

MOV metal oxide varistors

Leaded varistors, Standard, 07 series

Series/Type: VCRR07D***K****

Ordering code: VCRR07D***K

Date: January 2020

Version: 1

Construction

- Round varistor element, leaded
- Coating: epoxy resin, flame-retardant to UL 94 V-0
- Terminals: tinned wire

Features

- High performance with smaller disk diameter
- Wide operating voltage range 115 ... 510V_{RMS}
- High surge current ratings up to 1200 A
- No derating up to 125°C ambient temperature

Approvals

- UL Certificate:E531647
- TUV Certificate:B1199670002
- CQC Certificate :CQC23001392750

Delivery mode

- Bulk (standard), taped versions on reel or in Ammo pack upon request
- For further details refer to chapter "Taping, packaging and lead configuration" for leaded varistors.

General technical data

Climatic category	to IEC 60068-1	40/130/56	
Operating temperature	to IEC 61051	-40 ... +130	°C
Storage temperature		-40 ... +125	°C
Electric strength	to IEC 61051	≥ 2.5	kV _{RMS}
Insulation resistance	to IEC 61051	≥ 100	MΩ

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Electrical specifications and ordering codes

 Maximum ratings ($T_A = 130\text{ °C}$)

Ordering code	Type	V_{RMS} [V]	V_{DC} [V]	I_{max} (8/20 μs) 1 time [A]*	I_{n1} (8/20 μs) 15 times [A]*	W_{max} (10/100 0us) 1 time [J]	P_{max} [W]
VCRR07D180K0101	07D180L	10	14	250	125	2.1	0.02
VCRR07D220K0101	07D220K	14	18	250	125	2.4	0.02
VCRR07D270K0101	07D270K	17	22	250	125	2.8	0.02
VCRR07D330K0101	07D330K	20	26	250	125	3.5	0.02
VCRR07D390K0101	07D390K	25	31	250	125	4.2	0.02
VCRR07D470K0101	07D470K	30	38	250	125	5	0.02
VCRR07D560K0101	07D560K	35	45	250	125	6.2	0.02
VCRR07D680K0101	07D680K	40	56	250	125	7.2	0.02
VCRR07D820K0101	07D820K	50	65	1200	600	9.8	0.02
VCRR07D101K0101	07D101K	60	85	1200	600	11.6	0.02
VCRR07D121K0101	07D121K	75	100	1200	600	14	0.02
VCRR07D151K0101	07D151K	95	125	1200	600	16.8	0.02
VCRR07D181K0101	07D181K	115	150	1200	600	18.2	0.25
VCRR07D201K0101	07D201K	130	170	1200	600	25.2	0.25
VCRR07D221K0101	07D221K	140	180	1200	600	26.5	0.25
VCRR07D241K0101	07D241K	150	200	1200	600	28	0.25
VCRR07D271K0101	07D271K	175	225	1200	600	32.2	0.25
VCRR07D301K0101	07D301K	190	250	1200	600	35	0.25
VCRR07D331K0101	07D331K	210	270	1200	600	37.8	0.25
VCRR07D361K0101	07D361K	230	300	1200	600	42	0.25
VCRR07D391K0101	07D391K	250	320	1200	600	46.2	0.25
VCRR07D431K0101	07D431K	275	350	1200	600	50.4	0.25
VCRR07D471K0101	07D471K	300	385	1200	600	56	0.25
VCRR07D511K0101	07D511K	320	420	1200	600	57	0.25
VCRR07D561K0101	07D561K	350	460	1200	600	58	0.25
VCRR07D621K0101	07D621K	385	505	1200	600	61.6	0.25
VCRR07D681K0101	07D681K	420	560	1200	600	62.5	0.25
VCRR07D751K0101	07D751K	460	615	1200	600	67.2	0.25
VCRR07D821K0101	07D821K	510	670	1200	600	72	0.25

¹⁾ **Note:** Nominal discharge current is the specification defined in UL1449 4th edition and tested with 8/20 μs current waveform

Characteristics ($T_A=25\text{ °C}$):

Ordering code	Type	V_v (1 mA) [V]	ΔV_v (1 mA) [%]	Max clamping voltage		C_{typ} (1 kHz) [pF]
				V_c [V]	I_c [A]	
VCRR07D180K0101	07D180L	18	± 10	38	2.5	1400
VCRR07D220K0101	07D220K	22	± 10	43	2.5	1150
VCRR07D270K0101	07D270K	27	± 10	53	2.5	930
VCRR07D330K0101	07D330K	33	± 10	65	2.5	760
VCRR07D390K0101	07D390K	39	± 10	77	2.5	640
VCRR07D470K0101	07D470K	47	± 10	93	2.5	530
VCRR07D560K0101	07D560K	56	± 10	110	2.5	450
VCRR07D680K0101	07D680K	68	± 10	135	2.5	370

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VCRR07D820K0101	07D820K	82	±10	135	10	600
VCRR07D101K0101	07D101K	100	±10	165	10	500
VCRR07D121K0101	07D121K	120	±10	200	10	420
VCRR07D151K0101	07D151K	150	±10	250	10	330
VCRR07D181K0101	07D181K	180	±10	300	10	280
VCRR07D201K0101	07D201K	200	±10	340	10	245
VCRR07D221K0101	07D221K	220	±10	360	10	230
VCRR07D241K0101	07D241K	240	±10	395	10	210
VCRR07D271K0101	07D271K	270	±10	455	10	190
VCRR07D301K0101	07D301K	300	±10	500	10	165
VCRR07D331K0101	07D331K	330	±10	550	10	140
VCRR07D361K0101	07D361K	360	±10	595	10	130
VCRR07D391K0101	07D391K	390	±10	650	10	120
VCRR07D431K0101	07D431K	430	±10	710	10	110
VCRR07D471K0101	07D471K	470	±10	775	10	100
VCRR07D511K0101	07D511K	510	±10	840	10	90
VCRR07D561K0101	07D561K	560	±10	910	10	80
VCRR07D621K0101	07D621K	620	±10	1025	10	85
VCRR07D681K0101	07D681K	680	±10	1120	10	75
VCRR07D751K0101	07D751K	750	±10	1240	10	72
VCRR07D821K0101	07D821K	820	±10	1355	10	70

2) *Please refer to the suffix code

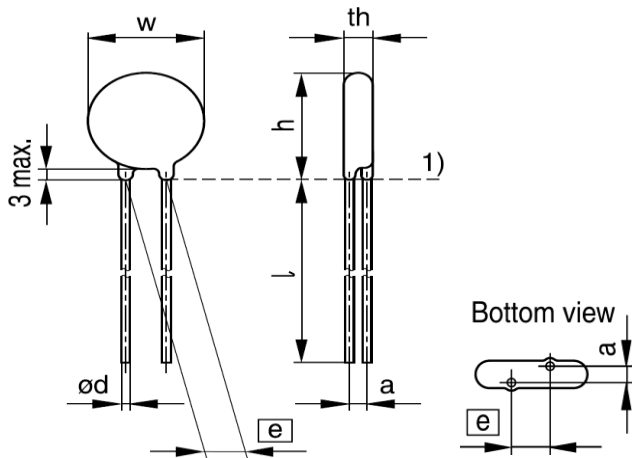
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Dimensional drawings



Weight

Nominal diameter mm	V _{RMS} V	Weight g
7	115...510	0.7...1.3

Different voltage levels result in differences in weight.

Dimensions

Ordering code ²⁾	[e] ±1 mm	W _{max} mm	h _{max} mm	th _{max} mm	a _{typ} mm	l _{min} mm	Ød±0.05 mm
VCRR07D180K0101	5.0	8.5	10.5	3.6	1.5	25.0	0.6
VCRR07D220K0101	5.0	8.5	10.5	3.6	1.5	25.0	0.6
VCRR07D270K0101	5.0	8.5	10.5	3.6	1.5	25.0	0.6
VCRR07D330K0101	5.0	8.5	10.5	3.6	1.5	25.0	0.6
VCRR07D390K0101	5.0	8.5	10.5	3.6	1.5	25.0	0.6
VCRR07D470K0101	5.0	8.5	10.5	3.6	1.5	25.0	0.6
VCRR07D560K0101	5.0	8.5	10.5	3.6	1.5	25.0	0.6
VCRR07D680K0101	5.0	8.5	10.5	3.6	1.5	25.0	0.6
VCRR07D820K0101	5.0	8.5	10.5	3.6	1.5	25.0	0.6
VCRR07D101K0101	5.0	8.5	10.5	3.6	1.5	25.0	0.6
VCRR07D121K0101	5.0	8.5	10.5	3.6	1.5	25.0	0.6
VCRR07D151K0101	5.0	8.5	10.5	3.6	1.5	25.0	0.6
VCRR07D201K0101	5.0	8.5	10.5	3.6	1.6	25.0	0.6
VCRR07D221K0101	5.0	8.5	10.5	3.7	1.7	25.0	0.6
VCRR07D241K0101	5.0	8.5	10.5	3.8	1.8	25.0	0.6
VCRR07D271K0101	5.0	8.5	10.5	4.0	2.0	25.0	0.6
VCRR07D301K0101	5.0	8.5	10.5	4.0	1.5	25.0	0.6
VCRR07D331K0101	5.0	8.5	10.5	4.0	1.5	25.0	0.6
VCRR07D361K0101	5.0	8.5	10.5	4.0	1.5	25.0	0.6
VCRR07D391K0101	5.0	8.5	10.5	4.2	1.5	25.0	0.6
VCRR07D431K0101	5.0	8.5	10.5	4.4	1.6	25.0	0.6
VCRR07D471K0101	5.0	8.5	10.5	4.5	1.7	25.0	0.6
VCRR07D511K0101	5.0	8.5	10.5	4.8	1.9	25.0	0.6
VCRR07D561K0101	5.0	8.5	10.5	4.9	2.0	25.0	0.6
VCRR07D621K0101	5.0	8.5	10.5	5.2	2.1	25.0	0.6
VCRR07D681K0101	5.0	8.5	10.5	5.4	2.4	25.0	0.6
VCRR07D751K0101	5.0	8.5	10.5	5.5	2.4	25.0	0.6
VCRR07D821K0101	5.0	8.5	10.5	5.7	2.6	25.0	0.6

2) *Please refer to the suffix code

Reliability data

Test	Test methods/conditions	Requirement
Varistor voltage	The voltage between two terminals with the specified measuring current applied is called V_V (1 mA _{DC} @ 0.2 ... 2 s).	To meet the specified value
Clamping voltage	The maximum voltage between two terminals with the specified standard impulse current (8/20 μ s) applied.	To meet the specified value
Endurance at upper category temperature	1000 h at UCT After having continuously applied the maximum allowable AC voltage at UCT ± 2 °C for 1000 h, the specimen shall be stored at room temperature and normal humidity for 1 to 2 h. Thereafter, the change of V_V shall be measured.	$ \Delta V/V (1 \text{ mA}) \leq 10\%$
Surge current derating, 8/20 μ s	10 surge currents (8/20 μ s), unipolar, interval 30 s, amplitude corresponding to derating curve for 10 impulses at 20 μ s	$ \Delta V/V (1 \text{ mA}) \leq 10\%$ (measured in direction of surge current) No visible damage
Surge current derating, 2 ms	10 surge currents (2 ms), unipolar, interval 120 s, amplitude corresponding to derating curve for 10 impulses at 2 ms	$ \Delta V/V (1 \text{ mA}) \leq 10\%$ (measured in direction of surge current) No visible damage
Electric strength	IEC 61051-1, test 4.9.2 Metal balls method, 2500 VRMS, 60 s The varistor is placed in a container holding 1.6 $\pm$ 0.2 mm diameter metal balls such that only the terminations of the varistor are protruding. The specified voltage shall be applied between both terminals of the specimen connected together and the electrode inserted between the metal balls.	No breakdown

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Test	Test methods/conditions	Requirement
Climatic sequence	The specimen shall be subjected to: a) dry heat at UCT, 16 h, IEC 60068-2-2, test Ba b) damp heat, 1st cycle: 55 °C, 93% r. H., 24 h, IEC 60068-2-30, test Db c) cold, LCT, 2 h, IEC 60068-2-1, test Aa d) damp heat, additional 5 cycles: 55 °C/25 °C, 93% r. H., 24 h/cycle, IEC 60068-2-30, test Db. Then the specimen shall be stored at room temperature and normal humidity for 1 to 2 h. Thereafter, the change of V_V shall be measured. Thereafter, insulation resistance R_{ins} shall be measured at $V = 500$ V.	$ \Delta V/V (1 \text{ mA}) \leq 10\%$ $R_{ins} \geq 100 \text{ M}\Omega$
Rapid change of temperature	IEC 60068-2-14, test Na, LCT/UCT, dwell time 30 min, 5 cycles	$ \Delta V/V (1 \text{ mA}) \leq 5\%$ No visible damage
Damp heat, steady state	IEC 60068-2-78, test Ca The specimen shall be subjected to 40 ± 2 °C, 90 to 95% r. H. for 56 days without load / with 10% of the maximum continuous DC operating voltage VDC. Then stored at room temperature and normal humidity for 1 to 2 h. Thereafter, the change of V_V shall be measured. Thereafter, insulation resistance R_{ins} shall be measured at $V = 500$ V (insulated varistors only).	$ \Delta V/V (1 \text{ mA}) \leq 10\%$ $R_{ins} \geq 100 \text{ M}\Omega$

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Test	Test methods/conditions	Requirement
Solderability	IEC 60068-2-20, test Ta, method 1 with modified conditions for lead-free solder alloys: 245 °C, 3 s: After dipping the terminals to a depth of approximately 3 mm from the body in a soldering bath of 245 °C for 3 s, the terminals shall be visually examined.	The inspection shall be carried out under adequate light with normal eyesight or with the assistance of a magnifier capable of giving a magnification of 4 to 10 times. The dipped surface shall be covered with a smooth and bright solder coating with no more than small amounts of scattered imperfections such as pinholes or un-wetted or de-wetted areas. These imperfections shall not be concentrated in one area.
Resistance to soldering heat	IEC 60068-2-20, test Tb, method 1A, 260 °C, 10 s: Each lead shall be dipped into a solder bath having a temperature of 260 ±5 °C to a point 2.0 to 2.5 mm from the body of the specimen, be held there for 10 ±1 s and then be stored at room temperature and normal humidity for 1 to 2 h. The change of VV shall be measured and the specimen shall be visually examined.	$ \Delta V/V (1 \text{ mA}) \leq 5\%$ No visible damage
Tensile strength	IEC 60068-2-21, test Ua1 After gradually applying the force specified below and keeping the unit fixed for 10 s, the terminal shall be visually examined for any damage. Force for wire diameter: 0.6 mm = 10 N 0.8 mm = 10 N 1.0 mm = 20 N	$ \Delta V/V (1 \text{ mA}) \leq 5\%$ No break of solder joint, no wire break

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Test	Test methods/conditions	Requirement
Vibration	IEC 60068-2-6, test Fc, method B4 Frequency range: 10 ... 55 Hz Amplitude: 0.75 mm or 98 m/s ² Duration: 6 h (3 · 2 h) Pulse: sine wave After repeatedly applying a single harmonic vibration according to the table above. The change of V _V shall be measured and the specimen shall be visually examined.	ΔV/V (1 mA) ≤5% No visible damage
Bump	IEC 60068-2-29, test Eb Pulse duration: 6 ms Max. acceleration: 400 m/s ² Number of bumps: 4000 Pulse: half sine	ΔV/V (1 mA) ≤5% No visible damage
Fire hazard	IEC 60695-11-5 (needle flame test) Severity: vertical 10 s	5 s max.

Note:

UCT = Upper category temperature

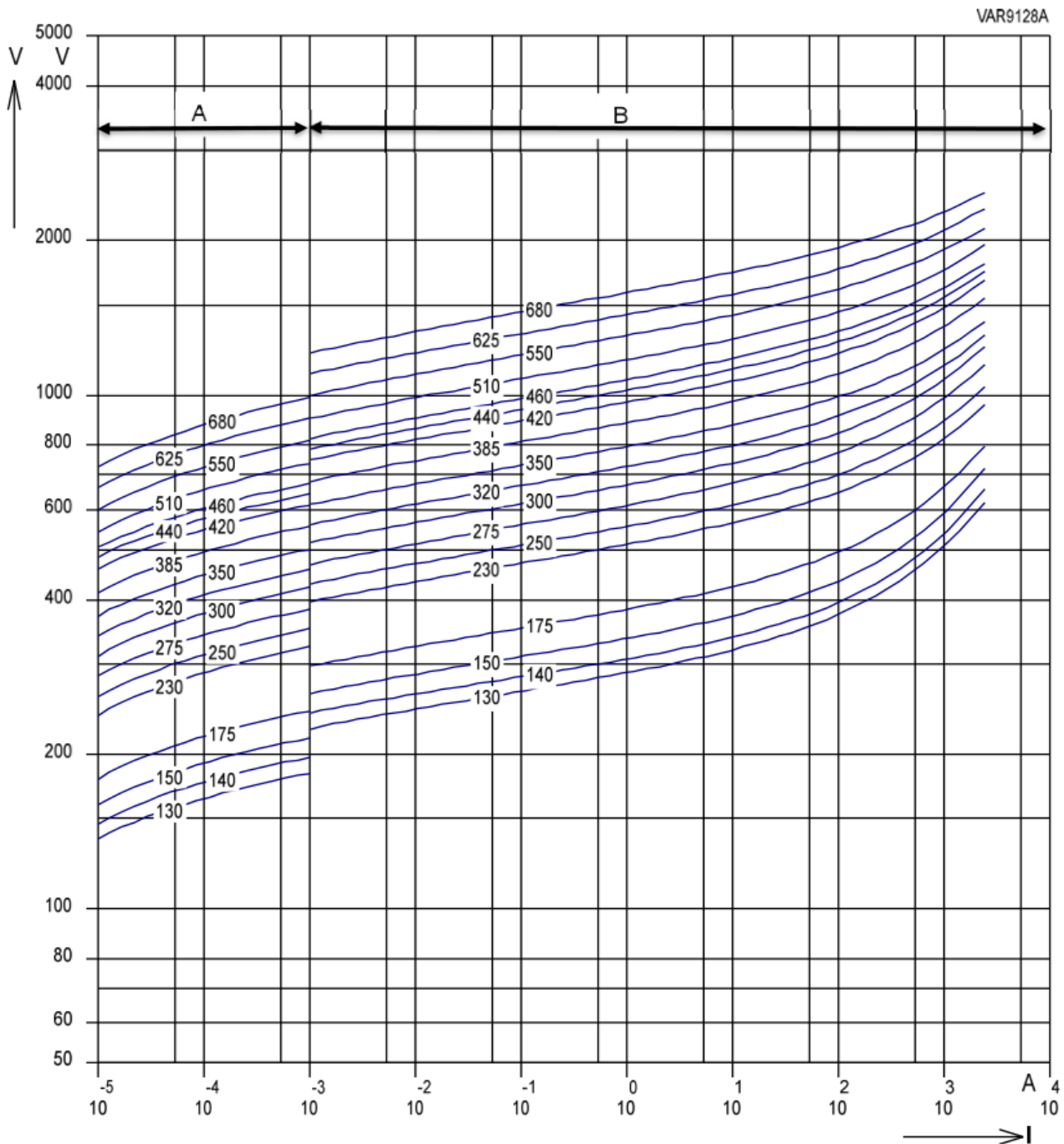
LCT = Lower category temperature

R_{ins} = Insulation resistance

v/i characteristics

$v = f(i)$ - for explanation of the characteristics refer to "General technical information",

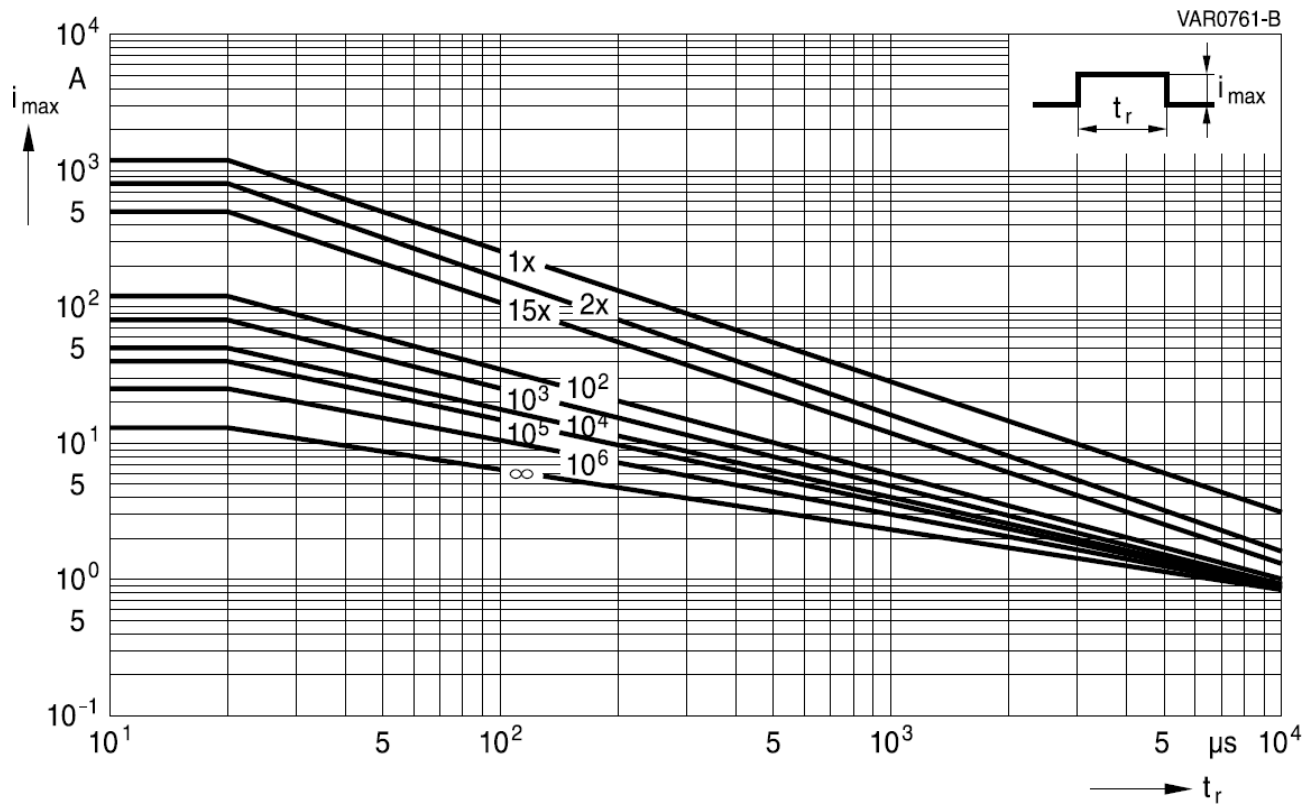
A = Leakage current, B = Protection level } for worst-case varistor tolerances



Derating curves

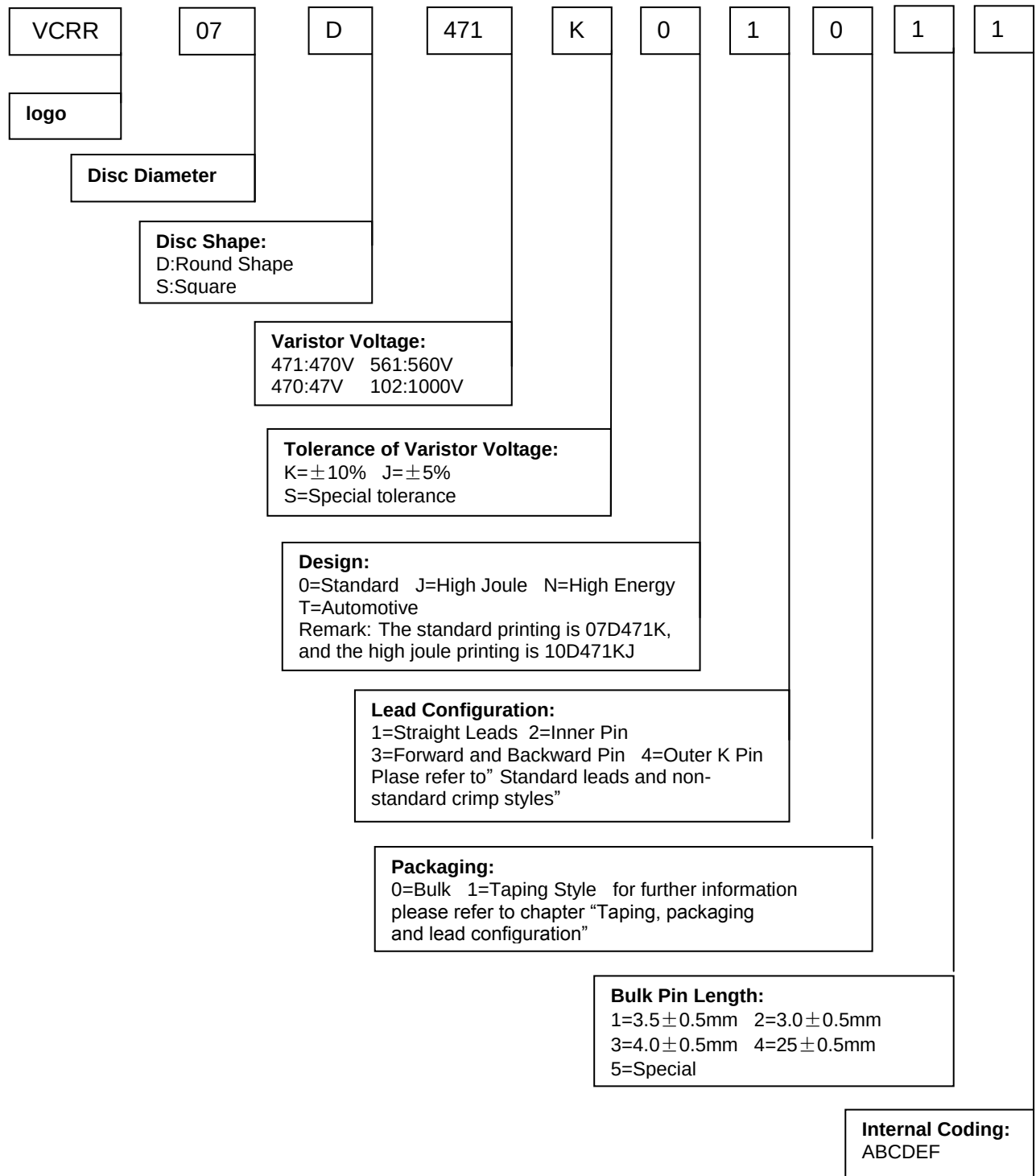
Maximum surge current $i_{\max} = f(t_r, \text{pulse train})$

For explanation of the derating curves refer to "General technical information",



Taping, packaging and lead configuration

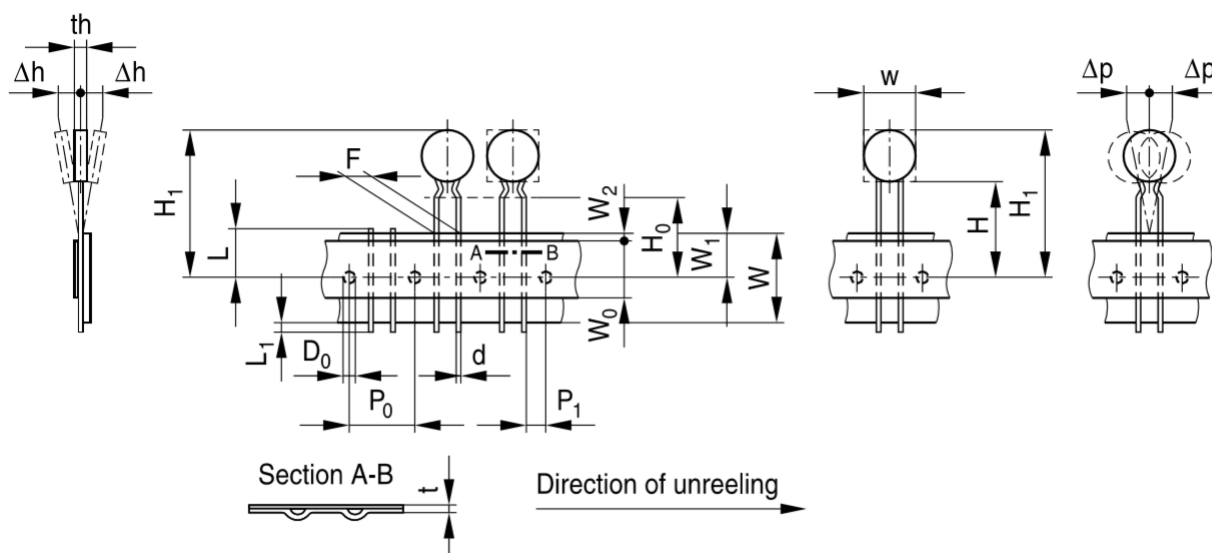
1 JORDUN Electronics ordering code system for leaded varistors



2 Taping and packaging of leaded varistors

Tape packaging for lead spacing $\boxed{e}$ = 5 fully conforms to IEC 60286-2, while for lead spacings $\boxed{e}$ = 7.5 and 10 the taping mode is based on this standard.

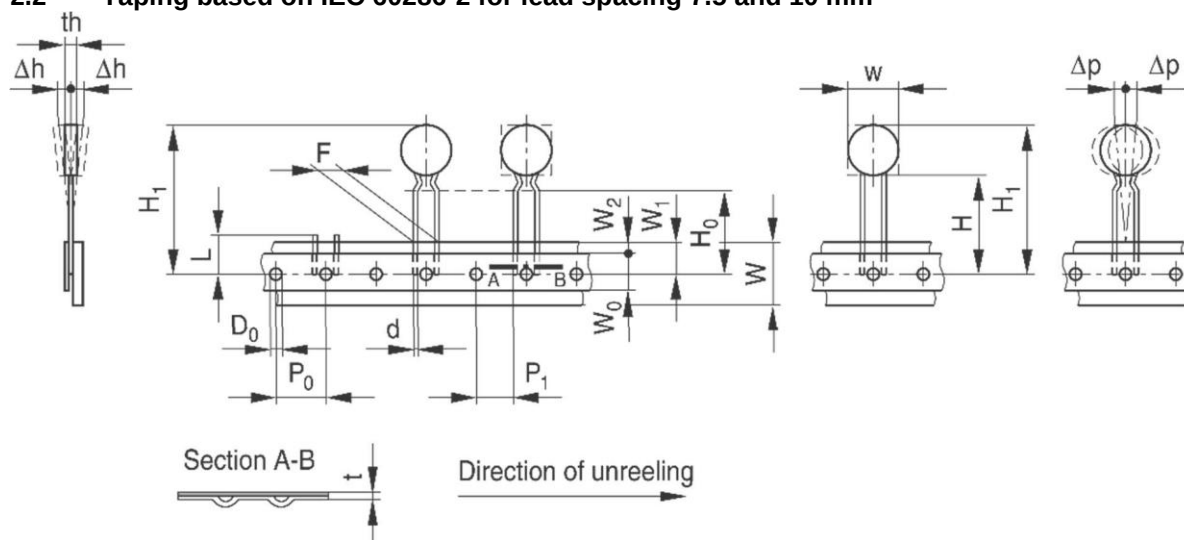
2.1 Taping in accordance with IEC 60286-2 for lead spacing 5.0 mm



$F \triangleq \boxed{e} = 5.0 \text{ mm}$

VAR0410-X-E

2.2 Taping based on IEC 60286-2 for lead spacing 7.5 and 10 mm



$F \triangleq \boxed{e} = 7.5 \text{ mm}$

$F \triangleq \boxed{e} = 10 \text{ mm}$

VAR0395-J-E

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2.3 Tape dimensions (in mm)

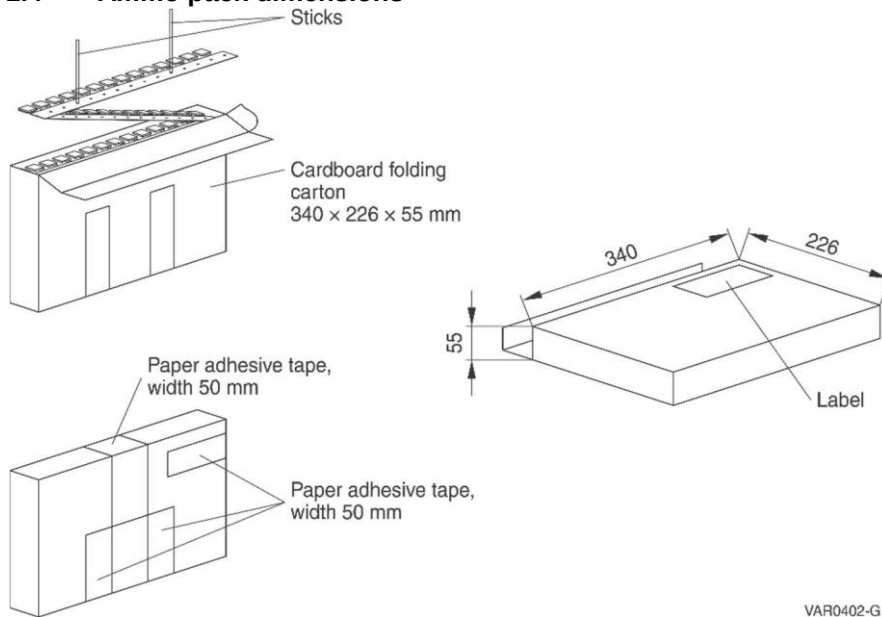
Symbol	$e = 5.0$	Tolerance	$e = 7.5$	Tolerance	$e = 10.0$	Tolerance	Remarks
w th d	0.6	max. max. ± 0.05	0.8	max. max. ± 0.05	1.0	max. max. ± 0.05	see tables in each series under "Dimensions "
P ₀	12.7	± 0.3	12.7 ¹⁾	± 0.3	12.7	± 0.3	± 1 mm/20 sprocket holes
P ₁	3.85	± 0.7	8.95	± 0.8	7.7	± 0.8	
F	5.0	± 10	7.5	± 0.8	10.0	± 0.8	measured at top of compo- nent body
Δh	0	± 2.0	depends on s		depends on s		
Δp	0	± 1.3	0	± 2.0	0	± 2.0	
W	18.0	± 0.5	18.0	± 0.5	18.0	± 0.5	Peel-off force ≥ 5 N
W ₀	5.5	min.	11.0	min.	11.0	min.	
W ₁	9.0	± 0.5	9.0	$+0.75/-0.5$	9.0	$+0.75/-0.5$	
W ₂	3.0	max.	3.0	max.	3.0	max.	
H	18.0	$+2.0/-0$	18.0	$+2.0/-0$	18.0	$+2.0/-0$	²⁾ ³⁾
H ₀	16.0	± 0.5	16.0	± 0.5	16.0	± 0.5	
	(18.0)		(18.0)				
H ₁	32.2	max.	45.0	max.	45.0	max.	
D ₀	4.0	± 0.2	4.0	± 0.2	4.0	± 0.2	without lead
t	0.9	max.	0.9	max.	0.9	max.	
L	11.0	max.	11.0	max.	11.0	max.	
L ₁	0.5	max.					

1) Taping with P₀ = 15.0 mm upon request

2) Applies only to uncrimped types

3) Applies only to crimped types (H₀ = 18 upon request)

2.4 Ammo pack dimensions



2.5 Quantities Per Packaging

Part No	Voltage	Bulk		Ammo Packing(Taping)	
		Bag	Carton	Box	Carton
7D	181-821	1000	12000	1000	10000
10D	180-182	500	6000	1000	10000
14D	180-182	500	6000	800	8000
20D	180-182	250	3000	----	----
25D	180-182	200	2400	----	----

3 Lead configuration

Straight leads are standard for disk varistors. Other lead configurations as crimp style or customerspecific lead wire length according to 3.1, 3.2, 3.3 and 3.4 are optional. Crimped leads (non-standard) are differently crimped for technical reasons; the individual crimp styles are denot-ed by consecutive numbers (S, S2 through S5) as shown in the dimensional drawings below.

The crimp styles of the individual types can be seen from the type designation in the ordering tables.

3.1 Standard leads and non-standard crimp styles

The basic dimensions in figure 1 to 5 are valid for types with either round or square (EnergetiQ series) component head

**Standard,
straight leads**

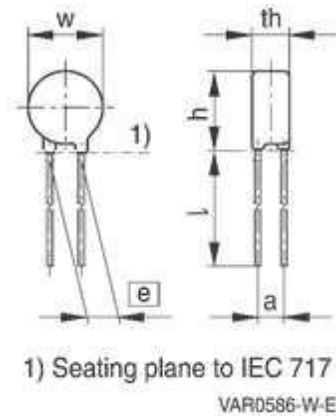


Figure 1

**Non-standard,
crimp style S2**

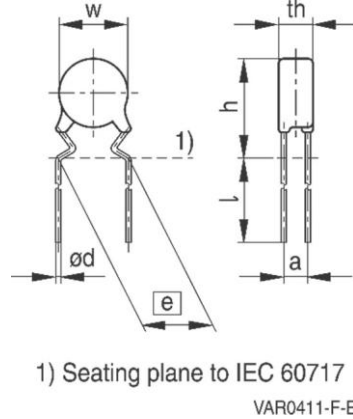


Figure 2

**Non-standard,
crimp style S3**

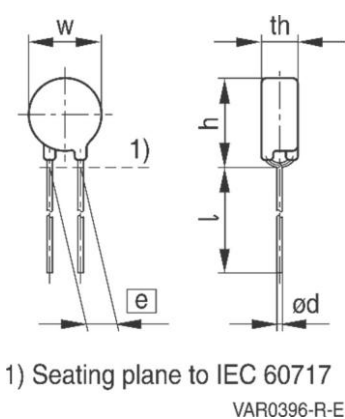
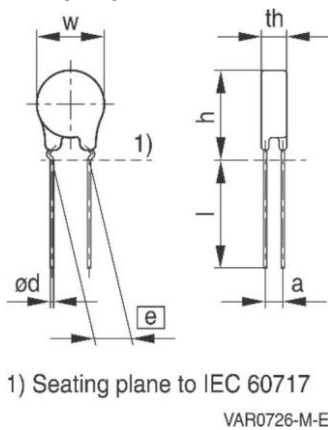


Figure 3

**Non-standard,
crimp style S5**



Figure

3.2 Trimmed leads (non-standard)

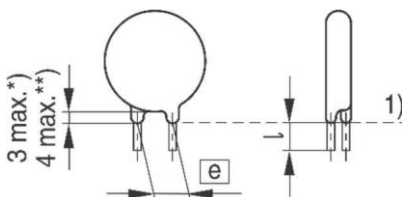
Varistors with cut leads available upon request.

Lead length tolerances:

Straight leads ± 0.8 mm

Crimped leads ± 0.5 mm

Minimum lead length 3.0 mm



1) Seating plane to IEC 60717

*) For round component head

**) For EnergetiQ series, square component head

VAR0642-U-E

Cautions and warnings

General

1. JORDUN Electronics metal oxide varistors (MOV) are designed for specific applications and should not be used for purposes not identified in our specifications, application notes and data books unless otherwise agreed with JORDUN Electronics during the design-in-phase.
2. Ensure suitability of MOV through reliability testing during the design-in phase. The MOV should be evaluated taking into consideration worst-case conditions.
3. For applications of MOV in line-to ground circuits based on various international and local standards there are restrictions existing or additional safety measures required.

Storage

1. Store MOV only in original packaging. Do not open the package prior to processing.
2. Recommended storage conditions in original packaging:

Storage temperature:	-25 °C ... +45 °C
Relative humidity:	<75% annual average, <95% on maximum 30 days a year.
Dew precipitation:	Is to be avoided.
3. Avoid contamination of an MOV's during storage, handling and processing.
4. Avoid storage of MOVs in harmful environments that can affect the function during long-term operation (examples given under operation precautions).
5. The MOV type series should be soldered after shipment from JORDUN ELECTRONIC within the time specified.

MOV-J,N,T	24 months
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Handling

1. MOVs must not be dropped.
2. Components must not be touched with bare hands. Gloves are recommended.
3. Avoid contamination of the surface of MOV electrodes during handling, be careful of the sharp edge of MOV electrodes.

Soldering (where applicable)

1. Use rosin-type flux or non-activated flux.
2. Insufficient preheating may cause ceramic cracks.

3. Rapid cooling by dipping in solvent is not recommended.
4. Complete removal of flux is recommended.
5. Temperatures of all preheat stages and the solder bath must be strictly controlled especially for T series (T14 and T20).

Mounting

1. Potting, sealing or adhesive compounds can produce chemical reactions in the MOV ceramic that will degrade the component's electrical characteristics.
2. Overloading MOVs may result in ruptured packages and expulsion of hot materials. For this reason the MOVs should be physically shielded from adjacent components.

Operation

1. Use MOVs only within the specified temperature operating range
2. Use MOVs only within the specified voltage and current ranges.
3. Environmental conditions must not harm the MOVs. Use MOVs only in normal atmospheric conditions. Avoid use in the presence of deoxidizing gases (chlorine gas, hydrogen sulfide gas, ammonia gas, sulfuric acid gas, etc), corrosive agents, humid or salty conditions, Avoid contact with any liquids and solvents.

Symbols and terms

Symbol	Term
C	Capacitance
C_{typ}	Typical capacitance
i	Current
i_c	Current at which $V_{c, max}$ is measured
I_{leak}	Leakage current
i_{max}	Maximum surge current (also termed peak current)
I_{max}	Maximum discharge current
I_n	Nominal discharge current to UL 1449
LCT	Lower category temperature
L_{typ}	Typical inductance
P_{max}	Maximum average power dissipation
R_{ins}	Insulation resistance
R_{min}	Minimum resistance
T_A	Ambient temperature
t_r	Duration of equivalent rectangular wave
UCT	Upper category temperature
v	Voltage
V_{clamp}	Clamping voltage
$V_{c, max}$	Maximum clamping voltage at specified current i_c DC operating voltage
V_{DC}	Maximum jump start voltage
V_{jump}	Maximum voltage
V_{max}	Operating voltage
V_{op}	AC operating voltage, root-mean-square value
V_{RMS}	Root-mean-square value of max. DC operating voltage incl. ripple current
$V_{RMS, op, max}$	Super imposed surge voltage
V_{surge}	Varistor voltage
V_V	Tolerance of varistor voltage
ΔV_V	
W_{LD}	Maximum load dump
W_{max}	Maximum energy absorption
	Lead spacing

All dimensions are given in mm.

The commas used in numerical values denote decimal points.

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