Characterization results of EPSON crystals with LPC5410x (RTC) 32.768kHz Oscillator.
Driving LPC5410x with EPSON Crystals

Revision history

<table>
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<th>Rev</th>
<th>Date</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>1.0</td>
<td>20151006</td>
<td>Initial version</td>
</tr>
</tbody>
</table>

Contact information

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For sales office addresses, please send an email to: [salesaddresses@nxp.com](mailto:salesaddresses@nxp.com)
1. Introduction

The LPC5410x series microcontrollers are ARM Cortex-M4F-based MCUs designed to handle the space and power constraints of sensing applications, from simple, ultra-low-power sensor listening, to data aggregation, sensor fusion or other sensor data processing, and external communication.

This microcontroller family supports four different clock sources: internal IRC oscillator, watchdog oscillator, external CLKin and 32.768 kHz RTC oscillator. The nominal IRC frequency is 12 MHz. Upon power-up or any chip reset, the LPC5410x starts up with IRC as the clock source. Software may later switch to one of the other available clock sources.

We have evaluated/characterized EPSON make 32.768 kHz (RTC) crystals with LPC5410x oscillator and the results/recommendations are given below.

2. Characterization results

2.1 Oscillator circuit

![Oscillator circuit diagram]

Fig 1. Oscillator circuit
2.2 Recommended crystals and external components

Based on the characterization results, following crystals and external components are recommended for LPC5410x series microcontrollers. Note that equivalent crystals from other manufacturers can also be used instead.

Table 1. Recommended crystals and external components

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Frequency [kHz]</th>
<th>Product Code</th>
<th>CL [pF]</th>
<th>External Components</th>
<th>Drive Level [uW]</th>
<th></th>
<th>[kΩ]</th>
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<tbody>
<tr>
<td>X1A0001410003xx</td>
<td>32.768</td>
<td></td>
<td>12.5</td>
<td>22</td>
<td>0.008</td>
<td>430</td>
<td></td>
</tr>
<tr>
<td>X1A0001410002xx</td>
<td>9.0</td>
<td></td>
<td>9.0</td>
<td>15</td>
<td>0.005</td>
<td>820</td>
<td></td>
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<tr>
<td>X1A0001410001xx</td>
<td>7.0</td>
<td></td>
<td>7.0</td>
<td>10</td>
<td>0.003</td>
<td>1000</td>
<td></td>
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<tr>
<td>X1A0001410006</td>
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<td>6.0</td>
<td>8</td>
<td>0.003</td>
<td>1000</td>
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Table 2. Recommended crystals and external components

Table description (optional)

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Frequency [kHz]</th>
<th>CL [pF]</th>
<th>External Components</th>
<th>Drive Level [uW]</th>
<th></th>
<th>[kΩ]</th>
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<tr>
<td>FC1610AN</td>
<td>32.768</td>
<td>12.5</td>
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<td>0.007</td>
<td>510</td>
<td></td>
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<tr>
<td></td>
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<td>9.0</td>
<td>12</td>
<td>0.005</td>
<td>1000</td>
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</table>

Notes:

1. Above recommendations are based on the actual evaluation results and solely intended to help users in picking the right components.
2. Note that these results are based on a particular hardware board (design) and a particular LPC MCU sample. So, it does not cater to part to part variation, be it MCU or the external components.
3. 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.
4. 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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## 4. Contents

1. **Introduction** ......................................................... 3
2. **Characterization Results** .................................... 3
   2.1 Oscillator Circuit ................................................. 3
   2.2 Recommended Crystals and External Components .......... 4
3. **Legal information** ................................................ 5
   3.1 Definitions .......................................................... 5
   3.2 Disclaimers ......................................................... 5
   3.3 Trademarks ........................................................ 5
4. **Contents** ............................................................... 6