

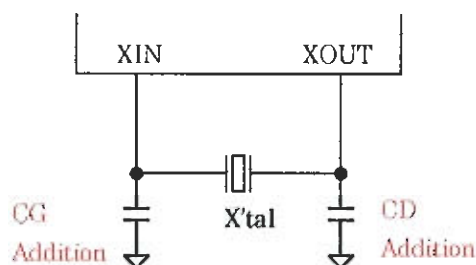
To: Atmel

EPSON TOYOCOM CORPORATION  
QD QUALITY ASSURANCE GROUP**MC-306 (32.768 kHz) Quartz Crystal Circuit Evaluation**

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. Details of Investigation**

- We investigated the drive level, negative resistance and load capacitance of the PCB from your company.
- Quartz crystal : MC-306 ·Frequency : 32.768 kHz ·CL :  $7.0 \text{ pF} \pm 20 \times 10^{-6}$
- Input Voltage : +1.8 V ~ +5.5 V ·IC : ATMEGA169

**2. Circuit**

	Present Constants	Reference Constants
CG	—	2 pF
CD	—	2 pF
CL value		7.0 pF

**3. The Investigation results**

## (1) The oscillation of the Present constants.

- We used Crystal with CL 7.0 pF for this evaluation.
- The drive level and the negative resistance are fine. The oscillatory frequency is high. ( VDD =+3.3 V )

## (2) The oscillation of the Reference constants.

- We used Crystal with CL 7.0 pF for this evaluation.
- The drive level and the negative resistance are fine. The oscillatory frequency is fine. ( VDD =+3.3 V )
- Data are shown in the table below.

(D.L: Drive Level, -R: negative resistance)

PCB No.	CG (pF)	CD (pF)	VDD (V)	Oscillation Frequency ( $\times 10^{-6}$ ) Based on CL 7.0 pF	DL ( $\mu\text{W}$ )	-R (k $\Omega$ )	Oscillation start up time. (ms)
1	N.C.	N.C.	+1.8	-15.6	0.104	1000	600
			+3.3	+25.3	0.047	1000	500
			+5.0	+47.6	0.031	1000	400
			+5.5	+56.8	0.026	1000	400
	2	2	+1.8	-29.3	0.145	1000	600
			+3.3	-0.3	0.079	1000	500
			+5.0	+13.7	0.058	1000	400
			+5.5	+19.2	0.051	1000	400
2	N.C.	N.C.	+1.8	-15.2	0.104	1000	600
			+3.3	+27.5	0.047	1000	500
			+5.0	+50.7	0.030	1000	400
			+5.5	+61.0	0.025	1000	400
	2	2	+1.8	-29.3	0.139	1000	600
			+3.3	+0.6	0.074	1000	500
			+5.0	+15.6	0.054	1000	400
			+5.5	+21.4	0.048	1000	400

\* Recommendation for this product : D.L. is less than 1.0  $\mu\text{W}$ , -R is more than 250 k $\Omega$ .)

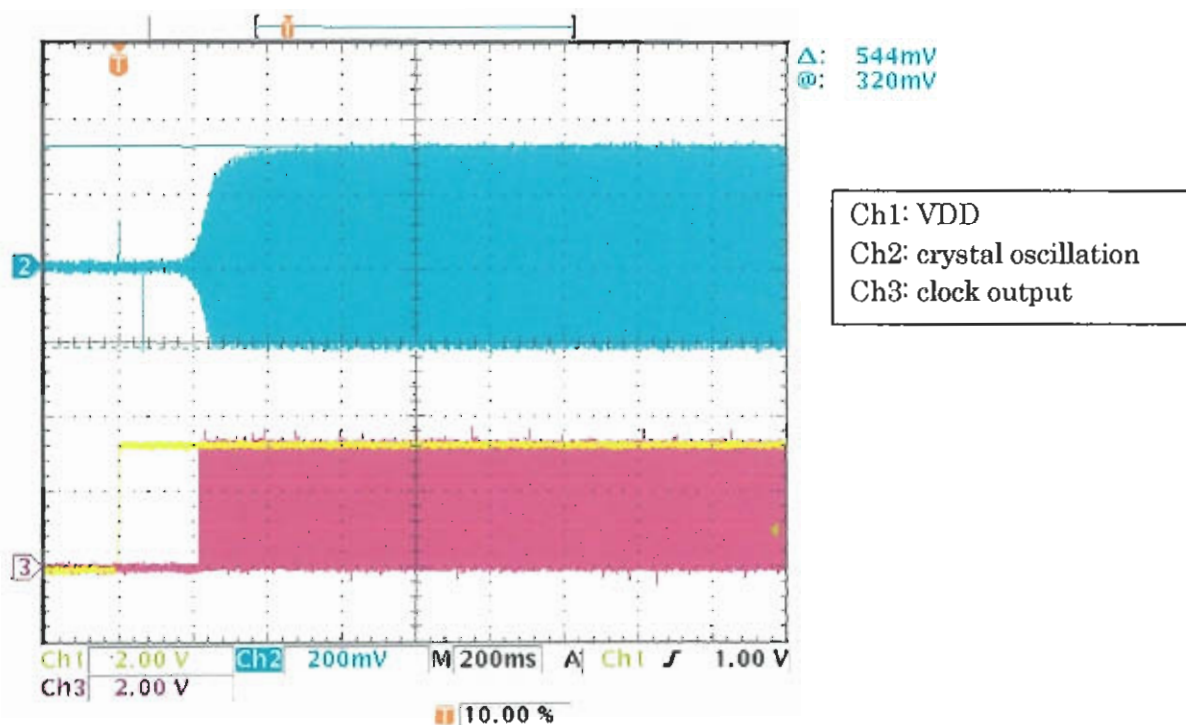
\* All above "-R" do not include any CI values (30.4 k $\Omega$ ) of the crystal units.

\* Considering the temperature characteristics of crystal unit, we recommend to set up the crystal unit on the plus side.

## (3) Oscillation start up time.

Measurement condition : VDD=+3.3 V , CG=CD=2 pF , Ta=+25 °C , PCB No.1

Measurement result : Data were shown in the table and waveform figure.



## [Notes]

This report describes the result of the examination using the set you offered us, and the tolerance of devices are not considered. We would like you to check the design about the frequency precision caused by parts deviation. In addition, content of this report is not guaranteed. Please understand it.

Thank you.

Approved by

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