COM Express™ conga-TCA7

COM Express Type 6 Compact module based on the Intel® Atom™, Pentium™ and Celeron® Elkhart Lake SoC

User's Guide

Revision 1.01

congatec

Revision History

Revision	Date (yyyy-mm-dd)	Author	Changes
0.1	2021-07-31	AEM	• Preliminary release
0.2	2021-11-16	AEM	• Deleted HDMI references in table 4 "Feature Summary" • Changed table 17 to TMDS Signal Description
1.00	2022-02-15	AEM	• Added Windows 10 to section 2.2 “Supported Operating Systems” • Updated table 6 "Power Consumption Values" and table 7 "CMOS Battery Power Consumption" • Corrected DisplayPort specification in section 5.1.2.1 "DisplayPort (DP)" • Added note about CSM to section 2.2 "Supported Operating Systems" • Deleted section 6.4.4 "OEM BIOS Code/Data" • Official release
1.01	2022-07-26	AEM	• Corrected the number of PCIe lanes in section 3 "Block Diagram"

Preface

This user's guide provides information about the components, features, connectors, system resources and BIOS features available on the conga-TCA7. It is one of three documents that should be referred to when designing a COM Express™ application. The other reference documents that should be used include the following:

COM Express™ Design Guide

COM Express™ Specification

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Terminology

Term	Description
COM	Computer-on-Module
GB	Gigabyte
GHz	Gigahertz
kB	Kilobyte
MB	Megabyte
Mbit	Megabit
MT/s	Megatransfers per second
kHz	Kilohertz
MHz	Megahertz
TDP	Thermal Design Power
PCIe	PCI Express
PWM	Pulse Width Modulation
SATA	Serial ATA
DDC	Display Data Channel
SoC	System On Chip
LVDS	Low-Voltage Differential Signaling
Gbe	Gigabit Ethernet
eMMC	Embedded Multi-media Controller
HDA	High Definition Audio
cBC	congatec Board Controller
N.C.	Not connected
N.A.	Not available
TBD	To be determined

Contents

1 Introduction 11
1.1 Options Information 12
2 Specifications 13
2.1 Feature List 13
2.2 Supported Operating Systems 14
2.3 Mechanical Dimensions 14
2.4 Supply Voltage Standard Power 15
2.4.1 Electrical Characteristics 15
2.4.2 Rise Time 16
2.5 Power Consumption 16
2.6 Supply Voltage Battery Power 17
2.7 Environmental Specifications 18
3 Block Diagram 19
4 Cooling Solutions 20
4.1 CSP Dimensions 21
4.2 HSP Dimensions 23
5 Connector Rows 25
5.1 Primary and Secondary Connector Rows 25
5.1.1 PCI Express™ 25
5.1.2 Display Interface 25
5.1.2.1 DisplayPort (DP) 26
5.1.2.2 LVDS 26
5.1.2.3 Optional eDP 27
5.1.3 SATA 27
5.1.4 USB 27
5.1.5 Gigabit Ethernet 28
5.1.6 High Definition Audio (HDA) Interface 28
5.1.7 UART 28
5.1.8 GPIOs/SDIO 28
5.1.9 LPC Bus 29
5.1.10 I²C Bus 29
5.1.11 SPI 29
5.1.12 Power Control 29
5.1.13 Power Management 31
6 Additional Features 32
6.1 eMMC 32
6.2 TPM 32
6.3 congatec Board Controller (cBC) 32
6.3.1 Board Information 32
6.3.2 General Purpose Input/Output 33
6.3.3 Fan Control 33
6.3.4 Power Loss Control 33
6.3.5 Watchdog 33
6.3.6 Enhanced Soft-Off State 34
6.3.7 I²C Bus 34
6.4 OEM BIOS Customization 34
6.4.1 OEM Default Settings 34
6.4.2 OEM Boot Logo 34
6.4.3 OEM POST Logo 35
6.4.4 OEM DXE Driver 35
6.5 congatec Battery Management Interface 35
6.6 API Support (CGOS) 35
6.7 Suspend to Ram 35
7 conga Tech Notes 36
7.1 Intel® Elkhart Lake SoC Features 36
7.1.1 Processor Core 36
7.1.1.1 Intel Virtualization Technology 36
7.1.1.2 Thermal Management 37
7.2 ACPI Suspend Modes and Resume Events 38
8 Signal Descriptions and Pinout Tables 39
8.1 Connector Signal Descriptions 40
8.2 Bootstrap Signals 62
9 System Resources 63

9.1 I/O Address Assignment 63
9.1.1 LPC Bus 63
9.2 PCI Configuration Space Map 63
9.3 I²C Bus 65
9.4 SM Bus 65

10 BIOS Setup Description 66

10.1 Navigating the BIOS Setup Menu 66
10.2 BIOS Versions 66
10.3 Updating the BIOS 67
10.3.1 Update from External Flash 67
10.4 Supported Flash Devices 67

List of Tables

Table 1 COM Express™ 3.0 Pinout Types 11
Table 2 Commercial Variants 12
Table 3 Industrial Variants 12
Table 4 Feature Summary 13
Table 5 Measurement Description 16
Table 6 Power Consumption Values 17
Table 7 CMOS Battery Power Consumption 17
Table 8 Cooling Solution Variants 20
Table 9 Display Combinations and Resolutions 26
Table 10 Wake Events 38
Table 11 Signal Tables Terminology Descriptions 39
Table 12 Connector A–B Pinout 40
Table 13 Connector C–D Pinout 42
Table 14 PCI Express Signal Descriptions (General Purpose) 44
Table 15 PCI Express Signal Descriptions (x16 Graphics) 45
Table 16 DDI Signal Description 47
Table 17 TMDS Signal Descriptions 48
Table 18 DisplayPort (DP) Signal Descriptions 49
Table 19 Embedded DisplayPort Signal Descriptions 51
Table 20 CRT Signal Descriptions 51
Table 21 LVDS Signal Descriptions 52
Table 22 Serial ATA Signal Descriptions 52
Table 23 USB 2. 0 Signal Descriptions 53
Table 24 USB 3.0 Signal Descriptions 54
Table 25 Gigabit Ethernet Signal Descriptions 54
Table 26 High Definition Audio Link Signals Descriptions 55
Table 27 LPC Signal Descriptions 56
Table 28 SPI BIOS Flash Interface Signal Descriptions 56
Table 29 Miscellaneous Signal Descriptions 57
Table 30 General Purpose I/O Signal Descriptions 57
Table 31 Power and System Management Signal Descriptions 58
Table 32 Rapid Shutdown Signal Descriptions 58
Table 33 Thermal Protection Signal Descriptions 58
Table 34 SMBus Signal Description 59
Table 35 General Purpose Serial Interface Signal Descriptions 59
Table 36 Module Type Definition Signal Description 60
Table 37 Power and GND Signal Descriptions 61
Table 38 Bootstrap Signal Descriptions 62
Table 39 I/O Address Assignment 63
Table 40 PCI Configuration Space Map 63

1 Introduction

COM Express™ is an open industry standard defined specifically for COMs (Computer-on-Modules). Its creation makes it possible to smoothly transition from legacy interfaces to the newest technologies available today. COM Express™ modules are available in following form factors:

- Mini 84 mm x 55 mm
- Compact 95 mm x 95 mm
- Basic 125 mm x 95 mm
- Extended 155 mm x 110 mm

Table 1 COM Express™ 3.0 Pinout Types

Types	Connector Rows	PCIe Lanes	PEG	SATA Ports	LAN ports	USB 2.0/ SuperSpeed USB	Display Interfaces
Type 6	A-B C-D	Up to 24	1	Up to 4	1	Up to 8 / 4 [1]	VGA,LVDS/eDP, PEG, 3x DDI
Type 7	A-B C-D	Up to 32	-	Up to 2	5 (1x 1 Gb, 4x 10 Gb)	Up to 4 / 4	
Type 10	A-B	Up to 4	-	Up to 2	1	Up to 8 / 2 [1]	LVDS/eDP, 1xDDI

1. *The SuperSpeed USB ports (USB 3.0) are not in addition to the USB 2.0 ports. Ports that support SuperSpeed USB 3.0 also support USB 2.0.*

The conga-TCA7 modules use the Type 6 pinout definition and comply with COM Express 3.0 specification. They are equipped with two high performance connectors that ensure stable data throughput.

The COM integrates all the core components of a common PC and is mounted onto an application-specific carrier board. COM modules are legacy-free design (no Super I/O, PS/2 keyboard and mouse) and provide most of the functional requirements for any application. These functions include, but are not limited to a rich complement of contemporary high bandwidth serial interfaces such as PCI Express, Serial ATA, USB 2.0, and Gigabit Ethernet. The robust thermal and mechanical concept, combined with extended power-management capabilities, is perfectly suited for all applications.

Carrier board designers can use as little or as many of the I/O interfaces as deemed necessary. The carrier board can therefore provide all the interface connectors required to attach the system to the application specific peripherals. This versatility allows the designer to create a dense and optimized package, which results in a more reliable product while simplifying system integration.

Most importantly, COM Express™ modules are scalable. Once an application has been created, the product range can be diversified by using different performance-class or form-factor size modules. Simply unplug one module and replace it with another; redesign is not necessary.

1.1 Options Information

The conga-TCA7 is available in eight variants (five commercial and three industrial). The table below shows the different configurations available.

Table 2 Commercial Variants

Part-No	049300	049301	049302	049320	049321
Processor	Intel® Atom® x6425E 2.0 GHz, Quad Core	Intel® Atom® x6413E 1.5 GHz, Quad Core	Intel® Atom® x6211E 1.3 GHz, Dual Core	Intel® Pentium® J6426 2.0 GHz, Quad Core	Intel® Celeron® J6413 1.8 GHz, Quad Core
Burst Freq.	3.0 GHz	3.0 GHz	3.0 GHz	3.0 GHz	3.0 GHz
L2 Cache	1.5 MB	1.5 MB	1.5 MB	1.5 MB	1.5 MB
Graphics	Intel® UHD Graphics	Intel® UHD Graphics	Intel® UHD Graphics	Intel® UHD Graphics	Intel® UHD Graphics
GFX Base/Burst Freq.	500 / 750 MHz	500 / 750 MHz	350 / 750 MHz	400 / 850 MHz	400 / 800 MHz
Memory (DDR4)	32 GB, 3200 MTps dual channel	32 GB, 3200 MTps dual channel	32 GB, 3200 MTps dual channel	32 GB, 3200 MTps dual channel	32 GB, 3200 MTps dual channel
TPM (Discrete)	Infineon SLB9670	Infineon SLB9670	Infineon SLB9670	Infineon SLB9670	Infineon SLB9670
SD Card	1x 4-bit	1x 4-bit	1x 4-bit	1x 4-bit	1x 4-bit
Max. TDP	12 W	9 W	6 W	10 W	10 W

Table 3 Industrial Variants

Part-No	049310	049311	049312
Processor	Intel® Atom® x6425RE 1.9 GHz, Quad Core	Intel® Atom® x6414RE 1.5 GHz, Quad Core	Intel® Atom® x6212RE 1.2 GHz, Dual Core
Burst Freq.	N.A	N.A	N.A
L2 Cache	1.5 MB	1.5 MB	1.5 MB
Graphics	Intel® UHD Graphics	Intel® HD Graphics 500	Intel® HD Graphics 505
GFX Base/Burst Freq.	400 MHz/ N.A	400 MHz/ N.A	350 MHz/ N.A
Memory (DDR4)	32 GB, 3200 MTps dual channel	32 GB, 3200 MTps dual channel	32 GB, 3200 MTps dual channel
TPM (Discrete)	Infineon SLB9670	Infineon SLB9670	Infineon SLB9670
SD Card	1x 4-bit	1x 4-bit	1x 4-bit
Max. TDP	12 W	9 W	6 W

2 Specifications

2.1 Feature List

Table 4 Feature Summary

Form Factor	Based on COM Express™ standard pinout Type 6 revision 3.0 (Compact size 95 x 95 mm)	
Processor	Intel® Atom®, Pentium® and Celeron SoCs	
Memory	Two memory sockets (located on the top and bottom side). Supports - SO-DIMM non-ECC DDR4 modules - Data rates up to 3200 MT/s - Maximum 32 GB capacity	
Chipset	Integrated in the SoC	
Audio	High Definition Audio	
Ethernet	1x Gigabit Ethernet with TSN support via TI DP83867E Ethernet PHY	
Graphics Options	Intel® UHD (Gen 11). Supports: - API (DirectX 12.1, OpenGL 4.5, OpenCL 1.2, OpenGL ES 3.1, Vulkan 1.0) - Intel® QuickSync & Clear Video Technology HD (hardware accelerated video decode/encode/processing/transcode) - Up to 3 independent displays (must be two DDI's and one eDP/DSI/LVDS)	
	1x LVDS (dual channel) 2x DP++	Optional 1x eDP 1.3 [1,2]
Peripheral Interfaces	6x PCIe® Gen3 ports 2x SATA® (6 Gbps) 8x USB 2.0 (Up to 2x USB 3.1 Gen 2) 2x UART GPIOs/SDIO	Optional eMMC 5.1 [2] LPC SPI I²C (fast mode, multi-master) SM Bus
congatec Board Controller	Multi-stage watchdog, non-volatile user data storage, manufacturing and board information, board statistics, hardware monitoring, fan control, I2C bus, Power loss control	
BIOS	AMI Aptio® V UEFI 2.x firmware, 32 MB serial SPI with congatec Embedded BIOS features	
Power Management	ACPI 5.0 compliant with battery support. S5e mode (see section 6.3.6 "Enhanced Soft-Off State" Also supports Suspend to RAM (S3) Configurable TDP	
Storage	Optional eMMC 5.1	
Security	Discrete SPI TPM 2.0 (Infineon SLB9670)	

Note

1. *Variants with optional eDP do not support LVDS*
2. *Not available by default (assembly option)*

2.2 Supported Operating Systems

The conga-TCA7 supports the following operating systems

- Microsoft® Windows® 10
- Microsoft® Windows® 10 IoT Enterprise (64-bit)
- Linux Ubuntu (64-bit)
- Android 10 (64-bit)
- Yocto (64-bit)
- RTS Hypervisor

Note

1. *The conga-TCA7 supports only native UEFI Operating Systems. Legacy Operating Systems which require CSM (Compatibility Suppport Module) as part of the UEFI firmware are not supported anymore.*

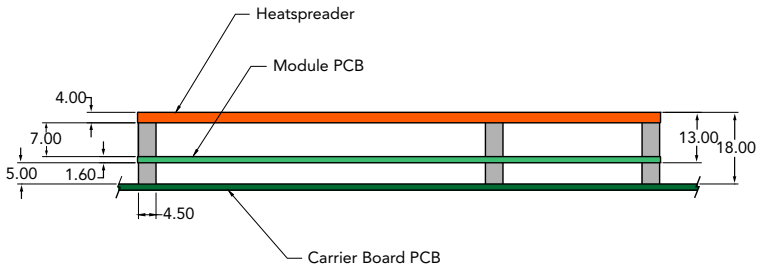
2. *For Windows 10 installation, we recommend a minimum storage capacity of 20 GB. congatec will not offer technical support for systems with less than 20 GB storage space.*

2.3 Mechanical Dimensions

The conga-TCA7 has the following dimensions:

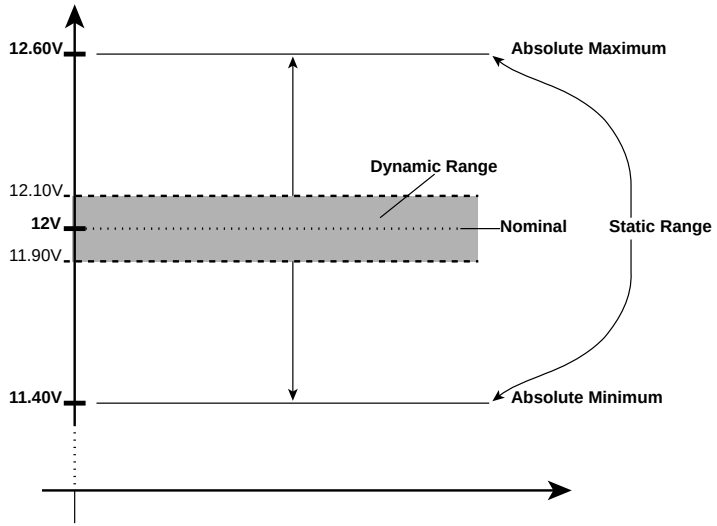
- length of 95 mm
- width of 95 mm

The overall height (module, heatspreader and stack) is shown below:



2.4 Supply Voltage Standard Power

The conga-TCA7 provides a standard supply voltage of 12 V DC ± 5%.



Note

The dynamic range shall not exceed the static range.

2.4.1 Electrical Characteristics

Power supply pins on the module's connectors limit the amount of input power. The following table provides an overview of the limitations for pinout Type 6 (dual connector, 440 pins).

Power Rail	Module Pin Current Capability (Ampere)	Nominal Input (Volts)	Input Range (Volts)	Derated Input (Volts)	Max. Input Ripple (10Hz to 20MHz) (mV)	Max. Module Input Power (w. derated input) (Watts)	Assumed Conversion Efficiency	Max. Load Power (Watts)
VCC_12V	12	12	11.4-12.6	11.4	+/- 100	137	85%	116
VCC_5V-SBY	2	5	4.75-5.25	4.75	+/- 50	9		
VCC_RTC	0.5	3	2.5-3.3		+/- 20			

2.4.2 Rise Time

The input voltages shall rise from 10% of nominal to 90% of nominal at a minimum slope of 250V/s. The smooth turn-on requires that during the 10% to 90% 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 +12 V
- conga-TCA7 COM
- modified congatec carrier board
- conga-TCA7 cooling solution
- Microsoft® Windows® 10 IoT Enterprise

Note

The CPU was stressed to its maximum workload.

Table 5 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	COM is powered by VCC_5V_SBY	
S5	COM is powered by VCC_5V_SBY	

Note

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

Table 6 Power Consumption Values

The table below provides additional information about the conga-TCA7 power consumption. The values are recorded at various operating modes.

Part No.	Memory Size	H.W Rev.	BIOS Rev.	OS (64 bit)	CPU			Current (A)					
					Variant	Cores	Freq/Turbo (GHz)	S0:Min	S0: Max	S0: Peak	S3	S5	S5e
049300	3 x 4 GB	A.2	TA70r012	Windows 10	Intel® Atom® x6425E	4	2.0 / 3.0	0.35	2.16	2.58	0.24	0.20	0.00095
049301	3 x 4 GB	A.2	TA70r012	Windows 10	Intel® Atom® x6413E	4	1.5 / 3.0	0.37	1.76	2.42	0.24	0.22	0.00095
049302	3x 4 GB	A.2	TA70r012	Windows 10	Intel® Atom® x6211E	2	1.3 / 3.0	0.37	1.21	2.11	0.24	0.22	0.00095
049310	3 x 4 GB	A.2	TA70r012	Windows 10	Intel® Atom® x6425RE	4	1.9 / N.A	0.36	1.33	1.45	0.24	0.22	0.00095
049311	3 x 4 GB	A.2	TA70r012	Windows 10	Intel® Atom® x6414RE	4	1.5 / N.A	0.36	1.06	1.33	0.24	0.22	0.00095
049312	3 x 4 GB	A.2	TA70r012	Windows 10	Intel® Atom® x6212RE	2	1.2 / N.A	0.35	0.74	0.98	0.24	0.22	0.00095
049320	3 x 4 GB	A.2	TA70r012	Windows 10	Intel® Pentium® J6425	4	2.0 / 3.0	0.37	1.78	2.63	0.32	0.28	0.00095
049321	3 x 4 GB	A.2	TA70r012	Windows 10	Intel® Celeron® J6413	4	1.8 / 3.0	0.41	1.78	2.48	0.32	0.28	0.00095

Note

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

2.6 Supply Voltage Battery Power

Table 7 CMOS Battery Power Consumption

RTC @	Voltage	Current
-10°C	3V DC	1.81 µA
20°C	3V DC	2.26 µA
70°C	3V DC	2.73 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 also 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-TCA7.*

2.7 Environmental Specifications

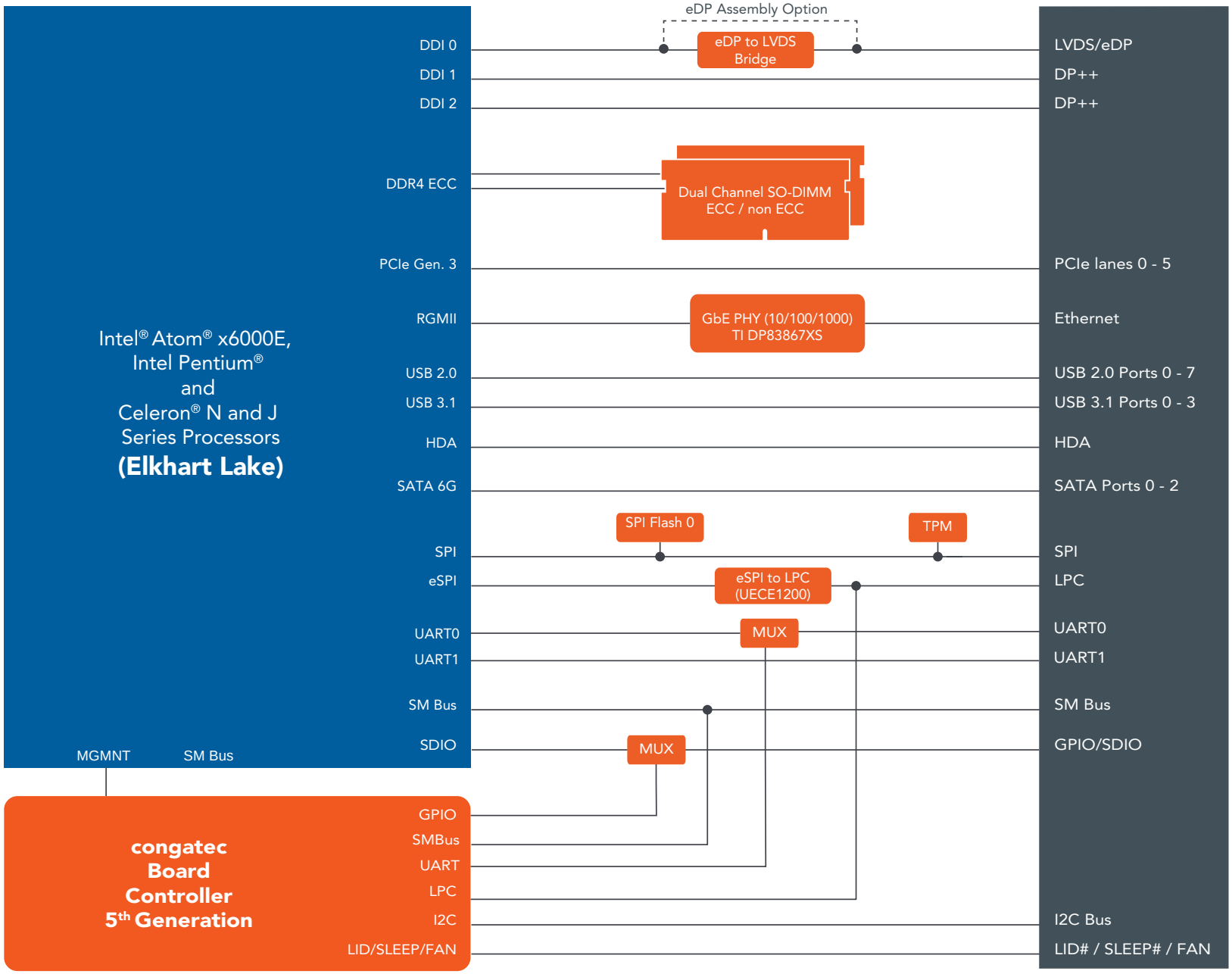
Temperature (commercial variants)	Operation: 0° to 60°C	Storage: -20° to +80°C
Temperature (industrial variants)	Operation: -40° to 85°C	Storage: -40° to +85°C
Humidity	Operation: 10% to 90%	Storage: 5% to 95%

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 Solutions

congatec GmbH offers the following cooling solutions for the conga-TCA7. The dimensions of the cooling solutions are shown in the sub-sections. All measurements are in millimeters.

Table 8 Cooling Solution Variants

	Cooling Solution	Part No	Description
1	HSP	049350	Heatspreader with 2.7 mm bore-hole standoffs for lidded Intel Atom CPU variants
		049351	Heatspreader with M2.5 mm threaded standoffs for lidded Intel Atom CPU variants
		049354	Heatspreader with 2.7 mm bore-hole standoffs for bare-die Intel Pentium and Celeron CPU variants
		049355	Heatspreader with M2.5 mm threaded standoffs for bare-die Intel Pentium and Celeron CPU variants
2	CSP	049352	Passive cooling with 2.7 mm bore-hole standoffs for lidded Intel Atom CPU variants
		049353	Passive cooling with M2.5 mm threaded standoffs for lidded Intel Atom CPU variants
		049356	Passive cooling with 2.7 mm bore-hole standoffs for bare-die Intel Pentium and Celeron CPU variants
		049357	Passive cooling with M2.5 mm threaded standoffs for bare-die Intel Pentium and Celeron CPU variants

Note

1. *We recommend a maximum torque of 0.4 Nm for carrier board mounting screws and 0.5 Nm for 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.*

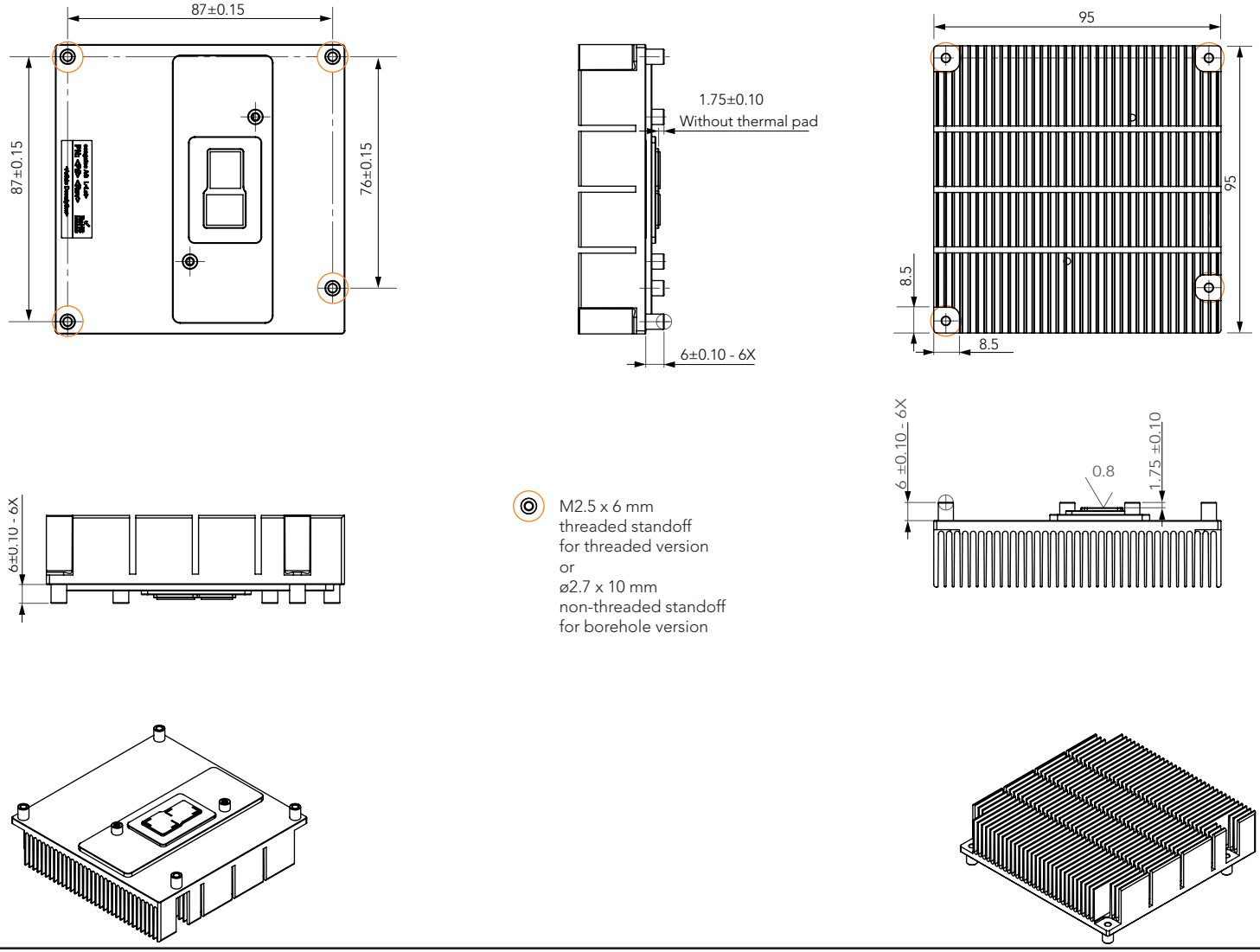
2. *For adequate heat dissipation, use the mounting holes on the cooling solution to attach it to the module. Apply thread-locking fluid on the screws if the cooling solution is used in a high shock and/or vibration environment. To prevent the standoff from stripping or cross-threading, use non-threaded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

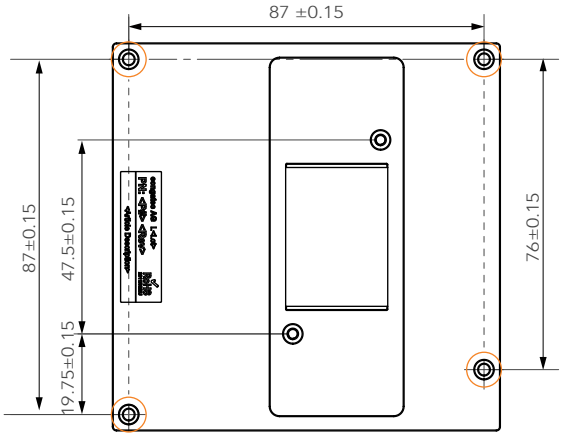
4. *Do not exceed the recommended maximum torque. Doing so may damage the module or the carrier board, or both.*

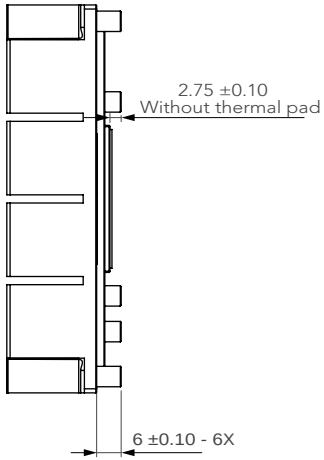
4.1 CSP Dimensions

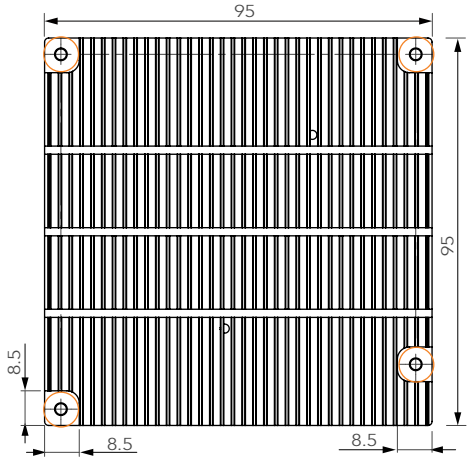
For Bare-die Variants

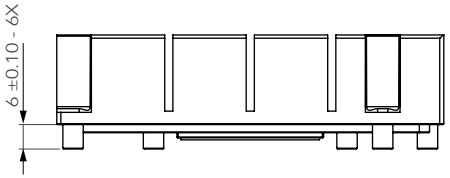


For Lidded Variants

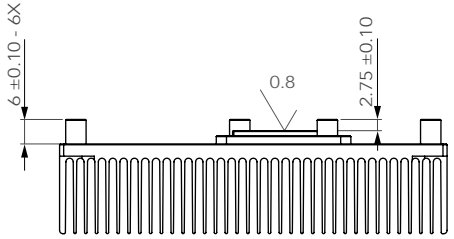


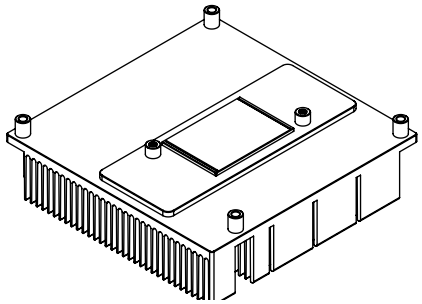


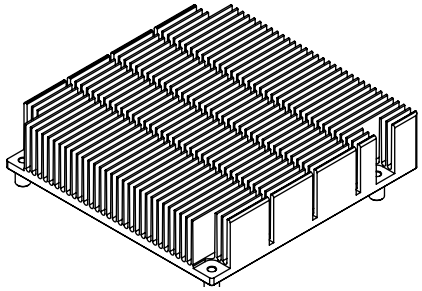




M2.5 x 6 mm
threaded standoff
for threaded version
or
ø2.7 x 10 mm
non-threaded standoff
for borehole version

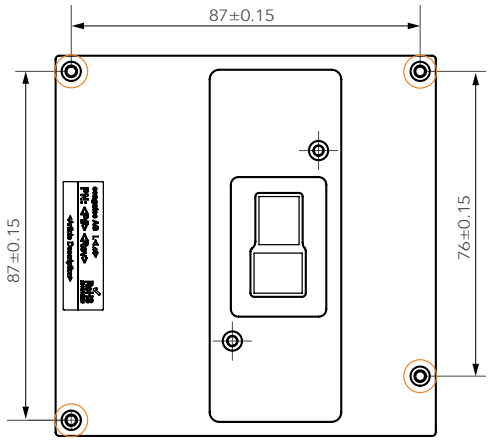


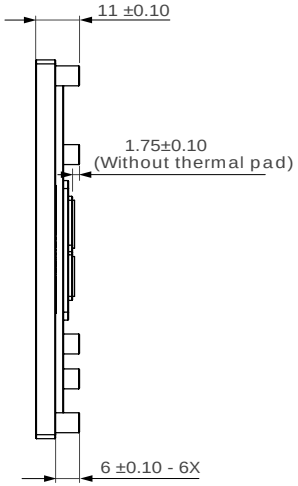


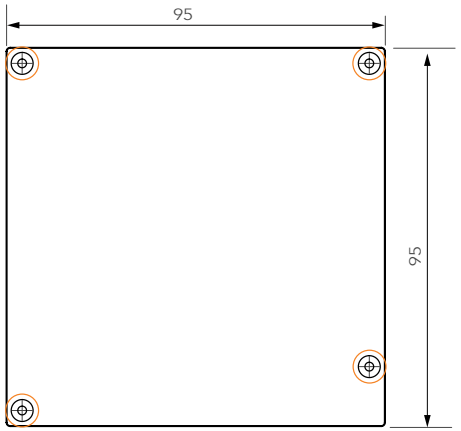


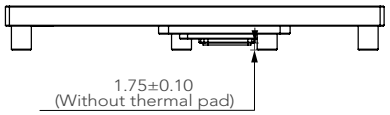
4.2 HSP Dimensions

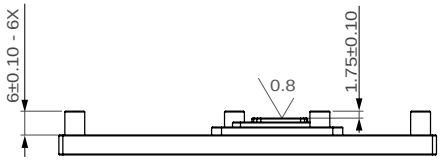
For Bare-die Variants



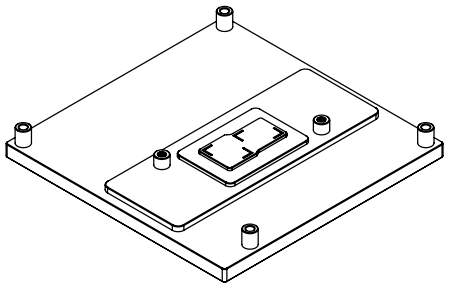


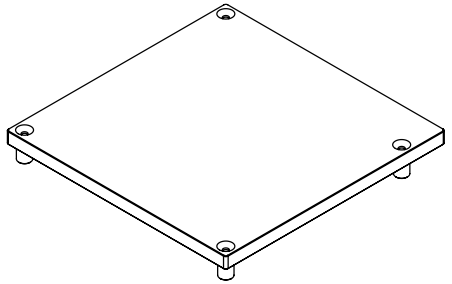




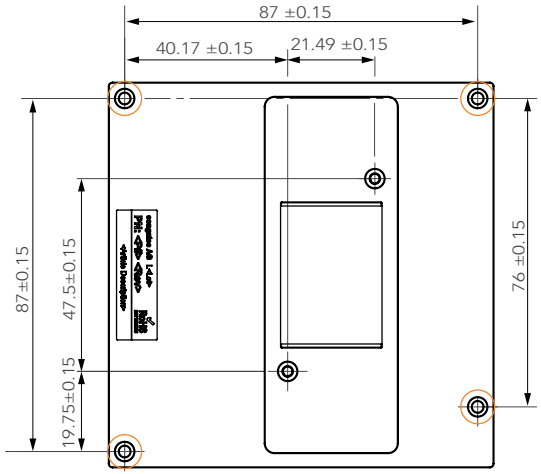


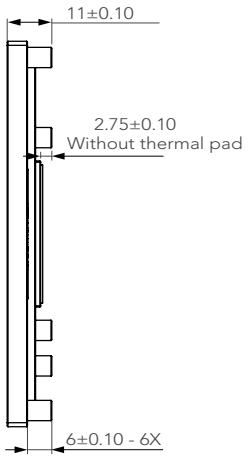
M2.5 x 11 mm
threaded standoff
for threaded version
or
ø2.7 x 11 mm
non-threaded standoff
for borehole version

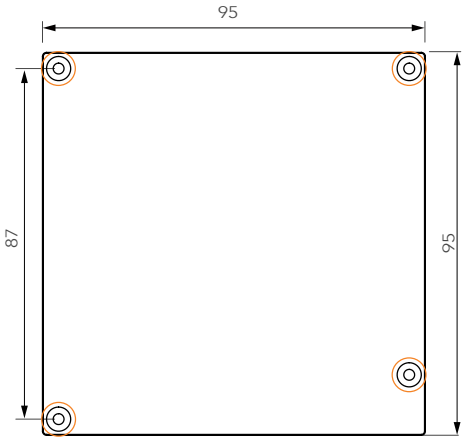


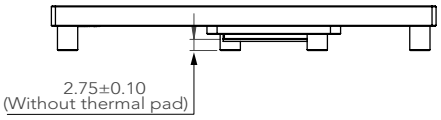


For Lidded Variants









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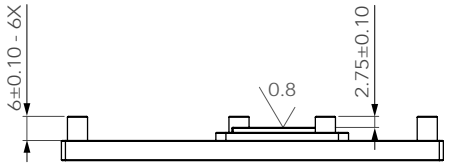

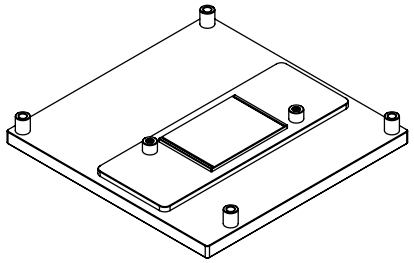

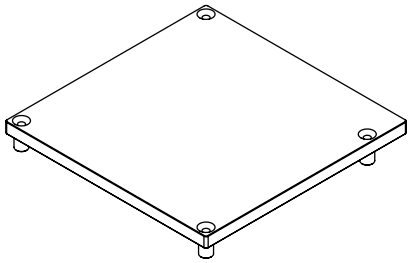

5 Connector Rows

The conga-TCA7 is connected to the carrier board via two 220-pin connectors (COM Express Type 6 pinout). These connectors are broken down into four rows. The primary connector consists of rows A and B while the secondary connector consists of rows C and D.

5.1 Primary and Secondary Connector Rows

The following subsystems can be found on the primary and secondary connector rows.

5.1.1 PCI Express™

The conga-TCA7 offers six PCIe lanes on the A–B connector. The lanes support the following:

- up to 8 GT/s (Gen 3) speed
- a 6 x1 link configuration
- a 1 x4 + 2 x1 link, 1 x4 + 1 x2 link, 3 x2 link, 2 x2 + 2 x1 link or 4 x1 + 1 x2 link via a special/customized BIOS firmware [1]
- lane polarity inversion

Note

1. *Assembly option (not available by default)*

5.1.2 Display Interface

The conga-TCA7 offers the following display interfaces:

- two DP++
- VESA DisplayPort Standard 1.4
- VESA embedded DisplayPort Standard 1.3
- single or dual LVDS
- up to three independent displays [1]

Note

1. *Default display combinations must be 2 x DP++ and 1 x LVDS/eDP*

The table below shows the supported display combinations and resolutions.

Table 9 Display Combinations and Resolutions

	Display 1 (DDI1)		Display 2 (DDI2)		Display 3 (DDI0)	
	Interface	Max. Resolution	Interface	Max. Resolution	Interface	Max. Resolution
Option 1	DP Or TMDS	4096x2160 @ 60 Hz 4096x2160 @ 60 Hz	DP Or TMDS	4096x2160 @ 60 Hz 4096x2160 @ 60 Hz	LVDS	1920x1200 @ 60 Hz (dual LVDS mode)
Option 2	DP Or TMDS	4096x2160 @ 60 Hz 4096x2160 @ 60 Hz	DP Or TMDS	4096x2160 @ 60 Hz 4096x2160 @ 60 Hz	eDP (BOM option)	4096x2160 @ 60 Hz

5.1.2.1 DisplayPort (DP)

The conga-TCA7 offers up to two DP++ ports. The ports support the following:

- VESA DisplayPort Standard 1.4
- up to 4096x2160 at 60 Hz
- maximum of two independent DP displays

5.1.2.2 LVDS

The conga-TCA7 offers an LVDS interface with optional eDP overlay on the A–B connector. The LVDS interface provides LVDS signals by default, but can optionally support eDP signals (assembly option). For more information, contact congatec technical center.

The LVDS interface supports:

- single or dual channel LVDS (color depths of 18 bpp or 24 bpp)
- integrated flat panel interface with clock frequency up to 112 MHz
- VESA and OpenLDI LVDS color mappings
- automatic panel detection via Embedded Panel Interface based on VESA EDID™ 1.3
- resolution up to 1920x1200 in dual LVDS bus mode

Note

The LVDS/eDP interface supports either LVDS or eDP signals. Both signals are not supported simultaneously.

5.1.2.3 Optional eDP

The conga-TCA7 offers an optional eDP interface on the A–B connector. Variants with optional eDP interface do not support LVDS.

5.1.3 SATA

The conga-TCA7 offers two SATA interfaces (SATA 0-1) on the A–B connector. The interfaces support:

- independent DMA operation
- data transfer rates up to 6.0 Gbps
- Serial ATA Specification, revision 3.2
- AHCI mode using memory space
- Hot-plug detect

Note

The interface does not support IDE mode.

5.1.4 USB

The conga-TCA7 offers up to eight USB 2.0 interfaces on the A–B connector and two SuperSpeed differential signals on the C–D connector. The xHCI host controller supports the following:

- USB 3.1 Specification
- SuperSpeedPlus, SuperSpeed, High-Speed, Full-Speed and Low-Speed USB signaling
- data transfers of up to 10 Gbps for USB 3.1 Gen 2 port
- data transfers of up to 5 Gbps for USB 3.1 Gen 1 port
- dual-role support on USB port 0
- USB debug port

Note

1. *Each SuperSpeed differential signal should be paired with corresponding USB 2.0 differential data pairs on the carrier board.*
2. *The USB ports are configured in BIOS setup menu to operate by default in Gen 1 mode. Before you change the default setting to Gen 2, ensure the carrier board is designed for Gen 2 operation. For Gen 2 design considerations, contact congatec technical support center.*

5.1.5 Gigabit Ethernet

The conga-TCA7 offers a Gigabit Ethernet interface via an onboard Gigabit Ethernet PHY. The interface supports full-duplex operation at 10/100/1000 Mbps and half-duplex operation at 10/100 Mbps.

Note

1. *The GBE0_LINK# output is not active during a 10 Mb connection. It is only active during a 100 Mb or 1 Gb connection. This is a limitation of Ethernet Phy since it only has 3 LED outputs—ACT#, LINK100# and LINK1000#.*

2. *The GBE0_LINK# signal is a logic AND of the GBE0_LINK100# and GBE0_LINK1000# signals on the conga-TCA7 module.*

5.1.6 High Definition Audio (HDA) Interface

The conga-TCA7 provides an interface that supports HDA audio codecs.

5.1.7 UART

The conga-TCA7 provides two UART ports (UART0 and UART1) from the SoC by default. The UART ports support low-speed, full-speed and high-speed mode with up to 3.68 Mbps.

Optionally, UART0 port can be routed from the congatec Board Controller (Microchip MEC1705Q-C2-SZ-I).

5.1.8 GPIOs/SDIO

The conga-TCA7 offers four General Purpose Input signals (GPIs) and four General Purpose Output signals (GPOs) on the A–B connector. The GPIOs are multiplexed with SD signals and are controlled by the cBC.

You can select GPIO or SDIO via the BIOS setup menu.

5.1.9 LPC Bus

The conga-TCA7 offers the LPC (Low Pin Count) bus on the A–B connector via eSPI to LPC bridge (Microchip ECE1200) . For information about the decoded LPC addresses, see section 9 "System Resources".

Note

The LPC bus runs at 25 MHz.

5.1.10 I²C Bus

The I²C bus is implemented through the congatec board controller and accessed through the congatec CGOS driver and API. The controller provides a fast-mode multi-master I²C bus that has the maximum I²C bandwidth.

5.1.11 SPI

The conga-TCA7 supports SPI interface. This interface makes it possible to boot from an external SPI flash (alternative interface for the BIOS flash device).

5.1.12 Power Control

PWR_OK

Power OK from main power supply or carrier board voltage regulator circuitry. A high value indicates that the power is good and the module can start its onboard power sequencing.

Carrier board hardware must drive this signal low until all power rails and clocks are stable. Releasing PWR_OK too early or not driving it low at all can cause numerous boot up problems. It is a good design practice to delay the PWR_OK signal a little (typically 100ms) after all carrier board power rails are up, to ensure a stable system.

A sample screenshot is shown below:

Note

The module is kept in reset as long as the PWR_OK is driven by carrier board hardware.

The conga-TCA7 supports the controlling of ATX-style power supplies. If you do not use an ATX power supply, do not connect the conga-TCA7 pins SUS_S3/PS_ON, 5V_SB, and PWRBTN# on the conga-TCA7.

SUS_S3#/PS_ON#

The SUS_S3#/PS_ON# (pin A15 on the A-B connector) signal is an active-low output that can be used to turn on the main outputs of an ATX-style power supply. In order to accomplish this the signal must be inverted with an inverter/transistor that is supplied by standby voltage and is located on the carrier board.

PWRBTN#

When using ATX-style power supplies PWRBTN# (pin B12 on the A-B connector) is used to connect to a momentary-contact, active-low debounced push-button input while the other terminal on the push-button must be connected to ground. This signal is internally pulled up to 3V_SB using a 10k resistor. When PWRBTN# is asserted it indicates that an operator wants to turn the power on or off. The response to this signal from the system may vary as a result of modifications made in BIOS settings or by system software.

Power Supply Implementation Guidelines

The 12 volt input power is the sole operational power source for the conga-TCA7. Other required voltages are generated internally on the module using onboard voltage regulators.

Note

When designing a power supply for a conga-TC570 application, be aware that the system may malfunction when a 12V power supply that produces non-monotonic voltage is used to power the system up. Though this problem is rare, it has been observed in some mobile power supply applications.

This problem occurs because 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.

To ensure this problem does not occur, observe the power supply rise waveform through an oscilloscope, during the power supply qualication phase. This will help to determine if the rise is indeed monotonic and does not have any dips. For more information, see the "Power Supply Design Guide for Desktop Platform Form Factors" document at www.intel.com

5.1.13 Power Management

ACPI 5.0 compliant with battery support. Also supports Suspend to RAM (S3).

6 Additional Features

The following additional features are available on the conga-TCA7.

6.1 eMMC

The conga-TCA7 offers an optional eMMC 5.0 flash onboard. Changes to the onboard eMMC may occur during the lifespan of the module in order to keep up with the rapidly changing eMMC technology.

The performance of the newer eMMC may vary depending on the eMMC technology.

Note

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

6.2 TPM

The conga-TCA7 offers an integrated discrete SPI TPM 2.0 (Infineon SLB9670).

6.3 congatec Board Controller (cBC)

The conga-TCA7 is equipped with Microchip microcontroller. This onboard microcontroller plays an important role for most of the congatec embedded/industrial PC 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. It also ensures that the congatec embedded feature set is fully compatible amongst all congatec modules.

The board controller supports the following features:

6.3.1 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.

6.3.2 General Purpose Input/Output

The conga-TCA7 offers general purpose inputs and outputs for custom system design. These GPIOs are multiplexed with SD signals and are controlled by the cBC.

6.3.3 Fan Control

The conga-TCA7 has additional signals and functions to further improve system management. One of these signals is the FAN_PWMOUT output signal, which controls the system fan using a PWM output. Another signal is the FAN_TACHOIN input signal, which helps in monitoring the RPM (revolutions per minute) of the system fan.

The FAN_TACHOIN input 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.

Note

1. *Use a four-wire fan to generate the correct speed readout.*

2. *For the correct fan control (FAN_PWMOUT, FAN_TACHIN) implementation, see the COM Express Design Guide.*

6.3.4 Power Loss Control

The cBC has full control of the power-up of the module and 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”.

6.3.5 Watchdog

The conga-TCA7 is equipped with a multi stage watchdog solution that is triggered by software. The conga-TCA7 does not support external hardware triggering because the COM Express™ Specification does not provide support for external hardware triggering of the Watchdog.

For more information, see the application note AN3_Watchdog.pdf on the congatec GmbH website at www.congatec.com.

Note

The conga-TCA7 module does not support the watchdog NMI mode.

6.3.6 Enhanced Soft-Off State

The conga-TCA7 supports an enhanced Soft-Off state (S5e)—a congatec proprietary low-power Soft-Off state. In this state, the CPU module switches off almost all the onboard logic in order to reduce the power consumption to absolute minimum (usually 1 mA or lower).

The S5e supports power button, sleep button and SMBALERT# wake events. Refer to congatec application note AN36_Enhanced_Soft_Off.pdf for detailed description of the S5e state.

6.3.7 I²C Bus

The conga-TCA7 supports I²C bus. Thanks to the I²C host controller in the cBC the I²C bus is multimaster capable and runs at fast mode.

6.4 OEM BIOS Customization

The conga-TCA7 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 CGUTLm1x.pdf on the congatec website at www.congatec.com or contact technical support.

The customization features supported are described below.

6.4.1 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.

6.4.2 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.

6.4.3 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.

6.4.4 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.

6.5 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 any additional modifications to the system BIOS.

In addition to the ACPI-Compliant Control Method Battery mentioned above, the latest versions of the conga-TCA7 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.

6.6 API Support (CGOS)

To benefit from the above mentioned non-industry standard feature set, congatec provides an API that allows application software developers to easily integrate all these features 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.

6.7 Suspend to Ram

The Suspend to RAM feature is available on the conga-TCA7.

7 conga Tech Notes

The conga-TCA7 has some technological features that require additional explanation. The following section will give the reader a better understanding of some of these features.

7.1 Intel® Elkhart Lake SoC Features

7.1.1 Processor Core

The SoC features Dual or Quad 3-way Supersclar, Out-of-Order Execution processor cores. Some of the features supported by the core are:

- Intel® 64 architecture
- Intel® Streaming SIMD Extensions
- Intel® VTx-2 and VT-d Virtualization Technology
- Thermal management support vial Intel® Thermal Monitor
- Programmable Service Engine Interrupt Routing
- 10 nm process technology

Note

Intel Hyper-Threading technology is not supported (four cores execute four threads)

7.1.1.1 Intel Virtualization Technology

Intel® Virtualization Technology (Intel® VT) makes a single system appear as multiple independent systems to software. With this technology, multiple, independent operating systems can run simultaneously on a single system. The technology components support virtualization of platforms based on Intel architecture microprocessors and chipsets. Intel® Virtualization Technology for IA-32, Intel® 64 and Intel® Architecture (Intel® VT-x) added hardware support in the processor to improve the virtualization performance and robustness.

RTS Real-Time Hypervisor supports Intel® VT and is verified on all current congatec x86 hardware.

Note

congatec supports RTS Hypervisor.

7.1.1.2 Thermal Management

ACPI is responsible for allowing the operating system to play an important part in the system's thermal management. This results in the operating system having the ability to take control of the operating environment by implementing cooling decisions according to the demands put on the CPU by the application.

The conga-TCA7 ACPI thermal solution offers two different cooling policies.

- **Passive Cooling**

When the temperature in the thermal zone must be reduced, the operating system can decrease the power consumption of the processor by throttling the processor clock. One of the advantages of this cooling policy is that passive cooling devices (in this case the processor) do not produce any noise. Use the "passive cooling trip point" setup node in the BIOS setup program to determine the temperature threshold that the operating system will use to start or stop the passive cooling procedure.

- **Critical Trip Point**

If the temperature in the thermal zone reaches a critical point then the operating system will perform a system shut down in an orderly fashion in order to ensure that there is no damage done to the system as result of high temperatures. Use the "critical trip point" setup node in the BIOS setup program to determine the temperature threshold that the operating system will use to shut down the system.

Note

The end user must determine the cooling preferences for the system by using the setup nodes in the BIOS setup program to establish the appropriate trip points.

If passive cooling is activated and the processor temperature is above the trip point the processor clock is throttled. See section 12 of the ACPI Specification 2.0 C for more information about passive cooling.

7.2 ACPI Suspend Modes and Resume Events

The conga-TCA7 BIOS supports S3 (Suspend to RAM). The BIOS does not support S4 (Suspend to Disk).

Table 10 Wake Events

The table below lists the events that wake the system from S3.

Wake Event	Conditions/Remarks
Power Button	Wakes unconditionally from S3-S5.
Onboard LAN Event	Device driver must be configured for Wake On LAN support.
SMBALERT#	Wakes unconditionally from S3-S5.
PCI Express WAKE#	Wakes unconditionally from S3-S5.
WAKE#	Wakes unconditionally from S3.
PME#	Activate the wake up capabilities of a PCI device using Windows Device Manager configuration options for this device OR set Resume On PME# to Enabled in the Power setup menu.
USB Mouse/Keyboard Event	When Standby mode is set to S3, USB hardware must be powered by standby power source. Set USB Device Wakeup from S3/S4 to ENABLED in the ACPI setup menu (if setup node is available in BIOS setup program). In Device Manager look for the keyboard/mouse devices. Go to the Power Management tab and check 'Allow this device to bring the computer out of standby'.
RTC Alarm	Activate and configure Resume On RTC Alarm in the Power setup menu. Only available in S5.
Watchdog Power Button Event	Wakes unconditionally from S3-S5.

8 Signal Descriptions and Pinout Tables

The following section describes the signals found on COM Express™ Type 6 connectors used for congatec GmbH modules. The pinout of the modules complies with COM Express Type 6 Rev. 3.0.

The table below describes the terminology used in this section. The PU/PD column indicates if a COM Express™ module pull-up or pull-down resistor has been used. If the field entry area in this column for the signal is empty, then no pull-up or pull-down resistor has been implemented by congatec.

The "#" symbol at the end of the signal name indicates that the active or asserted state occurs when the signal is at a low voltage level. When "#" is not present, the signal is asserted when at a high voltage level.

Note

The Signal Description tables do not list internal pull-ups or pull-downs implemented by the chip vendors. Only pull-ups or pull-downs implemented by congatec are listed. For information about the internal pull-ups or pull-downs implemented by the chip vendors, refer to the respective chip's datasheet.

Table 11 Signal Tables Terminology Descriptions

Term	Description
PU	congatec implemented pull-up resistor
PD	congatec implemented pull-down resistor
I/O 3.3V	Bi-directional signal 3.3V tolerant
I/O 5V	Bi-directional signal 5V tolerant
I 3.3V	Input 3.3V tolerant
I 5V	Input 5V tolerant
I/O 3.3VSB	Input 3.3V tolerant active in standby state
O 3.3V	Output 3.3V signal level
O 5V	Output 5V signal level
OD	Open drain output
P	Power Input/Output
DDC	Display Data Channel
PCIE	In compliance with PCI Express Base Specification, Revision 1.0a
SATA	In compliance with Serial ATA specification, Revision 3.0
REF	Reference voltage output. May be sourced from a module power plane

PDS	Pull-down strap. A module output pin that is either tied to GND or is not connected. Used to signal module capabilities (pinout type) to the Carrier Board.

8.1 Connector Signal Descriptions

Table 12 Connector A–B Pinout

Pin	Row A	Pin	Row B	Pin	Row A	Pin	Row B
A1	GND (FIXED)	B1	GND (FIXED)	A56	PCIE_TX4-	B56	PCIE_RX4-
A2	GBE0_MDI3-	B2	GBE0_ACT#	A57	GND	B57	GPO2
A3	GBE0_MDI3+	B3	LPC_FRAME#/ESPI_CS0#	A58	PCIE_TX3+	B58	PCIE_RX3+
A4	GBE0_LINK100#	B4	LPC_AD0/ESPI_IO_0	A59	PCIE_TX3-	B59	PCIE_RX3-
A5	GBE0_LINK1000#	B5	LPC_AD1/ESPI_IO_1	A60	GND (FIXED)	B60	GND (FIXED)
A6	GBE0_MDI2-	B6	LPC_AD2/ESPI_IO_2	A61	PCIE_TX2+	B61	PCIE_RX2+
A7	GBE0_MDI2+	B7	LPC_AD3/ESPI_IO_3	A62	PCIE_TX2-	B62	PCIE_RX2-
A8	GBE0_LINK#	B8	LPC_DRQ0#/ESPI_ALERT0# [2]	A63	GPI1	B63	GPO3
A9	GBE0_MDI1-	B9	LPC_DRQ1#/ESPI_ALERT1# [2]	A64	PCIE_TX1+	B64	PCIE_RX1+
A10	GBE0_MDI1+	B10	LPC_CLK/ESPI_CK	A65	PCIE_TX1-	B65	PCIE_RX1-
A11	GND (FIXED)	B11	GND (FIXED)	A66	GND	B66	WAKE0#
A12	GBE0_MDI0-	B12	PWRBTN#	A67	GPI2	B67	WAKE1#
A13	GBE0_MDI0+	B13	SMB_CK	A68	PCIE_TX0+	B68	PCIE_RX0+
A14	GBE0_CTREF [1]	B14	SMB_DAT	A69	PCIE_TX0-	B69	PCIE_RX0-
A15	SUS_S3#	B15	SMB_ALERT#	A70	GND (FIXED)	B70	GND (FIXED)
A16	SATA0_TX+	B16	SATA1_TX+	A71	eDP_TX2+/LVDS_A0+	B71	LVDS_B0+
A17	SATA0_TX-	B17	SATA1_TX-	A72	eDP_TX2-/LVDS_A0-	B72	LVDS_B0-
A18	SUS_S4#	B18	SUS_STAT#/ESPI_RESET#	A73	eDP_TX1+/LVDS_A1+	B73	LVDS_B1+
A19	SATA0_RX+	B19	SATA1_RX+	A74	eDP_TX1-/LVDS_A1-	B74	LVDS_B1-
A20	SATA0_RX-	B20	SATA1_RX-	A75	eDP_TX0+/LVDS_A2+	B75	LVDS_B2+
A21	GND (FIXED)	B21	GND (FIXED)	A76	eDP_TX0-/LVDS_A2-	B76	LVDS_B2-
A22	SATA2_TX+ [1]	B22	SATA3_TX+ [1]	A77	eDP_VDD_EN/LVDS_VDD_EN	B77	LVDS_B3+
A23	SATA2_TX- [1]	B23	SATA3_TX- [1]	A78	LVDS_A3+	B78	LVDS_B3-
A24	SUS_S5#	B24	PWR_OK	A79	LVDS_A3-	B79	eDP_BKLT_EN/LVDS_BKLT_EN
A25	SATA2_RX+ [1]	B25	SATA3_RX+ [1]	A80	GND (FIXED)	B80	GND (FIXED)
A26	SATA2_RX- [1]	B26	SATA3_RX- [1]	A81	eDP_TX3+/LVDS_A_CK+	B81	LVDS_B_CK+
A27	BATLOW#	B27	WDT	A82	eDP_TX3-/LVDS_A_CK-	B82	LVDS_B_CK-

Pin	Row A	Pin	Row B	Pin	Row A	Pin	Row B
A28	(S)ATA_ACT#	B28	HDA_SDIN2 [1]	A83	eDP_AUX+/LVDS_I2C_CK	B83	eDP/LVDS_BKLT_CTRL
A29	HDA_SYNC	B29	HDA_SDIN1	A84	eDP_AUX-/LVDS_I2C_DAT	B84	VCC_5V_SBY
A30	HDA_RST#	B30	HDA_SDIN0	A85	GPI3	B85	VCC_5V_SBY
A31	GND (FIXED)	B31	GND (FIXED)	A86	RSVD	B86	VCC_5V_SBY
A32	HDA_BITCLK	B32	SPKR [3]	A87	eDP_HPD	B87	VCC_5V_SBY
A33	HDA_SDOUT [3]	B33	I2C_CK	A88	PCIE_CLK_REF+	B88	BIOS_DIS1# [3]
A34	BIOS_DIS0# [3]/ESPI_SAFS	B34	I2C_DAT	A89	PCIE_CLK_REF-	B89	VGA_RED [1]
A35	THRMTRIP#	B35	THRM#	A90	GND (FIXED)	B90	GND (FIXED)
A36	USB6-	B36	USB7-	A91	SPI_POWER [2]	B91	VGA_GRN [1]
A37	USB6+	B37	USB7+	A92	SPI_MISO	B92	VGA_BLU [1]
A38	USB_6_7_OC#	B38	USB_4_5_OC#	A93	GPO0	B93	VGA_HSYNC [1]
A39	USB4-	B39	USB5-	A94	SPI_CLK	B94	VGA_VSYNC [1]
A40	USB4+	B40	USB5+	A95	SPI_MOSI [3]	B95	VGA_I2C_CK [1]
A41	GND (FIXED)	B41	GND (FIXED)	A96	TPM_PP	B96	VGA_I2C_DAT [1]
A42	USB2-	B42	USB3-	A97	TYPE10# [1]	B97	SPI_CS#
A43	USB2+	B43	USB3+	A98	SER0_TX	B98	RSVD [1]
A44	USB_2_3_OC#	B44	USB_0_1_OC#	A99	SER0_RX	B99	RSVD [1]
A45	USB0-	B45	USB1-	A100	GND (FIXED)	B100	GND (FIXED)
A46	USB0+	B46	USB1+	A101	SER1_TX	B101	FAN_PWMOUT
A47	VCC_RTC	B47	ESPI_EN# [2]	A102	SER1_RX	B102	FAN_TACHIN
A48	RSVD [1]	B48	USB0_HOST_PRSNT [2]	A103	LID#	B103	SLEEP#
A49	GBE0_SDP	B49	SYS_RESET#	A104	VCC_12V	B104	VCC_12V
A50	LPC_SERIRQ/ESPI_CS1#	B50	CB_RESET#	A105	VCC_12V	B105	VCC_12V
A51	GND (FIXED)	B51	GND (FIXED)	A106	VCC_12V	B106	VCC_12V
A52	PCIE_TX5+	B52	PCIE_RX5+	A107	VCC_12V	B107	VCC_12V
A53	PCIE_TX5-	B53	PCIE_RX5-	A108	VCC_12V	B108	VCC_12V
A54	GPI0	B54	GPO1	A109	VCC_12V	B109	VCC_12V
A55	PCIE_TX4+	B55	PCIE_RX4+	A110	GND (FIXED)	B110	GND (FIXED)

Note

1. *Not connected*
2. *Not supported*
3. *Bootstrap signals*

Table 13 Connector C–D Pinout

Pin	Row C	Pin	Row D	Pin	Row C	Pin	Row D
C1	GND (FIXED)	D1	GND (FIXED)	C56	PEG_RX1- [1]	D56	PEG_TX1- [1]
C2	GND	D2	GND	C57	TYPE1# [1]	D57	TYPE2#
C3	USB_SSRX0-	D3	USB_SSTX0-	C58	PEG_RX2+ [1]	D58	PEG_TX2+ [1]
C4	USB_SSRX0+	D4	USB_SSTX0+	C59	PEG_RX2- [1]	D59	PEG_TX2- [1]
C5	GND	D5	GND	C60	GND (FIXED)	D60	GND (FIXED)
C6	USB_SSRX1-	D6	USB_SSTX1-	C61	PEG_RX3+ [1]	D61	PEG_TX3+ [1]
C7	USB_SSRX1+	D7	USB_SSTX1+	C62	PEG_RX3- [1]	D62	PEG_TX3- [1]
C8	GND	D8	GND	C63	RSVD	D63	RSVD [1]
C9	USB_SSRX2- [1]	D9	USB_SSTX2- [1]	C64	RSVD	D64	RSVD [1]
C10	USB_SSRX2+ [1]	D10	USB_SSTX2+ [1]	C65	PEG_RX4+ [1]	D65	PEG_TX4+ [1]
C11	GND (FIXED)	D11	GND (FIXED)	C66	PEG_RX4- [1]	D66	PEG_TX4- [1]
C12	USB_SSRX3- [1]	D12	USB_SSTX3- [1]	C67	RAPID_SHUTDOWN [1,2]	D67	GND
C13	USB_SSRX3+ [1]	D13	USB_SSTX3+ [1]	C68	PEG_RX5+ [1]	D68	PEG_TX5+ [1]
C14	GND	D14	GND	C69	PEG_RX5- [1]	D69	PEG_TX5- [1]
C15	DDI1_PAIR6+ [1]	D15	DDI1_CTRLCLK_AUX+	C70	GND (FIXED)	D70	GND (FIXED)
C16	DDI1_PAIR6- [1]	D16	DDI1_CTRLDATA_AUX- [3]	C71	PEG_RX6+ [1]	D71	PEG_TX6+ [1]
C17	RSVD [1]	D17	RSVD [1]	C72	PEG_RX6- [1]	D72	PEG_TX6- [1]
C18	RSVD [1]	D18	RSVD [1]	C73	GND	D73	GND
C19	PCIE_RX6+ [1]	D19	PCIE_TX6+ [1]	C74	PEG_RX7+ [1]	D74	PEG_TX7+ [1]
C20	PCIE_RX6- [1]	D20	PCIE_TX6- [1]	C75	PEG_RX7- [1]	D75	PEG_TX7- [1]
C21	GND (FIXED)	D21	GND (FIXED)	C76	GND	D76	GND
C22	PCIE_RX7+ [1]	D22	PCIE_TX7+ [1]	C77	RSVD [1]	D77	RSVD [1]
C23	PCIE_RX7- [1]	D23	PCIE_TX7- [1]	C78	PEG_RX8+ [1]	D78	PEG_TX8+ [1]
C24	DDI1_HPD	D24	RSVD [1]	C79	PEG_RX8- [1]	D79	PEG_TX8- [1]
C25	DDI1_PAIR4+ [1]	D25	RSVD [1]	C80	GND (FIXED)	D80	GND (FIXED)
C26	DDI1_PAIR4- [1]	D26	DDI1_PAIR0+	C81	PEG_RX9+ [1]	D81	PEG_TX9+ [1]
C27	RSVD [1]	D27	DDI1_PAIR0-	C82	PEG_RX9- [1]	D82	PEG_TX9- [1]
C28	RSVD [1]	D28	RSVD [1]	C83	RSVD [1]	D83	RSVD [1]
C29	DDI1_PAIR5+ [1]	D29	DDI1_PAIR1+	C84	GND	D84	GND
C30	DDI1_PAIR5- [1]	D30	DDI1_PAIR1-	C85	PEG_RX10+ [1]	D85	PEG_TX10+ [1]
C31	GND (FIXED)	D31	GND (FIXED)	C86	PEG_RX10- [1]	D86	PEG_TX10- [1]
C32	DDI2_CTRLCLK_AUX+	D32	DDI1_PAIR2+	C87	GND	D87	GND

Pin	Row C	Pin	Row D	Pin	Row C	Pin	Row D
C33	DDI2_CTRLDATA_AUX-	D33	DDI1_PAIR2-	C88	PEG_RX11+ [1]	D88	PEG_TX11+ [1]
C34	DDI2_DDC_AUX_SEL	D34	DDI1_DDC_AUX_SEL	C89	PEG_RX11- [1]	D89	PEG_TX11- [1]
C35	RSVD [1]	D35	RSVD [1]	C90	GND (FIXED)	D90	GND (FIXED)
C36	DDI3_CTRLCLK_AUX+ [1]	D36	DDI1_PAIR3+	C91	PEG_RX12+ [1]	D91	PEG_TX12+ [1]
C37	DDI3_CTRLDATA_AUX- [1]	D37	DDI1_PAIR3-	C92	PEG_RX12- [1]	D92	PEG_TX12- [1]
C38	DDI3_DDC_AUX_SEL [1]	D38	RSVD [1]	C93	GND	D93	GND
C39	DDI3_PAIR0+ [1]	D39	DDI2_PAIR0+	C94	PEG_RX13+ [1]	D94	PEG_TX13+ [1]
C40	DDI3_PAIR0- [1]	D40	DDI2_PAIR0-	C95	PEG_RX13- [1]	D95	PEG_TX13- [1]
C41	GND (FIXED)	D41	GND (FIXED)	C96	GND	D96	GND
C42	DDI3_PAIR1+ [1]	D42	DDI2_PAIR1+	C97	RVSD [1]	D97	RSVD [1]
C43	DDI3_PAIR1- [1]	D43	DDI2_PAIR1-	C98	PEG_RX14+ [1]	D98	PEG_TX14+ [1]
C44	DDI3_HPD [1]	D44	DDI2_HPD	C99	PEG_RX14- [1]	D99	PEG_TX14- [1]
C45	RSVD [1]	D45	RSVD [1]	C100	GND (FIXED)	D100	GND (FIXED)
C46	DDI3_PAIR2+ [1]	D46	DDI2_PAIR2+	C101	PEG_RX15+ [1]	D101	PEG_TX15+ [1]
C47	DDI3_PAIR2- [1]	D47	DDI2_PAIR2-	C102	PEG_RX15- [1]	D102	PEG_TX15- [1]
C48	RSVD [1]	D48	RSVD [1]	C103	GND	D103	GND
C49	DDI3_PAIR3+ [1]	D49	DDI2_PAIR3+	C104	VCC_12V	D104	VCC_12V
C50	DDI3_PAIR3- [1]	D50	DDI2_PAIR3-	C105	VCC_12V	D105	VCC_12V
C51	GND (FIXED)	D51	GND (FIXED)	C106	VCC_12V	D106	VCC_12V
C52	PEG_RX0+ [1]	D52	PEG_TX0+ [1]	C107	VCC_12V	D107	VCC_12V
C53	PEG_RX0- [1]	D53	PEG_TX0- [1]	C108	VCC_12V	D108	VCC_12V
C54	TYPE0# [1]	D54	PEG_LANE_RV# [1]	C109	VCC_12V	D109	VCC_12V
C55	PEG_RX1+ [1]	D55	PEG_TX1+ [1]	C110	GND (FIXED)	D110	GND (FIXED)

Note

1. *Not connected*

2. *Not supported*

Table 14 PCI Express Signal Descriptions (General Purpose)

Signal	Pin	Description	I/O	PU/PD	Comment
PCIE_RX0+ PCIE_RX0-	B68 B69	PCI Express channel 0, Receive Input differential pair	I PCIE		Supports PCI Express Base Specification, Revision 3.0
PCIE_TX0+ PCIE_TX0-	A68 A69	PCI Express channel 0, Transmit Output differential pair	O PCIE		Supports PCI Express Base Specification, Revision 3.0
PCIE_RX1+ PCIE_RX1-	B64 B65	PCI Express channel 1, Receive Input differential pair	I PCIE		Supports PCI Express Base Specification, Revision 3.0
PCIE_TX1+ PCIE_TX1-	A64 A65	PCI Express channel 1, Transmit Output differential pair	O PCIE		Supports PCI Express Base Specification, Revision 3.0
PCIE_RX2+ PCIE_RX2-	B61 B62	PCI Express channel 2, Receive Input differential pair	I PCIE		Supports PCI Express Base Specification, Revision 3.0
PCIE_TX2+ PCIE_TX2-	A61 A62	PCI Express channel 2, Transmit Output differential pair	O PCIE		Supports PCI Express Base Specification, Revision 3.0
PCIE_RX3+ PCIE_RX3-	B58 B59	PCI Express channel 3, Receive Input differential pair	I PCIE		Supports PCI Express Base Specification, Revision 3.0
PCIE_TX3+ PCIE_TX3-	A58 A59	PCI Express channel 3, Transmit Output differential pair	O PCIE		Supports PCI Express Base Specification, Revision 3.0
PCIE_RX4+ PCIE_RX4-	B55 B56	PCI Express channel 4, Receive Input differential pair	I PCIE		Supports PCI Express Base Specification, Revision 3.0
PCIE_TX4+ PCIE_TX4-	A55 A56	PCI Express channel 4, Transmit Output differential pair	O PCIE		Supports PCI Express Base Specification, Revision 3.0
PCIE_RX5+ PCIE_RX5-	B52 B53	PCI Express channel 5, Receive Input differential pair	I PCIE		Supports PCI Express Base Specification, Revision 3.0
PCIE_TX5+ PCIE_TX5-	A52 A53	PCI Express channel 5, Transmit Output differential pair	O PCIE		Supports PCI Express Base Specification, Revision 3.0
PCIE_RX6+ PCIE_RX6-	C19 C20	PCI Express channel 6, Receive Input differential pair	I PCIE		Not supported
PCIE_TX6+ PCIE_TX6-	D19 D20	PCI Express channel 6, Transmit Output differential pair	O PCIE		Not supported
PCIE_RX7+ PCIE_RX7-	C22 C23	PCI Express channel 7, Receive Input differential pair	I PCIE		Not supported
PCIE_TX7+ PCIE_TX7-	D22 D23	PCI Express channel 7, Transmit Output differential pair	O PCIE		Not supported
PCIE_CLK_REF+ PCIE_CLK_REF-	A88 A89	PCI Express Reference Clock output for all PCI Express and PCI Express Graphics Lanes	O PCIE		A PCI Express Gen2/3 compliant clock buffer chip must be used on the carrier board if the design involves more than one PCI Express device.

Table 15 PCI Express Signal Descriptions (x16 Graphics)

Signal	Pin	Description	I/O	PU/PD	Comment
PEG_RX0+	C52	PCI Express Graphics Receive Input differential pairs	I PCIE		Not supported
PEG_RX0-	C53				
PEG_RX1+	C55	*Note: Can also be used as PCI Express Receive Input differential pairs 16 through 31 known as PCIE_RX[16-31] + and -*			
PEG_RX1-	C56				
PEG_RX2+	C58				
PEG_RX2-	C59				
PEG_RX3+	C61				
PEG_RX3-	C62				
PEG_RX4+	C65				
PEG_RX4-	C66				
PEG_RX5+	C68				
PEG_RX5-	C69				
PEG_RX6+	C71				
PEG_RX6-	C72				
PEG_RX7+	C74				
PEG_RX7-	C75				
PEG_RX8+	C78				
PEG_RX8-	C79				
PEG_RX9+	C81				
PEG_RX9-	C82				
PEG_RX10+	C85				
PEG_RX10-	C86				
PEG_RX11+	C88				
PEG_RX11-	C89				
PEG_RX12+	C91				
PEG_RX12-	C92				
PEG_RX13+	C94				
PEG_RX13-	C95				
PEG_RX14+	C98				
PEG_RX14-	C99				
PEG_RX15+	C101				
PEG_RX15-	C102				

Signal	Pin	Description	I/O	PU/PD	Comment
PEG_TX0+ PEG_TX0- PEG_TX1+ PEG_TX1- PEG_TX2+ PEG_TX2- PEG_TX3+ PEG_TX3- PEG_TX4+ PEG_TX4- PEG_TX5+ PEG_TX5- PEG_TX6+ PEG_TX6- PEG_TX7+ PEG_TX7- PEG_TX8+ PEG_TX8- PEG_TX9+ PEG_TX9- PEG_TX10+ PEG_TX10- PEG_TX11+ PEG_TX11- PEG_TX12+ PEG_TX12- PEG_TX13+ PEG_TX13- PEG_TX14+ PEG_TX14- PEG_TX15+ PEG_TX15-	D52 D53 D55 D56 D58 D59 D61 D62 D65 D66 D68 D69 D71 D72 D74 D75 D78 D79 D81 D82 D85 D86 D88 D89 D91 D92 D94 D95 D98 D99 D101 D102	PCI Express Graphics Transmit Output differential pairs *Note: Can also be used as PCI Express Transmit Output differential pairs 16 through 31 known as PCIE_TX[16-31] + and -*	O PCIE		Not supported
PEG_LANE_RV#	D54	PCI Express Graphics lane reversal input strap. Pull low on the carrier board to reverse lane order	I		Not supported

Note

The conga-TCA7 does not support PCI Express Graphics.

Table 16 DDI Signal Description

Signal	Pin	Description	I/O	PU/PD	Comment
DDI1_PAIR0+ DDI1_PAIR0-	D26 D27	Multiplexed with DP1_LANE0+ and TMDS1_DATA2+ Multiplexed with DP1_LANE0- and TMDS1_DATA2-	O DP		
DDI1_PAIR1+ DDI1_PAIR1-	D29 D30	Multiplexed with DP1_LANE1+ and TMDS1_DATA1+ Multiplexed with DP1_LANE1- and TMDS1_DATA1-	O DP		
DDI1_PAIR2+ DDI1_PAIR2-	D32 D33	Multiplexed with DP1_LANE2+ and TMDS1_DATA0+ Multiplexed with DP1_LANE2- and TMDS1_DATA0-	O DP		
DDI1_PAIR3+ DDI1_PAIR3-	D36 D37	Multiplexed with DP1_LANE3+ and TMDS1_CLK+ Multiplexed with DP1_LANE3- and TMDS1_CLK-	O DP		
DDI1_PAIR4+ DDI1_PAIR4-	C25 C26	Digital Display Interface 1, differential pair 4			Not supported
DDI1_PAIR5+ DDI1_PAIR5-	C29 C30	Digital Display Interface 1, differential pair 5			Not supported
DDI1_PAIR6+ DDI1_PAIR6-	C15 C16	Digital Display Interface 1, differential pair 6			Not supported
DDI1_HPD	C24	Multiplexed with DP1_HPD and HDMI1_HPD	I 3.3 V	PD 1 MΩ	
DDI1_CTRLCLK_AUX+	D15	Multiplexed with DP1_AUX+ and HMDI1_CTRLCLK DP AUX+ function if DDI1_DDC_AUX_SEL is no connect HDMI/DVI I2C CTRLCLK if DDI1_DDC_AUX_SEL is pulled high	 I/O DP I/O OD 3.3 V	PD 100 kΩ	
DDI1_CTRLDATA_AUX-	D16	Multiplexed with DP1_AUX- and HDMI1_CTRLDATA DP AUX- function if DDI1_DDC_AUX_SEL is no connect HDMI/DVI I2C CTRLDATA if DDI1_DDC_AUX_SEL is pulled high	 I/O DP I/O OD 3.3 V	PU 100 kΩ 3.3V	
DDI1_DDC_AUX_SEL	D34	Selects the function of DDI1_CTRLCLK_AUX+ and DDI1_CTRLDATA_AUX- This pin shall have a IM pull-down to logic ground on the module. If this input is floating, the AUX pair is used for the DP AUX+/- signals. If pulled-high, the AUX pair contains the CTRLCLK and CTRLDATA signals.	I 3.3 V	PD 1 MΩ	
DDI2_PAIR0+ DDI2_PAIR0-	D39 D40	Multiplexed with DP2_LANE0+ and TMDS2_DATA2+ Multiplexed with DP2_LANE0- and TMDS2_DATA2-	O DP		
DDI2_PAIR1+ DDI2_PAIR1-	D42 D43	Multiplexed with DP2_LANE1+ and TMDS2_DATA1+ Multiplexed with DP2_LANE1- and TMDS2_DATA1-	O DP		
DDI2_PAIR2+ DDI2_PAIR2-	D46 D47	Multiplexed with DP2_LANE2+ and TMDS2_DATA0+ Multiplexed with DP2_LANE2- and TMDS2_DATA0-	O DP		
DDI2_PAIR3+ DDI2_PAIR3-	D49 D50	Multiplexed with DP2_LANE3+ and TMDS2_CLK+ Multiplexed with DP2_LANE3- and TMDS2_CLK-	O DP		
DDI2_HPD	D44	Multiplexed with DP2_HPD and HDMI2_HPD	I 3.3 V	PD 1 MΩ	
DDI2_CTRLCLK_AUX+	C32	Multiplexed with DP2_AUX+ and HDMI2_CTRLCLK DP AUX+ function if DDI2_DDC_AUX_SEL is no connect HDMI/DVI I2C CTRLCLK if DDI2_DDC_AUX_SEL is pulled high	 I/O DP I/O OD 3.3 V	PD 100 kΩ	
DDI2_CTRLDATA_AUX-	C33	Multiplexed with DP2_AUX- and HDMI2_CTRLDATA DP AUX- function if DDI2_DDC_AUX_SEL is no connect HDMI/DVI I2C CTRLDATA if DDI2_DDC_AUX_SEL is pulled high	 I/O DP I/O OD 3.3 V	PU 100 kΩ 3.3 V	

Signal	Pin	Description	I/O	PU/PD	Comment
DDI2_DDC_AUX_SEL	C34	Selects the function of DDI2_CTRLCLK_AUX+ and DDI2_CTRLDATA_AUX- This pin shall have a 1M pull-down to logic ground on the module. If this input is floating, the AUX pair is used for the DP AUX+/- signals. If pulled-high, the AUX pair contains the CTRLCLK and CTRLDATA signals	I 3.3V	PD 1 MΩ	
DDI3_PAIR0+ DDI3_PAIR0-	C39 C40	Multiplexed with DP3_LANE0+ and TMDS3_DATA2+ Multiplexed with DP3_LANE0- and TMDS3_DATA2-	O DP		Not supported
DDI3_PAIR1+ DDI3_PAIR1-	C42 C43	Multiplexed with DP3_LANE1+ and TMDS3_DATA1+ Multiplexed with DP3_LANE1- and TMDS3_DATA1-	O DP		Not supported
DDI3_PAIR2+ DDI3_PAIR2-	C46 C47	Multiplexed with DP3_LANE2+ and TMDS3_DATA0+ Multiplexed with DP3_LANE2- and TMDS3_DATA0-	O DP		Not supported
DDI3_PAIR3+ DDI3_PAIR3-	C49 C50	Multiplexed with DP3_LANE3+ and TMDS3_CLK+ Multiplexed with DP3_LANE3- and TMDS3_CLK-	O DP		Not supported
DDI3_HPD	C44	Multiplexed with DP3_HPD and HDMI3_HPD	I 3.3 V		Not supported
DDI3_CTRLCLK_AUX+	C36	Multiplexed with DP3_AUX+ and HDMI3_CTRLCLK DP AUX+ function if DDI3_DDC_AUX_SEL is no connect HDMI/DVI I2C CTRLCLK if DDI3_DDC_AUX_SEL is pulled high	 I/O DP I/O OD 3.3 V		Not supported
DDI3_CTRLDATA_AUX-	C37	Multiplexed with DP3_AUX- and HDMI3_CTRLDATA DP AUX- function if DDI3_DDC_AUX_SEL is no connect HDMI/DVI I2C CTRLDATA if DDI3_DDC_AUX_SEL is pulled high	 I/O DP I/O OD 3.3 V		Not supported
DDI3_DDC_AUX_SEL	C38	Selects the function of DDI3_CTRLCLK_AUX+ and DDI3_CTRLDATA_AUX- This pin shall have a IM pull-down to logic ground on the module. If this input is floating, the AUX pair is used for the DP AUX+/- signals. If pulled-high, the AUX pair contains the CTRLCLK and CTRLDATA signals	I 3.3 V		Not supported

Table 17 TMDS Signal Descriptions

Signal	Pin	Description	I/O	PU/PD	Comment
TMDS1_CLK + TMDS1_CLK -	D36 D37	TMDS Clock output differential pair Multiplexed with DDI1_PAIR3+ and DDI1_PAIR3-	O DP		
TMDS1_DATA0+ TMDS1_DATA0-	D32 D33	TMDS differential pair Multiplexed with DDI1_PAIR2+ and DDI1_PAIR2-	O DP		
TMDS1_DATA1+ TMDS1_DATA1-	D29 D30	TMDS differential pair Multiplexed with DDI1_PAIR1+ and DDI1_PAIR1-	O DP		
TMDS1_DATA2+ TMDS1_DATA2-	D26 D27	TMDS differential pair Multiplexed with DDI1_PAIR0+ and DDI1_PAIR0-	O DP		
HDMI1_HPD	C24	TMDSI Hot-plug detect Multiplexed with DDI1_HPD	I DP	PD 1 MΩ	
HDMI1_CTRLCLK	D15	TMDS I²C Control Clock Multiplexed with DDI1_CTRLCLK_AUX+	I/O OD 3.3 V	PD 100 kΩ	
HDMI1_CTRLDATA	D16	TMDS I²C Control Data Multiplexed with DDI1_CTRLDATA_AUX-	I/O OD 3.3 V	PU 100 kΩ 3.3V	

Signal	Pin	Description	I/O	PU/PD	Comment
TMDS2_CLK + TMDS2_CLK -	D49 D50	TMDS Clock output differential pair Multiplexed with DDI2_PAIR3+ and DDI2_PAIR3-	O DP		
TMDS2_DATA0+ TMDS2_DATA0-	D46 D47	TMDS differential pair Multiplexed with DDI2_PAIR2+ and DDI2_PAIR2-	O DP		
TMDS2_DATA1+ TMDS2_DATA1-	D42 D43	TMDS differential pair Multiplexed with DDI2_PAIR1+ and DDI2_PAIR1-	O DP		
TMDS2_DATA2+ TMDS2_DATA2-	D39 D40	TMDS differential pair Multiplexed with DDI2_PAIR0+ and DDI2_PAIR0-	O DP		
HDMI2_HPD	D44	TMDS Hot-plug detect Multiplexed with DDI2_HPD	I DP	PD 1 MΩ	
HDMI2_CTRLCLK	C32	TMDS I²C Control Clock Multiplexed with DDI2_CTRLCLK_AUX+	I/O OD 3.3 V	PD 100 kΩ	
HDM12_CTRLDATA	C33	TMDS I²C Control Data Multiplexed with DDI2_CTRLDATA_AUX-	I/O OD 3.3 V	PU 100 kΩ 3.3 V	
TMDS3_CLK + TMDS3_CLK -	C49 C50	TMDS Clock output differential pair Multiplexed with DDI3_PAIR3+ and DDI3_PAIR3-	O DP		Not supported
TMDS3_DATA0+ TMDS3_DATA0-	C46 C47	TMDS differential pair Multiplexed with DDI3_PAIR2+ and DDI3_PAIR2-	O DP		Not supported
TMDS3_DATA1+ TMDS3_DATA1-	C42 C43	TMDS differential pair Multiplexed with DDI3_PAIR1+ and DDI3_PAIR1-	O DP		Not supported
TMDS3_DATA2+ TMDS3_DATA2-	C39 C40	TMDS differential pair Multiplexed with DDI3_PAIR0+ and DDI3_PAIR0-	O DP		Not supported
HDMI3_HPD	C44	TMDS Hot-plug detect Multiplexed with DDI3_HPD	I DP		Not supported
HDMI3_CTRLCLK	C36	TMDS I²C Control Clock Multiplexed with DDI3_CTRLCLK_AUX+	I/O OD 3.3 V		Not supported
HDMI3_CTRLDATA	C37	TMDS I²C Control Data Multiplexed with DDI3_CTRLDATA_AUX-	I/O OD 3.3 V		Not supported

Table 18 DisplayPort (DP) Signal Descriptions

Signal	Pin	Description	I/O	PU/PD	Comment
DP1_LANE3+ DP1_LANE3-	D36 D37	Uni-directional main link for the transport of isochronous streams and secondary data; multiplexed with DDI1_PAIR3+ and DDI1_PAIR3-	O DP		
DP1_LANE2+ DP1_LANE2-	D32 D33	Uni-directional main link for the transport of isochronous streams and secondary data; multiplexed with DDI1_PAIR2+ and DDI1_PAIR2-	O DP		
DP1_LANE1+ DP1_LANE1-	D29 D30	Uni-directional main link for the transport of isochronous streams and secondary data; multiplexed with DDI1_PAIR1+ and DDI1_PAIR1-	O DP		
DP1_LANE0+ DP1_LANE0-	D26 D27	Uni-directional main link for the transport of isochronous streams and secondary data; multiplexed with DDI1_PAIR0+ and DDI1_PAIR0-	O DP		

Signal	Pin	Description	I/O	PU/PD	Comment
DP1_HPD	C24	Detection of Hot Plug / Unplug and notification of the link layer Multiplexed with DDI1_HPD	I 3.3 V	PD 1 MΩ	
DP1_AUX+	D15	Half-duplex bi-directional AUX channel for services such as link configuration or maintenance and EDID access	I/O DP	PD 100 kΩ	
DP1_AUX-	D16	Half-duplex bi-directional AUX channel for services such as link configuration or maintenance and EDID access	I/O DP	PU 100 kΩ 3.3 V	
DP2_LANE3+ DP2_LANE3-	D49 D50	Uni-directional main link for the transport of isochronous streams and secondary data; multiplexed with DDI2_PAIR3+ and DDI2_PAIR3-	O DP		
DP2_LANE2+ DP2_LANE2-	D46 D47	Uni-directional main link for the transport of isochronous streams and secondary data; multiplexed with DDI2_PAIR2+ and DDI2_PAIR2-	O DP		
DP2_LANE1+ DP2_LANE1-	D42 D43	Uni-directional main link for the transport of isochronous streams and secondary data; multiplexed with DDI2_PAIR1+ and DDI2_PAIR1-	O DP		
DP2_LANE0+ DP2_LANE0-	D39 D40	Uni-directional main link for the transport of isochronous streams and secondary data; multiplexed with DDI2_PAIR0+ and DDI1_PAIR0-	O DP		
DP2_HPD	D44	Detection of Hot Plug / Unplug and notification of the link layer Multiplexed with DDI2_HPD	I 3.3 V	PD 1 MΩ	
DP2_AUX+	C32	Half-duplex bi-directional AUX channel for services such as link configuration or maintenance and EDID access	I/O DP	PD 100 kΩ	
DP2_AUX-	C33	Half-duplex bi-directional AUX channel for services such as link configuration or maintenance and EDID access	I/O DP	PU 100 kΩ 3.3 V	
DP3_LANE3+ DP3_LANE3-	C49 C50	Uni-directional main link for the transport of isochronous streams and secondary data; multiplexed with DDI3_PAIR3+ and DDI3_PAIR3-	O DP		Not supported
DP3_LANE2+ DP3_LANE2-	C46 C47	Uni-directional main link for the transport of isochronous streams and secondary data; multiplexed with DDI3_PAIR2+ and DDI3_PAIR2-	O DP		Not supported
DP3_LANE1+ DP3_LANE1-	C42 C43	Uni-directional main link for the transport of isochronous streams and secondary data; multiplexed with DDI3_PAIR1+ and DDI3_PAIR1-	O DP		Not supported
DP3_LANE0+ DP3_LANE0-	C39 C40	Uni-directional main link for the transport of isochronous streams and secondary data; multiplexed with DDI3_PAIR0+ and DDI3_PAIR0-	O DP		Not supported
DP3_HPD	C44	Detection of hot plug / unplug and notification of the link layer; multiplexed with DDI3_HPD	I 3.3 V		Not supported
DP3_AUX+	C36	Half-duplex bi-directional AUX channel for services such as link configuration or maintenance and EDID access	I/O DP		Not supported
DP3_AUX-	C37	Half-duplex bi-directional AUX channel for services such as link configuration or maintenance and EDID access	I/O DP		Not supported

Table 19 Embedded DisplayPort Signal Descriptions

Signal	Pin	Description	I/O	PU/PD	Comment
eDP_TX3+ eDP_TX3- eDP_TX2+ eDP_TX2- eDP_TX1+ eDP_TX1- eDP_TX0+ eDP_TX0-	A81 A82 A71 A72 A73 A74 A75 A76	eDP differential pairs	AC coupled off module.		Not supported by default
eDP_VDD_EN	A77	eDP power enable	O 3.3 V		
eDP_BKLT_EN	B79	eDP backlight enable	O 3.3 V		
eDP_BKLT_CTRL	B83	eDP backlight brightness control	O 3.3 V		
eDP_AUX+	A83	eDP AUX+	AC coupled off module		
eDP_AUX-	A84	eDP AUX-	AC coupled off module		
eDP_HPD	A87	Detection of hot plug / unplug and notification of the link layer	I 3.3 V	PD 1M Ω	

Note

The optional eDP interface requires a customized variant.

Table 20 CRT Signal Descriptions

Signal	Pin	Description	I/O	PU/PD	Comment
VGA_RED	B89	Red for monitor; analog DAC output designed to drive a 37.5-Ohm equivalent load	O Analog		Not supported
VGA_GRN	B91	Green for monitor; analog DAC output designed to drive a 37.5-Ohm equivalent load	O Analog		
VGA_BLU	B92	Blue for monitor. Analog DAC output, designed to drive a 37.5-Ohm equivalent load	O Analog		
VGA_HSYNC	B93	Horizontal sync output to VGA monitor	O 3.3 V		
VGA_VSYNC	B94	Vertical sync output to VGA monitor	O 3.3 V		
VGA_I2C_CK	B95	DDC clock line (I²C port dedicated to identify VGA monitor capabilities)	I/O OD 5 V		
VGA_I2C_DAT	B96	DDC data line	I/O OD 5 V		

Note

The conga-TCA7 does not support VGA interface.

Table 21 LVDS Signal Descriptions

Signal	Pin	Description	I/O	PU/PD	Comment
LVDS_A0+ LVDS_A0- LVDS_A1+ LVDS_A1- LVDS_A2+ LVDS_A2- LVDS_A3+ LVDS_A3-	A71 A72 A73 A74 A75 A76 A78 A79	LVDS Channel A differential pairs	O LVDS		
LVDS_A_CK+ LVDS_A_CK-	A81 A82	LVDS Channel A differential clock	O LVDS		
LVDS_B0+ LVDS_B0- LVDS_B1+ LVDS_B1- LVDS_B2+ LVDS_B2- LVDS_B3+ LVDS_B3-	B71 B72 B73 B74 B75 B76 B77 B78	LVDS Channel B differential pairs	O LVDS		
LVDS_B_CK+ LVDS_B_CK-	B81 B82	LVDS Channel B differential clock	O LVDS		
LVDS_VDD_EN	A77	LVDS panel power enable	O 3.3 V	PU 100 kΩ 3.3 V	
LVDS_BKLT_EN	B79	LVDS panel backlight enable	O 3.3 V	PU 100 kΩ 3.3 V	
LVDS_BKLT_CTRL	B83	LVDS panel backlight brightness control	O 3.3 V		
LVDS_I2C_CK	A83	DDC lines used for flat panel detection and control	I/O 3.3 V	PU 2k2 3.3 V	
LVDS_I2C_DAT	A84	DDC lines used for flat panel detection and control	I/O 3.3 V	PU 2k2 3.3 V	

Table 22 Serial ATA Signal Descriptions

Signal	Pin	Description	I/O	PU/PD	Comment
SATA0_RX+ SATA0_RX-	A19 A20	Serial ATA channel 0, receive input differential pair	I SATA		Supports Serial ATA specification, Revision 3.0
SATA0_TX+ SATA0_TX-	A16 A17	Serial ATA channel 0, transmit output differential pair	O SATA		Supports Serial ATA specification, Revision 3.0
SATA1_RX+ SATA1_RX-	B19 B20	Serial ATA channel 1, receive input differential pair	I SATA		Supports Serial ATA specification, Revision 3.0
SATA1_TX+ SATA1_TX-	B16 B17	Serial ATA channel 1, transmit output differential pair	O SATA		Supports Serial ATA specification, Revision 3.0
SATA2_RX+ SATA2_RX-	A25 A26	Serial ATA channel 2, receive input differential pair	I SATA		Not supported

Signal	Pin	Description	I/O	PU/PD	Comment
SATA2_TX+ SATA2_TX-	A22 A23	Serial ATA channel 2, transmit output differential pair	O SATA		Not supported
SATA3_RX+ SATA3_RX-	B25 B26	Serial ATA channel 3, receive input differential pair	I SATA		Not supported
SATA3_TX+ SATA3_TX-	B22 B23	Serial ATA channel 3, transmit output differential pair	O SATA		Not supported
(S)ATA_ACT#	A28	Serial ATA activity indicator, active low	I/O 3.3 V		

Table 23 USB 2. 0 Signal Descriptions

Signal	Pin	Description	I/O	PU/PD	Comment
USB0+	B46	USB Port 0, data + or D+	I/O		USB 2.0 compliant. Backwards compatible to USB 1.1
USB0-	B45	USB Port 0, data - or D-	I/O		USB 2.0 compliant. Backwards compatible to USB 1.1
USB1+	A46	USB Port 1, data + or D+	I/O		USB 2.0 compliant. Backwards compatible to USB 1.1
USB1-	A45	USB Port 1, data - or D-	I/O		USB 2.0 compliant. Backwards compatible to USB 1.1
USB2+	A43	USB Port 2, data + or D+	I/O		USB 2.0 compliant. Backwards compatible to USB 1.1
USB2-	A42	USB Port 2, data - or D-	I/O		USB 2.0 compliant. Backwards compatible to USB 1.1
USB3+	B43	USB Port 3, data + or D+	I/O		USB 2.0 compliant. Backwards compatible to USB 1.1
USB3-	B42	USB Port 3, data - or D-	I/O		USB 2.0 compliant. Backwards compatible to USB 1.1
USB4+	A40	USB Port 4, data + or D+	I/O		USB 2.0 compliant. Backwards compatible to USB 1.1
USB4-	A39	USB Port 4, data - or D-	I/O		USB 2.0 compliant. Backwards compatible to USB 1.1
USB5+	B40	USB Port 5, data + or D+	I/O		USB 2.0 compliant. Backwards compatible to USB 1.1
USB5-	B39	USB Port 5, data - or D-	I/O		USB 2.0 compliant. Backwards compatible to USB 1.1
USB6+	A37	USB Port 6, data + or D+	I/O		USB 2.0 compliant. Backwards compatible to USB 1.1
USB6-	A36	USB Port 6, data - or D-	I/O		USB 2.0 compliant. Backwards compatible to USB 1.1
USB7+	B37	USB Port 7, data + or D+	I/O		USB 2.0 compliant. Backwards compatible to USB 1.1
USB7-	B36	USB Port 7, data - or D-	I/O		USB 2.0 compliant. Backwards compatible to USB 1.1
USB_0_1_OC#	B44	USB over-current sense, USB ports 0 and 1. A pull-up for this line shall be present on the module. An open drain driver from a USB current monitor on the carrier board may drive this line low	I 3.3 VSB	PU 10 kΩ 3.3 VSB	Do not pull this line high on the carrier board
USB_2_3_OC#	A44	USB over-current sense, USB ports 2 and 3. A pull-up for this line shall be present on the module. An open drain driver from a USB current monitor on the carrier board may drive this line low	I 3.3 VSB	PU 10 kΩ 3.3 VSB	Do not pull this line high on the carrier board
USB_4_5_OC#	B38	USB over-current sense, USB ports 4 and 5. A pull-up for this line shall be present on the module. An open drain driver from a USB current monitor on the carrier board may drive this line low	I 3.3 VSB	PU 10 kΩ 3.3 VSB	Do not pull this line high on the carrier board
USB_6_7_OC#	A38	USB over-current sense, USB ports 6 and 7. A pull-up for this line shall be present on the module. An open drain driver from a USB current monitor on the carrier board may drive this line low	I 3.3 VSB	PU 10 kΩ 3.3 VSB	Do not pull this line high on the carrier board

Signal	Pin	Description	I/O	PU/PD	Comment
USB0_HOST_PRSNT	B48	Module USB client may detect the presence of a USB host on USB0. A high values indicates that a host is present	I 3.3 VSB	PD 100 kΩ	Not supported

Table 24 USB 3.0 Signal Descriptions

Signal	Pin	Description	I/O	PU/PD	Comment
USB_SSRX0+	C4	Additional receive signal differential pairs for the Superspeed USB data path	I		
USB_SSRX0-	C3		I		
USB_SSTX0+	D4	Additional transmit signal differential pairs for the Superspeed USB data path	O		
USB_SSTX0-	D3		O		
USB_SSRX1+	C7	Additional receive signal differential pairs for the Superspeed USB data path	I		
USB_SSRX1-	C6		I		
USB_SSTX1+	D7	Additional transmit signal differential pairs for the Superspeed USB data path	O		
USB_SSTX1-	D6		O		
USB_SSRX2+	C10	Additional receive signal differential pairs for the Superspeed USB data path	I		
USB_SSRX2-	C9		I		
USB_SSTX2+	D10	Additional transmit signal differential pairs for the Superspeed USB data path	O		
USB_SSTX2-	D9		O		
USB_SSRX3+	C13	Additional receive signal differential pairs for the Superspeed USB data path	I		
USB_SSRX3-	C12		I		
USB_SSTX3+	D13	Additional transmit signal differential pairs for the Superspeed USB data path	O		
USB_SSTX3-	D12		O		

Table 25 Gigabit Ethernet Signal Descriptions

Gigabit Ethernet	Pin	Description				I/O	PU/PD	Comment
GBE0_MDI0+ GBE0_MDI0- GBE0_MDI1+ GBE0_MDI1- GBE0_MDI2+ GBE0_MDI2- GBE0_MDI3+ GBE0_MDI3-	A13 A12 A10 A9 A7 A6 A3 A2	Gigabit Ethernet Controller 0: Media Dependent Interface Differential Pairs 0, 1, 2, 3. The MDI can operate in 1000, 100, and 10 Mbps modes. Some pairs are unused in some modes according to the following:				I/O Analog		
			1000BASE-T	100BASE-TX	10BASE-T			
		MDI[0]+/-	B1_DA+/-	TX+/-	TX+/-			
		MDI[1]+/-	B1_DB+/-	RX+/-	RX+/-			
		MDI[2]+/-	B1_DC+/-					
		MDI[3]+/-	B1_DD+/-					
GBE0_ACT#	B2	Gigabit Ethernet Controller 0 activity indicator, active low				OD 3.3 V	PU 100 kΩ 3.3 V	

Gigabit Ethernet	Pin	Description	I/O	PU/PD	Comment
GBE0_LINK# [1, 2]	A8	Gigabit Ethernet Controller 0 link indicator, active low	OD 3.3 V	PU 100 kΩ 3.3 V	
GBE0_LINK100# [2]	A4	Gigabit Ethernet Controller 0 100 Mbps link indicator, active low	OD 3.3 V	PU 100 kΩ 3.3 V	
GBE0_LINK1000# [2]	A5	Gigabit Ethernet Controller 0 1000 Mbps link indicator, active low	OD 3.3 V	PU 100 kΩ 3.3 V	
GBE0_CTREF	A14	Reference voltage for Carrier Board Ethernet channel 0 magnetics center tap. The reference voltage is determined by the requirements of the module PHY and may be as low as 0 V and as high as 3.3 V. The reference voltage output shall be current limited on the module. In the case in which the reference is shorted to ground, the current shall be limited to 250 mA or less.	REF		Not connected
GBE0_SDP	A49	Gigabit Ethernet Controller 0 Software-Definable Pin. Can also be used for IEEE1588 support such as a 1 pps signal	I/O		

Note

1. *The GBE0_LINK# output is not active during a 10 Mb connection. It is only active during a 100 Mb or 1 Gb connection. This is a limitation of Ethernet Phy since it only has 3 LED outputs—ACT#, LINK100# and LINK1000#.*

2. *The GBE0_LINK# signal is a logic AND of the GBE0_LINK100# and GBE0_LINK1000# signals on the conga-TCA7 module.*

Table 26 High Definition Audio Link Signals Descriptions

Signal	Pin	Description	I/O	PU/PD	Comment
HDA_RST# [2]	A30	Reset output to codec; active low	O 3.3 V		
HDA_SYNC [2]	A29	Sample-synchronization signal to the codec(s)	O 3.3 V		
HDA_BITCLK [2]	A32	Serial data clock generated by the external codec(s)	O 3.3 V		
HDA_SDOUT [1, 2]	A33	Serial TDM data output to the codec	O 3.3 V		
HDA_SDIN[1:0]	B29-B30	Serial TDM data inputs from up to three codecs	I 3.3 V		HDA_SDIN2 (pin B28) is not connected

Note

1. *This signal has special functionality during the reset process. It may bootstrap some basic important functions of the module. For more information refer to section 8.2 "Bootstrap Signals".*

2. *AC'97 codecs are not supported.*

Table 27 LPC Signal Descriptions

Signal	Pin	Description	I/O	PU/PD	Comment
LPC_AD[0:3]	B4-B7	LPC Mode: LPC multiplexed address, command and data bus	I/O 3.3 V	PU 20 KΩ 3.3 V	
LPC_FRAME#	B3	LPC Mode: LPC Frame indicates the start of a LPC cycle.	O 3.3 V		
LPC_CLK	B10	LPC Mode: LPC clock output, 33MHz	O 3.3 V		
LPC_DRQ[0:1]#	B8	LPC Mode: LPC serial DMA request	I 3.3 V		Not supported
LPC_SERIRQ	A50	LPC Mode: LPC serial interrupt	I/O 3.3 V	PU 10 KΩ 3.3 V	
SUS_STAT#	B18	LPC Mode: Indicates imminent suspend operation. It is used to notify LPC devices that a low power state will be entered soon. LPC devices may need to preserve memory or isolate outputs during the low power state.	O 3.3 V		
ESPI_EN# [1]	B47	This signal is used by the carrier to indicate the operating mode of the LPC/eSPI bus. If left unconnected on the carrier, LPC mode (default) is selected. If pulled to GND on the carrier, eSPI mode is selected. This signal is pulled to a logic high on the module through a resistor. The carrier should only float this line or pull it low.	I		Not supported

Note

1. *The conga-TCA7 does not support eSPI mode.*

Table 28 SPI BIOS Flash Interface Signal Descriptions

Signal	Pin	Description	I/O	PU/PD	Comment
SPI_CS#	B97	Chip select for Carrier Board SPI BIOS Flash	O 3.3 VSB	PU 100 KΩ 3.3 VSB	Carrier shall pull to SPI_POWER when external SPI is provided but not used
SPI_MISO	A92	Data in to module from carrier board SPI BIOS flash	I 3.3 VSB		
SPI_MOSI [1]	A95	Data out from module to carrier board SPI BIOS flash	O 3.3 VSB	PU 75 KΩ 1.8 VSB	
SPI_CLK	A94	Clock from module to carrier board SPI BIOS flash	O 3.3 VSB	PD 100 KΩ	
SPI_POWER	A91	Power source for carrier board SPI BIOS flash SPI_POWER shall be used to power SPI BIOS flash on the carrier only	3.3 VSB		
BIOS_DIS0# [1]	A34	Selection strap to determine the BIOS boot device	I 3.3 VSB		Carrier shall be left as no-connect
BIOS_DIS1# [1]	B88	Selection strap to determine the BIOS boot device Refer to table 4.13 of the COM Express Module Base Specification 3.0 for strapping options of BIOS disable signals	I 3.3 VSB	PU 10 KΩ 3.3 VSB	Carrier shall be left as no-connect

Note

1. *Signal has special functionality during the reset process and may bootstrap some basic important functions of the module. For more information refer to section 8.2 "Bootstrap Signals".*

Table 29 Miscellaneous Signal Descriptions

Signal	Pin	Description	I/O	PU/PD	Comment
I2C_CK	B33	General purpose I²C port clock output/input	I/O 3.3 V	PU 2K2 3.3 VSB	
I2C_DAT	B34	General purpose I²C port data I/O line	I/O 3.3 V	PU 2K2 3.3 VSB	
SPKR [1]	B32	Output for audio enunciator, the "speaker" in PC-AT systems	O 3.3 V		
WDT	B27	Output indicating that a watchdog time-out event has occurred	O 3.3 V	PD 100 KΩ	
FAN_PWMOUT [2]	B101	Fan speed control Uses the Pulse Width Modulation (PWM) technique to control the fan's RPM	O OD 3.3 V	PU 10KΩ 3.3 VSB	
FAN_TACHIN [2]	B102	Fan tachometer input	I OD	PU 47 KΩ 3.3 V	Requires a fan with a two pulse output
TPM_PP	A96	Physical Presence pin of Trusted Platform Module (TPM); active high TPM chip has an internal pull-down. This signal is used to indicate Physical Presence to the TPM	I 3.3 V	PD 10 KΩ	

Note

1. *This signal has special functionality during the reset process. It may bootstrap some basic important functions of the module. For more information refer to section 8.2 "Bootstrap Signals".*

2. *Protected on the module by a series schotty diode. Therefore, pull-down resistor is required on the carrier board for proper logic level.*

Table 30 General Purpose I/O Signal Descriptions

Signal	Pin	Description	I/O	PU/PD	Comment
GPO0	A93	General purpose output pin, shared with SD_CLK Output from COM Express, input to SD	O 3.3 V		
GPO1	B54	General purpose output pin, shared with SD_CMD Output from COM Express, input to SD	O 3.3 V		
GPO2	B57	General purpose output pin, shared with SD_WP Output from COM Express, input to SD	O 3.3 V		
GPO3	B63	General purpose output pin, shared with SD_CD Output from COM Express, input to SD	O 3.3 V		
GPI0	A54	General purpose input pin (bidirectional signal) Pulled high internally on the module; shared with SD_DATA0	I 3.3 V	PU 100KΩ 3.3 V	Pull-up only active in GPIO mode
GPI1	A63	General purpose input pin (bidirectional signal) Pulled high internally on the module; shared with SD_DATA1	I 3.3 V		
GPI2	A67	General purpose input pin (bidirectional signal) Pulled high internally on the module; shared with SD_DATA2	I 3.3 V		
GPI3	A85	General purpose input pin (bidirectional signal) Pulled high internally on the module; shared with SD_DATA3	I 3.3 V		

Note

The conga-TCA7 provides GPIO signals on the COM Express connector by default.

Table 31 Power and System Management Signal Descriptions

Signal	Pin	Description	I/O	PU/PD	Comment
PWRBTN#	B12	Power button to bring system out of S5 (soft off), active on falling edge Note: For proper detection, assert a pulse width of at least 16 ms.	I 3.3 VSB	PU 100 kΩ 3.3 VSB	
SYS_RESET#	B49	Reset button input. Active low input. Edge triggered System will not be held in hardware reset while this input is kept low Note: For proper detection, assert a pulse width of at least 16 ms.	I 3.3 VSB	PU 10 kΩ 3.3 VSB	
CB_RESET#	B50	Reset output from module to Carrier Board Active low, issued by module chipset and may result from a low SYS_RESET# input, a low PWR_OK input, a VCC_12V power input that falls below the minimum specification, a watchdog timeout, or may be initiated by the module software.	O 3.3 V	PD 100 kΩ	
PWR_OK	B24	Power OK from main power supply. A high value indicates that the power is good	I 3.3 V	PU 10 kΩ 3.3 VSB	Connected via series diode to onboard voltage monitor
SUS_STAT#	B18	Indicates imminent suspend operation; used to notify LPC devices	O 3.3 VSB		
SUS_S3#	A15	Indicates system is in Suspend to RAM state (active-low output). An inverted copy of SUS_S3# on the carrier board (also known as "PS_ON") may be used to enable the non-standby power on a typical ATX power supply.	O 3.3 VSB		
SUS_S4#	A18	Indicates system is in Suspend to Disk state. Active low output	O 3.3 VSB		
SUS_S5#	A24	Indicates system is in Soft Off state	O 3.3 VSB	PD 100 kΩ	
WAKE0#	B66	PCI Express wake up signal	I 3.3 VSB	PU 10 kΩ 3.3 VSB	
WAKE1#	B67	General purpose wake up signal May be used to implement wake-up on PS/2 keyboard or mouse activity	I 3.3 VSB	PU 10 kΩ 3.3 VSB	
BATLOW#	A27	Battery low input This signal may be driven low by external circuitry to signal that the system battery is low, or may be used to signal some other external power-management event.	I 3.3 VSB	PU 10 kΩ 3.3 VSB	
LID#	A103	Lid button used by the ACPI operating system for a LID switch Note: For proper detection, assert a pulse width of at least 16 ms.	I OD 3.3 V	PU 10 kΩ 3.3 VSB	
SLEEP#	B103	Sleep button used by the ACPI operating system to bring the system to sleep state or to wake it up again. Note: For proper detection, assert a pulse width of at least 16 ms.	I OD 3.3 V	PU 100 kΩ 3.3 VSB	

Table 32 Rapid Shutdown Signal Descriptions

Signal	Pin	Description	I/O	PU/PD	Comment
RAPID_SHUTDOWN	C67	Trigger for Rapid Shutdown Must be driven to 5V though a <=50 ohm source impedance for ≥ 20 µs	I 3.3 V		Not connected

Note

The conga-TCA7 does not support Rapid Shutdown.

Table 33 Thermal Protection Signal Descriptions

Signal	Pin	Description	I/O	PU/PD	Comment
THRM#	B35	Input from off-module temp sensor indicating an over-temp situation	I 3.3 V	PU 10 kΩ 3.3 V	
THRMTRIP#	A35	Active low output indicating that the CPU has entered thermal shutdown	O 3.3 V	PU 10 kΩ 3.3 V	

Table 34 SMBus Signal Description

Signal	Pin	Description	I/O	PU/PD	Comment
SMB_CK	B13	System Management Bus bidirectional clock line	I/O 3.3 VSB	PU 2k2 3.3 VSB	
SMB_DAT#	B14	System Management Bus bidirectional data line	I/O OD 3.3 VSB	PU 2k2 3.3 VSB	
SMB_ALERT#	B15	System Management Bus Alert – active low input can be used to generate an SMI# (System Management Interrupt) or to wake the system	I 3.3 VSB	PU 10 kΩ 3.3 VSB	

Table 35 General Purpose Serial Interface Signal Descriptions

Signal	Pin	Description	I/O	PU/PD	Comment
SER0_TX [1]	A98	General purpose serial port transmitter	O 3.3 V		
SER1_TX [1]	A101	General purpose serial port transmitter	O 3.3 V		
SER0_RX [1]	A99	General purpose serial port receiver	I 3.3 V	PU 47 kΩ 3.3 V	
SER1_RX [1]	A102	General purpose serial port receiver	I 3.3 V	PU 47 kΩ 3.3 V	

Note

1. *Pins are protected on the module by a series schotty diode. Therefore, pull-down resistor is required on the carrier board for proper logic level.*

Table 36 Module Type Definition Signal Description

<table>
<tr><th>Signal</th><th>Pin</th><th>Description</th><th>I/O</th><th>Comment</th></tr>
<tr><td>TYPE0#
TYPE1#
TYPE2#</td><td>C54
C57
D57</td><td>The TYPE pins indicate to the carrier board the pinout type that is implemented on the module.
The pins are tied on the module to either ground (GND) or are no-connects (NC). For pinout Type 1, these pins are don’t care (X).
<table>
<tr><th>TYPE2#</th><th>TYPE1#</th><th>TYPE0#</th><th></th></tr>
<tr><td>X
NC
NC
NC
NC
GND</td><td>X
NC
NC
GND
GND
NC</td><td>X
NC
GND
NC
GND
NC</td><td>Pinout Type 1
Pinout Type 2
Pinout Type 3 (no IDE)
Pinout Type 4 (no PCI)
Pinout Type 5 (no IDE, no PCI)
Pinout Type 6 (no IDE, no PCI)</td></tr>
</table>
The carrier board should implement combinatorial logic that monitors the module ‘TYPE’ pins and keeps power off (e.g deactivates the ATX_ON signal for an ATX power supply) if an incompatible module pin-out type is detected.

The carrier board logic may also implement a fault indicator such as an LED.</td><td>PDS</td><td>TYPE[0:2]# signals are available on all modules following the Type 2-6 Pinout standard.

The conga-TC370 is based on the COM Express Type 6 pinout therefore the pins 0 and 1 are not connected and pin 2 is connected to GND.</td></tr>
<tr><td>TYPE10#</td><td>A97</td><td>Dual use pin.
Indicates to the carrier board that a Type 10 module is installed.
Indicates to the carrier that a Rev. 1.0/2.0 module is installed.
<table>
<tr><th>TYPE10#</th><th></th></tr>
<tr><td>NC
PD
12V</td><td>Pinout R2.0
Pinout Type 10 pull down to ground with 4.7k resistor
Pinout R1.0</td></tr>
</table>
This pin is reclaimed from VCC_12V pool. In R1.0 modules this pin will connect to other VCC_12V pins.

In R2.0 this pin is defined as a no-connect for Types 1-6. A carrier can detect a R1.0 module by the presence of 12 V on this pin. R2.0 module Types 1-6 will no-connect this pin. Type 10 modules shall pull this pin to ground through a 4.7 kΩ resistor.</td><td>PDS</td><td>Not connected to indicate “Pinout R2.0”.</td></tr>
</table>

Table 37 Power and GND Signal Descriptions

Signal	Pin	Description	I/O	PU/PD	Comment
VCC_12V	A104-A109 B104-B109 C104-C109 D104-D109	Primary power input: +12V nominal. All available VCC_12V pins on the connector(s) shall be used.	P		
VCC_5V_SBY	B84-B87	Standby power input: +5.0V nominal. If VCC5_SBY is used, all available VCC_5V_SBY pins on the connector(s) shall be used. Only used for standby and suspend functions. May be left unconnected if these functions are not used in the system design.	P		
VCC_RTC	A47	Real-time clock circuit-power input. Nominally +3.0V.	P		
GND	A1, A11, A21, A31, A41, A51, A57, A60, A66, A70, A80, A90, A100, A110, B1, B11, B21, B31, B41, B51, B60, B70, B80, B90, B100, B110 C1, C2, C5, C8, C11, C14, C21, C31, C41, C51, C60, C70,C73, C76, C80, C84, C87, C90, C93, C96, C100, C103, C110, D1, D2, D5, D8, D11, D14, D21, D31, D41, D51, D60, D67, D70, D73, D76, D80, D84, D87, D90, D93, D96, D100, D103, D110	Ground: DC power and signal and AC signal return path. All available GND connector pins shall be used and tied to Carrier Board GND plane.	P		

8.2 Bootstrap Signals

Table 38 Bootstrap Signal Descriptions

Signal	Pin #	Description of Bootstrap Signal	I/O	PU/PD	Comment
SPKR	B32	Output for audio enunciator, the "speaker" in PC-AT systems	O 3.3 V	PU(i) 20 kΩ	
SPI_MOSI	A95	Data out from module to carrier board SPI BIOS flash	O 3.3 VSB	PU(i) 20 kΩ	
HDA_SDOUT	A33	High Definition Audio Serial Data Output	O 3.3 VSB	PU(i) 20 kΩ	
BIOS_DIS0#	A34	Selection strap to determine the BIOS boot device	I 3.3 VSB	PU 10 KΩ 3.3 VSB	Carrier shall be left as no-connect
BIOS_DIS1#	B88	Selection strap to determine the BIOS boot device Refer to table 4.13 of the COM Express Module Base Specification 3.0 for strapping options of BIOS disable signals	I 3.3 VSB	PU 10 KΩ 3.3 VSB	Carrier shall be left as no-connect

Caution

1. *The signals listed in the table above are used as chipset configuration straps during system reset. In this condition (during reset), they are inputs that are pulled to the correct state by either COM Express™ internally implemented resistors or chipset internally implemented resistors that are located on the module.*

2. *No external DC loads or external pull-up or pull-down resistors should change the configuration of the signals listed in the above table. External resistors may override the internal strap states and cause the COM Express™ module to malfunction and/or cause irreparable damage to the module.*

9 System Resources

9.1 I/O Address Assignment

On the conga-TA7, the Platform P2SB acts as the subtractive decoding agent. Fixed I/O addresses positively decoded by system agents are listed in table 39 "I/O Address Assignment". These Fixed address ranges are either positively decoded in the system agent or subtractively routed to the Primary to Sideband Bridge (P2SB). Many of the fixed I/O accesses are claimed by the P2SB and forwarded to their functional target via the sideband fabric.

Address ranges that are not listed or reserved are not positively decoded by the PCH (unless assigned to one of the variable ranges). These address ranges are terminated internally by the PCH.

Table 39 I/O Address Assignment

Device	IO Address
Interrupt Controller	20h-21h, 24h-25h, 28h-29h, 2Ch-2Dh, 30h-31h, 34h-35h, 38h-39h, 3Ch-3Dh, A0h- A1h, A4h-A5h, A8h-A9h, ACh-ADh, B0h-B1h, B4h-B5h, B8h-B9h, Bch-BDh, 4D0h-4D1h
8254 Timers	40h-43h, 50h-53h
NMI Controller (CPU I/F)	61h, 63h, 65h, 67h
Reset Generator (CPU I/F)	92h
RTC	70h-77h
Reset Generator (CPU)	CF9h
PMC	B2h-B3h
eSPI	2Eh-2F, 4Eh-4Fh, 60h, 62h, 64h, 66h, 80h, 84h-86h, 8Ch-8Eh, 90h, 94h-96h, 98h, 9Ch-9Eh, 200-207h, 208-20Fh, E00h - EFFh

9.1.1 LPC Bus

The LPC interface is connected by default to the eSPI controller of the SoC via a Microchip ECE1200 eSPI to LPC bridge (Secondary Slave).

9.2 PCI Configuration Space Map

Table 40 PCI Configuration Space Map

Bus Number (hex)	Device Number (hex)	Function Number (hex)	Device ID	Description and Device ID
00h	00h	00h	0x452E	Host bridge
00h	02h	00h	0x4571	Graphics and display

00h	08h	00h	0x4511	Gauss Newton Algorithm (GNA) registers
00h	11h	00h	0x4B96	Intel® PSE: UART controller #0
00h	11h	01h	0x4B97	Intel® PSE: UART controller #1
00h	12h	00h	0x4B37	Intel® Serial I/O: SPI controller #2
00h	14h	00h	0x4B7D	USB eXtensible Host Controller Interface (xHCI)
00h	14h	02h	0x4B7F	Memory controller
00h	16h	00h	0x4B70	Intel® Converged Security Engine (Intel® CSE)
00h	17h	00h	0x4B63	SATA controller (AHCI)
00h	18h	00h	0x4BC0	Intel® Programmable Services Engine (Intel® PSE): I2C controller #7
00h	18h	01h	0x4BC1	Intel® PSE: CAN controller #0
00h	1Ah	00h	0x4B47	embedded Multi Media Card (eMMC) controller
00h	1Ah	01h	0x4B48	Secure Digital (SD) & Secure Digital I/O controller
00h	1Bh	00h	0x4BB9	Intel® PSE: Inter-Integrated Circuit (I2C) controller #0
00h	1Ch	00h	0x4B38	PCIe* Root Port #0 (PCIe 0, Single VC) 1
00h	1Ch	01h	0x4B39	PCIe* Root Port #1 (PCIe 0, Single VC) 1
00h	1Ch	02h	0x4B3A	PCIe* Root Port #2 (PCIe 0, Single VC) 1
00h	1Ch	03h	0x4B3B	PCIe* Root Port #3 (PCIe 0, Single VC) 1
00h	1Ch	04h	0x4B3C	PCIe* Root Port #4 (PCIe 1, Multi VC) 1
00h	1Ch	05h	0x4B3D	PCIe* Root Port #5 (PCIe 2, Multi VC) 1
00h	1Ch	06h	0x4B3E	PCIe* Root Port #6 (PCIe 3, Multi VC) 1
00h	1Dh	00h	0x4BB3	Intel® Programmable Services Engine (Intel® PSE): Local Host to PSE (LH2OSE) IPC
00h	1Dh	01h	0x4BA0	Intel® PSE: Gigabit Ethernet Time Sensitive Networking (TSN) controller #0 (RGMII: 1 Gb mode)
00h	1Fh	00h	0x4B00	Enhanced Serial Peripheral Interface (eSPI) controller
00h	1Fh	01h	0x4B20	Primary to Sideband Bridge (P2SB)
00h	1Fh	02h	0x4B21	Power Management Controller (PMC)
00h	1Fh	03h	0x4B58	Converged Audio, Voice, Speech (cAVS) controller
00h	1Fh	04h	0x4B23	System Management Bus (SMBus) controller
00h	1Fh	05h	0x4B24	Serial Peripheral Interface (SPI) controller for flash & TPM
00h	1Fh	07h	0x4B26	Intel® trace hub

Note

1. *The PCI Express ports is visible only if the PCI Express port is set to "Enabled" or "Auto" in the BIOS setup menu and the device is attached to the corresponding PCI Express port on the carrier board.*

2. *Internal PCI devices not connected to the conga-TA7 are not listed.*

9.3 I²C Bus

No onboard resource is connected to the I²C bus. Address 16h is reserved for congatec Battery Management solutions.

9.4 SM Bus

The System Management (SM) bus signals are connected to the Intel chipset and are not intended to be used by off-board non-system management devices. For more information about this subject, contact congatec technical support.

10 BIOS Setup Description

The BIOS setup description of the conga-TCA7 can be viewed without having access to the module. 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.

10.1 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 <DEL> 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.

10.2 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-TCA7 is identified as TA70R0xx, where:

- R is the identifier for a BIOS ROM file
- 0 is the so called feature number
- xx is the major and minor revision number

The TA70 binary size is 32 MB.

10.3 Updating the BIOS

BIOS updates are recommended to correct platform issues or enhance the feature set of the module. The conga-TCA7 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 line[1], 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.

Note

1. *Deprecated*

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.

10.3.1 Update from External Flash

For instructions on how to update the BIOS from external flash, refer to the AN7_External_BIOS_Update.pdf application note on the congatec website at http://www.congatec.com.

10.4 Supported Flash Devices

The conga-TCA7 supports the following flash device:

- Macronix MX25L25645G (32 MB)

The flash device listed above can be used on the carrier board to support external BIOS. For more information about external BIOS support, refer to the Application Note AN7_External_BIOS_Update.pdf on the congatec website at http://www.congatec.com.