R_10072

Driving LPC175x with EPSON Crystals

Rev. 1.0 — 06 October 2015 **Report**

Document information

Info	Content
Keywords	LPC175x, RTC, Crystal, Oscillator
Abstract	Characterization results of EPSON crystals with LPC175x MHz and (RTC) 32.768kHz Oscillator.

Revision history

Rev	Date	Description
1.0	20151006	Initial version

Contact information

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1. Introduction

The LPC175x series Microcontrollers are ARM Cortex-M3 based MCUs running at frequencies up to 100MHz.

This microcontroller family supports three different clock sources: internal IRC oscillator, crystal (MHz) oscillator, and 32.768 kHz (RTC) oscillator. The nominal IRC frequency is 12MHz. On power-up or any chip reset, the MCU starts up with the IRC as the clock source. Software may later switch to one of the other available clock sources.

We have evaluated/characterized EPSON make 12 MHz and 32.768 kHz (RTC) crystals with LPC175x and the results/recommendations are given below.

2. Characterization results

2.1 MHz oscillator circuit

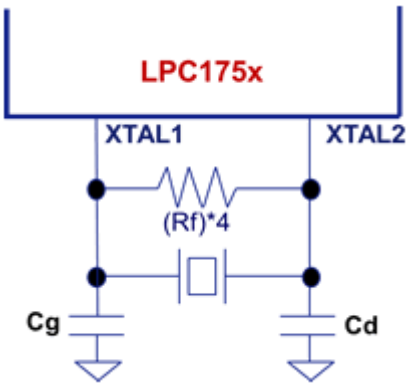

Fig 1. MHz oscillation circuit

2.2 MHz crystal and external components

Based on the characterization results, following crystals and external components are recommended for LPC175x series microcontrollers. Note that equivalent crystals from other manufacturers can also be used instead.

Table 1. Crystal and external components

Product Name	Product Code	Frequency [MHz]	CL [pF]	External Components Cg [pF]	Cd [pF]	Rf [Ω]	Drive Level [uW]	|-R| [Ω]
FA-238V	Q22FA23V00019**	12	10	10	10	1M	45	2445

2.3 RTC oscillator circuit

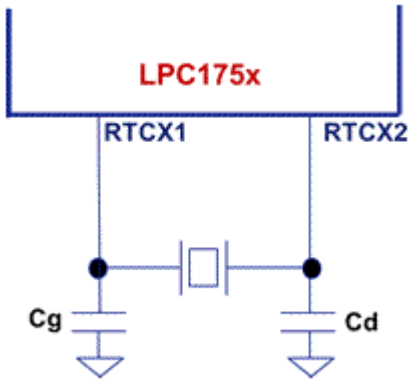

Fig 2. kHz (RTC) oscillation circuit

2.4 RTC recommended crystals and external components

Table 2. Recommended Crystal and External components

Product Name	Product Code	Frequency [kHz]	CL [pF]	External Components Cg [pF]	Cd [pF]	Drive Level [uW]	|-R| [kΩ]
FC-135	Q13FC13500004**	32.768	12.5	22	18	0.004	560
MC-146	Q13MC14620002**	32.768	12.5	22	18	0.005	1000

Notes:

1. Above recommendations are based on the actual evaluation results and solely intended to help users in picking the right components.
2. Though the MHz oscillator evaluation was done with an external feedback resistor (Rf), it is not a requirement and might not be needed in your design. Note that the on-chip oscillator does have an internal feedback resistor.
3. Note that these results are based on a particular hardware board (design) and a particular LPC MCU sample. Therefore, it does not cater to part to part variation, be it MCU or the external components.
4. As the actual board layout (design) and choice of external components greatly influences the best suitable crystal load capacitance, we do not assume any responsibility and grant warranty for above recommendations.
5. It is always recommended that the end users evaluate their own designs to ensure the best performance desired.

For more information on these crystals and guidelines, please visit the EPSON website.
http://www5.epsondevice.com/en/ic_partners/nxp/lpc1x.html

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