MOV Metal Oxide Varistors

Leaded varistors, High Surge, 10D series

Series/Type: **VCRR10D***K****
Ordering code: **VCRR10D***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 10 ... 680V_{RMS}
- High surge current ratings up to 3500 A
- No derating up to 130℃ ambient temperature

Approvals

- UL Certificate:E531647
- TUV Certificate:B1199670002
- CQC Certificate :CQC23001396761

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

Electrical specifications and ordering codes

Maximum ratings (T_A = 130 °C)

Ordering code	Type	V_{RMS} [V]	V_{DC} [V]	i_{max} (8/20 µs) 1 time [A]*	I_n[1)] (8/20 µs) 15 times [A]*	W_{max} (10/1000us) [J]	P_{max} [W]
VCRR10D180KJ101	10D180LJ	10	14	1000	500	3	0.05
VCRR10D220KJ101	10D220KJ	14	18	1000	500	5	0.05
VCRR10D270KJ101	10D270KJ	17	22	1000	500	6.5	0.05
VCRR10D330KJ101	10D330KJ	20	26	1000	500	8	0.05
VCRR10D390KJ101	10D390KJ	25	31	1000	500	9.5	0.05
VCRR10D470KJ101	10D470KJ	30	38	1000	500	11	0.05
VCRR10D560KJ101	10D560KJ	35	45	1000	500	13	0.05
VCRR10D680KJ101	10D680KJ	40	56	1000	500	16	0.05
VCRR10D820KJ101	10D820KJ	50	65	3500	1750	17	0.05
VCRR10D101KJ101	10D101KJ	60	85	3500	1750	18.5	0.05
VCRR10D121KJ101	10D121KJ	75	100	3500	1750	21.5	0.05
VCRR10D151KJ101	10D151KJ	95	125	3500	1750	26	0.05
VCRR10D181KJ101	10D181KJ	115	150	3500	1750	38	0.4
VCRR10D201KJ101	10D201KJ	130	170	3500	1750	42.5	0.4
VCRR10D221KJ101	10D221KJ	140	180	3500	1750	46.5	0.4
VCRR10D241KJ101	10D241KJ	150	200	3500	1750	51	0.4
VCRR10D271KJ101	10D271KJ	175	225	3500	1750	58	0.4
VCRR10D301KJ101	10D301KJ	190	250	3500	1750	63.5	0.4
VCRR10D331KJ101	10D331KJ	210	270	3500	1750	69	0.4
VCRR10D361KJ101	10D361KJ	230	300	3500	1750	75	0.4
VCRR10D391KJ101	10D391KJ	250	320	3500	1750	82	0.4
VCRR10D431KJ101	10D431KJ	275	350	3500	1750	89	0.4
VCRR10D471KJ101	10D471KJ	300	385	3500	1750	100	0.4
VCRR10D511KJ101	10D511KJ	320	420	3500	1750	102	0.4
VCRR10D561KJ101	10D561KJ	350	460	3500	1750	104	0.4
VCRR10D621KJ101	10D621KJ	385	505	3500	1750	106	0.4
VCRR10D681KJ101	10D681KJ	420	560	3500	1750	108	0.4
VCRR10D751KJ101	10D751KJ	460	615	3500	1750	118	0.4
VCRR10D821KJ101	10D821KJ	510	670	3500	1750	120	0.4
VCRR10D911KJ101	10D911KJ	550	745	3500	1750	125	0.4
VCRR10D951KJ101	10D951KJ	575	765	3500	1750	134	0.4
VCRR10D102KJ101	10D102KJ	625	825	3500	1750	134	0.4
VCRR10D112KJ101	10D112KJ	680	895	3500	1750	140	0.4

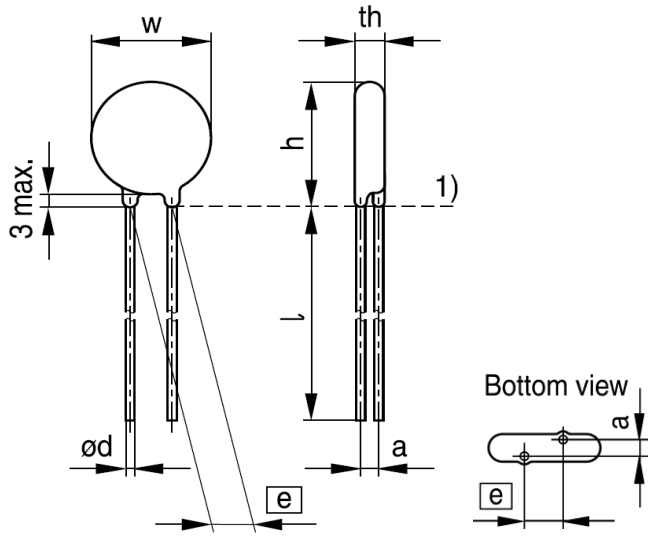
[1)] **Note:** Nominal discharge current is the specification defined in UL1449 4th edition and tested with 8/20 µs current waveform

Characteristics (T_A=25 °C):

Ordering code	Type	V_v (1 mA)	ΔV_v (1 mA)	Max clamping voltage		C_{typ} (1 kHz)
				Vc	Ic	
		[V]	[%]	[V]	[A]	[pF]
VCRR10D180KJ101	10D180LJ	18	5	38	5	5600
VCRR10D220KJ101	10D220KJ	22	±10	43	5	4500
VCRR10D270KJ101	10D270KJ	27	±10	53	5	3700
VCRR10D330KJ101	10D330KJ	33	±10	65	5	3000
VCRR10D390KJ101	10D390KJ	390	±10	77	5	2600
VCRR10D470KJ101	10D470KJ	47	±10	93	5	2100
VCRR10D560KJ101	10D560KJ	56	±10	110	5	1800
VCRR10D680KJ101	10D680KJ	68	±10	135	5	1500
VCRR10D820KJ101	10D820KJ	82	±10	135	25	1200
VCRR10D101KJ101	10D101KJ	100	±10	165	25	1000
VCRR10D121KJ101	10D121KJ	120	±10	200	25	830
VCRR10D151KJ101	10D151KJ	150	±10	250	25	670
VCRR10D181KJ101	10D181KJ	180	±10	300	25	560
VCRR10D201KJ101	10D201KJ	200	±10	340	25	500
VCRR10D221KJ101	10D221KJ	220	±10	360	25	450
VCRR10D241KJ101	10D241KJ	240	±10	395	25	420
VCRR10D271KJ101	10D271KJ	270	±10	455	25	370
VCRR10D301KJ101	10D301KJ	300	±10	500	25	330
VCRR10D331KJ101	10D331KJ	330	±10	550	25	300
VCRR10D361KJ101	10D361KJ	360	±10	595	25	280
VCRR10D391KJ101	10D391KJ	390	±10	650	25	260
VCRR10D431KJ101	10D431KJ	430	±10	710	25	230
VCRR10D471KJ101	10D471KJ	470	±10	775	25	210
VCRR10D511KJ101	10D511KJ	510	±10	840	25	200
VCRR10D561KJ101	10D561KJ	560	±10	910	25	180
VCRR10D621KJ101	10D621KJ	620	±10	1025	25	160
VCRR10D681KJ101	10D681KJ	680	±10	1120	25	150
VCRR10D751KJ101	10D751KJ	750	±10	1240	25	140
VCRR10D821KJ101	10D821KJ	820	±10	1355	25	120
VCRR10D911KJ101	10D911KJ	910	±10	1500	25	110
VCRR10D951KJ101	10D951KJ	950	±10	1570	25	100
VCRR10D102KJ101	10D102KJ	1000	±10	1650	25	90
VCRR10D112KJ101	10D112KJ	1100	±10	1815	25	90

2) *Please refer to the suffix code

Dimensional drawings



Weight

Nominal diameter mm	V_{RMS} V	Weight g
10	130…680	0.9…2.9

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	∅d±0.05 mm
VCRR10D180KJ101	7.5	11.5	14	3.6	1.2	25.0	0.8
VCRR10D220KJ101	7.5	11.5	14	3.6	1.2	25.0	0.8
VCRR10D270KJ101	7.5	11.5	14	3.6	1.2	25.0	0.8
VCRR10D330KJ101	7.5	11.5	14	3.6	1.2	25.0	0.8
VCRR10D390KJ101	7.5	11.5	14	3.6	1.2	25.0	0.8
VCRR10D470KJ101	7.5	11.5	14	3.6	1.2	25.0	0.8
VCRR10D560KJ101	7.5	11.5	14	3.6	1.2	25.0	0.8
VCRR10D680KJ101	7.5	11.5	14	3.6	1.2	25.0	0.8
VCRR10D820KJ101	7.5	11.5	14	3.6	1.3	25.0	0.8
VCRR10D101KJ101	7.5	11.5	14	3.6	1.3	25.0	0.8
VCRR10D121KJ101	7.5	11.5	14	3.6	1.3	25.0	0.8
VCRR10D151KJ101	7.5	11.5	14	3.6	1.3	25.0	0.8
VCRR10D181KJ101	7.5	11.5	14	3.6	1.5	25.0	0.8
VCRR10D201KJ101	7.5	11.5	14	4.2	1.5	25.0	0.8
VCRR10D221KJ101	7.5	11.5	14	4.3	1.5	25.0	0.8
VCRR10D241KJ101	7.5	11.5	14	4.4	1.5	25.0	0.8
VCRR10D271KJ101	7.5	11.5	14	4.6	1.5	25.0	0.8
VCRR10D301KJ101	7.5	11.5	14	4.7	1.5	25.0	0.8
VCRR10D331KJ101	7.5	11.5	14	4.8	1.5	25.0	0.8
VCRR10D361KJ101	7.5	11.5	14	5.0	1.6	25.0	0.8
VCRR10D391KJ101	7.5	11.5	14	5.1	1.8	25.0	0.8
VCRR10D431KJ101	7.5	11.5	14	5.4	2.0	25.0	0.8
VCRR10D471KJ101	7.5	11.5	14	5.6	2.1	25.0	0.8
VCRR10D511KJ101	7.5	11.5	14	5.8	2.3	25.0	0.8
VCRR10D561KJ101	7.5	11.5	14	6.1	2.3	25.0	0.8

MOV metal oxide varistors 10D***k****

Leaded varistors, High Surge, 10 series VCRR10D***K****

Ordering code[2)]	[e] ±1 mm	w_{max} mm	h_{max} mm	th_{max} mm	a_{typ} mm	l_{min} mm	∅d±0.05 mm
VCRR10D621KJ101	7.5	11.5	14	6.2	2.8	25.0	0.8
VCRR10D681KJ101	7.5	11.5	14	6.3	2.4	25.0	0.8
VCRR10D751KJ101	7.5	11.5	14	6.7	3.1	25.0	0.8
VCRR10D821KJ101	7.5	11.5	14	7.1	3.4	25.0	0.8
VCRR10D911KJ101	7.5	11.5	14	7.5	3.7	25.0	0.8
VCRR10D951KJ101	7.5	11.5	14	7.9	3.9	25.0	0.8
VCRR10D102KJ101	7.5	11.5	14	7.9	4.1	25.0	0.8
VCRR10D112KJ101	7.5	11.5	14	8.0	4.4	25.0	0.8

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 µs) 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 bestored at room temperature and normal humidity for 1 to 2 h. Thereafter, the change of V_V shall be measured.	|ΔV/V (1 mA)| ≤10%
Surge current derating, 8/20 µs	10 surge currents (8/20 µs), unipolar, interval 30 s, amplitude corresponding to derating curve for 10 impulses at 20 µs	|ΔV/V (1 mA)| ≤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	|ΔV/V (1 mA)| ≤10% (measured in direction of surge current) No visible damage
Electric strength	IEC 61051-1, test 4.9.2 Metal balls method, 2500 V_{RMS}, 60 s The varistor is placed in a container holding 1.6 ±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

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.	$\lvert\Delta V/V\ (1\ mA)\rvert \leq 10\%$ $R_{ins} \geq 100\ M\Omega$
Rapid change of temperature	IEC 60068-2-14, test Na, LCT/UCT, dwell time 30 min, 5 cycles	$\lvert\Delta V/V\ (1\ mA)\rvert \leq 5\%$ 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 V_{DC}. 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).	$\lvert\Delta V/V\ (1\ mA)\rvert \leq 10\%$ $R_{ins} \geq 100\ M\Omega$

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.	|ΔV/V (1 mA)| ≤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	|ΔV/V (1 mA)| ≤5% No break of solder joint, no wire break

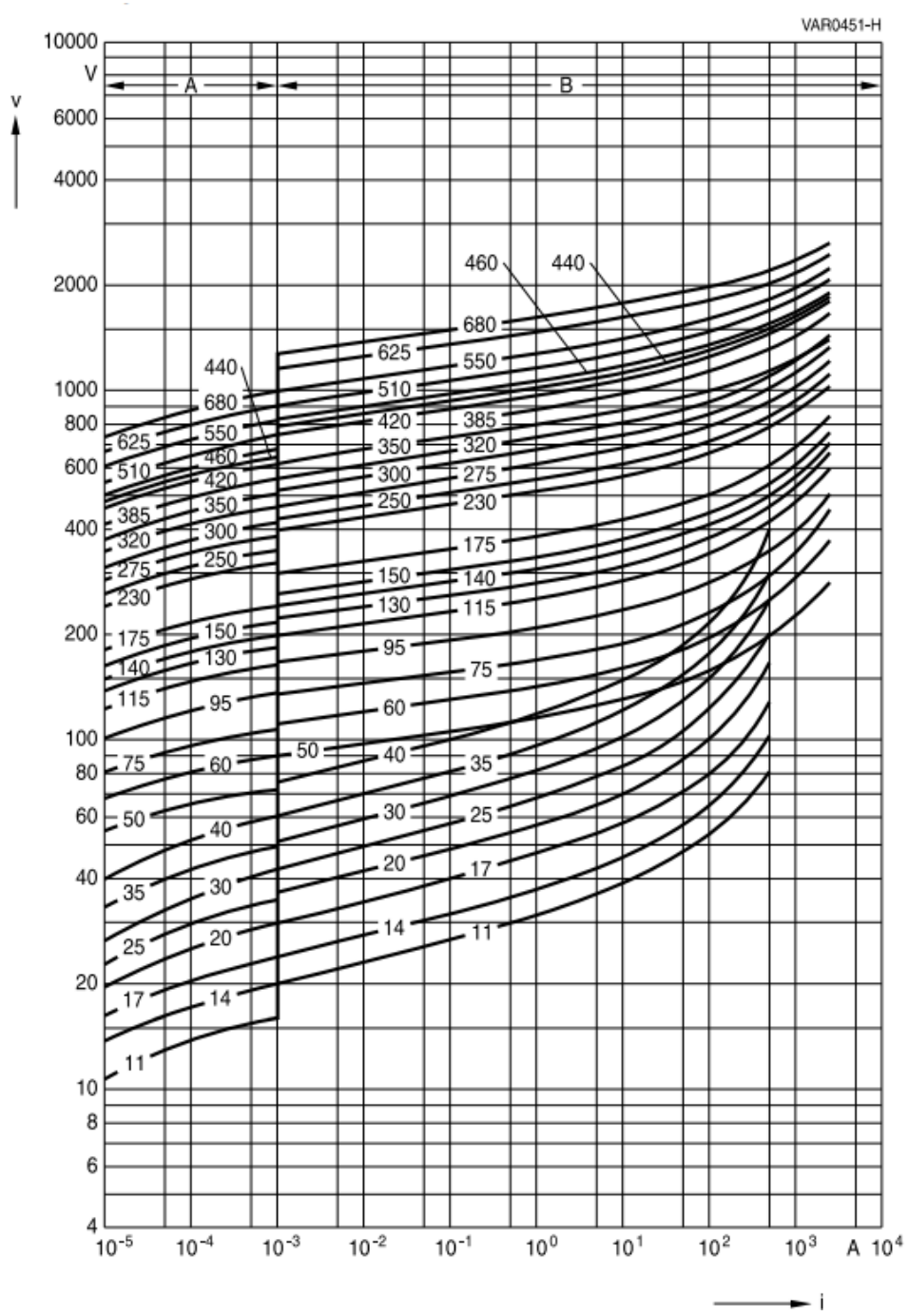
Test	Test methods/conditions	Requirement
Vibration	IEC 60068-2-6, test Fc, method B4 Frequency range: 10 … 55 Hz Amplitude: 0.75 mm or 98 m/s^2 Duration: 6 h (3 · 2 h) Pulse: sine wave After repeatedly applying a single harmonic vibration according to the table above. The change of V_V shall be measured and the specimen shall be visually examined.	$\lvert\Delta V/V\ (1\ mA)\rvert \leq 5\%$ 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	$\lvert\Delta V/V\ (1\ mA)\rvert \leq 5\%$ 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

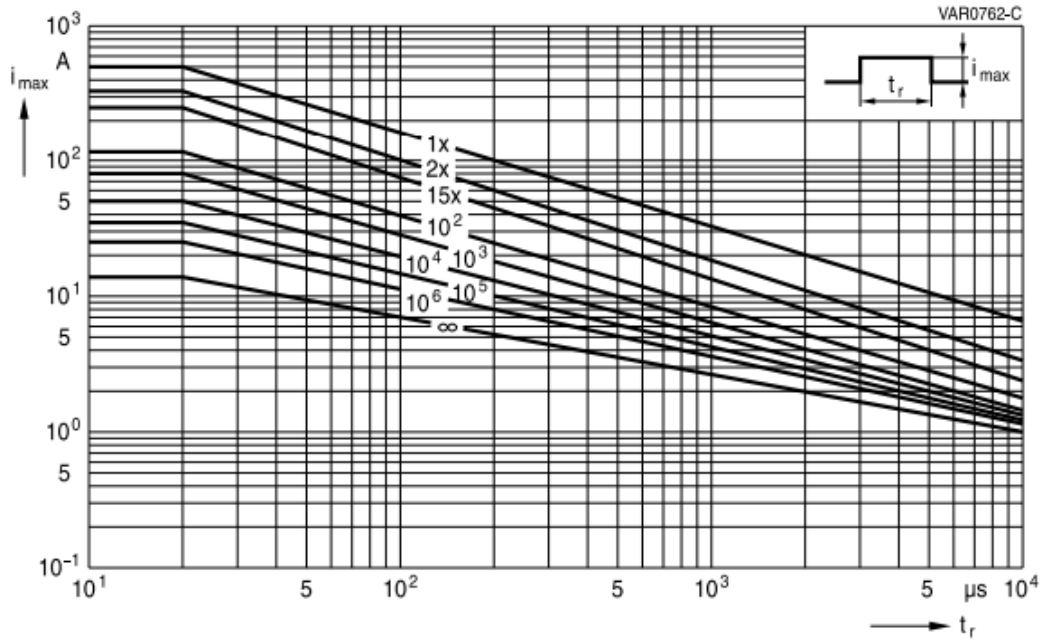
v = f (i) - for explanation of the characteristics refer to "General technical information",

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



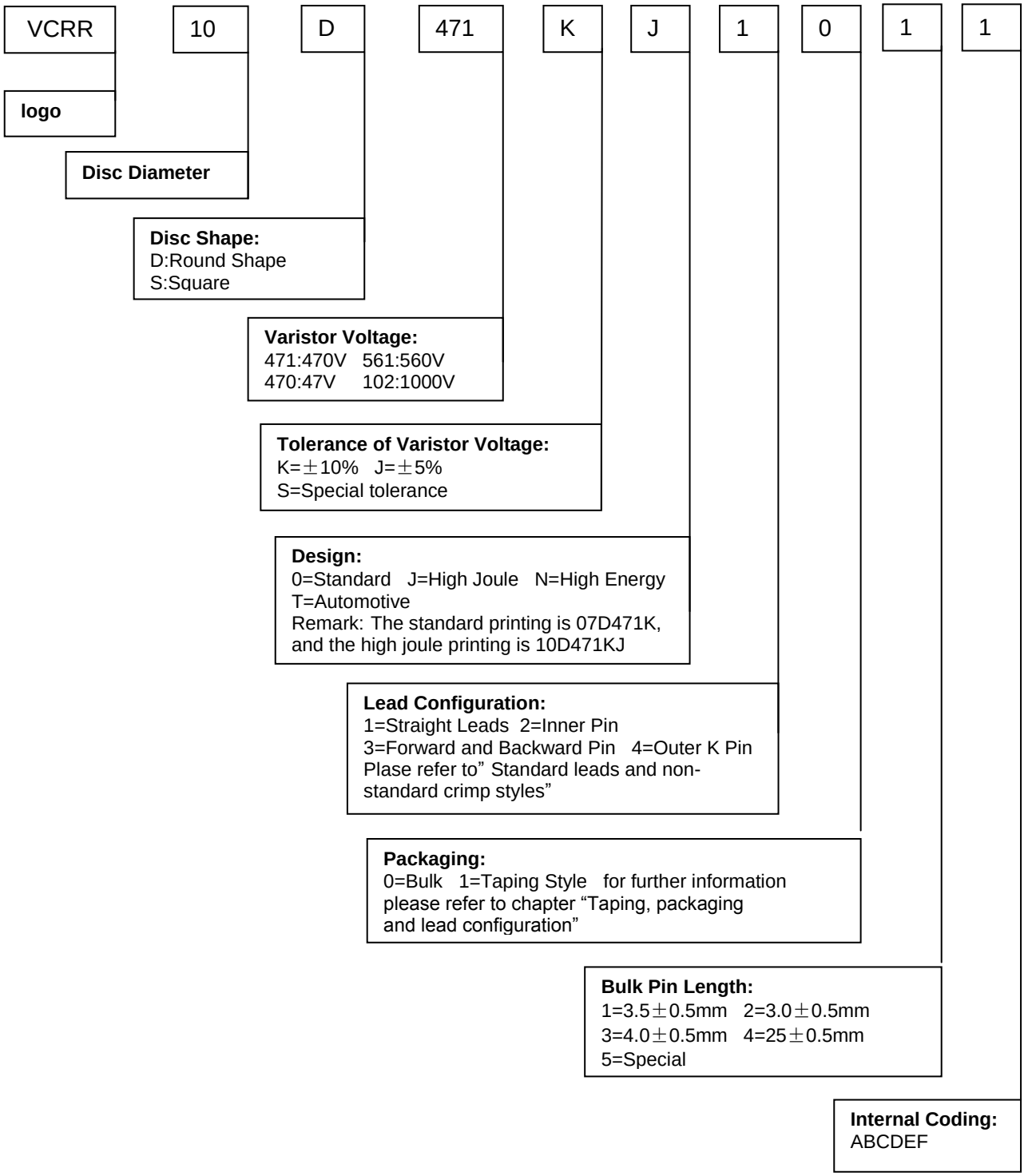
Derating curves

Maximum surge current $i_{max} = f(t_r$, pulse train)
For explanation of the derating curves refer to "General technical information".



Taping, packaging and lead configuration

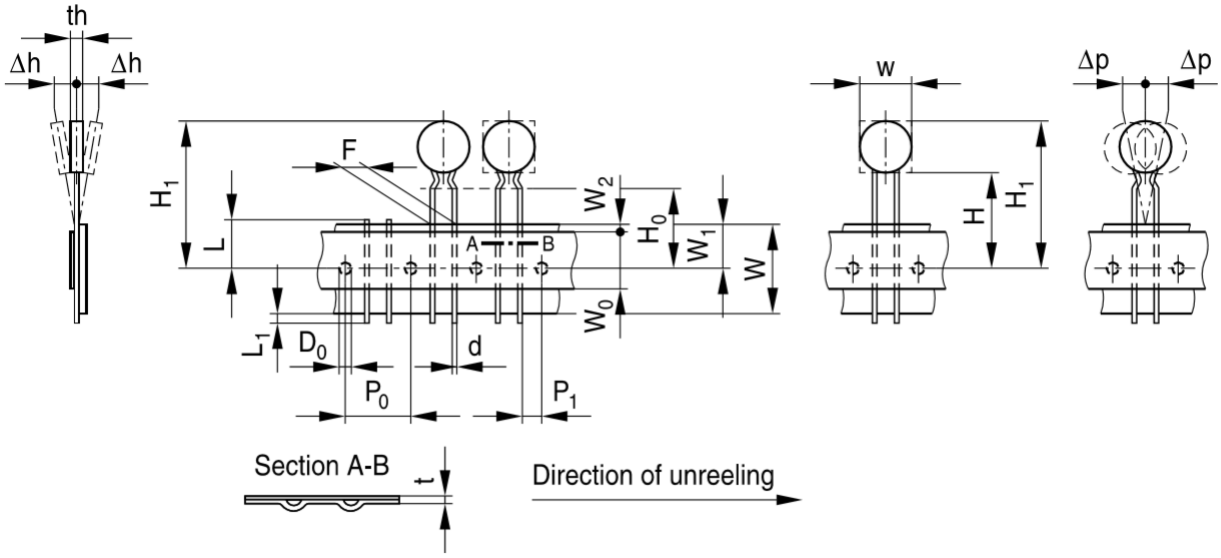
1 JORDUN Electronics ordering code system for leaded varistors



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.

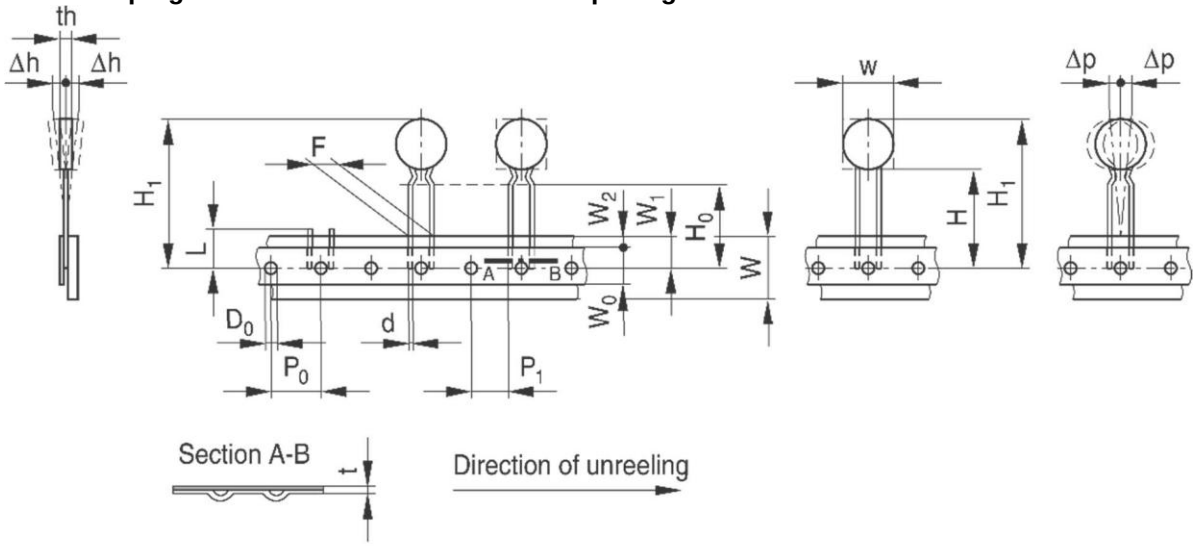
2.1 Taping in accordance with IEC 60286-2 for lead spacing 5.0 mm



F ≙ $\boxed{e}$ = 5.0 mm

VAR0410-X-E

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



F ≙ $\boxed{e}$ = 7.5 mm

F ≙ $\boxed{e}$ = 10 mm

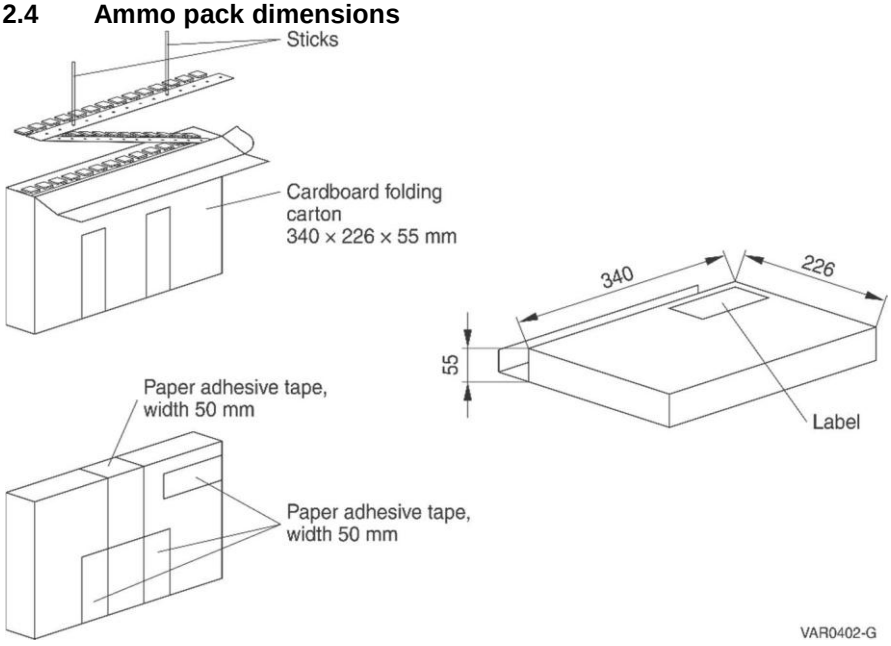
VAR0395-J-E

2.3 Tape dimensions (in mm)

Symbol	ⓔ = 5.0	Tolerance	ⓔ = 7.5	Tolerance	ⓔ = 10.0	Tolerance	Remarks
w th d 0.6		max. max. ±0.05		max. max. ±0.05		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	
Δh	0	±2.0	depends on s		depends on s		measured at
Δp	0	±1.3	0	±2.0	0	±2.0	top of compo-nent body
W	18.0	±0.5	18.0	±0.5	18.0	±0.5	
W_0	5.5	min.	11.0	min.	11.0	min.	Peel-off force ≥ 5 N
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	
t	0.9	max.	0.9	max.	0.9	max.	without lead
L	11.0	max.	11.0	max.	11.0	max.	
L_1	0.5	max.					

1) Taping with P_0 = 15.0 mm upon request
2) Applies only to uncrimped types
3) Applies only to crimped types (H_0 = 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	20000	1000	10000
10D	180-182	1000	10000	1000	10000
14D	180-182	500	8000	800	8000
20D	180-182	250	5000	----	----
25D	180-182	200	3000	----	----

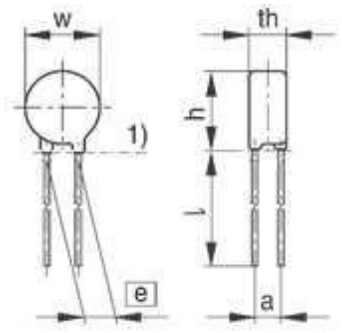
3 Lead configuration

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

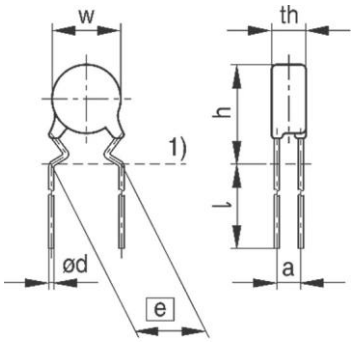
Standard,
straight leads



1) Seating plane to IEC 717
VAR0586-W-E

Figure 1

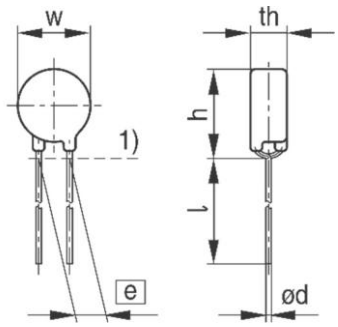
Non-standard,
crimp style S2



1) Seating plane to IEC 60717
VAR0411-F-E

Figure 2

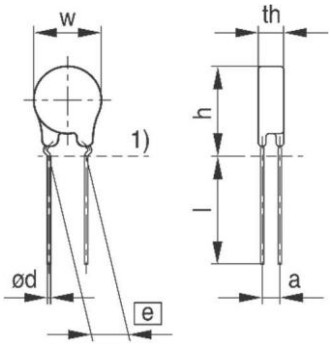
Non-standard,
crimp style S3



1) Seating plane to IEC 60717
VAR0396-R-E

Figure 3

Non-standard,
crimp style S5



1) Seating plane to IEC 60717
VAR0726-M-E

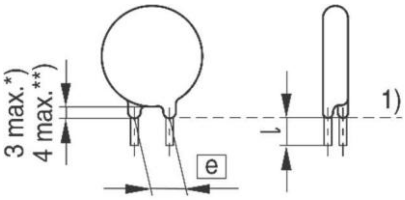
Figure

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

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	Maximum load dump
W_{LD}	Maximum energy absorption
W_{max}	
e	Lead spacing

All dimensions are given in mm.

The commas used in numerical values denote decimal points.

Release:Version January,2020