SIOV metal oxide varistors

Leaded varistors, Automotive series

Series/Type: **S07, S10, S14, S20**

Date: December 2007

Construction

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

Features

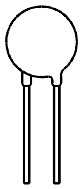
- High energy absorption, particularly for load dump
- Jump-start strength
- Stable protection level, minimum leakage current
- High resistance to cyclic temperature stress
- PSpice models
- High operating temperature range up to 125 °C

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.

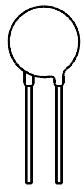
General technical data

Climatic category	to IEC 60068-1	40/85/56	
	for …D1 types	40/125/56	
Operating temperature	to CECC 42 000	–40 … + 85	°C
	for …D1 types	–40 … +125	
Storage temperature		–40 … +125	°C
	for …D1 types	–40 … +150	
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



Maximum ratings (T_A = 85 °C, T_A = 125 °C for S…D1 types)

Ordering code	Type (untaped) SIOV-	V_{RMS} V	V_{DC} V	i_{max} (8/20 µs) 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

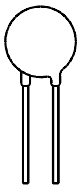


Characteristics (T_A = 25 °C)

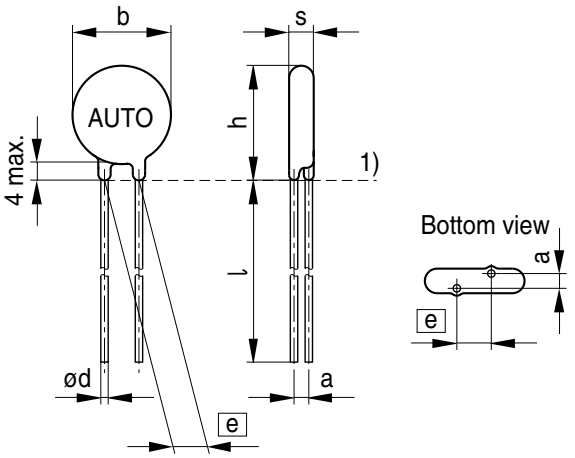
Ordering code	V_{Jump} (5 min) V	V_v (1 mA) V	ΔV_v (1 mA) %	$v_{c, max}$ (i_c) V	i_c A	C_{typ} (1 kHz) nF
12-V supply systems						
B72207S1140K201	25	22	±10	43	2.5	2.3
B72210S1140K102	25	22	±10	43	5.0	5.2
B72210S1140K501	25	22	±10	43	5.0	5.2
B72214S1140K102	25	22	±10	43	10.0	10.0
B72214S1140K501	25	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.



Dimensional drawing



1) Seating plane to IEC 60717

VAR0401-Y

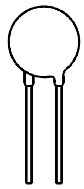
Weight

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 ±1 mm	a ±1 mm	b_{max} mm	s_{max} mm	h_{max} mm	l_{min} mm	d ±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”.

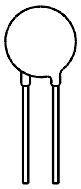


Reliability data

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	$\lvert\Delta V/V$ (1 mA)$\rvert \leq 10\%$ 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 mA) ≤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 mA) ≤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	$\lvert\Delta V/V$ (1 mA)$\rvert \leq 5\%$ No visible damage
Damp heat, steady state	IEC 60068-2-67, test Cy, 85% r. H., V_{DC}, 1000 h	$\lvert\Delta V/V$ (1 mA)$\rvert \leq 10\%$ No visible damage

Note:

UCT = Upper category temperature
LCT = Lower category temperature

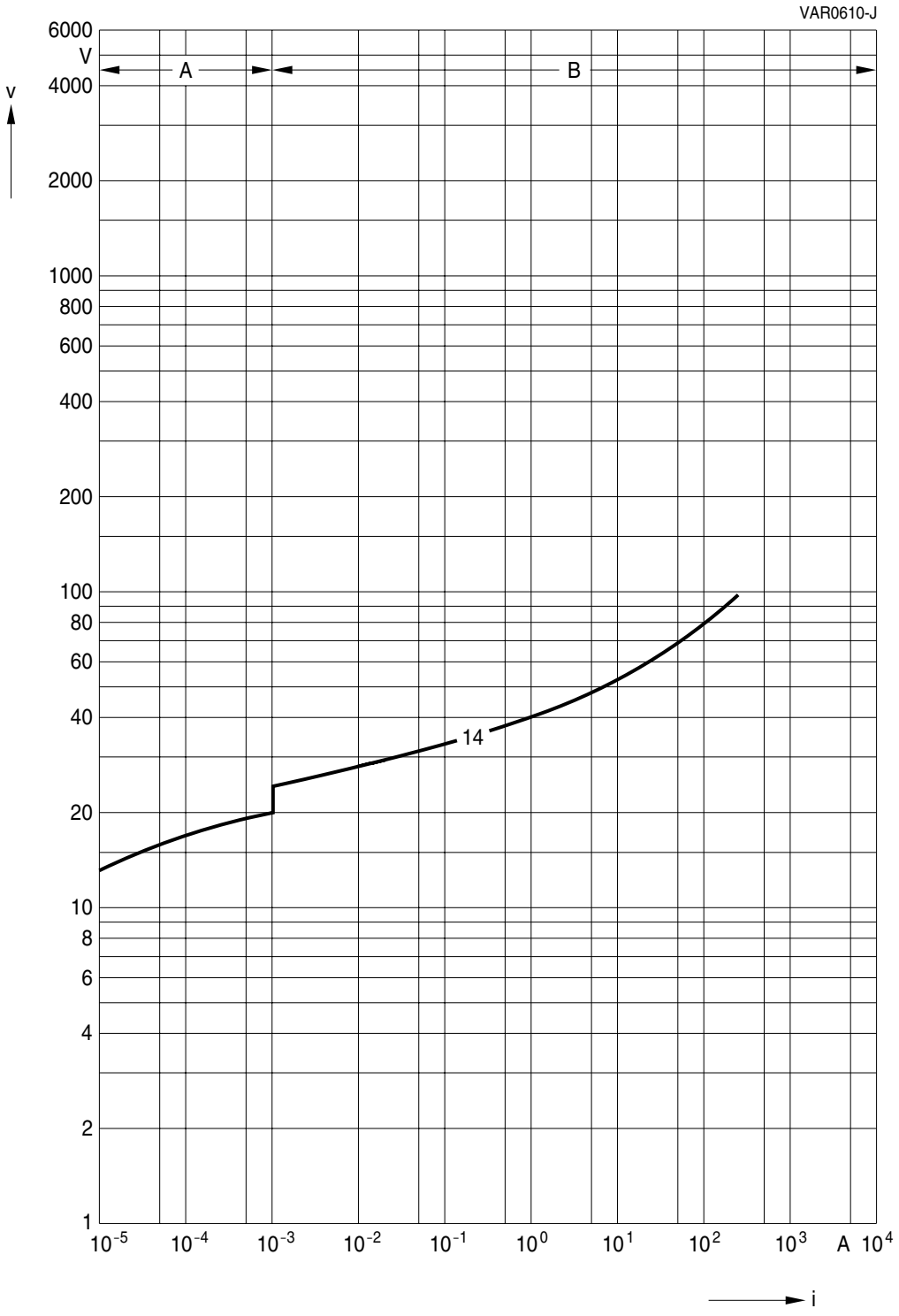


v/i characteristics

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

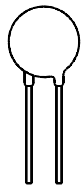
A = Leakage current
B = Protection level

} for worst-case varistor tolerances



SIOV-S07 … D1

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



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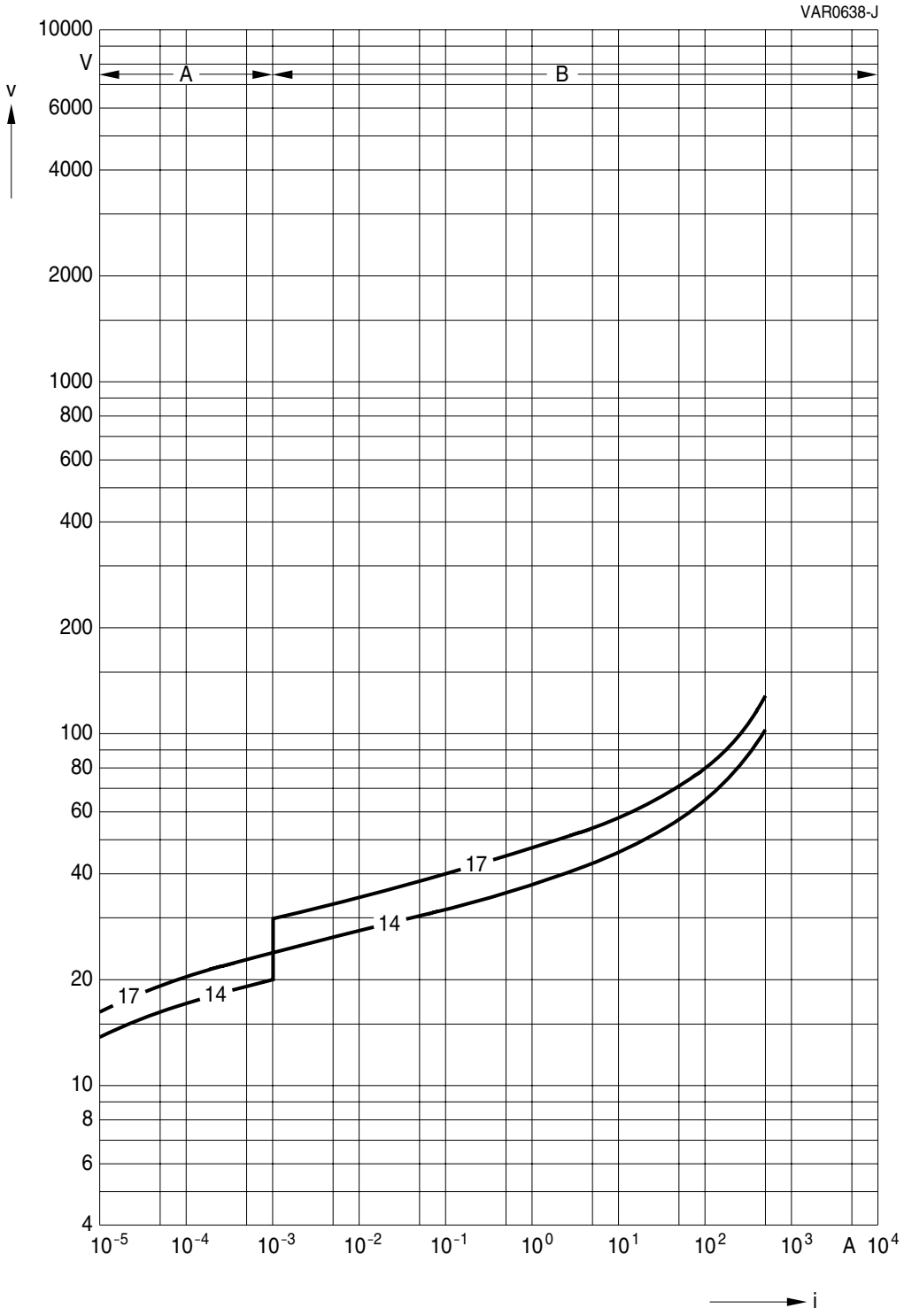
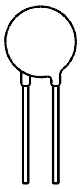


SIOV-S10 … (AUTO)(D1)



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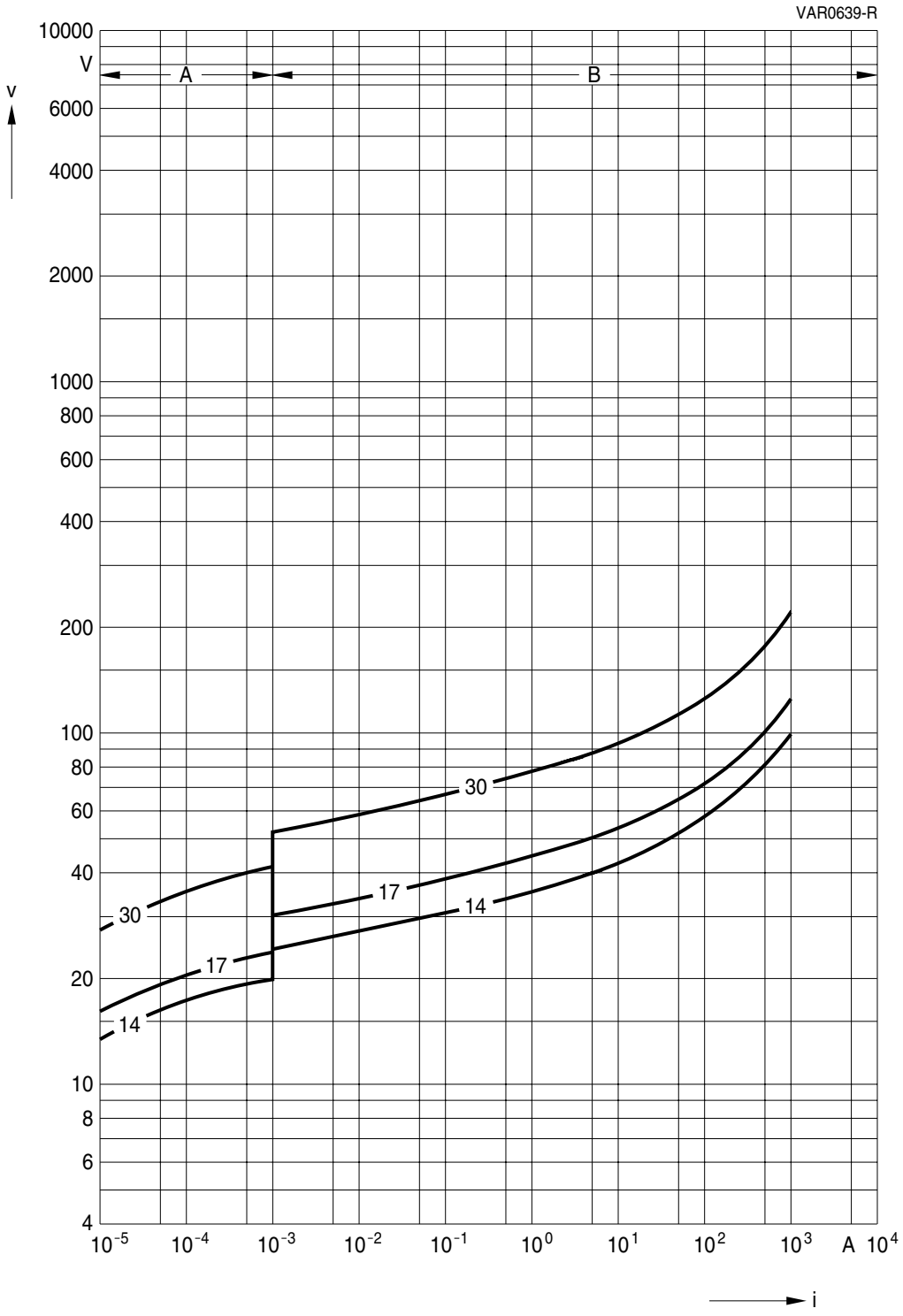
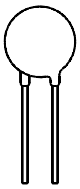


SIOV-S14 … (AUTO)(D1)



v/i characteristics

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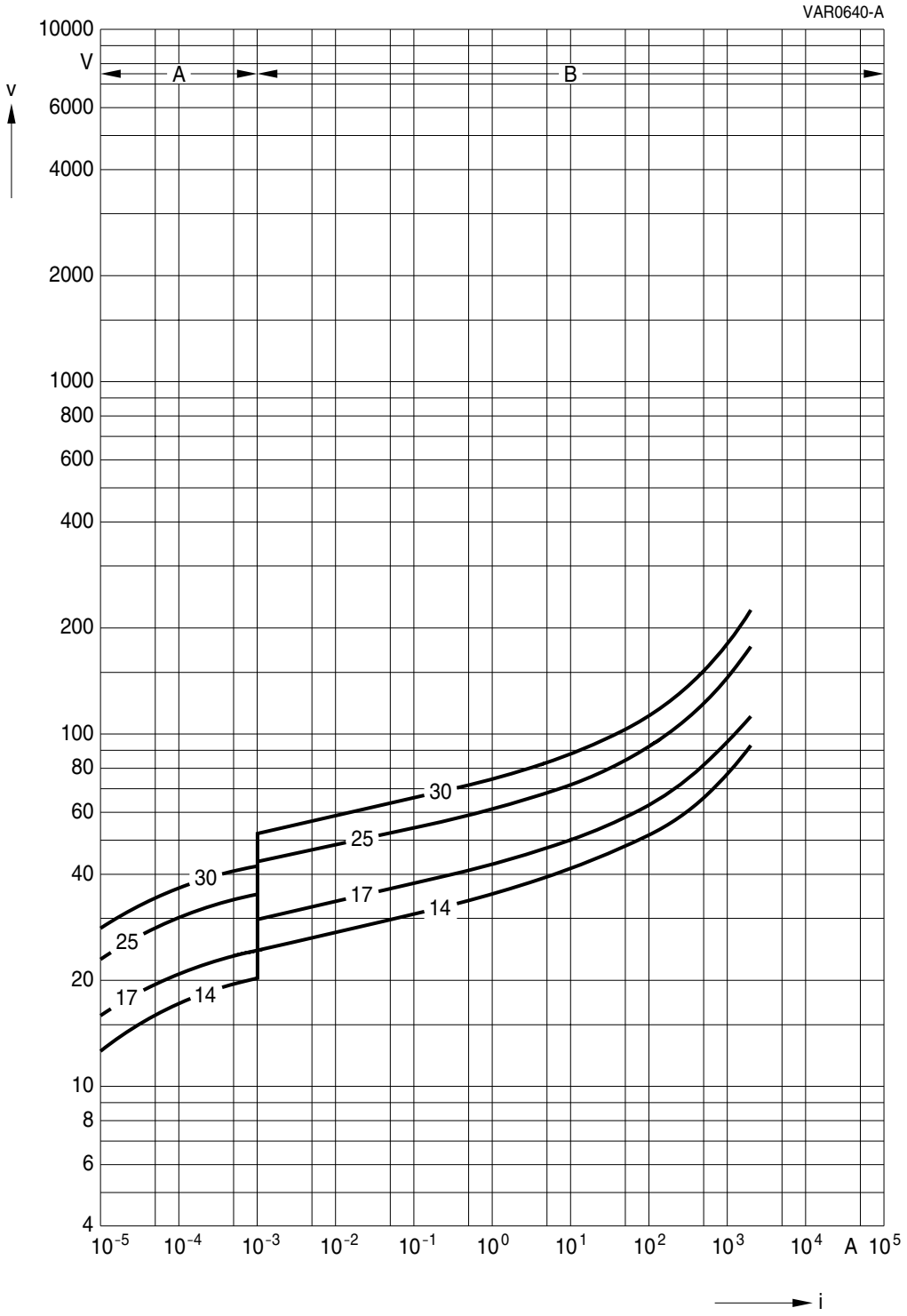
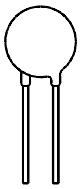
} for worst-case varistor tolerances



SIOV-S20 … AUTO

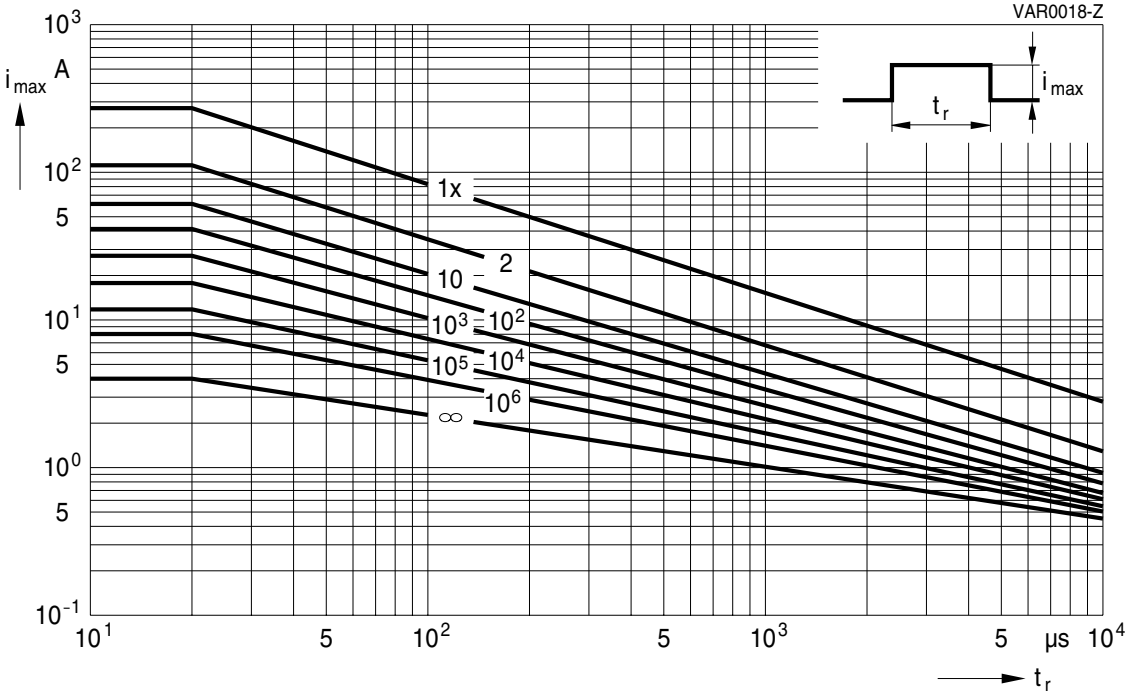
Please read *Cautions and warnings* and *Important notes* at the end of this document.



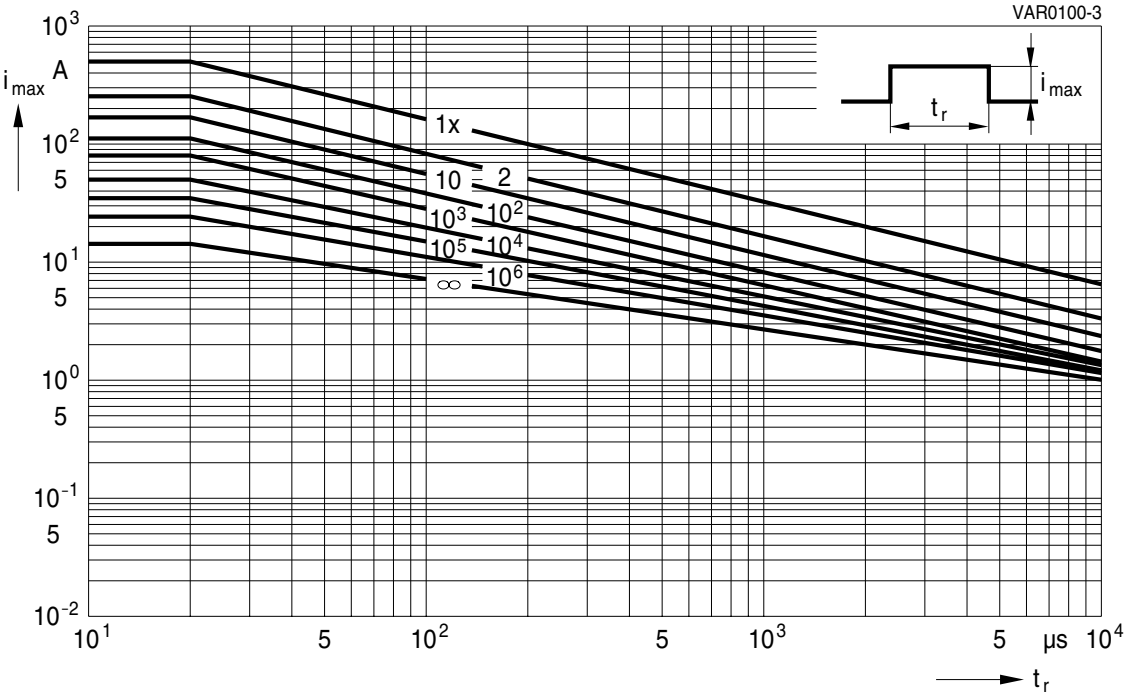
Derating curves

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

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

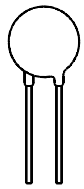


SIOV-S07K14AUTOS2D1



SIOV-S10K14AUTO … K17AUTO

SIOV-S10K14AUTOS5D1



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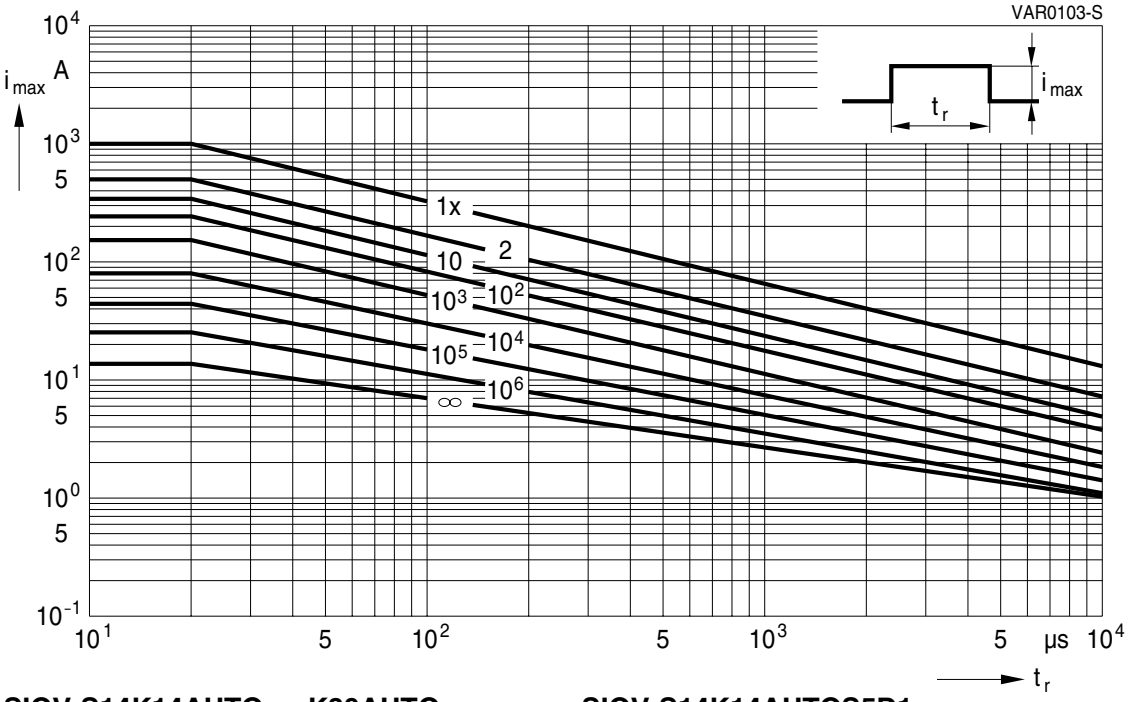
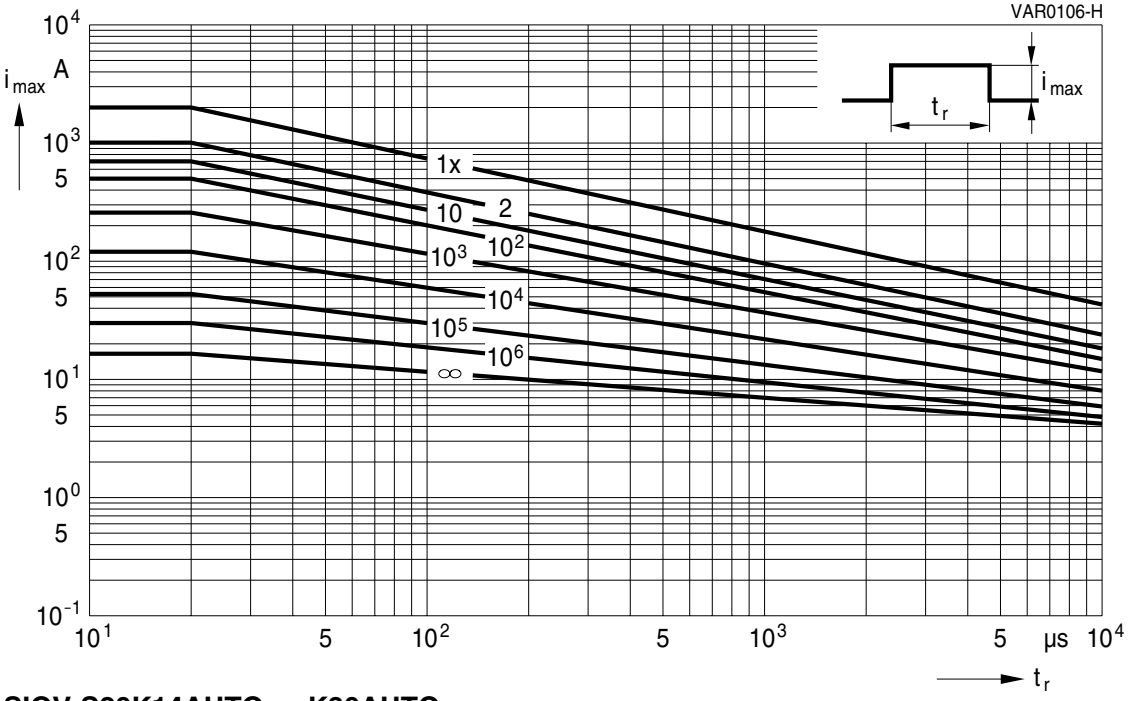


SIOV-S14K14AUTO … K30AUTO **SIOV-S14K14AUTOS5D1**



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 °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 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.

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.
2. We also point out that **in individual cases, a malfunction of passive 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 a passive 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 a passive electronic component.
3. **The warnings, cautions and product-specific notes must be observed**.
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