

Optimal circuit conditions for Murata's MEMS resonator (0906size / -30 to 85°C) with the RSL10 by On Semiconductor



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Product Engineering Section
Timing Device Division
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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 32.768KHz MEMS resonator part number
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 32kHz MEMS resonator 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.

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1. MEMS resonator part number for RSL10 *WMRAG32K76CS1C00R0*

Specifications of Murata's MEMS resonator

| Parameter | Specifications |
|--|--------------------|
| Size [mm] (L x W x H) | 0.95 x 0.60 x 0.30 |
| Frequency tolerance [ppm] | ±20 |
| Frequency drift over temp. [ppm] (-30 to 85°C) | -150 to +10 |
| ESR [kohm] (*1) | 75 max. |
| Load cap CL [pF] (*2) | 8.0 |
| Drive level [μW] (*3) | 0.2 max. |

* 1: Equivalent Series Resistance. Resistance of the MEMS resonator.

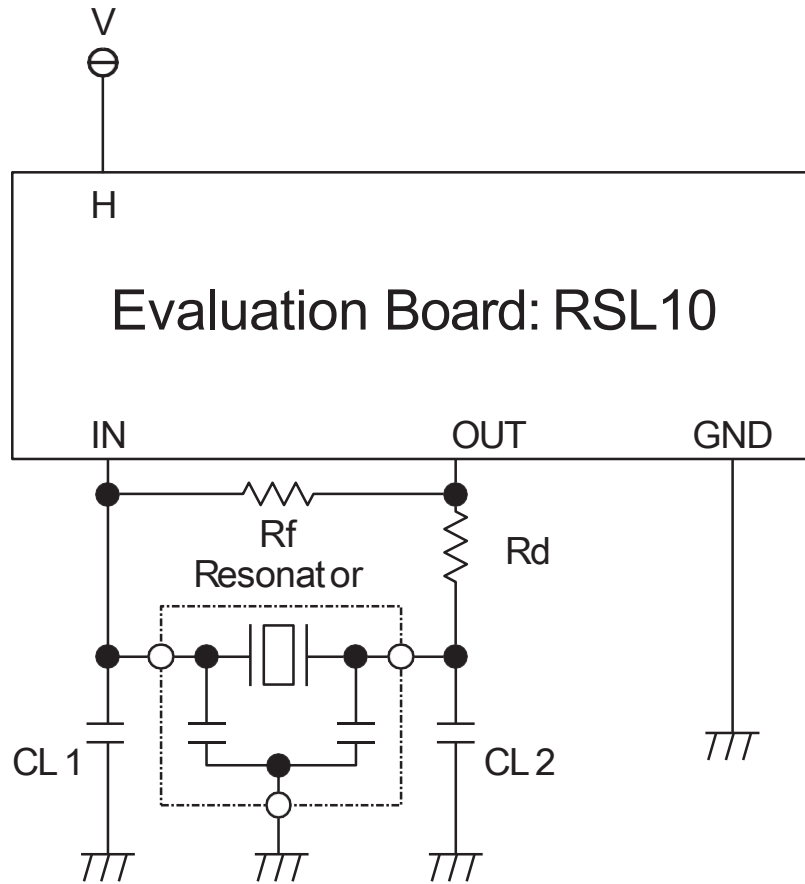
* 2: Specified capacitance for frequency sorting on the MEMS resonator.

* 3: Maximum power the MEMS resonator can withstand.

Please refer to the oscillation characteristics data for actual power consumption of the MEMS resonator.

Murata confirmed that the MEMS resonator above can be used with the RSL10.

2. Optimized circuit conditions



CLOAD_TRIM: 0x0A

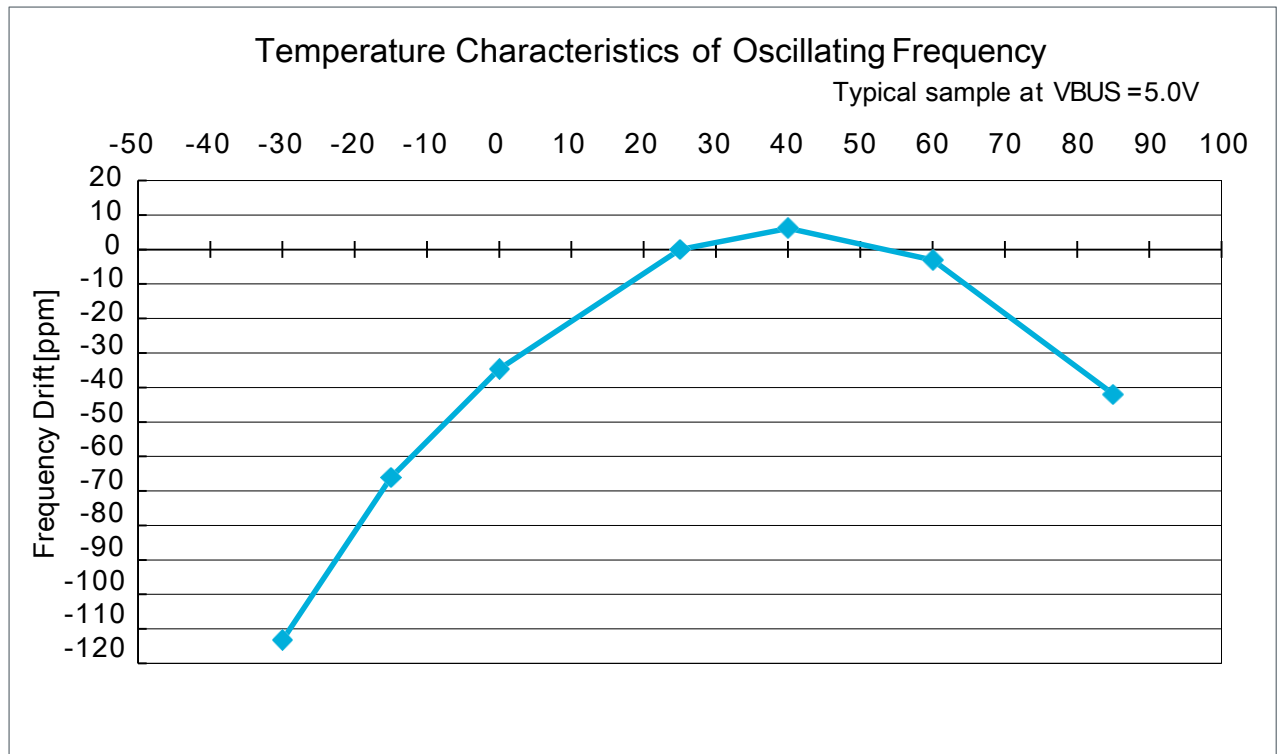
| Symbol | Parameter | Optimized value |
|--------|---------------------------|-----------------|
| R_f | Feedback resistor [ohm] | No mount |
| R_d | Damping resistor [ohm] | 0 |
| $CL1$ | External capacitance [pF] | Open |
| $CL2$ | External capacitance [pF] | Open |

3. Oscillation characteristics

Measured oscillation characteristics

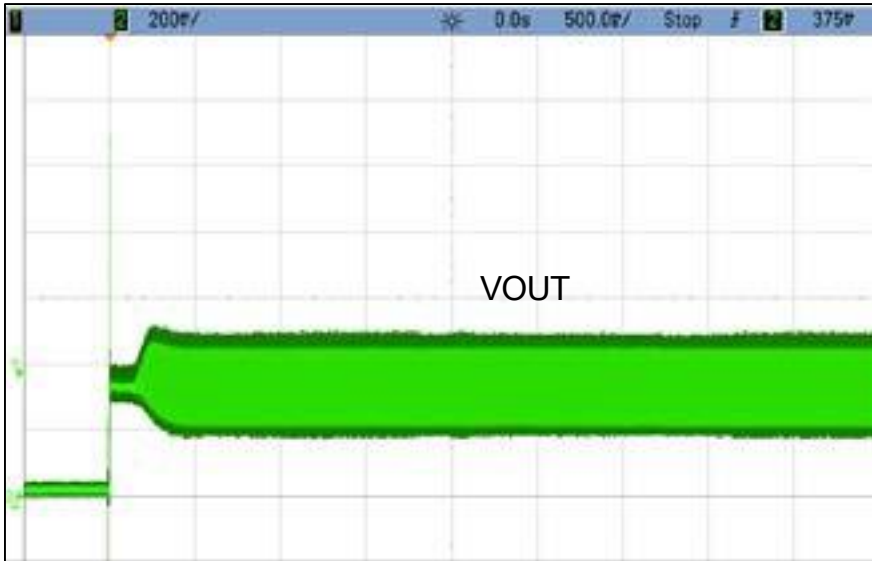
| Parameter | Measured results |
|--|------------------|
| Oscillation margin | 8.4 [times] |
| Drive level | 0.016 [μ W] |
| Actual load capacitance | 8.0 [pF] |
| Nominal frequency shift (from 32.768kHz) | +1 [ppm] |
| Frequency drift by temperature | See chart below |
| Startup time of MEMS resonator | 235.3 [ms] |

Measured frequency drift by temperature



All above results have been measured using a RSL10 evaluation board, provided by On Semiconductor, with optimized circuit conditions for the WMRAG32K76CS1C00R0. Please refer to TCD-18-0165, issued by Murata, for more details.

4. Startup time of MEMS resonator



Typical sample at VBUS=5.0V, +25°C
[VOUT] Vertical: 0.2V/div.,
Horizontal: 500ms/div.
Broken line: GND

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