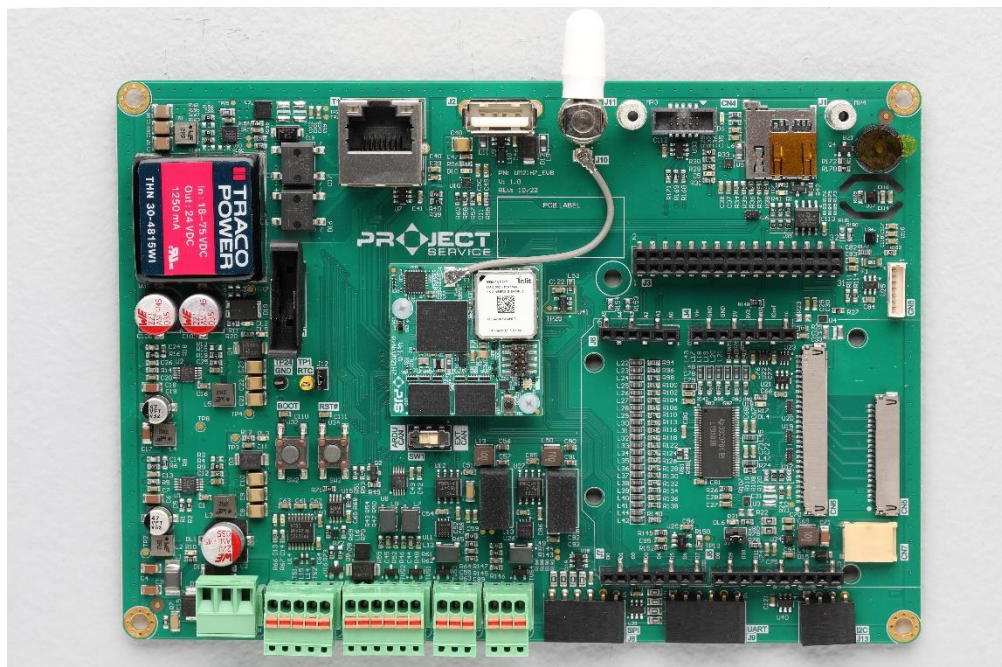




PJS-UM21H7-EVAL v1.0 Datasheet

UM21H7 Custom Carrier Board

July, 2023

Project Service S.r.l.

PJS-UM21H7-EVAL v1.0 Datasheet

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1. Introduction

This chapter gives an overview of the UM21H7-EVAL custom carrier board.

2. Reference Documents

ID	Doc. Name	Date	Revision
RD1			
RD2			
RD3			
RD4			
RD5			
RD6			
RD7			
RD8			

3. General Information

This document describes the hardware architecture of the PJS-UM21H7 EVAL.

The PJS-UM21H7-EVAL is a complete development board, utilizing all the UM21H7 System-on-Module's features.

It's assembled with large of user and debug interfaces enabling it to serve as both a complete development kit or as a stand-alone end-product.

3.1 Supported Project Service products

- UM21H7 SOM

3.2 Supported O.S

- FreeRTOS 10.3.1 (Hard Real-Time Multi-Tasking available)

3.3 Supported Framework

- TouchGFX

3.4 Additional information

Board schematics as well as mechanical CAD documentation is available.

For further information contact Project Service support at <mailto:info@projectservice.it>

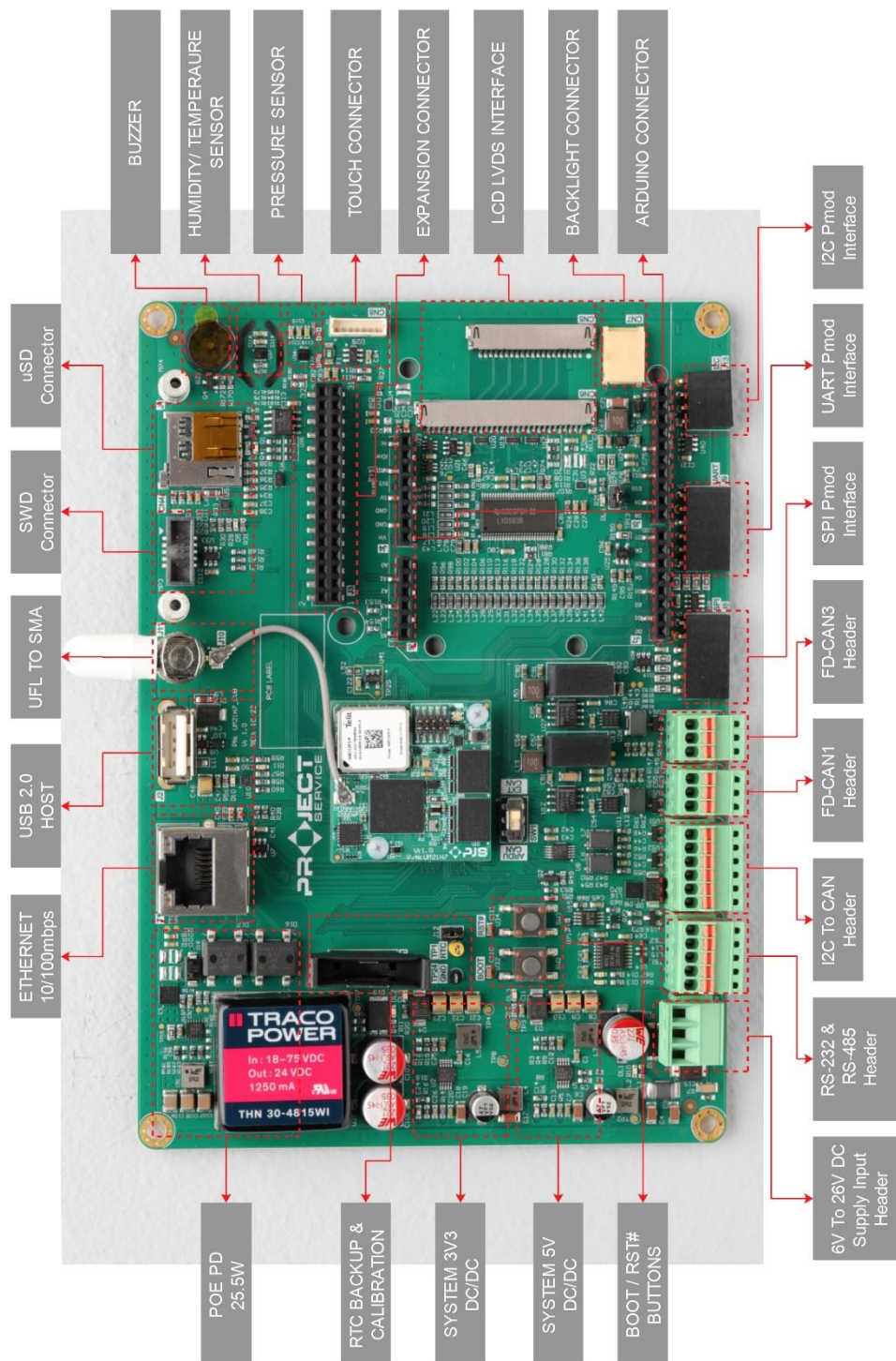
4. PJS-UM21H7 EVAL features summary

- Two 80-pin 0.4mm pitch connectors compatible with UM21H7
- Display
 - 24-bit LVDS Interface supporting LVDS Display up to XGA Resolution
 - On-Board backlight controller
- Touch panel interface
 - Capacitive - I2C based
- Ethernet
 - 10/100BaseT - RJ45 With POE & PD Controller
- USB
 - USB2.0, Type A
- CAN FD Bus
 - 2 x Isolated ISO 11898-1 CAN-FD
- RS-232 / RS-485
 - 1 x RS-232 Interface up to 250 kbit/s
 - 1 x Half-Duplex RS-485 up to 20Mbps
- μ SD-Card slot
- I2C To CAN Interface
- Additional
 - Various Pmod Header (SPI / I2C / UART)
 - On-board Expansion Header
 - Arduino Interface
 - On-Board Temperature / Humidity / Pressure Sensors
 - uFL to SMA connector Adapter

5. Block Diagram

v1.0

PJS UM21H7 EVAL



6. UM15M7-EVAL connectors

The below table lists all available connectors on the UM21H7-EVAL, refer to chapter 7 for a more detailed description and Pin-out of each connector.

Reference	Function	Type
H1	Power In	3 Pin Terminal Block, 3.81mm, Vertical
H2	I2C TO CAN INTERFACE	6 Pin Terminal Block, 2.5mm, Vertical
H3	FDCAN1 INTERFACE	3 Pin Terminal Block, 2.5mm, Vertical
H4	RS232 & RS485 INTERFACE	5 Pin Terminal Block, 2.5mm, Vertical
H5	FDCAN3 INTERFACE	3 Pin Terminal Block, 2.5mm, Vertical
J1	uSD INTERFACE	uSD Card Connector, Push & Push
J2	USB HOST	USB 2.0, Type-A, Vertical
J3	EXPANSION CONNECTOR	32 Pin Socket Header, 2.54mm, Vertical
J4 / J5 / J6 / J7	ARDUINO INTERFACE	Socket Header, 2.54mm, Vertical
J8	SPI PMOD	6 Pin Socket Header, 2.54mm, Angled
J9	UART PMOD	6 Pin Socket Header, 2.54mm, Angled
J10	UFL ANTENNA	UFL RF Connector, 50R, Push-On
J11	SMA ANTENNA	SMA RF Connector, 50R, DC to 18Ghz
J12	RTC CALIB ON / OFF	2 Pin Header, 2.00mm, Vertical
J13	I2C PMOD	4 Pin Socket Header, 2.54mm, Angled
T1	LAN CONNECTOR	1 Port, 10/100 Base-T, Tab Vertical, POE+
CN1	RTC BATTERY HOLDER	Battery Holder, CR2032, Vertical
CN2 / CN3	UM21H7 RECEPTACLE	80 Pin Receptacle, 0.4mm, Vertical
CN4	SWD HEADER	10 Pin Header, 1.27mm, Vertical
CN5	DISPLAY LVDS INTERFACE	20 Pin Connector, DF19, 1.00mm, Horizontal
CN6	DISPLAY LVDS INTERFACE	30 Pin Connector, DF19, 1.00mm, Horizontal
CN7	BACKLIGHT CONNECTOR	2 Pin Header, 3.50mm, Right-Angle
CN8	TOUCH INTERFACE	7 Pin Header, 1.25mm, Vertical

Table 6-1 UM21H7-EVAL connectors

7. Detailed Description

7.1 Overview

This chapter details the UM21H7-EVAL's features and external interfaces, some of which are driven directly by the UM21H7 system-on-module.

Please refer to UM21H7 data sheet for more information regarding those interfaces.

The following list describes this chapter table's column header:

Pin#:

Pin number on the specific connector

UM21H7-EVAL Signal:

UM21H7-EVAL schematic signal name

Type:

Pin type & direction:

- I – In
- O – Out
- DS – Differential Signal
- A – Analog
- Power – Power Pin

Description:

Short Pin functionality description

7.2 UM21H7-EVAL Interfaces

7.2.1 UM21H7

The UM21H7-EVAL features two low profile, 80-Pin board to board connectors (**CN2 & CN3**) to connect with the UM21H7 System-on-module.

Please refer to UM21H7 module data sheet for a complete signal description and pin-out.

7.3 Standard External Interfaces

7.3.1 μ SD Card

μ SD Card interface is driven by SDMMC interface of the UM21H7 (**J1**).

- 4-bit bus
- ESD protection.

Pin #	UM21H7-EVAL	Type	Description
1	SDIO_D2	IO	SDIO Parallel Data2
2	SDIO_D3	IO	SDIO Parallel Data3
3	SDIO_CMD	IO	SDIO Command Line
4	uSD_POWER	POWER	Peripheral Power Supply 3.3V
5	SDIO_CK	O	SDIO Clock Line
6	GND_SIGNAL	POWER	Digital ground
7	SDIO_D0	IO	SDIO Parallel Data0
8	SDIO_D1	IO	SDIO Parallel Data1
9	GND_SIGNAL	POWER	Digital ground
10	SDIO_CD	O	SD Card Detect

Table 7-1 μ SD Card slot Connector Pin-out (J1)

7.3.2 USB2.0 HOST

The UM21H7 drives USB host interface to USB Type A connector (**J2**).

- Transfer rates of up to 12 Mbps.
- ESD protection.

Pin #	UM21H7-EVAL	Type	Description
1	USB_VBUS	POWER	5V out (Host)
2	USB_D_N	DSI/O	USB Data Negative
3	USB_D_P	DSI/O	USB Data Positive
4	USB_GND	POWER	USB Ground

Table 7-2 USB2.0 Type-A connector Pin-out (J2)

7.3.3 FD-CAN bus

The UM21H7 exposes up two FD-CAN bus interfaces to the UM21H7-EVAL. (**H3 & H5**)

- Nominal maximum data rate: 5 Mbit/s.
- Integrated ESD protection.
- 60 Ω termination resistors are on board, with 4.7 nF to GND.

The signals are driven by an on-board isolated FD-CAN Bus Transceiver and exported to 3 pin terminal blocks. H3 connector exposes FDCAN1 interface:

Pin #	UM21H7-EVAL	Type	Description
1	FD_CAN1H_ISO	DSI/O	FDCAN H Differential signal
2	FD_CAN1L_ISO	DSI/O	FDCAN L Differential signal
3	GND_CAN1	POWER	Isolated CAN1 ground

Table 7-3 FD-CAN1 Bus connector Pin-out (H3)

H5 connector exposes FDCAN3 interface:

Pin #	UM21H7-EVAL	Type	Description
1	FD_CAN2H_ISO	DSI/O	FDCAN H Differential signal
2	FD_CAN2L_ISO	DSI/O	FDCAN L Differential signal
3	GND_CAN2	POWER	Isolated CAN2 ground

Table 7-4 FD-CAN2 Bus connector Pin-out (H5)

Also, FDCAN3 interface can be switched between the external interface (**H5**) or on the Arduino expander connector using the switch SW1.

7.3.4 Ethernet

The UM21H7-EVAL exposes a standard 10/100 Base-T Ethernet jack connector with integrated magnetics and POE+ capability.

- On-board transformer.
- ESD protection.

Please refer to the UM21H7 datasheet for more information.

Pin #	UM21H7-EVAL	Type	Description
1	TD+	DSO	Positive transmit signal
2	CD	O	Bias capacitor
3	TD-	DSO	Negative transmit signal
4	RD+	DSI	Positive receive signal
5	RD-	DSI	Negative receive signal
7	V1+	POWER	POE Positive Supply
8	V1-	POWER	POE Negative Supply
9	V2+	POWER	POE Positive Supply
10	V2-	POWER	POE Negative Supply
11	LED1 (+)	ANODE	Anode of LED 1
12	LED1 (-)	CATHODE	Cathode of LED 1
13	LED2 (-)	CATHODE	Cathode of LED 2
14	LED2 (+)	ANODE	Anode of LED 2
SH	SHIELD	POWER	Connector SHIELD

Table 7-5 10/100BaseT RJ45 Connector Pin-out (T1)

LED1	Status
Off	Link off
On	10/100 link
Blinking	Communicating

Table 7-6 RJ-45 LED1 configuration

LED2	Status
Off	10Mbps Speed
On	100Mbps Speed

Table 7-7 RJ-45 LED2 configuration

7.3.5 RS-232 / RS-485

The UM21H7 exposes:

- USART1 interface to the UM21H7-EVAL driving an RS-232 transceiver up to 250 kbit/s
- USART3 interface to the UM21H7-EVAL driving an RS-485 transceiver up to 20Mbps
- Integrated RS-485 120 Ω differential cable termination.
- Integrated ESD protection.

Signals are exported on 5 pin terminal block **(H4)** as shown below:

Pin #	UM21H7-EVAL	Type	Description
1	EXT_RS-232_TX	O	RS-232 transmit signal
2	EXT_RS-232_RX	I	RS-232 receive signal
3	GND_SIGNAL	POWER	Digital ground
4	EXT_RS485_A	IO	RS-485 driver output or receiver input
5	EXT_RS485_B	IO	RS-485 driver output or receiver input

Table 7-8 RS-232 / RS-485 Connector Pin-out (H4)

7.3.6 I2C to CAN

The UM21H7-EVAL exposes one I2C (I2C1) to CAN converter (master mode).

- Nominal maximum data rate: 400 Kbps
- Integrated ESD protection.
- 60 Ω termination resistors are on board, with 4.7 nF to GND.

Signals are exported on 6 pin terminal block **(H2)** as shown below:

Pin #	UM21H7-EVAL	Type	Description
1	EXT_POWER	O	External slave power (Follow Input voltage)
2	EXT_CANSDA_L	IO	Low Level CAN Bus Line. Carries the I2C data bus.
3	EXT_CANSDA_H	IO	High Level CAN Bus Line. Carries the I2C data bus.
4	EXT_CANSCL_L	O	High Level CAN Bus Line. Carries the I2C clock bus.
5	EXT_CANSCL_H	O	High Level CAN Bus Line. Carries the I2C clock bus.
6	GND_SIGNAL	POWER	Digital ground

Table 7-9 I2C to CAN Connector Pin-out (H2)

7.3.1 SWD Connector

The UM21H7-EVAL exposes the SWD programming connector **(CN4)** with Cortex-M standard pinout as shown below.

Pin #	UM21H7-EVAL	Type	Description
1	VCC	POWER	Power supply for JTAG interface drivers.
2	SWDIO	IO	Data I/O pin.
3	GND_SIGNAL	POWER	Digital ground
4	SWDCLK	IO	Clock pin
5	GND_SIGNAL	POWER	Digital ground
6	SWO	O	Optional trace output pin
3	KEY		
4	NC		
5	GND_SIGNAL	POWER	Digital ground
6	nRESET	I	Reset input pin

Table 7-10 SWD Connector Pin-out (CN4)

7.3.2 Expansion Connector

The UM21H7-EVAL has an expansion connector (**J3**) designed to accommodate additional connectivity modules (LORAWAN, LTE-M, NB-IoT, etc..) or customized modules as required.

Also, two 2.5mm threaded steel spacer (**MP3, MP4**) are present to guarantee mechanical seal to the expansion module.

Pin #	UM21H7-EVAL	Type	Description
1	3V3_SYS	POWER	System 3V3 supply rail
2	3V3_SYS	POWER	System 3V3 supply rail
3	3V3_SYS	POWER	System 3V3 supply rail
4	3V3_SYS	POWER	System 3V3 supply rail
5	GND_SIGNAL	POWER	Digital ground
6	GND_SIGNAL	POWER	Digital ground
7	PE10_UART7_CTS	I	UART clear to send signal
8	PE8_UART7_TX	O	UART transmit signal
9	PE9_UART7_RTS	O	UART request to send signal
10	PB3_UART7_RX	I	UART receive signal
11	GND_SIGNAL	POWER	Digital ground
12	GND_SIGNAL	POWER	Digital ground
13	PB7_I2C1_SDA	IO	I2C data bus
14	PB6_I2C1_SCL	O	I2C clock bus.
15	GND_SIGNAL	POWER	Digital ground
16	GND_SIGNAL	POWER	Digital ground

Table 7-11 Expansion Connector Pin-out (J3) -Part 1/2

Pin #	UM21H7-EVAL	Type	Description
17	5V_SYS	POWER	System 5V supply rail
18	5V_SYS	POWER	System 5V supply rail
19	5V_SYS	POWER	System 5V supply rail
20	5V_SYS	POWER	System 5V supply rail
21	EXP_IO_2	IO	SOM Expander GPIO
22	EXP_IO_1	IO	SOM Expander GPIO
23	EXP_IO_4	IO	SOM Expander GPIO
24	EXP_IO_3	IO	SOM Expander GPIO
25	EXP_IO_6	IO	SOM Expander GPIO
26	EXP_IO_5	IO	SOM Expander GPIO
27	NC		
28	EXP_IO_7	IO	Digital ground
29	NC		
30	NC		
31	VIN_EMI	POWER	Filtered Input Supply
32	VIN_EMI	POWER	Filtered Input Supply

Table 7-12 Expansion Connector Pin-out (J3) -Part 2/2

7.3.3 Antenna Connectors

The UM21H7-EVAL exhibits a connection adaptation for UFL to SMA antennas (**J10 / J11**) in order to allow connection with standard antennas

7.3.4 Arduino Interface

The UM21H7-EVAL provides the Arduino interface in order to easily connect on the market shields. (J4, J5, J6, J7)

7.3.5 Pmod Interfaces

The UM21H7-EVAL exports the UM21H7 SPI / UART signals through a different header connector (J8 / J9 / J13 Digilent Pmod standard).

7.3.5.1 SPI Pmod Interface

SPI5 is exported on J8 connector, pinout is shown below:

Pin #	UM21H7-EVAL	Type	Description
1	PE7_SPI_CS	O	SPI Chip Select
2	PF11_SPI5_MOSI	O	SPI Master Output → Slave Input
3	PH7_SPI5_MISO	I	SPI Master Input ← Slave Output
4	PF7_SPI5_SCK	I	SPI Serial Clock
5	GND_SIGNAL	POWER	Digital ground
6	3V3_SYS	POWER	System 3V3 power supply

Table 7-13 SPI5 connector Pin-out (J8)

7.3.5.2 UART Pmod Interface

UART7 is exported on J9 connector, pinout is shown below:

Pin #	UM21H7-EVAL	Type	Description
1	PE10_UART7_CTS	I	UART clear to send signal
2	PE9_UART7_RTS	O	UART request to send signal
3	PB3_UART7_RX	I	UART receive signal
4	PE8_UART7_TX	O	UART transmit signal
5	GND_SIGNAL	POWER	Digital ground
6	3V3_SYS	POWER	System 3V3 power supply

Table 7-14 UART7 connector Pin-out (J9)

7.3.6 I2C Pmod Interface

I2C1 is exported on J13 connector, pinout is shown below:

Pin #	UM21H7-EVAL	Type	Description
1	PB7_I2C1_SDA	IO	I2C data bus
2	PB6_I2C1_SCL	O	I2C clock bus
3	5V_SYS	POWER	System 5V power supply
4	GND_SIGNAL	POWER	Digital ground

Table 7-15 I2C1 connector Pin-out (J13)

7.3.7 Display Interface

The UM21H7_EVAL exposes a series of connectors for LVDS display interfacing and related touch and backlight controller management.

Specifically, the relative connectors are described below.

7.3.7.1 LVDS Interface

Two Hirose connectors (CN5, CN6) with different pin number and pinout, are present in order to be able to drive displays already used by project service or customer custom displays

- Implemented using SN75LVDS83BDGG
- Support Single-Link “FLATLINK” LVDS output format.
- Resolution up to 1024x768 60 fps at 24 bpp/18 bpp
- LVDS link has 4 data lanes + 1 CLK lane.
- ESD protection

Pin #	UM21H7-EVAL	Type	Description
1	DP_3V3	POWER	Display 3V3 supply rail
2	DP_3V3	POWER	Display 3V3 supply rail
3	GND_SIGNAL	POWER	Digital ground
4	GND_SIGNAL	POWER	Digital ground
5	OUTY0_N	DSO	Differential LVDS data0 negative output
6	OUTY0_P	DSO	Differential LVDS data0 positive output
7	GND_SIGNAL	POWER	Digital ground
8	OUTY1_N	DSO	Differential LVDS data1 negative output
9	OUTY1_P	DSO	Differential LVDS data1 positive output
10	GND_SIGNAL	POWER	Digital ground
11	OUTY2_N	DSO	Differential LVDS data2 negative output
12	OUTY2_P	DSO	Differential LVDS data2 positive output
13	GND_SIGNAL	POWER	Digital ground
14	CLKOUT_N	DSO	Differential LVDS clock negative output
15	CLKOUT_P	DSO	Differential LVDS clock positive output
16	GND_SIGNAL	POWER	Digital ground
17	OUTY3_N	DSO	Differential LVDS data3 negative output
18	OUTY3_P	DSO	Differential LVDS data3 positive output
19	GND_SIGNAL	POWER	Digital ground
20	GND_SIGNAL	POWER	Digital ground

Table 7-16 LVDS connector Pin-out (CN5)

DP_3V3 & DP_5V are power supplies derived from system power rails, but controlled through power switches which can be turned off if necessary.

Pin #	UM21H7-EVAL	Type	Description
1	DP_3V3	POWER	Display 3V3 supply rail
2	DP_3V3	POWER	Display 3V3 supply rail
3	DP_3V3	POWER	Display 3V3 supply rail
4	GND_SIGNAL	POWER	Digital ground
5	GND_SIGNAL	POWER	Digital ground
6	GND_SIGNAL	POWER	Digital ground
7	LR-UD/RPFI	I	Reverse panel function
8	GND_SIGNAL	POWER	Digital ground
9	OUTY0_N	DSO	Differential LVDS data0 negative output
10	OUTY0_P	DSO	Differential LVDS data0 positive output
11	GND_SIGNAL	POWER	Digital ground
12	OUTY1_N	DSO	Differential LVDS data1 negative output
13	OUTY1_P	DSO	Differential LVDS data1 positive output
14	GND_SIGNAL	POWER	Digital ground
15	OUTY2_N	DSO	Differential LVDS data2 negative output
16	OUTY2_P	DSO	Differential LVDS data2 positive output
17	GND_SIGNAL	POWER	Digital ground
18	CLKOUT_N	DSO	Differential LVDS clock negative output
19	CLKOUT_P	DSO	Differential LVDS clock positive output
20	GND_SIGNAL	POWER	Digital ground
21	OUTY3_N	DSO	Differential LVDS data3 negative output
22	OUTY3_P	DSO	Differential LVDS data3 positive output
23	GND_SIGNAL	POWER	Digital ground
24	LVDS68	O	Display function control (6/8 bit)
25	EXT_BL_CTRL	O	External PWM backligh control
26	EXT_BL_ON/FF	O	External ON/OFF backlight control
27	EXT_LCD_RST	O	External panel reset control
28	DP_5V	POWER	Display 5V supply rail
29	DP_5V	POWER	Display 5V supply rail
30	GND_SIGNAL	POWER	Digital ground

Table 7-17 LVDS connector Pin-out (CN6)

7.3.7.2 Backlight Connector

A JST connector (CN7) is available to directly drive the display backlight connected to the UM21H7-EVAL. The section is managed through the TPS61161DRVR component.

Pin #	UM21H7-EVAL	Type	Description
1	BKL_ANODE	O	I2C data bus
2	BKL_CATHODE	O	I2C clock bus

Table 7-18 Backlight connector Pin-out (CN7)

7.3.7.3 Touch Panel Connector

A Molex connector (CN8) is available to interface the display touch controller connected to the UM21H7-EVAL.

Pin #	UM21H7-EVAL	Type	Description
1	3V3_SYS	POWER	System 3V3 power supply
2	TP_I2C_SDA	IO	I2C data bus
3	TP_I2C_SCL	O	I2C clock bus
4	TP_INT#	POWER	TP Interrupt input pin
5	TP_RST#	POWER	TP reset output pin
6	GND_SIGNAL	POWER	Digital ground
7	GND_SIGNAL	POWER	Digital ground

Table 7-19 TP connector Pin-out (CN8)

7.4 User Interfaces

7.4.1 Power-On LED VIN (DL1)

LED DL1 indicates that the UM21H7-EVAL is powered via terminal block or via POE.

7.4.2 Power-On LED 12V (DL2)

LED DL2 indicates that the 12V_SYS power rail of the UM21H7-EVAL is on and that the board is supplied by POE.

7.4.3 Power-On LED 5V (DL3)

LED DL3 indicates that the 5V_SYS power rail of the UM21H7-EVAL is on.

7.4.4 Power-On LED 3V3 (DL5)

LED DL5 indicates that the 3V3_SYS power rail of the UM21H7-EVAL is on.

7.4.5 Power-On LED DP_5V (DL4)

LED DL4 indicates that the DP_5V (5V for display interface) power rail of the UM21H7-EVAL is on.

7.4.6 Power-On LED DP_3V3 (DL6)

LED DL6 indicates that the DP_3V3 (3V3 for display interface) power rail of the UM21H7-EVAL is on.

7.4.7 CAN Switch selection (SW1)

SW1 allows the user to select the FDCAN3 interface towards the H5 connector or towards the Arduino expansion connector.

7.4.8 BOOT Button (SW2)

SW2 is the system boot mode button, forcing boot pin to 3V3.

7.4.9 Reset Button (SW3)

SW3 is the system hardware-reset button

7.4.10 Sensors

UM21H7-EVAL is equipped with two sensors, respectively for temperature / humidity (U37) and pressure (U36).

7.5 Peripheral Voltage Levels

Most of the peripheral interface lines used as inputs or output to the UM21H7-EVAL uses 3.3V LVCMOS levels, except the following interfaces:

- **USB, LVDS, ETHERNET:** Interfaces follow a different standard since they are highspeed signals.

7.6 Power Input

The UM21H7-EVAL can be powered via 3-Pin terminal block (**H1**) or via Ethernet POE (**T1**).

7.6.1 DC-in 3-Pin Terminal Block Pin-out

Pin #	UM15M7-EVAL	Type	Description
1	VIN	POWER	Power Input (6V to 36V DC)
2	DGND	POWER	Digital Ground
3	SHIELD	POWER	Shield (Connected via 1M / 1NF 2KV to DGND)

Table 7-20 DC-in 3-Pin Terminal Block Pin-out (H1)

7.6.2 IEEE 802.3 at 25.5W Compliant PD

The system is designed to be powered via POE, connecting ethernet cable on T1 connector.

On board there is the LT4275A PD controller and the relative conditioning network for powers up to 25.5W.

7.6.3 RTC Backup Battery (CN1)

The UM21H7-EVAL features CN1, a CR2032 battery holder for powering the On-board RTC module.

RTC calibration TP (**TP1**) is available on UM21H7-EVAL. Before starting the calibration remove **J12**.

8. Electrical Environmental Specifications

8.1 Absolute Maximum Ratings

	Min	Max	Unit
Main Power Supply, DC-IN	-0.3	42	V

8.2 Operating Conditions

	Min	Typical	Max	Unit
Main Power Supply, DC-IN	6	24	36	V

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