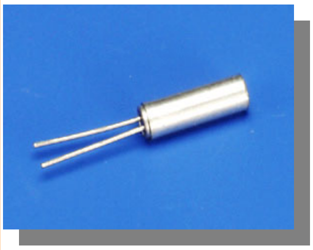
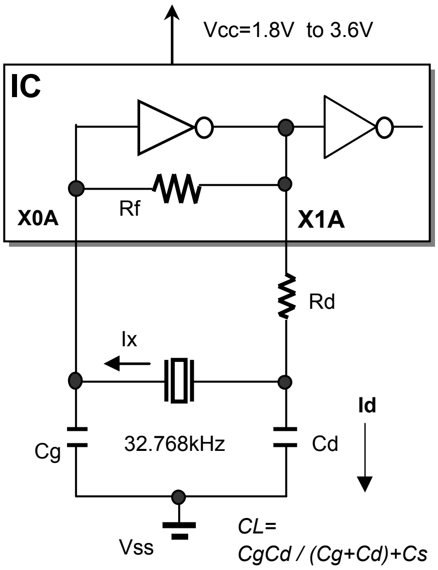
Evaluation of Low Frequency Clock Oscillation Circuit

VT-200 12.5pF with MB95107A-64P [LQFP(10x10) 0.50mm pitch]

Measurement conditions :3.0V , 2.2V



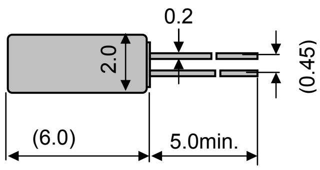
Model	:VT-200
Frequency	:Fo=32.768kHz
Frequency tolerance	:dF/Fo= +/-20x10^{6}
Load capacitance	:CL=12.5pF
Equivalent series resistance	:R1=50kohm max
Max. drive level	:DL=1x10^{-6}W max
Level of drive	:DL=0.1x10^{-6}W typ



FEATURES

1.Compact tubular package
2.Photolithographic process
3.Excellent shock resistance and environmental characteristics.
4.Real time clocks, Timers, Portable applications

DIMENSIONS(VT-200)



Unit:mm

Remark) Ix : current through crystal

MODEL:VT-200 12.5pF with MB95107A at 25°C

Key specifications	Vcc=2.2V	Vcc=3.0V	Remarks
Current control resistance : Rd (k ohm)	0	0	Control drive level & secure phase margin
Capacitance at gate : Cg (pF)	22	22	Optimal capacitance in response to CL
Capacitance at drain : Cd (pF)	18	18	(CL = Cd // Cg + stray capacitance)

Circuit characteristics (at 25°C)	Vcc=2.2V	Vcc=3.0V	Remarks
Matching Accuracy : df / f (x10^{-6})	-2.4	-1.5	Frequency offset volume at specified Vcc
Voltage Fluctuation : +/-df / V (x10^{-6})	0.3	0.3	Vcc +/-10% (Standard operating voltage range)
Drive Level : DL (x10^{-6}W)	0.06	0.07	DL=Ix^{2} Re < 1x10^{-6}W,Re=R1(1 + Co / CL)^{2}
Negative resistance : | - RL | (kohm)	393	393	5 times larger than R_{1MAX}
Oscillation allowance : M (times)	8	8	Judgemental standard of oscillation stability
consumption current : Id (nA)	655	664	Cd charge current, Id = ωCd*Vd
Voltage of oscillation start : Vstrat (V)	1.23	1.23	
Voltage of oscillation stop : Vstop (V)	0.93	0.93	
Oscillation start up time : Ts (sec)	1.46	1.35	Time to reach 90% of output level

Temperature characteristics of circuit		Vcc=2.2V	Vcc=3.0V	Remarks
at -40°C	Variation : df / T (x10^{-6})	-142	-142	Typ.Tp=25°C (K = -3.5×10^{-8} / °C^{2})
at +85°C	Variation : df / T (x10^{-6})	-131	-131	Typ.Tp=25°C (K = -3.5×10^{-8} / °C^{2})

The above mentioned value is only for your reference. The value is for the arbitrary samples and does not guarantee the product's characteristics. Please review and check above parameters at customer's end.

Seiko Instruments USA Inc.
2990,West Lomita Blvd., Torrance, CA 90505, U.S.A
Telephone :+1 310-517-7771 Facsimile :+1 310-517-7792
Email :info@siu-la.com

Seiko Instruments GmbH
Siemensstrasse 9,D-63263 Neu-Isenburg,Germany
Telephone :+49-6102-297-0 Facsimile :+49-6102-297-320
Email :info@seiko-instruments.de

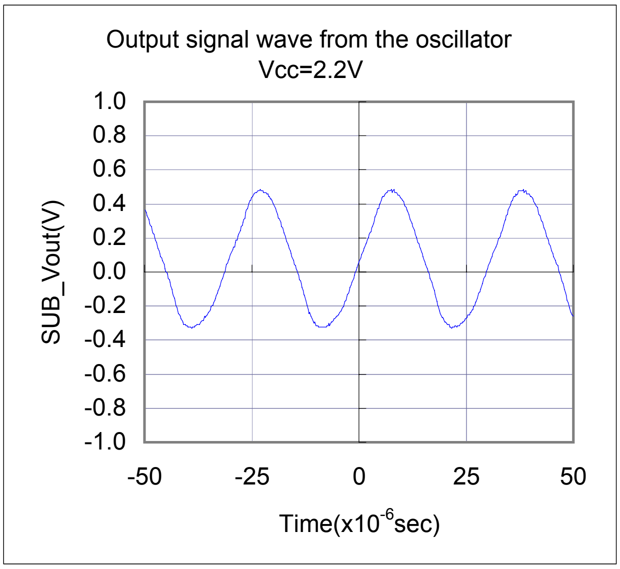
Seiko Instruments Inc.
1-8,Nakase,Mihama-ku,Chiba-shi,Chiba 261-8507,Japan
Facsimile :+81-43-211-8030
E-mail :component@sii.co.jp

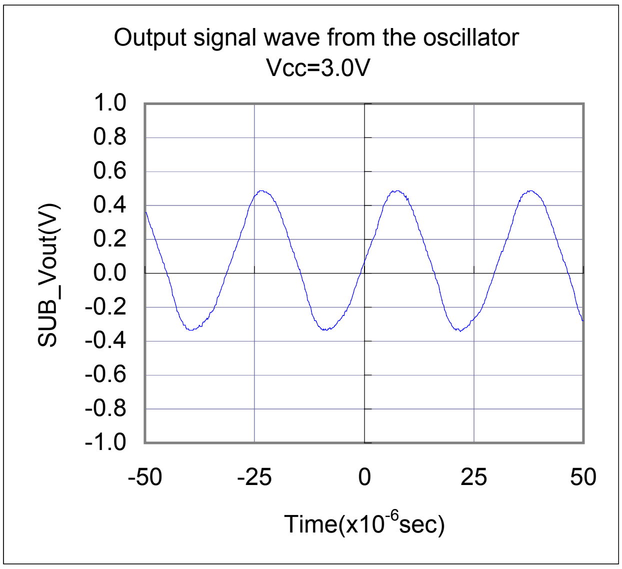
Evaluation of Low Frequency Clock Oscillation Circuit

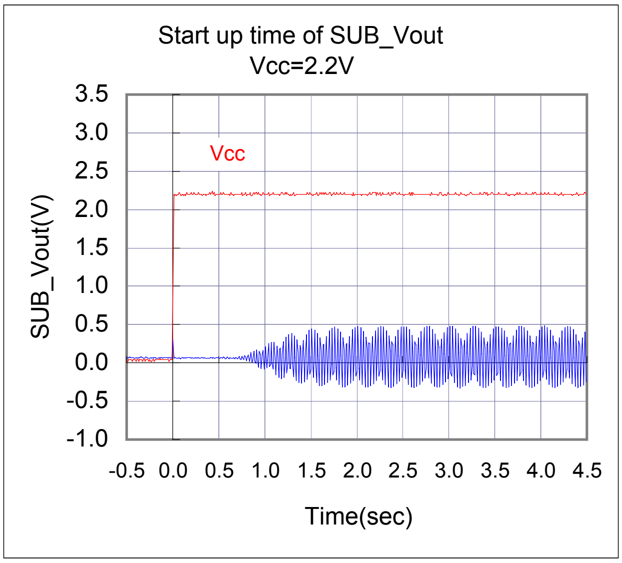
VT-200 12.5pF with MB95107A-64P [LQFP(10x10) 0.50mm pitch]

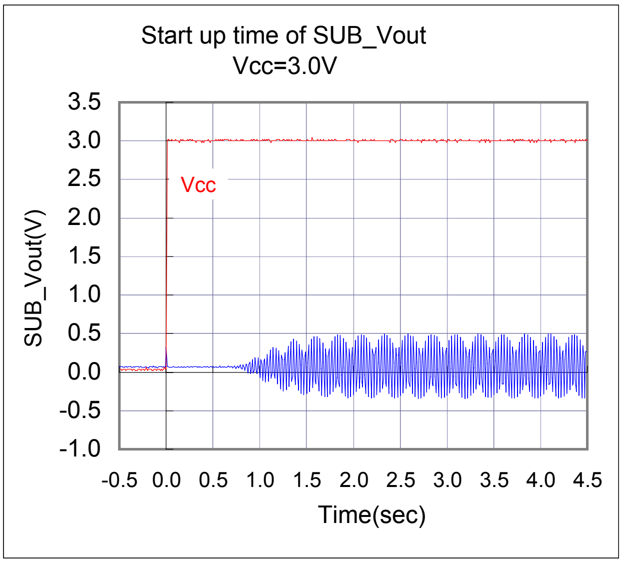
Measurement conditions :3.0V , 2.2V

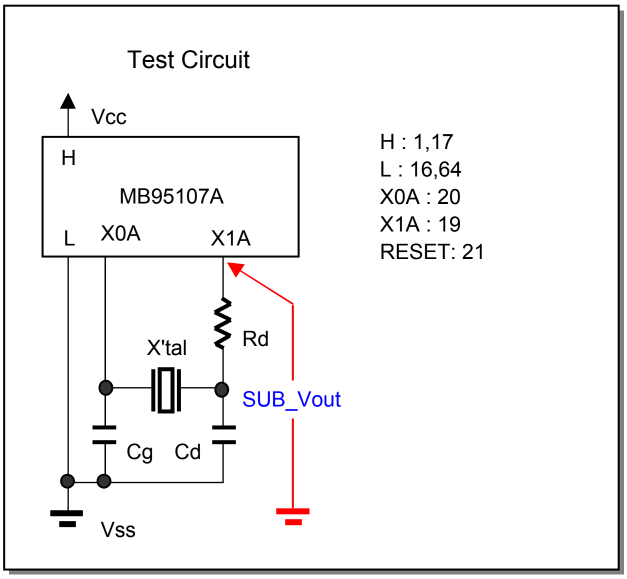
Test Data at 25°C

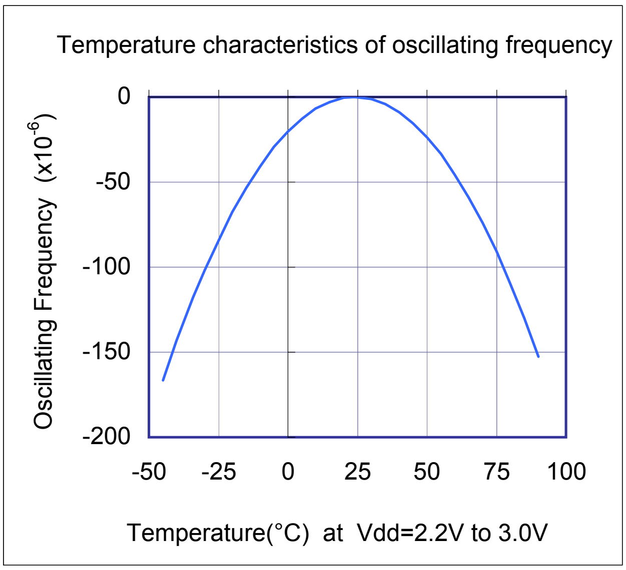










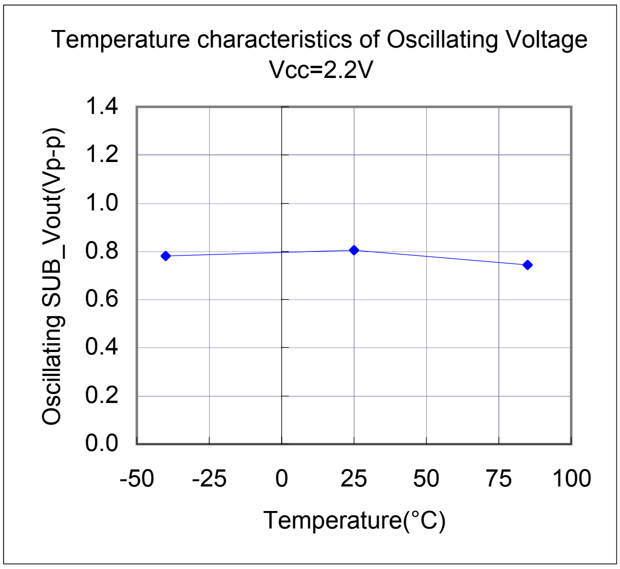


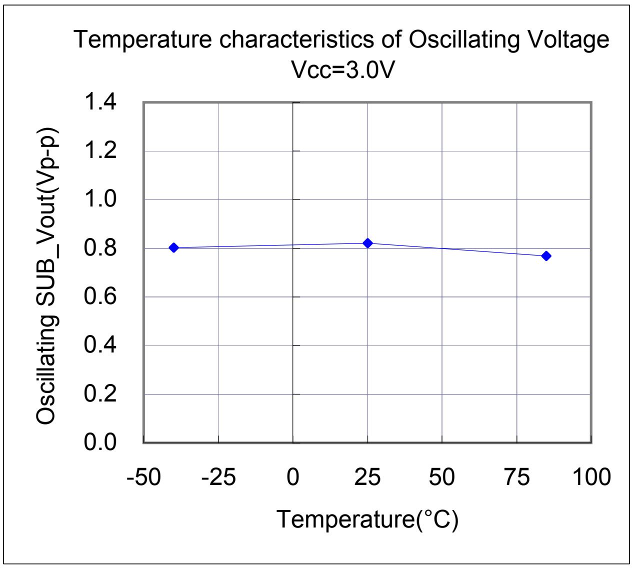
Evaluation of Low Frequency Clock Oscillation Circuit

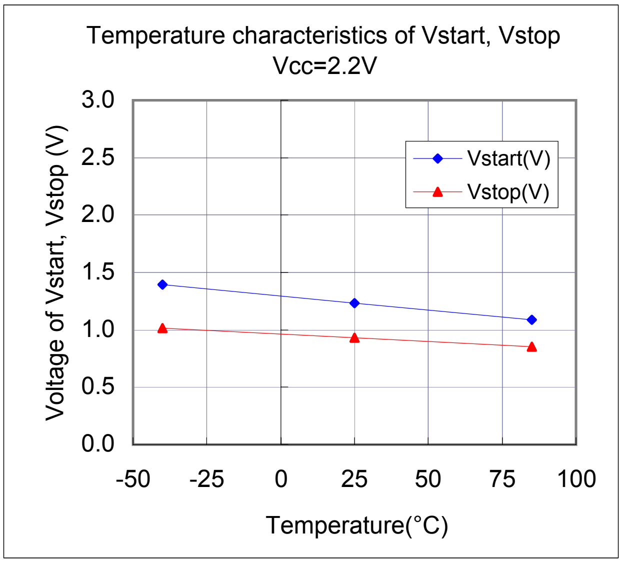
VT-200 12.5pF with MB95107A-64P [LQFP(10x10) 0.50mm pitch]

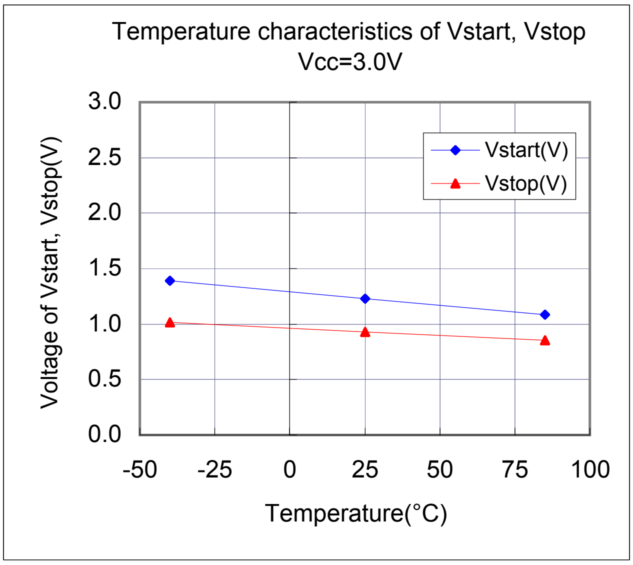
Measurement conditions :3.0V , 2.2V

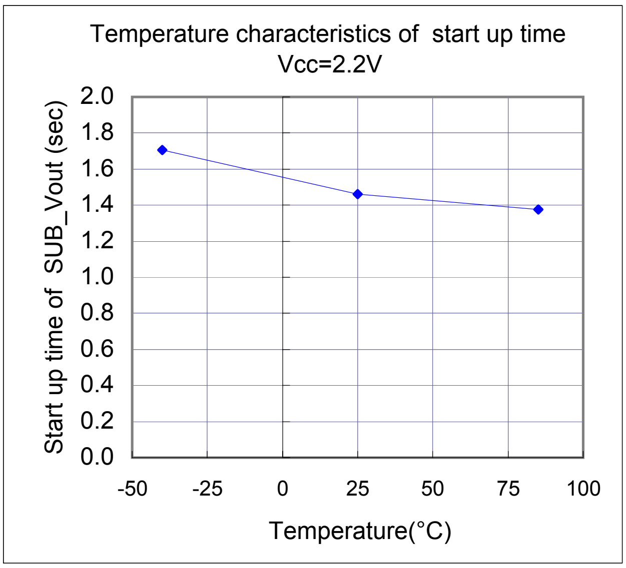
Test Data : Temperature characteristics

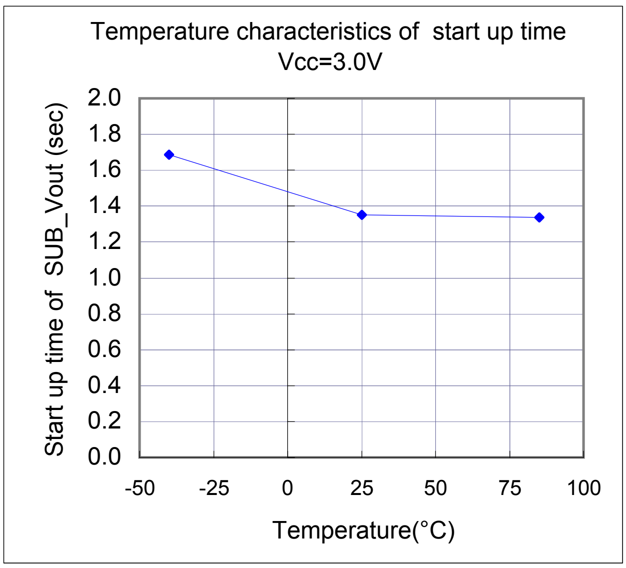












Seiko Instruments Inc.
Phone:+81-43-211-1207(Direct)

Evaluation of Low Frequency Clock Oscillation Circuit

VT-200 12.5pF with MB95107A-64P [LQFP(10x10) 0.50mm pitch]

Measurement conditions :3.0V , 2.2V

Referential components layout(see Figure 1)

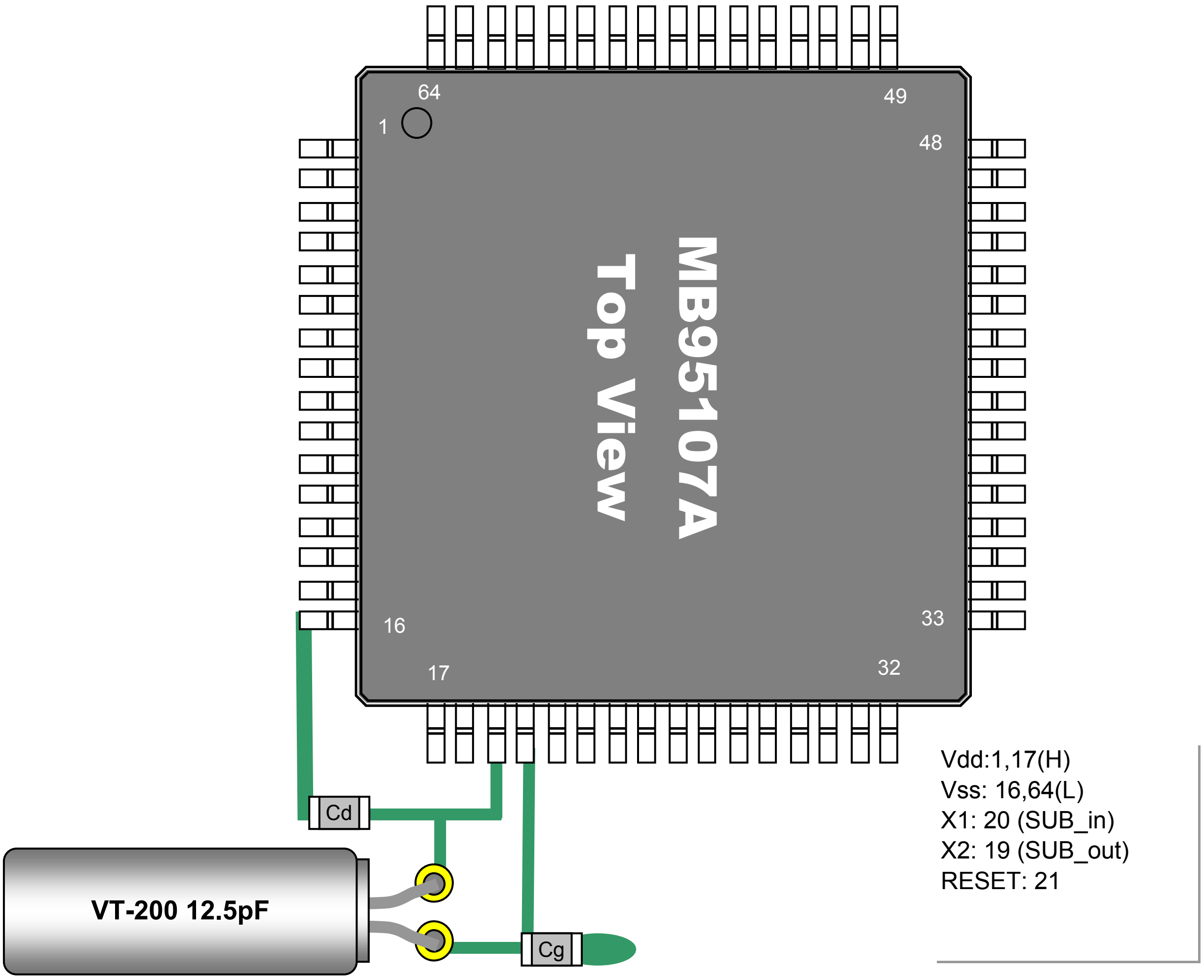


Figure 1 Referential components layout

Notes for Board Design

When using a crystal resonator, place the resonator and its load capacitors as close as possible to SUB_in and SUB_out pins.
Other signal lines should be routed away from the resonator circuit to prevent induction from interfering with correct oscillation (see figure 2).

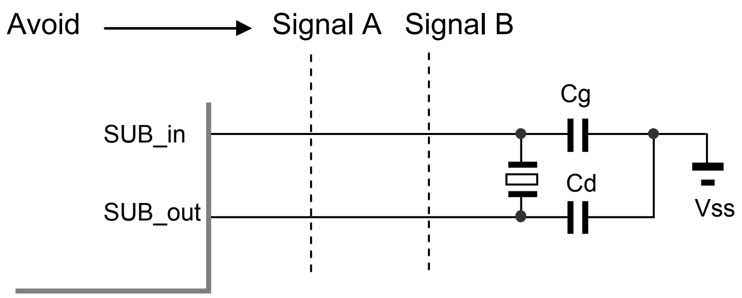


Figure 2 Example of Incorrect Board Design

Remark When using the subsystem clock, insert resistors Rd in series on the SUB_out side.

Evaluation of Low Frequency Clock Oscillation Circuit

VT-200 12.5pF with MB95107A-64P [LQFP(10x10) 0.50mm pitch]

Measurement conditions :3.0V , 2.2V

[Evaluation Sample at 25°C]

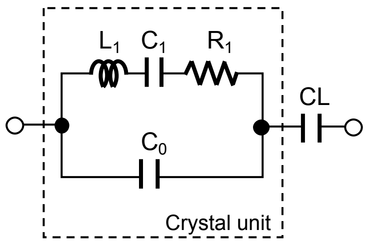
SAMPLE	No.	CL(pF)	Fo(Hz)	fr(Hz)	R1(kohm)	Co(pF)	C1(fF)	Q(k)
VT-200	1	12.5	32768.30	32765.60	27.8	0.89	2.207	79.2
	2	12.5	32767.83	32765.10	29.0	0.90	2.233	75.0
	3	12.5	32768.40	32765.63	30.0	0.90	2.266	71.5

[IC Test Data : IC sample Rd=0k ohm,Cg=22pF,Cd=18pF at 25°C]

Vcc(V)	IC sample	Fosc(Hz)	df / f($x10^{-6}$)	DL($x10^{-6}$W)	| -RL |(kohm)	Vstart(V)	Ts(sec)
3.0	TYP_#1	32767.780	-1.53	0.07	393	1.23	1.35
	TYP_#2	32767.785	-1.37	0.07	393	1.23	1.35
2.2	TYP_#1	32767.750	-2.44	0.06	393	1.23	1.46
	TYP_#2	32767.752	-2.38	0.06	393	1.23	1.50

Remark (see figure 3)

Fo = fr ×{ C1/ (2×(Co + CL)) + 1 } (Hz)



Fo : Load resonance frequency
fr : Resonance frequency
R1 : Motional resistance
C1 : Motional capacitance
Co : Shunt capacitance
CL : Load Capacitance

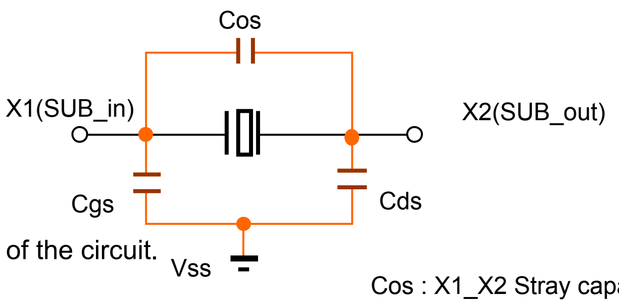
Figure 3 Equivalent circuit of crystal unit, and CL

Remark (see figure 4)

Approximate formula of the load capacitance of the circuit CL.

CL = Cg×Cd / (Cg + Cd) + Cs (pF)

Where Cs(=2 to 4pF) Stands for stray capacitance of the circuit.



Cos : X1_X2 Stray capacitance
Cgs : X1_Vss Stray capacitance
Cds : X2_Vss Stray capacitance

Figure 4 Stray capacitance Cos,Cgs,Cds of the circuit

Resonator circuit constants will differ depending on the resonator element, stray capacitance in its interconnecting circuit, and other factors. Suitable constants should be determined in consultation with the resonator element manufacturer.

Seiko Instruments Inc.
Phone:+81-43-211-1207(Direct)

MB95100B

Evaluation of Low Frequency Clock Oscillation Circuit

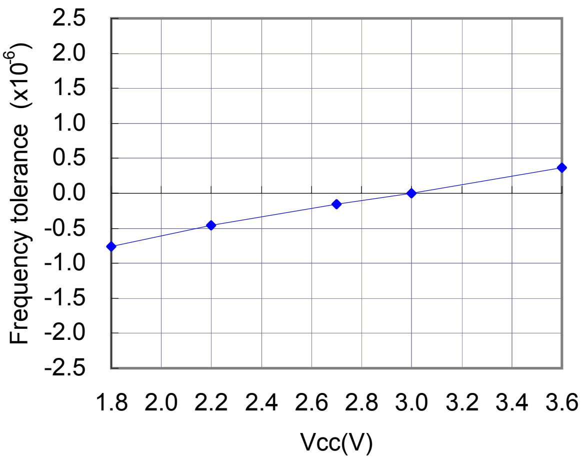
VT-200 12.5pF with MB95107A-64P [LQFP(10x10) 0.50mm pitch]

Measurement conditions : Vdd=1.8V to 3.6V at 25°C

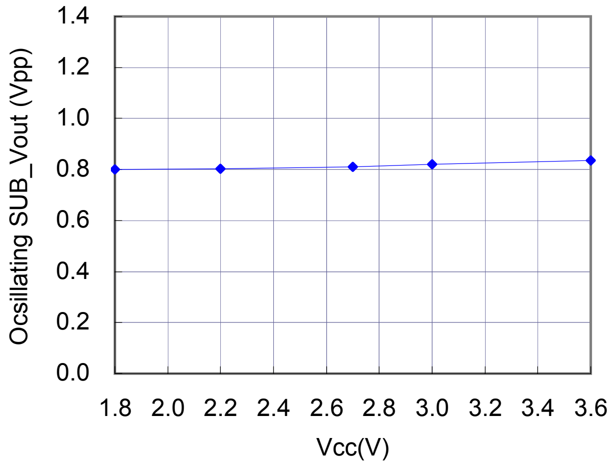
SII

Referential Data : Voltage characteristics

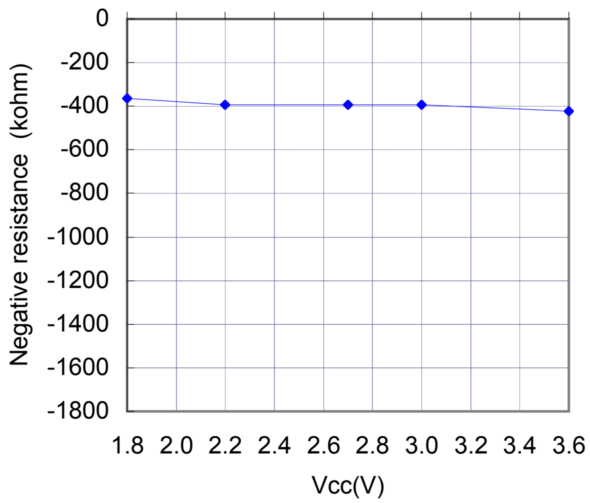
Frequency / voltage coefficient



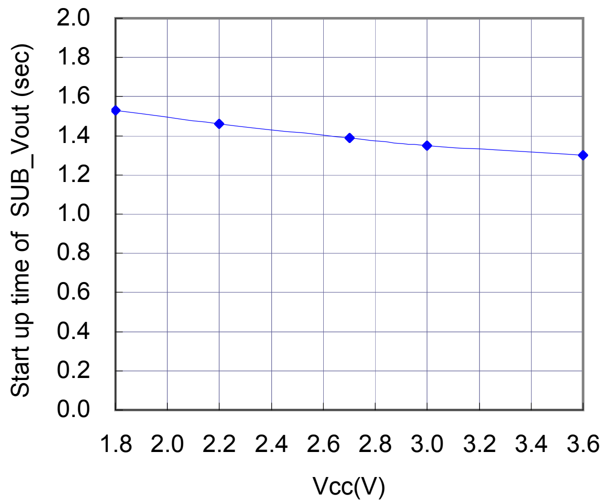
SUB_Vout / voltage coefficient



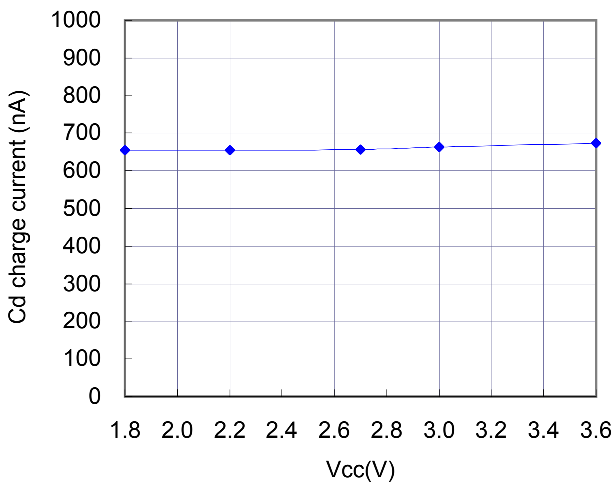
Negative resistance / voltage coefficient



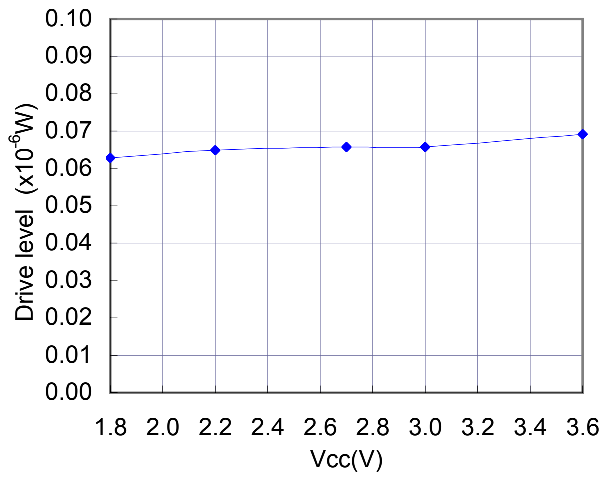
Start up time / voltage coefficient



Cd charge current / voltage coefficient



Drive level / voltage coefficient



Seiko Instruments Inc.
Phone:+81-43-211-1207(Direct)