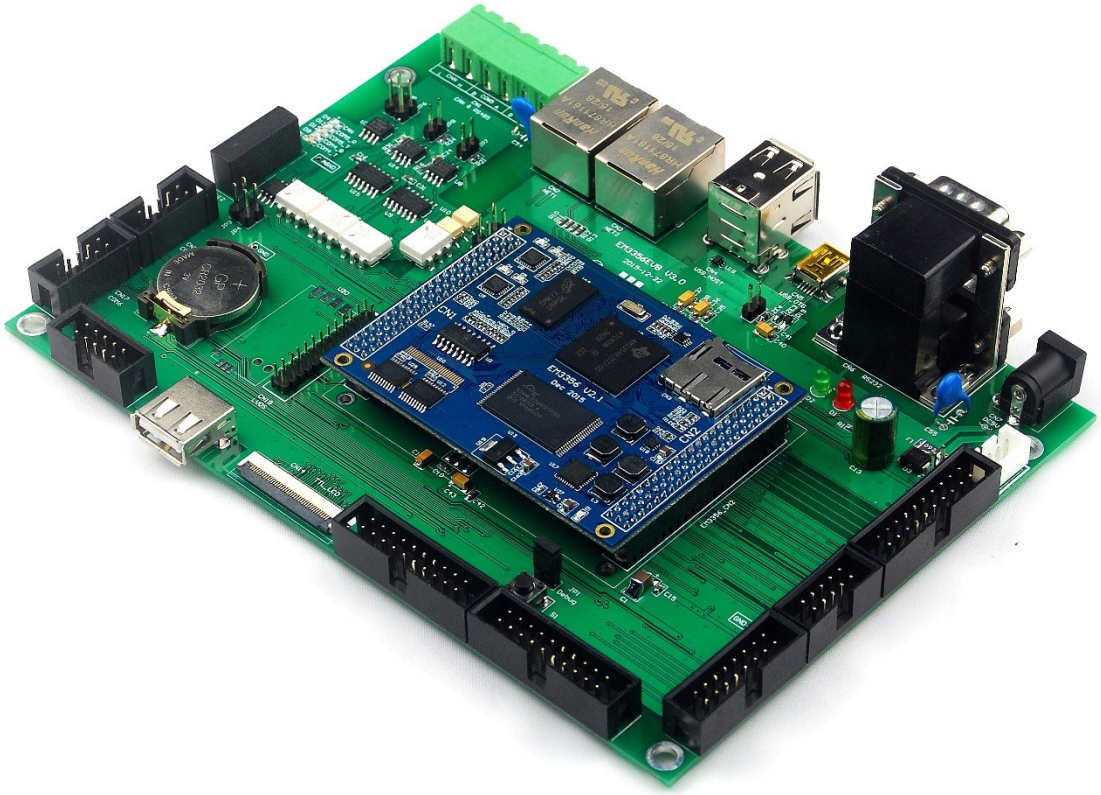
Emtronix



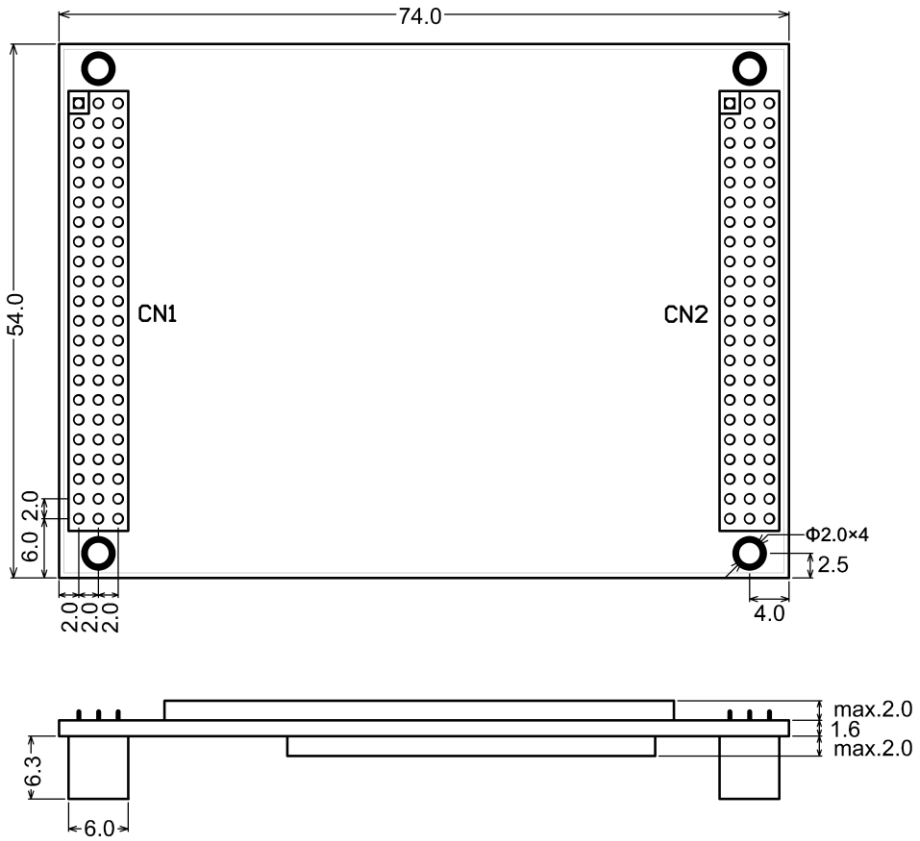
ESMARC Evaluation Board Datasheet

1. Introduction

1.1 ESMARC Overview

Emtronix Smart Module Architecture (ESMARC) is a specification which describes mechanical characteristics of an embedded computer module and its connections with a carrier board. ESMARC Evaluation Board is a carrier board which is compliance with ESMARC specification.

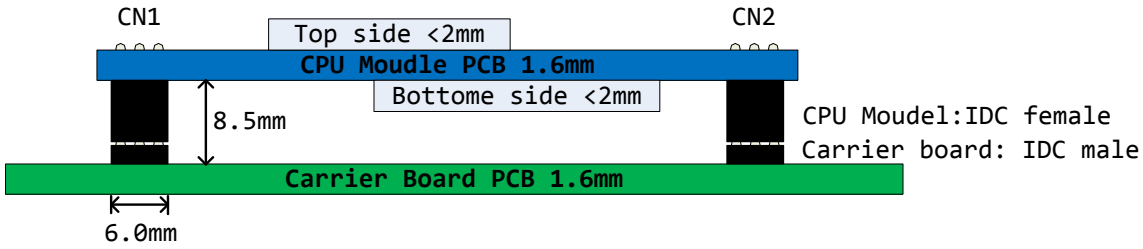
ESMARC defines small form factor computer module with size of 74mm*54mm and 4 mounting holes near the corners of the board. The following figure shows mechanical characteristics of ESMARC computer module.



ESMARC Computer Module Size (unit: mm)

ESMARC specification defines two insulation-displacement contact (IDC) connectors to connect a computer module and its carrier board. The two IDC connectors CN1 and CN2 are located on the opposite side of the module. Each connector has the same 3 x 22 pin configuration with 2mm pitch. The following figure shows the connection between ESMARC computer module

and its carrier board.



Relationship of Connection in ESMARC

The female connectors are on the computer module and male connectors are to be placed on the carrier board. The female connectors on computer module have certain header pin filled which enforces correct docking orientation with the carrier board.

ESMARC Evaluation Board can be used for customer to evaluate all types of ESMARC computer modules, and further more to take as design reference of their own carrier board. Term EVB will be used to refer ESMARC Evaluation Board in rest of the document.

1.2 Interfaces on Evaluation Board

The ESMARC Evaluation Board provides the following features and communication interfaces:

1x CAN 2.0B interface with digital isolation enabled (up to 1Mbps)

2x RS485 interfaces with photo-isolation enabled

2x RJ45 Ethernet (10/100Mbps)

4x USB ports

1x USB OTG

2x RS232 interfaces

Digital RGB LCD interface with touch screen

LVDS LCD interface (18-bit and 24-bit compatible)

3x UART ports in LVCMOS level (one port with flow control, others 3-wire)

32x GPIO

1x I2C

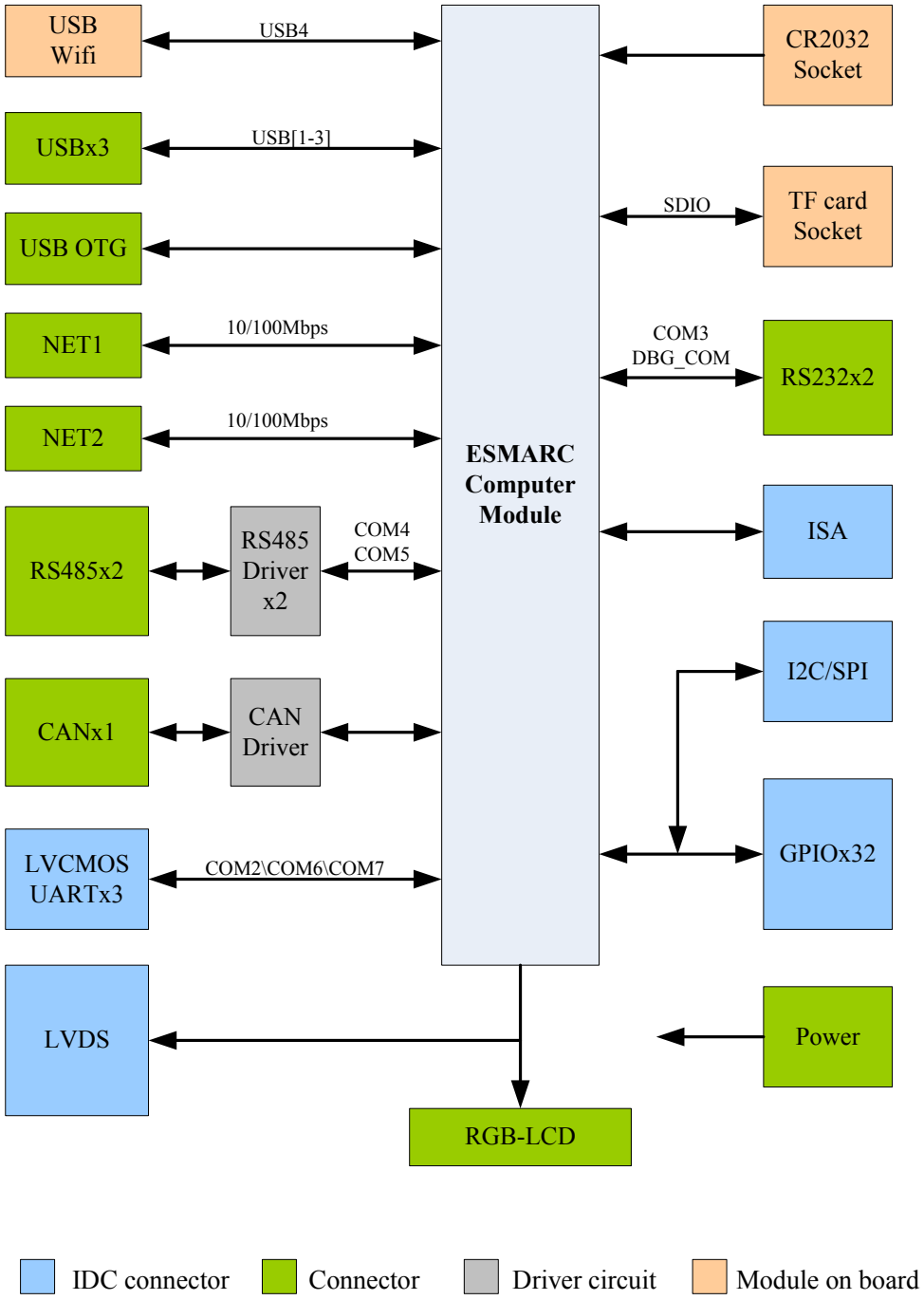
1x SPI

Simplified ISA bus

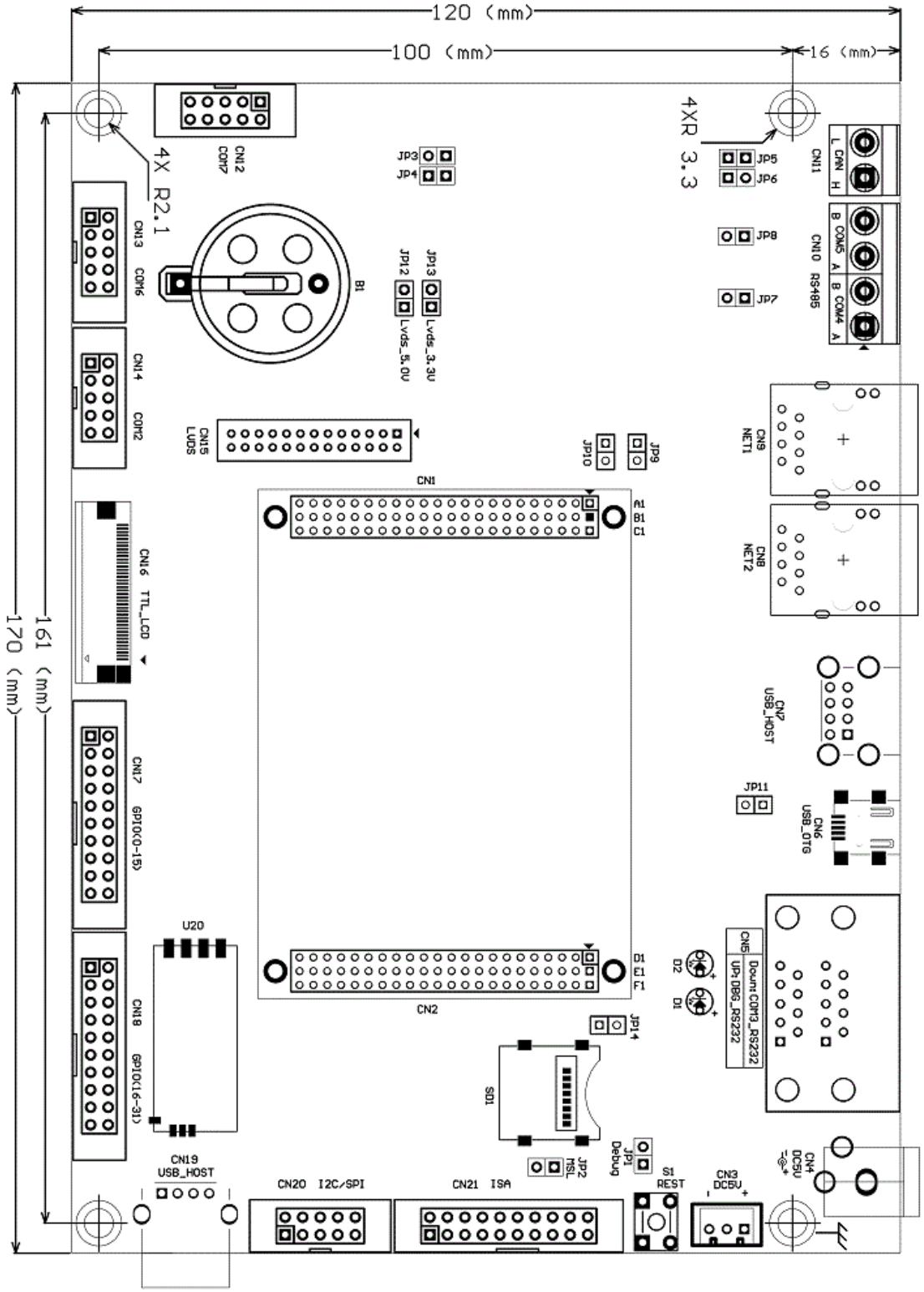
RTC backup battery socket

LEDs and Switches

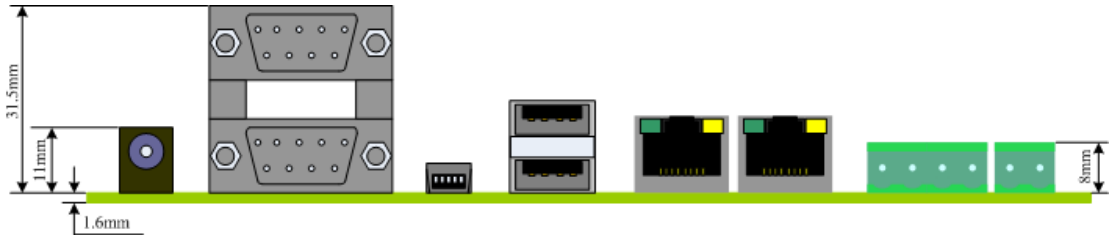
1.3 Block Diagram



1.4 Mechanical Characteristics



ESMARC Evaluation Board Mechanical Drawing – Top Side (unit: mm)



ESMARC Evaluation Board Mechanical Drawing (unit: mm)

1.5 Connectors

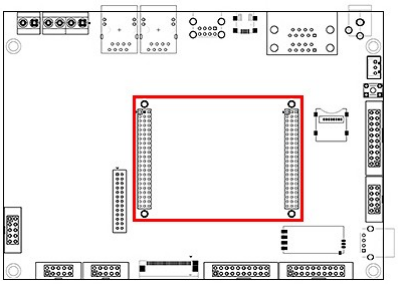
The pins of all connectors in EVB are numbered from 1. The shape of solder pad of all pin #1 are square and others are round. The suffix “n” after a signal name means this signal is active low.

Table of Connectors in EVB

Symbol	Type	Description
CN1	3x22 Pin Header Male, 2.0mm	Connectors for ESMARC computer module
CN2	3x22 Pin Header Male, 2.0mm	
CN3	1x3 Pin Header Male, 2.54mm	Main power (DC 5V±10%) input
CN4	Power jack, 5.5mm/2mm	
CN5	Stacked DB9 male connectors	DBG/Console (upper), COM3/ttyS2(base)
CN6	USB mini-AB connector	USB OTG
CN7	Stacked USB Type-A connectors	2x USB host ports
CN8	RJ45 with transformer and LED	Ethernet port2
CN9	RJ45 with transformer and LED	Ethernet port1
CN10	1x4 TB header, male, 5.08mm	2x RS485 interfaces
CN11	1x2 TB Header, male, 5.08mm	1x CAN interface
CN12	2x5 Pin Header Male, 2.54mm	COM7/ttyS6, 3-wire
CN13	2x5 Pin Header Male, 2.54mm	COM6/ttyS5, 3-wire
CN14	2x5 Pin Header Male, 2.54mm	COM2/ttyS1, flow control capable
CN15	2x13 Pin Header Male, 2.0mm	LVDS LCD interface with touchscreen
CN16	1x40 FPC socket, 0.5mm	Digital RGB LCD interface with touchscreen
CN17	2x10 Pin Header Male, 2.54mm	GPIO0 - GPIO15
CN18	2x10 Pin Header Male, 2.54mm	GPIO16 - GPIO31
CN19	USB Type-A connector	1x USB host port
CN20	2x5 Pin Header Male, 2.54mm	SPI and I2C interfaces
CN21	2x10 Pin Header Male, 2.54mm	Simplified ISA Bus

2. Interface Description

2.1 Computer Module



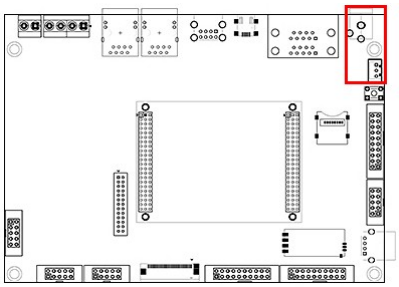
An ESMARC Compute Module can be firmly connected with the EVB through CN1 and CN2. For the pin-out of the ESMARC module, please refer to the applicable ESMARC module datasheet. The pin B1 in CN1 is blanked out so that ESMARC module can be plugged in correct orientation. It is recommended to use M2 size screws to fasten ESMARC module with the carrier board if required.

The part of GPIO pins are multiplexed with the following interfaces which are routed to connectors in ESMARC EVB.

GPIO	Multiplexed Function	CE Device	Linux Device
GPIO0 – GPIO1	RTS/CTS flow control	L“COM2:”	/dev/ttyS1
GPIO2 – GPIO3	COM6/ttyS5 (RXD, TXD)	L“COM6:”	/dev/ttyS5
GPIO4 – GPIO5	COM7/ttyS6 (RXD, TXD)	L“COM7:”	/dev/ttyS6
GPIO6	PWM1 output	L“PWM1:”	/dev/pwm1
GPIO7	PWM2 output	L“PWM2:”	/dev/pwm2
GPIO8	PWM3 output	L“PWM3:”	/dev/pwm3
GPIO9	PWM4 output	L“PWM4:”	/dev/pwm4
GPIO10 – GPIO11	CAN1 (RXD, TXD)	L“CAN1:”	can0
GPIO24	IRQ1	L“IRQ1:”	/dev/irq1
GPIO25	IRQ2	L“IRQ2:”	/dev/irq2
GPIO26 – GPIO27	I2C (SDA, SCL)	L“I2C1:”	/dev/i2c-0
GPIO28 – GPIO31	4-wire SPI (MISO, etc.)	L“SPI1:”	/dev/spidev1.0

2.2 Main Power Supply

There are two main power connectors (CN3 and CN4) in EVB as shown in following figure. Customer can use one of them for convenient.



Locations of power connectors (red block) in EVB

CN3 connector type: 1x3 Pin Header Male, 2.54 pitch

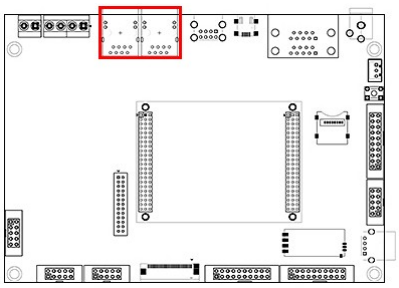
PIN#	Symbol	Description
1	VCC	+5V input, range ±10%
2		
3	GND	Power ground

CN4 connector type: 5.5mm/2mm power jack with core pin for +5V shown as follows

Caution: There is no protection against reverse input polarity or input over voltage!

2.3 Ethernet

The ESMARC Evaluation Board provides two RJ45 connectors with integrated magnetics for 10/100Mb ethernet.



Locations of RJ45 connectors (red block) in EVB

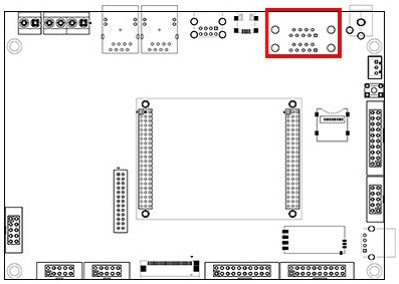
CN8 and CN9 connector type: RJ45, HR871181A

PIN#	Signal	Description
1	TX+	Transmit/Receive Differential Channel 1
2	TX-	
3	RX+	Transmit/Receive Differential Channel 2
4	-	
5	-	
6	RX-	Transmit/Receive Differential Channel 2
7	-	
8	-	

Two LEDs in both CN8 and CN9 are used to indicate state of ethernet port, green for link state, and yellow for 100Mb speed.

2.4 RS232

Two RS232 serial ports come to two stacked DB9 connectors. The base DB9 is for COM3/ttyS2 port, and the upper DB9 is for DBG_COM/console port.



Locations of CN5 connectors (red block) in EVB

CN5 connector type: 2x stacked DB9 male connector

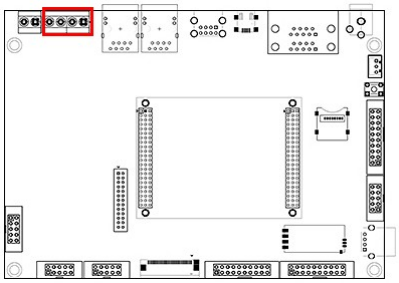
COM3 and ttyS2 are the signal names in CE platform and Linux platform respectively. DBG_COM is mainly used to dump kernel message in CE platform, and console is for Linux platform. DBG_COM/console works with parameter 115200-8-N-1. The signals assignments in each DB9 connector are the same as follows

Signal	PIN#	PIN#	Signal
	1	6	

RX, serial input	2	7	
TX, serial output, ±9V	3	8	
	4	9	
GND	5		

2.5 RS485

The ESMARC Evaluation Board provides two RS485 interfaces with photo-isolated drive circuit. The RS485 transfer direction (transmit or receive) can be set in either auto-switch mode or hardware control mode with proper setting of jumper.



Pins of RS485 interfaces are contained in CN1

Connector type: 1x6 Terminal Block Headers, male header pin, open side, 5.08mm pitch

PIN#	Signal	Description
1	A	COM4/ttyS3 port differential I/O positive
2	B	COM4/ttyS3 port differential I/O negative
3	A	COM5/ttyS4 port differential I/O positive
4	B	COM5/ttyS4 port differential I/O negative

Direction control settings

Port	Jumper	State	Description
COM4/ttyS3	JP9	ON	GPIO14 used as hardware direction control
		OFF	direction auto-switch mode
COM5/ttyS4	JP10	ON	GPIO15 used as hardware direction control
		OFF	direction auto-switch mode

The serial driver provides a software interface to select certain GPIO as RS485 hardware

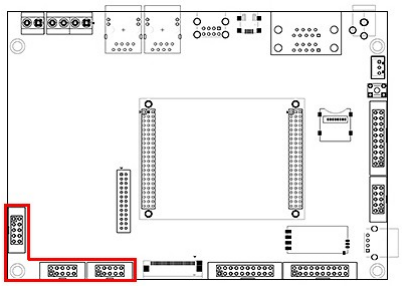
direction control. GPIO14 and GPIO15 can be used as direction control in ESMARC Evaluation Board. It is recommended to use RS485 hardware direction control in harsh electro-magnetic environment.

Termination resistor setting

Jumper	State	Description
JP7	ON	A 120Ω resistor is connected between A and B of COM4/ttyS3
	OFF	Unconnected
JP8	ON	A 120Ω resistor is connected between A and B of COM5/ttyS4
	OFF	Unconnected

2.6 UART

ESMARC Evaluation Board provides three UART interfaces in 3.3V LVCMOS. The port COM2/ttyS1 is capable of hardware flow control, and the other ports are in normal 3-wire mode.



Locations of UART connectors (red block) in EVB

Connector type: 2x5 IDC, male header pin, 2.54mm pitch

Connector CN14 is for COM2/ttyS1 with description as follows:

Signals in CN14	PIN#	PIN#	Signals in CN14
	1	2	
RXD2, serial input	3	4	RTS2n, active low
TXD2, serial output	5	6	CTS2n, active low
	7	8	
GND	9	10	VCC, +5Vmain power

The port COM6/ttyS5 and COM7/ttyS6 are all pin multiplexed with GPIO, and are routed to connector CN13 and CN12 respectively.

Signals in CN13	PIN#	PIN#	Signals in CN13
	1	2	
RXD6, multiplexed with GPIO2	3	4	
TXD6, multiplexed with GPIO3	5	6	
	7	8	
GND	9	10	VCC, +5Vmain power

Signals in CN12	PIN#	PIN#	Signals in CN12
	1	2	
RXD7, multiplexed with GPIO4	3	4	
TXD7, multiplexed with GPIO5	5	6	
	7	8	
GND	9	10	VCC, +5Vmain power

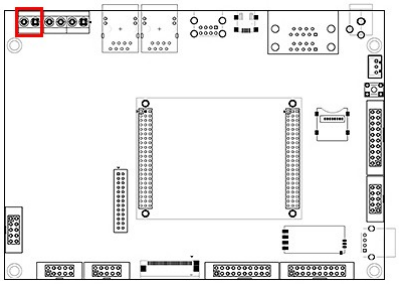
The USB OTG port can be virtualized as serial port so that a high speed connection can be established between ESMARC module and PC through USB cable. Therefore there are totally 8 serial ports in ESMARC system.

CE	Linux	RS232	RS485	UART	Description
COM1	ttyGS0	-	-	-	USB virtual serial port
COM2	ttyS1	-	-	√	Supporting GPRS/CDMA module
COM3	ttyS2	√	-	-	LVCMOS optional
COM4	ttyS3	-	√	-	
COM5	ttyS4	-	√	-	
COM6	ttyS5	-	-	√	
COM7	ttyS6	-	-	√	
DBGCOM	console	√	-	-	For system only

2.7 CAN

The CAN1 interface is multiplexed with GPIO10 and GPIO11. A digital isolator is used in CAN

drive circuit to guarantee the high speed transfer rate of the interface.



Locations of CAN connector (red block) in EVB

Connector type: 1x2 Terminal Block Headers, male header pin, open side, 5.08mm pitch

PIN#	Symbol	Description
1	CANH	Differential signal pair, high
2	CANL	Differential signal pair, low

As the CAN1 interface is multiplexed with GPIO, two jumpers JP3 and JP4 are placed to rout the pins to the circuit as required.

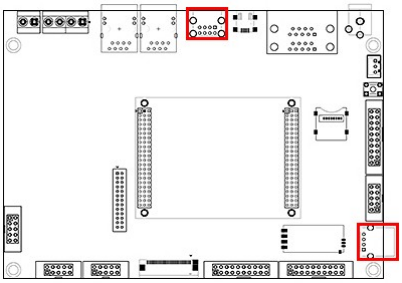
Jumper	State	Description
JP3	ON	Routing signals to CAN interface drive circuit
JP4		
JP3	OFF	disconnecting signals from CAN interface drive circuit
JP4		

Jumper JP5 and JP6 are used to connect a terminal match resistor (120Ω) between CANH and CANL. It is required to turn on or off the both jumpers at the same time.

Jumper	State	Description
JP5	ON	120Ω resistor is connected between CANH and CANL
JP6		
JP5	OFF	No resistor connected
JP6		

2.8 USB Host

ESMARC EVB provides 4 USB host ports. Three of them are routed to connector CN7 and CN19 which are all USB type-A connectors.



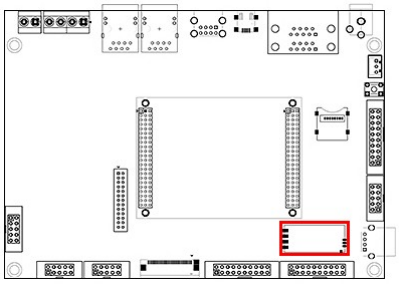
Locations of USB type-A connectors (red block) in EVB

CN7 connector type: 2x stacked USB 2.0 type-A connector

CN19 connector type: USB 2.0 type-A connector

PIN#	Symbol	Description
1	+5V	+5V output, maximum current < 500mA
2	USB_HD-	Data differential pair
3	USB_HD+	
4	GND	Power ground

The fourth port of USB host is assigned to a built-in WiFi module. The location of built-in module is shown with red block in following figure.



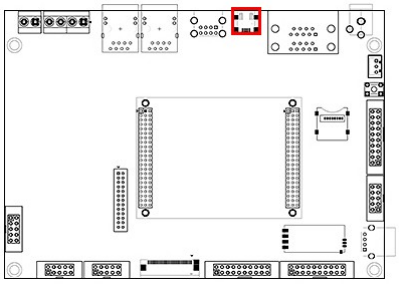
The WiFi module is not contained in EVB unless the module is ordered on purchase.

2.9 USB OTG

Connector type: USB OTG mini A/B

PIN#	Symbol	Description
1	VBUS	+5V output (host, < 500mA), input only for voltage sensing
2	USB_DD-	Positive differential USB signal, OTG capable
3	USB_DD+	Negative differential USB signal, OTG capable

4	USB_ID	USB OTG identification
5	GND	Digital ground



Location of USB OTG connector (red block) in EVB

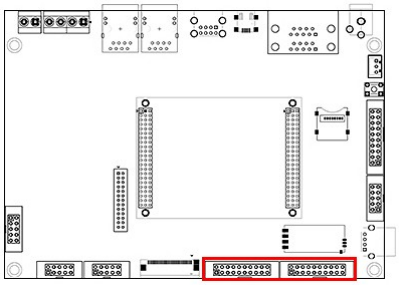
Jumper JP11 can be shorten to enforce the USB OTG port in host mode.

The USB OTG port can be configured by software to work as virtual serial port in both platforms CE and Linux.

2.10 GPIO

ESM335x computer mode can provide up to 32 GPIOs. Each GPIO can be configured as input or output mode independently. All of GPIO are default setting in input mode on power up or by external reset. As some pins of GPIO are multiplexed with other interfaces so that those pins are routed to GPIO connectors and the connectors of the multiplexed interfaces. GPIO0 – GPIO15 are in CN17 and GPIO16 – GPIO31 in CN18.

Note: GPIO function is disabled if the multiplexed interface is enabled.



Locations of GPIO connectors (red block) in EVB

Connector type: 2x10 IDC, male header pin, 2.54mm pitch

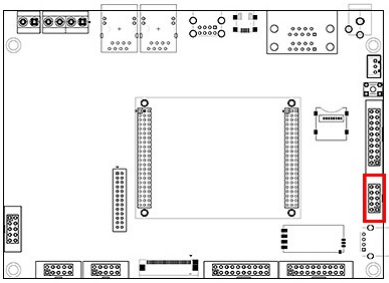
Signals in CN17	PIN#	PIN#	Signals in CN17
GPIO0	1	2	GPIO1

GPIO2	3	4	GPIO3
GPIO4	5	6	GPIO5
GPIO6	7	8	GPIO7
GPIO8	9	10	GPIO9
GPIO10	11	12	GPIO11
GPIO12	13	14	GPIO13
GPIO14	15	16	GPIO15
VCC	17	18	VCC
GND	19	20	GND

Signals in CN18	PIN#	PIN#	Signals in CN18
GPIO16	1	2	GPIO17
GPIO18	3	4	GPIO19
GPIO20	5	6	GPIO21
GPIO22	7	8	GPIO23
GPIO24	9	10	GPIO25
GPIO26	11	12	GPIO27
GPIO28	13	14	GPIO29
GPIO30	15	16	GPIO31
VCC	17	18	VCC
GND	19	20	GND

2.11 SPI and I2C

The pins of SPI interface and I2C interface are put together in CN20 of EVB. Additional two GPIOs are used as interrupt source of external devices if required. In following figure the connector marked with red block is CN20.

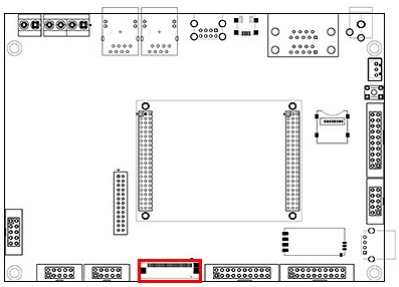


Connector type: 2x5 IDC, male header pin, 2.54mm pitch

Signal and Description	PIN#	PIN#	Signal and Description
I2C_SDA, I2C data/address	1	2	I2C_SCL, I2C clock
IRQ1, interrupt	3	4	IRQ2, interrupt
SPI_SCLK, SPI clock	5	6	SPI_MOSI, SPI data output
SPI_CSN, SPI chip select, active low	7	8	SPI_MISO, SPI data input
GND	9	10	VCC, +5V main power

2.12 RGB LCD

The digital RGB interface comes with 18-bit data width for low cost LCD modules. The connector for RGB LCD is CN16 which location is shown in following figure.



Connector type: 1x 40 FPC socket, 0.5mm pitch

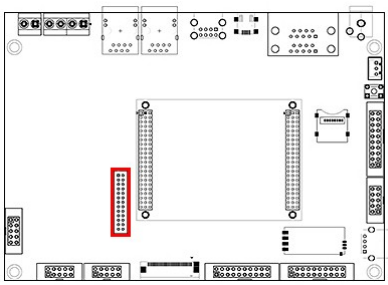
PIN#	Symbol	I/O	Description
1	GND	P	Power ground
2	LCD_DCLK	O	Stream Pixel Clock
3	LCD_HSYNC	O	Horizontal Sync Pulse, active low
4	LCD_VSYNC	O	Vertical Sync Pulse, active low
5	GND	P	Power ground
6-11	LCD_R2 – LCD_R7	O	Red component output, R7(MSB), R2(LSB)
12	GND	P	Power ground
13-18	LCD_G2 – LCD_G7	O	Green component output, G7(MSB), G2(LSB)
19	GND	P	Power ground
20-25	LCD_B2 – LCD_B7	O	Blue component output, B7(MSB), B2(LSB)
26	GND	P	Power ground

27	LCD_DE	O	Display Enable, active high
28-29	+3.3V	P	3.3V power output, max current < 200mA
30	LCD_BLn	O	Backlight control, active low, PWM configurable
31	NC		No connection
32	NC		No connection
33-34	+5.0V	P	5Vpower output, max current <200mA
35	NC		No connection
36	X- / TSC_IRQn	I/O	Resistive TSC input/capacitive TSC interrupt
37	X+ / TSC_RSTn	I/O	Resistive TSC input/capacitive TSC reset
38	Y- / TSC_I2C_SCL	I/O	Resistive TSC input/capacitive TSC I2C clock
39	Y+ / TSC_I2C_SDA	I/O	Resistive TSC input/capacitive TSC I2C data
40	GND	P	Power ground

Note: as the part of pins of RGB LCD are shared with LVDS LCD interface, only one of LCD connectors can be used to connect external LCD module.

2.13 LVDS LCD

The LVDS interface is compatible with both 18-bit mode and 24-bit mode. The signal group LVDS_DATA3 is used in 24-bit mode only.



Location of LVDS connector (red block) in EVB

Connector type: 2x13 IDC, male header pin, 2.0mm pitch

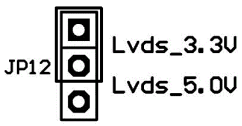
Description	PIN	PIN	Description
Power Supply, 5V/3.3V optional	1	2	Power Supply, 5V/3.3V optional
U/D, Vertical scanning direction control	3	4	R/L, Horizontal scanning direction control
LVDS_DATA0_N	5	6	LVDS_DATA0_P
GND	7	8	LVDS_DATA1_N

LVDS_DATA1_P	9	10	GND
LVDS_DATA2_N	11	12	LVDS_DATA2_
GND	13	14	LVDS_CLK_N
LVDS_CLK_P	15	16	GND
SEL6/8, 18-bit/24-bit mode selection	17	18	LCD_BLn, backlight control
LVDS_DATA3_N	19	20	LVDS_DATA3_P
GND	21	22	GND
X+ / TSC_RSTn	23	24	X- / TSC_IRQn
Y+ / TSC_I2C_SDA	25	26	Y- / TSC_I2C_SCL

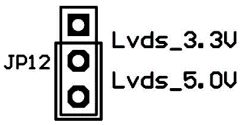
The JP12 is a 1x 3 header pin jumper which is defined in following table.

PIN#	Signal	Description
1	+3.3V	Connecting 1-2 to output +3.3V
2	Power Output	
3	+5.0V	Connecting 3-2 to output +5.0V

The following figures show the two outputs of power supply of LVDS



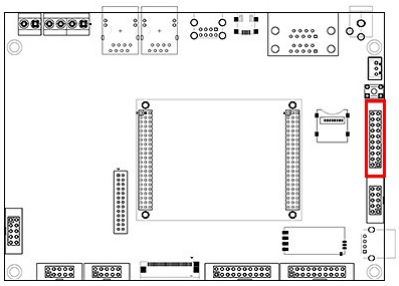
3.3V supply



5.0V supply

2.14 Simplified ISA Bus

Simplified ISA consists of only 12 signals by utilizing address and data multiplexed access. Four interrupt lines are also included in the connector CN21 for ISA bus. The ISA bus can connect with two external devices at the same time.



Location of ISA connector (red block) in EVB

Connector type: 2x10 IDC, male header pin, 2.54mm pitch

Signals in CN9	PIN#	PIN#	Signals in CN9
RSTIN_OUTn, reset I/O	1	2	ISA_ADVn
ISA_SD0	3	4	ISA_SD4
ISA_SD1	5	6	ISA_SD5
ISA_SD2	7	8	ISA_SD6
ISA_SD3	9	10	ISA_SD7
MSL, device select	11	12	ISA_WEn
IRQ4, interrupt	13	14	ISA_RDn
IRQ3, interrupt	15	16	ISA_CSn
IRQ2, interrupt	17	18	VCC
IRQ1, interrupt	19	20	GND

The following table lists the descriptions of signals in CN21.

Signals	Description
ISA_D0 - ISA_D7	8-bit address/data bus with multiplexed access
ISA_CSn	Chip select, active low on bus cycle
ISA_ADVn	Address latch, active low, rising edge latch
ISA_RDn	Read enable, active low
ISA_WEn	Write enable, active low
MSL	= L: select the second device
IRQ1 – IRQ4	GPIO based interrupt request lines with rising edge

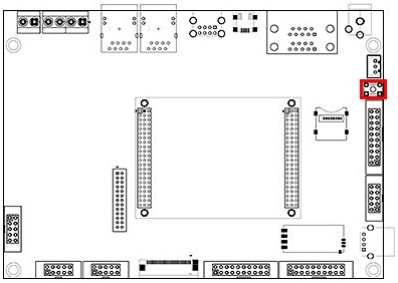
Jumper JP2 is used to connect MSL to ground.

JP2	State of MSL
ON	Connected to GND = L
OFF	No connected

3. Other Utilities

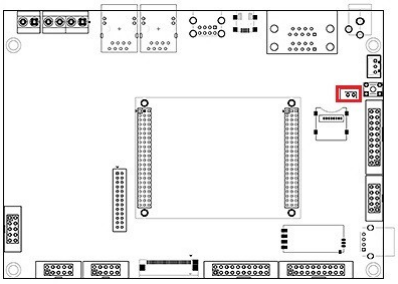
3.1 Reset

The push button S1 in ESMARC EVB is used to reset the system manually.



3.2 Debug Mode

The jumper JP1 is connected with the pin DBGSLn of computer module. With shorten JP1 ESMARC compute module can start up in debug mode. In debug mode, some necessary parameters and customer's main program can be configured so that customer's main program can be automatically executed when system booting up with JP1 opened (running mode).



Location of JP1 jumper (red block) in EVB

JP1	Description
ON	Route DBGSLn to ground, system start up in debug mode
OFF	DBGSLn No connected, system start up in normal running mode

3.3 RTC Backup Battery

A CR2032 battery socket (B1) is placed in EVB for RTC backup battery.

3.4 LED Indication

Table of LED indication in ESMARC Evaluation Board

LED#	Symbol	Description
D1	PWR	Active when +5Vmain power supplied
D2	RUN	Active when DBGCOM/console transmit data
D9	RXD4	Active when COM4/ttyS3 RS485 receives data
D10	TXD4	Active when COM4/ttyS3 RS485 transmits data
D11	RXD5	Active when COM5/ttyS4 RS485 receives data
D12	TXD5	Active when COM5/ttyS4 RS485 transmits data
D18	CAN	Active when CAN bus transceiver data

3.5 Jumpers

Symbol	Connector Type	Description
JP1	1x 2 header pin male	Debug mode setting
JP2	1x 2 header pin male	Select the second device on ISA
JP3, JP4	1x 2 header pin male	Route CAN_RXD/CAN_TXD to its driver
JP5, JP6	1x 2 header pin male	CAN bus 120Ω terminal match resistor
JP7, JP8	1x 2 header pin male	RS485 bus 120Ω terminal match resistor
JP9, JP10	1x 2 header pin male	RS485 hardware direction control
JP11	1x 2 header pin male	Force USB_OTG as host port
JP12	1x 3 header pin male	LVDS power supply, 3.3V or 5V
JP14	1x 2 header pin male	System reserved

3.6 Mounting Holes

4 mounting holes with Φ4.2 are near the corner of EVB. One of them near power connectors is connected with shield of DB9 and RJ45, which can be used to chassis ground.

4. Order Information

Module Type	Description
ESMARC Evaluation Board	

5. Technical Support

Emtronix is a company specializing on embedded computer modules for industrial applications. Technical support can be obtained from company's website, forum, email and telephone. The contact details are below:

Website: http://www.emtronix.com

Email: support@emtronix.com

Telephone: 86-28-8618-0660

FAX: 86-28-85141028

Company Location: #5 Gaopeng Dadao, Chengdu, Sichuan, China 610041

6. Revision History

Version	Module Type	Description	Date
V2.0	ESMARC EVB	Datasheet created	2016-1

Note: The manual will be updated without notice. The latest version of the manual can be downloaded from Emtronix's website.