SIOV metal oxide varistors

Leaded varistors, EnergetiQ series

Series/Type: **B722***

Date: January 2018

EPCOS AG is a TDK Group Company.

Construction

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

Features

- High-EnergetiQ series Q14/ Q20
- Maximum load capacity at minimum component height
- Very high surge current ratings up to 15 kA
- All types duty cycle @ 6 kV/ 3 kA → 10 pulses, according to IEC 62368-1; G.8.2 and IEC 60950-1; Annex Q, IEC 61051-2
- All types I_n @ 3 kA (Q14), I_n = 5 kA (Q20) → 15 impulses according to UL 1449, 4th edition surge current generator (8/20 µs), type 5 listed
- PSpice models

Approvals

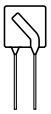
- UL
- CSA
- VDE
- IEC

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	40/105/56	
Operating temperature	to IEC 61051	−40 ... +105	°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

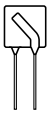
Maximum ratings (T_A = 105 °C)

Ordering code	Type (untaped) SIOV-	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} (2 ms) J	P_{max} W
B72214Q0131K101	Q14K130	130	170	8000	3000	75	0.80
B72220Q0131K101	Q20K130	130	170	15000	5000	100	1.20
B72214Q0141K101	Q14K140	140	180	8000	3000	80	0.80
B72220Q0141K101	Q20K140	140	180	15000	5000	110	1.20
B72214Q0151K101	Q14K150	150	200	8000	3000	85	0.80
B72220Q0151K101	Q20K150	150	200	15000	5000	120	1.20
B72214Q0171K101	Q14K175	175	225	8000	3000	100	0.80
B72220Q0171K101	Q20K175	175	225	15000	5000	135	1.20
B72214Q0211K101	Q14K210	210	270	8000	3000	115	0.80
B72220Q0211K101	Q20K210	210	270	15000	5000	165	1.20
B72214Q0231K101	Q14K230	230	300	8000	3000	130	0.80
B72220Q0231K101	Q20K230	230	300	15000	5000	180	1.20
B72214Q0251K101	Q14K250	250	320	8000	3000	140	0.80
B72220Q0251K101	Q20K250	250	320	15000	5000	195	1.20
B72214Q0271K101	Q14K275	275	350	8000	3000	150	0.80
B72220Q0271K101	Q20K275	275	350	15000	5000	215	1.20
B72214Q0301K101	Q14K300	300	385	8000	3000	175	0.80
B72220Q0301K101	Q20K300	300	385	15000	5000	235	1.20
B72214Q0321K101	Q14K320	320	420	8000	3000	185	0.80
B72220Q0321K101	Q20K320	320	420	15000	5000	255	1.20
B72214Q0351K101	Q14K350	350	460	8000	3000	200	0.80
B72220Q0351K101	Q20K350	350	460	15000	5000	280	1.20
B72214Q0381K101	Q14K385	385	505	8000	3000	225	0.80
B72220Q0381K101	Q20K385	385	505	15000	5000	315	1.20
B72214Q0421K101	Q14K420	420	560	8000	3000	245	0.80
B72220Q0421K101	Q20K420	420	560	15000	5000	340	1.20
B72214Q0461K101	Q14K460	460	615	8000	3000	270	0.80
B72220Q0461K101	Q20K460	460	615	15000	5000	380	1.20

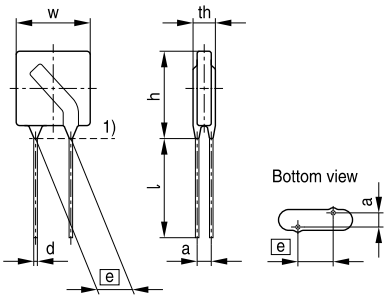
[1] **Note:** Nominal discharge current I_n according to UL 1449, 4th edition.

Characteristics (T_A = 25 °C)

Ordering code	V_v (1 mA) V	ΔV_v (1 mA) %	$v_{c,max}$ (i_c) V	i_c A	C_{typ} (1 kHz) pF
B72214Q0131K101	205	±10	340	65	1300
B72220Q0131K101	205	±10	340	130	2400
B72214Q0141K101	220	±10	360	65	1200
B72220Q0141K101	220	±10	360	130	2200
B72214Q0151K101	240	±10	395	65	1100
B72220Q0151K101	240	±10	395	130	2000
B72214Q0171K101	270	±10	455	65	1000
B72220Q0171K101	270	±10	455	130	1800
B72214Q0211K101	330	±10	550	65	750
B72220Q0211K101	330	±10	550	130	1500
B72214Q0231K101	360	±10	595	65	700
B72220Q0231K101	360	±10	595	130	1350
B72214Q0251K101	390	±10	650	65	650
B72220Q0251K101	390	±10	650	130	1250
B72214Q0271K101	430	±10	710	65	600
B72220Q0271K101	430	±10	710	130	1150
B72214Q0301K101	470	±10	775	65	550
B72220Q0301K101	470	±10	775	130	1050
B72214Q0321K101	510	±10	840	65	500
B72220Q0321K101	510	±10	840	130	950
B72214Q0351K101	560	±10	910	65	450
B72220Q0351K101	560	±10	910	130	870
B72214Q0381K101	620	±10	1025	65	400
B72220Q0381K101	620	±10	1025	130	780
B72214Q0421K101	680	±10	1120	65	360
B72220Q0421K101	680	±10	1120	130	710
B72214Q0461K101	750	±10	1240	65	330
B72220Q0461K101	750	±10	1240	130	650



Dimensional drawings



1) Seating plane to IEC 60717

VAR0393-T-E

Weight

Nominal diameter mm	V_{RMS} V	Weight g
14	130 ... 460	2.4 ... 4.4
20	130 ... 460	4.1 ... 8.2

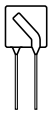
The weight of varistors in between these voltage classes can be interpolated.

Dimensions

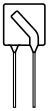
Ordering code	[e] ±1 mm	a (typical) mm	w_{max} mm	th_{max} mm	h_{max} mm	l_{min} mm	d ±0.05 mm
B72214Q0131K101	10.0	1.9	16.5	5.0	19.5	25.0	1.0
B72220Q0131K101	10.0	1.9	22.5	5.0	27.0	25.0	1.0
B72214Q0141K101	10.0	2.0	16.5	5.1	19.5	25.0	1.0
B72220Q0141K101	10.0	2.0	22.5	5.1	27.0	25.0	1.0
B72214Q0151K101	10.0	2.1	16.5	5.2	19.5	25.0	1.0
B72220Q0151K101	10.0	2.1	22.5	5.2	27.0	25.0	1.0
B72214Q0171K101	10.0	2.2	16.5	5.3	19.5	25.0	1.0
B72220Q0171K101	10.0	2.2	22.5	5.3	27.0	25.0	1.0
B72214Q0211K101	10.0	2.2	16.5	5.4	19.5	25.0	1.0
B72220Q0211K101	10.0	2.2	22.5	5.4	27.0	25.0	1.0
B72214Q0231K101	10.0	2.3	16.5	5.5	19.5	25.0	1.0
B72220Q0231K101	10.0	2.3	22.5	5.5	27.0	25.0	1.0
B72214Q0251K101	10.0	2.4	16.5	5.7	19.5	25.0	1.0
B72220Q0251K101	10.0	2.4	22.5	5.7	27.0	25.0	1.0
B72214Q0271K101	10.0	2.5	16.5	5.8	19.5	25.0	1.0
B72220Q0271K101	10.0	2.5	22.5	5.8	27.0	25.0	1.0
B72214Q0301K101	10.0	2.6	16.5	6.1	19.5	25.0	1.0
B72220Q0301K101	10.0	2.6	22.5	6.1	27.0	25.0	1.0
B72214Q0321K101	10.0	2.7	16.5	6.3	19.5	25.0	1.0
B72220Q0321K101	10.0	2.7	22.5	6.3	27.0	25.0	1.0
B72214Q0351K101	10.0	3.0	16.5	7.3	19.5	25.0	1.0
B72220Q0351K101	10.0	3.0	22.5	7.3	27.0	25.0	1.0
B72214Q0381K101	10.0	3.3	16.5	7.6	19.5	25.0	1.0
B72220Q0381K101	10.0	3.3	22.5	7.6	27.0	25.0	1.0
B72214Q0421K101	10.0	3.6	16.5	7.9	19.5	25.0	1.0
B72220Q0421K101	10.0	3.6	22.5	7.9	27.0	25.0	1.0
B72214Q0461K101	10.0	3.9	16.5	8.2	19.5	25.0	1.0
B72220Q0461K101	10.0	3.9	22.5	8.2	27.0	25.0	1.0

Reliability data

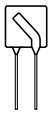
Test	Test methods/conditions	Requirement
Varistor voltage	The voltage between two terminals with the specified measuring current applied is called V_V (1 mA_{DC} @ 0.2 ... 2 s).	To meet the specified value
Clamping voltage	The maximum voltage between two terminals with the specified standard impulse 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.	$\lvert\Delta V/V$ (1 mA)$\rvert \leq 10\%$
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	$\lvert\Delta V/V$ (1 mA)$\rvert \leq 10\%$ (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	$\lvert\Delta V/V$ (1 mA)$\rvert \leq 10\%$ (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 V_V shall be measured and the specimen shall be visually examined.	$\lvert\Delta V/V$ (1 mA)$\rvert \leq 5\%$ 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	$\lvert\Delta V/V$ (1 mA)$\rvert \leq 5\%$ 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/s² 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/s² 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:

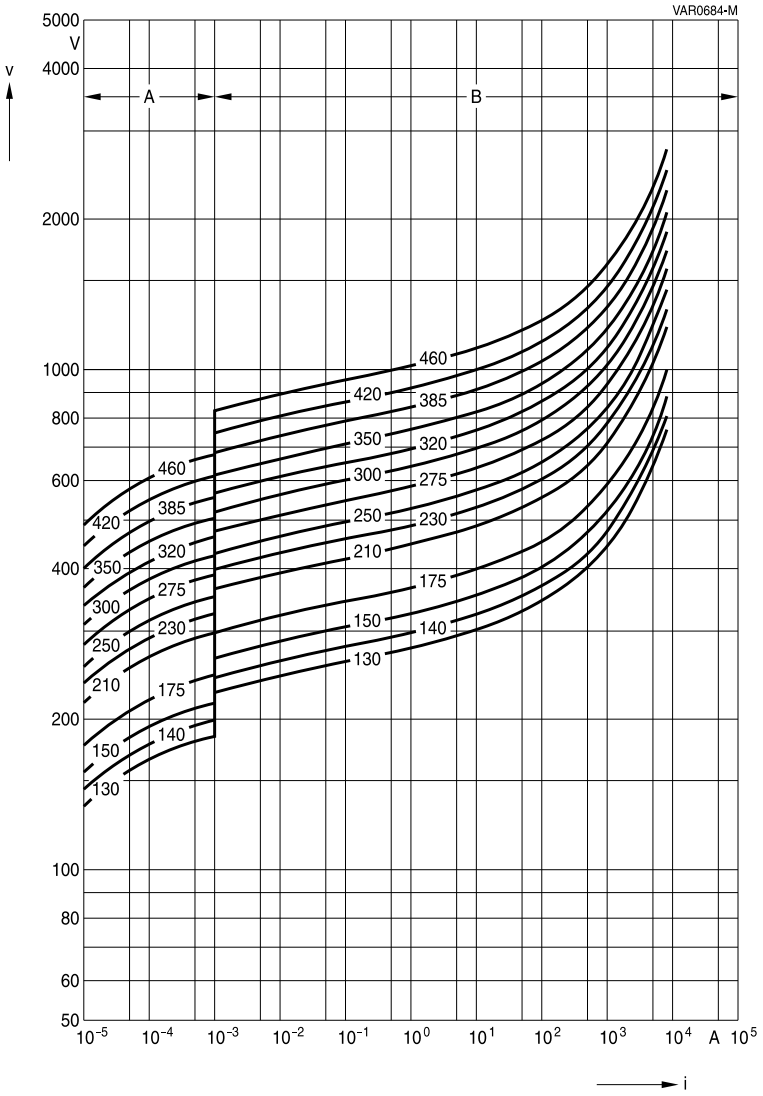
UCT = Upper category temperature

LCT = Lower category temperature

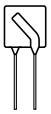
R_{ins} = Insulation resistance

v/i characteristics

v = f (i) - for explanation of the characteristics refer to "General technical information", 1.6.3
A = Leakage current, B = Protection level } for worst-case varistor tolerances



SIOV-Q14 ...



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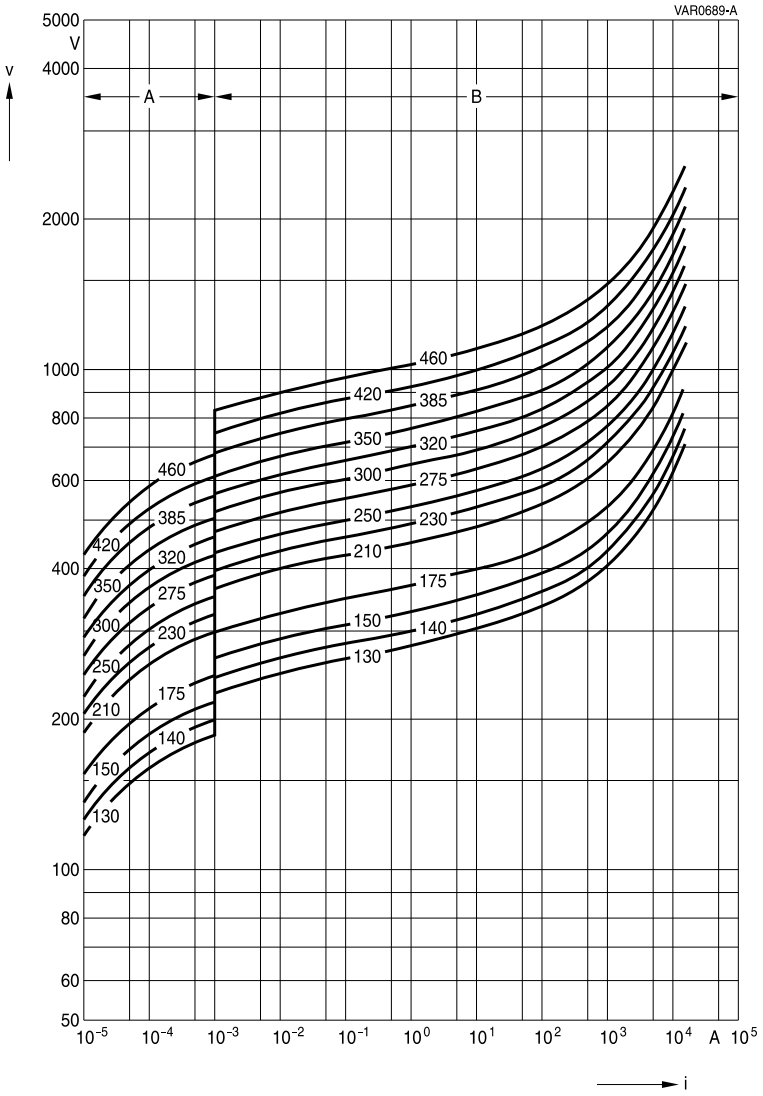
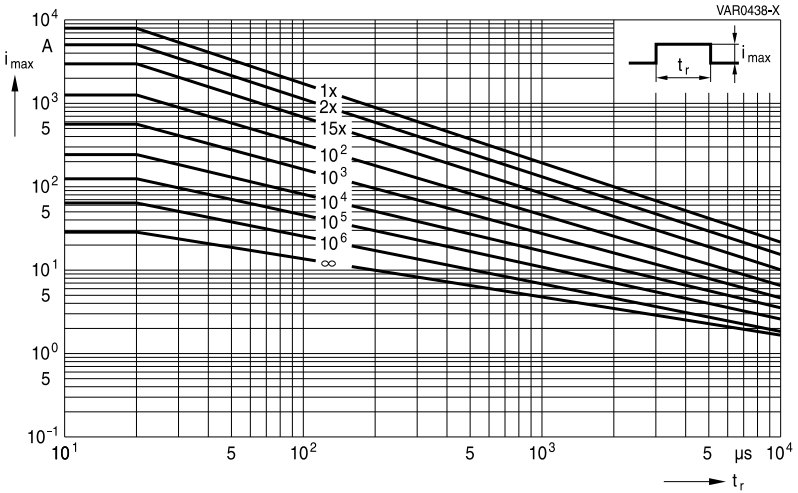


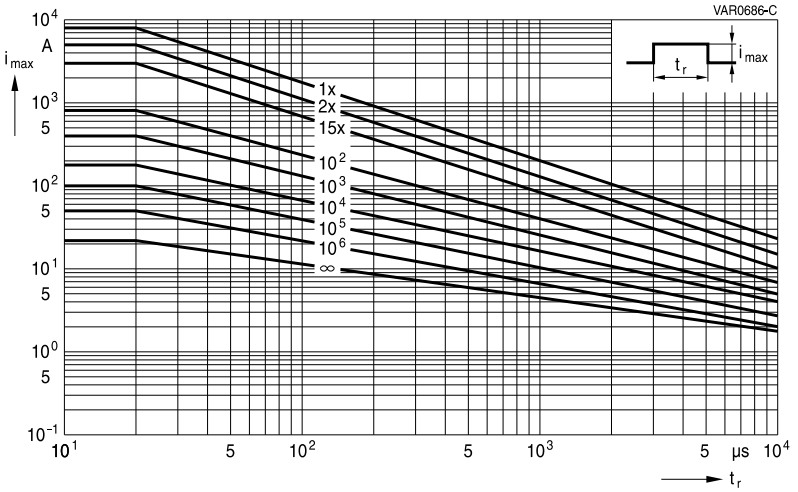
SIOV-Q20 ...

Derating curves

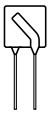
Maximum surge current $i_{max} = f(t_r$, pulse train)
For explanation of the derating curves refer to "General technical information", section 1.8.1



SIOV-Q14K130 ... K320



SIOV-Q14K350 ... K460



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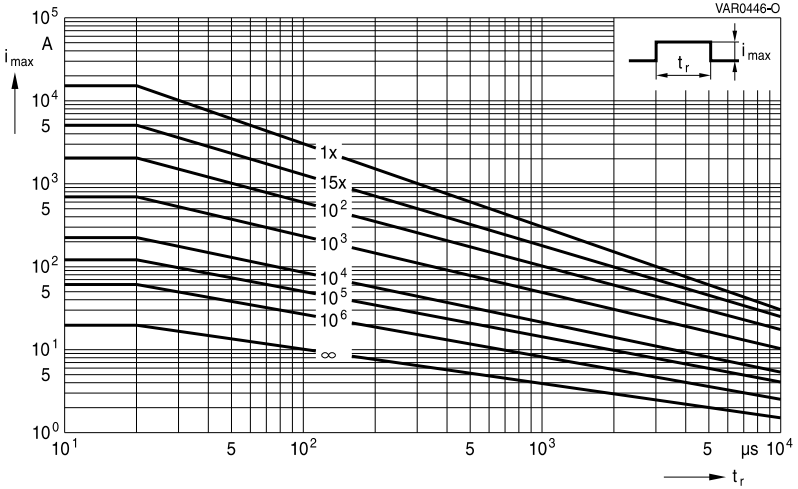
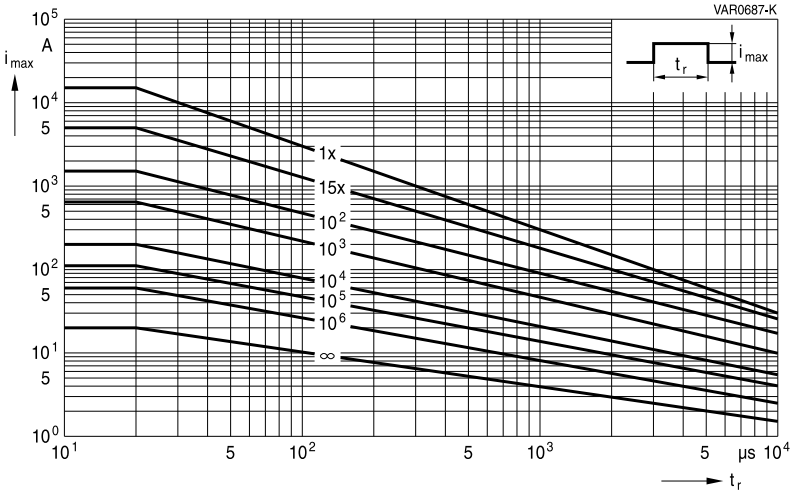


SIOV-Q20K130 ... K320

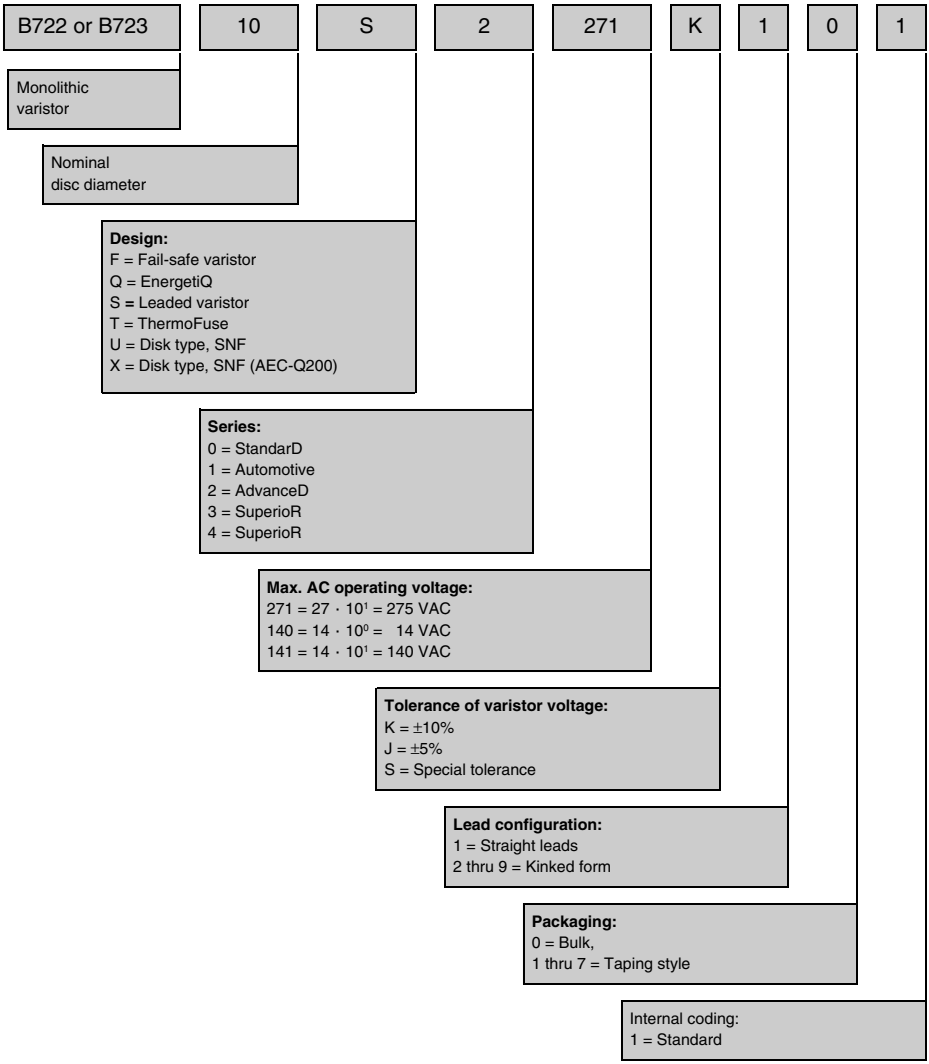


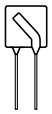
SIOV-Q20K350 ... K460

Taping, packaging and lead configuration

1 EPCOS ordering code system

For leaded varistors

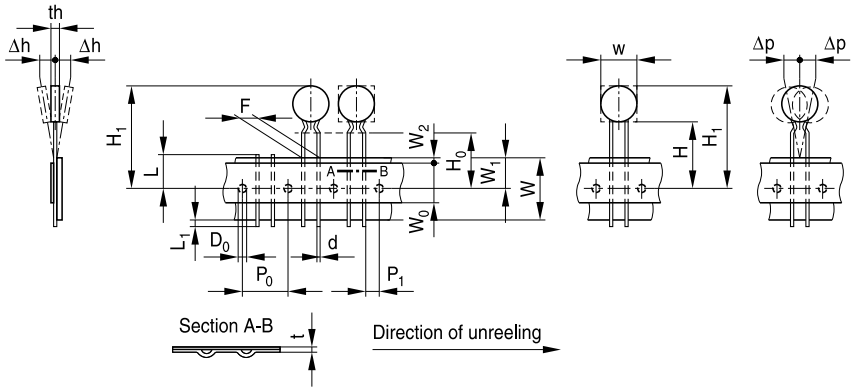




2 Taping and packaging of leaded varistors

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.

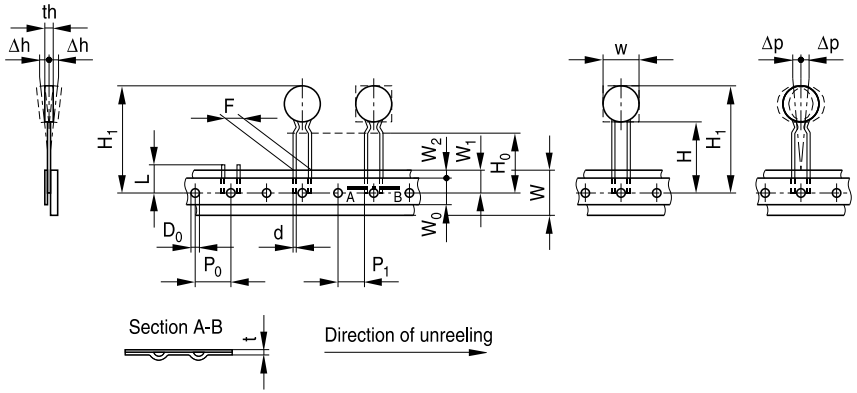
2.1 Taping in accordance with IEC 60286-2 for lead spacing 5.0 mm



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



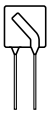
F ≙ $\boxed{e}$ = 7.5 mm
F ≙ $\boxed{e}$ = 10 mm

VAR0395-J-E

2.3 Tape dimensions (in mm)

Symbol	e = 5.0	Tolerance	e = 7.5	Tolerance	e = 10.0	Tolerance	Remarks
w		max.		max.		max.	see tables in each series
th		max.		max.		max.	under "Dimensions"
d	0.6	±0.05	0.8	±0.05	1.0	±0.05	
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	+0.6/−0.1	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 component 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]
H_0	16.0 (18.0)	±0.5	16.0 (18.0)	±0.5	16.0	±0.5	[3]
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)



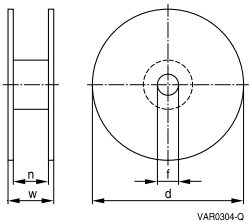
2.4 Taping mode

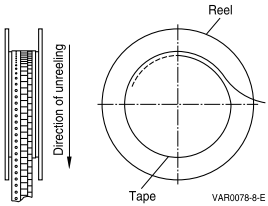
Example: B72210S0271K1 **5** 1

Digit 14

Digit 14	Taping mode	Reel type	Seating plane height H_0 for crimped types mm	Seating plane height H for uncrimped types mm	Pitch distance P_0 mm
0	–	Bulk	–	–	–
1	G	I	16	18	12.7
2	G2	I	18	–	12.7
3	G3	II	16	18	12.7
4	G4	II	18	–	12.7
5	G5	III	16	18	12.7
6	GA	Ammo pack	16	18	12.7
7	G2A	Ammo pack	18	–	12.7
Internal coding for special taping					
	G6	III	18	–	12.7
	G10	II	16	18	15.0
	G11	II	18	–	15.0
	G10A	Ammo pack	16	18	15.0
	G11A	Ammo pack	18	–	15.0

2.5 Reel dimension



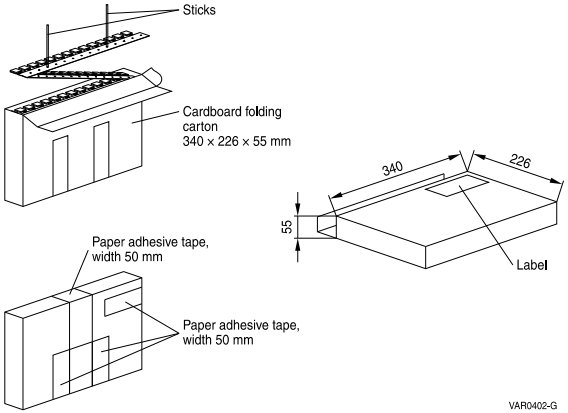


Dimensions (in mm)

Reel type	d	f	n	w
I	360 max.	31 ±1	approx. 45	54 max.
II	360 max.	31 ±1	approx. 55	64 max.
III	500 max.	23 ±1	approx. 59	72 max.

If reel type III is not compatible with insertion equipment because of its large diameter, nominal disk diameter 10 mm and 14 mm can be supplied on reel II upon request (taping mode G3).

2.6 Ammo pack dimensions



3 Lead configuration

Straight leads are standard for disk varistors. Other lead configurations as crimp style or customer-specific 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 denoted by consecutive numbers (S, S2 through S5) as shown in the dimensional drawings below.

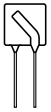
The crimp styles of the individual types can be seen from the type designation in the ordering tables.

3.1 Crimp style mode

Example: B72210S0271K **5** 01

Digit 13

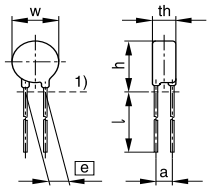
Digit 13 of ordering code	Crimp style	Figure
1	Standard, straight leads	1
2	S2	2
3	S3	3
5	S5	4
Available upon request		
Internal coding	–	5



3.2 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

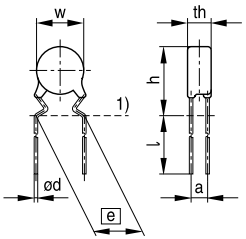


1) Seating plane to IEC 717

VAR0586-W-E

Figure 1

Non-standard, crimp style S2

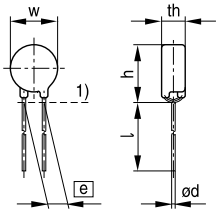


1) Seating plane to IEC 60717

VAR0411-F-E

Figure 2

Non-standard, crimp style S3

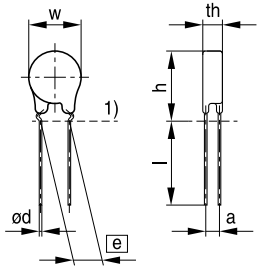


1) Seating plane to IEC 60717

VAR0396-R-E

Figure 3

Non-standard, crimp style S5



1) Seating plane to IEC 60717

VAR0726-M-E

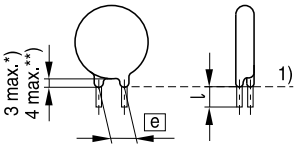
Figure 4

3.3 Trimmed leads (non-standard)

Varistors with cut leads available upon request.

Lead length tolerances:

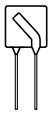
Straight leads	+/−0.8 mm
Crimped leads	+/−0.5 mm
Minimum lead length	3.0 mm



1) Seating plane to IEC 60717
*) For round component head
**) For EnergetiQ series, square component head

VAR0642-U-E

Figure 5



Cautions and warnings

General

1. EPCOS metal oxide varistors 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 EPCOS during the design-in-phase.
2. Ensure suitability of SIOVs through reliability testing during the design-in phase. SIOVs should be evaluated taking into consideration worst-case conditions.
3. For applications of SIOVs in line-to-ground circuits based on various international and local standards there are restrictions existing or additional safety measures required.

Storage

1. Store SIOVs 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 SIOV's during storage, handling and processing.
4. Avoid storage of SIOVs in harmful environments that can affect the function during long-term operation (examples given under operation precautions).
5. The SIOV type series should be soldered after shipment from EPCOS within the time specified:

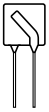
SIOV-S, -Q, -LS, -B, -SNF	24 months
ETFV/ T series, -CU	12 months.

Handling

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

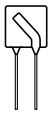
1. Potting, sealing or adhesive compounds can produce chemical reactions in the SIOV ceramic that will degrade the component's electrical characteristics.
2. Overloading SIOVs may result in ruptured packages and expulsion of hot materials. For this reason SIOVs should be physically shielded from adjacent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

Operation

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

Display of ordering codes for EPCOS products

The ordering code for one and the same EPCOS product can be represented differently in data sheets, data books, other publications, on the EPCOS website, or in order-related documents such as shipping notes, order confirmations and product labels. **The varying representations of the ordering codes are due to different processes employed and do not affect the specifications of the respective products**. Detailed information can be found on the Internet under www.epcos.com/orderingcodes



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
V_{DC}	DC operating voltage
V_{jump}	Maximum jump start voltage
v_{max}	Maximum voltage
V_{op}	Operating voltage
V_{RMS}	AC operating voltage, root-mean-square value
$V_{RMS,\ op,\ max}$	Root-mean-square value of max. DC operating voltage incl. ripple current
V_{surge}	Super imposed surge voltage
V_V	Varistor voltage
ΔV_V	Tolerance of varistor voltage
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.

Important notes

The following applies to all products named in this publication:

1. Some parts of this publication contain **statements about the suitability of our products for certain areas of application**. These statements are based on our knowledge of typical requirements that are often placed on our products in the areas of application concerned. We nevertheless expressly point out **that such statements cannot be regarded as binding statements about the suitability of our products for a particular customer application**. As a rule, EPCOS is either unfamiliar with individual customer applications or less familiar with them than the customers themselves. For these reasons, it is always ultimately incumbent on the customer to check and decide whether an EPCOS product with the properties described in the product specification is suitable for use in a particular customer application.
2. We also point out that **in individual cases, a malfunction of electronic components or failure before the end of their usual service life cannot be completely ruled out in the current state of the art, even if they are operated as specified**. In customer applications requiring a very high level of operational safety and especially in customer applications in which the malfunction or failure of an electronic component could endanger human life or health (e.g. in accident prevention or lifesaving systems), it must therefore be ensured by means of suitable design of the customer application or other action taken by the customer (e.g. installation of protective circuitry or redundancy) that no injury or damage is sustained by third parties in the event of malfunction or failure of an electronic component.
3. **The warnings, cautions and product-specific notes must be observed.**
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