ThermoFuse Varistor

Series/Type:	**NT14***
Ordering code:	**B72214***
Date:	2017-05-15
Version:	a

Construction

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

Features

- Wide operating voltage range 130 ⋯ 680 VRMS
- Self-protected under abnormal overvoltage conditions
- High-energy AdvanceD series E2

Applications

- Inverters in solar power systems Houshold appliances
- Power supply units
- Inverters in solar power systems
- Lighting applications
- Communication and data systems
- Transient voltage surge suppressors (TVSS)
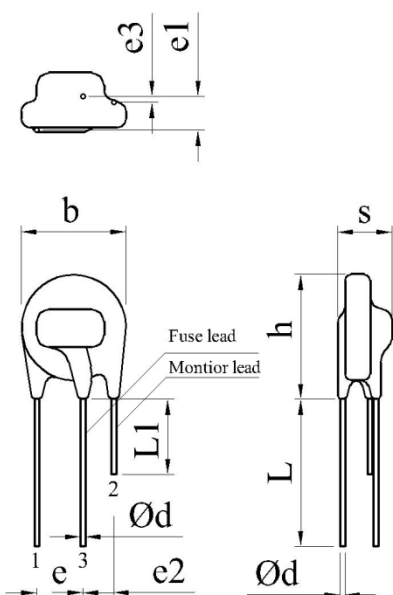- Electronic metering

General technical data

Climatic category	to IEC 60068-1	40/85/56	
Operating temperature		-40…+85	°C
Storage temperature		-40... +85	°C
Electric strength		$\geq$2.5	kV$_{RMS}$
Insulation resistance		$\geq$100	MΩ
Response time		< 25	ns

Nomenclature

NT	=	Series designation
14	=	Rated disk diameter (mm)
K	=	Tolerance of V_V at 1 mA: $\pm$10%
***	=	Max. AC voltage
E2	=	Energy absorption characteristics, AdvanceD series
S5	=	Crimp design S5
K4	=	2 pins version

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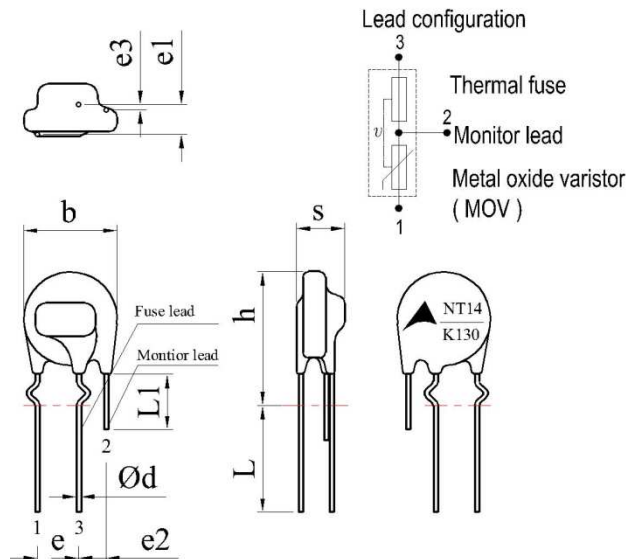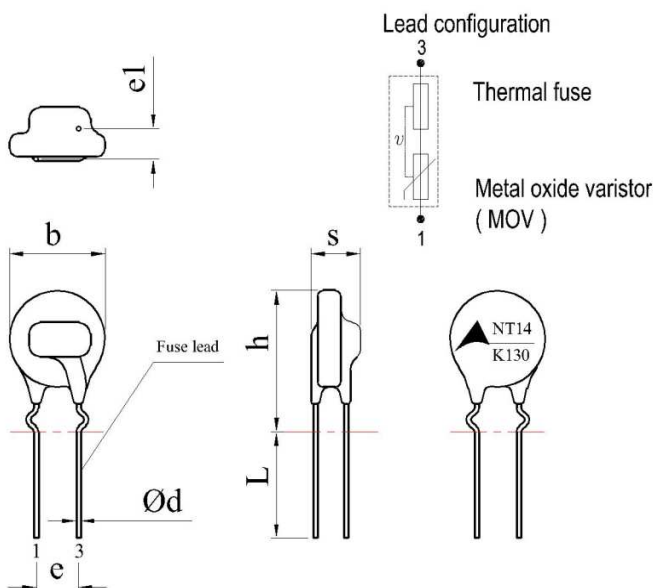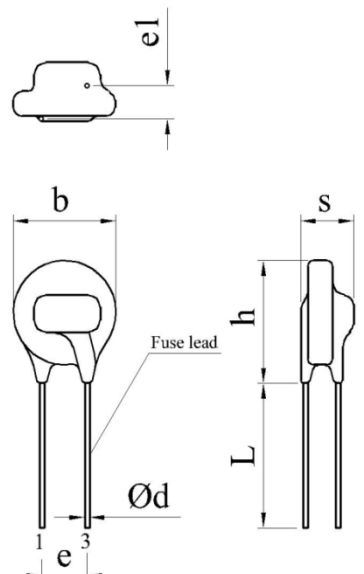*Important notes* at the end of this document.

Dimensional drawing in mm

Straight leads   Crimp leads

*K4   *S5K4

Typical applications

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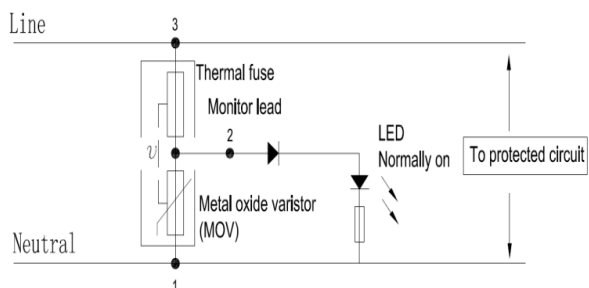
Dimension

Ordering code	Type （untaped） -SIOV	b_{max} mm	h_{max} mm	s_{max} mm	e ±1 mm	e1 ±1 mm	e2 ±1 mm	e3 ±1 mm	L_{min} mm	$L1_{min}$ mm	φd ±0.05 mm
B72214W2131K101	NT14K130E2	17	22		7.5	2.6	5	1	25	6	0.8
B72214R2131K101	NT14K130E2K4	17	22		7.5	2.6	/	/	25	/	0.8
B72214W2141K101	NT14K140E2	17	22		7.5	2.7	5	1	25	6	0.8
B72214R2141K101	NT14K140E2K4	17	22	9.0	7.5	2.7	/	/	25	/	0.8
B72214W2151K101	NT14K150E2	17	22		7.5	2.8	5	1	25	6	0.8
B72214R2151K101	NT14K150E2K4	17	22		7.5	2.8	/	/	25	/	0.8
B72214W2171K101	NT14K175E2	17	22		7.5	2.8	5	1	25	6	0.8
B72214R2171K101	NT14K175E2K4	17	22		7.5	2.8	/	/	25	/	0.8
B72214W2211K101	NT14K210E2	17	22		7.5	2.9	5	1	25	6	0.8
B72214R2211K101	NT14K210E2K4	17	22		7.5	2.9	/	/	25	/	0.8
B72214W2251K101	NT14K250E2	17	22		7.5	3.1	5	1	25	6	0.8
B72214R2251K101	NT14K250E2K4	17	22	9.5	7.5	3.1	/	/	25	/	0.8
B72214W2271K101	NT14K275E2	17	22		7.5	3.2	5	1	25	6	0.8
B72214R2271K101	NT14K275E2K4	17	22		7.5	3.2	/	/	25	/	0.8
B72214W2301K101	NT14K300E2	17	22		7.5	3.3	5	1	25	6	0.8
B72214R2301K101	NT14K300E2K4	17	22		7.5	3.3	/	/	25	/	0.8
B72214W2321K101	NT14K320E2	17	22		7.5	3.5	5	1	25	6	0.8
B72214R2321K101	NT14K320E2K4	17	22		7.5	3.5	/	/	25	/	0.8
B72214W2351K101	NT14K350E2	17	22		7.5	3.7	5	1	25	6	0.8
B72214R2351K101	NT14K350E2K4	17	22		7.5	3.7	/	/	25	/	0.8
B72214W2381K101	NT14K385E2	17	22		7.5	4.0	5	1	25	6	0.8
B72214R2381K101	NT14K385E2K4	17	22	11.0	7.5	4.0	/	/	25	/	0.8
B72214W2421K101	NT14K420E2	17	22		7.5	4.2	5	1	25	6	0.8
B72214R2421K101	NT14K420E2K4	17	22		7.5	4.2	/	/	25	/	0.8
B72214W2461K101	NT14K460E2	17	22		7.5	4.4	5	1	25	6	0.8
B72214R2461K101	NT14K460E2K4	17	22		7.5	4.4	/	/	25	/	0.8
B72214W2511K101	NT14K510E2	17	22		7.5	4.5	5	1	25	6	0.8
B72214R2511K101	NT14K510E2K4	17	22		7.5	4.5	/	/	25	/	0.8
B72214W2551K101	NT14K550E2	17	22	12.0	7.5	4.7	5	1	25	6	0.8
B72214R2551K101	NT14K550E2K4	17	22		7.5	4.7	/	/	25	/	0.8
B72214W2621K101	NT14K625E2	17	22		7.5	5.0	5	1	25	6	0.8
B72214R2621K101	NT14K625E2K4	17	22	13.0	7.5	5.0	/	/	25	/	0.8
B72214W2681K101	NT14K680E2	17	22		7.5	5.5	5	1	25	6	0.8
B72214R2681K101	NT14K680E2K4	17	22		7.5	5.5	/	/	25	/	0.8

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Ordering code	Type （untaped） -SIOV	b_{max} mm	h_{max} mm	s_{max} mm	e ±1 mm	e1 ±1 mm	e2 ±1 mm	e3 ±1 mm	L_{min} mm	$L1_{min}$ mm	ϕd ±0.05 mm
B72214W2131K501	NT14K130E2S5	17	23	9.0	7.5	2.6	5	1	25	6	0.8
B72214R2131K501	NT14K130E2S5K4	17	23		7.5	2.6	/	/	25	/	0.8
B72214W2141K501	NT14K140E2S5	17	23		7.5	2.7	5	1	25	6	0.8
B72214R2141K501	NT14K140E2S4K4	17	23		7.5	2.7	/	/	25	/	0.8
B72214W2151K501	NT14K150E2S5	17	23		7.5	2.8	5	1	25	6	0.8
B72214R2151K501	NT14K150E2S5K4	17	23		7.5	2.8	/	/	25	/	0.8
B72214W2171K501	NT14K175E2S5	17	23		7.5	2.8	5	1	25	6	0.8
B72214R2171K501	NT14K175E2S5K4	17	23		7.5	2.8	/	/	25	/	0.8
B72214W2211K501	NT14K210E2S5	17	23	9.5	7.5	2.9	5	1	25	6	0.8
B72214R2211K501	NT14K210E2S5K4	17	23		7.5	2.9	/	/	25	/	0.8
B72214W2251K501	NT14K250E2S5	17	23		7.5	3.1	5	1	25	6	0.8
B72214R2251K501	NT14K250E2S5K4	17	23		7.5	3.1	/	/	25	/	0.8
B72214W2271K501	NT14K275E2S5	17	23		7.5	3.2	5	1	25	6	0.8
B72214R2271K501	NT14K275E2S5K4	17	23		7.5	3.2	/	/	25	/	0.8
B72214W2301K501	NT14K300E2S5	17	23	11.0	7.5	3.3	5	1	25	6	0.8
B72214R2301K501	NT14K300E2S5K4	17	23		7.5	3.3	/	/	25	/	0.8
B72214W2321K501	NT14K320E2S5	17	23		7.5	3.5	5	1	25	6	0.8
B72214R2321K501	NT14K320E2S5K4	17	23		7.5	3.5	/	/	25	/	0.8
B72214W2351K501	NT14K350E2S5	17	23		7.5	3.7	5	1	25	6	0.8
B72214R2351K501	NT14K350E2S5K4	17	23		7.5	3.7	/	/	25	/	0.8
B72214W2381K501	NT14K385E2S5	17	23		7.5	4.0	5	1	25	6	0.8
B72214R2381K501	NT14K385E2S5K4	17	23		7.5	4.0	/	/	25	/	0.8
B72214W2421K501	NT14K420E2S5	17	23		7.5	4.2	5	1	25	6	0.8
B72214R2421K501	NT14K420E2S5K4	17	23		7.5	4.2	/	/	25	/	0.8
B72214W2461K501	NT14K460E2S5	17	23		7.5	4.4	5	1	25	6	0.8
B72214R2461K501	NT14K460E2S5K4	17	23		7.5	4.4	/	/	25	/	0.8
B72214W2511K501	NT14K510E2S5	17	23	12.0	7.5	4.5	5	1	25	6	0.8
B72214R2511K501	NT14K510E2S5K4	17	23		7.5	4.5	/	/	25	/	0.8
B72214W2551K501	NT14K550E2S5	17	23		7.5	4.7	5	1	25	6	0.8
B72214R2551K501	NT14K550E2S5K4	17	23		7.5	4.7	/	/	25	/	0.8
B72214W2621K501	NT14K625E2S5	17	23	13.0	7.5	5.0	5	1	25	6	0.8
B72214R2621K501	NT14K625E2S5K4	17	23		7.5	5.0	/	/	25	/	0.8
B72214W2681K501	NT14K680E2S5	17	23		7.5	5.5	5	1	25	6	0.8
B72214R2681K501	NT14K680E2S5K4	17	23		7.5	5.5	/	/	25	/	0.8

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Electrical data

Maximum ratings (85 ℃):

Type (untaped) -SIOV	V_{RMS} V	V_{DC} V	i_{max} (8/20 µs) A	In 1) (8/20 µs) 15 times A	W_{max} (2 ms) J	P_{max} W
NT14K130E2*	130	170	6000	3000	50	0.6
NT14K140E2*	140	180	6000	3000	55	0.6
NT14K150E2*	150	200	6000	3000	60	0.6
NT14K175E2*	175	225	6000	3000	70	0.6
NT14K210E2*	210	270	6000	3000	80	0.6
NT14K250E2*	250	320	6000	3000	100	0.6
NT14K275E2*	275	350	6000	3000	110	0.6
NT14K300E2*	300	385	6000	3000	125	0.6
NT14K320E2*	320	420	6000	3000	136	0.6
NT14K350E2*	350	460	6000	3000	110	0.6
NT14K385E2*	385	505	6000	3000	136	0.6
NT14K420E2*	420	560	6000	3000	136	0.6
NT14K460E2*	460	615	6000	3000	150	0.6
NT14K510E2*	510	670	6000	3000	165	0.6
NT14K550E2*	550	745	6000	3000	180	0.6
NT14K625E2*	625	825	6000	3000	200	0.6
NT14K680E2*	680	895	6000	3000	220	0.6
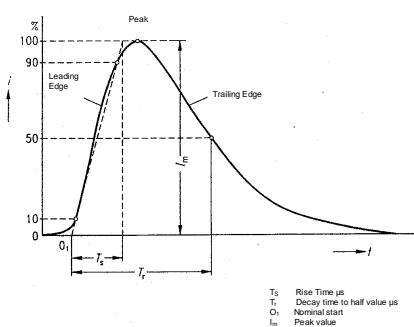
*May be suffix S5,K4

1) Note: nominal discharge current is the specification defined in UL1449 4th and tested with 8/20µs current waveform.

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Characteristics (25 ℃):

Type	V_V (1 mA) V	$\triangle V_v$ (1 mA) %	$V_{c,max}$ i_c V	i_c A	C_{typ} 1 kHz pF
NT14K130E2*	205	10	340	50	880
NT14K140E2*	220	10	360	50	820
NT14K150E2*	240	10	395	50	750
NT14K175E2*	270	10	455	50	670
NT14K210E2*	330	10	545	50	580
NT14K250E2*	390	10	650	50	490
NT14K275E2*	430	10	710	50	440
NT14K300E2*	470	10	775	50	400
NT14K320E2*	510	10	840	50	370
NT14K350E2*	560	10	910	50	350
NT14K385E2*	620	10	1025	50	315
NT14K420E2*	680	10	1120	50	290
NT14K460E2*	750	10	1240	50	260
NT14K510E2*	820	10	1355	50	240
NT14K550E2*	910	10	1500	50	215
NT14K625E2*	1000	10	1650	50	200
NT14K680E2*	1100	10	1815	50	180

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Reliability Data Electrical

Test	Test methods	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) illustrated below applied. T_S　Rise Time µs T_r　Decay time to half value µs O_1　Nominal start I_m　Peak value	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	| V/V (1 mA)| ≤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	| V/V (1 mA)|≤10% (measured in direction of surge current) No visible damage

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Test	Test Methods/Description	Requirement
Abnormal over voltage	This device is designed to form open circuit in the event of overheating due to the limited current abnormal over voltage conditions as outlined in section 44.4 of UL1449 4th edition. The device (pin 1 & 3) is to be connected to a power supply having an open circuit voltage equal to the test voltage specified below. The power supply is to incorporate a series variable resistor that can be adjusted to obtain the short-circuit current (Isc). The variable resistor is to be adjusted such that Isc equals 5A, 2.5A, 0.5A or 0.125A respectively (measured without the device in the circuit). The device will be energized for 7 hours, or until the device becomes disconnected from the power supply, or until current to, or temperature within the device attains equilibrium [3)]. The test result will be visually inspected. Detailed test voltages applied onto the devices are as in the following table:	Any of below phenomena shall not be observed, otherwise this device will be judged as failed part: 1. Emission of flame, molten metal, glowing or flaming particles through any openings (pre-existed or created as a result of the test) in the device. 2. Charring, glowing, or flaming of the supporting surface, or cheesecloth draped on the device. 3. Ignition of the enclosure. 4. Creation of any openings in the enclosure that result in accessibility of live parts.

Type	Device rating	Test voltage
	(V ac)	(V ac)
NT14K130E2*	130	240
NT14K150E2*	150	240
NT14K175E2*	175	240
NT14K210E2*	210	240
NT14K250E2*	250	480
NT14K275E2*	275	480
NT14K300E2*	300	480
NT14K320E2*	320	480
NT14K350E2*	350	600
NT14K385E2*	385	600
NT14K420E2*	420	690
NT14K460E2*	460	690
NT14K510E2*	510	1000
NT14K550E2*	550	1000
NT14K625E2*	625	1000
NT14K680E2*	680	1000

Note:

3) Thermal fuse may not form open circuit under low current [e.g. 0.125A] due to less heat generated by MOV, however the device will reach thermal equilibrium within 30 minutes under a low temperature which will not be able to cause any damage to the device.

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v/i characteristic

A = Leakage current, B = Protection level } for worst-case varistor tolerances

Derating curves

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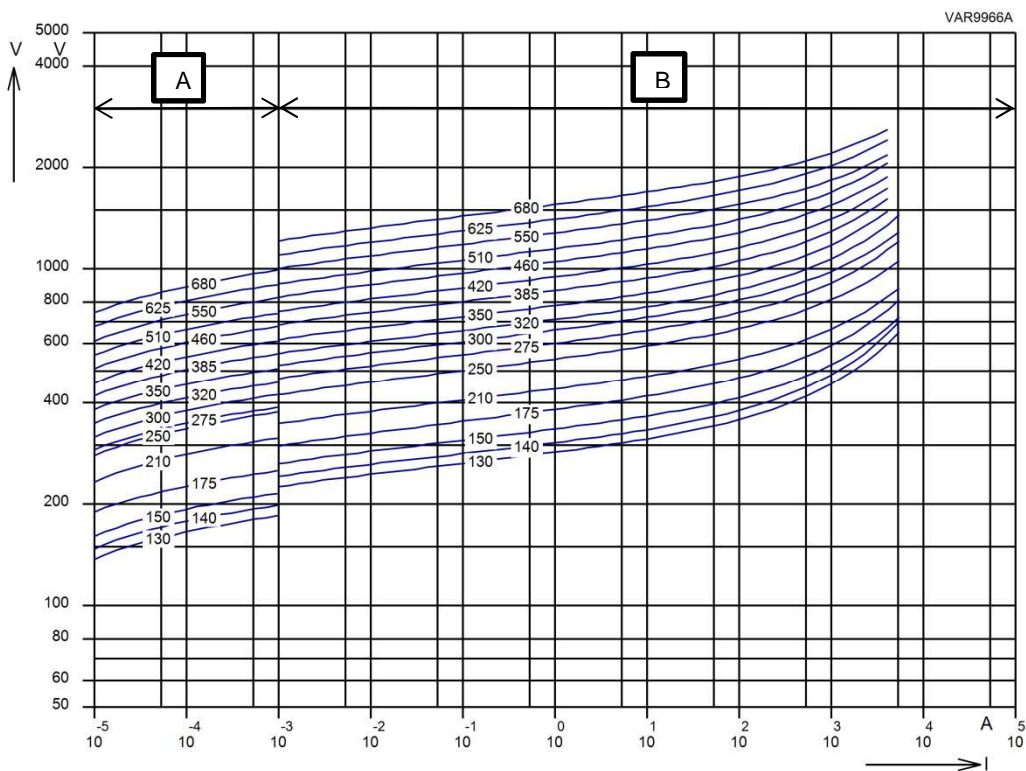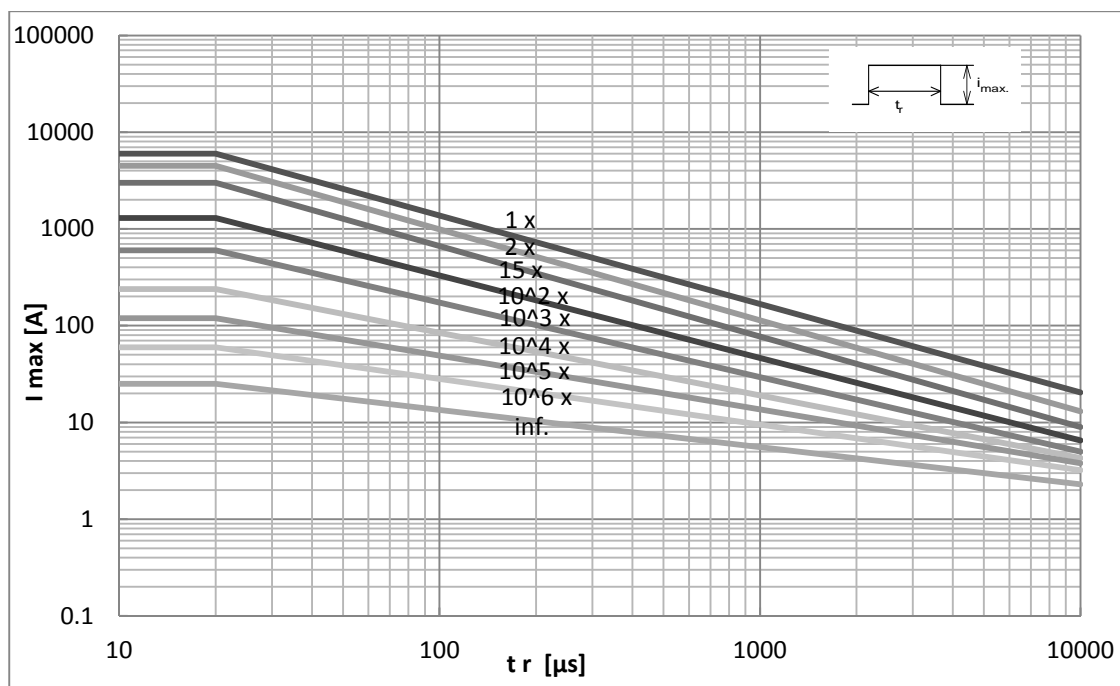
1 Soldering instructions only for NT series

1.1 Manual soldering

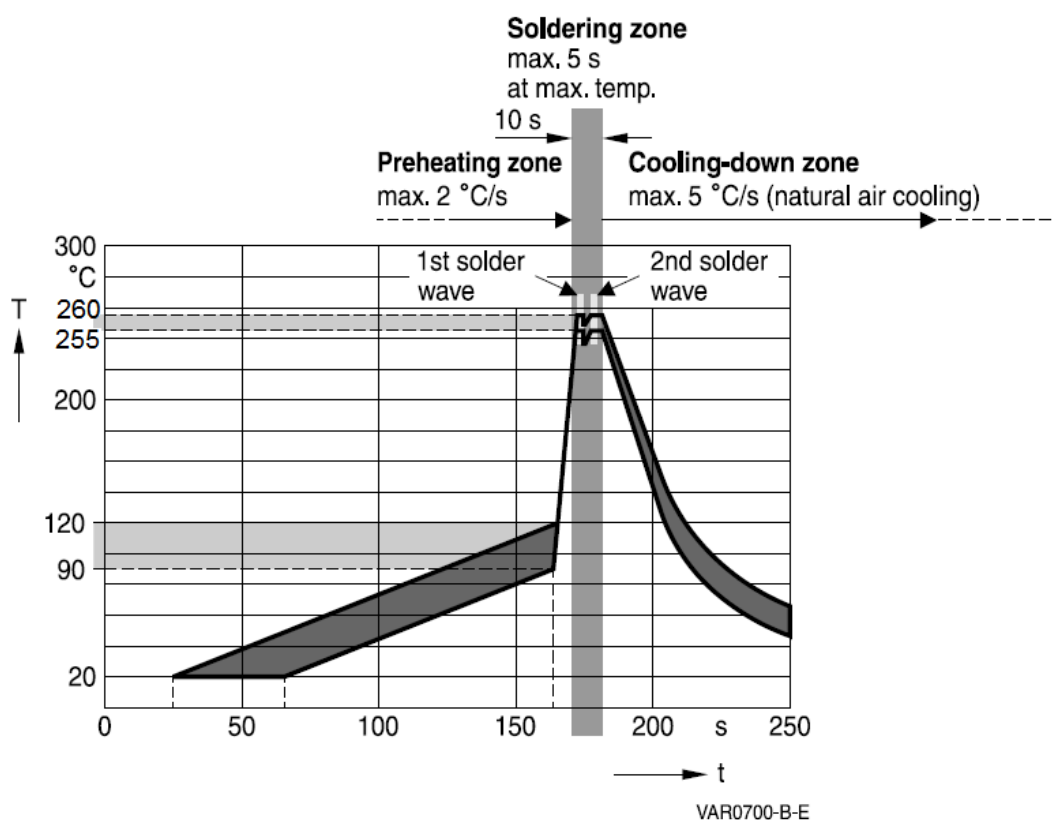Maximum soldering temperature 350 ° C for 3 s. It is recommended to heat sink the lead wires of
the ThermoFuse varistors (NT series).

1.2 Wave soldering

Recommended temperature profile for wave soldering only for ThermoFuse varistors (NT series).

VAR0700-B-E

Important note: Temperatures of all preheat stages and the solder bath must be strictly controlled.

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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 ℃ … +45 ℃
   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   24 month
   T, ETFV and NT 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.

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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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