SIOV metal oxide varistors

SMD varistors standard series, CU types

Series/Type: **B726***

Date: January 2018

EPCOS AG is a TDK Group Company.

Standard series

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EPCOS type designation system for SMD varistor standard series

CU	4032	K	275	G2

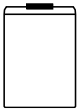
Construction:
CU ≙ Encapsulated chip

Case sizes:
3225 ≙ 32 x 25
4032 ≙ 40 x 32

Varistor voltage tolerance:
K ≙ ±10%

Maximum RMS operating voltage (V_{RMS}):
275 ≙ 275 V

Taping mode:
G2 ≙ Taped, 330-mm reel



SMD varistors (CU types) **B726***

Standard series

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Construction

- Cylindrical varistor element, encapsulated.
- Encapsulation: thermoplastic, flame-retardant to UL 94 V-0.
- Termination: tinned copper alloy, suitable for lead-free wave and reflow soldering, and compatible with tin/lead solder.

Features

- Electrical equivalents to leaded types SIOV-S05/S07
- Operating voltage up to 300 V_{RMS}
- SMD plastic package
- RoHS-compatible
- Suitable for lead-free soldering
- PSpice models available

Approvals

- UL
- IEC
- CSA approved (types with voltages higher than 30 V_{RMS})

Delivery mode

- Blister tape, 330-mm reel
- Packing unit: 1000 pcs.

V/I characteristics and derating curves

V/I and derating curves are attached to the data sheet. The curves are sorted by V_{RMS} and then by case size, which is included in the type designation.

General technical data

Maximum RMS operating voltage		V_{RMS}	11 ... 300	V
Maximum DC operating voltage		V_{DC}	14 ... 385	V
Maximum surge current	(8/20 µs) 1 time	i_{max}	100 ... 1200	A
Maximum energy absorption	(2 ms)	W_{max}	300 ... 23000	mJ
Maximum clamping voltage	(8/20 µs)	$v_{c,max}$	36 ... 775	V
Operating temperature			−40/+85	°C
Storage temperature			−40/+125	°C

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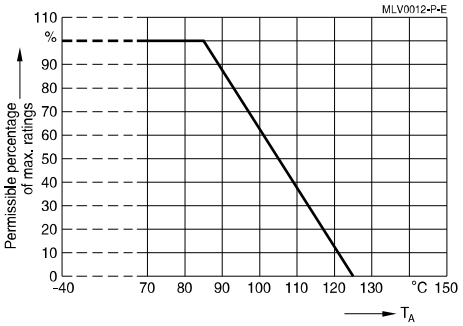
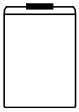
Temperature derating

Climatic category: −40/+85 °C





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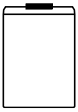
Electrical specifications and ordering codes

Maximum ratings (T_A = 85 °C)

Type	Ordering code	V_{RMS}	V_{DC}	i_{max} (8/20 µs) 1 time	I_n [1] (8/20 µs) 15 times	W_{max} (2 ms)	P_{max}
		V	V	A	A	mJ	mW
CU3225K11G2	B72650M0110K072	11	14	100	50	300	10
CU4032K11G2	B72660M0110K072	11	14	250	100	800	20
CU3225K14G2	B72650M0140K072	14	18	100	50	400	10
CU4032K14G2	B72660M0140K072	14	18	250	100	900	20
CU3225K17G2	B72650M0170K072	17	22	100	50	500	10
CU4032K17G2	B72660M0170K072	17	22	250	100	1100	20
CU3225K20G2	B72650M0200K072	20	26	100	50	600	10
CU4032K20G2	B72660M0200K072	20	26	250	100	1300	20
CU3225K25G2	B72650M0250K072	25	31	100	50	700	10
CU4032K25G2	B72660M0250K072	25	31	250	100	1600	20
CU3225K30G2	B72650M0300K072	30	38	100	50	900	10
CU4032K30G2	B72660M0300K072	30	38	250	100	2000	20
CU3225K35G2	B72650M0350K072	35	45	100	50	1100	10
CU4032K35G2	B72660M0350K072	35	45	250	100	2500	20
CU3225K40G2	B72650M0400K072	40	56	100	50	1300	10
CU4032K40G2	B72660M0400K072	40	56	250	100	3000	20
CU3225K50G2	B72650M0500K072	50	65	400	150	1800	100
CU4032K50G2	B72660M0500K072	50	65	1200	500	4200	250
CU3225K60G2	B72650M0600K072	60	85	400	150	2200	100
CU4032K60G2	B72660M0600K072	60	85	1200	500	4800	250
CU3225K75G2	B72650M0750K072	75	100	400	150	2500	100
CU4032K75G2	B72660M0750K072	75	100	1200	500	5900	250
CU3225K95G2	B72650M0950K072	95	125	400	150	3400	100
CU4032K95G2	B72660M0950K072	95	125	1200	500	7600	250
CU3225K115G2	B72650M0111K072	115	150	400	150	3600	100
CU4032K115G2	B72660M0111K072	115	150	1200	500	8400	250
CU3225K130G2	B72650M0131K072	130	170	400	150	4200	100
CU4032K130G2	B72660M0131K072	130	170	1200	500	9500	250
CU3225K140G2	B72650M0141K072	140	180	400	150	4500	100
CU4032K140G2	B72660M0141K072	140	180	1200	500	10000	250
CU3225K150G2	B72650M0151K072	150	200	400	150	4900	100
CU4032K150G2	B72660M0151K072	150	200	1200	500	11000	250
CU3225K175G2	B72650M0171K072	175	225	400	150	5600	100
CU4032K175G2	B72660M0171K072	175	225	1200	500	13000	250

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



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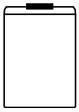
Characteristics (T_A = 25 °C)

Type	V_V (1 mA) V	ΔV_V %	$v_{c,max}$ V	I_c (8/20 µs) A	C_{typ} (1 kHz, 1 V) pF
CU3225K11G2	18	±10	36	1.0	1750
CU4032K11G2	18	±10	36	2.5	2750
CU3225K14G2	22	±10	43	1.0	1450
CU4032K14G2	22	±10	43	2.5	2300
CU3225K17G2	27	±10	53	1.0	1200
CU4032K17G2	27	±10	53	2.5	1900
CU3225K20G2	33	±10	65	1.0	980
CU4032K20G2	33	±10	65	2.5	1600
CU3225K25G2	39	±10	77	1.0	850
CU4032K25G2	39	±10	77	2.5	1400
CU3225K30G2	47	±10	93	1.0	720
CU4032K30G2	47	±10	93	2.5	1200
CU3225K35G2	56	±10	110	1.0	620
CU4032K35G2	56	±10	110	2.5	1050
CU3225K40G2	68	±10	135	1.0	520
CU4032K40G2	68	±10	135	2.5	900
CU3225K50G2	82	±10	135	5.0	300
CU4032K50G2	82	±10	135	10.0	530
CU3225K60G2	100	±10	165	5.0	250
CU4032K60G2	100	±10	165	10.0	480
CU3225K75G2	120	±10	200	5.0	210
CU4032K75G2	120	±10	200	10.0	430
CU3225K95G2	150	±10	250	5.0	135
CU4032K95G2	150	±10	250	10.0	260
CU3225K115G2	180	±10	300	5.0	110
CU4032K115G2	180	±10	300	10.0	220
CU3225K130G2	205	±10	340	5.0	100
CU4032K130G2	205	±10	340	10.0	200
CU3225K140G2	220	±10	360	5.0	95
CU4032K140G2	220	±10	360	10.0	180
CU3225K150G2	240	±10	395	5.0	90
CU4032K150G2	240	±10	395	10.0	170
CU3225K175G2	270	±10	455	5.0	75
CU4032K175G2	270	±10	455	10.0	150



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Electrical specifications and ordering codes
Maximum ratings (T_A = 85 °C)

Type	Ordering code	V_{RMS}	V_{DC}	i_{max} (8/20 µs) 1 time	I_n[1] (8/20 µs) 15 times	W_{max} (2 ms)	P_{max}
		V	V	A	A	mJ	mW
CU3225K230G2	B72650M0231K072	230	300	400	150	7200	100
CU4032K230G2	B72660M0231K072	230	300	1200	500	17000	250
CU3225K250G2	B72650M0251K072	250	320	400	150	8200	100
CU4032K250G2	B72660M0251K072	250	320	1200	500	19000	250
CU3225K275G2	B72650M0271K072	275	350	400	150	8600	100
CU4032K275G2	B72660M0271K072	275	350	1200	500	21000	250
CU3225K300G2	B72650M0301K072	300	385	400	150	9600	100
CU4032K300G2	B72660M0301K072	300	385	1200	500	23000	250

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

Characteristics (T_A = 25 °C)

Type	V_V (1 mA)	ΔV_V	$v_{c,max}$	I_c (8/20 µs)	C_{typ} (1 kHz, 1 V)
	V	%	V	A	pF
CU3225K230G2	360	±10	595	5.0	60
CU4032K230G2	360	±10	595	10.0	115
CU3225K250G2	390	±10	650	5.0	55
CU4032K250G2	390	±10	650	10.0	105
CU3225K275G2	430	±10	710	5.0	50
CU4032K275G2	430	±10	710	10.0	95
CU3225K300G2	470	±10	775	5.0	45
CU4032K300G2	470	±10	775	10.0	90

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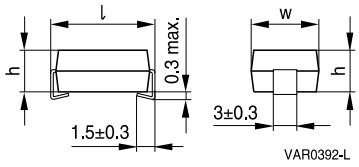
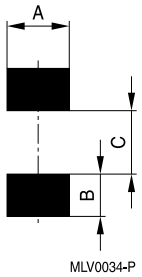
Dimensional drawing



Dimensions in mm

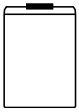
Chip size EIA in mm	$V_{RMS,max}$	l	w	h
3225	11 ... 175	8.0 ±0.3	6.3 ±0.3	3.2 ±0.3
3225	230 ... 300	8.0 ±0.3	6.3 ±0.3	4.5 ±0.3
4032	11 ... 175	10.2 ±0.3	8.0 ±0.3	3.2 ±0.3
4032	230 ... 300	10.2 ±0.3	8.0 ±0.3	4.5 ±0.3

Recommended solder pad layout



Dimensions in mm

Chip size EIA in mm	A	B	C
3225	3.50	2.80	4.50
4032	3.50	2.80	6.50



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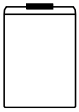
Delivery mode

EIA case size	Taping	Reel size mm	Packing unit pcs.	Type	Ordering code
3225	Blister	330	1000	CU3225K115G2	B72650M0111K072
3225	Blister	330	1000	CU3225K11G2	B72650M0110K072
3225	Blister	330	1000	CU3225K130G2	B72650M0131K072
3225	Blister	330	1000	CU3225K140G2	B72650M0141K072
3225	Blister	330	1000	CU3225K14G2	B72650M0140K072
3225	Blister	330	1000	CU3225K150G2	B72650M0151K072
3225	Blister	330	1000	CU3225K175G2	B72650M0171K072
3225	Blister	330	1000	CU3225K20G2	B72650M0200K072
3225	Blister	330	1000	CU3225K230G2	B72650M0231K072
3225	Blister	330	1000	CU3225K250G2	B72650M0251K072
3225	Blister	330	1000	CU3225K25G2	B72650M0250K072
3225	Blister	330	1000	CU3225K275G2	B72650M0271K072
3225	Blister	330	1000	CU3225K300G2	B72650M0301K072
3225	Blister	330	1000	CU3225K30G2	B72650M0300K072
3225	Blister	330	1000	CU3225K35G2	B72650M0350K072
3225	Blister	330	1000	CU3225K40G2	B72650M0400K072
3225	Blister	330	1000	CU3225K50G2	B72650M0500K072
3225	Blister	330	1000	CU3225K60G2	B72650M0600K072
3225	Blister	330	1000	CU3225K75G2	B72650M0750K072
3225	Blister	330	1000	CU3225K95G2	B72650M0950K072
3225	Blister	330	1000	CU4032K11G2	B72660M0110K072
4032	Blister	330	1000	CU3225K17G2	B72650M0170K072
4032	Blister	330	1000	CU4032K115G2	B72660M0111K072
4032	Blister	330	1000	CU4032K130G2	B72660M0131K072
4032	Blister	330	1000	CU4032K140G2	B72660M0141K072
4032	Blister	330	1000	CU4032K14G2	B72660M0140K072
4032	Blister	330	1000	CU4032K150G2	B72660M0151K072
4032	Blister	330	1000	CU4032K175G2	B72660M0171K072
4032	Blister	330	1000	CU4032K17G2	B72660M0170K072
4032	Blister	330	1000	CU4032K20G2	B72660M0200K072
4032	Blister	330	1000	CU4032K230G2	B72660M0231K072
4032	Blister	330	1000	CU4032K250G2	B72660M0251K072
4032	Blister	330	1000	CU4032K25G2	B72660M0250K072
4032	Blister	330	1000	CU4032K275G2	B72660M0271K072
4032	Blister	330	1000	CU4032K300G2	B72660M0301K072
4032	Blister	330	1000	CU4032K30G2	B72660M0300K072
4032	Blister	330	1000	CU4032K35G2	B72660M0350K072
4032	Blister	330	1000	CU4032K40G2	B72660M0400K072
4032	Blister	330	1000	CU4032K50G2	B72660M0500K072
4032	Blister	330	1000	CU4032K60G2	B72660M0600K072
4032	Blister	330	1000	CU4032K75G2	B72660M0750K072
4032	Blister	330	1000	CU4032K95G2	B72660M0950K072

Reliability data

Note: For CU varistors mounted on PCB by reflow soldering.

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



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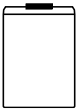
Test	Test methods/conditions	Requirement
Climatic sequence	The specimen shall be subjected to: a) dry heat at UCT, 16 h, IEC 60068-2-2, test Ba b) damp heat, 1st cycle: 55 °C, 93% r. H., 24 h, IEC 60068-2-30, test Db c) cold, LCT, 2 h, IEC 60068-2-1, test Aa d) damp heat, additional 5 cycles: 55 °C/25 °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.	$\lvert\Delta V/V\ (1\ mA)\rvert \leq 10\%$ $R_{ins} \geq 100\ M\Omega$
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).	$\lvert\Delta V/V\ (1\ mA)\rvert \leq 10\%$ $R_{ins} \geq 100\ M\Omega$
Solderability	IEC 60068-2-58, test Td1, method 1 - solder bath, Sn96, 5Ag3Cu0.5 T = 245 ±3 °C t = 2 s	The terminations shall be uniformly tinned for soldering test.
Resistance to soldering heat	IEC 60068-2-58, test Td2, method 1 - solder bath, Sn96, 5Ag3Cu0.5 T = 260 ±5 °C d = 10 ±1 s	$\lvert\Delta V/V\ (1\ mA)\rvert \leq 5\%$ No visible damage



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Test	Test methods/conditions	Requirement
Robustness of termination	Substrate bending test IEC 60068-2-21, test Ue1 Deflection = 2 mm t = 60 s	|ΔV/V (1 mA)| ≤10% No visible damage
	Shear test IEC 60068-2-21, test Ue3 Force = 5 N t = 10 ±1 s	|ΔV/V (1 mA)| ≤10% No visible damage
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.	|ΔV/V (1 mA)| ≤5% No visible damage
Bump	IEC 60068-2-27, test Ea Pulse duration: 6 ms Max. acceleration: 400 m/s² Number: 6 x 5000 shocks Pulse shape: 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

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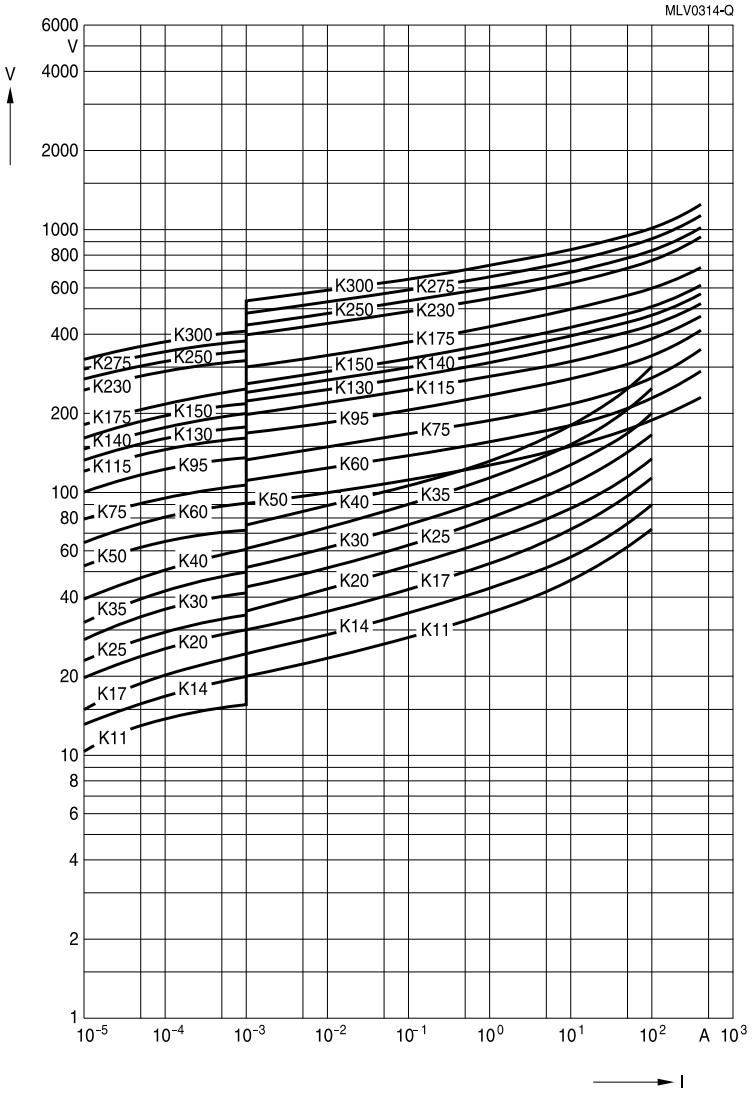
V/I characteristics



CU3225 ...

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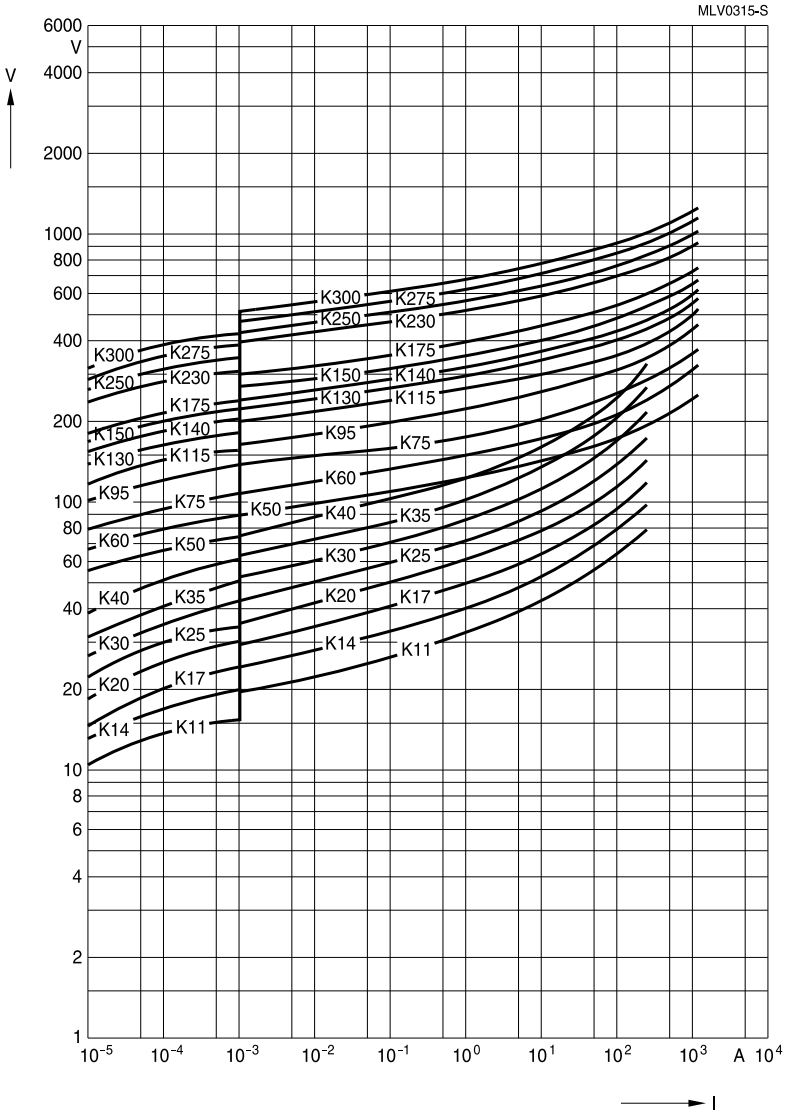
V/I characteristics



CU4032 ...

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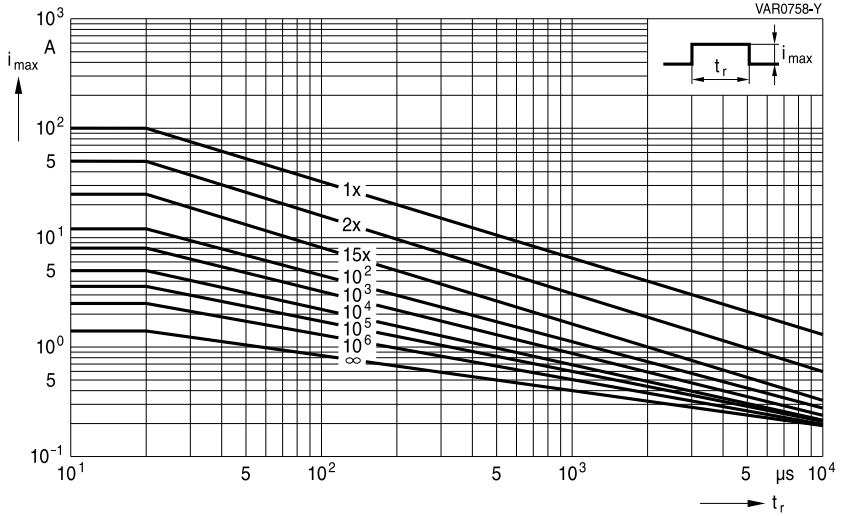
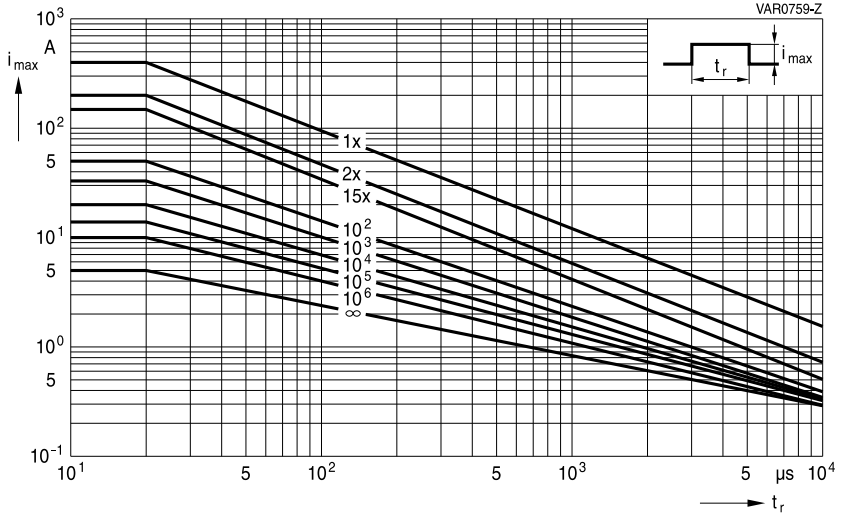
Derating curves for CU3225...

Maximum surge current $I_{surge,max}$ = f (t_r, pulse train)
For explanation of the derating curves refer to "General technical information", chapter 2.7.2



CU3225K11G2 ... K40G2



CU3225K50G2 ... K300G2

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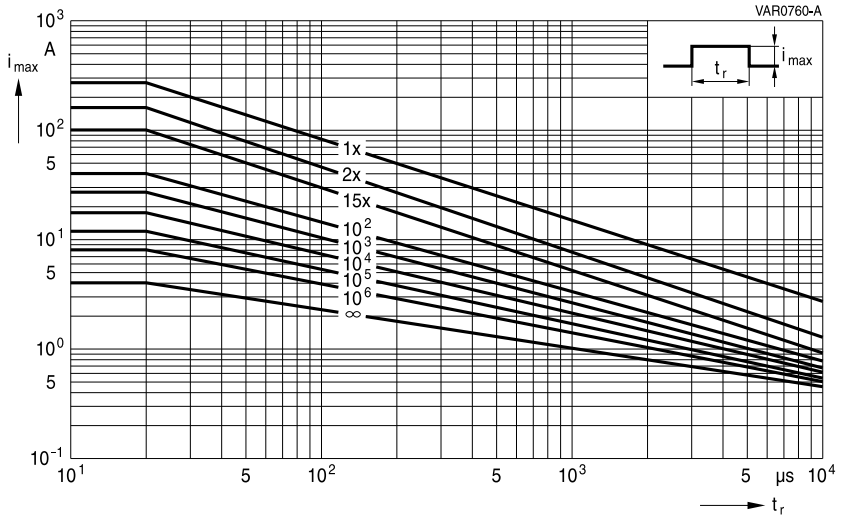
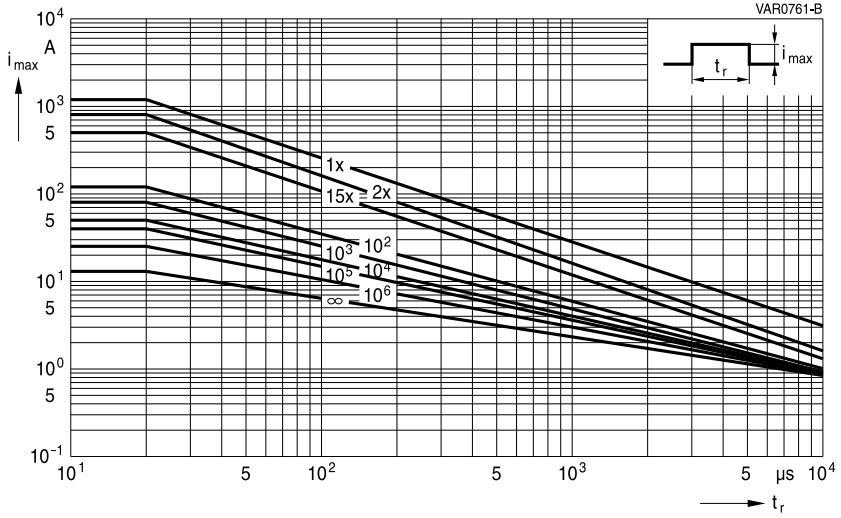
Derating curves for CU4032...

Maximum surge current $I_{surge,max}$ = f (t_r, pulse train)
For explanation of the derating curves refer to "General technical information", chapter 2.7.2



CU4032K11G2 ... K40G2



CU4032K50G2 ... K300G2

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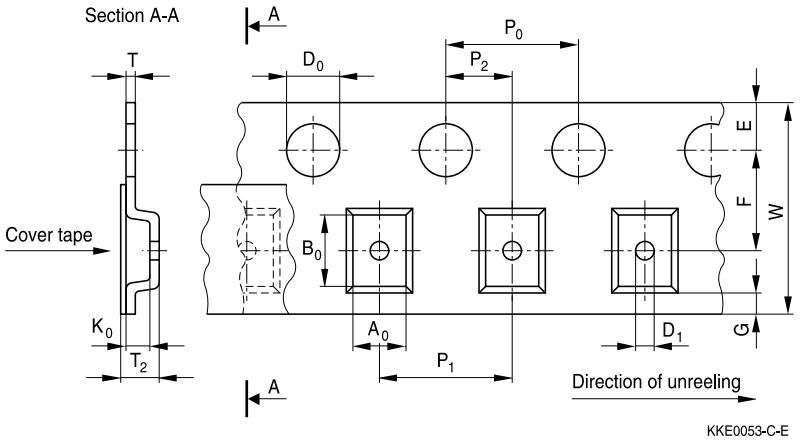
Taping and packing for CU varistors

Blister tape (taping to IEC 60286-3)



Dimensions in mm

	Symbol	Case size		Tolerance
		3225	4032	
Compartment width	A_0	7.0	8.6	±0.20
Compartment length	B_0	8.70	10.6	±0.20
Thickness cover tape	K_0	5.00		max.
Overall thickness	T_2	5.50		max.
Thickness tape	T	0.30		max.
Sprocket hole diameter	D_0	1.50		+0.10/−0
Sprocket hole diameter	D_1	1.50		min.
Sprocket hole pitch	P_0	4.00		±0.10[1)]
Distance center hole to center compartment	P_2	2.00		±0.05
Pitch of the component compartments	P_1	12.00		±0.10
Tape width	W	16.00		±0.30
Distance edge to center of hole	E	1.75		±0.10
Distnace center hole to center compartment	F	7.50		±0.05
Distance compartment to edge	G	0.75		min.

1) ≤0.2 mm over 10 sprocket holes

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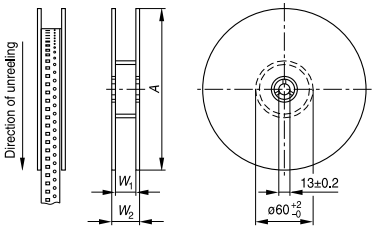
Additional taping information

Reel material	Polystyrol (PS)
Tape material	Polystyrol (PS) or Polycarbonat (PC), PVC or PET
Tape break force	min. 10 N
Top cover tape strength	min. 10 N
Tape peel angle	Angle between top cover tape and the direction of feed during peel off: 165° to 180°
Cavity play	Each part rests in the cavity so that the angle between the part and cavity center line is no more than 20°

Reel packing

Packing material: Plastic

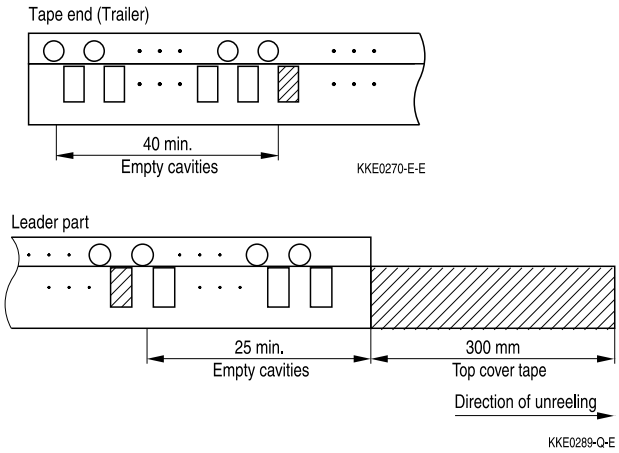


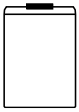
Dimensions in mm

		Dimension	Tolerance
Reel diameter	A	330	+0/−2.0
Reel width (inside)	W_1	16.4	+1.5/−0
Reel width (outside)	W_2	22.4	max.

Packing unit: 1000 pcs./ reel

Leader, trailer





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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

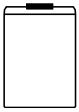
1. Potting, sealing or adhesive compounds can produce chemical reactions in the SIOV ceramic that will degrade the component's electrical characteristics.
2. Overloading SIOVs may result in ruptured packages and expulsion of hot materials. For this reason SIOVs should be physically shielded from adjacent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



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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 we are 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 a 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 life-saving 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.**
4. In order to satisfy certain technical requirements, **some of the products described in this publication may contain substances subject to restrictions in certain jurisdictions (e.g. because they are classed as hazardous)**. Useful information on this will be found in our Material Data Sheets on the Internet (www.tdk-electronics.tdk.com/material). Should you have any more detailed questions, please contact our sales offices.
5. We constantly strive to improve our products. Consequently, **the products described in this publication may change from time to time**. The same is true of the corresponding product specifications. Please check therefore to what extent product descriptions and specifications contained in this publication are still applicable before or when you place an order.

   We also **reserve the right to discontinue production and delivery of products**. Consequently, we cannot guarantee that all products named in this publication will always be available. The aforementioned does not apply in the case of individual agreements deviating from the foregoing for customer-specific products.
6. Unless otherwise agreed in individual contracts, **all orders are subject to our General Terms and Conditions of Supply.**
7. **Our manufacturing sites serving the automotive business apply the IATF 16949 standard.** The IATF certifications confirm our compliance with requirements regarding the quality management system in the automotive industry. Referring to customer requirements and customer specific requirements (“CSR”) TDK always has and will continue to have the policy of respecting individual agreements. Even if IATF 16949 may appear to support the acceptance of unilateral requirements, we hereby like to emphasize that **only requirements mutually agreed upon can and will be implemented in our Quality Management System.** For clarification purposes we like to point out that obligations from IATF 16949 shall only become legally binding if individually agreed upon.

Important notes

8. The trade names EPCOS, CeraCharge, CeraDiode, CeraLink, CeraPad, CeraPlas, CSMP, CTVS, DeltaCap, DigiSiMic, ExoCore, FilterCap, FormFit, LeaXield, MiniBlue, MiniCell, MKD, MKK, MotorCap, PCC, PhaseCap, PhaseCube, PhaseMod, PhiCap, PowerHap, PQSine, PQvar, SIFERRIT, SIFI, SIKOREL, SilverCap, SIMDAD, SiMic, SIMID, SineFormer, SIOV, ThermoFuse, WindCap are **trademarks registered or pending** in Europe and in other countries. Further information will be found on the Internet at www.tdk-electronics.tdk.com/trademarks.

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