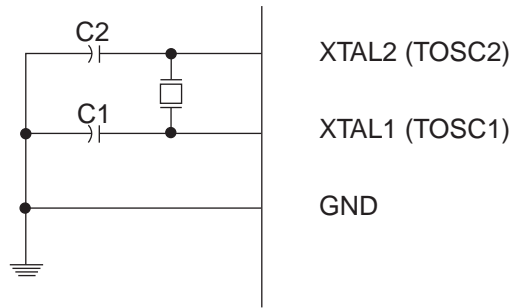


Figure 6-2. Crystal Oscillator Connections



The Low Power Oscillator can operate in three different modes, each optimized for a specific frequency range. The operating mode is selected by the fuses CKSEL3..1 as shown in [Table 6-3 on page 29](#).

Table 6-3. Low Power Crystal Oscillator Operating Modes⁽³⁾

Frequency Range ⁽¹⁾ (MHz)	Recommended Range for Capacitors C1 and C2 (pF)	CKSEL3..1
0.4 - 0.9	—	100 ⁽²⁾
0.9 - 3.0	12 - 22	101
3.0 - 8.0	12 - 22	110
8.0 - 16.0	12 - 22	111

- Notes:
1. This is the recommended CKSEL settings for the different frequency ranges.
 2. This option should not be used with crystals, only with ceramic resonators.
 3. If 8 MHz frequency exceeds the specification of the device (depends on V_{CC}), the CKDIV8 Fuse can be programmed in order to divide the internal frequency by 8. It must be ensured that the resulting divided clock meets the frequency specification of the device.

The CKSEL0 Fuse together with the SUT1..0 Fuses select the start-up times as shown in [Table 6-4](#).

Table 6-4. Start-up Times for the Low Power Crystal Oscillator Clock Selection

Oscillator Source / Power Conditions	Start-up Time from Power-down and Power-save	Additional Delay from Reset ($V_{CC} = 5.0V$)	CKSEL0	SUT1..0
Ceramic resonator, fast rising power	258 CK	14CK + 4.1 ms ⁽¹⁾	0	00
Ceramic resonator, slowly rising power	258 CK	14CK + 65 ms ⁽¹⁾	0	01
Ceramic resonator, BOD enabled	1K CK	14CK ⁽²⁾	0	10
Ceramic resonator, fast rising power	1K CK	14CK + 4.1 ms ⁽²⁾	0	11
Ceramic resonator, slowly rising power	1K CK	14CK + 65 ms ⁽²⁾	1	00