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1.5 Imprint

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1.6 Service and Support

Please visit our website TQ-Group for latest product documentation, drivers, utilities and technical support.

For direct technical support, you can contact our FAE team by email: TQ-Support.

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 or RMA, please contact our [Service](#) or your sales representative.

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. Please note the relevant statutory regulations in this regard. Non-compliance with these regulations can lead to serious damage to your health and 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.

1.9 Handling and ESD Tips

General handling of your TQ-products

	The TQ product may only be used and serviced by certified personnel who have read the information and safety instructions in this document and all related rules and regulations. Generally, do not touch the TQ product while it is operating. This is especially important when turning on, changing jumper settings, or connecting other devices without first ensuring that the system's power supply has been turned off. Violating this guideline can result in damage to or destruction of the TQMxCU3-C6 and endanger your health. Improper handling of your TQ product will void the warranty.
---	---

Proper ESD handling

	The electronic components of your TQ-product are sensitive to electrostatic discharge (ESD). 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 are to be taken note of.
They contain, if applicable, additional information that has to 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 adhered to.
- **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 (3), 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 (2), (4).



2. INTRODUCTION

Based on the internationally established PICMG® standard COM Express™ (COM.0 Rev. 3.1), the TQMxCU3-C6 enables the development of powerful and economical x86-based systems. The user has access to all essential CPU interfaces via the Type 6 compliant pin-out connector. This means that all functions of the Intel® Core™ Ultra Series 3 processor can be used. Direct access to all interfaces gives the user the freedom to use the CPU's functions in the way that best suits their application.

The compact and robust design, as well as the option of conformal coating, extend the range of applications to include harsh industrial, transportation and aviation environments. Due to the very low power consumption and the optional extended temperature range, it is also possible to realize outdoor applications in an easy and reliable way.

2.1 Overview

The following key functions are implemented on the TQMxCU3-C6:

Processor:

Intel® Core™ Ultra Series 3 processor (404 4Xe CT, 25 W TDP, 12 W – 45 W cTDP) with up to 8 processor cores

- Intel® Core™ Ultra 5 Processor 322 (2P+0E+4LPE, up to 4.3 GHz / 2 Xe / 12 MB / 12 PCIe / 0 °C – 100 °C)
- Intel® Core™ Ultra 5 Processor 332 (2P+0E+4LPE, up to 4.3 GHz / 2 Xe / 12 MB / 12 PCIe / 0 °C – 100 °C / vPro)
- Intel® Core™ Ultra 5 Processor 325 (4P+0E+4LPE, up to 4.5 GHz / 4 Xe / 12 MB / 12 PCIe / 0 °C – 100 °C)
- Intel® Core™ Ultra 5 Processor 335 (4P+0E+4LPE, up to 4.6 GHz / 4 Xe / 12 MB / 12 PCIe / 0 °C – 100 °C / vPro)
- Intel® Core™ Ultra 7 Processor 355 (4P+0E+4LPE, up to 4.7 GHz / 4 Xe / 12 MB / 12 PCIe / 0 °C – 100 °C)
- Intel® Core™ Ultra 7 Processor 365 (4P+0E+4LPE, up to 4.8 GHz / 4 Xe / 12 MB / 12 PCIe / 0 °C – 100 °C / vPro)

Intel® Core™ Ultra Series 3 processor (404 4Xe ET, 25 W TDP, 15 W – 65 W cTDP) with up to 8 processor cores

- Intel® Core™ Ultra 5 Processor 335RE (4P+0E+4LPE, up to TBD GHz / 4 Xe / 12 MB / 20 PCIe / -40 °C – 100 °C / vPro / FuSa)
- Intel® Core™ Ultra 7 Processor 365RE (4P+0E+4LPE, up to TBD GHz / 4 Xe / 12 MB / 20 PCIe / -40 °C – 100 °C / vPro / FuSa)

Intel® Core™ Ultra Series 3 processor (484 4Xe CT, 25 W TDP, 15 W – 65 W cTDP) with up to 16 processor cores

- Intel® Core™ Ultra 5 Processor 336H (4P+4E+4LPE, up to 4.6 GHz / 4 Xe / 18 MB / 20 PCIe / 0 °C – 100 °C / vPro)
- Intel® Core™ Ultra 7 Processor 356H (4P+8E+4LPE, up to 4.7 GHz / 4 Xe / 18 MB / 20 PCIe / 0 °C – 100 °C)
- Intel® Core™ Ultra 7 Processor 366H (4P+8E+4LPE, up to 4.8 GHz / 4 Xe / 18 MB / 20 PCIe / 0 °C – 100 °C / vPro)
- Intel® Core™ Ultra 9 Processor 386H (4P+8E+4LPE, up to 4.9 GHz / 4 Xe / 18 MB / 20 PCIe / 0 °C – 100 °C / vPro)

Intel® Core™ Ultra Series 3 processor (484 4Xe ET, 25 W TDP, 15 W – 65 W cTDP) with up to 16 processor cores

- Intel® Core™ Ultra 5 Processor 336HRE (4P+4E+4LPE, up to TBD GHz / 4 Xe / 18 MB / 20 PCIe / -40 °C – 100 °C / vPro / FuSa)
- Intel® Core™ Ultra 7 Processor 366HRE (4P+8E+4LPE, up to TBD GHz / 4 Xe / 18 MB / 20 PCIe / -40 °C – 100 °C / vPro / FuSa)

Intel® Core™ Ultra Series 3 processor (484 12Xe CT, 25 W TDP, 15 W – 65 W cTDP) with up to 16 processor cores

- Intel® Core™ Ultra 5 Processor 338H (4P+4E+4LPE, up to 4.7 GHz / 10 Xe / 18 MB / 12 PCIe / 0 °C – 100 °C / vPro)
- Intel® Core™ Ultra X7 Processor 358H (4P+8E+4LPE, up to 4.8 GHz / 12 Xe / 18 MB / 12 PCIe / 0 °C – 100 °C)
- Intel® Core™ Ultra X7 Processor 358HR (4P+8E+4LPE, up to TBD GHz / 12 Xe / 18 MB / 12 PCIe / 0 °C – 100 °C / vPro / FuSa)
- Intel® Core™ Ultra X7 Processor 368H (4P+8E+4LPE, up to 5.0 GHz / 12 Xe / 18 MB / 12 PCIe / 0 °C – 100 °C / vPro)
- Intel® Core™ Ultra X9 Processor 378H (4P+8E+4LPE, up to 5.0 GHz / 12 Xe / 18 MB / 12 PCIe / 0 °C – 100 °C)
- Intel® Core™ Ultra X9 Processor 388H (4P+8E+4LPE, up to 5.1 GHz / 12 Xe / 18 MB / 12 PCIe / 0 °C – 100 °C / vPro)

Memory:

- Up to 96 Gbyte LPDDR5x max. 9600 MT/s SDRAM dual channel, soldered down, with IBEC option
- Onboard NVMe BGA SSD with PCIe Gen 4 x 2 up to 1 Tbyte

Graphics:

- Up to 3 × Digital Display Interface / DP++ with up to 8K; with support for Multi-Stream Transport (MST)
- 1 × Embedded Digital Display Interface (eDP) or dual channel LVDS interface (eDP 1.4b or dual LVDS)

**Peripheral interfaces:**

- 1 × NBASE-T Ethernet with 2.5 Gigabit (Intel® i226)
- 4 × USB 3.2 Gen 2 (up to 10 Gb/s) with USB 3.0 compatibility
- 8 × USB 2.0
- 4 × PCI Express Gen4, 4 (×1), 2 (×2), or 1 (×4)
- 4 × PCI Express Gen4, 4 (×1), 2 (×2), or 1 (×4)
- 8 × PCI Express Gen5 (PEG Port), 2 (×4), or 1 (×8)
- 1 × eSPI bus or LPC bus
- 1 × Intel® HD audio (HDA)
- 1 × I²C
- 1 × SMBus
- 1 × SPI for external UEFI BIOS flash
- 1 × SPI general-purpose interface
- 2 × Serial port, 4-wire (Rx/Tx/RTS/CTS)
- 8 × GPIO through TQ-flexiCFG
- 2 × MIPI-CSI Camera input interface connector (option)

Security components:

- Internal firmware TPM (fTPM) controller or discrete TPM with SLB9672 TPM 2.0 controller

Others:

- TQMx86 board controller with watchdog and TQ-flexiCFG
- Temperature monitor and fan control

Power supply voltage:

- Wide input: 8.5 V to 20 V maximum input ripple: ±100 mV (embedded processor series)
- Standard input: nominal voltage 12 V (11.4 V to 12.6 V) (industrial temperature range)
- 5 V Standby (optional) 5 V (4.75 V to 5.25 V)
- 3 V Battery for RTC

Environment:

- Operating standard temperature: 0 °C to +60 °C
- Operating industrial temperature: -40 °C to +85 °C
- Storage temperature: -40 °C to +85 °C
- Relative humidity (operation): 10 % to 90 % (non-condensing)
- Relative humidity (storage): 5 % to 95 % (non-condensing)

Form factor / dimensions:

- COMExpress™ Compact, Type 6, 95 mm × 95 mm



2.2 Compliance

The TQMxCU3-C6 complies with PICMG® COM Express™ Module Base Specification (COM.0 Rev. 3.1).

2.3 Versions

The TQMxCU3-C6 is available in several standard configurations.

Table 2: TQMxCU3-C6 Module configurations and features (preferred standard versions)

Feature	TQMxCU3-C6-AA	TQMxCU3-C6-AB	TQMxCU3-C6-AC	TQMxCU3-C6-AD
Intel® CPU	Intel® Core™ Ultra 5 325	Intel® Core™ Ultra 7 356H	Intel® Core™ Ultra 9 386H	Intel® Core™ Ultra X7 358H
vPro	No	No	Yes	No
CPU TDP	25 W	25 W	25 W	25 W
LPDDR5x	16 Gbyte	16 Gbyte	32 Gbyte	32 Gbyte
CPU Use Condition	Embedded	Embedded	Embedded	Embedded
Independent displays	3	3	3	3
NVMeEBCA SSD	--	--	--	--
eDP / LVDS	1/--	--/1	1/--	1/--
DP or HDMI	2	2	2	2
USB 3.2 host	4	4	4	4
USB 2.0 host	8	8	8	8
PCI Express lanes	8	16	16	8
PCIe Gen4 x1 (0-3)	4	4	4	4
PCIe Gen4 x4 (4-7)	1	1	1	1
PEG Gen5 x8	--	1	1	--
NBASE-T	1	1	1	1
eSPI or LPC	--/1	--/1	--/1	--/1
SPI (BIOS Flash)	1	1	1	1
GSPI	1	1	1	1
TPM 2.0 (chip)	SLB9672	SLB9672	SLB9672	SLB9672
I ² C	1	1	1	1
SMbus	1	1	1	1
HDA	1	1	1	1
UART	2	2	2	2
GPIO	8	8	8	8

Please visit [TQ-Group](#) (tab "Ordering Information") for a full list of standard versions.

Other configurations are available on request. Hardware and software configuration on request:

- Conformal coating
- Customized BIOS
- SPI general purpose support



2.4 Accessories

- **TQMxCU3-C6-HSP-AB**

Aluminium heat spreader with copper inlay for TQMxCU3-C6, according to COM Express™ specification. Suitable for H404 4Xe ET, H484 4Xe CT/ET, H484 12Xe CT CPUs

- **TQMxCU3-C6-HSP-AC**

Aluminium heat spreader with copper inlay for TQMxCU3-C6, according to COM Express™ specification. Suitable for H404 4Xe CT CPUs.

- **Evaluation platform MB-COME6-4**

Mainboard for COM Express™ Basic and Compact, Type 6, 170 mm × 170 mm, with the following interfaces:

- 3 x DP (2x up to 8k HBR3, 1x up to 4k HBR2)
- 1 x dual LVDS
- 1 x eDP (up to 4k HBR2)
- 2 x 2.5 Gbit Ethernet
- 2 x USB 3.2 USB-A
- 1 x USB 3.2 USB-C
- 3 x USB 2.0 internal
- 2 x Serial Port RS232
- 1 x High-Definition Audio (Line In, MIC In, HP Out)
- 1 x M.2 Socket Key E (Wi-Fi/BT),
- 1 x M.2 Socket Key B with μSIM (WWAN or SATA SSD)
- 1 x M.2 Socket Key M PCIe x4 (SSD)
- 1 x M.2 Socket Key M PCIe x2 (SSD)
- 1 x PCI Express x16 PEG port
- Fan header
- Debug header

- **Debug module**

POST debug card for TQMxCU3-C6, see 3.6.3. The debug card is not a standard accessory.

3. FUNCTION

3.1 Block Diagram

The following figure shows the TQMxCU3-C6 block diagram.

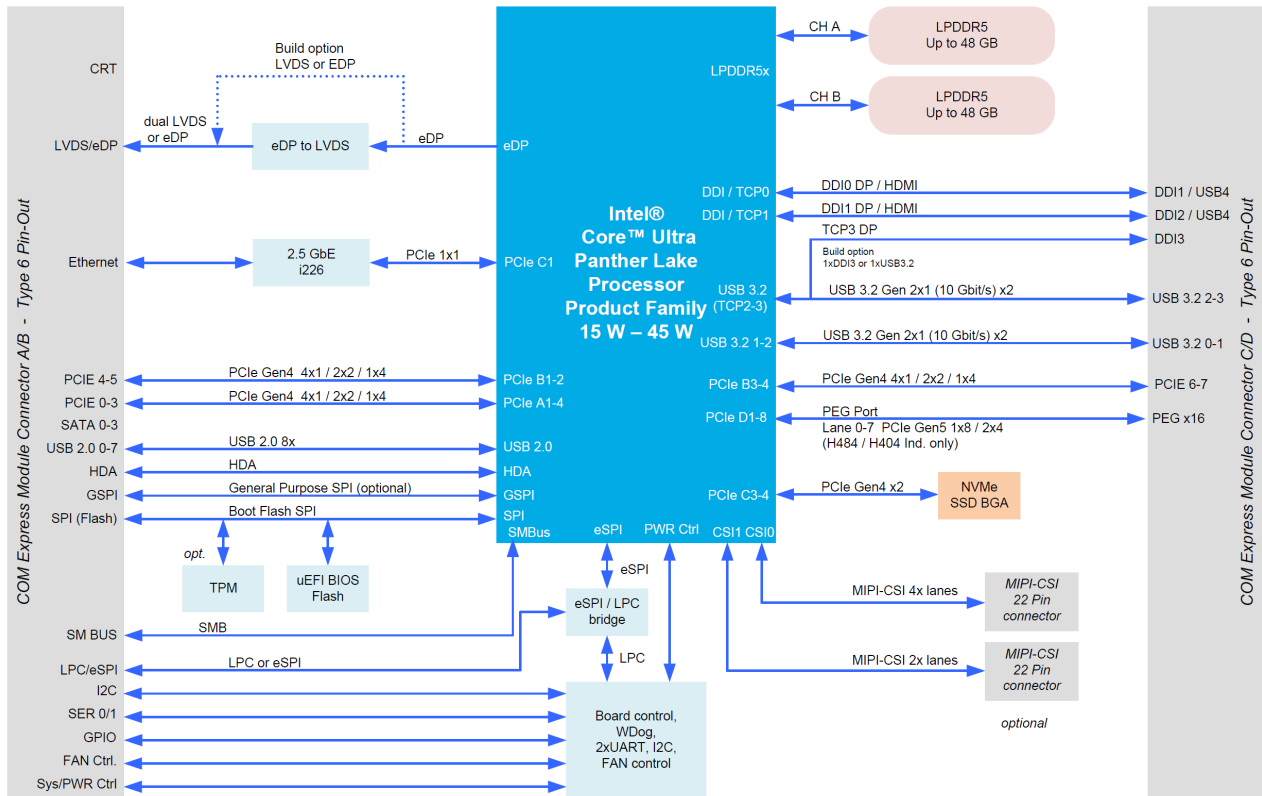


Figure 1: TQMxCU3-C6 Block Diagram

3.2 Electrical Characteristics

3.2.1 Supply Voltage

The TQMxCU3-C6 supports a wide-range single voltage input from 8.5 V to 20 V.

The following supply voltages are specified at the COM Express™ connector:

Wide input:	8.5 V to 20 V	maximum input ripple: ±100 mV (embedded processor series)
Standard input:	11.4 V to 12.6 V	maximum input ripple: ±100 mV (industrial temperature range)
VCC_5V_SBY:	4.75 V to 5.25 V	maximum input ripple: ±50 mV
VCC_RTC:	2.0 V to 3.3 V	maximum input ripple: ±20 mV

The input voltages shall rise from 10 % to 90 % of nominal within 0.1 msec to 20 msec ($0.1 \text{ msec} \leq \text{Rise Time} \leq 20 \text{ msec}$).

The increase of each DC output voltage has to be smooth and continuous from 10 % to 90 % of its final set point within the regulation range.

Note: Power source



For single supply operations, the 5 V Standby voltage is not required.
VCC_5V_SBY can be left unconnected.

3.2.2 Power Consumption

The power consumption values below show the TQMxCU3-C6 voltage and power specifications.

The values were measured with two power supplies, one for the TQMxCU3-C6 and the other one for the MB-COME6-4 carrier board.

The power consumption of each TQMxCU3-C6 version was measured running Windows® 11, 64-bit and an LPDDR5x configuration (32 Gbyte). All measurements were done at +25 °C and an input voltage of +12 V.

The power consumption of the TQMxCU3-C6 depends on the application, the mode of operation and the operating system.

The power consumption was measured under the following test conditions:

- **Suspend mode:**
The system is in S5/S4 state, Ethernet ports are disconnected.
- **Windows® 11, 64-bit, idle state:**
Desktop idle state, Ethernet ports are disconnected.
- **Windows® 11, 64-bit, maximum workload (cTDP down mode enabled):**
These values show the maximum cTDP down power consumption using the Intel® stress test tool to stress the processor and graphics engine.
- **Windows® 11, 64-bit, maximum workload (cTDP nominal configuration):**
These values show the maximum worst-case power consumption using the Intel® stress test tool to stress the processor and graphics engine.
- **Windows® 11, 64-bit, maximum workload (cTDP up mode enabled):**
These values show the maximum cTDP up power consumption using the Intel® stress test tool to stress the processor and graphics engine.
- **Windows® 11, 64-bit, maximum workload (turbo mode first seconds)**
These values show the maximum worst-case power consumption using the Intel® stress test tool to stress the processor and graphics engine.
This value was measured only for a short time (<28 sec) when the processor is in turbo mode.
This value should be used for designing the power supply for the TQMxCU3-C6 module.

Please contact [TQ-Support](#) for further information about the S3 software support.

The following table shows the TQMxCU3-C6 power consumption with different CPUs.

Table 3: TQMxCU3-C6 Power Consumption Turbo Mode ON

CPU	Mode				
	Win11, 64-bit idle	Win11, 64-bit cTDP down	Win11, 64-bit cTDP nominal	Win11, 64-bit cTDP up max. load	Win11, 64-bit max load (Turbo mode)
Intel® Core™ Ultra 5 325	TBD	TBD	TBD	TBD	TBD
Intel® Core™ Ultra 7 356H	TBD	TBD	TBD	TBD	TBD
Intel® Core™ Ultra 9 386H	TBD	TBD	TBD	TBD	TBD
Intel® Core™ Ultra 7 358H	TBD	TBD	TBD	TBD	TBD

Table 4: TQMxCU3-C6 Power Consumption Turbo Mode OFF

CPU	Mode				
	Win11, 64-bit idle	Win11, 64-bit cTDP down	Win11, 64-bit cTDP nominal	Win11, 64-bit cTDP up max. load	Win11, 64-bit max load (Turbo mode)
Intel® Core™ Ultra 5 325	TBD	TBD	TBD	TBD	TBD
Intel® Core™ Ultra 7 356H	TBD	TBD	TBD	TBD	TBD
Intel® Core™ Ultra 9 386H	TBD	TBD	TBD	TBD	TBD
Intel® Core™ Ultra 7 358H	TBD	TBD	TBD	TBD	TBD

Attention: Power requirement



The power supplies on the carrier board for the TQMxCU3-C6 must be designed with sufficient reserves. The carrier board should be able to provide at least twice the maximum TQMxCU3-C6 workload power. The TQMxCU3-C6 supports multiple low-power states. The power supply of the carrier board must be stable, even with no load.

3.2.3 Real Time Clock Power Consumption

The RTC (VCC_RTC) current consumption is shown below.

The values were measured at +25 °C and battery operating conditions.

Table 5: RTC Current Consumption

Mode	Voltage	Current
Intel® Core™ Ultra Series 3 processor integrated RTC	3.0 V	3 µA

The current consumption of the RTC in the Intel® Core™ Ultra Series 3 processor Product Family Datasheet is specified with 6 µA in average, but the values measured on several TQMxCU3-C6 are lower.

3.3 Environmental Conditions

- Operating standard temperature: 0 °C to +60 °C
- Operating industrial temperature: -40 °C to +85 °C
- Storage temperature: -40 °C to +85 °C
- Relative humidity (operating): 10 % to 90 % (non-condensing)
- Relative humidity (storage): 5 % to 95 % (non-condensing)

Attention: Maximum operating temperature



Do not operate the TQMxCU3-C6 without properly attached heat spreader and heat sink.
The heat spreader is not a sufficient heat sink.



3.4 System Components

3.4.1 Processor

The TQMxCU3-C6 supports the Intel® Core™ Ultra Series 3 processor series (Panther Lake).

The following list illustrates some key features of the Intel® Core™ Ultra Series 3 processor series:

- Intel® Core™ Ultra 9, Intel® Core™ Ultra 7 and Intel® Core™ Ultra 5 (Codename: "Panther Lake H")
- Up to 16 CPU Cores based on Intel® Hybrid Technology with various combinations of Performance-Cores (P), Efficient-Cores (E) and Low Power Efficient-Cores (LP)
- LPDDR5x memory technology
- Intel® 64 Architecture
- Intel® Configurable Thermal Design Power (Intel® cTDP up and down)
- Intel® Enhanced Intel® SpeedStep® technology
- Intel® Arc Graphics architecture with up to 12Xe
- Intel® Neural Processing Unit (NPU) for optimized AI acceleration
- Extended temperature option (-40°C to +85°C)

Table 6: Intel® Core™ Ultra Series 3 404 4Xe CT* (Intel Spec)

Mode	Intel® Core™ Ultra 5 322	Intel® Core™ Ultra 5 332	Intel® Core™ Ultra 5 325
Processor Cores	2P + 0E + 4LP	2P + 0E + 4LP	4P + 0E + 4LP
Cache	12 Mbyte	12 Mbyte	12 Mbyte
P-Core Base clock	2.5 GHz	2.5 GHz	2.1 GHz
E-Core Base clock	--	--	--
LP-Core Base clock	0.4 GHz	0.4 GHz	0.4 GHz
P-Core Max. Turbo clock	4.3 GHz	4.3 GHz	4.2 GHz
E-Core Max. Turbo clock	--	--	--
LP-Core Max. Turbo clock	3.3 GHz	3.3 GHz	3.4 GHz
T _{junction}	0 °C to +100 °C	0 °C to +100 °C	0 °C to +100 °C
Memory speed LPDDR5x	7467 MT/s	7467 MT/s	7467 MT/s
Max. memory LPDDR5x	96 Gbyte	96 Gbyte	96 Gbyte
Graphics	Intel® Arc® 2Xe	Intel® Arc® 2Xe	Intel® Arc® 4Xe
Graphics Execution Units	32	32	64
Graphics Performance	18 TOPS	18 TOPS	40 TOPS
Graphics Turbo clock	2.3 GHz	2.3 GHz	2.45 GHz
Nominal Assured Power (cTDP nominal)	25 W	25 W	25 W
Minimum Assured Power (cTDP down)	12 W	12 W	12 W
Minimum Assured Frequency (cTDP down)	1.0 GHz	1.0 GHz	1.0 GHz
Maximum Assured Power (cTDP up)	45 W	45 W	45 W
Maximum Assured Frequency (cTDP up)	3.5 GHz	3.5 GHz	3.1 GHz
Intel® Hyper-Threading Technology	No	No	No
vPro	No	Yes	No
NPU TOPS	Yes	Yes	Yes
NPU Performance	46 TOPS	46 TOPS	46 TOPS
FuSa	No	No	No
NPU Max. Frequency	3.8 GHz	3.8 GHz	3.9 GHz
Number of PCIe Lanes	12	12	12
CPU Use Condition	Embedded	Embedded	Embedded



Table 7: Intel® Core™ Ultra Series 3 404 4Xe CT* (Intel Spec)

Mode	Intel® Core™ Ultra 5 335	Intel® Core™ Ultra 7 355	Intel® Core™ Ultra 7 365
Processor Cores	4P + 0E + 4LP	4P + 0E + 4LP	4P + 0E + 4LP
Cache	12 Mbyte	12 Mbyte	12 Mbyte
P-Core Base clock	2.2 GHz	2.3 GHz	2.4 GHz
E-Core Base clock	--	--	--
LP-Core Base clock	0.4 GHz	0.4 GHz	0.4 GHz
P-Core Max. Turbo clock	4.3 GHz	4.4 GHz	4.5 GHz
E-Core Max. Turbo clock	--	--	--
LP-Core Max. Turbo clock	3.4 GHz	3.5 GHz	3.6 GHz
T _{junction}	0 °C to +100 °C	0 °C to +100 °C	0 °C to +100 °C
Memory speed LPDDR5x	7467 MT/s	7467 MT/s	7467 MT/s
Max. memory LPDDR5x	96 Gbyte	96 Gbyte	96 Gbyte
Graphics	Intel® Arc® 4Xe	Intel® Arc® 4Xe	Intel® Arc® 4Xe
Graphics Execution Units	64	64	64
Graphics Performance	40 TOPS	40 TOPS	40 TOPS
Graphics Turbo clock	2.45 GHz	2.5 GHz	2.5 GHz
Nominal Assured Power (cTDP nominal)	25 W	25 W	25 W
Minimum Assured Power (cTDP down)	12 W	12 W	12 W
Minimum Assured Frequency (cTDP down)	1.0 GHz	1.0 GHz	1.1 GHz
Maximum Assured Power (cTDP up)	45 W	45 W	45 W
Maximum Assured Frequency (cTDP up)	3.2 GHz	3.3 GHz	3.4 GHz
Intel® Hyper-Threading Technology	No	No	No
vPro	Yes	No	Yes
NPU	Yes	Yes	Yes
NPU Performance	47 TOPS	49 TOPS	50 TOPS
NPU Max. Frequency	3.9 GHz	4.0 GHz	4.1 GHz
FuSa	No	No	No
Number of PCIe Lanes	12	12	12
CPU Use Condition	Embedded	Embedded	Embedded



Table 8: Intel® Core™ Ultra Series 3 484 4Xe CT* (Intel Spec)

Mode	Intel® Core™ Ultra 5 336H	Intel® Core™ Ultra 7 356H	Intel® Core™ Ultra 7 366H	Intel® Core™ Ultra 9 386H
Processor Cores	4P + 4E + 4LP	4P + 8E + 4LP	4P + 8E + 4LP	4P + 8E + 4LP
Cache	18 Mbyte	18 Mbyte	18 Mbyte	18 Mbyte
P-Core Base clock	1.9 GHz	1.9 GHz	2.0 GHz	2.1 GHz
E-Core Base clock	1.5 GHz	1.5 GHz	1.6 GHz	1.6 GHz
LP-Core Base clock	0.4 GHz	0.4 GHz	0.4 GHz	0.4 GHz
P-Core Max. Turbo clock	4.3 GHz	4.4 GHz	4.5 GHz	4.6 GHz
E-Core Max. Turbo clock	3.4 GHz	3.3 GHz	3.4 GHz	3.5 GHz
LP-Core Max. Turbo clock	3.2 GHz	3.3 GHz	3.4 GHz	3.5 GHz
T _{junction}	0 °C to +100 °C	0 °C to +100 °C	0 °C to +100 °C	0 °C to +100 °C
Memory speed LPDDR5x	8533 MT/s	8533 MT/s	8533 MT/s	8533 MT/s
Max. memory LPDDR5x	96 Gbyte	96 Gbyte	96 Gbyte	96 Gbyte
Graphics	Intel® Arc® 4Xe	Intel® Arc® 4Xe	Intel® Arc® 4Xe	Intel® Arc® 4Xe
Graphics Execution Units	64	64	64	64
Graphics Performance	37 TOPS	40 TOPS	40 TOPS	40 TOPS
Graphics Turbo clock	2.3 GHz	2.45 GHz	2.5 GHz	2.5 GHz
Nominal Assured Power (cTDP nominal)	25 W	25 W	25 W	25 W
Minimum Assured Power (cTDP down)	15 W	15 W	15 W	15 W
Minimum Assured Frequency (cTDP down)	1.0 GHz	1.0 GHz	1.0 GHz	1.1 GHz
Maximum Assured Power (cTDP up)	65 W	65 W	65 W	65 W
Maximum Assured Frequency (cTDP up)	3.7 GHz	3.7 GHz	3.7 GHz	3.8 GHz
Intel® Hyper-Threading Technology	No	No	No	No
vPro	Yes	No	Yes	Yes
NPU	Yes	Yes	Yes	Yes
NPU Performance	47 TOPS	50 TOPS	50 TOPS	50 TOPS
NPU Max. Frequency	3.9 GHz	4.1 GHz	4.1 GHz	4.1 GHz
FuSa	No	No	No	No
Number of PCIe Lanes	20	20	20	20
CPU Use Condition	Embedded	Embedded	Embedded	Embedded

Table 9: Intel® Core™ Ultra Series 3 484 12Xe CT* (Intel Spec)

Mode	Intel® Core™ Ultra 5 338H	Intel® Core™ Ultra X7 358H	Intel® Core™ Ultra X7 368H	Intel® Core™ Ultra X9 388H
Processor Cores	4P + 4E + 4LP	4P + 8E + 4LP	4P + 8E + 4LP	4P + 8E + 4LP
Cache	18 Mbyte	18 Mbyte	18 Mbyte	18 Mbyte
P-Core Base clock	1.9 GHz	1.9 GHz	2.0 GHz	2.1 GHz
E-Core Base clock	1.5 GHz	1.5 GHz	1.6 GHz	1.6 GHz
LP-Core Base clock	0.4 GHz	0.4 GHz	0.4 GHz	0.4 GHz
P-Core Max. Turbo clock	4.4 GHz	4.5 GHz	4.7 GHz	4.8 GHz
E-Core Max. Turbo clock	3.4 GHz	3.3 GHz	3.6 GHz	3.6 GHz
LP-Core Max. Turbo clock	3.3 GHz	3.3 GHz	3.6 GHz	3.7 GHz
T _{junction}	0 °C to +100 °C	0 °C to +100 °C	0 °C to +100 °C	0 °C to +100 °C
Memory speed LPDDR5x	8533 MT/s	9600 MT/s	9600 MT/s	9600 MT/s
Max. memory LPDDR5x	96 Gbyte	96 Gbyte	96 Gbyte	96 Gbyte
Graphics	Intel® Arc® 10Xe	Intel® Arc® 12Xe	Intel® Arc® 12Xe	Intel® Arc® 12Xe
Graphics Execution Units	160	192	192	192
Graphics Performance	98 TOPS	122 TOPS	122 TOPS	122 TOPS
Graphics Turbo clock	2.4 GHz	2.5 GHz	2.5 GHz	2.5 GHz
Nominal Assured Power (cTDP nominal)	25 W	25 W	25 W	25 W
Minimum Assured Power (cTDP down)	15 W	15 W	15 W	15 W
Minimum Assured Frequency (cTDP down)	1.0 GHz	1.0 GHz	1.1 GHz	1.1 GHz
Maximum Assured Power (cTDP up)	65 W	65 W	65 W	65 W
Maximum Assured Frequency (cTDP up)	3.7 GHz	3.7 GHz	3.8 GHz	4.0 GHz
Intel® Hyper-Threading Technology	No	No	No	No
vPro	Yes	No	Yes	Yes
NPU	Yes	Yes	Yes	Yes
NPU Performance	47 TOPS	50 TOPS	50 TOPS	50 TOPS
NPU Max. Frequency	3.9 GHz	4.1 GHz	4.1 GHz	4.1 GHz
Number of PCIe Lanes	12	12	12	12
FuSa	No	No	No	No
CPU Use Condition	Embedded	Embedded	Embedded	Embedded

Note: Intel® Core™ Ultra Series 3 processor series cTDP up mode



The TQMxCU3-C6 module supports the Configurable Thermal Design Power (cTDP) up mode. The maximum module power is limited to 45 W processor power consumption.



3.4.1.1 Intel® Turbo Boost Technology

Intel® Turbo Boost Technology accelerates processor and graphics performance for peak loads, automatically allowing processor cores to run faster than the rated operating frequency if they are operating within power, current, and temperature specification limits. It depends on the workload and operating environment and the period of time the processor spends in that state whether the processor enters Intel® Turbo Boost.

To maximize performance, the Intel® Turbo Boost Technology allows the processor to operate for short durations at a power level that is higher than its Thermal Design Power (TDP) configuration.

The Intel® Turbo Boost Technology can be configured in the UEFI BIOS; default is “enabled”.

To meet full industrial lifetime expectations of the Intel® Core™ Ultra Series 3 processor, the Turbo Mode must be switched off.

3.4.1.2 Intel® Configurable Thermal Design Power

With the Intel® Configurable Thermal Design Power (cTDP) feature, the processor's power consumption can be customized.

The cTDP consists of three modes:

1. The cTDP nominal mode specifies the processor rated clock and maximum power consumption.
2. The cTDP down mode specifies a lower maximum processor power consumption and lower guaranteed clock versus the nominal mode. This mode is intended for ultra low-power applications, e.g. systems with limited cooling solutions.
3. The cTDP up mode specifies a higher maximum processor power consumption and a higher guaranteed clock versus the nominal mode. This mode is intended for high-performance applications with optimized cooling solutions.

3.4.1.3 Intel® Neural Processing Unit (Intel® NPU)

The Intel® Neural Processing Unit (NPU) is a dedicated AI accelerator integrated into Intel® Panther Lake processors. It is designed to execute artificial intelligence workloads efficiently while minimizing power consumption, making it well suited for embedded systems, edge computing, and client devices.

By handling AI inference tasks independently of the CPU and GPU, the NPU reduces the load on the main processing resources, resulting in improved overall system performance, lower latency, and enhanced energy efficiency.

The NPU architecture combines a host control subsystem with a dedicated deep learning accelerator that coordinates workload scheduling and execution. The accelerator itself is built around multiple Neural Compute Engine (NCE) tiles, enabling highly parallel and scalable AI processing. Each NCE tile integrates specialized compute hardware together with local memory, allowing neural network operations to be executed efficiently while reducing data movement and power consumption.

3.4.2 Graphics

The Intel® Core™ Ultra Series 3 processor features an integrated Intel® HD graphics accelerator.

It provides excellent 2D / 3D graphics performance with support of up to three simultaneous displays.

The following list illustrates some key features of the Intel® Core™ Ultra Series 3 processor:

- Intel® ARC® 12Xe Graphics
- Hardware accelerated video decoding/encoding for H.264/AVC, H.265/HEVC, AV1, MPEG2, VP9, H2
- DirectX 12.2
- OpenGL 4.6
- OpenCL 3.0
- Vulkan 1.3
- Single 8K60Hz panel support

The TQMxCU3-C6 supports two external Digital Display Interfaces (DDI0, DDI1) with DP++ configuration and one internal eDP display, either dual channel LVDS or eDP interface at the COM Express™ connector. Furthermore, an optional third external Digital Display Interface (DDI3) could be configured. This display interface is shared with one USB3.2 Interface and has no DP++ configuration.

Please contact [TQ-Support](#) for further information about the optional third external Digital Display Interface support.

3.4.3 Memory

3.4.3.1 LPDDR5x SDRAM

The TQMxCU3-C6 supports a dual-channel LPDDR5x memory that operates at up to 9600 MT/s.

System memory sizes of 8, 16, 32, 64, 96 Gbyte are supported. Some of these configurations will be supported by project basis.

The Intel® Core™ Ultra Series 3 processor supports IBECC (In-Band ECC).

3.4.3.2 Onboard NVMe BGA SSD

The TQMxCU3-C6 supports an on-board NVMe BGA SSD flash device.

The NVMe BGA SSD device capacity is available from 128 Gbyte up to 1 Tbyte. The NVMe BGA SSD offering a PCI Express Gen 4 x2 high speed interface supporting the NVMe protocol that is designed to address the needs of the industrial segment: longevity, reliability, quality and ruggedness.

Benefits of the NVMe BGA SSD

- High integration (single chip BGA)
- High speed interface PCI Express Gen 4 x2
- Robust design optimized for rugged application
- Extended temperature ranges available (industrial)
- Intelligent power fail protection and recovery protects data from unexpected power loss
- Low power consumption
- Robust data security
- Sophisticated wear leveling and bad block management

Pseudo Single Level Cell (pSLC) configuration is available for high endurance.

3.4.3.3 SPI Boot Flash Interface

The TQMxCU3-C6 provides a 256 Mbit SPI boot flash. It includes the Intel® Management Engine (Intel® ME) and the UEFI BIOS. An external SPI boot flash on the carrier can be used instead of the on-board SPI boot flash.

The UEFI BIOS supports the following 1.8 V SPI flash devices on the carrier board:

- Macronix MX25U25643G

3.4.3.4 SPI General-purpose Interface

The TQMxCU3-C6 supports a general-purpose SPI interface. The SPI Master is on the module. The interface may be used with general-purpose SPI devices such as DACs, A/D converters or CAN controller on the carrier.

Attention: General Purpose SPI carrier design	
	SPI General Purpose support is introduced in COM.0 Rev. 3.1. To support the SPI General Purpose interface the COM Express™ carrier must be designed for the SPI standard! Please contact support@tq-group.com for further information about the SPI design requirements.

3.4.4 Real Time Clock

The TQMxCU3-C6 features a standard RTC integrated in the Intel® Core™ Ultra Series 3 processor.

3.4.5 Trusted Platform Module

The TQMxCU3-C6 supports the Trusted Platform Module (TPM) 2.0 with the Infineon SLB9672 controller.

The Intel® Core™ Ultra Series 3 processor also support a Firmware Trusted Platform Module (fTPM), which is a Trusted Platform Module 2.0 implementation in firmware. This feature can be configured in the BIOS.

3.4.6 Temperature Monitor and Fan Control

The TQMxCU3-C6 features an integrated Hardware Monitor to monitor the processor die temperature and manage the fan control of the COM Express™ interface.



3.4.7 TQ Flexible I/O Configuration (TQ-flexiCFG)

The TQ-Systems COM Express™ module TQMxCU3-C6 features a flexible I/O configuration feature, TQ-flexiCFG. Using the TQ-flexiCFG feature, several COM Express™ I/O interfaces and functions can be configured via a programmable FPGA. This option allows TQ-Systems to integrate special embedded features and configuration options in the TQMxCU3-C6 to reduce the carrier board design effort. Some examples of flexible I/O configuration are:

- GPIO interrupt configuration
- Interrupt configuration
- Serial Port handshake signals via GPIOs
- Integration of additional I/O functions, (e.g. additional Serial, CAN, I²C, PWM controller or special power management configurations)

Note: The configuration/adaption of the FPGA cannot be done by the user. All changes have to be implemented by TQ.

Please contact [TQ-Support](#) for further information about the TQ-flexiCFG.

3.5 Interfaces

3.5.1 PCI Express Interface

On the COM Express™ connector, the TQMxCU3-C6 supports up to 8 × PCI Express Gen4 lanes with 16 Gb/s speed. The PCI Express Lane configuration can be defined with a customized BIOS.

Table 10: COM Express™ PCI Express port 0 – 7 Configuration Options

COM Express™ Port 0 – 3	Configuration
(4) ×1 ports	Configuration via custom BIOS
(1) ×2 and (2) ×1 ports	Standard BIOS
(1) ×4 port	Configuration via custom BIOS
COM Express™ Port 4 – 7	Configuration
(1) ×1 port	Configuration via custom BIOS
(1) ×2 port	Configuration via custom BIOS
(1) ×4 port	Standard BIOS

The PCI Express COM Express™ connector port 4 to 7 supports a flexible I/O configuration to directly connect an M.2 SSD module with PCI Express 1 (×4) interface.

3.5.2 PCI Express Graphics (PEG-Port)

At the COM Express™ connector PEG interface, the TQMxCU3-C6 supports one Gen 5 PCI Express Graphics port with up to 32.0 Gbit/s speed per lane. The PCI Express Graphic port can be used for PCI Express graphics devices or high speed non-graphic PCI Express devices (e.g. quad Gigabit Ethernet or 10 Gigabit Ethernet controller). The PCI Express graphics port is only available on Intel® Core™ Ultra Series 3 484 4Xe CT processor SKUs.

Table 11: COM Express™ PCI Express Graphics port Configuration Options

COM Express™ PEG Port 0 – 7	Configuration
(1) ×8 port	Standard BIOS
(2) ×4 port	Configuration via custom BIOS

3.5.3 Digital Display Interface

The TQMxCU3-C6 supports up to four Digital Display Interfaces (DDI1, DDI2, DDI3 and eDP) at the COM Express™ connector. The external Digital Display Interface supports Display Port (DP), High-Definition Multimedia Interface (HDMI) and Digital Visual Interface (DVI). Any display combination is supported. The internal eDP / LVDS port supports LVDS (via an eDP to LVDS Bridge). The optional third Digital Display Interface (DDI3) is pin shared with an USB3.2 interface. This soldered option is only available on request.

Please contact support@tq-group.com for further information about the optional third Digital Display Interface.

Table 12: Maximum Resolution Display Configuration

Display	Maximum Display Resolution
eDP 1.4 / 1.5	7680 × 4320 @ 60 Hz
DP 1.4a	7680 × 4320 @ 60 Hz
HDMI 2.1	4096 × 2304 @ 60 Hz (HDMI 2.1 TMDS) 7680 × 4320 @ 60 Hz (HDMI2.1 FRL)
LVDS	1920 x 1200 @ 60 Hz in dual LVDS mode

3.5.4 LVDS / eDP Interface

The TQMxCU3-C6 supports a LVDS / eDP interface at the COM Express™ connector. The LVDS interface is provided through an on-board eDP to LVDS Bridge. The eDP to LVDS Bridge supports single or dual bus LVDS signalling with colour depths of 18 bits per pixel or 24 bits per pixel up to 112 MHz and a resolution up to 1920 × 1200 @ 60 Hz in dual channel LVDS mode.

The TQMxCU3-C6 module supports either the LVDS or the eDP interface on the COM Express™ connector pins. The desired interface can be configured accordingly during manufacturing (solder option).

The LVDS data output packing can be configured either in VESA or JEIDA format.

To support panels without EDID ROM, the eDP to LVDS bridge can emulate EDID ROM behaviour avoiding specific changes in system video BIOS.

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

3.5.5 NBASE-T Ethernet

The TQMxCU3-C6 provides an Intel® i226 Ethernet controller with 10/100/1000/2500 Mbps speed.

Features of the Intel® i226 Ethernet controller:

- Automatic speed configuration 10BASE-T / 100BASE-TX / 1000BASE-T / 2500BASE-T
- Automatic MDI/MDIX crossover at all speeds
- Jumbo frames (up to 9 kB)
- 802.1as/1588 conformance
- Reduced power consumption during normal operation
- Energy Efficient Ethernet (EEE)
- Ethernet TSN support

Attention: 2500BASE-T Ethernet carrier design



If the COM Express™ carrier is not designed for the Gigabit Ethernet 2500BASE-T operation, the Gigabit Ethernet ports should be configured to operate in 1000BASE-T mode.

3.5.6 USB 2.0 and USB 3.2 Interfaces

The TQMxCU3-C6 supports eight USB 2.0 and four USB 3.2 Gen 2 ports with data rate up to 10 Gbit/s at the COM Express™ connector. All USB 3.2 Gen 2 ports are configurable to USB 3.2 Gen 1 (5 Gbit/s).

Care must be taken in the COM Express™ carrier design; the carrier must support the USB 3.2 Gen 2 (10 Gbit/s) high speed standard.

Attention: USB 3.2 Gen 2 (10 Gb/s) carrier design



If the COM Express™ carrier is not designed for the USB 3.2 Gen 2 (10 Gb/s) operation, the USB 3.2 ports should be configured to operate in Gen 1 mode.

Please contact support@tq-group.com for further information about USB 3.1 high-speed Design Guidelines.

Note: USB Port Mapping



The USB 2.0 port 0 must be paired with USB 3.2 SuperSpeedPlus port 0.
 The USB 2.0 port 1 must be paired with USB 3.2 SuperSpeedPlus port 1.
 The USB 2.0 port 2 must be paired with USB 3.2 SuperSpeedPlus port 2.
 The USB 2.0 port 3 must be paired with USB 3.2 SuperSpeedPlus port 3.

3.5.7 General-Purpose Input/Output

The TQMxCU3-C6 provides 8 GPIO signals at the COM Express™ connector.

3.5.8 High-Definition Audio Interface

The TQMxCU3-C6 provides a High-Definition Audio (HDA) interface, which supports one audio codes at the COM Express™ connector. The HDA_SDIN1 and 2 signals at the COM Express™ connector are not connected. The Audio Codec is assembled on the carrier board.

Please contact [TQ-Support](#) to check if your codec is supported by default (BIOS verb table...).

3.5.9 LPC / eSPI Bus

The TQMxCU3-C6 supports a Low Pin Count (LPC) legacy bus and the Enhanced Serial Peripheral (eSPI) bus on the same COM Express™ connector pins.

The TQMxCU3-C6 supports either the LPC or the eSPI bus on the COM Express™ connector pins. The desired interface is configured by a resistor population option during manufacturing.

The default COM Express™ interface configuration is LPC bus.

Please contact support@tq-group.com for further information about the Serial Peripheral eSPI Interface and Carrier integration.

3.5.10 I²C Bus

The TQMxCU3-C6 supports a general purpose I²C port via a dedicated LPC to I²C controller integrated in the TQ-flexiCFG block. The I²C host controller supports a transfer rate of up to 400 kHz and can be configured independently.

3.5.11 SMBus

The TQMxCU3-C6 provides a System Management Bus (SMBus) via the Intel® Core™ Ultra Series 3 processor.

3.5.12 MIPI-CSI Camera Serial Interface

The TQMxCU3-C6 supports two MIPI-CSI Camera Serial Interfaces using 22-pin SMT connectors (X4 and X5) on the COM Express™ module. One interface is equipped with two CSI Lanes and the other one with four CSI Lanes.

The MIPI-CSI pin-out is compliant with the COM.0 Rev. 3.1 MIPI-CSI implementation.

Please contact support@tq-group.com for further information about the MIPI-CSI support because of limited software / device support. For each device a special implementation in BIOS is necessary.

3.5.13 Serial Ports

The TQMxCU3-C6 offers a dual Universal Asynchronous Receiver and Transmitter (UART) controller. The register set is based on the industry standard 16550 UART. The UART operates with standard serial port drivers without requiring a custom driver to be installed. The 16 byte transmit and receive FIFOs reduce CPU overhead and minimize the risk of buffer overflow and data loss. With the TQ-flexiCFG feature the serial ports can be configured to route the handshake signals to free pins at the COM Express™ connector.

Table 13: Serial Port COM Express™ Port Mapping

COM Express™ Signal	COM Express™ Pin	TQMxCU3-C6	Remark
SER0_TX	A98	SER0_TX	3.3 V output (without protection)
SER0_RX	A99	SER0_RX	3.3 V input (without protection)
SER1_TX	A101	SER1_TX	3.3 V output (without protection)
SER1_RX	A102	SER1_RX	3.3 V input (without protection)
SER0_RTS#	B98	SER0_RTS#	3.3 V output
SER0_CTS#	B99	SER0_CTS#	3.3 V input
SER1_RTS#	D24	SER1_RTS#	3.3 V output
SER1_CTS#	D25	SER1_CTS#	3.3 V input

Note: Protection circuits



In COM Express™ specification Revision 3.0 the signals A98, A99, A101 and A102 have been reclaimed from the VCC_12V pool. Therefore, protection on the carrier board is necessary to avoid damage to those when accidentally exposed to 12 V. The implementation of this circuitry causes lower transfer rates on the two serial ports.

On the TQMxCU3-C6 the protection circuit is removed by default, and the serial ports provide transfer rates of up to 115 kbaud. Therefore the TQMxCU3-C6 can only be used in a COM Express™ COM.0 2.0 and 3.0 Type 6 pin-out carrier board.

3.5.14 Watchdog Timer

The TQMxCU3-C6 supports an independently programmable two-stage Watchdog timer integrated in the TQ-flexiCFG block. There are four operation modes available for the Watchdog timer:

- Dual-stage mode
- Interrupt mode
- Reset mode
- Timer mode

The Watchdog timer timeout ranges from 125 msec to 1 h.

Note: Once the watchdog is enabled, the application cannot disable it. Only a system reset can disable the watchdog.

The COM Express™ Specification does not support external hardware triggering of the Watchdog. An external Watchdog Trigger can be configured to GPIO pins at the COM Express™ connector with the TQ-flexiCFG feature.

3.6 Connectors

3.6.1 COM Express™ Connector

Two 220-pin 0.5 mm pitch receptacle connectors are used to interface the TQMxCU3-C6 on the carrier board.

On the carrier board two 220-pin 0.5 mm pitch plug connectors have to be used.

Two versions with 5 mm and 8 mm stack height are available. Connector samples are available from:

<https://www.ept.de/index.php?tq-colibri-lp>

Attention: USB 3.2 Gen 2 (10 Gb/s), PCI Express Gen 4 (16 Gb/s) and DisplayPort HBR3 (8.1 GB/s) carrier design



To support the new high-speed interfaces, USB 3.2 Gen 2 (10 Gb/s), PCI Express Gen 4 (16 Gb/s) and DisplayPort HBR3 (8.1 Gb/s) data rate on the COM Express™ carrier, a COM Express™ optimized high speed connector must be used.

The company EPT offers an optimized COM Express™ connector (Colibri) for applications up to 16 Gb/s, this connector is compatible with all popular COM Express™ connectors.

The Carrier design also needs to be optimized to support the new high-speed interfaces.

For PCIe Gen 5 operation, a connector supporting a data rate of at least 32 Gb/s per lane is required.

Please contact support@tq-group.com for further information about the new high speed design requirements

3.6.2 Debug Header

The TQMxCU3-C6 features a 14-pin flat cable connector to connect an external debug module (TQ specific) providing UEFI BIOS POST code information, debug LEDs and a JTAG interface for on-board FPGA.

The TQM debug card can be connected at this header.



3.6.3 TQM Debug Card

The TQM debug card is available only upon special request (not a standard accessory). It visualizes several processor and chipset control signals. When the TQMxCU3-C6 is powered up, the UEFI BIOS POST codes are shown. If the TQMxCU3-C6 does not boot, the UEFI BIOS POST has detected a fatal error and stopped. The number displayed on the TQM debug card is the number of the test step, where the UEFI BIOS boot failed.



Figure 2: TQM Debug Card

Please contact [TQ-Support](#) for more details and ordering information about the TQM debug card.

3.6.4 Debug Module LED

The TQMxCU3-C6 features a dual colour LED, providing boot and BIOS information. The following table illustrates some LED boot messages:

Table 14: LED Boot Messages

Red LED	Green LED	Remark
ON	OFF	Power supply error
ON	ON	S4/S5 state
Blinking	Blinking	S3 state
OFF	Blinking	UEFI BIOS is booting
OFF	ON	UEFI BIOS boot is completed

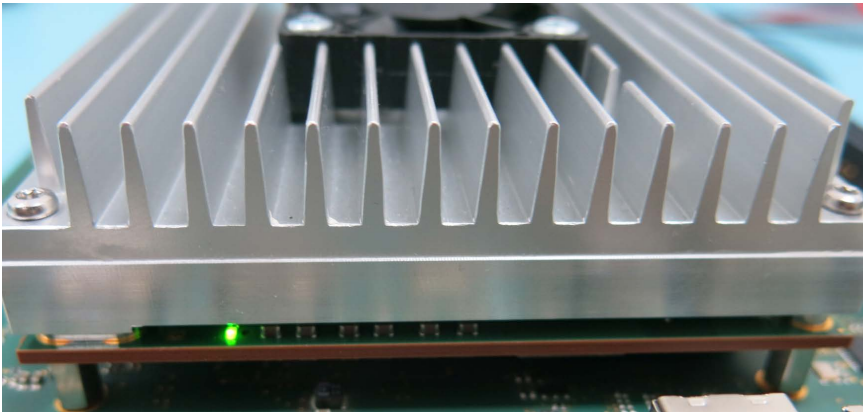


Figure 3: Debug Module LED

3.7 COM Express™ Connector Pinout

This section describes the TQMxCU3-C6 COM Express™ connector pin assignment, which is compliant with COM.0 R3.0 Type 6 pin-out definitions.

3.7.1 Signal Assignment Abbreviations

The following table lists the abbreviations used within this chapter:

Table 15: Signal Assignment Abbreviations

Abbreviation	Description
GND	Ground
PWR	Power
I	Input
I PU	Input with pull-up resistor
I PD	Input with pull-down resistor
O	Output
OD	Open drain output
I/O	Bi-directional

Note: Unused signals on the carrier board



Unused inputs at the COM Express™ connector can be left open on the carrier board, since these signals are terminated on the TQMxCU3-C6.

Note: COM Express™ Module Pinout configuration



The TQMxCU3-C6 complies with the PICMG® COM Express™ Module Base Specification (COM.0 Rev. 3.0 and the new COM.0 Rev 3.1).
 The default COM Express™ Module pinout configuration of the TQMxCU3-C6 module is the COM.0 Rev. 3.0.
 To support the new COM.0 Rev. 3.1 features (e.g. GP SPI and USB4) special hardware and BIOS configuration are necessary.
 Please contact support@tq-group.com for further information about the COM.0 Rev. 3.1 requirements.



3.7.2 COM Express™ Connector Pin Assignment

Table 16: COM Express™ Connector Pin Assignment

Pin	Pin-Signal	Description	Type	Remark
A1	GND(FIXED)	Ground	GND	
A2	GBE0_MDI3-	Gigabit Ethernet Controller 0: Media Dependent Interface	IO	
A3	GBE0_MDI3+	Gigabit Ethernet Controller 0: Media Dependent Interface	IO	
A4	GBE0_LINK100#	Gigabit Ethernet Controller 0 100 / 2500 Mbit/s link indicator	OD	
A5	GBE0_LINK1000#	Gigabit Ethernet Controller 0 1000 Mbit/s link indicator	OD	
A6	GBE0_MDI2-	Gigabit Ethernet Controller 0: Media Dependent Interface	IO	
A7	GBE0_MDI2+	Gigabit Ethernet Controller 0: Media Dependent Interface	IO	
A8	GBE0_LINK#	Gigabit Ethernet Controller 0 link indicator	OD	
A9	GBE0_MDI1-	Gigabit Ethernet Controller 0: Media Dependent Interface	IO	
A10	GBE0_MDI1+	Gigabit Ethernet Controller 0: Media Dependent Interface	IO	
A11	GND(FIXED)	Ground	GND	
A12	GBE0_MDI0-	Gigabit Ethernet Controller 0: Media Dependent Interface	IO	
A13	GBE0_MDI0+	Gigabit Ethernet Controller 0: Media Dependent Interface	IO	
A14	GBE0_CTREF	Reference voltage for Carrier Board Ethernet channel 0	Power	
A15	SUS_S3#	Indicates system is in Suspend to RAM state. Active low output.	O PD	
A16	SATA0_TX+	SATA differential transmit pairs	O	NC
A17	SATA0_TX-	SATA differential transmit pairs	O	NC
A18	SUS_S4#	Indicates system is in Suspend to Disk state. Active low output.	O PD	
A19	SATA0_RX+	SATA differential receive pairs	I	NC
A20	SATA0_RX-	SATA differential receive pairs	I	NC
A21	GND(FIXED)	Ground	GND	
A22	SATA2_TX+	SATA differential transmit pairs	O	NC
A23	SATA2_TX-	SATA differential transmit pairs	O	NC
A24	SUS_S5#	Indicates system is in Soft Off state. Active low output.	O PD	
A25	SATA2_RX+	SATA differential receive pairs	I	NC
A26	SATA2_RX-	SATA differential receive pairs	I	NC
A27	BATLOW#	Indicates that external battery is low	I PU	
A28	(S)ATA_ACT#	SATA activity indicator	O	NC
A29	HDA_SYNC	Sample-synchronization signal to the CODEC(s)	O	
A30	HDA_RST#	Reset output to CODEC, active low.	O	
A31	GND(FIXED)	Ground	GND	
A32	HDA_BITCLK	Serial data clock generated by the external CODEC(s)	IO	
A33	HDA_SDOUT	Serial TDM data output to the CODEC	O	
A34	BIOS_DIS0#/ESPI_SAFS	Selection straps to determine the BIOS boot device	I PU	
A35	THRMTRIP#	indicating that the CPU has entered thermal shutdown	O	
A36	USB6-	USB differential pairs	IO	
A37	USB6+	USB differential pairs	IO	
A38	USB_6_7_OC#	USB over-current sense, USB channels 6 and 7	I PU	
A39	USB4-	USB differential pairs	IO	
A40	USB4+	USB differential pairs	IO	
A41	GND(FIXED)	Ground	GND	
A42	USB2-	USB differential pairs	IO	
A43	USB2+	USB differential pairs	IO	
A44	USB_2_3_OC#	USB over-current sense, USB channels 2 and 3	I PU	
A45	USB0-	USB differential pairs	IO	
A46	USB0+	USB differential pairs	IO	
A47	VCC_RTC	Real-time clock circuit-power input.	Power	
A48	RSMRST_OUT#	RSMReset (Resume Reset, active low) signal	O	Rev 3.1
A49	GBE0_SDP	Gigabit Ethernet Controller 0 Software-Definable Pin.	IO	TQ-flexiCFG
A50	LPC_SERIRQ/ESPI_CS1#	LPC serial interrupt / eSPI CS1#	IO	3.3V / 1.8V
A51	GND(FIXED)	Ground	GND	
A52	PCIE_TX5+	PCI Express differential transmit pairs	O	
A53	PCIE_TX5-	PCI Express differential transmit pairs	O	
A54	GPIO/SD_DATA0	GPIO	I PU	TQ-flexiCFG
A55	PCIE_TX4+	PCI Express differential transmit pairs	O	



COM Express™ Connector Pin Assignment (continued)

Pin	Pin-Signal	Description	Type	Remark
A56	PCIE_TX4-	PCI Express differential transmit pairs	O	
A57	GND	Ground	GND	
A58	PCIE_TX3+	PCI Express differential transmit pairs	O	
A59	PCIE_TX3-	PCI Express differential transmit pairs	O	
A60	GND(FIXED)	Ground	GND	
A61	PCIE_TX2+	PCI Express differential transmit pairs	O	
A62	PCIE_TX2-	PCI Express differential transmit pairs	O	
A63	GPI1/SD_DATA1	GPI1	I PU	TQ-flexiCFG
A64	PCIE_TX1+	PCI Express differential transmit pairs	O	
A65	PCIE_TX1-	PCI Express differential transmit pairs	O	
A66	GND	Ground	GND	
A67	GPI2/SD_DATA2	GPI2	I PU	TQ-flexiCFG
A68	PCIE_TX0+	PCI Express differential transmit pairs	O	
A69	PCIE_TX0-	PCI Express differential transmit pairs	O	
A70	GND(FIXED)	Ground	GND	
A71	LVDS_A0+ / eDP_TX2+	LVDS Channel A differential pairs 0 / eDP_TX2+	O	
A72	LVDS_A0- / eDP_TX2-	LVDS Channel A differential pairs 0 / eDP_TX2-	O	
A73	LVDS_A1+ / eDP_TX1+	LVDS Channel A differential pairs 1 / eDP_TX1+	O	
A74	LVDS_A1- / eDP_TX1-	LVDS Channel A differential pairs 1 / eDP_TX1-	O	
A75	LVDS_A2+ / eDP_TX0+	LVDS Channel A differential pairs 2 / eDP_TX0+	O	
A76	LVDS_A2- / eDP_TX0-	LVDS Channel A differential pairs 2 / eDP_TX0-	O	
A77	LVDS_VDD_EN	LVDS / eDP panel power enable	O PD	
A78	LVDS_A3+	LVDS Channel A differential pairs 3	O	
A79	LVDS_A3-	LVDS Channel A differential pairs 3	O	
A80	GND(FIXED)	Ground	GND	
A81	LVDS_A_CK+ / eDP_TX3+	LVDS Channel A differential clock / eDP_TX3+	O	
A82	LVDS_A_CK- / eDP_TX3-	LVDS Channel A differential clock / eDP_TX3-	O	
A83	LVDS_I2C_CK / eDP_AUX+	I2C clock output for LVDS display / eDP_AUX+	IO	
A84	LVDS_I2C_DAT / eDP_AUX-	I2C data line for LVDS display / eDP_AUX-	IO	
A85	GPI3/SD_DATA3	GPI3 / SD_DATA3	I PU	TQ-flexiCFG
A86	GP_SPI_MOSI	General Purpose SPI MOSI	O	NC / Rev 3.1 (opt.)
A87	eDP_HPD	eDP Detection of Hot Plug	I PD	
A88	PCIE_CLK_REF+	Reference clock output for all PCI Express lanes	O	
A89	PCIE_CLK_REF-	Reference clock output for all PCI Express lanes	O	
A90	GND(FIXED)	Ground	GND	
A91	SPI_POWER	Power supply for Carrier Board SPI Flash	PWR	3.3V
A92	SPI_MISO	Data in to Module from Carrier SPI	I PU	
A93	GPO0/SD_CLK	GPO0	O PD	TQ-flexiCFG
A94	SPI_CLK	Clock from Module to Carrier SPI	O	
A95	SPI_MOSI	Data out from Module to Carrier SPI	O	
A96	TPM_PP	Trusted Platform Module (TPM) Physical Presence pin	I PD	
A97	TYPE10#	Type 10 Module indication (NC)	NC	
A98	SER0_TX	Serial port 0 transmitter	O	w/o protection 3.3V
A99	SER0_RX	Serial port 0 receiver	I PU	w/o protection 3.3V
A100	GND(FIXED)	Ground	GND	
A101	SER1_TX	Serial port 1 transmitter	O	w/o protection 3.3V
A102	SER1_RX	Serial port 1 receiver	I PU	w/o protection 3.3V
A103	LID#	LID switch	I PU	
A104	VCC_12V	Primary wide power input	PWR	
A105	VCC_12V	Primary wide power input	PWR	
A106	VCC_12V	Primary wide power input	PWR	
A107	VCC_12V	Primary wide power input	PWR	
A108	VCC_12V	Primary wide power input	PWR	
A109	VCC_12V	Primary wide power input	PWR	
A110	GND(FIXED)	Ground	GND	



COM Express™ Connector Pin Assignment (continued)

Pin	Pin-Signal	Description	Type	Remark
B1	GND(FIXED)	Ground	GND	
B2	GBE0_ACT#	Gigabit Ethernet Controller 0 active indicator	OD	
B3	LPC_FRAME#/ESPI_CS0#	LPC frame / eSPI CS0# ¹	IO	3.3V / 1.8V
B4	LPC_AD0/ESPI_IO_0	LPC multiplexed address, command and data bus / eSPI IO0 ¹	IO	3.3V / 1.8V
B5	LPC_AD1/ESPI_IO_1	LPC multiplexed address, command and data bus / eSPI IO1 ¹	IO	3.3V / 1.8V
B6	LPC_AD2/ESPI_IO_2	LPC multiplexed address, command and data bus / eSPI IO2 ¹	IO	3.3V / 1.8V
B7	LPC_AD3/ESPI_IO_3	LPC multiplexed address, command and data bus / eSPI IO3 ¹	IO	3.3V / 1.8V
B8	LPC_DRQ0#/ESPI_ALERT0#	LPC serial DMA request / eSPI ALERT0# ¹	IO	3.3V / 1.8V
B9	LPC_DRQ1#/ESPI_ALERT1#	LPC serial DMA request / eSPI ALERT1# ¹	IO	1.8V
B10	LPC_CLK/ESPI_CLK	LPC clock output / eSPI Clock ¹	O	3.3V / 1.8V
B11	GND(FIXED)	Ground	GND	
B12	PWRBTN#	Power button input	I PU	
B13	SMB_CLK	System Management Bus bidirectional clock line	IO	
B14	SMB_DAT	System Management Bus bidirectional data line	IO	
B15	SMB_ALERT#	System Management Bus Alert	I PU	
B16	SATA1_TX+	SATA differential transmit pairs	O	NC
B17	SATA1_TX-	SATA differential transmit pairs	O	NC
B18	SUS_STAT#/ESPI_RST#	LPC indicates suspend operation / eSPI RST# ¹	O	3.3V / 1.8V
B19	SATA1_RX+	SATA differential receive pairs	I	NC
B20	SATA1_RX-	SATA differential receive pairs	I	NC
B21	GND(FIXED)	Ground	GND	
B22	SATA3_TX+	SATA differential transmit pairs	O	NC
B23	SATA3_TX-	SATA differential transmit pairs	O	NC
B24	PWR_OK	Power OK from main power supply	I PU	
B25	SATA3_RX+	SATA differential receive pairs	I	NC
B26	SATA3_RX-	SATA differential receive pairs	I	NC
B27	WDT	watchdog time-out	O	
B28	HDA_SDIN2 / SNDW0_CLK	Serial TDM data input / SNDW0_CLK	IO	NC / Rev 3.1 (opt.)
B29	HDA_SDIN1 / SNDW0_DAT	Serial TDM data input / SNDW0_DAT	IO	NC / Rev 3.1 (opt.)
B30	HDA_SDIN0	Serial TDM data input	I PU	
B31	GND(FIXED)	Ground	GND	
B32	SPKR	PC Audio Speaker output	O	
B33	I2C_CLK	General purpose I2C port clock output	IO	TQ-flexiCFG
B34	I2C_DAT	General purpose I2C port data I/O line	IO	TQ-flexiCFG
B35	THRM#	Input from carrier temperature sensor	I PU	
B36	USB7-	USB differential pairs	IO	
B37	USB7+	USB differential pairs	IO	
B38	USB_4_5_OC#	USB over-current sense, USB channels 4 and 5	I PU	
B39	USB5-	USB differential pairs	IO	
B40	USB5+	USB differential pairs	IO	
B41	GND(FIXED)	Ground	GND	
B42	USB3-	USB differential pairs	IO	
B43	USB3+	USB differential pairs	IO	
B44	USB_0_1_OC#	USB over-current sense, USB channels 0 and 1	I PU	
B45	USB1-	USB differential pairs	IO	
B46	USB1+	USB differential pairs	IO	
B47	ESPI_EN#	The Carrier shall tie ESPI_EN# to GND for eSPI operation, LPC NC ¹	I PU	
B48	USB0_HOST_PRSNT	Module USB client may detect the presence of a USB host on USB0	I PD	
B49	SYS_RESET#	Reset button input	I PU	
B50	CB_RESET#	Reset output from Module to Carrier Board	O	
B51	GND(FIXED)	Ground	GND	
B52	PCIE_RX5+	PCI Express differential receive pairs	I	
B53	PCIE_RX5-	PCI Express differential receive pairs	I	
B54	GPO1/SD_CMD	GPO1	O PD	TQ-flexiCFG
B55	PCIE_RX4+	PCI Express differential receive pairs	I	

¹ See chapter 3.5.11



COM Express™ Connector Pin Assignment (continued)

Pin	Pin-Signal	Description	Type	Remark
B56	PCIE_RX4-	PCI Express differential receive pairs	I	
B57	GPO2 / SD_WP	GPO2	O PD	TQ-flexiCFG
B58	PCIE_RX3+	PCI Express differential receive pairs	I	
B59	PCIE_RX3-	PCI Express differential receive pairs	I	
B60	GND(FIXED)	Ground	GND	
B61	PCIE_RX2+	PCI Express differential receive pairs	I	
B62	PCIE_RX2-	PCI Express differential receive pairs	I	
B63	GPO3/SD_CD#	GPO3	O PD	TQ-flexiCFG
B64	PCIE_RX1+	PCI Express differential receive pairs	I	
B65	PCIE_RX1-	PCI Express differential receive pairs	I	
B66	WAKE0#	PCI Express wake up signal	I PU	
B67	WAKE1#	General purpose wake up signal	I PU	
B68	PCIE_RX0+	PCI Express differential receive pairs	I	
B69	PCIE_RX0-	PCI Express differential receive pairs	I	
B70	GND(FIXED)	Ground	GND	
B71	LVDS_B0+	LVDS Channel B differential pairs 0	O	
B72	LVDS_B0-	LVDS Channel B differential pairs 0	O	
B73	LVDS_B1+	LVDS Channel B differential pairs 1	O	
B74	LVDS_B1-	LVDS Channel B differential pairs 1	O	
B75	LVDS_B2+	LVDS Channel B differential pairs 2	O	
B76	LVDS_B2-	LVDS Channel B differential pairs 2	O	
B77	LVDS_B3+	LVDS Channel B differential pairs 3	O	
B78	LVDS_B3-	LVDS Channel B differential pairs 3	O	
B79	LVDS_BKLT_EN	LVDS / eDP panel backlight enable	O PD	
B80	GND(FIXED)	Ground	GND	
B81	LVDS_B_CK+	LVDS Channel B differential clock	O	
B82	LVDS_B_CK-	LVDS Channel B differential clock	O	
B83	LVDS_BKLT_CTRL	LVDS / eDP panel backlight brightness control	O PD	
B84	VCC_5V_SBY	Standby power input: +5.0V nominal	PWR	
B85	VCC_5V_SBY	Standby power input: +5.0V nominal	PWR	
B86	VCC_5V_SBY	Standby power input: +5.0V nominal	PWR	
B87	VCC_5V_SBY	Standby power input: +5.0V nominal	PWR	
B88	BIOS_DIS1#	Selection straps to determine the BIOS boot device	I PU	
B89	VGA_RED	Red for monitor	O	NC
B90	GND(FIXED)	Ground	GND	
B91	VGA_GRN	Green for monitor	O	NC
B92	VGA_BLU	Blue for monitor	O	NC
B93	VGA_HSYNC	Horizontal sync output to VGA monitor	O	NC
B94	VGA_VSYNC	Vertical sync output to VGA monitor	O	NC
B95	VGA_I2C_CK	DDC clock line	O	NC
B96	VGA_I2C_DAT	DDC data line	IO	NC
B97	SPI_CS#	Chip select for Carrier Board SPI	O	
B98	GP_SPI_MISO	General Purpose SPI MISO or SER0_RTS# (output)	I	SER0_RTS# / Rev 3.1
B99	GP_SPI_CK	General Purpose SPI CLK or SER0_CTS# (input)	O	SER0_CTS# / Rev 3.1
B100	GND(FIXED)	Ground	GND	
B101	FAN_PWMOUT	Fan Pulse Width Modulation speed control output	O	
B102	FAN_TACHIN	Fan tachometer input	I PU	
B103	SLEEP#	Sleep button	I PU	
B104	VCC_12V	Primary wide power input	PWR	
B105	VCC_12V	Primary wide power input	PWR	
B106	VCC_12V	Primary wide power input	PWR	
B107	VCC_12V	Primary wide power input	PWR	
B108	VCC_12V	Primary wide power input	PWR	
B109	VCC_12V	Primary wide power input	PWR	
B110	GND(FIXED)	Ground	GND	



COM Express™ Connector Pin Assignment (continued)

Pin	Pin-Signal	Description	Type	Remark
C1	GND(FIXED)	Ground	GND	
C2	GND	Ground	GND	
C3	USB_SS_RX0-	SuperSpeed USB3.2 differential receive pairs	I	
C4	USB_SS_RX0+	SuperSpeed USB3.2 differential receive pairs	I	
C5	GND	Ground	GND	
C6	USB_SS_RX1-	SuperSpeed USB3.2 differential receive pairs	I	
C7	USB_SS_RX1+	SuperSpeed USB3.2 differential receive pairs	I	
C8	GND	Ground	GND	
C9	USB_SS_RX2-	SuperSpeed USB3.2 differential receive pairs	I	
C10	USB_SS_RX2+	SuperSpeed USB3.2 differential receive pairs	I	
C11	GND(FIXED)	Ground	GND	
C12	USB_SS_RX3-	SuperSpeed USB3.2 differential receive pairs	I	
C13	USB_SS_RX3+	SuperSpeed USB3.2 differential receive pairs	I	
C14	GND	Ground	GND	
C15	USB4_1_LSTX	Sideband TX interface for USB4 Alternate modes	IO	NC
C16	USB4_1_LSRX	Sideband RX interface for USB4 Alternate modes	IO	NC
C17	USB4_RT_ENA	Power Enable for Carrier based USB Retimers.	O	NC
C18	GND	Ground	GND	Rev 3.1
C19	PCIE_RX6+	PCI Express differential receive pairs	I	
C20	PCIE_RX6-	PCI Express differential receive pairs	I	
C21	GND(FIXED)	Ground	GND	
C22	PCIE_RX7+	PCI Express differential receive pairs	I	
C23	PCIE_RX7-	PCI Express differential receive pairs	I	
C24	DDI1_HPD	DDI1 Detection of Hot Plug	I PD	
C25	SML0_CLK	Clock lines for System Management Links 0	IO	NC
C26	SML0_DAT	Data line for I2C data based System Management Links 0	IO	NC
C27	SML1_CLK	Clock lines for System Management Links 1	IO	NC
C28	SML1_DAT	Data line for I2C data based System Management Links 1	IO	NC
C29	USB4_PD_I2C_CLK	I2C clock line between Module based Embedded Controller master and Carrier based USB Power Delivery Controller slave.	IO	NC
C30	USB4_PD_I2C_DAT	I2C clock line between Module based Embedded Controller master and Carrier based USB Power Delivery Controller slave.	IO	NC
C31	GND(FIXED)	Ground	GND	
C32	DDI2_CTRLCLK_AUX+/ USB4_2_AUX+	DDI2_CTRLCLK_AUX+ signal DP AUX, HDMI DVI CLK	IO	Rev 3.1
C33	DDI2_CTRLDATA_AUX-/ USB4_2_AUX-	DDI2_CTRLDATA_AUX- signal DP AUX, HDMI DVI DATA	IO	Rev 3.1
C34	DDI2_DDC_AUX_SEL	Selects the function of DDI2_CTRLx AUX+/- Signals	I PD	
C35	USB4_2_LSTX	Sideband TX interface for USB4 Alternate modes	IO	NC
C36	DDI3_CTRLCLK_AUX+	DDI3_CTRLCLK_AUX+ signal DP AUX, HDMI DVI CLK	IO	Opt.
C37	DDI3_CTRLDATA_AUX-	DDI3_CTRLDATA_AUX- signal DP AUX, HDMI DVI DATA	IO	Opt.
C38	DDI3_DDC_AUX_SEL	Selects the function of DDI3_CTRLx AUX+/- Signals	I PU	NC
C39	DDI3_PAIR0+	DDI3 DP / HDMI / DVI differential pairs 0	O	Opt.
C40	DDI3_PAIR0-	DDI3 DP / HDMI / DVI differential pairs 0	O	Opt.
C41	GND(FIXED)	Ground	GND	
C42	DDI3_PAIR1+	DDI3 DP / HDMI / DVI differential pairs 1	O	Opt.
C43	DDI3_PAIR1-	DDI3 DP / HDMI / DVI differential pairs 1	O	Opt.
C44	DDI3_HPD	DDI3 Detection of Hot Plug	I PD	Opt.
C45	GP_SPI_CS#	General Purpose SPI CS#	O	NC / Rev 3.1 (opt.)
C46	DDI3_PAIR2+	DDI3 DP / HDMI / DVI differential pairs 2	O	Opt.
C47	DDI3_PAIR2-	DDI3 DP / HDMI / DVI differential pairs 2	O	Opt.
C48	RSVD18	Reserved	NC	
C49	DDI3_PAIR3+	DDI3 DP / HDMI / DVI differential pairs 3	O	Opt.
C50	DDI3_PAIR3-	DDI3 DP / HDMI / DVI differential pairs 3	O	Opt.
C51	GND(FIXED)	Ground	GND	
C52	PEG_RX0+	PCI Express differential receive pairs	I	
C53	PEG_RX0-	PCI Express differential receive pairs	I	
C54	TYPE0#	Type 0 Module indication (NC)	NC	
C55	PEG_RX1+	PCI Express differential receive pairs	I	



COM Express™ Connector Pin Assignment (continued)

Pin	Pin-Signal	Description	Type	Remark
C56	PEG_RX1-	PCI Express differential receive pairs	I	
C57	TYPE1#	Type 1 Module indication (NC)	NC	
C58	PEG_RX2+	PCI Express differential receive pairs	I	
C59	PEG_RX2-	PCI Express differential receive pairs	I	
C60	GND(FIXED)	Ground	GND	
C61	PEG_RX3+	PCI Express differential receive pairs	I	
C62	PEG_RX3-	PCI Express differential receive pairs	I	
C63	GND	Ground	GND	Rev 3.1
C64	GND	Ground	GND	Rev 3.1
C65	PEG_RX4+	PCI Express differential receive pairs	I	
C66	PEG_RX4-	PCI Express differential receive pairs	I	
C67	RAPID_SHUTDOWN	Trigger for Rapid Shutdown. Must be driven to 5V	I PD	
C68	PEG_RX5+	PCI Express differential receive pairs	I	
C69	PEG_RX5-	PCI Express differential receive pairs	I	
C70	GND(FIXED)	Ground	GND	
C71	PEG_RX6+	PCI Express differential receive pairs	I	
C72	PEG_RX6-	PCI Express differential receive pairs	I	
C73	GND	Ground	GND	
C74	PEG_RX7+	PCI Express differential receive pairs	I	
C75	PEG_RX7-	PCI Express differential receive pairs	I	
C76	GND	Ground	GND	
C77	GND	Ground	GND	Rev 3.1
C78	PEG_RX8+	PCI Express differential receive pairs	I	NC
C79	PEG_RX8-	PCI Express differential receive pairs	I	NC
C80	GND(FIXED)	Ground	GND	
C81	PEG_RX9+	PCI Express differential receive pairs	I	NC
C82	PEG_RX9-	PCI Express differential receive pairs	I	NC
C83	GND	Ground	GND	Rev 3.1
C84	GND	Ground	GND	
C85	PEG_RX10+	PCI Express differential receive pairs	I	NC
C86	PEG_RX10-	PCI Express differential receive pairs	I	NC
C87	GND	Ground	GND	
C88	PEG_RX11+	PCI Express differential receive pairs	I	NC
C89	PEG_RX11-	PCI Express differential receive pairs	I	NC
C90	GND(FIXED)	Ground	GND	
C91	PEG_RX12+	PCI Express differential receive pairs	I	NC
C92	PEG_RX12-	PCI Express differential receive pairs	I	NC
C93	GND	Ground	GND	
C94	PEG_RX13+	PCI Express differential receive pairs	I	NC
C95	PEG_RX13-	PCI Express differential receive pairs	I	NC
C96	GND	Ground	GND	
C97	GND	Ground	GND	Rev 3.1
C98	PEG_RX14+	PCI Express differential receive pairs	I	NC
C99	PEG_RX14-	PCI Express differential receive pairs	I	NC
C100	GND(FIXED)	Ground	GND	
C101	PEG_RX15+	PCI Express differential receive pairs	I	NC
C102	PEG_RX15-	PCI Express differential receive pairs	I	NC
C103	GND	Ground	GND	
C104	VCC_12V	Primary wide power input	PWR	
C105	VCC_12V	Primary wide power input	PWR	
C106	VCC_12V	Primary wide power input	PWR	
C107	VCC_12V	Primary wide power input	PWR	
C108	VCC_12V	Primary wide power input	PWR	
C109	VCC_12V	Primary wide power input	PWR	
C110	GND(FIXED)	Ground	GND	



COM Express™ Connector Pin Assignment (continued)

Pin	Pin-Signal	Description	Type	Remark
D1	GND(FIXED)	Ground	GND	
D2	GND	Ground	GND	
D3	USB_SSTX0-	SuperSpeed USB3.2 differential transmit pairs	O	
D4	USB_SSTX0+	SuperSpeed USB3.2 differential transmit pairs	O	
D5	GND	Ground	GND	
D6	USB_SSTX1-	SuperSpeed USB3.2 differential transmit pairs	O	
D7	USB_SSTX1+	SuperSpeed USB3.2 differential transmit pairs	O	
D8	GND	Ground	GND	
D9	USB_SSTX2-	SuperSpeed USB3.2 differential transmit pairs	O	
D10	USB_SSTX2+	SuperSpeed USB3.2 differential transmit pairs	O	
D11	GND(FIXED)	Ground	GND	
D12	USB_SSTX3-	SuperSpeed USB3.2 differential transmit pairs	O	
D13	USB_SSTX3+	SuperSpeed USB3.2 differential transmit pairs	O	
D14	GND	Ground	GND	
D15	DDI1_CTRLCLK_AUX+/USB4_1_AUX+	DDI1_CTRLCLK_AUX+ signal DP AUX, HDMI DVI CLK	IO	Rev 3.1
D16	DDI1_CTRLDATA_AUX-/USB4_1_AUX-	DDI1_CTRLDATA_AUX- signal DP AUX, HDMI DVI DATA	IO	Rev 3.1
D17	USB4_PD_I2C_ALERT#	Alert signal associated with the System Management link	I	NC
D18	PMCALERT#	Alert signal associated with the System Management link	I	NC
D19	PCIE_TX6+	PCI Express differential transmit pairs	O	
D20	PCIE_TX6-	PCI Express differential transmit pairs	O	
D21	GND(FIXED)	Ground	GND	
D22	PCIE_TX7+	PCI Express differential transmit pairs	O	
D23	PCIE_TX7-	PCI Express differential transmit pairs	O	
D24	GND	Ground or SER1_RTS# (output)	GND	SER1_RTS# / Rev 3.1
D25	GND	Ground or SER1_CTS# (input)	GND	SER1_CTS# / Rev 3.1
D26	DDI1_PAIR0+/USB4_1_SSTX0+	DDI1 DP / HDMI / DVI differential pairs 0	O	Rev 3.1
D27	DDI1_PAIR0-/USB4_1_SSTX0-	DDI1 DP / HDMI / DVI differential pairs 0	O	Rev 3.1
D28	GND	Ground	GND	Rev 3.1
D29	DDI1_PAIR1+/USB4_1_SSRX0+	DDI1 DP / HDMI / DVI differential pairs 1	O	Rev 3.1
D30	DDI1_PAIR1-/USB4_1_SSRX0-	DDI1 DP / HDMI / DVI differential pairs 1	O	Rev 3.1
D31	GND(FIXED)	Ground	GND	
D32	DDI1_PAIR2+/USB4_1_SSTX1+	DDI1 DP / HDMI / DVI differential pairs 2	O	Rev 3.1
D33	DDI1_PAIR2-/USB4_1_SSTX1-	DDI1 DP / HDMI / DVI differential pairs 2	O	Rev 3.1
D34	DDI1_DDC_AUX_SEL	Selects the function of DDI1_CTRLxAUX+/- Signals	I PD	
D35	USB4_2_LSRX	Sideband RX interface for USB4 Alternate modes	IO	NC
D36	DDI1_PAIR3+/USB4_1_SSRX1+	DDI1 DP / HDMI / DVI differential pairs 3	O	Rev 3.1
D37	DDI1_PAIR3-/USB4_1_SSRX1-	DDI1 DP / HDMI / DVI differential pairs 3	O	Rev 3.1
D38	GND	Ground	GND	Rev 3.1
D39	DDI2_PAIR0+/USB4_2_SSTX0+	DDI2 DP / HDMI / DVI differential pairs 0	O	Rev 3.1
D40	DDI2_PAIR0-/USB4_2_SSTX0-	DDI2 DP / HDMI / DVI differential pairs 0	O	Rev 3.1
D41	GND(FIXED)	Ground	GND	
D42	DDI2_PAIR1+/USB4_2_SSRX0+	DDI2 DP / HDMI / DVI differential pairs 1	O	Rev 3.1
D43	DDI2_PAIR1-/USB4_2_SSRX0-	DDI2 DP / HDMI / DVI differential pairs 1	O	Rev 3.1
D44	DDI2_HPD	DDI2 Detection of Hot Plug	I PD	
D45	GND	Ground	GND	Rev 3.1
D46	DDI2_PAIR2+/USB4_2_SSTX1+	DDI2 DP / HDMI / DVI differential pairs 2	O	Rev 3.1
D47	DDI2_PAIR2-/USB4_2_SSTX1-	DDI2 DP / HDMI / DVI differential pairs 2	O	Rev 3.1
D48	GND	Ground	GND	Rev 3.1
D49	DDI2_PAIR3+/USB4_2_SSRX1+	DDI2 DP / HDMI / DVI differential pairs 3	O	Rev 3.1
D50	DDI2_PAIR3-/USB4_2_SSRX1-	DDI2 DP / HDMI / DVI differential pairs 3	O	Rev 3.1
D51	GND(FIXED)	Ground	GND	
D52	PEG_TX0+	PCI Express differential transmit pairs	O	
D53	PEG_TX0-	PCI Express differential transmit pairs	O	
D54	PEG_LANE_RV#	PCI Express Graphics lane reversal input strap	I PU	NC
D55	PEG_TX1+	PCI Express differential transmit pairs	O	



COM Express™ Connector Pin Assignment (continued)

Pin	Pin-Signal	Description	Type	Remark
D56	PEG_TX1-	PCI Express differential transmit pairs	O	
D57	TYPE2#	Type 2 Module indication (GND)	O	
D58	PEG_TX2+	PCI Express differential transmit pairs	O	
D59	PEG_TX2-	PCI Express differential transmit pairs	O	
D60	GND(FIXED)	Ground	GND	
D61	PEG_TX3+	PCI Express differential transmit pairs	O	
D62	PEG_TX3-	PCI Express differential transmit pairs	O	
D63	GND	Ground	GND	Rev 3.1
D64	GND	Ground	GND	Rev 3.1
D65	PEG_TX4+	PCI Express differential transmit pairs	O	
D66	PEG_TX4-	PCI Express differential transmit pairs	O	
D67	GND	Ground	GND	
D68	PEG_TX5+	PCI Express differential transmit pairs	O	
D69	PEG_TX5-	PCI Express differential transmit pairs	O	
D70	GND(FIXED)	Ground	GND	
D71	PEG_TX6+	PCI Express differential transmit pairs	O	
D72	PEG_TX6-	PCI Express differential transmit pairs	O	
D73	GND	Ground	GND	
D74	PEG_TX7+	PCI Express differential transmit pairs	O	
D75	PEG_TX7-	PCI Express differential transmit pairs	O	
D76	GND	Ground	GND	
D77	GND	Ground	GND	Rev 3.1
D78	PEG_TX8+	PCI Express differential transmit pairs	O	NC
D79	PEG_TX8-	PCI Express differential transmit pairs	O	NC
D80	GND(FIXED)	Ground	GND	
D81	PEG_TX9+	PCI Express differential transmit pairs	O	NC
D82	PEG_TX9-	PCI Express differential transmit pairs	O	NC
D83	GND	Ground	GND	Rev 3.1
D84	GND	Ground	GND	
D85	PEG_TX10+	PCI Express differential transmit pairs	O	NC
D86	PEG_TX10-	PCI Express differential transmit pairs	O	NC
D87	GND	Ground	GND	
D88	PEG_TX11+	PCI Express differential transmit pairs	O	NC
D89	PEG_TX11-	PCI Express differential transmit pairs	O	NC
D90	GND(FIXED)	Ground	GND	
D91	PEG_TX12+	PCI Express differential transmit pairs	O	NC
D92	PEG_TX12-	PCI Express differential transmit pairs	O	NC
D93	GND	Ground	GND	
D94	PEG_TX13+	PCI Express differential transmit pairs	O	NC
D95	PEG_TX13-	PCI Express differential transmit pairs	O	NC
D96	GND	Ground	GND	
D97	GND	Ground	GND	Rev 3.1
D98	PEG_TX14+	PCI Express differential transmit pairs	O	NC
D99	PEG_TX14-	PCI Express differential transmit pairs	O	NC
D100	GND(FIXED)	Ground	GND	
D101	PEG_TX15+	PCI Express differential transmit pairs	O	NC
D102	PEG_TX15-	PCI Express differential transmit pairs	O	NC
D103	GND	Ground	GND	
D104	VCC_12V	Primary wide power input	PWR	
D105	VCC_12V	Primary wide power input	PWR	
D106	VCC_12V	Primary wide power input	PWR	
D107	VCC_12V	Primary wide power input	PWR	
D108	VCC_12V	Primary wide power input	PWR	
D109	VCC_12V	Primary wide power input	PWR	
D110	GND(FIXED)	Ground	GND	

4. MECHANICS

4.1 Dimensions

The TQMxCU3-C6 has dimensions of 95 mm × 70 mm (±0.2 mm).
The following figure shows the TQMxCU3-C6 in a three view.

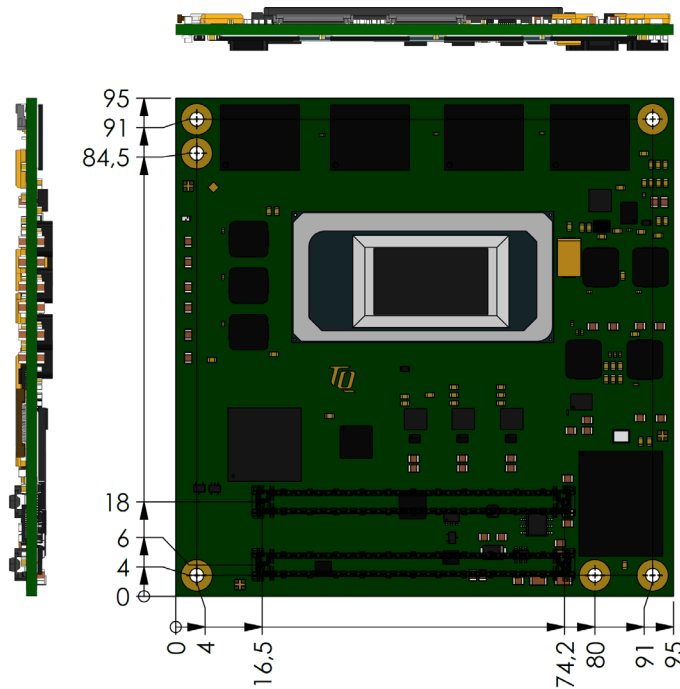


Figure 4: TQMxCU3-C6 Three View

The following illustration shows the TQMxCU3-C6 bottom view.

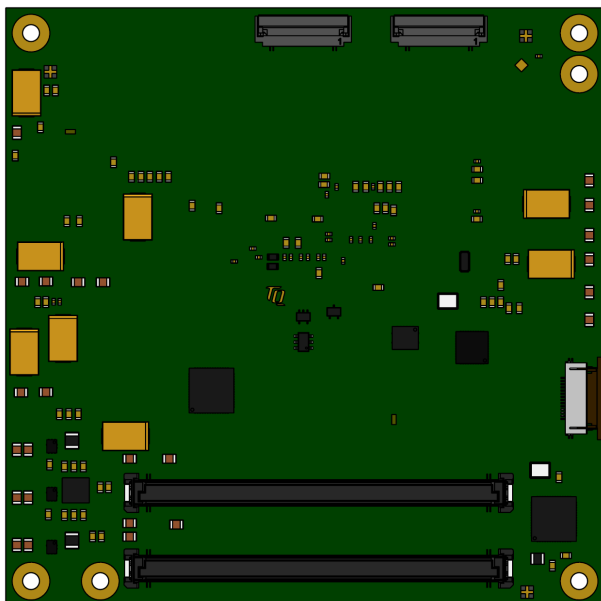


Figure 5: TQMxCU3-C6 Bottom View

4.2 Component Placement and Labels

The following illustration shows the TQMxCU3-C6 component placement.

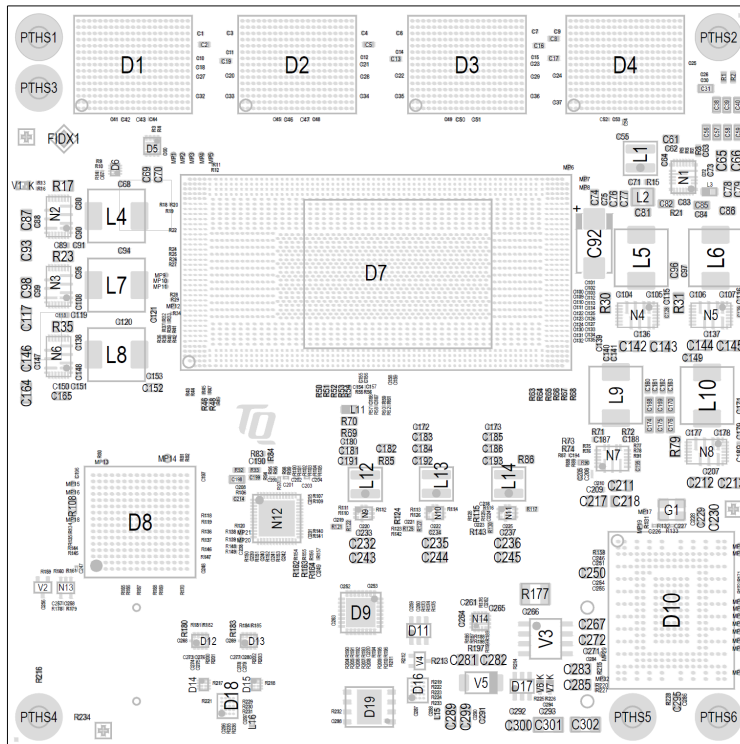


Figure 6: TQMxCU3-C6 Component Placement Top

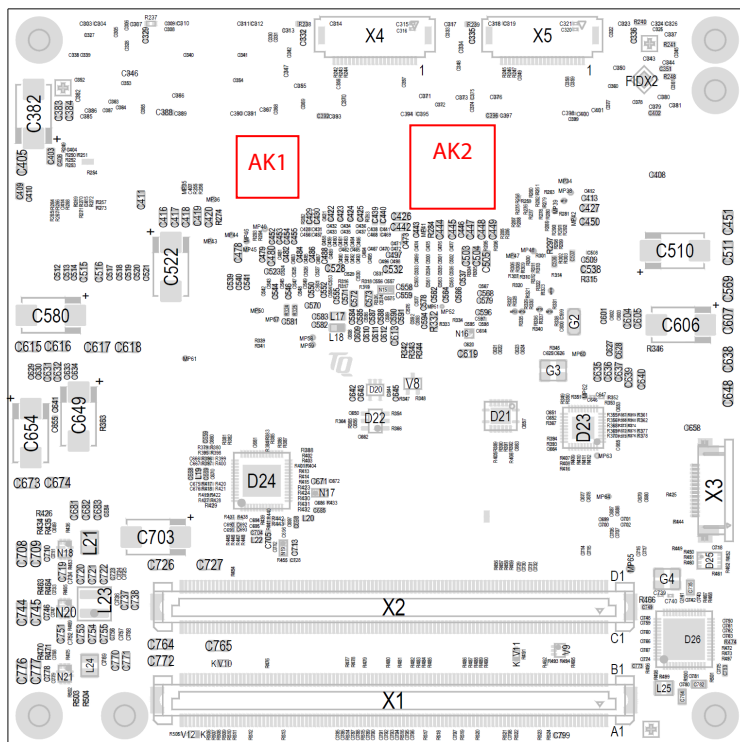


Figure 7: TQMxCU3-C6 Component Placement Bottom

Table 17: Labels on TQMxCU3-C6

Label	Content
AK1	TQMxCU3-C6 version and revision / MAC address
AK2	BIOS label

4.3 Heat Spreader

Two heat spreaders "TQMxCU3-C6-HSP-x" are available for the TQMxCU3-C6. Due to variations in CPU housing height appropriately adapted heat spreaders are required. The provided heat spreaders comply with the latest COM Express™ specification (13 mm ±0.2 mm, including PCB).

The TQMxCU3-C6 can also be delivered with pre-mounted heat spreader (optional).

The following illustration shows the heat spreader (TQMxCU3-C6-HSP) for the TQMxCU3-C6.



Figure 8: TQMxCU3-C6-HSP Heat Spreader

The following table shows the heat spreaders offered by TQ:

Table 18: HSP variants

CPU category	HSP structure	H404 4Xe CT (SMT Height: 1.15 mm)	H404 4Xe ET H484 4Xe CT/ET H484 12Xe CT (SMT Height: 1.26 mm)
TQMxCU3-C6-HSP-AB	11mm; AL/CU; M2.5 high profile		X
TQMxCU3-C6-HSP-AC	11mm; AL/CU; M2.5 low profile	X	

The White Paper "Heat Spreader Mounting Instruction" provides information how to mount the heat spreader.

Please contact [TQ-Support](#) for more details about 2D/3D STEP models.

4.4 Mechanical and Thermal Considerations

The TQMxCU3-C6 is designed to operate within a wide range of thermal environments.

An important factor for each system integration is the thermal design. The heat spreader provides the thermal coupling to the TQMxCU3-C6. The heat spreader is thermally coupled to the processor and provides optimal heat transfer from the TQMxCU3-C6 to the heat sink. The heat spreader itself is not an appropriate heat sink.

System designers can implement passive and active cooling systems using the thermal connection to the heat spreader.

Attention: Thermal Considerations



Do not operate the TQMxCU3-C6 without properly attached heat spreader and heat sink!

If a special cooling solution is required, an extensive thermal design analysis and verification has to be performed.

TQ-Systems GmbH offers thermal analysis and simulation as a service.



4.5 Protection against External Effects

The TQMxCU3-C6 itself is not protected against dust, external impact and contact (IP00). Adequate protection has to be guaranteed by the surrounding system and carrier board. Conformal coating can be offered for harsh environment applications.



5. SOFTWARE

5.1 System Resources

5.1.1 I2C0 Bus Devices

The TQMxCU3-C6 provides a general-purpose I2C0 port via I2C controller in the TQ-flexiCFG block.

The following table shows the I2C0 address mapping for the COM Express™ I2C0 port.

Table 19: I2C Address Mapping COM Express™ I2C Port

8-bit Address	Function	Remark
0xAE	Carrier board EEPROM	Embedded EEPROM configuration not supported

Make sure the address space of the carrier board I2C0 devices does not overlap the address space of the module devices.

5.1.2 SMBus

The TQMxCU3-C6 provides a System Management Bus. No device is connected to the SMBus on the TQMxCU3-C6.

5.1.3 Memory Mapping

The TQMxCU3-C6 supports the standard PC system memory and I/O memory map.

5.1.4 Interrupt Mapping

The TQMxCU3-C6 supports the standard PC Interrupt routing.

The integrated legacy devices (COM1, COM2) can be configured via the BIOS to IRQ3 and IRQ4.

5.2 Operating Systems

5.2.1 Supported Operating Systems

The TQMxCU3-C6 supports several Operating Systems:

- Microsoft® Windows® 11 (IoT) Enterprise (64-bit)
- Linux Ubuntu (64-bit)

Other Operating Systems are supported on request.

Please visit [TQ-Group](#) (tab "Specifications") or contact [TQ-Support](#) for further information about supported Operating Systems.

5.2.2 Driver Download

The TQMxCU3-C6 is well supported by the Standard Operating Systems, which already include most of the drivers required. It is recommended to use the latest Intel® drivers to optimize performance and make use of the full TQMxCU3-C6 feature set.

The White Paper "Windows Driver Installation Instructions" provides information how to install the Windows driver.

Please visit [TQ-Group](#) or contact [TQ-Support](#) for further driver download assistance.

5.3 TQ-Systems Embedded Application Programming Interface (EAPI)

The TQ-Systems Embedded Application Programming Interface (EAPI) is a driver package to access and control hardware resources on all TQ-Systems COM Express™ modules. The TQ-Systems EAPI is compatible with the PICMG® specification.

5.4 Software Tools

Please visit [Support TQ-Group](#) or contact [TQ-Support](#) for further information about available software tools.



6. BIOS-UPDATE

The UEFI BIOS update instruction serves to guarantee a proper way to update the UEFI BIOS on the TQMxCU3-C6.

Please read the entire instructions before beginning the BIOS update.

By disregarding the information, you can destroy the UEFI BIOS on the TQMxCU3-C6!

This document will guide the user to update the UEFI BIOS on the TQMxCU3-C6 by using the Insyde Flash Firmware Tools.

The InsydeH2O Tools are only available on [request](#).

Please contact [TQ-Support](#) for more information about the BIOS Tools and the latest UEFI BIOS version for the TQMxCU3-C6.

Note: Installation procedures and screen shots



Installation procedures and screen shots in this section are for your reference and may not be exactly the same as shown on your screen.

Step 1: Preparing USB Stick

A FAT32 formatted USB stick can be used. Copy the following files to the USB stick.

- H2OFFT-Sx64.efi (Flash Firmware Tool from Insyde for update via UEFI Shell)
 - Be sure to have H2OFFT Version 200.02.00.06 or later
- InsydeH2OFF_x86_WINx64 folder (Flash Firmware Tool from Insyde for update via Windows 64-bit system)
- BIOS binary file, e.g. xx.bin

See: <https://www.tq-group.com/en/support/downloads/tq-embedded/software-drivers/x86-architecture/>

Step 2: Preparing Management Engine (ME) FW for update

Enter the BIOS menu by pressing <ESC> while booting (POST phase) and navigate to the following page:

Setup Utility ⇒ Advanced ⇒ PCH-FW Configuration ⇒ Firmware Update Configuration

Then, set option "ME FW Image Re-Flash" to "enabled", save and exit by pressing <F10> and <Enter>.

Note: Option availability



This option will only be valid for the next boot.

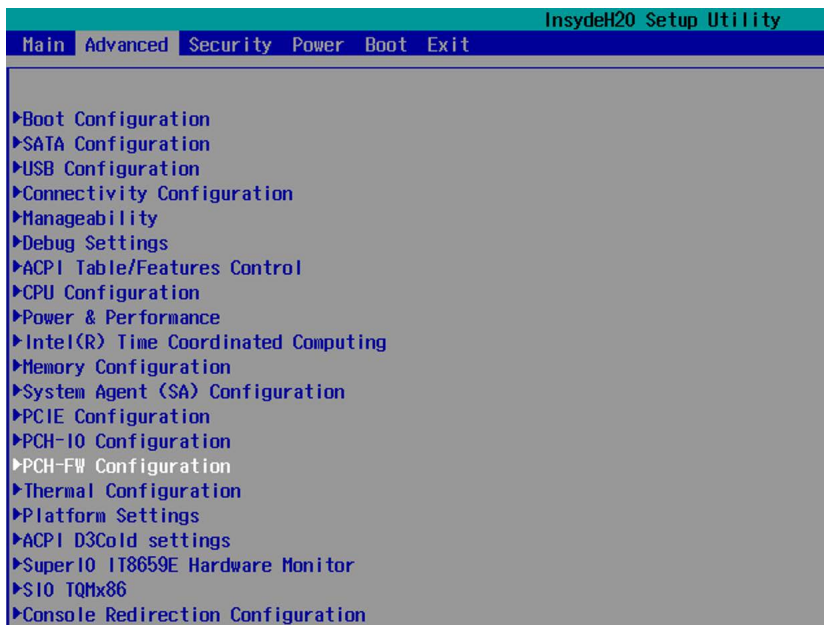


Figure 9: PCH-FW Configuration Menu

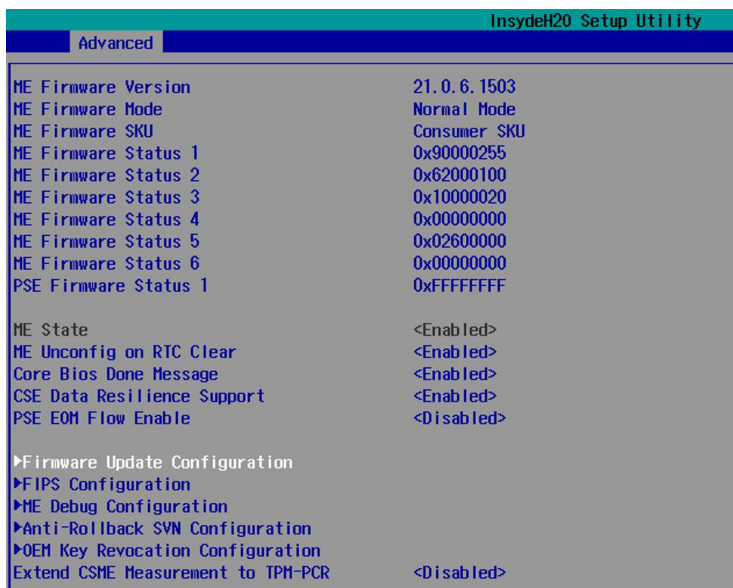


Figure 10: Firmware Update Configuration Menu

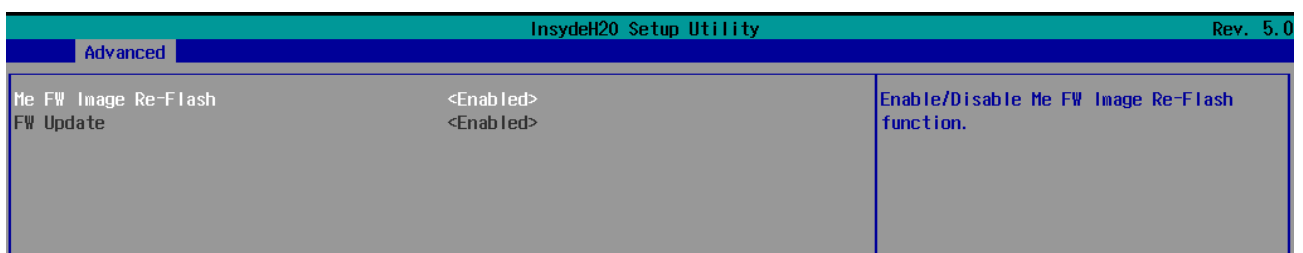


Figure 11: ME FW Image Re-Flash Option

Step 3a: Updating UEFI BIOS via EFI Shell

Plug the USB stick into the board on which you want to update the UEFI BIOS and power up the board. The board will boot and go to the internal EFI shell.



Note: If a boot device is connected, change to "Boot Manager" via Front Page and select "Internal EFI Shell".

```

UEFI Interactive Shell v2.2
EDK II
UEFI v2.90 (INSYDE Corp., 0x71520025)
Mapping table
  FS0: Alias(s):HD0f0b:;BLK1:
        PciRoot(0x0)/Pci(0x14,0x0)/USB(0x5,0x0)/HD(1,GPT,C3A1151B-6DB3-4ABF-B28F-88808E320561)
  BLK0: Alias(s):
        PciRoot(0x0)/Pci(0x14,0x0)/USB(0x5,0x0)
Press ESC in 1 seconds to skip startup.nsh or any other key to continue.
Shell>

```

Figure 12: EFI Shell

Please see device mapping table on the screen and select the removable hard disk file system "fsX" (X = 0, 1, 2, ...).

Move operating directory to USB drive with e.g. "fs0:"

Then, navigate to the BIOS folder (e.g. "cd TQMxCU3-C6") to execute the Insyde BIOS update tool:

```
H2OFFT-Sx64.efi <BIOS file> -all -ra
```

If the option "-ra" is set, the SMBIOS data will not be overwritten and the UUID included in SMBIOS data will be preserved. However, this argument is not mandatory.

```

UEFI Interactive Shell v2.2
EDK II
UEFI v2.90 (INSYDE Corp., 0x71520025)
Mapping table
  FS0: Alias(s):HD0e0b:;BLK1:
        PciRoot(0x0)/Pci(0xD,0x0)/USB(0x4,0x0)/HD(1,MBR,0x00A00814)
  BLK0: Alias(s):
        PciRoot(0x0)/Pci(0xD,0x0)/USB(0x4,0x0)
Press ESC in 4 seconds to skip startup.nsh or any other key to continue.
Shell> fs0:
FS0:\> dir
Directory of: FS0:\
07/08/2026 17:04 <DIR>          16,384 Ethernet
06/08/2026 04:28              1,037,920 H2OFFT-Sx64.efi
07/22/2026 10:24          33,554,432 TQMxCU3-C6_05.71.52.25.01_2026-07-22_debug.bin
        2 File(s) 34,592,352 bytes
        1 Dir(s)
FS0:\> H2OFFT-Sx64.efi TQMxCU3-C6_05.71.52.25.01_2026-07-22_debug.bin -all -ra

```

Figure 13: EFI Shell UEFI BIOS Update

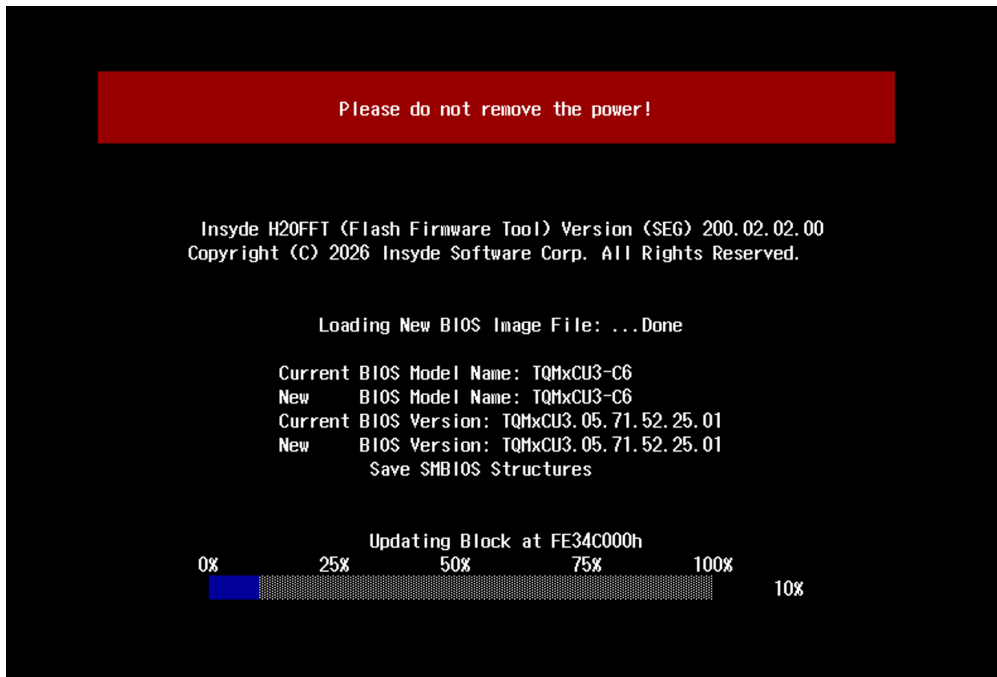


Figure 14: Screen during BIOS Update

Step 3b: Updating UEFI BIOS via Windows Operating System

Boot the Windows operating system (64-bit) and insert the USB stick into the board on which you want to update the UEFI BIOS. Start the Command Prompt (CMD). It is important to note that the Command Prompt must be started in the administrator mode!

Select the BIOS update folder with the Insyde Windows 64-bit update tool and execute the Insyde BIOS update tool.

```
H2OFFT-Wx64.exe <BIOS file>.bin -all -ra
```

For the <BIOS file> argument, please specify the .bin file with the full path (e.g. D:\TQMXXXX_X.xx.xx.xx.bin).

If the option “-ra” is used, the SMBIOS data will not be overwritten and the UUID included in SMBIOS data will be preserved. However, this argument is not mandatory.

Start the BIOS update with the Insyde Windows 64-bit update tool.

Step 4: BIOS update check on the TQMxCU3-C6 Module

After the UEFI BIOS update, the new UEFI BIOS configures the complete TQMxCU3-C6 hardware. This results in several reboots and the first boot time takes longer (up to 1 ~ 2 minutes).

The TQMxCU3-C6 features a dual colour Debug LED providing boot and UEFI BIOS information.

If the green LED blinks, the UEFI BIOS is booting. If the green LED is lit permanently, the UEFI BIOS boot is completed.





Figure 15: TQMxCU3-C6 Debug LED

After the UEFI BIOS flash is completed, please check whether the UEFI BIOS has been flashed successfully. The BIOS Main menu provides the board and hardware information and it shows the installed BIOS version.

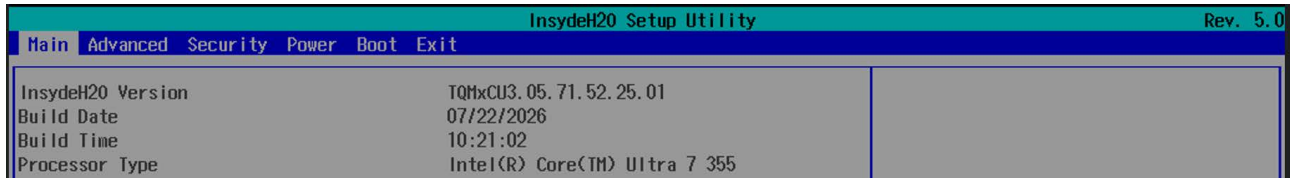


Figure 16: EFI BIOS Main Menu



7. SAFETY REQUIREMENTS AND PROTECTIVE REGULATIONS

7.1 EMC

The TQMxCU3-C6 was developed according to electromagnetic compatibility requirements (EMC). Depending on the target system, anti-interference measures may still be necessary to guarantee the adherence to the limits for the overall system.

7.2 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 placed directly at the inputs of a system. As these measures always have to be implemented on the carrier board, no special preventive measures were taken on the TQMxCU3-C6.

7.3 Shock & Vibration

The TQMxCU3-C6 is designed to be insensitive to shock, vibration, and impact.

7.4 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.

7.5 Cyber Security

The user must always perform a Threat Analysis and Risk Assessment (TARA) for their individual end application, since the TQMxCU3-C6 is only a sub-component of an overall system.

7.6 Reliability and Service Life

The MTBF according to MIL-HDBK-217 FN2 is approximately 788,701 hours, Ground Benign, @ +40 °C.

7.7 RoHS

The TQMxCU3-C6 is manufactured RoHS compliant.

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

7.8 WEEE®

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.

7.9 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.

7.10 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 to 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, 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-Systems GmbH reserves the right to update and modify this notice, as it deems necessary or appropriate.



7.11 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 TQMxCU3-C6 must therefore always be seen in conjunction with the complete device. The available standby and sleep modes

of the components on the TQMxCU3-C6 enable compliance with EuP requirements for the TQMxCU3-C6.

7.12 Battery

No batteries are assembled on the TQMxCU3-C6.

7.13 Packaging

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

To be able to reuse the TQMxCU3-C6, it is produced in such a way (a modular construction) that it can be easily repaired and disassembled.

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

The TQMxCU3-C6 is delivered in reusable packaging.

7.14 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.

7.15 Warranty

TQ-Systems GmbH warrants that the product, when used in accordance with the contract, fulfils 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

7.16 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.

Since there is currently 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.

8. APPENDIX

8.1 Acronyms and Definitions

The following acronyms and abbreviations are used in this document.

Table 20: Acronyms

Acronym	Meaning
AHCI	Advanced Host Controller Interface
BIOS	Basic Input/Output System
CAN	Controller Area Network
CMOS	Complementary Metal Oxide Semiconductor
CODEC	Code/Decode
COM	Computer-On-Module
CPU	Central Processing Unit
CSM	Compatibility Support Module
cTDP	Configurable Thermal Design Power
DC	Direct Current
DDC	Display Data Channel
DDI	Digital Display Interface
DDR	Double Data Rate
DMA	Direct Memory Access
DP	DisplayPort
DVI	Digital Visual Interface
EAPI	Embedded Application Programming Interface
ECC	Error-Correcting Code
EDID	Extended Display Identification Data
eDP	embedded DisplayPort
EEPROM	Electrically Erasable Programmable Read-Only Memory
EFI	Extensible Firmware Interface
EMC	Electromagnetic Compatibility
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
FW	Firmware
GPIO	General-purpose Input/Output
HDA	High Definition Audio
HDMI	High Definition Multimedia Interface
HEVC	High Efficiency Video Coding
HSP	Heat Spreader
HT	Hyper-Threading
I	Input
I PD	Input with internal Pull-Down resistor
I PU	Input with internal Pull-Up resistor
I/O	Input/Output
I ² C	Inter-Integrated Circuit
IEC	International Electrotechnical Commission
IoT	Internet of Things
IP00	Ingress Protection 00
IRQ	Interrupt Request
JEIDA	Japanese Electronics Industry Development Association
JPEG	Joint Photographic Experts Group
JTAG®	Joint Test Action Group
LED	Light Emitting Diode
LPDDR5	Low Power Double Data Rate 5
ME	Management Engine
MMC	Multimedia Card
MPEG	Moving Picture Experts Group
MST	Multi-Stream Transport
MT/s	Mega Transfers per second
MTBF	Mean operating Time Between Failures



7.1 Acronyms and Definitions (continued)

Table 19: Acronyms (continued)

Acronym	Meaning
N/A	Not Available
NC	Not Connected
O	Output
OD	Open Drain
OpROM	Option ROM
OS	Operating System
PC	Personal Computer
PCB	Printed Circuit Board
PCH	Platform Controller Hub
PCI	Peripheral Component Interconnect
PCIe	Peripheral Component Interconnect Express
PD	Pull-Down
PEG	PCI Express for Graphics
PICMG®	PCI Industrial Computer Manufacturers Group
POST	Power-On Self-Test
PU	Pull-Up
PWM	Pulse-Width Modulation
RAID	Redundant Array of Independent/Inexpensive Disks/Drives
RAM	Random Access Memory
RMA	Return Merchandise Authorization
RoHS	Restriction of (the use of certain) Hazardous Substances
RSVD	Reserved
RTC	Real-Time Clock
SATA	Serial ATA
SCU	System Control Unit
SD	Secure Digital
SD/MMC	Secure Digital Multimedia Card
SDIO	Secure Digital Input/Output
SIMD	Single Instruction, Multiple Data
SMART	Self-Monitoring, Analysis and Reporting Technology
SMBus	System Management Bus
SO-DIMM	Small Outline Dual In-Line Memory Module
SPD	Serial Presence Detect
SPI	Serial Peripheral Interface
SPKR	Speaker
SSD	Solid-State Drive
STEP	Standard for Exchange of Products
TDM	Time-Division Multiplexing
TDP	Thermal Design Power
TPM	Trusted Platform Module
UART	Universal Asynchronous Receiver/Transmitter
UEFI	Unified Extensible Firmware Interface
USB	Universal Serial Bus
VC-1	Video Coding (format) 1
VESA	Video Electronics Standards Association
VGA	Video Graphics Array
VP8	Video Progressive (compression format) 8
WDT	Watchdog Timer
WEEE®	Waste Electrical and Electronic Equipment
WES	Windows® Embedded Standard



8.2 References

Table 21: Further Applicable Documents and Links

No.	Name	Rev.	Company
(1)	Intel® Core™ Ultra Series 3 processor Product Brief	–	Intel
(2)	PICMG® COM Express™ Module Base Specification	Rev. 3.1, Oct 12, 2022	PICMG
(3)	PICMG® COM Express™ Carrier Design Guide	Rev. 2.0, Dec. 6, 2013	PICMG
(4)	PICMG® COM Express™ Embedded Application Programming Interface	Rev. 1.0, Aug. 8, 2010	PICMG

