TQMxE39M
User's Manual

TQMxE39M UM 0103
2019-12-17

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REVISION HISTORY

Rev.	Date	Name	Pos.	Modification
0100	2017-05-22	KG		Initial release
0101	2019-03-14	FP	Illustration 1	Corrected
0102	2019-08-14	FP	All Table 10 6, 8	Typo, formatting, non-functional changes Direction of A22 and A23 corrected Chapters added
0103	2019-12-17	FP	2.3 Table 2 Table 3	Reworked Added TBD values added

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1.5 Service and Support

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

Through our website www.tq-group.com you could also get registered, to have access to restricted information and automatic update services.

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

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

1.6   Tips on safety

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

1.7   Symbols and typographic conventions

Table 1:   Terms and Conventions

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

1.8   Handling and ESD tips

General handling of your TQ-products

	The TQ-product may only be used and serviced by certified personnel who have taken note of the information, the safety regulations in this document and all related rules and regulations. A general rule is: do not touch the TQ-product during operation. This is especially important when switching on, changing jumper settings or connecting other devices without ensuring beforehand that the power supply of the system has been switched off. Violation of this guideline may result in damage / destruction of the TQMxE39M and be dangerous to your health. Improper handling of your TQ-product would render the guarantee invalid.

Proper ESD handling

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

1.9   Naming of signals

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

Example: RESET#

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

Example: C / D#

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

The identification of the individual functions follows the above conventions.

Example: WE2# / OE#

1.10   Further applicable documents / presumed knowledge

- **Specifications and manual of the modules used:**
  These documents describe the service, functionality and special characteristics of the module used.

- **Specifications of the components used:**
  The manufacturer's specifications of the components used, for example CompactFlash cards, are to be taken note of. They contain, if applicable, additional information that must be taken note of for safe and reliable operation. These documents are stored at TQ-Systems GmbH.

- **Chip errata:**
  It is the user's responsibility to make sure all errata published by the manufacturer of each component are taken note of. The manufacturer's advice should be followed.

- **Software behaviour:**
  No warranty can be given, nor responsibility taken for any unexpected software behaviour due to deficient components.

- **General expertise:**
  Expertise in electrical engineering / computer engineering is required for the installation and the use of the device.

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

It includes detailed information with schematics and detailed layout guidelines.

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

2.   INTRODUCTION

The TQ module TQMxE39M is based on the latest generation of Intel® Atom™, Pentium® and Celeron® CPUs (code name "Apollo Lake"). It achieves a new level of computing performance, security and media processing performance in a very compact form factor to empower real-time computing, industrial automation, digital surveillance, aviation, medical, retail and more.

The TQMxE39M corresponds to the internationally established PICMG® standard COM Express™ Mini (COM.0 R2.1) with Type10 pinout. 8 USB ports – including 2 USB 3.0 – and up to 4 PCIe lanes natively supported by the CPUs enable high bandwidth communication with peripherals and additional interfaces on the carrier board. With the latest Intel® graphics processor integrated, the TQMxE39M delivers 4K high resolution graphics output, immersive 3D processing and also greatly increased video encode and playback performance.

Time coordinated computing capabilities enable time synchronized processes within IoT networks and industrial control applications. On-board eMMC up to 64 Gbyte and the option for LVDS or native eDP enable flexibility and reduce overall BOM cost.

The integrated TQMx86 board controller enables high flexibility through "flexiCFG" and supports thermal management, watchdog and "Green ECO-Off" with a minimum of standby power. Combined with options like conformal coating and optimized cooling solutions the TQMxE39M also fits perfectly into ruggedized applications.

2.1   COM Express™ Specification Compliance

The TQMxE39M is compliant to the PICMG® COM Express™ Module Base Specification (COM.0 R2.1) Mini, Type10, with dimensions of 84 mm × 55 mm.

2.2   Functional Overview

The following key functions are implemented on the TQMxE39M, or are available as an assembly option:

CPU:

- Intel® Atom™ E3900 („Apollo Lake-I")
- Intel® Pentium® N4200 („Apollo Lake")
- Intel® Celeron® N3350 („Apollo Lake")

Memory:

- DDR3L: 2 Gbyte, 4 Gbyte, 8 Gbyte
- eMMC 5.0 on-board flash up to 64 Gbyte
- EEPROM: 32 kbit (24LC32)

Graphics:

- 1 × Digital Display Interface (DDI) (DP 1.2a, DVI, HDMI 1.4b)
- 1 × Embedded Digital Display Interface (eDDI) or single LVDS interface (eDP 1.3 or single LVDS)
- 1 × Gigabit Ethernet (Intel® i210), external IEEE1588 sync optional through TQ-flexiCFG
- 2 × USB 3.0 (with USB 2.0 backward compatibility)
- 8 × USB 2.0 (incl. USB 3.0 ports)

Peripheral interfaces:

- 2 × SATA 3.0 (up to 6 Gb/s), eSATA capable
- 4 × PCIe 2.0 (up to 5 Gb/s) (4th lane optional, if no Ethernet)
- 1 × LPC bus
- 1 × Intel® HD audio (HDA)
- 1 × I²C, (2nd I²C optional) (master/slave capable)
- 1 × SMBus
- 1 × SPI (for external uEFI BIOS flash)
- 2 × Serial port (Rx/Tx, legacy compatible), 4 wire optional through TQ-flexiCFG
- 1 × SD card interface / optional 8 × GPIO through TQ-flexiCFG (multiplexed)

Security components:

- TPM (SLB9660 TPM 1.2, alternatively SLB9665 TPM 2.0)

Others:

- TQMx86 board controller with Watchdog and TQ-flexiCFG
- Hardware monitor

Power supply:

- Voltage: 4.75 V - 20 V
  5 V Standby (optional)
  3 V Battery for RTC

Environment:

- Standard Temperature: 0 °C to +60 °C
- Extended temperature: −40 °C to +85 °C

Form factor / dimensions:

- COM Express™ Mini, Type10; 84 mm × 55 mm

2.3   TQMxE39M Variants

The TQMxE39M is available in several standard configurations:

Table 2:   TQMxE39M Standard Configurations

TQMxE39M	CPU	CPU clock / GHz	Cache / Mbyte	TDP / W	SDRAM / Gbyte	eMMC / Gbyte	Display interface	Temp. range	SD card or GPIO
TQMxE39M-AA	Intel® Atom™ x7-E3950	4× 1.6 / 2.0	2	12	4	32	eDP	–40 °C to +85 °C	SD card
TQMxE39M-AB	Intel® Atom™ x5-E3940	4× 1.6 / 1.8	2	9.5	4	16	LVDS	–40 °C to +85 °C	SD card
TQMxE39M-AC	Intel® Atom™ x5-E3930	2× 1.3 / 1.8	2	6.5	2	–	eDP	0 °C to +60 °C	SD card
TQMxE39M-AD	Intel® Celeron® N3350	2× 1.1 / 2.4	2	6	2	–	eDP	0 °C to +60 °C	SD card
TQMxE39M-AE	Intel® Pentium® N4200	4× 1.1 / 2.5	2	6	4	–	LVDS	0 °C to +60 °C	SD card
TQMxE39M-AF	Intel® Atom™ x5-E3930	2× 1.3 / 1.8	2	6.5	4	64	LVDS	–40 °C to +85 °C	SD card
TQMxE39M-AG	Intel® Atom™ x5-E3930	2× 1.3 / 1.8	2	6.5	2	–	LVDS	–40 °C to +85 °C	SD card
TQMxE39M-AH	Intel® Atom™ x7-E3950	4× 1.6 / 2.0	2	12	8	32	eDP	–40 °C to +85 °C	SD card
TQMxE39M-AI	Intel® Atom™ x5-E3930	2× 1.3 / 1.8	2	6.5	2	–	LVDS	–40 °C to +85 °C	GPIO
TQMxE39M-AJ	Intel® Atom™ x5-E3940	4× 1.6 / 1.8	2	9.5	4	16	LVDS	–40 °C to +85 °C	GPIO

Standard configuration features are:
- CPU version
- SDRAM
- eMMC
- eDP or single channel LVDS
- Temperature range
- SD card or GPIO

Optional hardware and software configuration features (on request, MOQ):
- TPM
- Conformal coating
- Custom specific GPIO configuration through TQ-flexiCFG
- Custom specific BIOS

2.4   Accessories

TQMxE39M-HSP-E, TQMxE39M-HSP-N: Heat spreader for TQMxE39M according to the COM Express™ specification
TQMxE39M-HSP-E-LP, TQMxE39M-HSP-N-LP: Heat spreader for TQMxE39M, low profile for designs with very low heights

Evaluation platform MB-COME10-1:
- Mainboard for COM Express™, Type10 modules
- 170 mm × 170 mm
- Interfaces: DP, eDP/LVDS or second DP, 2 × GbE, 4 × USB, 3 × COM, audio, mini PCIe, mSATA, 2.5" SSD, SD card, Riser extension with PCIe and USB, fan, debug

3.   FUNCTION

3.1   TQMxE39M Block diagram

The following illustration shows the block diagram of the TQMxE39M.
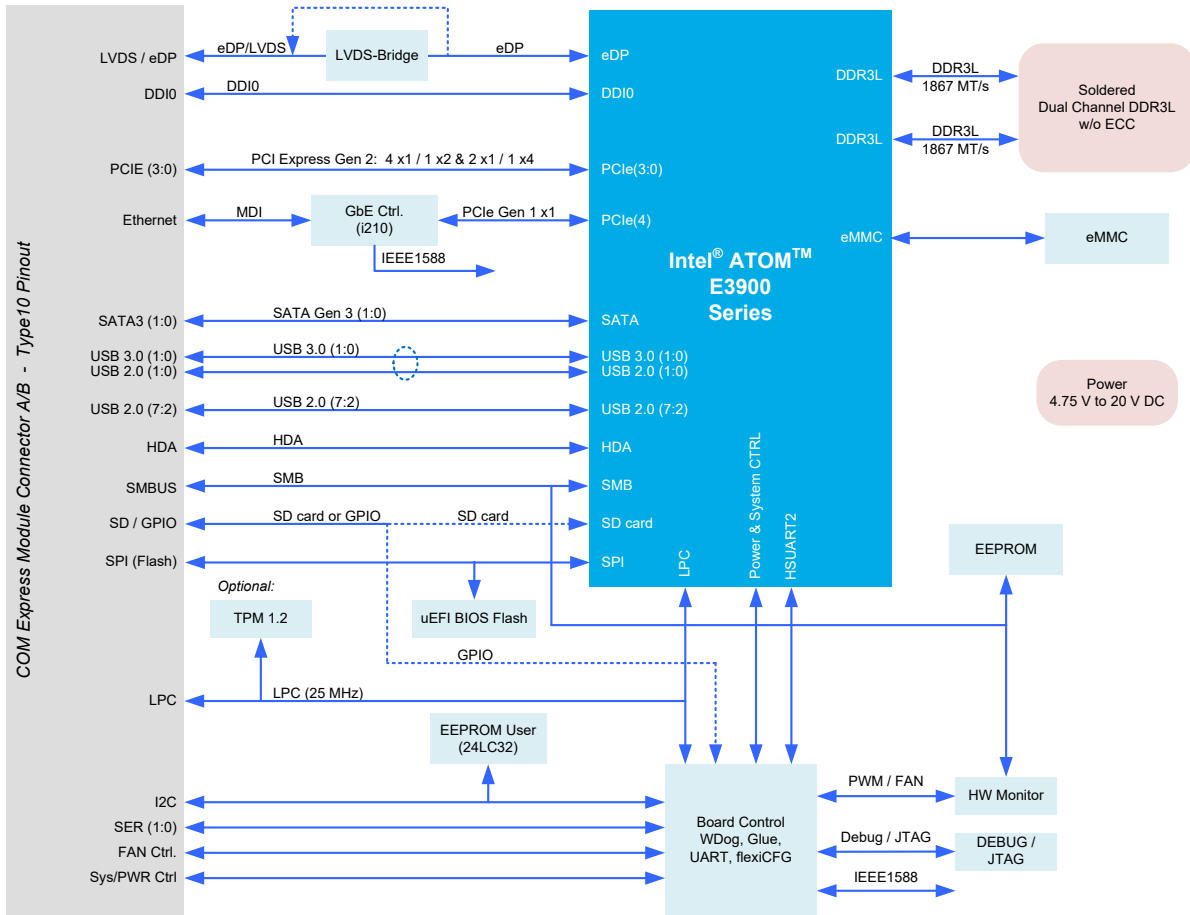
Illustration 1:   Block Diagram TQMxE39M

3.2   Electrical Characteristics

3.2.1   Supply voltage

The TQMxE39M supports a wide-range voltage input from 4.75 V to 20.0 V DC.

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

- Wide input: 4.75 V to 20.0 V   max. input ripple: ±100 mV
- VCC_5V_SBY: 4.75 V to 5.25 V   max. input ripple: ±50 mV
- VCC_RTC: 2.0 V to 3.3 V   max. input ripple: ±20 mV

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

There must be a smooth and continuous ramp of each DC output voltage from 10 % to 90 % of its final set point within the regulation band.

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 values given below show the voltage and power consumption of the TQMxE39M.

The values were measured using the TQMxE39M and the MB-COME10-1COM Express™ carrier board.

The measurement was done with two power supplies, one for the TQMxE39M and the other one for the MB-COME10-1COM Express™ carrier board.

The power consumption of each TQMxE39M was measured running Windows® 10, 64 bit and a dual channel DDR3L configuration (2 × 2 Gbyte). All measurements were done at a temperature of +25 °C and an input voltage of +5.0 V.

The power consumption of the TQMxE39M depends on the application, the mode of operation and the operating system.

The power consumption was measured under the following conditions:

- **5 V Standby, Green ECO-Off state:**
  The system is in Green ECO-Off state, all DC/DC power supplies on the TQMxE39M are off.

- **5 V Standby, Suspend mode:**
  The system is in S5/S4 state, Ethernet port is disconnected.

- **Wide input 12 V, Windows 10, 64 bit, idle:**
  Desktop idles, Ethernet port is disconnected.

- **Wide input 12 V, Windows 10, 64 bit, maximum load:**
  These values show the maximum worst case power consumption, achieved by using the Intel® stress test tool to apply maximum load to the cores only, and cores plus graphics engine, Ethernet port is connected (1000 Mbps Speed)

The following table shows the power consumption with different CPU configurations.

Table 3: TQMxE39M Power Consumption

CPU on TQMxE39M Size of SDRAM	Mode			
	Standby 5 V		Wide input 12 V	
	Green ECO-Off	Suspend (OS shut down)	Win10, 64 bit idle	Win10, 64 bit max. load
Intel® Atom™ x7-E3950 4 Gbyte DDR3L	4.9 mW	0.22 W	1.9 W	17.9 W
Intel® Atom™ x5-E3940 4 Gbyte DDR3L	4.9 mW	0.22 W	1.9 W	12.9 W
Intel® Atom™ x5-E3930 2 Gbyte DDR3L	4.9 mW	0.22 W	1.9 W	9.9 W
Intel® Pentium® N4200 4 Gbyte DDR3L	4.9 mW	0.22 W	1.9 W	5.8 W
Intel® Celeron® N3350 2 Gbyte DDR3L	4.9 mW	0.22 W	1.9 W	3.5 W

Note: Power requirement	
⚠️	The power supplies on the carrier board for the TQMxE39M must be designed with enough reserve. The carrier board should provide at least twice the maximum workload power of the TQMxE39M. The TQMxE39M supports several low-power states. The power supply of the carrier board has to 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 under battery operating conditions.

Table 4:   RTC Power Consumption

Integrated RTC	Voltage	Current
Intel® Atom™ E3900, Intel® Pentium® N4200, Intel® Celeron® N3350	3.0 V	3 μA

The current consumption of the RTC in the Intel® Atom™ E3900, Intel® Pentium® N4200, and Intel® Celeron® N3350 is specified in the Product Family Datasheet with 6 μA in average, but the values measured on several modules were lower.

3.3 Environmental conditions

- Operating Temperature Standard: 0 °C to +60 °C
- Operating Temperature Extended: −40 °C to +85 °C
- Storage Temperature: −40 °C to +85 °C
- Relative humidity (operating / storage):   10 % to 90 % (non-condensing)

Attention: Maximum operating temperature	
⚠	Do not operate the TQMxE39M without heat spreader or without heat sink! The heat spreader is not a sufficient heat sink!

3.4 System components

3.4.1 CPUs

The TQMxE39M supports the Intel® Atom™ E3900, Intel® Pentium® N4200, and Intel® Celeron® N3350 CPUs.

The following list shows some key features of these CPUs:

- Quad and dual CPU cores
- Intel® 64 Architecture
- Intel® Virtualization Technology (VT-x)
- Intel® Streaming SIMD Extensions 4.2 (Intel® SSE4.2)
- Intel® Enhanced Intel® SpeedStep® technology
- Intel® HD Graphics
- 2 Mbyte Cache
- Triple independent displays (on TQMxE39M only dual)

Table 5: Intel® Atom™ E3900, Intel® Pentium® N4200, and Intel® Celeron® N3350

Mode	N3350	N4200	x5-E3930	x5-E3940	x7-E3950
CPU Cores	2	4	2	4	4
Cache	2 Mbyte	2 Mbyte	2 Mbyte	2 Mbyte	2 Mbyte
CPU frequency HFM / Turbo	1.1 / 2.4 GHz	1.1 / 2.5 GHz	1.3 / 1.8 GHz	1.6 / 1.8 GHz	1.6 / 2.0 GHz
Temperature $T_{junction}$	0 ℃ to +105 ℃	0 ℃ to +105 ℃	−40 ℃ to +110 ℃	−40 ℃ to +110 ℃	−40 ℃ to +110 ℃
Memory Speed	1866 MT/s	1866 MT/s	1866 MT/s	1866 MT/s	1866 MT/s
Maximum size of memory	8 Gbyte	8 Gbyte	8 Gbyte	8 Gbyte	8 Gbyte
Memory configuration	Dual	Dual	Dual	Dual	Dual
Intel® HD Graphics Gen 9	500	505	500	500	505
GFX: No. of Execution Units	12	18	12	12	18
GFX: Base / Burst	200 / 650 MHz	200 / 750 MHz	400 / 550 MHz	400 / 600 MHz	500 / 650 MHz
Thermal Design Power (TDP)	6 W	6 W	6.5 W	9.5 W	12 W

3.4.2 Graphics

The Intel® Atom™ E3900, Intel® Pentium® N4200, and Intel® Celeron® N3350 CPUs includes an integrated Intel® HD (Gen 9) graphics accelerator. It provides excellent 2D/3D graphics performance with dual simultaneous display support.

The following list shows some key features of the Intel® Atom™ E3900, Intel® Pentium® N4200, and Intel® Celeron® N3350 CPUs:

- Graphics Technology (Gen 09 LP) with 12 Execution Units (HD Graphics 500) or 18 Execution Units (HD Graphics 505)
- Hardware accelerated video decoding/encoding for H.264, MPEG2, MVC, VC-1, WMV9, H.265/HEVC, VP9, JPEG/MJPAG
- Direct3D* 12, DirectX* 12 support
- OpenGL* 4.3, OpenCL* 1.2 support

The TQMxE39M supports one Digital Display Interface (DDI0) and one eDP or single LVDS interface at the COM Express™ connector.

Table 6: Maximum Resolution in dual Display Configuration

Display	Maximum Display Resolution
LVDS	1400 × 1050 at 60 Hz (single channel)
eDP	3840 × 2160 at 60 Hz
DP	4096 × 2160 at 60 Hz
HDMI	3840 × 2160 at 30 Hz

3.4.3   Memory

3.4.3.1   DDR3L SDRAM

The TQMxE39M supports a memory-down dual-channel DDR3L configuration running at up to 1866 MT/s.
The maximum memory size is 8 Gbyte. The available memory configuration can be either 2 Gbyte, 4 Gbyte, or 8 Gbyte.

3.4.3.2   eMMC

The TQMxE39M supports up to 64 Gbyte on-board eMMC 5.0 flash (compatible with rev. 5.0).

Attention: eMMC OS installation
⚠ The on-board eMMC Flash has to be pre-configured via EFI Shell before OS installation (e.g. diskpart utility)

3.4.3.3   SPI Boot Flash

The TQMxE39M provides a 128 Mbit SPI boot flash. It includes the Intel® Trusted Execution Engine and the uEFI BIOS.
An external SPI boot flash can be used instead of the on-board SPI boot flash.
The uEFI BIOS supports the following 3.3 V SPI flash devices on the carrier board:
Winbond W25Q128FV

3.4.3.4   EEPROM

The TQMxE39M supports a COM Express™ Module EEPROM. The 2 kbit (AT24C32C) EEPROM is connected to the general purpose I²C interface (COM Express™ pin names I2C_DAT and I2C_CK).

3.4.4   Real Time Clock

The TQMxE39M includes a standard RTC (Motorola MC146818B) integrated in the Intel® Atom™ E3900, Intel® Pentium® N4200, and Intel® Celeron® N3350 CPU.

3.4.5   Trusted Platform Module

The TQMxE39M has been designed to support the Trusted Platform Module (TPM) 1.2 (Infineon SLB9660).
The TPM 2.0 configuration is available on request.
Intel® Atom™ E3900, Intel® Pentium® N4200, and Intel® Celeron® N3350 CPU supports also a Firmware Trusted Platform Module (FTPM); this is a Trusted Platform Module 2.0 implementation in firmware. This feature can be configured in the BIOS.

3.4.6   Hardware Monitor

The TQMxE39M includes an integrated Hardware Monitor to monitor the on-board temperature, board voltages and manage the fan control of the COM Express™ interface (FAN_PWMOUT and FAN_TACHOIN).

3.4.7   TQ flexible I/O configuration (TQ-flexiCFG)

The TQ-Systems COM Express™ module includes a flexible I/O configuration feature, the TQ-flexiCFG.
Using the TQ-flexiCFG feature several COM Express™ I/O interfaces and functions can be configured via a programmable FPGA.
This feature enables the user to integrate special embedded features and configuration options in the TQMxE39M to reduce the carrier board design effort. Here are some examples of the flexible I/O configuration:

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

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

3.4.8   Ultra Deep Power State Green ECO-Off

The TQMxE39M supports the ultra-deep power state Green ECO-Off.
In this configuration all DC/DC power supplies on the TQMxE39M are switched off.
This results in lowest power consumption. The Green ECO-Off mode can be configured in the uEFI BIOS setup.
To wake up the system from the Green ECO-Off mode the power button signal must be pulled low for a minimum of 100 msec.

3.5   Interfaces

3.5.1   PCI Express

The TQMxE39M with Intel® Atom™ E3900, Intel® Pentium® N4200, and Intel® Celeron® N3350 CPU supports a very flexible
PCI Express configuration with up 4 PCI Express Gen 2 ports.
With a customized BIOS the PCI Express lanes can be configured as follows:

Table 7:   PCI Express configuration options

COM Express™ Port 0 – 3	On-board Ethernet i210	Configuration
4 × 1 ports (maximum 3 ports enabled)	enabled	Configuration in the BIOS
4 × 1 ports	disabled	Configuration in the BIOS
2 × 2 ports	enabled	Configuration via custom BIOS
1 × 4 port	enabled	Configuration via custom BIOS

3.5.2   Gigabit Ethernet

The TQMxE39M provides the Intel® i210IT Ethernet controller with 10/100/1000 Mbps speed and IEEE1588 support.
Due to the TQ-flexiCFG feature the Intel® i210IT Ethernet controller supports an external IEEE1588 synchronisation via GPIOs.

3.5.3   Serial ATA

The TQMxE39M supports two SATA Gen 3.0 6 Gb/s interfaces.
The integrated SATA host controller supports AHCI mode, the SATA controller no longer supports legacy IDE mode using
I/O space.

3.5.4   Digital Display Interface

The TQMxE39M supports two Digital Display Interfaces (DDI0 & DDI1) at the COM Express™ connector.
The DDI0 port supports DisplayPort or HDMI/DVI.
The DDI1 port supports LVDS (via an eDP to LVDS Bridge) or eDP as an assembly option.

The TQMxE39M supports the following maximum display resolutions:
* DisplayPort 1.2a up to 4096 × 2160 at 60 Hz
* Embedded DisplayPort 1.3 up to 3840 × 2160 at 60 Hz
* HDMI 1.4b up to 3840 × 2160 at 30 Hz
* DVI up to 3840 × 2160 at 30 Hz (HDMI without Audio)

Please contact support@tq-group.com for further information about the DDI0 / DDI1 configuration.

3.5.5   LVDS Interface

The TQMxE39M supports a single channel LVDS 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 LVDS signalling only with colour depths of 18 bits per pixel or 24 bits per pixel up to
112 MHz and a resolution up to 1400 × 1050 at 60 Hz in single LVDS mode.
The LVDS data 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.

3.5.6   USB 2.0 Interfaces

The TQMxE39M supports eight USB 2.0 ports at the COM Express™ connector.

3.5.7   USB 3.0 Interfaces

The TQMxE39M supports two USB 3.0 ports at the COM Express™ connector.

Note: USB Port Mapping	
	USB 2.0 port 0 must be paired with USB 3.0 SuperSpeed port 0. USB 2.0 port 1 must be paired with USB 3.0 SuperSpeed port 1.

3.5.8   SD Card Interface

The TQMxE39M provides an SD card interface for 4-bit SD/MMC cards at the COM Express™ connector.
The SD card signals are shared with the GPIO signals and can be configured via an assembly option.
The default configuration at the COM Express™ connector is with SD card signals.

3.5.9   General Purpose Input / Output

The TQMxE39M provides eight GPIO signals at the COM Express™ connector.
The GPIO signals are shared with the SD card signals and can be configured via an assembly option.
The default configuration at the COM Express™ connector is with SD card signals.
The GPIO signals are integrated in the TQ-flexiCFG block and can be flexible configured.
Therefore the signals can also be used for several special functionality, see 3.4.7.

3.5.10   High Definition Audio Interface

The TQMxE39M provides a High Definition Audio (HDA) interface, which supports an Audio codec at the
COM Express™ connector. The HDA_SDIN1 and HDA_SDIN2 signals are not routed to the COM Express™ connector.

3.5.11   LPC Bus

The TQMxE39M supports a Low Pin Count (LPC) legacy bus for I/O expansion. The LPC bus DMA is not supported.

3.5.12   I²C Bus

The TQMxE39M supports a general purpose I^2C port via a dedicated LPC to I^2C controller, integrated in the TQ-flexiCFG block.
The I^2C host controller supports a clock frequency of up to 400 kHz and can be configured independently.

3.5.13   SMBus

The TQMxE39M provides an SMBus.

3.5.14   Serial Peripheral Interface

The TQMxE39M provides an SPI interface. The SPI interface can only be used for SPI boot Flash devices.

3.5.15   Serial Ports

The TQMxE39M 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. These signals are only available in the eDP configuration option.

Table 8:   Serial Port COM Express™ Port Mapping

COM Express™ Signal	COM Express™ Pin	TQMxE39M	Remark
SER0_TX	A98	SER0_TX	3.3 V output
SER0_RX	A99	SER0_RX	3.3 V input
SER1_TX	A101	SER1_TX	3.3 V output
SER1_RX	A102	SER1_RX	3.3 V input
SER0_RTS#	B77	SER0_RTS#	3.3 V output
SER0_CTS#	B78	SER0_CTS#	3.3 V input
SER1_RTS#	A78	SER1_RTS#	3.3 V output
SER1_CTS#	A79	SER1_CTS#	3.3 V input

Note: Protection circuits	
⚠️	In Revision 2.1 of the COM Express™ specification, 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 connected to 12 V. The implementation of this circuitry causes lower transfer rates at both serial ports. On the TQMxE39M the protection circuit is removed by default and the serial ports provide transfer rates of up to 115 kbaud. Therefore the TQMxE39M can only be used in COM.0 Revision 2.1 Type10 pinout carrier boards.

3.5.16   Watchdog Timer

The TQMxE39M supports a freely 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 timeout of the Watchdog timer ranges from 125 msec to 1 h.

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

A 220-pin 0.5 mm pitch receptacle connector is used to interface the TQMxE39M to the carrier board.

On the carrier board a 220-pin 0.5 mm pitch plug connector has to be used.

There are two versions available with 5 mm and 8 mm stacking height.

3.6.2   Debug Header

The TQMxE39M includes a 14-pin flat cable connector, to connect an external debug module (TQ specific), to provide BIOS post code information, debug LEDs and a JTAG interface for on-board FPGA.

This header is intended for TQ internal use only.

Please contact support@tq-group.com for more details about the external debug module.

3.6.3   Debug Module LED

The TQMxE39M includes a dual colour LED providing boot and BIOS information.
The following table shows some LED boot messages.

Table 9:   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 finished

3.7   COM Express™ Connector Pinout List

This section describes the TQMxE39M COM Express™ connector pin assignment, which is compliant with COM.0 Revision 2.1 Type10 pinout definitions.

3.7.1   Signal Assignment Abbreviations

The following table lists the abbreviations used in Table 11.

Table 10:   Abbreviations used in Table 11

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
IO	Bi-directional

Note: Unused signals on the carrier board
If the input signals at the COM Express™ connector are not used, these signals can be left open on the carrier board, since these signals have a termination on the TQMxE39M.

3.7.2 COM Express™ Connector Pin Assignment

Table 11: 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 Mbit / sec link indicator	OD	
A5	GBE0_LINK1000#	Gigabit Ethernet Controller 0 1000 Mbit / sec 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 low-active output.	O PD	
A16	SATA0_TX+	SATA differential transmit pair 0	O	
A17	SATA0_TX−	SATA differential transmit pair 0	O	
A18	SUS_S4#	Indicates system is in Suspend to Disk state low-active output.	O PD	
A19	SATA0_RX+	SATA differential receive pair 0	I	
A20	SATA0_RX−	SATA differential receive pair 0	I	
A21	GND (FIXED)	Ground	GND	
A22	USB_SSRX0−	SuperSpeed USB3.0 differential receive pair 0	I	
A23	USB_SSRX0+	SuperSpeed USB3.0 differential receive pair 0	I	
A24	SUS_S5#	Indicates system is in Soft Off state low-active output.	O PD	
A25	USB_SSRX1−	SuperSpeed USB3.0 differential receive pair 1	I	
A26	USB_SSRX1+	SuperSpeed USB3.0 differential receive pair 1	I	
A27	BATLOW#	Indicates that external battery is low.	I PU	
A28	(S)ATA_ACT#	SATA activity indicator	O	
A29	AC / HDA_SYNC	Sample-synchronization signal to the CODEC(s)	O	
A30	AC / HDA_RST#	Reset output to CODEC, Active-low	O	
A31	GND (FIXED)	Ground	GND	
A32	AC / HDA_BITCLK	Serial data clock generated by the external CODEC(s)	IO	
A33	AC / HDA_SDOUT	Serial TDM data output to the CODEC	O	
A34	BIOS_DIS0#	Selection straps to determine the BIOS boot device	I PU	
A35	THRMTRIP#	Indicates that the CPU has entered thermal shutdown.	O	
A36	USB6−	USB differential pair 6	IO	
A37	USB6+	USB differential pair 6	IO	
A38	USB_6_7_OC#	USB over-current sense, USB channels 6 and 7	I PU	
A39	USB4−	USB differential pair 4	IO	
A40	USB4+	USB differential pair 4	IO	
A41	GND (FIXED)	Ground	GND	
A42	USB2−	USB differential pair 2	IO	
A43	USB2+	USB differential pair 2	IO	
A44	USB_2_3_OC#	USB over-current sense, USB channels 2 and 3	I PU	
A45	USB0−	USB differential pair 0	IO	
A46	USB0+	USB differential pair 0	IO	
A47	VCC_RTC	Real-time clock circuit-power input. Nominally +3.0 V	Power	
A48	EXCD0_PERST#	PCI ExpressCard: reset, Active-low, one per card	O	TQ-flexiCFG
A49	EXCD0_CPPE#	PCI ExpressCard: PCI Express capable card request, Active-low	I PU	TQ-flexiCFG
A50	LPC_SERIRQ	LPC serial interrupt	IO	
A51	GND (FIXED)	Ground	GND	
A52	RSVD	Reserved		
A53	RSVD	Reserved		
A54	GPI0 / SD_DATA0	SDIO Data lines / GPI	I	TQ-flexiCFG
A55	RSVD	Reserved		

3.7.2   COM Express™ Connector Pin Assignment (continued)

Table 11:   COM Express™ Connector Pin Assignment (continued)

Pin	Pin-Signal	Description	Type	Remark
A56	RSVD	Reserved		
A57	GND	Ground	GND	
A58	PCIE_TX3+	PCI Express differential transmit pair 3	O	
A59	PCIE_TX3−	PCI Express differential transmit pair 3	O	
A60	GND (FIXED)	Ground	GND	
A61	PCIE_TX2+	PCI Express differential transmit pair 2	O	
A62	PCIE_TX2−	PCI Express differential transmit pair 2	O	
A63	GPI1 / SD_DATA1	SDIO Data lines / GPI1	I	TQ-flexiCFG
A64	PCIE_TX1+	PCI Express differential transmit pair 1	O	
A65	PCIE_TX1−	PCI Express differential transmit pair 1	O	
A66	GND	Ground	GND	
A67	GPI2 / SD_DATA2	SDIO Data lines / GPI2	I	TQ-flexiCFG
A68	PCIE_TX0+	PCI Express differential transmit pair 0	O	
A69	PCIE_TX0−	PCI Express differential transmit pair 0	O	
A70	GND (FIXED)	Ground	GND	
A71	LVDS_A0+ / eDP_TX2+	LVDS A or eDP / DP differential pair 2	O	eDP or LVDS
A72	LVDS_A0− / eDP_TX2−	LVDS A or eDP / DP differential pair 2	O	eDP or LVDS
A73	LVDS_A1+ / eDP_TX1+	LVDS A or eDP / DP differential pair 1	O	eDP or LVDS
A74	LVDS_A1− / eDP_TX1−	LVDS A or eDP / DP differential pair 1	O	eDP or LVDS
A75	LVDS_A2+ / eDP_TX0+	LVDS A or eDP / DP differential pair 0	O	eDP or LVDS
A76	LVDS_A2− / eDP_TX0−	LVDS A or eDP / DP differential pair 0	O	eDP or LVDS
A77	LVDS_VDD_EN	LVDS or eDP panel power enable	O	
A78	LVDS_A3+	LVDS A	O	eDP or LVDS
A79	LVDS_A3−	LVDS A	O	eDP or LVDS
A80	GND (FIXED)	Ground	GND	
A81	LVDS_A_CK+ / eDP_TX3+	LVDS A or eDP / DP differential pair 3	O	eDP or LVDS
A82	LVDS_A_CK− / eDP_TX3−	LVDS A or eDP / DP differential pair 3	O	eDP or LVDS
A83	LVDS_I2C_CK / eDP_AUX+	LVDS A I2C_CK or eDP AUX+ signal	IO	eDP or LVDS
A84	LVDS_I2C_DAT / eDP_AUX−	LVDS A I2C_DAT or eDP AUX− signal	IO	eDP or LVDS
A85	GPI3 / SD_DATA3	SDIO Data lines / GPI3	I	TQ-flexiCFG
A86	RSVD13	Reserved	I PD	TQ-flexiCFG
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	PWR	
A92	SPI_MISO	Data in to TQMxE39M from Carrier Board SPI	I	
A93	GPO0 / SD_CLK	SDIO Clock / GPO0	O	TQ-flexiCFG
A94	SPI_CLK	Clock from TQMxE39M to Carrier Board SPI	O	
A95	SPI_MOSI	Data out from TQMxE39M to Carrier Board SPI	O	
A96	TPM_PP	Trusted Platform Module (TPM) Physical Presence pin	I PD	TQ-flexiCFG
A97	TYPE10#	Type10 Module indication (47 kΩ to GND)	O PD	
A98	SER0_TX	Serial port 0 transmitter	O 3V3	without protection
A99	SER0_RX	Serial port 0 receiver	I 3V3	without protection
A100	GND (FIXED)	Ground	GND	
A101	SER1_TX	Serial port 1 transmitter	O 3V3	without protection
A102	SER1_RX	Serial port 1 receiver	I 3V3	without protection
A103	LID#	LID switch	I PU	
A104	VCC_12V	Primary wide power input 4.75 V – 20 V	PWR	
A105	VCC_12V	Primary wide power input 4.75 V – 20 V	PWR	
A106	VCC_12V	Primary wide power input 4.75 V – 20 V	PWR	
A107	VCC_12V	Primary wide power input 4.75 V – 20 V	PWR	
A108	VCC_12V	Primary wide power input 4.75 V – 20 V	PWR	
A109	VCC_12V	Primary wide power input 4.75 V – 20 V	PWR	
A110	GND (FIXED)	Ground	GND	

3.7.2   COM Express™ Connector Pin Assignment (continued)

Table 11:   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#	LPC frame indicates the start of an LPC cycle.	IO	
B4	LPC_AD0	LPC multiplexed address, command and data bus	IO	
B5	LPC_AD1	LPC multiplexed address, command and data bus	IO	
B6	LPC_AD2	LPC multiplexed address, command and data bus	IO	
B7	LPC_AD3	LPC multiplexed address, command and data bus	IO	
B8	(LPC_DRQ0#) GPIO	LPC serial DMA request	IO	N/A TQ-flexiCFG
B9	(LPC_DRQ1#) GPIO	LPC serial DMA request	IO	N/A TQ-flexiCFG
B10	LPC_CLK	LPC clock output	O	
B11	GND (FIXED)	Ground	GND	
B12	PWRBTN#	Power button input	I PU	
B13	SMB_CK	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 pair 1	O	
B17	SATA1_TX−	SATA differential transmit pair 1	O	
B18	SUS_STAT#	Indicates imminent suspend operation.	O	
B19	SATA1_RX+	SATA differential receive pair 1	I	
B20	SATA1_RX−	SATA differential receive pair 1	I	
B21	GND (FIXED)	Ground	GND	
B22	USB_SSTX0−	SuperSpeed USB3.0 differential transmit pair 0	O	
B23	USB_SSTX0+	SuperSpeed USB3.0 differential transmit pair 0	O	
B24	PWR_OK	Power OK from main power supply	I PU	
B25	USB_SSTX1−	SuperSpeed USB3.0 differential transmit pair 1	O	
B26	USB_SSTX1+	SuperSpeed USB3.0 differential transmit pair 1	O	
B27	WDT	Watchdog time-out	O	TQ-flexiCFG
B28	AC / HDA_SDIN2	Serial TDM data input	I	N/A
B29	AC / HDA_SDIN1	Serial TDM data input	I	N/A
B30	AC / HDA_SDIN0	Serial TDM data input	I PU	
B31	GND (FIXED)	Ground	GND	
B32	SPKR	PC Audio Speaker output	O	
B33	I2C_CK	General purpose I²C port clock output	IO	
B34	I2C_DAT	General purpose I²C port data I / O line	IO	
B35	THRM#	Input from Carrier Board temperature sensor	I PU	
B36	USB7−	USB differential pair 7	IO	
B37	USB7+	USB differential pair 7	IO	
B38	USB_4_5_OC#	USB over-current sense, USB channels 4 and 5	I PU	
B39	USB5−	USB differential pair 5	IO	
B40	USB5+	USB differential pair 5	IO	
B41	GND (FIXED)	Ground	GND	
B42	USB3−	USB differential pair 3	IO	
B43	USB3+	USB differential pair 3	IO	
B44	USB_0_1_OC#	USB over-current sense, USB channels 0 and 1	I PU	
B45	USB1−	USB differential pair 1	IO	
B46	USB1+	USB differential pair 1	IO	
B47	EXCD1_PERST#	PCI ExpressCard: reset, Active-low, one per card	O	TQ-flexiCFG
B48	EXCD1_CPPE#	PCI ExpressCard: PCI Express capable card request, Active-low	I PU	TQ-flexiCFG
B49	SYS_RESET#	Reset button input	I PU	
B50	CB_RESET#	Reset output from TQMxE39M to carrier board	O	
B51	GND (FIXED)	Ground	GND	
B52	RSVD	Reserved		
B53	RSVD	Reserved		
B54	GPO1 / SD_CMD	SDIO Command / GPO1	O	TQ-flexiCFG
B55	RSVD	Reserved		

3.7.2   COM Express™ Connector Pin Assignment (continued)

Table 11:   COM Express™ Connector Pin Assignment (continued)

Pin	Pin-Signal	Description	Type	Remark
B56	RSVD	Reserved		
B57	GPO2 / SD_WP	SDIO Write Protect / GPO2	O	TQ-flexiCFG
B58	PCIE_RX3+	PCI Express differential receive pair 3	I	
B59	PCIE_RX3−	PCI Express differential receive pair 3	I	
B60	GND (FIXED)	Ground	GND	
B61	PCIE_RX2+	PCI Express differential receive pair 2	I	
B62	PCIE_RX2−	PCI Express differential receive pair 2	I	
B63	GPO3 / SD_CD#	SDIO Card Detect / GPO3	O	TQ-flexiCFG
B64	PCIE_RX1+	PCI Express differential receive pair 1	I	
B65	PCIE_RX1−	PCI Express differential receive pair 1	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 pair 0	I	
B69	PCIE_RX0−	PCI Express differential receive pair 0	I	
B70	GND (FIXED)	Ground	GND	
B71	DDI0_PAIR0+	DDI0 DP / HDMI / DVI differential pair 0	O	
B72	DDI0_PAIR0−	DDI0 DP / HDMI / DVI differential pair 0	O	
B73	DDI0_PAIR1+	DDI0 DP / HDMI / DVI differential pair 1	O	
B74	DDI0_PAIR1−	DDI0 DP / HDMI / DVI differential pair 1	O	
B75	DDI0_PAIR2+	DDI0 DP / HDMI / DVI differential pair 2	O	
B76	DDI0_PAIR2−	DDI0 DP / HDMI / DVI differential pair 2	O	
B77	(DDI0_PAIR4+) SER0_RTS#	Serial port 0 Request To Send	O	TQ-flexiCFG
B78	(DDI0_PAIR4−) SER0_CTS#	Serial port 0 Clear To Send	I PU	TQ-flexiCFG
B79	LVDS_BKLT_EN	LVDS or eDP panel backlight enable	O	
B80	GND (FIXED)	Ground	GND	
B81	DDI0_PAIR3+	DDI0 DP / HDMI / DVI differential pair 3	O	
B82	DDI0_PAIR3−	DDI0 DP / HDMI / DVI differential pair 3	O	
B83	LVDS_BKLT_CTRL	LVDS or eDP panel backlight brightness control	O	
B84	VCC_5V_SBY	Standby power input: +5.0 V nominal	PWR	
B85	VCC_5V_SBY	Standby power input: +5.0 V nominal	PWR	
B86	VCC_5V_SBY	Standby power input: +5.0 V nominal	PWR	
B87	VCC_5V_SBY	Standby power input: +5.0 V nominal	PWR	
B88	BIOS_DIS1#	Selection straps to determine the BIOS boot device	I PU	
B89	DDI0_HPD	DDI0 Detection of Hot Plug	I PD	
B90	GND (FIXED)	Ground	GND	
B91	DDI0_PAIR5+	DDI0 differential pair 5	O	N/A
B92	DDI0_PAIR5−	DDI0 differential pair 5	O	N/A
B93	DDI0_PAIR6+	DDI0 differential pair 6	O	N/A
B94	DDI0_PAIR6−	DDI0 differential pair 6	O	N/A
B95	DDI0_DDC_AUX_SEL	Selects the function of DDI0_CTRLxAUX+ / − Signals	I PD	
B96	USB_HOST_PRSNT	TQMxE39M USB client may detect the presence of a USB host	I PD	TQ-flexiCFG
B97	SPI_CS#	Chip select for Carrier Board SPI	O	
B98	DDI0_CTRLCLK_AUX+	DDI0_CTRLCLK_AUX+ signal DP AUX, HDMI / DVI CLK	IO	
B99	DDI0_CTRLDATA_AUX−	DDI0_CTRLDATA_AUX− signal DP AUX, HDMI / DVI DATA	IO	
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 4.75 V – 20 V	PWR	
B105	VCC_12V	Primary wide power input 4.75 V – 20 V	PWR	
B106	VCC_12V	Primary wide power input 4.75 V – 20 V	PWR	
B107	VCC_12V	Primary wide power input 4.75 V – 20 V	PWR	
B108	VCC_12V	Primary wide power input 4.75 V – 20 V	PWR	
B109	VCC_12V	Primary wide power input 4.75 V – 20 V	PWR	
B110	GND (FIXED)	Ground	GND	

4. MECHANICS

4.1 TQMxE39M Dimensions

The dimensions of the TQMxE39M are 84×55 mm^2 (± 0.2 mm).
The following illustration shows the Three View Drawing of the TQMxE39M.
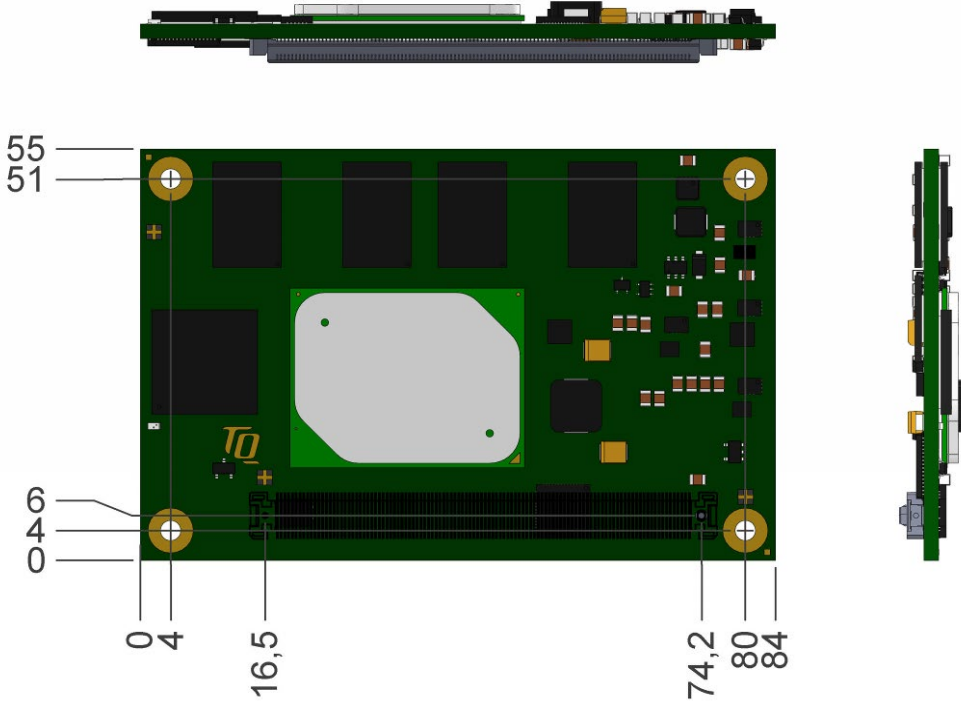

Illustration 2:   Three view drawing TQMxE39M

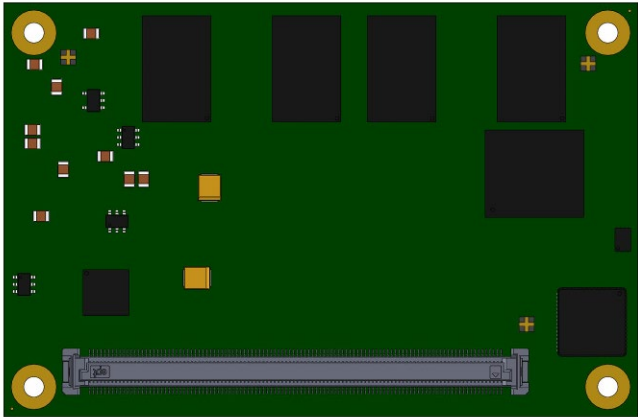The following illustration shows the bottom view of the TQMxE39M.

Illustration 3:   Bottom view drawing TQMxE39M

4.2   Heat spreader Dimensions

The TQMxE39M supports two different heat spreader versions with different heights.

Heat spreader for the Intel® Pentium® N4200, and Intel® Celeron® N3350 CPU
- Standard: TQMxE39M-HSP-N (TQMxE39M-HSP-N-11-M)
  The standard version is compliant to the COM Express™ specification with 13 mm (±0.2 mm) (including PCB).
- Low-Profile: TQMxE39M-HSP-N-LP (TQMxE39M-HSP-N-6-M)
  The low profile version is focused on low profile applications: Height reduced to 8 mm (±0.2 mm) (including PCB).

Heat spreader for the Intel® Atom™ E3900 CPU
- Standard: TQMxE39M-HSP-E (TQMxE39M-HSP-E-11-M)
  The standard version is compliant to the COM Express™ specification with 13 mm (±0.2 mm) (including PCB).
- Low-Profile: TQMxE39M-HSP-E-LP (TQMxE39M-HSP-E-6-M)
  The low profile version is focused on low profile applications: Height reduced to 8 mm (±0.2 mm) (including PCB).

The following illustration shows the standard heat spreader (TQMxE39M-HSP) for the TQMxE39M.
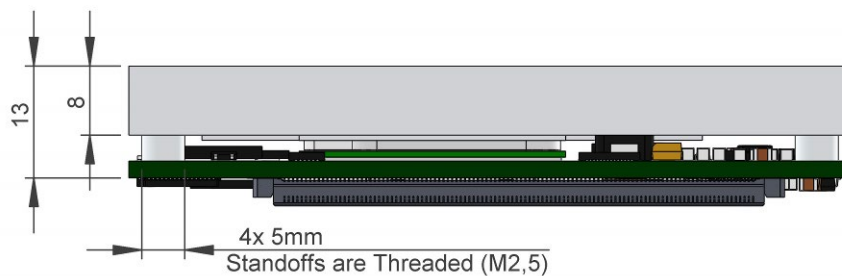
Illustration 4:   Standard Heat Spreader TQMxE39M-HSP

The following illustration shows the low profile heat spreader (TQMxE39M-HSP-LP) for the TQMxE39M.
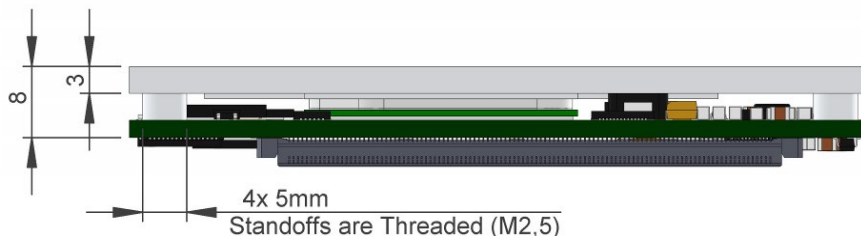
Illustration 5:   Low-Profile Heat Spreader TQMxE39M-HSP-LP

Attention: Heat Spreader	
⚠	The packages of the Intel® Pentium® N4200 and the Intel® Celeron® N3350 CPU have a different height than the package of the Intel® Atom™ E3900 CPU! The Intel® Atom™ E3900 CPU family includes an integrated heat spreader, the Intel® Pentium® N4200 and the Intel® Celeron® N3350 CPUs have no integrated heat spreaders. Both CPU packages require different heat spreader versions. It is not permitted to use the TQMxE39M-HSP-E heat spreader on the Intel® Pentium® N4200 or the Intel® Celeron® N3350 CPU. It is also not permitted to use the TQMxE39M-HSP-N heat spreader on the Intel® Atom™ E3900 CPU. To mount the wrong heat spreader will damage the TQMxE39M.

If a special cooling solution has to be implemented an extensive thermal design analysis and verification has to be performed. TQ-Systems GmbH offers thermal analysis and simulation as a service.
The White Paper "Heat Spreader Mounting Instruction" provides information how to mount the heat spreader.
Please contact support@tq-group.com for more details about 2D/3D Step models.

4.3   Mechanical and Thermal Considerations

The TQMxE39M is designed to operate in a wide range of thermal environments.

An important factor for each system integration is the thermal design. The heat spreader acts as a thermal coupling device to the TQMxE39M. The heat spreader is thermally coupled to the CPU: It provides optimal heat transfer from the TQMxE39M to the heat spreader. The heat spreader itself is not an appropriate heat sink.

System designers can use passive or active cooling, the thermal interface to the heat spreader is always the same.

Attention: Thermal Considerations
⚠️   Do not operate the TQMxE39M without heat spreader or without heat sink! The heat spreader is not a sufficient heat sink!

If a special cooling solution has to be implemented, an extensive thermal design analysis and verification has to be performed. TQ-Systems GmbH offers thermal analysis and simulation as a service.

Please contact support@tq-group.com for more information about the thermal configuration.

4.4   Protection against external effects

The TQMxE39M itself is not protected against dust, external impact and contact (IP00).

Adequate protection has to be guaranteed by the surrounding system and carrier board.

To support applications in harsh environment, conformal coating can be offered as custom specific add-on.

Please contact support@tq-group.com for further details.

5.   SOFTWARE

5.1   System Resources

5.1.1   I²C Bus

The TQMxE39M provides a general purpose I²C port via a dedicated LPC to I²C controller in the TQ-flexiCFG block.
The following table shows the I²C address mapping for the COM Express™ I²C port.

Table 12:   I²C Address Mapping COM Express™ I²C Port

8-bit Address	Function	Remark
0xA0	TQMxE39M EEPROM	–
0xAE	Carrier Board EEPROM	Embedded EEPROM configuration not supported

5.1.2   SMBus

The TQMxE39M provides a System Management Bus (SMBus).
The following table shows the I²C address mapping for the COM Express™ SMBus port.

Table 13:   I²C Address Mapping COM Express™ SMBus Port

8-bit Address	Function	Remark
0xA0, 0xA4	SPD EEPROM	Only accessed by the BIOS
0x30, 0x34	Thermal Sensor	–
0x58	Hardware Monitor	–

5.1.3   Memory Map

The TQMxE39M supports the standard PC system memory and I/O memory map.
Please contact support@tq-group.com for further information about the memory map.

5.1.4   IRQ Map

The TQMxE39M supports the standard PC Interrupt routing.
The integrated legacy devices (COM1, COM2) can be configured via the BIOS to IRQ3 and IRQ4.
Please contact support@tq-group.com for further information about the Interrupt configuration.

5.2   Operating Systems

5.2.1   Supported Operating Systems

The TQMxE39M supports various Operating Systems:
- Microsoft® Windows® 10
- Linux (i.e. Ubuntu 16.10 or later)

Other Operating Systems are supported on request.

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

5.2.2   Driver Download

The TQMxE39M is well supported by the Standard Operating Systems, which already include most of the required drivers.
The use of the latest Intel® drivers to optimize performance and the full feature set of the TQMxE39M is recommended.

Drivers for Graphics can be downloaded at this Intel® page:
https://downloadcenter.Intel®.com/download/26228/Intel®-Graphics-Driver-for-Windows-10-and-Windows-7-8-1-15-40-?v=t

Drivers for Chipset Components in the Device Manager can be downloaded at this Intel® page:
https://downloadcenter.Intel®.com/download/20775/Intel®-Chipset-Device-Software-INF-Update-Utility

The Intel® Driver Update Utility is a tool that analyses the system drivers on your computer. The utility reports if any new drivers are available, and provides the download files for the driver updates so you can install them quickly and easily.
https://downloadcenter.Intel®.com/download/24345/Intel®-Driver-Update-Utility

Drivers for the Intel® Gigabit Ethernet controller can be downloaded at this Intel® page:
https://downloadcenter.intel.com/download/18713/Intel-Network-Adapter-Driver-for-Windows-7-?v=t

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

Please contact support@tq-group.com 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 contact support@tq-group.com for further information about available software tools.

6.   BIOS

The TQMxE39M uses a 64 bit uEFI BIOS with a legacy Compatibility Support Module (CSM).

This additional functionality permits to load a traditional OS or a traditional OpROM.

To access the InsydeH2O BIOS Front Page, the button <ESC> has to be pressed after System Power-Up during POST phase.

If the button is successfully pressed, you will get to the BIOS front page, which shows the main menu items.

For Help Dialog please press <F1>.

```
                                      Front Page
 Front Page

 Continue                                      This selection will direct the system to
▶Boot Manager                                  continue to booting process
▶Device Manager
▶Boot From File
▶Administer Secure Boot
▶Setup Utility

















 F1  Help                          Enter Select ▶ SubMenu
 ↑/↓ Select Item
```
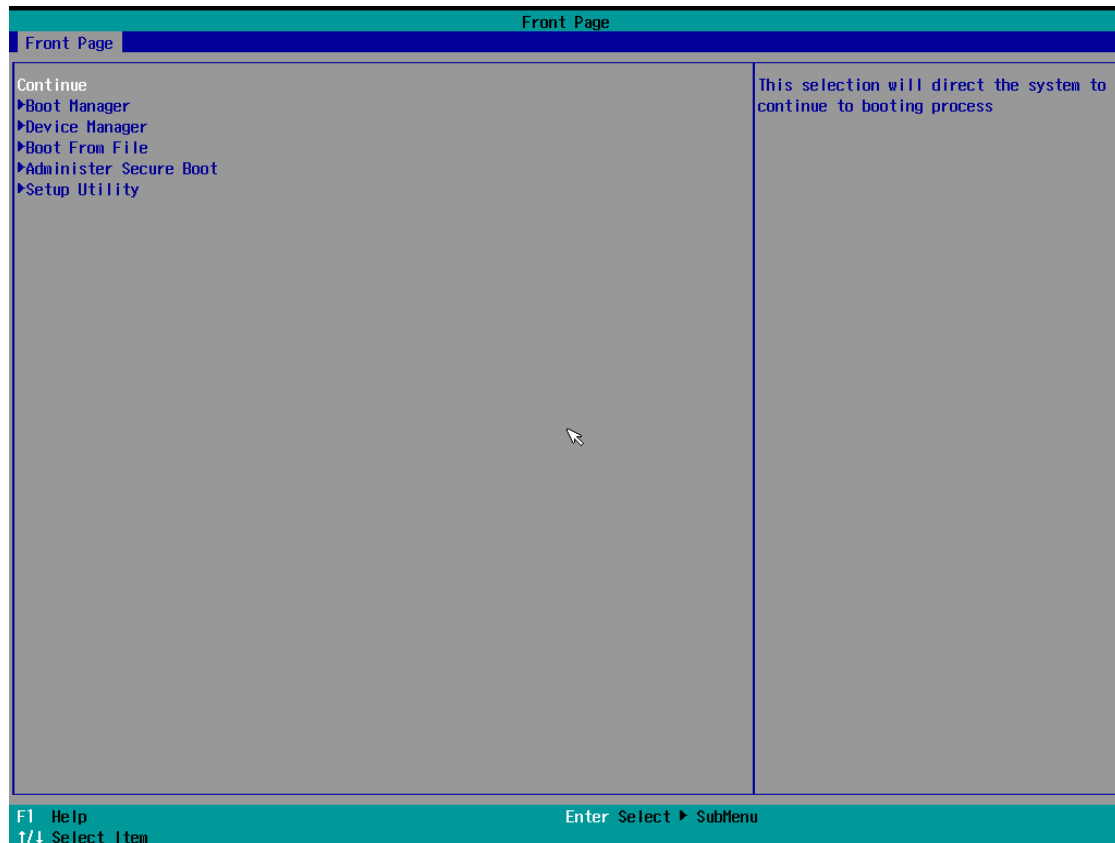
Illustration 6:   InsydeH2O BIOS Front Page

6.1   Continue Boot Process

Continue boot process the same way if <ESC> was not be pressed.

6.2   Boot Manager

Choose between possible Boot Options. If system is in UEFI Boot Mode one Boot Option will be "Internal EFI Shell".

You can go back to "Boot Manager" by entering command "exit" and press <ENTER>.

6.3 Device Manager

6.3.1 SioTqmx86

Menu Item	Option	Description
Power State S5	Normal / Low Power / Ultra Low Power	Configure Power State S5. Normal: Wakeup over LAN (WOL), timer, external Wake and Power Button possible. Ultra Low Power: Wakeup over Power Button possible.
Serial Port X	Enabled / Disabled / Auto	Disabled: No configuration Enabled: User Configuration Auto: EFI/OS chooses configuration
Base I/O Address	2E8 / 2F8 / 3E8 / 3F8	Configure Base I/O Address of corresponding Serial Port X.
Interrupt	IRQ3 / IRQ4 / IRQ5 / IRQ6 / IRQ7	Configure Interrupt of corresponding Serial Port X.
LVDS Configuration	Enabled / Disabled	Enable or Disable the configuration of eDP-to-LVDS bridge.
LVDS Colour depth and data packing format	VESA 24 bpp / JEIDA 24 bpp / VESA and JEIDA 18 bpp	Configure the LVDS Colour depth in eDP-to-LVDS bridge.
LVDS EDID information	EDID Emulation off – read from DDC EDID Emulation on – read from internal Flash	Configure if the EDID information should be read from DDC or internal flash of eDP-to-LVDS bridge.
LVDS Resolution	1024 × 768 @ 60 Hz NXP Generic / 800 × 480 @ 60 Hz NXP Generic / 480 × 272 @ 60 Hz NXP Generic / 1600 × 900 @ 60 Hz Samsung LTM200 KT / 1920 × 1080 @ 60 Hz Samsung LTM230 HT / 1366 × 768 @ 60 Hz NXP Generic / 320 × 240 @ 60 Hz NXP Generic	Configure the Resolution of eDP-to-LVDS bridge. Note: This option is only visible if 'LVDS EDID information' is set on 'EDID Emulation on – read from internal Flash.

6.4 Boot From File

Boot from a specific mass storage device where a boot file is stored.

6.5 Administer Secure Boot

Enable and configure Secure Boot mode. This option can be also used to integrate PK, KEK, DB and DBx.

Note: Secure Boot	
⚠	This option should only be used by advanced users.

6.6   Setup Utility

A basic setup of the board can be done by Insyde Software Corp. "Insyde Setup Utility" stored inside an on-board SPI flash.
To get access to InsydeH2O Setup Utility the button <ESC> has to be pressed after System Power Up during POST phase.
If the button successfully pressed can be seen by sentence "ESC is pressed. Go to boot options" shown below the boot logo.
On the splash screen that will appear, select "Setup Utility". The left frame of each menu page show the option, which can be configured whereas the right frame shows the corresponding help.

Key:

↑ / ↓	Navigate between setup items.
← / →	Navigate between setup screens (Main, Advanced, Security, Power, Boot and Exit).
<F1>	Show general help screen (Key Legend).
<F5> / <F6>	In the Main screens this buttons allow to change between different languages. Otherwise it allows to change the value of highlighted menu item.
<ENTER>	Press to display or change setup option listed for a certain menu or to display setup sub-screens.
<F9>	Press to load the setup default configuration of the board which cannot be changed by the user. This option has to be confirmed and saved by <F10> afterwards. Leaving the InsydeH2O Setup Utility will discard the changes.
<F10>	Press to save any changes made and exit setup utility by executing a restart.
<ESC>	Press to leave the current screen or sub-screen and discard all changes.

6.6.1   Main

The Main screen shows details regarding the BIOS version, processor type, bus speed, memory configuration and further information. There are three options which can be configured.

Menu Item	Option	Description
Language	English / Francis / Korean / Chinese	Configures the language of the InsydeH2O Setup Utility
System Time	HH:MM:SS	Use to change the system time to the 24-hour format
System Date	MM:DD:YYYY	Use to change the system date

6.6.2   Advanced

Use the right cursor to get from the main menu item to the advanced menu item.

Menu Item	Option	Description
Boot Configuration	See submenu	Configures settings for Boot Phase
Uncore Configuration	See submenu	Configure Graphical settings
South Cluster Configuration	See submenu	Configure parameter for Audio, PCI Express, SATA, SCC, USB and others
Security Configuration	See submenu	Configure TPM parameters
System Component	See submenu	Configure System Components parameters
Debug Configuration	See submenu	Configure Debug parameters
RTD3 settings	See submenu	Configure RTD3 parameters
Memory System Configuration	See submenu	Configure Memory parameters
ACPI Table/Features Control	See submenu	Configure ACPI parameters
SIO Hardware Monitor Nuvoton NCT7802Y	See submenu	Configure parameters of Super-IO chip NCT7802y
Console Redirection	See submenu	Configure parameters of Console Redirection
H2OUve Configuration	See submenu	Configure parameters of Insyde Tool H2OUve

6.6.2.1   Boot Configuration

Setup Utility ⇨ Advanced ⇨ Boot Configuration

Menu Item	Option	Description
OS Selection	Windows / Android / Linux	Choose the preferred Operating System
Numlock	On / Off	Allows to choose whether NumLock Key at system boot must be turned On or Off
Real Time Option	RT Disabled / RT Enabled. Agent IDI1 / RT Enabled. Agent Disabled	Select Real-Time Enable and IDI Agent Real-Time Traffic Mask Bits.

6.6.2.2   Uncore Configuration

Setup Utility ⇨ Advanced ⇨ Uncore Configuration

Menu Item	Option	Description
Logo & SCU Resolution	Auto / 640 x 480 / 800 x 600 / 1024 x 768	Select which solution should be used for Boot Logo and Setup Utility screen.
Rotate Screen	Disabled / 90 degrees clockwise / 270 degrees clockwise	Allows to rotate screen with 90 or 270 degrees clockwise.
VBT Hook Configuration	See submenu	Set VBT Hook Configuration parameters.
GOP Driver	Enabled / Disabled	Allows to disable or enable the driver for Graphical Output Protocol (GOP).
GOP Brightness Level	20 / 40 / 60 / 80 / 100 / 120 / 140 / 160 / 180 / 200 / 220 / 240 / 255	Select which GOP (Graphical Output Protocol) brightness level.
Integrated Graphics Device	Enabled / Disabled	Allows to enable or disable Integrated Graphics Device (IGD). If Primary Display is set on IGD enable this option.
Primary Display	Auto / IGD / PCIe	Select which of IGD or PCI Graphics device should be Primary Display.
RC6 (Render Standby)	Enabled / Disabled	Allows to enable or disable Intel's Render Standby technology where the standby voltage is adjusted very low. RC6 should be enabled when Max Package C-State is set on S0ix.
GTT Size	2 MB / 4 MB / 8 MB	Select the Size of the Graphical Translation Table (GTT).
Aperture Size	256 MB	Just 256MB is adjustable because of an Intel® Graphics driver issue (IPS case #00215535).
DVMT Pre-Allocated	64M / 96M / 128M / 160M / 192M / 224M / 256M / 288M / 320M / 352M / 384M / 416M / 448M / 480M / 512M	Select DVMT5.0 (Dynamic Video Memory Technology) Pre-Allocated (fixed) Graphics Memory size used by the Internal Graphic Device.
DVMT Total Gfx Mem	128M / 256M / MAX	Select the DVMT5.0 (Dynamic Video Memory Technology) Total Graphics Memory size used by the Internal Graphics Device.
Cd Clock Frequency	144 MHz / 288 MHz / 384 MHz / 576 MHz / 624 MHz	Select the highest Cd Clock frequency supported by the platform.
GT PM Support	Enabled / Disabled	Enable/Disable GT PM Support.
PAVP Enable	Enabled / Disabled	Enable/Disable PAVP.

6.6.2.2   Uncore Configuration (continued)

Setup Utility ⇨ Advanced ⇨ Uncore Configuration ⇨ VBT Hook Configuration

Menu Item	Option	Description
LFP 1 Configuration	eDP / No Device	Allows to enable the Local Flat Panel (LFP) as embedded Display Port (eDP)
EFP 1 Configuration	HDMI/DVI / DisplayPort with HDMI/DVI Compatible / No Device	Configure or disable the External Flat Panel (EFP).

6.6.2.3   South Cluster Configuration

Setup Utility ⇨ Advanced ⇨ South Cluster Configuration

Menu Item	Option	Description
HD-Audio Configuration	See submenu	Set HD-Audio Configuration parameters
PCI Express Configuration	See submenu	Set PCI Express Configuration parameters
SATA Drives	See submenu	Set SATA Drives parameters
SCC Configuration	See submenu	Set SCC (South Cluster Configuration) Configuration parameters
USB Configuration	See submenu	Set USB Configuration parameters
Miscellaneous Configuration	See submenu	Set Miscellaneous Configuration parameters

Setup Utility ⇨ Advanced ⇨ South Cluster Configuration ⇨ HD-Audio Configuration

Menu Item	Option	Description
HD-Audio Support	Enabled / Disabled	Allows to enable or disable HD-Audio Support
HD-Audio DSP	Enabled / Disabled	Allows to enable or disable HD-Audio DSP

Setup Utility ⇨ Advanced ⇨ South Cluster Configuration ⇨ PCI Express Configuration

Menu Item	Option	Description
PCI Express Root Port 1 (Local i210 Controller)	See submenu	Configure PCI Express Root Port parameters respectively.
PCI Express Root Port 3 (COME Port 0)	See submenu	
PCI Express Root Port 4 (COME Port 1)	See submenu	
PCI Express Root Port 5 (COME Port 2)	See submenu	
PCI Express Root Port 6 (COME Port 3)	See submenu	

6.6.2.3   South Cluster Configuration (continued)

Setup Utility ⇨ Advanced ⇨ South Cluster Configuration ⇨ PCI Express Configuration ⇨ PCI Express Root Port X

Note: All PCI Express Root Port Configuration submenus are identical. Thus, they just will be listed once

Menu Item	Option	Description
PCI Express Root Port X	Enabled / Disabled / Auto	Enable or disable single PCI Express Root Port X. Set them to Auto means to disable unused root port automatically for the most optimum power savings. PCI Express Root Port 1 is internally connected to Intel® Gigabit Ethernet Controller I210. Disabling this port will result in disabling Ethernet interface.
ASPM	Disabled / Los / L1 / LOsL1 / Auto	This manages PCI Express LOs power states, for Operating Systems able to handle Active State Power Management (ASPM).
PCIe Speed	Auto / Gen1 / Gen2	Select the PCIe Speed.
Extra Bus Reserved	0-7	Configure Extra Bus Reserved for bridges behind this Root Bridge. Numbers from 0 to 7 are configurable.
Reserved Memory	1-20 MB	Configure Reserved Memory and Prefetchable Memory Range for this Root Bridge. Range from 1 to 20MB are configurable.
Reserved I/O	4-20K	Configure Reserved I/O Range for this Root Bridge. Range from 4 to 20 are configurable.
PCIe Selectable De-emphasis	Enabled / Disabled	When the Link is operating at 5.0 GT/s speed, this bit selects the level of de-emphasis for an Upstream component. 1b = -3.5dB 0b = -6 dB

Setup Utility ⇨ Advanced ⇨ South Cluster Configuration ⇨ SATA Drives

Menu Item	Option	Description
SATA Mode Selection	AHCI	Determines how SATA controller operates. Just AHCI for standard SATA functionalities are selectable.
SATA Interface Speed	Gen1 / Gen2 / Gen3	Select SATA Interface Speed.
Aggressive LPM Support	Enabled / Disabled	Enable or disable PCH to aggressively enter Link power state.

Note: All SATA Port Configurations are identical and, thus, they just will be listed once.

Menu Item	Option	Description
SATA Port X	Enabled / Disabled	Enable or disable respective SATA Port X.
SATA Port X Hot Plug Capability	Enabled / Disabled	Enable or disable respective SATA Port X Hot Plug Capability.
Spin Up Device	Enabled / Disabled	Enable or disable SATA device as Spin Up Device. If enabled for any of ports Staggered Spin Up sill be performed and only the drives which have this option enabled will spin up at boot. Otherwise all drives spin up at boot.
SATA Device Type	Hard Disk Drive / Solid State Drive	Identify the SATA port is connected to Solid State Drive or Hard Disk Drive.
DITO Configuration	Enabled / Disabled	Enable or disable the possibility to configure DITO Value or DM Value.
DITO Value	0 - 1023	Set the Device Sleep Idle Timeout (DITO). This specifies the amount of the time (with approximately 1ms granularity) that the HBA shall wait before driving the Device Sleep (DEVSLP) signal. Only configurable if DITO configuration is enabled.
DM Value	0 - 15	0's based value that specifies the DITO multiplier that the HBA applies to the specified DITO value, effectively extending the range of DITO from 1ms to 16368ms. ($DITO\_actual = DITO*(DM+1)$). Only configurable if DITO configuration is enabled.

6.6.2.3 South Cluster Configuration (continued)

Setup Utility ⇨ Advanced ⇨ South Cluster Configuration ⇨ SCC Configuration

Menu Item	Option	Description
SCC SD Card Support (D27:F0)	Enabled / Disabled	Enable or disable the SCC SD Card Support.
SCC eMMC Support (D28:F0)	Enabled / Disabled	Enable or disable the SCC eMMC Support.
eMMC Max Speed	HS400 / HS200 / DDR50	Select the maximum Speed allowed of the eMMC.

Setup Utility ⇨ Advanced ⇨ South Cluster Configuration ⇨ USB Configuration

Menu Item	Option	Description
USB BIOS Support	Enabled / Disabled	Enable or disable the support of USB Keyboard / mouse / storage under UEFI and Legacy environment.
USB Per-Port Control	Enabled / Disabled	Allows to Enable or disable every single USB Port.
USB Port #X	Enabled / Disabled	Enable or disable USB Port #X. Only visible if USB Per-Port Control is enabled.
USB Host/Client Configuration	Host / Client	Configure logical USB Port 0 to Host or Client. Note: This is a static configuration and there is no automatic change between host and client.

Setup Utility ⇨ Advanced ⇨ South Cluster Configuration ⇨ Miscellaneous Configuration

Menu Item	Option	Description
High Precision Timer	Enabled / Disabled	Enable or disable the High Precision Event Timer.
State After G3	S0 State / S5 State / Last State	Specify which state to go to when power is reapplied after a power failure (G3 state). S0 State: System will boot directly as soon as power applied. S5 State: System keeps in power-off state until power button is pressed.
DCI enable (HDCIEN)	Enabled / Disabled	When DCI is Enabled, it is taken ass user consent to enable the DCI which allows debug over the USB3 interface. When Disabled, the host control is not enabling DCI feature.

6.6.2.4 Security Configuration

Setup Utility ⇨ Advanced ⇨ Security Configuration

Menu Item	Option	Description
Target TPM device	dTPM / fTPM	Select the TPM device as a discrete TPM (dTPM) or firmware TPM (fTPM).

6.6.2.5 System Component

Setup Utility ⇨ Advanced ⇨ System Component

Menu Item	Option	Description
OS Reset Select	Warm Reset / Cold Reset	Select the reset type In FACP table.

6.6.2.6   Debug Configuration

Setup Utility ⇨ Advanced ⇨ Debug Configuration

Menu Item	Option	Description
TXE Prepare For Update	Enabled / Disabled	Send Prepare For Update Command in next boot, please send this command before update IAFW BIOS or TXE data region: Note: NVMs data is unavailable in next boot.

6.6.2.7   RTD3 Settings

Setup Utility ⇨ Advanced ⇨ RTD3 settings

Menu Item	Option	Description
RTD3 Support	Enabled / Disabled	Enable or disable Runtime Device Power State D3 (RTD3) support.

6.6.2.8   Memory System Configuration

Setup Utility ⇨ Advanced ⇨ Memory System Configuration

Menu Item	Option	Description
Minimum Refresh Rate of 2x	Enabled / Disabled	Ensure that refresh rate never drops below 2x.

6.6.2.9   ACPI Table/Features Control

Setup Utility ⇨ Advanced ⇨ ACPI Table/Features Control

Menu Item	Option	Description
FACP – RTC S4 Wakeup	Enabled / Disabled	Enable or disable S4 Wakeup from RTC. Value only for ACPI.
APIC – IO APIC Mode	Enabled / Disabled	This item is valid only for Win2k and WinXP. Also, a fresh install of the OS must occur when APIC Mode is desired. Test the IO ACPI by setting item to Enable. The APIC Table will then be pointed to by the RSDT, the Local APIC will be initialized, and the proper enable bits will be set in ICH4M.
Smart Battery Support	Enabled / Disabled	Enable or disable Smart Battery Support. Note: Due to the SMBus driver i2c_i801 the SMBus is not working under Linux if Smart Battery is enabled. To get Smart Battery and the SMBus work simultaneously under Linux the i2c_i801 driver has to be adapted. Windows is not affected of this issue.

6.6.2.10   SIO Hardware Monitor Nuvoton NCT7802Y

Setup Utility ⇨ Advanced ⇨ SIO Hardware Monitor Nuvoton NCT7802Y

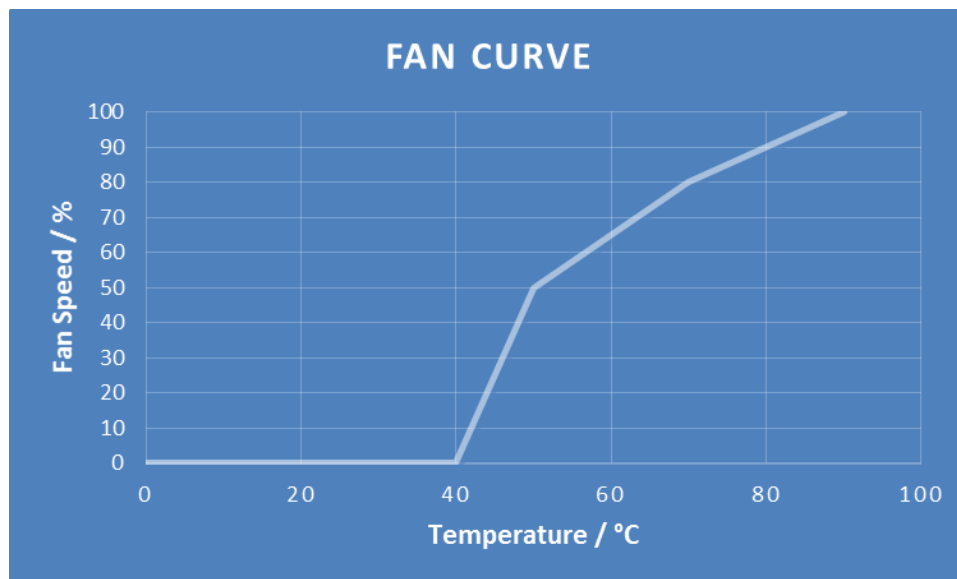| Menu Item	Option	Description
Hardware Monitor	See submenu	Set Hardware Monitor parameters.
Fan PWM Frequency	Low (32 Hz) / High (25 kHz)	Select PWM Frequency for the FAN.
Enable Fan Scaling	[ ] / [X]	Enabling Fan Scaling unhides a menu to define trip points to configure the Fan Speed / Temperature curve. The default is shown in the diagram below.

Illustration 7:   Fan Curve

6.6.2.11　Console Redirection

Setup Utility ⇨ Advanced ⇨ Console Redirection

Menu Item	Option	Description
Console Serial Redirect	Enabled / Disabled	Enable or disable the Console Redirection. This options unhide CR parameters when enabled.

If enabled:

Menu Item	Option	Description
Terminal Type	VT_100 / VT_100+ / VT_UTF8 / PC_ANSI	Select the Console Redirection terminal type.
Baud Rate	115200 / 57600 / 38400 / 19200 / 9600 / 4800 / 2400 / 1200	Select the Console Redirection Baud Rate.
Data Bits	7 Bits / 8 Bits	Select the Console Redirection Data Bits.
Parity	None / Even / Odd	Select the Console Redirection Parity Bits.
Stop Bits	1 Bit / 2 Bits	Select the Console Redirection Stop Bits.
Flow Control	None / RTS/CTS / XON/XOFF	Select the Console Redirection Flow Control type.
Information Wait Time	0 Second / 2 Second / 5 Second / 10 Second / 30 Second	Select the Console Redirection Port information display time.
C.R. After Post	Yes / No	Console Redirection continue works after POST time.
Text Mode Resolution	AUTO / Force 80x25 / Force 80x24 (DEL FIRST ROW) / Force 80x24 (DEL LAST ROW)	Console Redirection Text Mode Resolution. Auto: Follow VGA text mode Force 80x25: Don't care about VGA and force text mode to be 80x25 Force 80x24 (DEL FIRST ROW): Don't care about VGA and force text mode to be 80x24 and Del first row Force 80x24 (DEL LAST ROW): Don't care about VGA and force text mode to be 80x24 and Del last row
AutoRefresh	Enabled / Disabled	When feature enable, screen will be auto refresh once after detect remote terminal was connected.
COM_A	See submenu	Set parameters of serial Port COMA.
COM_B	See submenu	Set parameters of serial Port COMB.
HSUART-2	See submenu	Set parameters of High-Speed-UART-2.

Note: All COM / HSUART submenu are identical and, thus, they just will be listed once.

Menu Item	Option	Description
PortEnable	Enabled / Disabled	Enable or disable corresponding port.
UseGlobalSetting	Enabled / Disabled	If enabled use settings defined in superordinate CR menu. Disabling this option unhides corresponding settings.
Terminal Type	VT_100 / VT_100+ / VT_UTF8 / PC_ANSI	Select the Console Redirection terminal type.
Baud Rate	115200 / 57600 / 38400 / 19200 / 9600 / 4800 / 2400 / 1200	Select the Console Redirection Baud Rate.
Data Bits	7 Bits / 8 Bits	Select the Console Redirection Data Bits.
Parity	None / Even / Odd	Select the Console Redirection Parity Bits.
Stop Bits	1 Bit / 2 Bits	Select the Console Redirection Stop Bits.
Flow Control	None / RTS/CTS / XON/XOFF	Select the Console Redirection Flow Control type.

6.6.2.12   H2OUVE Configuration

Setup Utility ⇨ Advanced ⇨ H2OUVE Configuration

Menu Item	Option	Description
H2OUVE Support	Enabled / Disabled	Enable or disable support for Insyde Tool H2OUVE (UEFI Variable Editor). This tool is used to change i.e. default values of a BIOS image.

6.6.3   Security

Menu Item	Option	Description
TPM Availability	Available / Hidden	Unhide or hide TPM parameters. When Hidden, don't exposes TPM to 0.
TPM Operation	No Operation / Disable and Deactivate / Enable and Activate	Enable or disable the TPM Function. Note: This option will automatically return to No-operation in next boot.
Clear TPM	[X] / [ ]	Removes all TPM context associated with a specific owner.
Set Supervisor Password	123456	Install or change the BIOS password. The length of password must be greater than one and smaller or equal ten characters.

6.6.4   Power

Menu Item	Option	Description
CPU Configuration	See submenu	
Wake on PME	Disabled / Enabled by OS / Force Enabled	Determines the action taken when the system power is off and a PCI Power Management Enable (PME) wake up event occurs.

6.6.4.1 CPU Configuration

Setup Utility ⇨ Power ⇨ CPU Configuration

Menu Item	Option	Description
Bi-directional PROCHOT#	Enabled / Disabled	When a processor thermal sensor trips (either core), the PROCHOT# will be driven. If bi-direction is enabled, external agents can drive PROCHOT# to throttle the processor.
VTX-2	Enabled / Disabled	Enable or disable the VTX-2 mode support.
VT-d	Enabled / Disabled	Enable or disable VT-d capability. It is recommended to disable IPU when enabling this option. Note: IPU is already disabled and hided in this BIOS.
TM1	Enabled / Disabled	Enable or disable TM1.
DTS	Enabled / Disabled	Enable or disable Digital Thermal Sensor (DTS).
Active Processor Cores	Enabled / Disabled	Enable this option to disable core in each processor package.
Core 1	Enabled / Disabled	Enable or disable Core 1. This option is hided when Active Processor Cores is disabled.
Core 2	Enabled / Disabled	Enable or disable Core 2. This option is hided when Active Processor Cores is disabled.
Core 3	Enabled / Disabled	Enable or disable Core 3. This option is hided when Active Processor Cores is disabled.
Monitor Mwait	Enabled / Disabled / Auto	Enable or disable Monitor Mwait. If Auto is selected, Monitor Mwait will be disabled for Linux/Yocto OS with B1 silicon. For the rest Monitor Mwait will be enabled.
CPU Power Management	See submenu	

Setup Utility ⇨ Power ⇨ CPU Configuration ⇨ CPU Power Management

Menu Item	Option	Description
Intel® SpeedStep™	Enabled / Disabled	Allows more than two frequency ranges to be supported.
Boot performance mode	Max Performance / Max Battery	Select the performance state that the BIOS will set before OS handoff.
Intel® Turbo Boost Technology	Enabled / Disabled	Enable to automatically allow processor cores to run faster than the base operating frequency if it's operating below power, current and temperature specification limits. Hided if Intel® SpeedStep™ is disabled.
Power Limit 1 Enable	Enabled / Disabled	Enable or Disable Power Limit 1.
Power Limit 1 Clamp Mode	Enabled / Disabled	Enable or Disable Power Limit 1 Clamp Mode.
Power Limit 1 Power	Auto / 6 – 25	Power Limit 1 in Watts. Auto will program Power Limit 1 based on silicon default support value.
Power Limit 1 Time Window	Auto / 6 -128	Power Limit 1 Time Window Value in Seconds. Auto will program Power Limit 1 Time Window based on silicon default support value.
C-States	Enabled / Disabled	Enable or disable C-States. This option hide corresponding C-States options.
Enhanced C-states	Enabled / Disabled	Enable or disable C1E (Auto halt, low frequency, low voltage). When enabled, CPU will switch to minimum speed when all cores enter C-State. Hided if C-States is disabled.
Max Package C State	S0ix default / PC2 / C0	This option controls the Max Package C-State that the processor will support. Hided if C-States is disabled.
Max Core C State	Fused value / Core C10 / Core C9 / Core C8 / Core C7 / Core C6 / Core C1 / Unlimited	This option controls the Max Core C-State that cores will support. Hided if C-States is disabled.
C-State Auto Demotion	Disabled / C1	Configure C-State Auto Demotion. Hided if C-States is disabled.
C-State Un-demotion	Disabled / C1	Configure C-State Un-demotion. Hided if C-States is disabled.

6.6.5   Boot

Menu Item	Option	Description
Boot Type	Dual Boot Type / Legacy Boot Type / UEFI Boot Type	Select boot type to Dual type, Legacy type or UEFI type. Note: Operating systems installed in UEFI only will boot in UEFI or Dual boot type, not in Legacy. Also the other way around when an OS is installed in Legacy it will not boot in UEFI type.
Quick Boot	Enabled / Disabled	Allow InsydeH2O to skip certain tests while booting. This will decrease the time needed to boot the system.
Quite Boot	Enabled / Disabled	Enable or disable booting in Text mode. No textual outputs are given while booting if this option is disabled.
Network Stack	Enabled / Disabled	Enable or disable Network stack Support: Windows 8 BitLocker Unlock UEFI IPv4/IPv6 PXE Legacy PXE OPROM Note: This option will grey-out the PXE Boot capability option.
PXE Boot capability	Disabled / UEFI: IPv4 / UEFI: IPv6 / UEFI: IPv4/IPv6	Disabled: Support Network Stack UEFI PXE: IPv4/IPv6 Legacy: Legacy PXE OPROM only
Power up In Standby Support	Enabled / Disabled	Enable or disable the Power Up in Standby Support (PUIS). The PUIS feature allows devices to be powered-up into the Standby power management state to minimize inrush current at power-up and to allow the host to sequence the spin-up of devices.
Add Boot Options	First / Last / Auto	Position in Boot Order for Shell, Network and Removables.
ACPI Selection	Acpi1.0B / Acpi3.0 / Acpi4.0 / Acpi5.0 / Acpi6.0 / Acpi6.1	Select booting to which ACPI version.
USB Boot	Enabled / Disabled	Enable or disable booting to USB boot device.
UEFI OS Fast Boot	Enabled / Disabled	If enabled the system firmware does not initialize keyboard and check for firmware menu key. Note: If enabled it is not possible to change to BIOS menu by pressing <F10> when booting Windows.
USB Hot Key Support	Enabled / Disabled	Enable or disable to support USB hot key while booting. This will decrease the time needed to boot the system, however, it is not possible to get into BIOS menu by pressing <ESC> while booting. The change into BIOS has to be done over OS.
Timeout	0 – 10	The number of seconds that the firmware will wait before booting the original default boot selection.
Automatic Failover	Enabled / Disabled	Enable: If boot to default device fail, it will directly try to boot next device. Disable: If boot to default device fail, it will pop warning message then go into firmware UI.
EFI / Legacy	Submenu depends on bootable devices	Option to adapt boot order. Selection depends on boot devices connected. Note: Add Boot Options has to be configured as First or Last. The order can be changed by pressing <F5> or <F6>.

6.6.6   Exit

Menu Item	Option	Description
Exit Saving Changes		Save changes and reboot system afterwards. <F10> can be used for this operation.
Save Change Without Exit		Save changes without reboot system.
Exit Discarding Changes		Exit InsydeH2O Setup Utility without saving any changes. <ESC> can be used for this operation.
Load Optimal Defaults		Load optimal default values for all setup items. <F9> can be used for this operation.
Load Custom Defaults		Load custom default values for all setup items.
Save Custom Defaults		Save custom defaults for all setup items.
Discard Changes		Discard all changes without exiting InsydeH2O Setup Utility.

6.7   BIOS Update

The uEFI BIOS update instruction serves to guarantee a proper way to update the uEFI BIOS on the TQMxE39M.
Please read the entire instructions before beginning the BIOS update.
By disregarding the information you can destroy the uEFI BIOS on the TQMxE39M.
This document will guide the customer to update the uEFI BIOS on the TQMxE39M by using the Insyde Flash Firmware Tools.
Please contact support@tq-group.com for more information to the latest uEFI BIOS version for the TQMxE39M.

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.

6.7.1   Step 1: Preparing USB Stick

A USB stick with FAT32 format can be used. Copy the following files to the USB stick.
(See: https://www.tq-group.com/de/support/downloads/tq-embedded/software-treiber/x86-architektur/)
- H2OFFT-Sx64.efi (Flash Firmware Tool from Insyde for update via UEFI Shell)
- InsydeH2OFF_x86_WIN folder (Flash Firmware Tool from Insyde for update via Windows 32-bit system)
- InsydeH2OFF_x86_WINx64 folder (Flash Firmware Tool from Insyde for update via Windows 64-bit system)
- BIOS.bin file e.g. xx.bin

6.7.2   Step 2a: Updating uEFI BIOS via EFI Shell

Plug the USB stick into the board you want to update the uEFI BIOS, and turn on the board. The board will boot and go to the internal EFI shell. Note: If a boot device is plugged change to "Boot Manager" over Front Page and select "Internal EFI Shell".

```
EFI Shell version 2.50 [22320.4129]
Current running mode 1.1.2
Device mapping table
  fs0  :Removable HardDisk - Alias hd35b0b0b blk0
        PciRoot(0x0)/Pci(0x15,0x0)/USB(0x1,0x0)/USB(0x1,0x0)/HD(1,MBR,0x00000000,0x2000,0x1E1D800)
  blk0 :Removable HardDisk - Alias hd35b0b0b fs0
        PciRoot(0x0)/Pci(0x15,0x0)/USB(0x1,0x0)/USB(0x1,0x0)/HD(1,MBR,0x00000000,0x2000,0x1E1D800)
  blk1 :Removable BlockDevice - Alias (null)
        PciRoot(0x0)/Pci(0x15,0x0)/USB(0x1,0x0)/USB(0x1,0x0)

Press ESC in 5 seconds to skip startup.nsh, any other key to continue.
Shell>
```

Illustration 8:   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, enter into the BIOS folder (e.g. "`cd tqmxe39m`") to execute the Insyde BIOS update tool:

```
H2OFFT-Sx64.efi <BIOS file> -ALL -RA
```

If the argument "`-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 necessary.

```
EFI Shell version 2.50 [22320.4129]
Current running mode 1.1.2
Device mapping table
  fs0  :Removable HardDisk - Alias hd35b0b0b blk0
        PciRoot(0x0)/Pci(0x15,0x0)/USB(0x1,0x0)/USB(0x1,0x0)/HD(1,MBR,0x00000000,0x2000,0x1E1D800)
  blk0 :Removable HardDisk - Alias hd35b0b0b fs0
        PciRoot(0x0)/Pci(0x15,0x0)/USB(0x1,0x0)/USB(0x1,0x0)/HD(1,MBR,0x00000000,0x2000,0x1E1D800)
  blk1 :Removable BlockDevice - Alias (null)
        PciRoot(0x0)/Pci(0x15,0x0)/USB(0x1,0x0)/USB(0x1,0x0)

Press ESC in 5 seconds to skip startup.nsh, any other key to continue.
Shell> fs0:

fs0:\> H2OFFT-Sx64.efi TQMxE39M\TQMxE39M_5.12.30.21.18.bin -all
```

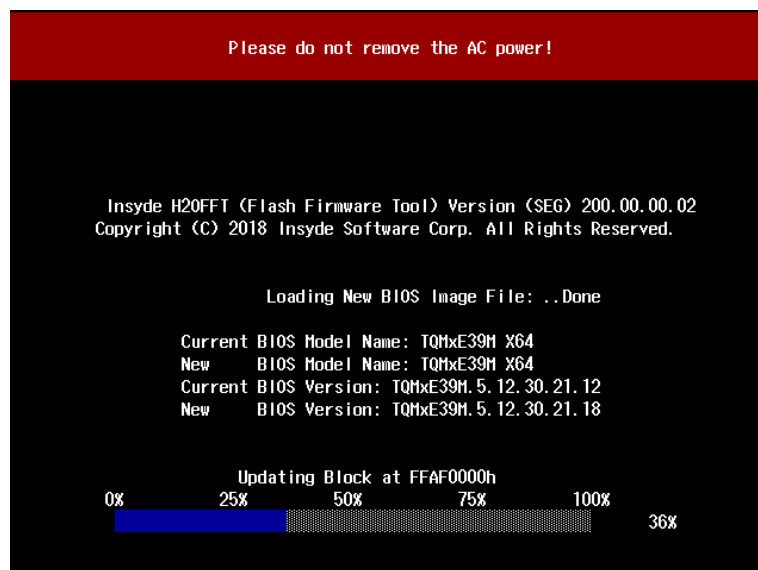Illustration 9:   EFI Shell uEFI BIOS Update

```
                    Please do not remove the AC power!




         Insyde H2OFFT (Flash Firmware Tool) Version (SEG) 200.00.00.02
         Copyright (C) 2018 Insyde Software Corp. All Rights Reserved.


                  Loading New BIOS Image File: ..Done

           Current BIOS Model Name: TQMxE39M X64
           New     BIOS Model Name: TQMxE39M X64
           Current BIOS Version: TQMxE39M.5.12.30.21.12
           New     BIOS Version: TQMxE39M.5.12.30.21.18


                    Updating Block at FFAF0000h
           0%        25%       50%       75%      100%

                                                         36%
```

Illustration 10:   Screen during BIOS Update

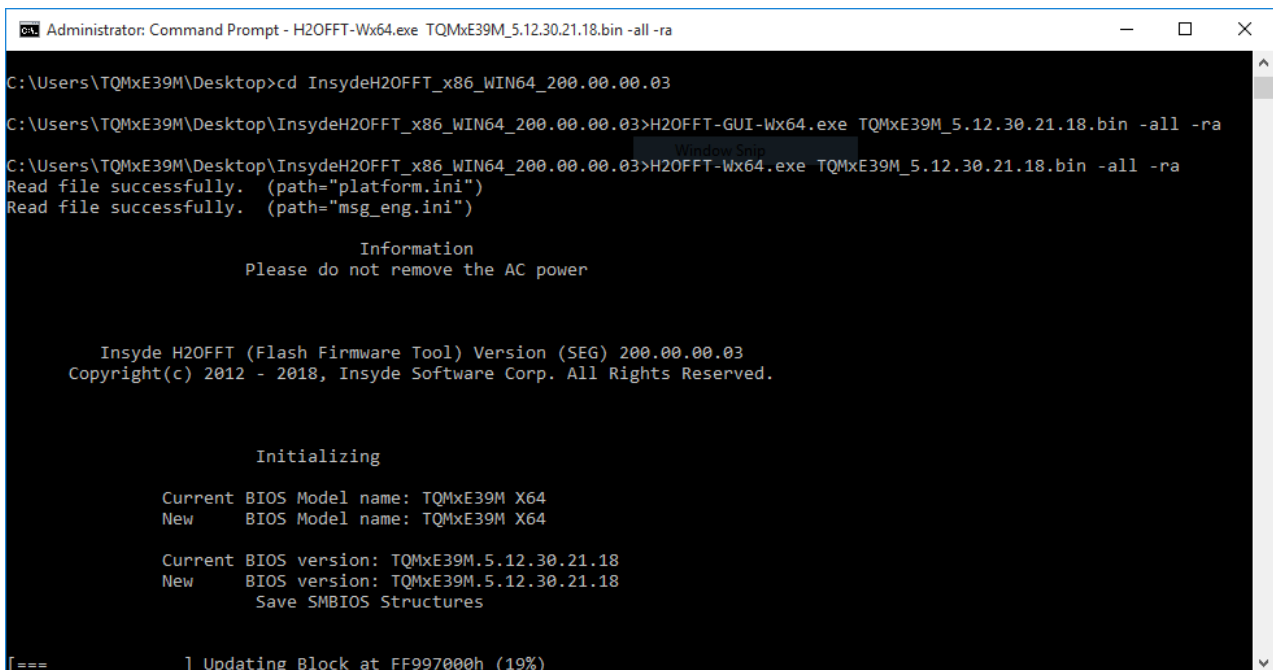### 6.7.3   Step 2b: Updating uEFI BIOS via Windows Operating System

Boot the Windows operating system (64-bit) and plug the USB stick into the board you want to update the uEFI BIOS.
Start the Command prompt (CMD), important 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:\TQMxXXXX_X.xx.xx.xx.xx.bin).

If the argument "–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 necessary.

Illustration 11:   Windows 10 64-bit BIOS update

Start the BIOS update with the Insyde Windows 64-bit update tool.
Note: The start of updating BIOS could need longer time (up to 2 – 3 minutes). Means, the initializing information of current and new BIOS will be shown immediately whereas the "Updating Block at …" need longer time.

6.7.4 Step 3: BIOS update check on the TQMxE39M Module

After the uEFI BIOS update the new uEFI BIOS configures the complete TQMxE39M hardware and this results in some reboots and the first boot time takes longer (up to 1 – 2 minutes).

The TQMxE39M includes a dual colour Debug LED providing boot and uEFI BIOS information.

If the green LED is blinking the uEFI BIOS is booting. If the green LED is lit the uEFI BIOS boot is finished.
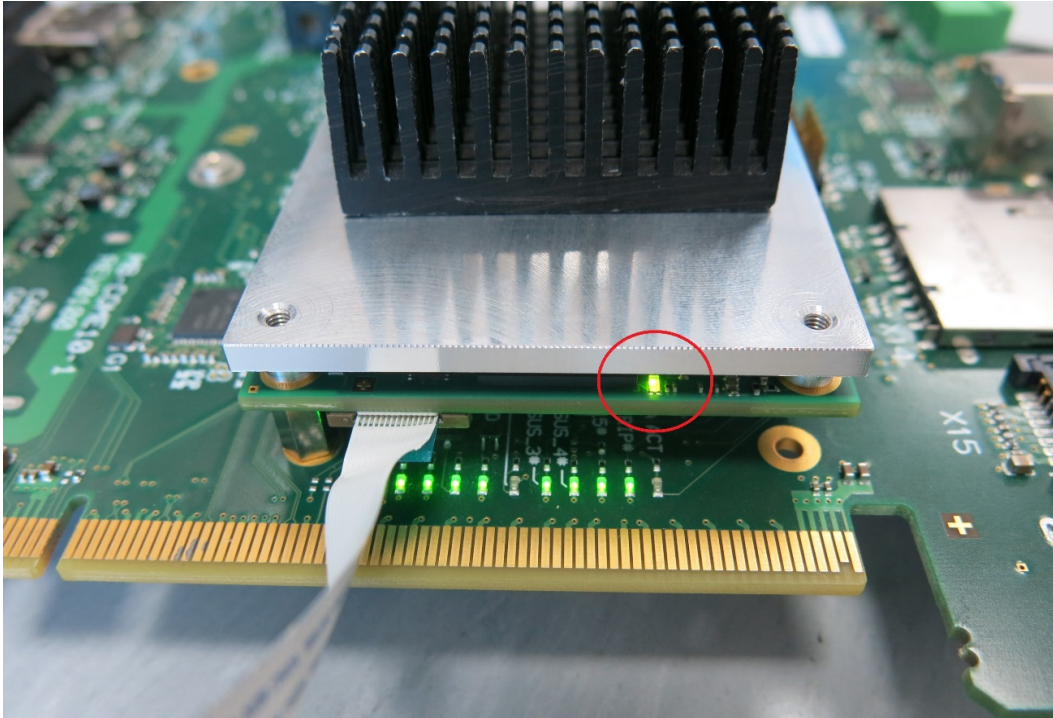
Illustration 12:   TQMxE39M Debug LED

After the uEFI BIOS has been flashed completely, please check whether the uEFI BIOS has been flashed successfully.

The BIOS Main menu includes the board and hardware information and it shows the installed BIOS version.

InsydeH20 Setup Utility	
Main Advanced Security Power Boot Exit	
InsydeH20 Version	TQMxE39M.5.12.30.21.18
UEFI Version	2.50
Product Name	TQMxE39M X64
Build Date	04/12/2019 07:39:22

Illustration 13:   EFI BIOS Main Menu

7. SAFETY REQUIREMENTS AND PROTECTIVE REGULATIONS

7.1 EMC

The TQMxE39M was developed according to the requirements of electromagnetic compatibility (EMC). Depending on the target system, anti-interference measures may still be necessary to guarantee the adherence to the limits for the overall system.
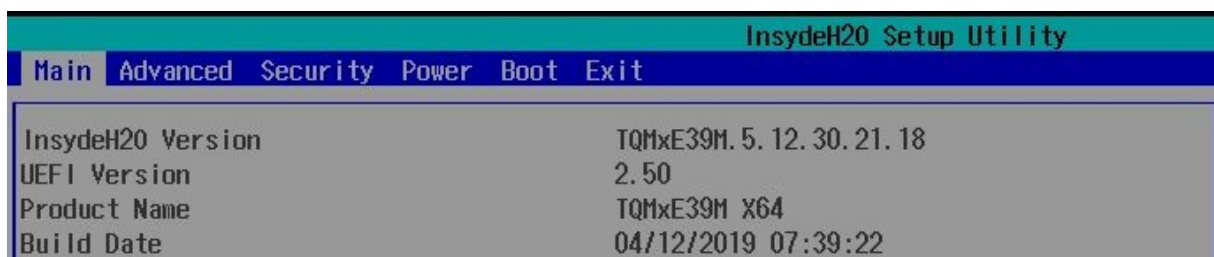
7.2 ESD

In order to avoid interspersion on the signal path from the input to the protection circuit in the system, the protection against electrostatic discharge should be arranged directly at the inputs of a system. As these measures always have to be implemented on the carrier board, no special preventive measures were done on the TQMxE39M.

7.3 Shock & Vibration

The TQMxE39M is designed to be insensitive to shock and vibration and impact.
The design avoids additional connectors like SO-DIMM sockets to support applications also in harsh environments.

7.4 Operational safety and personal security

Due to the occurring voltages ($\leq$20 V DC), tests with respect to the operational and personal safety haven't been carried out.

7.5 Reliability and service life

The MTBF according to MIL-HDBK-217F N2 is 395,606 hours, Ground Benign, at +40 °C.

8. ENVIRONMENT PROTECTION

8.1 RoHS

The TQMxE39M is manufactured RoHS compliant.

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

8.2 WEEE®

The final distributor is responsible for compliance with the WEEE® regulation.
Within the scope of the technical possibilities, the TQMxE39M was designed to be recyclable and easy to repair.

8.3 REACH®

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

8.4 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 TQMxE39M must therefore always be seen in conjunction with the complete device. The available standby and sleep modes of the components on the TQMxE39M enable compliance with EuP requirements for the TQMxE39M.

8.5 Battery

No batteries are assembled on the TQMxE39M.

8.6 Packaging

By environmentally friendly processes, production equipment and products, we contribute to the protection of our environment. To be able to reuse the TQMxE39M, 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 TQMxE39M is delivered in reusable packaging.

8.7 Other entries

By environmentally friendly processes, production equipment and products, we contribute to the protection of our environment.
The energy consumption of this subassembly is minimised by suitable measures.
Printed PC-boards are delivered in reusable packaging.
Modules and devices are delivered in an outer packaging of paper, cardboard or other recyclable material.
Due to the fact that at the moment there is still no technical equivalent alternative for printed circuit boards with bromine-containing flame protection (FR-4 material), such printed circuit boards are still used.
No use of PCB containing capacitors and transformers (polychlorinated biphenyls).
These points are an essential part of the following laws:

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

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

9. APPENDIX

9.1 Acronyms and definitions

The following acronyms and abbreviations are used in this document:

Table 14:   Acronyms

Acronym	Meaning
AHCI	Advanced Host Controller Interface
ATA	Advanced Technology Attachment
BIOS	Basic Input/Output System
BOM	Bill Of Material
CAN	Controller Area Network
CPU	Central Processing Unit
CSM	Compatibility Support Module
DDI	Digital Display Interface
DDR3L	Double Data Rate 3 Low Voltage
DMA	Direct Memory Access
DP	Display Port
DVI	Digital Visual Interface
EAPI	Embedded Application Programming Interface
eDDI	embedded Digital Display Interface
EDID	Extended Display Identification Data
eDP	embedded Display Port
EEPROM	Electrically Erasable Programmable Read-only Memory
EFI	Extensible Firmware Interface
EMC	Electro-Magnetic Compatibility
eMMC	embedded Multi-Media Card
eSATA	external Serial ATA
ESD	Electro-Static Discharge
FAE	Field Application Engineer
FPGA	Field Programmable Gate-Array
FR-4	Flame Retardant 4
FTPM	Firmware Trusted Platform Module
GbE	Gigabit Ethernet
GFX	Graphics
GPI	General Purpose Input
GPIO	General Purpose Input/Output
GPMI	General Purpose Media Interface
GPO	General Purpose Output
GPT	General Purpose Timer
HD	High Definition
HDA	High Definition Audio
HDMI	High Definition Multimedia Interface
HEVC	High Efficiency Video Coding
HFM	High Frequency Mode
HPD	Hot Plug Detection
I/O	Input Output
I^2C	Inter-Integrated Circuit
IDE	Integrated Device Electronics
IEEE®	Institute of Electrical and Electronics Engineers
IO	Input Output
IoT	Internet of Things
IP	Ingress Protection
IRQ	Interrupt Request
JEIDA	Japan Electronic Industries Development Association
JPEG	Joint Photographic Experts Group
JTAG®	Joint Test Action Group
LED	Light Emitting Diode
LP	Low Power or Low Profile

9.1   Acronyms and definitions (continued)

Table 14:   Acronyms (continued)

Acronym	Meaning
LPC	Low Pin-Count
LVDS	Low Voltage Differential Signal
MISO	Master In Slave Out
MMC	Multimedia Card
MOSI	Master Out Slave In
mPCIe	Mini PCIe
MPEG	Moving Picture Experts Group
mSATA	Mini SATA
MTBF	Mean operating Time Between Failures
N/A	Not Applicable
OD	Open Drain
OpROM	Option ROM
OS	Operating System
PC	Personal Computer
PCB	Printed Circuit Board
PCIe	PCI Express
PCMCIA	People Can't Memorize Computer Industry Acronyms
PD	Pull-Down
PICMG®	PCI Industrial Computer Manufacturers Group
PU	Pull-Up
PWM	Pulse-Width Modulation
RAM	Random Access Memory
RMA	Return Merchandise Authorization
RoHS	Restriction of (the use of certain) Hazardous Substances
ROM	Read-Only Memory
RSVD	Reserved
RTC	Real-Time Clock
SATA	Serial ATA
SCU	System Configuration Utility
SD card	Secure Digital Card
SD/MMC	Secure Digital Multimedia Card
SDIO	Secure Digital Input Output
SDRAM	Synchronous Dynamic Random Access Memory
SIMD	Single Instruction Multiple Data
SMBus	System Management Bus
SO-DIMM	Small Outline Dual In-Line Memory Module
SPD	Serial Presence Detect
SPI	Serial Peripheral Interface
SSD	Solid-State Drive
TBD	To Be Determined
TDM	Time-Division Multiplexing
TDP	Thermal Design Power
TPM	Trusted Platform Module
TPM_PP	Trusted Platform Module Physical Presence
UART	Universal Asynchronous Receiver and Transmitter
uEFI	Unified Extensible Firmware Interface
USB	Universal Serial Bus
VC1	Video Coding (standard) 1
VESA	Video Electronics Standards Association
VP9	Video Playback 9
WDT	Watchdog Timer
WEEE®	Waste Electrical and Electronic Equipment

9.2   References

Table 15:   Further Applicable Documents and Links

No.	Name	Rev., Date	Company
(1)	PICMG® COM Express™ Module Base Specification	Rev. 2.1, May 14, 2014	PICMG®
(2)	PICMG® COM Express™ Carrier Design Guide	Rev. 2.0, Dec. 6, 2013	PICMG®
(3)	PICMG® COM Express™ Embedded Application Programming Interface	Rev. 1.0, Aug. 8, 2010	PICMG®