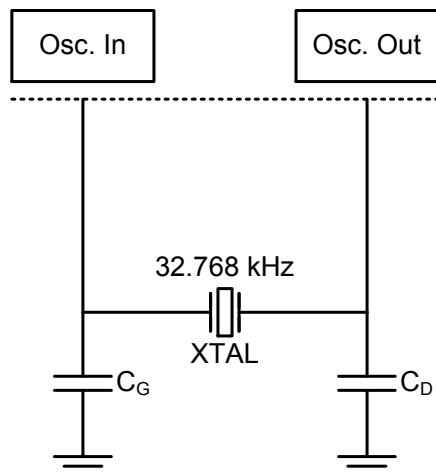


ATmega128RFA1



Oscillator Design Check

Test Conditions

| | | |
|-------------------------------|-----------|-------------------|
| Power Supply Voltage V_{DD} | 1.8 – 3.3 | V |
| Load Capacitors C_D / C_G | 22 / 18 | pF |
| Results | | |
| Effective Load Capacitance | 12.7 | pF |
| Oscillation Allowance | >500 | kΩ |
| Oscillator Output Voltage AC | 120 | mV _{RMS} |
| Drive Level | 0.025 | μW |
| Startup Time | 400 | ms |
| Overtone Mode Suppression | Safe | ---- |

Recommendation

Crystal

| | | |
|------------------------|---------------------|-----|
| Crystal Type | MS3V-T1R / CM7V-T1A | |
| Frequency | 32.768 | kHz |
| Load Capacitance C_L | 12.5 | pF |
| Tolerance | +/-20 | ppm |

Oscillator Design

| | | |
|-------|----|----|
| C_D | 22 | pF |
| C_G | 18 | pF |

Remarks

The ATmega128RFA1 consists of an ultra low power Pierce Oscillator.

Placing $C_D = 22$ pF and $C_G = 18$ pF load capacitors on each side of the crystal results in an effective load capacitance of 12.7 pF (including board stray capacitances) which is a perfect match for a crystal specified for $C_L = 12.5$ pF.

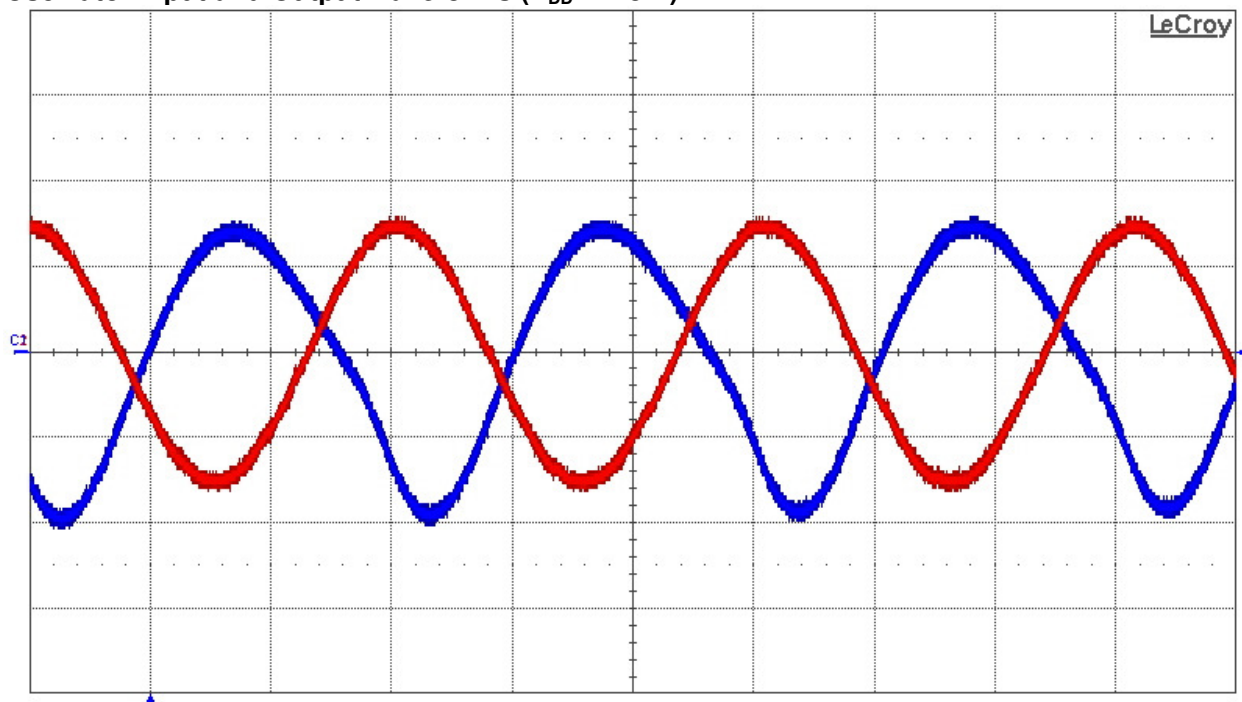
The oscillator circuit provides an oscillation allowance greater than 500 kΩ; this allows the safe use of smallest SMD quartz crystals ($ESR \leq 100$ kΩ).

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.

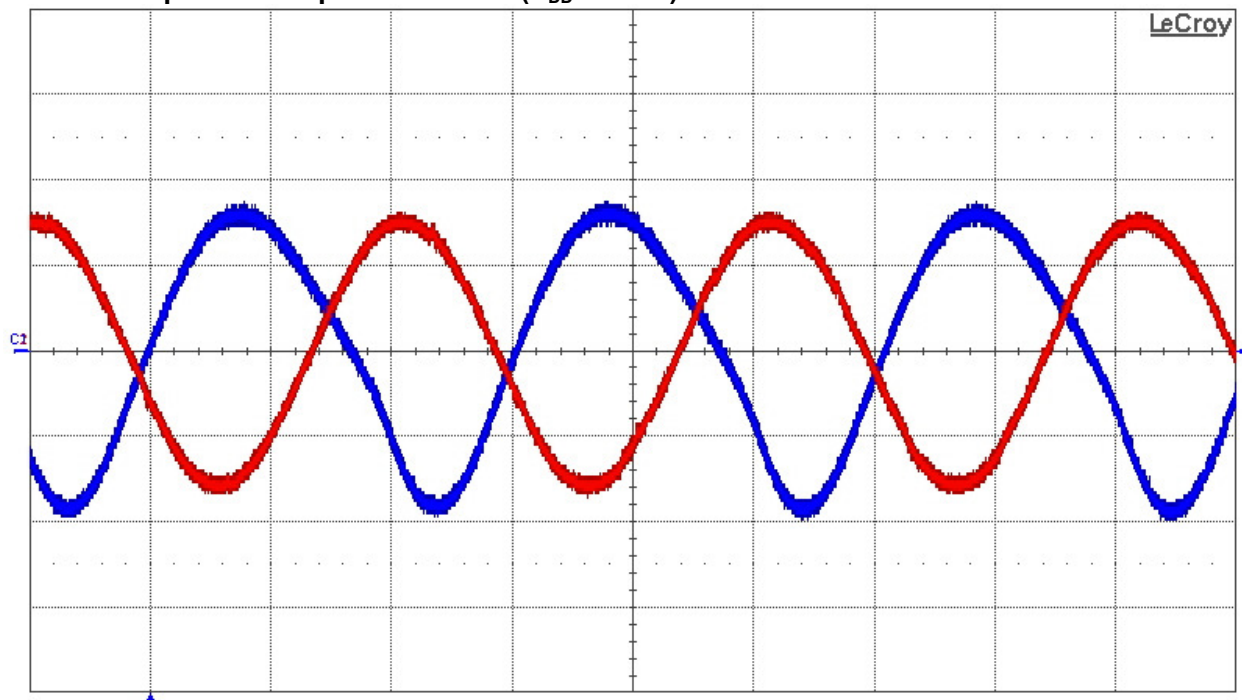
Recommended crystals, ceramic package: CC1V-T1A, CC4V-T1A, CC5V-T1A, CM7V-T1A and CM8V-T1A.

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



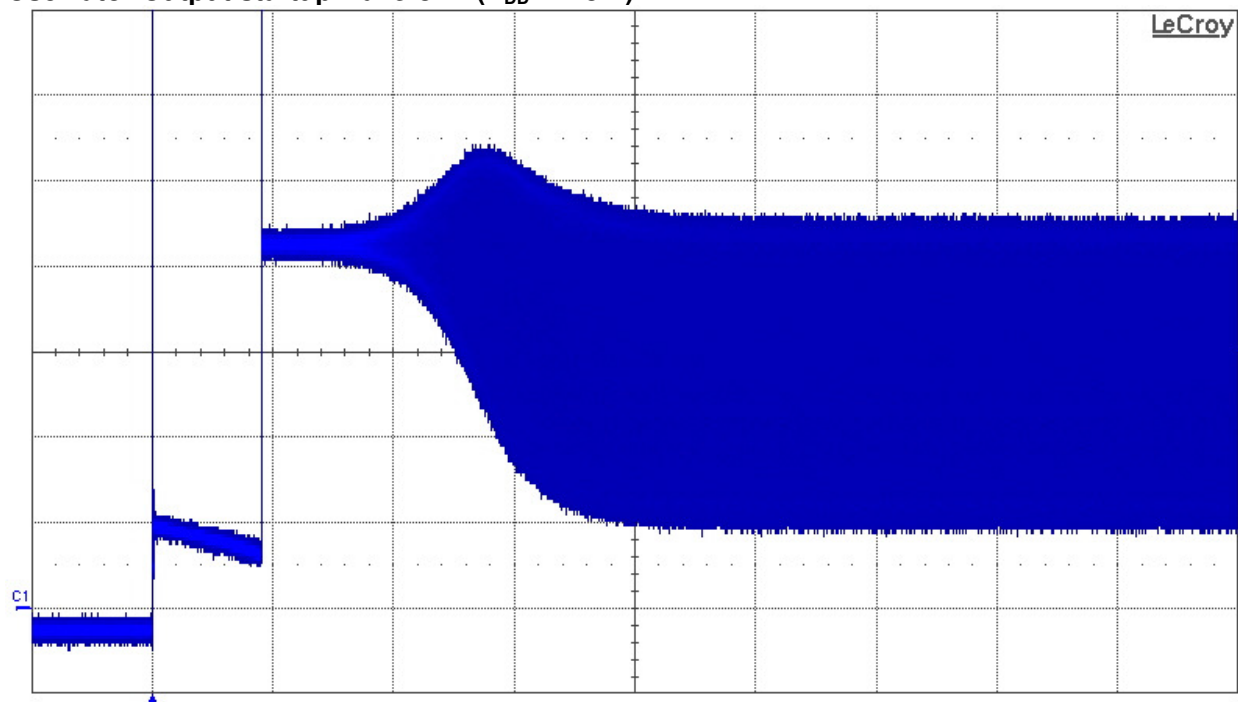
■ C1: Osc. Out (100 mV/div - AC) ■ C2: Osc. In (100 mV/div - AC) Time base: 10 $\mu\text{s}/\text{div}$

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



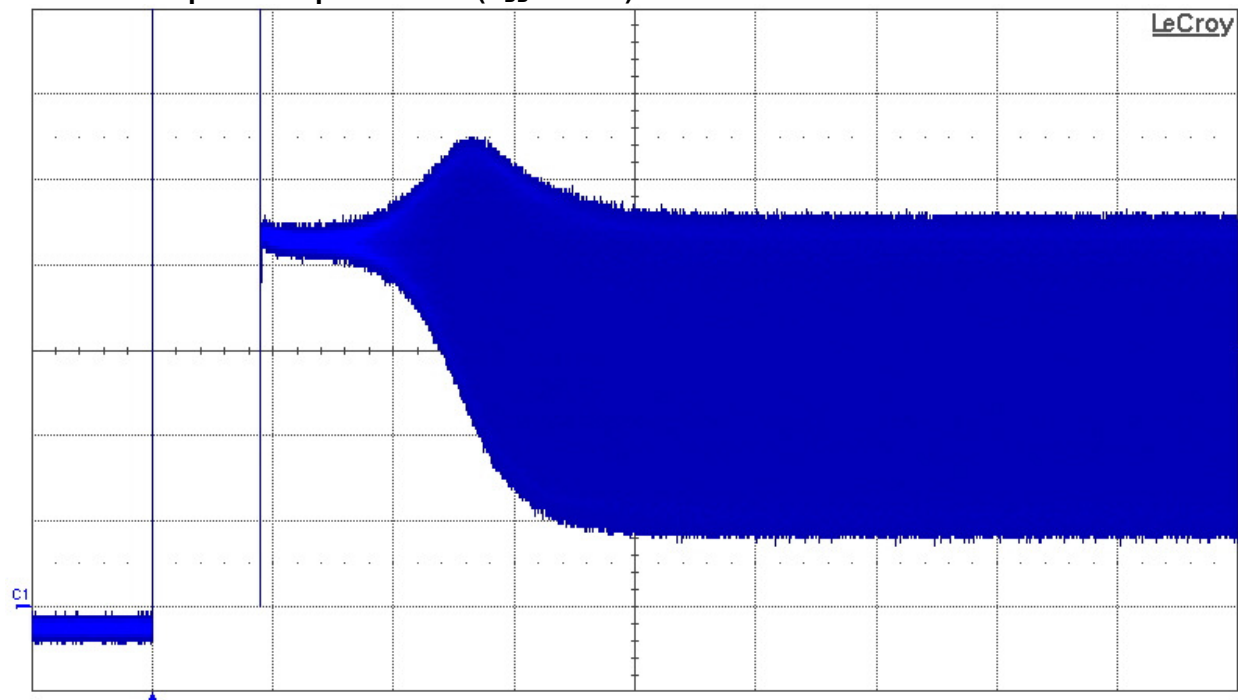
■ C1: Osc. Out (100 mV/div - AC) ■ C2: Osc. In (100 mV/div - AC) Time base: 10 $\mu\text{s}/\text{div}$

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



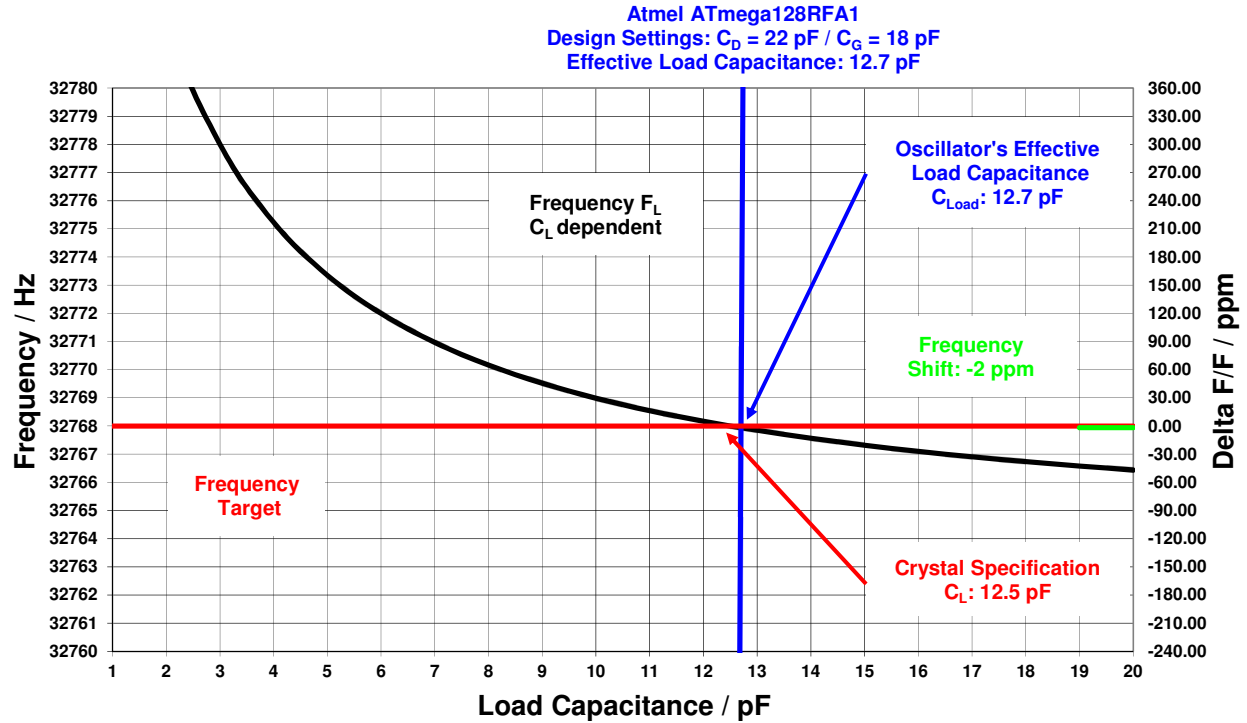
■ C1: Osc. Out (100 mV/div - DC) Time base: 100 ms/div

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 12.7 pF results in a frequency offset of -2 ppm using a CM7V-T1A crystal specified for $C_L: 12.5 \text{ pF}$.

Frequency vs. temperature chart:

