

**Ceramic Resonators, Chip Type.
(3 Array Type)****Type S/B/SS/SM/BM/JM****Ceramic Resonators, Chip Type.
(2 Array Type)****Type P/D/PS/PM/DM/LM****Handling Precautions****■ Design Engineering Notes****1 Fail-Safe Design for Equipment**

When using The Ceramic Resonators, it is recommended that you build a protective failsafe circuit into your design to prevent equipment damage in the event that the resonator malfunctions or fails.

2 Operating Temperature Ranges

The Ceramic Resonators should not be operated beyond the "Operating Temperature Range" specified in the catalog.

3 Changes/Drifts in Oscillating Frequency

Oscillating frequency may drift depending upon the controlling IC and/or external capacitors C₁* and C₂* used in the circuit design.

Note: *Refer to "Standard Test Circuit Diagram" in the catalog or the individual specification.

4 Abnormal Oscillation

The Ceramic Resonators are always accompanied by spurious resonances. Spurious oscillations or stoppage of oscillation may occur depending on the circuit design (IC used, frequency characteristics of the IC, supply voltage etc.) and/or environmental conditions. These factors should be taken into consideration when designing the circuit.

5 Stray Capacitance

Stray capacitances and insulation resistances on printed circuit boards may cause abnormal oscillation or stoppage of oscillation. These factors should be taken into consideration when designing the circuit.

6 Matching Capacitors

When using The Ceramic Resonators of Type PM and LM/P/D/PS/DM, two selected capacitors** should be added for constructing "Colpitts Oscillation Circuit".

Note: ** The capacitance values are specified in the catalog.

■ Prohibited Applications

- 1 "Flow Soldering" should not be used to solder ceramic resonators.
- 2 "Ultrasonic Cleaning" and "Ultrasonic Welding" should not be used on ceramic resonators.
- 3 Avoid washing in water because it could deteriorate the resonator's performance characteristics.
- 4 Avoid resin coating or potting for humidity protection because it could deteriorate the resonator's performance characteristics.

■ Application Notes**1 Overvoltage Spikes & Electrostatic Discharges**

Voltage spikes and electrostatic discharges may cause damage/malfunction or failures of the resonators.

2 Abnormal Mechanical Stresses

Abnormal/excess mechanical stresses such as vibration or shock should be avoided when handling/storing resonators to prevent damage and cracking.

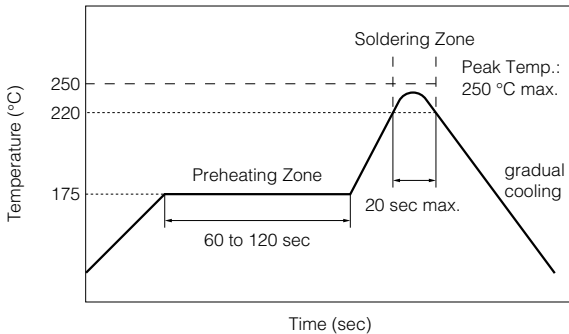
3 Surface Mounting Consideration

In automated mounting of The Ceramic Resonators on printed circuit boards, any bending, expanding and pulling forces or shocks to The Ceramic Resonators should be kept to a minimum to prevent electrical failures and/or mechanical damage to the devices.

4 Soldering (Reflow)

- (1) Follow the soldering instructions given in the ceramic data sheet specifications.
- (2) The Ceramic Resonators are designed for "Reflow Soldering"
- (3) Too high of a soldering temperature and/or too large of a temperature gradient, such as rapid heating or cooling, may cause electrical failure and/or mechanical damage.

Fig. 1 Recommended Soldering Temperature-Time profile (Reflow Soldering)



- Preheating: 175 °C for 60 to 120 seconds
- Soldering Temperature: 220 °C for 20 seconds max.
- Peak Soldering Temperature: 250 °C max.

5 Soldering Flux

Product performance may be affected by flux residue, which may result in deterioration or failure of the ceramic resonator.

6 Post Soldering Cleaning

Liquid cleaning is prohibited.

7 Operating and Storage Conditions

The Ceramic Resonators should not be operated and/or stored under the following environmental conditions;

- a) Direct exposure to water or salt water
- b) Direct exposure to sunlight
- c) Under conditions of dew formation
- d) Corrosive atmospheres such as hydrogen sulfide, sulfuric acid, chlorine and ammonia

8 Long Term Storage

The Ceramic Resonators should not be stored under severe conditions of high temperatures and high humidities.

Store them indoors under 40 °C max. and 75 % RH max. Use them within one year and check the solderability before use.