Qseven

User Manual

CQ7-D03

Carrier Board for Qseven® Rel. 2.1
in embedded NUC™ form factor

SECO

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REVISION HISTORY

Revision	Date	Note	Rif
1.0	26th April 2022	First official release	SO
1.1	20th May 2022	Included indications on balancing peripherals' power consumptions	SO

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For further information on this module or other SECO products, but also to get the required assistance for any and possible issues, please contact us using the dedicated web form available at http://www.seco.com (registration required).

Our team is ready to assist you.

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Chapter 1.
INTRODUCTION

- Warranty
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1.1 Warranty

This product is subject to the Italian Law Decree 24/2002, acting European Directive 1999/44/CE on matters of sale and warranties to consumers.

The warranty on this product lasts 1 year.

Under the warranty period, the Supplier guarantees the buyer assistance and service for repairing, replacing or credit of the item, at the Supplier's own discretion.

Shipping costs that apply to non-conforming items or items that need replacement are to be paid by the customer.

Items cannot be returned unless previously authorised by the supplier.

The authorisation is released after completing the specific form available on the web-site https://www.seco.com/us/support/online-rma.html (RMA Online). The RMA authorisation number must be put both on the packaging and on the documents shipped with the items, which must include all the accessories in their original packaging, with no signs of damage to, or tampering with, any returned item.

The error analysis form identifying the fault type must be completed by the customer and has must accompany the returned item.

If any of the above-mentioned requirements for RMA is not satisfied, the item will be shipped back and the customer will have to pay any and all shipping costs.

Following a technical analysis, the supplier will verify if all the requirements, for which a warranty service applies, are met. If the warranty cannot be applied, the Supplier will calculate the minimum cost of this initial analysis on the item and the repair costs. Costs for replaced components will be calculated separately.

Warning!
All changes or modifications to the equipment not explicitly approved by SECO S.p.A. could impair the equipment and could void the warranty.

1.2 Information and assistance

What do I have to do if the product is faulty?

SECO S.p.A. offers the following services:

- SECO website: visit http://www.seco.com to receive the latest information on the product. In most cases it is possible to find useful information to solve the problem.
- SECO Sales Representative: the Sales Rep can help to determine the exact cause of the problem and search for the best solution.
- SECO Help-Desk: contact SECO Technical Assistance. A technician is at disposal to understand the exact origin of the problem and suggest the correct solution.

  E-mail: technical.service@seco.com

  Fax (+39) 0575 350210
- Repair centre: it is possible to send the faulty product to the SECO Repair Centre. In this case, follow this procedure:
  - Returned items must be accompanied by a RMA Number. Items sent without the RMA number will be not accepted.
  - Returned items must be shipped in an appropriate package. SECO is not responsible for damages caused by accidental drop, improper usage, or customer neglect.

Note: Please have the following information before requesting for technical assistance:

- Name and serial number of the product;
- Description of Customer's peripheral connections;
- Description of Customer's software (operating system, version, application software, etc.);
- A complete description of the problem;
- The exact words of every kind of error message encountered.

1.3 RMA number request

To request a RMA number, please visit SECO's web-site. On the home page, please select "RMA Online" and follow the procedure described.

A RMA Number will be released within 1 working day (only for on-line RMA requests).

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1.4 Safety

The CQ7-D03 board uses only low voltages.

While handling the board, please use extreme caution to avoid any kind of risk or damages to electronic components.

Always switch the power off, and unplug the power supply unit, before handling the board and/or connecting cables or other boards.

Avoid using metallic components - like paper clips, screws and similar - near the board when connected to a power supply, to avoid short circuits due to unwanted contacts with other board components.

If the board has become wet, never connect it to any external power supply unit or battery.

Check carefully that all cables are correctly connected and that they are not damaged.

1.5 Electrostatic Discharges

The CQ7-D03 board, like any other electronic product, is an electrostatic sensitive device: high voltages caused by static electricity could damage some or all the devices and/or components on-board.

Whenever handling a CQ7-D59 board, ground yourself through an anti-static wrist strap. Placement of the board on an anti-static surface is also highly recommended.

1.6 RoHS compliance

The CQ7-D03 board is designed using RoHS compliant components and is manufactured on a lead-free production line. It is therefore fully RoHS compliant.

1.7 Terminology and definitions

ACPI	Advanced Configuration and Power Interface, an open industrial standard for the board's devices configuration and power management
AC'97	Audio Codec'97, a standard for audio hardware codecs developed by Intel® in 1997
API	Application Program Interface, a set of commands and functions that can be used by programmers for writing software for specific Operating Systems
BIOS	Basic Input / Output System, the Firmware Interface that initializes the board before the OS starts loading
CEC	Consumer Electronics Control, an HDMI feature which allows controlling more devices connected together by using only one remote control
DDC	Display Data Channel, a kind of I2C interface for digital communication between displays and graphics processing units (GPU)
DP	Display Port, a type of digital video display interface
DVI	Digital Visual interface, a type of digital video display interface
eDP	embedded Display Port, a type of digital video display interface developed especially for internal connections between boards and digital displays
GbE	Gigabit Ethernet
Gbps	Gigabits per second
GND	Ground
GPI/O	General purpose Input/Output
HD Audio	High Definition Audio, most recent standard for hardware codecs developed by Intel® in 2004 for higher audio quality
HDMI	High Definition Multimedia Interface, a digital audio and video interface
I2C Bus	Inter-Integrated Circuit Bus, a simple serial bus consisting only of data and clock line, with multi-master capability
I2S	Inter-Integrated Circuit Sound, an audio serial bus protocol interface developed by Philips (now NXP) in 1986
JTAG	Joint Test Action Group, common name of IEEE1149.1 standard for testing printed circuit boards and integrated circuits through the Debug port
LPC Bus	Low Pin Count Bus, a low speed interface based on a very restricted number of signals, deemed to management of legacy peripherals
LVDS	Low Voltage Differential Signalling, a standard for transferring data at very high speed using inexpensive twisted pair copper cables, usually used for video applications
Mbps	Megabits per second
N.A.	Not Applicable
N.C.	Not Connected
OS	Operating System
PCI-e	Peripheral Component Interface Express
PSU	Power Supply Unit

PWM	Pulse Width Modulation
PWR	Power
SATA	Serial Advance Technology Attachment, a differential half duplex serial interface for Hard Disks
SD	Secure Digital, a memory card type
SDIO	Secure Digital Input/Output, an evolution of the SD standard that allows the use of the same SD interface to drive different Input/Output devices, like cameras, GPS, Tuners and so on
SIM	Subscriber Identity Module, a card which stores all data of the owner necessary to allow him accessing to mobile communication networks
SM Bus	System Management Bus, a subset of the I2C bus dedicated to communication with devices for system management, like a smart battery and other power supply-related devices
SPI	Serial Peripheral Interface, a 4-Wire synchronous full-duplex serial interface which is composed a master and one or more slaves, individually enabled through a Chip Select line
TBM	To be measured
TMDS	Transition-Minimized Differential Signalling, a method for transmitting high speed serial data, normally used on DVI and HDMI interfaces
TTL	Transistor-transistor Logic
UIM	User Identity Module, an extension of SIM modules.
USB	Universal Serial Bus
V_REF	Voltage reference Pin

1.8 Reference specifications

Here below it is a list of applicable industry specifications and reference documents.

Reference	Link
ACPI	http://www.acpi.info
AC'97	http://download.intel.com/support/motherboards/desktop/sb/ac97_r23.pdf
Gigabit Ethernet	http://standards.ieee.org/about/get/802/802.3.html
HD Audio	http://www.intel.com/content/dam/www/public/us/en/documents/product-specifications/high-definition-audio-specification.pdf
HDMI	http://www.hdmi.org/index.aspx
I2C	http://www.nxp.com/documents/other/UM10204_v5.pdf
I2S	https://www.sparkfun.com/datasheets/BreakoutBoards/I2SBUS.pdf
LVDS	http://www.ti.com/ww/en/analog/interface/lvds.shtml http://www.ti.com/lit/ml/snla187/snla187.pdf
PCI Express	http://www.pcisig.com/specifications/pciexpress
Qseven® specifications	Qseven Specification Rev. 2.1 (sget.org)
Qseven® Design Guide	https://sget.org/wp-content/uploads/2018/09/Qseven_Design_Guide_2_0.pdf
SD Card Association	https://www.sdcard.org/home
TMDS	http://www.siliconimage.com/technologies/tmds
USB 2.0 and USB OTG	http://www.usb.org/developers/docs/usb_20_070113.zip
USB 3.0	http://www.usb.org/developers/docs/usb_30_spec_070113.zip

Chapter 2.
OVERVIEW

- Introduction
- Technical Specifications
- Electrical Specifications
- Mechanical Specifications
- Block Diagram

2.1 Introduction

CQ7-D03 is a carrier board for Qseven® rel. 2.1 Modules in embedded NUC™ form factor

The connection to the Qseven® board is implemented through a standardized MXM connector, which is a proven high speed signal interface connector.

All the features on the CQ7-D03 board are implemented according to the Qseven® standard bus interface, thus the board is fully Qseven® Rel. 2.1 compliant.

2.2 Technical Specifications

Supported Modules
- Qseven® and µQseven® Rel. 2.1 modules

Mass Storage interfaces
- microSD Slot

Video Interfaces
- LVDS Single/Dual Channel 18-/24-bit
- HDMI Connector

Audio
- Optional Line Out + Mic In combo TRRS audio jack with I2S Audio Codec

USB
- 1 x USB 2.0 Host port on Type-A socket
- 1 x USB 3.0 Host ports on Type-A socket shared with USB 2.0 OTG Client
- 1 x USB 2.0 OTG port on micro-AB socket shared with USB 3.0 Host
- 1 x USB 2.0 Host port on internal connector
- 1 x USB 2.0 Host port on M.2 Socket 1 KeyE Slot
- 1 x USB 2.0 Host port on mini-PCIe Slot

PCIe
- 1 x PCIe x1 lane on M.2 Socket 1 Key E Slot
- 1 x PCIe x1 lane on Mini-PCIe Slot

Networking
- 1 x Gigabit Ethernet connectors
- 1 x Mini-PCIe Slot for WWAN Modem Modules, connected to on-board microSIM slot

Serial Ports
- Optional 4-wires RS-232 / RS-422 / RS-485 configurable serial port on pin header
- Debug UART on pin header (shared with USB Debug Serial)
- USB Debug Serial on micro-AB socket (shared with Debug UART on pin header)

Other Interfaces
- 1 x M.2 Socket 1 Key E Slot for a M.2 NPU or a WiFI/BT module
- Optional 1 x CAN port on pin header
- 1 x 40 pin connector for I2C, SPI and General Purpose I/O, pinout compatible with the Raspberry Pi - GPIO Connector
- 1 x LED driver connector
- FAN connector configurable for 3 or 4 wires and +12V or +5V
- microSIM Slot for miniPCIe Modem
- Debug USB port on micro-AB socket
- MFG connector for JTAG programming of Qseven® module

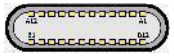
Power supply voltage: $12V_{DC}$ through USB Type-C connector
Coin cell battery Holder for CMOS and RTC

Operating temperature: 0°C ÷ +70°C (Commercial temperature range)

Dimensions: 101.6 x 101.6 mm, embedded NUC™ form factor

! ** Temperature ranges indicated mean that all components available onboard are certified for working with a Tcase included in these temperature ranges. This means that it is customer's responsibility to ensure that all components' Tcases remain in the range above indicated. Please also check paragraph 4.1.*

2.3 Electrical Specifications



CQ7-D03 board needs to be supplied with an external 12VDC power supply compliant with USB Power Delivery (PD). All the other voltages necessary for the working of the board and of the connected peripherals are derived from the main V_{IN} power rail.

Power Connector is a USB Type-C, with pinout according to the standard specification, connected to a Power Delivery Controller IC for sink applications. The Power Delivery Controller negotiates the 12VDC supply from the compliant power supply.

The cable used for the connection of the power supply must be capable of delivering 5A of continuous current, in order to ensure the proper amperage of the power section.

When choosing the power supply for CQ7-D03 board, please consider well what is the typical scenario for using the board (i.e., which peripherals will be connected).

Internal power section is able to draw up to 4A from 12V and to supply a maximum of 4.8A @ 5V and 3.8A @ 3.3V for Qseven module and for the external devices supplied directly by the carrier board (i.e. USB devices, storage modules, display, etc).

It is very important to balance well the typical final configuration, summing all possible power consumptions of devices attached to carrier board.

For example, considering the use case of a connected LVDS panel with typical power consumption of 15W, all USB populated and delivering a full power of 10W, is possible to use a Qseven or uQseven module with a maximum absorbed power of 10W (this is not the TDP but the peak value of power absorbed by the module typically reported in the Electrical Specifications section of the module documentation), leaving apart 12.5W of the 3.3V line for the M.2 and miniPCI modules.

This way it is possible to choose a PSU capable to supply enough current for the whole system.

2.3.1 RTC Battery

For the occurrences when the system (Carrier Board + Qseven® module) is not powered with an external power supply, on board there is a horizontal battery holder, for the use of standard coin battery type CR1225 with a nominal capacity of 50mAh, to supply, with a 3V voltage, the Real Time Clock and CMOS memory mounted on the Qseven® module.

The batteries should only be replaced with devices of the same type. Always check the orientation before inserting and make sure that they are aligned correctly and are not damaged or leaking.

Never allow the batteries to become short-circuited during handling.

! CAUTION: handling batteries incorrectly or replacing with not-approved devices may present a risk of fire or explosion.

Batteries supplied with CQ7-D03 board are compliant to requirements of European Directive 2006/66/EC regarding batteries and accumulators. When putting out of order CQ7-D03 board, remove the batteries from the board in order to collect and dispose them according to the requirement of the same European Directive above mentioned. Even when replacing the batteries, the disposal has to be made according to these requirements.

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2.3.2 Power Rails meanings

In all the tables contained in this manual, Power rails are named with the following meaning:

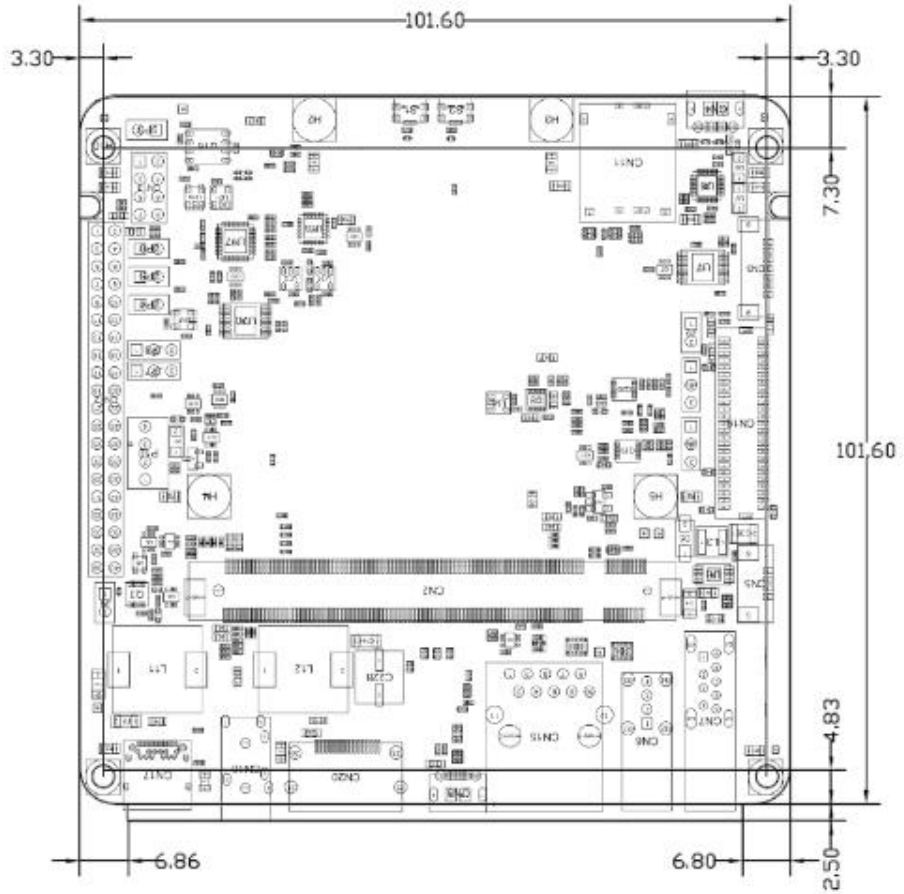
VCC_RTC: Low current RTC circuit backup power. 3V coin cell voltage coming from the RTC Coin Cell Battery holder for supplying the RTC clock on Qseven® module.

_RUN: Switched voltages, i.e. power rails that are active only when the board is in ACPI s S0 (Working) state. Examples:+3.3V_RUN, +5V_RUN, +12V_RUN

_ALW: Always-on voltages, i.e. power rails that are active both in ACPI s S0 (Working), S3 (Standby) and S5 (Soft Off) state. Examples: +5V_ALW, +3.3V_ALW

2.4 Mechanical Specifications

According to embedded NUC form factor, board dimensions are 101.6 x 101.6 mm (4" x 4"). The printed circuit of the board is made of ten layers, some of them are ground planes, for disturbance rejection.



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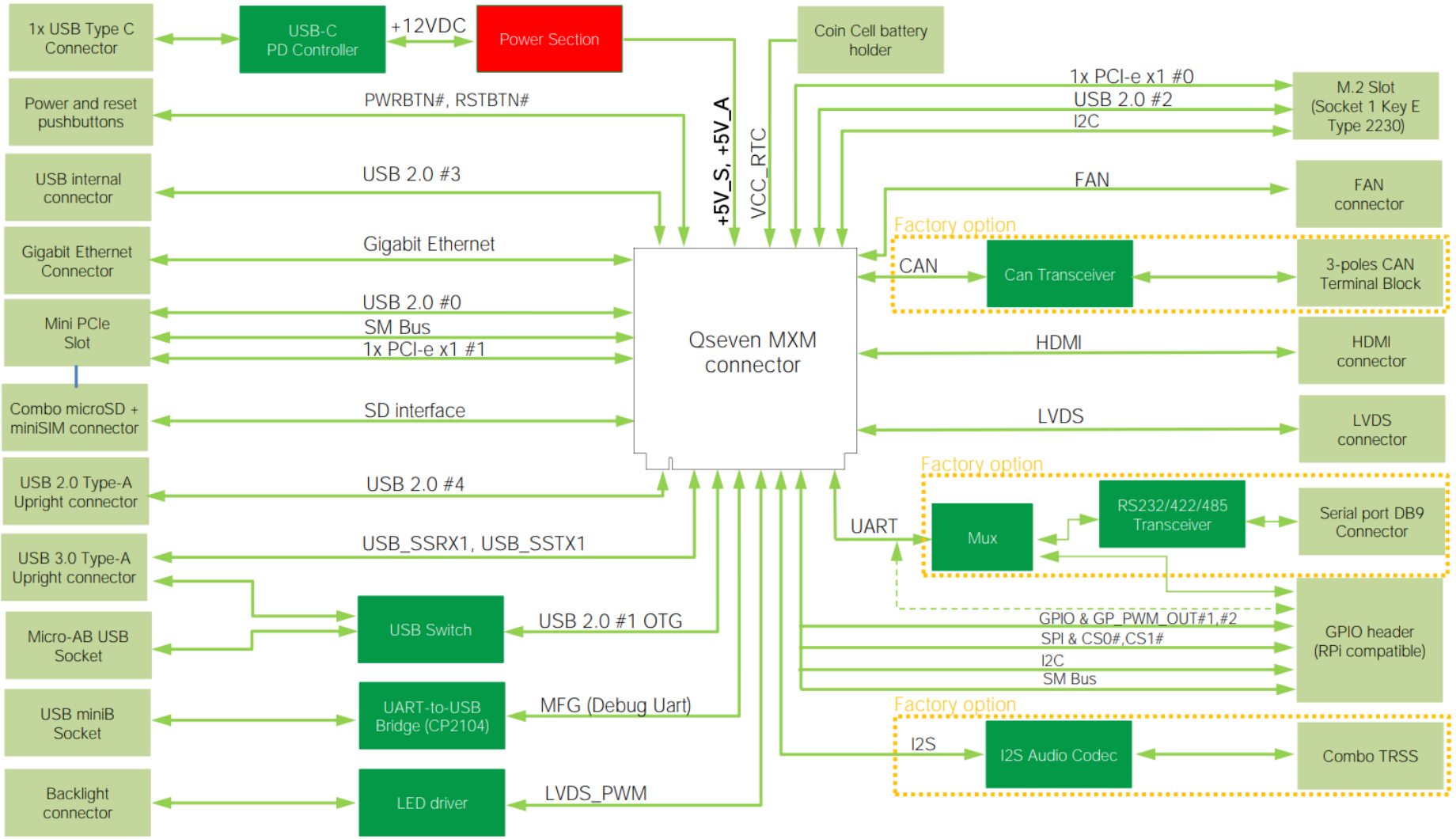
2.5 Block Diagram



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Chapter 3.
CONNECTORS

- Connectors placement
- Connectors overview
- Connectors description

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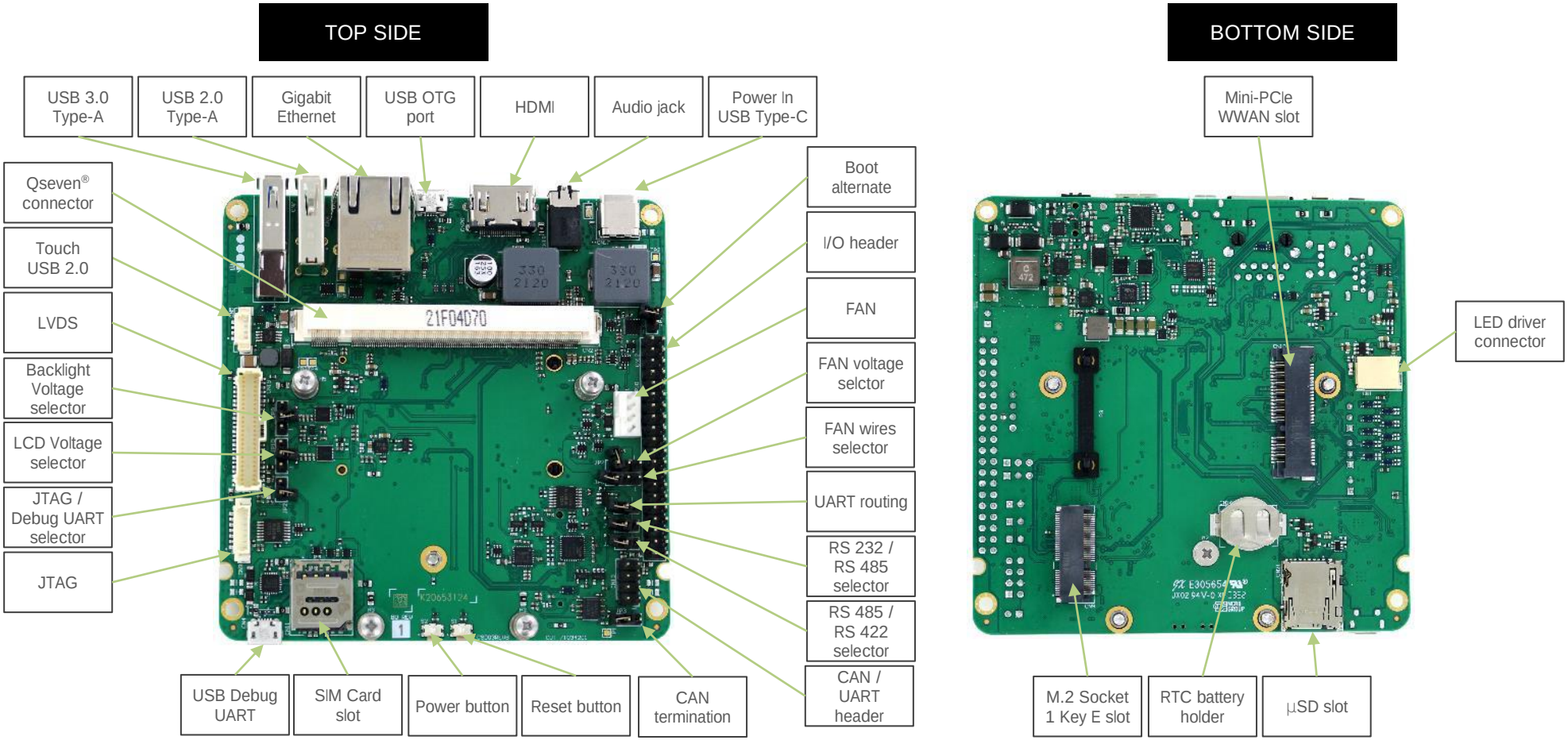
3.1 Connectors placement

On CQ7-D03 carrier board, there are several connectors. Standard connectors are placed on the same side of PCB, so that it is possible to place them on a panel of an eventual enclosure.

> **!** Please be aware that, depending on the configuration purchased, the appearance of the board could be different from the following pictures.



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3.2 Connectors overview

3.2.1 Connectors list

Name	Description	Name	Description
CN1	LCD Backlight	CN11	miniSIM Slot
CN2	Qseven® connector	CN12	GPIO internal pin header
CN3	JTAG connector	CN13	CAN bus and RS-232 internal pin header
CN4	USB Debug UART type micro-AB port	CN15	Gigabit Ethernet port
CN5	Touch USB 2.0	CN17	Power In connector USB Type-C
CN6	USB 2.0 type A port	CN18	Audio jack
CN7	USB 3.0 type A port	CN19	LVDS interface
CN8	USB OTG type micro-AB port	CN20	HDMI connector
CN9	M.2 socket Key E WWAN Slot	CN21	µSD slot
CN10	Mini PCIe socket		

3.2.2 Jumpers list

Name	Description	Name	Description
JP1	Boot_Alternate# Jumper	JP6	RS-485 Half/Full Duplex (RS-422) selector
JP2	JTAG or Debug UART selector	JP7	FAN voltage selector
JP3	CAN termination jumper	JP8	FAN wires selector
JP4	UART to GPIO or UART to RS-232/RS-485 jumper	JP9	Backlight Voltage selector
JP5	RS-232/RS-485 jumper	JP10	LCD Voltage selector

3.3 Connectors description

3.3.1 Qseven® Connector

According to Qseven® specifications, all interface signals are reported on the card edge connector, which is a 230-pin Card Edge that can be inserted into standard 230 pin MXM connectors, as described in Qseven® specifications.

Not all signals contemplated in Qseven® standard are implemented on MXM connector, due to the functionalities really implemented on CQ7-D03 CPU module. Therefore, please refer to the following table for a list of effective signals reported on MXM connector. Please be aware that on signals' description, Input and Output (if specifically written) are referred to the Qseven® module, i.e. they are inputs and outputs of the module itself, not of the carrier board (where they are, respectively, outputs and inputs).

NOTE: Even pins are available on top side of Qseven® module; odd pins are available on bottom side of Qseven® module.

Qseven® Connector – CN2					
BOTTOM SIDE			TOP SIDE		
Description	Pin name	Pin nr.	Pin nr.	Pin name	Description
Power Ground	GND	1	2	GND	Power Ground
Gigabit Ethernet differential pair 3-	GBE_MDI3-	3	4	GBE_MDI2-	Gigabit Ethernet differential pair 2-
Gigabit Ethernet differential pair 3+	GBE_MDI3+	5	6	GBE_MDI2+	Gigabit Ethernet differential pair 2+
Ethernet 100Mb/s link indicator	GBE_LINK100#	7	8	GBE_LINK1000#	Ethernet 1000Mb/s link indicator
Gigabit Ethernet differential pair 1-	GBE_MDI1-	9	10	GBE_MDI0-	Gigabit Ethernet differential pair 0-
Gigabit Ethernet differential pair 1+	GBE_MDI1+	11	12	GBE_MDI0+	Gigabit Ethernet differential pair 0+
	N.C.	13	14	GBE_ACT#	Ethernet Activity indicator
Ethernet Reference Voltage	GBE_CTREF	15	16	SUS_S5#	Soft Off (S5) output Signal
	N.C	17	18	SUS_S3#	Suspend to RAM (S3) output signal
	N.C	19	20	PWRBTN#	Power Button Input
	N.C.	21	22	N.C	
Power Ground	GND	23	24	GND	Power Ground
Power Ground	GND	25	26	PWGIN	QSeven® module Power Good Input
	N.C.	27	28	RSTBTN#	Reset Button Input
	N.C.	29	30	N.C.	

	N.C.	31	32	N.C.	
	N.C.	33	34	GND	Power Ground
	N.C.	35	36	N.C.	
	N.C.	37	38	N.C.	
Power Ground	GND	39	40	GND	Power Ground
Module alternate Boot Input	BIOS_DISABLE#/BOOT_ALT#	41	42	SDIO_CLK	SDIO Clock
SDIO Card Detect Input	SDIO_CD#	43	44	N.C.	
SDIO Command/Response (Bidir)	SDIO_CMD	45	46	SDIO_WP (Tied to GND)	SDIO Write Protect (Disabled)
SDIO Power Enable output	SDIO_PWR#	47	48	SDIO_DAT1	SDIO Data Line 1
SDIO Data Line 0	SDIO_DAT0	49	50	SDIO_DAT3	SDIO Data Line 3
SDIO Data Line 2	SDIO_DAT2	51	52	N.C.	
	N.C.	53	54	N.C.	
	N.C.	55	56	N.C.	
Power Ground	GND	57	58	GND	Power Ground
Audio Synchronization output signal	HDA_SYNC/I2S_WS	59	60	SMB_CLK	System Management Bus Clock
Audio Codec Reset, output	HDA_RST#/I2S_RST#	61	62	SMB_DAT	System Management Bus Data
Audio Bit Clock output	HDA_BCLK/I2S_CLK	63	64	N.C.	
Audio Serial Data Input	HDA_SDI/I2S_SDI	65	66	GP0_I2C_CLK	I^2C Bus Clock Line
Audio Serial Data Output	HDA_SDO/I2S_SDO	67	68	GP0_I2C_DAT	I^2C Bus Data Line
	N.C.	69	70	N.C.	
	N.C.	71	72	N.C:	
Power Ground	GND	73	74	GND	Power Ground
	N.C.	75	76	N.C.	
	N.C.	77	78	N.C	
	N.C.	79	80	USB_4_5_OC#	USB ports 4/5 overcurrent detect
	N.C.	81	82	USB_P4-	USB Data Port #4 -
	N.C.	83	84	USB_P4+	USB Data Port #4 +
USB ports 2/3 overcurrent detect	USB_2_3_OC#	85	86	USB_0_1_OC#	USB ports 0/1 overcurrent detect
USB Data Port #3 -	USB_P3-	87	88	USB_P2-	USB Data Port #2 -
USB Data Port #3 +	USB_P3+	89	90	USB_P2+	USB Data Port #2 +

USB VBus Input	USB_VBUS	91	92	USB_ID	USB Port 1 mode configuration output
USB Data Port #1 -	USB_P1-	93	94	USB_P0-	USB Data Port #0 -
USB Data Port #1 +	USB_P1+	95	96	USB_P0+	USB Data Port #0 +
Power Ground	GND	97	98	GND	Power Ground
LVDS primary channel pair 0 +	LVDS_A0+	99	100	LVDS_B0 +	LVDS secondary channel pair 0 +
LVDS primary channel pair 0 -	LVDS_A0-	101	102	LVDS_B0 -	LVDS secondary channel pair 0 -
LVDS primary channel pair 1 +	LVDS_A1+	103	104	LVDS_B1 +	LVDS secondary channel pair 1 +
LVDS primary channel pair 1 -	LVDS_A1-	105	106	LVDS_B1 -	LVDS secondary channel pair 1 -
LVDS primary channel pair 2 +	LVDS_A2+	107	108	LVDS_B2 +	LVDS secondary channel pair 2 +
LVDS primary channel pair 2 -	LVDS_A2-	109	110	LVDS_B2 -	LVDS secondary channel pair 2 -
LCD Panel Power Enable	LVDS_PPEN	111	112	LVDS_BLEN	LCD Panel Backlight Enable
LVDS primary channel pair 3 +	LVDS_A3+	113	114	LVDS_B3 +	LVDS secondary channel pair 3 +
LVDS primary channel pair 3 -	LVDS_A3-	115	116	LVDS_B3 -	LVDS secondary channel pair 3 -
Power Ground	GND	117	118	GND	Power Ground
LVDS primary channel Clock +	LVDS_A_CLK+	119	120	LVDS_B_CLK +	LVDS secondary channel Clock +
LVDS primary channel Clock +	LVDS_A_CLK-	121	122	LVDS_B_CLK-	LVDS secondary channel Clock -
LCD Panel brightness control	LVDS_BLT_CTRL	123	124	GP_1-Wire_Bus	General Purpose 1-Wire bus interface
LVDS DisplayID Data Line	LVDS_DID_DAT	125	126	N.C.	
LVDS DisplayID Clock Line	LVDS_DID_CLK	127	128	N.C.	
CAN Port Transmit line	CAN_TX	129	130	CAN_RX	CAN Port Receive line
TMDS Clock +	TMDS_CLK+	131	132	USB_SSTX1-	USB SuperSpeed Port #1 transmit -
TMDS Clock -	TMDS_CLK-	133	134	USB_SSTX1+	USB SuperSpeed Port #1 transmit +
Power Ground	GND	135	136	GND	Power Ground
TMDS Data Line 1+	TMDS_LANE1+	137	138	DP_AUX+	Display Port auxiliary channel +
TMDS Data Line 1-	TMDS_LANE1-	139	140	DP_AUX-	Display Port auxiliary channel -
Power Ground	GND	141	142	GND	Power Ground
TMDS Data Line 0+	TMDS_LANE0+	143	144	USB_SSRX1-	USB SuperSpeed Port #1 receive -
TMDS Data Line 0-	TMDS_LANE0-	145	146	USB_SSRX1+	USB SuperSpeed Port #1 receive +
Power Ground	GND	147	148	GND	Power Ground
TMDS Data Line 2+	TMDS_LANE2+	149	150	HDMI_CTRL_DAT	HDMI I^2C Control Data Line

TMDS Data Line 2-	TMDS_LANE2-	151	152	HDMI_CTRL_CLK	HDMI I²C Control Clock Line
HDMI Hot Plug Detect Input	HDMI_HPD#	153	154	N.C.	
PCI-E Reference Clock +	PCIE_CLK_REF+	155	156	PCIE_WAKE#	Wake signal from ext. devices
PCI-E Reference Clock -	PCIE_CLK_REF-	157	158	PCIE_RST#	Reset signal to external devices
Power Ground	GND	159	160	GND	Power Ground
	N.C.	161	162	N.C.	
	N.C.	163	164	N.C.	
Power Ground	GND	165	166	GND	Power Ground
	N.C.	167	168	N.C.	
	N.C.	169	170	N.C.	
TTL Serial Port Transmit	UART0_TX	171	172	UART0_RTS#	TTL Serial Port Request To Send output
PCI-E Channel 1 Transmit +	PCIE1_TX+	173	174	PCIE1_RX+	PCI-E Channel 1 Receive +
PCI-E Channel 0 Transmit -	PCIE1_TX-	175	176	PCIE1_RX-	PCI-E Channel 1 Receive -
TTL Serial Port Receive signal	UART0_RX	177	178	UART0_CTS#	TTL Serial Port Clear To Send input
PCI-E Channel 0 Transmit +	PCIE0_TX+	179	180	PCIE0_RX+	PCI-E Channel 0 Receive +
PCI-E Channel 0 Transmit -	PCIE0_TX-	181	182	PCIE0_RX-	PCI-E Channel 0 Receive -
Power Ground	GND	183	184	GND	Power Ground
General Purpose I/O	GPIO0	185	186	GPIO1	General Purpose I/O
General Purpose I/O	GPIO2	187	188	GPIO3	General Purpose I/O
General Purpose I/O	GPIO4	189	190	GPIO5	General Purpose I/O
General Purpose I/O	GPIO6	191	192	GPIO7	General Purpose I/O
Battery Power Line for RTC	VCC_RTC (+3.3V_ALW)	193	194	GP_PWM_OUT2	General Purpose PWM output
FAN Tachometric Input	FAN_TACHOIN	195	196	FAN_PWMOUT	Fan speed control, PWM output
Power Ground	GND	197	198	GND	Power Ground
SPI Master Output / Slave Input	SPI_MOSI	199	200	SPI_CS0#	SPI Chip Select 0
SPI Master Input / Slave Output	SPI_MISO	201	202	SPI_CS1#	SPI Chip Select 1
SPI Clock	SPI_CLK	203	204	MFG_NC4	Manufacturer Reserved Pin
Standby Power Supply Line	+5V_ALW	205	206	+5V_ALW	Standby Power Supply Line
Manufacturer Reserved Pin #0	MFG_NC0	207	208	MFG_NC2	Manufacturer Reserved Pin
Manufacturer Reserved Pin #1	MFG_NC1	209	210	MFG_NC3	Manufacturer Reserved Pin

	N.C.	211	212	N.C.	
	N.C.	213	214	N.C.	
	N.C.	215	216	N.C.	
	N.C.	217	218	N.C.	
Switched Power Supply Line	+5V_RUN	219	220	+5V_RUN	Switched Power Supply Line
Switched Power Supply Line	+5V_RUN	221	222	+5V_RUN	Switched Power Supply Line
Switched Power Supply Line	+5V_RUN	223	224	+5V_RUN	Switched Power Supply Line
Switched Power Supply Line	+5V_RUN	225	226	+5V_RUN	Switched Power Supply Line
Switched Power Supply Line	+5V_RUN	227	228	+5V_RUN	Switched Power Supply Line
Switched Power Supply Line	+5V_RUN	229	230	+5V_RUN	Switched Power Supply Line

3.3.2 Boot alternate jumper

Connected to pin #41 of the card edge connector, there is a two-way P 2.54mm jumper, JP1, which allows to select different booting option (which depend on the Qseven® module installed. Please refer to the Qseven® module's User Manual for more details about the meaning of this signal).

JP1 position	BIOS_DISABLE#/BOOT_ALT# signal
Not inserted	Floating
Inserted	Tied to GND

3.3.3 Buttons

On board, there are two momentary pushbuttons (with contacts normally open) for the direct handling of Qseven® module power management signals.

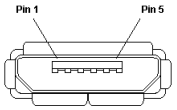
The first pushbutton, S1, is placed on PWRBTN# signal. Upon the pressure of this pushbutton, the Qseven® module will perform a power up / power down sequence.

The second pushbutton, S2, is placed on RSTBTN# signal. Upon the pressure of this pushbutton, the Qseven® module will perform a reset.

3.3.4 Debug port connectors

Micro-AB USB connector – CN4	
Pin	**Signal**
1	+5V_ALW
2	USB_-
3	USB_ +
4	N.C.
5	GND

CQ7-D03 carrier board allows for a simple interfacing to the module Debug Serial interface using a Silicon Labs® CP2104 USB-to-UART bridge. This port is carried out through a standard micro-AB connector, described in the table on the left.



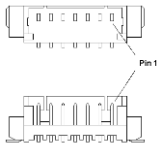
JP2 position	JTAG / Debug UART selector
Not inserted	JTAG enabled
Inserted	Debug UART enabled

Please be aware that the TXD and RXD signals of the Serial adapter IC are respectively shared with JTAG_TDI and JTAG_TDO on connector CN3. Therefore, to enable the Debug Serial interface on CN4 it is necessary for the jumper located on JP2, which is a standard 2.54mm pitch 1x2 pin header, to be inserted

JTAG Connector- CN3	
Pin	**Signal**
1	+3.3V_ALW
2	JTAG_TMS
3	JTAG_TCK
4	JTAG_TDI
5	JTAG_TDO
6	JTAG_TRST#
7	GND

The module JTAG interface can be accessed through connector CN3, a 1.25mm pitch connector, type MOLEX p/n 53398-0771 or equivalent.

Mating connector: MOLEX 51021-0700 receptacle with MOLEX 50058 or 50079 crimp terminals.

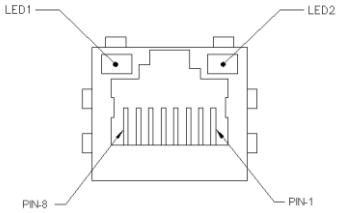


Please be aware that to enable the JTAG interface on connector CN3 it is necessary for the jumper located on JP2 to not be inserted.

Please refer to the specific mounted Qseven® module processor's documentation for a description of the signals and their usage.

3.3.5 Ethernet connector

Gigabit Ethernet Port #0 – CN15			
Pin	Signal	Pin	Signal
1	GBE0_MDI0+	5	GBE0_MDI2-
2	GBE0_MDI0-	6	GBE0_MDI1-
3	GBE0_MDI1+	7	GBE0_MDI3+
4	GBE0_MDI2+	8	GBE0_MDI3-



On board, there is a Gigabit Ethernet connection on CN15 which provides direct access to the Gigabit Ethernet signals directly managed by the Qseven® modules.

On the connectors there are also two bicolour Green/Yellow LEDs: LED1 (Left LED) shows 10/100 or 1000 connection: green means 100Mbps connection, yellow means 1000Mpbs connection, when the LED is Off then 10Mpbs or no connection is available. LED2 (Right LED) shows ACTIVITY presence.

This interface is compatible with Gigabit Ethernet (1000Mbps) and with Fast Ethernet (10/100Mbps) Networks. It will configure itself automatically to work with the existing network.

Please be aware that it will work in Gigabit mode only in case that it is connected to Gigabit Ethernet switches/hubs/routers. For the connection, cables category Cat5e or better are required. Cables category Cat6 are recommended for noise reduction and EMC compatibility issues, especially when the length of the cable is significant.

GBE0_MDI0+/GBE0_MDI0-: Ethernet Controller #0 Media Dependent Interface (MDI) I/O differential pair #0. It is the first differential pair in Gigabit Ethernet mode, and the Transmit differential pair in 10/100 Mbps modes.

GBE0_MDI1+/GBE0_MDI1-: Ethernet Controller #0 Media Dependent Interface (MDI) I/O differential pair #1. It is the second differential pair in Gigabit Ethernet mode, and the Receive differential pair in 10/100 Mbps modes.

GBE0_MDI2+/GBE0_MDI2-: Ethernet Controller #0 Media Dependent Interface (MDI) I/O differential pair #2. It is the third differential pair in Gigabit Ethernet mode; it is not used in 10/100Mbps modes.

GBE0_MDI3+/GBE0_MDI3-: Ethernet Controller #0 Media Dependent Interface (MDI) I/O differential pair #3. It is the fourth differential pair in Gigabit Ethernet mode; it is not used in 10/100Mbps modes.

3.3.6 USB connectors

CQ7-D03 carrier board offers the possibility of connecting multiple USB devices, exploiting the USB lanes that can come out from Qseven® module.

Common mode chokes are placed on all USB differential pairs for EMI compliance. For ESD protection, on all data and voltage lines are placed clamping diodes for voltage transient suppression.

USB 2.0 type A receptacle - CN6	
Pin	**Signal**
1	$+5V_{USB2}$
2	USB_P4-
3	USB_P4+
4	GND

USB 2.0 port #4, coming out from Qseven® module, is carried out on a vertical Type-A receptacle, CN6.

Since this connector is a standard type receptacle, it can be connected to all types of USB 1.1 / USB 2.0 devices using Standard-A USB 2.0 cables.

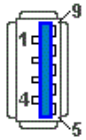
Signal description of this port:

USB_P4+ / USB_P4- : Qseven® Module USB Port #4 differential pair

$+5V_{USB2}$ is derived from +5V_ALW through a 500mA current limited power switch.

USB 3.0 type A receptacle – CN7	
Pin	**Signal**
10	$+5V_{USB1}$
11	USB_P1-
12	USB_P1+
13	GND
14	USB_SSRX1-
15	USB_SSRX1+
16	GND
17	USB_SSTX1-
18	USB_SSTX1+

USB 3.0 port #1, coming out from Qseven® module, is available on a vertical USB connector, CN7.



Since this connector is a standard type receptacle, it can be connected to all types of USB 1.1 / USB 2.0 / USB 3.0 devices using Standard-A USB 3.0 or USB 2.0 plugs.

For USB 3.0 connections it is mandatory the use of SuperSpeed certified cables, whose SuperSpeed differential pairs are individually shielded inside the global cable's external shielding.

Please be aware that USB Port #1, coming out from Qseven module, is shared between connector CN7 and the USB Micro-AB connector CN8.

Signal description of this port:

USB_P1+ / USB_P1- : Qseven® Module USB Port #1 differential pair

USB_SSRX1+ / USB_SSRX1- : Qseven® Module USB Super Speed Port #1 receive signal differential pair

USB_SSTX1+ / USB_SSTX1- : Qseven® Module USB Super Speed Port #1 transmit signal differential pair

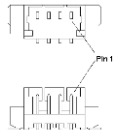
$+5V_{USB0}$ and $+5V_{USB1}$ are derived from +5V_ALW through a 1A current limited power switch.

! Please be aware that USB 3.0 connectivity can be obtained only in case that it is supported by the Qseven® module plugged into the MXM connector. In case the Qseven® module used doesn't offer USB 3.0 ports, it will be always possible to use USB 2.0 port #0, simply by plugging an USB 2.0 cable. Avoid using USB 3.0 cables if the Qseven® module used doesn't offer such an interface.

Touch USB pin header – CN5

Pin	Signal
1	$+5V_{USB4}$
3	USB_P3-
5	USB_P3+
7	GND

Other than the USB ports available through the standard connectors there is USB port #3 coming out from Qseven® module that can be dedicated to a panel touch module.



The connector, CN5, is a 1.25mm pitch connector, type MOLEX p/n 53398-0471 or equivalent.

Mating connector: MOLEX 51021-0400 receptacle with MOLEX 50058 or 50079 crimp terminals.

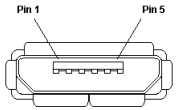
Signal description of this port:

USB_P3+ / USB_P3- : Qseven® Module USB Port #3 differential pair

$+5V_{USB4}$ and $+5V_{USB5}$ are derived from +5V_ALW through a 500mA current limited power switch.

Micro-AB USB connector – CN8

Pin	Signal
1	USB_VBUS
2	USB_OTG-
3	USB_OTG+
4	USB_ID
5	GND



According to Qseven® specification, USB Port #1, coming out from Qseven® module, could support OTG functionalities (it depends on the functionalities offered by the Qseven® module used, however). For this reason, this port is carried out through a standard micro-AB connector, described in the table on the left.

When a micro-B USB cable is used, its USB_ID pin is floating; this way, the board acknowledges that it must configure itself to work as a Client. In this case, USB_VBUS is an input of the carrier board from the external Host.

Please be aware that USB Port #1, coming out from Qseven module, is shared between CN8 and the USB 2.0 signals on the USB3.0 Type-A connector CN7. Therefore, when the system is intended to work in Host mode only the USB 2.0 signals on connector CN7 will be enabled.

Typically a micro-A USB cable has to be used when the system has to work in Host mode. Instead, on the CN8 connector the USB 2.0 signals are disabled when the system has to work in Host mode.

Signal description of this port:

USB_OTG+/USB_OTG-: USB Port #1 differential pair, switched to the micro-AB connector CN8 using the dedicated jumper JP2.

USB_VBUS: USB voltage rail. It is an input for USB port working in Client mode, an output for Host mode.

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USB_ID: Client/Host identification signal. This signal is high when the USB port works in client mode, is low when works in Host mode.

Please be aware that the USB OTG port has been designed according to, published by SGET consortium, that foresee the use of signal USB_DRIVE_VBUS, present on formerly reserved pin #56.

Correct USB OTG functionalities, therefore, are ensured only for modules developed according to Qseven® Specifications rel. 2.0 Errata Sheet.

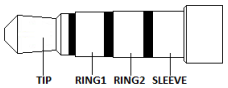
> **!** When the system (Carrier board + Qseven® module) is working in client mode (i.e., an external Host is connected to port CN8), please avoid disconnecting and reconnecting main power supply of the carrier board.
>
> In case main power supply is disconnected, it is necessary to also disconnect the external Host from CN8 before reconnecting again the main PSU, otherwise the system will not boot.

3.3.7 Audio connector

The CQ7-D03 carrier board offers an optional audio connection, controlled by the I2S Audio Codec type TLV320AIC3204IRHBR.

TRRS Audio jack- CN18	
Pin	**Signal**
TIP	Headphone Out Left Channel
RING1	Headphone Out Right Channel
RING2	GND
SLEEVE	MIC_IN

In order to reduce the space dedicated to connectors, there is a TRRS Combo Audio Jack, i.e. a single jack which offer both stereo Line Out and Mic In functionalities.



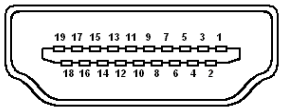
Such TRRS Combo Audio jack can be used with any 4-poles 3.5mm diameter audio jack, with pinout compatible with the most recent Headsets, shown in the table on the left.

The I2S Audio Codec is managed by the I2S signals and the GP0_I2C bus, both from the Qseven® module.

3.3.8 HDMI connector

HDMI connector – CN20			
Pin	Signal	Pin	Signal
1	TMDS_LANE2+	2	GND
3	TMDS_LANE2-	4	TMDS_LANE1+
5	GND	6	TMDS_LANE1-
7	TMDS_LANE0+	8	GND
9	TMDS_LANE0-	10	TMDS_CLK+
11	GND	12	TMDS_CLK-
13	HDMI_CEC	14	N.C.
15	HDMI_CTRL_CLK	16	HDMI_CTRL_DAT
17	GND	18	$+5V_{HDMI}$
19	HDMI_HPD		

The carrier board comes with a HDMI connector mounted.



This is a standard certified HDMI connector, type A, model FCI Connect p/n 10029449-111RLF, with the pinout shown in the table on the left.

Signals involved in HDMI management are the following:

TMDS_CLK+/TMDS_CLK-: TMDS differential Clock.

TMDS_LANE0+/TMDS_LANE0-: TMDS differential pair #0.

TMDS_LANE1+/TMDS_LANE1-: TMDS differential pair #1.

TMDS_LANE2+/TMDS_LANE2-: TMDS differential pair #2.

HDMI_CTRL_DAT: DDC Data line for HDMI panel.

HDMI_CTRL_CLK: DDC Clock line for HDMI panel.

HDMI_CEC: HDMI Consumer Electronics Control (CEC) Line. This is a General Purpose 1_wire bus interface, that can be used for implementation of HDMI_CEC functionality. The support of such functionality depends on the Qseven® module used.

HDMI_HPD: Hot Plug Detect Input signal.

For ESD protection, on all data and voltage lines are placed clamping diodes for voltage transient suppression.

Always use HDMI-certified cables for the connection between the board and the HDMI display; a category 2 (High-Speed) cable is recommended for higher resolutions, category 1 cables can be used for 720p resolution.

3.3.9 Embedded LCD displays connectors

Optional LVDS connector – CN16			
Pin	**Signal**	**Pin**	**Signal**
2	VDD_BKLT	1	VDD_LCD
4	VDD_BKLT	3	VDD_LCD
6	VDD_BKLT	5	VDD_LCD
8	GND	7	3.3V_RUN
10	LVDS_A0+	9	GND
12	LVDS_A0-	11	LVDS_A1+
14	GND	13	LVDS_A1-
16	LVDS_A2+	15	GND
18	LVDS_A2-	17	LVDS_A3+
20	GND	19	LVDS_A3-
22	LVDS_A_CLK+	21	GND
24	LVDS_A_CLK-	23	LVDS_B0+
26	GND	25	LVDS_B0-
28	LVDS_B1+	27	GND
30	LVDS_B1 -	29	LVDS_B2+
32	GND	31	LVDS_B2-
34	LVDS_B3+	33	GND
36	LVDS_B3-	35	LVDS_B_CLK+
38	GND	37	LVDS_B_CLK-
40	GND	39	GND
42	LVDS_BLT_CTRL	41	LVDS_BACKLIGHT_EN
44	LVDS_PANEL_EN	43	N.C.
46	N.C.	45	N.C.
48	N.C.	47	N.C.
50	LVDS_DID_CLK	49	LVDS_DID_DAT

The CQ7-D03 carrier board comes with an internal connector for a LVDS interface. This allows the connection of displays with a colour depth of 18 or 24 bit, single or dual channel.

Please notice that the effective support of this kind of displays depends only by the Qseven® module used with the carrier board, it is not a feature dependent from the carrier board itself. The pin-out of this connector is given according to Qseven® specifications, so that the carrier board is ready for the use of any Qseven® module that follows those specifications. Please refer to the CPU module's User manual for the details regarding the panels supported and the availability of the LVDS signals.

For the connection, a connector type HR A1014WV-S-2x25P or equivalent (2 x 25p, male, straight, P1, low profile, polarised), with the pin-out shown in the table on the left.

Mating connector: HR A1014H-2X25P with HR A1014-T female crimp terminals.

Alternative mating connector, MOLEX 501189-5010 with crimp terminals series 501334.

On the same connector, are also implemented voltage rails that can be used to supply the Backlight Unit and related LCD and signals for direct driving of display's backlight: voltages (VDD_BKLT and VDD_LCD) and control signals (LCD enable signal, LVDS_PANEL_EN, Backlight enable signal, LVDS_BACKLIGHT_EN, and Backlight Brightness Control signal, LVDS_BLT_CTRL).

When building a cable for connection of LVDS displays, please take care of twist as tight as possible differential pairs' signal wires, in order to reduce EMI interferences. Shielded cables are also recommended.

! +3.3V_RUN power rail available on pin 7 can be used only for the connection of an external EDID (max 500mA); it MUST NOT be used to supply the digital section of the connected LCD.
Use instead the dedicated signals for the power in rails of the connected display.

Signal description related to LVDS interface:

LVDS_A[0..3]+ / LVDS_A[0..3]-: Qseven® Module LVDS Channel#A Differential pairs

LVDS_A_CLK+ / LVDS_A_CLK-: Qseven® Module LVDS Channel#A Differential clock

LVDS_B[0..3]+ / LVDS_B[0..3]-: Qseven® Module LVDS Channel#B Differential pairs

LVDS_B_CLK+ / LVDS_B_CLK-: Qseven® Module LVDS Channel#B Differential clock

LVDS_DID_DAT: Display ID Data line for Flat Panel detection and control. Signal directly routed from Qseven® Module

LVDS_DID_CLK: Display ID Clock line for Flat Panel detection and control. Signal directly routed from Qseven® Module

LVDS_PANEL_EN: Enable Signal for LVDS LCD Panel Power

LVDS_BACKLIGHT_EN: Enable Signal for Panel Backlight Power

LVDS_BLT_CTRL: Panel Backlight Brightness Control, PWM signal directly routed from Qseven® Module

JP9 position	BKLT PWR selector (VDD_BKLT)
1-2	+5V_ALW
2-3	+12V_ALW

The LCD Backlight Voltage rail VDD_BKLT value can be set to +5V_ALW or +12V_ALW by using dedicated jumper JP9, which is a standard pin header, P2.54mm, 1x3 pin.

Configurations are shown on the table to the left.

JP10 position	LCD PWR selector (VDD_LCD)
1-2	+3.3V_ALW
2-3	+5V_ALW

The LCD Voltage rail VDD_LCD value can be set to +3.3V_ALW or +5V_ALW by using a dedicated jumper JP10, which is a standard pin header, P2.54mm, 1x3 pin.

Configurations are shown on the table to the left.

3.3.10 LED driver connector

LED driver connector – CN1	
Pin	Signal
1	VLED+
2	VLED-

The CQ7-D03 carrier board allows the direct control of a LCD LED backlight.

The functionality is implemented using an a 1-Channel step-down converter type RICHTEK RT8471 driven by LVDS_BLT_CTRL, PWM signal directly routed from Qseven® Module and also available on the LVDS connector, CN16.

Through this connector, it is possible to drive a LED string requiring a max of 500mA (12V max voltage). The connector is a 2-pin 3.5mm pitch, type JST SM02B-BHSS-1-TB, with the pinout indicated in the table on the left. Mating connector: JST BHSR-02VS-1

VLED+: Strings' common LED Anode output

VLED-: LED String x Cathode Input

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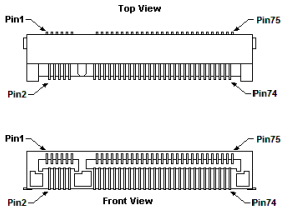
3.3.11 M.2 Socket 1 Key E type 2230 Slot

M.2 Socket 1 Key E type 2230 Slot – CN9			
Pin	**Signal**	**Pin**	**Signal**
1	GND	2	+3.3V_ALW
3	USB_P2+	4	+3.3V_ALW
5	USB_P2-	6	N.C.
7	GND	8	N.C.
9	N.C.	10	N.C.
11	N.C.	12	N.C.
13	N.C.	14	N.C.
15	N.C.	16	N.C.
17	GND	18	GND
19	N.C.	20	N.C.
21	N.C.	22	N.C.
23	N.C.	32	N.C.
33	GND	34	N.C.
35	PCIE0_TX+	36	N.C.
37	PCIE0_TX-	38	N.C.
39	GND	40	N.C.
41	PCIE0_RX+	42	N.C.
43	PCIE0_RX-	44	N.C.
45	GND	46	N.C.
47	PCIE0_CLK+	48	N.C.
49	PCIE0_CLK-	50	PCIE_RST#
51	GND	52	N.C.
53	PCIE0_CLKREQ#	54	N.C.

On the CQ7-D03 carrier board there is a M.2 Socket 1 Key E Slot, CN9, to allow the installation of modules to expand the connectivity or processing power of the mounted Qseven® module.



Thi slot allows plugging M.2 modules with USB 2.0 and/or PCI-e x1 interface.

The connector used on CN9 is a standard 75 pin M.2 Key E connector, type LOTES p/n APCI0076-P001A, H=4.5mm, with the pinout shown in the table on the left.

A Threaded Spacer is present on the board to allow the placement of the M.2 Socket 1 Key E module in 2230 size.

55	PCIE_WAKE#	56	N.C.
57	GND	58	GP0_I2C_DAT
59	N.C.	60	GP0_I2C_CLK
61	N.C.	62	N.C.
63	GND	64	N.C.
65	N.C.	66	N.C.
67	N.C.	68	N.C.
69	GND	70	N.C.
71	N.C.	72	+3.3V_RUN
73	N.C.	74	+3.3V_RUN
75	GND		

Signals carried to the CN9, M.2 Slot, are the following:

PCIE0_TX+/PCIE0_TX-: PCI Express lane #0, Transmitting Output Differential pair.

PCIE0_RX+/PCIE0_RX-: PCI Express lane #0, Receiving Input Differential pair.

PCIE0_CLK+ / PCIE0_CLK-: PCI Express Reference Clock for lane #0, Differential Pair.

PCIE_WAKE#: Board's Wake Input, it must be externally driven by the module inserted in the slot when it requires waking up the system.

PCIE_RST#: Reset Signal that is sent from Qseven® module to all PCI-e devices available on the board and the module. It is a +3.3V_ALW active-low signal.

PCIE0_CLOCK_REQUEST# PCI Express Clock Request Input. This signal shall be driven correctly by any module inserted in the slot, in order to ensure that the PCI-e clock buffer, available on the carrier board, makes available the reference clock to the slot.

USB_P2+/ USB_P2-: Qseven® Module USB Port #2 differential pair

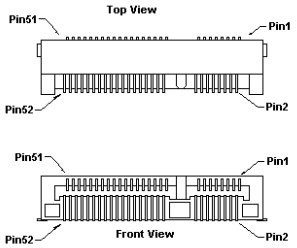
GP0_I2C_CLK: general purpose I2C Bus clock line. Bidirectional signal, electrical level +3.3V_RUN with a 2.2kΩ pull-up resistor.

GP0_I2C_DAT: general purpose I2C Bus data line. Bidirectional signal, electrical level +3.3V_RUN with a 2.2kΩ pull-up resistor.

3.3.12 Half/Full Mini-PCIe WWAN slot

Half/Full Mini-PCIe WWAN slot – CN10			
Pin	**Signal**	**Pin**	**Signal**
1	PCIE_WAKE#	2	+3.3V_ALW
3	N.C.	4	GND
5	N.C.	6	+1.5V_RUN
7	PCIE1_CLKREQ#	8	UIM_PWR
9	GND	10	UIM_DATA
11	PCIE1_CLK-	12	UIM_CLK
13	PCIE1_CLK+	14	UIM_RESET
15	GND	16	N.C.
17	N.C.	18	GND
19	N.C.	20	N.C.
21	GND	22	PCIE_RST#
23	PCIE1_RX-	24	+3.3V_ALW
25	PCIE1_RX+	26	GND
27	GND	28	+1.5V_RUN
29	GND	30	SMB_CLK
31	PCIE1_TX-	32	SMB_DAT
33	PCIE1_TX+	34	GND
35	GND	36	USB_P0-
37	GND	38	USB_P0+
39	+3.3V_ALW	40	N.C.
41	+3.3V_ALW	42	N.C.
43	GND	44	N.C.
45	N.C.	46	N.C.
47	N.C.	48	+1.5V_RUN
49	N.C.	50	GND
51	N.C.	52	+3.3V_ALW

To add communications functionality, it is available a dedicated Half/Full Mini-PCIe slot for WWAN connectivity (Modems), which allows plugging modules with USB 2.0 and/or PCI-e x1 interface.



The connector used for the WWAN module is CN10, which is a standard 52 pin Mini-PCIe slot, type TE 1775861-1, H=4.0mm, with the pinout shown in the table on the left.

On-board there is also a clip support on the space which allows the placement of Full size module while an Half size module can be installed using a Mini-PCIe Half to Full Size Extension Bracket.

Signals carried to the CN10 Mini-PCIe WWAN Slot are the following:

PCIE1_TX+/PCIE1_TX-: PCI Express lane #1, Transmitting Output Differential pair.

PCIE1_RX+/PCIE1_RX-: PCI Express lane #1, Receiving Input Differential pair.

PCIE1_CLK+ / PCIE1_CLK-: PCI Express Reference Clock for lane #1, Differential Pair.

PCIE_WAKE#: Board's Wake Input, it must be externally driven by the module inserted in the slot when it requires waking up the system.

PCIE_RST#: Reset Signal that is sent from Qseven® module to all PCI-e devices available on the board and the module. It is a +3.3V_ALW active-low signal.

PCIE1_CLOCK_REQUEST# PCI Express Clock Request Input. This signal shall be driven correctly by any module inserted in the slot, in order to ensure that the PCI-e clock buffer, available on the carrier board, makes available the reference clock to the slot.

USB_P0+/ USB_P0-: Qseven® Module USB Port #0 differential pair

UIM_PWR: Power line for UIM module.

UIM_DATA: Bidirectional Data line between WWAN card and UIM module.

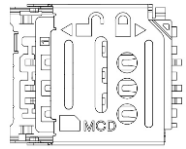
UIM_CLK: Clock line, output from WWAN card to the UIM module.

UIM_RESET: Reset signal line, sent from WWAN card to the UIM module.

Please be aware that all signals related to User Identity Modules are managed directly by the WWAN module circuitry, they don't involve neither carrier board's nor Qseven® module's management. The CQ7-D03 carrier board embeds only clamping diodes for ESD protection on UIM signal and voltage lines.

3.3.13 MicroSIM card slot

MicroSIM Card Slot – CN11			
Pin	Signal	Pin	Signal
1	UIM_PWR	6	UIM_DATA
2	UIM_RESET	7	SHIELD GND
3	UIM_CLK	8	SHIELD GND
4	GND	9	SHIELD GND
5	N.C.	10	SHIELD GND



CQ7-D03 carrier board can accept MicroSIM cards, for use of Mini-PCIe WWAN modems. These cards can be installed in the dedicated connector CN11, which is a hinged slot type, 1.5 mm height, type MOLEX 78800-0001 or equivalent. Pinout here reported is related only to signal routing on specific connector; internally the pin-out is the same of any standard MicroSIM card.

For ESD protection, on all signal lines are placed clamping diodes for voltage transient suppression.

Signals related to UIM (SIM) card have already been described in the previous paragraph.

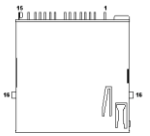
SDIO_CLK: SD Clock Line (output).

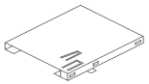
SDIO_CMD: Command/Response bidirectional line.

SDIO_DAT[0÷3]: SD Card data bus. SDIO_DAT0 signal is used for all communication modes. SDIO_DAT[1÷3] signals are required for 4-bit communication mode.

3.3.14 µSD card slot

µSD Card Slot – CN21			
Pin	Signal	Pin	Signal
1	SDIO_DAT2	8	SDIO_DAT1
2	SDIO_DAT3	9	SDIO_CD#
3	SDIO_CMD	10	GND
4	+3.3V_ALW	11	SHIELD GND
5	SDIO_CLK	12	SHIELD GND
6	GND	13	SHIELD GND
7	SDIO_DAT0		





Since Qseven® standard contemplates signals for Secure Digital Input/Output and MultiMedia Cards, on CQ7-D03 carrier board there is also a socket, for the use of standard SD or MMC cards, to be used as Mass Storage Device and/or Boot Device (if the Qseven® module used with this carrier board implements this functionality).

Please refer to the User Manual of the used Qseven® module for information about Card types supported by the chipset.

SHIELD GND Pinout here reported is related only to signal routing on specific connector; internally the pin-out is the same of any standard SD/MMC 4.0 card.

For ESD protection, on all signal lines are placed clamping diodes for voltage transient suppression.

Signals related to SDIO/MMC cards are the following:

SDIO_CD#: Card Detect Input.

SDIO_CLK: SD Clock Line (output).

SDIO_CMD: Command/Response bidirectional line.

SDIO_DAT[0÷3]: SD Card data bus. SDIO_DAT0 signal is used for all communication modes. SDIO_DAT[1÷3] signals are required for 4-bit communication mode.

3.3.15 Multistandard serial port and CAN bus

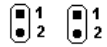
According to Qseven® specifications rel.2.1, there is the possibility of having a serial port directly on Qseven® card edge connector.

This interface (eventually managed by the processor/chipset of the Qseven® module used), is at TTL electrical level, i.e. it cannot be used directly for the connection of common PCs or consumer peripherals.

For this reason, on CQ7-D03 carrier board has been introduced an optional multistandard transceiver, which allows using the serial port interface offered by the Qseven® module in RS-232, RS-422 or RS-485 mode.

JP5 position	JP6 position	Serial Port #0 working
Not Inserted	Not Inserted	RS-485 Half Duplex mode
Not Inserted	Inserted	RS-485 Full Duplex mode (RS-422)
Inserted	Not relevant	RS-232 mode

Selection of working mode is made using jumpers JP5 and JP6, which are standard pin headers, P2.54mm, 1x2 pin.



Please refer to the table on the left for the selection of working mode of the serial port coming out from Qseven® connector.

Such a serial port is available on connector CN13, which is a standard pin header, P2.54mm, 2x4 pin.

Serial port #0 connector – CN13											
RS-232 mode				RS-485 Full Duplex mode				RS-485 Half Duplex mode			
Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	CAN L	2	CAN H	1	CAN L	2	CAN H	1	CAN L	2	CAN H
3	GND	4	GND	3	GND	4	GND	3	GND	4	GND
5	RxD_0	6	RTS_0#	5	RX+	6	TX+	5	N.C.	6	RX+/TX+
7	TxD_0	8	CTS_0#	7	TX-	8	RX-	7	N.C.	8	RX-/TX-

According to the working mode selected via jumpers JP5 and JP6, and assuming presence of the optional CAN bus port, the pinout of the connector will be as described in the following table.

Please consider that RS-232 signals RxD_0, TxD_0, RTS_0# and CTS_0# are obtained from signals UART0_RX, UART0_TX, UART0_RTS# and UART0_CTS# coming out from Qseven® card edge connector.

If the Qseven® module used doesn't support the UART interface in those pins, then serial port #0 on connector CN29 will not be usable, neither in RS-232 nor in RS-485 (Half and Full Duplex) modes.

JP4 position	UART routing
Not Inserted	To GPIO header connector
Inserted	To multistandard transceiver

When the optional multistandard transceiver is mounted, signals of the UART interface can be routed to the GPIO header, CN30, by jumper JP4 configuration which is a standard pin header, P2.54mm, 1x2 pin, according to the table on the left.

According to Qseven® specifications rel.2.1, the modules can optionally offer a CAN interface, since many architectures offer this kind of interface natively.

For this reason, on CQ7-D03 carrier board there is a CAN transceiver, which allows the system to be interfaced directly to any CAN Network.

This optional interface is available on the same CN13 connector of the optional multistandard Serial port.

JP3 position	120Ω CAN Termination
Not Inserted	Termination disconnected
Inserted	Termination present

CAN interface can optionally be terminated with a 120Ω Resistor, in case CQ7-D03 carrier is at one of the extremities of the CAN line. To enable this termination, is necessary to use jumper JP3, which is a standard pin header, P2.54mm, 1x2 pin, according to the table on the left.

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3.3.16 GPIO header

For further expandability of the system, on board there is an expansion connector, which carries out the signals related to SPI, I2C bus and 8 General Purpose I/O. These signals allow implementing, through external expansion modules, further functionalities that are not already realised by the carrier board.

Feature internal pin header - CN30

Pin	Signal	Pin	Signal
1	+3.3V_RUN	2	+5V_RUN
3	I2C_SDA	4	+5V_RUN
5	I2C_SCL	6	GND
7	GPIO4	8	TXD
9	GND	10	RXD
11	GPIO0	12	N.C.
13	GPIO2	14	GND
15	GPIO7	16	GPIO1
17	+3.3V_RUN	18	GPIO3
19	SPI_MOSI	20	GND
21	SPI_MISO	22	N.C.
23	SPI_SCK	24	SPI_CS0#
25	GND	26	SPI_CS1#
27	I2C_SDA	28	I2C_SCL
29	GPIO5	30	GND
31	GPIO6	32	GP_PWM_OUT2
33	N.C.	34	GND
35	N.C.	36	N.C.
37	N.C.	38	N.C.
39	GND	40	N.C.

For this purpose, it is available a dual row, 40 pin, P2.54mm standard pin header, with the pinout shown in the table on the left.

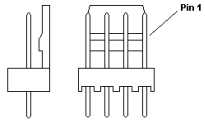
The pinout on this connector is compatible with the Raspberry Pi - GPIO Connector

All the signals available on this connector come out directly from the Qseven® connector and are listed on the table to the left.

3.3.17 FAN Connector

Depending on the usage model of systems based on CQ7-D03 carrier board, for critical applications/environments it is available a 4-pin dedicated connector for an external +12V_{DC} FAN.

FAN Connector - CN23	
Pin	**Signal**
1	GND
2	FAN_POWER
3	FAN_TACHO_IN
4	FAN_PWM_OUT



FAN Connector is a 4-pin single line connector, type MOLEX 47053-3000 or equivalent, with pinout shown in the table on the left.

Mating connector: MOLEX 22-01-2035 receptacle with MOLEX 4754 and 2759 crimp terminals.

Please be aware that the use of an external fan depends strongly on customer's application/installation.

Please refer to chapter 4.1 for considerations about thermal dissipation.

FAN_TACHO_IN: tachometric input from the fan to the Qseven® module.

FAN_PWM_OUT: PWM signal for direct control of a 4 wires connected FAN, this signal is coming from Qseven® connector.

FAN_POWER: power rail for FAN, voltage is selected by configuration of jumper JP7; when a 3 wires FAN this is connected this output is managed by PWM signal FAN_PWM_OUT

JP7 position	FAN Voltage
1-2	+12V_ALW
2-3	+5V_RUN

The voltage of the power supplied to the connected FAN can be set to +12V_ALW or +5V_RUN by using dedicated jumper JP7, which is a standard pin header, P2.54mm, 1x3 pin.

Configurations are shown on the table to the left.

JP8 position	FAN connector
1-2	3 wires FAN
2-3	4 wires FAN

The wires number of the connected FAN can be selected by using a dedicated jumper JP8, which is a standard pin header, P2.54mm, 1x3 pin.

Configurations are shown on the table to the left.

Chapter 4.
Appendices

- Thermal Design

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4.1 Thermal Design

A parameter that has to be kept in very high consideration is the thermal design of the system.

Highly integrated modules, like Qseven® modules, offer to the user very good performances in minimal spaces, therefore allowing the systems' minimisation. On the counterpart, the miniaturising of IC's and the rise of operative frequencies of processors lead to the generation of a big amount of heat, that must be dissipated to prevent system hang-off or faults.

Qseven® specifications take into account the use of a heatspreader, which will act only as thermal coupling device between the Qseven® module and an external dissipating surface/cooler. The heatspreader also needs to be thermally coupled to all the heat generating surfaces using a thermal gap pad, which will optimise the heat exchange between the module and the heatspreader.

The heatspreader is not intended to be a cooling system by itself, but only as means for transferring heat to another surface/cooler, like heatsinks, fans, heat pipes and so on.

Conversely, heatsinks in some situation can represent the cooling solution. Until the modules are used on a development Carrier board, on free air, just for software development and system tuning, then a finned heatsink could be sufficient for modules' cooling. Anyhow, please remember that all depends also on the workload of the processor. Heavy computational tasks will generate much heat.

Indeed, when using CQ7-D03 carrier board with any Qseven® module, it is necessary to consider carefully the global heat generated by the system, and the scenario of utilisation.

Therefore, it is always necessary that the customer study and develop accurately the cooling solution for his system, by evaluating processor's workload, utilisation scenarios, the enclosures of the system, the air flow and so on. This is particularly needed for industrial grade modules.

SECO can provide Qseven® modules' specific heatspreaders and heatsinks, but please remember that their use must be evaluated accurately inside the final system (electronics + mechanics), and that they should be used only as a part of a more comprehensive ad-hoc cooling solutions, which also keeps the surface temperature of all carrier board's components in the temperature range specified for the specific carrier board configuration (industrial or commercial grade).

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