

MOV Metal Oxide Varistors

Leaded varistors, TMOV Ultra High Energy , 20 Shell series

Series/Type:

VCRR20E*KU****

*** Ordering code: VCRR20E***KU**

Date: January 2020

Version: 1

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20E***KU***

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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 50 ... 680V_{RMS}
- High surge current ratings up to 15KA
- No derating up to 85°C ambient temperature
- Series connection of varistors and fuses to disconnect when about to fail, protecting the circuit
- Action temperature 136C, matched with 15A.136C temperature fuse

Approvals

- UL Certificate:E531647
- TUV Certificate:B1199670002
- CQC Certificate :CQC23001399121

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	40/85/56	
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 ($T_A = 85\text{ }^{\circ}\text{C}$)

Ordering code	Type	V_{RMS} [V]	V_{DC} [V]	i_{max} (8/20 μ s) 1 time [kA]*	$I_n^{(1)}$ (8/20 μ s) 15 times [kA]*	W_{max} (10/1000 μ s) [J]	P_{max} [W]
VCRR20E820KU10S	20E820KU	50	65	10	5	67	1.0
VCRR20E101KU10S	20E101KU	60	85	10	5	84	1.0
VCRR20E121KU10S	20E121KU	75	100	10	5	102	1.0
VCRR20E151KU10S	20E151KU	95	125	10	7.5	127	1.0
VCRR20E181KU10S	20E181KU	115	150	10	7.5	156	1.0
VCRR20E201KU10S	20E201KU	130	170	15	7.5	170	1.0
VCRR20E221KU10S	20E221KU	140	180	15	7.5	185	1.0
VCRR20E241KU10S	20E241KU	150	200	15	7.5	200	1.0
VCRR20E271KU10S	20E271KU	175	225	15	7.5	285	1.0
VCRR20E301KU10S	20E301KU	190	250	15	7.5	310	1.0
VCRR20E331KU10S	20E331KU	210	270	15	7.5	325	1.0
VCRR20E361KU10S	20E361KU	230	300	15	7.5	340	1.0
VCRR20E391KU10S	20E391KU	250	320	15	7.5	360	1.0
VCRR20E431KU10S	20E431KU	275	350	15	7.5	440	1.0
VCRR20E471KU10S	20E471KU	300	385	15	7.5	490	1.0
VCRR20E511KU10S	20E511KU	320	420	15	7.5	530	1.0
VCRR20E561KU10S	20E561KU	350	460	15	7.5	560	1.0
VCRR20E621KU10S	20E621KU	385	505	15	7.5	590	1.0
VCRR20E681KU10S	20E681KU	420	560	15	7.5	620	1.0
VCRR20E751KU10S	20E751KU	460	615	15	7.5	630	1.0
VCRR20E821KU10S	20E821KU	510	670	15	7.5	690	1.0
VCRR20E911KU10S	20E911KU	550	745	15	7.5	715	1.0
VCRR20E951KU10S	20E951KU	575	765	15	7.5	740	1.0
VCRR20E102KU10S	20E102KU	625	825	15	7.5	770	1.0
VCRR20E112KU10S	20E112KU	680	895	15	7.5	840	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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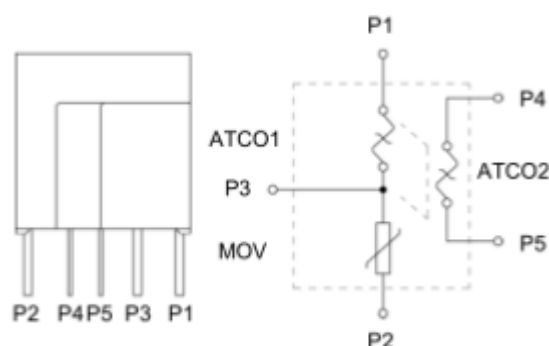
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Characteristics (T_A=25 °C):

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]	
VCRR20E820KU10S	20E820KU	82	±10	135	125	5880
VCRR20E101KU10S	20E101KU	100	±10	165	125	4800
VCRR20E121KU10S	20E121KU	120	±10	200	125	4000
VCRR20E151KU10S	20E151KU	150	±10	250	125	3200
VCRR20E181KU10S	20E181KU	180	±10	300	125	2650
VCRR20E201KU10S	20E201KU	200	±10	340	125	2400
VCRR20E221KU10S	20E221KU	220	±10	360	125	2160
VCRR20E241KU10S	20E241KU	240	±10	395	125	2000
VCRR20E271KU10S	20E271KU	270	±10	455	125	1800
VCRR20E301KU10S	20E301KU	300	±10	500	125	1560
VCRR20E331KU10S	20E331KU	330	±10	550	125	1440
VCRR20E361KU10S	20E361KU	360	±10	595	125	1320
VCRR20E391KU10S	20E391KU	390	±10	650	125	1200
VCRR20E431KU10S	20E431KU	430	±10	710	125	1160
VCRR20E471KU10S	20E471KU	470	±10	775	125	1020
VCRR20E511KU10S	20E511KU	510	±10	840	125	935
VCRR20E561KU10S	20E561KU	560	±10	910	125	850
VCRR20E621KU10S	20E621KU	620	±10	1025	125	780
VCRR20E681KU10S	20E681KU	680	±10	1120	125	720
VCRR20E751KU10S	20E751KU	750	±10	1240	125	635
VCRR20E821KU10S	20E821KU	820	±10	1355	125	600
VCRR20E911KU10S	20E911KU	910	±10	1500	125	525
VCRR20E951KU10S	20E951KU	950	±10	1570	125	480
VCRR20E102KU10S	20E102KU	1000	±10	1650	125	430
VCRR20E112KU10S	20E112KU	1100	±10	1815	125	420

2) *Please refer to the suffix code

Schematic Diagram:



E type
Remark: P3, P4, P5 are optional. If remote signaling pins are required, please add "IT" in the suffix

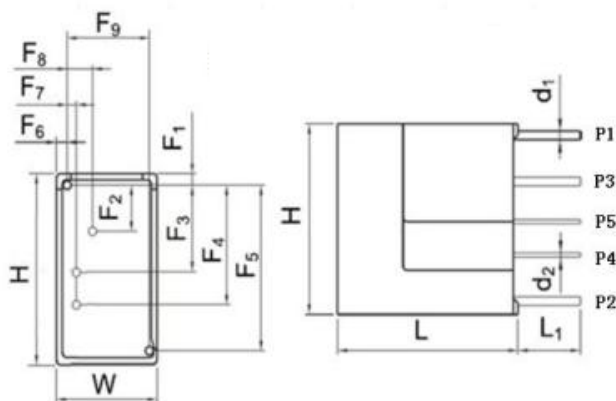
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Dimensional drawings



Weight

Nominal diameter mm	V _{RMS} V	Weight g
20	50...680	6.5...55

Different voltage levels result in differences in weight.

Dimensions

VN	L±1.0	L1±1.0	w±1.0	H±1.0	d±0.05	F1±0.5	F2±0.5	F3±0.5	F4±0.5	F5±0.5	F6±0.5
820-121	23.2	8.0	9.1	22.8	1.05	1.4	5.5	10.3	14.3	19.8	1.4
151-271	23.2	8.0	9.5	22.8	1.05	1.4	5.5	10.3	14.3	19.8	1.4
301-471	23.2	8.0	11	22.8	1.05	1.4	5.5	10.3	14.3	19.8	1.4
511-681	23.2	8.0	12	22.8	1.05	1.4	5.5	10.3	14.3	19.8	1.4
751-821	23.2	8.0	13	22.8	1.05	1.4	5.5	10.3	14.3	19.8	1.4
911-112	23.2	8.0	15.5	22.8	1.05	1.4	5.5	10.3	14.3	19.8	1.4

F7±0.5	F8±0.5	F9±0.5
1.2	3.3	6.7
1.2	3.3	7.1
1.2	3.3	8.6
1.2	3.3	9.6
1.2	3.3	10.6
1.2	3.3	13.1

2) *Please refer to the suffix code.

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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

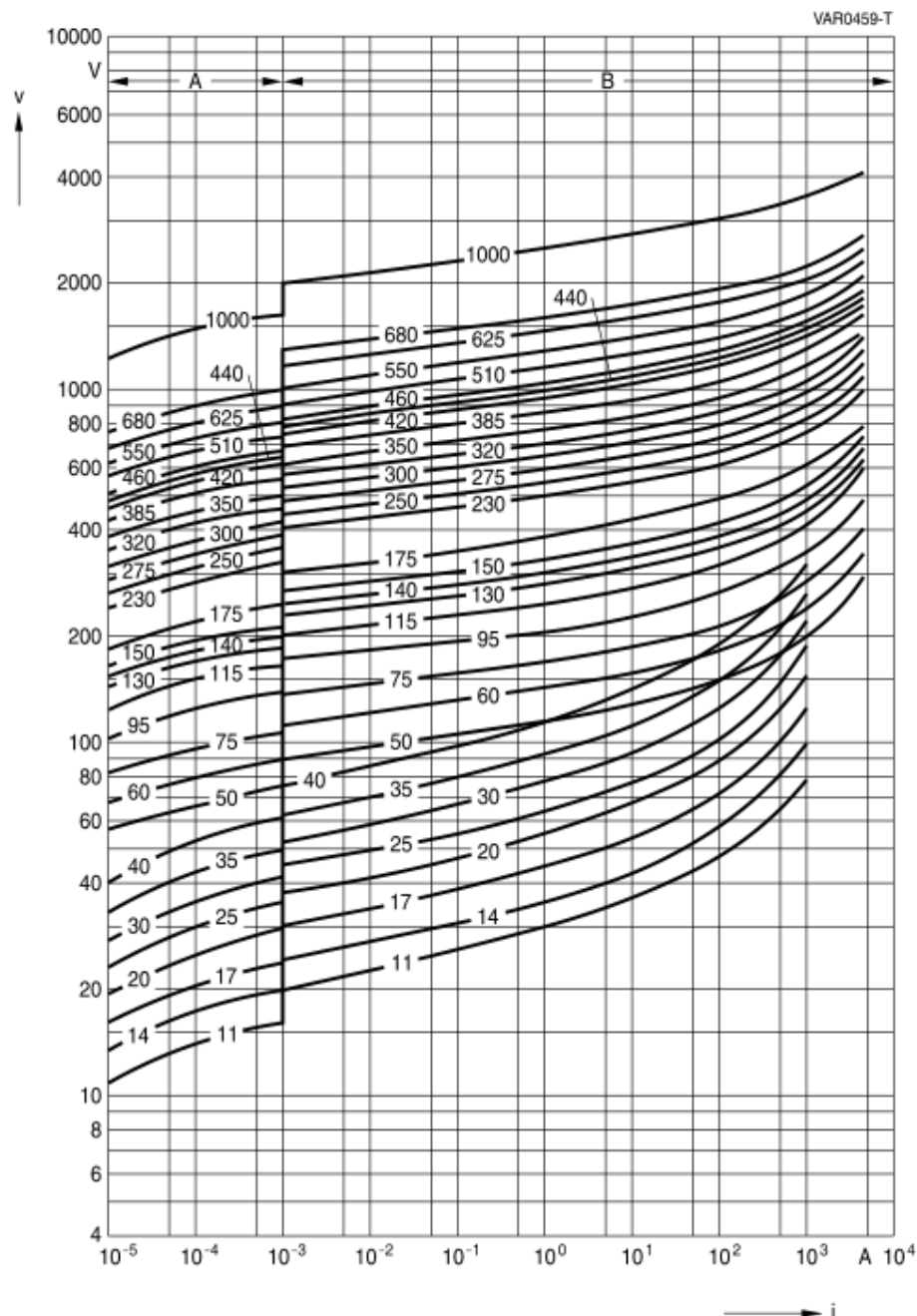
LCT = Lower category temperature

R_{ins} = Insulation resistance

v/i characteristics

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

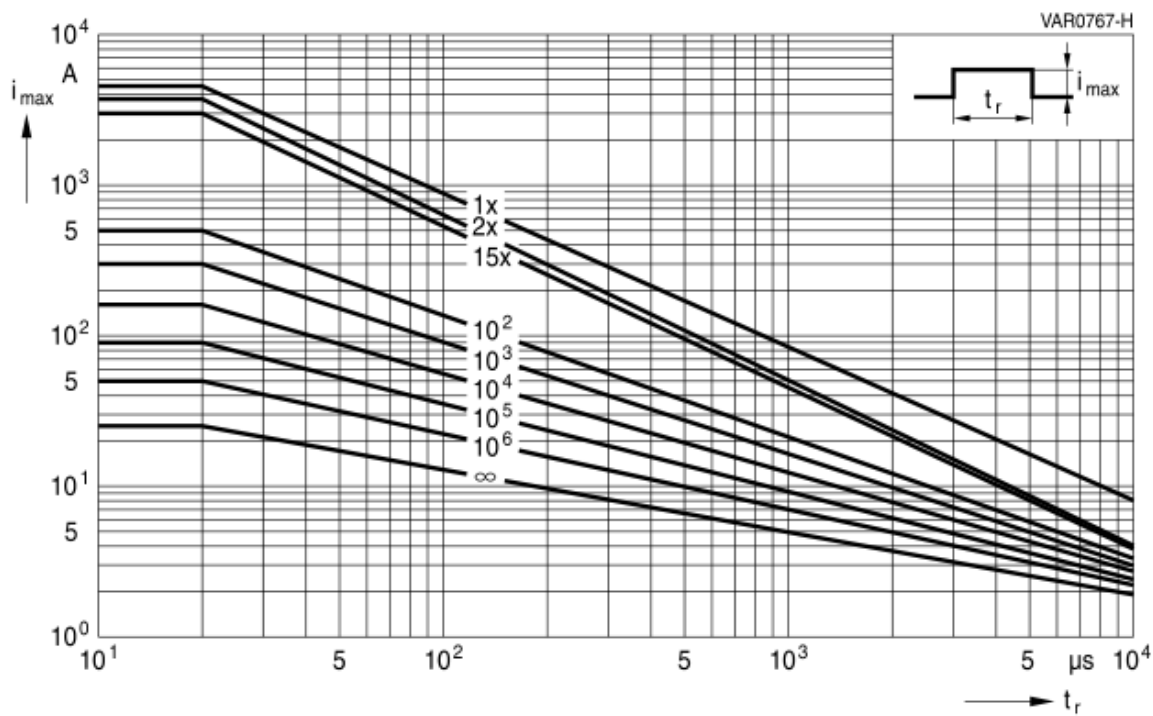
A = Leakage current, B = Protection level } for worst-case varistor tolerances



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

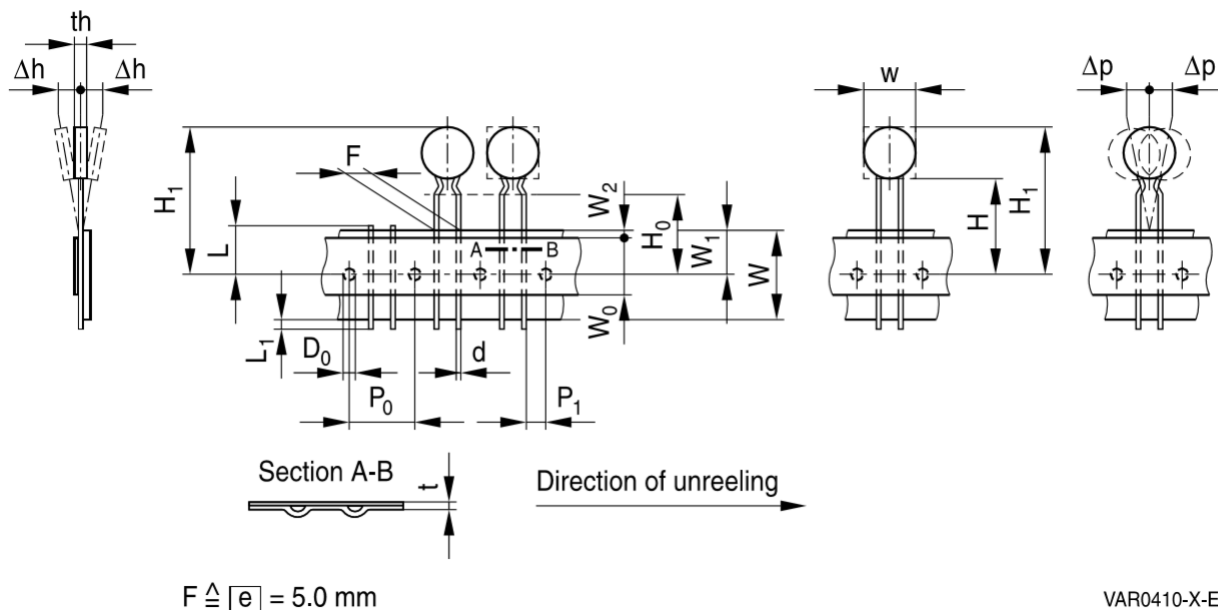
1 JORDUN Electronics ordering code system for leaded varistors

VCRR	20	E	471	K	U	1	0	5	S
logo									
Disc Diameter									
Design structure: N: 2 Pin E: Fuse is pin 3									
Varistor Voltage: 471:470V 561:560V 470:47V 102:1000V									
Tolerance of Varistor Voltage: K=±10% J=±5% S=Special tolerance									
Design: J=High Joule N=High Energy U=Ultra High Energy Remark: eg:printing 20E561KU									
Lead Configuration: 1=Straight Leads 2=Inner Pin 3=Forward and Backward Pin 4=Outer K Pin Please refer to "Standard leads and non- standard crimp styles"									
Packaging: 0=Bulk 1=Taping Style for further information please refer to chapter "Taping, packaging and lead configuration"									
Bulk Pin Length: 1=3.5±0.5mm 2=3.0±0.5mm 3=4.0±0.5mm 4=25±0.5mm 5=5.0±0.5mm									
Internal Coding: S=Shell A=Automotive Eg: If it is a car standard box, then "SA" IT= Remote signaling pin									

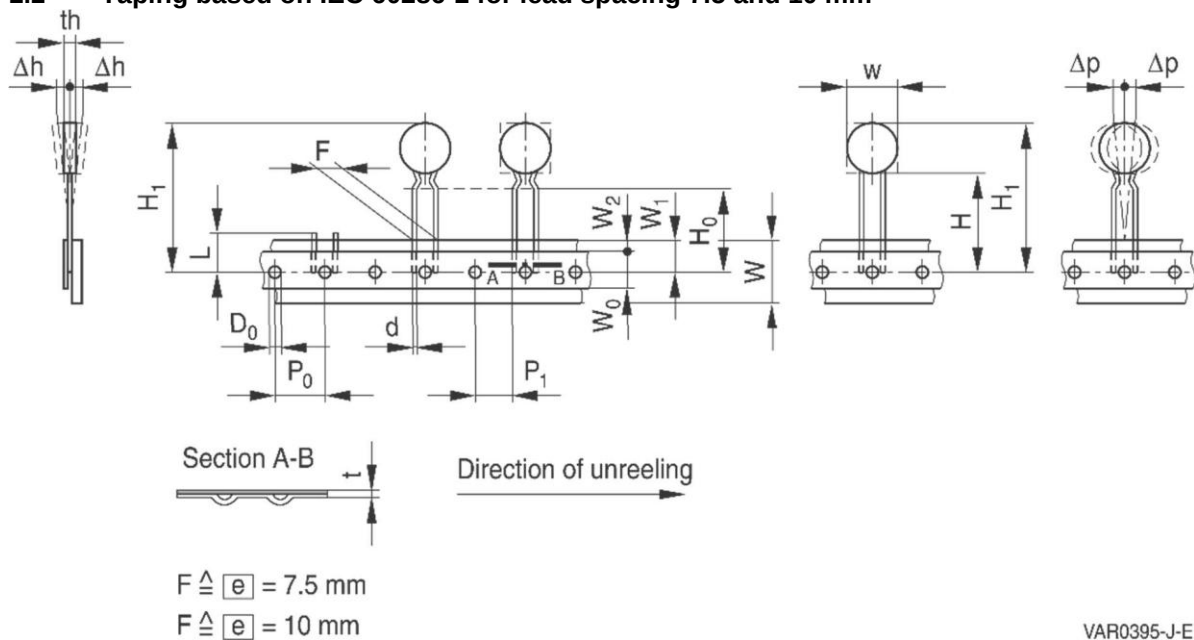
2 Taping and packaging of leaded varistors

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)

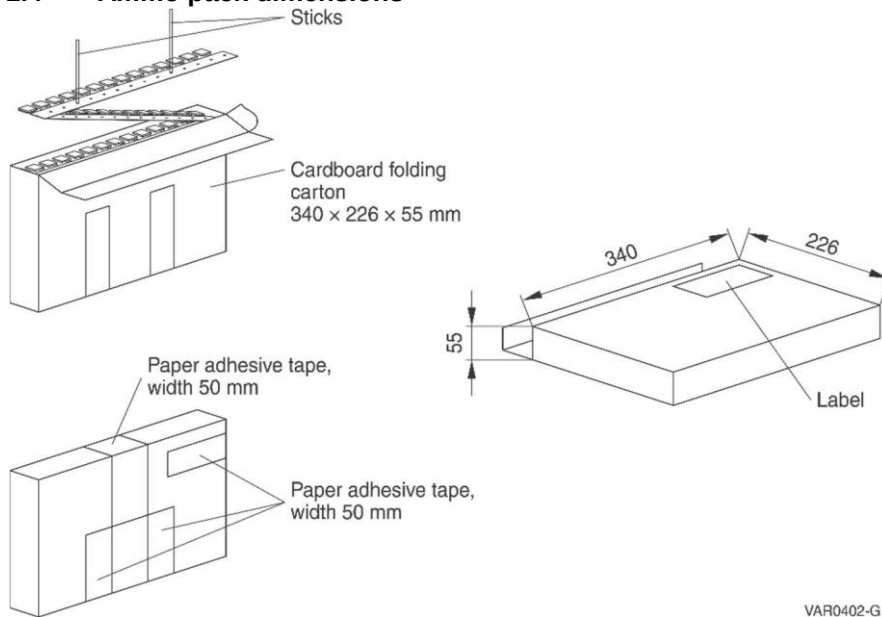
Symbol	$e = 5.0$	Tolerance	$e = 7.5$	Tolerance	$e = 10.0$	Tolerance	RemarkKU
w th d	0.6	max. max. ± 0.05	0.8	max. max. ± 0.05	1.0	max. max. ± 0.05	see tables in each series under "Dimensions "
P ₀	12.7	± 0.3	12.7 ¹⁾	± 0.3	12.7	± 0.3	± 1 mm/20 sprocket holes
P ₁	3.85	± 0.7	8.95	± 0.8	7.7	± 0.8	
F	5.0	± 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



VAR0402-G

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	----	----
20E	820-112	100	600	----	----

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**

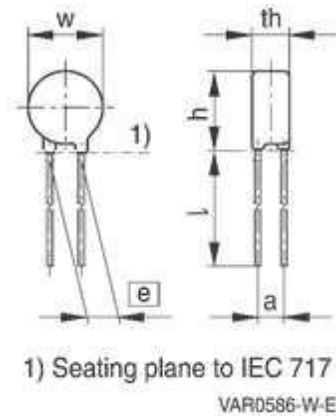


Figure 1

**Non-standard,
crimp style S2**

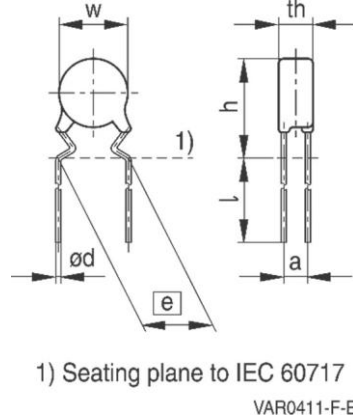


Figure 2

**Non-standard,
crimp style S3**

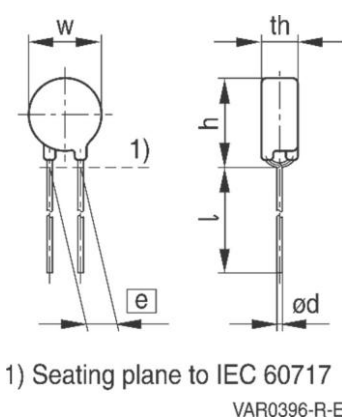
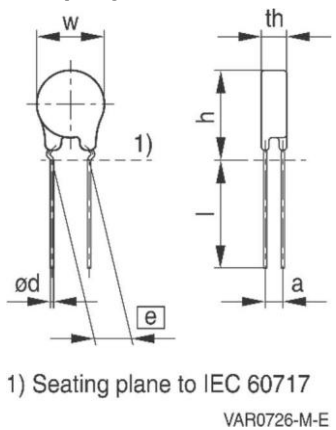


Figure 3

**Non-standard,
crimp style S5**



Figure

3.2 Trimmed leads (non-standard)

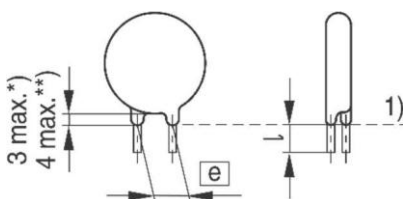
Varistors with cut leads available upon request.

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 book 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 crack.

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

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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