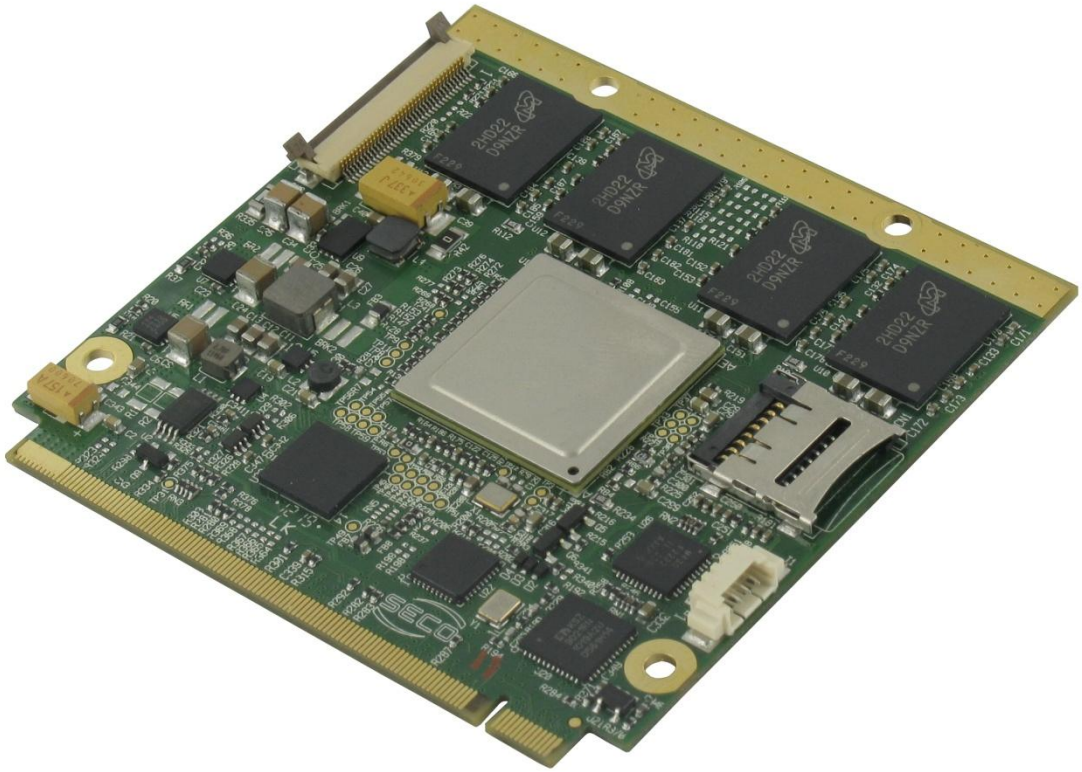
QUADMO747-X/i.MX6

Qseven® Module with Freescale™ i.MX6 Processor



User Manual

SECO

QUADMO747-X/i.MX6

REVISION HISTORY

Revision	Date	Note	Rif.
1.0	16th November 2012	First release	SB

For further information as regards this module or other SECO products please visit our websites at http://www.seco.com and http://www.secoqseven.com.

Moreover in order to have the proper assistance for any possible issue please complete your registration online on our specific website for Qseven modules (http://www.secoqseven.com).

Our team will be pleased and ready to assist you.

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Chapter 1. INTRODUCTION

- **Warranty**
- **Information and assistance**
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- **Safety**
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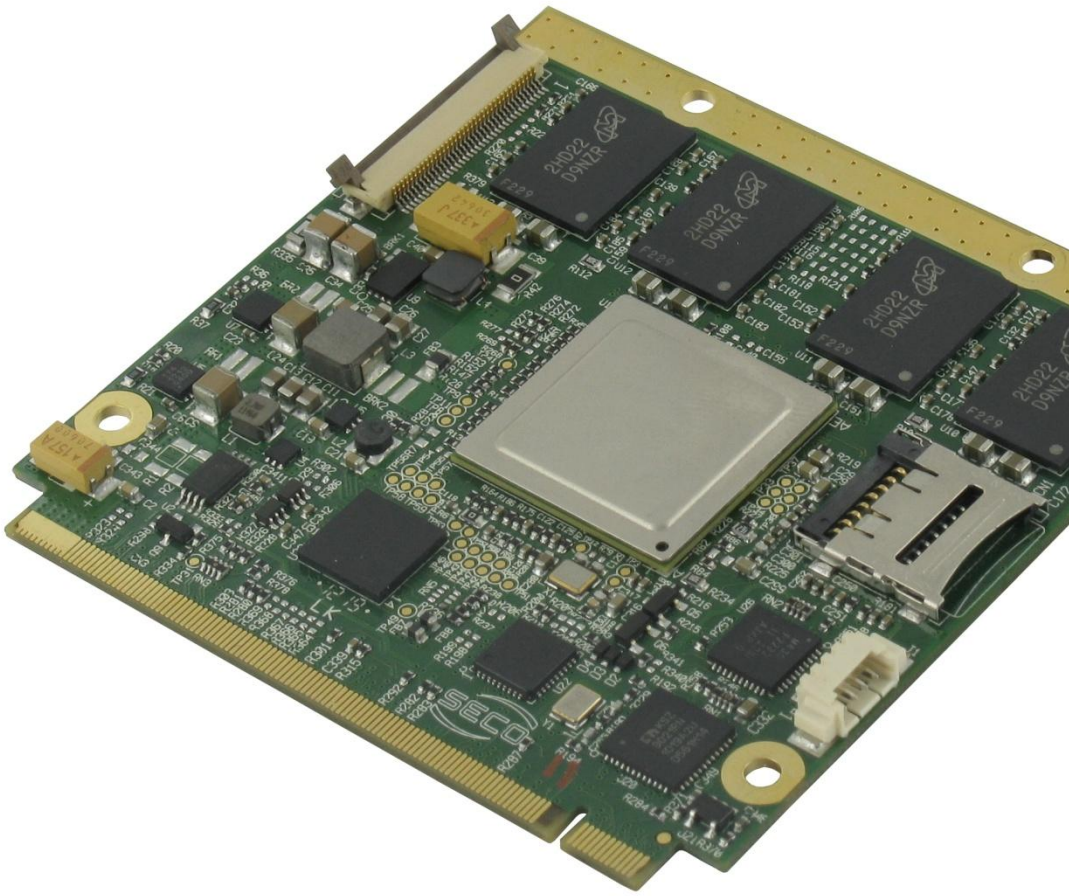


1.1 Warranty

This product is subject to Italian law D. Lgs 24/2002, acting European Directive 1999/44/CE on arguments of sale and warranties to consumer.

The warranty for this product lasts 1 year

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

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

Items cannot be returned unless formerly authorised by the supplier.

The authorisation is released after compiling the specific form available from the web-site http://www.seco.com (RMA Online). Authorisation number for returning the item must be put both on the packaging and on the documents brought with the items, which have to be not damaged, not tampered, with all accessories in their original packaging.

Error analysis form identifying the fault type has to be compiled by the customer and has to be sent in the packaging of the returned item.

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

The supplier, after a technical analysis, will verify if all the requirements for warranty service are met. If warranty can not be applied, he calculates the minimum cost of this initial analysis on the item and the repairing costs. Costs for replaced components will be calculated aside.

Warning!

All changes or modifications to the equipment not clearly approved by SECO S.r.l. could impair equipment's functionality and lead to the expire of the warranty

1.2 Information and assistance

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

SECO S.r.l. offers the following services:

- SECO website: visit http://www.secoqseven.com to receive the last information on the product. In most of the cases you can find useful information to resolve your problem.
- SECO reseller: the reseller or agent can help you in determining the exact cause of the problem and search the best solution for it.
- SECO Help-Desk: contact SECO Technical Assistance.

  A technician is at your disposal to understand the exact origin of the problem and suggest the right solution.

  E-mail: technical.service@seco.com

  Fax (+39) 0575 340434
- Repairing centre: it is possible to send the faulty product to SECO Repairing Centre. In this case, follow this procedure:
  - Returned items have to be provided with RMA Number. Items sent without RMA number will be not accepted.
  - Returned items have to be packed in the appropriate manner. SECO is not responsible for damages caused by accidental drop, improper usage, or customer neglects.

  Note: We ask to prepare the following information before asking for technical assistance:

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

1.3 RMA number request

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

You will receive an RMA Number within 1 working day (only for on-line RMA request).

1.4 Safety

Quadmo747-X/i.MX6 module only uses extremely-low voltages.

While handling the board, it is necessary to be careful in order 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.

Don't use metallic components, like paper clips, screws and similar, near the board, when this is supplied, to avoid short circuits due to unwanted contacts with other components of the board.

Never connect the board to an external power supply unit or battery, if the board has become wet.

Make sure that all cables are correctly connected and are not damaged.

1.5 Electrostatic Discharges

Quadmo747-X/i.MX6, like any other electronic product, is an electrostatic sensitive device and some device on-board could be damaged by high voltages caused by static electricity.

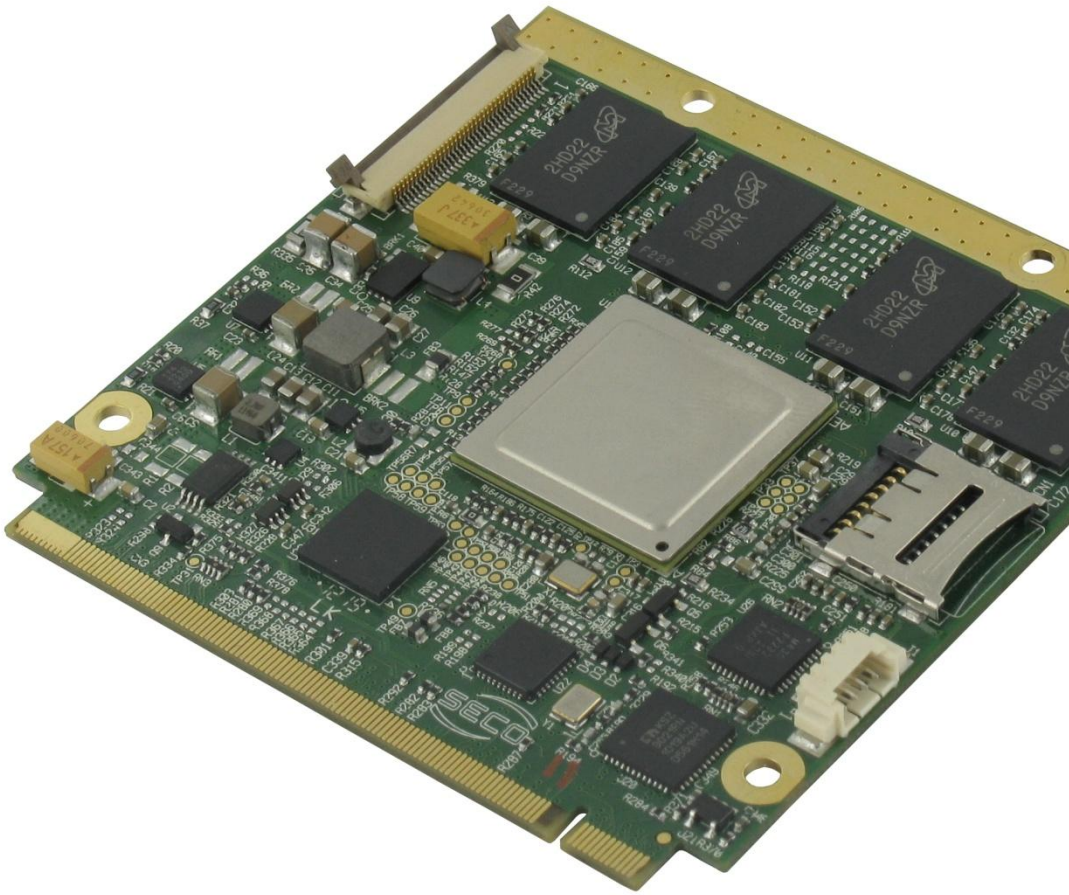
So whenever handling a Quadmo747-X/i.MX6 board, take care to ground yourself through an anti-static wrist strap. Placement of the board on an anti-static surface is also highly recommended.

1.6 RoHS compliance

Quadmo747-X/i.MX6 board is designed using RoHS compliant components and is manufactured on a lead-free production line. It is therefore fully RoHS compliant.

Chapter 2. OVERVIEW

- **Introduction**
- **Technical Specifications**
- **Electrical specifications**
- **Mechanical specifications**
- **Block diagram**



2.1 Introduction

Quadmo747-X/i.MX6 is a CPU module, in Qseven® format, based on embedded Freescale™ i.MX6 processor, an ARM® Cortex®-A9 processor, Single- Dual- and Quad-Core, with frequencies up to 1.2GHz, which is ideal for applications requiring multimedia capabilities and/or high levels of parallel computing.

Along with programmable CPLD Lattice LCMXO640, the board offers a very high level of integration, both for all most common used peripherals in ARM world and for bus interfaces normally used in x86 world, like PCI-Express and S-ATA.

All this comes out in the extremely reduced space offered by Qseven® boards, which offers all functionalities of standard boards in just 70x70mm.

This solution allows combining the advantages of a standard, ready-to-use board, like Qseven® boards are, with all advantages offered by ARM application specific processors like Freescale™ i.MX6 processor, in its different versions (Single Core, Dual Core, Quad Core)

Moreover, Freescale™ i.MX6 processors integrates, for each processor's core, three separeted accelerators for 2D, OpenGL® ES2.0 3D and OpenVG™, giving the processor incredible graphical performances.

The board is completed with up to 4GB DDR3 directly soldered on board, and one eMMC Flash Disk, directly accessible like any standard Hard Disk, with up to 32GB of capacity.

The board has up to four display interfaces, all of them can work simultaneously in an independent way: the first one, is a 24 bit Single/Dual Channel LVDS interface, which can be configured to work as two independent 24 bit Single Channel interfaces. Third display interface, is i.MX6's native HDMI interface. The last display interface is i.MX6's DSI interface (optional).

HW video decoding of the most common coding standard (i.e., H.264, MPEG2, MPEG4, DivX, RealVideo and other) is supported.

Many other features available through the standard Qseven® controller are native for i.MX6 processor: CAN Interface, UART interfaces, SD/SDIO/MMC interface, PCI –Express x1 , SATA, 2 x PWM Channels, AUDIO, GPI/Os, one USB OTG port.

USB Hi-Speed interface drives an SMSC USB2514 USB2.0 Hi-Speed USB Hub Controller, which allows the board to have 4 USB 2.0 Host Ports.

RGMII i.MX6 native interface is internally carried to a Micrel KSZ9031RN Ethernet Transceiver, allowing the implementation of a Gigabit Ethernet interface

The Lattice CPLD mounted on board, makes available LPC Bus, one additional PWM Channel and one Timer input.

For external interfacing to standard devices, a carrier board with a 230-pin MXM connector is needed. This board will implement all the routing of the interface signals to external standard connectors, as well as integration of other peripherals/devices not already included in Quadmo747-X/i.MX6 CPU module.

Furthermore, an FFC/FPC connector is provided to give access to Image Processing Unit of i.MX6 processor, which supports multiple formats and can be connected to a wide variety of image sensors for video-preview, video-record and frame grabbing applications. Interfacing is possible using the direct parallel interface or the integrated MIPI/CSI interface (both available on the same connector).

To learn more about Qseven® standard: http://www.qseven-standard.org.

To learn more about SECOQseven philosophy: http://www.secoqseven.com.

2.2 Technical Specifications

- **Processors:** Freescale™ i.MX6 Family, single-, dual- and quad-core processors based on ARM® CORTEX-A9, up to 1.2GHz per Core
- **Memory:** Up to 4GB DDR3 onboard
- **Graphics:** integrated graphics, each processor provides 3 separated accelerators for 2D, OpenGL® ES2.0 3D and OpenVG™
  Supports up to 4 independent displays
- **Display:** 1 x LVDS Dual Channel or 2 x LVDS Single Channel 18/24 bit interface (resolution up to 1920x1200)
  HDMI interface (resolution up to 1080p)
  Optional DSI Interface
- **Mass Storage:** On board eMMC, up to 32GB
  1 x S-ATA channels
  MMC/SD/SDIO interface
  1 x µSD card slot onboard
- **PCI Express:** 1 x PCI-e x 1 lanes
- **USB:** 1 x USB OTG
  4 x USB 2.0 Host
- **Ethernet:** Gigabit Ethernet interface
- **Audio:** AC'97 Audio interface
- **Video Input Port / Camera Connector**
- **Serial Ports:** 2x serial ports
  CAN Interface
- **Expansion Bus:** I^2C, SM Bus, LPC, SPI
- **Power Management signals**
- **Power supply voltage:** $+5V_{DC}$ ± 5%
- **Operating temperature:** 0°C ÷ +60°C
- **Dimensions:** 70 x 70 mm (2.76" x 2.76")

2.3 Electrical specifications

According to Qseven® specifications, Quadmo747-X/i.MX6 board needs to be supplied only with an external +5V_{DC} power supply.

+5V_{SB} voltage needs to be supplied for working in ATX mode. For Real Time Clock working and CMOS memory data retention, it is also needed a backup battery voltage. All these voltages are supplied directly through card edge fingers (see connector's pinout).

All remaining voltages needed for board's working are generated internally from +5V_{DC} power rail.

2.3.1 Power Consumption

TBM

2.4 Supported Operating Systems

Quadmo747-X/i.MX6 supports the following operating systems:

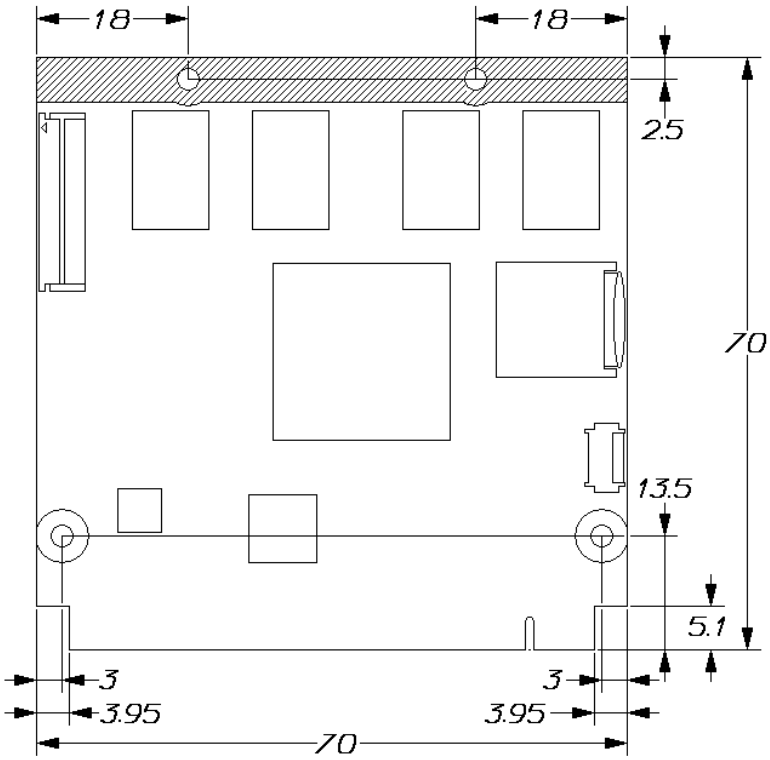
- Linux
- Android
- Windows EC 7

SECO will offer the BSP (Board Support Package) for these O.S., to reduce at minimum SW development of the board, giving all the drivers and libraries needed for use both the Qseven® board and the Carrier Board, according that the Carrier Board is designed following SECOQseven Design Guide, with the same IC's.

For further details, please visit http://www.secoqseven.com.

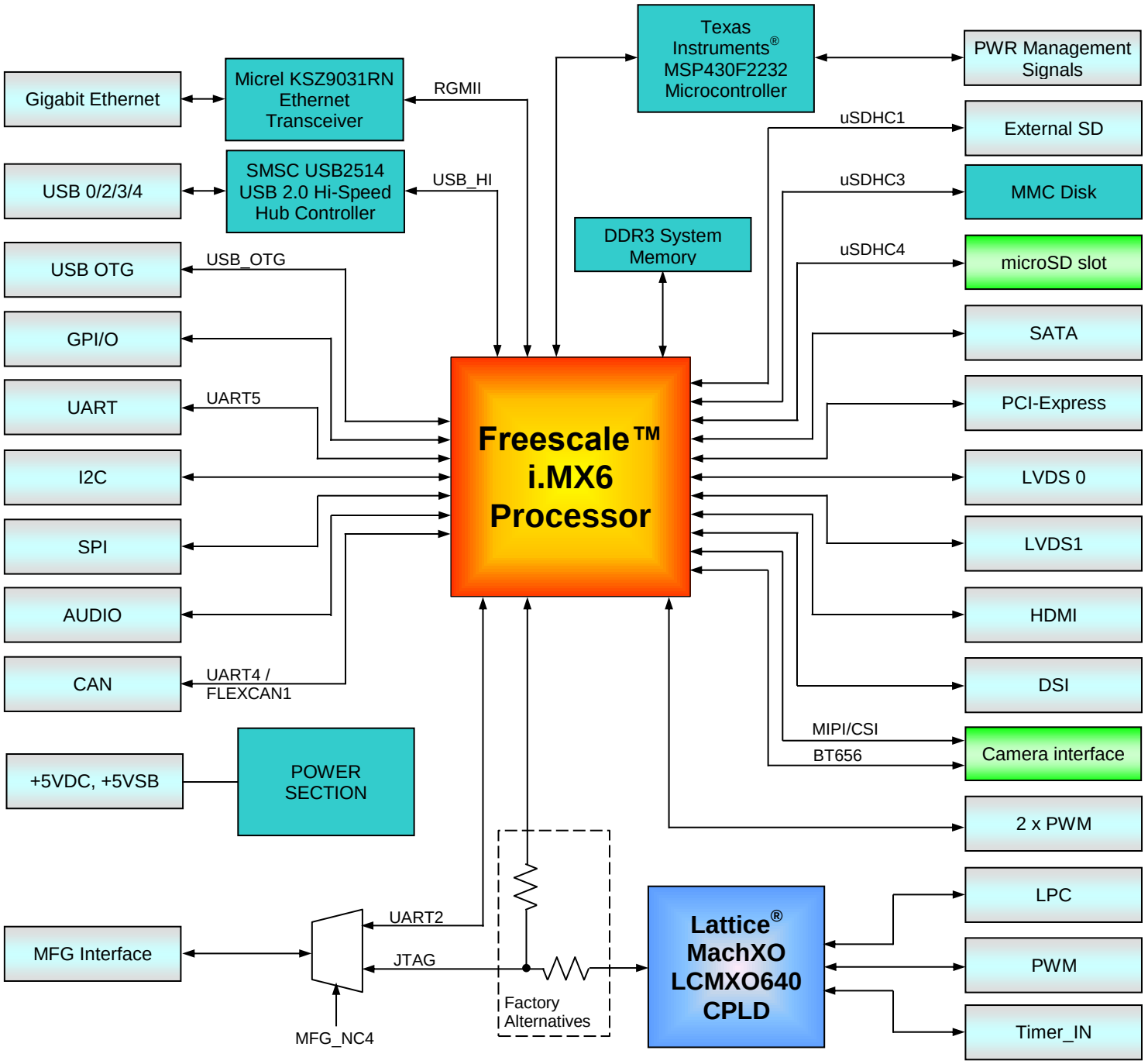
2.5 Mechanical specifications

According to Qseven® specifications, board dimensions are: 70 x 70 mm (2.76" x 2.76").



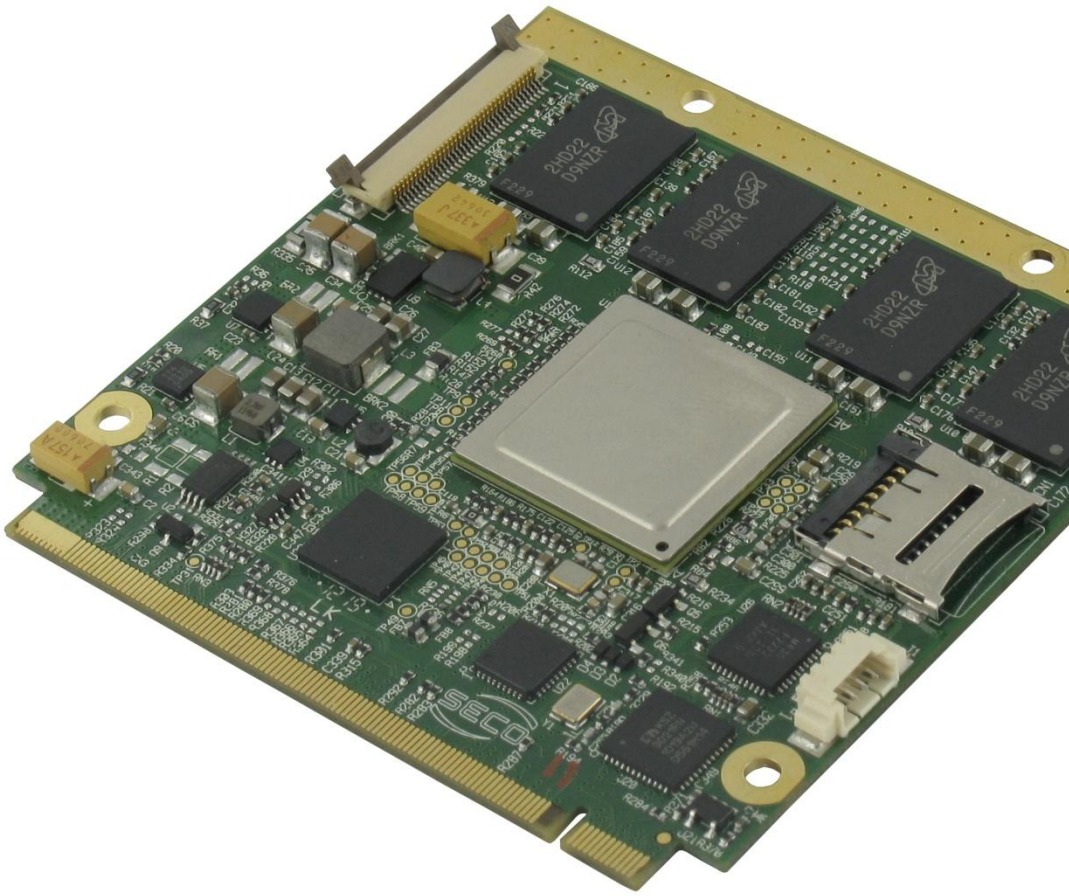
Printed circuit of the board is made of twelve layers, some of them are ground planes, for noise rejection.

2.6 Block diagram



Chapter 3. CONNECTORS

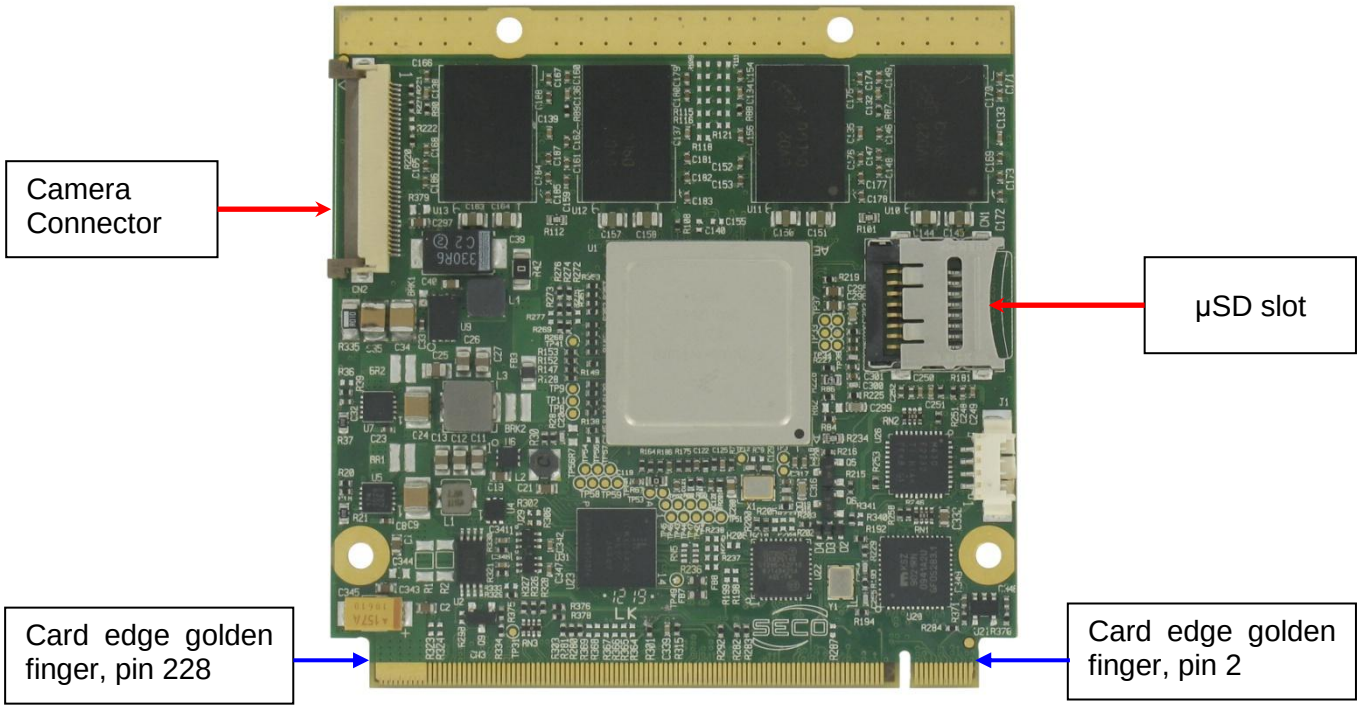
- **Connectors overview**
- **Connectors description**



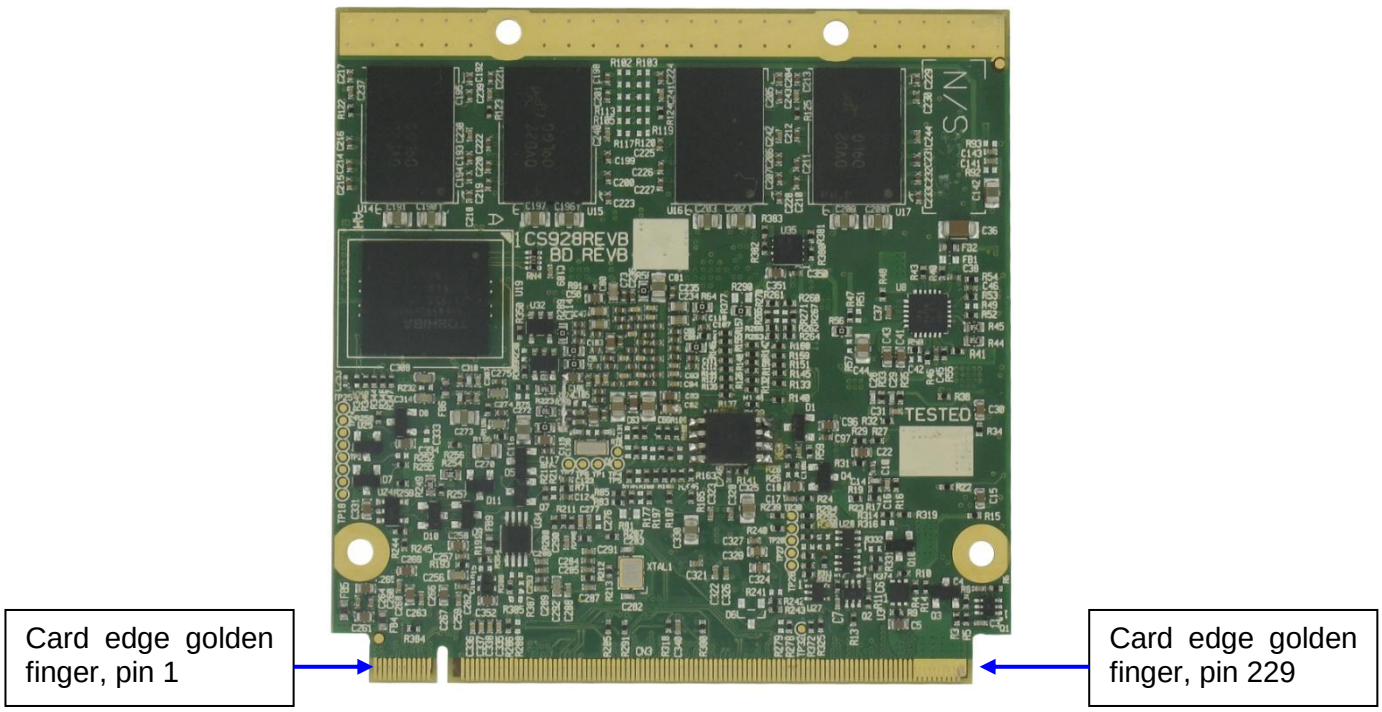
3.1 Connectors overview

According to Qseven® specifications, all interfaces to the board are available through a single card edge connector. In addition, a camera FFC/FPC connector card slot is present on the side of the board to take advantage of the integrated ISP (Image Signal Processing) subsystem of i.MX6 processor.

Top side



Bottom side



3.2 Connectors description

3.2.1 FFC/FPC Camera Interface

Freescale™ i.MX6 Processor includes an Image Processing Subsystem, that can be used for video applications, like video-preview, video recording and frame grabbing.

The access to the video input port comes through an FFC/FPC connector, type HIROSE p/n FH12A-36-S-0.5SH(55).

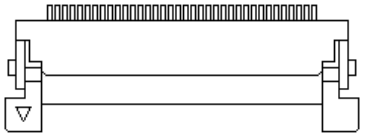
On the same connector are carried:

- a 10-bit parallel port, supporting ITU-r BT.656 and so on;
- MIPI CSI (Camera Serial Interface) Port.

Both video inputs can work independently and simultaneously

CSI0_DATx signals are at +3.3V_{DC} electrical level, while CSI0_Dx differential signals are at +1.2V_{DC} electrical level.

CAMERA CONNECTOR – CN2			
Pin	**Signal**	**Pin**	**Signal**
1	CAM_XCLK_A	19	CSI0_DAT11
2	GND	20	CSI0_D2_DN
3	---	21	CSI0_D2_DP
4	GND	22	CAM_GPIO_A
5	CAM_PCLK	23	GP0_I2C_CLK
6	CAM_VS	24	GP0_I2C_DAT
7	CAM_HS	25	CAM_RESETB
8	CAM_FLD	26	GND
9	GND	27	CSI0_D3_DN
10	CSI0_DAT12	28	CSI0_D3_DP
11	CSI0_DAT13	29	+3.3V_{DC}
12	CSI0_DAT14	30	+3.3V_{DC}
13	CSI0_DAT15	31	CSI0_CLK0_DN
14	CSI0_DAT16	32	CSI0_CLK0_DP
15	CSI0_DAT17	33	CSI0_D0_DN
16	CSI0_DAT18	34	CSI0_D0_DP
17	CSI0_DAT19	35	CSI0_D1_DN
18	CSI0_DAT10	36	CSI0_D1_DP



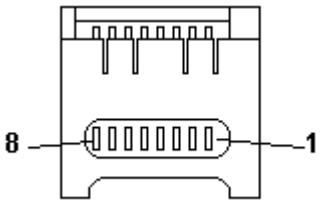
3.2.2 MicroSD Card Slot

On Quadmo747-X/i.MX6 board, Freescale™ i.MX6 processor offer many different SDIO interfaces, that can be used independently one from the other to implement different mass storages (internal eMMC, internal SD Card, external SDI/O interface)

SDI/O port #4 is carried to a microSD card slot, soldered on board on top side.

The connector is a standard microSD slot, type TOWNES TKS0192003 or equivalent.

SD/MMC Card Connector – CN1	
Pin	**Signal**
1	SD4_DATA_2
2	SD4_DATA_3
3	SD4_Command
4	SD_Power(+3.3V, software enabled)
5	SD4_Clock
6	GND
7	SD4_DATA_0
8	SD4_DATA_1



3.2.3 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 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 Quadmo747-X/i.MX6 CPU module. Therefore, please refer to the following table for a list of effective signals reported on MXM connector.

For accurate signals description, please consult Qseven® specifications.

NOTE: Even pins are available on top side of CPU board; odd pins are available on bottom side of CPU board. Please refer to board photos.

Card Edge Golden Fingers – CN4			
Pin	**Signal**	**Pin**	**Signal**
1	GND	2	GND
3	GBE_MDI3-	4	GBE_MDI2-
5	GBE_MDI3+	6	GBE_MDI2+
7	GBE_LINK100#	8	GBE_LINK1000#
9	GBE_MDI1-	10	GBE_MDI0-
11	GBE_MDI1+	12	GBE_MDI0+
13	GBE_ACT#	14	GBE_ACT#
15	GBE_CTREF	16	SUS_S4#
17	WAKE#	18	SUS_S3#
19	SUS_STAT#	20	PWRBTN#
21	SLP_BTN#	22	LID_BTN#
23	GND	24	GND
25	GND	26	PWGIN

27	BATLOW#	28	RST_BTN#
29	SATA0_TX+	30	---
31	SATA0_TX-	32	---
33	SATA_ACT#	34	GND
35	SATA0_RX+	36	---
37	SATA0_RX-	38	---
39	GND	40	GND
41	BOOT_ALT#	42	SDIO_CLK#
43	SDIO_CD#	44	SDIO_LED
45	SDIO_CMD	46	SDIO_WP
47	---	48	SDIO_DATA_1
49	SDIO_DAT0	50	SDIO_DATA_3
51	SDIO_DAT2	52	SDIO_DATA_5
53	SDIO_DAT4	54	SDIO_DATA_7
55	SDIO_DAT6	56	RSVD
57	GND	58	GND
59	AC'97_SYNC	60	SMB_CLK
61	AC'97_RST#	62	SMB_DAT
63	AC'97_BCLK	64	---
65	AC'97_SDI	66	GP0_I2C_CLK
67	AC'97_SDO	68	GP0_I2C_DAT
69	THRM#	70	WDTRIG#
71	THRMTRIP#	72	WDOUT
73	GND	74	GND
75	---	76	---
77	---	78	---
79	---	80	USB_4_5_OC#
81	---	82	USB_P4-
83	---	84	USB_P4+
85	USB_2_3_OC#	86	USB_0_1_OC#
87	USB_P3-	88	USB_P2-
89	USB_P3+	90	USB_P2+
91	USB_CC	92	USB_ID
93	USB_P1-	94	USB_P0-
95	USB_P1+	96	USB_P0+
97	GND	98	GND
99	LVDS_A0+	100	LVDS_B0+
101	LVDS_A0-	102	LVDS_B0-
103	LVDS_A1+	104	LVDS_B1+
105	LVDS_A1-	106	LVDS_B1-
107	LVDS_A2+	108	LVDS_B2+

109	LVDS_A2-	110	LVDS_B2-
111	LVDS_PPEN	112	LVDS_BLEN
113	LVDS_A3+	114	LVDS_B3+
115	LVDS_A3-	116	LVDS_B3-
117	GND	118	GND
119	LVDS_A_CLK+	120	LVDS_B_CLK+
121	LVDS_A_CLK-	122	LVDS_B_CLK-
123	GP_PWM_OUT0	124	HDMI_CEC
125	GPIO_6	126	GPIO_7
127	GPIO_19	128	GPIO_8
129	CAN0_TX	130	CAN0_RX
131	HDMI_CLK+	132	---
133	HDMI_CLK-	134	---
135	GND	136	GND
137	HDMI_TX1+	138	---
139	HDMI_TX1-	140	---
141	GND	142	GND
143	HDMI_TX0+	144	---
145	HDMI_TX0-	146	---
147	GND	148	GND
149	HDMI_TX2+	150	HDMI_CTRL_DAT
151	HDMI_TX2-	152	HDMI_CTRL_CLK
153	HDMI_HPD#	154	GPIO6_9
155	PCIE_CLK_REF+	156	PCIE_WAKE#
157	PCIE_CLK_REF-	158	PCIE_RST#
159	GND	160	GND
161	---	162	---
163	---	164	---
165	GND	166	GND
167	---	168	---
169	---	170	---
171	UART0_TX	172	UART0_RTS#
173	---	174	---
175	---	176	---
177	UART0_RX	178	UART0_CTS#
179	PCIE0_TX+	180	PCIE0_RX+
181	PCIE0_TX-	182	PCIE0_RX-
183	GND	184	GND
185	LPC_AD0	186	LPC_AD1
187	LPC_AD2	188	LPC_AD3
189	LPC_CLK	190	LPC_FRAME#

191	SERIRQ	192	LPC_LDRQ#
193	Vcc_RTC	194	GP_PWM_OUT2
195	GP_TIMER_IN	196	GP_PWM_OUT1
197	GND	198	GND
199	SPI_MOSI	200	SPI_CS0#
201	SPI_MISO	202	SPI_CS1#
203	SPI_CLK	204	MFG_NC4
205	$+5V_{SB}$	206	$+5V_{SB}$
207	JTAG_TCK	208	JTAG_TDI / UART_DEBUG_RX
209	JTAG_TDO / UART_DEBUG_TX	210	JTAG_TMS
211	VCC	212	VCC
213	VCC	214	VCC
215	VCC	216	VCC
217	VCC	218	VCC
219	VCC	220	VCC
221	VCC	222	VCC
223	VCC	224	VCC
225	VCC	226	VCC
227	VCC	228	VCC
229	VCC	230	VCC

According to Qseven® Standard specifications, rel. 2.0, on pin designed as MFG_NCx (pins 204, 207÷210) are carried the JTAG signal necessary to program Quadmo747-X/i.MX6 internal FPGA.

Pins 208 and 209 are multiplexed, according to the above mentioned specifications, with Freescale™ i.MX6 Internal UART #3 signals TX and RX.

Selection between JTAG and UART DEBUG signals is made by driving the MFG_NC4 signal carried on pin 20, with the following meaning:

MFG_NC4 signal level	**Pin 208 signal:**	**Pin 209 signal:**
LOW	UART_DEBUG_RX	UART_DEBUG_TX
HIGH	JTAG_TDI	JTAG_TDO

In case MFG_NC4 signal is not driven externally, then an internal pull-up makes available JTAG_TDI and JTAG_TDO signals on pin 208 and 209.

3.2.4 SECOQseven philosophy's specific signals.

According to SECOQseven philosophy, on Quadmo747-X/i.MX6 finger connector there are some signals that are not implemented in Qseven® Specifications rel. 2.0, but that don't interfere with standard Carrier Boards (i.e., Carrier Boards not designed according to SECOQseven philosophy's Design Guide).

GPIO Signals

Pin 125: GPIO_6: General Purpose I/O, connected to i.MX6 pin GPIO_6 (pin T3, GPIO port)
Pin 126: GPIO_7: General Purpose I/O, connected to i.MX6 pin GPIO_7 (pin R3, GPIO port)
Pin 127: GPIO_19: General Purpose I/O, connected to i.MX6 pin GPIO_19 (pin P5, GPIO port)
Pin 128: GPIO_8: General Purpose I/O, connected to i.MX6 pin GPIO_8 (pin R5, GPIO port)
Pin 154: GPIO6_9: General Purpose I/O, connected to i.MX6 pin NANDF_WP_B (pin E15, GPIO port)

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