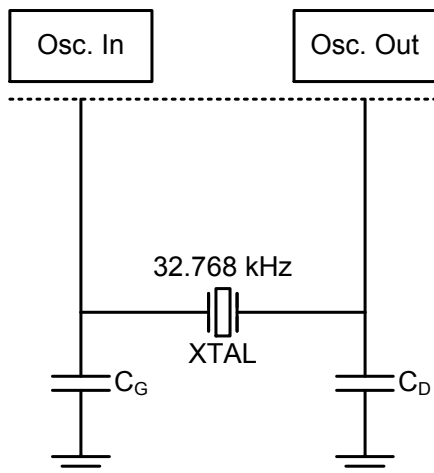


## ATmega128RFA1



## Oscillator Design Check

### Test Conditions

Power Supply Voltage $V_{DD}$	1.8 – 3.3	V
Load Capacitors $C_D / C_G$	8.2 / 8.2	pF
<b>Results</b>		
Effective Load Capacitance	7.0	pF
Oscillation Allowance	>500	kΩ
Oscillator Output Voltage AC	160	mV <sub>RMS</sub>
Drive Level	0.015	μW
Startup Time	250	ms
Overtone Mode Suppression	Safe	----

## Recommendation

### Crystal

Crystal Type	MS3V-T1R / CM7V-T1A	
Frequency	32.768	kHz
Load Capacitance $C_L$	7.0	pF
Tolerance	+/-20	ppm

### Oscillator Design

$C_D$	8.2	pF
$C_G$	8.2	pF

## Remarks

The ATmega128RFA1 consists of an ultra low power Pierce Oscillator.

Placing  $C_D = 8.2$  pF and  $C_G = 8.2$  pF load capacitors on each side of the crystal results in an effective load capacitance of 7.0 pF (including board stray capacitances) which is a perfect match for a crystal specified for  $C_L = 7.0$  pF.

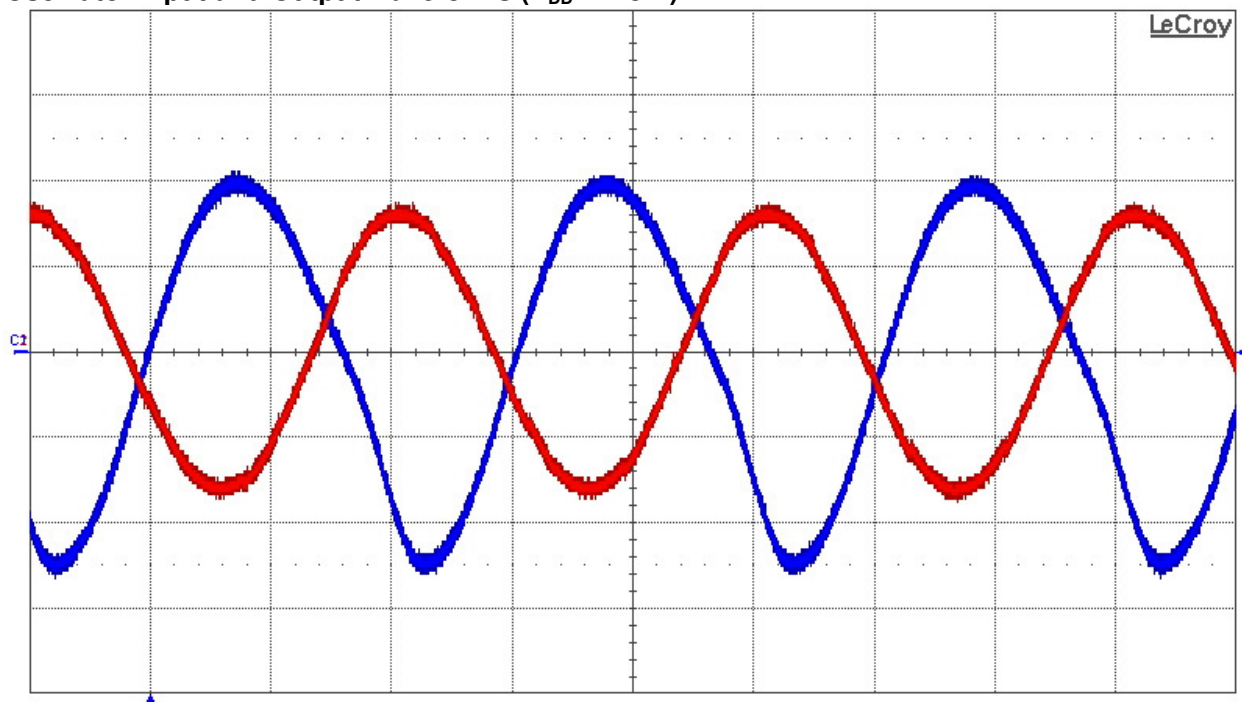
The oscillator circuit provides an oscillation allowance greater than 500 kΩ; this allows the safe use of smallest SMD quartz crystals ( $ESR \leq 100$  kΩ).

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.

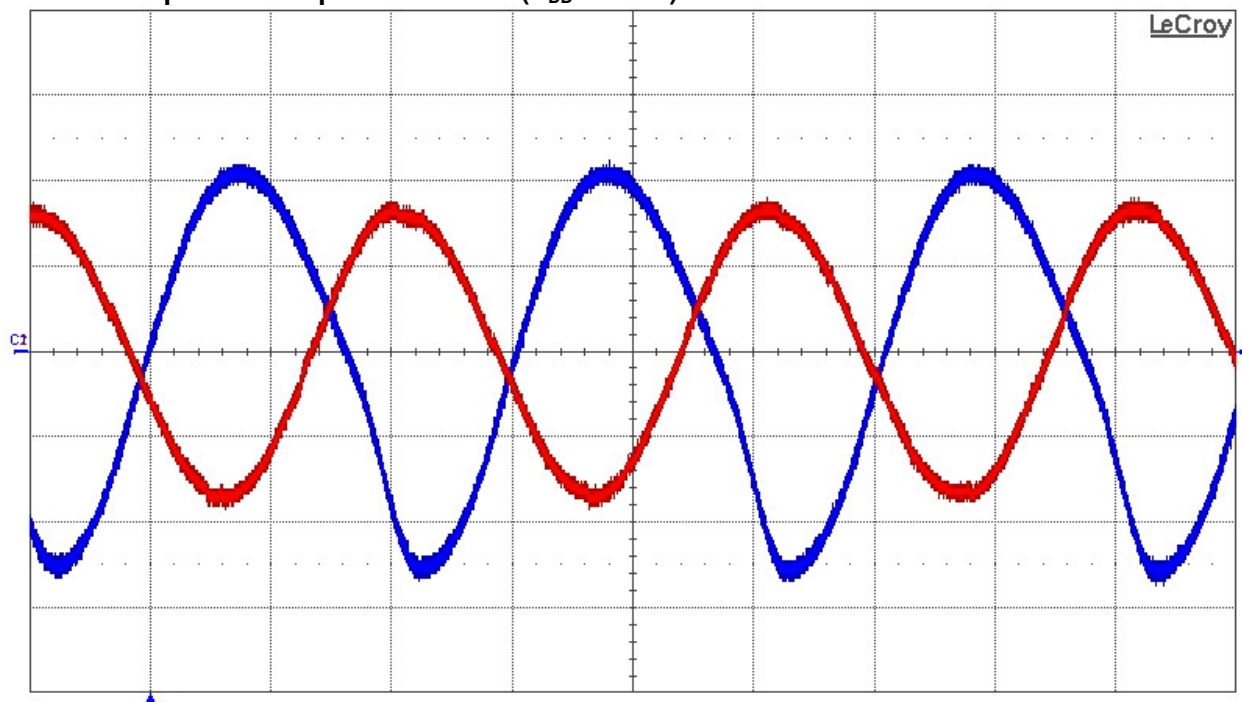
Recommended crystals, ceramic package: CC1V-T1A, CC4V-T1A, CC5V-T1A, CM7V-T1A and CM8V-T1A.

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



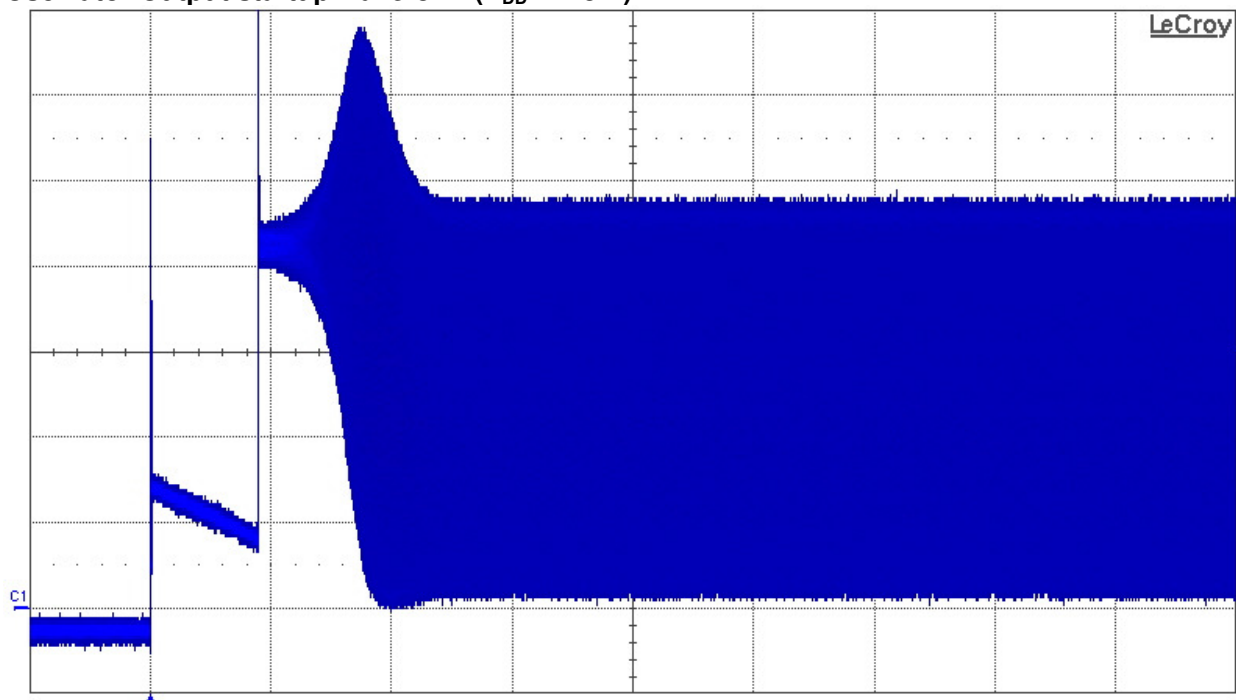
■ C1: Osc. Out (100 mV/div - AC) ■ C2: Osc. In (100 mV/div - AC) Time base: 10  $\mu\text{s}/\text{div}$

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



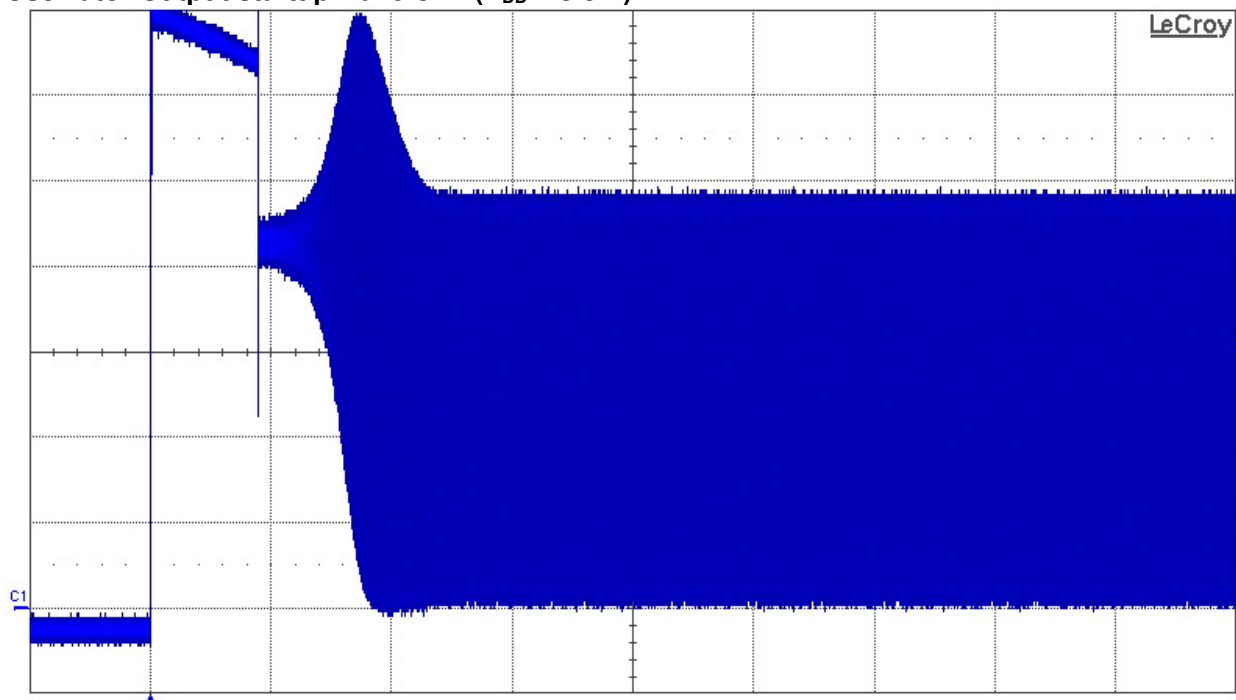
■ C1: Osc. Out (100 mV/div - AC) ■ C2: Osc. In (100 mV/div - AC) Time base: 10  $\mu\text{s}/\text{div}$

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



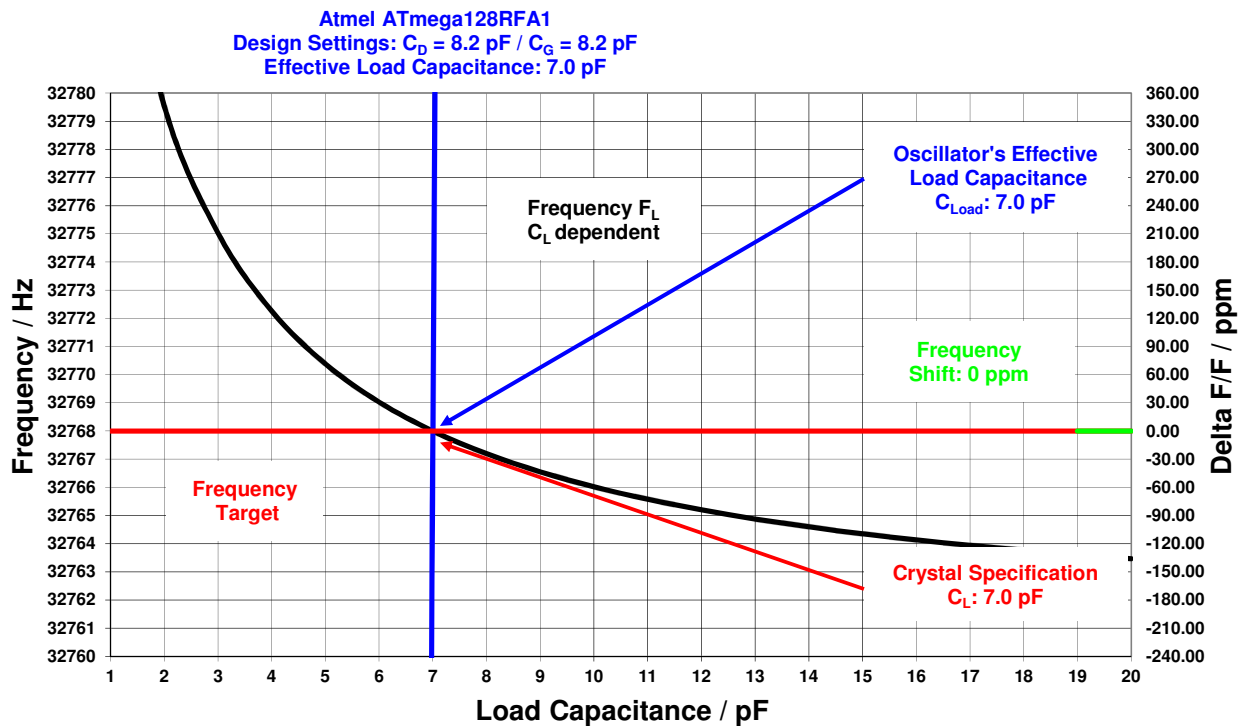
■ C1: Osc. Out (100 mV/div - DC) Time base: 100 ms/div

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  $7.0 \text{ pF}$  results in a frequency offset of 0 ppm using a CM7V-T1A crystal specified for  $C_L = 7.0 \text{ pF}$ .

## Frequency vs. temperature chart:

Conventional Tuning Fork Crystal

