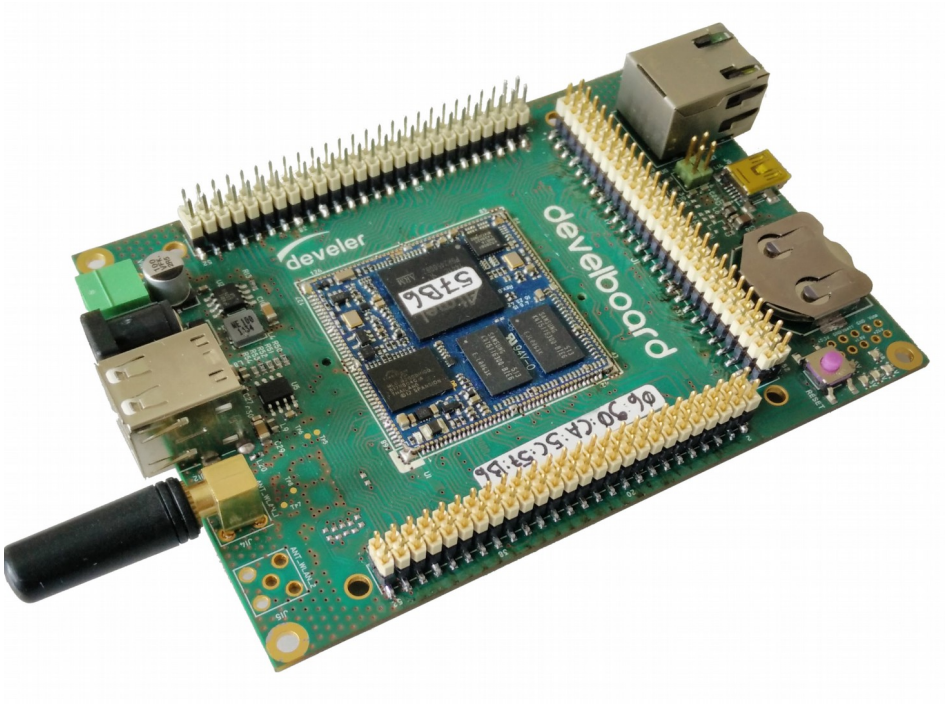
DevelBoard EVA01-R2

Evaluation Toolkit

DRAFT

USER MANUAL



Introduction

EVA01 is the best way to get started with DevelBoard, a powerful Linux-based SoM designed for embedded system beginners as well as heavy-duty industrial applications.
This evaluation toolkit helps you design and prototype a wide range of real-world applications, providing easy access to DevelBoard's debug interface and its most common peripherals (Ethernet, Wi-Fi etc.).

February 2016

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1. Quick start

EVA01 is a easy-to-use evaluation board to quickly get started prototyping with DevelBoard.

For more information on DevelBoard, visit www.develboard.com.

Documentation and user guides are also available at docs.develboard.com.

2. Features

EVA01 offers the following features:

- DevelBoard SoM, featuring an Atmel ATSAMA5D44 ARM® Cortex® A5 core @ 600 MHz
- Up to 512 MiB of DDR2 RAM
- Up to 512 MiB of NAND Flash
- On-board serial debugging interface, both using a 4-pin header and a USB mini-A connector
- Hardware reset push-button
- Board power supply: through USB bus or using an external power supply
- External application power supply: 1.8V, 3.3V, 5V, 24V
- CR1632 battery slot for RTC and backup registers
- Electrical test points for each voltage level on the board
- Five LEDs: V_{USB}, +1.8V, +3.3V, +5V, +24V
- Two USB 2.0 High speed host ports
- Micro-SD card slot
- Ethernet 10/100 shielded connector
- Two antennas for WLAN 2.4GHz MIMO channel access, with support for Bluetooth LE
- Three 26x2 52-pin extension headers for access to I/O pins on DevelBoard:
  - Almost all 152 GPIO pins (except for Ethernet and SDIO)
  - USB OTG High speed with host / device support
  - 24-bit LCD/TFT display controller

3. Hardware and Layout

This section describes the hardware layout and component placement on EVA01, and how the peripherals map to the physical connectors on the board.

3.1. Board overview

EVA01 is designed around DevelBoard to integrate multiple peripherals and connectors.

Figure 3.1 shows the component placement on the board.

Figure 3.2 shows the top layout of the board.

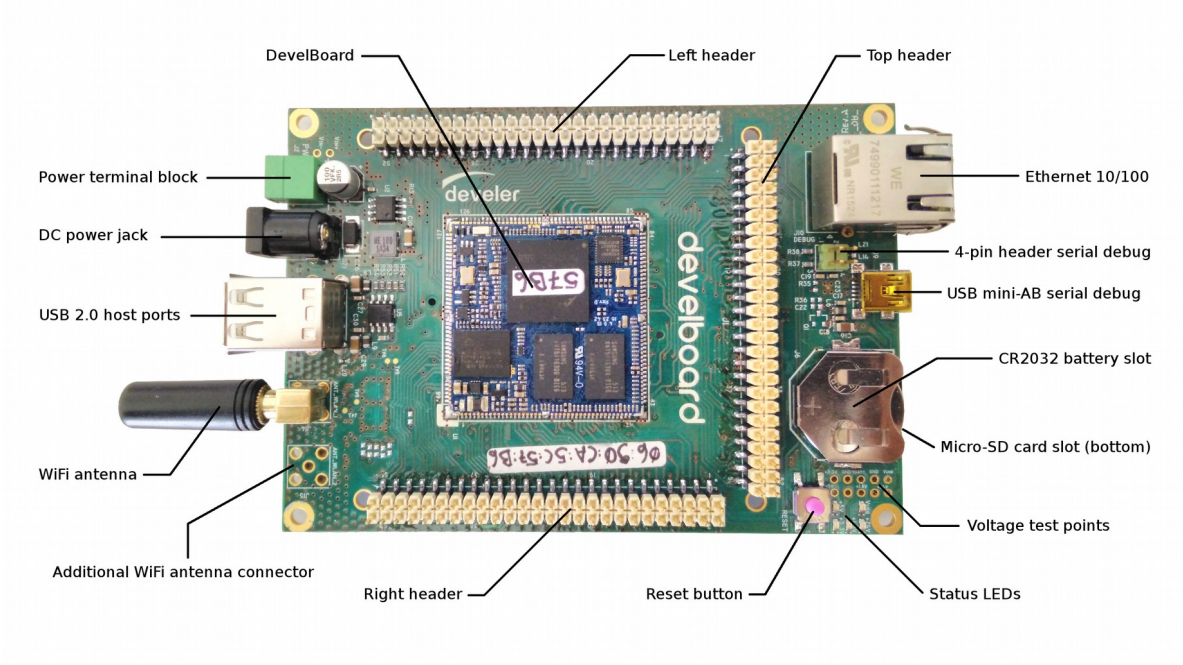

Figure 3.1. Component placement

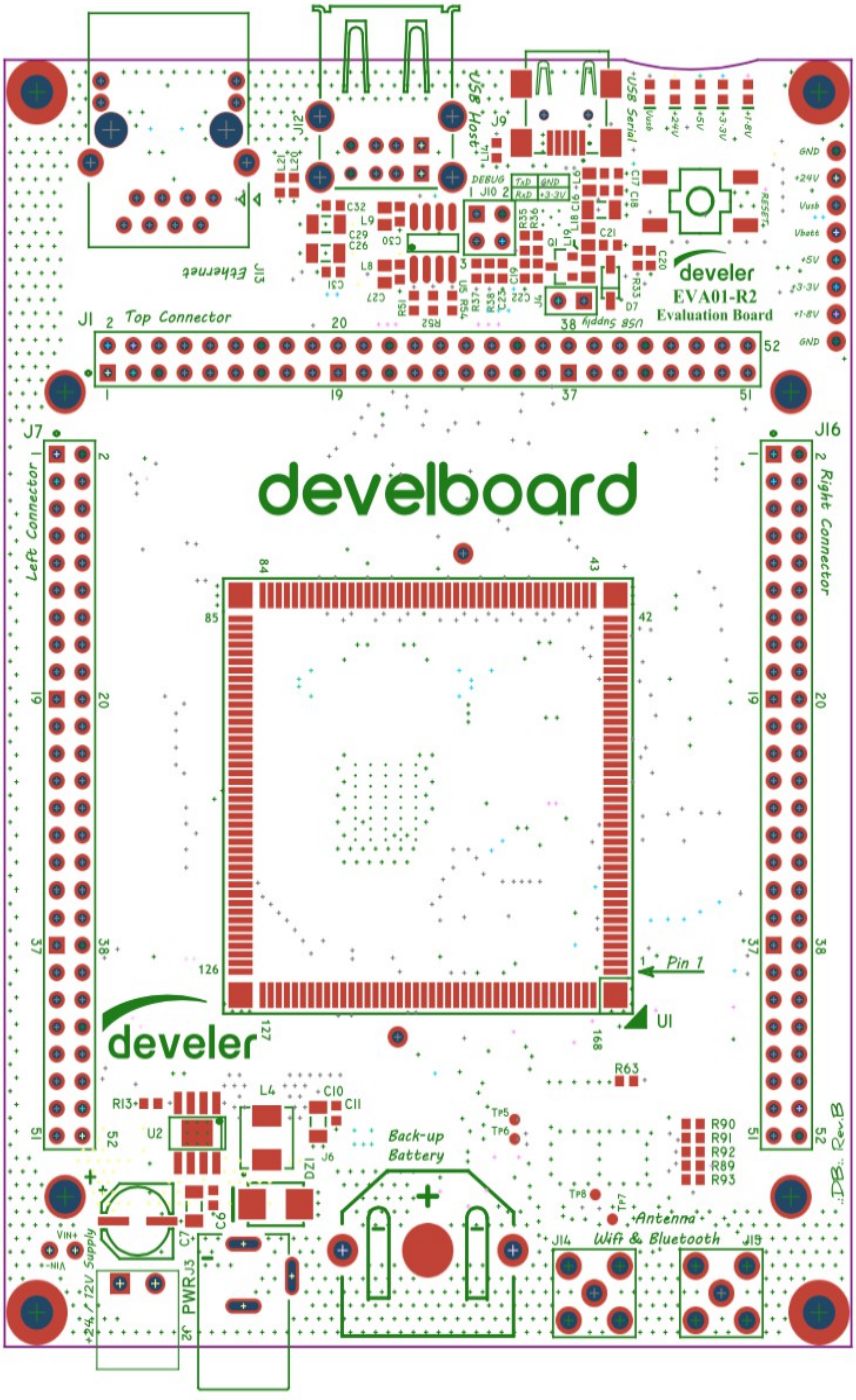

Figure 3.2. Top layout

3.2. Connectors

Table 3.1 describes the interface connectors on the board and the interface to which they are connected.

Table 3.1: Connector list

Identifier	Connector	Interfaces to
J2	3.5mm terminal block	Main power supply
J3	Power jack	Main power supply
J4	2-pin header	USB power supply jumper
J6	Battery slot	V_{bat} for RTC and backup registers
J1, J7, J16	52-pin header	General purpose I/O pins
J9	USB Mini-B	Serial debug interface (RTX3)
J10	4-pin header	Serial debug interface (RTX3)
J11	Micro-SD slot	SDIO port (MCI1A)
J12	USB Type A Dual	USB 2.0 Host interface
J13	Shielded RJ45	Ethernet 10/100 Mbps (GMAC0)
J14, J15	WLAN Antenna	SDIO port (MCI0B)

3.3. Functional blocks

3.3.1 Power supply

The power supply is either provided by the host PC through the USB cable, or by an external AC or DC power supply. Details regarding operating voltages and currents are available in Section 4.1.

A switching regulator is used to drop the input voltage down to 5V, while the 3.3V and 1.8V are generated using two LDO linear regulators.

The two diodes D1 and D2 offer over- and reverse- voltage protection on the main power line. Polarity of power supply is not relevant.

Test points are available to read the actual voltages available on the board when powered on.

3.3.2 LEDs

Several status LEDs are available on EVA01 to verify the correct operation of the board.

Five LEDs are located in the mini-USB connector region of the board, indicating that a certain voltage level is currently available on the board.

Typically, when using the USB port to provide power, only the V_{USB} status LED will be lit. This is the typical case in which the board is connected to a host PC for debugging, without relying on any external supply.

When power is supplied via the available power connectors, without any connection to the host PC, typically the +24V, +5V, +3.3V and +1.8V will be lit.

3.3.3 Hardware reset

A reset switch is available on the board. The switch is connected to the RESET pin available on DevelBoard. When pushed, the RESET pin will read a low state and a reset will be performed.

3.3.4 Backup battery

A backup battery slot is available to keep the RTC running. It also provides power to the backup registers available on DevelBoard, providing persistence among uses.

The holder is suited for a CR1632 battery, and the battery voltage should be maintained between 2.7 and 3.3 volts to guarantee its correct operation.

Please note that no status LED is available for the backup battery, in order to avoid fast discharge times. Ensure to check the battery level periodically, to avoid loss of data.

3.3.5 Debug interface

EVA01 allows easy debugging of applications running on DevelBoard. This is possible thanks to two different connectors interfacing with the RTX3 serial port on DevelBoard, to which debug messages are redirected. This interface is available as early as during the boot phase of the board, in order to access the boot menu.

It can be used in two different ways:

- Via the USB mini-A connector (J9), which can be used to both power up the board and debug it at the same time. This allows troubleshooting using a host PC without the need of additional power supplies. Please note that in this case, disconnecting the USB cable will also power down the board. Remember also to short the jumper J4 in order to power the board from the USB supply.
- Using the 4-pin debug header (J10). For information on pin connections on the header, please refer to the schematics available in this document.

Table 3.2: Debug interface connections

Connector	Pin	Function	Connected to
J9	1	TX	PE17 (TXD3)
	2	GND	GND
	3	RX	PE16 (RXD3)
	4	VCC	+3.3V
J10	1	VCC	VCC_USB
	2	D-	USBDM
	3	D+	USBDP
	4	ID	NC
	5	GND	GND

3.3.6 High speed USB host

Two USB Type-A ports (J12) are available on EVA01 to provide USB host capabilities to DevelBoard.

This allows to connect a device component to the board, such as a USB mouse, keyboard and so on, to use with Linux embedded on-board.

Table 3.3: High speed USB connections

Connector	Pin	Function	Connected to
J12A	A1	VCC	VBUS1
	A2	D-	HHSDMB
	A3	D+	HHSDPB
	A4	GND	GND
J12B	B1	VCC	VBUS2
	B2	D-	HHSDMC
	B3	D+	HHSDPC
	B4	GND	GND

3.3.7 USB OTG support

It is possible to use USB OTG with both host and device capabilities by using the respective pins available in the extension header. They are labeled as HHSDMA and HHSDPA.

For information on which pins are connected to the USB interface on DevelBoard, refer to Table 3.6. For a typical application layout, refer to the schematics for the high speed USB ports.

3.3.8 Ethernet

DevelBoard is able to provide Internet connectivity by implementing two Ethernet MAC layers, one of which also includes an internal PHY for 10/100 Mbps operation.

The PHY is connected to a shielded RJ45 connector (J13) on EVA01, thus providing Ethernet 10/100 connectivity out of the box. This can be used even during the boot phase to perform network booting from a local or remote TFTP server.

The connector also has two status LEDs:

- A green LED to indicate transfer speed.
- A yellow LED to indicate link status.

Table 3.4: Ethernet connections

Connector	Pin	Function	Connected to
J13	1	TD+	ETH_TXP
	2	TCT	GND
	3	TD-	ETH_TXN
	4	RD+	ETH_RXP
	5	RCT	GND
	6	RD-	ETH_RXN
	7	-	-
	8	SHLD	SHIELD
	9	GRN_LED_A	+3.3V
	10	GRN_LED_K	ETH_LEDSPEED
	11	YLW_LED_A	+3.3V
	12	YLW_LED_K	ETH_LEDACTLINK
	13	SHLD	SHIELD
	14	SHLD	SHIELD
	15	SHLD	SHIELD
	16	SHLD	SHIELD

3.3.9 Wi-Fi and Bluetooth LE

Wireless connectivity is also available on EVA01, using a WL1831MOD (U9). It support Wi-Fi (WLAN 2.4 GHz band) with optional MIMO channel access, and Bluetooth LE dual mode.

Wi-Fi is controlled using the SDIO 0B interface on the DevelBoard, through a 3.3-to-1.8 voltage level shifter (U11). Bluetooth is driven using the serial port TRX1, also using a level shifter (U8)

EVA01 also comes equipped with an external 2.4-GHz band antenna (J14) to boost reception. An additional antenna connector (J15) is present but not fitted, to allow the possibility of MIMO channel access.

Table 3.5: Wi-Fi and Bluetooth connections

Component	Pin	Function	Connected to
-	-	-	PB29 (WLAN_PWR)
U11	20	B1	PE8 (SDIO_IRQ)
	18	B2	PE4 (MCI0_DB3)
	17	B3	PE3 (MCI0_DB2)
	16	B4	PE2 (MCI0_DB1)
	15	B5	PE1 (MCI0_DB0)
	14	B6	PC4 (MSI0_CK)
	13	B7	PE0 (MSI0_CDB)
	12	B8	PD26 (WIFI_EN)
U8	20	B1	PD17 (TXD1)
	18	B2	PD16 (RXD1)
	17	B3	PD15 (RTS1)
	16	B4	PD14 (CTS1)
	15	B5	PB30 (BT_EN)

3.3.10 TFT/LCD interface

DevelBoard offers an integrated TFT/LCD display controller for 24-bit parallel display interfaces.

Although there is no specific connector on EVA01 reserved for this function, the interface is available on the top extension header (J1), laid out using the typical pin-out for these drivers.

For information on which pins are connected to the USB interface on DevelBoard, refer to Table 3.6.

3.3.11 Extension headers

Three 52-pin male extension headers (J1, J7 and J16) are mounted on the board to allow access to almost all the pins available on DevelBoard. In particular:

- Multiple voltage levels are available on the headers:
  - +1.8V and +3.3V on J1 and J16
  - +5V on each header
  - +24V on J1 and J7
  - V_{BATT} on J7
- the RESET pin is available on J1 for external resets

The extension headers are placed in such a way to allow the stacking of another component on top of EVA01, using female headers. This allows the user to create extension shield boards that can take full advantage of DevelBoard and of the functionalities available on EVA01, such as LCD shields, protoboards and so on.

Table 3.6 describes how pins on DevelBoard are mapped to the extension headers on the board, and what functions are available on each pin.

Table 3.6: Pin mappings

EVA01

Conn.	Pin	System function	Function 1	Function 2	Function 3	Analog	Note
J1	1	+24V	-	-	-	-	
	2	+3.3V	-	-	-	-	
	3	+5V	-	-	-	-	
	4	+1.8V	-	-	-	-	
	5	GND	-	-	-	-	
	6	RESET	-	-	-	-	
	7	PA27	LCDHSYNC	PWML0	SPI1_NPCS2	-	
	8	PA29	LCDDEN	PWML1	-	-	
	9	PA26	LCDVSYNC	PWMH0	SPI1_NPCS1	-	
	10	PA24	LCDPWM	PCK0	-	-	
	11	PA28	LCDPCK	PWMH1	SPI1_NPCS3	-	
	12	PA25	LCDDISP	TD0	-	-	
	13	GND	-	-	-	-	
	14	GND	-	-	-	-	
	15	PA23	LCDDAT23	G1_MDIO	-	-	
	16	PA22	LCDDAT22	G1_MDC	-	-	
	17	PA21	LCDDAT21	G1_TX3	-	-	
	18	PA20	LCDDAT20	G1_TX2	-	-	
	19	PA19	LCDDAT19	G1_RX3	-	-	
	20	PA18	LCDDAT18	G1_RX2	-	-	
	21	PA17	LCDDAT17	-	-	-	
	22	PA16	LCDDAT16	-	NTRST	-	
	23	GND	-	-	-	-	
	24	GND	-	-	-	-	
	25	PA15	LCDDAT15	G1_TX1	-	-	
	26	PA14	LCDDAT14	G1_TX0	-	-	
	27	PA13	LCDDAT13	G1_RX1	-	-	
	28	PA12	LCDDAT12	G1_RX0	-	-	
	29	PA11	LCDDAT11	G1_RXER	-	-	
	30	PA10	LCDDAT10	G1_RXDV	-	-	
	31	PA9	LCDDAT9	G1_COL	-	-	
	32	PA8	LCDDAT8	-	TCK	-	
	33	GND	-	-	-	-	
	34	GND	-	-	-	-	
	35	PA7	LCDDAT7	-	-	-	
	36	PA6	LCDDAT6	G1_CRS	-	-	

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Conn.	Pin	System function	Function 1	Function 2	Function 3	Analog	Note
	37	PA5	LCDDAT5	G1_TXER	-	-	
	38	PA4	LCDDAT4	G1_TXEN	-	-	
	39	PA3	LCDDAT3	G1_RXCK	-	-	
	40	PA2	LCDDAT2	G1_TXCK	-	-	
	41	PA1	LCDDAT1	-	-	-	
	42	PA0	LCDDAT0	-	TMS	-	
	43	GND	-	-	-	-	
	44	GND	-	-	-	-	
	45	PC27	-	SPI0_NPCS1	PWML0	AD0	
	46	PB18	SPI1_MISO	-	-	-	
	47	PC28	-	SPI0_NPCS2	PWML1	AD1	
	48	PB19	SPI1_MOSI	-	-	-	
	49	PC29	-	SPI0_NPCS3	PWMFI0	AD2	
	50	PB20	SPI1_SPCK	-	-	-	
	51	PC30	-	-	PWMH0	AD3	
	52	PB23	SPI1_NPCS2	-	-	-	
J7	1	VBATT	-	-	-	-	
	2	GND	-	-	-	-	
	3	+5V	-	-	-	-	
	4	PB1	G0_RXCK	SCK2	ISI_PCK	-	
	5	PB3	G0_TXER	CTS2	ISI_VSYNC	-	
	6	PB14	G0_TX2	SPI2_NPCS1	PWMH0	-	
	7	PB24	DRXD	-	TDI	-	
	8	PB15	G0_TX3	SPI2_NPCS2	PWML0	-	
	9	PB10	G0_RX2	PCK2	PWML1	-	
	10	PB22	SPI1_NPCS1	-	-	-	
	11	PB5	G0_COL	TXD2	PCK2	-	
	12	PB25	DTXD	-	TDO	-	
	13	PB4	G0_CRS	RXD2	ISI_HSYNC	-	
	14	PB11	G0_RX3	RTS2	PWMH1	-	
	15	PB28	SPI2_NCS3	TD0	PWMH1	-	
	16	PB21	SPI1_NPCS0	-	-	-	
	17	PB31	-	TF0	-	-	Connected to generic LED on DevelBoard
	18	PB27	SPI1_NPCS3	TK0	PWML0	-	
	19	PD8	PCK0	-	-	-	

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Conn.	Pin	System function	Function 1	Function 2	Function 3	Analog	Note
	20	PD9	FIQ	-	-	-	
	21	PD12	RXD0	-	-	-	
	22	PE31	ADTRG	-	-	-	
	23	PD11	RTS0	SPI2_MISO	-	-	
	24	PD10	CTS0	-	-	-	
	25	PD29	SCK1	-	-	-	
	26	PD13	TXD0	SPI2_MOSI	-	-	
	27	PE29	DIBP	URXD0	TWD1	-	
	28	PD28	SCK0	-	-	-	
	29	PE30	DIBN	UTXD0	TWCK1	-	
	30	SHDN	-	-	-	-	
	31	PD16	RXD1	-	-	-	Used by Bluetooth
	32	PD17	TXD1	SPI2_NPCS0	-	-	Used by Bluetooth
	33	PB30	TWCK2	RF0	-	-	Used by Bluetooth (BT_EN)
	34	PD14	CTS1	-	-	-	Used by Bluetooth
	35	WKUP	-	-	-	-	
	36	JTAGSEL	-	-	-	-	
	37	PD26	-	-	-	-	Used by WiFi (WLAN_EN)
	38	GND	-	-	-	-	
	39	PIOBU0_U3	-	-	-	-	
	40	HHSDPA	-	-	-	DHSDP	
	41	PB29	TWD2	RD0	PWML1	-	Used by WiFi (WLAN_PWR)
	42	HHSDMA	-	-	-	DHSDM	
	43	RESET	-	-	-	-	
	44	GND	-	-	-	-	
	45	ADCREF	-	-	-	-	
	46	PA31	TWCK0	-	-	-	Internal E2PROM on DevelBoard
	47	PC2	SPI0_SPCK	PWMH3	ISI_D10	-	Driven at Boot by Atmel Bootloader
	48	PA30	TWD0	-	-	-	Internal E2PROM on DevelBoard
	49	PC0	SPI0_MISO	PWMH2	ISI_D8	-	Driven at Boot by Atmel Bootloader
	50	+5V	-	-	-	-	
	51	BOOT_RCV	-	-	-	-	
	52	+24V	-	-	-	-	
J16	1	+5V	-	-	-	-	
	2	GND	-	-	-	-	
	3	+3.3V	-	-	-	-	

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Conn.	Pin	System function	Function 1	Function 2	Function 3	Analog	Note
	4	PE28	-	RTS4	-	-	
	5	PE15	-	SCK3	TIOA0	-	
	6	PE17	-	TXD3	TCLK0	-	Connected to debug connector
	7	PE25	-	SCK4	IRQ	-	
	8	PE11	-	TCLK2	-	-	Used by USB (USB1_EN)
	9	PE24	-	RTS3	-	-	
	10	PE13	-	TIOB1	PWML2	-	
	11	PE7	-	TIOB3	PWMFI1	-	
	12	PE9	-	TIOA2	-	-	
	13	PE14	-	TCLK1	PWMH3	-	Used by USB (USB2_EN)
	14	PE6	-	TIOA3	-	-	
	15	PC25	ISI_D6	TWD3	URXD1	-	
	16	PE12	-	TIOA1	PWMH2	-	Used by USB (USB_OVCUR)
	17	PE5	-	CTS3	-	-	
	18	PE27	-	TXD4	-	-	
	19	PE1	-	MCI0_DB0	-	-	Used by WiFi
	20	PE2	-	MCI0_DB1	-	-	Used by WiFi
	21	PE3	-	MCI0_DB2	-	-	Used by WiFi
	22	PE4	-	MCI0_DB3	-	-	Used by WiFi
	23	PE8	-	TCLK3	PWML3	-	Used by WiFi
	24	PE26	-	RXD4	-	-	
	25	PE16	-	RXD3	TIOB0	-	Connected to debug connector
	26	PC26	ISI_D7	TWCK3	UTXD1	-	
	27	PC23	ISI_D4	RD1	-	-	
	28	PC21	ISI_D2	TD1	-	-	
	29	PC24	ISI_D5	RK1	PCK1	-	
	30	PE0	-	MCI0_CDB	CTS4	-	Used by WiFi
	31	PC19	ISI_D0	TK1	-	-	
	32	PC31	-	-	PWMH1	AD4	
	33	PD25	-	-	-	-	
	34	PC4	SPI0_NPCS1	MCI0_CK	PCK1	-	Driven at Boot by Atmel Bootloader/Used by WiFi
	35	PC20	ISI_D1	TF1	-	-	
	36	PD19	-	-	-	-	
	37	PD22	-	-	-	-	
	38	PD24	-	-	-	-	

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Conn.	Pin	System function	Function 1	Function 2	Function 3	Analog	Note
	39	PC3	SPI0_NPCS0	PWML3	ISI_D11	-	Driven at Boot by Atmel Bootloader
	40	PD21	-	-	-	-	
	41	PD23	-	-	-	-	
	42	PC22	ISI_D3	RF1	-	-	
	43	PE10	-	TIOB2	-	-	
	44	PC1	SPI0_MOSI	PWML2	ISI_D9	-	Driven at Boot by Atmel Bootloader
	45	PD27	-	-	-	-	
	46	PB26	PCK0	RK0	PWMH0	-	
	47	PD20	-	-	-	-	
	48	PD15	RTS1	SPI2_SPCK	-	-	Used by Bluetooth
	49	PD31	SPI0_NPCS2	PCK1	-	-	
	50	+1.8V	-	-	-	-	
	51	PIOBU1	-	-	-	-	
	52	GND	-	-	-	-	

4. Electrical specifications

DevelBoard is designed to operate at 3.3V. EVA01 provides several means to power up DevelBoard without damaging it, provided that the following guidelines are observed.

4.1. Power source

Several connectors are available to power up the EVA01 board.

It can be:

- USB-powered through the USB mini-A connector (J9)
- Powered using the 3.5mm terminal block (J2). The polarity of the plug is not relevant.
- Powered through a 2.1mm DC plug via the power jack connector (J3). The polarity of the plug is not relevant.

Table 4.1 specifies the electrical characteristics of the power supply in order to power up EVA01.

Table 4.1: Electrical parameters

Electrical Parameter	Min	Typ	Max	Unit
USB input voltage	-	5	-	V
USB current draw	-	-	500	mA
Terminal block input voltage	7	-	30	V
Power jack input voltage	7	-	30	V
V_{BATT} input voltage	2.6	-	3.3	V

4.2. Warnings

DevelBoard and EVA01 can be damaged by ESD. It is recommended that proper care is taken when handling electronic components. ESD damage can range from subtle performance degradation to complete device failure.

5. Mechanical drawings and Schematics

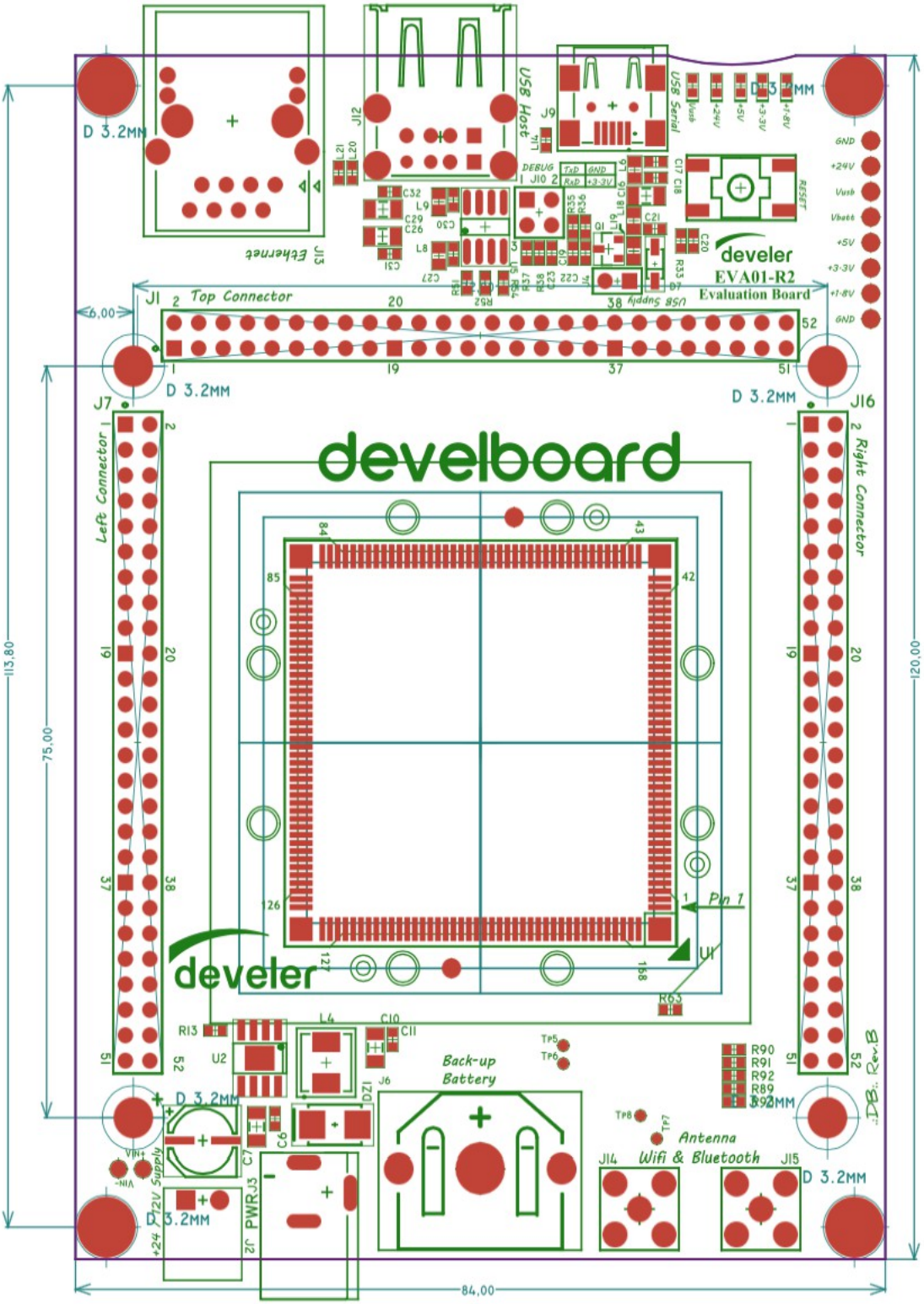

Figure 5.1. Dimensions

Mechanical drawings and Schematics

EVA01

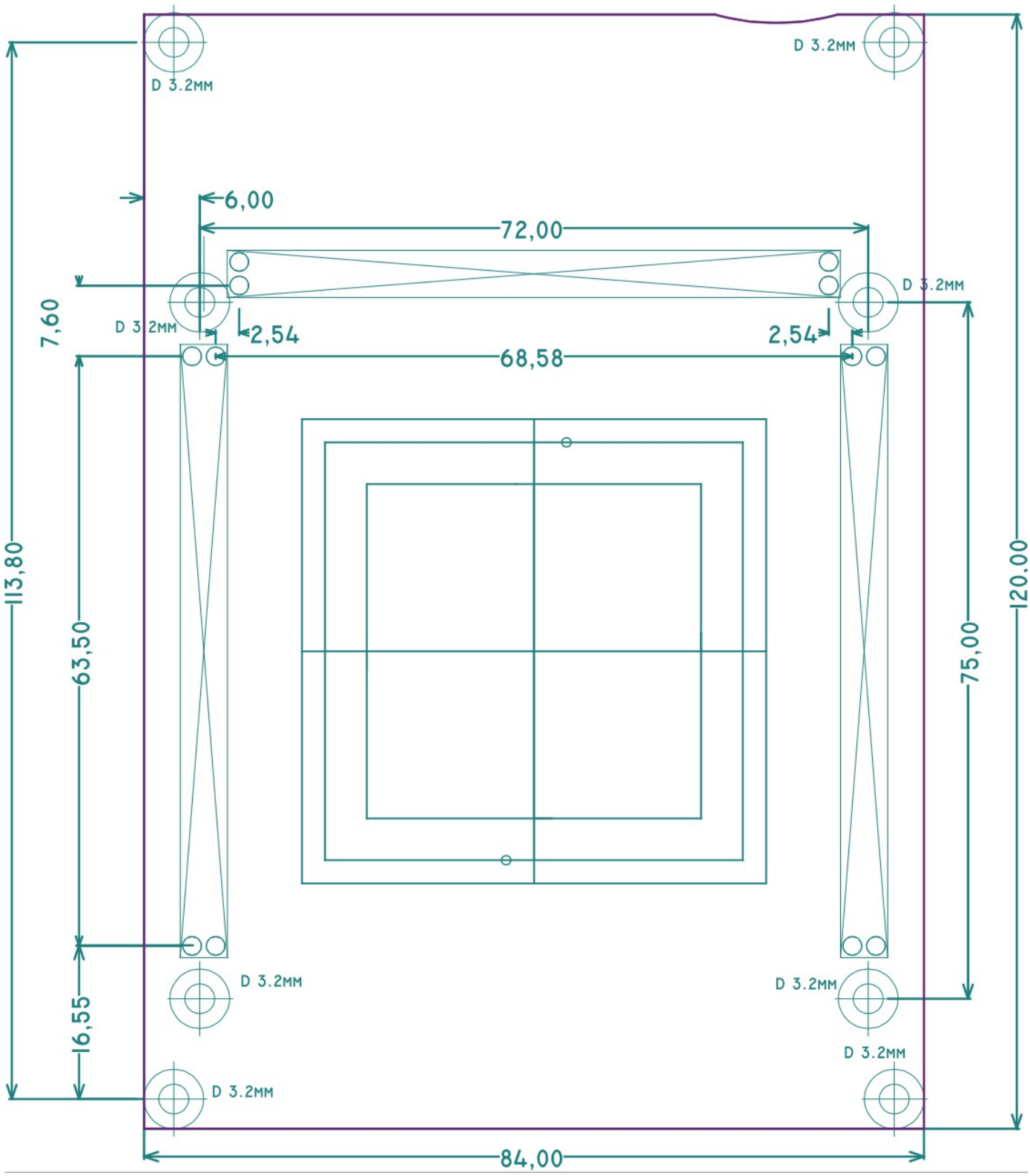

Figure 5.2: Connectors position