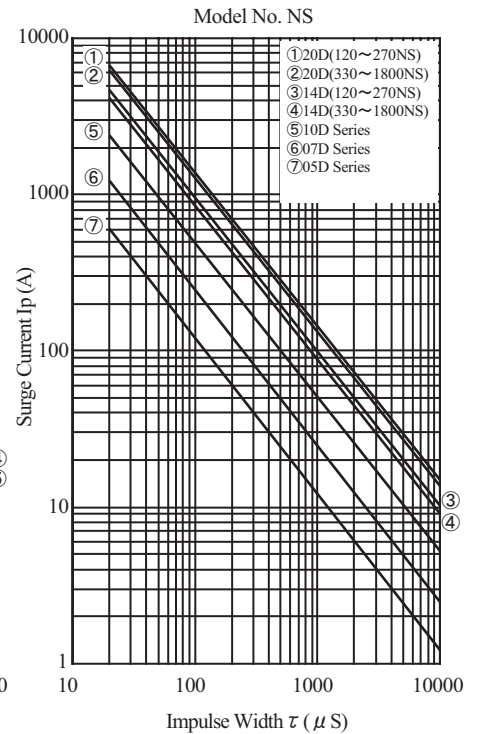
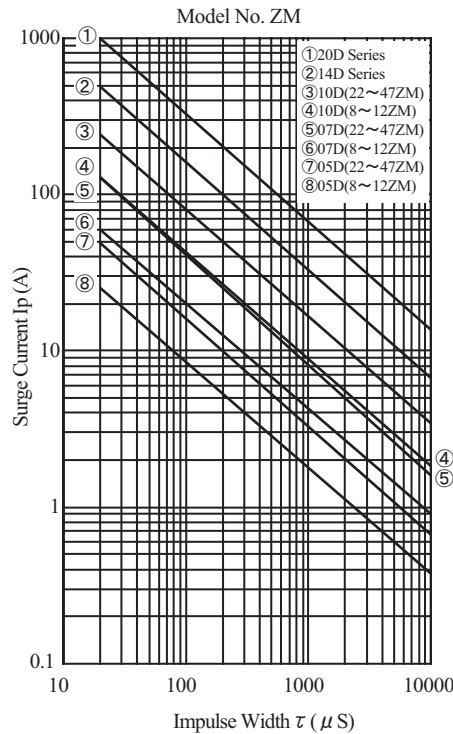
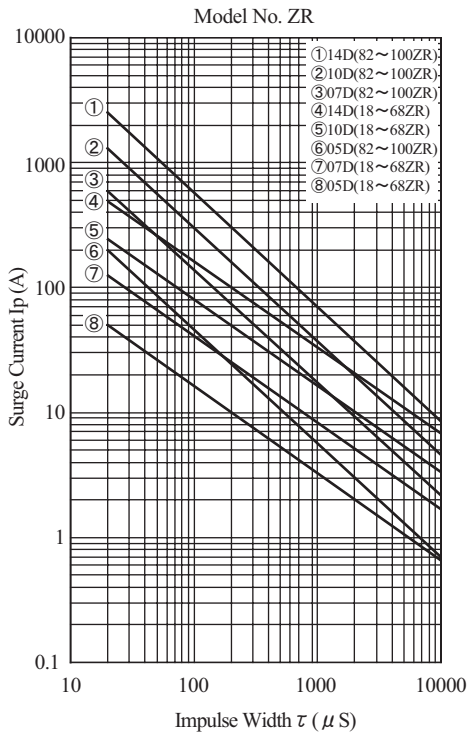
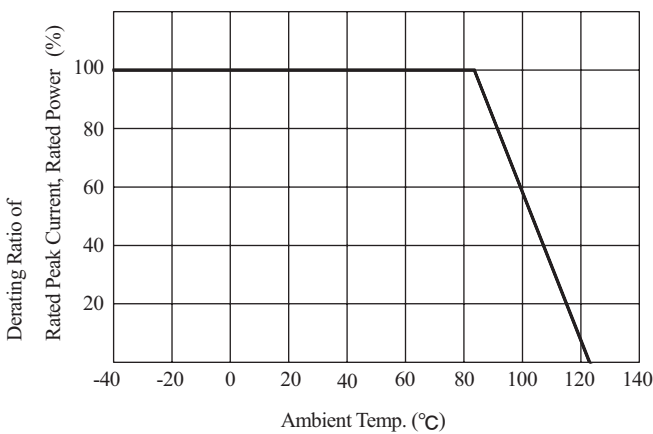


Surge Derating

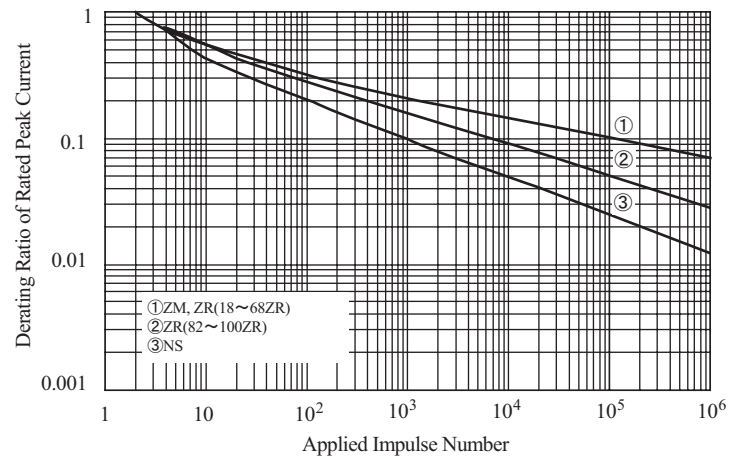
■ Impulse Width VS Peak Current



■ Rated Peak Current, Rated Power VS Ambient Temp.



■ Applied Impulse Number VS Derating Ratio of Rated Peak Current



■ Application Example of Figure

Sample; 220NS-10D

Impulse Width; 100 μ s This Time $I_p=500A$

Impulse Numbers; 10³ Times.

Derating Ratio on This Time=0.10

Repeatable peak current is found as follow

$$I=500 \times 0.10=50.0A$$



Environmental and Reliability Data

(1) Environmental

Test Item	Test Condition	Results
Low Temperature Storage	-40±3°C 1000hrs	ΔVc ≤ 5% No Defect
High Temperature Storage	125±2°C 1000hrs	ΔVc ≤ 5% No Defect
Moisture Resistance	40±2°C, 90~95%RH1000hrs	ΔVc ≤ 5%
Temperature Cycling	5Cycles : Step Temp. Time(min.) 1 -40±3°C 30 2 Room Temp. 2~3min. 3 125±2°C 30 4 Room Temp. 2~3min.	ΔVc ≤ 5% No Defect
Thermal Shock	5Cycles : Step Temp. Time(min.) 1 -25±3°C 30 2 85±2°C 30	ΔVc ≤ 5% No Defect

(2) Mechanical

Test Item	Test Condition	Results								
Solderability	235±5°C 5±0.5sec.	Wetting of Contact Area ≥ 95%								
Resistance to Soldering Heat	260±5°C 10±1sec. (05D Type: 5±1sec.)	ΔVc ≤ 5%								
Terminal Pull Strength	<table border="1"> <thead> <tr> <th>Lead Diameter</th> <th>Weight(Lead Wire Axis)</th> </tr> </thead> <tbody> <tr> <td>φ 0.6, 0.8mm</td> <td>10N</td> </tr> <tr> <td>φ 1.0</td> <td>20N</td> </tr> </tbody> </table>	Lead Diameter	Weight(Lead Wire Axis)	φ 0.6, 0.8mm	10N	φ 1.0	20N	No Defect		
Lead Diameter	Weight(Lead Wire Axis)									
φ 0.6, 0.8mm	10N									
φ 1.0	20N									
Terminal Bending Strength	A bend of Lead Wire shall be repeated 2 times. <table border="1"> <thead> <tr> <th>Lead Diameter</th> <th>Weight</th> </tr> </thead> <tbody> <tr> <td>φ 0.6, 0.8mm</td> <td>5N</td> </tr> <tr> <td>φ 1.0</td> <td>10N</td> </tr> </tbody> </table>	Lead Diameter	Weight	φ 0.6, 0.8mm	5N	φ 1.0	10N	No Defect		
Lead Diameter	Weight									
φ 0.6, 0.8mm	5N									
φ 1.0	10N									
Vibration	Sine 1.5mm PP, 10Hz↔55Hz/min. for 2hrs in each of 3 mutually perpendicular planes, (Total 6hrs)	ΔVc ≤ 5% No Defect								
Dielectric Withstanding Voltage	Body insulation to lead wire, test voltage for 1min.. <table border="1"> <thead> <tr> <th>Allowable voltage</th> <th>Test voltage</th> </tr> </thead> <tbody> <tr> <td>~ 150Vrms</td> <td>1000Vrms</td> </tr> <tr> <td>150~1000Vrms</td> <td>1500Vrms</td> </tr> <tr> <td>1000~1500Vrms</td> <td>2000Vrms</td> </tr> </tbody> </table>	Allowable voltage	Test voltage	~ 150Vrms	1000Vrms	150~1000Vrms	1500Vrms	1000~1500Vrms	2000Vrms	No Defect
Allowable voltage	Test voltage									
~ 150Vrms	1000Vrms									
150~1000Vrms	1500Vrms									
1000~1500Vrms	2000Vrms									

(3) Life Test

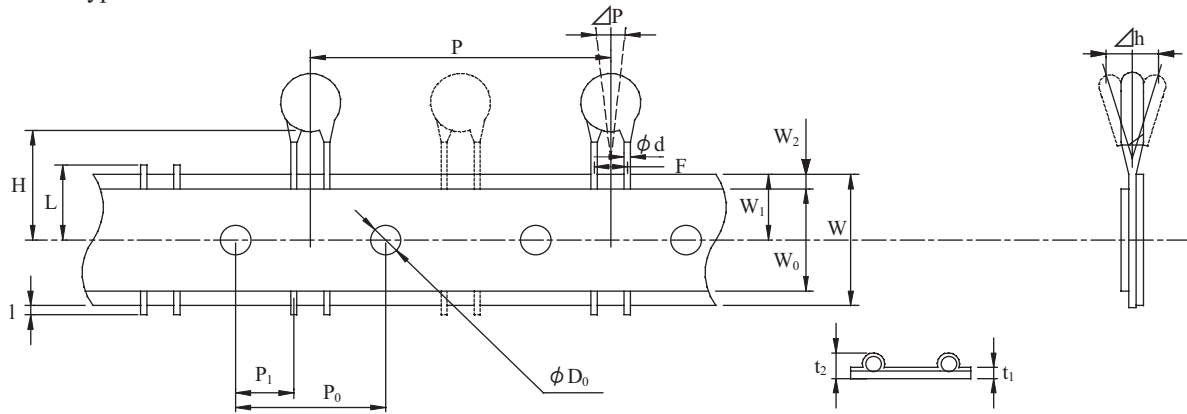
Test Item	Test Condition	Results
High Temperature Operation	85±2°C With Max. Applied voltage 1000hrs	ΔVc ≤ 10%
Humidity Load	40±2°C 90~95%RH With Max. Applied voltage 1000hrs	ΔVc ≤ 10%
Surge Life	8×20μsec. According to rated surge current derating curves. Applied 1000 times in 30sec, intervals.	ΔVc ≤ 10%

ΔVc: Varistor Voltage Max. Change

Taping

The taping standard of MNR varistors is in accordance with the EIAJ Standard.

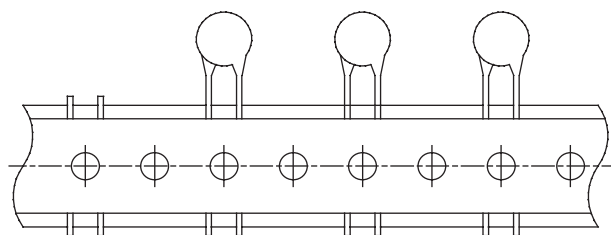
Taping for Disk Type



Type	P ₀	P	F	d	P ₁	ΔP	Δh	W	W ₀	W ₁	W ₂
2	12.7±0.3	12.7±1	5.0±0.8	0.6± ^{0.06} / _{0.05}	3.85±0.7	Max.1.3	Max.2.0	18± ^{1.0} / _{0.5}	12±2	9±0.5	Max.3
4		25.4±1	7.5±0.8	0.8±0.1	8.95±0.7	Max.1.6					
6	15.0±0.3	15.0±1			3.75±0.7						
8		30.0±1.3									

Type	H	I	D ₀	t ₁	t ₂	L	Applicable types 18ZR~500NR
2	20± ^{1.5} / _{1.0}	Max.1.0	4.0±0.2	0.6±0.3	Max.1.5	Max.11.0	05D,07D,(10D)
4					Max.1.7		10D,12D,14D
6	18± ² / ₀						10D,12D
8							14D,20D

The position of type4 product is shown in the following drawing.



*Crimped leads and taped are also available.

Selecting methods and precautions for applications

■ Selecting methods

- (1) Presetting of varistor voltages
Attention must be paid so that operating circuit voltages do not exceed the maximum allowable circuit voltage.
At this time, also consider the regulation of operating circuit voltages.
- (2) Presetting of surge currents
Calculation is carried out for surge currents from assumed surge voltages and surge impedances.
- (3) Presetting of clamping voltages
Reading is carried out for the maximum clamping voltage in the preset surge currents from the voltage-current characteristic curve.
At this time, MNR varistor is selected so that the maximum clamping voltage is smaller than the allowable voltage of protected electronic devices.
- (4) In the case of repeated surges and long wave form surges, MNR varistor is selected so that it satisfies the surge current reduced characteristics.

■ Notice for application

Please refer and apply following notice to prevent the troubles and degradation of varistors.

The troubles of varistor may cause the fire and / or degradation of your appliances.

- (1) In case the surge and / or excess voltage application, varistor may be broken, heated, smoked, arced, fired and exploded.

To prevent such a situation, fuse or circuit breaker be set in series of varistor or in between the power source side and varistor.

Recommended fuse ratings

Element size(Diameter)	05D	07D	10D	12D	14D	20D
Fuse rated current	1~2A	2~3A	3~5A	3~7A	3~10A	5~15A

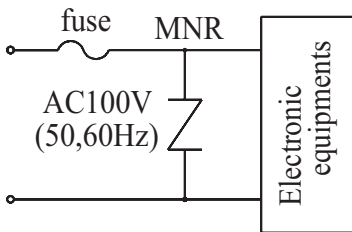
- (2) Don't apply in excess of the limit of energy and surge.
- (3) In case of grounding troubles on 100V single phase 3 line power source, 200V is possibly applied across the line and ground.
If you apply the varistors for the higher voltage like the lightning surge, you are suggested to apply the varistor for 200V power line.
- (4) In case of insulation test and high voltage test, sometimes varistor works to mis-read the test to be failed.
- (5) Varistor has the capacitive impedance to cause a heating and / or troubles in case of high frequency application.
- (6) Such a high temperature ambient like a direct sun exposure or the vicinity of heating element may cause a excess temperature for varistor performance.
- (7) Watery or high humidity area, corrosive, salty or dusty ambient be avoided.
- (8) Storage condition be $-10\sim+40^{\circ}\text{C}$, 75% RH or below, without rapid temperature change to varistor.
- (9) Alcoholic base solvent is suggested for flux cleaning, acetone, thinner or strong solvent be avoided.
- (10) To apply resin coating, please inquire about the selection of resin.
Some resin may affect to the varistor performance, be sure to confirm the varistor performance after resin coating.
- (11) Mechanical force like shock or pressure to damage visually, be avoided.
- (12) Flammable materials should not be positioned in the vicinity of varistor.
- (13) For lead forming, body side of leads be clamped.
- (14) For soldering, conditions be selected so as the solder of varistor and coating resin are not be melted or softened.
- (15) Soldering pad for surface mount varistor be adequately designed to avoid the degradation of performance and terminal strength.
- (16) Don't warp or bend the PCB after the mounting of surface mount varistor.

Applications

■ For surge protection

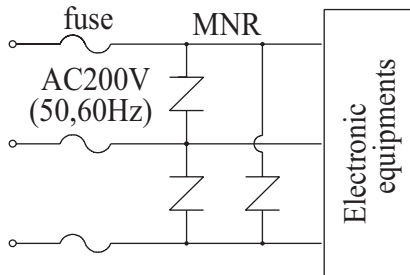
■ Single-phase circuit

■ Line-Line

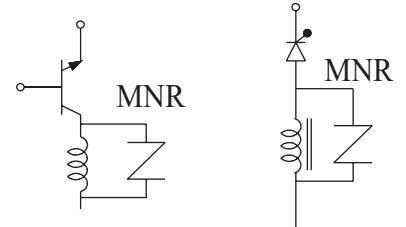


■ Three-phase circuit

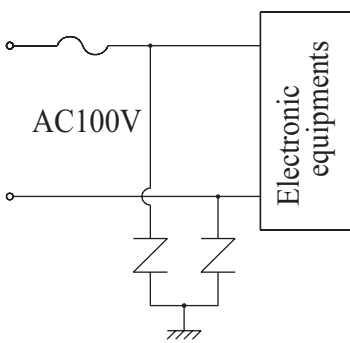
■ Line-Line



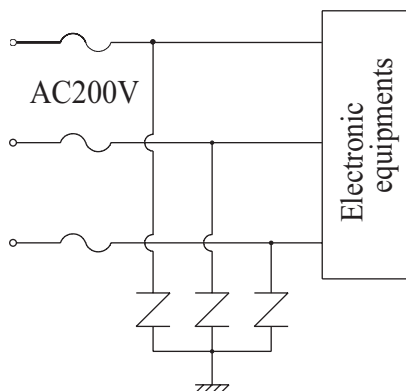
■ Protection of Semiconductor



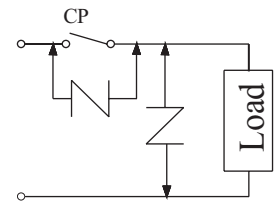
■ Line-Ground



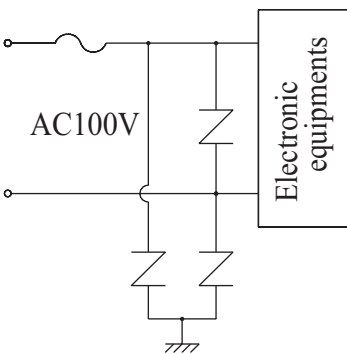
■ Line-Ground



■ Protection of contact



■ Line-Line and Line-Ground



■ Line-Line and Line-Ground

