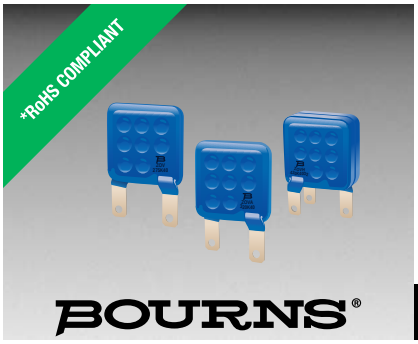


Features

- Formerly KEKO VARICON products
- Standard operating voltage range V_{rms} 275 V to 440 V
- Custom operating voltage range V_{rms} 150 V to 440 V
- Low limiting voltages @ I_n
- Broad range of current (pulse shape 8/20 µs) and energy (current pulse shape 10/350 µs) handling capabilities
- +85 °C continuous operating temperature; higher operating temperatures are available upon request
- Available in various versions and custom designed terminals

ZOVS/ZOVA/ZOVH Series Square Shaped Stacked High Energy Varistors

General Information

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

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

Additional Information

Click these links for more information:

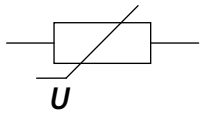
PRODUCT SELECTOR | TECHNICAL LIBRARY | INVENTORY | SAMPLES | CONTACT

Agency Recognition

Standard	UL 1449 4th Edition
File Number	E313168**

**Not all rated voltages and sizes are UL recognized. Check the file for details.

Varistor Symbol



Absolute Maximum Ratings

Parameter	Standard Types		Custom Designed Types	
	Value	Units	Value	Units
Continuous:				
Steady State Applied Voltage				
DC Voltage Range (V_{dc})	350 to 585	V	200 to 585	V
AC Voltage Range (V_{rms})	275 to 440	V	150 to 440	V
Transient:				
Peak Single Pulse Surge Current, 8/20 µs Waveform (I_{max})	40000 to 80000	A	> 5500	A/cm²
Single Pulse Surge Energy, 10/1000 µs Waveform (W_{max})	1280 to 4290	J	> 400	J/cm³
I_{imp} (10/350) peak current value	4000 to 12500	A	4000 to 12500	A
Operating Ambient Temperature	-40 to +85	°C	-40 to +85	°C
Storage Temperature Range	-40 to +125	°C	-40 to +125	°C
Threshold Voltage Temperature Coefficient	< +0.05	%/°C	< +0.05	%/°C
Insulation Resistance[1]	> 1	GΩ	> 1	GΩ
Isolation Voltage Capability[1]	> 2.5	kV	> 2.5	kV
Response Time	< 25	ns	< 25	ns
Climatic Category[1]	40 / 85 / 56		40 / 85 / 56	

Note 1: Epoxy coated components

WARNING
Cancer and Reproductive Harm
www.P65Warnings.ca.gov

* RoHS Directive 2015/863, Mar 31, 2015 and Annex.
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Users should verify actual device performance in their specific applications.
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Device Ratings

ZOVS Series

Model	V_{rms}	V_{dc}	V_n @ 1 mA	V_c @ I_c	I_c	W_{max} 10/1000 µs	P max.	I_{max} 8/20 µs	I_n 8/20 µs	I_{Imp} 10/350 µs	C Typ. @ 1 kHz
	V	V	V	V	A	J	W	A	A	A	pF
ZOVS 275 K 40	275	350	430	710	300	1280	1.4	40000	20000	4000	3400
ZOVS 320 K 40	320	420	510	840	300	1620	1.4	40000	20000	4000	3050
ZOVS 385 K 40	385	505	620	1025	300	1660	1.4	40000	20000	4000	2500
ZOVS 420 K 40	420	560	680	1120	300	1780	1.4	40000	20000	4000	2280
ZOVS 440 K 40	440	585	715	1180	300	1860	1.4	40000	20000	4000	2100

ZOVA Series

Model	V_{rms}	V_{dc}	V_n @ 1 mA	V_c @ I_c	I_c	W_{max} 10/1000 µs	P max.	I_{max} 8/20 µs	I_n 8/20 µs	I_{Imp} 10/350 µs	C Typ. @ 1 kHz
	V	V	V	V	A	J	W	A	A	A	pF
ZOVA 275 K 40	275	350	430	710	300	1920	1.4	40000	20000	5000	3150
ZOVA 320 K 40	320	420	510	840	300	2430	1.4	40000	20000	5000	2800
ZOVA 385 K 40	385	505	620	1025	300	2490	1.4	40000	20000	5000	2250
ZOVA 420 K 40	420	560	680	1120	300	2670	1.4	40000	20000	5000	2050
ZOVA 440 K 40	440	585	715	1180	300	2790	1.4	40000	20000	5000	1950

ZOVH Series

Model	V_{rms}	V_{dc}	V_n @ 1 mA	V_c @ I_c	I_c	W_{max} 10/1000 µs	P max.	I_{max} 8/20 µs	I_n 8/20 µs	I_{Imp} 10/350 µs	C Typ. @ 1 kHz
	V	V	V	V	A	J	W	A	A	A	pF
ZOVH 275 K 40	275	350	430	710	300	2580	1.4	40000	15000	6500	2900
ZOVH 320 K 40	320	420	510	840	300	3060	1.4	40000	15000	6500	2400
ZOVH 385 K 40	385	505	620	1025	300	3720	1.4	40000	15000	6500	2000
ZOVH 420 K 40	420	560	680	1120	300	4080	1.4	40000	15000	6500	1900
ZOVH 440 K 40	440	585	715	1180	300	4290	1.4	40000	15000	6500	1800

Disc Configurations

ZOVS Series

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

ZOVA Series

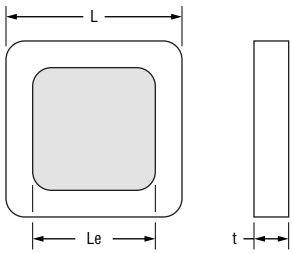
Size – number of discs	I_{imp} (10/350 µs) capability
Single disc – 40	5 kA
Double disc – 40 D2	10 kA

ZOVH Series

Size – number of discs	I_{imp} (10/350 µs) capability
Single disc – 40	6.5 kA
Double disc – 40 D2	12.5 kA

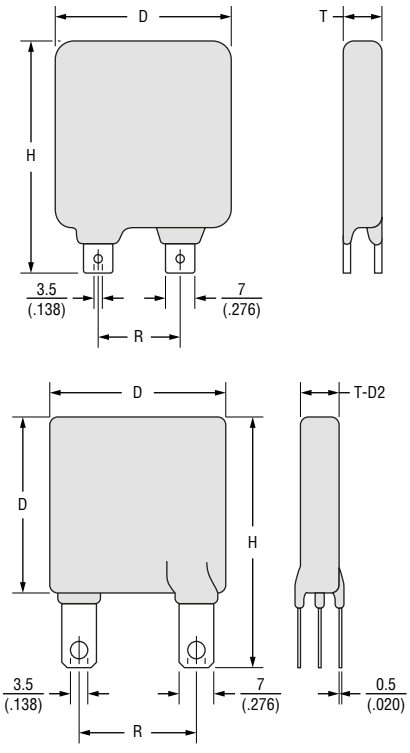
Product Dimensions

Metallized Varistor Block



Size	Dimension	
	L (max)	Le (max)
40	34 (1.339)	31 (1.220)

Epoxy Coated Varistor



Size	Dimension		
	D (max)	R[1]	H (max)
40	36.5 (1.437)	25.4 (1.00)	56 (2.205)

Model	Dimension		
	t (max)	T (max)	T-D2 (max)
ZOVS 275 K 40	4.0 (.157)	8.0 (.315)	11.2 (.441)
ZOVS 320 K 40	4.4 (.173)	8.4 (.331)	12.5 (.492)
ZOVS 385 K 40	5.6 (.220)	9.6 (.378)	14.4 (.567)
ZOVS 420 K 40	6.2 (.244)	10.2 (.402)	15.3 (.602)
ZOVS 440 K 40	6.9 (.272)	10.9 (.429)	15.9 (.626)

Model	Dimension		
	t (max)	T (max)	T-D2 (max)
ZOVA 275 K 40	4.3 (.169)	8.2 (.323)	11.8 (.465)
ZOVA 320 K 40	4.7 (.185)	8.7 (.343)	13.3 (.524)
ZOVA 385 K 40	5.9 (.232)	9.9 (.390)	15.3 (.602)
ZOVA 420 K 40	6.5 (.256)	10.5 (.413)	16.4 (.646)
ZOVA 440 K 40	7.2 (.283)	10.9 (.441)	17.0 (.669)

Model	Dimension		
	t (max)	T (max)	T-D2 (max)
ZOVH 275 K 40	4.6 (.181)	8.6 (.339)	12.6 (.496)
ZOVH 320 K 40	5.0 (.197)	9.0 (.354)	14.2 (.559)
ZOVH 385 K 40	6.2 (.244)	10.2 (.402)	16.4 (.646)
ZOVH 420 K 40	6.8 (.268)	10.8 (.425)	17.6 (.693)
ZOVH 440 K 40	7.5 (.295)	11.5 (.453)	18.5 (.728)

DIMENSIONS: MM (INCHES)

How to Order

ZOVS275K40xxE

Series Designator
- ZOVS = ZOVS Series
- ZOVA = ZOVA Series
- ZOVH = ZOVH Series

Max. Continuous Operating Voltage (V_{rms})

V_n Tolerance
- K = ±10 %

Model Size
- 40 = 40 mm

Stack
- (blank) = one varistor block
- D2 = epoxy coated with 2 varistor blocks

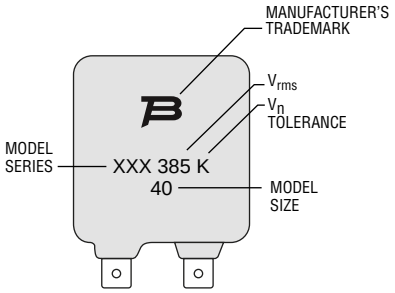
Design
- E = Epoxy Coated Varistor w/Rigid Terminals
- M = Metallized Varistor Block
- ME = Uncoated Block w/Rigid Terminals (available upon request)
- MP = Metallized Varistor Block w/Passivation (available upon request)

Instructions for Creating Orderable Part Number:

1) Start with base part number in characteristics table: (example ZOVS275K40).
2) Add information on number of varistor blocks
   For a single block: No additional letters (example part number remains ZOVS275K40)
   For two discs (epoxy-coated only): Add D2 (example part number becomes ZOVS275K40D2).
3) Add Design:
   Add M for metallized varistor block and E for epoxy coated varistor block
   For a metallized varistor block: (example part number becomes ZOVS275K40M).
   For an epoxy-coated varistor with a single varistor block: (example part number becomes ZOVS275K40E).
   For an epoxy-coated varistor with two varistor blocks: (example part number becomes ZOVS275K40D2E).
4) Part number can have no spaces or lower case letters.

Typical Part Marking

Epoxy Coated Varistor



Metallized Varistor Block

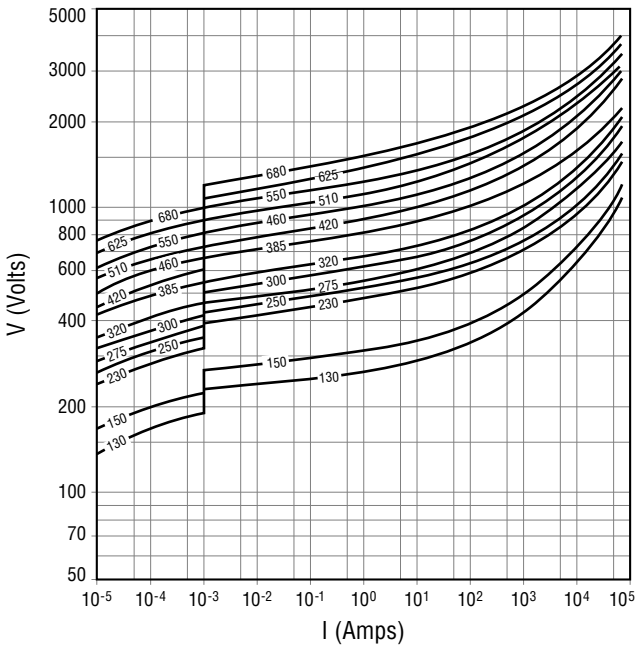
no marking

Packaging Quantities – Bulk

Model	Quantity	Model	Quantity
ZOVS 275 K 40	64	ZOVS 275 K 40 D2	30
ZOVS 320 K 40	64	ZOVS 320 K 40 D2	30
ZOVS 385 K 40	64	ZOVS 385 K 40 D2	30
ZOVS 420 K 40	64	ZOVS 420 K 40 D2	30
ZOVS 440 K 40	64	ZOVS 440 K 40 D2	30
ZOVA 275 K 40	64	ZOVA 275 K 40 D2	30
ZOVA 320 K 40	64	ZOVA 320 K 40 D2	30
ZOVA 385 K 40	64	ZOVA 385 K 40 D2	30
ZOVA 420 K 40	64	ZOVA 420 K 40 D2	30
ZOVA 440 K 40	64	ZOVA 440 K 40 D2	30
ZOVH 275 K 40	64	ZOVH 275 K 40 D2	30
ZOVH 320 K 40	64	ZOVH 320 K 40 D2	30
ZOVH 385 K 40	64	ZOVH 385 K 40 D2	30
ZOVH 420 K 40	64	ZOVH 420 K 40 D2	30
ZOVH 440 K 40	64	ZOVH 440 K 40 D2	30

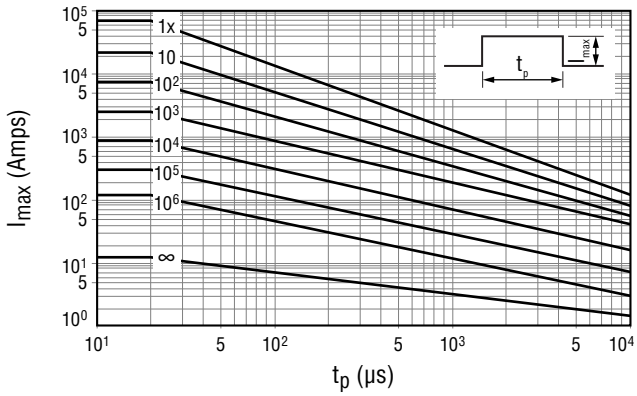
Protection Level

Model Size 40 - (ZOVx 275 K 40 ~ ZOVx 440 K 40)



Pulse Rating Curves

Model Size 40 - (ZOVx 275 K 40 ~ ZOVx 440 K 40)



Reliability Testing Procedures (Where Applicable)

Varistor test procedures comply with CECC 42200 and IEC 1051-1/2. Test results are available upon customer request. Special tests can be performed upon customer request.

Reliability Parameter	Test	Tested According to	Condition to be Satisfied after Testing
AC/DC Bias Reliability	AC/DC Life Test	CECC 42200, Test 4.20 or IEC 1051-1, Test 4.20	$\lvert\delta V_n$ (1 mA)$\rvert$ < 10 %
Pulse Current Capability	I_{max} 8/20 μs	CECC 42200, Test C 2.1 or IEC 1051-1, Test 4.5 10 pulses in the same direction at 2 pulses per minute at maximum peak current for 10 pulses	$\lvert\delta V_n$ (1 mA)$\rvert$ < 10 % no visible damage
Pulse Energy Capability	W_{max} 10/1000 μs	CECC 42200, Test C 2.1 or IEC 1051-1, Test 4.5 10 pulses in the same direction at 1 pulse every 2 minutes at maximum peak current for 10 pulses	$\lvert\delta V_n$ (1 mA)$\rvert$ < 10 % no visible damage
Environmental and Storage Reliability	Climatic Sequence	CECC 42200, Test 4.16 or IEC 1051-1, Test 4.17 a) Dry heat, 16h, UCT, Test Ba, IEC 68-2-2 b) Damp heat, cyclic, the first cycle: 55 °C, 93 % RH, 24 h, Test Db 68-2-4 c) Cold, LCT, 2 h, Test Aa, IEC 68-2-1 d) Damp heat cyclic, remaining 5 cycles: 55 °C, 93 % RH, 24 h/cycle, Test Bd, IEC 68-2-30	$\lvert\delta V_n$ (1 mA)$\rvert$ < 10 %
	Thermal Shock	CECC 42200, Test 4.12, Test Na, IEC 68-2-14	$\lvert\delta V_n$ (1 mA)$\rvert$ < 10 % no visible damage
	Steady State Damp Heat	CECC 42200, Test 4.17, Test Ca, IEC 68-2-3	$\lvert\delta V_n$ (1 mA)$\rvert$ < 10 %
	Storage Test	IEC 68-2-2, Test Ba, 1000 h at maximum storage temperature	$\lvert\delta V_n$ (1 mA)$\rvert$ < 5 %

Continued on Next Page

Reliability Testing Procedures (Where Applicable – Continued)

Reliability Parameter	Test	Tested According to	Condition to be Satisfied after Testing
Mechanical Reliability	Solderability	CECC 42200, Test 4.10.1, Test Ta, IEC 68-2-20 solder bath and reflow method	Solderable at shipment and after 2 years of storage, criteria: >95% must be covered by solder for reflow meniscus
	Resistance to Soldering Heat	CECC 42200, Test 4.10.2, Test Tb, IEC 68-2-20 solder bath and reflow method	$\lvert\delta V_n$ (1 mA)$\rvert$ < 5 %
	Terminal Strength	JIS-C-6429, App. 1, 18 N for 60 sec.	No visual damage
	Board Flex	JIS-C-6429, App. 2, 2 mm min.	$\lvert\delta V_n$ (1 mA)$\rvert$ < 2 % No visible damage
	Vibration	CECC 42200, Test 4.15, Test Fc, IEC 68-2-6 Frequency range 10 to 55 Hz (AEC: 10-2000 Hz) Amplitude 0.75 m/s^2 or 98 m/s^2 (AEC: 5 g for 20 minutes) Total duration 6 h (3x2 h) (AEC: 12 cycles each of 3 directions) Waveshape - half sine	$\lvert\delta V_n$ (1 mA)$\rvert$ < 2 % No visible damage
	Mechanical Shock	CECC 42200, Test 4.14, Test Ea, IEC 68-2-27 Acceleration = 490 m/s^2 (AEC: MIL-STD-202-Method 213), Pulse duration = 11 ms, Waveshape - half sine; Number of shocks = 3x6	$\lvert\delta V_n$ (1 mA)$\rvert$ < 10 % No visible damage
Electrical Transient Conduction	ISO-7637-1 Pulses	Other pulses - freestyle.	$\lvert\delta V_n$ (1 mA)$\rvert$ < 10 % No visible damage

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Terminology

Term	Symbol	Definition
Rated AC Voltage	V_{rms}	Maximum continuous sinusoidal AC voltage (<5 % total harmonic distortion) which may be applied to the component under continuous operation conditions at +25 °C
Rated DC Voltage	V_{dc}	Maximum continuous DC voltage (<5 % ripple) which may be applied to the component under continuous operating conditions at +25 °C
Supply Voltage	V	The voltage by which the system is designated and to which certain operating characteristics of the system are referred; V_{rms} = 1.1 x V
Leakage Current	I_{dc}	The current passing through the varistor at V_{dc} and at +25 °C or at any other specified temperature
Varistor Voltage	V_n	Voltage across the varistor measured at a given reference current (I_n)
Reference Current	I_n	Reference current = 1 mA DC
Clamping Voltage Protection Level	V_c	The peak voltage developed across the varistor under standard atmospheric conditions, when passing an 8/20 μs class current pulse
Class Current	I_c	A peak value of current which is 1/10 of the maximum peak current for 100 pulses at two per minute for the 8/20 μs pulse
Voltage Clamping Ratio	V_c/V_{app}	A figure of merit measure of the varistor clamping effectiveness as defined by the symbols V_c/V_{app}, where (V_{app} = V_{rms} or V_{dc})
Jump Start Transient	V_{jump}	The jump start transient results from the temporary application of an overvoltage in excess of the rated battery voltage. The circuit power supply may be subjected to a temporary overvoltage condition due to the voltage regulation failing or it may be deliberately generated when it becomes necessary to boost start the car.
Rated Single Pulse Transient Energy	W_{max}	Energy which may be dissipated for a single 10/1000 μs pulse of a maximum rated current, with rated AC voltage or rated DC voltage also applied, without causing device failure
Load Dump Transient	WLD	Load Dump is a transient which occurs in automotive environments. It is an exponentially decaying positive voltage which occurs in the event of a battery disconnect while the alternator is still generating charging current with other loads remaining on the alternator circuit at the time of battery disconnect.
Rated Peak Single Pulse Transient Current	I_{max}	Maximum peak current which may be applied for a single 8/20 μs pulse, with rated line voltage also applied, without causing device failure
Rated Transient Average Power Dissipation	P	Maximum average power which may be dissipated due to a group of pulses occurring within a specified isolated time period, without causing device failure at 25 °C
Capacitance	C	Capacitance between two terminals of the varistor measured @ 1 kHz
Non-linearity Exponent	α	A measure of varistor nonlinearity between two given operating currents, I_n and I_1 as described by I = k V exp(a), where: - k is a device constant, - $I_1 < I < I_n$ and - a log $(I_1/I_n)/\log(V_1/V_n)$ = $1/\log (V_1/V_n)$, where: - I_r is reference current (1 mA) and V_n is varistor voltage - I_1 = 10 I_n, V_1 is the voltage measured at I_1
Response Time	tr	The time lag between application of a surge and varistor's "turn-on" conduction action
Varistor Voltage Temperature Coefficient	TC	(V_n @ 85 °C - V_n @ 25 °C) / (V_n @ 25 °C) x 60 °C) x 100
Insulation Resistance	IR	Minimum resistance between shorted terminals and varistor surface
Isolation Voltage		The maximum peak voltage which may be applied under continuous operating conditions between the varistor terminations and any conducting mounting surface
Operating Temperature		The range of ambient temperature for which the varistor is designed to operate continuously as defined by the temperature limits of its climatic category
Climatic Category	LCT/UCT/DHD	LCT & UCT = Lower and Upper Category Temperature - the minimum and maximum ambient temperatures for which a varistor has been designed to operate continuously. DHD = Dump Heat Test Duration
Storage Temperature		Storage temperature range without voltage applied
Current/Energy Derating		Derating of maximum values when operated above UCT

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