



## **SIOV metal oxide varistors**

Leaded varistors, Telecom series

**Series/Type:** S07 ... AGS2  
**Date:** December 2007

**Leaded varistors**
**Telecom series**
**Construction**

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

**Features**

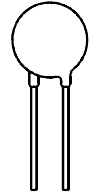
- Suitable for handling the surge current of the 10/700  $\mu$ s pulse to ITU-T and IEC 1000-4-5
- Suitable for handling the increased surge voltage according to the directives of Germany's Central Telecommunications Engineering Bureau (FTZ)
- Matched to line conditions with or without superimposed ringing voltage
- PSpice models

**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	40/85/56	
Operating temperature	to CECC 42 000	-40 ... + 85	°C
Storage temperature		-40 ... +125	°C
Electric strength	to CECC 42 000	$\geq 2.5$	kV <sub>RMS</sub>
Insulation resistance	to CECC 42 000	$\geq 10$	M $\Omega$
Response time		<25	ns



**Leaded varistors**  
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**Maximum ratings** ( $T_A = 85\text{ °C}$ )

Ordering code	Type	$V_{RMS}$	$V_{DC}$	$i$ ( $10 \times$ ) 10/700 $\mu\text{s}$ A <sup>1)</sup>	$i_{max}$ (8/20 $\mu\text{s}$ ) A	$W_{max}$ (2 ms) J	$P_{max}$ W
B72207S0600S212	S07S60AGS2	60	85	45	1200	4.8	0.25
B72207S0950S212	S07S95AGS2	95	125	45	1200	7.6	0.25

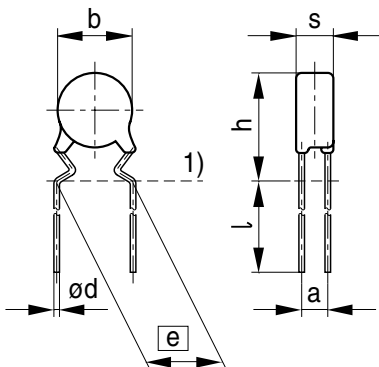
**Characteristics** ( $T_A = 25\text{ °C}$ )

Ordering code	Type	$V_v$ (1 mA) V	$\Delta V_v$ (1 mA) %	$v_{c, max}$ ( $i_c$ ) V	$i_c$ A	$C_{typ}$ (1 kHz) pF
B72207S0600S212	S07S60AGS2	100	+18/-1	200	45	480
B72207S0950S212	S07S95AGS2	150	+10/-2	270	45	260

**Note**

In addition to the telecom varistors listed above, all varistors of the standard series can be used for telecom applications if the selection criteria are considered.

**Dimensional drawing**



1) Seating plane to IEC 60717

VAR0409-K

**Dimensions**

Ordering code	$e$ +0.6/-0.1 mm	$a \pm 1$ mm	$b_{max}$ mm	$s_{max}$ mm	$h_{max}$ mm	$l_{min}$ mm	$d$ mm
B72207S0600S212	5.0	1.2	9.0	3.3	12.0	(*)	0.6
B72207S0950S212	5.0	1.3	9.0	3.4	12.0	(*)	0.6

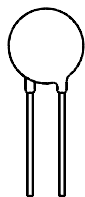
For (\*) see chapter "Taping, packaging and lead configuration".

**Weight**

Nominal diameter mm	$V_{RMS}$ V	Weight g
7	60; 95	0.6 ... 0.8

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

1) The test circuit according to figure 15 in chapter "Application notes" yields a surge current amplitude of approx. 45 A.

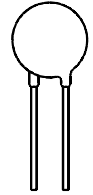


## Leaded varistors

### Telecom series

#### 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 <sub>DC</sub> @ 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 $\mu$ s) applied.	To meet the specified value.
Max. AC operating voltage	CECC 42 000, test 4.20 1000 h at UCT  After having continuously applied the maximum allowable voltage at UCT $\pm 2$ °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\%$
Surge current derating, 8/20 $\mu$ s	CECC 42 000, test C 2.1  100 surge currents (8/20 $\mu$ s), unipolar, interval 30 s, amplitude corresponding to derating curve for 100 impulses at 20 $\mu$ s	$ \Delta V/V (1 \text{ mA})  \leq 10\%$ (measured in direction of surge current) No visible damage
Surge current derating, 2 ms	CECC 42 000, test C 2.1  100 surge currents (2 ms), unipolar, interval 120 s, amplitude corresponding to derating curve for 100 impulses at 2 ms	$ \Delta V/V (1 \text{ mA})  \leq 10\%$ (measured in direction of surge current) No visible damage
Surge current derating, 10/700 $\mu$ s	IEC 61000-4-5  Pulse current testing: 10/700 $\mu$ s, open circuit voltage = 2 kV.  Number of pulses: 10 (5 times for each polarity). Pulse interval 60 s.	$ \Delta V/V (1 \text{ mA})  \leq 10\%$ No visible damage
Electric strength	CECC 42 000, test 4.7  Metal balls method, 2500 V <sub>RMS</sub> , 60 s  The varistor is placed in a container holding 1.6 $\pm$ 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


**Reliability data**

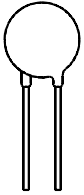
Test	Test methods/conditions	Requirement												
Climatic sequence	CECC 42 000, test 4.16 The specimen shall be subjected to: a) dry heat at UCT, 16 h b) damp heat, 1st cycle: 55 °C/25 °C, 93% r. H., 24 h c) cold, LCT, 2 h d) damp heat, additional 5 cycles: 55 °C/25 °C, 93% r. H., 24 h/cycle. Then 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 according to CECC 42 000, test 4.8 at $V = 500$ V.	$ \Delta V/V (1 \text{ mA})  \leq 10\%$ $R_{ins} \geq 1 \text{ M}\Omega$												
Fast temperature cycling	IEC 60068-2-14, test Na, LCT/UCT, dwell time 30 min, 5 cycles: The temperature cycle shown below shall be repeated 5 times. Then the specimen shall be stored at room temperature and normal humidity for 1 to 2 h. The change of $V_v$ and mechanical damage shall be examined. <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Step</th> <th>Temperature</th> <th>Period</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>LCT <math>\pm 3</math> °C</td> <td>30 <math>\pm 3</math> min</td> </tr> <tr> <td>2</td> <td>transition time</td> <td>&lt;10 s</td> </tr> <tr> <td>3</td> <td>UCT <math>\pm 2</math> °C</td> <td>30 <math>\pm 3</math> min</td> </tr> </tbody> </table>	Step	Temperature	Period	1	LCT $\pm 3$ °C	30 $\pm 3$ min	2	transition time	<10 s	3	UCT $\pm 2$ °C	30 $\pm 3$ min	$ \Delta V/V (1 \text{ mA})  \leq 5\%$ No visible damage
Step	Temperature	Period												
1	LCT $\pm 3$ °C	30 $\pm 3$ min												
2	transition time	<10 s												
3	UCT $\pm 2$ °C	30 $\pm 3$ min												
Damp heat, steady state	The specimen shall be subjected to 40 $\pm 2$ °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 according to CECC 42 000, test 4.8 at $V = 500$ V.	$ \Delta V/V (1 \text{ mA})  \leq 10\%$ $R_{ins} \geq 1 \text{ M}\Omega$												

**Note:**

UCT = Upper category temperature

LCT = Lower category temperature

 $R_{ins}$  = Insulation resistance to CECC 42 000, test 4.8



## Leaded varistors

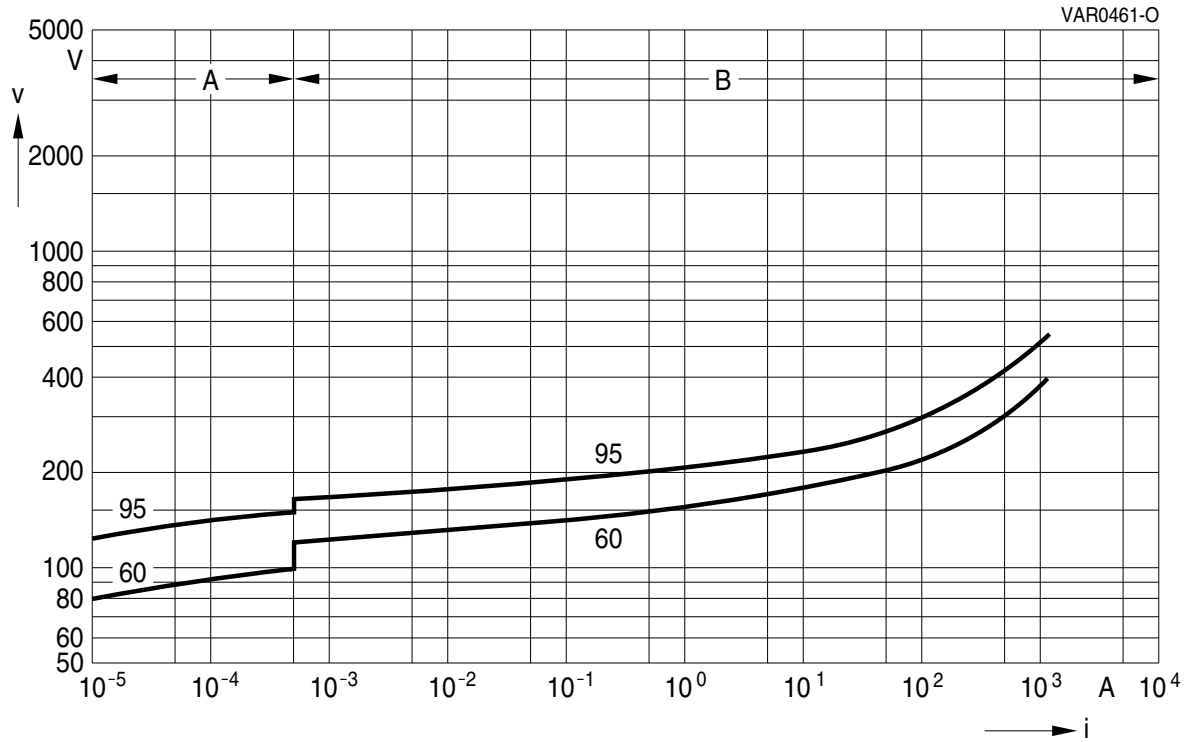
### Telecom series

#### v/i characteristics

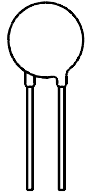
$v = f(i)$  – for explanation of the characteristics refer to “General technical information”, 1.6.3

A = Leakage current  
B = Protection level

for worst-case varistor tolerances



SIOV-S07S60AGS2, SIOV-S07S95AGS2

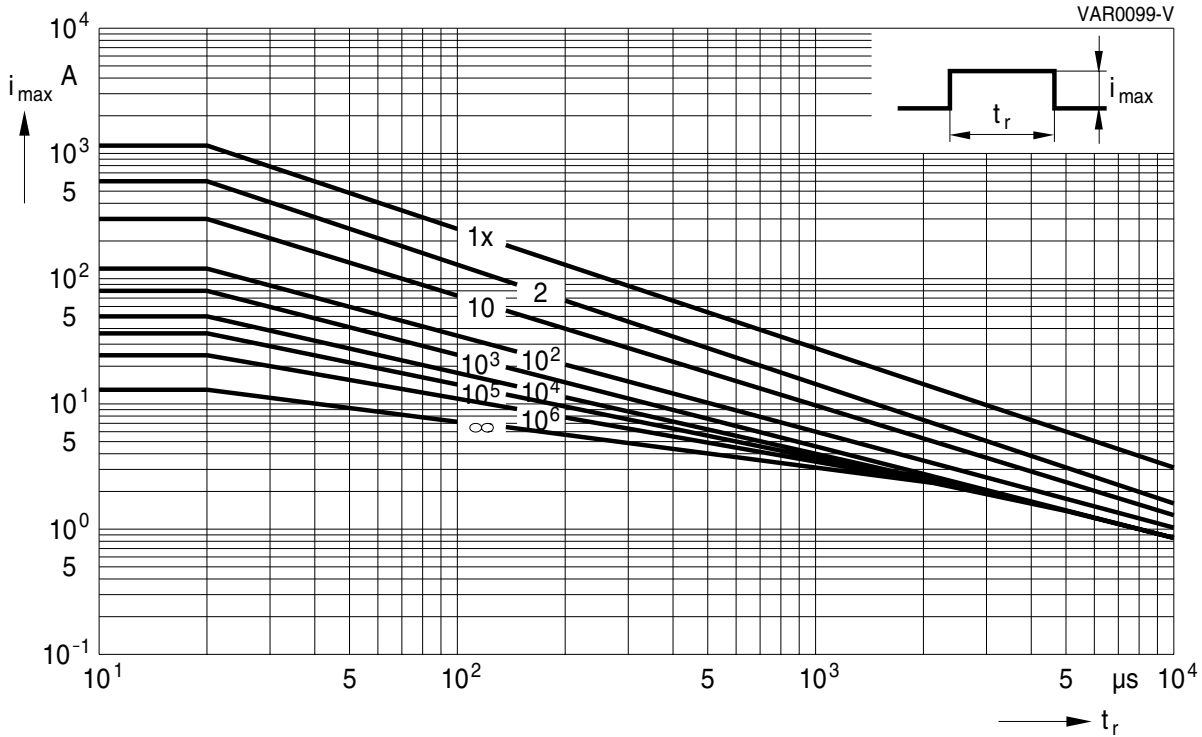


**Leaded varistors**  
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**Derating curves**

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-S07S60AGS2, SIOV-S07S95AGS2**

## 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.

## 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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