

SIOV metal oxide varistors

Block varistors, HighE series

Series/Type: B722*

Date: January 2018

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HighE series
Construction

- Disk-shaped varistor element, potted in plastic housing
- Housing and potting flame-retardant to UL 94 V-0
- Screw terminals M4 (SIOV-B32 ... 40)
Screw terminals M5 (SIOV-B60 ... 80)

Features

- Heavy-duty varistors (surge current capability up to 100 kA)
- Wide operating voltage range 75 ... 1100 V_{RMS}
- SIOV-B40 also available without housing (LS40 series)
- PSpice models

Approvals

- UL
- CSA (≥ K130)

Delivery mode

- Cardboard box

General technical data

| | | | |
|--------------------------------------|----------------|--------------|-------------------|
| Climatic category | to IEC 60068-1 | 40/85/56 | |
| Operating temperature | to CECC 42 000 | -40 ... + 85 | °C |
| Storage temperature | | -40 ... +110 | °C |
| Electric strength | to CECC 42 000 | ≥ 2.5 | kV _{RMS} |
| Insulation resistance | to CECC 42 000 | ≥ 10 | MΩ |
| Maximum torque for B32 and B40 types | | 1.0 | Nm |
| Maximum torque for B60 and B80 types | | 2.5 | Nm |


Block varistors
B722*
HighE series
Electrical specifications and ordering codes
Maximum ratings ($T_A = 85\text{ }^\circ\text{C}$)

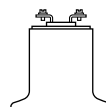
| Ordering code | Type | V_{RMS} | V_{DC} | i_{max} (8/20 μs) | W_{max} (2 ms) | P_{max} |
|--------------------------|---------|-----------|----------|------------------------------------|---------------------|-----------|
| | SIOV- | V | V | A | J | W |
| $V_{RMS} = 75\text{ V}$ | | | | | | |
| B72240B0750K001 | B40K75 | 75 | 100 | 25000 | 190 | 1.4 |
| $V_{RMS} = 130\text{ V}$ | | | | | | |
| B72232B0131K001 | B32K130 | 130 | 170 | 25000 | 210 | 1.2 |
| B72240B0131K001 | B40K130 | 130 | 170 | 40000 | 310 | 1.4 |
| B72260B0131K001 | B60K130 | 130 | 170 | 70000 | 490 | 1.6 |
| B72280B0131K001 | B80K130 | 130 | 170 | 100000 | 660 | 2.0 |
| $V_{RMS} = 150\text{ V}$ | | | | | | |
| B72232B0151K001 | B32K150 | 150 | 200 | 25000 | 240 | 1.2 |
| B72240B0151K001 | B40K150 | 150 | 200 | 40000 | 360 | 1.4 |
| B72260B0151K001 | B60K150 | 150 | 200 | 70000 | 570 | 1.6 |
| B72280B0151K001 | B80K150 | 150 | 200 | 100000 | 800 | 2.0 |
| $V_{RMS} = 230\text{ V}$ | | | | | | |
| B72232B0231K001 | B32K230 | 230 | 300 | 25000 | 300 | 1.2 |
| B72240B0231K001 | B40K230 | 230 | 300 | 40000 | 460 | 1.4 |
| B72260B0231K001 | B60K230 | 230 | 300 | 70000 | 730 | 1.6 |
| B72280B0231K001 | B80K230 | 230 | 300 | 100000 | 1200 | 2.0 |
| $V_{RMS} = 250\text{ V}$ | | | | | | |
| B72232B0251K001 | B32K250 | 250 | 320 | 25000 | 330 | 1.2 |
| B72240B0251K001 | B40K250 | 250 | 320 | 40000 | 490 | 1.4 |
| B72260B0251K001 | B60K250 | 250 | 320 | 70000 | 800 | 1.6 |
| B72280B0251K001 | B80K250 | 250 | 320 | 100000 | 1300 | 2.0 |
| $V_{RMS} = 275\text{ V}$ | | | | | | |
| B72232B0271K001 | B32K275 | 275 | 350 | 25000 | 360 | 1.2 |
| B72240B0271K001 | B40K275 | 275 | 350 | 40000 | 550 | 1.4 |
| B72260B0271K001 | B60K275 | 275 | 350 | 70000 | 860 | 1.6 |
| B72280B0271K001 | B80K275 | 275 | 350 | 100000 | 1400 | 2.0 |
| $V_{RMS} = 320\text{ V}$ | | | | | | |
| B72232B0321K001 | B32K320 | 320 | 420 | 25000 | 430 | 1.2 |
| B72240B0321K001 | B40K320 | 320 | 420 | 40000 | 640 | 1.4 |
| B72260B0321K001 | B60K320 | 320 | 420 | 70000 | 1000 | 1.6 |
| B72280B0321K001 | B80K320 | 320 | 420 | 100000 | 1600 | 2.0 |

Varistor elements without plastic housing (suitable for soldering) are available upon request.


Block varistors
B722*
HighE series
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 |
|--------------------------------|-------------------------------|--------------------------------|--|---------------------|-----------------------------------|
| V_{RMS} = 75 V | | | | | |
| B72240B0750K001 | 120 | ±10 | 220 | 300 | 11000 |
| V_{RMS} = 130 V | | | | | |
| B72232B0131K001 | 205 | ±10 | 340 | 200 | 4400 |
| B72240B0131K001 | 205 | ±10 | 340 | 300 | 5600 |
| B72260B0131K001 | 205 | ±10 | 340 | 500 | 15000 |
| B72280B0131K001 | 205 | ±10 | 340 | 800 | 28000 |
| V_{RMS} = 150 V | | | | | |
| B72232B0151K001 | 240 | ±10 | 395 | 200 | 3700 |
| B72240B0151K001 | 240 | ±10 | 395 | 300 | 4800 |
| B72260B0151K001 | 240 | ±10 | 395 | 500 | 12000 |
| B72280B0151K001 | 240 | ±10 | 395 | 800 | 23000 |
| V_{RMS} = 230 V | | | | | |
| B72232B0231K001 | 360 | ±10 | 595 | 200 | 2500 |
| B72240B0231K001 | 360 | ±10 | 595 | 300 | 3200 |
| B72260B0231K001 | 360 | ±10 | 595 | 500 | 7900 |
| B72280B0231K001 | 360 | ±10 | 595 | 800 | 16000 |
| V_{RMS} = 250 V | | | | | |
| B72232B0251K001 | 390 | ±10 | 650 | 200 | 2200 |
| B72240B0251K001 | 390 | ±10 | 650 | 300 | 2900 |
| B72260B0251K001 | 390 | ±10 | 650 | 500 | 7100 |
| B72280B0251K001 | 390 | ±10 | 650 | 800 | 14000 |
| V_{RMS} = 275 V | | | | | |
| B72232B0271K001 | 430 | ±10 | 710 | 200 | 2000 |
| B72240B0271K001 | 430 | ±10 | 710 | 300 | 2700 |
| B72260B0271K001 | 430 | ±10 | 710 | 500 | 6600 |
| B72280B0271K001 | 430 | ±10 | 710 | 800 | 13000 |
| V_{RMS} = 320 V | | | | | |
| B72232B0321K001 | 510 | ±10 | 840 | 200 | 1700 |
| B72240B0321K001 | 510 | ±10 | 840 | 300 | 2300 |
| B72260B0321K001 | 510 | ±10 | 840 | 500 | 5600 |
| B72280B0321K001 | 510 | ±10 | 840 | 800 | 11000 |

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

| Ordering code | Type | V_{RMS} | V_{DC} | i_{max} (8/20 μs) | W_{max} (2 ms) | P_{max} |
|--------------------------|---------|-----------|----------|------------------------------------|---------------------|-----------|
| | SIOV- | V | V | A | J | W |
| $V_{RMS} = 385\text{ V}$ | | | | | | |
| B72232B0381K001 | B32K385 | 385 | 505 | 25000 | 550 | 1.2 |
| B72240B0381K001 | B40K385 | 385 | 505 | 40000 | 800 | 1.4 |
| B72260B0381K001 | B60K385 | 385 | 505 | 70000 | 1200 | 1.6 |
| B72280B0381K001 | B80K385 | 385 | 505 | 100000 | 2000 | 2.0 |
| $V_{RMS} = 420\text{ V}$ | | | | | | |
| B72232B0421K001 | B32K420 | 420 | 560 | 25000 | 600 | 1.2 |
| B72240B0421K001 | B40K420 | 420 | 560 | 40000 | 910 | 1.4 |
| B72260B0421K001 | B60K420 | 420 | 560 | 70000 | 1500 | 1.6 |
| B72280B0421K001 | B80K420 | 420 | 560 | 100000 | 2200 | 2.0 |
| $V_{RMS} = 440\text{ V}$ | | | | | | |
| B72232B0441K001 | B32K440 | 440 | 585 | 25000 | 630 | 1.2 |
| B72240B0441K001 | B40K440 | 440 | 585 | 40000 | 950 | 1.4 |
| B72260B0441K001 | B60K440 | 440 | 585 | 70000 | 1580 | 1.6 |
| B72280B0441K001 | B80K440 | 440 | 585 | 100000 | 2350 | 2.0 |
| $V_{RMS} = 460\text{ V}$ | | | | | | |
| B72232B0461K001 | B32K460 | 460 | 615 | 25000 | 660 | 1.2 |
| B72240B0461K001 | B40K460 | 460 | 615 | 40000 | 1000 | 1.4 |
| B72260B0461K001 | B60K460 | 460 | 615 | 70000 | 1650 | 1.6 |
| B72280B0461K001 | B80K460 | 460 | 615 | 100000 | 2500 | 2.0 |
| $V_{RMS} = 550\text{ V}$ | | | | | | |
| B72232B0551K001 | B32K550 | 550 | 745 | 25000 | 620 | 1.2 |
| B72240B0551K001 | B40K550 | 550 | 745 | 40000 | 960 | 1.4 |
| B72260B0551K001 | B60K550 | 550 | 745 | 70000 | 1500 | 1.6 |
| B72280B0551K001 | B80K550 | 550 | 745 | 100000 | 3100 | 2.0 |
| $V_{RMS} = 680\text{ V}$ | | | | | | |
| B72232B0681K001 | B32K680 | 680 | 895 | 25000 | 760 | 1.2 |
| B72240B0681K001 | B40K680 | 680 | 895 | 40000 | 1100 | 1.4 |
| B72260B0681K001 | B60K680 | 680 | 895 | 70000 | 1800 | 1.6 |
| B72280B0681K001 | B80K680 | 680 | 895 | 100000 | 3600 | 2.0 |

Varistor elements without plastic housing (suitable for soldering) are available upon request.


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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 |
|--------------------------------|-------------------------------|--------------------------------|--|---------------------|-----------------------------------|
| V_{RMS} = 385 V | | | | | |
| B72232B0381K001 | 620 | ±10 | 1025 | 200 | 1400 |
| B72240B0381K001 | 620 | ±10 | 1025 | 300 | 1900 |
| B72260B0381K001 | 620 | ±10 | 1025 | 500 | 4600 |
| B72280B0381K001 | 620 | ±10 | 1025 | 800 | 9000 |
| V_{RMS} = 420 V | | | | | |
| B72232B0421K001 | 680 | ±10 | 1120 | 200 | 1300 |
| B72240B0421K001 | 680 | ±10 | 1120 | 300 | 1800 |
| B72260B0421K001 | 680 | ±10 | 1120 | 500 | 4300 |
| B72280B0421K001 | 680 | ±10 | 1120 | 800 | 8500 |
| V_{RMS} = 440 V | | | | | |
| B72232B0441K001 | 715 | ±10 | 1180 | 200 | 1250 |
| B72240B0441K001 | 715 | ±10 | 1180 | 300 | 1700 |
| B72260B0441K001 | 715 | ±10 | 1180 | 500 | 4100 |
| B72280B0441K001 | 715 | ±10 | 1180 | 800 | 8100 |
| V_{RMS} = 460 V | | | | | |
| B72232B0461K001 | 750 | ±10 | 1240 | 200 | 1200 |
| B72240B0461K001 | 750 | ±10 | 1240 | 300 | 1600 |
| B72260B0461K001 | 750 | ±10 | 1240 | 500 | 3900 |
| B72280B0461K001 | 750 | ±10 | 1240 | 800 | 7700 |
| V_{RMS} = 550 V | | | | | |
| B72232B0551K001 | 910 | ±10 | 1500 | 200 | 1000 |
| B72240B0551K001 | 910 | ±10 | 1500 | 300 | 1400 |
| B72260B0551K001 | 910 | ±10 | 1500 | 500 | 3300 |
| B72280B0551K001 | 910 | ±10 | 1500 | 800 | 6500 |
| V_{RMS} = 680 V | | | | | |
| B72232B0681K001 | 1100 | ±10 | 1815 | 200 | 830 |
| B72240B0681K001 | 1100 | ±10 | 1815 | 300 | 1100 |
| B72260B0681K001 | 1100 | ±10 | 1815 | 500 | 2600 |
| B72280B0681K001 | 1100 | ±10 | 1815 | 800 | 5200 |

Varistor elements without plastic housing (suitable for soldering) are available upon request.


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

| Ordering code | Type | V_{RMS} V | V_{DC} V | i_{max} (8/20 μ s) A | W_{max} (2 ms) J | P_{max} W |
|---------------------------|------------------------|----------------|---------------|----------------------------------|--------------------------|----------------|
| $V_{RMS} = 750\text{ V}$ | | | | | | |
| B72232B0751K001 | B32K750 | 750 | 970 | 25000 | 800 | 1.2 |
| B72240B0751K001 | B40K750 | 750 | 970 | 40000 | 1200 | 1.4 |
| B72260B0751K001 | B60K750 | 750 | 970 | 70000 | 2000 | 1.6 |
| B72280B0751K001 | B80K750 | 750 | 970 | 100000 | 4000 | 2.0 |
| $V_{RMS} = 1100\text{ V}$ | | | | | | |
| B72260B0102K001 | B60K1000 ¹⁾ | 1100 | 1465 | 70000 | 3000 | 1.6 |
| B72280B0112K001 | B80K1100 | 1100 | 1465 | 100000 | 6000 | 2.0 |

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

| 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 |
|---------------------------|----------------------|-----------------------------|-------------------------------|------------|----------------------------|
| $V_{RMS} = 750\text{ V}$ | | | | | |
| B72232B0751K001 | 1200 | ± 10 | 2000 | 200 | 800 |
| B72240B0751K001 | 1200 | ± 10 | 2000 | 300 | 1000 |
| B72260B0751K001 | 1200 | ± 10 | 2000 | 500 | 2400 |
| B72280B0751K001 | 1200 | ± 10 | 2000 | 800 | 4800 |
| $V_{RMS} = 1100\text{ V}$ | | | | | |
| B72260B0102K001 | 1800 | ± 10 | 2970 | 500 | 1600 |
| B72280B0112K001 | 1800 | ± 10 | 2970 | 800 | 3200 |

Varistor elements without plastic housing (suitable for soldering) are available upon request.

1) Operating voltage differs from type designation



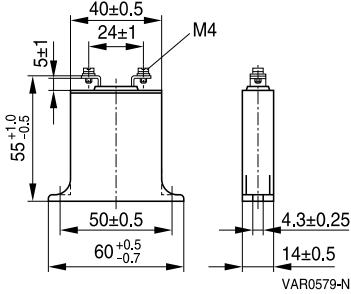
Block varistors

B722*

HighE series

Dimensional drawings

SIOV-B32/-B40



Weight

| Nominal diameter mm | V _{RMS} V | Weight g |
|------------------------|-----------------------|-------------|
| 32 | 130 ... 750 | 45 |
| 40 | 75 ... 750 | 50 |
| 60 | 130 ... 1100 | 250 |
| 80 | 130 ... 1100 | 650 |

SIOV-B60



SIOV-B80



Dimensions in mm


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 |
| Max. DC operating voltage | The maximum allowable DC operating voltage V_{DC} at UCT +5/-0 °C is applied for 1000 \pm 48 h. The leakage current I_{leak} (t) during test is recorded. 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. | I_{leak} (t = 1000 h) \leq I_{leak} (t = 0 h) $ \Delta V/V$ (1 mA) \leq 10% |
| Surge current derating, 8/20 μ s | 10 surge currents (8/20 μ s), unipolar, interval \geq 60 s, amplitude corresponding to derating curve for 10 impulses at 20 μ s | $ \Delta V/V$ (1 mA) \leq 10% (measured in direction of surge current) No visible damage |
| Fast temperature cycling | IEC 60068-2-14, test Na, LCT/UCT, dwell time 120 min, 5 cycles | $ \Delta V/V$ (1 mA) \leq 10% No visible damage |
| Damp heat, steady state | IEC 60068-2-78 The specimen shall be subjected to 40 \pm 2 °C, 90 to 95% r. H. for 56 \pm 2 days 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. | $ \Delta V/V$ (1 mA) \leq 10% |

Note:

UCT = Upper category temperature

LCT = Lower category temperature



v/i characteristics

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



SIOV-B32K130 ... K750



v/i characteristics

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

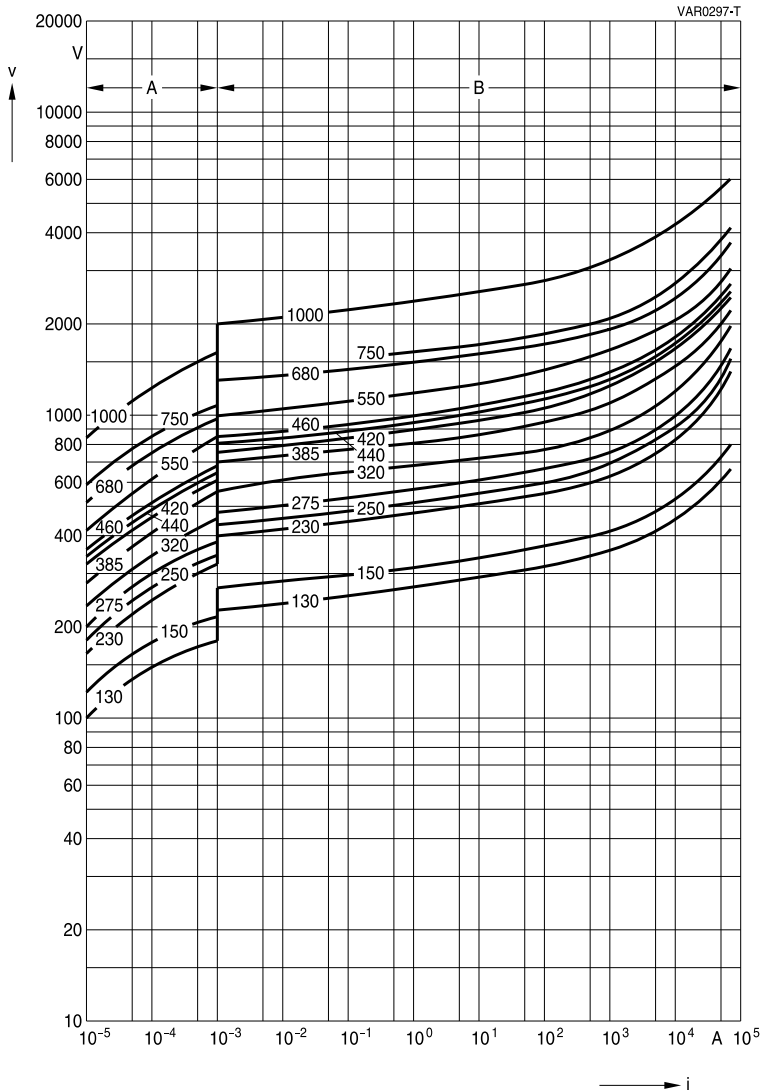


SIOV-B40K75 ... K750



v/i characteristics

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



SIOV-B60K130 ... K1000



v/i characteristics

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



SIOV-B80K130 ... K1100



Derating curves

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

For explanation of the derating curves refer to "General technical information", section 1.8.1



SIOV-B32K130 ... K150

SIOV-B40K75



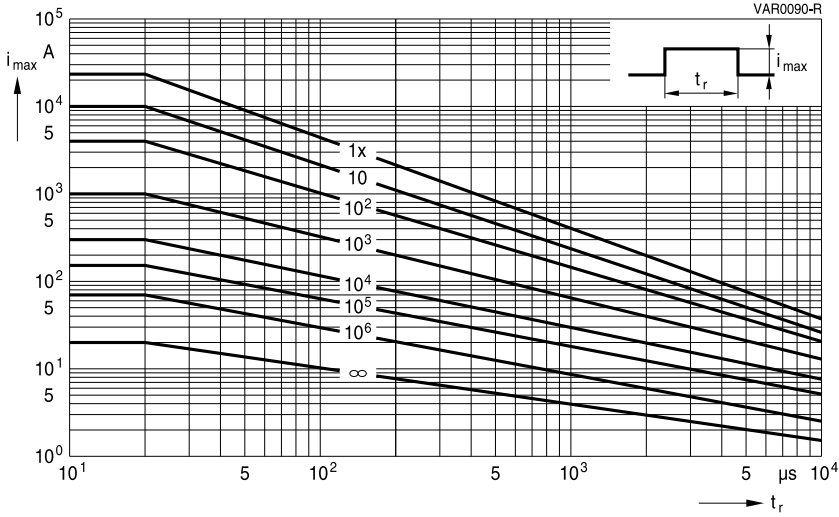
SIOV-B32K230 ... K460



Derating curves

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

For explanation of the derating curves refer to "General technical information", section 1.8.1



SIOV-B32K550 ... K750



SIOV-B40K130 ... K150



Derating curves

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

For explanation of the derating curves refer to "General technical information", section 1.8.1



SIOV-B40K230 ... K460



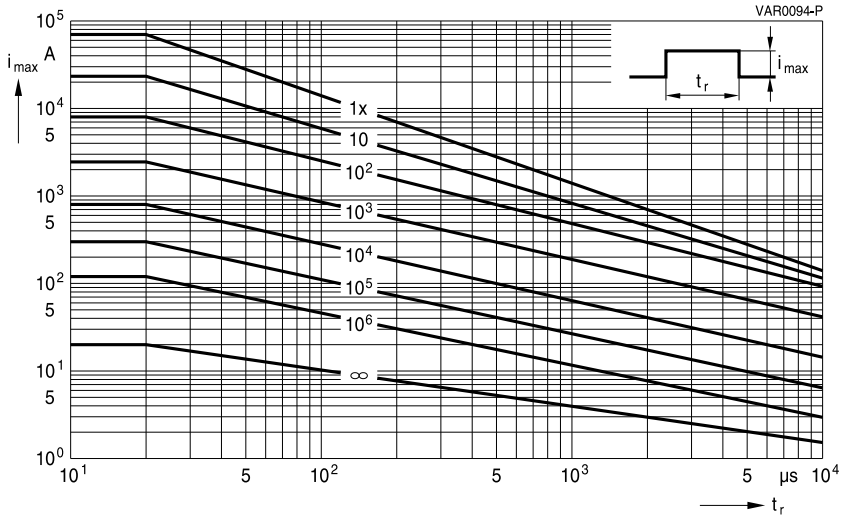
SIOV-B40K550 ... K750



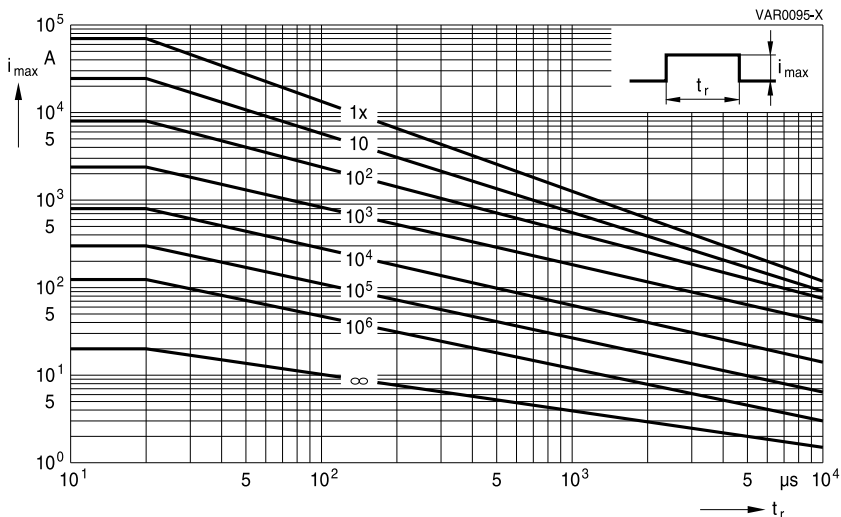
Derating curves

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

For explanation of the derating curves refer to "General technical information", section 1.8.1



SIOV-B60K130 ... K150



SIOV-B60K230 ... K460



Derating curves

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

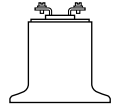
For explanation of the derating curves refer to "General technical information", section 1.8.1



SIOV-B60K550 ... K1000



SIOV-B80K130 ... K1100



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



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 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.**
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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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