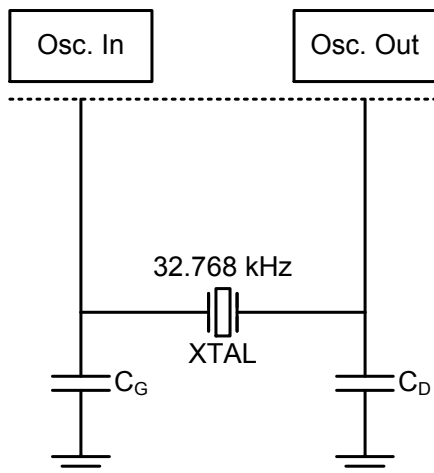


ATmega128RFA1



Oscillator Design Check

Test Conditions

Power Supply Voltage V_{DD}	1.8 – 3.3	V
Load Capacitors C_D / C_G	12 / 12	pF
Results		
Effective Load Capacitance	8.7	pF
Oscillation Allowance	>500	kΩ
Oscillator Output Voltage AC	150	mV _{RMS}
Drive Level	0.020	μW
Startup Time	300	ms
Overtone Mode Suppression	Safe	----

Recommendation

Crystal

Crystal Type	MS3V-T1R / CM7V-T1A	
Frequency	32.768	kHz
Load Capacitance C_L	9.0	pF
Tolerance	+/-20	ppm

Oscillator Design

C_D	12	pF
C_G	12	pF

Remarks

The ATmega128RFA1 consists of an ultra low power Pierce Oscillator.

Placing $C_D = 12$ pF and $C_G = 12$ pF load capacitors on each side of the crystal results in an effective load capacitance of 8.7 pF (including board stray capacitances) which is a perfect match for a crystal specified for $C_L = 9.0$ pF.

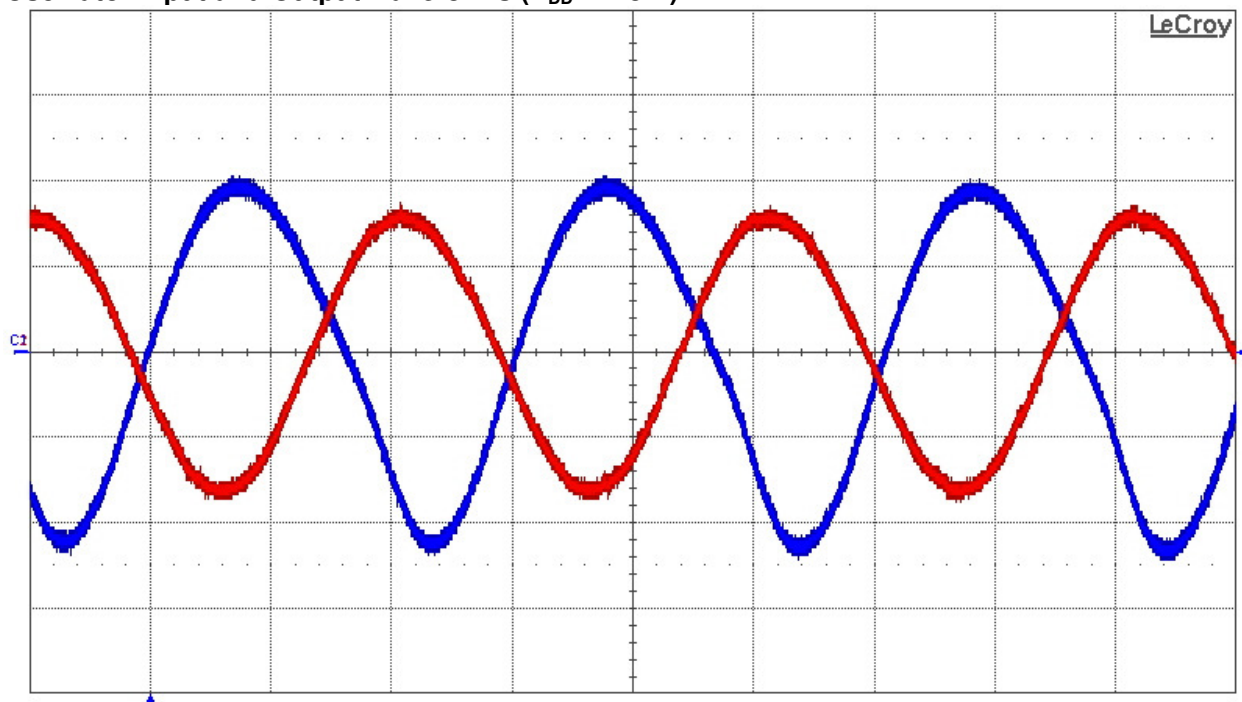
The oscillator circuit provides an oscillation allowance greater than 500 kΩ; this allows the safe use of smallest SMD quartz crystals ($ESR \leq 100$ kΩ).

This design is working perfectly and safe to work in the whole temperature range (-40 to +85°C).

Recommended crystals, metal package: MS1V-T1K and MS3V-T1R.

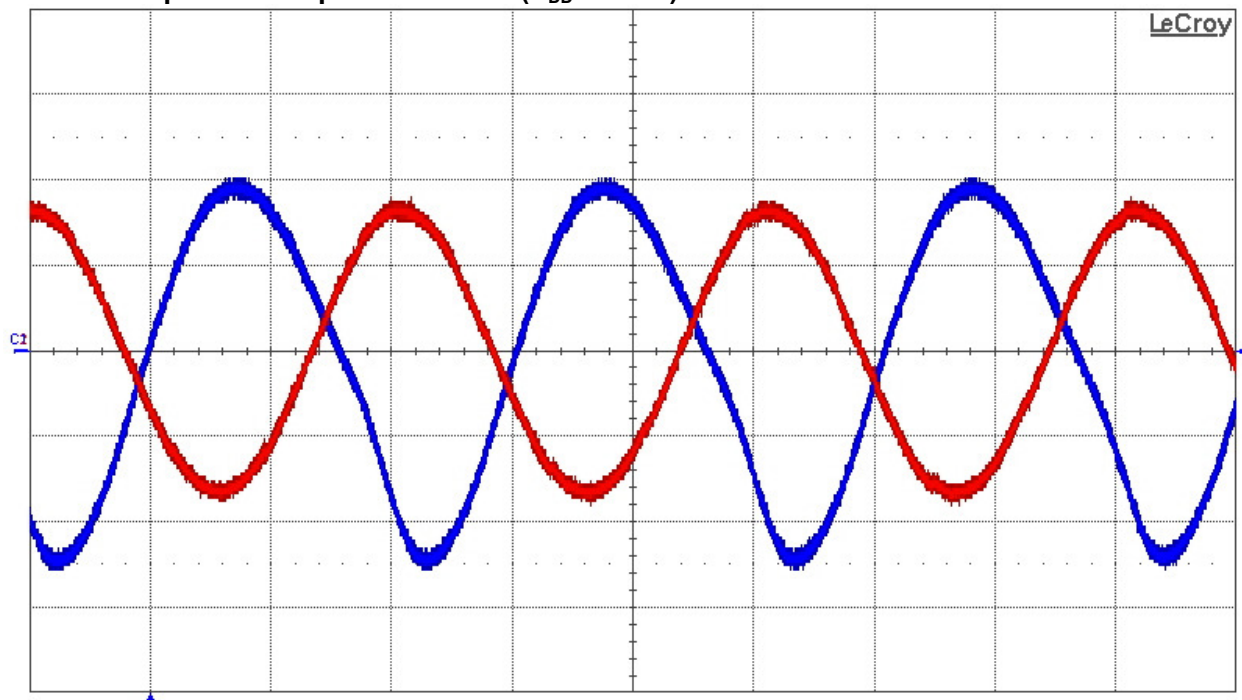
Recommended crystals, ceramic package: CC1V-T1A, CC4V-T1A, CC5V-T1A, CM7V-T1A and CM8V-T1A.

Oscillator Input and Output waveforms ($V_{DD} = 1.8\text{ V}$):



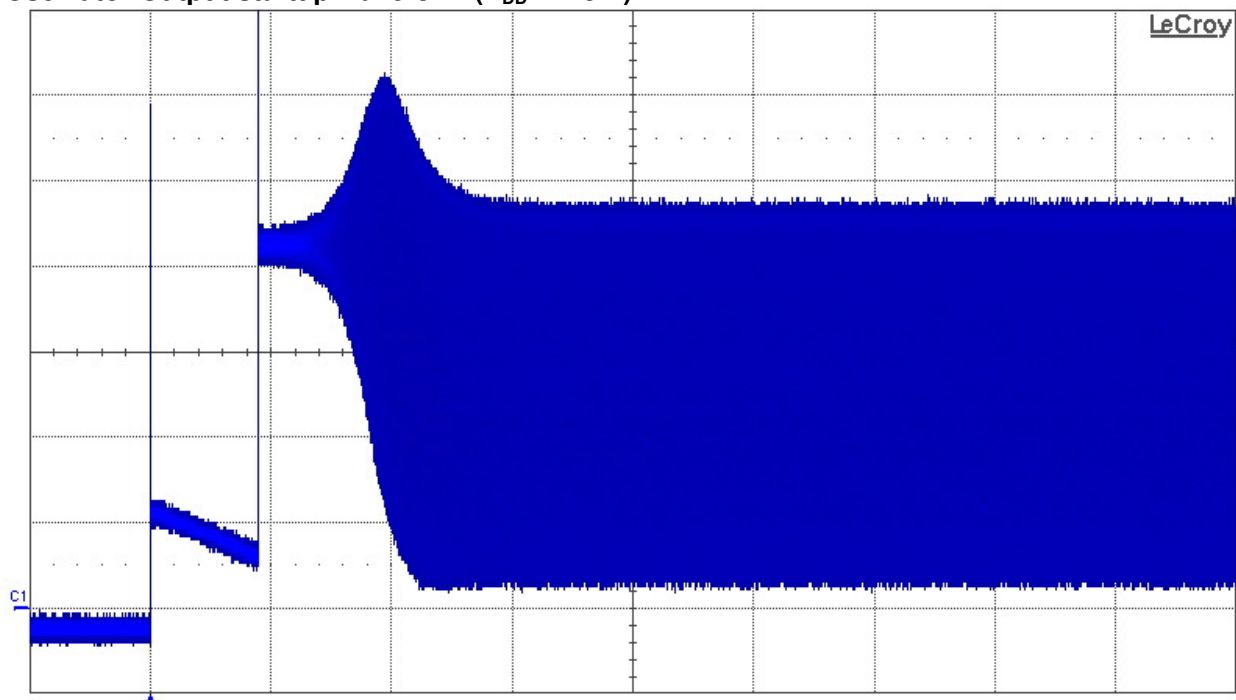
■ C1: Osc. Out (100 mV/div - AC) ■ C2: Osc. In (100 mV/div - AC) Time base: 10 $\mu\text{s}/\text{div}$

Oscillator Input and Output waveforms ($V_{DD} = 3.3\text{ V}$):



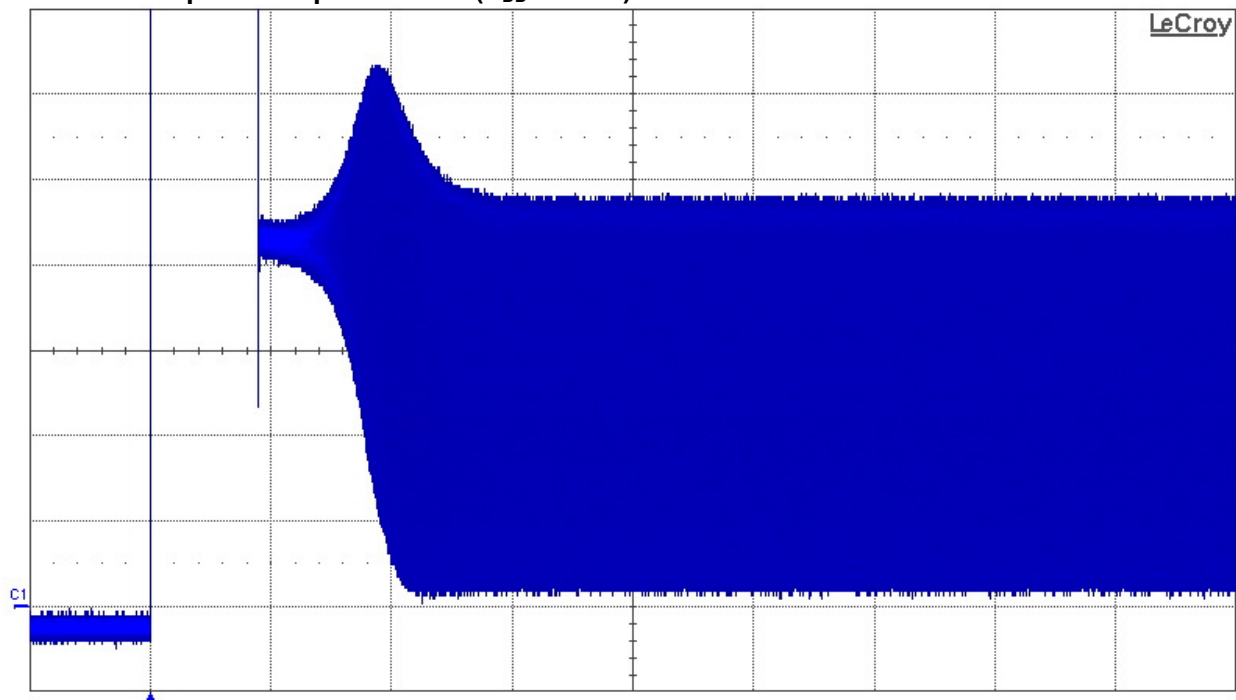
■ C1: Osc. Out (100 mV/div - AC) ■ C2: Osc. In (100 mV/div - AC) Time base: 10 $\mu\text{s}/\text{div}$

Oscillator Output startup waveform ($V_{DD} = 1.8\text{ V}$):



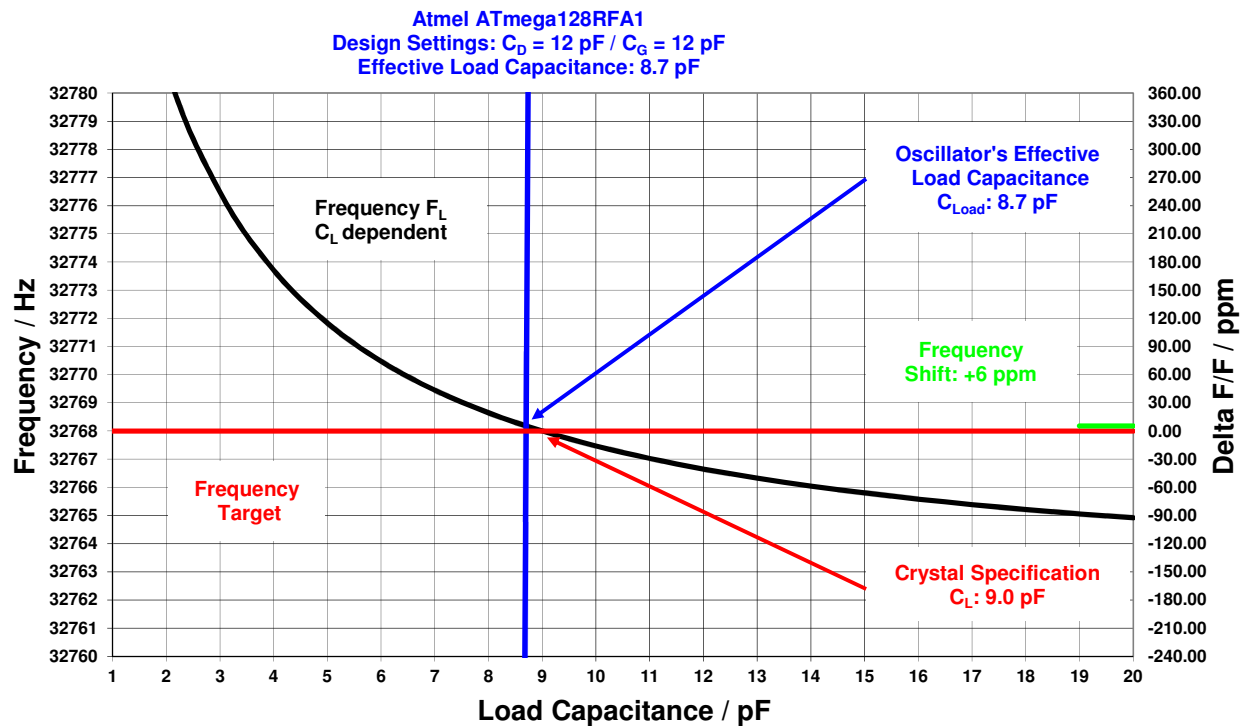
■ C1: Osc. Out (100 mV/div - DC) Time base: 100 ms/div

Oscillator Output startup waveform ($V_{DD} = 3.3\text{ V}$):



■ C1: Osc. Out (100 mV/div - DC) Time base: 100 ms/div

Crystal matching chart:



As shown in the chart above, an effective load capacitance of 8.7 pF results in a frequency offset of +6 ppm using a CM7V-T1A crystal specified for $C_L: 9.0 \text{ pF}$.

Frequency vs. temperature chart:

