

# COMEX-IC60U

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Reference Guide



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**Table 1 Revision Notes**

Date	Description
Apr 2017	First release

Please check for a newer revision of this manual at the CompuLab web site <http://www.compulab.com/>. Compare the revision notes of the updated manual from the web site with those of the printed or electronic version you have.

# 1 INTRODUCTION

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## 1.1 About This Document

This document is part of a set of reference documents providing information necessary to operate and program CompuLab COMEX-IC60U Computer-on-Module.

## 1.2 COMEX-IC60U Part Number Legend

Please refer to the CompuLab website ‘Ordering information’ section to decode the COMEX-IC60U part number: <http://www.compulab.com/products/com-express/comex-ic60u-intel-core-7th-gen-com-express-compact-type-6-computer-on-module/#ordering>.

## 1.3 Related Documents

For additional information, refer to the documents listed in [Table 2](#).

**Table 2** Related Documents

Document	Location
COMEX-IC60U Developer Resources	<a href="http://www.compulab.com/">http://www.compulab.com/</a>

## 2 OVERVIEW

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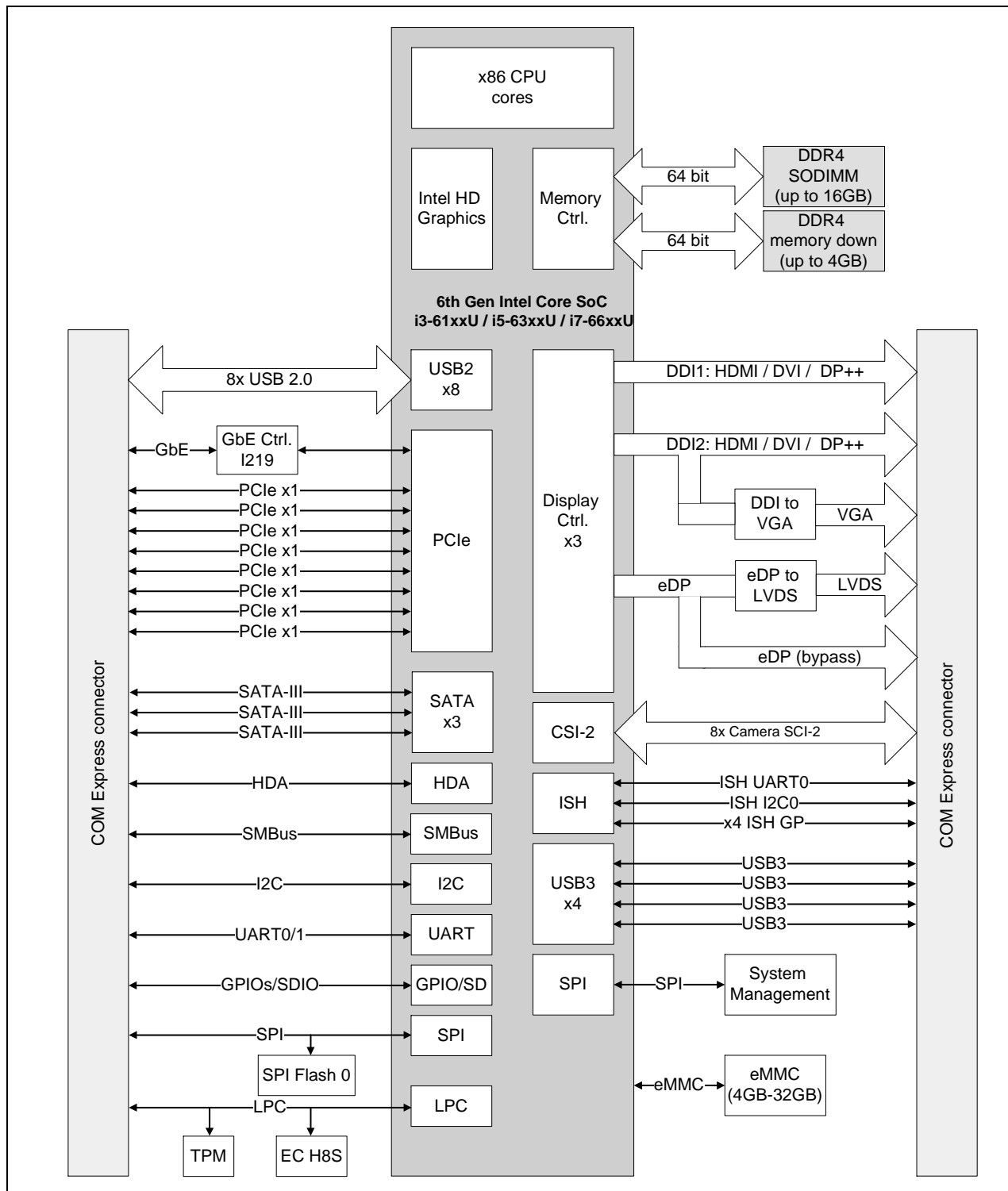
### 2.1 Highlights

- COM Express Compact Type-6
- 7th Generation Intel® Core™ i7, i5, i3 Single Chip Processors
- Up-to 24GB DDR4 /-RS memory (8 GB DDR4 memory down)
- Intel® HD Graphics 620
- 1x LVDS, 1x eDP (optional)
- 2x DDIs (Digital Display Interfaces) with support for HDMI and DisplayPort
- 1x VGA (optional)
- Up to 8x PCIe lanes (only 6 PCIe devices supported at any time)
- 3x SATA, 4x USB3, 8x USB2
- Up to 8x CSI-2 Camera interface lanes, support of one camera with x8 lanes, or two cameras with x4 lanes each.
- 2x UART, I2C bus, 4x GPIO for Integrated Sensor Hub (ISH)
- Linux and MS Windows

COMEX-IC60U is a Computer-on-Module packed in the industry-standard COM Express Compact form factor. COMEX-IC60U is fully compliant with the COM Express standard and has been designed for seamless integration into COM Express system designs.

## 2.2 Block Diagram

Figure 1 COMEX-IC60U Block Diagram





## 2.3 COMEX-IC60U Features

The "Option" column specifies the COMEX-IC60U configuration option required to have the particular feature. When a configuration option is prefixed by "NOT", the particular feature is only available when the option is not used. A feature is only available when a COMEX-IC60U configuration complies with all options denoted in the "Option" column.

"+" means that the feature is always available.

**Table 3 Features and Configuration options**

Feature	Description	Option
<b>CPU Core</b>		
CPU	Intel Core i7-7600U dual-core 2.8 / 3.9 GHz, 15W TDP	C76
	Intel Core i5-7300U dual-core 2.6 / 3.5 GHz, 15W TDP	C73
	Intel Core i3-7100U dual-core 2.4GHz, 15W TDP	C71
Chipset	Intel® 100 Series PCH-LP, Integrated in SoC	+
<b>Memory and Storage</b>		
RAM	Up-to 24GB DDR4 /-RS memory (8 GB DDR4 memory down)	D
Storage	3x SATA 6Gb/s	+
	On-board eMMC flash, 4GB - 64GB	NS
<b>Display / Camera</b>		
Graphics Controller	Intel® HD Graphics 620 Triple display mode supported	+
DDI	DDI1: HDMI / DVI / DP / DP++, up to 4096 x 2304	+
	DDI2: HDMI / DVI / DP / DP++, up to 4096 x 2304	NOT V
eDP	eDP v1.3 up to 4096 x 2304	NOT L
LVDS	Dual-channel LVDS, up-to 1920 x 1200 * precludes ePD port	L
VGA	Up-to 1920 x 1200 * precludes DDI2 port	V
CSI-2	2xMIPI-CSI, up-to 8 data lanes	+
<b>Network</b>		
Gigabit Ethernet	1000Base-T Ethernet port implemented with Intel I219 GbE PHY Supports remote management with Intel AMT 11	+
<b>Audio</b>		
Digital Audio	High Definition Audio (HDA) interface	+
	HDMI audio output	+
<b>I/O</b>		
PCI Express	Up to 8 PCIe* Lanes *maximum of 6 PCIe devices at any time	+
USB	4x USB3.0	+
	8x USB2.0	+
Serial Ports	2x UART	+
General Interfaces	LPC Bus I2C Bus SM Bus Watch Dog Timer FAN control	+
GPIOs	Up to 8 GPIOs	+
<b>System Logic</b>		
RTC	Real time clock, powered by external lithium battery	+
Security	TPM - Trusted Platform Module device	TPM
Power Management	ACPI 5.0 compliant, Smart Battery Management	+

**Table 4 Electrical, Mechanical and Environmental Specifications**

Electrical Specifications	
Supply Voltage	Single 12V DC
Digital I/O voltage	3.3V
Active power consumption	2.5 – 6.5 W, depending on board configuration and system workload
Mechanical Specifications	
Form-factor	COM Express Compact, pin-out Type 6
Dimensions	95 x 95 mm
Weight	74 gram
Environmental and Reliability	
MTTF	> 200,000 hours
Operation temperature (case)	Commercial: 0° to 70° C
	Extended: -20° to 70° C
	Industrial: -40° to 85° C
Storage temperature	-40° to 85° C
Relative humidity	10% to 90% (operation)
	05% to 95% (storage)
Shock	50G / 20 ms
Vibration	20G / 0 - 600 Hz

## 3 CORE SYSTEM COMPONENTS

### 3.1 CPU

COMEX-IC60U module supports Intel® 7<sup>th</sup> generation 'Kaby Lake' U platforms, in FCBGA1356 package, with TDP up to 25 Watt. Compulab offers COMEX-IC60U with processors specified in the table below:

**Table 5 Intel® 'Kaby Lake' U CPUs Feature List**

	Core™ i3-7100U	Core™ i5-7300U	Core™ i7-7600U
# of Cores	2	2	2
# of Threads	4	4	4
Processor Base Frequency	2.40 GHz	2.60 GHz	2.80 GHz
Cache	3 MB SmartCache	3 MB SmartCache	4 MB SmartCache
Bus Speed	4 GT/s OPI	4 GT/s OPI	4 GT/s OPI
TDP	15 W	15 W	15 W
Configurable TDP-down	7.5 W	7.5 W	7.5 W
Max Turbo Frequency		3.50 GHz	3.90 GHz
Configurable TDP-up		25 W	25 W
Processor Graphics ‡	Intel® HD Graphics 620	Intel® HD Graphics 620	Intel® HD Graphics 620
Graphics Base Frequency	300.00 MHz	300.00 MHz	300.00 MHz
Graphics Max Dynamic Frequency	1.00 GHz	1.10 GHz	1.15 GHz
Graphics Video Max Memory	32 GB	32 GB	32 GB
Graphics Output	eDP/DP/HDMI/DVI	eDP/DP/HDMI/DVI	eDP/DP/HDMI/DVI
DirectX* Support	12	12	12
OpenGL* Support	4.4	4.4	4.4
Intel® Quick Sync Video	Yes	Yes	Yes
Intel® InTru™ 3D Technology	Yes		
Intel® Clear Video HD Technology	Yes	Yes	Yes
Intel® Clear Video Technology	Yes	Yes	Yes
Intel® Speed Shift Technology	Yes	Yes	Yes
Intel® Turbo Boost Technology	No	2.0	2.0
Intel® vPro Technology ‡	No	Yes	Yes
Intel® Hyper-Threading Technology ‡	Yes	Yes	Yes
Intel® Virtualization Technology (VT-x) ‡	Yes	Yes	Yes
Intel® Virtualization Technology for Directed I/O (VT-d) ‡	Yes	Yes	Yes
Intel® VT-x with Extended Page Tables (EPT) ‡	Yes	Yes	Yes
Intel® TSX-NI	No	Yes	Yes
Intel® 64 ‡	Yes	Yes	Yes
Instruction Set	64-bit	64-bit	64-bit
Instruction Set Extensions	SSE4.1/4.2, AVX 2.0	SSE4.1/4.2, AVX 2.0	SSE4.1/4.2, AVX 2.0
Idle States	Yes	Yes	Yes
Enhanced Intel SpeedStep® Technology	Yes	Yes	Yes
Thermal Monitoring Technologies	Yes	Yes	Yes
Intel® Flex Memory Access	Yes	Yes	Yes
Intel® Stable Image Platform Program (SIPP)	No	Yes	Yes
Intel® Smart Response Technology	Yes	Yes	Yes
Intel® My WiFi Technology	Yes	Yes	Yes
Intel® AES New Instructions	Yes	Yes	Yes
Secure Key	Yes	Yes	Yes
Intel® Software Guard Extensions (Intel® SGX)	Yes	Yes	Yes
Intel® Memory Protection Extensions (Intel® MPX)	Yes	Yes	Yes
Trusted Execution Technology ‡	No	Yes	Yes
Execute Disable Bit ‡	Yes	Yes	Yes
OS Guard	Yes	Yes	Yes

## 3.2 PCH (Chipset)

The U-Processor Line are offered in a 1-Chip Platform that includes the 7th Generation Intel® processor families I/O Platform Controller Hub (PCH) die on the same package as the processor die. The PCH provides extensive I/O support. Functions and capabilities include:

- ACPI Power Management Logic Support, Revision 4.0a
- PCI Express\* Base Specification Revision 3.0
- Integrated Serial ATA Host controller, supports data transfer rates of up to 6Gb/s on all ports
- xHCI USB controller with SuperSpeed USB 3.0 ports
- USB Dual Role/OTG Capability
- MIPI\*-Camera Serial Interface-2 (CSI-2)
- embedded MultiMedia Card (eMMC\*) Revision 5.0 Controller
- Serial Peripheral Interface (SPI)
- Enhanced Serial Peripheral Interface (eSPI)
- Flexible I/O—Allows some high speed I/O signals to be configured as PCIe\*, SATA or USB 3.0
- General Purpose Input Output (GPIO)
- Low Pin Count (LPC) interface
- Interrupt controller
- Timer functions
- System Management Bus (SMBus) Specification, Version 2.0
- Integrated Clock Controller (ICC)/Real Time Clock Controller (RTCC)
- Intel® High Definition Audio and Intel® Smart Sound Technology (Intel® SST)
- Intel® Serial I/O UART Host controllers
- Intel® Serial I/O I2C Host controllers
- SD Card (SDXC) support
- Integrated 10/100/1000 Gigabit Ethernet MAC
- Integrated Sensor Hub (ISH)

The chipset on PCH-U includes 16 high speed I/O ports. Some of these ports are configured according to COMEX-IC60U functionality implementation. The I/O ports and the configurations are described in the following table:

**Table 6 HSI0 configuration**

HSIO Port	PCH I/O	COMEX-IC60U implementation
1	USB 3.0 Port 1	USB 3.0 Port 0
2	USB 3.0 Port 2	USB 3.0 Port 1
3	USB 3.0 Port 3	USB 3.0 Port 2
4	USB 3.0 Port 4	USB 3.0 Port 3
5	USB 3.0 Port 5 or PCIe Port 1	PCIe Port 0
6	USB 3.0 Port 6 or PCIe Port 2	PCIe Port 1
7	GbE or PCIe Port 3	PCIe Port 2
8	GbE or PCIe Port 4	PCIe Port 3
9	GbE or PCIe Port 5	PCIe Port 4
10	PCIe Port 6	PCIe Port 5
11	SATA 6 Gb/s Port 0 or PCIe Port 7	SATA Port 0
12	SATA 6 Gb/s Port 1A or PCIe Port 8	SATA Port 1
13	GbE or PCIe Port 9	PCIe Port 6
14	GbE or PCIe Port 10	I219LM
15	SATA 6 Gb/s Port 1B or PCIe Port 11	PCIe Port 7
16	SATA 6 Gb/s Port 2 or PCIe Port 12	SATA Port 2

### 3.3 Memory

COMEX-IC60U features up-to 8GB soldered memory and a SO-DIMM socket.

COMEX-IC60U supports SO-DIMM modules of up to 16GB, 1866/2133 MT/s, non-ECC.

### 3.4 Storage

COMEX-IC60U features up-to 64GB of on-board eMMC storage.

### 3.5 Graphics Core

The graphics cores are located in the processor die. The Core processors feature Intel® HD Graphics 620.

**Table 7 Intel® 'Kaby Lake' U Integrated Graphics**

	Core™ i3-7100U	Core™ i5-7300U	Core™ i7-7600U
Processor Graphics	Intel® HD Graphics 620	Intel® HD Graphics 620	Intel® HD Graphics 620
Graphics Base Frequency	300.00 MHz	300.00 MHz	300.00 MHz
Graphics Max Dynamic Frequency	1.00 GHz	1.10 GHz	1.15 GHz
Graphics Video Max Memory	32 GB	32 GB	32 GB
Graphics Output	eDP/DP/HDMI/DVI	eDP/DP/HDMI/DVI	eDP/DP/HDMI/DVI
4K Support	Yes, at 60Hz	Yes, at 60Hz	Yes, at 60Hz
DirectX Support	12	12	12
OpenGL Support	4.4	4.4	4.4
Intel® Quick Sync Video	Yes	Yes	Yes
Intel® InTru™ 3D Technology	Yes		
Intel® Clear Video HD Technology	Yes	Yes	Yes
Intel® Clear Video Technology	Yes	Yes	Yes
# of Displays Supported	3	3	3

### 3.6 Display Interfaces

COMEX-IC60U supports the following display interfaces:

- Two Digital Display Interfaces (DDI)
- Embedded Display Port (eDP)
- Optional dual-channel LVDS
- Optional VGA

**Table 8 Display Interfaces Maximum Resolution**

Interface	Max. Resolution
HDMI 1.4	4096x2160 @ 30 Hz
DVI	1920x1200 @ 60 Hz
eDP/DP	4096x2304 @ 60Hz
LVDS	1920 x 1200
VGA	1920 x 1200

**Table 9 Display Link Data Rate Support**

Technology	Link Data Rate
eDP	RBR (1.62 GT/s) HBR (2.7 GT/s) HBR2 (5.4 GT/s)
DisplayPort	RBR (1.62 GT/s) HBR (2.7 GT/s) HBR2 (5.4 GT/s)
HDMI	1.65 Gb/s 2.97 Gb/s

**Table 10 Display Resolution per Link Width**

Link Data Rate	1 Lane	2 Lanes	4 Lanes
<b>HBR</b> (2.7 Gbps)	1280x960	2048x1280	2880x1800
<b>HBR2</b> (5.4 Gbps)	2048x1280	2880x1800	4096x2304

### 3.6.1 DDI

DDI1 and DDI2 interfaces support Dual Mode, and can be natively used as HDMI or DisplayPort, according to the state of AUX\_SEL pins on the connector, that should be connected to the DisplayPort on the carrier board, if available.

### 3.6.2 eDP

The COMEX-IC60U embedded DisplayPort\* (eDP\*) is an embedded version of the DisplayPort standard oriented towards applications, such as notebook and All In-One PCs. Like DisplayPort, embedded DisplayPort\* also consists of a Main Link, Auxiliary channel, and an optional Hot-Plug Detect signal. The Embedded DisplayPort utilizes DisplayPort 1.62, 2.7 and 5.4 GT/s differential signaling with up to 4096x2304 @60 Hz resolution.

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**NOTE: eDP is only available without the ‘L’ configuration option.**

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### 3.6.3 LVDS

The optional LVDS interface is implemented with an eDP to LVDS bridge. COMEX-IC60U can support single or dual LVDS, 18 or 24 bits per pixel, with resolutions of up to 1920x1200@60Hz. The data format can be VESA or JEIDA.

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**NOTE: eDP is only available with ‘L’ configuration option.**

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**NOTE: LVDS port precludes eDP port.**

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### 3.6.4 VGA

The VGA interface is implemented with an optional DisplayPort to VGA adapter. The adapter supports display resolutions from VGA to WUXGA.

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**NOTE: VGA is only available with the ‘V’ configuration option.**

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**NOTE: VGA port precludes DDI2 port.**

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## 3.7 Camera Interfaces

COMEX-IC60U provides an optional access to SoC Camera I/O Controller. The Camera I/O Controller provides a native/integrated interconnect to camera sensors, compliant with MIPI\* CSI-2 protocol. A total of 8 lanes are available for the camera interface supporting up to 2 sensors. Also, two PCH I2C channels are available for this interface (I2C2 and I2C3).

## 4 PERIPHERAL INTERFACES

### 4.1 PCI Express

COMEX-IC60U incorporates up to 6 PCIe Ports and 8 PCIe Lanes, with transfer rates up to 8 GT/s (Gen3). The PCIe Lanes can be configured independently from one another but the max number of configured Root Ports (Devices) must not be exceeded:

- A maximum of 6 PCIe Root Ports (or devices) can be enabled
- A maximum of 5 PCIe Root Ports (or devices) can be enabled when a GbE Port is enabled

**Table 11 PCIe Gen. 3 ports**

PCH Port Number	COMEX-IC40D Port Number
1	0
2	1
3	2
4	3
5	4
6	5
9	6
11	7

**Table 12 PCIe Ports Configurations Supported**

Port 0	Port 1	Port 2	Port 3	Port 4	Port 5	Port 6	Port 7
PCIe x4				PCIe x2		PCIe x1	PCIe x1
PCIe x2		PCIe x2		PCIe x1	PCIe x1		
PCIe x1	PCIe x1	PCIe x2					
PCIe x2		PCIe x1	PCIe x1				
PCIe x1	PCIe x1	PCIe x1	PCIe x1				

- For information related to support of Intel® RST or NVMe SSD or Intel® Optane™ Memory Device please refer to Kaby Lake U Platform Design Guide chapter 12.1.

### 4.2 USB 2.0/3.0

COMEX-IC60U supports 4 Super-Speed USB 3.0 ports, and 8 USB 2.0 ports.

The USB 2.0 ports can be connected to low-speed, full-speed and high speed devices. In order for the USB 3.0 ports to be back-compatible with USB 2.0, each USB 3.0 can be paired with any USB 2.0 port.

### 4.3 SATA

COMEX-IC60U incorporates three SATA 6Gb/s (Gen. 3) ports.

The COMEX-IC60U PCH supports Intel's Rapid Storage Technology (RST) that enables the SATA controller to operate in RAID mode, supporting RAID 0/1/5.

### 4.4 Ethernet

COMEX-IC60U features an onboard Gigabit Ethernet interface.

The CPU SoC integrated GbE controller is interfaced with Intel I219 GbE PHY through the PCIe port 10 (HSIO 14) and SMBus.

## 4.5 Audio

COMEX-IC60U supports Intel® HD Audio interface. The HDA signals include one SDO output, two SDIN inputs and ctrl/clock signals.

The CPU also supports 2 High Definition audio streams integrated in HDMI or Display Port video streams.

## 4.6 SPI

COMEX-IC60U SPI interface is used for booting from external SPI flash. For additional details please refer to section 5.2.

## 4.7 SMBus

There are five System Management (SM) compatible busses on COMEX-IC60U:

- SML0: Internal only, communication of the PCH with the I219 GbE PHY.
- SML1: Internal only, communication between the CPU and the embedded controller.
- Thermal SMB: Internal only, communication between the embedded controller and the DIMM area thermal sensor.
- EC\_SMB0: Internal only, communication between the embedded controller and: two load switches, on board EEPROM, and two GPIO expanders.
- PCH\_SMB: Internal and external. Used to link between the PCH to peripheral devices: on module EEPROM, DDR4 channel A and channel B SPD, and SMB bus on base board.

## 4.8 I2C

There are 4 I2C busses on COMEX-IC60U:

- I2C0: Internal only, communication between PCH and eDP to LVDS Bridge.
- I2C1: Connected to I2C bus on Carrier Board. Used to connect to an optional Carrier EEPROM.
- I2C2: Used for CSI-2 Camera interface
- I2C3: Used for CSI-2 Camera interface

## 4.9 LPC

COMEX-IC60U Low Pin Count (LPC) interface is used by the PCH to communicate with several devices:

- Embedded Controller
- Trusted Platform Module (TPM) if available

In addition, the LPC interface is available on the carrier board via the COM Express connectors.

## 4.10 Serial Ports

COMEX-IC60U incorporates two full function 16750 compatible UARTs, each implementing a 2-wire serial port interface.

All serial port pins are 12V tolerant.

## 4.11 Integrated Sensor Hub (ISH)

COMEX-IC60U provides an optional access to Integrated Sensor Hub (ISH). The ISH is designed with the goal of “Always On, Always Sensing” and uses dedicated interfaces for communicating



with various sensors (I2C, UART, GPIO). COMEX-IC60U provides access to the following interfaces:

- ISH\_I2C0
- ISH\_UART0
- ISH\_GP[0-3]

## 4.12 GPIOs/SDIO

There are eight General Purpose Input/Output signals available from COMEX-IC60U. The GPIO signals are derived PCH GPIO pins. Each of the GPIO signals can be configured as input or output (GPI or GPO).

The GPIO signals are multiplexed with 4 bit SD signals. The SD card controller supports SDXC specification 3.01.

**Table 13 GPIO Signals Details**

Pin Name	PCH Pin Name	Default Function
GPI0	GPP_G1/SD_DATA0	GPI
GPI1	GPP_G2/SD_DATA1	GPI
GPI2	GPP_G3/SD_DATA2	GPI
GPI3	GPP_G4/SD_DATA3	GPI
GPO0	GPP_G6/SD_CLK	GPI
GPO1	GPP_GO/SD_CMD	GPI
GPO2	GPP_G7/SD_WP	GPI
GPO3	GPP_G5/SD_CD#	GPI

## 5 SYSTEM LOGIC

### 5.1 Power Supply

#### 5.1.1 Power Rails

The COMEX-IC60U requires the following power rails:

**Table 14 Power Rails**

Power Rail	Module Pin Current Capability (Amps)	Nominal Voltage (Volts)	Voltage Range (Volts)	Max. Input Ripple (mV)
VCC_12V	10	12	11.4-12.6	+/- 100
VCC_5V_SBY	2	5	4.75-5.25	+/- 50
VCC_RTC	0.5	3	2.0-3.2	+/- 20

#### 5.1.2 Single Supply Mode

COMEX-IC60U supports single-supply operation. In this operation mode, VCC\_5V\_SBY and the VCC\_RTC rails are not supported, and the matching power pins must be left unconnected on the carrier board.

Single supply mode does not allow the system to be at stand-by, i.e. suspend-to-RAM or suspend-to-disk. Absence of VCC\_RTC prevents the RTC circuit to keep time and date, and to store system data in the RTC SRAM when the system is not powered.

#### 5.1.3 Power Management

COMEX-IC60U supports the following power states:

G0 - Working

S0 - Processor powered on

C0 - Active mode

C1 - Auto halt

C1E - Auto halt, low frequency, low voltage

C2 - Temporary state before C3 or deeper. Memory path open

C3 - L1/L2 cache flush, clocks off

C6 - Save core states before shutdown and PLL off

C7 - C6 + LLC may be flushed

C8 - C7 + LLC must be flushed

C9 - C8 + Most Uncore Voltages at 0V. IA, GT and SA reduced to 0V, while VCCIO stays on

C10 - C9 + All VRs at PS4

G1 - Sleeping

S3 - Sleep, Suspend to RAM

S4 - Hibernate, Suspend to Disk

G2 - Soft Off

S5 - Soft off, no power

G3 - Mechanical Off

---

**NOTE: Power states availability may vary between the different SKUs**

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COMEX-IC60U supports the wake events listed below:

- PWRBTN# of SLEEP# signals falling edge
- RTC Alarm, if enabled
- LAN\_WAKE#
- PCIe WAKE#
- Wake Alarm Device Timer

### 5.1.4 Power Control

The following table summarizes carrier board accessible power-management signals:

- PWRBTN# / SLEEP# (Module Input): If the system is in S0, PWRBTN# will initiate a system request to go to a sleep state. If the system is in Deep S3, PWRBTN# causes a wake event. If PWRBTN# is pressed for more than 4 seconds, this will cause an unconditional transition (power button override) to the S5 state. This signal has an internal pull-up resistor and has an internal 16 ms de-bounce on the input buffer.
- SYS\_RESET# (Module Input): This signal forces an internal reset after being de-bounced (16ms). The PCH will reset immediately if the SMBus is idle; otherwise, it will wait up to 25 ms  $\pm$  2 ms for the SMBus to idle before forcing a reset on the system.
- CB\_RESET# (Module Output): The PCH asserts PLTRST# to reset devices on the module and the carrier board. The PCH asserts PLTRST# during power-up, at a detection of a System Lockup, when PCH\_PWROK is low, or when S/W initiates a hard reset sequence.
- PWR\_OK (Module Input): The power OK signal indicates to the module that the main power supply is within specification. It can be held low by the carrier board in order to delay the startup of the module. After pulled up by the carrier, PWR\_OK must be left up as long as the main power supply is within specification.
- SUS\_STAT# (Module Output): The suspend status signals indicates peripheral devices that the system will be entering a low power state soon.
- WAKE0# / WAKE1# (Module Input): The wake signals are indicates the PCH that a PCIe Device generated a wake event. Upon a falling edge, the system should wake up to S0 operation mode.

## 5.2 SPI Boot

The SPI bus is used in COMEX-IC60U in order to boot from SPI flash device.

When the BIOS\_DIS1# signal is pulled to GND, external SPI Flash devices are selected as boot source. When BIOS\_DIS1# is pulled-up or left unconnected, COMEX-IC60U will boot from the onboard SPI flash.

The BIOS\_DIS0# signal is not used.

### 5.3 RTC

The COMEX-IC60U RTC is based on integrated in PCH Motorola MC146818B-compatible real-time clock with 256 bytes of battery-backed RAM. The RTC provides time and calendar information and storing system data. Additionally, a backup battery can keep the RTC running to maintain clock and time information even if the main supply is not present. The backup battery must be connected to the VCC\_RTC power input.

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**NOTE: VCC\_RTC must remain valid at all times for proper operation of the on-board RTC.**

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### 5.4 LEDs and Buttons

COMEX-IC60U incorporates three push buttons and three LEDs.

The table below describes the functionality of the On LED (DS3) and the Sleep LED (DS4). Additionally, there is one general purpose green LED controlled by onboard microcontroller.

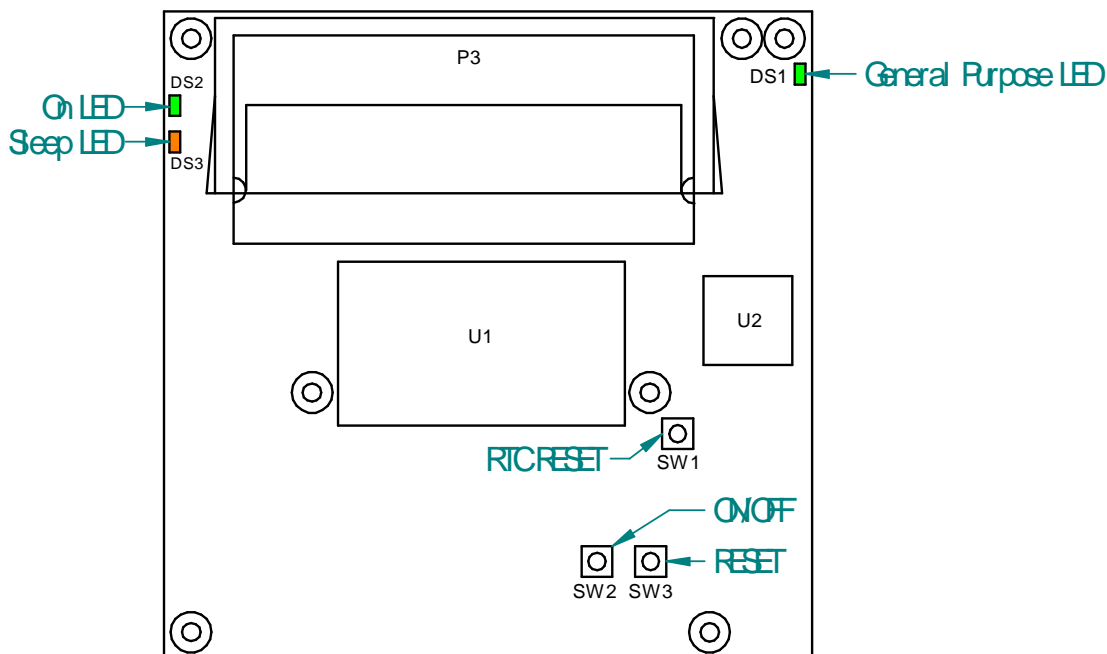
**Table 15 LEDs**

Power State	On LED (Green)	Sleep LED (Orange)
S0 (On)	ON	OFF
S3 (Suspend To RAM)	OFF	ON
S4 (Suspend To Disk)	OFF	ON
S5 (Off)	OFF	OFF

**Table 16 Push Buttons**

Button Ref.	Function	Carrier Board Pin
SW1	Real Time Clock Reset	N/A
SW2	On/Off Switch	PWRBTN#
SW3	Front-Panel Reset	SYS_RESET#

**Figure 2 COMEX-IC60U LEDs and Buttons**



## 6 CARRIER BOARD INTERFACE

The COMEX-IC60U carrier board interface uses the 220-pin COM Express edge connector. The module pinout is detailed in the table below

### 6.1 Carrier Board Connector Pinout

The COMEX-IC60U connects to a carrier board with 2x110 pin connector. The pin numbering is divided to two groups: A, B, where each pin number starts with the letter of the row it's in.

The pin-out of the connectors is compatible to type 6 COM Express specifications.

Each described signal can be one of the following types. Signal type is noted in the “Signal description” tables. Multifunctional pin direction, pull resistor and open drain functionality may be software controlled. The “Type” column header for multifunctional pins refers to the recommended pin configuration with regards to the discussed signal.

- “I” – Digital Input
- “O” – Digital Output
- “IO” – Digital Input/Output
- “PU33SPI” – Always pulled up to 3.3V SPI power rail
- “PU33” – Always pulled up to 3.3V on-board COMEX-IC60U
- “PD” - Always pulled down on-board COMEX-IC60U
- “NC” – Connector Pin is Not Connected
- “P” – Power pin
- “G” – Ground pin

**Table 17 COMEX-IC60U Carrier Board Connectors Signals**

Pin	Signal Name	Type	Description	Comments / Availability
A1	GND	G	Ground	
A2	GBE0_MDI3-	IO	GbE MDI 3 -	
A3	GBE0_MDI3+	IO	GbE MDI 3 +	
A4	GBE0_LINK100#	O	Ethernet 100 Mbit Indicator	Configurable function
A5	GBE0_LINK1000#	O	Ethernet 1000 Mbit Indicator	Configurable function
A6	GBE0_MDI2-	IO	GbE MDI 2 -	
A7	GBE0_MDI2+	IO	GbE MDI 2 +	
A8	GBE0_LINK#	O	Ethernet Link Indicator	Configurable function
A9	GBE0_MDI1-	IO	GbE MDI 1 -	
A10	GBE0_MDI1+	IO	GbE MDI 1 +	
A11	GND	G	Ground	
A12	GBE0_MDI0-	IO	GbE MDI 0 -	
A13	GBE0_MDI0+	IO	GbE MDI 0 +	
A14	GBE0_CTREF	AP	GbE Center Tap Reference	100nF capacitor on module
A15	SUS_S3#	O	Suspend S3	
A16	SATA0_TX+	O	SATA 0 TX +	AC coupled on module
A17	SATA0_TX-	O	SATA 0 TX -	AC coupled on module
A18	SUS_S4#	O	Suspend S4	
A19	SATA0_RX+	I	SATA 0 RX +	AC coupled on module
A20	SATA0_RX-	I	SATA 0 RX -	AC coupled on module
A21	GND	G	Ground	
A22	SATA2_TX+	O	SATA 2 TX +	AC coupled on module
A23	SATA2_TX-	O	SATA 2 TX -	AC coupled on module
A24	SUS_S5#	O	Soft Off	
A25	SATA2_RX+	I	SATA 2 RX +	AC coupled on module
A26	SATA2_RX-	I	SATA 2 RX -	AC coupled on module
A27	BATLOW#	I	Battery Low	10K PU
A28	(S)ATA_ACT#	O	SATA Activity	Buffer output with 100R serial res (S0)
A29	AC/HDA_SYNC	O	HDA Sync	9K - 50K PD in PCH
A30	AC/HDA_RST#	O	HDA RST	
A31	GND	G	Ground	
A32	AC/HDA_BITCLK	O	HDA Bit Clock (BCLK)	
A33	AC/HDA_SDOOUT	O	HDA SD Out (SDO)	9K - 50K PD in PCH
A34	BIOS_DIS0#	PU33	SPI routing selection	10K PU (S0), no function on module

Pin	Signal Name	Type	Description	Comments / Availability
A1	GND	G	Ground	
A35	THRMTRIP#	O	CPU Thermal Trip Indicator	1K PU (S0) to 1.00V
A36	USB6-	IO	USB 2.0 Port 6 -	14.25K - 24.8K PD in PCH
A37	USB6+	IO	USB 2.0 Port 6 +	14.25K - 24.8K PD in PCH
A38	USB_6_7_OC#	I	USB Overcurrent #3	10K PU (S5)
A39	USB4-	IO	USB 2.0 Port 4 -	14.25K - 24.8K PD in PCH
A40	USB4+	IO	USB 2.0 Port 4 +	14.25K - 24.8K PD in PCH
A41	GND	G	Ground	
A42	USB2-	IO	USB 2.0 Port 2 -	14.25K - 24.8K PD in PCH
A43	USB2+	IO	USB 2.0 Port 2 +	14.25K - 24.8K PD in PCH
A44	USB_2_3_OC#	I	USB Overcurrent #1	10K PU (S5)
A45	USB0-	IO	USB 2.0 Port 0 -	14.25K - 24.8K PD in PCH
A46	USB0+	IO	USB 2.0 Port 0 +	14.25K - 24.8K PD in PCH
A47	VCC_RTC	P	RTC Power	
A48	EXCD0_PERST#	O	Express Card 0 Reset	Connected to CB_RESET#, 100K PD on module
A49	EXCD0_CPPE#	PU33	Express Card 0 Request	10K PU (S0), no function on module
A50	LPC_SERIRQ	I	Serial IRQ	10K PU (S0)
A51	GND	G	Ground	
A52	PCIE_TX5+	O	PCIe Lane 5 TX +	AC coupled on module
A53	PCIE_TX5-	O	PCIe Lane 5 TX -	AC coupled on module
A54	GPI0	IO	GPI 0	50K PU (S0)
A55	PCIE_TX4+	O	PCIe Lane 4 TX +	AC coupled on module
A56	PCIE_TX4-	O	PCIe Lane 4 TX -	AC coupled on module
A57	GND	G	Ground	
A58	PCIE_TX3+	O	PCIe Lane 3 TX +	AC coupled on module
A59	PCIE_TX3-	O	PCIe Lane 3 TX -	AC coupled on module
A60	GND	G	Ground	
A61	PCIE_TX2+	O	PCIe Lane 2 TX +	AC coupled on module
A62	PCIE_TX2-	O	PCIe Lane 2 TX -	AC coupled on module
A63	GPI1	IO	GPI 1	50K PU (S0)
A64	PCIE_TX1+	O	PCIe Lane 1 TX +	AC coupled on module
A65	PCIE_TX1-	O	PCIe Lane 1 TX -	AC coupled on module
A66	GND	G	Ground	
A67	GPI2	IO	GPI 2	50K PU (S0)
A68	PCIE_TX0+	O	PCIe Lane 0 TX +	AC coupled on module
A69	PCIE_TX0-	O	PCIe Lane 0 TX -	AC coupled on module
A70	GND	G	Ground	
A71	LVDS_A0+	O	LVDS Ch. A 0 + / eDP 2 +	Configuration Dependent
A72	LVDS_A0-	O	LVDS Ch. A 0 - / eDP 2 -	Configuration Dependent
A73	LVDS_A1+	O	LVDS Ch. A 1 + / eDP 1 +	Configuration Dependent
A74	LVDS_A1-	O	LVDS Ch. A 1 - / eDP 1 -	Configuration Dependent
A75	LVDS_A2+	O	LVDS Ch. A 2 + / eDP 0 +	Configuration Dependent
A76	LVDS_A2-	O	LVDS Ch. A 2 - / eDP 0 -	Configuration Dependent
A77	LVDS_VDD_EN	O	LVDS Power CTRL	Available at LVDS configuration
A78	LVDS_A3+	O	LVDS Ch. A 3 +	Available at LVDS configuration
A79	LVDS_A3-	O	LVDS Ch. A 3 -	Available at LVDS configuration
A80	GND	G	Ground	
A81	LVDS_A_CLK+	O	LVDS Ch. A CLK + / eDP 3 +	Configuration Dependent
A82	LVDS_A_CLK-	O	LVDS Ch. A CLK - / eDP 3 -	Configuration Dependent
A83	LVDS_I2C_CLK	O	LVDS I2C Clock / eDP AUX +	2.2K PU (S3) (LVDS)
A84	LVDS_I2C_DAT	IO	LVDS I2C Data / eDP AUX -	2.2K PU (S3) (LVDS)
A85	GPI3	IO	GPI 3	50K PU (S0)
A86	RSVD	I	Reserved	
A87	eDP_HPD	I	eDP HPD	100K PD (available without LVDS option only)
A88	PCIE_CLK_REF+	O	PCIe Reference Clock +	
A89	PCIE_CLK_REF-	O	PCIe Reference Clock -	
A90	GND	G	Ground	
A91	SPI_POWER	P	SPI Power output	3.3V Typical
A92	SPI_MISO	I	SPI MISO	
A93	GPO0	IO	GPO 0	50K PD
A94	SPI_CLK	O	SPI Clock	
A95	SPI_MOSI	O	SPI MOSI	
A96	TPM_PP	PD/NC	TPM Physical Presence	10K PD if TPM is assembled
A97	TYPE10#	NC	Not Connected	
A98	SER0_TX	O	Serial Port 0 TX	12V Tolerant
A99	SER0_RX	I	Serial Port 0 RX	12V Tolerant
A100	GND	G	Ground	
A101	SER1_TX	O	Serial Port 1 TX	12V Tolerant

Pin	Signal Name	Type	Description	Comments / Availability
A1	GND	G	Ground	
A102	SER1_RX	I	Serial Port 1 RX	12V Tolerant
A103	LID#	PU33	LID Switch	12V Tolerant, 10K PU (S5), no function
A104	VCC_12V	P	Main VCC Input	12V Typical
A105	VCC_12V	P	Main VCC Input	12V Typical
A106	VCC_12V	P	Main VCC Input	12V Typical
A107	VCC_12V	P	Main VCC Input	12V Typical
A108	VCC_12V	P	Main VCC Input	12V Typical
A109	VCC_12V	P	Main VCC Input	12V Typical
A110	GND	G	Ground	
B1	GND	G	Ground	
B2	GBE0_ACT	O	Ethernet Activity Indicator	Connected to GBE0_LINK#
B3	LPC_FRAME#	IO	LPC FRAME#	
B4	LPC_AD0	IO	LPC AD0	15K - 40K PU in PCH (S0)
B5	LPC_AD1	IO	LPC AD1	15K - 40K PU in PCH (S0)
B6	LPC_AD2	IO	LPC AD2	15K - 40K PU in PCH (S0)
B7	LPC_AD3	IO	LPC AD3	15K - 40K PU in PCH (S0)
B8	LPC_DRQ0#	NC	Not Connected	
B9	LPC_DRQ1#	NC	Not Connected	
B10	LPC_CLK	O	LPC Clock	33MHz Clock
B11	GND	G	Ground	
B12	PWRBTN#	I	Power Button	100K PU (S5)
B13	SMB_CK	O	SMBus Clock	1K PU (S5)
B14	SMB_DAT	IO	SMBus Data	1K PU (S5)
B15	SMB_ALERT#	I	SMBus Alert	2.2K PU (S5)
B16	SATA1_TX+	O	SATA 1 TX +	AC coupled on module
B17	SATA1_TX-	O	SATA 1 TX -	AC coupled on module
B18	SUS_STAT#	O	Suspend Status	10K PU (S5)
B19	SATA1_RX+	I	SATA 1 RX +	AC coupled on module
B20	SATA1_RX-	I	SATA 1 RX -	AC coupled on module
B21	GND	G	Ground	
B22	SATA3_TX+	NC	Not Connected	
B23	SATA3_TX-	NC	Not Connected	
B24	PWR_OK	I	Power OK	
B25	SATA3_RX+	NC	Not Connected	
B26	SATA3_RX-	NC	Not Connected	
B27	WDT	I	Watch Dog Timer Event	10K PD
B28	AC/HDA_SDIN2	NC	HDA IN 2	N.C. on module
B29	AC/HDA_SDIN1	I	HDA IN 1	9K - 50K PD in PCH
B30	AC/HDA_SDIN0	I	HDA IN 0	9K - 50K PD in PCH
B31	GND	G	Ground	
B32	SPKR	O	Speaker	PCH int. Weak PD, Strap, Don't PU at reset.
B33	I2C_CK	IO	I2C Clock	2.2K PU (S0)
B34	I2C_DAT	IO	I2C Data	2.2K PU (S0)
B35	THRM#	I	Over Temperature Input	10K PU (S0)
B36	USB7-	IO	USB 2.0 Port 7 -	14.25K - 24.8K PD in PCH
B37	USB7+	IO	USB 2.0 Port 7 +	14.25K - 24.8K PD in PCH
B38	USB_4_5_OC#	I	USB Overcurrent #2	10K PU (S5)
B39	USB5-	IO	USB 2.0 Port 5 -	14.25K - 24.8K PD in PCH
B40	USB5+	IO	USB 2.0 Port5 +	14.25K - 24.8K PD in PCH
B41	GND	G	Ground	
B42	USB3-	IO	USB 2.0 Port 3 -	14.25K - 24.8K PD in PCH
B43	USB3+	IO	USB 2.0 Port 3 +	14.25K - 24.8K PD in PCH
B44	USB_0_1_OC#	I	USB Overcurrent #0	10K PU (S5)
B45	USB1-	IO	USB 2.0 Port 1 -	14.25K - 24.8K PD in PCH
B46	USB1+	IO	USB 2.0 Port 1 +	14.25K - 24.8K PD in PCH
B47	EXCD1_PERST#	O	Express Card 1 Reset	Connected to CB_RESET#
B48	EXCD1_CPPE#	PU	Express Card 1 Request	10K PU (S0), no function on module
B49	SYS_RESET#	I	Reset Request Input	10K PU (S0)
B50	CB_RESET#	O	Reset Output	100K PD
B51	GND	G	Ground	
B52	PCIE_RX5+	I	PCIe Lane 5 RX +	
B53	PCIE_RX5-	I	PCIe Lane 5 RX -	
B54	GPO1	IO	GPO 1	50K PU (S0)
B55	PCIE_RX4+	I	PCIe Lane 4 RX +	
B56	PCIE_RX4-	I	PCIe Lane 4 RX -	
B57	GPO2	IO	GPO 2	
B58	PCIE_RX3+	I	PCIe Lane 3 RX +	
B59	PCIE_RX3-	I	PCIe Lane 3 RX -	

Pin	Signal Name	Type	Description	Comments / Availability
A1	GND	G	Ground	
B60	GND	G	Ground	
B61	PCIE_RX2+	I	PCIE Lane 2 RX +	
B62	PCIE_RX2-	I	PCIE Lane 2 RX -	
B63	GPO3	IO	GPO 3	
B64	PCIE_RX1+	I	PCIE Lane 1 RX +	
B65	PCIE_RX1-	I	PCIE Lane 1 RX -	
B66	WAKE0#	I	PCIE Wake	1K PU (S5)
B67	WAKE1#	I	General Wake	1K PU (S5), PCIE Wake
B68	PCIE_RX0+	I	PCIE Lane 0 RX +	
B69	PCIE_RX0-	I	PCIE Lane 0 RX -	
B70	GND	G	Ground	
B71	LVDS_B0+	O	LVDS Ch. B 0 +	Available at LVDS configuration
B72	LVDS_B0-	O	LVDS Ch. B 0 -	Available at LVDS configuration
B73	LVDS_B1+	O	LVDS Ch. B 1 +	Available at LVDS configuration
B74	LVDS_B1-	O	LVDS Ch. B 1 -	Available at LVDS configuration
B75	LVDS_B2+	O	LVDS Ch. B 2 +	Available at LVDS configuration
B76	LVDS_B2-	O	LVDS Ch. B 2 -	Available at LVDS configuration
B77	LVDS_B3+	O	LVDS Ch. B 3 +	Available at LVDS configuration
B78	LVDS_B3-	O	LVDS Ch. B 3 -	Available at LVDS configuration
B79	LVDS_BKLT_EN	O	LVDS Backlight Enable	Available at LVDS configuration
B80	GND	G	Ground	
B81	LVDS_B_CLK+	O	LVDS Ch. B Clock +	Available at LVDS configuration
B82	LVDS_B_CLK-	O	LVDS Ch. B Clock -	Available at LVDS configuration
B83	LVDS_BKLT_CTRL	O	LVDS Backlight Enable	Available at LVDS configuration
B84	VCC_5V_SBY	P	Standby Power Input	
B85	VCC_5V_SBY	P	Standby Power Input	
B86	VCC_5V_SBY	P	Standby Power Input	
B87	VCC_5V_SBY	P	Standby Power Input	
B88	BIOS_DIS1#	I	SPI routing selection	10K PU (S5)
B89	VGA_RED	AO	Red Analog Video Output	150R PD
B90	GND	G	Ground	
B91	VGA_GRN	AO	Green Analog Video Output	150R PD
B92	VGA_BLU	AO	Blue Analog Video Output	150R PD
B93	VGA_HSYNC	AO	VGA H-Sync	
B94	VGA_VSYNC	AO	VGA V-Sync	
B95	VGA_I2C_CLK	IO	VGA I2C Clock	2.2K PU (S0)
B96	VGA_I2C_DAT	IO	VGA I2C Data	2.2K PU (S0)
B97	SPI_CS#	O	SPI CS#	10K PU 3.3V SPI
B98	RSVD	NC	Reserved	
B99	RSVD	NC	Reserved	
B100	GND	G	Ground	
B101	FAN_PWMOUT	O	Fan PWM Output	12V Tolerant
B102	FAN_TACHIN	I	Fan Tachometer Input	12V Tolerant, 47K PU (S0)
B103	SLEEP#	I	Sleep Request Input	12V Tolerant, connected to PWR_BTN#
B104	VCC_12V	P	Main VCC Input	12V Typical
B105	VCC_12V	P	Main VCC Input	12V Typical
B106	VCC_12V	P	Main VCC Input	12V Typical
B107	VCC_12V	P	Main VCC Input	12V Typical
B108	VCC_12V	P	Main VCC Input	12V Typical
B109	VCC_12V	P	Main VCC Input	12V Typical
B110	GND	G	Ground	
C1	GND	G	Ground	
C2	GND	G	Ground	
C3	USB_SSRX0-	I	USB 3.0 Port 0 RX -	
C4	USB_SSRX0+	I	USB 3.0 Port 0 RX +	
C5	GND	G	Ground	
C6	USB_SSRX1-	I	USB 3.0 Port 1 RX -	
C7	USB_SSRX1+	I	USB 3.0 Port 1 RX +	
C8	GND	G	Ground	
C9	USB_SSRX2-	I	USB 3.0 Port 2 RX -	
C10	USB_SSRX2+	I	USB 3.0 Port 2 RX +	
C11	GND	G	Ground	
C12	USB_SSRX3-	I	USB 3.0 Port 3 RX -	
C13	USB_SSRX3+	I	USB 3.0 Port 3 RX +	
C14	GND	G	Ground	
C15	DDI1_PAIR6+	NC	Not Connected	
C16	DDI1_PAIR6-	NC	Not Connected	
C17	RSVD	I	KBC_PROG_RX#	UART for Programming EC
C18	RSVD	O	KBC_PROG_TX#	UART for Programming EC



Pin	Signal Name	Type	Description	Comments / Availability
A1	GND	G	Ground	
C19	PCIE_RX6+	I	PCIe Lane 6 RX +	
C20	PCIE_RX6-	I	PCIe Lane 6 RX -	
C21	GND	G	Ground	
C22	PCIE_RX7+	I	PCIe Lane 7 RX +	
C23	PCIE_RX7-	I	PCIe Lane 7 RX -	
C24	DDI1_HPD	I	DDI 1 HPD	100K PD
C25	DDI1_PAIR4+	NC	Not Connected	
C26	DDI1_PAIR4-	NC	Not Connected	
C27	RSVD	NC	Reserved	
C28	RSVD	NC	Reserved	
C29	DDI1_PAIR5+	NC	Not Connected	
C30	DDI1_PAIR5-	NC	Not Connected	
C31	GND	G	Ground	
C32	DDI2_CTRLCLK_AUX+	IO	DDI 2 CTRL Clock / AUX +	100K PD / 2.2K PU (S0)
C33	DDI2_CTRLDATA_AUX-	IO	DDI 2 CTRL Data / AUX -	100K PU / 2.2K PU (S0)
C34	DDI2_DDC_AUX_SEL	I	DDI2	1M PD. High for HDMI/DVI, Low for DP
C35	RSVD	NC	Reserved	
C36	DDI3_CTRLCLK_AUX+	NC	Not Connected	
C37	DDI3_CTRLDATA_AUX-	NC	Not Connected	
C38	DDI3_DDC_AUX_SEL	NC	Not Connected	
C39	DDI3_PAIR0+	NC	Not Connected	
C40	DDI3_PAIR0-	NC	Not Connected	
C41	GND	G	Ground	
C42	DDI3_PAIR1+	NC	Not Connected	
C43	DDI3_PAIR1-	NC	Not Connected	
C44	DDI3_HPD	NC	Not Connected	
C45	RSVD	NC	Reserved	
C46	DDI3_PAIR2+	NC	Not Connected	
C47	DDI3_PAIR2-	NC	Not Connected	
C48	RSVD	NC	Reserved	
C49	DDI3_PAIR3+	NC	Not Connected	
C50	DDI3_PAIR3-	NC	Not Connected	
C51	GND	G	Ground	
C52	PEG_RX0+	I	PCIe Graphics Lane 0 RX +	connected to CSI2_DN1
C53	PEG_RX0-	I	PCIe Graphics Lane 0 RX -	connected to CSI2_DP1
C54	TYPE0#	NC	Not Connected	
C55	PEG_RX1+	I	PCIe Graphics Lane 1 RX +	connected to CSI2_DP0
C56	PEG_RX1-	I	PCIe Graphics Lane 1 RX -	connected to CSI2_DN0
C57	TYPE1#	NC	Not Connected	
C58	PEG_RX2+	I	PCIe Graphics Lane 2 RX +	connected to CSI2_CLKP0
C59	PEG_RX2-	I	PCIe Graphics Lane 2 RX -	connected to CSI2_CLKN0
C60	GND	G	Ground	
C61	PEG_RX3+	I	PCIe Graphics Lane 3 RX +	connected to CSI2_DP3
C62	PEG_RX3-	I	PCIe Graphics Lane 3 RX -	connected to CSI2_DN3
C63	RSVD	NC	Reserved	
C64	RSVD	NC	Reserved	
C65	PEG_RX4+	I	PCIe Graphics Lane 4 RX +	connected to CSI2_DN2
C66	PEG_RX4-	I	PCIe Graphics Lane 4 RX -	connected to CSI2_DP2
C67	RSVD	NC	Reserved	
C68	PEG_RX5+	I	PCIe Graphics Lane 5 RX +	connected to CSI2_CLKP1
C69	PEG_RX5-	I	PCIe Graphics Lane 5 RX -	connected to CSI2_CLKN1
C70	GND	G	Ground	
C71	PEG_RX6+	I	PCIe Graphics Lane 6 RX +	connected to CSI2_DN4
C72	PEG_RX6-	I	PCIe Graphics Lane 6 RX -	connected to CSI2_DP4
C73	GND	G	Ground	
C74	PEG_RX7+	I	PCIe Graphics Lane 7 RX +	connected to CSI2_DN5
C75	PEG_RX7-	I	PCIe Graphics Lane 7 RX -	connected to CSI2_DP5
C76	GND	G	Ground	
C77	RSVD	NC	Reserved	
C78	PEG_RX8+	I	PCIe Graphics Lane 8 RX +	connected to PCH_I2C2_SCL
C79	PEG_RX8-	I	PCIe Graphics Lane 8 RX -	connected to PCH_I2C2_SDA
C80	GND	G	Ground	
C81	PEG_RX9+	I	PCIe Graphics Lane 9 RX +	connected to PCH_I2C3_SCL
C82	PEG_RX9-	I	PCIe Graphics Lane 9 RX -	connected to PCH_I2C3_SDA
C83	RSVD	NC	Reserved	
C84	GND	G	Ground	
C85	PEG_RX10+	NC	Not Connected	
C86	PEG_RX10-	NC	Not Connected	
C87	GND	G	Ground	

Pin	Signal Name	Type	Description	Comments / Availability
A1	GND	G	Ground	
C88	PEG_RX11+	NC	Not Connected	
C89	PEG_RX11-	NC	Not Connected	
C90	GND	G	Ground	
C91	PEG_RX12+	NC	Not Connected	
C92	PEG_RX12-	NC	Not Connected	
C93	GND	G	Ground	
C94	PEG_RX13+	NC	Not Connected	
C95	PEG_RX13-	NC	Not Connected	
C96	GND	G	Ground	
C97	RSVD	NC	Reserved	
C98	PEG_RX14+	NC	Not Connected	
C99	PEG_RX14-	NC	Not Connected	
C100	GND	G	Ground	
C101	PEG_RX15+	NC	Not Connected	
C102	PEG_RX15-	NC	Not Connected	
C103	GND	G	Ground	
C104	VCC_12V	P	Main VCC Input	12V Typical
C105	VCC_12V	P	Main VCC Input	12V Typical
C106	VCC_12V	P	Main VCC Input	12V Typical
C107	VCC_12V	P	Main VCC Input	12V Typical
C108	VCC_12V	P	Main VCC Input	12V Typical
C109	VCC_12V	P	Main VCC Input	12V Typical
C110	GND	G	Ground	
D1	GND	G	Ground	
D2	GND	G	Ground	
D3	USB_SSTX0-	O	USB 3.0 Port 0 TX -	AC coupled on module
D4	USB_SSTX0+	O	USB 3.0 Port 0 TX +	AC coupled on module
D5	GND	G	Ground	
D6	USB_SSTX1-	O	USB 3.0 Port 1 TX -	AC coupled on module
D7	USB_SSTX1+	O	USB 3.0 Port 1 TX +	AC coupled on module
D8	GND	G	Ground	
D9	USB_SSTX2-	O	USB 3.0 Port 2 TX -	AC coupled on module
D10	USB_SSTX2+	O	USB 3.0 Port 2 TX +	AC coupled on module
D11	GND	G	Ground	
D12	USB_SSTX3-	O	USB 3.0 Port 3 TX -	AC coupled on module
D13	USB_SSTX3+	O	USB 3.0 Port 3 TX +	AC coupled on module
D14	GND	G	Ground	
D15	DDI1_CTRLCLK_AUX+	IO	DDI 1 CTRL Clock / AUX +	100K PD / 2.2K PU (S0)
D16	DDI1_CTRLCLK_AUX-	IO	DDI 1 CTRL Data / AUX -	100K PU / 2.2K PU (S0)
D17	RSVD	NC	Reserved	
D18	RSVD	NC	Reserved	
D19	PCIE_TX6+	O	PCIE Lane 6 TX +	AC coupled on module
D20	PCIE_TX6-	O	PCIE Lane 6 TX -	AC coupled on module
D21	GND	G	Ground	
D22	PCIE_TX7+	O	PCIE Lane 7 TX +	AC coupled on module
D23	PCIE_TX7-	O	PCIE Lane 7 TX -	AC coupled on module
D24	RSVD	NC	Reserved	
D25	RSVD	NC	Reserved	
D26	DDI1_PAIR0+	O	DDI 1 Lane 0 +	
D27	DDI1_PAIR0-	O	DDI 1 Lane 0 -	
D28	RSVD	NC	Reserved	
D29	DDI1_PAIR1+	O	DDI 1 Lane 1 +	
D30	DDI1_PAIR1-	O	DDI 1 Lane 1 -	
D31	GND	G	Ground	
D32	DDI1_PAIR2+	O	DDI 1 Lane 2 +	
D33	DDI1_PAIR2-	O	DDI 1 Lane 2 -	
D34	DDI1_DDC_AUX_SEL	I	DDI 1 Aux. select	1M PD. High for HDMI/DVI, Low for DP
D35	RSVD	NC	Reserved	
D36	DDI1_PAIR3+	O	DDI 1 Lane 3 +	
D37	DDI1_PAIR3-	O	DDI 1 Lane 3 -	
D38	RSVD	NC	Reserved	
D39	DDI2_PAIR0+	O	DDI 2 Lane 0 +	Available without VGA
D40	DDI2_PAIR0-	O	DDI 2 Lane 0 -	Available without VGA
D41	GND	G	Ground	
D42	DDI2_PAIR1+	O	DDI 2 Lane 1 +	Available without VGA
D43	DDI2_PAIR1-	O	DDI 2 Lane 1 -	Available without VGA
D44	DDI2_HPD	I	DDI 2 HPD	Available without VGA (100K PD)
D45	RSVD	NC	Reserved	
D46	DDI2_PAIR2+	O	DDI 2 Lane 2 +	

Pin	Signal Name	Type	Description	Comments / Availability
A1	GND	G	Ground	
D47	DDI2_PAIR2-	O	DDI 2 Lane 2 -	
D48	RSVD	NC	Reserved	
D49	DDI2_PAIR3+	O	DDI 2 Lane 3 +	
D50	DDI2_PAIR3-	O	DDI 2 Lane 3 -	
D51	GND	G	Ground	
D52	PEG_TX0+	NC	Not Connected	
D53	PEG_TX0-	NC	Not Connected	
D54	PEG_LANE_RV#	NC	Not Connected	
D55	PEG_TX1+	NC	Not Connected	
D56	PEG_TX1-	NC	Not Connected	
D57	TYPE2#	O	GND	
D58	PEG_TX2+	NC	Not Connected	
D59	PEG_TX2-	NC	Not Connected	
D60	GND	G	Ground	
D61	PEG_TX3+	NC	Not Connected	
D62	PEG_TX3-	NC	Not Connected	
D63	RSVD	NC	Reserved	
D64	RSVD	NC	Reserved	
D65	PEG_TX4+	NC	Not Connected	
D66	PEG_TX4-	NC	Not Connected	
D67	GND	G	Ground	
D68	PEG_TX5+	NC	Not Connected	
D69	PEG_TX5-	NC	Not Connected	
D70	GND	G	Ground	
D71	PEG_TX6+	O	PCIe Graphics Lane 6 TX +	connected to CSI2_DN7
D72	PEG_TX6-	O	PCIe Graphics Lane 6 TX -	connected to CSI2_DP7
D73	GND	G	Ground	
D74	PEG_TX7+	O	PCIe Graphics Lane 7 TX +	connected to CSI2_DN6
D75	PEG_TX7-	O	PCIe Graphics Lane 7 TX -	connected to CSI2_DP6
D76	GND	G	Ground	
D77	RSVD	NC	Reserved	
D78	PEG_TX8+	O	PCIe Graphics Lane 8 TX +	connected to FLASHTRIG
D79	PEG_TX8-	O	PCIe Graphics Lane 8 TX -	connected to RSMRST#
D80	GND	G	Ground	
D81	PEG_TX9+	NC	Not Connected	
D82	PEG_TX9-	NC	Not Connected	
D83	RSVD	NC	Reserved	
D84	GND	G	Ground	
D85	PEG_TX10+	NC	Not Connected	
D86	PEG_TX10-	NC	Not Connected	
D87	GND	G	Ground	
D88	PEG_TX11+	NC	Not Connected	
D89	PEG_TX11-	NC	Not Connected	
D90	GND	G	Ground	
D91	PEG_TX12+	NC	Not Connected	
D92	PEG_TX12-	NC	Not Connected	
D93	GND	G	Ground	
D94	PEG_TX13+	NC	Not Connected	
D95	PEG_TX13-	NC	Not Connected	
D96	GND	G	Ground	
D97	RSVD	NC	Reserved	
D98	PEG_TX14+	NC	Not Connected	
D99	PEG_TX14-	NC	Not Connected	
D100	GND	G	Ground	
D101	PEG_TX15+	NC	Not Connected	
D102	PEG_TX15-	NC	Not Connected	
D103	GND	G	Ground	
D104	VCC_12V	P	Main VCC Input	12V Typical
D105	VCC_12V	P	Main VCC Input	12V Typical
D106	VCC_12V	P	Main VCC Input	12V Typical
D107	VCC_12V	P	Main VCC Input	12V Typical
D108	VCC_12V	P	Main VCC Input	12V Typical
D109	VCC_12V	P	Main VCC Input	12V Typical
D110	GND	G	Ground	
A1	GND	G	Ground	

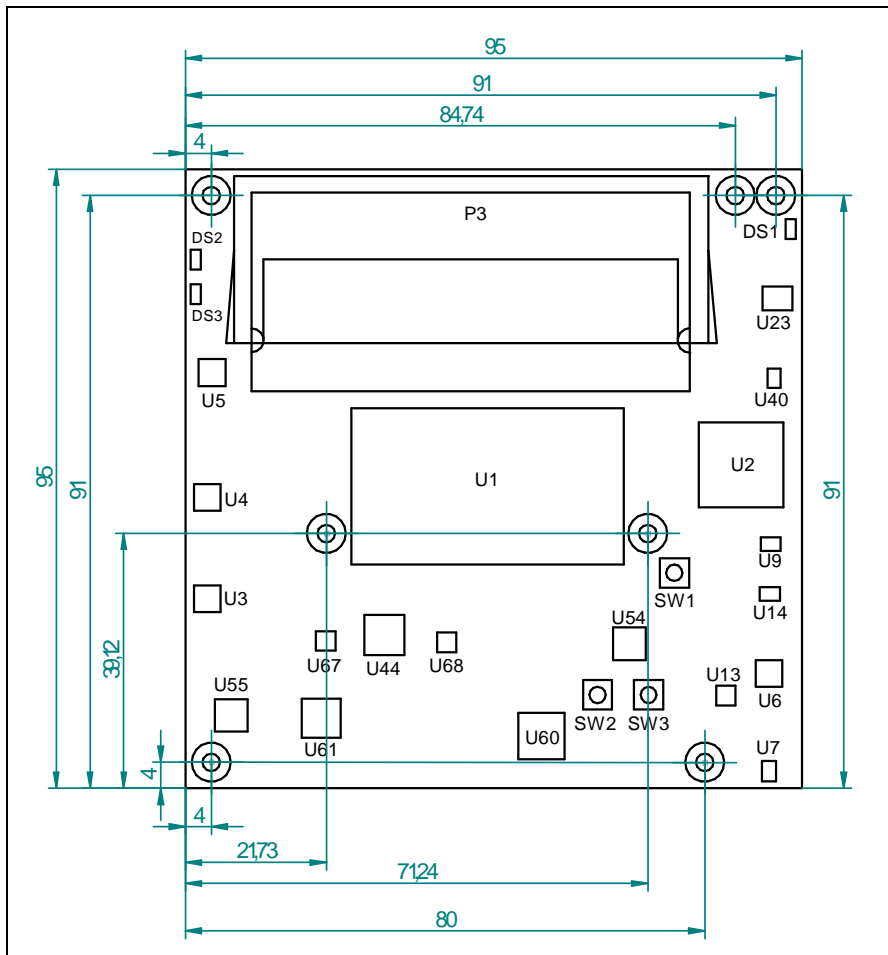
## 6.2 Mating Connectors

COMEX-IC60U should be connected to a carrier board using two 110x2 pins, 0.5mm pitch connector. The connector on the carrier board should be Foxconn QT002206-2141-3H for 5mm stack, Foxconn QT002206-4131-3H for 8mm stack, or other compatible connectors.

## 7 MECHANICAL SPECIFICATIONS

### 7.1 Mechanical Drawing

Figure 3 COMEX-IC60U Top



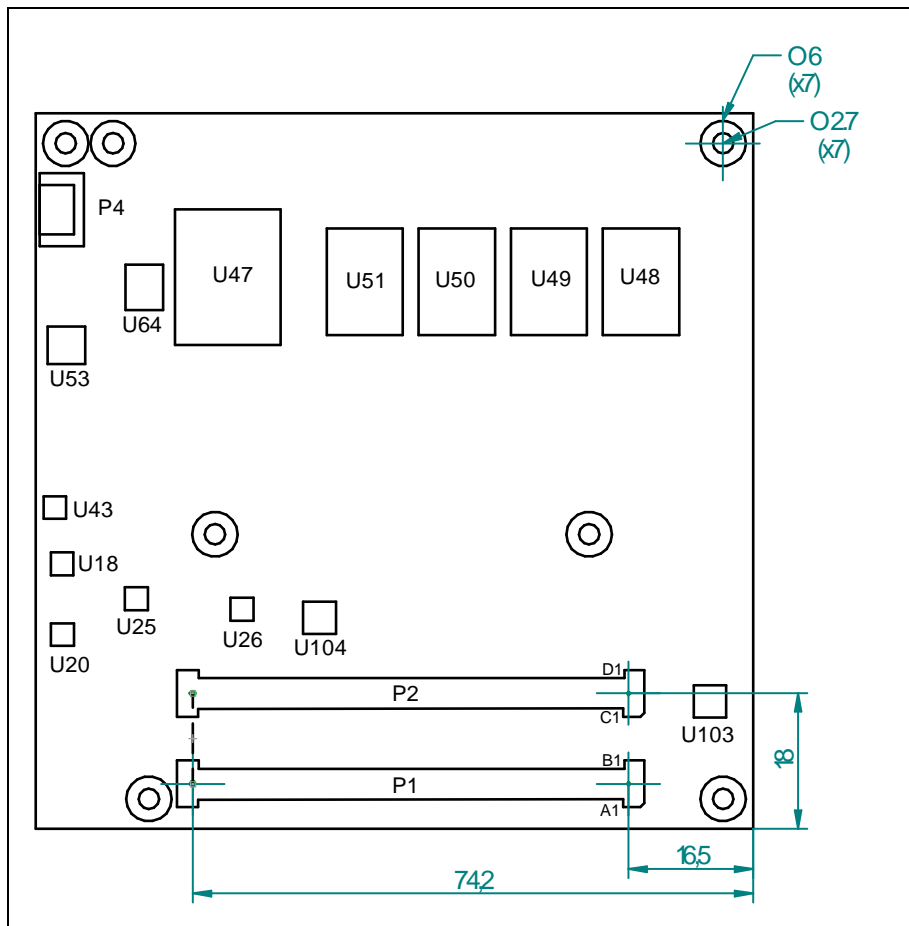
All dimensions are in millimeters. The tolerances are  $\pm 0.1$ mm.

Board thickness is 1.6mm. The drawing is intended for reference uses only.

3D models and detailed mechanical drawings are available at

<http://www.compulab.com/products/com-express/comex-ic60u-intel-core-7th-gen-com-express-compact-type-6-computer-on-module/#devres>

**Figure 4 COMEX-IC60U bottom**



All dimensions are in millimeters. The tolerances are  $\pm 0.1$ mm.

Board thickness is 1.6mm. The drawing is intended for reference uses only.

3D models and detailed mechanical drawings are available at

<http://www.compulab.com/products/com-express/comex-ic60u-intel-core-7th-gen-com-express-compact-type-6-computer-on-module/#devres>

## 7.2 Heat Spreader and Cooling Solutions

CompuLab provides COMEX-IC60U with a dedicated heat-spreader assembly. The COMEX-IC60U heat-spreader has been designed to act as a thermal interface and should be used in conjunction with a heat-sink or an external cooling solution.

External cooling must be provided to maintain the heat-spreader at proper operating temperatures. The cooling solution must ensure that under worst-case conditions the temperature on any spot of the heat-spreader surface is maintained according to the COMEX-IC60U temperature specifications.

Various thermal management solutions can be used with the heat-spreader, including active and passive approaches.

Reference cooling solutions are provided by CompuLab.

Documentation and CAD drawings for the COMEX-IC60U heat-spreader and cooling solutions are provided at <http://www.compulab.com/products/com-express/comex-ic60u-intel-core-7th-gen-com-express-compact-type-6-computer-on-module/#devres>

## 8 OPERATIONAL CHARACTERISTICS

### 8.1 Absolute Maximum Ratings

**Table 18 Absolute Maximum ratings**

Power Rail	Min (V)	Max(V)
VCC_12V	-0.3	18
VCC_5V_SBY	-0.3	6
VCC_RTC	-0.3	3.2

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**NOTE: Exceeding the absolute maximum ratings may damage the device.**

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### 8.2 Recommended Operating Conditions

**Table 19 Recommended Operating Conditions**

Power Rail	Min (V)	Typ (V)	Max (V)
VCC_12V	11.4	12	12.6
VCC_5V_SBY	4.75	5	5.25
VCC_RTC	2	3	3.2

### 8.3 Operating Temperature Ranges

**Table 20 COMEX-IC60U Temperature Range Options**

Range	Temp.	Description
Commercial	0° to 70° C	Sample boards from each batch are tested for the lower and upper temperature limits. Individual boards are not tested.
Extended	-20° to 70° C	Every board undergoes a short test for the lower limit (-20° C) qualification.
Industrial	-40° to 85° C	Every board is extensively tested for both lower and upper limits and at several midpoints.