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 8μs/wave-tail length 20μs). The waveform in a practical use may be different from the test conditions, in which case, select the proper parts from the Voltage-Current Curves in the varistor catalog.
- 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

- The varistors will deteriorate and have a possibility of short-circuiting if they are exposed to an excessive surge over the specification.

  A short-circuit occurs when the load factor rises against the circuit voltage due to the deterioration of a varistor voltage. Then the Joule heat is generated by the leakage current and a thermal runaway occurs. The varistors may burst and become open if a commercial power supply of 200V r.m.s. is connected to a varistor for 100V r.m.s. (270V/1mA).

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

Terms and Definitions

Maximum Allowable Circuit Voltage
- The maximum commercial frequency sinusoidal voltage effective value or maximum DC voltage which can be applied continuously.

Maximum Energy (E)
- The maximum energy within the varistor voltage change rate of ±10% when a single impulse of 2ms is applied. (NV73 2E, 2J, 2L are applied 100 times.)

Maximum Peak Current (I_P)
- The maximum peak current within the varistor voltage change rate of ±10%, when a single standard impulse of 8/20μs is applied in two times with an interval of 5 min. (NV73 2E, 2J, 2L are 100 times.)

Operating Temperature (T_{opt})
- The allowable ambient temperature range while the device is operating.

Storage Temperature (T_{stg})
- The temperature range in which the elements do not deteriorate.

Varistor Voltage (V_C)
- The terminal voltages on both ends of the varistor when the specified current is applied.

Clamping Voltage (V_P)
- The peak value of the voltage between two terminals of the varistor when the specified standard waveform impulse current (8/20μs) 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
100V a.c. Line-to-Line	220V, 240V, 270V
100V a.c. Line-to-Earth	470V
200V a.c. Line-to-Line, Line-to-Earth	430V, 470V