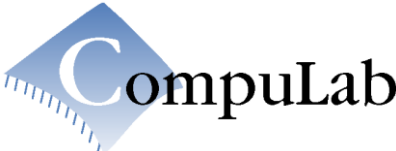


# COMEX-IC40D

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Reference Guide



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**Table 1 Document Revision Notes**

Date	Description
Aug 2015	First release
Sep 2015	Added "Serial Ports" sub-section 4.10. Added "LEDs and Buttons" sub-section 5.5. Added "Power Consumption" sub-section 9.4.

Please check for a newer revision of this document at the CompuLab web site <http://www.compulab.co.il/>.

# 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 the CompuLab COMEX-IC40D Computer-on-Module.

## 1.2 COMEX-IC40D Part Number Legend

Please refer to the CompuLab website ‘Ordering information’ section to decode the COMEX-IC40D part number: <http://www.compulab.co.il/products/com-express/comex-ic40d/#ordering>.

## 1.3 Related Documents

For additional information, refer to the documents listed in Table 2.

**Table 2 Related Documents**

Document	Location
COMEX-IC40D Developer Resources	<a href="http://www.compulab.com/">http://www.compulab.com/</a>

## 2 OVERVIEW

---

### 2.1 COMEX-IC40D Highlights

- COM Express Compact Type-6
- Intel Haswell Core i3/i5/i7 Desktop Processors up-to 3.2GHz
- Up-to 16GB dual-channel DDR3L
- Intel HD Graphics 4600
- 7x PCIe, 8x USB2, 4x USB3, 4x SATA
- Triple mode display: LVDS, eDP, HDMI, DisplayPort
- Linux and MS Windows

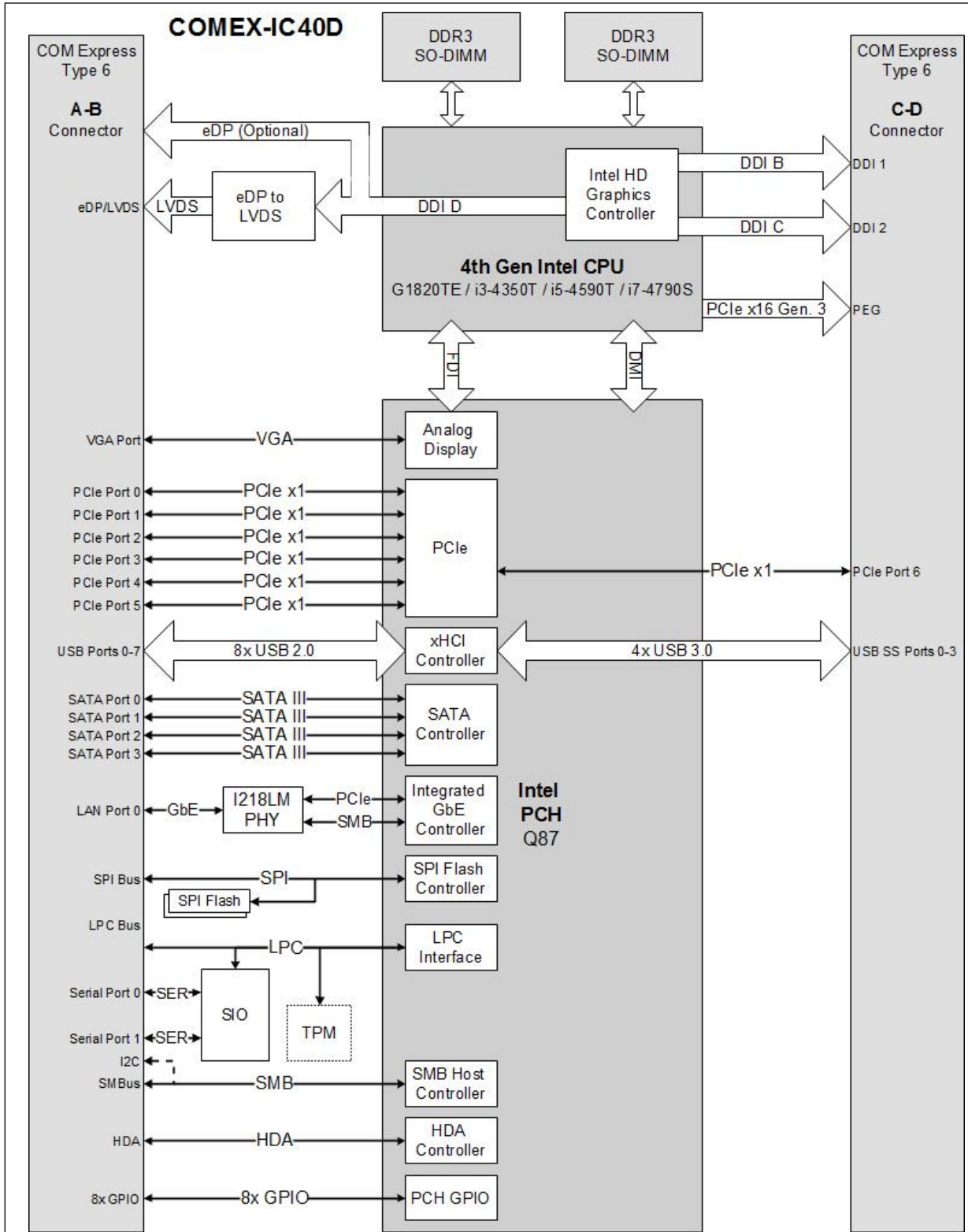
COMEX-IC40D is a Computer-on-Module packed in the industry-standard COM Express Basic form factor. COMEX-IC40D is fully compliant with the COM Express standard and has been designed for seamless integration into COM Express system designs.

COMEX-IC40D is built around the Intel Haswell Core Desktop processor family. High CPU performance and attractive pricing make COMEX-IC40D the most powerful COM Express module on the market with best-in-class price-performance ratio.

Featuring a wide range of industry standard interfaces, COMEX-IC40D is an excellent platform for networking, industrial automation, communications and IoT applications. High-performance Intel HD Graphics GPU and support for triple display operation make COMEX-IC40D a powerful solution for high-end multimedia applications such as digital signage, point of sale and surveillance.

## 2.2 COMEX-IC40D Block Diagram

Figure 1 COMEX-IC40D Block Diagram





## 2.3 COMEX-IC40D Features

The "Option" column specifies the COMEX-IC40D configuration option required for a particular feature to be populated. When a configuration option is prefixed by "not", the particular feature is only available when the option is not populated.

"+" means that the feature is always available.

**Table 3 Features and Configuration options**

Feature	Description	Option
<b>CPU Core</b>		
CPU	Intel Celeron G1820TE 64-bit dual-core 2.2GHz, 35W TDP	C1820
	Intel Core i3-4350T 64-bit dual-core 3.1GHz, 35W TDP	C4350
	Intel Core i5-4590T 64-bit quad-core 2.0GHz, 35W TDP	C4590
	Intel Core i7-4790S 64-bit quad-core 3.2GHz, 65W TDP	C5650
Chipset	Q87	+
<b>Memory and Storage</b>		
RAM	DDR3L SO-DIMM 204-pin 1x4GB	D4
	DDR3L SO-DIMM 204-pin 2x4GB	D8
	DDR3L SO-DIMM 204-pin 2x8GB	D16
Storage	4x SATA 6Gb/s	+
<b>Display</b>		
Graphics Controller	Intel Graphics HD / HD 4600 Triple display mode supported	+
DDI	DDI1: HDMI / DVI / DP / DP++, up-to 4096x2304	+
	DDI2: HDMI / DVI / DP / DP++, up-to 4096x2304	+
eDP	eDP v1.2 up to 3840x2160	not L
LVDS	Dual-channel LVDS, up-to 1920 x 1200 * precludes ePD port	L
VGA	Up-to 1920 x 1200	+
<b>Network</b>		
Ethernet	1000Base-T Ethernet port implemented with Intel I218 GbE PHY Supports remote management with Intel AMT Technology	+
<b>Audio</b>		
Digital Audio	HD Audio Interface	+
	Dual HDMI audio output	+
<b>I/O</b>		
PCI Express	7x PCI Express x1 ports	+
	1x PCIe x16 (PEG) Gen. 3.0	+
USB	4x USB3.0	+
	8x USB2.0	+
Serial	2x UART	+
General Interfaces	LPC Bus SMBus Watch Dog Timer FAN control	+
GPIO	8 GPIO signals	+
<b>System Logic</b>		
RTC	Real time clock, powered from the carrier board	+
Security	TPM - Trusted Platform Module device	TPM
Power Management	ACPI 4.0a	+

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

Electrical Specifications	
Supply Voltage	Minimum: Single 12V DC
Digital I/O voltage	3.3V
Mechanical Specifications	
Form-factor	COM Express Basic, pin-out Type 6
Dimensions	125 x 95 mm
Weight	180 gram
Environmental and Reliability	
MTTF	> 100,000 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 SYSTEM CORE

### 3.1 CPU

COMEX-IC40D module supports Intel® 4<sup>th</sup> generation 'Haswell' Core/Pentium/Celeron, in LGA1150 package, with TDP up to 65 Watt. CompuLab offers COMEX-IC40D with processors specified in the table below:

**Table 5 Intel® LGA1150 CPUs Feature List**

	Celeron® G1820TE	Core™ i3-4350T	Core™ i5-4590T	Core™ i7-4790S
Cache	2 MB	4 MB	6 MB	8 MB
Embedded Options Available	Yes	Yes	Yes	Yes
# of Cores	2	2	4	4
# of Threads	2	4	4	8
Processor Base Frequency	2.2 GHz	3.1 GHz	2 GHz	3.2 GHz
TDP	35 W	35 W	35 W	65 W
Max Turbo Frequency			3 GHz	4 GHz
Processor Graphics	Intel® HD	Intel® HD 4600	Intel® HD 4600	Intel® HD 4600
Graphics Base Frequency	350 MHz	200 MHz	350 MHz	350 MHz
Graphics Max Dynamic Frequency	1 GHz	1.15 GHz	1.15 GHz	1.2 GHz
Graphics Video Max Memory	1 GB	1.7 GB	1.7 GB	1.7 GB
Intel® Quick Sync Video	Yes	Yes	Yes	Yes
Intel® InTru™ 3D Technology		Yes	Yes	Yes
Intel® Wireless Display		Yes	Yes	Yes
Intel® Clear Video HD Technology		Yes	Yes	Yes
Intel® Insider™			Yes	Yes
Intel® Turbo Boost Technology	No	No	2.0	2.0
Intel® vPro Technology	No	No	Yes	Yes
Intel® Hyper-Threading Technology	No	Yes	No	Yes
Intel® Virtualization Technology	Yes	Yes	Yes	Yes
Intel® Virtualization for Directed I/O	No	No	Yes	Yes
Intel® VT-x with Extended Page Tables	Yes	Yes	Yes	Yes
Intel® TSX-NI	No	No	No	No
Intel® 64	Yes	Yes	Yes	Yes
Idle States	Yes	Yes	Yes	Yes
Enhanced Intel SpeedStep® Technology	Yes	Yes	Yes	Yes
Thermal Monitoring Technologies	Yes	Yes	Yes	Yes
Intel® Identity Protection Technology	No		Yes	Yes
Intel® Stable Image Platform Program (SIPP)	No	No	Yes	Yes
Intel® My WiFi Technology			Yes	Yes
AES New Instructions	No	Yes	Yes	Yes
Secure Key	Yes		Yes	Yes
Trusted Execution Technology	No	No	Yes	Yes
Execute Disable Bit	Yes	Yes	Yes	Yes
OS Guard			Yes	Yes
Anti-Theft Technology			Yes	Yes

## 3.2 Chipset

COMEX-IC40D features the Intel® Q87 PCH chipset, with the features specified in the table below:

**Table 6 Intel® Q87 PCH**

	Q87 Chipset
Code Name	Lynx Point
Embedded Options Available	Yes
TDP	4.1 W
Graphics Output	VGA
PCI Express Configurations	x1, x2, x4
Max # of PCI Express Lanes	8
USB Revision	3.0/2.0
# of USB Ports	14
USB 3.0	6
USB 2.0	8
Total # of SATA Ports	6
Max # of SATA 6.0 Gb/s Ports	6
Integrated LAN	MAC
Intel® Virtualization Technology for Directed I/O	Yes
Intel® vPro Technology	Yes
Intel® ME Firmware Version	9.0
Intel® Rapid Storage Technology	Yes
Intel® Smart Connect Technology	Yes
Intel® Standard Manageability	Yes
Intel® Smart Response Technology	Yes
Intel® Stable Image Platform Program (SIPP)	Yes
Intel® Small Business Advantage	Yes
Intel® Rapid Start Technology	Yes
Trusted Execution Technology	Yes
Anti-Theft Technology	Yes

Intel® Q87 chipset includes 18 high speed I/O ports. Some of these ports are configured according to COMEX-IC40D functionality implementation. The I/O ports and the configurations are described in the following table.

**Table 7 Chipset HSIO configuration**

HSIO Port	Q87 I/O	COMEX-IC40D
1	USB 3.0 Port 1	USB SS Port 0
2	USB 3.0 Port 2	USB SS Port 1
3	USB 3.0 Port 5	USB SS Port 2
4	USB 3.0 Port 6	USB SS Port 3
5	USB 3.0 Port 3 or PCIe Port 1	PCIe Port 0
6	USB 3.0 Port 4 or PCIe Port 2	PCIe Port 1
7	PCIe Port 3	PCIe Port 2
8	PCIe Port 4	PCIe Port 3
9	PCIe Port 5	PCIe Port 4
10	PCIe Port 6	PCIe Port 5
11	PCIe Port 7	PCIe Port 6
12	PCIe Port 8	GbE (Integrated LAN)
13	SATA 6Gb/s Port 4 or PCIe Port 1	-
14	SATA 6Gb/s Port 5 or PCIe Port 2	-
15	SATA 6Gb/s Port 0	SATA Port 0
16	SATA 6Gb/s Port 1	SATA Port 1

17	SATA 6Gb/s Port 2	SATA Port 2
18	SATA 6Gb/s Port 3	SATA Port 3

### 3.3 Memory

COMEX-IC40D includes two SO-DIMM sockets. Each socket interfaces with the CPU by a separate DDR3 channel.

The SO-DIMM modules can be up to 8GB each, 1333/1600 MT/s, unbuffered, non-ECC.

### 3.4 Graphics Core

The graphics cores are located in the processor die. The Core processors feature Intel® HD 4600 graphics, and the Celeron processor features Intel® HD graphics.

**Table 8 Intel® LGA1150 Integrated Graphics**

	Celeron® G1820TE	Core™ i3-4350T	Core™ i5-4590T	Core™ i7-4790S
Processor Graphics	Intel® HD	Intel® HD 4600	Intel® HD 4600	Intel® HD 4600
Graphics Base Frequency	350 MHz	200 MHz	350 MHz	350 MHz
Graphics Max Dynamic Frequency	1 GHz	1.15 GHz	1.15 GHz	1.2 GHz
Graphics Video Max Memory	1 GB	1.7 GB	1.7 GB	1.7 GB
Intel® Quick Sync Video	Yes	Yes	Yes	Yes
Intel® InTru™ 3D Technology		Yes	Yes	Yes
Intel® Wireless Display		Yes	Yes	Yes
Intel® Clear Video HD Technology		Yes	Yes	Yes
Intel® Insider™			Yes	Yes

### 3.5 Display Interfaces

COMEX-IC40D supports the following display interfaces:

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

**Table 9 Display Interfaces Maximum Resolution**

Interface	Max. Resolution
<b>HDMI</b>	4096x2304 @ 24Hz 2560x1600 @ 60Hz
<b>DVI</b>	1920x1200 @ 60Hz
<b>VGA</b>	1920x2000 @ 60Hz

**Table 10 eDP and DP maximum resolutions**

Link Data Rate	1 Lane	2 Lanes	3 Lanes
<b>RBR</b>	1064x600	1400x1050	2240x1400
<b>HBR</b>	1280x960	1920x1200	2880x1800
<b>HBR2</b>	1920x1200	2880x1800	3840x2160

**Table 11 Digital Display Configurations and Max. Resolutions**

	DDI 1 Port	DDI 2 Port	eDP/LVDS Port
<b>Option 1</b>	HDMI/DVI	HDMI/DVI	DP/eDP/LVDS
<b>Option 2</b>	HDMI/DVI	DP	DP/eDP/LVDS
<b>Option 3</b>	DP	DP	DP/eDP/LVDS

### 3.5.1 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.

### 3.5.2 eDP

The COMEX-IC40D eDP interface can support resolutions of up to 3840x2160 @ 60Hz.

---

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

---

### 3.5.3 LVDS

The optional LVDS interface is implemented with an eDP to LVDS bridge. COMEX-IC40D 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.

---

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

---

### 3.5.4 VGA

Digital video data is received by the PCH via FDI interface from the graphics core of the CPU. The PCH drives analog VGA signals, available at COMEX-IC40D connectors.

The VGA output supports resolution of up to 1920x2000 pixels and 24-bit color at a refresh rate of 60 Hz.

## 4 PERIPHERAL INTERFACES

### 4.1 PCI Express

COMEX-IC40D incorporates 7 PCIe gen. 2 channels, and one PEG PCIe gen. 3 channel.

**Table 12 PCIe Gen. 2 ports**

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

The PCIe groups can be configured in three independent groups: PCIe 0 – 3, PCIe 4 – 6, and PCIe gen. 3 (PEG).

**Table 13 PCIe Ports 0 – 3 Configurations**

Port 0	Port 1	Port 2	Port 3
PCIe x4			
PCIe x2		PCIe x2	
PCIe x2		PCIe x1	PCIe x1
PCIe x1	PCIe x1	PCIe x1	PCIe x1

**Table 14 PCIe Ports 4 – 6 Configurations**

Port 4	Port 5	Port 6
PCIe x2		PCIe x1
PCIe x1	PCIe x1	PCIe x1

**Table 15 PCIe Gen. 3 (PEG) Configurations**

Lane:	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	PCIe x16															
	PCIe x8								PCIe x8							
	PCIe x8								PCIe x4				PCIe x4			

### 4.2 USB 2.0/3.0

COMEX-IC40D 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-IC40D incorporates four SATA 6Gb/s (Gen. 3) ports.

The Q87 PCH chipset supports Intel's Rapid Storage Technology (RST) that enables to the SATA controller to be configured as a RAID controller, supporting RAID 0/1/5/10.

## 4.4 Ethernet

COMEX-IC40D features a GbE LAN controller integrated in the Q87 PCH chipset. Through the physical interface of PCIe port 8 (HSIO 12), and SMBus, the LAN controller is connected to Intel I218 PHY.

COMEX-IC40D LAN supports 10/100/1000 Mbps.

## 4.5 Audio

COMEX-IC40D supports Intel® HD Audio signals. The HDA signals include one SDO output, four SDIN inputs and ctrl/clock signals.

The CPU also supports up to two HD audio streams, integrated in HDMI or Display Port video outputs.

## 4.6 SPI

COMEX-IC40D SPI interface is used for booting from external SPI flash. For additional details please refer to section 5.4.

## 4.7 SMBus

There are three System Management (SM) compatible busses on COMEX-IC40D:

- SML0: Internal only, communication of the PCH with the i218LM LAN PHY.
- SML1: Internal only, communication between the embedded controller and the PCH.
- Thermal SMB: Internal only, communication between the embedded controller and the DIMM area thermal sensor.
- SMB: Internal and external. Used to link between the PCH to peripheral devices.

The design of SMB on COMEX-IC40D separates it to two portions: SMBus for devices running in standby, and SMBus for devices not running in standby. The SMB available for the carrier can be used also in standby mode.

The SMBus devices onboard COMEX-IC40D are described in the following table:

**Table 16 SMBus Devices**

Write/Read Address	Device
A0h / A1h	DDR3 SPD Channel A (top)
A4h / A5h	DDR3 SPD Channel B (bottom)
30h / 31h	DDR3 Thermal Sensor Channel A
34h / 35h	DDR3 Thermal Sensor Channel B
TBD	eDP to LVDS Bridge

## 4.8 I2C

The I2C bus of the carrier board connection allows access to the COM Express standard EeeP EEPROM onboard COMEX-IC40D, at writing address 0xA0.



## 4.9 LPC

The COMEX-IC40D Low Pin Count (LPC) interface of is used by the PCH to communicate with several devices:

- Embedded Controller
- Supper IO (SIO)
- 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

The COMEX-IC40D incorporates two full function 16C550A compatible UARTs, each implementing a 2-wire serial port interface.

All serial port pins are 12V tolerant.

## 4.11 GPIO

There are eight General Purpose I/O (GPIO) signals available from COMEX-IC40D.

Each GPIO signal can be configured as input or output (GPI or GPO). All the GPIO signals are PCH GPIO pins, as described in table 17, along with the power plane and the state at reset of each signal:

**Table 17 GPIO Signals Details**

Pin Name	PCH Name	Default Function	State On Reset	Power Plane
GPI0	GPIO34	GPI	High	Core
GPI1	GPIO52	GPI	High	Core
GPI2	GPIO54	GPI	High	Core
GPI3	GPIO8	GPO	High	Suspend
GPO0	GPIO57	GPI	Low	Suspend
GPO1	GPIO15	GPO	Low	Suspend
GPO2	GPIO24	GPO	Low	Suspend
GPO3	GPIO28	GPO	Low	Suspend

The GPI signals are pulled up to 3.3V by a 10K resistor.

## 5 SYSTEM LOGIC

### 5.1 Power Supply

#### 5.1.1 Power Rails

COMEX-IC40D requires the following power rails:

**Table 18 Power Rails**

Power Rail	Maximum Current (Ampere)	Voltage Range (Volt)	Nominal Voltage (Volt)	Max Input Ripple (mV)
VCC_12V	See below	11.4 – 12.6	12	100
VCC_5V_SBY	2	4.75 – 5.25	5	50
VCC_RTC	<0.001	2.0 – 3.3	3	20

#### 5.1.2 Single Supply Mode

COMEX-IC40D 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.

### 5.2 Power Management

COMEX-IC40D supports the power states listed below:

#### G0 – Work

- S0 – System powered on
  - C0 – Active
  - C1 – Auto halt
  - C1E – Auto halt, low frequency, low voltage
  - C3 – L1/L2 cache flush + clocks off
  - C6 – Save core states, before shutdown
  - C7 – Save core states, before shutdown + L3 flush

#### G1 – Sleep

- S3 – Sleep, Suspend to RAM
- S4 – Hibernate, Suspend to disk

#### G2 – Power Off

- S5 – Soft off, no power

#### G3 – Mechanical Off

The C states availability depends on the CPU installed.

Among the causes of wake events, there are:

- PWRBTN# of SLEEP# signals falling edge
- RTC Alarm, if enabled
- GPO0 and GPO1, if enabled
- Wake On LAN
- SMB\_ALERT# falling edge
- Intel ME non-maskable wake (on supporting CPU)
- EHCI/xHCI USB controller

## 5.3 Power Control

The COMEX-IC40D power control signals available on the carrier board interface include:

- **PWRBTN# / SLEEP#** (Module Input): The power button signal is an ACPI standard. It has a 16 milliseconds de-bounce circuit at the PCH, and may initiate a power event, depending on the software. At any power state, if PWRBTN# is held low for at least four seconds, the system should be immediately powered off (G2/S5 state).
- **SYS\_RESET#** (Module Input): The system reset signal has a 16 milliseconds de-bounce circuit at the PCH. At falling edge of SYS\_RESET#, after de-bouncing, the system should wait up to 25 milliseconds for the SMBus to go idle, and then initiate a system reset.
- **CB\_RESET#** (Module Output): The Carrier Board reset signal originates from the PCH, and generates a reset for all the subsystems on the module. It is asserted at PWR\_OK low input, at a watchdog timeout, after a SYS\_RESET# event, or by the software.
- **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 should switch into a sleep mode, at least 210 microseconds later.
- **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.

## 5.4 SPI Boot

The SPI bus is used in COMEX-IC40D in order to boot from SPI flash devices.

COMEX-IC40D requires two separate SPI Flash boot, and therefore uses two active-low Chip Select signals: CS0 and CS1.

In order to support external boot from two SPI Flash devices, CS1 signal is routed to pin A86 on the carrier-board connector, in addition to the COM Express standard Chip Select signal SPI\_CS#, which is allocated to CS0.

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-IC40D will boot from the onboard SPI flash.

The BIOS\_DIS0# signal is not used.

## 5.5 LEDs and Buttons

COMEX-IC40D incorporates three push buttons and two LEDs

The table below describes the functionality of the On LED (DS3) and of the Sleep LED (DS4).

**Table 19 LEDs**

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

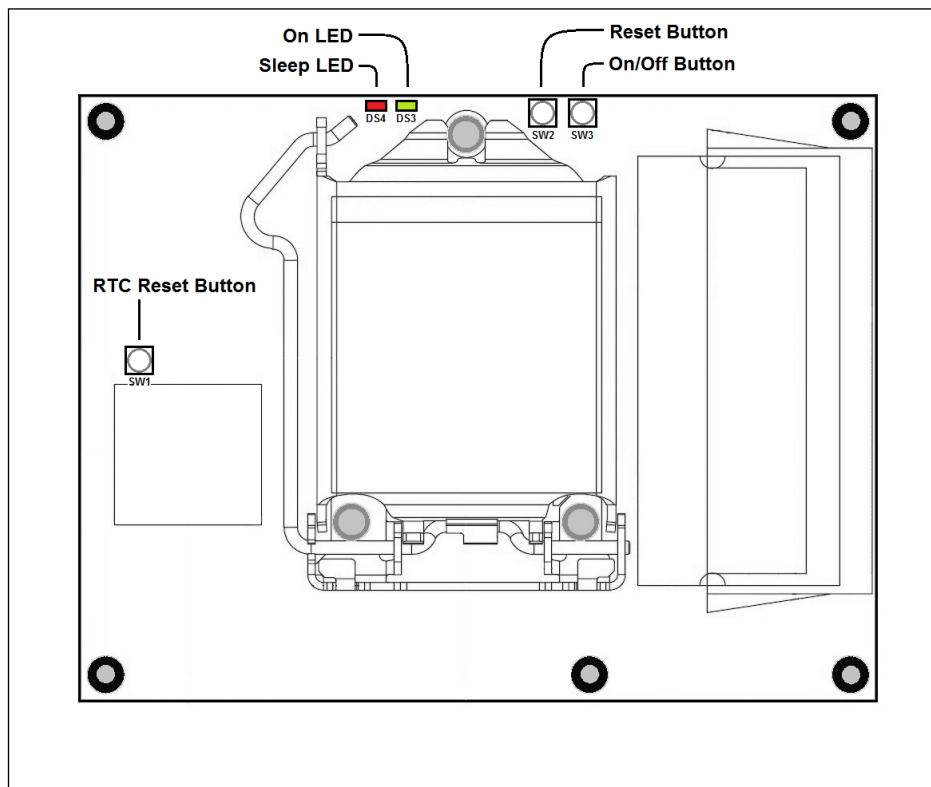
On-board buttons and their functionality are detailed in the table below.

**Table 20 Push Buttons**

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

The LEDs and the push buttons are all located on the top side of COMEX-IC40D. See the figure below for LED and button locations.

**Figure 2 COMEX-IC40D LEDs and Buttons**



## 6 SYSTEM RESOURCES

### 6.1 Interrupt Request (IRQ) Lines

COMEX-IC40D includes an interrupt controller that can function as two 8259 standard ISA-compatible Programmable Interrupt Controllers (PIC) for legacy or PCI based interrupts. In addition, an Advanced Programmable Interrupt Controller (APIC) is available in the PCH.

The APIC supports 24 interrupts, as described:

**Table 21 APIC Interrupt Mapping**

IRQ #	Using SERIRQ#	Using PCI Message	Comments
0	No	No	Cascade from 8259
1	Yes	Yes	
2	No	No	8254 Counter 0, HPET #0
3	Yes	Yes	
4	Yes	Yes	
5	Yes	Yes	
6	Yes	Yes	
7	Yes	Yes	
8	No	No	RTC, HPET #1
9	Yes	Yes	
10	Yes	Yes	Option for SCI, TCO
11	Yes	Yes	HPET #2, Option for SCI, TCO
12	Yes	Yes	HPET #3
13	No	No	FERR# logic
14	Yes	Yes	SATA
15	Yes	Yes	SATA
16	No	Yes	Directed, to a pin of the PCH and can be routable to internal PCH devices. IRQ #18 is connected onboard to SIO.
17	No	Yes	
18	No	Yes	
19	No	Yes	
20	No	Yes	
21	No	Yes	
22	No	Yes	
23	No	Yes	

### 6.2 PCI Devices

**Table 22 PCI Devices and Functions**

Bus	Device	Function	Function Description
0	31	0	LPC Controller
0	31	2	SATA Controller 1
0	31	3	SMBus Controller
0	31	5	SATA Controller 2
0	31	6	Thermal Subsystem
0	29	0	USB EHCI Controller 1
0	26	0	USB EHCI Controller 2
0	28	0	PCIe Port 1
0	28	1	PCIe Port 2
0	28	2	PCIe Port 3
0	28	3	PCIe Port 4
0	28	4	PCIe Port 5
0	28	5	PCIe Port 6
0	28	6	PCIe Port 7
0	28	7	PCIe Port 8
0	27	0	Intel HDA Controller
0	25	0	GbE Controller

0	22	0	Intel ME Interface 1
0	22	1	Intel ME Interface 2
0	22	2	IDE-R
0	22	3	KT
0	20	0	xHCI Controller

## 7 CARRIER BOARD INTERFACE

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### 7.1 Carrier Board Connectors Pinout

COMEX-IC40D connects to a carrier board with two connectors, each incorporates two 110 pin rows. The pin numbering is divided to four groups: A, B C and D, where each pin number starts with the letter of the row it's in.

The pinout of the connectors is compatible to type 6 COM Express specifications.

COMEX-IC40D implements a variety of peripheral interfaces through the COM Express carrier board connectors. The following notes apply to interfaces available through the COM Express connectors interface:

- Some interfaces/signals are available only with/without certain configuration options of COMEX-IC40D. The availability restrictions of each signal are described in the “Signals description” table for each interface.
- All of the COMEX-IC40D digital interfaces operate at 3.3V levels, unless otherwise noted.

The signals for each interface are described in the “Signal description” table for the interface in question. The following notes provide information on the “Signal description” tables:

- **“Signal name”** – The name of each signal with regards to the discussed interface. The signal name corresponds to the signal name as appears in the COM Express Module Base Specification.
- **“Pin#”** – The carrier board interface pin number, including the connector's dedicated letter (A/B/C/D).
- **“Type”** – Signal type, see the definition of different signal types below
- **“Description”** – Signal description with regards to the interface in question.
- **“Availability”** – Depending on COMEX-IC40D configuration options, certain carrier board interface pins are physically disconnected (floating) on-board COMEX-IC40D. The “Availability” column summarizes configuration requirements for each signal. All the listed requirements must be met (logical AND) for a signal to be “available” unless otherwise noted.

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.**

- **“AI”** – Analog Input
- **“AO”** – Analog Output
- **“AIO”** – Analog Input/Output
- **“AP”** – Analog Power Output
- **“I”** – Digital Input
- **“O”** – Digital Output
- **“IO”** – Digital Input/Output
- **“OD”** – Open Drain Signal (not pulled up on-board COMEX-IC40D)
- **“P”** – Power
- **“SPU”** – Software controlled pull up to 3.3V
- **“SPD”** – Software controlled pull down to GND
- **“PU105”** – Always pulled up to 1.05V on-board COMEX-IC40D, (typ. 5KΩ-15KΩ).

- **"PU33"** – Always pulled up to 3.3V on-board COMEX-IC40D, (typ. 5KΩ-15KΩ).
- **"PU5"** – Always pulled up to 5.0V on-board COMEX-IC40D, (typ. 5KΩ-15KΩ).
- **"PD"** - Always pulled down on-board COMEX-IC40D, (typ. 5KΩ-15KΩ).
- **"NC"** – Connector Pin is Not Connected

**Table 23 COMEX-IC40D Carrier Board Connectors Signals**

Pin	Signal Name	Type	Description	Comments / Availability
A1	GND	P	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	P	Ground	
A12	GBE0_MDI0-	IO	GbE MDI 0 -	
A13	GBE0_MDI0+	IO	GbE MDI 0 +	
A14	GBE0_CTREF	AP	GbE Center Tap Reference	1uF capacitor on module
A15	SUS_S3#	O	Suspend S3	10K PD (S5)
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	P	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 (S5)
A28	(S)ATA_ACT#	O	SATA Activity	10K PU (S0)
A29	AC/HDA_SYNC	O	HDA Sync	9K - 50K PD in PCH
A30	AC/HDA_RST#	O	HDA RST	
A31	GND	P	Ground	
A32	AC/HDA_BITCLK	O	HDA Bit Clock (BCLK)	
A33	AC/HDA_SDOUT	O	HDA SD Out (SDO)	9K - 50K PD in PCH
A34	BIOS_DIS0#	PU33	SPI routing selection	10K PU (S5), no function on module
A35	THRMTRIP#	O	CPU Thermal Trip Indicator	1K PU (S0) to 1.05V
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	P	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#
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	P	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	GPIO	IO	GPIO	10K 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	P	Ground	
A58	PCIE_TX3+	O	PCIe Lane 3 TX +	AC coupled on module



Pin	Signal Name	Type	Description	Comments / Availability
A59	PCIE_TX3-	O	PCIe Lane 3 TX -	AC coupled on module
A60	GND	P	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	10K 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	P	Ground	
A67	GPI2	IO	GPI 2	10K 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	P	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	P	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 (S0) (LVDS) / 100K PD
A84	LVDS_I2C_DAT	IO	LVDS I2C Data / eDP AUX -	2.2K PU (S0) (LVDS) / 100K PU (S0)
A85	GPI3	IO	GPI 3	10K PU (S5)
A86	RSVD	I	Reserved (Leave unconnected)	
A87	eDP_HPD	I	eDP HPD	100K PD
A88	PCIE_CLK_REF+	O	PCIe Reference Clock +	
A89	PCIE_CLK_REF-	O	PCIe Reference Clock -	
A90	GND	P	Ground	
A91	SPI_POWER	P	SPI Power output	3.3V Typical
A92	SPI_MISO	I	SPI MISO	
A93	GPO0	IO	GPO 0	
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	P	Ground	
A101	SER1_TX	O	Serial Port 1 TX	12V Tolerant
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	P	Ground	
B1	GND	P	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#	I	LPC DRQ0#	15K - 40K PU in PCH (S0)
B9	LPC_DRQ1#	I	LPC DRQ1#	15K - 40K PU in PCH (S0)
B10	LPC_CLK	O	LPC Clock	33MHz Clock
B11	GND	P	Ground	
B12	PWRBTN#	OD	Power Button	15K - 40K PU in PCH (S5)
B13	SMB_CLK	O	SMBus Clock	2.2K PU (S5)
B14	SMB_DAT	IO	SMBus Data	2.2K PU (S5)
B15	SMB_ALERT#	I	SMBus Alert	10K PU (S5)

Pin	Signal Name	Type	Description	Comments / Availability
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	
B19	SATA1_RX+	I	SATA 1 RX +	AC coupled on module
B20	SATA1_RX-	I	SATA 1 RX -	AC coupled on module
B21	GND	P	Ground	
B22	SATA3_TX+	O	SATA 3 TX +	AC coupled on module
B23	SATA3_TX-	O	SATA 3 TX -	AC coupled on module
B24	PWR_OK	I	Power OK	10K PU (S5)
B25	SATA3_RX+	I	SATA 3 RX +	AC coupled on module
B26	SATA3_RX-	I	SATA 3 RX -	AC coupled on module
B27	WDT	PD	Watch Dog Timer Event	1K PD TBD
B28	AC/HDA_SDIN2	I	HDA IN 2	9K - 50K PD in PCH
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	P	Ground	
B32	SPKR	O	Speaker	100R PD. Strap, Don't PU at reset.
B33	I2C_CK	IO	I2C Clock	2.2K PU (S5), I2C to EeeP EEPROM
B34	I2C_DAT	IO	I2C Data	2.2K PU (S5), I2C to EeeP EEPROM
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	P	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	
B51	GND	P	Ground	
B52	PCIE_RX5+	I	PCIe Lane 5 RX +	
B53	PCIE_RX5-	I	PCIe Lane 5 RX -	
B54	GPO1	IO	GPO 1	
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 -	
B60	GND	P	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	10K PU (S5)
B67	WAKE1#	I	General Wake	10K PU (S5), PCIe Wake
B68	PCIE_RX0+	I	PCIe Lane 0 RX +	
B69	PCIE_RX0-	I	PCIe Lane 0 RX -	
B70	GND	P	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	P	Ground	
B81	LVDS_B_CK+	O	LVDS Ch. B Clock +	Available at LVDS configuration
B82	LVDS_B_CK-	O	LVDS Ch. B Clock -	Available at LVDS configuration

Pin	Signal Name	Type	Description	Comments / Availability
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	
B90	GND	P	Ground	
B91	VGA_GRN	AO	Green Analog Video Output	
B92	VGA_BLU	AO	Blue Analog Video Output	
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#	
B98	RSVD	NC	Reserved	
B99	RSVD	NC	Reserved	
B100	GND	P	Ground	
B101	FAN_PWMOUT	O	Fan PWM Output	12V Tolerant
B102	FAN_TACHIN	I	Fan Tachometer Input	12V Tolerant, 10K PU (S0)
B103	SLEEP#	OD	Sleep Request Input	12V Tolerant, 15K - 40K PU in PCH (S5)
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	P	Ground	
C1	GND	P	Ground	
C2	GND	P	Ground	
C3	USB_SSRX0-	I	USB 3.0 Port 0 RX -	
C4	USB_SSRX0+	I	USB 3.0 Port 0 RX +	
C5	GND	P	Ground	
C6	USB_SSRX1-	I	USB 3.0 Port 1 RX -	
C7	USB_SSRX1+	I	USB 3.0 Port 1 RX +	
C8	GND	P	Ground	
C9	USB_SSRX2-	I	USB 3.0 Port 2 RX -	
C10	USB_SSRX2+	I	USB 3.0 Port 2 RX +	
C11	GND	P	Ground	
C12	USB_SSRX3-	I	USB 3.0 Port 3 RX -	
C13	USB_SSRX3+	I	USB 3.0 Port 3 RX +	
C14	GND	P	Ground	
C15	DDI1_PAIR6+	NC	Not Connected	
C16	DDI1_PAIR6-	NC	Not Connected	
C17	RSVD	I	Reserved	
C18	RSVD	O	Reserved	
C19	PCIE_RX6+	I	PCIe Lane 6 RX +	
C20	PCIE_RX6-	I	PCIe Lane 6 RX -	
C21	GND	P	Ground	
C22	PCIE_RX7+	NC	Not Connected	
C23	PCIE_RX7-	NC	Not Connected	
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	P	Ground	
C32	DDI2_CTRLCLK_AUX+	O	DDI 2 CTRL Clock / AUX +	100K PD / 2.2K PU (S0)
C33	DDI2_CTRLDATA_AUX-	O	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	

Pin	Signal Name	Type	Description	Comments / Availability
C40	DDI3_PAIR0-	NC	Not Connected	
C41	GND	P	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	P	Ground	
C52	PEG_RX0+	I	PCIe Graphics Lane 0 RX +	
C53	PEG_RX0-	I	PCIe Graphics Lane 0 RX -	
C54	TYPE0#	NC	Not Connected	
C55	PEG_RX1+	I	PCIe Graphics Lane 1 RX +	
C56	PEG_RX1-	I	PCIe Graphics Lane 1 RX -	
C57	TYPE1#	NC	Not Connected	
C58	PEG_RX2+	I	PCIe Graphics Lane 2 RX +	
C59	PEG_RX2-	I	PCIe Graphics Lane 2 RX -	
C60	GND	P	Ground	
C61	PEG_RX3+	I	PCIe Graphics Lane 3 RX +	
C62	PEG_RX3-	I	PCIe Graphics Lane 3 RX -	
C63	RSVD	NC	Not Connected	
C64	RSVD	NC	Not Connected	
C65	PEG_RX4+	I	PCIe Graphics Lane 4 RX +	
C66	PEG_RX4-	I	PCIe Graphics Lane 4 RX -	
C67	RSVD	NC	Not Connected	
C68	PEG_RX5+	I	PCIe Graphics Lane 5 RX +	
C69	PEG_RX5-	I	PCIe Graphics Lane 5 RX -	
C70	GND	P	Ground	
C71	PEG_RX6+	I	PCIe Graphics Lane 6 RX +	
C72	PEG_RX6-	I	PCIe Graphics Lane 6 RX -	
C73	GND	P	Ground	
C74	PEG_RX7+	I	PCIe Graphics Lane 7 RX +	
C75	PEG_RX7-	I	PCIe Graphics Lane 7 RX -	
C76	GND	P	Ground	
C77	RSVD	NC	Not Connected	
C78	PEG_RX8+	I	PCIe Graphics Lane 8 RX +	
C79	PEG_RX8-	I	PCIe Graphics Lane 8 RX -	
C80	GND	P	Ground	
C81	PEG_RX9+	I	PCIe Graphics Lane 9 RX +	
C82	PEG_RX9-	I	PCIe Graphics Lane 9 RX -	
C83	RSVD	NC	Not Connected	
C84	GND	P	Ground	
C85	PEG_RX10+	I	PCIe Graphics Lane 10 RX +	
C86	PEG_RX10-	I	PCIe Graphics Lane 10 RX -	
C87	GND	P	Ground	
C88	PEG_RX11+	I	PCIe Graphics Lane 11 RX +	
C89	PEG_RX11-	I	PCIe Graphics Lane 11 RX -	
C90	GND	P	Ground	
C91	PEG_RX12+	I	PCIe Graphics Lane 12 RX +	
C92	PEG_RX12-	I	PCIe Graphics Lane 12 RX -	
C93	GND	P	Ground	
C94	PEG_RX13+	I	PCIe Graphics Lane 13 RX +	
C95	PEG_RX13-	I	PCIe Graphics Lane 13 RX -	
C96	GND	P	Ground	
C97	RSVD	NC	Reserved	
C98	PEG_RX14+	I	PCIe Graphics Lane 14 RX +	
C99	PEG_RX14-	I	PCIe Graphics Lane 14 RX -	
C100	GND	P	Ground	
C101	PEG_RX15+	I	PCIe Graphics Lane 15 RX +	
C102	PEG_RX15-	I	PCIe Graphics Lane 15 RX -	
C103	GND	P	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

Pin	Signal Name	Type	Description	Comments / Availability
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	P	Ground	
D1	GND	P	Ground	
D2	GND	P	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	P	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	P	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	P	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	P	Ground	
D15	DDI1_CTRLCLK_AUX+	O	DDI 1 CTRL Clock / AUX +	100K PD / 2.2K PU (S0)
D16	DDI1_CTRLDATA_AUX-	O	DDI 1 CTRL Data / AUX -	100K PU / 2.2K PU (S0)
D17	RSVD	NC	Not Connected	
D18	RSVD	NC	Not Connected	
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	P	Ground	
D22	PCIE_TX7+	NC	Not Connected	
D23	PCIE_TX7-	NC	Not Connected	
D24	RSVD	NC	Not Connected	
D25	RSVD	NC	Not Connected	
D26	DDI1_PAIR0+	O	DDI 1 Lane 0 +	
D27	DDI1_PAIR0-	O	DDI 1 Lane 0 -	
D28	RSVD	NC	Not Connected	
D29	DDI1_PAIR1+	O	DDI 1 Lane 1 +	
D30	DDI1_PAIR1-	O	DDI 1 Lane 1 -	
D31	GND	P	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	Not Connected	
D36	DDI1_PAIR3+	O	DDI 1 Lane 3 +	
D37	DDI1_PAIR3-	O	DDI 1 Lane 3 -	
D38	RSVD	NC	Not Connected	
D39	DDI2_PAIR0+	O	DDI 2 Lane 0 +	
D40	DDI2_PAIR0-	O	DDI 2 Lane 0 -	
D41	GND	P	Ground	
D42	DDI2_PAIR1+	O	DDI 2 Lane 1 +	
D43	DDI2_PAIR1-	O	DDI 2 Lane 1 -	
D44	DDI2_HPD	I	DDI 2 HPD	100K PD
D45	RSVD	NC	Not Connected	
D46	DDI2_PAIR2+	O	DDI 2 Lane 2 +	
D47	DDI2_PAIR2-	O	DDI 2 Lane 2 -	
D48	RSVD	NC	Not Connected	
D49	DDI2_PAIR3+	O	DDI 2 Lane 3 +	
D50	DDI2_PAIR3-	O	DDI 2 Lane 3 -	
D51	GND	P	Ground	
D52	PEG_TX0+	O	PCIe Graphics Lane 0 TX +	AC coupled on module
D53	PEG_TX0-	O	PCIe Graphics Lane 0 TX -	AC coupled on module
D54	PEG_LANE_RV#	PU105	PCIe Graphics Lanes Reversal	5K - 8K PU (S0) to 1.05V in the CPU
D55	PEG_TX1+	O	PCIe Graphics Lane 1 TX +	AC coupled on module
D56	PEG_TX1-	O	PCIe Graphics Lane 1 TX -	AC coupled on module
D57	TYPE2#	O	GND	
D58	PEG_TX2+	O	PCIe Graphics Lane 2 TX +	AC coupled on module
D59	PEG_TX2-	O	PCIe Graphics Lane 2 TX -	AC coupled on module
D60	GND	P	Ground	
D61	PEG_TX3+	O	PCIe Graphics Lane 3 TX +	AC coupled on module
D62	PEG_TX3-	O	PCIe Graphics Lane 3 TX -	AC coupled on module
D63	RSVD	NC	Not Connected	

Pin	Signal Name	Type	Description	Comments / Availability
D64	RSVD	NC	Not Connected	
D65	PEG_TX4+	O	PCIe Graphics Lane 4 TX +	AC coupled on module
D66	PEG_TX4-	O	PCIe Graphics Lane 4 TX -	AC coupled on module
D67	GND	P	Ground	
D68	PEG_TX5+	O	PCIe Graphics Lane 5 TX +	AC coupled on module
D69	PEG_TX5-	O	PCIe Graphics Lane 5 TX -	AC coupled on module
D70	GND	P	Ground	
D71	PEG_TX6+	O	PCIe Graphics Lane 6 TX +	AC coupled on module
D72	PEG_TX6-	O	PCIe Graphics Lane 6 TX -	AC coupled on module
D73	GND	P	Ground	
D74	PEG_TX7+	O	PCIe Graphics Lane 7 TX +	AC coupled on module
D75	PEG_TX7-	O	PCIe Graphics Lane 7 TX -	AC coupled on module
D76	GND	P	Ground	
D77	RSVD	NC	Not Connected	
D78	PEG_TX8+	O	PCIe Graphics Lane 8 TX +	AC coupled on module
D79	PEG_TX8-	O	PCIe Graphics Lane 8 TX -	AC coupled on module
D80	GND	P	Ground	
D81	PEG_TX9+	O	PCIe Graphics Lane 9 TX +	AC coupled on module
D82	PEG_TX9-	O	PCIe Graphics Lane 9 TX -	AC coupled on module
D83	RSVD	NC	Not Connected	
D84	GND	P	Ground	
D85	PEG_TX10+	O	PCIe Graphics Lane 10 TX +	AC coupled on module
D86	PEG_TX10-	O	PCIe Graphics Lane 10 TX -	AC coupled on module
D87	GND	P	Ground	
D88	PEG_TX11+	O	PCIe Graphics Lane 11 TX +	AC coupled on module
D89	PEG_TX11-	O	PCIe Graphics Lane 11 TX -	AC coupled on module
D90	GND	P	Ground	
D91	PEG_TX12+	O	PCIe Graphics Lane 12 TX +	AC coupled on module
D92	PEG_TX12-	O	PCIe Graphics Lane 12 TX -	AC coupled on module
D93	GND	P	Ground	
D94	PEG_TX13+	O	PCIe Graphics Lane 13 TX +	AC coupled on module
D95	PEG_TX13-	O	PCIe Graphics Lane 13 TX -	AC coupled on module
D96	GND	P	Ground	
D97	RSVD	NC	Not Connected	
D98	PEG_TX14+	O	PCIe Graphics Lane 14 TX +	AC coupled on module
D99	PEG_TX14-	O	PCIe Graphics Lane 14 TX -	AC coupled on module
D100	GND	P	Ground	
D101	PEG_TX15+	O	PCIe Graphics Lane 15 TX +	AC coupled on module
D102	PEG_TX15-	O	PCIe Graphics Lane 15 TX -	AC coupled on module
D103	GND	P	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	P	Ground	

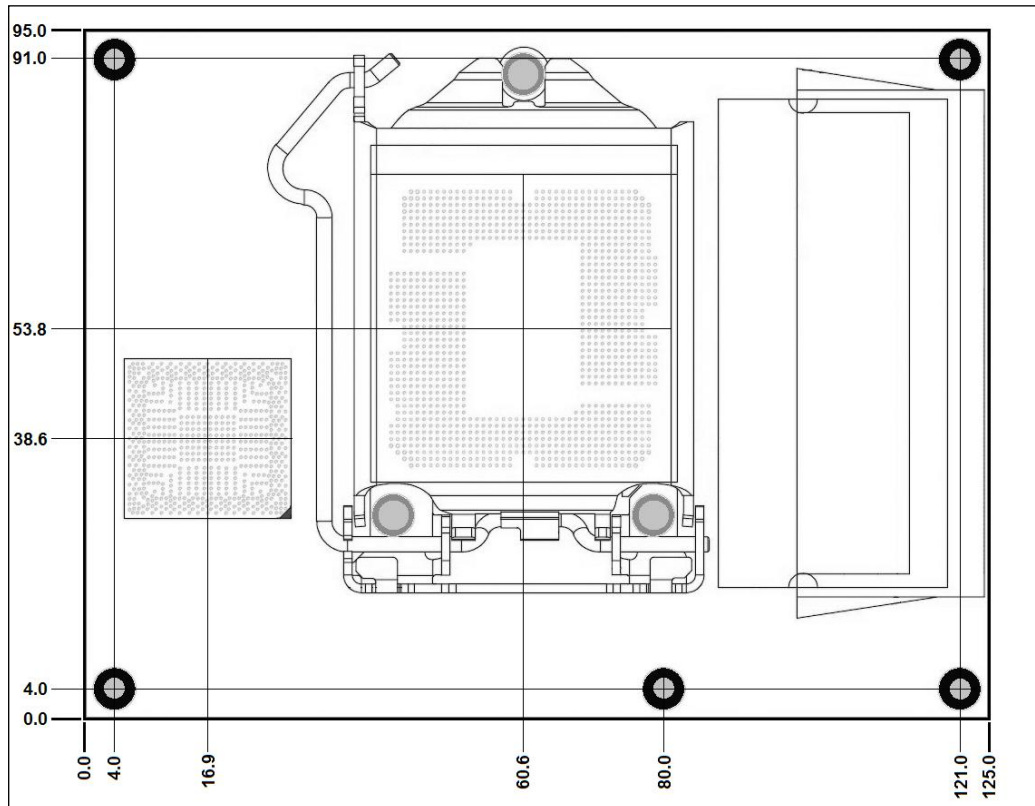
## 7.2 Mating Connectors

COMEX-IC40D can be connected to a carrier board using two 110x2 pins, 0.5mm pitch connectors. The connectors of the carrier board should be Foxconn QT002206-2141-3H for 5mm stack, Foxconn QT002206-4131-3H for 8mm stack, or other compatible connectors.

## 8 MECHANICAL SPECIFICATIONS

### 8.1 Mechanical Drawings

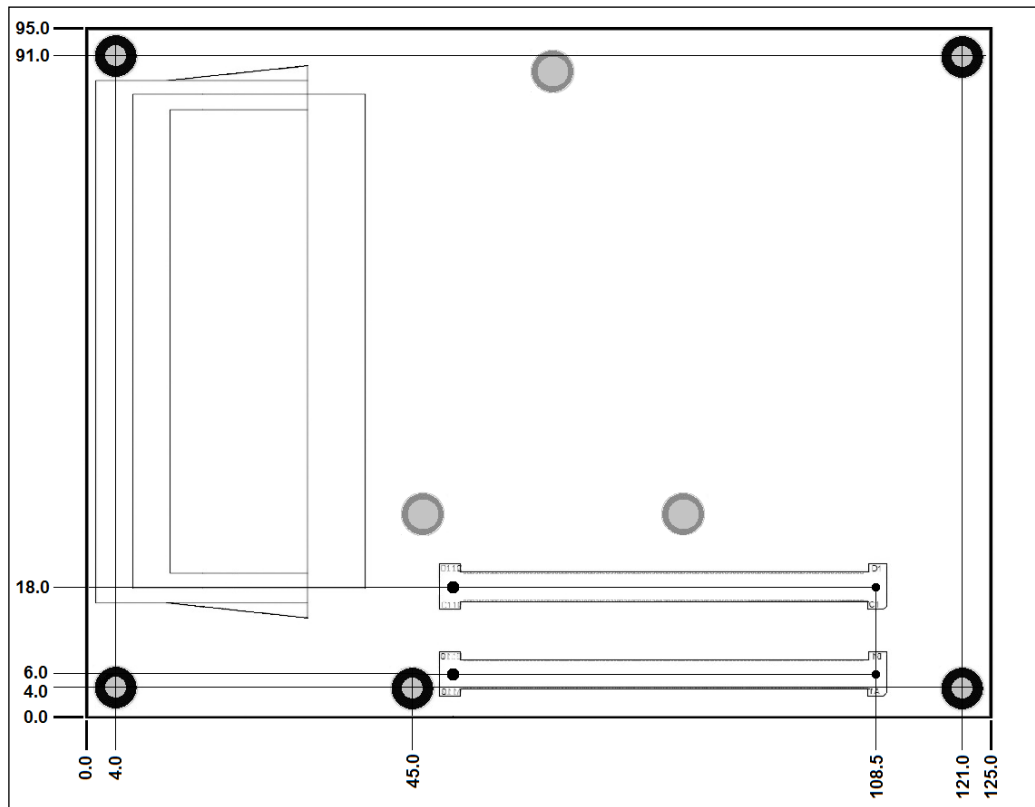
Figure 3 COMEX-IC40D Top Side



All dimensions are in millimeters.

The tolerances are  $\pm 0.1\text{mm}$ .

The drawing is intended for reference uses only.

**Figure 4 COMEX-IC40D Bottom Side**


All dimensions are in millimeters.

The tolerances are  $\pm 0.1\text{mm}$ .

The module is shown as it seems from a bottom view.

The drawing is intended for reference uses only.

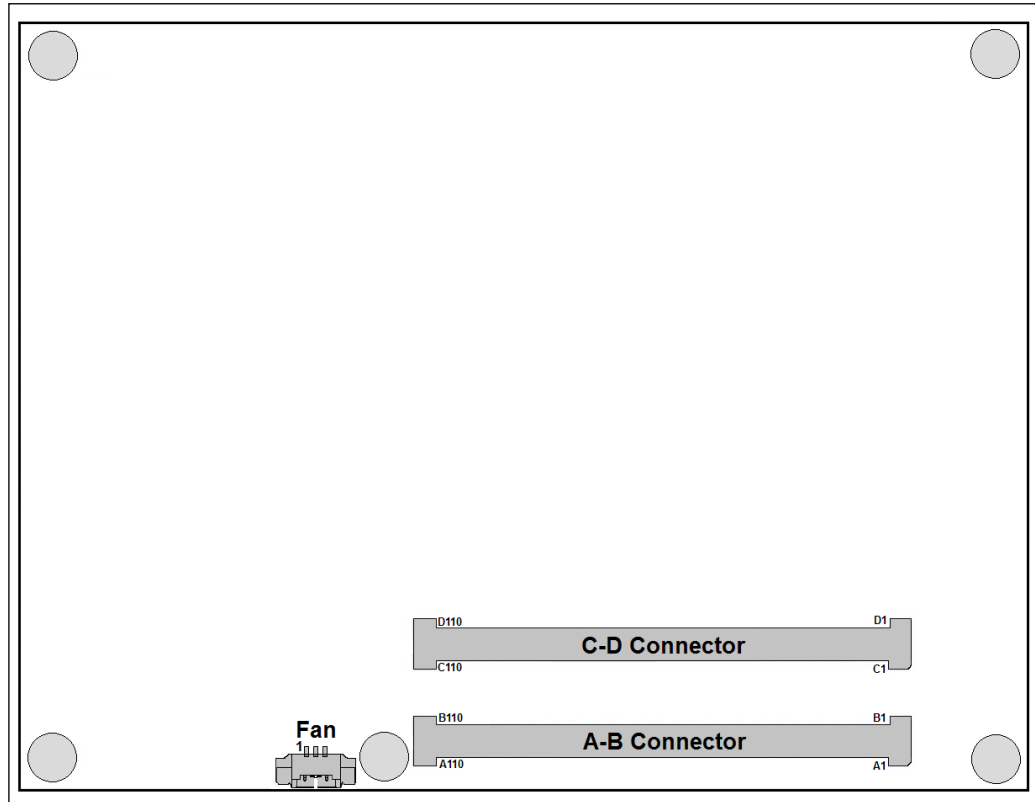
3D model and detailed mechanical drawings are available at  
<http://www.compulab.co.il/products/com-express/comex-ic40d/#devres>



## 8.2 On-Board Connectors

COMEX-IC40D includes two 220-pin COM Express connectors at type 6 pinout, and one 3-pin fan connector. The connectors are located at the bottom side of COMEX-IC40D, as described in the following figure.

**Figure 5 COMEX-IC40D Connectors**



The module is shown as it seems from a bottom view.

The drawing is intended for reference uses only.

The specification and pinout of the COM Express A-B and C-D connectors are described at [chapter 7: Carrier Board Interface](#).

The fan connector is a 3-pin right angle 1.25mm pitch, Molex P/N: 53261-0371.

The pinout of the fan connector is herein described:

**Table 24 Fan Connector Pinout**

Pin #	Signal Name	Type	Description
1	FAN_TACH	I	Tachometer input from fan, 10K PU to 5V (S0) on module
2	FAN_PWR	P	5V Nominal Power Output
3	GND	P	Ground

## 8.3 Heat Spreader and Cooling Solutions

CompuLab provides COMEX-IC40D with a dedicated heat-spreader assembly. The COMEX-IC40D 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-IC40D 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-IC40D heat-spreader and cooling solutions are provided at <http://www.compulab.co.il/products/com-express/comex-ic40d/#devres>.

## 9 OPERATIONAL CHARACTERISTICS

### 9.1 Absolute Maximum Ratings

**Table 25 Absolute Maximum Voltage**

Power Rail	Min.	Typ.	Max.	Unit
VCC_12V	-0.3	12	16	V
VCC_5V_SBY	-0.3	5	8	V
VCC_RTC	-0.3	3.3	3.6	V

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

### 9.2 Recommended Operating Conditions

**Table 26 Recommended Operating Conditions**

Power Rail	Min.	Typ.	Max.	Unit
VCC_12V	11.4	12	12.6	V
VCC_5V_SBY	4.75	5.0	5.25	V
VCC_RTC	2.0	3.0	3.3	V

### 9.3 DC Electrical Characteristics

**Table 27 Recommended Operating Conditions**

Signal	Parameter	Min.*	Max.*	Unit
GPIO ,GPI1 ,GPI2 ,GPO0 ,GPO2	V <sub>IH</sub>	2.0	V <sub>CC</sub> +0.5	V
	V <sub>IL</sub>	-0.5	0.8	V
	V <sub>OH</sub>	V <sub>CC</sub> -0.5	V <sub>CC</sub>	V
	V <sub>OL</sub>	-	0.4	V
GPI3, GPO1, GPO3	V <sub>IH</sub>	0.5 x V <sub>CC</sub>	V <sub>CC</sub> +0.5	V
	V <sub>IL</sub>	-0.5	0.3 x V <sub>CC</sub>	V
	V <sub>OH</sub>	0.9 x V <sub>CC</sub>	-	V
	V <sub>OL</sub>	-	0.1 x V <sub>CC</sub>	V

**NOTE: The nominal value of VCC is 3.3V.**

## 9.4 Power Consumption

Power consumption has been measured with COMEX-IC40D with 2x8GB DDR3L 1600MHz running Windows 7 64-bit. The power consumption has been measured on 12V and +5V power rails, at the power input of the module.

**Table 28 COMEX-IC40D Power Consumption**

Operating Mode	Core i5-4590T	Core i7-4790S
Suspend to Disk (Hibernate, S4 / M3)	0.4 W	0.4 W
Suspend to RAM (Sleep, S3 / M3)	0.7 W	0.7 W
Windows idle	9.0 W	9.0 W
CPU at 100% load w/o turbo	31.3 W	58.1 W
CPU + GPU at 100% load w/o turbo	47.7 W	72.0 W
CPU at 100% load with turbo	40.5 W	75.4 W
CPU + GPU at 100% load with turbo	53.1 W	88.8 W

## 9.5 Operating Temperature Ranges

**Table 29 Operating Temperature Ranges**

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	-20o to 70o C	Every board undergoes a short test for the lower limit (-20o C) qualification.
Industrial	-40 to 85 C	Every board is extensively tested for both lower and upper limits and at several midpoints.