

SB-COMEX

Reference Guide

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Table 1 Document Revision Notes

Date	Description
May 2015	First release

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

1 INTRODUCTION

1.1 About This Document

This document is part of a set of reference documents providing information necessary to operate and program CompuLab's SB-COMEX carrier board.

1.2 Related Documents

For additional information not covered in this manual, refer to the documents listed in Table 2.

Table 2 **Related Documents**

Document	Location
SB-COMEX design resources	http://www.compulab.co.il/

2 OVERVIEW

2.1 Highlights

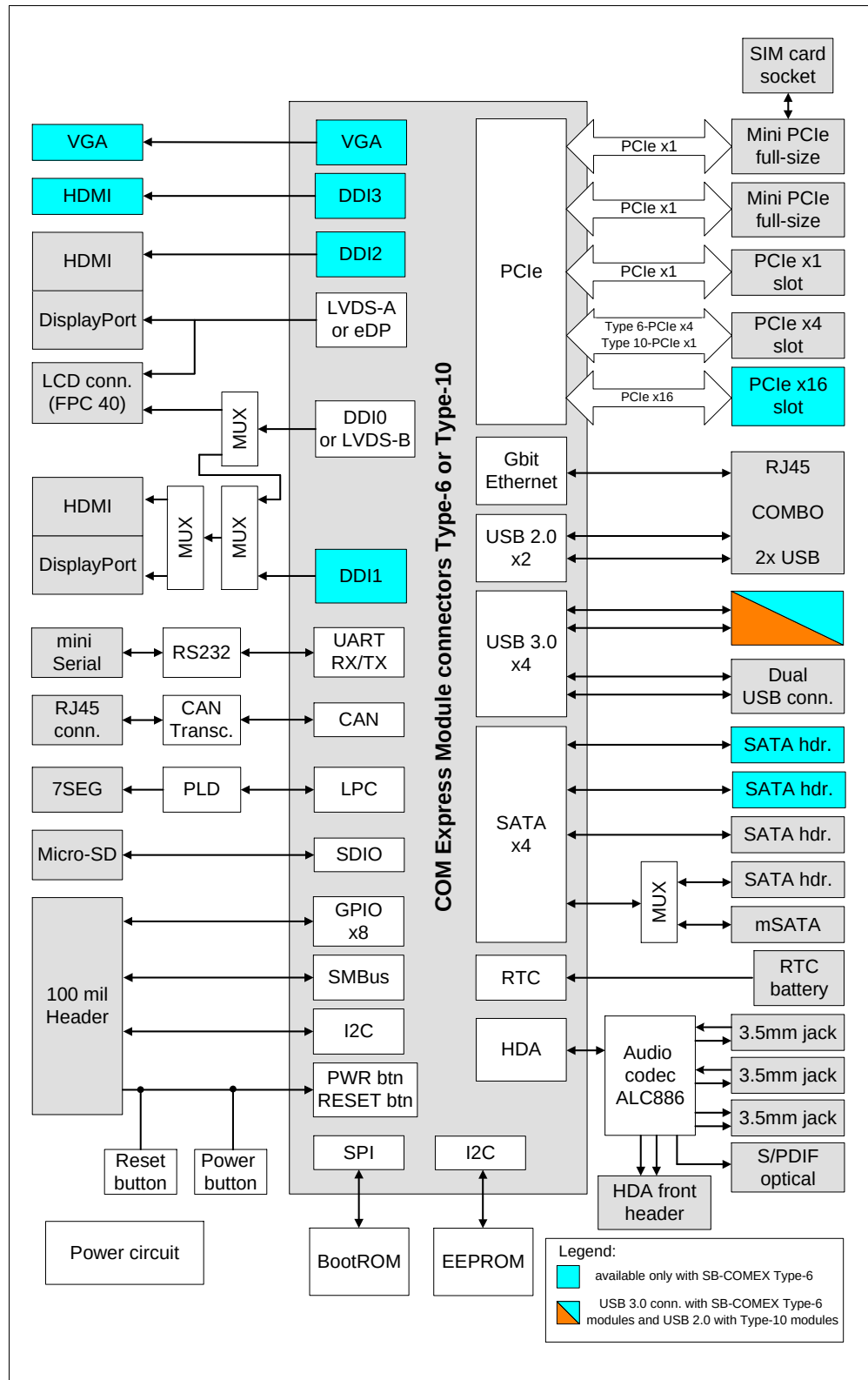
SB-COMEX is a COM Express carrier board designed as an evaluation platform for COM Express Computer-on-Modules and a reference for custom carrier board development. SB-COMEX is fully compliant with the COM Express standard.

SB-COMEX has been designed to allow users full and easy access to all functions present on COM Express Type-6 or Type-10 Computer-on-Modules. Combining extensive and highly configurable set of interfaces and connectors with rich debug functionality, SB-COMEX allows all around evaluation and SW development with COM Express Computer-on-Modules.

- Fully compliant with the COM Express standard
- Support for Type-6 and Type-10 modules
- ATX Form Factor (305mm x 244mm)
- HDMI, DisplayPort, LVDS, eDP
- Up to 4 SATA (Type-6)
- Up to 4 USB 3.0 (Type-6)
- ATX and Single Power Supply

2.2 Block Diagram

Figure 1 SB-COMEX Block Diagram



2.3 Specifications

SB-COMEX is a COM Express carrier board designed as an evaluation platform for COM Express Computer-on-Modules. Table 3 summarizes the features available with SB-COMEX.

Table 3 SB-COMEX Features

Feature	Type-6 Configuration SB-COMEX-T6	Type-10 Configuration SB-COMEX-T10
Supported Modules	Basic and compact with Type-6 pin-out	COM Express mini with Type-10 pin-out
Compliance	COM Express Rev. 2.0 pin-out Type 6	COM Express Rev. 2.0 pin-out Type 10
HDMI / DisplayPort	3x HDMI or DisplayPort	1x HDMI or DisplayPort
LVDS	1x dual-channel LVDS	1x single-channel LVDS
eDP	1x eDP, standard DisplayPort connector	1x eDP, standard DisplayPort connector
VGA	1x VGA, standard VGA connector	-
Hard Disk	4x SATA ports, SATA connector	2x SATA ports, SATA connector
mSATA	1x mSATA	1x mSATA
SD	1x uSD	1x uSD
Ethernet	1x 10/100/1000 MBit	1x 10/100/1000 MBit
Analog Audio	On-board Realtek ALC886 codec 7.1 Audio jacks	On-board Realtek ALC886 codec 7.1 Audio jacks
Digital Audio	S/PDIF in/out, Toslink connector HDMI audio output	S/PDIF in/out, Toslink connector HDMI audio output
PCI Express	1x PCIe x16	-
	1x PCIe x4	1x PCIe x4 (electrically x1)
	1x PCIe x1	1x PCIe x1
	2x mini-PCIe sockets	2x mini-PCIe sockets
USB	4x USB3.0	2x USB3.0
	2x USB2.0	4x USB2.0
Serial	1 x RS232 (RX/TX only)	1 x RS232 (RX/TX only)
CAN bus	1x CAN, RJ45 connector	1x CAN, RJ45 connector
GPIO	8x GPIO, 100-mil header	8x GPIO, 100-mil header
General Features	PWM fan control Feature Connector SIM socket PWR/RST Buttons	PWM fan control Feature Connector SIM socket PWR/RST Buttons
Debug Features	SPI boot Port80 POST Code Display Diagnostic LED	SPI boot Port80 POST Code Display Diagnostic LED

Table 4 Electrical, Mechanical and Environmental Specifications

Supply Voltage	ATX Power Supply	Standard ATX voltages
	Single Power Supply	8.5V-12.5V
Maximum Current (SB-COMEX inclusive the module and all other connector consumers)	ATX Power Supply	12V rail current must not exceed 21A
	Single Power Supply	12V rail current must not exceed 10A
Dimensions	305mm x 244mm	
Weight	440 grams	
Storage temperature	-40° to 85° C	
Relative humidity	10% to 90% (operation) 5% to 95% (storage)	
Shock	50G / 20 ms	
Vibration	20G / 0 - 600 Hz	
MTBF	> 100,000 hours	

2.4 Type-6 and Type-10 configurations

SB-COMEX is available in either Type-6 or Type-10 configuration. Support of certain COM Express Module functions and interfaces depends on SB-COMEX type configuration. The following table describes the differences between two configurations.

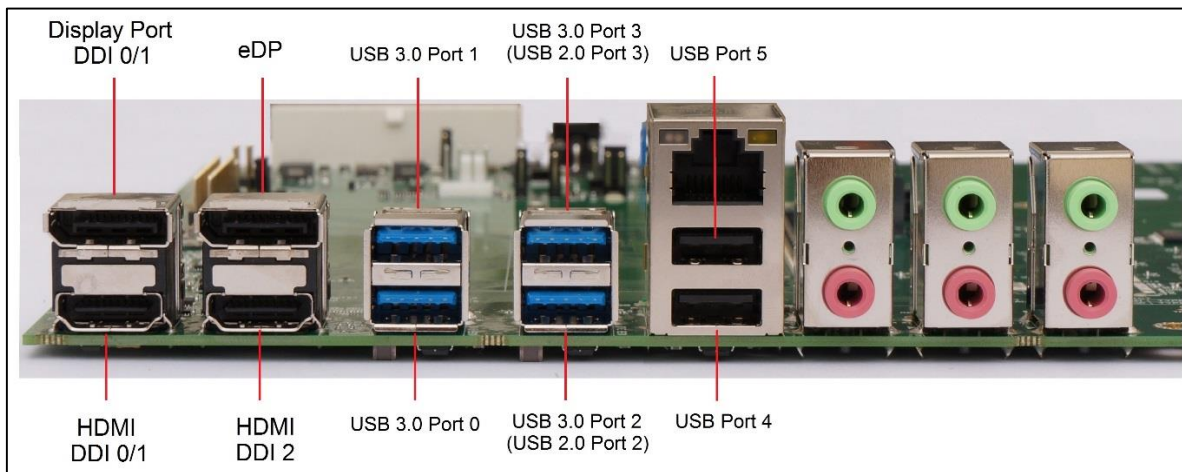
Table 5 SB-COMEX type dependent interfaces

Feature	Type-6 Configuration SB-COMEX-T6	Type-10 Configuration SB-COMEX-T10
DDI 0	NA	HDMI/DP on P10 connector
DDI 1	HDMI/DP on P10 connector	NA
DDI 2	HDMI on P11 connector	NA
DDI 3	HDMI on P12 connector	NA
LVDS-B	available on P13	NA
VGA	available on P14	NA
SATA 2	available on P3	NA
SATA 3	available on P4	NA
PCIe Graphics x16	available on J12 (PCIe Graphics x16 slot)	NA
PCIe Lane 0	available on J13 (PCIe x4 slot)	available on J13 (PCIe x4 slot)
PCIe Lane 1	available on J13 (PCIe x4 slot)	available on J11 (PCIe x1 slot)
PCIe Lane 2	available on J13 (PCIe x4 slot)	available on J14 (mini PCIe connector)
PCIe Lane 3	available on J13 (PCIe x4 slot)	available on J15 (mini PCIe connector)
PCIe Lane 4	available on J11 (PCIe x1 slot)	NA
PCIe Lane 5	available on J14 (mini PCIe connector)	NA
PCIe Lane 6	available on J15 (mini PCIe connector)	NA
PCIe Lane 7	optional on J11 (PCIe x1 slot)	NA
USB port 2	available on P7 as USB 3.0	available on P7 as USB 2.0
USB port 3	available on P7 as USB 3.0	available on P7 as USB 2.0

3 INTERFACES AND CONNECTORS

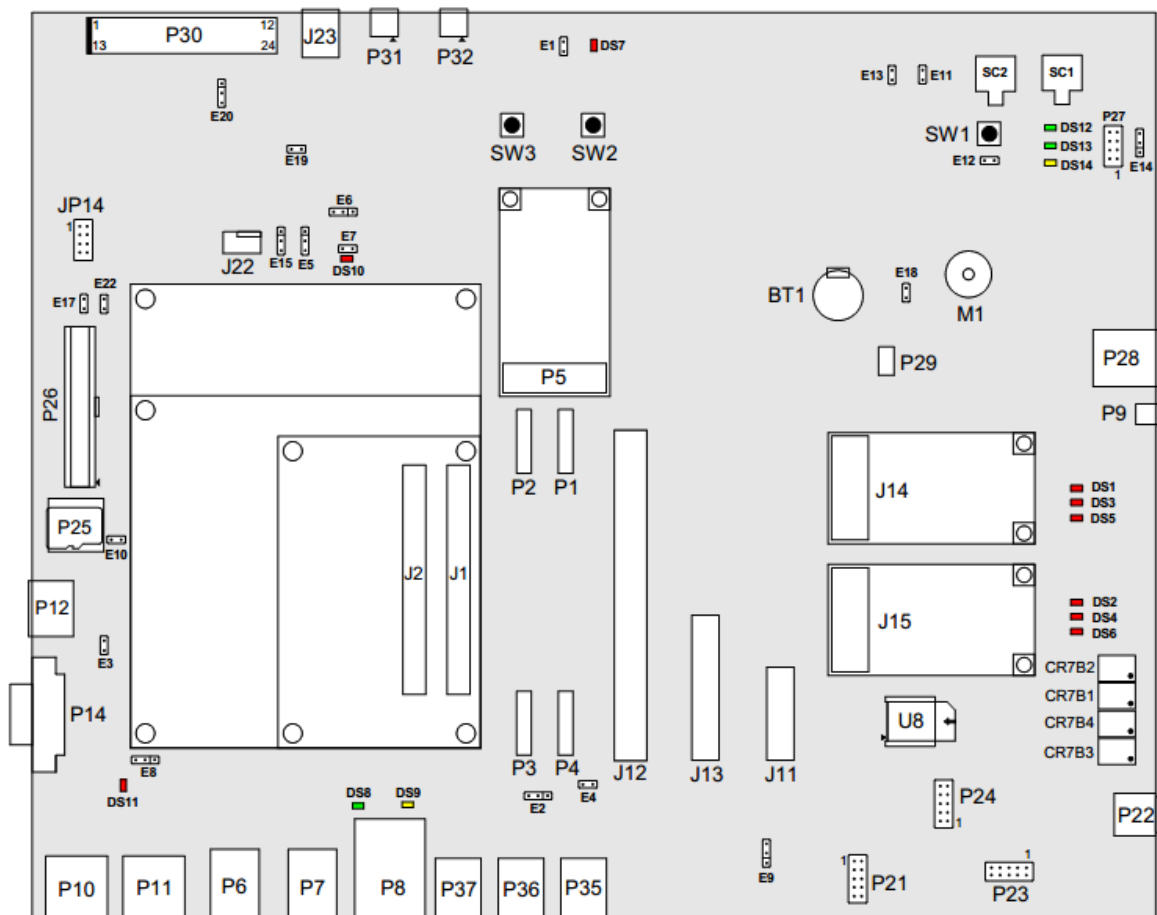
3.1 CONNECTOR LAYOUT

3.1.1 Rear Panel



3.1.2 Connector Locations

The image below illustrates SB-COMEX in Type-6 configuration.



3.1.3 Connector overview

Table 6 Connector overview

Connector	Description
P1	SATA #0
P2	SATA #1
P3	SATA #2
P4	SATA #3
P5	mSATA
P6	USB #0 - #1
P7	USB #2 - #3
P8	1Gbit RJ45, USB #4 - #5
P9	RS232
P10	HDMI + DP (DDI0 or DDI1)
P11	HDMI + eDP (DDI2 and eDP)
P12	HDMI
P13	LVDS single or dual
P14	VGA
P21	HDA Front Header
P22	S/PDIF
P23	PLD Programming
P24	LPC Debug
P25	Micro SD
P26	Feature Connector
P27	Flash Programming
P28	CAN
P29	RTC External Battery Connector
P30	ATX power
P35	Rear Panel HDAudio (Line input, Line out)
P36	Rear Panel HDAudio (Mic in, Center-LFE out)
P37	Rear Panel HDAudio (Sur out, Side sur out)
J1	COM Express Connector Row A and B
J2	COM Express Connector Row C and D
J11	PCIe x1
J12	PCIe x16
J13	PCIe x4
J14	Mini PCIe
J15	Mini PCIe
J22	FAN Connector
J23	Single Power Supply
JP14	PWR Good input select
SW1	On Board EPROM enable
SW2	Power Button
SW3	Reset Button
SC1	Socket for SPI FLASH #0
SC2	Socket for SPI FLASH #1
DS1	Status LED: Mini PCIe WWAN #1
DS2	Status LED: Mini PCIe WWAN #2
DS3	Status LED: Mini PCIe WLAN #1
DS4	Status LED: Mini PCIe WLAN #2
DS5	Status LED: Mini PCIe WPAN #1
DS6	Status LED: Mini PCIe WPAN #2
DS7	Status LED: HDD Activity
DS8	Status LED: Gbit Ethernet Activity Link100
DS9	Status LED: Gbit Ethernet Activity Link
DS10	Status LED: LCD Backlight Power

DS11	Status LED: LCD Supply Power
DS12	Status LED: SPI SLASH #1 CS Activity
DS13	Status LED: SPI SLASH #0 CS Activity
DS14	Status LED: SPI SLASH #0 - #1 Enabled
CR7B1	POST Code port 80h high nibble
CR7B2	POST Code port 80h low nibble
CR7B3	POST Code port 81h high nibble
CR7B4	POST Code port 81h low nibble
BT1	Battery Socket for RTC Battery
M1	PC Speaker
U8	SIM Card socket
E1	SATA #0 mSATA Select
E2	VCC LAN Select
E3	HDMI or DP Manual Select (DDI0 or DDI1)
E4	Mode Type-6 or Type-10 Select
E5	LCD Backlight EN Polarity Select
E6	LCD Backlight Voltage Select
E7	Power Connector (for LCD Backlight VDD)
E8	LCD Supply Voltage Select
E9	HDAudio CODEC VDD_IO Select
E10	Micro SD WP Enable
E11	Jumper for BIOS_DIS0#
E12	On Board EPROM select
E13	Jumper for BIOS_DIS1#
E14	SPI FLASH CS0 or CS1 Select (for Flash programming)
E15	FAN Voltage Select
E17	Header for external PWR LED (VCC5V)
E18	RTC Reset
E19	Header for Current Measure on VCC5V_SBY Rail
E20	ATX PS_ON# Input Select
E22	Power IC on Module Programming Control

3.2 COM Express Connector

SB-COMEX is a carrier board for Type-6 or Type-10 COM Express Computer-on-Modules. COM Express standard defines one (Type-10) or two (Type-6) connectors with 2 rows with 220 pins each. J1 is the connector for rows A and B, and J2 is the connector for rows C and D. Please refer to your module documentation for detailed pin-out descriptions.

Table 7 J1 and J2 connector data

Manufacturer	P/N of SB-COMEX Connector	P/N of COM Express module Connector (Mating)
AMP	3-1827253-6	3-6318490-6

3.3 HDMI and DisplayPort

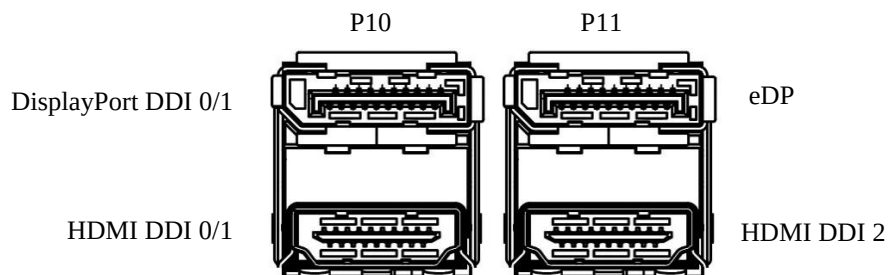
SB-COMEX supports up-to three Digital Display Interfaces (DDI) in Type-6 configuration and one DDI in Type-10 configuration. The table below describes the available video outputs for each configuration.

The type of video interface for DDI0 (Type-10) or DDI1 (Type-6) is selectable and can be either HDMI or DisplayPort. Dedicated circuitry on SB-COMEX automatically detects which plug is being used and routes the signals to the relevant connector.

DDI2 (Type-6) is routed to HDMI connector on HDMI/DP combo connector (P11). The DisplayPort part of P11 is used for eDP output and is covered in eDP section below.

Table 8 DDI0-DDI3 Interfaces

Module Type	DDI	Usage	Connector
Type 10	DDI0	HDMI or DP	P10
Type-6	DDI1	HDMI or DP	P10
	DDI2	HDMI	P11



3.4 LVDS

SB-COMEX provides on-board LCD FPC connector (P13), which allows easy integration with custom LCD panels.

Table 9 P13 connector pin-out

Pin	Signal Name	Pin	Signal Name
1	VDD_LCD-	21	GND
2	VDD_LCD	22	LVDS_B0_N
3	VDD_LCD	23	LVDS_B0_P
4	LVDS_I2C_CK	24	GND
5	LVDS_I2C_DAT	25	LVDS_B1_N
6	GND	26	LVDS_B1_P
7	LVDS_A0_N	27	GND
8	LVDS_A0_P	28	LVDS_B2_N
9	GND	29	LVDS_B2_P
10	LVDS_A1_N	30	GND
11	LVDS_A1_P	31	LVDS_B3_N
12	GND	32	LVDS_B3_P
13	LVDS_A2_N	33	GND
14	LVDS_A2_P	34	LVDSB_CK_N
15	GND	35	LVDSB_CK_P
16	LVDS_A3_N	36	LED_EN
17	LVDS_A3_P	37	N.C.
18	GND	38	LVDS_VDD_EN
19	LVDSA_CK_N	39	LVDS_BKLT_CTRL
20	LVDSA_CK_P	40	BKLT_EN

The polarity of the backlight enable signal LVDS_EDP_BKLT_EN from the COM Express module is selectable and can be set up using configuration jumper E5.

Table 10 E5 configuration

Jumper	Function
1-2	Non-inverted BKLT_EN signal (default)
2-3	Inverted BKLT_EN signal

NOTE: Connector P13 does not provide power to the LCD backlight. Optional power supply for LCD backlight is available on jumper E7. For additional details, please refer to [section 3.4.1](#) of this document.

NOTE: Dual-channel LVDS is supported in SB-COMEX Type-6 configuration only.

3.4.1 Flat panel and backlight power supply

The voltage level of flat panel power supply is selectable and can be set up using configuration jumper E8.

Table 11 E8 configuration

Jumper	Function
1-2	3.3V LCD supply voltage (default)
2-3	5V LCD supply voltage

The optional LCD backlight power supply is available on connector E7. The voltage level of this power supply is selectable and can be set up using configuration jumper E6.

Table 12 E7 pin-out

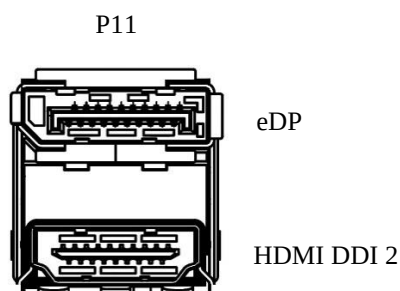
Pin	Signal Name
1	GND
2	VDD_BKLT

Table 13 E6 configuration

Jumper	Function
1-2	12V backlight voltage (default)
2-3	5V backlight voltage

3.5 eDP

SB-COMEX provides an embedded DisplayPort (eDP) interface via DP connector on HDMI-DP combo connector (P11). Since the COM Express specification shares the LVDS-A pins with eDP pins, the eDP connector is mutually exclusive with LCD FPC connector P13.



NOTE: The following signals are not available on DP (P11) connector: eDP power enable, eDP backlight enable and EDP backlight brightness control. If these signals are necessary please use LCD FPC connector (P13).

3.6 VGA

SB-COMEX provides VGA interface via standard VGA connector P14.

NOTE: VGA interface is supported in SB-COMEX Type-6 configuration only.

3.7 SATA, mSATA

SB-COMEX provides four 7-pin SATA data connectors in Type-6 configuration (P1, P2, P3 and P4) and two 7-pin SATA data connectors in Type-10 configuration (P1 and P2). Also, the SB-COMEX board is equipped with mSATA socket (P5).

The COM Express module SATA-0 port is accessible via 7-pin data connector (P1) or via mSATA socket P5. The usage of mSATA connector precludes usage SATA-0 data connector (P1). Configuration jumper E1 allows to select the desired connector for SATA-0 port.

Table 14 E1 configuration

Jumper	Function
Closed	SATA connector (P1)
Open	mSATA connector (P5)

Table 15 SATA0-SATA3 Interfaces

SATA port	Type-10 configuration	Type-6 configuration
SATA #0	available on P1 or P5	available on P1 or P5
SATA #1	available on P2	available on P2
SATA #2	NA	available on P3
SATA #3	NA	available on P4

Table 16 SATA connector pin-out

Pin	Signal Name
1	GND
2	TX+
3	TX-
4	GND
5	RX-
6	RX+
7	GND

The red LED DS7 indicates activity on SATA interface.

Table 17 mSATA connector pin-out

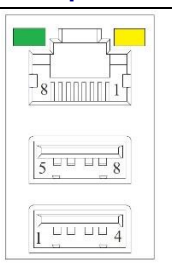
Pin	Signal Name	Pin	Signal Name
1	N.C.	27	GND
2	VCC3V3	28	VCC1V5
3	N.C.	29	GND
4	GND	30	N.C.
5	N.C.	31	TX-
6	VCC1V5	32	N.C.
7	N.C.	33	TX+
8	N.C.	34	GND
9	GND	35	GND
10	N.C.	36	N.C.
11	N.C.	37	GND
12	N.C.	38	N.C.
13	N.C.	39	VCC3V3
14	N.C.	40	GND
15	GND	41	VCC3V3
16	N.C.	42	N.C.
17	N.C.	43	N.C.
18	GND	44	N.C.
19	N.C.	45	N.C.
20	N.C.	46	N.C.
21	GND	47	N.C.
22	N.C.	48	VCC1V5
23	RX+	49	N.C.
24	VCC3V3	50	GND
25	RX-	51	N.C.
26	GND	52	VCC3V3

3.8 Ethernet

SB-COMEX features RJ45/Dual USB combo connector P8 with a single RJ45 in combination with 2 USB ports (USB 4/5). The Ethernet connector is equipped with integrated magnetics and LEDs. Two additional discrete LEDs (DS8, DS9) used for activity indication on LINK100# and LINK# lines.

Table 18 P8 connector pin-out

Pin	Signal Name
1	MDI[0]+
2	MDI[1]+
3	MDI[2]+
4	MDI[3]+
5	MDI[0]-
6	MDI[1]-
7	MDI[2]-
8	MDI[3]-



DS8 DS9



Table 19 P8 LEDs and discrete LEDs description

LEDs	Description
Green	LINK 1000#
Yellow	Activity#
DS8	LINK100#
DS9	LINK#

The source voltage for Ethernet activity LEDs (RJ45 and on board) VCC_LAN is selectable and can be set up to 3.3V or 3.3V_SBY, depends on LAN controller power rail. The selection is available with configuration jumper E2.

Table 20 E2 configuration

Jumper	Function
1-2	VCC_LAN connected to 3.3V_SBY rail
2-3	VCC_LAN connected to 3.3V rail

3.9 PCI Express

SB-COMEX is equipped with one PCIe Graphics x16 socket (J12), one PCIe x4 socket (J13) and one PCIe x1 socket (J11). The pin-out of all onboard PCIe connectors is fully compliant with PCI standard. Implementation of PCIe interfaces on SB-COMEX depends on Type board configuration. The following table summarizes the available PCIe connectors for each configuration.

Table 21 PCIe interfaces on SB-COMEX

PCIe	Type-10 configuration	Type-6 configuration
PCIe Graphics x16	NA	available on J12 (PCIe Graphics x16 slot)
PCIe Lane 0	available on J13 (PCIe x4 slot)	available on J13 (PCIe x4 slot)
PCIe Lane 1	available on J11 (PCIe x1 slot)	available on J13 (PCIe x4 slot)
PCIe Lane 2	available on J14 (mini PCIe connector)	available on J13 (PCIe x4 slot)
PCIe Lane 3	available on J15 (mini PCIe connector)	available on J13 (PCIe x4 slot)
PCIe Lane 4	NA	available on J11 (PCIe x1 slot)
PCIe Lane 5	NA	available on J14 (mini PCIe connector)
PCIe Lane 6	NA	available on J15 (mini PCIe connector)
PCIe Lane 7	NA	optional on J11 (PCIe x1 slot)

NOTE: In Type-6 board configuration, PCI Express lane 7 can be optionally accessed via PCIe x1 slot. For additional details, please contact CompuLab technical support.

3.10 Mini PCIe

SB-COMEX is equipped with two PCI Express Mini Card sockets (J14, J15). For each COM Express Type configuration (6 and 10) the PCI Express Mini Card sockets on SB-COMEX utilize different PCI Express lanes. The following table describe PCI Express lanes and USB ports used for PCI Express Mini Card sockets in SB-COMEX type 6 and 10.

Table 22 Mini PCI Express on SB-COMEX

SB-COMEX Type	J14	J15
Type-6	PCI Express Lane 5	PCI Express Lane 6
	USB port 6	USB port 7
Type-10	PCI Express Lane 2	PCI Express Lane 3
	USB port 6	USB port 7

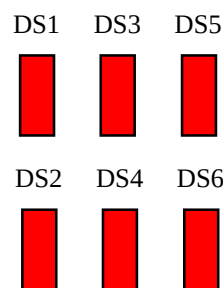
Table 23 Mini PCI Express default pin-out

Pin	Signal Name	Pin	Signal Name
1	WAKE#	2	+3.3V_AUX
3	N.C.	4	GND
5	N.C.	6	+1.5V
7	CLKREQ#	8	N.C.
9	GND	10	N.C.
11	CLK-	12	N.C.
13	CLK+	14	N.C.
15	GND	16	N.C.
17	N.C.	18	GND
19	N.C.	20	W_DISABLE#
21	GND	22	PCIE_RST#
23	RX5-/RX2-	24	+3.3V_AUX
25	RX5+/RX2+	26	GND
27	GND	28	+1.5V
29	GND	30	SMB_CLK
31	TX5-/TX2-	32	SMB_DAT
33	TX5+/TX5-	34	GND
35	GND	36	USB6-
37	GND	38	USB6+
39	+3.3V_AUX	40	GND
41	+3.3V_AUX	42	WWAN_LED#
43	GND	44	WLAN_LED#
45	N.C.	46	WPAN_LED#
47	N.C.	48	+1.5V
49	N.C.	50	GND
51	N.C.	52	+3.3V_AUX

Three different LEDs for each PCI Mini Card socket are used to indicate the presence of certain area network types.

Table 24 J14 and J15 discrete LEDs

PCI Mini Card socket	LEDs	Description
J14	DS1	Wireless Wide Area Network
	DS3	Wireless Local Area Network
	DS5	Wireless Personal Area Network
J15	DS2	Wireless Wide Area Network
	DS4	Wireless Local Area Network
	DS6	Wireless Personal Area Network



NOTE: PCI Mini Card socket J15 includes interface with onboard SIM card socket (U8). For additional details, please refer to [section 3.18](#) of this document.

3.11 USB

SB-COMEX provides 6 standard USB ports. Four USB 3.0 ports on dual port connectors P6 and P7, and two USB 2.0 ports on RJ45/Dual USB Combo connector P8. Implementation of USB ports on SB-COMEX depends on Type board configuration. The following table summarizes the available USB ports options for each configuration.

Table 25 USB connectors on SB-COMEX

USB port	Type-10 configuration	Type-6 configuration
USB 0	USB 3.0 on P6	USB 3.0 on P6
USB 1	USB 3.0 on P6	USB 3.0 on P6
USB 2	USB 2.0 on P7	USB 3.0 on P7
USB 3	USB 2.0 on P7	USB 3.0 on P7
USB 4	USB 2.0 on P8	USB 2.0 on P8
USB 5	USB 2.0 on P8	USB 2.0 on P8

NOTE: USB ports 0, 1, 4 and 5 are supplied by 5V_SBY rail and can be used for "wake up via USB" functionality.

NOTE: SB-COMEX supports maximal load-current of 1A on any of the USB connectors. Total maximal current drawn from USB connectors should not exceed 3.5A.

3.11.1 USB 2.0 Ports

SB-COMEX provides two USB 2.0 ports on RJ45/Dual USB Combo connector (P8). In Type-6 configuration P8 is the only USB 2.0 connector on SB-COMEX. In Type-10 configuration the dual USB 3.0 connector (P7) is used as USB 2.0 connector adding 2 more USB 2.0 ports, in total 4 USB 2.0 ports.

Table 26 USB 2.0 connectors on SB-COMEX

USB port	Type-10 configuration	Type-6 configuration
USB 2	USB 2.0 on P7	NA
USB 3	USB 2.0 on P7	NA
USB 4	USB 2.0 on P8	USB 2.0 on P8
USB 5	USB 2.0 on P8	USB 2.0 on P8

Table 27 P8 (USB 2.0) connector pin-out

Pin	Signal Name
1	+5V
2	USB4_DATA-
3	USB4_DATA+
4	GND
5	+5V
6	USB5_DATA-
7	USB5_DATA+
8	GND

3.11.2 USB 3.0 Ports

SB-COMEX provides four USB 3.0 ports on two dual USB 3.0 connectors (P6 and P7). In Type-10 configuration P7 connector can be used as USB 2.0 connector only. Each of USB 3.0 ports are composed of Super Speed Signals and USB 2.0 interface.

Table 28 USB 3.0 connectors on SB-COMEX

USB port	Type-10 configuration	Type-6 configuration
USB 1	USB 3.0 on P6	USB 3.0 on P6
USB 2	USB 3.0 on P6	USB 3.0 on P6
USB 3	NA	USB 3.0 on P7
USB 4	NA	USB 3.0 on P7

3.12 Audio

SB-COMEX is equipped with HD Audio codec. The codec's 7.1 audio interface is available on connectors P35, P36 and P37 described below.

Table 29 P35 connector pinout

Stereo Jack 4	Signal
Tip	Line Input Left
Ring	Line Input Right
Sleeve	Analog Ground
Stereo Jack 5	Signal
Tip	Line Output Left
Ring	Line Output Right
Sleeve	Analog Ground

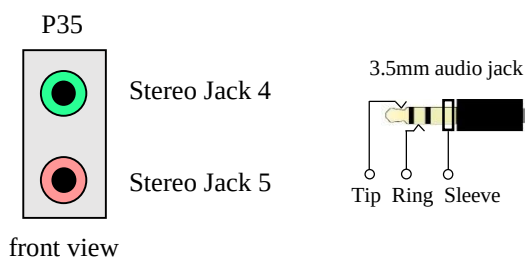


Table 30 P36 connector pinout

Stereo Jack 6	Signal
Tip	Microphone Input Left
Ring	Microphone Input Right
Sleeve	Analog Ground
Stereo Jack 1	Signal
Tip	Center
Ring	LFE
Sleeve	Analog Ground

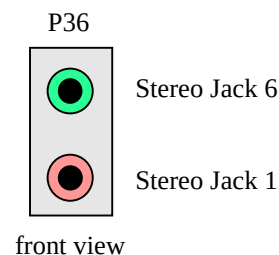
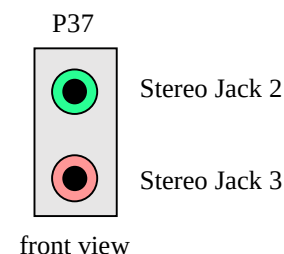


Table 31 P37 connector pinout

Stereo Jack 2	Signal
Tip	Surround Left
Ring	Surround Right
Sleeve	Analog Ground
Stereo Jack 3	Signal
Tip	Side Surround Left
Ring	Side Surround Right
Sleeve	Analog Ground



The voltage level of codec DVDD_IO is selectable and can be set up using configuration jumper E9.

Table 32 E9 configuration

Jumper	Function
1-2	3.3V DVDD_IO voltage
2-3	1.5V DVDD_IO voltage (default)

SB-COMEX is equipped with S/PDIF optical interface, which is available via connector P22.

3.12.1 HDA Front Panel Header

The 100mil header P21 enables connection of Front Panel Line and MIC connectors. The following table describe the pin-out of connector P21.

Table 33 P21 connector pin-out

Pin	Signal	Pin	Signal
1	Microphone 2 Input Left	2	Analog Ground
3	Microphone 2 Input Right	4	HDA_PRESENCE#
5	Line 2 Output Right	6	Microphone 2 Sense
7	Analog Ground	8	N.C.
9	Line 2 Output Left	10	Line 2 Sense

3.13 Serial

Two optional 2-pin serial interfaces are available on Type-10 and Type-6 COM Express Modules. On SB-COMEX, one of the interfaces (SER0) is connected via RS-232 transceiver to RS232 ultra-mini connector (P9).

Table 34 P9 connector pin-out

Pin	Signal Name	Pin	Signal Name
1	RS232_TXD	5	NC
2	NC	6	NC
3	RS232_RXD	7	NC
4	NC	8	GND

3.14 CAN

SB-COMEX uses the 2-pin serial interface SER1 to implement CAN bus interface. SER1 port is connected through the SB-COMEX onboard CAN isolator and PHY to RJ45 connector P28.

Table 35 P28 connector pin-out

Pin	Signal Name
1	CAN_H
2	CAN_L
3	GND
4	N.C.
5	N.C.
6	SHLD
7	GND
8	+5V

3.15 GPIO / SD

COM Express GPIO signals are routed to SB-COMEX feature connector P26. For P26 pin-out details please refer to [section 3.17](#). GPIO signals may also be used as SDIO signals. The SB-COMEX SD interface is available on standard micro SD socket P25. There is no buffer between GPIO signals on feature connector and micro SD socket pins.

E10 jumper, located near the SD socket, controls the SD write-protect signal.

Table 36 P25 connector pin-out

Pin	Signal Name	Pin	Signal Name
1	SD_DAT2	7	SD_DAT0
2	SD_DAT3	8	SD_DAT1
3	SD_CMD	9	GND
4	+3.3V	10	GND
5	SD_CLK	11	GND
6	GND	12	GND

Table 37 E10 configuration

E10	Functionality
Open	SD Write Protect disabled
Closed	SD Write Protect enabled

3.16 PWM FAN Control

SB-COMEX provides the option to connect cooling fan via connector J22. The fan working voltage is selectable and can be set-up using configuration jumper E15. The following table describes the pin-out and jumper configuration for fan connector J22.

Table 38 J22 connector pin-out

Pin	Signal Name
1	GND
2	FAN_VCC
3	FAN_TACH
4	FAN_PWM

Table 39 E15 configuration

Jumper	Function
1-2	12V Fan voltage(default)
2-3	5V Fan voltage

3.17 Feature Connector

SB-COMEX feature connector is a 100-mil dual-row 34-pin header P26.

Table 40 P26 connector pin-out

Pin	Signal Name	Pin	Signal Name
1	+5V	2	+5V_SBY
3	+5V	4	SATA_ACT#
5	I2C_CLK	6	SMB_CLK
7	I2C_DAT	8	SMB_DAT
9	GPI0	10	GPO0
11	GPI1	12	GPO1
13	GPI2	14	GPO2
15	GPI3	16	GPO3
17	SMB_ALERT	18	SUS_S4#
19	THRMTRIP#	20	SUS_S5#
21	THRM#	22	SUS_STAT#
23	BATLOW#	24	LID#
25	TPM_PP	26	SLEEP#
27	WDT	28	PEG_LANE_RV#
29	WAKE1#	30	SYS_RESET
31	PWR_OK	32	PWRBTN#
33	GND	34	GND

3.18 SIM socket

The uSIM socket (U8) is connected to PCI Express mini card socket (J15) pins 8, 10, 12, 14 and 16.

Table 41 U8 connector pin-out

Pin	Signal Name	Pin	Signal Name
1	SIM_VCC	5	GND
2	SIM_RST	6	SIM_VPP
3	SIM_CLK	7	SIM_DATA
4	N.C.	8	N.C.

4 SYSTEM COMPONENTS

4.1 RS-232 Transceiver

SB-COMEX features a RS-232 transceiver that is based on the MAX3221 IC. The device consists of one line driver, one line receiver, and a dual charge-pump circuit with $\pm 15\text{-kV}$ ESD protection pin to pin. The device meets the requirements of TIA/EIA-232-F and provides the electrical interface between an asynchronous communication controller and the serial-port connector. These devices operate at data signaling rates up to 250 kbit/s and a maximum of 30-V/ μs driver output slew rate.

The RS-232 transceiver output is routed to mini serial connector P9.

4.2 CAN transceiver

SB-COMEX is equipped with a CAN transceiver and a galvanic isolator. The CAN transceiver is based on the SN65HVD1050 component from TI. It is fully compatible with the ISO 11898-2 standard and supports speeds up to 1 Mbps. The galvanic isolator is based on the ISO7221 component from TI, supporting a 150 Mbps top signaling rate. The isolator is UL 1577, IEC 60747-5-2 (VDE 0884, Rev 2), IEC 61010-1, and CSA approved

The CAN transceiver output is routed to RJ45, RA connector (P28).

4.3 SPI Flash

SB-COMEX is equipped with SPI flash memory (SC1, SC2). SB-COMEX offers the possibility to boot the COM Express module using external BIOS. Jumpers E11 and E13 allow the user to select the desired boot flash device. The following table describe jumper setting for boot options.

Table 42 E11 and E13 configuration

E13 (BISO_DIS1#)	E11 (BISO_DIS0#)	BIOS boot
Open	Open	Boot from on-module firmware (default)
Open	Closed	Boot from carrier FWH
Closed	Open	Boot from carrier SPI Flash
Closed	Closed	Boot from on-module firmware, management data from carrier SPI

The SPI flash "HOLD#" input (active low) allows the device to be paused while it is actively selected. On SB-COMEX the "HOLD#" input is controlled with the on-board jumper E12 and switch button SW1. When the SPI flash is not in HOLD state, yellow LED DS14 will be on. The following table describes E12 and SW1 settings.

Table 43 E12 and SW1 configuration

E12	SW1	Functionality
Open	Not pressed	SPI Flash is in HOLD state (DO in Hi-Z, DI and CLK ignored)
Open	Pressed	SPI Flash active (Yellow LED DS14 light on)
Closed	Don't care	SPI Flash active (Yellow LED DS14 light on)

4.3.1 SPI Flash Programming

SB-COMEX supports programming the on-board SPI Flash memory via dedicated connector P27. The connector is a 100-mil 8-pin dual-row header. The target SPI flash device for programming must be selected using configuration jumper E14.

Table 44 E14 configuration

Jumper	Function
1-2	SC1 SPI flash CS is connected to programmer CS output (default)
2-3	SC2 SPI flash CS is connected to programmer CS output

Table 45 P27 connector pin-out

Pin	Signal Name	Pin	Signal Name
1	+3.3V_SPI	5	GND
2	SPI_CS#	6	SPI_CLK
3	SPI_MISO	7	SPI_MOSI
4	N.C.	8	N.C.

4.4 EEPROM

SB-COMEX is equipped with I²C EEPROM (U46). The device is a standard 2-wire serial EEPROM, supporting both the Standard (100 kHz) as well as Fast (400 kHz) I2C protocol.

4.5 HD Audio CODEC

SB-COMEX provides HD Audio via Realtek ALC886 High Definition Audio Codec supporting analog, optical and digital audio connections. The codec is connected to AC_HDA_SDIN0. AC_HDA_SDIN1 and AC_HDA_SDIN2 are connected to test points on SB-COMEX. The 7.1 audio output interface of this codec is available on connectors P35, P36 and P37.

The optical S/PDIF interface is available on connector P22, and HDA front header is available on connector P21.

4.6 CMOS Battery

An on-board 210mAh coin cell lithium battery is the back-up power supply for RTC timekeeping. This battery is in charge of powering the COM Express module RTC whenever the main power supply is not present. The optional connector P29 allows the user to use an external battery.

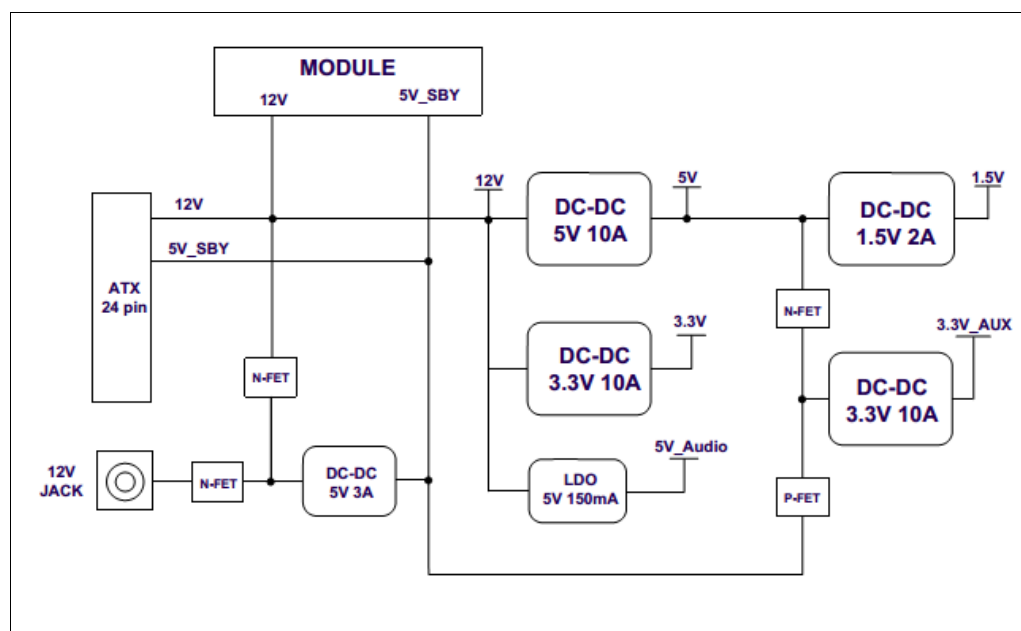
5 SYSTEM LOGIC

5.1 Power Supply

SB-COMEX power topology enables operation from ATX 24 pin power supply or single power supply (via J23).

The various voltages required for powering SB-COMEX peripherals are generated by on-board circuitry according to the block diagram below.

Figure 2 Power Scheme



NOTE: Please note the jumpers E20 and JP14 setting description before connecting SB-COMEX to DC power supply. See section 5.2.1 and 5.2.4 for details.

NOTE: Single power supply can only be used when ATX power supply is not connected to SB-COMEX.

5.2 Power Management

SB-COMEX power topology enables operation from ATX 24 pin power supply or single power supply (via J23).

5.2.1 ATX Power Supply

ATX power supply unit (PSU) has two sets of power rails: a set of normal operation rails (12V, 5V 3.3V and -12V) and a separate 5V suspend rail. The 5V suspend rail is present whenever the ATX PSU has AC input power. Other rails are enabled only when a control signal from the PC hardware PS_ON# is low. In SB-COMEX this signal is controlled by selectable control circuitry jumper E20. In default mode this signal is controlled by SLP_S3# signal from the COM Express module and the module Type detection circuitry. When using ATX power supply with PS_ON# control circuitry in default mode, the COM Express module will start after a wake up event: power button press, keyboard key press, mouse button press etc. The ATX power supply may be used in AT mode. In this mode the system will start after the power switch of ATX power supply is turned on.

Table 46 Jumper E20 configuration for ATX Power Supply

Jumper	Description
1-2	Module control over ATX_PS_ON# (Default)
2-3	ATX Power supply runs in AT mode
Left open	Only 5V_SBY and 3.3V_SBY present

ATX power supply with ATX 2.0 compliant, 24 pin power connector must be used.

The following table list the pin-out for ATX connector (P30).

Table 47 ATX connector pin-out

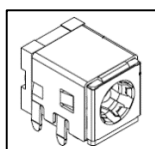
Pin	Description	Pin	Description
1	+3.3V	13	+3.3V
2	+3.3V	14	-12V
3	GND	15	GND
4	+5V	16	PS_ON#
5	GND	17	GND
6	+5V	18	GND
7	GND	19	GND
8	Power Good	20	N.C.
9	+5V_SBY	21	+5V
10	+12V	22	+5V
11	+12V	23	+5V
12	+3.3V	24	GND

5.2.2 Single Power Supply

Single power supply may be used via connector J23 located at the top left corner of the SB-COMEX board. PS_ON# control (see previous section for details) for this type of power input is implemented with dedicated circuitry on SB-COMEX. PS_ON# signal is controlled by SLP_S3# signal from the COM Express module and module Type detection circuitry. When single power supply is plugged into connector J23, the first two voltages that are enabled are: 5V_SBY and 3.3V_SBY. The COM Express module will start only after a wake up event: power button press, keyboard key press, mouse button press etc.

J23 is a 5.5/2.5mm 20V/10A DC jack type connector. Nominal input voltage is +12V DC (11.5-12.5V). Voltage different from 12V is possible, with range of 8.5V-12V. With input voltage lower than 11.5V, SB-COMEX PCIe connectors are not supplied with 12V and should not be used.

J23



NOTE: Single power supply can only be used when ATX power supply is not connected to SB-COMEX.

NOTE: Jumper E20 has no effect on the module power up mode when single power supply is being used.

5.2.3 PWR_OK Signal

COM Express specification defines the signal PWR_GOOD, which is a HIGH active input from the main power supply to the module and indicates whether the power is good. On SB-COMEX this input can be driven by 3 selectable inputs: pull up to local VCC3V3, PWR_GOOD output from ATX PSU or PWR_GOOD output from two onboard DC-to-DC supplies. The input source is selected with JP14.

Table 48 JP14 configuration

Jumper	PWR_GOOD connection option
1-2	Pull up to on board VCC3V3
3-4	PWR GOOD from ATX PSU
5-6	PWR GOOD from on board 5V DC-DC and 3.3V DC-DC

5.2.4 Module Type Detection

COM Express specification includes four signals to determine the pin-out type of the Module connected to the carrier board. The pins 'TYPE0#', 'TYPE1#', 'TYPE2#' and 'TYPE10#' are either left open (NC), strapped to ground (GND) or connected to 12V by the module to encode the pin-out type according to the following table.

Table 49 Module Type Detection

Module Type	Pin TYPE0#	Pin TYPE1#	Pin TYPE2#	Pin TYPE10#
Module Type 1	X (don't care)	X (don't care)	X (don't care)	12V or NC
Module Type 2	NC	NC	NC	12V or NC
Module Type 3	NC	NC	GND	12V or NC
Module Type 4	NC	GND	NC	12V or NC
Module Type 5	NC	GND	GND	12V or NC
Module Type 6	NC	NC	GND	12V or NC
Module Type 10	X (don't care)	X (don't care)	X (don't care)	PD with 47K

If an incompatible module pin-out type is detected on SB-COMEX, onboard logic will prevent the board from powering up the system by controlling the 'PS_ON#' signal.

5.2.5 5V_SBY Current Measure

The current of VCC5V_SBY rail can be measured using 2-pin header (E19) or two T.H. Test Points. The serial resistor value is 0.018Ohm.

5.3 Power Button

SB-COMEX features a user-accessible power button SW2. The power button is connected to the COM Express module's PWRBTN# signal. The behavior of the system after a power failure depends on the Module chipset capabilities and on the Module hardware and BIOS implementation. With most Modules, the following behaviors may be set by RTC chipset register settings:

Table 50 Power Button States

State	Description
Always On	No Power Button press needed Chipset de-asserts SUS_S5#, SUS_S4# and SUS_S3# after Suspend rail to chipset is stable
Wait For Power Button Press	Chipset remains in Suspend state until power button press is received
Last State	If unit was "on" when power was removed, then unit returns to "on" state when power is restored

5.4 Reset Button

SB-COMEX features a user-accessible reset button SW3. The COM Express module and all connected components will perform a hard reset when this button is pressed. The reset button is connected to the COM Express module's SYS_RESET# signal.

5.5 PC Speaker

SB-COMEX on-board speaker provides audible error code (beep code) information during POST. The speaker M1 is connected to the COM Express module's SPKR signal.

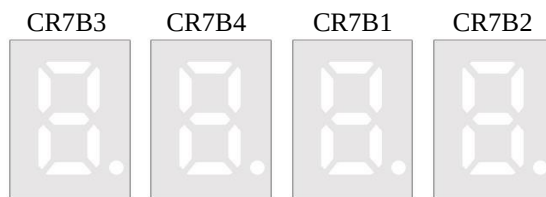
6 DEBUG FEATURES

6.1 SPI boot

SB-COMEX is equipped with SPI flash memory (SC1, SC2). SB-COMEX offers the possibility to boot the COM Express module using external BIOS. For additional details, please refer to [section 4.3](#) of this document.

6.2 Port 80 POST code display

During the POST, the BIOS generates POST codes to IO port 80h. SB-COMEX is equipped with PLD device and 4 seven-segment display (CR7B1 to CR7B3 and CR7B4) for decoding and displaying POST codes during POST process.



6.3 Diagnostic LEDs

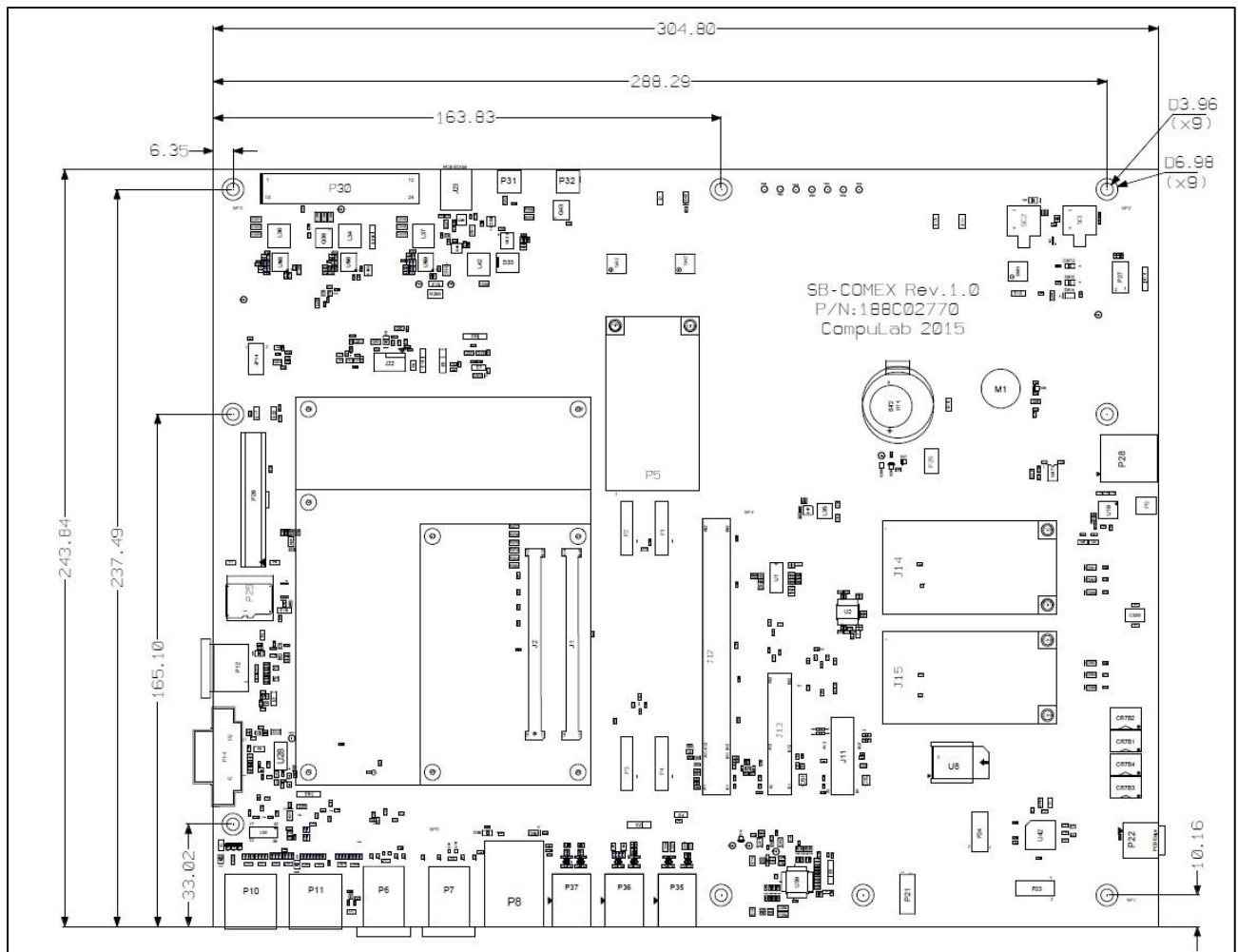
The table below describes SB-COMEX LEDS.

Table 51 LED Description

LED	Color	LED activity
DS1	RED	Mini PCIe WWAN #1 activity
DS2	RED	LED: Mini PCIe WWAN #2 activity
DS3	RED	LED: Mini PCIe WLAN #1 activity
DS4	RED	LED: Mini PCIe WLAN #2 activity
DS5	RED	LED: Mini PCIe WPAN #1 activity
DS6	RED	LED: Mini PCIe WPAN #2 activity
DS7	RED	HDD Activity
DS8	GREEN	Gbit Ethernet Link100# activity
DS9	YELLOW	Gbit Ethernet Link activity
DS10	RED	LCD Backlight Power present
DS11	RED	LCD Supply Power present
DS12	GREEN	SPI SLASH #1 CS Activity
DS13	GREEN	SPI SLASH #0 CS Activity
DS14	YELLOW	SPI SLASH #0 - #1 Enabled

7 MECHANICAL DRAWINGS

* All dimensions are in millimeters



8 OPERATIONAL CHARACTERISTICS

8.1 Absolute Maximum Ratings

Table 52 Absolute Maximum Ratings

Parameter	Min	Max	Unit
Single power supply	8.5	18*	V
ATX power supply	Standard ATX voltages		NA

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

NOTE: Voltage levels in absolute maximum ratings are for SB-COMEX onboard peripherals only. For absolute maximum ratings of CPU fan and all PCIe cards (which are powered directly from SB-COMEX input power) please refer to manufacturer documentation.

8.2 Recommended Operating Conditions

Table 53 Recommended Operating Conditions

Parameter	Min	Typ.	Max	Unit
Single power supply	8.5	12	12.5	V
ATX power supply	Standard ATX voltages			NA

8.3 DC Electrical Characteristics

Table 54 DC Electrical Characteristics

Parameter	Min	Typ.	Max	Unit
RS232				
VOH High-level output voltage	5	5.4		V
VOL Low-level output voltage	-5	-5.4		V
VIT+ Positive-going input threshold voltage		1.6	2.4	V
VIT- Negative-going input threshold voltage	0.6	1.1		V
CAN				
VO(D) Bus output voltage (Dominant)	CANH	2.9	3.4	V
	CANL	0.8	1.5	
VIT+ Positive-going input threshold voltage		0.8	0.9	V
VIT- Negative-going input threshold voltage	0.5	0.65		V

NOTE: For HDMI, DP, LVDS, eDP, VGA, PCIe, USB, SATA, GPIO and SD electrical characteristics, please refer to the COM Express module datasheet.

8.4 ESD Performance

Table 55 ESD Performance

Interface	ESD Performance
RS232	±15 kV Using Human-Body Model (HBM)
CAN	Limited built-in ESD protection
USB, HDMI, DP and eDP ports	ESD Rating of Class 3B (Exceeding 8 kV) per Human Body model and Class C (Exceeding 400 V) per Machine Model

8.5 Operating Temperature Ranges

The information in this section refers to the SB-COMEX board only. For temperature ranges of off-board components such as the LCD panel, please refer to the component's datasheet.

The SB-COMEX is available with three options of operating temperature range:

Table 56 SB-COMEX 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 cards 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.