VARSI

High Energy Varistors E Series

About the company

HOW IT STARTED?

The beginnings of the company date back to the early seventies, when the company was a part of the former world-wide known ISKRA Group - TOZD Keramika in DO ISKRA IEZE Ljubljana, reputed producer of technical and high frequency ceramics.

GENERAL COMPANY DATA AND ITS STRATEGY

Varsi, d.o.o. decided to carry on with the program of varistors, couplings and temperature probes, which had been a part of the production program also in the former Iskra TOZD Keramika since 1983. Varsi, d.o.o. therefore continues the tradition and upgrades the past experiences in the production of high technology ceramics on the base of its own knowledge and research.

The company has dedicated itself to total customer satisfaction. Market research - product development - purchase production - testing & control - sales - environmental protection - these are the activities incorporated in the company managing.

Varsi, d.o.o. strives for perfection on all levels of its activity. The company is present on all major world markets, daily facing strong competition. It is therefore important to offer high quality products at reasonable costs.

The company has been successful, because:

- ☐ It has been able to satisfy and respect customers' expectations and requirements
- ☐ It has been balancing the internal costs properly in correlation with the care for good realization of processes
- ☐ It has been able to evaluate its efficiency
- ☐ It constantly monitors its performance and eliminates the reasons for any possible mistakes
- ☐ It creates sufficient new value (added value)
- ☐ It takes care for qualifications of the employees, stressing the importance of each single employee being a relevant part of the chain
- ☐ It confirms its accomplishments by international standards: UL, CSA, ISO 9001:2000, RoHS

COMPANY RESEARCH AND DEVELOPMENT ACTIVITIES

VARSI, d.o.o. works on the base of its own knowledge and research. Its R&D activity is regulated within the company R&D Department.

In May 1999 Varsi, d.o.o. established its own, independent research & development group named ISVAR, with the purpose to upgrade the link between the existing production and research spheres.

The activity well generates the link between basic and application research, which enables the optimization of single technological parameters in the varistor manufacturing process.

WHY VARSI?

VARSI's major advantages are:

- ☐ top quality products
- ☐ custom tailored products
- ☐ flexibility
- ☐ fast response time
- ☐ attractive lead times
- ☐ challenging prices
- ☐ short design-in period (from samples to the serial production)
- ☐ top skilled engineering & application specialists

We're small, but not fragile,

we're flexible and simple, but highly skilled and experienced,

we offer fast and efficient customer service with a personal touch.

Choosing Varsi means being one step ahead of the general development.

Together we're winners! Give us a chance!

Table of Contents

General Data

Varistors, also called VDRs (Voltage Dependent Resistors), show a high degree of non-linearity between their resistance values and the applied voltages.
A metal oxide varistor is a voltage dependent, symmetrical non-linear resistor. Its resistance decreases with the increasing voltage. This can be expressed by the equation $I = K \cdot V^{\alpha}$, where

I = current through the varistor
V = voltage
K = material constant
α = non-linear index

Varistor resistance is a non-linear inverse function of the applied voltage. At rated voltage the varistor resistance is high. When a higher transient voltage appears across the varistor, its resistance sharply decreases to a low value. This transient voltage is clamped to a safe level and the energy in the transient is dissipated in the varistor. Thereby the equipment is protected against overvoltages.

Varistors are intended for safeguarding sensitive electronic components against voltage pulses of various sources. Varistors are also used for stabilizing higher DC voltages.
Should a high voltage pulse occur, the varistor`s resistance would immediatelly shift from a very high value to a level of good conductance. The varistor would absorb the energy of the pulse and decrease the voltage to a safe level, thereby protecting the electronic component against damages.

CONSTRUCTION

A varistor is primarily made of zinc oxide, formed into disc configuration and sintered together with other metal oxide additives at high temperature.
The tablet-shaped varistor ceramics is silver electroded and fired. Copper leads are soldered to the electrodes.
Discs can be either epoxy coated or put into a plastic housing.

STANDARD VARISTORS

The basic design of metal oxide varistors consists of Disc Varistors with Radial Leads and High Energy Varistors.
The standard range of varistors with radial leads covers the diameters of 5, 7, 10, 14, 18 and 20 mm.
High Energy types are available in the 25, 32, 40, 60 and 80 mm versions.

AVAILABLE ON REQUEST (CUSTOM DESIGNS):

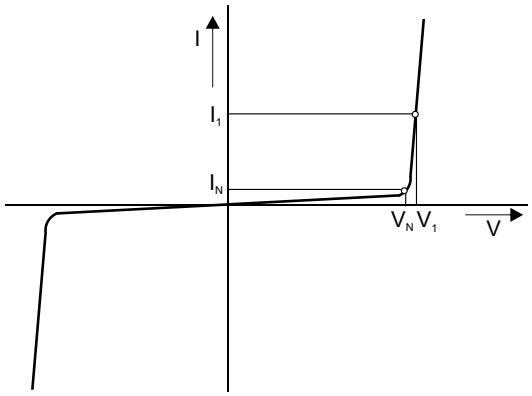
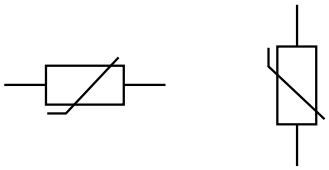
- non-standard voltages V_{RMS}, V_{DC}, V_N
- non-standard tolerances of nominal voltage V_N
- crimped leads
- non-standard leads' spacing and length
- non-standard disc dimensions

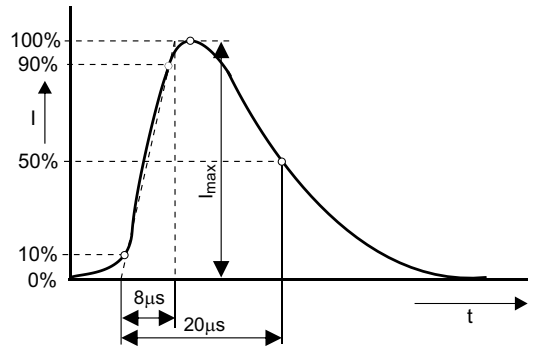
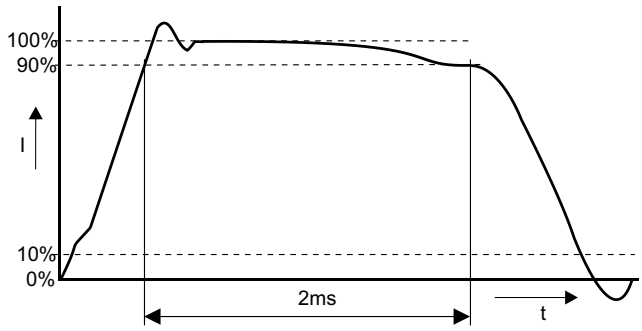
APPLICATION AREAS:

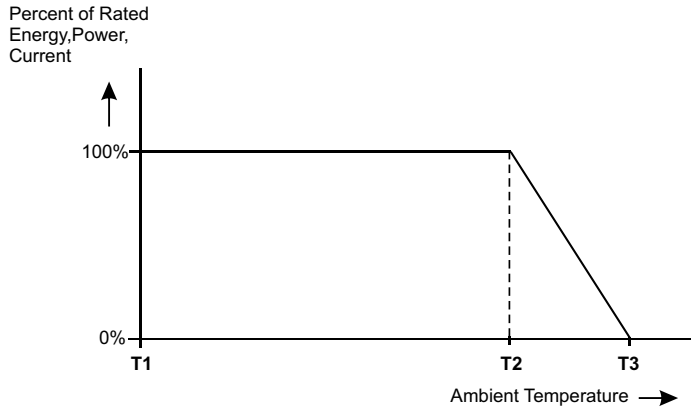
1. Railways and trams:
For the protection of electrical equipment, power electronics (IGBT, tyristors...) in systems with alternating, direct or combinated power supply, especially in power supply of AC/DC, DC/AC, DC/DC converters. They may be used in systems with main and auxiliary power supply for example: automatic control and regulation systems, cooling systems, warming systems, ventilation systems, and combination systems (electromechanical, electropneumatic and other systems).

2. Wind powerplants
For protection of automatic control and regulation in power electronics (IGTB, tyristors...), as well as the protection of sensitive electronic systems (e. g. AC/DC, DC/AC, DC/DC converters, drive systems) from direct or indirect lightning strikes.

3. Photovoltaic systems
For protection of photopanels, automatic control electronics with sensitive electronic components, and DC/AC converters (invertors) from direct or indirect lightning strikes.
Depending on the application, both serial and parallel connections are possible. With serial connection the required voltage is achieved. With parallel connection higher current absorption is achieved in the modules.

Description	Technical Term
 I current through the varistor V voltage on the varistor I_N nominal current (1 mA DC) I_1 the 10-time value of I_N (I_1 = 10 x I_N =10 mA DC) V_N nominal voltage V_1 the voltage measured at the current I_1 (10 mA DC)	Characteristics
	Graphic Symbol
Operating temperature range without derating	Operating Ambient Temperature
The upper category temperature is the maximum ambient temperature for which the varistor has been designed to operate continuously	Upper Category Temperature (UCT)
The lower category temperature is the minimum ambient temperature at which the varistor has been designed to operate continuously	Lower Category Temperature (LCT)
Storage temperature range without pulse or voltage applied	Storage Temperature
Derating of maximum values when operated above +85°C (+185°F)	Current/Energy Derating
The shift of varistor voltage at ambient temperature between +25°C (+77°F) and +85°C (+185°F) is expressed by γ (%/K) $\gamma\,(\%/K) = \frac{V_N\,at\,85°C(+185°F) - V_N\,at + 25°C(+77F)}{V_N at + 25°C(+77°C)} \times \frac{1}{60K} \times 100$	Varistor Voltage Temperature Coefficient
Minimum resistance between shorted terminals and varistor surface	Insulation Resistance
Minimum voltage applied for one minute between shorted terminals and varistor surface	Insulation Voltage
Maximum continuous sinusoidal RMS voltage (50-60 Hz) which may be applied	AC Voltage **V_{RMS}**
Maximum continuous DC voltage which may be applied	DC Voltage **V_{DC}**
Voltage across the varistor measured at 1 mA DC	Varistor Voltage **V_N**
The maximum energy absorbed with a varistor voltage change of less than ±10% when one pulse of 2 ms is applied	Transient Pulse Energy **W_{max}**
The maximum current with a varistor voltage change of less than 10% when one pulse of 8/20 µs is applied. When pulses are applied more than once the current should be reduced. See pulse duration rating curves for other pulse sequences and number of pulses.	Transient Peak Current **I_{max}**

Description	Technical Term
Maximum current with rated DC voltage applied	DC Leakage Current
The non linear index α is a measure of varistor`s nonlinearity between two given operating currents (I_N and I_1): $\alpha = \frac{\log \frac{I_1}{I_N}}{\log \frac{V_1}{V_N}} = \frac{1}{\log \frac{V_1}{V_N}}$ I_N nominal current (1 mA DC) I_1 the 10-time value of I_N (I_1 = 10x I_N =10 mA DC) V_N nominal voltage V_1 the voltage measured at the current I_1 (10 mA DC)	Non linear Index **α**
Peak voltage across the varistor with a specified peak pulse current (8 x 20 µs)	Maximum Clamping Voltage **V_C**
The maximum power that can be applied within the specified ambient temperature	Average Power Dissipation **P_{max}**
Typical value measured at a test frequency of 1 kHz	Capacitance **C**
 The pulse current of 8x20 µs waveforms is applied as standard pulse current when PEAK PULSE CURRENT, CLAMPING VOLTAGE and V - I CHARACTERISTIC are measured.  The pulse current of 2 ms waveforms is applied as standard pulse current when ENERGY is measured.	Standard Pulse Current Waveforms
Disc Varistors with Radial Leads, High Energy Varistors (E Series), High Energy Suppressor Discs and High Energy Varistors (LE Series) -40°C to +85°C (-40°F to +185°F)	Operating Ambient Temperature
Disc Varistors with Radial Leads, High Energy Varistors (E Series) and High Energy Suppressor Discs -40°C to +125°C (-40°F to +257°F) High Energy Varistors (LE Series) -40°C to +110°C (-40°F to +230°F)	Storage Temperature

Description	Technical Term	
40/085/56 Disc Varistors with Radial Leads, High Energy Varistors (E Series), High Energy Suppressor Discs and High Energy Varistors (LE Series)	Climatic Category	
- 0.1%/K max. Disc Varistors with Radial Leads, High Energy Varistors and High Energy Suppressor Discs	Varistor Voltage Temperature Coefficient	
≥ 1000 MΩ	Insulation Resistance	
≥ 1000 V DC	Insulation Voltage	
Disc Varistors with Radial Leads, High Energy Varistors and Energy Suppressor Discs < 25 ns	Response Time	
See ratings table	AC Voltage	V_{RMS}
See ratings table	DC Voltage	V_{DC}
See ratings table	Varistor Voltage	V_N
See ratings table	Transient Pulse Energy	W_{max}
See ratings table	Transient Peak Current	I_{max}
See ratings table	Maximum Clamping Voltage	V_C
See ratings table	Average Power Dissipation	P_{max}
See ratings table	Capacitance	C
	Current/Energy Derating	

	T1	T2	T3	
Disc varistors with radial terminals	- 40°C	+ 85°C	+125°C	-2.5%/K
High energy varistors (E series) & varistor discs	- 40°C	+ 85°C	+110°C	-4%/K
High energy varistors (LE series)	- 25°C	+ 85°C	+110°C	-4%/K

Non-flammable epoxy resin (Blue Disc Varistors with Radial Leads and LE Series High Energy Varistors)	Coating
UL Specification #1449 (Transient Voltage Surge Suppressors), File E103662	UL Recognition (Underwriters Laboratories)
CSA Specification Class 2221 01 (Accessories and Parts for Electronic Products), File LR109328 **Applicable Requirements** C22.2 No. 1-94 (Audio, Video and Similar Equipment) C22.2 No. 0-M91 General Requirements - Canadian Electrical Code, Part II	CSA Certifications (Canadian Standards Association)

Varistor Testing Procedure

Testing in accordance with CECC 42 000

Test Item	Test Conditions/Methods	Final Measurements	Requirement
Endurance at UCT	**CECC 42 000, Test 4.20** 1. 000 h, UCT, Maximum continuous V_{RMS} or V_{DC}	Varistor voltage V_N Insulation resistance R_i (Insulated varistors only)	$\left\|\frac{\Delta V_N}{V_N}\right\| \leq 10\%$
Pulse Current I_{max} (8 x 20 µs)	**CECC 42 000, Test C2.1**	Varistor voltage V_N Visual examination	$\left\|\frac{\Delta V_N}{V_N}\right\| \leq 10\%$ No visible damage Legible marking
Pulse Current I_{max} (10 x 1000 µs)	**CECC 42 000, Test C2.1**	Varistor voltage V_N Visual examination	$\left\|\frac{\Delta V_N}{V_N}\right\| \leq 10\%$ No visible damage Legible marking
W_{MAX} (10 x 1000 µs or 2 ms)	**CECC 42 000 Test C2.1**	Varistor voltage V_N Visual examination	$\left\|\frac{\Delta V_N}{V_N}\right\| \leq 10\%$ No visible damage Legible marking
Insulation Voltage	**CECC 42 000, Test 4.7** (Insulated varistors only)		≥ 2500 V
Climatic Sequence	**CECC 42 000, Test 4.7** 1) Dry heat IEC 68- 2-2, Ba Test UCT, 16h 2) Damp heat, cyclic, the first cycle: IEC 68-2-30, Db Test +55 °C, 93 % RH, 24h 3) Cold IEC 68- 2-1, Aa Test LCT, 2h 4) Damp heat, cyclic, remaining 5 cycles: IEC 68-2-30, Db Test +55 °C, 93 % RH, 24h/cycle	Varistor voltage V_N Insulation resistance R_i (Insulated varistors only)	$\left\|\frac{\Delta V_N}{V_N}\right\| \leq 10\%$
Thermal Shock (Rapid Change of Temperature)	**CECC 42 000, Test 4.12** IEC 68-2-14, Na Test 5 cycles UCT/LCT, 30 min	Varistor voltage V_N Visual examination	$\left\|\frac{\Delta V_N}{V_N}\right\| \leq 10\%$ No visible damage Legible marking
Damp Heat, Steady State	**CECC 42 000, Test 4.17** IEC 68-2-3, Ca Test +40 °C, 93%RH, 56 days	Varistor voltage V_N Insulation resistance R_i (Insulated varistors only)	$\left\|\frac{\Delta V_N}{V_N}\right\| \leq 10\%$
Solderability	**CECC 42 000, Test 4.10.1** IEC 68-2-3, Ta Test Solder bath method at 235 °C ±5 °C		Solderable upon delivery and after storage for 6 month
Resistance to Soldering Heat	**CECC 42 000, Test 4.10.2** IEC 68-2-20, Tb Test 260 °C ±5 °C, 10s	Varistor voltage V_N	$\left\|\frac{\Delta V_N}{V_N}\right\| \leq 5\%$
Robustness of Terminals	**CECC 42 000, Test 4.11** IEC 68-2-21, Ua Test	Varistor voltage V_N	$\left\|\frac{\Delta V_N}{V_N}\right\| \leq 5\%$ No break of solder joint and no wire break
Mechanical Shock	**CECC 42 000, Test 4.11** IEC 68-2-27, Ea Test Acceleration: 490 m/s^2 Pulse duration: 11 ms Number of shocks: 3 x 6 Waveshape: half sine	Varistor voltage V_N Visual examination	$\left\|\frac{\Delta V_N}{V_N}\right\| \leq 5\%$ No visible damage Legible marking

Varistor Testing Procedure

Testing in accordance with CECC 42 000

Test Item	Test Conditions/Methods	Final Measurements	Requirement
Vibration	**CECC 42 000, Test 4.15** IEC 68-2-6, Fc Test Frequency range: 10 to 55 Hz Amplitude: 0.75 mm or Acceleration: 98 m/s^2 Total duration: 6 h (3 x 2 h) Waveshape: half sine	Varistor voltage V_N Visual examination	$\left\|\frac{\Delta V_N}{V_N}\right\| \leq 10\%$ No visible damage Legible marking
Flammability Needle Flame Test	**CECC 42 000, Test 4.18.1** IEC 695-2-2 Severity: 10s		5 s max.

Storage Instructions

Store varistors at a temperature of -10° to +40° in a relative humidity of less than 75%.

Avoid storing in environment of rapid changes in temperature, direct sunlight, corrosive gas or dust, and store with the varistors packaged.

Do not expose varistors to intense vibration and do not install them in places near by flammable substances.

Do not apply high voltage exceeding the rated maximum applying voltage to varistors.

Do not apply peak currents exceeding the rated maximum energy.

Do not apply any high voltages, peak currents or exceeding the specified limits.

High Energy Varistors - E25, E32, E40 Series

Description

The E types are heavy-duty metal oxide varistors designed mainly for industrial applications. They offer excellent surge protection for various electronic equipment such as: traffic and railway signal systems, communication equipment, waterworks, automatic control devices for power distribution, oil drilling and mining equipment (dredgers, cranes, etc.). The E housings offer excellent protection also when they are exposed to different kinds of vibrations, dust, moisture, etc. The advantages of the E Series are: rigid terminals for good wire contact, solid plastic housing for secure mounting, higher insulation resistance (polyurethane filling and plastic housing).

Main Features

Wide Operating Voltage Range V_{RMS}	130 V to 750 V
Three Model Sizes Available	25 mm, 32 mm, square 33 mm
High Energy Absorption Capability W_{max} (2 ms)	150 J to 1230 J
High Peak Current Capability I_{max} (8/20 µs)	15000 A to 40000 A
Rigid Terminals for Secure Wire Contact	
Case Design Provides Complete Electrical Isolation of Disc Assembly	
UL Specification #1449 File No.: E103662;	Models E40, E32, prefixed by: V130, V140, V150, 175,
	V230, V250, V275, V300, V320, V350, V385, V420,
	V440, V460, V510, V550, V625, V680, V750

General Technical Data

Climatic Category	40/85/56	in accordance with IEC 68-1
LCT	- 40°C	
UCT	+ 85°C	
Damp Heat, Steady State (93% r.h., 40°C)	56 days	in accordance with IEC 68-2-3
Operating Temperature	- 40 ... + 85°C	in accordance with CECC 42 000
Storage Temperature	- 40 ... + 110°C	
Electric Strength	≥ 2.5 kV	in accordance with CECC 42 000
Insulation Resistance	≥ 1.0 GΩ	in accordance with CECC 42 000
Response Time	< 25 ns	
Max. Torque	1.0 Nm	

Type Designation

V 750 E 40

VARSI
Metal Oxide Varistor

Max. AC Operating Voltage

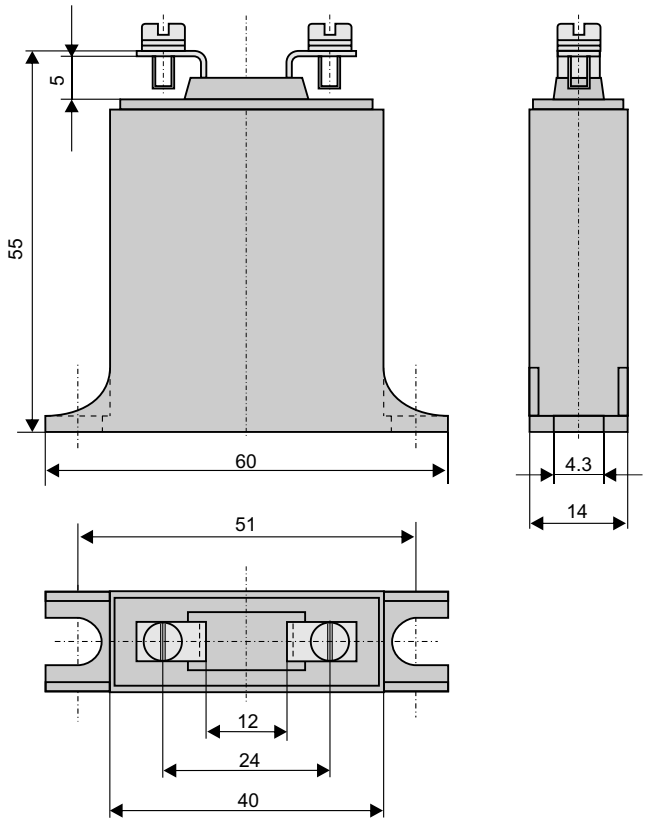
Varistor Design

Rated Diameter of Varistor Disc

Table of Standard Values

Part Number	Maximum Ratings T_A=+85°C (+185°F)					Characteristics T_A = +25°C (+77°F)					V - I Characteristic	Derating curve
	Operating Voltage		Average Power Dissipation	Permissible Peak Current (8/20 µs)	Energy Absorption (2 ms)	Varistor Voltage (1 mA)	Standard Tolerance of V_N	Maximum Clamping Voltage at Test Current (8/20 µs)		Typical Capacitance f=1kHz		
	RMS Voltage V_{RMS} (V)	DC Voltage V_{DC} (V)	P_{max} (W)	I_{max} (A)	W_{max} (J)	V_N (V)	ΔV_N (±%)	V_C (V)	I (A)	C (pF)	Page	Page
V130E25	130	170	1.0	15000	150	205	10	340	150	2600	8	11
V130E32	130	170	1.2	25000	220	205	10	340	200	4400	8	11
V130E40	130	170	1.4	40000	320	205	10	340	300	5800	9	12
V140E25	140	180	1.0	15000	155	220	10	360	150	2400	8	11
V140E32	140	180	1.2	25000	235	220	10	360	200	4100	8	11
V140E40	140	180	1.4	40000	340	220	10	360	300	5400	9	12
V150E25	150	200	1.0	15000	160	240	10	395	150	2200	8	11
V150E32	150	200	1.2	25000	250	240	10	395	200	3700	8	11
V150E40	150	200	1.4	40000	370	240	10	395	300	5000	9	12
V175E25	175	225	1.0	15000	170	270	10	455	150	2000	8	11
V175E32	175	225	1.2	25000	270	270	10	455	200	3000	8	11
V175E40	175	225	1.4	40000	410	270	10	455	300	4200	9	12
V230E25	230	300	1.0	15000	190	360	10	595	150	1600	8	11
V230E32	230	300	1.2	25000	310	360	10	595	200	2500	8	11
V230E40	230	300	1.4	40000	470	360	10	595	300	3400	9	12
V250E25	250	320	1.0	15000	210	390	10	650	150	1400	8	11
V250E32	250	320	1.2	25000	340	390	10	650	200	2200	8	11
V250E40	250	320	1.4	40000	505	390	10	650	300	3100	9	12
V275E25	275	350	1.0	15000	230	430	10	710	150	1300	8	11
V275E32	275	350	1.2	25000	370	430	10	710	200	2000	8	11
V275E40	275	350	1.4	40000	565	430	10	710	300	2900	9	12
V300E25	300	385	1.0	15000	240	470	10	775	150	1200	8	11
V300E32	300	385	1.2	25000	400	470	10	775	200	1900	8	11
V300E40	300	385	1.4	40000	600	470	10	775	300	2700	9	12
V320E25	320	420	1.0	15000	275	510	10	840	150	1100	8	11
V320E32	320	420	1.2	25000	440	510	10	840	200	1700	8	11
V320E40	320	420	1.4	40000	655	510	10	840	300	2400	9	12
V385E25	385	505	1.0	15000	320	620	10	1025	150	900	8	11
V385E32	385	505	1.2	25000	560	620	10	1025	200	1400	8	11
V385E40	385	505	1.4	40000	815	620	10	1025	300	2000	9	12
V420E25	420	560	1.0	15000	360	680	10	1120	150	800	8	11
V420E32	420	560	1.2	25000	615	680	10	1120	200	1300	8	11
V420E40	420	560	1.4	40000	930	680	10	1120	300	1900	9	12
V440E25	440	585	1.0	15000	380	715	10	1180	150	750	8	11
V440E32	440	585	1.2	25000	630	715	10	1180	200	1250	8	11
V440E40	440	585	1.4	40000	950	715	10	1180	300	1800	9	12
V460E25	460	615	1.0	15000	390	750	10	1240	150	700	8	11
V460E32	460	615	1.2	25000	670	750	10	1240	200	1200	8	11
V460E40	460	615	1.4	40000	1010	750	10	1240	300	1700	9	12
V510E25	510	670	1.0	15000	410	820	10	1355	150	650	8	11
V510E32	510	670	1.2	25000	690	820	10	1355	200	1100	8	11
V510E40	510	670	1.4	40000	1040	820	10	1355	300	1600	9	12
V550E25	550	745	1.0	15000	425	910	10	1500	150	600	8	11
V550E32	550	745	1.2	25000	710	910	10	1500	200	1000	8	11
V550E40	550	745	1.4	40000	1080	910	10	1500	300	1500	9	12
V625E25	625	825	1.2	25000	435	1000	10	1650	200	550	8	11
V625E32	625	825	1.2	25000	730	1000	10	1650	200	950	8	11
V625E40	625	825	1.4	40000	1100	1000	10	1650	300	1400	9	12
V680E25	680	895	1.2	25000	465	1100	10	1815	200	530	8	11
V680E32	680	895	1.2	25000	780	1100	10	1815	200	850	8	11
V680E40	680	895	1.4	40000	1130	1100	10	1815	300	1200	9	12
V750E25	750	1060	1.0	15000	485	1200	10	2000	150	500	8	11
V750E32	750	1060	1.2	25000	820	1200	10	2000	200	800	8	11
V750E40	750	1060	1.4	40000	1230	1200	10	2000	300	1100	9	12

Dimensions



All dimensions are maximum except where noted.
Dimensions are in millimeters.

Part Number	Approx. Weight (g)
V130E25	52
V130E32	55
V130E40	58
V140E25	53
V140E32	56
V140E40	59
V150E25	54
V150E32	57
V150E40	60
V175E25	56
V175E32	57
V175E40	60
V230E25	55
V230E32	58
V230E40	61
V250E25	55
V250E32	58
V250E40	61
V275E25	56
V275E32	59
V275E40	62
V300E25	57
V300E32	60
V300E40	63
V320E25	58
V320E32	61
V320E40	64
V385E25	59
V385E32	62
V385E40	65
V420E25	60
V420E32	63
V420E40	66
V440E25	61
V440E32	64
V440E40	67
V460E25	62
V460E32	65
V460E40	68
V510E25	62
V510E32	67
V510E40	70
V550E25	64
V550E32	68
V550E40	72
V625E25	65
V625E32	70
V625E40	73
V680E25	65
V680E32	70
V680E40	74
V750E25	66
V750E32	71
V750E40	76

High Energy Varistors - E60 Series

Description

The E60 types are heavy-duty metal oxide varistors designed mainly for industrial applications. They offer excellent surge protection for various electronic equipment such as: traffic and railway signal systems, communication equipment, waterworks, automatic control devices for power distribution, oil drilling and mining equipment (dredgers, cranes, etc.). The E60 housings offer excellent protection also when they are exposed to different kinds of vibrations, dust, moisture, etc. The advantages of the E60 Series are: rigid terminals for good wire contact, solid plastic housing for secure mounting, higher insulation resistance (polyurethane filling and plastic housing).

Main Features

Wide Operating Voltage Range V_{RMS}	130 V to 1100 V
High Energy Absorption Capability W_{max} (2 ms)	490 J to 3000 J
High Peak Current Capability I_{max} (8/20 µs)	70000 A
Rigid Terminals for Secure Wire Contact	
Case Design Provides Complete Electrical Isolation of Disc Assembly	
Flame-retardand Housing (UL 94 V-0)	
Flame-retardand Filling (UL 94 V-0)	
UL Specification #1449 File No.:E103662;	Models E60 prefixed by V130, V140, V150, V175, V230, V250, V251, V275, V300, V320, V321, V385, V420, V440, V460, V510, V550, V625, V680, V750, V1100

General Technical Data

Climatic Category	40/85/56	in accordance with IEC 68-1
LCT	- 40°C	
UCT	+ 85°C	
Damp Heat, Steady State (93% r.h., 40°C)	56 days	in accordance with IEC 68-2-3
Operating Temperature	- 40 ... + 85°C	in accordance with CECC 42 000
Storage Temperature	- 40 ... + 110°C	
Electric Strength	≥ 2.5 kV	in accordance with CECC 42 000
Insulation Resistance	≥ 1.0 GΩ	in accordance with CECC 42 000
Response Time	< 25 ns	
Max. Torque	2.5 Nm	

Type Designation

V 7 5 0 E 6 0

VARSI
Metal Oxide Varistor

Max. AC Operating Voltage

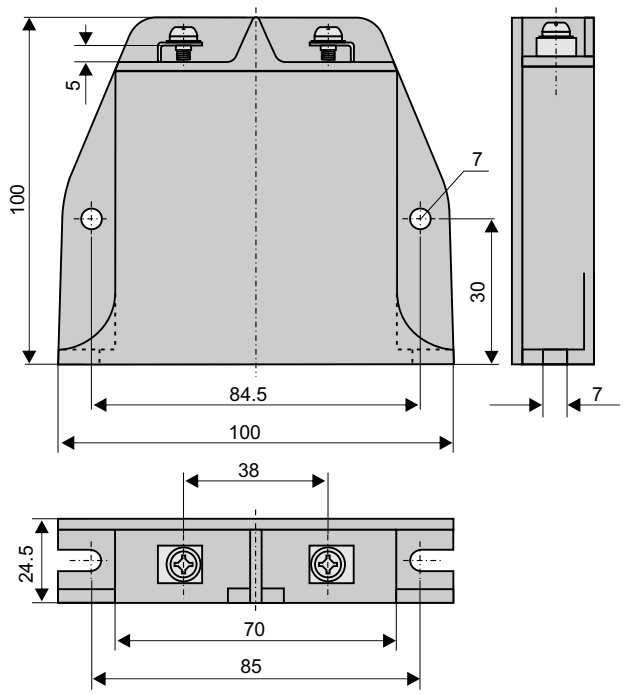
Varistor Design

Rated Diameter of Varistor Disc

Table of Standard Values

Part Number	Maximum Ratings T_A =+85°C (+185°F)					Characteristics T_A = +25°C (+77°F)					V - I Characte-ristic	Pulse Rating
	Operating Voltage		Average Power Dissipation	Permissible Peak Current (8/20 µs)	Energy Absorption (2 ms)	Varistor Voltage (1 mA)	Standard Tolerance of V_N	Maximum Clamping Voltage at Test Current (8/20 µs)		Typical Capacitance f=1kHz		
	RMS Voltage V_{RMS} (V)	DC Voltage V_{DC} (V)	P_{max} (W)	I_{max} (A)	W_{max} (J)	V_N (V)	ΔV_N (±%)	V_C (V)	I (A)	C (pF)	Page	Page
V130E60	130	170	1.6	70000	490	205	10	340	500	15000	9	12
V140E60	140	180	1.6	70000	445	220	10	360	500	12500	9	12
V150E60	150	200	1.6	70000	485	240	10	395	500	11500	9	12
V175E60	175	225	1.6	70000	545	270	10	455	500	9800	9	12
V230E60	230	300	1.6	70000	725	360	10	595	500	8000	9	12
V250E60	250	320	1.6	70000	785	390	10	650	500	7200	9	12
V275E60	275	350	1.6	70000	870	430	10	710	500	6800	9	12
V300E60	300	385	1.6	70000	950	470	10	840	500	6300	9	12
V320E60	320	420	1.6	70000	1050	510	10	840	500	5800	9	12
V385E60	385	505	1.6	70000	1250	620	10	1025	500	4800	9	12
V420E60	420	560	1.6	70000	1500	680	10	1120	500	4500	9	12
V440E60	440	585	1.6	70000	1550	715	10	1180	500	4300	9	12
V460E60	460	615	1.6	70000	1600	750	10	1240	500	4100	9	12
V510E60	510	670	1.6	70000	1650	820	10	1355	500	3800	9	12
V550E60	550	745	1.6	70000	1700	910	10	1500	500	3500	9	12
V625E60	625	825	1.6	70000	1750	1000	10	1650	500	3200	9	12
V680E60	680	895	1.6	70000	1800	1100	10	1815	500	2800	9	12
V750E60	750	1060	1.6	70000	2000	1200	10	2000	500	2600	9	12
V1100E60	1100	1465	1.6	70000	3000	1800	10	2970	500	1800	9	12

Dimensions



Part Number	Approx. Weight (g)
V130E60	190
V140E60	190
V150E60	195
V175E60	200
V230E60	205
V250E60	210
V275E60	215
V300E60	220
V320E60	225
V385E60	230
V420E60	230
V440E60	230
V460E60	240
V510E60	250
V550E60	260
V625E60	280
V680E60	310
V750E60	330
V1100E60	380

All dimensions are maximum except where noted.
Dimensions are in millimeters.

High Energy Varistors - E80 Series

Description

The E80 types are heavy-duty metal oxide varistors designed mainly for industrial applications. They offer excellent surge protection for various electronic equipment such as: traffic and railway signal systems, communication equipment, waterworks, automatic control devices for power distribution, oil drilling and mining equipment (dredgers, cranes, etc.). The E80 housings offer excellent protection also when they are exposed to different kinds of vibrations, dust, moisture, etc. The advantages of the E80 Series are: rigid terminals for good wire contact, solid plastic housing for secure mounting, higher insulation resistance (polyurethane filling and plastic housing).

Main Features

Wide Operating Voltage Range V_{RMS}	130 V to 1100 V
High Energy Absorption Capability W_{max} (2 ms)	660 J to 6000 J
High Peak Current Capability I_{max} (8/20 µs)	100000 A
Rigid Terminals for Secure Wire Contact	
Case Design Provides Complete Electrical Isolation of Disc Assembly	
Flame-retardand Housing (UL 94 V-0)	
Flame-retardand Filling (UL 94 V-0)	
UL Specification #1449 File No.:E103662;	Models E80 prefixed by V130, V140, V150, V175, V230,
	V250, V251, V275, V300, V320, V321, V385, V420,
	V440, V460, V510, V550, V625, V680, V750, V1100

General Technical Data

Climatic Category	40/85/56	in accordance with IEC 68-1
LCT	- 40°C	
UCT	+ 85°C	
Damp Heat, Steady State (93% r.h., 40°C)	56 days	in accordance with IEC 68-2-3
Operating Temperature	- 40 ... + 85°C	in accordance with CECC 42 000
Storage Temperature	- 40 ... + 110°C	
Electric Strength	≥ 2.5 kV	in accordance with CECC 42 000
Insulation Resistance	≥ 1.0 GΩ	in accordance with CECC 42 000
Response Time	< 25 ns	
Max. Torque	2.5 Nm	

Type Designation

V 7 5 0 E 8 0

VARSI
Metal Oxide Varistor

Max. AC Operating Voltage

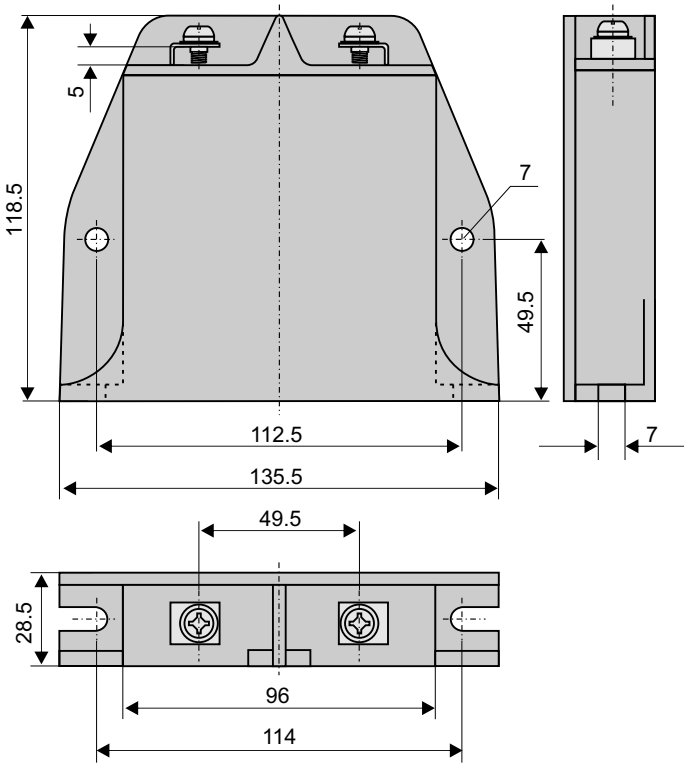
Varistor Design

Rated Diameter of Varistor Disc

Table of Standard Values

Part Number	Maximum Ratings T_A =+85°C (+185°F)					Characteristics T_A = +25°C (+77°F)					V - I Characte-ristic	Pulse Rating
	Operating Voltage		Average Power Dissipation	Permissible Peak Current (8/20 µs)	Energy Absorption (2 ms)	Varistor Voltage (1 mA)	Standard Tolerance of V_N	Maximum Clamping Voltage at Test Current (8/20 µs)		Typical Capacitance f=1kHz		
	RMS Voltage V_{RMS} (V)	DC Voltage V_{DC} (V)	P_{max} (W)	I_{max} (A)	W_{max} (J)	V_N (V)	ΔV_N (±%)	V_C (V)	I (A)	C (pF)	Page	Page
V130E80	130	170	2.0	100000	660	205	10	340	800	28000	10	12
V140E80	140	180	2.0	100000	710	220	10	360	800	26000	10	12
V150E80	150	200	2.0	100000	800	240	10	395	800	23000	10	12
V175E80	175	225	2.0	100000	890	270	10	455	800	20000	10	12
V230E80	230	300	2.0	100000	1200	360	10	595	800	16000	10	12
V250E80	250	320	2.0	100000	1300	390	10	650	800	14100	10	12
V275E80	275	350	2.0	100000	1400	430	10	710	800	13000	10	12
V300E80	300	385	2.0	100000	1500	470	10	755	800	12000	10	12
V320E80	320	420	2.0	100000	1600	510	10	840	800	11000	10	12
V385E80	385	505	2.0	100000	2000	620	10	1025	800	9000	10	12
V420E80	420	560	2.0	100000	2200	680	10	1120	800	8600	10	12
V440E80	440	585	2.0	100000	2350	715	10	1180	800	8200	10	12
V460E80	460	615	2.0	100000	2500	750	10	1240	800	7800	10	12
V510E80	510	670	2.0	100000	2600	820	10	1355	800	7000	10	12
V550E80	550	745	2.0	100000	3100	910	10	1500	800	6600	10	12
V625E80	625	825	2.0	100000	3300	1000	10	1650	800	6000	10	12
V680E80	680	895	2.0	100000	3600	1100	10	1815	800	5200	10	12
V750E80	750	1060	2.0	100000	4000	1200	10	2000	800	4900	10	12
V1100E80	1100	1465	2.0	100000	6000	1800	10	2970	800	3300	10	12

Dimensions

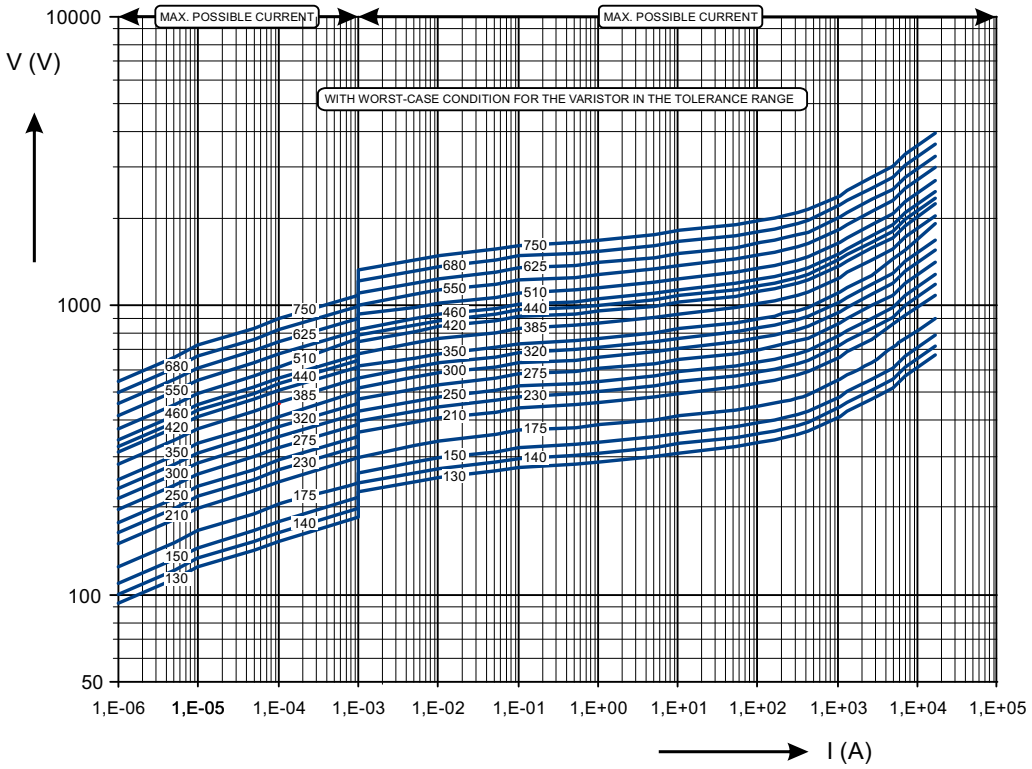


All dimensions are maximum except where noted.
Dimensions are in millimeters.

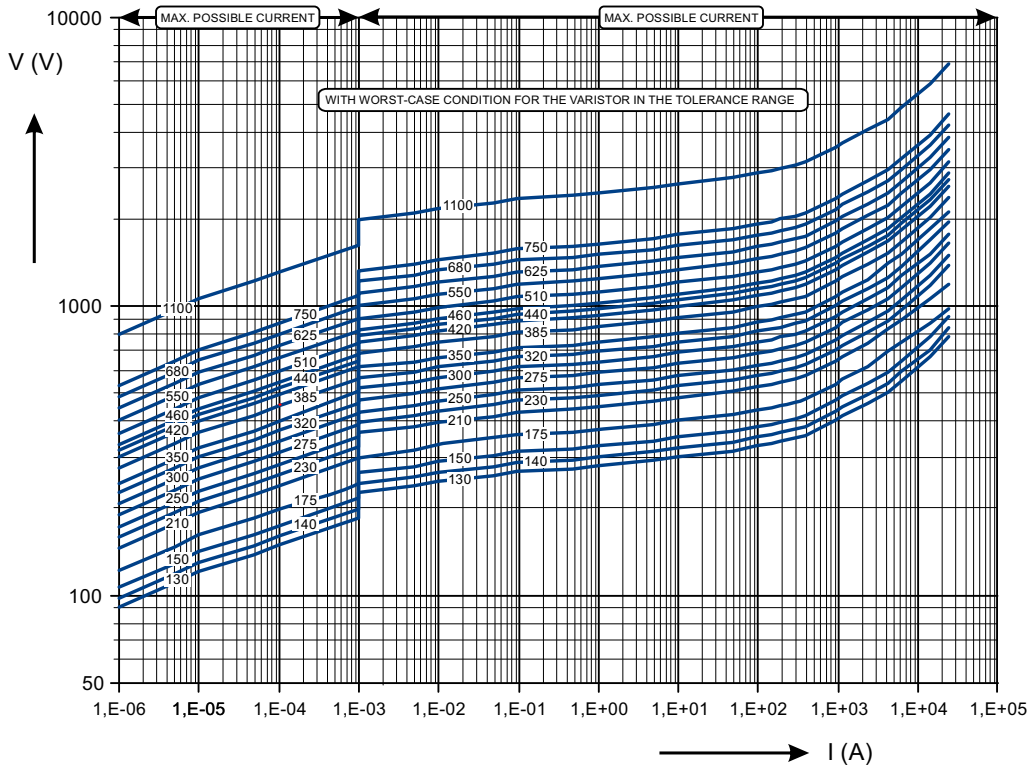
Part Number	Approx. Weight (g)
V130E80	490
V140E80	495
V150E80	500
V175E80	505
V230E80	510
V250E80	520
V275E80	530
V300E80	540
V320E80	550
V385E80	560
V420E80	580
V440E80	600
V460E80	610
V510E80	620
V550E80	630
V625E80	640
V680E80	650
V750E80	660
V1100E80	690

V-I Characteristics

V130-V750E25

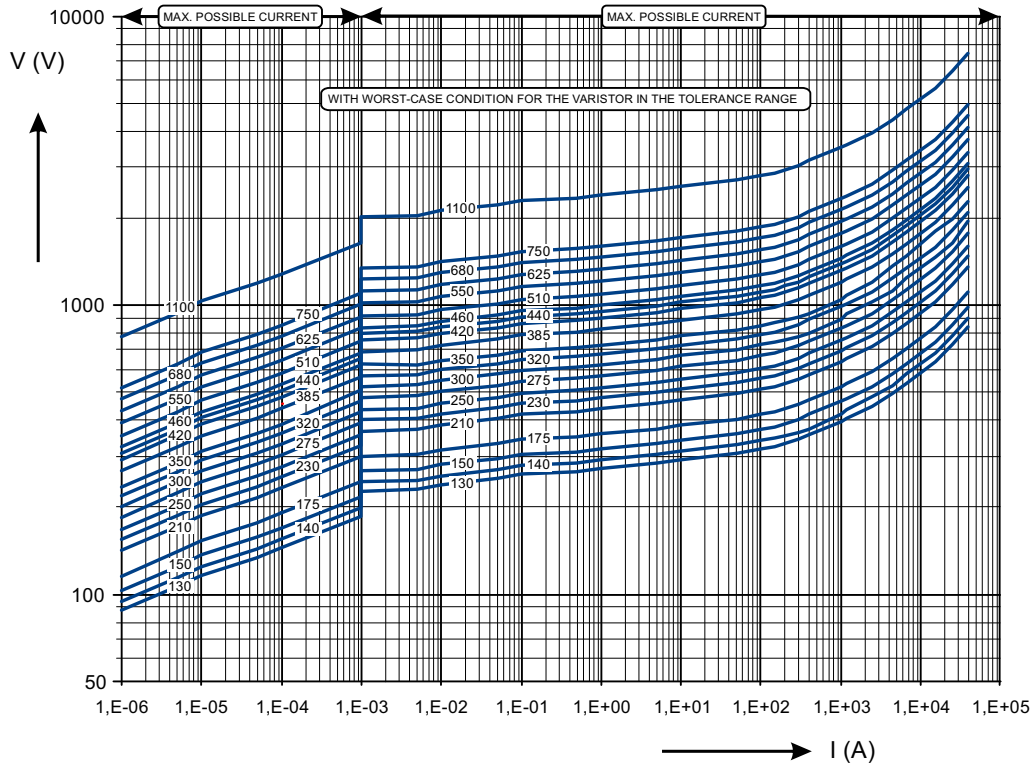


V130-V750E32

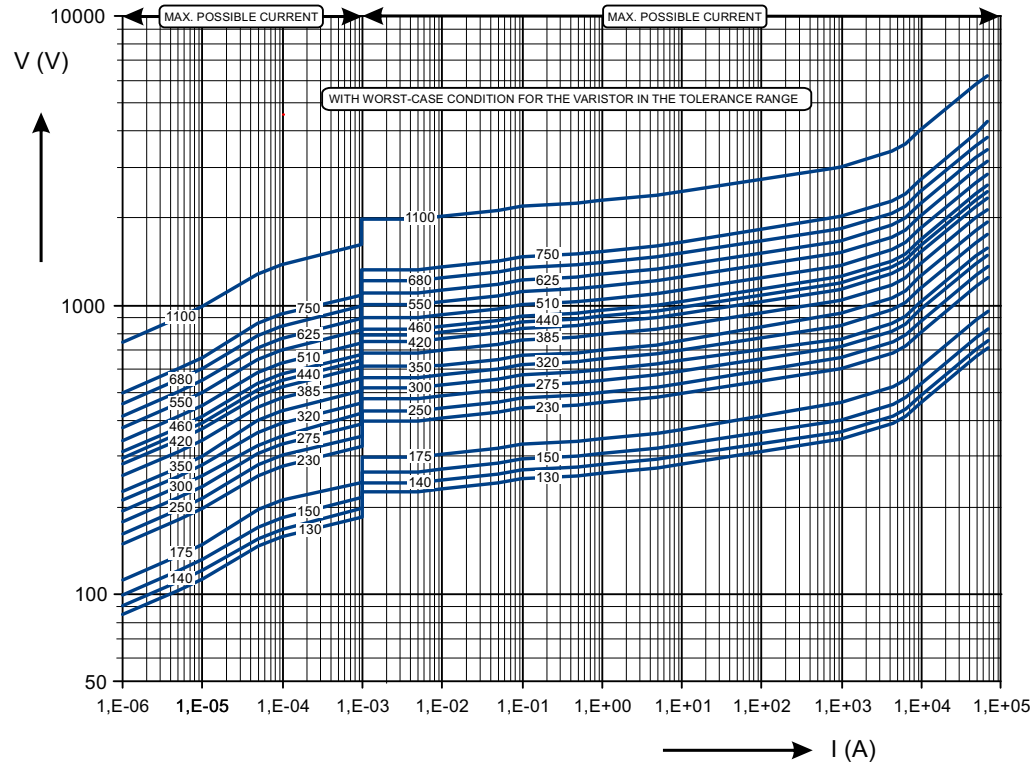


V-I Characteristics

V130-V750E40

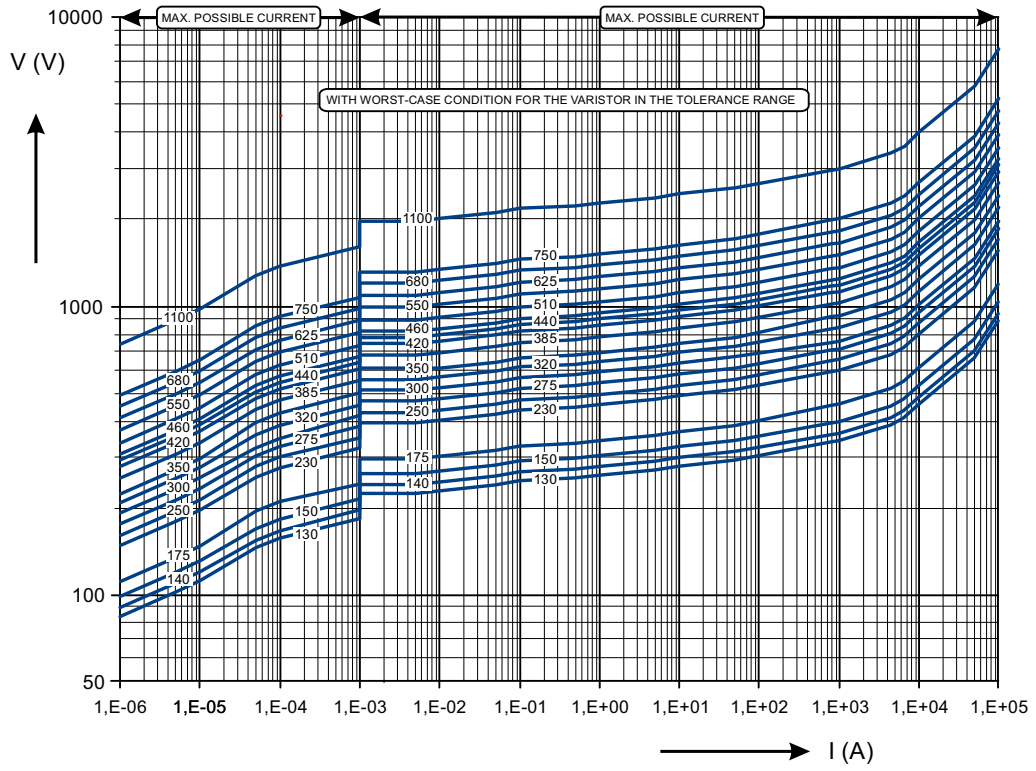


V130-V1100E60



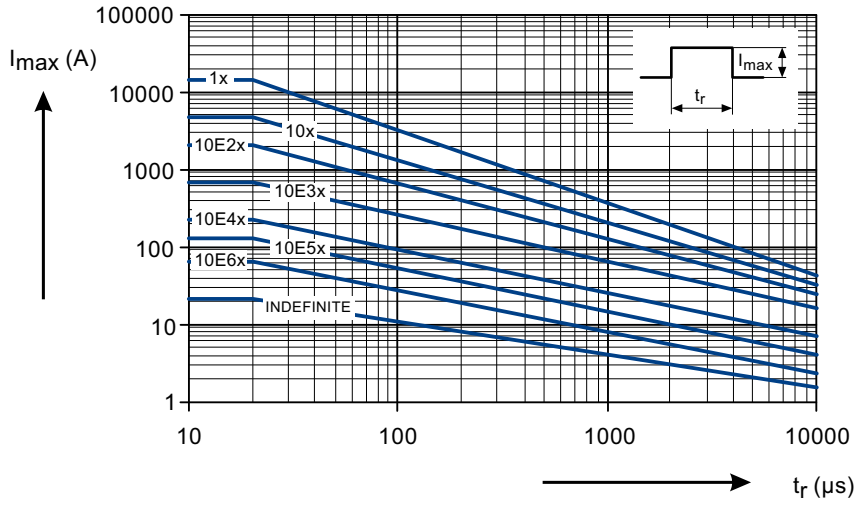
V-I Characteristics

V130-V1100E80

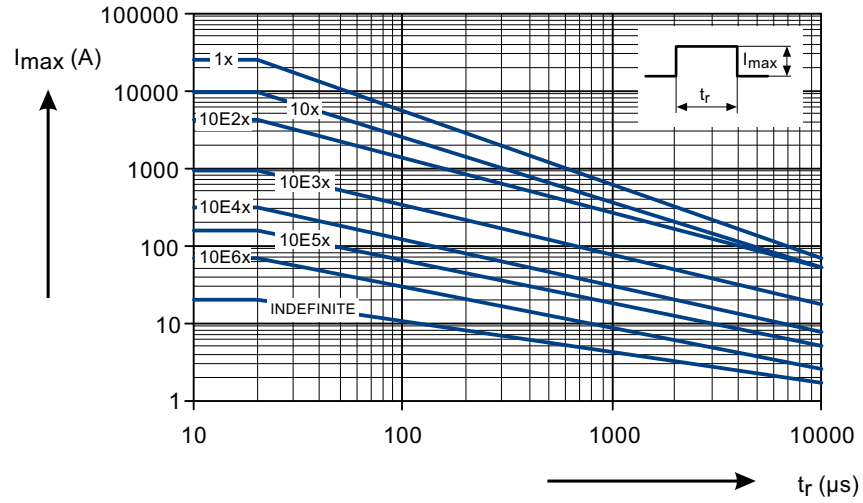


Pulse Ratings

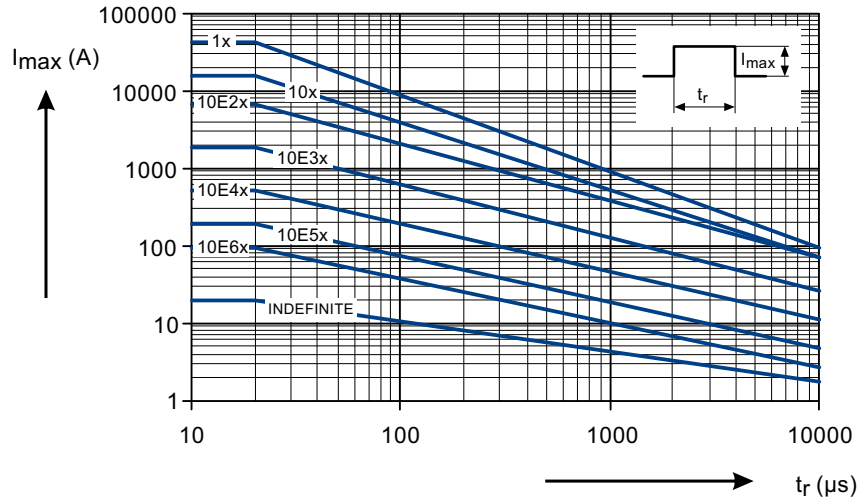
V130-V750E25



V130-V750E32

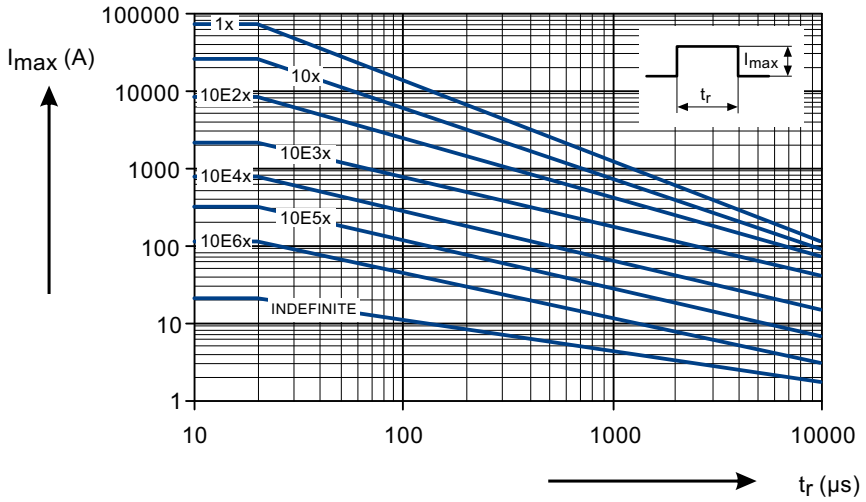


V130-V750E40

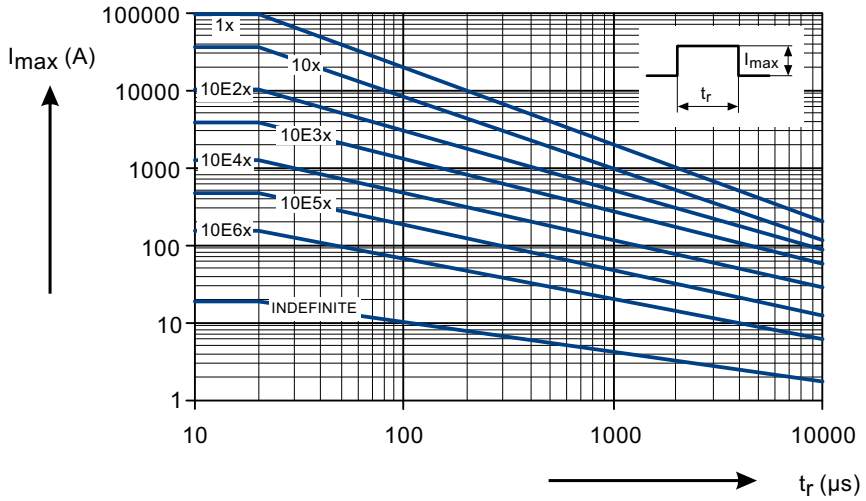


Pulse Ratings

V275-V1100E60



V275-V1100E80



High Energy Varistors



	E25 E32 E40 E60 E80	D32LE D60LE D80LE	S40LE
Varistor Element Diameter	25, 32, 60, 80, 33*mm	32, 60, 80mm	33*mm
Varistor Voltage V_N	205V ... 1 800V	205V ... 1 800V	205V ... 1 800V
Surge Current (8/20µs) I_{max}	15kA ... 100kA	25kA ... 100kA	40kA
Energy Absorption W_{max}	150J ... 6 000J	220J ... 6 000J	1 850J
Average Power Dissipation P_{max}	1.0W ... 2.0W	1.2W ... 2.0W	1.4W

Energy Suppresor Discs

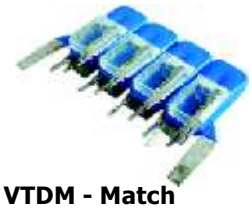

	D25 D32 D40, D60, D80	S20 S40
Varistor Element Diameter	25, 32, 40, 60, 80mm	20*, 33*mm
Varistor Voltage V_N	205V ... 1 800V	205V ... 1 800V
Surge Current (8/20µs) I_{max}	15kA ... 100kA	15kA ... 40kA
Energy Absorption W_{max}	150J ... 6 000J	150J ... 1 850J
Average Power Dissipation P_{max}	1.0W ... 2.0W	1.0W ... 1.4W

High Energy Block

	D40HEB
Varistor Element Diameter	40mm
Rated Voltage U_R	3kV, 6kV
High Current Pulse (4x10 ⌣A) with Secondary Insulation	100kA
Continuous Operating Voltage U_C	2.45kV, 4.9kV
Power Dissipation P_{max}	0.30W, 0.60W

Varistors with Thermal Decoupler

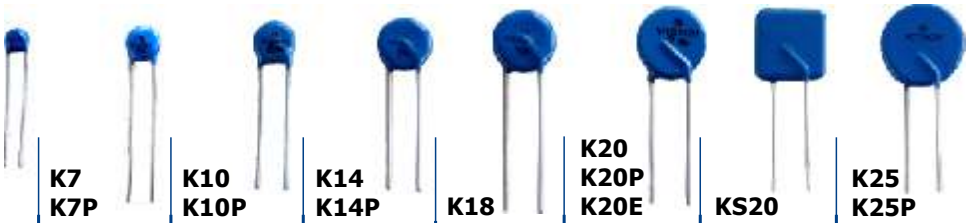





	VTD	VTDM	VTDM - Match	VTDM-MV
Operating Voltage Range V_{RMS}	75V ... 440V	75V ... 440V	75V ... 440V	75V ... 440V
Protection Level Up (at U_{OC}/I_{SC})	400V ... 1 800V	400V ... 1 800V	400V ... 1 800V	400V ... 1 800V
Max. Discharge Current Capability (8/20µs) I_{max}	8kA ... 20kA	20kA	20kA ... 160kA	20kA ... 160kA**

* Square Shape Varistor Element
** For Match Version only

Disc Varistors with Radial Terminals



	K5 K5P	K7 K7P	K10 K10P	K14 K14P	K18	K20 K20P K20E	KS20	K25 K25P
Varistor Element Diameter	5mm	7mm	10mm	14mm	18mm	20mm	20*mm	25mm
Varistor Voltage V_N	18V ... 560V	18V ... 560V	18V ... 1 200V	18V ... 1 200V	18V ... 1 200V	18V ... 1 800V	130V ... 1 800V	130V ... 1 800V
Surge Current (8/20µs) I_{max}	0.1kA ... 0.4kA	0.25kA ... 1.2kA	0.5kA ... 2.5kA	1.0kA ... 5.5kA	6.5kA	2.0kA ... 12.0kA	15.0kA	15.0kA ... 20.0kA
Energy Absorption W_{max}	11J	27J	100J	190J	340J	420J	580J	580J
Average Power Dissipation P_{max}	0.01W ... 0.10W	0.02W ... 0.25W	0.05W ... 0.40W	0.10W ... 0.60W	1.0W	1.0W	1.0W	1.0W

Certified ISO 9001 : 2000 by

Cert. No.: 177434

RoHS Compliant

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