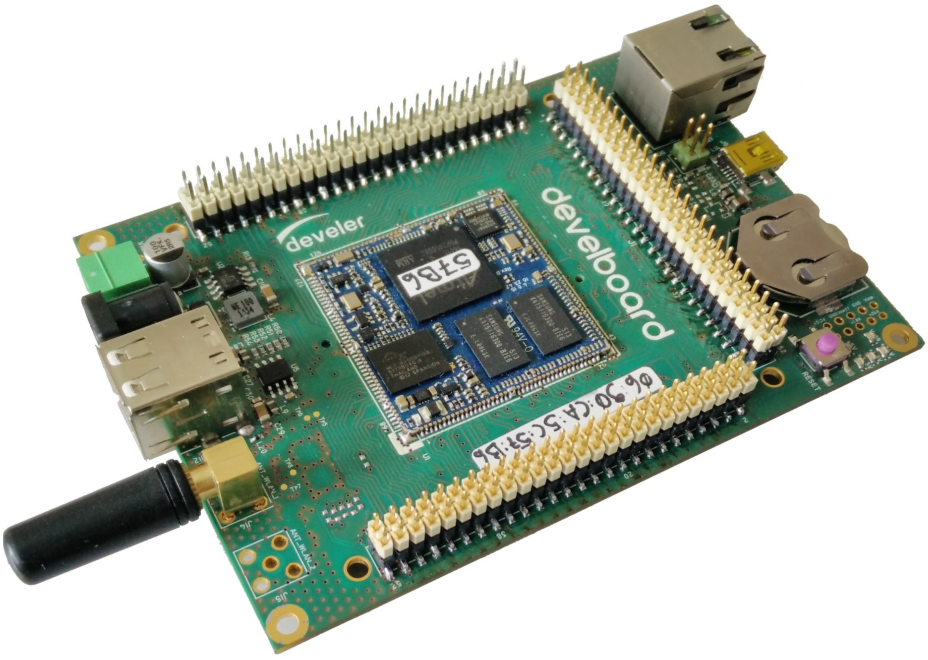
DevelBoard EVA

Evaluation Toolkit

DRAFT

USER MANUAL



Introduction

EVA 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.).

October 2015

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1. Quick start

EVA 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

EVA offers the following features:

- DevelBoard SoM, featuring an Atmel ATSAMA5D44 ARM® Cortex® A5 core @ 528 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
- CR2032 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 EVA, and how the peripherals map to the physical connectors on the board.

3.1. Board overview

EVA 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.

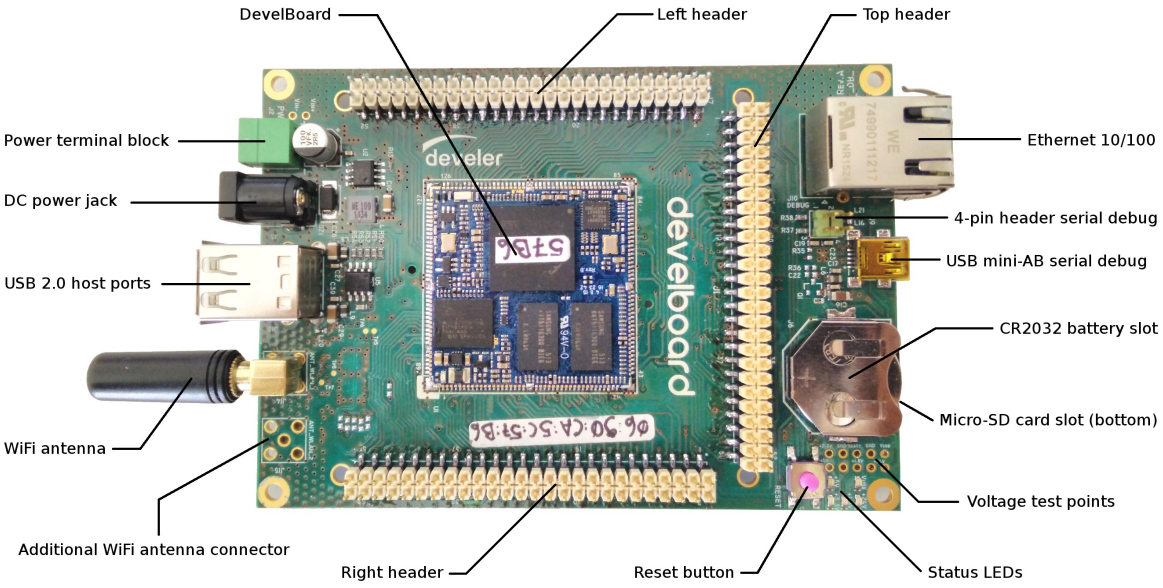


Figure 3.1. Component placement

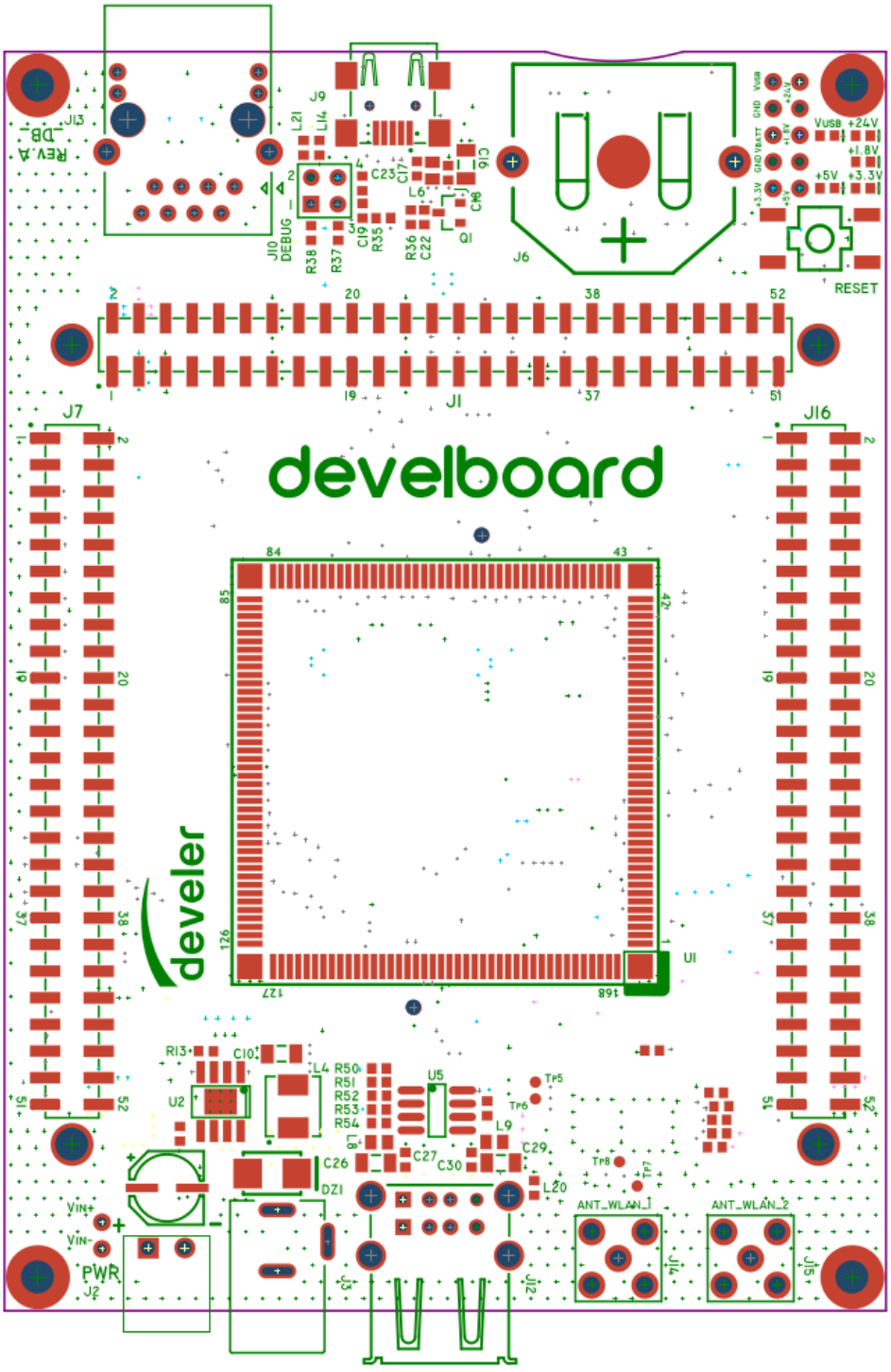


Figure 3.2. Top layout

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
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 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.

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 EVA to verify the correct operation of the board.

Five LEDs are located in the power supply 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 CR2032 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

EVA 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.
- 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 EVA 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 EVA, 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 EVA, 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 used 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)

EVA 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
U11	19	VCCB	+3.3V
	20	B1	PE8
	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	PC28
	11	GND	GND
U8	19	VCCB	+3.3V
	20	B1	PD17 (TXD1)
	18	B2	PD16 (RXD1)
	17	B3	PD15 (RTS1)
	16	B4	PD14 (CTS1)
	11	GND	GND

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 EVA 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 EVA, using female headers. This allows the user to create extension boards that can take full advantage of DevelBoard and of the functionalities available on EVA, 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

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

Connector	Pin	System function	Pin type	Function 1	Function 2	Function 3	Analog
	35	PA7	I/O	LCDDAT7	-	-	-
	36	PA6	I/O	LCDDAT6	G1_CRS	-	-
	37	PA5	I/O	LCDDAT5	G1_TXER	-	-
	38	PA4	I/O	LCDDAT4	G1_TXEN	-	-
	39	PA3	I/O	LCDDAT3	G1_RXCK	-	-
	40	PA2	I/O	LCDDAT2	G1_TXCK	-	-
	41	PA1	I/O	LCDDAT1	-	-	-
	42	PA0	I/O	LCDDAT0	-	TMS	-
	43	GND	POWER	-	-	-	-
	44	GND	POWER	-	-	-	-
	45	PC27	I/O	-	SPI0_NPCS1	PWML0	AD0
	46	PB18	I/O	SPI1_MISO	-	-	-
	47	PC28	I/O	-	SPI0_NPCS2	PWML1	AD1
	48	PB19	I/O	SPI1_MOSI	-	-	-
	49	PC29	I/O	-	SPI0_NPCS3	PWMFI0	AD2
	50	PB20	I/O	SPI1_SPCK	-	-	-
	51	PC30	I/O	-	-	PWMH0	AD3
	52	PB23	I/O	SPI1_NPCS2	-	-	-
J7	1	VBATT	POWER	-	-	-	-
	2	GND	POWER	-	-	-	-
	3	+5V	POWER	-	-	-	-
	4	PB1	I/O	G0_RXCK	SCK2	ISI_PCK	-
	5	PB3	I/O	G0_TXER	CTS2	ISI_VSYNC	-
	6	PB14	I/O	G0_TX2	SPI2_NPCS1	PWMH0	-
	7	PB24	I/O	DRXD	-	TDI	-
	8	PB15	I/O	G0_TX3	SPI2_NPCS2	PWML0	-
	9	PB10	I/O	G0_RX2	PCK2	PWML1	-
	10	PB22	I/O	SPI1_NPCS1	-	-	-
	11	PB5	I/O	G0_COL	TXD2	PCK2	-
	12	PB25	I/O	DTXD	-	TDO	-
	13	PB4	I/O	G0_CRS	RXD2	ISI_HSYNC	-
	14	PB11	I/O	G0_RX3	RTS2	PWMH1	-
	15	PB28	I/O	SPI2_NCS3	TD0	PWMH1	-
	16	PB21	I/O	SPI1_NPCS0	-	-	-

Connector	Pin	System function	Pin type	Function 1	Function 2	Function 3	Analog
	17	PB31	I/O	-	TF0	-	-
	18	PB27	I/O	SPI1_NPCS3	TK0	PWML0	-
	19	PD8	I/O	PCK0	-	-	-
	20	PD9	I/O	FIQ	-	-	-
	21	PD12	I/O	RXD0	-	-	-
	22	PE31	I/O	ADTRG	-	-	-
	23	PD11	I/O	RTS0	SPI2_MISO	-	-
	24	PD10	I/O	CTS0	-	-	-
	25	PD29	I/O	SCK1	-	-	-
	26	PD13	I/O	TXD0	SPI2_MOSI	-	-
	27	PE29	I/O	DIBP	URXD0	TWD1	-
	28	PD28	I/O	SCK0	-	-	-
	29	PE30	I/O	DIBN	UTXD0	TWCK1	-
	30	SHDN	OUTPUT	-	-	-	-
	31	PD16	I/O	RXD1	-	-	-
	32	PD17	I/O	TXD1	SPI2_NPCS0	-	-
	33	PB30	I/O	TWCK2	RF0	-	-
	34	PD14	I/O	CTS1	-	-	-
	35	WKUP	INPUT	-	-	-	-
	36	JTAGSEL	INPUT	-	-	-	-
	37	PD26	I/O	-	-	-	-
	38	GND	POWER	-	-	-	-
	39	PIOBU0_U3	I/O	-	-	-	-
	40	HHSDPA	ANALOG	-	-	-	DHSDP
	41	PB29	I/O	TWD2	RD0	PWML1	-
	42	HHSDMA	ANALOG	-	-	-	DHSDM
	43	RESET	OD	-	-	-	-
	44	GND	POWER	-	-	-	-
	45	ADCREF	ANALOG	-	-	-	-
	46	PA31	I/O	TWCK0	-	-	-
	47	PC2	I/O	SPI0_SPCK	PWMH3	ISI_D10	-
	48	PA30	I/O	TWD0	-	-	-
	49	PC0	I/O	SPI0_MISO	PWMH2	ISI_D8	-
	50	+5V	POWER	-	-	-	-

Connector	Pin	System function	Pin type	Function 1	Function 2	Function 3	Analog
	51	BOOT_RCV	INPUT	-	-	-	-
	52	+24V	POWER	-	-	-	-
J16	1	+5V	POWER	-	-	-	-
	2	GND	POWER	-	-	-	-
	3	+3.3V	POWER	-	-	-	-
	4	PE28	I/O	-	RTS4	-	-
	5	PE15	I/O	-	SCK3	TIOA0	-
	6	PE17	I/O	-	TXD3	TCLK0	-
	7	PE25	I/O	-	SCK4	IRQ	-
	8	PE11	I/O	-	TCLK2	-	-
	9	PE24	I/O	-	RTS3	-	-
	10	PE13	I/O	-	TIOB1	PWML2	-
	11	PE7	I/O	-	TIOB3	PWMFI1	-
	12	PE9	I/O	-	TIOA2	-	-
	13	PE14	I/O	-	TCLK1	PWMH3	-
	14	PE6	I/O	-	TIOA3	-	-
	15	PC25	I/O	ISI_D6	TWD3	URXD1	-
	16	PE12	I/O	-	TIOA1	PWMH2	-
	17	PE5	I/O	-	CTS3	-	-
	18	PE27	I/O	-	TXD4	-	-
	19	PE1	I/O	-	MCI0_DB0	-	-
	20	PE2	I/O	-	MCI0_DB1	-	-
	21	PE3	I/O	-	MCI0_DB2	-	-
	22	PE4	I/O	-	MCI0_DB3	-	-
	23	PE8	I/O	-	TCLK3	PWML3	-
	24	PE26	I/O	-	RXD4	-	-
	25	PE16	I/O	-	RXD3	TIOB0	-
	26	PC26	I/O	ISI_D7	TWCK3	UTXD1	-
	27	PC23	I/O	ISI_D4	RD1	-	-
	28	PC21	I/O	ISI_D2	TD1	-	-
	29	PC24	I/O	ISI_D5	RK1	PCK1	-
	30	PE0	I/O	-	MCI0_CDB	CTS4	-
	31	PC19	I/O	ISI_D0	TK1	-	-
	32	PC31	I/O	-	-	PWMH1	AD4

Connector	Pin	System function	Pin type	Function 1	Function 2	Function 3	Analog
	33	PD25	I/O	-	-	-	-
	34	PC4	I/O	SPI0_NPCS1	MCI0_CK	PCK1	-
	35	PC20	I/O	ISI_D1	TF1	-	-
	36	PD19	I/O	-	-	-	-
	37	PD22	I/O	-	-	-	-
	38	PD24	I/O	-	-	-	-
	39	PC3	I/O	SPI0_NPCS0	PWML3	ISI_D11	-
	40	PD21	I/O	-	-	-	-
	41	PD23	I/O	-	-	-	-
	42	PC22	I/O	ISI_D3	RF1	-	-
	43	PE10	I/O	-	TIOB2	-	-
	44	PC1	I/O	SPI0_MOSI	PWML2	ISI_D9	-
	45	PD27	I/O	-	-	-	-
	46	PB26	I/O	PCK0	RK0	PWMH0	-
	47	PD20	I/O	-	-	-	-
	48	PD15	I/O	RTS1	SPI2_SPCK	-	-
	49	PD31	I/O	SPI0_NPCS2	PCK1	-	-
	50	+1.8V	POWER	-	-	-	-
	51	PIOBU1	I/O	-	-	-	-
	52	GND	POWER	-	-	-	-

4. Electrical specifications

DevelBoard is designed to operate at 3.3V. EVA 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 EVA 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 EVA.

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 EVA 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

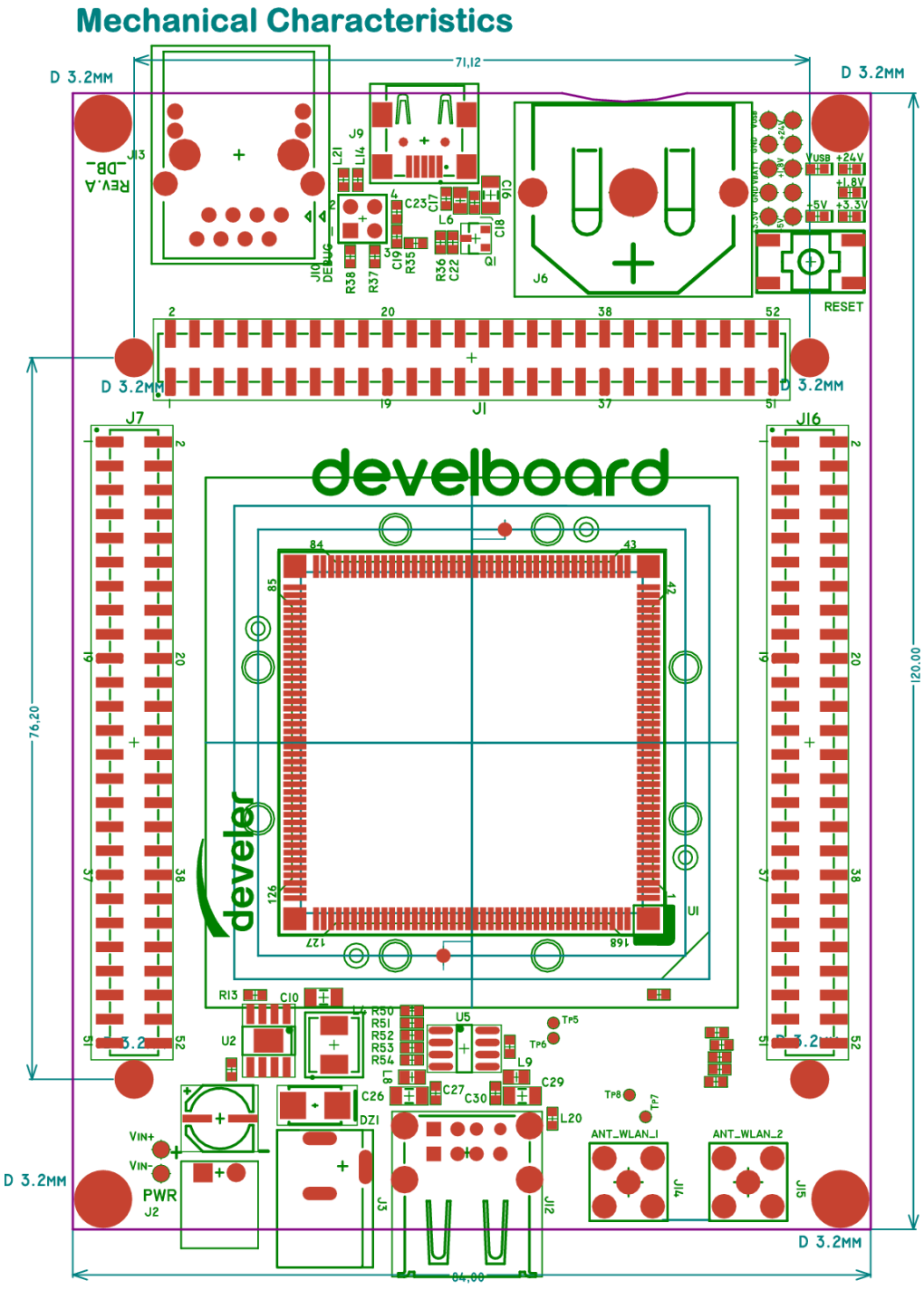
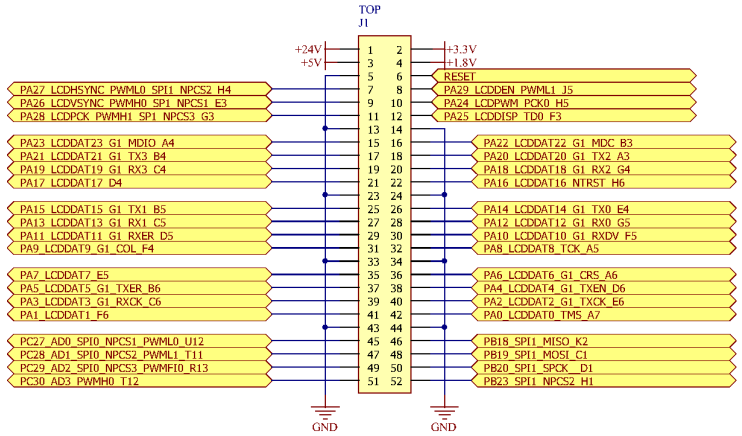
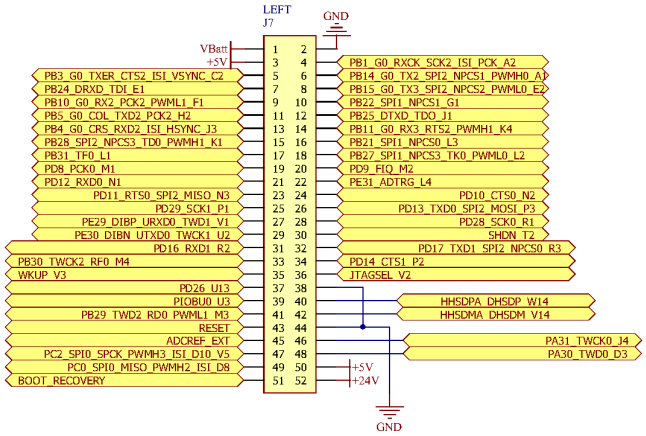
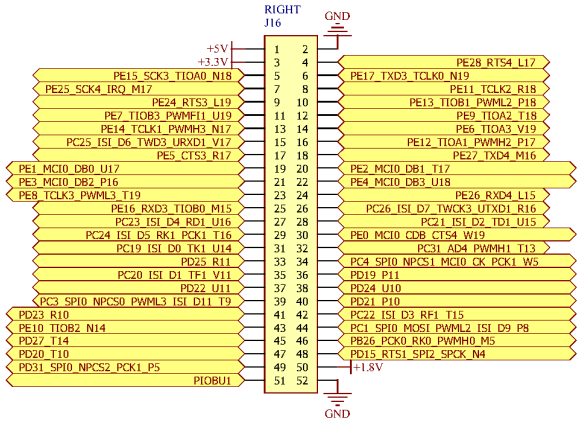


Figure 5.1. Dimensions







Title:
DevelBoard EVA Main Connectors

Author:
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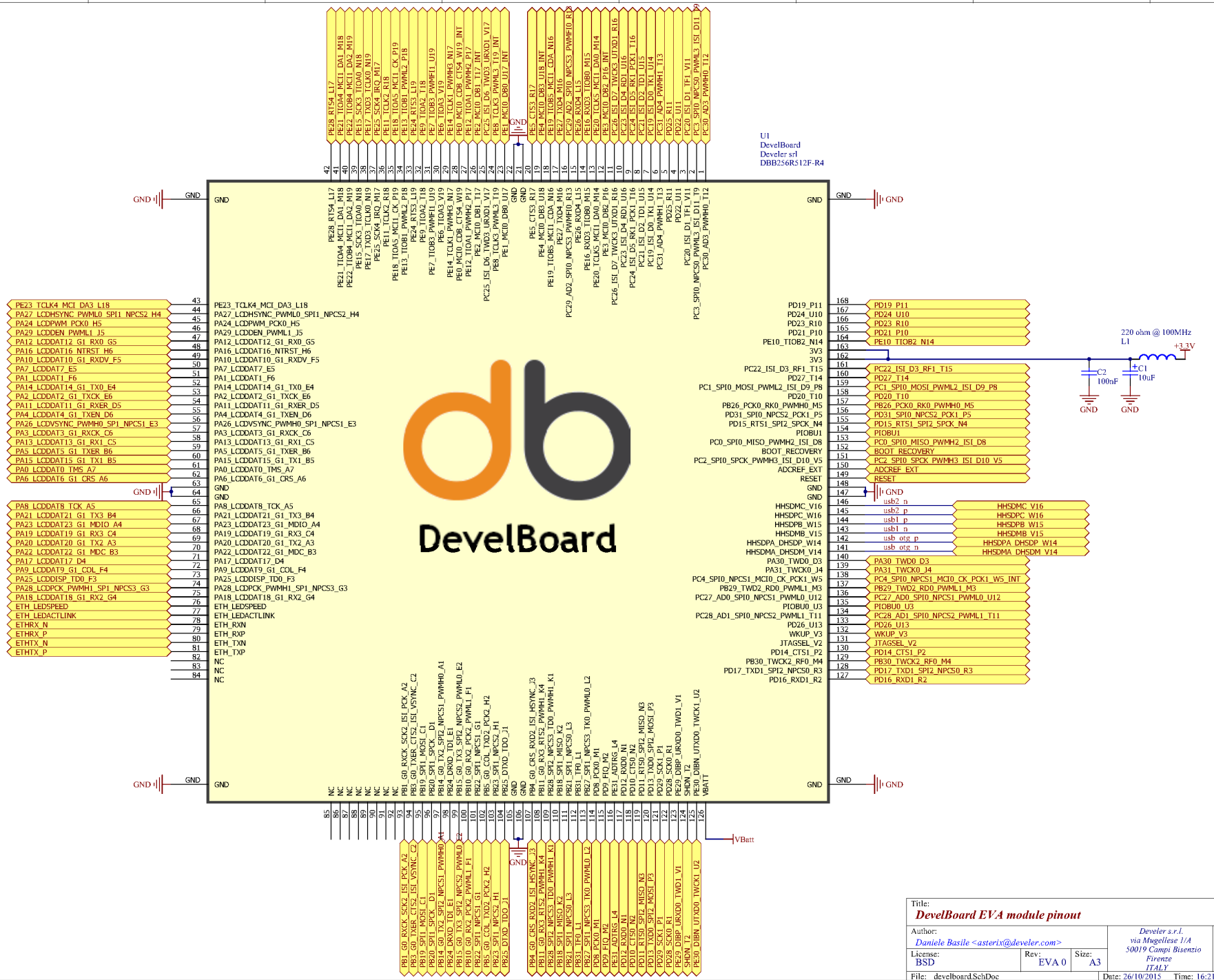
Develer s.r.l.
via Mugellese 1/A
50019 Campi Bisenzio
Firenze
ITALY

License: BSD | Rev: EVA 0 | Size: A3

File: connectors.SchDoc | Date: 26/10/2015 | Time: 16:21:21 | Sheet 1 of 6



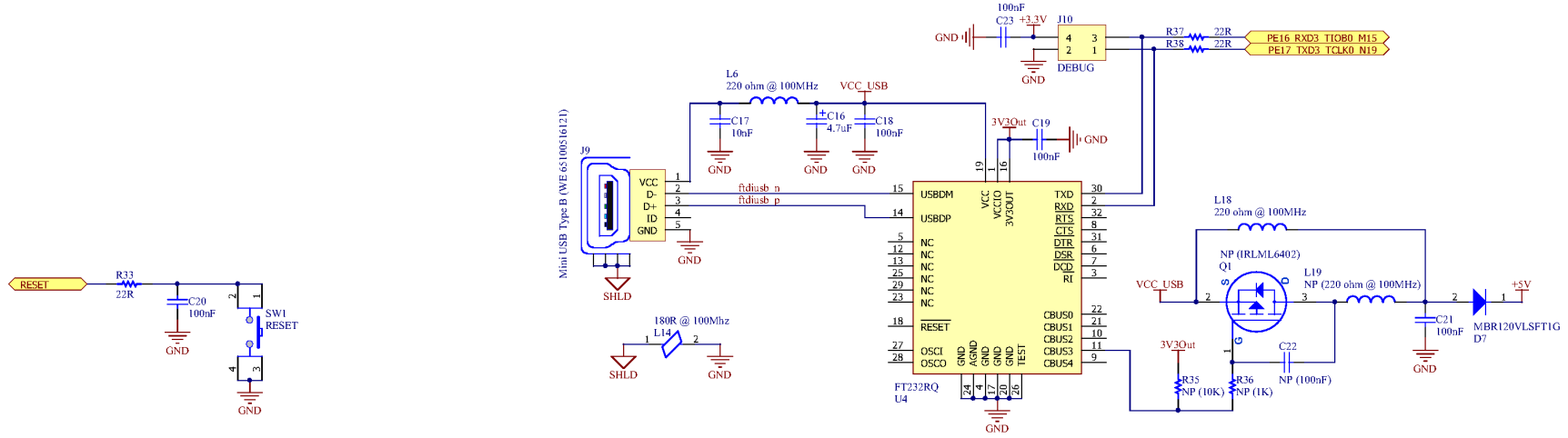
Title: DevelBoard EVA module pinout

Author: Daniele Basile <asterix@develer.com>

License: BSD | Rev: EVA 0 | Size: A3

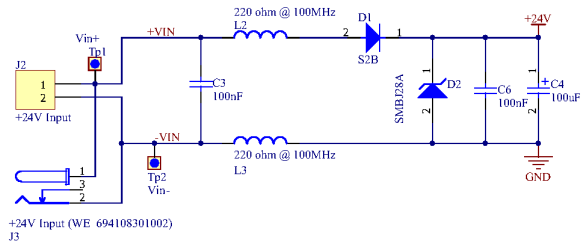
Develer s.r.l.
via Mugellese 1/A
50019 Campi Bisenzio
Firenze
ITALY

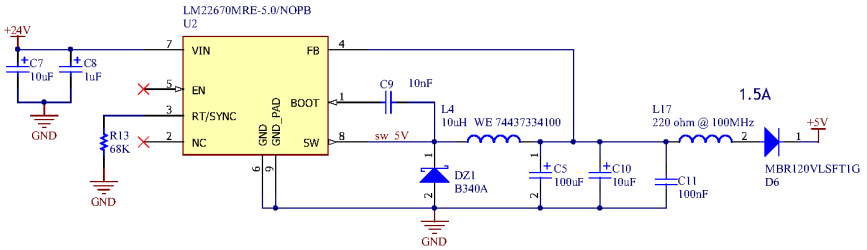
File: develboard.SchDoc | Date: 26/10/2015 | Time: 16:21:21 | Sheet 2 of 6

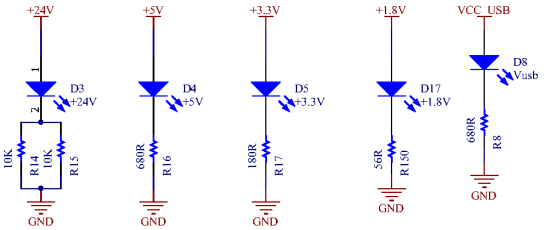


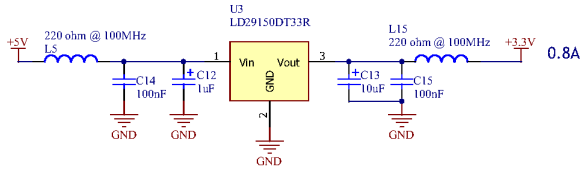
To boot from SD CARD use MCI1A

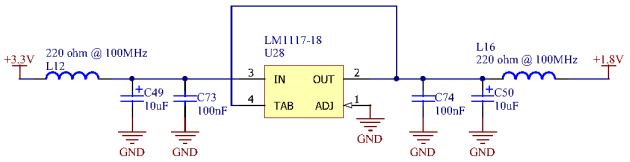
Title: *DevelBoard EVA MicroSD and Debug.*			
Author: *Daniele Basile <asterix@develer.com>*		*Develer s.r.l.* *via Mugellese 1/A* *50019 Campi Bisenzio* *Firenze* *ITALY*	develer
License: BSD	Rev: EVA 0	Size: A3	
File: sd_debug.SchDoc	Date: 26/10/2015	Time: 16:21:21	Sheet 3 of 6

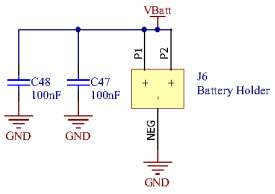


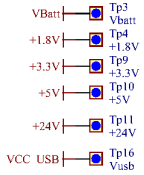


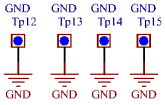




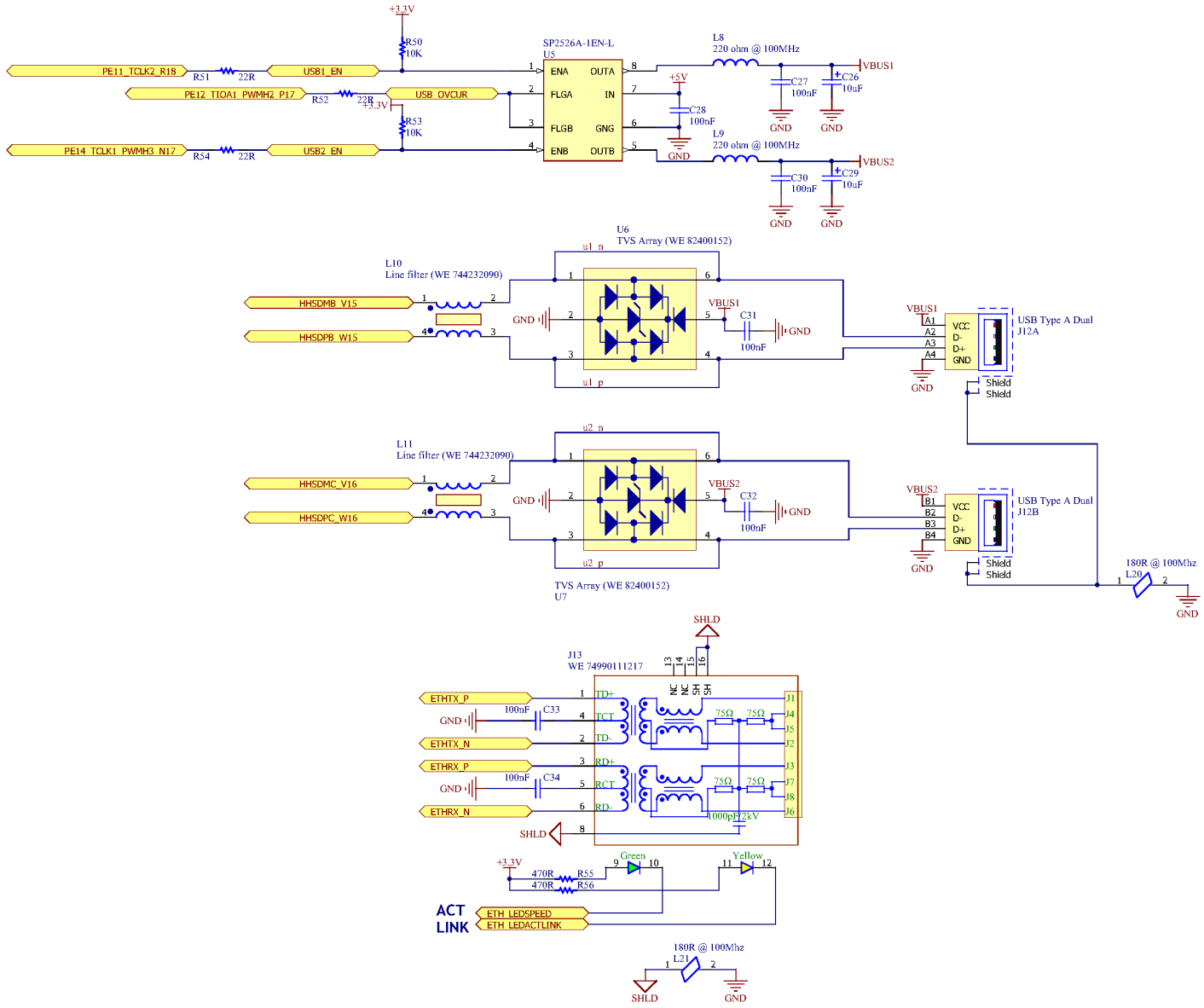




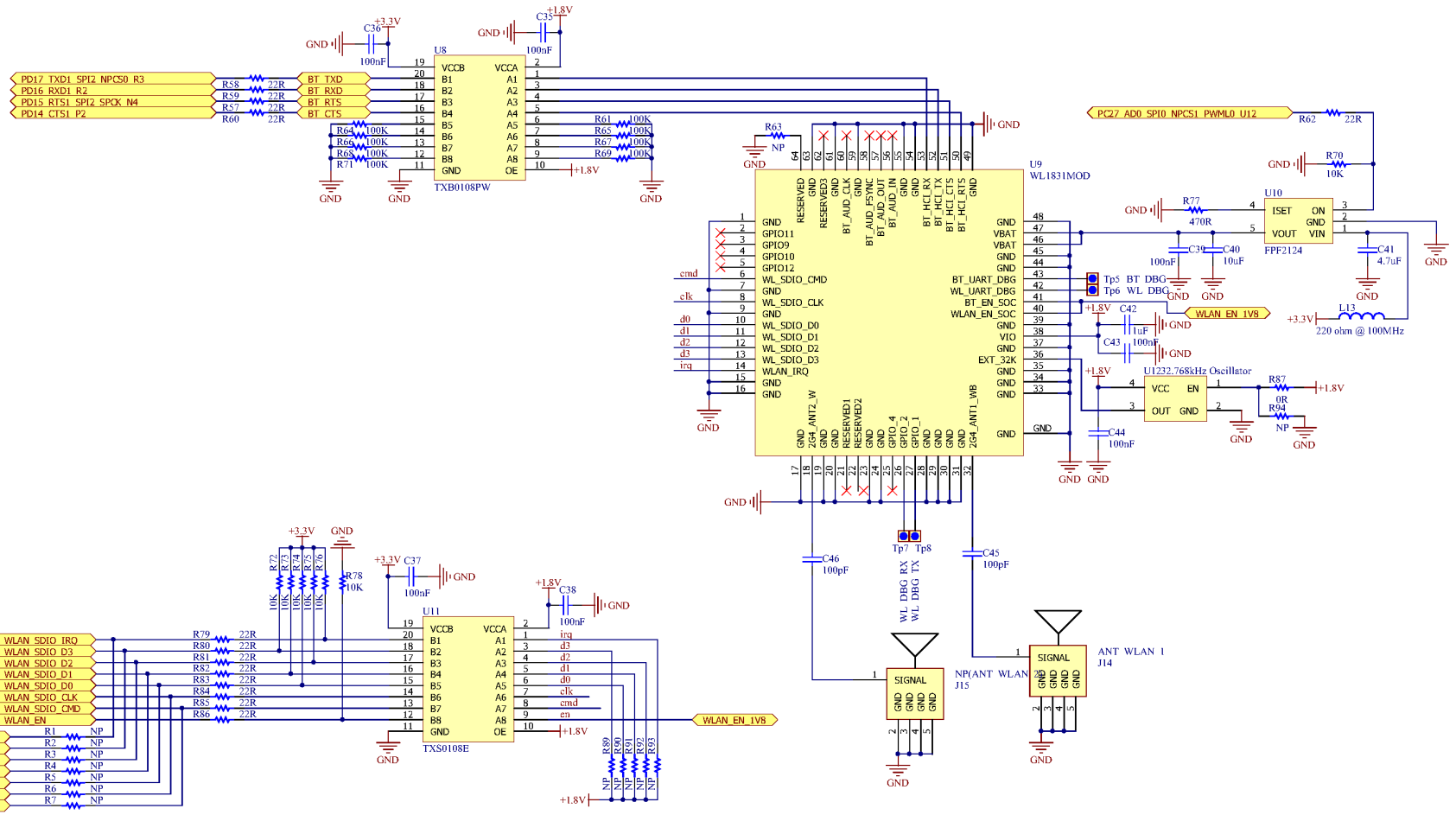




Title: *DevelBoard EVA Power Supply.*			
Author: *Daniele Basile <asterix@develer.com>*			*Develer s.r.l. via Mugellese 1/A 50019 Campi Bisenzio Firenze ITALY*
License: BSD	Rev: EVA 0	Size: A3	
File: supply.SchDoc	Date: 26/10/2015	Time: 16:21:21	Sheet 4 of 6



Title:	*DevelBoard EVA USB Host and Ethernet Connectors.*		
Author:	*Daniele Basile <asterix@develer.com>*	*Develer s.r.l.* *via Mugellese 1/A* *50019 Campi Bisenzio* *Firenze* *ITALY*	develer
License: BSD	Rev: EVA 0	Size: A3	
File: usb_ethernet.SchDoc	Date: 26/10/2015	Time: 16:21:21	Sheet 5 of 6



Title:	*DevelBoard EVA WiFi Module.*
Author:	*Daniele Basile <asterix@develer.com>*
License:	BSD
Rev:	EVA 0
Size:	A3
	Develer s.r.l. *via Mugellese 1/A* *50019 Campi Bisenzio* *Firenze* *ITALY*
File:	wifi.schdoc
Date:	26/10/2015
Time:	16:21:22
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