

## Precautions for the Varistors

The reliability of the metal oxide varistors are dependant on the ways of their use and could lead to accidents so please be aware.

### Selection and Protection

- It is recommended that the steady-state circuit voltage which remains at 80% or less of the max. allowable circuit voltage. Exceeding the specification will cause deterioration, short-circuits, etc.
- Select proper parts according to the surge energy and the number of the impressions if the varistors are used to absorb the surge for an inductive loading.
- The rated surge endurance is defined in terms of shock wave current waveform (starting up 8 $\mu$ s/wave-tail length 20 $\mu$ s).
- Insert fuses or thermal fuses in series with varistors if the size of the surge power cannot be estimated, in order to prevent varistors from bursting due to an excessive surge over the rating.
- Give consideration on the layout to combustible materials and to take measurements on the circuits (fuses or thermal fuses) since there may be smoking or flaming if the varistor short-circuits due to an excessive surge over the rating.
- Upon mold sealing, fully confirm the reliability and use the resin which has small contractile stress at stiffening since the protection coat may peel off, cracks may occur at the solder connection, and the characteristics of the varistor may change.
- Perform the withstand voltage test and the insulation resistance test with the varistors removed from the circuit since the test voltage may exceed the varistor voltage.

### Failure Mode

- Varistor voltage will drop and the leakage current will increase when excessive surge which is above the rating is applied to the varistor. Temperature will increase due to Joule heating as the leakage current increases, which will cause thermal runaway and short circuit.
- When commercial power of 200Vr.m.s. is connected to varistors for 100Vr.m.s. (270V/1mA), the varistor may burst and become open.

### Chip Varistors for Surface Mount

- Please perform damp-proofing on the surface of the varistors prior to the use when installing in a high-humidity and high-temperature environment.

### Reference

- For basic precautions, please refer to the technical report of JEITA EMAJ-R039 Safety application guide for varistors.

## Terms and Definitions

### Maximum Allowable Circuit Voltage

- The maximum commercial frequency sinusoidal voltage effective value or maximum D.C. voltage or A.C. voltage (rms) that can be continuously applied.

### Maximum Energy (E)

- The maximum energy within the varistor voltage change rate of  $\pm 10\%$  when a single impulse of 2ms is applied.

### Maximum Peak Current (I<sub>P</sub>)

- The maximum peak current within the varistor voltage change rate of  $\pm 10\%$ , when a single standard impulse of 8/20 $\mu$ s is applied in two times with an interval of 5 min. (NV73DL is once.)

### Operating Temperature (T<sub>opt</sub>)

- The allowable ambient temperature range while the device is operating.

### Storage Temperature (T<sub>stg</sub>)

- The temperature range in which the elements do not deteriorate.

### Varistor Voltage (V<sub>c</sub>)

- The terminal voltages on both ends of the varistor when the specified current is applied.

### Clamping Voltage (V<sub>P</sub>)

- The peak value of the voltage between two terminals of the varistor when the specified standard waveform impulse current (8/20 $\mu$ s) is applied.

### Recommended value of varistor voltage for the power supply voltage

Voltage of Power Line	Varistor Voltage
3.3V d.c.	8.2V
5V d.c.	8.2V, 12V
12V d.c.	24V, 27V
24V d.c.	47V, 56V
48V d.c.	82V, 100V, 120V