



SPECIFICATION FOR APPROVAL

Customer	<u>Delta</u>
Customer P/N	<u></u>
EPCOS Type	<u>SNF14K385E2S5M7K1</u>
EPCOS Series Type	<u>SNF14K385E2K1</u>
EPCOS Ordering Code	<u>B72214X2381K502</u>
Data Sheet	<u>SNF14K385E2S5M7K1_a(Delta)</u>
Dimension Drawing	<u>See below datasheet</u>
Date	<u>2013-10-21</u>

Prepared by:	Signed By: PD	Signed: QM	Issue Date:	Version:
Wyatt Wang	Terry Tian	Mac Gao	2013/10/21	a

For Customer Approval:

Designed:	Inspected:	Approved:

To ensure that the attached datasheet meets your requirement we ask you to return this cover sheet with your confirmation or otherwise comments. If we will get no reaction from you within 30 days we will assume that you accept the attached datasheet and subsequent deliveries will be in accordance with the data sheet.



Leaded Varistors

Non-Flammable varistor (AdvanceD-MP Series)

Series/Type:	SIOV-SNF14K385E2S5M7K1
Ordering code:	B72214X2381K502
Date:	2013-10-21
Version:	a

Applications

Overvoltage protection

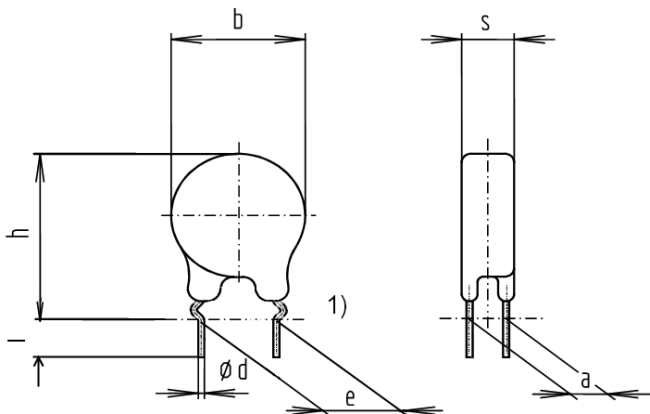
Features

- UL approval to UL1449 (file number E321126), for use in Type 2 SPD's
- Qualified according to AEC-Q200 REV D
- Meet the surge requirements of IEC 60950-1 Annex Q and IEC 60065 § 14.12
- Ideally suited for AC applications where low level repetitive surges are expected
- VDE certificate No: 40027582

SIOV nomenclature

SNF	=	Disk type, Non-Flammable
14	=	Rated disk diameter
K	=	Tolerance of V_V at 1mA : $\pm 10\%$
385	=	Max. AC operating voltage
E2...K1	=	AdvanceD-MP series
S5	=	Crimp style S5
M7	=	Customized lead length

Dimensional drawings in mm

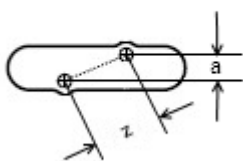


b_{max}	=	18.5
h_{max}	=	25.0
s_{max}	=	10.7
e	=	6.1 (typical value) ²⁾
z	=	7.5 ± 0.8
a	=	4.4 ± 1.0
l_{min}	=	7.0
$\varnothing d$	=	0.8 ± 0.05

1) seating plane in accordance with IEC 60717

2) typical values not measure

Bottom view



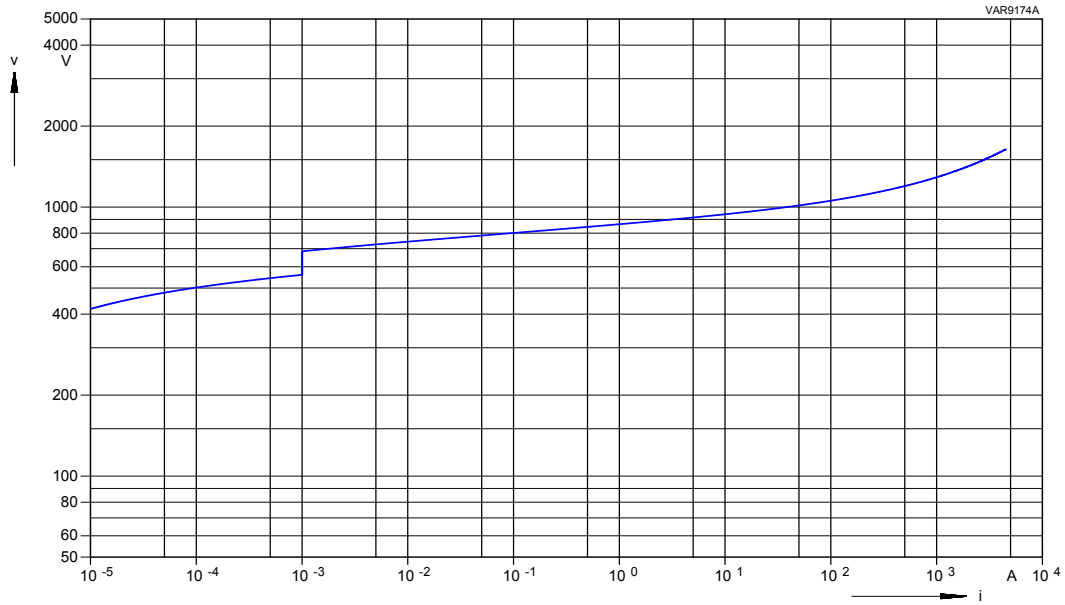
Electrical data
Maximum Ratings (125 °C):

Max. operating AC voltage		V_{RMS}	=	385 V
Max. operating DC voltage		V_{DC}	=	505 V
Surge current (8/20 μ s)	1 time	I_{max}	=	6000 A
Energy absorption (2 ms)	1 time	W_{max}	=	180.0 J
Energy absorption (10/1000 μ s)	1 time	W_{max}	=	255.0 J
Average power dissipation		P_{max}	=	0.60 W

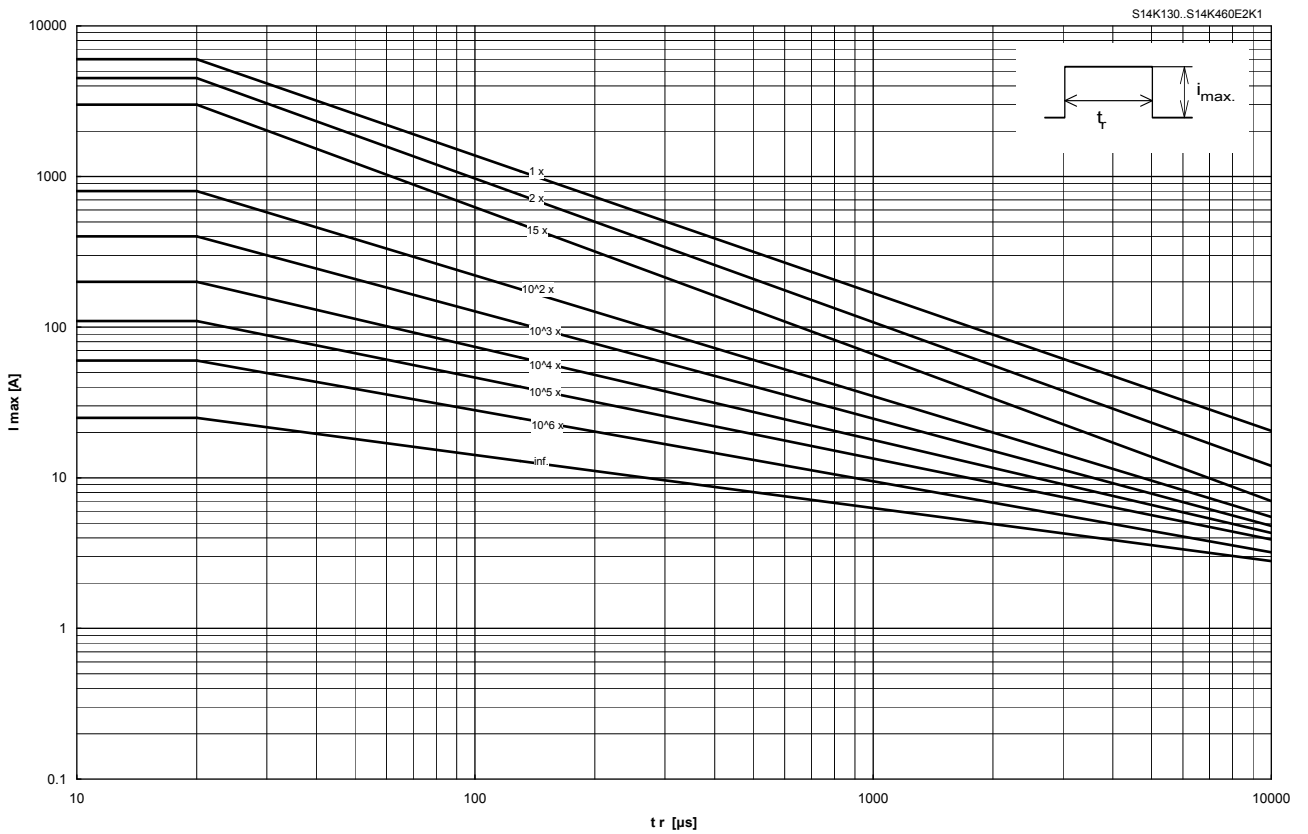
Characteristics (25 °C):

Varistor voltage at 1 mA		V_V	=	620 V \pm 10%
Clamping voltage at 50 A (8/20 μ s)		$V_{C,max}$	=	1025 V
Typ. capacitance at 1 kHz		C	=	390 pF

v/i Characteristic

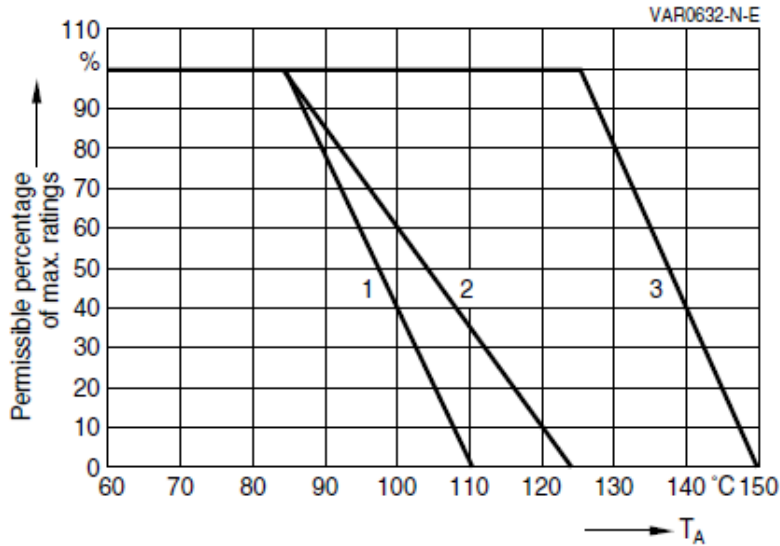


Derating



Temperature derating

for operating voltage, surge current, energy absorption and average power dissipation



Derating curve 1	Derating curve 2	Derating curve 3
SIOV- B LS	SIOV- S...(AUTO) (E2)(E3) Q ETFV types SFS types	SIOV- S... AUTOD1 SNF

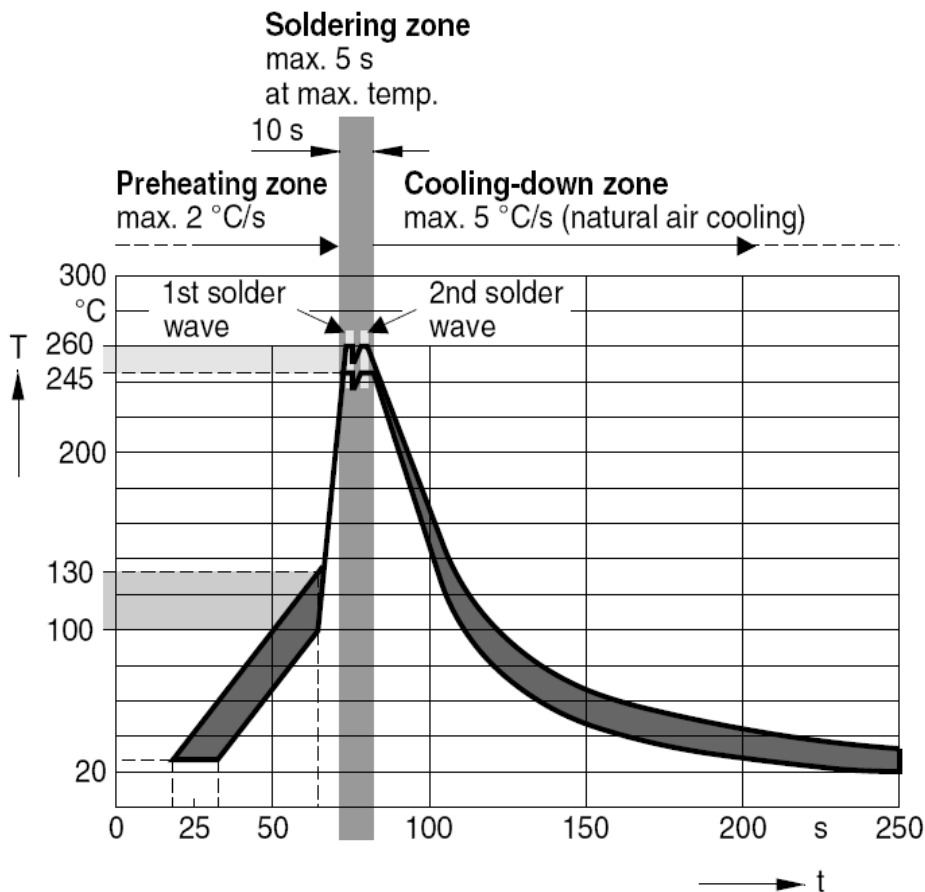
General technical data

Climatic category	to IEC 60068-1	40/125/56
Operating temperature		-40...+125 °C
Storage temperature		-40...+150 °C
Electric strength	to IEC 61051	≥2.5 kV _{RMS}
Insulation resistance	to IEC 61051	≥100 MΩ
Response time		<25 ns

Soldering

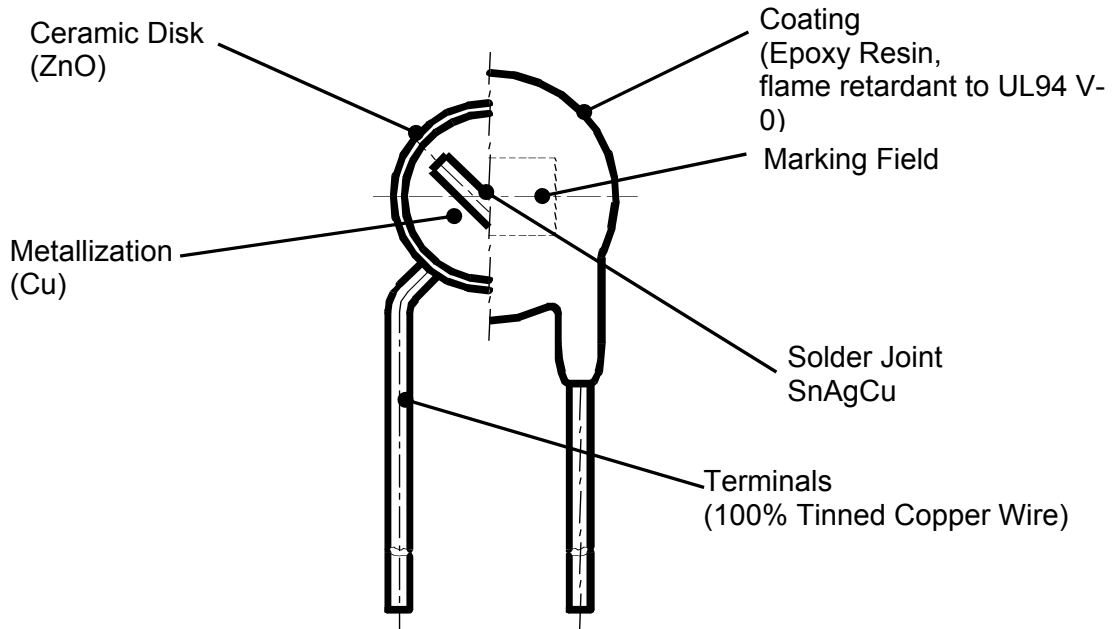
Varistors with wire leads can be soldered using all conventional methods.

Recommended wave soldering temperature profile.

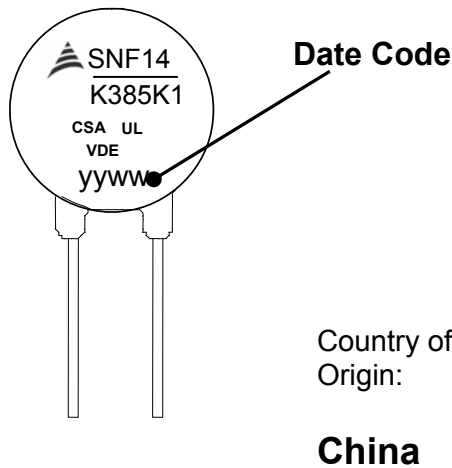


Recommended soldering by iron: 350° C max., 3s.

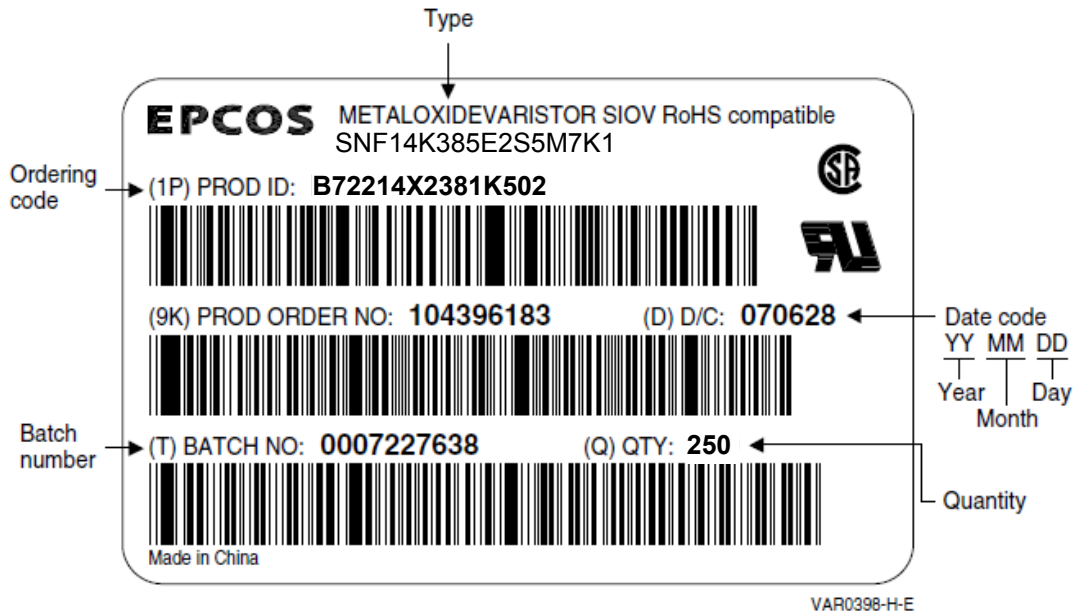
INTERNAL CONSTRUCTION:



PART MARKING: (Schematic Drawing):

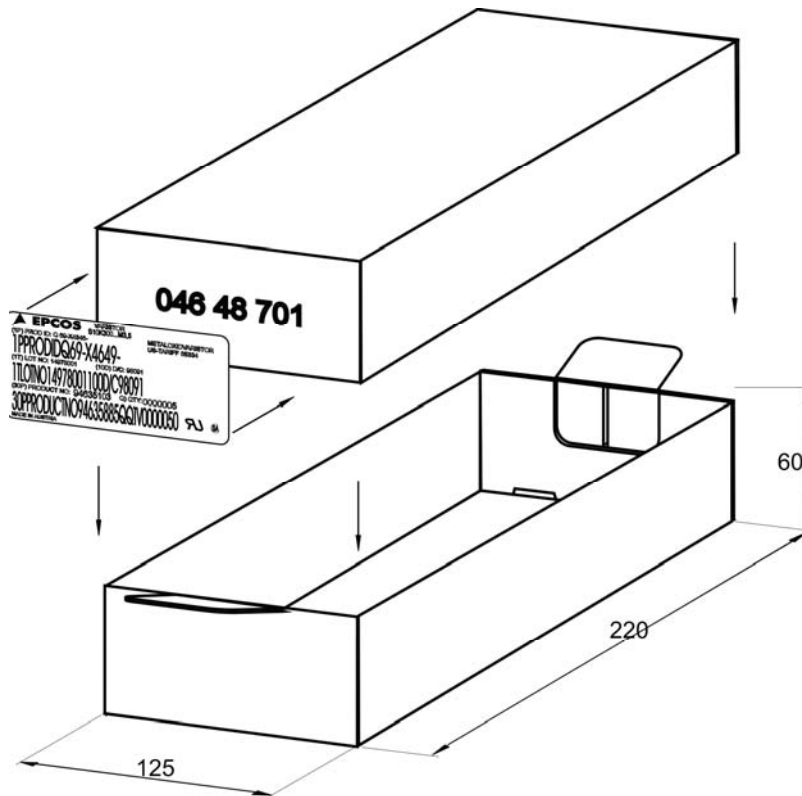


PACKAGE LABEL INFORMATION:

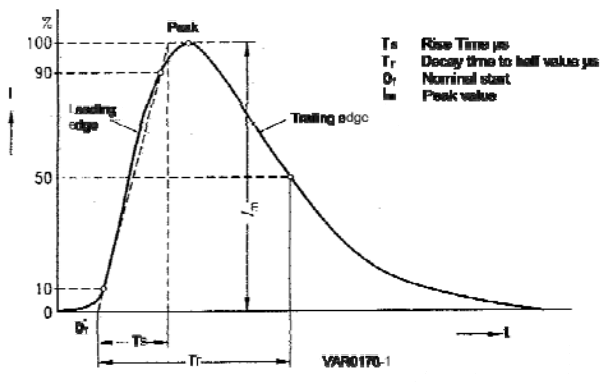


Remark: Please refer to EPCOS databook 2011 version.

Packaging specification



Reliability Data Electrical

Characteristics	Test Methods/Description	Specifications
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 (8/20µs) illustrated below applied. 	To meet the specified value.
Surge current derating, 8/20 µs	10 surge currents (8/20 µs), unipolar, interval 30 s, amplitude corresponding to derating curve for 10 impulses at 20 µs	$ \Delta V/V (1 \text{ mA}) \leq 10\%$ (measured in direction of surge current) No visible damage
Surge current derating, 2 ms	10 surge currents (2ms), unipolar, interval 120s, amplitude corresponding to derating curve for 10 impulses at 2 ms	$ \Delta V/V (1 \text{ mA}) \leq 10\%$ (measured in direction of surge current) No visible damage
Over voltage test	The varistor should be subjected to a U_{rms} test = 0.85U _v (1 mA) until it fails.	The fire should be ≤ 20 mm and should be extinguished within 4 sec

Reliability Data Mechanical

Characteristics	Test Methods/Description	Specifications
Tensile strength	IEC 60068-2-21, test Ua1 After gradually applying the force specified below and keeping the unit fixed for 10 s, the terminal shall be visually examined for any damage. Force for wire diameter: 0.6 mm = 10 N 0.8 mm = 10 N 1.0 mm = 20 N	$ \Delta V/V (1 \text{ mA}) \leq 5\%$ No break of solder joint, no wire break
Vibration	MIL-STD-202 Method 204, 5g's; 3x4h; 10 - 2000Hz; Pulse : sin wave	$ \Delta V/V (1 \text{ mA}) \leq 5\%$ No visible damage
Solderability	IEC 60068-2-20, test Ta, method 1 with modified conditions for lead-free solder alloys: 245°C, 3 s: After dipping the terminals to a depth of approximately 3 mm from the body in a soldering bath of 245 °C for 3 s, the terminals shall be visually examined.	The inspection shall be carried out under adequate light with normal eyesight or with the assistance of a magnifier capable of giving a magnification of 4 to 10 times. The dipped surface shall be covered with a smooth and bright solder coating with no more than small amounts of scattered imperfections such as pinholes or un-wetted or de-wetted areas. These imperfections shall not be concentrated in one area.

Characteristics	Test Methods/Description	Specifications
Resistance to soldering heat	IEC 60068-2-20, test Tb, method 1A, 260 °C, 10 s: Each lead shall be dipped into a solder bath having a temperature of 260 ±5 °C to a point 2.0 to 2.5 mm from the body of the unit, be held there for 10 ±1 s and then be stored at room temperature and normal humidity for 1 to 2 hours. The change of V_v shall be measured and the part shall be visually examined.	$ \Delta V/V (1 \text{ mA}) \leq 5\%$ No visible damage
Bump	IEC 60068-2-29, test Eb Pulse duration: 6 ms Max. acceleration: 400m/s ² Number of bumps: 4000 Pulse: half sine	$ \Delta V/V (1 \text{ mA}) \leq 5\%$ No visible damage
Fire hazard	IEC 60695-11-5 (needle flame test) Severity: vertical 10 s	5 s max.
Electric strength	IEC 61051-1, test 4.9.2 Metal balls method, 2500 V _{RMS} , 60 s The varistor is placed in a container holding 1.6 ±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 Environmental

Characteristics	Test Methods/Description	Specifications
High temperature exposure	MIL-STD-202 Method 108, 1000hrs. @ 150°C, unpowered.	$ \Delta V/V (1 \text{ mA}) \leq 10\%$ No visible damage
Mechanical shock	MIL-STD-202 Method 213, 100g's, 3x6 shocks, half sine	$ \Delta V/V (1 \text{ mA}) \leq 5\%$ No visible damage
ESD	According to AEC Q200, AEC-Q200-002	$ \Delta V/V (1 \text{ mA}) \leq 10\%$ No visible damage
Resistance to Solvents	MIL-STD-202 Method 211, Also aqueous wash chemical-OKEM clean or equivalent. Do not use banned solvents	$ \Delta V/V (1 \text{ mA}) \leq 5\%$ Marking should be legible
Max. DC operating voltage	MIL STD 202F, method 108A, UCT, 0.85Uv (1 mA), 1000h	$ \Delta V/V (1 \text{ mA}) \leq 10\%$ No visible damage
Damp heat	IEC 60068-2-67, test Cy, 85°C, 85% r.H., 0.85Uv (1 mA), 1000h	$ \Delta V/V (1 \text{ mA}) \leq 10\%$ No visible damage
Climatic sequence	The specimen shall be subjected to: a) IEC 60068-2-2, test Ba, dry heat at UCT, 16 h b) IEC 60068-2-30, test Db, damp heat, 1st cycle: 55 °C, 93% r.H., 24 h c) IEC 60068-2-1, test Aa, cold, LCT, 2 h d) IEC 60068-2-30, test Db, 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 at $V = 500 \text{ V}$.	$ \Delta V/V (1 \text{ mA}) \leq 10\%$ $R_{ins} \geq 100 \text{ M}\Omega$
Fast temperature cycling	-40°C to 125°C, dwell time 10 min, 1000 cycles	$ \Delta V/V (1 \text{ mA}) \leq 5\%$ No visible damage

Note:

UCT = Upper category temperature

LCT = Lower category temperature

 R_{ins} = Insulation resistance

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. The 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 SIOVs surface during storage, handling and processing.
4. Avoid storage of SIOVs in harmful environments which 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	12 month
ETFV and SFS types	12 month.

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 the 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 the 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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