

MOV metal oxide varistors

Leaded varistors, High Surge, 25 series

Series/Type: VCRR25D***K****

Ordering code: VCRR25D***K

Date: January 2020

Version: 1

MOV metal oxide varistors

25D***k****

Leaded varistors, High Surge, 25 series

VCRR25D***K****

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 6500 A
- No derating up to 130°C ambient temperature

Approvals

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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 ($T_A = 130\text{ }^{\circ}\text{C}$)

Ordering code	Type	V_{RMS} [V]	V_{DC} [V]	i_{max} (8/20 μ s) 1 time [A]*	$I_n^{(1)}$ (8/20 μ s) 15 times [A]*	W_{max} (10/1000u s) [J]	P_{max} [W]
VCRR25D180K0101	25D180L	10	14	3000	1500	20	0.2
VCRR25D220K0101	25D220K	14	18	3000	1500	25	0.2
VCRR25D270K0101	25D270K	17	22	3000	1500	30	0.2
VCRR25D330K0101	25D330K	20	26	3000	1500	35	0.2
VCRR25D390K0101	25D390K	25	31	3000	1500	40	0.2
VCRR25D470K0101	25D470K	30	38	6000	3000	50	0.2
VCRR25D560K0101	25D560K	35	45	6000	3000	60	0.2
VCRR25D680K0101	25D680K	40	56	6000	3000	70	0.2
VCRR25D820K0101	25D820K	50	65	20000	10000	80	0.2
VCRR25D101K0101	25D101K	60	85	20000	10000	100	0.2
VCRR25D121K0101	25D121K	75	100	20000	10000	120	0.2
VCRR25D151K0101	25D151K	95	125	20000	10000	160	0.2
VCRR25D181K0101	25D181K	115	150	20000	10000	175	1.0
VCRR25D201K0101	25D201K	130	170	20000	10000	190	1.0
VCRR25D221K0101	25D221K	140	180	20000	10000	200	1.0
VCRR25D241K0101	25D241K	150	200	20000	10000	220	1.0
VCRR25D271K0101	25D271K	175	225	20000	10000	255	1.0
VCRR25D301K0101	25D301K	190	250	20000	10000	275	1.0
VCRR25D331K0101	25D331K	210	270	20000	10000	300	1.0
VCRR25D361K0101	25D361K	230	300	20000	10000	330	1.0
VCRR25D391K0101	25D391K	250	320	20000	10000	360	1.0
VCRR25D431K0101	25D431K	275	350	20000	10000	380	1.0
VCRR25D471K0101	25D471K	300	385	20000	10000	400	1.0
VCRR25D511K0101	25D511K	320	420	20000	10000	420	1.0
VCRR25D561K0101	25D561K	350	460	20000	10000	440	1.0
VCRR25D621K0101	25D621K	385	505	20000	10000	450	1.0
VCRR25D681K0101	25D681K	420	560	20000	10000	460	1.0
VCRR25D751K0101	25D751K	460	615	20000	10000	510	1.0
VCRR25D821K0101	25D821K	510	670	20000	10000	520	1.0
VCRR25D911K0101	25D911K	550	745	20000	10000	620	1.0
VCRR25D951K0101	25D951K	575	765	20000	10000	690	1.0
VCRR25D102K0101	25D102K	625	825	20000	10000	760	1.0
VCRR25D112K0101	25D112K	680	895	20000	10000	820	1.0

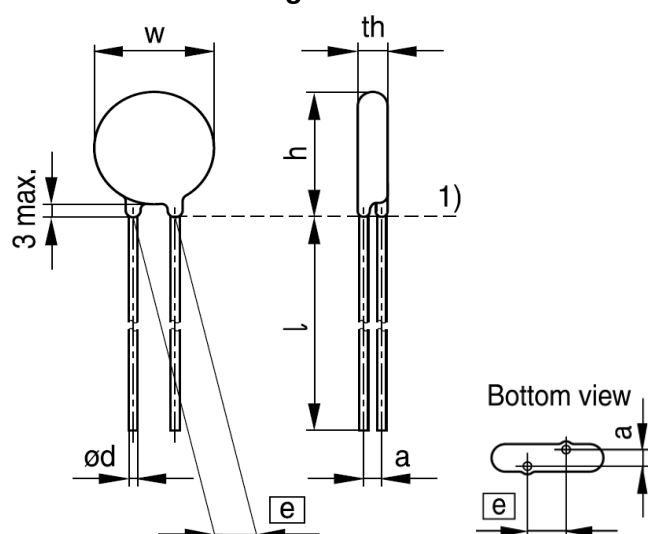
¹⁾ **Note:** Nominal discharge current is the specification defined in UL1449 4th edition and tested with 8/20 μ s current waveform

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Characteristics (T_A=25 °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]	
VCRR25D180K0101	25D180L	18	5	38	30	21500
VCRR25D220K0101	25D220K	22	±10	43	30	20500
VCRR25D270K0101	25D270K	27	±10	53	30	26500
VCRR25D330K0101	25D330K	33	±10	65	30	18000
VCRR25D390K0101	25D390K	390	±10	77	30	13500
VCRR25D470K0101	25D470K	47	±10	93	30	11500
VCRR25D560K0101	25D560K	56	±10	110	30	10500
VCRR25D680K0101	25D680K	68	±10	135	30	9050
VCRR25D820K0101	25D820K	82	±10	135	150	7700
VCRR25D101K0101	25D101K	100	±10	165	150	6300
VCRR25D121K0101	25D121K	120	±10	200	150	5200
VCRR25D151K0101	25D151K	150	±10	250	150	4300
VCRR25D181K0101	25D181K	180	±10	300	150	3500
VCRR25D201K0101	25D201K	200	±10	340	150	3200
VCRR25D221K0101	25D221K	220	±10	360	150	2900
VCRR25D241K0101	25D241K	240	±10	395	150	2650
VCRR25D271K0101	25D271K	270	±10	455	150	2400
VCRR25D301K0101	25D301K	300	±10	500	150	2100
VCRR25D331K0101	25D331K	330	±10	550	150	1900
VCRR25D361K0101	25D361K	360	±10	595	150	1750
VCRR25D391K0101	25D391K	390	±10	650	150	1600
VCRR25D431K0101	25D431K	430	±10	710	150	1500
VCRR25D471K0101	25D471K	470	±10	775	150	1400
VCRR25D511K0101	25D511K	510	±10	840	150	1250
VCRR25D561K0101	25D561K	560	±10	910	150	1150
VCRR25D621K0101	25D621K	620	±10	1025	150	1050
VCRR25D681K0101	25D681K	680	±10	1120	150	950
VCRR25D751K0101	25D751K	750	±10	1240	150	850
VCRR25D821K0101	25D821K	820	±10	1355	150	830
VCRR25D911K0101	25D911K	910	±10	1500	150	730
VCRR25D951K0101	25D951K	950	±10	1570	150	660
VCRR25D102K0101	25D102K	1000	±10	1650	150	600
VCRR25D112K0101	25D112K	1100	±10	1815	150	530

2) *Please refer to the suffix code

Dimensional drawings



Weight

Nominal diameter mm	V _{RMS} V	Weight g
25	10...680	2.7...15.7

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
VCRR25D180K0101	10	27	30	3.6	1.7	25.0	1.0
VCRR25D220K0101	10	27	30	3.6	1.7	25.0	1.0
VCRR25D270K0101	10	27	30	3.6	1.7	25.0	1.0
VCRR25D330K0101	10	27	30	3.6	1.7	25.0	1.0
VCRR25D390K0101	10	27	30	3.6	1.7	25.0	1.0
VCRR25D470K0101	10	27	30	3.6	1.7	25.0	1.0
VCRR25D560K0101	10	27	30	3.6	1.7	25.0	1.0
VCRR25D680K0101	10	27	30	3.6	1.7	25.0	1.0
VCRR25D820K0101	10	27	30	3.6	1.7	25.0	1.0
VCRR25D101K0101	10	27	30	3.6	1.7	25.0	1.0
VCRR25D121K0101	10	27	30	3.6	1.7	25.0	1.0
VCRR25D151K0101	10	27	30	3.6	1.7	25.0	1.0
VCRR25D181K0101	10	27	30	3.6	1.7	25.0	1.0
VCRR25D201K0101	10	27	30	4.2	1.7	25.0	1.0
VCRR25D221K0101	10	27	30	4.3	1.8	25.0	1.0
VCRR25D241K0101	10	27	30	4.4	1.8	25.0	1.0
VCRR25D271K0101	10	27	30	4.6	1.8	25.0	1.0
VCRR25D301K0101	10	27	30	4.7	1.7	25.0	1.0
VCRR25D331K0101	10	27	30	4.8	1.7	25.0	1.0
VCRR25D361K0101	10	27	30	5.0	1.8	25.0	1.0
VCRR25D391K0101	10	27	30	5.1	1.9	25.0	1.0
VCRR25D431K0101	10	27	30	5.4	1.9	25.0	1.0
VCRR25D471K0101	10	27	30	5.6	1.9	25.0	1.0
VCRR25D511K0101	10	27	30	5.8	2.1	25.0	1.0
VCRR25D561K0101	10	27	30	6.1	2.2	25.0	1.0

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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
VCRR25D621K0101	10	27	30	6.2	2.4	25.0	1.0
VCRR25D681K0101	10	27	30	6.3	2.6	25.0	1.0
VCRR25D751K0101	10	27	30	6.7	2.7	25.0	1.0
VCRR25D821K0101	10	27	30	7.1	3.1	25.0	1.0
VCRR25D911K0101	10	27	30	7.5	3.4	25.0	1.0
VCRR25D951K0101	10	27	30	7.9	3.7	25.0	1.0
VCRR25D102K0101	10	27	30	7.9	4.0	25.0	1.0
VCRR25D112K0101	10	27	30	8.0	4.4	25.0	1.0

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 be stored 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 VRMS, 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

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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

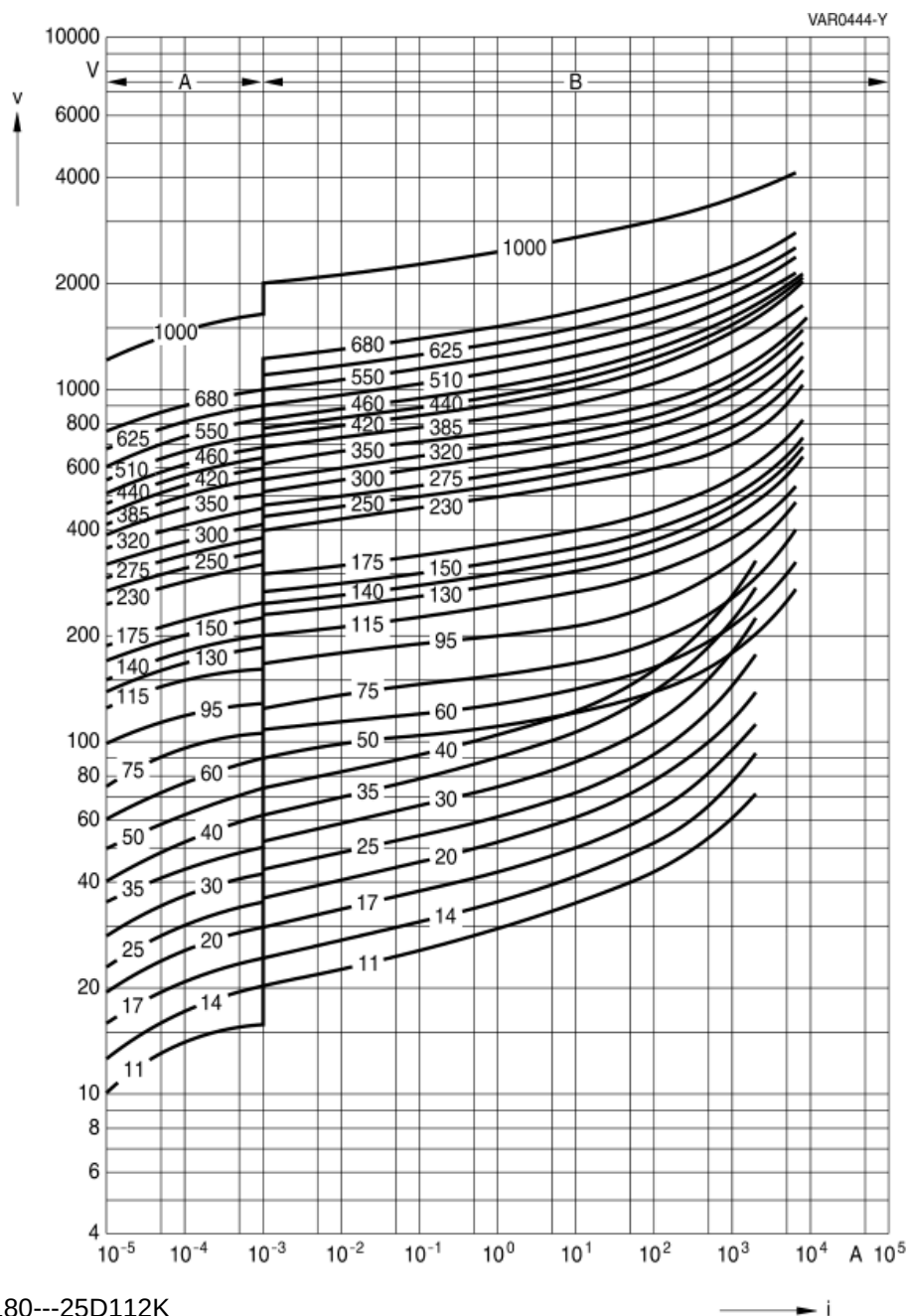
LCT = Lower category temperature

R_{ins} = Insulation resistance

v/i characteristics

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

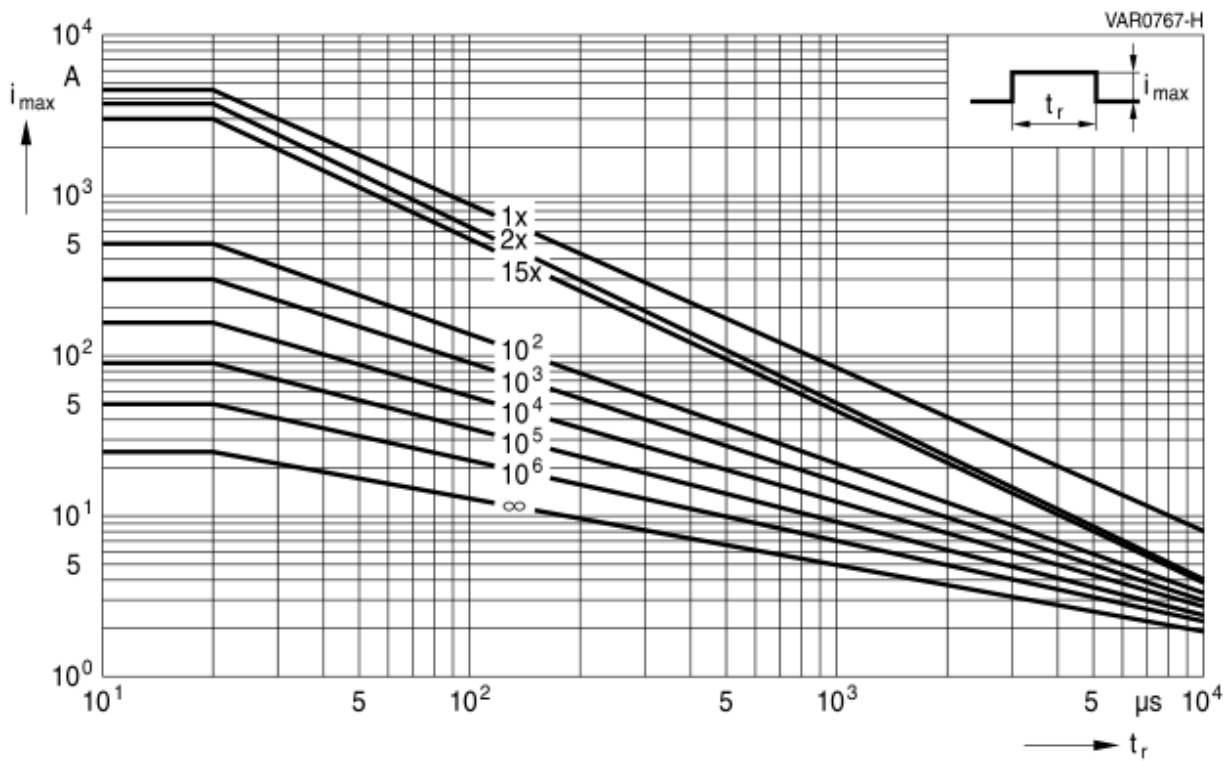
A = Leakage current, B = Protection level } for worst-case varistor tolerances



Derating curves

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

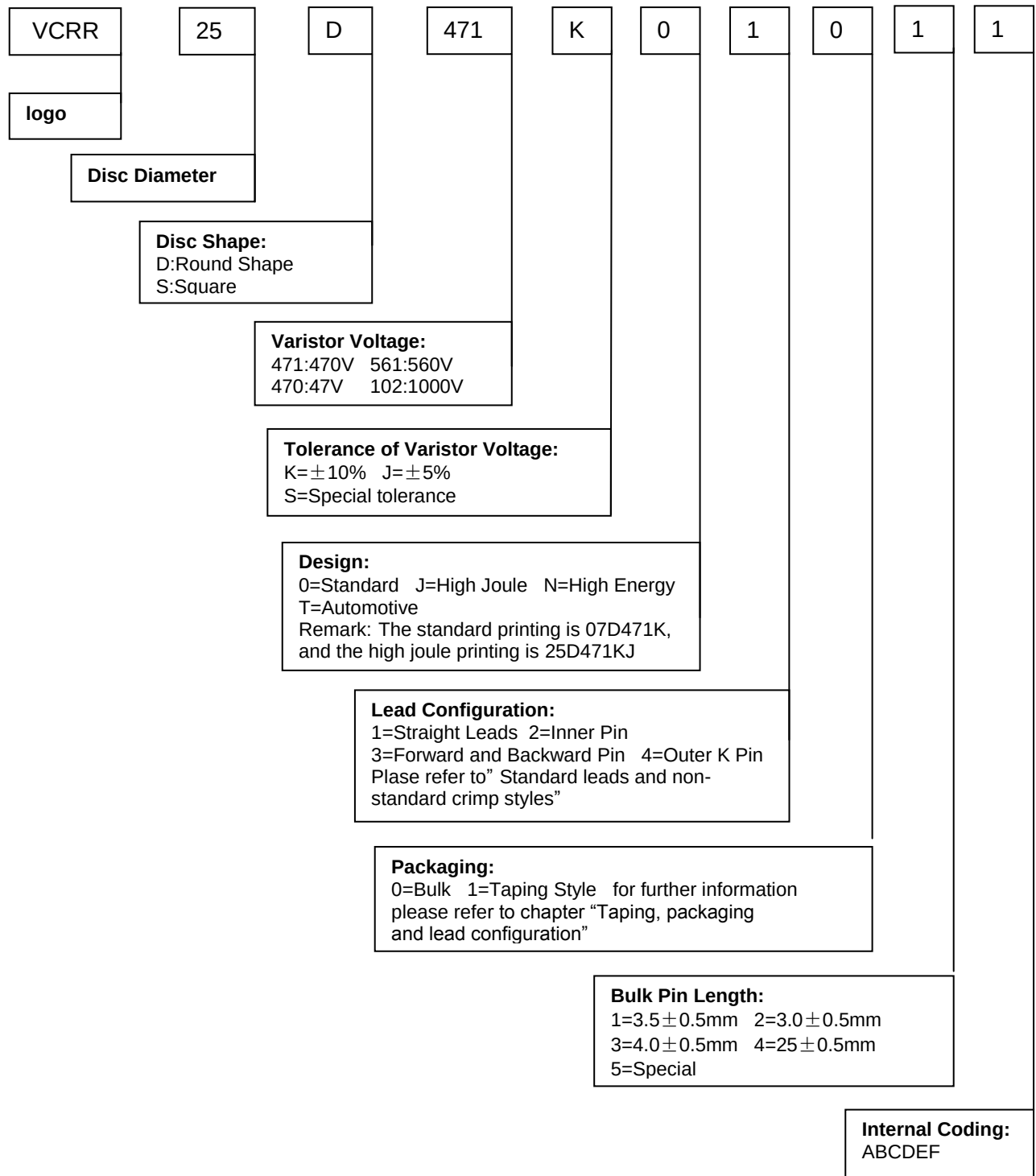
For explanation of the derating curves refer to "General technical information".



VCRR25D180---VCRR25D112K

Taping, packaging and lead configuration

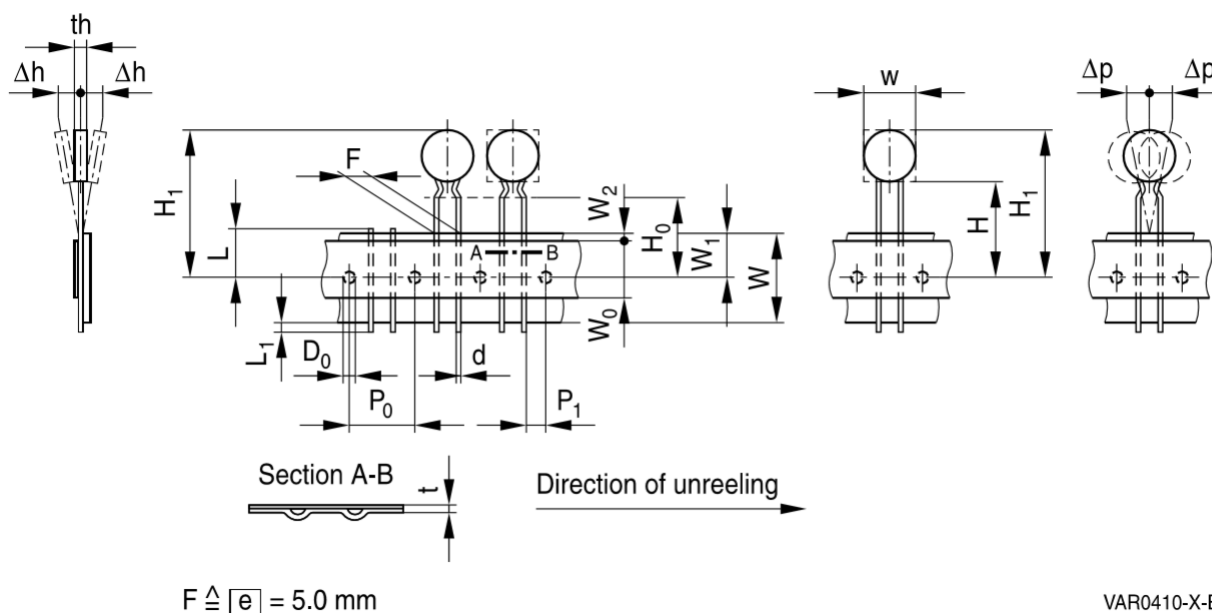
1 JORDUN Electronics ordering code system for leaded varistors



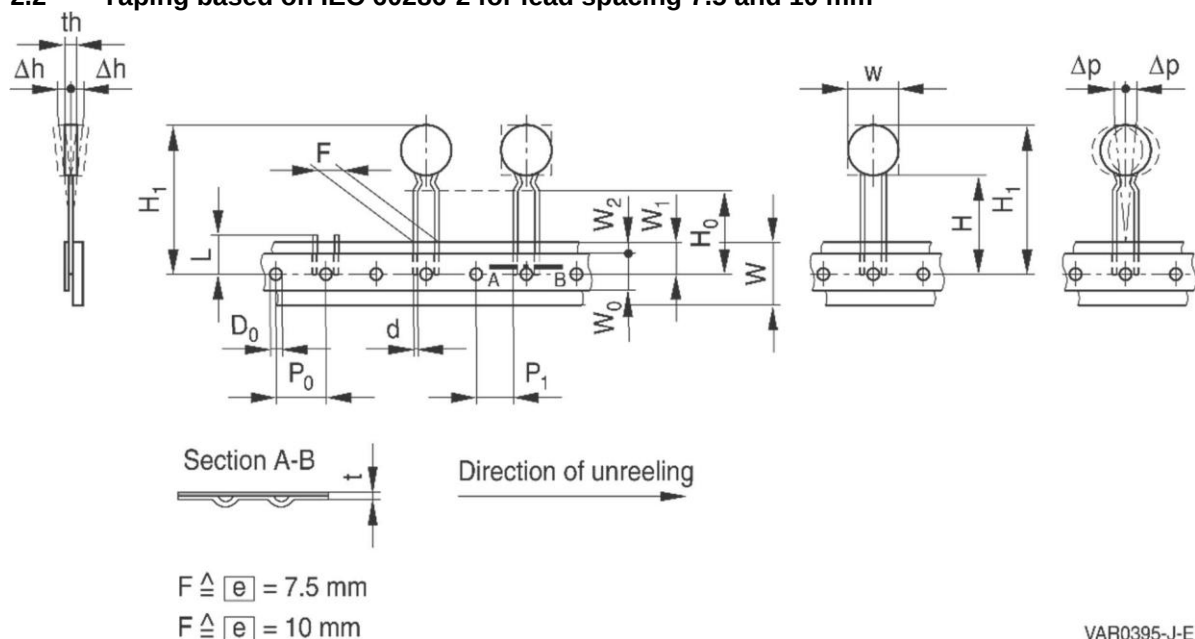
2 Taping and packaging of leaded varistors

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



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



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2.3 Tape dimensions (in mm)

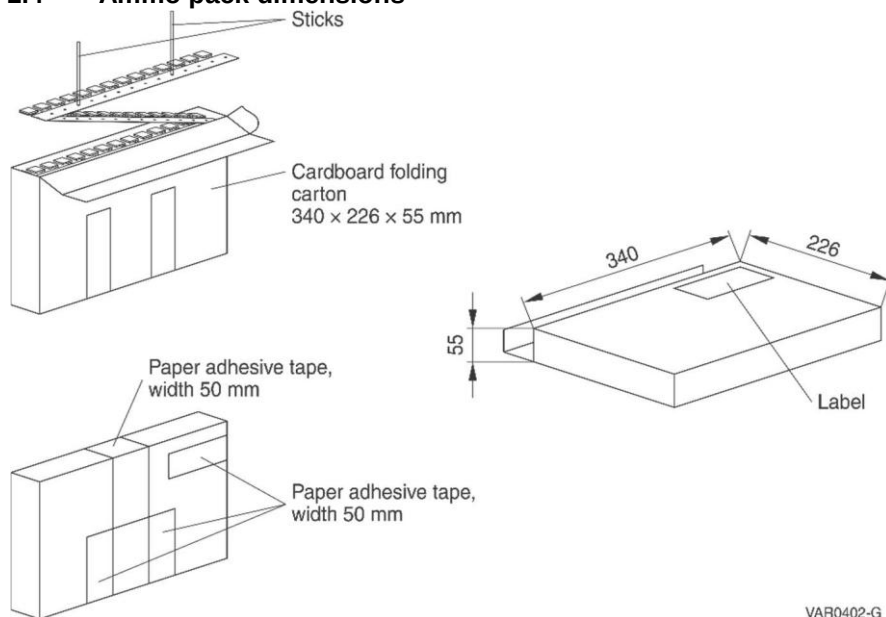
Symbol	$e = 5.0$	Tolerance	$e = 7.5$	Tolerance	$e = 10.0$	Tolerance	Remarks
w th d	0.6	max. max. ± 0.05	0.8	max. max. ± 0.05	1.0	max. max. ± 0.05	see tables in each series under "Dimensions "
P_0	12.7	± 0.3	12.7 ¹⁾	± 0.3	12.7	± 0.3	± 1 mm/20 sprocket holes
P_1	3.85	± 0.7	8.95	± 0.8	7.7	± 0.8	
F	5.0	± 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 $P_0 = 15.0$ 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	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**

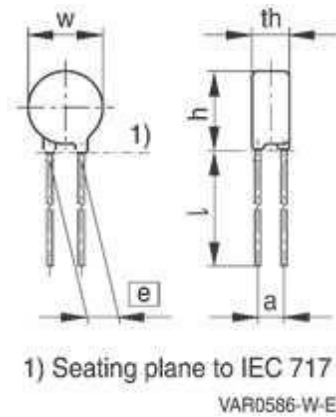


Figure 1

**Non-standard,
crimp style S2**

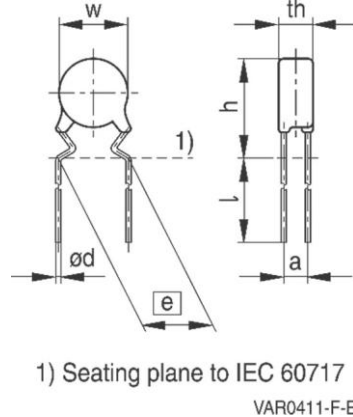


Figure 2

**Non-standard,
crimp style S3**

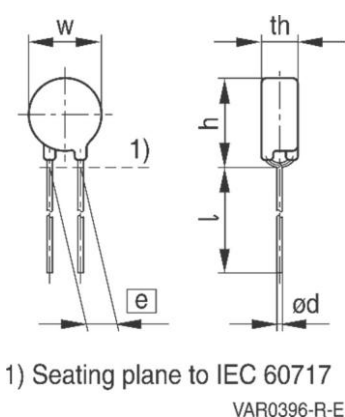
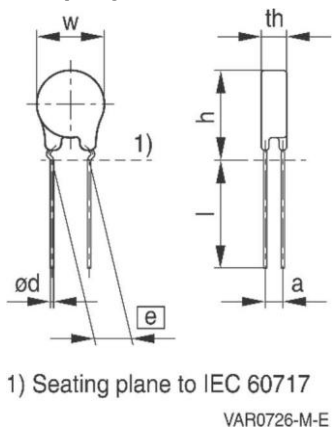


Figure 3

**Non-standard,
crimp style S5**



Figure

3.2 Trimmed leads (non-standard)

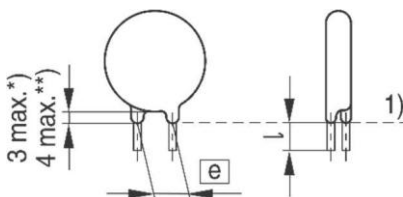
Varistors with cut leads available upon request.

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
e	Lead spacing

All dimensions are given in mm.

The commas used in numerical values denote decimal points.

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