

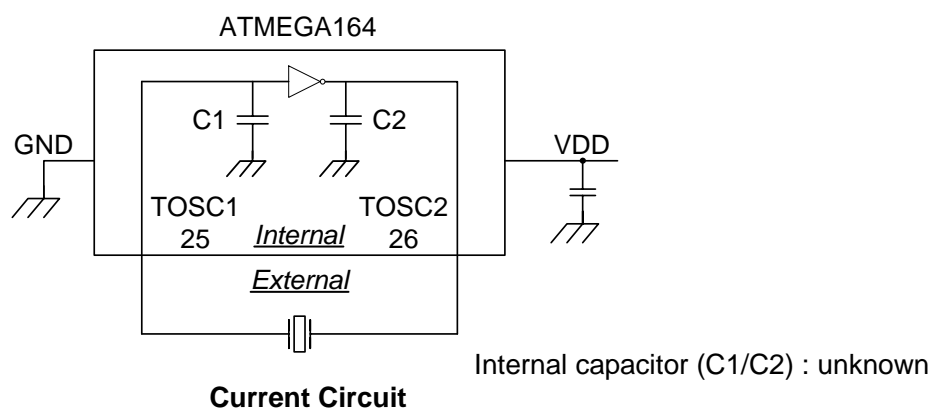
Thank you for your inquiry and we are pleased to report you our circuit analysis report as follows.

## Circuit Analysis Report

### 1. CONDITION

Test IC	ATMEGA164	
Crystal	Holder	NX3215SA
	Frequency	32.768kHz
	Load capacitance	CL=9pF(Current) CL=6pF(Reference)
	NDK Spec. No.	STD-MUA-9
Test Circuit	IC	ATMEGA164PA 24AU 0930
	VDD	+1.8V / +3.7V / +5.5V
	PCB	ATmega164P/324P 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)	CL=6pF (Reference)			
Current	+1.8V	None	+154ppm	+46ppm	980k $\Omega$	0.24uW	0.5s
	+3.7V	None	+185ppm	+77ppm	1170k $\Omega$	0.24uW	0.5s
	+5.5V	None	+199ppm	+91ppm	1240k $\Omega$	0.24uW	0.5s

- 3) The current circuit has enough Negative Resistance at VDD=+1.8V~+5.5V.
- 4) In the current circuit, dF/F is shifted to plus very much.
- 5) The changing of Internal capacitor(C1/C2) is necessary for frequency matching.