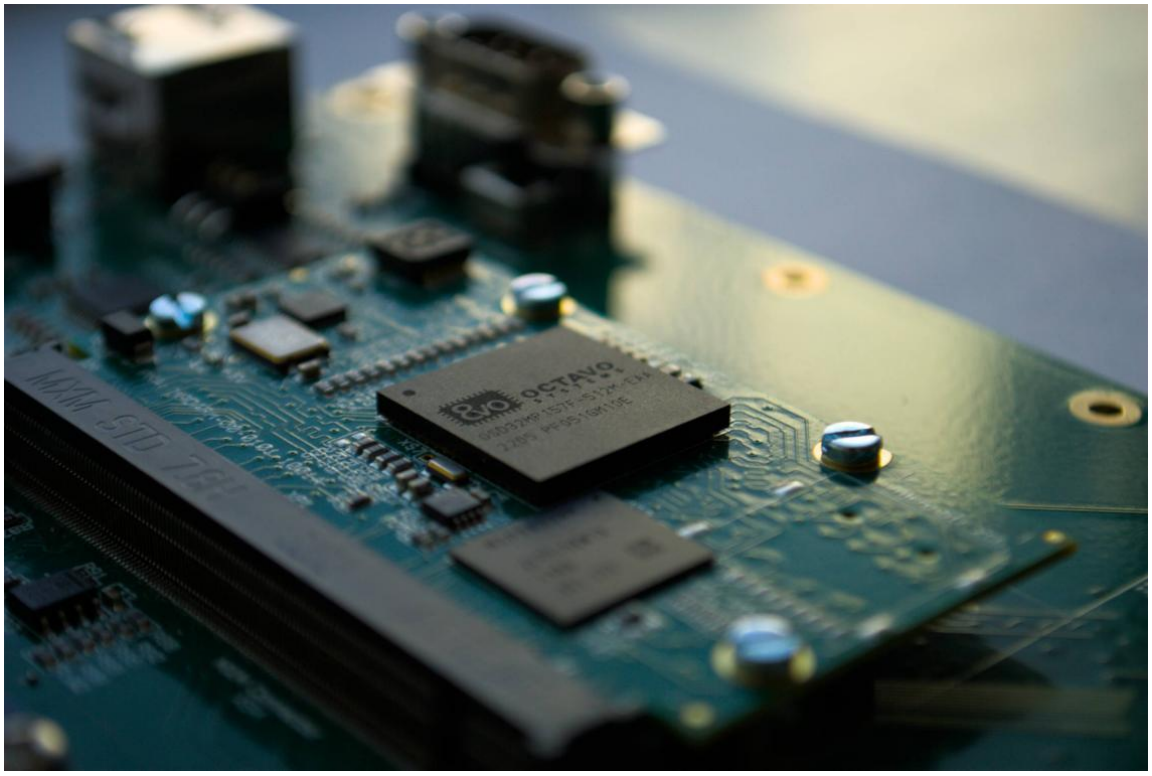
QSeven Development Kit

with

µQSeven Computer on Module

System-on-module with easy accessible Development board

USER GUIDE



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Contents

1. Introduction

Thank you for choosing QSeven Development Kit with µQSeven Computer on Module. This manual will guide you through setting up and using your device effectively. Please read this guide carefully to ensure a smooth experience and optimal performance.

1.1. Device Overview

The µQSeven Development Kit is a high-performance embedded computing platform designed for industrial, IoT, and automation applications. It features the µQSeven Computer on Module powered by the Octavo OSD32MP157C-512M-IAA/OSD32MP157F-512M-EAA, which integrates dual-core Arm® Cortex®-A7 processor for high-performance computing and a Cortex®-M4 processor for real-time processing. This architecture ensures efficient multitasking and low power consumption, making it ideal for energy-sensitive applications. The kit is made out of two separated parts:

1. Development Board for µQSeven and
2. The µQSeven computer on module itself.

The kit includes extensive connectivity options such as USB 3.1 type C, USB 2.0 type microA, Ethernet, UART, CAN, SPI and I2C, enabling seamless integration into various environments. Its modular design allows for hardware and software customization, providing scalability for evolving project requirements. The ability to support OpenSTLinux and Yocto-based Linux distributions ensures flexibility in software development and deployment.

With its compact design and industrial-grade durability, the QSeven Development Kit simplifies embedded system development while reducing time-to-market. It is particularly suited for applications requiring real-time data processing, robust connectivity, and high efficiency, making it an ideal choice for developers seeking a versatile and future-proof platform.

2. Setup and Getting Started

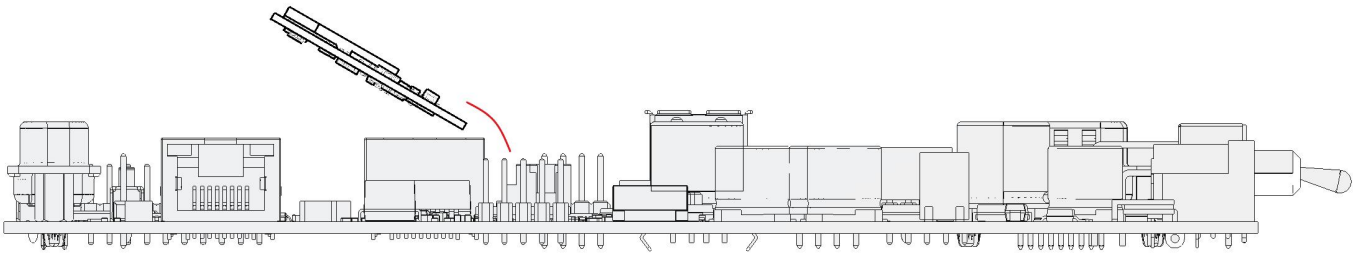
In this chapter you can find instructions for setting up and running QSeven Development Kit with µQSeven computer on module.

2.1. How to Insert µQSeven Module Into the Development Board

Development board has MXM2 Edge Card Connector that is located near the LCD display on the board. That connector serves as holder for µQSeven module.

- **Step 1.** Insert µQSeven Computer on Module at 30-degree angle into connector and get sure that board is fully inserted.
- **Step 2.** Gently press the µQSeven Computer on Module board down until it is parallel to the development board.
- **Step 3.** Install the screws and spacers and secure µQSeven Computer on Module board!

Figure 2.1 shows a side view of how µQSeven module installation should be approached and the Figure 2.2. shows a top view.



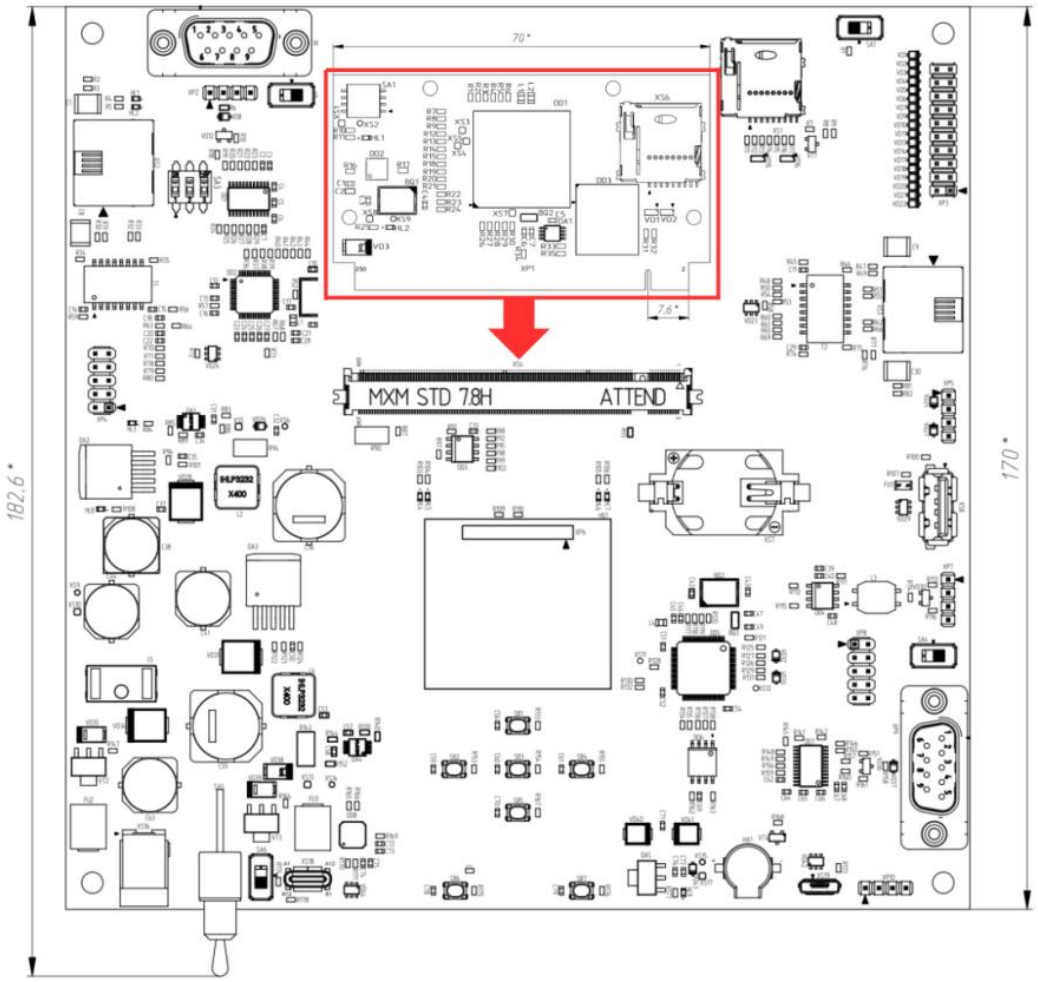


Figure 2.1. and 2.2. Installation of µQSeven module.

2.2. Power Up the Board

The Development board has two separate power supplies. One of them comes from the DC connector marked XS16 on the PCB of Development Board. The other power supply comes from USB-C input that also provides UART interface for control of the Linux operating system.

When powering up the board using USB-C connector, it is recommended to use an appropriate cable (USB 3.1 or higher) and use a reliable power source.

3. Using of Development Kit

In this chapter you can find instructions for using QSeven Development Kit with µQSeven Computer on Module, such as configuring peripherals and how to boot operating system.

3.1. Development kit overview

On figure 3.1. is shown overview of the available connectors and devices on QSeven Development Kit.

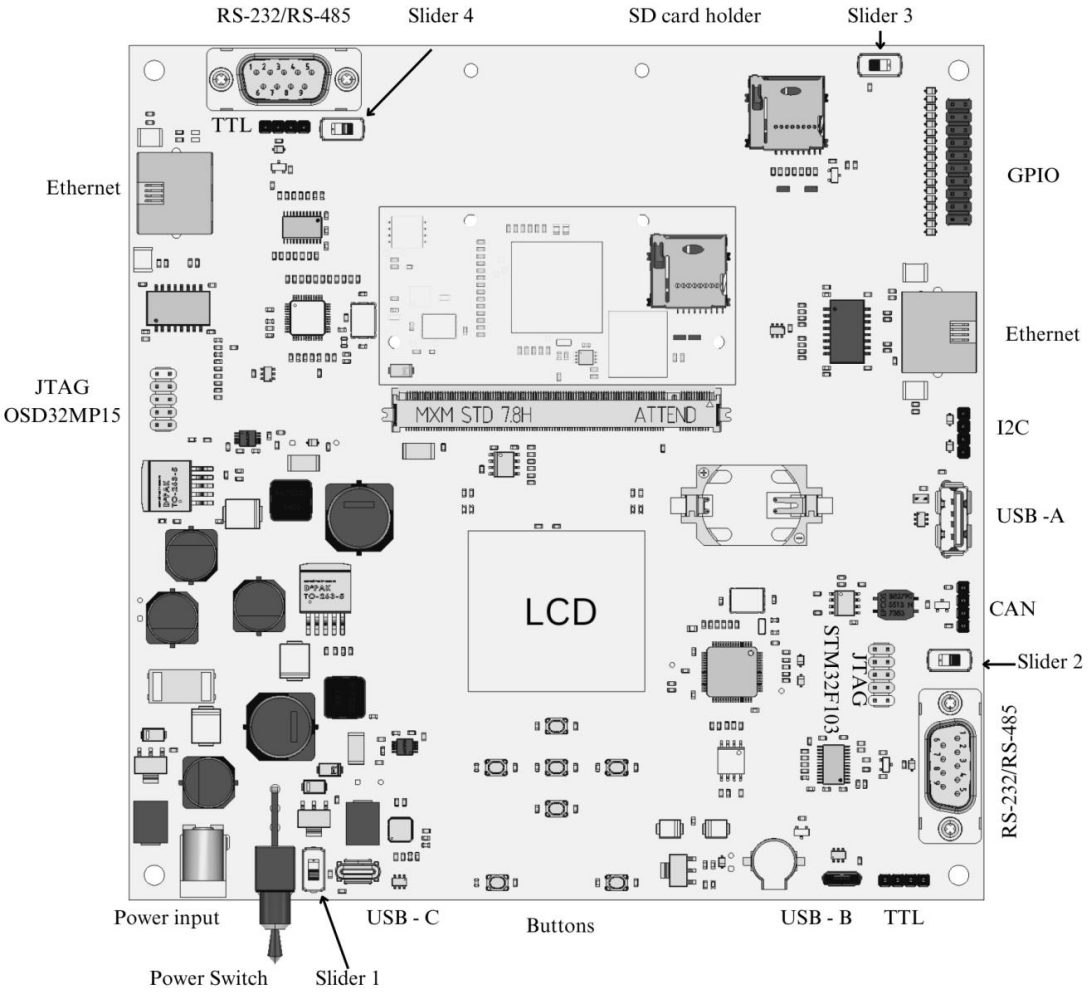


Figure 3.1.QSeven Development kit with µQSeven Computer on Module

3.2. Power Supply

As it was mentioned before, this Development Kit can operate with 2 different power supply sources, micro-USB-C 3.1 and 12 V_{DC} input and circuit for regulating voltage to 5 V. Power can be controlled manually on the Development Board itself by control power switch. Control power switch is located at the lower left side of the board between 12 V DC input and USB type C connector. The development board can be powered from either of the available power sources, depending on the position of the power control switch. Certainly, µQSeven module will boot immediately after it receives power.

Figure 3.2. illustrates the 12V power connector located next to the power switch and the USB-C input.

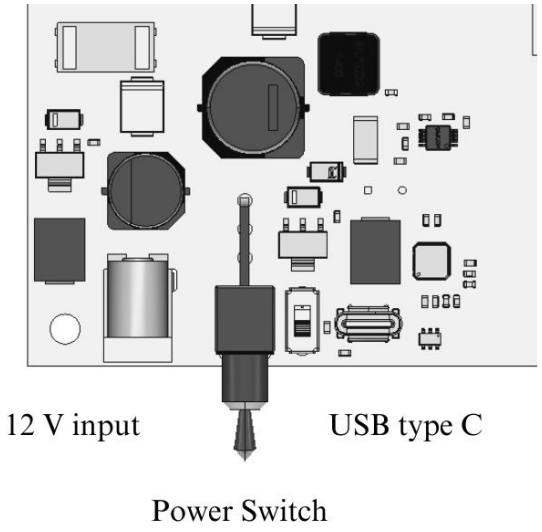


Figure 3.2. Power supply sources

3.3. Buttons and Switches

The control buttons and switches on the Development Kit offer various functionality options.

The control buttons, shown in Figure 3.3, provide the following functions:

- Power toggle for the module power supply.
- Reset trigger buttons for both the OSD32MP157C/F processor and the

STM32F103 microcontroller (located at the bottom of the board).

- Five interrupt function buttons for the STM32F103 microcontroller (positioned below the LCD display).

Additionally, the kit includes four slider switches, as illustrated in Figure 3.1:

- Slider 1: Controls the LM2596HVGR DC-DC converter.
- Slider 2 and Slider 4: Used for selecting between RS-232 and RS-485 communication.
- Slider 3: Activates the pulse generator for the OSD32MP157C/F.

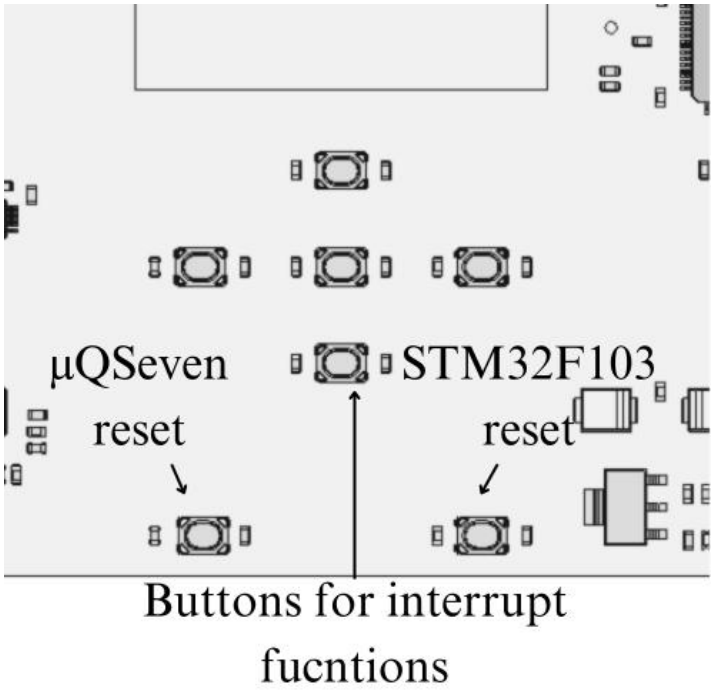


Figure 3.3. Buttons functions on Development Kit

3.4. Boot Mode

The µQSeven Computer on Module supports multiple boot options, which are determined by a four-switch configuration. This integrated switch component is located on the upper left side of the µQSeven Computer on Module, with switches numbered from 1 to 4. Boot0 is equivalent with switch 1 and Boot3 is equivalent with switch 4.

The QSeven Development Kit with the µQSeven Computer on Module board may boot from different sources as described in table below.

Boot Mode	Boot0	Boot1	Boot2	Boot3
Serial NOR	1	0	0	X
µSD card	1	0	1	X
eMMC	0	1	0	X
NAND	1	1	0	X
UART and USB	0	0	0	X
	0	1	1	X
Reserved	0	0	1	X

3.5. USB Serial Console

The QSeven Development Kit with the µQSeven Computer on Module features an onboard Silicon Labs CP2102N USB-to-serial converter. The converter and its corresponding connector are sown in Figure 3.4.To establish a connection, plug the Micro-USB cable into the designated connector and ensure that the appropriate driver for the CP2102N chip is installed on your computer.

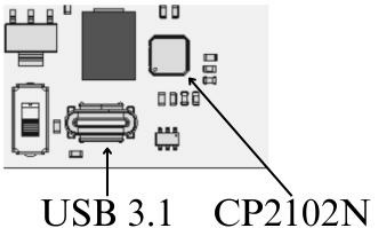


Figure 3.4. USB 3.1 and CP2102N on Development kit

The link to the site where the drivers can be downloaded is:

https://www.silabs.com/developer-tools/usb-to-uart-bridge-vcp-drivers

3.6. RS-232 and RS-485

Figureig 3.5presents two RS-232/RS-485 jack connectors. First is located in the down-right corner of the Development kit is connector for STM32F103R8T6, the second external connector located in upper left corner of the Development kit for OSD32MP157C/F, Figure 3.5. The switches labeled SA2 and SA4 selects between RS-232 and RS-485 mode on the jack.

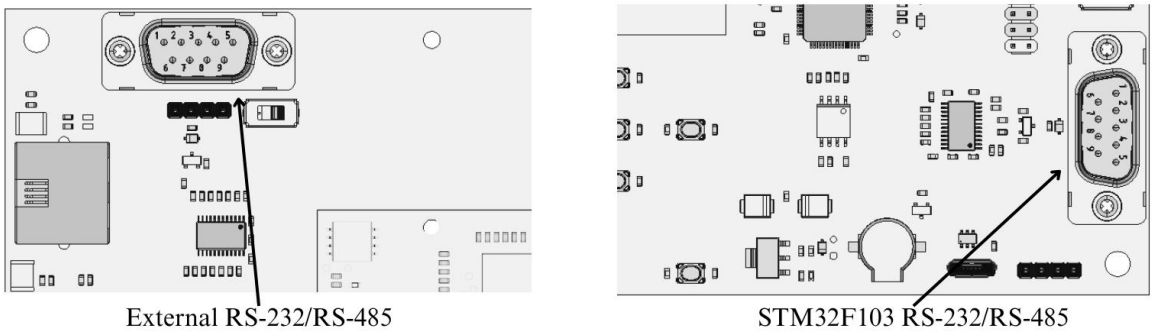


Figure 3.5. RS-232/RS-485 Connectors

To verify the available UART peripherals on your installed Linux system, you can use the following command:

```
ls /dev/ttyS*
```

To monitor a specific UART channel, use the following command, replacing "x" with the desired channel number:

```
cat /dev/ttySX
```

To send data to a specific UART channel, use following command:

```
echo “Atronax” > /dev/ttySX
```

To configure settings for UART channel use following command:

```
stty -F /dev/ttySTM0 raw speed 115200 cs8 -cstopb -parenb
```

The components of this command are explained as follows: stty -F /dev/ttySTM0 applies settings to the specified UART channel. The raw option disables special character processing, allowing raw data transmission. Speed 115200 sets the baud rate to 115200, which can be adjusted as needed. CS8 configures the channel to use 8 data bits per frame. -cstopb uses 1 stop bit by default; if cstopb is set, it uses 2 stop bits. -parenb disables the parity bit, meaning no error-checking bit is used.

If you intend to use RS-485, ensure that RTS/CTS hardware flow control is disabled and that proper half-duplex behavior is maintained. You can do this by entering the following command.

```
stty -F /dev/ttySTM0 -crtscts
```

3.7. TTL UART

Both the OSD32MP157C/F system in package and the STM32F103 microcontroller feature TTL UART interfaces. These are implemented as pin headers: XP10 for the STM32F103 and XP2 for the OSD32MP157C/F. Both headers are positioned near the RS232/RS485 jacks, with a signal level of 3.3V.

3.8. Ethernet

The QSeven Development Kit with the µQSeven Computer on Module features two built-in Fast Ethernet (100 Mbit/s) channels, as illustrated in Figure 3.6.

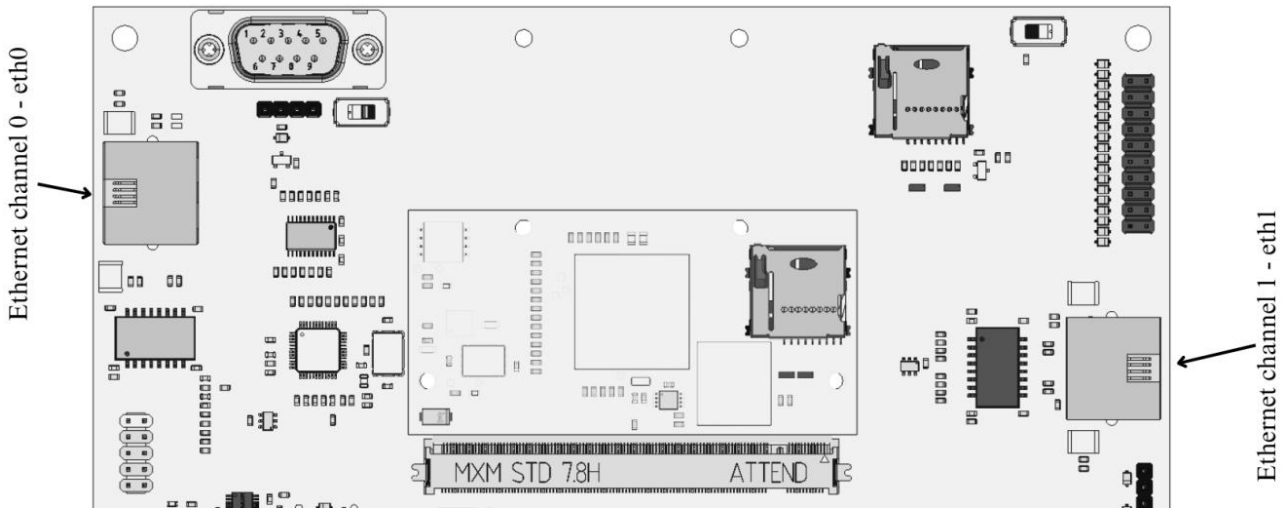


Figure 3.6. Ethernet Connectors

To verify the available Ethernet peripherals on your installed Linux system, you can use the following command, replace X with the desired channel number:

```
ip addr show
ip addr show ethX
```

To check link status of channel, use following ocmmand:

```
ethtool eth0
```

Check link using external web site:

```
ping -c 5 atronax.com
```

3.9. MicroSD Card

The QSeven development kit with the µQSeven Computer on Module includes a microSD card holder, located at the upper right corner of the development board. It is directly connected to the MXM2 Edge Card Connector and the OSD32MP157C/F. Additionally, there is an option to add a microSD Card holder on the µQSeven Computer on Module for the same functionality. The development kit supports UHS SD cards with a maximum write speed of 50 MB/s, while the actual read and write speeds depend on the

capabilities of the inserted SD card.

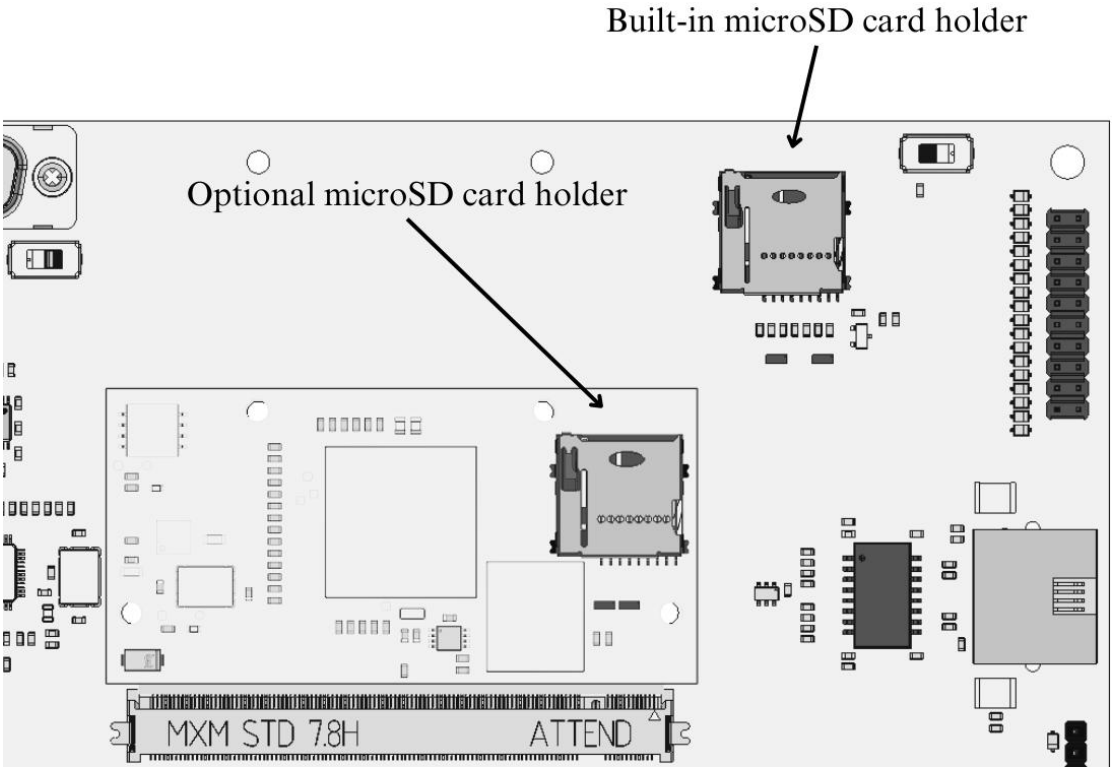


Figure 3.7. MicroSD card holder

3.10. USB Interfaces

The QSeven Development Kit with the µQSeven Computer on Module features three distinct USB interfaces:

- USB Type A: Provides connectivity for the OSD32MP157C/F.
- USB Micro A/B: Connected to the onboard STM32F103 microcontroller.
- USB Type C: Supplies power and can also be used as a serial console port, as described in Chapter 3.5.

Figure 3.8. shows the USB connectors.

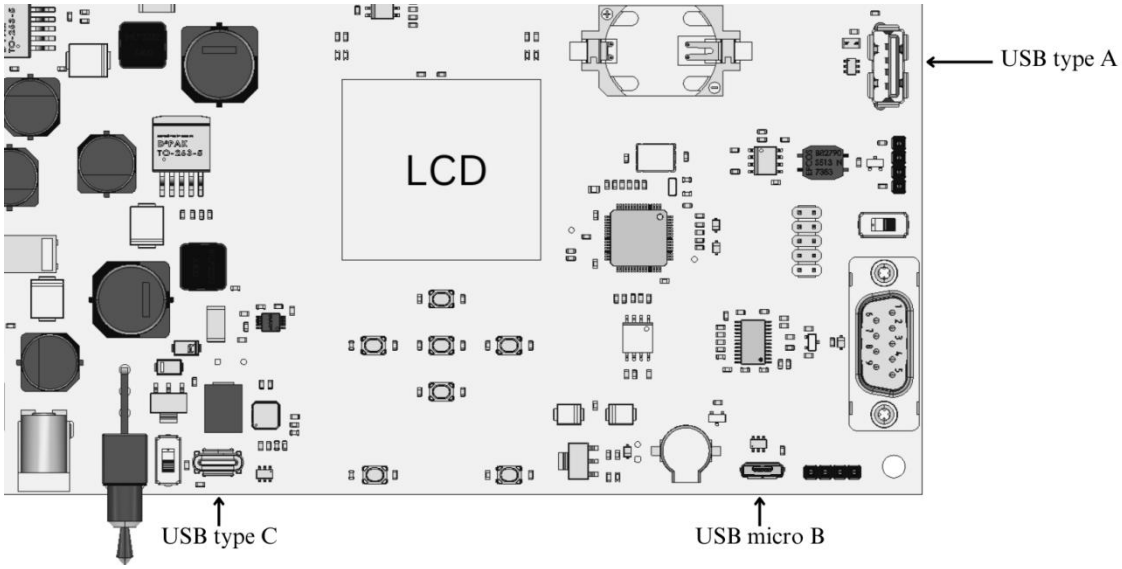


Figure 3.8.USB connectors

3.11. I²C and SPI Interfaces

The QSeven Development Kit with the µQSeven Computer on Module includes a dedicated pin header for the I²C interface, located on the right side of the board. However, a pin header for the SPI interface is not available.

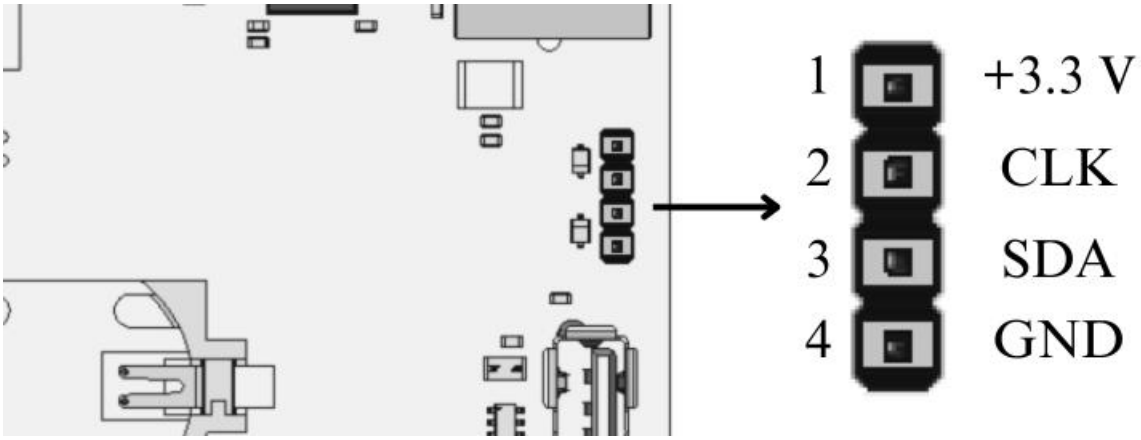


Fig 3.9. I²C interface pinout

To check the available I²C peripherals, you can use the following command:

```
ls /dev/i2c-*
```

For scanning an I²C devices:

```
i2cset -y 1 0x50 0x25 0xFF
```

To write data to an I²C device

```
i2cset -y 1 0x50 0x25 0xFF
```

To read register from your device:

```
i2cget -y 1 0x50 0x25
```

To show device's full register map:

```
i2cdump -y 1 0x50
```

3.12. CAN Interface

The QSeven Development Kit includes a CAN connector, positioned on the right side of the development board between the RS-232 and USB Type-A connectors.

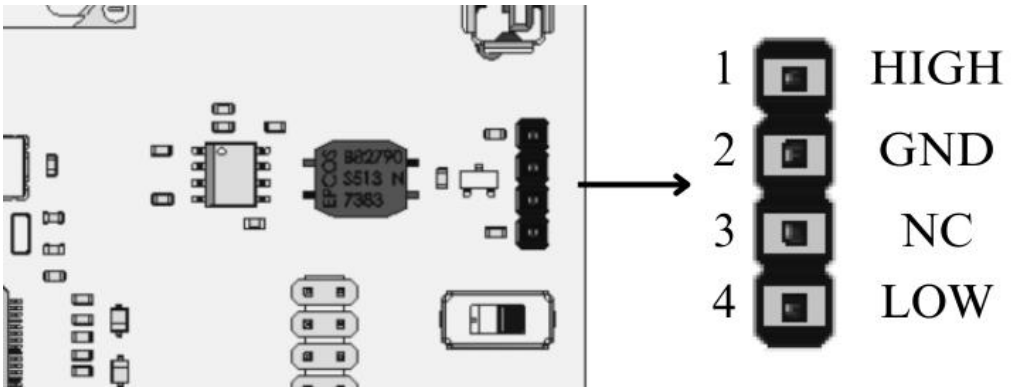


Figure 3.10. CAN Connector

To see the available CAN interface, you can use the following command:

```
ip link show type can
```

For enabling the CAN interface:

```
ip link set can0 up type can bitrate 500000
```

For monitoring incoming CAN messages:

```
candump can0
```

3.13. JTAG Connector

The QSeven Development kit contains two JTAG connectors responsible for communicating with both the OSD32MP157C/F and the STM32F103. They can be used for debugging and programming these components. Connectors and their pinout are shown on Figure 3. 11.

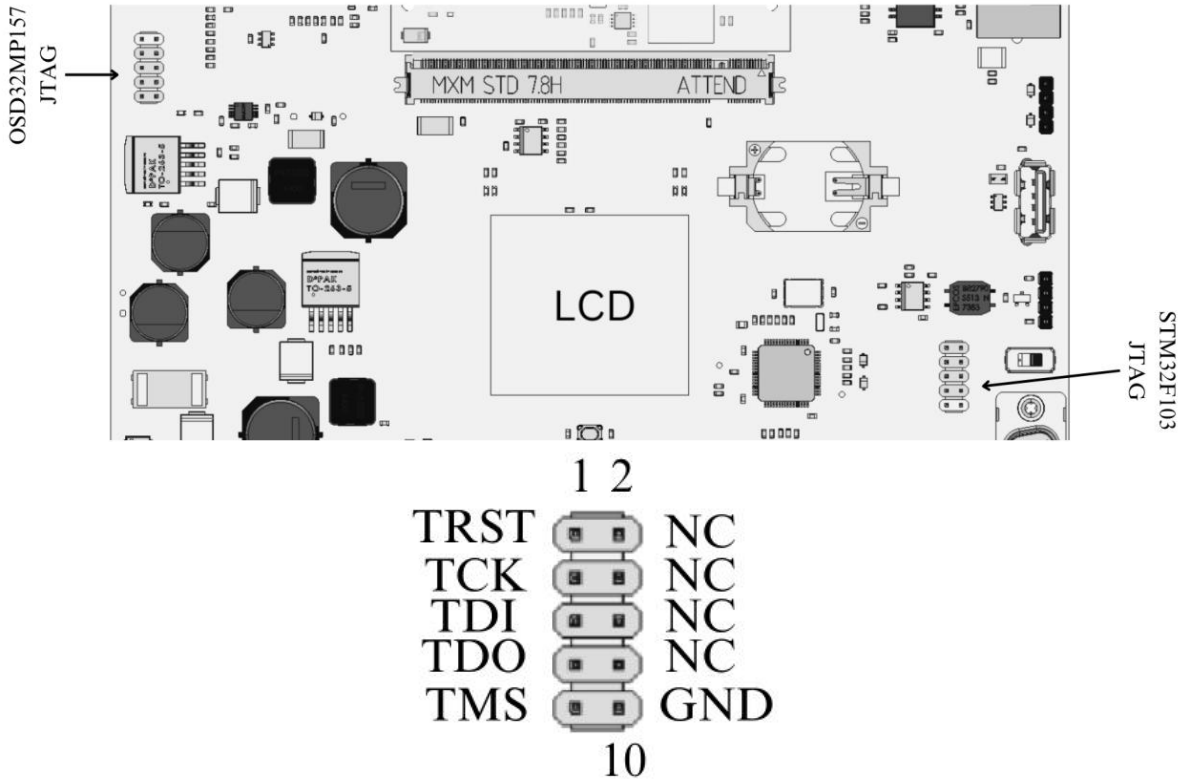


Figure. 3.11. JTAG connectors

3.14. GPIO

The Development Kit features a 20-pin header that provides access to the GPIO pins of both the OSD32MP157C/F which is on the computer on module and the STM32F103 which is on the development board. This pin header is located in the upper right corner of the Development board. The pin assignments are listed below. Also, Figure 3.12 shows the 20-pin header.

Pin 1 - +3.3 V	Pin 2 - GPO0, OSD32MP157C/F
Pin 3 - GPII0, OSD32MP157C/F	Pin 4 - GPII2, OSD32MP157C/F
Pin 5 - GPI1, OSD32MP157C/F	Pin 6 - GPIO1, OSD32MP157C/F
Pin 7 - ADC_IN, OSD32MP157C/F	Pin 8 - DAC_OUT, OSD32MP157C/F

Pin 9 - !WAKE, OSD32MP157C/F	Pin 10 - !BIOS_DIS, OSD32MP157C/F
Pin 11 - MCU_State_Anode, OSD32MP157C/F	Pin 12 - USR1_Anode, OSD32MP157C/F
Pin 13 - PA0, STM32F103R8T6	Pin 14 - PB5, STM32F103R8T6
Pin 15 - PB8, STM32F103R8T6	Pin 16 - PB9, STM32F103R8T6
Pin 17 - PC13, STM32F103R8T6	Pin 18 - PC5, STM32F103R8T6
Pin 19 - PC9, STM32F103R8T6	Pin 20 - GND

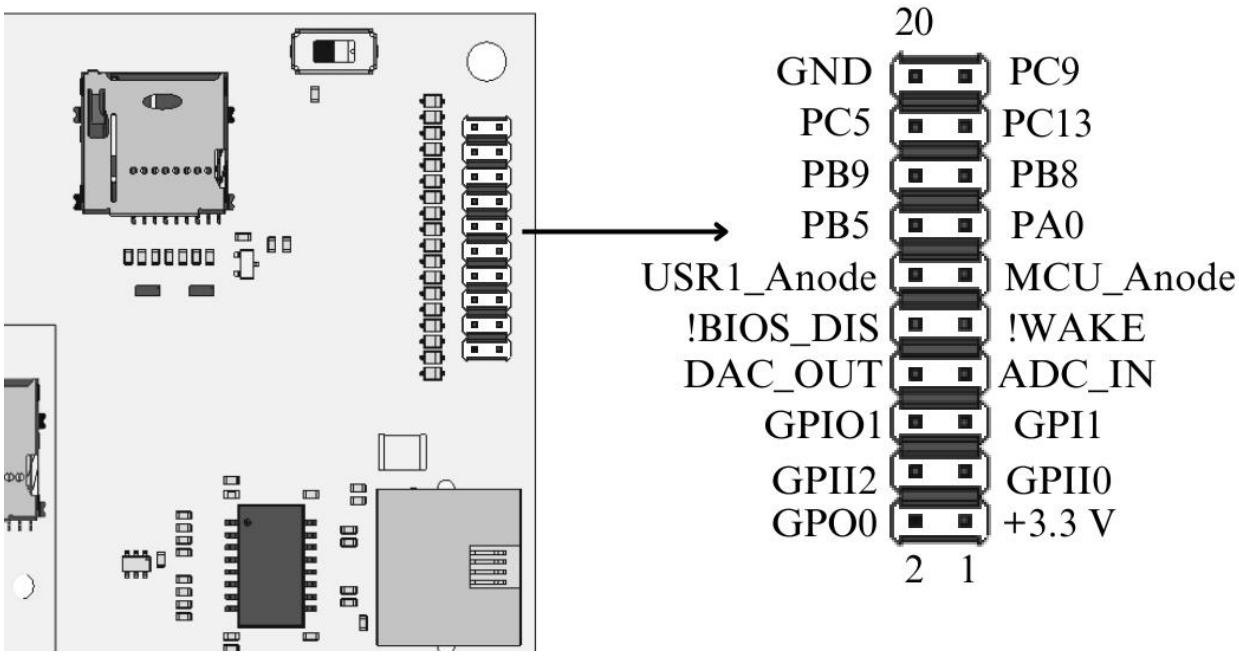


Figure 3. 12. Pinout of GPIO pins

4. Software Overview

The QSeven Development Kit with the µQSeven Computer on Module includes OSD32MP157C/F System-in-Package and it is built around the STM32MP157C/F microprocessor, offering a combination of high-performance computing and real-time processing. Information in this chapter will mostly depend on this chip-set possibilities and limitations.

4.1. Supported Software Distributions

At the core of the software ecosystem is OpenSTLinux, the official Linux distribution from STMicroelectronics, based on Yocto. It provides a flexible and scalable environment for embedded applications, featuring U-Boot as the bootloader, Wayland/Weston for graphical interfaces, and standard Linux communication protocols such as I2C, SPI, UART, and Ethernet. For developers requiring a lightweight alternative, Buildroot offers a customizable option for operating system configuration.

Another aspect of the software implementation is the minimal configuration options in STM32CubeMX and the organization of the Device Tree, both of which has function in system initialization and peripheral management.

4.2. How to make Linux OS image

Full tutorial of how to make Linux OS image can be found on following link.
https://octavosystems.com/app_notes/stm32mp1-cubemx-tutorial-for-osd32mp15x/

5. Serial Number and MAC Address

5.1. Serial Number

The serial number is the number that is fixed in hardware and it is derived from the OSD32MP157C/F and cannot be modified. Under Linux operational system, it is represented as a simple text file within the /sys directory. The serial number can be print on using the command:

```
cat /sys/firmware/devicetree/base/serial-number
```

5.2. MAC Address

The MAC address of each module is a unique, 12-character, random value derived from the serial number of the product, and it is used to identify individual device on a network.

To find MAC address of the Ethernet interface on device, use following command:

```
cat /sys/class/net/eth0/address
```

.

6. Development Board's MCU

The companion microcontroller of the OSD32MP157C/F is STM32F103R8T6. The STM32F103R8T6 is a high-performance 32-bit microcontroller from STMicroelectronics, based on the ARM Cortex-M3 core, operating at up to 72 MHz. It features 64 KB of Flash memory and 20 KB of SRAM. The microcontroller offers a rich set of peripherals, including two I2C interfaces, three USARTs, two SPI interfaces, and a USB 2.0 full-speed device. It also includes 12-bit ADCs, multiple timers, and PWM outputs, providing flexibility for control and signal processing applications. These functionalities can be used on available GPIO pins on extern pin header. The onboard STM32F103 microcontroller features dedicated peripherals and communication interfaces. Their functionality and usage will be described in the following sections.

6.1. Peripherals

The QSeven Development Kit with integrated STM32F103R8T6 microcontroller on the Development Board provides its own set of peripherals and communication interfaces listed below.

Peripherals:

- ST7789 LCD
- 2× INA226IDGST current/voltage sensors
- AT45DB161E flash memory
- HCS0905H buzzer
- 5× interrupt buttons
- 2× status LEDs
- 2× debugging holes

- GPIO channels

  Communication Interfaces:

- USB Micro-B
- USART
- Two JTAG access points
- I²C communication with the main processor (OSD32MP157C/F)

Figure 6.1. displays the pinout configuration of the STM32F103R8T6 microcontroller as generated by the STM32CubeMX software.

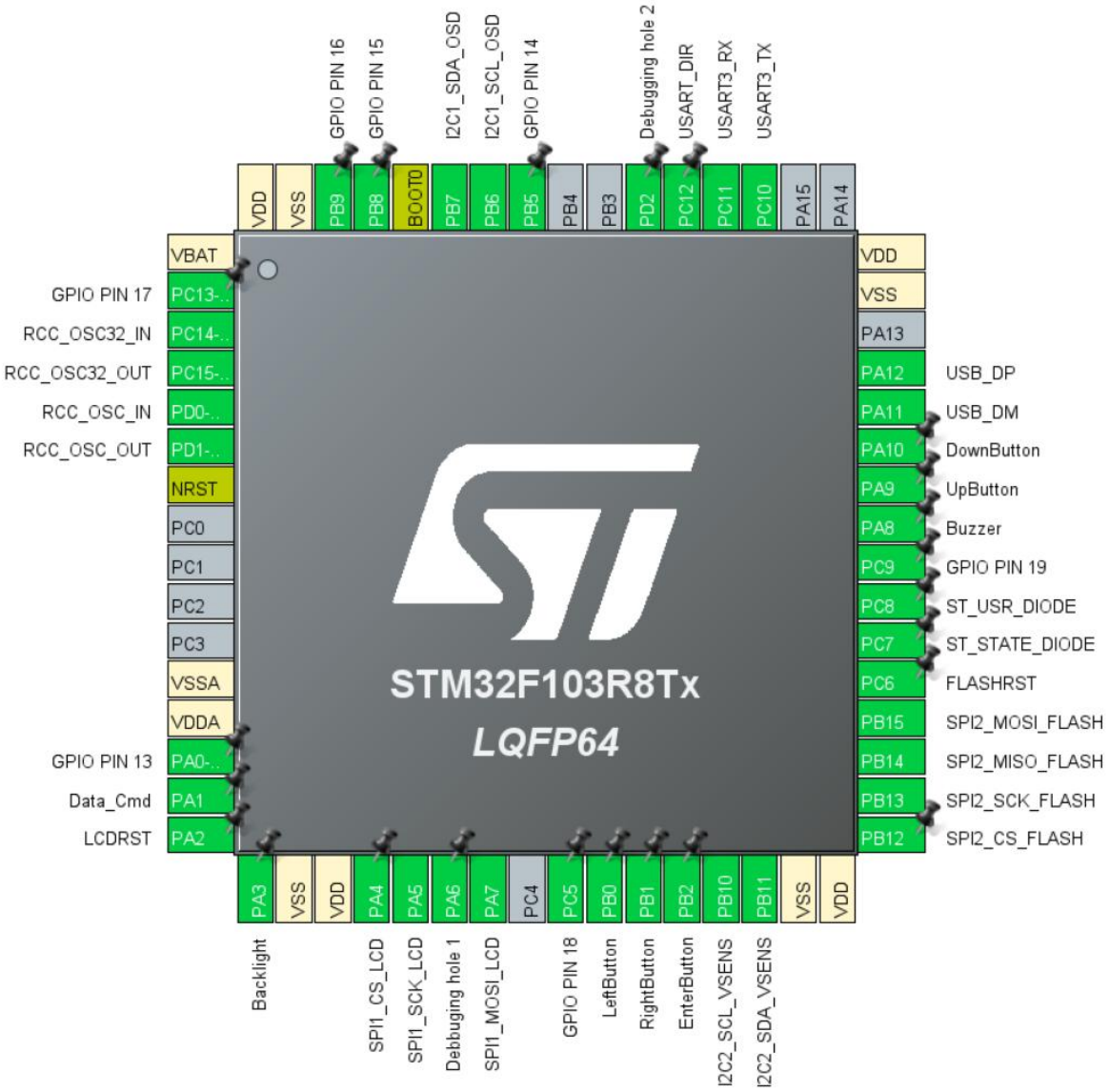


Figure 6.1. pinout configuration of the Development Kit MCU.

6.2. Flashing code

The STM32F103R8T6 microcontroller can be programmed via the onboard JTAG connectors. Pins PC0 to PC4, PA13 to PA15, PB3, and PB4 are reserved for JTAG programming. These pins are not required for use in this STM32CubeMX configuration. Additionally, since the XP4 JTAG connector is connected to the both µQSeven module and this microcontroller, the STM32F103R8T6 can be programmed directly via the µQSeven module.

7. Hardware Guide

This Hardware Guide provides information about the features, connectors and signals available on QSeven Development Kit with µQSeven Computer on Module

7.1. µQ7 Implementation

µQSeven Computer on Module has mandatory and optional features.

The following table shows the feature set of the Atronax µQSeven module compared to the minimum ARM/RISC based configuration according to the Q7 standard.

Table 7.1. QSeven Support Features

System I/O Interface	ARM/RISC Based Minimum Configuration	Atronax µQSeven module Configuration
PCI Express lanes	0	0
Serial ATA channels	0	0
USB 2.0 ports	3	3
USB 3.0 ports	0	0
LVDS channels	0	0
Embedded DisplayPort	0	0
MIPI-CSI	0	0
HDMI	0	0
High-Definition Audio / AC'97 / I2S	0	0
Ethernet 10/100/Gigabit	0	1x 100Mbps
UART	0	2

GPIO	0	5
Secure Digital I/O	0	0
System Management Bus	0	0
I²C Bus	1	3
SPI Bus	0	1
CAN Bus	0	1
Watchdog Trigger	1	1
Power Button	1	1
Power Good	1	1
Reset Button	1	1
LID Button	0	0
Sleep Button	0	0
Suspend to RAM (S3 mode)	0	0
Wake	0	0
Battery low alarm	0	0
Thermal control	0	0
FAN control	0	0

7.2. Pinout configuration

The following table shows the signals on the edge connector of Atronax-µQSeven module. Empty cells are not connected (NC) pins.

Table 7.2. QSeven Pinout Configuration

Pin	Signal	Pin	Signal
1	GND	2	GND
3		4	
5		6	
7	LINK100	8	
9	MDI_RX_N	10	MDI_TX_N
11	MDI_RX_P	12	MDI_TX_P
13		14	ACT
15	CTREF	16	
17	WAKE	18	
19	GPO0	20	PWRBTN#

21	GPI1	22	
23	GND	24	GND
25	GND	26	PWGIN
27	GPII2	28	RSTBTN#
29		30	
31		32	
33		34	GND
35		36	
37		38	
39	GND	40	GND
41		42	EXT_SDIO_CLK
43	EXT_SDIO_CD	44	
45	EXT_SDIO_CMD	46	
47	EXT_SDIO_PWR	48	EXT_SDIO_DAT1
49	EXT_SDIO_DAT0	50	EXT_SDIO_DAT3
51	EXT_SDIO_DAT2	52	
53		54	
55		56	
57	GND	58	GND
59		60	I2C1_CLK
61		62	I2C1_SDA
63		64	
65		66	I2C0_CLK
67		68	I2C0_SDA
69		70	
71		72	
73	GND	74	GND
75		76	
77		78	
79		80	
81		82	
83		84	
85		86	
87		88	
89		90	
91	USB_VBUS	92	
93		94	USB0_N
95		96	USB0_P

97	GND	98	GND
99		100	
101		102	
103		104	
105		106	
107		108	
109		110	
111		112	
113		114	
115		116	
117	GND	118	GND
119		120	
121		122	
123		124	
125	I2C2_SDA	126	
127	I2C2_CLK	128	
129	CAN_TX	130	CAN_RX
131		132	
133		134	
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	
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	
179		180	
181		182	
183	GND	184	GND
185	Eth0_ACT	186	GPIO1
187	MCU_State_Anode	188	ADC_IN
189	DAC_OUT	190	UART1_TX
191	UART1_RX	192	USR1_Anode
193	VCC_RTS	194	
195		196	
197	GND	198	GND
199	SPI_MOSI	200	SPI_CS0#
201	SPI_MISO	202	
203	SPI_SCK	204	JTAG_TRST#
205	VCC_SB_5V	206	VCC_SB_5V
207	JTAG_TCK	208	JTAG_TDI
209	JTAG_TDO	210	JTAG_TMS
211		212	
213		214	
215		216	
217		218	
219	VCC	220	VCC
221	VCC	222	VCC
223	VCC	224	VCC
225	VCC	226	VCC
227	VCC	228	VCC
229	VCC	230	VCC

7.3. Signal Details

7.3.1. Ethernet

Table 7.3. QSeven Ethernet signal

Q7 Signal	Type	Signal Level	Description
MDI_TX_P	I/O	Analog	Fast Ethernet Controller: Media Dependent Interface Differential Pairs. The MDI can operate in 100 and 10 Mbit/sec modes
MDI_TX_N			
MDI_RX_P			
MDI_RX_N			
ACT	OC	3.3V	Ethernet Controller activity indicator, active low
LINK100	OC	3.3V	Ethernet Controller link indicator, active low
CTREF	REF	Analog	Center Tap Voltage

7.3.2. USB

Table 7.4. QSeven USB signal

Q7 Signal	Type	Signal Level	Description
USB0_P	I/O	USB	High speed universal Serial Bus Port differential pairs
USB0_N			
USB_VBUS	I	5.0V	USB VBUS pin, 5V tolerant

7.3.3. SDIO

Table 7.5. QSeven SDIO signal

Q7 Signal	Type	Signal	Description

		Level	
SDIO_CD	I	3.3V	SDIO Card Detect. This signal indicates when a SDIO/MMC card is present
SDIO_CLK	O	3.3V	SDIO Clock
SDIO_CMD	I/O	3.3V	SDIO Command/Response
SDIO_PWR	O	3.3V	SDIO Power Enable. This signal is used to enable the power being supplied to a SD/MMC card device
SDIO_DAT [0-3]	OC	3.3V	SDIO Data lines

7.3.4. I2C

Table 7.6. QSeven I2C signal

Q7 Signal	Type	Signal Level	Description
I2C_CLK [0-2]	O	3.3V	I2C bus clock line
I2C_SDA [0-2]	I/O	3.3V	I2C bus data line

7.3.5. GPIO

Table 7.6. QSeven GPIO signal

Q7 Signal	Type	Signal Level	Description
GPIO [0-4]	I/O	3.3V	General purpose inputs/outputs 0 to 4

7.3.6. CAN

Table 7.7. QSeven CAN signal

Q7 Signal	Type	Signal Level	Description
CAN_TX	O	3.3V	CAN (Controller Area Network) TX output
CAN_RX	I	3.3V	CAN (Controller Area Network) RX input

7.3.7. SPI

Table 7.8. QSeven SPI signal

Q7 Signal	Type	Signal Level	Description
SPI_MOSI	O	3.3V	Master serial output/Slave serial input signal
SPI_MISO	I	3.3V	Master serial input/Slave serial output signal
SPI_SCK	O	3.3V	SPI clock output
SPI_CS0#	O	3.3V	SPI chip select 0 output

7.3.8. UART

Table 7.9. QSeven UART signal

Q7 Signal	Type	Signal Level	Description
UART0_TX	O	3.3V	Serial data transmit for UART Bus channel 0
UART0_RX	I	3.3V	Serial data receive for UART Bus channel 0
UART1_TX	O	3.3V	Serial data transmit for UART Bus channel 1
UART1_RX	I	3.3V	Serial data receive for UART Bus channel 1
UART0_RTS	O	3.3V	Handshake signal: ready to receive data

7.3.9. Misc

Table 7.10. QSeven Misc signal

Q7 Signal	Type	Signal Level	Description
MCU_State_Anode	O	3.3V	Serial data transmit for UART Bus channel 0
USR1_Anode			
ADC_IN	I	3.3V	Input signal of a Analog-to-Digital Converter (ADC)
DAC_OUT	O	3.3V	Output signal of a Digital-to-Analog Converter (DAC)
JTAG_TRST#	I	3.3V	Test Reset: An optional pin that resets the JTAG logic
JTAG_TCK	I	3.3V	Test Clock: This clock signal synchronizes the JTAG operations
JTAG_TDI	I	3.3V	Test Data In: Data is shifted into the device
JTAG_TDO	O	3.3V	Test Data Out: Data is shifted out of the device
JTAG_TMS	I	3.3V	Test Mode Select: This pin controls the JTAG state machine

7.3.10. Power Management

Table 7.11. QSeven Power Management

Q7 Signal	Type	Signal Level	Description
RSTBTN#	I	3.3V	Reset button input. An active low signal resets the module
WAKE#	I	3.3V	External system wake event. An active low signal wakes the module from a sleep state

7.3.11. Power

Table 7.12. QSeven Power Signals

Q7 Signal	Type	Description
VCC	5V	Main supply for the module
VCC_SB_5V	5V	5V standby voltage supply, 5V supply is active even when the main device or circuit is turned off or in a low-power state.
VCC_RTS	3.3V	VCC_RTS

7.4. On-board Devices

7.4.1. Octavo OSD32MP157C/F System in Package (SiP)

The OSD32MP15C/F System-in-Package (SiP) devices deliver all the power of a Microprocessor in a package that feels like a microcontroller in the smallest possible footprint.

7.4.1.1. STM OSD32MP157 MCU

At their core, the OSD32MP157C/F devices have the versatile STMicroelectronics STM32MP157 featuring:

- Arm® Cortex® A7 Dual Core CPU with up to 800MHz clock speed, 2x 32 KB L1 cache and 256KB L2 cache and an
- Arm® Cortex® M4 CPU with up to 209MHz clock speed and with and integrated Floating Point Unit (FPU) and Memory Protection Unit (MPU)
- 3D OpenGL ES2.0 integrated GPU
- 256KB System SRAM, 384KB MCU Sys SRAM, 64KB MCU Ret SRAM
- ARM® Trust Zone®

- 2x 22 channel 16bit ADC
- 2x 12bit DAC

7.4.1.2. Power Management

The power management portion of the OSD32MP157C/F consists of the STPMIC1A (PMIC). The PMIC provides the necessary power rails to the OSD32MP157C/F, DDR3L, EEPROM and all the other internal components to the OSD32MP157C/F. It also provides power supply outputs that may be used to power circuitry external to the OSD32MP15x. The PMIC is connected to I2C4 at the 7-bit I2C address 0x33 (0b0110011).

7.4.1.3. Memory

- 512MB RAM x16 LPDDR3
- 4KB EEPROM nonvolatile memory for configuration

7.4.1.4. Oscillator

There is a low power, low jitter, highly stable MEMS CMOS 24 MHz oscillator used for the high-speed external (HSE) primary clock input.

7.4.2. Ethernet PHY

Micorchips KSZ8081RNACA-TR is a highly-integrated, single-supply 10BASE-T/100BASE-TX Ethernet physical-layer transceiver for transmission and reception of data over standard CAT-5 unshielded twisted pair (UTP) cable. It offers the Reduced Media Independent Interface (RMII) for direct connection to RMII-compliant MACs in Ethernet processors and switches. Further connections to the MCU are shown below.

Table 7.13. Ethernet connecions

PHY Signal	Connected to MCU pin
RMII_TXD0	PG13
RMII_TXD1	PG14
RMII_TXEN	PB11

RMII_RXD0	PC4
RMII_RXD1	PC5
RMII_RXER	PB10
MDIO	PA2
MDC	PC1

7.4.3. USB

On the board, the SiP has an integrated USB 2.0 controller and also a dedicated MIC2075, a high-side MOSFET switch optimized for general-purpose power distribution requiring circuit protection. It offers smart thermal shutdown that reduces current consumption in fault modes and protects the device and load. Further connections to the CPU are shown below.

Table 7.14. USB connections

PHY Signal	Connected to MCU pin
USB_PWR_EN	PI7
USB_FAULT#	PI8

7.4.4. Embedded Multimedia Card (eMMC)

KLM8G1GETF-B041 is a 8GB NAND flash eMMC solution.

eMMC operation is identical to a MMC device and therefore is a simple read and write to memory using MMC protocol v5.1 which is an industry standard. eMMC consists of NAND flash and a MMC controller. There are several advantages of using eMMC. It is easy to use as the MMC interface allows easy integration with any microprocessor with MMC host. The embedded flash management software or FTL (Flash Transition Layer) of eMMC manages Wear Leveling, Bad Block Management and ECC. The FTL supports all features of the Samsung NAND flash and achieves optimal performance.

Table 7.15. eMMC connections

PHY Signal	Connected to MCU pin
eMMC_CLK	PE3
eMMC_CMD	PG6
eMMC_RST#	PB9
eMMC_DAT [0-7]	PB14,PB15,PB3,PB4,PB8,PA9,PE6,PD3

7.4.5. Onboard uSD Card (Do Not Populate by Default)

The QSeven Development Kit with µQSeven Computer on Module storage can be expanded by adding an external microSD card which communicates with the MCU.

7.5. Electrical Specification

The power supply requirements are listed in the table below and are identical to the Qseven specification.

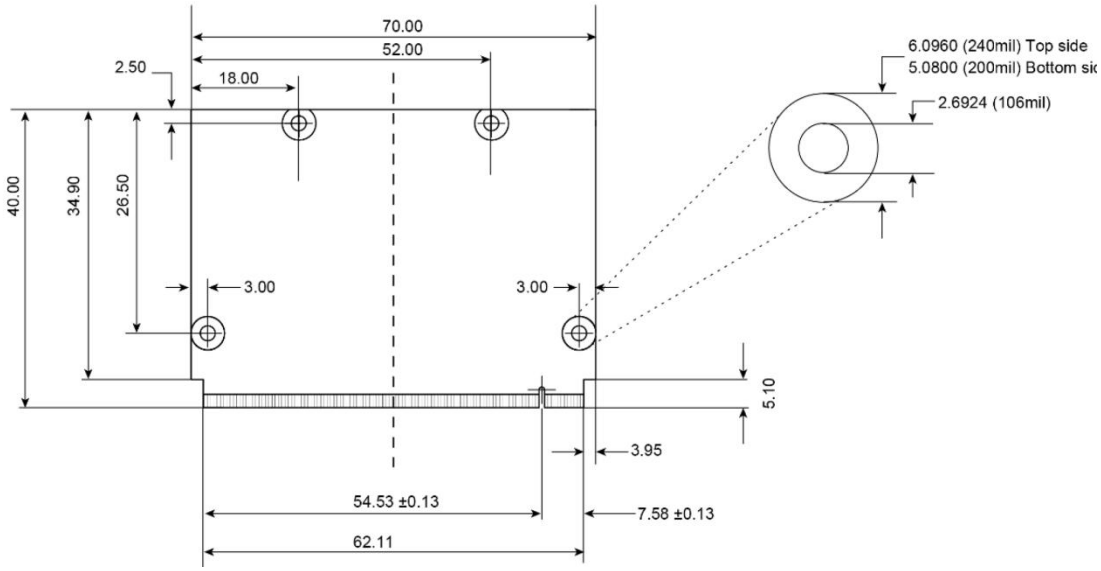
Table 7.16. Electrical specifications

Rail	Description	Nominal voltage	Tolerance	Max Input Ripple
VCC	Main power supply	+5V	+4.75 ... +5.25V	50 mV
VCC_SB_5V	5V standby voltage supply	+5V	+4.75 ... +5.25V	50 mV
VCC_RTC	Backup battery	+3V	+2.4 ... +3.3V	20 mV

7.6. Mechanical Specification

7.6.1. Module Dimensions

The mechanical dimensions of the module are shown below.



Note: Module dimensions are shown in mm.

7.6.2. Development Board Dimensions

The mechanical dimensions of the development board match the Mini-ITX form factor (170mm x 170mm) and can be mounted in a standard Mini-ITX PC Case.

8. Contact

HS Devices d.o.o. Nis
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info@hsdevices.com

www.atronax.com

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9. Reference and resources

No.	Link	Description
1	STM32MP157C Datasheet	Technical datasheet for the STM32MP157C microprocessor, including electrical characteristics and pin configurations.
2	STM32F103 Datasheet	Datasheet for the STM32F103 microcontroller, detailing features, peripherals, and electrical specifications.
3	OSD32MP15x Datasheet	Datasheet for the Octavo Systems OSD32MP15x System-in-Package, including specifications and pin mappings.
4	STM32MP157C-DK2 Data Brief	Overview of the STM32MP157C-DK2 Discovery Kit, highlighting features and key components.
5	STM32MP157C Datasheet (Alternative Source)	Alternative download link for the STM32MP157C datasheet.
6	CubeMX Tutorial for OSD32MP15x	Application note guiding the setup of STM32MP1 with CubeMX for OSD32MP15x.
7	STM32CubeMX	ST's graphical configuration tool for STM32 microcontrollers, supporting peripheral configuration and code generation.
8	OSD32MP15x Minimal Config	Minimal configuration guide for the OSD32MP15x, focusing on essential settings for boot and power.
9	UM1472 User Manual	User manual for STM32 development boards, detailing hardware setup and usage.
10	RM0436 Reference Manual	Detailed reference manual for the STM32MP157 series, covering registers,

		peripherals, and system architecture.
11	OSD32MP15x Family Overview	Overview document for the OSD32MP15x family, including features and product line differences.
12	OSD32MP1 Variant Migration Guide	Guide for migrating between different variants of the OSD32MP1.
13	OSD32MP15x Pin Mapping	Pin mapping guide comparing OSD32MP15x to STM32MP1 pin assignments.
14	STM32MP1 Developer Package	Comprehensive software package for STM32MP1 series, including Linux kernel, U-Boot, and Yocto support.
15	OSD32MP1 Design Guide	Design guide providing best practices for integrating OSD32MP1 into custom hardware designs.
16	STM32MP1 Ecosystem Overview	Overview of the STM32MP1 ecosystem, including available tools, software, and development boards.
17	AT45DB161E Datasheet	Datasheet for the AT45DB161E flash memory, detailing pin configurations and electrical characteristics.
18	INA226 Datasheet	Datasheet for the INA226 power monitor, including specifications and usage details.
19	ST7789 Datasheet	Datasheet for the ST7789 display driver, detailing interface specifications and operational modes.
20	Silicon Labs Driver	Silicon Labs Driver for USB type C to UART.