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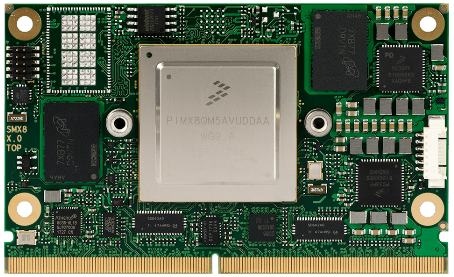
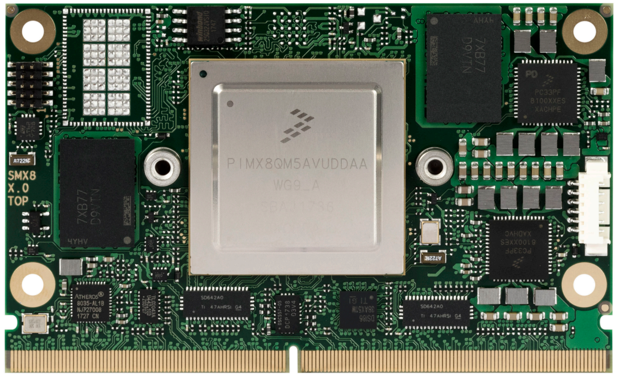
conga-SMX8

SMARC™2.0 Computer-on-Module with NXP i.MX8 ARM Cortex-A72, Cortex-A53 und Cortex-M4 Processors





SMARC® conga-SMX8

SMARC 2.1 module based on the NXP® i.MX 8QuadMax and 8QuadPlus applications processors

User's Guide

Revision 0.4 (Preliminary)

Revision History

Revision	Date (yyyy-mm-dd)	Author	Changes
0.1	2020-06-05	BEU	• Preliminary release
0.2	2021-07-06	BEU	• Updated congatec AG to congatec GmbH throughout the document • Added Software License Information to preface section • Corrected typographical error in section 6.5 “Wi-Fi and Bluetooth”
0.3	2021-08-03	BEU	• Changed specification of the module from SMARC 2.0 to SMARC 2.1 throughout the document
0.4	2021-08-11	BEU	• Updated drawings in section 4 “Cooling Solutions”

Preface

This user's guide provides information about the components, features and connectors available on the conga-SMX8. 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 Pinout Description (https://git.congatec.com/arm-nxp/imx8-family/doc/cgtimx8_pinlist/tree/cgtsmx8_pinlist)
SMARC® Design Guide 2.0 (https://sget.org)
SMARC® Specification 2.1 (https://sget.org)
NXP® i.MX 8QuadMax/8QuadPlus Data Sheet (www.nxp.com)

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Caution

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Note

Notes call attention to important information that should be observed.

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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	Display Serial Interface
D-SUB	D-Subminiature
eMMC	embedded MultiMediaCard
eSPI	enhanced Serial Peripheral Interface
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
HDMI	High-Definition Multimedia Interface
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 Secure Digital Host Controller
V	Volt
Vdc	Volts direct current
VESA	Video Electronics Standards Association
W	Watt
Wi-Fi	Wireless Fidelity

Contents

List of Tables

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

The conga-SMX8 is based on the SMARC 2.1 Specification and features an NXP® i.MX 8QuadMax or 8QuadPlus applications processor. With a typical power consumption of 5-15 W, the conga-SMX8 is a low power module with high computing performance and outstanding graphics. Additionally, the conga-SMX8 supports up to 8 GB LPDDR4 SDRAM, multiple I/O interfaces, and up to three independent displays.

By offering most of the functional requirement for any SMARC application, the conga-SMX8 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 is available in three commercial and three industrial variants:

Table 1 Commercial Variants

PN	051000	051001	051003
Processor	i.MX 8QuadMax	i.MX 8QuadPlus	i.MX 8QuadPlus
LPDDR4 SDRAM	4 GB	4 GB	2 GB

Table 2 Industrial Variants

PN	051020	051021	051023
Processor	i.MX 8QuadMax	i.MX 8QuadPlus	i.MX 8QuadPlus
LPDDR4 SDRAM	4 GB	4 GB	2 GB

1.2.2 Accessories

Table 3 conga-SMX8 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 8QuadMax or 8QuadPlus	
Memory	Up to 8 GB onboard LPDDR4 memory @ 1600 MHz (2 or 4 GB assembled by default)	
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) microSD card slot with support for SDXC cards	
Audio	2x I²S with optional support for Tensilica® HiFi 4 DSP	
Ethernet	2x GbE with support for IEEE 1588	
Display Interfaces	One 4Kp60 display or up to three independept 1080p60 displays: 1x HDMI 2.0a with HDCP 2.2 (default) or DP[1] (assembly option) 1x DP[1] 1x Dual channel LVDS 24 bit (default) or 1x DSI x4 (software option)	**NOTE**: 1 *DP++ is not supported.*
Peripheral Interfaces	1x MIPI CSI-2 with four lanes 1x MIPI CSI-2 with two lanes 1x SD/SDIO Card Interface 2x SPI 1x 4-Wire serial ports with support for handshaking 3x 2-Wire serial ports with support for data only 2x CAN with support for CAN FD (FlexCAN) 1x USB 2.0 OTG 2x USB 2.0 2x USB 3.0/2.0	2x PCIe Gen3 x1 or 1x PCIe Gen3 x2 1x SATA 6 Gbps Up to 12x GPIOs I²C 1x Onboard JTAG Debug Connector (assembly option) 1x Onboard A73/A53 Console and SCU Debug Connector[1] 1x Onboard Wi-Fi and Bluetooth M.2 1216 Module (assembly option) **NOTE**: 1 *Requires RS-232 adapter cable 48000023 (See Table 3).*
Features	Watchdog timer	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

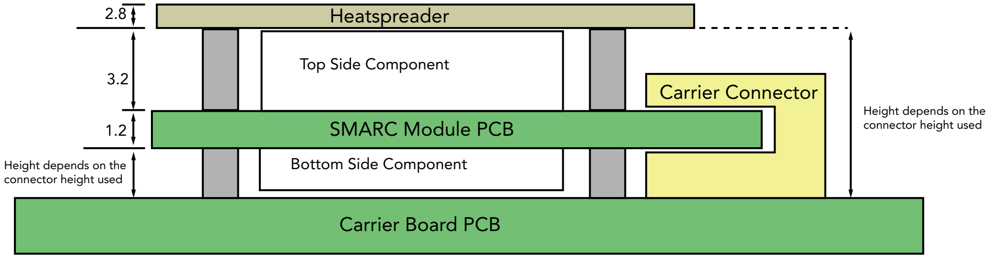
The conga-SMX8 supports the following operating systems:

- 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:

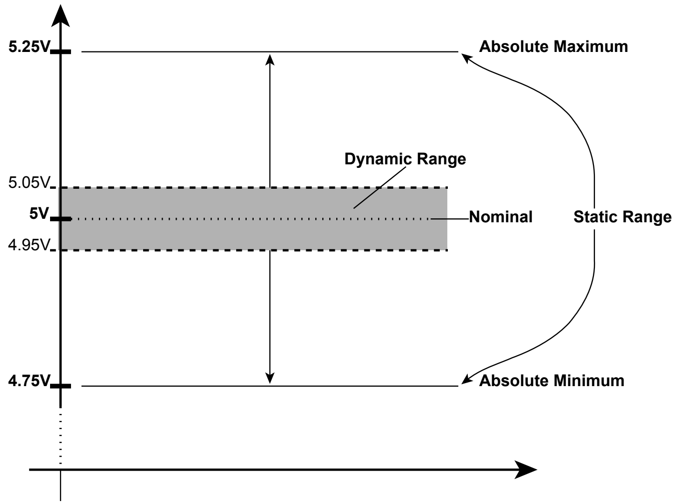


All dimensions are in millimeters

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
- conga-SEVA carrier board
- conga-SMX8 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

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 variant during different operating modes:

Table 5 Power Consumption Values

PN	Memory Size	HW Revision	U-Boot	OS	CPU	Current (A) @ 5 V			
						KS1	KS3	100% Workload	Peak Power Consumption
51000	4 GB	TBD	TBD	TBD	i.MX 8QuadMax	TBD	TBD	TBD	TBD
51001	4 GB	TBD	TBD	TBD	i.MX 8QuadPlus	TBD	TBD	TBD	TBD
51003	2 GB	TBD	TBD	TBD	i.MX 8QuadPlus	TBD	TBD	TBD	TBD
51020	4 GB	TBD	TBD	TBD	i.MX 8QuadMax	TBD	TBD	TBD	TBD
51021	4 GB	TBD	TBD	TBD	i.MX 8QuadPlus	TBD	TBD	TBD	TBD
51023	2 GB	TBD	TBD	TBD	i.MX 8QuadPlus	TBD	TBD	TBD	TBD

2.6 Supply Voltage Battery Power

Table 6 CMOS Battery Power Consumption

RTC @	Voltage	Current
-10°C	3V DC	TBD µA
20°C	3V DC	0.35 µA
70°C	3V DC	TBD 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 GmbH website at www.congatec.com/support/application-notes.*
4. *We recommend to always have a CMOS battery present when operating the conga-SMX8.*

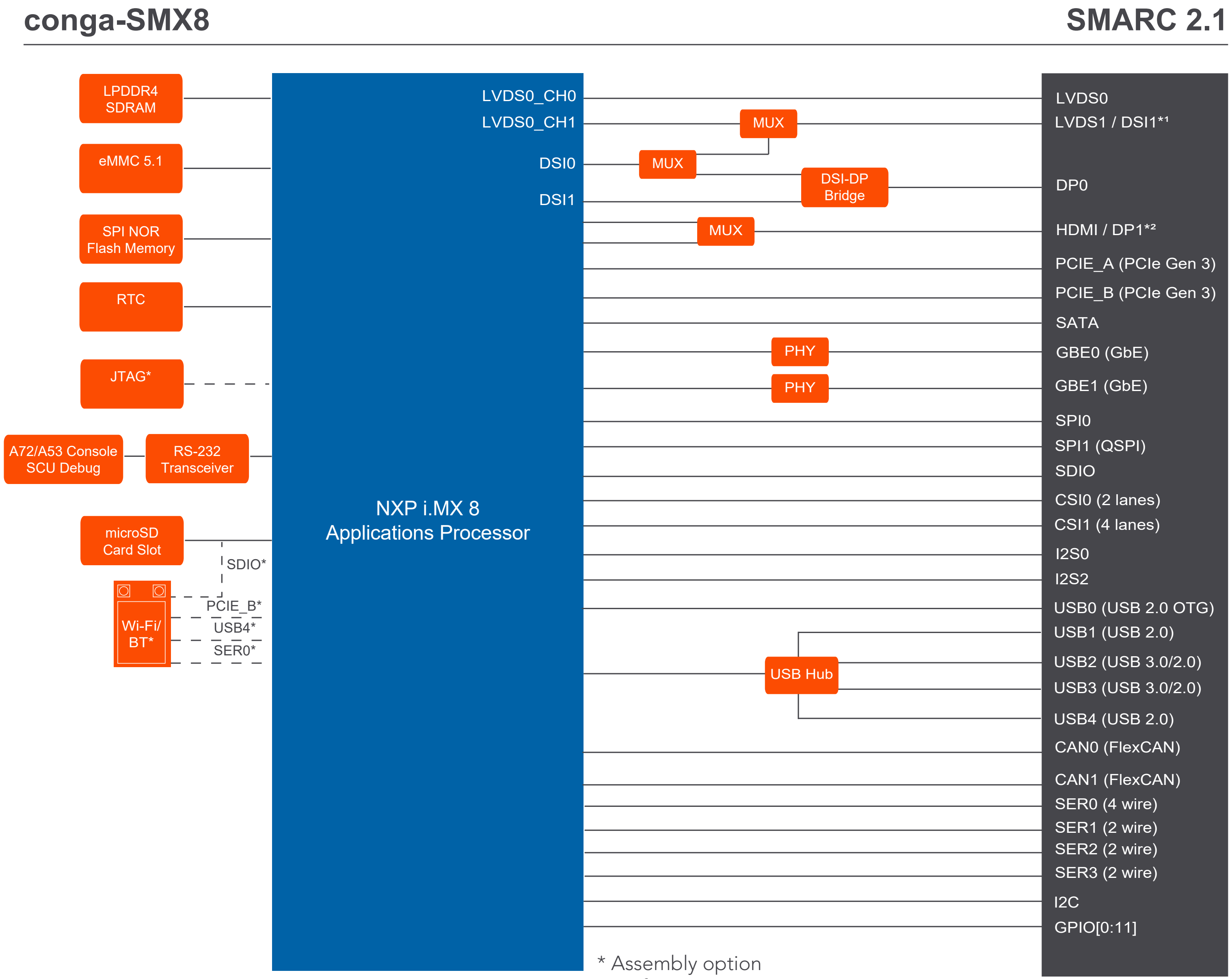
2.7 Environmental Specifications

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

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.
Humidity specifications are for non-condensing conditions.

3 Block Diagram



* Assembly option
*1 Software option
*2 Assembly + Software option

4 Cooling Solutions

congatec GmbH offers the following cooling solutions for the conga-SMX8 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	051050	Passive cooling with 2.7 mm borehole standoffs.
HSP	051051	Heatspreader with 2.7 mm borehole standoffs.
CSA-Adapter	051060	Active cooling solution adapter for SMARC 2.1 modules used in combination with module heatspreader.

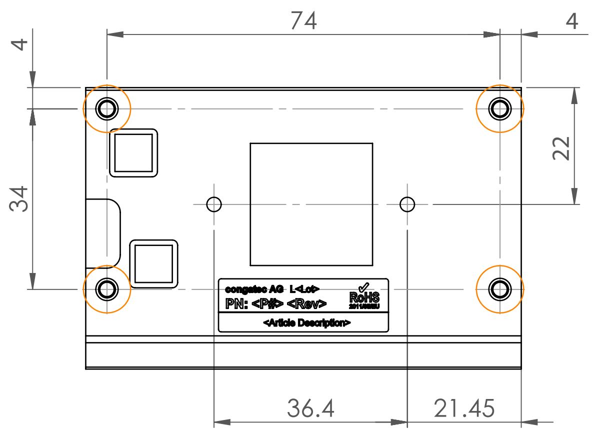
Note

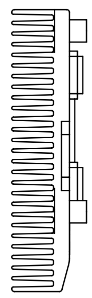
1. *We recommend a maximum torque of 0.4 Nm for carrier board and module mounting screws.*
2. *The gap pad material used on congatec heatspreaders may contain silicon oil that can seep out over time depending on the environmental conditions it is subjected to. For more information about this subject, contact your local congatec sales representative and request the gap pad material manufacturer's specification.*

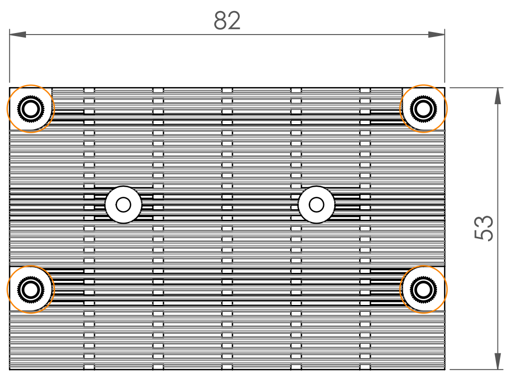
Caution

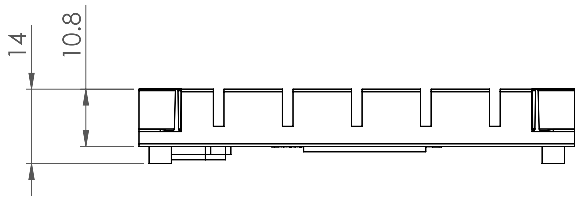
1. *The congatec heatspreaders/cooling solutions are tested only within the commercial temperature range of 0° to 60°C. Therefore, if your application that features a congatec heatspreader/cooling solution operates outside this temperature range, ensure the correct operating temperature of the module 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

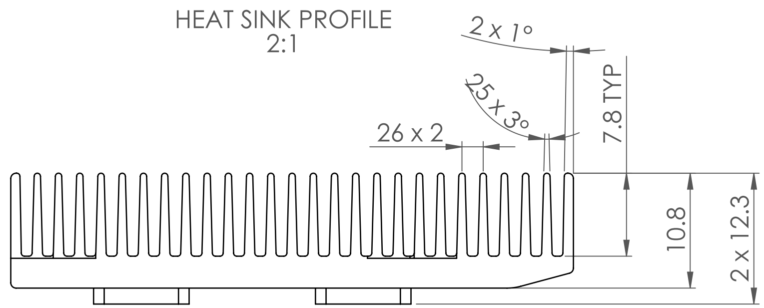


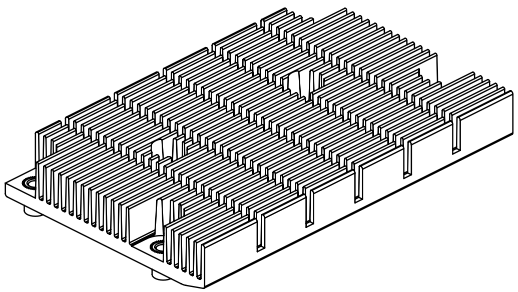


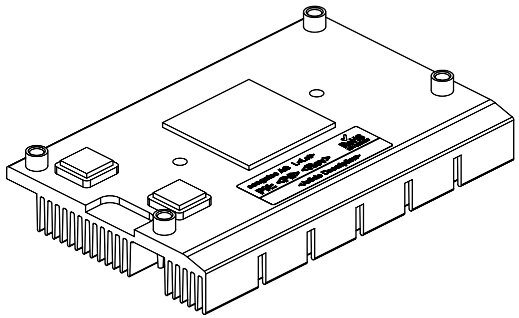




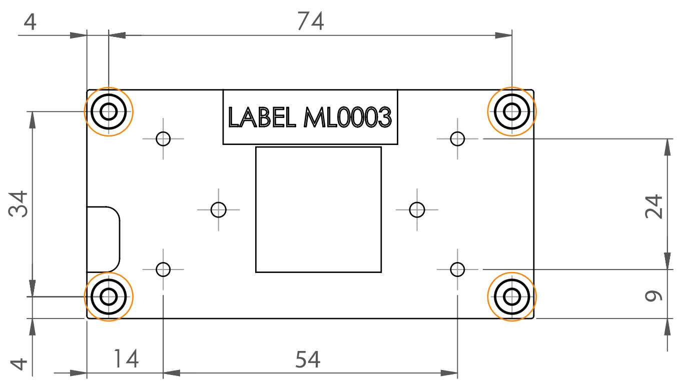
ø2.7 x 6 mm
non-threaded standoff
for borehole version

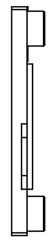


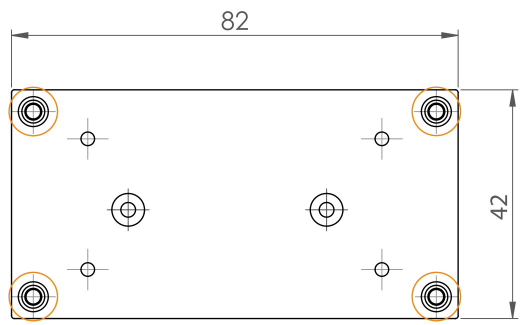


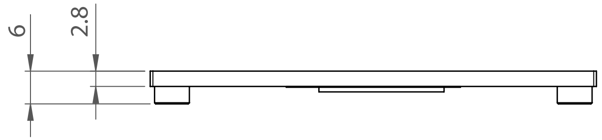


4.2 HSP Dimensions

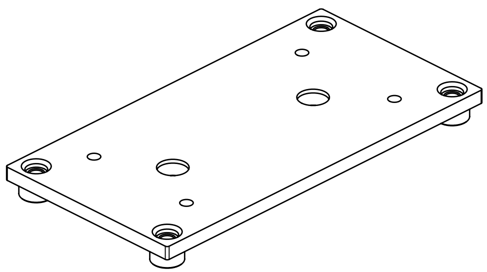


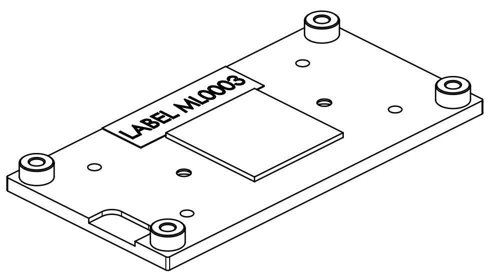






ø2.7 x 6 mm
non-threaded standoff
for borehole version





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5 Connector Rows

The conga-SMX8 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 with the carrier board peripherals.

5.1 Display Interfaces

The conga-SMX8 supports one display interface @ 4Kp60 (UltraHD) or up to three independent display interfaces @ 1080p60 (FullHD) as shown in the table below:

Table 8 Display Interfaces

	Display 1	Display 2	Display 3
Default	Dual channel LVDS (LVDS[0:1])	HDMI	DP (DP0)[1]
Software Option	DSI (DSI1)	HDMI	DP (DP0)[1]
Assembly + Software Option	Dual channel LVDS (LVDS[0:1])	DP (DP1)[1]	DP (DP0)[1]
Assembly + Software Option	DSI (DSI1)	DP (DP1)[1]	DP (DP0)[1]

Note

1. *DP++ is not supported.*

5.1.1 LVDS/DSI

The conga-SMX8 offers LVDS[0:1] lines for one 24 bit dual channel Low-voltage differential signaling (LVDS) interface.[1]

Alternatively, the pins used for LVDS1 can support DSI1 instead as defined in the SMARC Hardware Specification (software option).[2] The NXP® i.MX 8 DSI0 signals can be switched to the SMARC DSI1 interface via software. For clarification, see the block diagram in section 3 "Block Diagram".

Note

1. *The conga-SMX8 does not support two single channel LVDS interfaces.*

2. *The pins used for LVDS0 can not support DSI0.*

5.1.2 HDMI/DP1

The conga-SMX8 offers HDMI lines for one High-Definition Multimedia Interface (HDMI) with support for HDMI 2.0a and HDCP 2.2.

Optionally, the conga-SMX8 can offer DP1[1] lines for one DisplayPort (DP) display interface instead of HDMI with support for eDP 1.4 or DP 1.3 (assembly option).[1] This assembly option also requires different software configuration.

Note

1. *DP++ is not supported.*

5.1.3 DP0

The conga-SMX8 offers DP0 lines for one DisplayPort (DP)[1] via a TI SN65DSI86 MIPI DSI to eDP bridge with support for eDP 1.4 or DP 1.3.

5.2 Camera Intefaces (MIPI® CSI)

The conga-SMX8 offers CSI[0:1] lines for one MIPI Camera Serial Interface 2 (CSI-2) with two lanes (CSI0) and one MIPI CSI-2 with four lanes (CSI1) with support for up to 1.5 Gbps per lane.

5.3 SD/SDIO Card Interface

The conga-SMX8 offers SDIO lines for one Secure Digital Input Output (SDIO) card interface with support for:

- 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
- 3.3 V Signaling @Default Mode and High Speed Mode

Optionally, the conga-SMX8 can offer an onboard Wi-Fi/BT module instead of SDIO (assembly option). For more information, see section 6.5 “Wi-Fi and Bluetooth”

5.4 SPI

The conga-SMX8 offers lines for one Serial Peripheral Interface (SPI0) and one Quad SPI (SPI1).

5.5 Audio (I2S)

The conga-SMX8 offers I2S0[1] and I2S2 lines for two Inter-IC Sound (I^2S) buses with support for full duplex serial interfaces with frame synchronization (e.g. I2S, AC97, TDM) and codec/DSP interfaces. Optionally, the conga-SMX8 can offer a Tensilica® HiFi 4 DSP for pre- and post-audio processing as well as voice recognition (assembly option).

5.6 I2C

The conga-SMX8 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 I^2C device addresses are listed in the table below:

Table 9 I2C Buses

I2C-Bus	Sink Address	conga-SMX8 (Module)	conga-SEVAL (Carrier Board)	conga-SMX8 Assembly Option
I2C-0	0x68	External RTC clock U79		PMIC1+PMIC2
	TBD	HDMI-TX		USB-Hub U12
	N/A			Wi-Fi Module
I2C-1	0x1A	Routed to SMARC connector	Audio codec U71	
	0x50…57		EEPROM U40	
	0x71		POST Code Display	
I2C-2	0x27		USB Type-C PD controller U3	
	0x57		EEPROM U42	
	0x6b		PCIe clock buffer U8	
I2C-3	0x50…57		EEPROM U28	

5.7 Serial Ports

The conga-SMX8 offers SER[0:3] lines for four asynchronous serial ports by default with support for:

- Programmable baud rates of up to 4 Mbps
- Handshake by SER0
- Data only by SER[1:3]

Optionally, the conga-SMX8 can offer an onboard Wi-Fi/BT module instead of SER0 (assembly option). For more information, see section 6.5 "Wi-Fi and Bluetooth".

5.8 CAN Bus

The conga-SMX8 offers CAN[0:1] lines for two Controller Area Network (CAN) buses with support for:

- ISO 11898-1 standard
- CAN FD and CAN 2.0 B protocol

5.9 USB Ports

The conga-SMX8 offers USB[0:4] lines for up to five Universal Serial Bus (USB) ports as shown in the table below:

Table 10 USB Ports

SMARC	Default	Assembly Option (BT/Wi-FI)	Assembly Option (No USB Hub)
USB0[1]	USB 2.0 OTG	USB 2.0 OTG	USB 2.0 OTG
USB1[2]	USB 2.0	USB 2.0	N/A
USB2[2]	USB 3.0/2.0	USB 3.0/2.0	N/A
USB3[2]	USB 3.0/2.0	USB 3.0/2.0	USB 3.0/2.0
USB4[2,3]	USB 2.0	H&D Wireless SPB228	N/A

Note

1. *USB0 is used for the Serial Downloader mode. Fore more information, see FORCE_RECOV# description in section 5.14 "Boot Select".*
2. *The USB[1:4] ports are provided via a TI TUSB8041 USB 3.0 hub. Optionally, the USB hub can be removed (assembly option).*
3. *Optionally, the conga-SMX8 can offer an onboard Wi-Fi/BT module. For more information, see section 6.5 "Wi-Fi and Bluetooth".*

5.10 PCI Express™

The conga-SMX8 offers PCIE_[A:B] lines for two PCIe Gen3 x1 links or one x2 link by default. Optionally, the conga-SMX8 can offer an onboard Wi-Fi/BT module instead of PCIE_B (assembly option). For more information, see section 6.5 "Wi-Fi and Bluetooth".

5.11 SATA

The conga-SMX8 offers SATA lines for one Serial AT Attachment (SATA) 6 Gbps port.

5.12 Ethernet

The conga-SMX8 offers two ethernet interfaces via two onboard Atheros AR8031 Physical Layers (PHYs) with support for:

- Data transfer rates of up to 1000 Mbps—also known as Gigabit Ethernet (GbE)
- IEEE 1588-2008 standard—also known as Precision Time Protocol (PTP) Version 2

5.13 GPIO

The conga-SMX8 offers up to twelve GPIOs (GPIO[0:11]) as defined in the SMARC Hardware Specification 2.1.

5.14 Boot Select

FORCE_RECOV#

Low on the FORCE_RECOV# pin enables the Serial Downloader mode. The program image can be downloaded over the USB0 port (see section 5.9 "USB Ports").

BOOT_SEL[0:2]#

The microSD card reader onboard the conga-SMX8 is currently configured as the default boot device via hardware straps (Revision A.0 and earlier). The OS boot device is defined via the U-Boot environment variables. For more information, refer to the conga-SMX8 software documentation (link in section 8 "Software Documentation").

Note

The default boot device may change to the onboard SPI Flash in a later revision.

Optionally, the hardware straps can be configured for a different boot device (assembly option). The options are onboard eMMC, carrier board SD card reader, onboard microSD card reader, or the onboard SPI flash device.

Optionally, the boot device can be selected via BOOT_SEL[0:2] pins (assembly option). The boot selection does not conform to the SMARC hardware specification and the conga-SEVAL (carrier board) documentation. Refer to the table below instead:

Table 11 BOOT_SEL[0:2]

	conga-SEVAL (Carrier Board)		
Boot Device	BOOT_SEL#0 (DIP switch M18.1)	BOOT_SEL#1 (DIP switch M17.2)	BOOT_SEL#0 (DIP switch M17.1)
Onboard eMMC	on (low)	on (low)	on (low)
Carrier board SD Card	on (low)	off (high)	on (low)
Onboard micro SD Card	on (low)	off (high)	off (high)
Onboard SPI Flash	off (high)	on (low)	on (low)

5.15 Power Control

The module operates within an input voltage range of 4.75 to 5.25 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. The module starts the power-up sequence after the first VIN power on.
4. The module enables the carrier board power by asserting CARRIER_PWR_ON (SUS_S5#) and CARRIER_STBY# (SUS_S3#).
5. If RESET_IN# is not driven low, 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 or reboot. The booting process can be postponed by driving RESET_IN# low during power on sequence.

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 up or shut down the system from standby.

Power Supply Implementation Guidelines

The operational power source for the conga-SMX8 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 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 VDD_IN (5 V) power rail can be as high as TBD A for a maximum of 100 μs. You should therefore ensure the power supply and decoupling capacitors provide enough power to drive the module.

Note

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

6 Onboard Interfaces and Devices

6.1 DRAM

The conga-SMX8 offers onboard LPDDR4 SDRAM @ 1600 MHz (64 bit) with 2 GB or 4 GB by default. The default memory size of each conga-SMX8 variant is listed in section 1.2.1 “Options Information”.

Optionally, the conga-SMX8 can offer up to 8 GB LPDDR4 SDRAM (assembly option).

6.2 eMMC

The conga-SMX8 offers an onboard eMMC 5.1 HS400 storage device with 16 GB by default.[1] 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.

Optionally, the conga-SMX8 can offer up to 128 GB eMMC storage capacity (assembly option).

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 microSD Card Reader

The conga-SMX8 offers an onboard microSD card reader with support for:

- SD Physical Layer Specification v3.0 UHS-I (SDR104/DDR50)
- SDIO specification v3.0

6.4 SPI NOR Flash

The conga-SMX8 offers an onboard SPI NOR flash memory chip with 64 Mbit by default.

Optionally, the conga-SMX8 can offer up to 128 Mbit SPI NOR flash memory (assembly option).

6.5 Wi-Fi and Bluetooth

Optionally, the conga-SMX8 can offer Wi-Fi and Bluetooth connectivity via an onboard H&D Wireless SPB228 M.2 1216 module (assembly option). This module can be connected via:

- SDIO (instead of onboard microSD card reader)
- PCI Express (instead of PCIE_B lines)
- USB (instead of USB4 port)
- or Serial Port (instead of SER0 lines; SER0 can only support Bluetooth)

6.6 RTC

The conga-SMX8 offers a discrete Real-Time Clock (RTC) via an onboard Micro Crystal RV-4162-C7 module with the I²C device address 0x68.

6.7 Console and Debug Interfaces

6.7.1 A72/A53 Console and SCU Debug

The conga-SMX8 offers a Cortex®-A72/A53 console and SCU debug interface via the onboard connector X4. The connector pinout is described in the table below:

Table 12 A72/A53 and SCU Connector (X4) Pinout Description

Pin	SoC Signal	Description
1	SCU_GPIO0_01	SCU Debug: Transmit signal via ISL3243E RS-232 Transmitter/Receiver
2	+VIN	SMARC VDD_IN (+5V)
3	GND	Ground
4	UART0_TX	A72/A53 Console: Transmit signal via ISL3243E RS-232 Transmitter/Receiver
5	UART0_RX	A72/A53 Console: Receive signal via ISL3243E RS-232 Transmitter/Receiver
6	SCU_GPIO0_00	SCU Debug: Receive signal via ISL3243E RS-232 Transmitter/Receiver

Connector Type

X4: 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

6.7.2 JTAG Debug

Optionally, the conga-SMX8 can offer an onboard JTAG debug interface via a 10 pin PicoBlade connector (X5) (assembly option).

The connector pinout is described in the table below:

Table 13 JTAG Debug Connector (X5) Pinout Description

Pin	SMARC 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_MOD	Test mode select
8	JTAG_TDI	JTAG data in
9	NC	Not connected
10	JTAG_TRST#	JTAG test reset

Connector Type

X5: Molex PicoBlade 0532611071 (10 Circuits, 1.25mm Pitch, Right-Angle, Friction Lock)
Mates with Molex PicoBlade Cable Assembly Series 15134 with 10 Circuits

7 Signal Descriptions and Pinout Tables

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

	X6A + X6B - SMX8 SMARC Edge Connection					
SMX8 Interface	i.MX8QM Ball Nam	i.MX8QM BGA609 Ball	SMARC Pin Name	SMARC Pin	Remark	alt. Function
n.c. - not supported	GPT1_COMPARE	BA51	SMB_ALERT_1V8#	P1		
SMARC CSI1 MIPI-CSI 4ch	MIPI_CSI1_I2C0_SCL	BN17	CSI1_TX+ / I2C_CAM1_CK	S1		
GND	#NV		GND	P2		
SMARC CSI1 MIPI-CSI 4ch	MIPI_CSI1_I2C0_SDA	BE15	CSI1_TX- / I2C_CAM1_DAT	S2		
SMARC CSI1 MIPI-CSI 4ch	MIPI_CSI1_CLK_P	BJ17	CSI1_CK+	P3		
GND	#NV		GND	S3		
SMARC CSI1 MIPI-CSI 4ch	MIPI_CSI1_CLK_N	BH16	CSI1_CK-	P4		
n.c. - reserved	#NV		RSVD	S4	reserved	
SMARC Gigabit Ethernet 1	#NV		GBE1_SDP	P5	IEEE1588 from Ethernet controller 1 (AR8031)	
n.c. - not supported	MIPI_CSI0_I2C0_SCL	BH24	CSI0_TX- / I2C_CAM0_CK	S5		
SMARC Gigabit Ethernet 0	#NV		GBE0_SDP	P6	IEEE1588 from Ethernet controller 0 (AR8031)	
SMARC CSI1 MIPI-CSI 4ch	MIPI_CSI1_MCLK_OUT	BN23	CAM_MCK	S6		
SMARC CSI1 MIPI-CSI 4ch	MIPI_CSI1_DATA0_P	BJ19	CSI1_RX0+	P7		
n.c. - not supported	MIPI_CSI0_I2C0_SDA	BN19	CSI0_TX+ / I2C_CAM0_DAT	S7		
SMARC CSI1 MIPI-CSI 4ch	MIPI_CSI1_DATA0_N	BH18	CSI1_RX0-	P8		
n.c. - not supported	MIPI_CSI0_CLK_P	BF20	CSI0_CK+	S8		
GND	#NV		GND	P9		
n.c. - not supported	MIPI_CSI0_CLK_N	BE21	CSI0_CK-	S9		

Alternatively, you can find the conga-SMX8 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:

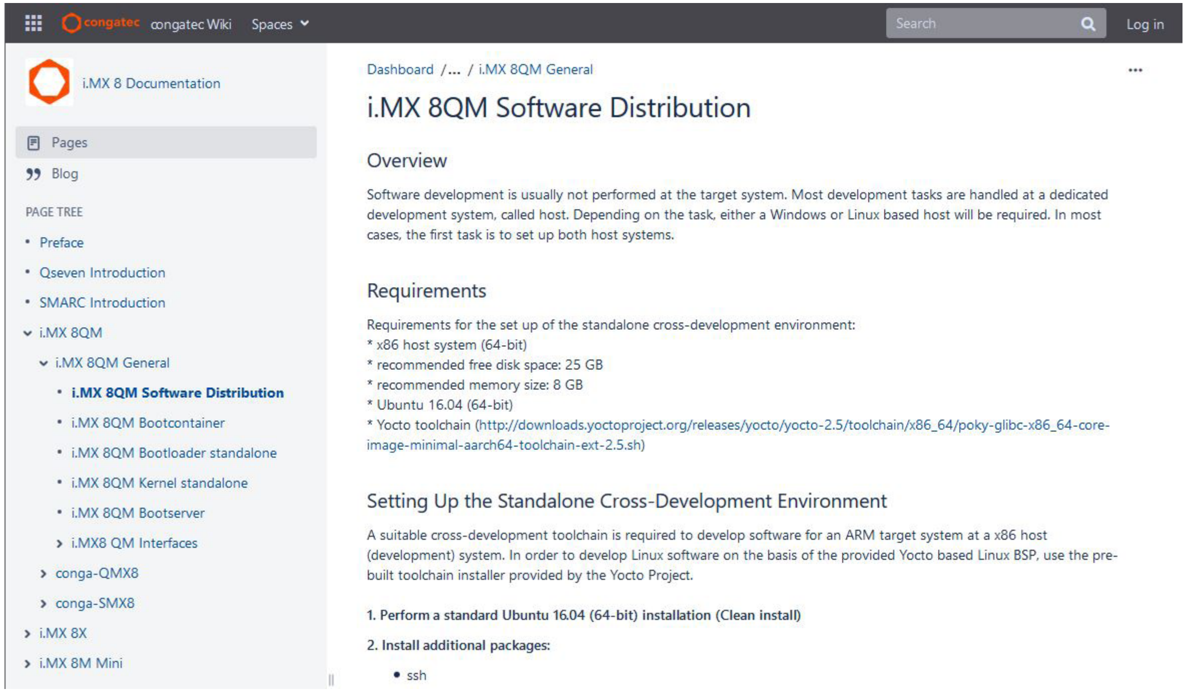
https://sget.org

The SoC signals are described in the NXP® i.MX 8QuadMax/QuadPlus data sheet publicly available at:

https://www.nxp.com

8 Software Documentation

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



Alternatively, you can find the conga-SMX8 software documentation by selecting it from the navigation menu at:

https://wiki.congatec.com

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Our company network supports you worldwide with offices in Germany, Austria, Switzerland, the UK and the USA. For more information please contact:

Headquarters

Germany	FORTEC ELEKTRONIK AG	**FORTEC Elektronik AG** Augsburger Str. 2b 82110 Germering	Phone: +49 89 894450-0 E-Mail: info@fortecag.de Internet: www.fortecag.de

Fortec Group Members

Austria	DISTEC A FORTEC GROUP MEMBER	**Distec GmbH,** **Office Vienna** Nuschinggasse 12 1230 Wien	Phone: +43 1 8673492-0 E-Mail: info@distec.de Internet: www.distec.de
Germany	DISTEC A FORTEC GROUP MEMBER	**Distec GmbH** Augsburger Str. 2b 82110 Germering	Phone: +49 89 894363-0 E-Mail: info@distec.de Internet: www.distec.de
Switzerland	ALTRAC A FORTEC GROUP MEMBER	**ALTRAC AG** Bahnhofstraße 3 5436 Würenlos	Phone: +41 44 7446111 E-Mail: info@altrac.ch Internet: www.altrac.ch
United Kingdom	DISPLAY TECHNOLOGY A FORTEC GROUP MEMBER	**Display Technology Ltd.** Osprey House, 1 Osprey Court Hinchingbrooke Business Park Huntingdon, Cambridgeshire, PE29 6FN	Phone: +44 1480 411600 E-Mail: info@displaytechnology.co.uk Internet: www. displaytechnology.co.uk
USA	APOLLO DISPLAY TECHNOLOGIES A FORTEC GROUP MEMBER	**Apollo Display Technologies, Corp.** 87 Raynor Avenue, Unit 1Ronkonkoma, NY 11779	Phone: +1 631 5804360 E-Mail: info@apollodisplays.com Internet: www.apollodisplays.com