



# TQMxE39C2 User's Manual

TQMxE39C2 UM 0103  
2019-08-27





## TABLE OF CONTENTS

1	ABOUT THIS MANUAL.....	1
1.1	Copyright and license expenses.....	1
1.2	Registered trademarks.....	1
1.3	Disclaimer.....	1
1.4	Imprint.....	1
1.5	Service and Support.....	1
1.6	Tips on safety.....	2
1.7	Symbols and typographic conventions.....	2
1.8	Handling and ESD tips.....	2
1.9	Naming of signals.....	3
1.10	Further applicable documents / presumed knowledge.....	3
2	INTRODUCTION.....	3
2.1	Functional Overview.....	4
2.2	PICMG® COM Express™ Specification Compliance.....	5
2.3	Variants.....	5
2.4	Accessories.....	5
2.5	Block diagram.....	6
3	FUNCTION.....	6
3.1	Supply Voltage.....	6
3.2	Power Consumption.....	7
3.3	Real-Time Clock Power Consumption.....	8
3.4	Environmental Conditions.....	8
3.5	System Components.....	9
3.5.1	CPU.....	9
3.5.2	Graphics.....	9
3.5.3	Memory.....	10
3.5.3.1	DDR3L SDRAM.....	10
3.5.3.2	eMMC.....	10
3.5.3.3	SPI Boot Flash.....	10
3.5.3.4	EEPROM.....	10
3.5.4	Real-Time Clock.....	10
3.5.5	Trusted Platform Module.....	10
3.5.6	Hardware Monitor.....	10
3.5.7	TQ flexible I/O configuration (TQ-flexiCFG).....	11
3.5.8	Ultra Deep Power State Green ECO-Off.....	11
3.6	Interfaces.....	11
3.6.1	PCI Express.....	11
3.6.2	Gigabit Ethernet.....	11
3.6.3	Serial ATA.....	11
3.6.4	Digital Display Interface.....	11
3.6.5	LVDS Interface.....	12
3.6.6	USB 2.0 Interfaces.....	12
3.6.7	USB 3.0 Interfaces.....	12
3.6.8	SD Card Interface.....	12
3.6.9	General Purpose Input and Output.....	12
3.6.10	High Definition Audio Interface.....	12
3.6.11	LPC Bus.....	12
3.6.12	I <sup>2</sup> C Bus.....	12
3.6.13	SMBus.....	12
3.6.14	Serial Peripheral Interface.....	13
3.6.15	Serial Ports.....	13
3.6.16	Watchdog Timer.....	13



## TABLE OF CONTENTS (continued)

3.7	Connectors .....	14
3.7.1	COM Express™ Connector .....	14
3.7.2	Debug Header .....	14
3.7.3	TQM Debug Card .....	14
3.7.4	Debug Module LED .....	14
3.8	COM Express™ Connector Pinout .....	15
3.8.1	Signal Assignment Abbreviations .....	15
3.8.2	COM Express™ Connector Pin Assignment .....	16
4	MECHANICS .....	24
4.1	TQMxE39C2 Dimensions .....	24
4.2	Heat spreader Dimensions .....	25
4.3	Mechanical and Thermal Considerations .....	26
4.4	Protection Against External Effects .....	26
5	SOFTWARE .....	27
5.1	System Resources .....	27
5.1.1	I <sup>2</sup> C Bus .....	27
5.1.2	SMBus .....	27
5.1.3	Memory Map .....	27
5.1.4	IRQ Map .....	27
5.2	Operating Systems .....	28
5.2.1	Supported Operating Systems .....	28
5.2.2	Driver Download .....	28
5.3	TQ-Systems Embedded Application Programming Interface (EAPI) .....	28
5.4	Software Tools .....	28
6	BIOS .....	29
6.1	Continue Boot Process .....	29
6.2	Boot Manager .....	29
6.3	Device Manager .....	30
6.3.1	SioTqmx86 .....	30
6.4	Boot From File .....	30
6.5	Administer Secure Boot .....	30
6.6	Setup Utility .....	31
6.6.1	Main .....	31
6.6.2	Advanced .....	31
6.6.2.1	Boot Configuration .....	32
6.6.2.2	Uncore Configuration .....	32
6.6.2.3	South Cluster Configuration .....	33
6.6.2.4	Security Configuration .....	35
6.6.2.5	System Component .....	35
6.6.2.6	Debug Configuration .....	36
6.6.2.7	RTD3 Settings .....	36
6.6.2.8	Memory System Configuration .....	36
6.6.2.9	ACPI Table / Features Control .....	36
6.6.2.10	SIO Hardware Monitor Nuvoton NCT7802Y .....	37
6.6.2.11	Console Redirection .....	38
6.6.2.12	H2OUVE Configuration .....	39
6.6.3	Security .....	39
6.6.4	Power .....	39
6.6.4.1	CPU Configuration .....	40
6.6.5	Boot .....	41
6.6.6	Exit .....	42
6.7	BIOS Update .....	42
6.7.1	Step 1: Preparing USB Stick .....	42
6.7.2	Step 2a: Updating uEFI BIOS via EFI Shell .....	43
6.7.3	Step 2b: Updating uEFI BIOS via Windows Operating System .....	44
6.7.4	Step 3: BIOS update check on the TQMxE39C2 Module .....	45



## TABLE OF CONTENTS (continued)

7	SAFETY REQUIREMENTS AND PROTECTIVE REGULATIONS .....	46
7.1	EMC.....	46
7.2	ESD.....	46
7.3	Shock & Vibration .....	46
7.4	Operational Safety and Personal Security .....	46
7.5	Reliability and Service Life .....	46
8	ENVIRONMENTAL PROTECTION.....	47
8.1	RoHS .....	47
8.2	WEEE®.....	47
8.3	REACH® .....	47
8.4	EuP .....	47
8.5	Battery.....	47
8.6	Packaging .....	47
8.7	Other entries .....	47
9	APPENDIX.....	48
9.1	Acronyms and definitions.....	48
9.2	References .....	50



## TABLE DIRECTORY

Table 1:	Terms and Conventions .....	2
Table 2:	TQMxE39C2 Power Consumption.....	7
Table 3:	RTC Current Consumption.....	8
Table 4:	Intel® Atom™ E3900, Intel® Pentium® N4200, and Intel® Celeron® N3350.....	9
Table 5:	Maximum Resolution in dual Display Configuration .....	9
Table 6:	PCI Express configuration options .....	11
Table 7:	Serial Port COM Express™ Port Mapping.....	13
Table 8:	LED Boot Messages.....	14
Table 9:	Abbreviations used.....	15
Table 10:	COM Express™ Connector Pin Assignment .....	16
Table 11:	I <sup>2</sup> C Address Mapping COM Express™ I <sup>2</sup> C Port .....	27
Table 12:	I <sup>2</sup> C Address Mapping COM Express™ SMBus Port .....	27
Table 13:	Acronyms .....	48
Table 14:	Further Applicable Documents and Links .....	50

## ILLUSTRATION DIRECTORY

Illustration 1:	Block Diagram TQMxE39C2.....	6
Illustration 2:	TQM debug card .....	14
Illustration 3:	Three-view drawing TQMxE39C2 .....	24
Illustration 4:	Bottom view drawing TQMxE39C2.....	24
Illustration 5:	Heat Spreader TQMxE39C2-HSP.....	25
Illustration 6:	InsydeH2O BIOS Front Page.....	29
Illustration 7:	Fan Curve .....	37
Illustration 8:	EFI Shell.....	43
Illustration 9:	EFI Shell uEFI BIOS Update.....	43
Illustration 10:	Screen during BIOS Update.....	43
Illustration 11:	Windows 10 64-bit BIOS update.....	44
Illustration 12:	TQMxE39C2 Debug LED .....	45
Illustration 13:	EFI BIOS Main Menu.....	45

## REVISION HISTORY

Rev.	Date	Name	Pos.	Modification
0100	2017-07-18	GM		First issue
0101	2017-11-17	WM	2.1 2.8.3.4 Table 10	Interface allocation corrected EEPROM corrected Maximum voltage for VCC_RTC pin (A47) removed
0102	2018-09-06	FP	All 5.6.3, 5.6.4, 5.6.5, 5.6.6	Links updated, formatting Added
0103	2019-08-27	US	6	BIOS chapter added



## 1 ABOUT THIS MANUAL

### 1.1 Copyright and license expenses

Copyright protected © 2019 by TQ-Systems GmbH.

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

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

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

License expenses for the Operating System and applications are not taken into consideration and must be calculated / declared separately.

### 1.2 Registered trademarks

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

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

### 1.3 Disclaimer

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

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

### 1.4 Imprint

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

Tel: +49 8153 9308-0

Fax: +49 8153 9308-4223

E-Mail: [Info@TQ-Group](mailto:Info@TQ-Group)

Web: [TQ-Group](http://TQ-Group)

### 1.5 Service and Support

Please visit our website [TQ-Group](http://TQ-Group) for latest product documentation, drivers, utilities and technical support.

Through our website [TQ-Group](http://TQ-Group) 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: [TQ-Support](mailto:TQ-Support).

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





For service/RMA, please contact our service team by email ([TQ-Service](mailto:TQ-Service)) 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.
<b>Command</b>	A font with fixed-width is used to denote commands, contents, file names, or menu items.

## 1.8 Handling and ESD tips

General handling of your TQ-products

	<p>The TQ-product may only be used and serviced by certified personnel who have taken note of the information, the safety regulations in this document and all related rules and regulations.</p> <p>A general rule is: do not touch the TQ-product during operation. This is especially important when switching on, changing jumper settings or connecting other devices without ensuring beforehand that the power supply of the system has been switched off.</p> <p>Violation of this guideline may result in damage / destruction of the TQMxE39C2 and be dangerous to your health.</p> <p>Improper handling of your TQ-product would render the guarantee invalid.</p>
---	---

Proper ESD handling

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





## 1.9 Naming of signals

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

Example: RESET#

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

Example: C / D#

If a signal has multiple functions, the individual functions are separated by slashes when they are important for the wiring. The identification of the individual functions follows the above conventions.

Example: WE2# / OE#

## 1.10 Further applicable documents / presumed knowledge

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

The COM Express™ Design Guide (2) maintained by the PICMG® provides implementation information for the carrier board.

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 TQMxE39C2 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 TQMxE39C2 corresponds to the internationally established PICMG® standard COM Express™ Compact COM.0 Revision 2.1 with Type 6 pinout. Eight USB ports – including three USB 3.0 – and up to four PCIe lanes natively supported by the CPUs enable high bandwidth communication with peripherals and additional interfaces on the carrier board. With the latest integrated Intel® graphics processor, the TQMxE39C2 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 optional 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 TQMxE39C2 is a perfect fit for ruggedized applications.





## 2.1 Functional Overview

The following key functions are available on the TQMxE39C2:

### 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:

- 2 × Digital Display Interface (DDI) (DP 1.2a, DVI, HDMI 1.4b)
- 1 × Embedded Digital Display Interface (eDDI) or dual LVDS interface (eDP 1.3 or dual LVDS)

### Peripheral interfaces:

- 1 × Gigabit Ethernet (Intel® i210); on request: external IEEE1588 sync through TQ-flexiCFG
- 3 × USB 3.0 (with USB 2.0 backward compatibility)
- 8 × USB 2.0 (incl. USB 3.0 ports)
- 2 × SATA 3.0 (up to 6 Gb/s), eSATA capable
- 4 × PCIe 2.0 (up to 5 Gb/s)  
(4<sup>th</sup> lane on request, if no Ethernet or other lane configuration i.e. (1) ×2 and (2) ×1 / (2) ×2 / (1) ×4)
- 1 × LPC bus
- 1 × Intel® HD audio (HDA)
- 1 × I<sup>2</sup>C (master/slave capable)
- 1 × SMBus
- 1 × SPI (for external uEFI BIOS flash)
- 2 × Serial port (Rx/Tx, legacy compatible), 4-wire through TQ-flexiCFG on request
- 1 × SD card interface; on request: 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 to 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™ Compact, Type 6; 95 mm × 95 mm



## 2.2 PICMG® COM Express™ Specification Compliance

The TQMxE39C2 complies with the PICMG® COM Express™ Module Base Specification COM.0 Revision 2.1 Type 6 Compact, with dimensions of 95 mm × 95 mm.

## 2.3 Variants

The TQMxE39C2 is available in several standard configurations:

### TQMxE39C2-AA ("Premium LVDS")

Intel® Atom™ x7-E3950 (Quad core, 1.6 / 2.0 GHz, 2 Mbyte L2-Cache, 12 W TDP),  
Separate SO-DIMM, LVDS, no eMMC, no TPM, SD card, Standard-Temp. 0 °C to +60 °C

### TQMxE39C2-AB ("Mainstream LVDS")

Intel® Atom™ x5-E3940 (Quad core, 1.6 / 1.8 GHz, 2 Mbyte L2-Cache, 9.5 W TDP),  
Separate SO-DIMM, LVDS, no eMMC, no TPM, SD card, Standard-Temp. 0 °C to +60 °C

### TQMxE39C2-AC ("Entry LVDS")

Intel® Atom™ x5-E3930 (Dual core, 1.3 / 1.8 GHz, 2 Mbyte L2-Cache, 6.5 W TDP),  
Separate SO-DIMM, LVDS, no eMMC, no TPM, SD card, Standard-Temp. 0 °C to +60 °C

### TQMxE39C2-AD ("Celeron LVDS")

Intel® Celeron™ N3350 (Dual core, 1.1 / 2.4 GHz, 2 Mbyte L2-Cache, 6 W TDP),  
Separate SO-DIMM, LVDS, no eMMC, no TPM, SD card, Standard-Temp. 0 °C to +60 °C

### TQMxE39C2-AE ("Pentium LVDS")

Intel® Pentium™ N4200 (Quad core, 1.1 / 2.5 GHz, 2 Mbyte L2-Cache, 6 W TDP),  
Separate SO-DIMM, LVDS, no eMMC, no TPM, SD card, Standard-Temp. 0 °C to +60 °C

Please refer to [www.tq-group.com/TQMxE39C2](http://www.tq-group.com/TQMxE39C2) for a complete list of standard versions.

Other configurations are available on request.

### Standard configuration features are:

- eDP (on request)
- eMMC
- CPU derivative
- Memory configuration
- TPM (on request)

### Hardware and software configuration features on request:

- Conformal coating can be offered as custom specific add-on
- GPIO instead of SD card
- Custom specific GPIO configuration through TQ-flexiCFG
- Custom specific BIOS configuration

## 2.4 Accessories

TQMxE39C2-HSP-E, TQMxE39C2-HSP-N: Heat spreader for TQMxE39C2 according to the COM Express™ specification.

Evaluation platform MB-COME6-1 or MB-COME6-2:

- Mainboard for COM Express™ Compact modules, Type 6
- 170 mm × 170 mm
- Usable Interfaces:
  - MB-COME6-1: 2 × DP, eDP/LVDS, 2 × GbE, 4 × USB, 3 × COM, audio, mini PCIe, mSATA, 2.5" SSD, SD card, riser extension with PCIe and USB, fan, debug
  - MB-COME6-2: 2 × HDMI, eDP/LVDS, 2 × GbE, 4 × USB, 1 × COM, audio, mini PCIe, M.2, 2.5" SSD, fan, debug
- Functional Specification

## 2.5 Block diagram

The following illustration shows the block diagram of the TQMxE39C2:

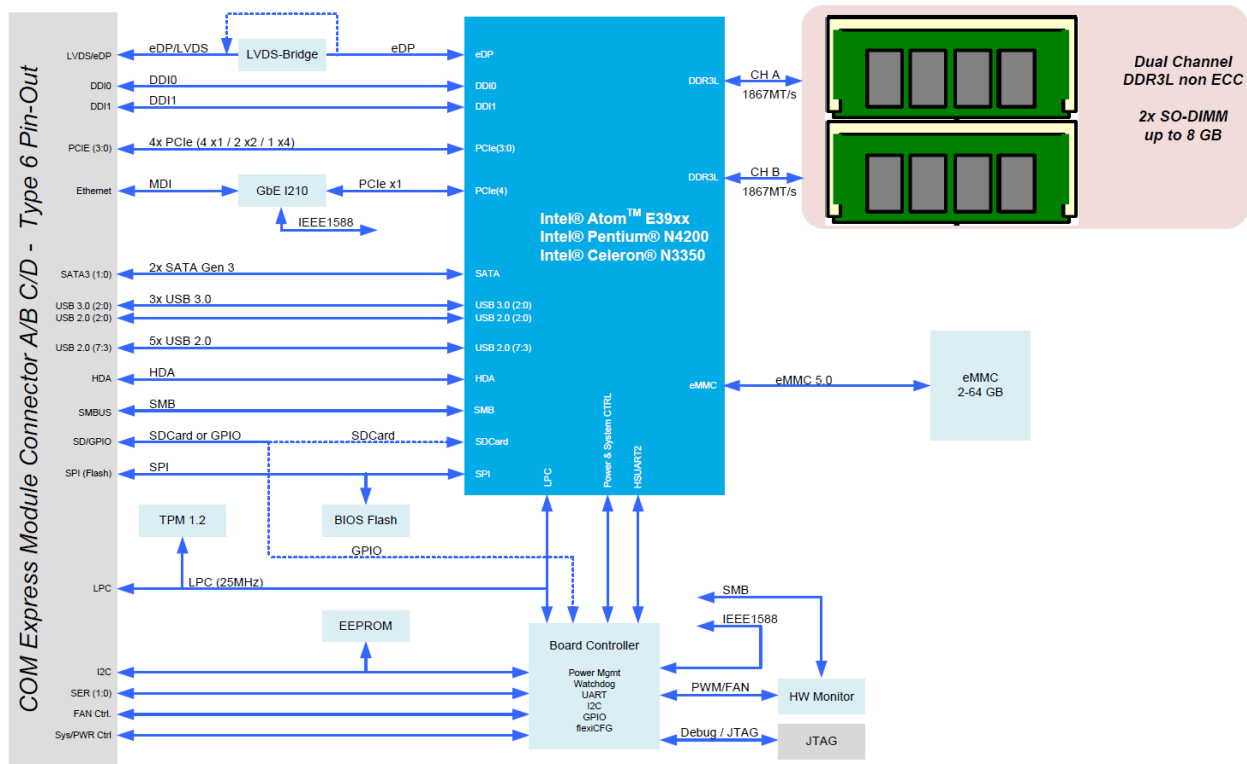


Illustration 1: Block Diagram TQMxE39C2

## 3 FUNCTION

### 3.1 Supply Voltage

The TQMxE39C2 supports a wide-range voltage input from 4.75 V to 20.0 V.

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

- 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 % of nominal to 90 % of nominal within 0.1 ms to 20 ms (0.1 ms ≤ Rise Time ≤ 20 ms). Each DC output voltage must ramp smoothly and continuously from 10 % to 90 % of its final set point within the regulation band.

<b>Note: Power source</b>	
	<p>The 5 V Standby voltage is not required for single supply operation. VCC_5V_SBY can be left open.</p>

### 3.2 Power Consumption

The power consumption values below show the voltage and power specifications for the TQMxE39C2.

The values were measured using the TQMxE39C2 and the MB-COME6-1 COM Express™ carrier board.

The power was measured using two power supplies; one for the TQMxE39C2 and one for the MB-COME6-1 COM Express™ carrier board.

The power consumption of each TQMxE39C2 was measured running Windows® 10, 64 bit and a dual channel DDR3L configuration (2 × 2 Gbyte). All measurements were carried out at +25 °C and an input voltage of +12.0 V.

The power consumption of the TQMxE39C2 depends on the application, the mode of operation and the Operating System.

The power consumption was measured under the following conditions:

- **Green ECO-Off state:**  
The system is in Green ECO-Off state, all DC/DC power supplies on the TQMxE39C2 are off.
- **Suspend mode:**  
The system is in S5/S4 state, Ethernet port is disconnected.
- **Windows 10, 64 bit, idle:**  
Desktop idles, Ethernet port is disconnected.
- **Windows 10, 64 bit, maximum load:**  
The 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 2: TQMxE39C2 Power Consumption

CPU on TQMxE39C2	Mode				
	Standby 5 V		Input 5.0 V		
	Green ECO-Off state	Suspend	Win10, 64 bit idle	Win10, 64 bit max. load	Win10, 64 bit Max load, cores only
Intel® Pentium® N4200	4.3 mW	250 mW	1.8 W	8.6 W	4.3 W
Intel® Celeron® N3350	4.3 mW	250 mW	1.8 W	8.6 W	3.4 W
Intel® Atom™ x5-E3930	4.3 mW	250 mW	1.8 W	9.0 W	4.5 W
Intel® Atom™ x5-E3940	4.3 mW	250 mW	1.8 W	11.9 W	6.5 W
Intel® Atom™ x7-E3950	4.3 mW	250 mW	1.8 W	16.9 W	7.8 W

The TQMxE39C2 may exceed the values mentioned in the table above, when Turbo Mode is enabled in the BIOS.

#### Note: Power requirement



The power supplies on the carrier board for the TQMxE39C2 must be designed with enough reserve. The carrier board should provide at least twice the maximum workload power of the TQMxE39C2. The TQMxE39C2 supports several low-power states. The power supply of the carrier board has to be stable even with no load.

### 3.3 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 3: RTC Current 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.

### 3.4 Environmental Conditions

- Operating temperature, Standard: 0 °C to +60 °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 TQMxE39C2 without heat spreader or without heat sink!  
The heat spreader is not a sufficient heat sink!



### 3.5 System Components

#### 3.5.1 CPU

The TQMxE39C2 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
- 2 Mbyte Cache
- Intel® HD Graphics
- Triple independent displays

Table 4: 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 <sub>junction</sub>	0 °C to +105 °C	0 °C to +105 °C	-40 °C to +110 °C	-40 °C to +110 °C	-40 °C to +110 °C
Memory Speed	1866 MT/s	1866 MT/s	1866 MT/s	1866 MT/s	1866 MT/s
Max 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

#### 3.5.2 Graphics

The Intel® Atom™ E3900, Intel® Pentium® N4200, and Intel® Celeron® N3350 CPUs include an integrated Intel® HD (Gen 9) graphics accelerator. It provides excellent 2D/3D graphics performance with triple 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/MJPG
- Direct3D\* 12, DirectX\* 12 support
- OpenGL\* 4.3, OpenCL\* 1.2 support

The TQMxE39C2 supports two Digital Display Interfaces (DDI0 and DDI1) and one eDP or dual LVDS interface at the COM Express™ connector.

Table 5: Maximum Resolution in dual Display Configuration

Display	Maximum Display Resolution
LVDS	1920 × 1200 @ 60 Hz (dual channel)
eDP	3840 × 2160 @ 60 Hz
DP	4096 × 2160 @ 60 Hz
HDMI	3840 × 2160 @ 30 Hz

### 3.5.3 Memory

#### 3.5.3.1 DDR3L SDRAM

The TQMxE39C2 supports a dual-channel DDR3L memory configuration running at up to 1866 MT/s. It provides two 204-pin DDR3L SO-DIMM sockets for two DDR3L SO-DIMM modules that support system memory configurations of 2 GB, 4 GB or 8 GB. DDR3L supports an operating voltage of 1.35 V, compared to DDR3 resulting in a reduction in overall power consumption and heat dissipation.

#### Note: DDR3L SO-DIMM modules



Only DDR3L SO-DIMM modules qualified by TQ-Systems GmbH are authorized to be used with the TQMxE39C2. The use of DDR3L SO-DIMM modules not released by TQ-Systems GmbH may cause malfunction.

#### 3.5.3.2 eMMC

The TQMxE39C2 supports up to 64 Gbyte on-board eMMC flash, compatible with JESD84-B50 (eMMC 5.0).

#### Attention: eMMC OS installation



The on-board eMMC flash requires pre-configuration via EFI Shell before OS installation (using e.g. diskpart utility)

#### 3.5.3.3 SPI Boot Flash

The TQMxE39C2 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 Winbond W25Q128FV 3.3 V SPI flash on the carrier board:

#### 3.5.3.4 EEPROM

The TQMxE39C2 supports a COM Express™ Module EEPROM.

The 32 kbit EEPROM is connected to the general purpose I<sup>2</sup>C interface (COM Express™ pin names I2C\_DAT and I2C\_CK).

#### 3.5.4 Real-Time Clock

The TQMxE39C2 includes a standard Motorola RTC MC146818B, integrated in the Intel® Atom™ E3900, Intel® Pentium® N4200, and Intel® Celeron® N3350 CPU.

#### 3.5.5 Trusted Platform Module

The TQMxE39C2 supports 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 CPUs also support a Trusted Platform Module (FTPM), which is a Trusted Platform Module 2.0 implementation in firmware. This feature can be configured in the BIOS.

#### 3.5.6 Hardware Monitor

The TQMxE39C2 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).





### 3.5.7 TQ flexible I/O configuration (TQ-flexiCFG)

The TQMxE39C2 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 TQMxE39C2 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, I<sup>2</sup>C, PWM controller or special power management configurations

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

### 3.5.8 Ultra Deep Power State Green ECO-Off

The TQMxE39C2 supports the Ultra-Deep power state Green ECO-Off.

In this configuration all DC/DC power supplies on the TQMxE39C2 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 Green ECO-Off mode, the power button signal must be pulled low for a minimum of 100 ms.

## 3.6 Interfaces

### 3.6.1 PCI Express

The TQMxE39C2, with Intel® Atom™ E3900, Intel® Pentium® N4200, and Intel® Celeron® N3350 CPU, supports a very flexible PCI Express configuration with up to four PCI Express Gen 2 ports.

With a customized BIOS the PCI Express lanes can be configured as follows:

Table 6: PCI Express configuration options

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

### 3.6.2 Gigabit Ethernet

The TQMxE39C2 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.

### 3.6.3 Serial ATA

The TQMxE39C2 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.

### 3.6.4 Digital Display Interface

The TQMxE39C2 supports three Digital Display Interfaces (DDI0, DDI1 & DDI2) at the COM Express™ connectors.

The DDI0 & DDI1 ports support DisplayPort or HDMI/DVI.

The DDI2 port supports LVDS (via an eDP to LVDS bridge) or eDP as an assembly option.

The TQMxE39C2 supports the following maximum display resolutions:

- DisplayPort 1.2a: Up to 4096 × 2160 @ 60 Hz
- Embedded DisplayPort 1.3: Up to 3840 × 2160 @ 60 Hz
- HDMI 1.4b: Up to 3840 × 2160 @ 30 Hz
- DVI: Up to 3840 × 2160 @ 30 Hz (HDMI without Audio)

Please contact [TQ-Support](#) for further information about the DDI0 / DDI1 / DDI2 configuration.

### 3.6.5 LVDS Interface

The TQMxE39C2 supports an 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 or dual 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 LVDS mode. The LVDS data packing can be configured either in VESA or JEIDA format.

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


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

### 3.6.6 USB 2.0 Interfaces

The TQMxE39C2 supports eight USB 2.0 ports at the COM Express™ connector.

### 3.6.7 USB 3.0 Interfaces

The TQMxE39C2 supports three USB 3.0 ports at the COM Express™ connector.

Note: USB Port Mapping	
	<p>The USB 2.0 port 0 must be paired with USB 3.0 SuperSpeed port 0.</p> <p>The USB 2.0 port 1 must be paired with USB 3.0 SuperSpeed port 1.</p> <p>The USB 2.0 port 2 must be paired with USB 3.0 SuperSpeed port 2.</p>

### 3.6.8 SD Card Interface

The TQMxE39C2 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.

### 3.6.9 General Purpose Input and Output

The TQMxE39C2 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 configured flexibly.

Therefore the signals can also be used for several special functionality (see 3.5.7).

### 3.6.10 High Definition Audio Interface

The TQMxE39C2 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.

### 3.6.11 LPC Bus

The TQMxE39C2 supports a Low Pin Count (LPC) legacy bus for I/O expansion. The LPC bus DMA is not supported.

### 3.6.12 I<sup>2</sup>C Bus

The TQMxE39C2 supports a general purpose I<sup>2</sup>C port via a dedicated LPC to I<sup>2</sup>C controller, integrated in the TQ-flexiCFG block.

The I<sup>2</sup>C host controller supports a clock frequency of up to 400 kHz and can be configured independently.

### 3.6.13 SMBus

The TQMxE39C2 provides an SMBus.

### 3.6.14 Serial Peripheral Interface

The TQMxE39C2 provides an SPI interface. The SPI interface can only be used for SPI boot Flash devices.

### 3.6.15 Serial Ports

The TQMxE39C2 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 7: Serial Port COM Express™ Port Mapping

COM Express™ Signal	COM Express™ Pin	TQMxE39C2	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#	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



Since Revision 2.0 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 TQMxE39C2 the protection circuit is removed by default and the serial ports provide transfer rates of up to 115 kbaud. Therefore the TQMxE39C2 can only be used in COM.0 Revision 2.0 Type 6 pin-out carrier boards.

### 3.6.16 Watchdog Timer

The TQMxE39C2 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.

### 3.7 Connectors

#### 3.7.1 COM Express™ Connector

Two 220-pin 0.5 mm pitch receptacles connect the TQMxE39C2 to the carrier board. On the carrier board two 220-pin 0.5 mm pitch plug connectors have to be provided. Two versions with 5 mm and 8 mm stacking height are available.

#### 3.7.2 Debug Header

The TQMxE39C2 includes a 14-pin flat cable connector, to connect an external debug module (TQ specific), to provide uEFI BIOS post code information, debug LEDs and a JTAG interface for on-board FPGA. On this header a TQM debug card can be plugged.

#### 3.7.3 TQM Debug Card

The TQM debug card is designed to provide access to several processor and chipset control signals. The uEFI BIOS Power-On Self-Test (POST) codes can be displayed through four hexadecimal display panels on the TQM debug card. When the COM Express module is turned on, the hexadecimal display should show the uEFI BIOS POST codes. If the COM Express module does not boot, the uEFI BIOS POST has detected a fatal fault and stopped. The number showing in the hexadecimal display on the TQM debug card is the number of the test in which uEFI BIOS boot failed.

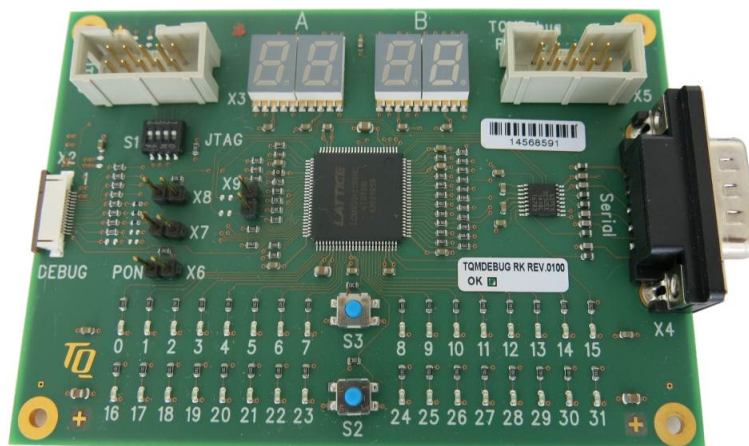


Illustration 2: TQM debug card

#### 3.7.4 Debug Module LED

The TQMxE39C2 includes a dual colour LED providing boot and BIOS information. The following table shows some LED boot messages.

Table 8: 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

### 3.8 COM Express™ Connector Pinout

This section describes the TQMxE39C2 COM Express™ connector pin assignment, which is compliant with COM.0 Revision 2.1 Type 6 pin-out definitions.

#### 3.8.1 Signal Assignment Abbreviations

Table 9 lists the abbreviations used in Table 10.

Table 9: Abbreviations used

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



Input signals at the COM Express™ connector can be left open on the carrier board, since these signals are terminated on the TQMxE39C2.



### 3.8.2 COM Express™ Connector Pin Assignment

Table 10: COM Express™ Connector Pin Assignment

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. Active low output.	O PD	TQ-flexiCFG
A16	SATA0_TX+	SATA differential transmit pair	O	
A17	SATA0_TX-	SATA differential transmit pair	O	
A18	SUS_S4#	Indicates system is in Suspend to Disk state. Active low output.	O PD	TQ-flexiCFG
A19	SATA0_RX+	SATA differential receive pair	I	
A20	SATA0_RX-	SATA differential receive pair	I	
A21	GND(FIXED)	Ground	GND	
A22	SATA2_TX+	SATA differential transmit pair	O	N/A
A23	SATA2_TX-	SATA differential transmit pair	O	N/A
A24	SUS_S5#	Indicates system is in Soft Off state. Active low output.	O PD	TQ-flexiCFG
A25	SATA2_RX+	SATA differential receive pair	I	N/A
A26	SATA2_RX-	SATA differential receive pair	I	N/A
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#	indicating that the CPU has entered thermal shutdown	O	
A36	USB6-	USB differential pair	IO	
A37	USB6+	USB differential pair	IO	
A38	USB_6_7_OC#	USB over-current sense, USB channels 6 and 7	I PU	
A39	USB4-	USB differential pair	IO	
A40	USB4+	USB differential pair	IO	
A41	GND(FIXED)	Ground	GND	
A42	USB2-	USB differential pair	IO	
A43	USB2+	USB differential pair	IO	
A44	USB_2_3_OC#	USB over-current sense, USB channels 2 and 3	I PU	
A45	USB0-	USB differential pair	IO	
A46	USB0+	USB differential pair	IO	
A47	VCC_RTC	Real-time clock circuit-power input	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	TQ-flexiCFG
A51	GND(FIXED)	Ground	GND	
A52	PCIE_TX5+	PCI Express differential transmit pair	O	N/A
A53	PCIE_TX5-	PCI Express differential transmit pair	O	N/A
A54	GPIO/SD_DATA0	GPIO / SDIO Data lines	I PU	TQ-flexiCFG
A55	PCIE_TX4+	PCI Express differential transmit pair	O	N/A



### 3.8.2 COM Express™ Connector Pin Assignment (continued)

Table 10: COM Express™ Connector Pin Assignment (continued)

Pin	Signal	Description	Type	Remark
A56	PCIE_TX4-	PCI Express differential transmit pair	O	N/A
A57	GND	Ground	GND	
A58	PCIE_TX3+	PCI Express differential transmit pair	O	
A59	PCIE_TX3-	PCI Express differential transmit pair	O	
A60	GND(FIXED)	Ground	GND	
A61	PCIE_TX2+	PCI Express differential transmit pair	O	
A62	PCIE_TX2-	PCI Express differential transmit pair	O	
A63	GPI1/SD_DATA1	GPI1 / SDIO Data lines	I PU	TQ-flexiCFG
A64	PCIE_TX1+	PCI Express differential transmit pair	O	
A65	PCIE_TX1-	PCI Express differential transmit pair	O	
A66	GND	Ground	GND	
A67	GPI2/SD_DATA2	GPI2 / SDIO Data lines	I PU	TQ-flexiCFG
A68	PCIE_TX0+	PCI Express differential transmit pair	O	
A69	PCIE_TX0-	PCI Express differential transmit pair	O	
A70	GND(FIXED)	Ground	GND	
A71	LVDS_A0+	LVDS Channel A differential pair 0	O	On request eDP
A72	LVDS_A0-	LVDS Channel A differential pair 0	O	On request eDP
A73	LVDS_A1+	LVDS Channel A differential pair 1	O	On request eDP
A74	LVDS_A1-	LVDS Channel A differential pair 1	O	On request eDP
A75	LVDS_A2+	LVDS Channel A differential pair 2	O	On request eDP
A76	LVDS_A2-	LVDS Channel A differential pair 2	O	On request eDP
A77	LVDS_VDD_EN	LVDS eDP panel power enable	O	On request eDP
A78	LVDS_A3+	LVDS Channel A differential pair 3	O	
A79	LVDS_A3-	LVDS Channel A differential pair 3	O	
A80	GND(FIXED)	Ground	GND	
A81	LVDS_A_CK+	LVDS Channel A differential clock	O	On request eDP
A82	LVDS_A_CK-	LVDS Channel A differential clock	O	On request eDP
A83	LVDS_I2C_CK	I <sup>2</sup> C clock output for LVDS display	IO	On request eDP
A84	LVDS_I2C_DAT	I <sup>2</sup> C data line for LVDS display	IO	On request eDP
A85	GPI3/SD_DATA3	GPI3 / SD_DATA3	I PU	TQ-flexiCFG
A86	RSVD18	Reserved	NC	
A87	eDP_HPDP	eDP Detection of Hot Plug	I PD	On request eDP
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 Module from Carrier SPI	I PU	
A93	GPO0/SD_CLK	GPO0 / SDIO Clock	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	TQ-flexiCFG
A97	TYPE10#	Type 10 Module indication (NC)	NC	
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	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	





### 3.8.2 COM Express™ Connector Pin Assignment (continued)

Table 10: COM Express™ Connector Pin Assignment (continued)

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	TQ-flexiCFG
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	O	
B17	SATA1_TX-	SATA differential transmit pair	O	
B18	SUS_STAT#	Indicates imminent suspend operation	O	
B19	SATA1_RX+	SATA differential receive pair	I	
B20	SATA1_RX-	SATA differential receive pair	I	
B21	GND(FIXED)	Ground	GND	
B22	SATA3_TX+	SATA differential transmit pair	O	N/A
B23	SATA3_TX-	SATA differential transmit pair	O	N/A
B24	PWR_OK	Power OK from main power supply	I PU	TQ-flexiCFG
B25	SATA3_RX+	SATA differential receive pair	I	N/A
B26	SATA3_RX-	SATA differential receive pair	I	N/A
B27	WDT	watchdog time-out	O	TQ-flexiCFG
B28	AC/HDA_SDIN2	Serial TDM data input	I PU	N/A
B29	AC/HDA_SDIN1	Serial TDM data input	I PU	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 I <sup>2</sup> C port clock output	IO	TQ-flexiCFG
B34	I2C_DAT	General purpose I <sup>2</sup> C port data I/O line	IO	TQ-flexiCFG
B35	THRM#	Input from carrier temperature sensor	I PU	
B36	USB7-	USB differential pair	IO	
B37	USB7+	USB differential pair	IO	
B38	USB_4_5_OC#	USB over-current sense, USB channels 4 and 5	I PU	
B39	USB5-	USB differential pair	IO	
B40	USB5+	USB differential pair	IO	
B41	GND(FIXED)	Ground	GND	
B42	USB3-	USB differential pair	IO	
B43	USB3+	USB differential pair	IO	
B44	USB_0_1_OC#	USB over-current sense, USB channels 0 and 1	I PU	
B45	USB1-	USB differential pair	IO	
B46	USB1+	USB differential pair	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	TQ-flexiCFG
B50	CB_RESET#	Reset output from Module to Carrier Board	O	TQ-flexiCFG
B51	GND(FIXED)	Ground	GND	
B52	PCIE_RX5+	PCI Express differential receive pair	I	N/A
B53	PCIE_RX5-	PCI Express differential receive pair	I	N/A
B54	GPO1/SD_CMD	GPO1 / SDIO Command	O PD	TQ-flexiCFG
B55	PCIE_RX4+	PCI Express differential receive pair	I	N/A



### 3.8.2 COM Express™ Connector Pin Assignment (continued)

Table 10: COM Express™ Connector Pin Assignment (continued)

Pin	Signal	Description	Type	Remark
B56	PCIE_RX4-	PCI Express differential receive pair	I	N/A
B57	GPO2 / SD_WP	GPO2 / SDIO Write Protect	I PD	TQ-flexiCFG
B58	PCIE_RX3+	PCI Express differential receive pair	I	
B59	PCIE_RX3-	PCI Express differential receive pair	I	
B60	GND(FIXED)	Ground	GND	
B61	PCIE_RX2+	PCI Express differential receive pair	I	
B62	PCIE_RX2-	PCI Express differential receive pair	I	
B63	GPO3/SD_CD#	GPO3 / SDIO Card Detect	O PD	TQ-flexiCFG
B64	PCIE_RX1+	PCI Express differential receive pair	I	
B65	PCIE_RX1-	PCI Express differential receive pair	I	
B66	WAKE0#	PCI Express wake up signal	I PU	TQ-flexiCFG
B67	WAKE1#	General purpose wake up signal	I PU	TQ-flexiCFG
B68	PCIE_RX0+	PCI Express differential receive pair	I	
B69	PCIE_RX0-	PCI Express differential receive pair	I	
B70	GND(FIXED)	Ground	GND	
B71	LVDS_B0+	LVDS Channel B differential pair 0	O	
B72	LVDS_B0-	LVDS Channel B differential pair 0	O	
B73	LVDS_B1+	LVDS Channel B differential pair 1	O	
B74	LVDS_B1-	LVDS Channel B differential pair 1	O	
B75	LVDS_B2+	LVDS Channel B differential pair 2	O	
B76	LVDS_B2-	LVDS Channel B differential pair 2	O	
B77	LVDS_B3+	LVDS Channel B differential pair 3	O	
B78	LVDS_B3-	LVDS Channel B differential pair 3	O	
B79	LVDS_BKLT_EN	LVDS panel backlight enable	O	On request eDP
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 panel backlight brightness control	O	On request eDP
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	VGA_RED	Red for monitor	O	N/A
B90	GND(FIXED)	Ground	GND	
B91	VGA_GRN	Green for monitor	O	N/A
B92	VGA_BLU	Blue for monitor	O	N/A
B93	VGA_HSYNC	Horizontal sync output to VGA monitor	O	N/A
B94	VGA_VSYNC	Vertical sync output to VGA monitor	O	N/A
B95	VGA_I2C_CK	DDC clock line	O	N/A
B96	VGA_I2C_DAT	DDC data line	IO	N/A
B97	SPI_CS#	Chip select for Carrier Board SPI	O	
B98	(RSVD) SER0_RTS#	Serial port 0, Request To Send	O	TQ-flexiCFG
B99	(RSVD) SER0_CTS#	Serial port 0, Clear To Send	I PU	TQ-flexiCFG
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	

### 3.8.2 COM Express™ Connector Pin Assignment (continued)

Table 10: COM Express™ Connector Pin Assignment (continued)

Pin	Signal	Description	Type	Remark
C1	GND(FIXED)	Ground	GND	
C2	GND	Ground	GND	
C3	USB_SSRX0-	SuperSpeed USB3.0 differential receive pair	I	
C4	USB_SSRX0+	SuperSpeed USB3.0 differential receive pair	I	
C5	GND	Ground	GND	
C6	USB_SSRX1-	SuperSpeed USB3.0 differential receive pair	I	
C7	USB_SSRX1+	SuperSpeed USB3.0 differential receive pair	I	
C8	GND	Ground	GND	
C9	USB_SSRX2-	SuperSpeed USB3.0 differential receive pair	I	
C10	USB_SSRX2+	SuperSpeed USB3.0 differential receive pair	I	
C11	GND(FIXED)	Ground	GND	
C12	USB_SSRX3-	SuperSpeed USB3.0 differential receive pair	I	N/A
C13	USB_SSRX3+	SuperSpeed USB3.0 differential receive pair	I	N/A
C14	GND	Ground	GND	
C15	DDI1_PAIR6+	DDI1 DP / HDMI / DVI differential pair 6	O	N/A
C16	DDI1_PAIR6-	DDI1 DP / HDMI / DVI differential pair 6	O	N/A
C17	RSVD18	Reserved	NC	
C18	RSVD18	Reserved	NC	
C19	PCIE_RX6+	PCI Express differential receive pair	I	N/A
C20	PCIE_RX6-	PCI Express differential receive pair	I	N/A
C21	GND(FIXED)	Ground	GND	
C22	PCIE_RX7+	PCI Express differential receive pair	I	N/A
C23	PCIE_RX7-	PCI Express differential receive pair	I	N/A
C24	DDI1_HPD	DDI1 Detection of Hot Plug	I PD	
C25	DDI1_PAIR4+	DDI1 DP / HDMI / DVI differential pair 4	O	N/A
C26	DDI1_PAIR4-	DDI1 DP / HDMI / DVI differential pair 4	O	N/A
C27	RSVD18	Reserved	NC	
C28	RSVD18	Reserved	NC	
C29	DDI1_PAIR5+	DDI1 DP / HDMI / DVI differential pair 5	O	N/A
C30	DDI1_PAIR5-	DDI1 DP / HDMI / DVI differential pair 5	O	N/A
C31	GND(FIXED)	Ground	GND	
C32	DDI2_CTRLCLK_AUX+	DDI2_CTRLCLK_AUX+ signal DP AUX, HDMI / DVI CLK	IO	
C33	DDI2_CTRLDATA_AUX-	DDI2_CTRLDATA_AUX- signal DP AUX, HDMI / DVI DATA	IO	
C34	DDI2_DDC_AUX_SEL	Selects the function of DDI2_CTRLxAUX+/- Signals	I PD	
C35	RSVD18	Reserved	NC	
C36	DDI3_CTRLCLK_AUX+	DDI3_CTRLCLK_AUX+ signal DP AUX, HDMI / DVI CLK	IO	N/A
C37	DDI3_CTRLDATA_AUX-	DDI3_CTRLDATA_AUX- signal DP AUX, HDMI / DVI DATA	IO	N/A
C38	DDI3_DDC_AUX_SEL	Selects the function of DDI3_CTRLxAUX+/- Signals	I PU	N/A
C39	DDI3_PAIR0+	DDI3 DP / HDMI / DVI differential pair 3	O	N/A
C40	DDI3_PAIR0-	DDI3 DP / HDMI / DVI differential pair 3	O	N/A
C41	GND(FIXED)	Ground	GND	
C42	DDI3_PAIR1+	DDI3 DP / HDMI / DVI differential pair 1	O	N/A
C43	DDI3_PAIR1-	DDI3 DP / HDMI / DVI differential pair 1	O	N/A
C44	DDI3_HPD	DDI3 Detection of Hot Plug	I PD	N/A
C45	RSVD18	Reserved	NC	
C46	DDI3_PAIR2+	DDI3 DP / HDMI / DVI differential pair 2	O	N/A
C47	DDI3_PAIR2-	DDI3 DP / HDMI / DVI differential pair 2	O	N/A
C48	RSVD18	Reserved	NC	
C49	DDI3_PAIR3+	DDI3 DP / HDMI / DVI differential pair 3	O	N/A
C50	DDI3_PAIR3-	DDI3 DP / HDMI / DVI differential pair 3	O	N/A
C51	GND(FIXED)	Ground	GND	
C52	PEG_RX0+	PCI Express differential receive pair	I	N/A
C53	PEG_RX0-	PCI Express differential receive pair	I	N/A
C54	TYPE0#	Type 0 Module indication (NC)	NC	
C55	PEG_RX1+	PCI Express differential receive pair	I	N/A



### 3.8.2 COM Express™ Connector Pin Assignment (continued)

Table 10: COM Express™ Connector Pin Assignment (continued)

Pin	Signal	Description	Type	Remark
C56	PEG_RX1-	PCI Express differential receive pair	I	N/A
C57	TYPE1#	Type 1 Module indication (NC)	NC	
C58	PEG_RX2+	PCI Express differential receive pair	I	N/A
C59	PEG_RX2-	PCI Express differential receive pair	I	N/A
C60	GND(FIXED)	Ground	GND	
C61	PEG_RX3+	PCI Express differential receive pair	I	N/A
C62	PEG_RX3-	PCI Express differential receive pair	I	N/A
C63	RSVD18	Reserved	NC	
C64	RSVD18	Reserved	NC	
C65	PEG_RX4+	PCI Express differential receive pair	I	N/A
C66	PEG_RX4-	PCI Express differential receive pair	I	N/A
C67	RSVD18	Reserved	NC	
C68	PEG_RX5+	PCI Express differential receive pair	I	N/A
C69	PEG_RX5-	PCI Express differential receive pair	I	N/A
C70	GND(FIXED)	Ground	GND	
C71	PEG_RX6+	PCI Express differential receive pair	I	N/A
C72	PEG_RX6-	PCI Express differential receive pair	I	N/A
C73	GND	Ground	GND	
C74	PEG_RX7+	PCI Express differential receive pair	I	N/A
C75	PEG_RX7-	PCI Express differential receive pair	I	N/A
C76	GND	Ground	GND	
C77	RSVD18	Reserved	NC	
C78	PEG_RX8+	PCI Express differential receive pair	I	N/A
C79	PEG_RX8-	PCI Express differential receive pair	I	N/A
C80	GND(FIXED)	Ground	GND	
C81	PEG_RX9+	PCI Express differential receive pair	I	N/A
C82	PEG_RX9-	PCI Express differential receive pair	I	N/A
C83	RSVD18	Reserved	NC	
C84	GND	Ground	GND	
C85	PEG_RX10+	PCI Express differential receive pair	I	N/A
C86	PEG_RX10-	PCI Express differential receive pair	I	N/A
C87	GND	Ground	GND	
C88	PEG_RX11+	PCI Express differential receive pair	I	N/A
C89	PEG_RX11-	PCI Express differential receive pair	I	N/A
C90	GND(FIXED)	Ground	GND	
C91	PEG_RX12+	PCI Express differential receive pair	I	N/A
C92	PEG_RX12-	PCI Express differential receive pair	I	N/A
C93	GND	Ground	GND	
C94	PEG_RX13+	PCI Express differential receive pair	I	N/A
C95	PEG_RX13-	PCI Express differential receive pair	I	N/A
C96	GND	Ground	GND	
C97	RSVD18	Reserved	IO	TQ-flexiCFG
C98	PEG_RX14+	PCI Express differential receive pair	I	N/A
C99	PEG_RX14-	PCI Express differential receive pair	I	N/A
C100	GND(FIXED)	Ground	GND	
C101	PEG_RX15+	PCI Express differential receive pair	I	N/A
C102	PEG_RX15-	PCI Express differential receive pair	I	N/A
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	



### 3.8.2 COM Express™ Connector Pin Assignment (continued)

Table 10: COM Express™ Connector Pin Assignment (continued)

Pin	Signal	Description	Type	Remark
D1	GND(FIXED)	Ground	GND	
D2	GND	Ground	GND	
D3	USB_SSTX0-	SuperSpeed USB3.0 differential transmit pair	O	
D4	USB_SSTX0+	SuperSpeed USB3.0 differential transmit pair	O	
D5	GND	Ground	GND	
D6	USB_SSTX1-	SuperSpeed USB3.0 differential transmit pair	O	
D7	USB_SSTX1+	SuperSpeed USB3.0 differential transmit pair	O	
D8	GND	Ground	GND	
D9	USB_SSTX2-	SuperSpeed USB3.0 differential transmit pair	O	
D10	USB_SSTX2+	SuperSpeed USB3.0 differential transmit pair	O	
D11	GND(FIXED)	Ground	GND	
D12	USB_SSTX3-	SuperSpeed USB3.0 differential transmit pair	O	N/A
D13	USB_SSTX3+	SuperSpeed USB3.0 differential transmit pair	O	N/A
D14	GND	Ground	GND	
D15	DDI1_CTRLCLK_AUX+	DDI1_CTRLCLK_AUX+ signal DP AUX, HDMI / DVI CLK	IO	
D16	DDI1_CTRLDATA_AUX-	DDI1_CTRLDATA_AUX- signal DP AUX, HDMI / DVI DATA	IO	
D17	RSVD18	Reserved	NC	
D18	RSVD18	Reserved	NC	
D19	PCIE_TX6+	PCI Express differential transmit pair	O	N/A
D20	PCIE_TX6-	PCI Express differential transmit pair	O	N/A
D21	GND(FIXED)	Ground	GND	
D22	PCIE_TX7+	PCI Express differential transmit pair	O	N/A
D23	PCIE_TX7-	PCI Express differential transmit pair	O	N/A
D24	(RSVD) SER1_RTS#	Serial port 1, Request To Send	O	TQ-flexiCFG
D25	(RSVD) SER1_CTS#	Serial port 1, Clear To Send	I PU	TQ-flexiCFG
D26	DDI1_PAIR0+	DDI1 DP / HDMI / DVI differential pair 0	O	
D27	DDI1_PAIR0-	DDI1 DP / HDMI / DVI differential pair 0	O	
D28	RSVD18	Reserved	NC	
D29	DDI1_PAIR1+	DDI1 DP / HDMI / DVI differential pair 1	O	
D30	DDI1_PAIR1-	DDI1 DP / HDMI / DVI differential pair 1	O	
D31	GND(FIXED)	Ground	GND	
D32	DDI1_PAIR2+	DDI1 DP / HDMI / DVI differential pair 2	O	
D33	DDI1_PAIR2-	DDI1 DP / HDMI / DVI differential pair 2	O	
D34	DDI1_DDC_AUX_SEL	Selects the function of DDI1_CTRLxAUX+/- Signals	I PD	
D35	RSVD18	Reserved	NC	
D36	DDI1_PAIR3+	DDI1 DP / HDMI / DVI differential pair 3	O	
D37	DDI1_PAIR3-	DDI1 DP / HDMI / DVI differential pair 3	O	
D38	RSVD18	Reserved	NC	
D39	DDI2_PAIR0+	DDI2 DP / HDMI / DVI differential pair 0	O	
D40	DDI2_PAIR0-	DDI2 DP / HDMI / DVI differential pair 0	O	
D41	GND(FIXED)	Ground	GND	
D42	DDI2_PAIR1+	DDI2 DP / HDMI / DVI differential pair 1	O	
D43	DDI2_PAIR1-	DDI2 DP / HDMI / DVI differential pair 1	O	
D44	DDI2_HPD	DDI2 Detection of Hot Plug	I PD	
D45	RSVD18	Reserved	NC	
D46	DDI2_PAIR2+	DDI2 DP / HDMI / DVI differential pair 2	O	
D47	DDI2_PAIR2-	DDI2 DP / HDMI / DVI differential pair 2	O	
D48	RSVD18	Reserved	NC	
D49	DDI2_PAIR3+	DDI2 DP / HDMI / DVI differential pair 3	O	
D50	DDI2_PAIR3-	DDI2 DP / HDMI / DVI differential pair 3	O	
D51	GND(FIXED)	Ground	GND	
D52	PEG_TX0+	PCI Express differential transmit pair	O	N/A
D53	PEG_TX0-	PCI Express differential transmit pair	O	N/A
D54	PEG_LANE_RV#	PCI Express Graphics lane reversal input strap	I PU	
D55	PEG_TX1+	PCI Express differential transmit pair	O	N/A

## 3.8.2 COM Express™ Connector Pin Assignment (continued)

Table 10: COM Express™ Connector Pin Assignment (continued)

Pin	Signal	Description	Type	Remark
D56	PEG_TX1-	PCI Express differential transmit pair	O	N/A
D57	TYPE2#	Type 2 Module indication (GND)	O	
D58	PEG_TX2+	PCI Express differential transmit pair	O	N/A
D59	PEG_TX2-	PCI Express differential transmit pair	O	N/A
D60	GND(FIXED)	Ground	GND	
D61	PEG_TX3+	PCI Express differential transmit pair	O	N/A
D62	PEG_TX3-	PCI Express differential transmit pair	O	N/A
D63	RSVD18	Reserved	NC	
D64	RSVD18	Reserved	NC	
D65	PEG_TX4+	PCI Express differential transmit pair	O	N/A
D66	PEG_TX4-	PCI Express differential transmit pair	O	N/A
D67	GND	Ground	GND	
D68	PEG_TX5+	PCI Express differential transmit pair	O	N/A
D69	PEG_TX5-	PCI Express differential transmit pair	O	N/A
D70	GND(FIXED)	Ground	GND	
D71	PEG_TX6+	PCI Express differential transmit pair	O	N/A
D72	PEG_TX6-	PCI Express differential transmit pair	O	N/A
D73	GND	Ground	GND	
D74	PEG_TX7+	PCI Express differential transmit pair	O	N/A
D75	PEG_TX7-	PCI Express differential transmit pair	O	N/A
D76	GND	Ground	GND	
D77	RSVD18	Reserved	NC	
D78	PEG_TX8+	PCI Express differential transmit pair	O	N/A
D79	PEG_TX8-	PCI Express differential transmit pair	O	N/A
D80	GND(FIXED)	Ground	GND	
D81	PEG_TX9+	PCI Express differential transmit pair	O	N/A
D82	PEG_TX9-	PCI Express differential transmit pair	O	N/A
D83	RSVD18	Reserved	NC	
D84	GND	Ground	GND	
D85	PEG_TX10+	PCI Express differential transmit pair	O	N/A
D86	PEG_TX10-	PCI Express differential transmit pair	O	N/A
D87	GND	Ground	GND	
D88	PEG_TX11+	PCI Express differential transmit pair	O	N/A
D89	PEG_TX11-	PCI Express differential transmit pair	O	N/A
D90	GND(FIXED)	Ground	GND	
D91	PEG_TX12+	PCI Express differential transmit pair	O	N/A
D92	PEG_TX12-	PCI Express differential transmit pair	O	N/A
D93	GND	Ground	GND	
D94	PEG_TX13+	PCI Express differential transmit pair	O	N/A
D95	PEG_TX13-	PCI Express differential transmit pair	O	N/A
D96	GND	Ground	GND	
D97	RSVD18	Reserved	IO	TQ-flexiCFG
D98	PEG_TX14+	PCI Express differential transmit pair	O	N/A
D99	PEG_TX14-	PCI Express differential transmit pair	O	N/A
D100	GND(FIXED)	Ground	GND	
D101	PEG_TX15+	PCI Express differential transmit pair	O	N/A
D102	PEG_TX15-	PCI Express differential transmit pair	O	N/A
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 TQMxE39C2 Dimensions

The dimensions of the TQMxE39C2 are  $95 \times 95 \text{ mm}^2 (\pm 0.2 \text{ mm})$ .

The following illustration shows the Three-View Drawing of the TQMxE39C2.

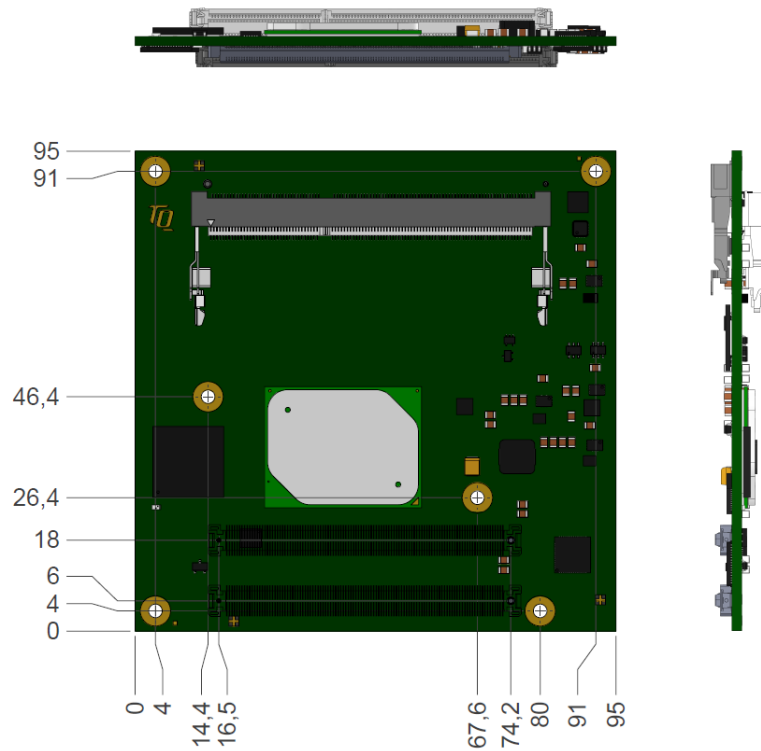


Illustration 3: Three-view drawing TQMxE39C2

The following illustration shows the bottom view of the TQMxE39C2.

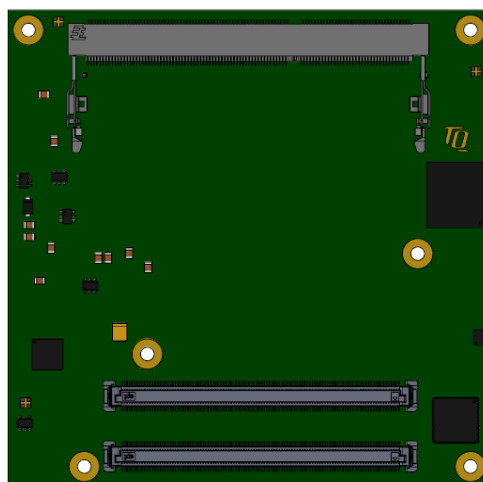


Illustration 4: Bottom view drawing TQMxE39C2



## 4.2 Heat spreader Dimensions

The TQMxE39C2 supports two different heat spreader versions.

Heat spreader for the Intel® Pentium® N4200, and Intel® Celeron® N3350 CPU

- **TQMxE39C2-HSP-N:**  
This version is compliant to the COM Express™ specification with 13 mm ( $\pm 0.2$  mm) (including PCB).

Heat spreader for the Intel® Atom™ E3900 CPU

- **TQMxE39C2-HSP-E:**  
This version is compliant to the COM Express™ specification with 13 mm ( $\pm 0.2$  mm) (including PCB).

The following illustration shows the heat spreader (TQMxE39C2-HSP) for the TQMxE39C2.

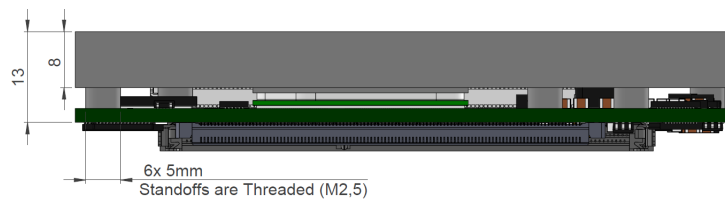


Illustration 5: Heat Spreader TQMxE39C2-HSP

### Attention: Heat Spreader



The packages of Intel® Pentium® N4200 and Intel® Celeron® N3350 CPUs differ to the package of the Intel® Atom™ E3900 CPU!

The Intel® Atom™ E3900 CPU family includes an integrated heat spreader, the Intel® Pentium® N4200 and Intel® Celeron® N3350 CPUs have no integrated heat spreader.

Both CPU packages require different heat spreader versions. It is not permitted to use the TQMxE39C2-HSP-E heat spreader on the Intel® Pentium® N4200 or the Intel® Celeron® N3350 CPU.

It is also not permitted to use the TQMxE39C2-HSP-N heat spreader on the Intel® Atom™ E3900 CPU. Mounting the wrong heat spreader will damage the TQMxE39C2.

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

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

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

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

### 4.3 Mechanical and Thermal Considerations

The TQMxE39C2 is designed to operate in a wide thermal range.

An important factor for each system integration is the thermal design. The heat spreader acts as a thermal coupling element to the TQMxE39C2. The heat spreader is thermally coupled to the CPU. It provides optimal heat transfer from the TQMxE39C2 to the heat spreader. The heat spreader itself is not an appropriate heat sink.

System designers can implement different passive and active cooling through the thermal connection to the heat spreader.

#### Attention: Thermal Considerations



Do not operate the TQMxE39C2 without heat spreader or without heat sink!  
The heat spreader is not a sufficient heat sink!

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

Please contact [TQ-Support](#) for more information about thermal configuration.

### 4.4 Protection Against External Effects

The TQMxE39C2 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 [TQ-Support](#) for further details.



## 5 SOFTWARE

### 5.1 System Resources

#### 5.1.1 I<sup>2</sup>C Bus

The TQMxE39C2 provides a general purpose I<sup>2</sup>C port via a dedicated LPC to I<sup>2</sup>C controller in the TQ-flexiCFG block. The following table shows the I<sup>2</sup>C address mapping for the COM Express™ I<sup>2</sup>C port.

Table 11: I<sup>2</sup>C Address Mapping COM Express™ I<sup>2</sup>C Port

8-bit Address	Function	Remark
0xA0	TQMxE39C2 EEPROM	–
0xAE	Carrier Board EEPROM	Embedded EEPROM configuration not supported

#### 5.1.2 SMBus

The TQMxE39C2 provides a System Management Bus (SMBus). The following table shows the I<sup>2</sup>C address mapping for the COM Express™ SMBus port.

Table 12: I<sup>2</sup>C 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 TQMxE39C2 supports the standard PC system memory and I/O memory map. Please contact [TQ-Support](#) for further information about the memory map.

#### 5.1.4 IRQ Map

The TQMxE39C2 supports the standard PC Interrupt routing. The integrated legacy devices (COM1, COM2) can be configured via the BIOS to IRQ3 and IRQ4. Please contact [TQ-Support](#) for further information about the Interrupt configuration.



## 5.2 Operating Systems

### 5.2.1 Supported Operating Systems

The TQMxE39C2 supports various Operating Systems:

- Microsoft® Windows® 10
- Linux (i.e. Ubuntu 16.04.2 or later)

Other Operating Systems are supported on request.

Please contact [TQ-Support](#) for further information about supported Operating Systems.

### 5.2.2 Driver Download

The TQMxE39C2 is well supported by Standard Operating Systems, which already include most of the drivers required. The latest Intel® drivers are recommended for best performance and to support the full feature set of the TQMxE39C2.

A pre-selection for the SoC used on the TQMxE39C2 can be found on this Intel® page:

<https://downloadcenter.intel.com/download/26744/Processor-E3900-Series-Intel-Celeron-Processor-N3350-and-Intel-Pentium-Processor-N4200-Patch-File>

The generic entry for Intel® download center can be found here:

<https://downloadcenter.intel.com/>

The White Paper “Windows Driver Installation Instructions” provides information about how to install the Windows driver.

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

## 5.3 TQ-Systems Embedded Application Programming Interface (EAPI)

The Embedded Application Programming Interface (EAPI) provided by TQ-Systems is a driver package to access and control hardware resources on all TQ-Systems COM Express™ modules.

The TQ-Systems EAPI complies with the PICMG® specification.

## 5.4 Software Tools

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

## 6 BIOS

The TQMxE39C2 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>.

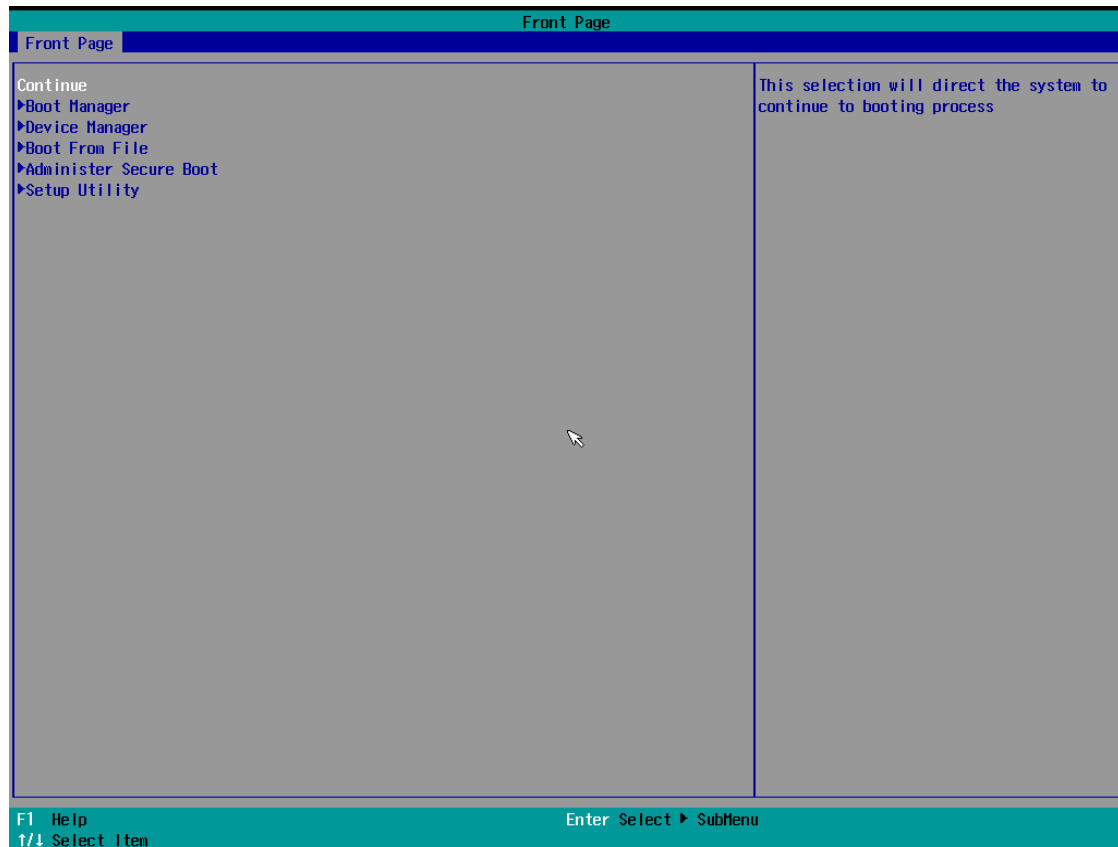


Illustration 6: InsydeH2O BIOS Front Page

### 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 dual/single mode	Single LVDS bus mode / Dual LVDS bus mode	Configure LVDS Single/dual bus mode.
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



### 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 1 (EFP1).
EFP 2 Configuration	HDMI/DVI / DisplayPort with HDMI/DVI Compatible / No Device	Configure or disable the External Flat Panel 2 (EFP2).

### 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 will 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.

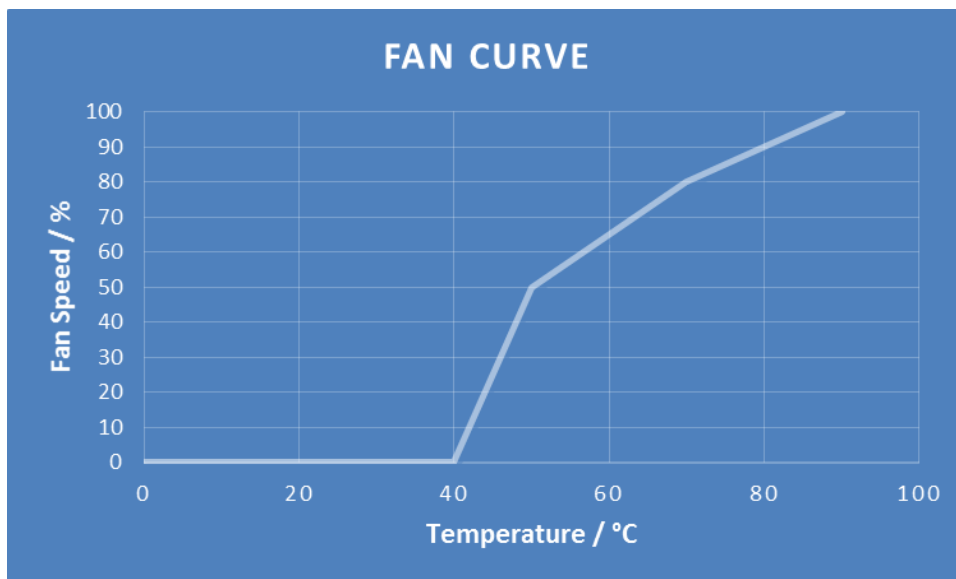


Illustration 7: Fan Curve



### 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 (Ser3)	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 hidden 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 hidden when Active Processor Cores is disabled.
Core 2	Enabled / Disabled	Enable or disable Core 2. This option is hidden when Active Processor Cores is disabled.
Core 3	Enabled / Disabled	Enable or disable Core 3. This option is hidden 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. Hidden 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. Hidden 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. Hidden 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. Hidden if C-States is disabled.
C-State Auto Demotion	Disabled / C1	Configure C-State Auto Demotion. Hidden if C-States is disabled.
C-State Un-demotion	Disabled / C1	Configure C-State Un-demotion. Hidden 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.
Quiet 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 TQMxE39C2.

Please read the entire instructions before beginning the BIOS update.

By disregarding the information you can destroy the uEFI BIOS on the TQMxE39C2.

This document will guide the customer to update the uEFI BIOS on the TQMxE39C2 by using the Insyde Flash Firmware Tools.

Please contact [support@tq-group.com](mailto:support@tq-group.com) for more information to the latest uEFI BIOS version for the TQMxE39C2.

#### 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 hd34b0b0b blk0
      PciRoot(0x0)/Pci(0x15, 0x0)/USB(0x1, 0x0)/USB(0x1, 0x0)/HD(1, MBR, 0x00000000, 0x2000, 0x1E1D800)
  blk0 :Removable HardDisk - Alias hd34b0b0b 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 tqmxe39c”) 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 hd34b0b0b blk0
      PciRoot(0x0)/Pci(0x15, 0x0)/USB(0x1, 0x0)/USB(0x1, 0x0)/HD(1, MBR, 0x00000000, 0x2000, 0x1E1D800)
  blk0 :Removable HardDisk - Alias hd34b0b0b 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 TQMxE39C\TQMxE39C_5.12.30.21.12.bin -all -ra
```

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: TQMxE39C X64
New BIOS Model Name: TQMxE39C X64
Current BIOS Version: TQMxE39C.5.12.30.21.08
New BIOS Version: TQMxE39C.5.12.30.21.12
```

```
Save SMBIOS Structures
Updating Block at FFB50000h
```

```
0% 25% 50% 75% 100%
[Progress bar showing 40% completion]
```

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.

```
Administrator: Command Prompt - H2OFFT-Wx64.exe TQMxE39C_5.12.30.21.12.bin -all -ra
C:\Users\TQMxE39M>cd Desktop
C:\Users\TQMxE39M\Desktop>cd InsydeH2OFFT_x86_WIN64_200.00.00.03
C:\Users\TQMxE39M\Desktop\InsydeH2OFFT_x86_WIN64_200.00.00.03>H2OFFT-Wx64.exe TQMxE39C_5.12.30.21.12.bin -all -ra
Read file successfully. (path="platform.ini")
Read file successfully. (path="msg_eng.ini")

          Information
    Please do not remove the AC power

    Insyde H2OFFT (Flash Firmware Tool) Version (SEG) 200.00.00.03
    Copyright(c) 2012 - 2018, Insyde Software Corp. All Rights Reserved.

          Initializing

    Current BIOS Model name: TQMxE39C X64
    New     BIOS Model name: TQMxE39C X64

    Current BIOS version: TQMxE39C.5.12.30.21.08
    New     BIOS version: TQMxE39C.5.12.30.21.12
           Save SMBIOS Structures

[===          ] Updating Block at FF9AC000h (20%)
```

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 TQMxE39C2 Module

After the uEFI BIOS update the new uEFI BIOS configures the complete TQMxE39C2 hardware and this results in some reboots and the first boot time takes longer (up to 1 – 2 minutes).

The TQMxE39C2 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: TQMxE39C2 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.

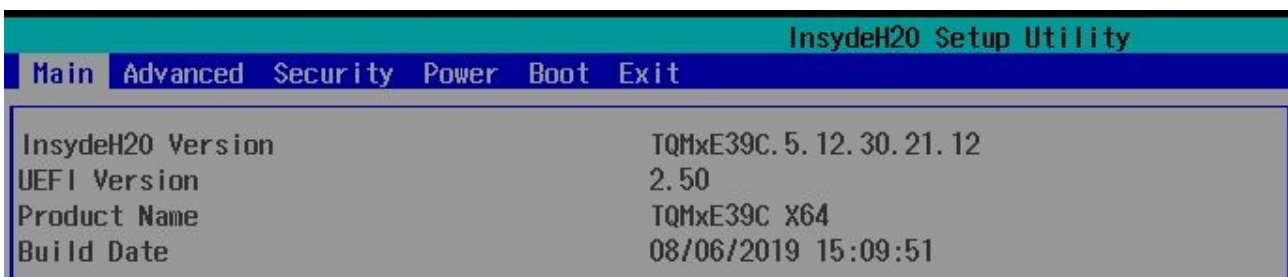


Illustration 13: EFI BIOS Main Menu



## 7 SAFETY REQUIREMENTS AND PROTECTIVE REGULATIONS

### 7.1 EMC

The TQMxE39C2 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 interspersions on the signal path from the input to the protection circuit in the system, the protection against electrostatic discharge should be arranged directly at the inputs of a system. As these measures always have to be implemented on the carrier board, no special preventive measures were done on the TQMxE39C2.

### 7.3 Shock & Vibration

The TQMxE39C2 is designed to be insensitive to shock / vibration and impact.

### 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 have not been carried out.

### 7.5 Reliability and Service Life

The MTBF according to MIL-HDBK-217F N2 is 417,006 hours, Ground Benign, at +40 °C.



## 8 ENVIRONMENTAL PROTECTION

### 8.1 RoHS

The TQMxE39C2 is manufactured RoHS compliant.

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

### 8.2 WEEE®

The company placing the product in 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.

### 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 Ecodesign Directive, also Energy using Products (EuP), is applicable to products for the end user with an annual quantity >200,000. The TQMxE39C2 must therefore always be seen in conjunction with the complete device.

The available standby and sleep modes of the components on the TQMxE39C2 enable compliance with EuP requirements for the TQMxE39C2.

### 8.5 Battery

No batteries are assembled on the TQMxE39C2.

### 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 TQMxE39C2, 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 TQMxE39C2 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 there is currently 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 13: 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 <sup>2</sup> C	Inter-Integrated Circuit
IDE	Integrated Device Electronics
IEEE®	Institute of Electrical and Electronics Engineers
IO	Input Output
IoT	Internet of Things
IP	Ingress Protection
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
LPC	Low Pin-Count
LVDS	Low Voltage Differential Signal





## 9.1 Acronyms and definitions (continued)

Table 13: Acronyms (continued)

Acronym	Meaning
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
OS	Operating System
PC	Personal Computer
PCB	Printed Circuit Board
PCI	Peripheral Component Interconnect
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 14: Further Applicable Documents and Links

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

