



## TEB0728 TRM

Revision v.131

Exported on 2019-04-30

Online version of this document:

<https://wiki.trenz-electronic.de/display/PD/TEB0728+TRM>

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## 4 Overview

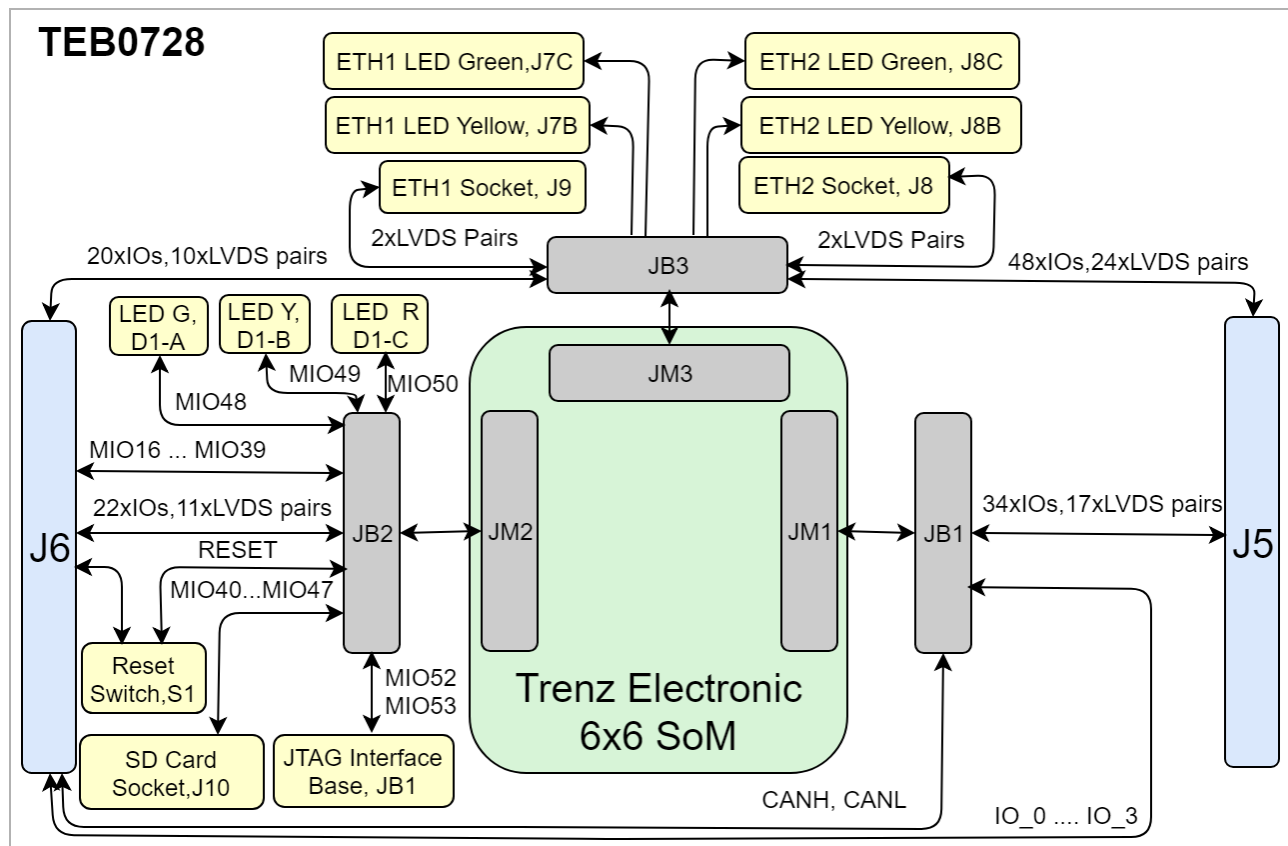
The Trenz Electronic TEB0728 Carrier Board provides functionalities for testing, evaluation and development purposes of company's 6 x 6 cm SoMs. The Carrier Board is equipped with various components and connectors for different configuration setups. See "[6 x 6 SoM](https://wiki.trenz-electronic.de/display/PD/6+x+6+SoM)"<sup>1</sup> Carriers" page for more information about 6 x 6 cm SoMs.

Refer to <http://trenz.org/TEB0728-info><sup>2</sup> for the current online version of this manual and other available documentation.

### 4.1 Key Features

- Samtec Tiger Eye Terminal Socket ( 80 pins, 2 rows)
- Micro SD card socket
- 3 User LEDs, Red, Yellow, Green
- Two RJ45 Gigabit Ethernet socket
- Trenz 6x6 module connector strips (3 x Samtec Tiger Eye series connectors)
- Barrel Jack for 5V power supply
- One user push button

### 4.2 Block Diagram

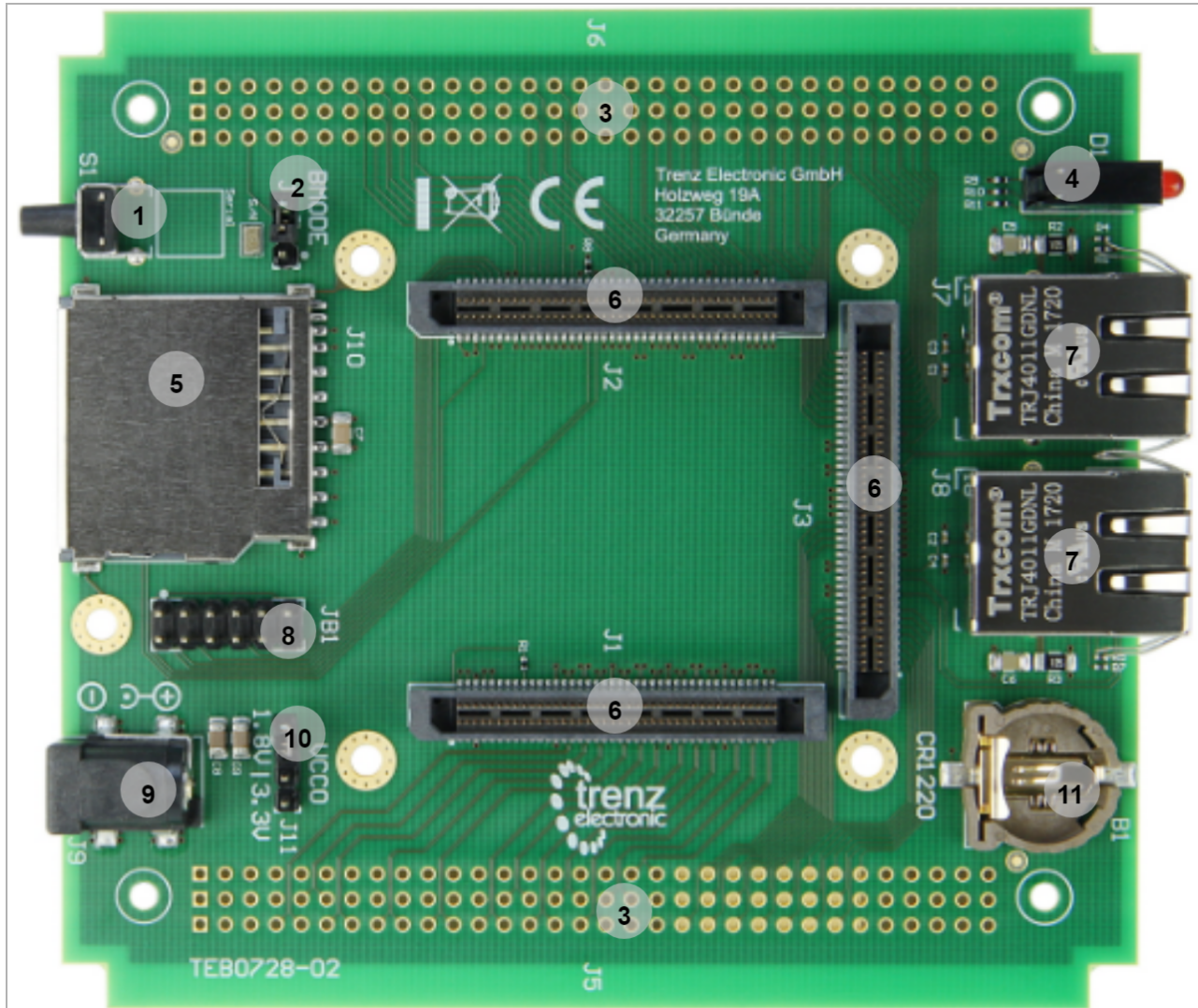


**Figure 1: TEB0728 block diagram**

<sup>1</sup> <https://wiki.trenz-electronic.de/display/PD/6+x+6+SoM+Documentation>

<sup>2</sup> <https://wiki.trenz-electronic.de/display/PD/TEB0728>

## 4.3 Main Components



**Figure 2: TEB0728 main components**

1. User push-button, S1
2. Jumper (Boot Mode), J4
3. External connector (VG96) placeholder, J5 / J6
4. LEDs , D1
5. SD Card Connector, J10
6. Board to Board Connector, J1-J2-J3
7. RJ45 Gigabit Ethernet connector, J7-J8
8. XMOD JTAG- / UART-header, JB1
9. Barrel jack for 5V power supply, J9
10. Jumper(VCCIO\_13), J11
11. CR1220 Backup-Battery holder, B1

## 4.4 Initial Delivery State

There is no hardware component to be programmed on the carrier.

| Storage device name | Content | Notes |
|---------------------|---------|-------|
| ---                 | ---     | ---   |

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

## 4.5 Configuration Signals

| Signal | Designator | B2B   | Jumper | Boot Mode |
|--------|------------|-------|--------|-----------|
| Boot_R | J4         | J2-11 | Open   | QSPI      |
|        |            |       | Short  | SD Card   |

**Table 2: Boot process.**

There is a user push button which is used for RESET signal.

| Signal | Designator | B2B  | Active Level |
|--------|------------|------|--------------|
| RESET  | S1         | J2-7 | Active High  |

**Table 3: Reset process.**

## 5 Signals, Interfaces and Pins

### 5.1 Board to Board (B2B) I/Os

Number of I/O signals FPGA bank numbers connected to the B2B connectors:

| B2B Connector | Interfaces          | Number of I/O                    | Notes                                                                         |
|---------------|---------------------|----------------------------------|-------------------------------------------------------------------------------|
| J1            | User I/O            | 48 singel ended, 24 differential | Connected to Bank 13                                                          |
|               |                     | 4 Single ended                   | MIO10...13                                                                    |
|               | CANH , CANL         | 2 single ended                   | MIO8, MIO9                                                                    |
| J2            | User I/O            | 22 singel ended, 11 differential |                                                                               |
|               |                     | 38 single ended                  | MIO16...53                                                                    |
|               | SoM Control Signals | 5                                | RESET, RST_OUT, BOOT_R,                                                       |
|               | JTAG Interface      | 4                                | TCK , TDO, TDI, TMS                                                           |
| J3            | User I/O            | 20 Single ended, 10 differential | Connected to Bank 35                                                          |
|               |                     | 34 single ended, 17 differential | Connected to Bankd 33                                                         |
|               | Ethernet 1          | 4 single ended, 2 differential   | ETH_CTREF , ETH_TD+, ETH_TD- , ETH_RD+, ETH_RD-, ETH_LED1, ETH_LED2, ETH_LED3 |
|               | Ethernet 2          | 4 single ended, 2 differential   | ETH_CTREF , ETH_TD+, ETH_TD- , ETH_RD+, ETH_RD-, ETH_LED1, ETH_LED2, ETH_LED3 |

**Table 4: General overview of PL I/O signals and SoM's interfaces connected to the B2B connectors.**

## 5.2 On-board Connector

| B2B Connector | Interfaces          | Number of I/O                    | Notes                       |
|---------------|---------------------|----------------------------------|-----------------------------|
| J5            | User I/O            | 48 singel ended, 24 differential | Connected to Bank 13        |
|               |                     | 34 single ended, 17 differential | Connected to Bank 33        |
| J6            | User I/O            | 42 singel ended, 21 differential |                             |
|               |                     | 27 single ended                  | MIO16... MIO39 + MIO51...53 |
|               |                     | 4 single ended                   | MIO10...13                  |
|               | SoM Control Signals | 3                                | RESET, RST_OUT, BOOT_R      |
|               | JTAG Interface      | 4                                | TCK , TDO, TDI, TMS         |
|               | CANH , CANL         | 2 single ended                   | MIO8, MIO9                  |

**Table 5: General PL I/O to B2B connectors information**

## 5.3 JTAG Interface Base

JTAG access to the TEB0728 Trenz module is available through B2B connector J2. JTAG Programmer TE0790\_02 is provided by Trenz Electronic, More information is available [here](https://wiki.trenz-electronic.de/display/PD/TE0790+TRM)<sup>3</sup>.

| Designator | B2B Pin | XMOD Header JB1 | Note              |
|------------|---------|-----------------|-------------------|
| A          | J2-15   | JB1-3           | UART Txd - input  |
| B          | J2-16   | JB1-7           | UART Rxd - Output |
| C          | J2-12   | JB1-4           | JTAG-TMS          |
| D          | J2-10   | JB1-8           | JTAG-TDI          |
| F          | J2-8    | JB1-10          | JTAG-TDO          |

<sup>3</sup> <https://wiki.trenz-electronic.de/display/PD/TE0790+TRM>

| Designator | B2B Pin | XMOD Header JB1 | Note                                                      |
|------------|---------|-----------------|-----------------------------------------------------------|
| H          | J2-6    | JB1-12          | JTAG-TCK                                                  |
| G          | J2-7    | JB1-11          | RESET will be connected to Push Button on JTAG Programmer |
| 3.3V       | -       | JB1-5           | connected to GND                                          |
| VIO        | J2-2/4  | JB1-6           | VIO is connected to 3.3V which is supplied by carrier     |

**Table 6: JTAG interface Base**

## 5.4 SD Card Socket

Power supply voltage for SD card holder is 3.3V.

| Signals | B2B   | Notes |
|---------|-------|-------|
| CMD     | J2-29 |       |
| CLK     | J2-34 |       |
| DAT0    | J2-37 |       |
| DAT1    | J2-40 |       |
| DAT2    | J2-32 |       |
| CD/DAT3 | J2-31 |       |
| CD      | J2-35 |       |
| WP      | J2-33 |       |

**Table 7: On board peripherals**

## 5.5 RJ45 Connector

Both Ethernet sockets,ETH1 and ETH2, are connected to the Board to Board (B2B) J3 on the carrier.

| Signal  | ETH1  | ETH2  | Notes    |
|---------|-------|-------|----------|
| ETH_TD+ | J3-58 | J3-28 | Transfer |
| ETH_TD- | J3-56 | J3-26 |          |

| Signal    | ETH1  | ETH2  | Notes                |
|-----------|-------|-------|----------------------|
| ETH_RD+   | J3_52 | J3-22 | Receive              |
| ETH_RD-   | J3-50 | J3-20 |                      |
| ETH_CTREF | J3_57 | J3-25 |                      |
| ETH_LED1  | J3-55 | J3-23 | Yellow LED- Activity |
| ETH_LED3  | J3-51 | J3-19 | Green Green- Link    |

**Table 8: Quad SPI interface MIOs and pins**

## 6 On-board Peripherals

### 6.1 Push button

| Designator | Connected to | B2B  | Active Level | Note                |
|------------|--------------|------|--------------|---------------------|
| S1-A       | RESET        | J2-7 | Active high  | General Input RESET |

**Table 9: On-board push button**

### 6.2 Jumpers

| Designator | Connected to | B2B   | Note           |
|------------|--------------|-------|----------------|
| J4         | Boot_R       | J2-11 | Open: QSPI     |
|            |              |       | Short: SD Card |

**Table 10: On-board Jumpers**

| Designator | Connected to | Voltage | Note                                   |
|------------|--------------|---------|----------------------------------------|
| J11        | VCCIO_13     | 3.3 V   | Pin 1 and the middle pin are connected |
|            |              | 1.8 V   | Pin 3 and the middle pin are connected |

**Table 11: On-board Jumpers**

### 6.3 LEDs

| Designator | Color  | B2B   | Active Level | Note |
|------------|--------|-------|--------------|------|
| D1-A       | Red    | J2-30 | Active high  |      |
| D1-B       | Yellow | J2-38 | Active high  |      |
| D1-C       | Green  | J2-36 | Active high  |      |

**Table 12: On-board LEDs**

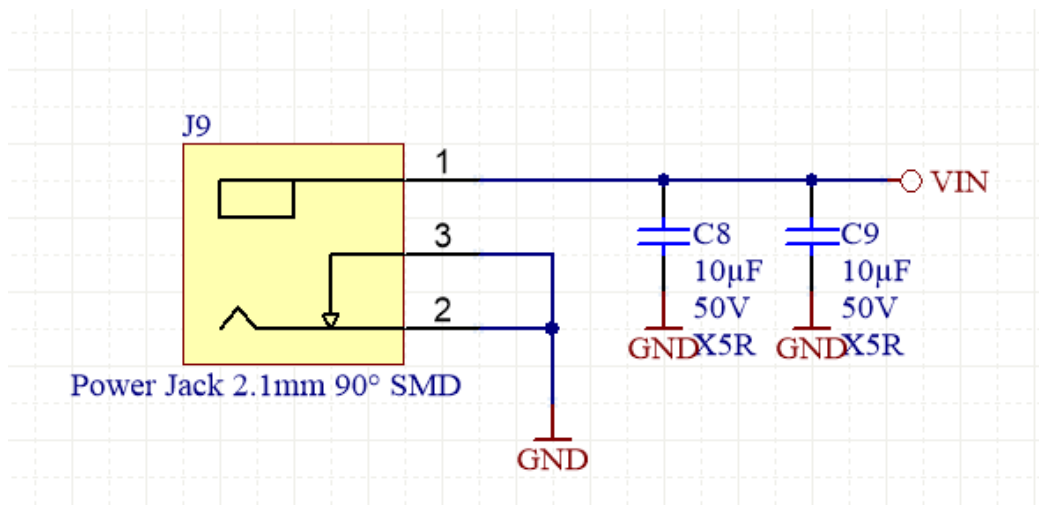
## 7 Power and Power-On Sequence

### 7.1 Power Supply

**⚠** No power supply protection circuit on the carrier, module will be powered directly

Single 5V power supply with minimum current capability of 2.5A is recommended to operate the board.

- 5V VIN (inner)
- GND (outer)
- 



**Figure 3: Power Connector**

### Power Consumption

| Power Input Pin | Typical Current |
|-----------------|-----------------|
| VIN             | TBD*            |
| VBATT           | TBD*            |

**Table 13: Power Consumption**

\* TBD - To Be Determined

### 7.2 Power Supply

| Power Rail Name | B2B Connector | Direction | Notes |
|-----------------|---------------|-----------|-------|
| VIN             | J1-1, J1-3    | Input     | 5V    |

| Power Rail Name | B2B Connector | Direction | Notes                      |
|-----------------|---------------|-----------|----------------------------|
| VBAT            | J2-1          | Input     | Battery for RTC            |
| VCCO_13         | J1-39         | Input     | Selectable over Jumper J11 |

**Table 14: Module power rails.**

## 7.3 Power Rails

| Module Connector (B2B) Designator | VCC / VCCIO | Direction | Pins | Notes                            |
|-----------------------------------|-------------|-----------|------|----------------------------------|
| JB1                               | VIN         | Input     | 1,3  | Up to 12V carrier supply voltage |
|                                   | 3.3V        | Input     | 19   | PL IO-bank VCCIO                 |
|                                   | VCCO_13     | Input     | 39   | 1.8V or 3.3V                     |
| JB2                               | 3.3V        | Input     | 2, 4 | 3.3V module supply voltage       |
|                                   | 1.8V        | Input     | 5    | PL IO-bank VCCIO                 |
|                                   | VBATT       | Input     | 1    | RTC buffer voltage               |
| JB3                               | -           | -         | -    | -                                |

**Table 15: Carrier Power Rails.**

## 8 Board to Board Connectors

6 x 6 modules use two or three [Samtec Micro Tiger Eye Socket Strip](#)<sup>4</sup> on the bottom side.

- 3 x REF-189018-01 (compatible to TEM-140-02-03.0-H-D-A), (80 pins, "40" per row)

| Connector Specifications    | Value                            |
|-----------------------------|----------------------------------|
| Insulator material          | Black Liquid Crystal Polymer     |
| Stacking height             | 6 mm                             |
| Contact material            | Phosphor-bronze                  |
| Plating                     | Au or Sn over 50 µ" (1.27 µm) Ni |
| Current rating              | 2.9 A per pin (2 pins powered)   |
| Operating temperature range | -55 °C to +125 °C                |
| RoHS compliant              | Yes                              |

**Table 16: Connector specifications.**

### 8.1 Connector Mating height

When using the same type on baseboard, the mating height is 6mm. Other mating heights are possible by using connectors with a different height

| Order number | Connector on baseboard | compatible to         | Mating height |
|--------------|------------------------|-----------------------|---------------|
| 26056        | REF-189018-01          | TEM-140-02-03.0-H-D-A | 6 mm          |
|              | SEM-140-02-03.0-H-D-A  | TEM-140-02-03.0-H-D-A | 6 mm          |

**Table 17: Connectors.**

The module can be manufactured using other connectors upon request.

### 8.2 Connector Speed Ratings

The LSHM connector speed rating depends on the stacking height; please see the following table:

| Stacking height    | Speed rating |
|--------------------|--------------|
| 6 mm, Single-Ended | 12 GHz       |

<sup>4</sup> <https://shop.trenz-electronic.de/en/26056-Samtec-Micro-Tiger-Eye-REF-189018-01-80-Pins-fuer-TE0728>

| Stacking height     | Speed rating |
|---------------------|--------------|
| 10 mm, Differential | 17 GHz       |
| 6 mm, Single-Ended  | 14.5 GHz     |
| 10 mm, Differential | 17.5 GHz     |

**Table 18: Speed rating.**

## 8.3 Current Rating

Current rating of Samtec Micro Tiger Eye Connector™ LSHM B2B connectors is 2.9A per pin (2 adjacent pins powered).

## 8.4 Connector Mechanical Ratings

- Shock: 100G, 6 ms Sine
- Vibration: 7.5G random, 2 hours per axis, 3 axes total

## 8.5 Manufacturer Documentation

## 8.6 Absolute Maximum Ratings

| Parameter           | Min | Max | Units | Note                                                                                                              |
|---------------------|-----|-----|-------|-------------------------------------------------------------------------------------------------------------------|
| VIN supply voltage  | --  | --  | V     | <ul style="list-style-type: none"> <li>• Connected directly to the module power supply, see Module TRM</li> </ul> |
| Storage Temperature | -25 | +85 | °C    |                                                                                                                   |

**Table 19: Module absolute maximum ratings.**

## 8.7 Recommended Operating Conditions

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

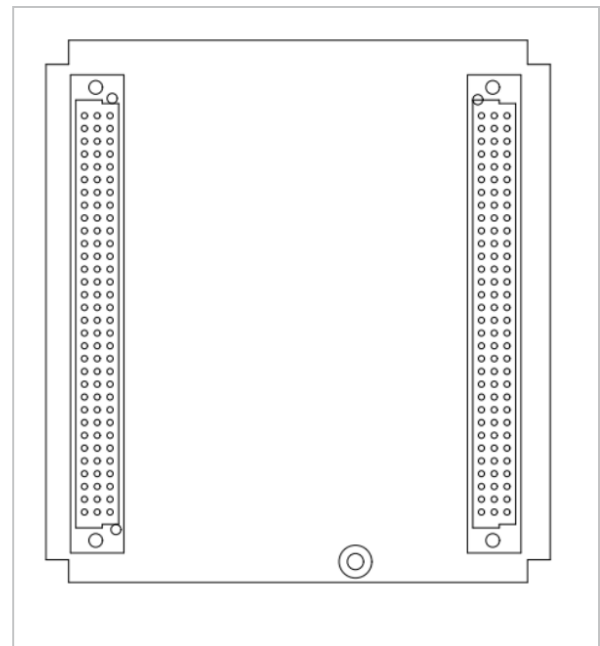
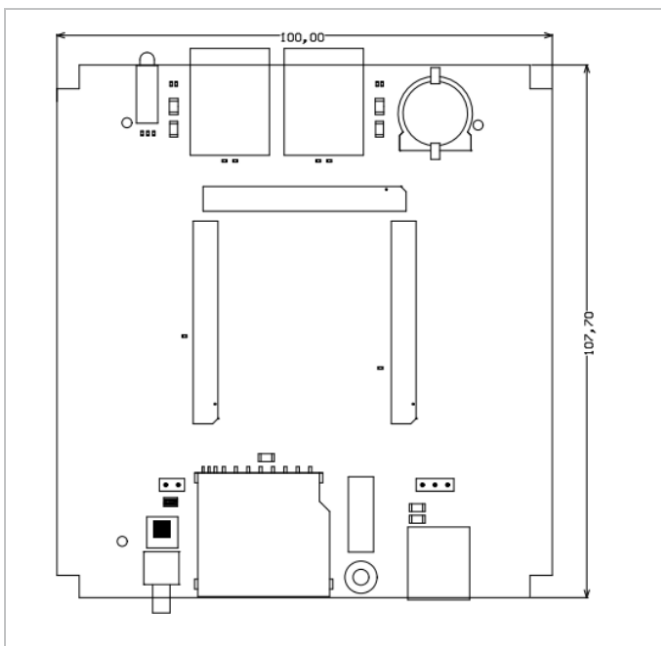
| Parameter          | Min | Max | Units | Note                                                                                                                                                              |
|--------------------|-----|-----|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| VIN supply voltage | --  | --  | V     | <ul style="list-style-type: none"> <li>• Connected directly to the module power supply, see Module TRM</li> <li>• 5V recommended for usage with TE0728</li> </ul> |

| Parameter             | Min | Max | Units | Note |
|-----------------------|-----|-----|-------|------|
| Operating Temperature | -25 | +85 | °C    |      |

**Table 20: Recommended operating conditions.**

## 8.8 Physical Dimensions

- Module size: 100 mm × 107.7 mm. Please download the assembly diagram for exact numbers.
- Mating height with standard connectors: 7 mm.
- PCB thickness: 1.6 mm.



**Figure 4: Physical Dimension**

## 9 Currently Offered Variants

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| Trenz shop TEB0728 overview page         |                                         |
|------------------------------------------|-----------------------------------------|
| <a href="#">English page<sup>5</sup></a> | <a href="#">German page<sup>6</sup></a> |

**Table 21: Trenz Electronic Shop Overview**

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<sup>5</sup> <https://shop.trenz-electronic.de/en/TEB0728-02-Carrierboard-for-a-TE0728-Automotive-Zynq-7020-SoC-micromodule>

<sup>6</sup> <https://shop.trenz-electronic.de/de/TEB0728-02-Traegerboard-fuer-TE0728-Automotive-Zynq-7020-SoC-Micromodul>

## 10 Revision History

### 10.1 Hardware Revision History

| Date       | Revision | Changes                                                                                                                                                                                                                                                                                                                                                                                                                      |
|------------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2018-07-18 | 02       | <ul style="list-style-type: none"> <li>changed value R1</li> <li>changed magjack connectors J7, J8</li> <li>changed 2.1mm power jack THT on SMD</li> <li>magjack connectors: pin8 connected to frame (shassis ground)</li> <li>lib component update</li> <li>added thermal bias to mounting holes</li> <li>added visual serial number</li> <li>changed 2.1mm power jack THT on SMD</li> <li>added 2 x 10uF to VIN</li> </ul> |
| 2016-11-02 | 01       | <ul style="list-style-type: none"> <li>---</li> </ul>                                                                                                                                                                                                                                                                                                                                                                        |

**Table 22: Hardware Revision History**

Hardware revision number is printed on the PCB board next to the module model number separated by the dash.

### 10.2 Document Change History

| Date                                                                                           | Revision          | Contributor                                                                                | Description                                                       |
|------------------------------------------------------------------------------------------------|-------------------|--------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
|  2019-04-29 | v.131(see page 6) | <a href="#">John Hartfiel</a> <sup>7</sup>                                                 | <ul style="list-style-type: none"> <li>initial release</li> </ul> |
| --                                                                                             | all               | <a href="#">Pedram Babakhani</a> <sup>8</sup> , <a href="#">John Hartfiel</a> <sup>9</sup> | <ul style="list-style-type: none"> <li>--</li> </ul>              |

**Table 23: Document change history.**

<sup>7</sup> <https://wiki.trenz-electronic.de/display/~j.hartfiel>

<sup>8</sup> <https://wiki.trenz-electronic.de/display/~P.Babakhani>

<sup>9</sup> <https://wiki.trenz-electronic.de/display/~j.hartfiel>

## 11 Disclaimer

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### 11.1 Data privacy

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Please also note our data protection declaration at <https://www.trenz-electronic.de/en/Data-protection-Privacy>

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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.

 2018-09-18

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<sup>10</sup> <http://guidance.echa.europa.eu/>

<sup>11</sup> <https://echa.europa.eu/candidate-list-table>

<sup>12</sup> <http://www.echa.europa.eu/>

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