ThermoFuse Varistor

Series/Type:	**NT20***
Ordering code:	**B72220*** **
Date:	2017-05-15
Version:	a

EPCOS AG is a TDK Group Company.

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 ⋯ 750VRMS
- 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

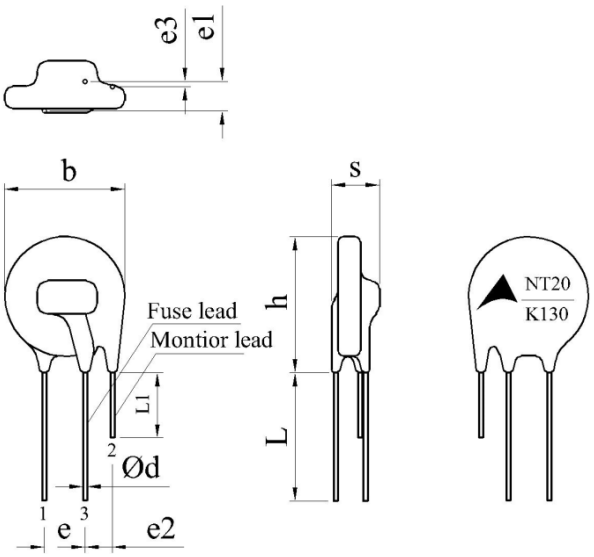
Climatic category	**to IEC 60068-1**	**40/85/56**	
Operating temperature		**-40…+85**	**℃**
Storage temperature		**-40... +85**	**℃**
Electric strength		**⩾2.5**	**kV_{RMS}**
Insulation resistance		**⩾100**	**MΩ**
Response time		**< 25**	**ns**

Nomenclature

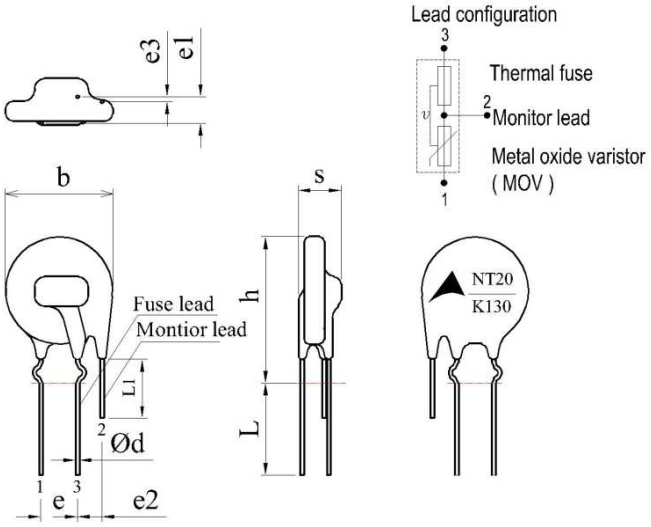
NT	=	Series designation
20	=	Rated disk diameter (mm)
K	=	Tolerance of V_V at 1 mA: ±10%
***	=	Max. AC voltage
E2	=	Energy absorption characteristics, AdvanceD series
S5	=	Crimp design S5
K4	=	2 pins version

Dimensional drawing in mm

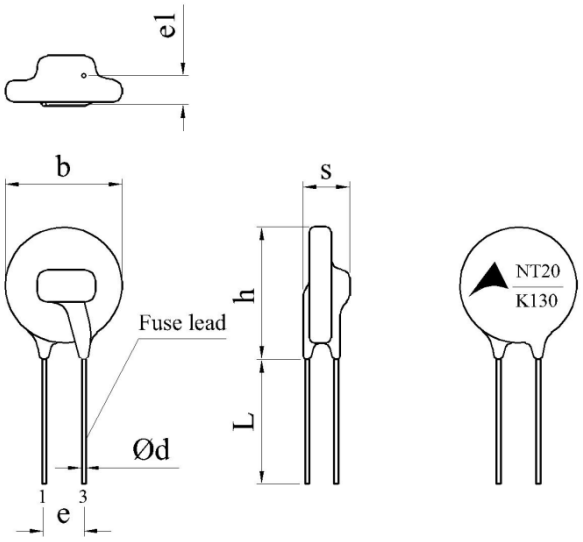
Straight leads



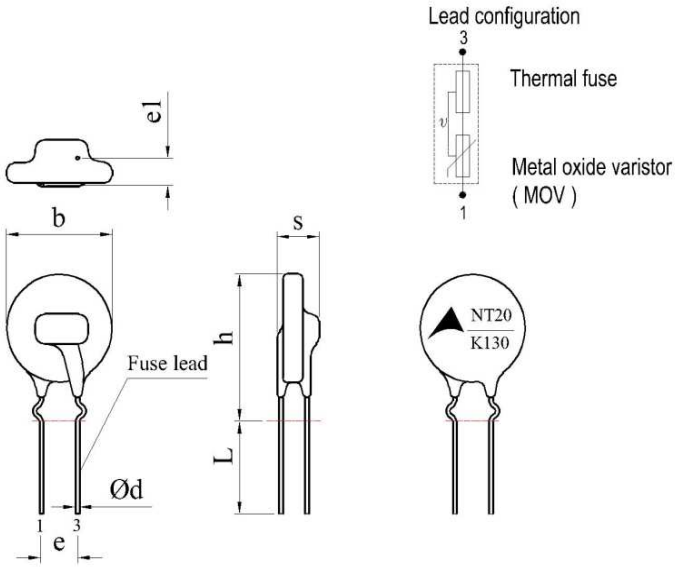
Crimp leads



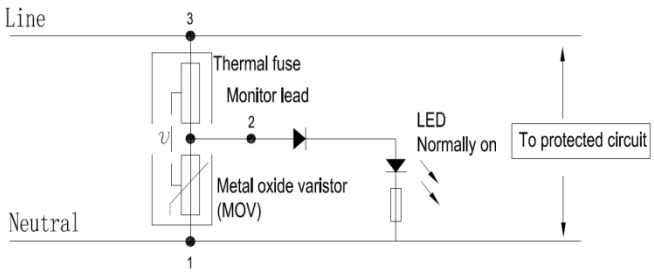
*K4



*S5K4



Typical applications



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	L_{1min} mm	Φ d ± 0.05 mm	Φ d_1 ± 0.05 mm
B72220W2131K101	NT20K130E2	23	28	9.0	7.5	2.6	5	1	25	6	0.8	0.8
B72220R2131K101	NT20K130E2K4	23	28		7.5	2.6	/	/	25	/	0.8	0.8
B72220W2141K101	NT20K140E2	23	28		7.5	2.7	5	1	25	6	0.8	0.8
B72220R2141K101	NT20K140E2K4	23	28		7.5	2.7	/	/	25	/	0.8	0.8
B72220W2151K101	NT20K150E2	23	28		7.5	2.8	5	1	25	6	0.8	0.8
B72220R2151K101	NT20K150E2K4	23	28		7.5	2.8	/	/	25	/	0.8	0.8
B72220W2171K101	NT20K175E2	23	28		7.5	2.8	5	1	25	6	0.8	0.8
B72220R2171K101	NT20K175E2K4	23	28		7.5	2.8	/	/	25	/	0.8	0.8
B72220W2211K101	NT20K210E2	23	28	9.5	7.5	2.9	5	1	25	6	0.8	0.8
B72220R2211K101	NT20K210E2K4	23	28		7.5	2.9	/	/	25	/	0.8	0.8
B72220W2251K101	NT20K250E2	23	28		7.5	3.1	5	1	25	6	0.8	0.8
B72220R2251K101	NT20K250E2K4	23	28		7.5	3.1	/	/	25	/	0.8	0.8
B72220W2271K101	NT20K275E2	23	28		7.5	3.2	5	1	25	6	0.8	0.8
B72220R2271K101	NT20K275E2K4	23	28		7.5	3.2	/	/	25	6	0.8	0.8
B72220W2301K101	NT20K300E2	23	28	11.0	7.5	3.3	5	1	25	/	0.8	0.8
B72220R2301K101	NT20K300E2K4	23	28		7.5	3.3	/	/	25	6	0.8	0.8
B72220W2321K101	NT20K320E2	23	28		7.5	3.5	5	1	25	/	0.8	0.8
B72220R2321K101	NT20K320E2K4	23	28		7.5	3.5	/	/	25	6	0.8	0.8
B72220W2351K101	NT20K350E2	23	28		7.5	3.7	5	1	25	/	0.8	0.8
B72220R2351K101	NT20K350E2K4	23	28		7.5	3.7	/	/	25	6	0.8	0.8
B72220W2381K101	NT20K385E2	23	28		7.5	4.0	5	1	25	/	0.8	0.8
B72220R2381K101	NT20K385E2K4	23	28		7.5	4.0	/	/	25	6	0.8	0.8
B72220W2421K101	NT20K420E2	23	28		7.5	4.2	5	1	25	/	0.8	0.8
B72220R2421K101	NT20K420E2K4	23	28		7.5	4.2	/	/	25	6	0.8	0.8
B72220W2461K101	NT20K460E2	23	28		7.5	4.4	5	1	25	/	1.0	0.8
B72220R2461K101	NT20K460E2K4	23	28		7.5	4.4	/	/	25	6	1.0	0.8
B72220W2511K101	NT20K510E2	23	28	12.0	7.5	4.5	5	1	25	6	1.0	0.8
B72220R2511K101	NT20K510E2K4	23	28		7.5	4.5	/	/	25	/	1.0	0.8
B72220W2551K101	NT20K550E2	23	28		7.5	4.7	5	1	25	6	1.0	0.8
B72220R2551K101	NT20K550E2K4	23	28		7.5	4.7	/	/	25	/	1.0	0.8
B72220W2621K101	NT20K625E2	23	28	13.0	7.5	5.0	5	1	25	6	1.0	0.8
B72220R2621K101	NT20K625E2K4	23	28		7.5	5.0	/	/	25	/	1.0	0.8
B72220W2681K101	NT20K680E2	23	28		7.5	5.5	5	1	25	6	1.0	0.8
B72220R2681K101	NT20K680E2K4	23	28		7.5	5.5	/	/	25	/	1.0	0.8
B72220W2751K101	NT20K750E2	23	28		7.5	6.0	5	1	25	6	1.0	0.8
B72220R2751K101	NT20K750E2K4	23	28		7.5	6.0	/	/	25	/	1.0	0.8

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	L_{1min} mm	Φ d ± 0.05 mm	Φ d_1 ± 0.05 mm
B72220W2131K501	NT20K130E2S5	23	31	9.0	7.5	2.6	5	1	25	6	0.8	0.8
B72220R2131K501	NT20K130E2S5K4	23	31		7.5	2.6	/	/	25	/	0.8	0.8
B72220W2141K501	NT20K140E2S5	23	31		7.5	2.7	5	1	25	6	0.8	0.8
B72220R2141K501	NT20K140E2S5K4	23	31		7.5	2.7	/	/	25	/	0.8	0.8
B72220W2151K501	NT20K150E2S5	23	31		7.5	2.8	5	1	25	6	0.8	0.8
B72220R2151K501	NT20K150E2S5K4	23	31		7.5	2.8	/	/	25	/	0.8	0.8
B72220W2171K501	NT20K175E2S5	23	31		7.5	2.8	5	1	25	6	0.8	0.8
B72220R2171K501	NT20K175E2S5K4	23	31		7.5	2.8	/	/	25	/	0.8	0.8
B72220W2211K501	NT20K210E2S5	23	31	9.5	7.5	2.9	5	1	25	6	0.8	0.8
B72220R2211K501	NT20K210E2S5K4	23	31		7.5	2.9	/	/	25	/	0.8	0.8
B72220W2251K501	NT20K250E2S5	23	31		7.5	3.1	5	1	25	6	0.8	0.8
B72220R2251K501	NT20K250E2S5K4	23	31		7.5	3.1	/	/	25	/	0.8	0.8
B72220W2271K501	NT20K275E2S5	23	31		7.5	3.2	5	1	25	6	0.8	0.8
B72220R2271K501	NT20K275E2S5K4	23	31		7.5	3.2	/	/	25	6	0.8	0.8
B72220W2301K501	NT20K300E2S5	23	31	11.0	7.5	3.3	5	1	25	/	0.8	0.8
B72220R2301K501	NT20K300E2S5K4	23	31		7.5	3.3	/	/	25	6	0.8	0.8
B72220W2321K501	NT20K320E2S5	23	31		7.5	3.5	5	1	25	/	0.8	0.8
B72220R2321K501	NT20K320E2S5K4	23	31		7.5	3.5	/	/	25	6	0.8	0.8
B72220W2351K501	NT20K350E2S5	23	31		7.5	3.7	5	1	25	/	0.8	0.8
B72220R2351K501	NT20K350E2S5K4	23	31		7.5	3.7	/	/	25	6	0.8	0.8
B72220W2381K501	NT20K385E2S5	23	31		7.5	4.0	5	1	25	/	0.8	0.8
B72220R2381K501	NT20K385E2S5K4	23	31		7.5	4.0	/	/	25	6	0.8	0.8
B72220W2421K501	NT20K420E2S5	23	31		7.5	4.2	5	1	25	/	0.8	0.8
B72220R2421K501	NT20K420E2S5K4	23	31		7.5	4.2	/	/	25	6	0.8	0.8
B72220W2461K501	NT20K460E2S5	23	31		7.5	4.4	5	1	25	/	1.0	0.8
B72220R2461K501	NT20K460E2S5K4	23	31		7.5	4.4	/	/	25	6	1.0	0.8
B72220W2511K501	NT20K510E2S5	23	31	12.0	7.5	4.5	5	1	25	6	1.0	0.8
B72220R2511K501	NT20K510E2S5K4	23	31		7.5	4.5	/	/	25	/	1.0	0.8
B72220W2551K501	NT20K550E2S5	23	31		7.5	4.7	5	1	25	6	1.0	0.8
B72220R2551K501	NT20K550E2S5K4	23	31		7.5	4.7	/	/	25	/	1.0	0.8
B72220W2621K501	NT20K625E2S5	23	31	13.0	7.5	5.0	5	1	25	6	1.0	0.8
B72220R2621K501	NT20K625E2S5K4	23	31		7.5	5.0	/	/	25	/	1.0	0.8
B72220W2681K501	NT20K680E2S5	23	31		7.5	5.5	5	1	25	6	1.0	0.8
B72220R2681K501	NT20K680E2S5K4	23	31		7.5	5.5	/	/	25	/	1.0	0.8
B72220W2751K501	NT20K750E2S5	23	31		7.5	6.0	5	1	25	6	1.0	0.8
B72220R2751K501	NT20K750E2S5K4	23	31		7.5	6.0	/	/	25	/	1.0	0.8

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
NT20K130E2*	130	170	10000	5000	100	1.0
NT20K140E2*	140	180	10000	5000	110	1.0
NT20K150E2*	150	200	10000	5000	120	1.0
NT20K175E2*	175	225	10000	5000	135	1.0
NT20K210E2*	210	270	10000	5000	160	1.0
NT20K250E2*	250	320	10000	5000	195	1.0
NT20K275E2*	275	350	10000	5000	215	1.0
NT20K300E2*	300	385	10000	5000	250	1.0
NT20K320E2*	320	420	10000	5000	273	1.0
NT20K350E2*	350	460	10000	5000	200	1.0
NT20K385E2*	385	505	10000	5000	273	1.0
NT20K420E2*	420	560	10000	5000	273	1.0
NT20K460E2*	460	615	10000	5000	300	1.0
NT20K510E2*	510	670	10000	5000	325	1.0
NT20K550E2*	550	745	10000	5000	360	1.0
NT20K625E2*	625	825	10000	5000	400	1.0
NT20K680E2*	680	895	10000	5000	440	1.0
NT20K750E2*	750	1060	10000	3000	480	1.0

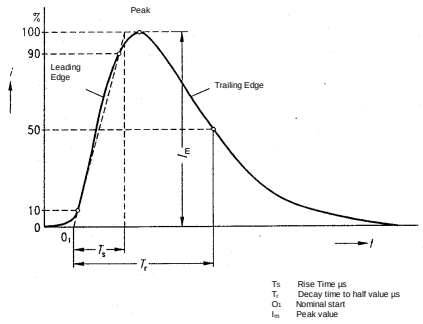
*May be suffix S5, K4

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

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
NT20K130E2*	205	10	340	100	1850
NT20K140E2*	220	10	360	100	1700
NT20K150E2*	240	10	395	100	1550
NT20K175E2*	270	10	455	100	1350
NT20K210E2*	330	10	545	100	1100
NT20K250E2*	390	10	650	100	940
NT20K275E2*	430	10	710	100	850
NT20K300E2*	470	10	775	100	780
NT20K320E2*	510	10	840	100	720
NT20K350E2*	560	10	910	100	660
NT20K385E2*	620	10	1025	100	600
NT20K420E2*	680	10	1120	100	550
NT20K460E2*	750	10	1240	100	500
NT20K510E2*	820	10	1355	100	460
NT20K550E2*	910	10	1500	100	410
NT20K625E2*	1000	10	1650	100	380
NT20K680E2*	1100	10	1815	100	340
NT20K750E2*	1200	10	2000	100	250

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.  	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

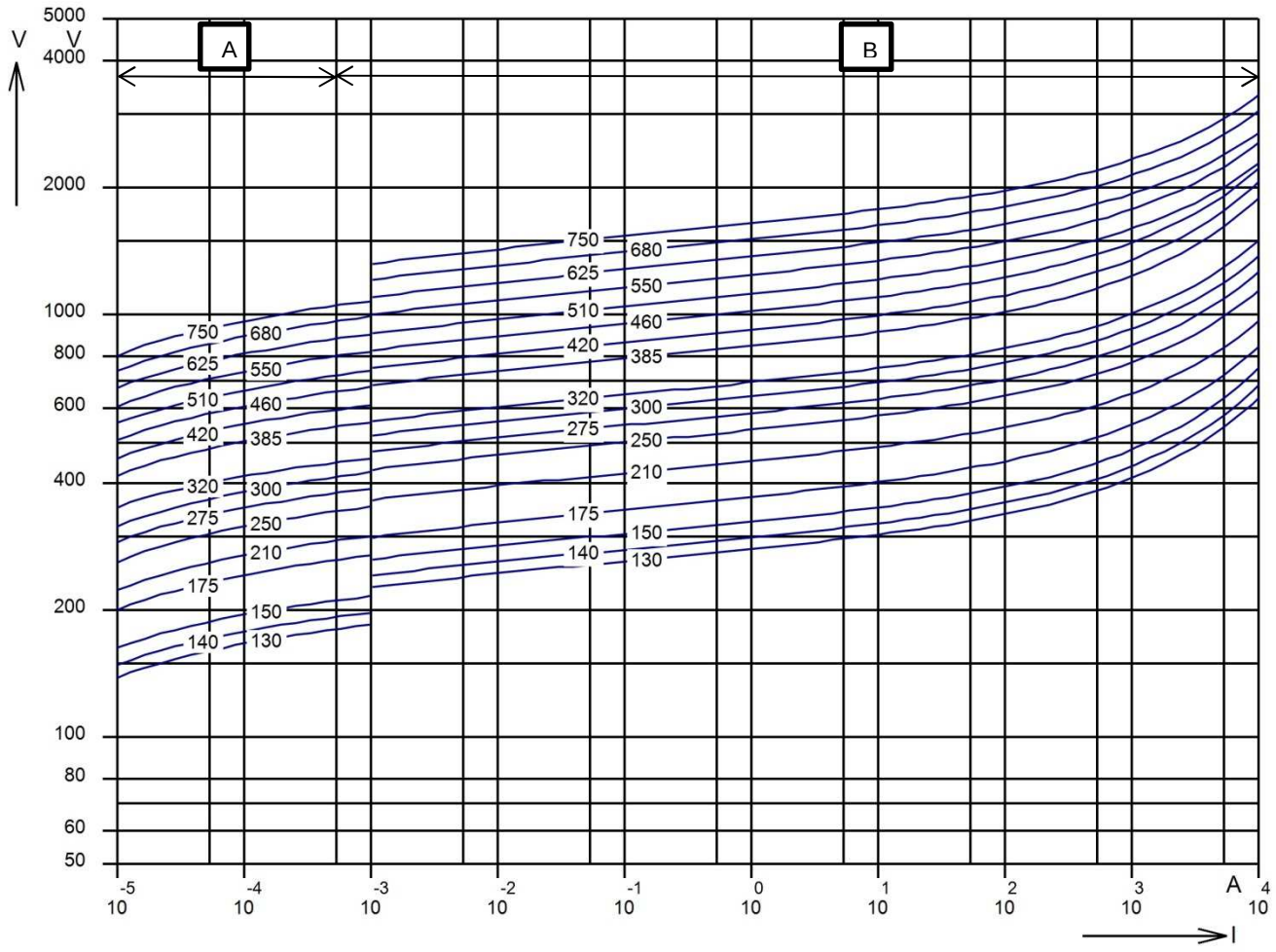
<table>
<tr><th>Test</th><th>Test Methods/Description</th><th>Requirement</th></tr>
<tr>
<td>Abnormal over voltage</td>
<td>This device is designed to form open circuit in the event of overheating due to the limited current abnormal over voltage conditions as outlined in section 44.4 of UL1449 4th edition.
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 equilibrium3).
The test result will be visually inspected.
Detailed test voltages applied onto the devices are as in the following table:
<table>
<tr><th rowspan="2">Type</th><th>Device rating</th><th>Test voltage</th></tr>
<tr><th>(V ac)</th><th>(V ac)</th></tr>
<tr><td>NT20K130E2*</td><td>130</td><td>240</td></tr>
<tr><td>NT20K140E2*</td><td>140</td><td>240</td></tr>
<tr><td>NT20K150E2*</td><td>150</td><td>240</td></tr>
<tr><td>NT20K175E2*</td><td>175</td><td>240</td></tr>
<tr><td>NT20K210E2*</td><td>210</td><td>240</td></tr>
<tr><td>NT20K250E2*</td><td>250</td><td>480</td></tr>
<tr><td>NT20K275E2*</td><td>275</td><td>480</td></tr>
<tr><td>NT20K300E2*</td><td>300</td><td>480</td></tr>
<tr><td>NT20K320E2*</td><td>320</td><td>480</td></tr>
<tr><td>NT20K350E2*</td><td>350</td><td>600</td></tr>
<tr><td>NT20K385E2*</td><td>385</td><td>600</td></tr>
<tr><td>NT20K420E2*</td><td>420</td><td>690</td></tr>
<tr><td>NT20K460E2*</td><td>460</td><td>690</td></tr>
<tr><td>NT20K510E2*</td><td>510</td><td>1000</td></tr>
<tr><td>NT20K550E2*</td><td>550</td><td>1000</td></tr>
<tr><td>NT20K625E2*</td><td>625</td><td>1000</td></tr>
<tr><td>NT20K680E2*</td><td>680</td><td>1000</td></tr>
<tr><td>NT20K750E2*</td><td>750</td><td>1000</td></tr>
</table>
</td>
<td>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.</td>
</tr>
</table>

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.

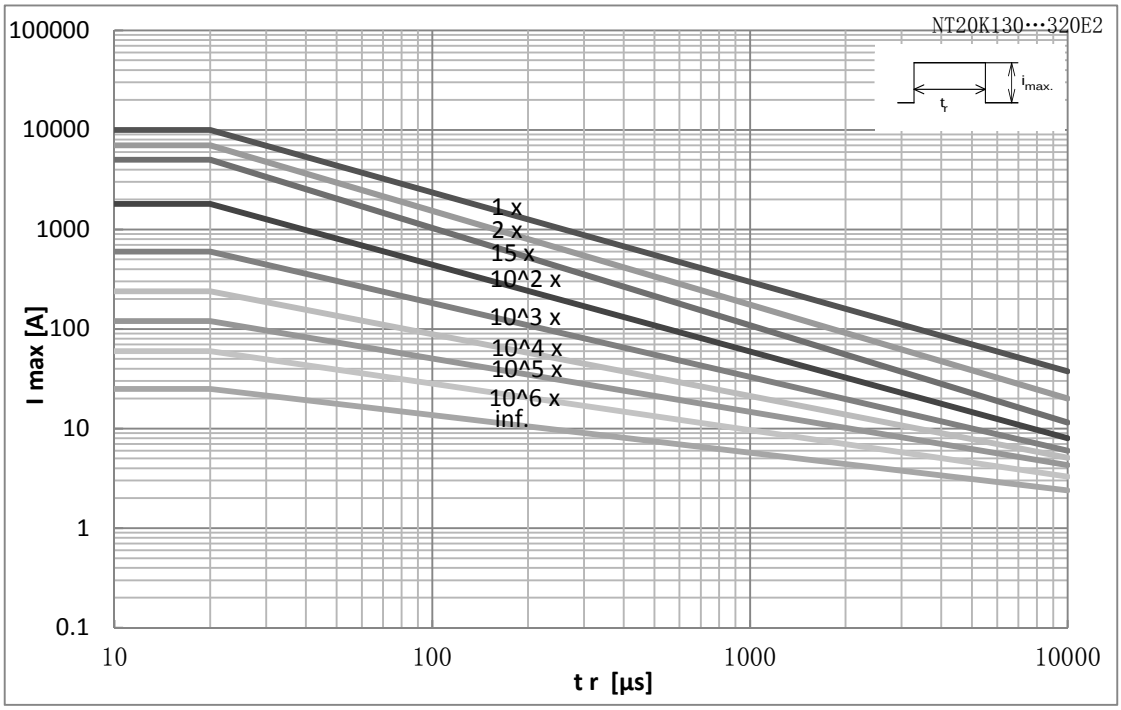
v/i characteristic

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

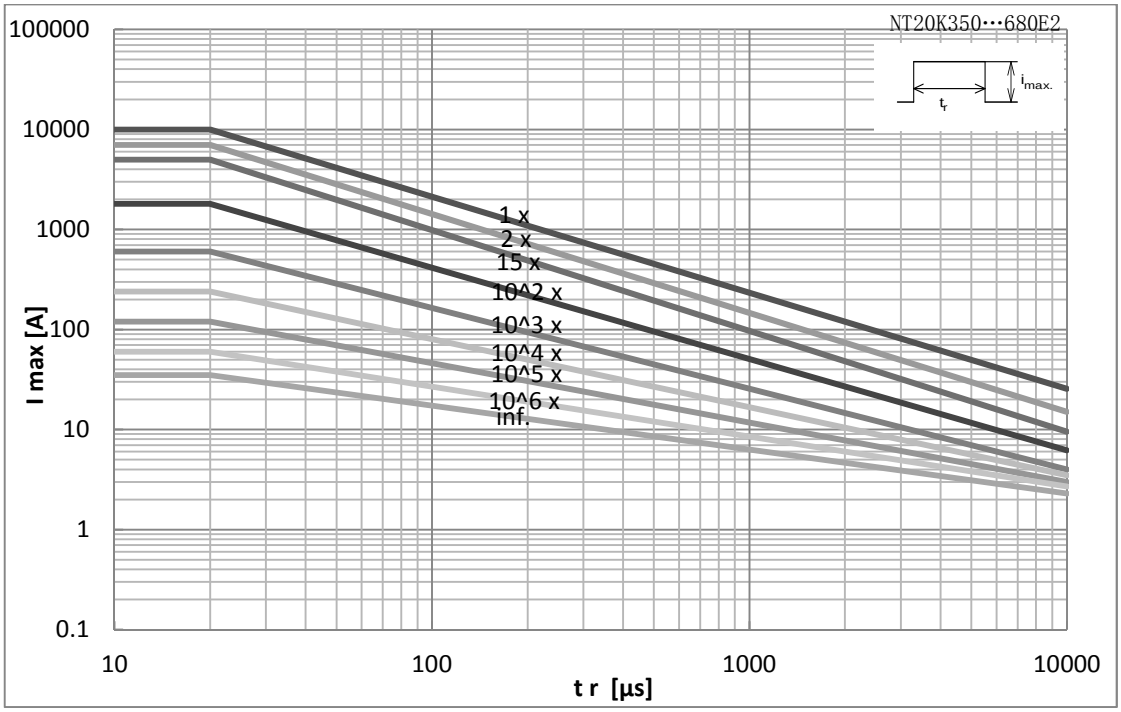


Derating curves

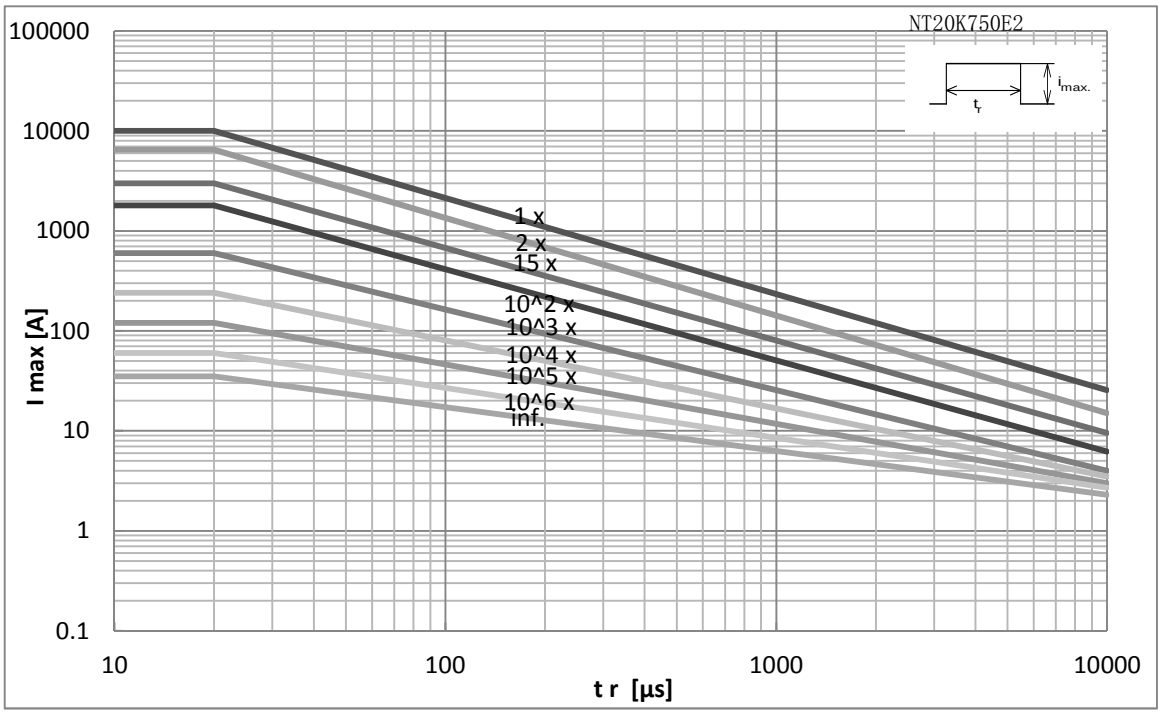
Suitable for 130 -320



Suitable for 350 -680



Suitable for 750



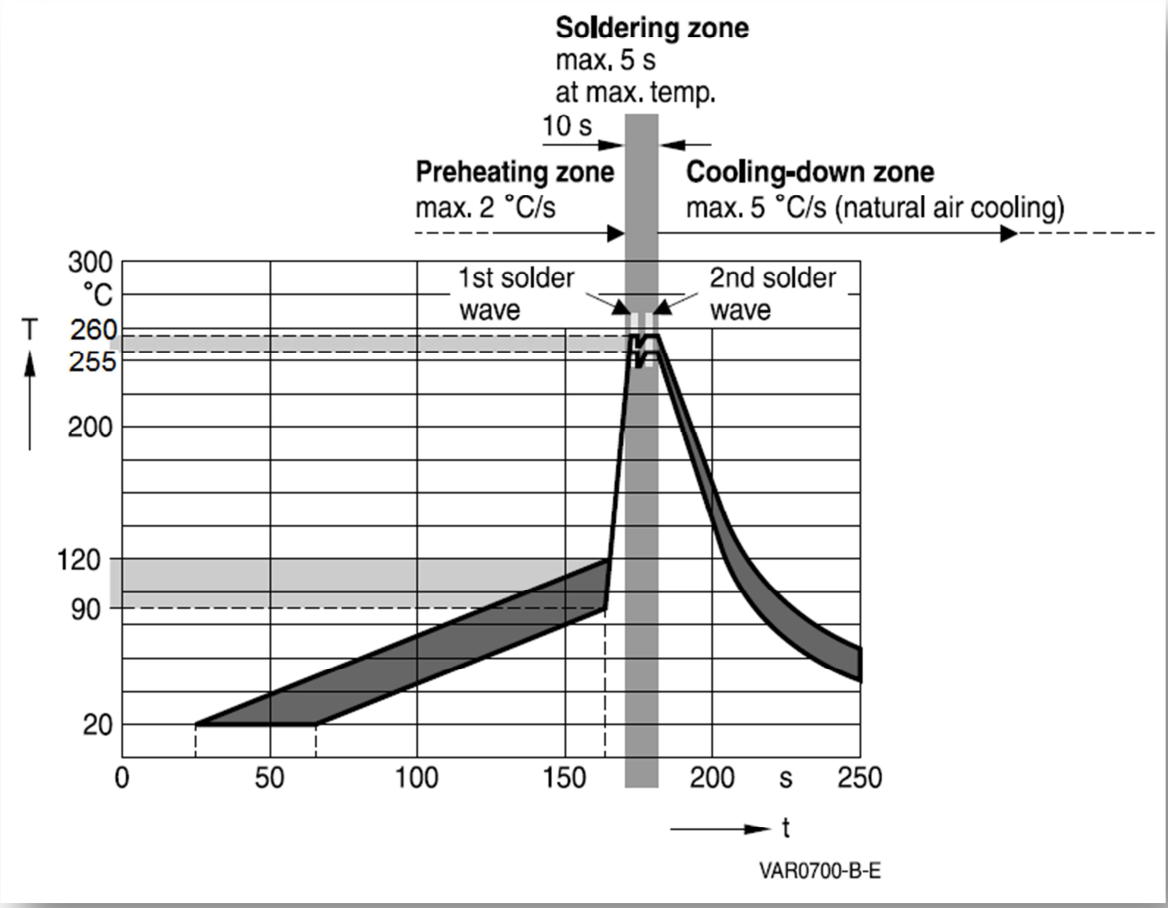
1 Soldering instructions only for NT series

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).



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

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.

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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