



METAL OXIDE VARISTORS (TNR[®])

CAT. No. E1006J Version1.0

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Please ask for the individual catalog (NO. E1006), If you require the detailed specifications.



Item	Series	Features	
Chip Type	C Series	<ul style="list-style-type: none">• Single Layer Chip Type• Direct Surface Mounting	
	V Series	<ul style="list-style-type: none">• Very Large Surge Capability	
Disk Type	H Series	<ul style="list-style-type: none">• High Energy• Low Voltage	Disk Type
	HP Series		with Heat Sink
	GF Series	<ul style="list-style-type: none">• Disk Type with Thermal Fuse	
	32HP Series	<ul style="list-style-type: none">• High Energy with Heat Sink	
	^(NEW) SE Series	<ul style="list-style-type: none">• Non Flammable Type• Very Large Surge Capability	
Axial Lead Type	A Series	<ul style="list-style-type: none">• Axial Lead Type• High Voltage	
Case Type	E Series	<ul style="list-style-type: none">• Case Type• High Energy	

1. The performance of varistors may deteriorate, the inside elements may be damaged, and they cause the varistors to smoke or catch fire, if the following precautions are not observed.
 - (1) Do not use varistors in places whose temperature exceeds their rated operating temperature due to direct sunlight or heating objects.
 - (2) Do not use varistors in a humid place directly exposed to the weather or steam.
 - (3) Do not use varistors in places filled with dust, salt-mist or corrosive gas.
 - (4) Apply soldering conditions within the limits prescribed in the catalog or product specifications.
For surface mount varistors, use flux with a halogen content of less than 0.2 wt.%. Do not use strong acid flux.
 - (5) Do not use solvents such as thinner and acetone which dissolve or make the exterior covering of varistors deteriorate.
Ultrasonic cleaning shall be so set that the vibration can not travel the assembly boards.
 - (6) Do not expose varistors to intense vibration, shock (drop shock etc.) or pressure making the exterior covering or inside element crack.
 - (7) Do not apply high voltage exceeding the rated maximum applying voltage to varistors. In the case of automotive jump starts, however, use the varistors within short-term allowable voltage limits prescribed in the catalog.
If voltage wave form is not complete DC, a maximum value of peak voltages shall not exceed the rated maximum applying voltage.
 - (8) Do not apply peak currents exceeding the rated maximum energy.
 - (9) When peak currents are repeatedly applied to varistors, do not exceed the pulse life time ratings prescribed in the catalog.
 - (10) When peak currents are intermittently applied to varistors at short intervals, do not exceed the rated wattage.
 - (11) Using varistors in circuits whose frequency exceeds 1kHz may damage their elements by heat generation due to dielectric loss.
 - (12) In the case of coating or molding varistors with resin, do not use the resin which makes the varistors deteriorate.
 - (13) Do not install varistors in places near by flammable substances.

2. Varistors may blow up, if the following precautions are not observed.
 - (1) Do not use varistors in circuits applied peak currents exceeding the specified limits.
 - (2) Do not exceed the rated maximum applying voltage.

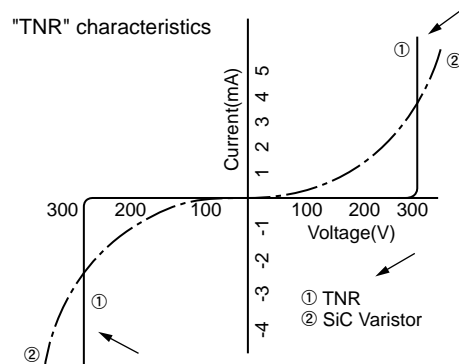
3. Varistors do not function but damages devices, if the following precautions are not observed.
 - (1) Hold the root of the varistor lead when bending or cutting the lead.
 - (2) The lead close to insulation cover shall not be bent or applied to outer force.
 - (3) When soldering the lead, do not damage a solder material and insulator fabricating the varistor.

- (4) Put the proper volume of solder (the height of fillet) on pc boards for installing surface mount varistors, because it directly affects the installed varistors. The design of copper pad patterns and dimensions should be set so that the proper volume of solder can be provided.
 - (5) When mounting surface mount varistors on the pc board, the improper soldering temperature and time out of the limits may reduce the adhesive strength of their terminals.
 - (6) When cutting off a multi-board to make individual units, curving or twisting the board may make the varistors crack. Appropriate tools should be used to cut it off.
4. The following preventive measures should be made for avoiding unexpected accident.
- (1) When using a varistor in between circuits, connect an earth leakage breaker (ground-fault circuit interrupter) or current fuse in series with the varistor.
 - (2) When using a varistor in between a circuit and ground, connect an earth leakage breaker (ground-fault circuit interrupter) or both of a current fuse and thermal fuse in series with the varistor. Also, in case of excessive voltage due to ground short circuit accident, use the varistor with the rated voltage higher than the excessive voltage.
5. Store varistors at a temperature of -10 to $+40^{\circ}\text{C}$ and a relative humidity of less than 75%. Avoid storing in environment of rapid changes in temperature, direct sunlight, corrosive gas or dust, and store with the varistors packaged.
6. Follow safety standards such as Electrical, UL, CSA and so forth, which specify the use of varistors.
7. Catalogs
Specifications in catalogs may be subject to change without notice.
Performance test data in the catalogs show typical values, which are not assured in the catalogs.

TNR is a "NEW" metal oxide varistor having steep non-linear V-I characteristics and high discharge current capability, as follows:

● TNR Features

1. Excellent transient voltage suppression
2. High discharge current capability
3. Wide range of voltage ratings
4. Symmetrical V-1 characteristics (Non Polarity)
5. Fast response
6. Steady operation for repeating surge
7. Low temperature coefficient
8. High reliability
9. UL recognized
10. CSA recognized



● Applications

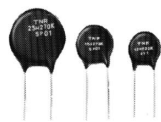
1. Electronics instrument protection
2. Telephone system protection
3. Relay contact point protection
4. Rectification diode protection
5. SCR protection
6. Reduction of abnormal voltage in high voltage current
7. Switching transistor protection
8. Reduction of switching surge in electromagnetic brake
9. Prevention of error in digital circuit

Group Chart

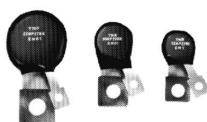
V Series



H Series



HP Series



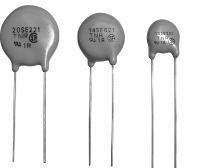
32HP Series



C Series



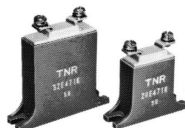
SE Series (NEW)



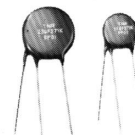
A Series



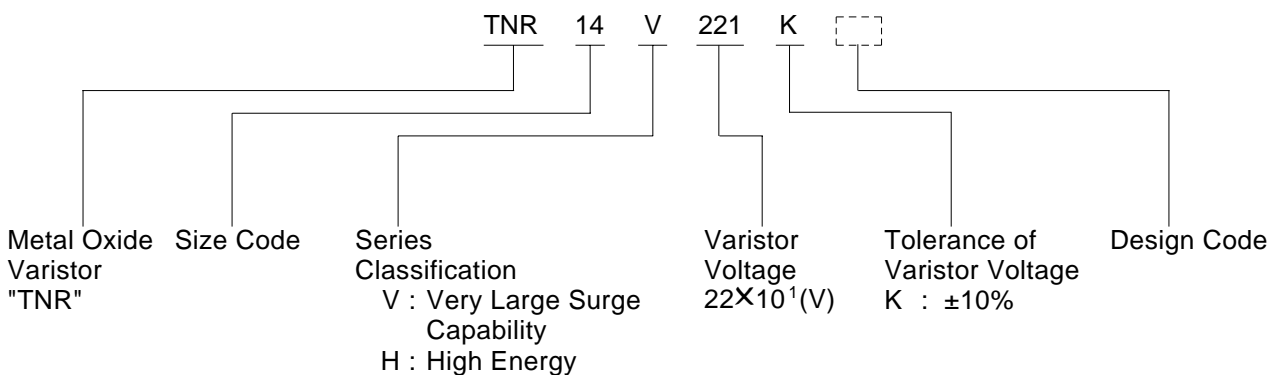
E Series

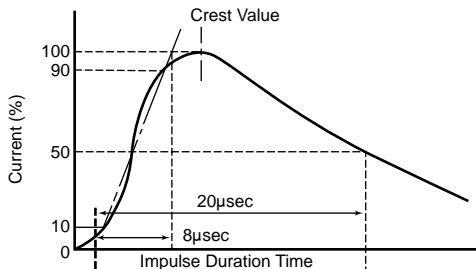


GF Series

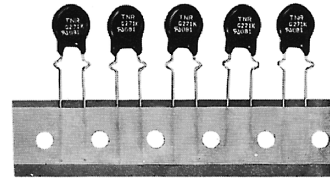


Part Numbering System



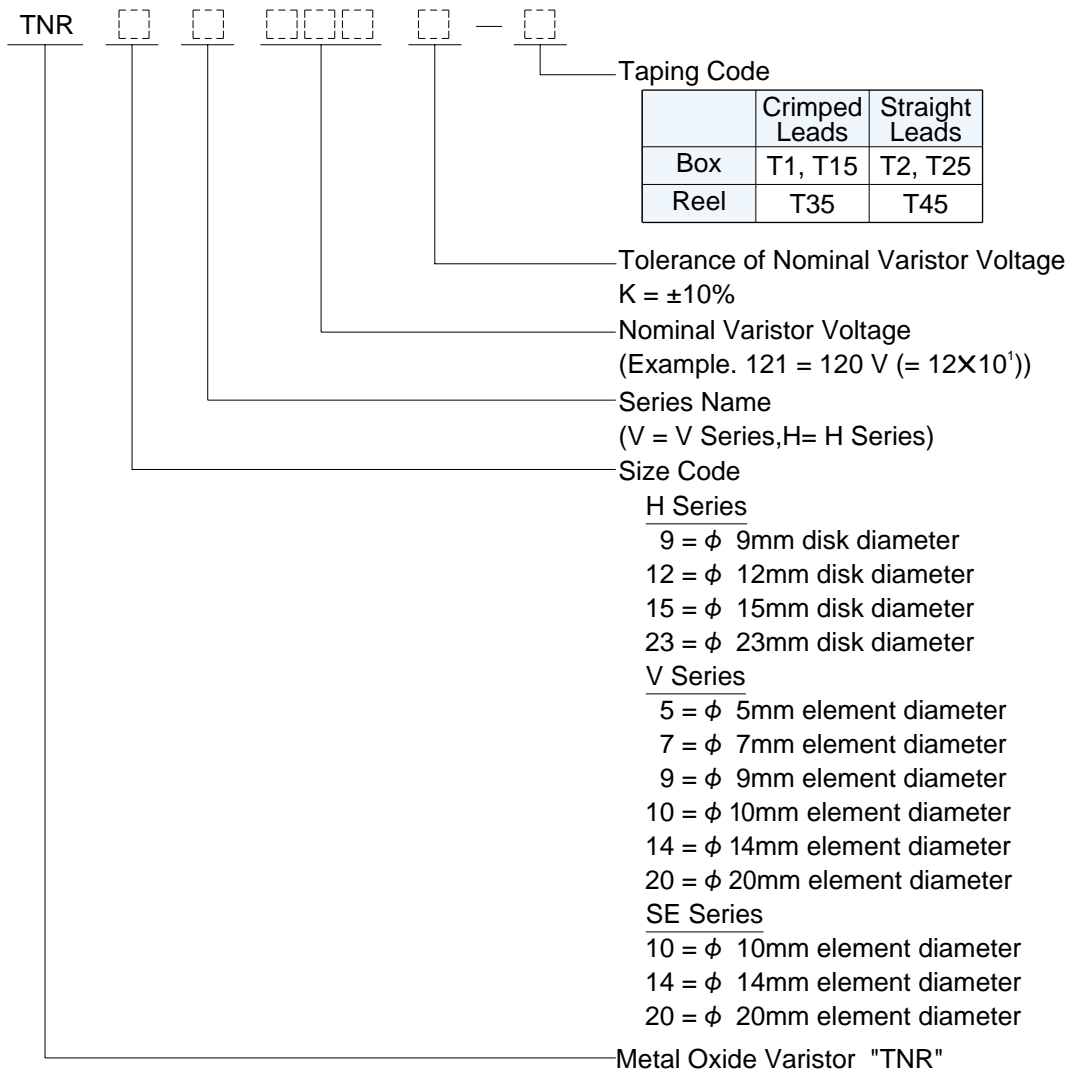
Technical Term	Description
Varistor Voltage	Voltage across the varistor measured at CmA DC. C = 0.1 or 1.0 as specified.
Applied Voltage (ACrms)	Maximum continuous sinusoidal RMS voltage which may be applied.
Applied Voltage (DC)	Maximum continuous DC voltage which may be applied.
Maximum Clamping Voltage	Peak voltage across the varistor, measured under conditions of a specified peak impulse current and specified waveform (8/20 μ Sec.) applied 1 time.
Rated Wattage	Maximum power that can be applied within the specified ambient temperature.
Maximum Peak Current	Maximum current within the $\pm 10\%$ varistor voltage change with standard impulse current (8/20 μ Sec.) applied 1time.
Current Wave Form for Clamping Voltage Test and Maximum Peak Current	
Energy	Maximum energy within the $\pm 10\%$ varistor voltage change when 1 impulse τ msec long is applied. $\tau = 2$ or 20 or 200 ms as specified.
Capacitance	Typical value measured at a 1kHz test frequency. (Sinusoidal wave. Reference purpose only)

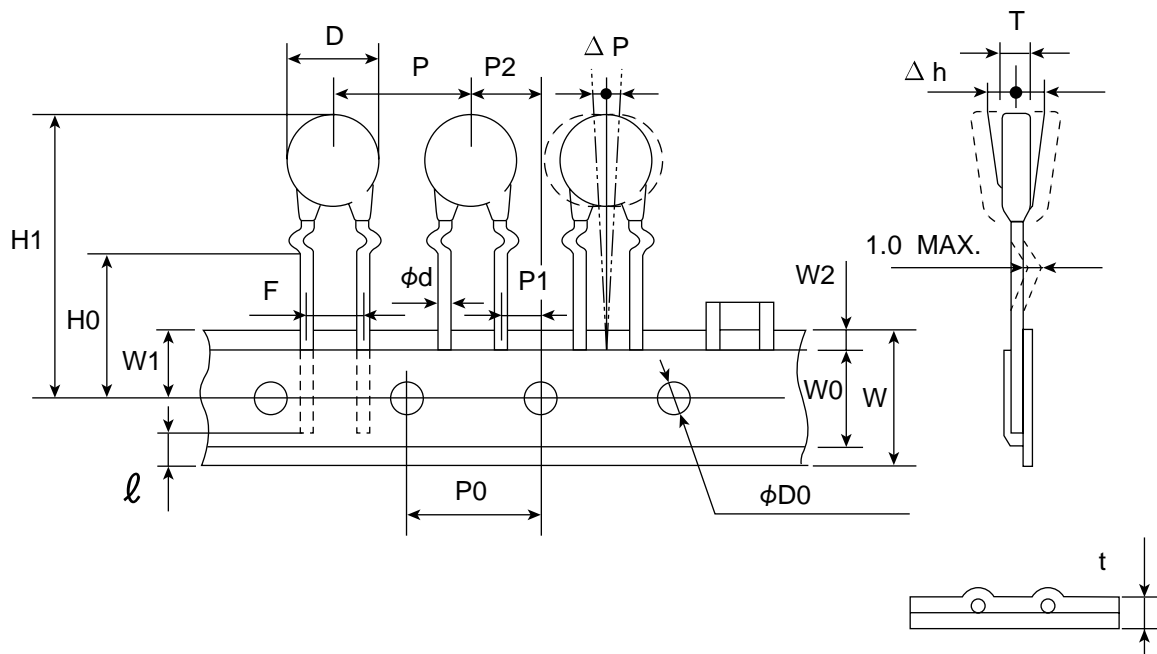
- ◆ This Specifies taping specifications for TNR varistors which have normal disk diameter of 5~15mm and nominal varistor voltage of 15~470V.
- ◆ These taping specifications conform to JIS C 0805.



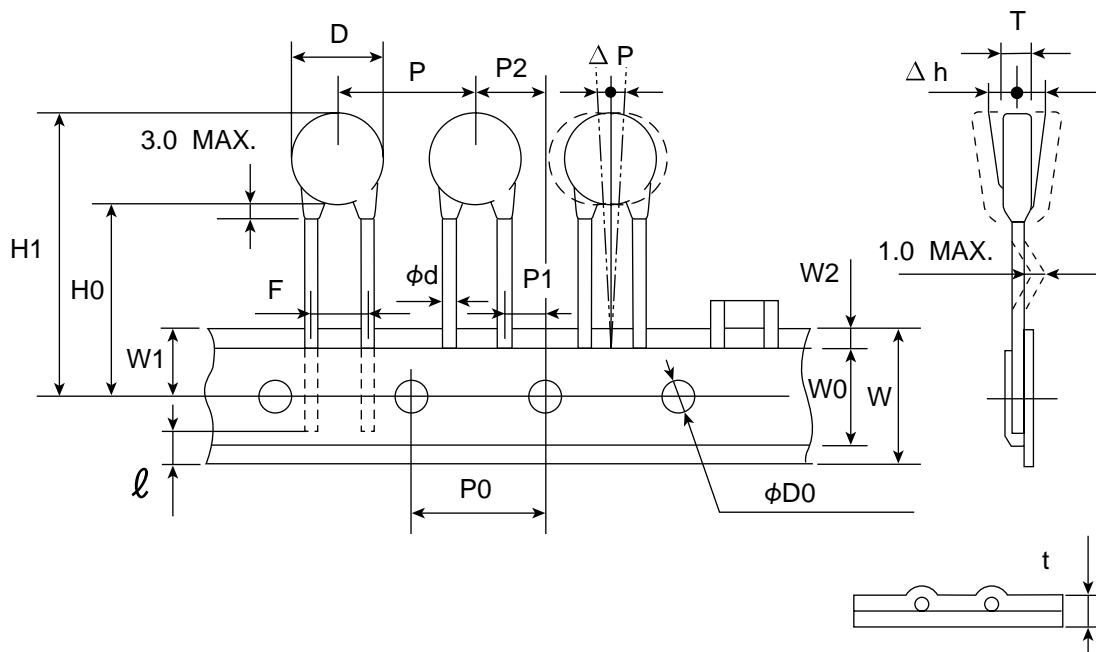
● Part Numbering System

(Taping code is to be added at the end of model number.)

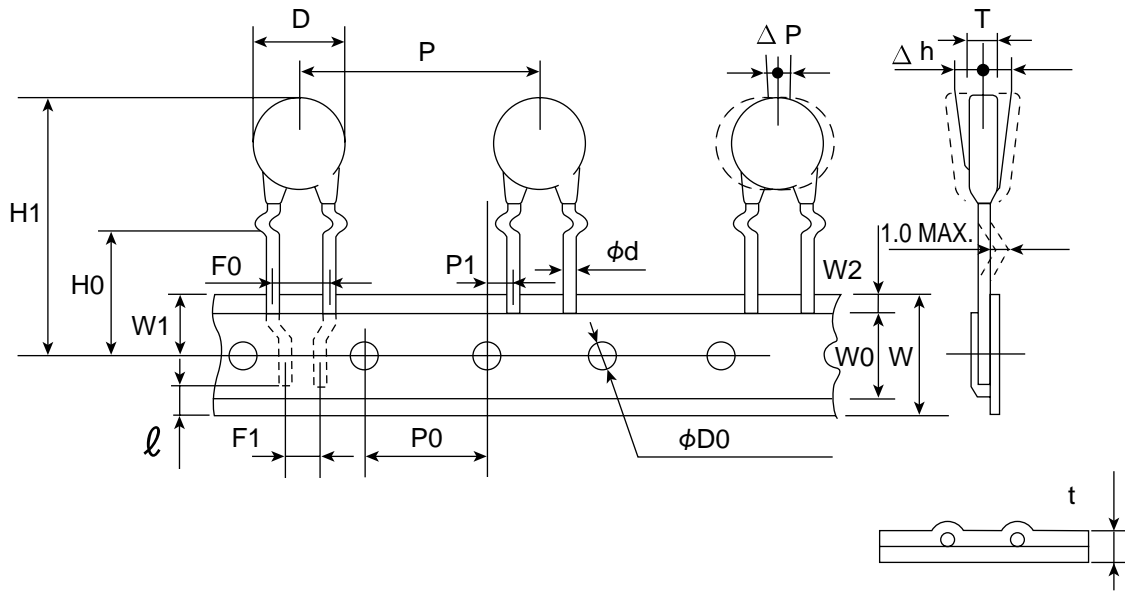


● 5V, 7V, 9V, 9H : TYPE T15, T35 (Crimped Lead)

● 5V, 7V, 9V, 9H (TYPE : T15, T35)

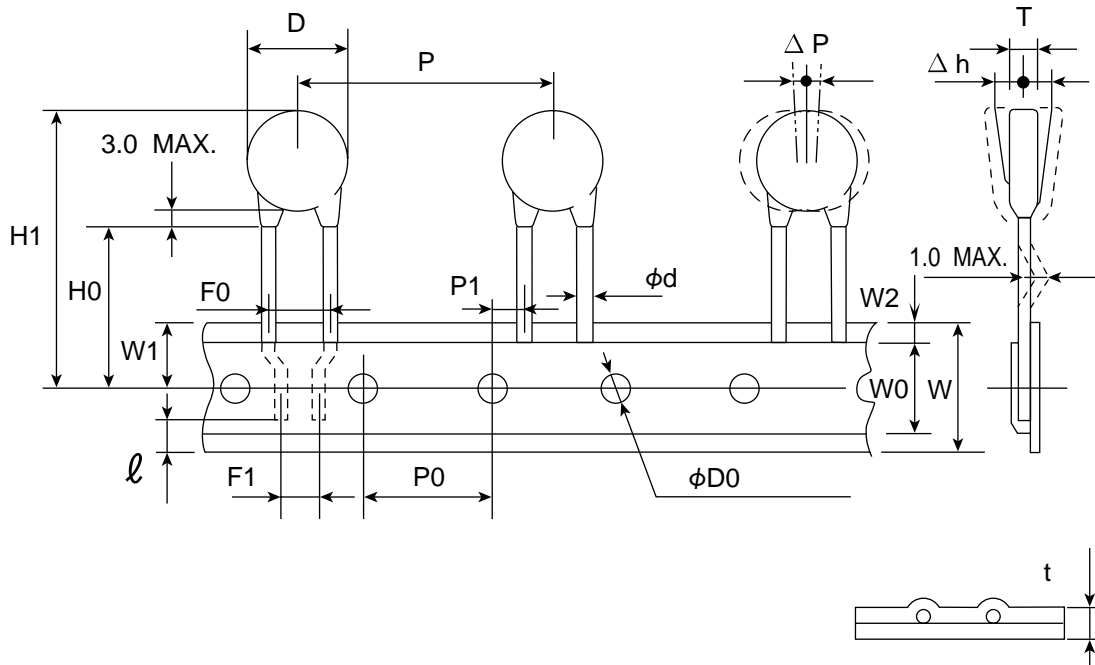
Parameter	Code	Dimensions (mm)	Note
Diameter of component	D	-----	Refer to the applicable detail spec
Thickness of component	T	-----	Refer to the applicable detail spec
Lead diameter	ϕd	0.6±0.05	
Pitch of component	P	12.7±1.0	
Feed hole pitch	P ₀	12.7±0.3	Cumulative pitch error : ±1 mm/20 pitches
Feed hole diameter	ϕD_0	4.0±0.2	
Feed hole center to lead	P ₁	3.85±0.7	Measured at the upper end of tape
Feed hole center to component center	P ₂	6.35±1.3	
Feed hole position	W ₁	9.0±0.5	
Lead spacing	F	5.0±0.8	
Deviation across tape	Δh	0±2.0	
Deviation along tape	ΔP	0±1.3	
Carrier tape width	W	18.0± 1.0 0.5	
Hold down tape width	W ₀	12.5 MIN.	
Total tape thickness	t	0.6±0.3	
Hold down tape position	W ₂	3.0 MAX.	
Seating plane height	H ₀	16.0±0.5	
Component height	H ₁	32.2 MAX.	9V : 34.0 MAX.
Lead position	ℓ	6.0 MAX.	

● 5V, 7V, 9V, 9H : TYPE T25, T45 (Straight Lead)

● 5V, 7V, 9V, 9H (TYPE : T25, T45)

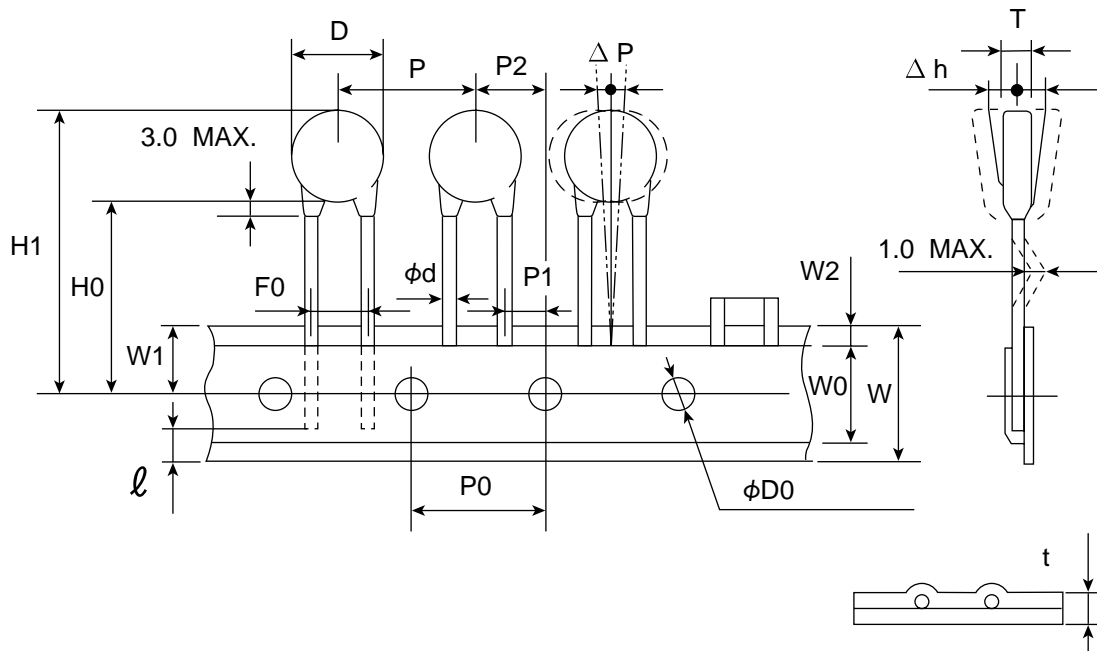
Parameter	Code	Dimensions (mm)	Note
Diameter of component	D	-----	Refer to the applicable detail spec
Thickness of component	T	-----	Refer to the applicable detail spec
Lead diameter	φd	0.6±0.05	
Pitch of component	P	12.7±1.0	
Feed hole pitch	P0	12.7±0.3	Cumulative pitch error : ±1 mm/20 pitches
Feed hole diameter	φD0	4.0±0.2	
Feed hole center to lead	P1	3.85±0.7	Measured at the upper end of tape
Feed hole center to component center	P2	6.35±1.3	
Feed hole position	W1	9.0±0.5	
Lead spacing	F	5.0±0.8	
Deviation across tape	Δh	0±2.0	
Deviation along tape	ΔP	0±1.0	
Carrier tape width	W	18.0 ^{+1.0} _{-0.5}	
Hold down tape width	W0	5.0 MIN.	
Total tape thickness	t	0.6±0.3	
Hold down tape position	W2	3.0 MAX.	
Height from tape center to component base	H0	20.0 ^{+1.5} _{-1.0}	
Component height	H1	32.2 MAX.	9V : 34.0 MAX.
Lead position	ℓ	6.0 MAX.	

● 10V, 14V, 10SE, 14SE, 12H, 15H : TYPE T1 (Crimped Lead)

● 10V, 14V, 10SE, 14SE, 12H, 15H (T1 TYPE)

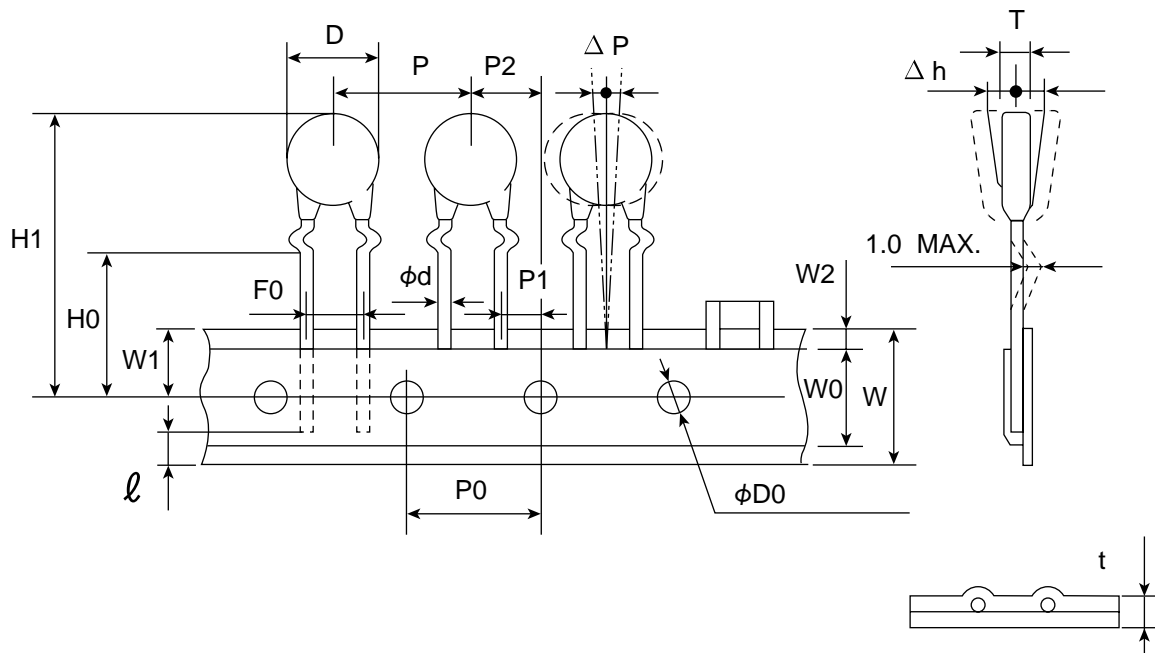
Parameter	Code	Dimensions (mm)	Note
Diameter of component	D	-----	Refer to the applicable detail spec
Thickness of component	T	-----	Refer to the applicable detail spec
Lead diameter	ϕd	0.8±0.05	
Pitch of component	P	25.4±1.0	
Feed hole pitch	P0	12.7±0.3	Cumulative pitch error : ±1 mm/20 pitches
Feed hole diameter	$\phi D0$	4.0±0.2	
Feed hole center to lead	P1	2.6±0.5	Measured at the upper end of tape
Feed hole position	W1	9.0±0.5	
Lead spacing	F0	7.5±0.8	
	F1	5.0 Nom	
Deviation across tape	Δh	0±2.0	
Deviation along tape	ΔP	0±1.0	
Carrier tape width	W	18.0±0.5	
Hold down tape width	W0	5.0 MIN.	
Total tape thickness	t	0.6±0.3	
Hold down tape position	W2	3.0 MAX.	
Seating plane height	H0	16.0±1.0	
Component height	H1	41.0 MAX.	
Lead position	ℓ	6.0 MAX.	

● 10V, 14V, 10SE, 14SE, 12H, 15H : TYPE T2 (Straight Lead)

● 10V, 14V, 10SE, 14SE, 12H, 15H (T2 TYPE)

Parameter	Code	Dimensions (mm)	Note
Diameter of component	D	-----	Refer to the applicable detail spec
Thickness of component	T	-----	Refer to the applicable detail spec
Lead diameter	φd	0.8±0.05	
Pitch of component	P	25.4±1.0	
Feed hole pitch	P0	12.7±0.3	Cumulative pitch error : ±1 mm/20 pitches
Feed hole diameter	φD0	4.0±0.2	
Feed hole center to lead	P1	2.6±0.5	Measured at the upper end of tape
Feed hole position	W1	9.0±0.5	
	F0	7.5±0.8	
Lead spacing	F1	5.0 Nom	
Deviation across tape	Δh	0±2.0	
Deviation along tape	ΔP	0±1.0	
Carrier tape width	W	18.0±0.5	
Hold down tape width	W0	5.0 MIN.	
Total tape thickness	t	0.6±0.3	
Hold down tape position	W2	3.0 MAX.	
Height from tape center to component base	H0	20.0 MIN.	SE : 19.0 MIN.
Component height	H1	41.0 MAX.	
Lead position	ℓ	6.0 MAX.	

● 10V, 14V : TYPE T7 (Straight Lead, 15mm Pitch)

● 10V, 14V (T7 TYPE)

Parameter	Code	Dimensions (mm)	Note
Diameter of component	D	-----	Refer to the applicable detail spec
Thickness of component	T	-----	Refer to the applicable detail spec
Lead diameter	φd	0.8±0.05	
Pitch of component	P	15.0±1.0	The other : 30.0 ±1.0 mm
Feed hole pitch	P0	15.0±0.3	Cumulative pitch error : ±1 mm/20 pitches
Feed hole diameter	φD0	4.0±0.2	
Feed hole center to lead	P1	3.75±0.5	Measured at the upper end of tape
Feed hole center to component center	P2	7.5±1.3	
Feed hole position	W1	9.0±0.5	
Lead spacing	F	7.5±0.8	
Deviation across tape	Δh	0±2.0	
Deviation along tape	ΔP	0±1.3	
Carrier tape width	W	18.0 ^{+1.0} / _{-0.5}	
Hold down tape width	W0	5.0 MIN.	
Total tape thickness	t	0.6±0.3	
Hold down tape position	W2	3.0±MAX.	
Height from tape center to component base	H0	20 ^{+1.5} / _{-1.0}	
Component height	H1	41.0 MAX.	
Lead position	ℓ	6.0 MAX.	

● 10V, 14V : TYPE T8 (Crimped Lead, 15mm Pitch)

● 10V, 14V (T8 TYPE)

Parameter	Code	Dimensions (mm)	Note
Diameter of component	D	-----	Refer to the applicable detail spec
Thickness of component	T	-----	Refer to the applicable detail spec
Lead diameter	ϕd	0.8±0.05	
Pitch of component	P	15.0±1.0	The other : 30.0 ±1.0 mm
Feed hole pitch	P0	15.0±0.3	Cumulative pitch error : ±1 mm/20 pitches
Feed hole diameter	$\phi D0$	4.0±0.2	
Feed hole center to lead	P1	3.75±0.5	Measured at the upper end of tape
Feed hole center to component center	P2	7.5±1.3	
Feed hole position	W1	9.0±0.5	
Lead spacing	F	7.5±0.8	
Deviation across tape	Δh	0±2.0	
Deviation along tape	ΔP	0±1.3	
Carrier tape width	W	18.0± ^{1.0} / _{0.5}	
Hold down tape width	W0	5.0 MIN.	
Total tape thickness	t	0.6±0.3	
Hold down tape position	W2	3.0 MAX.	
Seating plane height	H	-----	10V ; 17.5 MAX. 14V ; 21.0 MAX.
	H0	16.0±2.5	
Component height	H1	41.0 MAX.	
Lead position	ℓ	6.0 MAX.	

● Packaging

Configuration	Box				Reel		
Dimensions (mm)		T15, T25	T1, T2		T7, T8		T35, T45
		5V, 7V 9V, 9H	10V, 14V 12H, 15H	10SE 14SE	10V, 14V		5V, 7V, 9V, 9H
	W	325±5	330±5	340 max.	340 max.	W	50±1
	H	47±3	57±3	65 max.	65 max.	D	370 max.
	B	280±10	315±10	360 max.	360 max.	A	30
					B	76.5±1	

● Packaging Quantity

Size, Series (Taping Code)	150K ~ 271K	331K ~ 511K
5V,7V,9V,9H (T15,T25,T35,T45)	1,500	1,000
10V,14V,10SE,14SE (T1,T2)	800	500
12H,15H (T1,T2)	500 (220K ~ 470K)	
10V,14V (T7,T8)	1000	

● Others

- 1) On the box or the reel, followings are noted.
 1. Model number
 2. Lot number
 3. Quantity
 4. Manufacturer country
- 2) Minimum order quantity shall be the packaging quantity per one box one reel.



● **Ordering Information**

Metal Oxide Varistors "TNR G Series" are decided to be "Retentive Products" and be replaced by our new products of V Series.

In case of your new design and/or application, please order by replacement recommendation listed in the following table.

Retentive Products			Replacement Recommendation			
"TNR" G Series Part No.	Maximum Peak Current 8/20μs (A)		"TNR" V Series Part No.	Maximum Peak Current 8/20μs (A)		
	1 time	2 times		1 time	2 times	
TNR7G180K TNR7G220K TNR7G270K TNR7G330K TNR7G390K TNR7G470K TNR7G560K TNR7G680K	100	60	TNR5V180K TNR5V220K TNR5V270K TNR5V330K TNR5V390K TNR5V470K TNR5V560K TNR5V680K	250	125	
TNR7G820K TNR7G101K TNR7G121K TNR7G151K TNR7G181K TNR7G201K TNR7G221K TNR7G241K TNR7G271K TNR7G331K TNR7G361K TNR7G391K TNR7G431K TNR7G471K	400	250	TNR5V820K TNR5V101K TNR5V121K TNR5V151K TNR5V181K TNR5V201K TNR5V221K TNR5V241K TNR5V271K TNR5V331K TNR5V361K TNR5V391K TNR5V431K TNR5V471K	800	600	
TNR9G150K TNR9G180K TNR9G220K TNR9G270K TNR9G330K TNR9G390K TNR9G470K TNR9G560K TNR9G680K	250	125	TNR7V150K TNR7V180K TNR7V220K TNR7V270K TNR7V330K TNR7V390K TNR7V470K TNR7V560K TNR7V680K	500	250	
TNR9G820K TNR9G101K TNR9G121K TNR9G151K TNR9G181K TNR9G201K TNR9G221K TNR9G241K TNR9G271K TNR9G331K TNR9G361K TNR9G391K TNR9G431K TNR9G471K TNR9G511K	1200	600	TNR7V820K TNR7V101K TNR7V121K TNR7V151K TNR7V181K TNR7V201K TNR7V221K TNR7V241K TNR7V271K TNR7V331K TNR7V361K TNR7V391K TNR7V431K TNR7V471K TNR7V511K	1750	1250	

Retentive Products			Replacement Recommendation			
"TNR" G Series Part No.	Maximum Peak Current 8/20μs (A)		"TNR" V Series Part No.	Maximum Peak Current 8/20μs (A)		
	1 time	2 times		1 time	2 times	
TNR10G150K TNR10G180K TNR10G220K TNR10G270K TNR10G330K TNR10G390K TNR10G470K TNR10G560K TNR10G680K	500	250	TNR9V150K TNR9V180K TNR9V220K TNR9V270K TNR9V330K TNR9V390K TNR9V470K TNR9V560K TNR9V680K	800	400	
TNR10G820K TNR10G101K TNR10G121K TNR10G151K TNR10G181K TNR10G201K TNR10G221K TNR10G241K TNR10G271K TNR10G331K TNR10G361K TNR10G391K TNR10G431K TNR10G471K TNR10G511K	2500	1300	TNR9V820K TNR9V101K TNR9V121K TNR9V151K TNR9V181K TNR9V201K TNR9V221K TNR9V241K TNR9V271K TNR9V311K TNR9V361K TNR9V391K TNR9V431K TNR9V471K TNR9V511K	3000	2000	
TNR12G150K TNR12G180K TNR12G220K TNR12G270K TNR12G330K TNR12G390K TNR12G470K TNR12G560K TNR12G680K	500	250	TNR10V150K TNR10V180K TNR10V220K TNR10V270K TNR10V330K TNR10V390K TNR10V470K TNR10V560K TNR10V680K	1000	500	
TNR12G820K TNR12G101K TNR12G121K TNR12G151K TNR12G181K TNR12G201K TNR12G221K TNR12G241K TNR12G271K TNR12G331K TNR12G361K TNR12G391K TNR12G431K TNR12G471K TNR12G511K TNR12G561K TNR12G621K TNR12G681K TNR12G751K TNR12G821K TNR12G911K TNR12G102K TNR12G112K TNR12G122K TNR12G152K TNR12G182K	2500	1300	TNR10V820K TNR10V101K TNR10V121K TNR10V151K TNR10V181K TNR10V201K TNR10V221K TNR10V241K TNR10V271K TNR10V331K TNR10V361K TNR10V391K TNR10V431K TNR10V471K TNR10V511K TNR10V561K TNR10V621K TNR10V681K TNR10V751K TNR10V821K TNR10V911K TNR10V102K TNR10V112K TNR10V122K TNR10V152K TNR10V182K	3500	2500	



● Ordering Information

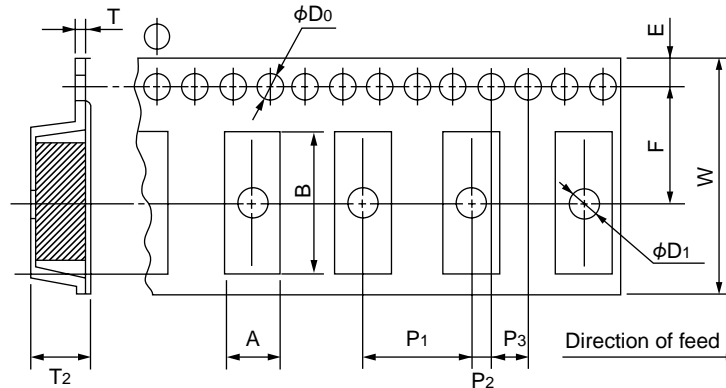
Retentive Products			Replacement Recommendation						
"TNR" G Series Part No.	Maximum Peak Current 8/20µs (A)		"TNR" V Series Part No.	Maximum Peak Current 8/20µs (A)					
	1 time	2 times		1 time	2 times				
TNR15G150K	1000	500	TNR14V150K	2000	1000				
TNR15G180K									
TNR15G220K									
TNR15G270K									
TNR15G330K									
TNR15G390K									
TNR15G470K									
TNR15G560K									
TNR15G680K									
TNR15G820K			4500			2500	TNR14V820K	6000	5000
TNR15G101K									
TNR15G121K									
TNR15G151K									
TNR15G181K									
TNR15G201K									
TNR15G221K									
TNR15G241K									
TNR15G271K									
TNR15G331K									
TNR15G361K									
TNR15G391K									
TNR15G431K									
TNR15G471K									
TNR15G511K									
TNR15G561K	4500	2500		TNR14V561K	5000		4500		
TNR15G621K									
TNR15G681K									
TNR15G751K									
TNR15G821K									
TNR15G911K									
TNR15G102K									
TNR15G112K									
TNR15G122K									
TNR15G152K									
TNR15G182K									

Retentive Products			Replacement Recommendation						
"TNR" G Series Part No.	Maximum Peak Current 8/20µs (A)		"TNR" V Series Part No.	Maximum Peak Current 8/20µs (A)					
	1 time	2 times		1 time	2 times				
TNR23G180K	2000	100	TNR20V180K	3000	2000				
TNR23G220K									
TNR23G270K									
TNR23G330K									
TNR23G390K									
TNR23G470K									
TNR23G560K									
TNR23G680K									
TNR23G820K			6500			4000	TNR20V820K	10000	7000
TNR23G101K									
TNR23G121K									
TNR23G151K									
TNR23G181K									
TNR23G201K									
TNR23G221K									
TNR23G241K									
TNR23G271K									
TNR23G331K									
TNR23G361K									
TNR23G391K									
TNR23G431K									
TNR23G471K									
TNR23G511K	6500	4000	TNR20V561K	7500	6500				
TNR23G621K									
TNR23G681K									
TNR23G751K									
TNR23G821K									
TNR23G911K									
TNR23G102K									
TNR23G112K									
TNR23G122K									
TNR23G152K									
TNR23G182K									

As to replacements, ask factory for technical specifications before purchase and/or use.

◆ Taping Specification

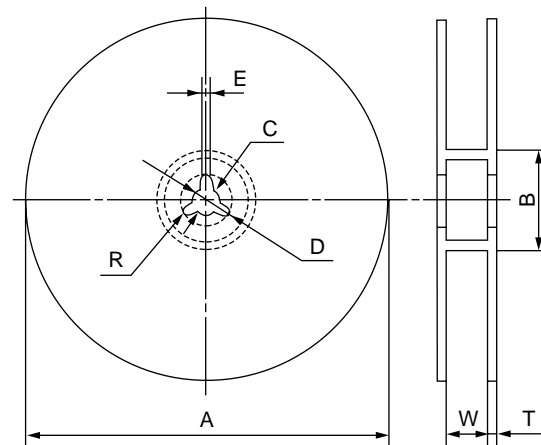
● The Specifications for TNR C Series



Size Code	Dimensions (mm)											
	A	B	W	F	E	P ₁	P ₂	P ₃	φD ₀	T	T ₂	φD ₁
5C-A	±0.1	±0.1	±0.3	±0.1	±0.1	±0.1	±0.1	±0.1	+0.1 0	Max.	Max.	Min.
5C-B	6.9	10.4				8.0					3.0	
7C	6.85	8.05				12.0					3.5	
9C	8.3	10.6	24.0	11.5	1.75	2.0	4.0	1.5	0.6	4.0	1.5	
12C	10.85	13.0										16.0
12C	12.5	16.3										

● Reel

Size Code	Rating of varistor
5C-A	TNR5C220K~470K, TNR5C820K~271K
5C-B	TNR5C560K, 680K



Size Code	Dimensions (mm)							
	A	B	C	D	E	W	T	R
5C-A, 5C-B	±0.2	Min.	±0.5	±0.8	±0.5	±1.0	±0.5	Nom.
7C	330	50	13	21	2.0	17.4	2.0	1.0
9C						25.4		
12C								

● Standard Packing quantity per reel

(Unit : Pcs)

Size Code	5C-A	5C-B	7 C	9 C	12C
Quantity	3500	2000	2000	1500	1000



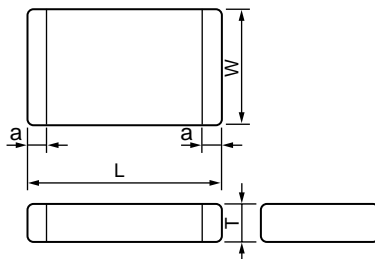
TNR® C SERIES

● Chip Type For Direct Surface Mounting (5C and 7C Type)

Operating Temperature Range: -40 ~ +125°C
Storage Temperature Range: -50 ~ +150°C

Model Number	Maximum Applied Voltage (Continuous)		Maximum Peak Current (8/20μSec.) (A)	Maximum Energy Rating (2mSec.) (J)	Rated Wattage (W)	Maximum Clamping Voltage		Varistor Voltage at V0.1mA (V)	T±1 (mm)
	Acrms(V)	DC(V)				Ip(A)	Vc (V)		
TNR5C220K	14	18	25/2 times	0.16	0.005	0.5	48	22 (20~ 24)	1.5
TNR5C270K	17	22		60			27 (24~ 30)		
TNR5C330K	20	26		73			33 (30~ 36)		
TNR5C390K	25	30		86			39 (35~ 43)		
TNR5C470K	30	37		104			47 (42~ 52)		
TNR5C560K	35	44	100/2 times	0.37	0.05	2.5	123	56 (50~ 62)	2.0
TNR5C680K	40	55		150			68 (61~ 75)		
TNR5C820K	50	65	100/2 times	0.65	0.05	2.5	145	82 (74~ 90)	1.5
TNR5C101K	60	85		175			100 (90~110)		
TNR5C121K	75	100		210			120 (108~132)		
TNR5C151K	95	125		260			150 (135~165)		
TNR5C181K	110	145		325			180 (162~198)		
TNR5C201K	130	170		355			200 (180~220)		
TNR5C221K	140	180		380			220 (198~242)		
TNR5C241K	150	200		415			240 (216~264)		
TNR5C271K	175	225		475			270 (243~297)		
TNR7C220K	14	18		60/2 times			0.4	0.01	
TNR7C270K	17	22	60		27 (24~ 30)				
TNR7C330K	20	26	73		33 (30~ 36)				
TNR7C390K	25	30	86		39 (35~ 43)				
TNR7C470K	30	37	104		47 (42~ 52)				
TNR7C560K	35	44	250/2 times	1.1	0.1	5.0	123	56 (50~ 62)	2.0
TNR7C680K	40	55		150			68 (61~ 75)		
TNR7C820K	50	65	250/2 times	2.0	0.1	5.0	145	82 (74~ 90)	1.5
TNR7C101K	60	85		175			100 (90~110)		
TNR7C121K	75	100		210			120 (108~132)		
TNR7C151K	95	125		260			150 (135~165)		
TNR7C181K	110	145		325			180 (162~198)		
TNR7C201K	130	170		355			200 (180~220)		
TNR7C221K	140	180		380			220 (198~242)		
TNR7C241K	150	200		415			240 (216~264)		
TNR7C271K	175	225		475			270 (243~297)		
TNR7C331K	210	270		600			330 (297~363)		
TNR7C361K	230	300	2.0	8.0	0.1	5.0	620	360 (324~396)	
TNR7C391K	250	320		8.0			675	390 (351~429)	
TNR7C431K	275	350	2.5	10.0	0.1	5.0	745	430 (387~473)	
TNR7C471K	300	385		10.0			810	470 (423~517)	

● Dimensions



Type	L±0.3	W±0.3	a (NOM.)
5C	8.0	6.3	0.8
7C	10.0	8.0	1.0
9C	12.5	10.0	1.0
12C	16.0	12.5	1.0

Unit : mm

● Precautions for pattern design and soldering

Do not line under the chip varistors at pattern design.
TNR C Series is designed for reflow soldering only.
Peak temperature of reflow soldering profile shall be 220~240°C during 5~10 sec.

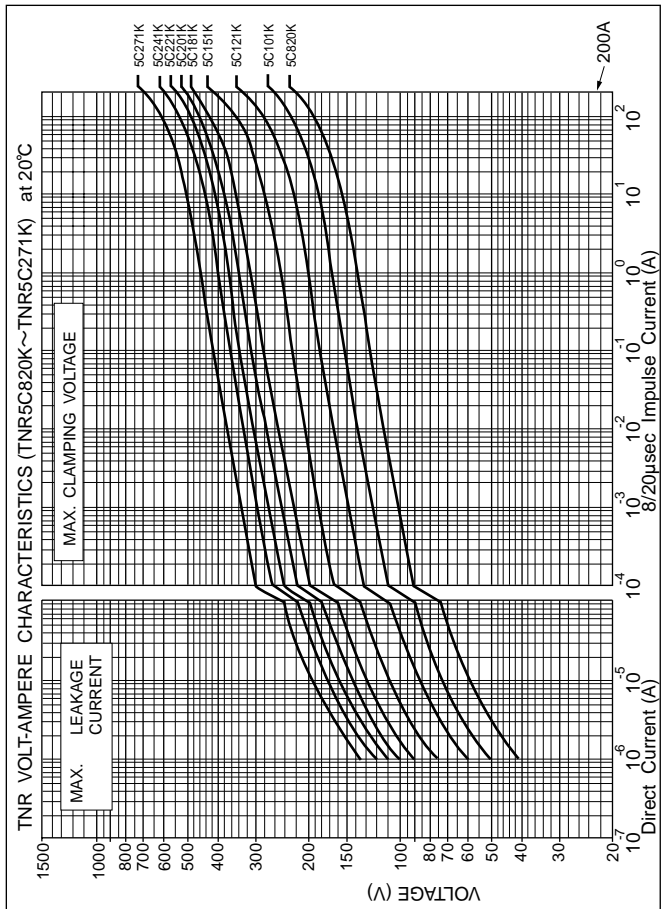
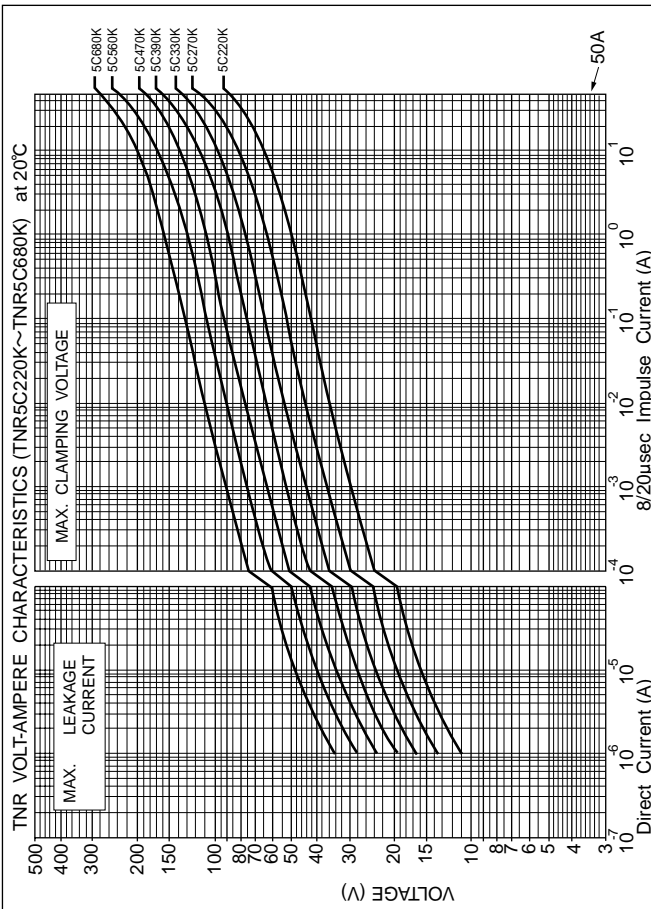
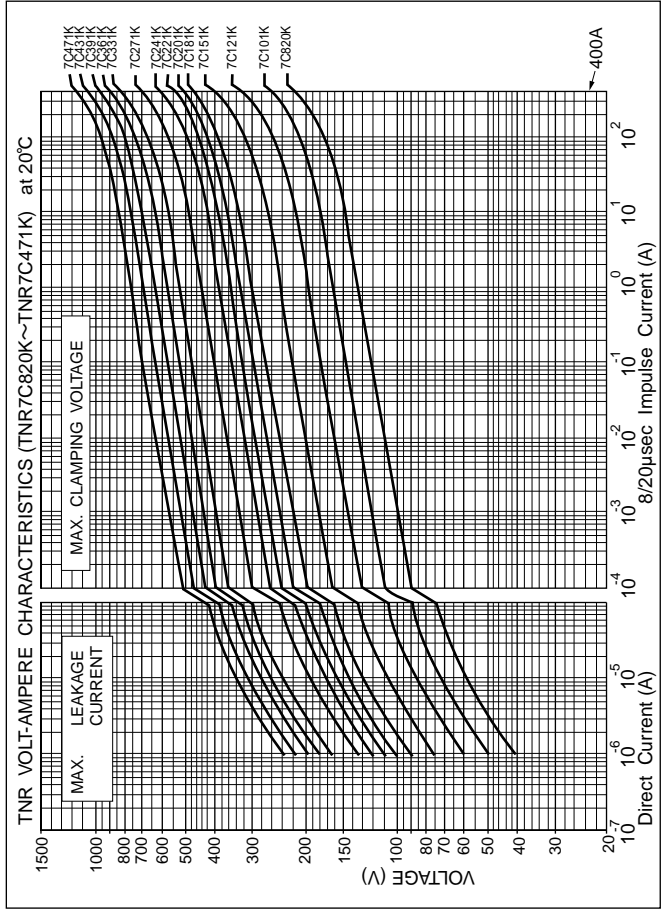
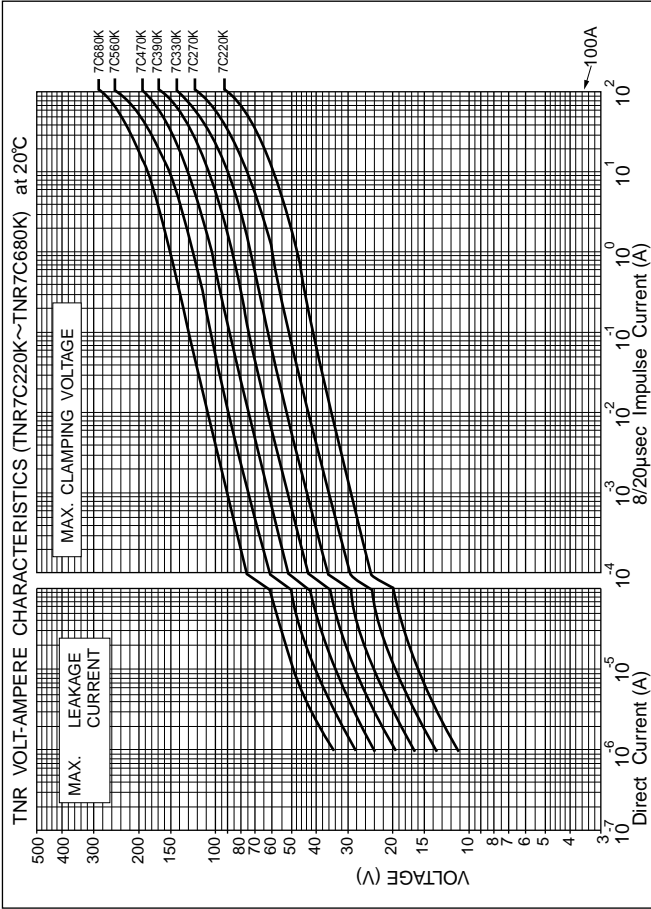


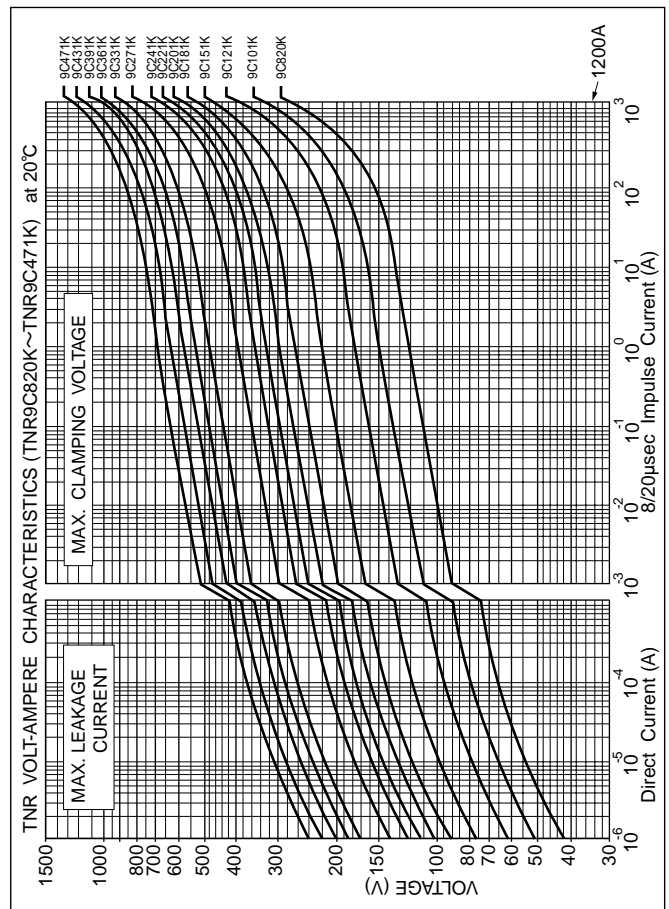
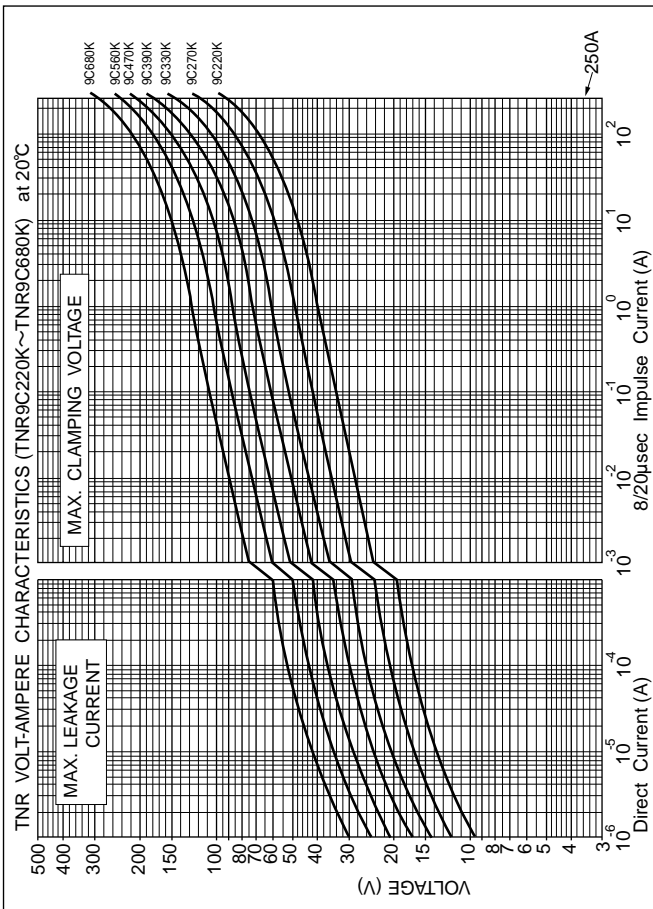
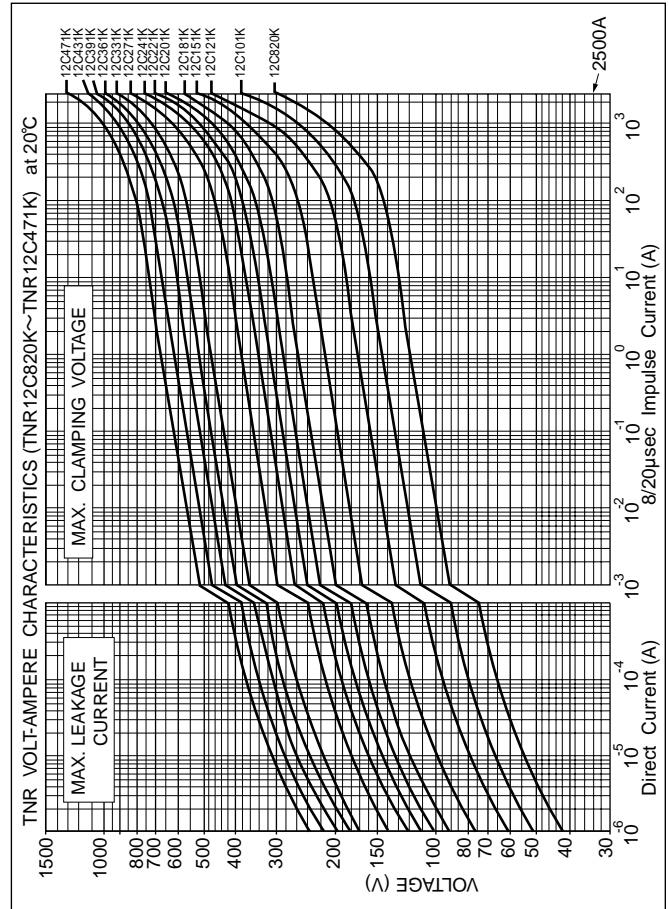
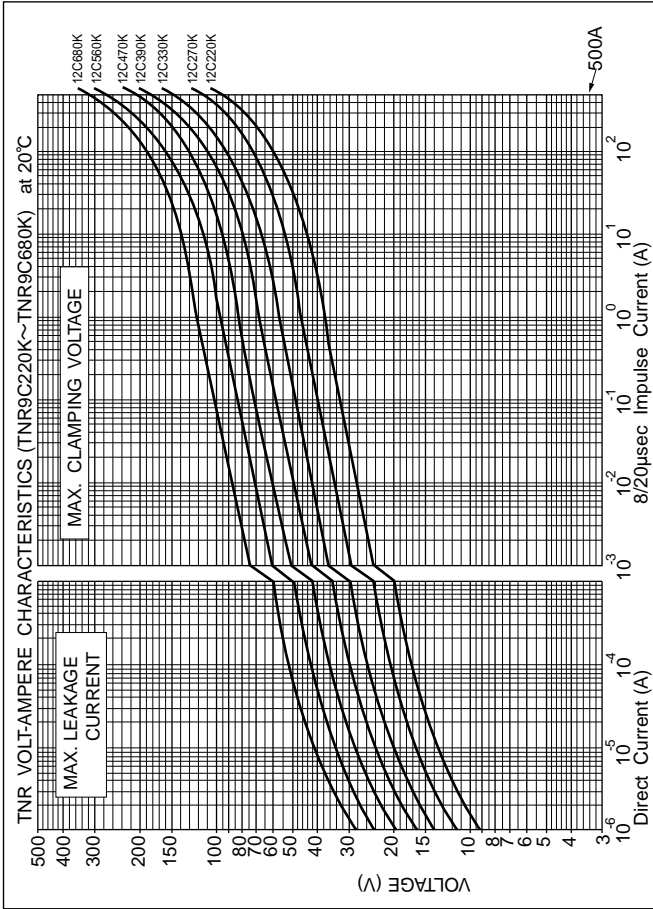
TNR® C SERIES

● Chip Type For Direct Surface Mounting (9C and 12C Type)

Operating Temperature Range: -40 ~ +125°C
Storage Temperature Range: -50 ~ +150°C

Model Number	Maximum Applied Voltage (Continuous)		Maximum Peak Current (8/20μSec.) (A)	Maximum Energy Rating (2mSec.) (J)	Rated Wattage (W)	Maximum Clamping Voltage		Varistor Voltage at V1mA (V)	T±1 (mm)	
	Acrms(V)	DC(V)				Ip(A)	Vc(V)			
TNR9C220K	14	18	125/2 times	1.0	0.02	2.0	43	22(20~ 24)	1.5	
TNR9C270K	17	22		53			27(24~ 30)			
TNR9C330K	20	26		65			33(30~ 36)			
TNR9C390K	25	30		77			39(35~ 43)			
TNR9C470K	30	37		93			47(42~ 52)			
TNR9C560K	35	44		2.2			110	56(50~ 62)	2.0	
TNR9C680K	40	55		2.5			135	68(61~ 75)		
TNR9C820K	50	65	600/2 times	4.0	0.2	10.0	135	82(74~ 90)	1.5	
TNR9C101K	60	85		164			100(90~110)			
TNR9C121K	75	100		195			120(108~132)			
TNR9C151K	95	125		245			150(135~165)			
TNR9C181K	110	145		295			180(162~198)			
TNR9C201K	130	170		330			200(180~220)			
TNR9C221K	140	180		360			220(198~242)			
TNR9C241K	150	200		390			240(216~264)			
TNR9C271K	175	225		440			270(243~297)			
TNR9C331K	210	270		540			330(297~363)			
TNR9C361K	230	300		16.0			590	360(324~396)		2.0
TNR9C391K	250	320		17.0			640	390(351~429)		
TNR9C431K	275	350		20.0			700	430(387~473)		2.5
TNR9C471K	300	385	20.0	765	470(423~517)					
TNR12C220K	14	18	250/2 times	2.0	0.05	5.0	43	22(20~ 24)	1.5	
TNR12C270K	17	22		53			27(24~ 30)			
TNR12C330K	20	26		65			33(30~ 36)			
TNR12C390K	25	30		77			39(35~ 43)			
TNR12C470K	30	37		93			47(42~ 52)			
TNR12C560K	35	44		5.5			110	56(50~ 62)	2.0	
TNR12C680K	40	55		6.5			135	68(61~ 75)		
TNR12C820K	50	65	1300/2 times	8.0	0.4	25.0	135	82(74~ 90)	1.5	
TNR12C101K	60	85		165			100(90~110)			
TNR12C121K	75	100		195			120(108~132)			
TNR12C151K	95	125		245			150(135~165)			
TNR12C181K	110	145		295			180(162~198)			
TNR12C201K	130	170		330			200(180~220)			
TNR12C221K	140	180		360			220(198~242)			
TNR12C241K	150	200		390			240(216~264)			
TNR12C271K	175	225		440			270(243~297)			
TNR12C331K	210	270		540			330(297~363)			
TNR12C361K	230	300		35.0			590	360(324~396)		2.0
TNR12C391K	250	320		40.0			640	390(351~429)		
TNR12C431K	275	350		45.0			700	430(387~473)		2.5
TNR12C471K	300	385	45.0	765	470(423~517)					





● Features

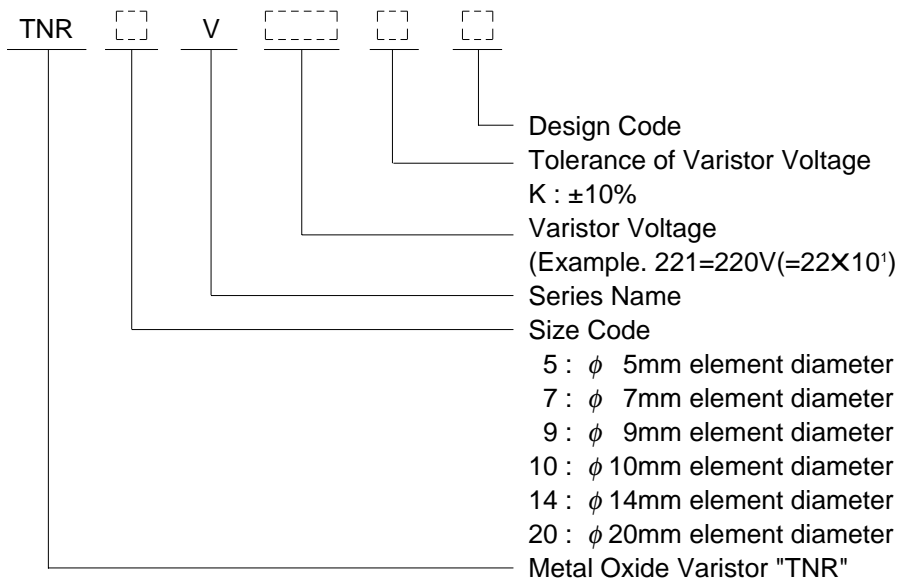
- ◆ Large surge capability (the surge current ratings of TNR V series, by 8/20 μ Sec., are about two times larger than TNR G series).
- ◆ Large energy capability (1.5 time larger than TNR G series).
- ◆ One rank smaller TNR V has same peak current as TNR G.
- ◆ Excellent voltage non-linear coefficient.
Low clamping voltage.
- ◆ Symmetrical V-I characteristics (No polarity).
- ◆ Fast response.
- ◆ Stable characteristics against repeated surges.
- ◆ Superior temperature characteristics.
- ◆ High reliability
- ◆ UL recognized
 - UL 1449 : File E95427
 - UL 1414 : File E65426
- ◆ CSA recognized
CSA CLASS 2221 01 : File LR 97864-2
- ◆ VDE recognized
 - CECC42000
 - CECC42200
 - CECC42201
 - 118623 ÜG



● Applications

- ◆ Protection for semiconductors from over voltage.
 - ◆ Protection for electronic instruments from lightning surges.
 - ◆ Absorption of on-off surges from motors and relays.
- Operating temperature range : - 40 ~ +85°C
Storage temperature range : - 50 ~ +125°C

● Part Numbering System





TNR® V SERIES (5V Type)

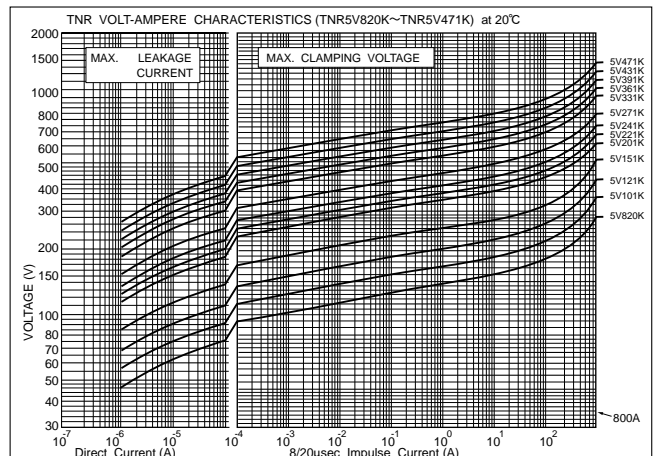
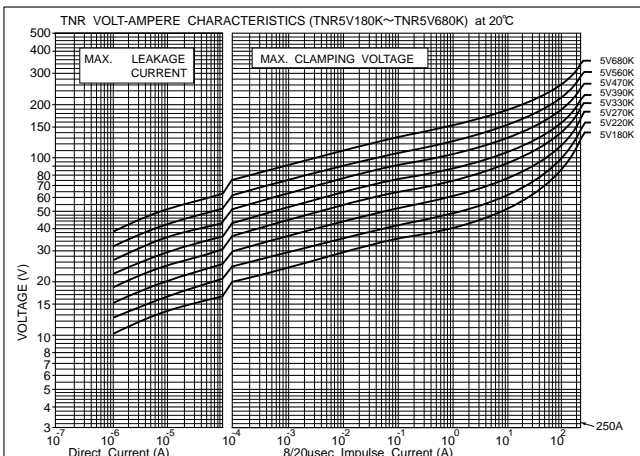
● Ratings (Type 5V)

Model Number	Maximum Ratings					Maximum Clamping Voltage		Capacitance Typical	Varistor Voltage V0.1mA
	Maximum Allowable Voltage		Maximum Peak Current	Maximum Energy	Rated Wattage	(A)	(V)		
	AC (Vrms)	DC (V)	8/20μs (A)	2ms (J)	(W)			at 1kHz (pF)	(V)
TNR5V180K	11	14	250/1time 125/2times	0.4	0.01	1	40	2540	18(16 ~ 20)
TNR5V220K	14	18		0.5			48	2090	22(20 ~ 24)
TNR5V270K	17	22		0.7			60	1790	27(24 ~ 30)
TNR5V330K	20	26		0.8			73	1480	33(30 ~ 36)
TNR5V390K	25	30		0.9			86	1310	39(35 ~ 43)
TNR5V470K	30	37		1.1			104	1140	47(42 ~ 52)
TNR5V560K	35	44		1.3			123	1000	56(50 ~ 62)
TNR5V680K	40	55	1.6	150	870	68(61 ~ 75)			
TNR5V820K	50	65	800/1time 600/2times	2.5	0.1	5	145	400	82(74 ~ 90)
TNR5V101K	60	85		3.0			175	350	100(90 ~ 110)
TNR5V121K	75	100		3.5			210	310	120(108 ~ 132)
TNR5V151K	95	125		4.5			260	270	150(135 ~ 165)
TNR5V201K	130	170		6.0			355	110	200(185 ~ 225)
TNR5V221K	140	180		6.5			380	110	220(198 ~ 242)
TNR5V241K	150	200		7.5			415	100	240(216 ~ 264)
TNR5V271K	175	225		8.0			475	90	270(247 ~ 303)
TNR5V331K	210	270		9.5			570	80	330(297 ~ 363)
TNR5V361K	230	300		11.0			620	80	360(324 ~ 396)
TNR5V391K	250	320		12.0			675	70	390(351 ~ 429)
TNR5V431K	275	350		13.5			745	70	430(387 ~ 473)
TNR5V471K	300	385		15.0			810	60	470(423 ~ 517)

● Dimensions (Type 5V)

Model Number	D MAX.	H MAX.	T MAX.	L MIN.	φd ±0.05	W ±1.0	Dimensions(mm)
TNR5V180K } TNR5V680K	7	10	4.5	20	0.6	5.0	
TNR5V820K } TNR5V221K	7	10	4.5	20	0.6	5.0	
TNR5V241K } TNR5V471K			5.8				

● V-I Curve





TNR® V SERIES (7V Type)

● Ratings (Type 7V)

Model Number	Maximum Ratings					Maximum Clamping Voltage		Capacitance Typical at 1kHz (pF)	Varistor Voltage V1mA (V)		
	Maximum Allowable Voltage		Maximum Peak Current	Maximum Energy	Rated Wattage	(A)	(V)				
	AC (Vrms)	DC (V)	8/20μs (A)	2ms (J)	(W)						
TNR7V150K	8	12	500/1time 250/2times	0.7	0.02	2.5	30	4600	15(13 ~ 17)		
TNR7V180K	11	14		0.9						36	18(16 ~ 20)
TNR7V220K	14	18		1.1						43	22(20 ~ 24)
TNR7V270K	17	22		1.3						53	27(24 ~ 30)
TNR7V330K	20	26		1.6						65	33(30 ~ 36)
TNR7V390K	25	30		1.9						77	39(35 ~ 43)
TNR7V470K	30	37		2.3						93	47(42 ~ 52)
TNR7V560K	35	44		2.7						110	56(50 ~ 62)
TNR7V680K	40	55	3.3	135	68(61 ~ 75)						
TNR7V820K	50	65	1750/1time 1250/2times	5.0	0.25	10	135	800	82(74 ~ 90)		
TNR7V101K	60	85		6.0						165	100(90 ~ 110)
TNR7V121K	75	100		7.0						200	120(108 ~ 132)
TNR7V151K	95	125		9.0						250	150(135 ~ 165)
TNR7V201K	130	170		12.5						340	200(185 ~ 225)
TNR7V221K	140	180		13.5						360	220(198 ~ 242)
TNR7V241K	150	200		15.0						395	240(216 ~ 264)
TNR7V271K	175	225		17.0						455	270(247 ~ 303)
TNR7V331K	210	270		20.0						545	330(297 ~ 363)
TNR7V361K	230	300		23.0						595	360(324 ~ 396)
TNR7V391K	250	320		25.0						650	390(351 ~ 429)
TNR7V431K	275	350		27.5						710	430(387 ~ 473)
TNR7V471K	300	385	30.0	775	470(423 ~ 517)						
TNR7V511K	320	410	32.0	845	510(459 ~ 561)						

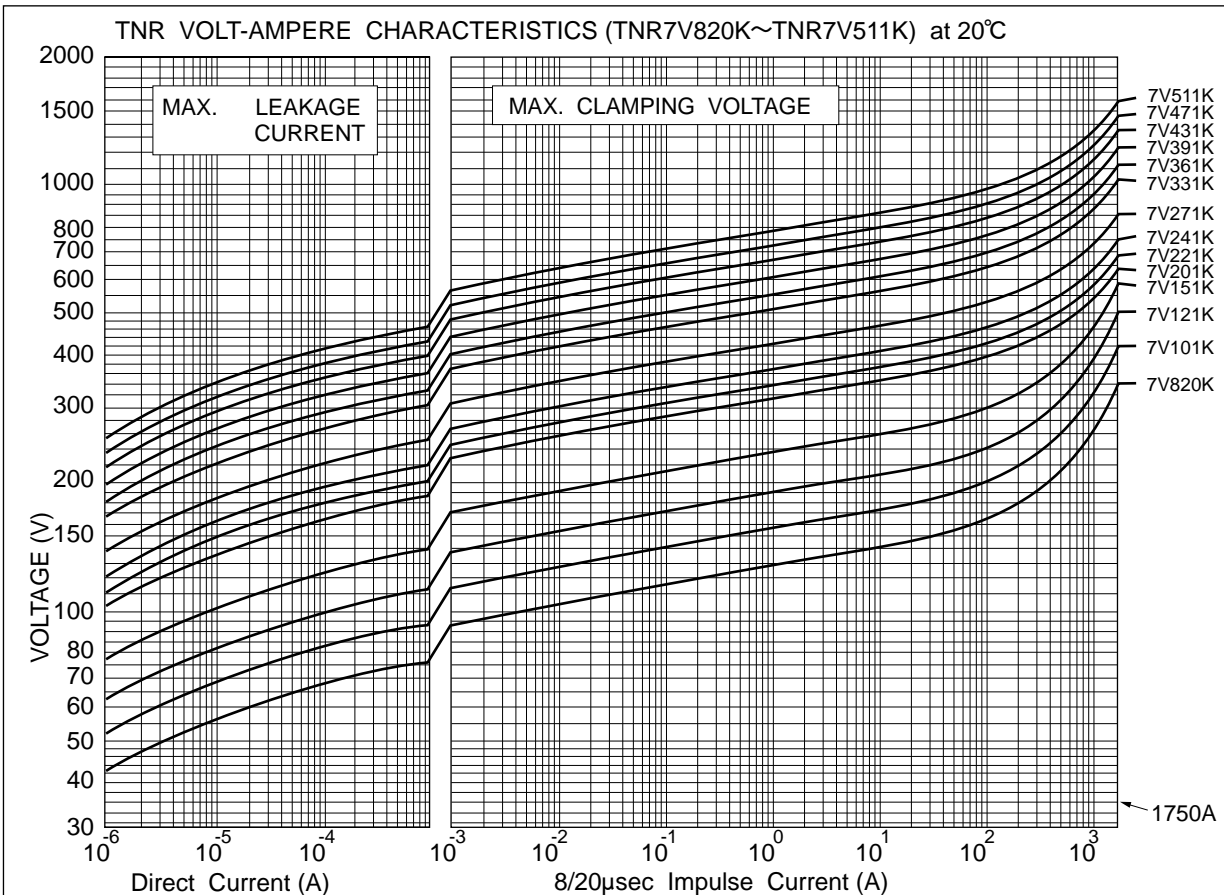
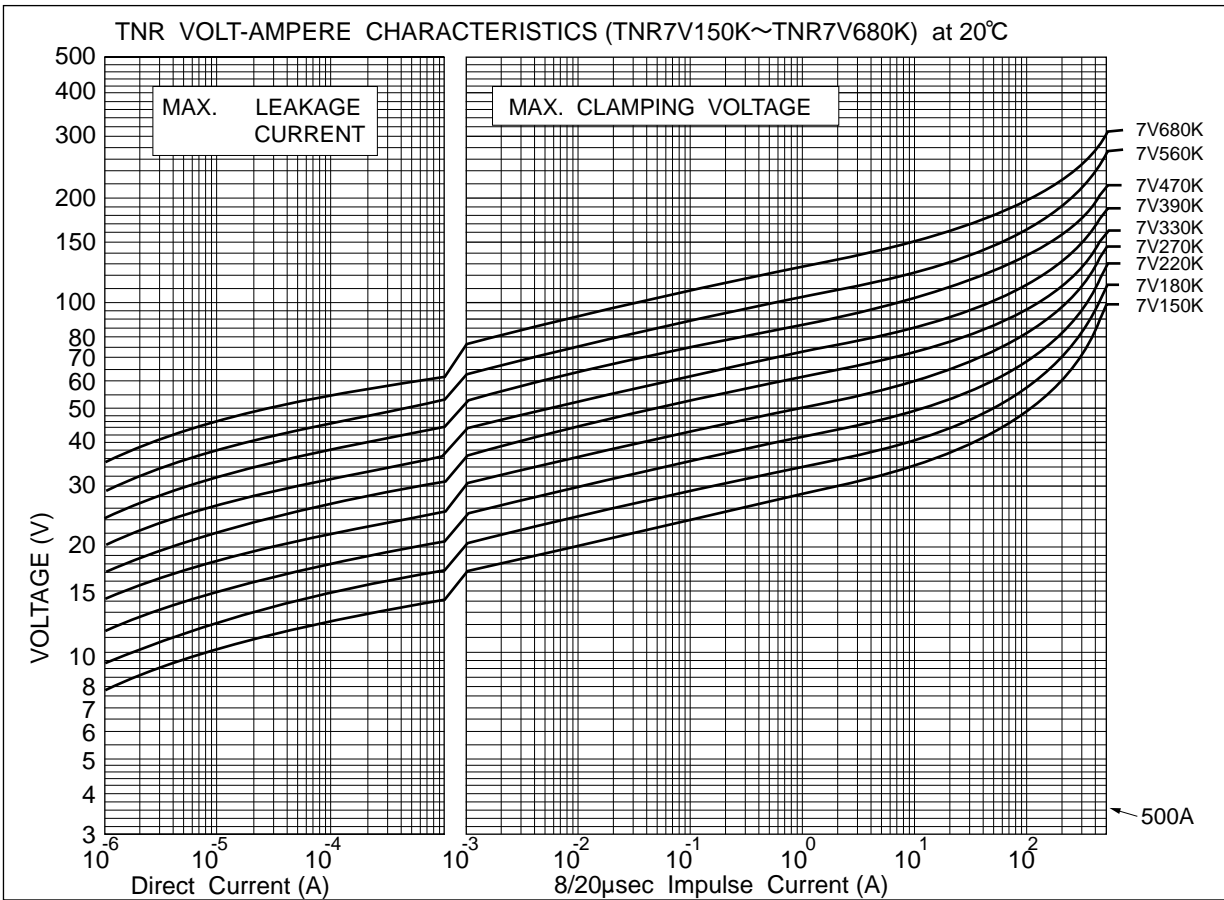
● Dimensions (Type 7V)

Model Number	D MAX.	H MAX.	T MAX.	L MIN.	φ d ±0.05	W ±1.0	Dimensions(mm)
TNR7V150K } TNR7V680K	8.5	11.5	5.2	20	0.6	5.0	
TNR7V820K } TNR7V271K			4.8				
TNR7V331K } TNR7V511K			6.0				



TNR® V SERIES (7V Type)

● V-I Curve





TNR® V SERIES (9V Type)

● Ratings (Type 9V)

Model Number	Maximum Ratings					Maximum Clamping Voltage		Capacitance Typical at 1kHz (pF)	Varistor Voltage V1mA (V)	
	Maximum Allowable Voltage		Maximum Peak Current	Maximum Energy	Rated Wattage	(A)	(V)			
	AC (Vrms)	DC (V)	8/20μs (A)	2ms (J)	(W)					
TNR9V150K	8	12	800/1time	2.0	0.02	5	30	9600	15(13 ~ 17)	
TNR9V180K	11	14		2.2			36	8000	18(16 ~ 20)	
TNR9V220K	14	18		2.6			43	7000	22(20 ~ 24)	
TNR9V270K	17	22		3.2			53	6000	27(24 ~ 30)	
TNR9V330K	20	26		4.0			65	5000	33(30 ~ 36)	
TNR9V390K	25	30		400/2times			4.7	77	4500	39(35 ~ 43)
TNR9V470K	30	37		5.6			93	4000	47(42 ~ 52)	
TNR9V560K	35	44		6.7			110	3500	56(50 ~ 62)	
TNR9V680K	40	55	8.2	135	3200	68(61 ~ 75)				
TNR9V820K	50	65	3,000/1time	10.0	0.25	25	135	1700	82(74 ~ 90)	
TNR9V101K	60	85		12.0			165	1600	100(90 ~ 110)	
TNR9V121K	75	100		14.5			200	1400	120(108 ~ 132)	
TNR9V151K	95	125		18.0			250	1300	150(135 ~ 165)	
TNR9V201K	130	170		25.0			340	500	200(185 ~ 225)	
TNR9V221K	140	180		27.5			360	450	220(198 ~ 242)	
TNR9V241K	150	200		30.0			395	400	240(216 ~ 264)	
TNR9V271K	175	225		35.0			455	350	270(247 ~ 303)	
TNR9V331K	210	270		2,000/2times			42.0	545	300	330(297 ~ 363)
TNR9V361K	230	300		45.0			595	280	360(324 ~ 396)	
TNR9V391K	250	320		50.0			650	260	390(351 ~ 429)	
TNR9V431K	275	350		55.0			710	240	430(387 ~ 473)	
TNR9V471K	300	385		60.0			775	220	470(423 ~ 517)	
TNR9V511K	320	410		67.0			845	210	510(459 ~ 561)	

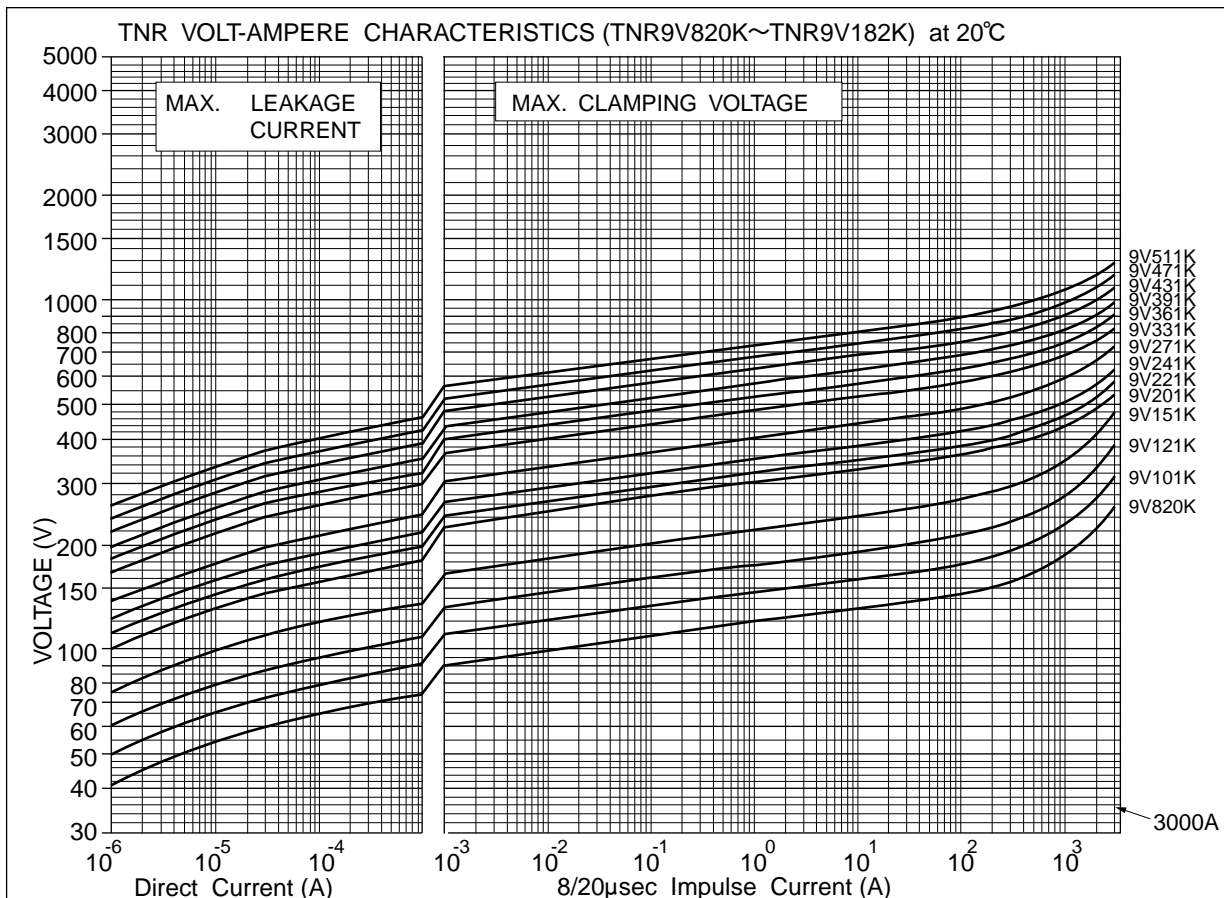
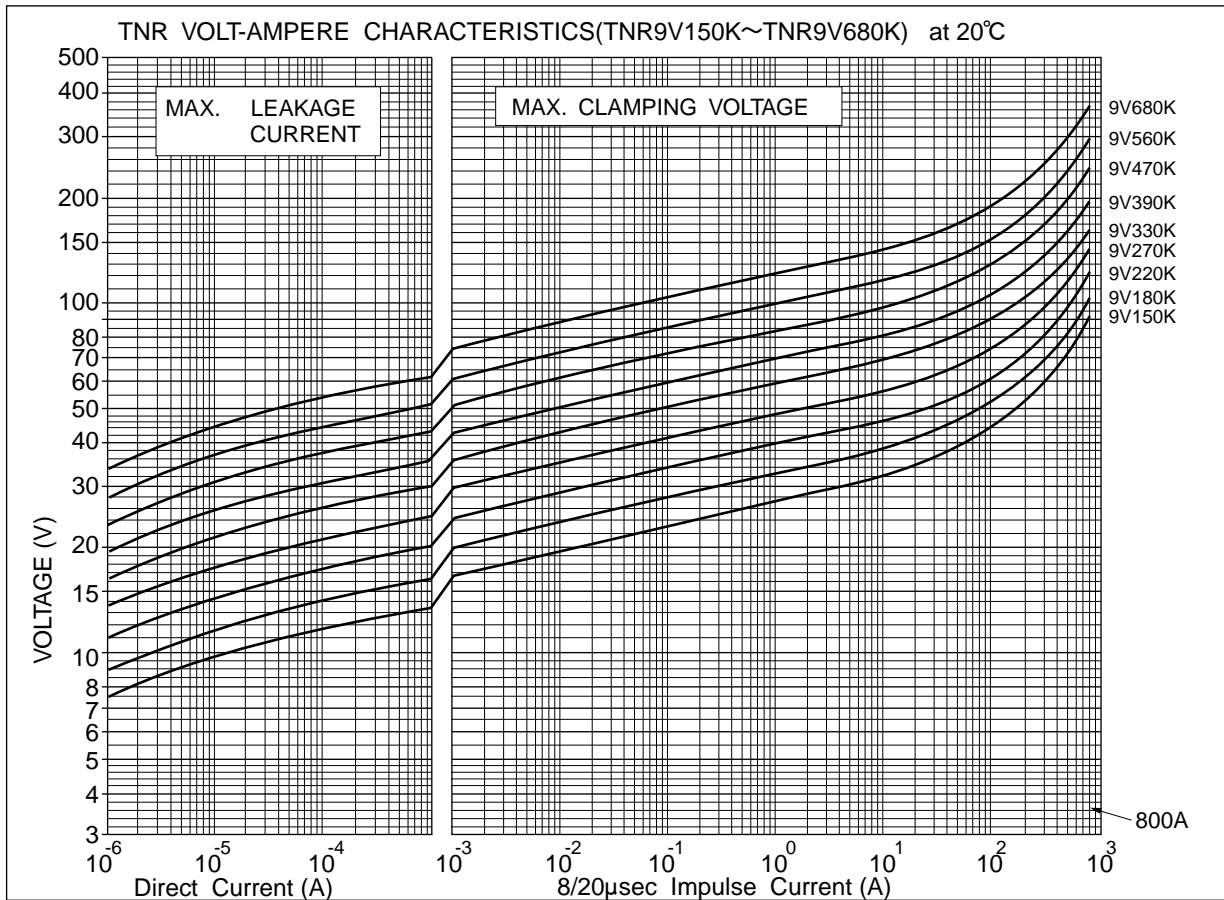
● Dimensions (Type 9V)

Model Number	D MAX.	H MAX.	T MAX.	L MIN.	φd ±0.05	W ±1.0	Dimensions(mm)
TNR9V150K } TNR9V680K	11.5	14.5	5.3	20	0.6	5.0	
TNR9V820K } TNR9V271K	11.5	14.5	5.3	20	0.6	5.0	
TNR9V331K } TNR9V511K			6.4				



TNR® V SERIES (9V Type)

● V-I Curve





TNR® V SERIES (10V Type)

● Ratings (Type 10V)

Model Number	Maximum Ratings					Maximum Clamping Voltage		Capacitance Typical	Varistor Voltage V1mA	Dimensions E±1.0	
	Maximum Allowable Voltage		Maximum Peak Current	Maximum Energy	Rated Wattage	(A)	(V)				
	AC (Vrms)	DC (V)	8/20µs (A)	2ms (J)	(W)			at 1kHz (pF)	(V)	(mm)	
TNR10V150K	8	12	1000/1time	2.0	0.05	5	30	9600	15(13 ~ 17)	1.2	
TNR10V180K	11	14		2.2			36	8000	18(16 ~ 20)	1.3	
TNR10V220K	14	18		2.6			43	7000	22(20 ~ 24)	1.4	
TNR10V270K	17	22		3.2			53	6000	27(24 ~ 30)	1.5	
TNR10V330K	20	26		4.0			65	5000	33(30 ~ 36)	1.7	
TNR10V390K	25	30		500/2times			4.7	77	4500	39(35 ~ 43)	1.6
TNR10V470K	30	37		5.6			93	4000	47(42 ~ 52)	1.7	
TNR10V560K	35	44		6.7			110	3500	56(50 ~ 62)	1.8	
TNR10V680K	40	55	8.2	135	3200	68(61 ~ 75)	2.0				
TNR10V820K	50	65	3500/1time	10.0	0.4	25	135	1700	82(74 ~ 90)	1.6	
TNR10V101K	60	85		12.0			165	1600	100(90 ~ 110)	1.8	
TNR10V121K	75	100		14.5			200	1400	120(108 ~ 132)	2.0	
TNR10V151K	95	125		18.0			250	1300	150(135 ~ 165)	2.3	
TNR10V201K	130	170		25.0			340	500	200(185 ~ 225)	1.9	
TNR10V221K	140	180		27.5			360	450	220(198 ~ 242)	2.0	
TNR10V241K	150	200		30.0			395	400	240(216 ~ 264)	2.1	
TNR10V271K	175	225		35.0			455	350	270(247 ~ 303)	2.3	
TNR10V331K	210	270		42.0			545	300	330(297 ~ 363)	2.6	
TNR10V361K	230	300		45.0			595	280	360(324 ~ 396)	2.8	
TNR10V391K	250	320		50.0			650	260	390(351 ~ 429)	2.9	
TNR10V431K	275	350		55.0			710	240	430(387 ~ 473)	3.1	
TNR10V471K	300	385		60.0			775	220	470(423 ~ 517)	3.3	
TNR10V511K	320	410		2500/2times			67.0	845	210	510(459 ~ 561)	3.5
TNR10V561K	350	460		67.0			922	195	560(504 ~ 626)	3.8	
TNR10V621K	385	505		67.0			1025	180	620(558 ~ 682)	4.2	
TNR10V681K	420	560	67.0	1120	165	680(612 ~ 748)	4.5				
TNR10V751K	460	615	70.0	1240	150	750(675 ~ 825)	4.9				
TNR10V821K	510	670	80.0	1355	140	820(738 ~ 902)	5.2				
TNR10V911K	550	745	90.0	1500	125	910(819 ~ 1001)	5.7				
TNR10V102K	625	825	100.0	1650	115	1000(900 ~ 1100)	6.2				
TNR10V112K	680	895	110.0	1815	105	1100(990 ~ 1210)	6.8*				
TNR10V182K	1000	1465	183.0	2970	70	1800(1700~1980)	10.5*				

* E±2.0

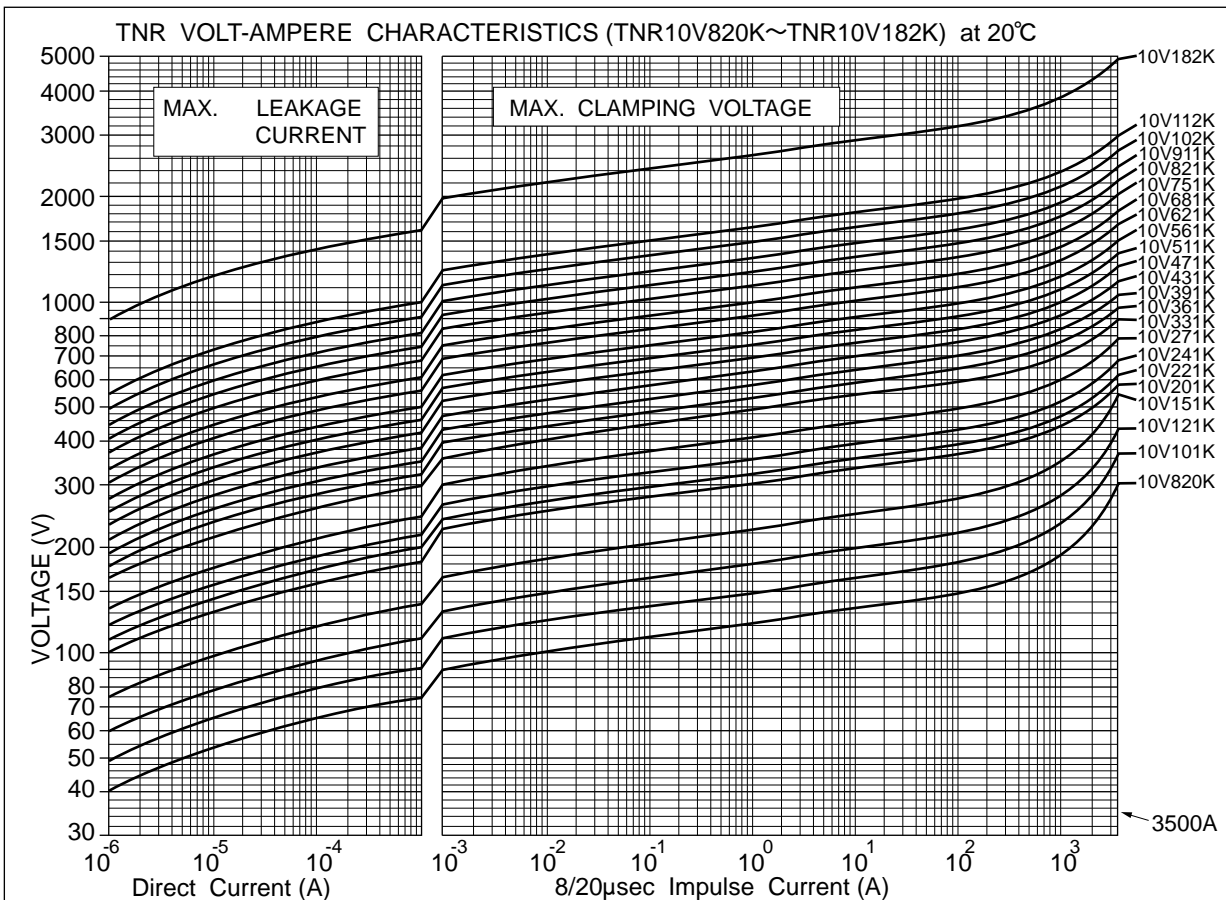
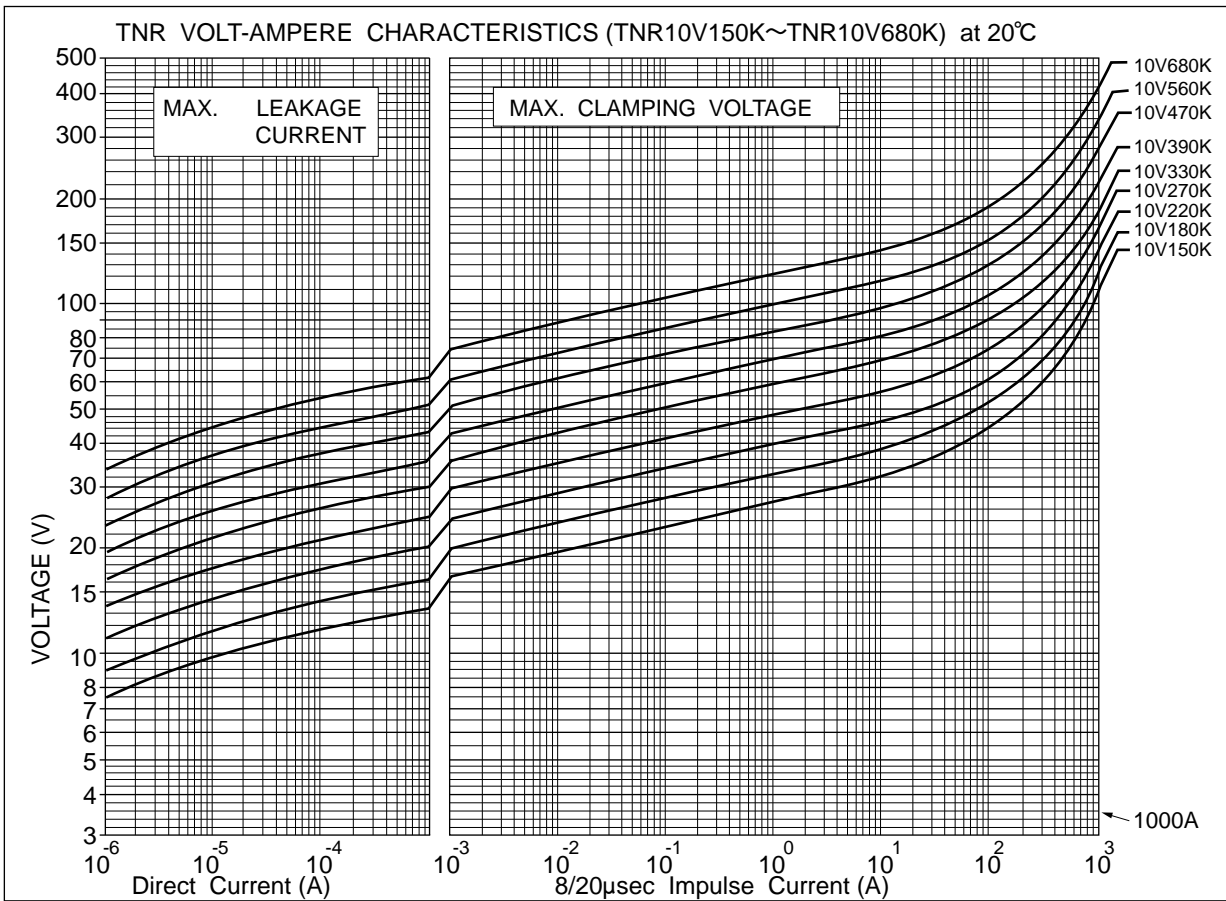
● Dimensions (Type 10V)

Model Number	D MAX.	H MAX.	T MAX.	L MIN.	φd ±0.05	W ±1.0	Dimensions(mm)
TNR10V150K } TNR10V680K	11.5	14.5	5.3	20	0.8	7.5	
TNR10V820K } TNR10V271K	11.5	14.5	5.3	20	0.8	7.5	
TNR10V331K } TNR10V511K			6.4				
TNR10V561K } TNR10V112K	12.5	15.5	9.7	20	0.8	7.5	
TNR10V182K	13.5	16.5	14.4				



TNR® V SERIES (10V Type)

● V-I Curve





TNR® V SERIES (14V Type)

● Ratings (Type 14V)

Model Number	Maximum Ratings					Maximum Clamping Voltage		Capacitance Typical	Varistor Voltage V1mA	Dimensions E±1.0
	Maximum Allowable Voltage		Maximum Peak Current	Maximum Energy	Rated Wattage	(A)	(V)			
	AC (Vrms)	DC (V)	8/20µs (A)	2ms (J)	(W)			at 1kHz (pF)	(V)	(mm)
TNR14V150K	8	12	2000/1time 1000/2times	3.6	0.1	10	30	19500	15(13 ~ 17)	1.2
TNR14V180K	11	14		4.3			36	16500	18(16 ~ 20)	1.3
TNR14V220K	14	18		5.3			43	13500	22(20 ~ 24)	1.4
TNR14V270K	17	22		6.5			53	12000	27(24 ~ 30)	1.5
TNR14V330K	20	26		7.9			65	10000	33(30 ~ 36)	1.7
TNR14V390K	25	30		9.4			77	9000	39(35 ~ 43)	1.6
TNR14V470K	30	37		11.0			93	8000	47(42 ~ 52)	1.7
TNR14V560K	35	44		13.0			110	7500	56(50 ~ 62)	1.8
TNR14V680K	40	55	16.0	135	6500	68(61 ~ 75)	2.0			
TNR14V820K	50	65	6000/1time 5000/2times 5000/1time 4500/2times	20.0	0.6	50	135	3000	82(74 ~ 90)	1.6
TNR14V101K	60	85		25.0			165	2700	100(90 ~ 110)	1.8
TNR14V121K	75	100		30.0			200	2500	120(108 ~ 132)	2.0
TNR14V151K	95	125		37.0			250	2300	150(135 ~ 165)	2.3
TNR14V201K	130	170		50.0			340	950	200(185 ~ 225)	1.9
TNR14V221K	140	180		55.0			360	850	220(198 ~ 242)	2.0
TNR14V241K	150	200		60.0			395	800	240(216 ~ 264)	2.1
TNR14V271K	175	225		70.0			455	700	270(247 ~ 303)	2.3
TNR14V331K	210	270		80.0			545	600	330(297 ~ 363)	2.6
TNR14V361K	230	300		90.0			595	550	360(324 ~ 396)	2.8
TNR14V391K	250	320		100.0			650	500	390(351 ~ 429)	2.9
TNR14V431K	275	350		110.0			710	460	430(387 ~ 473)	3.1
TNR14V471K	300	385		125.0			775	420	470(423 ~ 517)	3.3
TNR14V511K	320	410		136.0			845	390	510(459 ~ 561)	3.5
TNR14V561K	350	460		136.0			922	360	560(504 ~ 616)	3.8
TNR14V621K	385	505		136.0			1025	330	620(558 ~ 682)	4.2
TNR14V681K	420	560	136.0	1120	310	680(612 ~ 748)	4.5			
TNR14V751K	460	615	150.0	1240	280	750(675 ~ 825)	4.9			
TNR14V821K	510	670	165.0	1355	250	820(738 ~ 902)	5.2			
TNR14V911K	550	745	180.0	1500	230	910(819 ~ 1001)	5.7			
TNR14V102K	625	825	200.0	1650	210	1000(900 ~ 1100)	6.2			
TNR14V112K	680	895	220.0	1815	190	1100(990 ~ 1210)	6.8			
TNR14V182K	1000	1465	360.0	2970	120	1800(1700~1980)	10.5*			

* E±2.0

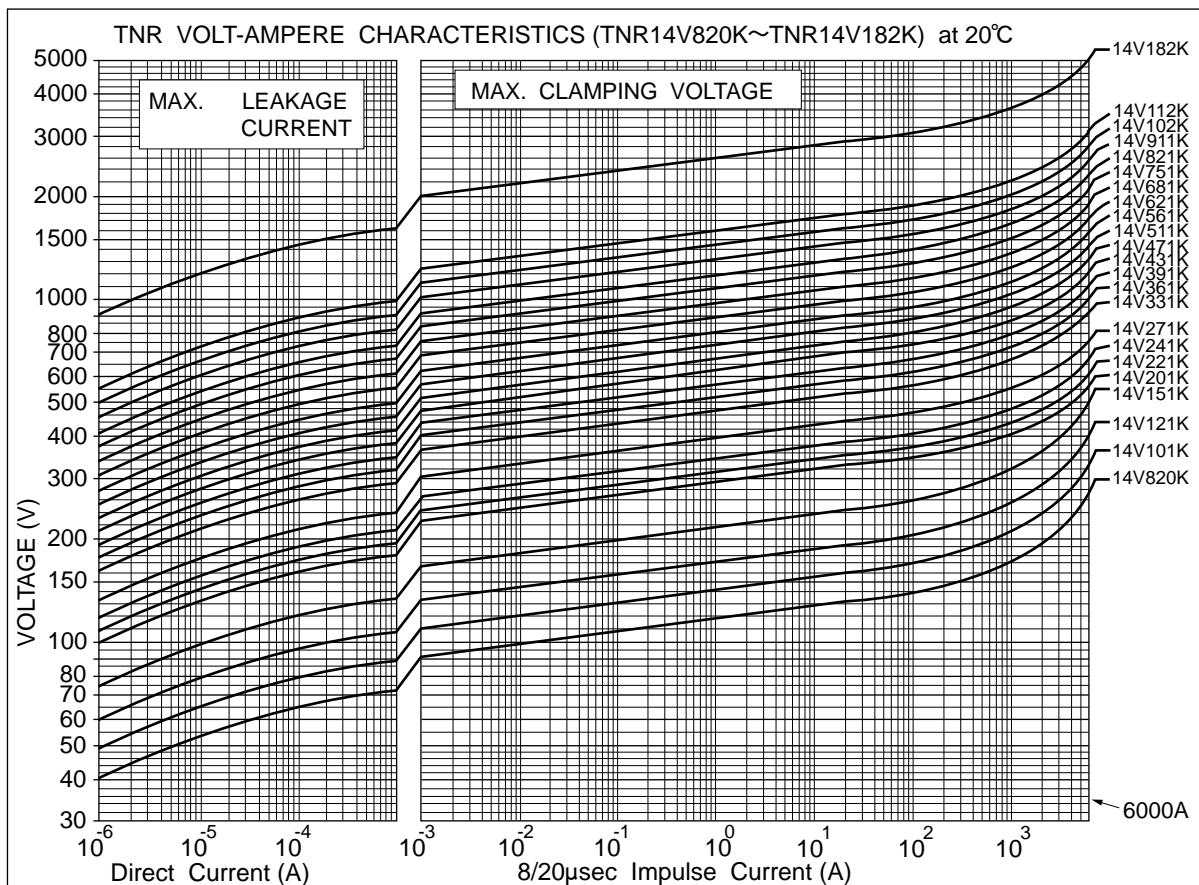
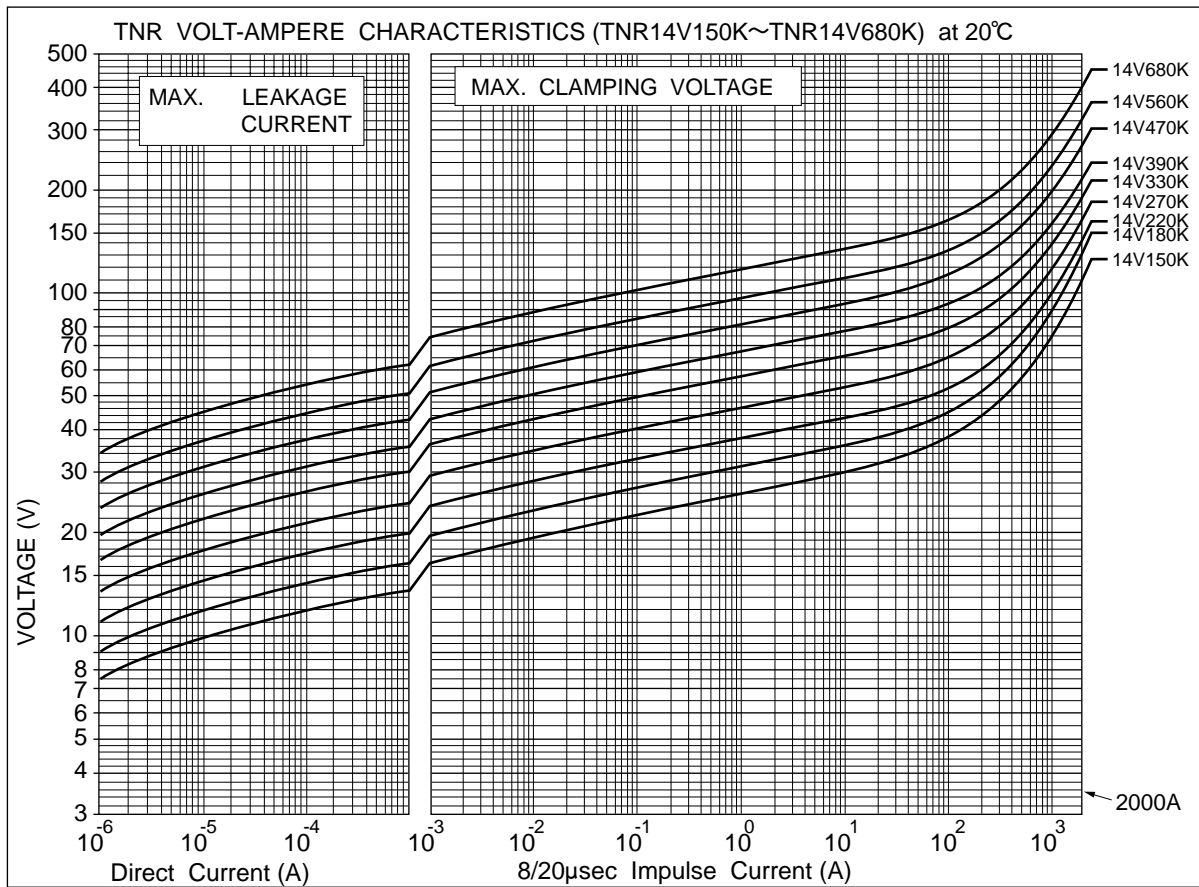
● Dimensions (Type 14V)

Model Number	D MAX.	H MAX.	T MAX.	L MIN.	φ d ±0.05	W ±1.0	Dimensions(mm)	
TNR14V150K } TNR14V680K	15.5	18.5	5.3	20	0.8	7.5		
TNR14V820K } TNR14V271K	15.5	18.5	5.3	20	0.8	7.5		
TNR14V331K } TNR14V511K			6.4					
TNR14V561K } TNR14V112K	16.0	19.0	9.7					
TNR14V182K	17.0	20.5	14.4					*11.0



TNR® V SERIES (14V Type)

● V-I Curve





TNR® V SERIES (20V Type)

● Ratings (Type 20V)

Model Number	Maximum Ratings					Maximum Clamping Voltage		Capacitance Typical at 1kHz (pF)	Varistor Voltage V1mA (V)	Dimensions E±1.0 (mm)
	Maximum Allowable Voltage		Maximum Peak Current	Maximum Energy	Rated Wattage	(A)	(V)			
	AC (Vrms)	DC (V)	8/20μs (A)	2ms (J)	(W)					
TNR20V180K	11	14	3000/1time	12.0	0.2	20	36	39000	18(16 ~ 20)	1.5
TNR20V220K	14	18		14.0			43	33000	22(20 ~ 24)	1.6
TNR20V270K	17	22		17.0			53	28000	27(24 ~ 30)	1.7
TNR20V330K	20	26	2000/2times	21.0	0.2	20	65	24000	33(30 ~ 36)	1.9
TNR20V390K	25	30		25.0			77	21000	39(35 ~ 43)	1.9
TNR20V470K	30	37		30.0			93	19000	47(42 ~ 52)	2.0
TNR20V560K	35	44	10000/1time	36.0	1.0	100	110	17000	56(50 ~ 62)	2.1
TNR20V680K	40	55		44.0			135	15000	68(61 ~ 75)	2.2
TNR20V820K	50	65		40.0			135	6700	82(74 ~ 90)	1.8
TNR20V101K	60	85	7000/2times	50.0	1.0	100	165	6100	100(90 ~ 110)	2.0
TNR20V121K	75	100		60.0			200	5600	120(108 ~ 132)	2.2
TNR20V151K	95	125		75.0			250	5100	150(135 ~ 165)	2.5
TNR20V201K	130	170	7000/2times	100.0	1.0	100	340	2700	200(185 ~ 225)	2.1
TNR20V221K	140	180		110.0			360	2500	220(198 ~ 242)	2.2
TNR20V241K	150	200		120.0			395	2300	240(216 ~ 264)	2.3
TNR20V271K	175	225	6500/2times	135.0	1.0	100	455	2000	270(247 ~ 303)	2.5
TNR20V331K	210	270		160.0			545	1700	330(297 ~ 363)	2.8
TNR20V361K	230	300		180.0			595	1500	360(324 ~ 396)	3.0
TNR20V391K	250	320	7500/1time	195.0	1.0	100	650	1400	390(351 ~ 429)	3.1
TNR20V431K	275	350		215.0			710	1300	430(387 ~ 473)	3.3
TNR20V471K	300	385		250.0			775	1200	470(423 ~ 517)	3.5
TNR20V511K	320	410	6500/2times	273.0	1.0	100	845	1100	510(459 ~ 561)	3.7
TNR20V561K	350	460		273.0			922	1000	560(504 ~ 626)	4.0
TNR20V621K	385	505		273.0			1025	900	620(558 ~ 682)	4.4
TNR20V681K	420	560	7500/1time	273.0	1.0	100	1120	830	680(612 ~ 748)	4.7
TNR20V751K	460	615		300.0			1240	750	750(675 ~ 825)	5.1
TNR20V821K	510	670		325.0			1355	700	820(738 ~ 902)	5.4
TNR20V911K	550	745	6500/2times	360.0	1.0	100	1500	620	910(819 ~ 1001)	5.9
TNR20V102K	625	825		400.0			1650	560	1000(900 ~ 1100)	6.4
TNR20V112K	680	895		440.0			1815	510	1100(990 ~ 1210)	7.0
TNR20V182K	1000	1465	720.0	2970	340	1800(1700 ~ 1980)	10.7*			

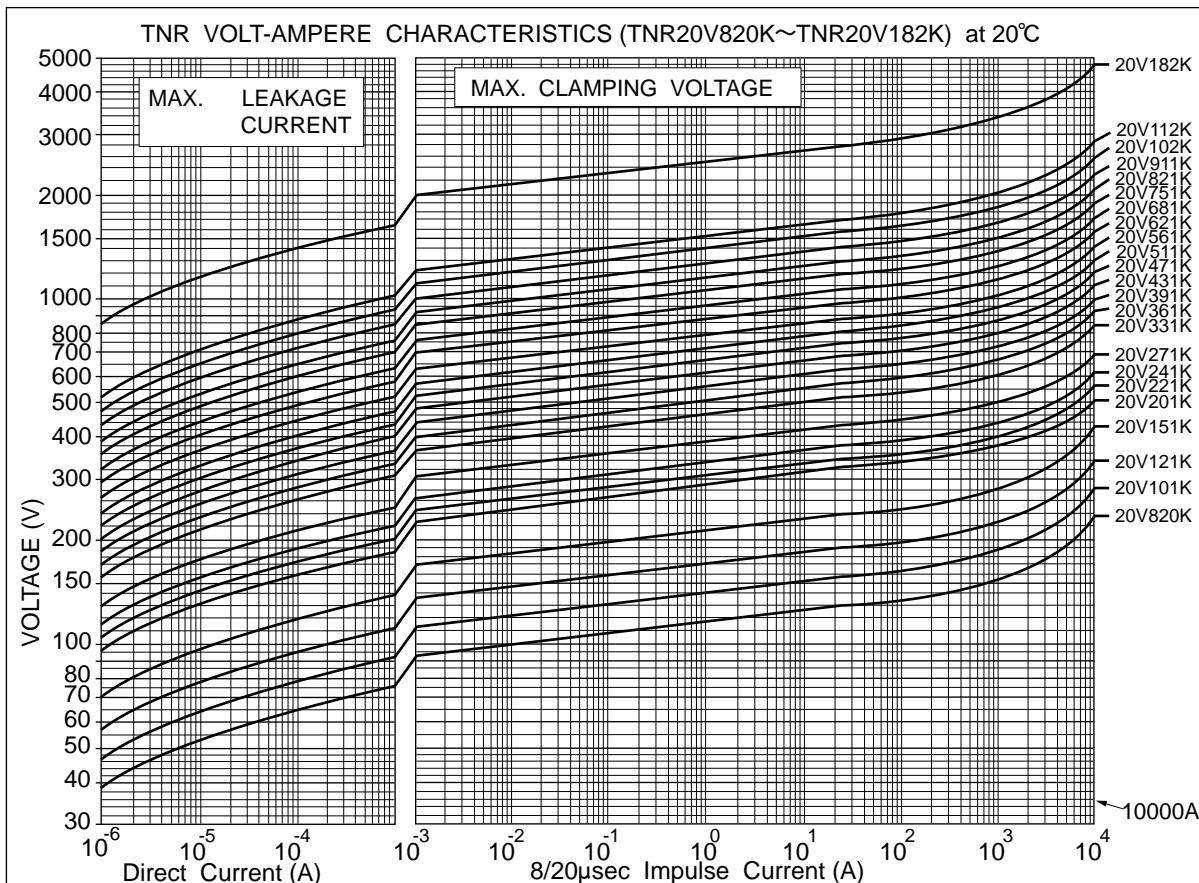
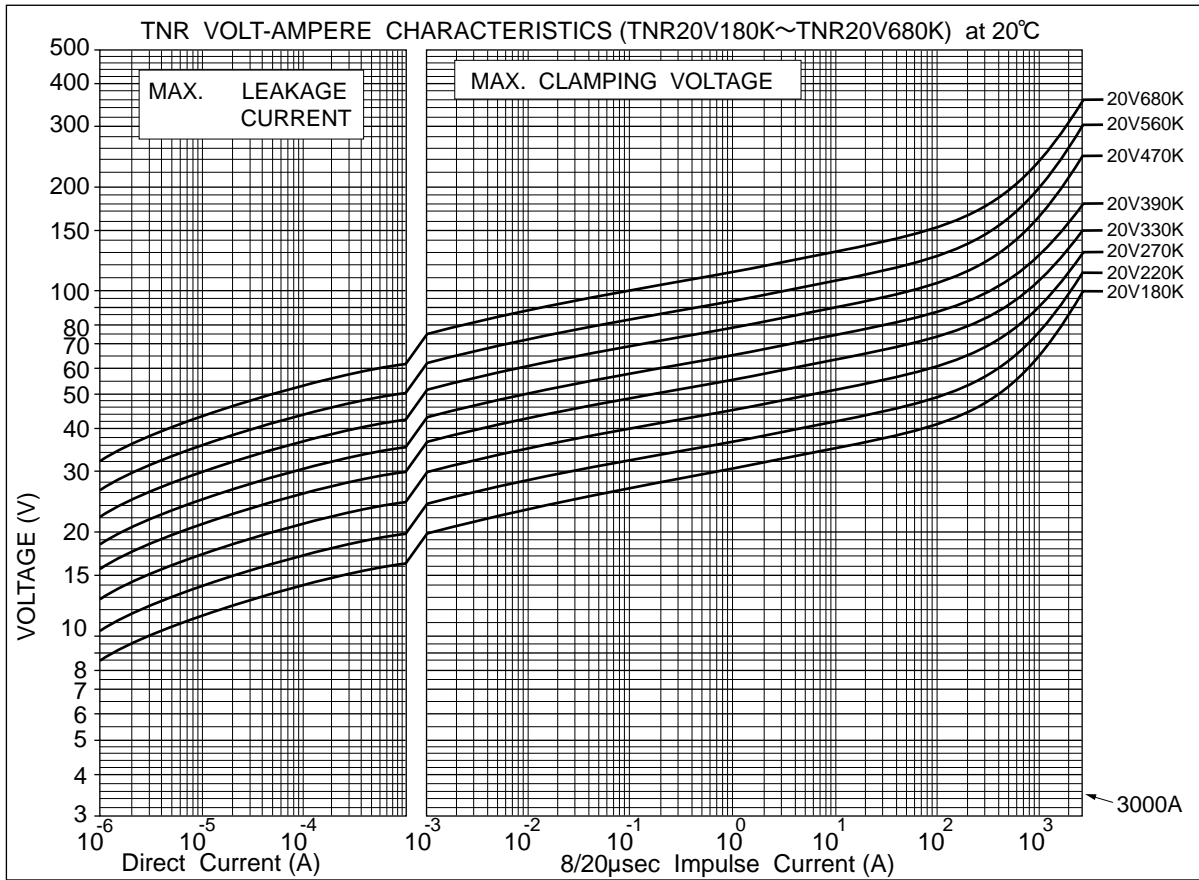
* E±2.0

● Dimensions (Type 20V)

Model Number	D MAX.	H MAX.	T MAX.	L MIN.	φ d ±0.05	W ±1.0	Dimensions(mm)
TNR20V180K }	21.5	24.5	5.8	20	0.8	10.0	
TNR20V680K			5.6				
TNR20V820K }	21.5	24.5	6.8	20	0.8	10.0	
TNR20V271K			5.6				
TNR20V331K }			6.8				
TNR20V511K	22.5	25.5	10.1	20	0.8	10.0	
TNR20V561K }			10.1				
TNR20V112K	23.5	28.0	14.8	20	0.8	10.0	
TNR20V182K			14.8				

* : W₂ ± 2.0

● V-I Curve





● **General Specifications for TNR V Series**

Operating temperature range : $-40 \pm \sim 85^{\circ}\text{C}$ Storage temperature range : $-50 \sim +125^{\circ}\text{C}$

Item	Test conditions	Specifications						
Standard Test Condition	$20 \pm 5^{\circ}\text{C}$, $65 \pm 20\%$ RH unless specified. However, if it does not affect test result, the condition can be $20 \pm 15^{\circ}\text{C}$, $65 \pm 20\%$ RH also.	—————						
Varistor Voltage	Voltage across varistor at specified current.	Satisfy the specification						
	<table border="1"> <thead> <tr> <th>Type</th> <th>Current C(mA)</th> </tr> </thead> <tbody> <tr> <td>5V</td> <td>0.1</td> </tr> <tr> <td>7V,9V,10V,14V,20V</td> <td>1.0</td> </tr> </tbody> </table>		Type	Current C(mA)	5V	0.1	7V,9V,10V,14V,20V	1.0
	Type		Current C(mA)					
5V	0.1							
7V,9V,10V,14V,20V	1.0							
Maximum Allowable Voltage	Maximum continuous AC voltage (50 ~ 60Hz AC) and maximum DC voltage which can be applied.	Satisfy the specification						
Maximum Peak Surge Current	Maximum surge current (8/20 μ Sec. pulse wave to be applied once, or twice, 2 minute apart) for varistor voltage change within $\pm 10\%$ of the initial value.	Satisfy the specification						
Energy Rating	Maximum energy (2mSec. square wave to be applied once) for varistor voltage change within $\pm 10\%$ of the initial value.	Satisfy the specification						
Rated Wattage	Maximum power (50 ~ 60Hz AC power to be applied for 1,000 hours at $85 \pm 2^{\circ}\text{C}$) for varistor voltage change within $\pm 10\%$ of the initial value.	Satisfy the specification						
Maximum Clamping Voltage	Maximum voltage across varistor when 8/20 μ Sec. rated current surge is applied.	Satisfy the specification						
Capacitance	Varistor's capacitance at 1kHz, standard test condition.	For reference only.						
Voltage Temperature Coefficient	$\frac{V_{cmA} \text{ at } 85^{\circ}\text{C} - V_{cmA} \text{ at } 25^{\circ}\text{C}}{V_{cmA} \text{ at } 25^{\circ}\text{C}} \times \frac{1}{60} \times 100 (\% / ^{\circ}\text{C})$ VcmA : Actual varistor voltage	Within $\pm 0.05\% / ^{\circ}\text{C}$						
Insulation	Short circuit the two leads of varistor, and put the varistor body into lead balls (1.6mm diameter) leaving 2mm epoxy coating outside. Then, apply 2.5kVrms between the leads and the lead balls for 60 \pm 5 seconds.	The varistor shall withstand with no abnormality.						

● **Reliability Characteristics**

Item	Test conditions	Specifications
Heat Cycle	Subject varistor to the following temperature cycles. -40°C for 30 minutes \rightarrow Normal room temperature for 10 minutes \rightarrow 85°C for 30 minutes \rightarrow Normal room temperature for 10 minutes. This completes one cycle. The cycle shall be repeated 5 times total. After the cycles, the varistor shall be stored at normal room temperature for one hour. Then check the varistor voltage and the appearance.	$\Delta V_{cmA} \leq \pm 5\%$ No appearance abnormality.
High Temperature Exposure	Store varistor at 125°C for 1,000 hours. After that, store the varistor at normal room temperature for one hour. Then check the varistor voltage.	$\Delta V_{cmA} \leq \pm 5\%$ However, on varistors have nominal varistor voltages from 15V to 68V, the varistor voltage change shall be $\Delta V_{cmA} \leq \pm 10\%$
Humidity Resistivity	Store at 40°C , 90~95% RH for 1,000 hours. After that, store the varistor at normal room temperature for one hour. Then check the varistor voltage.	$\Delta V_{cmA} \leq \pm 5\%$
High Temperature Operation	Apply maximum applied voltage to varistor at 85°C for 1,000 hours. After that, store the varistor at normal room temperature for one hour. Then check the varistor voltage.	$\Delta V_{cmA} \leq \pm 10\%$

● Mechanical Characteristics

Item	Test conditions	Specifications									
Soldering Heat Resistivity	Store varistor at normal room temperature. Dip the varistor leads to solder, at 350 ±10°C for 3 ± 1 seconds, up to 2.0 ~2.5 mm from the varistor body. After that, store the varistor at normal room temperature for 30 minutes, and measure the varistor voltage.	$\Delta V_{cmA} \leq \pm 5\%$ Vc : Actual varistor voltage No mechanical damages									
Solderability	Dip varistor leads to methanol solution (JIS K 1501, about 25%) of rosin (JIS Z 5902) for 5~10 seconds. Then, dip the lead to solder (JIS Z 3282 H60A or H63A) at 225 ~ 240°C, up to 2.0 ~ 2.5mm from the varistor body for 5 ± 0.5 seconds. Then, check the solderability.	At least, 95% of the surface dipped to solder shall be covered by new solder.									
Lead Pull Strength	Fix varistor body, and suspend specified weight toward direction of lead axis. <table border="1" data-bbox="587 703 1102 808"> <thead> <tr> <th>Type</th> <th>Lead Diameter</th> <th>Weight</th> </tr> </thead> <tbody> <tr> <td>5V, 7V, 9V</td> <td>0.6mm</td> <td>10N</td> </tr> <tr> <td>10V, 14V, 20V</td> <td>0.8mm</td> <td>10N</td> </tr> </tbody> </table>	Type	Lead Diameter	Weight	5V, 7V, 9V	0.6mm	10N	10V, 14V, 20V	0.8mm	10N	No abnormality such as disconnection. $\Delta V_{cmA} \leq \pm 5\%$
Type	Lead Diameter	Weight									
5V, 7V, 9V	0.6mm	10N									
10V, 14V, 20V	0.8mm	10N									
Lead Bend Strength	Fix varistor body vertically. Then suspend specified weight and bent the varistor body by 90°, and return it to the original position. Carry out the operation in the opposite direction and return the body to the original position. <table border="1" data-bbox="587 954 1102 1059"> <thead> <tr> <th>Type</th> <th>Lead Diameter</th> <th>Weight</th> </tr> </thead> <tbody> <tr> <td>5V, 7V, 9V</td> <td>0.6mm</td> <td>5N</td> </tr> <tr> <td>10V, 14V, 20V</td> <td>0.8mm</td> <td>5N</td> </tr> </tbody> </table>	Type	Lead Diameter	Weight	5V, 7V, 9V	0.6mm	5N	10V, 14V, 20V	0.8mm	5N	The leads shall not disconnect, slacken and peel off.
Type	Lead Diameter	Weight									
5V, 7V, 9V	0.6mm	5N									
10V, 14V, 20V	0.8mm	5N									
Vibration Resistivity	Mount varistor body on vibrator, and conduct following vibration test. Peak-to-Peak amplitude : 1.5mm Vibration frequency range : 10Hz ~ 55Hz Sweeping time: Approximately one minute for 10Hz → 55Hz → 10Hz Direction and duration of vibration : Three directions of X, Y and Z. Two hours each. Six hours total.	No remarkable appearance abnormality. $\Delta V_{cmA} \pm 5\%$									

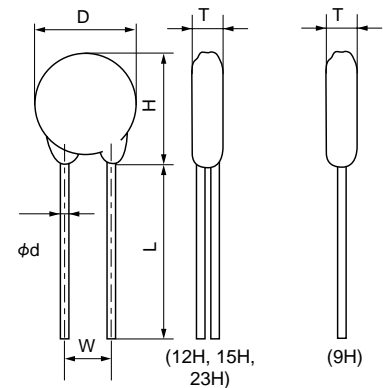


TNR® H SERIES AND HP SERIES

High Energy, Low Varistor Voltage Series

● H Series

Model Number	Maximum Applied Voltage			Maximum Energy (20mSec.) (J)	Maximum Clamping Voltage		Varistor Voltage at 1mA DC (V)
	Continuous		5 Minutes		(A)	(V)	
	ACrms(V)	DC(V)	DC(V)				
TNR9H220K	12	16	24	5	2	43	22 (20~24)
TNR9H270K	15	19	29			53	27 (24~30)
TNR9H330K	18	24	36			65	33 (30~36)
TNR9H390K	22	28	42			77	39 (35~43)
TNR9H470K	26	34	50			93	47 (42~52)
TNR12H220K	12	16	24	10	5	43	22 (20~24)
TNR12H270K	15	19	29			53	27 (24~30)
TNR12H330K	18	24	36			65	33 (30~36)
TNR12H390K	22	28	42			77	39 (35~43)
TNR12H470K	26	34	50			93	47 (42~52)
TNR15H220K	12	16	24	20	10	43	22 (20~24)
TNR15H270K	15	19	29			53	27 (24~30)
TNR15H330K	18	24	36			65	33 (30~36)
TNR15H390K	22	28	42			77	39 (35~43)
TNR15H470K	26	34	50			93	47 (42~52)
TNR23H220K	12	16	24	40	25	43	22 (20~24)
TNR23H270K	15	19	29			53	27 (24~30)
TNR23H330K	18	24	36			65	33 (30~36)
TNR23H390K	22	28	42			77	39 (35~43)
TNR23H470K	26	34	50			93	47 (42~52)



Type	D Max.	H Max.	W ±1	L Min.	φd
9H	10.0	14.0	5.0	25.0	0.6
12H	14.0	17.0	7.5	25.0	0.8
15H	17.0	20.0	7.5	25.0	0.8
23H	24.0	28.0	10.0	25.0	0.8

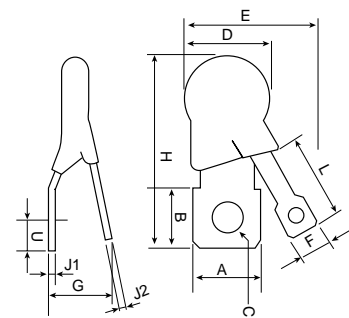
(mm)

	T Max.
220K~330K	6.0
390K~470K	8.0

Operating Temperature Range - 40 ~ +125°C Storage Temperature Range - 50 ~ +150°C

● HP Series

Model Number	Maximum Applied Voltage			Maximum Energy (200ms) (J)	Maximum Clamping Voltage		Varistor Voltage at 1mA DC (V)
	Continuous		5 Minutes		(A)	(V)	
	ACrms(V)	DC(V)	DC(V)				
TNR12HP220K	12	16	24	100	5	43	22 (20~24)
TNR12HP270K	15	19	29			53	27 (24~30)
TNR12HP330K	18	24	36			65	33 (30~36)
TNR12HP390K	22	28	42			77	39 (35~43)
TNR12HP470K	26	34	50			93	47 (42~52)
TNR15HP220K	12	16	24	200	10	43	22 (20~24)
TNR15HP270K	15	19	29			53	27 (24~30)
TNR15HP330K	18	24	36			65	33 (30~36)
TNR15HP390K	22	28	42			77	39 (35~43)
TNR15HP470K	26	34	50			93	47 (42~52)
TNR23HP220K	12	16	24	400	25	43	22 (20~24)
TNR23HP270K	15	19	29			53	27 (24~30)
TNR23HP330K	18	24	36			65	33 (30~36)
TNR23HP390K	22	28	42			77	39 (35~43)
TNR23HP470K	26	34	50			93	47 (42~52)

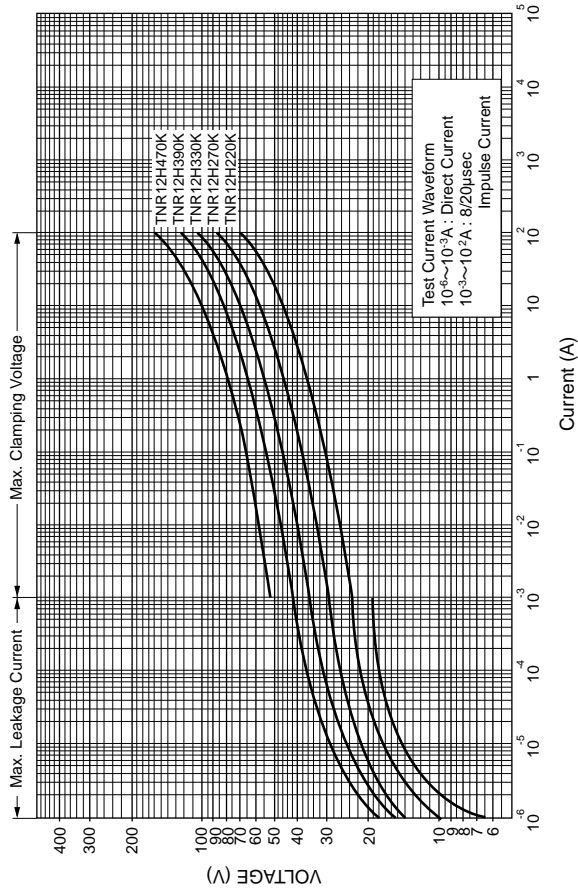


	12HP	15HP	23HP
A	10	12	14
B	10	12	14
φC	5.0	5.5	6.5
D	15 max.	18 max.	25 max.
E	23 max.	25 max.	30 max.
F	6.4	6.4	6.4
G	17 max.	20 max.	25 max.
H	32 max.	37 max.	45 max.
J1	0.8	0.8	0.8
J2	0.8	0.8	0.8
L	8 min.	9 min.	10 min.
U	5.0	6.0	7.0

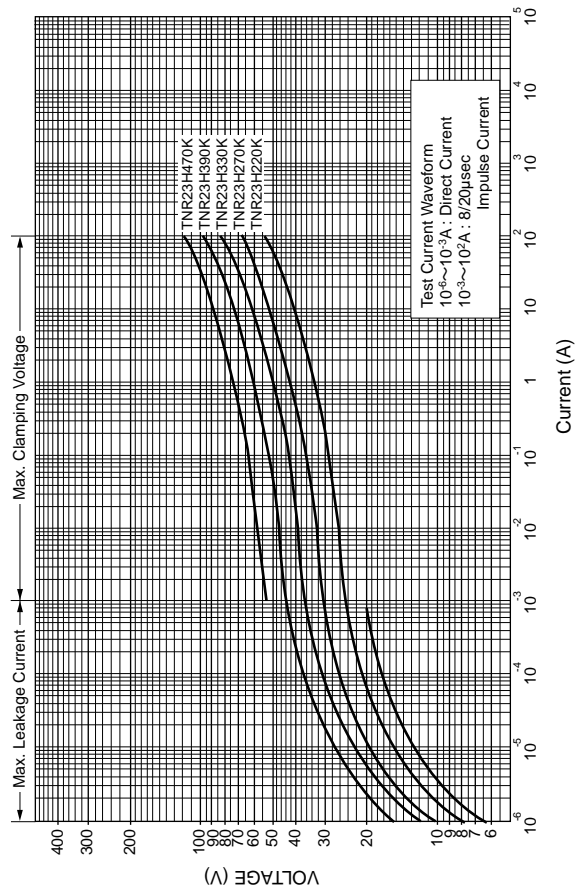
Operating Temperature Range - 40 ~ +150°C Storage Temperature Range - 50 ~ +150°C

Unit : mm

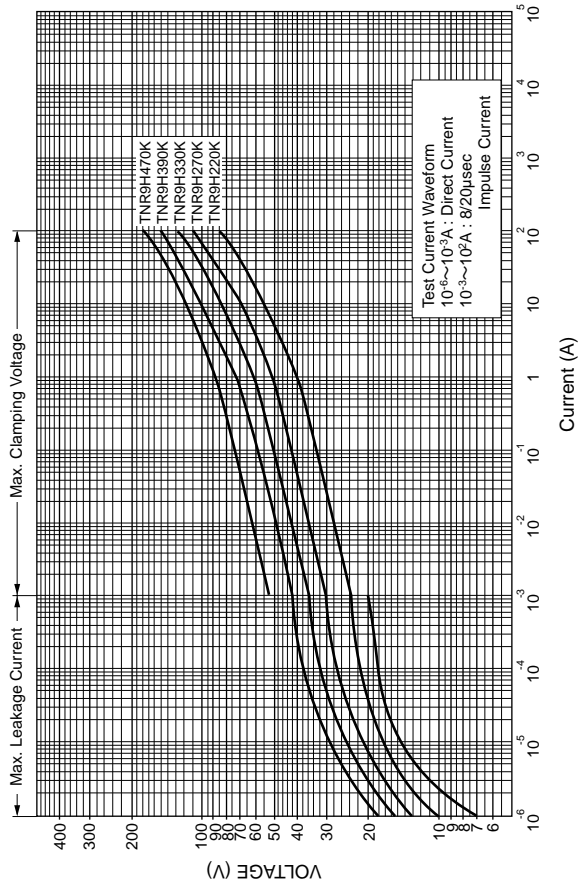
● 12H220K~470K



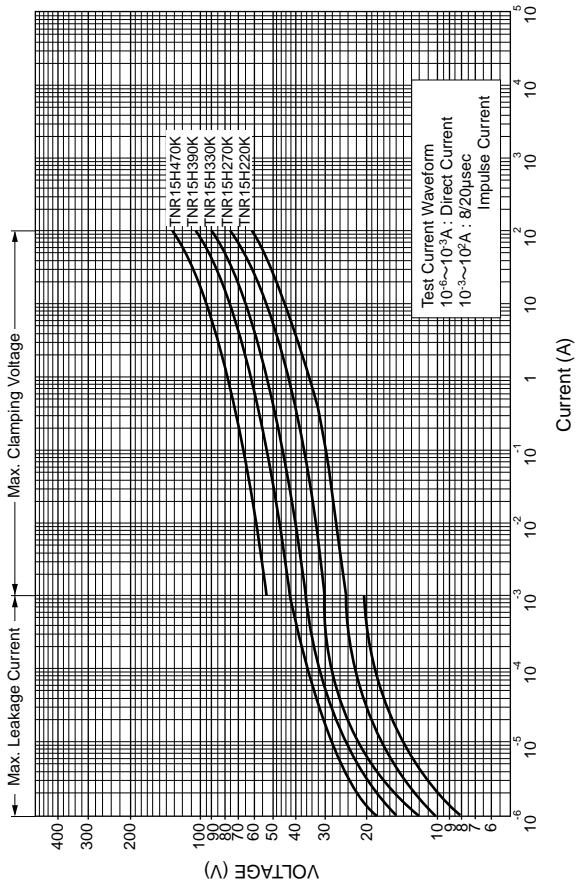
● 23H220K~470K



● V-I Curve (TNR9H220K~9H470K)



● 15H220K~470K





● General Specifications of TNR H Series

Operating temperature range : - 40°C to +125°C Storage temperature range : - 50°C to +150°C

Item	Test Conditions	Specifications
Standard Test Condition	Ambient temperature : 20 ± 5°C Relative humidity : 65 ± 20% RH if there is any doubt about the results, measurement shall be made within the following limits. Ambient temperature : 20 ± 5°C Relative humidity : 65 ± 20% RH	_____
Varistor Voltage	The voltage between the two terminals measured at 1mA DC is called Varistor Voltage. The measurement shall be made as fast as possible to avoid heat effecton.	Satisfy the specification.
Maximum Allowable Voltage	Maximum continuous sinusoidal RMS voltage or Maximum continuous DC voltage which may be applied.	Refer to RATINGS.
Maximum applicable voltage for a short period (5 minutes)	Maximum DC voltage to be applied for only 5 minutes.	Refer to RATINGS.
Maximum Clamping Voltage	The maximum voltage between the terminals, measured standard impluse current (8/20 μs).	Satisfy the specification.
Maximum Energy	Maximum energy within the ±10% varistor voltage change when 1 impulse 20 msec long is applied.	Satisfy the specification.
Temperature Coefficient	$\frac{V_{1mA \text{ at } 85^{\circ}C} - V_{1mA \text{ at } 25^{\circ}C}}{V_{1mA \text{ at } 25^{\circ}C}} \times \frac{1}{60} \times 100 (\%/^{\circ}C)$	Within ±0.05%/°C

● Mechanical characteristics

Item	Test Conditions	Specifications				
Terminal Pull Strength	After gradually applying the force keeping the unit fixed for 10 ± 1 second in axial direction, the damage of the terminals shall be visually examined. <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center; width: 50%; border-bottom: 1px solid black;">Lead diameter</td> <td style="text-align: center; width: 50%; border-bottom: 1px solid black;">Force</td> </tr> <tr> <td style="text-align: center;">φ0.6mm. φ0.8mm</td> <td style="text-align: center;">10 N (1.0 kgf)</td> </tr> </table>	Lead diameter	Force	φ0.6mm. φ0.8mm	10 N (1.0 kgf)	No remarkable damage
Lead diameter	Force					
φ0.6mm. φ0.8mm	10 N (1.0 kgf)					
Terminal Bending Strength	The unit shall be secured with its terminal kept vertical and the weight specified below be applied in the axial direction. The terminal shall gradually be bend by 90° in one direction then 90° in the opposite direction, and again back to original position. The damage of the terminal shall be visually examined. <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center; width: 50%; border-bottom: 1px solid black;">Lead diameter</td> <td style="text-align: center; width: 50%; border-bottom: 1px solid black;">Force</td> </tr> <tr> <td style="text-align: center;">φ0.6mm. φ0.8mm</td> <td style="text-align: center;">5 N (0.5 kgf)</td> </tr> </table>	Lead diameter	Force	φ0.6mm. φ0.8mm	5 N (0.5 kgf)	No remarkable damage
Lead diameter	Force					
φ0.6mm. φ0.8mm	5 N (0.5 kgf)					
Vibration	After repeatedly applying a single harmonic vibration (amplitude : 0.75mm) double amplitude : 1.5mm with 1 minute vibration frequency cycle (10Hz→500Hz→10Hz) to each three perpendicular directions for 2 hours. Total 6 hours. The devices shall be visually examined.	No remarkable damage				
Solderability	Dipping the terminal to a Rosin depth for 5 ~ 10 seconds. After dipping the terminal to a depth of 2.0 ~ 2.5mm from the body in a soldering bath of 230 ± 5°C for 5 ± 0.5 seconds, the terminal shall be visually examined.	75% of the terminals should be covered with solder uniformly.				
Resistance to Soldering Heat	The terminal shall be dipped into a soldering bath of 350 ± 10°C to a depth of 2.0 ~ 2.5mm from the body and be held there for 5 ± $\frac{1}{0}$ seconds. or The terminal shall be dipped into a soldering bath of 260 ± 5°C to a depth of 2.0 ~ 2.5mm from the body and be held there for 10 ± 1 seconds.	$\Delta V_{1mA} \leq \pm 5\%$ No outstanding damage				

**● Environmental characteristics**

Item	Test Conditions	Specifications
High Temperature Storage (Dry heat)	The specimen shall be subjected 150±2°C for 1000±12 hours without load.	$\Delta V_{1mA} \leq \pm 10\%$
Damp heat (Humidity)	The specimen shall be subjected to 60±2°C, 90 to 95%RH for 1000±12 hours without load.	$\Delta V_{1mA} \leq \pm 10\%$
Temperature Cycle	The temperature cycle shown below shall be repeated 50 cycles. -40°C±3°C, 30 minutes ← → +150°C±2°C, 30 minutes	$\Delta V_{1mA} \leq \pm 10\%$ No remarkable damage
High Temperature Operating	The specimen shall be subjected to 125±2°C with the maximum allowable voltage for 1000 ±12 hours.	$\Delta V_{1mA} \leq \pm 20\%$
Damp heat Operating	The specimen shall be subjected to 60±2°C, 90 to 95%RH With the maximum allowable voltage for 1000 ±12 hours.	$\Delta V_{1mA} \leq \pm 10\%$

Varistor voltage change of forward direction shall be measured in the test of unipole surge life and DC load life. Varistor voltage change is measured after stored at Standard Test Conditions for 1 to 2 hours.

Note : For 42V battery line, please contact our sales office.



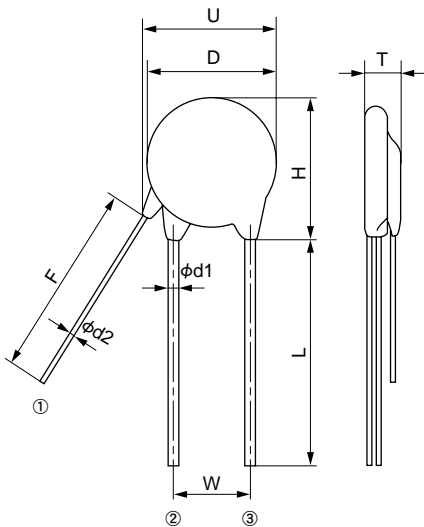
TNR® GF SERIES

● GF Series are combined TNR G Series with Thermal Fuse

Model Number	Maximum Applied Voltage (Continuous)		Maximum Peak Current (8/20 μ Sec.) (A)	Maximum Energy (2mSec.) (J)	Rated Wattage (W)	Maximum Clamping Voltage V _{50A(V)}	Capacitance (Typical) (pF)	Varistor Voltage at 1mA DC (V)	T Max. (mm)
	ACrms(V)	DC(V)							
TNR15GF271K	175	225		50	0.6	440	680	270(243 ~ 297)	9
TNR15GF471K	300	385	2,500	80	0.6	765	450	470(423 ~ 517)	10
TNR15GF821K	510	670		110	0.6	1,340	280	820(738 ~ 902)	12
	ACrms(V)	DC(V)	(A)	(J)	(W)	V _{100A(V)}	(pF)	(V)	(mm)
TNR23GF271K	175	225		90	0.8	440	1,850	270(243 ~ 297)	9
TNR23GF471K	300	385	4,000	150	1.0	765	1,200	470(423 ~ 517)	10
TNR23GF821K	510	670		190	1.5	1,340	800	820(738 ~ 902)	12

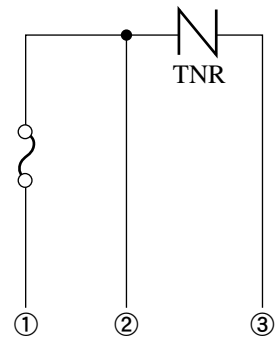
Operating Temperature Range -40 ~ +85°C Storage Temperature Range -50 ~ +125°C

● Dimensions



	15G	23G
D	18max.	25max.
T	9 to 12	9 to 12
H	22max.	32max.
W	7.5 \pm 1	10 \pm 1
L	30min.	30min.
U	23max.	28max.
F	22min.	22min.
ϕ d1	0.8	0.8
ϕ d2	0.5	0.6

Unit : mm





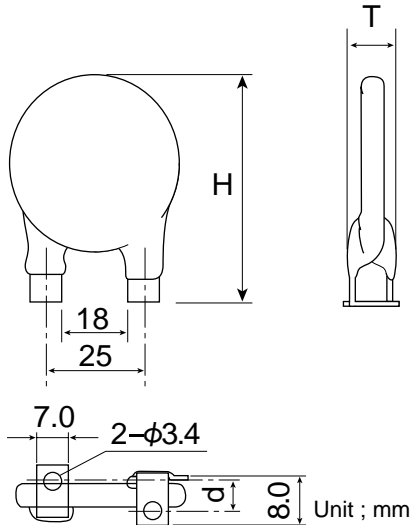
TNR® 32HP SERIES

High Peak Current with tabs.

● Ratings (Type 32HP)

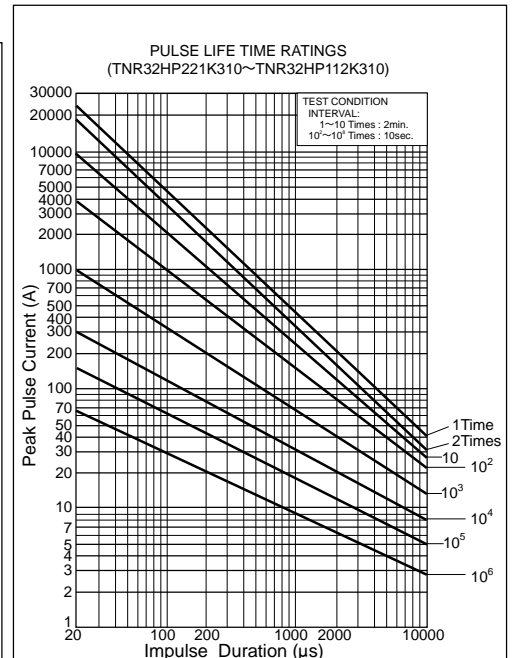
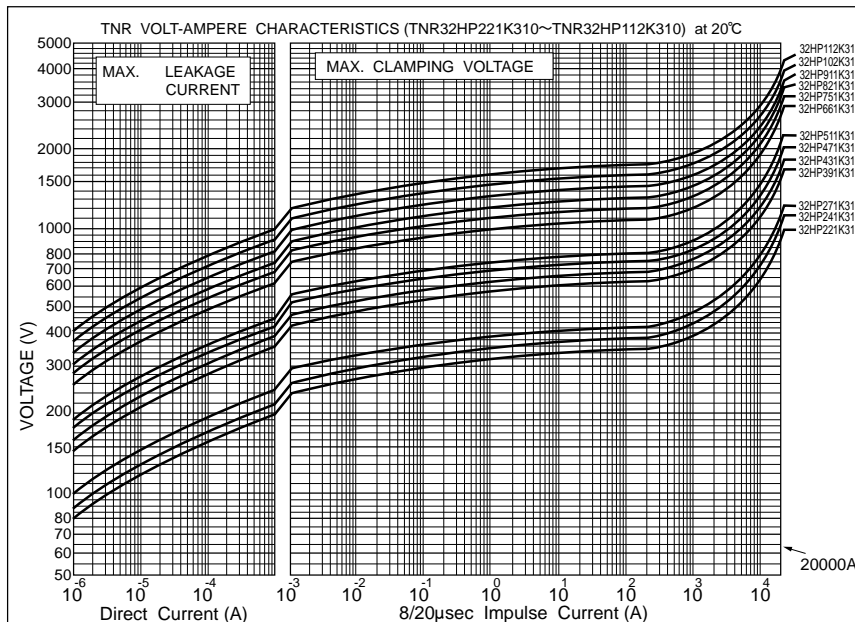
Model Number	Maximum Ratings					Maximum Clamping Voltage V _{200A} (V)	Capacitance Typical at 1kHz(pF)	Varistor Voltage V _{1mA} (V)
	Maximum Allowable Voltage		Maximum Peak Current	Maximum Energy	Rated Wattage			
	ACrms(V)	DC(V)	8/20μs(kA)	2ms(J)	(W)			
TNR32HP221K310	140	180	25/1time 20/2times	200	1.2	360	5,500	220(198 ~ 242)
TNR32HP241K310	150	200		240		395	4,800	240(216 ~ 264)
TNR32HP271K310	175	225		260		445	4,200	270(243 ~ 297)
TNR32HP391K310	250	320		350		650	3,500	390(351 ~ 429)
TNR32HP431K310	275	350		400		710	2,700	430(387 ~ 473)
TNR32HP471K310	300	385		410		775	2,600	470(423 ~ 517)
TNR32HP511K310	315	420		420		840	2,400	510(453 ~ 561)
TNR32HP681K310	420	560		450		1,120	2,100	680(612 ~ 748)
TNR32HP751K310	460	615		500		1,240	2,000	750(675 ~ 825)
TNR32HP821K310	510	670		545		1,355	1,800	820(738 ~ 902)
TNR32HP911K310	550	745		600		1,500	1,700	910(819 ~ 1,001)
TNR32HP102K310	625	825		620		1,650	1,000	1,000(900 ~ 1,100)
TNR32HP112K310	680	895	640	1,815	800	1,100(990 ~ 1,210)		

Operating Temperature Range : -40 ~ +85°C, Storage Temperature Range : -50 ~ +125°C



● Dimensions (Type 32HP)

Model Number	H MAX.	T MAX.	d ±1.0
TNR32HP221K310	46.0	7.5	6.8
TNR32HP241K310	46.0	7.5	6.7
TNR32HP271K310	46.0	7.5	6.5
TNR32HP391K310	46.0	7.5	5.8
TNR32HP431K310	46.0	7.5	5.6
TNR32HP471K310	46.0	7.5	5.4
TNR32HP511K310	46.0	10.0	5.2
TNR32HP681K310	46.0	10.0	4.2
TNR32HP751K310	46.0	10.0	3.9
TNR32HP821K310	46.0	10.0	3.5
TNR32HP911K310	46.0	10.0	3.0
TNR32HP102K310	46.0	11.0	2.5
TNR32HP112K310	46.0	11.0	1.9



When the surge energy much higher than the rated maximum energy is applied to the varistors, it may blow up and catch fire.

Our newly developed TNR SE series is to prevent from being caught fire even very high surge energy is applied.

Thus electric appliance using our TNR SE series can be much safer.

● Features

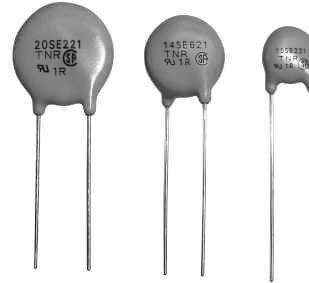
- ◆ Newly developed non-flammable material (Halogen Free) is used for outer coating.
- ◆ The new outer coating will meet UL flammability test.
- ◆ At the over voltage test, the new material shall deter burning caused by the high temperature, arc and the large surge current when TNR shall blow up.
- ◆ General specifications are same as that of V series, large surge capability TNR.

● Applications

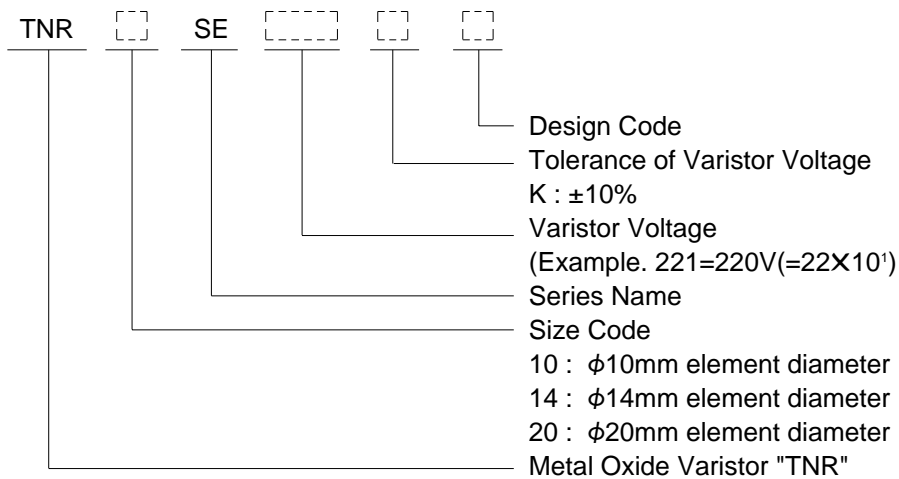
- ◆ Protection for semiconductors from over voltage.
- ◆ Protection for electronic instruments from lightning surge.
- ◆ Absorption of on-off surge from motors and relays..

Operating temperature range : - 40 ~ +85°C

Storage temperature range : - 50 ~ +125°C



● Part Numbering System



● Ratings and Characteristics

Model Number	Maximum Ratings					Maximum Clamping Voltage		Capacitance Typical	Varistor Voltage V1mA
	Maximum Allowable Voltage		Maximum Peak Current	Maximum Energy	Rated Wattage				
	AC (Vrms)	DC (V)	8/20 μ s (A)	2ms (J)	(W)	(A)	(V)	at 1kHz (pF)	(V)
TNR10SE221K	140	180	3500/1time	27.5	0.4	25	360	450	220(198~242)
TNR10SE241K	150	200		30.0			395	400	240(216~264)
TNR10SE271K	175	225	2500/2times	35.0			455	350	270(247~303)
TNR10SE431K	275	350		55.0			710	240	430(387~473)
TNR10SE471K	300	385		60.0			775	220	470(423~517)
TNR10SE621K	385	505		67.0			1025	180	620(558~682)
TNR14SE221K	140	180	6000/1time	55.0	0.6	50	360	850	220(198~242)
TNR14SE241K	150	200		60.0			395	800	240(216~264)
TNR14SE271K	175	225	5000/2times	70.0			455	700	270(247~303)
TNR14SE431K	275	350		110.0			710	460	430(387~473)
TNR14SE471K	300	385		125.0			775	420	470(423~517)
TNR14SE621K	385	505		136.0			1025	330	620(558~682)
TNR20SE221K	140	180	10000/1time	110.0	1.0	100	360	2,500	220(198~242)
TNR20SE241K	150	200		120.0			395	2,300	240(216~264)
TNR20SE271K	175	225	7000/2times	135.0			455	2,000	270(247~303)
TNR20SE431K	275	350		215.0			710	1,300	430(387~473)
TNR20SE471K	300	385		250.0			775	1,200	470(423~517)
TNR20SE621K	385	505		273.0			1025	900	620(558~682)

● Dimensions




Model Number	D MAX.	H MAX.	T MAX.	L MIN.	ϕ d ± 0.05	W ± 1.0	E ± 1.0	Dimensions(mm)
TNR10SE221K	13.0	17.5	6.9	20	0.8	7.5	2.0	
TNR10SE241K			8.2				2.1	
TNR10SE271K							2.3	
TNR10SE431K			3.1					
TNR10SE471K	3.3							
TNR10SE621K	14.0	18.5	11.5	4.2				
TNR14SE221K	17.5	22.0	6.9	20	0.8	7.5	2.0	
TNR14SE241K			8.2				2.1	
TNR14SE271K							2.3	
TNR14SE431K			3.1					
TNR14SE471K	3.3							
TNR14SE621K	18.5	24.0	11.5	4.2				
TNR20SE221K	22.5	27.5	6.9	20	0.8	10.0	2.2	
TNR20SE241K			8.2				2.3	
TNR20SE271K							2.5	
TNR20SE431K			3.3					
TNR20SE471K	3.5							
TNR20SE621K	24.5	29.5	11.5	4.4				

**● V - I Curve**

V-I characteristics is same as that of V series.

Please see V-I Curve of V series.

CROSS REFERENCE TABLE

TNR SE SERIES	TNR V SERIES	GO TO REF. PAGE
TNR10SE221K TNR10SE241K TNR10SE271K TNR10SE431K TNR10SE471K TNR10SE621K	TNR10V221K TNR10V241K TNR10V271K TNR10V431K TNR10V471K TNR10V621K	
TNR14SE221K TNR14SE241K TNR14SE271K TNR14SE431K TNR14SE471K TNR14SE621K	TNR14V221K TNR14V241K TNR14V271K TNR14V431K TNR14V471K TNR14V621K	
TNR20SE221K TNR20SE241K TNR20SE271K TNR20SE431K TNR20SE471K TNR20SE621K	TNR20V221K TNR20V241K TNR20V271K TNR20V431K TNR20V471K TNR20V621K	

● General Specifications for TNR SE Series

 Operating temperature range : $-40 \pm \sim 85^{\circ}\text{C}$ Storage temperature range : $-50 \sim +125^{\circ}\text{C}$

Item	Test conditions	Specifications
Standard Test Condition	$20 \pm 5^{\circ}\text{C}$, $65 \pm 20\%$ RH unless specified. However, if it does not affect test result, the condition can be $20 \pm 15^{\circ}\text{C}$, $65 \pm 20\%$ RH also.	—————
Varistor Voltage	The voltage between the two terminals measured at 1mA DC is called Varistor Voltage. The measurement shall be made as fast as possible to avoid heat effect.	Satisfy the specification
Maximum Allowable Voltage	Maximum continuous AC voltage (50 ~ 60Hz AC) and maximum DC voltage which can be applied.	Satisfy the specification
Maximum Peak Surge Current	Maximum surge current (8/20 μ Sec. pulse wave to be applied once, or twice, 2 minute apart) for varistor voltage change within $\pm 10\%$ of the initial value.	Satisfy the specification
Energy Rating	Maximum energy (2mSec. square wave to be applied once) for varistor voltage change within $\pm 10\%$ of the initial value.	Satisfy the specification
Rated Wattage	Maximum power (50 ~ 60Hz AC power to be applied for 1,000 hours at $85 \pm 2^{\circ}\text{C}$) for varistor voltage change within $\pm 10\%$ of the initial value.	Satisfy the specification
Maximum Clamping Voltage	Maximum voltage across varistor when 8/20 μ Sec. rated current surge is applied.	Satisfy the specification
Capacitance	Varistor's capacitance at 1kHz, standard test condition.	For reference only.
Voltage Temperature Coefficient	$\frac{V_{1\text{mA at } 85^{\circ}\text{C}} - V_{1\text{mA at } 25^{\circ}\text{C}}}{V_{1\text{mA at } 25^{\circ}\text{C}}} \times \frac{1}{60} \times 100 (\%/^{\circ}\text{C})$ V1mA : Actual Varistor Voltage	Within $\pm 0.05\%/^{\circ}\text{C}$
Insulation	Short circuit the two leads of varistor, and put the varistor body into lead balls (1.6mm diameter) leaving 2mm epoxy coating outside. Then, apply 2.5kVrms between the leads and the lead balls for 60 ± 5 seconds.	The varistor shall withstand with no abnormality.

● Reliability Characteristics

Item	Test conditions	Specifications
Heat Cycle	Subject varistor to the following temperature cycles. -40°C for 30 minutes \rightarrow Normal room temperature for 10 minutes \rightarrow 85°C for 30 minutes \rightarrow Normal room temperature for 10 minutes. This completes one cycle. The cycle shall be repeated 50 times total. After the cycles, the varistor shall be stored at normal room temperature for one hour. Then check the varistor voltage and the appearance.	$\Delta V_{1\text{mA}} \leq \pm 5\%$ No appearance abnormality.
High Temperature Exposure	Store varistor at 125°C for 1,000 hours. After that, store the varistor at normal room temperature for one hour. Then check the varistor voltage.	$\Delta V_{1\text{mA}} \leq \pm 5\%$
Humidity Resistivity	Store at 40°C , 90~95% RH for 1,000 hours. After that, store the varistor at normal room temperature for one hour. Then check the varistor voltage.	$\Delta V_{1\text{mA}} \leq \pm 5\%$
High Temperature Operation	Apply maximum applied voltage to varistor at 85°C for 1,000 hours. After that, store the varistor at normal room temperature for one hour. Then check the varistor voltage.	$\Delta V_{1\text{mA}} \leq \pm 10\%$

● Mechanical Characteristics

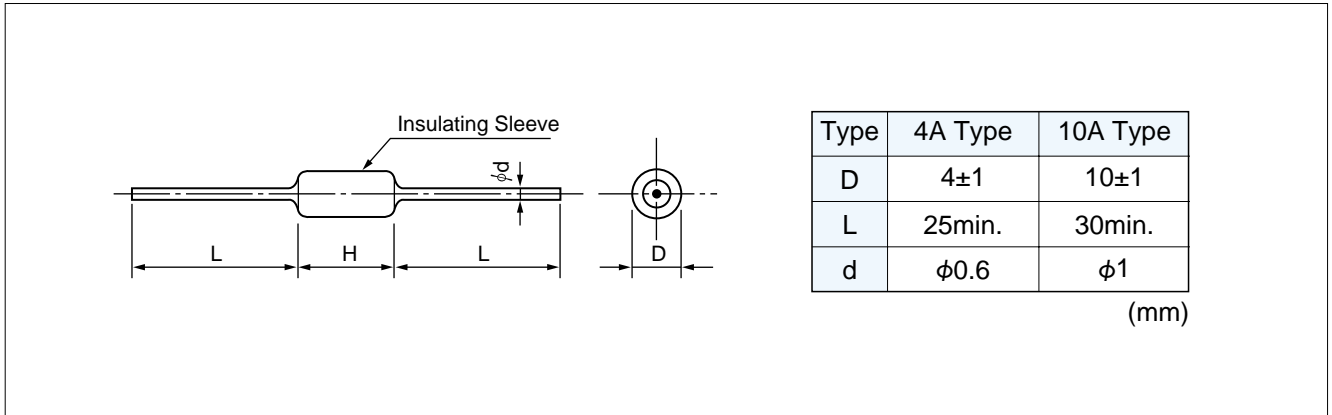
Item	Test conditions	Specifications				
Soldering Heat Resistivity	Store varistor at normal room temperature. Dip the varistor leads to solder, at $350 \pm 10^{\circ}\text{C}$ for $3 \pm \frac{1}{2}$ seconds, up to 2.0 ~2.5 mm from the varistor body. After that, store the varistor at normal room temperature for 30 minutes, and measure the varistor voltage.	$\Delta V_{1\text{mA}} \leq \pm 5\%$ Vc : Actual varistor voltage No mechanical damages				
Solderability	Dip varistor leads to methanol solution (JIS K 1501, about 25%) of rosin (JIS Z 5902) for 5~10 seconds. Then, dip the lead to solder (JIS Z 3282 H60A or H63A) at $225 \sim 240^{\circ}\text{C}$, up to 2.0 ~ 2.5mm from the varistor body for 5 ± 0.5 seconds. Then, check the solderability.	At least, 95% of the surface dipped to solder shall be covered by new solder.				
Lead Pull Strength	Fix varistor body, and suspend specified weight toward direction of lead axis. <table style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <tr> <td style="text-align: center; border-bottom: 1px solid black;">Lead diameter</td> <td style="text-align: center; border-bottom: 1px solid black;">Force</td> </tr> <tr> <td style="text-align: center;">$\phi 0.6\text{mm}, \phi 0.8\text{mm}$</td> <td style="text-align: center;">10N</td> </tr> </table>	Lead diameter	Force	$\phi 0.6\text{mm}, \phi 0.8\text{mm}$	10N	No abnormality such as disconnection. $\Delta V_{1\text{mA}} \leq \pm 5\%$
Lead diameter	Force					
$\phi 0.6\text{mm}, \phi 0.8\text{mm}$	10N					
Lead Bend Strength	The varistor shall be secured with its terminal kept vertical and the force specified below shall be applied in the axial direction. The terminal shall gradually be bend by 90 in one direction then back to original position. The damage of the terminal shall be visually examined. <table style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <tr> <td style="text-align: center; border-bottom: 1px solid black;">Lead diameter</td> <td style="text-align: center; border-bottom: 1px solid black;">Force</td> </tr> <tr> <td style="text-align: center;">$\phi 0.6\text{mm}, \phi 0.8\text{mm}$</td> <td style="text-align: center;">2.5N</td> </tr> </table>	Lead diameter	Force	$\phi 0.6\text{mm}, \phi 0.8\text{mm}$	2.5N	No remarkable damage as remarkable the inner ceramic element or terminal open.
Lead diameter	Force					
$\phi 0.6\text{mm}, \phi 0.8\text{mm}$	2.5N					
Vibration Resistivity	Mount varistor body on vibrator, and conduct following vibration test. Peak-to-Peak amplitude : 1.5mm Vibration frequency range : 10Hz ~ 55Hz Sweeping time: Approximately one minute for 10Hz → 55Hz → 10Hz Direction and duration of vibration : Three directions of X, Y and Z. Two hours each. Six hours total.	No remarkable appearance abnormality. $\Delta V_{1\text{mA}} \pm 5\%$				
Flammability test	The varistor shall be subjected to 60 second applications of test flame. Burner : Bunsen gas burner 9000kcal / m ³ Diameter of flame nozzle : $\phi 9.5$ mm Position : The specimen shall be fixed horizontal. Point of application shall be approximately center of the specimen.	No catching fire, and no flaming drops.				

● High Varistor Voltage (Axial Lead Type)

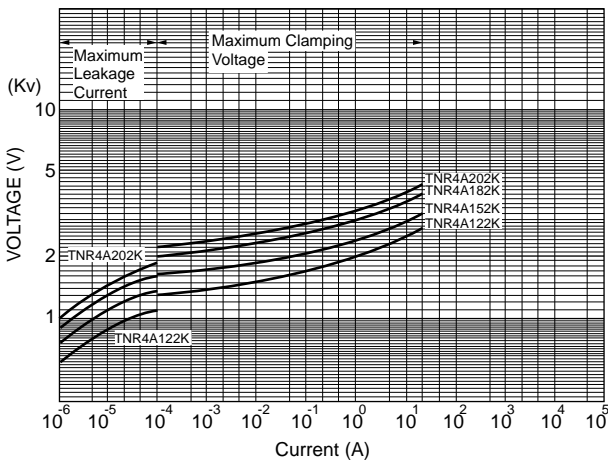
Model Number	Maximum Applied Voltage (Continuous)		Maximum Peak Current (8/20 μ Sec.) (A)	Maximum Energy (2mSec.) (J)	Rated Wattage (W)	Maximum Clamping Voltage (V _{2A}) (V)	Varistor Voltage at 0.1mA DC (V)	H Max. (mm)
	ACrms(V)	DC(V)						
4A Type	ACrms(V)	DC(V)	(A)	(J)	(W)	(V _{2A})	(V)	(mm)
TNR4A122K	620	880	40/1 time 20/2 time	1.8	0.05	2,200	1,200(1,080~ 1,320)	11
TNR4A152K	780	1,100		2.0		2,600	1,500(1,350~ 1,650)	12
TNR4A182K	930	1,300		2.5		3,100	1,800(1,620~ 1,980)	13
TNR4A202K	1,040	1,450		3.0		3,500	2,000(1,800~ 2,200)	15
10A Type	ACrms(V)	DC(V)	(A)	(J)	(W)	(V _{5A})	(V)	(mm)
TNR10A472K	2,200	3,100	100/1 time 50/2 time	10	0.5	8,700	4,700(4,230~ 5,170)	40
TNR10A562K	2,600	3,700		10		10,000	5,600(5,040~ 6,160)	40
TNR10A682K	3,200	4,500		10		12,000	6,800(6,120~ 7,480)	40
TNR10A822K	3,900	5,500		10		16,000	8,200(7,380~ 9,020)	50
TNR10A103K	4,700	6,700	15	19,500	10,000(9,000~11,000)	50		
TNR10A123K	5,700	8,100	15	21,500	12,000(10,800~13,200)	55		

Operating Temperature Range - 40 ~ +85°C Storage Temperature Range - 50 ~ +105°C

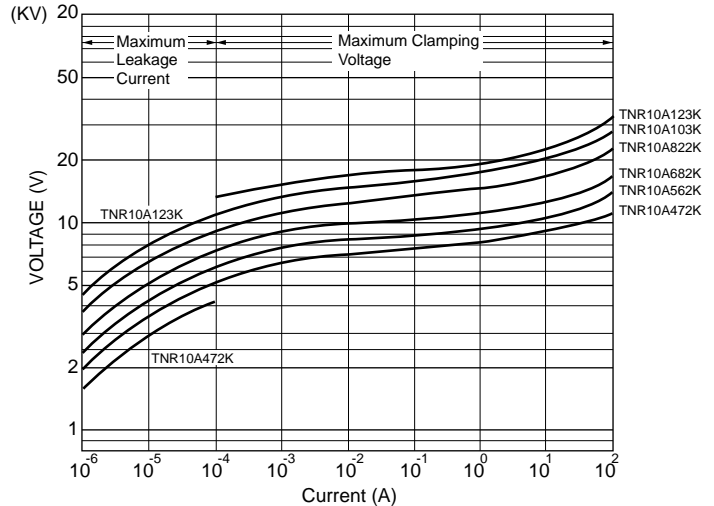
● Dimensions



● V-I Curve (TNR4A122K~TNR4A202K)



● V-I Curve (TNR10A472K~TNR10A123K)





TNR® E SERIES

● 20E Series

Model Number	Maximum Applied Voltage		Maximum Peak Current (8/20μSec.) (A)	Energy (2mSec.) (J)	Rated Wattage (W)	Maximum Clamping Voltage V _{100A} (V)	Typical Capacitance at 1kHz (pF)	Varistor Voltage at 1mA DC (V)
	ACrms(V)	DC(V)						
TNR20E221K	140	180	8,000	80	0.8	360	2,200	220(198 ~ 242)
TNR20E241K	150	200		95		395	1,500	240(216 ~ 264)
TNR20E271K	175	225		100		445	1,400	270(243 ~ 297)
TNR20E391K	250	320		130		650	1,200	390(351 ~ 429)
TNR20E431K	275	350		140		710	1,000	430(387 ~ 473)
TNR20E471K	300	385		150		775	950	470(423 ~ 517)
TNR20E511K	315	420		160		840	930	510(459 ~ 561)
TNR20E681K	420	560		175		1,120	850	680(612 ~ 748)
TNR20E751K	460	615		190		1,240	800	750(675 ~ 825)
TNR20E821K	510	670		215		1,355	700	820(738 ~ 902)
TNR20E911K	550	745		240		1,500	600	910(819 ~ 1,001)
TNR20E102K	625	825		245		1,650	400	1,000(900 ~ 1,100)
TNR20E112K	680	895		250		1,815	350	1,100(990 ~ 1,210)

Operating Temperature Range -40 ~ +85°C Storage Temperature Range -40 ~ +110°C

● 32E Series

Model Number	Maximum Applied Voltage		Maximum Peak Current (8/20μSec.) (A)	Energy (2mSec.) (J)	Rated Wattage (W)	Maximum Clamping Voltage V _{200A} (V)	Typical Capacitance at 1kHz (pF)	Varistor Voltage at 1mA DC (V)
	ACrms(V)	DC(V)						
TNR32E221K	140	180	25,000	200	1.2	360	5,500	220(198 ~ 242)
TNR32E241K	150	200		240		395	4,800	240(216 ~ 264)
TNR32E271K	175	225		260		445	4,200	270(243 ~ 297)
TNR32E391K	250	320		350		650	3,500	390(351 ~ 429)
TNR32E431K	275	350		400		710	2,700	430(387 ~ 473)
TNR32E471K	300	385		410		775	2,600	470(423 ~ 517)
TNR32E511K	315	420		420		840	2,400	510(459 ~ 561)
TNR32E681K	420	560		450		1,120	2,100	680(612 ~ 748)
TNR32E751K	460	615		500		1,240	2,000	750(675 ~ 825)
TNR32E821K	510	670		545		1,355	1,800	820(738 ~ 902)
TNR32E911K	550	745		600		1,500	1,700	910(819 ~ 1,001)
TNR32E102K	625	825		620		1,650	1,000	1,000(900 ~ 1,100)
TNR32E112K	680	895		640		1,815	800	1,100(990 ~ 1,210)

Operating Temperature Range -40 ~ +85°C Storage Temperature Range -40 ~ +110°C

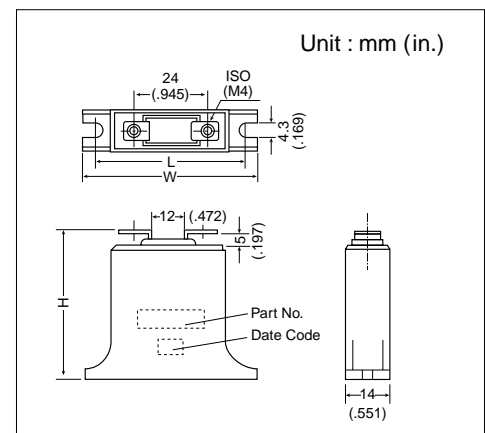
● Features

- ◆ Excellent clamping voltage characteristic and fast response time (<50nsec.) when subjected to impulse surges.
- ◆ No follow current.
- ◆ Any voltage rating within a VImA range from 200V to 1,100V available. (V1mA : varistor voltage.)
- ◆ Bilateral and symmetrical V- I characteristics curve. The TNR can, therefore, be used both in AC and DC circuits, for protection of either positive or negative transients.
- ◆ Large withstanding peak current 8,000A-25,000A(8/20μSec.).

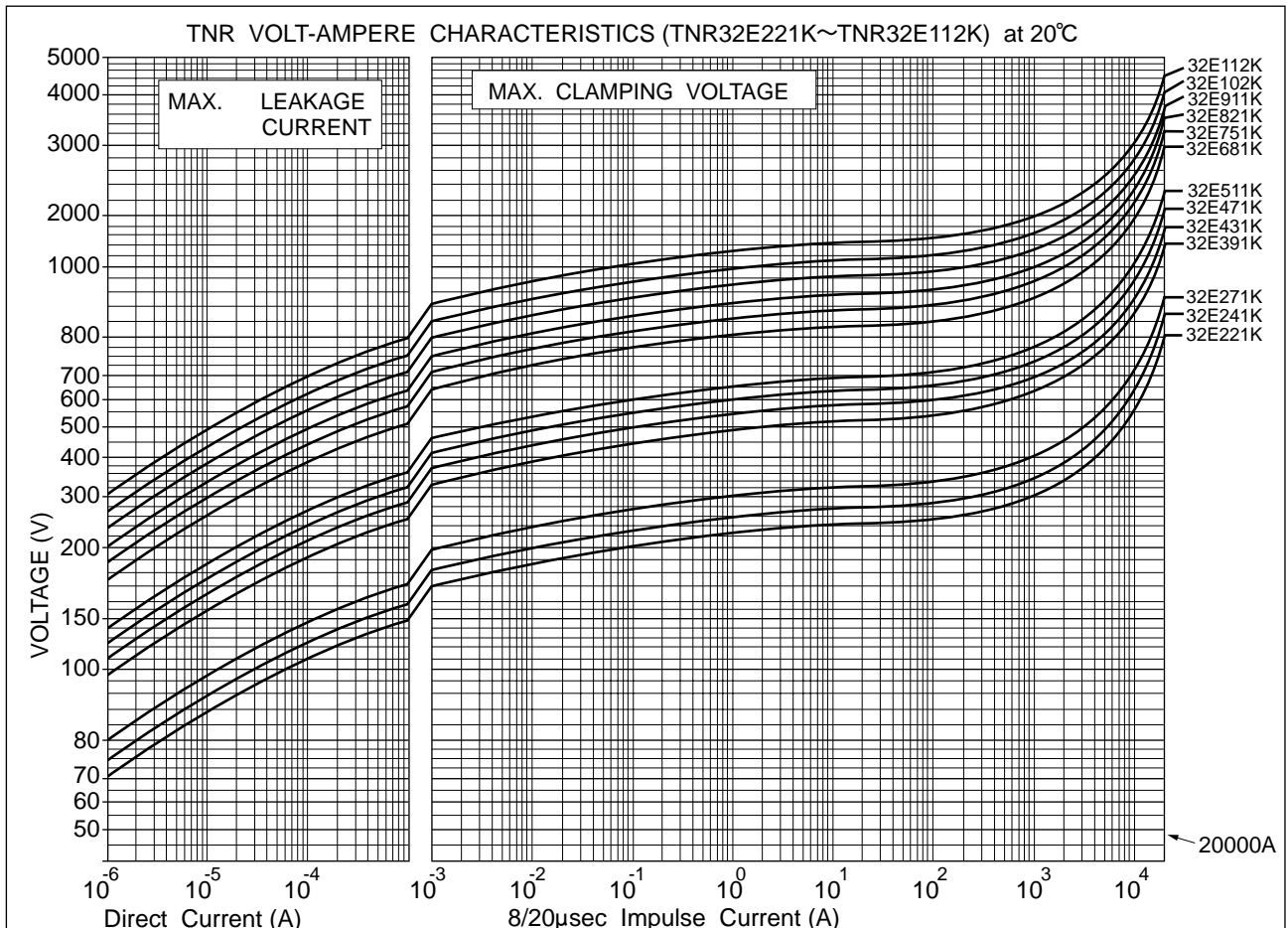
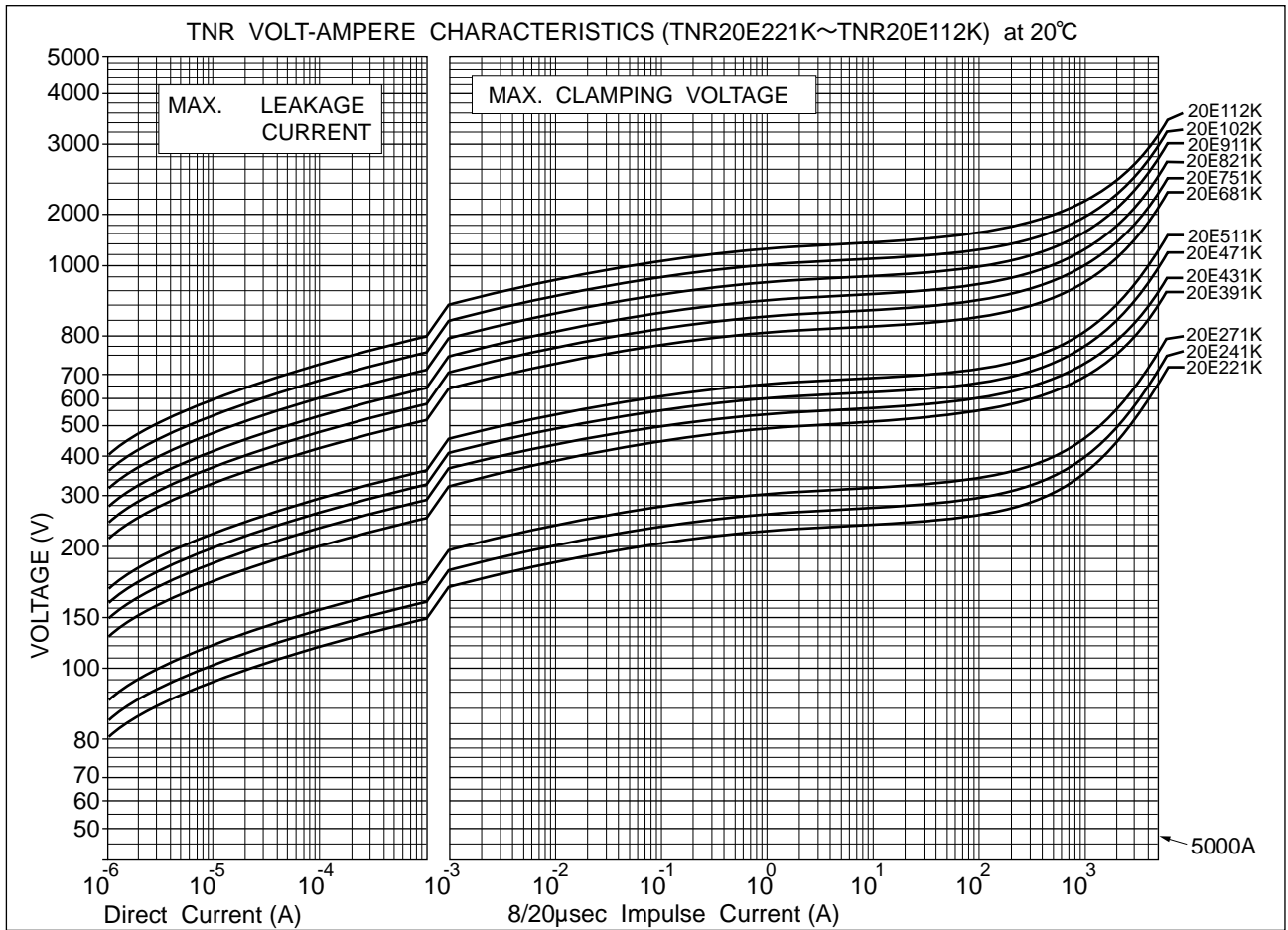
● Applications

- ◆ Protection of semiconductors such as transistors, diodes, ICs, thyristors, triacs, etc.
- ◆ Protection of various equipment including :
 - *Broadcasting, communications equipment.
 - *Traffic and railway signal systems.
 - *Automatic control devices for power distribution.
 - *Waterworks.
 - *Home entertainment equipment.
- ◆ Surge absorption of relays and electromagnetic valves.
- ◆ Absorption of surges generated within equipment such as TVs.

● Dimensions



Series	W	H	L
TNR20E	48±1 (1.890±0.039)	42±1 (1.653±0.039)	39±1 (1.535±0.039)
TNR32E	60±1 (2.362±0.039)	55±1 (2.165±0.039)	51±1 (2.008±0.039)

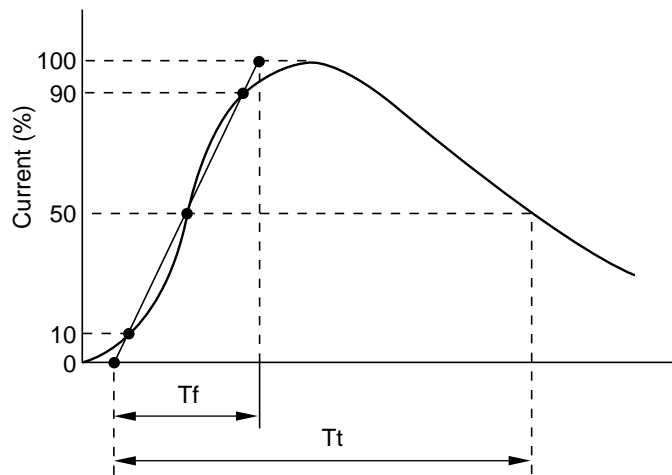


Pulse Life Time Ratings

When the following factors are different from the specified conditions, the peak pulse current should be revised based on the PULSE LIFE TIME RATINGS.

- Impulse duration time
- Number of impulse

(Impulse Current Wave Form)

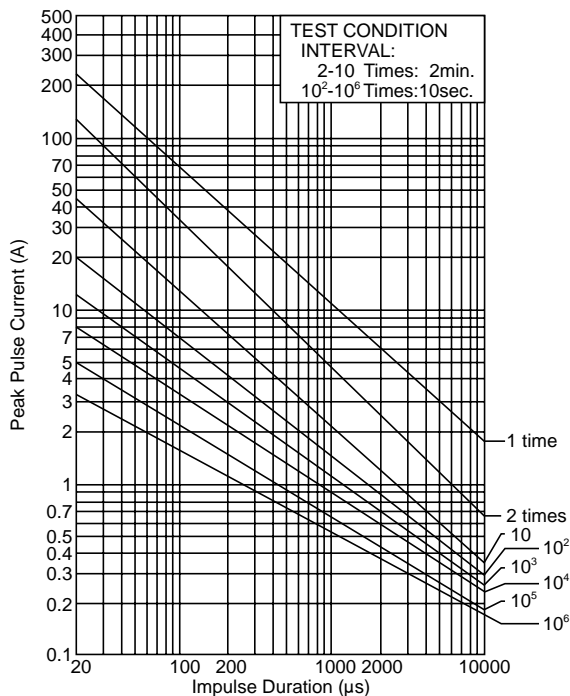


Tf : (Rise Time)

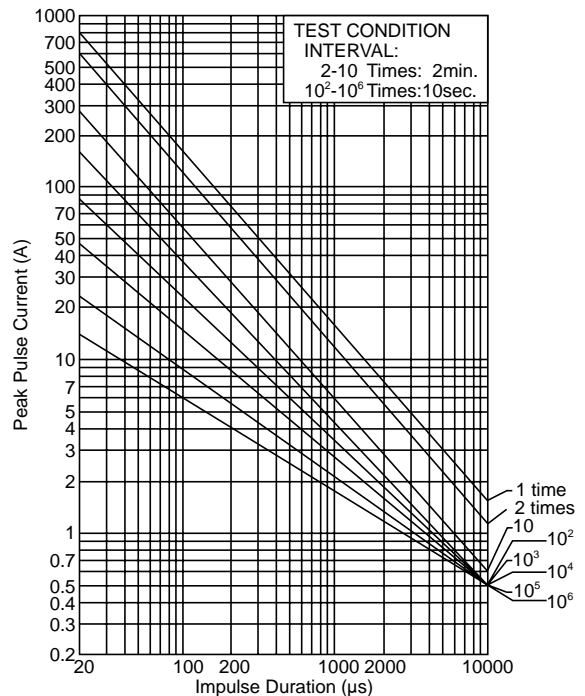
Tt : (Impulse Duration)

●V series

PULSE LIFE TIME RATINGS
(TNR5V180K~TNR5V680K)

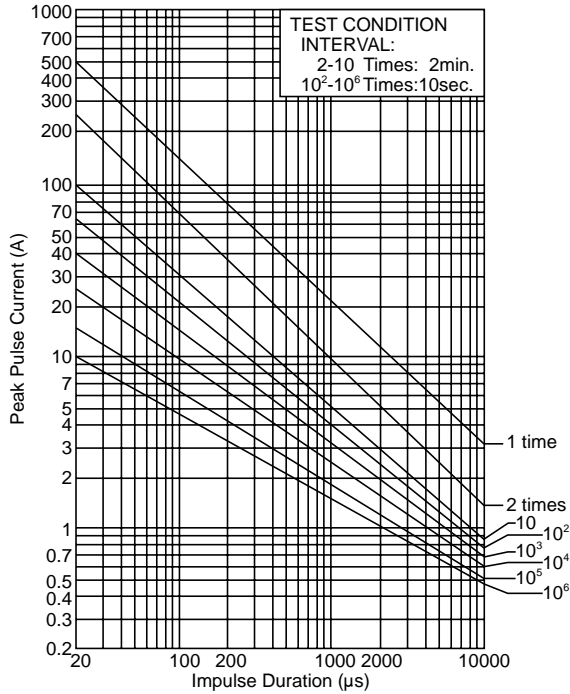


PULSE LIFE TIME RATINGS
(TNR5V820K~TNR5V471K)

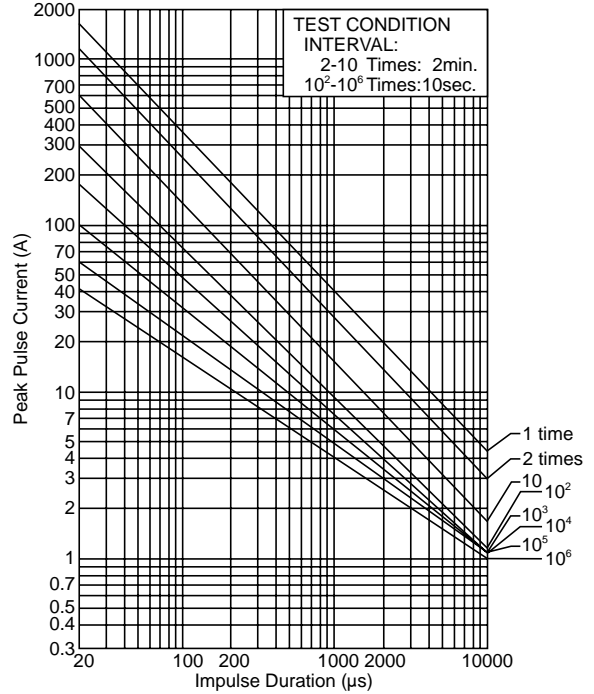


●V series

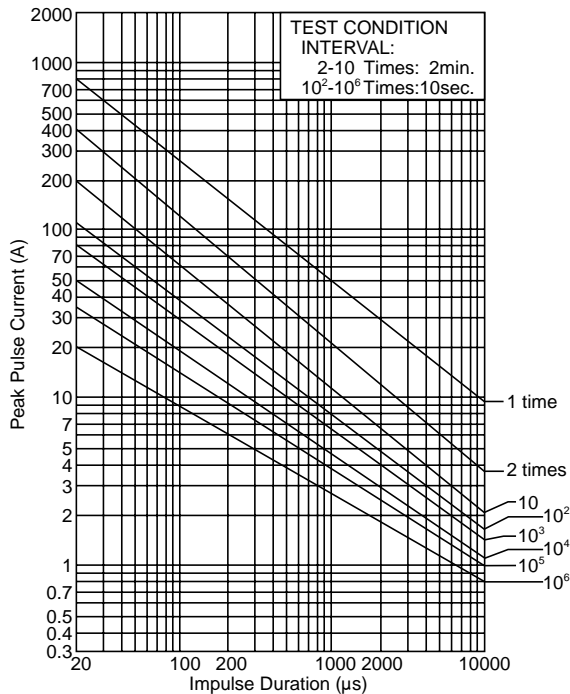
PULSE LIFE TIME RATINGS
(TNR7V150K~TNR7V680K)



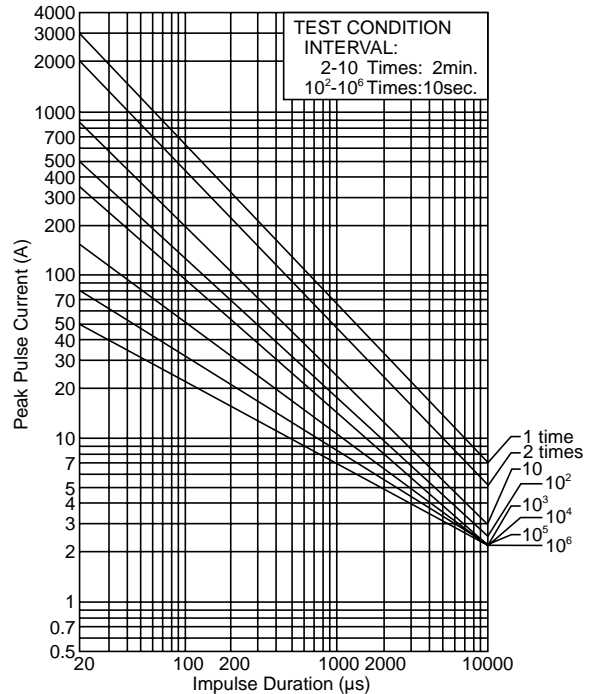
PULSE LIFE TIME RATINGS
(TNR7V820K~TNR7V511K)



PULSE LIFE TIME RATINGS
(TNR9V150K~TNR9V680K)

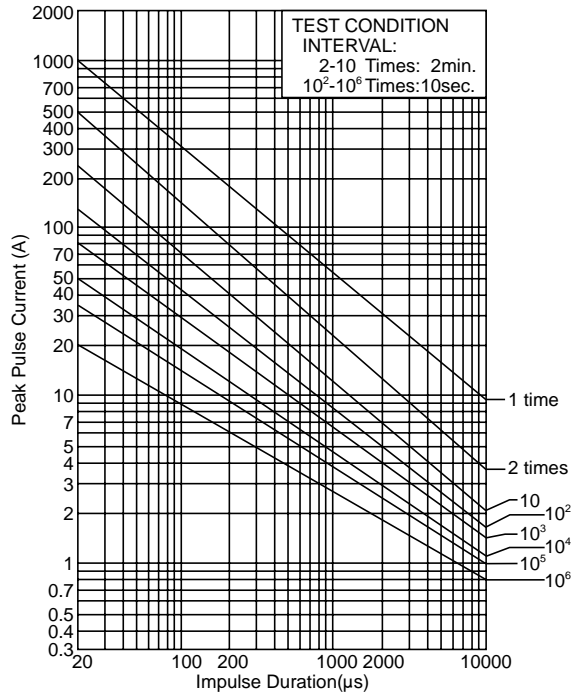


PULSE LIFE TIME RATINGS
(TNR9V820K~TNR9V511K)

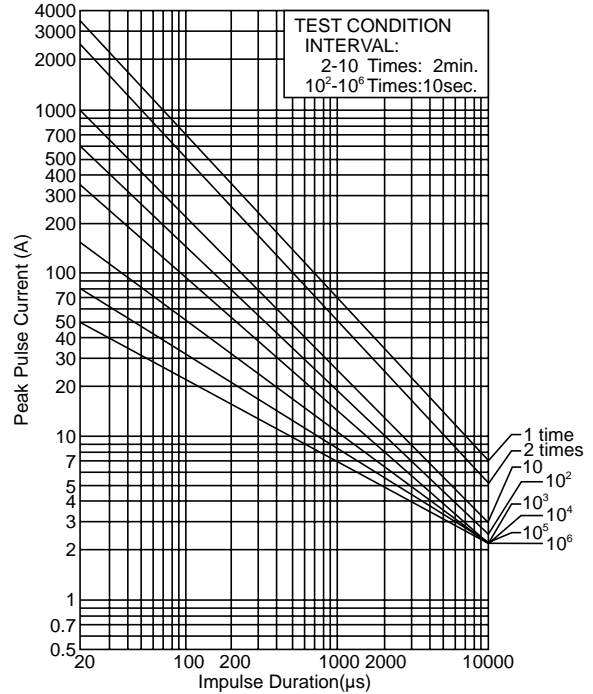


●V series

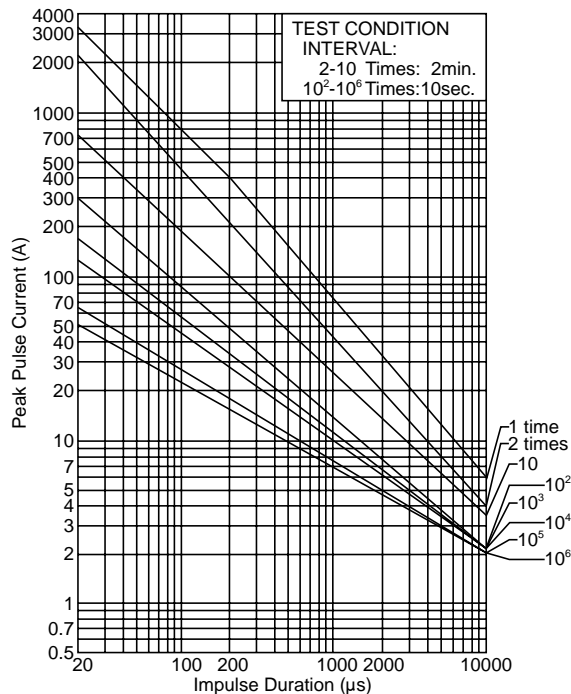
PULSE LIFE TIME RATINGS
(TNR10V150K~TNR10V680K)



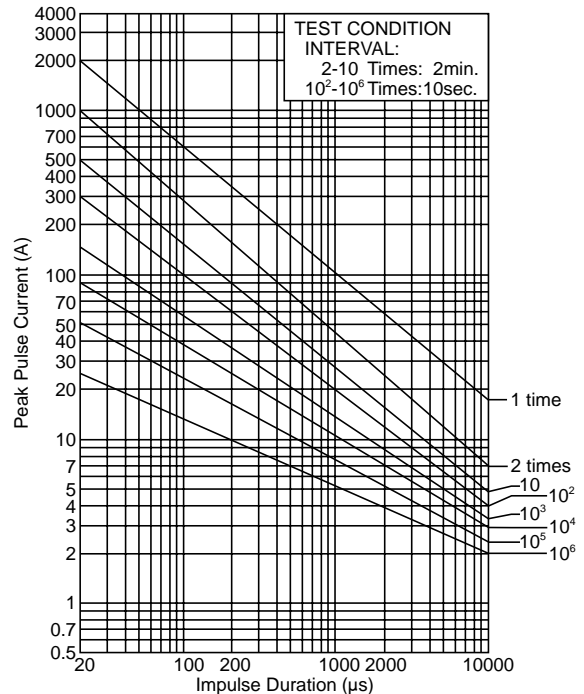
PULSE LIFE TIME RATINGS
(TNR10V820K~TNR10V511K)



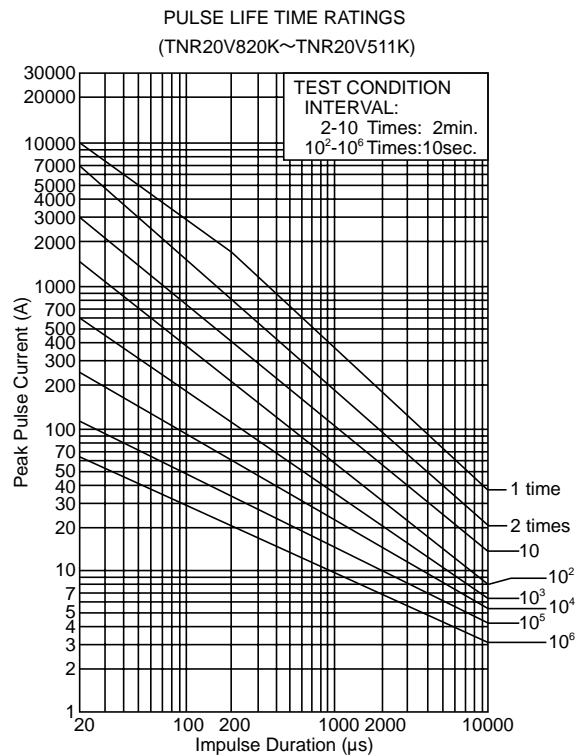
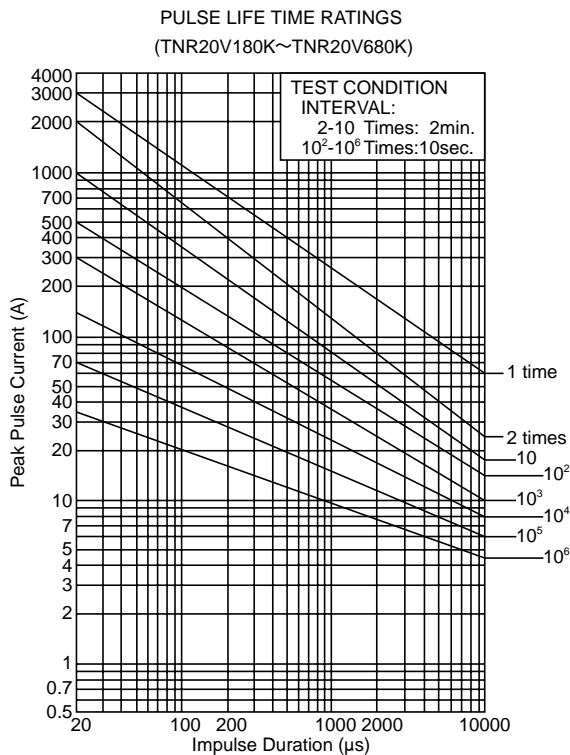
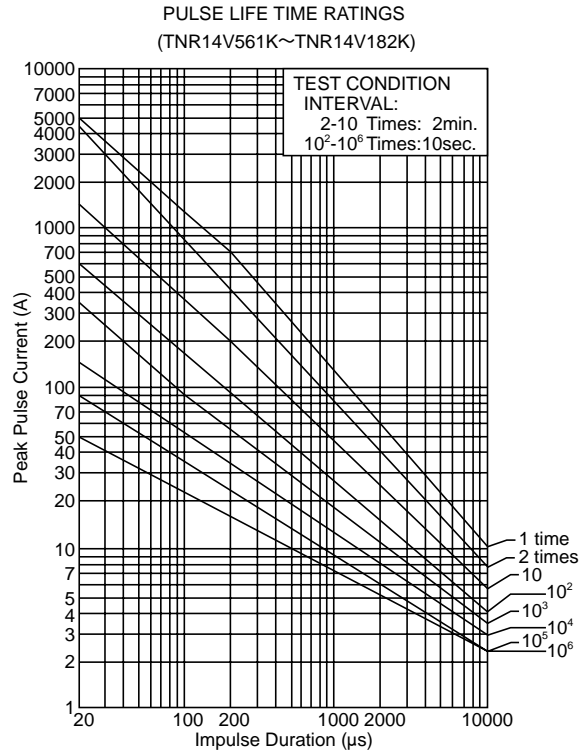
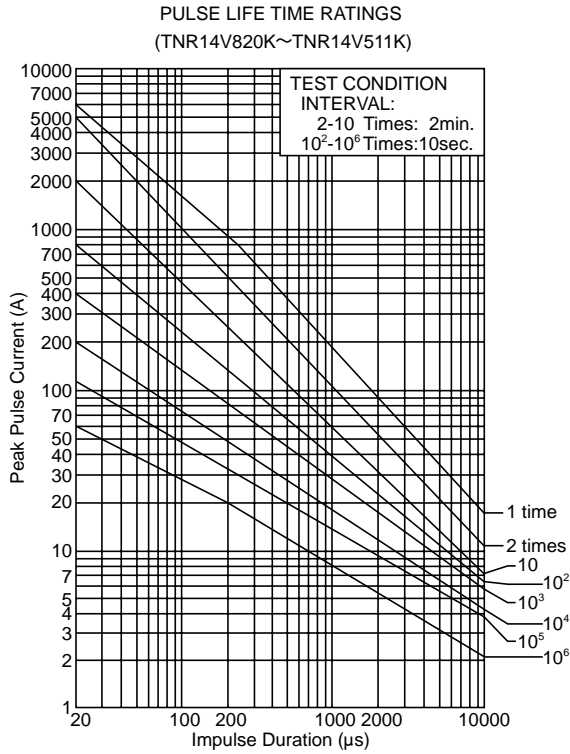
PULSE LIFE TIME RATINGS
(TNR10V561K~TNR10V182K)



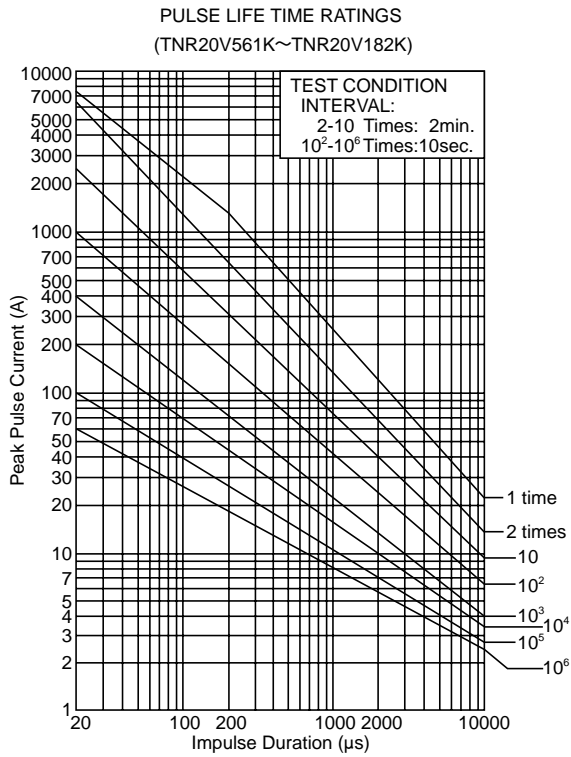
PULSE LIFE TIME RATINGS
(TNR14V150K~TNR14V680K)



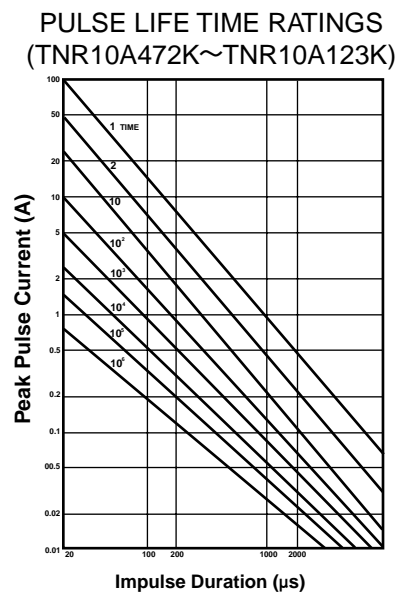
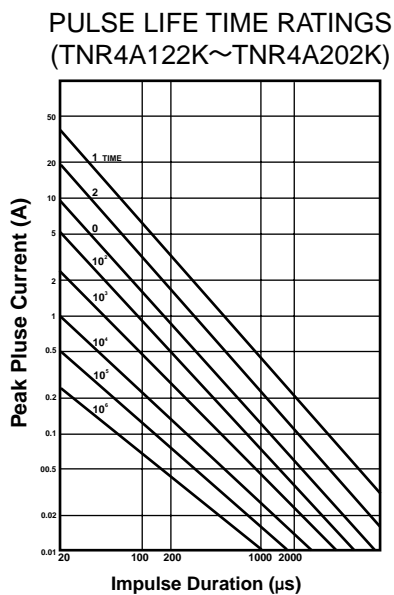
●V series



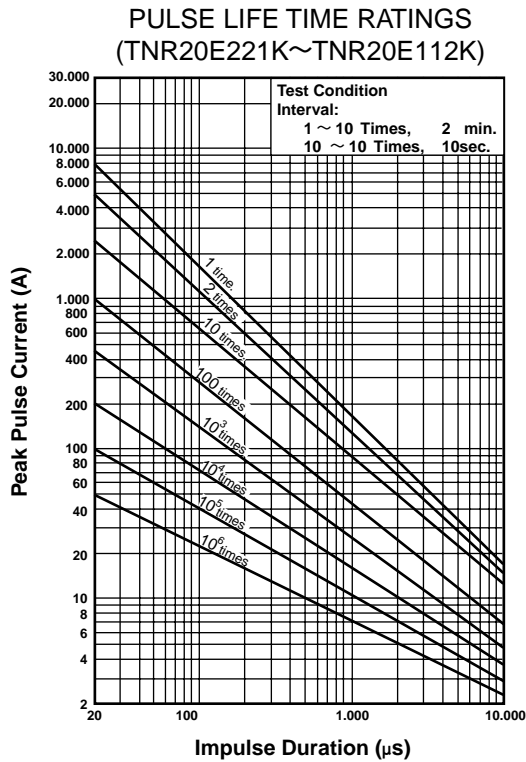
●V series



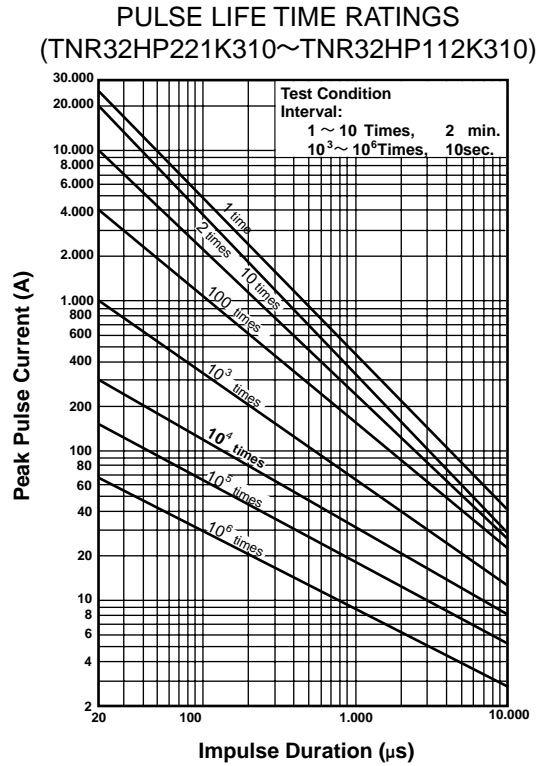
●A series



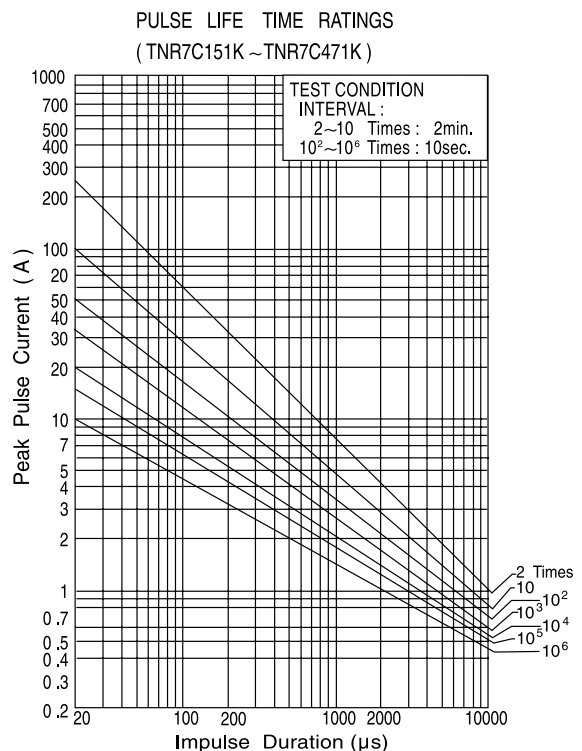
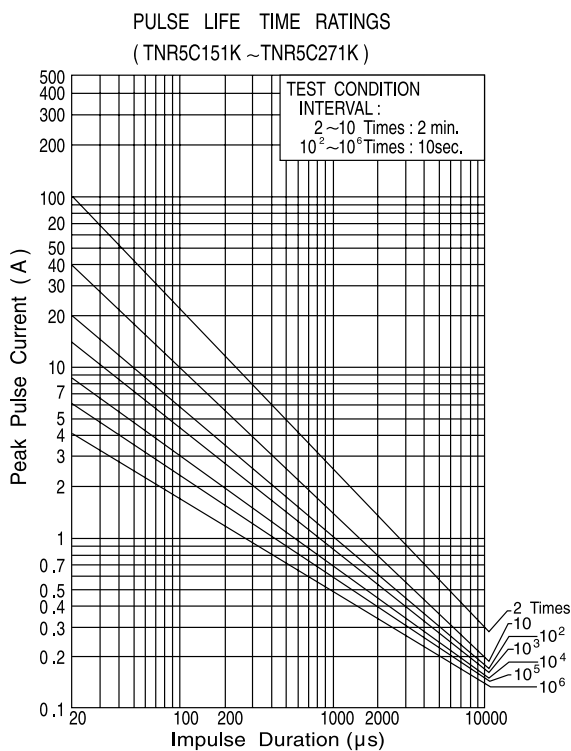
● E series



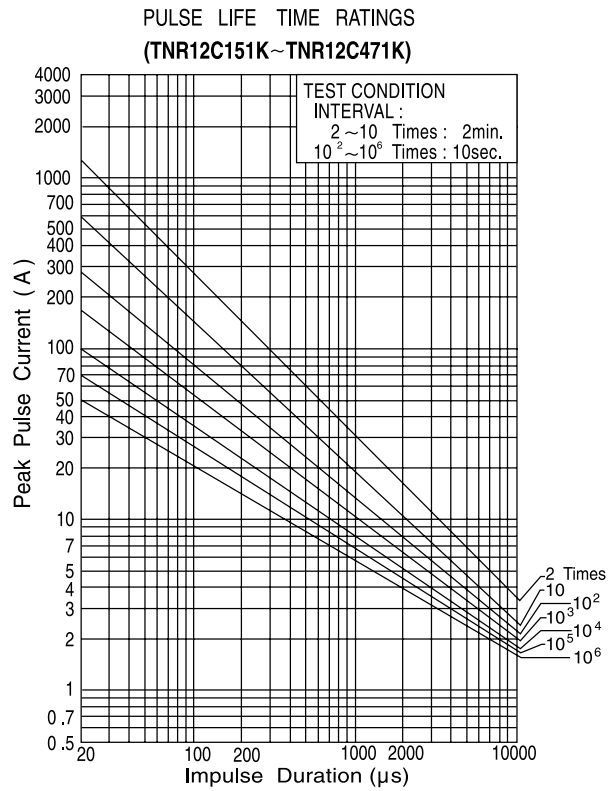
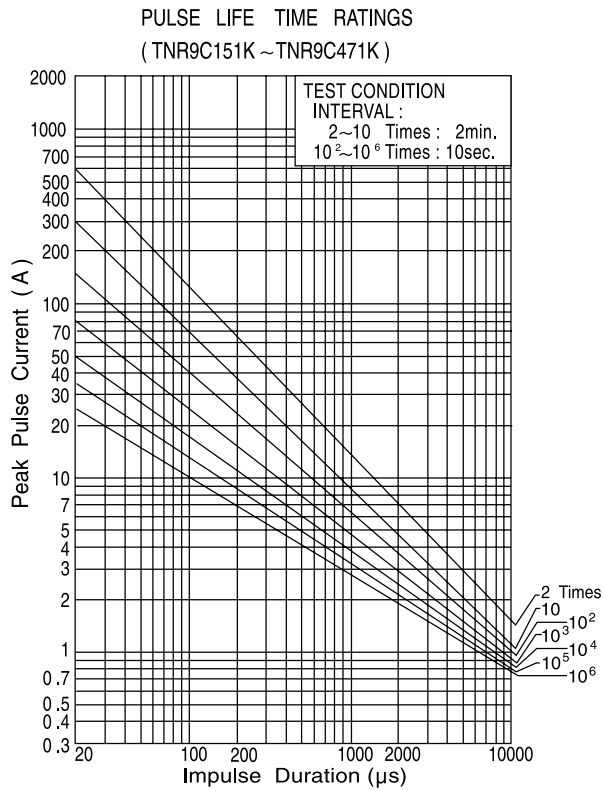
● HP series



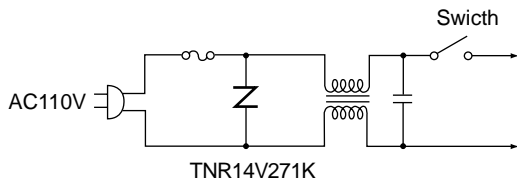
● C series



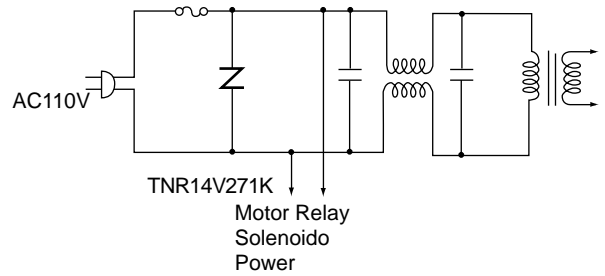
● C series



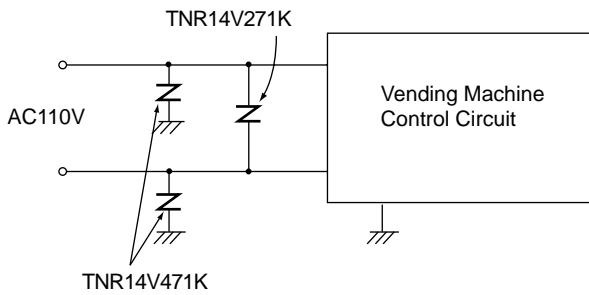
(1) Power Source Circuit



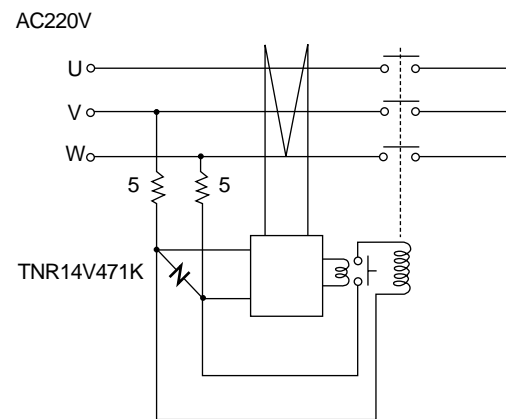
(2) Micro Computer Equipment



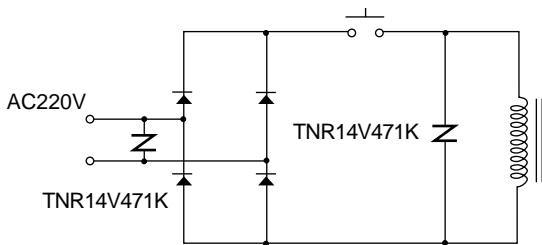
(3) Vending Machine



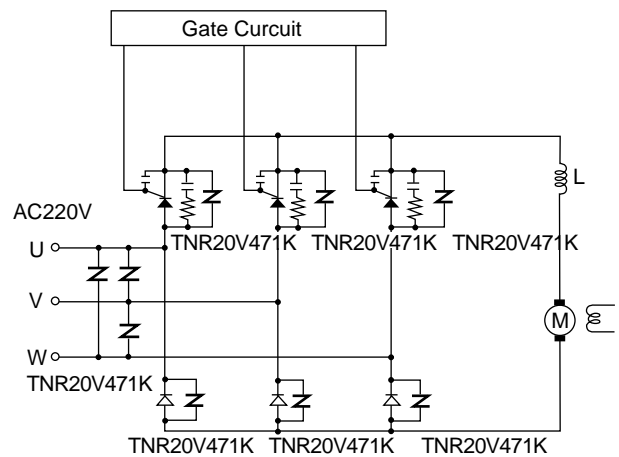
(4) Leakage Current Detector



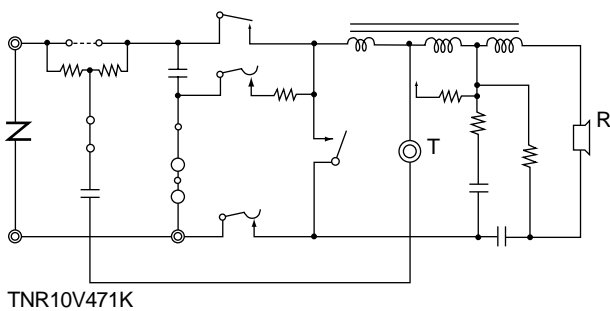
(5) Magnetic Brake



(6) Control of 20kW DC Motor



(7) Telephone





NOTICE OF DISCONTINUANCE

Unfortunately, due to extremely low order intake, we have decided to sell off our Multilayer Varistor Chip technology along with the production lines.

This in no way means we are getting out of the MOV business as we will continue to develop, design and manufacture radial leaded Metal Oxide Varistors.

The market for SMD multilayer varistors never truly developed due to their high cost versus comparable radial lead MOV components. In most cases, a 5 : 1 cost disadvantage is present for MLV chips versus radial leaded duplicates.

The following company is the new owner of our equipment and technology. We have included their web page information below.

MARUWA CO. LTD

<http://www.maruwa.co.jp/e/>