RASPBERRY PI-Shield for industrial Ethernet Extension

Quickstart Guide Hardware

Version: 1.3

please note:

We reserve the right to make changes.
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Revision History

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<th>Status</th>
<th>Author</th>
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<td>Initial document</td>
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1. **Scope**

This document describes the use of the printed circuit board “2015_013_RASPI-Shield_1V1”.

2. **Definitions**

With the RASPI-Shield and assembled SoM module the range of functions for development applications with the SoM is realized.

There are 3 LEDs for visualization on the PCB integrated. The LED “PWR” shows the presence of the supply voltage of 3.3V. A reset switch “RST” can manual reset the SoM module. The 2 LEDs (LED1 & LED2) are bicolour versions (red/green) to show the status of the industrial network. The action of the LEDs must be implemented by the software of the RASPBERRY PI. The communication LEDs “link” and “activity” inside the RJ45 jacks are controlled by the SoM module.

The meaning of the LEDs is shown in Table 1 Meaning of the LED’s.

![Figure 1 Top view of RASPI-Shield](image_url)

<table>
<thead>
<tr>
<th>Protocol</th>
<th>LED1</th>
<th>LED2</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROFINET</td>
<td>PN</td>
<td>SF</td>
</tr>
<tr>
<td>PROFINET</td>
<td>PN</td>
<td>SF</td>
</tr>
<tr>
<td>EtherNET/IP</td>
<td>EI</td>
<td>MS</td>
</tr>
<tr>
<td>EtherCAT</td>
<td>EC</td>
<td>RUN</td>
</tr>
<tr>
<td>Modbus/TCP</td>
<td>MB</td>
<td>ST</td>
</tr>
</tbody>
</table>

Table 1 Meaning of the LED’s
3. Pin assignment

The Figure 2 40pin RASPBERRY GPIO connector shows the pin assignment of the RASPBERRY PI board.

![40pin RASPBERRY GPIO connector](image)

**Figure 2 40pin RASPBERRY GPIO connector**

In **Table 2 used pins** the pins are listed used by the shield.

<table>
<thead>
<tr>
<th>PIN Nr</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>MOSI SPI0</td>
</tr>
<tr>
<td>21</td>
<td>MISO SPI0</td>
</tr>
<tr>
<td>23</td>
<td>SCK SPI0</td>
</tr>
<tr>
<td>24</td>
<td>CS SPI0</td>
</tr>
<tr>
<td>33</td>
<td>RESET</td>
</tr>
<tr>
<td>35</td>
<td>LED1 green</td>
</tr>
<tr>
<td>36</td>
<td>LED1 red</td>
</tr>
<tr>
<td>37</td>
<td>LED2 green</td>
</tr>
<tr>
<td>38</td>
<td>LED2 red</td>
</tr>
</tbody>
</table>

**Table 2 used pins**

The MOSI, MISO, SCK, CS pins are connected with the standard SPI0 interface of the Raspberry Pi. The four LED pins are GPIOs of the Raspberry Pi and these are low active.
4. Electrical Characteristics

**Note:** All following ratings refer only the Shield-Board with assembled SoM module. Electrical characteristics of RaspberryPi single board computer can differ.

Stress exceeding maximum ratings even for short time may damage the module. Functional operation above the recommended operating conditions is not guaranteed. Extended exposure to stress above the recommended operating conditions may affect device reliability.

Table 3: Operating Conditions for the RasPi-Shield-Board

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>$V_{CC}$</td>
<td>4.9 to +5.1</td>
<td>V</td>
</tr>
<tr>
<td>I/O voltage</td>
<td>$V_I / V_O$</td>
<td>-0.3 to +3.6</td>
<td>V</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>$T_S$</td>
<td>-40 to +85</td>
<td>°C</td>
</tr>
</tbody>
</table>

Table 4: Operating Conditions for the Module

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply</td>
<td>$V_{CC}$</td>
<td>3.15</td>
<td>3.3</td>
<td>3.45</td>
<td>V</td>
</tr>
<tr>
<td>Power consumption</td>
<td>$P$</td>
<td>1.3</td>
<td>2.0</td>
<td></td>
<td>W</td>
</tr>
<tr>
<td>(at 3.3V)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>$T_a$</td>
<td>-40</td>
<td>-40 to +70</td>
<td>°C</td>
<td></td>
</tr>
</tbody>
</table>

Table 5: Operating conditions for application interface

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage high</td>
<td>$V_{IH}$</td>
<td>2.0</td>
<td></td>
<td>$V_{CC} + 0.3$</td>
<td>V</td>
</tr>
<tr>
<td>Input voltage low</td>
<td>$V_{IL}$</td>
<td>-0.3</td>
<td>0.8</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Output voltage high</td>
<td>$V_{OH}$</td>
<td></td>
<td>$V_{CC} - 0.1$</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Output voltage low</td>
<td>$V_{OL}$</td>
<td></td>
<td>0.1</td>
<td></td>
<td>V</td>
</tr>
</tbody>
</table>

All further specifications and timings assume the application of the above mentioned operating conditions.

Table 6: SPI (slave) operation

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPI clock period</td>
<td>$t_{cl}$</td>
<td>60</td>
<td></td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>Setup time</td>
<td>$t_{su}$</td>
<td>10</td>
<td></td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>Hold time</td>
<td>$t_{h}$</td>
<td>15</td>
<td></td>
<td></td>
<td>ns</td>
</tr>
</tbody>
</table>

Figure 3: SPI timing
5. Board Dimension

All dimensions are metric (mm).

Figure 4 Board dimension
6. Application
Sample applications and library can download from ours webside at

https://www.system-on-module.com/en.html