Method of selecting the crystal oscillator for MKY40

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■ Product of interest

MKY40

■ Description

Described here is the rough peripheral part constant and the method of selecting the crystal oscillator when you use the crystal oscillator, not the oscillation device, in MKY40.

■ Method of establishing the peripheral constant, observing the stability of the crystal oscillation

Normally, it is general that, when selecting the oscillator that is used for a mass-produced product, the user provides the LSI of interest to the oscillator maker and then receives from the oscillator maker the value of the peripheral part compatible with that LSI and that oscillator. This is because, since the oscillator operates analog-wise, you need to establish the peripheral part value, based on the oscillator-specific characteristics. However, for other than mass-produced products, the oscillator maker may not present the value of the peripheral part. So, the method of establishing the peripheral constant by observing the stability of crystal oscillation is shown below. In this method, the stability is established, determining the peripheral part value from the load capacitance and equivalent resistance value specific to the selected crystal oscillator. In MKY40, there exists no feedback resistor so that you can set more appropriate feedback resistance value. The oscillator has its specific parameters that are posted by the oscillator maker. In an oscillation circuit that uses the C-MOS inverter adopted by MKY40, as an amplifier, focus on the load capacitance and the equivalent resistance, which are parameters that are posted by the oscillator maker. The equivalent resistance value is an criterion to measure and determine the stability and margin of the oscillation circuit. Evaluate MKY40 and select the circuit constant, seeing Figure 1 below and using the following method.

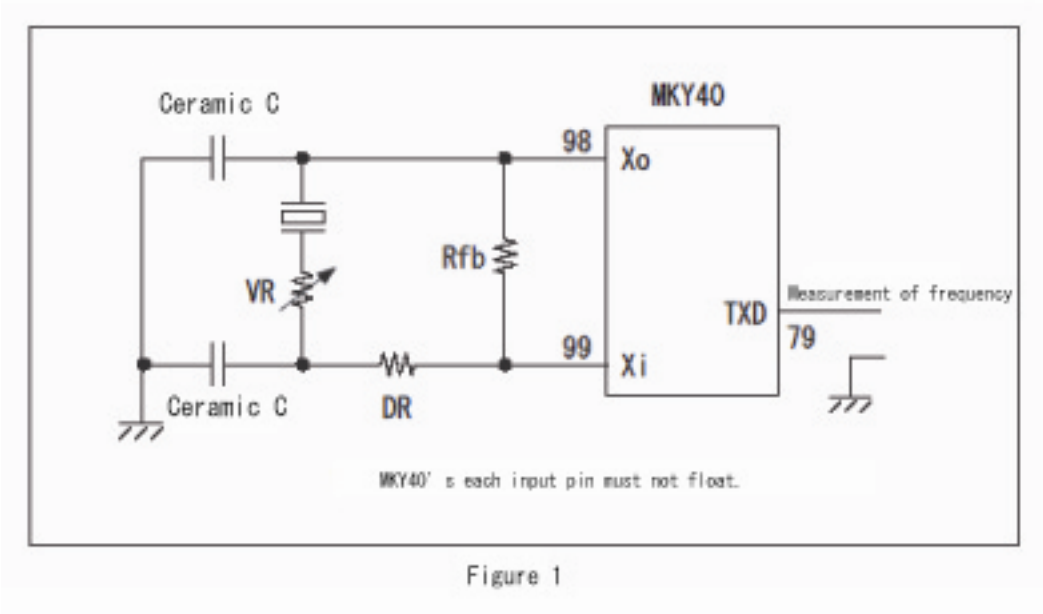

Figure 1

*: The oscillation frequency goes up and down in some degree depending on the C value, DR value and the power supply voltage (; after having established the peripheral part constant, make sure that the frequency is within ±500ppm at the power supply voltage of 4.5V to 5.5V that ensure operation).

1. As shown in Figure 1 above, connect VR to the oscillator in series, and at the TXD pin, check the oscillation and measure the frequency (place each part close to the LSI, and do not route wiring; also it is favorable to use, as VR, a potentiometer with high-frequency characteristics).
2. With VR set to 0Ω, turn ON/OFF the power when the power supply voltage is 4V, 5V and 6V, and select the C value at which the desired frequency oscillates. Change the C value incrementally starting with several pF; the max C value is roughly a little greater than twice the load capacitance value. The load capacitance that is generally posted by the oscillator maker for your reference is the value as viewed from the crystal oscillator (that is, the value that is connected to both pins of the oscillator), and so that value is different from the C value that is connected to the circuit. In the circuit, total of the C value synthesized in series and the capacitance of LSI pins and wiring is the actual load capacitance.
3. If you cannot obtain a favorable oscillation operation by just selecting the above C value, select the DR value also that is in the range from 0 to 300Ω. When oscillation does not start, decrease the DR value starting with about 33Ω; when frequency oscillation becomes abnormal, increase the DR value starting with about 33Ω (see "Role of DR").

4. When you have successfully checked the oscillation at each power supply voltage of 4V, 5V and 6V, then measure the stability and margin. At each power supply voltage of 4V, 5V and 6V, turn ON/OFF the power while incrementing the VR value; and at the point at which the desired frequency has stopped oscillating (with the power set to OFF), measure the VR value.
5. If the minimum VR value measured at each power supply voltage of 4V, 5V and 6V is more than five times the equivalent resistance value (an oscillator-specific parameter), the oscillator and circuit constant that have been selected are stable.

(Note) In this evaluation method, "the minimum VR value measured at normal temperature and 5V power is more than three times the equivalent resistance value" may be the general standard (; the equipment maker has the judgment standard according to the exactness for the equipment).

Also, it is assumed that the allowance for temperature change is also taken into consideration, having a margin more than five times (three times) as much by measuring the VR value at 4 to 6V, which are wider than the ensured power supply voltage width.

■ Role of DR (damping resistor)

When the signal output is strong, signal distortion such as overshoot or undershoot occurs, which may cause unstable oscillation operation. The damping resistor is used to prevent such a signal distortion.

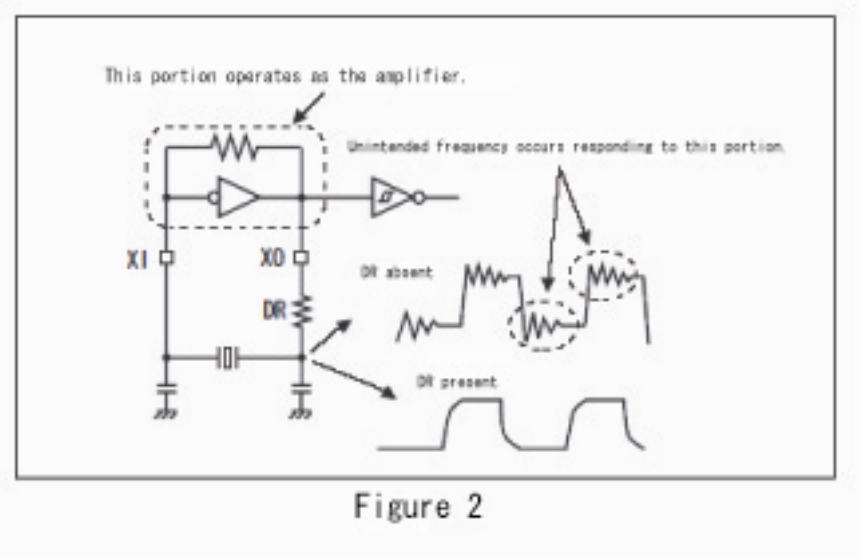

Figure 2

■ Oscillator selection example

Since MKY40's oscillation output is strong, oscillation becomes the fundamental wave of the crystal oscillator if the damping resistor is not used. For 48MHz (three-time

overtone type) crystal oscillator, oscillation becomes 16MHz. Described below and in Figure 3 below is the HC49U type 48MHz (three-time overtone type) crystal oscillator of several companies (such as Kinseki, Toyocom, Showa Crystal) in which we established stable constants when we connected it to cause oscillation.

Whether or not the oscillation frequency is normal (when it is normal, the oscillation frequency accuracy is within ±500ppm) can be determined by checking the output of the following frequencies at the TXD pin in the case of 48MHz oscillation:

When reset is Lo: 1.5MHz is output from the TXD pin.

When reset is Hi and the RXD level is fixed:

For 12Mbps: 1.5MHz is output from the TXD pin.

For 6Mbps: 750kHz is output from the TXD pin.

For 3Mbps: 375kHz is output from the TXD pin.

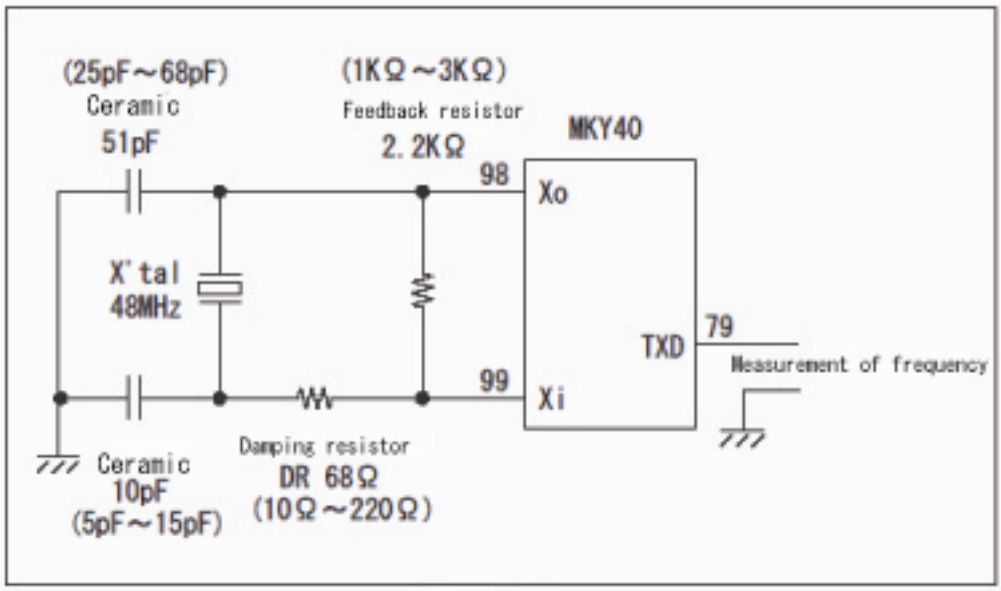

Figure 3

(Notes)

1. The characteristics of the oscillator depend on the type and maker of the oscillator, and so constants stated in Figure 3 above do not provide absolute assurance. When using the maker-specific crystal oscillator for a mass-produced product, please contact the crystal oscillator maker and then determine the peripheral part constant compatible with the characteristic value specific to the crystal oscillation part.
2. In MKY40, you cannot apply the ceramic oscillator because the oscillation frequency accuracy needs to be within ±500ppm.

To avoid selector miss due to individual variability, we recommend that you try more than two or three oscillators or LSIs, using the peripheral constant established by the exemplified method, to make sure that stability was maintained.

STEP TECHNICA CO.,LTD.