



NIHON DEMPA KOGYO CO., LTD.

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NDK Ref. No.: EXC10B-23492
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Atmel Norway

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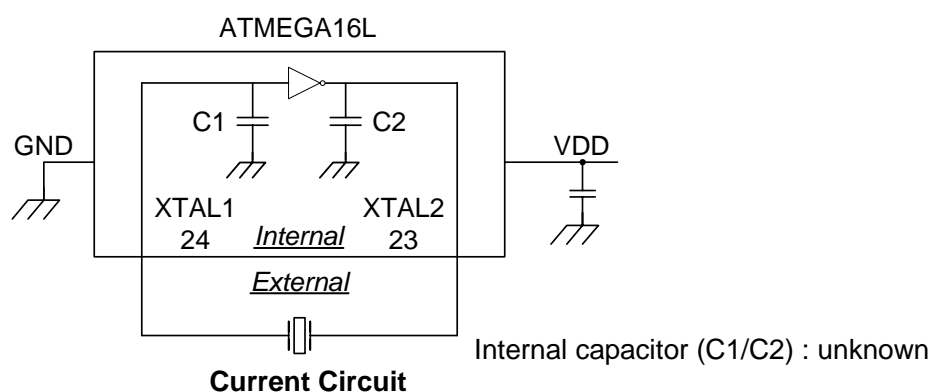
Thank you for your inquiry and we are pleased to report you our circuit analysis report as follows.

Circuit Analysis Report

1. CONDITION

Test IC	ATMEGA169	
Crystal	Holder	NX3215SA
	Frequency	32.768kHz
	Load capacitance	CL=9pF(Current)
	NDK Spec. No.	STD-MUA-9
Test Circuit	IC	ATMEGA169 16AI 0509E
	VDD	+1.8V / +3.7V / +5.5V
	PCB	Atmega64/128/169 TQFP Characterization top-card

2. CIRCUIT DIAGRAM



3. RESULTS

1) This crystal unit requires negative resistance of $-R = 240k\Omega$ minimum for stable oscillation

2) Circuit characteristics

Circuit	VDD	External C	Frequency deviation dF/F	Negative Resistance -R	Drive Level DL	Startup time Tstr
			CL=9pF (Current)			
Current	+1.8V	None	+6ppm	1750k Ω	0.19uW	0.7s
	+3.7V	None	+102ppm	More than 2M Ω	0.19uW	0.7s
	+5.5V	None	+155ppm	More than 2M Ω	0.19uW	0.7s

3) In the current circuit, Negative Resistance is too large at VDD=+1.8V~+5.5V.

4) In the current circuit, dF/F is small at VDD=+1.8V, but dF/F is shifted to plus very much at VDD=+3.7V,+5.5V.

5) According to selection of VDD, the changing of Internal capacitor(C1/C2) is necessary for frequency matching.

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