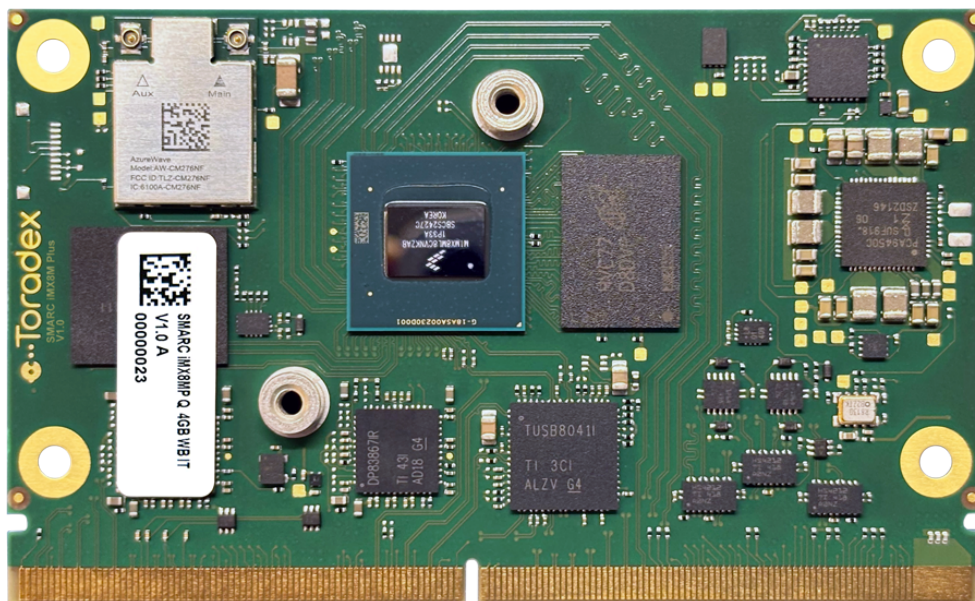


SMARC i.MX8M Plus

HW Datasheet

Preliminary – Subject to Change



Revision History

Document Revisions

Date	Doc. Revision	Product Version	Changes
10-Mar-2025	Rev. 0.1	V1.0	Initial documentation
16-May-2025	Rev. 0.2	V1.0	Section 3 : Updated information about GPIOs and Display interfaces Section 7 : Updated Block Diagram on Figure 1 Section 8.2 : Updated SPI Signal Group naming on Pin Assignment Tables on Table 9 and Table 10 . Section 8.2 : Updated Signal Group from PCIE_A_RST# Signal on Table 9 . Section 8.2 : Add note about connection with multiplexer for LVDS1 pins on Table 9 . Section 10.1 : Updated information for GPIO[0:3] on Table 15 Minor changes.
02-Jul-2025	Rev. 0.3	V1.0	Section 13.2 : Add Giteki certification marking (Japan)
03-Jul-2025	Rev. 0.4	V1.1	Section 1 : Fix link for SMARC iMX8MP page on developer website. Section 2 : Fix mention to SMARC iMX8MPlus on headers for tables Table 2 , Table 3 , Table 4 and Table 5 Section 2 : Update I ² C and PWM interface information on Table 3 Section 3 : Add note on GPIO6 usage on Table 6 . Section 3 : Add comment for I ² C signal names on Table 6 . Section 8.2 : Add pull-up and pull-down resistor notes for Table 9 and Table 10 . Section 10.3 : Update bluetooth version for the AW-CM276NF module. Minor changes.
23-Jul-2025	Rev. 0.5	V1.1	Section 8.1 : Add pin S158 on Table 10
13-Aug-2025	Rev. 0.6	V1.1	Fix Revision History entry formatting Section 8.1 : Add pull-up resistors for USB*_EN_OC# pins on Table 9 . Correct pull-up value for USB0_OTG_ID on Table 9

Contents

1	Introduction	6
1.1	Purpose of the Datasheet	6
1.2	SMARC SoM Family	6
1.3	NXP i.MX 8M Plus SoC	6
1.4	SMARC i.MX 8M Plus SoM	6
2	Main Features	8
2.1	CPU	8
2.2	GPU	8
2.3	Interfaces	9
2.4	Memory	10
2.5	Physical	10
3	Interface Overview	12
4	Reference Documents	15
4.1	EEPROM	15
4.2	PCB Temperature Sensor	15
4.3	Ethernet Transceiver	15
4.4	NXP i.MX 8M Plus	15
4.5	Layout Design Guide	15
4.6	RTC	15
4.7	SMARC Specification	15
4.8	SMARC Carrier Board Schematics	15
4.9	Toradex Developer Center	16
4.10	Wi-Fi and Bluetooth Module	16
5	Naming Conventions	17
5.1	Naming of NXP System on Chip	17
5.2	Naming of Toradex Modules	17
6	Build-To-Order Options	18
7	Architecture Overview	19
7.1	Block Diagram	19
8	SMARC i.MX 8M Plus Connector	20
8.1	Pin Numbering	20
8.2	Pin Assignment	20
9	I/O Pins	35
9.1	Function Multiplexing	35
9.2	Pin Control	35
9.3	SoC Functions List	36
9.3.1	Alternate Functions	37
10	Interface Description	46
10.1	GPIOs	46
10.2	USB	46
10.3	Wi-Fi and Bluetooth	47
11	Recovery Mode	48
12	Known Issues	49
13	Technical Specifications	50
13.1	Absolute Maximum Ratings	50

13.2 Product Compliance	50
13.3 Power Consumption	50
13.4 Recommended Operation Conditions	50
13.5 Mechanical Characteristics	50
13.5.1 Sockets for SMARC Modules	50
13.6 Thermal Specification	50
14 Device and Documentation Support	51
14.1 Trademarks	51

List of Tables

1	CPU features	8
2	GPU Features	8
3	Interfaces Features	9
4	Memory Features	10
5	Physical Features	10
6	Interfaces Overview	12
7	Naming of NXP System on Chip	17
8	Naming of Toradex Modules	17
9	X1 pin assignment – top side – Primary pins Secondary pins – Alternate functions	21
10	X1 pin assignment – bottom side – Secondary pins Primary pins – Alternate functions	28
11	Pad Mux Register	35
12	Pad Mux Register	36
13	Function Short Forms	36
14	X1 pin Alternate Functions Primary pins – Secondary pins	38
15	Dedicated GPIOs	46
16	USB Signal Assignments	46
17	Recommended operation conditions	50

List of Figures

1	Block Diagram	19
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1 Introduction

1.1 Purpose of the Datasheet

The datasheet represents the hardware capabilities of the SMARC iMX8M Plus. For information on the actual features supported by software, please refer to the relevant SoM product page on the Toradex Developer website: <https://developer.toradex.com/hardware/smarc-som-family/modules/smarc-imx8mp>.

1.2 SMARC SoM Family

The Toradex SMARC Family brings the trusted well-known Toradex quality, reliability, and ease-of-use to the SMARC (Smart Mobility Architecture) standard. The Toradex SMARC Module is built according to the latest SMARC 2.2 and is compatible with most SMARC 2.1/2.0 carrier boards.

As a standard designed to accommodate a wide range of ARM and x86 Systems-on-Chip, SMARC made trade-offs to prioritize broad compatibility over cost, size, and performance.

1.3 NXP i.MX 8M Plus SoC

The SMARC iMX8M Plus SoM is based on the NXP i.MX 8M Plus family of embedded System on Chips (SoCs). The i.MX 8M Plus family consists of the i.MX 8M Plus Quad, i.MX 8M Plus QuadLite, and i.MX 8M Plus Dual. [Section 5](#) on page [17](#) gives a detailed information about each of those chips.

The top-tier i.MX 8M Plus Quad features four Arm®Cortex®-A53 cores as the main processor cluster. The cores provide complete 64-bit Arm®v8-A support while maintaining seamless backward compatibility with 32-bit Arm®v7-A software. The main cores run at up to 1.8 GHz for commercial graded products and 1.6 GHz for industrial temperature range products.

In addition to the main CPU complex, the i.MX 8M Plus features a Arm®Cortex®-M7 processor, which peaks up to 800 MHz. This processor is independent of the main complex. However, it has shared access to the peripheral interface. This heterogeneous multicore system allows for running additional real-time operating systems on the M7 cores for time- and security-critical tasks.

Depending on the version, the SoC features a Neural Processing Unit (NPU) with up to 2.3 TOPS that can significantly accelerate machine learning tasks. Some SoC versions also feature a Video Processing Unit (VPU) for accelerating video decoding and encoding. The optional Image Signal Processing (ISP) core accelerates the camera interface by providing a complete video and still picture input block. It features image processing and color space conversion.

The i.MX 8M Plus SoC features inline ECC (error-correcting code) for the LPDDR4 DRAM for high system reliability and safety.

The i.MX 8M Plus Quad features the GC7000 UltraLite 3D Graphics Processing Unit (GPU) from Vivante®. The GPU provides eight Vega shader core which peaks up to 16 GFLOPS and supports OpenGL® ES 3.0, OpenCL™ 1.2, and Vulkan®. In addition to the GPU, the SoC features the GC520L Composition Processing Core (CPC).

The i.MX 8M Plus SoC incorporates DVFS (Dynamic Voltage and Frequency Switching) and thermal throttling, enabling the system to continuously adjust both the operating frequency and the voltage in response to changes in workload and temperature, thus achieving the best performance with the lowest power consumption.

1.4 SMARC i.MX 8M Plus SoM

Introducing Toradex SMARC i.MX8M Plus (**compatible with SMARC 2.2**), a compact, yet powerful, SoM designed to bring exceptional performance, flexibility, and scalability to a variety of embedded applica-

tions.

With SMARC's standard form factor and the NXP i.MX8M Plus's advanced processing, multimedia, and connectivity capabilities, this SoM is ideal for industrial automation, edge computing, IoT devices, and smart applications. The i.MX8M Plus integrates a quad-core Arm Cortex-A53 CPU, a dedicated NPU (in the 4GB model), and multimedia features like hardware-accelerated video decoding and encoding, ensuring robust and efficient operation for a wide range of use cases.

2 Main Features

2.1 CPU

Table 1: CPU features

Parameter	SMARC i.MX8M Plus Quad 4GB WB IT
SoC	MIMX8ML8CVNKZAB
A53 Cores	4
M7 Cores	1
CPU Clock	A53: 1600MHz M7: 800MHz
L1 Instruction Cache <i>per core</i>	A53: 32 kB M7: 32 kB
L1 Data Cache <i>each core</i>	A53: 32 kB M7: 32 kB
L2 Cache <i>shared</i>	A53: 512 kB
Tightly Coupled Memory	M7: 256 kB
Maximum CPU frequency	A53: 1.6 GHz M7: 800 MHz
Arm® Neon™ MPE	Yes
NPU	Yes
NPU Performance	2.3 TOP/s
ISP	Yes
ISP Performance	375 Mpixel/s HDR
VPU	Yes
Resource Domain Controller	Yes
Arm® TrustZone®	Yes
High Assurance Boot	Yes
Cryptographic Acceleration and Assurance Module	Yes
Secure Real-Time Clock	Yes
Secure JTAG Controller	Yes
Secure Non-Volatile Storage ¹	Yes

¹ Secure Non-Volatile Storage (SNVS) runs from the main VCC, not the VCC_BACKUP. Therefore, it can only be used if VCC is permanently applied to the module.

2.2 GPU

Table 2: GPU Features

Parameter	SMARC iMX8M Plus Quad 4GB WB IT
Vivante GC7000UL GPU Units	1
Vega Shader cores	8

Continued on next page

Table 2: GPU Features (Continued)

Parameter	SMARC iMX8M Plus Quad 4GB WB IT
OpenGL® ES 3.0, 2.0, 1.1	Yes
OpenGL® 3.0, 2.1	Yes
OpenVG™ 1.1	Yes
OpenCL™ 1.2	Yes
Vulkan	Yes
GC520L CPC Units	1

2.3 Interfaces

Table 3: Interfaces Features

Parameter	SMARC iMX8M Plus Quad 4GB WB IT
Audio	
Digital Audio	2x I²S
Camera	
MIPI® CSI-2	1x Quad Lane + 1x Dual Lane
Display	
Display Controllers	Triple
HDMI 2.0a	1x (up to 4K)
LVDS 1x dual-channel	1x (up to 1920x1080)
MIPI® DSI	1x Quad Lane
Low Speed	
CAN-FD	2
GPIO	14
I²C	6 (5 + HDMI private I²C port)
PWM	3 (1 + LCD0_BKLT_PWM for LVDS0 + LCD1_BKLT_PWM for LVDS1)
SPI	2
UART	4
Network	
Bluetooth	Classic / LE 5.0
Ethernet	2x Gigabit
Wi-Fi	2.4/5 GHz Dual Band 2x2 Wi-Fi 5 (802.11ac)
Other	
PCIe Gen 3	1

Continued on next page

Table 3: Interfaces Features (Continued)

Parameter	SMARC iMX8M Plus Quad 4GB WB IT
Storage	
SD/SDIO/MMC	1
USB	
USB 2.0 (Host)	5
USB 3.1 (Gen 1 OTG)	2

2.4 Memory

Table 4: Memory Features

Parameter	SMARC iMX8M Plus Quad 4GB WB IT
eMMC	
eMMC Configuration	3D TLC
eMMC Capacity	32 GB
I²C EEPROM	
I ² C EEPROM Capacity	2 kbit 256 × 8bit
I ² C EEPROM Bus Speed	Fast: 400kHz Std.: 100 kHz
RAM	
RAM Capacity	4 GB <i>Dual-rank</i>
RAM Configuration <i>Ctrl. × Ch. × bpc¹</i>	32 bits <i>1 × 2 × 16</i>
RAM Type	LPDDR4
RAM Speed	4000 MT/s <i>2 GHz</i>
Inline ECC	Yes

¹ Controllers × Channels per controller × bits per channel.

² eMMC is based on MLC or TLC NAND flash memory. As with all flash memories, the write endurance is limited. Extensive writing to the memory can wear out the memory cell. The wear leveling in the eMMC controller helps to ensure that cells are getting worn out evenly. More information can be found here <https://developer.toradex.com/hardware/hardware-resources/flash-memory-overview-on-toradex-products>.

2.5 Physical

Table 5: Physical Features

Parameter	SMARC iMX8M Plus Quad 4GB WB IT
Module dimensions	82.0 × 50.0 mm

Continued on next page

Table 5: Physical Features (Continued)

Parameter	SMARC iMX8M Plus Quad 4GB WB IT
Temperature range	-40 °C to +85 °C ¹
Shock / Vibration	EN 60068-2-6/50g 20 ms
Power dissipation	TBD

¹ The Wi-Fi/Bluetooth module featured on the SoM has been validated for an operating temperature range of -30 °C to 85 °C. The rest of the components are rated and have been validated for the complete -40 °C to 85 °C temperature range.

3 Interface Overview

Table 6: Interfaces Overview

Feature	Sub Feature	SMARC Spec	Toradex SMARC i.MX8M Plus	Comments
Wireless Module	It is optional, shows if option is available	May	Yes	Build-to-Order (BTO) options without Wi-fi
Size	82 x 50 mm	Shall	Yes	
	82 x 80 mm	May	Not Available	Unavailable
LVDS LCD	LVDS0 18/24 bit single channel	Should	Yes	
	LVDS1 24 bit single channel	May	Yes	Muxed with DSI1
eDP on LVDS Pins	eDP0 on LVDS0 - 4 diff pairs	May	Not Available	
	eDP1 on LVDS1 - 4 diff pairs	May	Not Available	
DSI on LVDS Pins	DSI0-2 lane implementation	May	Not Available	
	DSI0-4 lane implementation	May	Not Available	
	DSI1-2 lane implementation	May	Not Available	
	DSI1-4 lane implementation	May	Yes	Muxed with LVDS1
HDMI	HDMI Display interface	Should	Yes	HDMI 2.0a up to 4K30 (3840x2160@30Hz)
DP on HDMI Pins		May	Not Available	
DP++	DisplayPort++	May	Not Available	
CSI	CSI0 - 2 lane	May	Yes	
	CSI1 - 2 lane implementation	Should	Yes	
	CSI1 - 4 lane implementation	Should	Yes	
	CSI2 - 2 lane implementation	May	Not Available	
	CSI2 - 4 lane implementation	May	Not Available	
	CSI3 - 2 lane implementation	May	Not Available	
	CSI3 - 4 lane implementation	May	Not Available	
SDIO	SDIO (4 bit, for SD cards)	Should	Yes	
SPI	SPI0	Should	Yes	ECSP1
	SPI1	Should	Yes	ECSP2
	QuadSPI	Should	Not Available	
	eSPI	Should	Not Available	
Audio	I2S0	Should	Yes	
	HDA or I2S2	Should	Yes(I2S2)	
I2C	Power Management	Shall	Yes	I2C_PM
	General Purpose	Shall	Yes	I2C_GP
	Camera 0/1/2/3	Should	Yes	I2C_CAM0, I2C_CAM1
	LCD Display I/D	Should	Yes	I2C_LCD
	HDMI	Should	Yes	HDMI_CTRL
Serial Ports	SER0 (4 wire)	Shall	Yes	Console output is acceptable on SER1 and SER3.
	SER1 (2 wire)	Shall	Yes	
	SER2 (4 wire)	Should	Yes	

Continued on next page

Table 6: Interfaces Overview (Continued)

Feature	Sub Feature	SMARC Spec	Toradex SMARC i.MX8M Plus	Comments
Serial Ports	SER3 (2 wire)	Should	Yes	
CAN	CAN0	May	Yes	
	CAN1	May	Yes	
USB	USB0 (2.0) OTG	Shall	Yes	
	USB1 (2.0)	Should	Yes	Assembly option: USB Hub
	USB2 (2.0)	May	Yes	
	USB2 (3.2) - Additional SS signals	Should	Yes	
	USB3 (2.0)	May	Yes	Assembly option: USB Hub
	USB3 (3.2) - Additional SS signals	May	Yes	Assembly option: USB Hub
	USB4 (2.0)	May	Yes	Assembly option: USB Hub
	USB5 (2.0)	May	Not Available	
PCIe	PCIe_A (x1 Gen 1 Root)	Should	Yes	PCIe x1 Gen 3
	PCIe_B (x1 Gen 1 Root)	May	Not Available	
	PCIe_C (x1 Gen 1 Root)	May	Not Available	
	PCIe_D (x1 Gen 1 Root)	May	Not Available	
SERDES	Alternative use of PCIe_C and/or PCIe_D	May	Not Available	
SATA	SATA Gen 1	Should	Not Available	
	SATA Gen 2 operation	May	Not Available	
	SATA Gen 3 operation	May	Not Available	
GbE	GBE0	Should	Yes	Ethernet PHYs on SoM
	GBE1	May	Yes	Ethernet PHYs on SoM
	IEEE1588 Triggers(GBE[0:1]_SDP)	May	Yes	
Watchdog	WDT Out	Should	Yes	
GPIO	GPIO[0:11]	Shall	Yes	GPIO[0:3] available via GPIO expander
	GPIO[12:13]	Should	Yes	
	GPIO[0:11] interrupt capability	Shall	Yes	
	GPIO[12:13] interrupt capability	Should	Yes	
	GPIO Camera Support	Shall	Yes	
	GPIO5 PWM capability	Should	Yes	
	GPIO6 Tachin capability	Should	Not Available	GPIO Only
Management	System and power management features	Shall	Yes	Implemented according to SMARC V2.2 Specifications
	BATLOW#	Shall	Yes	
	CARRIER_PWR_ON	Shall	Yes	
	CARRIER_STBY#	Should	Yes	
	CHARGER_PRSENT#	Should	Yes	
	CHARGING#	Should	Yes	
	VIN_PWR_BAD#	Should	Yes	

Continued on next page

Table 6: Interfaces Overview (Continued)

Feature	Sub Feature	SMARC Spec	Toradex SMARC i.MX8M Plus	Comments
Management	SLEEP#	Should	Yes	
	LID#	Should	Yes	
	POWER_BTN#	Should	Yes	
	RESET_OUT#	Should	Yes	
	RESET_IN#	Should	Yes	
	SMB_ALERT#	Should	Yes	
	TEST#	Should	Yes	
Boot Select	BOOT_SEL0# nBOOT_SEL1# nBOOT_SEL2#	Shall	Yes	Implemented according to SMARC V2.2 Specifications. Boot sources supported: Carrier SD Card (SDIO interface), Module eMMC Flash, Remote boot (GBE, serial)
Force Recovery	FORCE_RECOV	Shall	Yes	Implemented according to SMARC V2.2 Specifications
JTAG	JTAG Connector on Module	May	Yes	Assembly option - assembled on samples
RTC		Should	Yes	VDD_RTC

Note: Data provided is based on the latest available specifications.

4 Reference Documents

4.1 EEPROM

The SMARC iMX8M Plus has an on-module I²C EEPROM, the M24C02 from STMicroelectronics.
<https://www.st.com/en/memories/m24c02-r.html>

4.2 PCB Temperature Sensor

The SMARC iMX8M Plus can be assembled with a PCB temperature sensor, the TMP1075DSGR from TI.
<https://www.ti.com/lit/gpn/tmp1075>

4.3 Ethernet Transceiver

SMARC iMX8M Plus utilizes a Texas Instruments DP83867IRRGZR Gigabit Ethernet Transceiver (PHY) with RGMII.
<https://www.ti.com/product/DP83867IR/part-details/DP83867IRRGZR>

4.4 NXP i.MX 8M Plus

You will find additional details about the i.MX 8M Plus SoC in the Datasheet and Reference Manual provided by NXP.
<https://www.nxp.com/products/processors-and-microcontrollers/arm-processors/i-mx-applications-processors/i-mx-8-processors/i-mx-8m-plus-arm-cortex-a53-machine-learning-vision-multimedia-and-industrial-iot:IMX8MPLUS>

4.5 Layout Design Guide

This document contains information about high-speed layout design and additional factors that help get the carrier board layout right the first time.
<https://docs.toradex.com/102492-layout-design-guide.pdf>

4.6 RTC

The SMARC iMX8M Plus has a low-power RX8130CE real-time clock from Epson.
<https://www5.epsondevice.com/en/products/rtc/rx8130ce.html>

4.7 SMARC Specification

The SMARC iMX8M Plus follows the SMARC 2.2 specification.

- [SMARC Hardware Specification 2.2](#)
- [SMARC Design Guide 2.1.1](#)

4.8 SMARC Carrier Board Schematics

We provide complete schematics plus an Altium project file that includes library symbols and IPC-7351 compliant footprints for the SMARC Development Board and other carrier boards, free of charge. This resource is of great help when designing your own carrier board.
<https://developer.toradex.com/carrier-board-design/reference-designs>

4.9 Toradex Developer Center

The Toradex Developer Center is updated with the latest product support information regularly. You can find an abundance of additional information there.

Please note that the Developer Center is shared across all Toradex products. You should always check to ensure that the information provided is valid and relevant for the SMARC iMX8M Plus.

<https://developer.toradex.com/>

4.10 Wi-Fi and Bluetooth Module

Some SMARC iMX8M Plus models utilize an AzureWave AW-CM276NF wireless module. The AW-CM276NF datasheet is available from AzureWave.

<https://www.azurewave.com/wireless-modules-nxp.html>

Information on pre-certified antennas and cables can be found here:

<https://developer.toradex.com/knowledge-base/wi-fi-accessories-recommended-for-toradex-products>

Certification documents are available on the Toradex website:

<https://developer.toradex.com/knowledge-base/certification-documents-for-azurewave-aw-cm276nf-wi-fi-bluetooth-module>

5 Naming Conventions

The naming of i.MX 8M Plus based products can be confusing. In this document, a consistent naming convention is used. It is essential to notice the punctuation and spaces in the names. Do not confuse:

- The i.MX 8M Plus, the i.MX 8 or the i.MX 8M. These are three different SoC families with different features.
- The **SMARC** i.MX 8M Plus or the **Verdin** i.MX 8M Plus. These are different SoM families with different features.

5.1 Naming of NXP System on Chip

Table 7: Naming of NXP System on Chip

NXP System on Chip	Description
i.MX 8 Series	A series of different SoC families which consist of the i.MX 8, i.MX8M, i.MX 8M Plus, i.MX 8M Mini, i.MX 8M Nano, as well as the i.MX 8X families. This document only contains information on the SMARC module, which uses an i.MX 8M Plus family SoC. For information on other i.MX 8 Series based modules, please visit the Toradex website.
i.MX 8M Plus	The NXP i.MX 8M Plus SoC family, which consists of the i.MX 8M Plus Quad, i.MX 8M Plus Quad Lite, and i.MX 8M Plus Dual. Whenever this document uses the term i.MX 8M Plus, all versions of the i.MX 8M Plus SoC family are meant.
i.MX 8MP	Short name for the i.MX 8M Plus SoC family.
i.MX 8M Plus Quad	The top-tier SoC of the i.MX 8M Plus family. It features a quad-core Cortex-A53 main CPU with VPU, ISP, and an optional NPU.
i.MX 8MPQ	Short name for the i.MX 8M Plus Quad.
i.MX 8M Plus Quad Lite	Quad-Core SoC of the i.MX 8M Plus family, which does not include the VPU, NPU, and ISP.
i.MX 8MPQL	Short name for the i.MX 8M Plus Quad Lite.
i.MX 8M Plus Dual	Dual Core Cortex-A53 version of the i.MX 8M Plus family. It contains VPU, NPU, and ISP.
i.MX 8MPD	Short name for the i.MX 8M Plus Dual.

5.2 Naming of Toradex Modules

Table 8: Naming of Toradex Modules

Toradex Module	Description
SMARC iMX8M Plus	SMARC module based on the i.MX 8M Plus family SoC. Whenever this document uses the term SMARC iMX8M Plus, all versions of the SMARC iMX8MP are meant.
SMARC iMX8MP	Short name for the SMARC iMX8M Plus. Whenever this document uses the term SMARC iMX8MP, all versions of the SMARC iMX8M Plus are meant.
SMARC iMX8M Plus Quad 4GB WB IT	SMARC module based on the i.MX 8M Plus Quad processor with 4GB memory, Wi-Fi and Bluetooth function, and Industrial Temperature (IT) range.
SMARC iMX8MP Q 4GB WB IT	Short name for the SMARC iMX8M Plus Quad 4GB WB IT.
Verdin iMX8M Plus	Verdin module based on the i.MX 8M Plus family SoC. This document only contains information on the SMARC module. For information on other i.MX 8 Series based modules, please visit the Toradex website.

6 Build-To-Order Options

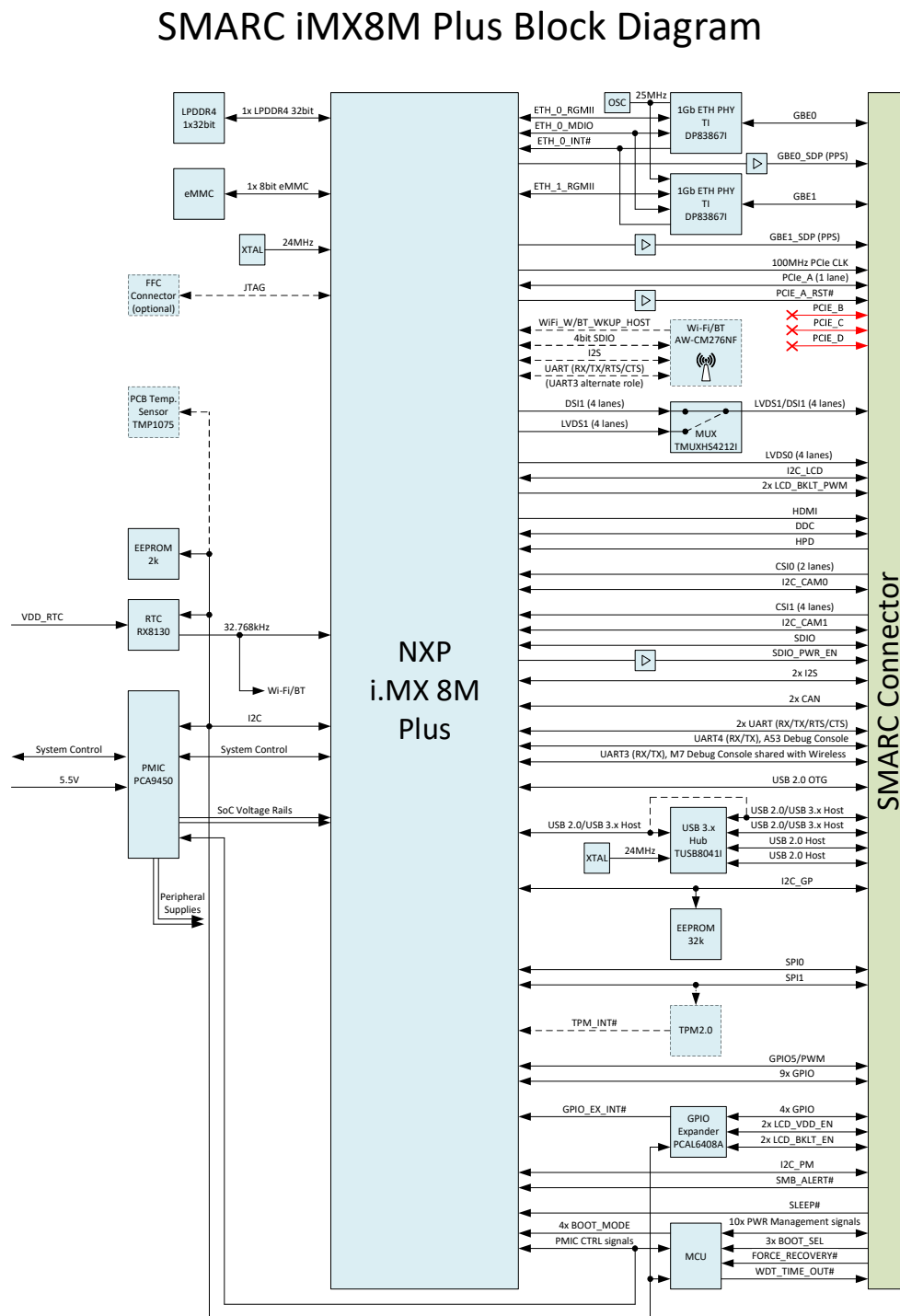
It is possible to order customized versions of this module. These versions are Build-To-Order (BTO). The following customization options are available for Toradex SMARC i.MX8M Plus:

- Connectivity
 - Options without WiFi/BT module
 - Options without Ethernet PHY(s)
- Memory
 - RAM Density (1-8GB)
 - eMMC Capacity (8-128GB)
 - EEPROM Capacity
- Temperature Range
 - Commercial : 0°C - 70°C
 - Wide Temp : -25°C - 85°C
 - Industrial : -40°C - 85°C
- TPM 2.0 (on SPI or I2C interface)

7 Architecture Overview

7.1 Block Diagram

Figure 1: Block Diagram



8 SMARC i.MX 8M Plus Connector

8.1 Pin Numbering

The SMARC module follows the same pin numbering scheme defined by the SMARC standard ([Section 4.7](#)). Pins on the top side (primary) of the module are numbered from P1 to P156, while the pins on the bottom side (secondary) are numbered from S1 to S158. The key pins are not numbered.

8.2 Pin Assignment

Table 9: X1 pin assignment – top side – Primary pins Secondary pins – Alternate functions

MXM3 Pins	Signal Group	SMARC Signal	Soc Signal	Soc Ball Name	Power Group	Note
P1	CTRL	SMB_ALERT#	NAND_READY_B	T28	NVCC_NAND	
P2	CTRL	GND	_GND			
P3	CSI	CSI1_CK+	MIPI_CSI1_CLK_P	D22	VDD_MIPI_0P8	
P4	CSI	CSI1_CK-	MIPI_CSI1_CLK_N	E22	VDD_MIPI_0P8	
P5	Ethernet	GBE1_SDP	SAI1_RXC	AH8	NVCC_SAI1_SAI5	Level Shifted - Output - CMOS - IC
P6	Ethernet	GBE0_SDP	GPIO1_IO09	B8	NVCC_GPIO1	Level Shifted - Output - CMOS - IC
P7	CSI	CSI1_RX0+	MIPI_CSI1_D0_P	D18	VDD_MIPI_0P8	
P8	CSI	CSI1_RX0-	MIPI_CSI1_D0_N	E18	VDD_MIPI_0P8	
P9	CSI	GND	_GND			
P10	CSI	CSI1_RX1+	MIPI_CSI1_D1_P	D20	VDD_MIPI_0P8	
P11	CSI	CSI1_RX1-	MIPI_CSI1_D1_N	E20	VDD_MIPI_0P8	
P12	CSI	GND	_GND			
P13	CSI	CSI1_RX2+	MIPI_CSI1_D2_P	D24	VDD_MIPI_0P8	
P14	CSI	CSI1_RX2-	MIPI_CSI1_D2_N	E24	VDD_MIPI_0P8	
P15	CSI	GND	_GND			
P16	CSI	CSI1_RX3+	MIPI_CSI1_D3_P	D26	VDD_MIPI_0P8	
P17	CSI	CSI1_RX3-	MIPI_CSI1_D3_N	E26	VDD_MIPI_0P8	
P18	CSI	GND	_GND			
P19	Ethernet	GBE0_MDI3-	ETH_0 PHY			
P20	Ethernet	GBE0_MDI3+	ETH_0 PHY			
P21	Ethernet	GBE0_LINK_MID#	ETH_0 PHY			Level Shifted - MOSFET - Output - OD
P22	Ethernet	GBE0_LINK_MAX#	ETH_0 PHY			Level Shifted - MOSFET - Output - OD
P23	Ethernet	GBE0_MDI2-	ETH_0 PHY			

Continued on next page

Table 9: X1 pin assignment – top side – Primary pins Secondary pins – Alternate functions (Continued)

MXM3 Pins	Signal Group	SMARC Signal	Soc Signal	Soc Ball Name	Power Group	Note
P24	Ethernet	GBE0_MDI2+	ETH_0 PHY			
P25	Ethernet	GBE0_LINK_ACT#	ETH_0 PHY			Level Shifted - MOSFET - Output - OD
P26	Ethernet	GBE0_MDI1-	ETH_0 PHY			
P27	Ethernet	GBE0_MDI1+	ETH_0 PHY			
P28	Ethernet	GBE0_CTREF		Not Connected		
P29	Ethernet	GBE0_MDI0-	ETH_0 PHY			
P30	Ethernet	GBE0_MDI0+	ETH_0 PHY			
P31	SPI	SPI0_CS1#	SAI3_RXFS	AJ19	NVCC_SAI2_SAI3_SPDIF	
P32	SPI	GND	_GND			
P33	SDIO	SDIO_WP	SD2_WP	AC26	NVCC_SD2	10kΩ pull-up resistor on module
P34	SDIO	SDIO_CMD	SD2_CMD	AB28	NVCC_SD2	
P35	SDIO	SDIO_CD#	SD2_CD_B	AD29	NVCC_SD2	10kΩ pull-up resistor on module
P36	SDIO	SDIO_CK	SD2_CLK	AB29	NVCC_SD2	
P37	SDIO	SDIO_PWR_EN	SD2_RESET_B	AD28	NVCC_SD2	Level Shifted - Output - CMOS - IC
P38	SDIO	GND	_GND			
P39	SDIO	SDIO_D0	SD2_DATA0	AC28	NVCC_SD2	
P40	SDIO	SDIO_D1	SD2_DATA1	AC29	NVCC_SD2	
P41	SDIO	SDIO_D2	SD2_DATA2	AA26	NVCC_SD2	
P42	SDIO	SDIO_D3	SD2_DATA3	AA25	NVCC_SD2	
P43	SPI	SPI0_CS0#	ECSP1_SS0	AE20	NVCC_ECSP1_HDMI	
P44	SPI	SPI0_CK	ECSP1_SCLK	AF20	NVCC_ECSP1_HDMI	
P45	SPI	SPI0_DIN	ECSP1_MISO	AD20	NVCC_ECSP1_HDMI	
P46	SPI	SPI0_DO	ECSP1_MOSI	AC20	NVCC_ECSP1_HDMI	

Continued on next page

Table 9: X1 pin assignment – top side – Primary pins Secondary pins – Alternate functions (Continued)

MXM3 Pins	Signal Group	SMARC Signal	Soc Signal	Soc Ball Name	Power Group	Note
P47	SPI	GND	_GND			
P48	SATA	SATA_TX+		Not Connected		
P49	SATA	SATA_TX-		Not Connected		
P50	SATA	GND	_GND			
P51	SATA	SATA_RX+		Not Connected		
P52	SATA	SATA_RX-		Not Connected		
P53	SATA	GND	_GND			
P54	SPI	ESPI_CS0# / SPI1_CS0# / QSPI_CS0#	ECSPI2_SS0	AJ22	NVCC_ECSPi_HDMI	
P55	SPI	ESPI_CS1# / SPI1_CS1# / QSPI_CS1#	SAI1_RXD1	AF10	NVCC_SAI1_SAI5	
P56	SPI	ESPI_CK / SPI1_CK / QSPI_CK	ECSPI2_SCLK	AH21	NVCC_ECSPi_HDMI	
P57	SPI	ESPI_IO_1 / SPI1_DIN / QSPI_IO_1	ECSPI2_MISO	AH20	NVCC_ECSPi_HDMI	
P58	SPI	ESPI_IO_0 / SPI1_DO / QSPI_IO_0	ECSPI2_MOSI	AJ21	NVCC_ECSPi_HDMI	
P59	SPI	GND	_GND			
P60	USB	USB0+	USB1_D_P	D10	VDD_USB_3P3	
P61	USB	USB0-	USB1_D_N	E10	VDD_USB_3P3	
P62	USB	USB0_EN_OC#	GPIO1_IO12	A5	NVCC_GPIO1	Level Shifted - MOSFET - Output - OD, 10k PU
P63	USB	USB0_VBUS_DET	USB1_VBUS	A11	VDD_USB_3P3	5V Capable
P64	USB	USB0_OTG_ID	SAI3_MCLK	AJ20	NVCC_SAI2_SAI3_SPDIF	Level Shifted - Diode - Input - OD, CMOS - 100k PU
P65	USB	USB1+	USB_Hub			
P66	USB	USB1-	USB_Hub			
P67	USB	USB1_EN_OC#	USB_Hub			Level Shifted - MOSFET - Output - OD - 10k PU
P68	USB	GND	_GND			
P69	USB	USB2+	USB_Hub			

Continued on next page

Table 9: X1 pin assignment – top side – Primary pins Secondary pins – Alternate functions (Continued)

MXM3 Pins	Signal Group	SMARC Signal	Soc Signal	Soc Ball Name	Power Group	Note
P70	USB	USB2-	USB_Hub			
P71	USB	USB2_EN_OC#	USB_Hub			Level Shifted - MOSFET - Output - OD - 10k PU
P72	USB	RSVD		Not Connected		
P73	USB	RSVD		Not Connected		
P74	USB	USB3_EN_OC#	USB_Hub			Level Shifted - MOSFET - Output - OD - 10k PU
key						
key						
key						
key						
P75	PCIe	PCI_E_A_RST#	SAI1_TXD7	AJ13	NVCC_SAI1_SAI5	Level Shifted - Output - CMOS - IC
P76	USB	USB4_EN_OC#	USB_Hub			Level Shifted - MOSFET - Output - OD - 10k PU
P77	PCIe	PCI_E_B_CKREQ#		Not Connected		
P78	PCIe	PCI_E_A_CKREQ#		Not Connected		
P79	PCIe	GND	_GND			
P80	PCIe	PCI_E_C_REFCK+		Not Connected		
P81	PCIe	PCI_E_C_REFCK-		Not Connected		
P82	PCIe	GND	_GND			
P83	PCIe	PCI_E_A_REFCK+	PCI_E_REF_PAD_CLK_P	D16	PCI_E_VDDH_CMN	
P84	PCIe	PCI_E_A_REFCK-	PCI_E_REF_PAD_CLK_N	E16	PCI_E_VDDH_CMN	
P85	PCIe	GND	_GND			
P86	PCIe	PCI_E_A_RX+	PCI_E_RXN_P	A14	PCI_E_VDDH_CH0	
P87	PCIe	PCI_E_A_RX-	PCI_E_RXN_N	B14	PCI_E_VDDH_CH0	
P88	PCIe	GND	_GND			

Continued on next page

Table 9: X1 pin assignment – top side – Primary pins Secondary pins – Alternate functions (Continued)

MXM3 Pins	Signal Group	SMARC Signal	Soc Signal	Soc Ball Name	Power Group	Note
P89	PCIe	PCIE_A_TX+	PCIE_TXN_P	A15	PCIE_VDDH_CH0	
P90	PCIe	PCIE_A_TX-	PCIE_TXN_N	B15	PCIE_VDDH_CH0	
P91	HDMI/DP	GND	_GND			
P92	HDMI/DP	HDMI_D2+ / DP1_LANE0+	HDMI_TXD2_P			
P93	HDMI/DP	HDMI_D2- / DP1_LANE0-	HDMI_TXD2_N			
P94	HDMI/DP	GND	_GND			
P95	HDMI/DP	HDMI_D1+ / DP1_LANE1+	HDMI_TXD1_P			
P96	HDMI/DP	HDMI_D1- / DP1_LANE1-	HDMI_TXD1_N			
P97	HDMI/DP	GND	_GND			
P98	HDMI/DP	HDMI_D0+ / DP1_LANE2+	HDMI_TXD0_P			
P99	HDMI/DP	HDMI_D0- / DP1_LANE2-	HDMI_TXD0_N			
P100	HDMI/DP	GND	_GND			
P101	HDMI/DP	HDMI_CK+ / DP1_LANE3+	HDMI_TXC_P			
P102	HDMI/DP	HDMI_CK- / DP1_LANE3-	HDMI_TXC_N			
P103	HDMI/DP	GND	_GND			
P104	HDMI/DP	HDMI_HPD / DP1_HPD	HDMI_HPD	AE22	NVCC_ECSPi_HDMI	
P105	HDMI/DP	HDMI_CTRL_CK / DP1_AUX+	HDMI_DDC_SCL	AC22	NVCC_ECSPi_HDMI	
P106	HDMI/DP	HDMI_CTRL_DAT / DP1_AUX-	HDMI_DDC_SDA	AF22	NVCC_ECSPi_HDMI	
P107	HDMI/DP	DP1_AUX_SEL		Not Connected		
P108	GPIO	GPIO0 / CAM0_PWR#	GPIO_Expander			470kΩ pull-up resistor on module
P109	GPIO	GPIO1 / CAM1_PWR#	GPIO_Expander			470kΩ pull-up resistor on module
P110	GPIO	GPIO2 / CAM0_RST#	GPIO_Expander			470kΩ pull-up resistor on module
P111	GPIO	GPIO3 / CAM1_RST#	GPIO_Expander			470kΩ pull-up resistor on module

Continued on next page

Table 9: X1 pin assignment – top side – Primary pins Secondary pins – Alternate functions (Continued)

MXM3 Pins	Signal Group	SMARC Signal	Soc Signal	Soc Ball Name	Power Group	Note
P112	GPIO	GPIO4 / HDA_RST#	SAI1_TXD6	AC12	NVCC_SAI1_SAI5	
P113	GPIO	GPIO5 / PWM_OUT	GPIO1_IO10	B7	NVCC_GPIO1	
P114	GPIO	GPIO6 / TACHIN	SAI3_RXC	AJ18	NVCC_SAI2_SAI3_SPDIF	Alternate Function: GPT1_CLK
P115	GPIO	GPIO7	GPIO1_IO00	A7	NVCC_GPIO1	
P116	GPIO	GPIO8	GPIO1_IO01	E8	NVCC_GPIO1	
P117	GPIO	GPIO9	GPIO1_IO05	B4	NVCC_GPIO1	
P118	GPIO	GPIO10	GPIO1_IO06	A3	NVCC_GPIO1	
P119	GPIO	GPIO11	GPIO1_IO07	F6	NVCC_GPIO1	
P120	I2C	GND	_GND			
P121	I2C	I2C_PM_CK	HDMI_CEC	AD22	NVCC_ECSPi_HDMI	2.2k Ω pull-up resistor on module
P122	I2C	I2C_PM_DAT	SAI5_RXC	AD14	NVCC_SAI1_SAI5	2.2k Ω pull-up resistor on module
P123	CTRL	BOOT_SELO#	MCU			10k Ω pull-up resistor on module
P124	CTRL	BOOT_SEL1#	MCU			10k Ω pull-up resistor on module
P125	CTRL	BOOT_SEL2#	MCU			10k Ω pull-up resistor on module
P126	CTRL	RESET_OUT#	MCU			100k Ω pull-down resistor on module
P127	CTRL	RESET_IN#	MCU			10k Ω pull-up resistor on module
P128	CTRL	POWER_BTN#	MCU+SoC			10k Ω pull-up resistor on module
P129	UART	SER0_TX	UART1_TXD	AJ3	NVCC_I2C_UART	
P130	UART	SER0_RX	UART1_RXD	AD6	NVCC_I2C_UART	100k Ω pull-up resistor on module
P131	UART	SER0_RTS#	SAI2_TXFS	AJ17	NVCC_SAI2_SAI3_SPDIF	
P132	UART	SER0_CTS#	SAI2_RXD0	AJ14	NVCC_SAI2_SAI3_SPDIF	100k Ω pull-up resistor on module
P133	UART	GND	_GND			
P134	UART	SER1_TX	UART4_TXD	AH5	NVCC_I2C_UART	

Continued on next page

Table 9: X1 pin assignment – top side – Primary pins Secondary pins – Alternate functions (Continued)

MXM3 Pins	Signal Group	SMARC Signal	Soc Signal	Soc Ball Name	Power Group	Note
P135	UART	SER1_RX	UART4_RXD	AJ5	NVCC_I2C_UART	100kΩ pull-up resistor on module
P136	UART	SER2_TX	UART2_TXD	AH4	NVCC_I2C_UART	
P137	UART	SER2_RX	UART2_RXD	AF6	NVCC_I2C_UART	100kΩ pull-up resistor on module
P138	UART	SER2_RTS#	SD1_DATA5	AA29	NVCC_SD1	
P139	UART	SER2_CTS#	SD1_DATA4	U26	NVCC_SD1	100kΩ pull-up resistor on module
P140	UART	SER3_TX	UART3_TXD	AJ4	NVCC_I2C_UART	
P141	UART	SER3_RX	UART3_RXD	AE6	NVCC_I2C_UART	100kΩ pull-up resistor on module
P142	UART	GND	_GND			
P143	CAN	CAN0_TX	SAI2_TXD0	AH16	NVCC_SAI2_SAI3_SPDIF	
P144	CAN	CAN0_RX	SAI2_MCLK	AJ15	NVCC_SAI2_SAI3_SPDIF	
P145	CAN	CAN1_TX	SAI2_RXC	AJ16	NVCC_SAI2_SAI3_SPDIF	
P146	CAN	CAN1_RX	SAI2_TXC	AH15	NVCC_SAI2_SAI3_SPDIF	
P147	PWR	VDD_IN	_VCC			
P148	PWR	VDD_IN	_VCC			
P149	PWR	VDD_IN	_VCC			
P150	PWR	VDD_IN	_VCC			
P151	PWR	VDD_IN	_VCC			
P152	PWR	VDD_IN	_VCC			
P153	PWR	VDD_IN	_VCC			
P154	PWR	VDD_IN	_VCC			
P155	PWR	VDD_IN	_VCC			
P156	PWR	VDD_IN	_VCC			

Table 10: X1 pin assignment – bottom side – Secondary pins Primary pins – Alternate functions

MXM3 Pins	Signal Group	SMARC Signal	Soc Signal	Soc Ball Name	Power Group	Note
S1	CSI	CSI1_TX+ / I2C_CAM1_CK	SPDIF_TX	AE18	NVCC_SAI2_SAI3_SPDIF	2.2kΩ pull-up resistor on module
S2	CSI	CSI1_TX- / I2C_CAM1_DAT	SPDIF_RX	AD18	NVCC_SAI2_SAI3_SPDIF	2.2kΩ pull-up resistor on module
S3	CSI	GND	_GND			
S4	CSI	RSVD		Not Connected		
S5	CSI	CSI0_TX+ / I2C_CAM0_CK	I2C3_SCL	AJ7	NVCC_I2C_UART	2.2kΩ pull-up resistor on module
S6	CSI	CAM_MCK	GPIO1_IO15	B5	NVCC_GPIO1	
S7	CSI	CSI0_TX- / I2C_CAM0_DAT	I2C3_SDA	AJ6	NVCC_I2C_UART	2.2kΩ pull-up resistor on module
S8	CSI	CSI0_CK+	MIPI_CSI2_CLK_P	A23	MIPI_VREG1_CAP	
S9	CSI	CSI0_CK-	MIPI_CSI2_CLK_N	B23	MIPI_VREG1_CAP	
S10	CSI	GND	_GND			
S11	CSI	CSI0_RX0+	MIPI_CSI2_D0_P	A25	MIPI_VREG1_CAP	
S12	CSI	CSI0_RX0-	MIPI_CSI2_D0_N	B25	MIPI_VREG1_CAP	
S13	CSI	GND	_GND			
S14	CSI	CSI0_RX1+	MIPI_CSI2_D1_P	A24	MIPI_VREG1_CAP	
S15	CSI	CSI0_RX1-	MIPI_CSI2_D1_N	B24	MIPI_VREG1_CAP	
S16	CSI	GND	_GND			
S17	Ethernet	GBE1_MDI0+	ETH_1 PHY			
S18	Ethernet	GBE1_MDI0-	ETH_1 PHY			
S19	Ethernet	GBE1_LINK_MID#	ETH_1 PHY			Level Shifted - MOSFET - Output - OD
S20	Ethernet	GBE1_MDI1+	ETH_1 PHY			
S21	Ethernet	GBE1_MDI1-	ETH_1 PHY			
S22	Ethernet	GBE1_LINK_MAX#	ETH_1 PHY			Level Shifted - MOSFET - Output - OD
S23	Ethernet	GBE1_MDI2+	ETH_1 PHY			

Continued on next page

Table 10: X1 pin assignment – bottom side – Secondary pins Primary pins – Alternate functions (Continued)

MXM3 Pins	Signal Group	SMARC Signal	Soc Signal	Soc Ball Name	Power Group	Note
S24	Ethernet	GBE1_MDI2-	ETH_1 PHY			
S25	Ethernet	GND	_GND			
S26	Ethernet	GBE1_MDI3+	ETH_1 PHY			
S27	Ethernet	GBE1_MDI3-	ETH_1 PHY			
S28	Ethernet	GBE1_CTREF		Not Connected		
S29	PCIe/ETH SERDES	PCIE_D_TX+ / SERDES_0_TX+		Not Connected		
S30	PCIe/ETH SERDES	PCIE_D_TX- / SERDES_0_TX-		Not Connected		
S31	PCIe/ETH SERDES	GBE1_LINK_ACT#	ETH_1 PHY			Level Shifted - MOSFET - Output - OD
S32	PCIe/ETH SERDES	PCIE_D_RX+ / SERDES_0_RX+		Not Connected		
S33	PCIe/ETH SERDES	PCIE_D_RX- / SERDES_0_RX-		Not Connected		
S34	USB	GND	_GND			
S35	USB	USB4+	USB_Hub			
S36	USB	USB4-	USB_Hub			
S37	USB	USB3_VBUS_DET		Not Connected		5V Capable
S38	I2S	AUDIO_MCK	SAI1_MCLK	AE12	NVCC_SAI1_SAI5	
S39	I2S	I2S0_LRCK	SAI5_RXD1	AD16	NVCC_SAI1_SAI5	
S40	I2S	I2S0_SDOUT	SAI5_RXFS	AC14	NVCC_SAI1_SAI5	
S41	I2S	I2S0_SDIN	SAI1_RXD0	AC10	NVCC_SAI1_SAI5	
S42	I2S	I2S0_CK	SAI5_MCLK	AF14	NVCC_SAI1_SAI5	
S43	SPI	ESPI_ALERT0#		Not Connected		
S44	SPI	ESPI_ALERT1#		Not Connected		
S45	ETH SERDES	MDIO_CLK		Not Connected		
S46	ETH SERDES	MDIO_DAT		Not Connected		

Continued on next page

Table 10: X1 pin assignment – bottom side – Secondary pins [Primary pins – Alternate functions](#) (Continued)

MXM3 Pins	Signal Group	SMARC Signal	Soc Signal	Soc Ball Name	Power Group	Note
S47	I2C	GND	_GND			
S48	I2C	I2C_GP_CK	I2C4_SCL	AF8	NVCC_I2C_UART	2.2kΩ pull-up resistor on module
S49	I2C	I2C_GP_DAT	I2C4_SDA	AD8	NVCC_I2C_UART	2.2kΩ pull-up resistor on module
S50	HDA	HDA_SYNC / I2S2_LRCK	SAI3_TXFS	AC16	NVCC_SAI2_SAI3_SPDIF	
S51	HDA	HDA_SDO / I2S2_SDOUT	SAI3_TXD	AH18	NVCC_SAI2_SAI3_SPDIF	
S52	HDA	HDA_SDI / I2S2_SDIN	SAI3_RXD	AF18	NVCC_SAI2_SAI3_SPDIF	
S53	HDA	HDA_CK / I2S2_CK	SAI3_TXC	AH19	NVCC_SAI2_SAI3_SPDIF	
S54	CTRL	SATA_ACT#		Not Connected		
S55	CTRL	USB5_EN_OC#		Not Connected		
S56	SPI	ESPI_IO_2 / QSPI_IO_2		Not Connected		
S57	SPI	ESPI_IO_3 / QSPI_IO_3		Not Connected		
S58	SPI	ESPI_RESET#		Not Connected		
S59	USB	USB5+		Not Connected		
S60	USB	USB5-		Not Connected		
S61	USB	GND	_GND			
S62	USB	USB3_SSTX+	USB_Hub			
S63	USB	USB3_SSTX-	USB_Hub			
S64	USB	GND	_GND			
S65	USB	USB3_SSRX+	USB_Hub			
S66	USB	USB3_SSRX-	USB_Hub			
S67	USB	GND	_GND			
S68	USB	USB3+	USB_Hub			
S69	USB	USB3-	USB_Hub			

Continued on next page

Table 10: X1 pin assignment – bottom side – Secondary pins Primary pins – Alternate functions (Continued)

MXM3 Pins	Signal Group	SMARC Signal	Soc Signal	Soc Ball Name	Power Group	Note
S70	USB	GND	_GND			
S71	USB	USB2_SSTX+	USB_Hub			
S72	USB	USB2_SSTX-	USB_Hub			
S73	USB	GND	_GND			
S74	USB	USB2_SSRX+	USB_Hub			
S75	USB	USB2_SSRX-	USB_Hub			
S76	PCIe	PCIE_B_RST#		Not Connected		
key						
key						
key						
S77	PCIe	PCIE_C_RST#		Not Connected		
S78	PCIe	PCIE_C_RX+ / SERDES_1_RX+		Not Connected		
S79	PCIe	PCIE_C_RX- / SERDES_1_RX-		Not Connected		
S80	PCIe	GND	_GND			
S81	PCIe	PCIE_C_TX+ / SERDES_1_TX+		Not Connected		
S82	PCIe	PCIE_C_TX- / SERDES_1_TX-		Not Connected		
S83	PCIe	GND	_GND			
S84	PCIe	PCIE_B_REFCK+		Not Connected		
S85	PCIe	PCIE_B_REFCK-		Not Connected		
S86	PCIe	GND	_GND			
S87	PCIe	PCIE_B_RX+		Not Connected		
S88	PCIe	PCIE_B_RX-		Not Connected		
S89	PCIe	GND	_GND			

Continued on next page

Table 10: X1 pin assignment – bottom side – Secondary pins Primary pins – Alternate functions (Continued)

MXM3 Pins	Signal Group	SMARC Signal	Soc Signal	Soc Ball Name	Power Group	Note
S90	PCIe	PCIE_B_TX+		Not Connected		
S91	PCIe	PCIE_B_TX-		Not Connected		
S92	PCIe	GND	_GND			
S93	Display Port	DP0_LANE0+		Not Connected		
S94	Display Port	DP0_LANE0-		Not Connected		
S95	Display Port	DP0_AUX_SEL		Not Connected		
S96	Display Port	DP0_LANE1+		Not Connected		
S97	Display Port	DP0_LANE1-		Not Connected		
S98	Display Port	DP0_HPD		Not Connected		
S99	Display Port	DP0_LANE2+		Not Connected		
S100	Display Port	DP0_LANE2-		Not Connected		
S101	Display Port	GND	_GND			
S102	Display Port	DP0_LANE3+		Not Connected		
S103	Display Port	DP0_LANE3-		Not Connected		
S104	Display Port	USB3_OTG_ID		Not Connected		
S105	Display Port	DP0_AUX+		Not Connected		
S106	Display Port	DP0_AUX-		Not Connected		
S107	LVDS	LCD1_BKLT_EN	GPIO_Expander			
S108	LVDS	LVDS1_CLK+ / eDP1_AUX+ / DSI1_CLK+	LVDS1_CLK_P	A28	VDD_LVDS_1P8	Alternate Function: MIPI_DSI1_CLK_P over a multiplexer
S109	LVDS	LVDS1_CLK- / eDP1_AUX- / DSI1_CLK-	LVDS1_CLK_N	B28	VDD_LVDS_1P8	Alternate Function: MIPI_DSI1_CLK_N over a multiplexer
S110	LVDS	GND	_GND			
S111	LVDS	LVDS1_0+ / eDP1_TX0+ / DSI1_D0+	LVDS1_D0_P	A26	VDD_LVDS_1P8	Alternate Function: MIPI_DSI1_D0_P over a multiplexer
S112	LVDS	LVDS1_0- / eDP1_TX0- / DSI1_D0-	LVDS1_D0_N	B26	VDD_LVDS_1P8	Alternate Function: MIPI_DSI1_D0_N over a multiplexer

Continued on next page

Table 10: X1 pin assignment – bottom side – Secondary pins [Primary pins – Alternate functions](#) (Continued)

MXM3 Pins	Signal Group	SMARC Signal	Soc Signal	Soc Ball Name	Power Group	Note
S113	LVDS	eDP1_HPD / DSI1_TE		Not Connected		
S114	LVDS	LVDS1_1+ / eDP1_TX1+ / DSI1_D1+	LVDS1_D1_P	A27	VDD_LVDS_1P8	Alternate Function: MIPI_DSI1_D1_P over a multiplexer
S115	LVDS	LVDS1_1- / eDP1_TX1- / DSI1_D1-	LVDS1_D1_N	B27	VDD_LVDS_1P8	Alternate Function: MIPI_DSI1_D1_N over a multiplexer
S116	LVDS	LCD1_VDD_EN	GPIO_Expander			
S117	LVDS	LVDS1_2+ / eDP1_TX2+ / DSI1_D2+	LVDS1_D2_P	B29	VDD_LVDS_1P8	Alternate Function: MIPI_DSI1_D2_P over a multiplexer
S118	LVDS	LVDS1_2- / eDP1_TX2- / DSI1_D2-	LVDS1_D2_N	C28	VDD_LVDS_1P8	Alternate Function: MIPI_DSI1_D2_N over a multiplexer
S119	LVDS	GND	_GND			
S120	LVDS	LVDS1_3+ / eDP1_TX3+ / DSI1_D3+	LVDS1_D3_P	C29	VDD_LVDS_1P8	Alternate Function: MIPI_DSI1_D3_P over a multiplexer
S121	LVDS	LVDS1_3- / eDP1_TX3- / DSI1_D3-	LVDS1_D3_N	D28	VDD_LVDS_1P8	Alternate Function: MIPI_DSI1_D3_N over a multiplexer
S122	LVDS	LCD1_BKLT_PWM	SPDIF_EXT_CLK	AC18	NVCC_SAI2_SAI3_SPDIF	
S123	LVDS	GPIO13	GPIO1_IO13	A6	NVCC_GPIO1	
S124	LVDS	GND	_GND			
S125	LVDS	LVDS0_0+ / eDP0_TX0+ / DSI0_D0+	LVDS0_D0_P	D29	VDD_LVDS_1P8	
S126	LVDS	LVDS0_0- / eDP0_TX0- / DSI0_D0-	LVDS0_D0_N	E28	VDD_LVDS_1P8	
S127	LVDS	LCD0_BKLT_EN	GPIO_Expander			
S128	LVDS	LVDS0_1+ / eDP0_TX1+ / DSI0_D1+	LVDS0_D1_P	E29	VDD_LVDS_1P8	
S129	LVDS	LVDS0_1- / eDP0_TX1- / DSI0_D1-	LVDS0_D1_N	F28	VDD_LVDS_1P8	
S130	LVDS	GND	_GND			
S131	LVDS	LVDS0_2+ / eDP0_TX2+ / DSI0_D2+	LVDS0_D2_P	G29	VDD_LVDS_1P8	
S132	LVDS	LVDS0_2- / eDP0_TX2- / DSI0_D2-	LVDS0_D2_N	H28	VDD_LVDS_1P8	
S133	LVDS	LCD0_VDD_EN	GPIO_Expander			
S134	LVDS	LVDS0_CLK+ / eDP0_AUX+ / DSI0_CLK+	LVDS0_CLK_P	F29	VDD_LVDS_1P8	
S135	LVDS	LVDS0_CLK- / eDP0_AUX- / DSI0_CLK-	LVDS0_CLK_N	G28	VDD_LVDS_1P8	

Continued on next page

Table 10: X1 pin assignment – bottom side – Secondary pins [Primary pins – Alternate functions](#) (Continued)

MXM3 Pins	Signal Group	SMARC Signal	Soc Signal	Soc Ball Name	Power Group	Note
S136	LVDS	GND	_GND			
S137	LVDS	LVDS0_3+ / eDP0_TX3+ / DSI0_D3+	LVDS0_D3_P	H29	VDD_LVDS_1P8	
S138	LVDS	LVDS0_3- / eDP0_TX3- / DSI0_D3-	LVDS0_D3_N	J28	VDD_LVDS_1P8	
S139	LVDS	I2C_LCD_CK	I2C2_SCL	AH6	NVCC_I2C_UART	2.2kΩ pull-up resistor on module
S140	LVDS	I2C_LCD_DAT	I2C2_SDA	AE8	NVCC_I2C_UART	2.2kΩ pull-up resistor on module
S141	CTRL	LCD0_BKLT_PWM	GPIO1_IO11	D8	NVCC_GPIO1	
S142	CTRL	GPIO12	GPIO1_IO08	A8	NVCC_GPIO1	
S143	CTRL	GND	_GND			
S144	CTRL	eDP0_HPD / DSI0_TE		Not Connected		
S145	CTRL	WDT_TIME_OUT#	MCU			
S146	CTRL	PCIE_WAKE#	SAI1_RXFS	AJ9	NVCC_SAI1_SAI5	Level Shifted - Diode - Input - OD, CMOS - 10k PU
S147	CTRL	VDD_RTC				
S148	CTRL	LID#	MCU			10kΩ pull-up resistor on module
S149	CTRL	SLEEP#	NAND_CE0_B	L26	NVCC_NAND	10kΩ pull-up resistor on module
S150	CTRL	VIN_PWR_BAD#	MCU			10kΩ pull-up resistor on module 5V Capable
S151	CTRL	CHARGING#	MCU			10kΩ pull-up resistor on module
S152	CTRL	CHARGER_PRSENT#	MCU			10kΩ pull-up resistor on module
S153	CTRL	CARRIER_STBY#	MCU			100kΩ pull-down resistor on module
S154	CTRL	CARRIER_PWR_ON	MCU			100kΩ pull-down resistor on module
S155	CTRL	FORCE_RECOV#	MCU			10kΩ pull-up resistor on module
S156	CTRL	BATLOW#	MCU			10kΩ pull-up resistor on module
S157	CTRL	TEST#	MCU			10kΩ pull-up resistor on module
S158	CTRL	GND	_GND			

9 I/O Pins

9.1 Function Multiplexing

Low-speed I/O pins of the NXP i.MX 8M Plus SoC can be configured for any of the (and up to) seven alternate functions. Most of the pins can also be used as GPIOs (General-Purpose I/O, sometimes also referred to as Digital I/O). For example, the i.MX 8M Plus signal pin on the **SMARC MXM3 pin P129** has the primary function **UART1_TX**. Besides this UART function, the pin can also be configured as **ECSPi3_MOSI** (SPI master out, slave in) and **GPIO5_IO23** (GPIO).

The default setting for this pin is the primary function **UART1_TX**. The SMARC standard defines ([Section 4.7](#)) that some pins shall have a specific function. It is strongly recommended, whenever possible, to use a function that is compatible with the SMARC specification. This guarantees the best compatibility with the standard software and with other modules.

Some of the alternate functions are available on more than one pin. Care should be taken to ensure that two pins are not configured with the same function. This could lead to system instability and undefined behavior.

On [Table 14](#) on page [38](#) there is a list of all pins which have alternate functions. There you can find which alternate functions are available for each individual pin.

9.2 Pin Control

The alternate function of each pin can be changed independently. Every pin has a Pad Mux Register in which the following settings can be configured (some settings might not be available for certain pins). The register is called IOMUXC_SW_MUX_CTL_PAD_x, where x is the name of the i.MX 8M Plus pin. More information about the available register settings can be found in the [i.MX 8M Plus Reference Manual](#).

Table 11: Pad Mux Register

Bit	Field	Description	Remarks
31-5	Reserved		
4	SION	0 Software Input On Field disabled 1 Software Input On Field enable	Force the selected mux mode input path
3	Reserved		
2-0	MUX_MODE	000 Select mux mode: ALT0 mux port 001 Select mux mode: ALT1 mux port 010 Select mux mode: ALT2 mux port 011 Select mux mode: ALT3 mux port 100 Select mux mode: ALT4 mux port 101 Select mux mode: ALT5 mux port (GPIO) 110 Select mux mode: ALT6 mux port	Check section 4.4 for the available alternate function of the pin

For most pins, the ALT5 multiplexing option is reserved for the GPIO function. However, there are a few pins that feature the GPIO function on ALT0. Carefully check [Table 14](#) on page [38](#) and the reference manual provided by NXP.

The pins have an additional register that allows the configuration of pull-up/down resistors, drive strength, and other settings. The register is called IOMUXC_SW_PAD_CTL_PAD_x, where x is the name of the i.MX 8M Plus pin. Some settings might not be available on certain pins. More information about the available register settings can be found in the [i.MX 8M Plus Reference Manual](#).

Table 12: Pad Mux Register

Bit	Field	Description	Remarks
31-9	Reserved		
8	PE	0 Pull resistor disabled 1 Pull resistor enable	
7	HYS	0 CMOS input 1 Schmitt trigger input	
6	PUE	0 Select pull-down resistor 1 Select pull-up resistor	Typical pull-up value 22kΩ Typical pull-down value 23kΩ
5	ODE	0 Output is CMOS 1 Output is open-drain	
4-3	FSE	0x Slow Slew Rate 1x Fast Slew Rate	Use a slow slew rate, if possible, for reducing EMC problems
2-0	MUX_MODE	00x Drive strength X1 01x Drive strength X2 10x Drive strength X4 11x Drive strength X6	If possible, decrease the drive strength to reduce EMC problems

Input functions that are available at more than one physical pin require an additional input multiplexer. This multiplexer is configured by a register called IOMUXC_x_SELECT_INPUT, where x is the name of the input function. More information about this register can be found in the [i.MX 8M Plus Reference Manual](#).

9.3 SoC Functions List

[Table 14](#) on page 38 shows a list of all the i.MX 8M Plus pins that are available on the MXM3 connector. It shows the alternate functions that are available for each pin. For most of the pins, the GPIO functionality is defined as the ALT5 function.

Table 13: Function Short Forms

Short Form	Description
ADC	Analog to Digital Converter input
CAAM	Cryptographic Acceleration and Assurance Module
CAN	Controller Area Network
CCM	Clock Control Module
CSI	Camera Serial Interface
CSU	Central Security Unit
EARC	Enhanced Audio Return Channel (for HDMI)
ECC	Error-Correcting Code
ECSPI	Enhanced Configurable SPI
ENET	Ethernet MAC interface
GPIO	General-Purpose Input Output
GPC	General Power Controller
GPT	General Purpose Timer
HDMI	High-Definition Multimedia Interface
I2C	Inter-Integrated Circuit
ISP	Image Signal Processor

Continued on next page

Table 13: Function Short Forms (Continued)

Short Form	Description
JTAG	Test Interface
LVDS	FPD-Link/FlatLink Display interface
MIPI_CSI	MIPI CSI Subsystem
MIPI_DSI	MIPI DSI Subsystem
NAND	Interface for NAND Flash
NPU	Neural Processing Unit
PCIE	PCI Express
PDM	Pulse-Density Modulation Microphone Input
PWM	Pulse Width Modulation output
QSPI	Quad Serial Peripheral Interface
SAI	Serial Interface for Audio (I2S and AC97)
SDMA	Smart Direct Memory Access Controller
SNVS	Secure Non-Volatile Storage
SPDIF	Sony/Philips Digital Interface
UART	Universal Asynchronous Receiver/Transmitter
USB	Universal Serial Bus
USDHC	Ultra-Secured Digital Host Controller (interface for SD and MMC cards)
VPU	Video Processing Unit (acceleration for video encoding and decoding)

9.3.1 Alternate Functions

Table 14: X1 pin Alternate Functions Primary pins – Secondary pins

MXM3 Pin	SMARC Signal	Soc Signal	Soc Ball Name	ALT0	ALT1	ALT2	ALT3	ALT4	ALT5	ALT6
P1	SMB_ALERT#	NAND_READY_B	T28	NAND_READY_B		USDHC3_RESET_B		I2C3_SCL	GPIO3_IO16	
P3	CSI1_CK+	MIPI_CSI1_CLK_P	D22	MIPI_CSI1_CLK_P						
P4	CSI1_CK-	MIPI_CSI1_CLK_N	E22	MIPI_CSI1_CLK_N						
P5	GBE1_SDP	SAI1_RXC	AH8	SAI1_RX_BCLK	SAI5_RX_BCLK		PDM_CLK	ENET1_1588_EVENT0_OUT	GPIO4_IO1	
P6	GBE0_SDP	GPIO1_IO09	B8	GPIO1_IO9	ENET_QOS_1588_EVENT0_OUT	PWM2_OUT	ISP_SHUTTER_OPEN_1	USDHC3_RESET_B	SDMA2_EXT_EVENT0	
P7	CSI1_RX0+	MIPI_CSI1_D0_P	D18	MIPI_CSI1_D0_P						
P8	CSI1_RX0-	MIPI_CSI1_D0_N	E18	MIPI_CSI1_D0_N						
P10	CSI1_RX1+	MIPI_CSI1_D1_P	D20	MIPI_CSI1_D1_P						
P11	CSI1_RX1-	MIPI_CSI1_D1_N	E20	MIPI_CSI1_D1_N						
P13	CSI1_RX2+	MIPI_CSI1_D2_P	D24	MIPI_CSI1_D2_P						
P14	CSI1_RX2-	MIPI_CSI1_D2_N	E24	MIPI_CSI1_D2_N						
P16	CSI1_RX3+	MIPI_CSI1_D3_P	D26	MIPI_CSI1_D3_P						
P17	CSI1_RX3-	MIPI_CSI1_D3_N	E26	MIPI_CSI1_D3_N						
P31	SPI0_CS1#	SAI3_RXFS	AJ19	SAI3_RX_SYNC	SAI2_RX_DATA1	SAI5_RX_SYNC	SAI3_RX_DATA1	SPDIF1_IN	GPIO4_IO28	PDM_BIT_STREAM0
P33	SDIO_WP	SD2_WP	AC26	USDHC2_WP					GPIO2_IO20	CORESIGHT_EVENT1
P34	SDIO_CMD	SD2_CMD	AB28	USDHC2_CMD		ECSPI2_MOSI	UART4_TX	PDM_CLK	GPIO2_IO14	
P35	SDIO_CD#	SD2_CD_B	AD29	USDHC2_CD_B					GPIO2_IO12	
P36	SDIO_CK	SD2_CLK	AB29	USDHC2_CLK		ECSPI2_SCLK	UART4_RX		GPIO2_IO13	
P37	SDIO_PWR_EN	SD2_RESET_B	AD28	USDHC2_RESET_B					GPIO2_IO19	SRC_SYSTEM_RESET
P39	SDIO_D0	SD2_DATA0	AC28	USDHC2_DATA0		I2C4_SDA	UART2_RX	PDM_BIT_STREAM0	GPIO2_IO15	
P40	SDIO_D1	SD2_DATA1	AC29	USDHC2_DATA1		I2C4_SCL	UART2_TX	PDM_BIT_STREAM1	GPIO2_IO16	
P41	SDIO_D2	SD2_DATA2	AA26	USDHC2_DATA2		ECSPI2_SS0	SPDIF1_OUT	PDM_BIT_STREAM2	GPIO2_IO17	

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Table 14: X1 pin Alternate Functions Primary pins – Secondary pins (Continued)

MXM3 Pin	SMARC Signal	Soc Signal	Soc Ball Name	ALT0	ALT1	ALT2	ALT3	ALT4	ALT5	ALT6
P42	SDIO_D3	SD2_DATA3	AA25	USDHC2_DATA3		ECSPI2_MISO	SPDIF1_IN	PDM_BIT_STREAM3	GPIO2_IO18	SRC_EARLY_RESET
P43	SPI0_CS0#	ECSPI1_SS0	AE20	ECSPI1_SS0	UART3_RTS_B	I2C2_SDA	SAI7_TX_SYNC		GPIO5_IO9	
P44	SPI0_CK	ECSPI1_SCLK	AF20	ECSPI1_SCLK	UART3_RX	I2C1_SCL	SAI7_RX_SYNC		GPIO5_IO6	
P45	SPI0_DIN	ECSPI1_MISO	AD20	ECSPI1_MISO	UART3_CTS_B	I2C2_SCL	SAI7_RX_DATA0		GPIO5_IO8	
P46	SPI0_DO	ECSPI1_MOSI	AC20	ECSPI1_MOSI	UART3_TX	I2C1_SDA	SAI7_RX_BCLK		GPIO5_IO7	
P54	ESPI_CS0# / SPI1_CS0# / QSPI_CS0#	ECSPI2_SS0	AJ22	ECSPI2_SS0	UART4_RTS_B	I2C4_SDA		CCM_CLKO2	GPIO5_IO13	
P55	ESPI_CS1# / SPI1_CS1# / QSPI_CS1#	SAI1_RXD1	AF10	SAI1_RX_DATA1	SAI5_RX_DATA1		PDM_BIT_STREAM1	ENET1_1588_EVENT1_OUT	GPIO4_IO3	
P56	ESPI_CK / SPI1_CK / QSPI_CK	ECSPI2_SCLK	AH21	ECSPI2_SCLK	UART4_RX	I2C3_SCL	SAI7_TX_BCLK		GPIO5_IO10	
P57	ESPI_IO_1 / SPI1_DIN / QSPI_IO_1	ECSPI2_MISO	AH20	ECSPI2_MISO	UART4_CTS_B	I2C4_SCL	SAI7_MCLK	CCM_CLKO1	GPIO5_IO12	
P58	ESPI_IO_0 / SPI1_DO / QSPI_IO_0	ECSPI2_MOSI	AJ21	ECSPI2_MOSI	UART4_TX	I2C3_SDA	SAI7_TX_DATA0		GPIO5_IO11	
P60	USB0+	USB1_D_P	D10	USB1_D_P						
P61	USB0-	USB1_D_N	E10	USB1_D_N						
P62	USB0_EN_OC#	GPIO1_IO12	A5	GPIO1_IO12	USB1_OTG_PWR				SDMA2_EXT_EVENT1	
P63	USB0_VBUS_DET	USB1_VBUS	A11	USB1_VBUS						
P64	USB0_OTG_ID	SAI3_MCLK	AJ20	SAI3_MCLK	PWM4_OUT	SAI5_MCLK		SPDIF1_OUT	GPIO5_IO2	SPDIF1_IN
P75	PCIE_A_RST#	SAI1_TXD7	AJ13	SAI1_TX_DATA7	SAI6_MCLK		PDM_CLK	ENET1_TX_ER	GPIO4_IO19	
P78	PCIE_A_CKREQ#	NAND_DQS	R26	NAND_DQS	QSPI_A_DQS	SAI3_MCLK	ISP_SHUTTER_OPEN_0	I2C3_SCL	GPIO3_IO14	
P83	PCIE_A_REFCK+	PCIE_REF_PAD_CLK_P	D16	PCIE1_REF_PAD_CLK_P						

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Table 14: X1 pin Alternate Functions Primary pins – Secondary pins (Continued)

MXM3 Pin	SMARC Signal	Soc Signal	Soc Ball Name	ALT0	ALT1	ALT2	ALT3	ALT4	ALT5	ALT6
P84	PCIE_A_REFCK-	PCIE_REF_PAD_CLK_N	E16	PCIE1_REF_PAD_CLK_N						
P86	PCIE_A_RX+	PCIE_RXN_P	A14	PCIE1_RXN_P						
P87	PCIE_A_RX-	PCIE_RXN_N	B14	PCIE1_RXN_N						
P89	PCIE_A_TX+	PCIE_TXN_P	A15	PCIE1_TXN_P						
P90	PCIE_A_TX-	PCIE_TXN_N	B15	PCIE1_TXN_N						
P104	HDMI_HPD / DP1_HPD	HDMI_HPD	AE22	HDMI_HPD	HDMI_HPD_O		I2C6_SDA	CAN2_RX	GPIO3_IO29	
P105	HDMI_CTRL_CK / DP1_AUX+	HDMI_DDC_SCL	AC22	HDMI_SCL			I2C5_SCL	CAN1_TX	GPIO3_IO26	
P106	HDMI_CTRL_DAT / DP1_AUX-	HDMI_DDC_SDA	AF22	HDMI_SDA			I2C5_SDA	CAN1_RX	GPIO3_IO27	
P108	GPIO0 / CAM0_PWR#	GPIO_Expander		GPIO1_IO0	CCM_ENET_PHY_REF_CLK_ROOT		ISP_FL_TRIG_0		CCM_REF_CLK_32K	CCM_EXT_CLK1
P109	GPIO1 / CAM1_PWR#	GPIO_Expander		GPIO1_IO1	PWM1_OUT		ISP_SHUTTER_TRIG_0		CCM_REF_CLK_24M	CCM_EXT_CLK2
P110	GPIO2 / CAM0_RST#	GPIO_Expander		GPIO1_IO5	M7_NMI		ISP_FL_TRIG_1		CCM_PMIC_READY	
P111	GPIO3 / CAM1_RST#	GPIO_Expander		GPIO1_IO6	ENET_QOS_MDC		ISP_SHUTTER_TRIG_1		USDHC1_CD_B	CCM_EXT_CLK3
P112	GPIO4 / HDA_RST#	SAI1_TXD6	AC12	SAI1_TX_DATA6	SAI6_RX_SYNC	SAI6_TX_SYNC		ENET1_RX_ER	GPIO4_IO18	
P113	GPIO5 / PWM_OUT	GPIO1_IO10	B7	GPIO1_IO10	USB1_OTG_ID	PWM3_OUT				
P114	GPIO6 / TACHIN	SAI3_RXC	AJ18	SAI3_RX_BCLK	SAI2_RX_DATA2	SAI5_RX_BCLK	GPT1_CLK	UART2_CTS_B	GPIO4_IO29	PDM_CLK
P115	GPIO7	GPIO1_IO00	A7	GPIO1_IO0	CCM_ENET_PHY_REF_CLK_ROOT		ISP_FL_TRIG_0		CCM_REF_CLK_32K	CCM_EXT_CLK1
P116	GPIO8	GPIO1_IO01	E8	GPIO1_IO1	PWM1_OUT		ISP_SHUTTER_TRIG_0		CCM_REF_CLK_24M	CCM_EXT_CLK2

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Table 14: X1 pin Alternate Functions Primary pins – Secondary pins (Continued)

MXM3 Pin	SMARC Signal	Soc Signal	Soc Ball Name	ALT0	ALT1	ALT2	ALT3	ALT4	ALT5	ALT6
P117	GPIO9	GPIO1_IO05	B4	GPIO1_IO5	M7_NMI		ISP_FL_TRIG_1		CCM_PMIC_READY	
P118	GPIO10	GPIO1_IO06	A3	GPIO1_IO6	ENET_QOS_MDC		ISP_SHUTTER_TRIG_1		USDHC1_CD_B	CCM_EXT_CLK3
P119	GPIO11	GPIO1_IO07	F6	GPIO1_IO7	ENET_QOS_MDIO		ISP_FLASH_TRIG_1		USDHC1_WP	CCM_EXT_CLK4
P121	I2C_PM_CK	HDMI_CEC	AD22	HDMI_CEC			I2C6_SCL	CAN2_TX	GPIO3_IO28	
P122	I2C_PM_DAT	SAI5_RXC	AD14	SAI5_RX_BCLK	SAI1_TX_DATA1	PWM3_OUT	I2C6_SDA	PDM_CLK	GPIO3_IO20	
P129	SER0_TX	UART1_TXD	AJ3	UART1_TX	ECSPI3_MOSI				GPIO5_IO23	
P130	SER0_RX	UART1_RXD	AD6	UART1_RX	ECSPI3_SCLK				GPIO5_IO22	
P131	SER0_RTS#	SAI2_TXFS	AJ17	SAI2_TX_SYNC	SAI5_TX_DATA1	ENET_QOS_1588_EVENT3_OUT	SAI2_TX_DATA1	UART1_CTS_B	GPIO4_IO24	PDM_BIT_STREAM2
P132	SER0_CTS#	SAI2_RXD0	AJ14	SAI2_RX_DATA0	SAI5_TX_DATA0	ENET_QOS_1588_EVENT2_OUT	SAI2_TX_DATA1	UART1_RTS_B	GPIO4_IO23	PDM_BIT_STREAM3
P134	SER1_TX	UART4_TXD	AH5	UART4_TX	UART2_RTS_B		GPT1_CAPTURE1	I2C6_SDA	GPIO5_IO29	
P135	SER1_RX	UART4_RXD	AJ5	UART4_RX	UART2_CTS_B	PCIE1_CLKREQ_B	GPT1_COMPARE1	I2C6_SCL	GPIO5_IO28	
P136	SER2_TX	UART2_TXD	AH4	UART2_TX	ECSPI3_SS0		GPT1_COMPARE2		GPIO5_IO25	
P137	SER2_RX	UART2_RXD	AF6	UART2_RX	ECSPI3_MISO		GPT1_COMPARE3		GPIO5_IO24	
P138	SER2_RTS#	SD1_DATA5	AA29	USDHC1_DATA5	ENET1_TX_ER		I2C1_SDA	UART2_CTS_B	GPIO2_IO7	
P139	SER2_CTS#	SD1_DATA4	U26	USDHC1_DATA4	ENET1_RGMII_TX_CTL		I2C1_SCL	UART2_RTS_B	GPIO2_IO6	
P140	SER3_TX	UART3_TXD	AJ4	UART3_TX	UART1_RTS_B	USDHC3_VSELECT	GPT1_CLK	CAN2_RX	GPIO5_IO27	
P141	SER3_RX	UART3_RXD	AE6	UART3_RX	UART1_CTS_B	USDHC3_RESET_B	GPT1_CAPTURE2	CAN2_TX	GPIO5_IO26	
P143	CAN0_TX	SAI2_TXD0	AH16	SAI2_TX_DATA0	SAI5_TX_DATA3	ENET_QOS_1588_EVENT2_IN	CAN2_TX	ENET_QOS_1588_EVENT2_AUX_IN	GPIO4_IO26	SRC_BOOT_MODE4
P144	CAN0_RX	SAI2_MCLK	AJ15	SAI2_MCLK	SAI5_MCLK	ENET_QOS_1588_EVENT3_IN	CAN2_RX	ENET_QOS_1588_EVENT3_AUX_IN	GPIO4_IO27	SAI3_MCLK
P145	CAN1_TX	SAI2_RXC	AJ16	SAI2_RX_BCLK	SAI5_TX_BCLK		CAN1_TX	UART1_RX	GPIO4_IO22	PDM_BIT_STREAM1
P146	CAN1_RX	SAI2_TXC	AH15	SAI2_TX_BCLK	SAI5_TX_DATA2		CAN1_RX		GPIO4_IO25	PDM_BIT_STREAM1

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Table 14: X1 pin Alternate Functions Primary pins – Secondary pins (Continued)

MXM3 Pin	SMARC Signal	Soc Signal	Soc Ball Name	ALT0	ALT1	ALT2	ALT3	ALT4	ALT5	ALT6
S1	CSI1_TX+ / I2C_CAM1_CK	SPDIF_TX	AE18	SPDIF1_OUT	PWM3_OUT	I2C5_SCL	GPT1_COMPARE1	CAN1_TX	GPIO5_IO3	
S2	CSI1_TX- / I2C_CAM1_DAT	SPDIF_RX	AD18	SPDIF1_IN	PWM2_OUT	I2C5_SDA	GPT1_COMPARE2	CAN1_RX	GPIO5_IO4	
S5	CSI0_TX+ / I2C_CAM0_CK	I2C3_SCL	AJ7	I2C3_SCL	PWM4_OUT	GPT2_CLK	ECSPI2_SCLK		GPIO5_IO18	
S6	CAM_MCK	GPIO1_IO15	B5	GPIO1_IO15	USB2_OTG_OC			USDHC3_WP	PWM4_OUT	CCM_CLKO2
S7	CSI0_TX- / I2C_CAM0_DAT	I2C3_SDA	AJ6	I2C3_SDA	PWM3_OUT	GPT3_CLK	ECSPI2_MOSI		GPIO5_IO19	
S8	CSI0_CK+	MIPI_CSI2_CLK_P	A23	MIPI_CSI2_CLK_P						
S9	CSI0_CK-	MIPI_CSI2_CLK_N	B23	MIPI_CSI2_CLK_N						
S11	CSI0_RX0+	MIPI_CSI2_D0_P	A25	MIPI_CSI2_D0_P						
S12	CSI0_RX0-	MIPI_CSI2_D0_N	B25	MIPI_CSI2_D0_N						
S14	CSI0_RX1+	MIPI_CSI2_D1_P	A24	MIPI_CSI2_D1_P						
S15	CSI0_RX1-	MIPI_CSI2_D1_N	B24	MIPI_CSI2_D1_N						
S38	AUDIO_MCK	SAI1_MCLK	AE12	SAI1_MCLK	SAI5_MCLK	SAI1_TX_BCLK		ENET1_TX_CLK	GPIO4_IO20	
S39	I2S0_LRCK	SAI5_RXD1	AD16	SAI5_RX_DATA1	SAI1_TX_DATA3	SAI1_TX_SYNC	SAI5_TX_SYNC	PDM_BIT_STREAM1	GPIO3_IO22	CAN1_TX
S40	I2S0_SDOUT	SAI5_RXFS	AC14	SAI5_RX_SYNC	SAI1_TX_DATA0	PWM4_OUT	I2C6_SCL		GPIO3_IO19	
S41	I2S0_SDIN	SAI1_RXD0	AC10	SAI1_RX_DATA0	SAI5_RX_DATA0	SAI1_TX_DATA1	PDM_BIT_STREAM0	ENET1_1588_EVENT1_IN	GPIO4_IO2	
S42	I2S0_CK	SAI5_MCLK	AF14	SAI5_MCLK	SAI1_TX_BCLK	PWM1_OUT	I2C5_SDA		GPIO3_IO25	CAN2_RX
S48	I2C_GP_CK	I2C4_SCL	AF8	I2C4_SCL	PWM2_OUT	PCIE1_CLKREQ_B	ECSPI2_MISO		GPIO5_IO20	
S49	I2C_GP_DAT	I2C4_SDA	AD8	I2C4_SDA	PWM1_OUT		ECSPI2_SS0		GPIO5_IO21	
S50	HDA_SYNC / I2S2_LRCK	SAI3_TXFS	AC16	SAI3_TX_SYNC	SAI2_TX_DATA1	SAI5_RX_DATA1	SAI3_TX_DATA1	UART2_RX	GPIO4_IO31	PDM_BIT_STREAM3
S51	HDA_SDO / I2S2_SDOUT	SAI3_TXD	AH18	SAI3_TX_DATA0	SAI2_TX_DATA3	SAI5_RX_DATA3	GPT1_CAPTURE2	SPDIF1_EXT_CLK	GPIO5_IO1	SRC_BOOT_MODE5

Continued on next page

Table 14: X1 pin Alternate Functions Primary pins – Secondary pins (Continued)

MXM3 Pin	SMARC Signal	Soc Signal	Soc Ball Name	ALT0	ALT1	ALT2	ALT3	ALT4	ALT5	ALT6
S52	HDA_SD1 / I2S2_SDIN	SAI3_RXD	AF18	SAI3_RX_DATA0	SAI2_RX_DATA3	SAI5_RX_DATA0		UART2_RTS_B	GPIO4_IO30	PDM_BIT_STREAM1
S53	HDA_CK / I2S2_CK	SAI3_TXC	AH19	SAI3_TX_BCLK	SAI2_TX_DATA2	SAI5_RX_DATA2	GPT1_CAPTURE1	UART2_TX	GPIO5_IO0	PDM_BIT_STREAM2
S62	USB3_SSTX+	USB2_TX_P	A13	USB2_TX_P						
S63	USB3_SSTX-	USB2_TX_N	B13	USB2_TX_N						
S65	USB3_SSRX+	USB2_RX_P	A12	USB2_RX_P						
S66	USB3_SSRX-	USB2_RX_N	B12	USB2_RX_N						
S71	USB2_SSTX+	USB1_TX_P	A10	USB1_TX_P						
S72	USB2_SSTX-	USB1_TX_N	B10	USB1_TX_N						
S74	USB2_SSRX+	USB1_RX_P	A9	USB1_RX_P						
S75	USB2_SSRX-	USB1_RX_N	B9	USB1_RX_N						
S107	LCD1_BKLT_EN	SAI3_RXFS	AJ19	SAI3_RX_SYNC	SAI2_RX_DATA1	SAI5_RX_SYNC	SAI3_RX_DATA1	SPDIF1_IN	GPIO4_IO28	PDM_BIT_STREAM0
S108	LVDS1_CK+ / eDP1_AUX+ / DSI1_CLK+	LVDS1_CLK_P	A28	LVDS1_CLK_P						
S109	LVDS1_CK- / eDP1_AUX- / DSI1_CLK-	LVDS1_CLK_N	B28	LVDS1_CLK_N						
S111	LVDS1_0+ / eDP1_TX0+ / DSI1_D0+	LVDS1_D0_P	A26	LVDS1_D0_P						
S112	LVDS1_0- / eDP1_TX0- / DSI1_D0-	LVDS1_D0_N	B26	LVDS1_D0_N						
S114	LVDS1_1+ / eDP1_TX1+ / DSI1_D1+	LVDS1_D1_P	A27	LVDS1_D1_P						

Continued on next page

Table 14: X1 pin Alternate Functions Primary pins – Secondary pins (Continued)

MXM3 Pin	SMARC Signal	Soc Signal	Soc Ball Name	ALT0	ALT1	ALT2	ALT3	ALT4	ALT5	ALT6
S115	LVDS1_1- / eDP1_TX1- / DSI1_D1-	LVDS1_D1_N	B27	LVDS1_D1_N						
S117	LVDS1_2+ / eDP1_TX2+ / DSI1_D2+	LVDS1_D2_P	B29	LVDS1_D2_P						
S118	LVDS1_2- / eDP1_TX2- / DSI1_D2-	LVDS1_D2_N	C28	LVDS1_D2_N						
S120	LVDS1_3+ / eDP1_TX3+ / DSI1_D3+	LVDS1_D3_P	C29	LVDS1_D3_P						
S121	LVDS1_3- / eDP1_TX3- / DSI1_D3-	LVDS1_D3_N	D28	LVDS1_D3_N						
S122	LCD1_BKLT_PWM	SPDIF_EXT_CLK	AC18	SPDIF1_EXT_CLK	PWM1_OUT		GPT1_COMPARE3		GPIO5_IO5	
S123	GPIO13	GPIO1_IO13	A6	GPIO1_IO13	USB1_OTG_OC				PWM2_OUT	
S125	LVDS0_0+ / eDP0_TX0+ / DSI0_D0+	LVDS0_D0_P	D29	LVDS0_D0_P						
S126	LVDS0_0- / eDP0_TX0- / DSI0_D0-	LVDS0_D0_N	E28	LVDS0_D0_N						
S128	LVDS0_1+ / eDP0_TX1+ / DSI0_D1+	LVDS0_D1_P	E29	LVDS0_D1_P						
S129	LVDS0_1- / eDP0_TX1- / DSI0_D1-	LVDS0_D1_N	F28	LVDS0_D1_N						
S131	LVDS0_2+ / eDP0_TX2+ / DSI0_D2+	LVDS0_D2_P	G29	LVDS0_D2_P						

Continued on next page

Table 14: X1 pin Alternate Functions Primary pins – Secondary pins (Continued)

MXM3 Pin	SMARC Signal	Soc Signal	Soc Ball Name	ALT0	ALT1	ALT2	ALT3	ALT4	ALT5	ALT6
S132	LVDS0_2- / eDP0_TX2- / DSI0_D2-	LVDS0_D2_N	H28	LVDS0_D2_N						
S134	LVDS0_CLK+ / eDP0_AUX+ / DSI0_CLK+	LVDS0_CLK_P	F29	LVDS0_CLK_P						
S135	LVDS0_CLK- / eDP0_AUX- / DSI0_CLK-	LVDS0_CLK_N	G28	LVDS0_CLK_N						
S137	LVDS0_3+ / eDP0_TX3+ / DSI0_D3+	LVDS0_D3_P	H29	LVDS0_D3_P						
S138	LVDS0_3- / eDP0_TX3- / DSI0_D3-	LVDS0_D3_N	J28	LVDS0_D3_N						
S139	I2C_LCD_CK	I2C2_SCL	AH6	I2C2_SCL	ENET_QOS_1588_EVENT1_IN	USDHC3_CD_B	ECSPI1_MISO	ENET_QOS_1588_EVENT1_AUX_IN	GPIO5_IO16	
S140	I2C_LCD_DAT	I2C2_SDA	AE8	I2C2_SDA	ENET_QOS_1588_EVENT1_OUT	USDHC3_WP	ECSPI1_SS0		GPIO5_IO17	
S141	LCD0_BKLT_PWM	GPIO1_IO11	D8	GPIO1_IO11	USB2_OTG_ID	PWM2_OUT		USDHC3_VSELECT	CCM_PMIC_READY	
S142	GPIO12	GPIO1_IO08	A8	GPIO1_IO08	ENET_QOS_1588_EVENT0_IN	PWM1_OUT	ISP_PRELIGHT_TRIG_1	ENET_QOS_1588_EVENT0_AUX_IN	USDHC2_RESET_B	
S145	WDT_TIME_OUT#	GPIO1_IO02	B6	GPIO1_IO02	WDOG1_WDOG_B		ISP_FLASH_TRIG_0		WDOG1_WDOG_ANY	SJC_DE_B (ALT7)
S146	PCIE_WAKE#	SAI1_RXFS	AJ9	SAI1_RX_SYNC	SAI5_RX_SYNC			ENET1_1588_EVENT0_IN	GPIO4_IO0	
S149	SLEEP#	NAND_CE0_B	L26	NAND_CE0_B	QSPI_A_SS0_B	SAI3_TX_DATA0	ISP_SHUTTER_TRIG_0	UART3_TX	GPIO3_IO1	

10 Interface Description

10.1 GPIOs

As described in [Table 6](#), the SMARC iMX8M Plus implements 14 dedicated general-purpose input-output (GPIO). Besides these 14 GPIOs, several pins can be used as GPIO if their primary function is not used. For compatibility reasons, it is recommended to use the dedicated GPIOs first.

Table 15: Dedicated GPIOs

MXM3 Pin	SMARC Signal	Soc Signal	Soc Ball Name	SoC Alternate Function	SoC Function Name
P108	GPIO0 / CAM0_PWR#	GPIO_Expander			
P109	GPIO1 / CAM1_PWR#	GPIO_Expander			
P110	GPIO2 / CAM0_RST#	GPIO_Expander			
P111	GPIO3 / CAM1_RST#	GPIO_Expander			
P112	GPIO4 / HDA_RST#	SAI1_TXD6	AC12	ALT5	GPIO4_IO18
P113	GPIO5 / PWM_OUT	GPIO1_IO10	B7	ALT0	GPIO1_IO10
P114	GPIO6 / TACHIN	SAI3_RXC	AJ18	ALT5	GPIO4_IO29
P115	GPIO7	GPIO1_IO00	A7	ALT0	GPIO1_IO0
P116	GPIO8	GPIO1_IO01	E8	ALT0	GPIO1_IO1
P117	GPIO9	GPIO1_IO05	B4	ALT0	GPIO1_IO5
P118	GPIO10	GPIO1_IO06	A3	ALT0	GPIO1_IO6
P119	GPIO11	GPIO1_IO07	F6	ALT0	GPIO1_IO7
S123	GPIO13	GPIO1_IO13	A6	ALT0	GPIO1_IO13
S142	GPIO12	GPIO1_IO08	A8	ALT0	GPIO1_IO8

10.2 USB

As described in [Table 6](#), the SMARC iMX8M Plus implements 5 sets of USB 2.0 signals and two sets of USB 3.2 Super Speed signals. USB OTG and USB Client functionalities are also supported.

Table 16: USB Signal Assignments

Port	USB 2.0	USB 3.2 (SS)	OTG / VBUS	Client Capability
USB0	yes	no	yes	yes
USB1	yes	no	no	no
USB2	yes	yes	no	no
USB3	yes	yes	no	no
USB4	yes	no	no	no
USB5	no	no	no	no

Check the USB Signals section of the Smarc Specification [Section 4.7](#).

10.3 Wi-Fi and Bluetooth

The SMARC iMX8M Plus is available with on-module Wi-Fi and Bluetooth interfaces. Optionally, the BTO options (Section 6) includes a version without the Wi-Fi and Bluetooth module. The SMARC module versions make use of the AW-CM276NF Dual-Band Wi-Fi and Bluetooth module from AzureWave.

Features:

- Wi-Fi 802.11a/b/g/n/ac
- Dual-Band 5 GHz and 2.4GHz
- Up to 866.7 Mbps
- 20/40/80 MHz channel bandwidth
- Station/Client Mode, Access Point Mode, Wi-Fi- Direct Mode, and Simultaneous Station and Access point mode
- Bluetooth 5.0 (BR/EDR), BLE
- Murata HSC (MXHP32) connector for the dual external antenna in 2×2 configuration, compatible to IPX/IPEX connector MHF4 series
- Pre-certified for CE (Europe), FCC (United States), IC (Canada), TELEC (Japan), and WPC (India). See <https://developer.toradex.com/knowledge-base/wi-fi-accessories-recommended-for-toradex-products>.

11 Recovery Mode



Missing Content

More information about recovery mode will be available on the next release of the datasheet.

12 Known Issues

Up-to-date information about all known hardware issues can be found in the errata document, which can be downloaded from our website at

<https://developer.toradex.com/hardware/smarc-som-family/modules/smarc-imx8mp/#errataknown-issues>.

13 Technical Specifications

13.1 Absolute Maximum Ratings



Missing Content

More information about absolute maximum ratings will be available on the next release of the datasheet.

13.2 Product Compliance

Up-to-date information about product compliance such as RoHS, CE, UL-94, Conflict Mineral, REACH, etc. can be found on our website at: <https://www.toradex.com/support/product-compliance>.



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13.3 Power Consumption



Missing Content

More information about power consumption will be available on the next release of the datasheet.

13.4 Recommended Operation Conditions

Table 17: Recommended operation conditions

Symbol	Description	Minimum	Typical	Maximum	Unit
VCC	Main power supply	3.0	3.3 or 5	5.25	V
VCC_BACKUP	RTC power supply	2.0	3.0	3.25	V

13.5 Mechanical Characteristics

The SMARC modules are available in the 82 x 50 mm size, as described in the [Section 3](#). Check the “Module Outline – 82×50mm Module” section of the SMARC specification [Section 4.7](#) on page [15](#).

13.5.1 Sockets for SMARC Modules

The SMARC iMX8M Plus modules uses the MXM3 graphics cards edge connector with 314 pins. Check the “Carrier Connector” section of the SMARC specification [Section 4.7](#) on page [15](#).

13.6 Thermal Specification



Missing Content

More information about thermal specification will be available on the next release of the datasheet.

14 Device and Documentation Support

14.1 Trademarks

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