

# **SmartFusion2 SOM (System-On-Module) Baseboard Hardware Architecture**

Version 1.5

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## 1. Introduction

This document is the Technical Specification for the Emcraft Systems SOM (System-On-Module) baseboard (SOM-BSB-EXT).

The SOM-BSB is intended to provide a hardware platform for the evaluation of and initial custom product development with the Emcraft Systems SmartFusion2 SOM product.

The SOM-BSB-EXT can be powered either from the USB port or from a separate external 5 volt power supply.

All the unused pins of the SOM are routed to a breadboard area on the SOM-BSB-EXT, which facilitates hardware and software prototyping.

The SOM-BSB-EXT comes complete with the hardware schematics and Bill of Materials (BOM) file, facilitating the design of custom baseboard hardware for the Emcraft Systems SOMs.

## 2. Hardware Platform

This section defines the hardware platform of the SOM-BSB-EXT.

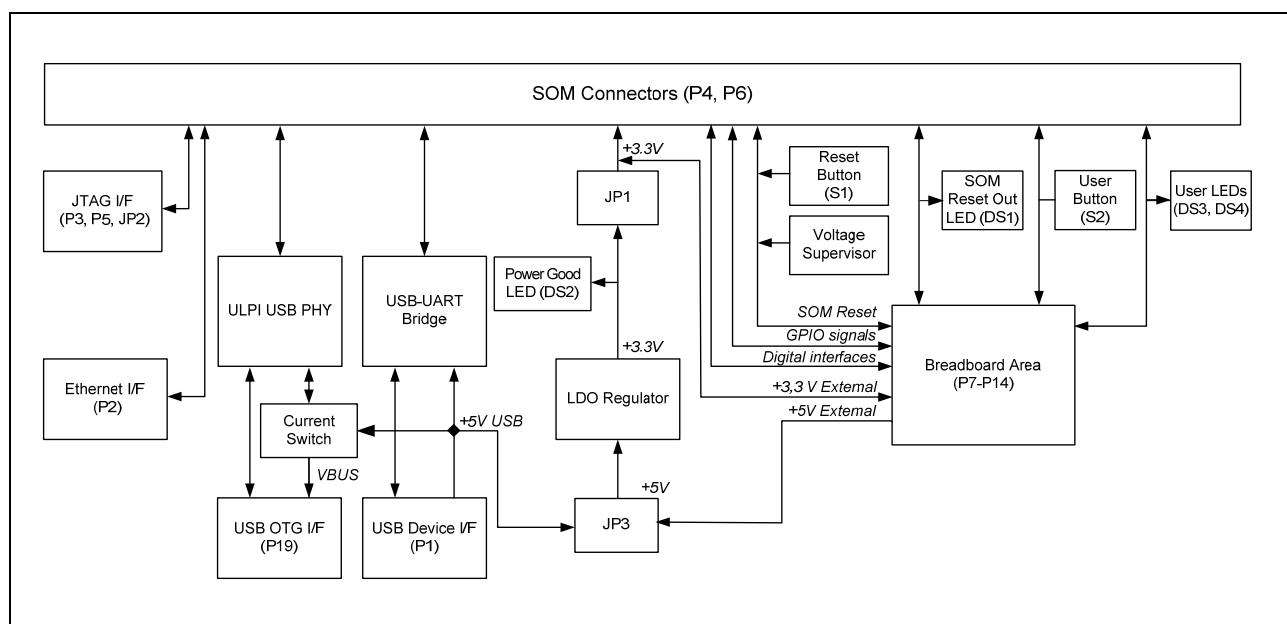
### 2.1. Overview

The SOM-BSB-EXT implements the following hardware facilities:

- Two 80-pin SOM connectors;
- USB UART and power interface using USB/UART bridge connected to the UART0 port of the SOM;
- 10/100 Ethernet interface and RJ-45 connector;
- USB OTG Interface and mini-USB connector;
- Microsemi FlashPro JTAG interface, for programming of the SmartFusion2 device on the SmartFusion2 SOM;
- Standard 20-pin ARM JTAG interface, for debugging of the SmartFusion2 Cortex-M3 MCU;
- LDO regulator for conversion of the USB +5 V to the +3.3 V SOM power supply;
- Reset push button;
- Reset-out LED;
- User push button connected to GPIO on the SOM;
- Power Good LED indicating presence of the +3.3 V SOM power;
- Two user-controlled LEDs connected to GPIO on the SOM;
- Unused SOM signals available on the breadboard area;
- Possibility to provide necessary power supply voltages (+5 V, +3.3 V) from external sources through dedicated pads of the breadboard area.

## 2.2. Functional Block Diagram

Figure 1 is the functional block diagram of the SOM-BSB-EXT.



**Figure 1:** SOM-BSB-EXT Functional Block Diagram

## 2.3. SOM Connectors

The SOM-BSB-EXT provides two Hirose DF40 series connectors for the connection to the SOM. The connectors are 80-pin, 0.4 mm pitch receptacles, providing 4 mm stacking height.

## 2.4. USB UART Interface

The SOM-BSB-EXT provides a USB UART interface on the type B mini USB connector (P1).

The interface is provided using an FTDI FT232RL USB-UART bridge. The FT232RL UART TX and RX pins are connected to the SOM serial console UART port.

## 2.5. Ethernet Interface

The SOM-BSB-EXT provides a 10/100 Ethernet interface using the P2 connector. This is an RJ-45 Ethernet port providing 10 Mbit (10BASE-T) and 100 Mbit (100BASE-TX) protocols.

The SOM-BSB-EXT provides two status LEDs integrated in the P2 connector. The LEDs are:

- Yellow, used to indicate the 10/100 Mbit link status when lit;
- Green, used to indicate RX/TX activity when blinking.

The LEDs are connected on the SOM-BSB-EXT between the SOM outputs and +3.3 V power plane.

## 2.6. USB OTG Interface

The SOM-BSB-EXT provides a USB OTG interface on the mini B USB connector (P19).

The interface is implemented using the USB ULPI interface of the SmartFusion2. On the SOM-BSB-EXT the interface is buffered using an SMSC USB3300-EZK ULPI USB PHY device.

To improve quality of the USB signals, custom designs that use the SOM-BSB-EXT schematics as a reference are recommended to add voltage suppressors such as, for

instance, the Littelfuse PGB1010603M device onto the USB data lines (USB\_OTG\_N, USB\_OTG\_P, USB\_N, and USB\_P).

**Note:** Depending on what revision of SmartFusion2 SOM is used with SOM-BSB-EXT, to make the ULPI interface operational, resistors R37, R38, R39, R40, R42, R43 should be installed as follows:

- M2S-SOM Rev 1A:
  - R37, R39, R42 - installed;
  - R38, R40, R43 - not installed.
- M2S-SOM Rev 2A:
  - R37, R39, R42 - not installed;
  - R38, R40, R43 - installed.

## 2.7. Microsemi FlashPro JTAG Interface

The SOM-BSB-EXT provides a JTAG interface on the P5 connector for use with the Microsemi FlashPro device for programming of the SmartFusion2 SoC FPGA on the SmartFusion2 SOM.

The connector is a standard 10-pin JTAG port fully compatible with the Microsemi FlashPro3/4 devices.

Jumpers on the JP2 header set the mode of the SmartFusion2 JTAG controller and connect +3.3 V from the output of the LDO regulator to the programming supply voltage pin and the JTAG controller supply voltage pin on the SmartFusion2.

The default settings of JP2 are: 1-2 open, 3-4 closed. For further details on the JP2 settings, see Section 4.

## 2.8. ARM JTAG Interface

The SOM-BSB-EXT provides an ARM JTAG interface on the P3 connector for debugging of the SmartFusion2 SoC FPGA on the SmartFusion2 SOM.

The connector is a standard 20-pin JTAG port supported by standard Cortex-M3 programmers/emulators.

When using the Cortex-M3 programmer/emulators for debugging of the SmartFusion2 Cortex-M3 MCU the settings of the JP2 header should be: 1-2 closed, 3-4 closed. For further details on the JP2 settings, see section 4.

## 2.9. Power

The SOM-BSB-EXT receives the +5 V power from the USB connector. Additionally, it is possible to supply an external +5 V power through the dedicated pad P10.2 of the SOM-BSB-EXT breadboard area. Configuration of the +5 V input power supply is defined by the JP3 header. The default settings of the JP3 are: 1-3 open, 2-4 closed. For further details on the JP3 settings, see Section 4.

The +3.3 V supply voltage for the SOM and other components of the SOM-BSB-EXT is derived from the +5 V input voltage using a TPS73733DCQ LDO regulator. The regulator dissipates approximately 1 Watt and is mounted on a heatsink. The SOM-BSB-EXT provides a green Power Good LED that indicates presence of the +3.3 V power on the output of the LDO regulator.

It is possible to turn the LDO regulator off for debug purposes. To do so, the control signal VCC3\_EN (P10.6 pad of the SOM-BSB-EXT breadboard area) must be connected to the ground.

## 2.10. Reset Button

The SOM-BSB-EXT provides the S1 reset button used to trigger a hardware reset of the SOM.

## 2.11. Reset LED

The Reset LED indicates the status of the `nRESET_OUT` signal of the SOM. The LED is lit when `nRESET_OUT` is low.

## 2.12. User Button and User LEDs

The SOM-BSB-EXT provides the S2 user button and the DS3 and DS4 user LEDs as a simple input/output interface for testing and demonstration purposes.

For further details, refer to Sections 5 and 6.

## 2.13. Breadboard Area

All unused signal pins of the SOM are available on the breadboard area marked as P7-P14. For further details, refer to Section 3.7.

# 3. Connectors

This section provides a full pin definition of all connectors available on the SOM-BSB-EXT.

## 3.1. SOM-BSB-EXT Connectors

Table 1 provides a summary of the SOM-BSB-EXT connectors:

Connector	Description
P1	Mini USB Type B connector (USB UART interface)
P2	RJ45 Ethernet connector
P3	ARM JTAG connector
P4, P6	SOM interface connectors
P5	Microsemi FlashPro JTAG connector
P7-P14	Breadboard area (no actual connectors installed)
P19	Mini USB Type B connector (USB OTG interface)

**Table 1:** SOM-BSB-EXT Connectors

## 3.2. Mini USB Type B Connectors

The P1 and P19 USB connectors have a standard mini-B receptacle pin-out.

## 3.3. RJ45 Ethernet Connector

The P2 is a standard RJ45 NIC connector with the following definition:

Pin	Signal
1	TX+
2	TX-
3	RX+
4, 5	Unused pair; terminated on the SOM-BSB-EXT
6	RX-
7, 8	Unused pair, terminated on the SOM-BSB-EXT

**Table 2:** Ethernet Connector

### 3.4. SOM Interface Connectors

For the definition of the two 80-pin SOM connectors (P4 and P6) refer to the *SmartFusion2 SOM Hardware Architecture* document.

### 3.5. Microsemi FlashPro JTAG Connector

The P5 is a standard 10-pin Microsemi FlashPro JTAG connector with the following definition:

Pin	Signal	Type	Description
1	JTAG_TCK	Input	JTAG clock signal to the SmartFusion2.
2, 10	GND	Power	Target ground.
3	JTAG_TDO	Output	JTAG data output from the SmartFusion2.
4	NC	No Connection	JTAG mode set input of target MCU.
5	JTAG_TMS	Input	JTAG mode select.
6	VJTAG_VPP	Power	Not connected to M2S-SOM.
7	VJTAG_VPP	Power	Not connected to M2S-SOM.
8	JTAG_nTRST	Input	JTAG controller reset.
9	JTAG_TDI	Input	JTAG data input to the SmartFusion2.

**Table 3:** FlashPro JTAG Connector

### 3.6. ARM JTAG Connector

The P3 is a standard 20-pin ARM JTAG connector with the following definition:

Pin	Signal	Type	Description
1	VCC3	Power	Target MCU reference voltage.
2	NC	No Connection	
3	JTAG_nTRST	Input	JTAG controller reset.
4, 6, 8, 10, 12, 14, 16, 18, 20	GND	Power	Target ground.
5	JTAG_TDI	Input	JTAG data input to the SmartFusion2.
7	JTAG_TMS	Input	JTAG mode select.
9	JTAG_TCK	Input	JTAG clock signal to the SmartFusion2.
11, 17, 19	-	-	These pins are not connected to the SOM connectors and are pulled to GND on the SOM-BSB-EXT.
13	JTAG_TDO	Output	JTAG data output from the SmartFusion2.
15	nRESET_IN	Input/Output	Target MCU reset signal.

**Table 4:** ARM JTAG Connector

### 3.7. Breadboard Area

**Note:** Users of the SF2-STARTER-KIT-ES (Rev 1A SOM) and SF2-STARTER-KIT-ES-2 (Rev 2A SOM) should be aware of the following planned design change. With the next revision of the Emcraft Systems SmartFusion2 SOM, certain 3.3 V signals available on the SOM interface connectors will be switched to 2.5 V LVCMOS signals. Consequently, the corresponding

signals available on the SOM-BSB-EXT baseboard 2 mm breakout area will be switched to 2.5 V as well.

Any such signals are marked with "(2.5 V)" in Column "SOM Connector Pin" in the following tables. Any signals that do not have such marking are 3.3 V signals.

The reason for this change is that the SmartFusion2 IO banks that drive these signals have a max voltage rating of 2.5 V. Driving these signals at 3.3 V reduces the lifetime of the SmartFusion2 device to approximately 2.7 years. Switching these signals to 2.5 V will eliminate this problem.

It is extremely important that customers planning to design custom baseboards for the SmartFusion2 SOM or add-on boards for the SOM-BSB-EXT baseboard be aware of this change, and plan their 2.5/3.3 V signals use accordingly.

**Note:** For the multi-function SmartFusion2 signals, the item in Bold shows the function initialized by the Libero project included with the SmartFusion2 Starter Kit.

The test points in the breadboard area are grouped as PCB patterns for 12x2 2 mm pitch through-hole connectors (P7-P14) with the following definition:

Breadboard Pin #	Signal Name	SOM Connector Pin	Connected To
1	VCC3	77, 79 on P4	+3.3 V SOM power supply.
2, 8, 10, 12, 14, 16, 18, 20, 22, 23, 24,	GND	2, 3, 5, 8, 9, 11, 14, 57, 75, 76 on P4	SOM ground.
3	ADC8	68 on P4	SmartFusion2 pin R28 (MSIO24NB3/SPI_1_SS3/GPIO_16_A).
4	ADC17	66 on P4	SmartFusion2 pin R24 (MSIO24PB3/SPI_1_SS2/GPIO_15_A).
5	ADC9	64 on P4	SmartFusion2 pin R29 (MSIO23NB3/SPI_1_SS1/GPIO_14_A).
6	ADC18	40 on P4 (2.5 V)	SmartFusion2 pin v1 (MSIOD127PB7).
7	ADC10	52 on P4 (2.5 V)	SmartFusion2 pin AJ19 (DDRIO167NB5/FDDR_DQS2_N);  (SmartFusion2 pin AK9 (DDRIO148PB5/PROBE_A) in SOM Rev 3A).
9	ADC11	48 on P4 (2.5 V)	SmartFusion2 pin w7 (MSIOD141PB7).
11	ADC12	55 on P4 (2.5 V)	SmartFusion2 pin AK20 (DDRIO168NB5/FDDR_DQ20).
13	ADC13	58 on P4 (2.5 V)	SmartFusion2 pin AK22 (DDRIO173NB5/FDDR_DQS3_N).
15	ADC14	53 on P4 (2.5 V)	SmartFusion2 pin AK19 (DDRIO167PB5/FDDR_DQS2).
17	ADC15	50 on P4 (2.5 V)	SmartFusion2 pin AK18 (DDRIO165PB5/FDDR_DQ16).
19	ADC16	42 on P4 (2.5 V)	SmartFusion2 pin v5 (MSIOD130PB7).

**Table 5:** P7 Breadboard Area Connector



Breadboard Pin #	Signal Name	SOM Connector Pin	Connected To
1	VCC3	77, 79 on P4	+3.3 V SOM power supply.
2, 4, 6, 8, 10, 12, 14, 16, 18, 19, 20, 21, 22, 23, 24	GND	2, 3, 5, 8, 9, 11, 14, 57, 75, 76 on P4	SOM ground.
3	ADC0	70 on P4	SmartFusion2 pin G28 (FLASH_GOLDEN_N).
5	ADC1	60 on P4 (2.5 V)	SmartFusion2 pin AJ24 (DDRIO179NB5/FDDR_CAS_N).
7	ADC4	56 on P4 (2.5 V)	SmartFusion2 pin AJ22 (DDRIO173PB5/FDDR_DQS3).
9	ADC5	54 on P4 (2.5 V)	SmartFusion2 pin AJ20 (DDRIO170PB5/FDDR_DQ23); (SmartFusion2 pin AJ9 (DDRIO148NB5/PROBE_B) in SOM Rev 3A).
11	ADC3	46 on P4 (2.5 V)	SmartFusion2 pin W6 (MSIOD133NB7).
13	ADC2	44 on P4 (2.5 V)	SmartFusion2 pin V6 (MSIOD129PB7).
15	ADC6	51 on P4 (2.5 V)	SmartFusion2 pin AJ18 (DDRIO165NB5/FDDR_DQ17).
17	ADC7	47 on P4	SmartFusion2 pin Y2 (MSIOD131PB7).

Table 6: P8 Breadboard Area Connector

Breadboard Pin #	Signal Name	SOM Connector Pin	Connected To
1	VCC3	77, 79 on P4	+3.3 V SOM power supply.
2	VCC1V5	78, 80 on P4	Not connected on SOM.
3	VBATT	74 on P4	Not connected on SOM.
4, 12, 21, 22, 23, 24	GND	2, 3, 5, 8, 9, 11, 14, 57, 75, 76 on P4	SOM ground.
5	1V5_EN	72 on P4	Not connected on SOM.
6	UART_1_TXD	28 on P4	SmartFusion2 pin H30 (MSIO41NB1/MMUART_1_TXD/GPIO_24_B/USB_DATA2_C).
7	UART_1_RXD	31 on P4	SmartFusion2 pin G29 (MSIO42NB1/MMUART_1_RXD/GPIO_26_B/USB_DATA3_C).
8	I2C_0_SCL	33 on P4	SmartFusion2 pin K24 (MSIO48NB1/I2C_0_SCL/GPIO_31_B/USB_DATA1_C).
9	I2C_0_SDA	27 on P4	SmartFusion2 pin K23 (MSIO48PB1/I2C_0_SDA/GPIO_30_B/USB_DATA0_C).

Breadboard Pin #	Signal Name	SOM Connector Pin	Connected To
10	I2C_1_SDA	26 on P4	SmartFusion2 pin V23 (MSIO11PB3/CCC_NE0_I0/I2C_1_SDA/ GPIO_0_A/USB_DATA3_A).
11	I2C_1_SCL	25 on P4	SmartFusion2 pin V26 (MSIO11NB3/CCC_NE1_I0/I2C_1_SCL/ GPIO_1_A/USB_DATA4_A).
13	SPI0_DO	63 on P4	SmartFusion2 pin Y29 (SC_SPI_SDO).
14	SPI0_DI	65 on P4	SmartFusion2 pin Y28 (SC_SPI_SDI).
15	SPI0_nSS	73 on P4	SmartFusion2 pin W26 (SC_SPI_SS).
16	SPI0_CLK	71 on P4	SmartFusion2 pin AA30 (SC_SPI_CLK).
17	SPI1_nSS	69 on P4	SmartFusion2 pin V28 (MSIO17NB3/SPI_1_SS0/GPIO_13_A).
18	SPI1_CLK	67 on P4	SmartFusion2 pin U23 (MSIO16PB3/SPI_1_CLK).
19	SPI1_DI	61 on P4	SmartFusion2 pin U27 (MSIO16NB3/SPI_1_SDI/GPIO_11_A).
20	SPI1_DO	59 on P4	SmartFusion2 pin V27 (MSIO17PB3/SPI_1_SDO/GPIO_12_A).

Table 7: P9 Breadboard Area Connector

Breadboard Pin #	Signal Name	SOM Connector Pin	Connected To
1	VCC3	77, 79 on P4	+3.3 V SOM power supply.
2	+5V_IN	N/A	SOM-BSB-EXT JP3 pin 1, external +5 V power supply.
3, 21, 22, 23, 24	GND	2, 3, 5, 8, 9, 11, 14, 57, 75, 76 on P4	SOM ground.
4	nRESET_OUT	13 on P4	SmartFusion2 pin R2 (MSIOD119NB7); (SmartFusion2 pin AC27 (DEV_RST_N) in SOM Rev 1A). SOM-BSB-EXT DS1 LED.
5	nRESET_IN (nRESET_OUT in SOM Rev 2A and Rev 3A)	15 on P4	SmartFusion2 pin AC27 (DEV_RST_N); (SmartFusion2 pin R2 (MSIOD119NB7) in SOM Rev 2A); (SmartFusion2 pin J1 (MSIO102PB8) in SOM Rev 3A). SOM-BSB-EXT S1 reset button (only with installed M2S-SOM-1A).
6	VCC3_EN	N/A	SOM-BSB-EXT U2 pin 5; +3.3 V LDO enable.
7	GPIO_90	37 on P4 (2.5 V)	SmartFusion2 pin AB1 (MSIOD135NB7).
8	GPIO_88	23 on P4 (2.5 V)	SmartFusion2 pin AC1 (MSIOD138NB7). SOM-BSB-EXT DS4 LED.

Breadboard Pin #	Signal Name	SOM Connector Pin	Connected To
9	GPIO_89	35 on P4 (2.5 V)	SmartFusion2 pin AA2 (MSIOD134PB7).
10	GPIO_87	21 on P4 (2.5 V)	SmartFusion2 pin AD3 (MSIOD143NB7).
11	GPIO_86	19 on P4 (2.5 V)	SmartFusion2 pin AD2 (MSIOD139PB7).
12	GPIO_85	17 on P4 (2.5 V)	SmartFusion2 pin AD1 (MSIOD139NB7).
13	GPIO_91	39 on P4 (2.5 V)	SmartFusion2 pin AB2 (MSIOD135PB7).
14	GPIO_83	32 on P4 (2.5 V)	SmartFusion2 pin AC4 (MSIOD143PB7).
15	GPIO_92	41 on P4 (2.5 V)	SmartFusion2 pin V7 (MSIOD144PB7).
16	GPIO_84	34 on P4 (2.5 V)	SmartFusion2 pin AA1 (MSIOD134NB7).
17	GPIO_93	43 on P4 (2.5 V)	SmartFusion2 pin W1 (MSIOD128NB7).
18	GPIO_82	18 on P4 (2.5 V)	SmartFusion2 pin AC3 (MSIOD140NB7).
19	GPIO_94	45 on P4 (2.5 V)	SmartFusion2 pin Y1 (MSIOD131NB7).
20	GPIO_81	16 on P4	SmartFusion2 pin AC2 (MSIOD138PB7); (SmartFusion2 pin J2 (MSIO102NB8) in SOM Rev 3A).

**Table 8:** P10 Breadboard Area Connector

Breadboard Pin #	Signal Name	SOM Connector Pin	Connected To
1	VCC3	77, 79 on P4	+3.3 V SOM power supply.
2, 23, 24	GND	2, 3, 5, 8, 9, 11, 14, 57, 75, 76 on P4	SOM ground.
3	GPIO_20	20 on P6	SmartFusion2 pin N6 (MSIO100PB8).
4	GPIO_26		Not connected to SOM.
5	GPIO_18	18 on P6	SmartFusion2 pin N5 (MSIO109NB8).
6	GPIO_24	24 on P6	SOM ground.
7	GPIO_16	16 on P6	SmartFusion2 pin N4 (MSIO110NB8).
8	GPIO_22	22 on P6	SmartFusion2 pin N7 (MSIO96PB8).
9	GPIO_14	14 on P6	SmartFusion2 pin L4 (MSIO113NB8).
10	GPIO_28	28 on P6	SOM ground.
11	GPIO_6	6 on P6	SmartFusion2 pin G3 (MSIO95NB8).
12	GPIO_30		Not connected to SOM.
13	GPIO_10	10 on P6	SmartFusion2 pin L2 (MSIO103PB8).
14	GPIO_32		Not connected to SOM.
15	GPIO_8	8 on P6	SmartFusion2 pin L1 (MSIO104NB8).
16	GPIO_34		Not connected to SOM.
17	GPIO_12	12 on P6	SmartFusion2 pin L3 (MSIO103NB8).
18	GPIO_36		Not connected to SOM.

Breadboard Pin #	Signal Name	SOM Connector Pin	Connected To
19	GPIO_4	4 on P6	SmartFusion2 pin G2 (MSIO95PB8).
20	GPIO_38		Not connected to SOM.
21	GPIO_2	2 on P6	SmartFusion2 pin G1 (MSIO100NB8).
22	GPIO_40		Not connected to SOM.

**Table 9:** P11 Breadboard Area Connector

Breadboard Pin #	Signal Name	SOM Connector Pin	Connected To
1	VCC3	77, 79 on P4	+3.3 V SOM power supply.
2, 23, 24	GND	2, 3, 5, 8, 9, 11, 14, 57, 75, 76 on P4	SOM ground.
3	GPIO_56	56 on P6 (2.5 V)	SmartFusion2 pin U3 (MSIOD123NB7).
4	GPIO_62	62 on P6	SmartFusion2 pin L29 (MSIO33NB2/GPIO_2_B).
5	GPIO_58	58 on P6 (2.5 V)	SmartFusion2 pin U5 (MSIOD124NB7).
6	GPIO_64	64 on P6	SmartFusion2 pin L30 (MSIO33PB2/GPIO_1_B).
7	GPIO_60	60 on P6 (2.5 V)	SmartFusion2 pin U7 (MSIOD121PB7/CCC_SW0_I0).
8	GPIO_66	66 on P6	SmartFusion2 pin M27 (MSIO32NB2/GPIO_0_B).
9	GPIO_54	54 on P6 (2.5 V)	SmartFusion2 pin U1 (MSIOD122NB7).
10	GPIO_68	68 on P6	SmartFusion2 pin R25 (MSIO23PB3/SPI_0_SS3/GPIO_10_A/USB_DATA7_A).
11	GPIO_52	52 on P6	SOM ground.
12	GPIO_70	70 on P6	SmartFusion2 pin R30 (MSIO22NB3/SPI_0_SS2/GPIO_9_A/USB_DATA6_A).
13	GPIO_50		Not connected to SOM.
14	GPIO_72	72 on P6	SmartFusion2 pin J27 (MSIO35NB2/GPIO_6_B).
15	GPIO_44		Not connected to SOM.
16	GPIO_74	74 on P6	SmartFusion2 pin J28 (MSIO38NB1/MMUART_1_DTR/GPIO_12_B).
17	GPIO_46		Not connected to SOM.
18	GPIO_76	76 on P6	SmartFusion2 pin J29 (MSIO38PB1/MMUART_1_RTS/GPIO_11_B).
19	GPIO_48		Not connected to SOM.
20	GPIO_78	78 on P6	SmartFusion2 pin J30 (MSIO41PB1/GB10/VCCC_SE0/USB_XCLK_C).
21	GPIO_42		Not connected to SOM.

Breadboard Pin #	Signal Name	SOM Connector Pin	Connected To
22	GPIO_80	80 on P6	SmartFusion2 pin G30 (MSIO45PB1/MMUART_0_RI/GPIO_21_B). SOM-BSB-EXT DS3 LED.

**Table 10:** P12 Breadboard Area Connector

Breadboard Pin #	Signal Name	SOM Connector Pin	Connected To
1	VCC3	77, 79 on P4	+3.3 V SOM power supply.
2, 23, 24	GND	2, 3, 5, 8, 9, 11, 14, 57, 75, 76 on P4	SOM ground.
3	GPIO_61	61 on P6	SmartFusion2 pin U8 (MSIOD125PB7);  (SmartFusion2 pin U26 (MSIO15NB3/SPI_0_SS7/GPIO_22_A) in SOM Rev 3A).
4	GPIO_59	59 on P6	SmartFusion2 pin U6 (MSIOD136PB7);  (SmartFusion2 pin U24 (MSIO15PB3/SPI_0_SS6/GPIO_21_A) in SOM Rev 3A).
5	GPIO_63	63 on P6	SmartFusion2 pin K29 (MSIO37NB2/GPIO_10_B).
6	GPIO_57	57 on P6	SmartFusion2 pin U4 (MSIOD123PB7);  (SmartFusion2 pin P9 (MSIO116PB8/CCC_NW1_I0) in SOM Rev 3A).
7	GPIO_65	65 on P6	SmartFusion2 pin K30 (MSIO37PB2/GPIO_9_B).
8	GPIO_55	55 on P6	SmartFusion2 pin U2 (MSIOD122PB7);  (SmartFusion2 pin N9 (MSIO104PB8) in SOM Rev 3A).
9	GPIO_67	67 on P6	SmartFusion2 pin M24 (MSIO43PB1/MMUART_0_RTS/GPIO_17_B/ USB_DATA5_C).
10	GPIO_53	53 on P6	SmartFusion2 pin T8 (MSIOD124PB7);  (SmartFusion2 pin R9 (MSIO117PB8/CCC_NW0_I0) in SOM Rev 3A).
11	GPIO_69	69 on P6	SmartFusion2 pin M25 (MSIO40PB1/CCC_NE1_I1/MMUART_1_RI/ GPIO_15_B).
12	GPIO_51	51 on P6	SmartFusion2 pin T6 (MSIOD128PB7);  (SmartFusion2 pin K5 (MSIO97NB8) in SOM Rev 3A).
13	GPIO_71	71 on P6	SmartFusion2 pin M26 (MSIO36NB2/GPIO_8_B).
14	GPIO_49	49 on P6	SmartFusion2 pin T5 (MSIOD125NB7);  (SmartFusion2 pin J4 (MSIO98NB8) in SOM Rev 3A).

Breadboard Pin #	Signal Name	SOM Connector Pin	Connected To
15	GPIO_73	73 on P6	SmartFusion2 pin H26 (MSIO47NB1/MMUART_0_CLK/GPIO_29_B/ USB_NXT_C).
16	GPIO_45	45 on P6	SmartFusion2 pin R8 (MSIO113PB8).
17	GPIO_79	79 on P6	SmartFusion2 pin F30 (MSIO45NB1/MMUART_0_DCD/GPIO_22_B). SOM-BSB-EXT S2 user button.
18	GPIO_47	47 on P6	SmartFusion2 pin T1 (MSIOD120NB7); (SmartFusion2 pin J3 (MSIO98PB8) in SOM Rev 3A).
19	GPIO_77	77 on P6	SmartFusion2 pin H29 (MSIO42PB1/GB14/VCCC_SE1/MMUART_1_CLK/ GPIO_25_B/USB_DATA4_C).
20	GPIO_43	43 on P6	SmartFusion2 pin R7 (MSIO109PB8).
21	GPIO_75	75 on P6	SmartFusion2 pin H28 (MSIO40NB1/MMUART_1_DCD/GPIO_16_B).
22	GPIO_41	41 on P6	SmartFusion2 pin R6 (MSIO117NB8).

**Table 11:** P13 Breadboard Area Connector

Breadboard Pin #	Signal Name	SOM Connector Pin	Connected To
1	VCC3	77, 79 on P4	+3.3 V SOM power supply.
2, 23, 24	GND	2, 3, 5, 8, 9, 11, 14, 57, 75, 76 on P4	SOM ground.
3	GPIO_25	25 on P6	SmartFusion2 pin P4 (MSIO114NB8).
4	GPIO_19	19 on P6	SmartFusion2 pin P1 (MSIO115PB8/GB2/CCC_NW0_I1).
5	GPIO_23	23 on P6	SmartFusion2 pin P3 (MSIO114PB8/GB6/CCC_NW1_I1).
6	GPIO_17	17 on P6	SmartFusion2 pin N3 (MSIO110PB8).
7	GPIO_21	21 on P6	SmartFusion2 pin P2 (MSIO115NB8).
8	GPIO_15	15 on P6	SmartFusion2 pin N2 (MSIO111NB8).
9	GPIO_27	27 on P6	SmartFusion2 pin P5 (MSIO112NB8).
10	GPIO_13	13 on P6	SmartFusion2 pin N1 (MSIO111PB8).
11	GPIO_29	29 on P6	SmartFusion2 pin P6 (MSIO105PB8).
12	GPIO_11	11 on P6	SmartFusion2 pin M4 (MSIO106NB8).
13	GPIO_31	31 on P6	SmartFusion2 pin P7 (MSIO108PB8).
14	GPIO_9	9 on P6	SmartFusion2 pin M3 (MSIO106PB8).
15	GPIO_33	33 on P6	SmartFusion2 pin P8 (MSIO112PB8).
16	GPIO_7	7 on P6	SmartFusion2 pin M2 (MSIO107NB8).

Breadboard Pin #	Signal Name	SOM Connector Pin	Connected To
17	GPIO_35	35 on P6	SmartFusion2 pin R3 (MSIO18PB7/GB5/CCC_SW1_I1); (SmartFusion2 pin N8 (MSIO101PB8) in SOM Rev 3A).
18	GPIO_5	5 on P6	SmartFusion2 pin M1 (MSIO107PB8).
19	GPIO_37	37 on P6	SmartFusion2 pin R4 (MSIOD118NB7); (SmartFusion2 pin F2 (MSIO108NB8) in SOM Rev 3A).
20	GPIO_3	3 on P6	SmartFusion2 pin H2 (MSIO99NB8).
21	GPIO_39	39 on P6	SmartFusion2 pin R5 (MSIO116NB8).
22	GPIO_1	1 on P6	SmartFusion2 pin H1 (MSIO99PB8).

**Table 12:** P14 Breadboard Area Connector

## 4. Jumpers

The SOM-BSB-EXT provides the configurable jumpers listed in the table below. The default settings are marked in bold:

Designation	Name	Settings	Description
JP1	VCC3	<b>1-2 closed</b>	The +3.3 V voltage from the output of the U2 LDO regulator is applied to the SOM and to the SOM-BSB-EXT.
		1-2 open	The +3.3 V voltage from the output of the U2 LDO regulator is disconnected from the SOM and from the SOM-BSB-EXT. To measure the current consumption of the SOM, connect an ammeter between these pins of the jumper.
		3-4 closed	The +3.3 V voltage from the output of the U2 LDO regulator is applied to the D1 double diode ORing scheme. This voltage is used to provide the V <sub>BATT</sub> power supply for the SOM RTC.
		<b>3-4 open</b>	The +3.3 V voltage from the output of the U2 LDO regulator is not applied to the D1 double diode ORing scheme.
JP2	JTAG Mode Selection	1-2 closed	The SmartFusion2 JTAG controller is in the Cortex-M3 debug mode. The JTAGSEL pin of SmartFusion2 is low.
		<b>1-2 open</b>	The SmartFusion2 JTAG controller is in the FPGA programming mode. The JTAGSEL pin of SmartFusion2 is high.
		<b>3-4 closed</b>	The settings of jumpers 3-4 do not affect M2S-SOM.

Designation	Name	Settings	Description
JP3	VCC5	1-3 closed 2-4 open	The +3.3 V LDO regulator is powered from the external +5 V voltage through the P10.2 pad of the breadboard area.
		<b>1-3 open</b> <b>2-4 closed</b>	The +3.3 V LDO regulator is powered from the +5 V USB power through the P1 mini USB connector.

**Table 13:** Jumpers

## 5. LEDs

The SOM-BSB-EXT provides the following LEDs:

Designation	Color	Description
DS1	Green	Indicates the status of nRESET_OUT signal of the SOM. The LED is lit when nRESET_OUT is 0.  Connected to the SmartFusion2 pin R2 (AC27 in Rev1A of the M2S SOM).
DS2	Green	Power Good LED. The LED is lit when the output on the U2 LDO regulator is +3.3 V.
DS3	Green	User-controlled LED connected to the pin 75 on the P6 SOM connector (GPIO_80 signal).  Connected to the SmartFusion2 pin G30.
DS4	Green	User-controlled LED connected to the pin 77 on the P6 SOM connector (GPIO_88 signal).  Connected to the SmartFusion2 pin AC1.
Integrated in the P2 RJ45 Ethernet connector	Yellow	Ethernet Link/Activity status.
Integrated in the P2 RJ45 Ethernet connector	Green	Ethernet 10/100 Mbit link status.

**Table 14:** LEDs

## 6. Switches

The SOM-BSB-EXT provides the following switches:

Switch	Type	Signal	Function
S1	Push button	nRESET_IN	SOM hardware reset.  Connected to the SmartFusion2 pin AC27.
S2	Push button	GPIO_79	User button connected to the pin 79 on the P6 SOM connector.  Connected to the SmartFusion2 pin F30.  To operate the user button, the SmartFusion2 pin F30 should be configured with enabled internal pull-up.

**Table 15:** Switches



## 7. Document Revision History

Revision	Date	Changes Summary
1.5	June 17, 2013	<ul style="list-style-type: none"> <li>Updated the description of switch S2 in Table 15.</li> </ul>
1.4	May 7, 2013	<ul style="list-style-type: none"> <li>Corrected the name of pin 3 in Table 6.</li> </ul>
1.3	March 27, 2013	<ul style="list-style-type: none"> <li>Added info to Section 2.6, describing the need to use transient suppressors on the USB interfaces.</li> </ul>
1.2	February 27, 2013	<ul style="list-style-type: none"> <li>Added info about the JTAGSEL signal state dependency on the JP2 settings.</li> </ul>
1.1	February 6, 2013	<ul style="list-style-type: none"> <li>Allocation of SF2 signals updated to provide DDRIO148PB5/PROBE_A and DDRIO148NB5/PROBE_B on the SOM connectors and on the breadboard area of SOM-BSB-EXT.</li> <li>Added detailed definition for the multi-function SF2 signals.</li> </ul>
1.0	February 1, 2013	Initial version.