressors cover operating voltage (V<sub>RMS</sub>) from 11V to 300V and feature maximum surge currents from 400A to 1200A.



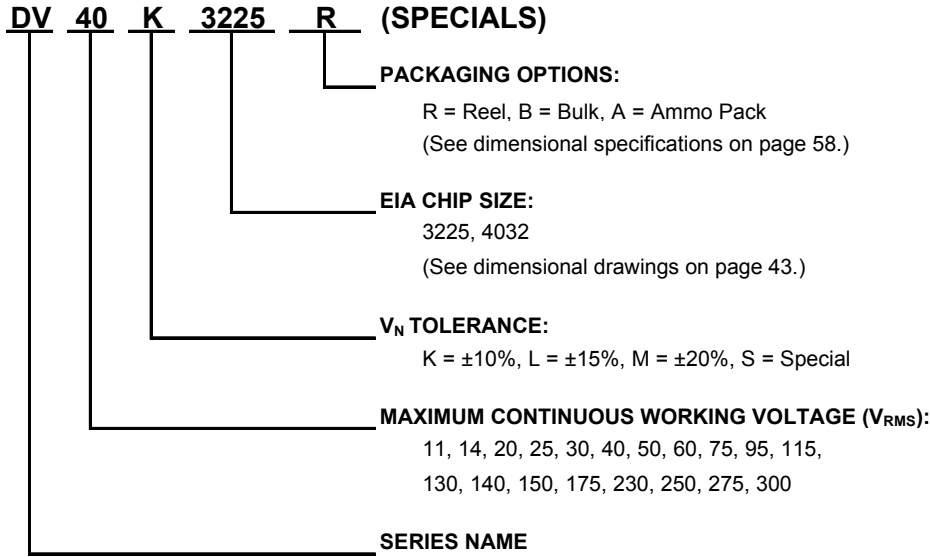
**Features**

- Lead-free component
- Operating voltage range V<sub>RMS</sub>.....11V to 300V
- Operating voltage range V<sub>DC</sub>.....14V to 385V
- 2 model sizes.....3225 and 4032
- Broad range of current and energy handling capabilities
- Ultra-low inductance, leadless chip guarantees the fastest response time to transient surges
- +125°C continuous operating temperature
- Insensitive to water cleaning procedures and to humidity according to the climatic category 55/125/56
- Low profile dimensions and weight savings on printed circuit board
- No plastic coating guarantees excellent flammability rating
- Available in tape and reel for automatic pick and place

**Absolute Maximum Ratings**

Continuous:	Value
Steady State Applied Voltage:	
AC Voltage Range (V <sub>RMS</sub> )	11V to 300V
DC Voltage Range (V <sub>DC</sub> )	14V to 385V
<b>Transient:</b>	
Single Pulse Peak Surge Current(I <sub>P</sub> ), 8/20µs Waveform	100A to1200A
Single Pulse Energy Absorption (W <sub>MAX</sub> ), 10/1000µs Waveform	0.6J to 30J
Operating Ambient Temperature	-55°C to +125°C
Storage Temperature Range	-55°C to +150°C
Threshold Voltage Temperature Coefficient	< - 0.05%/°C
Response Time	< 5ns
Climatic Category	55/125/56

**HOW TO ORDER: DV SERIES (MEDIUM VOLTAGE SMD VARISTORS)**



**Standard Packaging Options / Quantities**

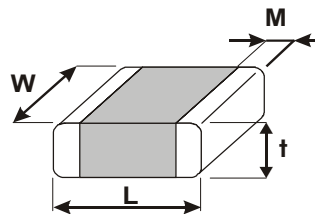
(K) PCS/REEL

Sizes	R	B	A
3225	1	N/A	N/A
4032	1	N/A	N/A

Device Ratings and Characteristics

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

Catalog Number	V <sub>RMS</sub>	V <sub>DC</sub>	V <sub>N</sub> @ 1 mA	V <sub>C</sub>	I <sub>C</sub>	W <sub>MAX</sub> 10/1000 μs	P <sub>MAX</sub>	I <sub>P</sub> 8/20 μs	C <sub>TYP</sub> @ 1kHz	L ± 0.5	W ± 0.4	t <sub>MAX</sub>
Unit of Measure	Volts	Volts	Volts	Volts	Amps	Joules	Watts	Amps	pF	mm	mm	mm
DV 11 K 3225	11	14	18	36	2.5	0.6	0.01	100	2500	8.0	6.3	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 17 K 3225	17	22	27	53	2.5	0.9	0.01	100	1750	8.0	6.3	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 25 K 3225	25	31	39	77	2.5	1.2	0.01	100	1500	8.0	6.3	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 35 K 3225	35	45	56	110	2.5	1.8	0.01	100	800	8.0	6.3	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 50 K 3225	50	65	82	135	5.0	2.5	0.10	400	400	8.2	6.3	2.0
DV 60 K 3225	60	85	100	165	5.0	3.0	0.10	400	300	8.2	6.3	2.0
DV 75 K 3225	75	100	120	200	5.0	4.0	0.10	400	240	8.2	6.3	2.0
DV 95 K 3225	95	125	150	250	5.0	6.0	0.10	400	210	8.2	6.3	2.0
DV 115 K 3225	115	150	180	300	5.0	6.5	0.10	400	200	8.2	6.3	2.0
DV 130 K 3225	130	170	205	340	5.0	7.0	0.10	400	150	8.2	6.3	2.0
DV 140 K 3225	140	180	220	360	5.0	7.5	0.10	400	180	8.2	6.3	2.0
DV 150 K 3225	150	200	240	395	5.0	9.0	0.10	400	150	8.2	6.3	2.0
DV 175 K 3225	175	225	270	455	5.0	9.5	0.10	400	130	8.2	6.3	2.0
DV 230 K 3225	230	300	360	595	5.0	10.0	0.10	400	110	8.2	6.3	2.0
DV 250 K 3225	250	320	390	650	5.0	11.0	0.10	400	100	8.2	6.3	2.0
DV 275 K 3225	275	350	430	710	5.0	13.0	0.10	400	90	8.2	6.3	2.0
DV 300 K 3225	300	385	470	775	5.0	15.0	0.10	400	85	8.2	6.3	2.0



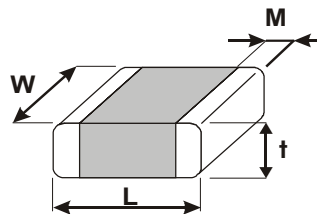
Single Layer Technology

Varistor Plus

Device Ratings and Characteristics

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

Catalog Number	V <sub>RMS</sub>	V <sub>DC</sub>	V <sub>N</sub> @ 1 mA	V <sub>C</sub>	I <sub>C</sub>	W <sub>MAX</sub> 10/1000 μs	P <sub>MAX</sub>	I <sub>P</sub> 130	C <sub>TYP</sub> @ 1kHz	L ± 0.5	W ± 0.4	t <sub>MAX</sub>
Unit of Measure	Volts	Volts	Volts	Volts	Amps	Joules	Watts	Amps	pF	mm	mm	mm
DV 11 K 4032	11	14	18	36	2.5	1.1	0.02	250	4300	10.0	8.0	1.4
DV 14 K 4032	14	18	22	43	2.5	1.3	0.02	250	3500	10.0	8.0	1.6
DV 17 K 4032	17	22	27	53	2.5	1.6	0.02	250	3000	10.0	8.0	1.8
DV 20 K 4032	20	26	33	65	2.5	2.0	0.02	250	2300	10.0	8.0	1.8
DV 25 K 4032	25	31	39	77	2.5	2.4	0.02	250	1900	10.0	8.0	2.0
DV 30 K 4032	30	38	47	93	2.5	2.8	0.02	250	1600	10.0	8.0	2.0
DV 35 K 4032	35	45	56	110	2.5	3.4	0.02	250	1400	10.0	8.0	2.0
DV 40 K 4032	40	56	68	135	2.5	4.1	0.02	250	1200	10.0	8.0	2.0
DV 50 K 4032	50	65	82	135	10.0	6.5	0.25	1200	580	10.0	8.0	2.0
DV 60 K 4032	60	85	100	165	10.0	7.0	0.25	1200	530	10.0	8.0	2.0
DV 75 K 4032	75	100	120	200	10.0	9.0	0.25	1200	480	10.0	8.0	2.0
DV 95 K 4032	95	125	150	250	10.0	11.0	0.25	1200	310	10.0	8.0	2.0
DV 115 K 4032	115	150	180	300	10.0	13.0	0.25	1200	270	10.0	8.0	2.0
DV 130 K 4032	130	170	205	340	10.0	15.0	0.25	1200	250	10.0	8.0	2.0
DV 140 K 4032	140	180	220	360	10.0	18.0	0.25	1200	240	10.0	8.0	2.0
DV 150 K 4032	150	200	240	395	10.0	18.5	0.25	1200	220	10.0	8.0	2.0
DV 175 K 4032	175	225	270	455	10.0	21.0	0.25	1200	200	10.0	8.0	2.0
DV 230 K 4032	230	300	360	595	10.0	23.0	0.25	1200	170	10.0	8.0	2.0
DV 250 K 4032	250	320	390	650	10.0	25.0	0.25	1200	160	10.0	8.0	2.0
DV 275 K 4032	275	350	430	710	10.0	29.0	0.25	1200	150	10.0	8.0	2.0
DV 300 K 4032	300	385	470	775	10.0	30.0	0.25	1200	140	10.0	8.0	2.0

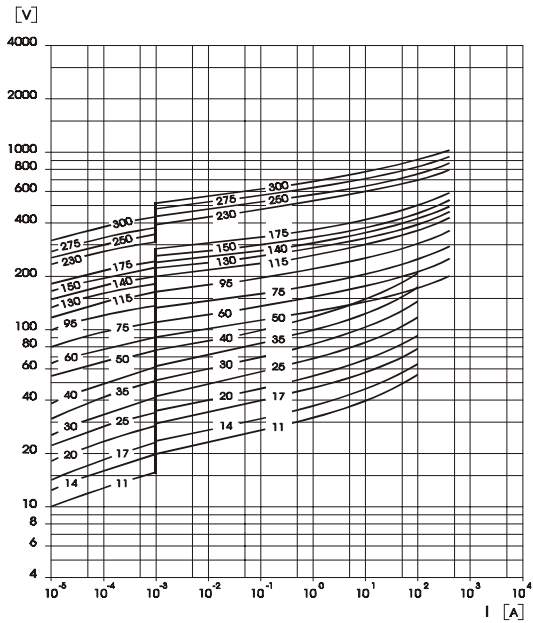




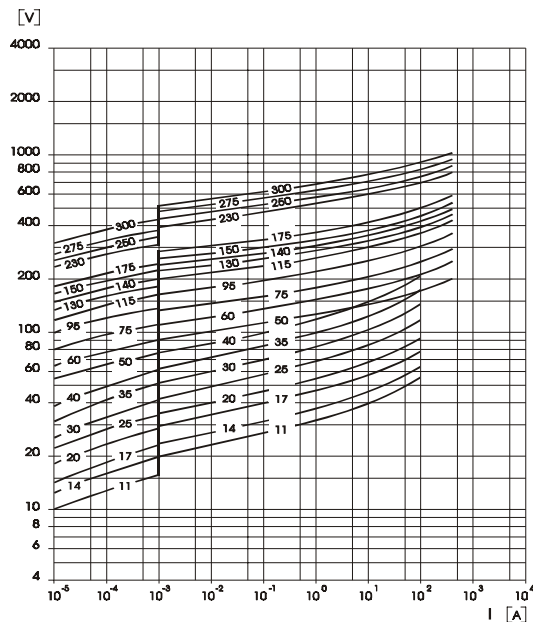
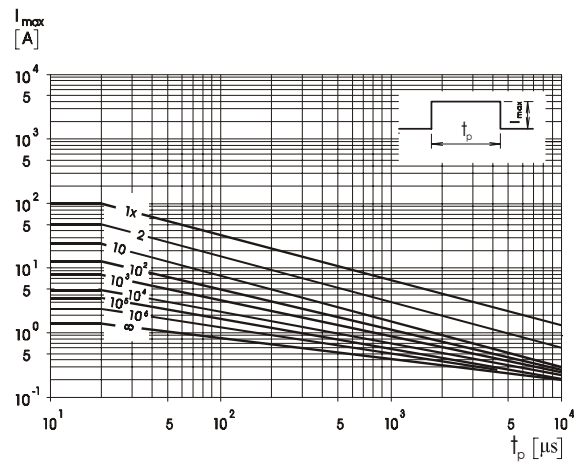
Performance Characteristics

Voltage/Current Curves

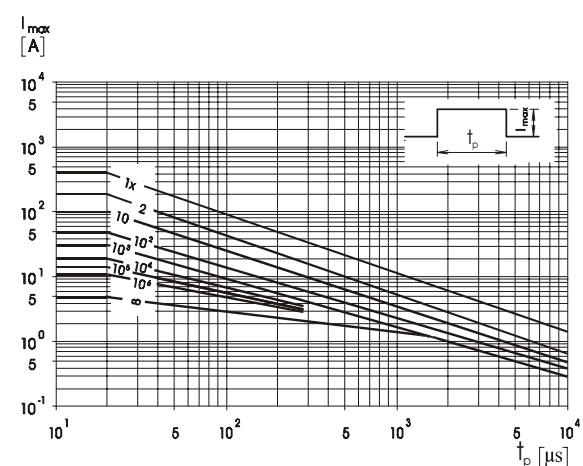
Pulse Rating Curves



DV 11...40K 3225

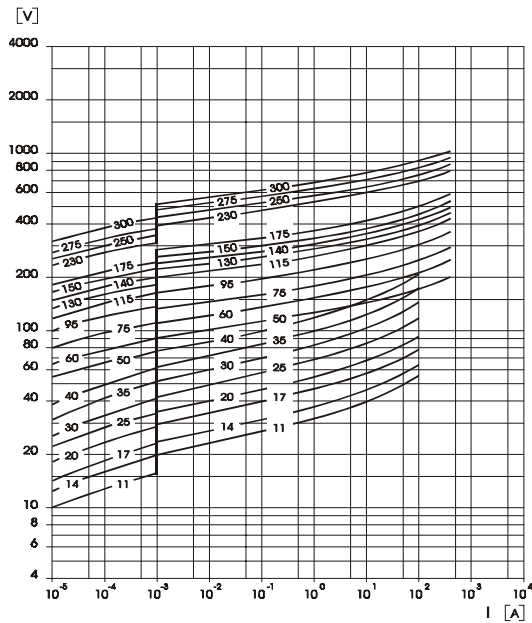


DV 50...300K 3225



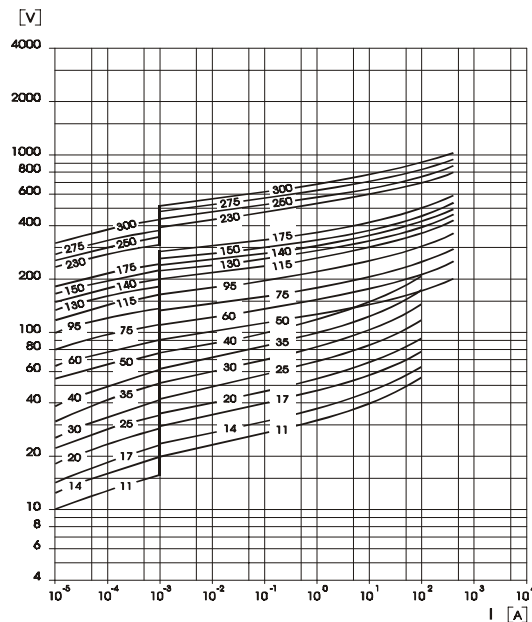
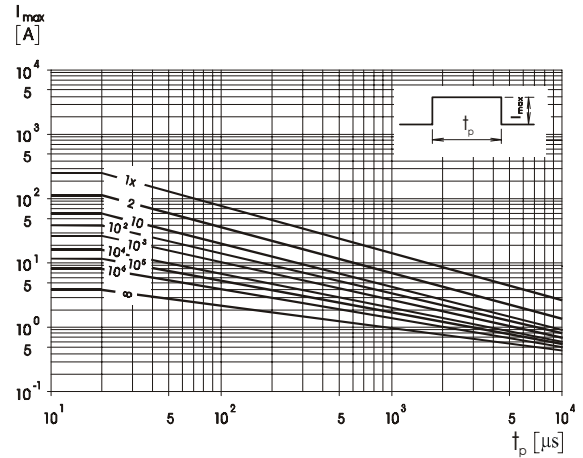
Performance Characteristics

Voltage/Current Curves

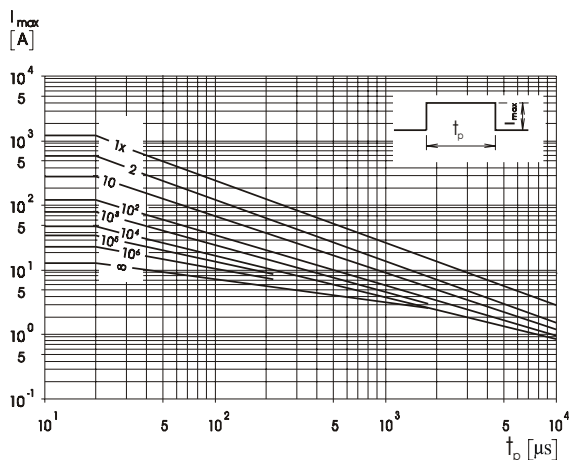


DV 11...40K 4032

Pulse Rating Curves



DV 50...300K 4032



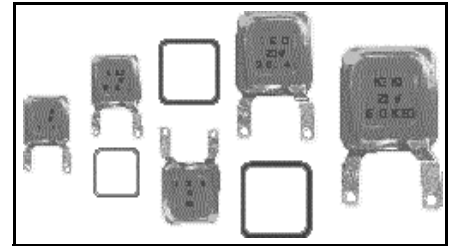
Single Layer Technology

Varistor Plus

Description

ZOV Series of varistors square shaped components that feature a wide range of surge current and energy absorption capabilities over an operating voltage range from 60 to 680 V<sub>RMS</sub>. There are two versions of these varistors.

The standard version is available in a 5 model sizes from 23mm to 60mm, with single-pulse (8/20 us) surge capabilities ranging from 15kA to 80kA. Offered in both block format and rigid leaded construction, these varistors provide excellent protection against high-energy transients such as inductively coupled lightning strikes, line switching load surges, and other transient events where large amounts on current are present.



The second version features a broad range of custom parameters to meet specific over-voltage protection requirements. Customers are given the opportunity to design the optimum varistor with minimum dimensions to satisfy a custom TVS application. Available customized parameters are: non-standard AC/DC operating voltages, maximum surge current, maximum dissipation power and the varistor shape, the dimensions being a function of required electrical parameters and vice-versa.

Both of these groups are offered in two versions: epoxy coated with rigid terminals and metallized varistor blocks. The first version is designed to provide secondary surge protection in outdoor and service entrance environments (distribution panels), in computers and also in industrial applications for motor controls and power supplies for equipment in oil-drilling, mining, and transportation field. The second version is 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<sub>RMS</sub>.....60V to 680V
- Operating voltage range V<sub>DC</sub>.....85V to 900V
- 5 model sizes available.....23, 25, 32, 40, and 60 mm
- Broad range of current and energy handling capabilities
- Low limiting voltage @ I<sub>MAX</sub> /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
- UL1449 & CSA 22.2, File E 221545 (Transient Voltage Surge Suppression) for ZOV 75...680 K 32 and 40

Full Custom Parameter Design Varistors

- Operating voltage range V<sub>RMS</sub>.....60V to 680V
- Operating voltage range V<sub>DC</sub>.....85V to 900V
- Indefinite number of sizes of both square and rectangular shape, the maximum one being 45 x 90 mm
- Broad range of current and energy handling capabilities
- +85°C continuous operating temperature
- Available customized parameters 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 metallized varistor blocks

Absolute Maximum Ratings

	Standard Values	Custom Designed Values
<b>Continuous:</b>		
Steady State Applied Voltage:		
DC Voltage Range (V <sub>DC</sub> )	85V to 900V	85V to 900V
AC Voltage Range (V <sub>RMS</sub> )	60V to 680V	60V to 680V
<b>Transient:</b>		
Peak Single Pulse Surge Current (I <sub>P</sub> ), 8/20 μs Waveform	15000A to 80000A	> 5500A/cm <sup>3</sup>
Single Pulse Surge Energy (W <sub>MAX</sub> ), 10/1000 μs Waveform	90J to 4140J	> 400J/cm <sup>3</sup>
Operating Ambient Temperature	-40°C to +85°C	-40°C to +85°C
Storage Temperature Range	-40°C to +125°C	-40°C to +125°C
Threshold Voltage Temperature Coefficient	< - 0.05%/°C	< - 0.005%/°C>
Insulation Resistance	> 1GΩ	1GΩ
Isolation Voltage Capability	> 2.5kV	> 2.5kV
Response Time	< 25ns	< 25ns
Climate Category	40/85/56	40/85/56

**HOW TO ORDER: ZOV SERIES (HIGH ENERGY VARISTORS)**

**ZOV 680 J 60 E**

**DESIGN:**

- E = Epoxy coated varistor with rigid terminals
- M = Metallized varistor block
- ME = Uncoated block with rigid terminals

**MODEL SIZE (in mm):**

- 23, 25, 32, 40, 60
- (See dimensional drawings on page 50.)

**V<sub>N</sub> TOLERANCE:**

- J = ± 5%, K = ±10%, L = ±15%, M = ±20%, S = Special

**MAXIMUM CONTINUOUS WORKING VOLTAGE (V<sub>RMS</sub>):**

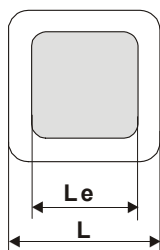
- 60, 75, 95, 130, 150, 230, 250, 275, 300,
- 320, 385, 420, 460, 510, 550, 680

**SERIES NAME**

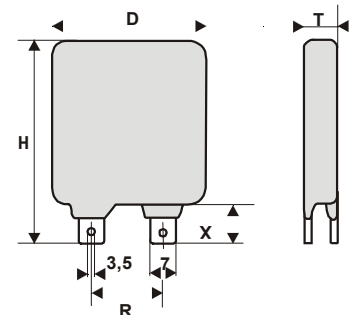
Device Ratings and Characteristics

ZOV 60 K 23.....ZOV 680 K 25

Catalog Number	V <sub>RMS</sub>	V <sub>DC</sub>	V <sub>N</sub> @ 1 mA	V <sub>C</sub>	I <sub>C</sub>	W <sub>MAX</sub> 10/1000 μs	P <sub>MAX</sub>	I <sub>P</sub> 8/20 μs	C <sub>(TYP)</sub> @ 1kHz	t <sub>MAX</sub>	T <sub>MAX</sub>
Unit of Measure	Volts	Volts	Volts	Volts	Amps	Joules	Watts	Amps	pF	mm	mm
ZOV 60 K 23	60	85	100	165	100	90	1.0	15,000	3,850	1.0	7.7
ZOV 75 K 23	75	100	120	200	100	100	1.0	15,000	3,500	1.2	7.9
ZOV 95 K 23	95	125	150	250	100	135	1.0	15,000	2,950	1.4	8.1
ZOV 130 K 23	130	170	205	340	100	180	1.0	15,000	2,310	1.5	8.1
ZOV 150 K 23	150	200	240	395	100	215	1.0	15,000	1,990	1.6	8.3
ZOV 230 K 23	230	300	360	595	100	320	1.0	15,000	1,320	2.2	9.0
ZOV 250 K 23	250	320	390	650	100	350	1.0	15,000	1,220	2.4	9.2
ZOV 275 K 23	275	350	430	710	100	380	1.0	15,000	1,100	2.6	9.4
ZOV 300 K 23	300	385	470	775	100	440	1.0	15,000	1,010	3.0	9.7
ZOV 320 K 23	320	420	510	840	100	480	1.0	15,000	990	3.2	9.9
ZOV 385 K 23	385	505	620	1025	100	500	1.0	15,000	810	3.8	10.6
ZOV 420 K 23	420	560	680	1120	100	530	1.0	15,000	740	4.4	10.9
ZOV 460 K 23	460	615	750	1240	100	580	1.0	15,000	670	4.8	11.4
ZOV 510 K 23	510	670	820	1355	100	600	1.0	15,000	610	5.2	11.8
ZOV 550 K 23	550	745	910	1500	100	650	1.0	15,000	550	5.9	12.5
ZOV 680 K 23	680	895	1100	1815	100	770	1.0	15,000	460	6.9	13.5
ZOV 60 K 25	60	85	100	165	150	125	1.0	18,000	4,850	1.0	7.7
ZOV 75 K 25	75	100	120	200	150	145	1.0	18,000	4,500	1.2	7.9
ZOV 95 K 25	95	125	150	250	150	190	1.0	18,000	3,680	1.4	8.1
ZOV 130 K 25	130	170	205	340	150	250	1.0	18,000	2,900	1.5	8.1
ZOV 150 K 25	150	200	240	395	150	300	1.0	18,000	2,480	1.6	8.3
ZOV 230 K 25	230	300	360	595	150	450	1.0	18,000	1,650	2.2	9.0
ZOV 250 K 25	250	320	390	650	150	490	1.0	18,000	1,530	2.4	9.2
ZOV 275 K 25	275	350	430	710	150	530	1.0	18,000	1,380	2.6	9.4
ZOV 300 K 25	300	385	470	775	150	615	1.0	18,000	1,270	3.0	9.7
ZOV 320 K 25	320	420	510	840	150	680	1.0	18,000	1,240	3.2	9.9
ZOV 385 K 25	385	505	620	1025	150	690	1.0	18,000	1,020	3.8	10.6
ZOV 420 K 25	420	560	680	1120	150	740	1.0	18,000	930	4.4	10.9
ZOV 460 K 25	460	615	750	1240	150	810	1.0	18,000	840	4.8	11.4
ZOV 510 K 25	510	670	820	1355	150	840	1.0	18,000	770	5.2	11.8
ZOV 550 K 25	550	745	910	1500	150	900	1.0	18,000	690	5.9	12.5
ZOV 680 K 25	680	895	1100	1815	150	1080	1.0	18,000	570	6.9	13.5



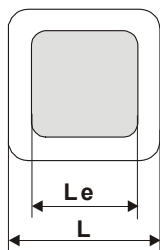
Size	L <sub>MAX</sub> mm	L <sub>EMAX</sub> mm	D <sub>MAX</sub> mm	R <sub>MAX</sub> mm
23	23	21.0	26.0	18.5
25	25	23.0	27.0	18.5
32	30	28.0	32.0	25.4
40	34	32.0	38.0	25.4
60	44	42.0	47.0	25.4



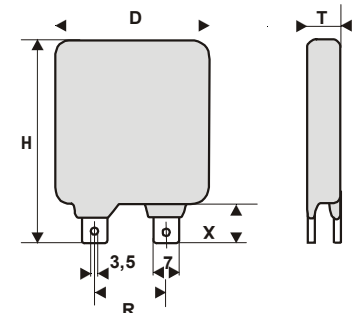
Device Ratings and Characteristics

ZOV 60 K 32.....ZOV 680 K 40

Catalog Number	V <sub>RMS</sub>	V <sub>DC</sub>	V <sub>N</sub> @ 1 mA	V <sub>C</sub>	I <sub>C</sub>	W <sub>MAX</sub> 10/1000 μs	P <sub>MAX</sub>	I <sub>P</sub> 8/20 μs	C <sub>(TYP)</sub> @ 1kHz	t <sub>MAX</sub>	T <sub>MAX</sub>
Unit of Measure	Volts	Volts	Volts	Volts	Amps	Joules	Watts	Amps	pF	mm	mm
ZOV 60 K 32	60	85	100	165	200	250	1.2	30,000	9,700	1.0	7.7
ZOV 75 K 32	75	100	120	200	200	280	1.2	30,000	8,900	1.2	7.9
ZOV 95 K 32	95	125	150	250	200	380	1.2	30,000	7,470	1.4	8.1
ZOV 130 K 32	130	170	205	340	200	500	1.2	30,000	5,780	1.5	8.1
ZOV 150 K 32	150	200	240	395	200	600	1.2	30,000	4,960	1.6	8.3
ZOV 230 K 32	230	300	360	595	200	900	1.2	30,000	3,300	2.2	9.0
ZOV 250 K 32	250	320	390	650	200	970	1.2	30,000	3,050	2.4	9.2
ZOV 275 K 32	275	350	430	710	200	1060	1.2	30,000	2,770	2.6	9.4
ZOV 300 K 32	300	385	470	775	200	1225	1.2	30,000	2,540	3.0	9.7
ZOV 320 K 32	320	420	510	840	200	1350	1.2	30,000	2,470	3.2	9.9
ZOV 385 K 32	385	505	620	1025	200	1390	1.2	30,000	2,040	3.8	10.6
ZOV 420 K 32	420	560	680	1120	200	1480	1.2	30,000	1,850	4.4	10.9
ZOV 460 K 32	460	615	750	1240	200	1610	1.2	30,000	1,680	4.8	11.4
ZOV 510 K 32	510	670	820	1355	200	1680	1.2	30,000	1,530	5.2	11.8
ZOV 550 K 32	550	745	910	1500	200	1810	1.2	30,000	1,380	5.9	12.5
ZOV 680 K 32	680	895	1100	1815	200	2160	1.2	30,000	1,150	6.9	13.5
ZOV 60 K 40	60	85	100	165	300	300	1.4	45,000	12,000	1.0	7.7
ZOV 75 K 40	75	100	120	200	300	340	1.4	45,000	11,000	1.2	7.9
ZOV 95 K 40	95	125	150	250	300	450	1.4	45,000	9,200	1.4	8.1
ZOV 130 K 40	130	170	205	340	300	600	1.4	45,000	7,200	1.5	8.1
ZOV 150 K 40	150	200	240	395	300	720	1.4	45,000	6,100	1.6	8.3
ZOV 230 K 40	230	300	360	595	300	1080	1.4	45,000	4,060	2.2	9.0
ZOV 250 K 40	250	320	390	650	300	1160	1.4	45,000	3,760	2.4	9.2
ZOV 275 K 40	275	350	430	710	300	1280	1.4	45,000	3,400	2.6	9.4
ZOV 300 K 40	300	385	470	775	300	1470	1.4	45,000	3,130	3.0	9.7
ZOV 320 K 40	320	420	510	840	300	1620	1.4	45,000	3,050	3.2	9.9
ZOV 385 K 40	385	505	620	1025	300	1660	1.4	45,000	2,500	3.8	10.6
ZOV 420 K 40	420	560	680	1120	300	1780	1.4	45,000	2,280	4.4	10.9
ZOV 460 K 40	460	615	750	1240	300	1930	1.4	45,000	2,060	4.8	11.4
ZOV 510 K 40	510	670	820	1355	300	2010	1.4	45,000	1,900	5.2	11.8
ZOV 550 K 40	550	745	910	1500	300	2170	1.4	45,000	1,700	5.9	12.5
ZOV 680 K 40	680	895	1100	1515	300	2590	1.4	45,000	1,400	6.9	13.5



Size	L <sub>MAX</sub> mm	L <sub>EMAX</sub> mm	D <sub>MAX</sub> mm	R <sub>MAX</sub> mm
23	23	21.0	26.0	18.5
25	25	23.0	27.0	18.5
32	30	28.0	32.0	25.4
40	34	32.0	38.0	25.4
60	44	42.0	47.0	25.4

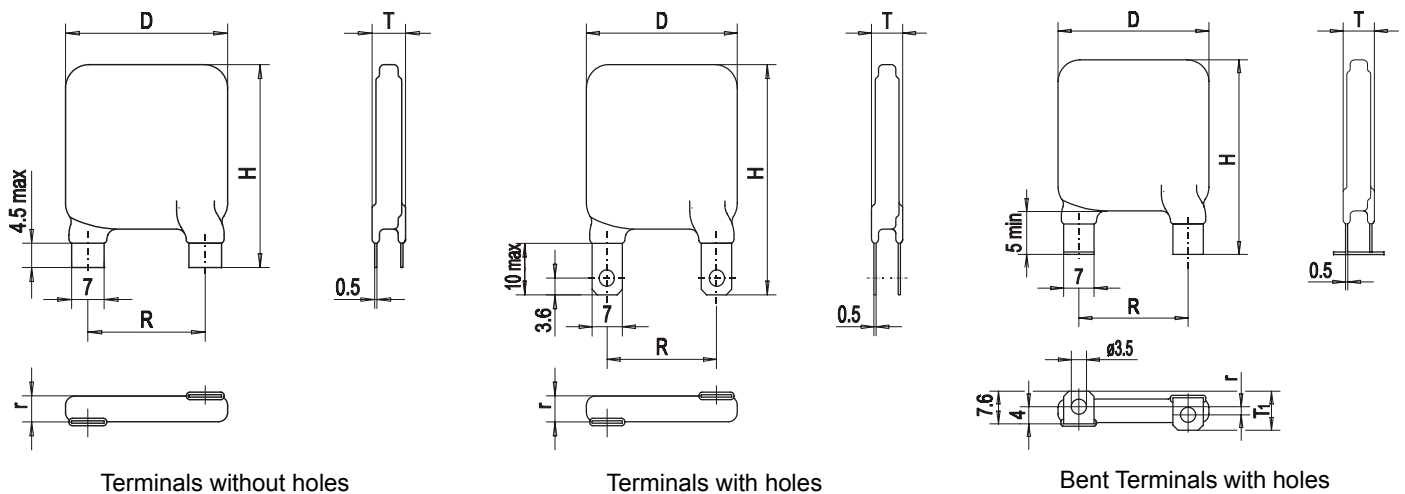


Device Ratings and Characteristics

ZOV 130 K 60.....ZOV 680 K 60

Catalog Number	V <sub>RMS</sub>	V <sub>DC</sub>	V <sub>N</sub> @ 1 mA	V <sub>C</sub>	I <sub>C</sub>	W <sub>MAX</sub> 10/1000 μs	P <sub>MAX</sub>	I <sub>P</sub> 8/20 μs	C <sub>(TYP)</sub> @ 1kHz	t <sub>MAX</sub>	T <sub>MAX</sub>
Unit of Measure	Volts	Volts	Volts	Volts	Amps	Joules	Watts	Amps	pF	mm	mm
ZOV 130 K 60	130	170	205	340	500	960	1.6	80,000	11,520	1.5	8.1
ZOV 150 K 60	150	200	240	395	500	1150	1.6	80,000	9,760	1.6	8.3
ZOV 230 K 60	230	300	360	595	500	1730	1.6	80,000	6,490	2.2	9.0
ZOV 250 K 60	250	320	390	650	500	1860	1.6	80,000	6,050	2.4	9.2
ZOV 275 K 60	275	350	430	710	500	2050	1.6	80,000	5,440	2.6	9.4
ZOV 300 K 60	300	385	470	775	500	2350	1.6	80,000	5,000	3.0	9.7
ZOV 320 K 60	320	420	510	840	500	2600	1.6	80,000	4,880	3.2	9.9
ZOV 385 K 60	385	505	620	1025	500	2660	1.6	80,000	4,000	3.8	10.6
ZOV 420 K 60	420	560	680	1120	500	2850	1.6	80,000	3,650	4.4	10.9
ZOV 460 K 60	460	615	750	1240	500	3090	1.6	80,000	3,300	4.8	11.4
ZOV 510 K 60	510	670	820	1355	500	3220	1.6	80,000	3,040	5.2	11.8
ZOV 550 K 60	550	745	910	1500	500	3470	1.6	80,000	2,720	5.9	12.5
ZOV 680 K 60	680	895	1100	1815	500	4140	1.6	80,000	2,240	6.9	13.5

Available Versions of ZOV Terminals



Terminals without holes

Terminals with holes

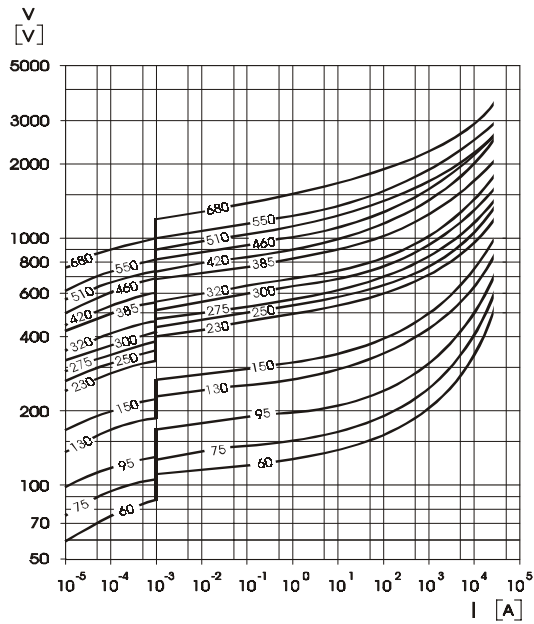
Bent Terminals with holes





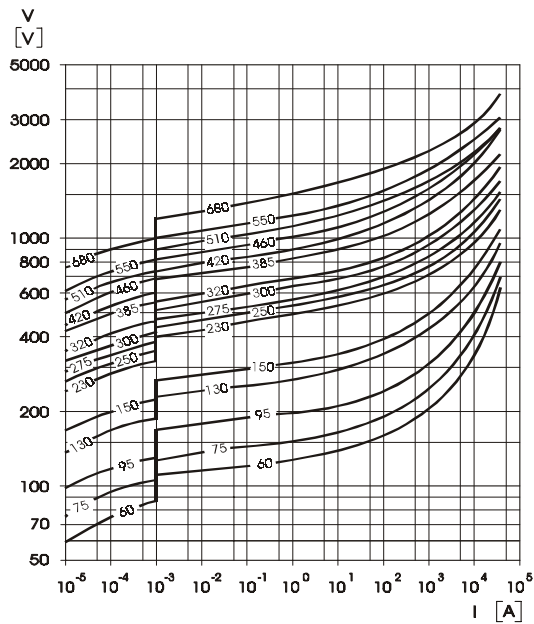
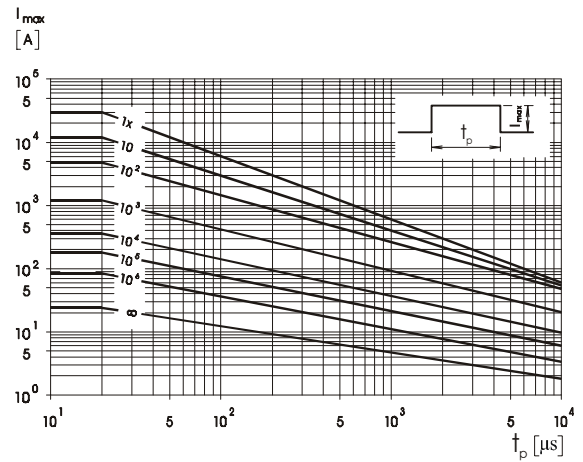
Performance Characteristics

Voltage/Current Curves

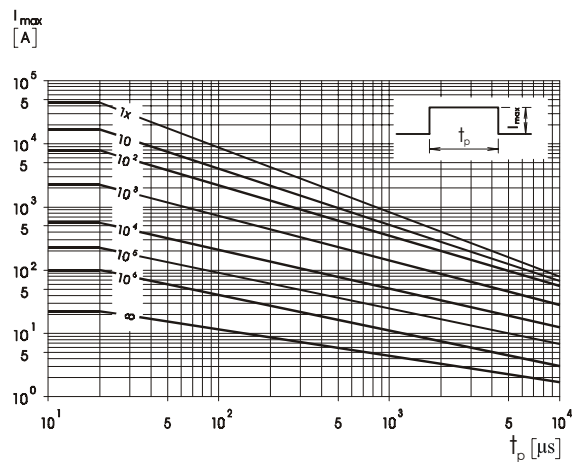


ZOV 60...680K 32

Pulse Rating Curves

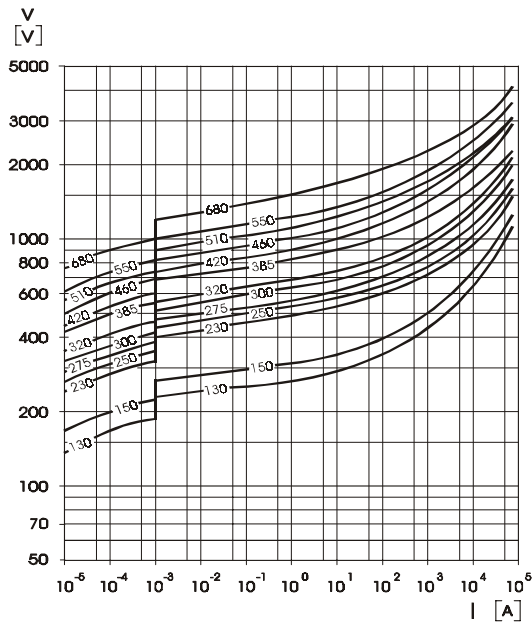


ZOV 60...680K 40



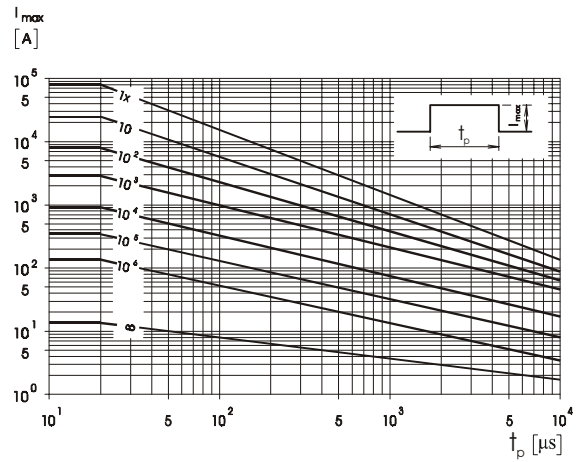
Performance Characteristics

Voltage/Current Curves



ZOV 60...680K 60

Pulse Rating Curves

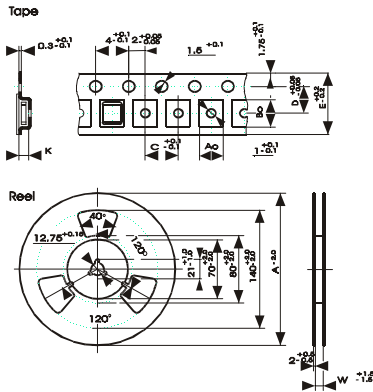




Tape & Reel Specification – DV Series

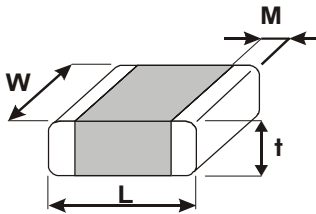
Tape / Reel Dimensions

Conforms to IEC Publication 286-2



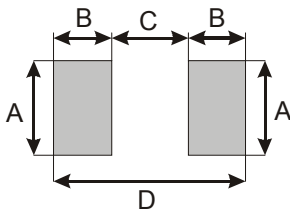
PARAMETERS	CASE SIZE	
	3225	4032
	mm	
A <sub>0</sub>	8.9	8.6
B <sub>0</sub>	8.7	10.6
C	12.0	12.0
D	7.5	7.5
E	16.4	16.4
K <sub>MAX</sub>	4.7	4.7
W	16.4	16.4
A	330	330

Case Size Dimensions



DV Series	Voltage Range	Length	Width	Land Length	Thickness
		L ± 0.5	W ± 0.4	M ± 0.25	t <sub>MAX</sub>
Size	V <sub>RMS</sub>	mm	mm	mm	mm
3225	11 to 300	8.0	6.3	0.5	2.0
4032	11 to 300	10.0	8.0	0.1	2.0

Recommended Soldering Pad Dimensions

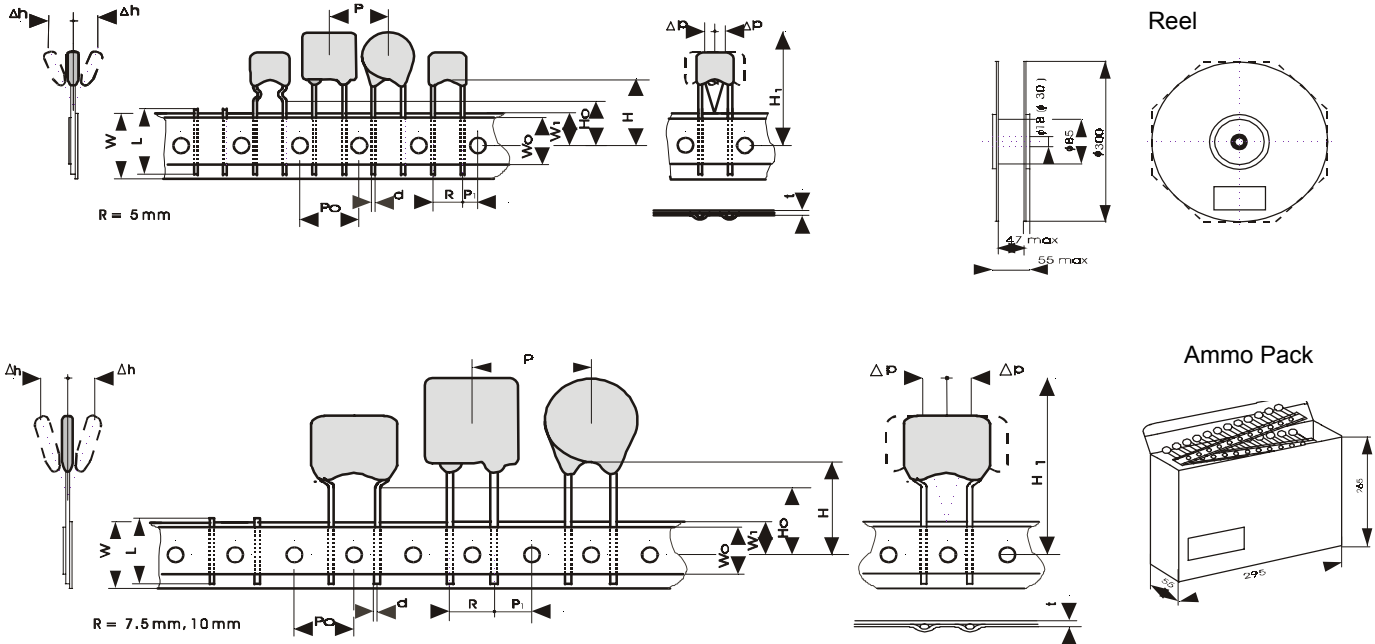


DV Series	Voltage Range	A	B	C	D
		mm	mm	mm	mm
Size	V <sub>RMS</sub>				
3225	11 to 300	6.8	1.5	6.5	9.5
4032	11 to 300	6.8	1.5	8.7	11.7

Tape & Reel Specification – CV, CV+, SV Series

Ammo Pack Dimensions

Conforms to IEC Publication 286-2



Symbol	Parameters	Series CV CV+ SV	Model Size				
			05	07	10	14	20
W	Tape Width		18 +1.0/-0.5 (0.71 +0.04/-0.02)	18 +1.0/-0.5 (0.71 +0.04/-0.02)	18 +1.0/-0.5 (0.71 +0.04/-0.02)	18 +1.0/-0.5 (0.71 +0.04/-0.02)	18 +1.0/-0.5 (0.71 +0.04/-0.02)
W <sub>0</sub>	Hold Down Tape Width		12 Min. (0.47 Min.)	12 Min. (0.47 Min.)	12 Min. (0.47 Min.)	12 Min. (0.47 Min.)	12 Min. (0.47 Min.)
W <sub>1</sub>	Hold position		9 +0.75/0.5 (0.35 +0.03/0.02)	9 +0.75/0.5 (0.35 +0.03/0.02)	9 +0.75/0.5 (0.35 +0.03/0.02)	9 +0.75/0.5 (0.35 +0.03/0.02)	9 +0.75/0.5 (0.35 +0.03/0.02)
t	Total Tape Thickness		0.9 Max. (0.04 Max.)	0.9 Max. (0.04 Max.)	0.9 Max. (0.04 Max.)	0.9 Max. (0.04 Max.)	0.9 Max. (0.04 Max.)
P	Pitch of Component		12.7 ± 1.0 (0.5 ± 0.04)	12.7 ± 1.0 (0.5 ± 0.04)	12.7 ± 1.0 (0.5 ± 0.04)	12.7 ± 1.0 (0.5 ± 0.04)	12.7 ± 1.0 (0.5 ± 0.04)
P <sub>0</sub>	Feed Hold Pitch		12.7 ± 0.2 (0.5 ± 0.01)	12.7 ± 0.2 (0.5 ± 0.01)	12.7 ± 0.2 (0.5 ± 0.01)	12.7 ± 0.2 (0.5 ± 0.01)	12.7 ± 0.2 (0.5 ± 0.01)
P <sub>1</sub>	Feed Hold Center to Pitch		3.81 ± 0.7 (0.15 ± 0.03)	3.81 ± 0.7 (0.15 ± 0.03)	8.89 ± 0.8 (0.35 ± 0.03)	8.89 ± 0.8 (0.35 ± 0.03)	7.62 ± 0.8 (0.30 ± 0.03)
R	Lead Spacing		5.08 +0.6/-0.1 (0.2 +0.02/-0.004)	5.08 +0.6/-0.1 (0.2 +0.02/-0.004)	7.62 +0.6/-0.1 (0.3 +0.02/-0.004)	7.62 +0.6/-0.1 (0.3 +0.02/-0.004)	10.16 +0.6/-0.1 (0.4 +0.02/-0.004)
ΔP	Component Alignment		± 1.3 Max. (± 0.05 Max.)	± 1.3 Max. (± 0.05 Max.)	± 2.0 Max. (± 0.08 Max.)	± 2.0 Max. (± 0.08 Max.)	± 2.0 Max. (± 0.08 Max.)
Δh	Component Alignment		± 2.0 Max. (± 0.08 Max.)	± 2.0 Max. (± 0.08 Max.)	Depends on t <sub>max</sub>	Depends on t <sub>max</sub>	Depends on t <sub>max</sub>
d	Wire Diameter		0.6 ± 0.05 (0.024 ± 0.002)	0.6 ± 0.05 (0.024 ± 0.002)	0.8 ± 0.05 (0.031 ± 0.002)	0.8 ± 0.05 (0.031 ± 0.002)	0.8 ± 0.05 (0.031 ± 0.002)
D <sub>0</sub>	Feed Hold Diameter		4 +/- 0.2 (0.16 +/- 0.01)	4 ± 0.2 (0.16 ± 0.01)	4 ± 0.2 (0.16 ± 0.01)	4 ± 0.2 (0.16 ± 0.01)	4 ± 0.2 (0.16 ± 0.01)
H	Height from Tape Center		18 +2.0/-0.0 (0.71 +/- 0.0)	18 +2.0/-0.0 (0.71 ± 0.0)	18 +2.0/-0.0 (0.71 ± 0.0)	18 +2.0/-0.0 (0.71 ± 0.0)	18 +2.0/-0.0 (0.71 +/- 0.0)
H <sub>0</sub>	Seating Plane Height		16 +/- 0.5 (0.63 +/- 0.02)	16 ± 0.5 (0.63 ± 0.02)	16 ± 0.5 (0.63 ± 0.02)	16 ± 0.5 (0.63 ± 0.02)	16 ± 0.5 (0.63 ± 0.02)
H <sub>1</sub>	Component Height		32.2 Max. (1.27 Max.)	32.2 Max. (1.27 Max.)	38.5 Max. (1.52 Max.)	40.0 Max. (1.57 Max.)	46.5 Max. (1.83 Max.)
L	Length of Clipped Lead		11 Max. (0.43 Max.)	11 Max. (0.43 Max.)	11 Max. (0.43 Max.)	11 Max. (0.43 Max.)	11 Max. (0.43 Max.)

Legend: mm (inch)

Lead Style (Version) / Lead Spacing – CV, CV+, SV Series

Product Series / Range	Dimensions			Version 1	Version 5
	R	h	A		
	mm (inch)	mm (inch)	mm (inch)		
CV 11...275 K 05	5	9.5	14.5		
CV 11...300 K 07	5	9.5	16.5		
CV 60...275 K 07					
CV 14...550 K 10	7.5	15			
CV 50...550 K 14	7.5	19			
CV 50...550 K 20	10	26			
CV+ 60...550 K 10	7.5	15			
CV+ 60...550 K 14	7.5	16			
CV+ 60...550 K 20	10	26			
CV+ 130...550 K 23	10	29			
SV 60...300 K 05	5	9.5	14.5		
SV 60...300 K 07	5	11.5	16.5		
SV 60...550 K 10	7.5	15			
SV 60...550 K 14	7.5	19			
SV 60...550 K 20	10	26			
SV 60...550 K 23	10	29			

For additional lead styles (e.g., clipped leads), contact the factory.

## Varistor Marking – CV, CV+, SV, PV, ZOV Series

### Leaded Varistor – CV, CV+, SV Series

#### For Model Sizes 5, 7

**CV 130**  
**K7**

CV = Series Name  
130 =  $V_{RMS}$   
K =  $V_N$  Tolerance  
7 = Model Size: 5, 7

#### For Model Sizes 10, 14, 18, 20, 23

**KEKO**  
**CV 130**  
**K 20**

KEKO = Tradename  
CV = Series Name  
130 =  $V_{RMS}$   
K =  $V_N$  Tolerance  
20 = Model Size: 10, 14, 18, 20, 23

### Leaded High Energy Varistor – ZOV Series

#### **Standard**

#### For Model Sizes 23, 25, 32, 40, 60

**KEKO**  
**ZOV 680**  
**K 40**

KEKO = Tradename  
ZOV = Series Name  
680 =  $V_{RMS}$   
K =  $V_N$  Tolerance  
40 = Model Size: 23, 25, 40, 60

#### **Custom Designed**

**KEKO**  
**ZOV 275**  
**K 503**

KEKO = Tradename  
ZOV = Series Name  
275 =  $V_{RMS}$   
K =  $V_N$  Tolerance  
503 = Surge Current Code: 503, 50,000A, 8/20  $\mu$ s

### SMD Varistor – PV Series

#### For Model Sizes 3225, 4032

**KEKO**  
**PV 20**  
**K 3225**

KEKO = Tradename  
PV = Series Name  
20 =  $V_{RMS}$   
K =  $V_N$  Tolerance  
3225 = Model Size: 3225, 4032

### Reliability Testing Procedures

Reliability Parameter	Test	Tested according to	Condition to be satisfied after testing
AC/DC Bias Reliability	AC/DC Life Test	CECC 42000, Test 4.20 or IEC 1051-1, Test 4.20. 1000 h at UCT	$ DV_n/V_n @ 1 \text{ mA}  < 10 \%$ $R > 10 \text{ M}\Omega$
Pulse Current Capability	$I_{\text{MAX}}$ 8/20 $\mu\text{s}$	CECC 42000, 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	$ DV_n/V_n @ 1 \text{ mA}  < 10 \%$ no visible damage
Pulse Energy Capability	$W_{\text{MAX}}$ 10/1000 $\mu\text{s}$	CECC 42000, Test C 2.1 or IEC 1051-1, Test 4.5. 10 pulses in the same direction at 1 pulse every minutes at maximum peak current for 10 pulses	$ DV_n/V_n @ 1 \text{ mA}  < 10 \%$ no visible damage
Isolation Voltage Capability	Voltage proof	CECC 42000, Test 4.7 or IEC 1051-1, Test 4.8. Metal Ball method, 1 minute AC at isolation voltage	There shall be breakdown or flashover
Environmental and Storage Reliability	Climatic Sequence	CECC 42000, Test 4.16 or IEC 1051-1, Test 4.17. 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 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	$ DV_n/V_n @ 1 \text{ mA}  < 10 \%$ $R > 10 \text{ M}\Omega$
	Thermal Shock	CECC 42000, Test 4.12, Test Na, IEC 68-2-14 5 cycles UCT/LCT, 30 minutes	$ DV_n/V_n @ 1 \text{ mA}  < 10 \%$ no visible damage
	Steady State Damp Heat	CECC 42000, Test 4.17, Test Ca, IEC 68-2-3 56 days, 40°C, 93% RH	$ DV_n/V_n @ 1 \text{ mA}  < 10 \%$ $R > 10 \text{ M}\Omega$
Mechanical Reliability	Solderability	CECC 42000, Test 4.10.1., Test Ta, IEC 68-2-20 solder bath method, 235°C $\pm$ 5°C, 2 s	Solderable at shipment and after 6 months of storage
	Resistance to Soldering Heat	CECC 42000, Test 4.10.2., Test Tb, IEC 68-2-20 260°C $\pm$ 5°C, 10 s	$ DV_n/V_n @ 1 \text{ mA}  < 5 \%$
	Robustness of Termination	CECC 42000, Test 4.11 Test Ua, IEC 68-2-21	$ DV_n/V_n @ 1 \text{ mA}  < 5 \%$
	Vibration	CECC 42000, Test 4.15., Test Fc, IEC 68-2-6, Frequency range 10 to 55 Hz Amplitude 0.75 mm or 98 m/s <sup>2</sup> Total duration 6 h (3 x 2 h) Waveshape - half sine	$ DV_n/V_n @ 1 \text{ mA}  < 10 \%$ no visible damage
	Mechanical Shock	CECC 42000, Test 4.14, Test Ea, IEC 68-2-27 Acceleration = 490 m/s <sup>2</sup> , Pulse duration = 11 ms, Waveshape - half sine Number of shocks = 3 x 6	$ DV_n/V_n @ 1 \text{ mA}  < 10 \%$ no visible damage
Fire Hazard	Flammability Test	CECC 42000, Test 4.18.1 or IEC 695-2-2 Needle Flame Test, 10 s	Maximum 5 s



### Soldering Recommendations

The techniques used for soldering of components in surface mount technology are Infrared Reflow, Wave and Vapour Phase. With Wave soldering SMD Varicon is attached to the circuit board by an adhesive. The assembly is then placed on a conveyor and run through the soldering process to contact the wave. With Infrared Reflow and Vapour Phase Reflow, SMD Varicon is placed in a solder paste on the substrate. When the solder paste is heated it reflows and solder the unit to the board. Typical recommended solder paste wet layer thickness is 25 to 40  $\mu\text{m}$ .

Recommended solders are 62Sn/36Pb/2Ag, 60Sn / 40Pb or Pb free ones.

We recommend the following fluxes ( either as a part of the solder paste or themselves ) :

- non-activated (R)flux in cases where it is possible
- mildly activated (RMA) fluxes of class L3CN (such as Multicore Nucleon low residue X33F8S-07i f l u x )
- and class ORL0 ( such as Kester VOC Free No Clean977 flux)

Not to be used: activated (RA), water soluble or strong acidic fluxes with chlorine content exceeding 0,2 wt % . In case of Wave soldering solvent from the flux must be completely dried before soldering.

To avoid the possibility of generating stress due to the thermal shock, a preheat stage to within 100 °C of the peak temperature is recommended. Additionally SMD Varicon should not be subjected to a thermal gradient steeper than 4 °C/s, the ideal one being 2 °C/s. Peak temperature should be rigidly controlled as well. Examples of soldering conditions for S MD Varicons are given in Fig. 1 to 3 .

In case where several different parts are soldered, each having different soldering conditions, use those conditions requiring the least heat and minimum time.

Once soldering has been completed, it is still necessary to ensure that any further thermal shocks are avoided. The hot printed circuit board must be allowed to cool to less than 50 °C before cleaning.

Inspection criteria for soldered SMD Varicons on the board in case of Wave and Reflow soldering are given in Fig. 4.

In case of Vapor Phase Soldering of AgPd end terminations and when peak soldering temperature is < 210 °C the effect of 'negative' or 'mirror' meniscus appears as shown in Fig. 5. The reason is the following : solder forms metallurgical junction with the whole volume of end termination, i.e. it diffuses from pad to end termination across its inner side, forming 'negative' or ' mirror' meniscus. Height of solder penetration can be clearly seen on the end termination and is always higher than 30% of the chip height.

In case of Ni-barrier end termination solder forms metallurgical junction with thin Sn layer (on top of Ni-barrier), and due to its small volume 'climbs' the outer side of chip forming classical meniscus as given in Fig. 5.

Both AgPd and Ni-barrier end termination form reliable metallurgical and electrical contacts between end termination and pads. The same holds for strength of adhesion between end termination and pads, being tested either by vertical upward pull or horizontal force applied to chip. The only difference is optical appearance of meniscus and this should be taken in consideration when programming visual inspection of the PCB after soldering.

### Tests related to Soldering

We perform the following tests on each lot of varicons. Samples from each lot are kept for minimum of 2 years and we can check their solderability if the customer needs that information at any time within this period.

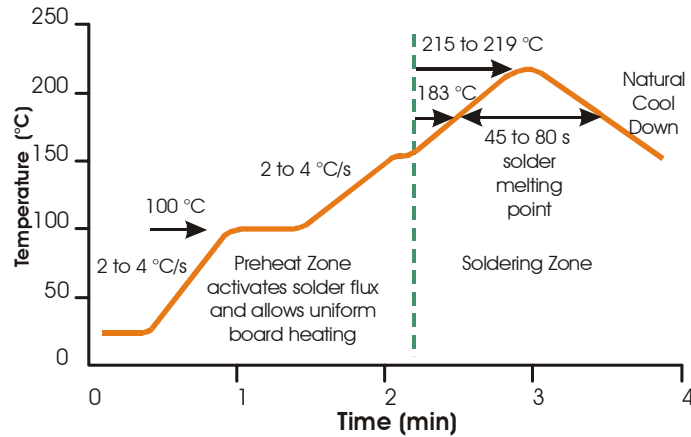


Fig. 1. Infrared Reflow Temperature Profile

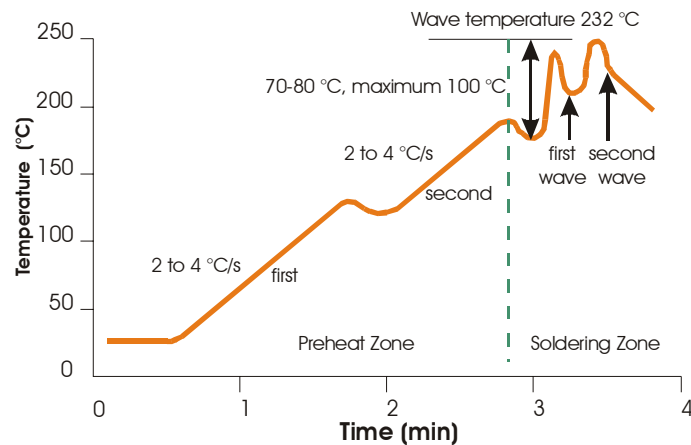


Fig. 2. Wave Soldering Temperature Profile

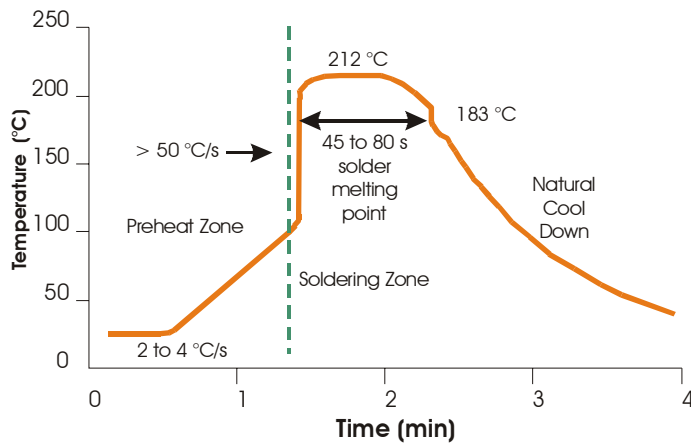


Fig. 3. Vapour Phase Temperature Profile

Single Layer Technology

Varistor Plus

Test Parameter	Resistance to Flux	Solderability	Static Leaching	Dynamic Leaching
Soldering method	Dipping	Dipping	Dipping	Dipping with agitation
Flux	L3CN ORLO	L3CN, ORLO, R	L3CN, ORLO, R	L3CN, ORLO, R
Solder	62Sn/36 Pb/2 Ag	62Sn/36 Pb/2 Ag	62Sn/36 Pb/2 Ag	62Sn/36 Pb/2 Ag
Soldering temperature (C)	235 ± 5	235 ± 5	260 ± 5	235 ± 5
Soldering time	2	2	10	>15
Burn-in Conditions	Vdcmx, 48 h	-	-	-
<b>Acceptance criterion</b>	Vn < 5% I <sub>dc</sub> must stay unchanged	> 95% of end terminal must be covered by solder	> 95% of end terminal must be covered by solder	> 95% of end terminal must be covered by solder

**Reworking with Solder Iron**

Do not allow the tip to directly contact the top of the chip. The following conditions must be strictly followed when using a soldering iron :

Soldering iron power output : 30 Wmax

Temperature of soldering iron tip : 280 °C max

Soldering time : 10 s max

**Environment Friendly End Terminations**

SMD Varicons with AgPd end termination have soldering performances very close to Ni-barrier ones without use of environmentally problematic Ni-plating process - so we can call them environment friendly. Comparison of SMD Varicon soldering curve typical to AgPd and Ni-barrier ones is given in the Fig. 6.

**Storage**

SMD varicons should be used within 1 year. They are to be left in the original package in order to avoid soldering problems caused by oxidized terminals. Air humidity should be less than 40 %. In case that SMD varicons have been in the stock longer than 1 year, KEKO VARICON can refresh them if necessary.

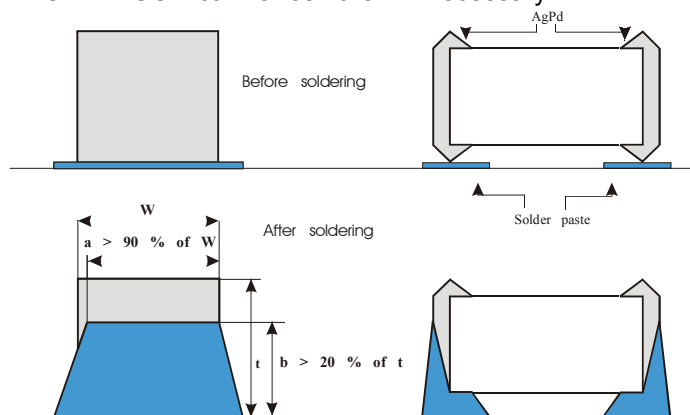


Fig. 4. Soldering Criterion in case of Wave and IR Reflow Soldering

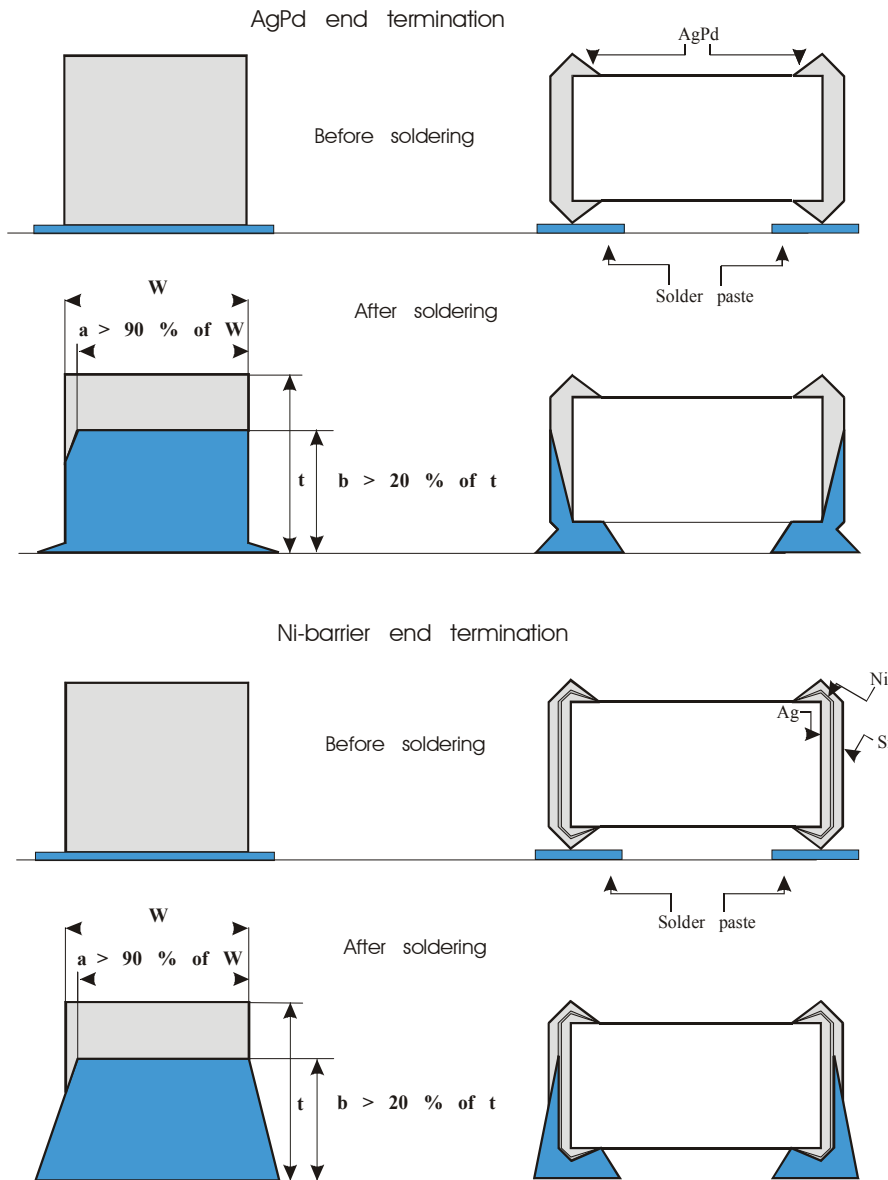


Fig. 5. Soldering Criterion in case of Vapour soldering

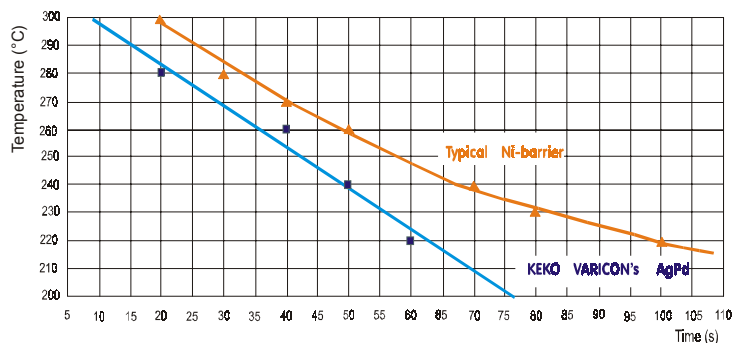


Fig. 6. Soldering Temperature-Time Characteristics

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