

Chapter 1

Oscillator (OSCV2) Block Description

1.1 Introduction

The OSCV2 module provides two alternative oscillator concepts:

- A low noise and low power Colpitts oscillator with amplitude limitation control (ALC)
- A robust full swing Pierce oscillator with the possibility to feed in an external square wave

1.1.1 Features

The Colpitts OSCV2 option provides the following features:

- Amplitude limitation control (ALC) loop:
 - Low power consumption and low current induced RF emission
 - Sinusoidal waveform with low RF emission
 - Low crystal stress (an external damping resistor is not required)
 - Normal and low amplitude mode for further reduction of power and emission
- An external biasing resistor is not required

The Pierce OSC option provides the following features:

- Wider high frequency operation range
- No DC voltage applied across the crystal
- Full rail-to-rail (2.5 V nominal) swing oscillation with low EM susceptibility
- Fast start up

Common features:

- Clock monitor (CM)
- Operation from the V_{DDPLL} 2.5 V (nominal) supply rail

1.1.2 Modes of Operation

Two modes of operation exist:

- Amplitude limitation controlled Colpitts oscillator mode suitable for power and emission critical applications
- Full swing Pierce oscillator mode that can also be used to feed in an externally generated square wave suitable for high frequency operation and harsh environments

1.2 External Signal Description

This section lists and describes the signals that connect off chip.

1.2.1 V_{DDPLL} and V_{SSPLL} — PLL Operating Voltage, PLL Ground

These pins provide the operating voltage (V_{DDPLL}) and ground (V_{SSPLL}) for the OSCV2 circuitry. This allows the supply voltage to the OSCV2 to be independently bypassed.

1.2.2 EXTAL and XTAL — Clock/Crystal Source Pins

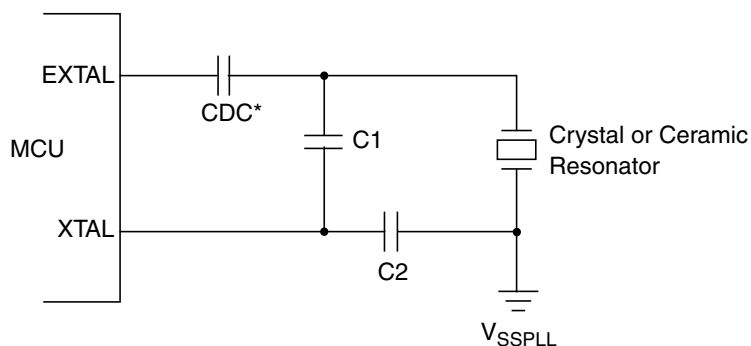
These pins provide the interface for either a crystal or a CMOS compatible clock to control the internal clock generator circuitry. EXTAL is the external clock input or the input to the crystal oscillator amplifier. XTAL is the output of the crystal oscillator amplifier. All the MCU internal system clocks are derived from the EXTAL input frequency. In full stop mode ($PSTP = 0$) the EXTAL pin is pulled down by an internal resistor of typical 200 k Ω .

NOTE

Freescale Semiconductor recommends an evaluation of the application board and chosen resonator or crystal by the resonator or crystal supplier.

The Crystal circuit is changed from standard.

The Colpitts circuit is not suited for overtone resonators and crystals.



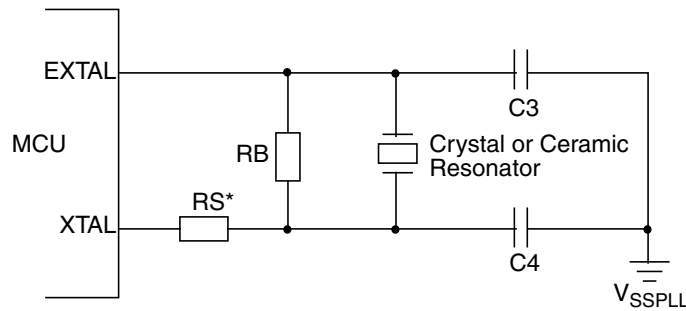
* Due to the nature of a translated ground Colpitts oscillator a DC voltage bias is applied to the crystal.

Please contact the crystal manufacturer for crystal DC bias conditions and recommended capacitor value CDC.

Figure 1-1. Colpitts Oscillator Connections (XCLKS = 0)

NOTE

The Pierce circuit is not suited for overtone resonators and crystals without a careful component selection.



* Rs can be zero (shorted) when used with higher frequency crystals. Refer to manufacturer's data.

Figure 1-2. Pierce Oscillator Connections (XCLKS = 1)

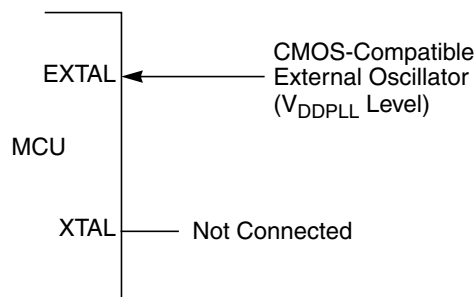


Figure 1-3. External Clock Connections (XCLKS = 1)

1.2.3 XCLKS — Colpitts/Pierce Oscillator Selection Signal

The XCLKS is an input signal which controls whether a crystal in combination with the internal Colpitts (low power) oscillator is used or whether the Pierce oscillator/external clock circuitry is used. The XCLKS signal is sampled during reset with the rising edge of $\overline{\text{RESET}}$. Table 1-1 lists the state coding of the sampled XCLKS signal. Refer to the device overview chapter for polarity of the XCLKS pin.

Table 1-1. Clock Selection Based on XCLKS

XCLKS	Description
0	Colpitts oscillator selected
1	Pierce oscillator/external clock selected

1.3 Memory Map and Register Definition

The CRG contains the registers and associated bits for controlling and monitoring the OSCV2 module.

1.4 Functional Description

The OSCV2 block has two external pins, EXTAL and XTAL. The oscillator input pin, EXTAL, is intended to be connected to either a crystal or an external clock source. The selection of Colpitts oscillator or Pierce oscillator/external clock depends on the XCLKS signal which is sampled during reset. The XTAL pin is an output signal that provides crystal circuit feedback.

A buffered EXTAL signal, OSCCLK, becomes the internal reference clock. To improve noise immunity, the oscillator is powered by the V_{DDPLL} and V_{SSPLL} power supply pins.

The Pierce oscillator can be used for higher frequencies compared to the low power Colpitts oscillator.

1.4.1 Amplitude Limitation Control (ALC)

The Colpitts oscillator is equipped with a feedback system which does not waste current by generating harmonics. Its configuration is “Colpitts oscillator with translated ground.” The transistor used is driven by a current source under the control of a peak detector which will measure the amplitude of the AC signal appearing on EXTAL node in order to implement an amplitude limitation control (ALC) loop. The ALC loop is in charge of reducing the quiescent current in the transistor as a result of an increase in the oscillation amplitude. The oscillation amplitude can be limited to two values. The normal amplitude which is intended for non power saving modes and a small amplitude which is intended for low power operation modes. Please refer to the CRG block description chapter for the control and assignment of the amplitude value to operation modes.

1.4.2 Clock Monitor (CM)

The clock monitor circuit is based on an internal resistor-capacitor (RC) time delay so that it can operate without any MCU clocks. If no OSCCLK edges are detected within this RC time delay, the clock monitor indicates a failure which asserts self clock mode or generates a system reset depending on the state of SCME bit. If the clock monitor is disabled or the presence of clocks is detected no failure is indicated. The clock monitor function is enabled/disabled by the CME control bit, described in the CRG block description chapter.

1.5 Interrupts

OSCV2 contains a clock monitor, which can trigger an interrupt or reset. The control bits and status bits for the clock monitor are described in the CRG block description chapter.