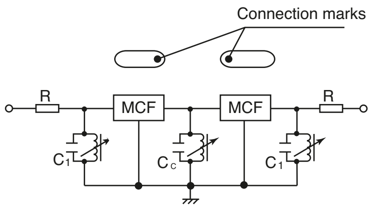
■ Precautions for Use

■ How to Adjust the Transformer in the Connected Section of MC

■ How to Adjust the Transformer in the Connected Section of MCF
The figure below shows a circuit when the input/output section and the connected section are inductive in the same way as in an overtone MCF.
Figures 5a to 5c show (in-band) changes in the filter characteristics when the coil inductance of each LC tuned circuit in the circuit diagram was changed. When the inductance of the coils L_1 and L_3 in the input/output section is increased or decreased, the in-band characteristics (ripple, loss, and bandwidth) are affected to some degree. However, when the inductance of the coil L_2 in the connected section is increased or decreased, the in-band characteristics change considerably. Particularly when the inductance is decreased below the specified value, the positive side of the passband width becomes narrower and may sometimes become less than half its normal value. Therefore, in order to obtain the correct inductance value of each coil, check the filter characteristics, using a network analyzer, etc., to adjust the coil.
In addition, concerning the connection marks of two-element pair type products, position the marks so that they face inward as shown in the right figure.



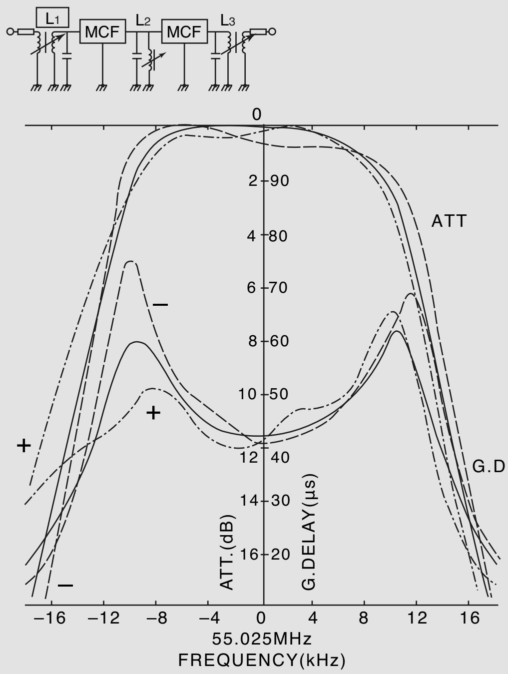


Figure 5a Characteristics change by L_1

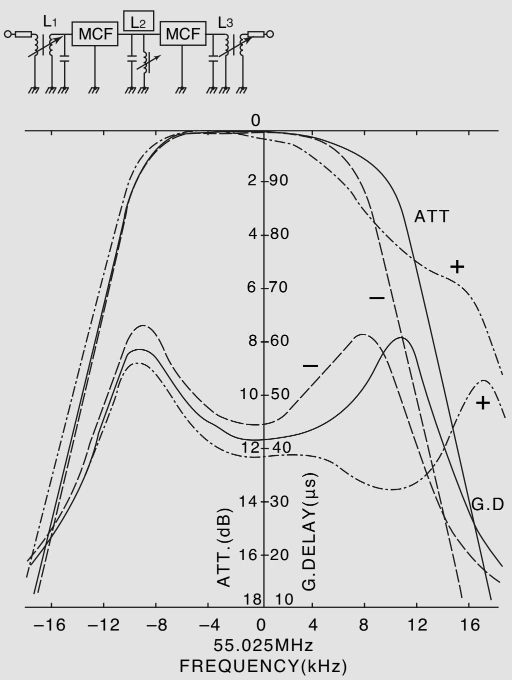


Figure 5b Characteristics change by L_2

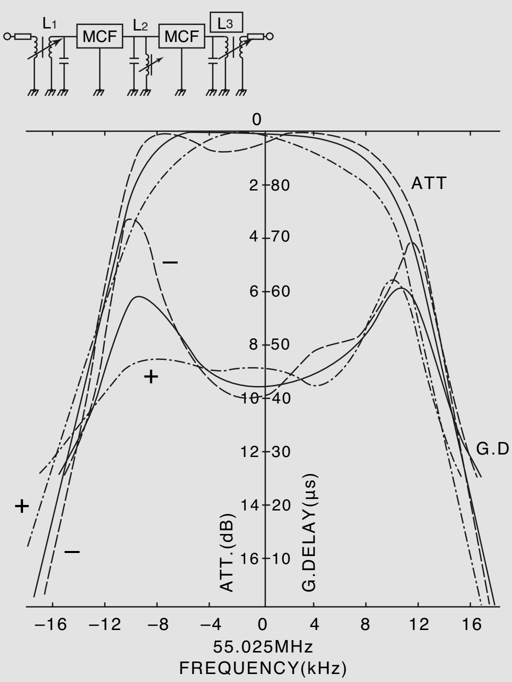


Figure 5c Characteristics change by L_3

■ Necessity of an LC Tuned Circuit for a Capacitive Circuit

Also for a capacitive circuit, a tuned circuit is needed when the capacitance of a circuit used before and behind an MCF and the stray capacitance of the board and the wiring section exceed the capacitance value (specified by terminating impedance).

Precautions for Use

Terminating Impedance

Terminating impedance refers to source impedance or load impedance viewed from the filter side, and it is generally specified separately as resistance and parallel capacitance. When this terminating impedance is different from the specified value, characteristics in the passband in particular are seriously disordered with the insertion loss, ripple, and bandwidth changed, thereby causing the original characteristics to be unavailable. Therefore, measure the impedance on the circuit side, using an impedance analyzer, etc., to meet the termination conditions. Figures 6a and 6b (page 209) show the characteristics of the passband when the terminating impedance with N being 2 (two poles) was changed by a crystal filter of which the nominal frequency and the passband width are 10.7 MHz and ±7.5 kHz, respectively. Particularly when the resistance value changes, note that the passband deviates considerably from the specified band.

Maximum Level

The input level must be the same as or less than the specified value.
When a value more than the specified value is input, the characteristics of the crystal resonator deteriorate, and the original characteristics of the filter cannot be obtained.
The input level must be 0.1 mW (–10 dBm or less).

Separation between Input and Output

In order to prevent electrostatic and electromagnetic coupling, make sure to use a shield between input and output.
When this type of coupling exists between input and output, input signals directly enter the output side in the area where attenuation is large, thereby causing the guaranteed attenuation to decrease, and, therefore, the original characteristics of the crystal filter cannot be obtained. As an example of this, Figure 7 (page 209) shows the characteristics of a crystal filter of which the nominal frequency, passband width, and N are 10.7 MHz, ±7.5 kHz, and six (six poles), respectively, when electrostatic coupling exists between the input and the output. As you can understand from Figure 7, even extremely small coupling can cause the guaranteed attenuation to decrease considerably.

Filter Grounding

A crystal filter can be grounded with mounting screws or ground terminals. Use these to ground the filter.
When this filter is directly soldered to the case, the parts inside may be damaged. Therefore, take precautions to avoid this.
In addition, make sure to ground the entire bottom surface of the filter case so that there is no potential difference from the ground potential on the circuit side.
When a double-sided printed board is used, connect the filter through holes so that the potential difference between the patterns on both sides is removed. Do not use a solder mask for the pattern on the filter bottom surface.

Direct Superimposed Current

Do not pass a direct current that is the same as or more than the specified value to a balanced filter.
When a current exceeding the specified value is used, the transformer winding inside generates heat, thereby causing failures, due to insufficient insulation and disconnection.

Mechanical Shock

Never give any strong shocks to the filter.
When carrying the filter or mounting it on another device, be careful not to cause any shocks, for example, by dropping it or hitting it with a hard object.
If a strong shock has been given to the filter, make sure to check its characteristics before using it.

Custody

Keeping the filter in a high-temperature and high-humidity environment will cause a deterioration in its performance. Keep it at a normal room temperature and at a normal level of humidity.

■ Precautions for Use

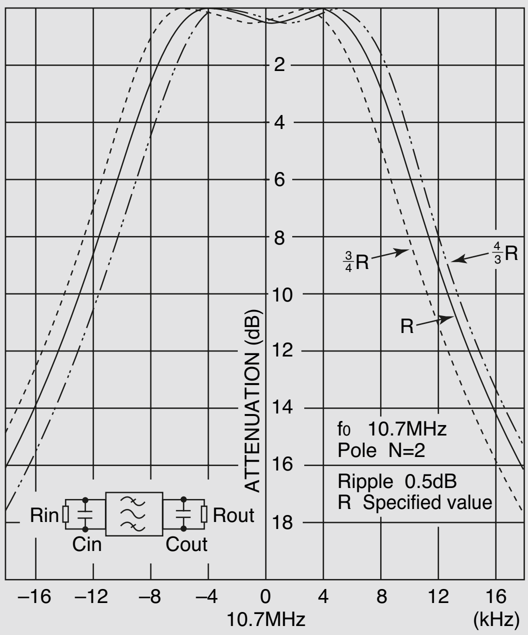


Figure 6a Characteristics change by a resistance value (N=2)

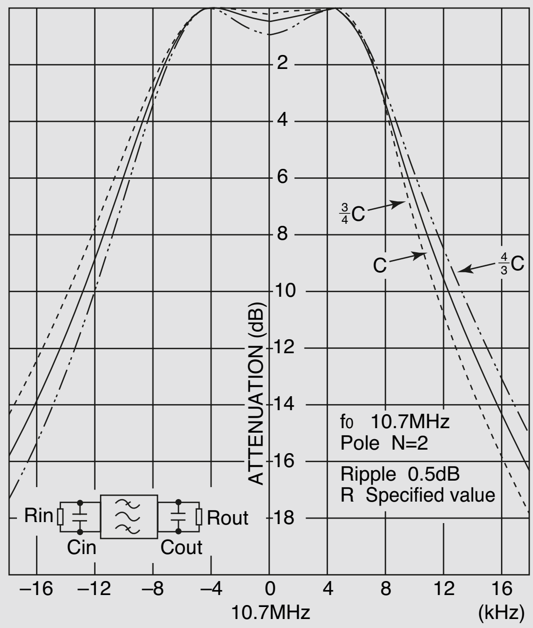


Figure 6b Characteristics change by a capacitance value (N=2)

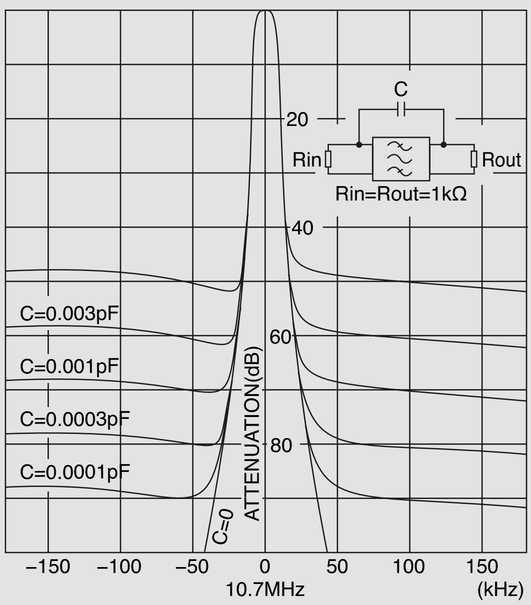


Figure 7 Change in the guaranteed attenuation by coupling between input and output (an example of capacitive coupling)

■ Precautions for Use

■ Mounting Method

1. How to Install a Conventional Crystal Filter

(1) As a rule, do not bend the terminals because they are hermetically sealed. Particularly, never bend terminals with a size of ϕ0.6 mm or more. Even when it is necessary to bend terminals with a size of ϕ0.6mm or less, do not bend them directly from the base glass.

(2) When cutting terminals short, mount a crystal filter on the printed board and solder the terminals beforehand. Set the tightening torque of mounting screws to values that are the same as or less than those shown in the table below.

Screw diameter	Tightening torque
M2.6	0.392N • m
M3	0.49N • m

2. Mounting of a Lead-mount MCF

(1) When closely mounting a lead-mount MCF on a printed board, align the distance between the holes of the printed board with that between the terminals of the MCF. Failure to do this may cause the holder-base glass to crack, resulting in a loss of airtightness and a deterioration of the MCF.

(2) When mounting an MCF on a printed board, it is recommended that the MCF be soldered to the printed board as closely as possible in order to prevent lead fatigue caused by mechanical resonance.
(Refer to Figure 8-(a).) However, when the printed board is double-sided, solder flows in through the holes, and this causes a short circuit. Therefore, it is recommended that an insulating plate be attached.
When mounting an MCF vertically, in order to prevent the holder-base glass from cracking, perform bending beforehand so that the lead wire is not bent from the base glass (the broken line in Figure 8-(b)) and then fix the MCF on the printed board with a band, adhesive, etc.
Do not move the crystal resonator as shown in Figure 9 after it has been mounted on the printed board as this will cause the holder-base glass to crack.

3. Mounting of a Surface-mount MCF

(1) Rapid temperature change after a board has been installed
When the material of the mounting board for a surface-mount MCF package with ceramics has an expansion coefficient that is different from that of the ceramic material, the soldered fillet section may crack if subjected to repeated extreme temperature changes over a long time.
Under such conditions, it is recommended that the situation be checked beforehand.

(2) Shock by automatic mounting
When an MCF is adsorbed or chucked in the course of automatic mounting or a shock that exceeds the specified value occurs when mounting on the board, the characteristics will change or deteriorate.

(3) Stress by board bending
After an MCF has been soldered to a printed board, bending the board surface may cause the soldered part to peel off or the MCF package to crack due to mechanical stress.

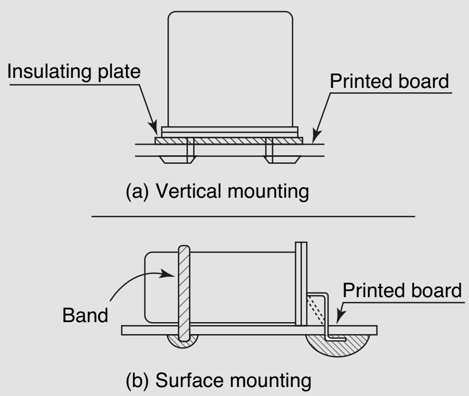


Figure 8 How to mount a lead-mount MCF

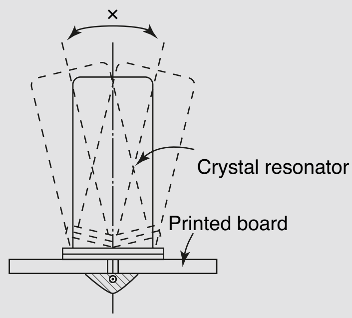


Figure 9 Precautions after a lead-mount MCF has been mounted

■ Precautions for Use

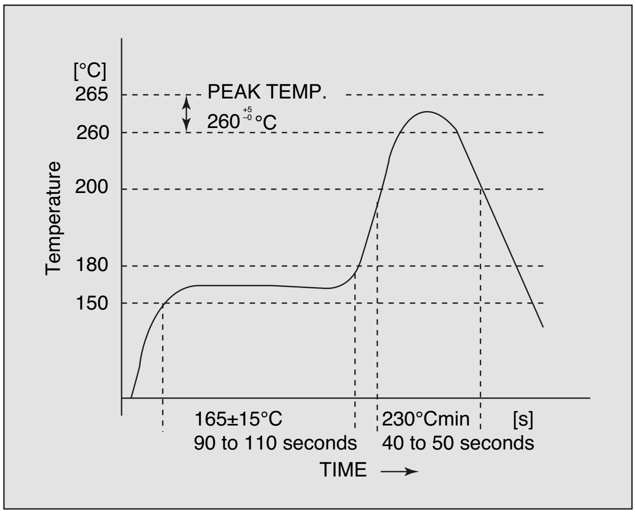
4. Soldering and Ultrasonic Cleaning

Soldering temperature conditions for crystal filters are established so that other general electronic parts can be soldered at the same time. However, such conditions may be limited according to the different types of products. Check the conditions beforehand. In addition, there is no problem with ultrasonic cleaning of flux, but it may resonate with the oscillation frequency of the ultrasonic cleaner, thereby causing deterioration of characteristics. Check beforehand that the mounting board is free of any abnormalities. Note that products with a non-enclosed structure cannot be washed.

5. Reflow Soldering

The recommended temperature profile for reflow soldering of a surface-mount MCF is as follows:

●Examples of soldering conditions



■ Others

If your crystal filter is found to be abnormal, return it to NDK in its present condition. Inappropriate handling, such as opening of the filter, may cause further damage making it impossible to repair. It is important to do nothing to the abnormal filter. In addition, when you return the filter, to facilitate a speedy and accurate repair, please include as accurately as possible a description of the abnormality.

■ Precautions

We manufacture our products according to specifications requested by customers. We cannot anticipate conditions of use or deal with circuit margins when they are not shown in the specifications. Please inform us of them beforehand.

●Examples of soldering conditions

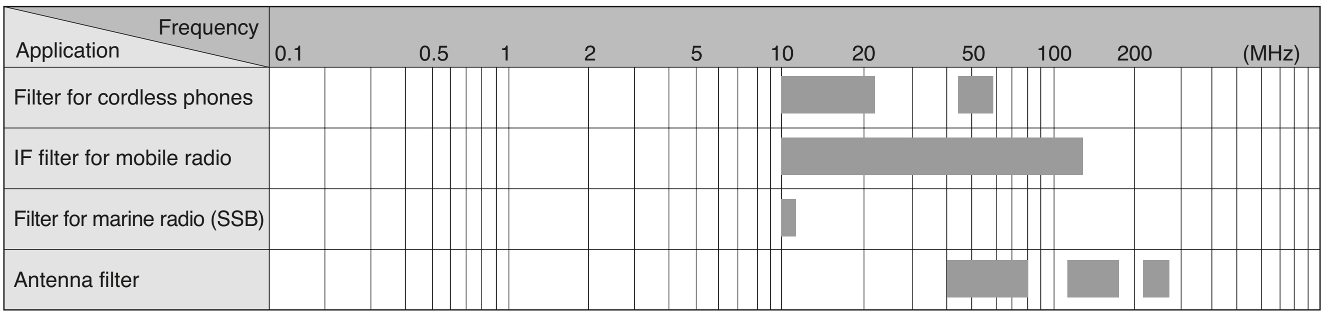
*Preparatory conditions

165±15 °C Time: 90 to 110 seconds

- Application of heat: 230 °C or higher Time: 40 to 50 seconds
- Peak temperature 260^{+5}_{-0} °C

■ List of Frequencies According to Applications

A list of representative frequencies for crystal filters according to applications is shown below.



Contact us for any applications other than the above.