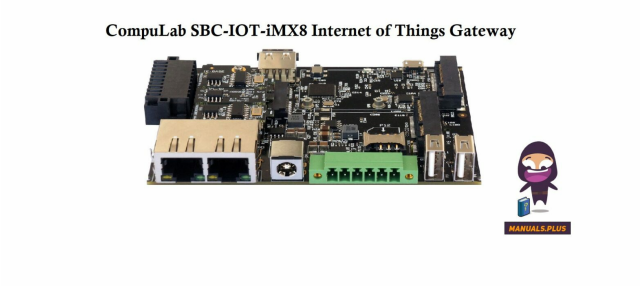
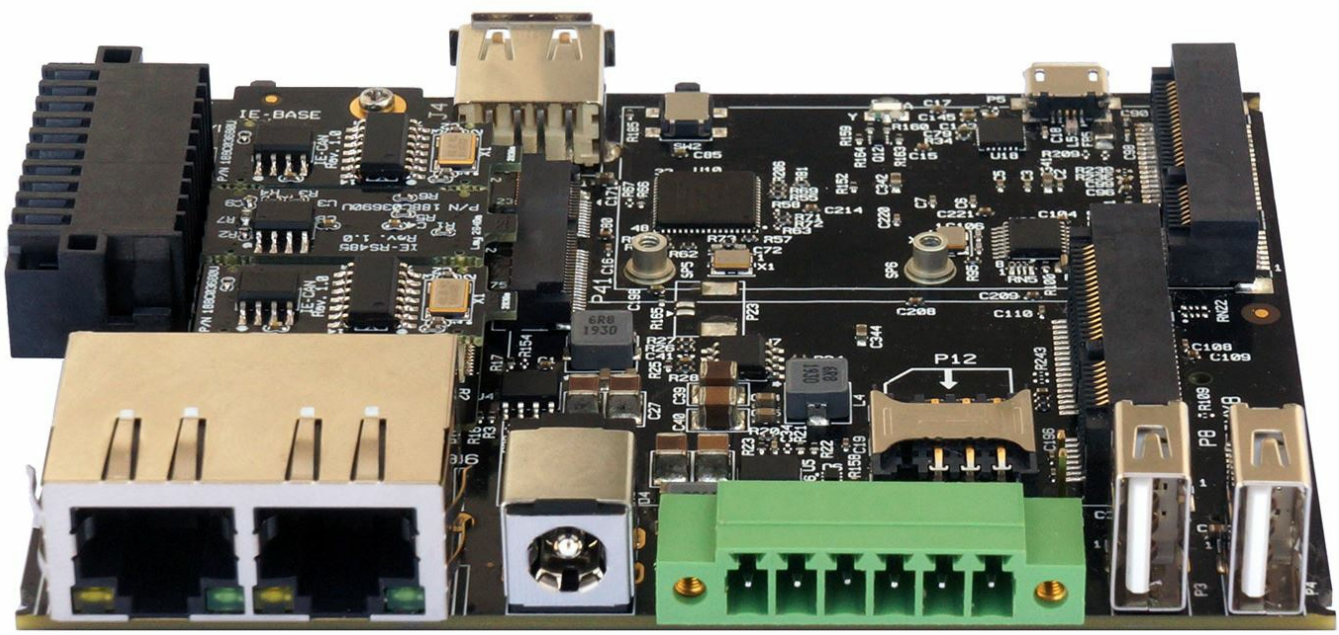


CompuLab SBC-IOT-iMX8 Internet of Things Gateway User Guide

Contents

CompuLab SBC-IOT-iMX8 Internet of Things Gateway



Product Information

Specifications

- CPU: NXP i.MX8M Mini quad-core Cortex-A53
- RAM: Up to 4GB
- Storage: 128GB eMMC
- Connectivity: LTE modem, WiFi 802.11ax, Bluetooth 5.1
- Ports: 2x Ethernet, 3x USB2, RS485 / RS232, CAN-FD
- Expansion: Custom I/O expansion boards
- Operating Temperature: -40°C to 80°C
- Warranty: 5 years with 15 years availability
- Input Voltage Range: 8V to 36V
- Operating Systems: Debian Linux and Yocto Project

Product Usage Instructions

1. Installation

Ensure the SBC-IOT-iMX8 is powered off. Connect necessary peripherals such as Ethernet cables, USB devices, and power source.

2. Powering On

Press the power button to turn on the device. Wait for the system to boot up.

3. Operating System Setup

Follow the on-screen instructions to set up the operating system (Debian Linux or Yocto Project) during the initial boot.

4. Connectivity

Establish connections to WiFi networks, LTE modems, and other devices using the available ports.

5. Expansion Boards

If using custom I/O expansion boards, refer to their respective manuals for installation and configuration instructions.

Frequently Asked Questions

- **Q: What is the warranty period for the SBC-IOT-iMX8?**
  - A: The product comes with a 5-year warranty and is available for up to 15 years.
- **Q: What is the recommended operating temperature range?**
  - A: The device can operate in temperatures ranging from -40°C to 80°C.

- CompuLab 17 Ha Yetzira St., Yokneam Illit
- 2069208, Israel
- Tel: +972 (4) 8290100
- **http://www.compulab.com**
- Fax: +972 (4) 8325251

Table 1 Document Revision Notes

Date	Description
May 2020	· First release
July 2020	· Added P41 pin-out table in section 5.8 · Added connector pin numbering in sections 5.3 and 5.9
August 2020	· Added industrial I/O add-on sections 3.10 and 5.10
September 2020	· Fixed LED GPIO number in section 5.11
February 2021	· Removed legacy section
August 2023	· Added “Heat Plate and Cooling Solutions” section 6.1

INTRODUCTION

About This Document

This document is part of a set of documents providing information necessary to operate and program Compulab SBC-IOT-iMX8.

Related Documents

For additional information not covered in this manual, please refer to the documents listed in Table 2.

Table 2 Related Documents

Document	Location
SBC-IOT-iMX8 design resources	https://www.compulab.com/products/sbcs/sbc-iot-imx8-nxp-i-mx8m- mini-internet-of-things-single-board-computer/#devres

OVERVIEW

Highlights

- NXP i.MX8M Mini CPU, quad-core Cortex-A53
- Up-to 4GB RAM and 128GB eMMC
- LTE modem, WiFi 802.11ax, Bluetooth 5.1
- 2x Ethernet, 3x USB2, RS485 / RS232, CAN-FD
- Custom I/O expansion boards
- Designed for reliability and 24/7 operation
- Wide temperature range of -40C to 80C
- 5 year warranty and 15 year availability
- Wide input voltage range of 8V to 36V
- Debian Linux and Yocto Project

Specifications

Table 3 CPU, RAM and Storage

Feature	Specifications
CPU	NXP i.MX8M Mini, quad-core ARM Cortex-A53, 1.8GHz
Real-Time Co-processor	ARM Cortex-M4
RAM	1GB – 4GB, LPDDR4
Primary Storage	4GB – 64GB eMMC flash, soldered on-board
Secondary Storage	16GB – 64GB eMMC flash, optional module

Table 4 Network

Feature	Specifications
LAN	1x 1000Mbps Ethernet port, RJ45 connector
	1x 100Mbps Ethernet port, RJ45 connector
WiFi	802.11ax WiFi interface Intel WiFi 6 AX200 module
Bluetooth	Bluetooth 5.1 BLE Intel WiFi 6 AX200 module
Cellular	4G/LTE CAT1 cellular module, Simcom SIM7600G * via mini-PCie socket
	On-board micro-SIM card socket
GNSS	GPS / GLONASS Implemented with Simcom SIM7600G module

Table 5 I/O and System

Feature	Specifications
PCI Express	mini-PCIe socket, full-size * mutually exclusive with WiFi/BT module
USB	3x USB2.0 ports, type-A connectors
Debug	1x serial console via UART-to-USB bridge, micro-USB connector
Serial	1x RS485 (2-wire) / RS232 port, terminal-block
Interface add-on	Up-to 2x CAN-FD | RS485 | RS232 ports Isolated, terminal-block connector * implemented with an add-on board
Digital I/O add-on	4x digital outputs + 4x digital inputs Compliant with EN 61131-2, isolated, terminal-block connector * implemented with an add-on board
Expansion Connector	Expansion connector for add-on boards 2x SPI, 2x UART, I2C, 12x GPIO
Security	Secure boot, implemented with i.MX8M Mini HAB module
RTC	Real-time clock operated from onboard coin-cell battery

Table 6 Electrical, Mechanical and Environmental

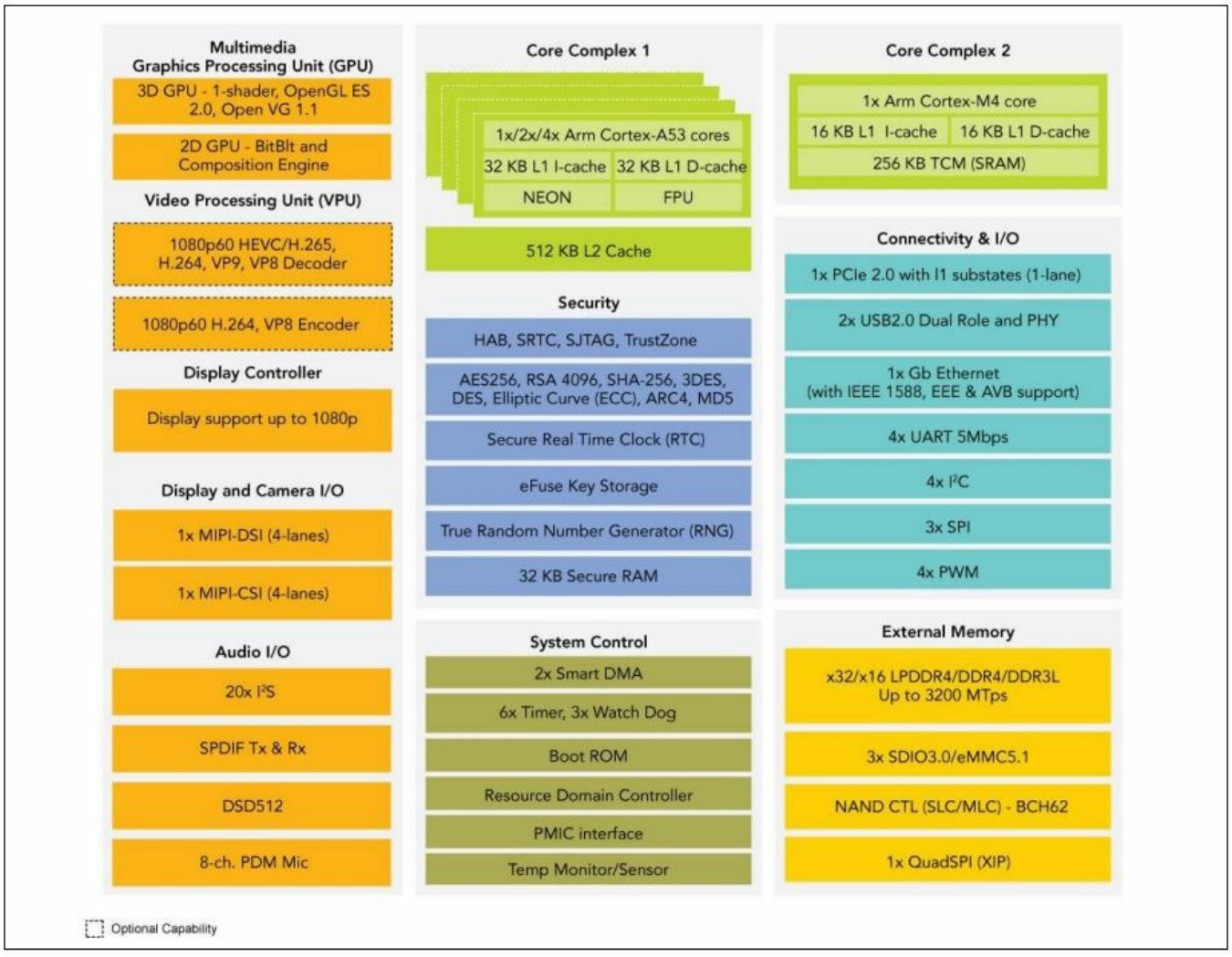
Supply Voltage	Unregulated 8V to 36V
Power Consumption	2W – 7W, depending on system load and configuration
Dimensions	104 x 80 x 23 mm
Weight	150 grams
MTTF	> 200,000 hours
Operation temperature	Commercial: 0° to 60° C Extended: -20° to 60° C Industrial: -40° to 80° C

CORE SYSTEM COMPONENTS

NXP i.MX8M Mini SoC

The NXP i.MX8M Mini family of processors features advanced implementation of a quad ARM® Cortex®-A53 core, which operates at speeds of up to 1.8 GHz. A general purpose Cortex®-M4 core processor enables low-power processing.

Figure 1 i.MX8M Mini Block Diagram



System Memory

DRAM

SBC-IOT-iMX8 is available with up-to 4GB of on-board LPDDR4 memory.

Primary Storage

SBC-IOT-iMX8 features up-to 64GB of soldered on-board eMMC memory for storing the boot-loader and operating system (kernel and root filesystem). The remaining eMMC space can be used to store general-purpose (user) data.

Secondary Storage

SBC-IOT-iMX8 features an optional eMMC module that allows to expand the system's non-volatile memory for storing additional data, back-up of the primary storage or installation of a secondary operating system. The eMMC module is installed in socket P14.

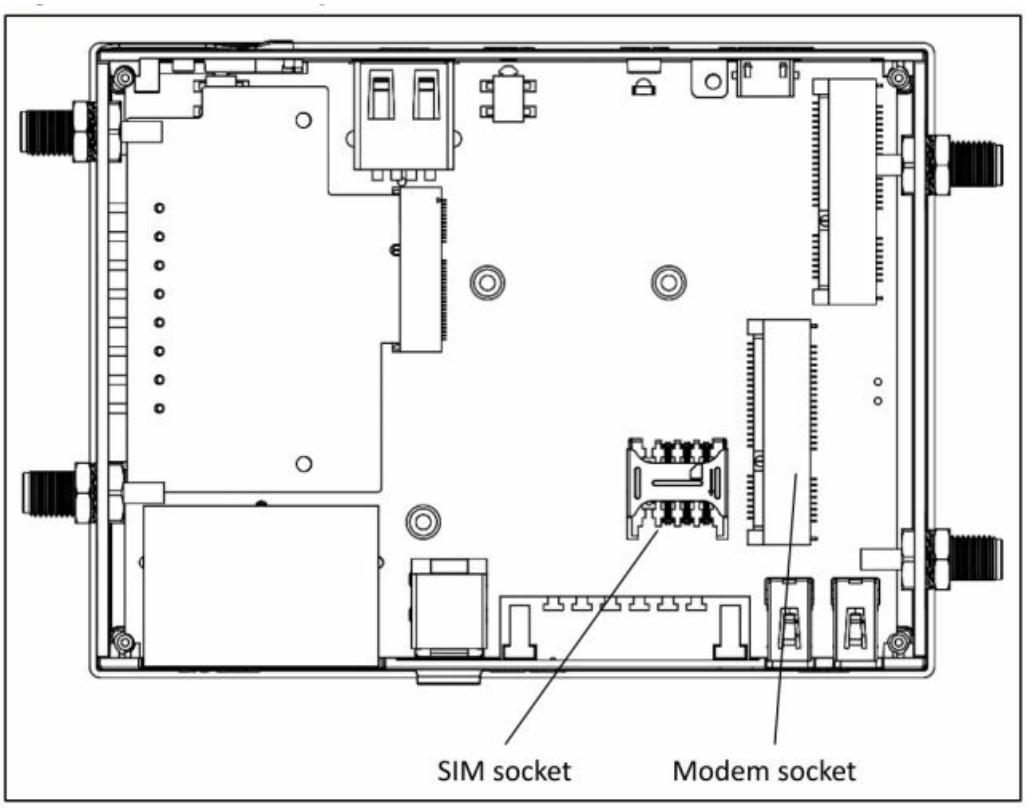
WiFi and Bluetooth

SBC-IOT-iMX8 can be optionally assembled with the Intel WiFi 6 AX200 module providing 2×2 WiFi 802.11ax and Bluetooth 5.1 interfaces. AX200 module is assembled in mini-PCIe socket #1 (P6).

Cellular and GPS

SBC-IOT-iMX8 cellular interface is implemented with a mini-PCIe modem module and a micro-SIM socket. In order to setup SBC-IOT-iMX8 for cellular functionality install an active SIM card into micro-SIM socket P12. The cellular module should be installed into mini-PCIe socket P8.The cellular modem module also implements GNNS / GPS.

Figure 2 service bay – cellular modem



Ethernet

SBC-IOT-iMX8 incorporates two Ethernet ports:

- ETH1 – primary 1000Mbps port implemented with i.MX8M Mini MAC and Atheros AR8033 PHY
- ETH2 – secondary 100Mbps port implemented with Microchip LAN9514 controller

The Ethernet ports are available on dual RJ45 connector P46.

USB 2.0

SBC-IOT-iMX8 features three external USB2.0 host ports. The ports are routed to USB connectors P3, P4 and J4. Front panel USB port (J4) is implemented directly with the i.MX8M Mini native USB interface. Back panel ports (P3, P4) are implemented with the on-board USB hub.

RS485 / RS232

SBC-IOT-iMX8 features a user configurable RS485 / RS232 port implemented with the SP330 transceiver connected to NXP i.MX8M Mini UART port. Port signals are routed to terminal block connector P7.

Serial Debug Console

SBC-IOT-IMX8 features a serial debug console via UART-to-USB bridge over micro USB connector P5. CP2104 UART-to-USB bridge is interfaced with i.MX8M Mini UART port. CP2104 USB signals are routed to micro USB connector located on the front panel.

I/O Expansion interface

SBC-IOT-iMX8 expansion interface is available on M.2 Key-E socket P41. The expansion connector allows to integrate custom I/O add-on boards into SBC-IOT-iMX8. The expansion connector features a set of embedded interfaces such as I2C, SPI, UART and GPIOs. All the interfaces are derived directly from the i.MX8M Mini SoC.

Industrial I/O add-on

IOT-GATE-iMX8 can be optionally assembled with the industrial I/O add-on board installed into the I/O expansion socket. The industrial I/O add-on features up-to three separate I/O modules which allow to implement different combinations of isolated CAN, RS485, RS232, digital outputs and inputs. The following table shows the supported I/O combinations and ordering codes.

CompuLab supplies SBC-IOT-iMX8 with the following cellular modem options:

- 4G/LTE CAT1 module, Simcom SIM7600G (global bands

Table 7 Industrial I/O add-on – supported combinations

	Function	Ordering Code
I/O module A	RS232 (rx/tx)	FARS2
	RS485 (2-wire)	FARS4
	CAN-FD	FACAN
I/O module B	RS232 (rx/tx)	FBRS2
	RS485 (2-wire)	FBRS4
	CAN-FD	FBCAN
I/O module C	4x DI + 4x DO	FCDIO

Combination examples:

- For 2x RS485 the ordering code will be IOTG-IMX8-…-FARS4-FBRS4-…
- For RS485 + CAN + 4xDI+4xDO ordering code will be IOTG-IMX8-…-FARS4-FBCAN-FCDIO-…
  For connector details please refer to section 5.9

RS485

RS485 function is implemented with MAX13488 transceiver interfaced with i.MX8M-Mini UART port. Key characteristics:

- 2-wire, half-duplex
- Galvanic isolation from main unit and other I/O modules
- Programmable baud rate of up-to 4Mbps
- Software-controlled 120ohm termination resistor

CAN-FD

CAN function is implemented with MCP2518FD controller interfaced with i.MX8M-Mini SPI port.

- Supports both CAN 2.0B and CAN FD modes
- Galvanic isolation from main unit and other I/O modules
- Data rate of up to 8Mbps

RS232

RS232 function is implemented with MAX3221 (or compatible) transceiver interfaced with i.MX8M-Mini UART port. Key characteristics:

- RX/TX only
- Galvanic isolation from main unit and other I/O modules
- Programmable baud rate of up to 250kbps

Digital inputs and outputs

Four digital inputs are implemented with the CLT3-4B digital termination in accordance with EN 61131-2. Four digital outputs are implemented with the VNI4140K solid state relay in accordance with EN 61131-2. Key characteristics:

- External supply voltage up-to 24V
- Galvanic isolation from main unit and other I/O modules
- Digital outputs maximal output current – 0.5A per channel

Figure 3 Digital output – typical wiring example

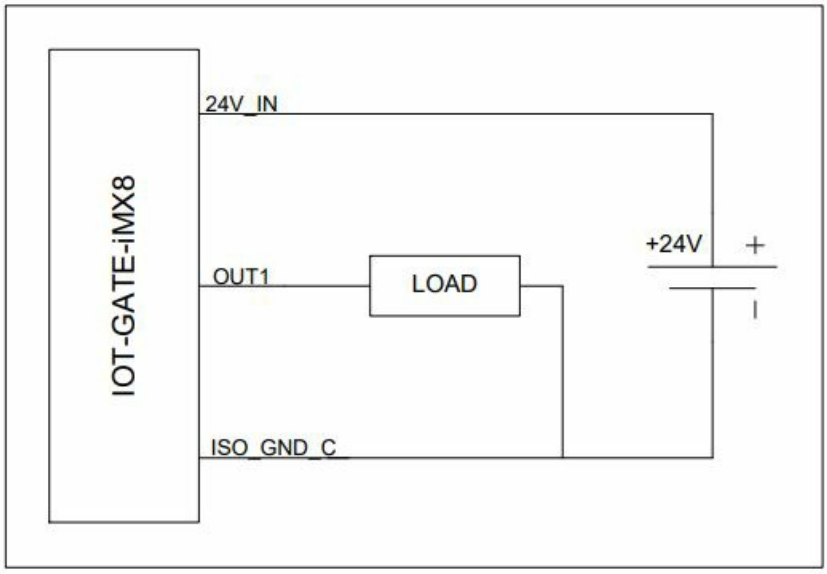
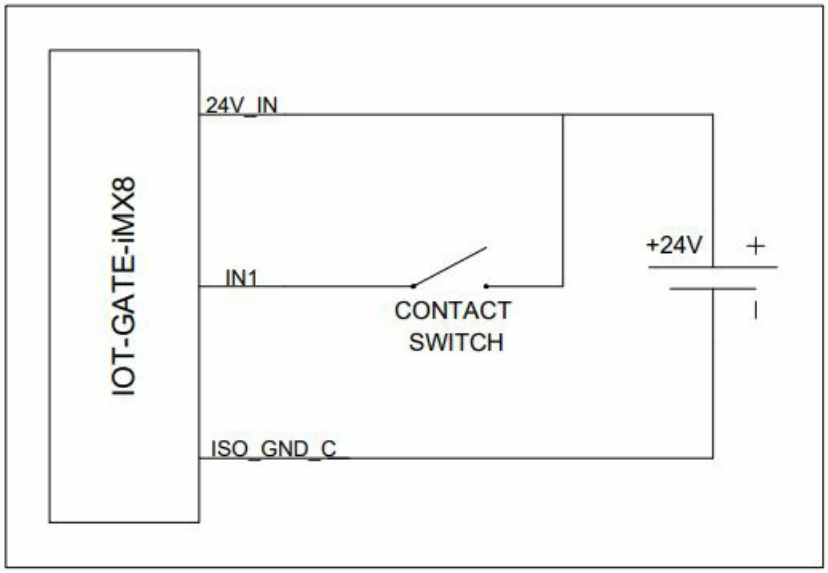


Figure 4 Digital input – typical wiring example



SYSTEM LOGIC

Power Subsystem

Power Rails

SBC-IOT-iMX8 is powered with a single power rail with input voltage range of 8V to 36V.

Power Modes

SBC-IOT-iMX8 supports two hardware power modes.

Table 8 Power modes

Power Mode	Description
ON	All internal power rails are enabled. Mode entered automatically when main power supply is connected.
OFF	i.MX8M Mini core power rails are off, most of the peripherals power rails are off.

RTC Back-Up Battery

SBC-IOT-iMX8 features a 120mAh coin cell lithium battery, which maintains the on-board RTC whenever the main power supply is not present.

Real Time Clock

The SBC-IOT-iMX8 RTC is implemented with the AM1805 real time clock (RTC). The RTC is connected to the i.MX8M SoC using I2C2 interface at address 0xD2/D3. SBC-IOT-iMX8 backup battery keeps the RTC running to maintain clock and time information whenever the main power

INTERFACES AND CONNECTORS

INTERFACES AND CONNECTORS supply is not present.

DC Power Jack (J1)

DC power input connector.

Table 9 J1 connector pin-out

Pin	Signal Name
1	DC IN
2	GND

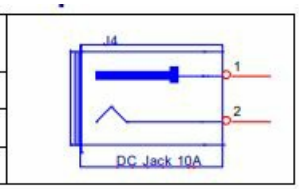


Table 10 J1 connector data

Manufacturer	Mfg. P/N
Contact Technology	DC-081HS(-2.5)

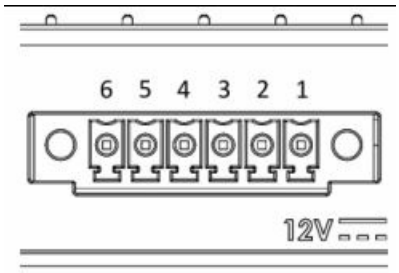
USB Host Connectors (J4, P3, P4)

The SBC-IOT-iMX8 external USB2.0 host ports are available through three standard type-A USB connectors (J4, P3, P4). For additional details, please refer to section 3.6 of this document.

RS485 / RS232 Connector (P7)

SBC-IOT-iMX8 features a configurable RS485 / RS232 interface routed to terminal block P7. RS485 / RS232 operation mode is controlled in software. For additional details please refer to SBC-IOT-iMX8 Linux documentation.

Table 11 P7 connector pin-out

Pin	RS485 mode	RS232 mode	Pin numbering
1	RS485_NEG	RS232_TXD	
2	RS485_POS	RS232_RTS	
3	GND	GND	
4	NC	RS232_CTS	
5	NC	RS232_RXD	
6	GND	GND	

Serial Debug Console (P5)

The SBC-IOT-iMX8 serial debug console interface is routed to micro USB connector P5. For more information, please refer to section 3.8 of this document.

RJ45 Dual Ethernet Connector (P46)

The SBC-IOT-iMX8 two Ethernet ports are routed to dual RJ45 connector P46. For additional details, please refer to section 3.5 of this document.

uSIM socket (P12)

The uSIM socket (P12) is connected to the mini-PCIe socket P8.

Mini-PCIe Sockets (P6, P8)

SBC-IOT-iMX8 features two mini-PCIe sockets (P6, P8) which implement different interfaces and are intended to different functions.

- Mini-PCie socket #1 is mainly intended for WiFi modules that require PCIe interface
- Mini-PCIe socket #2 is mainly intended for cellular modems and LORA modules

Table 12 mini-PCIe socket interfaces

Interface	mini-PCIe socket #1 (P6)	mini-PCIe socket #2 (P8)
PCIe	Yes	No
USB	Yes	Yes
SIM	No	Yes

NOTE: Mini-PCIe socket #2 (P8) does not feature PCIe interface.

I/O Expansion Connector

SBC-IOT-iMX8 I/O expansion connector P41 allows to connect add-on boards to SBC-IOT-iMX8. Some of the P41 signals are derived from i.MX8M Mini multifunctional pins. The following table outlines the connector pin-out and available pin functions.

- NOTE: Multifunctional pin function selection is controlled in software.
- NOTE: Each multifunctional pin can be used for a single function at a time.
- NOTE: Only one pin can be used for each function (in case a function is available on more than one carrier board interface pin).

Table 13 P41 connector pin-out

Pin	Singal name	Description
1	GND	SBC-IOT-iMX8 common ground
2	VCC_3V3	SBC-IOT-iMX8 3.3V power rail
3	EXT_HUSB_DP3	Optional USB port positive data signal. Multiplexed with back-panel connector P4
4	VCC_3V3	SBC-IOT-iMX8 3.3V power rail
5	EXT_HUSB_DN3	Optional USB port negative data signal. Multiplexed with back-panel con nector P4.
6	RESERVED	Reserved for future use. Must be left unconnected
7	GND	SBC-IOT-iMX8 common ground
8	RESERVED	Reserved for future use. Must be left unconnected
9	JTAG_NTRST	Processor JTAG interface. Test reset signal.
10	RESERVED	Reserved for future use. Must be left unconnected.
11	JTAG_TMS	Processor JTAG interface. Test mode select signal.
12	VCC_SOM	SBC-IOT-iMX8 3.7V power rail
13	JTAG_TDO	Processor JTAG interface. Test data out signal.
14	VCC_SOM	SBC-IOT-iMX8 3.7V power rail
15	JTAG_TDI	Processor JTAG interface. Test data in signal.
16	RESERVED	Reserved for future use. Must be left unconnected.
17	JTAG_TCK	Processor JTAG interface. Test clock signal.
18	RESERVED	Reserved for future use. Must be left unconnected.
19	JTAG_MOD	Processor JTAG interface. JTAG mode signal.

20	RESERVED	Reserved for future use. Must be left unconnected.
21	VCC_5V	SBC-IOT-iMX8 5V power rail
22	RESERVED	Reserved for future use. Must be left unconnected.
23	VCC_5V	SBC-IOT-iMX8 5V power rail
32	RESERVED	Reserved for future use. Must be left unconnected.
33	QSPIA_DATA3	Multifunctional signal. Available functions: QSPIA_DATA3, GPIO3_IO[9]
34	RESERVED	Reserved for future use. Must be left unconnected.
35	QSPIA_DATA2	Multifunctional signal. Available functions: QSPI_A_DATA2, GPIO3_IO[8]
36	ECSPI2_MISO/UART4_CTS	Multifunctional signal. Available functions: ECSPI2_MISO, UART4_CTS, GPIO5_IO[12]
37	QSPIA_DATA1	Multifunctional signal. Available functions: QSPI_A_DATA1, GPIO3_IO[7]
38	ECSPI2_SS0/UART4_RTS	Multifunctional signal. Available functions: ECSPI2_SS0, UART4_RTS, GPIO5_IO[13]
39	QSPIA_DATA0	Multifunctional signal. Available functions: QSPI_A_DATA0, GPIO3_IO[6]
40	ECSPI2_SCLK/UART4_RX	Multifunctional signal. Available functions: ECSPI2_SCLK, UART4_RXD, GPIO5_IO[10]
41	QSPIA_NSS0	Multifunctional signal. Available functions: QSPI_A_SS0_B, GPIO3_IO[1]
42	ECSPI2_MOSI/UART4_TX	Multifunctional signal. Available functions: ECSPI2_MOSI, UART4_TXD, GPIO5_IO[11]
43	QSPIA_SCLK	Multifunctional signal. Available functions: QSPI_A_SCLK, GPIO3_IO[0]
44	VCC_SOM	SBC-IOT-iMX8 3.7V power rail
45	GND	SBC-IOT-iMX8 common ground
46	VCC_SOM	SBC-IOT-iMX8 3.7V power rail
47	DSI_DN3	MIPI-DSI, data diff-pair #3 negative
48	I2C4_SCL_CM	Multifunctional signal. Available functions: I2C4_SCL, PWM2_OUT, GPIO5_IO[20]
49	DSI_DP3	MIPI-DSI, data diff-pair #3 positive

50	I2C4_SDA_CM	Multifunctional signal. Available functions: I2C4_SDA, PWM1_OUT, GPIO5_IO[21]
51	GND	SBC-IOT-iMX8 common ground
52	SAI3_TXC	Multifunctional signal. Available functions: GPT1_COMPARE2, UART2_TXD, GPIO5_IO[0]
53	DSI_DN2	MIPI-DSI, data diff-pair #2 negative
54	SAI3_TXFS	Multifunctional signal. Available functions: GPT1_CAPTURE2, UART2_RXD, GPIO4_IO[31]
55	DSI_DP2	MIPI-DSI, data diff-pair #2 positive
56	UART4_TXD	Multifunctional signal. Available functions: UART4_TXD, UART2_RTS, GPIO5_IO[29]
57	GND	SBC-IOT-iMX8 common ground
58	UART2_RXD/ECSPI3_MISO	Multifunctional signal. Available functions: UART2_RXD, ECSPI3_MISO, GPIO5_IO[24]
59	DSI_DN1	MIPI-DSI, data diff-pair #1 negative
60	UART2_TXD/ECSPI3_SS0	Multifunctional signal. Available functions: UART2_TXD, ECSPI3_SS0, GPIO5_IO[25]
61	DSI_DP1	MIPI-DSI, data diff-pair #1 positive
62	RESERVED	Reserved for future use. Must be left unconnected.

63	GND	SBC-IOT-iMX8 common ground
64	RESERVED	Reserved for future use. Must be left unconnected.
65	DSI_DN0	MIPI-DSI, data diff-pair #0 negative
66	UART4_RXD	Multifunctional signal. Available functions: UART4_RXD, UART2_CTS, GPIO5_IO[28]
67	DSI_DP0	MIPI-DSI, data diff-pair #0 positive
68	ECSPI3_SCLK	Multifunctional signal. Available functions: ECSPI3_SCLK, GPIO5_IO[22]
69	GND	SBC-IOT-iMX8 common ground
70	ECSPI3_MOSI	Multifunctional signal. Available functions: ECSPI3_MOSI, GPIO5_IO[23]
71	DSI_CKN	MIPI-DSI, clock diff-pair negative
72	EXT_PWRBTNn	SBC-IOT-iMX8 ON/OFF signal
73	DSI_CKP	MIPI-DSI, clock diff-pair positive
74	EXT_RESETn	The SBC-IOT-iMX8 cold reset signal
75	GND	SBC-IOT-iMX8 common ground

Table 14 P41 connector data

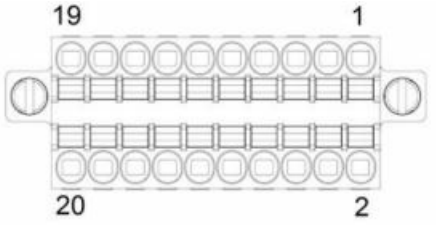
Type	Manufacturer	Mfg. P/N
M.2, E key, H 4.2mm	Lotes	APCI0076-P001A

Industrial I/O add-on board

Table 15 Industrial I/O add-on connector pin-out

I/O module	Pin	Singal
A	1	RS232_TXD / RS485_POS / CAN_H
	2	ISO_GND_A
	3	RS232_RXD / RS485_NEG / CAN_L
	4	NC
	5	NC
B	6	NC
	7	RS232_TXD / RS485_POS / CAN_H
	8	ISO_GND_B
	9	RS232_RXD / RS485_NEG / CAN_L
	10	NC
C	11	OUT0
	12	OUT2
	13	OUT1
	14	OUT3
	15	IN0
	16	IN2
	17	IN1
	18	IN3
	19	24V_IN
	20	ISO_GND_C

Table 16 Industrial I/O add-on connector data

Connector type	Pin numbering
20-pin dual-raw plug with push-in spring connections Locking: screw flange Pitch: 2.54 mm Wire cross-section: AWG 20 – AWG 30	

Indicator LEDs

The tables below describe SBC-IOT-iMX8 indicator LEDs.

Table 17 Power LED (DS1)

Main power connected	LED state
Yes	On
No	Off

Table 18 User LED (DS4)

General purpose LED (DS4) is controlled by SoC GPIOs GP3_IO19 and GP3_IO25.

GP3_IO19 state	GP3_IO25 state	LED state
Low	Low	Off
Low	High	Green
High	Low	Yellow
High	High	Orange

MECHANICAL

Heat Plate and Cooling Solutions

SBC-IOT-iMX8 is provided with an optional heat-plate assembly. The heat plate is designed to act as a thermal interface and should usually be used in conjunction with a heat sink or an external cooling solution. A cooling solution must be provided to ensure that under worst-case conditions the temperature on any spot of the heat-spreader surface is maintained according to the SBC-IOT-iMX8 temperature specifications. Various thermal management solutions can be used, including active and passive heat dissipation approaches.

Mechanical Drawings

SBC-IOT-iMX8 3D model is available for download at:

- **https://www.compulab.com/products/sbcs/sbc-iot-imx8-nxp-i-mx8m-mini-internet-of-things-single-board-computer/#devres**

OPERATIONAL CHARACTERISTICS

Absolute Maximum Ratings

Table 19 Absolute Maximum Ratings

Parameter	Min	Max	Unit
Main power supply voltage	-0.3	40	V

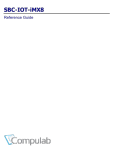
NOTE: Stress beyond Absolute Maximum Ratings may cause permanent damage to the device.

Recommended Operating Conditions

Table 20 Recommended Operating Conditions

Parameter	Min	Typ.	Max	Unit
Main power supply voltage	8	12	36	V

Documents / Resources

	CompuLab SBC-IOT-iMX8 Internet of Things Gateway [pdf] User Guide SBC-IOT-iMX8 Internet of Things Gateway, SBC-IOT-iMX8, Internet of Things Gateway, Things Gateway, Gateway

References

- CompuLab
- SBC-IOT-iMX8 | NXP i.MX8M Mini | Internet of Things Gateway SBC | CompuLab
- SBC-IOT-iMX8 | NXP i.MX8M Mini | Internet of Things Gateway SBC | CompuLab
- SBC-IOT-iMX8 | NXP i.MX8M Mini | Internet of Things Gateway SBC | CompuLab
- User Manual