



TEI0001 TRM

Revision v.44

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[Current online version of this document.](#)

4 Overview

The Trenz Electronic TEI0001 / MAX1000 is a low cost small-sized FPGA module integrating an [Intel / Altera MAX 10 FPGA](#), serial memory for user application, SDRAM and a 3-axis accelerometer.

Refer to <http://trenz.org/tei0001-info> for current online available documentation.

4.1 Key Features

- **SoC/FPGA/Module**
 - Device: Intel MAX 10
 - Logic Size: 02 / 04 / 08 / 16
 - Speedgrade: 6 / 7 / 8
 - Temperature Range: C / I / A
 - Package: U169
- **RAM/Storage**
 - 8 MByte SDRAM ¹⁾
 - 8 MByte SPI Flash ¹⁾
 - 4 KBit EEPROM for FTDI
- **On Board**
 - ST Microelectronics LIS3DH 3-axis accelerometer
 - JTAG and UART over Micro USB2 connector
 - 8x user LEDs
 - 1x user push button
 - 1x reset button
 - MEMS Oscillator ²⁾
- **Interface**
 - 2x 14-pin headers (2.54 mm pitch) for 7 analog, 15 digital inputs and various connections.
 - 1x PMOD header providing 8 GPIOs
 - 1x 6 pin header for JTAG access to FPGA SoC
 - 1x 3 pin header providing 2 analog inputs or 1 GPIO
- **Power**
 - 5.0 V single power supply via Micro USB or Pin Header
- **Dimension**
 - 61.5 mm x 25 mm
- **Notes**
 - ¹⁾ Assembly variant dependent.
 - ²⁾ Assembly option, default not fitted

4.2 Block Diagram

TEI0001

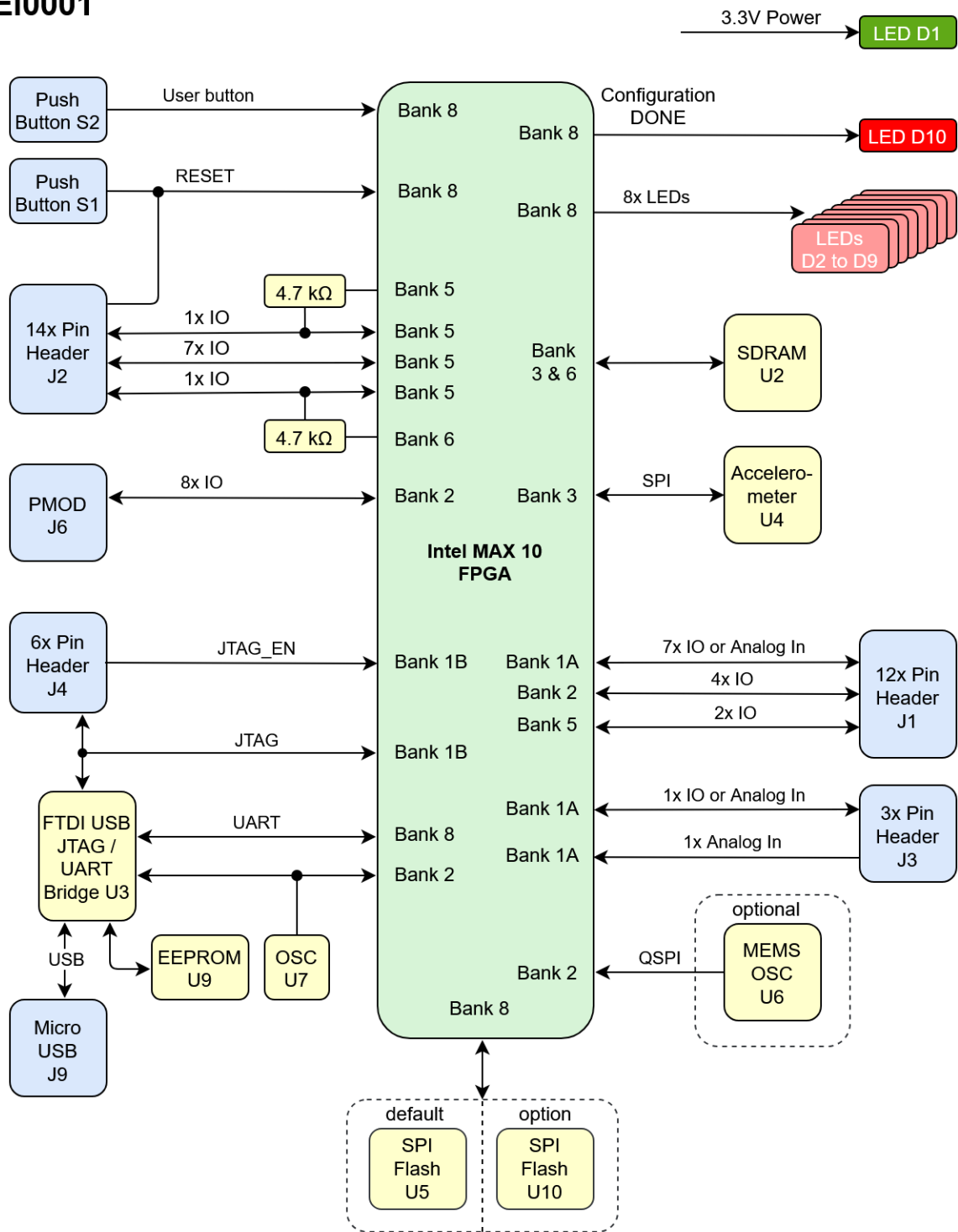


Figure 1: TEI0001 block diagram

4.3 Main Components

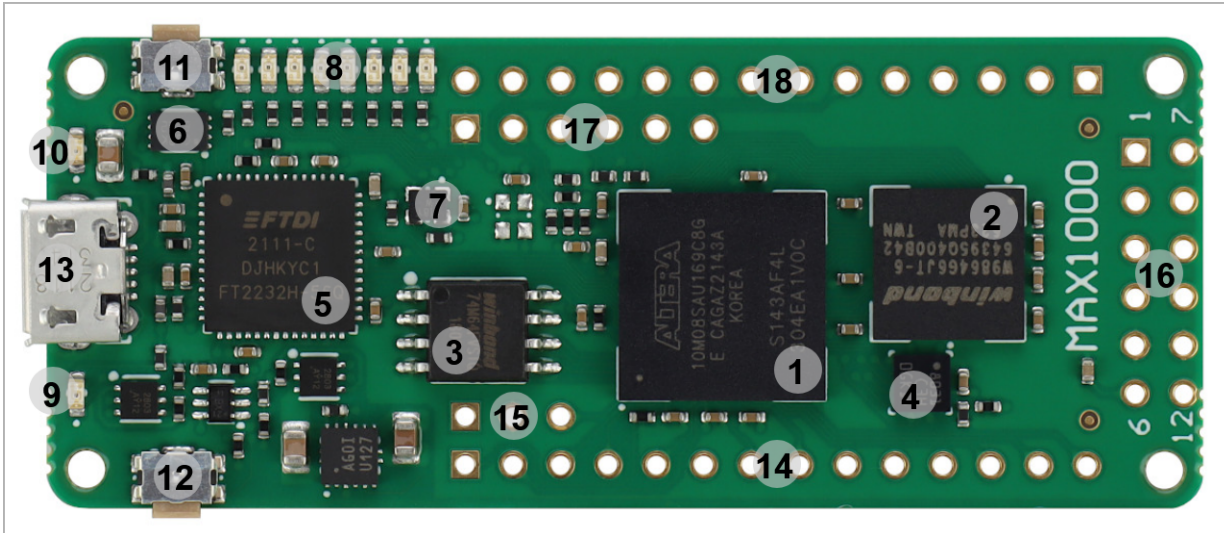


Figure 2: TEI0001 main components

1. Intel MAX 10 FPGA SoC, U1
2. SDRAM, U2
3. SPI Flash memory, U5
4. ST Microelectronics LIS3DH 3D accelerometer, U4
5. FTDI USB-to-JTAG-UART adapter, U3
6. EEPROM for FTDI Configuration, U9
7. 12 MHz oscillator, U7
8. 8x red user LEDs, D2 ... D9
9. Red LED (Configuration DONE), D10
10. Green LED (Module supply voltage), D1
11. Push button (user), S2
12. Push button (reset), S1
13. Micro USB Type B socket, J9
14. 14x pin header (2.54 mm pitch), J2
15. 3x pin header (2.54 mm pitch), J4
16. Pmod connector, J6
17. 6x pin header (2.54 mm pitch), J3
18. 14x pin header (2.54 mm pitch), J1

4.4 Initial Delivery State

Storage device name	Content	Notes
EEPROM, U9 (FTDI configuration EEPROM)	Programmed with INTEL programmer license.	Do not overwrite!
SPI Flash, U5	DEMO Design	TEI0001 Demo - Test Board
FPGA, U1	Bootloader for QSPI Flash	

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

5 Signals, Interfaces and Pins

5.1 Connectors

Connector Type	Designator	Interface	IO CNT	Notes
Micro USB Type B	J9	USB 2.0	2	
PMod 2x6 Pins	J6 ¹⁾	PMOD	8	
Pin Header 2.54 mm	J4 ¹⁾	JTAG	5	
Pin Header 2.54 mm	J3 ¹⁾	Analog IN / IO	2	
Pin Header 2.54 mm	J2 ¹⁾	Digital IO	9	
Pin Header 2.54 mm	J2 ¹⁾	Reset	1	
Pin Header 2.54 mm	J1 ¹⁾	Analog Reference IN	1	
Pin Header 2.54 mm	J1 ¹⁾	Analog IN / IO	6	
Pin Header 2.54 mm	J1 ¹⁾	Digital IO	7	

Table 2: Board Connectors

¹⁾ By default pin headers are assembly option and not soldered.

Test Point	Signal	Notes ¹⁾
-	-	-

Table 3: Test Points Information

¹⁾ Direction:

- IN: Input from the point of view of this board.
- OUT: Output from the point of view of this board.

6 On-board Peripherals

Chip/Interface	Designator	Connected To	Notes
Intel MAX 10 FPGA	U1	- Connectors J1, J2, J3, J4, J6, J9 - SDRAM U2 - FTDI U3 3D Accelerometer U4 - SPI Flash U5 / U10 ¹⁾ 12 MHz OSC U7 - MEMS OSC U6 ²⁾	
SDRAM	U2	FPGA	
FTDI	U3	EEPROM U9	
3D Accelerometer	U4	FPGA	
SPI Flash ¹⁾	U5	FPGA	
SPI Flash ¹⁾	U10	FPGA	
Oscillator	U7	FPGA	12 MHz
Oscillator MEMS ²⁾	U6	FPGA	12 MHz

Chip/Interface	Designator	Connected To	Notes
EEPROM	U9	• FTDI U3	Programmed with INTEL programmer license. Do not overwrite!

Table 4: On board peripherals

¹⁾ Assembly option; default: U5 fitted / U10 not fitted

²⁾ Assembly option.

7 Configuration and System Control Signals

Signal Name	Connector.Pin	Direction ¹⁾	Description
RESET	J2.10	INOUT	Reset FPGA
RESET	S1	IN	Reset FPGA.
JTAG	J4.2	IN	Enable JTAG.

Table 5: Controller signal.

¹⁾ Direction:

- IN: Input from the point of view of this board.
- OUT: Output from the point of view of this board.

8 Power and Power-On Sequence

The TEI0001 module needs one single power supply of 5.0 V nominal. A power supply with minimum current capability of 1 A is recommended.

The power for the FPGA module can be supplied through either the Micro USB connector J9 via supply line 'USB-VBUS' or alternative through pin header J2 via supply line 'VIN'.

8.1 Power Rails

Power Rail Name/ Schematic Name	Connector.Pin	Direction ¹⁾	Notes
VIN	J2.13	IN	
USB_VBUS	J9.1	IN	
5V	J2.14	OUT	
3.3V	J2.12 J6.6 / J6.12	OUT	Generated by U8 from VIN or USB_VBUS.

Table 6: Module power rails.

¹⁾ Direction:

- IN: Input from the point of view of this board.
- OUT: Output from the point of view of this board.

8.2 Recommended Power up Sequencing

There is no power-up sequence, just one single power source via either USB or VIN is needed to power the module.

Sequence	Net name	Recommended Voltage Range	Pull-up/down	Description	Notes
-	-	-	-	-	

Table 7: Baseboard Design Hints

9 Technical Specifications

9.1 Absolute Maximum Ratings ^{*)}

Power Rail Name/ Schematic Name	Description	Min	Max	Unit	Notes
VIN	Supply voltage.	-0.2	6.5	V	
USB_BUS	USB Bus voltage.	4.75	5.5	V	

Table 8: Absolute maximum ratings

^{*)} Stresses beyond those listed under [Absolute Maximum Ratings](#) may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under [Recommended Operating Condition](#). Exposure to absolute-maximum rated conditions for extended periods may affect device reliability.

9.2 Recommended Operating Conditions

This TRM is generic for all variants. Temperature range can be different in dependence to the assembly variant. The Voltage Ranges should not be affected by assembly variants (exceptions are possible, depending on custom request)

9.2.1 Temperature range

The modules components are capable of being operated at commercial-grade temperatures, which cover at least the range of 0 °C to 70 °C.

The operating temperature range depends also on customer design and cooling solution.

9.2.2 Voltage rails

Power Rail Name / Schematic Name	Description	Min	Max	Unit
VIN	Supply voltage.	4.75	5.25	V
USB_BUS	USB Bus voltage.	4.75	5.25	V

Table 9: Recommended operating conditions.

9.3 Physical Dimensions

- Module size: 61.5 mm x 25 mm. Please download the assembly diagram for exact numbers.
- PCB thickness: 1.2 mm $\pm 10\%$.

TEI0001

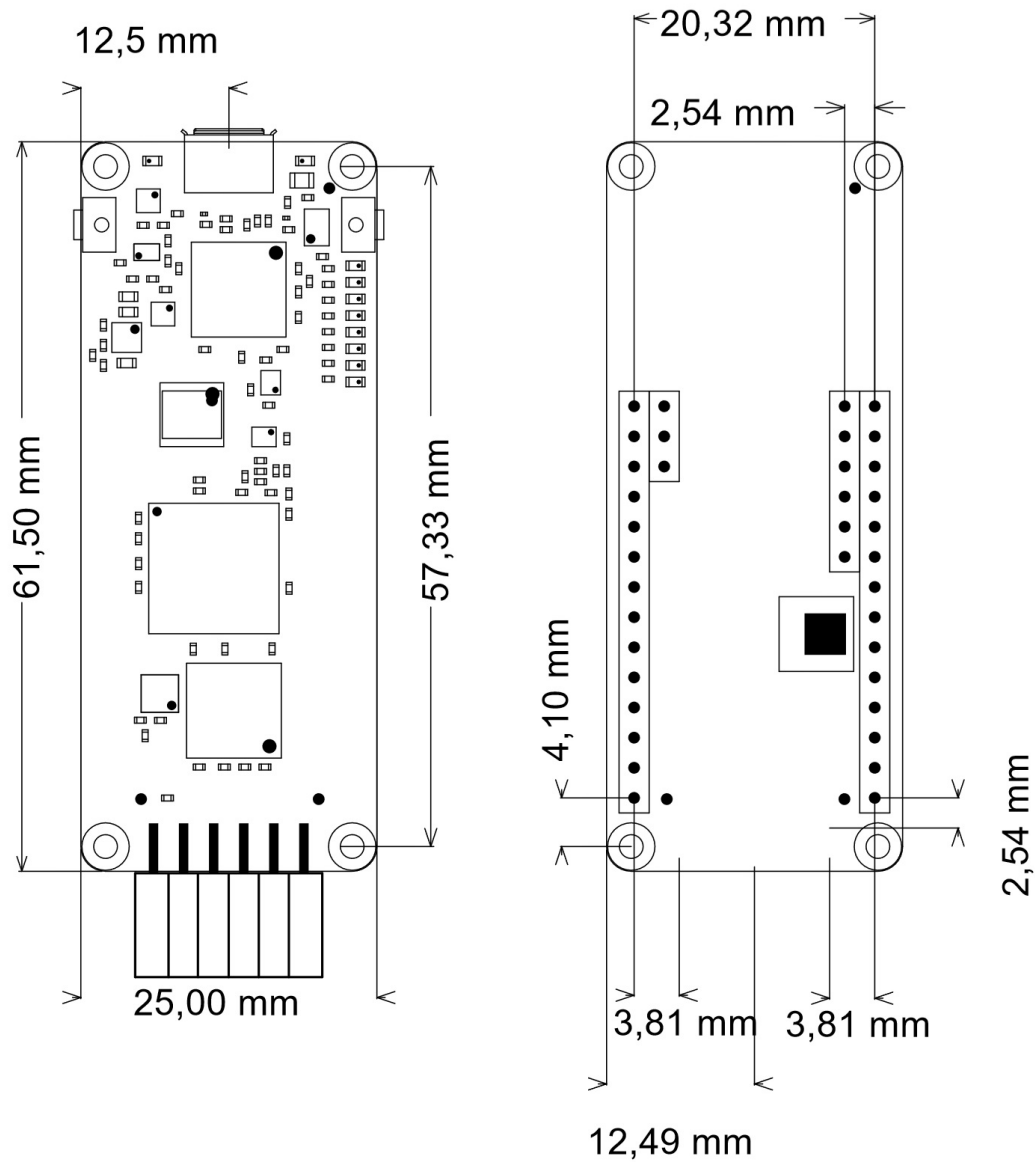


Figure 3: Physical Dimension

10 Currently Offered Variants

Trenz shop TEI0001 overview page	
English page	German page

Table 10: Trenz Electronic Shop Overview

11 Revision History

The hardware revision number is on the PCB adjacent to the module identifier, separated by a dash.



Figure 4: Board hardware revision number.

11.1 Hardware Revision History

Date	Revision	Changes	Documentation Link
2023-01	04	1) Changed SPI flash U5 (EOL) to W25Q64 and added SPI flash option U10. 2) Replaced ferrite beads L1, L2, mems OSC U6 and added capacitor C35. 3) Changed Enpirion to MPS. 4) Added UKCA logo. 5) Library update.	REV04-Documentation
2017-09	03	Replaced buttons S1 and S2 from KMS221GLFS to KMS221GPLFS.	REV03-Documentation
2017-04	02	1) Added resistors R35, R37. 2) Changed SPI-flash on W74M64FVSSIQ (populated in REV02). 3) Moved nets D0, D1, D4, and D5 from bank 1B to banks 5 and 2. 4) Optimized connections into banks 1A, 1B, 2, 5, and 6. 5) Changed pin-out on connector J4. 6) Added pin-header J3. 7) Changed LEDs 8) Updated schematic symbol of U1.	REV02-Documentation
2017-02	01	Initial revision / Prototypes	REV01-Documentation

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.

11.2 Document Change History

Date	Revision	Contributors	Description
 2025-05-13	v.44	Kilian Jahn	- Updated to TRM version 4.2 - Updated TRM to hardware revision 04 - Fixed Inter Page Links - Updated PDF & PDF-Web Link
2024-11-05	v.39	Ali Naseri	small corrections
2018-06-29	v . 17	Ali Naseri	First TRM release

Table 18: Document change history

12 Disclaimer

12.1 Data Privacy

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

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12.7 REACH, RoHS and WEEE

REACH

Trenz Electronic is a manufacturer and a distributor of electronic products. It is therefore a so called downstream user in the sense of [REACH](#). The products we supply to you are solely non-chemical products (goods). Moreover and under normal and reasonably foreseeable circumstances of application, the goods supplied to you shall not release any substance. For that, Trenz Electronic is obliged to neither register nor to provide safety data sheet. According to present knowledge and to best of our knowledge, no [SVHC \(Substances of Very High Concern\) on the Candidate List](#) are contained in our products. Furthermore, we will immediately and unsolicited inform our customers in compliance with REACH - Article 33 if any substance present in our goods (above a concentration of 0,1 % weight by weight) will be classified as SVHC by the [European Chemicals Agency \(ECHA\)](#).

RoHS

Trenz Electronic GmbH herewith declares that all its products are developed, manufactured and distributed RoHS compliant.

WEEE

Information for users within the European Union in accordance with Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment (WEEE).

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.

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