



MB-COME6-1 User's Manual

MB-COME6-1 UM 0100
2016-01-29





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REVISION HISTORY

| Rev. | Date | Name | Pos. | Modification |
|------|------------|------|------|---------------|
| 0100 | 2016-01-29 | FP | | First edition |



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1.5 Service and Support

Please visit our website www.tq-group.com for latest product documentation, drivers, utilities and technical support.

You can register on our website www.tq-group.com to have access to restricted information and automatic update services.

For direct technical support you can contact our FAE team by email: support@tq-group.com.

Our FAE team can also support you with additional information like 3D-STEP files and confidential information, which is not provided on our public website.





For service/RMA, please contact our service team by email (service@tq-group.com) or your sales team at TQ.

1.6 Tips on Safety

Improper or incorrect handling of the product can substantially reduce its life span.


1.7 Symbols and Typographic Conventions

Table 1: Terms and Conventions


| Symbol | Meaning |
|--|---|
|  | This symbol represents the handling of electrostatic-sensitive modules and / or components. These components are often damaged / destroyed by the transmission of a voltage higher than about 50 V. A human body usually only experiences electrostatic discharges above approximately 3,000 V. |
|  | This symbol indicates the possible use of voltages higher than 24 V. Please note the relevant statutory regulations in this regard. Non-compliance with these regulations can lead to serious damage to your health and also cause damage / destruction of the component. |
|  | This symbol indicates a possible source of danger. Acting against the procedure described can lead to possible damage to your health and / or cause damage / destruction of the material used. |
|  | This symbol represents important details or aspects for working with TQ-products. |
| Command | A font with fixed-width is used to denote commands, contents, file names, or menu items. |

1.8 Handling and ESD Tips

General handling of your TQ-products

| | |
|---|---|
|  | <p>The TQ-product may only be used and serviced by certified personnel who have taken note of the information, the safety regulations in this document and all related rules and regulations.</p> <p>A general rule is: do not touch the TQ-product during operation. This is especially important when switching on, changing jumper settings or connecting other devices without ensuring beforehand that the power supply of the system has been switched off.</p> <p>Violation of this guideline may result in damage / destruction of the MB-COME6-1 module and be dangerous to your health.</p> <p>Improper handling of your TQ-product would render the guarantee invalid.</p> |
|---|---|

Proper ESD handling

| | |
|---|--|
|  | <p>The electronic components of your TQ-product are sensitive to electrostatic discharge (ESD).</p> <p>Always wear antistatic clothing, use ESD-safe tools, packing materials etc., and operate your TQ-product in an ESD-safe environment. Especially when you switch modules on, change jumper settings, or connect other devices.</p> |
|---|--|



1.9 Naming of Signals

A hash mark (#) at the end of the signal name indicates a low-active signal.

Example: RESET#

If a signal can switch between two functions and if this is noted in the name of the signal, the low-active function is marked with a hash mark and shown at the end.

Example: C / D#

If a signal has multiple functions, the individual functions are separated by slashes when they are important for the wiring.

The identification of the individual functions follows the above conventions.

Example: WE2# / OE#

1.10 Further Applicable Documents / Presumed Knowledge

- **Specifications and manual of the modules used:**
These documents describe the service, functionality and special characteristics of the module used.
- **Specifications of the components used:**
The manufacturer's specifications of the components used, for example CompactFlash cards, are to be taken note of. They contain, if applicable, additional information that must be taken note of for safe and reliable operation. These documents are stored at TQ-Systems GmbH.
- **Chip errata:**
It is the user's responsibility to make sure all errata published by the manufacturer of each component are taken note of. The manufacturer's advice should be followed.
- **Software behaviour:**
No warranty can be given, nor responsibility taken for any unexpected software behaviour due to deficient components.
- **General expertise:**
Expertise in electrical engineering / computer engineering is required for the installation and the use of the device.

Implementation information for the carrier board design is provided in the COM Express™ Design Guide (2) maintained by the PICMG®. This Carrier Design Guide includes a very good guideline to design a COM Express™ carrier board.

It includes detailed information with schematics and detailed layout guidelines.

Please refer to the official PICMG® documentation for additional information (1), (2).



2. INTRODUCTION

The COM Express™ mainboard MB-COME6-1 is a carrier board for COM Express™ modules with Type 6 pinout. It can be used for embedded computers or as evaluation platform for COM Express™ modules. In combination with a standard COM Express™ module it forms a very compact hardware kit that can be used for a freely scalable embedded PC platform thanks to its modular design. Because of this – with uniform interfaces and mechanical dimensions – the PC system can be easily adjusted to suit the requirements of the application. The many extension options and storage media that can be added offer a high level of flexibility and allow functionalities and performance to be extended easily, quickly and inexpensively. Typical uses are found in embedded server applications, PC systems for automation, visualisation and monitoring and all applications that place high demands on quality, durability and long-term availability.

2.1 Functional Overview

The following key functions are implemented on the MB-COME6-1:

Supported Modules:

- COM Express™ Mini Modules with Type 6 pinout

External Interfaces:

- 2 × Gigabit Ethernet
- 4 × USB2.0 (2 × USB3.0)
- 2 × DisplayPort
- RS232
- Power Button / Reset

Internal Interfaces:

- LVDS
- 1 × USB (e.g. for touch applications)
- 2 × USB for internal usage only (no filters or protective circuitry)
- Mini PCIe socket (with SIM Card support)
- mSATA socket
- CFAST socket
- SATA interface
- SD card socket (Micro SD)
- Socket for 2.5" HDD/SSD
- Audio: 1 × headphone out + 1 × microphone in + stereo speaker out
- RS232
- RS485/RS422
- Riser interface for PCIe add in cards

Power supply:

- Voltage: 12 V DC ±5 %

Environment:

- Extended temperature: –20 °C to +85 °C

Form factor / dimensions:

- 170 × 170 mm² (Mini ITX)

2.2 Specification Compliance

The MB-COME6-1 supports modules compliant to the PICMG™ COM Express™ Module Base Specification (COM.0 R2.1) with Type 6 pinout.



2.3 Accessories

- **COMSET-HDD**
Mounting Set for 2.5" HDD/SSD on the MB-COME6-1
- **RISER-COME-PCIE**
Riser for 1 × PCIe; PCIe card is below mainboard
- **RISER-COME-2 × PCIE**
Riser for 2 × PCIe; PCIe cards are beside mainboard
- **RISER-COME-2 × PCIE-2**
Riser for 2 × PCIe; PCIe cards are below mainboard
- **DK-USB-TYPA-MOL5**
Adapter cable from internal USB connector to an A-Type receptacle
- **ADAP-Audio-Kit**
Adapter for internal head-phone / microphone connector to dual 3.5 mm audio jack.

Please contact support@tq-group.com for more details about Display Port cables and Display Port to DVI/HDMI adapters.

3. FUNCTIONAL SPECIFICATION

3.1 Block Diagram

The following illustration shows the block diagram of the MB-COME6-1:

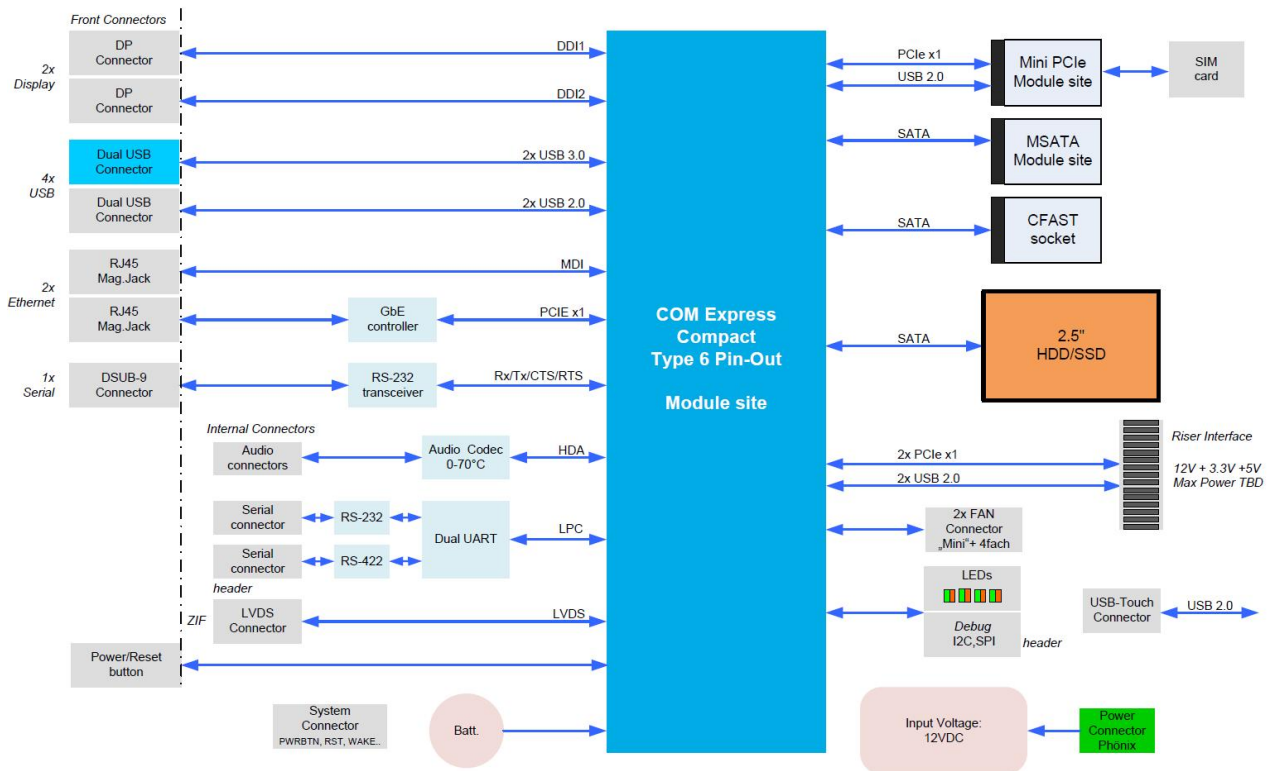


Illustration 1: Block Diagram MB-COME6-1

3.2 Electrical Specification

3.2.1 Supply Voltage Characteristics

The MB-COME6-1 requires an input voltage of 12 V DC $\pm 5\%$.

The input voltages shall rise from 10 % of nominal to 90 % of nominal within 0.1 ms to 20 ms ($0.1 \text{ ms} \leq \text{Rise Time} \leq 20 \text{ ms}$). There must be a smooth and continuous increase of each DC output voltage from 10 % to 90 % of its final set point within the regulation range.

3.2.2 Power Consumption Specification

The power consumption of the system significantly depends on the connected devices (COM Express™ module, Mass storage devices, USB devices, display backlight, speakers etc.).

The power consumption of the MB-COME6-1 itself is approximately 190 mA @ 12 V (COM Express™ module supplied externally; UEFI-shell active; no keyboard, no mouse, no mass storage device, no Ethernet cable etc. connected).

The maximum input current of the MB-COME6-1 is limited to 5 A by a fuse. The devices connected to the carrier should not exceed 40 W.

Note: Power requirement



The power supply for the MB-COME6-1 must be configured with enough reserve. It should be calculated with the maximum power of all connected components.



3.3 Environmental Specification

- Temperature operating, Extended: -20 °C to +85 °C
- Temperature storage: -40 °C to +85 °C
- Relative humidity (operating / storage): 10 % to 90 % (not condensing)

3.4 System Components

3.4.1 Gigabit Ethernet Controller

The MB-COME6-1 is equipped with an Intel® i210IT Ethernet controller with 10/100/1000 Mbps speed and IEEE1588 support. Please contact support@tq-group.com for further information about the IEEE1588 support.

3.4.2 Dual UART

The MB-COME6-1 is equipped with an EXAR XR28V382 dual UART with its register set is based on the industry standard 16550 UART. The connected serial ports operate with standard serial port drivers.

3.4.3 HD-Audio Codec

The MB-COME6-1 is equipped with a VIA VT1802P High Definition Audio Codec with a stereo Class D Amplifier with 2 W RMS output power per channel.

3.4.4 I²C Test Devices

The MB-COME6-1 is equipped with an EEPROM and an I/O Expander at the general purpose I²C bus (COM Express™ pin names I2C_DAT and I2C_CK) This devices can be used for software development and debug purposes. Further information can be found in the chapter Software.

3.5 Connectors and Interfaces

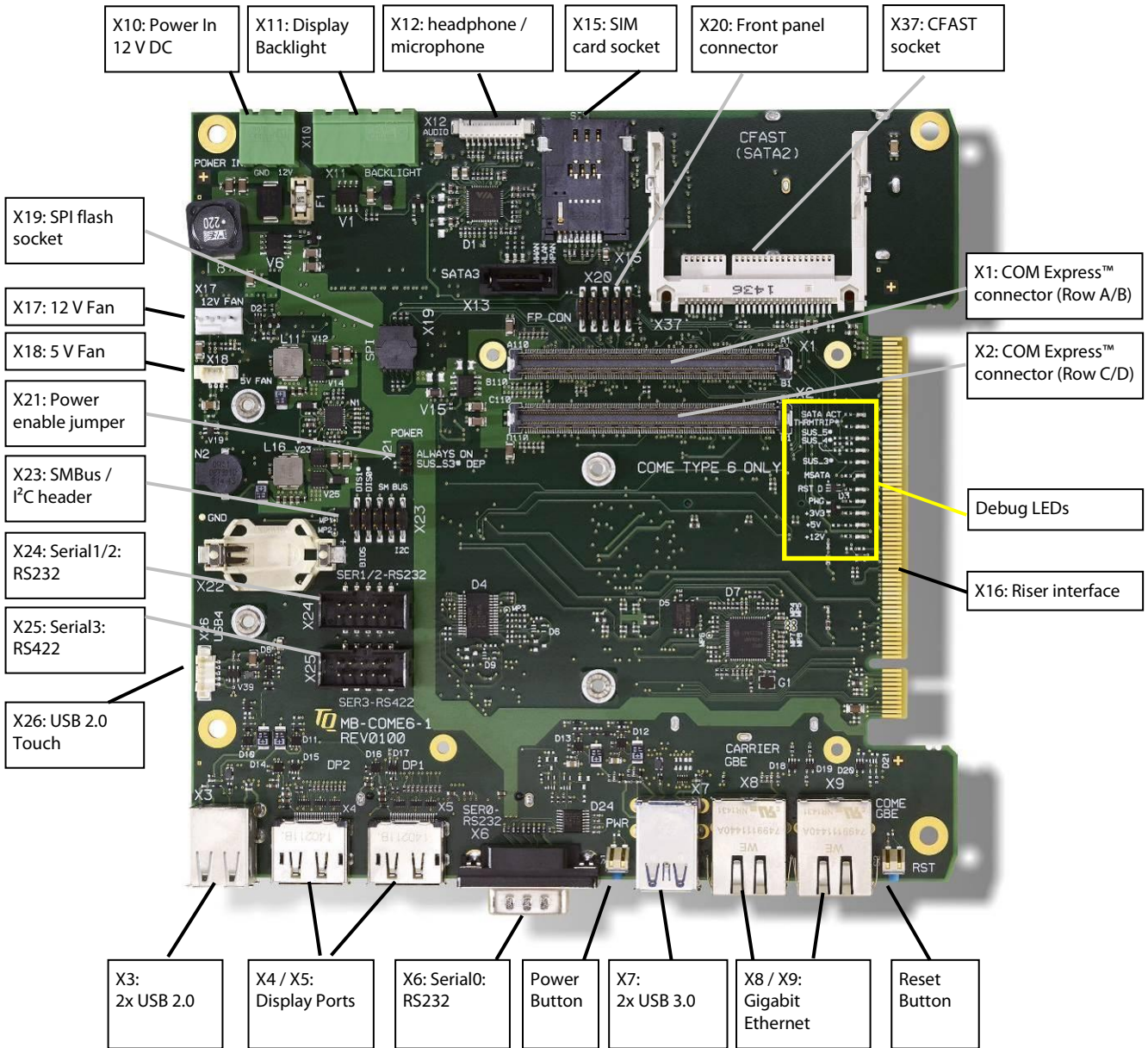


Illustration 2: MB-COME6-1, Top

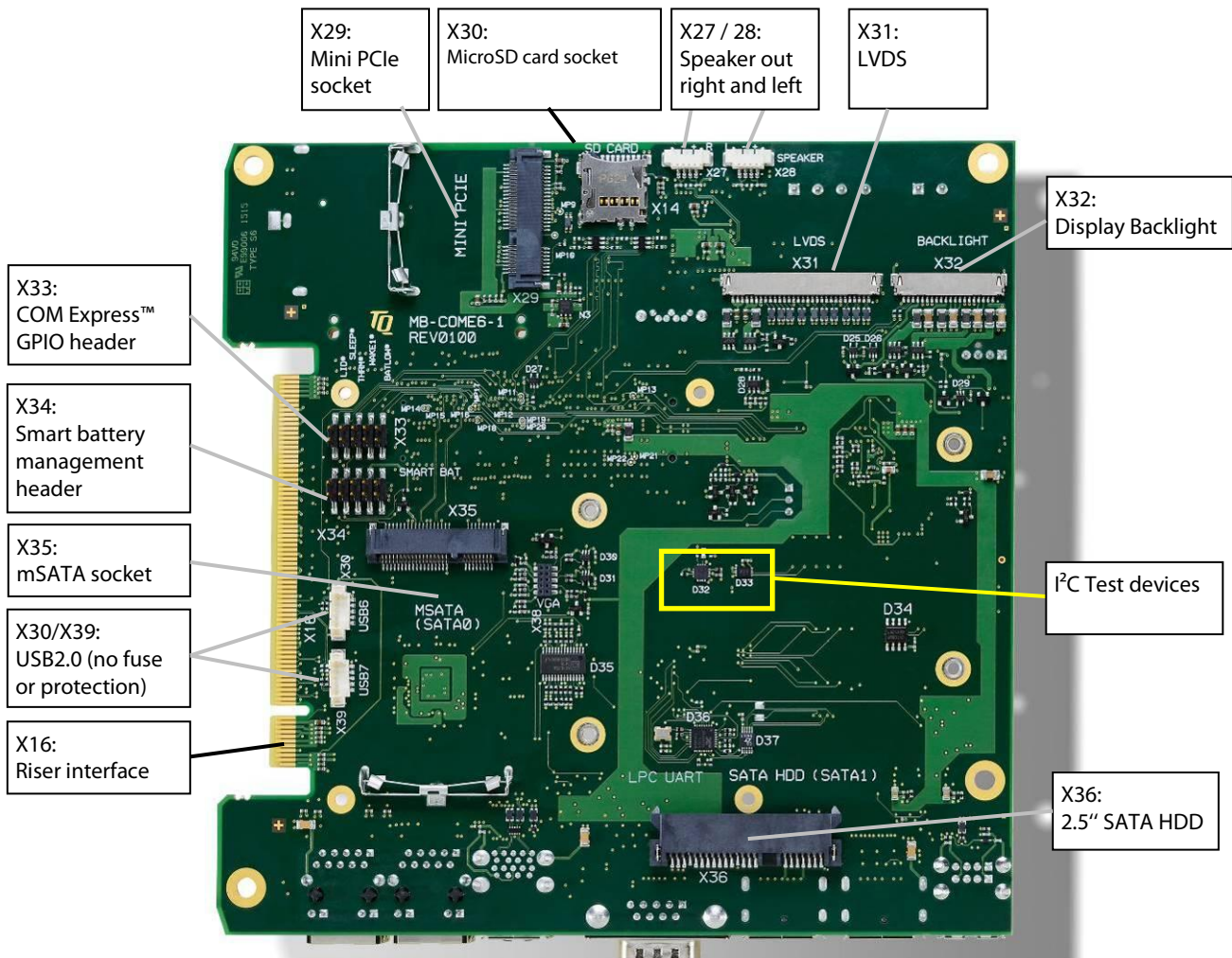


Illustration 3: MB-COME6-1, Bottom



3.5.1 Power Supply

The MB-COME6-1 requires a single 12 V DC power supply. The voltage should not vary more than $\pm 5\%$.

X10: Power-In Connector

- Connector type: Phoenix MSTBA 2,5/ 2-G-5,08
- Mating connector: e.g. Phoenix MSTBA 2,5/ 2-ST-5,08

Table 2: Pinout Power-In Connector X10

| Pin | Signal | Remark |
|-----|--------|-------------|
| 1 | 12 V | fused @ 5 A |
| 2 | GND | |

3.5.2 DisplayPort

The MB-COME6-1 supports two DisplayPort interfaces. The support of adapters from DP to HDMI, DVI or VGA depends on the combination of the COM Express™ module and the adapter used. The combination of some modules with some adapters might not work.

3.5.3 USB Host Interfaces

The MB-COME6-1 supports several USB Hosts interfaces.

X7: Double A-Type (USB3.0) connector for direct usage of USB host ports

X3: Double A-Type (USB2.0) connector for direct usage of USB host ports

X26: USB host extension connector for usage of an USB host port with an adapter cable (e.g. for touch display applications)

- Connector type: Molex 53398-0571
- Mating connector: Molex 51021-0500

X30: USB host extension connector for internal usage only (no filters or protective circuitry).

- Connector type: Molex 53398-0571
- Mating connector: Molex 51021-0500

X39: USB host extension connector for internal usage only (no filters or protective circuitry).

- Connector type: Molex 53398-0571
- Mating connector: Molex 51021-0500

Table 3: Pinout USB Host Extension Connectors X26, X30, X39

| Pin | Signal | Cable Colour | Remark |
|-----|--------|--------------|--------------------|
| 1 | +5 V | Red | X26: fused @ 0.9 A |
| 2 | D- | White | - |
| 3 | D+ | Green | - |
| 4 | GND | Black | - |
| 5 | GND | - | - |

3.5.4 Gigabit Ethernet

The MB-COME6-1 supports 2 common Gigabit Ethernet ports.

The Ethernet signals of the COM Express™ connector are routed to X9.

An Intel® i210IT Ethernet controller with 10/100/1000 Mbps speed implemented on the MB-COME6-1 is connected to X8.

Table 4: Ethernet LEDs

| LED | Colour/ State | Description |
|---------------|-----------------|----------------------|
| Left (ACT) | off | No link |
| Left (ACT) | yellow on | Link (no activity) |
| Left (ACT) | yellow blinking | Link and activity |
| Right (speed) | off | No link or 10 Mbit/s |
| Right (speed) | green | 100 Mbit/s |
| Right (speed) | orange/yellow | 1000 Mbit/s |

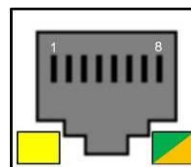


Illustration 4: RJ45 Connectors X8, X9

3.5.5 Serial Interfaces (RS232/RS422)

The MB-COME6-1 supports up to 3 serial ports:

- 2 × RS232 port (D-Sub front connector and on-board header)
- 1 × RS422 (on-board header)

The COM Express™ Specification does only provide signal definitions for RX and TX lines for the serial interface. Due to the TQ-flexiCFG feature the serial ports can be configured to route the handshake signals to free pins on the COM Express connector.

Table 5: Serial Port COM Express™ Port Mapping

| COM Express Signal | COM Express Pin | MB-COME6-1 | Remark |
|------------------------|-----------------|------------|--------------|
| SER0_TX | A98 | SER0_TX | 3.3 V input |
| SER0_RX | A99 | SER0_RX | 3.3 V output |
| SER1_TX | A101 | SER1_TX | 3.3 V input |
| SER1_RX | A102 | SER1_RX | 3.3 V output |
| SER0_RTS# ¹ | B98 | SER0_RTS# | 3.3 V input |
| SER0_CTS# ¹ | B99 | SER0_CTS# | 3.3 V output |
| SER1_RTS# ¹ | D24 | SER1_RTS# | 3.3 V input |
| SER1_CTS# ¹ | D25 | SER1_CTS# | 3.3 V output |

The four COM Express™ serial signals (RX/TX) are specified to provide a protection and level shifter circuit.

The implementation of this circuit would result in a lower transfer speed on the two serial ports of the COM Express™ module.

On the MB-COME6-1 the protection circuit is removed and the serial ports provide a transfer rate of up to 115 kbaud.

The MB-COME6-1 can only be used in combination with COM Express™ modules Type 6 pinout.

1: These signals are not specified in COM Express™ specification.

These signals are only available when the TQ flexiCFG feature is available on the COM Express™ module. TQMx50UC modules support this feature.

Table 6: RS232 D-Sub Connector X6

| Pin | RS232 Signal (all signals) | MB-COME6-1 |
|-----|----------------------------|------------------|
| 1 | DCD | NC ² |
| 2 | RXD | RXD |
| 3 | TXD | TXD |
| 4 | DTR | NC ² |
| 5 | GND | GND |
| 6 | DSR | NC ² |
| 7 | RTS | RTS ³ |
| 8 | CTS | CTS ³ |
| 9 | RI | NC ² |

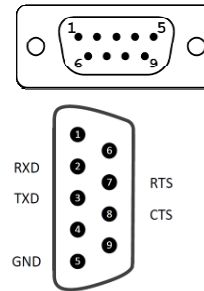


Illustration 5: RS232 D-SUB Connector X6

Table 7: RS232 Header X24

| Pin | RS232 Signal (all signals) | MB-COME6-1 | D-Sub connector (with standard adapter) |
|-----|----------------------------|------------------|---|
| 1 | DCD | NC ² | – |
| 2 | DSR | NC ² | RXD |
| 3 | RXD | RXD | TXD |
| 4 | RTS | RTS ³ | – |
| 5 | TXD | TXD | GND |
| 6 | CTS | CTS ³ | – |
| 7 | DTR | NC ² | RTS |
| 8 | RI | NC ² | CTS |
| 9 | GND | GND | – |
| 10 | NC | NC | – |

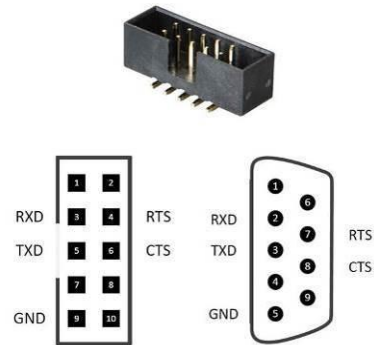


Illustration 6: RS232 Header X24

Table 8: RS422 Header X25

| Pin | MB-COME6-1 | D-Sub connector (with standard adapter) |
|-----|------------|---|
| 1 | NC | – |
| 2 | NC | RS422 RX– |
| 3 | RS422 RX– | RS422 TX+ |
| 4 | RS422 TX– | – |
| 5 | RS422 TX+ | GND |
| 6 | RS422 RX+ | – |
| 7 | NC | RS422 TX– |
| 8 | NC | RS422 RX+ |
| 9 | GND | – |
| 10 | NC | – |

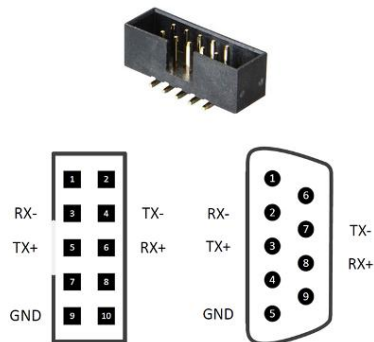


Illustration 7: RS422 Header X25

2: Not available since signal is not defined in COM Express™ specification.
 3: Only available when the TQ flexICFG feature is available on the COM Express™ module.

3.5.6 LVDS

The MB-COME6-1 supports an LVDS interface where suitable displays can be connected directly. There are also connectors for powering the backlight of the connected display.

The MB-COME6-1 has an on-board EDID EEPROM to store display specific timing information. This EEPROM can be programmed with an external I²C programmer. If the programmer supports a 3.3 V output voltage the MB-COME6-1 can be programmed without any additional power supply. In this case no COM Express™ module should be connected to the carrier.

X31: LVDS connector

- Connector type: Hirose DF19G-30P-1H
- Mating connector: e.g. Hirose DF19-30S-1C

Table 9: LVDS Connector X31

| Pin | Signal | Remark |
|-----|-----------|----------------------------|
| 1 | A0- | Odd bus |
| 2 | A0+ | Odd bus |
| 3 | A1- | Odd bus |
| 4 | A1+ | Odd bus |
| 5 | A2- | Odd bus |
| 6 | A2+ | Odd bus |
| 7 | GND | |
| 8 | ACLK- | Odd bus |
| 9 | ACLK+ | Odd bus |
| 10 | A3- | Odd bus |
| 11 | A3+ | Odd bus |
| 12 | B0- | Even bus |
| 13 | B0+ | Even bus |
| 14 | GND | |
| 15 | B1- | Even bus |
| 16 | B1+ | Even bus |
| 17 | GND | |
| 18 | B2- | Even bus |
| 19 | B2+ | Even bus |
| 20 | BCLK- | Even bus |
| 21 | BCLK+ | Even bus |
| 22 | B3- | Even bus |
| 23 | B3+ | Even bus |
| 24 | GND | |
| 25 | 5V_PANEL | 5 V Panel supply voltage |
| 26 | 5V_PANEL | |
| 27 | 5V_PANEL | |
| 28 | 3V3_PANEL | 3.3 V Panel supply voltage |
| 29 | 3V3_PANEL | |
| 30 | 3V3_PANEL | |



Illustration 8: LVDS Connector X31

X11: Backlight Power connector

- Connector type: Phoenix MSTBA2,5/ 4-G-5,08
- Mating connector: e.g. Phoenix MSTBA2,5/ 4-ST-5,08

Table 10: Backlight Power Connector X11

| Pin | Signal | Remark |
|-----|----------------------|--------------------------|
| 1 | 12V_BL_ALW | 12 V always-on output |
| 2 | VCC_IN ¹⁾ | Backlight voltage input |
| 3 | GND | – |
| 4 | VCC_SWITCHED | Backlight voltage output |

¹⁾ A voltage of up to 30 V can be supplied at this pin. Connect Pin 1 and 2 to use the 12 V of the MB-COME6-1 for the backlight.

X32: Backlight connector

- Connector type: Hirose DF19G-20P-1H
- Mating connector: e.g. Hirose DF19-20S-1C

Table 11: Backlight Connector X32

| Pin | Signal | Remark |
|-----|------------------------|--------------------------------|
| 1 | 12V_BL_ALW | 12 V always-on output |
| 2 | 12V_BL_ALW | |
| 3 | 12V_BL_SL | 12 V switched output |
| 4 | 12V_BL_SL | |
| 5 | GND | – |
| 6 | | |
| 7 | | |
| 8 | 5V_BL_ALW | 5 V always-on output |
| 9 | 5V_BL_ALW | |
| 10 | 5V_BL_ALW | |
| 11 | 5V_BL_SL | 5 V switched output |
| 12 | 5V_BL_SL | |
| 13 | 5V_BL_SL | |
| 14 | BLEN | Backlight Enable output |
| 15 | BLT_CTRL | Backlight (brightness) control |
| 16 | GND | – |
| 17 | 3V3_PROG ¹⁾ | 3.3 V input (programming) |
| 18 | EDID_CLK ¹⁾ | EDID I ² C clock |
| 19 | EDID_DAT ¹⁾ | EDID I ² C data |
| 20 | GND | – |

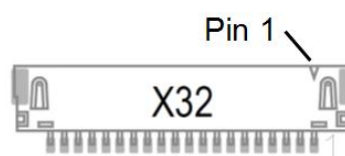


Illustration 9: Backlight Connector X32

¹⁾ These pins can be used for programming the on-board EDID EEPROM. The EEPROM can be powered by the 3V3_PROG pin.

3.5.7 Mini PCIe Socket

The MB-COME6-1 is equipped with a socket to support one full size Mini PCIe card. There is also a SIM card socket for native support of UMTS or LTE Mini PCIe cards.

A half size card can be inserted into this socket by means of a mechanical adapter.

The reachable transfer rate of this interface depends mainly on the COM Express™ module used and the connected device.

3.5.8 SATA Interfaces

The MB-COME6-1 supports two SATA interfaces:

- One mSATA socket for mSATA-SSDs
- One connector for 2.5" HDD/SSDs, which can be mounted on the carrier with a mounting set

The maximum transfer rates of these interfaces mainly depend on the COM Express™ module used and the connected devices.

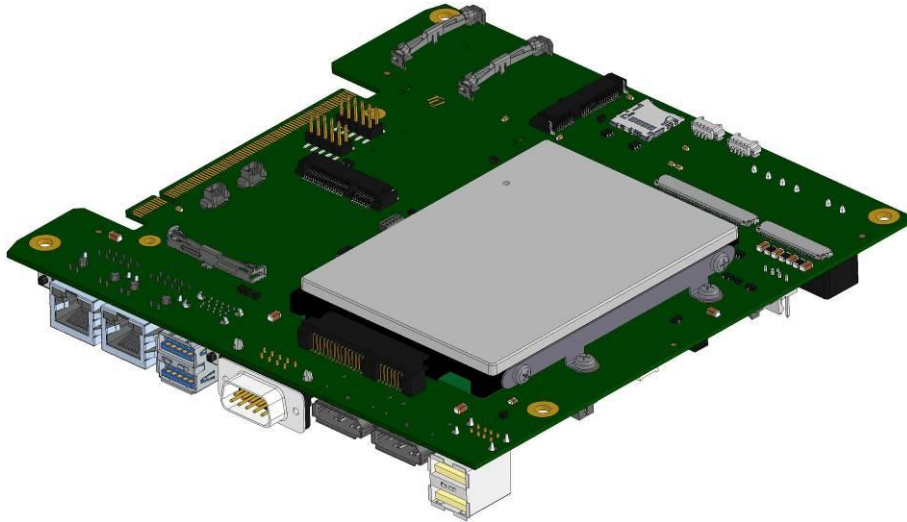


Illustration 10: 2.5" HDD/SSD Mounting

3.5.9 SD Card Socket (micro SD)

The MB-COME6-1 is equipped with a socket to support micro SD cards.

The Signals for SDIO on COM Express™ modules can also be used as GPIO signals. Please ensure that the module is configured for SDIO-usage of these pins.

3.5.10 Audio

The MB-COME6-1 is equipped with an audio codec to support following audio features:

- Headphone out
- Microphone in
- Speaker out (up to 2 × 2 W RMS)

X12: Headphone and microphone connector

- Connector type: Molex 53261-1071
- Mating connector: e.g. Molex 51021-1000 crimp housing

Table 12: Headphone and Microphone Connector X12

| Pin | Signal | Remark |
|-----|-------------|---|
| 1 | GND | – |
| 2 | HP_OUT_L | Headphone out left |
| 3 | HP_OUT_R | Headphone out right |
| 4 | GND | – |
| 5 | SENSE_HPOUT | Connect to GND if headphone is connected |
| 6 | SENSE_MIC | Connect to GND if microphone is connected |
| 7 | GND | – |
| 8 | MIC_L | Microphone in left |
| 9 | MIC_R | Microphone in right |
| 10 | GND | – |

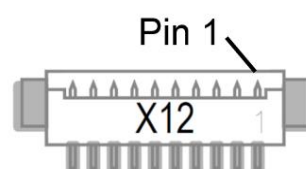


Illustration 11: Headphone / Microphone X12

X27: Speaker connector for right speaker

- Connector type: Molex 53261-0471
- Mating connector: e.g. Molex 51021-0400 crimp housing

Table 13: Speaker Connector for Right Speaker X27

| Pin | Signal | Remark |
|-----|------------|---------------------|
| 1 | SPK_OUT_R+ | Speaker out right + |
| 2 | | |
| 3 | SPK_OUT_R- | Speaker out right – |
| 4 | | |

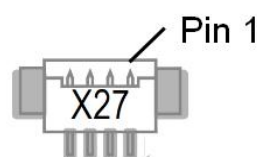


Illustration 12: Speaker Connector X27

X28: Speaker connector for left speaker

- Connector type: Molex 53261-0471
- Mating connector: e.g. Molex 51021-0400 crimp housing

Table 14: Speaker Connector for Left Speaker X28

| Pin | Signal | Remark |
|-----|------------|--------------------|
| 1 | SPK_OUT_L+ | Speaker out left + |
| 2 | | |
| 3 | SPK_OUT_L- | Speaker out left – |
| 4 | | |

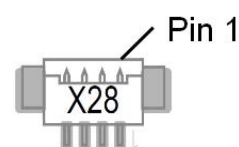


Illustration 13: Speaker Connector X28

3.5.11 Fan Connectors

The MB-COME6-1 is equipped with two connectors for connecting a fan. Don't use both connectors at the same time.

X17: 12 V fan connector

- Connector type: Molex 47053-1000
- Mating connector: 4-pin fan connector (2.54 mm contact spacing)

Table 15: 12 V Fan Connector X17

| Pin | Signal | Remark |
|-----|---------|---------------------------|
| 1 | GND | – |
| 2 | 12 V | – |
| 3 | SENSE | Sense input for fan speed |
| 4 | CONTROL | Speed control output |

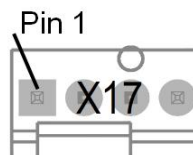


Illustration 14: 12 V Fan Connector X17

If a standard 3-pin 12 V – fan is connected it will run at its full speed.

X18: 5 V fan connector

- Connector type: Molex 53398-0371
- Mating connector: e.g. Molex 51021-0300 crimp housing

Table 16: 5 V Fan Connector X18

| Pin | Signal | Remark |
|-----|---------|----------------------------|
| 1 | SENSE | Sense input for fan speed |
| 2 | PWM_OUT | Speed control/power output |
| 3 | GND | – |

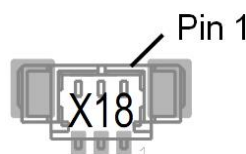


Illustration 15: 5 V Fan Connector X18

3.5.12 Riser Interface

The MB-COME6-1 is equipped with a card edge connector for extension purposes. Up to two PCIe cards can be connected to this interface with adapters.

For further information about the Riser interface, please contact TQ-Systems GmbH.

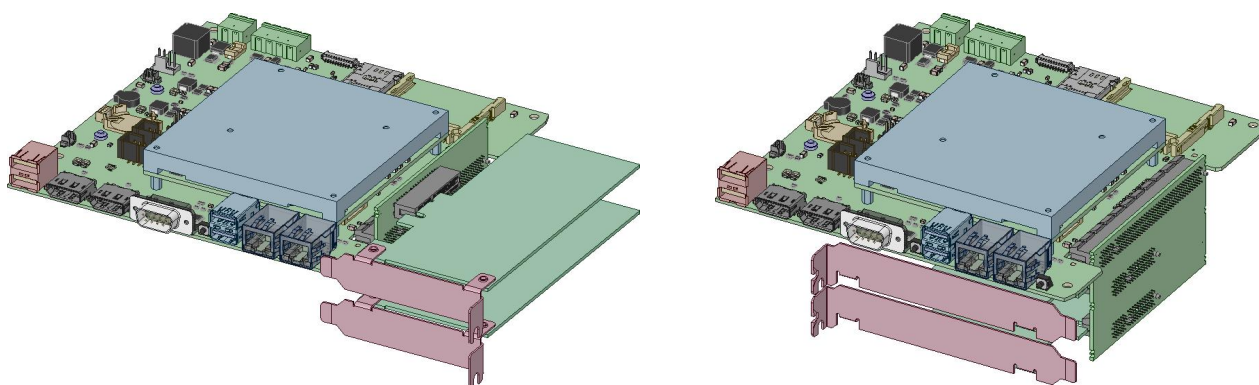


Illustration 16: PCIe card Installation Configuration

3.5.13 Front Panel Connector

The MB-COME6-1 is equipped with a front panel connector where LEDs for Power or Hard Disk activity indication or buttons for Power or Reset can be connected. LEDs can be connected directly. There is a series resistor (330 Ω) to 3.3 V.

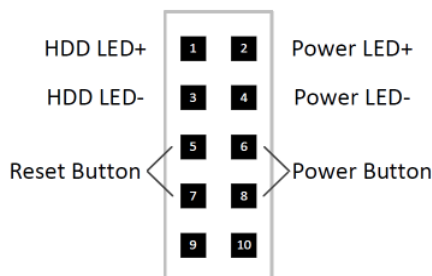


Illustration 17: Front Panel Connector

3.5.14 Debug LEDs

The MB-COME6-1 is equipped with several LEDs for debug purposes.

Table 17: Debug LEDs

| Function | PCB Text | Remark |
|------------------|-----------|--|
| 12 V Power | +12 V | Green if 12 V input power is present |
| 5 V Power | +5 V | Green if 5 V on-board power is present |
| 3.3 V Power | +3V3 | Green if 3.3 V on-board power is present |
| Power Good | PWG | Green if PWR_OK signal is sent to module |
| Reset inactive | RST_D | Green if Reset is deasserted |
| mSATA | MSATA DET | Green if an mSATA SSD is detected |
| SUS S3 inactive | SUS_3# | Green if module is not in power-saving mode S3 (Suspend to RAM) |
| SUS S4 inactive | SUS_4# | Green if module is not in power-saving mode S4 (Suspend to disk) |
| SUS S5 inactive | SUS_5# | Green if module is not in power-saving mode S5 (Soft off) |
| Thermal shutdown | THRMTRIP# | Green if module is not in thermal shutdown |
| SATA activity | SATA ACT | Green during SATA activity |

3.5.15 SMBus and I²C Header

The MB-COME6-1 is equipped with a header, the user can easily access to SMBus. The I²C Bus (in the TQ-flexiCFG block) can also be accessed here. On this header there is also the possibility to set 2 jumpers for the BIOS disable signals of the module. This header is only used for debug purposes.

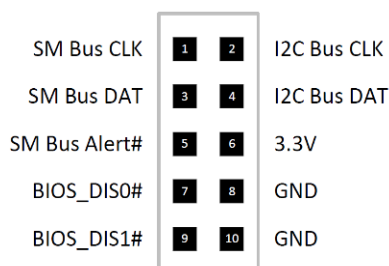


Illustration 18: SMBus and I²C Header

If there is no Jumper present on the BIOS_DIS0# or the BIOS_DIS1# signal the module will load its BIOS from the internal SPI flash. If there is a Jumper on the BIOS_DIS1# - signal (between pin 9 and 10) the module loads its BIOS from the flash in the SPI socket of the MB-COME6-1.

3.5.16 SPI Flash Socket

The MB-COME6-1 is equipped with a socket for SPI flashes. This is useful if a BIOS update fails or for BIOS development purposes. SPI-Flashes with SO8W package can be inserted. Whether a distinct flash device is supported depends on the COM Express™ module used.

3.5.17 COM Express™ GPIO Header

The MB-COME6-1 is equipped with a header for distinct COM Express™ signals. This header is used for debug purposes only.

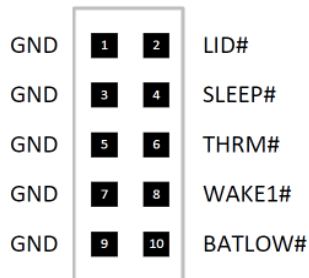


Illustration 19: COM Express™ GPIO Header

3.5.18 Smart Battery Management Header

The MB-COME6-1 is equipped with a header for smart battery development and debug purposes.

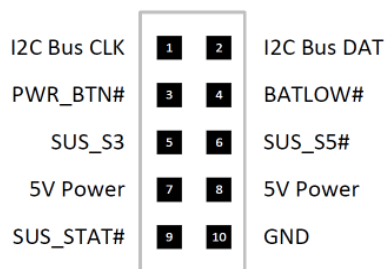


Illustration 20: Smart Battery Management Header

3.5.19 COM Express™ Connector

As COM Express™ connector the EPT 401-55101-51 or equivalent is used. The stacking height (board to board distance between carrier and module) is 8 mm.

4. MECHANICS

4.1 Dimensions

The dimensions are oriented on the Mini-ITX form factor, which is $170 \times 170 \text{ mm}^2$. The following illustration shows the MB-COME6-1.

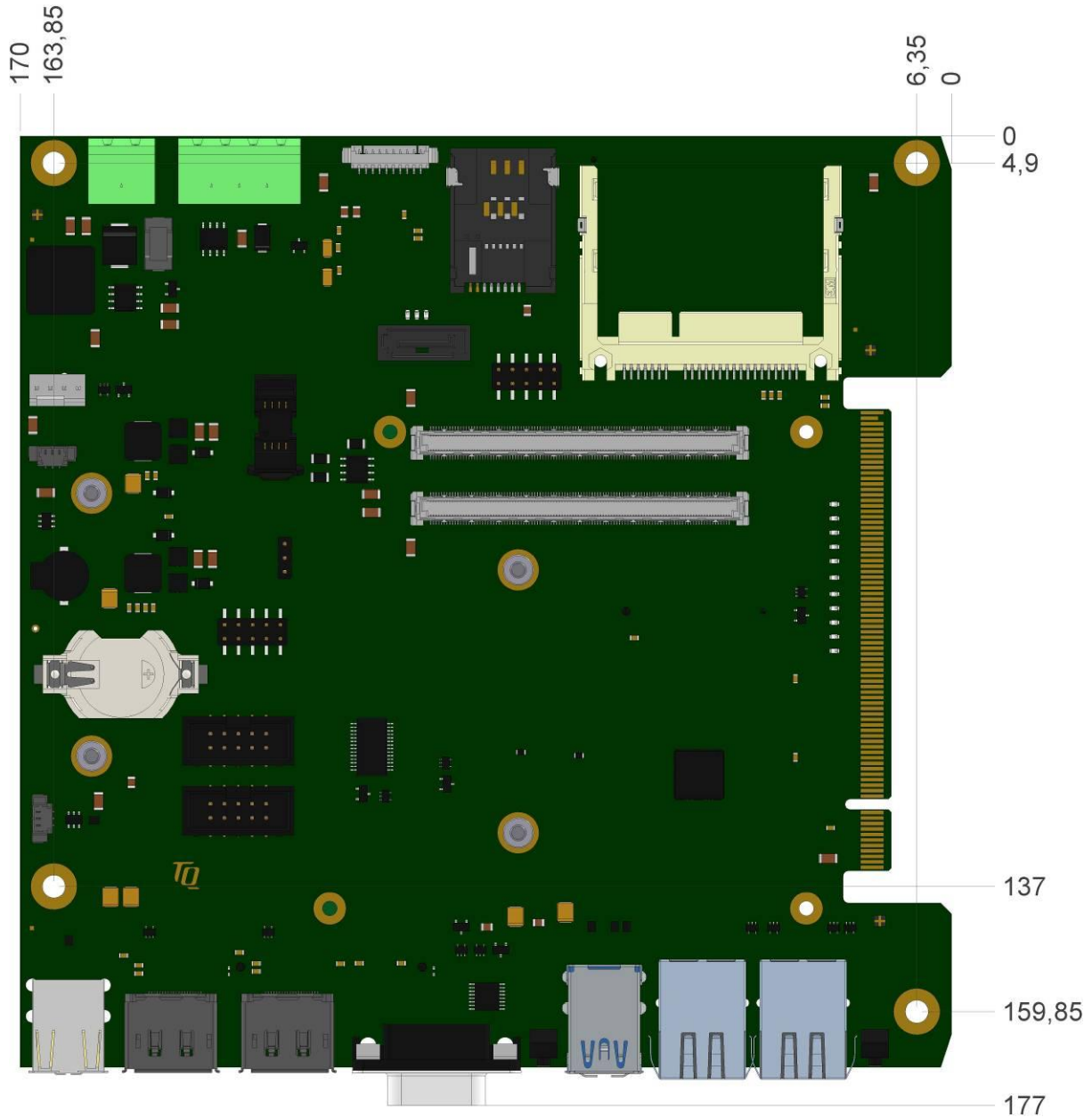


Illustration 21: MB-COME6-1

Please contact support@tq-group.com for more details about 2D/3D Step models.

4.2 Protection Against External Effects

The MB-COME6-1 is not protected against dust, external impact and contact (IP00). Adequate protection has to be guaranteed by the surrounding system.



5. SOFTWARE

5.1 System Resources

5.1.1 I²C Bus

The general purpose I²C bus (COM Express™ pin names I2C_DAT and I2C_CK) is accessible on the SMBus and I²C header. Additional there are I²C test devices on the MB-COME6-1: An EEPROM and an I/O-Expander.

The following table shows the I²C address mapping for the COM Express I²C port:

Table 18: I²C Address Mapping COM Express™ I²C Bus

| 8-bit Address | Function | Device | Remark |
|---------------|----------------|-------------------|---|
| 0xAE | Carrier EEPROM | Microchip 24AA32A | Address recommended in COM Express™ specification |
| 0xE0 | I/O Expander | NXP PCA9538A | Test device for I ² C I/O access |

5.1.2 SMBus

The SMBus (System Management Bus) on the MB-COME6-1 is connected to the PCIe clock buffer, the MiniPCIe socket and to the Riser interface. It is accessible on the SMBus and I²C header.

The following table shows the I²C address mapping for the COM Express™ SMBus port:

Table 19: I²C Address Mapping COM Express™ SMBus Port

| 8-bit Address | Function | Device | Remark |
|---------------|-------------------|------------|--------|
| 0xD4 | PCIe Clock buffer | IDT 9DB106 | |

5.2 Operating Systems

5.2.1 Supported Operating Systems

The MB-COME6-1 supports various Operating Systems:

- Microsoft® Windows® 10
- Microsoft® Windows® 8.1 / Microsoft® Windows® Embedded Standard 8 (WES8)
- Microsoft® Windows® 7 / Microsoft® Windows® Embedded Standard 7 (WES7)
- Linux (i.e. Ubuntu 14.10 or later)

Other Operating Systems are supported on request.

Please contact support@tq-group.com for further information about supported Operating Systems.

5.2.2 Driver Download

The MB-COME6-1 module is well supported by the Standard Operating Systems, which already include most of the required drivers. It is recommended to use the latest drivers for optimal performance and the full feature set of the module.

Drivers for the Intel® i201IT Gigabit Ethernet controller can be downloaded at this Intel® page:

- Intel® Download Center: Intel® Ethernet Controller i210 Series
<https://downloadcenter.intel.com/product/64399/Intel-Ethernet-Controller-I210-Series>

Please contact support@tq-group.com for further driver download assistance.



6. SAFETY REQUIREMENTS AND PROTECTIVE REGULATIONS

6.1 EMC

The MB-COME6-1 was developed according to the requirements of electromagnetic compatibility (EMC). Depending on the target system, anti-interference measures may still be necessary to guarantee the adherence to the limits for the overall system. (Incl. housing)

6.2 ESD

In order to avoid interspersions on the signal path from the input to the protection circuit in the system, the protection against electrostatic discharge should be arranged directly at the inputs of a system. Most external interfaces are protected using ESD protection diodes. Measurements for ESD protection have to be done with the electronic parts mounted in a housing. Since TQ-Systems GmbH does not offer a housing for the MB-COME6-1 so far, no special preventive measures were done up to now.

6.3 Operational Safety and Personal Security

Due to the occurring voltages (12 V DC), tests with respect to the operational and personal safety haven't been carried out.

6.4 Reliability and Service Life

6.4.1 RoHS Compliance

The MB-COME6-1 is manufactured RoHS compliant.

- All components and assemblies used are RoHS compliant
- RoHS compliant soldering processes are used

6.4.2 WEEE Regulation

The company placing the product on the market is responsible for the observance of the WEEE regulation. To be able to reuse the product, it is produced in such a way (a modular construction) that it can be easily repaired and disassembled.

6.5 Other Entries

By environmentally friendly processes, production equipment and products, we contribute to the protection of our environment.

The energy consumption of this subassembly is minimised by suitable measures.

Printed PC-boards are delivered in reusable packaging.

Modules and devices are delivered in an outer packaging of paper, cardboard or other recyclable material.

Due to the fact that at the moment there is still no technical equivalent alternative for printed circuit boards with bromine-containing flame protection (FR-4 material), such printed circuit boards are still used.

No use of PCB containing capacitors and transformers (polychlorinated biphenyls).

These points are an essential part of the following laws:

- The law to encourage the circular flow economy and assurance of the environmentally acceptable removal of waste as at 27.9.94 (source of information: BGBl I 1994, 2705)
- Regulation with respect to the utilization and proof of removal as at 1.9.96 (source of information: BGBl I 1996, 1382, (1997, 2860)
- Regulation with respect to the avoidance and utilization of packaging waste as at 21.8.98 (source of information: BGBl I 1998, 2379)
- Regulation with respect to the European Waste Directory as at 1.12.01 (source of information: BGBl I 2001, 3379)

This information is to be seen as notes. Tests or certifications were not carried out in this respect.



7. APPENDIX

7.1 Acronyms and Definitions

The following acronyms and abbreviations are used in this document.

Table 20: Acronyms

| Acronym | Meaning |
|------------------|---|
| ATA | AT Attachment |
| BIOS | Basic Input/Output System |
| CPU | Central Processing Unit |
| CSM | Compatibility Support Module |
| DC | Direct Current |
| DDC | Display Data Channel |
| DDI | Digital Display Interface |
| DDR3L | DDR3 Low Voltage |
| DMA | Direct Memory Access |
| DP | DisplayPort |
| DVI | Digital Visual Interface |
| ECC | Error-Correcting Code |
| eDP | embedded DisplayPort |
| EEPROM | Electrically Erasable Programmable Read-Only Memory |
| EMC | Electromagnetic Compatibility |
| eSATA | external Serial ATA |
| ESD | Electrostatic Discharge |
| FAE | Field Application Engineer |
| FIFO | First In First Out |
| flexiCFG | Flexible Configuration |
| FPGA | Field Programmable Gate-Array |
| FR4 | Flame Retardant 4 |
| GND | Ground |
| GPIO | General Purpose Input/Output |
| HD | High Definition |
| HDA | High Definition Audio |
| HDMI | High Definition Multimedia Interface |
| HSP | Heat Spreader |
| I | Input |
| I PD | Input with internal Pull-Down resistor |
| I PU | Input with internal Pull-Up resistor |
| I/O | Input/Output |
| IEEE® | Institute of Electrical and Electronics Engineers |
| IP | Ingress Protection |
| IRQ | Interrupt Request |
| iRTC | Industrial Real Time Clock |
| I ² C | Inter-Integrated Circuit |
| JTAG | Joint Test Action Group |
| LED | Light Emitting Diode |
| LP | Low-Profile |
| LPC | Low Pin Count |
| LVDS | Low Voltage Differential Signal |



Table 20: Acronyms (continued)

| Acronym | Meaning |
|---------|--|
| MMC | Multimedia Card |
| mSATA | Mini-SATA |
| MTBF | Mean operating Time Between Failures |
| NC | Not Connected |
| O | Output |
| OD | Open drain output |
| OpROM | Option ROM |
| PC | Personal Computer |
| PCB | Printed Circuit Board |
| PCI | Peripheral Component Interconnect |
| PCIe | Peripheral Component Interconnect express |
| PCMCIA | People Can't Memorize Computer Industry Acronyms |
| PD | Pull-Down |
| PICMG® | PCI Industrial Computer Manufacturers Group |
| PU | Pull-Up |
| PWM | Pulse-Width Modulation |
| PWR | Power |
| RMA | Return Merchandise Authorization |
| RoHS | Restriction of (the use of certain) Hazardous Substances |
| RTC | Real-Time Clock |
| SATA | Serial ATA |
| SCU | System Control Unit |
| SD | Secure Digital |
| SD/MMC | Secure Digital Multimedia Card |
| SDRAM | Synchronous Dynamic Random Access Memory |
| SMB | System Management Bus |
| SO-DIMM | Small Outline Dual In-Line Memory Module |
| SPD | Serial Presence Detect |
| SPI | Serial Peripheral Interface |
| SSD | Solid-State Drive |
| TDP | Thermal Design Power |
| TPM | Trusted Platform Module |
| UART | Universal Asynchronous Receiver/Transmitter |
| uEFI | Unified Extensible Firmware Interface |
| USB | Universal Serial Bus |
| WEEE® | Waste Electrical and Electronic Equipment |
| WES | Microsoft® Windows® Embedded Standard |



7.2 References

Table 21: Further Applicable Documents and Links

| No. | Name | Rev. / Date | Company |
|-----|---|------------------------|------------------------|
| (1) | PICMG® COM0 COM Express™ Module Base Specification | Rev. 2.1, May 14, 2014 | PICMG® |
| (2) | PICMG® COM Express™ Carrier Design Guide (available for public download) https://www.picmg.org/wp-content/uploads/PICMG_COMDG_2.0-RELEASED-2013-12-061.pdf | Rev. 2.0, Dec. 6, 2013 | PICMG® |
| (3) | Intel® Download Center: Intel® Ethernet Controller i210 Series https://downloadcenter.intel.com/product/64399/Intel-Ethernet-Controller-I210-Series | | Intel® |

