Optimal circuit conditions for Murata's crystal units （1612/1210 size / -30 to 85°C) with the RSL10 by On Semiconductor

INNOVATOR IN ELECTRONICS

Issued by
March 6, 2019

Product Engineering Section
Timing Device Division
Murata Mfg. Co., Ltd.

ON Semiconductor®

Checked by
August 26, 2019

This report has been written by Murata, and Murata has 100% responsibility for the evaluation data.
Please consult a Murata sales representative if you have any questions.
The application note has been confirmed by On Semiconductor based on the data sheet and results of Murata's testing. On Semiconductor saw no contradictions with the RSL10 oscillator requirements.
On Semiconductor ASA is not responsible for any information presented on Murata tests or documentation.

Purpose of this application note

For customers trying to embed low power RF functionality with an ultra-small solution by utilizing the RSL10* (released by On Semiconductor), Murata will provide information pertaining to

1. Murata's corresponding crystal units part number(s) and

2. Optimized circuit conditions for the oscillation circuit

for the purpose of saving customers' time and resources in the evaluation of the above.

* RSL10 has the capability to utilize a 48MHz crystal units as the reference clock. The oscillation characteristics in this document were confirmed by tests performed on a RSL10 evaluation board.

* PCB design may influence the oscillation characteristics. An evaluation of the actual PCB is recommended and can be supported by Murata.

Contents

1. Crystal units part number for RSL10

Specifications of Murata's crystal units

Parameter	XRCMD48M000FXQ2CR0	XRCTD48M000NXQ2ER0
Size [mm] (L x W x H)	1.6 x 1.2 x 0.33	1.2 x 1.0 x 0.30
Total Frequency Tolerance (including the following items) • Frequency tolerance [ppm] • Frequency drift over temp. • (-30 to 85°C)	±40	±40
ESR [ohm] [*1]	40 max.	40 max.
Load cap CL [pF] [*2]	9.0	9.0
Drive level [μW] [*3]	100 max.	100 max.

* 1: Equivalent Series Resistance. Resistance of the crystal units.

* 2: Specified capacitance for frequency sorting on the crystal units.

* 3: Maximum power the crystal units can withstand.
  Please refer to the oscillation characteristics data for actual power consumption of the crystal units.

Murata confirmed that the crystal units above can be used with the RSL10.

2. Optimized circuit conditions
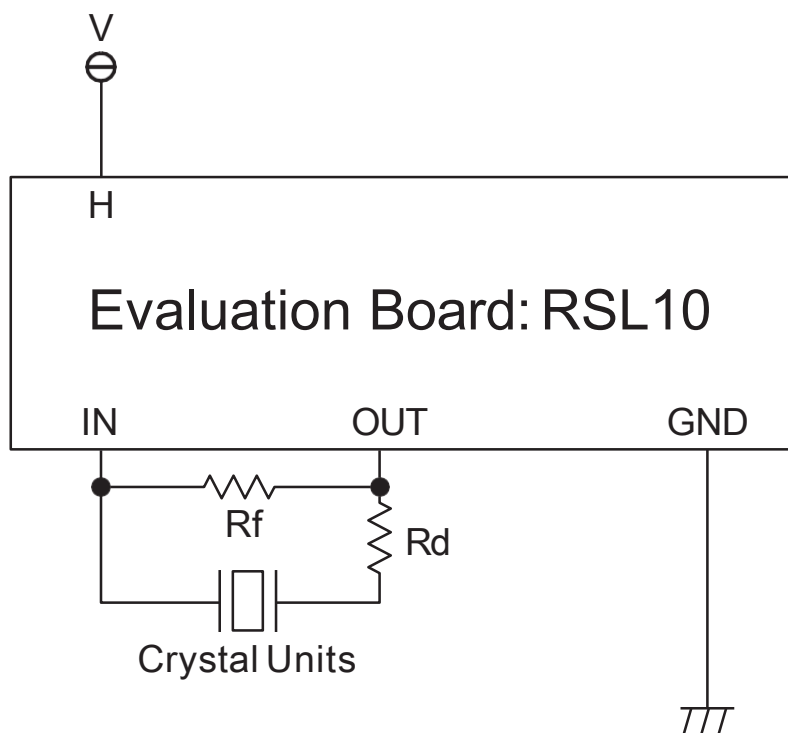
| Symbol	Parameter	XRCMD48M000FXQ2CR0	XRCTD48M000NXQ2ER0
Rf	Feedback resistor [ohm]	No mount	No mount
Rd	Damping resistor [ohm]	0	0

3. Oscillation characteristics
XRCMD48M000FXQ2CR0

Measured oscillation characteristics

Parameter	Measured results
Oscillation margin	5.5 [times]
Drive level	9 [μW]
Actual load capacitance	9.1 [pF]
Nominal frequency shift (from 48MHz)	-1 [ppm]
Frequency drift by temperature	See chart below
Startup time of crystal units	0.87 [ms]

Measured frequency drift by temperature
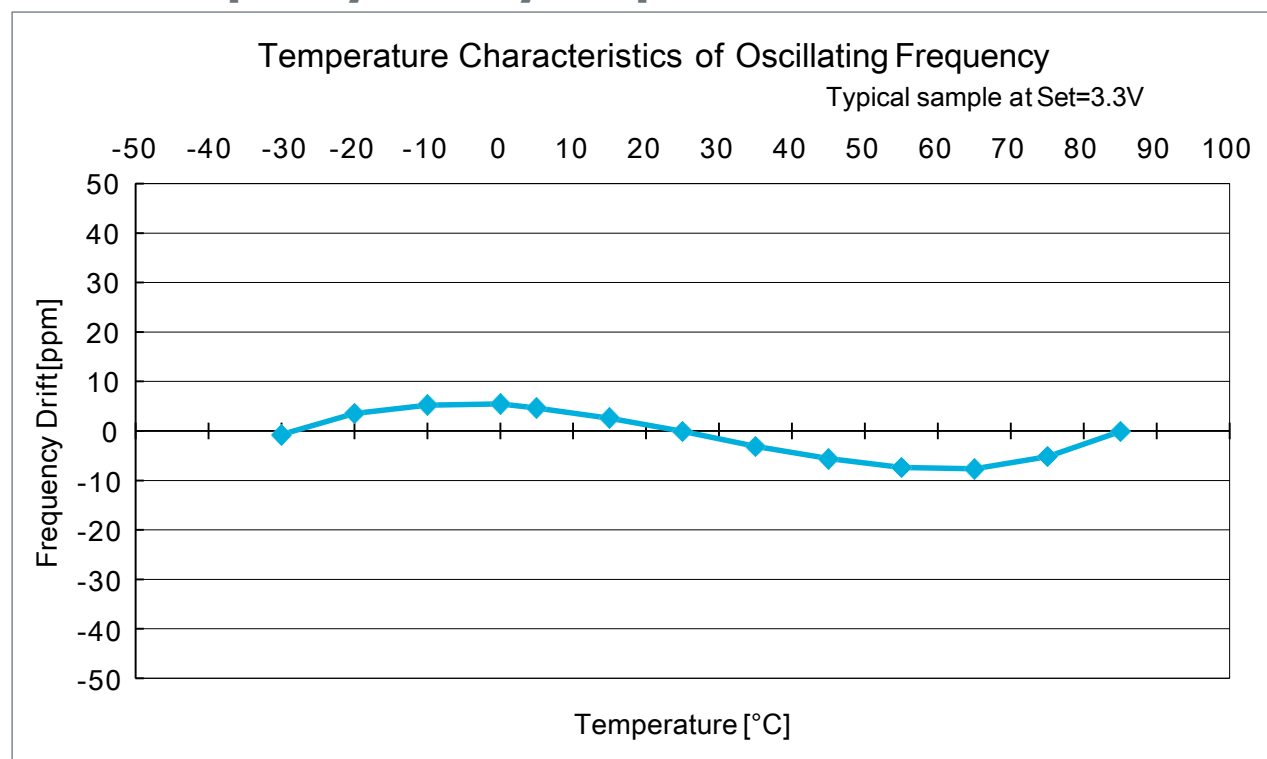
Temperature Characteristics of Oscillating Frequency
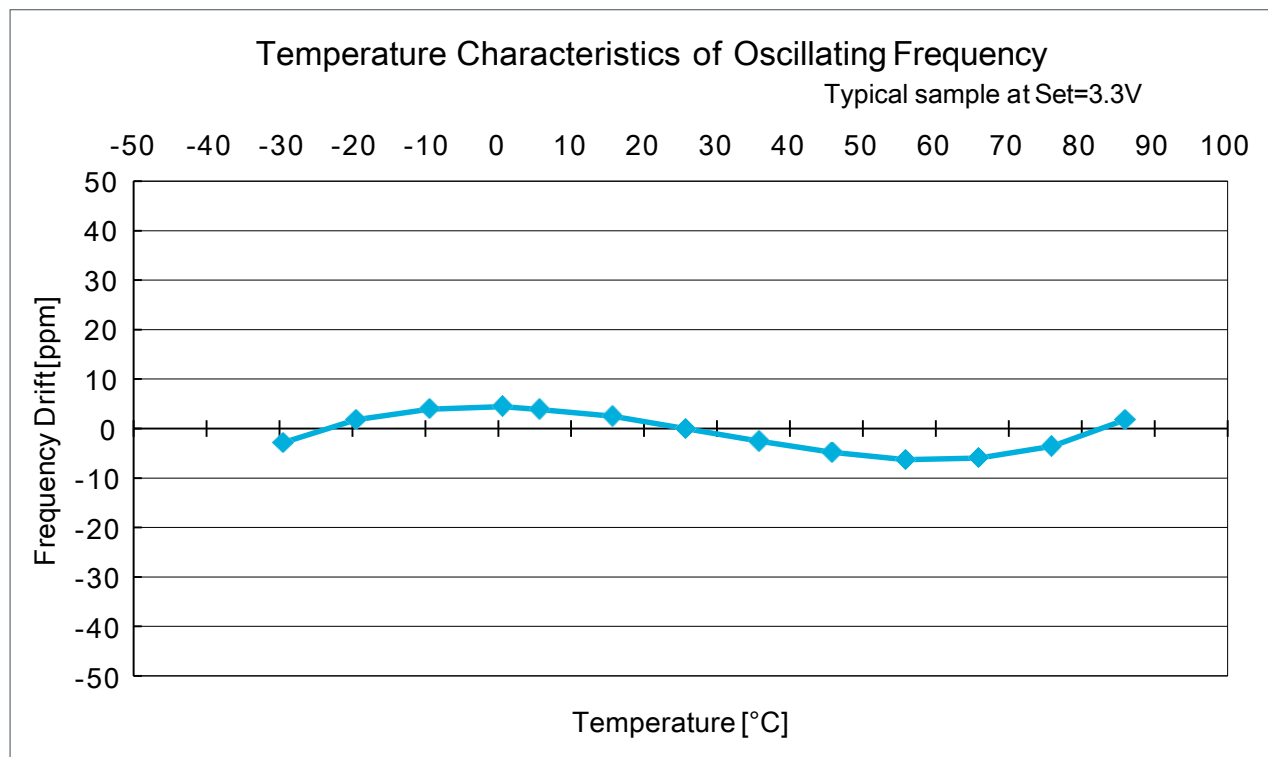Typical sample at Set=3.3V

All above results have been measured using a RSL10 evaluation board, provided by On Semiconductor, with optimized circuit conditions for the XRCMD48M000FXQ2CR0. Please refer to TCD-18-0157, issued by Murata, for more details.

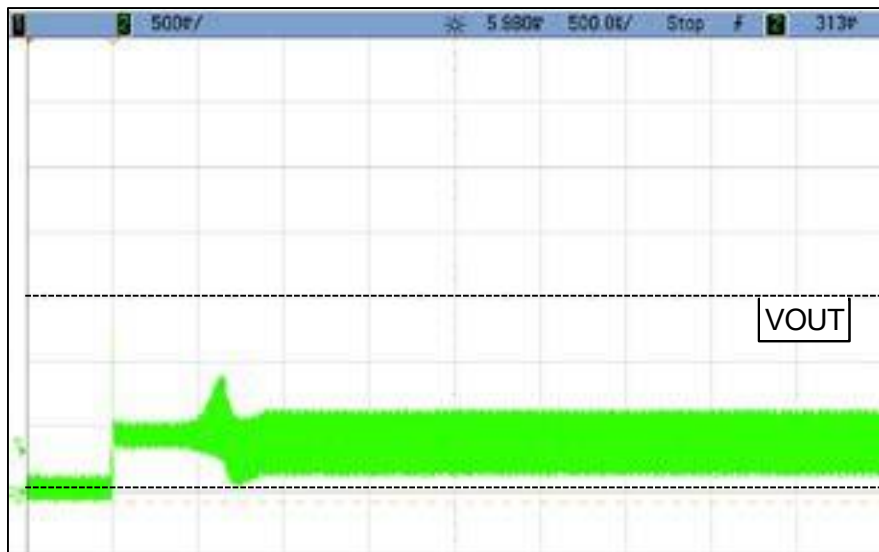# XRCTD48M000NXQ2ER0

Measured oscillation characteristics

Parameter	Measured results
Oscillation margin	5.6 [times]
Drive level	12 [μW]
Actual load capacitance	9.1 [pF]
Nominal frequency shift (from 48MHz)	-1 [ppm]
Frequency drift by temperature	See chart below
Startup time of crystal units	0.98 [ms]

Measured frequency drift by temperature

Temperature Characteristics of Oscillating Frequency
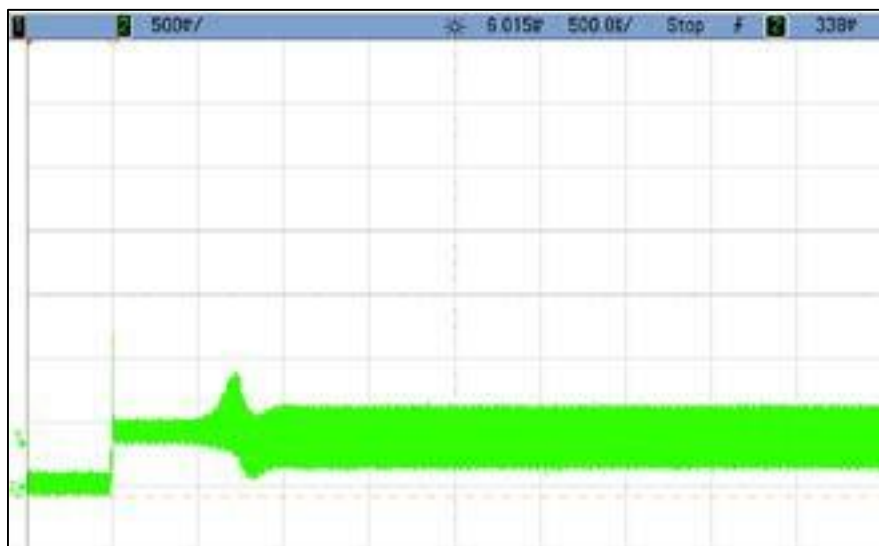
Typical sample at Set=3.3V

All above results have been measured using a RSL10 evaluation board, provided by On Semiconductor, with optimized circuit conditions for the XRCTD48M000NXQ2ER0. Please refer to TCD-18-0158, issued by Murata, for more details.

4. Startup time of crystal units

XRCMD48M000FXQ2CR0

Typical sample at Set=3.3V, +25°C
[VOUT] Vertical: 0.5V/div.,
Horizontal: 500us/div.
Broken line: GND

XRCTD48M000NXQ2ER0

Typical sample at Set=3.3V, +25°C
[VOUT] Vertical: 0.5V/div.,
Horizontal: 500us/div.
Broken line: GND

All above results have been measured using a RSL10 evaluation board, provided by On Semiconductor, with optimized circuit conditions for the XRCMD48M000FXQ2CR0 and XRCTD48M000NXQ2ER0. Please refer to TCD-18-0157 and TCD-18-0158, issued by Murata, for more details.