



SIOV metal oxide varistors

Leaded varistors, Automotive series

Series/Type: S07, S10, S14, S20

Date: December 2007

Leaded varistors

Automotive series

Construction

- Round varistor element, leaded
- Coating: epoxy resin (D1: phenolic resin), flame-retardant to UL 94 V-0
- Terminals: tinned copper wire

Features

- High energy absorption, particularly for load dump
- Jump-start strength
- Stable protection level, minimum leakage current
- High resistance to cyclic temperature stress
- PSpice models
- High operating temperature range up to 125 °C

Delivery mode

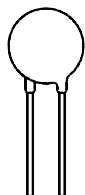
- Bulk (standard), taped versions on reel or in Ammo pack upon request.
- For further details refer to chapter "Taping, packaging and lead configuration" for leaded varistors.

General technical data

| | | | |
|-----------------------|-----------------------------------|------------------------------|-------------------|
| Climatic category | to IEC 60068-1 for ...D1 types | 40/85/56 40/125/56 | |
| Operating temperature | to CECC 42 000 for ...D1 types | -40 ... + 85 -40 ... +125 | °C |
| Storage temperature | for ...D1 types | -40 ... +125 -40 ... +150 | °C |
| Electric strength | to CECC 42 000 | ≥2.5 (not D1 types) | kV _{RMS} |
| Insulation resistance | to CECC 42 000 | ≥10 (not D1 types) | MΩ |
| Response time | | <25 | ns |


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Maximum ratings ($T_A = 85\text{ °C}$, $T_A = 125\text{ °C}$ for S...D1 types)

| Ordering code | Type (untaped) SIOV- | V_{RMS} V | V_{DC} V | i_{max} (8/20 μ s) A | W_{max} (2 ms) J | P_{max} W | W_{LD} (10x) J |
|----------------------------|----------------------------|----------------|---------------|----------------------------------|--------------------------|----------------|------------------------|
| 12-V supply systems | | | | | | | |
| B72207S1140K201 | S07K14AUTOS2D1 | 14 | 16 | 250 | 0.9 | 0.02 | 12 |
| B72210S1140K102 | S10K14AUTO | 14 | 16 | 500 | 2.0 | 0.05 | 25 |
| B72210S1140K501 | S10K14AUTOS5D1 | 14 | 16 | 500 | 2.0 | 0.05 | 25 |
| B72214S1140K102 | S14K14AUTO | 14 | 16 | 1000 | 4.0 | 0.10 | 50 |
| B72214S1140K501 | S14K14AUTOS5D1 | 14 | 16 | 1000 | 4.0 | 0.10 | 50 |
| B72220S1140K102 | S20K14AUTO | 14 | 16 | 2000 | 12.0 | 0.20 | 100 |
| B72210S1170K102 | S10K17AUTO | 17 | 20 | 500 | 2.5 | 0.05 | 25 |
| B72214S1170K102 | S14K17AUTO | 17 | 20 | 1000 | 5.0 | 0.10 | 50 |
| B72220S1170K102 | S20K17AUTO | 17 | 20 | 2000 | 14.0 | 0.20 | 100 |
| 24-V supply systems | | | | | | | |
| B72220S1250K102 | S20K25AUTO | 25 | 28 | 2000 | 22.0 | 0.20 | 100 |
| B72214S1300K102 | S14K30AUTO | 30 | 34 | 1000 | 9.0 | 0.10 | 50 |
| B72220S1300K102 | S20K30AUTO | 30 | 34 | 2000 | 26.0 | 0.20 | 100 |

**Leaded varistors****Automotive series****Characteristics** ($T_A = 25\text{ °C}$)

| Ordering code | V_{Jump} (5 min) V | V_V (1 mA) V | ΔV_V (1 mA) % | $V_{c, \text{max}}$ (i_c) V | i_c A | C_{typ} (1 kHz) nF |
|----------------------------|-----------------------------------|----------------------|-----------------------------|---------------------------------------|------------|-----------------------------------|
| 12-V supply systems | | | | | | |
| B72207S1140K201 | 25 | 22 | ± 10 | 43 | 2.5 | 2.3 |
| B72210S1140K102 | 25 | 22 | ± 10 | 43 | 5.0 | 5.2 |
| B72210S1140K501 | 25 | 22 | ± 10 | 43 | 5.0 | 5.2 |
| B72214S1140K102 | 25 | 22 | ± 10 | 43 | 10.0 | 10.0 |
| B72214S1140K501 | 25 | 22 | ± 10 | 43 | 10.0 | 10.0 |
| B72220S1140K102 | 25 | 22 | ± 10 | 43 | 20.0 | 19.0 |
| B72210S1170K102 | 30 | 27 | ± 10 | 53 | 5.0 | 4.4 |
| B72214S1170K102 | 30 | 27 | ± 10 | 53 | 10.0 | 8.2 |
| B72220S1170K102 | 30 | 27 | ± 10 | 53 | 20.0 | 15.6 |
| 24-V supply systems | | | | | | |
| B72220S1250K102 | 40 | 39 | ± 10 | 77 | 20.0 | 11.1 |
| B72214S1300K102 | 45 | 47 | ± 10 | 93 | 10.0 | 5.0 |
| B72220S1300K102 | 45 | 47 | ± 10 | 93 | 20.0 | 9.4 |

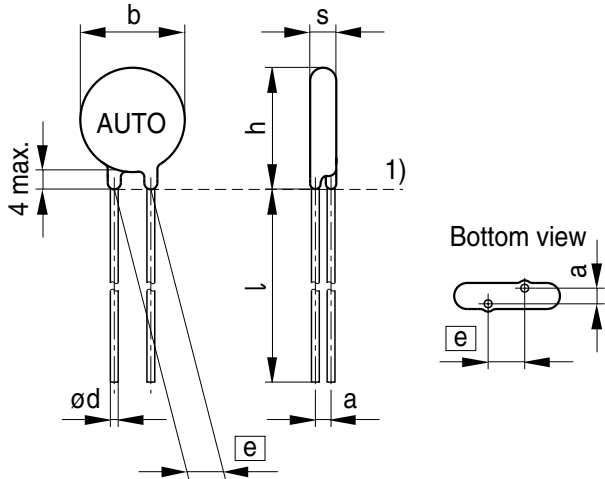
Notes

- If the maximum loads specified for load dump and jump start are fully utilized, subsequent polarity reversal of the AUTO varistors is inadmissible.
- If the load remains under the maximum ratings, polarity reversal may be admissible. Contact EPCOS for consultancy on this kind of problem.
- Load dump or jump start can decrease the varistor voltage in load direction by max. 15%.
- Load dump: min. time of energy input 40 ms, interval 60 s.



Leaded varistors
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Dimensional drawing



1) Seating plane to IEC 60717

VAR0401-Y

Weight

| Nominal diameter mm | V _{RMS} V | Weight g |
|------------------------|-----------------------|-------------|
| 7 | 14 | 0.6 ... 0.8 |
| 10 | 14; 17 | 1.0 ... 2.0 |
| 14 | 14; 17; 30 | 2.0 ... 4.0 |
| 20 | 14; 17; 25; 30 | 3.0 ... 6.0 |

Dimensions

| Ordering code | $e \pm 1$ mm | $a \pm 1$ mm | b_{max} mm | s_{max} mm | h_{max} mm | l_{min} mm | $d \pm 0.05$ mm |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|--------------------|
| B72207S1140K201 | 5.0 | 1.3 | 9.0 | 3.5 | 12.5 | 25.0 | 0.6 |
| B72210S1140K102 | 7.5 | 1.5 | 13.0 | 5.0 | 16.5 | 25.0 | 0.8 |
| B72210S1140K501 | 7.5 | 1.5 | 12.0 | 4.0 | 16.0 | 25.0 | 0.8 |
| B72214S1140K102 | 7.5 | 1.5 | 17.0 | 5.0 | 20.5 | 25.0 | 0.8 |
| B72214S1140K501 | 7.5 | 1.5 | 16.0 | 4.0 | 20.0 | 25.0 | 0.8 |
| B72220S1140K102 | 10.0 | 1.6 | 23.0 | 5.4 | 27.5 | 25.0 | 1.0 |
| B72210S1170K102 | 7.5 | 1.6 | 13.0 | 5.1 | 16.5 | 25.0 | 0.8 |
| B72214S1170K102 | 7.5 | 1.7 | 17.0 | 5.1 | 20.5 | 25.0 | 0.8 |
| B72220S1170K102 | 10.0 | 1.6 | 23.0 | 5.6 | 27.5 | 25.0 | 1.0 |
| B72220S1250K102 | 10.0 | 2.9 | 23.0 | 6.2 | 27.5 | 25.0 | 1.0 |
| B72214S1300K102 | 7.5 | 1.8 | 17.0 | 5.3 | 20.5 | 25.0 | 0.8 |
| B72220S1300K102 | 10.0 | 3.2 | 23.0 | 6.5 | 27.5 | 25.0 | 1.0 |

For crimp styles S2 and S5 refer to chapter "Taping, packaging and lead configuration".



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Reliability data

| Test | Test methods/conditions | Requirement |
|---------------------------|--|--|
| Varistor voltage | The voltage between two terminals with the specified measuring current applied is called V_V (1 mA _{DC} @ 0.2 ... 2 s). | To meet the specified value. |
| Clamping voltage | The maximum voltage between two terminals with the specified standard impulse current (8/20 μs) applied. | To meet the specified value. |
| Max. DC operating voltage | MIL STD 202F, method 108A, UCT, V _{DC} , 1000 h | $ \Delta V/V (1 \text{ mA}) \leq 10\%$ No visible damage |
| Load dump | ISO 7637-1, test pulse 5 ("load dump") (DIN 40 839 Part 1; impulse 5) 7 mm varistors (S07K...AUTO...): 10 × 12 J 10 mm varistors (S10K...AUTO...): 10 × 25 J 14 mm varistors (S14K...AUTO...): 10 × 50 J 20 mm varistors (S20K...AUTO...): 10 × 100 J (minimum 40 ms time of energy input, 60 s interval) | $\Delta V/V (1 \text{ mA}) \leq 15\%$ No visible damage |
| Jump start | V _{DC, load} = V _{jump} ; 5 min duration 14 V (S...K14AUTO...); V _{jump} = 25 V 17 V (S...K17AUTO...); V _{jump} = 30 V 25 V (S...K25AUTO...); V _{jump} = 40 V 30 V (S...K30AUTO...); V _{jump} = 45 V | $\Delta V/V (1 \text{ mA}) \leq 15\%$ No visible damage |
| Fast temperature cycling | IEC 60068-2-14, test Na, LCT/UCT, dwell time 15 min, 100 cycles for SIOV...AUTO types and dwell time 15 min, 1000 cycles for SIOV...AUTOD1 types | $ \Delta V/V (1 \text{ mA}) \leq 5\%$ No visible damage |
| Damp heat, steady state | IEC 60068-2-67, test Cy, 85% r. H., V _{DC} , 1000 h | $ \Delta V/V (1 \text{ mA}) \leq 10\%$ No visible damage |

Note:

UCT = Upper category temperature
LCT = Lower category temperature



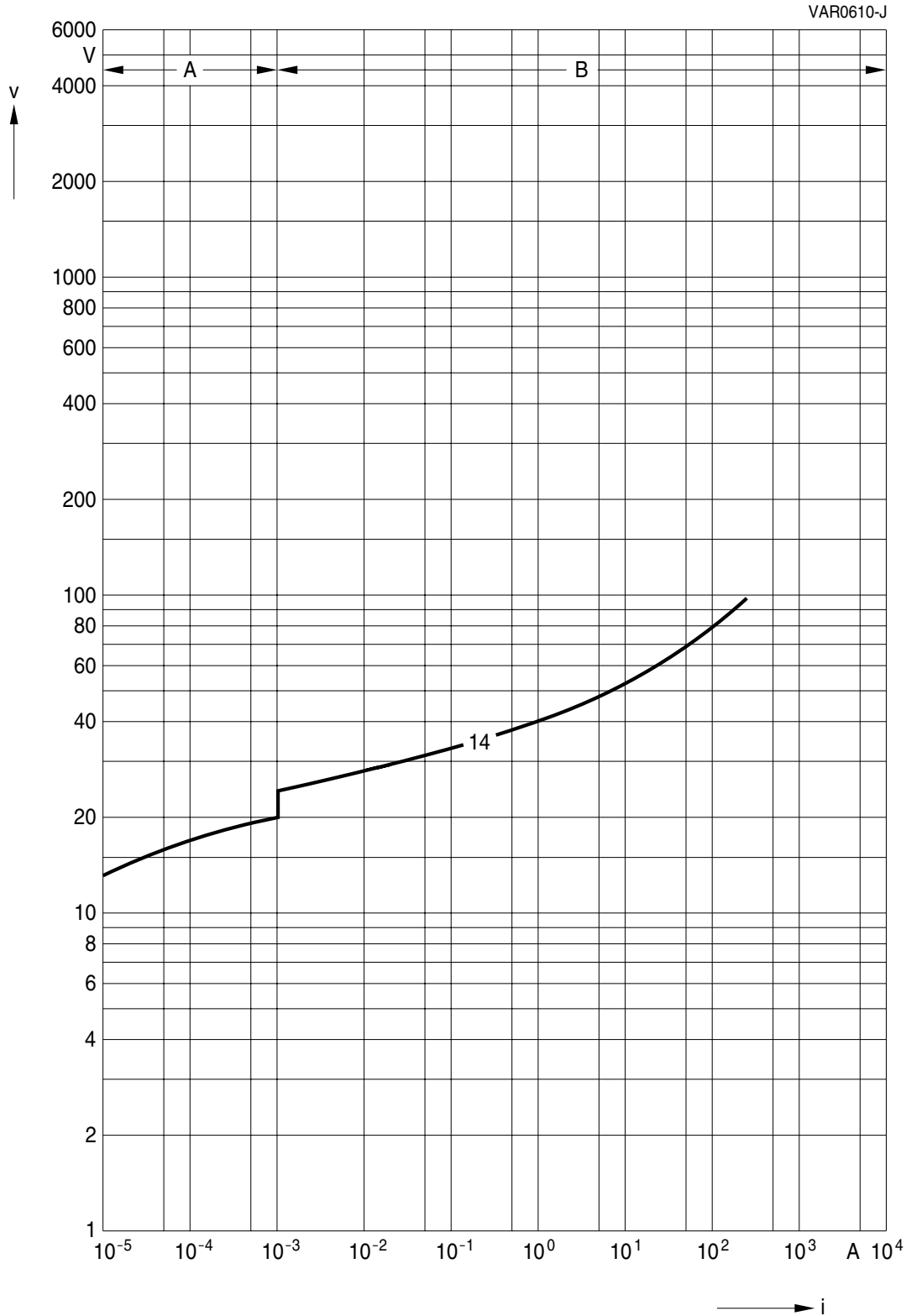
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v/i characteristics

$v = f(i)$ – 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-S07 ... D1



Leaded varistors

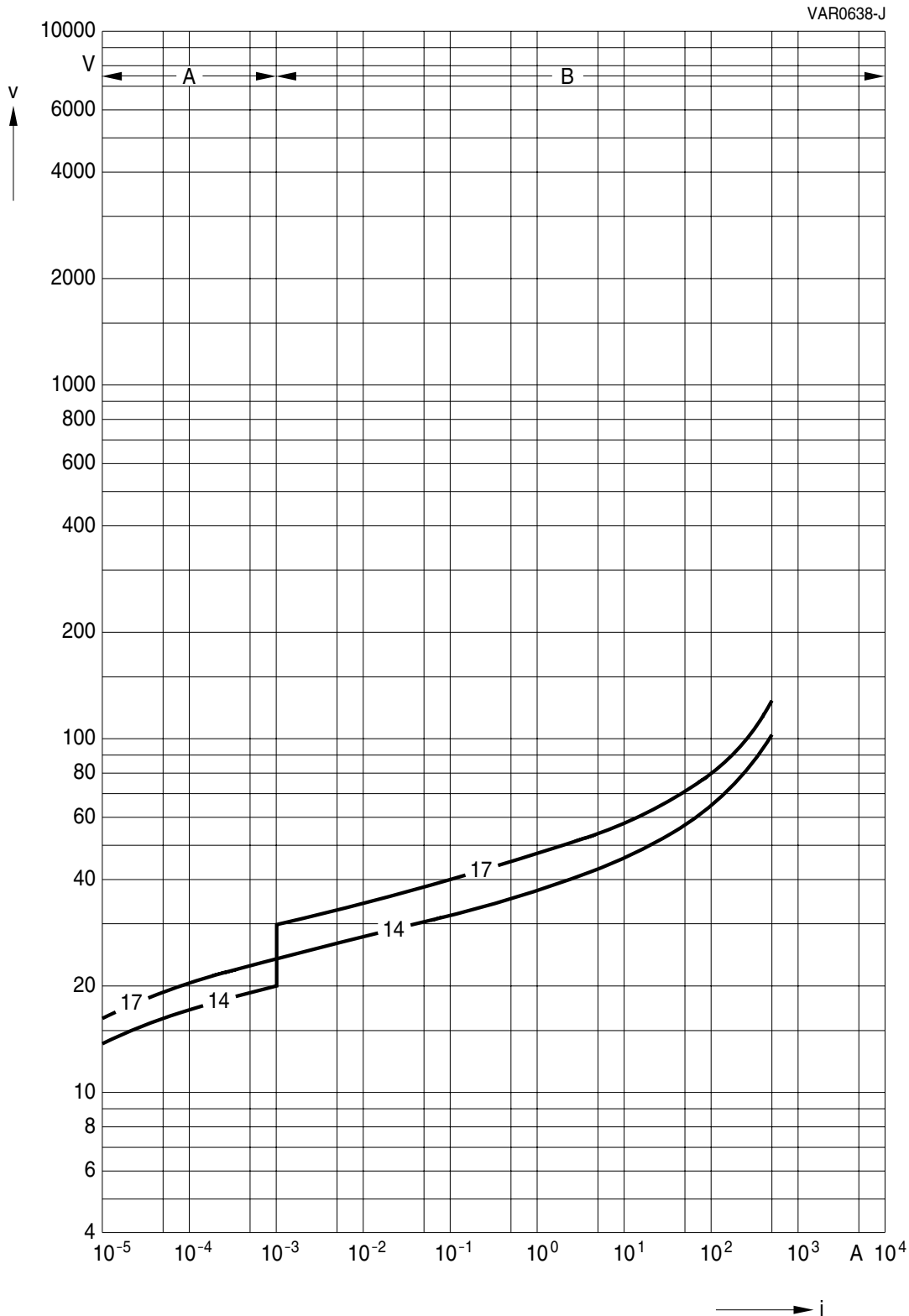
Automotive series

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-S10 ... (AUTO)(D1)



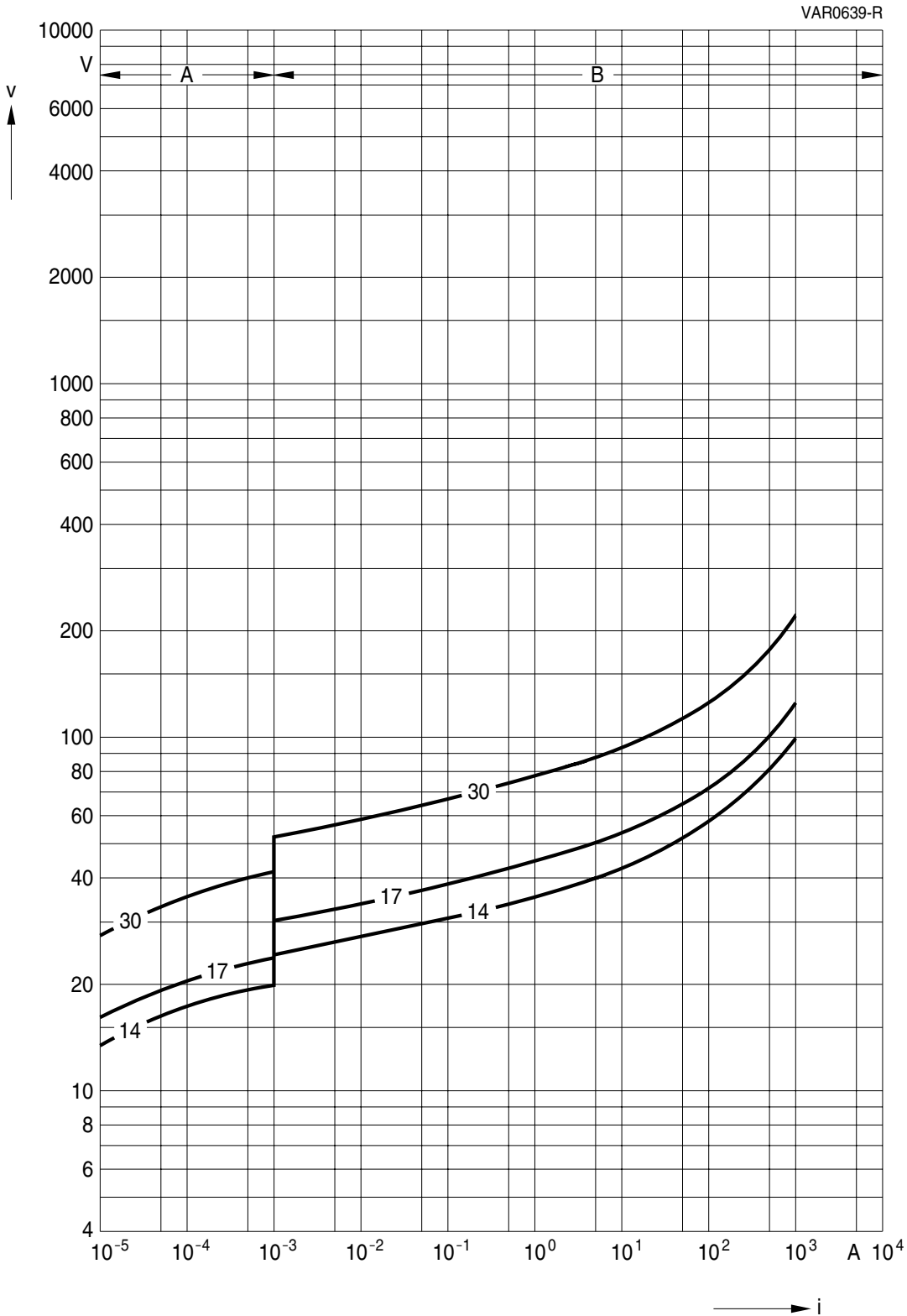
Leaded varistors
Automotive series

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-S14 ... (AUTO)(D1)



Leaded varistors

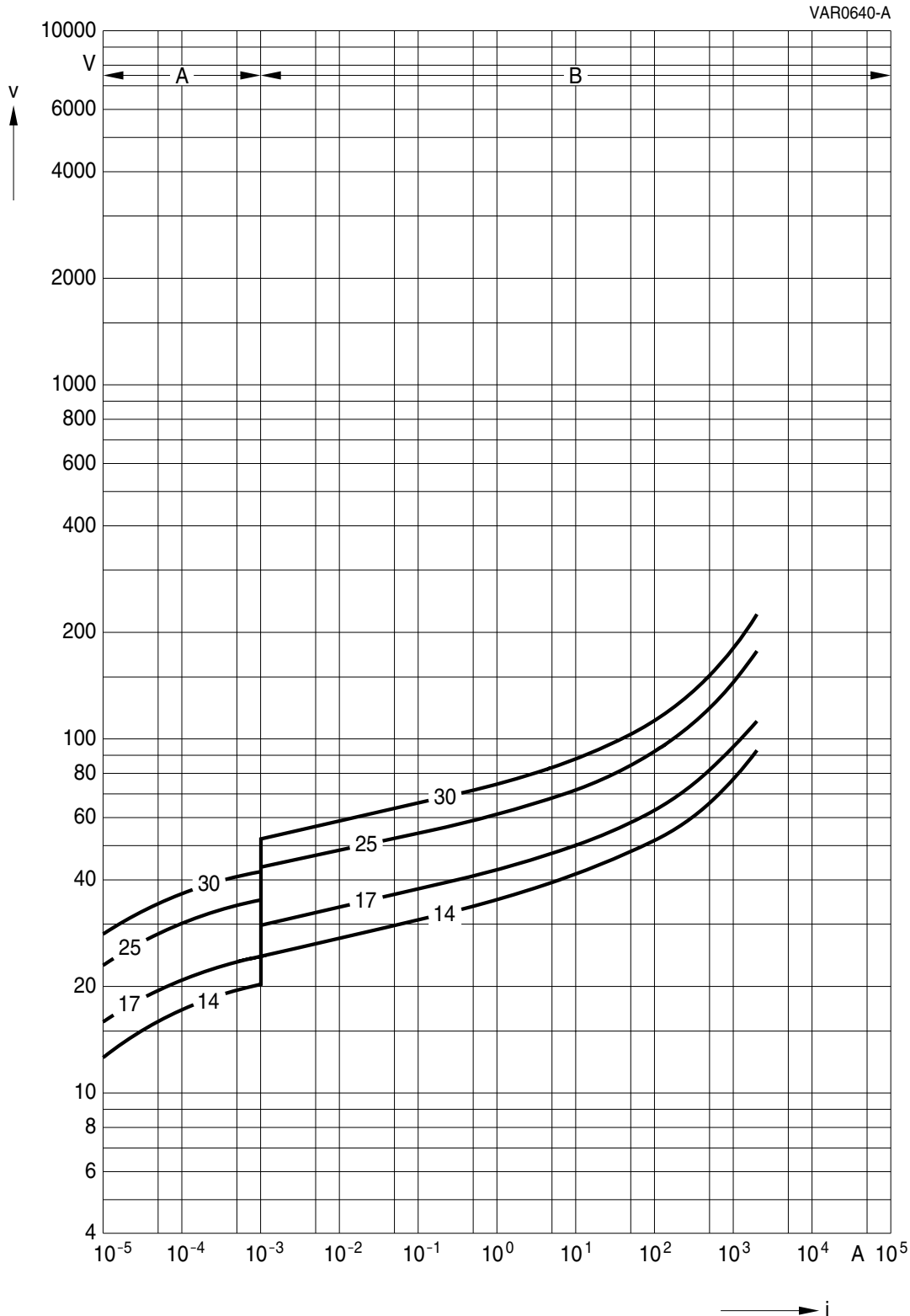
Automotive series

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-S20 ... AUTO

Please read *Cautions and warnings* and *Important notes* at the end of this document.

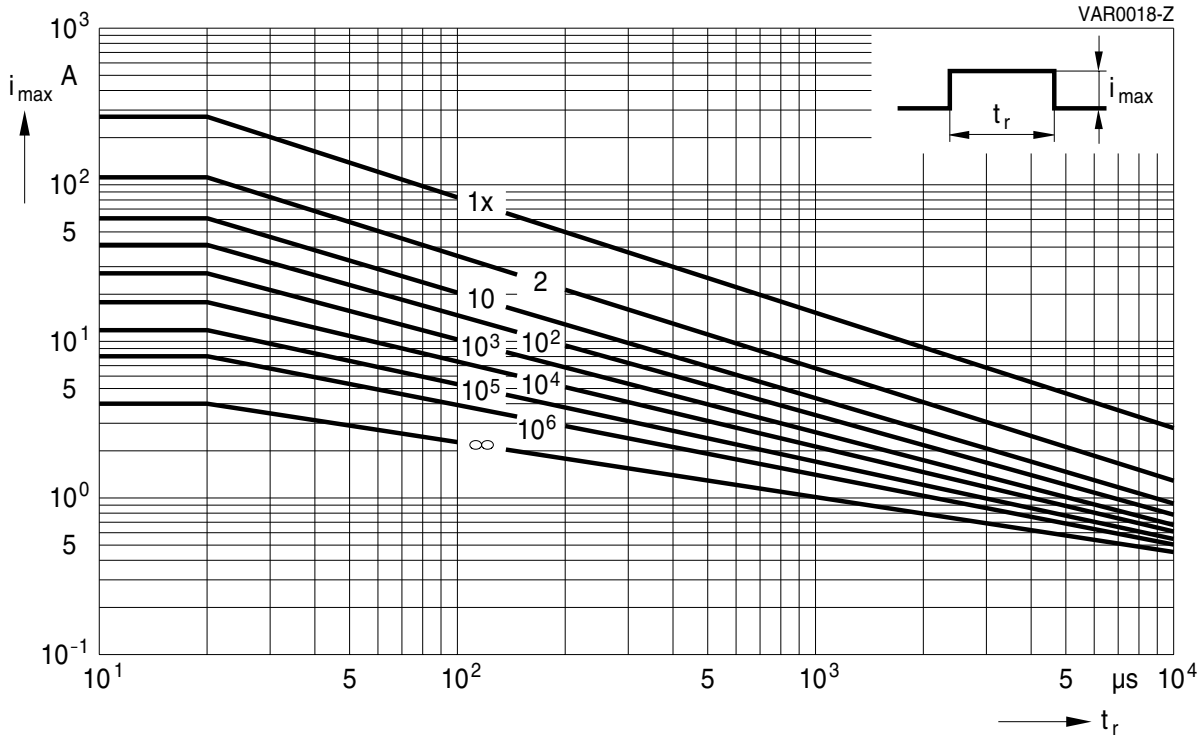


Leaded varistors
Automotive series

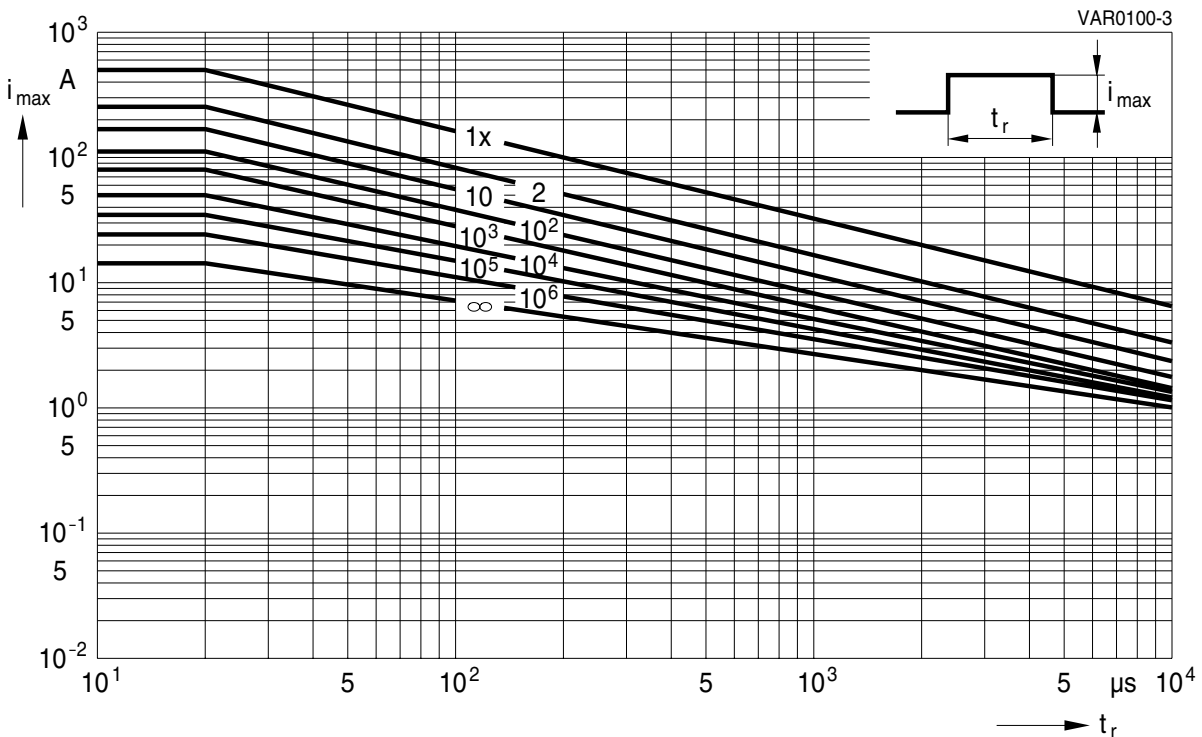
Derating curves

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

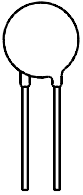


SIOV-S07K14AUTOS2D1



SIOV-S10K14AUTO ... K17AUTO

SIOV-S10K14AUTOS5D1

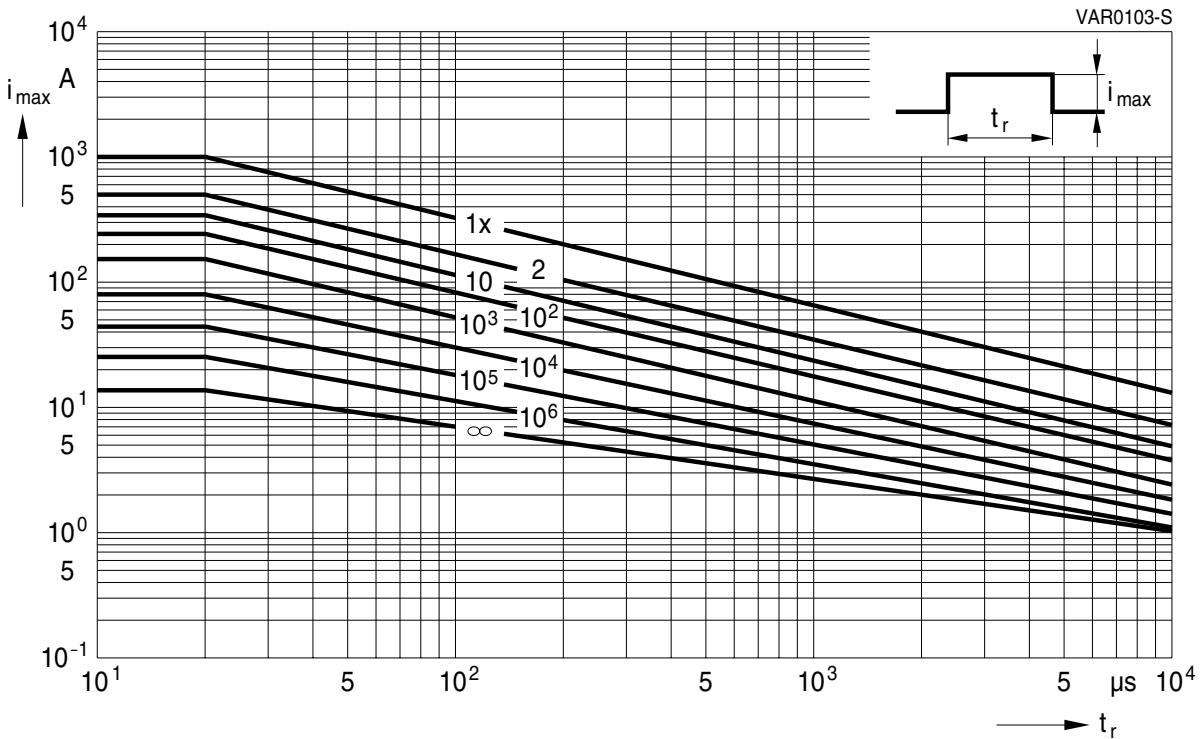


Leaded varistors
Automotive series

Derating curves

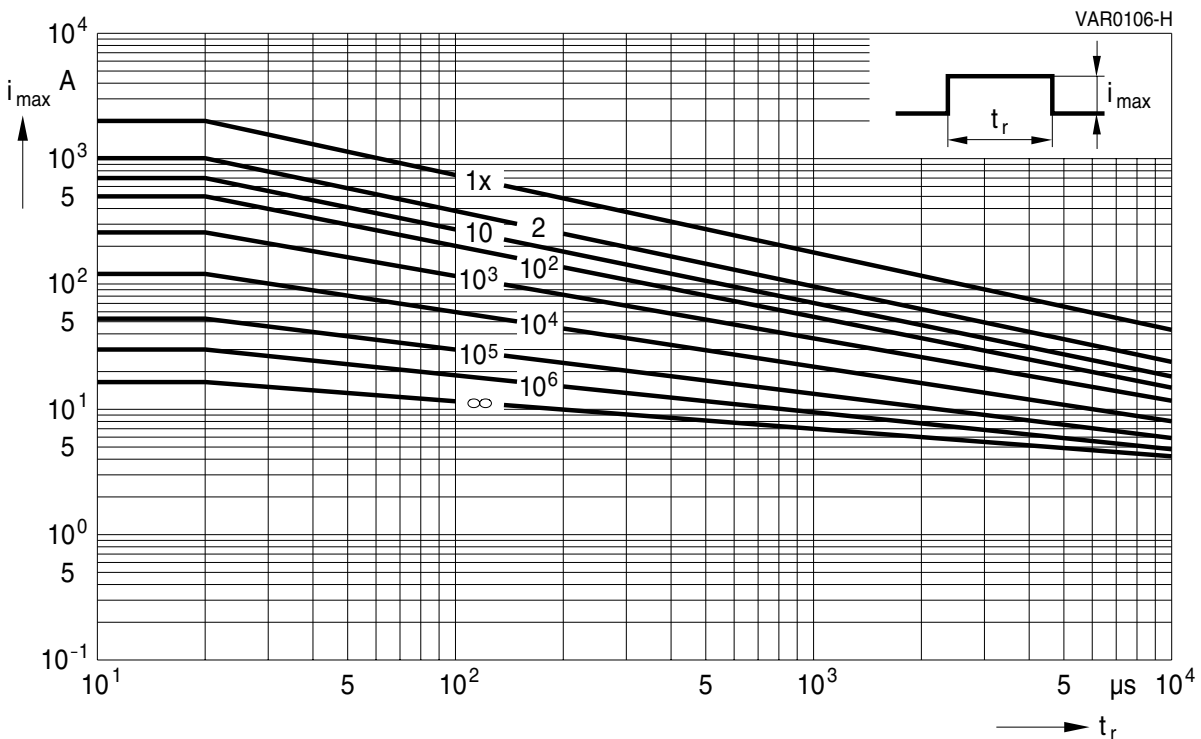
Maximum surge current $i_{max} = f(t_r, \text{pulse train})$

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



SIOV-S14K14AUTO ... K30AUTO

SIOV-S14K14AUTOS5D1



SIOV-S20K14AUTO ... K30AUTO

Cautions and warnings

General

1. EPCOS metal oxide varistors (SIOVs) 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 before storage.
2. 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 surface 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 within the time specified:
SIOV-S, -Q, -LS 24 months
ETFV and SFS types 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.

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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 the presence of deoxidizing gases (chlorine gas, hydrogen sulfide gas, ammonia gas, sulfuric acid gas, etc), corrosive agents, humid or salty conditions. Avoid contact with any liquids and solvents.

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