

No. TCD-13-0077

DATE: 26, Jul., 2013

TEST DATA SHEET OF MURATA CRYSTAL UNIT

TYPE: XRCGB27M120F3M10R0

Applied to IC:PN547-C2

Murata Manufacturing Co.,Ltd.

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1. Summary

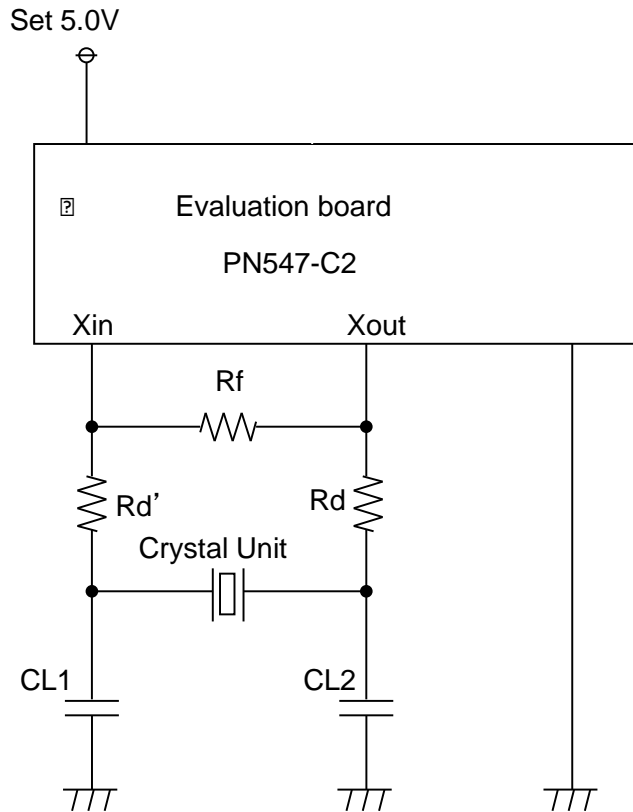
<Recommendable Circuit Conditions>

Item		Conditions	
IC		PN547-C2	
Crystal Unit		XRCGB27M120F3M10R0	
Circuit parameter	Feedback resistance	No mount	
	Damping resistance Rd'	680ohm	
	Damping resistance Rd	0ohm	
	External load capacitance	CL1	12pF
		CL2	12pF

<Results>

Item		Results
Frequency	Center frequency	27.120091MHz
	Center frequency difference	3ppm
Load capacitance on your PCB		9.4 pF
Negative resistance Ratio		8.4 times
Drive level		68 uW

2. Test circuit diagram



Measurement conditions

IC	PN547-C2	
Crystal Unit	XRCGB27M120F3M10R0	
Feedback resistance R_f	No mount	
Damping resistance $R_{d'}$	680ohm	
Damping resistance R_d	0ohm	
External load capacitance	CL1	12pF
	CL2	12pF
Supply voltage	5.0V	

Measurement equipment

Oscilloscope	DSO6052A (Agilent)	
Current probe	CT-6 (Tektronix)	
Passive Probe	P5100A (Tektronix, 40Mohm / 2.5pF)	
DC supply	E3631A (Agilent)	
Frequency counter	53181A (Agilent)	
Spectrum analyzer	E4401B (Agilent)	

3. Frequency

3-1. Center frequency 27.120091 MHz

Center frequency difference 3 ppm from 27.12MHz

This frequency difference causes imbalance of initial frequency tolerance on your PCB, because of load capacitance difference.

3-2. Load capacitance of the circuit 9.4 pF

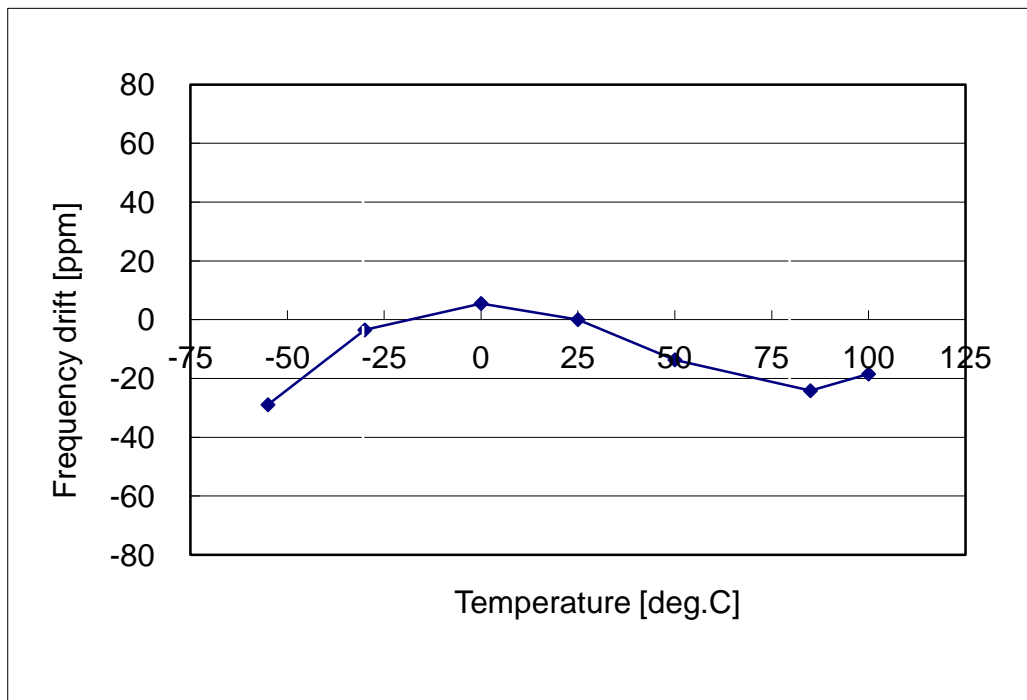
This value shows load capacitance the evaluated circuit has.

Our crystal unit proposed in this report is sorted with 10pF as load capacitance

3-3. Temperature characteristics

TC range : -30 to 85deg.C

TC drift spec : ± 40 ppm



4. Negative resistance

Ratio of negative resistance $|-R|$ to ESR_{spec}

Ratio 8.4 times

Ratio = $|-R| / ESR_{spec}$

$|-R|$ 669.8 ohm

Negative resistance $|-R| = R_{s_max} + R_e$

R_{s_max} : 620 ohm

Maximum series resistance for Crystal Unit to keep oscillation

R_e : 49.8 ohm

Effective resistance of Crystal Unit at actual oscillation frequency

ESR_{spec} 80 ohm

Equivalent series resistance

5. Drive level

Drive power of crystal unit under circuit condition shown in section.2

Drive level 68 uW

Drive level = $I^2 \times \text{ESR}$

I: 1.27 mA (RMS)

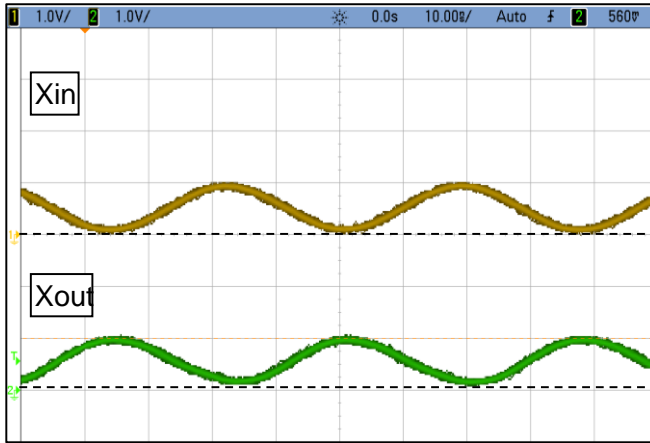
Current through Crystal Unit measured by current probe

ESR: 42.5 ohm

Equivalent series resistance

6. Appendix

6-1. Oscillation waveform



X-axis: 10ns/div.
Y-axis: 1V/div.
Broken line: GND

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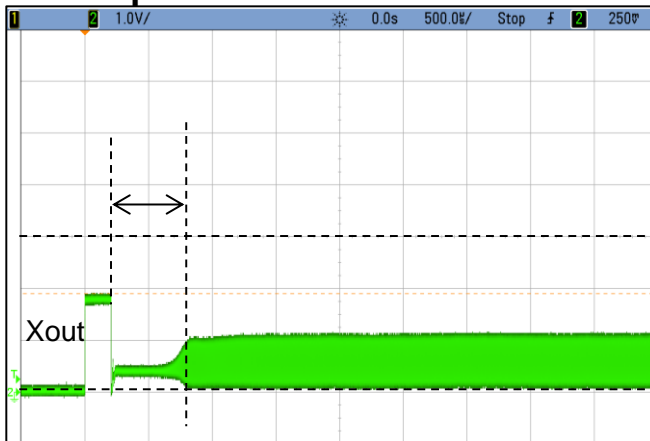
6-2. Oscillation amplitude

Xin [V]			Xout [V]		
Top	Bottom	p-p	Top	Bottom	p-p
1.01	0.06	0.95	1.00	0.12	0.88

6-3. Start up time of oscillation

Time Xout amplitude becomes 90% of its steady amplitude

Start up time 0.57 ms



X-axis: 500us/div.
Y-axis: 1V/div.
Broken line: GND