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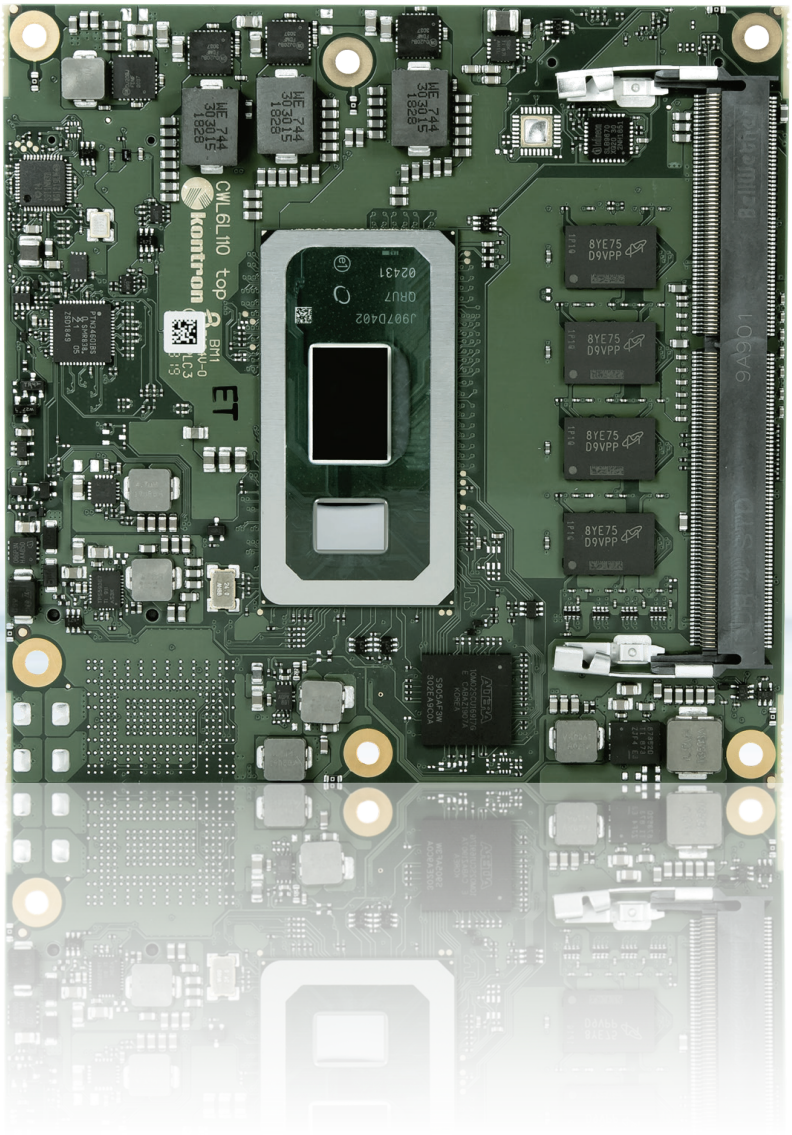
COMe-cWL6

COM Express Compact Type 6 Module with

Intel® 8th Generation Core i / Celeron 4000 U-Series Processors

USER GUIDE



COMe-cWL6

User Guide Rev. 1.1

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COME-CWL6 – USER GUIDE

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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 Instrctions for IT Equipment” supplied with the system.

Revision History

Revision	Brief Description of Changes	Date of Issue	Author
1.0	Initial Issue	2020-February-06	hjs
1.1	MTBF chapter inserted	2020-March-12	hjs

Terms and Conditions

Kontron warrants products in accordance with defined regional warranty periods. For more information about warranty compliance and conformity, and the warranty period in your region, visit http://www.kontron.com/terms-and-conditions.

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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.

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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.

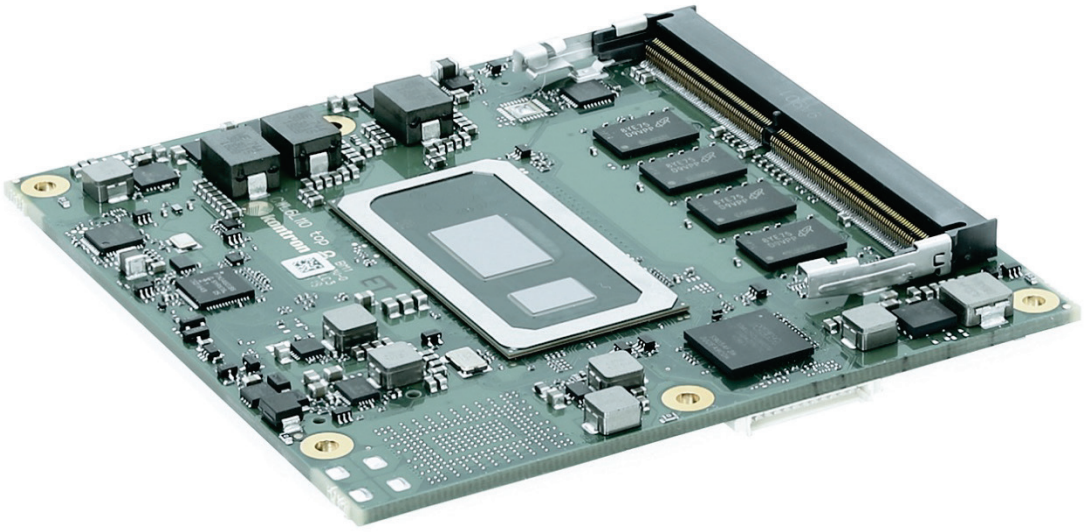
The COMe-cWL6 is ideally suited as a powerful successor for existing solutions, as it takes over their pin assignment and feature implementation. Typical applications include communication, digital signage, professional gaming and entertainment, medical imaging, surveillance and security, industrial 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
38106-0000-00-0	COM Express® Eval Carrier Type 6	Topanga Canyon	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
Part Number	**COMe Starter kit**	**Project Code**	**Comment**
38106-0000-00-S	COMe Eval. Starter kit T6	Topanga Canyon	Starter kit with COMe Evaluation Carrier T6

Table 6: General Accessories

Part Number	Cooling Solutions	Comments
36099-0000-99-0	COMe Active Uni cooler	For CPUs up to 20 W TDP, to be mounted on HSP
36099-0000-99-1	COMe Passive Uni Cooler	For CPUs up to 10 W TDP, to be mounted on HSP
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

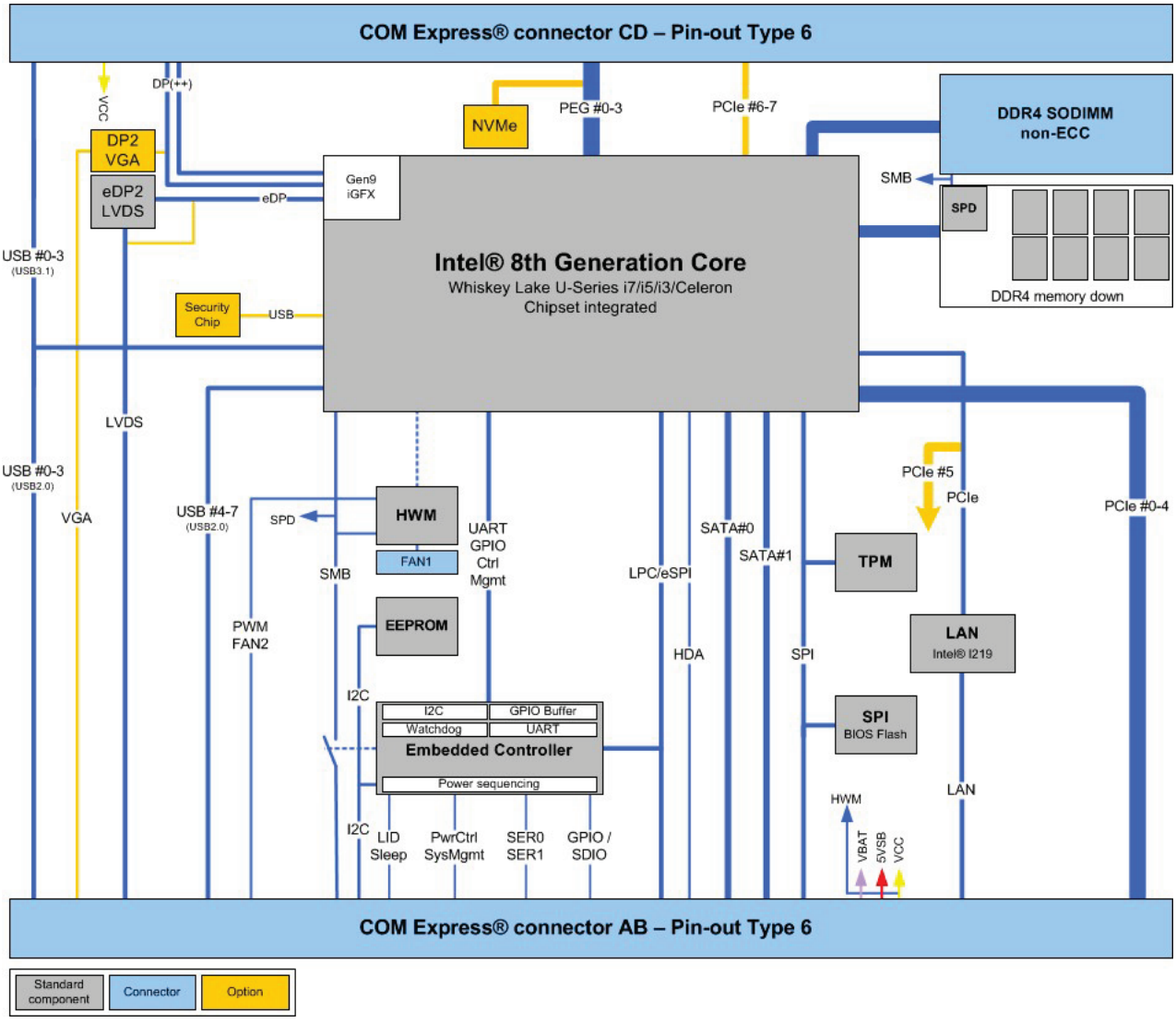
Table 8: Technical Data

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 I²C, 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.

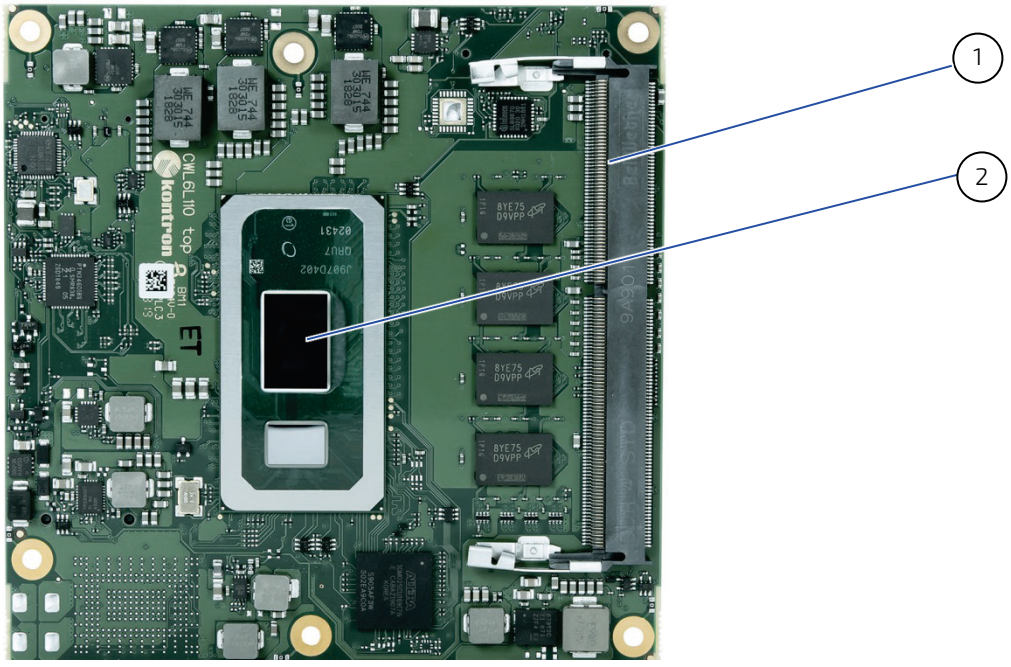
Figure 2: Block Diagram COMe-cWL6



2.3.3. Front and Rear View

2.3.3.1. Front View

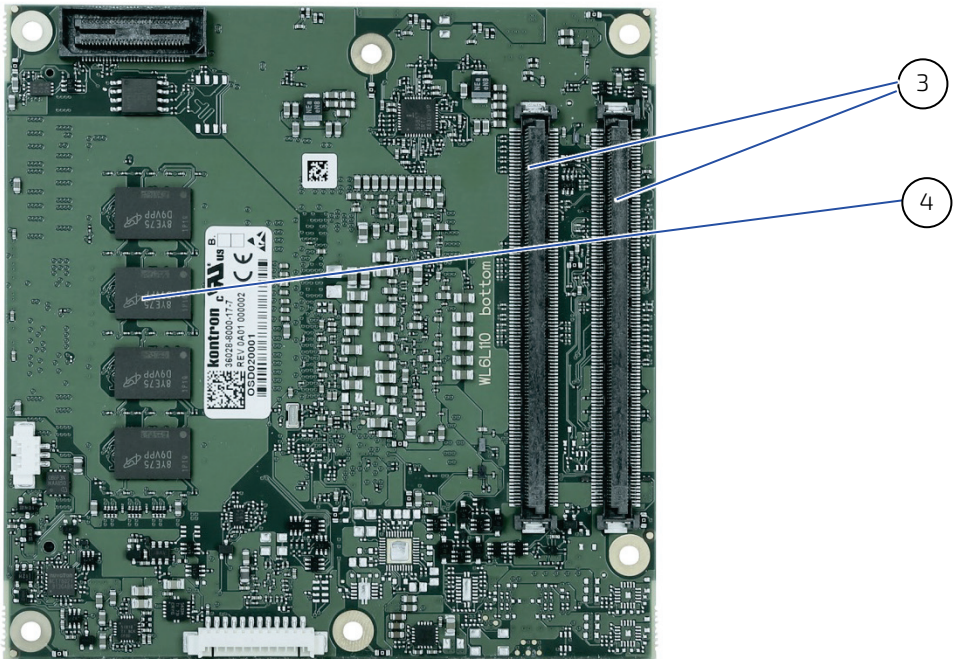
Figure 3: Front View COMe-cWL6



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

2.3.3.2. Rear View

Figure 4: Rear View COMe-cWL6

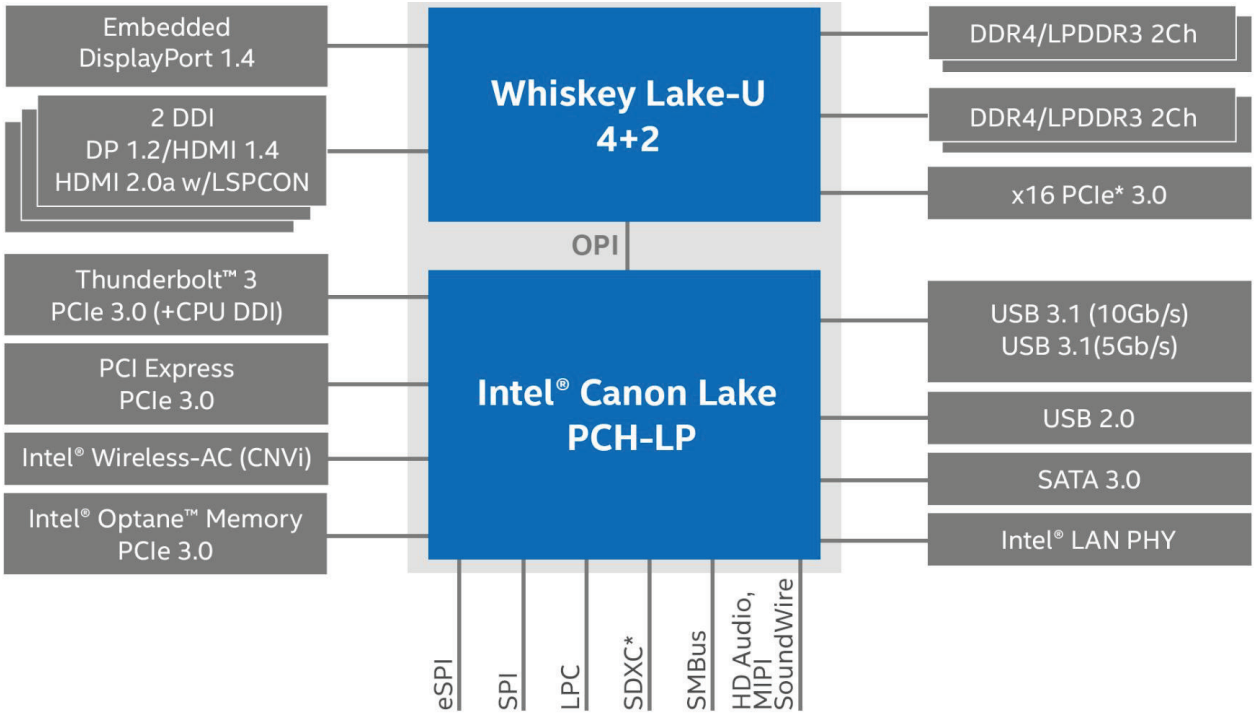


3. 2x COMe Connectors
4. Memory down

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, LPDDR3-2133	DDR4-2400, LPDDR3-2133	DDR4-2400, LPDDR3-2133	DDR4-2400, LPDDR3-2133
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 or LPDDR3-2133 with up to 37.5 GB/s. 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 or LPDDR3-2133
Memory Type	DDR4-2400, LPDDR3-2133 without ECC
Max Memory Module Size	32 GByte
Bandwidth	up to 37.5 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: Memory.

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: DDI1 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_HPD0	

Table 14: DDI2 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_HPD1	

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 FPGA's internal kCPLD block:

1. External user-accessible I2C connected to embedded EEPROM and COM Express connector.
2. Internal on-module I2C connected to VGA-bridge, LVDS-bridge, external LVDS-DDC-interface and S5-ECO switch.

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 19: 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 20: 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 21: 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 22: 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 23: 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	SPI0_CS0#	'1'	Module	
1	0	SPI0_CS0#	'1'	(Module)	Not Supported
0	1	SPI0_CS1#	SPI0_CS0#	Carrier	
0	0	SPI0_CS0#	SPI0_CS1#	Module	

2.3.16. Speaker Out (SPKR)

Table 24: Speaker Out (SPKR)

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

2.3.17. Watchdog Timeout (WDT)

Table 25: 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 26: 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 27: Onboard Fan Connector

Connector Pin	Description
1	FAN_TACH_IN#
2	V_FAN
3	GND
4	V_FAN
5	V_FAN

2.3.22. External Fan support

Table 28: External Fan Control

COMe Signal	HWM Pin
FAN_PWMOUT	FANCTL2
FAN_TACHIN	FANIN2

2.3.23. General Purpose PCI Express 3.0

Table 29: 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			NO
PCIE5 (no GbE)	PCIE9			
PCIE6 (no SATA0)	PCIE11	x1		
PCIE7 (no SATA1)	PCIE12	x1		
PCIG0	PCIE13	x1	x4	YES
PCIG1	PCIE14	x1		
PCIG2 (no NVME)	PCIE15	x1		
PCIE7 (no x2 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 30: 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 31: 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 32: 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 33: 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 34: 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 35: 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 ± 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 ≤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 ±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 36: 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 ms ≤ t < 4 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 VSB) for Computer-On-Modules supporting a wide input voltage range down to 8.5 V.

Table 37: 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 38: 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 39: 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 40: 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 60950-1/CSA 60950-1 Information Technology Equipment Including Electrical Business Equipment NWGQ2.E304278 NWGQ8.E304278
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)

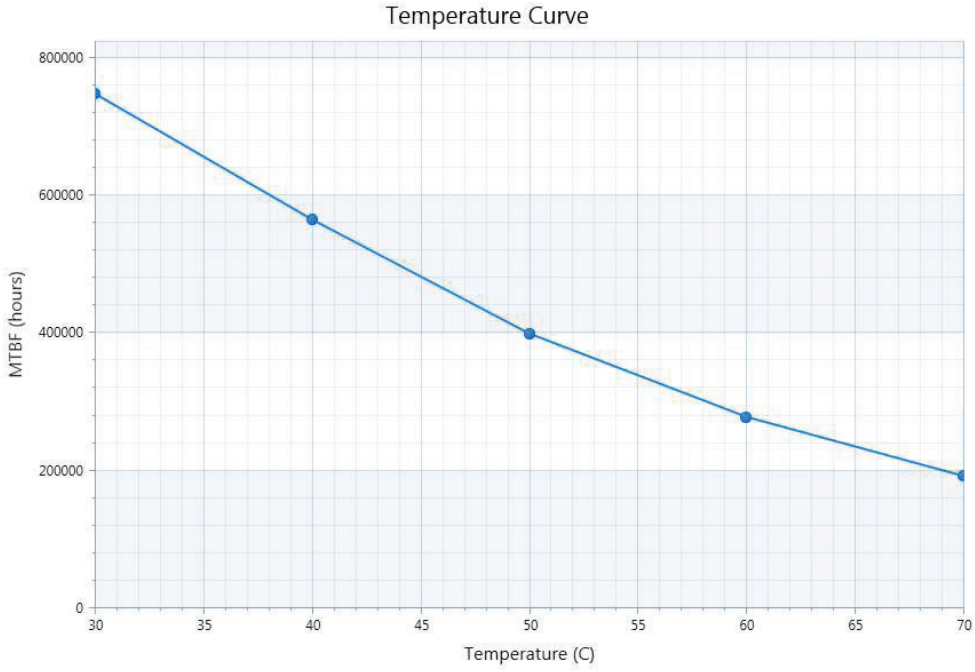
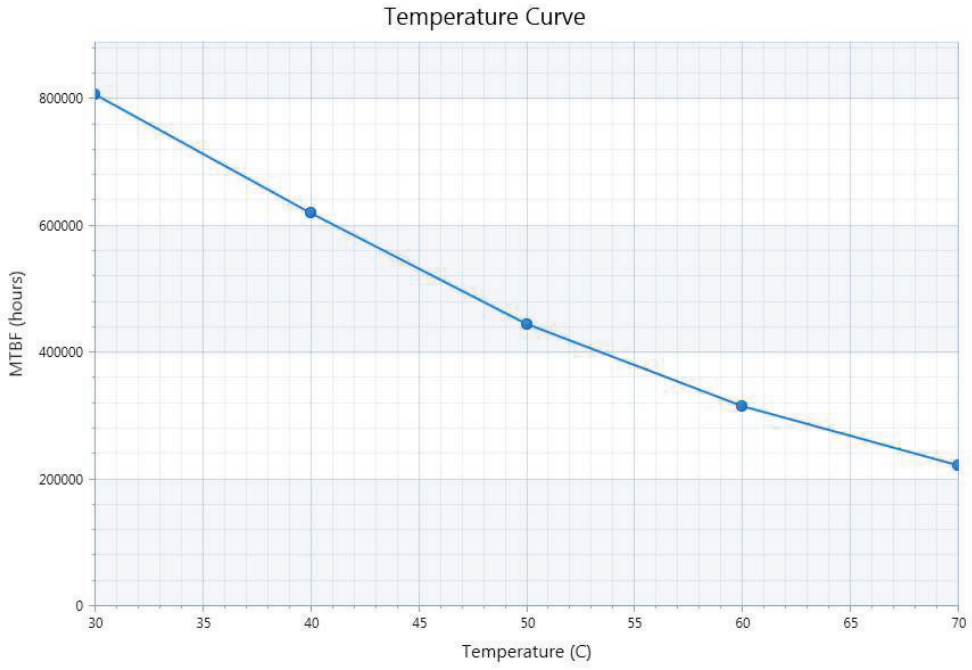


Figure 7: System MTBF (hours) = 620436 h @ 40°C (Reliability report article number 36029-0000-22-3)



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.

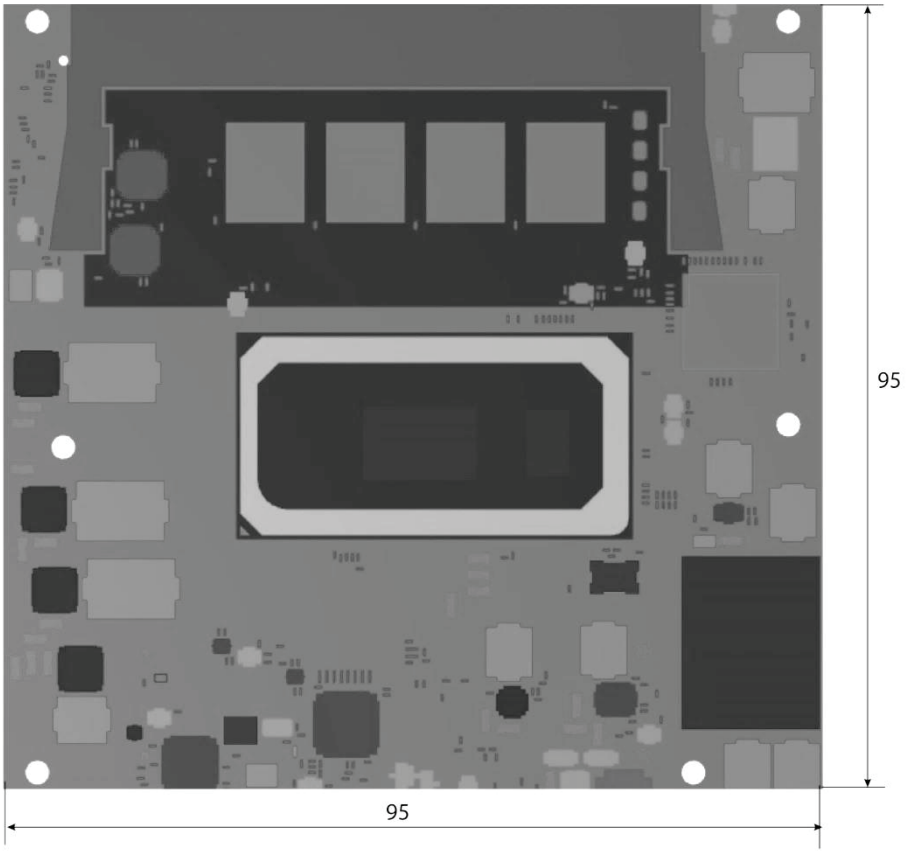
6/ Mechanical Specification

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



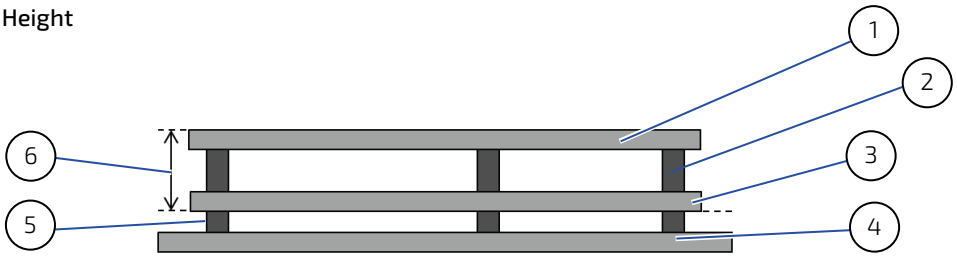
*All dimensions shown in mm.

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

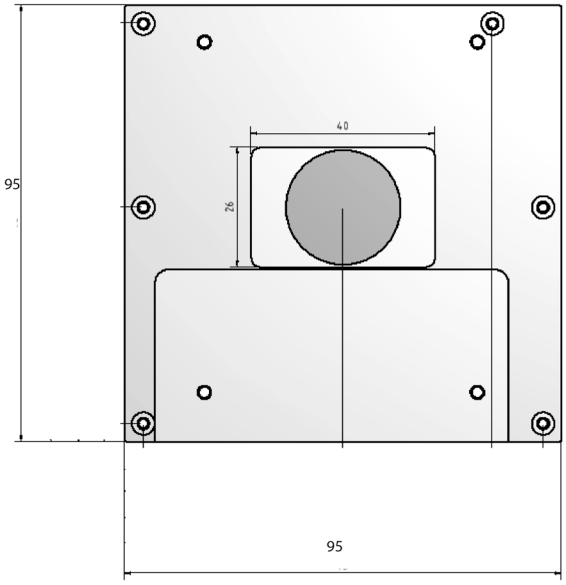


1	Heatspreader	4	Carrier Board PCB
2	Heatspreaader standoff(s)	5	Connector standoff(s) 5 or 8 mm
3	Module PCB	6	13 mm +/- 0.65 mm

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 41: 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 42: 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 43: 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 44: 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

Eight GPIO pins are available, with four pins for the in-direction (pin A54 for GPI0, pin A63 for GPI1, pin A67 for GPI2 and pin A85 for GPI3) and four pins for the out-direction (pin A93 for GPO0, pin B54 for GPO1, pin B57 for GPO2 and pin B63 for GPO3). The type of termination resistor on the module sets the direction of the GPIO where GPIs are terminated with pull-up resistors and GPOs are terminated with pull-down resistors.

Due to, the fact that both the pull-up and pull-down termination resistors are weak, it is possible to override the termination resistors using external pull-ups, pull-downs or IOs. Overriding the termination resistors means that the eight GPIO pins can be considered as bi-directional since there are no restrictions whether you use the available GPIO pins in the in-direction or out-direction.

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)

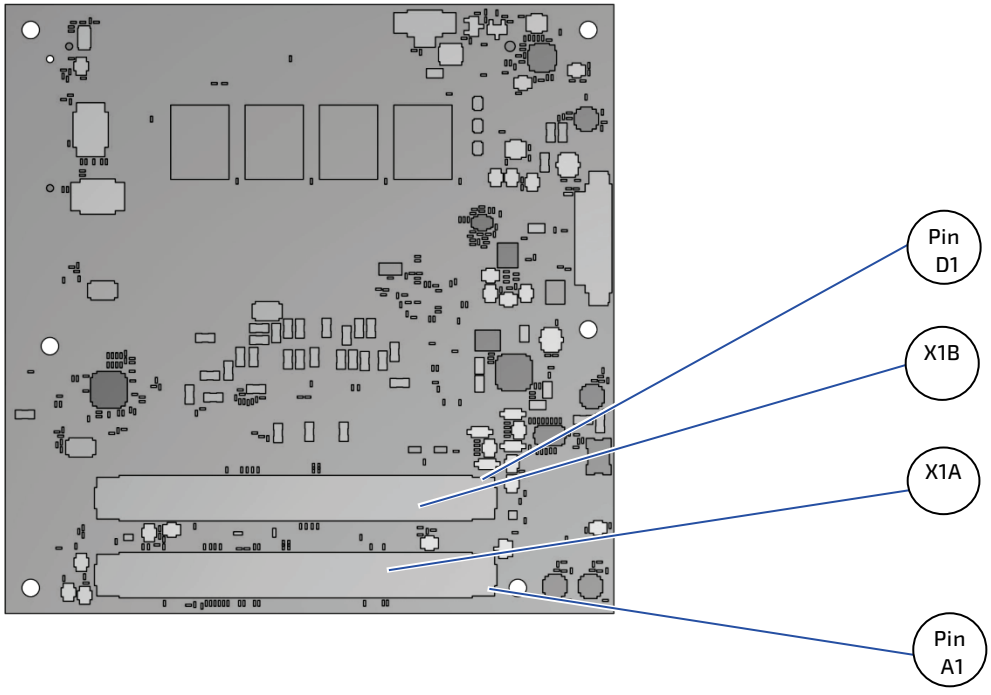
The COMe-cWL6 is a COM Express® compact module containing two 220-pin connectors; each with two rows called row A and B on the primary connector and row C and D on the secondary connector.

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 45: 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 45: 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 46: Connector X1A Row A Pin Assignment (A1- A110)
2. Table 47: Connector X1A Row B Pin Assignment (B1-B110)
3. Table 48: Connector X1B Row C Pin Assignment (C1-C110)
4. Table 49: Connector X1B Row D Pin Assignment (D1-D110)

8.2.1. Connector X1A Row A1 – A110

Table 46: 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	O	---	1 µF capacitor to GND
A15	SUS_S3#	Suspend To RAM (or deeper) Indicator	O-3.3	PD 10k	---
A16	SATA0_TX+	SATA Transmit Pair 0 +	DP-O	---	---
A17	SATA0_TX-	SATA Transmit Pair 0 -	DP-O	---	---
A18	SUS_S4#	Suspend To Disk (or deeper) Indicator	O-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-O	---	---
A23	SATA2_TX-	SATA Transmit Pair 2 -	DP-O	---	---
A24	SUS_S5#	Soft Off Indicator	O-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	O-3.3	PD 20k in PCH	---
A30	HDA_RST#	HD Audio Reset	O-3.3	PD 20k in PCH	---
A31	GND	Power Ground	PWR GND	---	---
A32	HDA_CLK	HD Audio Bit Clock Output	O-3.3	PD 20k in PCH	---
A33	HDA_SDOUT	HD Audio Serial Data Out	O-3.3	PD 20k in PCH	---
A34	BIOS_DIS0#/ESPI _SAFS	BIOS Selection Strap 0	I-3.3	PU 10k 3.3V (S5)	---
A35	THRMTRIP#	Thermal Trip	O-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-O	---	---
A53	PCIE_TX5-	PCI Express Lane 5 Transmit -	DP-O	---	---
A54	GPI0	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-O	---	---
A56	PCIE_TX4-	PCI Express Lane 4 Transmit -	DP-O	---	---
A57	GND	Power Ground	PWR GND	---	---
A58	PCIE_TX3+	PCI Express Lane 3 Transmit +	DP-O	---	---
A59	PCIE_TX3-	PCI Express Lane 3 Transmit -	DP-O	---	---
A60	GND	Power Ground	PWR GND	---	---
A61	PCIE_TX2+	PCI Express Lane 2 Transmit +	DP-O	---	---
A62	PCIE_TX2-	PCI Express Lane 2 Transmit -	DP-O	---	---
A63	GPI1	General Purpose Input 1	I-3.3	PU 100k 3.3V (S0)	---
A64	PCIE_TX1+	PCI Express Lane 1 Transmit +	DP-O	---	---
A65	PCIE_TX1-	PCI Express Lane 1 Transmit -	DP-O	---	---
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-O	---	---
A69	PCIE_TX0-	PCI Express Lane 0 Transmit -	DP-O	---	---
A70	GND	Power Ground	PWR GND	---	---
A71	LVDS_A0+	LVDS Channel A DAT0+/EDP Lane 2 Transmit +	DP-O	---	---
A72	LVDS_A0-	LVDS Channel A DAT0-/EDP Lane 2 Transmit -	DP-O	---	---
A73	LVDS_A1+	LVDS Channel A DAT1+/EDP Lane 1 Transmit +	DP-O	---	---
A74	LVDS_A1-	LVDS Channel A DAT1-/EDP Lane 1 Transmit -	DP-O	---	---
A75	LVDS_A2+	LVDS Channel A DAT2+/EDP Lane 0 Transmit +	DP-O	---	---
A76	LVDS_A2-	LVDS Channel A DAT2-/EDP Lane 0 Transmit -	DP-O	---	---
A77	LVDS_VDD_EN	LVDS/EDP Panel Power Control	O-3.3	PD 100k	---
A78	LVDS_A3+	LVDS Channel A DAT3+	DP-O	---	---
A79	LVDS_A3-	LVDS Channel A DAT3-	DP-O	---	---
A80	GND	Power Ground	PWR GND	---	---
A81	LVDS_A_CK+	LVDS Channel A Clock+/EDP Lane 3 Transmit +	DP-O	---	Clock: 20-80MHz
A82	LVDS_A_CK-	LVDS Channel A Clock-/EDP Lane 3 Transmit -	DP-O	---	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-O	---	100MHz
A89	PCIE_CLK_REF-	Reference PCI Express Clock -	DP-O	---	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 47: 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	O-3.3/eSPI O- 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	O-3.3/eSPI O- 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	O-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-O	---	---
B17	SATA1_TX-	SATA 1 Transmit Pair -	DP-O	---	---
B18	SUS_STAT#/ ESPI_RESET#	Suspend Status/eSPI Reset	O-3.3/O-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_PRSNT	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	O-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	O-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	O-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-O	---	---
B72	LVDS_B0-	LVDS Channel B DAT0-	DP-O	---	---
B73	LVDS_B1+	LVDS Channel B DAT1+	DP-O	---	---
B74	LVDS_B1-	LVDS Channel B DAT1-	DP-O	---	---
B75	LVDS_B2+	LVDS Channel B DAT2+	DP-O	---	---
B76	LVDS_B2-	LVDS Channel B DAT2-	DP-O	---	---
B77	LVDS_B3+	LVDS Channel B DAT3+	DP-O	---	---
B78	LVDS_B3-	LVDS Channel B DAT3-	DP-O	---	---
B79	LVDS_BKLT_EN	LVDS/EDP Panel Backlight On	O-3.3	PD 100k	---
B80	GND	Power Ground	PWR GND	---	---
B81	LVDS_B_CK+	LVDS Channel B Clock+	DP-O	---	20-80MHz
B82	LVDS_B_CK-	LVDS Channel B Clock-	DP-O	---	20-80MHz
B83	LVDS_BKLT_CTRL	LVDS/EDP Backlight Brightness Control	O-3.3	---	---
B84	VCC_5V_SBY	5V Standby	PWR 5V (S5)	---	optional (not neccessary in single supply mode)
B85	VCC_5V_SBY	5V Standby	PWR 5V (S5)	---	optional (not neccessary in single supply mode)

Pin	Signal	Description	Type	Termination	Comment
B86	VCC_5V_SBY	5V Standby	PWR 5V (S5)	---	optional (not neccessary in single supply mode)
B87	VCC_5V_SBY	5V Standby	PWR 5V (S5)	---	optional (not neccessary 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 48: 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 (S0)	---
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 49: 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-O	---	---
D4	USB_SSTX0+	USB Super Speed Transmit 0 +	DP-O	---	---
D5	GND	Power Ground	PWR GND	---	---
D6	USB_SSTX1-	USB Super Speed Transmit 1 -	DP-O	---	---
D7	USB_SSTX1+	USB Super Speed Transmit 1 +	DP-O	---	---
D8	GND	Power Ground	PWR GND	---	---
D9	USB_SSTX2-	USB Super Speed Transmit 2 -	DP-O	---	---
D10	USB_SSTX2+	USB Super Speed Transmit 2 +	DP-O	---	---
D11	GND	Power Ground	PWR GND	---	---
D12	USB_SSTX3-	USB Super Speed Transmit 3 -	DP-O	---	---
D13	USB_SSTX3+	USB Super Speed Transmit 3 +	DP-O	---	---
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-O	---	---
D20	PCIE_TX6-	PCI Express Lane 6 Transmit -	DP-O	---	---
D21	GND	Power Ground	PWR GND	---	---
D22	PCIE_TX7+	PCI Express Lane 7 Transmit +	DP-O	---	---
D23	PCIE_TX7-	PCI Express Lane 7 Transmit -	DP-O	---	---
D24	RSVD	Reserved for future use	nc	---	---
D25	RSVD	Reserved for future use	nc	---	---
D26	DDI1_PAIR0+	DDI1 Pair 0 +	DP-O	---	---
D27	DDI1_PAIR0-	DDI1 Pair 0 -	DP-O	---	---
D28	RSVD	Reserved for future use	nc	---	---
D29	DDI1_PAIR1+	DDI1 Pair 1 +	DP-O	---	---
D30	DDI1_PAIR1-	DDI1 Pair 1 -	DP-O	---	---
D31	GND	Power Ground	PWR GND	---	---

Pin	Signal	Description	Type	Termination	Comment
D32	DDI1_PAIR2+	DDI1 Pair 2 +	DP-O	---	---
D33	DDI1_PAIR2-	DDI1 Pair 2 -	DP-O	---	---
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-O	---	---
D37	DDI1_PAIR3-	DDI1 Pair 3 -	DP-O	---	---
D38	RSVD	Reserved for future use	nc	---	---
D39	DDI2_PAIR0+	DDI2 Pair 0 +	DP-O	---	---
D40	DDI2_PAIR0-	DDI2 Pair 0 -	DP-O	---	---
D41	GND	Power Ground	PWR GND	---	---
D42	DDI2_PAIR1+	DDI2 Pair 1 +	DP-O	---	---
D43	DDI2_PAIR1-	DDI2 Pair 1 -	DP-O	---	---
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-O	---	---
D47	DDI2_PAIR2-	DDI2 Pair 2 -	DP-O	---	---
D48	RSVD	Reserved for future use	nc	---	---
D49	DDI2_PAIR3+	DDI2 Pair 3 +	DP-O	---	---
D50	DDI2_PAIR3-	DDI2 Pair 3 -	DP-O	---	---
D51	GND	Power Ground	PWR GND	---	---
D52	PEG_TX0+	PEG Lane 0 Transmit +	DP-O	---	---
D53	PEG_TX0-	PEG Lane 0 Transmit -	DP-O	---	---
D54	PEG_LANE_RV#	Not Connected	nc	---	---
D55	PEG_TX1+	PEG Lane 1 Transmit +	DP-O	---	---
D56	PEG_TX1-	PEG Lane 1 Transmit -	DP-O	---	---
D57	TYPE2#	GND for type 6 module	PWR	---	---
D58	PEG_TX2+	PEG Lane 2 Transmit +	DP-O	---	---
D59	PEG_TX2-	PEG Lane 2 Transmit -	DP-O	---	---
D60	GND	Power Ground	PWR GND	---	---
D61	PEG_TX3+	PEG Lane 3 Transmit +	DP-O	---	---
D62	PEG_TX3-	PEG Lane 3 Transmit -	DP-O	---	---
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 <DEL> 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 50: 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 <DEL>) 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

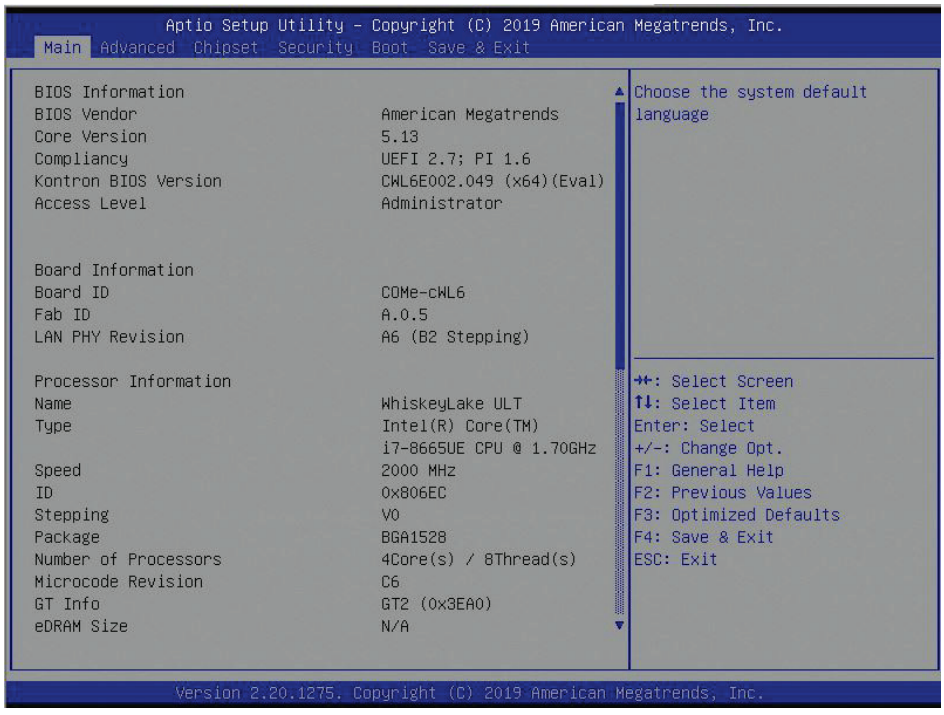
The currently active menu and the currently active UEFI BIOS Setup item are highlighted in white. Use the left and right arrow keys to navigate to the required Setup menu and select the Setup menu by pressing <RETURN>.

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 51: Main Setup Menu Sub-screens

Sub-Screen	Description
BIOS Information>	Read only field *Displays BIOS Information:* BIOS vendor, Core version, Compliancy, Kontron BIOS Version and Access level
Board Information>	Read only field *Displays Board Information:* Board ID, Fab ID, and LAN PHY revision
System Language	[**English**]
Platform Information>	Read only field *Displays Module Information* 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

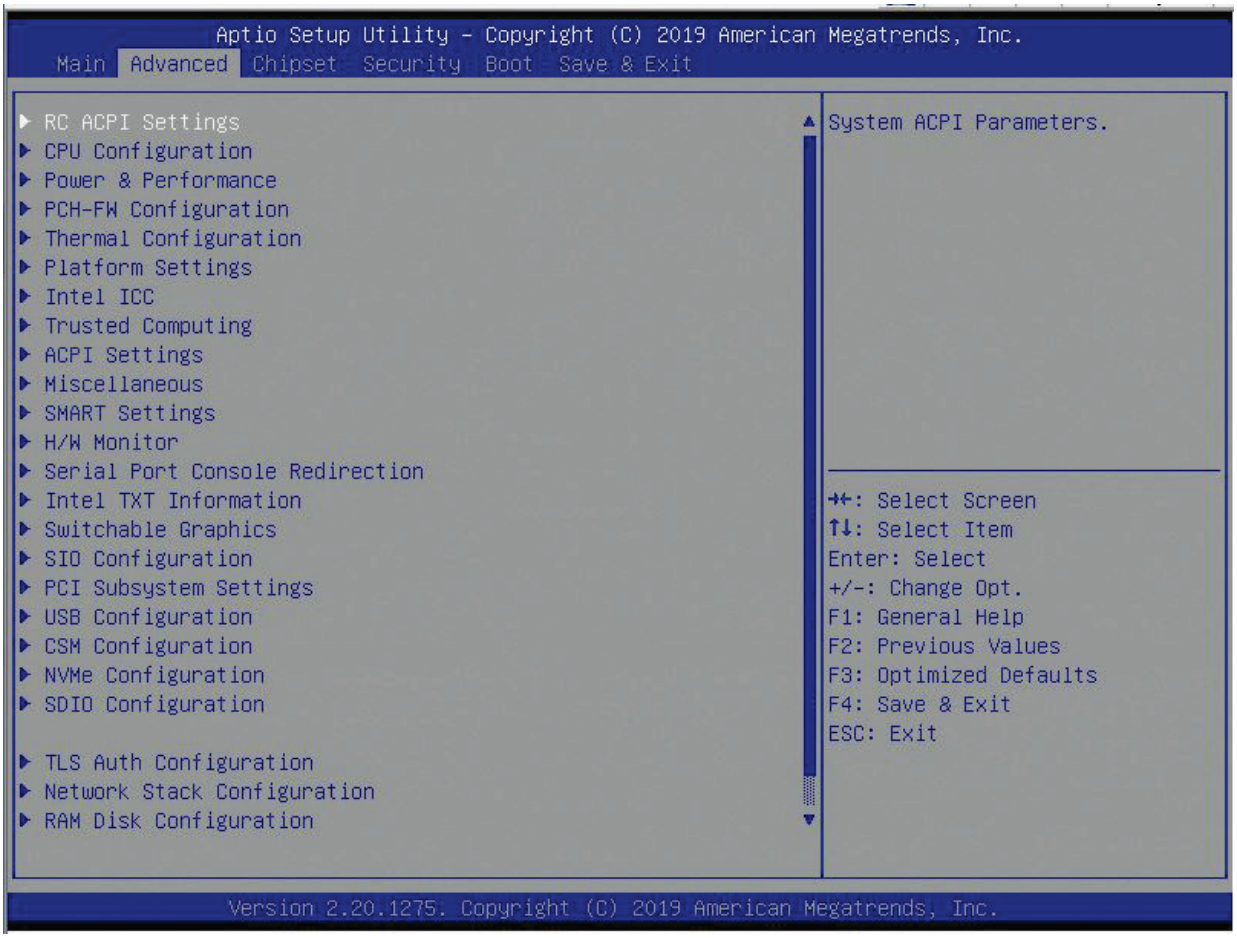


Table 52: Advanced Setup menu Sub-screens and Functions

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**

Sub-Screen	Function	Second level Sub-Screen / Description	
	PCI Delay Optimization	Enable/**Disable**	
	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

Sub-Screen	Function	Second level Sub-Screen / Description	
		Platform PL4 Lock	**Enable**/Disable
		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**	

Sub-Screen	Function	Second level Sub-Screen / Description	
	Enable Hibernation>	**Enable**/disable	
	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	

Sub-Screen	Function	Second level Sub-Screen / Description
	Fan Pulse	2
	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

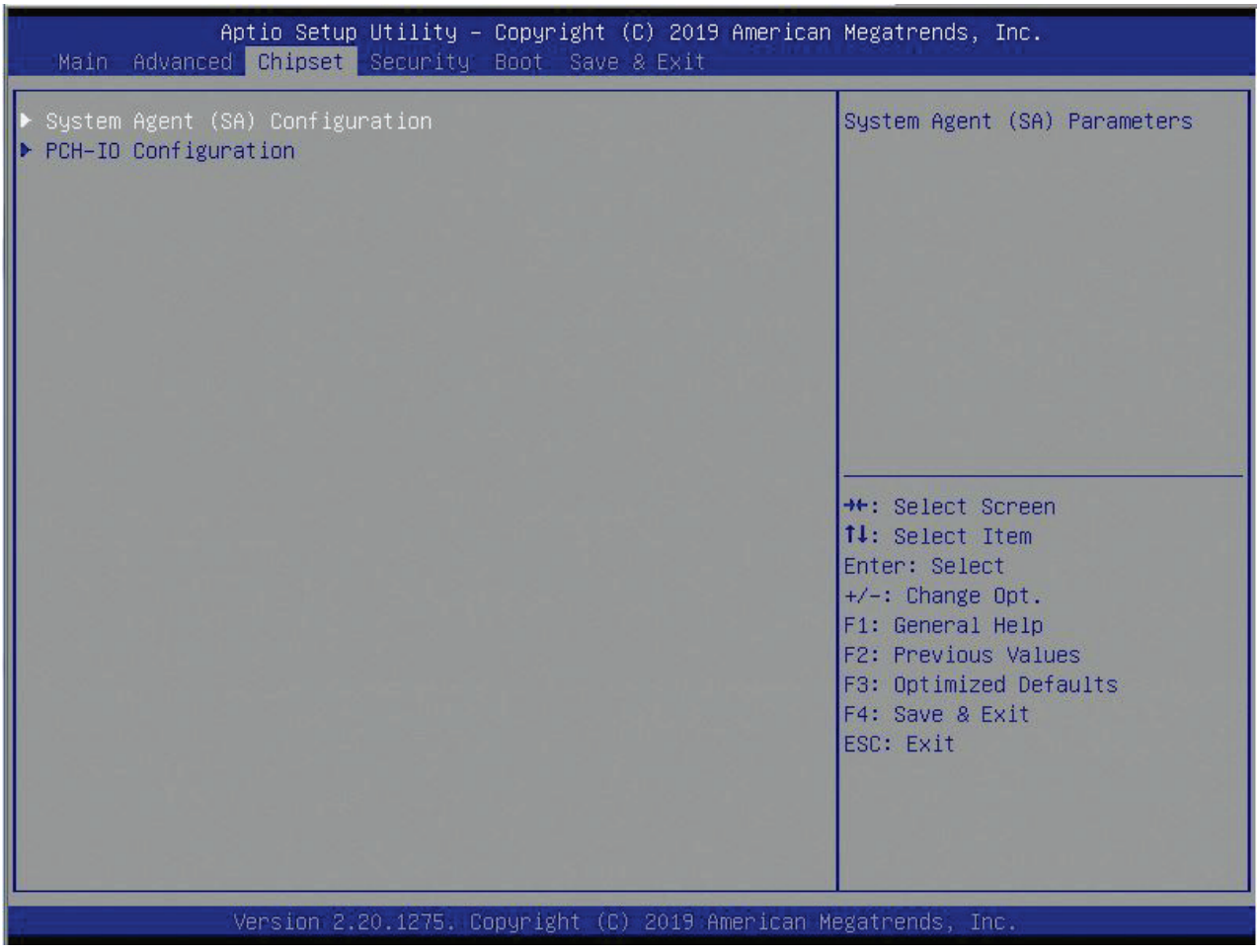


Table 53: Chipset menu Sub-screens and Functions

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		
	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 9 (opt. NVMe)	PCI Expr. Root Port 9	**Enable**/Disable
		Connection Type	Slot
		ASPM8	Auto
		PME SCI	**Enable**/Disable
		Hot Plug	Enable/**Disable**
		PCIe Speed	Auto
		Detect Timeout	0

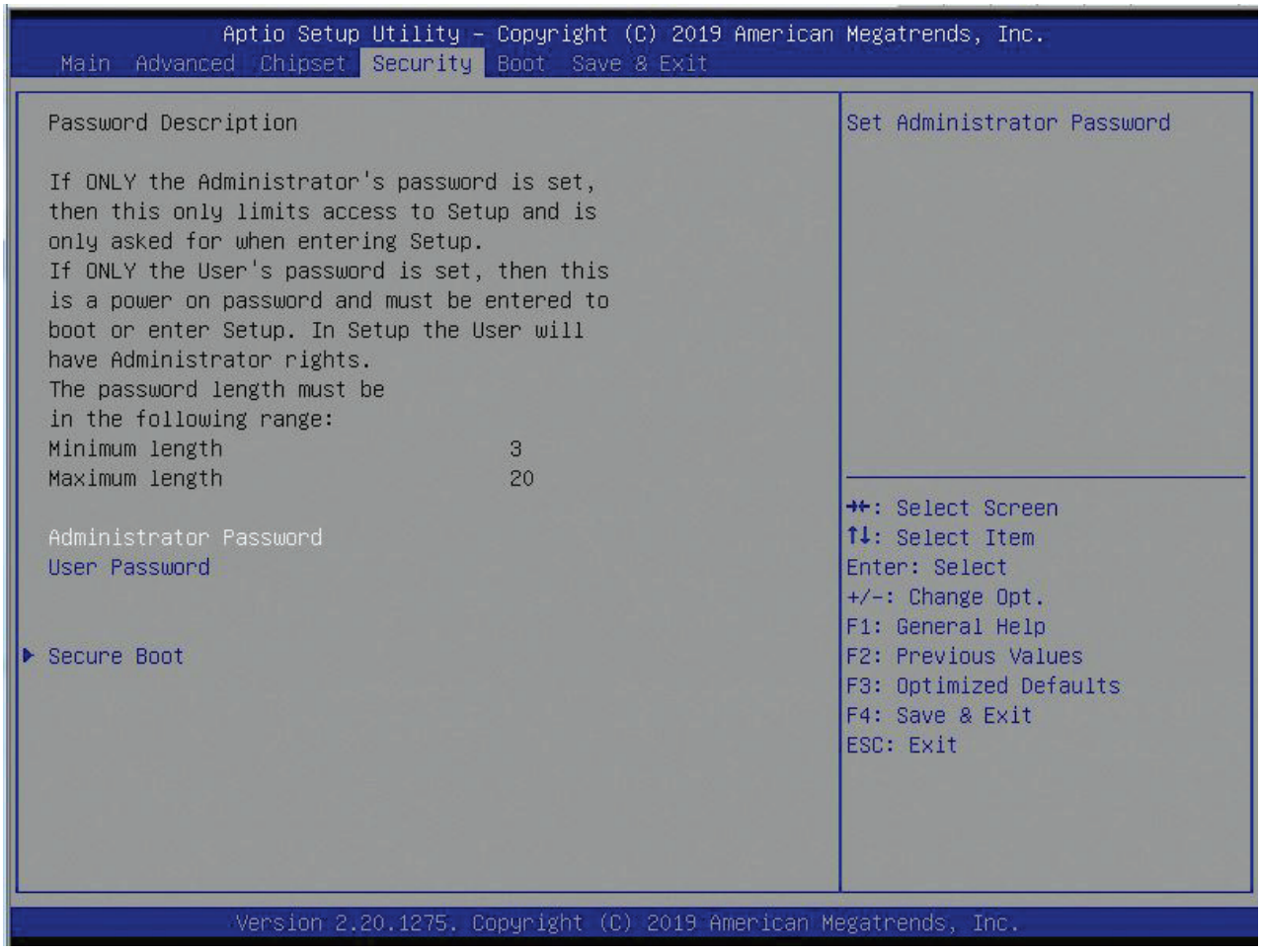
Function	Second level Sub-Screen / Description		
		Extra Bus Reserved	0
		Reserved Memory	10
		Reserved I/O	4
	PCIe Root Port 13 (COMe Lane 4) PCIe Root Port 14 (COMe Lane 5) PCIe Root Port 15 (COMe Lane 6) PCIe Root Port 16 (COMe Lane 7) PCIe Root Port 21 (COMe Lane 0) PCIe Root Port 22 (COMe Lane 1) PCIe Root Port 23 (COMe Lane 2) PCIe Root Port 24 (COMe Lane 3)	PCI Expr. Root Port 13, 14, 15, 16, 21, 22, 23, 24	**Enable**/Disable
		Connection Type	Slot
		ASPM8	Auto
		PME SCI	**Enable**/Disable
		Hot Plug	Enable/**Disable**
		PCIe Speed	Auto
		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**	

Function	Second level Sub-Screen / Description		
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**		
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 54: 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	
	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

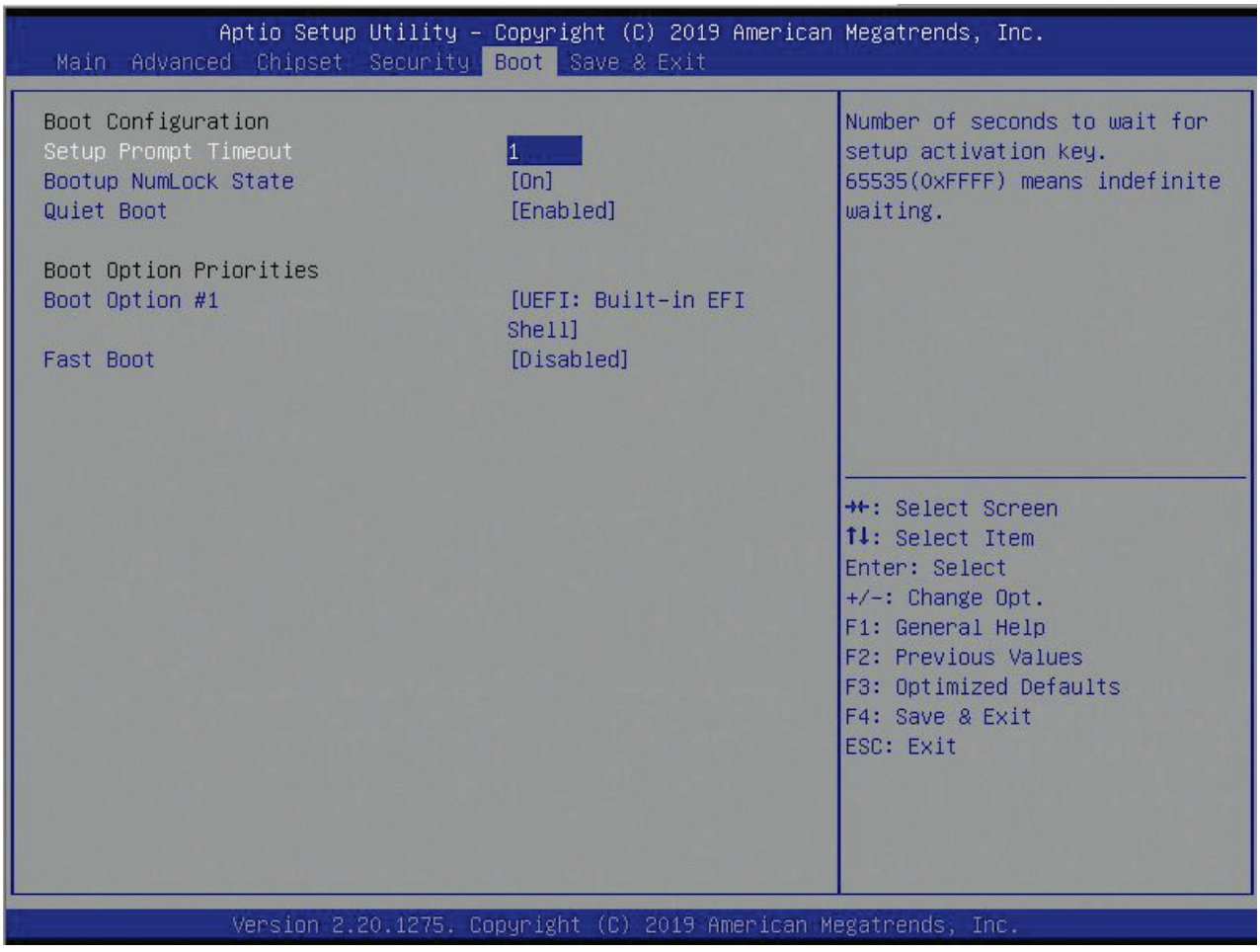


Table 55: Boot Menu Functions

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

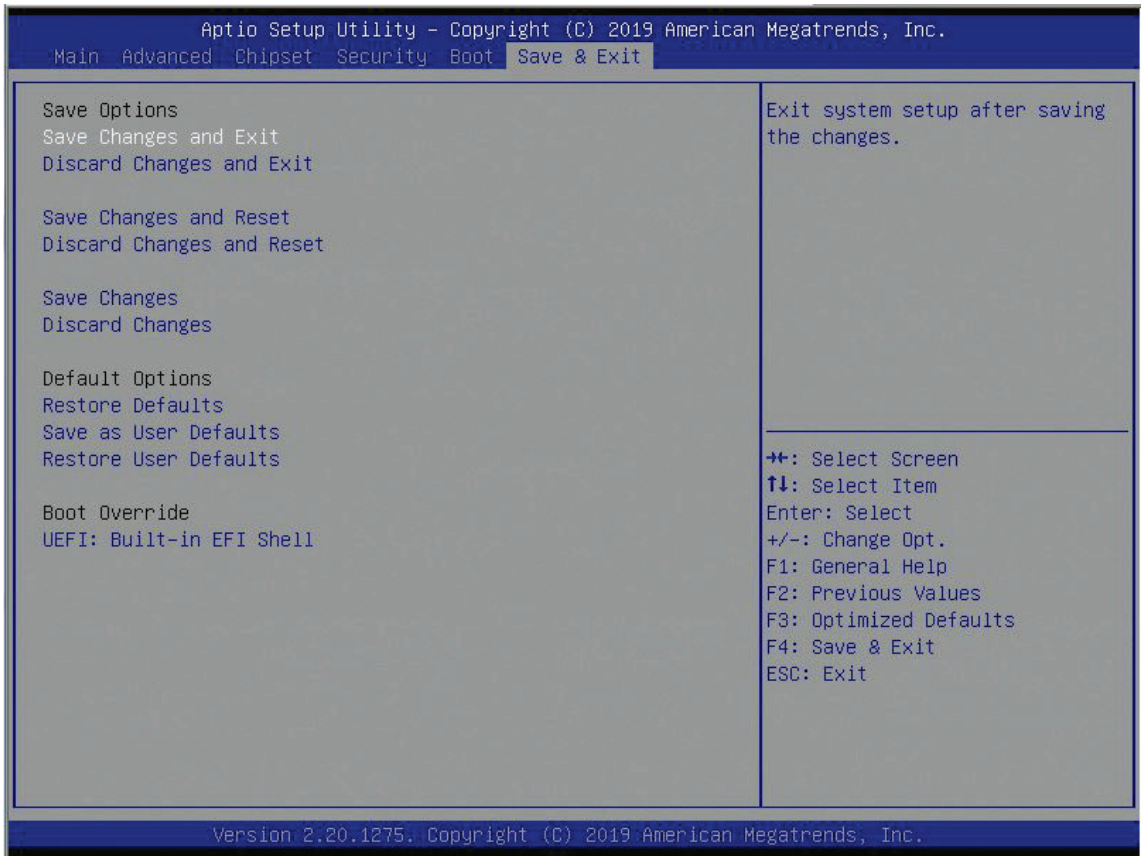


Table 56: Save and Exit Setup Menu Functions

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 A: List of Acronyms

Table 57: List of Acronyms

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

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

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