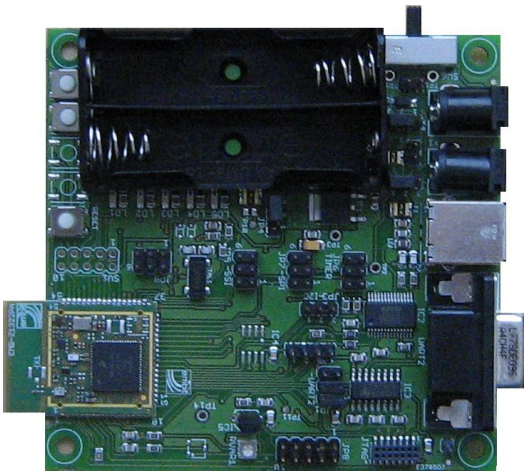
EMB-EVB
Unified Evaluation Board
For All Modules
From Embit
-
Reference Manual



embit s.r.l.

Document information

Versions & Revisions

Revision	Date	Author	Comments
1.0	06/04/2009	Embit	First release
2.0	06/09/2011	Embit	Newer evaluation board version (unified)
3.1	13/12/2012	Embit	Minor edits
3.2	17/05/2013	Embit	Add placement references
3.3	05/09/2013	Embit	Updated JP13 description
3.4	19/03/2014	Embit	Added schematic
3.5	30/05/2014	Embit	Changed name of module in schematic

References

Ref	Version	Date	Author	Title

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1 Introduction

1.1 Overview

This manual describes the hardware functionality of the Embit Evaluation Board (EVB). The board can carry every module with Embit standard pinout, including (but not limited to): EMB-WMBx EMB-Z253xPA EMB-ZRF2x EMB-ZRF212B EMB-BLE. See module documentation for specific hardware details.

1.2 Disclaimer of liability

The information provided in this and other documents associated to the product might contain technical inaccuracies as well as typing errors. Regulations might also vary in time. Updates to these documents are performed periodically and the information provided in these manuals might change without notice. The user is required to ensure that the documentation is updated and the information contained is valid. Embit reserves the right to change any of the technical/functional specifications as well as to discontinue manufacture or support of any of its products without any written announcement.

1.3 Trademarks

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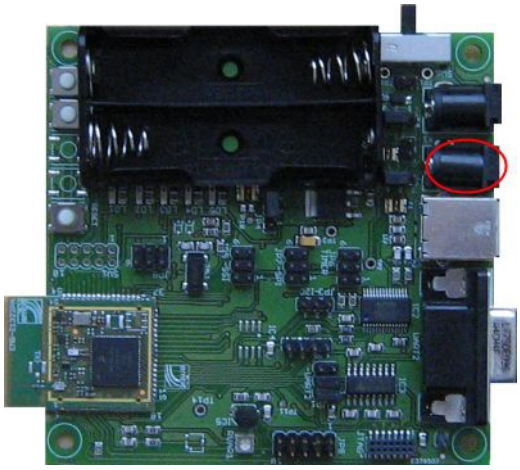
2 Power supply connectors

2.1 Filtered power connector (X1) (optional)

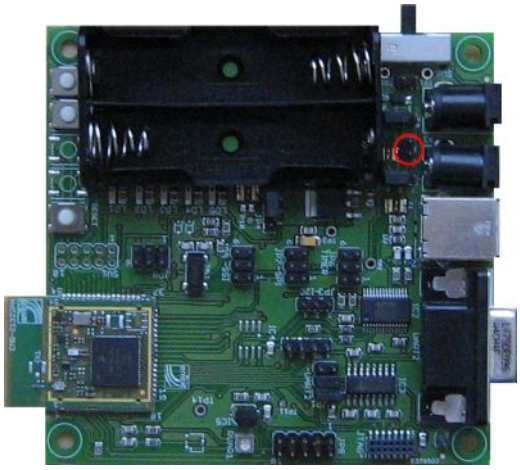


Coaxial male connector for powering the board. Specifications:

- Internal diameter 2,1 mm, external diameter 5,5 mm.
- Power supply: from 5 to 10 V dc.
- Polarity: +VCC internal, GND external.

The power line on the board is regulated by a 3,3V dc linear low drop-out voltage regulator.

2.2 Filtered power header (JP12)

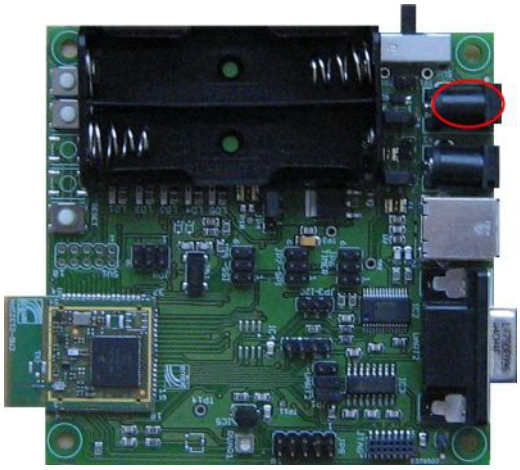


Header connector for powering the board.

This connector is in parallel with the associated coaxial connector X1. Higher pin (as seen in figure) is ground, lower pin is Vdd.

Avoid connecting a power source to both the coaxial connector and the header connector at the same time.

2.3 Unfiltered power connector (X4) (optional)



Coaxial male connector for powering the RF module. With this connector it is possible to power the RF module itself bypassing the whole board to measure current consumption, for example. There is no regulation stage here, the power provided is delivered directly to the module. Specifications:

- Internal diameter 2,1 mm, external diameter 5,5 mm.
- Power supply: depending on module installed, maximum 3,6V.
- Polarity: +VCC internal, GND external.

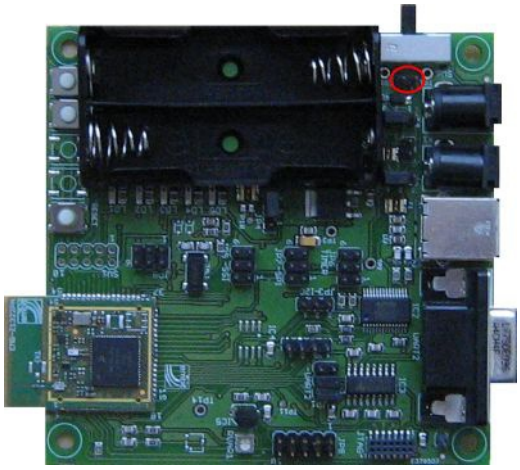
Warning: there is a no protection diode to avoid affecting the measure, double check the polarity of the power supply.

Note: to use this power source you must shortcircuit the pins 1-2 of the header JP4.

When using the this connector for powering the module care must be taken to avoid current leakage through the GPIO of the module to the other active components of the board (UART to USB converter, UART to RS232 converter, etc.). The board could be powered to the same voltage level as the module from an external source to avoid this.

This connector is optional and is typically not mounted.

2.4 Unfiltered power header (JP13)



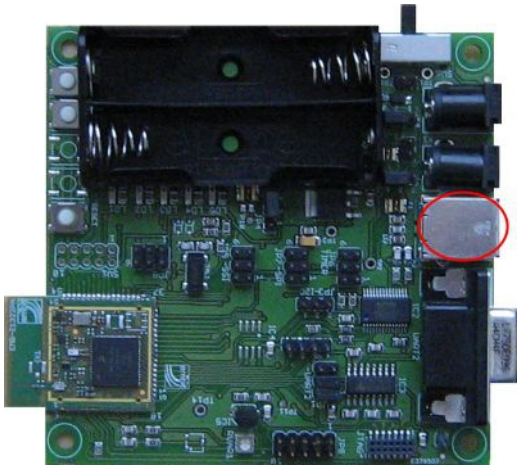
Header connector for powering the RF module.

This connector is in parallel with the associated coaxial connector X4. The pin on the right (as seen in figure) is ground, the pin on the left is Vdd. For details please refer to X4 connector documentation.

Avoid connecting a power source to both the coaxial connector and the header connector at the same time.

Warning: there is a no protection diode to avoid affecting the measure, double check the polarity of the power supply.

2.5 USB connector (X2)

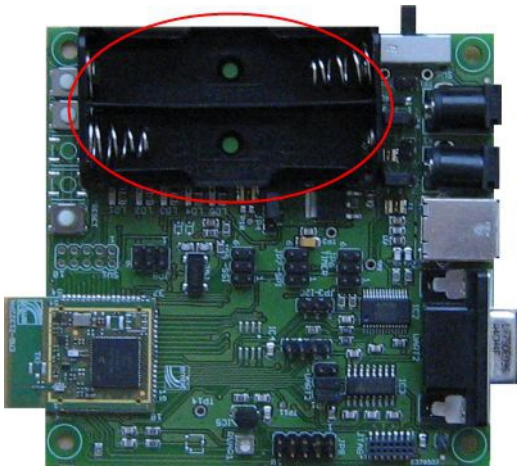


The board circuitry can be powered directly from a USB bus by plugging the USB cable to the USB connector (USB Type B).

The power line on the board is regulator with a 3,3V dc linear regulator. Make sure that the USB supply is capable to deliver enough current to supply the module.

Warning: In some cases, the current drain can be higher than the 500mA defined by the USB standard. Connect to an USB hub with external power supply capable do deliver enough power.

2.6 Battery holder (B1) (optional)

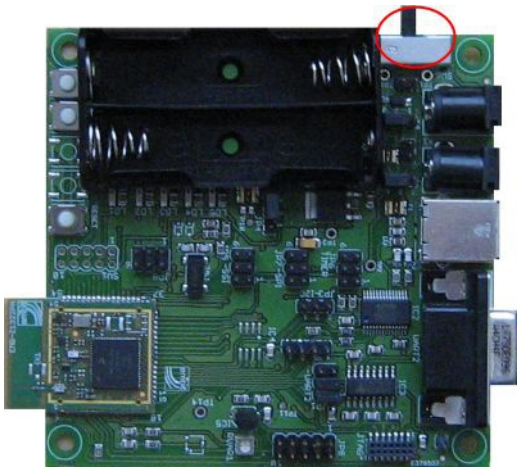


Slot for 2 AA alkaline batteries (1,5 V). The batteries must be connected with the proper orientation.

The use of rechargeable batteries is not allowed for safety reasons.

The 3,3V internal regulator is bypassed when powering from the batteries.

2.7 Power switch (SW6)



ON/OFF switch for power coming from:

1) External board power supply (X1);

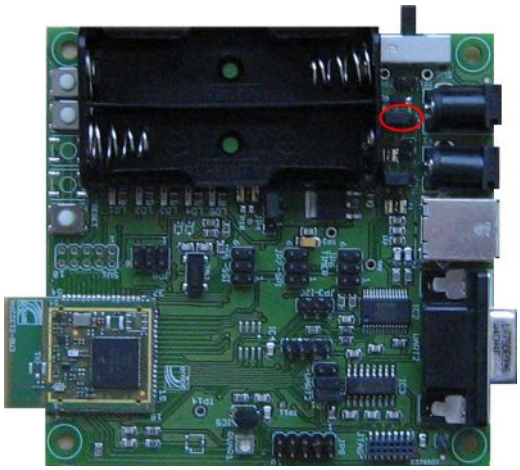
2) USB power supply (X2);

3) AA batteries power supply (B1).

If the switch is moved to the right, the board will be unpowered.

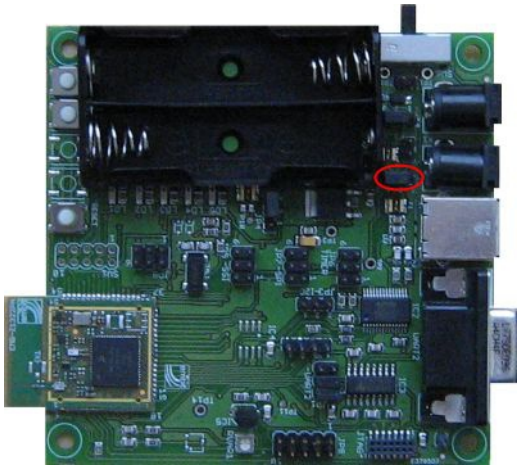
When the switch is moved to the left (as seen in the figure) and at least one of the three power supplies is present, the LED5 will turn on indicating that the board is powered. The switch doesn't control the power coming from the X4 connector.

2.8 Power filter source header (JP10)



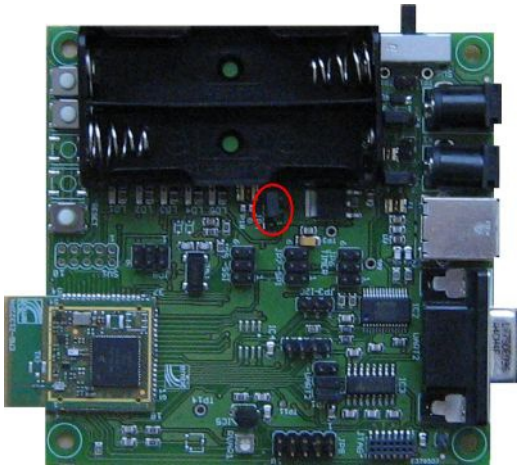
The highlighted header is used to select the external power source to be filtered. If the jumper is mounted on the right (1-2), the voltage regulator will be powered by the external supply connected to the filtered power connector. If the jumper is mounted on the left (2-3 as seen in the picture), the voltage regulator source will be the USB connector.

2.9 Board supply header (JP2)



The highlighted header is used to select the power source that will be supplied to the board. If the jumper is mounted on the right (3-2), the board power will come from the batteries. If the jumper is mounted on the left (1-2 as seen in the picture), the board power will come from the voltage regulator.

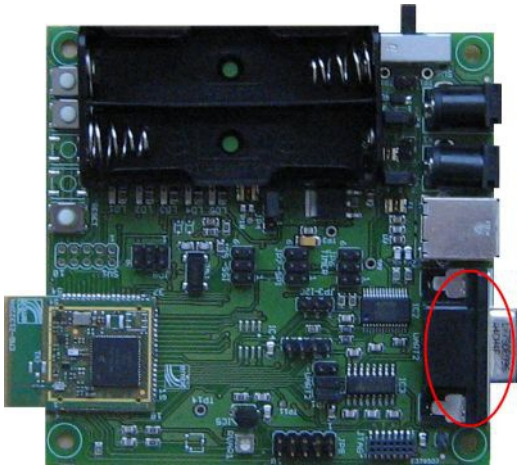
2.10 Module supply header (JP4)



The highlighted header is used to select the power source that will be supplied to the module. If the jumper is mounted on the higher position (3-2 as seen in the picture), the module voltage supply will come from the board voltage supply. If the jumper is mounted on the lower position (1-2), the module will be powered directly from the external source present in the unfiltered power connector (X4).

3 Communication interfaces

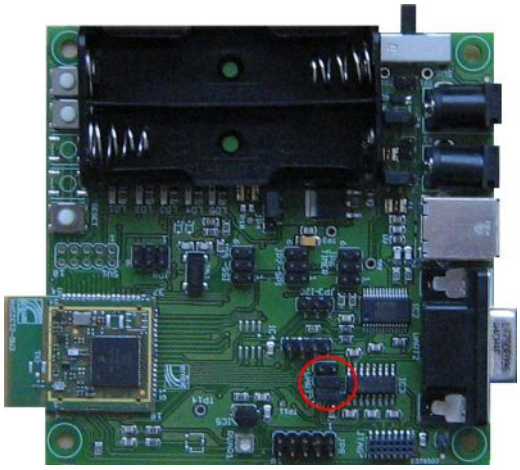
3.1 RS232 connector (X3)



DSUB 9 ways female connector for interfacing to RS-232 buses. This connector allows the connection from module to host over the UART2 serial port. The RS232 line is not equipped for hardware flow control.

Pin	Signal	Module	Direction
1	Not connected	--	--
2	UART2_TX	pin 21	Out
3	UART2_RX	pin 20	In
4	Not connected	--	--
5	GND	--	--
6	Not connected	--	--
7	Not connected	--	--
8	Not connected	--	--
9	Not connected	--	--

3.2 UART2 header (JP1)

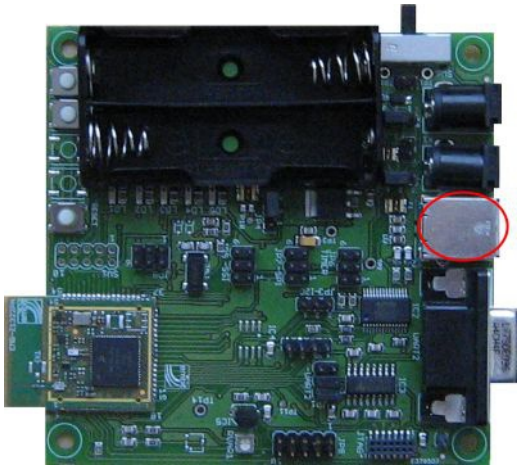


With this header the signals coming from UART2 can be connected to the UART to RS232 converter (with two jumpers). If the jumpers are removed, the UART2 port can be connected with an external system. The two pins on top are connected to ground, the second row of pins are the module RX line (on the left) and the converter TX line (on the right). The last row of pins (those on the bottom) are the module TX line (on the left) and the converter RX line (on the right).

Pin 1 is bottom right (in figure).

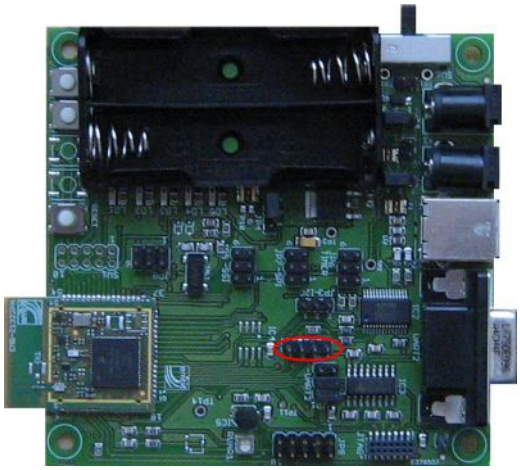
Pin	Signal	Module	Direction
1	TX signal to RS232	--	Input
2	UART2_TX	pin 21	Output
3	RX signal from RS232	--	Output
4	UART2_RX	pin 20	Input
5	GND	--	--
6	GND	--	--

3.3 USB connector (X2)



Type B USB connector (2.0 full-speed compatible) which allows accessing from a PC to the UART1 of the module through a virtual serial port over USB (FTDI FT232R USB-to-Serial UART converter). The UART to USB conversion implements a full UART with hardware flow control (TX, RX, RTS, CTS). Furthermore the USB port can be used to power the board.

3.4 UART1 header (JP14)

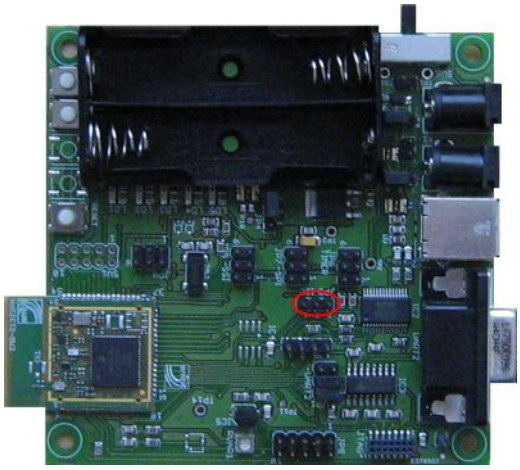


The UART1 serial port of the RF module can be interfaced through the USB connector or with a header. The UART1 signals from the module are connected directly to this header and then, with some 1.5 kOhm resistors for those signals driven by the USB to UART converter, to the converter itself. If the user needs to use the UART it can force the status of the pins through this header.

Pin 1 is left (in figure).

Pin	Signal	Module	Direction
1	UART1_RX (host TX through 1.5 kOhm)	Pin 24	Input / Output
2	UART1_TX (host RX)	Pin 25	Output
3	UART1_RTS (through 1.5 kOhm)	Pin 22	Input / Output
4	UART1_CTS	Pin 23	Output

3.5 I2C header (JP3)



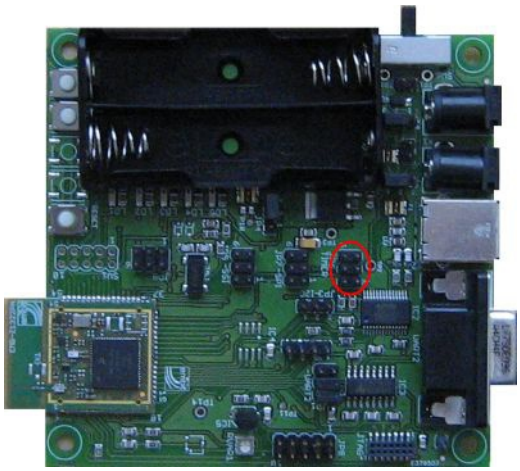
3 ways 2,54 mm pitch header male connector, for interfacing to the I2C bus.

Pin 1 is left (in figure).

Pin	Signal	Module	Dir.
1	GND	--	--
2	I2C SCL	Pin 27	I/O
3	I2C SDA	Pin 26	I/O

On the board two 10 kOhm pull up resistors are installed on each of the i2c lines. Furthermore, there are pads for soldering an external flash. This device is connected over the i2c bus (see appropriate paragraph).

3.6 Timer header (JP6)

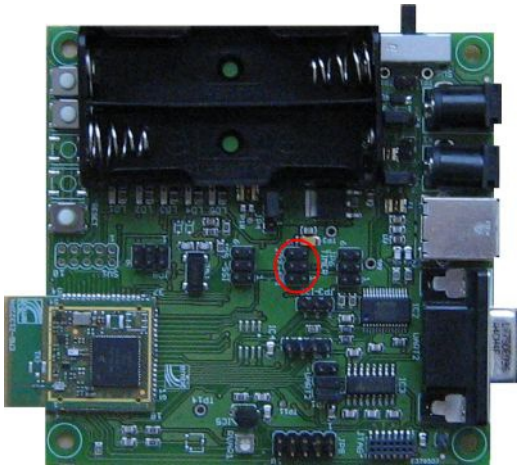


2x3 ways 2,54 mm pitch header male connector, for interfacing to the timer lines.

Pin 1 is bottom right (in figure).

Pin	Signal	Module	Dir.
1	GND	--	--
2	VCC	--	--
3	Timer 0	Pin 31	I/O
4	Timer 1	Pin 30	I/O
5	Timer 2	Pin 29	I/O
6	Timer 3	Pin 28	I/O

3.7 SPI header (JP7)

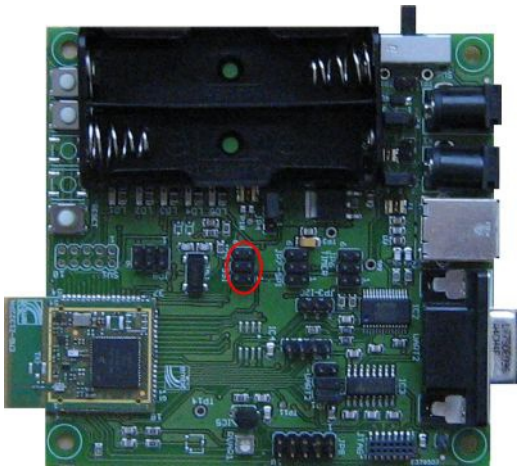


2x3 ways 2,54 mm pitch header male connector, for interfacing to the SPI lines.

Pin 1 is bottom right (in figure).

Pin	Signal	Module	Dir.
1	GND	--	--
2	VCC	--	--
3	SPI MISO	Pin 34	I/O
4	SPI MOSI	Pin 33	I/O
5	SPI SS#	Pin 35	I/O
6	SPI CLK	Pin 32	I/O

3.8 SSI header (JP5)



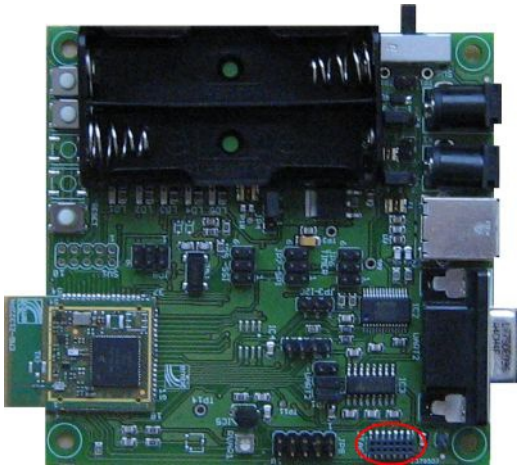
2x3 ways 2,54 mm pitch header male connector, for interfacing to the SSI lines (where available).

Pin 1 is bottom right (in figure).

Pin	Signal	Module	Dir.
1	GND	--	--
2	VCC	--	--
3	SSI_TX	Pin 40	I/O
4	SSI_RX	Pin 39	I/O
5	SSI_BITCK	Pin 36	I/O
6	SSI_FSYN	Pin 38	I/O

4 Debug / other interfaces

4.1 Debugging interface connector (U2)

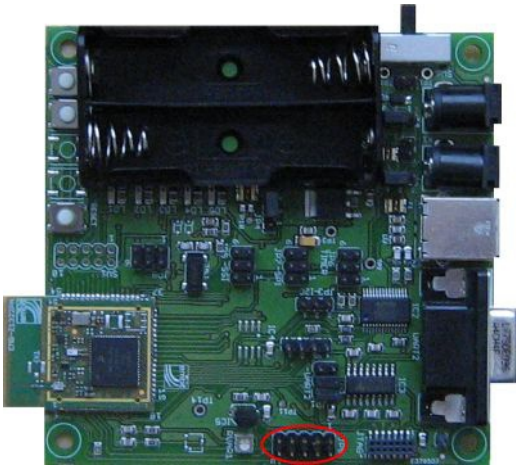


The Debugging interface of the evaluation board has a custom pinout specifically designed by Embit in order to provide compatibility with every microcontroller used in Embit's modules. This enables the user to change module on every design, changing RF technology and performances, without having to change anything on the host board. The connector is a 2x7 ways 1,27 mm pitch female header. With the provided adapter, the debug hardware associated with the microcontroller mounted on the module can be connected to the board.

Pin 1 is top right (in figure).

Pin	Signal	Module	Direction
1	GND	--	--
2	Vref+ (for memory erase on EMB-Z1322PA)	Pin 3	Input
3	VDD (from the board)	--	Output
4	Vref- (for memory erase on EMB-Z1322PA)	Pin 2	Output
5	TCK (for JTAGs), Debug clock (for CC debugger)	Pin 15	Input
6	RESET#, PDI clock (for Atmel's PDI emulator)	Pin 51, 52	Input
7	TDO (for JTAGs), Debug data (for CC debugger)	Pin 13	Input / Output
8	PDI data (for Atmel's PDI emulator)	Pin 53	Input / Output
9	TMS (for JTAGs)	Pin 16	Input
10	Not connected	--	--
11	TDI (for JTAGs)	Pin 14	Input
12	Not connected	--	--
13	RTCK (for EMB-Z1322PA) / TEST (for MSP430)	Pin 12	Input / Output
14	Not connected	--	--

4.2 Analog signals header (JP8)



2x5 ways 2,54 mm pitch header male connector, for interfacing to the analog lines (where available).

Pin 1 is top right (in figure).

Some ADC lines (ADC_3, ADC_4, ADC_6) are used to interfacing the sensors mounted on the board.

The Vref- and Vref+ lines are used for the hardware chip erase in the EMB-Z1322PA module. To start a chip erase, the following connections must be made and the module must be reset:

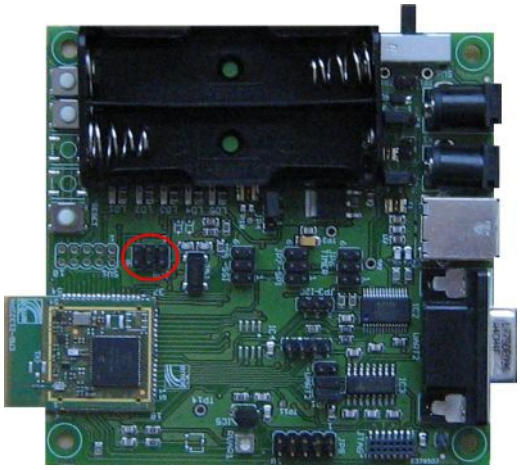
• Vref- = VCC (+3,3 Vdc);

• Vref+ = GND.

The ADC_7 line is used by the JTAG too in the EMB-Z1322PA module. During debug with JTAG, this line could be not available.

Pin	Signal	Module	Direction
1	GND	--	--
2	GND	--	--
3	VDD	--	--
4	VDD	--	--
5	Vref+	Pin 3	Input
6	ADC_1	Pin 6	Input
7	ADC_5	Pin 10	Input
8	ADC_7	Pin 12	Input
9	ADC_2	Pin 7	Input
10	VDD	--	--

4.3 PDI Header (JP9)

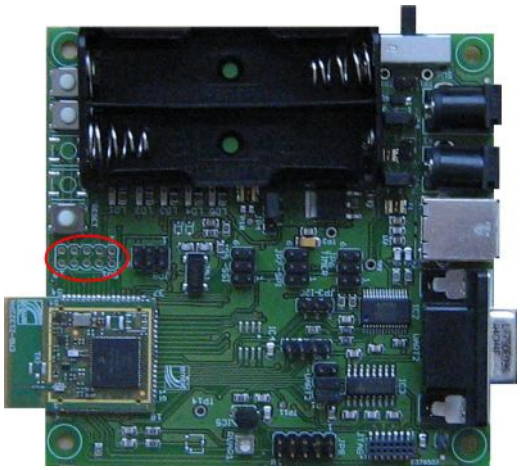


2x3 ways 2,54 mm pitch header male connector, for interfacing to Atmel's PDI programming interface.

Pin 1 is top right (in figure).

Pin	Signal	Module	Dir.
1	PDI data	Pin 53	I/O
2	VCC	--	--
3	Not connected	--	--
4	Not connected	--	--
5	PDI clock / Reset #	Pin 51	I/O
6	GND	--	--

4.4 Digital GPIO header (SV1)



2x5 ways 2,54 mm pitch header male connector, for interfacing to the digital lines used on the board for switches and LEDs.

Care must be taken when using this line to avoid overcurrent due to LED in parallel with an external load or due to the switch forcing a stas on the gpio different than the one imposed from the external source. In some modules (EMB-Z1322PA for example) the GPIOS connected to the switches are weakly pulled up by the micro itself.

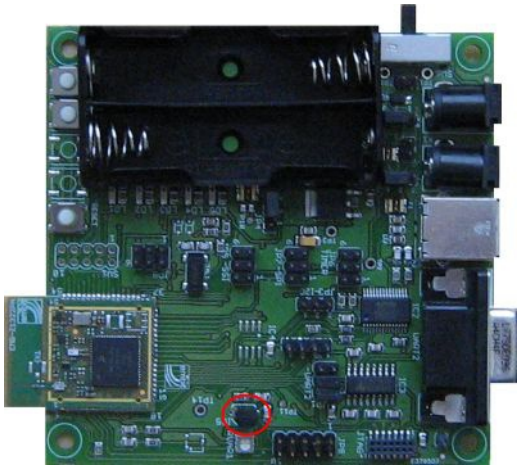
Pin 1 is top right (in figure).

Pin	Signal	Module	Direction
1	GND	--	--
2	VDD	--	--
3	LED1	Pin 48	Input / Output
4	LED2	Pin 47	Input / Output
5	LED3	Pin 46	Input / Output
6	LED4	Pin 45	Input / Output

7	Switch 1	Pin 44	Input / Output
8	Switch 2	Pin 43	Input / Output
9	Switch 3	Pin 42	Input / Output
10	Switch 4	Pin 41	Input / Output

On the board a 128 Kbit EEPROM memory (IC4: 24LC124) is installed on the i2c bus. The memory has a physical address on the bus of (A0,A1,A2) = (0,0,0). The JP3 connector can be used to debug the i2c signal flow too.

5 Temperature sensor (optional)

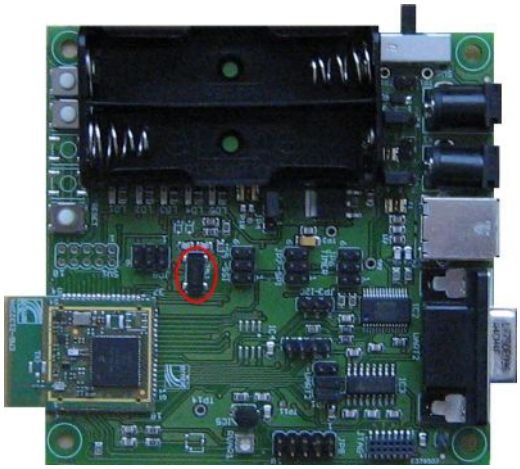


An analog temperature sensor (National Semiconductor LM61BIZ) is installed on the board and connected to the ADC6 line. The output of the sensor is 10 mV / °C with an offset of +600 mV.

Note: ADC6 pin may be not used on some modules.

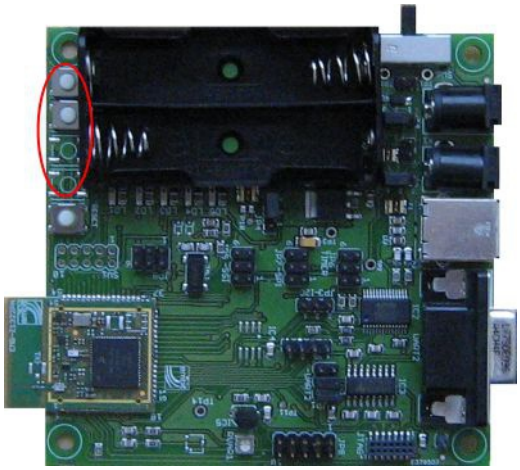
Pin	Signal	Module	Direction
	ADC6	Pin 11	Analog

6 32.768 kHz Crystal



A 32.768 kHz crystal is installed on the board for obtaining an accurate RTC. The component (ABS25 Abracon Corporation family) is connected to the XTAL_IN (pin 49) and XTAL_OUT (pin 50) lines of the module.

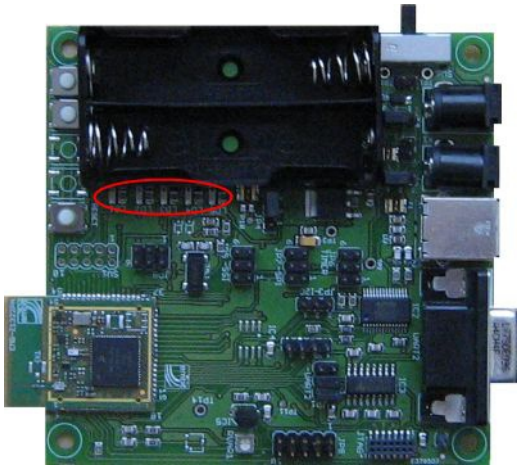
7 Switches



The 4 push-button on the board (some might not be mounted) are connected to 4 GPIOs that can handle interrupts. By pushing a button, the corresponding line is grounded.

Switch	Module
SW1	Pin 44
SW2	Pin 43
SW3	Pin 42
SW4	Pin 41

8 Leds



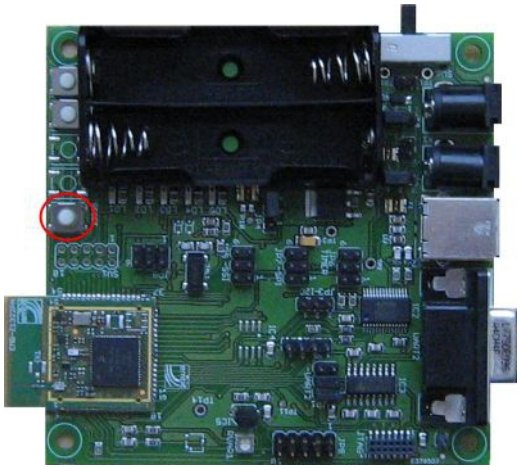
The 4 leds mounted on the board are connected to 4 GPIO lines as follows:

LED	Module
LD1	Pin 48
LD2	Pin 47
LD3	Pin 46
LD4	Pin 45

To light up an LED, the corresponding line must be driven to high logical level

A fifth LED is installed (LD5) and lights up when the board is powered.

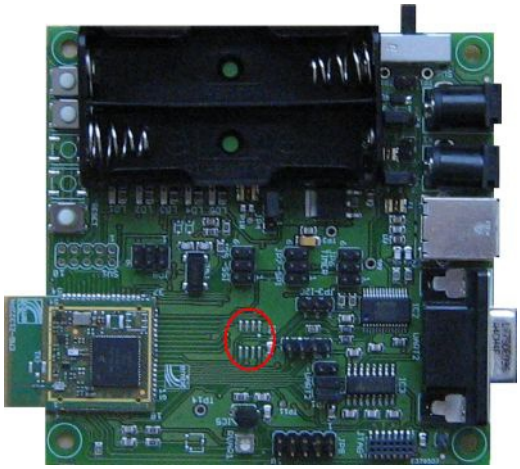
9 Reset



The hardware reset of the module can be forced by pressing the SW5 button. The switch signal is kept high by a 10 kOhm pull-up resistor and the signal is routed to the RESET# pin on the module (pin 51) through a 1 kOhm series resistor. By pressing SW5 the RESET# line is grounded (through this 1 kOhm resistor).

The programming interface is allowed to force the reset line too.

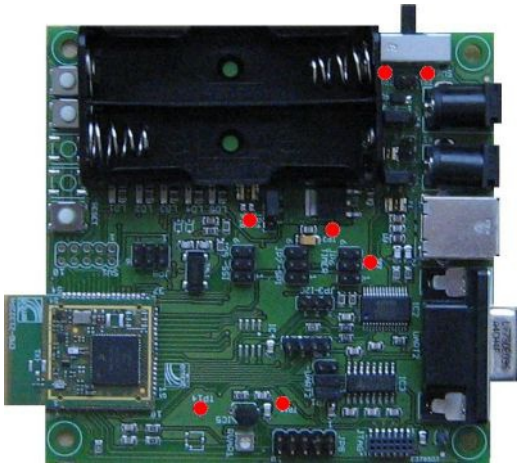
10 I2C External memory (optional)



The board features soldering pads to install an external i2c memory in order to test the i2c bus or for firmware swap.

The suggested device is the 24LC128-I/SN (or different versions of the same with larger capacity if required).

11 Test Points

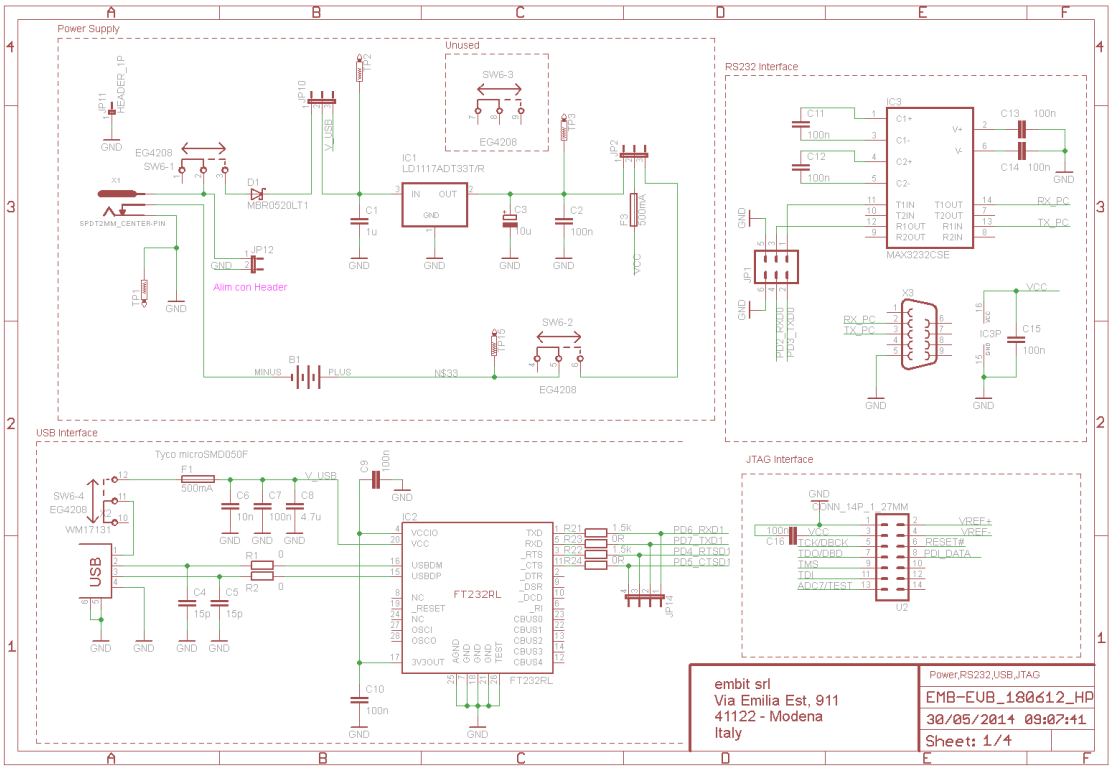


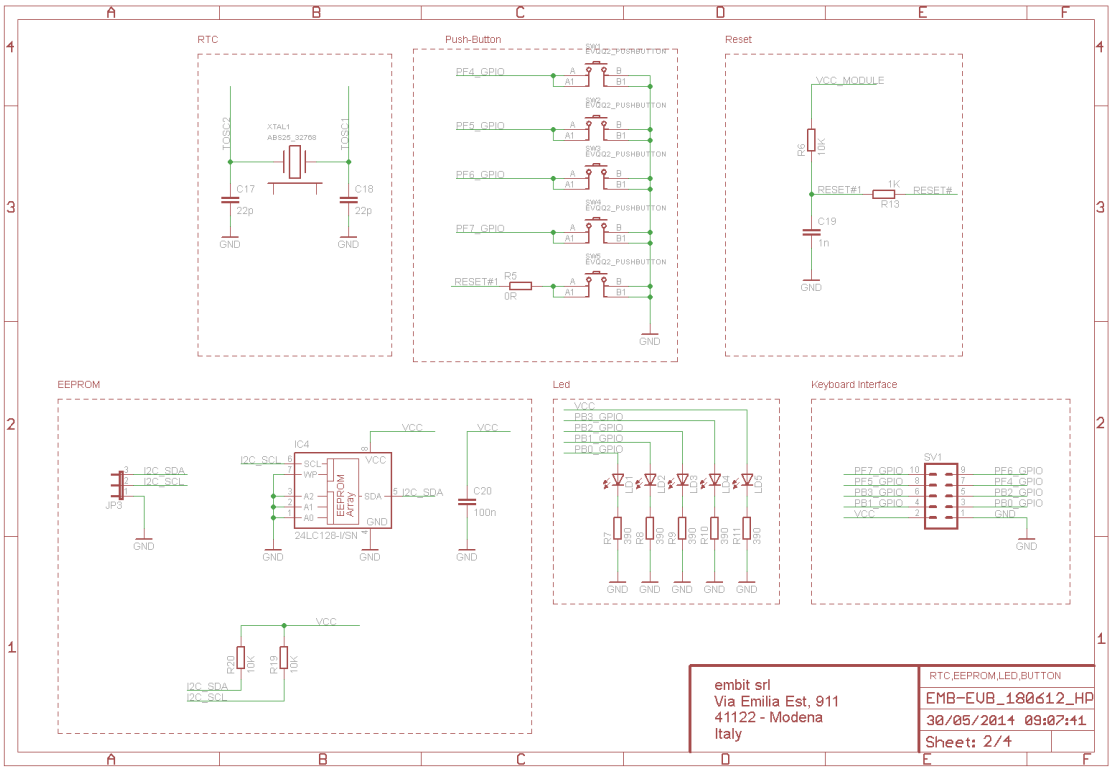
On the board there are lots of test points, both SMD and PTH.

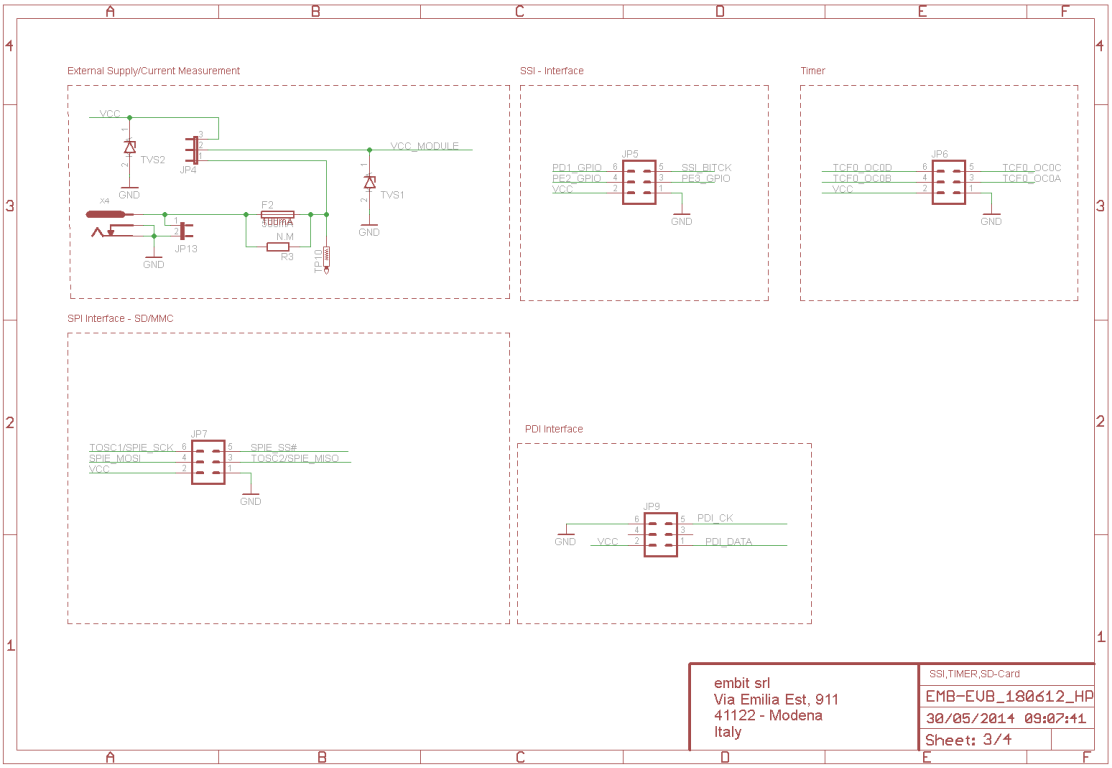
In the picture on left the position of the test points is highlighted and in the following table each test point's function is explained.

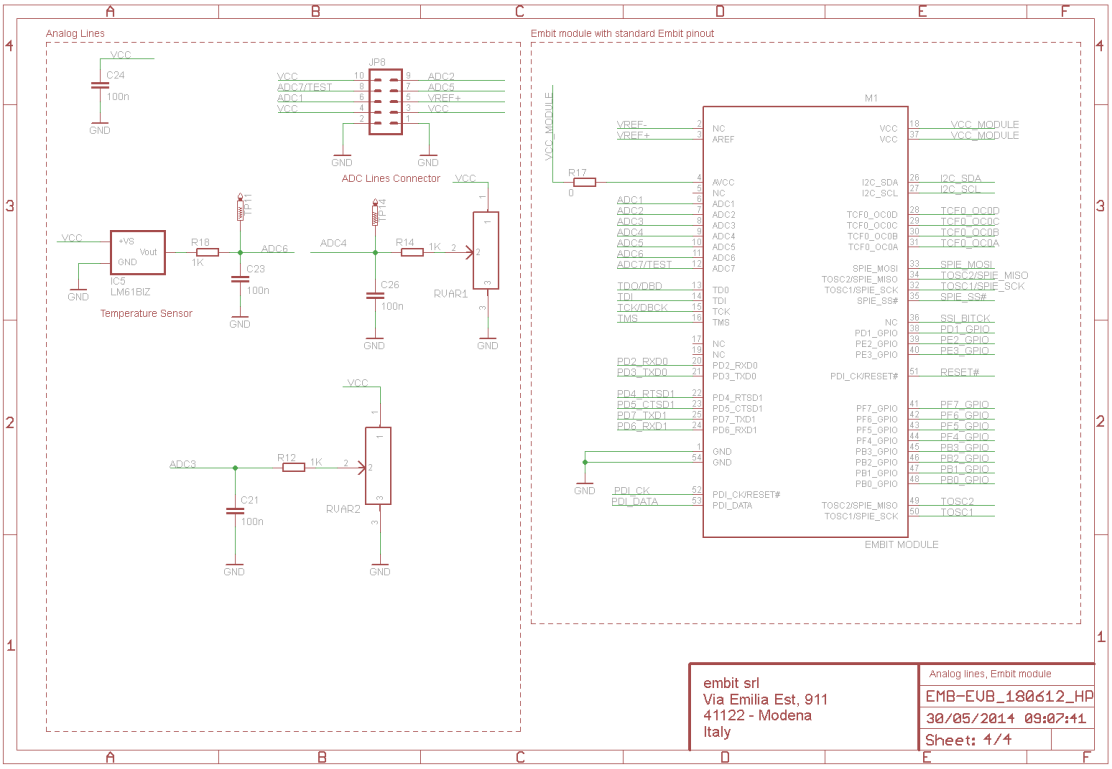
Test Point	Line	Pin on the module	Comments
TP1	GND	--	--
TP2	V_MAIN	--	Power supply entering the linear regulator
TP3	--	--	Power supply after the linear regulator
TP10	--	18,37	Power supply entering the module
TP11	ADC_6	11	Temperature sensor output
TP14	ADC_4	9	Trimmer output
TP15	--	--	Batteries voltage

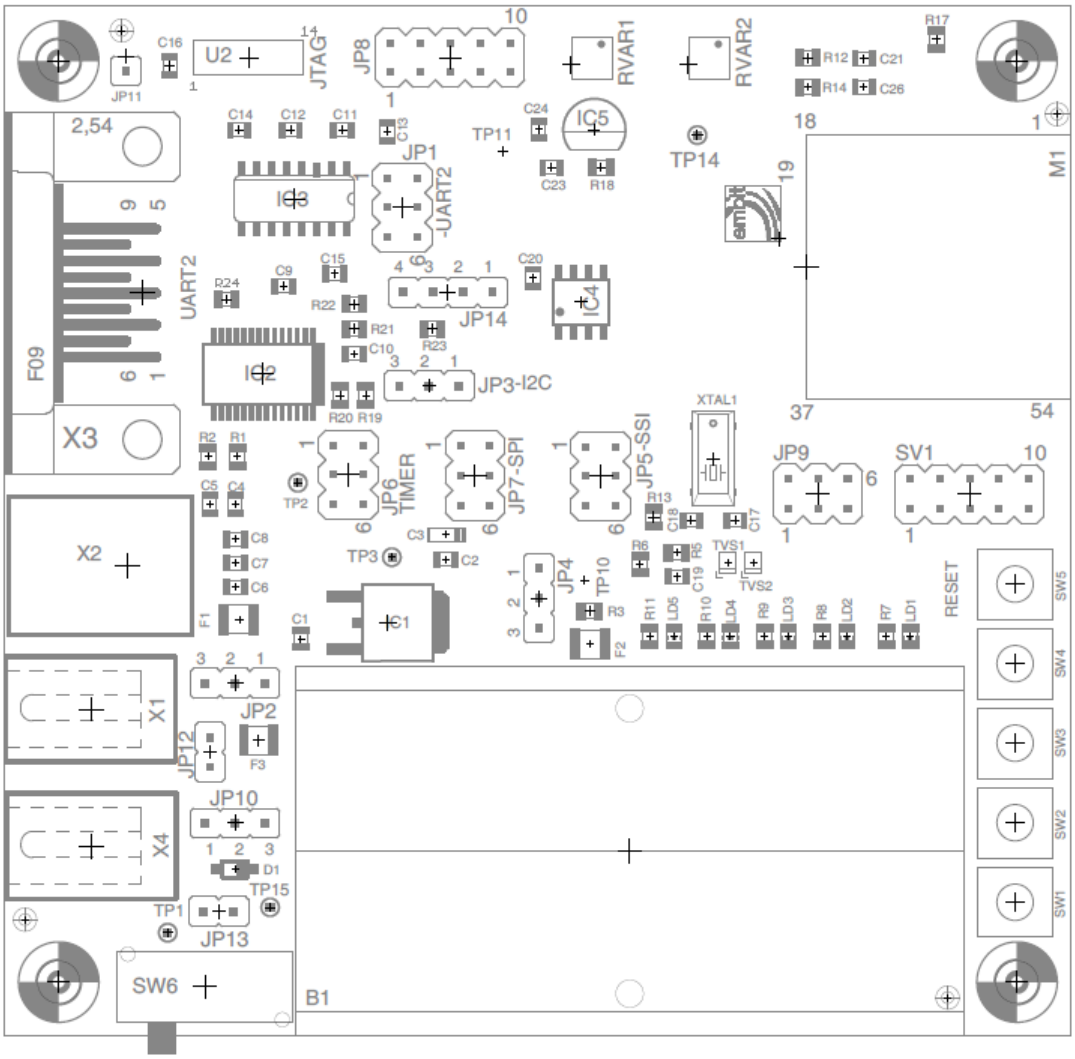
12 Board schematic and placing






External Supply/Current Measurement
SSI - Interface
Timer
SPI Interface - SD/MMC
PDI Interface
VCC
VCC_MODULE
GND
TVS2
TVS1
JP4
JP13
JP5
JP6
JP7
JP9
F2
400mA
N.M
R3
TP10
PD1_GPIO
PE2_GPIO
SSI_BITCK
PE3_GPIO
TCF0_OC0D
TCF0_OC0B
TCF0_OC0C
TCF0_OC0A
TOSC1/SPIE_SCK
SPIE_MOSI
SPIE_SS#
TOSC2/SPIE_MISO
PDI_CK
PDI_DATA
embit srl
Via Emilia Est, 911
41122 - Modena
Italy
SSI,TIMER,SD-Card
EMB-EUB_180612_HP
30/05/2014 09:07:41
Sheet: 3/4


Analog Lines
Embit module with standard Embit pinout
JP8
ADC Lines Connector
C24
100n
IC5
LM61BIZ
Temperature Sensor
R18
1K
C23
R14
C26
RVAR1
R12
C21
RVAR2
ADC1
ADC2
ADC3
ADC4
ADC5
ADC6
ADC7/TEST
VREF+
VREF-
M1
EMBIT MODULE
VCC_MODULE
I2C_SDA
I2C_SCL
RESET#
embit srl
Via Emilia Est, 911
41122 - Modena
Italy
Analog lines, Embit module
EMB-EUB_180612_HP
30/05/2014 09:07:41
Sheet: 4/4


U2
JTAG
JP8
RVAR1
RVAR2
JP11
C16
TP11
IC5
TP14
JP1
UART2
IC3
JP14
IC4
IC2
JP3-I2C
X3
X2
X1
X4
JP6
TIMER
JP7-SPI
JP5-SSI
XTAL1
JP9
SV1
TP2
TP3
JP4
TP10
JP2
JP12
JP10
TP15
TP1
JP13
SW6
B1
M1
F09
RESET
SW5
SW4
SW3
SW2
SW1