

To Atmel R&D India Pvt Ltd

CE12-0513
29.Oct.2012
SEIKO EPSON CORPORATION
TD·CS Quality Assurance Dept.

FA-20H 16.000000[MHz] Quartz Crystal Circuit Evaluation Report (TB1_XMEGA_231)

Thank you for considering our products, and we hope greatly you get useful information from our service.
With reference to the above subject, we would like to report as follows.

1. Outline of evaluation

[Specifications of crystal unit]

Model : FA-20H
Nominal frequency(f) : 16.000000[MHz]
Frequency tolerance : $\pm 20 \times 10^{-6}$
Load capacitance(C_L) : 9.0[pF]
Series resistance(R_1) : 80[Ω]Max.
Drive level(DL) : 200[μW]Max.
Negative resistance(|-R|) : 400[Ω]Min. (Five times or more R_1)
(recommended value)

[Evaluation board]

PCB : TB1_XMEGA_231
Supply voltage : DC+3.0[V]
IC for oscillation : AT86RF231

[Evaluation items]

Standard : Frequency deviation / DL / |-R|
Voltage characteristics : 1.8[V], 3.0[V], 3.3[V]
Frequency temperature characteristics : -40[deg.C] to +85[deg.C] 10[deg.C] step, VDD 3.0[V]
OSC start-up time : Trigger point→VDD
: Measurement point→IC_25pin

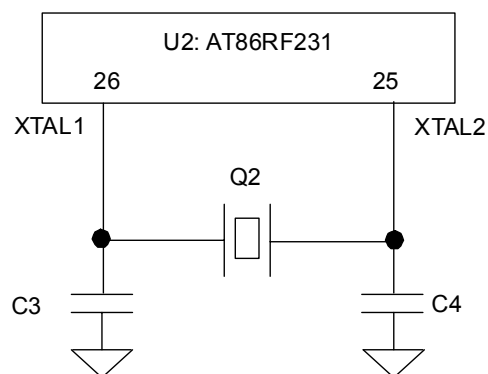


Fig.-1. Oscillation circuit diagram

2. Result about circuit constants

Table-1. Present & Proposal circuit constants

Circuit Constants	C3 [pF]	C4 [pF]	Frequency deviation [$\times 10^{-6}$] $C_L=9.0$ [pF]std.	DL [μW]	-R [Ω]
Present	10	10	+10.8	2	1340
Proposal	12	12	+0.1	3	1040

3. Result of evaluation

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•**Circuit constants adjustment** : Data is shown in Table-2.

Both the drive level and the negative resistance of proposal circuit constants satisfy recommended values. Besides, you can match frequencies by implementing a crystal unit with the load capacitance $C_L=9.0$ [pF].

Table-2. Matching Data

Circuit Constants	C3 [pF]	C4 [pF]	Frequency deviation [$\times 10^{-6}$] $C_L=9.0$ [pF]std.	DL [μ W]	R [Ω]
Present	10	10	+10.8	2	1340
Proposal	12	12	+0.1	3	1040
	15	15	-11.9	4	790

•**Voltage characteristics** : Data is shown in Table-3.

Table-3. Voltage characteristics(Proposal circuit constants)

VDD [V]	Frequency deviation [$\times 10^{-6}$] $C_L=9.0$ [pF]std.	DL [μ W]	R [Ω]
1.8	-0.4	3	1040
3.0	+0.1	3	1040
3.3	+0.2	3	1040

•**Negative resistance in high temperature and low voltage** : Data is shown in Table-4.

In the high temperature and low voltage, negative resistance has satisfied the recommended value.

Table-4. Negative resistance in high temperature and low voltage (Proposal circuit constants)

Temp. [deg.C]	VDD [V]	R [Ω]
85	1.8	1040

•**Frequency temperature characteristics** : Data is shown in Fig.-2.

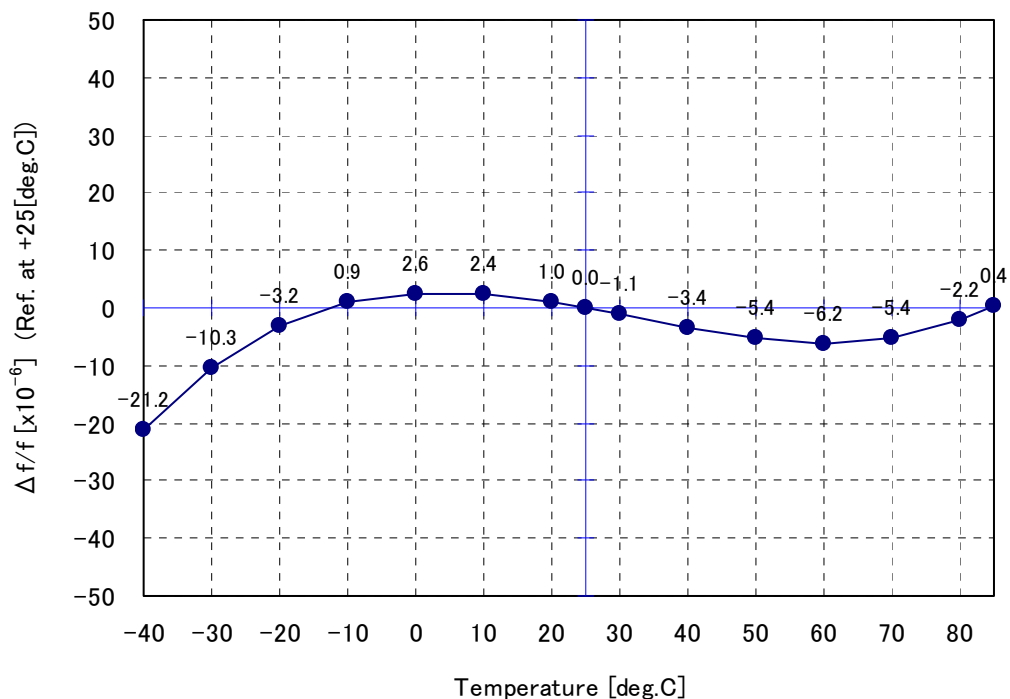


Fig.-2. Frequency temperature characteristics (Proposal circuit constants, VDD=3.0[V])

• **Oscillation start-up time** : Data is shown in Fig.-3.

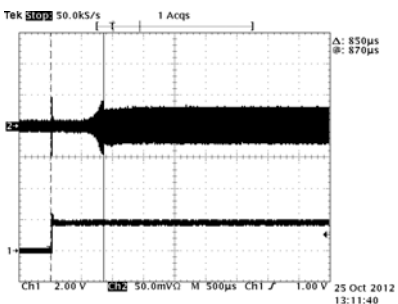
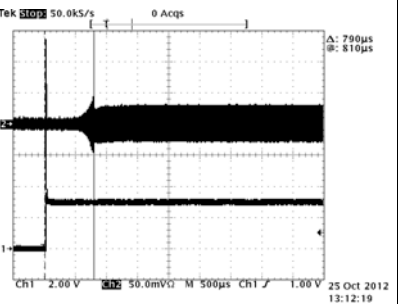
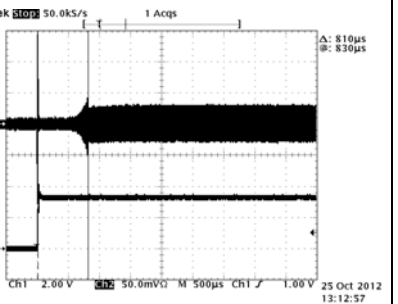
VDD. [V]	1.8	3.0	3.3
Time [ms]	0.9	0.8	0.8
Waveform			

Fig.-3. Oscillation start-up time (Proposal circuit constants)

• **Oscillation start-up time in high temperature and low voltage** : Data is shown in Fig.-4.

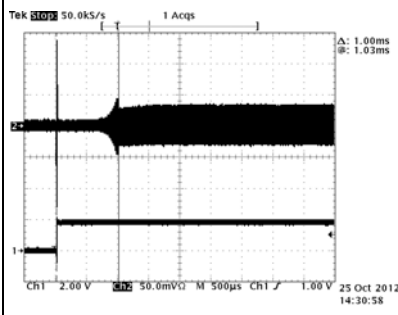
VDD[V]	1.8
Temp.[deg.C]	85
Time[ms]	1.0
Waveform	

Fig.-4. Oscillation start-up time in high temperature and low voltage (Proposal circuit constants)

[Notes]

Result in this information is only according to the sample set that received from your company.

It is not including the dispersion trend.

Therefore, please also confirm it again at your side.

Also please be informed that the content of this information is not guaranteed as the final result by our company.

Thank you very much

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