

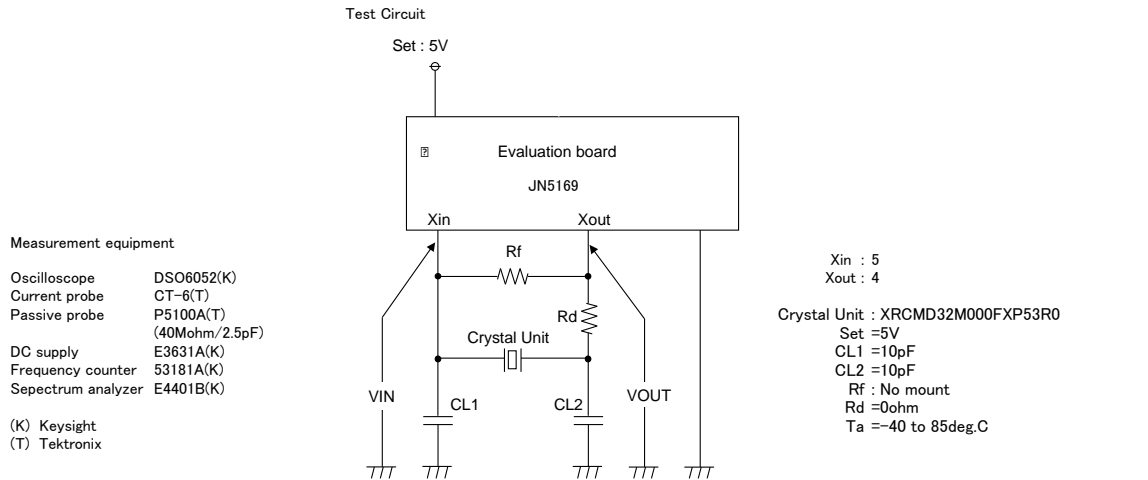
Technical Data of Crystal Unit

MURATA Part No.: XRCMD32M000FXP53R0

Applied to JN5169

Murata's recommendation 推奨回路定数

Item		Condition	
IC name		IC名	
Parts Number of Crystal Unit		品番	
Circuit Parameter	External load capacitance	負荷容量	CL1
		負荷容量	CL2
	Feedback resistance	帰還抵抗	Rf
	Damping resistance	制限抵抗	Rd
Supply Voltage		電源電圧	
Temp. Range		温度範囲	



Characteristics of oscillation circuit on above condition 推奨定数での発振回路特性

Circuit Characteristics 特性	Value 測定値	Remarks 備考
Center Frequency and Difference 発振回路における発振周波数とそのずれ量 (*1) (Typical sample at Set=5V,+25deg.C)	31.999984 [MHz]	Oscillating frequency and its shift against nominal frequency 発振回路における発振周波数と振動子の公称周波数に対するずれ量
	-0.5 [ppm]	
Load Capacitance on your PCB 負荷容量値 (Typical sample at Set=5V,+25deg.C)	6.1 [pF]	This value shows load capacitance the evaluated circuit has 発振回路において振動子の両端に仮想的に接続される容量
Negative Resistance and Oscillation margin 負性抵抗／発振余裕度 (at Set=5V,+25deg.C)	−R  856 [Ω]	The details is explained in page 2 詳細につきましては、次頁をご参照下さい。
	Ratio 10.7 [Times]	
Drive Level ドライブレベル (Typical sample at Set=5V,+25deg.C)	62.8 [uW]	Drive power of crystal under circuit condition 発振回路が動作している状態において振動子で消費される電力
Oscillating Voltage 発振電圧 (Typical sample at Set=5V,+25deg.C)	VINp-p 1.3 [V]	Swing level at input side 発振入力振幅 (VIN_H - VIN_L)
	VOUTp-p 1.1 [V]	Swing level at output side 発振出力振幅 (VOUT_H - VOUT_L)
Oscillation Start up Time 起動時間 (*2) (Typical sample at Set=5V,+25deg.C)	2.44 [ms]	Time to reach 90% of the oscillation level under steady state 定常状態の発振振幅の90%に達するまでの時間

\*1 Frequency difference means the oscillating frequency difference between your PCB and Murata's frequency sorting circuit.  
貴社基板と当社検査回路では、同一振動子を使用した場合でも発振周波数の差が生じます。これを発振周波数相間と呼びます。  
\*2 The measurement results is affected by the rise-up characteristics of supplied voltage on your PCB.  
測定結果は実装基板の電源立ち上がり特性の影響を受けます。

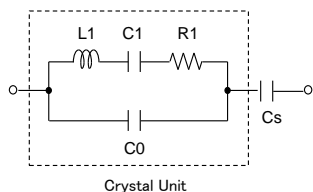
Notes  
The characteristics of the crystal oscillation circuit is affected by the circuit constants and actual mounting conditions and so on. Therefore, it is possible to get the different results from above one due to the production variation of the crystal oscillator circuitry. In your company, please use this results after confirmation of the matching between our crystal unit and oscillator circuit. And furthermore, since the above-mentioned evaluation results evaluate only an oscillating circuit block, please confirm the checking of operations of a set in your company.

注意事項  
発振回路の特性は回路定数や実装状態により影響を受けるため、回路や基板のバラツキ等によっては上記の結果と異なる可能性があります。貴社におかれましても弊社水晶振動子と発振回路とのマッチングをご確認の上、ご使用下さるようお願い致します。また上記評価結果は発振回路ブロックのみを評価したものですので、セットの動作確認は貴社にてご確認下さるようお願い致します。

■ Test Data : Characteristics of recommended conditions

The following values are for the arbitrary sample and only for your reference.

**Electrical equivalent circuit of crystal unit and Cs**



Fr : Resonant frequency  
 R1 Equivalent series resistance ESR  
 C1 Series capacitance  
 C0 Series capacitance  
 L1 Series inductance  
 Cs Load capacitance  
 FL Load resonant frequency

**Electrical circuit constants of a crystal unit**

Cs=6pF

No.	FL [MHz]	S [ppm/pF]	Fr [MHz]	R1 [Ω]	C1 [fF]	Q(10 <sup>4</sup> )	C0 [pF]	r	L1 [mH]
1	32.000011	0.3	12.6	31.997769	31.4	1.05	15.1	0.46	438

**Center frequency 31.999984 MHz**

Center frequency difference -0.5 ppm from 32MHz

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

**Load capacitance of the circuit 6.1 pF**

This value shows load capacitance the evaluated circuit has.

Our crystal proposed in this report is sorted with 6pF as load capacitance

**Negative resistance**

Ratio of negative resistance |-R| to R1spec.

**Ratio 10.7 times**

Ratio = |-R| / R1spec.

$$\frac{|-R|}{R1spec} = \frac{856 \text{ ohm}}{80 \text{ ohm}} = 10.7$$

Negative resistance |-R| = Rs\_max + Re

Rs\_max: 820 ohm  
 Maximum series resistance for Crystal Unit to keep oscillation

Re: 36.4 ohm  
 Effective resistance of Crystal Unit at actual oscillation frequency

$$Effective \text{ resistance } Re = R1 \times (1 + C0/CL)^2$$

R1: 31.4 ohm  
 Equivalent series resistance

C0: 0.46 pF  
 Equivalent parallel capacitance

CL: 6.1 pF  
 Load capacitance on your PCB

R1spec: 80 ohm  
 Equivalent series resistance

**Drive level**

Drive power of crystal under circuit condition shown in page 1

**Drive level 62.8 uW**

Drive level = I<sup>2</sup> x R1

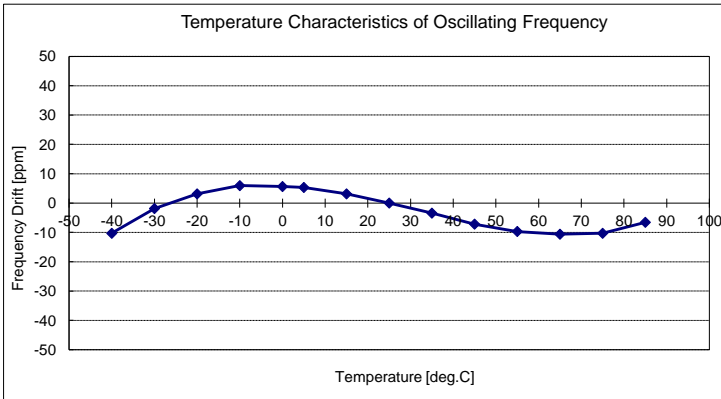
I: 1.41 mA (RMS)  
 Current through Crystal Unit measured by current probe

R1: 31.4 ohm

■ Test Data : Characteristics of recommended conditions

**Temperature Characteristics**

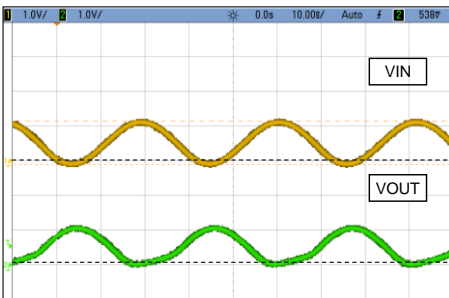
MODEL : XRCMD32M000FXP53R0 with JN5169



Typical sample at Set=5V

**Oscillation waveform**

MODEL : XRCMD32M000FXP53R0 with JN5169



VIN [V]			VOUT [V]		
High	Low	p-p	High	Low	p-p
1.2	-0.1	1.3	1.1	-0.1	1.1

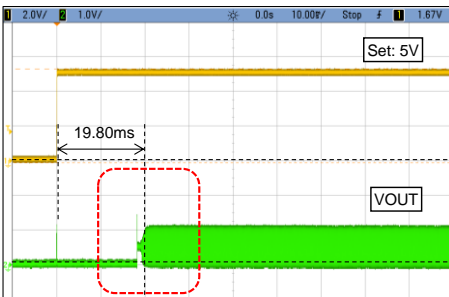
Typical sample at Set=5V, +25deg.C

[VIN] Vertical: 1V/div., Horizontal: 10ns/div.  
Broken line: GND

[VOUT] Vertical: 1V/div., Horizontal: 10ns/div.  
Broken line: GND

**Oscillation start up waveform**

MODEL : XRCMD32M000FXP53R0 with JN5169

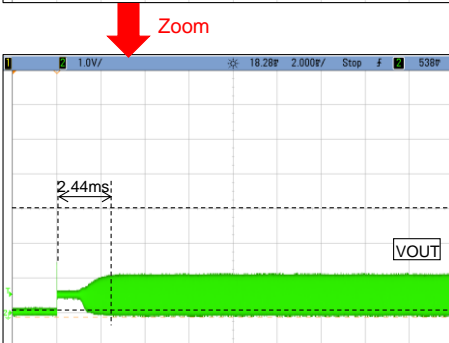


**Start up time**

The time it takes to become 90% of steady amplitude of Vout(Xout) once power is applied.

Typical sample at Set=5V, +25deg.C

[Set] Vertical: 2V/div., Horizontal: 10ms/div.  
[VOUT] Vertical: 1V/div., Horizontal: 10ms/div.  
Broken line: GND



[VOUT] Vertical: 1V/div., Horizontal: 2ms/div.  
Broken line: GND