

conga-TS570

COM Express® 3.0 Type 6 Basic Module with 11th Generation Intel® Processors

User's Guide

Revision 1.03

Revision History

| Revision | Date (yyyy-mm-dd) | Author | Changes |
|----------|-------------------|--------|---|
| 0.1 | 2022-02-14 | AEM | <ul style="list-style-type: none">• Preliminary release |
| 1.00 | 2023-12-01 | AEM | <ul style="list-style-type: none">• Updated the RoHS directive• Corrected the USB0 and USB1 pin numbers in table 24 "USB 2.0 Signal Descriptions"• Changed the Ethernet controller from i225 to i226 in sections 1.2 "Options Information", 2.1 "Feature List", 5.1.7 "Gigabit Ethernet" and table 26 "Gigabit Ethernet Signal Descriptions"• Deleted the Ethernet speed limitation in section 2.7 "Environmental Specifications"• Updated sections 5.1.3 "Display Interface", 5.1.3.3 "VGA" and table 21 "VGA Signal Descriptions"• Added section 5.1.11 "SMBus"• Added section 5.1.14 "Inrush and Maximum Current Peaks"• Updated the diagram in section 7.6 "SO-DIMM Population Rules"• Updated the note in table 31 "General Purpose I/O Signal Descriptions" indicating that SDIO is not supported• Updated the notes in table 30 "Miscellaneous Signal Descriptions", table 32 "Power and System Management Signal Descriptions" and table 36 "General Purpose Serial Interface Signal Descriptions"• Updated section 6.1.3 "Power Loss Control"• Updated section 9 "System Resources"• Updated section 10.4 "Supported Flash Devices"• Official release |
| 1.01 | 2024-05-06 | AEM | <ul style="list-style-type: none">• Updated the preface section• Added Windows 11 support to section 2.2 "Supported Operating Systems"• Moved the storage note from section 4 "Cooling Solutions" to section 2.8 "Storage Specifications"• Added information about optimal storage conditions to section 2.8 "Storage Specifications" |
| 1.02 | 2024-11-08 | AEM | <ul style="list-style-type: none">• Added note about Turbo mode to table 3 "Industrial Variants"• Added note about MAC address programming to section 1.2 "Options Information" and section 5.1.7 "Gigabit Ethernet"• Added a caution to table 16 "Connector C-D Pinout"• Changed Ethernet PHY to Ethernet controller in the whole document |
| 1.03 | 20205-01-10 | AEM | <ul style="list-style-type: none">• Added the WEEE directive to the preface section• Added a note about 3D models to section 2.3 "Mechanical Dimensions"• Added a note about operating the Ethernet LEDs in COM Express 3.0 or 3.1 mode to section 5.1.7 "Gigabit Ethernet"• Added section 6.1 "Integrated Real-Time Hypervisor" |

Preface

This user's guide provides information about the components, features, connectors and BIOS Setup menus available on the conga-TS570. 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® Module Base Specification
- COM Express® Carrier Design Guide

These documents are available on the PICMG website at www.picmg.org. Additionally, check the restricted area of the congatec website at www.congatec.com and the website of the respective silicon vendor for relevant documents (Erratum, PCN, Sighting Reports and others).

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Terminology

| Term | Description |
|------|----------------------------|
| CSA | Active Cooling Solution |
| CSP | Passive Cooling Solution |
| DDI | Digital Display Interface |
| DTR | Dynamic Temperature Range |
| eDP | Embedded DisplayPort |
| EU | Execution Units |
| GB | Gigabyte |
| GHz | Gigahertz |
| HDA | High Definition Audio |
| HSP | Heatspreader |
| kB | Kilobyte |
| kHz | Kilohertz |
| MB | Megabyte |
| Mbit | Megabit |
| MHz | Megahertz |
| N.A | Not available |
| N.C | Not connected |
| PCH | Platform Controller Hub |
| PCIe | PCI Express |
| PEG | PCI Express Graphics |
| SATA | Serial ATA |
| S5e | Enhanced Soft-Off State |
| TBD | To be determined |
| TDP | Thermal Design Power |
| TCC | Time Coordinated Computing |
| TSN | Time Sensitive Networking |

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1 Introduction

1.1 COM Express Concept

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, 1x DDI |

¹ The SuperSpeed USB ports (USB 3.0) are not in addition to the USB 2.0 ports. Up to 4 of the USB 2.0 ports can support SuperSpeed USB.

The conga-TS570 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 (computer on module) integrates all the core components 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 Type 6 pinout provides the ability to offer PCI Express, Serial ATA, and LPC options thereby expanding the range of potential peripherals. 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, which means once an application has been created there is the ability to diversify the product range through the use of different performance class or form factor size modules. Simply unplug one module and replace it with another; no redesign is necessary.

1.2 Options Information

The conga-TS570 is currently available in 10 variants (seven commercial and three industrial). The table below shows the different configurations available.

Table 2 Commercial Variants

| Part-No. | 050700 | 050701 | 050702 | 050703 |
|---|--|---|---|--|
| Processor | Intel® Core™ i7-11850HE 2.6 GHz, 8 Core™ | Intel® Core™ i5-11500HE 2.6 GHz, 6 Core™ | Intel® Core™ i3-11100HE 2.4 GHz, 4 Core™ | Intel® Celeron® 6600HE 2.6 GHz, 2 Core™ |
| Intel® Smart Cache | 24 MB | 12 MB | 8 MB | 8 MB |
| Max. Turbo Frequency | 4.7 GHz | 4.5 GHz | 4.4 GHz | N.A |
| Chipset | QM580E | QM580E | HM570E | HM570E |
| Processor Graphics | Intel® UHD Graphics (with 32 EU) | Intel® UHD Graphics (with 32 EU) | Intel® UHD Graphics (with 16 EU) | Intel® UHD Graphics (with 16 EU) |
| GFX Base/Max. Dynamic Freq. | 0.35/1.35 GHz | 0.35/1.35 GHz | 0.35/1.25 GHz | 0.35/1.10 GHz |
| DDR4 Memory (ECC or non-ECC) | 3200 MTps dual channel Non-ECC | 3200 MTps dual channel Non-ECC | 3200 MTps dual channel Non-ECC | 3200 MTps dual channel Non-ECC |
| Ethernet Controller ¹ | Intel® I226-LM | Intel® I226-LM | Intel® I226-V | Intel® I226-V |
| Intel® TSN/TCC | TSN | TSN | N.A | N.A |
| Processor TDP (cTDP down) | 45 (35) W | 45 (35) W | 45 (35) W | 35 W |
| CPU Use Condition ² | Embedded | Embedded | Embedded | Embedded |
| CPU Tjunction | Min. | 0°C | 0°C | 0°C |
| | Max. | 100°C | 100°C | 100°C |
| DTR (Cold to Hot Transition) ³ | $T_{Boot} + 70^{\circ}\text{C}$ | $T_{Boot} + 70^{\circ}\text{C}$ | $T_{Boot} + 70^{\circ}\text{C}$ | $T_{Boot} + 70^{\circ}\text{C}$ |
| DTR (Hot to Cold Transition) ³ | $T_{Boot} - 70^{\circ}\text{C}$ | $T_{Boot} - 70^{\circ}\text{C}$ | $T_{Boot} - 70^{\circ}\text{C}$ | $T_{Boot} - 70^{\circ}\text{C}$ |
| Compatible Carrier Board | conga-TEVAL/COMe 3.0 Evaluation Carrier Board for COM Express Type 6 modules | | | |



- Note**
- ¹ The MAC address of the Intel i226 Ethernet controller is preprogrammed by default. The MAC address cannot be reprogrammed. If you require custom MAC address, contact your local sales representative.
 - ² Intel SoC use conditions. For more information, see Intel documentation.
 - ³ T_{Boot} is the boot temperature. If the Tjunction is not within the DTR range, you must reboot the system. See Intel documentation for more information.

| Part-No. | 050713 | 050714 | 050715 |
|---|--|---|---|
| Processor | Intel® Xeon® W-11865MLE 1.5 GHz, 8 Core™ | Intel® Xeon® W-11555MLE 1.9 GHz, 6 Core™ | Intel® Xeon® W-11155MLE 1.8 GHz, 4 Core™ |
| Intel® Smart Cache | 24 MB | 12 MB | 8 MB |
| Max. Turbo Frequency | 4.5 GHz | 4.4 GHz | 3.1 GHz |
| Chipset | RM590E | RM590E | RM590E |
| Processor Graphics | Intel® UHD Graphics (with 32 EU) | Intel® UHD Graphics (with 32 EU) | Intel® UHD Graphics (with 16 EU) |
| GFX Base/Max. Dynamic Freq. | 0.35/1.35 GHz | 0.35/1.35 GHz | 0.35/1.25 GHz |
| DDR4 Memory (ECC or non-ECC) | 3200 MTps dual channel ECC or non-ECC | 3200 MTps dual channel ECC or non-ECC | 3200 MTps dual channel ECC or non-ECC |
| Ethernet Controller ¹ | Intel® I226-IT | Intel® I226-IT | Intel® I226-IT |
| Intel® TSN/TCC | TSN/TCC | TSN/TCC | TSN/TCC |
| Processor TDP (cTDP down) | 25 W | 25 W | 25 W |
| CPU Use Condition ² | Industrial (Commercial Temperature) | Industrial (Commercial Temperature) | Industrial (Commercial Temperature) |
| CPU Tjunction | Min. | 0°C | 0°C |
| | Max. | 100°C | 100°C |
| DTR (Cold to Hot Transition) ³ | $T_{Boot} + 70^{\circ}\text{C}$ | $T_{Boot} + 70^{\circ}\text{C}$ | $T_{Boot} + 70^{\circ}\text{C}$ |
| DTR (Hot to Cold Transition) ³ | $T_{Boot} - 70^{\circ}\text{C}$ | $T_{Boot} - 70^{\circ}\text{C}$ | $T_{Boot} - 70^{\circ}\text{C}$ |
| Compatible Carrier Board | conga-TEVAL/COMe 3.0 Evaluation Carrier Board for COM Express Type 6 modules | | |



- Note**
- ¹ The MAC address of the Intel i226 Ethernet controller is preprogrammed by default. The MAC address cannot be reprogrammed. If you require custom MAC address, contact your local sales representative.
 - ² Intel SoC use conditions. For more information, see Intel documentation.
 - ³ T_{Boot} is the boot temperature. If the Tjunction is not within the DTR range, you must reboot the system. See Intel documentation for more information.

Table 3 Industrial Variants

| Part-No. | 050710 | 050711 | 050712 |
|---|--|---|---|
| Processor | Intel® Xeon® W-11865MRE 2.6 GHz, 8 Core™ | Intel® Xeon® W-11555MRE 2.6 GHz, 6 Core™ | Intel® Xeon® W-11155MRE 2.4 GHz, 4 Core™ |
| Intel® Smart Cache | 24 MB | 12 MB | 8 MB |
| Max. Turbo Frequency ¹ | 4.7 GHz | 4.5 GHz | 4.4 GHz |
| Chipset | RM590E | RM590E | RM590E |
| Processor Graphics | Intel® UHD Graphics (with 32 EU) | Intel® UHD Graphics (with 32 EU) | Intel® UHD Graphics (with 16 EU) |
| GFX Base/Max. Dynamic Freq. | 0.35/1.35 GHz | 0.35/1.35 GHz | 0.35/1.25 GHz |
| DDR4 Memory (ECC or non-ECC) | 3200 MTps dual channel ECC or non-ECC | 3200 MTps dual channel ECC or non-ECC | 3200 MTps dual channel ECC or non-ECC |
| Ethernet Controller ² | Intel® I226-IT | Intel® I226-IT | Intel® I226-IT |
| Intel® TSN/TCC | TSN/TCC | TSN/TCC | TSN/TCC |
| Processor TDP (cTDP down) | 45 (35) W | 45 (35) W | 45 (35) W |
| CPU Use Condition ³ | Industrial | Industrial | Industrial |
| CPU Tjunction | Min. | -40°C | -40°C |
| | Max. | 100°C | 100°C |
| DTR (Cold to Hot Transition) ⁴ | $T_{\text{Boot}} + 110^{\circ}\text{C}$ | $T_{\text{Boot}} + 110^{\circ}\text{C}$ | $T_{\text{Boot}} + 110^{\circ}\text{C}$ |
| DTR (Hot to Cold Transition) ⁴ | $T_{\text{Boot}} - 110^{\circ}\text{C}$ | $T_{\text{Boot}} - 110^{\circ}\text{C}$ | $T_{\text{Boot}} - 110^{\circ}\text{C}$ |
| Compatible Carrier Board | conga-TEVAL/COMe 3.0 Evaluation Carrier Board for COM Express Type 6 modules | | |



- Note**
- ¹ Disable Turbo mode for industrial use conditions.
 - ² The MAC address of the Intel i226 Ethernet controller is preprogrammed by default. The MAC address cannot be reprogrammed. If you require custom MAC address, contact your local sales representative.
 - ³ Intel SoC use conditions. For more information, see Intel documentation.
 - ⁴ T_{Boot} is the boot temperature. If the Tjunction is not within the DTR range, you must reboot the system. See Intel documentation for more information.

2 Specifications

2.1 Feature List

Table 4 Feature Summary

| | | |
|---------------------------|--|---|
| Form Factor | Based on COM Express standard pinout Type 6 Rev. 3.0 (Basic size: 125 mm x 95 mm) | |
| Processor | 11th Generation Intel® Core i7,i5,i3, Celeron and Xeon H-processors | |
| Memory | Up to three memory sockets (located on the top and bottom side of the conga-TS570). Supports <ul style="list-style-type: none">- SO-DIMM ECC ¹ or non-ECC DDR4 modules ²- Data rates up to 3200 MT/s- Maximum 96 GB capacity (32 GB each) | |
| Chipset | Intel® 500 Series Chipset QM580E, HM570E ³ and RM590E PCH | |
| Audio | High definition audio interface with support for multiple codecs | |
| Ethernet | Intel® i226-LM/V/IT 2.5 GbE controller with support for TSN | |
| Graphics Options | Intel® Iris® Xe (Gen. 12). Supports: <ul style="list-style-type: none">- API (DirectX 12, Direct3D 12, Direct3D 10.1, OpenGL 4.5, OpenCL 2.2)- Intel® QuickSync & Clear Video Technology HD (hardware accelerated video decode/encode/processing/transcode)- Up to four independent displays (see table 10 “Display Combination and Resolution”) | |
| | 3x DP++ 1x LVDS/eDP ⁴ 1x VGA ⁵ 1x PEG Gen 4 port (x16 lanes) Resolutions up to 4x4k @ 60 Hz | NOTE: <i>The conga-TS570 does not natively support TMDS. For TMDS support, a DP++ to TMDS converter (e.g. PTN3360D) needs to be implemented on the carrier board.</i> |
| Peripheral Interfaces | 8x USB 2.0 (Up to 4x USB 3.2 Gen 2x1) 4x SATA® 6 Gbps (with RAID 0/1/5/10 support) 8x PCI Express® Gen. 3 lanes 1x Optional onboard NVMe SSD (PCIe x4 Gen 4) 2x UART (16C550 compatible) GPIOs | LPC/eSPI ⁶ I²C (fast mode, multi-master) SMB SPI |
| BIOS | AMI Aptio® V UEFI 2.6 firmware 32 MB serial SPI flash with congatec Embedded BIOS features | |
| Power Management | ACPI 5.0a compliant with battery support. S5e mode (see section 6.2.5 “Enhanced Soft-Off State”) Deep Sx and Suspend to RAM (S3) Configurable TDP | |
| 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 | |
| Security | Discrete SPI Trusted Platform Module (Infineon SLB9670_VQ2.0); AES Instructions | |



Note

1. Only variants that feature the Intel RM590E support ECC memory.
2. See section 7.6 "SO-DIMM Population Rules" for a list of memory population rules.
3. Variants with Intel® HM570E chipset do not support Intel VPro/AMT Technology.
4. Both interfaces are not supported at the same time.
5. Default on variants equipped with Intel® QM580E or Intel® HM570E PCH; assembly option on variants equipped with Intel® RM590E PCH.
6. The conga-TS570 does not currently support eSPI interface.



Caution

The conga-TS570 will not boot if the top, upper slot is not populated in a dual memory configuration. See section 7.5 "SO-DIMM Population Rules" for more information.

2.2 Supported Operating Systems

The conga-TS570 supports the following operating systems.

- Microsoft® Windows® 11 (64-bit)
- Microsoft® Windows® 11 IoT Enterprise (64-bit)
- Microsoft® Windows® 10 (64-bit)
- Microsoft® Windows® 10 IoT Enterprise (64-bit)
- Linux (64-bit)
- Yocto
- Real Time Systems Hypervisor



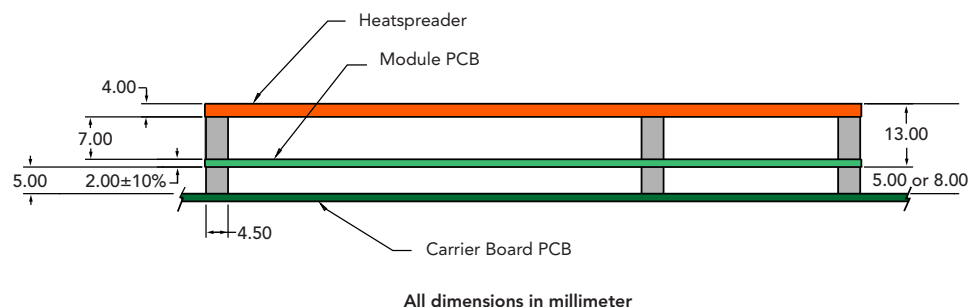
Note

1. The conga-TS570 supports only native UEFI Operating Systems. Legacy Operating Systems which require CSM (Compatibility Support Module) as part of the UEFI firmware are not supported anymore.
2. For Windows 10/11 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

- Length of 125 mm
- Width of 95 mm

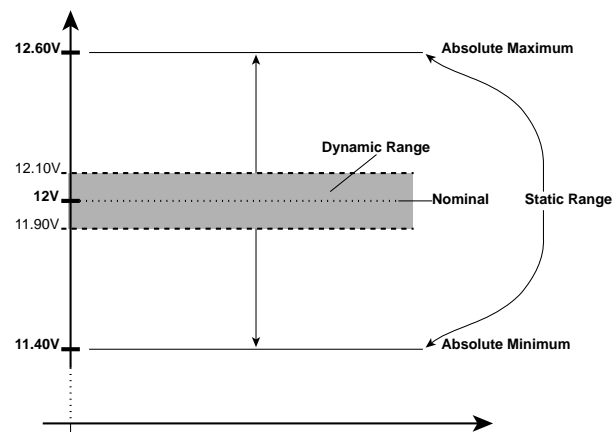
The overall height of the heatspreader is shown below:



The 3D models of congatec products are available at www.congatec.com/login. These models indicate the overall length, height and width of each product. If you need login access, contact your local sales representative.

2.4 Supply Voltage Standard Power

The conga-TS570 supports 12 V DC $\pm 5\%$ input voltage.



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 (10 Hz to 20 MHz) (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 250 V/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:

- conga-TS570 COM
- modified congatec carrier board
- conga-TS570 cooling solution
- Microsoft Windows 10 (64 bit)



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

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 current | 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 | |
| S5e | COM is powered by VCC_5V_SBY | |



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-TS570 power consumption. The values were recorded at various operating mode.

| Part No. | Memory Size | H.W Rev. | BIOS Rev. | OS (64 bit) | CPU | | | Current (Ampere) | | | | | |
|----------|-------------|----------|-----------|-------------|-------------------------|-------|--------------------|------------------|---------|----------|------|------|--------|
| | | | | | Variant | Cores | Freq. /Turbo (GHz) | S0: Min | S0: Max | S0: Peak | S3 | S5 | S5e |
| 050700 | 3 x 16 GB | A.1 | BQTLR723 | Windows 10 | Intel® Core™ i7-11850HE | 8 | 2.6 / 4.7 | 0.61 | 7.67 | 11.96 | 0.12 | 0.08 | 0.0006 |
| 050701 | 3 x 16 GB | A.3 | BQTLR729 | Windows 10 | Intel® Core™ i5-11500HE | 6 | 2.6 / 4.5 | 0.82 | 6.53 | 7.98 | 0.22 | 0.18 | 0.0004 |
| 050702 | 3 x 16 GB | A.1 | BHTLR129 | Windows 10 | Intel® Core™ i3-11100HE | 4 | 2.4 / 4.4 | 0.65 | 5.37 | 5.79 | 0.25 | 0.04 | 0.0006 |
| 050703 | 3 x 16 GB | A.1 | BHTLR723 | Windows 10 | Intel® Celeron® 6600HE | 2 | 2.6 / N.A | 0.64 | 2.01 | 2.16 | 0.12 | 0.07 | 0.0006 |
| 050710 | 3 x 16 GB | A.1 | BQTLR723 | Windows 10 | Intel® Xeon® W-11865MRE | 8 | 2.6 / 4.7 | 0.85 | 7.59 | 11.40 | 0.12 | 0.12 | 0.0008 |
| 050711 | 3 x 16 GB | A.1 | BQTLR723 | Windows 10 | Intel® Xeon® W-11555MRE | 6 | 2.6 / 4.5 | 0.87 | 5.90 | 8.62 | 0.12 | 0.12 | 0.0006 |
| 050712 | 3 x 16 GB | A.1 | BQTLR723 | Windows 10 | Intel® Xeon® W-11155MRE | 4 | 2.4 / 4.4 | 0.60 | 5.02 | 5.43 | 0.11 | 0.11 | 0.0006 |
| 050713 | 3 x 16 GB | A.1 | BQTLR723 | Windows 10 | Intel® Xeon® W-11865MLE | 8 | 1.5 / 4.5 | 0.58 | 6.19 | 10.02 | 0.12 | 0.12 | 0.0006 |
| 050714 | 3 x 16 GB | A.1 | BQTLR129 | Windows 10 | Intel® Xeon® W-11555MLE | 6 | 1.9 / 4.4 | 0.63 | 4.47 | 8.15 | 0.23 | 0.16 | 0.0006 |
| 050715 | 3 x 16 GB | A.1 | BQTLR723 | Windows 10 | Intel® Xeon® W-11155MLE | 4 | 1.8 / 3.1 | 0.59 | 2.57 | 2.78 | 0.12 | 0.12 | 0.0012 |



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 (Commercial Variant)

| RTC @ | Voltage | Current |
|-------|---------|--------------|
| -10°C | 3V DC | 1.31 μ A |
| 20°C | 3V DC | 1.48 μ A |
| 70°C | 3V DC | 2.40 μ A |

Table 8 CMOS Battery Power Consumption (Industrial Variant)

| RTC @ | Voltage | Current |
|-------|---------|--------------|
| -50°C | 3V DC | 2.41 μ A |
| 20°C | 3V DC | 3.92 μ A |
| 95°C | 3V DC | 5.35 μ A |



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 of your application in worst case conditions (for example, during high temperature and high battery voltage).
3. Consider the self-discharge of the battery when calculating the lifetime of the CMOS battery. For more information, refer to application note AN9_RTC_Battery_Lifetime.pdf on congatec GmbH website at www.congatec.com/support/application-notes.
4. We recommend to always have a CMOS battery present when operating the conga-TS570.

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 |
| Relative 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.

2.8 Storage Specifications

This section describes the storage conditions that must be observed for optimal performance of congatec products.

2.8.1 Module

For long-term storage of the conga-TS570 (more than six months), keep the conga-TS570 in a climate-controlled building at a constant temperature between 5°C and 40°C, with humidity of less than 65% and at an altitude of less than 3000 m. Also ensure the storage location is dry and well ventilated.



Note

We do not recommend storing the conga-TS570 for more than five years under these conditions.

2.8.2 Cooling Solution

The heatpipes of congatec heatspreaders/cooling solutions are filled with water by default. For optimal cooling performance, do not store the heatspreaders/cooling solutions at temperatures below -20°C.



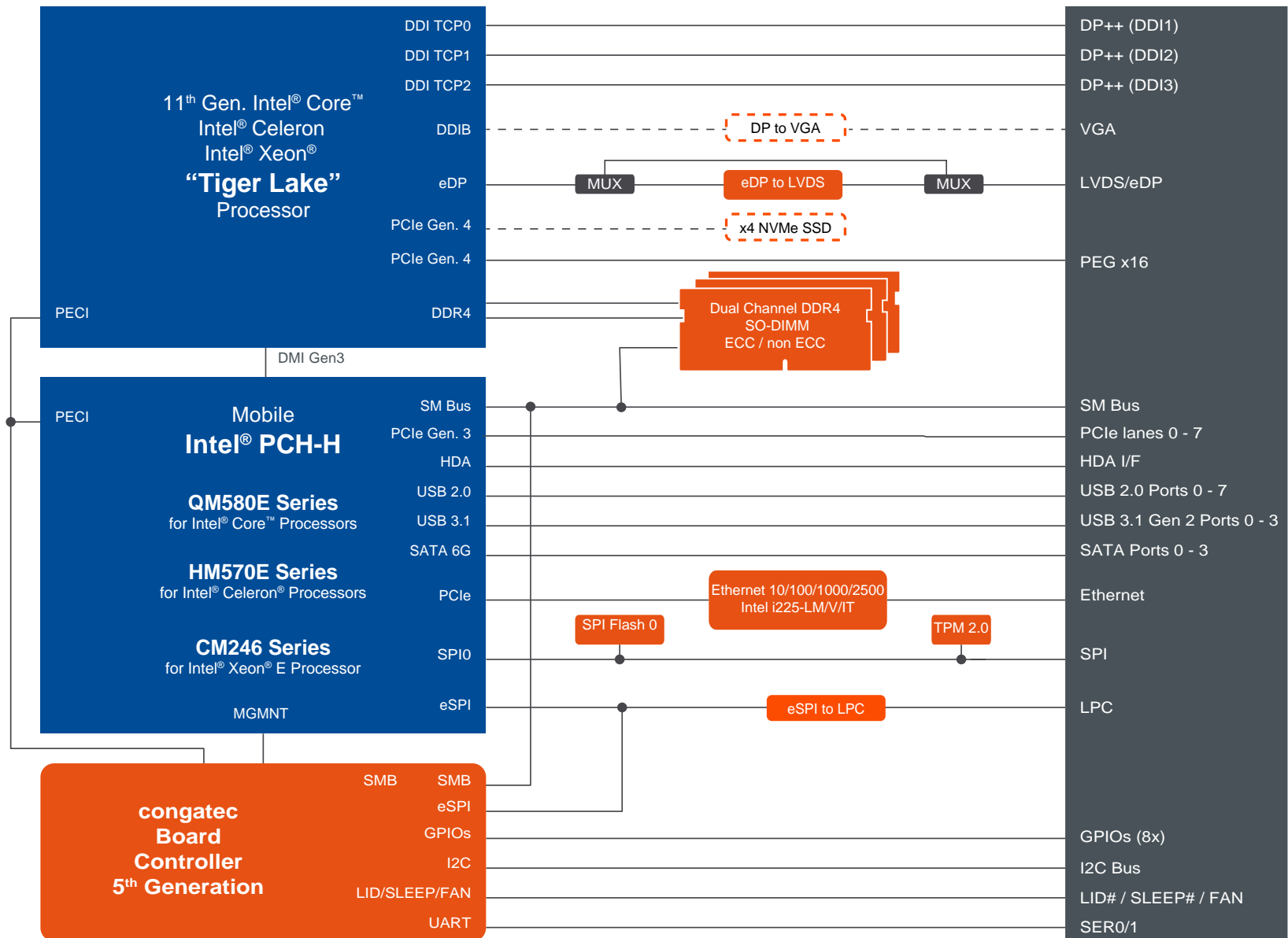
Caution

- 1. For temperatures between -10°C and -20°C, preheat the heatpipes before operation. Optionally, the heatpipes can be filled with acetone instead. For more information, contact your local sales representative.*
- 2. For optimal thermal dissipation, do not store the congatec cooling solutions for more than six months*

3 Block Diagram

conga-TS570

COM Express Rev. 3.0, Basic Size, Type 6 Pinout



4 Cooling Solutions

congatec GmbH offers the cooling solutions listed in table 8 for the conga-TS570. The dimensions of the cooling solutions are shown in the sub-sections. All measurements are in millimeters.

Table 9 Cooling Solution Variants

| | Cooling Solution | Part No. | Description |
|---|------------------|----------|--|
| 1 | CSA | 050750 | Active cooling solution with integrated heat pipes and 2.7 mm bore-hole standoffs |
| | | 050751 | Active cooling solution with integrated heat pipes and M2.5 mm threaded standoffs |
| 2 | CSP | 050752 | Passive cooling solution with integrated heat pipes and 2.7 mm bore-hole standoffs |
| | | 050753 | Passive cooling solution with integrated heat pipes and M2.5 mm threaded standoffs |
| 3 | HSP | 050754 | Heatspreader with integrated heat pipes and 2.7 mm bore-hole standoffs |
| | | 050755 | Heatspreader with integrated heat pipes and M2.5 mm threaded standoffs |
| 4 | HPA | 050756 | Standard heatpipe adapter for conga-TS570 |



Note

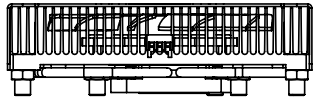
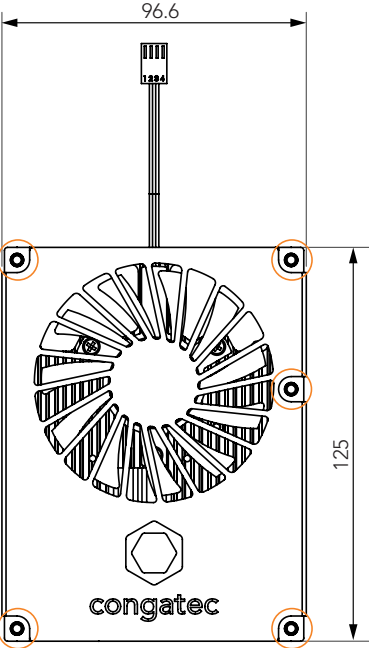
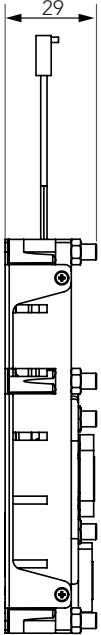
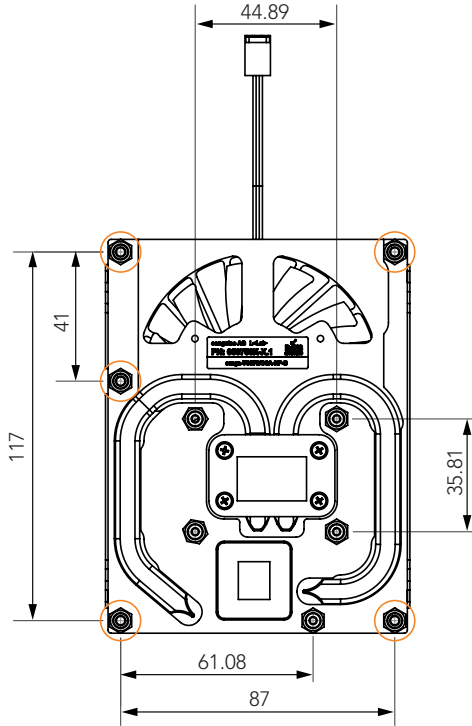
1. We recommend a maximum torque of 0.4 Nm for carrier board mounting screws and 0.5 Nm for module mounting screws.
2. The gap pad material used on congatec heatspreaders may contain silicon oil that can seep out over time depending on the environmental conditions it is subjected to. For more information about this subject, contact your local congatec sales representative and request the gap pad material manufacturer's specification.




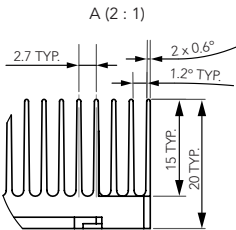
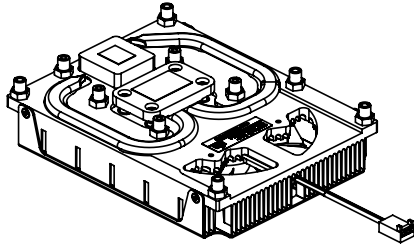
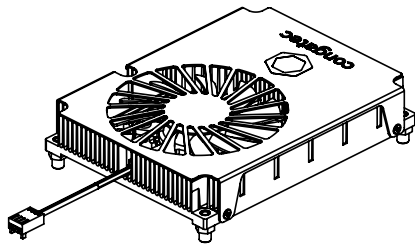
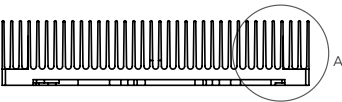
Caution

1. The congatec heatspreaders/cooling solutions are tested only within the commercial temperature range of 0° to 60°C. 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.

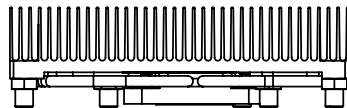
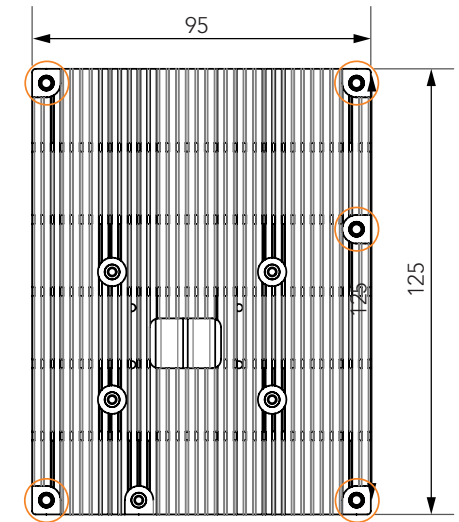
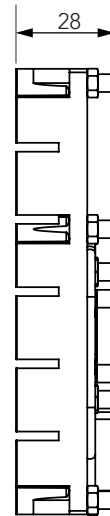
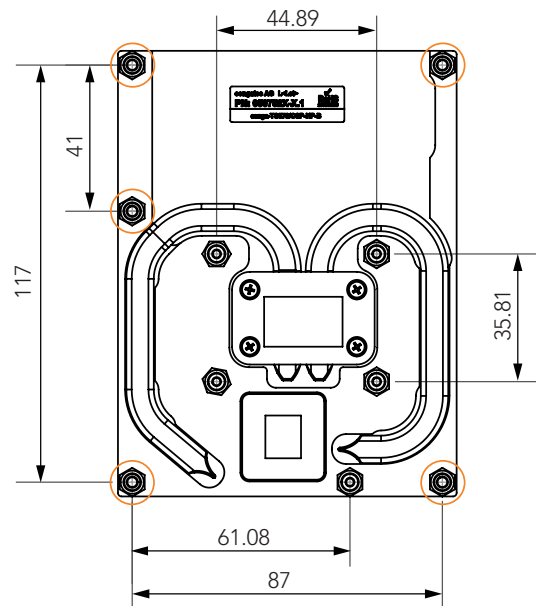
4.1 CSA Dimensions



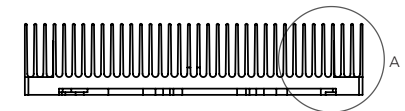
 M2.5
threaded standoff
for threaded version
or
ø2.7
non-threaded standoff
for borehole version



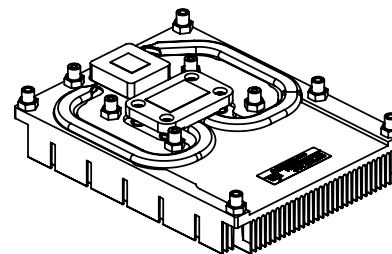
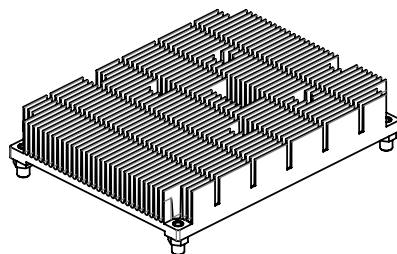
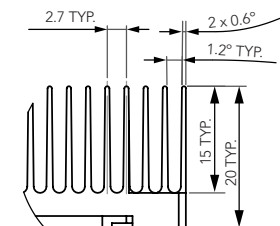
4.2 CSP Dimensions



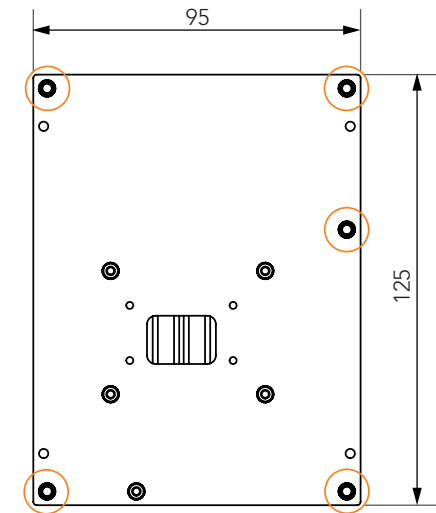
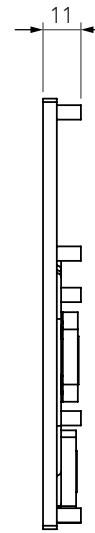
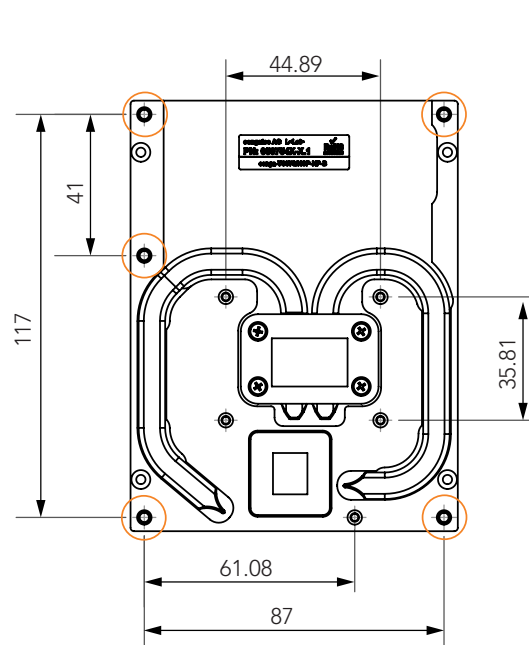
M2.5
threaded standoff
for threaded version
or
ø2.7
non-threaded standoff
for borehole version




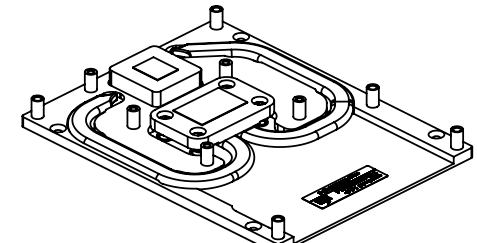
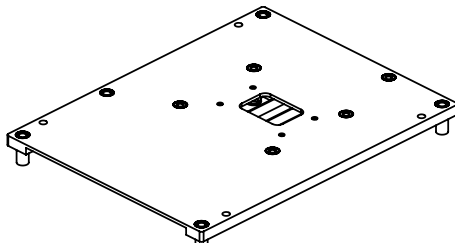
A (2 : 1)



4.3 HSP Dimensions



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



5 Connector Rows

The conga-TS570 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–B while the secondary connector consists of rows C–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-TS570 offers six PCIe lanes on the A–B connector and two PCIe lanes on the C–D connector. The lanes support:

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

5.1.2 PCI Express Graphics (PEG)

The conga-TS570 supports PEG x16 interface (PCIe Gen 4) on the C–D connector. The interface supports:

- PCI Express Specification 4.0, with up to 16 GTps
- a 1 x16 link configuration by default
- a 2 x8 link or a 1 x8 + 2 x4 link configuration as option
- graphics or non-graphics PCI Express devices
- lane reversal

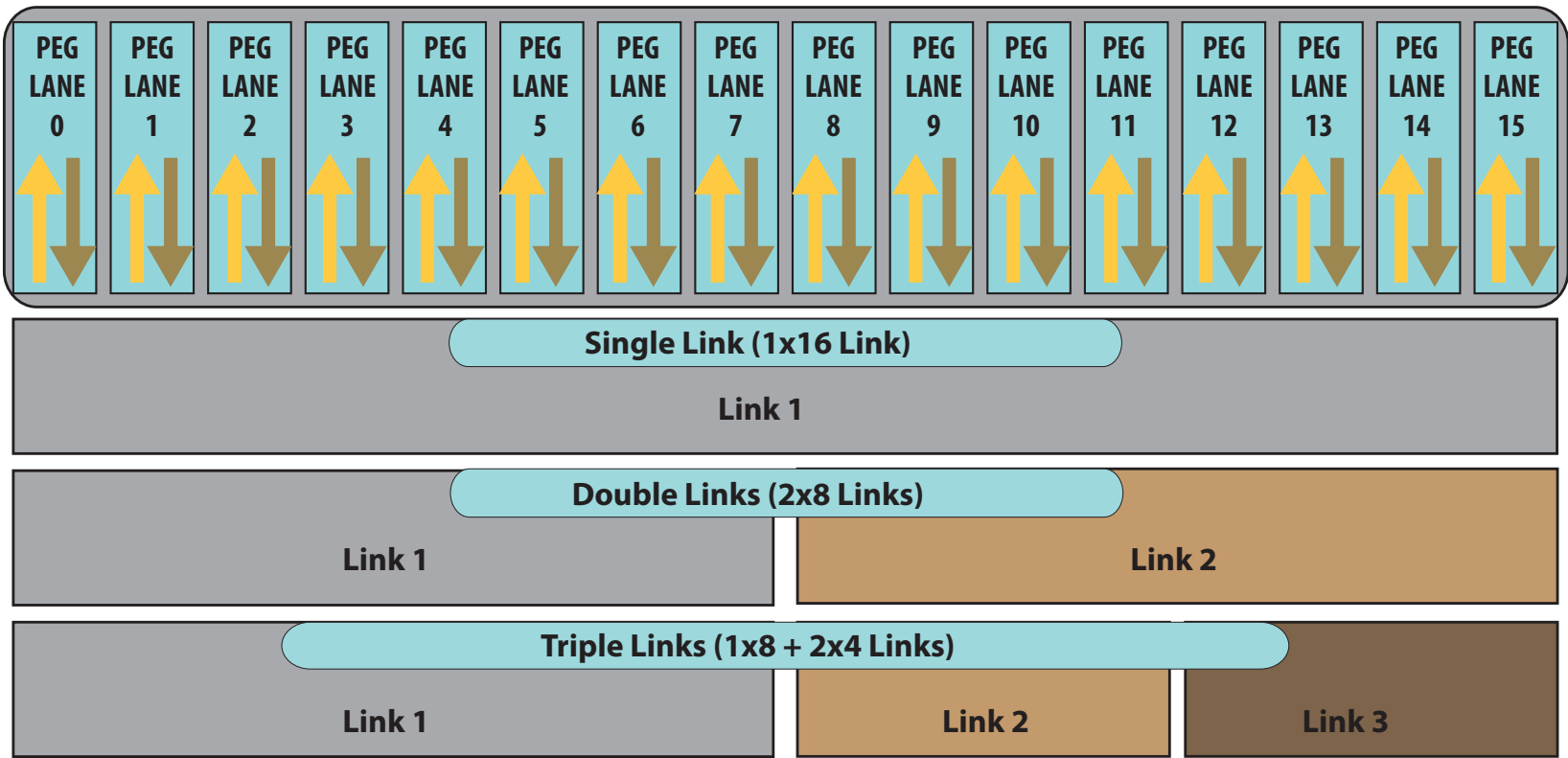


Note

The PEG lanes can not be linked together with the PCI Express lanes in section 5.1.1 “PCI Express”.

5.1.2.1 PEG Link Configuraton

The possible PEG link configurations are shown in the diagram below:



5.1.3 Display Interface

The conga-TS570 supports the following:

- three DP++
- single- or dual-channel LVDS
- one VGA on variants equipped with Intel® QM580E or Intel® HM570E PCH
- optional VGA on variants equipped with Intel® RM590E PCH
- four independent displays (DP++, eDP/LVDS and VGA)

The table below shows the supported display combinations and resolutions.

Table 10 Display Combination and Resolution

| | Display 1 (DDI1) | | Display 2 (DDI2) | | Display 3 (DDI3) | | Display 4 | |
|----------|------------------|---------------------------|------------------|---------------------------|------------------|---------------------------|-------------|---|
| | Interface | Max. Resolution | Interface | Max. Resolution | Interface | Max. Resolution | Interface | Max. Resolution |
| Option 1 | DP++ | 4096x2304 @ 60 Hz, 36 bpp | DP++ | 4096x2304 @ 60 Hz, 36 bpp | DP++ | 4096x2304 @ 60 Hz, 36 bpp | LVDS or eDP | 1920x1200 @ 60 Hz (dual LVDS mode) 4096x2304 @ 60 Hz, 24 bpp |
| Option 2 | DP++ | 4096x2304 @ 60 Hz, 36 bpp | DP++ | 4096x2304 @ 60 Hz, 36 bpp | DP++ | 4096x2304 @ 60 Hz, 36 bpp | VGA | 1920x1200 @ 60 Hz |
| Option 3 | DP++ | 4096x2304 @ 60 Hz, 36 bpp | DP++ | 4096x2304 @ 60 Hz, 36 bpp | VGA | 1920x1200 @ 60 Hz | LVDS or eDP | 1920x1200 @ 60 Hz (dual LVDS mode) 4096x2304 @ 60 Hz, 24 bpp |



Note

A single DP/eDP display supports maximum resolution of 5120x3200 @ 60 Hz.

5.1.3.1 DP++

The conga-TS570 offers three DP++ interfaces. The interfaces support:

- three independent DP displays (DP++)
- VESA DisplayPort Standard 1.2
- data rate of 1.62 GT/s, 2.97 GT/s and 5.4 GT/s on 1, 2 or 4 data lanes
- up to 4096x2304 resolutions at 60 Hz
- Audio formats such as AC-3 Dolby Digital, Dolby Digital Plus, DTS-HD, LPCM, 192 KHz/24 bit, 8 channel, Dolby TrueHD, DTS-HD Master Audio (Lossless Blu-Ray Disc Audio Format)

5.1.3.2 LVDS/eDP

The conga-TS570 offers an LVDS/eDP interface. This interface is configured in the BIOS to support LVDS by default. For eDP support, go to Advanced -> Graphics -> Active LFP Configuration in the BIOS setup menu and select "eDP".

The LVDS ¹ 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 channel mode

The eDP ^{1,2} interface supports:

- eDP 1.4 specification
- Spread-Spectrum Clocking
- eDP display authentication



Note

^{1.} The LVDS/eDP interface does not support LVDS and eDP signals at the same time.

^{2.} The eDP interface does not support HDCP.

5.1.3.3 VGA

The Intel® Tiger Lake H chipset does not natively support VGA interface. However, the conga-TS570 variants equipped with Intel® QM580E or Intel® HM570E PCH support VGA via a DisplayPort to VGA adapter chip.



Note

For VGA support on variants equipped with Intel® RM590E PCH, you need a customized conga-TS570 variant.

5.1.4 SATA

The conga-TS570 offers four SATA interfaces (SATA 0-3) on the A-B connector. The interfaces support:

- independent DMA operation
- SATA specification 3.2
- data transfer rates up to 6.0 Gb/s
- AHCI mode using memory space and RAID mode
- Hot-plug detect



Note

The PCH SATA controller no longer supports IDE legacy mode using I/O space. Therefore, you need an AHCI driver.

5.1.5 Optional NVMe SSD

The conga-TS570 offers an optional NVMe SSD onboard via a PCIe x4 Gen 4 lane. The NVMe storage does not support hotplug.

5.1.6 USB

The conga-TS570 offers eight USB 2.0 interfaces on the A-B connector and up to four SuperSpeed signals on the C-D connector. The xHCI host controller supports:

- USB 3.2 specification
- SuperSpeedPlus, SuperSpeed, High-Speed, Full-Speed and Low-Speed USB signaling
- data transfers of up to 10 Gbps for USB 3.2 Gen 2x1 port
- data transfers of up to 5 Gbps for USB 3.2 Gen 1x1 port
- supports USB debug port on all USB 3.2 capable ports



Note

The USB ports are configured in the 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.

5.1.7 Gigabit Ethernet

The conga-TS570 offers a 2.5 Gigabit Ethernet interface via an onboard Intel® i226-LM/V/IT Ethernet controller. The interface supports:

- full-duplex operation at 10/100/1000/2500 Mbps
- half-duplex operation at 10/100 Mbps
- Audio Video Bridging
- Time Sensitive Networking (TSN)



Note

1. The MAC address of the Intel i226 Ethernet controller is preprogrammed by default. The MAC address cannot be reprogrammed. If you require custom MAC address, contact your local sales representative.
2. 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 controller since it has only three LED outputs—ACT#, LINK100# and LINK1000#. The GBE0_LINK# signal is a logic AND of the GBE0_LINK100# and GBE0_LINK1000# signals on the conga-TS570 module.
3. Windows Operating System does not support TSN.
4. Beginning with BIOS revision BxTLRx37, you can configure the Ethernet LEDs to operate in either COM Express 3.0 or 3.1 mode. To set the LEDs to COM Express 3.0 mode (default), go to Advanced -> Misc in the BIOS setup menu and enable the “COM Express Compliant Ethernet LED Configuration” option.

To revert to the previous COM Express 3.1 configuration, disable this option. For more information about Ethernet LED specifications, see the COM Express documentation or contact congatec technical support.

5.1.8 High Definition Audio (HDA)

The conga-TS570 provides an HDA interface on the A–B connector.

5.1.9 LPC Bus

The conga-TS570 offers the LPC bus through through an eSPI to LPC bridge. For information about the decoded LPC addresses, see section 9 “System Resources”.

5.1.10 SMBus

The conga-TS570 offers the SMBus via congatec Board Controller by default. Optionally, you can route the SMBus signals from the SoC instead by selecting the routing options in the BIOS setup menu.



Note

Do not use the SMBus for off-board non-system management devices. For more information, contact congatec technical support.

5.1.11 I²C Bus

The conga-TS570 offers the I²C bus via congatec Board Controller. The controller provides a fast-mode multi-master I²C bus that has the maximum I²C bandwidth.

Use the congatec CGOS driver and API to access the I²C bus.

Table 11 Reserved I²C Bus Addresses

| 8-bit Device Address | 7-bit Device Address | Device | Description |
|----------------------|----------------------|---------------------------|---|
| 0xAE | 0x57 | Carrier board EEPROM | Reserved for COM Express carrier board EEPROM |
| 0x14 | 0x0A | congatec Board Controller | Reserved for battery management |
| 0x16 | 0x0B | congatec Board Controller | Reserved for battery management |



Note

Onboard resources are not connected to the I²C bus.

5.1.12 GPIOs

The conga-TS570 offers General Purpose Input/Output signals on the A–B connector. The GPIO signals are controlled by the congatec Board controller.

5.1.13 General Purpose Serial Interface

The conga-TS570 offers two standard 16C550 UARTs on the A–B connector via the congatec Board Controller. The interfaces support up to 115200 baud rate.



Note

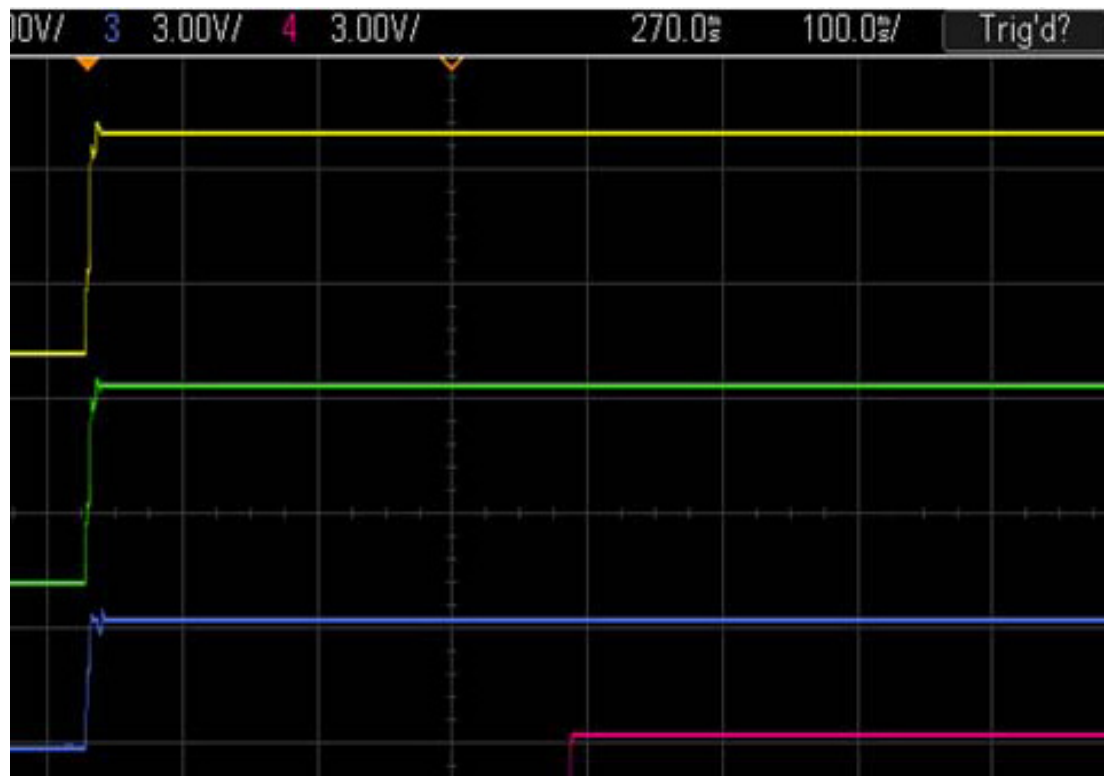
The UART interfaces do not support hardware handshake and flow control.

5.1.14 Power Control

Power OK (PWR_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.

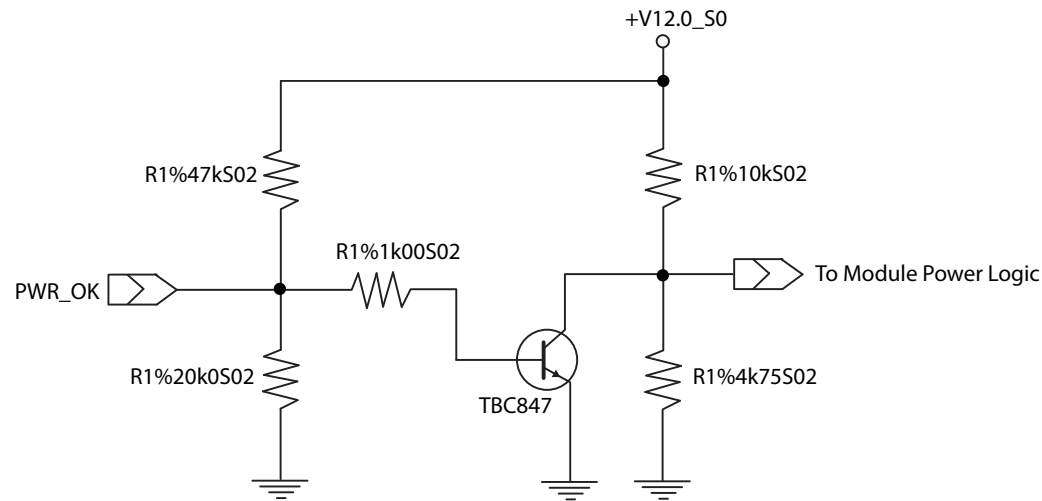
A sample screenshot is shown below.



Note

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

The conga-TS570 PWR_OK input circuitry is implemented as shown below:



The voltage divider ensures that the input complies with 3.3V CMOS characteristic and also makes it possible to use the module on carrier board designs that do not drive the PWR_OK signal. Although the PWR_OK input is not mandatory for the onboard power-up sequencing, it is strongly recommended that the carrier board hardware drives the signal low until it is safe to let the module boot-up.

When considering the above shown voltage divider circuitry and the transistor stage, the voltage measured at the PWR_OK input pin may be only around 0.8 V when the 12 V is applied to the module. Actively driving PWR_OK high complies with the COM Express specification but can cause back driving. Therefore, congatec recommends driving the PWR_OK low to keep the module in reset and tri-state PWR_OK when the carrier board hardware is ready to boot.

The three typical usage scenarios for a carrier board design are:

- Connect PWR_OK to the “power good” signal of an ATX type power supply.
- Connect PWR_OK to the last voltage regulator in the chain on the carrier board.
- Simply pull PWR_OK with a 1k resistor to the carrier board 3.3V power rail.

With this solution, you must ensure that all carrier board hardware is fully powered and all clocks are stable when the 3.3V is up.



The conga-TS570 supports the controlling of ATX-style power supplies. If you do not use an ATX power supply, do not connect the conga-TS570 pins SUS_S3/PS_ON, 5V_SB, and PWRBTN#.

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. 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 100 k 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 V input power is the sole operational power source for the conga-TS570. The other voltages required are generated internally on the module using onboard voltage regulators.



Note

When designing a power supply for a conga-TS570 application, be aware that the system may malfunction when a 12 V 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 qualification 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.

5.1.15 Inrush and Maximum Current Peaks

The inrush current on the conga-TS570 can rise as high as 23.4 A on the VCC_12V power rail and as high as 5 A on the VCC_5V_SBY power rail with a slew rate of 250 V/s. Therefore, ensure the power supply and decoupling capacitors on the carrier board are adequate for proper power sequencing.

5.1.16 Power Management

ACPI

The conga-TS570 supports Advanced Configuration and Power Interface (ACPI) specification, revision 4.0a. It also supports Suspend to RAM (S3). For more information, see section 7.6 "ACPI Suspend Modes and Resume Events".

DEEP Sx

The Deep Sx is a lower power state employed to minimize the power consumption while in S3/S4/S5. In the Deep Sx state, the system entry condition determines if the system context is maintained or not. All power is shut off except for minimal logic which supports limited set of wake events for Deep Sx. The Deep Sx on resumption, puts system back into the state it is entered from. In other words, if Deep Sx state was entered from S3 state, then the resume path will place system back into S3.

S5e Power State

The conga-TS570 features a congatec proprietary Enhanced Soft-Off power state. See section 6.2.5 "Enhanced Soft-Off State" for more information.

6 Additional Features

This section describes the additional features the conga-TS570 offers.

6.1 Integrated Real-Time Hypervisor

The RTS Hypervisor is integrated into the congatec firmware on the conga-TS570 by default. With the RTS Hypervisor, you can consolidate functionality that previously required multiple dedicated systems on a single x86 hardware platform.

The integrated RTS Hypervisor offers a 30-day free evaluation license. The 30-day evaluation starts when the customer receives the x86-based modules. To access the full package, contact congatec Sales team via the online "Request Quote" button for your particular product at <https://www.congatec.com/en/products/hypervisor-products/>.

To activate the RTS Hypervisor, change the "Boot Device" in the BIOS setup menu to "Integrated RTS Hypervisor".

1. Press F2 or DEL during POST to enter the BIOS setup menu.
2. Go to the Boot tab to enter the Boot setup screen.
3. Select "Integrated RTS Hypervisor" as "1st Boot Device".
4. Go to the Save & Exit tab and select "Save Changes and Exit".

For more information about the integrated Hypervisor, see the congatec Application Note AN56_Hypervisor_on_Module.pdf on the congatec website at <https://www.congatec.com/en/support/application-notes/>.



Note

1. The configuration steps and the BIOS setup menu above are valid for "Type Based Boot Priority". For "UEFI Boot Priority", the BIOS setup menu may differ.
2. The Real-Time Operating System images, driver packages for the General-Purpose Operating System and the installation procedures for the Operating Systems are available for download under the "Technical information" section, in the restricted area of congatec website at www.congatec.com/login. If you require login access, contact your local sales representative.

6.2 congatec Board Controller (cBC)

The conga-TS570 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, resulting in better performance and 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:

- Board Information
- Watchdog
- General Purpose Input/Output (see section 5.1.12 "GPIOs")
- I2C bus (see section 5.1.11 "I²C Bus")
- SMBus (see section 5.1.10 "SMBus")
- UART (see section 5.1.13 "General Purpose Serial Interface")
- Power loss control
- Fan control
- Enhanced soft-off state (S5e)

6.2.1 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.

6.2.2 Watchdog

The conga-TS570 is equipped with a multi stage watchdog solution that is triggered by software. For more information about the Watchdog feature, see the application note AN3_Watchdog.pdf on the congatec GmbH website at www.congatec.com.



Note

The conga-TS570 module does not support the watchdog NMI mode.

6.2.3 Power Loss Control

The cBC provides the power loss control feature. The power loss control feature determines the behaviour of the system after an AC power loss occurs. This feature applies to systems with ATX-style power supplies which support standby power rail.

The term “power loss” implies that all power sources, including the standby power are lost (G3 state). Once power loss (transition to G3) or shutdown (transition to S5) occurs, the board controller continuously monitors the standby power rail. If the standby voltage remains stable for 30 seconds, the cBC assumes the system was switched off properly. If the standby voltage is no longer detected within 30 seconds, the module considers this an AC power loss condition.

The power loss control feature has three different modes that define how the system responds when standby power is restored after a power loss occurs. The modes are:

- Turn On: The system is turned on after a power loss condition
- Remain Off: The system is kept off after a power loss condition
- Last State: The board controller restores the last state of the system before the power loss condition



1. If a power loss condition occurs within 30 seconds after a regular shutdown, the cBC may incorrectly set the last state to “ON”.
2. The settings for power loss control have no effect on systems with AT-style power supplies which do not support standby power rail.
3. The 30 seconds monitoring cycle applies only to the “Last State” power loss control mode.

6.2.4 Fan Control

The conga-TS570 has additional signals and functions to further improve system management. One of these signals is FAN_PWMOUT, an output signal that allows system fan control using a PWM (Pulse Width Modulation) output. Additionally, an input signal called FAN_TACHOIN provides the ability to monitor the system’s fan RPMs (revolutions per minute). This signal must receive two pulses per revolution in order to produce an accurate reading. For this reason, a two pulse per revolution fan or similar hardware solution is recommended.



1. A four wire fan must be used to generate the correct speed readout.
2. For the correct fan control (FAN_PWMOUT, FAN_TACHIN) implementation, see the COM Express Design Guide.

6.2.5 Enhanced Soft-Off State

The conga-TS570 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_S5e_Implementation.pdf for detailed description of the S5e state.

6.3 OEM BIOS Customization

The conga-TS570 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:

6.3.1 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.

6.3.2 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.

6.3.3 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.

6.3.4 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.

6.4 congatec Battery Management Interface

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

In addition to the ACPI-Compliant Control Method Battery mentioned above, the latest versions of the conga-TS570 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.

6.5 API Support (CGOS)

In order 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, available on the congatec website.

6.6 Security Features

The conga-TS570 offers a discrete SPI TPM 2.0 (Infineon SLB9670VQ2.0) by default.

6.7 Suspend to Ram

The Suspend to RAM feature is available on the conga-TS570.

7 conga Tech Notes

The conga-TS570 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 Adaptive Thermal Monitor and Catastrophic Thermal Protection

Intel® Xeon, Core™ i7/i5/i3 and Celeron® processors have a thermal monitor feature that helps to control the processor's temperature. The integrated TCC (Thermal Control Circuit) activates if the processor silicon reaches its maximum operating temperature. The activation temperature which the Intel® Thermal Monitor uses in activating the TCC can be slightly modified via TCC Activation Offset in BIOS setup submenu "CPU submenu".

The Adaptive Thermal Monitor controls the processor's temperature using two methods:

- Adjusting the processor's operating frequency and core voltage (EIST transitions)
- Modulating (start/stop) the processor's internal clocks at a duty cycle of 25% on and 75% off

When activated, the TCC causes both processor core and graphics core to reduce frequency and voltage adaptively. The Adaptive Thermal Monitor will remain active as long as the package temperature remains at its specified limit. Therefore, the Adaptive Thermal Monitor will continue to reduce the package frequency and voltage until the TCC is de-activated. Clock modulation is activated if frequency and voltage adjustments are insufficient. Additional hardware, software driver, or operating system support is not required.

Intel®'s Core™ i7/i5/i3 and Celeron® processors use the THERMTRIP# signal to shut down the system if the processor's silicon reaches a temperature of approximately 125°C. The THERMTRIP# signal activation is completely independent from the processor's activity and therefore does not produce any bus cycles.



Note

1. For THERMTRIP# to switch off the system automatically, use an ATX style power supply
2. The maximum operating temperature for Intel® Xeon, Core™ i7/i5/i3 and Celeron® processors is 100°C
3. To ensure that the TCC is active for only short periods of time, thus reducing the impact on processor performance to a minimum, use a properly designed thermal solution. The Intel® Xeon, Core™ i7/i5/i3 and Celeron® processor's respective datasheet can provide you with more information about this subject.

7.2 Intel® SpeedStep® Technology (EIST)

Intel® processors on the conga-TS570 run at different voltage/frequency states (performance states), referred to as Enhanced Intel® SpeedStep® Technology (EIST). Operating systems that support performance control take advantage of microprocessors that use several different performance states in order to efficiently operate the processor when it is not being fully used.

The operating system will determine the necessary performance state that the processor should run at so that the optimal balance between performance and power consumption can be achieved during runtime. The Windows family of operating systems links its processor performance control policy to the power scheme setting. You must ensure that the power scheme setting you choose has the ability to support Enhanced Intel® SpeedStep® technology.

The 11th Generation Intel® Core™ processor family supports Intel Speed Shift, a new and energy efficient method for frequency control. This feature is also referred to as Hardware-controlled Performance States (HWP). It is a hardware implementation of the ACPI defined Collaborative Processor Performance Control (CPPC2) and is supported by newer operating systems (Win 8.1 or newer).

With this feature enabled, the processor autonomously selects performance states based on workload demand and thermal limits while also considering information provided by the OS e.g., the performance limits and workload history.

7.3 Intel® Turbo Boost Technology

Intel® Turbo Boost Technology allows processor cores to run faster than the base operating frequency if it is operating below power, current, and temperature specification limits. Intel® Turbo Boost Technology is activated when the Operating System (OS) requests the highest processor performance state.

The maximum frequency of Intel® Turbo Boost Technology depends on the number of active cores. The amount of time the processor spends in the Intel Turbo Boost 2 Technology state depends on the workload and operating environment.

Any of the following can set the upper limit of Intel® Turbo Boost Technology on a given workload:

- Number of active cores
- Estimated current consumption
- Estimated power consumption
- Processor temperature

When the processor is operating below these limits and the user's workload demands additional performance, the processor frequency dynamically increases by 100 MHz on short and regular intervals until the upper limit is met or the maximum possible upside for the number of active cores is reached.

For more information about Intel® Turbo Boost 2 Technology visit the Intel® website.



Note

1. Only conga-TS570 variants that feature the Xeon, Core™ i7, i5 and i3 processors support Intel® Turbo Boost 2 Technology. Refer to section 2.5 "Power Consumption" for information about the maximum turbo frequency available for each variant of the conga-TS570
2. For real-time sensitive applications, disable EIST and Turbo Mode in the BIOS setup to ensure a more deterministic performance.
3. Disable Turbo mode for industrial use conditions.

7.4 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.

7.5 Thermal Management

ACPI allows the operating system to play an important part in the system's thermal management. This helps the operating system to implement cooling decisions according to the demands of the application.

The conga-TS570 offers hardware-based support for passive and active cooling. Passive cooling is implemented in the Intel CPU via the Thermal Control Circuit (TCC) Activation Offset setting in the CPU configuration setup sub-menu. The TCC in the processor is activated at 100°C by default but can be lowered by the Activation Offset. For example, an activation offset of "10" will activate TCC at 90°C (ACPI OS support is not required). See section 7.1 "Adaptive Thermal Monitor and Catastrophic Thermal Protection" for more information.

The congatec board controller supports active cooling solution. The board controller controls the fan's speed based on the temperature readings of the CPU. This feature does not require ACPI OS support. The only software-controlled thermal trip point on conga-TS570 is the Critical Trip Point.

The active or passive cooling policy should ensure that the CPU temperature does not reach this trip point. However, if the critical trip point is reached, the OS will shut down properly in order to prevent damage to the system.



Use the “critical trip point” setup node in the BIOS setup menu to determine the temperature threshold at which the system shuts down.

The Automatic Critical Trip Point BIOS setting shuts down the system at 5°C above the maximum specified temperature of the processor

7.6 ACPI Suspend Modes and Resume Events

The conga-TS570 BIOS supports S3 (Suspend to RAM), S4 (Suspend to Disk), and S5 (Soft-Off).

Table 12 Wake Events

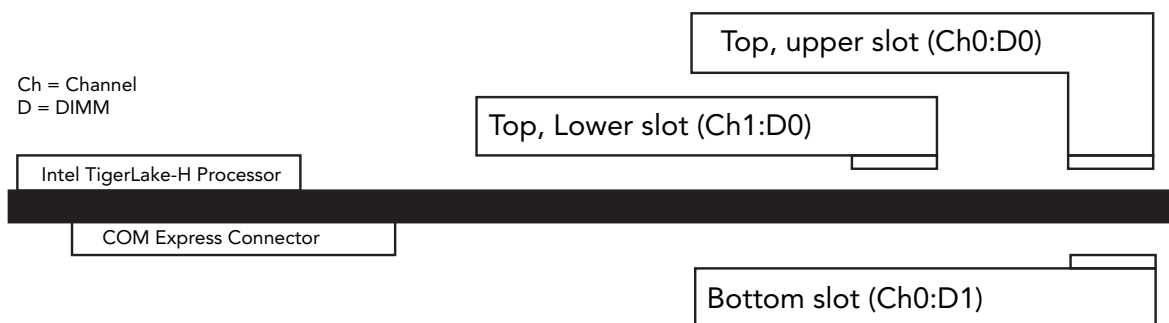
The table below lists the events that wake the system from S3-S5.

| 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 |

7.7 SO-DIMM Population Rules

The Intel TigerLake SoC featured on the conga-TS570 supports ECC and non-ECC DDR4 memory modules, up to 3200 MT/s. The DDR4 memory modules have lower voltage requirements with higher data rate transfer speeds. They operate at a nominal voltage of 1.2 V. With this low voltage system memory interface, the conga-TS570 offers a system optimized for lowest possible power consumption. The reduction in power consumption due to lower voltage subsequently reduces the heat generated.

The diagram below shows the location of the memory slots on the conga-TS570.



The following population rules must be observed:

- For single memory module, either of the top slots can be populated (ch0:D0 or ch1:D0).
- The top, upper slot (ch0:D0) must be populated if the bottom slot (ch0:D1) is populated.
 - The module will not boot (POST code 53) if only the bottom slot is populated in a single memory configuration.
 - The module will not boot (POST code 53) if the bottom slot and the top, lower slot are populated in a double memory configuration.
 - POST code "53" indicates that no memory module is detected.
- Use same DIMMs (same part numbers) in channel 0 (top, upper slot and bottom slot). Mixing DIMMs in this channel will reduce the speed to 2933 Mhz.
- No requirement to match DIMMs between channels.
- For best IA and Gfx performance, use same memory capacity in a channel.
- ECC with non-interleave is not supported.

Table 13 Memory Population Compatibility

The table below shows the possible memory combinations and their corresponding results.

| Top Upper Slot Channel 0, DIMM 0 | Top Lower Slot Channel 1, DIMM 0 | Bottom Slot Channel 0, DIMM 1 | Result |
|-------------------------------------|-------------------------------------|----------------------------------|---------------------------|
| x | x | x | OK |
| x | x | – | OK |
| x | – | x | OK |
| x | – | – | OK |
| – | x | – | OK |
| – | – | x | Boot error (POST Code 53) |
| – | x | x | Boot error (POST Code 53) |

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 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.

Table 14 Signal Tables Terminology Descriptions

| Term | Description |
|------------|--|
| PU | Implemented pull-up resistor |
| PD | Implemented pull-down resistor |
| I/O 3.3V | Bi-directional signal 3.3 V tolerant |
| I/O 5V | Bi-directional signal 5 V tolerant |
| I 3.3V | Input 3.3 V tolerant |
| I 5V | Input 5 V tolerant |
| I/O 3.3VSB | Input or output 3.3 V tolerant active in standby state |
| O 3.3V | Output 3.3 V signal level |
| O 5V | Output 5 V signal level |
| OD | Open drain output |
| P | Power input/output |
| DDC | Display Data Channel |
| PCIe | PCI Express compatible differential signal |
| DP | DisplayPort compatible differential signal |
| PEG | PCI Express Graphics |
| SATA | In compliance with Serial ATA specification revision 2.6 and 3.0 |
| LVDS | Low Voltage Differential Signal - 330 mV nominal,; 450 mV maximum differential signal |
| 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 15 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# | A63 | GPI1 | B63 | GPO3 |
| A9 | GBE0_MDI1- | B9 | LPC_DRQ1#/ESPI_ALERT1# | A64 | PCIE_TX1+ | B64 | PCIE_RX1+ |
| A10 | GBE0_MDI1+ | B10 | LPC_CLK/ESPI_CLK | 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_CLK | 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# ³ | 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+ | B22 | SATA3_TX+ | A77 | eDP_VDD_EN/LVDS_VDD_EN | B77 | LVDS_B3+ |
| A23 | SATA2_TX- | B23 | SATA3_TX- | 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+ | B25 | SATA3_RX+ | A80 | GND (FIXED) | B80 | GND (FIXED) |
| A26 | SATA2_RX- | B26 | SATA3_RX- | A81 | eDP_TX3+/LVDS_A_CK+ | B81 | LVDS_B_CK+ |
| A27 | BATLOW# | B27 | WDT | A82 | eDP_TX3-/LVDS_A_CK- | B82 | LVDS_B_CK- |
| 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 |

| Pin | Row A | Pin | Row B | Pin | Row A | Pin | Row B |
|-----|------------------------------------|-----|-------------------------------|------|-----------------------|------|-------------------------|
| A31 | GND (FIXED) | B31 | GND (FIXED) | A86 | RSVD ¹ | B86 | VCC_5V_SBY |
| A32 | HDA_BITCLK | B32 | SPKR ³ | A87 | eDP_HPD | B87 | VCC_5V_SBY |
| A33 | HDA_SDOOUT 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 |
| A35 | THRMTRIP# | B35 | THRM# | A90 | GND (FIXED) | B90 | GND (FIXED) |
| A36 | USB6- | B36 | USB7- | A91 | SPI_POWER | B91 | VGA_GRN |
| A37 | USB6+ | B37 | USB7+ | A92 | SPI_MISO | B92 | VGA_BLU |
| A38 | USB_6_7_OC# | B38 | USB_4_5_OC# | A93 | GPO0 | B93 | VGA_HSYNC |
| A39 | USB4- | B39 | USB5- | A94 | SPI_CLK | B94 | VGA_VSYNC |
| A40 | USB4+ | B40 | USB5+ | A95 | SPI_MOSI ³ | B95 | VGA_I2C_CK |
| A41 | GND (FIXED) | B41 | GND (FIXED) | A96 | TPM_PP | B96 | VGA_I2C_DAT |
| 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# ¹ | A102 | SER1_RX | B102 | FAN_TACHIN |
| A48 | RSVD ¹ | B48 | USB0_HOST_PRSENT 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 | GPIO | B54 | GPO1 | A109 | VCC_12V | B109 | VCC_12V |
| A55 | PCIE_TX4+ | B55 | PCIE_RX4+ | A110 | GND (FIXED) | B110 | GND (FIXED) |



- ^{1.} Not connected
- ^{2.} Not supported
- ^{3.} Bootstrap signals

Table 16 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- | D56 | PEG_TX1- |
| C2 | GND | D2 | GND | C57 | TYPE1# ¹ | D57 | TYPE2# |
| C3 | USB_SSRX0- | D3 | USB_SSTX0- | C58 | PEG_RX2+ | D58 | PEG_TX2+ |
| C4 | USB_SSRX0+ | D4 | USB_SSTX0+ | C59 | PEG_RX2- | D59 | PEG_TX2- |
| C5 | GND | D5 | GND | C60 | GND (FIXED) | D60 | GND (FIXED) |
| C6 | USB_SSRX1- | D6 | USB_SSTX1- | C61 | PEG_RX3+ | D61 | PEG_TX3+ |
| C7 | USB_SSRX1+ | D7 | USB_SSTX1+ | C62 | PEG_RX3- | D62 | PEG_TX3- |
| C8 | GND | D8 | GND | C63 | RSVD | D63 | RSVD ¹ |
| C9 | USB_SSRX2- | D9 | USB_SSTX2- | C64 | RSVD (see caution below) | D64 | RSVD ¹ |
| C10 | USB_SSRX2+ | D10 | USB_SSTX2+ | C65 | PEG_RX4+ | D65 | PEG_TX4+ |
| C11 | GND (FIXED) | D11 | GND (FIXED) | C66 | PEG_RX4- | D66 | PEG_TX4- |
| C12 | USB_SSRX3- | D12 | USB_SSTX3- | C67 | RAPID_SHUTDOWN ² | D67 | GND |
| C13 | USB_SSRX3+ | D13 | USB_SSTX3+ | C68 | PEG_RX5+ | D68 | PEG_TX5+ |
| C14 | GND | D14 | GND | C69 | PEG_RX5- | D69 | PEG_TX5- |
| C15 | DDI1_PAIR6+ ¹ | D15 | DDI1_CTRLCLK_AUX+ | C70 | GND (FIXED) | D70 | GND (FIXED) |
| C16 | DDI1_PAIR6- ¹ | D16 | DDI1_CTRLCLK_AUX- ³ | C71 | PEG_RX6+ | D71 | PEG_TX6+ |
| C17 | RSVD ¹ | D17 | RSVD ¹ | C72 | PEG_RX6- | D72 | PEG_TX6- |
| C18 | RSVD ¹ | D18 | RSVD ¹ | C73 | GND | D73 | GND |
| C19 | PCIE_RX6+ | D19 | PCIE_TX6+ | C74 | PEG_RX7+ | D74 | PEG_TX7+ |
| C20 | PCIE_RX6- | D20 | PCIE_TX6- | C75 | PEG_RX7- | D75 | PEG_TX7- |
| C21 | GND (FIXED) | D21 | GND (FIXED) | C76 | GND | D76 | GND |
| C22 | PCIE_RX7+ | D22 | PCIE_TX7+ | C77 | RSVD ¹ | D77 | RSVD ¹ |
| C23 | PCIE_RX7- | D23 | PCIE_TX7- | C78 | PEG_RX8+ | D78 | PEG_TX8+ |
| C24 | DDI1_HPD | D24 | RSVD ¹ | C79 | PEG_RX8- | D79 | PEG_TX8- |
| C25 | DDI1_PAIR4+ ¹ | D25 | RSVD ¹ | C80 | GND (FIXED) | D80 | GND (FIXED) |
| C26 | DDI1_PAIR4- ¹ | D26 | DDI1_PAIR0+ | C81 | PEG_RX9+ | D81 | PEG_TX9+ |
| C27 | RSVD ¹ | D27 | DDI1_PAIR0- | C82 | PEG_RX9- | D82 | PEG_TX9- |
| 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+ | D85 | PEG_TX10+ |
| C31 | GND (FIXED) | D31 | GND (FIXED) | C86 | PEG_RX10- | D86 | PEG_TX10- |
| 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- ³ | D33 | DDI1_PAIR2- | C88 | PEG_RX11+ | D88 | PEG_TX11+ |
| C34 | DDI2_DDC_AUX_SEL | D34 | DDI1_DDC_AUX_SEL | C89 | PEG_RX11- | D89 | PEG_TX11- |
| C35 | RSVD ¹ | D35 | RSVD ¹ | C90 | GND (FIXED) | D90 | GND (FIXED) |
| C36 | DDI3_CTRLCLK_AUX+ | D36 | DDI1_PAIR3+ | C91 | PEG_RX12+ | D91 | PEG_TX12+ |
| C37 | DDI3_CTRLDATA_AUX- ³ | D37 | DDI1_PAIR3- | C92 | PEG_RX12- | D92 | PEG_TX12- |
| C38 | DDI3_DDC_AUX_SEL | D38 | RSVD ¹ | C93 | GND | D93 | GND |
| C39 | DDI3_PAIR0+ | D39 | DDI2_PAIR0+ | C94 | PEG_RX13+ | D94 | PEG_TX13+ |
| C40 | DDI3_PAIR0- | D40 | DDI2_PAIR0- | C95 | PEG_RX13- | D95 | PEG_TX13- |
| C41 | GND (FIXED) | D41 | GND (FIXED) | C96 | GND | D96 | GND |
| C42 | DDI3_PAIR1+ | D42 | DDI2_PAIR1+ | C97 | RSVD ¹ | D97 | RSVD ¹ |
| C43 | DDI3_PAIR1- | D43 | DDI2_PAIR1- | C98 | PEG_RX14+ | D98 | PEG_TX14+ |
| C44 | DDI3_HPD | D44 | DDI2_HPD | C99 | PEG_RX14- | D99 | PEG_TX14- |
| C45 | RSVD ¹ | D45 | RSVD ¹ | C100 | GND (FIXED) | D100 | GND (FIXED) |
| C46 | DDI3_PAIR2+ | D46 | DDI2_PAIR2+ | C101 | PEG_RX15+ | D101 | PEG_TX15+ |
| C47 | DDI3_PAIR2- | D47 | DDI2_PAIR2- | C102 | PEG_RX15- | D102 | PEG_TX15- |
| C48 | RSVD ¹ | D48 | RSVD ¹ | C103 | GND | D103 | GND |
| C49 | DDI3_PAIR3+ | D49 | DDI2_PAIR3+ | C104 | VCC_12V | D104 | VCC_12V |
| C50 | DDI3_PAIR3- | D50 | DDI2_PAIR3- | C105 | VCC_12V | D105 | VCC_12V |
| C51 | GND (FIXED) | D51 | GND (FIXED) | C106 | VCC_12V | D106 | VCC_12V |
| C52 | PEG_RX0+ | D52 | PEG_TX0+ | C107 | VCC_12V | D107 | VCC_12V |
| C53 | PEG_RX0- | D53 | PEG_TX0- | C108 | VCC_12V | D108 | VCC_12V |
| C54 | TYPE0# ¹ | D54 | PEG_LANE_RV# ³ | C109 | VCC_12V | D109 | VCC_12V |
| C55 | PEG_RX1+ | D55 | PEG_TX1+ | C110 | GND (FIXED) | D110 | GND (FIXED) |



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



Caution

Using the conga-TS570 on a COM Express 3.1 carrier board may cause functionality issues. Pin C64 (defined as RSVD in COM Express 3.0) is used for cBC diagnostic output. This pin is defined as GND in COM Express 3.1 specification.

Table 17 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 | | Supports PCI Express Base Specification, Revision 3.0 |
| PCIE_TX6+ PCIE_TX6- | D19 D20 | PCI Express channel 6, Transmit Output differential pair | O PCIe | | Supports PCI Express Base Specification, Revision 3.0 |
| PCIE_RX7+ PCIE_RX7- | C22 C23 | PCI Express channel 7, Receive Input differential pair | I PCIe | | Supports PCI Express Base Specification, Revision 3.0 |
| PCIE_TX7+ PCIE_TX7- | D22 D23 | PCI Express channel 7, Transmit Output differential pair | O PCIe | | Supports PCI Express Base Specification, Revision 3.0 |
| 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 Gen2/3/4 compliant clock buffer chip must be used on the carrier board if the design involves more than one PCI Express device. |

Table 18 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>Note: Can also be used as PCI Express Receive Input differential pairs 16 through 31 known as PCIE_RX[16-31] + and -</i> | I PCIe | | Supports PCI Express Base Specification, Revision 4.0 |
| PEG_RX0- | C53 | | | | |
| PEG_RX1+ | C55 | | | | |
| 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+ | D52 | PCI Express Graphics Transmit Output differential pairs <i>Note: Can also be used as PCI Express Transmit Output differential pairs 16 through 31 known as PCIE_TX[16-31] + and -</i> | O PCIE | | Supports PCI Express Base Specification, Revision 4.0 |
| PEG_TX0- | D53 | | | | |
| PEG_TX1+ | D55 | | | | |
| PEG_TX1- | D56 | | | | |
| PEG_TX2+ | D58 | | | | |
| PEG_TX2- | D59 | | | | |
| PEG_TX3+ | D61 | | | | |
| PEG_TX3- | D62 | | | | |
| PEG_TX4+ | D65 | | | | |
| PEG_TX4- | D66 | | | | |
| PEG_TX5+ | D68 | | | | |
| PEG_TX5- | D69 | | | | |
| PEG_TX6+ | D71 | | | | |
| PEG_TX6- | D72 | | | | |
| PEG_TX7+ | D74 | | | | |
| PEG_TX7- | D75 | | | | |
| PEG_TX8+ | D78 | | | | |
| PEG_TX8- | D79 | | | | |
| PEG_TX9+ | D81 | | | | |
| PEG_TX9- | D82 | | | | |
| PEG_TX10+ | D85 | | | | |
| PEG_TX10- | D86 | | | | |
| PEG_TX11+ | D88 | | | | |
| PEG_TX11- | D89 | | | | |
| PEG_TX12+ | D91 | | | | |
| PEG_TX12- | D92 | | | | |
| PEG_TX13+ | D94 | | | | |
| PEG_TX13- | D95 | | | | |
| PEG_TX14+ | D98 | | | | |
| PEG_TX14- | D99 | | | | |
| PEG_TX15+ | D101 | | | | |
| PEG_TX15- | D102 | | | | |
| PEG_LANE_RV# ¹ | D54 | PCI Express Graphics lane reversal input strap. Pull low on the carrier board to reverse lane order | I | PU 10 kΩ 3.3 V | PEG_LANE_RV# is a bootstrap signal (see note below) |

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".

Table 19 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 connected |
| DDI1_PAIR5+ DDI1_PAIR5- | C29 C30 | Digital Display Interface 1, differential pair 5 | | | Not connected |
| DDI1_PAIR6+ DDI1_PAIR6- | C15 C16 | Digital Display Interface 1, differential pair 6 | | | Not connected |
| DDI1_HPD | C24 | Multiplexed with DP1_HPD and HDMI1_HPD | I 3.3 V | PD 100 kΩ | |
| DDI1_CTRLCLK_AUX+ | D15 | Multiplexed with DP1_AUX+ and HDMI1_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- ¹ | 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 PCIE I/O OD 3.3 V | PU 100 kΩ 3.3V | Bootstrap signal (see note below). Enable strap is already populated |
| DDI1_DDC_AUX_SEL | D34 | Selects the function of DDI1_CTRLCLK_AUX+ and DDI1_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 3.3 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 100 kΩ | |
| 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- ¹ | 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 | Bootstrap signal (see note below). Enable strap is already populated |

| 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+ | C39 | Multiplexed with DP3_LANE0+ and TMDS3_DATA2+ | O DP | | |
| DDI3_PAIR0- | C40 | Multiplexed with DP3_LANE0- and TMDS3_DATA2- | | | |
| DDI3_PAIR1+ | C42 | Multiplexed with DP3_LANE1+ and TMDS3_DATA1+ | O DP | | |
| DDI3_PAIR1- | C43 | Multiplexed with DP3_LANE1- and TMDS3_DATA1- | | | |
| DDI3_PAIR2+ | C46 | Multiplexed with DP3_LANE2+ and TMDS3_DATA0+ | O DP | | |
| DDI3_PAIR2- | C47 | Multiplexed with DP3_LANE2- and TMDS3_DATA0- | | | |
| DDI3_PAIR3+ | C49 | Multiplexed with DP3_LANE3+ and TMDS3_CLK+ | O DP | | |
| DDI3_PAIR3- | C50 | Multiplexed with DP3_LANE3- and TMDS3_CLK- | | | |
| DDI3_HPD | C44 | Multiplexed with DP3_HPD and HDMI3_HPD | I 3.3 V | PD 100 kΩ | |
| 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/ODP I/O OD 3.3 V | PD 100 kΩ | |
| DDI3_CTRLDATA_AUX- ¹ | 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 | PU 100 kΩ 3.3 V | Bootstrap signal (see note below). Enable strap is already populated |
| DDI3_DDC_AUX_SEL | C38 | Selects the function of DDI3_CTRLCLK_AUX+ and DDI3_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 3.3 V | PD 1 MΩ | |



¹. These signals have special functionality during the reset process. They may bootstrap some basic important functions of the module. For more information refer to section 8.2 "Bootstrap Signals".

Table 20 TMDS Signal Descriptions

| Signal | Pin # | Description | I/O | PU/PD | Comment |
|--------------|-------|--|------|-------|---------|
| TMDS1_CLK + | D36 | TMDS Clock output differential pair. | O DP | | |
| TMDS1_CLK - | D37 | Multiplexed with DDI1_PAIR3+ and DDI1_PAIR3- | | | |
| TMDS1_DATA0+ | D32 | TMDS differential pair | O DP | | |
| TMDS1_DATA0- | D33 | Multiplexed with DDI1_PAIR2+ and DDI1_PAIR2- | | | |
| TMDS1_DATA1+ | D29 | TMDS differential pair | O DP | | |
| TMDS1_DATA1- | D30 | Multiplexed with DDI1_PAIR1+ and DDI1_PAIR1- | | | |
| TMDS1_DATA2+ | D26 | TMDS differential pair | O DP | | |
| TMDS1_DATA2- | D27 | Multiplexed with DDI1_PAIR0+ and DDI1_PAIR0- | | | |

| Signal | Pin # | Description | I/O | PU/PD | Comment |
|------------------------------|------------|---|-----------------|--------------|--|
| HDMI1_HPD | C24 | Hot-plug detect Multiplexed with DDI1_HPD | I DP | PD 100 kΩ | |
| HDMI1_CTRLCLK | D15 | TMDS I ² C Control Clock Multiplexed with DDI1_CTRLCLK_AUX+ | I/O OD 3.3 V | PU 2k2 3.3 V | |
| HDMI1_CTRLDATA | D16 | TMDS I ² C Control Data Multiplexed with DDI1_CTRLDATA_AUX- | I/O OD 3.3 V | PU 2k2 3.3 V | Bootstrap signal (see note below). Enable strap is already populated |
| 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 100 kΩ | |
| HDMI2_CTRLCLK | C32 | TMDS I ² C Control Clock Multiplexed with DDI2_CTRLCLK_AUX+ | I/O OD 3.3 V | PU 2k2 3.3 V | |
| HDMI2_CTRLDATA | C33 | TMDS I ² C Control Data Multiplexed with DDI2_CTRLDATA_AUX- | I/O OD 3.3 V | PU 2k2 3.3 V | Bootstrap signal (see note below). Enable strap is already populated |
| TMDS3_CLK + TMDS3_CLK - | C49 C50 | TMDS Clock output differential pair Multiplexed with DDI3_PAIR3+ and DDI3_PAIR3- | O DP | | |
| TMDS3_DATA0+ TMDS3_DATA0- | C46 C47 | TMDS differential pair Multiplexed with DDI3_PAIR2+ and DDI3_PAIR2- | O DP | | |
| TMDS3_DATA1+ TMDS3_DATA1- | C42 C43 | TMDS differential pair Multiplexed with DDI3_PAIR1+ and DDI3_PAIR1- | O DP | | |
| TMDS3_DATA2+ TMDS3_DATA2- | C39 C40 | TMDS differential pair Multiplexed with DDI3_PAIR0+ and DDI3_PAIR0- | O DP | | |
| HDMI3_HPD | C44 | TMDS Hot-plug detect Multiplexed with DDI3_HPD | I DP | PD 100 kΩ | |
| HDMI3_CTRLCLK | C36 | TMDS I ² C Control Clock Multiplexed with DDI3_CTRLCLK_AUX+ | I/O OD 3.3 V | PU 2k2 3.3 V | |
| HDMI3_CTRLDATA | C37 | TMDS I ² C Control Data Multiplexed with DDI3_CTRLDATA_AUX- | I/O OD 3.3 V | PU 2k2 3.3 V | Bootstrap signal (see note below). Enable strap is already populated. |



1. Some signals have special functionality during the reset process. They may bootstrap some basic important functions of the module. For more information refer to section 8.2 "Bootstrap Signals".
2. The conga-TS570 does not natively support TMDS. For TMDS support, a DP++ to TMDS converter (e.g PTN3360D) needs to be implemented on the carrier board.

Table 21 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 | | |
| DP1_HPD | C24 | Detection of Hot Plug / Unplug and notification of the link layer Multiplexed with DDI1_HPD | I 3.3 V | PD 100 k Ω | |
| 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 k Ω | |
| DP1_AUX- ¹ | D16 | Half-duplex bi-directional AUX channel for services such as link configuration or maintenance and EDID access | I/O DP | PU 100 k Ω 3.3 V | DP1_AUX- is a bootstrap signal (see note below). DP enable strap is already populated |
| 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 100 k Ω | |
| 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 k Ω | |
| DP2_AUX- ¹ | C33 | Half-duplex bi-directional AUX channel for services such as link configuration or maintenance and EDID access | I/O DP | PU 100 k Ω 3.3 V | DP2_AUX- is a bootstrap signal (see note below). DP enable strap already populated |
| 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 | | |

| Signal | Pin # | Description | I/O | PU/PD | Comment |
|--------------------------|------------|---|---------|--------------------|---|
| 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 | | |
| 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 | | |
| 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 | | |
| DP3_HPD | C44 | Detection of Hot Plug / Unplug and notification of the link layer Multiplexed with DDI3_HPD | I 3.3 V | PD 100 kΩ | |
| DP3_AUX+ | C36 | Half-duplex bi-directional AUX channel for services such as link configuration or maintenance and EDID access | I/O DP | PD 100 kΩ | |
| DP3_AUX- ¹ | C37 | 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_AUX- is a bootstrap signal (see note below). DP enable strap already populated |



Note

¹. These signals have special functionality during the reset process. They may bootstrap some basic important functions of the module. For more information refer to section 8.2 "Bootstrap Signals".

Table 22 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. | | |
| 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 100 kΩ | |

Table 23 VGA 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 | PD 150R | Default on variants equipped with Intel® QM580E or Intel® HM570E PCH |
| VGA_GRN | B91 | Green for monitor; analog DAC output designed to drive a 37.5-Ohm equivalent load | O Analog | PD 150R | |
| VGA_BLU | B92 | Blue for monitor. Analog DAC output, designed to drive a 37.5-Ohm equivalent load | O Analog | PD 150R | |
| 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 (I ² C port dedicated to identify VGA monitor capabilities) | I/O OD 5 V | PU 2k2 3.3 V | |
| VGA_I2C_DAT | B96 | DDC data line | I/O OD 5 V | PU 2k2 3.3 V | |

**Note**

For VGA interface on variants equipped with Intel RM590E PCH, you need a customized conga-TS570 variant (assembly option)

Table 24 LVDS Signal Descriptions

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

Table 25 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 | | Supports Serial ATA specification, Revision 3.0 |
| SATA2_TX+ SATA2_TX- | A22 A23 | Serial ATA channel 2, transmit output differential pair | O SATA | | Supports Serial ATA specification, Revision 3.0 |
| SATA3_RX+ SATA3_RX- | B25 B26 | Serial ATA channel 3, receive input differential pair | I SATA | | Supports Serial ATA specification, Revision 3.0 |
| SATA3_TX+ SATA3_TX- | B22 B23 | Serial ATA channel 3, transmit output differential pair | O SATA | | Supports Serial ATA specification, Revision 3.0 |
| (S)ATA_ACT# | A28 | Serial ATA activity indicator, active low | I/O 3.3 V | | |

Table 26 USB 2.0 Signal Descriptions

| Signal | Pin # | Description | I/O | PU/PD | Comment |
|--------|-------|--------------------------|-----|-------|--|
| USB0+ | A46 | USB Port 0, data + or D+ | I/O | | USB 2.0 compliant. Backwards compatible to USB 1.1 |
| USB0- | A45 | USB Port 0, data - or D- | I/O | | USB 2.0 compliant. Backwards compatible to USB 1.1 |
| USB1+ | B46 | USB Port 1, data + or D+ | I/O | | USB 2.0 compliant. Backwards compatible to USB 1.1 |
| USB1- | B45 | 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 |

| Signal | Pin # | Description | I/O | PU/PD | Comment |
|------------------|-------|--|--------------|---------------------|---|
| 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 | |
| USB0_HOST_PRSENT | B48 | Module USB client may detect the presence of a USB host on USB0. A high value indicates that a host is present | I 3.3 VSB | PD 1 MΩ | Not supported |

Table 27 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 28 Gigabit Ethernet Signal Descriptions

| Gigabit Ethernet | Pin # | Description | I/O | PU/PD | Comment |
|-------------------------------|-------|--|---------------|-------|---|
| GBE0_MDI0+ | A13 | 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 | | |
| GBE0_MDI0- | A12 | | | | |
| GBE0_MDI1+ | A10 | | | | |
| GBE0_MDI1- | A9 | | | | |
| GBE0_MDI2+ | A7 | | | | |
| GBE0_MDI2- | A6 | | | | |
| GBE0_MDI3+ | A3 | | | | |
| GBE0_MDI3- | A2 | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| GBE0_ACT# | B2 | Gigabit Ethernet Controller 0 activity indicator, active low | OD 3.3 V | | |
| GBE0_LINK# ^{1,2} | A8 | Gigabit Ethernet Controller 0 link indicator, active low | OD 3.3 V | | |
| GBE0_LINK100# ² | A4 | Gigabit Ethernet Controller 0 100 Mbps link indicator, active low | OD 3.3 V | | |
| GBE0_LINK1000# ^{2,3} | A5 | Gigabit Ethernet Controller 0 1000 Mbps link indicator, active low | OD 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 | | Signal is provided by the Intel i226 controller |

**Note**

- ¹. The GBE0_LINK# output is not active during a 10 Mb connection. It is only active during a 100 Mb, 1 Gb or 2.5 Gb connection. This is a limitation of Ethernet controller 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-TS570 module.
- ³. The LINK1000# output is active during 2.5 Gb connection.

Table 29 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_SDOUT is a bootstrap signal |
| HDA_SDIN[1:0] ¹ | B29-B30 | Serial TDM data inputs from up to three codecs | I 3.3 V | | HDA_SDIN2 (pin B28) is not connected |



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 30 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 K Ω 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-B9 | LPC Mode: LPC serial DMA request | I 3.3 V | PU 100 K Ω 3.3 V | |
| LPC_SERIRQ | A50 | LPC Mode: LPC serial interrupt | I/O 3.3 V | PU 10 K Ω 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# | 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 connected |



The conga-TS570 does not support ESPI mode.

Table 31 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 | | 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 4K75 3.3 VSB | SPI_MOSI is a bootstrap signal (see note below) |
| SPI_CLK | A94 | Clock from module to carrier board SPI BIOS flash | O 3.3 VSB | | |
| 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# | A34 | Selection strap to determine the BIOS boot device | I 3.3 VSB | PU 10 K Ω 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 K Ω 3.3 VSB | Carrier shall be left as no-connect |



Note

¹ These signals have special functionality during the reset process. They may bootstrap some basic important functions of the module. For more information refer to section 8.2 "Bootstrap Signals".

Table 32 Miscellaneous Signal Descriptions

| Signal | Pin # | Description | I/O | PU/PD | Comment |
|-------------------------|-------|---|------------|-------------------|---|
| I2C_CLK | B33 | General purpose I ² C port clock output/input | I/O 3.3 V | PU 2K2 3.3 VSB | |
| I2C_DAT | B34 | General purpose I ² C 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 | | SPKR is a bootstrap signal (see note below) |
| WDT | B27 | Output indicating that a watchdog time-out event has occurred | O 3.3 V | PD 100 K Ω | |
| 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 | | |
| FAN_TACHIN ² | B102 | Fan tachometer input | I OD | PU 47K5 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 1 K Ω | |



Note

¹ This signal has special function during the reset process. For more information, see section 9.2 "Bootstrap Signals".

² Pins are protected on the module by a series schottky diode.

Table 33 General Purpose I/O Signal Descriptions

| Signal | Pin # | Description | I/O | PU/PD | Comment |
|--------|-------|---|---------|----------------|---------|
| GPO0 | A93 | General purpose output pins. Pin should be low on hardware reset. | O 3.3 V | | |
| GPO1 | B54 | General purpose output pins. Pin should be low on hardware reset. | O 3.3 V | | |
| GPO2 | B57 | General purpose output pins. Pin should be low on hardware reset. | O 3.3 V | | |
| GPO3 | B63 | General purpose output pins. Pin should be low on hardware reset. | O 3.3 V | | |
| GPI0 | A54 | General purpose input pins. Pulled high internally on the module | I 3.3 V | PU 10 kΩ 3.3 V | |
| GPI1 | A63 | General purpose input pins. Pulled high internally on the module | I 3.3 V | PU 10 kΩ 3.3 V | |
| GPI2 | A67 | General purpose input pins. Pulled high internally on the module | I 3.3 V | PU 10 kΩ 3.3 V | |
| GPI3 | A85 | General purpose input pins. Pulled high internally on the module | I 3.3 V | PU 10 kΩ 3.3 V | |



Note

The conga-TS570 does not support SDIO.

Table 34 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, active low, edge triggered input. 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 | Active low reset output from module to Carrier Board. Issued by module chipset and may occur 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 | | Set by resistor divider to accept 3.3V |
| 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 | PD 100 kΩ | |
| SUS_S4# | A18 | Indicates system is in Suspend to Disk state. Active low output | O 3.3 VSB | PD 100 kΩ | Not supported |
| 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 1 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 | |

| Signal | Pin # | Description | I/O | PU/PD | Comment |
|---------------------|-------|--|------------|----------------------|---------|
| LID# ¹ | 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 47K5 3.3 VSB | |
| SLEEP# ¹ | 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 | |



Note

^{1.} Pins are protected on the module by a series schottky diode.

Table 35 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-TS570 does not support Rapid Shutdown.

Table 36 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 37 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 2k2 3.3 VSB | |

Table 38 General Purpose Serial Interface Signal Descriptions

| Signal | Pin # | Description | I/O | PU/PD | Comment |
|------------------------|-------|---|---------|---------------|---------|
| SER0_TX ^{1,2} | A98 | General purpose serial port transmitter | O 3.3 V | | |
| SER1_TX ^{1,2} | A101 | General purpose serial port transmitter | O 3.3 V | | |
| SER0_RX ¹ | A99 | General purpose serial port receiver | I 3.3 V | PU 47K5 3.3 V | |
| SER1_RX ¹ | A102 | General purpose serial port receiver | I 3.3 V | PU 47K5 3.3 V | |

**Note**

- ^{1.} Pins are protected on the module by a series schottky diode.
- ^{2.} Pull-down resistor is required on the carrier board for proper logic level.

Table 39 Module Type Definition Signal Description

| Signal | Pin # | Description | | | | I/O | Comment |
|----------------------------|-------------------|--|--------|---|--------------------------------|-----|--|
| TYPE0# TYPE1# TYPE2# | C54 C57 D57 | The TYPE pins indicate to the Carrier Board the Pin-out 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) | | | | PDS | TYPE[0:2]# signals are available on all modules following the Type 2-6 Pinout standard The conga-TS570 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 |
| | | TYPE2# | TYPE1# | TYPE0# | | | |
| | | X | X | X | Pinout Type 1 | | |
| | | NC | NC | NC | Pinout Type 2 | | |
| | | NC | NC | GND | Pinout Type 3 (no IDE) | | |
| | | NC | GND | NC | Pinout Type 4 (no PCI) | | |
| | | NC | GND | GND | Pinout Type 5 (no IDE, no PCI) | | |
| | | GND | NC | NC | Pinout Type 6 (no IDE, no PCI) | | |
| | | 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 | | | | | |
| TYPE10# | A97 | 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 | | | | PDS | Not connected to indicate "Pinout R2.0" |
| | | TYPE10# | | | | | |
| | | NC PD 12V | | Pinout R2.0 Pinout Type 10 pull down to ground with 4.7k resistor Pinout R1.0 | | | |
| | | 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 | | | | | |

Table 40 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 41 Bootstrap Signal Descriptions

| Signal | Pin # | Description of Bootstrap Signal | I/O | PU/PD | Comment |
|--------------------|-------|---|--------------|--------------------------|---------|
| HDA_SDOUT | A33 | High Definition Audio Serial Data Output | O 3.3 VSB | PU 1 k Ω 3.3 VSB | |
| SPKR | B32 | Output for audio enunciator, the "speaker" in PC-AT systems | O 3.3 V | | |
| PEG_LAN_RV# | D54 | PCI Express Graphics lane reversal input strap. Pull low on the carrier board to reverse lane order | I 3.3 V | PU 10 k Ω 3.3 V | |
| 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 2k2 3.3 VSB | |
| SPI_MOSI | A95 | Data out from module to carrier board SPI BIOS flash | O 3.3 VSB | PU 4k75 3.3 VSB | |
| BIOS_DIS0# | A34 | Selection strap to determine the BIOS boot device | I 3.3 VSB | PU 10 k Ω 3.3 VSB | |
| BIOS_DIS1# | B88 | Selection strap to determine the BIOS boot device | I 3.3 VSB | PU 10 k Ω 3.3 VSB | |
| DDI1_CTRLDATA_AUX- | D16 | Multiplexed with DP1_AUX- and HDMI1_CTRLDATA | | PU 2k2 3.3 V | |
| DP1_AUX- | | DP AUX- function if DDI1_DDC_AUX_SEL is no connect | I/O PCIE | | |
| HDMI1_CTRLDATA | | HDMI/DVI I2C CTRLDATA if DDI1_DDC_AUX_SEL is pulled high | I/O OD 3.3 V | | |
| DDI2_CTRLDATA_AUX- | C33 | Multiplexed with DP2_AUX- and HDMI2_CTRLDATA | | PU 2k2 3.3 V | |
| DP2_AUX- | | DP AUX- function if DDI2_DDC_AUX_SEL is no connect | I/O PCIE | | |
| HDMI2_CTRLDATA | | HDMI/DVI I2C CTRLDATA if DDI2_DDC_AUX_SEL is pulled high | I/O OD 3.3 V | | |
| DDI3_CTRLDATA_AUX- | C37 | Multiplexed with DP3_AUX- and HDMI3_CTRLDATA | | PU 2k2 3.3 V | |
| DP3_AUX- | | DP AUX- function if DDI3_DDC_AUX_SEL is no connect | I/O PCIE | | |
| HDMI3_CTRLDATA | | HDMI/DVI I2C CTRLDATA if DDI3_DDC_AUX_SEL is pulled high | I/O OD 3.3 V | | |



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

The I/O address assignment of the conga-TS570 module is functionally identical with a standard PC/AT.



Note

The BIOS assigns PCI and PCI Express I/O resources from FFF0h downwards. Non PnP/PCI/PCI Express compliant devices must not consume I/O resources in that area.

9.1.1 LPC Bus

On the conga-TS570 the PCI Express Bus acts as the subtractive decoding agent. All I/O cycles that are not positively decoded are forwarded to the PCI Bus not the ESPI or LPC Bus. Only specified I/O ranges are forwarded to the ESPI/LPC Bus. In the congatec Embedded BIOS, the following I/O address ranges are sent to the ESPI/LPC bus:

2Eh – 2Fh

4Eh – 4Fh

60h, 64h

8Ch – 8Dh (consumed internally by ESPI to LPC bridge)

A00h – A1Fh

E00h - EFFh (always used internally)

Parts of these ranges are not available if a Super I/O is used on the carrier board. If a Super I/O is not implemented on the carrier board, then these ranges are available for customer use. If you require additional LPC Bus resources other than those mentioned above, or need more information about this subject, contact congatec technical support for assistance.

9.2 PCI Configuration Space Map

| Bus Number (hex) | Device Number (hex) | Function Number (hex) | Description |
|------------------|---------------------|-----------------------|--|
| 00h | 00h | 00h | HOST and DRAM Controller |
| 00h | 02h | 00h | Integrated Graphics Device |
| 00h | 04h | 00h | Dynamic Tuning Technology |
| 00h | 08h | 00h | Gaussian Mixture Model and Neural Network Accelerator |
| 00h | 0Ah | 00h | Tiger Lake Telemetry Aggregator |
| 00h | 0Dh | 00h | USB 3.0 xHCI Controller |
| 00h | 14h | 00h | USB 3.0 xHCI Controller |
| 00h | 14h | 02h | RAM Controller |
| 00h (Note1) | 16h | 00h | Management Engine (ME) Interface 1 |
| 00h (Note1) | 16h | 01h | Intel ME Interface 2 |
| 00h (Note1) | 16h | 02h | ME IDE Redirection (IDE-R) Interface |
| 00h (Note1) | 16h | 03h | ME Keyboard and Text (KT) Redirection |
| 00h (Note1) | 16h | 04h | Intel ME Interface 3 |
| 00h (Note1) | 16h | 05h | Intel ME Interface 4 |
| 00h | 17h | 00h | SATA Controller |
| 00h (Note2) | 01h | 00h | PEG root port |
| 00h (Note2) | 1Ch | 00h | PCI Express Root Port 5 |
| 00h (Note2) | 1Ch | 05h | PCI Express Root Port 6 |
| 00h (Note2) | 1Ch | 06h | PCI Express Root Port 7 |
| 00h (Note2) | 1Ch | 07h | PCI Express Root Port 8 |
| 00h (Note2) | 1Dh | 00h | PCI Express Root Port 9 connected to Ethernet controller |
| 00h (Note2) | 1Bh | 00h | PCI Express Root Port 17 |
| 00h (Note2) | 1Bh | 01h | PCI Express Root Port 18 |
| 00h (Note2) | 1Bh | 02h | PCI Express Root Port 19 |
| 00h (Note2) | 1Bh | 03h | PCI Express Root Port 20 |
| 00h | 1Fh | 00h | PCI to ESPI Bridge |
| 00h | 1Fh | 03h | Intel® High Definition Audio |
| 00h | 1Fh | 04h | SMBus Controller |
| 00h | 1Fh | 05h | SPI Flash Controller |
| 01h (Note3) | 00h | 00h | PCIe Device connected to PEG Root Port |
| 05h (Note3) | 00h | 00h | PCIe Device inserted in PCI Express Port 7 |
| 06h (Note3) | 00h | 00h | PCIe Device inserted in PCI Express Port 0 |
| 07h (Note3) | 00h | 00h | PCIe Device inserted in PCI Express Port 1 |
| 09h (Note3) | 00h | 00h | PCIe Device inserted in PCI Express Port 2 |
| 0Ah (Note3) | 00h | 00h | PCIe Device inserted in PCI Express Port 3 |
| 0Bh (Note3) | 00h | 00h | Intel Ethernet controller I226 |
| 02h (Note3) | 00h | 00h | PCIe Device inserted in PCI Express Port 4 |

| | | | |
|-------------|-----|-----|--|
| 03h (Note3) | 00h | 00h | PCIe Device inserted in PCI Express Port 5 |
| 04h (Note3) | 00h | 00h | PCIe Device inserted in PCI Express Port 6 |

Note

1. In the standard configuration, the Intel Management Engine (ME) related devices are partly present or not present at all.
2. The PCI Express ports are visible only if a device is attached to the PCI Express slot on the carrier board.
3. The table represents a case when a single function PCI/PCIe device is connected to all possible slots on the carrier board. The given bus numbers will change based on actual hardware configuration.

Note

Internal PCI devices that are not connected to the conga-TS570 are not listed.

10 BIOS Setup Description

The BIOS setup description of the conga-TS570 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 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-TS570 is identified as BQTLR1xx, where:

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

The conga-TS570 BIOS 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-TS570 features a congatec/AMI AptioEFI firmware on an onboard flash ROM chip. You can update the firmware with the congatec System Utility. The utility has five versions—UEFI shell, DOS based command line¹, Win32 command line, Win32 GUI, and Linux version.

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



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 Updating 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-TS570 supports:

- Winbond W25R256JVEIQ 32 MB
- Macronix MX25L25645G 32 MB

The flash devices 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>.