Introduction

This user manual describes the implementation of the EVALSP320SPLC evaluation board (order code: EVALSP320SPLC). This evaluation board can be used to evaluate the SPEAr320S microprocessor with a variety of devices and especially its Media Independent Interface (MII) Automation mode.

The EVALSP320SPLC evaluation kit includes a single application board identified as "MII mode".

The SPEAr320S microprocessor is mounted on a separate CPU board, which is not included with the EVALSP320SPLC kit. It must be ordered separately with order code EVALSP320SCPU.

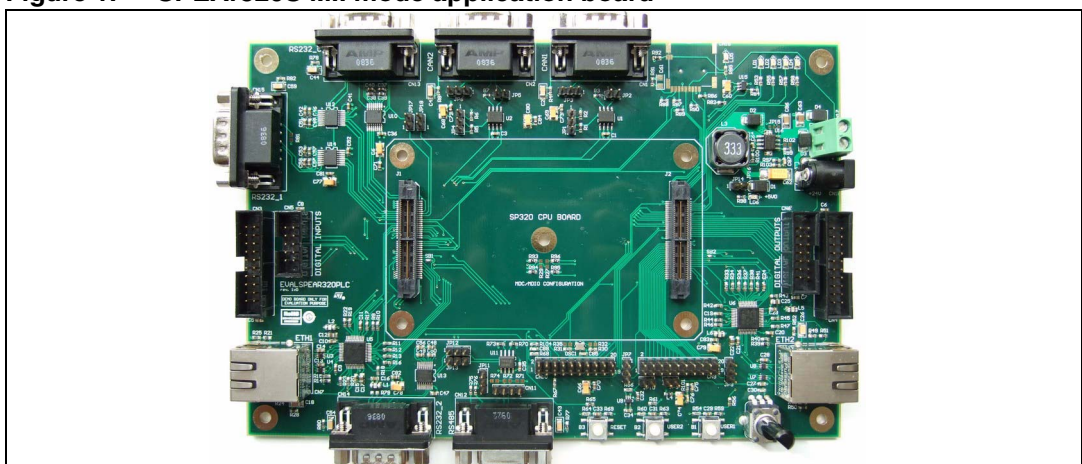The EVALSP320SCPU board must be plugged on the MII mode application board.

The MII mode 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.   SPEAr320S MII mode application board

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- 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

1.1 Application board block diagram

Figure 2. Block diagram

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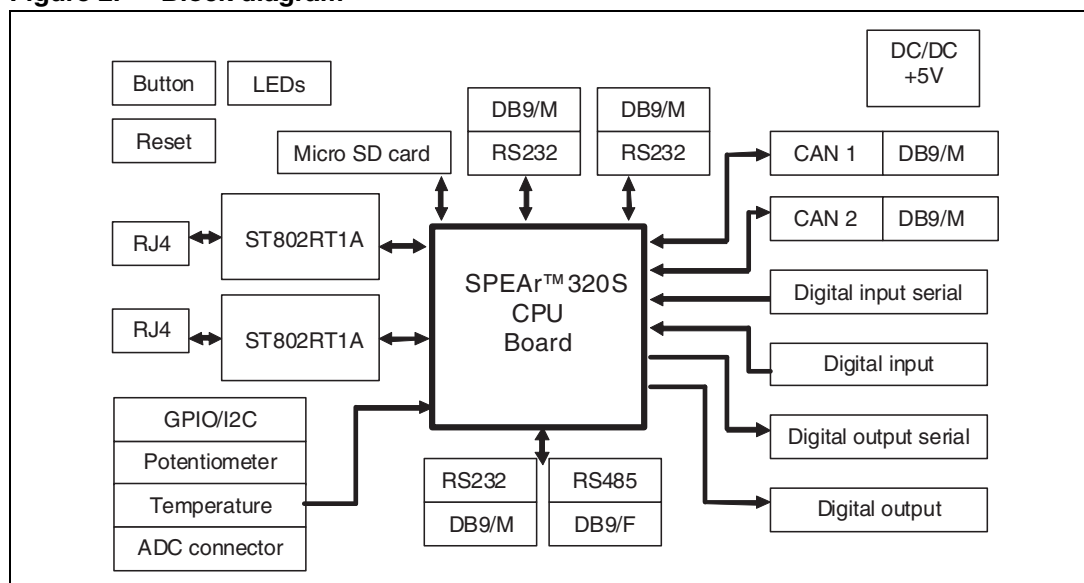
2   Application board layout

Figure 3.   Application board layout
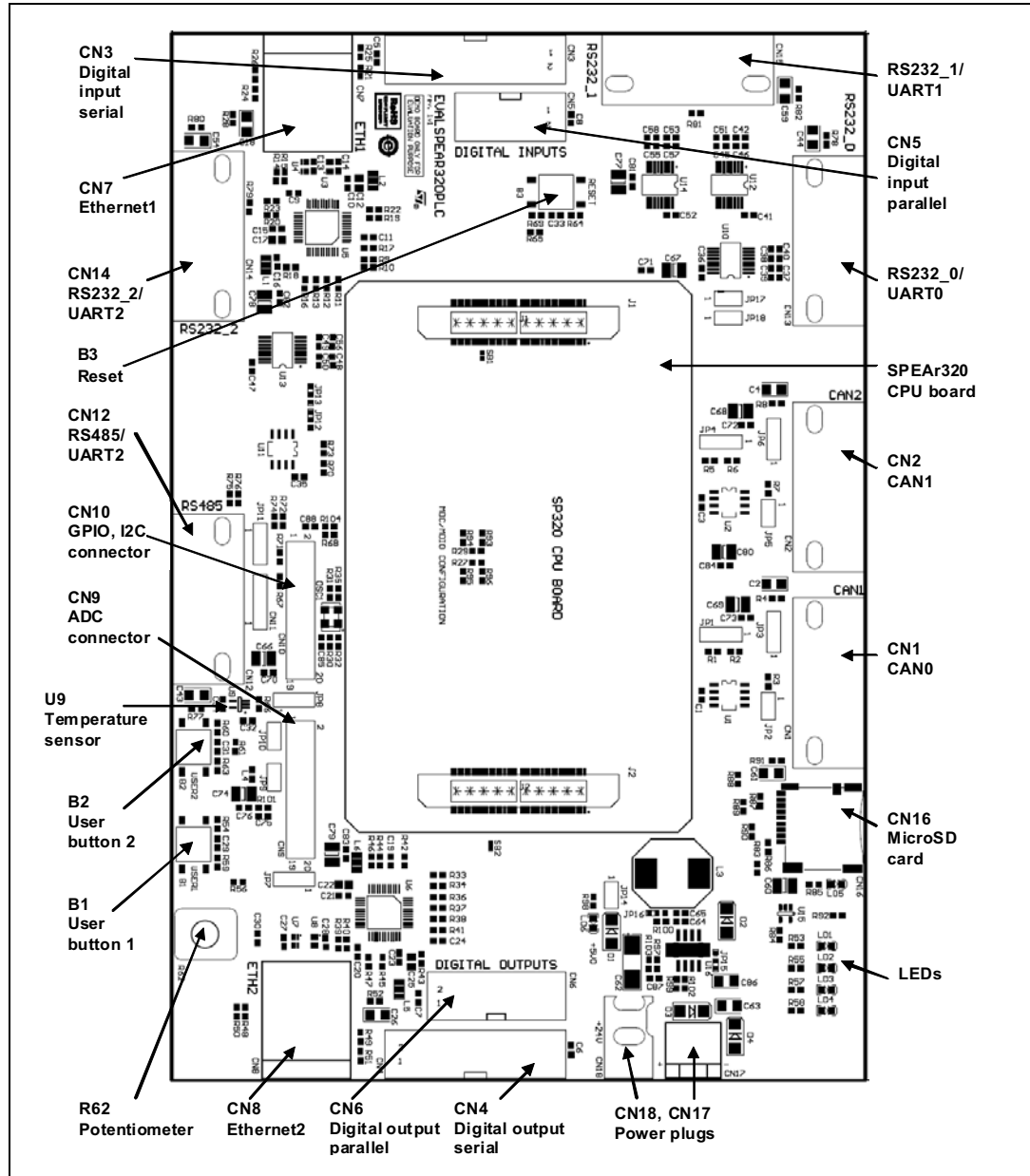
Note: *Evaluation boards for SPEAr320S may use the same PCB as SPEAR320 devices. This is why the label "SPEAr320 CPU BOARD" can be found on some SPEAr320S boards.*

3 Getting started

3.1 Unpacking

Warning: **This board contains static sensitive devices.**

The EVALSP320SPLC 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.

3.2 Connecting

1. Connect a serial cable from the application board (connector CN13: RS232_0/UART0) to a host PC (see *Figure 3: Application board layout*).

2. On a host PC running Windows or Linux, start the Terminal program.

3. Connect a power supply to the EVALSP320SPLC evaluation board as described in *Section 4.5: Power supply on page 13*.

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*.

3.3 Booting

The EVALSP320SPLC 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.

4 Configuration

4.1 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.

4.2 Digital input / digital output connectors

The digital input and digital output connectors are used to extend the EVALSP320SPLC 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 EVALSP320SPLC 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 4. **EVALSP320SPLC board with digital input and digital output cards**
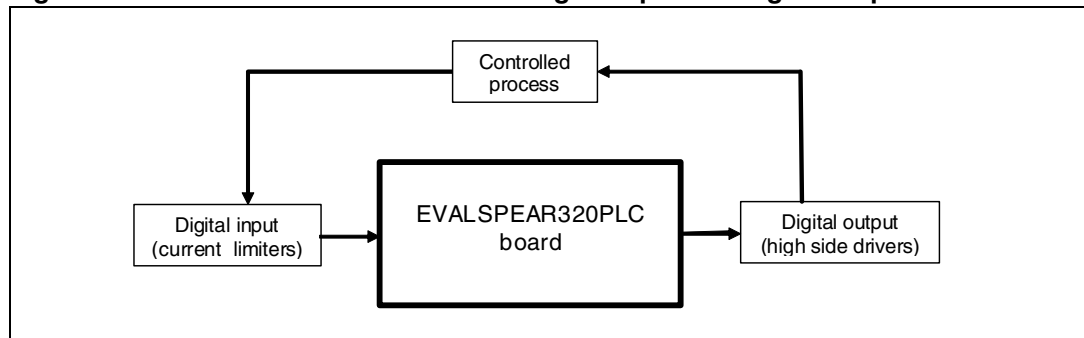
Figure 5.   8/16 input channel current limiter based on SCLT3-8, STEVAL-IFP007V1

4.3   Controller–area network bus

The EVALSP320SPLC 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.	1 2 3
	CAN1 transceiver works in high-speed mode when JP4 is set (Default).	1 2 3
	CAN1 transceiver works in slope control mode when JP4 is open.	1 2 3
JP5	CAN1 terminal 120Ω resistor is enabled when JP5 is loaded. Default setting: loaded	1 2

4.4   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.	1 2 3
	Connects +3.3 V to the RS-485 (R71, R72 and R74) termination network (Default).	1 2 3

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.	1 2 3
	UART2_TX line is connected to the RS-232 transceiver U13 (Default).	1 2 3
JP13 (SMD resistor)[1]	UART2_RX line is connected to the RS-485 transceiver U11.	1 2 3
	UART2_RX line is connected to the RS-232 transceiver U13 (Default).	1 2 3

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.**

4.5   Power supply

There are two options to supply the EVALSP320SPLC evaluation board:

1. Connecting the +5 V voltage adapter (delivered in the EVALSP320SPLC 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 EVALSP320SPLC 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).	1 2
JP15 (SMD resistor)[1]	For L7986A the jumper must be set (Default).	1 2 3
	Optional when L5973A would be assembled, the jumper must be set as shown at right.	1 2 3
JP16 (SMD resistor)[1]	For L7986A the jumper must be set as shown at right. (Default)	1 2 3
	Optional when L5973A would be assembled, the jumper must be set as shown at right.	1 2 3

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

4.6 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.

4.7 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.

4.8 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).	1 2 3
	Connects the external ADC application supply voltage to the ADC_VREFP pin of the CPU board.	1 2 3
JP8	Connects the evaluation board GND of the ADC supply voltage domain to the ADC_VREFN pin of the CPU board (Default).	1 2 3
	Connects the external ADC application GND (lower limit) supply voltage to the ADC_VREFN pin of the CPU board.	1 2 3

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

0 V	$\leq$	CN9-1	$\leq$	CN9-3 - CN9-17	$\leq$	CN9-19	$\leq$	+2.5 V
GND	$\leq$	ADC_VREFN	$\leq$	AIN0 -AIN7	$\leq$	ADC_VREFP	$\leq$	+2.5 V ADC

4.9 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.

4.10 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

4.11 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.

4.12 MicroSD card

The MicroSD card connector connected to the SDIO interface of the EVALSP320SPLC 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.

5 Connectors

5.1 CAN DB9 plug connectors (CN1 and CN2)

Figure 6.   **CAN DB9 plug connectors pinout**
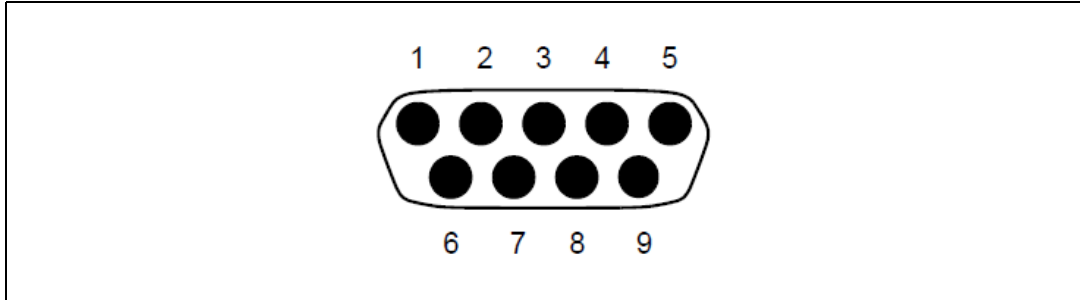
Table 11.   **CAN DB9 plug connectors description**

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)

5.2 Digital input serial connector (CN3)

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

Figure 7.   **Digital input serial connector pinout**
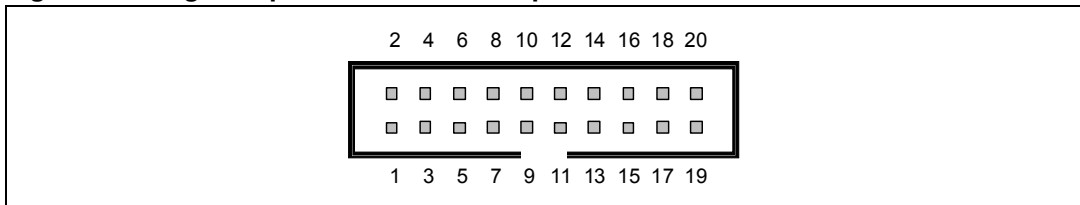
Table 12.   **Digital input serial connector description**

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

5.3 Digital output serial connector (CN4)

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

Figure 8. Digital output serial connector pinout
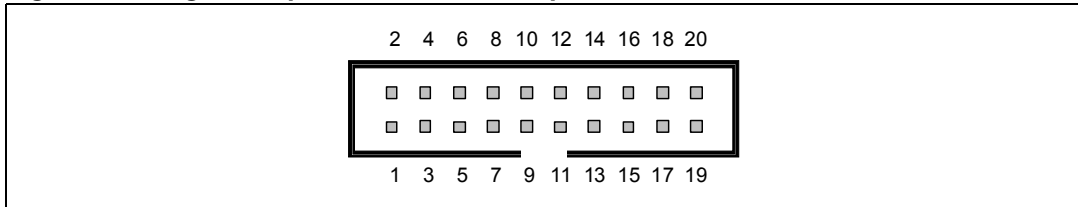
Table 13. Digital output serial connector description

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

5.4 Digital input parallel connector (CN5)

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

Figure 9. Digital input parallel connector (CN5) pinout
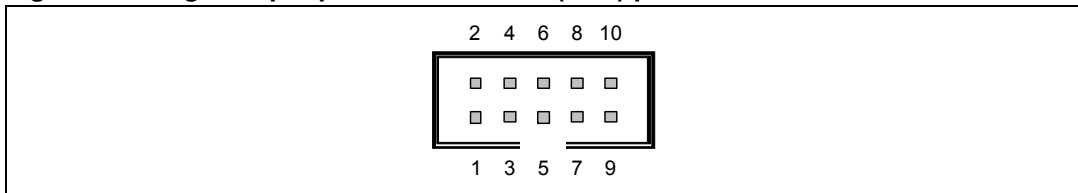
Table 14. Digital input parallel connector (CN5) description

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

5.5 Digital output parallel connector (CN6)

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

Figure 10. Digital output parallel connector (CN6) pinout
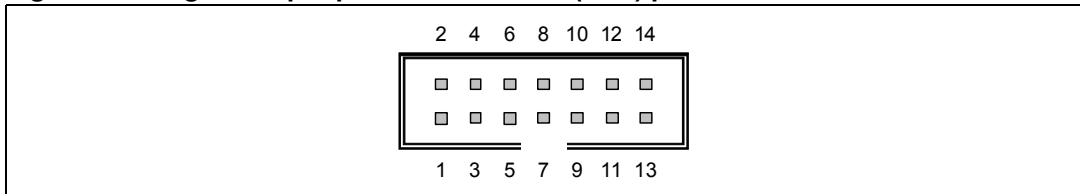
Table 15. Digital output parallel connector (CN6) description

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		

5.6 Ethernet RJ-45 connectors (CN7 and CN8)

Figure 11. Ethernet RJ-45 connectors (CN7 and CN8) - Front view
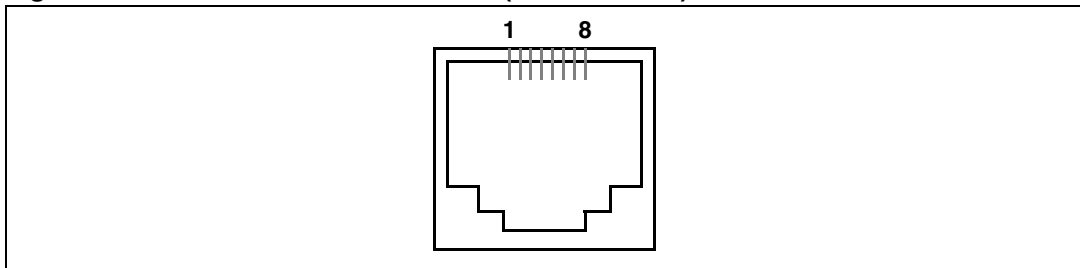
Table 16. Ethernet RJ-45 connectors (CN7 and CN8) description

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

5.7 General-purpose ADC connector (CN9)

Figure 12. General-purpose ADC connector (CN9) pinout
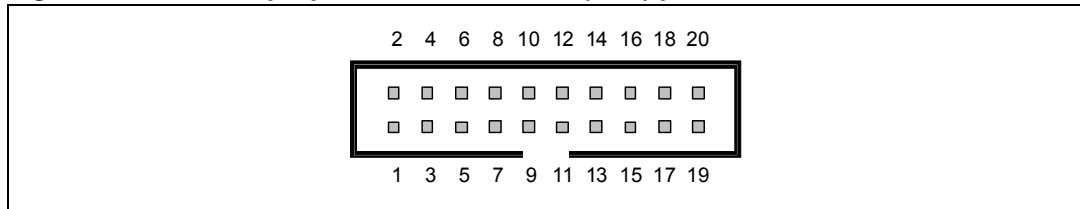
Table 17. General-purpose ADC connector (CN9) description

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

5.8 General-purpose GPIO and I^{2}C connector (CN10)

Figure 13. General-purpose GPIO and I^{2}C connector (CN10) pinout
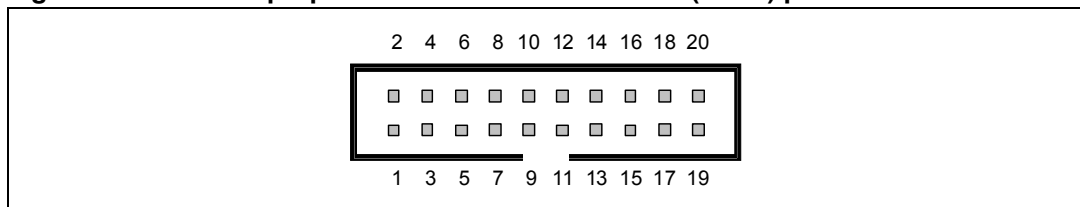
Table 18. General-purpose GPIO and I^{2}C connector (CN10) pinout description

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.

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

Figure 14. RS-485 DB9 socket connector CN11 pinout
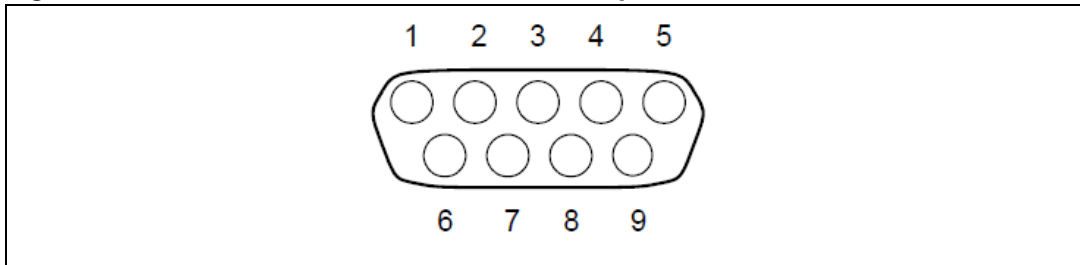
Table 19. RS-485 DB9 socket connector CN11 description

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 15. RS-485 header connector CN12 pinout
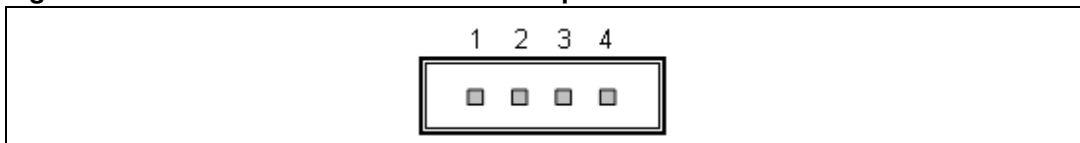
Table 20. RS-485 header connector CN12 description

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

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

Figure 16. RS-232/UART0 DB9 plug connector (CN13) pinout
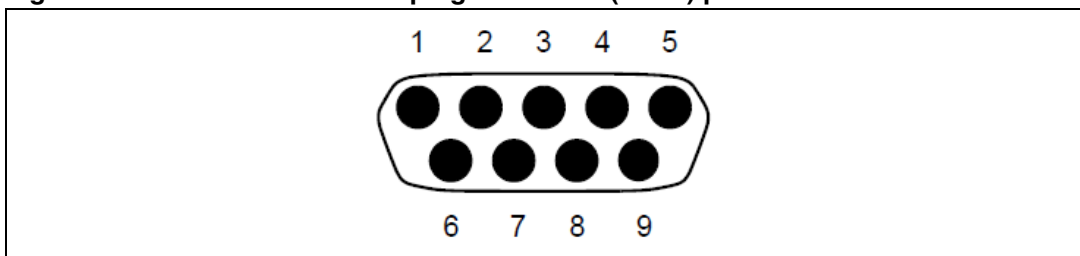
Table 21. RS-232/UART0 DB9 plug connector (CN13) description

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		

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

Figure 17. RS-232/UART2 DB9 plug connector (CN14) pinout
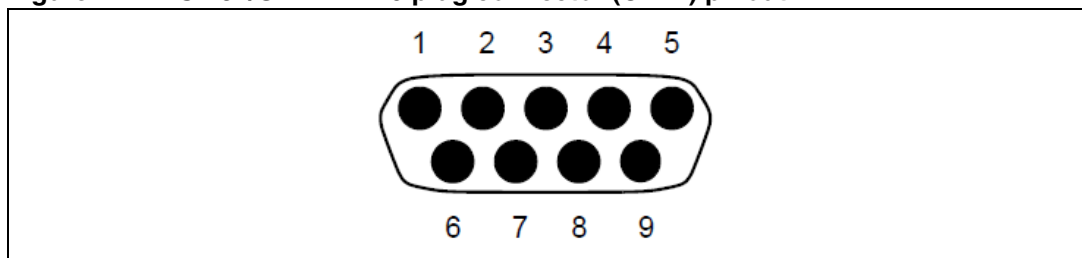
Table 22. RS-232/UART2 DB9 plug connector (CN14) description

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		

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

Figure 18. RS-232/UART1 DB9 plug connector (CN15) pinout
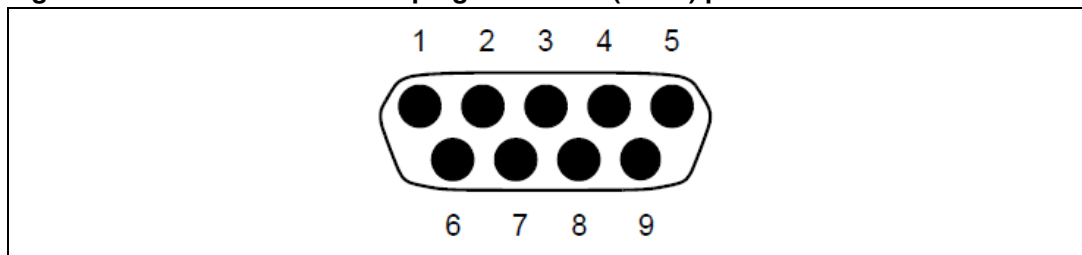
Table 23.   RS-232/UART1 DB9 plug connector (CN15) description

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		

5.13   MicroSD card connector (CN16)

See also: *MicroSD card on page 16*.

Figure 19.   MicroSD card connector (CN16) pinout
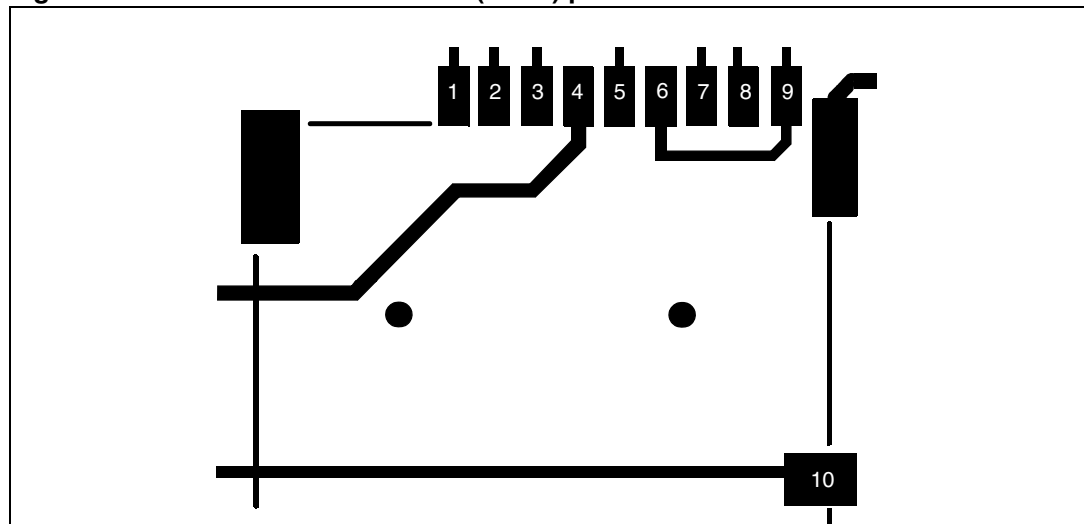
Table 24.   MicroSD card connector (CN16) description

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)

5.14 Power supply connectors (CN17 and CN18)

Figure 20. Power supply connector CN18 diagram
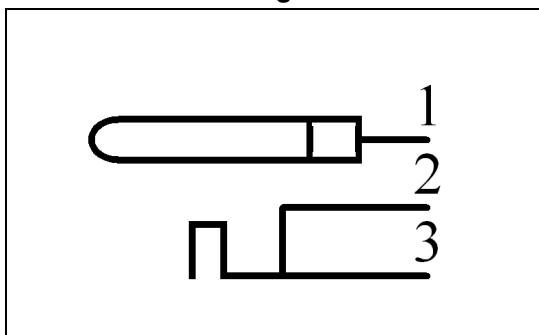
Figure 21. Power supply connector CN17 diagram
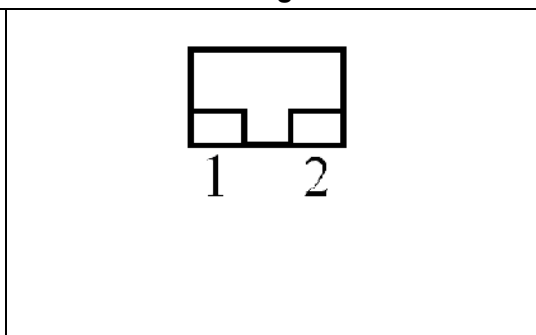
Table 25. Power supply connector CN18 description

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

5.15 SPEAr320S 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 SPEAr320S CPU board.

Figure 22. 86-pin connectors (J1 and J2) pinout
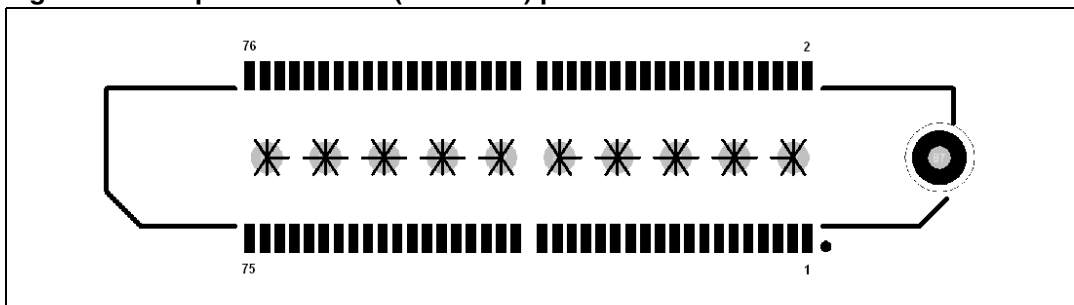
Table 27. 86-pin connector (J1) description

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   Application board bill of materials

Table 29.   **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 29.   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 29.   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	

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Revision history

Table 30.   Document revision history

Date	Revision	Changes
01-Mar-2012	1	Initial release.
21-Mar-2012	2	Modified introduction to indicate that the CPU board is ordered separately and removed CPU board hardware description sections.

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