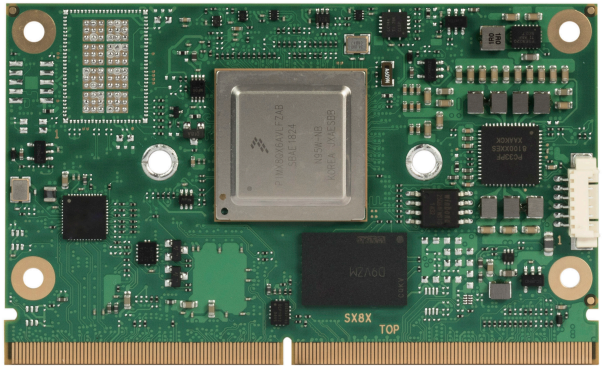

SMARC® conga-SMX8-X

SMARC 2.1 module based on the NXP® i.MX 8QuadXPlus and 8DualXPlus applications processors

User's Guide

Revision 1.3

Revision History

Revision	Date (yyyy-mm-dd)	Author	Changes
0.1	2020-03-27	BEU	• Preliminary release
0.2	2020-07-13	BEU	• Removed all references to conga-SMX8-X variants with NXP® i.MX 8DualX SoC • Updated block diagram in section 3 “Block Diagram” • Updated table 7 • Updated section 7 “Signal Descriptions and Pinout Tables” and 8 “Software Documentation”
1.0	2021-01-29	BEU	• Final release
1.1	2021-04-23	BEU	• Added note for module variant 051105 B.x and prior to section 5.1.2
1.2	2021-06-09	BEU	• Added software licenses text to preface section • Updated congatec AG to congatec GmbH throughout the document • Changed drawings in section 4 “Cooling Solutions”
1.3	2021-06-10	BEU	• Removed module variant 051105 from table 1 and 5 • Removed a display interface from the entire document

Preface

This user's guide provides information about the components, features and connectors available on the conga-SMX8-X. It is one of five documents that should be referred to when designing a SMARC® application.

The other reference documents that should be used include the following:

conga-SMX8-X Pinout Description (https://git.congatec.com/arm-nxp/imx8-family/doc/cgtimx8_pinlist/tree/cgtsx8x_pinlist)
SMARC® Design Guide 2.0 (https://sget.org)
SMARC® Hardware Specification 2.1 (https://sget.org)
NXP® i.MX 8DualXPlus/8QuadXPlus Data Sheet (www.nxp.com)

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Caution

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Note

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Contents

List of Tables

Terminology

Term	Description
°C	Degrees Celsius
µA	Microamp
µs	Microsecond
A	Ampere
AN	Application Note
ARM	Advanced RISC Machine
AVB	Audio Video Bridging
BT	Bluetooth
CAAM	Cryptographic Acceleration and Assurance Module
CMOS	Complementary Metal Oxide Semiconductor
COM	Computer-on-Module
CPU	Central Processing Unit
CSI	Camera Serial Interface
CSP	Cooling Solution Passive
DDR	Double Data Rate
DP	DisplayPort
DP++	DisplayPort Dual-Mode
DRAM	Dynamic Random Access Memory
DSI	Digital Serial Interface
D-SUB	D-Subminiature
eMMC	embedded Multi-Media Controller
FlexCAN	Flexible Controller Area Network
GB	Gigabyte
GbE	Gigabit Ethernet
GHz	Gigahertz
GND	Ground
GPIO	General-Purpose Input/Output
GPU	Graphics Processing Unit
GTps	Gigatransfers per second
HW	Hardware
HAB	High Assurance Boot
HSP	Heat Spreader
Hz	Hertz
I/O	Input/Output
I²C (I2C)	Inter-Integrated Circuit
I²S (I2S)	Inter-Integrated Circuit Sound
IEEE	Institute of Electrical and Electronics Engineers
JEIDA	Japan Electronic Industries Development Association
JTAG	Joint Test Action Group
KS	Key State
LPDDR	Low-Power Double Data Rate
LVDS	Low-Voltage Differential Signaling
Mbps	Megabits per second
MBps	Megabytes per second
MHz	Megahertz
mm	Millimeter
MMU	Memory Management Unit
mVpp	Millivolts Peak to Peak
MXM	Mobile PCI Express Module
NC	Not Connected
Nm	Newton metre
NXP	NeXt exPerience
OS	Operating System
OTG	On-The-Go
PCB	Printed Circuit Board
PCI Express	Peripheral Component Interconnect Express
PHY	Physical Layer
PMIC	Power Management Integrated Circuit
PN	Part Number
QSPI	Quad Serial Peripheral Interface
RGMII	Reduced Gigabit-Media Independent Interface
RS-232	Recommended Standard 232
RTC	Real-Time Clock
SAI	Synchronous Audio Interface
SD	Secure Digital
SDIO	Secure Digital Input Output
SDR	Single Data Rate
SDRAM	Synchronous Dynamic Random Access Memory
SDXC	Secure Digital eXtended Capacity
SGET	Standardization Group for Embedded Technologies e.V
SMARC	Smart Mobility ARChitecture
SoC	System on Chip
SPI	Serial Peripheral Interface
TBD	To Be Defined
UART	Universal Asynchronous Receiver-Transmitter
U-Boot	Universal Boot Loader
UHS	Ultra High Speed
USB	Universal Serial Bus
uSDHC	ultra Secured Digital Host Controller
V	Volt
Vdc	Volts direct current
VESA	Video Electronics Standards Association
W	Watt
Wi-Fi	Wireless Fidelity

1 Introduction

1.1 SMARC® Concept

The Standardization Group for Embedded Technologies e.V (SGET) defined the SMARC standard for small form factor computer modules that target applications with low power, low cost and high performance. The SMARC connector and interfaces are optimized for high-speed communication, and are suitable for ARM SoCs and low power x86 SoCs.

The SMARC standard bridges the gap between the COM Express standard and the Qseven standard by offering most of the interfaces defined in the COM Express specification at a lower power. With a footprint of 82 mm x 50 mm or 82 mm x 80 mm, the SMARC standard promotes the design of highly integrated, energy efficient systems.

Due to its small size and lower power demands, PC appliance designers can design low cost devices as well as explore a huge variety of product development options—from compact space-saving designs to fully functional systems. This solution allows scalability, product diversification and faster time to market.

1.2 conga-SMX8-X

The conga-SMX8-X is based on the SMARC 2.1 Specification and features an NXP® i.MX 8QuadXPlus or 8DualXPlus applications processor. With a maximum power consumption of 5 W, the conga-SMX8-X is a low power module with high computing performance.

By offering most of the functional requirement for any SMARC application, the conga-SMX8-X provides manufacturers and developers with a platform to jump-start the development of systems and applications based on SMARC specification. Its features and capabilities make it an ideal platform for designing compact, energy-efficient, performance-oriented embedded systems.

1.2.1 Options Information

The conga-SMX8-X is available in four commercial and three industrial variants:

Table 1 Commercial Variants

PN	051100	051101	051103	051104
NXP® Processor	i.MX 8QuadXPlus	i.MX 8DualXPlus	i.MX 8QuadXPlus	i.MX 8QuadXPlus
Cortex®-A35	4x 1.2 GHz	2x 1.2 GHz	4x 1.2 GHz	4x 1.2 GHz
SDRAM	4 GB LPDDR4 @ 1200 MHz (32 bit)	2 GB LPDDR4 @ 1200 MHz (32 bit)	2 GB LPDDR4 @ 1200 MHz (32 bit)	4 GB LPDDR4 @ 1200 MHz (32 bit)
Ethernet	2x 1 Gigabit	2x 1 Gigabit	2x 1 Gigabit	2x 1 Gigabit
Wi-Fi/BT	Assembly Option	Assembly Option	Assembly Option	Yes
USB	1x USB 2.0 OTG 2x USB 2.0 2x USB 3.0	1x USB 2.0 OTG 2x USB 2.0 2x USB 3.0	1x USB 2.0 OTG 2x USB 2.0 2x USB 3.0	1x USB 2.0 OTG 1x USB 2.0 2x USB 3.0
Audio	2x I²S (default)	2x I²S (default)	2x I²S (default)	2x I²S (default)

Table 2 Industrial Variants

PN	051110	051111	051113
NXP® Processor	i.MX 8QuadXPlus	i.MX 8DualXPlus	i.MX 8QuadXPlus
Cortex®-A35	4x 1.0 GHz	2x 1.0 GHz	4x 1.0 GHz
SDRAM	4 GB LPDDR4 @ 1200 MHz (32 bit)	2 GB LPDDR4 @ 1200 MHz (32 bit)	2 GB LPDDR4 @ 1200 MHz (32 bit)
Ethernet	2x 1 Gigabit	2x 1 Gigabit	2x 1 Gigabit
Wi-Fi/BT	Assembly Option	Assembly Option	Assembly Option
USB	1x USB 2.0 OTG 2x USB 2.0 2x USB 3.0	1x USB 2.0 OTG 2x USB 2.0 2x USB 3.0	1x USB 2.0 OTG 2x USB 2.0 2x USB 3.0
Audio	2x I²S	2x I²S	2x I²S

1.2.2 Accessories

Table 3 conga-SMX8-X Adapters

PN	48000023
Product	RS-232 adapter cable for conga-ARM modules
Description	Adapter cable for ARM console. MOLEX PicoBlade 6 circuit to two D-SUB 9 connectors.

2 Specifications

2.1 Feature List

Form Factor	SMARC® form factor specification, revision 2.1 (82 mm x 50 mm)	
SoC	NXP® i.MX 8QuadXPlus or 8DualXPlus	
Memory	Up to 4 GB onboard LPDDR4 memory @ 1200 MHz	
Storage	SPI NOR flash memory with up to 256 Mbit (64 Mbit assembled by default) eMMC™ 5.1 HS400 with up to 128 GB (16 GB assembled by default)	
Audio	Up to 2x I²S	
Ethernet	Up to 2x GbE with support for IEEE 1588	
Display Interfaces	Support for up to two independent displays: 2x Single channel LVDS/DSI or 1x Dual channel LVDS/DSI (default)	
Peripheral Interfaces	1x MIPI CSI-2 with four lanes 1x SD/SDIO Card Interface 2x SPI I²C Up to 4x Serial Ports (SER3 instead of CAN1 via assembly option) 2x CAN with support for CAN FD (FlexCAN) 1x USB 2.0 OTG Up to 2x USB 2.0 (Wi-Fi/BT instead of USB4 via assembly option) Up to 2x USB 3.0/2.0	1x PCI Express x1 Gen3 12x GPIOs 1x Onboard JTAG Debug Connector (assembly option) 1x Onboard A35 Console and SCU Debug Connector[1] 1x Onboard Wi-Fi/BT M.2 1216 Module (assembly option; default on PN: 051104) **NOTE**: 1 *Requires RS-232 adapter cable PN: 48000023 (See Table 3).*
Features	Watchdog timer	Onboard Discrete Real-Time Clock (RTC)
Bootloader	U-Boot	
Virtualization	Multiple domains with hardware virtualization Multiple Operating Systems	System MMU Resource partitioning and split GPU
Security	High Assurance Boot (HAB) TrustZone®	Cryptographic Acceleration and Assurance Module (CAAM)

2.2 Supported Operating Systems

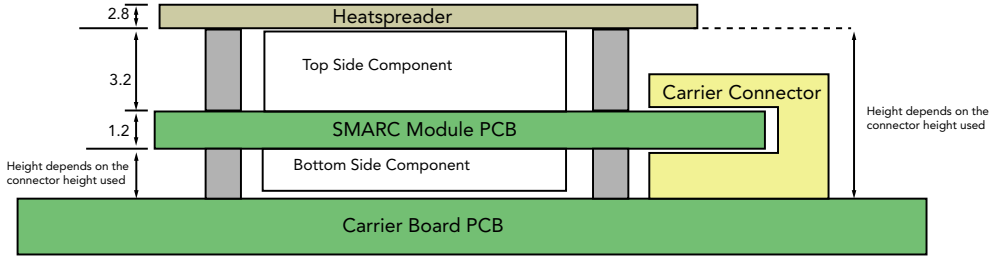
The conga-SMX8-X supports the following operating systems:

- Linux® (Yocto Project®)
- Android™

2.3 Mechanical Dimensions

- 82.0 mm x 50.0 mm

The height of the module, heatspreader and stack is shown below:

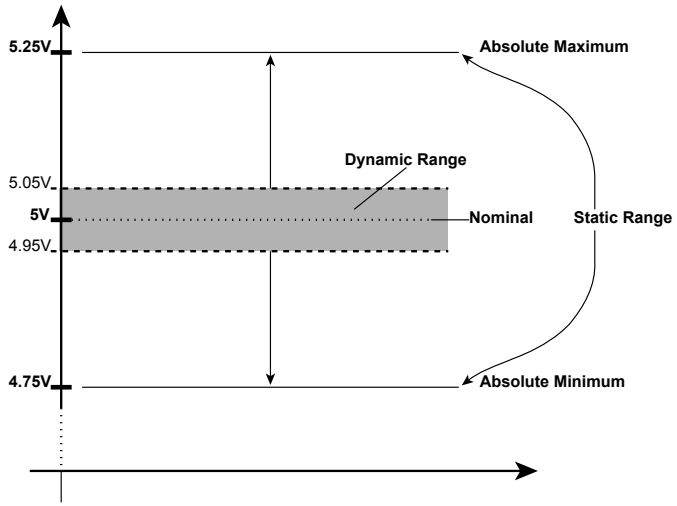


All dimensions are in millimeters

2.4 Standard Power

2.4.1 Supply Voltage

- 4.75 V – 5.25 V



2.4.2 Electrical Characteristics

Characteristics			Min.	Typ.	Max.	Units	Comment
5V	Voltage	± 5%	4.75	5.00	5.25	Vdc	
	Ripple		-	-	± 50	mV_{PP}	0-20 MHz
	Current						

2.4.3 Rise Time

The input voltages shall rise from 10 percent of nominal to 90 percent of nominal at a minimum slope of 250 V/s. The smooth turn-on requires that, during the 10 percent to 90 percent portion of the rise time, the slope of the turn-on waveform must be positive.

2.5 Power Consumption

The power consumption values were measured with the following setup:

- Input voltage +5 V
- conga-SMX8-X
- conga-SEVA carrier board
- conga-SMX8-X cooling solution

The power consumption values were recorded during the following operating modes:

Table 4 Measurement Description

System State	Description	Comment
KS1	Standby mode	For more information about the key states, refer to the Application Note "i.MX 8M Mini Power Consumption Measurement" available on the NXP website www.nxp.com.
KS3	User idle mode	
100% Workload	100% CPU workload	The CPU was stressed to its maximum frequency.
Peak Power Consumption	100% CPU workload at approximately 100°C peak power consumption	Consider this value when designing the system's power supply to ensure that sufficient power is supplied during worst case scenarios.

Note

1. *The peripherals did not influence the measured values because they were powered externally.*

The table below provides the power consumption values of each conga-SMX8-X variant during different operating modes:

Table 5 Power Consumption Values

PN	Memory Size	HW Revision	U-Boot	CPU	Current (A) @ 5 V			
					KS1	KS3	100% Workload	Peak Power Consumption
51100	4 GB	B.1	2018.03, rel_cgtsx8x_20-11-18-0	i.MX 8QuadXPlus	0.10	0.43	0.91	0.99
51101	2 GB	B.1	2018.03, rel_cgtsx8x_20-11-18-0	i.MX 8DualXPlus	0.10	0.42	0.78	0.89
51103	2 GB	B.1	2018.03, rel_cgtsx8x_20-11-18-0	i.MX 8QuadXPlus	0.10	0.40	0.88	0.91
51104	4 GB	B.1	2018.03, rel_cgtsx8x_20-11-18-0	i.MX 8QuadXPlus	0.10	0.45	0.90	0.97
51110	4 GB	B.1	2018.03, rel_cgtsx8x_20-11-18-0	i.MX 8QuadXPlus	0.09	0.42	0.87	0.94
51111	2 GB	B.1	2018.03, rel_cgtsx8x_20-11-18-0	i.MX 8DualXPlus	0.10	0.37	0.75	0.82
51113	2 GB	B.1	2018.03, rel_cgtsx8x_20-11-18-0	i.MX 8QuadXPlus	0.09	0.37	0.80	0.89

2.6 Supply Voltage Battery Power

Table 6 CMOS Battery Power Consumption

RTC @	Voltage	Current
-10°C	3V DC	1.09 µA
20°C	3V DC	1.14 µA
70°C	3V DC	1.22 µA

Note

1. *Do not use the CMOS battery power consumption values listed above to calculate CMOS battery lifetime.*
2. *Measure the CMOS battery power consumption in your customer specific application in worst case conditions (for example, during high temperature and high battery voltage).*
3. *Consider the self-discharge of the battery when calculating the lifetime of the CMOS battery. For more information, refer to application note AN9_RTC_Battery_Lifetime.pdf on congatec website at www.congatec.com/support/application-notes.*
4. *We recommend to always have a CMOS battery present when operating the conga-SMX8-X.*

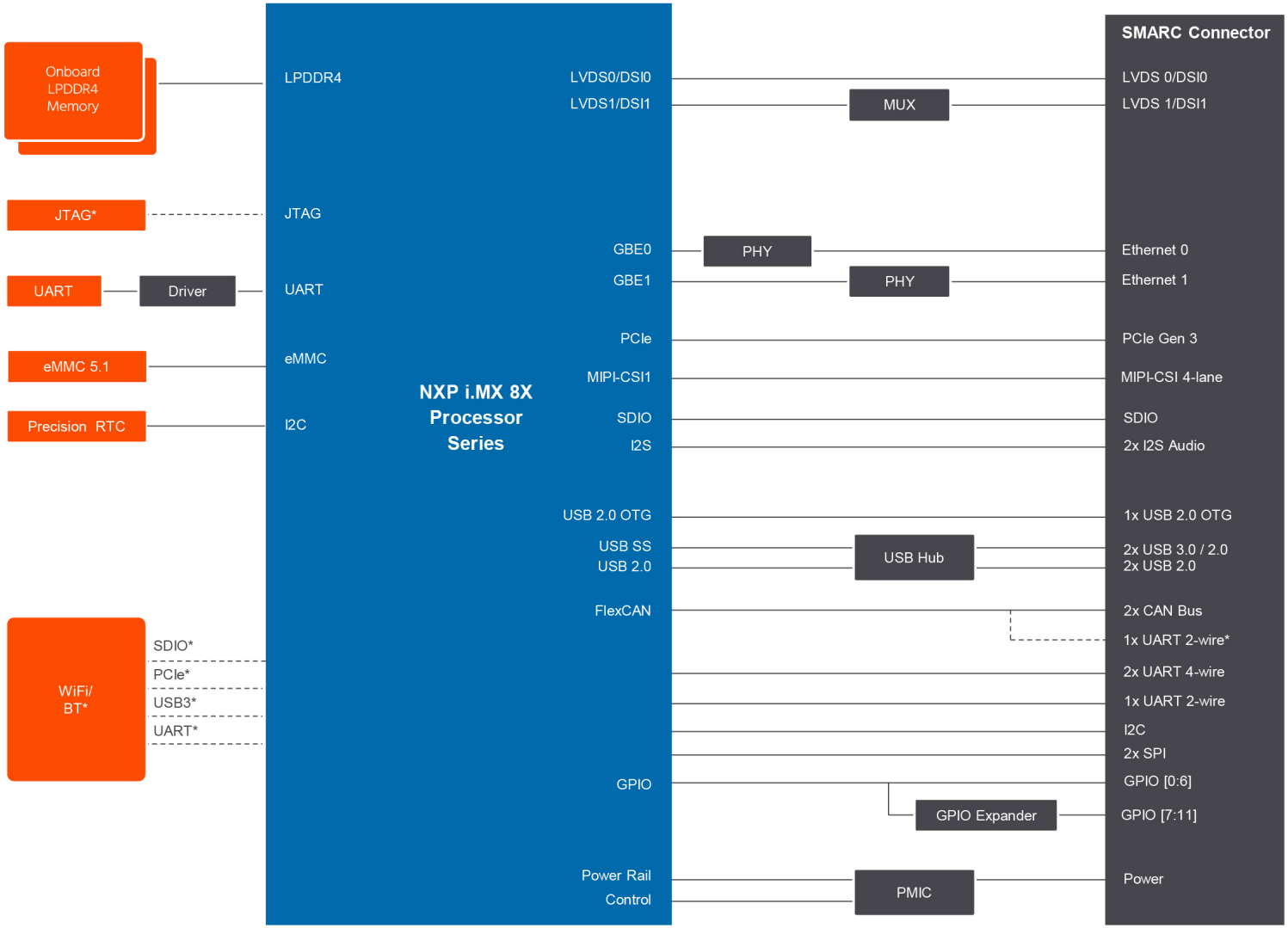
2.7 Environmental Specifications

Temperature (commercial variants)	Operation: 0° to 60°C	Storage: -40° to +85°C
Temperature (industrial variants)	Operation: -40° to 85°C	Storage: -40° to +85°C
Humidity	Operation: 10% to 90%	Storage: 5% to 95%

Caution

1. *The above operating temperatures must be strictly adhered to at all times. When using a congatec heatspreader, the maximum operating temperature refers to any measurable spot on the heatspreader's surface.*
2. *Humidity specifications are for non-condensing conditions.*

3 Block Diagram



* Assembly Option

4 Cooling Solutions

congatec GmbH offers the following cooling solutions for the conga-SMX8-X variants. The dimensions of the cooling solutions are shown in the sub-sections. All measurements are in millimeters.

Table 7 Cooling Solution Variants

Cooling Solution	PN	Description
CSP	051150	Passive cooling solution for SMARC module conga-SMX8-X with lidded NXP i.MX 8X ARM processor. All standoffs are with 2.7mm bore hole.
HSP	051151	Heat spreader solution for SMARC module conga-SMX8-X with lidded NXP i.MX 8X ARM processor. All standoffs are with 2.7mm bore hole.
CSA-Adapter	051060	Active cooling solution adapter for SMARC modules used in combination with module heat spreader.

Note

1. *We recommend a maximum torque of 0.4 Nm for carrier board and module mounting screws.*

2. *The gap pad material used on congatec heatspreaders may contain silicon oil that can seep out over time depending on the environmental conditions it is subjected to. For more information about this subject, contact your local congatec sales representative and request the gap pad material manufacturer's specification.*

Caution

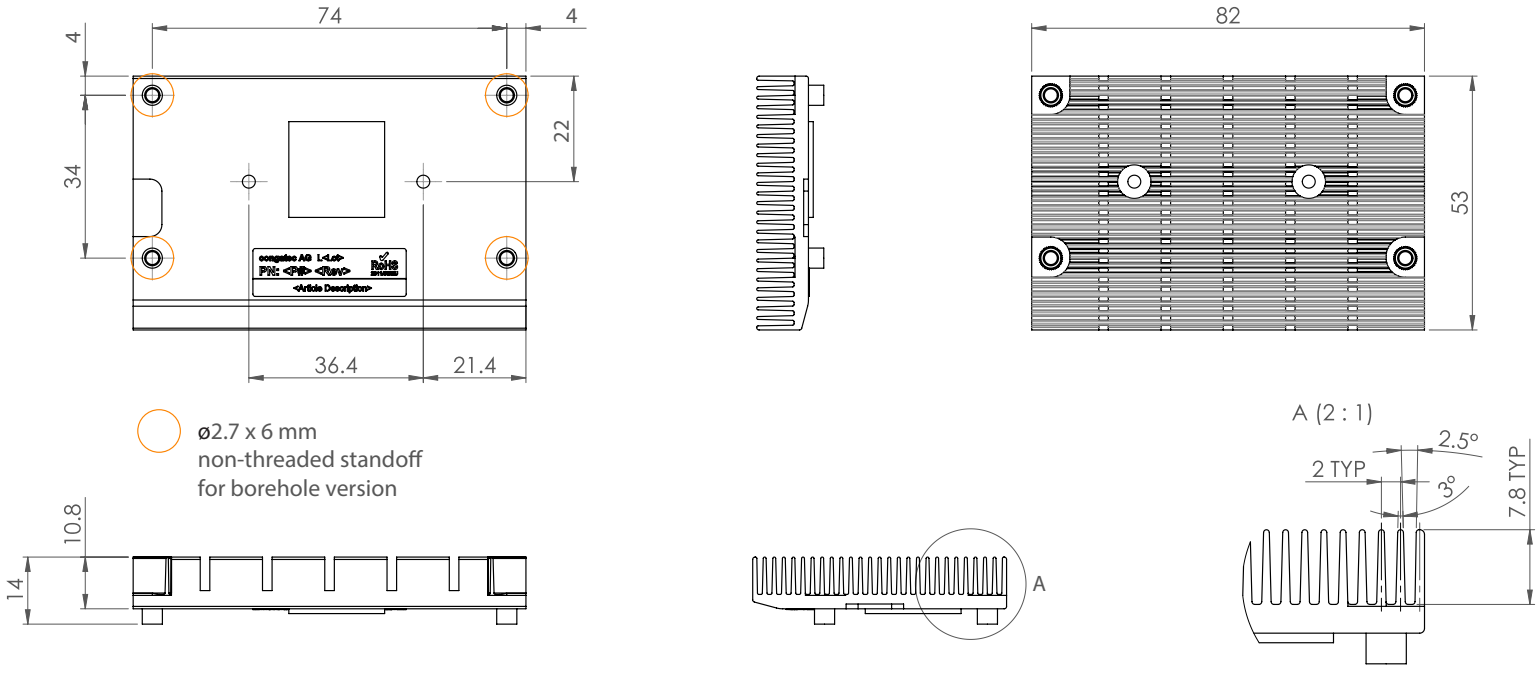
1. *The congatec heatspreaders/cooling solutions are tested only within the commercial temperature range of 0° to 60°C. Therefore, if your application that features a congatec heatspreader/cooling solution operates outside this temperature range, ensure the correct operating temperature of the module is maintained at all times. This may require additional cooling components for your final application's thermal solution.*

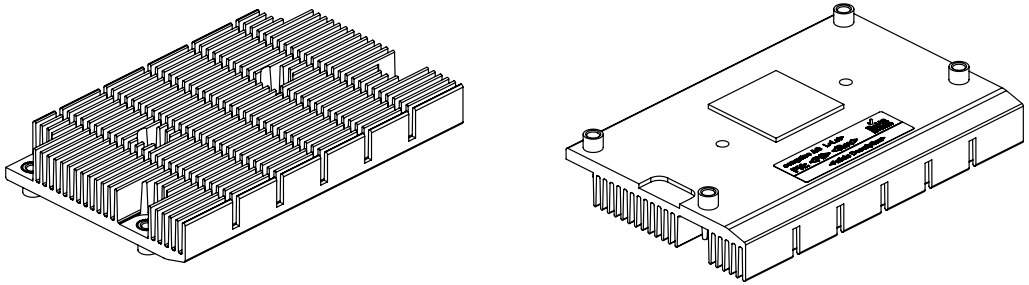
2. *For adequate heat dissipation, use the mounting holes on the cooling solution to attach it to the module. Apply thread-locking fluid on the screws if the cooling solution is used in a high shock and/or vibration environment. To prevent the standoff from stripping or cross-threading, use non-threaded carrier board standoffs to mount threaded cooling solutions.*

3. *For applications that require vertically-mounted cooling solution, use only coolers that secure the thermal stacks with fixing post. Without the fixing post feature, the thermal stacks may move.*

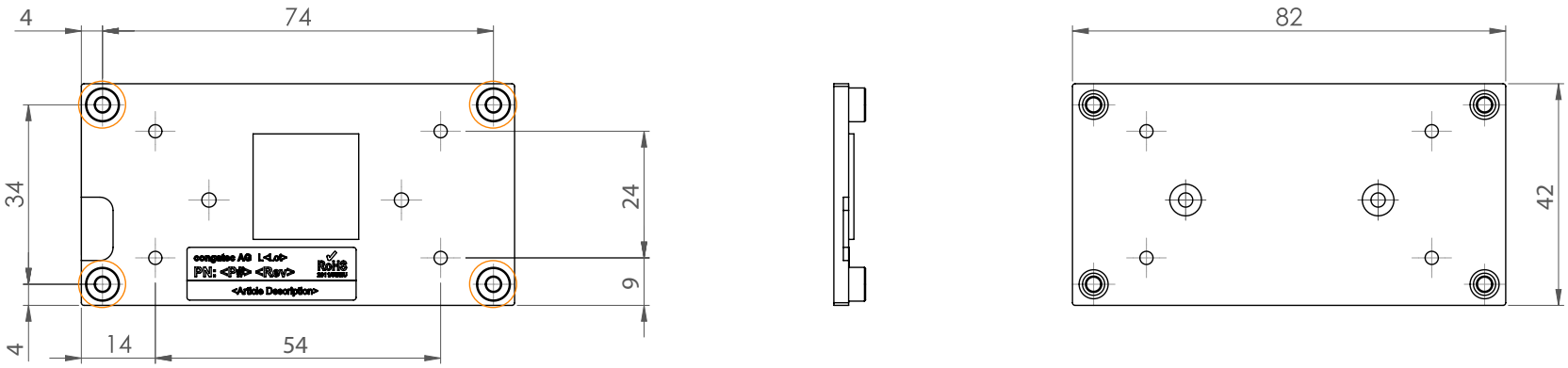
4. *Do not exceed the recommended maximum torque. Doing so may damage the module or the carrier board, or both.*

4.1 CSP Dimensions

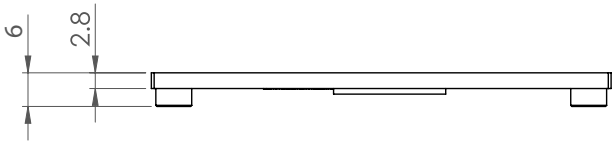


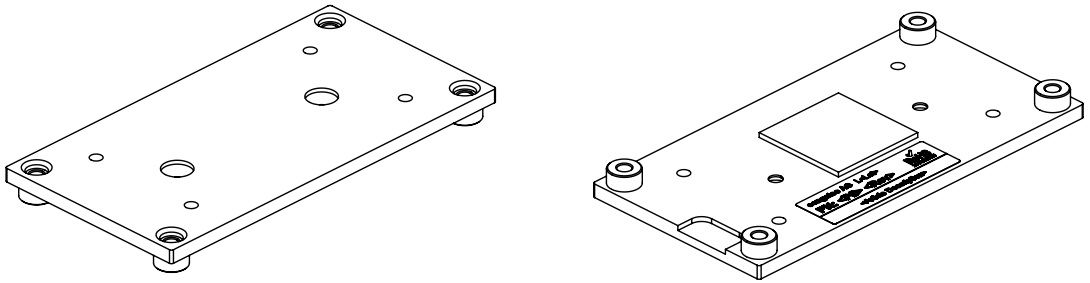


4.2 HSP Dimensions



ø2.7 x 6 mm
non-threaded standoff
for borehole version





5 Connector Rows

The conga-SMX8-X has 314 edge fingers that mate with the MXM3 connector located on the carrier board. This connector is able to interface the signals of the conga-SMX8-X with the carrier board peripherals.

5.1 Display Interfaces

The conga-SMX8-X supports up to two independent displays as shown in the table below:

Table 8 Display Combination

Display 1		Display 2	
Interface	Max. Resolution	Interface	Max. Resolution
Dual-channel LVDS/DSI	1080p60	-	-
Single-channel LVDS/DSI	1080p60	Single-channel LVDS/DSI	1080p60

5.1.1 LVDS/DSI

The conga-SMX8-X offers LVDS[0:1] pins for one dual channel LVDS display or two independent single channel LVDS displays.

Alternatively, the LVDS[0:1] pins can be used as DSI[0:1] pins for up to two MIPI DSI displays instead.

5.2 Camera Inteface (MIPI® CSI)

The conga-SMX8-X offers CSI1 pins for one MIPI CSI-2 camera with up to four lanes and supports a bitrate of up to 1.5 Gbps per lane.[1]

Note

1. *The conga-SMX8-X does not offer CSI0 pins.*

5.3 SDIO Card (4 bit) Interface

The conga-SMX8-X offers SDIO pins for one SD/SDIO card interface. This interface supports:

- SD/SDIO specification 3.0
- 200 MHz SDR signaling for up to 100 MBps
- Secure Digital eXtended Capacity (SDXC™) cards
- UHS-I @SDR 104/50 and DDR50 [1]
- Default Mode and High Speed Mode

Note

1. *UHS-I support is disabled in the congatec software (kernel and bootloader) by default. Check if your carrier board supports UHS-I before enabling it.*

5.4 SPI

The conga-SMX8-X offers SPI[0:1] pins for one Serial Peripheral Interface (SPI) via SPI1 pins and one Quad SPI (QSPI) via SPI1 pins.[1]

Note

1. *The conga-SMX8-X does not support eSPI.*

5.5 Audio (I2S)

The conga-SMX8-X offers I2S0[1] and I2S2 pins for up to two Inter-IC Sound (I²S) buses.

5.6 I2C Interfaces

The conga-SMX8-X offers the Inter-Integrated Circuit (I2C) buses as defined in the SMARC Hardware Specification 2.1. The buses support the recommended multi-master capability and data rates of 100 kHz and 400 kHz.

The I²C device addresses are listed in the table below:

Table 9 I2C Interfaces

I2C-Bus	Sink	Sink Address
PMIC_I2C	PMIC	0x08
M40_I2C0	RTC	0xD0
ADMA_I2C1	SMARC-I2C_PM	
ADMA_I2C3	SMARC-I2C_GP Expander	0x72 .. x073
MIPI_DSI0_I2C0	SMARC-I2C_LCD	
MIPI_DSI1_I2C0	TMDS-converter	0x7A
MIPI_CSI_I2C0	SMARC-CAM1_I2C	

5.7 Serial Ports

The conga-SMX8-X offers SER[0:2] pins for three asynchronous serial ports by default. Each port supports programmable baud rates of up to 4 Mbps. SER0 and SER2 support handshaking.

Optionally, the conga-SMX8-X can offer SER3 pins instead of CAN1 (assembly option). For more information, see section 5.8 “CAN Bus”.

5.8 CAN Bus

The conga-SMX8-X offers CAN[0:1] pins for two Controller Area Network (CAN) buses by default via ISO 11898-1 standard compliant FlexCAN controllers integrated in the SoC. Each bus supports the CAN FD and CAN 2.0 B protocols.

Optionally, the conga-SMX8-X can offer SER3 pins instead of the CAN1 pins (assembly option).

5.9 USB Interfaces

The conga-SMX8-X offers pins for five USB ports by default. The USB[1:4] pins are provided via a TI TUSB8041 USB 3.0 hub. USB0 is directly routed to the SoC.

Optionally, the conga-SMX8-X can be offered without the USB hub and the USB signals from the SoC directly routed to the USB3 pins instead (assembly option).

Optionally, the conga-SMX8-X can offer an onboard Wi-Fi/BT module instead of the USB4 pins.[1] For more information, see section 6.4 "Wi-Fi and Bluetooth".

The table below shows the default and optional USB combinations:

Table 10 USB Combination

SMARC	Default	Assembly Option (With Wi-Fi/BT)	Assembly Option (Without USB Hub)
USB0[2]	USB 2.0 OTG	USB 2.0 OTG	USB 2.0 OTG
USB1	USB 2.0	USB 2.0	N/A
USB2	USB 3.0	USB 3.0/2.0	N/A
USB3	USB 3.0	USB 3.0/2.0	USB 3.0/2.0 OTG
USB4	USB 2.0	Wi-Fi/BT Module	N/A

Note

1. *The conga-SMX8-X module variant PN: 051104 offers Wi-Fi/BT by default instead of USB4.*
2. *USB0 is used for the Serial Downloader mode. Fore more information, see FORCE_RECOV# description in section 5.13 "Boot Select".*

5.10 PCI Express™

The conga-SMX8-X offers PCIE_A pins for one PCI Express x1 Gen3 bus with a bitrate of up to 8 GTps.

Note

1. *The SMARC_PCIE_WAKE# signal is currently not supported.*

5.11 Ethernet

The conga-SMX8-X offers GBE[0:1] pins for two ethernet interfaces via two onboard Atheros AR8031 Physical Layers (PHYs). Both interfaces support 10/100/1000 Mbps and the IEEE 1588-2008 standard—also known as Precision Time Protocol (PTP) Version 2.

Note

1. *The Wake-on-LAN (WoL) feature is currently not supported.*

5.12 GPIO

The conga-SMX8-X offers GPIO[0:11] pins for twelve GPIOs as defined in the SMARC Hardware Specification 2.1.

The GPIO[7:9] pins are provided via a PCAL9538ABS GPIO expander with the I²C address 0x73.

The GPIO[10:11] pins are provided via a PCAL9538ABS GPIO expander with the I²C address 0x72.

5.13 Boot Select

BOOT_SEL[0:2]#

The boot source can be selected via the SMARC connector pins BOOT_SEL[0:2]# as described in the table below: [1]

BOOT_SEL			Selected Boot Source
0#	1#	2#	
Float	Ground	Ground	SPI flash (default) [2]
Ground	Ground	Float	SD card
Ground	Float	Float	Serial Download Mode [3]

On the conga-SEVA evaluation carrier board, the boot source can be selected via DIP switches M17 and M18 as described in the table below:

M17		M18	Selected Boot Source
#1	#2	#1	
OFF	ON	ON	SPI flash (default) [2]
ON	ON	OFF	SD card
ON	OFF	OFF	Serial Download Mode [3]

The OS boot device is defined via the U-Boot environment variables. For more information, refer to the conga-SMX8-X online software documentation at https://wiki.congatec.com

Note

1. *The available boot sources and their selection via BOOT_SEL[0:2]# pins corresponds with the boot mode options and configuration pins defined by NXP. Therefore, select the desired boot source according to this table instead of the SMARC specification.*

2. *The pre-compiled binaries from congatec only support SPI flash as the boot source.*

3. *The Serial Download Mode can also be selected via the FORCE_RECOV# pin. For normal operation, ensure this pin is not low.*

FORCE_RECOV#

Low on the FORCE_RECOV# pin enables the Serial Download Mode regardless of the selected boot source via the BOOT_SEL[0:2]# pins. For normal operation, ensure this pin is not low. The program image can be downloaded over the USB0 port (see section 5.9 “USB Interfaces”).

On the conga-SEVA evaluation carrier board, set the jumper X45 to position 2-3 to enable the Serial Download Mode. For normal operation, ensure the jumper X45 is set to the default position 1-2.

5.14 Power Control

The module operates within an input voltage range of 5 V. The power-up sequence is described below:

1. The carrier board provides the input voltage (VDD_IN) to the module.
2. If VIN_PWR_BAD# is not driven low, the module enables its power circuits.
3. After the first VIN power on, the module starts the power-up sequence.
4. The module enables the carrier board power by asserting CARRIER_PWR_ON (SUS_S5#) and CARRIER_STBY# (SUS_S3#).
5. The module releases RESET_OUT# and starts the boot process.

The power control signals are described below:

VIN_PWR_BAD#

VIN_PWR_BAD# (pin S150) is an active-low input signal. It indicates that the input voltage to the module is either not ready or out of specified range. Carrier board hardware should drive this signal low until the input power is up and stable. Releasing VIN_PWR_BAD# too early can cause numerous boot up problems. The module has a 10k pull up resistor to VDD_IN.

CARRIER_PWR_ON

CARRIER_PWR_ON (pin S154) is an active-high output signal. The module asserts this signal to enable power supplies for devices connected to the carrier board.

CARRIER_STBY#

The CARRIER_STBY# signal (pin S153) is an active-low output that can be used to indicate that the module is going into suspend state, where the A53 core power is turned off.

RESET_IN#

The RESET_IN# signal (pin P127) is an active-low input signal from the carrier board. The signal may be used to force the module to reset.

RESET_OUT#

The RESET_OUT# signal (pin P126) is an active-low output signal from the module. The module asserts this signal during the power-up sequencing to allow the carrier board power circuits to come up. The module deasserts this signal to begin the boot-up process.

POWER_BTN#

The POWER_BTN# (pin P128) is an active-low power button input from the carrier board. This power button signal is used to wake the system. Driving this signal low for at least 5 seconds powers off the system immediately.

Power Supply Implementation Guidelines

The operational power source for the conga-SMX8-X is 5 V. The remaining necessary voltages are internally generated on the module with onboard voltage regulators.

A carrier board designer should be aware of the important information below when designing a power supply for a conga-SMX8-X application:

- We have noticed that on some occasions, problems occur when using a 5 V power supply that produces non monotonic voltage when powered up. The problem is that some internal circuits on the module (e.g. clock-generator chips) generate their own reset signals when the supply voltage exceeds a certain voltage threshold. A voltage dip after passing this threshold may lead to these circuits becoming confused, thereby resulting in a malfunction. This problem though rare, has been observed in some mobile power supply applications. The best way to ensure that this problem is not encountered is to observe the power supply rise waveform through an oscilloscope. This will help to determine if the rise is indeed monotonic and does not have any dips. You should do this during the power supply qualification phase to ensure that the problem does not occur in the application. For more information, see the "Power Supply Design Guide for Desktop Platform Form Factors" document at www.intel.com.

Inrush and Maximum Current Peaks on VDD_IN

The maximum peak-current on the conga-SMX8-X VDD_IN (5 V) power rail can be as high as 0.77 A for a maximum of 109 µs. You should therefore ensure the power supply and decoupling capacitors provide enough power to drive the module.

Note

1. *For more information about power control event signals, refer to the SMARC® specification.*

6 Onboard Interfaces and Devices

6.1 DRAM

The conga-SMX8-X offers up to 4 GB 32 bit LPDDR4 onboard SDRAM @ 1200 MHz. The memory size of each conga-SMX8-X variant is listed in section 1.2.1 “Options Information”.

6.2 eMMC

The conga-SMX8-X offers an onboard eMMC 5.1 HS400 storage device with up to 128 GB (16 GB assembled by default). Changes to the onboard eMMC may occur during the lifespan of the module in order to keep up with the rapidly changing eMMC technology. The performance of the newer eMMC may vary depending on the eMMC technology.

Note

1. *For adequate operation of the eMMC, ensure that at least 15 % of the eMMC storage is reserved for vendor-specific functions.*

6.3 SPI NOR Flash

The conga-SMX8-X offers an onboard SPI NOR flash memory chip with up to 128 Mbit (64 Mbit assembled by default). The SPI NOR flash memory chip is connected via QSPI by default.

6.4 Wi-Fi and Bluetooth

Optionally, the conga-SMX8-X can offer Wi-Fi and Bluetooth connectivity via an onboard H&D Wireless SPB228 M.2 1216 module instead of USB4 (assembly option).[1]

USB4 is recommended but it is also possible to connect the module via SDIO (instead of SDIO pins), PCI Express (instead of PCIE_A pins), or Serial Port (instead of SER2 pins; can only be used for BT).

Note

1. *PN: 051104 offers Wi-Fi/BT instead of USB4 pins by default.*

6.5 RTC

The conga-SMX8-X offers a discrete Real-Time Clock (RTC) via an onboard MicroCrystal RV-4162-C7 module with the I²C device address 0xD0.

6.6 Console and Debug Interfaces

6.6.1 A35 Console and SCU Debug

The conga-SMX8-X offers a Cortex®-A35 console and an SCU debug interface via the onboard connector X2.

The connector pinout is described in the table below:

Table 11 A35 and SCU Connector (X2) Pinout Description

Pin	SoC Ball	Description
1	SCU_GPIO0_01	SCU Debug: Transmit signal via ISL3243E RS-232 Transmitter/Receiver connected to UART4_TXD of the SoC
2	+VIN	SMARC VDD_IN (+5 V)
3	GND	Ground
4	UART2_TXD	A35 Console: Transmit signal via ISL3243E RS-232 Transmitter/Receiver connected to UART2_TXD of the SoC
5	UART2_RXD	A35 Console: Receive signal via ISL3243E RS-232 Transmitter/Receiver connected to UART2_RXD of the SoC
6	SCU_GPIO0_00	SCU Debug: Receive signal via ISL3243E RS-232 Transmitter/Receiver connected to UART4_RXD of the SoC

Connector Type

X2: Molex PicoBlade 0532610671 (6 Circuits, 1.25mm Pitch, Right-Angle, Friction Lock)
Mates with Molex PicoBlade Cable Assembly Series 15134 with 6 Circuits
For a matching cable with two D-SUB 9 connectors, see Table 3.

6.6.2 JTAG Debug

Optionally, the conga-SMX8-X can offer an onboard JTAG debug interface (X1) (assembly option).

The connector pinout is described in the table below:

Table 12 Optional JTAG Debug Connector (X1) Pinout Description

Pin	Pin	Description
1	JTAG_VTREF	+1.8V sourced by Module
2	JTAG_TMS	JTAG mode select
3	GND	Ground
4	JTAG_TCK	JTAG clock
5	GND	Ground
6	JTAG_TDO	JTAG data out
7	JTAG_RTCLK	Not connected
8	JTAG_TDI	JTAG data in
9	JTAG_TRST#_R	Not used
10	JTAG_SRST#	System Reset, active low

Connector Type

X1: 5x2 Pin Header, 1.27 mm Pitch

Note

1. *Test Access Port Controller Reset (TRST) can be performed via Test Mode Select (TMS) signalling.*

7 Signal Descriptions and Pinout Tables

Click on the screenshot or link below to directly download the conga-SMX8-X pinout as an Excel file:

X3A + X3B - SMX8X SMARC edge connection							
SMX8X Interface	i.MX8X Ball Name	i.MX8X BGA609 Ball	SMARC conncetion	SMARC Pin Name	SMARC Pin	Remark	alt. Function
SMARC Gigabit Ethernet 1				GBE1_MDI3+	S26	Ethernet controller 1 (AR8033), i.MX8X:ENET1	Ethernet controller 1 (AR8031), i.MX8X:ENET1
SMARC Gigabit Ethernet 0				GBE0_MDI1+	P27	Ethernet controller 0 (AR8033), i.MX8X:ENET0	Ethernet controller 0 (AR8031), i.MX8X:ENET0
SMARC Gigabit Ethernet 1				GBE1_MDI3-	S27	Ethernet controller 1 (AR8033), i.MX8X:ENET1	Ethernet controller 1 (AR8031), i.MX8X:ENET1
n.c. - optional				GBE0_CTREF	P28	open	(+R255 : GND)
n.c. - optional				GBE1_CTREF	S28	open	(+R300 : GND)
SMARC Gigabit Ethernet 0				GBE0_MDI0-	P29	Ethernet controller 0 (AR8033), i.MX8X:ENET0	Ethernet controller 0 (AR8031), i.MX8X:ENET0
n.c. - not supported			NC	PCIE_D_TX+	S29	SMARC PCIe D not supported	
SMARC Gigabit Ethernet 0				GBE0_MDI0+	P30	Ethernet controller 0 (AR8033), i.MX8X:ENET0	Ethernet controller 0 (AR8031), i.MX8X:ENET0
n.c. - not supported			NC	PCIE_D_TX-	S30	SMARC PCIe D not supported	
SMARC SPI0	SPI3_CS1	K30		SPI0_CS1#	P31		
SMARC Gigabit Ethernet 1				GBE1_LINK_ACT#	S31	Ethernet controller 1 (AR8033), i.MX8X:ENET1	Ethernet controller 1 (AR8031), i.MX8X:ENET1
GND				GND	P32		
n.c. - not supported			NC	PCIE_D_RX+	S32	SMARC PCIe D not supported	
SMARC SDIO	USDHC1_WP	D24		SDIO_WP	P33		
n.c. - not supported			NC	PCIE_D_RX-	S33	SMARC PCIe D not supported	
SMARC SDIO	USDHC1_CMD	C25		SDIO_CMD	P34	Carrier SD-Card	stuffing option to WIFI-module (if SDIO)

https://git.congatec.com/arm-nxp/imx8-family/doc/cgtimx8_pinlist/raw/cgtsx8x_pinlist/cgtsx8x_pin_connection.xlsx

Alternatively, you can find the conga-SMX8-X pinout by selecting it from the drop-down list at:

https://git.congatec.com/arm-nxp/imx8-family/doc/cgtimx8_pinlist/tree/master

The SMARC signals are described in the SMARC Hardware Specification publicly available at:

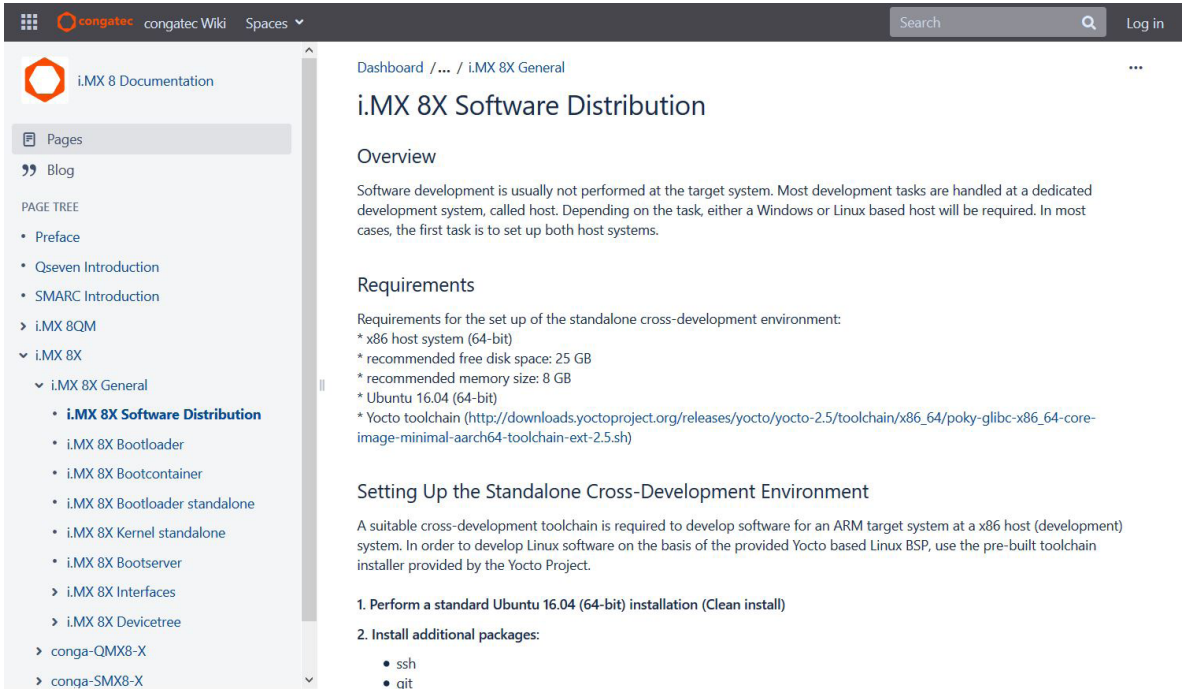
https://sget.org

The SoC documentation is available at:

https://www.nxp.com

8 Software Documentation

Click on the screenshot or link below to open the conga-SMX8-X software documentation in your browser:



https://wiki.congatec.com/display/IMX8DOC/i.MX+8X+Software+Distribution

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