

COMe-cWL6

User Guide Rev. 2.1

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 COME-CWL6 – USER GUIDE

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Kontron Europe GmbH

Gutenbergstraße 2
85737 Ismaning, Germany
Germany
www.kontron.com

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CAUTION

Handling and operation of the product is permitted only for trained personnel within a work place that is access controlled. Please follow the "General Safety Instructions" supplied with the system.

NOTICE

You find the most recent version of the "General Safety Instructions" online in the download area of this product.

NOTICE

This product is not suited for storage or operation in corrosive environments, in particular under exposure to sulfur and chlorine and their compounds. For information on how to harden electronics and mechanics against these stress conditions, contact Kontron Support.

Revision History

| Revision | Brief Description of Changes | Date of Issue | Author |
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Customer Support

Find Kontron contacts by visiting <https://www.kontron.de/support-and-services>.

Customer Service

As a trusted technology innovator and global solutions provider, Kontron extends its embedded market strengths into a services portfolio allowing companies to break the barriers of traditional product lifecycles. Proven product expertise coupled with collaborative and highly-experienced support enables Kontron to provide exceptional peace of mind to build and maintain successful products.

For more details on Kontron's service offerings such as: enhanced repair services, extended warranty, Kontron training academy, and more visit <http://www.kontron.com/support-and-services/services>.

Customer Comments

If you have any difficulties using this user guide, discover an error, or just want to provide some feedback, contact [Kontron support](#). Detail any errors you find. We will correct the errors or problems as soon as possible and post the revised user guide on our website.

Symbols

The following symbols may be used in this user guide

DANGER

DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

NOTICE

NOTICE indicates a property damage message.

CAUTION

CAUTION indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.



Electric Shock!

This symbol and title warn of hazards due to electrical shocks (> 60 V) when touching products or parts of products. Failure to observe the precautions indicated and/or prescribed by the law may endanger your life/health and/or result in damage to your material.



ESD Sensitive Device!

This symbol and title inform that the electronic boards and their components are sensitive to static electricity. Care must therefore be taken during all handling operations and inspections of this product in order to ensure product integrity at all times.



HOT Surface!

Do NOT touch! Allow to cool before servicing.



Laser!

This symbol inform of the risk of exposure to laser beam and light emitting devices (LEDs) from an electrical device. Eye protection per manufacturer notice shall review before servicing.



This symbol indicates general information about the product and the user guide.

This symbol also indicates detail information about the specific product configuration.



This symbol precedes helpful hints and tips for daily use.

For Your Safety

Your new Kontron product was developed and tested carefully to provide all features necessary to ensure its compliance with electrical safety requirements. It was also designed for a long fault-free life. However, the life expectancy of your product can be drastically reduced by improper treatment during unpacking and installation. Therefore, in the interest of your own safety and of the correct operation of your new Kontron product, you are requested to conform with the following guidelines.

High Voltage Safety Instructions

As a precaution and in case of danger, the power connector must be easily accessible. The power connector is the product's main disconnect device.

⚠ CAUTION

Warning

All operations on this product must be carried out by sufficiently skilled personnel only.

⚠ CAUTION



Electric Shock!

Before installing a non hot-swappable Kontron product into a system always ensure that your mains power is switched off. This also applies to the installation of piggybacks. Serious electrical shock hazards can exist during all installation, repair, and maintenance operations on this product. Therefore, always unplug the power cable and any other cables which provide external voltages before performing any work on this product.

Earth ground connection to vehicle's chassis or a central grounding point shall remain connected. The earth ground cable shall be the last cable to be disconnected or the first cable to be connected when performing installation or removal procedures on this product.

Special Handling and Unpacking Instruction

NOTICE



ESD Sensitive Device!

Electronic boards and their components are sensitive to static electricity. Therefore, care must be taken during all handling operations and inspections of this product, in order to ensure product integrity at all times.

Do not handle this product out of its protective enclosure while it is not used for operational purposes unless it is otherwise protected.

Whenever possible, unpack or pack this product only at EOS/ESD safe work stations. Where a safe work station is not guaranteed, it is important for the user to be electrically discharged before touching the product with his/her hands or tools. This is most easily done by touching a metal part of your system housing.

It is particularly important to observe standard anti-static precautions when changing piggybacks, ROM devices, jumper settings etc. If the product contains batteries for RTC or memory backup, ensure that the product is not placed on conductive surfaces, including anti-static plastics or sponges. They can cause short circuits and damage the batteries or conductive circuits on the product.

Lithium Battery Precautions

If your product is equipped with a lithium battery, take the following precautions when replacing the battery.

CAUTION

Danger of explosion if the battery is replaced incorrectly.

Replace only with same or equivalent battery type recommended by the manufacturer.

Dispose of used batteries according to the manufacturer's instructions.

General Instructions on Usage

In order to maintain Kontron's product warranty, this product must not be altered or modified in any way. Changes or modifications to the product, that are not explicitly approved by Kontron and described in this user guide or received from Kontron Support as a special handling instruction, will void your warranty.

This product should only be installed in or connected to systems that fulfill all necessary technical and specific environmental requirements. This also applies to the operational temperature range of the specific board version that must not be exceeded. If batteries are present, their temperature restrictions must be taken into account.

In performing all necessary installation and application operations, only follow the instructions supplied by the present user guide.

Keep all the original packaging material for future storage or warranty shipments. If it is necessary to store or ship the product then re-pack it in the same manner as it was delivered.

Special care is necessary when handling or unpacking the product. See Special Handling and Unpacking Instruction.

Quality and Environmental Management

Kontron aims to deliver reliable high-end products designed and built for quality, and aims to complying with environmental laws, regulations, and other environmentally oriented requirements. For more information regarding Kontron's quality and environmental responsibilities, visit <http://www.kontron.com/about-kontron/corporate-responsibility/quality-management>.

Disposal and Recycling

Kontron's products are manufactured to satisfy environmental protection requirements where possible. Many of the components used are capable of being recycled. Final disposal of this product after its service life must be accomplished in accordance with applicable country, state, or local laws or regulations.

WEEE Compliance

The Waste Electrical and Electronic Equipment (WEEE) Directive aims to:

Reduce waste arising from electrical and electronic equipment (EEE)

Make producers of EEE responsible for the environmental impact of their products, especially when the product become waste

Encourage separate collection and subsequent treatment, reuse, recovery, recycling and sound environmental disposal of EEE

Improve the environmental performance of all those involved during the lifecycle of EEE



Environmental protection is a high priority with Kontron.

Kontron follows the WEEE directive

You are encouraged to return our products for proper disposal.

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1/ Introduction

1.1. Product Description

The COMe-cWL6 (E2S) deliver high-performance, feature-rich Computer-on-Modules based on the standardized COM Express® compact form factor and Intel's single package BGA1528 System-on-Chip (SoC). The SoCs are containing: Intel's 8th Generation Core Series CPU processors. Through the use of COM Express connectors the COMe-cWL6 is easily exchangeable and offers the most flexibility for customers designing it into their embedded devices based on individual carrier boards.

The Kontron COMe-cWL6 (E2S) modules allow up to 48 GB of DDR4 memory. The board is also suited for harsh operating conditions in industrial environments. For example, rugged modules are available that can be used within a temperature range from -40°C to +85°C. The option with a soldered main memory (memory down) of up to 16 GB DDR4 ensures even more robustness. Kontron will also offer a screened E2 variant.

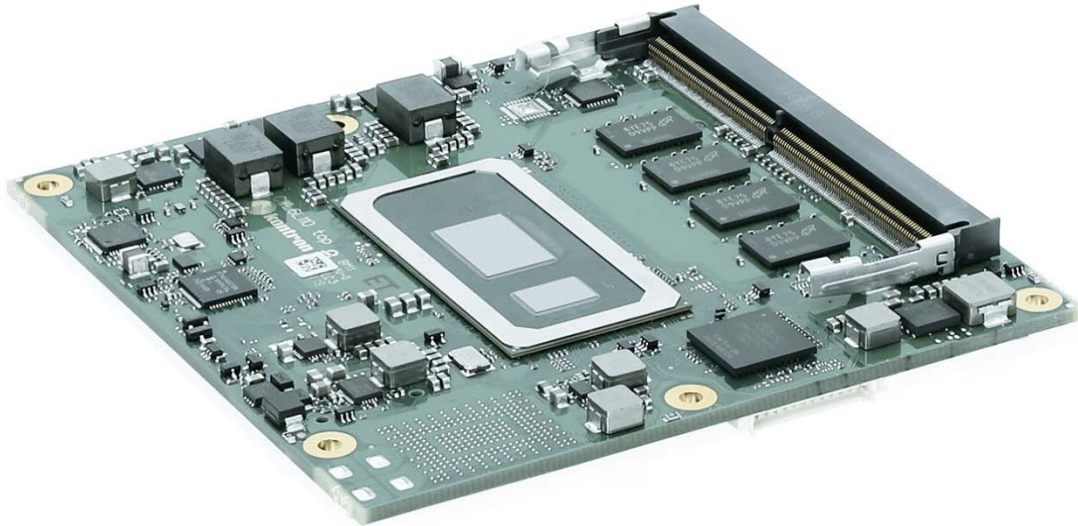
The COMe-cWL6 is ideally suited as a powerful successor for existing solutions, as it takes over their pin assignment and feature implementation. Typical applications include communication, digital signage, professional gaming and entertainment, medical imaging, surveillance and security, industrial edge computing as well as industrial plant-, machine- and robot-control at the shop floor level and from the control room.

The new COM Express® Compact modules support the Kontron APPROTECT security solution based on Wibu-Systems CodeMeter®. Kontron APPROTECT Licensing also enables new business models such as 'pay-per-use' and time-based trial versions.

Basic COMe-cWL6 features are:

- ▶ Dual/Quad -Core CPU on COM Express® compact form factor (Pin-out Type 6 compliant)
- ▶ Based on 8th Gen Intel® Core™ technology
- ▶ Up to 48 GB DDR4 non-ECC memory via 1x SO-DIMM socket (for up to 32 GB memory modules) + up to 16 GB non-ECC memory down (on 2nd channel, optional)
- ▶ Intel HD Graphics Gen9
- ▶ LVDS/eDP support
- ▶ 1x Gigabit Ethernet, WOL support
- ▶ SATA 6 Gb/s and USB 3.1 Gen2 support
- ▶ Support for Audio and common features (SPI, LPC, SMB etc.)
- ▶ TPM support
- ▶ Security Chip (BOM option)
- ▶ Optional vPro support
- ▶ Optional NVMe SSD onboard
- ▶ E2S versions for industrial grade temp. range (-40°C up to +85°C)

Figure 1: COMe-cWL6



1.2. Product Naming Clarification

COM Express® defines a Computer-On-Module, or COM, with all the components necessary for a bootable host computer, packaged as a super component. The product names for Kontron COM Express® Computer-on-Modules consist of:

- ▶ Short form of the industry standard
 - ▶ COMe-cWL6
- ▶ Module form factor
 - ▶ b=basic (125 mm x 95 mm)
 - ▶ c=compact (95mm x 95 mm)
 - ▶ m=mini (84 mm x 55 mm)
- ▶ Processor code name
 - ▶ WL = Whiskey Lake
- ▶ Pinout type
 - ▶ Type 6
- ▶ Available temperature variants
 - ▶ Commercial
 - ▶ Extended (E1)
 - ▶ Screened industrial (E2S)
- ▶ Processor Identifier
- ▶ Chipset identifier (if chipset assembled)
 - ▶ Memory size
 - ▶ Memory Down

1.3. COM Express® Documentation

The COM Express® specification defines the COM Express® module form factor, pinout and signals. The COM Express document is available at the PICMG® website.

1.4. COM Express® Functionality

All Kontron COM Express® basic and compact modules contain two 220-pin connector. Each connector has two rows called Row A & B on primary connector and Row C & D on secondary connector. COM Express® Computer-On-Modules feature the following maximum amount of interfaces according to the PICMG module pinout type:

Table 1: IOs of Type 6 and COMe-cWL6

| Feature | Type 6 Pinout | COMe-cWL6 Pinout |
|-------------------------------|---|---|
| HD Audio | 1x | 1x |
| Gb Ethernet | 1x | 1x |
| Serial ATA | 4x | 2x |
| PCI Express x 1 | 8x | 5x PCIe 3.0 (On request: 6x without Ethernet, up to 8x without Ethernet & SATA) |
| PCI Express x16 (PEG) | 1x | 4x PCIe 3.0 on PEG Lanes #0-3 |
| USB | 4x USB 3.0 (incl. USB 2.0) + 4x USB 2.0 | 4x USB 3.1 Gen 2 (Incl. USB 2.0) + 4x USB 2.0 Corresponding USB ports are configured to USB 3.1 Gen1 by default as support depends on appropriate carrier board design |
| VGA | 1x | 1x (optional) |
| LVDS | Dual Channel | Dual Channel LVDS with option to overlay with embedded Display port (eDP) |
| DP++ (eDP/DP/HDMI/DVI/VGA) | 3x | 2x |
| LPC | 1x | 1x |
| External SMB | 1x | 1x |
| External I2C | 1x | 1x |
| GPIO | 8x | 8x |
| SDIO shared w/GPIO | 1x optional | 1x optional |
| UART (2-wire COM) | 2x | 2x |
| FAN PWM out | 1x | 1x |

1.5. COM Express® Benefits

COM Express® defines a Computer-On-Module, or COM, with all the components necessary for a bootable host computer, packaged as a highly integrated computer. All Kontron COM Express® modules are very compact and feature a standardized form factor and a standardized connector layout that carry a specified set of signals. Each COM is based on the COM Express® specification. This standardization allows designers to create a single-system baseboard that can accept present and future COM Express® modules.

The baseboard designer can optimize exactly how each of these functions implements physically. Designers can place connectors precisely where needed for the application, on a baseboard optimally designed to fit a system's packaging.

A single baseboard design can use a range of COM Express® modules with different sizes and pinouts. This flexibility differentiates products at various price and performance points and provides a built-in upgrade path when designing future-proof systems. The modularity of a COM Express® solution also ensures against obsolescence when computer technology evolves. A properly designed COM Express® baseboard can work with several successive generations of COM Express® modules.

A COM Express® baseboard design has many advantages of a customized computer-board design and, additionally, delivers better obsolescence protection, heavily reduced engineering effort, and faster time to market.

2/ Product Specification

2.1. Module Variants

The COMe-cWL6 is available in different processor and temperature variants to cover demands in performance, price and power.

2.1.1. Commercial Grade Modules (0°C to +60°C)

Commercial Grade Modules (0°C to +60°C) are available as a standard product number.

Table 2: Commercial Grade Modules (0°C to +60°C)

| Product Number | Product Name | Description |
|-----------------|------------------------------|---|
| 36028-1610-17-7 | COMe-cWL6 i7-8665UE 16GB/1TB | COM Express® compact pin-out type 6 Computer-on-Module with Intel® Core™ i7-8665UE, 4x1.7 GHz, 16 GB memory down, DDR4 SO DIMM Socket, 1024 GB NVMe |
| 36028-8000-17-7 | COMe-cWL6 i7-8665UE 8GB | COM Express® compact pin-out type 6 Computer-on-Module with Intel® Core™ i7-8665UE, 4x1.7 GHz, 8 GB memory down, DDR4 SO DIMM Socket |
| 36028-0000-17-7 | COMe-cWL6 i7-8665UE | COM Express® compact pin-out type 6 Computer-on-Module with Intel® Core™ i7-8665UE, 4x1.7 GHz, DDR4 SO DIMM Socket |
| 36028-4000-16-5 | COMe-cWL6 i5-8365UE 4GB | COM Express® compact pin-out type 6 Computer-on-Module with Intel® Core™ i5-8365UE, 4x1.6 GHz, 4 GB memory down, DDR4 SO DIMM Socket |
| 36028-0000-16-5 | COMe-cWL6 i5-8365UE | COM Express® compact pin-out type 6 Computer-on-Module with Intel® Core™ i5-8365UE, 4x1.6 GHz, DDR4 SO DIMM Socket |
| 36028-0000-22-3 | COMe-cWL6 i3-8145UE | COM Express® compact pin-out type 6 Computer-on-Module with Intel® Core™ i3-8145UE, 2x2.2 GHz, DDR4 SO DIMM Socket |
| 36028-0000-20-2 | COMe-cWL6 4305UE | COM Express® compact pin-out type 6 Computer-on-Module with Intel® Celeron® 4305UE, 2x2.0 GHz, DDR4 SO DIMM Socket |

2.1.2. Extended Temperature Grade Modules (E1, -25°C to 75°C)

Extended Temperature grade modules (E1, -25°C to 75°C) are available as a standard product number, on request. For further information, contact your local Kontron sales representative or Kontron Inside Sales.

2.1.3. E2S Modules (E2S, -40°C to +85°C)

The following table provides a list of E2S modules available for E2 temperature grade (-40°C to +85°C) by screening.



For further information regarding the screening process contact Kontron Support

Table 3: E2S Modules (E2S, -40°C to +85°C operating)

| Product Number | Product Name | Description |
|-----------------|-----------------------------|--|
| 36029-8000-17-7 | COMe-cWL6 E2S i7-8665UE 8GB | COM Express® compact pin-out type 6 Computer-on-Module with Intel® Core™ i7-8665UE, 4x1.7 GHz, 8 GB memory down, DDR4 SO DIMM Socket, industrial temperature grade |
| 36029-4000-16-5 | COMe-cWL6 E2S i5-8365UE 4GB | COM Express® compact pin-out type 6 Computer-on-Module with Intel® Core™ i5-8365UE, 4x1.6 GHz, 4 GB memory down, DDR4 SO DIMM Socket, industrial temperature grade |
| 36029-0000-22-3 | COMe-cWL6 E2S i3-8145UE | COM Express® compact pin-out type 6 Computer-on-Module with Intel® Core™ i3-8145UE, 2x2.2 GHz, DDR4 SO DIMM Socket, industrial temperature grade |

2.2. Accessories

Accessories are either COMe-cWL6 product specific, COMe Type 6 specific or general accessories.

Table 4: Product Accessories

| Part Number | Heatspreader (validated ref.types) | Description |
|-----------------|------------------------------------|--|
| 36028-0000-99-0 | HSP COMe-cWL6 Cu-core threaded | Heatspreader for COMe-cWL6, Cu-core, threaded mounting holes |
| 36028-0000-99-1 | HSP COMe-cWL6 Cu-core through | Heatspreader for COMe-cWL6, Cu-core, through mounting holes |

Table 5: COMe Type 6 Specific Accessories

| Part Number | COMe Carrier | Project Code | Comment |
|-----------------|---|--------------|---|
| 38115-0000-00-x | COM Express® Reference Carrier-i Type 6 | ADTI | Thin-mITX Carrier with 5 mm COMe connector |
| 38116-0000-00-5 | COM Express® Eval Carrier2 Type 6 | ADT6 | ATX Carrier with 5 mm COMe connector |
| Part Number | COMe Adapter / Card | Project Code | Comment |
| 96007-0000-00-3 | ADA-PCIe-DP | APDP | PCIe x16 to DP Adapter for Evaluation Carrier |
| 96007-0000-00-7 | ADA-Type6-DP3 | DVO6 | (sandwich) Adapter Card for 3x DisplayPort |
| 96006-0000-00-2 | COMe POST T6 | NFCB | POST Code / Debug Card |
| 38019-0000-00-0 | ADA-COMe-Height-dual | EERC | Height Adapter |

Table 6: General Accessories

| Part Number | Cooling Solutions | Comments |
|-----------------|------------------------------------|---|
| 36099-0000-99-4 | COMe Active Uni Cooler2 (w/o HSP) | COM Express® Universal Active Cooler for Heatspreader Mounting (95x95x14.3) - 90° turnable |
| 36099-0000-99-5 | COMe Passive Uni Cooler2 (w/o HSP) | COM Express® Universal Passive Cooler for Heatspreader Mounting (95x95x14.3) - 90° turnable |
| Part Number | Mounting | Comments |
| 38017-0000-00-5 | COMe Mount KIT 5 mm 1 set | Mount. Kit for 1 module + screws for 5 mm conn. |
| 38017-0100-00-5 | COMe Mount KIT 5 mm 100 sets | Mount. Kit for 100 module + screws for 5 mm conn. |
| 38017-0000-00-0 | COMe Mount KIT 8 mm 1 set | Mount. Kit for 1 module + screws for 8 mm conn. |
| 38017-0100-00-0 | COMe Mount KIT 8 mm 100 sets | Mount. Kit for 100 module + screws for 8 mm conn. |
| Part Number | Display Adapter | Comment |
| 96006-0000-00-8 | ADA-DP-LVDS | DP to LVDS adapter |
| 96082-0000-00-0 | KAB-ADAPT-DP-DVI | DP to DVI adapter cable |
| 96083-0000-00-0 | KAB-ADAPT-DP-VGA | DP to VGA adapter cable |
| 96084-0000-00-0 | KAB-ADAPT-DP-HDMI | DP to HDMI adapter cable |
| Part Number | Cables | Comment |
| 96079-0000-00-0 | KAB-HSP 200mm | Cable adapter to connect FAN to module (COMe basic/compact) |
| 96079-0000-00-2 | KAB-HSP 40 mm | Cable adapter to connect FAN to module (COMe basic/compact) |

Table 7: Memory

| Part Number | Memory | Description |
|-----------------|-------------------------------|--|
| 97020-3224-CWL6 | DDR4-2400 SODIMM 32GB_CWL6 | Memory for Computer-on-Module COMe-cWL6; min. specification: DDR4-2400, 32 GB, 260P, 1200 MHz, PC4-2400 SODIMM; validated for: COMe-cWL6 |
| 97020-1624-CWL6 | DDR4-2400 SODIMM 16GB_CWL6 | Memory for Computer-on-Module COMe-cWL6; min. specification: DDR4-2400, 16 GB, 260P, 1200 MHz, PC4-2400 SODIMM; validated for: COMe-cWL6 |
| 97020-0824-CWL6 | DDR4-2400 SODIMM 8GB_CWL6 | Memory for Computer-on-Module COMe-cWL6; min. specification: DDR4-2400, 8 GB, 260P, 1200 MHz, PC4-2400 SODIMM; validated for: COMe-cWL6 |
| 97020-0424-CWL6 | DDR4-2400 SODIMM 4GB_CWL6 | Memory for Computer-on-Module COMe-cWL6; min. specification: DDR4-2400, 4 GB, 260P, 1200 MHz, PC4-2400 SODIMM; validated for: COMe-cWL6 |
| 97021-3224-CWL6 | DDR4-2400 SODIMM 32GB E2_CWL6 | Memory for Computer-on-Module COMe-cWL6; min. specification: DDR4-2400, 32 GB, 260P, 1200 MHz, PC4-2400 SODIMM; validated for: COMe-cWL6 E2S |
| 97021-1624-CWL6 | DDR4-2400 SODIMM 16GB E2_CWL6 | Memory for Computer-on-Module COMe-cWL6; min. specification: DDR4-2400, 16 GB, 260P, 1200 MHz, PC4-2400 SODIMM; validated for: COMe-cWL6 E2S |
| 97021-0824-CWL6 | DDR4-2400 SODIMM 8GB E2_CWL6 | Memory for Computer-on-Module COMe-cWL6; min. specification: DDR4-2400, 8 GB, 260P, 1200MHz, PC4-2400 SODIMM; validated for: COMe-cWL6 E2S |
| 97021-0424-CWL6 | DDR4-2400 SODIMM 4GB E2_CWL6 | Memory for Computer-on-Module COMe-cWL6; min. specification: DDR4-2400, 4 GB, 260P, 1200 MHz, PC4-2400 SODIMM; validated for: COMe-cWL6 E2S |

2.3. Functional Specification

2.3.1. Technical Data

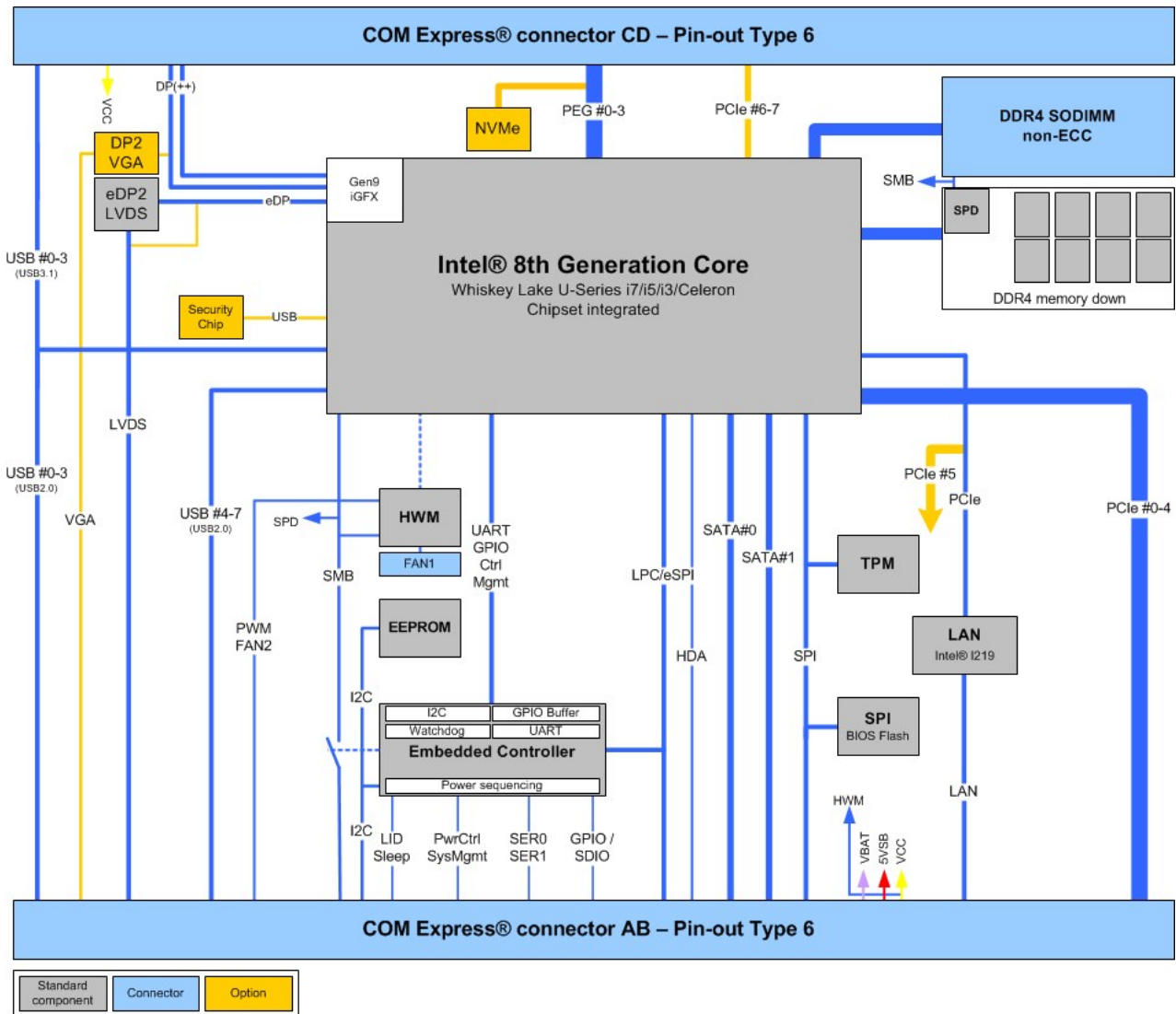
Table 8: Technical Data

| Function | Definition |
|----------------------|--|
| Compliance | COM Express® compact, Pin-out Type 6 |
| Dimensions (H X W) | 95mm x 95 mm |
| CPUs | Intel 8th generation processors: Intel® Core™ i7-8665UE, 4x 1.7 GHz, GT2, 15 W Intel® Core™ i5-8365UE, 4x 1.6 GHz, GT2, 15 W Intel® Core™ i3-8145UE, 2x 2.2 GHz, GT2, 15 W Intel® Celeron® 4305UE, 2x 2.0 GHz, GT1, 15 W |
| Main Memory | ▶ Channel 1: 1x SO-DIMMs DDR4 up to 32 GB ▶ Channel 2: Memory down DDR4 chips; up to 16 GB |
| Graphics Controller | Intel® UHD Graphics 620 (Celeron® 4305UE: Intel® UHD Graphics 610) |
| Graphic Interfaces | 2x DP++, LVDS,/eDP (eDP optional) |
| Ethernet | 10/100/1000 MBit Ethernet, Controller Intel® I219LM |
| Hard Disk | 2x SATA 6 Gb/s |
| PCI Express® Support | 5x PCIe 3.0 (On request: 6x without Ethernet, up to 8x without Ethernet & SATA) 4x PCIe 3.0 on PEG Lanes #0-3 |
| USB | 4x USB 3.1 Gen2 (incl USB2.0) + 4x USB 2.0 |
| Serial | 2x UART |
| Audio | High Definition Audio |
| Common Features | SPI, LPC, SMB, Fast I ² C, Staged Watchdog, RTC, support of Intel® Optane™ memory technology via PCIe |
| Special Features | POSCAP capacitors, Trusted Platform Module TPM 2.0 |
| Features on Request | vPRO (AMT/TXT/AES Support), eDP instead of LVDS, VGA, up to 3x PCIe x1 additional w/o onboard LAN and SATA, NVMe SSD, Security Chip |
| BIOS | AMI Aptio V |
| Power Supply | 8.5 V to 20 V Wide Range, Single Supply Power |
| Power Management | ACPI 6.0 |
| Approtect | Optional Wibu Code Meter ASIC connected to SoC USB2 Port 9. Wibu chip is only stuffed for option Security_WIBU |
| Operating Systems | Windows®10, Linux, VxWorks |
| Temperature | Commercial temperature: 0 °C to +60 °C operating, -30 °C to +85 °C non-operating Extended temperature: -25 °C to +75 °C operating, -30 °C to +85 °C non-operating Industrial temperature: -40 °C to +85 °C operating, -40 °C to +85 °C non-operating |

2.3.2. Block Diagram COMe-cWL6

The following figure displays the system block diagram applicable to all COMe-cWL6 modules.

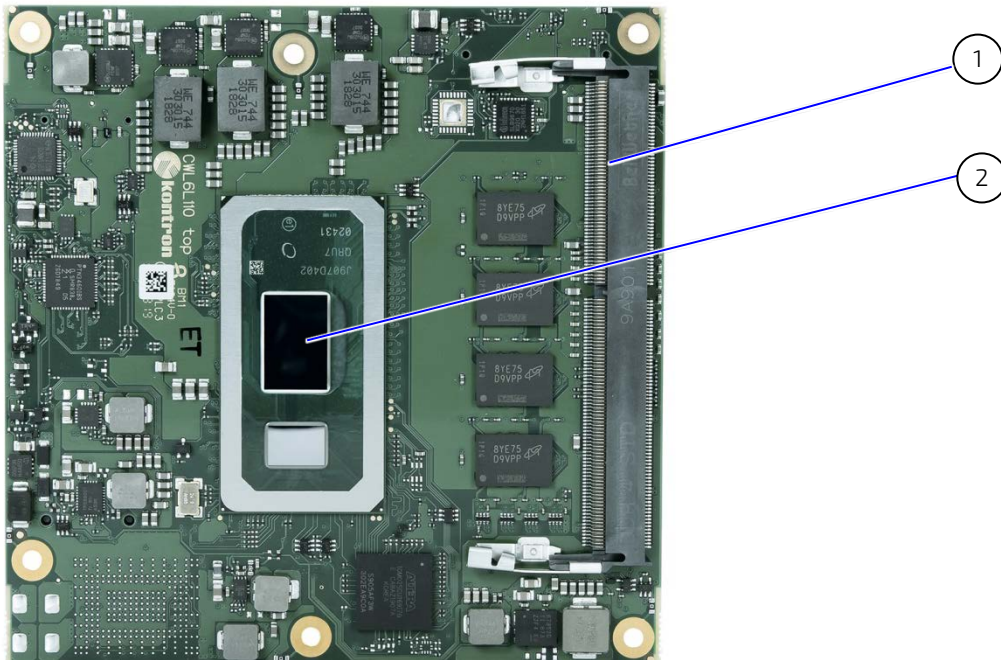
Figure 2: Block Diagram COMe-cWL6



2.3.3. Front and Rear View

2.3.3.1. Front View

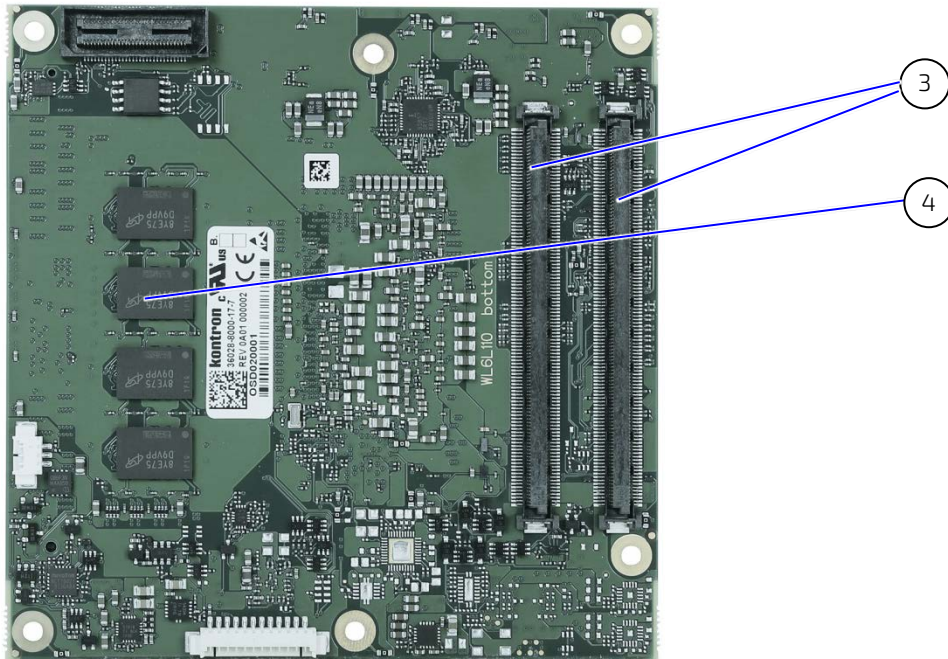
Figure 3: Front View COMe-cWL6



1. 1x SO-DIMM DDR4 slot
2. SoC Processor

2.3.3.2. Rear View

Figure 4: Rear View COMe-cWL6

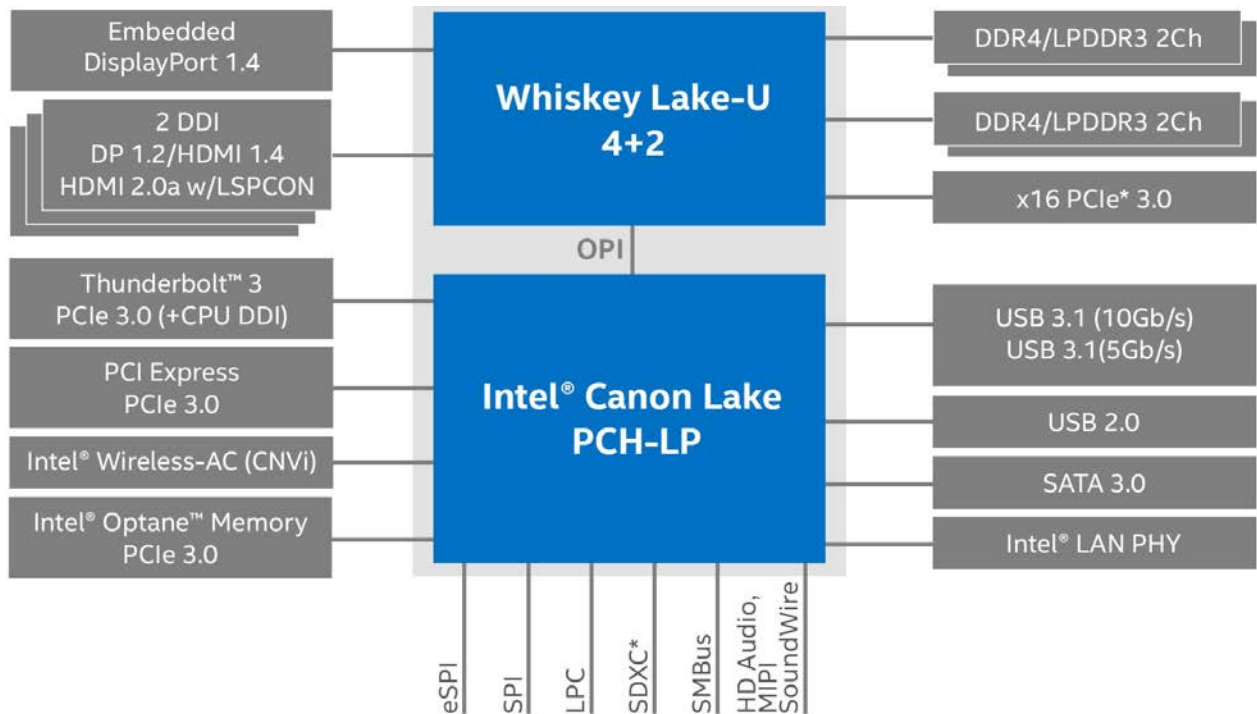


- 3. 2x COMe Connectors
- 4. Memory down

2.3.4. Processors

The 8th Generation Intel® Core™ U-Series processors for IoT applications are delivering high performance per watt. Intel IoT processors offer long-life availability, embedded use conditions, Intel® vPro™ technology on selected SKUs, increased I/O capacity, support for Intel® Optane™ memory and the DDR4-2400 memory. These processors meet the increasing requirements for graphics, audio, and compute capabilities while providing the headroom to consolidate data and applications.

Figure 5: Block Diagram 8th Generation processor (Source: Intel)



Key Benefits are:

- ▶ Up to 4.4 GHz max. frequency
- ▶ DDR4-2400 memory
- ▶ Intel Graphics GT2
- ▶ USB 3.1

Table 9: 8th Generation Intel® Core™ Processors U-Series (Mobile-U) Specifications

| Processor | Intel® Core™ i7-8665UE | Intel® Core™ i5-8365UE | Intel® Core™ i3-8145UE | Intel® Celeron™ 4305UE |
|--|------------------------|------------------------|------------------------|------------------------|
| # of Cores | 4 | 4 | 2 | 2 |
| # of Threads | 8 | 8 | 4 | 2 |
| Processor Base Frequency | 1.7 | 1.6 | 2.2 | 2.0 |
| Max. Turbo Frequency | 4.4 | 4.1 | 3.9 | 2.0 |
| Operating Temperature (T _{Junction}) | 0-100 °C | 0-100 °C | 0-100 °C | 0-100 °C |
| Thermal Design Power (TDP) | 15 W | 15 W | 15 W | 15 W |
| Cache | 8 MB | 6 MB | 4 MB | 2 MB |
| Memory Types | DDR4-2400 | DDR4-2400 | DDR4-2400 | DDR4-2400 |
| ECC memory | no | no | no | no |
| Max. Memory Size | 64 GB | 64 GB | 64 GB | 64 GB |
| Independent Displays | 3 | 3 | 3 | 3 |
| Package | FCBGA1528 | FCBGA1528 | FCBGA1528 | FCBGA1528 |

2.3.5. System Memory

The system memory supports a dual-channel 64-bit DDR4-2400. ECC memory is not available. One DIMM per channel offer 48 GB total. Following setups are considerable:

- ▶ Channel 1: One SO-DIMM DDR4, max 32 GB non-ECC
- ▶ Channel 2: Memory Down DDR4, max 16 GB non-ECC

Table 10: System Memory

| | |
|------------------------|-------------------------------|
| Socket | Dual-channel 64-bit DDR4-2400 |
| Memory Type | DDR4-2400 without ECC |
| Max Memory Module Size | 32 GByte |
| Bandwidth | up to 19.2 GB/s |

In general, memory modules have a much lower longevity than embedded motherboards, and therefore the EOL of the memory modules may occur several times during the lifetime of the module. Kontron guarantees to maintain memory modules by replacing EOL memory module with another qualified similar module.

As a minimum, it is recommend to use Kontron memory modules for prototype system(s) in order to prove the stability of the system and as a reference. In order to qualify RAM it is recommend to configure three systems running a RAM Stress Test program in a heat chamber at 60°C, for a minimum of 24 hours.



For a list of Kontron memory modules, see Table 7.

2.3.6. Graphics

2.3.6.1. Display Resolution

The following table lists the maximum display resolutions at a set frequency and bit per pixel (bpp) for the supported display interfaces.

Table 11: Display Resolution

| Display Interfaces | Maximum Resolution (Pixel) |
|--------------------|----------------------------|
| eDP | 4096x2304@60 Hz |
| DP | 4096x2304@60 Hz |
| HDMI 1.4 | 4096x2160@30/24 Hz |
| 4K Support | Yes, at 60 Hz |

2.3.6.2. Graphics Interfaces

The graphic part supports Intel® UHD 620 GPU with up to 12 Execution Units and DirectX* 12 or OpenGL 4.5 Support. Up to three independent Digital Display Interfaces (DDIs) can be used simultaneously and in combination, to implement an independent or cloned display configuration.

Table 12: Display Interfaces

| CPU Port | COMe Port | |
|----------|----------------------|--------------|
| DDI1 | DDI1 (DP++) w. Audio | |
| DDI2 | DDI2 (DP++) w. Audio | |
| DP3 | LVDS | eDP (option) |

Table 13: DD11 Interfaces

| COMe Connector | PCH | Description |
|--------------------|-------------------------------------|--------------------------|
| DDI1_PAIR[0:3] | DDI1_TX[0:3] | |
| DDI1_PAIR[4:6] | - | |
| DDI1_CTRLCLK_AUX+ | DDI1_AUXP (CPU) DDPB_CTRLCLK (PCH) | |
| DDI1_CTRLDATA_AUX- | DDI1_AUXN (CPU) DDPB_CTRLDATA (PCH) | |
| DDI1_DDC_AUX_SEL | - | Connected to DDC-AUX Mux |
| DDI1_HPD | DDPB_HPDP0 | |

Table 14: DD12 Interfaces

| COMe Connector | PCH | Description |
|--------------------|-------------------------------------|--------------------------|
| DDI2_PAIR[0:3] | DDI2_TX[0:3] | |
| DDI2_PAIR[4:6] | - | |
| DDI2_CTRLCLK_AUX+ | DDI2_AUXP (CPU) DDPC_CTRLCLK (PCH) | |
| DDI2_CTRLDATA_AUX- | DDI2_AUXN (CPU) DDPC_CTRLDATA (PCH) | |
| DDI2_DDC_AUX_SEL | - | Connected to DDC-AUX Mux |
| DDI2_HPD | DDPC_HPDP1 | |

2.3.6.3. LVDS

LVDS is implemented by NXP PTN3460 eDP to LVDS bridge chip:

- ▶ Input: Two eDP Lanes from CPU.
- ▶ Output: Dual Channel LVDS to COMe connector.

Table 15: LVDS Bridge

| COMe Connector | PTN3460 | Description |
|----------------|---------|----------------------------------|
| LVDS_A* | LVS*O | Pin order according to COMe spec |
| LVDS_B* | LVS*E | |
| LVDS_I2C_CK | - | connected to I2C_INT module bus |
| LVDS_I2C_DAT | - | connected to I2C_INT module bus |
| LVDS_VDD_EN | PVCCEN | |
| LVDS_BKLT_EN | BKLTEN | |
| LVDS_BKLT_CTRL | - | connected to EDP_BKLTCTL at SoC |

2.3.6.4. eDP

eDP is only available as option which bypasses the eDP2LVDS bridge.

Table 16: eDP

| COMe Connector | SoC |
|----------------|-------------|
| LVDS_A_CK | EDP_TX3 |
| LVDS_A2 | EDP_TX0 |
| LVDS_A1 | EDP_TX1 |
| LVDS_A0 | EDP_TX2 |
| LVDS_I2C_CK | EDP_AUX+ |
| LVDS_I2C_DAT | EDP_AUX- |
| EDP_HPD | EDP_HPD |
| LVDS_VDD_EN | EDP_VDDEN |
| LVDS_BKLT_EN | EDP_BKLTEN |
| LVDS_BKLT_CTRL | EDP_BKLTCTL |

2.3.7. HD Audio

The HD Audio (HDA) stream can be supported simultaneously on HDMI/DP.

Table 17: Audio

| COMe Connector | PCH |
|----------------|--------------|
| HDA_RST# | HDA_RST# |
| HDA_SYNC | HDA_SYNC |
| HDA_BITCLK | HDA_BCLK |
| HDA_SDOUT | HDA_SDO |
| HDA_SDIN[0:1] | HDA_SDI[0:1] |
| HDA_SDIN2 | NC |

2.3.8. LPC

Table 18: LPC

| COMe Connector | FPGA | PCH |
|----------------|---------------------------|-------------|
| LPC_AD[0:3] | LPC_LAD[0:3]_ESPI_IO[0:3] | LAD[0:3] |
| LPC_FRAME# | LPC_LFRAME#_ESPI_CS0# | LFRAME# |
| LPC_DRQ[0:1]# | - | - |
| LPC_SERIRQ | LPC_SERIRQ_ESPI_CS1# | SERIRQ |
| LPC_CLK | - | CLKOUT_LPC1 |
| - | CLKOUT_LPC0_ESPI_CLK | CLKOUT_LPC0 |

2.3.9. I2C Bus

Two I2C buses are generated by the FPGA's internal kCPLD block.

2.3.9.1. External user-accessible I2C (I2C_EXT)

Devices connected to the external I2C:

- ▶ Module Embedded EEPROM (JIDA EEPROM)
- ▶ Carrier EEPROM (optional)
- ▶ External RTC (optional)

The following addresses are reserved by Kontron and shall not be used otherwise:

Table 19: External user-accessible I2C (I2C_EXT)

| 8bit | 7bit | Description |
|------|------|--|
| A0h | 50h | Module Embedded EEPROM (On Module) |
| 64h | 32h | Dedicated I2C Realtime Clock (On Module – optional) |
| A0h | 57h | Carrier EEPROM (On Carrier – optional implemented by customer) |

2.3.9.2. Internal I2C (I2C_INT)

The second I2C bus is used for configuration of on-board devices only.

The following addresses are reserved by Kontron and shall not be used otherwise:

Table 20: Internal I2C (I2C_INT)

| 8bit | 7bit | Description |
|------|------|----------------------|
| C0h | 60h | LVDS bridge |
| A0h | 50h | external LVDS EEPROM |
| 40h | 20h | IMVP9 VR (optional) |

NOTICE

An external LVDS EEPROM can be connected to the LVDS-I2C Bus at pins A83 and A84.
Do not connect other devices this bus!

2.3.10. SMBus

SMBbus on COMe connector is shared with onboard devices, so special care must be taken while selecting addresses for carrier devices.

Reserved addresses are:

- ▶ A0h : DDR4 Channel A SPD EEPROM (SO-DIMM)
- ▶ A4h: DDR4 Channel B SPD EEPROM (memory down)
- ▶ 30h: DDR4 Channel A optional Temperature Sensor (SO-DIMM)
- ▶ 5Ch: Hardware Monitor

2.3.11. Wake Signals

Table 21: Wake Signals

| COMe Signal | PCH Pin | Description |
|-------------|---------|-----------------------------|
| WAKE0# | WAKE# | PCI Express wake signal |
| WAKE1# | GPP_C6 | General purpose wake signal |

2.3.12. Suspend Control

Table 22: Suspend Control

| COMe Signal | PCH Pin | Description |
|-----------------------|-----------------------|------------------------|
| SUS_STAT#/ESPI_RESET# | SUS_STAT#/ESPI_RESET# | |
| SUS_S3# | SLP_S3# | passed through FPGA/EC |
| SUS_S4# | SLP_S4# | |
| SUS_S5# | SLP_S5# | |

2.3.13. System Reset (SYS_RESET#)

Table 23: System Reset (SYS_RESET#)

| COMe Signal | PCH Pin | Description |
|-------------|-----------|--|
| SYS_RESET# | SYS_RESET | Input from carrier. Passed through FPGA/EC |

2.3.14. Carrier Board Reset (CB_RESET#)

Output to carrier. Derived from PLTRST# in FPGA/EC.

2.3.15. External BIOS ROM Support/SPI

The Boot SPI0 is routed to COMe connector. BOM option allows general purpose SPI (GSPI0) to be connected to COMe instead.

Table 24: External BIOS ROM Support

| COMe Signal | PCH Pin | Description |
|-------------|------------------------------------|---------------------------------|
| SPI_CS# | SPI0_CS0#/SPI0_CS1# or always high | SPI_CS# logic implemented in EC |
| SPI_MISO | SPI0_MISO | |
| SPI_MOSI | SPI0_MOSI | |
| SPI_POWER | - | connected to V_3V3_S5 |
| BIOS_DIS0# | | input to control SPI_CS# logic |
| BIOS_DIS1# | | input to control SPI_CS# logic |

COMe-cWL6 supports on-module and off-module boot from SPI. For additional safety, a second on-module SPI flash can be populated on the board. This also requires an adoption of the FPGA/EC code. Features as SAFS together with eSPI are under investigation and not supported.

Table 25: External BIOS ROM Support: On-module and Off-module boot from SPI

| BIOS_DIS1# | BIOS_DIS0# | MODULE_CS# | COME_CS# | BIOS entry | Description |
|------------|------------|------------|-----------|------------|---------------|
| 1 | 1 | SPIO_CS0# | '1' | Module | |
| 1 | 0 | SPIO_CS0# | '1' | (Module) | Not Supported |
| 0 | 1 | SPIO_CS1# | SPIO_CS0# | Carrier | |
| 0 | 0 | SPIO_CS0# | SPIO_CS1# | Module | |

2.3.16. Speaker Out (SPKR)

Table 26: Speaker Out (SPKR)

| COMe Signal | PCH Pin | Description |
|-------------|--------------|--------------------|
| SPKR | GPP_B14/SPKR | Speaker/Buzzer out |

2.3.17. Watchdog Timeout (WDT)

Table 27: Watchdog Timeout (WDT)

| COMe Signal | Description |
|-------------|------------------------|
| WDT | Generated from FPGA/EC |

2.3.18. General Purpose IOs

In addition to COMe spec, all GPIs can also be configured as output and all GPOs as inputs.

Table 28: General Purpose IOs

| COMe Signal | SDIO Function |
|-------------|---------------|
| GPI0 | DATA0 |
| GPI1 | DATA1 |
| GPI2 | DATA2 |
| GPI3 | DATA3 |
| GPO0 | CLK |
| GPO1 | CMD |
| GPO2 | WP |
| GPO3 | CD# |

2.3.19. Hardware Monitor (HWM)

Chip Nuvoton NCT7802Y, SM-Bus Adress: 5C. Used for measuring supply (VCC_12V, VCC_5V_SBY) and RTC Battery (VCC_RTC) voltage. Used for manual/temperature dependent control and RPM monitoring of on-module and external Fans (See chapter Onboard Fan Connector, chapter 2.3.21).

2.3.20. Trusted Platform Module (TPM)

Chip is Infineon SLB9670 (TPM 2.0), connected to BOOT SPI0. TPM_PP pin is connected to COMe TPM_PP pin.

2.3.21. Onboard Fan Connector

The analog output voltage on this connector is generated via a discrete linear voltage regulator from the PWM signal of the HWM. It is clipped at 12 V (+/- 10 %) across the whole input range of the module to prevent Fan damage at higher voltages.

The maximum supply current to the fan connected to the on-module fan connector is 350 mA if the input voltage is below 13.0 V and is further limited to 150 mA if the input voltage to the module is between 13.0 V and 20.0 V.

Table 29: Onboard Fan Connector

| Pin | Signal | Description |
|-----|--------------|-------------|
| 1 | FAN_TACH_IN# | |
| 2 | V_FAN | |
| 3 | GND | |
| 4 | V_FAN | |
| 5 | V_FAN | |

2.3.22. External Fan support

Table 30: External Fan Control

| COMe Signal | HWM Pin |
|-------------|---------|
| FAN_PWMOUT | FANCTL2 |
| FAN_TACHIN | FANIN2 |

2.3.23. General Purpose PCI Express 3.0

Table 31: General Purpose PCI Express 3.0

| COMe connector | PCH HSIO Function | Lane Config | | Intel RST/Optane |
|-------------------------|-------------------|-------------|----|------------------|
| PCIE0 | PCIE5 | x1 | x4 | NO |
| PCIE1 | PCIE6 | x1 | | |
| PCIE2 | PCIE7 | x1 | | |
| PCIE3 | PCIE8 | x1 | | |
| PCIE4 | PCIE10 | x1 | x4 | NO |
| PCIE5 (no GbE) | PCIE9 | x1 | | |
| PCIE6 (no SATA0) | PCIE11 | x1 | | |
| PCIE7 (no SATA1) | PCIE12 | x1 | | |
| PEG0 | PCIE13 | x1 | x4 | YES |
| PEG1 | PCIE14 | x1 | | |
| PEG2 (no NVME) | PCIE15 | x1 | | |
| PEG3 (no NVME/no SATA2) | PCIE16 | x1 | | |

2.3.24. Universal Serial Bus (USB)

For every USB 3.1 port, one USB2 and one USB31 lane has to be bonded. Therefore the number of available USB 2.0 ports decreases with every used 3.1 port. The SoC offers the following configurations:

- ▶ Up to 8x USB 2.0
- ▶ Up to 4x USB 3.1 with 10 Gbit/s

Table 32: USB

| COMe USB2 | COMe USB3 | PCH USB2 | PCH USB31 |
|-----------|-----------|----------|-----------|
| USB0 | USB_SS0 | USB2_1 | USB31_1 |
| USB1 | USB_SS1 | USB2_2 | USB31_2 |
| USB2 | USB_SS2 | USB2_3 | USB31_3 |
| USB3 | USB_SS3 | USB2_4 | USB31_4 |
| USB4 | - | USB2_5 | - |
| USB5 | - | USB2_6 | - |
| USB6 | - | USB2_7 | - |
| USB7 | - | USB2_8 | - |

NOTICE

Note: Intel starts counting USB Ports with 1 while COMe Specification starts counting with 0

Table 33: USB Overcurrent

| COMe connector | PCH |
|----------------|-----------|
| USB_OC_0_1# | USB2_OC0# |
| USB_OC_2_3# | USB2_OC1# |
| USB_OC_4_5# | USB2_OC2# |
| USB_OC_6_7# | USB2_OC3# |

2.3.25. SATA 3.0

The SATA high-speed storage interface supports two (optional: three) SATA Gen3 ports with transfer rates of up to 6 Gb/s.

Table 34: SATA

| COMe Port | PCH HSIO Function |
|-----------|-------------------|
| SATA0 | SATA0 |
| SATA1 | SATA1A |
| SATA2 | SATA2 (optional) |
| SATA3 | nc |

2.3.26. Ethernet

Intel I219LM Ethernet Connection (PHY only) connected to PCH HSIO Port 10 (PCIe #5).

Table 35: Ethernet

| | |
|----------------------------|--|
| Ethernet | 10 Base-T, 100 Base-TX and 1000 Base-T |
| Ethernet Controller | Intel® I219LM Ethernet Controller |

2.3.27. COMe Features

The following table lists the supported COM Express® features.

Table 36: COM Features

| | |
|----------------------|----------------------------------|
| SPI | Boot from an external SPI |
| LPC | Supported |
| UART | 2x UART (RX/TX) |
| LID Signals | Supported |
| Sleep Signals | Supported |
| Audio | HD Audio for external HDA codecs |
| SMBus | Supported |

2.3.28. Kontron Features

The following table lists the supported Kontron specific product features.

Table 37: Kontron Features

| | |
|--|--|
| External I2C Bus | Fast I2C, 100 KHz - 400 kHz, MultiMaster capable |
| Embedded API | KEAPI3 |
| Custom BIOS Settings/Flash Backup | Supported |
| Watchdog Support | Dual staged |
| External SIO | Supported on the base board |
| GPIO | 8x GPIO shared with SDIO, configurable in BIOS setup options |
| Rapid Shutdown | Not supported |

3/ Electrical Specification

3.1. Power Supply Voltage Specifications

The COMe-cWL6 supports operation in both single supply power supply mode and ATX power supply mode.



Industrial temperature grade modules are validated for 12 V power supply only.
Commercial temperature grade modules support the wide range 8.5 V to 20 V power supply.

The following table lists the power supply specifications.

| | |
|----------------------------|-----------------|
| Supply Voltage Range (VCC) | 8.5 V to 20 V |
| Supply Voltage (VCC) | 12 V |
| Standby Voltage | 5 V \pm 5% |
| RTC | 2.8 V to 3.47 V |



5 V Standby voltage is not mandatory for operation.

3.1.1. Power Supply Rise Time

The input voltage rise time is 0.1 ms to 20 ms from input voltage $\leq 10\%$ to nominal VCC. To comply with the ATX specification there must be a smooth and continuous ramp of each DC input voltage from 10% to 90% of the DC input voltage final set point.

3.1.2. Power Supply Voltage Ripple

The maximum power supply voltage ripple is 100 mV peak-to-peak at 0 MHz – 20 MHz.

3.2. Power Management

Power management options are available within the BIOS setup.

| | |
|--------------------------------|------------------------------|
| ACPI Settings | ACPI 6.0 |
| Miscellaneous Power Management | Supported in BIOS setup menu |

Within the BIOS setup, If VCC power is removed, 5 V $\pm 5\%$ can be applied to the V_5V_STBY pins to support the following suspend-states:

- ▶ Suspend to RAM (S3)
- ▶ Suspend-to-disk/Hibernate (S4)
- ▶ Soft-off state (S5)

The Wake-Up event (S0) requires VCC power, as the board is running.

3.3. Power Supply Control Settings

The power Supply control settings are set in the BIOS and enable the module to shut down, rest and wake from standby properly.

The following table lists the implemented power supply control settings.

Table 38: Power Supply Control Settings

| | | |
|----------------------------------|---------|---|
| Power Button (PWRBTN#) | Pin B12 | To start the module using the power button, the PWRBTN# signal must be at least 50 ms ($50 \text{ ms} \leq t < 4 \text{ s}$, typical 400 ms) at low level (Power Button Event). Pressing the power button for at least four seconds turns off power to the module (Power Button Override). |
| Power Good (PWR_OK) | Pin B24 | PWR_OK is internally pulled up to 3.3 V and must be at the high level to power on the module. This can be driven low to hold the module from powering up as long as needed. The carrier needs to release the signal when ready. Low level prevents the module from entering the S0 state. A falling edge during S0 will cause a direct switch to S5 (Power Failure). |
| Reset Button (SYS_RESET#) | Pin B49 | When the SYS_RESET# pin is detected active (falling edge triggered), it allows the processor to perform a "graceful" reset, by waiting up to 25 ms for the SMBus to go idle before forcing a reset, even though activity is still occurring. Once the reset is asserted, it remains asserted for 5 ms to 6 ms regardless of whether the SYS_RESET# input remains asserted or not. |
| SM-Bus Alert (SMB_ALERT#) | Pin B15 | With an external battery manager present and SMB_ALERT #connected, the module always powers on even if the BIOS switch "After Power Fail" is set to "Stay Off". |

3.4. Power Supply Modes

Setting the power supply controls enables the COMe-cWL6 to operating in either ATX power mode or in single power supply mode.

3.4.1. ATX Mode

To start the module in ATX mode and power VCC, follow the steps below.

1. Connect the ATX PSU with VCC and 5 VSB to set PWR_OK to low and VCC to 0 V.
2. Press the power button to set the PWR_OK to high and power VCC.

The PS_ON# signal, generated by SUS_S3# (A15), indicates that the system is in the Suspend to RAM state. An inverted copy of SUS_S3# on the carrier board may be used to enable non-standby power on a typical ATX supply. The input voltage must always be higher than 5 V standby ($VCC > 5 \text{ VSB}$) for Computer-On-Modules supporting a wide input voltage range down to 8.5 V.

Table 39: ATX mode settings

| State | PWRBTN# | PWR_OK | V5_StdBy | PS_ON# | VCC |
|---------|--------------|------------|----------|------------|-----------|
| G3 | x | x | 0V | x | 0 V |
| S5 | high | low | 5V | high | 0 V |
| S5 → S0 | PWRBTN Event | low → high | 5V | high → low | 0 V → VCC |
| S0 | high | high | 5V | low | VCC |

x – Signals are not relevant for the specific power state. It makes no difference if the signal is connected or open.

3.5. Single Supply Mode

In single supply mode, without 5 V standby, the module starts automatically if VCC power is connected and Power Good input is open or at the high level (internal pull up (PU) to 3.3 V).

PS_ON# is not used in single supply mode and the input voltage VCC range can be 8.5 V to 20 V.

To power on the module from S5 state, press the power button or reconnect VCC. Suspend/Standby states are not supported in single supply mode.

Table 40: Single Supply Mode Settings

| State | PWRBTN# | PWR_OK | V5_StdBy | VCC |
|---------|--------------|-----------|----------|------------------|
| G3 | x/0 V | x/0 V | x/0 V | 0 V |
| G3 → S0 | high | open/high | open | connecting VCC |
| S5 | high | open/high | open | VCC |
| S5 → S0 | PWRBTN Event | open/high | open | reconnecting VCC |

x – Signals are not relevant for the specific power state. It makes no difference if the signal is connected or open.



All ground pins must be connected to the carrier board's ground plane.

NOTICE

If any of the supply voltages drops below the allowed operating level longer than the specified hold-up time, all the supply voltages should be shut down and left OFF for a time long enough to allow the internal board voltages to discharge sufficiently.

If the OFF time is not observed, parts of the board or attached peripherals may work incorrectly or even suffer a reduction of MTBF.

The minimum OFF time depends on the implemented PSU model and other electrical factors and needs to be measured individually for each case.

4/ Thermal Management

4.1. Heatspreader and Active or Passive Cooling Solutions

A heatspreader plate assembly is available from Kontron for the COMe-cWL6. The heatspreader plate assembly is NOT a heat sink. The heatspreader works as a COM Express® standard thermal interface to be use with a heat sink or external cooling devices.

External cooling must be provided to maintain the heatspreader plate at proper operating temperatures. Under worst-case conditions, the cooling mechanism must maintain an ambient air and heatspreader plate temperature on any spot of the heatspreader's surface according to the module specifications:

- ▶ 60°C for commercial temperature grade modules
- ▶ 75°C for extended temperature grade modules (E1)
- ▶ 85°C for industrial temperature grade modules by screening (E2S)

4.2. Active or Passive Cooling Solutions

Both active and passive thermal management approaches can be used with heatspreader plates. The optimum cooling solution varies, depending on the COM Express® application and environmental conditions. Active or passive cooling solutions provided from Kontron for the COMe-cWL6 are usually designed to cover the power and thermal dissipation for a commercial temperature range used in housing with proper airflow.

4.3. Operating with Kontron Heatspreader Plate (HSP) Assembly

The operating temperature defines two requirements:

- ▶ Maximum ambient temperature with ambient being the air surrounding the module
- ▶ Maximum measurable temperature on any spot on the heatspreader's surface

The heatspreader is tested for the following temperature specifications.

Table 41: Heatspreader Test Temperature Specifications

| Temperature Specification | Validation Requirements |
|-------------------------------------|---|
| Commercial Grade | at 60°C HSP temperature the CPU @ 100% load needs to run at nominal frequency |
| Extended Grade (E1) | at 75°C HSP temperature the CPU @ 75% load is allowed to start speedstepping for thermal protection |
| Industrial Grade by screening (E2S) | at 85°C HSP temperature the CPU @ 50% load is allowed to start throttling for thermal protection |

4.4. Operating without Kontron Heatspreader Plate (HSP) Assembly

The operating temperature is the maximum measurable temperature on any spot on the module's surface.

5/ Environmental Specification

The COMe-cWL6 complies with the following standards and certifications. For more information, contact Kontron Support.

Table 42: Standards and Certification Compliance

| Standard | Definition |
|---------------------------------|---|
| Operating Temperature | 0°C to 60°C (for COMe-cWL6 variants) -25°C to 75°C (by qualification for COMe-cWL6 E1 variants) -40°C to 85°C (by design for COMe-cWL6 E2 variants) (PCB and components should selected and designed accordingly) |
| Storage Temperature | -30°C to 85°C (for COMe- cWL6 (E1) variants) -40°C to 85°C (for COMe- cWL6 E2 variants) |
| Humidity | 93% relative Humidity at 40°C, non-condensing (acc. to IEC 60068-2-78) |
| Emission (EMC) | According to EN55022 (Class B), EN61000-6-2 and EN61000-6-4 |
| Immunity (EMI) | IEC/EN 61000-6-2: Electromagnetic compatibility (EMC) – Part 6-2: Generic standards - immunity for industrial environments Immunity tests: IEC/EN 61000-4-2 - Electrostatic discharge immunity (ESD) IEC/EN 61000-4-3 – Radiated, radio frequency, electromagnetic field immunity IEC/EN 61000-4-4 - Electrical fast transient/burst immunity IEC/EN 61000-4-5 - Surge immunity IEC/EN 61000-4-6 - Immunity to conducted disturbances, induced by radio frequency fields IEC/EN 61000-4-8 - Power frequency magnetic field Immunity IEC/EN 61000-4-11 - Voltage dips, short interruptions, & voltage variation immunity |
| Safety/CE | EN 62368-1:2014 Safety for audio/video and information technology equipment |
| UL | UL 60950-1/CSA 60950-1 Component Recognition Recognized by Underwriters Laboratories Inc. Representative samples of this component have been evaluated by UL and meet applicable UL requirements. UL listings: AZOT2.E147705 AZOT8.E147705 |
| WEEE | WEEE compliant (Directive 2012/19/EU) |
| REACH | REACH compliant (Regulation (EC) No 1907/2006) |
| Shock | IEC/EN 60068-2-27 Non-operating shock – (half-sinusoidal, 11 ms, 15 g) |
| Vibration | IEC/EN 60068-2-6 Non-operating vibration – (sinusoidal, 10 Hz – 4000 Hz, +/- 0.15 mm, 2 g) |
| Theoretical MTBF [hours] | COMe-cWL6 i7-8665UE: 565206 h @ 40°C COMe-cWL6 E2S i3-8145UE: 620436 h @ 40°C |
| RoHS II | Compliant with the directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment. |

5.1. MTBF

The following MTBF (Mean Time Before Failure) values were calculated using a combination of manufacturer’s test data, if the data was available, and the Telcordia (Bellcore) issue 2 calculation for the remaining parts.

The Telcordia calculation used is "Method 1 Case 3" in a ground benign, controlled environment (GB,GC). This particular method takes into account varying temperature and stress data and the system is assumed to have not been burned in.

The figures below shows MTBF de-rating for the different temperature range in an office or telecommunications environment. Other environmental stresses (such as extreme altitude, vibration, salt-water exposure) lower MTBF values.

Figure 6: System MTBF (hours) = 565206 h @ 40°C (Reliability report article number 36028-1610-17-7)

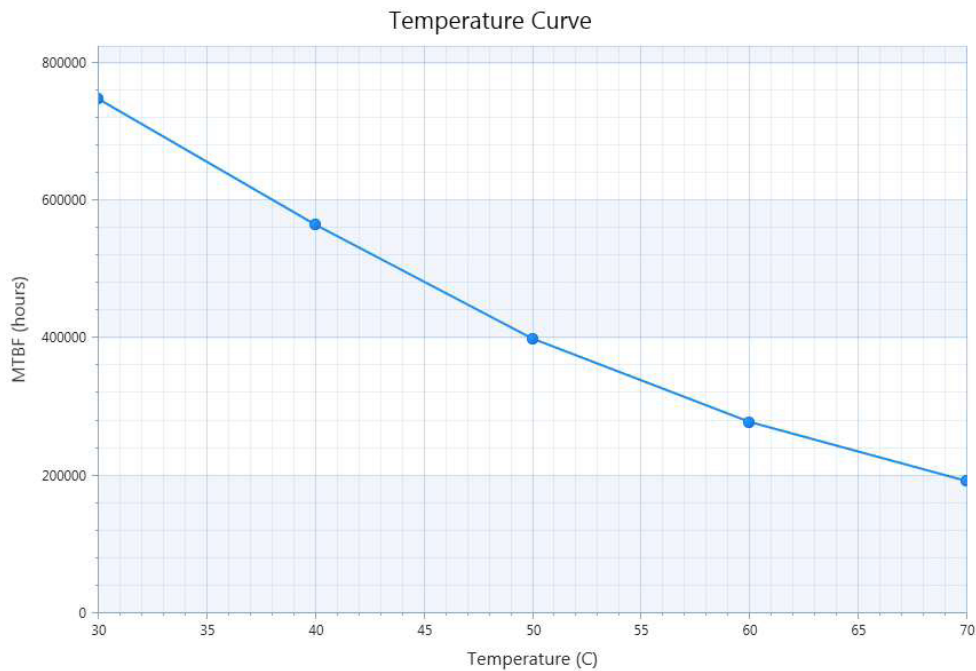
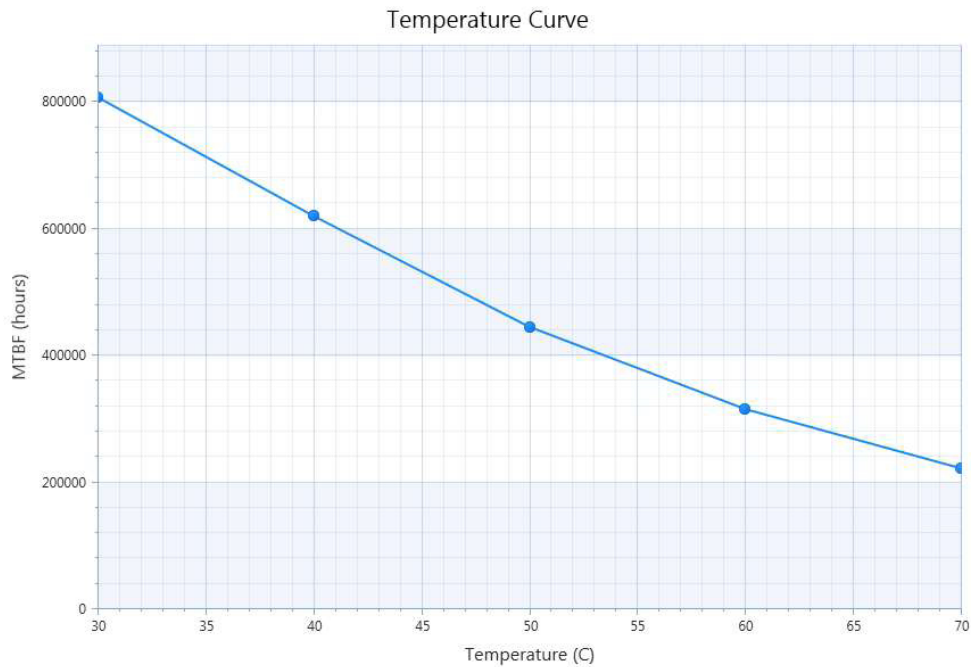


Figure 7: System MTBF (hours) = 620436 h @ 40°C (Reliability report article number 36029-0000-22-3)



The above estimates assume no fan, but a passive heat sinking arrangement. Estimated RTC battery life (as opposed to battery failures) is not accounted for in the above figure and needs to be considered separately. Battery life depends on both temperature and operating conditions. When the Kontron unit has external power, the only battery drain is from leakage paths.

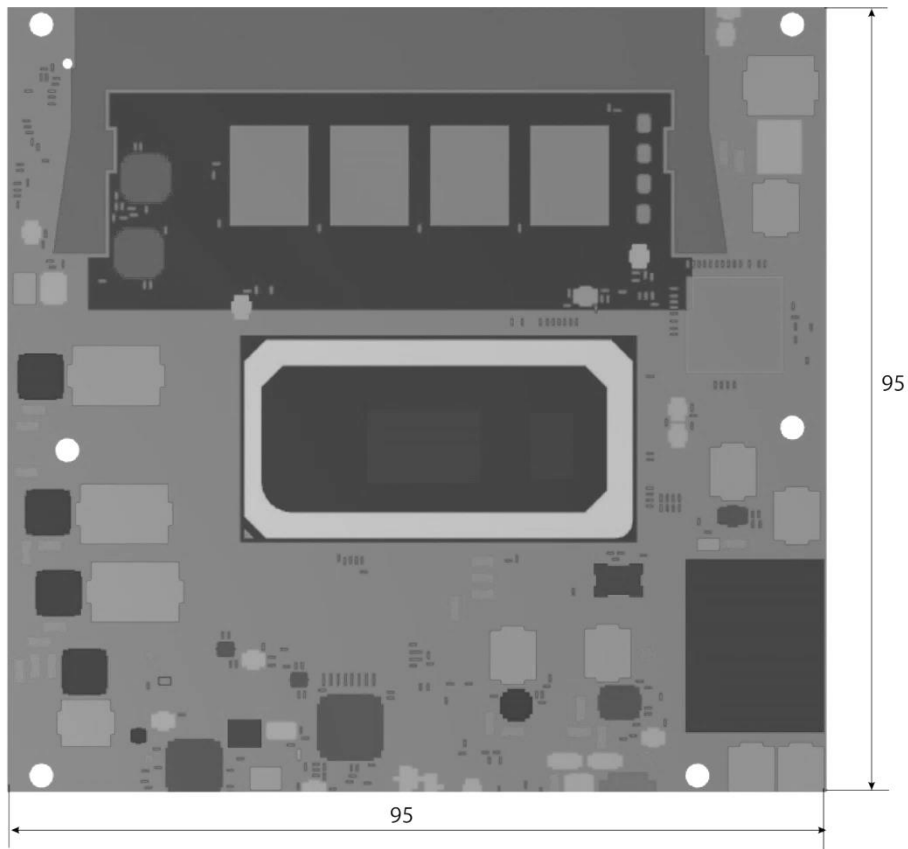
6/ Mechanical Specification

6.1. Dimensions

The dimensions of the module are:

95.0 mm x 95.0 mm (3.75 " x 3.75 ")

Figure 8: Module Dimensions



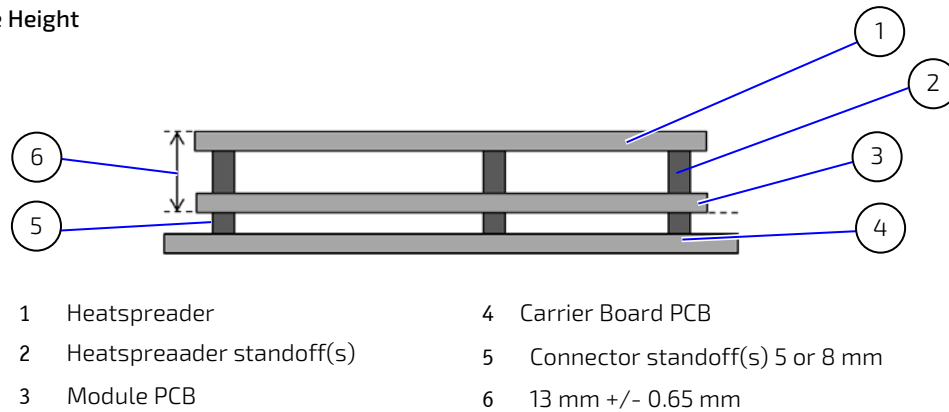
*All dimensions shown in mm.

6.2. Height

The height of the module depends on the height of the implemented cooling solution. The height of the cooling solution is not specified in the COM Express® specification.

The COM Express® specification defines a module height of approximately 13 mm from module PCB bottom to heatspreader top, as shown in Figure 9: Module Height below.

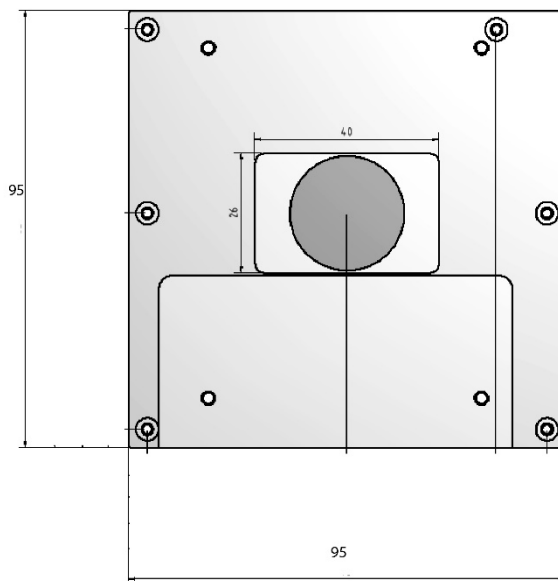
Figure 9: Module Height



6.3. Heatspreader Dimension

The following figure shows the heatspreader's dimensions and location on the module.

Figure 10: Heatspreader Location and Dimensions



*All dimensions shown in mm.

7/ Features and Interfaces

7.1. LPC

The Low Pin Count (LPC) interface signals are connected to the LPC bus bridge located in the CPU or chipset. The LPC low speed interface can be used for peripheral circuits such as an external Super I/O controller that typically combines legacy-device support into a single IC. The implementation of this subsystem complies with the COM Express® specification. The COM Express® Design Guide maintained by PICMG provides implementation information or refer to the official PICMG documentation for more information.

The LPC bus does not support DMA (Direct Memory Access). When more than one device is used on LPC, a zero delay clock buffer is required. This leads to limitations for ISA bus and SIO (standard I/O(s) like floppy or LPT interfaces) implementations.

All Kontron COM Express® Computer-On-Modules imply BIOS support for the following external baseboard LPC Super I/O controller features for the Winbond/Nuvoton 3.3V 83627DHG-P.

Table 43: Supported BIOS Features

| Winbond/Nuvoton 3.3V 83627DHG-P | AMI EFI APTIO V |
|---------------------------------|-----------------|
| PS/2 | Not supported |
| COM1/COM2 | Supported |
| LPT | Not supported |
| HWM | Not supported |
| Floppy | Not supported |
| GPIO | Not supported |

Features marked as not supported do not exclude OS support (e.g., HWM is accessible via SMB). If any other LPC Super I/O additional BIOS implementations are necessary then contact Kontron Support.

7.2. Serial Peripheral Interface (SPI)

The Serial Peripheral Interface Bus (SPI bus) is a synchronous serial data link standard. Devices communicate in master/slave mode, where the master device initiates the data frame. Multiple slave devices are allowed with individual slave select (chip select) lines. SPI is sometimes called a four-wire serial bus, contrasting with three, two and one-wire serial buses.



The SPI interface can only be used with a SPI flash device to boot from the external BIOS on the baseboard.

7.2.1. SPI Boot

The COMe-cWL6 supports boot from an external SPI Flash. Pin A34 (BIOS_DIS0#) and pin B88 (BIOS_DIS1#) configure the SPI Flash as follows:

Table 44: SPI Boot Pin Configuration

| Configuration | BIOS_DIS0# | BIOS_DIS1# | Function |
|---------------|------------|------------|-----------------------|
| 1 | open | open | Boot on module BIOS |
| 2 | GND | open | Not supported |
| 3 | open | GND | Boot on baseboard SPI |
| 4 | GND | GND | Not supported |



BIOS does not support being split between two chips. Booting takes place either from the module SPI or from the baseboard SPI.

Table 45: Supported SPI Boot Flash Types for 8-SOIC Package

| Size | Manufacturer | Part Number | Device ID |
|------|--------------|-------------|-----------|
| 8 MB | Macronix | MX25L6406E | 0x20 |

7.3. Fast I2C

Fast I2C supports transfer between components on the same board. The COMe-cWL6 features an onboard I2C controller connected to the LPC Bus.

The I2C controller supports:

- ▶ Multimaster transfers
- ▶ Clock stretching
- ▶ Collision detection
- ▶ Interruption on completion of an operation

7.4. UART

The UART implements an interface for serial communications and supports up to two serial RX/TX ports defined in the COM Express® specification on pins A98 (SER0_TX) /A99 (SER0_RX) for UART0 and pins A101 (SER1_TX)/A102 (SER1_RX) for UART1. The UART controller is fully 16550A compatible.

Features of the UART are:

- ▶ On-Chip bit rate (baud rate) generator
- ▶ No handshake lines
- ▶ Interrupt function to the host
- ▶ FIFO buffer for incoming and outgoing data

7.5. Dual Staged Watchdog Timer (WTD)

A watchdog timer or (computer operating properly (COP) timer) is a computer hardware or software timer. If there is a fault condition in the main program, the watchdog triggers a system reset or other corrective actions. The intention is to bring the system back from the non-responsive state to normal operation.

Possible fault conditions are a hang or neglecting to service the watchdog regularly. Such as writing a "service pulse" to it, also referred to as "kicking the dog", "petting the dog", "feeding the watchdog" or "triggering the watchdog").

The COMe-cWL6 offers a watchdog that works with two stages that can be programmed independently and used stage by stage.

Table 46: Dual Stage Watchdog Timer- Time-out Events

| Status | Events | Definition |
|--------|---------------------------|--|
| 0000b | No action | The stage is off and will be skipped. |
| 0001b | Reset | A reset restarts the module and starts a new POST and operating system. |
| 0010b | NMI | A non-maskable interrupt (NMI) is a computer processor interrupt that cannot be ignored by standard interrupt masking techniques in the system. It is used typically to signal attention for non-recoverable hardware errors. |
| 0011b | SMI | A system management interrupt (SMI) makes the processor entering the system management mode (SMM). As such, specific BIOS code handles the interrupt. The current BIOS handler for the watchdog SMI currently does nothing. For special requirements, contact Kontron Support. |
| 0100b | SCI | A system control interrupt (SCI) is a OS-visible interrupt to be handled by the OS using AML code. |
| 0101b | Delay -> No action* | Might be necessary when an operating system must be started and the time for the first trigger pulse must be extended. Only available in the first stage. |
| 1000b | WDT Only | This setting triggers the WDT pin on the baseboard connector (COM Express® pin B27) only. |
| 1001b | Reset + WDT | |
| 1010b | NMI + WDT | |
| 1011b | SMI + WDT | |
| 1100b | SCI + WDT | |
| 1101b | DELAY + WDT -> No action* | |

7.5.1. WDT Signal

Watchdog time-out event (pin B27) on COM Express® connector offers a signal that can be asserted when a watchdog timer has not been triggered with a set time. The WDT signal is configurable to any of the two stages. After reset, the signal is automatically deasserted. If deassertion is necessary during runtime, ask Kontron Support for further help.

7.6. Real Time Clock (RTC)

The RTC keeps track of the current time accurately. The RTC's low power consumption means that the RTC can be powered from an alternate source of power enabling the RTC to continue to keep time while the primary source of power is off or unavailable.

The RTC battery voltage range is 2.8 V to 3.47 V. A typical RTC voltage is 3 V with a current of >10 µA. If the module is powered by the mains supply the RTC voltage is generated by on-module regulators to reduce the RTC current draw.

7.7. GPIO

The eight GPIO pins support four inputs pins (A54 for GPIO, A63 for GPI1, A67 for GPI2 and A85 for GPI3) and four output pins (A93 for GPO0, B54 for GPO1, B57 for GPO2 and B63 for GPO3) by default. The four GPI [0-3] pins are pulled high with a pull-up resistor (e.g. 100 K ohms) and the four GPO [0-3] pins are pulled low with a pull-down resistor (e.g. 100 K ohms) on the module.

To change the default GPIO signal-state users are required to make BIOS and/or OS-driver changes, and additional hardware changes by adding external termination resistors on the carrier board to override the weak on-module pull-up resistors with a lower resistance pull-down (e.g. 10 K ohms), or pull-down resistors with a lower resistance pull-up (e.g. 10 K ohms).

7.8. Trusted Platform Module (TPM 2.0)

A Trusted Platform Module (TPM) stores RSA encryption keys specific to the host system for hardware authentication. The term TPM refers to the set of specifications applicable to TPM chips. The LPC bus connects the TPM chip to the CPU.

Each TPM chip contains an RSA key pair called the Endorsement Key (EK). The pair is maintained inside the chip and cannot be accessed by software. The Storage Root Key (SRK) is created when a user or administrator takes ownership of the system. This key pair is generated by the TPM based on the Endorsement Key and an owner-specified password.

A second key, called an Attestation Identity Key (AIK) protects the device against unauthorized firmware and software modification by hashing critical sections of firmware and software before they are executed. When the system attempts to connect to the network, the hashes are sent to a server that verifies that they match the expected values. If any of the hashed components have been modified since the last start, the match fails, and the system cannot gain entry to the network.

7.9. Kontron Security Solution

Kontron Security Solution is a combined hardware and software solution that includes an embedded hardware security module and a software framework to provide full protection for your application.

The COMe-cWL6 includes an integrated security module connected to USB2 port 9, supporting the following features:

- ▶ Copy protection
- ▶ IP protection
- ▶ License model enforcement
- ▶ If required customers can customize the solution to meet specific needs. For more information, contact Kontron Support.

8/ COMe Interface Connectors (X1A and X1B)

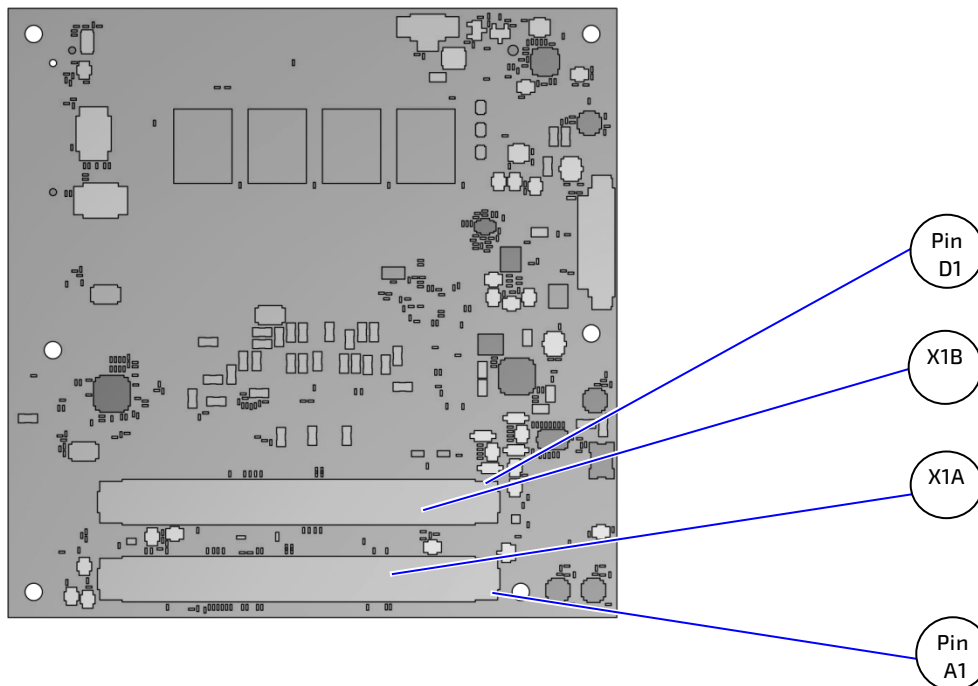
The COMe-cWL6 is a COM Express® compact module containing two 220-pin connectors; each with two rows called row A and B on the primary connector and row C and D on the secondary connector.

The following figure is a view from the bottom of the module showing the position of interface connectors X1A and X1B and the first pin of row A and row D.

8.1. X1A and X1B Signals

For a description of the terms used in the X1A and X1B pin assignment tables, see Table 47: General Signal Description or Appendix A, List of Acronyms. If a more detailed pin assignment description is required, refer to the PICMG specification COMe Rev 3.0 Type 6 standard.

Figure 11: X1A and X1B COMe Interface Connectors



The information provided under type, module terminations and comments is complimentary to the COM.0 Rev 3.0 Type 6 standard. For more information, contact Kontron Support.

Table 47: General Signal Description

| Type | Description | Type | Description |
|---------|--|---------|--------------------------------|
| NC | Not Connected (on this product) | O-1,8 | 1.8 V Output |
| I/O-3,3 | Bi-directional 3.3 V I/O-Signal | O-3,3 | 3.3 V Output |
| I/O-5T | Bi-dir. 3.3 V I/O (5 V Tolerance) | O-5 | 5 V Output |
| I/O-5 | Bi-directional 5V I/O-Signal | DP-I/O | Differential Pair Input/Output |
| I-3,3 | 3.3 V Input | DP-I | Differential Pair Input |
| I/OD | Bi-directional Input/Output Open Drain | DP-O | Differential Pair Output |
| I-5T | 3.3 V Input (5 V tolerance) | PU | Pull-Up Resistor |
| OA | Output Analog | PWR | Power Connection |
| OD | Output Open Drain | + and - | Differential Pair |

NOTICE

To protect external power lines of peripheral devices, make sure that: the wires have the right diameter to withstand the maximum available current.

The enclosure of the peripheral device fulfills the fire-protection requirements of IEC/EN60950.

8.2. X1A and X1B Pin Assignment

For more information regarding the pin assignment of connector X1A (Row A and Row B) and connector X1B (Row C and Row D), see the pin assignment tables:

1. Table 48: Connector X1A Row A Pin Assignment (A1- A110)
2. Table 49: Connector X1A Row B Pin Assignment (B1-B110)
3. Table 50: Connector X1B Row C Pin Assignment (C1-C110)
4. Table 51: Connector X1B Row D Pin Assignment (D1-D110)

8.2.1. Connector X1A Row A1 – A110

Table 48: Connector X1A Row A Pin Assignment (A1- A110)

| Pin | Signal | Description | Type | Termination | Comment |
|-----|----------------|--|---------|------------------|--|
| A1 | GND | Power Ground | PWR GND | --- | --- |
| A2 | GBE0_MDI3- | Ethernet Media Dependent Interface 3 - | DP-I/O | --- | --- |
| A3 | GBE0_MDI3+ | Ethernet Media Dependent Interface 3 + | DP-I/O | --- | --- |
| A4 | GBE0_LINK100# | Ethernet Speed LED | OD | --- | --- |
| A5 | GBE0_LINK1000# | Ethernet Speed LED | OD | --- | --- |
| A6 | GBE0_MDI2- | Ethernet Media Dependent Interface 2 - | DP-I/O | --- | --- |
| A7 | GBE0_MDI2+ | Ethernet Media Dependent Interface 2 + | DP-I/O | --- | --- |
| A8 | GBE0_LINK# | LAN Link LED | OD | --- | --- |
| A9 | GBE0_MDI1- | Ethernet Media Dependent Interface 1 - | DP-I/O | --- | --- |
| A10 | GBE0_MDI1+ | Ethernet Media Dependent Interface 1 + | DP-I/O | --- | --- |
| A11 | GND | Power Ground | PWR GND | --- | --- |
| A12 | GBE0_MDI0- | Ethernet Media Dependent Interface 0 - | DP-I/O | --- | --- |
| A13 | GBE0_MDI0+ | Ethernet Media Dependent Interface 0 + | DP-I/O | --- | --- |
| A14 | GBE0_CTREF | Center Tab Reference Voltage | 0 | --- | 1 μ F capacitor to GND |
| A15 | SUS_S3# | Suspend To RAM (or deeper) Indicator | 0-3.3 | PD 10k | --- |
| A16 | SATA0_TX+ | SATA Transmit Pair 0 + | DP-0 | --- | --- |
| A17 | SATA0_TX- | SATA Transmit Pair 0 - | DP-0 | --- | --- |
| A18 | SUS_S4# | Suspend To Disk (or deeper) Indicator | 0-3.3 | PD 10k | --- |
| A19 | SATA0_RX+ | SATA Receive Pair 0 + | DP-I | --- | --- |
| A20 | SATA0_RX- | SATA Receive Pair 0 - | DP-I | --- | --- |
| A21 | GND | Power Ground | PWR GND | --- | --- |
| A22 | SATA2_TX+ | SATA Transmit Pair 2 + | DP-0 | --- | --- |
| A23 | SATA2_TX- | SATA Transmit Pair 2 - | DP-0 | --- | --- |
| A24 | SUS_S5# | Soft Off Indicator | 0-3.3 | --- | --- |
| A25 | SATA2_RX+ | SATA Receive Pair 2 + | DP-I | --- | --- |
| A26 | SATA2_RX- | SATA Receive Pair 2 - | DP-I | --- | --- |
| A27 | BATLOW# | Battery Low | I-3.3 | PU 10k 3.3V (S5) | assertion will prevent wake from S3-S5 state |
| A28 | (S)ATA_ACT# | Serial ATA activity LED | OD-3.3 | PU 10k 3.3V (S0) | can sink 15mA |

| Pin | Signal | Description | Type | Termination | Comment |
|-----|----------------------|--|----------------|---------------------------|--|
| A29 | HDA_SYNC | HD Audio Sync | 0-3.3 | PD 20k in PCH | --- |
| A30 | HDA_RST# | HD Audio Reset | 0-3.3 | PD 20k in PCH | --- |
| A31 | GND | Power Ground | PWR GND | --- | --- |
| A32 | HDA_CLK | HD Audio Bit Clock Output | 0-3.3 | PD 20k in PCH | --- |
| A33 | HDA_SDOOUT | HD Audio Serial Data Out | 0-3.3 | PD 20k in PCH | --- |
| A34 | BIOS_DISO#/ESPI_SAFS | BIOS Selection Strap 0 | I-3.3 | PU 10k 3.3V (S5) | --- |
| A35 | THRMTRIP# | Thermal Trip | 0-3.3 | PU 10k 3.3V (S0) | Thermal Trip Event, transition to S5 indicator |
| A36 | USB6- | USB 2.0 Data Pair Port 6 - | DP-I/O | PD 14.25k to 24.8k in PCH | --- |
| A37 | USB6+ | USB 2.0 Data Pair Port 6 + | DP-I/O | PD 14.25k to 24.8k in PCH | --- |
| A38 | USB_6_7_OC# | USB Overcurrent Indicator Port 6/7 | I-3.3 | PU 10k 3.3V (S5) | --- |
| A39 | USB4- | USB 2.0 Data Pair Port 4 - | DP-I/O | PD 14.25k to 24.8k in PCH | --- |
| A40 | USB4+ | USB 2.0 Data Pair Port 4 + | DP-I/O | PD 14.25k to 24.8k in PCH | --- |
| A41 | GND | Power Ground | PWR GND | --- | --- |
| A42 | USB2- | USB 2.0 Data Pair Port 2 - | DP-I/O | PD 14.25k to 24.8k in PCH | --- |
| A43 | USB2+ | USB 2.0 Data Pair Port 2 + | DP-I/O | PD 14.25k to 24.8k in PCH | --- |
| A44 | USB_2_3_OC# | USB Overcurrent Indicator Port 2/3 | I-3.3 | PU 10k 3.3V (S5) | --- |
| A45 | USB0- | USB 2.0 Data Pair Port 0 - | DP-I/O | PD 14.25k to 24.8k in PCH | --- |
| A46 | USB0+ | USB 2.0 Data Pair Port 0 + | DP-I/O | PD 14.25k to 24.8k in PCH | --- |
| A47 | VCC_RTC | Real-Time Clock Circuit Power Input | PWR 3V | --- | voltage range 2.8-3.47V |
| A48 | RSVD | Reserved for future use | nc | --- | --- |
| A49 | GBE0_SDP | Gigabit Ethernet Controller 0 Software-Definable Pin | I/O-3.3 | --- | --- |
| A50 | LPC_SERIRQ/ESPI_CS1# | Serial Interrupt Request/eSPI Master Chip Select 1 | I/OD-3.3/O-1,8 | PU 8k2 3.3V (S0) | --- |
| A51 | GND | Power Ground | PWR GND | --- | --- |
| A52 | PCIE_TX5+ | PCI Express Lane 5 Transmit + | DP-0 | --- | --- |
| A53 | PCIE_TX5- | PCI Express Lane 5 Transmit - | DP-0 | --- | --- |
| A54 | GPIO | General Purpose Input 0 | I-3.3 | PU 100k 3.3V (S0) | --- |

| Pin | Signal | Description | Type | Termination | Comment |
|-----|--------------|---|---------|-------------------|-----------------|
| A55 | PCIE_TX4+ | PCI Express Lane 4 Transmit + | DP-0 | --- | --- |
| A56 | PCIE_TX4- | PCI Express Lane 4 Transmit - | DP-0 | --- | --- |
| A57 | GND | Power Ground | PWR GND | --- | --- |
| A58 | PCIE_TX3+ | PCI Express Lane 3 Transmit + | DP-0 | --- | --- |
| A59 | PCIE_TX3- | PCI Express Lane 3 Transmit - | DP-0 | --- | --- |
| A60 | GND | Power Ground | PWR GND | --- | --- |
| A61 | PCIE_TX2+ | PCI Express Lane 2 Transmit + | DP-0 | --- | --- |
| A62 | PCIE_TX2- | PCI Express Lane 2 Transmit - | DP-0 | --- | --- |
| A63 | GPI1 | General Purpose Input 1 | I-3.3 | PU 100k 3.3V (S0) | --- |
| A64 | PCIE_TX1+ | PCI Express Lane 1 Transmit + | DP-0 | --- | --- |
| A65 | PCIE_TX1- | PCI Express Lane 1 Transmit - | DP-0 | --- | --- |
| A66 | GND | Power Ground | PWR GND | --- | --- |
| A67 | GPI2 | General Purpose Input 2 | I-3.3 | PU 100k 3.3V (S0) | --- |
| A68 | PCIE_TX0+ | PCI Express Lane 0 Transmit + | DP-0 | --- | --- |
| A69 | PCIE_TX0- | PCI Express Lane 0 Transmit - | DP-0 | --- | --- |
| A70 | GND | Power Ground | PWR GND | --- | --- |
| A71 | LVDS_A0+ | LVDS Channel A DAT0+/EDP Lane 2 Transmit + | DP-0 | --- | --- |
| A72 | LVDS_A0- | LVDS Channel A DAT0-/EDP Lane 2 Transmit - | DP-0 | --- | --- |
| A73 | LVDS_A1+ | LVDS Channel A DAT1+/EDP Lane 1 Transmit + | DP-0 | --- | --- |
| A74 | LVDS_A1- | LVDS Channel A DAT1-/EDP Lane 1 Transmit - | DP-0 | --- | --- |
| A75 | LVDS_A2+ | LVDS Channel A DAT2+/EDP Lane 0 Transmit + | DP-0 | --- | --- |
| A76 | LVDS_A2- | LVDS Channel A DAT2-/EDP Lane 0 Transmit - | DP-0 | --- | --- |
| A77 | LVDS_VDD_EN | LVDS/EDP Panel Power Control | O-3.3 | PD 100k | --- |
| A78 | LVDS_A3+ | LVDS Channel A DAT3+ | DP-0 | --- | --- |
| A79 | LVDS_A3- | LVDS Channel A DAT3- | DP-0 | --- | --- |
| A80 | GND | Power Ground | PWR GND | --- | --- |
| A81 | LVDS_A_CK+ | LVDS Channel A Clock+/EDP Lane 3 Transmit + | DP-0 | --- | Clock: 20-80MHz |
| A82 | LVDS_A_CK- | LVDS Channel A Clock-/EDP Lane 3 Transmit - | DP-0 | --- | Clock: 20-80MHz |
| A83 | LVDS_I2C_CK | LVDS I2C Clock (DDC)/EDP AUX + | I/O-3.3 | PU 2k2 3.3V (S0) | --- |
| A84 | LVDS_I2C_DAT | LVDS I2C Data (DDC)/EDP AUX - | I/O-3.3 | PU 2k2 3.3V (S0) | --- |
| A85 | GPI3 | General Purpose Input 3 | I-3.3 | PU 100k 3.3V (S0) | --- |
| A86 | RSVD | Reserved for future use | nc | --- | --- |

| Pin | Signal | Description | Type | Termination | Comment |
|------|---------------|--|---------|-----------------------------|---|
| A87 | eDP_HPD | EDP Hot Plug Detect | I-3.3 | PD 400k LVDS/100k EDP | --- |
| A88 | PCIE_CLK_REF+ | Reference PCI Express Clock + | DP-0 | --- | 100MHz |
| A89 | PCIE_CLK_REF- | Reference PCI Express Clock - | DP-0 | --- | 100MHz |
| A90 | GND | Power Ground | PWR GND | --- | --- |
| A91 | SPI_POWER | 3.3V Power Output Pin for external SPI flash | O-3.3 | --- | 100mA (max.) |
| A92 | SPI_MISO | SPI Master IN Slave OUT | I-3.3 | PU 15k-40k in PCH (S5) | All SPI signals are tri-stated until reset is deasserted |
| A93 | GPO0 | General Purpose Output 0 | O-3.3 | PD 100k | --- |
| A94 | SPI_CLK | SPI Clock | O-3.3 | PU 15k-40k in PCH (S5) | All SPI signals are tri-stated with 20k ohm CPU internal weak pull-up until reset is deasserted |
| A95 | SPI_MOSI | SPI Master Out Slave In | O-3.3 | PU 15k-40k in PCH (S5) | All SPI signals are tri-stated with 20k ohm CPU internal weak pull-up until reset is deasserted |
| A96 | TPM_PP | TPM Physical Presence | I-3.3 | PD 10k | TPM does not use this functionality |
| A97 | TYPE10# | Indicates TYPE10# to carrier board | nc | --- | --- |
| A98 | SER0_TX | Serial Port 0 TXD | O-3.3 | --- | 20V protection circuit implemented on module, PD on carrier board needed for proper operation |
| A99 | SER0_RX | Serial Port 0 RXD | I-5T | PU 47k 3.3V (S0) | 20V protection circuit implemented on module |
| A100 | GND | Power Ground | PWR GND | --- | --- |
| A101 | SER1_TX | Serial Port 1 TXD | O-3.3 | --- | 20V protection circuit implemented on module, PD on carrier board needed for proper operation |

| Pin | Signal | Description | Type | Termination | Comment |
|------|---------|-------------------------------|--------------|------------------|--|
| A102 | SER1_RX | Serial Port 1 RXD | I-5T | PU 47k 3.3V (S0) | 20V protection circuit implemented on module |
| A103 | LID# | LID Switch Input | I-3.3 | PU 47k 3.3V (S5) | 20V protection circuit implemented on module |
| A104 | VCC_12V | Main Input Voltage (4.75-20V) | PWR 4.75-20V | --- | --- |
| A105 | VCC_12V | Main Input Voltage (4.75-20V) | PWR 4.75-20V | --- | --- |
| A106 | VCC_12V | Main Input Voltage (4.75-20V) | PWR 4.75-20V | --- | --- |
| A107 | VCC_12V | Main Input Voltage (4.75-20V) | PWR 4.75-20V | --- | --- |
| A108 | VCC_12V | Main Input Voltage (4.75-20V) | PWR 4.75-20V | --- | --- |
| A109 | VCC_12V | Main Input Voltage (4.75-20V) | PWR 4.75-20V | --- | --- |
| A110 | GND | Power Ground | PWR GND | --- | --- |

+ and - Differential pair differentiator

8.2.2. Connector X1A Row B 1 - B 110

Table 49: Connector X1A Row B Pin Assignment (B1-B110)

| Pin | Signal | Description | Type | Termination | Comment |
|-----|----------------------------|---|------------------------------|-----------------------------|---|
| B1 | GND | Power Ground | PWR GND | --- | --- |
| B2 | GBE0_ACT# | Ethernet Activity LED | OD | --- | --- |
| B3 | LPC_FRAME#/ ESPI_CS0 | LPC Frame Indicator/eSPI Master Chip Select 0 | 0-3.3/eSPI 0- 1.8 | --- | --- |
| B4 | LPC_AD0/ ESPI_IO_0 | LPC Multiplexed Command, Address & Data 0/eSPI Master Data I/O 0 | I/O- 3.3/eSPI I/O- 1.8 | PU 15k-40k in PCH (S5) | --- |
| B5 | LPC_AD1/ ESPI_IO_1 | LPC Multiplexed Command, Address & Data 1/eSPI Master Data I/O 1 | I/O-3. 3/eSPI I/O- 1.8 | PU 15k-40k in PCH (S5) | --- |
| B6 | LPC_AD2/ ESPI_IO_2 | LPC Multiplexed Command, Address & Data 2/eSPI Master Data I/O 2 | I/O-3. 3/eSPI I/O- 1.8 | PU 15k-40k in PCH (S5) | --- |
| B7 | LPC_AD3/ ESPI_IO_3 | LPC Multiplexed Command, Address & Data 3/eSPI Master Data I/O 3 | I/O-3. 3/eSPI I/O- 1.8 | PU 15k-40k in PCH (S5) | --- |
| B8 | LPC_DRQ0#/ ESPI_ALERT0# | LPC Serial DMA/Master Request 0 / eSPI Alert 0 | I-3.3/eSPI I-1.8 | ---/eSPI PU 1k 1.8V (S5) | --- |
| B9 | LPC_DRQ1#/ ESPI_ALERT1# | LPC Serial DMA/Master Request 1 / eSPI Alert 1 | I-3.3/eSPI I-1.8 | ---/eSPI PU 1k 1.8V (S5) | --- |
| B10 | LPC_CLK/ ESPI_CK | 24MHz LPC clock | 0-3.3/eSPI 0- 1.8 | PD 20k in PCH | 24MHz |
| B11 | GND | Power Ground | PWR GND | --- | --- |
| B12 | PWRBTN# | Power Button | I-3.3 | PU 10k 3.3V (S5eco) | --- |
| B13 | SMB_CLK | SMBUS Clock | 0-3.3 | PU 2k56 3.3V (S5) | --- |
| B14 | SMB_DAT | SMBUS Data | I/O-3.3 | PU 2k56 3.3V (S5) | --- |
| B15 | SMB_ALERT# | SMBUS Alert | I/O-3.3 | PU 2k2 3.3V (S5) | --- |
| B16 | SATA1_TX+ | SATA 1 Transmit Pair + | DP-0 | --- | --- |
| B17 | SATA1_TX- | SATA 1 Transmit Pair - | DP-0 | --- | --- |
| B18 | SUS_STAT#/ ESPI_RESET# | Suspend Status/eSPI Reset | 0-3.3/0- 1.8 | --- | --- |
| B19 | SATA1_RX+ | SATA 1 Receive Pair + | DP-I | --- | --- |
| B20 | SATA1_RX- | SATA 1 Receive Pair - | DP-I | --- | --- |
| B21 | GND | Power Ground | PWR GND | --- | --- |
| B22 | SATA3_TX+ | SATA 3 Transmit Pair + | nc | --- | --- |
| B23 | SATA3_TX- | SATA 3 Transmit Pair - | nc | --- | --- |
| B24 | PWR_OK | Power OK | I-5T | PU 61k 3.3V | 20V protection circuit implemented on module |

| Pin | Signal | Description | Type | Termination | Comment |
|-----|-----------------|-------------------------------------|---------|---------------------------|---|
| B25 | SATA3_RX+ | SATA 3 Receive Pair + | nc | --- | --- |
| B26 | SATA3_RX- | SATA 3 Receive Pair - | nc | --- | --- |
| B27 | WDT | Watch Dog Time-Out event | O-3.3 | PD 10K | --- |
| B28 | HDA_SDIN2 | Not Connected | nc | --- | not supported |
| B29 | HDA_SDIN1 | Audio Codec Serial Data in 1 | I-3.3 | PD 20k in PCH | --- |
| B30 | HDA_SDIN0 | Audio Codec Serial Data in 0 | I-3.3 | PD 20k in PCH | --- |
| B31 | GND | Power Ground | PWR GND | --- | --- |
| B32 | SPKR | Speaker | O-3.3 | PD 20k in PCH | PD is enabled until reset is deasserted |
| B33 | I2C_CK | I2C Clock | O-3.3 | PU 2k21 3.3V (S5) | --- |
| B34 | I2C_DAT | I2C Data | I/O-3.3 | PU 2k21 3.3V (S5) | --- |
| B35 | THRM# | Over Temperature Input | I-3.3 | PU 10k 3.3V (S0) | no function implemented |
| B36 | USB7- | USB 2.0 Data Pair Port 7 - | DP-I/O | PD 14.25k to 24.8k in PCH | --- |
| B37 | USB7+ | USB 2.0 Data Pair Port 7 + | DP-I/O | PD 14.25k to 24.8k in PCH | --- |
| B38 | USB_4_5_OC# | USB Overcurrent Indicator Port 4/5 | I-3.3 | PU 10k 3.3V (S5) | --- |
| B39 | USB5- | USB 2.0 Data Pair Port 5 - | DP-I/O | PD 14.25k to 24.8k in PCH | --- |
| B40 | USB5+ | USB 2.0 Data Pair Port 5 + | DP-I/O | PD 14.25k to 24.8k in PCH | --- |
| B41 | GND | Power Ground | PWR GND | --- | --- |
| B42 | USB3- | USB 2.0 Data Pair Port 3 - | DP-I/O | PD 14.25k to 24.8k in PCH | --- |
| B43 | USB3+ | USB 2.0 Data Pair Port 3 + | DP-I/O | PD 14.25k to 24.8k in PCH | --- |
| B44 | USB_0_1_OC# | USB Overcurrent Indicator Port 0/1 | I-3.3 | PU 10k 3.3V (S5) | --- |
| B45 | USB1- | USB 2.0 Data Pair Port 1 - | DP-I/O | PD 14.25k to 24.8k in PCH | --- |
| B46 | USB1+ | USB 2.0 Data Pair Port 1 + | DP-I/O | PD 14.25k to 24.8k in PCH | --- |
| B47 | ESPI_EN# | Enable/Disable ESPI- Mode/LPC- Mode | I-3.3 | PU 20k 3.3V (S5) | --- |
| B48 | USB_HOST_PRSN T | USB Host Detection | I-3.3 | --- | --- |
| B49 | SYS_RESET# | Reset Button Input | I-3.3 | PU 10k 3.3V (S5) | --- |
| B50 | CB_RESET# | Carrier Board Reset | O-3.3 | PU 10k 3.3V (S5) | --- |

| Pin | Signal | Description | Type | Termination | Comment |
|-----|----------------|---------------------------------------|-------------|------------------|--|
| B51 | GND | Power Ground | PWR GND | --- | --- |
| B52 | PCIE_RX5+ | PCI Express Lane 5 Receive + | DP-I | --- | --- |
| B53 | PCIE_RX5- | PCI Express Lane 5 Receive - | DP-I | --- | --- |
| B54 | GPO1 | General Purpose Output 1 | 0-3.3 | PD 100k | --- |
| B55 | PCIE_RX4+ | PCI Express Lane 4 Receive + | DP-I | --- | --- |
| B56 | PCIE_RX4- | PCI Express Lane 4 Receive - | DP-I | --- | --- |
| B57 | GPO2 | General Purpose Output 2 | 0-3.3 | PD 100k | --- |
| B58 | PCIE_RX3+ | PCI Express Lane 3 Receive + | DP-I | --- | --- |
| B59 | PCIE_RX3- | PCI Express Lane 3 Receive - | DP-I | --- | --- |
| B60 | GND | Power Ground | PWR GND | --- | --- |
| B61 | PCIE_RX2+ | PCI Express Lane 2 Receive + | DP-I | --- | --- |
| B62 | PCIE_RX2- | PCI Express Lane 2 Receive - | DP-I | --- | --- |
| B63 | GPO3 | General Purpose Output 3 | 0-3.3 | PD 100k | --- |
| B64 | PCIE_RX1+ | PCI Express Lane 1 Receive + | DP-I | --- | --- |
| B65 | PCIE_RX1- | PCI Express Lane 1 Receive - | DP-I | --- | --- |
| B66 | WAKE0# | PCI Express Wake Event | I-3.3 | PU 10k 3.3V (S5) | --- |
| B67 | WAKE1# | General Purpose Wake Event | I-3.3 | PU 10k 3.3V (S5) | --- |
| B68 | PCIE_RX0+ | PCI Express Lane 0 Receive + | DP-I | --- | --- |
| B69 | PCIE_RX0- | PCI Express Lane 0 Receive - | DP-I | --- | --- |
| B70 | GND | Power Ground | PWR GND | --- | --- |
| B71 | LVDS_B0+ | LVDS Channel B DAT0+ | DP-0 | --- | --- |
| B72 | LVDS_B0- | LVDS Channel B DAT0- | DP-0 | --- | --- |
| B73 | LVDS_B1+ | LVDS Channel B DAT1+ | DP-0 | --- | --- |
| B74 | LVDS_B1- | LVDS Channel B DAT1- | DP-0 | --- | --- |
| B75 | LVDS_B2+ | LVDS Channel B DAT2+ | DP-0 | --- | --- |
| B76 | LVDS_B2- | LVDS Channel B DAT2- | DP-0 | --- | --- |
| B77 | LVDS_B3+ | LVDS Channel B DAT3+ | DP-0 | --- | --- |
| B78 | LVDS_B3- | LVDS Channel B DAT3- | DP-0 | --- | --- |
| B79 | LVDS_BKLT_EN | LVDS/EDP Panel Backlight On | 0-3.3 | PD 100k | --- |
| B80 | GND | Power Ground | PWR GND | --- | --- |
| B81 | LVDS_B_CK+ | LVDS Channel B Clock+ | DP-0 | --- | 20-80MHz |
| B82 | LVDS_B_CK- | LVDS Channel B Clock- | DP-0 | --- | 20-80MHz |
| B83 | LVDS_BKLT_CTRL | LVDS/EDP Backlight Brightness Control | 0-3.3 | --- | --- |
| B84 | VCC_5V_SBY | 5V Standby | PWR 5V (S5) | --- | optional (not necessary in single supply mode) |
| B85 | VCC_5V_SBY | 5V Standby | PWR 5V (S5) | --- | optional (not necessary in single supply mode) |

| Pin | Signal | Description | Type | Termination | Comment |
|------|--------------|-------------------------------|--------------|------------------|---|
| B86 | VCC_5V_SBY | 5V Standby | PWR 5V (S5) | --- | optional (not necessary in single supply mode) |
| B87 | VCC_5V_SBY | 5V Standby | PWR 5V (S5) | --- | optional (not necessary in single supply mode) |
| B88 | BIOS_DIS1# | BIOS Selection Strap 1 | I-3.3 | PU 10k 3.3V (S0) | PU might be powered during suspend |
| B89 | VGA_RED | Analog Video RGB-RED | nc | --- | --- |
| B90 | GND | Power Ground | PWR GND | --- | --- |
| B91 | VGA_GREEN | Analog Video RGB-GREEN | nc | --- | --- |
| B92 | VGA_BLUE | Analog Video RGB-BLUE | nc | --- | --- |
| B93 | VGA_HSYNC | Analog Video H-Sync | nc | --- | --- |
| B94 | VGA_VSYNC | Analog Video V-Sync | nc | --- | --- |
| B95 | VGA_I2C_CLK | Display Data Channel Clock | nc | --- | --- |
| B96 | VGA_I2C_DATA | Display Data Channel Data | nc | --- | --- |
| B97 | SPI_CS# | SPI Chip Select | O-3.3 | --- | --- |
| B98 | RSVD | Reserved for future use | nc | --- | --- |
| B99 | RSVD | Reserved for future use | nc | --- | --- |
| B100 | GND | Power Ground | PWR GND | --- | --- |
| B101 | FAN_PWMOUT | Fan PWM Output | O-3.3 | --- | 20V protection circuit implemented on module, PD on carrier board needed for proper operation |
| B102 | FAN_TACHIN | Fan Tach Input | I-3.3 | PU 47k 3.3V (S0) | 20V protection circuit implemented on module |
| B103 | SLEEP# | Sleep Button Input | I-3.3 | PU 47k 3.3V (S5) | 20V protection circuit implemented on module |
| B104 | VCC_12V | Main Input Voltage (4.75-20V) | PWR 4.75-20V | --- | --- |
| B105 | VCC_12V | Main Input Voltage (4.75-20V) | PWR 4.75-20V | --- | --- |
| B106 | VCC_12V | Main Input Voltage (4.75-20V) | PWR 4.75-20V | --- | --- |
| B107 | VCC_12V | Main Input Voltage (4.75-20V) | PWR 4.75-20V | --- | --- |
| B108 | VCC_12V | Main Input Voltage (4.75-20V) | PWR 4.75-20V | --- | --- |

| Pin | Signal | Description | Type | Termination | Comment |
|------|---------|-------------------------------|--------------|-------------|---------|
| B109 | VCC_12V | Main Input Voltage (4.75-20V) | PWR 4.75-20V | --- | --- |
| B110 | GND | Power Ground | PWR GND | --- | --- |

+ and -Differential pair differentiator

8.2.3. Connector X1B Row C 1 - C 110

Table 50: Connector X1B Row C Pin Assignment (C1-C110)

| Pin | Signal | Description | Type | Termination | Comment |
|-----|-------------------|------------------------------|---------|-------------|---------|
| C1 | GND | Power Ground | PWR GND | --- | --- |
| C2 | GND | Power Ground | PWR GND | --- | --- |
| C3 | USB_SSRX0- | USB Super Speed Receive 0 - | DP-I | --- | --- |
| C4 | USB_SSRX0+ | USB Super Speed Receive 0 + | DP-I | --- | --- |
| C5 | GND | Power Ground | PWR GND | --- | --- |
| C6 | USB_SSRX1- | USB Super Speed Receive 1 - | DP-I | --- | --- |
| C7 | USB_SSRX1+ | USB Super Speed Receive 1 + | DP-I | --- | --- |
| C8 | GND | Power Ground | PWR GND | --- | --- |
| C9 | USB_SSRX2- | USB Super Speed Receive 2 - | DP-I | --- | --- |
| C10 | USB_SSRX2+ | USB Super Speed Receive 2 + | DP-I | --- | --- |
| C11 | GND | Power Ground | PWR GND | --- | --- |
| C12 | USB_SSRX3- | USB Super Speed Receive 3 - | DP-I | --- | --- |
| C13 | USB_SSRX3+ | USB Super Speed Receive 3 + | DP-I | --- | --- |
| C14 | GND | Power Ground | PWR GND | --- | --- |
| C15 | DDI1_PAIR6+ | Not Connected | nc | --- | --- |
| C16 | DDI1_PAIR6- | Not Connected | nc | --- | --- |
| C17 | RSVD | Reserved for future use | nc | --- | --- |
| C18 | RSVD | Reserved for future use | nc | --- | --- |
| C19 | PCIE_RX6+ | PCI Express Lane 6 Receive + | DP-I | --- | --- |
| C20 | PCIE_RX6- | PCI Express Lane 6 Receive - | DP-I | --- | --- |
| C21 | GND | Power Ground | PWR GND | --- | --- |
| C22 | PCIE_RX7+ | PCI Express Lane 7 Receive + | DP-I | --- | --- |
| C23 | PCIE_RX7- | PCI Express Lane 7 Receive - | DP-I | --- | --- |
| C24 | DDI1_HPD | DDI1 Hotplug Detect | I-3.3 | PD 100k | |
| C25 | DDI1_PAIR4+ | Not Connected | nc | --- | --- |
| C26 | DDI1_PAIR4- | Not Connected | nc | --- | --- |
| C27 | RSVD | Reserved for future use | nc | --- | --- |
| C28 | RSVD | Reserved for future use | nc | --- | --- |
| C29 | DDI1_PAIR5+ | Not Connected | nc | --- | --- |
| C30 | DDI1_PAIR5- | Not Connected | nc | --- | --- |
| C31 | GND | Power Ground | PWR GND | --- | --- |
| C32 | DDI2_CTRLCLK_AUX+ | DDI2 CTRLCLK/AUX+ | I/O-3.3 | PD 100k | --- |

| Pin | Signal | Description | Type | Termination | Comment |
|-----|--------------------|------------------------------|---------|-------------------|---------|
| C33 | DDI2_CTRLDATA_AUX- | DDI2 CTRLDATA/AUX- | I/O-3.3 | PU 100k 3.3V (50) | --- |
| C34 | DDI2_DDC_AUX_SEL | DDI2 DDC/AUX select | I-3.3 | PD 1M | --- |
| C35 | RSVD | Reserved for future use | nc | --- | --- |
| C36 | DDI3_CTRLCLK_AUX+ | DDI3 CTRLCLK/AUX+ | nc | --- | --- |
| C37 | DDI3_CTRLDATA_AUX- | DDI3 CTRLDATA/AUX- | nc | --- | --- |
| C38 | DDI3_DDC_AUX_SEL | DDI3 DDC/AUX select | nc | --- | --- |
| C39 | DDI3_PAIR0+ | DDI3 Pair 0 + | nc | --- | --- |
| C40 | DDI3_PAIR0- | DDI3 Pair 0 - | nc | --- | --- |
| C41 | GND | Power Ground | PWR GND | --- | --- |
| C42 | DDI3_PAIR1+ | DDI3 Pair 1 + | nc | --- | --- |
| C43 | DDI3_PAIR1- | DDI3 Pair 1 - | nc | --- | --- |
| C44 | DDI3_HPD | DDI3 Hotplug Detect | nc | --- | --- |
| C45 | RSVD | Reserved for future use | nc | --- | --- |
| C46 | DDI3_PAIR2+ | DDI3 Pair 2 + | nc | --- | --- |
| C47 | DDI3_PAIR2- | DDI3 Pair 2 - | nc | --- | --- |
| C48 | RSVD | Reserved for future use | nc | --- | --- |
| C49 | DDI3_PAIR3+ | DDI3 Pair 3 + | nc | --- | --- |
| C50 | DDI3_PAIR3- | DDI3 Pair 3 - | nc | --- | --- |
| C51 | GND | Power Ground | PWR GND | --- | --- |
| C52 | PEG_RX0+ | PEG Lane 0 Receive + | DP-I | --- | --- |
| C53 | PEG_RX0- | PEG Lane 0 Receive - | DP-I | --- | --- |
| C54 | TYPE0# | nc for type 6 module | nc | --- | --- |
| C55 | PEG_RX1+ | PEG Lane 1 Receive + | DP-I | --- | --- |
| C56 | PEG_RX1- | PEG Lane 1 Receive - | DP-I | --- | --- |
| C57 | TYPE1# | nc for type 6 module | nc | --- | --- |
| C58 | PEG_RX2+ | PEG Lane 2 Receive + | DP-I | --- | --- |
| C59 | PEG_RX2- | PEG Lane 2 Receive - | DP-I | --- | --- |
| C60 | GND | Power Ground | PWR GND | --- | --- |
| C61 | PEG_RX3+ | PEG Lane 3 Receive + | DP-I | --- | --- |
| C62 | PEG_RX3- | PEG Lane 3 Receive - | DP-I | --- | --- |
| C63 | RSVD | Reserved for future use | nc | --- | --- |
| C64 | RSVD | Reserved for future use | nc | --- | --- |
| C65 | PEG_RX4+ | PEG Lane 4 Receive + | nc | --- | --- |
| C66 | PEG_RX4- | PEG Lane 4 Receive - | nc | --- | --- |
| C67 | RAPID_SHUTDOWN | Rapid Shutdown Trigger Input | nc | --- | --- |
| C68 | PEG_RX5+ | PEG Lane 5 Receive + | nc | --- | --- |
| C69 | PEG_RX5- | PEG Lane 5 Receive - | nc | --- | --- |
| C70 | GND | Power Ground | PWR GND | --- | --- |

| Pin | Signal | Description | Type | Termination | Comment |
|------|-----------|-------------------------------|--------------|-------------|---------|
| C71 | PEG_RX6+ | PEG Lane 6 Receive + | nc | --- | --- |
| C72 | PEG_RX6- | PEG Lane 6 Receive - | nc | --- | --- |
| C73 | GND | Power Ground | PWR GND | --- | --- |
| C74 | PEG_RX7+ | PEG Lane 7 Receive + | nc | --- | --- |
| C75 | PEG_RX7- | PEG Lane 7 Receive - | nc | --- | --- |
| C76 | GND | Power Ground | PWR GND | --- | --- |
| C77 | RSVD | Reserved for future use | nc | --- | --- |
| C78 | PEG_RX8+ | PEG Lane 8 Receive + | nc | --- | --- |
| C79 | PEG_RX8- | PEG Lane 8 Receive - | nc | --- | --- |
| C80 | GND | Power Ground | PWR GND | --- | --- |
| C81 | PEG_RX9+ | PEG Lane 9 Receive + | nc | --- | --- |
| C82 | PEG_RX9- | PEG Lane 9 Receive - | nc | --- | --- |
| C83 | RSVD | Reserved for future use | nc | --- | --- |
| C84 | GND | Power Ground | PWR GND | --- | --- |
| C85 | PEG_RX10+ | PEG Lane 10 Receive + | nc | --- | --- |
| C86 | PEG_RX10- | PEG Lane 10 Receive - | nc | --- | --- |
| C87 | GND | Power Ground | PWR GND | --- | --- |
| C88 | PEG_RX11+ | PEG Lane 11 Receive + | nc | --- | --- |
| C89 | PEG_RX11- | PEG Lane 11 Receive - | nc | --- | --- |
| C90 | GND | Power Ground | PWR GND | --- | --- |
| C91 | PEG_RX12+ | PEG Lane 12 Receive + | nc | --- | --- |
| C92 | PEG_RX12- | PEG Lane 12 Receive - | nc | --- | --- |
| C93 | GND | Power Ground | PWR GND | --- | --- |
| C94 | PEG_RX13+ | PEG Lane 13 Receive + | nc | --- | --- |
| C95 | PEG_RX13- | PEG Lane 13 Receive - | nc | --- | --- |
| C96 | GND | Power Ground | PWR GND | --- | --- |
| C97 | RSVD | Reserved for future use | nc | --- | --- |
| C98 | PEG_RX14+ | PEG Lane 14 Receive + | nc | --- | --- |
| C99 | PEG_RX14- | PEG Lane 14 Receive - | nc | --- | --- |
| C100 | GND | Power Ground | PWR GND | --- | --- |
| C101 | PEG_RX15+ | PEG Lane 15 Receive + | nc | --- | --- |
| C102 | PEG_RX15- | PEG Lane 15 Receive - | nc | --- | --- |
| C103 | GND | Power Ground | PWR GND | --- | --- |
| C104 | VCC_12V | Main Input Voltage (4.75-20V) | PWR 4.75-20V | --- | --- |
| C105 | VCC_12V | Main Input Voltage (4.75-20V) | PWR 4.75-20V | --- | --- |
| C106 | VCC_12V | Main Input Voltage (4.75-20V) | PWR 4.75-20V | --- | --- |
| C107 | VCC_12V | Main Input Voltage (4.75-20V) | PWR 4.75-20V | --- | --- |
| C108 | VCC_12V | Main Input Voltage (4.75-20V) | PWR 4.75-20V | --- | --- |

| Pin | Signal | Description | Type | Termination | Comment |
|------|---------|-------------------------------|--------------|-------------|---------|
| C109 | VCC_12V | Main Input Voltage (4.75-20V) | PWR 4.75-20V | --- | --- |
| C110 | GND | Power Ground | PWR GND | --- | --- |

+ and - Differential pair differentiator

8.2.4. Connector X1B Row D 1 - D 110

Table 51: Connector X1B Row D Pin Assignment (D1-D110)

| Pin | Signal | Description | Type | Termination | Comment |
|-----|--------------------|-------------------------------|---------|-------------------|---------|
| D1 | GND | Power Ground | PWR GND | --- | --- |
| D2 | GND | Power Ground | PWR GND | --- | --- |
| D3 | USB_SSTX0- | USB Super Speed Transmit 0 - | DP-0 | --- | --- |
| D4 | USB_SSTX0+ | USB Super Speed Transmit 0 + | DP-0 | --- | --- |
| D5 | GND | Power Ground | PWR GND | --- | --- |
| D6 | USB_SSTX1- | USB Super Speed Transmit 1 - | DP-0 | --- | --- |
| D7 | USB_SSTX1+ | USB Super Speed Transmit 1 + | DP-0 | --- | --- |
| D8 | GND | Power Ground | PWR GND | --- | --- |
| D9 | USB_SSTX2- | USB Super Speed Transmit 2 - | DP-0 | --- | --- |
| D10 | USB_SSTX2+ | USB Super Speed Transmit 2 + | DP-0 | --- | --- |
| D11 | GND | Power Ground | PWR GND | --- | --- |
| D12 | USB_SSTX3- | USB Super Speed Transmit 3 - | DP-0 | --- | --- |
| D13 | USB_SSTX3+ | USB Super Speed Transmit 3 + | DP-0 | --- | --- |
| D14 | GND | Power Ground | PWR GND | --- | --- |
| D15 | DDI1_CTRLCLK_AUX+ | DDI1 CTRLCLK/AUX+ | I/O-3.3 | PD 100k | --- |
| D16 | DDI1_CTRLDATA_AUX- | DDI1 CTRLDATA/AUX- | I/O-3.3 | PU 100k 3.3V (S0) | --- |
| D17 | RSVD | Reserved for future use | nc | --- | --- |
| D18 | RSVD | Reserved for future use | nc | --- | --- |
| D19 | PCIE_TX6+ | PCI Express Lane 6 Transmit + | DP-0 | --- | --- |
| D20 | PCIE_TX6- | PCI Express Lane 6 Transmit - | DP-0 | --- | --- |
| D21 | GND | Power Ground | PWR GND | --- | --- |
| D22 | PCIE_TX7+ | PCI Express Lane 7 Transmit + | DP-0 | --- | --- |
| D23 | PCIE_TX7- | PCI Express Lane 7 Transmit - | DP-0 | --- | --- |
| D24 | RSVD | Reserved for future use | nc | --- | --- |
| D25 | RSVD | Reserved for future use | nc | --- | --- |
| D26 | DDI1_PAIR0+ | DDI1 Pair 0 + | DP-0 | --- | --- |
| D27 | DDI1_PAIR0- | DDI1 Pair 0 - | DP-0 | --- | --- |
| D28 | RSVD | Reserved for future use | nc | --- | --- |
| D29 | DDI1_PAIR1+ | DDI1 Pair 1 + | DP-0 | --- | --- |
| D30 | DDI1_PAIR1- | DDI1 Pair 1 - | DP-0 | --- | --- |
| D31 | GND | Power Ground | PWR GND | --- | --- |

| Pin | Signal | Description | Type | Termination | Comment |
|-----|------------------|-------------------------------|---------|-------------|---------|
| D32 | DDI1_PAIR2+ | DDI1 Pair 2 + | DP-0 | --- | --- |
| D33 | DDI1_PAIR2- | DDI1 Pair 2 - | DP-0 | --- | --- |
| D34 | DDI1_DDC_AUX_SEL | DDI1 DDC/AUX select | I-3.3 | PD 1M | --- |
| D35 | RSVD | Reserved for future use | nc | --- | --- |
| D36 | DDI1_PAIR3+ | DDI1 Pair 3 + | DP-0 | --- | --- |
| D37 | DDI1_PAIR3- | DDI1 Pair 3 - | DP-0 | --- | --- |
| D38 | RSVD | Reserved for future use | nc | --- | --- |
| D39 | DDI2_PAIR0+ | DDI2 Pair 0 + | DP-0 | --- | --- |
| D40 | DDI2_PAIR0- | DDI2 Pair 0 - | DP-0 | --- | --- |
| D41 | GND | Power Ground | PWR GND | --- | --- |
| D42 | DDI2_PAIR1+ | DDI2 Pair 1 + | DP-0 | --- | --- |
| D43 | DDI2_PAIR1- | DDI2 Pair 1 - | DP-0 | --- | --- |
| D44 | DDI2_HPD | DDI2 Hotplug Detect | I-3.3 | PD 100k | --- |
| D45 | RSVD | Reserved for future use | nc | --- | --- |
| D46 | DDI2_PAIR2+ | DDI2 Pair 2 + | DP-0 | --- | --- |
| D47 | DDI2_PAIR2- | DDI2 Pair 2 - | DP-0 | --- | --- |
| D48 | RSVD | Reserved for future use | nc | --- | --- |
| D49 | DDI2_PAIR3+ | DDI2 Pair 3 + | DP-0 | --- | --- |
| D50 | DDI2_PAIR3- | DDI2 Pair 3 - | DP-0 | --- | --- |
| D51 | GND | Power Ground | PWR GND | --- | --- |
| D52 | PEG_TX0+ | PEG Lane 0 Transmit + | DP-0 | --- | --- |
| D53 | PEG_TX0- | PEG Lane 0 Transmit - | DP-0 | --- | --- |
| D54 | PEG_LANE_RV# | Not Connected | nc | --- | --- |
| D55 | PEG_TX1+ | PEG Lane 1 Transmit + | DP-0 | --- | --- |
| D56 | PEG_TX1- | PEG Lane 1 Transmit - | DP-0 | --- | --- |
| D57 | TYPE2# | GND for type 6 module | PWR | --- | --- |
| D58 | PEG_TX2+ | PEG Lane 2 Transmit + | DP-0 | --- | --- |
| D59 | PEG_TX2- | PEG Lane 2 Transmit - | DP-0 | --- | --- |
| D60 | GND | Power Ground | PWR GND | --- | --- |
| D61 | PEG_TX3+ | PEG Lane 3 Transmit + | DP-0 | --- | --- |
| D62 | PEG_TX3- | PEG Lane 3 Transmit - | DP-0 | --- | --- |
| D63 | RSVD | Reserved for future use | nc | --- | --- |
| D64 | RSVD | Reserved for future use | nc | --- | --- |
| D65 | PEG_TX4+ | PEG Lane 4 Transmit + | nc | --- | --- |
| D66 | PEG_TX4- | PEG Lane 4 Transmit - | nc | --- | --- |
| D67 | GND | Power Ground | PWR GND | --- | --- |
| D68 | PEG_TX5+ | PEG Lane 5 Transmit + | nc | --- | --- |
| D69 | PEG_TX5- | PEG Express Lane 5 Transmit - | nc | --- | --- |
| D70 | GND | Power Ground | PWR GND | --- | --- |
| D71 | PEG_TX6+ | PEG Lane 6 Transmit + | nc | --- | --- |
| D72 | PEG_TX6- | PEG Lane 6 Transmit - | nc | --- | --- |
| D73 | GND | Power Ground | PWR GND | --- | --- |

| Pin | Signal | Description | Type | Termination | Comment |
|------|-----------|-------------------------------|--------------|-------------|---------|
| D74 | PEG_TX7+ | PEG Lane 7 Transmit + | nc | --- | --- |
| D75 | PEG_TX7- | PEG Lane 7 Transmit - | nc | --- | --- |
| D76 | GND | Power Ground | PWR GND | --- | --- |
| D77 | RSVD | Reserved for future use | nc | --- | --- |
| D78 | PEG_TX8+ | PEG Lane 8 Transmit + | nc | --- | --- |
| D79 | PEG_TX8- | PEG Lane 8 Transmit - | nc | --- | --- |
| D80 | GND | Power Ground | PWR GND | --- | --- |
| D81 | PEG_TX9+ | PEG Lane 9 Transmit + | nc | --- | --- |
| D82 | PEG_TX9- | PEG Lane 9 Transmit - | nc | --- | --- |
| D83 | RSVD | Reserved for future use | nc | --- | --- |
| D84 | GND | Power Ground | PWR GND | --- | --- |
| D85 | PEG_TX10+ | PEG Lane 10 Transmit + | nc | --- | --- |
| D86 | PEG_TX10- | PEG Lane 10 Transmit - | nc | --- | --- |
| D87 | GND | Power Ground | PWR GND | --- | --- |
| D88 | PEG_TX11+ | PEG Lane 11 Transmit + | nc | --- | --- |
| D89 | PEG_TX11- | PEG Lane 11 Transmit - | nc | --- | --- |
| D90 | GND | Power Ground | PWR GND | --- | --- |
| D91 | PEG_TX12+ | PEG Lane 12 Transmit + | nc | --- | --- |
| D92 | PEG_TX12- | PEG Lane 12 Transmit - | nc | --- | --- |
| D93 | GND | Power Ground | PWR GND | --- | --- |
| D94 | PEG_TX13+ | PEG Lane 13 Transmit + | nc | --- | --- |
| D95 | PEG_TX13- | PEG Lane 13 Transmit - | nc | --- | --- |
| D96 | GND | Power Ground | PWR GND | --- | --- |
| D97 | RSVD | Reserved for future use | nc | --- | --- |
| D98 | PEG_TX14+ | PEG Lane 14 Transmit + | nc | --- | --- |
| D99 | PEG_TX14- | PEG Lane 14 Transmit - | nc | --- | --- |
| D100 | GND | Power Ground | PWR GND | --- | --- |
| D101 | PEG_TX15+ | PEG Lane 15 Transmit + | nc | --- | --- |
| D102 | PEG_TX15- | PEG Lane 15 Transmit - | nc | --- | --- |
| D103 | GND | Power Ground | PWR GND | --- | --- |
| D104 | VCC_12V | Main Input Voltage (4.75-20V) | PWR 4.75-20V | --- | --- |
| D105 | VCC_12V | Main Input Voltage (4.75-20V) | PWR 4.75-20V | --- | --- |
| D106 | VCC_12V | Main Input Voltage (4.75-20V) | PWR 4.75-20V | --- | --- |
| D107 | VCC_12V | Main Input Voltage (4.75-20V) | PWR 4.75-20V | --- | --- |
| D108 | VCC_12V | Main Input Voltage (4.75-20V) | PWR 4.75-20V | --- | --- |
| D109 | VCC_12V | Main Input Voltage (4.75-20V) | PWR 4.75-20V | --- | --- |
| D110 | GND | Power Ground | PWR GND | --- | --- |

+ and - Differential pair differentiator

9/ UEFI BIOS Shell

9.1. Starting the UEFI BIOS

The COMe-cWL6 uses a Kontron-customized, pre-installed and configured version of Aptio® V UEFI BIOS based on the Unified Extensible Firmware Interface (UEFI) specification.



The BIOS version covered in this document might not be the latest version. The latest version might have certain differences to the BIOS options and features described in this chapter.



Register for the EMD Customer Section to get access to BIOS downloads and PCN service.

The UEFI BIOS comes with a Setup program that provides quick and easy access to the individual function settings for control or modification of the UEFI BIOS configuration. The Setup program allows for access to various menus that provide functions or access to sub-menus with further specific functions of their own.

To start the UEFI BIOS Setup program, follow the steps below:

1. Power on the board.
2. Wait until the first characters appear on the screen (POST messages or splash screen).
3. Press the key.
4. If the UEFI BIOS is password-protected, a request for password will appear. Enter either the User Password or Supervisor Password press <RETURN>, and proceed with step 5.
5. A Setup menu appears.

The COMe-cWL6 UEFI BIOS Setup program uses a hot key navigation system. The hot key legend bar is located at the bottom of the Setup screens. The following table provides a list of navigation hot keys available in the legend bar.

Table 52: Navigation Hot Keys Available in the Legend Bar

| Sub-screen | Description |
|------------|---|
| <F1> | <F1> key invokes the General Help window |
| <-> | <Minus> key selects the next lower value within a field |
| <+> | <Plus> key selects the next higher value within a field |
| <F2> | <F2> key loads previous values |
| <F3> | <F3> key loads optimized defaults |
| <F4> | <F4> key Saves and Exits |
| <←> or <→> | <Left/Right> arrows selects major Setup menus on menu bar, for example, Main or Advanced |
| <↑> or <↓> | <Up/Down> arrows select fields in the current menu, for example, Setup function or sub-screen |
| <ESC> | <ESC> key exits a major Setup menu and enters the Exit Setup menu Pressing the <ESC> key in a sub-menu displays the next higher menu level |
| <RETURN> | <RETURN> key executes a command or selects a submenu |

9.2. The UEFI Shell

The Kontron UEFI BIOS features a built-in and enhanced version of the UEFI Shell. For a detailed description of the available standard shell scripting, refer to the EFI Shell User Guide. For a detailed description of the available standard shell commands, refer to the EFI Shell Command Manual. Both documents can be downloaded from the EFI and Framework Open Source Community homepage (<http://sourceforge.net/projects/efi-shell/files/documents/>).



AMI APTIO update utilities for DOS, EFI Shell and Windows are available at AMI.com:
<http://www.ami.com/support/downloads/amiflash.zip>.



Kontron UEFI BIOS does not provide all shell commands described in the EFI Shell Command Manual.

9.2.1. Basic Operation of the UEFI Shell

The UEFI Shell forms an entry into the UEFI boot order and is the first boot option by default.

9.2.1.1. Entering the UEFI Shell

To enter the UEFI Shell, follow the steps below:

1. Power on the board.
1. Press the <F7> key (instead of) to display a choice of boot devices.
2. Choose 'UEFI: Built-in EFI shell'.

```
EFI Shell version 2.40 [5.11]
Current running mode 1.1.2
Device mapping table
Fs0      :HardDisk - Alias hd33b0b0b fs0
          Acpi(PNP0A03,0)/Pci(1D|7)/Usb(1, 0)/Usb(1, 0)/HD(Part1,Sig17731773)
```

Press the ESC key within 5 seconds to skip startup.nsh, and any other key to continue.

3. The output produced by the device-mapping table can vary depending on the board's configuration.
4. If the ESC key is pressed before the 5 second timeout elapses, the shell prompt is shown:

```
Shell>
```

9.2.1.2. Exiting the UEFI Shell

To exit the UEFI Shell, follow one of the steps below:

1. Use the **exit** UEFI Shell command to select the boot device, in the Boot menu, that the OS will boot from.
2. Reset the board using the **reset** UEFI Shell command.

9.3. UEFI Shell Scripting

9.3.1. Startup Scripting

If the ESC key is not pressed and the timeout has run out then the UEFI Shell tries to execute some startup scripts automatically. It searches for scripts and executes them in the following order:

1. Initially searches for Kontron flash-stored startup script.
2. If there is no Kontron flash-stored startup script present then the UEFI -specified `startup.nsh` script is used. This script must be located on the root of any of the attached FAT formatted disk drive.
3. If none of the startup scripts are present or the startup script terminates then the default boot order is continued.

9.3.2. Create a Startup Script

Startup scripts can be created using the UEFI Shell built-in editor `edit` or under any OS with a plain text editor of your choice. To create a startup shell script, simply save the script on the root of any FAT-formatted drive attached to the system. To copy the startup script to the flash, use the **kBootScript** UEFI Shell command.

In case there is no mass storage device attached, the startup script can be generated in a RAM disk and stored in the SPI boot flash using the **kRamdisk** UEFI Shell command.

9.3.3. Examples of Startup Scripts

9.3.3.1. Execute Shell Script on other Harddrive

This example (`startup.nsh`) executes the shell script named `bootme.nsh` located in the root of the first detected disc drive (`fs0`).

```
fs0:  
bootme.nsh
```

10/ BIOS

10.1. Setup Menus

The Setup utility features menus listed in the selection bar at the top of the screen are:

- ▶ Main
- ▶ Advanced
- ▶ Chipset
- ▶ Security
- ▶ Boot
- ▶ Save & Exit

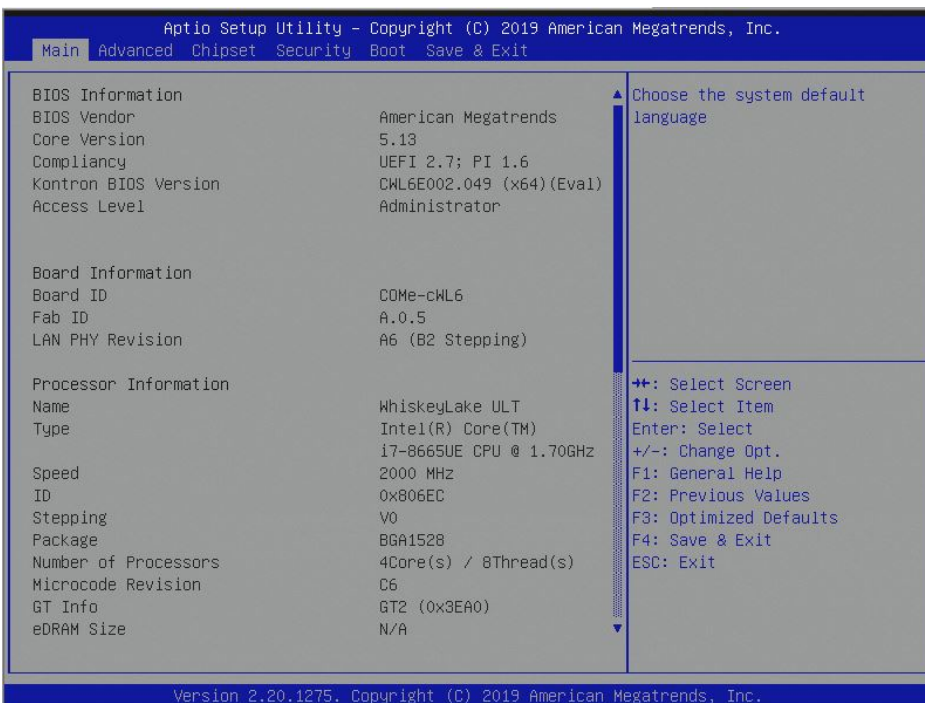
The currently active menu and the currently active UEFI BIOS Setup item are highlighted in white. Use the left and right arrow keys to navigate to the required Setup menu and select the Setup menu by pressing <RETURN>.

Each Setup menu provides two main frames. The left frame displays all available functions. Configurable functions are displayed in blue. Functions displayed in grey provide information about the status or the operational configuration. The right frame displays a Help window providing an explanation of the respective function.

10.1.1. Main Setup Menu

On entering the UEFI BIOS the Setup program displays the Main Setup menu. This screen lists the Main Setup menu sub-screens and provides basic system information as well as functions for setting the system language, time and date.

Figure 12: Main Setup Menu



The following table shows the Main Menu sub-screens and functions and describes the content. Default options are displayed **bold**. Some functions include additional information.

Table 53: Main Setup Menu Sub-screens

| Sub-Screen | Description |
|-----------------------|--|
| BIOS Information> | Read only field <i>Displays BIOS Information:</i> BIOS vendor, Core version, Compliancy, Kontron BIOS Version and Access level |
| Board Information> | Read only field <i>Displays Board Information:</i> Board ID, Fab ID, and LAN PHY revision |
| System Language | [English] |
| Platform Information> | Read only field <i>Displays Module Information</i> Product Name, Revision, Serial # ,MAC Address, Boot Counter, and CPLD Rev Additional information for MAC Address The MAC address entry is the value used by the Ethernet controller and may contain the entry 'Inactive' - Ethernet chip is inactive. Activate the Ethernet chip by setting the following to 'enable'. Advanced > Network Stack Configuration > Network Stack > Enable 88:88:88:88:87:88 is a special pattern that will be filled in by the Ethernet firmware if there is no valid entry in the firmware block of the BIOS SPI (i.e. the MAC address has been overwritten during the last attempt to flash the system). |
| System Date> | Displays the system date [Day mm/dd/yyyy] |
| System Time> | Displays the system time [hh:mm:ss] |

10.1.2. Advanced Setup Menu

The Advanced Setup menu provides sub-screens and second level sub-screens with functions for advanced configuration.

NOTICE Setting items, on this screen, to incorrect values may cause system malfunctions.

Figure 13: Advanced Setup Menu

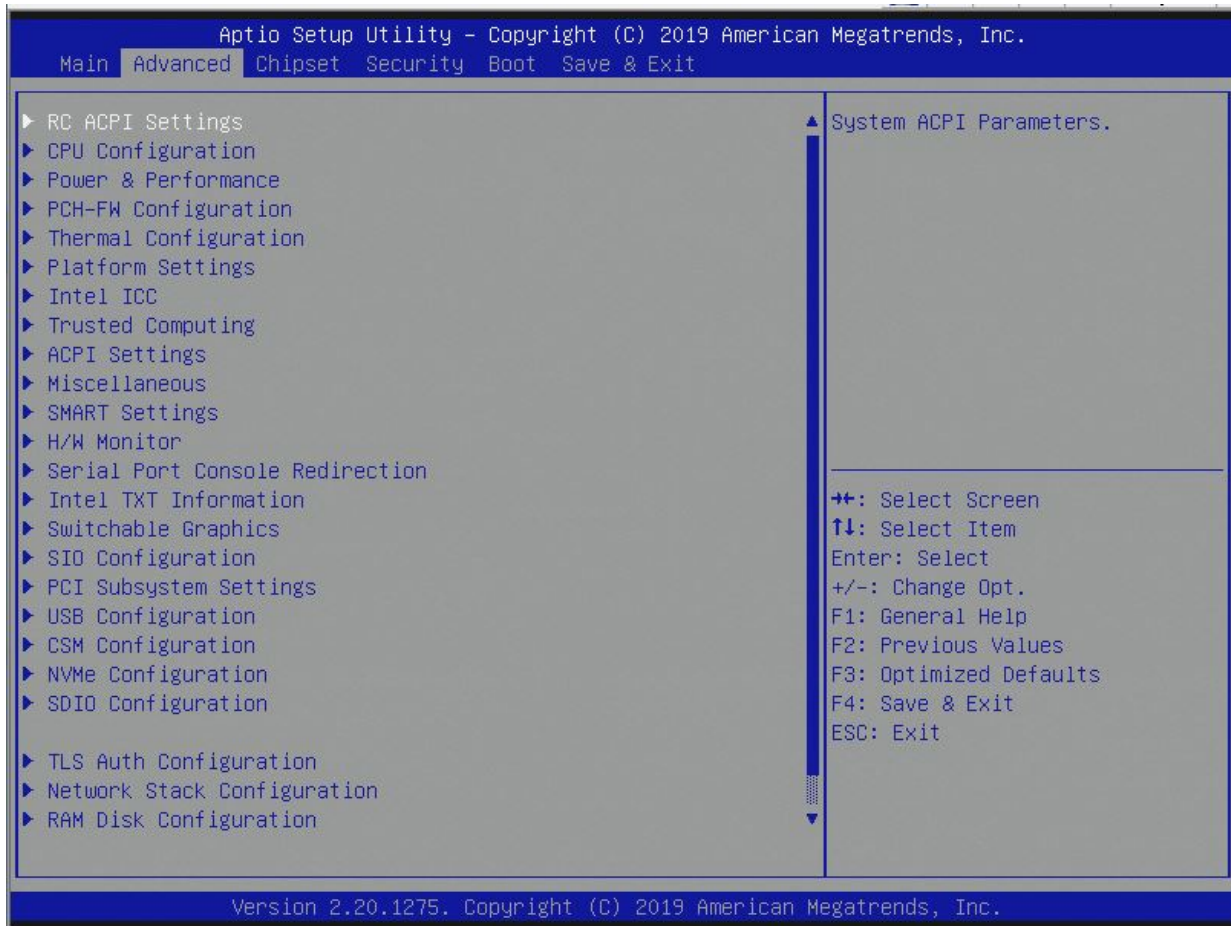


Table 54: Advanced Setup menu Sub-screens and Functions

| Sub-Screen | Function | Second level Sub-Screen / Description |
|------------|------------------------------|---------------------------------------|
| RC ACPI | PTID Support | Enable/Disable |
| | PECI Access Method | Direct I/O |
| | Native PCIE Enable | Enable/Disable |
| | Native ASPM | Auto |
| | Wake System from S5 | Enable/ Disable |
| | ACPI Debug | Enable/ Disable |
| | Low Power S0 Idle Capability | Enable/ Disable |
| | PCI Delay Optimization | Enable/ Disable |

| Sub-Screen | Function | Second level Sub-Screen / Description | | |
|-----------------------|---------------------------------|---------------------------------------|-----------------------------|-----------------------|
| | MSI enabled | Enable/Disable | | |
| CPU Configuration | C6DRAM | Enable/Disable | | |
| | Software Guard Extensions (SGX) | Software Controlled | | |
| | Select Owner EPOCH input type | No Change in Owner EPOCHs | | |
| | CPU Flex Ratio Override | Enable/Disable | | |
| | Intel Virtual Technology> | Enable/Disable | | |
| | Active Processor Cores> | All | | |
| | Hyper Threading> | Enable/Disable | | |
| | BIST | Enable/Disable | | |
| Power & Performance | CPU Power Management Control | Boot Performance Mode | Max Non-Turbo Performance | |
| | | Intel SpeedStep | Enable/Disable | |
| | | Intel Speed ShiftTechnology | Enable/Disable | |
| | | Turbo Mode | Enable/Disable | |
| | | View/Configure Turbo Options | Energy Efficient P-State | Enable/Disable |
| | | | Package Power Limit MSR | Enable/Disable |
| | | | 1-Core Ratio Limit Override | 44 |
| | | | 2-Core Ratio Limit Override | 44 |
| | | | 3-Core Ratio Limit Override | 42 |
| | | | 4-Core Ratio Limit Override | 42 |
| | | | Energy Efficient Turbo | Auto |
| | | Config TDP Configurations | Configurable TDP Boot Mode | Nominal |
| | | | Configurable TDP Lock | Enable/Disable |
| | | | Power Limit 1/2 | 0 |
| | Power Limit 1Time Window | | 0 | |
| | ConfigTDP Turbo Activation | | 0 | |
| | Power Limit 1/2 | | 0 | |
| | Power Limit 1Time Window | | 0 | |
| | ConfigTDP Turbo Activation | | 0 | |
| | Power Limit 1/2 | | 0 | |
| | Power Limit 1Time Window | | 0 | |
| | ConfigTDP Turbo Activation | 0 | | |
| Platform PL1 Enable | Enable/Disable | | | |
| Platform PL2 Enable | Enable/Disable | | | |
| Platform PL4 Override | Enable/Disable | | | |
| Platform PL4 Power | 0 | | | |
| Platform PL4 Lock | Enable/Disable | | | |

| Sub-Screen | Function | Second level Sub-Screen / Description | |
|-----------------------|---------------------------------|---------------------------------------|-----------------------|
| Power & Performance | | C states | Enable/Disable |
| | | Package C State List | Auto |
| | GT Power Management Control | RC6 (Render Standby) | Enable/Disable |
| | | Maximum GT frequency | Default Max Frequency |
| | | Disable Turbo GT frequency | Enable/Disable |
| PCH-FW Configuration | ME State | Enable/Disable | |
| | Firmware Update Configuration | ME FW Image Re-Flash | Enable/Disable |
| | | Local FW Update | Enable/Disable |
| | PTT Configuration | TPM Device Selection | dTPM/PTT |
| Thermal Configuration | CPU Thermal Configuration | DTS SMM | Enable/Disable |
| | | TCC Activation Offset | 0 |
| | | Disable PROCHOT# Output | Enable/Disable |
| | Platform Thermal Configuration | Automatic Thermal Reporting | Enable/Disable |
| | | Critical Trip Point | 119 C (POR) |
| | | Passive Trip Point | 95 C |
| | | Passive TC1 value | 1 |
| | | Passive TC2 value | 5 |
| | | Passive TSP value | 10 |
| | | Passive Trip Points | Enable/Disable |
| | | Critical Trip Point | Enable/Disable |
| Platform Settings | System Time and Alarm Source | ACPI Time and Alarm Device/Legacy RTC | |
| Intel ICC | ICC/OC Watchdog Timer | Enable/Disable | |
| | ICC Profile | 0 | |
| | ICC PLL Shutdown | Enable/Disable | |
| Trusted Computing | Security Device Support | Enable/Disable | |
| | SHA-1 PCR Bank | Enable/Disable | |
| | SHA256 PCR Bank | Enable/Disable | |
| | Pending Operation | None | |
| | Platform Hierarchy | Enable/Disable | |
| | Storage Hierarchy | Enable/Disable | |
| | Endorsement Hierarchy | Enable/Disable | |
| | TPM 2.0 UEFI Spec Version | TCG_2 | |
| | Physical Presence Spec Version | 1.3 | |
| | Device Select | Auto | |
| ACPI settings | Enable ACPI Auto Configuration> | Enable/disable | |
| | Enable Hibernation> | Enable/disable | |

| Sub-Screen | Function | Second level Sub-Screen / Description | |
|----------------|-----------------------------|---------------------------------------|------------------------|
| ACPI settings | ACPI Sleep State | S3 | |
| | Lock Legacy Resources> | Enable/ Disable | |
| | S3 Video Repost> | Enable/ Disable | |
| Miscellaneous | Generic LPC Decode Ranges | Generic LPC Decode 1 | Enable/ Disable |
| | Smart Battery Configuration | MARS | Auto |
| | | Battery #1/#2/#3/#4 | slot empty |
| | Watchdog | Auto-Reload | Enable/ Disable |
| | | Global Lock | Enable/ Disable |
| | | Stage 1 Mode | Enable/ Disable |
| | Reset Button Behavior | Chipset Reset/Power Cycle | |
| | I2C Speed | 200 | |
| | Onboard I2C Mode | Multimaster/Busclear | |
| | Lid Switch Mode | Enable/ Disable | |
| | Sleep Button Mode | Enable/ Disable | |
| | ACPI temperature polling | Enable/Disable | |
| | TZ00 temperature polling | 30 | |
| | SMBus device ACPI mode | Hidden/ Normal | |
| | CPLD device ACPI mode | Hidden/ Normal | |
| | SDIO/GPIO Mode | SDIO/ COMe-GPIO | |
| | SPI lines active | SPIO/GSPIO | |
| | Control COMe GPIOs in BIOS | Enable/ Disable | |
| | GPIO IRQ# | Enable/ Disable | |
| | I2C IRQ# | Enable/ Disable | |
| SMART Settings | SMART Self Test | Enable/ Disable | |
| H/W Monitor | CPU Fan: Fan Control | Auto | |
| | Fan Pulse | 2 | |
| | Fan Trip Point | 50 | |
| | Trip Point Speed | 50 | |
| | Reference Temperature | CPU Temperature | |
| | External Fan: Fan Control | Auto | |
| | Fan Pulse | 2 | |

| Sub-Screen | Function | Second level Sub-Screen / Description |
|---------------------------------|---------------------------------|--|
| H/W Monitor | Fan Trip Point | 50 |
| | Trip Point Speed | 50 |
| | Reference Temperature | CPU Temperature |
| Serial Port Console Redirection | COM0 Console Redirection | Enable/ Disable |
| | COM1 Console Redirection | Enable/ Disable |
| | Legacy Console Redirection | Redirection COM Port [COM0] |
| | | Resolution [80x24] |
| | | Redirecion After POST [Always Enable] |
| Console Redirection | Enable/ Disable | |
| Intel TXT Inf. | | |
| Switch. Graphics | | |
| SIO Configuration | Serial Port 0/1 | Use this device Enable/Disable |
| | | Possible Use Automatic Settings |
| PCI Subsystem Settings | BME DMA Mitigation | Enable/ Disable |
| USB Configuration | Legacy USB Support | Enable/Disable |
| | XHCI Hand-Off | Enable/Disable |
| | USB Mass Storage Driver Support | Enable/Disable |
| | USB transfer time-out | 20 sec |
| | Device reset time-out | 20 sec |
| | Device power-up delay | Auto |
| Network Stack Configuration | Network Stack | Enable/ Disable |
| CSM Configuration | CSM Support | Enable/ Disable |
| NVMe Configuration | | |
| SDIO Configuration | SDIO Access Mode | Auto |
| TLS Auth Configuration | Server CA Configuration | Enroll Cert/Delete Cert |
| | Client Cert Configuration | |
| RAM Disk Configuration | Disk Memory Type | Boot Service Data/Reserved |
| | Create raw | |
| | Create from file | |
| | Remove selected RAM disks | |

10.1.3. Chipset Menu

NOTICE

Setting items, on this screen, to incorrect values may cause system malfunctions.

Figure 14: Chipset Menu Initial Screen

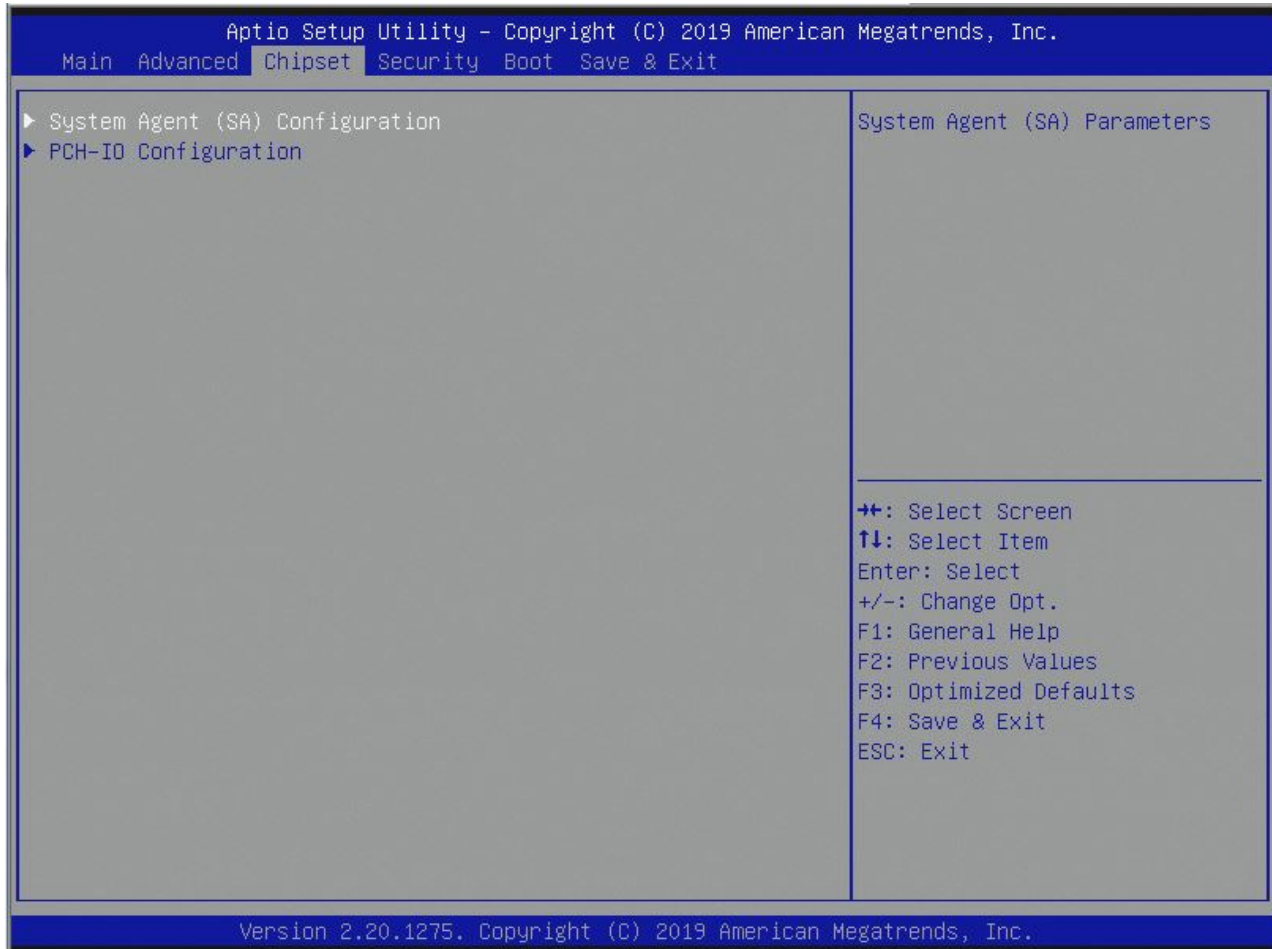


Table 55: Chipset menu Sub-screens and Functions

| Function | Second level Sub-Screen / Description | |
|-----------------------------------|---|-----------------------|
| System Agent/Memory Configuration | Memory Test on Warm Boot | Enable/Disable |
| | Maximum Memory Frequency | Auto |
| | Max TOLUD | Dynamic |
| | Fast Boot | Enable/Disable |
| Graphics Configuration | Skip Scanning Slots for External GfX Card | Enable/Disable |
| | Primary Display | Auto |
| | Select PCIE Card | Auto |

| Function | Second level Sub-Screen / Description | | | |
|---------------------------|--|-----------------------------|------------------------|--|
| Graphics Configuration | External Gfx Card Primary Display Configuration | | | |
| | Internal Graphics | Auto | | |
| | GTT Size | 8 MB | | |
| | Aperture Size | 256 MB | | |
| | DVMT Pre-Allocated | 32 M | | |
| | DVMT Total Gfx Mem | 256 M | | |
| | IGD Configuration | IGD Boot Type | Auto | |
| | | LFD Panel Type | LVDS | |
| | | Backlight Control | PWM | |
| | | PWM Frequency | 200 Hz | |
| | | Backlight Value | 128 | |
| | | LVDS Clock Center Spreading | no Spreading | |
| | | EFP1 Type | DP with HDMI/DVI | |
| | | EFP1 LSPCON | Enable/ Disable | |
| | | EFP2 Type | DP with HDMI/DVI | |
| | | EFP2 LSPCON | Enable/ Disable | |
| | | EFP3 Type | DP with HDMI/DVI | |
| | | EFP3 LSPCON | Enable/ Disable | |
| | | Mode Persistence | Enable/ Disable | |
| | | Center Mode | Enable/ Disable | |
| Stop Grant Conf. | Auto | | | |
| VT-d | Enable/Disable | | | |
| Above 4 GB MMIO | Enable/ Disable | | | |
| PCH-IO Configuration | | | | |
| PCI Express Configuration | Port8xh Decode | | Enable/ Disable | |
| | PCI-USB Glitch W/A | | Enable/ Disable | |
| | PCIe Root Port 1: Configured as USB/SATA PCIe Root Port 2: Configured as USB/SATA PCIe Root Port 3: Configured as USB/SATA PCIe Root Port 4: Configured as USB/SATA | PCI Expr. Root Port 1 to 16 | Enable/Disable | |
| | | Connection Type | Slot | |
| | | ASPM8 | Auto | |
| | | PME SCI | Enable/Disable | |
| | PCIe Root Port 5: (COMe Lane 0) PCIe Root Port 6: (COMe Lane 1) PCIe Root Port 7: (COMe Lane 2) | Hot Plug | Enable/ Disable | |
| | | PCIe Speed | Auto | |

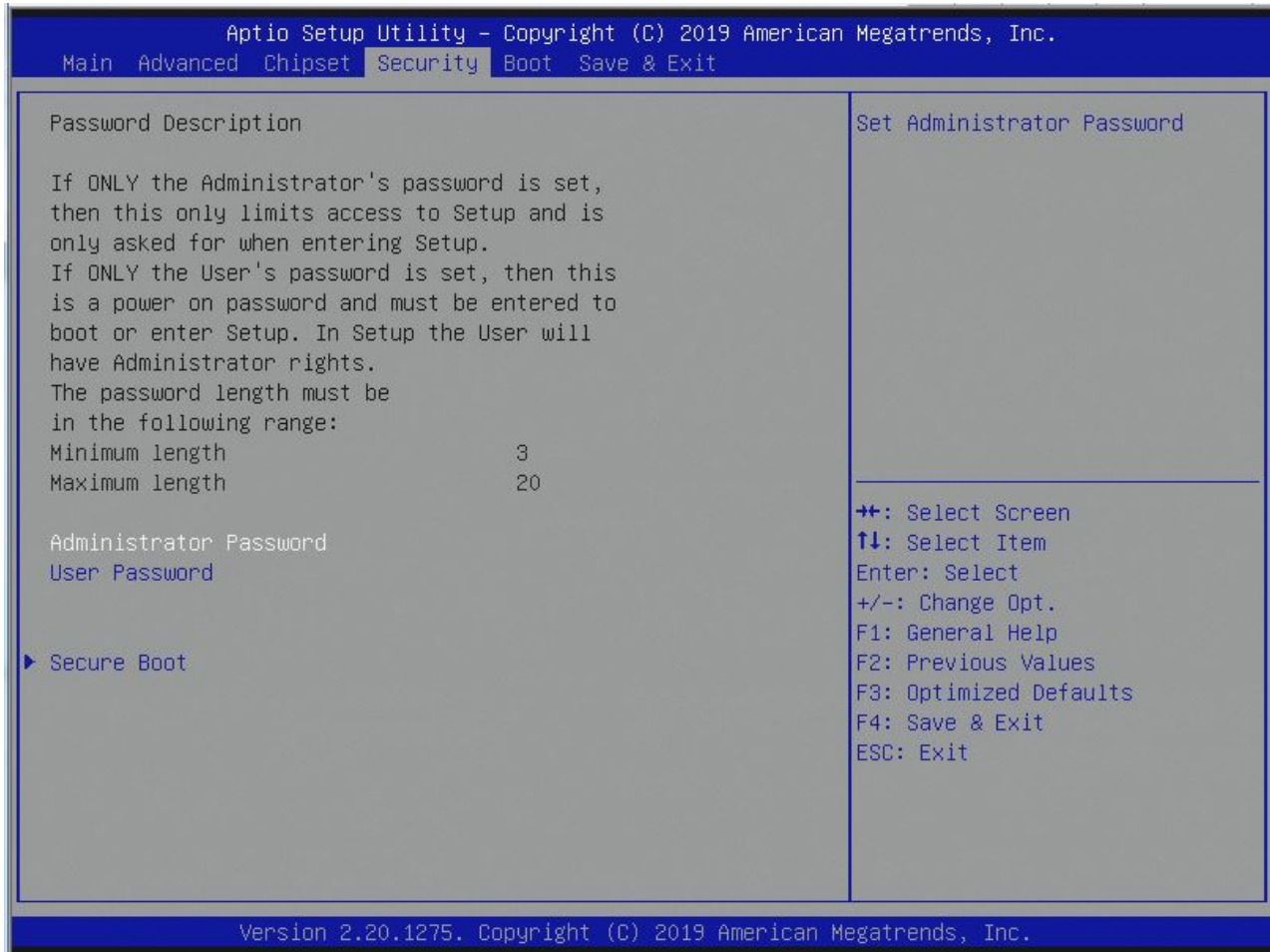
| Function | Second level Sub-Screen / Description | | |
|----------------------------------|--|------------------------|------------------------|
| PCI Express Configuration | PCIe Root Port 8: (COMe Lane 3) PCIe Root Port 9: (COMe Lane 5) Reserved for Ethernet PCIe Root Port 10: (COMe Lane 4) PCIe Root Port 11: Configured as USB/SATA PCIe Root Port 12: Configured as USB/SATA PCIe Root Port 13: (COMe PEG 0) PCIe Root Port 14: (COMe PEG 1) PCIe Root Port 15: (COMe PEG 2) PCIe Root Port 16: (COMe PEG 3) | Detect Timeout | 0 |
| | | Extra Bus Reserved | 0 |
| | | Reserved Memory | 10 |
| | | Reserved I/O | 4 |
| SATA and RST Configuration | SATA Controller | Enable/Disable | |
| | SATA Mode Selection | AHCI | |
| | Software Feature Mask Configuration | HDD Unlock | Enable/Disable |
| | | LED Locate | Enable/Disable |
| | Serial ATA Port 0, 1, 2, 3 | Port 0, 1, 2, 3 | Enable/Disable |
| | | External | Enable/ Disable |
| | | Spin Up Device | Enable/ Disable |
| SATA Device Type | Hard Disk Drive | | |
| USB Configuration | xDCI Support | Enable/ Disable | |
| | USB Overcurrent | Enable/Disable | |
| | USB Overcurrent Lock | Enable/Disable | |
| | USB Port Disable Override | Enable/ Disable | |
| Security Configuration | RTC Memory Lock | Enable/Disable | |
| | BIOS Lock | Enable/Disable | |
| | Force unlock on all GPIO pads | Enable/ Disable | |
| HD Audio Subsystem Configuration | HD Audio | Enable/Disable | |
| SerialIO Configuration | SPIO Controller | Enable/ Disable | |
| SCS Configuration | UFS 2.0 Controller | Enable/ Disable | |
| PCH LAN Controller | Enable/Disable | | |
| Wake on LAN | Enable/Disable | | |
| Serial IRQ Mode> | Continuous | | |
| State after G3 | S0 State | | |
| Port 80h Redirection | LPC Bus | | |
| Enhance Port 80h LPC Decoding | Enable/ Disable | | |

| Function | Second level Sub-Screen / Description | | |
|-------------------|---------------------------------------|--|--|
| Enable TCO Timer | Enable/ Disable | | |
| PCIe P11 SSC | [Auto, 0.0% , ...] | | |
| SPD Write Disable | True | | |

10.1.4. Security Setup Menu

The Security Setup menu provides information about the passwords and functions for specifying the security settings. The passwords are case-sensitive.

Figure 15: Security Setup Menu Initial Screen



The following table shows the Security set up sub-screens and functions, and describes the content.

Table 56: Security Setup Menu Functions

| Function | Description | |
|-------------------------|-----------------------------|-----------------------------|
| Administrator Password> | Sets administrator password | |
| User Password> | Sets user password | |
| Secure Boot | [Enabled, Disabled] | |
| | Secure Boot Mode | [Custom , Standard] |
| | Restore Factory Keys | |
| | Reset to Setup Mode | |
| | Key Management | |
| | Factory Key Provision | [Enabled, Disabled] |

| Function | Description | |
|-------------|-----------------------|--|
| Secure Boot | Restore Factory Keys | |
| | Enroll Efi Image | |
| | Restore DB Defaults | |
| | Platform Key | |
| | Key Exchange Keys | |
| | Authorized Signatures | |
| | Forbidden Signatures | |
| | Authorized TimeStamps | |
| | OSRecovery Signatures | |



If only the administrator's password is set, then only access to setup is limited and requested when entering the setup.

If only the user's password is set, then the password is a power on password and must be entered to boot or enter setup. In the setup the user has administrator rights.

The required password length in characters is max. 20 and min. 3.

10.1.4.1. Remember the Password

It is highly recommended to keep a record of all passwords in a safe place. Forgotten passwords results in the user being locked out of the system.

If the system cannot be booted because the User Password or the Supervisor Password are not known, clear the UEFI BIOS settings, or contact Kontron Support for further assistance.

10.1.5. Boot Menu

The Boot menu provides functions for booting up the setup program.

Figure 16: Boot Screen

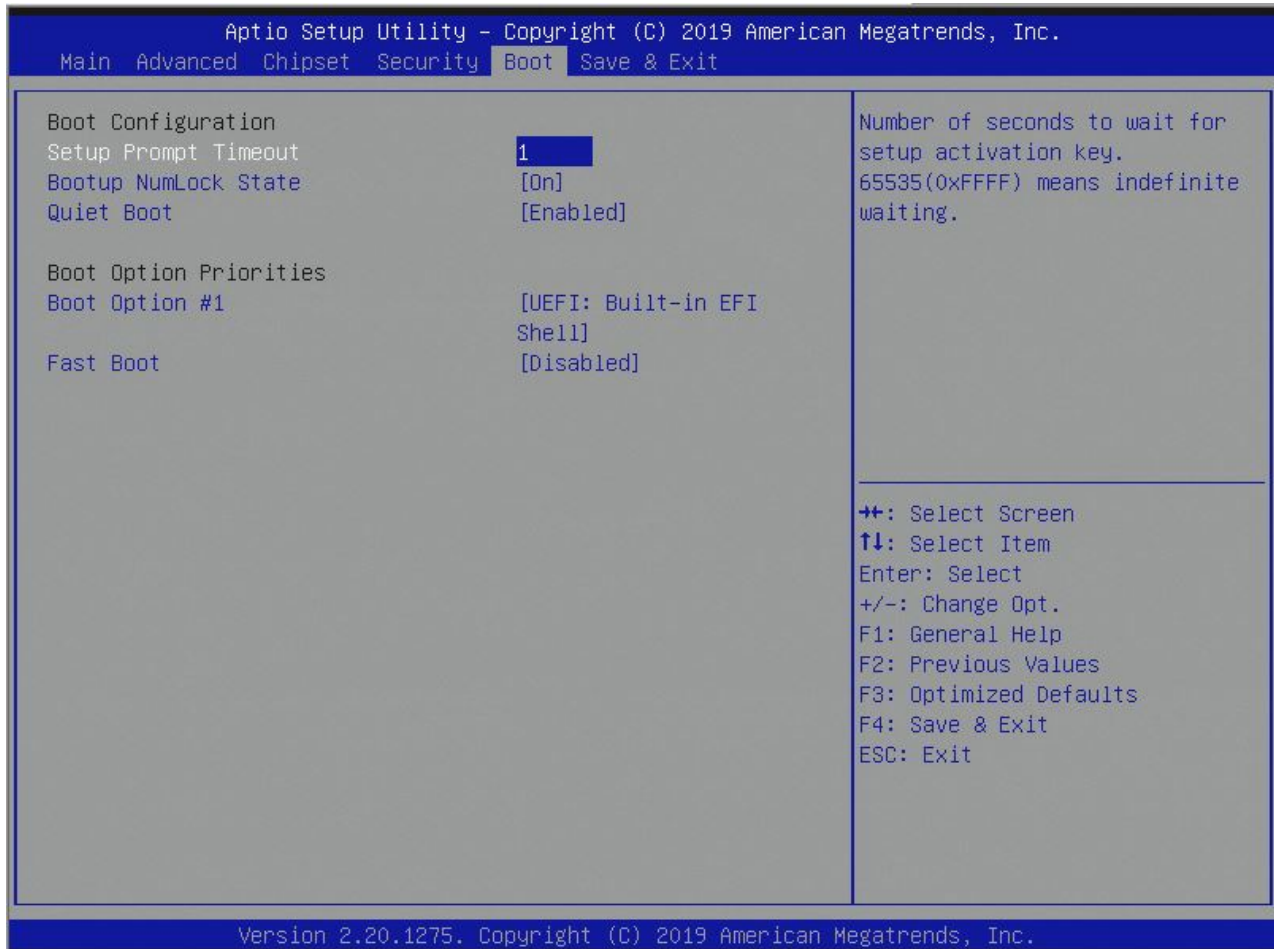


Table 57: Boot Menu Functions

| Function | Description |
|------------------------|--------------------------------------|
| Setup Prompt Timeout> | 1 |
| Bootup NumLock State> | [On, Off] |
| Quiet Boot> | [Enabled, Disabled] |
| Boot Option Priorities | |
| Boot Option #1 | [UEFI: Built-in EFI Shell, Disabled] |
| Fast Boot | [Enabled, Disabled] |

10.1.6. Save and Exit Setup Menu

The Save and Exit setup menu provides functions for handling changes made to the UEFI BIOS settings and exiting the setup program.

Figure 17: Save and Exit Setup Menu Initial Screen

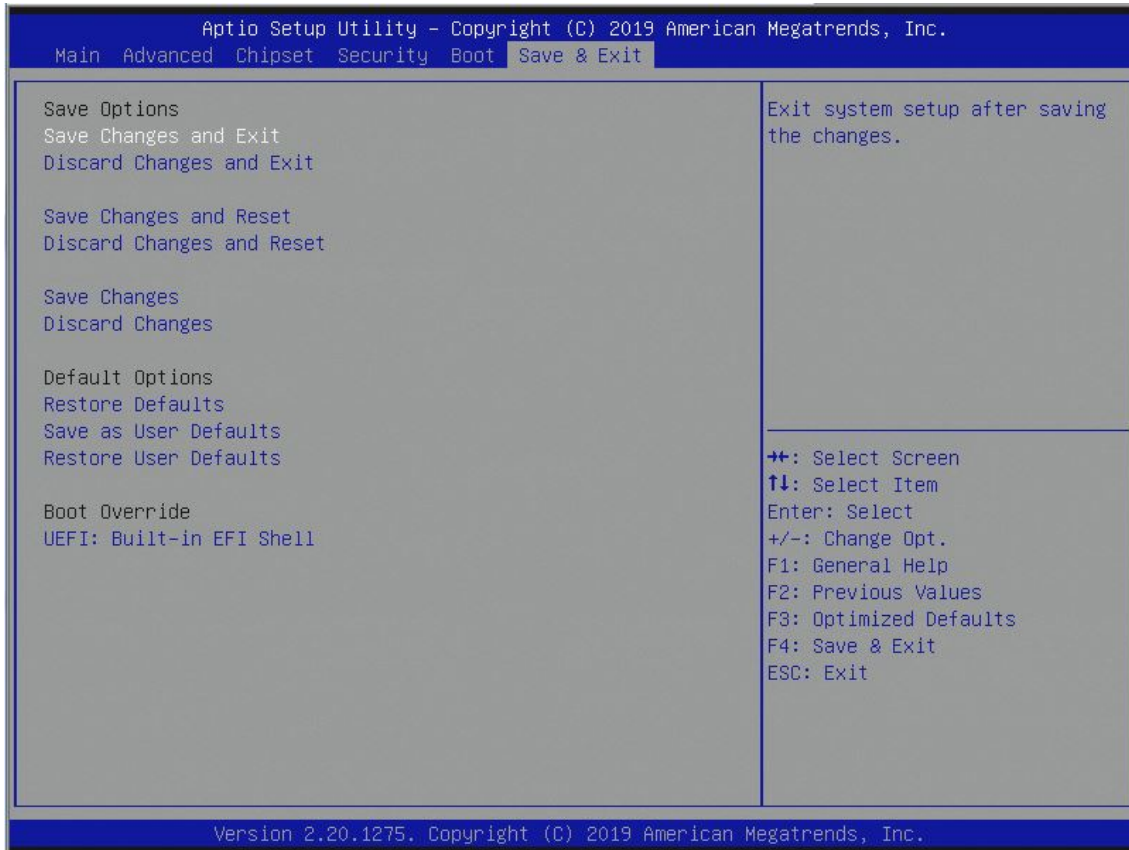


Table 58: Save and Exit Setup Menu Functions

| Function | Description |
|----------------------------|--|
| Save Changes and Exit> | Exits system after saving changes |
| Discard Changes and Exit> | Exits system setup without saving changes |
| Save Changes and Reset> | Resets system after saving changes |
| Discard Changes and Reset> | Resets system setup without saving changes |
| Save Changes> | Saves changes made so far for any setup options |
| Discard Changes> | Discards changes made so far for any setup options |
| Restore Defaults> | Restores/loads standard default values for all setup options |
| Save as User Defaults> | Saves changes made so far as user defaults |
| Restore User Defaults> | Restores user defaults to all setup options |
| UEFI Built-in EFI shell> | Attempts to launch the built-in EFI Shell |

11/Technical Support

For technical support contact our Support department:

E-mail: support@kontron.com

Phone: +49-821-4086-888

Make sure you have the following information available when you call:

- ▶ Product ID Number (PN),
- ▶ Serial Number (SN)
- ▶ Module's revision
- ▶ Operating System and Kernel/Build version
- ▶ Software modifications
- ▶ Addition connected hardware/full description of hardware set up



The serial number can be found on the Type Label, located on the product's rear side.

Be ready to explain the nature of your problem to the service technician.

11.1. Warranty

Due to their limited service life, parts that by their nature are subject to a particularly high degree of wear (wearing parts) are excluded from the warranty beyond that provided by law. This applies to the CMOS battery, for example.



If there is a protection label on your product, then the warranty is lost if the product is opened.

11.2. Returning Defective Merchandise

All equipment returned to Kontron must have a Return of Material Authorization (RMA) number assigned exclusively by Kontron. Kontron cannot be held responsible for any loss or damage caused to the equipment received without an RMA number. The buyer accepts responsibility for all freight charges for the return of goods to Kontron's designated facility. Kontron will pay the return freight charges back to the buyer's location in the event that the equipment is repaired or replaced within the stipulated warranty period. Follow these steps before returning any product to Kontron.

1. Visit the RMA Information website:
<http://www.kontron.com/support-and-services/support/rma-information>

Download the RMA Request sheet for **Kontron Europe GmbH** and fill out the form. Take care to include a short detailed description of the observed problem or failure and to include the product identification Information (Name of product, Product number and Serial number). If a delivery includes more than one product, fill out the above information in the RMA Request form for each product.

2. Send the completed RMA-Request form to the fax or email address given below at Kontron Europe GmbH. Kontron will provide an RMA-Number.

Kontron Europe GmbH
RMA Support
Phone: +49 (0) 821 4086-0
Fax: +49 (0) 821 4086 111
Email: service@kontron.com

3. The goods for repair must be packed properly for shipping, considering shock and ESD protection.



Goods returned to Kontron Europe GmbH in non-proper packaging will be considered as customer caused faults and cannot be accepted as warranty repairs.

4. Include the RMA-Number with the shipping paperwork and send the product to the delivery address provided in the RMA form or received from Kontron RMA Support.

Appendix: List of Acronyms

Table 59: List of Acronyms

| | | | |
|------------------------|---|---------------------|---|
| ACPI | Advanced Configuration Power Interface | HBR2 | High Bitrate 2 |
| API | Application Programming Interface | HDA | High Definition Audio (HD Audio) |
| Basic Module | COM Express® 125 x 95 Module form factor | HD/HDD | Hard Disk /Drive |
| BIOS | Basic Input Output System | HDMI | High Definition Multimedia Interface |
| BMC | Base Management Controller | HPM | PICMG Hardware Platform Management specification family |
| BSP | Board Support Package | I2C | Inter integrated Circuit Communications |
| BPP | Bit Per Pixel | IOL | IPMI-Over-LAN |
| CAN | Controller-area network | IOT | Internet of Things |
| Carrier Board | Application specific circuit board that accepts a COM Express® module | IPMI | Intelligent Platform Management Interface |
| COM | Computer-on-Module | KCS | Keyboard Controller Style |
| Compact Module | COM Express® 95x95 Module form factor | KVM | Keyboard Video Mouse |
| CNTG | Computer Network Transaction Group | LAN | Local Area Network |
| DDC | Display Data Control | LPC | Low Pin-Count Interface: |
| DDI | Digital Display Interface – | LVDS | Low Voltage Differential Signaling |
| DIMM | Dual In-line Memory Module | M.A.R.S. | Mobile Application for Rechargeable Systems |
| Display Port | DisplayPort (digital display interface standard) | MDI | Media Dependent Interface |
| DMA | Direct Memory Access | MEI | Management Engine Interface |
| DRAM | Dynamic Random Access Memory | Mini Module | COM Express® 84x55mm Module form factor |
| DVI | Digital Visual Interface | MTBF | Mean Time Before Failure |
| EAPI | Embedded Application Programming Interface | NA | Not Available |
| ECC | Error Checking and Correction | NC | Not Connected |
| EEPROM | Electrically Erasable Programmable Read-Only Memory | NCSI | Network Communications Services Interface |
| eDP | Embedded Display Port | PATA | Parallel AT Attachment |
| EMC | Electromagnetic Compatibility (EMC) | PCI | Peripheral Component Interface |
| ESD | Electro Sensitive Device | PCIe | PCI-Express |
| Extended Module | COM Express® 155mm x 110mm Module form factor. | PECI | Platform Environment Control Interface |
| FIFO | First In First Out | PEG | PCI Express Graphics |
| FRU | Field Replaceable Unit | PICMG® | PCI Industrial Computer Manufacturers Group |
| Gb | Gigabit | PHY | Ethernet controller physical layer device |
| GBE | Gigabit Ethernet | Pin-out Type | COM Express® definitions for signals on COM Express® Module connector pins. |
| GPI | General Purpose Input | PS2 | Personal System 2 (keyboard & mouse) |
| GPIO | General Purpose Input Output | PSU | Power Supply Unit |
| GPO | General Purpose Output | RoHS | Restriction of Hazardous Substances |
| GPU | Graphics Processing Unit | RTC | Real Time Clock |

| | |
|----------------|--|
| SAS | Serial Attached SCSI – high speed serial version of SCSI |
| SATA | Serial AT Attachment: |
| SCSI | Small Computer System Interface |
| SEL | System Event Log |
| ShMC | Shelf Management Controller |
| SMBus | System Management Bus |
| SO-DIMM | Small Outline Dual in-line Memory Module |
| SOIC | Small Outline Integrated Circuit |
| SOL | Serial Over LAN |
| SPI | Serial Peripheral Interface |
| SSH | Secure Shell |

| | |
|-------------|--|
| TPM | Trusted Platform Module |
| UART | Universal Asynchronous Receiver Transmitter |
| UEFI | Unified Extensible Firmware Interface |
| UHD | Ultra High Definition |
| ULP | Ultra Low Power |
| USB | Universal Serial Bus |
| VGA | Video Graphics Adapter |
| VLP | Very Low Profile |
| WDT | Watch Dog Timer |
| WEEE | Waste Electrical and Electronic Equipment (directive) |



About Kontron – Member of the S&T Group

Kontron is a global leader in embedded computing technology (ECT). As a part of technology group S&T, Kontron offers a combined portfolio of secure hardware, middleware and services for Internet of Things (IoT) and Industry 4.0 applications. With its standard products and tailor-made solutions based on highly reliable state-of-the-art embedded technologies, Kontron provides secure and innovative applications for a variety of industries. As a result, customers benefit from accelerated time-to-market, reduced total cost of ownership, product longevity and the best fully integrated applications overall.

For more information, please visit: www.kontron.com



GLOBAL HEADQUARTERS

Kontron Europe GmbH
Gutenbergstraße 2
85737 Ismaning, Germany
Tel.: +49 821 4086-0
Fax: +49 821 4086-111
info@kontron.com