

# Application Note

## *Suitable circuit conditions for Murata's crystal on nRF51xxx by Nordic*



Issued by

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Checked by

Confidential

## Purpose of this application note

For the customer who is trying to embed low power RF function by nRF51xxx\* (released by Nordic), Murata will provide information of

1. Suitable crystal part number by Murata
2. Optimized circuit conditions for oscillation circuit

to save customer's time and resources for evaluation above.

\* nRF51xxx has been released, and it will be able to use 32MHz xtal as reference clock by next update of IC. Oscillation characteristics in this document is confirmed by existed nRF51xxx, and those results are effective after update of the IC due to oscillation portion in the IC is same.

## Index

1. Spec. of crystal by Murata
2. Optimized circuit conditions
3. Oscillation characteristics

## 1. Crystal part number for nRF51xxx

***XRCGB32M000FAP11R0 (\*1)***

(\*1) Mass production is planned from January 2014.

## Spec. of Murata's crystal for ULP

Parameter	Spec. of Murata's crystal
Size [mm] (L x W x H)	2.0 x 1.6 x 0.7
Frequency tolerance [ppm]	+/-25
Frequency drift over temp [ppm] (-30 to 85deg.C)	+/-20
ESR [ohm] (*2)	70 max
Load cap CL [pF] (*3)	6
Drive level [uW] (*4)	300 max

(\*2): Equivalent Series Resistance. Resistance of the crystal.

(\*3): Specified capacitance for frequency sorting on crystal.

(\*4): Withstand-ability for how high power the crystal can use by.

Refer oscillation characteristics data for actual power consumption on crystal.

***Nordic and Murata confirmed crystal above can be used with nRF51xxx.***

## 1. Crystal part number for nRF51xxx

***XRCGB32M000F2P10R0 (\*1)***

(\*1) Mass production is planned from January 2014.

## Spec. of Murata's crystal for BLE

Parameter	Spec. of Murata's crystal
Size [mm] (L x W x H)	2.0 x 1.6 x 0.7
Frequency tolerance [ppm]	+/-20
Frequency drift over temp [ppm] (-30 to 85deg.C)	+/-20
ESR [ohm] (*2)	70 max
Load cap CL [pF] (*3)	6
Drive level [uW] (*4)	300 max

(\*2): Equivalent Series Resistance. Resistance of the crystal.

(\*3): Specified capacitance for frequency sorting on crystal.

(\*4): Withstand-ability for how high power the crystal can use by.

Refer oscillation characteristics data for actual power consumption on crystal.

***Nordic and Murata confirmed crystal above can be used with nRF51xxx.***

## 2. Optimized circuit conditions

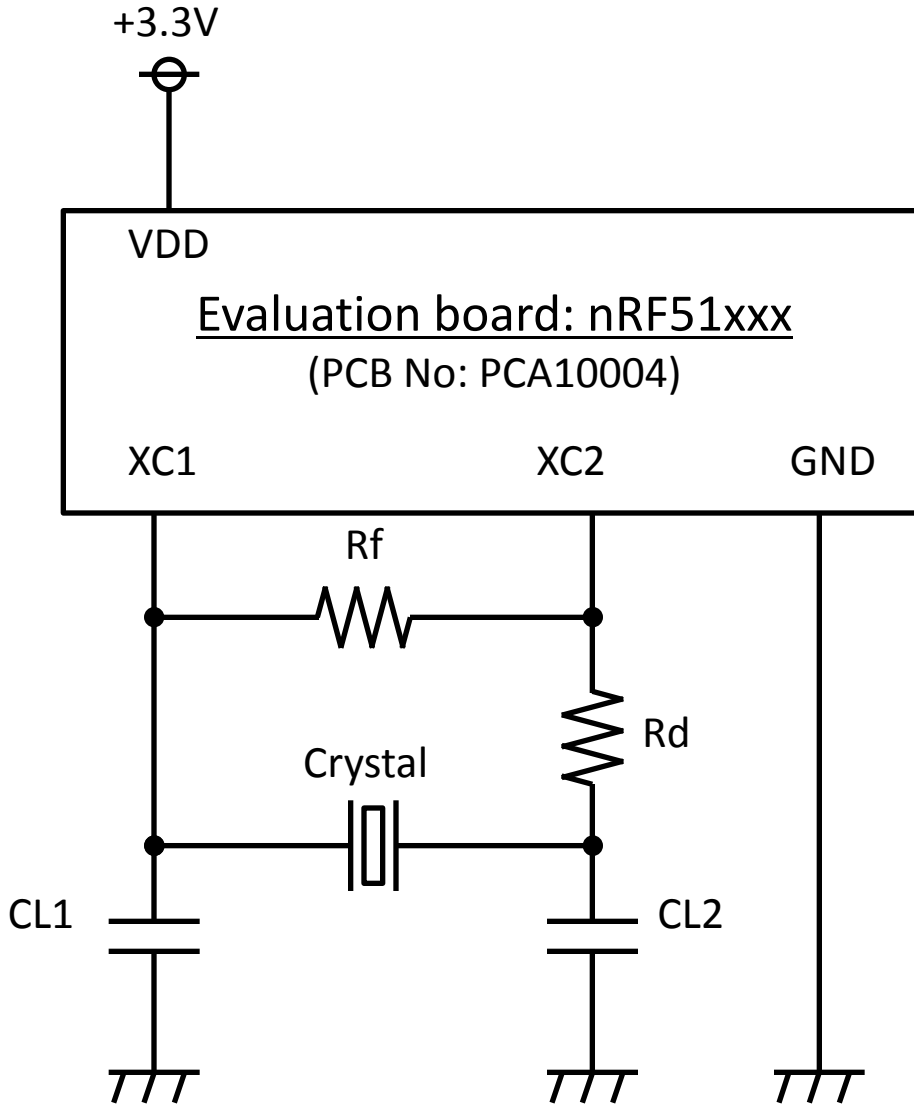


Figure of oscillation circuit

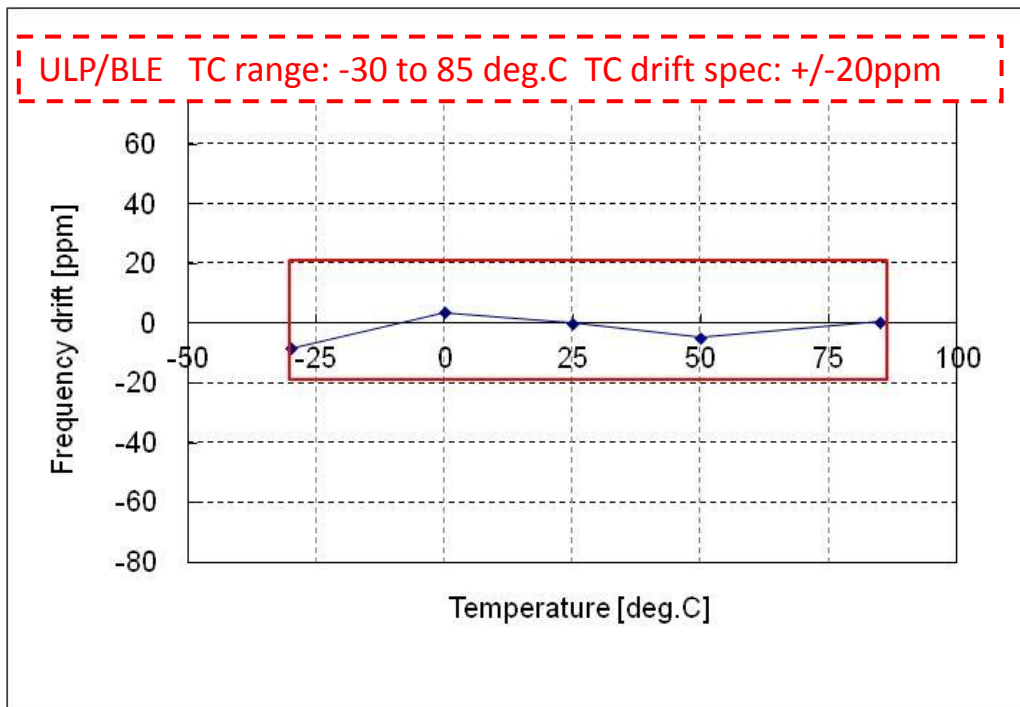
Symbol	Parameter	Optimized value
<b>Rf</b>	<b>Feedback resistor [ohm]</b>	<b>No mount</b>
<b>Rd</b>	<b>Damping resistor [ohm]</b>	<b>0</b>
<b>CL1</b>	<b>External capacitance [pF]</b>	<b>10</b>
<b>CL2</b>	<b>External capacitance [pF]</b>	<b>10</b>

## 3. Oscillation characteristics

### Measured oscillation characteristics

Parameter	Measured results
Oscillation margin	8.6 [times]
Drive level	14 [ $\mu$ W]
Actual load capacitance	6.2 [pF]
Nominal frequency shift (from 32MHz)	-3 [ppm]
Frequency drift by temperature	See chart below

### Measured frequency drift by temperature



All of above results have been measured on evaluation board of nRF51xxx (PCA10004) from Nordic, with optimized circuit conditions for XRCGB32M000F2P00R0. Refer TCD-13-0238, issued by Murata, for more detail.