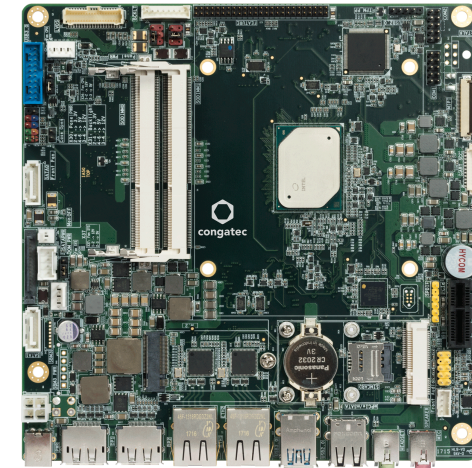


conga-IA5 Thin Mini-ITX SBC

Detailed Description Of The congatec Thin Mini-ITX Based On Intel® Apollo Lake SoCs



User's Guide

Revision 1.14

Revision History

Revision	Date (yyyy.mm.dd)	Author	Changes
0.1	2017.07.19	BEU	<ul style="list-style-type: none"> • Preliminary release
1.0	2018.01.08	BEU	<ul style="list-style-type: none"> • Updated image of the conga-IA5 on the title page • Removed Android from supported OS in section 2.2 "Supported Operating Systems" • Added power consumption values in section 2.5 "Power Consumption" and 2.6 "Supply Voltage Battery Power" • Corrected block diagram in section 3 "Block Diagram" • Corrected LVDS pinout in table "X33 Pinout Description" • Updated UART description in section 5.4.1 "UART Headers" • Corrected pinout description of UART header X25 in section 5.4.1 "UART Headers" • Added caution about maximum cable length of USB 2.0 devices in section 5.5.1 "USB 2.0 Ports", 5.5.2 "USB 3.0 Header", and 5.5.3 "USB 2.0 Header" • Added pinout description in section 5.5.2 "USB 3.0 Header" • Corrected note in section 5.7.4 "M.2 3042/2242 Card Slot" and 5.10 "Micro-SIM Card Slot" • Removed mSATA support in section 5.9 "PCI Express Connectors" • Corrected PCIe 0 to PCIe 2 in section 5.9.1 "PCIe x1 Card Slot" and 5.9.3 "Mini PCIe Card Slot (Full-Size)" • Corrected jumper mismatch in section 5.9.3.2 "Backlight/Panel Power Selection" • Corrected PCIe routing diagram and notes in section 5.11.1 "PCI Express Routing" • Updated security features in section 6.3 "Security Features" and table 7 "Feature Summary" • Added information to section 8 "BIOS Setup Description" • Added more information to table 42 "X35 Pinout Description"
1.1	2018.02.08	BEU	<ul style="list-style-type: none"> • Updated "Electrostatic Sensitive Device" information on page 3 • Updated section 2.1 "Feature List" • Corrected caution in section 2.4 "Supply voltage power" • Updated section 5.4.1 "UART Headers" • Corrected jumper mismatch in section 5.4.2 "CPU and System Fan Header"
1.2	2018.06.25	BEU	<ul style="list-style-type: none"> • Added errata as a document to read in the preface section
1.3	2018.08.21	BEU	<ul style="list-style-type: none"> • Added connectors X49 and X50 for IEEE1588 support
1.4	2018.12.17	BEU	<ul style="list-style-type: none"> • Added two industrial variants in table 2 • Added two IO shields in table 3 • Updated available memory modules in table 4 • Added default BIOS setting for power-on behavior to note in section 2.4 "Supply Voltage Power" • Corrected connector number in section 5.2.5 "Front Panel Audio Header"
1.5	2019.01.23	BEU	<ul style="list-style-type: none"> • Updated section 8.4 "Supported Flash Device" • Corrected power consumption values for S3 and S5 @12V Input Voltage (not 5V) in table 9
1.6	2019.07.08	BEU	<ul style="list-style-type: none"> • Added note about automatic fan speed control in section 5.4.2 "CPU and System Fan Header" • Corrected USB 3.0 header image in section 5.5 "Universal Serial Bus (USB)" and 5.5.2 "USB 3.0 Header" • Updated supported SATA port speed in table 7 and section 5.7.2 "SATA / SATADOM Ports"
1.7	2020.01.20	BEU	<ul style="list-style-type: none"> • Corrected USB connector numbering above the connector images in section 5.5.1 "USB 2.0 and USB 3.0 Ports" • Added reference to BIOS Setup Description application note in section 8 "BIOS Setup Description" • Updated information regarding SATA port 1 6Gb/s support in table 7 and section 5.7.2 "SATA / SATADOM Ports" • Updated section 8.3 "Updating the BIOS" • Updated supported flash device in section 8.4 "Supported Flash Device" • Updated section 9 "Industry Specifications"

Revision	Date (yyyy.mm.dd)	Author	Changes
1.8	2020.02.24	BEU	<ul style="list-style-type: none"> • Changed eDP cable description in table 5 "Cables" • Removed note about available LVDS cable in section 5.8.2 "LVDS Header"
1.9	2020.03.17	BEU	<ul style="list-style-type: none"> • Updated accessories in section 1.2.2 "Optional Accessories"
1.10	2020.04.16	BEU	<ul style="list-style-type: none"> • Corrected LVDS channel A and B mismatch in table 35 "X33 Pinout Description"
1.11	2020.05.13	BEU	<ul style="list-style-type: none"> • Changed Rx signal integrity caution to a note in section 5.7.2 "SATA / SATADOM Ports"
1.12	2020.12.17	BEU	<ul style="list-style-type: none"> • Deleted table 7 "Power Supplies" • Deleted section 9 "Industry Specifications"
1.13	2021.04.15	BEU	<ul style="list-style-type: none"> • Updated display interfaces in table 1, 2, 7 and section 3 "Block Diagram", 5.8.1 "DP++ Ports" • Removed a display adapter from table 6
1.14	2021.07.02	BEU	<ul style="list-style-type: none"> • Updated congatec AG to congatec GmbH throughout the document • Added Software License Information • Updated section 6.6 "congatec Battery Management Interface"

Preface

This user's guide provides information about the components, features and connectors available on the conga-IA5 Thin Mini-ITX Single Board Computer. This user's guide should be read in conjunction with the document "Errata_congatec_xA5_designs". Click on the document name to download it.

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Note

Notes call attention to important information that should be observed.



Connector Type

Describes the connector used on the Single Board Computer.

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Terminology

Term	Description
PCIe	Peripheral Component Interface Express
cBC	congatec Board Controller
SDIO	Secure Digital Input Output
USB	Universal Serial Bus
SATA	Serial AT Attachment: serial-interface standard for hard disks
HDA	High Definition Audio
S/PDIF	Sony/Philips Digital Interconnect Format
TMDS	Transition Minimized Differential Signaling
LPC	Low Pin-Count
I ² C Bus	Inter-Integrated Circuit Bus
SM Bus	System Management Bus
CAN	Controller Area Network
SPI	Serial Peripheral Interface
GbE	Gigabit Ethernet
LVDS	Low-Voltage Differential Signaling
DDC	Display Data Channel
N.C	Not connected
N.A	Not available
T.B.D	To be determined

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1 Introduction

1.1 Mini-ITX Concept

The Mini-ITX form factor provides engineers and manufacturers with a standardized ultra compact platform for development. With a footprint of 170mm x 170mm, this scalable platform promotes the design of highly integrated, energy efficient systems. Due to its small size, the Mini-ITX form factor enables PC appliance designers not only to design attractive low cost devices but also allows them to explore a huge variety of product development options—from compact space-saving designs to fully functional Information Station and Value PC systems. This helps to reduce product design cycle and encourages rapid innovation in system design, to meet the ever-changing needs of the market.

Additionally, the boards can also be passively cooled, presenting opportunities for fanless designs. The Mini-ITX boards are equipped with various interfaces such as PCI Express, SATA, USB 3.0/2.0, Ethernet, Displays and Audio.

1.2 conga-IA5

The conga-IA5 is a Single Board Computer design based on the Thin Mini-ITX specification. The conga-IA5 SBC features the Intel® Apollo Lake processors. With maximum 12 W TDP processors, the SBC offers Ultra-Low-Power boards with high computing performance and outstanding graphics. Additionally, the SBC supports dual channel DDR3L up to 1866 MT/s for a maximum system memory capacity of 8 GB, multiple I/O interfaces, up to three independent displays and various congatec embedded features.

With smaller board size and lower height keep-out zones, the conga-IA5 SBC provides manufacturers and enthusiasts with the opportunity to design compact systems for space restricted areas. With appropriate I/O shield, the same conga-IA5 SBC can be used in either a Thin Mini-ITX or a Mini-ITX design.

The various features and capabilities offered by the conga-IA5 makes it ideal for the design of compact, energy efficient, performance-oriented embedded systems.

1.2.1 Options Information

The conga-IA5 is currently available in eight variants. This user's guide describes all of these variants. The tables below show the different configurations available. Check for the part number (PN) that applies to your product. This will tell you what options described in this user's guide are available on your particular module.

Table 1 conga-IA5 Commercial Variants

Part-No.	052801	052802	052803	052820	052821
Processor	Intel® Atom® x7 E3950 Quad Core 1.6 GHz	Intel® Atom® x5 E3940 Quad Core 1.6 GHz	Intel® Atom® x5 E3930 Dual Core 1.3 GHz	Intel® Pentium® N4200 Quad Core 1.1 GHz	Intel® Celeron® N3350 Dual Core 1.1 GHz
Burst Frequency	2.0 GHz	1.8 GHz	1.8 GHz	2.5 GHz	2.4 GHz
L2 Cache	2 MB	2 MB	2 MB	2 MB	2 MB
Memory (DDR3L)	1866 MT/s dual channel	1866 MT/s dual channel	1866 MT/s dual channel	1866 MT/s dual channel	1866 MT/s dual channel
Processor Graphics	Intel® HD Graphics 505	Intel® HD Graphics 500	Intel® HD Graphics 500	Intel® HD Graphics 505	Intel® HD Graphics 500
Graphics Base/Burst Freq.	500/650 MHz	400/600 MHz	400/550 MHz	200/750 MHz	200/650 MHz
VGA	No	No	No	No	No
LVDS	Single/Dual 18/24-bit	Single/Dual 18/24-bit	Single/Dual 18/24-bit	Single/Dual 18/24-bit	Single/Dual 18/24-bit
DDI	DP++	DP++	DP++	DP++	DP++
Processor TDP	12 W	9.5 W	6.5 W	6 W	6 W

Table 2 conga-IA5 Industrial Variants

Part-No.	052811	052812	052813
Processor	Intel® Atom® x7 E3950 Quad Core 1.6 GHz	Intel® Atom® x5 E3940 Quad Core 1.6 GHz	Intel® Atom® x5 E3930 Dual Core 1.3 GHz
Burst Frequency	2.0 GHz	1.8 GHz	1.8 GHz
L2 Cache	2 MB	2 MB	2 MB
Memory (DDR3L)	1866 MT/s dual channel	1866 MT/s dual channel	1866 MT/s dual channel
Processor Graphics	Intel® HD Graphics 505	Intel® HD Graphics 500	Intel® HD Graphics 500
Graphics Base/Burst Freq.	500/650 MHz	400/600 MHz	400/550 MHz
VGA	No	No	No
LVDS	Single/Dual 18/24-bit	Single/Dual 18/24-bit	Single/Dual 18/24-bit
DDI	DP++	DP++	DP++
Processor TDP	12 W	9.5 W	6.5 W

1.2.2 Optional Accessories

Table 3 Cooling Solutions

Article	PN	Description
conga-IA5/CSP	052830	Passive cooling solution suitable for Mini-ITX conga IA5 [version for modules with standard (non lidded) CPU]
conga-IA5/i-CSP	052831	Passive Cooling Solution for Mini-ITX conga-IA5. [For modules with IHS CPU]
conga-IC87/Retention Frame	052254	Retention frame for standard cooling suitable for for conga-IC87/97/170/IA5

Table 4 I/O Shields

Article	PN	Description
conga-IA4/IO Shield - Standard	052651	IO shield for conga-IA4/IA5 with Standard Mini-ITX height.
conga-IA4/IO Shield - Thin	052652	IO shield for conga-IA4/IA5 with Thin Mini-ITX height.

Table 5 Memories

Article	PN	Description
DDR3L-SODIMM-1866 (2GB)	068730	DDR3L SODIMM, 1,35V &1,5V memory module with 1866 MT/s and 2GB RAM
DDR3L-SODIMM-1866 (4GB)	068731	DDR3L SODIMM, 1,35V &1,5V memory module with 1866 MT/s and 4GB RAM
DDR3L-SODIMM-1866 (8GB)	068732	DDR3L SODIMM, 1,35V &1,5V memory module with 1866 MT/s and 8GB RAM
DDR3L-SODIMM-1866 (2GB) / i-temp	068733	DDR3L SODIMM, 1,35V &1,5V memory module with 1866 MT/s and 2GB RAM supporting extended operating temperature range of -40°C to +85°C.
DDR3L-SODIMM-1866 (4GB) / i-temp	068734	DDR3L SODIMM, 1,35V &1,5V memory module with 1866 MT/s and 8GB RAM supporting extended operating temperature range of -40°C to +85°C.
DDR3L-SODIMM-1866 (8GB) / i-temp	068735	DDR3L SODIMM, 1,35V &1,5V memory module with 1866 MT/s and 8GB RAM supporting extended operating temperature range of -40°C to +85°C.

Table 6 Cables and Adapters

Article	PN	Description
conga-Thin mITX/eDP to DP Adapter	052231	eDP to standard DisplayPort evaluation adapter for congatec Thin Mini-ITX boards
Cab-ThinMini-ITX-SATA-Power	14000120	SATA Power Cable, 15pin female 3x, 6pin female 1x, length 500 mm
Cab-ThinMini-ITX-UART	14000121	UART cable, 2x5pin, 2.54mm female header, D-Sub 9P male, length 200mm
Cab-ThinMini-ITX-USB20-Single	14000122	USB2.0 cable - single, 1x5pin, 2.54mm female header, USB A female w/molding, length 200mm
Cab-ThinMini-ITX-LVDS-OE	14000125	eDP cable for conga-IA5, with open end, 40pin, length 250mm Note: Not for LVDS. LVDS cable is not available from congatec.
Cab-ThinMini-ITX-BKLT	14000127	Backlight cable for Thin Mini-ITX, 8pin, with open end, length 300mm
Cab-ThinMini-ITX-SATA-Power	14000136	SATA Power Cable, 15pin female 2x, length 300mm
SATA III Cable Straight/Straight	48000029	SATA III cable with data transfer rate of up to 6 Gbps, connector: straight / straight, length 300mm
SATA III Cable Down/Straight	48000030	SATA III cable with data transfer rate of up to 6 Gbps, connector: down / straight, length 300mm

2 Specification

2.1 Feature List

Table 7 Feature Summary

Form Factor	Based on Thin Mini-ITX form factor (170mm x 170mm)	
Processor	Intel® Apollo Lake Atom®, Pentium® or Celeron®	
Memory	Two memory sockets (SO-DIMM non-ECC DDR3L modules, Data rates up to 1866 MT/s, Maximum 8 GB system memory capacity)	
cBC	Multi-stage watchdog, manufacturing and board information, board statistics, I2C bus, Power loss control	
Chipset	Integrated in the SoC	
Audio	High Definition Audio codec Cirrus Logic CS4207	
Ethernet	2x Gigabit Ethernet Intel® I211 (commercial variants) or Intel® I210 (industrial variants)	
Graphics	Intel® HD Graphics Gen9-LP supporting DirectX12, OpenGL 4.3, OpenGL ES 3.0, OpenCL 1.2, PAVP 2.0 and HDCP 1.4/2.0. HEVC (H.265), AVC (H.264), MVC, VP8, VP9 (software encode only), and JPEG/MJPEG format decode and encode. MPEG2, VC-1, and WMV9 format decode.	
Graphic Interfaces	2x DP++ and 1x LVDS shared with 1x eDP 1.4	
Back Panel I/O Connectors	1x DC Power Jack (optional for industrial variants) 2x DP++ 2x Gigabit Ethernet	2x USB 2.0 and 2x USB 3.0 1x Headphone Jack 1x Microphone Jack
Onboard I/O Connectors	1x ATX 4-Pin Connector 1x SBM ³ Connectors (optional) 1x CR2032 Cell Battery Holder 1x Stereo Speakers Header 1x Digital Microphone (default) or S/PDIF Header (optional) 1x Front Panel Audio Header Up to 5x UART ports (ccTalk optional) 1x CPU Fan Header and 1x System Fan Header 1x USB 3.0 Header (for 1x USB 3.0 port) 1x USB 2.0 Header (for 1x USB 2.0 port) 1x SATA 6Gb/s Port with support for SATADOM 1x SATA 6Gb/s Port (Note: Not fully SATA 6Gb/s compliant, see section 5.7.2) 1x SATA Power Connector 1x 4-Pin Power Header	2x IEEE1588 Headers 1x M.2 3042/2242 Card Slot 1x LVDS Header 1x eDP Connector 1x Backlight Power Header 1x Monitor OFF Header 1x PCIe x1 Card Slot 1x Mini PCIe Card Slot (Full/Half-Size) 1x Micro-SIM Card Slot 1x microSD Card Slot 1x Front Panel Header 1x Chassis Intrusion Header 1x Feature Connector
BIOS	AMI Aptio® V UEFI 5.x firmware, 8 MByte serial SPI with congatec Embedded BIOS features.	
Power Management	ACPI 4.0 compliant with battery support. Also supports Suspend to RAM (S3) Configurable TDP Ultra low standby power consumption, Deep Sx	
Other Features	Thermal and voltage monitoring, CMOS Battery, Beeper congatec Standard BIOS (also possible to boot from an external BIOS by triggering the BIOS_DISABLE# signal on the feature connector)	
Security	Integrated Intel® PTT (TPM 2.0). Infineon SLB9665 (LPC TPM 2.0) or SLB9660 (LPC TPM 1.2) available by assembly option.	



Note

Some of the features mentioned above are optional. Check the part number of your module and compare it to the options information table in section 1.2.1 to determine what options are available on your particular module.

2.2 Supported Operating Systems

The conga-IA5 supports the following operating systems:

- Microsoft® Windows® 10 IoT Enterprise (64-bit)
- Microsoft® Windows® 10 IoT Core (32/64-bit)
- Microsoft® Windows® 10 (64-bit)
- Linux 3.x/4.x
- Yocto



Note

To install Microsoft® Windows® 10 (64-bit), we recommend a minimum storage capacity of 20 GB. congatec will not offer support for systems with less than 20 GB storage space.

2.3 Mechanical Dimensions

- 170mm x 170mm
- Maximum Height: 20mm

2.4 Supply Voltage Power

- 12V - 24V DC \pm 10%



Caution

The absolute maximum rating of the input voltage is 28 volts. Do not exceed this rating or expose the conga-IA5 to the absolute maximum voltage for a prolonged time. Doing so may damage the system or affect system reliability.



Note

Depending on your BIOS settings, the conga-IA5 may start immediately after power is supplied. The default BIOS setting starts the conga-IA5 after power is supplied.

2.5 Power Consumption

The power consumption values were measured with the following setup:

- conga-IA5
- conga-IA5 cooling solution
- Microsoft® Windows® 10 (64-bit)



Note

The CPU was stressed to its maximum workload with the Intel® Thermal Analysis Tool.

Table 8 Measurement Description

The power consumption values were recorded during the following system states:

System State	Description	Comment
S0: Minimum value	Lowest frequency mode (LFM) with minimum core voltage during desktop idle.	
S0: Maximum value	Highest frequency mode (HFM/Turbo Boost).	The CPU was stressed to its maximum frequency.
S0: Peak value	Highest current spike during the measurement of "S0: Maximum value". This state shows the peak value during runtime.	Consider this value when designing the system's power supply to ensure that sufficient power is supplied during worst case scenarios.
S3	Standby mode.	
S5	Soft-off mode.	



Note

The fan and SATA drives were powered externally. All other peripherals, except the LCD monitor, were disconnected before measurement.

The table below provide additional information about the power consumption data for each of the conga-IA5 variants offered. The values are recorded at various operating modes.

Table 9 Power Consumption Values

PN	Memory Size	H.W Rev.	BIOS Rev.	OS (64-bit)	CPU		Current (A) @12 Volt					
					Variant	Cores	Base/Burst Freq. (GHz)	S0: Min	S0: Max	S0: Peak	S3	S5
052801 052811	4 GB	A.0	IA50R019	Windows® 10	Intel® Atom® x7 E3950	4	1.6/2.0	0.31	1.92	2.14	0.11	0.09
052802 052812	4 GB	A.1	IA50R019	Windows® 10	Intel® Atom® x5 E3940	4	1.6/1.8	0.31	1.48	1.58	0.11	0.09
052803 052813	4 GB	A.1	IA50R019	Windows® 10	Intel® Atom® x5 E3930	2	1.3/1.8	0.31	1.14	1.23	0.11	0.09
052820	4 GB	A.1	IA50R019	Windows® 10	Intel® Pentium® N4200	4	1.1/2.5	0.31	1.32	2.15	0.11	0.09
052821	4 GB	A.0	IA50R019	Windows® 10	Intel® Celeron® N3350	2	1.1/2.4	0.31	1.20	1.94	0.11	0.09



With fast input voltage rise time, the inrush current may exceed the measured peak current.

2.6 Supply Voltage Battery Power

Table 10 CMOS Battery Power Consumption

RTC @	Voltage	Current
-10°C	3V DC	2.05 µA
20°C	3V DC	2.94 µA
70°C	3V DC	11.8 µA



Do not use the CMOS battery power consumption values listed above to calculate CMOS battery lifetime. Measure the CMOS battery power consumption in your customer specific application in worst case conditions (for example, during high temperature and high battery voltage). Also 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. We recommend to always have a CMOS battery present when operating the conga-IA5.

2.7 Environmental Specifications

Temperature (commercial variants)	Operation: 0° to 60°C	Storage: -20° to +80°C
Temperature (industrial variants)	Operation: -40° to 85°C	Storage: -40° to +85°C
Humidity	Operation: 10% to 90%	Storage: 5% to 95%

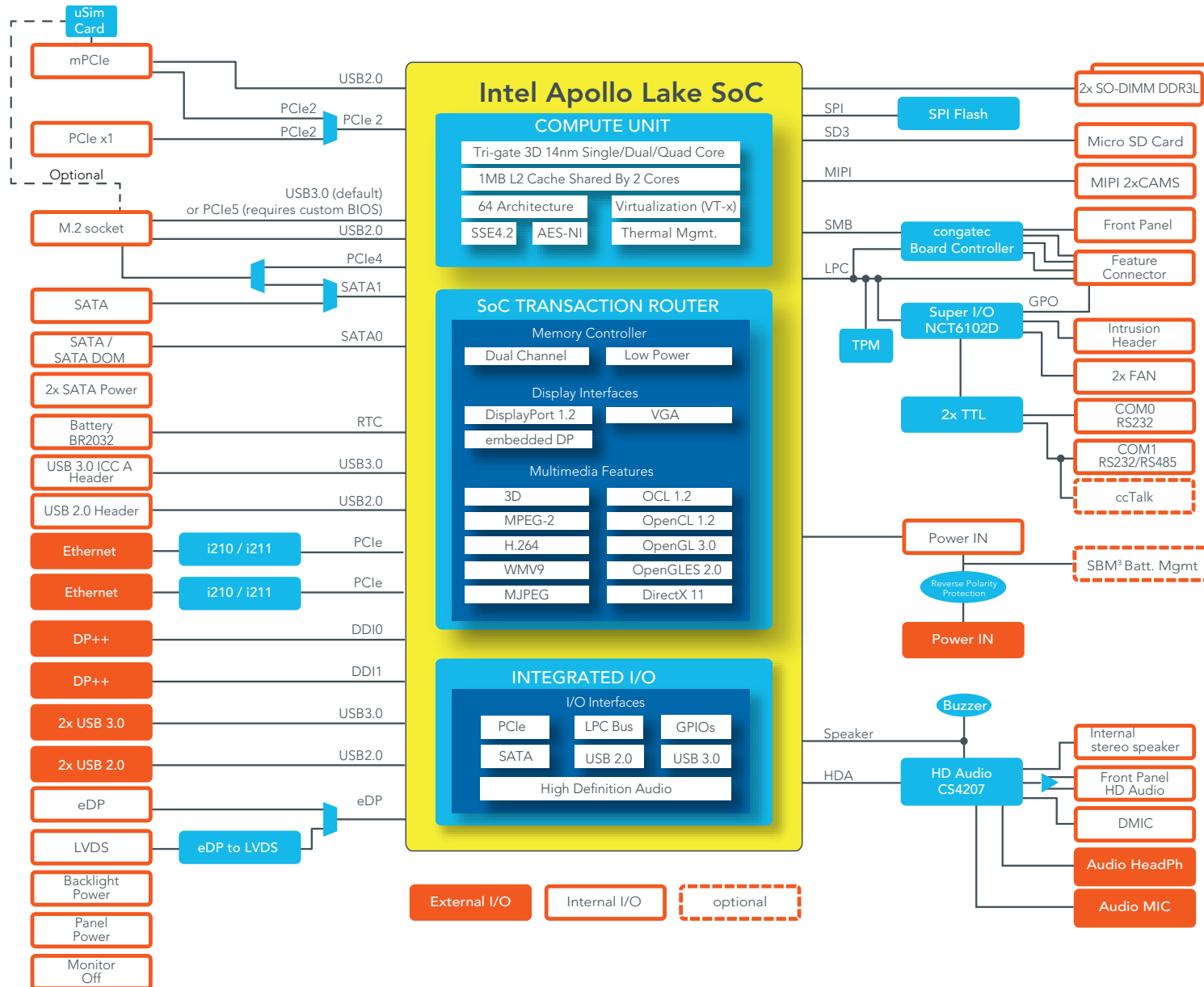


Caution

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



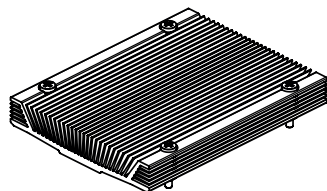
4 Cooling Solution

The conga-IA5 SBC offers Ultra Low Power boards with high computing performance and outstanding graphics. Due to its low power consumption, the SBC generates less heat and therefore requires less active cooling, allowing the use of quieter, lower profile coolers that are better suited to small form factor systems.

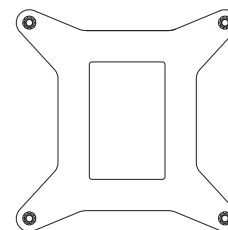
Nonetheless, all electronics contain semiconductor devices which have operating temperature ranges that should be adhered to. This means that for reliable operation, the thermal design of the conga-IA5 must be carefully considered. For this reason, it is imperative to provide sufficient air flow to each of the components, to ensure the specified operating temperature of the conga-IA5 is maintained.

congatec GmbH offers the following cooling options for the conga-IA5:

- A congatec passive cooling solution for lidless die Celeron® and Pentium® (PN: 052830) or lidded die Atom® (PN: 052831) variants in combination with the conga-IA5 retention frame (PN: 052254). This cooling solution complies with the Thin Mini-ITX height specification and features a Hi-Flow 225UT pressure sensitive, phase change thermal interface. Refer to section 4.2 "CSP Dimensions" for the dimensions of the congatec heatspreaders.
- The use of a custom cooling solution in combination with the conga-IA5 retention frame.



Passive Cooling Solution



Retention Frame

Note

When a passive cooling is used, the end user must ensure that adequate air flow is maintained.

4.1 Cooling Installation

Assembly Instruction:

- Flip over the SBC and locate the position of the CPU.
- Place retention frame on the bottom side of the board with insulating foil facing the PCB and standoffs inserted to PCB's mounting holes.
- Remove the CSP's protection pull tab foil from the phase changer and carefully place the CSP to the CPU.
- Hold the CSP with one hand so that it does not tilt while tightening the screws.
- Slightly tighten each of the 4 screws so that they hold the CSP in place. To do so, start with one screw and then slightly tighten the other screws in a crossover pattern. All the while keep holding the retention frame straight with one hand.
- Now you can fully tighten the screws. Once again start with one and then continue to tighten the other screws in a crossover pattern. All the while keep holding the cooling adapter straight with one hand.



Caution

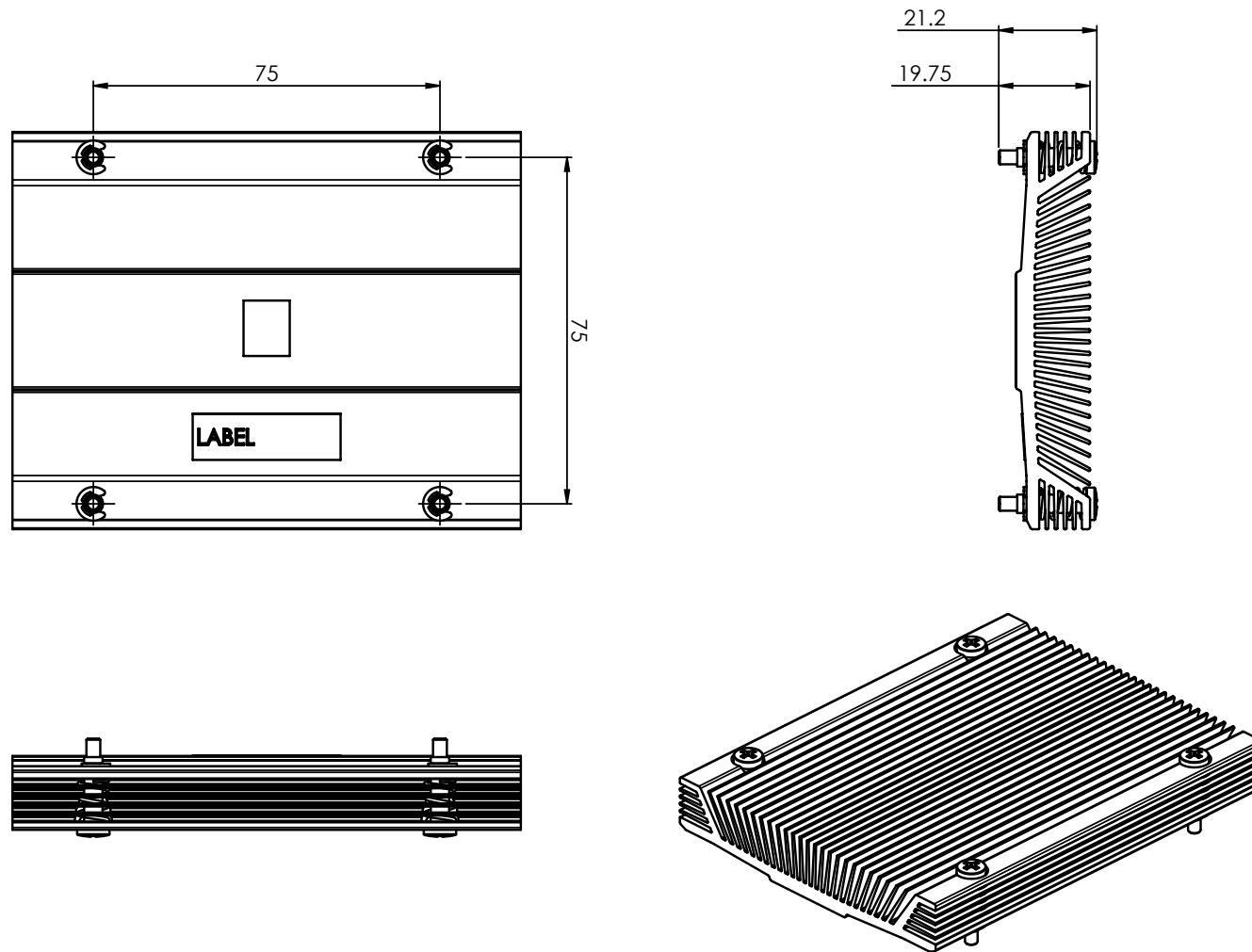
For adequate heat dissipation, follow the assembly instruction above. Apply thread-locking fluid on the screws if the CSP is used in a high shock and/or vibration environment.

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

Also, do not exceed the maximum torque specification for the cooling solution screws. Doing so may damage the SBC.

4.2 CSP Dimensions

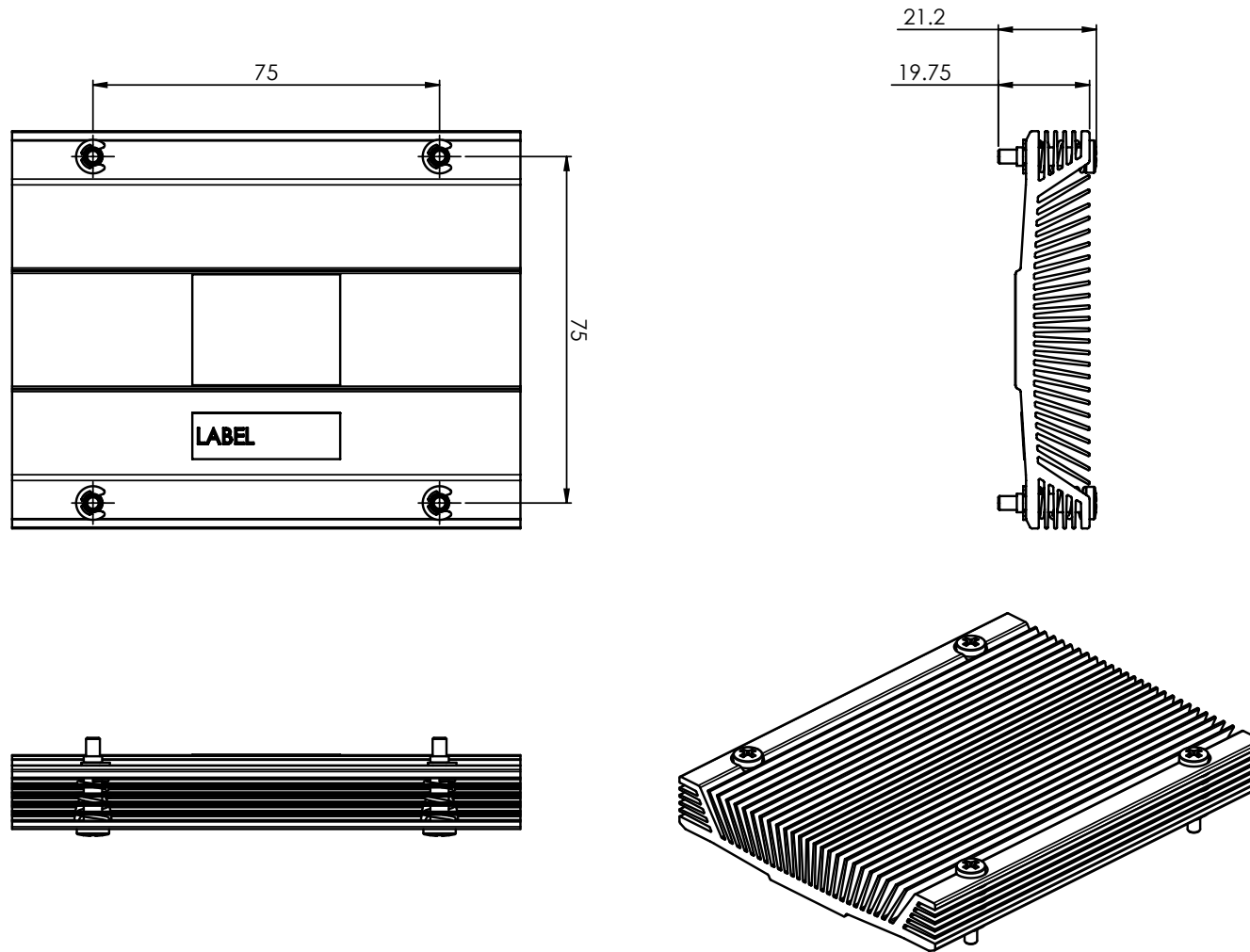
Celeron® and Pentium® Lidless Die Variants (PN: 052830)



Note

All measurements are in millimeters. Recommended maximum torque for cooling solution screws is 0.3 Nm. Mechanical system assembly mounting shall follow the valid DIN/ISO specifications.

Atom® Lidded Die Variants (PN: 052831)



 **Note**

All measurements are in millimeters. Recommended maximum torque for cooling solution screws is 0.3 Nm. Mechanical system assembly mounting shall follow the valid DIN/ISO specifications.

5 Connector Description

5.1 Power Supply Connectors

The conga-IA5 provides a DC power jack (optional for industrial variants) and a 4-pin ATX connector. Optionally, the conga-IA5 can provide SBM³ connectors.

5.1.1 DC Power Jack

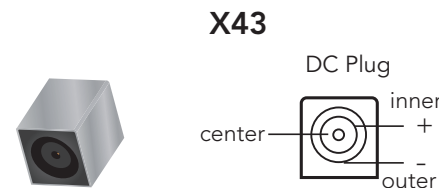
The commercial conga-IA5 variants provide a DC power jack (X43). Optionally, the industrial variants can also provide a DC power jack. The supported power supply is defined in section 2.4 "Supply Voltage Power".

Table 11 X43 Pinout Description

Pin	Function
Inner Shell	+12 - 24V
Outer Shell	GND

Connector Type

X43: DC power jack, 7.4x5.1mm



5.1.2 ATX 4-Pin Connector

The conga-IA5 offers a straight 4-pin power connector (X44). Optionally, a right angle 4-pin power connector (X48) can be placed instead. The supported power supply is defined in section 2.4 "Supply Voltage Power".

Table 12 X44 Pinout Description

Pin	Signal	Description
1	GND	Ground
2	GND	Ground
3	+12V - 24V	Power supply +12V-24V
4	+12V - 24V	Power supply +12V-24V

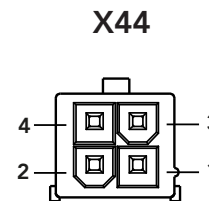
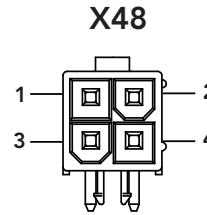


Table 13 X48 Pinout Description

Pin	Signal	Description
1	+12V - 24V	Power supply +12V-24V
2	+12V - 24V	Power supply +12V-24V
3	GND	Ground
4	GND	Ground



Connector Type

X44, X48: 2x2 pins, 4.2mm pitch (Molex 87427-044)

5.1.3 SBM³ Connectors

Optionally, the conga-IA5 provides connectors for SBM³ (X45, X46). Connect the data control cable to header X45. Connect the power cable to connector X46. The supported power supply is defined in section 2.4 "Supply Voltage Power".

Table 14 X45 Pinout Description

Pin	Function
1	GND
2	I2C_DAT
3	I2C_CLK
4	BATLOW#
5	SUS_STAT#
6	PM_SLP_S3#
7	PM_SLP_S5#
8	PWRBTN#

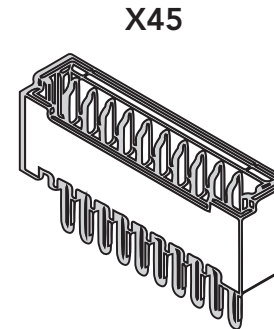
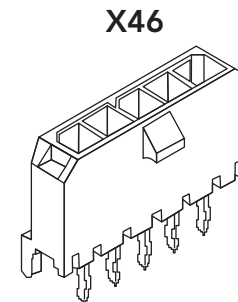


Table 15 X46 Pinout Description

Pin	Function
1	+12 - 24V
2	+12 - 24V
3	GND
4	GND
5	NC



Connector Type

X45: 8x1 pins, 1.25mm pitch (Molex 53047-1510); X46: 5x1 pins, 3.00mm pitch (Molex 43650-0517)

5.1.4 PWR_OK Signal

With the PWR_OK signal on the feature connector (X35), the user can control the SBC's start-up process. When this signal is set to low, the SBC is kept in reset until the PWR_OK signal is asserted. When the signal is asserted (set to high), it indicates to the SBC that the supplied power is stable. The SBC then begins its onboard power-up sequence.

5.1.5 Power Status LEDs

The conga-IA5 provides two LED signals (FP_LED+ and P_LED-) on pins 2 and 4 of the front panel connector X39. The signals indicate the different power states of the conga-IA5.

Table 16 Power Status LEDs Description

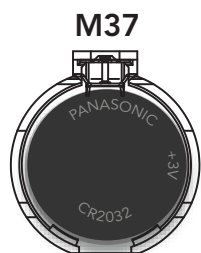
LED State	Description	ACPI State
Off	Power-off	S5
Steady Green	Running	S0
Steady Yellow	Sleeping	S3

Table 17 Single-Color Power LED

LED State	Description	ACPI State
Off	Sleeping or power-off (not running)	S3, S5
Steady Green	Running	S0

5.1.6 CR2032 Cell Battery Holder

The conga-IA5 provides a CR2032 cell battery (for commercial variants) or a BR2330A cell battery (for industrial variants) placed inside a battery holder (M37). The battery supplies power to maintain the CMOS settings and configuration data in the UEFI flash chip.



Warning

Danger of explosion if battery is incorrectly replaced. Replace only with same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.

5.2 Audio Connectors

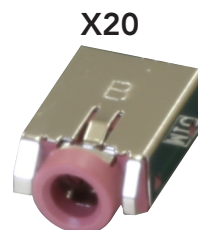
The audio signals of the following connectors are routed from a high definition audio (HDA) codec (Cirrus Logic CS4207).

5.2.1 Microphone Jack

The conga-IA5 provides a microphone jack (X20).

Table 18 X20 Pinout Description

Pin	Signal	Description
1	MIC1_L	1st Stereo microphone analog input left channel
2	A_GND	Analog ground
3	MIC1_R	1st Stereo microphone analog input right channel
4	A_GND	Analog ground
5	SENSE_A	Jack detect pin 1
6	A_GND	Analog ground



Connector Type

X20: 6-position, 3.5mm single audio jack

5.2.2 Headphone Jack

The conga-IA5 provides a headphone jack (X22).

Table 19 X22 Pinout Description

Pin	Signal	Description
1	FRONT_L	Front analog output left channel
2	A_GND	Analog ground
3	FRONT_R	Front analog output right channel
4	A_GND	Analog ground
5	SENSE_A	Jack detect pin 1
6	A_GND	Analog ground



Connector Type

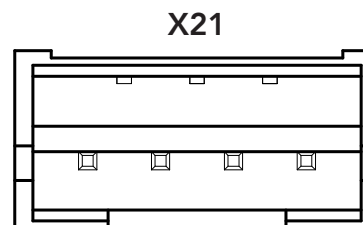
X22: 6-position, 3.5 mm single audio jack

5.2.3 Stereo Speakers Header

The conga-IA5 provides a stereo speakers header (X21). The signals are amplified (TI TPA2012D2), providing 2x 2.1W into 4ohm at 5V.

Table 20 X21 Pinout Description

Pin	Signal	Description
1	OURL-	Left channel negative differential output
2	OURL+	Left channel positive differential output
3	OUR+	Right channel positive differential output
4	OUR-	Right channel negative differential output



Connector Type

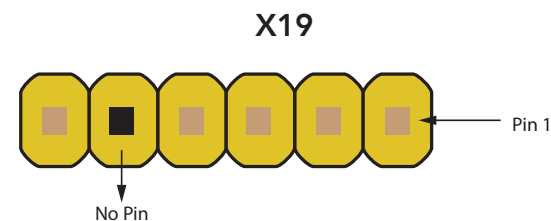
X21: 4x1 pins, 2.00mm pitch (Pinrex 721-81-04TW00)

5.2.4 Digital Microphone and S/PDIF Header

The conga-IA5 provides a digital microphone (DMIC) header (X19). Optionally, it can be used as an S/PDIF output instead.

Table 21 X19 Pinout Description

Pin	Signal	Description
1	+3.3V	3.3V supply
2	DMIC_DAT2_SPDIFOUT2	Serial data from digital MIC or S/PDIF output
3	GND	Ground
4	DMIC_CLK	Secondary S/PDIF output
5	KEY	No pin
6	+5V	5V supply



Connector Type

X19: 6x1 pins, 2.54mm pitch (keyed at pin 5)

Note

S/PDIF requires a custom BIOS and driver.

5.2.5 Front Panel Audio Header

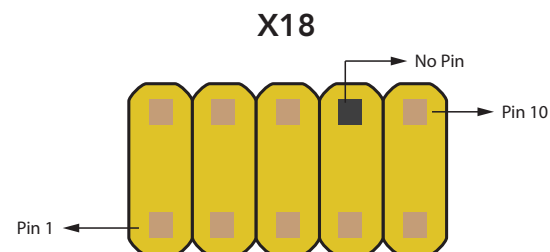
The conga-IA5 provides a front panel audio header (X18).

Table 22 X18 Pinout Description

Pin	Signal	Description
1	MIC2_L	2nd Analog stereo microphone input—left channel
2	GND	Ground
3	MIC2_R	2nd Analog stereo microphone input—right channel
4	PRESENCE#	Active low signal that indicates that an Intel HD Audio dongle is connected to the analog header.
5	LINE2_R	2nd Analog line input—right channel (headphone)
6	MIC2_JD	Microphone input jack detect
7	SENSE_B	Jack detection pin 2
8	KEY	No pin
9	LINE2_L	2nd Analog line input—left channel (headphone)
10	LINE2_JD	Line input jack detect

Connector Type

X18: 5x2 pins, 2.54mm pitch



5.3 Communication Bus

The conga-IA5 supports both SMBus and I²C compliant devices.

5.3.1 SMBus

The SMBus signals are available in different locations on the conga-IA5, including the feature connector (X35) described in section 6.11 of this document.

5.3.2 I²C Bus

The congatec Board controller provides I²C signals. These signals are available in different locations on the conga-IA5, including the feature connector (X35) described in section 6.11 of this document.

5.3.3 SPI Bus

The SPI signals are connected to the onboard SPI flash and also to the feature connector (X35). The SPI signals on the feature connector provides the ability to boot the conga-IA5 from external flash. This however requires a customized adapter for triggering the BIOS_DISABLE# signal (pin 46) of the feature connector.



Note
The congatec customized adapter for the feature connector is for internal use only.

5.4 LPC Interfaces

The interfaces in the following subsections are routed from an LPC Super I/O controller (Nuvoton NCT6102D).

5.4.1 UART Headers

The conga-IA5 provides up to five UART ports routed from a Super IO, the SoC, and optionally the congatec Board Controller (cBC).

5.4.1.1 Super IO UARTs

The conga-IA5 provides two UART headers (X24, X25) routed from a Super IO (NCT6102D). UART header X24 (COM 0) fully supports RS-232. UART header X25 (COM 1) supports RS232 (Rx and Tx only), RS422 and RS485. Optionally, UART header X25 can be used for ccTalk instead.

Table 23 X24 Pinout Description

Pin	Signal	Description	Pin	Signal	Description
1	DCD	Data Carrier Detect	2	RXD	Received Data
3	TXD	Transmit Data	4	DTR	Data Terminal Ready
5	GND	Ground	6	DSR	Data Set Ready
7	RTS	Request to Send	8	CTS	Clear to Send
9	RI	Ring Indicator	10	N.C	Not connected

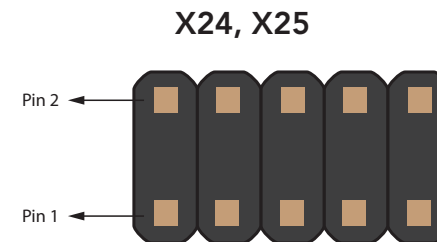


Table 24 X25 Pinout Description

Pin	Signal	Description	Pin	Signal	Description
1	N.C	Not connected	2	RX-	Receive -
3	TX-	Transfer -	4	N.C	Not connected
5	GND	Ground	6	N.C	Not connected
7	TX+	Transfer +	8	RX+	Receive +
9	N.C	Not connected	10	N.C	Not connected

 **Connector Type**

X24, X25: 5x2 pins, 2.54mm pitch

 **Note**

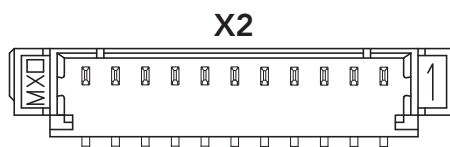
The conga-IA5 offers an optional ccTALK interface. This interface uses transmit and receive signals of COM 1. If this option is implemented, COM 1 will not be available. congatec offers cables for the COM ports (see section 1.2.2 "Optional Accessories"). For more information, contact congatec technical solution department.

5.4.1.2 SoC UARTs

The conga-IA5 also provides signals for two UART ports on header X2 routed directly from the SoC.

Table 25 X2 Pinout Description

Pin	Signal	Description
1	+V3.3	3.3V supply
2	+V1.8	1.8V supply
3	TXD1	Transmit Data port 1
4	RXD1	Received Data port 1
5	RTS1	Request to Send port 1
6	CTS1	Clear to Send port 1
7	TXD0	Transmit Data port 0
8	RXD0	Received Data port 0
9	RTS0	Request to Send port 0
10	CTS0	Clear to Send port 0
11	GND	Ground



 **Connector Type**

X2: 11x1 pins, 1.25mm pitch (Molex 53398-1171)



Caution

The UART signals on connector X2 are 1.8V.



The two UART ports routed directly from the SoC cannot be used under Windows because Intel® does not provide the necessary driver. The two UART ports routed directly from the SoC can only be used under Linux.

5.4.1.3 congatec Board Controller UART

Optionally, one UART port can also be provided on the feature connector (X35) routed from the congatec Board Controller (cBC). See section 6.11 "Feature Connector" for more information.

5.4.2 CPU and System Fan Header

The conga-IA5 provides a CPU fan header (X36) and system fan header (X38). Use jumper X34 to select the CPU fan voltage. Use jumper X37 to select the system fan voltage.

Table 26 X36 Pinout Description

Pin	Signal
1	GND
2	VCC +5VDC/+12VDC
3	FAN_TACHOIN
4	FAN_CTRL

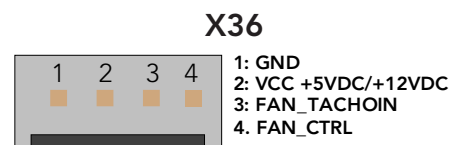


Table 27 X38 Pinout Description

Pin	Signal
1	GND
2	VCC +5VDC/+12VDC
3	FAN_TACHOIN
4	FAN_CTRL

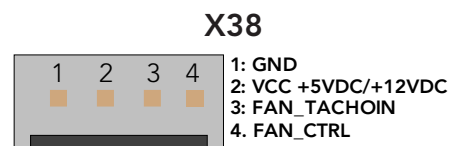


Table 28 X34, X37 Pinout Description

Pin	Configuration
1 - 2	FAN +12VDC (default)
2 - 3	FAN +5VDC

X34, X37



Connector Type

X36, X38: 4x1 pins, 2.54mm pitch, friction lock (Tyco 1734847-1)

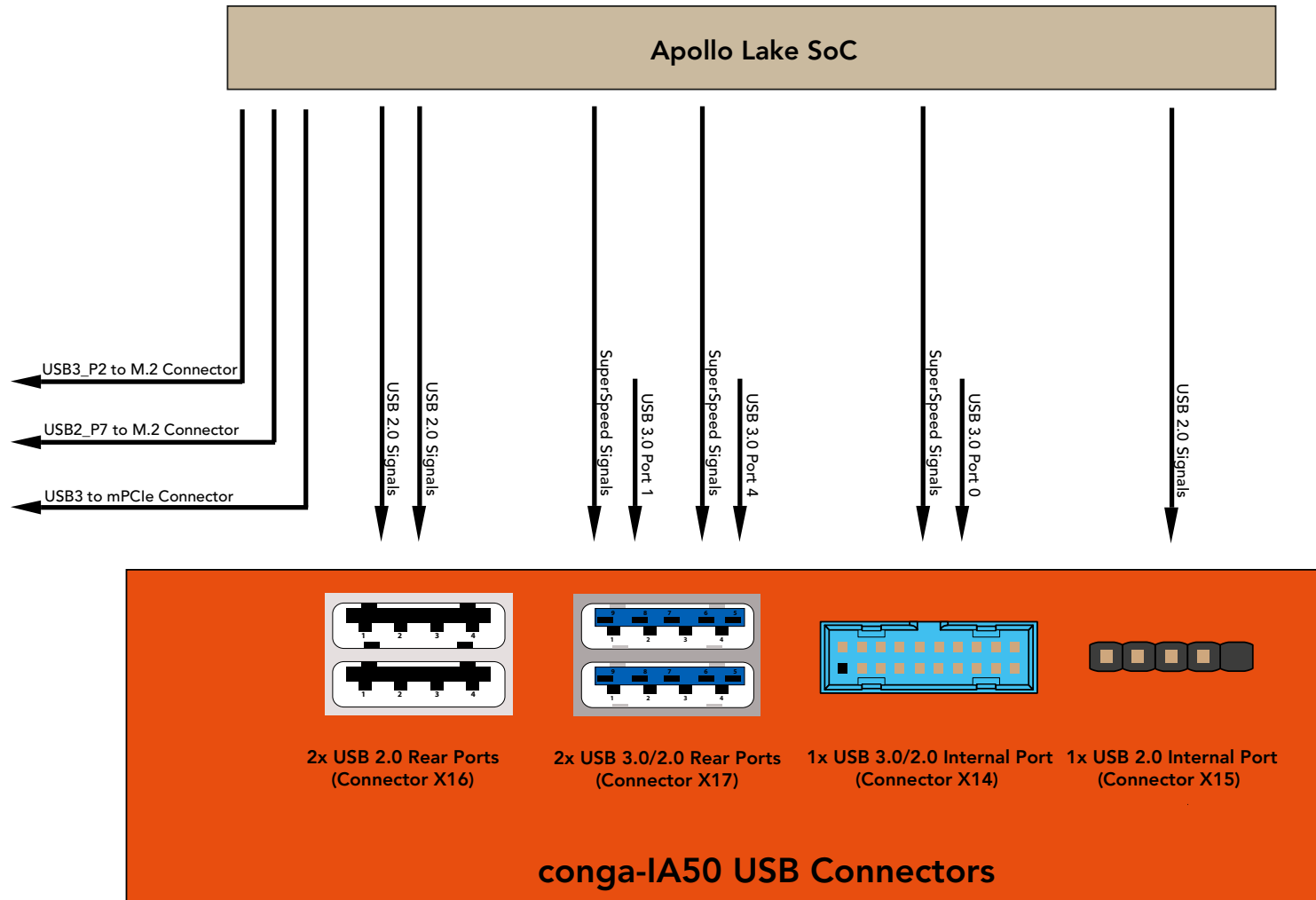
X34, X37: 3x1 pins, 2.54mm pitch

Note

The maximum supported power of the CPU fan is approximately 3W. The system fan has a maximum supported power of approximately 4.5W. A cable adapter is required to use 3-pin fans. The CPU fan header (X36) and system fan header (X38) do not support automatic fan control.

5.5 Universal Serial Bus (USB)

The conga-IA5 provides six USB ports. All USB ports are routed directly from the SoC.



5.5.1 USB 2.0 and USB 3.0 Ports

The conga-IA5 provides two USB 2.0 ports (X16) and two USB 3.0 ports (X17).

Connector Type

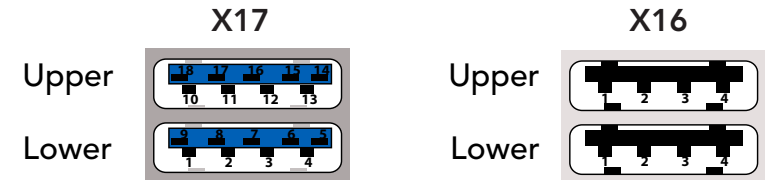
X16, X17: Two type A, dual port USB connectors

Note

The USB 2.0 ports have a maximum current of 0.5A. The USB 3.0 ports have a maximum current of 1.0A.

Caution

The maximum cable length of a USB 2.0 device connected to any port shall not exceed 3 meters in order to comply to EN 55024:2010.



5.5.2 USB 3.0 Header

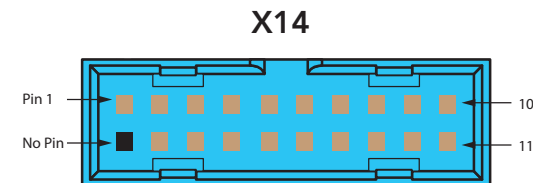
The conga-IA5 provides one USB 3.0 header (X14) with support for OTG.

Table 29 X14 Pinout Description

Pin	Signal	Pin	Signal
1	N.C	11	D+
2	N.C	12	D-
3	N.C	13	GND
4	GND	14	TX+
5	N.C	15	TX-
6	N.C	16	GND
7	GND	17	RX+
8	N.C	18	RX-
9	N.C	19	+V5
10	ID	20	No Pin

Connector Type

X14: 2x10 pins, 2.54mm pitch (LOTES ABA-USB-050-K04)





Caution

The maximum cable length of a USB 2.0 device connected to this header shall not exceed 3 meters in order to comply to EN 55024:2010.



Note

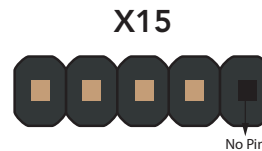
The maximum current is 1.2A. Only one USB port is supported on this connector. The signals for the second USB port are not connected. congatec offers a cable for this connector (see section 1.2.2 "Optional Accessories"). For more information, contact congatec technical solution department.

5.5.3 USB 2.0 Header

The conga-IA5 offers one USB 2.0 header (X15).

Table 30 X15 Pinout Description

Pin	Signal
1	+5V
2	D-
3	D+
4	GND
5	No Pin



Connector Type

X15: 5x1 pins, 2.54mm pitch



Caution

The maximum cable length of a USB 2.0 device connected to this header shall not exceed 3 meters in order to comply to EN 55024:2010.



Note

The maximum current is 0.5A. congatec offers a cable for connector X15 (see section 1.2.2 "Optional Accessories"). For more information, contact congatec technical solution department.

5.6 Gigabit Ethernet Ports

The conga-IA5 provides two Gigabit Ethernet ports (connectors X6 and X7) on the rear side. The two Gigabit Ethernet interfaces are supported via the Intel Gigabit Ethernet controller i211 (commercial variants) or i210 (industrial variants).

The two Gigabit Ethernet ports support the IEEE1588 standard via connector X49 (for X6) and X50 (for X7).

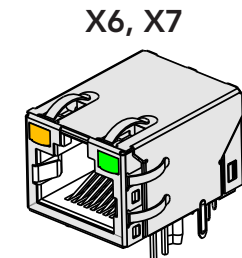
Table 31 X49, X50 Pinout Description

Pin	X49 Signal	Pin	X50 Signal
1	+3.3V	1	+3.3V
2	LAN1_SDP0	2	LAN2_SDP0
3	LAN1_SDP1	3	LAN2_SDP1
4	GND	4	GND



Table 32 Gigabit Ethernet LED Description

LED Left Side	Description	LED Right Side	Description
Off	10 Mbps link speed	Off	No link
Green	100 Mbps link speed	Steady On	Link established, no activity detected
Orange	1000 Mbps link speed	Blinking	Link established, activity detected



Connector Type

X6, X7: 8 pins, RJ45 connector with gigabit magnetic and LEDs

X49, X50: 4x1 pins, 2.54mm pitch

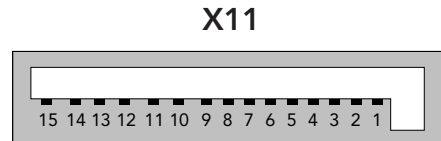
Note

Connectors X6 and X7 do not support the Intel® AMT feature.

5.7 SATA Connectors

5.7.1 SATA Power Connector

The conga-IA5 provides a SATA power connector (X11), supplying 3.3V, 5V and 12V with maximum 1.5A each.



Connector Type

X11: 15 pins, SATA connector

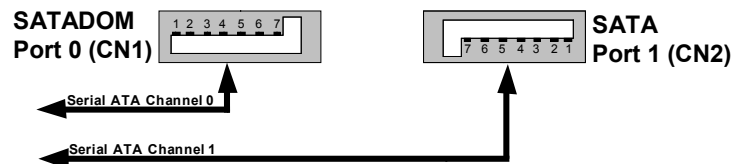
5.7.2 SATA / SATADOM Ports

The conga-IA5 provides two SATA 6Gb/s¹ ports by default:

- SATA port 0 (CN1) with support for SATADOM²
- SATA port 1 (CN2)

Optionally, the SATA port 1 (CN2) signals can be switched to the M.2 card slot (X12) instead via BIOS setup.

The SATA LED on the front panel connector (X39) is lit when there is activity on either of these ports.



Connector Type

CN1, CN2: Standard SATA connector



Caution

Only enable SATADOM if the device supports it. Otherwise, this will create a short and potentially damage the hardware. The current is limited to 1A. To enable SATADOM in the BIOS setup, go to "Chipset", "SATA Devices" and set "SATA Power" to SATADOM. "SATA Power" is set to SATA/HDD by default.



Note

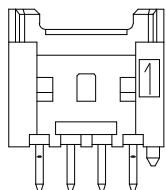
SATA port 1 (CN2) is not fully SATA 6 Gb/s compliant because of the Rx signal integrity. This port is fully SATA 3 Gb/s compliant and when the same signals are switched to the M.2 card slot (X12), they are fully SATA 6 Gb/s compliant. Therefore, congatec recommends to either:

- a) use only SATA port 0 (CN1)
- b) use SATA port 1 (CN2) signals on the M.2 card slot (X12) instead
- c) set SATA speed to 3 Gb/s (Gen 2) in BIOS setup menu (it is not possible to set CN1 to SATA 6 Gb/s and CN2 to SATA 3 Gb/s)

5.7.3 4-Pin Power Header

The conga-IA5 offers a 4-pin power header (X47) with 5V to power a SATA device.

X47



Connector Type

X47: 4x1 pins, 2.50mm pitch (Molex 53375-0410)

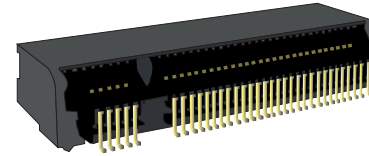
5.7.4 M.2 3042/2242 Card Slot

The conga-IA5 provides an M.2 3042/2242 card slot (X12) for connecting a SATA or PCIe SSD and WWAN device. This connector shares the SoC's SATA1 signals with CN2. You can have either SATA1 (default) or PCIe4 signals on the M.2 slot (X12). You can change the signals to PCIe4 in the BIOS setup.

Table 33 X12 Pinout Description

Pin	Signal	Pin	Signal
1	CONFIG_3	2	+3.3V
3	GND	4	+3.3V
5	GND	6	FULL_CARD_PWROFF#
7	USB_D+	8	W_DISABLE_1#
9	USB_D-	10	LED1 (optional)
11	GND	12	Key
13	Key	14	
15		16	
17		18	
19		20	N.C
21	CONFIG_0	22	N.C
23	WoWWAN#	24	N.C
25	N.C	26	W_DISABLE_2#
27	GND	28	N.C
29	PER1-	30	UIM_RESET
31	PER1+	32	UIM_CLK
33	GND	34	UIM_DATA
35	PET1-	36	UIM_PWR
37	PET1+	38	DEVSLP
39	GND	40	GNSS_SCL
41	PER0-/SATA_B+	42	GNSS_SDA
43	PER0+/SATA_B-	44	GNSS_IRQ
45	GND	46	N.C
47	PET0-/SATA_A-	48	N.C
49	PET0+/SATA_A+	50	RESET#
51	GND	52	CLKREQ#
53	REFCLK-	54	PEWAKE#

X12



Pin	Signal	Pin	Signal
55	REFCLK+	56	N.C
57	GND	58	N.C
59	N.C	60	N.C
61	N.C	62	N.C
63	N.C	64	N.C
65	N.C	66	N.C
67	RESET#	68	SUSCLK
69	CONFIG_1	70	+3.3V
71	GND	72	+3.3V
73	GND	74	+3.3V
75	CONFIG_2		

Connector Type

X12: M.2 type B slot (compatible with card size 3042 or 2242)

Note

Optionally, the micro-SIM card slot (connector X10) can be connected to the M.2 socket instead.

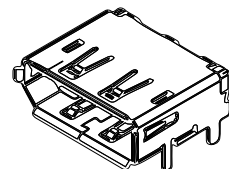
5.8 Display Interfaces

The conga-IA5 supports three simultaneous displays—two DP++ and an LVDS or eDP display.

5.8.1 DP++ Ports

The conga-IA5 SBC provides two DP++ ports (X26, X27).

X26, X27



Connector Type

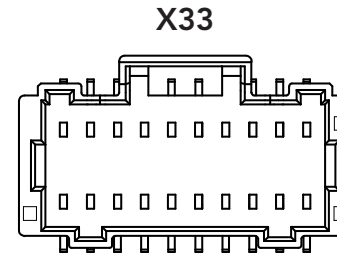
X26, X27: DisplayPort

5.8.2 LVDS Header

The conga-IA5 offers an LVDS header (X33). The LVDS signals are sourced from the SoC's DDI stream via a multiplexer. The header supports 24-bit dual channel, selectable backlight voltage, VESA color mappings, automatic panel detection and up to 1920x1200 resolution.

Table 34 X33 Pinout Description

Pin	Signal	Pin	Signal
1	GND	2	GND
3	LVDS_B3+	4	LVDS_A3+
5	LVDS_B3-	6	LVDS_A3-
7	GND	8	GND
9	LVDS_B2+	10	LVDS_A2+
11	LVDS_B2-	12	LVDS_A2-
13	GND	14	GND
15	LVDS_B1+	16	LVDS_A1+
17	LVDS_B1-	18	LVDS_A1-
19	GND	20	GND
21	LVDS_B0+	22	LVDS_A0+
23	LVDS_B0-	24	LVDS_A0-
25	GND	26	GND
27	LVDS_B_CK+	28	LVDS_A_CK+
29	LVDS_B_CK-	30	LVDS_A_CK-
31	GND	32	GND
33	DDC_DAT (3.3V)	34	DDC_CLK (3.3V)
35	+VCC_LVDS	36	+VCC_LVDS
37	GND	38	+VCC_LVDS
39	LVDS_VDD_EN (3.3V)	40	N.C



Connector Type

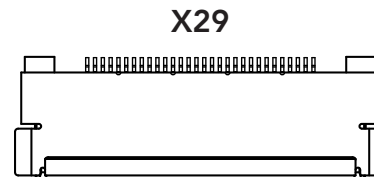
X33: 40 pins, 1.00mm pitch (Molex 501190-4017)

5.8.3 eDP Connector

The conga-IA5 provides an eDP connector (X29). In order to use it, change the "Active LFP Configuration" in the BIOS setup menu to "eDP".

Table 35 X29 Pinout Description

Pin	Signal	Pin	Signal
1	N.C	21	VCC_LCD
2	GND	22	N.C
3	eDP_TX3-	23	GND
4	eDP_TX3+	24	GND
5	GND	25	GND
6	eDP_TX2-	26	GND
7	eDP_TX2+	27	eDP_HPD
8	GND	28	GND
9	eDP_TX1-	29	GND
10	eDP_TX1+	30	GND
11	GND	31	GND
12	eDP_TX0-	32	eDP_LVDS_BKLT_EN
13	eDP_TX0+	33	eDP_LVDS_BKLT_CTRL
14	GND	34	N.C
15	eDP_AUX+	35	N.C
16	eDP_AUX-	36	N.C
17	GND	37	BKLT_PWR
18	VCC_LCD	38	BKLT_PWR
19	VCC_LCD	39	BKLT_PWR
20	VCC_LCD	40	N.C



Connector Type

X29: 40 pins, 0.5mm pitch (ACES 50203-04001-001)

Note

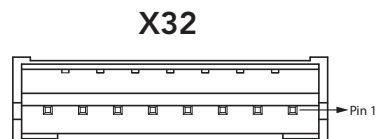
congatec offers cables and adapter for the eDP interface (see section 1.2.2 "Optional Accessories/Cables"). For more information, contact the congatec technical solution department.

5.8.3.1 Backlight Power Header

The conga-IA5 provides a backlight power header (X32). The power budget of BKLT_PWR (pins 3 and 4) is limited to 1.5A.

Table 36 X32 Pinout Description

Pin	Signal Name	Description
1	LVDS_BKLT_EN	Backlight enable
2	LVDS_BKLT_CTRL	Backlight control
3	BKLT_PWR	Backlight inverter power
4	BKLT_PWR	Backlight inverter power
5	GND	Backlight/brightness ground
6	GND	Backlight/brightness ground
7	Brightness_Up	Flat panel brightness increase
8	Brightness_Down	Flat panel brightness decrease



Connector Type

X32: 8x1 pins, 2mm pitch (PINREX 721-81-08TW00)

Note

congatec offers an open-end cable for this interface (see section 1.2.2 "Optional Accessories"). For more information, contact the congatec technical solution department.

5.8.3.2 Backlight/Panel Power Selection

The conga-IA5 supports different voltages for the panel and backlight connectors. With jumper X31, you can set the backlight voltage to 5V or 12V. With jumper X30, you can set the panel voltage to 3.3V, 5V or 12V.

Table 37 X31 Pinout Description

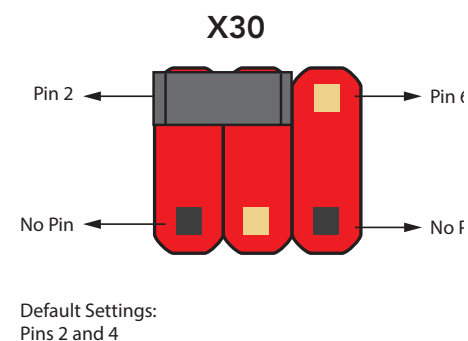
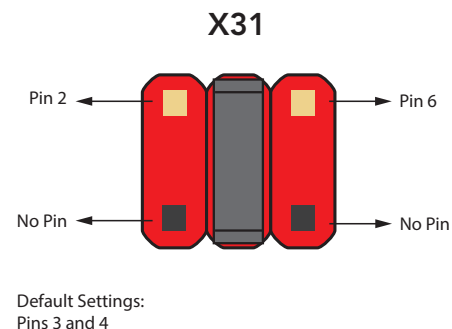
Pin	Signal Name
1	No Pin
2	N.C
3	12V
4	Selected backlight power
5	No Pin
6	5V

Table 38 X30 Pinout Description

Pin	Signal Name
1	No Pin
2	3.3V
3	12V
4	Selected LCD power
5	No Pin
6	5V

Connector Type

X30, X31: 2x3 pins (pin 1 and 5 removed), 2.54mm pitch

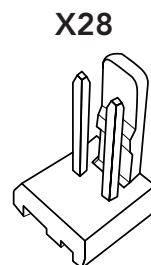


5.8.3.3 Monitor OFF Header

The conga-IA5 provides a monitor OFF header (X28). You can use it to turn off the attached displays.

Table 39 X28 Pinout Description

Pin	Function
1	MONITOR_OFF#
2	GND



Connector Type

X28: 2x1 pins, 2.54mm pitch (MOLEX 22-27-2021)

5.9 PCI Express Connectors

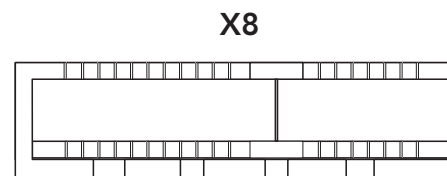
The conga-IA5 provides a PCIe x1 card slot, a mini PCIe card slot (half-size) and a mini PCIe (full-size) card slot. You can use either the mini PCIe half-size or full-size card slot.

5.9.1 PCIe x1 Card Slot

The conga-IA5 provides one PCIe x1 card slot (X8). This connector shares the SoC's PCIe 2 signals with mini PCIe card slot (X9) via a multiplexer. When an mPCIe device is inserted into connector X9, the multiplexer automatically switches the PCIe signals to the mini PCIe card slot (X9).

Table 40 X8 Pinout Description

Pin	Signal	Pin	Signal
B1	+12V	A1	GND
B2	+12V	A2	+12V
B3	+12V	A3	+12V
B4	GND	A4	GND
B5	SMB_CLK	A5	N.C.
B6	SMB_DAT	A6	N.C.
B7	GND	A7	N.C.
B8	+3.3V	A8	N.C.
B9	N.C.	A9	+3.3V



B10	+3.3V Aux	A10	+3.3V
B11	WAKE#	A11	PCIE_RST#
	Key		
B12	N.C.	A12	GND
B13	GND	A13	PCIE_CLK+
B14	PCIE_TX0+	A14	PCIE_CLK-
B15	PCIE_TX0-	A15	GND
B16	GND	A16	PCIE_RX0+
B17	PRSNT2#	A17	PCIE_RX0-
B18	GND	A18	GND

Connector Type

X8: PCIe x1 Card Slot

Note

You can use either the PCIe x1 (X8) or mPCIe slot (X9). The PCIe x1 slot (x8) will not function if you insert a card into the mPCIe slot (X9).

5.9.2 Mini PCIe Card Slot (Half-Size)

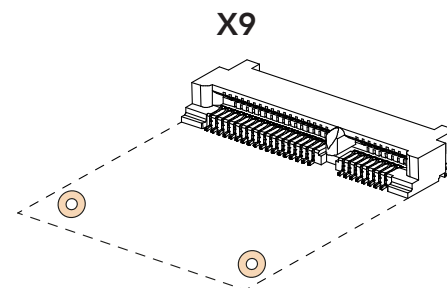
The conga-IA5 provides a mini PCIe slot (X9) for a half-size card. This connector shares the SoC's PCIe 2 signals with connector X8 (PCIe x1 slot), via a multiplexer.

When an mini PCIe device is attached to the mini PCIe slot (connector X9), the SoC automatically detects the type of device that is attached (via pin 43—the signal detect pin).

See section 5.9.3 "Mini PCIe Card Slot (Full-Size)" for the mini PCIe Pinout Description.

Table 41 X9 Pinout Description

Pin	Signal	Pin	Signal
1	WAKE#	2	+3.3Vaux
3	N.C.	4	GND
5	N.C.	6	+1.5V
7	CLKREQ#	8	N.C.
9	GND	10	N.C.
11	REFCLK-	12	N.C.



Pin	Signal	Pin	Signal
13	REFCLK+	14	N.C.
15	GND	16	N.C.
17	Pull down resistor (1M)	18	GND
19	N.C.	20	W_DISABLE#
21	GND	22	PERST#
23	PERn0	24	+3.3Vaux
25	PERp0	26	GND
27	GND	28	+1.5V
29	GND	30	SMB_CLK
31	PETn0	32	SMB_DATA
33	PETp0	34	GND
35	GND	36	USB_D-
37	GND	38	USB_D+
39	+3.3Vaux	40	GND
41	+3.3Vaux	42	N.C.
43	mSATA_mPCIe_detect	44	N.C.
45	CL_CLK	46	N.C.
47	CL_DATA	48	+1.5V
49	CL_RST#	50	GND
51	N.C.	52	+3.3Vaux
53	GND	54	GND

Connector Type

X9: Mini PCIe card slot (half-size)

Note

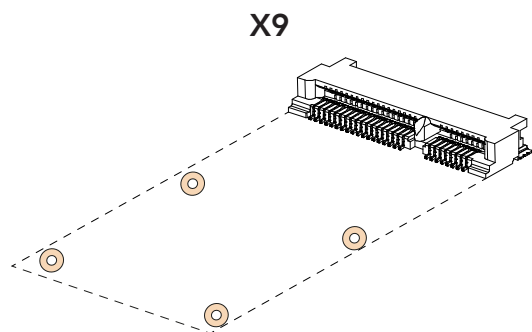
- Pins 21 and 43 of the mini PCIe card must be terminated to ground for card present detection and card type recognition respectively.
- You can use either the PCIe x1 (X8) or mini PCIe slot (X9). The PCIe x1 slot (x8) will not function if you insert a card into the mini PCIe slot (X9).

5.9.3 Mini PCIe Card Slot (Full-Size)

The conga-IA5 provides a mini PCIe slot (X9) for a full-size card. This connector shares the SoC's PCIe 2 signals with connector X8 (PCIe x1 slot), via a multiplexer.

When an mini PCIe device is attached to the mini PCIe slot (connector X9), the SoC automatically detects the type of device that is attached (via pin 43—the signal detect pin).

See section 5.9.2 "Mini PCIe Card Slot (Half-Size)" for the mini PCIe Pinout Description.



Connector Type

X9: Mini PCIe card slot (full-size)

Note

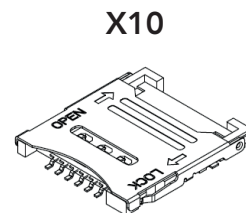
- Pins 21 and 43 of the mini PCIe card must be terminated to ground for card present detection and card type recognition respectively.
- You can use either the PCIe x1 (X8) or mini PCIe slot (X9). The PCIe x1 slot (x8) will not function if you insert a card into the mini PCIe slot (X9).

5.10 Micro-SIM Card Slot

The conga-IA5 provides a micro-SIM card slot (X10) connected to the UIM interface of the mini PCIe slot by default.

Table 42 X10 Pinout Description

Pin	Signal	Description
C1	PWR	Power
C2	RST	Reset
C3	CLK	Clock
C4	N.A	Not available
C5	GND	Ground
C6	VPP	Programming voltage input
C7	I/O	Data
C8	N.A	Not available



Connector Type

X10: Micro-SIM Card Slot

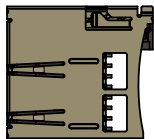
Note

Optionally, the micro-SIM card slot can be routed to the M.2 socket instead.

5.11 microSD Card Slot

The conga-IA5 provides a microSD card slot (X41).

X41

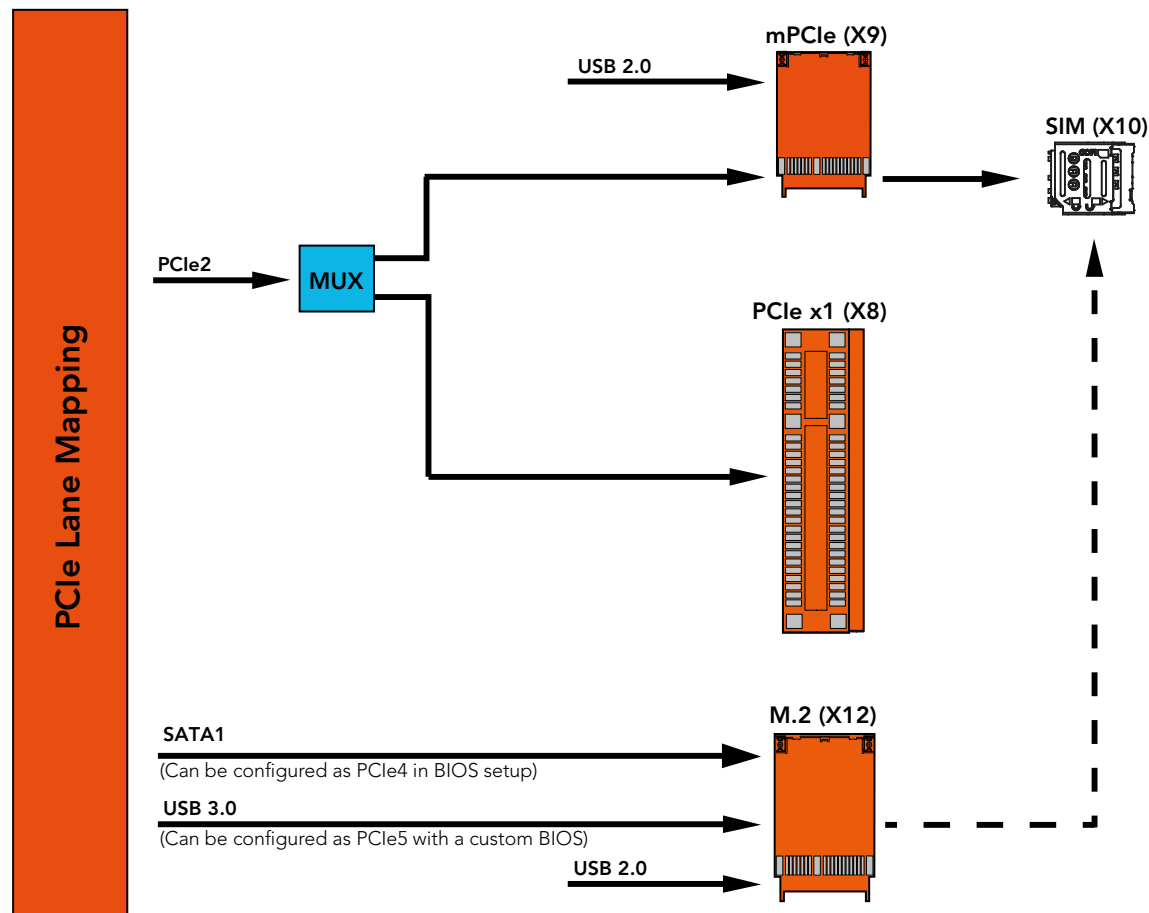


Connector Type

X41: microSD card slot

5.11.1 PCI Express Routing

The diagram below shows how the PCIe lanes are routed to the PCIe connectors.



Note

- You can use either the PCIe x1 (X8) or mPCIe slot (X9). The PCIe x1 slot (x8) will not function if you insert a card into the mPCIe slot (X9).
- Optionally, the SIM card slot (X10) can be connected to the M.2 slot (X12). It is connected to the mPCIe slot (X9) by default.
- You can have either USB3.0 (default) or PCIe5 signals on the M.2 slot (X12). You can change the signals to PCIe5 with a custom BIOS.
- You can have either SATA1 (default) or PCIe4 signals on the M.2 slot (X12). You can change the signals to PCIe4 in the BIOS setup.

6 Additional Features

6.1 Front Panel Header

The conga-IA5 provides a front panel header (X39).

Table 43 X39 Pinout Description

Pin	Function	Description
1	HDD_POWER_LED+	Hard disk power LED with pull-up resistor to 3.3V.
2	FP_LED+	Power LED (main color)
3	SATA_ACT#	Hard disk activity LED
4	FP_LED-	Power LED (alternate color)
5	GND	Ground
6	PWRBTN#	Power button. Note: For proper detection, assert a pulse width of at least 16 ms.
7	SYS_RST#	Reset button Note: For proper detection, assert a pulse width of at least 16 ms.
8	GND	Ground
9	3.3V	+3.3V power supply (500mA power budget)
10	KEY	No pin



Connector Type

X39: 5x2 pins, 2.54mm pitch

6.2 Chassis Intrusion Header

The conga-IA5 provides chassis intrusion header (X23).

Table 44 X23 Pinout Description

Pin	Function
1	GND
2	CASEOPEN#



Connector Type

X23: 2x1 pins, 2.54mm pitch

6.3 Security Features

The conga-IA5 provides a firmware TPM 2.0 (Intel® PTT). Follow the steps below to enable or disable the firmware TPM 2.0:

- enter the BIOS setup menu (see section 10.1 "Navigating the BIOS Setup Menu")
- navigate to **Advanced Setup** menu
- navigate to **Platform Trust Technology** submenu and press ENTER
- enable or disable fTPM



Note

1. The conga-IA5 supports discrete LPC TPM 2.0 (Infineon SLB9665) or discrete LPC TPM 1.2 (Infineon SLB9660) via assembly option.
2. Always disable fTPM (firmware TPM) if you use a discrete TPM.

6.4 congatec Board Controller (cBC)

The conga-IA5 is equipped with a Texas Instruments Tiva™ TM4E1231H6ZRBI microcontroller. This onboard microcontroller plays an important role for most of the congatec BIOS features. It fully isolates some of the embedded features such as system monitoring or the I²C bus from the x86 core architecture, which results in higher embedded feature performance and more reliability, even when the x86 processor is in a low power mode.

6.4.1 Fan Control

The conga-IA5 has additional signals and functions to further improve system management. One of these signals is an output signal called FAN_PWMOUT that allows system fan control using a PWM (Pulse Width Modulation) output. Additionally, there is an input signal called FAN_TACHOIN that provides the ability to monitor the system's fan RPMs (revolutions per minute). This signal must receive two pulses per revolution in order to produce an accurate reading. For this reason, a two pulse per revolution fan or similar hardware solution is recommended.

6.4.2 Power Loss Control

The cBC has full control of the power-up of the SBC, therefore can be used to specify the behavior of the system after an AC power loss condition. Supported modes are "Always On", "Remain Off" and "Last State".

6.4.3 Board Information

The cBC provides a rich data-set of manufacturing and board information such as serial number, EAN number, hardware and firmware revisions, and so on. It also keeps track of dynamically changing data like runtime meter and boot counter.

6.4.4 GPIOs

The conga-IA5 SBC provides eight General Purpose Inputs via the congatec board controller and eight General Purpose Outputs via the onboard Super I/O. The GPIO signals are routed to the feature connector X35.

6.5 OEM BIOS Customization

The conga-IA5 is equipped with congatec Embedded BIOS, which is based on American Megatrends Inc. Aptio UEFI firmware. The congatec Embedded BIOS allows system designers to modify the BIOS. For more information about customizing the congatec Embedded BIOS, refer to the congatec System Utility user's guide, which is called CGUTLm1x.pdf and can be found on the congatec website at www.congatec.com or contact technical support. The customization features supported are described below:

6.5.1 OEM Default Settings

This feature allows system designers to create and store their own BIOS default configuration. Customized BIOS development by congatec for OEM default settings is no longer necessary because customers can easily perform this configuration by themselves using the congatec system utility CGUTIL. See congatec application note AN8_Create_OEM_Default_Map.pdf on the congatec website for details on how to add OEM default settings to the congatec Embedded BIOS.

6.5.2 OEM Boot Logo

This feature allows system designers to replace the standard text output displayed during POST with their own BIOS boot logo. Customized BIOS development by congatec for OEM Boot Logo is no longer necessary because customers can easily perform this configuration by themselves using the congatec system utility CGUTIL. See congatec application note AN8_Create_And_Add_Bootlogo.pdf on the congatec website for details on how to add OEM boot logo to the congatec Embedded BIOS.

6.5.3 OEM POST Logo

This feature allows system designers to replace the congatec POST logo displayed in the upper left corner of the screen during BIOS POST with their own BIOS POST logo. Use the congatec system utility CGUTIL 1.5.4 or later to replace/add the OEM POST logo.

6.5.4 OEM BIOS Code / Data

With the congatec embedded BIOS, it is possible for system designers to add their own code to the BIOS POST process. The congatec Embedded BIOS first calls the OEM code before handing over control to the OS loader.

Except for custom specific code, this feature can also be used to support Windows® 10 OEM activation (OA3.0), verb tables for HDA codecs, PCI/PCIe opROMs, bootloaders, rare graphic modes and Super I/O controller initialization.



Note
The OEM BIOS code of the new UEFI based firmware is only called when the CSM (Compatibility Support Module) is enabled in the BIOS setup menu. Contact congatec technical support for more information on how to add OEM code.

6.5.5 OEM DXE Driver

This feature allows designers to add their own UEFI DXE driver to the congatec embedded BIOS. Contact congatec technical support for more information on how to add an OEM DXE driver.

6.6 congatec Battery Management Interface

To facilitate the development of battery powered mobile systems based on embedded modules, congatec GmbH defined an interface for the exchange of data between a CPU module (using an ACPI operating system) and a Smart Battery system. A system developed according to the congatec Battery Management Interface Specification can provide the battery management functions supported by an ACPI capable operating system (for example, charge state of the battery, information about the battery, alarms/events for certain battery states and so on) without the need for additional modifications to the system BIOS.

In addition to the ACPI-Compliant Control Method Battery mentioned above, the latest versions of the conga-IA5 BIOS and board controller firmware also support LTC1760 battery manager from Linear Technology and a battery only solution (no charger). All three battery solutions are supported on the I2C bus and the SMBus. This gives the system designer more flexibility when choosing the appropriate battery sub-system.

For more information about the supported Battery Management Interface, contact your local sales representative.

6.7 API Support (CGOS)

congatec provides an API that allows application software developers to easily integrate the BIOS customization features mentioned above into their code. The CGOS API (congatec Operating System Application Programming Interface) is the congatec proprietary API that is available for all commonly used Operating Systems such as Win32, Win64, Win CE, Linux.

The architecture of the CGOS API driver provides the ability to write application software that runs unmodified on all congatec CPU modules. All the hardware related code is contained within the congatec embedded BIOS on the module. See section 1.1 of the CGOS API software developers guide, which is available on the congatec website.

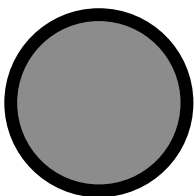
6.8 Thermal/Voltage Monitoring

The conga-IA5 SBC features three temperature sensors—the CPU, memory and board controller sensors. The board controller can monitor six different voltages which are main power, 5V (runtime), 5V (standby), 1.05V (runtime), VCORE, 3.3V (runtime) and 3.3V (standby).

6.9 Beeper

The board-mounted speaker (M18) provides audible error code (beep code) information during POST.

M18



6.10 External System Wake Event

The conga-IA5 supports LAN, USB, PCIe and PWRBTN driven wake up events.

6.11 Feature Connector

The conga-IA5 provides a feature connector (X35).

Table 45 X35 Pinout Description

Pin	Signal name	Pin Type	Voltage level	Onboard termination	Description
1	+5V	Power	5V		+5V runtime power output, 500mA max.
2	GND	Ground			
3	LAD0	I/O	3.3V		LPC command, address, data 0
4	LAD1	I/O	3.3V		LPC command, address, data 1
5	LAD2	I/O	3.3V		LPC command, address, data 2
6	LAD3	I/O	3.3V		LPC command, address, data 3
7	LFRAME#	Output	3.3V		LPC frame (start of cycle)
8	SERIRQ#	I/O	3.3V		Serial Interrupt Request
9	LPC_CLK_EXT	Output	3.3V		25MHz clock signal for external LPC device
10	PLT_RST_BUF#	Output	3.3V standby		System reset, active low
11	SMB_DAT_EXT	I/OD	3.3V standby	PU 2k	SMBus data
12	SMB_CLK_EXT	OD	3.3V standby	PU 2k	SMBUs clock output, up to 100kHz
13	SMB_ALERT#_EXT	Input	3.3V standby	PU 2k	SMBus Alert (system wake or SMI), active low
14	GND	Ground			
15	TX_FEAT	Output	3.3V		UART port from SoC, TX (assembly option UART from Board controller)
16	RX_FEAT	Input	3.3V		UART port from SoC, RX (assembly option UART from Board controller)
17	GPO0	Output	3.3V	PU 10k	General purpose output from Super IO (LPC)
18	GPO1	Output	3.3V	PU 10k	General purpose output from Super IO (LPC)
19	GPO2	Output	3.3V	PU 10k	General purpose output from Super IO (LPC)
20	GPO3	Output	3.3V	PU 10k	General purpose output from Super IO (LPC)
21	GPO4	Output	3.3V	PU 10k	General purpose output from Super IO (LPC)
22	GPO5	Output	3.3V	PU 10k	General purpose output from Super IO (LPC)
23	GPO6	Output	3.3V	PU 10k	General purpose output from Super IO (LPC)
24	GPO7	Output	3.3V	PU 10k	General purpose output from Super IO (LPC)
25	GPI0	Input	3.3V	PU 10k	General purpose input at Board controller
26	GPI1	Input	3.3V	PU 10k	General purpose input at Board controller
27	GPI2	Input	3.3V	PU 10k	General purpose input at Board controller
28	GPI3	Input	3.3V	PU 10k	General purpose input at Board controller

X35

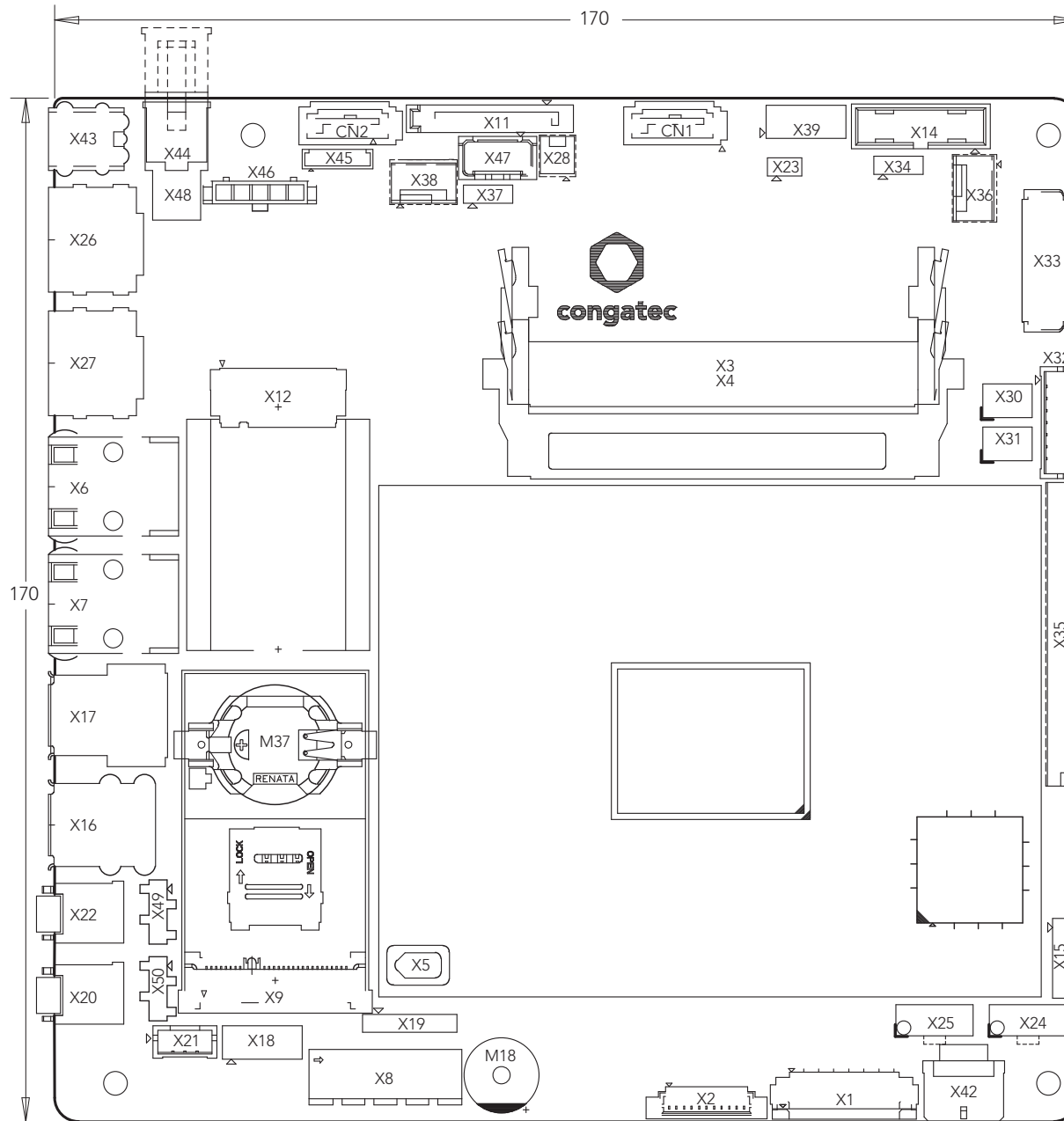


Pin	Signal name	Pin Type	Voltage level	Onboard termination	Description
29	GPI4	Input	3.3V	PU 10k	General purpose input at Board controller
30	GPI5	Input	3.3V	PU 10k	General purpose input at Board controller
31	GPI6	Input	3.3V	PU 10k	General purpose input at Board controller
32	GPI7	Input	3.3V	PU 10k	General purpose input at Board controller
33	SLP_S3#	Output	3.3V standby		S3 sleep control (suspend to RAM), active low
34	SLP_S4#	Output	3.3V standby		S4 sleep control (suspend do Disk), active low
35	SLP_S4#	Output	3.3V standby		S4 sleep control (suspend do Disk), active low
	CGBC_LID_BTN_L	Input	3.3V standby	PU 10k	connect directly to LID switch, active low
37	CGBC_SLP_BTN_L	Input	3.3V standby	PU 10k	connect directly to Sleep button, active low
38	PM_THRM#	Input	3.3V standby	PU 100k	external Thermal event, active low
39	WDOUT	Output	3.3V	PD 10k	Watchdog event output (Board controller), event after timer expires
40	WDTRIG_IN#	Input	3.3V	PU 10k	Watchdog trigger input (Board controller), timer reset, active low, use OD pin at external device
41	CGBC_SDA	I/OD	3.3V standby	PU 2k	I2C bus from Board controller (general use), data
42	PWR_OK	Input	VIN	10k PD	Power good signal from external PSU or Voltage Monitor. Onboard power rails are disabled if signal is low.
43	SPI_CS#_EXT	Output	3.3V standby	PU 100k	SPI chip select for external SPI flash
44	CGBC_SCL	OD	3.3V standby	PU 2k	I2C bus from Board controller (general use), clock
45	SPI_MISO_EXT	Input	3.3V standby		external SPI flash data output
46	BIOS_DISABLE#	Input	3.3V standby	PU 10k	external SPI flash enable (boot from external SPI flash), active low
47	SPI_CLK_EXT	Output	3.3V standby		external SPI flash clock input
48	SPI_MOSI_EXT	Output	3.3V standby		external SPI flash data input
49	+5V standby	Power	5V standby		+5V standby power, 500mA max.
50	GND	Ground			

Connector Type

X35: 25x2 pins, 2mm pitch

7 conga-IA5 Mechanical Drawing



8 BIOS Setup Description

The BIOS setup description of the conga-IA5 can be viewed without having access to the SBC. However, access to the restricted area of the congatec website is required in order to download the necessary tool (CgMlfViewer) and Menu Layout File (MLF).

The MLF contains the BIOS setup description of a particular BIOS revision. The MLF can be viewed with the CgMlfViewer tool. This tool offers a search function to quickly check for supported BIOS features. It also shows where each feature can be found in the BIOS setup menu.

For more information, read the application note "AN42 - BIOS Setup Description" available at www.congatec.com.



Note

If you do not have access to the restricted area of the congatec website, contact your local congatec sales representative.

8.1 Navigating the BIOS Setup Menu

The BIOS setup menu shows the features and options supported in the congatec BIOS. To access and navigate the BIOS setup menu, press the or <F2> key during POST.

The right frame displays the key legend. Above the key legend is an area reserved for text messages. These text messages explain the options and the possible impacts when changing the selected option in the left frame.

8.2 BIOS Versions

The BIOS displays the BIOS project name and the revision code during POST, and on the main setup screen. The initial production BIOS for conga-IA5 is identified as IA50R1xx, where:

- IA5 is the project name
- R is the identifier for a BIOS ROM file
- 1 is the feature number
- xx is the major and minor revision number.

The binary size of conga-IA5 BIOS is 8MB.

8.3 Updating the BIOS

BIOS updates are recommended to correct platform issues or enhance the feature set of the SBC. The conga-IA5 features a congatec/AMI AptioEFI firmware on an onboard flash ROM chip. You can update the firmware with the congatec System Utility. The utility has five versions—UEFI shell, DOS based command line¹, Win32 command line, Win32 GUI, and Linux version.

For more information about “Updating the BIOS” refer to the user’s guide for the congatec System Utility “CGUTLm1x.pdf” on the congatec website at www.congatec.com.



Caution

The DOS command line tool is not officially supported by congatec and therefore not recommended for critical tasks such as firmware updates. We recommend to use only the UEFI shell for critical updates.



Note

¹. *Deprecated*

8.4 Supported Flash Device

The conga-IA5 supports the Winbond W25Q64JVSSIQ (8MB) flash device. For more information about external BIOS support, refer to the Application Note “AN7_External_BIOS_Update.pdf” on the congatec website at www.congatec.com.