# MB-COME10-2
# User's Manual

MB-COME10-2 UM 0101
2024-10-29

# TABLE OF CONTENTS

# TABLE DIRECTORY



# FIGURE DIRECTORY

# REVISION HISTORY

| Rev. | Date | Name | Pos. | Modification |
|---|---|---|---|---|
| 0100 | 2021-06-15 | FP | | First edition |
| 0101 | 2024-10-29 | Kreuzer | 1.4, 6.5, 6.6, 6.7, 7.4<br>3.5.23<br>Table 16 | Chapter added<br>Reference source added<br>Table name optimized |

# 1. ABOUT THIS MANUAL

## 1.1 Copyright and Licence Expenses



This User's Manual may not be copied, reproduced, translated, changed or distributed, completely or partially in electronic, machine readable, or in any other form without the written consent of TQ-Systems GmbH.

The drivers and utilities for the components used as well as the BIOS are subject to the copyrights of the respective manufacturers. The licence conditions of the respective manufacturer are to be adhered to.

BIOS-licence expenses are paid by TQ-Systems GmbH and are included in the price.

Licence expenses for the operating system and applications are not taken into consideration and must be calculated / declared separately.

## 1.2 Registered Trademarks

TQ-Systems GmbH aims to adhere to copyrights of all graphics and texts used in all publications, and strives to use original or license-free graphics and texts.

All brand names and trademarks mentioned in this User's Manual, including those protected by a third party, unless specified otherwise in writing, are subjected to the specifications of the current copyright laws and the proprietary laws of the present registered proprietor without any limitation. One should conclude that brand and trademarks are rightly protected by a third party.

## 1.3 Disclaimer

TQ-Systems GmbH does not guarantee that the information in this User's Manual is up-to-date, correct, complete or of good quality. Nor does TQ-Systems GmbH assume guarantee for further usage of the information. Liability claims against TQ-Systems GmbH, referring to material or non-material related damages caused, due to usage or non-usage of the information given in this User's Manual, or due to usage of erroneous or incomplete information, are exempted, as long as there is no proven intentional or negligent fault of TQ-Systems GmbH.

TQ-Systems GmbH explicitly reserves the rights to change or add to the contents of this User's Manual or parts of it without special notification.

## 1.4 Intended Use

TQ DEVICES, PRODUCTS AND ASSOCIATED SOFTWARE ARE NOT DESIGNED, MANUFACTURED OR INTENDED FOR USE OR RESALE FOR THE OPERATION IN NUCLEAR FACILITIES, AIRCRAFT OR OTHER TRANSPORTATION NAVIGATION OR COMMUNICATION SYSTEMS, AIR TRAFFIC CONTROL SYSTEMS, LIFE SUPPORT MACHINES, WEAPONS SYSTEMS, OR ANY OTHER EQUIPMENT OR APPLICATION REQUIRING FAIL-SAFE PERFORMANCE OR IN WHICH THE FAILURE OF TQ PRODUCTS COULD LEAD TO DEATH, PERSONAL INJURY, OR SEVERE PHYSICAL OR ENVIRONMENTAL DAMAGE. (COLLECTIVELY, "HIGH RISK APPLICATIONS")

You understand and agree that your use of TQ products or devices as a component in your applications are solely at your own risk. To minimize the risks associated with your products, devices and applications, you should take appropriate operational and design related protective measures.

You are solely responsible for complying with all legal, regulatory, safety and security requirements relating to your products. You are responsible for ensuring that your systems (and any TQ hardware or software components incorporated into your systems or products) comply with all applicable requirements. Unless otherwise explicitly stated in our product related documentation, TQ devices are not designed with fault tolerance capabilities or features and therefore cannot be considered as being designed, manufactured or otherwise set up to be compliant for any implementation or resale as a device in high risk applications. All application and safety information in this document (including application descriptions, suggested safety precautions, recommended TQ products or any other materials) is for reference only. Only trained personnel in a suitable work area are permitted to handle and operate TQ products and devices. Please follow the general IT security guidelines applicable to the country or location in which you intend to use the equipment.

## 1.5 Imprint

TQ-Systems GmbH
Gut Delling, Mühlstraße 2
**D-82229 Seefeld**

Tel: +49 8153 9308–0
Fax: +49 8153 9308–4223
E-Mail: Info@TQ-Group
Web: TQ-Group

## 1.6 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.

## 1.7 Tips on Safety

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

## 1.8 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.<br>Please note the relevant statutory regulations in this regard.<br>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 denotes commands, contents, file names, or menu items. |

## 1.9 Handling and ESD Tips

General handling of your TQ-products

| | |
|---|---|
|  | 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.<br>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.<br>Violation of this guideline may result in damage / destruction of the MB-COME10-2 module and be dangerous to your health.<br>Improper handling of your TQ-product would render the guarantee invalid. |

Proper ESD handling

| | |
|---|---|
|  | The electronic components of your TQ-product are sensitive to electrostatic discharge (ESD).<br>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. |

## 1.10 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#

## 1.11 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-COME10-2 is a carrier board for COM Express™ modules with Type 10 pinout.
It can be used for panel PCs, embedded computers or as an 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. Because of this – with uniform interfaces and dimensions – the PC system can be easily adapted to suit the requirements of the application. The manifold extension options and storage media, which can be added, offer a high level of flexibility and allow functionalities and performance to be extended easily, quickly and inexpensively.
Typical usage is 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-COME10-2:

**Supported Modules:**

- COM Express™ Mini Modules with Type 10 pinout

**External Interfaces:**

- 2 × Gigabit Ethernet (1× 1.0 Gb/s and 1× 2.5 Gb/s)
- 4 × USB (1x Type C with 5 Gb/s; 1x Type A with up to 10 Gb/s, 2x Type A with 480 Mb/s)
- 1 × DisplayPort (DP++)
- Audio (headphone out, line in and microphone in)
- Power Button / Reset

**Internal Interfaces:**

- LVDS or eDP
- 2 × USB 2.0
- M.2 socket with B key (for SATA SSDs or WWAN modules) (with micro SIM Card support)
- M.2 socket with E key (e.g. for WLAN / Bluetooth cards)
- M.2 socket with M key (for PCIe SSDs)
- SATA interface
- µSD card socket
- 4 serial interfaces (e.g. with RS-232 transceivers)
- CAN interface (galvanically isolated)
- PCIe slot (for PCI add in cards)
- GPIO / $I^2C$ / MISC connectors

**Power supply:**

- Voltage: 12 V DC ±5 %

**Environment:**

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

**Form factor / dimensions:**

- 170 mm × 170 mm (Mini ITX)

## 2.2 Specification Compliance

The MB-COME10-2 supports modules compliant to the PICMG® COM Express™ Module Base Specification (COM.0 Revision 3.0) with Type 10 pinout.

## 2.3 Carrier Board Standard Configurations

- **MB-COME10-2-AA**
  COM Express™ Type 10 pinout for evaluation purposes

Other configurations are available on request.

## 2.4 Accessories

- **DK-USB-TYPA-MOL5**
  Adapter cable from internal USB connector to A-Type receptacle, 150 mm long

- **DK-RS-232-9POL-DSUB-PICOBLADE**
  Adapter cable from internal connector to 9-pin D-Sub male connector, 150 mm long

- **SPI Flash device MX25L25645GM2I-08G**

- **Battery CR2032 lithium coin cell**

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

# 3. FUNCTION

## 3.1 Block Diagram

The following illustration shows the block diagram of the MB-COME10-2:

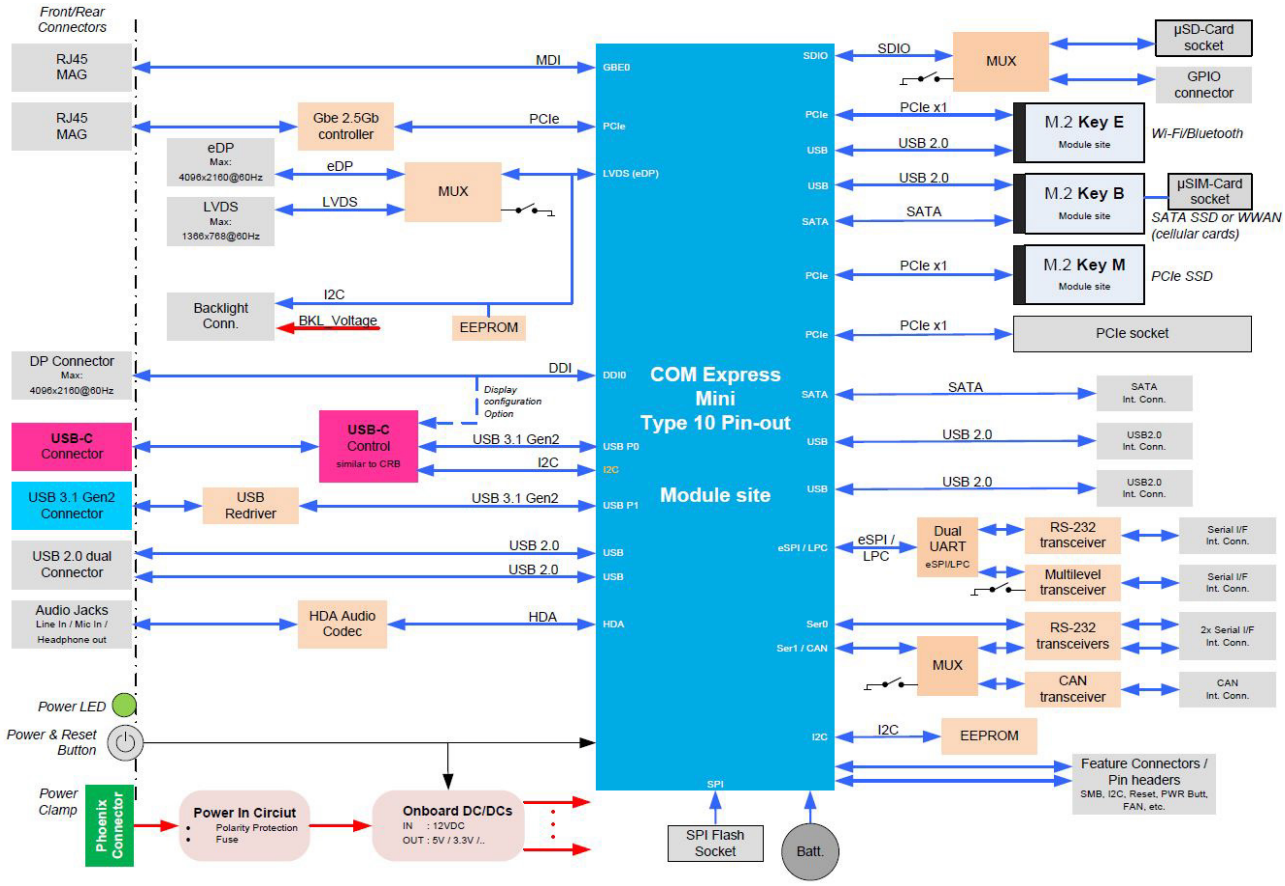


Figure 1: Block Diagram MB-COME10-2

## 3.2 Electrical Specification

### 3.2.1 Supply Voltage Characteristics

The MB-COME10-2 requires an input voltage of 12 V DC ±5 %.

The input voltages shall rise from 10 % to 90 % of nominal within 0.1 msec to 20 msec (0.1 msec ≤ Rise Time ≤ 20 msec).

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; e.g., COM Express™ module, mass storage devices, PCIe card, USB devices, display backlight, speakers, etc.

The power consumption of the MB-COME10-2 itself is approximately 2 watts (COM Express™ module supplied externally; UEFI-shell active; no keyboard, no mouse, no mass storage device, no Ethernet cable etc. connected).

The MB-COME10-2 input current is fused with 5 A. The load caused by devices connected to the carrier board should not exceed 50 watts.

| Note: Power requirement | |
|---|---|
|  | The power supply for the MB-COME10-2 must be configured with enough reserve.<br>It should be calculated with the maximum power consumption of all connected components. |

## 3.3 Environmental Specification

- Operating temperature, extended: –20 °C to +85 °C
- Storage temperature: –40 °C to +85 °C
- Relative humidity (operating / storage): 10 % to 90 % (not condensing)

## 3.4 System Components

### 3.4.1 2.5 Gigabit Ethernet Controller

The MB-COME10-2 provides an Intel® i225IT Ethernet controller with 10/100/1000/2500 Mbps speed and IEEE1588 support.

Please contact support@tq-group.com for further information about the IEEE1588 support.

### 3.4.2 HD-Audio

The MB-COME10-2 provides a Realtek ALC262 High Definition Audio Codec with a headphone output a line in input a microphone input.

### 3.4.3 Dual UART

The MB-COME10-2 is equipped with a Fintek F81214 dual UART which supports eSPI and LPC interface. If the connected module supports eSPI and LPC a hardware switch can be used to select LPC or eSPI. The register set of the UART is based on the industry standard 16550 UART. The connected serial ports operate with standard serial port drivers.

## 3.5 Connectors and Interfaces

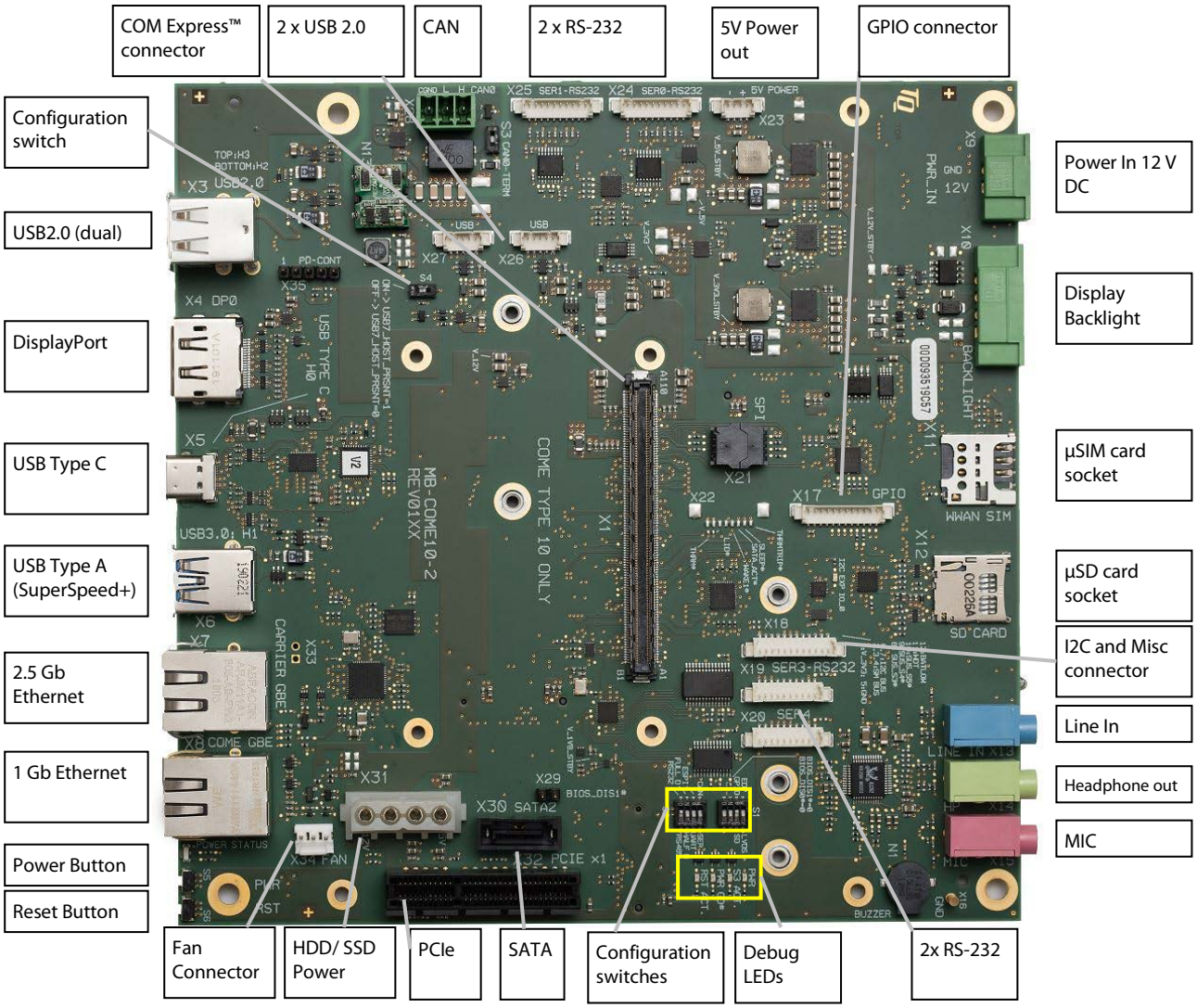


Figure 2: MB-COME10-2, Top

## 3.5 Connectors and Interfaces (continued)

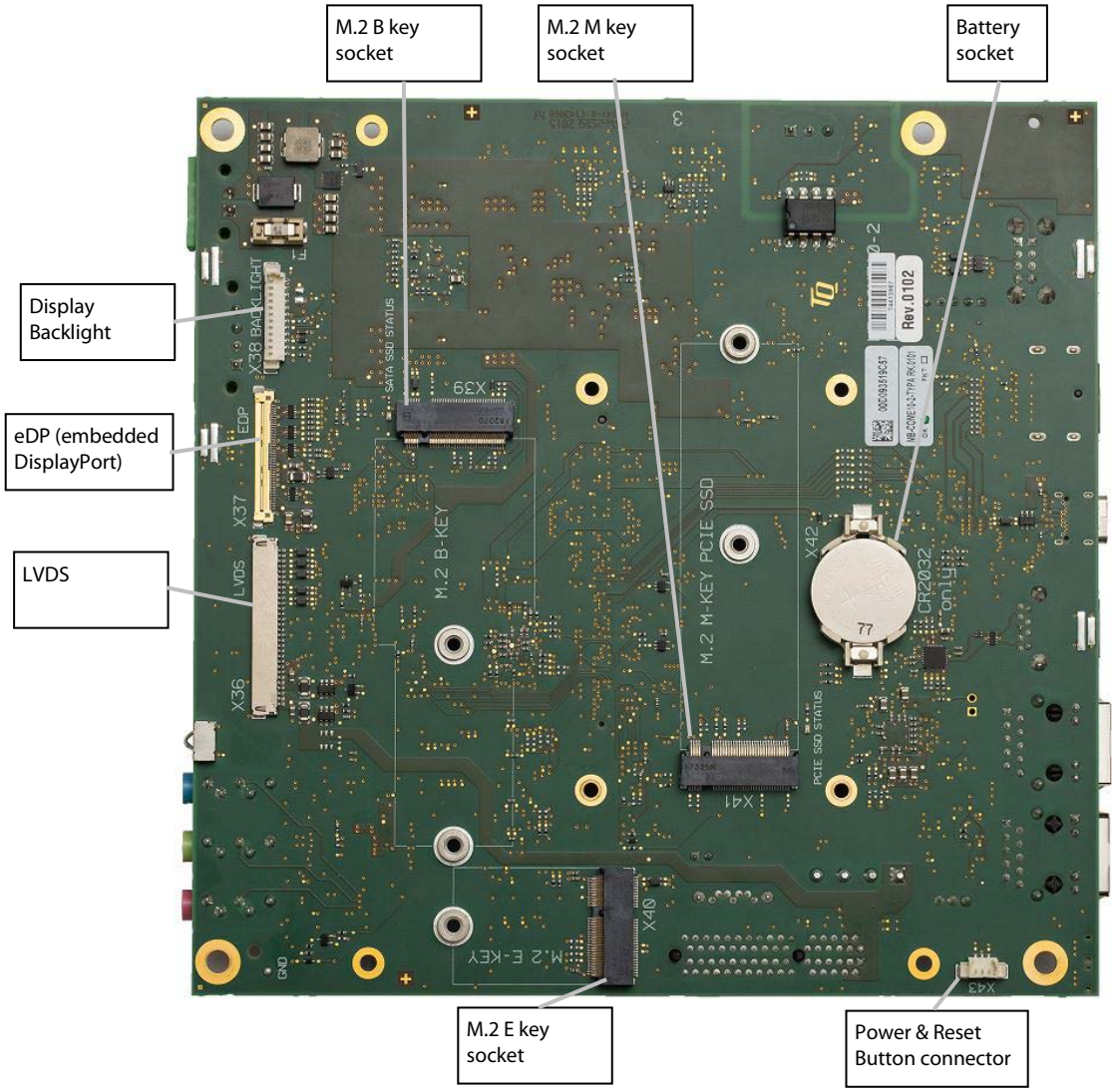


Figure 3: MB-COME10-2, Bottom

### 3.5.1 Power Supply

The MB-COME10-2 requires a single 12 V DC power supply. The supply voltage should not vary more than ±5 %.

X12: Power-In Connector:

- Connector type: Phoenix MC 1,5/ 2-GF-3,5-LR (1817615)
- Mating connector: e.g. Phoenix FMC 1,5/ 2-STF-3,5 (1966091)

Table 2: Pinout Power-In Connector, X9

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

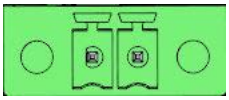


Figure 4: DC Power Supply Connector

### 3.5.2 DisplayPort

On the MB-COME10-2 there is a DisplayPort interface. The support of the interfaces and 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-COME10-2 supports several USB Host interfaces.

X5: C-Type connector connected to Host 0 of the COM Express™ module. Data rates of up to 5 Gb/s are supported. The USB device and OTG capability is dependent on the connected COM Express™ module.

X6: A-Type connector connected to Host 1 of the COM Express™ module. This port is equipped with a 10 Gb/s redriver and is SuperSpeed+ (USB 3.2 Gen2) capable, if this is supported by the connected COM Express™ module.

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

X26 / X27: USB host extension connector for usage of a USB host port with an adapter cable

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

Table 3: Pinout USB Host Extension Connectors

| Pin | Signal | Cable Colour |
|---|---|---|
| 1 | +5 V | Red |
| 2 | D– | White |
| 3 | D+ | Green |
| 4 | GND | Black |
| 5 | GND | – |


Figure 5: USB on-board Connectors X26, X27


Figure 6: Configuration Switch S4

S4 should be set to OFF for USB Port 7 (X27) host operation

### 3.5.4 Gigabit Ethernet

The MB-COME10-2 supports one Gigabit Ethernet port. The Ethernet signals of the COM Express™ connector are routed to X8. The maximum supported speed on this connector is 1 Gb/s.

Table 4: Ethernet LEDs, X8

| LED | Status | |
|---|---|---|
| Left, green (Link) | Off: | No link |
| | On: | Link established |
| Right, yellow (ACT) | Off: | No activity |
| | On: | Activity |

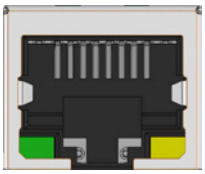

Figure 7: RJ45 Connector X8

### 3.5.5 2.5 Gigabit Ethernet

An Intel® i225 Ethernet controller with 10/100/1000/2500 Mbps is implemented on the MB-COME10-2. It is connected to X7.

Table 5: Ethernet LEDs, X7

| LED | Status | |
|---|---|---|
| Left, green (Link) | Off: | No link |
| | On: | Link established |
| Right, yellow (ACT) | Off: | No activity |
| | On: | Activity |

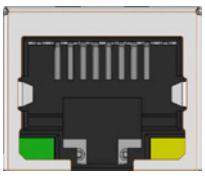

Figure 8: RJ45 Connector X7

### 3.5.6 Serial Interface (RS-232)

The MB-COME10-2 supports four RS-232 serial port at an on-board connector:

- Connector type: Molex 53398-1071
- Mating connector: Molex 51021-1000 crimp housing

The COM Express™ Specification only provides 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 6: MB-COME10-2, Serial Port Pin Mapping

| COM Express™ Signal | COM Express™ Pin | MB-COME10-2 | 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] | B77 | SER0_RTS# | 3.3 V input |
| SER0_CTS# [1] | B78 | SER0_CTS# | 3.3 V output |
| SER1_RTS# [1] | B91 | SER1_RTS# | 3.3 V input |
| SER1_CTS# [1] | B92 | SER1_CTS# | 3.3 V output |

1: Signals are not specified in **COM Express™** specification.
Signals are only available when the TQ flexiCFG feature is available on the COM Express™ module. TQ modules support this feature.

### 3.5.6 Serial Interface (RS-232) (continued)

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-COME10-2 the protection circuit is removed and the serial ports provide a transfer rate of up to 115 kbaud.
The MB-COME10-2 can only be used in combination with Type 10 pinout COM Express™ modules.
For SER1 functionality the corresponding hardware switch on the carrier has to be set to "SER" position.
The SER1 COM Express™ pins are multiplexed with CAN functionality.

Table 7: Serial interfaces on MB-COME10-2

| Connector | UART | Remark |
|---|---|---|
| X24 | Port COM Express™ module SER0 | RS-232 transceiver (Rx/Tx/RTS/CTS capable if supported by module) |
| X25 | Port COM Express™ module SER1 | RS-232 transceiver (Rx/Tx/RTS/CTS capable if supported by module) |
| X19 | Fintek 81214 | RS-232 transceiver (Rx/Tx/RTS/CTS/DTR/DSR/DCD/RI capable) |
| X20 | Fintek 81214 | RS-232 / RS-485 transceiver (Rx/Tx/RTS/CTS capable for RS-232) |

Table 8: RS-232 Signals

| Pin | RS-232 Signal (all signals) | MB-COME10-2 | D-Sub connector (with DSUB-Adaptor) |
|---|---|---|---|
| 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 | – |

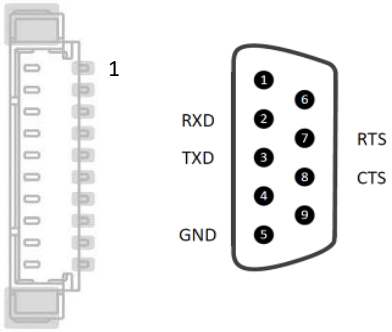


Figure 9: Molex Connector and RS-232 D-SUB Connector

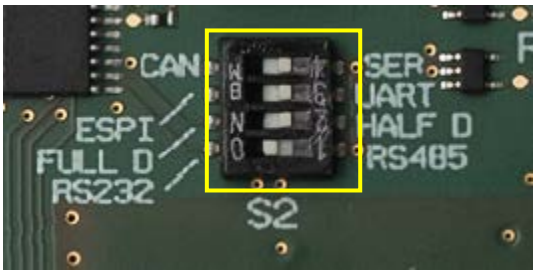


Figure 10: Configuration Switch S2

Configuration Switch S2
S2.4: Switch to "SER" for RS-232 at X25
S2.3: "ESPI" for ESPI UART / "UART" for LPC UART
S2.2: "Full D" for full duplex at X20 / "Half D" for half duplex at X20
S2.1: "RS-232" for RS-232 operation at X20 / "RS-485" for RS-485 at X20

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

### 3.5.7 Embedded Display Port

The MB-COME10-2 provides an embedded DisplayPort (eDP) interface where suitable displays can be directly connected.
If an eDP COM Express™ module is connected to the MB-COME10-2 the corresponding hardware switch on the carrier has to be set to the "EDP" position. This function is only available with COM Express™ modules, which provide eDP.

Please contact support@tq-group.com for further information about eDP or LVDS support.

X37: eDP connector:

- Connector type: JAE HD1S040HA1
- Mating connector: JAE HD1P040MA1

Table 9: eDP Connector, X37

| Pin | Signal | Remark |
|---|---|---|
| 1 | NC | – |
| 2 | GND | – |
| 3 | TX3– | Lane 3 differential pair |
| 4 | TX3+ | |
| 5 | GND | – |
| 6 | TX2– | Lane 2 differential pair |
| 7 | TX2+ | |
| 8 | GND | – |
| 9 | TX1– | Lane 1 differential pair |
| 10 | TX1+ | |
| 11 | GND | – |
| 12 | TX0– | Lane 0 differential pair |
| 13 | TX0+ | |
| 14 | GND | – |
| 15 | AUX+ | AUX channel |
| 16 | AUX– | |
| 17 | GND | – |
| 18 | 3V3 | 3.3 V supply voltage |
| 19 | 3V3 | |
| 20 | 3V3 | |
| 21 | 3V3 | |
| 22 | NC | – |
| 23 | GND | – |
| 24 | GND | |
| 25 | GND | |
| 26 | GND | |
| 27 | HPD | Hot Plug Detect |
| 28 | GND | – |
| 29 | GND | |
| 30 | GND | |
| 31 | GND | |
| 32 | BLKT_EN | Backlight enable |
| 33 | BLKT_CTRL | Backlight (brightness) control |
| 34 | VDD_EN | Panel power enable |
| 35 | AUX_SEL | Low ⇨ AUX; High ⇨ I²C |
| 36 | V_BLKT | 12 V Backlight supply voltage |
| 37 | V_BLKT | |
| 38 | V_BLKT | |
| 39 | V_BLKT | |
| 40 | NC | – |

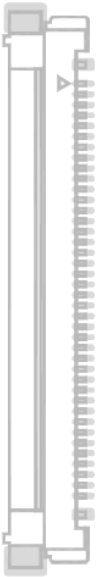


Figure 11: eDP Connector

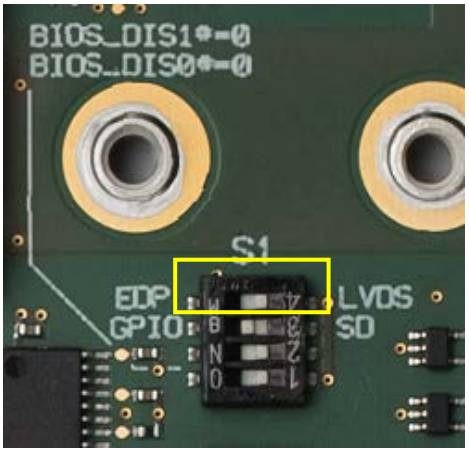


Figure 12: Config Switch S1: eDP/LVDS

### 3.5.8 LVDS

The MB-COME10-2 provides an LVDS interface where suitable displays can be directly connected.
This functionality is only available if the COM Express™ module used provides LVDS. If an LVDS COM Express™ module is connected to the MB-COME10-2 the corresponding hardware switch on the carrier has to be set to the “LVDS” position.

Connectors to power the backlight of the display are provided on the MB-COME10-2.

The MB-COME10-2 has an on-board EDID EEPROM to store display specific timing information. The EEPROM can be programmed with an I²C programmer.

X36: LVDS connector:

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

Table 10: LVDS Connector, X36

| 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[4] |
| 13 | B0+ | Even bus[4] |
| 14 | GND | – |
| 15 | B1– | Even bus[4] |
| 16 | B1+ | Even bus[4] |
| 17 | GND | – |
| 18 | B2– | Even bus[4] |
| 19 | B2+ | Even bus[4] |
| 20 | BCLK– | Even bus[4] |
| 21 | BCLK+ | Even bus[4] |
| 22 | B3– | Even bus[4] |
| 23 | B3+ | Even bus[4] |
| 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 | |


Figure 13: LVDS Connector X36

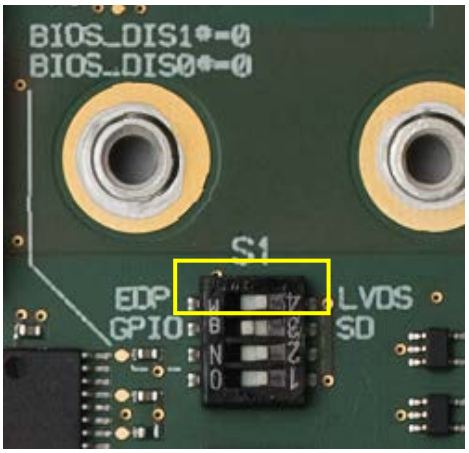


Figure 14: Config Switch S1: eDP/LVDS

4: Not available for COM Express™ Type 10 designs since signal is not defined in COM Express™ specification.

### 3.5.8 LVDS (continued)

X10: Backlight Power connector:

- Connector type: Phoenix MC 1,5/ 4-GF-3,5-LR (1817631)
- Mating connector: e.g. Phoenix FMC 1,5/ 4-STF-3,5 (1966114)

Table 11: Backlight Power Connector, X10

| Pin | Signal | Remark |
|---|---|---|
| 1 | 12V_BL | 12 V always-on output |
| 2 | VCC_IN [5] | Backlight voltage input |
| 3 | GND | – |
| 4 | VCC_BKLT_OUT | Backlight voltage output |

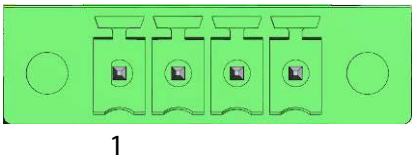


Figure 15: Backlight Power Connector X10

Connect Pin 1 and 2 to use the 12 V of the MB-COME10-2 for the backlight.

X38: Backlight connector:

- Connector type: Molex 53398-1271
- Mating connector: Molex 51021-1200 crimp housing

Table 12: Backlight Connector, X38

| Pin | Signal | Remark |
|---|---|---|
| 1 | V_BKLT_OUT | 12 V switched output |
| 2 | | |
| 3 | | |
| 4 | GND | – |
| 5 | | |
| 6 | | |
| 7 | NC | – |
| 8 | BLEN | Backlight Enable output |
| 9 | BLT_CTRL | Backlight (brightness) control |
| 10 | 3V3_PROG [6] | 3.3 V input (programming) |
| 11 | EDID_CLK [6] | EDID I²C clock |
| 12 | EDID_DAT [6] | EDID I²C data |


Figure 16: Backlight Connector X38

5: Connect Pin 1 and 2 to use the 12 V of the MB-COME10-2 for the backlight.
6: These pins can be used to program the on-board EDID EEPROM. The EEPROM can be powered by the 3V3_PROG pin.

### 3.5.9 M.2 Socket with B Key

The MB-COME10-2 provides a socket to support SATA based M.2 SSDs or USB based WWAN modules.
SATA and USB 2.0 interface signals are routed to this socket. A Micro SIM card socket for native support of UMTS or LTE modules is also available.
M.2 with sizes 2280, 2242 or 3042, single and double sided, with B or B+M key can be inserted. Modules with 42 mm length have to be mounted with an additional distance spacer.
The maximum transfer rate of this interface mainly depends on the COM Express™ module used and the connected device.

### 3.5.10 M.2 Socket with E Key

The MB-COME10-2 provides a socket to support M.2 modules with 22 mm width and 30 mm length.
USB and a PCIe ×1 interface signals are routed to this socket.
M.2 2230 single and double sided modules with E or A+E key can be inserted.
The transfer rate of this interface mainly depends on the COM Express™ module and the connected device.

### 3.5.11 M.2 Socket with M Key

The MB-COME10-2 provides a socket to support PCIe based M.2 SSDs. with 22 mm width and 80 or 42 mm length.
PCIe x1 interface signals are routed to this socket.
M.2 2280 or 2242 single and double sided modules with M or B+M key can be inserted. Modules with 42 mm length have to be mounted with an additional distance spacer.
The transfer rate of this interface mainly depends on the COM Express™ module and the connected device.

### 3.5.12 SATA Connector

The MB-COME10-2 provides a standard 7-pin SATA connector where SSDs or HDDs can be connected. For powering these drives with an appropriate adaptor an additional power connector is on the MB-COME10-2.
The transfer rate of this interface mainly depends on the COM Express™ module and the connected device.

### 3.5.13 PCI Express Socket

The MB-COME10-2 provides a socket to support PCI Express extension cards.
PCIe x1 interface signals are routed to this socket.
The transfer rate of this interface mainly depends on the COM Express™ module and the connected device.

### 3.5.14 µSD Card

The MB-COME10-2 is equipped with a socket to support micro SD cards.
This functionality is only working if the connected COM Express™ module provides an SD card interface. If a COM Express™ module with SD card interface is connected to the MB-COME10-2 the corresponding hardware switch on the carrier has to be set to the “SD” position.

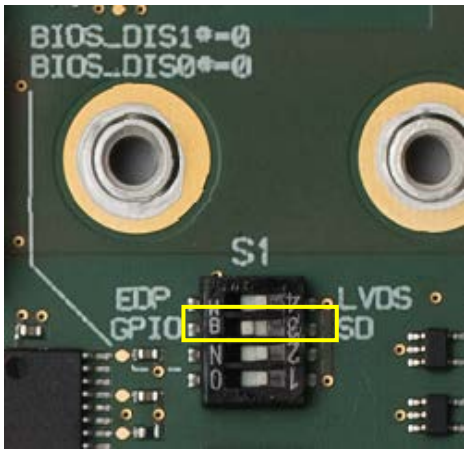


Figure 17: Config Switch S1: GPIO / SD

### 3.5.15 Audio

The MB-COME10-2 provides an audio codec to support following audio features:

- Headphone out
- Microphone in
- Line in

### 3.5.16 CAN

The MB-COME10-2 provides one isolated CAN interface.
This functionality is only working if the connected COM Express™ module provides a CAN interface on the SER1_TX and SER1_RX pins. For CAN functionality the corresponding hardware switch on the carrier has to be set to “CAN” position.

Table 13: CAN Connector, X28

| Pin | Signal | Remark |
|---|---|---|
| 1 | CAN_H | CAN High |
| 2 | CAN_L | CAN Low |
| 3 | GND_CAN | Isolated CAN Ground |

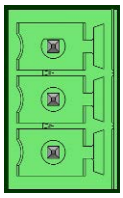


Figure 18: CAN Connector X28

The CAN port can be terminated with 120 Ω. Set switch S3 to “ON” to activate the termination.

### 3.5.17 Fan Connector

The MB-COME10-2 provides a connector for 12 V fans with a standard 3-pin connector.

Table 14: 12 V Fan Connector, X34

| Pin | Signal | Remark |
|---|---|---|
| 1 | GND | – |
| 2 | Fan Voltage | Output voltage (0 to 12 V PWM) |
| 3 | SENSE | Sense input for fan speed<br>(for open drain outputs of fans) |

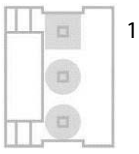


Figure 19: 12 V Fan Connector X34

### 3.5.18 Power and Reset Button Connector

A power and a reset button can be connected to the MB-COME10-2.

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

Table 15: Power and Reset Button Connector, X43

| Pin | Signal |
|---|---|
| 1 | PWR_BTN# |
| 2 | GND |
| 3 | RST_BTN# |

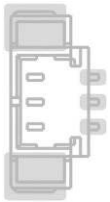


Figure 20: PWR and RST Button Connector X43

### 3.5.19 GPIO Connector

The MB-COME10-2 provides a connector for access to the COM Express™ module's GPIOs.

This functionality is only working if the connected COM Express™ module provides GPIO functionality. If a COM Express™ module with GPIO functionality is connected to the MB-COME10-2 the corresponding hardware switch on the carrier has to be set to the "GPIO" position.

- Connector type: Molex 53398-1271
- Mating connector: Molex 51021-1200 crimp housing

Table 16: Power and Reset Button Connector, X17

| Pin | Signal |
|---|---|
| 1 | GPO0 |
| 2 | GPO1 |
| 3 | GPO2 |
| 4 | GPO3 |
| 5 | GPI0 |
| 6 | GPI1 |
| 7 | GPI2 |
| 8 | GPI3 |
| 9 | NC |
| 10 | NC |
| 11 | V_3V3 |
| 12 | GND |


Figure 21: GPIO Connector X17

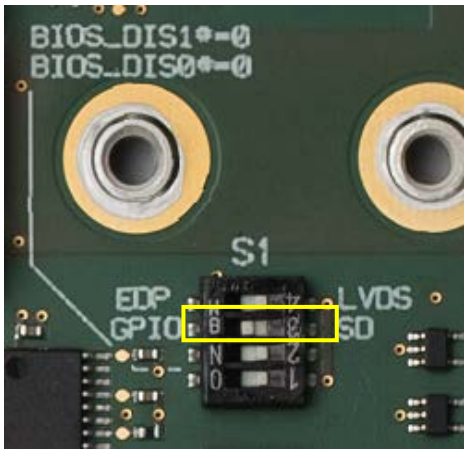


Figure 22: Config Switch S1: GPIO / SD

### 3.5.20 I²C and Misc Connector

The MB-COME10-2 provides a connector, where the COME I²C, the SMBus and a few COM Express™ signals are available.
This connector is for debug and software development purposes. The user can access to SMBus, I²C bus and a few other signals.

- Connector type: Molex 53261-1271
- Mating connector: Molex 51021-1200 crimp housing

Table 17: I²C and Misc. Connector, X18

| Pin | Signal | Remark |
|---|---|---|
| 1 | V_3V3# | 3.3 V supply |
| 2 | SMB_CK | SM bus clock |
| 3 | SMB_DAT | SM bus data |
| 4 | SMB_ALERT# | SM bus alert |
| 5 | GND | – |
| 6 | I2C_CK | COM Express™ I²C bus clock |
| 7 | I2C_DAT | COM Express™ I²C bus data |
| 8 | SUS_S3# | Suspend to RAM state signal |
| 9 | SUS_S4# | Suspend to disk state signal |
| 10 | SUS_S5# | Soft off state signal |
| 11 | COME_WDT | COM Express™ Watch dog timer |
| 12 | BATLOW# | COM Express™ BATLOW signal |


Figure 23: I²C and Misc. Connector X18

### 3.5.21 Debug LEDs

The MB-COME10-2 provides several LEDs for debug purposes.

Table 18: Debug LEDs

| Function | PCB Text | Remark |
|---|---|---|
| Power | PWR | Green, when 12 V input power is present |
| SUS S3 | S3 act. | Green, when module is in power-saving mode S3 (Suspend to RAM) |
| Power Good # | PWR GD# | Green, when no PWR_OK signal is sent to module (means power fail/off on carrier board) |
| Reset active | RST ACT. | Green, when Reset is asserted |
| Power Status | POWER STATUS | Off: Carrier is not powered<br>Green: Module in operation (S0 state)<br>Orange: Module is turned off or in sleep state (S5: soft off or S3/S4: sleep) |

### 3.5.22 SPI Flash Socket

The MB-COME10-2 provides 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.
It depends on the COM Express™ module used whether a certain flash device is supported.
If the "BIOS_DIS1#" jumper is set or the "BIOS_DIS1#" switch is "ON", the BIOS from the SPI flash in the socket is active.

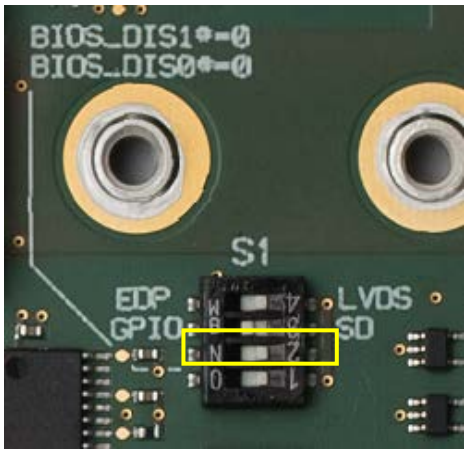


Figure 24: Config Switch S1: BIOS_DIS functionality

### 3.5.23 COM Express™ Connector

The EPT 401-55101-51 or equivalent is used as COM Express™ connector. Connector samples are available from:
https://www.ept.de/index.php?tq-colibri-lp

The stack height (board to board distance between carrier board and COM Express™ module) is 8 mm.

# 4. MECHANICS

## 4.1 Dimensions

The dimensions are according to Mini-ITX form factor, which is 170 × 170 mm².
The following illustration shows the dimensions of the MB-COME10-2.

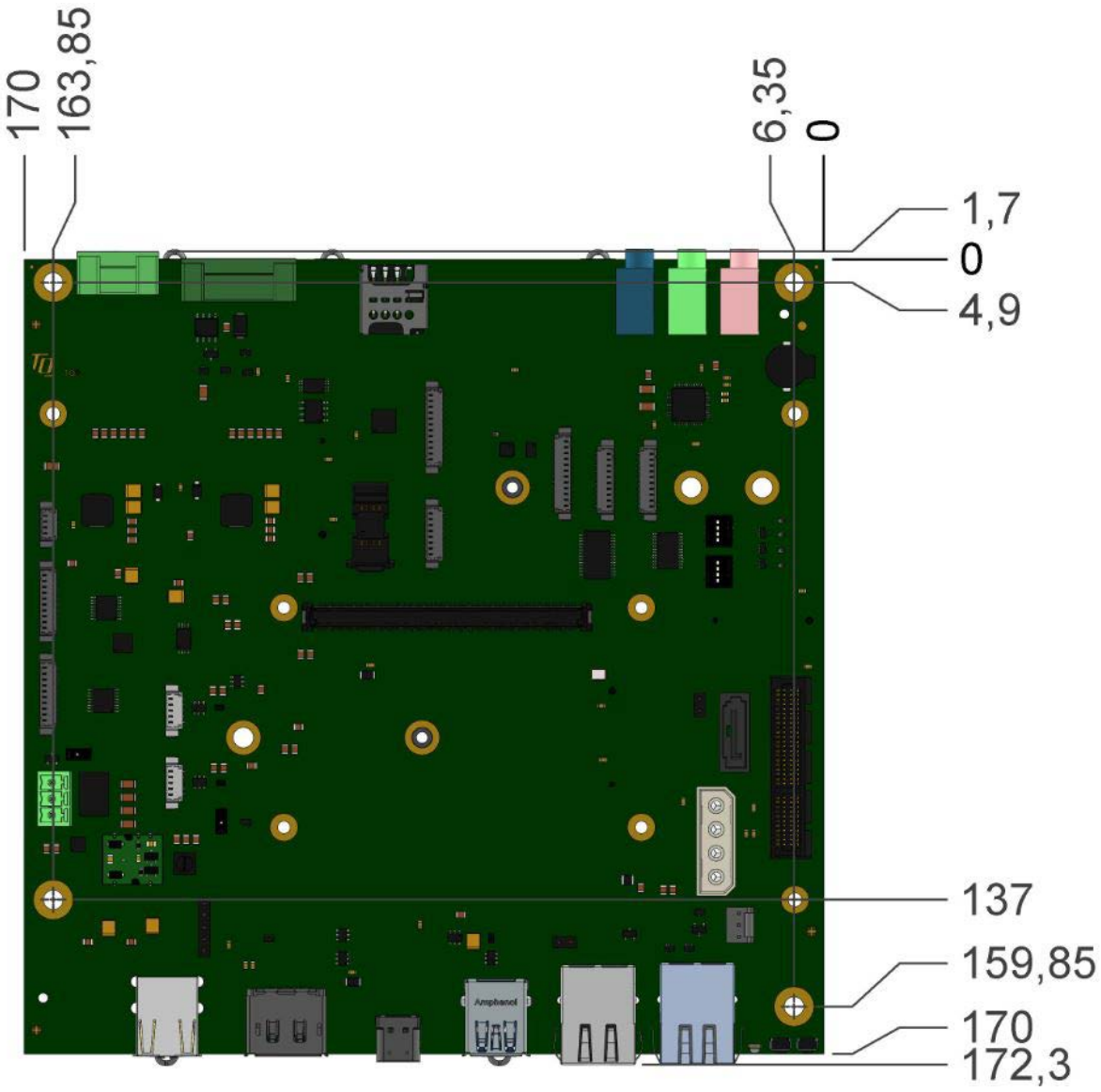


Figure 25: MB-COME10-2 Dimensions

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

## 4.2 Protection Against External Effects

The MB-COME10-2 is not protected against dust, external impact and contact (IP00).
Adequate protection has to be provided by the overall 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 I²C and COME connector.
The following table shows the I²C address mapping for the General Purpose I²C bus:

Table 19: I²C Address Mapping General Purpose I²C Bus

| 8-bit Address | Function | Device | Remark |
|---|---|---|---|
| 0xAE | EEPROM | 24AA32ATE | COM Express™ Carrier EEPROM |
| 0xE0 | GPIO Expander | PCA9538ABS | 8-bit I/O Expander e.g. for software test purposes |

### 5.1.2 SMBus

The SMBus (System Management Bus) on the MB-COME10-2 is routed to the i225 Ethernet controller.
The SMBus can be connected to the PCIe clock buffer, the PCIe slot and the M.2 E key socket by resistor assembly options.
The SMBus is also accessible at the I²C and Misc connector.
The following table shows the I²C address mapping for the COM Express™ SMBus port:

Table 20: I²C Address Mapping COM Express™ SMBus Port

| 8-bit Address | Function | Device | Remark |
|---|---|---|---|
| 0xA2 | Ethernet controller | Intel i225 | – |
| 0xC4 | PCIe Clock buffer | Silicon Labs SI53106 | – |

## 5.2 Operating Systems

### 5.2.1 Supported Operating Systems

The MB-COME10-2 supports various Operating Systems:

- Microsoft® Windows® 10
- Linux (i.e. Ubuntu 20.10 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-COME10-2 module is well supported by the Standard Operating Systems, which already include most of the drivers required. 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 and Intel® i225IT 2.5 Gigabit Ethernet controllers can be downloaded at this Intel® page:

- Intel® Download Center: Intel® Ethernet Controller Series
  https://downloadcenter.intel.com/download/22283/Intel-Ethernet-Adapter-Complete-Driver-Pack

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

# 6. SAFETY REQUIREMENTS AND PROTECTIVE REGULATIONS

## 6.1 EMC

The MB-COME10-2 was developed according to the requirements of electromagnetic compatibility (EMC). Depending on the target system, anti-interference measures may still be necessary to guarantee that the limits for the overall system including housing are met.

## 6.2 ESD

In order to avoid interspersion 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-COME10-2, no special preventive measures are taken.

## 6.3 Shock & Vibration

The MB-COME10-2 is designed to be insensitive to shock, vibration and impact.

## 6.4 Operational Safety and Personal Security

Due to the occurring voltages (≤20 V DC), tests with respect to the operational and personal safety have not been carried out.

## 6.5 Cyber Security

A Threat Analysis and Risk Assessment (TARA) must always be performed by the customer for their individual end application, as the MB-COM10-2 is only a sub-component of an overall system.

## 6.6 Export Control and Sanctions Compliance

The customer is responsible for ensuring that the product purchased from TQ is not subject to any national or international export/import restrictions. If any part of the purchased product or the product itself is subject to said restrictions, the customer must procure the required export/import licenses at its own expense. In the case of breaches of export or import limitations, the customer indemnifies TQ against all liability and accountability in the external relationship,irrespective of the legal grounds. If there is a transgression or violation, the customer will also be held accountable for any losses, damages or fines sustained by TQ. TQ is not liable for any delivery delays due to national or international export restrictions or for the inability to make a delivery as a result of those restrictions. Any compensation or damages will not be provided by TQ in such instances.

The classification according to the European Foreign Trade Regulations (export list number of Reg. No. 2021/821 for dual-use-goods) as well as the classification according to the U.S. Export Administration Regulations in case of US products (ECCN according to the U.S. Commerce Control List) are stated on TQ´s invoices or can be requested at any time. Also listed is the Commodity code (HS) in accordance with the current commodity classification for foreign trade statistics as well as the country of origin of the goods requested/ordered.

## 6.7 Warranty

TQ-Systems GmbH warrants that the product, when used in accordance with the contract, fulfills the respective contractually agreed specifications and functionalities and corresponds to the recognized state of the art.

The warranty is limited to material, manufacturing and processing defects. The manufacturer's liability is void in the following cases:

- Original parts have been replaced by non-original parts.
- Improper installation, commissioning or repairs.
- Improper installation, commissioning or repair due to lack of special equipment.
- Incorrect operation
- Improper handling
- Use of force
- Normal wear and tear

## 6.8 Reliability and Service Life

The MTBF according to MIL-HDBK-217F N2 is 401,843 hours, Ground Benign, at +40 °C.

# 7. ENVIRONMANT PROTECTION

## 7.1 RoHS

The MB-COME10-2 is manufactured RoHS compliant.

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

## 7.2 WEEE®

The final distributor is responsible for compliance with the WEEE® regulation.

Within the scope of the technical possibilities, the MB-COME10-2 was designed to be recyclable and easy to repair.

## 7.3 REACH®

The EU-chemical regulation 1907/2006 (REACH® regulation) stands for registration, evaluation, certification and restriction of substances SVHC (Substances of very high concern, e.g., carcinogen, mutagen and/or persistent, bio accumulative and toxic). Within the scope of this juridical liability, TQ-Systems GmbH meets the information duty within the supply chain with regard to the SVHC substances, insofar as suppliers inform TQ-Systems GmbH accordingly.

## 7.4 Statement on California Proposition 65

California Proposition 65, formerly known as the Safe Drinking Water and Toxic Enforcement Act of 1986, was enacted as a ballot initiative in November 1986. The proposition helps protect the state's drinking water sources from contamination by approximately 1,000 chemicals known to cause cancer, birth defects, or other reproductive harm ("Proposition 65 Substances") and requires businesses to inform Californians about exposure to Proposition 65 Substances.

The TQ device or product is not designed or manufactured or distributed as consumer product or for any contact with end-consumers. Consumer products are defined as products intended for a consumer's personal use, consumption, or enjoyment. Therefore, our products or devices are not subject to this regulation and no warning label is required on the assembly.

Individual components of the assembly may contain substances that may require a warning under California Proposition 65. However, it should be noted that the Intended Use of our products will not result in the release of these substances or direct human contact with these substances. Therefore you must take care through your product design that consumers cannot touch the product at all and specify that issue in your own product related documentation.

TQ reserves the right to update and modify this notice as it deems necessary or appropriate.

## 7.5 EuP

The Eco Design Directive, also Energy using Products (EuP), is applicable to products for the end user with an annual quantity >200,000. The MB-COME10-2 must therefore always be seen in conjunction with the complete device. The available standby and sleep modes of the components on the MB-COME10-2 enable compliance with EuP requirements for the MB-COME10-2.

## 7.6 Battery

No batteries are assembled on the MB-COME10-2 by default. The MB-COME10-2 provides a battery socket, which can be equipped with a CR2032, 3.0 V lithium coin cell. The MB-COME10-2 provides current limiting circuitry and protection against reverse current.

## 7.7 Packaging

The MB-COME10-2 is delivered in reusable packaging.

## 7.8 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.

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.

Capacitors and transformers containing PCB (polychlorinated biphenyls) are not used.

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.

# 8. APPENDIX

## 8.1 Acronyms and Definitions

The following acronyms and abbreviations are used in this document.

Table 21: Acronyms

| Acronym | Meaning |
|---|---|
| ATA | Advanced Technology 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 | Display Port |
| DP | DisplayPort |
| DVI | Digital Visual Interface |
| ECC | Error-Correcting Code |
| EDID | Extended Display Identification Data |
| 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 |
| FR-4 | Flame Retardant 4 |
| GND | Ground |
| GPIO | General Purpose Input/Output |
| HD | High Definition |
| HDA | High Definition Audio |
| HDD | Hard Disk Drive |
| HDMI | High Definition Multimedia Interface |
| HPD | Hot Plug Detect |
| 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 |
| $I^2C$ | Inter-Integrated Circuit |
| IEEE® | Institute of Electrical and Electronics Engineers |
| IP | Ingress Protection |
| IRQ | Interrupt Request |
| iRTC | Industrial Real Time Clock |
| LED | Light Emitting Diode |
| LP | Low-Profile |
| LPC | Low Pin Count |
| LTE | Long Term Evolution |
| LVDS | Low Voltage Differential Signal |

## 8.1 Acronyms and Definitions (continued)

Table 21: 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 |
| RAM | Random Access Memory |
| RMA | Return Merchandise Authorization |
| RoHS | Restriction of (the use of certain) Hazardous Substances |
| RS-232 | Recommended Standard (serial interface) |
| 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 |
| SIM | Subscriber Identity Module |
| 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 |
| UMTS | Universal Mobile Telecommunications System |
| USB | Universal Serial Bus |
| VGA | Video Graphics Array (640 × 480) |
| WEEE® | Waste Electrical and Electronic Equipment |
| WES | Microsoft® Windows® Embedded Standard |
| WLAN | Wireless Local Area Network |
| WWAN | Wireless Wide Area Network |

## 8.2 References

Table 22: Further Applicable Documents and Links

| No. | Name | Rev. / Date | Company |
|---|---|---|---|
| (1) | PICMG® COM0 COM Express™ Module Base Specification | Rev. 3.0 / Mar. 31, 2017 | PICMG® |
| (2) | PICMG® COM Express™ Carrier Design Guide (available for public download)<br>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 Series<br>https://downloadcenter.intel.com/download/22283/Intel-Ethernet-Adapter-Complete-Driver-Pack | – current – | Intel® |

**TQ-Systems GmbH**
Mühlstraße 2 I Gut Delling I 82229 Seefeld
info@tq-group.com I www.tq-group.com

Technology in Quality