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4 Overview

The Trenz Electronic TEP0006 is an Ultra96 LS Expansion to Pmod adapter.
Refer to http://trenz.org/tep0006-info for the current online version of this manual and other available documentation.

4.1 Key Features

- **On Board:**
  - 4x Voltage Level Translators
  - 2x Voltage Regulators

- **Interface:**
  - 1x Ultra96 LS Expansion Header (40 Pins)
  - 3x Pmod Connectors
  - 3x Jumpers

- **Power:**
  - 5V
  - VCC_PSAUX

- **Dimension:**
  - 85 mm x 17 mm

4.2 Block Diagram
Figure 1: TEP0006 block diagram

4.3 Main Components

Figure 2: TEP0006 Main Components
1. PMod 2x6 Host Socke (PMOD 2) ,J2
2. PMod 2x6 Host Socke (PMOD 2) ,J1
3. Level Translator (HP_GPIO[0..7]), U1
4. Level Translator (HP_GPIO[8..15]), U3
5. Level Translator PMOD(SPI), U6
6. Linear Voltage Regulator, U2
7. Jumper, J6-J7
8. PMod 2x6 Host Socke (SPI), J4
9. GROVE, J5
10. Level Translator (GROVE), U5
11. Jumper (Voltage select), J10
12. Ultra96 LS Expansion Header (40 Pos), J3

4.4 Initial Delivery State

<table>
<thead>
<tr>
<th>Storage device name</th>
<th>Content</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Initial delivery state of programmable devices on the module

4.5 Configuration Signals
5 Signals, Interfaces and Pins

5.1 Low Speed Expansion Connector

The SMD Header J3 has 40 pin (20x2) and it is compatible with Ultra96 LS Expansion Connector. You can find General information about the LS Expansion connector in the following table.

<table>
<thead>
<tr>
<th>Schematic</th>
<th>Connected to</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD_GPIO0...7</td>
<td>Level Translator HP_GPIO[0...7], U1</td>
<td>GPIO0...7</td>
</tr>
<tr>
<td>HD_GPIO8...15</td>
<td>Level Translator HP_GPIO[8...15], U3</td>
<td>GPIO8...15</td>
</tr>
<tr>
<td>MIO36...37</td>
<td>Level Translator PMOD(SPI)</td>
<td>PS_GPIO_0...1</td>
</tr>
<tr>
<td>MIO38, MIO41...43</td>
<td>Level Translator PMOD(SPI)</td>
<td>SPI</td>
</tr>
<tr>
<td>VCC_PSAUX</td>
<td>Level Translator, U1-U3-U5-U6 Voltage Regulator, U2</td>
<td>1.8 V nPOK</td>
</tr>
<tr>
<td>5V</td>
<td>Voltage Regulator, U2 Jumper, J10</td>
<td>Vin Pull up Voltage</td>
</tr>
</tbody>
</table>

**Table 2: Ultra96 LS Expansion information**

5.2 Pmod Connectors

The TEP0006 is equipped with three Pmod connectors. Pmod Connectors are the expanded outputs from Ultra96 Board.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Connected to</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pmod 1, J1</td>
<td>Pmod 2, J2</td>
</tr>
<tr>
<td>1</td>
<td>PMOD_HD-GPIO0</td>
<td>PMOD_HD-GPIO8</td>
</tr>
<tr>
<td>2</td>
<td>PMOD_HD-GPIO1</td>
<td>PMOD_HD-GPIO9</td>
</tr>
<tr>
<td>3</td>
<td>PMOD_HD-GPIO2</td>
<td>PMOD_HD-GPIO10</td>
</tr>
<tr>
<td>Pin</td>
<td>Connected to</td>
<td>Notes</td>
</tr>
<tr>
<td>-----</td>
<td>--------------</td>
<td>-------</td>
</tr>
<tr>
<td></td>
<td>Pmod 1, J1</td>
<td>Pmod 2, J2</td>
</tr>
<tr>
<td>4</td>
<td>PMOD_HD-GPIO3</td>
<td>PMOD_HD-GPIO11</td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
<td>GND</td>
</tr>
<tr>
<td>6</td>
<td>3.3 V</td>
<td>3.3 V</td>
</tr>
<tr>
<td>7</td>
<td>PMOD_HD-GPIO4</td>
<td>PMOD_HD-GPIO12</td>
</tr>
<tr>
<td>8</td>
<td>PMOD_HD-GPIO5</td>
<td>PMOD_HD-GPIO13</td>
</tr>
<tr>
<td>9</td>
<td>PMOD_HD-GPIO6</td>
<td>PMOD_HD-GPIO14</td>
</tr>
<tr>
<td>10</td>
<td>PMOD_HD-GPIO7</td>
<td>PMOD_HD-GPIO15</td>
</tr>
<tr>
<td>11</td>
<td>GND</td>
<td>GND</td>
</tr>
<tr>
<td>12</td>
<td>3.3 V</td>
<td>3.3 V</td>
</tr>
</tbody>
</table>

Table 3: Pmod Connectors information

### 5.3 Jumpers

<table>
<thead>
<tr>
<th>Designator</th>
<th>Functionality</th>
<th>Connection Between</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>J6</td>
<td>HD_GPIO_15</td>
<td>Level Translator U3 and U5</td>
<td>If you install the jumper HD_GPIO_15 will be driven through Level Translator (U5) and Grove (J5) otherwise it goes to Level Translator (U3).</td>
</tr>
<tr>
<td>J7</td>
<td>HD_GPIO_11</td>
<td>Level Translator U3 and U5</td>
<td>If you put the jumper HD_GPIO_11 will be driven through Level Translator (U5) and Grove (J5) otherwise it goes to Level Translator (U3).</td>
</tr>
<tr>
<td>J10</td>
<td>Voltage select</td>
<td>5 V, 3.3 V</td>
<td>Pull up Voltage</td>
</tr>
</tbody>
</table>

Table 4: Pmod Connectors information
6  

On-board Peripherals

<table>
<thead>
<tr>
<th>Chip/Interface</th>
<th>Designator</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

Table 5: On board peripherals
7 Power and Power-On Sequence

7.1 Power Supply

Power is supplied by Ultra96 Board through SMD Header J3.

7.2 Power Consumption

<table>
<thead>
<tr>
<th>Power Input Pin</th>
<th>Typical Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>5V</td>
<td>TBD</td>
</tr>
<tr>
<td>VCC_PSAUX</td>
<td>TBD</td>
</tr>
</tbody>
</table>

* Table 6: Power Consumption  
  * TBD - To Be Determined

7.3 Power Distribution Dependencies

![Figure 3: Power Distribution](image)

7.4 Power-On Sequence

There is no specific power on sequence, after power on the Ultra96 Board all electrical components on TEP0006 will be enabled.

7.5 Power Rails

<table>
<thead>
<tr>
<th>Power Rail Name</th>
<th>LS Expansion Connector Pin</th>
<th>Direction</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>+5V</td>
<td>37</td>
<td>Input</td>
<td>Supplied by Ultra96</td>
</tr>
</tbody>
</table>
### Power Rail Name

<table>
<thead>
<tr>
<th>Power Rail Name</th>
<th>LS Expansion Connector Pin</th>
<th>Direction</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>VCC_PSAUX</td>
<td>35</td>
<td>Input</td>
<td>Supplied by Ultra96</td>
</tr>
</tbody>
</table>

Table 7: Module power rails.

### 7.6 Technical Specifications

### 7.7 Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Symbols</th>
<th>Description</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>T_STG</td>
<td>Storage Temperature</td>
<td>-55</td>
<td>150</td>
<td>°C</td>
</tr>
</tbody>
</table>

Table 8: PS absolute maximum ratings

### 7.8 Recommended Operating Conditions

Operating temperature range depends also on customer design and cooling solution. Please contact us for options.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Min</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>T_OPT</td>
<td>-40</td>
<td>+85</td>
<td>°C</td>
</tr>
</tbody>
</table>

Table 9: Recommended operating conditions.

### 7.9 Physical Dimensions

- Module size: 85 mm × 17 mm. Please download the assembly diagram for exact numbers.

PCB thickness: 1.6 mm.

Figure 4: Physical Dimension
8 Currently Offered Variants

<table>
<thead>
<tr>
<th>Trenz shop TEP0006 overview page</th>
</tr>
</thead>
<tbody>
<tr>
<td>English page¹</td>
</tr>
</tbody>
</table>

Table 10: Trenz Electronic Shop Overview

¹ https://shop.trenz-electronic.de/en/search?sSearch=TEP0006
² https://shop.trenz-electronic.de/de/search?sSearch=TEP0006
9 Revision History

9.1 Hardware Revision History

<table>
<thead>
<tr>
<th>Date</th>
<th>Revision</th>
<th>Changes</th>
<th>Documentation Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019-07-19</td>
<td>01</td>
<td>Initial Release</td>
<td>REV01³</td>
</tr>
</tbody>
</table>

Table 11: Hardware Revision History

Hardware revision number can be found on the PCB board together with the module model number separated by the dash.

Figure 5: Board hardware revision number.

9.2 Document Change History

<table>
<thead>
<tr>
<th>Date</th>
<th>Revision</th>
<th>Contributor</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019-11-07</td>
<td>v.24(see page 6)</td>
<td>John Hartfiel⁴</td>
<td>• Initial release</td>
</tr>
<tr>
<td>--</td>
<td>all</td>
<td>Pedram Babakhani⁵, John Hartfiel⁶</td>
<td>• --</td>
</tr>
</tbody>
</table>

Table 12: Document change history.

---
³ https://shop.trenz-electronic.de/Download/?path=Trenz_Electronic/Pmods/TEP0006/REV01
⁴ https://wiki.trenz-electronic.de/display/~j.hartfiel
⁵ https://wiki.trenz-electronic.de/display/~P.Babakhani
⁶ https://wiki.trenz-electronic.de/display/~j.hartfiel
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Users of electrical and electronic equipment in private households are required not to dispose of waste electrical and electronic equipment as unsorted municipal waste and to collect such waste electrical and electronic equipment separately. By the 13 August 2005, Member States shall have ensured that systems are set up allowing final holders and distributors to return waste electrical and electronic equipment at least free of charge. Member States shall ensure the availability and accessibility of the necessary collection facilities. Separate collection is the precondition to ensure specific treatment and recycling of waste electrical and electronic equipment and is necessary to achieve the chosen level of protection of human health and the environment in the European Union. Consumers have to actively contribute to the success of such collection and the return of waste electrical and electronic equipment. Presence of hazardous substances in electrical and electronic equipment results in potential effects on the environment and human health. The symbol consisting of the crossed-out wheeled bin indicates separate collection for waste electrical and electronic equipment.

Trenz Electronic is registered under WEEE-Reg.-Nr. DE97922676.

\textsuperscript{7} http://guidance.echa.europa.eu/
\textsuperscript{8} https://echa.europa.eu/candidate-list-table
\textsuperscript{9} http://www.echa.europa.eu/