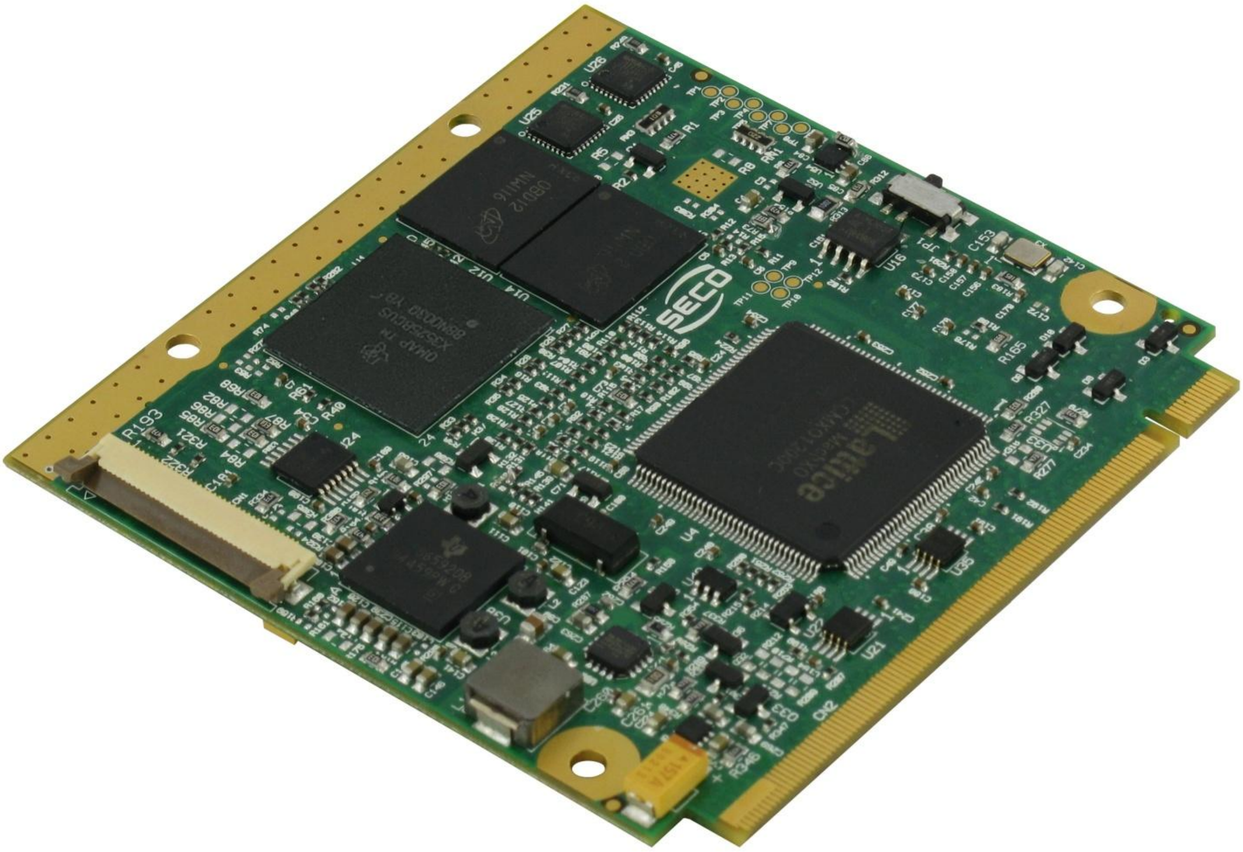
QUADMO747-X/OMAP3

Qseven™ Module with Texas Instruments® OMAP™ 35xx or 37xx Processor



User Manual

QUADMO747-X/OMAP3

REVISION HISTORY

Revision	Date	Note	Rif.
0.1	28/09/2010	First release	SB
0.2	16/11/2010	Corrected QSeven Specifications Release Number (1.20 instead of 1.2) Serial signals on par. 3.2.4 corrected	SB
0.3	14/04/2011	OMAP37xx Family Added. Specifications updated	SB

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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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- **Warranty**
- **Information and assistance**
- **RMA number request**
- **Safety**
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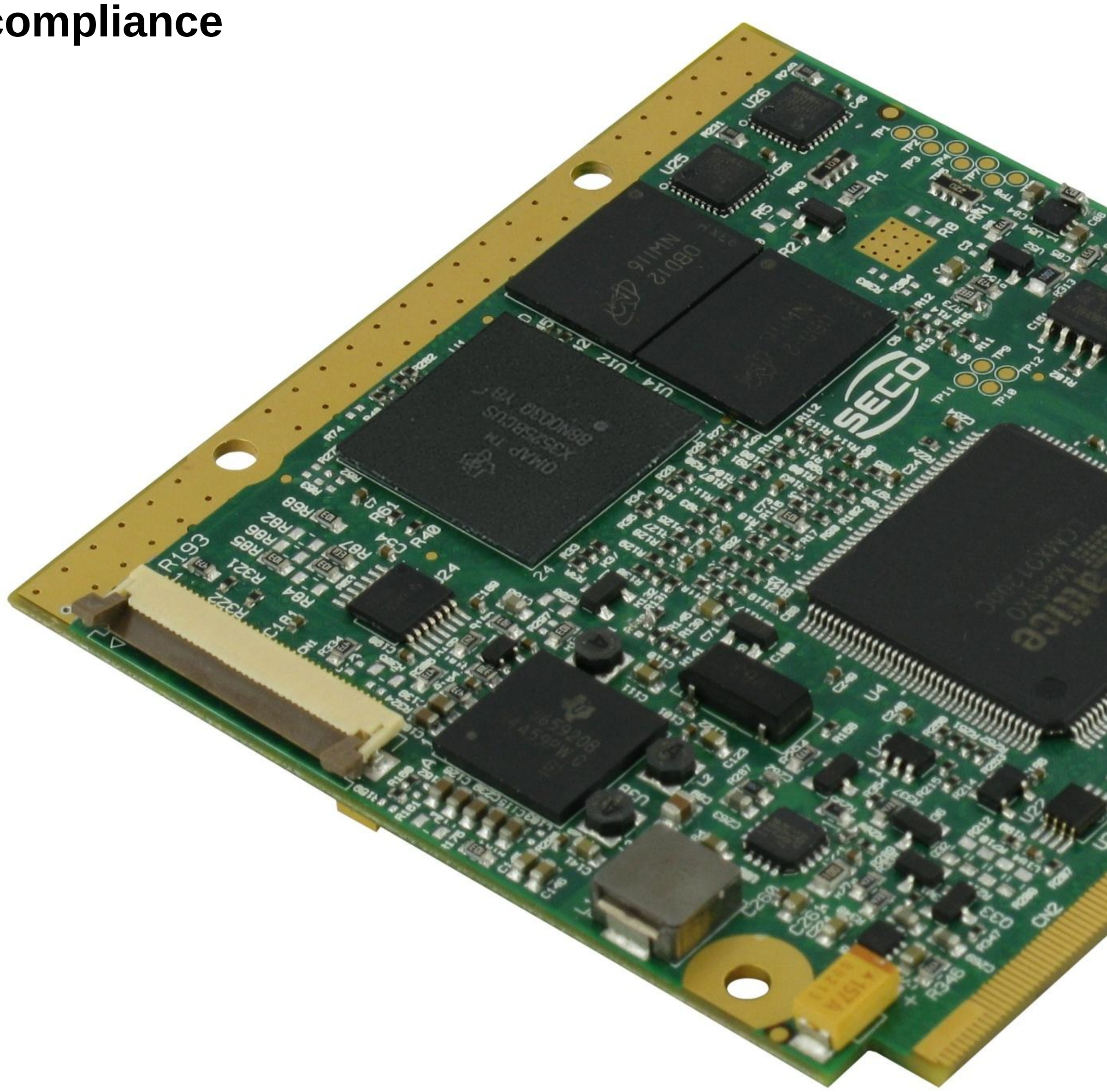
- **RoHS compliance**



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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.it (RMA Online). Authorisation number for returning the item must be put both on the packaging and on the documents brought with the items, that 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

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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.SECO.it 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 by phone the SECO Technical Assistance.

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

ITALY Tel. (+39) 0575 340427

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).

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1.4 Safety

Quadmo747-X/OMAP3 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/OMAP3, 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/OMAP3 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/OMAP3 board is designed using RoHS compliant components and is manufactured on a lead-free production line. It is therefore fully RoHS compliant.

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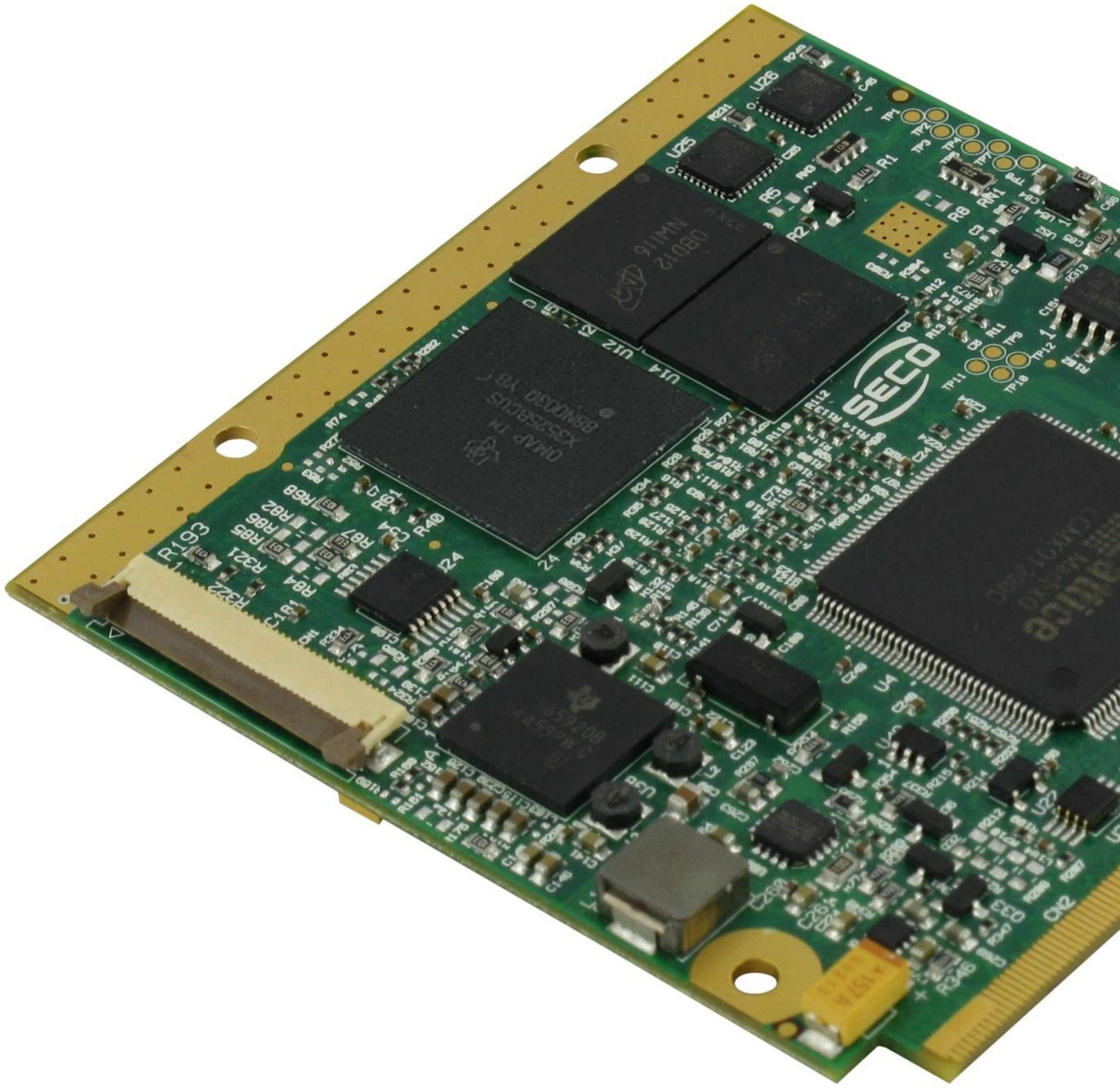
Chapter 2 OVERVIEW

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



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2.1 Introduction

Quadmo747-X/OMAP3 is a CPU module, in new QSeven™ format, based on Texas Instruments® OMAP™ 35xx or OMAP 37xx processor families, ARM® Cortex™-A8 based families of microprocessors that offer high performances with low power consumption. Paired to Companion chip TPS65920, the chipsets offer a high level of integration for all most common used peripherals in ARM world. All this comes out in an extremely reduced space, like that 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 OMAP™.

Processors available for Quadmo747-X/OMAP3 module are Texas Instruments® OMAP™ 3503 or AM3703, that represent the lower end solution, Texas Instruments® OMAP™ 3515, that is the middle-end solution, and Texas Instruments® OMAP™ 3530 or DM3730, with more Audio and Video capabilities.

Main difference between OMAP™ 35xx family and AM/DM 37xx family is productive process (65nm for 35xx, 45nm for 37xx), that allow to increase operative frequencies, while keeping power consumption unchanged.

This means that OMAP™ 3530 and DM3730 have the same functional characteristics, as well as OMAP™ 3503 in comparison with AM3703, but difference is in the Core Frequency: 720 MHz for OMAP™ 3530, 600 MHz for OMAP™ 3503, 800MHz or 1GHz core frequency for AM3703 and DM3730 (both frequencies are available for both processors)

OMAP™ 3515, 3530 and DM3730 also include a POWERVR SGX™ Graphics Accelerator, able to manage up to 10Mpoly/sec and support for Industry Standard API OpenGLES 1.1 and 2.0, OpenVG 1.0. Furthermore, OMAP™ 3530 and DM3730 include a C64x+™ DSP Imaging Video and Audio Accelerator.

The board is completed with up to 256MB DDR2 directly soldered on board (up to 512MB DDR2 for 37xx family), and one NAND Flash Disk, directly accessible like any standard Hard Disk, with up to 1GB of capacity. On 37xx family based boards, it is also possible to have an eMMC soldered on board, with a capacity up to

Onboard there can optionally be a Fast Ethernet Controller, SMSC® LAN9220.

The Lattice FPGA mounted onboard, finally, makes available an AC'97 Audio Interface, LVDS and LPC interfaces.

Interface to the board comes through the single card edge connector, as defined by QSeven™ specifications Rel. 1.20: on this connector, signals are available for FastEthernet, the SD/MMC Card interface, 2 USB 2.0 ports , 1 USB OTG, 18 or 24-bit Single Channel LVDS, AC'97/I^{2}S Audio interface, I^{2}C, LPC and SM buses, and other features.

External interfacing to standard devices requires a carrier board with a 230-pin MXM connector. 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 CPU module.

Furthermore, an FFC/FPC connector is provided to give access to Camera ISP (Image Signal Processing) subsystem of OMAP™35xx processors, that supports multiple formats and can be connected to a wide variety of image sensors (raw, YUV, JPEG image sensor modules) for video-preview, video-record and frame grabbing applications.

Due to the lowest power consumption of the board, it is not necessary to provide for application specific heatspreaders, since the board is able to work, as-it-is, both in 0°C÷70°C temperature range (commercial version) and in –40°C ÷ +85°C (industrial version, with all industrial temperature range certified components).

To learn more about QSeven™ standard: http://www.qseven-standard.org.

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

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2.2 Technical Specifications

- **Processors:** Texas Instruments® OMAP™ 3503@ 600MHz

  Texas Instruments® OMAP™ 3515@ 600MHz, with Power VR SGX™ graphics

  Texas Instruments® OMAP™ 3530@ 600MHz, with Power VR SGX™ graphics, C64x+ DSP & Video Accelerator

  Texas Instruments® AM3703, 800MHz / 1GHz

  Texas Instruments® DM3730, 800MHz / 1GHz, with Power VR SGX™ graphics, C64x+ DSP & Video Accelerator
- **Companion Chip:** Texas Instruments® TPS65920 (Triton2)
- **DRAM:** Up to 256MB DDR Mobile (up to 512MB DDR Mobile with 37xx family)
- **Flash Disk:** 256MB / 512MB / 1 GB NAND Flash Disk soldered onboard

  eMMC (only available with 37xx processors)
- **LVDS:** Single/dual channel LVDS interface, at 18 or 24 bit
- **Ethernet:** 10/100Base-T Ethernet interface
- **USB:** 1 x USB OTG

  2 x USB 2.0 Host (only USB2.0 working)
- **Serial Ports** 2 x COM Ports

  CAN Interface
- **AUDIO:** AC'97 / I^2S interface
- **SDIO:** MMC/HC MMC/SD/SDHC/SDIO interface
- **Video Input Port / Camera Connector**
- **I2C Bus**
- **LPC Bus**
- **SMBus**
- **SPI Interface**
- **JTAG interface**
- **Power Management Signals**
- **Power supply voltage:** $+3.3V_{DC} \div +5V_{DC}$
- **TDP:** Typical <2.5 W with Texas Instruments® OMAP™ 3530
- **Operating temperature:** 0°C ÷ +70°C (commercial version)

  -40°C ÷ +85°C (industrial version)
- **Dimensions:** 70 x 70 mm (2.756 x 2.756)

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2.3 Electrical specifications

According to QSeven(TM specifications, Quadmo747-X/OMAP3 board needs to be supplied only with an external $+5V_{DC}$ power supply. The board, however, has been designed so that it is able to work with Power supply ranging from $+3.3V_{DC}$ (lower limit) up to $+5.25V_{DC}$ (upper limit)

For working in ATX mode, also voltage $+5V_{SB}$ needs to be supplied. 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 connectors pinout).

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

2.3.1 Power Consumption

Quadmo747-X/OMAP3 module, like all QSeven™ modules, needs a carrier board for its normal working. All connections with the external world come through this carrier board, which provide also the required voltage to the board, deriving it from its power supply source.

Anyway, power consumption has been measured on $+5V_{DC}$ power rail that supplies the board. For this reason, the values indicated in the table below are real power consumptions of the board, and are independent from those of the peripherals connected to the Carrier Board. Following consumptions have been measured:

Texas Instruments® OMAP™ 3530, with 512MB DDR memory, 256MB Flash Disk, Ethernet Controller, O.S. Windows CE 6.0

Idle status1, OS enabled, mouse and external USB disk connected using an HUB to the board, power consumption: 295mA @ $+5,12V_{DC}$ (1,51W)

Idle status2, OS enabled, no external devices connected to the board, power consumption: 287mA @ $+5,12V_{DC}$ (1,47W)

Active status, OS enabled, mouse and external USB disk connected using an HUB to the board, video file running at full screen resolution, power consumption: 380mA @ $+5,12V_{DC}$ (1,95W)

2.4 Supported Operating Systems

Quadmo747-X/OMAP3 supports the following operating systems:

- Microsoft® Windows® CE 6.0
- Linux
- Android

SECO offers 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.

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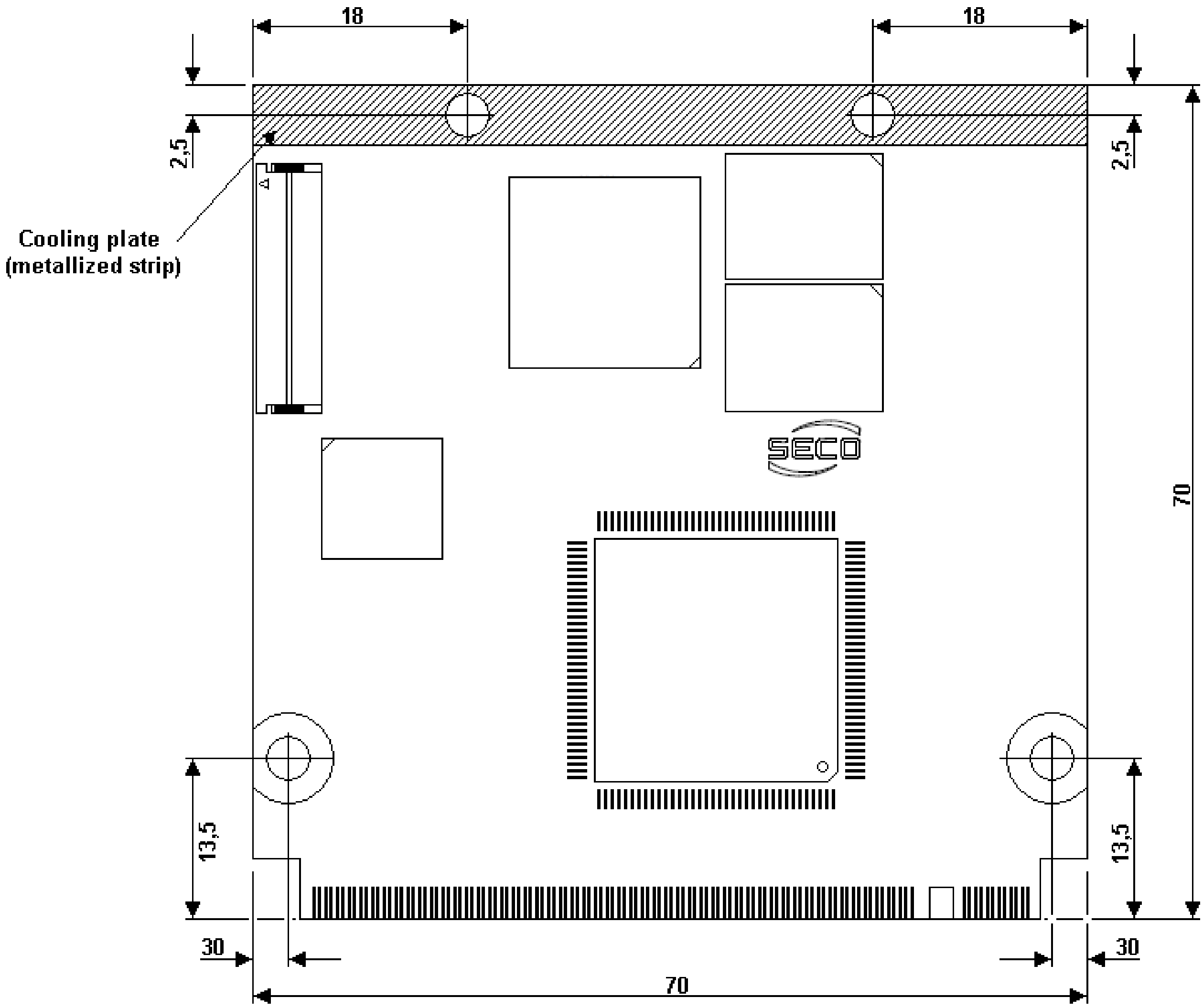
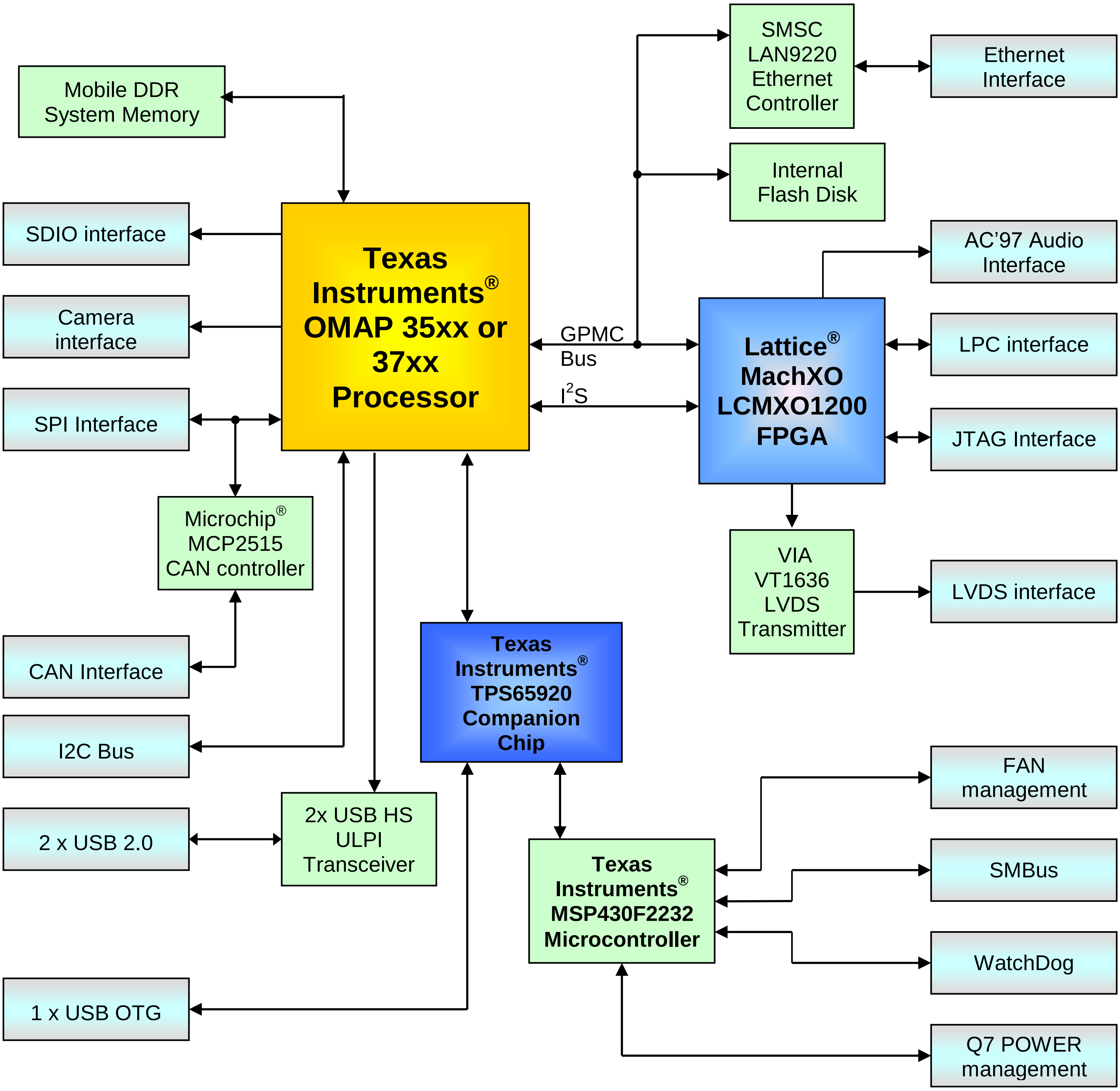
2.5 Mechanical specifications

According to QSeven™ specifications, board dimensions are: 70 x 70 mm (2.756” x 2.756”).



Printed circuit of the board is made of ten layers; some of them are ground planes, for disturbance rejection.

2.6 Block diagram



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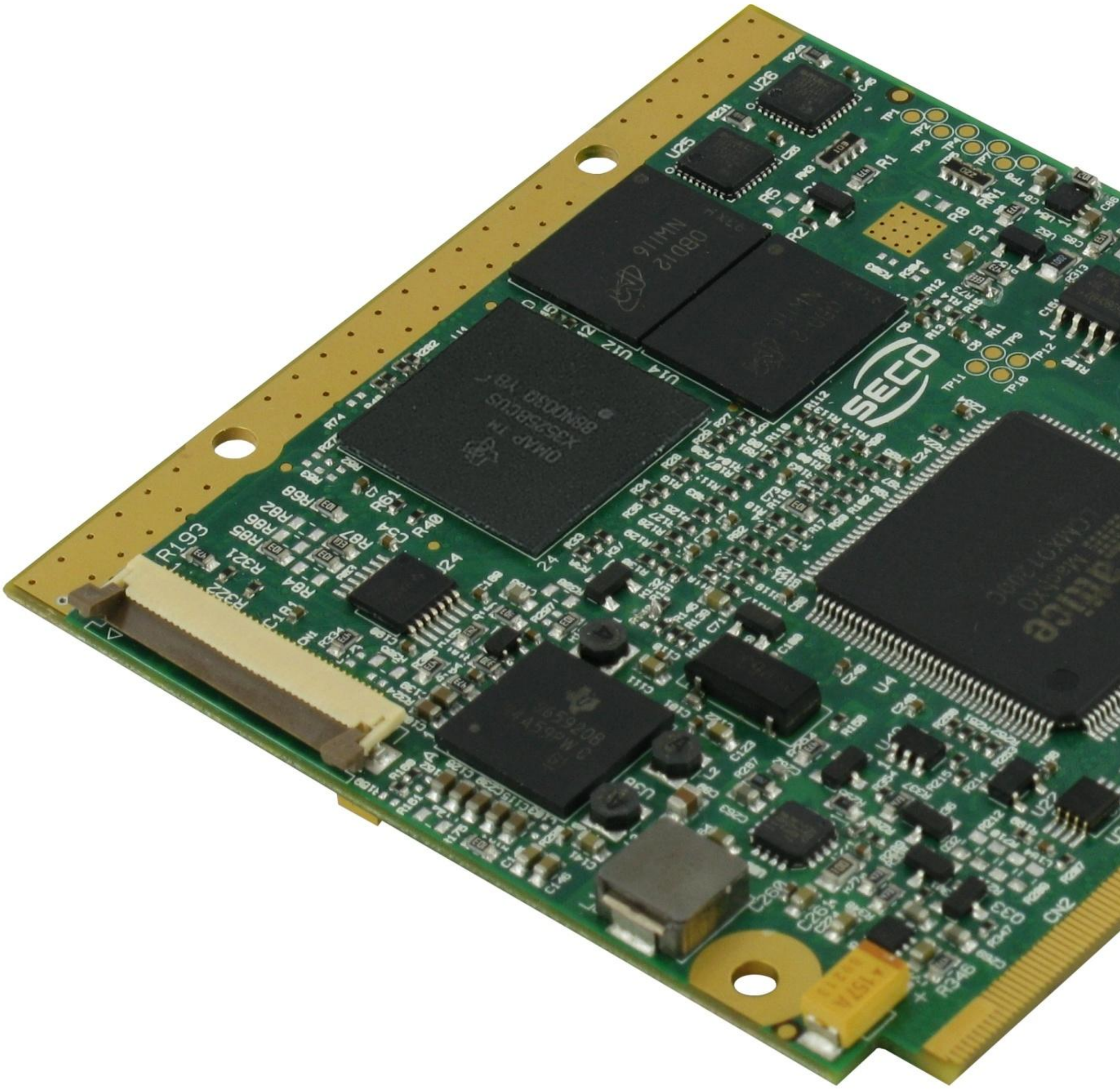
Chapter 3 CONNECTORS

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



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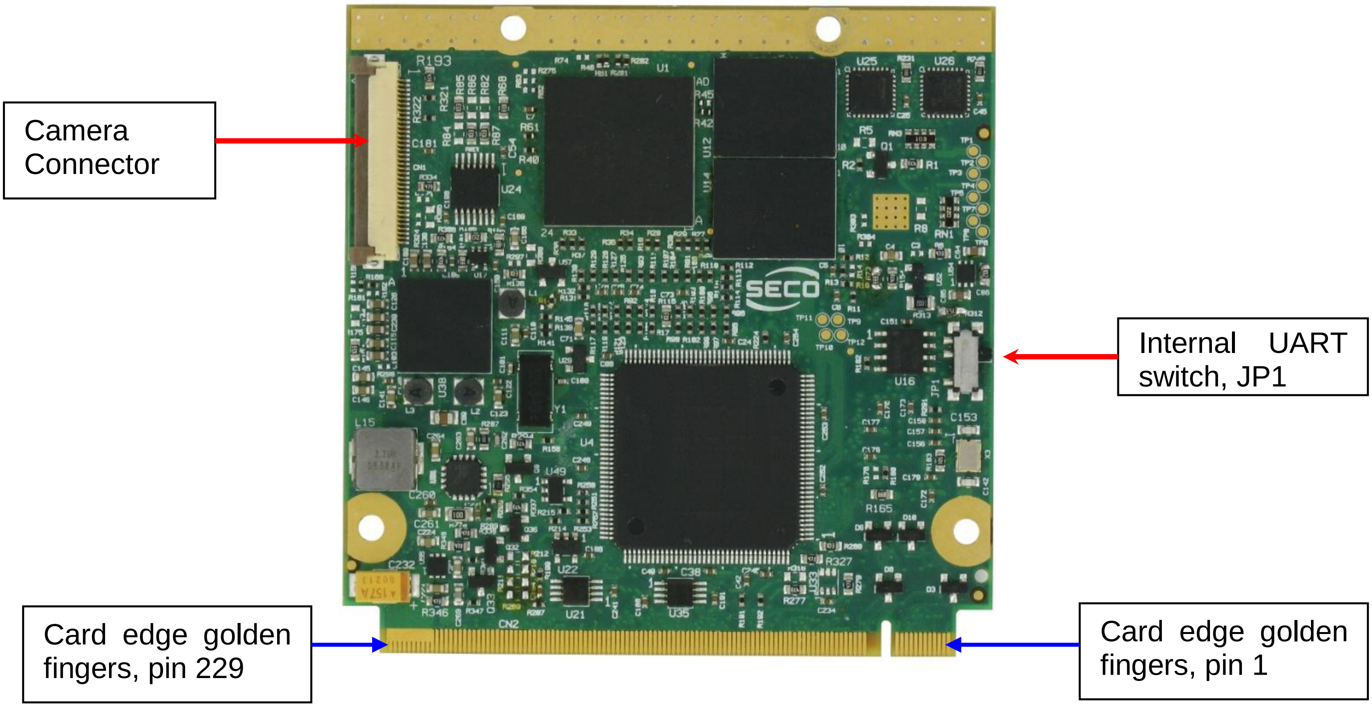
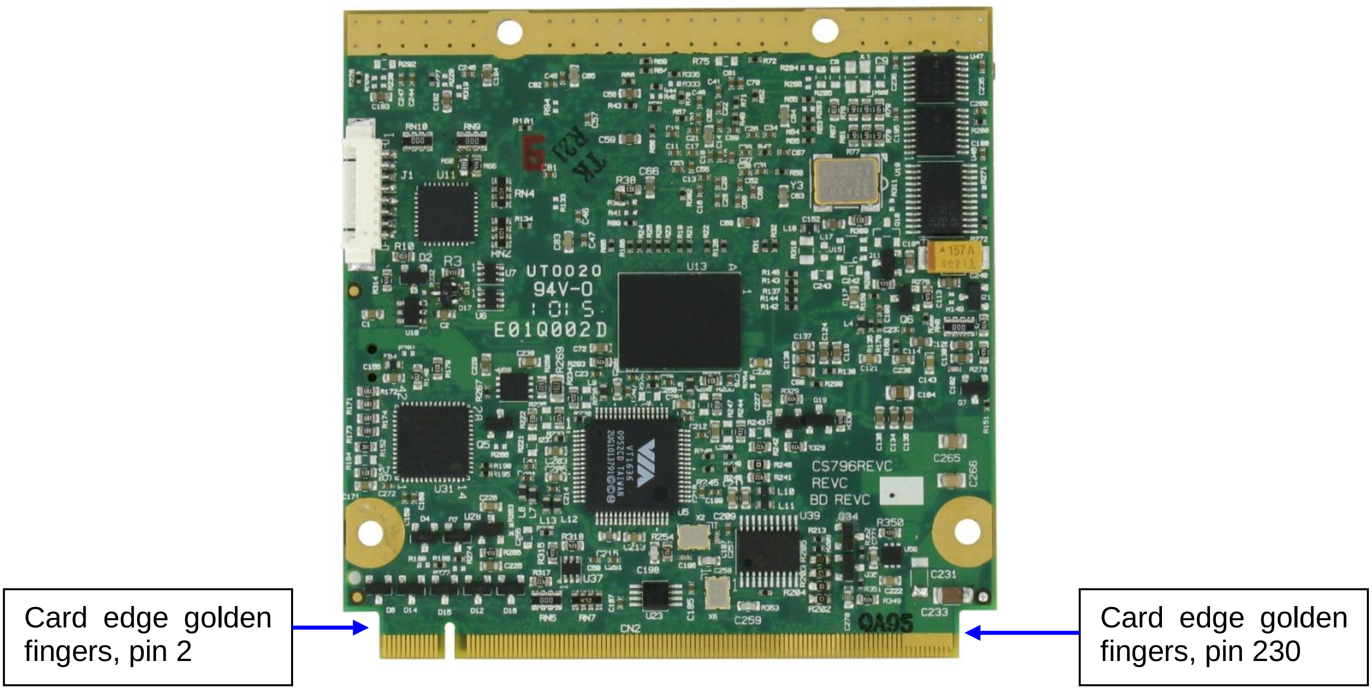
3.1 Connectors overview

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 OMAP™ 35xx/37xx processors.

Top side



Bottom side



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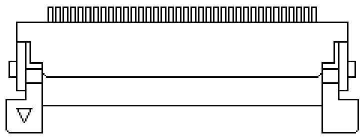
3.2 Connectors description

3.2.1 FFC/FPC Camera Interface

OMAP™ 35xx Processors includes an Image Signal Processing Subsystem, that can be used for video applications, like video-preview, video recording and frame grabbing.

The access to this 12-bit video input port comes through an FFC/FPC connector, type HIROSE p/n FH12A-36-S-0.5SH(55).

CAMERA CONNECTOR – CN1			
Pin	**Signal**	**Pin**	**Signal**
1	CAM_XCLK_A	19	CAM_D9
2	GND	20	CAM_D10
3	CAM_XCLK_B	21	CAM_D11
4	GND	22	CAM_WEN/CAM_SHUTTER
5	CAM_PCLK	23	CAM_I2C_CLK
6	CAM_VS	24	CAM_I2C_SDA
7	CAM_HS	25	CAM_STROBE
8	CAM_FLD	26	GND
9	GND	27	+3.3V_{DC}
10	CAM_D0	28	+3.3V_{DC}
11	CAM_D1	29	+1.8V_{DC}
12	CAM_D2	30	+1.8V_{DC}
13	CAM_D3	31	N.C.
14	CAM_D4	32	N.C.
15	CAM_D5	33	N.C.
16	CAM_D6	34	N.C.
17	CAM_D7	35	N.C.
18	CAM_D8	36	N.C.



These signals come out directly from OMAP35xx processor, so please refer the “OMAP35xx Applications Processor Manual” and “OMAP35xx Technical Reference Manual” for detailed description and instruction on how to use.

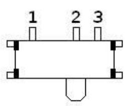
3.2.2 Internal UART switch

Quadmo747-X/OMAP3 complies to QSeven™ specifications Rel. 1.20, but on QSeven finger connector, there are the signals for two serial ports (see next paragraph) that are carried on the pin normally reserved for PCI Express Lanes #2 and #3.

To use these two serial ports, it is necessary that the Carrier Board is designed appropriately, like for example the SECOQSeven Development kit board.

In any case, UART signals come out through a transceiver, whose outputs are enabled by an SMD switch. This way, it is possible to put the serial ports outputs in an high-impedance state, and use the Quadmo747-X/OMAP3 board even on Carrier boards not designed specifically to use them.

JP1 switch position	Effect
1-2	High-Impedance state
2-3	Outputs enabled



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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/OMAP3 CPU module. Therefore, please refer to the following table for a list of effective signals reported on MXM connector, and QSeven™ specifications for an accurate signals description.

Some signals are optional, depending on Quadmo747-X/OMAP3 module configuration. See the description at the end of this document for the list of signals that are not always present (they are also highlighted in light blue in the following table, however).

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

Card Edge Golden Fingers - CN1

Pin	Signal	Pin	Signal
1	GND	2	GND
3	---	4	---
5	---	6	---
7	Ethernet_LINK100#	8	Ethernet_Link1000#
9	Ethernet_MDI1-	10	Ethernet_MDI0-
11	Ethernet_MDI1+	12	Ethernet_MDI0+
13	---	14	Ethernet_ACT_LED#
15	Ethernet_CTREF	16	SUS_S4#
17	WAKE#	18	SUS_S3#
19	SUS_STAT#	20	PWRBTN#
21	SLP_BTN#	22	---
23	GND	24	GND
25	GND	26	PWGIN
27	BATLOW#	28	RSTBTN#
29	---	30	---
31	---	32	---
33	---	34	GND
35	---	36	---
37	---	38	---
39	GND	40	GND
41	BOOT_ALT#	42	SDIO_CLK
43	SDIO_CD#	44	---
45	SDIO_CMD	46	SDIO_WP
47	SDIO_PWR#	48	SDIO_DAT1
49	SDIO_DAT0	50	SDIO_DAT3
51	SDIO_DAT2	52	SDIO_DAT5

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53	SDIO_DAT4	54	SDIO_DAT7
55	SDIO_DAT6	56	---
57	GND	58	GND
59	AUD_SYNC	60	SMB_CLK
61	AUD_RST#	62	SMB_DAT
63	AUD_BITCLK	64	SMB_ALERT#
65	AUD_SDI	66	I2C_CLK
67	AUD_SDO	68	I2C_DAT
69	---	70	WDTRIG#
71	---	72	WDOUT
73	GND	74	GND
75	---	76	---
77	---	78	---
79	---	80	---
81	---	82	---
83	---	84	---
85	---	86	---
87	---	88	USB_P2-
89	---	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	LCD_POWER_ENABLE	112	LCD_Backlight_Enable
113	LVDS_A3+	114	LVDS_B_3+
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	ONE_WIRE
125	---	126	---
127	---	128	---
129	CAN_TX	130	CAN_RX
131	---	132	---
133	---	134	---

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135	GND	136	GND
137	---	138	---
139	---	140	---
141	GND	142	GND
143	---	144	---
145	---	146	---
147	GND	148	GND
149	---	150	---
151	---	152	---
153	---	154	---
155	---	156	---
157	---	158	RESET#
159	GND	160	GND
161	UART3_RTS	162	---
163	UART3_TX	164	UART3_RX
165	GND	166	GND
167	UART1_RTS	168	UART1_CTS
169	UART1_TX	170	UART1_RX
171	GND	172	GND
173	---	174	---
175	---	176	---
177	GPI0	178	---
179	---	180	---
181	---	182	---
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	---
193	Vcc_RTC	194	GP_PWM_OUT2
195	FAN_TACHOIN	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_MUX_SEL#
205	$+5V_{SB}$	206	$+5V_{SB}$
207	JTAG_TCK	208	JTAG_TDI/UART3_RX
209	JTAG_TDO/UART3_TX	210	JTAG_TMS
211	---	212	+Vcc
213	+Vcc	214	+Vcc

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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

3.2.4 SECOQSeven philosophy's specific signals.

According to SECOQSeven philosophy, on Quadmo747-X/OMAP3 finger connector there are some signals that are not implemented in QSeven™ Specifications rel.1.20, but that don't interfere with standard Carrier Boards (i.e., Carrier Boards not designed according to SECOQSeven philosophy's Design Guide).

The following signals differ from the standard:

One-Wire Signal

Pin 124: ONE_WIRE: One-Wire protocol data line

One-Wire is a communication protocol, intended for low speed serial communications, which is widely used for simple, cheap devices like sensors and so on. All communications come through an unique line, that carry both power and signaling.

This interface is native for OMAP™ 35xx Applications Processor, and has been therefore carried out on Qseven™ golden finger, on pin 124, that is a pin defined as "Reserved" by Qseven™ specifications Rel. 1.20 (and previous releases). Carrier Boards that leave pin 124 not connected can be used without problem even with Quadmo747-X/OMAP3 board

UART Signals

Pin 161: UART3_RTS: OMAP 35xx / 37xx internal Uart #3 RTS signal
Pin 163: UART3_TX: OMAP 35xx / 37xx internal Uart #3 TX signal
Pin 164: UART3_RX: OMAP 35xx / 37xx internal Uart #3 RX signal
Pin 167: UART1_RTS: OMAP 35xx / 37xx internal Uart #1 RTS signal
Pin 168: UART1_CTS: OMAP 35xx / 37xx internal Uart #1 CTS signal
Pin 169: UART1_TX: OMAP 35xx / 37xx internal Uart #1 TX signal
Pin 170: UART1_RX: OMAP 35xx / 37xx internal Uart #1 RX signal

These are the signals related to OMAP™ 35xx / 37xx Internal UART #1 and #3. They are carried on the pins that, according to Qseven™ Specifications rel.1.20, are usually reserved for PCI Express lanes #2 and #3.

Anyway, this doesn't cause any kind of incompatibility, since onboard there is an SMD switch, JP1, that can put Output signals in an high-impedance state, so that, if the Carrier board is designed to use PCI-Express lanes #2 and #3, there aren't electrical problems. Please see par. 3.2.2 for further details on JP1 selector.

General Purpose Input

Pin 177: GPI0: general Purpose Input

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This signal is an additional general Purpose Input, normally sent to OMAP™ 35xx / 37xx Internal Uart#3 CTS pin. It is placed on a pin that, according to Qseven™ standard specifications, should be used for ExpressCard Slot 0# request pin (an input). Quadmo747-X/OMAP3 doesn't support Express cards, so this input pin has been designed as a General Purpose Input. This prevents from any incompatibilities using Quadmo747-X/OMAP3 board on Carrier Boards designed for use of Express cards (obviously, these are not managed by the board)

3.2.5 JTAG signals.

According to Qseven™ Standard specifications, rel. 1.20, on pin previously designed as MFG_NCx are carried the JTAG signal necessary to program Quadmo747-X/OMAP3 internal FPGA.

Pins 208 and 209 are multiplexed, according to the above mentioned specifications, with OMAP™ 35xx Internal UART #3 signals TX and RX.

Selection between JTAG and UART#3 signal is made by driving the MFG_MUX_SEL# signal carried on pin 204 (MFG_NC4), with the following meaning:

MFG_MUX_SEL# signal level	Pin 208 signal:	Pin 209 signal:
LOW	UART_3_TX	UART_3_RX
HIGH	JTAG_TDI	JTAG_TDO

In case MFG_MUX_SEL# signal is not driven externally, then an internal pull-down makes available UART_3_TX and UART_3_RX signals on pin 208 and 209.

3.2.6 Optional signals.

The following signals will be present only in case your Quadmo747-X/OMAP3 Module has the internal FastEthernet controller mounted:

Ethernet Signals

Pin 9-111, 10-12: Ethernet_MDIx+/-: FastEthernet Transmit/Receive Differential lines

Pin 7: Ethernet_LINK100#: Ethernet Controller 100Mbit/s link indicator, active low

Pin 8: Ethernet_FullDuplex#: Ethernet Controller Full Duplex Mode indicator, active low

Pin 14: Ethernet_ACT_LED: Ethernet controller activity indicator, active low

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