EVALSPEAr320PLC evaluation board for the SPEAr320

Introduction

This user manual describes the implementation of the SPEAr320PLC evaluation board (order code: EVALSPEAr320PLC). This evaluation board can be used to evaluate the SPEAr320 microprocessor with a variety of devices and especially its Media Independent Interface (MII) Automation mode.

The EVALSPEAr320PLC evaluation board kit comprises two boards:

- CPU board
- MII mode application board

The SPEAr320 microprocessor is mounted on the CPU board that is plugged on the MII mode application board.

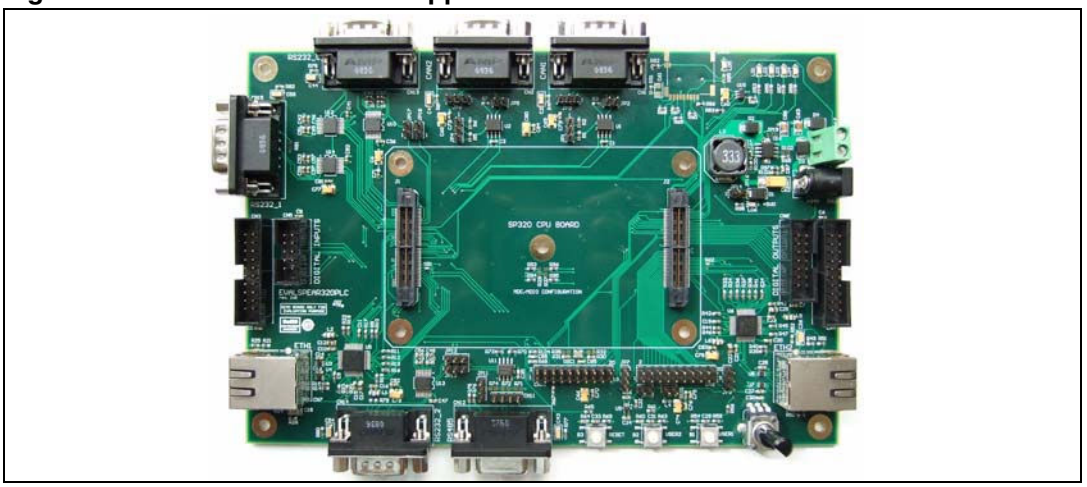
The application board is equipped with two Ethernet, three RS-232, one RS-485, two CAN, SPI, I²C communication interfaces and MicroSD card socket with SDIO interface. There are also two general-purpose push-buttons, four LEDs, a temperature sensor and a potentiometer available for the user interface.

The application board also includes digital input/output serial/parallel connectors with a pinout compatible to many existing evaluation boards from ST:

- Digital input serial: STEVAL-IFP007V1
- Digital input parallel: STEVAL-IFP004V1 and STEVAL-IFP008V1
- Digital output serial: STEVAL-IFP009V1
- Digital output parallel: STEVAL-IFP002V1, STEVAL-IFP001V1 and STEVAL-IFP006V1

The application board can be powered using a standard DC power supply (7 V to 30 V DC) or directly using a 24 V DC industrial mains supply.

Figure 1. SPEAr320 MII mode application board



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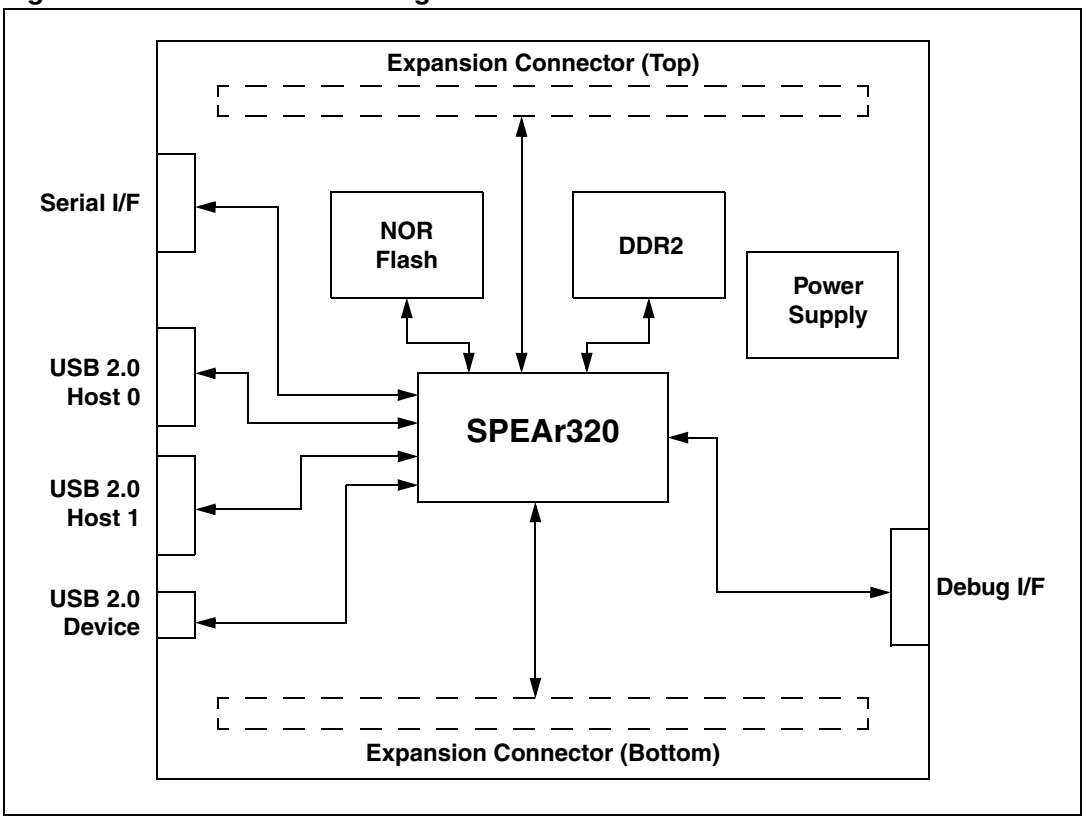
1 CPU board features

- SPEAr320 embedded MPU
- Up to 2 Gbit DDR2 333 MHz (standard 128 Mbytes)
- Up to 16 Mbyte Serial Flash memory (standard 8 Mbytes)
- Two USB 2.0 full host port channels
- One USB 2.0 host device port
- One serial port (up to 115 baud)
- JTAG Debug ports

For more information about the CPU board, please refer to *Appendix A: CPU board hardware description on page 28*.

1.1 CPU board block diagram

Figure 2. CPU board block diagram

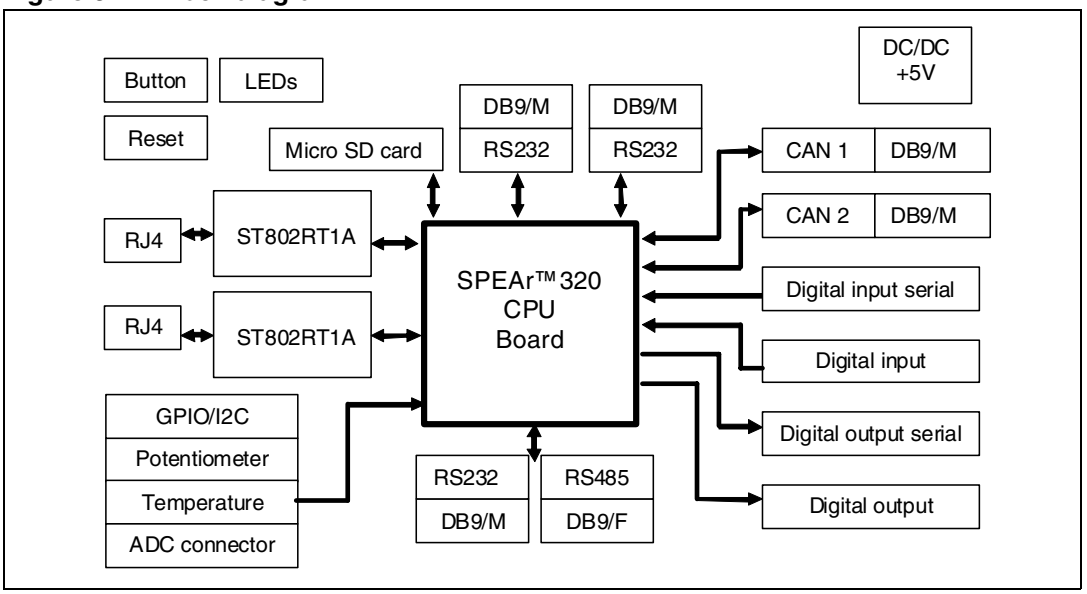


2 Application board features

- 2 x Ethernet RJ-45 connectors (ST802RT1A)
- 2 x CAN DB9 plug connectors
- 3 x RS-232 DB9 plug connectors (ST3232EBTR)
- 1 x RS-485 DB9 socket connector (ST3485EBDR)
- Digital input connectors (parallel and serial) compatible with STEVAL-IFP007V1, STEVAL-IFP008V1 and STEVAL-IFP004V1 evaluation boards
- Digital output connectors (parallel and serial) compatible with STEVAL-IFP009V1, STEVAL-IFP001V1, STEVAL-IFP002V1 and STEVAL-IFP006V1 evaluation boards
- On-board temperature sensor (STLM20W87F) and potentiometer (analog input for ADC)
- Analog extension connector featuring 8 ADC lines
- General-purpose extension connector with GPIOs and I^2C functionality
- DC/DC converter L7986A (+24 V / +5 V)
- MicroSD card socket
- 4 LEDs, 2 general-purpose buttons and system reset button

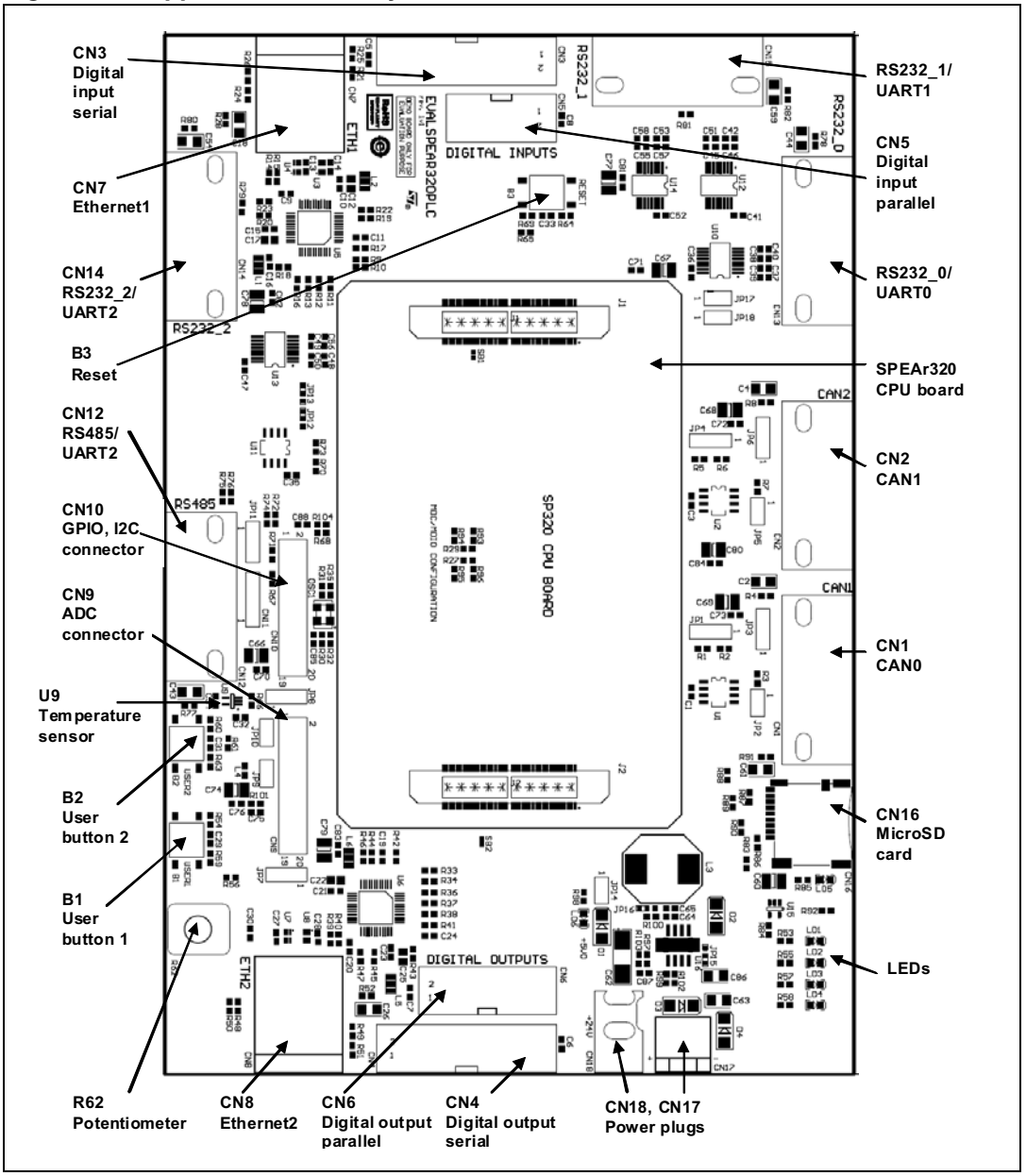
2.1 Application board block diagram

Figure 3. Block diagram



3 Application board layout

Figure 4. Application board layout



4 Getting started

4.1 Unpacking

Warning: This board contains static sensitive devices.

The EVALSPEAr320PLC evaluation board is shipped in protective anti-static packaging. Do not submit the board to high electrostatic potentials, and follow good practices for working with static sensitive devices.

- **Wear an anti-static wristband**. Wearing a simple anti-static wristband can help prevent ESD from damaging the board.
- **Zero potential**. Always touch a grounded conducting material before handling the board, and periodically while handling it.
- **Use an anti-static mat**. When configuring the board, place it on and anti-static mat to reduce the possibility of ESD damage.
- **Handle only the edges**. Handle the board by its edges only, and avoid touching board components.

4.2 Connecting

1. Connect a serial cable from the application board (connector CN13: RS232_0/UART0) to a host PC (see *Figure 4: Application board layout*).
2. On a host PC running Windows or Linux, start the Terminal program.
3. Connect a power supply to the SPEAr320 PLC evaluation board as described in *Section 5.5: Power supply on page 14*.
4. Power on the board. The Terminal program displays a sequence of boot messages followed by the Linux console prompt.

For more information, refer to user manual UM0844 *"Getting started with Linux for SPEAr"* available at *www.st.com/spear*.

4.3 Bootinging

The SPEAr320 PLC evaluation board can boot a Linux kernel pre-installed in the serial NOR Flash.

At power on, the serial port outputs a brief header message with some uBoot information (uBoot version, SDK version, and some internal hardware information). At this point you can choose to:

- **Stop the system directly in uBoot**: Press the spacebar on the host computer keyboard *before* the boot delay time expires (default is 3 seconds).
- **Boot Linux**: The system logs you in automatically as super user and the Linux shell prompt displays on the screen.

5 Configuration

5.1 Ethernet

There are two Ethernet PHYs (U5 and U6) available on the board that are connected through the media independent interfaces (MII) to the Ethernet MACs on the CPU board processor.

By default the MII addresses of the Ethernet PHYs are selected as shown in *Table 1*.

Table 1. MII addresses of the Ethernet PHYs (U5 and U6)

Ethernet PHY	MII address
U5	0x01
U6	0x02

By default the initial configuration of the Ethernet PHYs is selected as shown in *Table 2*.

Table 2. Default configuration of the Ethernet PHYs (U5 and U6)

Function	Default configuration
Auto negotiation	Enabled
10/100 Mbits	100 Mbits selected for auto negotiation advertisement
Half/Full duplex	Full duplex selected for auto negotiation advertisement
Internal Loopback	Disabled
Power down	Disabled (PHY is not in Power down state)
MII/RMII mode	MII selected

There are two LEDs embedded in each RJ-45 connector (CN7 and CN8) that indicate the status of the line:

- The green LED in the connector is driven on continuously when the Ethernet link is established with the counterpart.
- The yellow LED in the connector blinks when there is TX or RX activity.

The Serial Management Interface (SMI) is part of the MII interface and is used to transfer management information between the MAC and PHY (access of the PHY registers). There are two SMI interfaces coming from each Ethernet MAC. It is possible to use only one of them to control both Ethernet PHYs or each SMI can be used separately for each PHY.

Table 3. SMI interface configuration

Function	Default configuration
MII1_MDC, MII1_MDIO used for PHY1 (U5) and MII2_MDC, MII2_MDIO used for PHY2 (U6)	R93,R94, R95, R96 loaded R27, R29 not loaded (Default)

Table 3. SMI interface configuration (continued)

Function	Default configuration
MII1_MDC, MII1_MDIO used for both PHYs (U5, U6)	R93, R94, R27, R29 loaded R95, R96 not loaded
MII2_MDC, MII2_MDIO used for both PHYs (U5, U6)	R95, R96, R27, R29 loaded R93, R94 not loaded

For the two Ethernet PHYs (U5 and U6 in MII mode) to function correctly, it is necessary to clock them using a 25-MHz clock. There are two ways to deliver the 25-MHz clock signal to the devices.

5.2 Digital input / digital output connectors

The digital input and digital output connectors are used to extend the EVALSPEAR320PLC board with the industrial input and output cards.

The input sensors (for example, proximity switches) of the controlled industrial process are normally decoupled and connected by the current limiters based on the CLT and SCLT devices of the microcontroller. The digital outputs, also electrically decoupled, are based on high-side drivers which are used in industrial environments to switch industrial loads (valves, relays, …) and process control. For both the inputs and outputs, we can use either serial (SPI) or parallel (GPIO) IN/OUT cards.

The EVALSPEAR320PLC board is compatible with the following cards:

- Digital input serial (CN3): STEVAL-IFP007V1
- Digital output serial (CN4): STEVAL-IFP009V1
- Digital input parallel (CN5): STEVAL-IFP004V1 and STEVAL-IFP008V1
- Digital output parallel (CN6): STEVAL-IFP002V1, STEVAL-IFP001V1 and STEVAL-IFP006V1

Figure 5. EVALSPEAR320PLC board with digital input and digital output cards

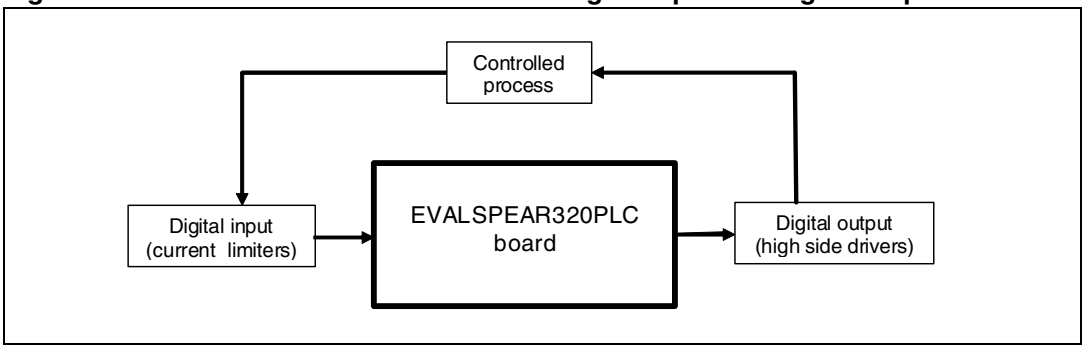


Figure 6. 8/16 input channel current limiter based on SCLT3-8, STEVAL-IFP007V1

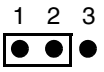
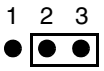
5.3 Controller–area network bus

The EVALSPEAR320PLC evaluation board supports two channels of CAN2.0A/B compliant controller–area network (CAN) bus communication based on a 3.3 V CAN transceiver. High-speed mode, standby mode and slope control mode are available and can be selected by setting jumper JP1 for CAN0 and jumper JP4 for CAN1.

Table 4. CAN0 transceiver settings

Jumper	Description	Configuration
JP1	CAN0 transceiver works in Standby mode when JP1 is set.	1 2 3 ●● ●
	CAN0 transceiver works in High-speed mode when JP1 is set (Default).	1 2 3 ● ●●
	CAN0 transceiver works in Slope control mode when JP1 is open.	1 2 3 ● ● ●
JP2	CAN0 terminal 120 Ω resistor is enabled when JP2 is loaded. Default setting: loaded	1 2 ●●

Table 5. CAN1 transceiver settings

Jumper	Description	Configuration
JP4	CAN1 transceiver works in standby mode when JP4 is set.	
	CAN1 transceiver works in high-speed mode when JP4 is set (Default).	
	CAN1 transceiver works in slope control mode when JP4 is open.	
JP5	CAN1 terminal 120Ω resistor is enabled when JP5 is loaded. Default setting: loaded	

5.4 RS-232 and RS-485 transceivers

There are three RS-232 DB9 plug connectors and one RS-485 DB9 socket connector with a Profibus DP compliant pinout available on the board.

UART0 features the full modem control signals and fully utilizes U10, U12 and partly U14 RS-232 transceivers. The RS232_0 signals are available through the CN13 connector. Optionally when the U10 RS-232 transceiver is not soldered on the board, it is possible to line in RS232_TXD and RS232_RXD signals from the CPU board to the CN13 connector.

UART1 features only RX/TX functionality and is connected to the U14 RS-232 transceiver which RS232_1 signals are then available from the CN15 connector.

UART2 features only RX/TX functionality and uses U13 RS232 transceiver which RS232_2 signals are available from the CN14 connector. Optionally by setting jumpers JP12 and JP13, the UART2 RX/TX lines can be connected to the RS-485 transceiver U11 whose outputs are then available from connectors CN11 and CN12. The RS-485 transceiver U11 can be controlled through GPIO pins PL_GPIO77 (receiver enable, R70 - pull up) and PL_GPIO78 (driver output enable, R73 pull down). Check the ST3485 datasheet for further details about all possible transceiver configurations.

Table 6. UART2 RS-232/RS-485 configuration

Jumper	Description	Configuration
JP11	Connects +5.0 V to the RS-485 (R71, R72 and R74) termination network.	
	Connects +3.3 V to the RS-485 (R71, R72 and R74) termination network (Default).	

Table 6. UART2 RS-232/RS-485 configuration (continued)

Jumper	Description	Configuration
JP12 (SMD resistor) (1)	UART2_TX line is connected to the RS-485 transceiver U11.	
	UART2_TX line is connected to the RS-232 transceiver U13 (Default).	
JP13 (SMD resistor)(1)	UART2_RX line is connected to the RS-485 transceiver U11.	
	UART2_RX line is connected to the RS-232 transceiver U13 (Default).	

1. The configuration of this JP is done loading a 0 ohm resistance between two different positions.

Table 7. UART0/RS-232 transceiver signals from the CPU board

Jumper	Description
JP17	Connects the RS232_TXD signal of the CPU board RS-232 transceiver to CN13 (UART0) Default setting: Not loaded
JP18	Connects the RS232_RXD signal of the CPU board RS-232 transceiver to CN13 (UART0) Default setting: Not loaded

Caution: Do not fit the jumpers when the U10 RS-232 transceiver is soldered on the evaluation board.

5.5 Power supply

There are two options to supply the SPEAr320 PLC evaluation board:

1. Connecting the +5 V voltage adapter (delivered in the EVALSPEAr320PLC package) to the J11 power voltage connector on the CPU board.
2. Connecting a 7 V to 30 V DC power source (not included in the EVALSPEAr320PLC package) to either connectors CN17 or CN18 on the application board.

The input voltage is connected to the DC/DC converter U16 (L7986A or optionally L5973A).

The board is protected against overvoltages by the D4 transil diode (SM6T33A) and against possible reverse polarity voltage from an incorrect power plug-in by the D3 Schottky diode (STPS3L40U).

Warning: Do not use both Power supply options at the same time. Doing this may destroy the boards.

Table 8. U16 DC/DC converter jumpers

Jumper	Description	Configuration
JP14	Can be used to disconnect the +5 V delivered from the DC/DC converter U16 (Default - loaded).	
JP15 (SMD resistor)(1)	For L7986A the jumper must be set (Default).	
	Optional when L5973A would be assembled, the jumper must be set as shown at right.	
JP16 (SMD resistor)(1)	For L7986A the jumper must be set as shown at right. (Default)	
	Optional when L5973A would be assembled, the jumper must be set as shown at right.	

1. The configuration of this JP is done loading a 0 ohm resistance between two different positions.

5.6 Temperature sensor

There is an analog temperature sensor (STLM20) available on the board that is connected to the analog input AIN0 of the CPU board. It is possible to disconnect it by removing jumper JP10. The jumper is loaded by default.

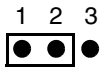
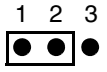
5.7 Potentiometer

There is a 10 kΩ potentiometer available on the board connected to the analog input AIN1 of the CPU board. It is possible to disconnect it by removing jumper JP9. The jumper is loaded by default.

5.8 General-purpose ADC connector

Eight analog input lines are available on connector CN9. Inside the connector it is also possible to determine the range of the conversion by setting the conversion limits on the pin CN9-19 (lower limit) and CN9-1 (upper limit) via jumpers JP7 and JP8.

Table 9. ADC conversion settings

Jumper	Description	Configuration
JP7	Connects the +2.5 V ADC evaluation board ADC supply voltage to the ADC_VREFP pin of the CPU board (Default).	
	Connects the external ADC application supply voltage to the ADC_VREFP pin of the CPU board.	
JP8	Connects the evaluation board GND of the ADC supply voltage domain to the ADC_VREFN pin of the CPU board (Default).	
	Connects the external ADC application GND (lower limit) supply voltage to the ADC_VREFN pin of the CPU board.	

The following relation between the pins should be guaranteed in the application:

0 V ≤ CN9-1 ≤ CN9-3 - CN9-17 ≤ CN9-19 ≤ +2.5 V

GND ≤ ADC_VREFN ≤ AIN0 -AIN7 ≤ ADC_VREFP ≤ +2.5 V ADC

5.9 General-purpose buttons (B1 and B2)

There are two general-purpose buttons (B1 and B2) available on the top side of the board. Button B1 can be disconnected from the input CPU board by soldering out resistor R56 and button B2 by soldering out resistor R61.

5.10 LEDs

There are 4 general-purpose LEDs (LD1-LD4) available on the top side of the board. All LEDs are driven on when the related GPIO pin is driven high.

Table 10. General-purpose LED configuration

GPIO pin	LED
PL_GPIO47	LD1
PL_GPIO49	LD2
PL_GPIO58	LD3
PL_GPIO64	LD4

5.11 Reset button

A manual reset button (B3) is available on the board's top side. It resets the microprocessor on the core board. It can be disconnected from the input reset signal of the core board by soldering out resistor R65. In order to perform a hardware reset of the first Ethernet PHY U5 (ETH1), it is necessary to drive low pin PL_GPIO66 of the microprocessor. In order to perform a hardware reset of the second Ethernet PHY U6 (ETH2), it is necessary to drive low pin PL_GPIO76 of the microprocessor.

5.12 MicroSD card

The MicroSD card connector connected to the SDIO interface of the EVALSPEAR320PLC is available on the board. MicroSD card detection is managed by the standard SDIO signal SDCD when the card is inserted. In order to power-up the MicroSD card properly, it is necessary to detect the card insertion and then to enable the single channel power switch U15 by means of PL_GPIO61 (active low).

Using the thermal and short-circuit protection of the power switch, it is possible to detect overcurrent conditions (> 500 mA) on the MicroSD card connector by pin PL_GPIO57 which is connected to the overcurrent pin of U15. By default the U15 power output is disabled by the R83 pull-up resistor connected to the Enable pin of the power switch.

6 Connectors

6.1 CAN DB9 plug connectors (CN1 and CN2)

Figure 7. CAN DB9 plug connectors pinout

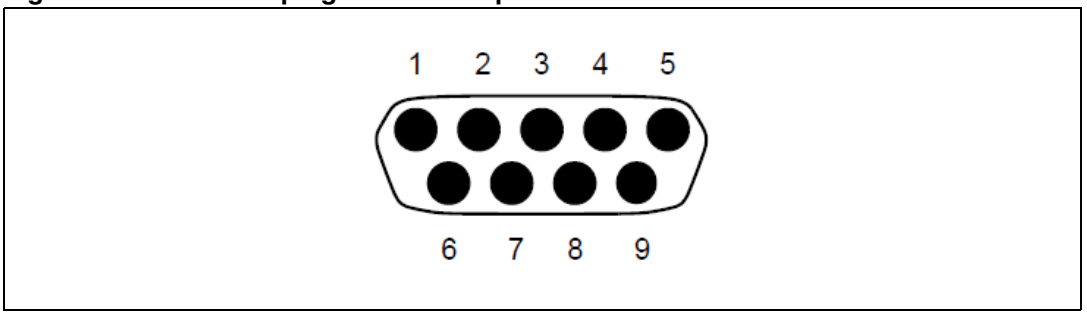


Table 11. CAN DB9 plug connectors description

Pin	Description	Pin	Description
1, 4, 8	NC	7	CANH
2	CANL	3, 6	GND
5	Chassis	9	Optional supply voltage (+3.3 V or +5.0 V)

6.2 Digital input serial connector (CN3)

This connector enables connection of industrial output card STEVAL-IFP007V1.

Figure 8. Digital input serial connector pinout

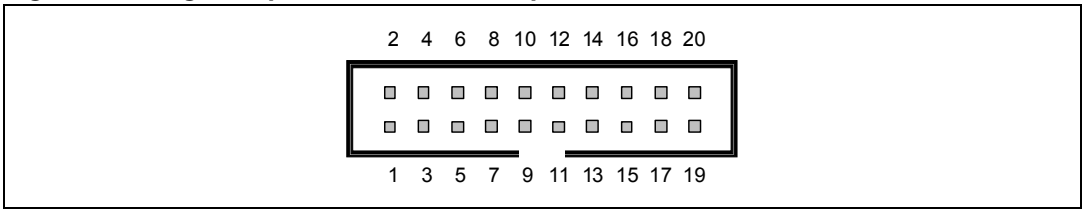


Table 12. Digital input serial connector description

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	NC	6	NC	11	SSP_MOSI (PL_GPIO9)	16	NC
2	NC	7	NC	12	SSP_CLK (PL_GPIO8)	17	+3.3 V
3	NC	8	NC	13	SSP_SS0 (PL_GPIO7)	18	GND
4	NC	9	NC	14	SSP_MISO (PL_GPIO6)	19	+3.3 V
5	NC	10	NC	15	NC	20	GND

6.3 Digital output serial connector (CN4)

This connector enables connection of industrial output card STEVAL-IFP009V1.

Figure 9. Digital output serial connector pinout

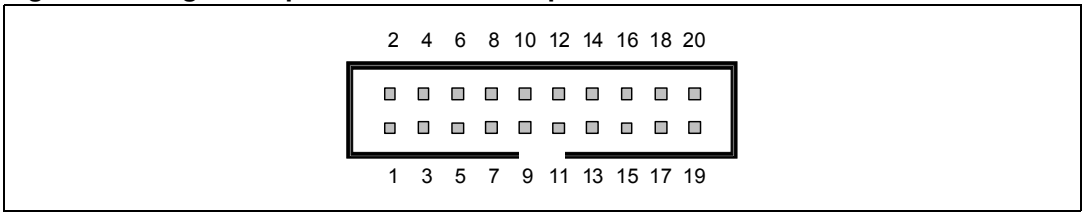


Table 13. Digital output serial connector description

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	NC	6	NC	11	NC	16	NC
2	NC	7	NC	12	SSP_MOSI (PL_GPIO9)	17	+3.3 V
3	NC	8	NC	13	SSP_MISO (PL_GPIO6)	18	GND
4	NC	9	SSP_CLK (PL_GPIO8)	14	SSP_SS3 (PL_GPIO35)	19	+3.3 V
5	NC	10	PL_GPIO56	15	NC	20	GND

6.4 Digital input parallel connector (CN5)

This connector enables connection of industrial input cards based on CLT, PCLT devices - STEVAL-IFP004V1 and STEVAL-IFP008V1.

Figure 10. Digital input parallel connector (CN5) pinout

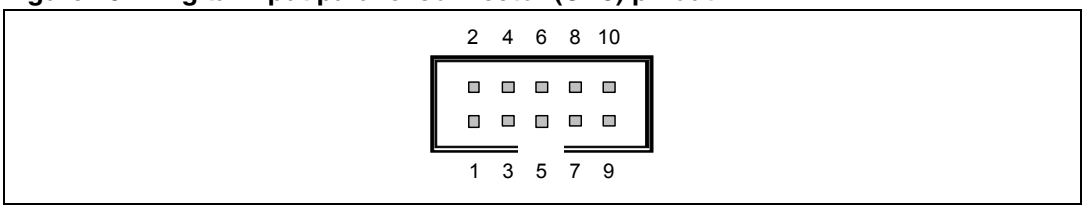


Table 14. Digital input parallel connector (CN5) description

Pin	Signal	Pin	Signal
1	+3.3 V	6	PL_GPIO71
2	GND	7	PL_GPIO70
3	PL_GPIO74	8	PL_GPIO73
4	PL_GPIO79	9	PL_GPIO72
5	PL_GPIO75	10	PL_GPIO69

6.5 Digital output parallel connector (CN6)

This connector enables connection of industrial output cards: STEVAL-IFP002V1, STEVAL-IFP001V1, STEVAL-IFP006V1.

Figure 11. Digital output parallel connector (CN6) pinout

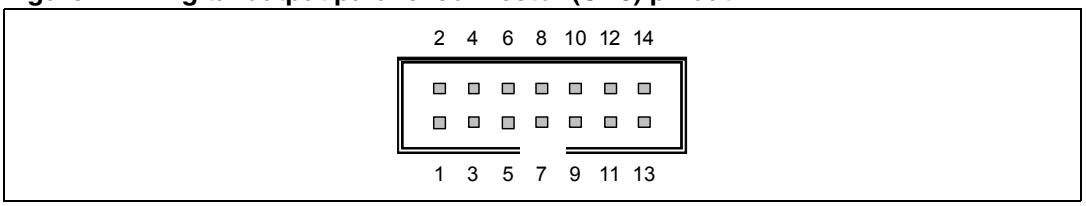


Table 15. Digital output parallel connector (CN6) description

Pin	Signal	Pin	Signal	Pin	Signal
1	+3.3 V	6	PL_GPIO52	11	PL_GPIO55
2	GND	7	PL_GPIO65	12	NC
3	PL_GPIO53	8	PL_GPIO62	13	NC
4	PL_GPIO54	9	PL_GPIO59	14	NC
5	PL_GPIO68	10	PL_GPIO60		

6.6 Ethernet RJ-45 connectors (CN7 and CN8)

Figure 12. Ethernet RJ-45 connectors (CN7 and CN8) - Front view

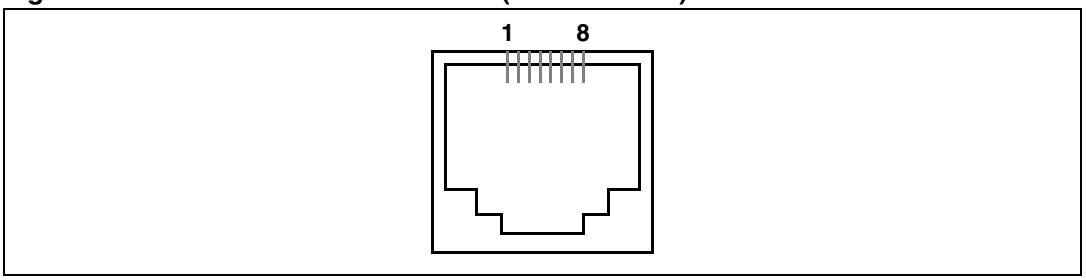


Table 16. Ethernet RJ-45 connectors (CN7 and CN8) description

Pin	Description	Pin	Description
1	TxData+	2	TxData-
3	RxData+	4	NC
5	NC	6	RxData-
7	NC	8	NC

6.7 General-purpose ADC connector (CN9)

Figure 13. General-purpose ADC connector (CN9) pinout

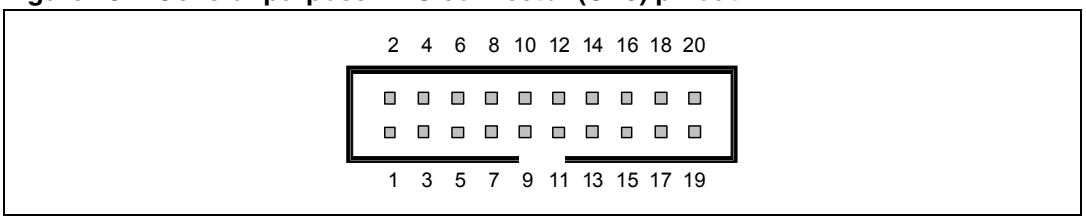


Table 17. General-purpose ADC connector (CN9) description

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	ADC VREF Negative or GND by JP8	6	GND	11	AIN4	16	GND
2	GND	7	AIN2	12	GND	17	AIN7
3	AIN0	8	GND	13	AIN5	18	GND
4	GND	9	AIN3	14	GND	19	ADC VREF Positive or +2.5 V by JP7
5	AIN1	10	GND	15	AIN6	20	+2.5 V

6.8 General-purpose GPIO and I²C connector (CN10)

Figure 14. General-purpose GPIO and I²C connector (CN10) pinout

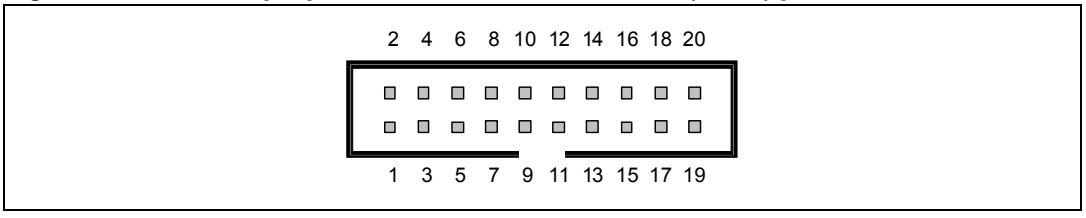


Table 18. General-purpose GPIO and I²C connector (CN10) pinout description

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	+3.3 V	6	PL_GPIO5 (I2C_SDA)(1) (2)	11	PL_CLK3	16	NC
2	NC	7	PL_GPIO34	12	NC	17	NC
3	NC	8	PL_GPIO63	13	NC	18	+2.5 V
4	GND	9	PL_GPIO67	14	NC	19	+5.0 V
5	PL_GPIO4 (I2C_SCK)(2)	10	NC	15	NC	20	NC

1. RC filter (R104 and C80) for the SDA line.
2. R67 and R68 are pull-ups for the SCLK and SDA line.

6.9 RS-485 DB9 socket and header connector (CN11 and CN12)

Figure 15. RS-485 DB9 socket connector CN11 pinout

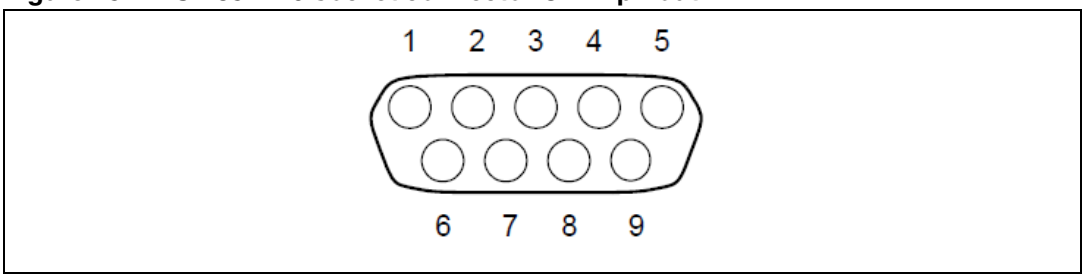


Table 19. RS-485 DB9 socket connector CN11 description

Pin	Description	Pin	Description
1	NC	6	+5.0 V
2	NC	7	NC
3	A	8	B
4	NC	9	NC
5	GND		

Figure 16. RS-485 header connector CN12 pinout

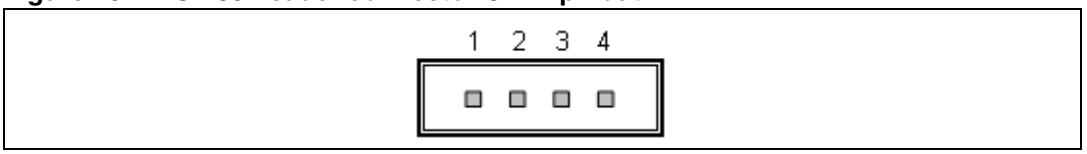


Table 20. RS-485 header connector CN12 description

Pin	Description	Pin	Description
1	+3.3 V	3	A
2	B	4	GND

6.10 RS-232/UART0 DB9 plug connector (CN13)

Figure 17. RS-232/UART0 DB9 plug connector (CN13) pinout

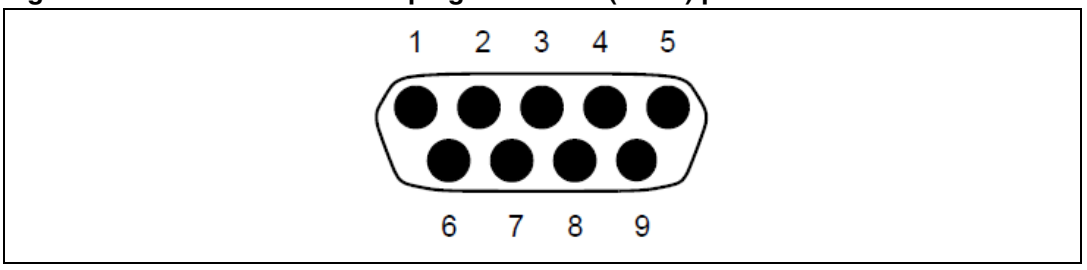


Table 21. RS-232/UART0 DB9 plug connector (CN13) description

Pin	Description	Pin	Description
1	UART0_DCD	6	UART0_DSR
2	UART0_RX	7	UART0_RTS
3	UART0_TX	8	UART0_CTS
4	UART0_DTR	9	UART0_RI
5	GND		

6.11 RS-232/UART2 DB9 plug connector (CN14)

Figure 18. RS-232/UART2 DB9 plug connector (CN14) pinout

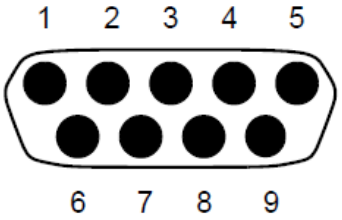


Table 22. RS-232/UART2 DB9 plug connector (CN14) description

Pin	Description	Pin	Description
1	NC (R79 can interconnect this pin with pins 4 and 6)	6	Connected to pin 4
2	UART2_RX	7	Connected to pin 8
3	UART2_TX	8	Connected to pin 7
4	Connected to pin 6	9	NC
5	GND		

6.12 RS-232/UART1 DB9 plug connector (CN15)

Figure 19. RS-232/UART1 DB9 plug connector (CN15) pinout

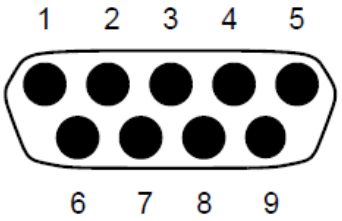


Table 23. RS-232/UART1 DB9 plug connector (CN15) description

Pin	Description	Pin	Description
1	NC (R81 can interconnect this pin with pins 4 and 6)	6	Connected to pin 4
2	UART1_RX	7	Connected to pin 8
3	UART1_TX	8	Connected to pin 7
4	Connected to pin 6	9	NC
5	GND		

6.13 MicroSD card connector (CN16)

Figure 20. MicroSD card connector (CN16) pinout

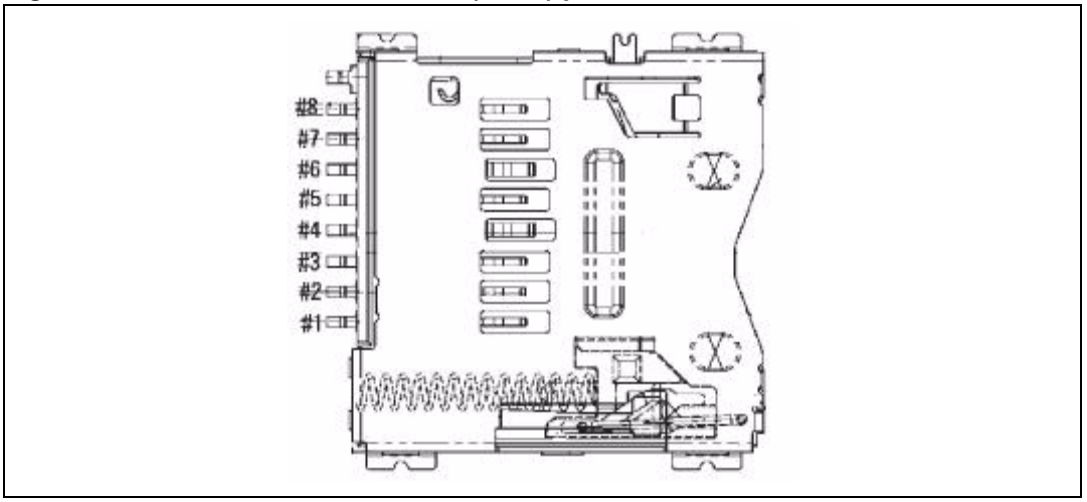


Table 24. MicroSD card connector (CN16) description

Pin	Description	Pin	Description
1	SDAT2 (PL_GPIO45)	6	GND
2	SDAT3 (PL_GPIO46)	7	SDAT0 (PL_GPIO43)
3	SDCMD (PL_CLK4)	8	SDAT1 (PL_GPIO44)
4	+3.3 V (from U15 -single channel power switch)	9	GND
5	SDCLK (PL_CLK2)	10	SDCD (PL_GPIO51)

6.14 Power supply connectors (CN17 and CN18)

Figure 21. Power supply connector CN18 diagram

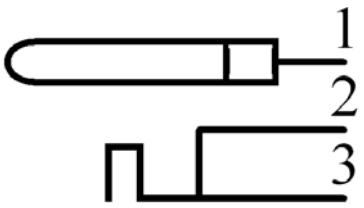


Figure 22. Power supply connector CN17 diagram

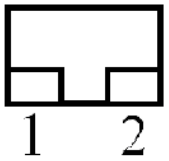


Table 25. Power supply connector CN18 description

Pin	Signal	Pin	Signal
1	24 V DC	3	GND
2	GND		

Table 26. Power supply connector CN17 description

Pin	Signal
1	24 V DC
2	GND

6.15 SPEAr320 CPU board connectors (J1 and J2)

There are two 86-pin connectors (J1 and J2) which are used to extend the evaluation board with the SPEAr320 CPU board.

Figure 23. 86-pin connectors (J1 and J2) pinout

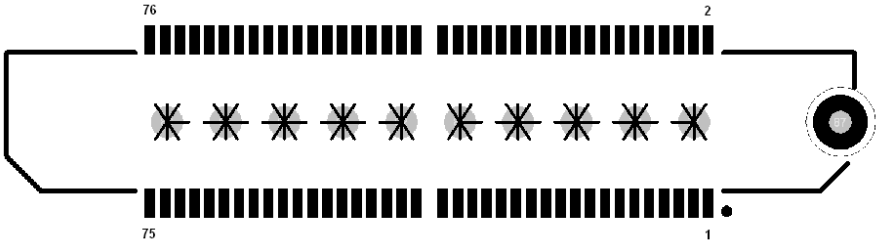


Table 27. 86-pin connector (J1) description

Pin	Description	Pin	Description	Pin	Description
1	NC	30	SSP_MOSI	59	MII1_RXD0
2	+5.0 V	31	MII1_TXD3	60	nRESET

Table 27. 86-pin connector (J1) description (continued)

Pin	Description	Pin	Description	Pin	Description
3	NC	32	MII1_COL	61	MII1_CRS
4	+5.0 V	33	MII1_RXER	62	NC
5	NC	34	SSP_CLK	63	MII1_MDIO
6	+5.0 V	35	MII1_MDC	64	NC
7	NC	36	SSP_MISO	65	SSP_SS0
8	+5.0 V	37	MII1_RXDV	66	NC
9	UART0_TX	38	I2C_SCL / PL_GPIO4	67	UART2_TX
10	SDAT1 / MicroSD card data 1	39	MII1_RXD2	68	NC
11	UART0_RX	40	I2C_SDA/ PL_GPIO5	69	UART2_RX
12	UART0_DCD	41	MII1_RXD3	70	+3.3 V
13	RS232_TXD	42	NC	71	NC
14	UART0_DSR	43	SSP_CS4	72	+3.3 V
15	RS232_RXD	44	NC	73	NC
16	UART0_RTS	45	UART0_RI	74	+3.3 V
17	UART0_DTR	46	NC	75	NC
18	UART1_TX	47	SSP_CS3	76	+3.3 V
19	SDAT0 / MicroSD card data 0	48	NC	77	GND
20	UART0_CTS	49	CAN1_TX	78	GND
21	GPIO34	50	+2.5 V	79	GND
22	CAN1_RX	51	CAN0_RX	80	GND
23	CAN0_TX	52	+2.5 V	81	GND
24	UART1_RX	53	MII1_TXD1	82	GND
25	MII1_RXD1	54	+3.3 V	83	GND
26	MII1_TXD0	55	MII1_TXEN	84	GND
27	MII1_TXD2	56	+2.5 V	85	GND
28	MII1_TXCLK	57	MII1_TXER	86	GND
29	MII1_RXCLK	58	INRESET		

Table 28. 86-pin connector (J2) description

Pin	Description	Pin	Description	Pin	Description
1	LED1 / PL_GPIO47	30	PL_GPIO76	59	MII2_RXER
2	+3.3 V	31	DIDO53 / PL_GPIO53	60	AIN4
3	LED2 / PL_GPIO49	32	MII2_RXD2	61	MII2_RXDV

Table 28. 86-pin connector (J2) description (continued)

Pin	Description	Pin	Description	Pin	Description
4	PL_GPIO63	33	SDCD / MicroSD card detect	62	GND
5	PL_GPIO56	34	MII2_RXD0	63	MII2_TXEN
6	SDAT3 / MicroSD card data 3	35	DIDO54 / PL_GPIO54	64	AIN5
7	LED3 / PL_GPIO58	36	MII2_TXD1	65	MII2_TXD3
8	PL_GPIO57 / MicroSD card over current	37	DIDO74 / PL_GPIO74	66	GND
9	LED4 / PL_GPIO64	38	DIDO79 / PL_GPIO79	67	MII2_TXCLK
10	PL_GPIO61 / MicroSD Power Enable	39	ST3485_RE / PL_GPIO77	68	AIN6
11	SDAT2/ MicroSD data 2	40	MII2_TXD2	69	SDCMD / MicroSD command line
12	PL_GPIO66	41	ST3485_DE / PL_GPIO78	70	GND
13	Button 1 / PL_GPIO48	42	ADC_VREFN	71	PL_CLK3 (PLL3)
14	DIDO69 / PL_GPIO69	43	MII2_MDIO	72	AIN7
15	Button 2 / PL_GPIO50	44	AIN0 / Temperature sensor	73	SDCLK
16	DIDO72 / PL_GPIO72	45	MII2_MDC	74	GND
17	DIDO55 / PL_GPIO55	46	GND	75	PL_CLK1 (PLL1)
18	DIDO73 / PL_GPIO73	47	MII2_RXD3	76	ADC_VREFP
19	DIDO59 / PL_GPIO59	48	AIN0 / Potentiometer	77	GND
20	DIDO70 / PL_GPIO70	49	MII2_COL	78	GND
21	DIDO60 / PL_GPIO60	50	GND	79	GND
22	PL_GPIO67	51	MII2_RXD1	80	GND
23	DIDO65 / PL_GPIO65	52	AIN2	81	GND
24	DIDO71 / PL_GPIO71	53	MII2_TXER	82	GND
25	DIDO62 / PL_GPIO62	54	GND	83	GND
26	DIDO75 / PL_GPIO75	55	MII2_RXCLK	84	GND
27	DIDO68 / PL_GPIO68	56	AIN3	85	GND
28	MII2_CRS	57	MII2_TXD0	86	GND
29	DIDO52 / PL_GPIO52	58	GND		

Note: DIDO stands for Digital Input / Digital Output.

Appendix A CPU board hardware description

A.1 CPU board layout

Figure 24. CPU board layout (top view)

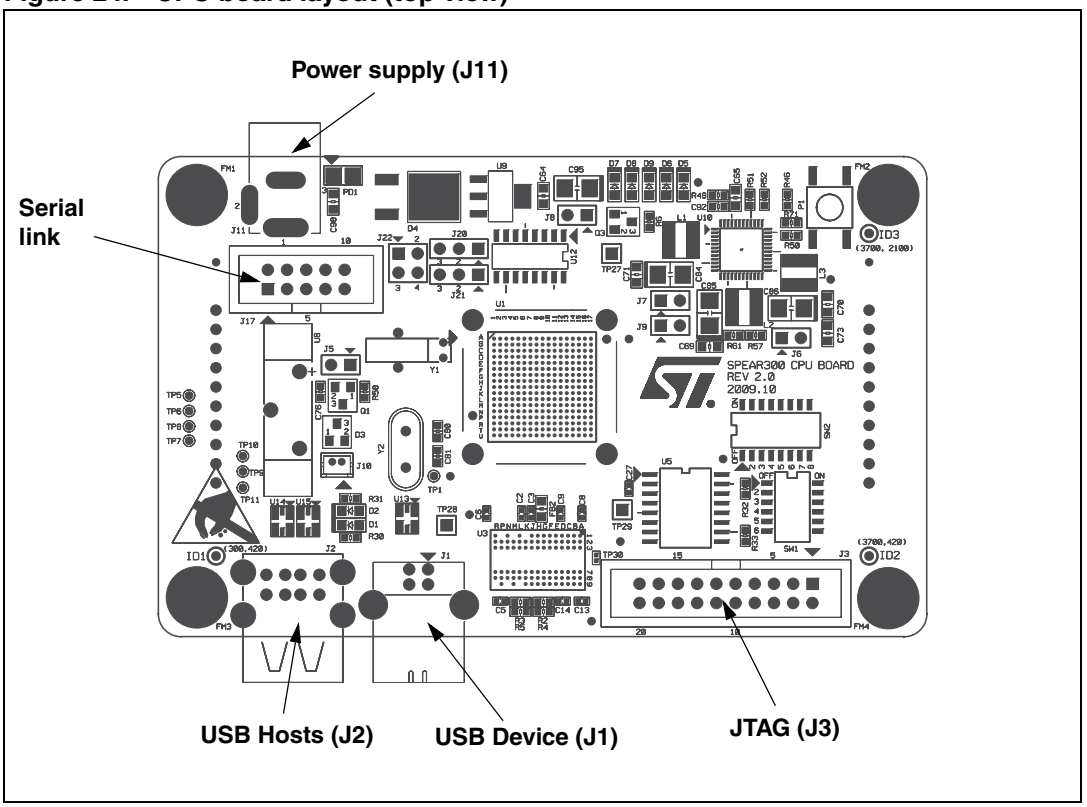
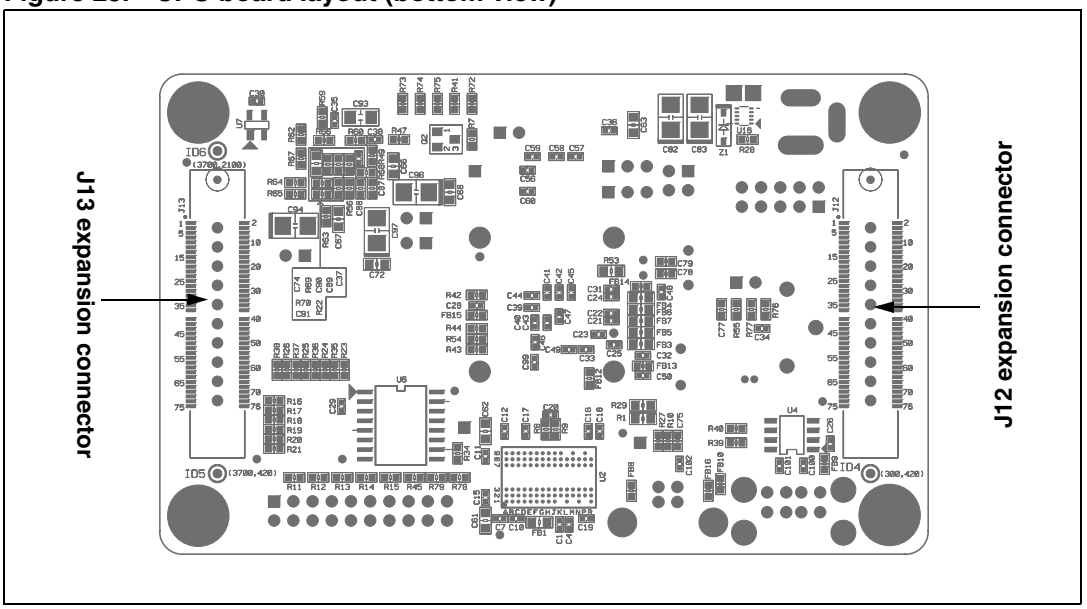


Figure 25. CPU board layout (bottom view)



A.2 Block descriptions

A.2.1 Dynamic memory subsystem

The Dynamic memory subsystem is composed of three major parts:

Memory chip

The SPEAr320 MPU supports up to 256 Mbytes of memory. Place and route is provided for 2 chips but only one has been populated. The memory used is a Micron DDR2 device, its part number is MT47H64M16HR-3 and its size is 128 Mbits x 8 (16 Mbits x 8 x 8 banks).

Local power supply

The local power supply is based on a monolithic voltage regulator for the chip set and DDR2/3 (PM6641). It is generated locally in order to minimize the layout impact and also to avoid any noise injection between different subsystems.

Signal termination

A parallel termination is added on the clock lines to compensate, if needed, for the layout dissymmetry. Two 100-Ohm resistors are used for each line in order to obtain an impedance of 50 Ohms. All the other terminations are directly inside the pads (both on the SPEAr320 MPU and the memory sides).

A.2.2 Static memory subsystem

Serial Flash memory

The SPEAr320 MPU supports up to 16 Mbytes of Serial Flash memory. Place and route for 2 blocks of 8 Mbytes are provided on the board but only one is populated. It is based on an M25P64-VMF6P (Numonix) Serial Flash memory device.

A resistor (R8) is also provided to protect the Flash memory from any unwanted write access.

A.2.3 USB 2.0 subsystem

Host ports

The board has two host ports that are fully compliant with the USB 2.0 specification (two controllers with one port each). This means that the two hosts can work in concurrent mode with the maximum possible bandwidth. Each host has also full control of the VBUS supplied by the ST2052 power switch that also provides overcurrent protection in case of a short circuit in the USB cable.

Device port

A USB 2.0 device port is also provided.

A.2.4 Debug interface

The JTAG interface can be used for "static" debugging. This means that it is possible to set a breakpoint and, when the system stops, verify the contents of the memory and/or registers and modify them if needed.

The debug feature can be selected by setting Switch SW1 bits [2:1].

Table 29. Switch SW1 bits [2:1]

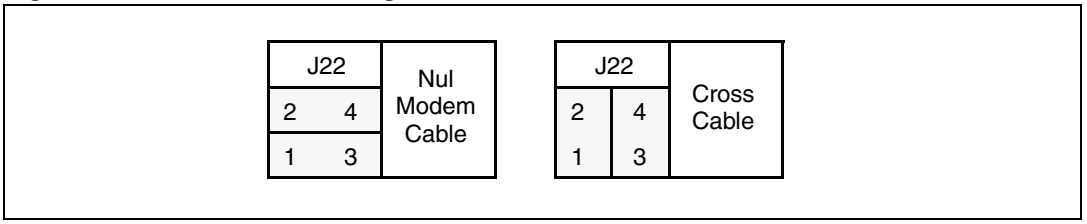
Bit 2	Bit 1	Description
0	0	No debug features available
0	1	The ARM JTAG is connected to J4

Please refer to the documentation of the trace box manufacturer for more information on the ETM interface (www.lauterbach.com, www.agilent.com, www.yokogawa.com).

A.2.5 Serial interface

One serial interface port is available. Typically used as an OS monitor, this port is available on the J17 connector. It is possible to simulate a cross cable by changing the position of the J22 jumpers.

Figure 26. Serial cable setting



A.2.6 Real time clock (battery powered)

The real time clock (RTC) is powered by an external battery (3 V) in order to prevent data loss even if the main power supply is switched off.

A.2.7 General power supply

From a 5 V external AC/DC regulator power source, this block generates all the required voltages as follows:

- 1.2 V (Switching regulator PM6641) to supply the internal logic of the SPEAr320 MPU
- 1.8 V (Switching regulator PM6641) for the DDR2 memory
- 2.5 V (LDO regulator) for the analog portion of SPEAr320
- 3.3 V (Switching regulator PM6641) to supply the other interfaces

A power monitor is also present to provide the general reset of the board.

A.3 CPU board switch and jumper settings

A.3.1 Switch 1 settings

Table 30. Switch 1 (SoC functional configuration)

Bit	Description
1	Test – see Debug configuration below
2	Reserved
3	Reserved
4	Reserved
5	Reserved
6	BootSel – see Debug configuration below

Table 31. Switch 1 (debug configuration)

Test bit		Debug configuration
2	1	
0	0	Normal Mode (No debug enabled)
0	1	ARM1 JTAG connected to J4
1	0	Reserved

Table 32. Switch 1 (functional configuration)

Test bit				Functional configuration
6	5	4	3	
1	0	1	1	Configuration 3

Note: When Switch SW1-x is in the ON position, the bit value is '0'. When Switch 1 is in the OFF position, the bit value is '1'.

Bits 3, 4, 5 and 6 allow you to set the Functional configuration. The default configuration is **Configuration 3**. For other configurations, please refer to the SPEAr320 user manual available on www.st.com/spear.

A.3.2 Switch 2 settings

Table 33. Switch 2 settings

Boot from	SW2-1	SW2-2	SW2-3	SW2-4	SW2-5	SW2-6	SW2-7	SW2-8
USB_BOOT	Off	On	Off	On	Off	On	Off	On
ETH (parameter from I2C ROM)	On	Off	Off	On	Off	On	Off	On
ETH (parameter from SPI ROM)	Off	On	On	Off	Off	On	Off	On
Serial NOR **(default setting)**	On	Off	On	Off	Off	On	Off	On
Parallel NOR 8 (EMI with ACK)	Off	On	Off	On	On	Off	Off	On
Parallel NOR 16 (EMI with ACK)	On	Off	Off	On	On	Off	Off	On
Parallel NAND 8	Off	On	On	Off	On	Off	Off	On
Parallel NAND 16	On	Off	On	Off	On	Off	Off	On
Reserved for SPI	Off	On	Off	On	Off	On	On	Off
Reserved for I²C	On	Off	Off	On	Off	On	On	Off
UART_BOOT	Off	On	On	Off	Off	On	On	Off
BootROM bypass	On	Off	On	Off	Off	On	On	Off
Parallel NOR 8 (EMI without ACK)	Off	On	Off	On	On	Off	On	Off
Parallel NOR 16 (EMI without ACK)	On	Off	Off	On	On	Off	On	Off
Reserved	Off	On	On	Off	On	Off	On	Off
Reserved	On	Off	On	Off	On	Off	On	Off

Note: 1 If SW2-1 and SW2-2 are both "OFF", B0 (pin PL_GPIO51) is in "HiZ state" and can be controlled from the application board.

2 If SW2-3 and SW2-4 are both "OFF", B1 (pin PL_GPIO52) is in "HiZ state" and can be controlled from the application board.

3 If SW2-5 and SW2-6 are both "OFF", B2 (pin PL_GPIO53) is in "HiZ state" and can be controlled from the application board.

4 If SW2-7 and SW2-8 are both "OFF", B3 (pin PL_GPIO54) is in "HiZ state" and can be controlled from the application board.

5 SW2-1 and SW2-2 "ON": INVALID Condition
SW2-3 and SW2-4 "ON": INVALID Condition
SW2-5 and SW2-6 "ON": INVALID Condition
SW2-7 and SW2-8 "ON": INVALID Condition

A.3.3 Jumpers & connectors

The jumpers and connectors numbered below refer to the CPU board schematics (available from your local ST representative).

Sheet 4

- Connector J3 is a standard 20-pin 2.54 mm connector used for JTAG connections.
- Jumper J5 enables the power supply to the Real Time Clock block.
  If jumper J5 is closed, the RTC is powered (standard).
- Connector J10 is a 2 vie 1.25 mm pitch connector for battery back-up with cable.

Sheet 5

- Connector J11 is a standard power connector for the ADC power supply with a 2.1-mm central pitch.

Sheet 6

- Jumpers J6, J7, J8 and J9 are serial jumpers for the SPEAr power rail.
  All jumpers MUST be closed. This configuration is used for power measurements.

Sheet 7

- Jumper J22 is a 4-pin symmetric IDC (or strip) connector that switches RX and TX signals for different types of RS-232 cables[(a)]:
  - Two pins are connected to the ST3232 Receive/Transmit side.
  - Two pins are connected to the RS-232 Receive/Transmit connector side.
- Connector J17 is a connector for standard IDC-to-DSUB converters.
- Jumper J20 switches between RS-232 transmit signals or GPIO2:
  - If jumper is on pins 1 and 2, pin PL_GPIO2 is connected to U12 (ST3232) and the COM0 is available on J17.
  - If jumper is on pins 2 and 3, pin PL_GPIO2 is connected to the expansion connector J12 pin 9. In this case the COM0 is available on CN13.
- Jumper J21 switches between RS-232 receive signals or GPIO3:
  - If jumper is on pins 1 and 2, pin PL_GPIO3 is connected to U12 (ST3232) and the COM0 is available on J17.
  - If jumper is on pins 2 and 3, pin PL_GPIO3 is connected to the expansion connector J12 pin 11. In this case the COM0 is available on CN13.

a. With 2 jumpers (inserted) the user can switch between two cases; two jumper inserted "vertically" or two jumpers inserted "horizontally". This enables the user to adapt the serial cable (null modem cable) to the CPU board. See *Figure 26: Serial cable setting*.

A.4 CPU board expansion connectors

The CPU board includes two 86-pin connectors (one on each side) used to extend the board with the SPEAr320 application boards.

Table 34. CPU board extension connector J12

Pin	Description	Pin	Description	Pin	Description
1	NC	30	SSP_MOSI	59	MII1_RXD0
2	+5.0 V	31	MII1_TXD3	60	nRESET
3	NC	32	MII1_COL	61	MII1_CRS
4	+5.0 V	33	MII1_RXER	62	NC
5	NC	34	SSP_CLK	63	MII1_MDC
6	+5.0 V	35	MII1_MDIO	64	NC
7	NC	36	SSP_MISO	65	SSP_SS0
8	+5.0 V	37	MII1_RXDV	66	NC
9	UART0_TX	38	I2C_SCL / PL_GPIO4	67	UART2_TX
10	SDAT1 / MicroSD card data 1	39	MII1_RXD2	68	NC
11	UART0_RX	40	I2C_SDA/ PL_GPIO5	69	UART2_RX
12	UART0_DCD	41	MII1_RXD3	70	+3.3 V
13	RS232_TXD	42	NC	71	NC
14	UART0_DSR	43	SSP_CS4	72	+3.3 V
15	RS232_RXD	44	NC	73	NC
16	UART0_RTS	45	UART0_RI	74	+3.3 V
17	UART0_DTR	46	NC	75	NC
18	UART1_TX	47	SSP_CS3	76	+3.3 V
19	SDAT0 / MicroSD card data 0	48	NC	77	GND
20	UART0_CTS	49	CAN2_TX	78	GND
21	GPIO34	50	+2.5 V	79	GND
22	CAN2_RX	51	CAN1_RX	80	GND
23	CAN1_TX	52	+2.5 V	81	GND
24	UART1_RX	53	MII1_TXD1	82	GND
25	MII1_RXD1	54	+2.5 V	83	GND
26	MII1_TXD0	55	MII1_TXEN	84	GND
27	MII1_TXD2	56	+2.5 V	85	GND
28	MII1_TXCLK	57	MII1_TXER	86	GND
29	MII1_RXCLK	58	INRESET		

Table 35. CPU board extension connector J13

Pin	Description	Pin	Description	Pin	Description
1	LED1 / PL_GPIO47	30	PL_GPIO76	59	MII2_RXER
2	+3.3 V	31	DIDO53 / PL_GPIO53	60	AIN4
3	LED2 / PL_GPIO49	32	MII2_RXD2	61	MII2_RXDV
4	PL_GPIO63	33	SDCD / MicroSD card detect	62	GND
5	PL_GPIO56	34	MII2_RXD0	63	MII2_TXEN
6	SDAT3 / MicroSD card data 3	35	DIDO54 / PL_GPIO54	64	AIN5
7	LED3 / PL_GPIO58	36	MII2_TXD1	65	MII2_TXD3
8	PL_GPIO57 / MicroSD card over current	37	DIDO74 / PL_GPIO74	66	GND
9	LED4 / PL_GPIO64	38	DIDO79 / PL_GPIO79	67	MII2_TXCLK
10	PL_GPIO61 / MicroSD Power Enable	39	ST3485_RE / PL_GPIO77	68	AIN6
11	SDAT2/ MicroSD data 2	40	MII2_TXD2	69	SDCMD / MicroSD command line
12	PL_GPIO66	41	ST3485_DE / PL_GPIO78	70	GND
13	Button 1 / PL_GPIO48	42	ADC_VREFN	71	PL_CLK3 (PLL3)
14	DIDO69 / PL_GPIO69	43	MII2_MDIO	72	AIN7
15	Button 2 / PL_GPIO50	44	AIN0 / Temperature sensor	73	SDCLK
16	DIDO72 / PL_GPIO72	45	MII2_MDC	74	GND
17	DIDO55 / PL_GPIO55	46	GND	75	PL_CLK1 (PLL1)
18	DIDO73 / PL_GPIO73	47	MII2_RXD3	76	ADC_VREFP
19	DIDO59 / PL_GPIO59	48	AIN0 / Potentiometer	77	GND
20	DIDO70 / PL_GPIO70	49	MII2_COL	78	GND
21	DIDO60 / PL_GPIO60	50	GND	79	GND
22	PL_GPIO67	51	MII2_RXD1	80	GND
23	DIDO65 / PL_GPIO65	52	AIN2	81	GND
24	DIDO71 / PL_GPIO71	53	MII2_TXER	82	GND
25	DIDO62 / PL_GPIO62	54	GND	83	GND
26	DIDO75 / PL_GPIO75	55	MII2_RXCLK	84	GND
27	DIDO68 / PL_GPIO68	56	AIN3	85	GND
28	MII2_CRS	57	MII2_TXD0	86	GND
29	DIDO52 / PL_GPIO52	58	GND		

A.5 CPU board bill of materials

Table 36. List of components

Item	Qty.	Reference	Part	Footprint	Description	Part number
1	59	C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, C18, C19, C20, C21, C22, C23, C24, C25, C26, C27, C28, C29, C30, C31, C32, C33, C34, C35, C36, C37, C38, C39, C40, C41, C42, C43, C44, C45, C46, C47, C48, C49, C50, C56, C57, C58, C59, C60, C99, C100, C101 and C102	0.1 uF X5R 10 V	0402	Capacitor/100 nF/ 10 V/10%/SC0402/X5R	
2	15	C61, C62, C63, C64, C65, C66, C67, C68, C69, C70, C71, C72, C73, C74 and C98	10 uF X5R 10 V	0805	Capacitor/10 uF/ 10 V/ 10%/SC0805/X5R	
3	3	C75, C76 and C77	10 nF X7R 50 V	0603	Capacitor/10 nF/ 50 V/10%/SC0603/X7R	
4	2	C78 and C79	15 pF COG 50 V	0603	Capacitor/15 pF/50 V/5%/SC0603/COG	
5	2	C80 and C81	33 pF COG 50 V	0603	Capacitor/33 pF/ 50 V/5%/SC0603/COG	
6	9	C82, C83, C84, C85, C86, C94, C95, C96 and C97	47 uF Tan 10 V	3528+	Capacitor/47 uF/ 10 V/20%/NO/NO/ STC3528/Tan/RoHS	
7	3	C87, C88 and C91	22 nF X7R	0603	Capacitor/22 nF/10 V/10%/SC0603/X7R	
8	1	C89	2.2 nF X7R	0603	Capacitor/2.2 nF/ 50 V/10%/SC0603/X7R	
9	1	C90	470 pF X7R	0603	Capacitor/470 pF/ 50 V/10%/SC0603/X7R	
10	1	C92	33 nF X7R 50 V	0603	Capacitor/33 nF/ 10 V/10%/SC0603/X7R	
11	1	C93	22 uF Y5V 6.3 V	1206	Capacitor/22uF/ 6.3 V/20%/SC1206/Y5V	
12	2	D1 and D2	Red LED	0805P	LED/RED/SLED0805	
13	1	D3	D BAV70	SOT23	Switching Diode/ 70 V/200 mA/ 250 mW/SOT23/RoHS	

Table 36. List of components (continued)

Item	Qty.	Reference	Part	Footprint	Description	Part number
14	1	D4	SCR TS420-B_1	DPAK	Switching Diode/600/4 A/ 200 mW/DPAK/RoHS	TS420-600B (STm)
15	5	D5, D6, D7, D8 and D9	GREEN	0805P	LED/GREEN/SLED0805	
16	2	FB1 and FB2	WURTH 742792023	0805	Bead/3 A/120 Ohm/ 0.03 Ohm/SL0805/RoHS	
17	5	FB3, FB4, FB5, FB6 and FB7	BLM21BD601SN1D	0805	Bead/200mA/600 Ohm/ 0.45 Ohm/SL0805/RoHS	
18	4	FB8, FB9, FB10 and FB16	FERRITE-0603	0603	Bead/500mA/600 Ohm/ 0.38 Ohm/SL0603/RoHS	
19	4	FB12, FB13, FB14 and FB15	FERRITE	0603	Bead/500 mA/600 Ohm/ 0.38 Ohm/SL0603/RoHS	
21	1	J1	USB B-TYPE RA	USB-B-RA-1	Type B USB Connector	
22	1	J2	USB A-TYPE RA DOUBLE	USB-A-RA-DB	TYPE A Double USB Connector/RA/TH	
23	1	J3	IDC 10X2 MD POL	IDC10X2MD	IDC 10x2/100 mil-pitch/ Header with shroud	
24	5	J5, J6, J7,J 8 and J9	STRIP-2X1-2.54-MD	2X1-2.54-MD	2x1 single row 2.54 mm pitch pin header	
25	1	J10	MOLEX 1.25MM 2W M	MLX-1.25MM-M	2x1 single row 1.25 mm pin pitch shrouded header	
26	1	J11	DC POWER SOCKET 2.1MM	DPS2.1MM	3 pin 2.1 power jack	
27	2	J12 and J13	SAMTEC-MIS-038	MIS-038	0.635 mm Doube Row HS Socket SMT	MIS-038-01-F-D (SAMTEC)
28	1	J17	IDC 5X2 MD POL	IDC5X2MD	IDC 5x2/100mil-pitch/ Header with shroud	
29	2	J20 and J21	STRIP-3X1	3X1-2.54-MD	3x1 single row 2.54 mm pitch pin header	
30	1	J22	STRIP-2X2-2.54-MD	2X2-2.54-MD	2X2 single row 2.54 mm pitch pin header	
31	2	L1 and L2	2.2 uH 1.2A	LPS3.9X3.9	Inductor/2.2 uH/1.2 A/ 20%/3.9x3.9/RoHS	LPS4012-222ML (Coilcraft)
32	1	L3	1 uH 1.7A	LPS3.9X3.9	Inductor/1 uH/1.7 A/ 20%/3.9x3.9/RoHS	LPS4012-102ML (Coilcraft)
34	1	P1	SW-PB-SMD	SW-PB-SMD6x6.6	Push Button/4PIN/ 6x6mm/SMT	TS6647S (Kingtek)
35	1	Q1	NPN BC848	SOT23	NPN Transistor/45 V/ 50 V/6 V/ 0.1 A/ 0.33 W/SOT23	

Table 36. List of components (continued)

Item	Qty.	Reference	Part	Footprint	Description	Part number
36	2	Q2 and Q3	NPN PDTD123Y	SOT23	NPN Transistor/50 V/50 V/5/ 0.5 A/ 0.25 W/SOT23	
38	2	R1 and R53	121 kOhm 1%	0805	Resistor/121 kOhm/NO/ 1%/SR0805/RoHS	
39	6	R2, R3, R4, R5, R6 and R7	100 Ohm	0603	Resistor/100 Ohm/NO/ 1%/SR0603/RoHS	
40	2	R8 and R9	470 Ohm	0603	Resistor/470 Ohm/NO/ 5%/SR0603/RoHS	
41	17	R10, R11, R12, R13, R14, R15, R16, R17, R18, R19, R20, R21, R22, R23, R24, R25 and R26	10 kOhm	0603	Resistor/10 kOhm/NO/ 5%/SR0603/RoHS	
42	2	R27 and R28	4.7 kOhm	0603	Resistor/4.7 kOhm/NO/ 1%/SR0603/RoHS	
43	1	R29	43.2 Ohm 1%	0805	Resistor/43.2 Ohm/NO/ 1%/SR0805/RoHS	
44	9	R30, R31, R32, R33, R34, R35, R36, R37, R38, R72, R73 and R74	1 kOhm	0603	Resistor/1 kOhm/NO/ 1%/SR0603/RoHS	
45	2	R39 and R40	150 Ohm	0603	Resistor/150 Ohm/NO/ 5%/SR0603/RoHS	
46	1	R41	680 Ohm	0603	Resistor/150 Ohm/NO/ 5%/SR0603/RoHS	
47	8	R42, R43, R44, R45, R46, R47, R48 and R50	0 Ohm	0603	Resistor/0 Ohm/NO/ 5%/SR0603/RoHS	
48	1	R49	56 kOhm	0603	Resistor/56ROhm/NO/5%/ SR0603/RoHS	
50	1	R54	R 0603 0 Ohm	0603	Resistor/0 Ohm/NO/ 5%/SR0603/RoHS	
51	3	R55, R56 and R57	150 kOhm	0603	Resistor/150 kOhm/NO/ 5%/SR0603/RoHS	
52	1	R58	390 kOhm	0603	Resistor/390 kOhm/NO/ 1%/SR0603/RoHS	
53	2	R59 and R60	4.3 Ohm	0603	Resistor/4.3 Ohm/NO/ 1%/SR0603/RoHS	
54	1	R61	75 kOhm	0603	Resistor/75 kOhm/NO/ 1%/SR0603/RoHS	
55	6	R62, R63, R64, R65, R66 and R67	68 kOhm	0603	Resistor/68 kOhm/NO/ 1%/SR0603/RoHS	
56	1	R68	15 kOhm	0603	Resistor/15 kOhm/NO/ 5%/SR0603/RoHS	

Table 36. List of components (continued)

Item	Qty.	Reference	Part	Footprint	Description	Part number
57	1	R69	47 kOhm	0603	Resistor/47 kOhm/ 0.063 W/ 5%/ SR0603/RoHS	
58	1	R70	27 kOhm	0603	Resistor/27 kOhm/0.063W /1%/SR0603/RoHS	
61	1	R75	330 Ohm	0603	Resistor/330 Ohm/NO/5%/ SR0603/RoHS	
63	1	SW1	DIP Micro Switch 6X SMD	SWM-6X-SMD	Micro Switch 6X SMD/ 1.27 mm	
64	1	SW2	DIP Micro Switch 8X SMD	SWM-8X-SMD	Micro Switch 6X SMD/ 1.27 mm	
66	3	TP27, TP28 and TP29	TP-TH-POWER	TPTH-PWR	Through Hole Test Point	
68	1	U1	Spear320	SG-BGA-6004	Spear320	Spear320 (STm)
70	1	U3	MT47H64M16HR3	FBGA84	DDR2/1 Gbit/16 bit/1.8 V/ bga84/RoHs	MT47H64M16HR-3 (Micron)
71	1	U4	ST2052	SO8	Power MOSFET Switch/80 mOhm/ 500 mA/ 2 Channel/ 2.7 V-5.5 V/RoHs	ST2052 (STm)
72	1	U5	M25P64	SO16	Flash/64 Mbit/SPI/3.3 V/ SO16/RoHs	M25P64-VMF6P (Numonix)
74	1	U7	STM811	SOT143-4	Reset IC/3 V/ SOT143-4/ RoHs	STM811SW16F (STm)
75	1	U8	BATT BR2032	BR2032	Backup Battery/3 V/220 mAh/ battery-holder-cr2032/VH	
76	1	U9	ST LD1117 S25TR	SOT223	LDO/15 Vmax/2.5 V/0.8 A/ 2%/SOT223/RoHs	LD1117S25TR (STm)
77	1	U10	ST PM6641	VFQFPN-48	DDR2 DDR3 Switching Power/2.7 V- 5.5 V/ 1.5 V-1.8 V/ 3.9 A-6.1 A/ QFPN48 7x7/ RoHs	PM6641 (STm)
78	1	U12	ST3232C	SO16	Low Power,3.3 V, RS-232 Line Drivers/ Receivers/ SOP16-50-235	ST3232C (STm)
79	3	U13, U14 and U15	ST USBLC6-2SC6	SOT23-6L	ESD Protection/ 2 data lines/ 3.5 pF/ 150 nA/ SOT23-6/RoHs	USBLC6-2SC6 (STm)

Table 36. List of components (continued)

Item	Qty.	Reference	Part	Footprint	Description	Part number
80	1	U16	ST STBP120C	TDFN-10	Overvoltage protection device with thermal shutdown/Rds 90 mOhm/ TDFN-10 2.5x2 mm/RoHs	STBP120BVDK6F
81	1	Y1	32.768 kHz	XT38T	Crystal/32.768 kHz/NO/ 12.5 pF/XTAL-60-85 A/ RoHS	
82	1	Y2	24 MHz	RAD-HC49	Crystal/24 MHz/NO/ 12.5 pF/HC49/RoHS	
83	1	Z1	MMSZ5232BT1	SOD123-C425	Zener Diode/5.6 V/0.5 A/ 0.5HearderW/ SOD-123/RoHs	

Appendix B Application board bill of materials

Table 37. List of components

Designator	Qty.	Description	Value	Order number	Not assembled
B1, B2, B3	3	SE Push button	B3S-1000		
C1, C3, C5, C6, C7, C8, C9, C10, C11, C13, C15, C16, C19, C20, C21, C23, C24, C29, C31, C32, C33, C34, C35, C36, C37, C38, C39, C40, C41, C42, C45, C46, C47, C48, C49, C50, C51, C52, C53, C55, C56, C57, C58, C70, C71, C72, C73, C81, C82, C83, C84 and C89	52	Capacitor (0603)	100 nF		
C2, C4, C18, C26, C43, C44, C54, C59 and C61	9	Capacitor (1206)	10 nF / 500 V		
C12, C17, C22 and C25	4	Capacitor (0805)	10 µF / X5R ceramic / JMK212BJ106KG		
C30, C64, C75, C76 and C85	5	Capacitor (0603)	10 nF		
C62	1	Polarized Capacitor (CDE)	100 uF / 10 V / TPSC107M010R0075		
C63	1	Capacitor (1206)	10 µF / ceramic / 35 V / GMK316F106ZL		
C65 and C88	2	Capacitor (0603)	47 pF		
C60, C66, C67, C68, C69, C74, C77, C78, C79 and C80	10	Polarized Capacitor (B)	22 µF / 6.3 V / TAJB226K006R		
C86	1	Capacitor (1206)	470 nF / 50 V / C1206C474K5RAC		
C87	1	Capacitor (0603)	1 nF		
CN1, CN2, CN13, CN14 and CN15	5	DB9-male connector	DB9-male		
CN3 and CN4	2	Header, 20-Pin, Dual row, With key			
CN5 and CN6	2	Header, 14-Pin, Dual row, With key			
CN7 and CN8	2	RJ45 Ethernet connector with integrated magnetic, Pulse: J00-0086	J00-0086	Pulse: J00-0086NL	
CN9 and CN10	2	Header, 20-Pin, Dual row			
CN11	1	Header, 4-Pin, Single row			
CN12	1	DB9-female connector	DB9-female Profibus DP		

Table 37. List of components (continued)

Designator	Qty.	Description	Value	Order number	Not assembled
CN16	1	MicroSD card socket	PJS008-2003	YAMAICHI: PJS008-2003 (www.manudax.fr)	
CN17	1	2-pin terminal block, 5.08 mm pitch	Terminal block		
CN18	1	Input power connector, 4.4 V-36 V	DC10A socket		
D1, D2 and D3	3	Schottky Diode	STPS3L40UF	ST: STPS3L40UF	
D4	1	Transil diode	SM6T33A	ST: SM6T33A	
J1 and J2	2	SAMTEC-MIT-038	MIT-38-01-F-D	Samtec: MIT-38-01-F-D	
JP1, JP3, JP4, JP6, JP7, JP8, JP11, JP12 and JP13	9	3-pin Jumper Wire			
JP2, JP5, JP9, JP10, JP14, JP17 and JP18	7	2-pin Jumper Wire			
JP15 and JP16	2	3-pin Jumper Resistor			
L1, L2, L5 and L6	4	Ferrite bead	NFE31PT222Z1E9L		
L3	1	Inductor	MSS1260-333	CoilCraft: MSS1260-333	
L4	1	Inductor	BLM18BA05OSN1D		
LD1 and LD3	2	Typical RED, GREEN, YELLOW, AMBER GaAs LED	Green / LGR971-Z		
LD2 and LD4	2	Typical RED, GREEN, YELLOW, AMBER GaAs LED	Yellow / LYR971-Z		
LD5 and LD6	2	Typical RED, GREEN, YELLOW, AMBER GaAs LED	Red / LSR976		
OSC1	1	25 MHz oscillator SG-210SCB or CFPS-69IB	EPSON SG-210SCB or IQD Frequency Products CFPS-69IB		
R1, R5, R22, R30, R32, R46, R70, R73, R83, R84, R86, R87, R88, R89, R90, R92 and R97	17	Resistor (0603)	10 kΩ		R32
R2, R6, R10, R11, R12, R13, R16, R17, R18, R19, R20, R34, R36, R37, R38, R41, R42, R43, R44 and R45	20	Resistor (0603)	2.2 kΩ		
R3 and R7	2	Resistor (0603)	120 Ω		
R4, R8, R28, R52, R77, R78, R80, R82 and R91	9	Resistor (0603)	1 MΩ		

Table 37. List of components (continued)

Designator	Qty.	Description	Value	Order number	Not assembled
R9, R23, R33, R47 and R99	5	Resistor (0603)	1.2 kΩ		
R14 and R39	2	Resistor (0603)	5.6 kΩ		
R15 and R40	2	Resistor (0603)	91 kΩ		
R21, R26, R48 and R51	4	Resistor (0603)	2 kΩ		
R24, R25, R49, R50 and R72	5	Resistor (0603)	220 Ω		R72
R27, R29, R35, R56, R61, R65, R75, R76, R79, R81, R93, R94, R95 and R96	14	Resistor (0603)	0 Ω		R27, R29, R35, R79, R81
R31	1	Resistor (0603)	33 Ω		
R53, R55, R57, R58, R85 and R104	6	Resistor (0603)	1 kΩ		
R54, R60, R64, R67, R68, R105 and R107	7	Resistor (0603)	4.7 kΩ		
R59, R63, R69, R103, R106 and R108	5	Resistor (0603)	100 Ω		
R62	1	Variable Resistor	10 kΩ, potentiometer RK09K11310KB		
R66	1	Resistor (0603)	470 Ω		
R71 and R74	2	Resistor (0603)	390 Ω NA		R71, R74
R98	1	Resistor (0603)	1.5 kΩ		
R100	1	Resistor (0603)	47 kΩ		
R101	1	Resistor (0603)	47 Ω		
R102	1	Resistor (0603)	102.5 kΩ (91K||5K6)		R102
SB1vSB2	2	Soldering Bridge			
U1 and U2	2	CAN transceiver	SN65HVD230		
U5 and U6	2	10/100 Fast Ethernet 3.3 V Transceiver	ST802RT1A	ST: ST802RT1A	
U9	1	Precision Analog Temperature Sensor	STLM20W87F	ST: STLM20W87F	
U10, U12, U13 and U14	4	3.3 V/5 V Dual RS232 Transceiver w/ Int. Cap.	ST3232EBTR	ST: ST3232EBTR	
U11	1	RS485 transceiver	ST3485EBDR	ST: ST3485EBDR	
U15	1	Single channel power switch	STMPS2141STR	ST: STMPS2141STR	
U16	1	DC/DC converter	L7986A	ST: L7986A	

Appendix C License agreements

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Revision history

Table 38. Document revision history

Date	Revision	Changes
25-Sep-2009	1	Initial release.
25-Feb-2010	2	Updated *Section A.3.3: Jumpers & connectors*. Changed the title of the document. Minor text changes.
06-Sep-2010	3	Updated *Section 4.2: Connecting*: corrected mistake in the first list item (“CPU board” replaced by “application board”) and specified the connector name. Updated *Section 5.5: Power supply*: corrected instructions in the list items 1 and 2.
2-Dec-2010	4	*Section 4.1: Unpacking*: anti-static warning updated Paragraph below *Table 10: General-purpose LED configuration* updated. Minor text and format edits.