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SIOV metal oxide varistors

SMD varistors for automotive applications, CU
types

Series/Type: B726*
Date: January 2018

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SMD
EPCOS type designation system for SMD disk varistor automotive series

| | | | | | |
|--|-------------|----------|-----------|-------------|-----------|
| CU | 4032 | K | 14 | AUTO | G2 |
| Construction: CU \triangleq Encapsulated chip | | | | | |
| Case sizes: 3225 \triangleq 32 x 25 4032 \triangleq 40 x 32 | | | | | |
| Varistor voltage tolerance: K \triangleq $\pm 10\%$ | | | | | |
| Maximum RMS operating voltage (V_{RMS}): 14 \triangleq 14 V 17 \triangleq 17 V 30 \triangleq 30 V | | | | | |
| Automotive series | | | | | |
| Taping mode: G2 \triangleq Taped, 330-mm reel | | | | | |



SMD

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

- 12 V and 24 V supply systems
- High energy absorption capability
- SMD plastic package
- No temperature derating up to 85 °C
- RoHS-compatible
- Suitable for lead-free soldering
- PSpice simulation modeling available for different pulses

Approvals

- UL approved

Delivery mode

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

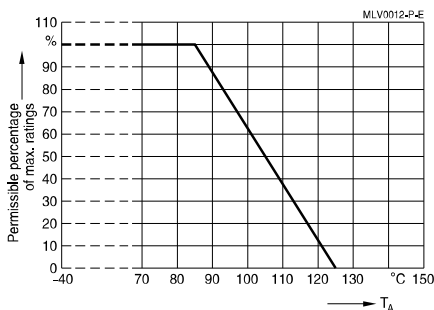
V/I characteristics and derating curves

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} | 14 ... 30 | V |
| Maximum DC operating voltage | | V_{DC} | 16 ... 34 | V |
| Maximum surge current | (8/20 μ s) | i_{max} | 100 ... 250 | A |
| Maximum load dump energy | (10 pulses) | W_{LD} | 6 ... 12 | J |
| Maximum jump start voltage | (5 min) | V_{jump} | 25 ... 50 | V |
| Maximum energy absorption | (2 ms) | W_{max} | 400 ... 2000 | mJ |
| Maximum clamping voltage | (8/20 μ s) | $V_{c,max}$ | 43 ... 93 | V |
| Operating temperature | | | -40/+85 | °C |
| Storage temperature | | | -40/+125 | °C |

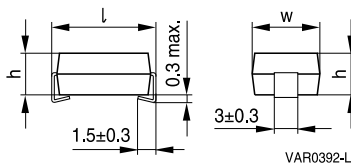

Temperature derating

 Climatic category: $-40/+85\text{ }^{\circ}\text{C}$

Electrical specifications and ordering codes
Maximum ratings ($T_A = 85\text{ }^{\circ}\text{C}$)

| Type | Ordering code | V_{RMS} V | V_{DC} V | i_{max} (8/20 μs) A | W_{max} (2 ms) mJ | W_{LD} (10 pulses) J | P_{max} mW |
|-----------------|-----------------|-----------------------|----------------------|--|----------------------------------|-------------------------------------|------------------------|
| CU3225K14AUTOG2 | B72650M1140K072 | 14 | 16 | 100 | 400 | 6 | 10 |
| CU4032K14AUTOG2 | B72660M1140K072 | 14 | 16 | 250 | 900 | 12 | 20 |
| CU3225K17AUTOG2 | B72650M1170K072 | 17 | 20 | 100 | 500 | 6 | 10 |
| CU4032K17AUTOG2 | B72660M1170K072 | 17 | 20 | 250 | 1100 | 12 | 20 |
| CU3225K30AUTOG2 | B72650M1300K072 | 30 | 34 | 100 | 900 | 6 | 10 |
| CU4032K30AUTOG2 | B72660M1300K072 | 30 | 34 | 250 | 2000 | 12 | 20 |

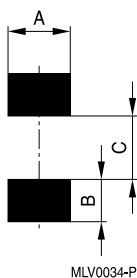
Characteristics ($T_A = 25\text{ }^{\circ}\text{C}$)

| Type | V_V (1 mA) V | ΔV_V % | V_{jump} (5 min) V | $V_{\text{c,max}}$ V | I_c (8/20 μs) A | C_{typ} (1 kHz, 1 V) pF |
|-----------------|----------------------|-------------------|-----------------------------------|-------------------------|-------------------------------------|--|
| CU3225K14AUTOG2 | 22 | ± 10 | 25 | 43 | 1 | 1400 |
| CU4032K14AUTOG2 | 22 | ± 10 | 25 | 43 | 2.5 | 2300 |
| CU3225K17AUTOG2 | 27 | ± 10 | 30 | 53 | 1 | 1200 |
| CU4032K17AUTOG2 | 27 | ± 10 | 30 | 53 | 2.5 | 1900 |
| CU3225K30AUTOG2 | 47 | ± 10 | 50 | 93 | 1 | 600 |
| CU4032K30AUTOG2 | 47 | ± 10 | 50 | 93 | 2.5 | 1100 |


SMD
Dimensional drawing


Dimensions in mm

| Chip size EIA in mm | $V_{RMS,max}$ | l | w | h |
|------------------------|---------------|----------------|---------------|---------------|
| 3225 | 14, 17, 30 | 8.0 ± 0.3 | 6.3 ± 0.3 | 3.2 ± 0.3 |
| 4032 | 14, 17, 30 | 10.2 ± 0.3 | 8.0 ± 0.3 | 3.2 ± 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 |

Delivery mode

| EIA case size | Taping | Reel size mm | Packing unit pcs. | Type | Ordering code |
|---------------|---------|-----------------|----------------------|-----------------|-----------------|
| 3225 | Blister | 330 | 1000 | CU3225K14AUTOG2 | B72650M1140K072 |
| 3225 | Blister | 330 | 1000 | CU3225K17AUTOG2 | B72650M1170K072 |
| 3225 | Blister | 330 | 1000 | CU3225K30AUTOG2 | B72650M1300K072 |
| 4032 | Blister | 330 | 1000 | CU4032K14AUTOG2 | B72660M1140K072 |
| 4032 | Blister | 330 | 1000 | CU4032K17AUTOG2 | B72660M1170K072 |
| 4032 | Blister | 330 | 1000 | CU4032K30AUTOG2 | B72660M1300K072 |

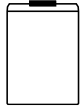

SMD varistors (CU types)
B726*
Automotive series
SMD
Reliability data

| 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 | 100 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\%$ |
| Load dump | ISO 7637-2 Number of pulses: 10 Pulse interval: 60 s Pulse duration: 500 ms | $ \Delta V/V (1 \text{ mA}) \geq -15\%$ No visible damage |
| Jump start | $V_{DC, load} = V_{jump}$; 5 min duration 14 V (S...K14AUTO...); $V_{jump} = 25 \text{ V}$ 17 V (S...K17AUTO...); $V_{jump} = 30 \text{ V}$ 30 V (S...K30AUTO...); $V_{jump} = 45 \text{ V}$ | $ \Delta V/V (1 \text{ mA}) \geq -15\%$ No visible damage |
| Fast temperature cycling | IEC 60068-2-14, test Na, LCT/UCT, dwell time 15 min, 100 cycles | $ \Delta V/V (1 \text{ mA}) \leq 5\%$ No visible damage |
| Damp heat | IEC 60068-2-67, test Cy, 85 °C, 85% r. H., V_{DC} , 1000 h | $ \Delta V/V (1 \text{ mA}) \leq 10\%$ No visible damage |
| Substrate bending test | IEC 60068-2-21, test Ue1 Deflection = 2 mm t = 60 s | $ \Delta V/V (1 \text{ mA}) \leq 10\%$ No visible damage |
| Shear test | IEC 60068-2-21, test Ue3 Force = 5 N t = 10 ± 1 s | $ \Delta V/V (1 \text{ mA}) \leq 10\%$ No visible damage |

Note:

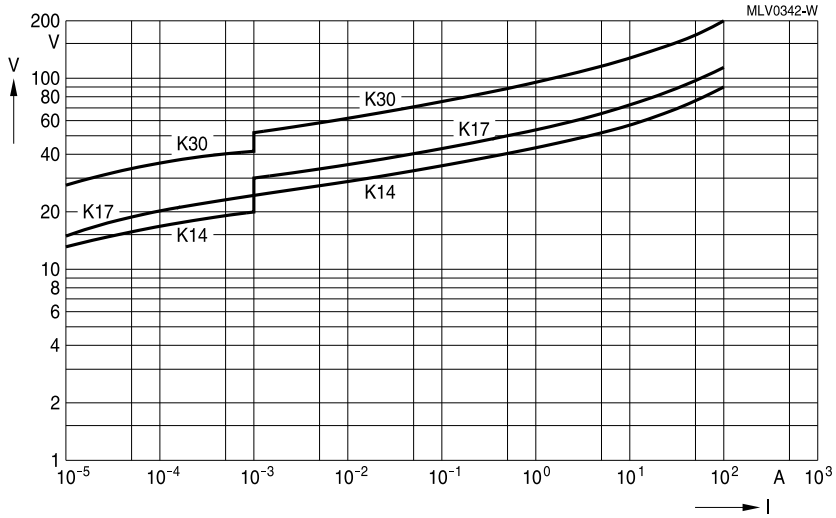
UCT = Upper category temperature

LCT = Lower category temperature

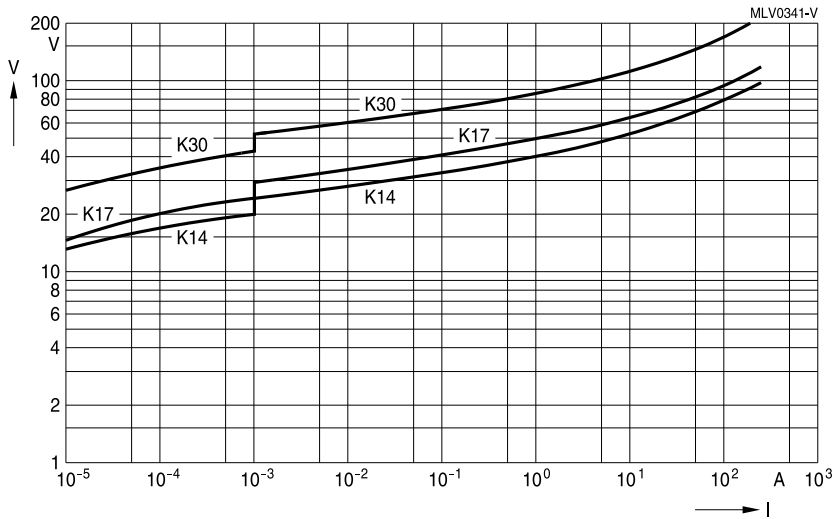


SMD

V/I characteristics



CU3225 ... AUTOG2



CU4032 ... AUTOG2

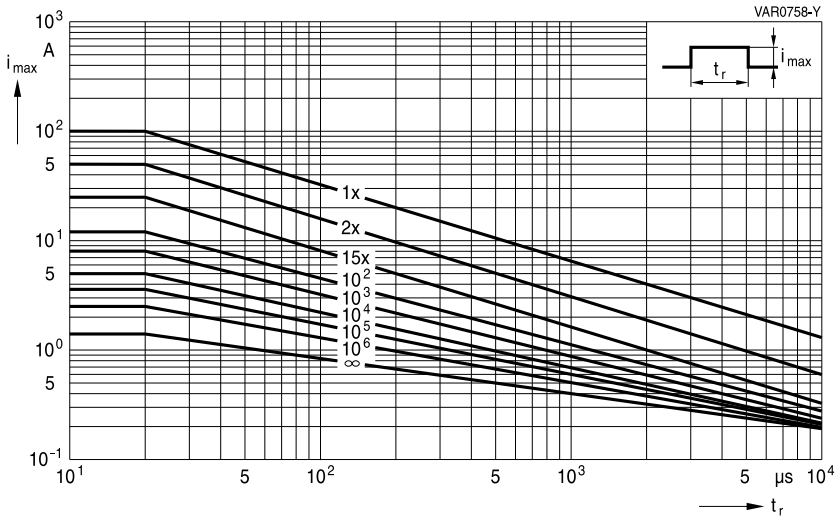


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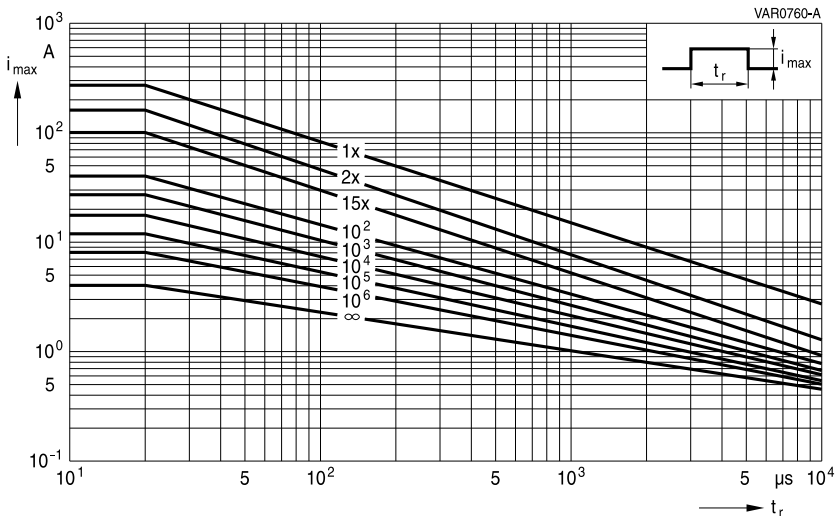
Derating curves

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

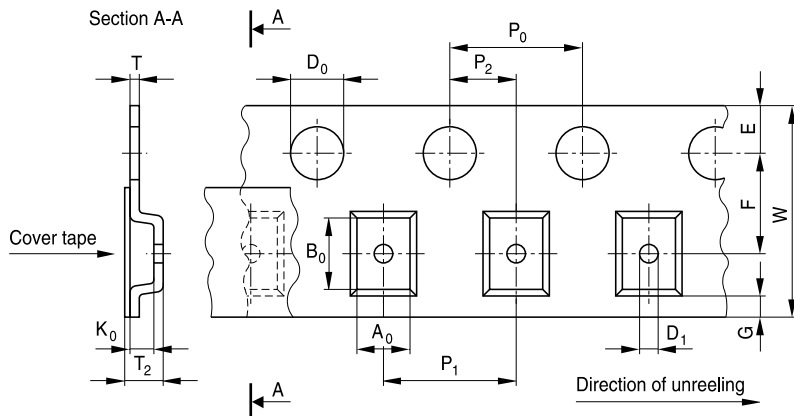
For explanation of the derating curves refer to "General technical information", chapter 2.7.2



CU3225K14AUGO2 ... K30AUGO2



CU4032K14AUGO2 ... K30AUGO2


SMD
Taping and packing for CU varistors
Blister tape (taping to IEC 60286-3)


KKE0053-C-E

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 | | $\pm 0.10^{1)}$ |
| 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 |
| Distance 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



SMD varistors (CU types)

B726*

Automotive series

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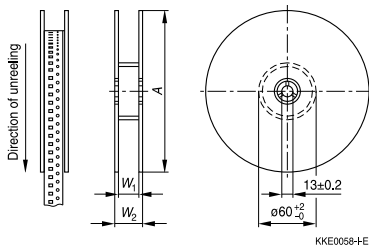
Additional taping information

| | |
|-------------------------|---|
| 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

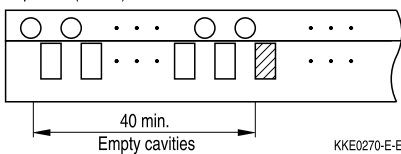


| | | Dimension | Tolerance |
|----------------------|----------------|-----------|-----------|
| Reel diameter | A | 330 | +0/-2.0 |
| Reel width (inside) | W ₁ | 16.4 | +1.5/-0 |
| Reel width (outside) | W ₂ | 22.4 | max. |

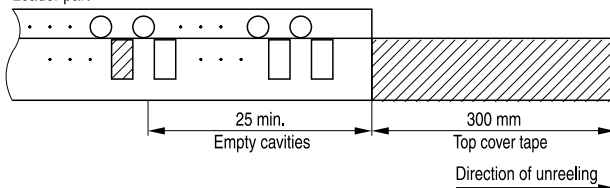
Packing unit: 1000 pcs./ reel

Leader, trailer

Tape end (Trailer)



Leader part



KKE0289-Q-E



SMD

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: $-25\text{ °C} \dots +45\text{ °C}$,
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).



SMD varistors (CU types)

B726*

Automotive series

SMD

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.

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SMD
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.
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Important notes

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