Sundance Multiprocessor Technology Limited

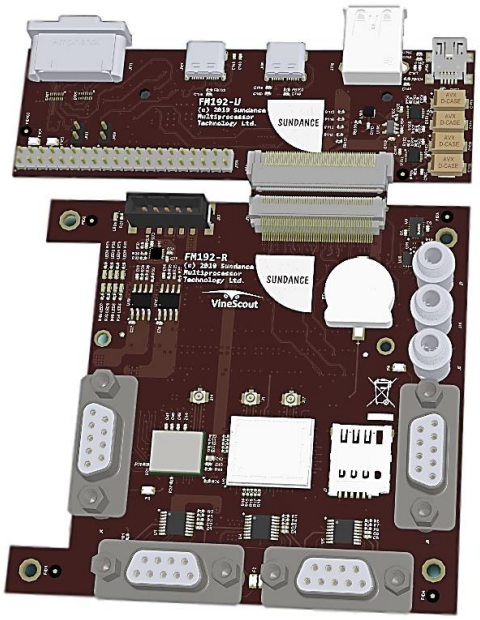
PCIe/104 OneBank ARM+FPGA+FMC Carrier

Form : QCF51
Template Date :
10 November 2017

Unit / Module Description:	FMC I/O Module with ADCS/DAC/CANS I/Os + WiFi/BLE/GPS/GNSS/4G/AUDIO MODULES + IMU/TEMPERATURE&HUMIDITY SENSOR AUDIO SENSORS + USB3.0 + GPIO
Unit / Module Number:	FM192-RU
Document Issue Number:	1.3
Original Issue Date:	24/11/2018
Original Author:	P Machado and T. Garcia Bertoa

FM192-RU

VITA57.1 FMC™-LPC Module
ADC + DAC
WiFi + BLE + GPS/GNSS + 4G
IMU + HUMIDITY&TEMPERATURE
AUDIO I/O + GPIO + CAN + USB3.0



Sundance Multiprocessor Technology Ltd,
Chiltern House, Waterside, Chesham, Bucks, HP5 1PS, UK.

Certicicate Number FM 55022

Revision History

Issue	Changes Made	Date	Initials
0.1	First draft.	01/10/2018	PM
0.2	Revisions	02/10/2018	FC
0.3	Apply changes	20/10/2018	PM
0.4	Added correct parts	10/11/2018	PM
1.0	Updated pinout and diagrams	24/11/2018	PM
1.1	Replaced the TiWi-BLE by the BX 3100.	01/12/2018	PM
1.2	Full update	13/02/2019	TG
1.3	Applied revision 1.5 of schematics	01/03/2019	TG

Table of Contents

List of Figures

1 Introduction

This document describes the hardware features and some operational details of the FM192-R and FM192-U or FM192-RU. The FM192-R is a FMC-LPC daughter card which has 3V-TTL Analogue and Digital ports, 3.3V-TTL CAN BUS ports, WiFi + Bluetooth Low Energy v4 module, 4G + GPS/GNSS module, IMU sensor, Audio I/O module and temperature and humidity sensor. The FM192-R follows the FMC-LPC standard and it was designed for expanding/complementing the EMC²-DPv2 carrier board.

The FM192-U is an expansion board that provides 4x USB3.0 ports (2x USB type C, 1x IP67 USB type C and 1x USB type A) and 28 General Propose I/O (GPIO) accessible via a 40x pin GPIO header (partially compatible with the Raspberry PI rev. 3).

This document was produced in accordance with the Sundance Quality Procedures (BSI9001:2015).

1.1 Main Features

1.1.1 Hardware

The FM192-R board is designed to fan out the FMC-LPC connector I/Os to four DB9 connectors and one SEIC connector. The FM912-R provides wireless connectivity via WiFi + BLE and 4G + GNSS/GPS modules. 3x antenna connectors (2x for the 4G + GNSS/GPS and 1x WiFi + BLE) are provided for connecting 3x external antennas. Furthermore, the FM192-R provides an IMU sensor, CAN BUS, humidity and temperature sensor and Audio I/O.

Optionally, 4x USB3.0 and 40x pin General Propose Input/Output (GPIO) can be added using the FM192-U expansion board via the SEIC connector.

The FM192-R was specially designed for adapting the Sundance EMC²-V2, and other FPGA systems compatible with the VITA57.1 FMC-LPC interface, for vision/robotics and autonomous systems/IoT applications

Common Features:

- FMC LPC connector with I/O and single high-speed serial.
- Single +5 (external ATX connector MOLEX part 8991) for powering external sensors via the DB9 connectors.
- 100-way SEIC peripheral interface connector.
- 12x analogue inputs 3V TTL, with a resolution of 12-bits@2kSPS via 2x DB9 (J6-J8).
- 8x analogue outputs 3V TTL, with a resolution of 24-bits@2kSPS via 1x DB9 (J9).
- IEEE 802.11 a/b/g/n WiFi + Bluetooth Low Energy V4
- 4G + GNSS/GPS
- 2x CAN BUS via 1x DB9 (J4).
- IMU sensor
- Humidity and Temperature sensor.
- Audio I/O
- Optional 4x USB3.0 connections available via the expansion FM191-U board.
- Optional 26x single-ended digital I/Os 5V TTL 40-pin via the expansion FM192-U board.

2 Related Documents

2.1 Referenced Documents

The reader should be familiar with the documents listed in this section. The following documents were referenced in this document:

1) FM192-schematics_v1_4.pdf

2.2 Applicable Documents

The FM192 is compatible with several Xilinx Zynq 7 and UltraScale+ series. The FM192 is compatible with the following devices:

- TE0715-7030 and TE0715-7015 – resources available here
- TE0720 – resources available here
- TE0820-ZU4EV, TE0820-ZU2CG and TE0820-ZU3EG – resources available here

3 Acronyms, Abbreviations and Definitions

3.1 Acronyms and Abbreviations

Abbreviation	Definition
ADC	Analog to Digital Converter
BLE	Bluetooth Low Energy
CAN	Controller Area Network BUS
DAC	Digital to Analogue Converter
EEPROM/E²PROM/E².	Electrically erasable and programmable ROM
FPGA	Field Programmable Gate Array.
GNSS	Global Navigation Satellite System
GPIO.	General Purpose Input Output
GPS	Global Positioning System
I²C	Inter-integrated Circuit bus. A two wire low speed serial interface
SEIC	Sundance External Interface Connector
SPI	Serial Peripheral Interface
WiFi	Wireless Fidelity

3.2 Definitions

Several part numbers are described in the text, as HyperLinks. These are possible part numbers, and alternative devices may be designed later. Hyperlinks will provide access to external sites for more details.

4 Functional Description

4.1 Block Diagram

Figure 1 shows a use-case diagram.

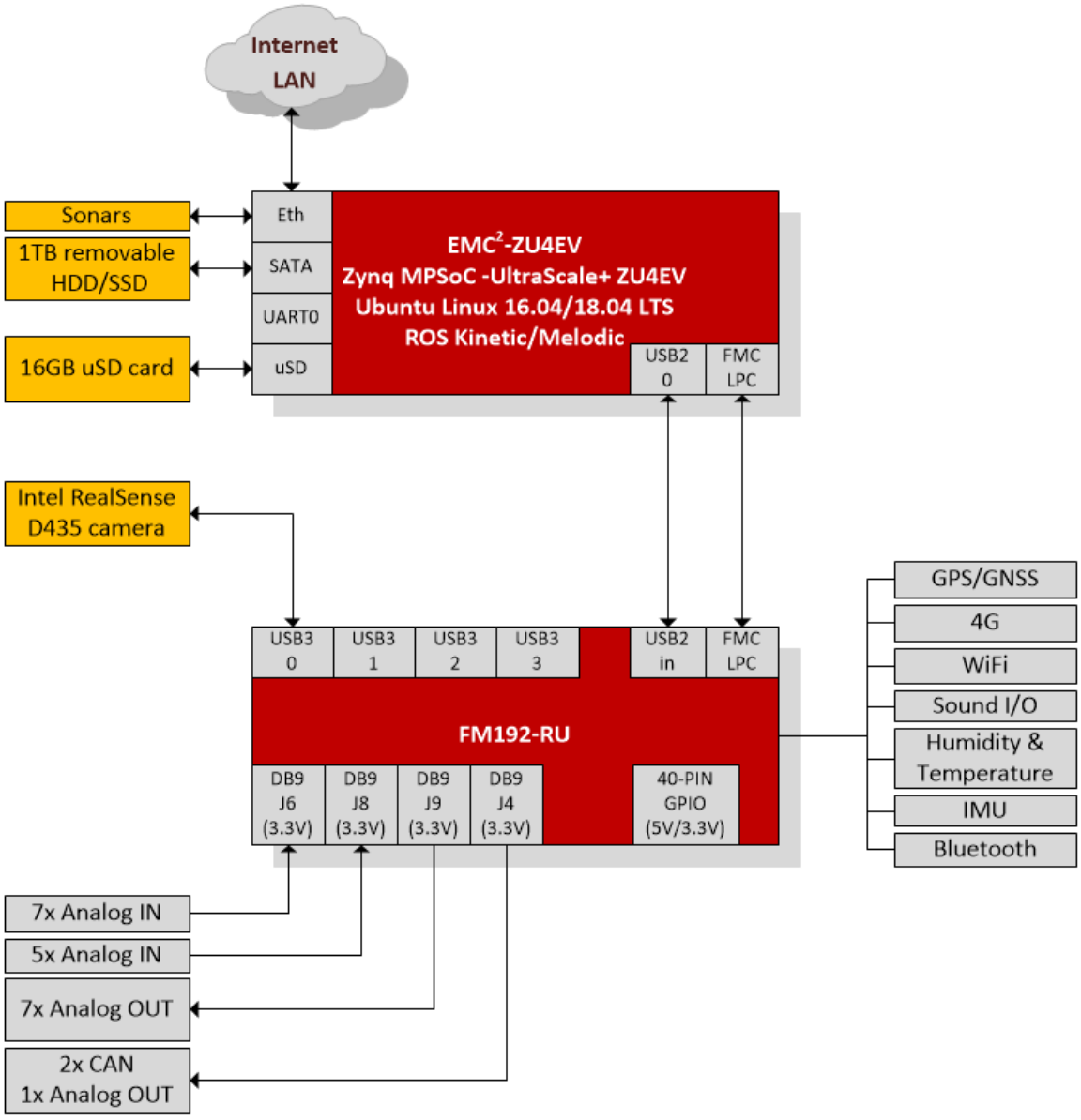


Figure 1: Use-Case diagram

4.2 Module Description

The main connectors of the FM192-R (Figure 1) are the 4x DB9 connectors. DB9 connectors were chosen because of their reliability, low-price and mechanic locking which is desirable in applications exposed to high level of vibrations

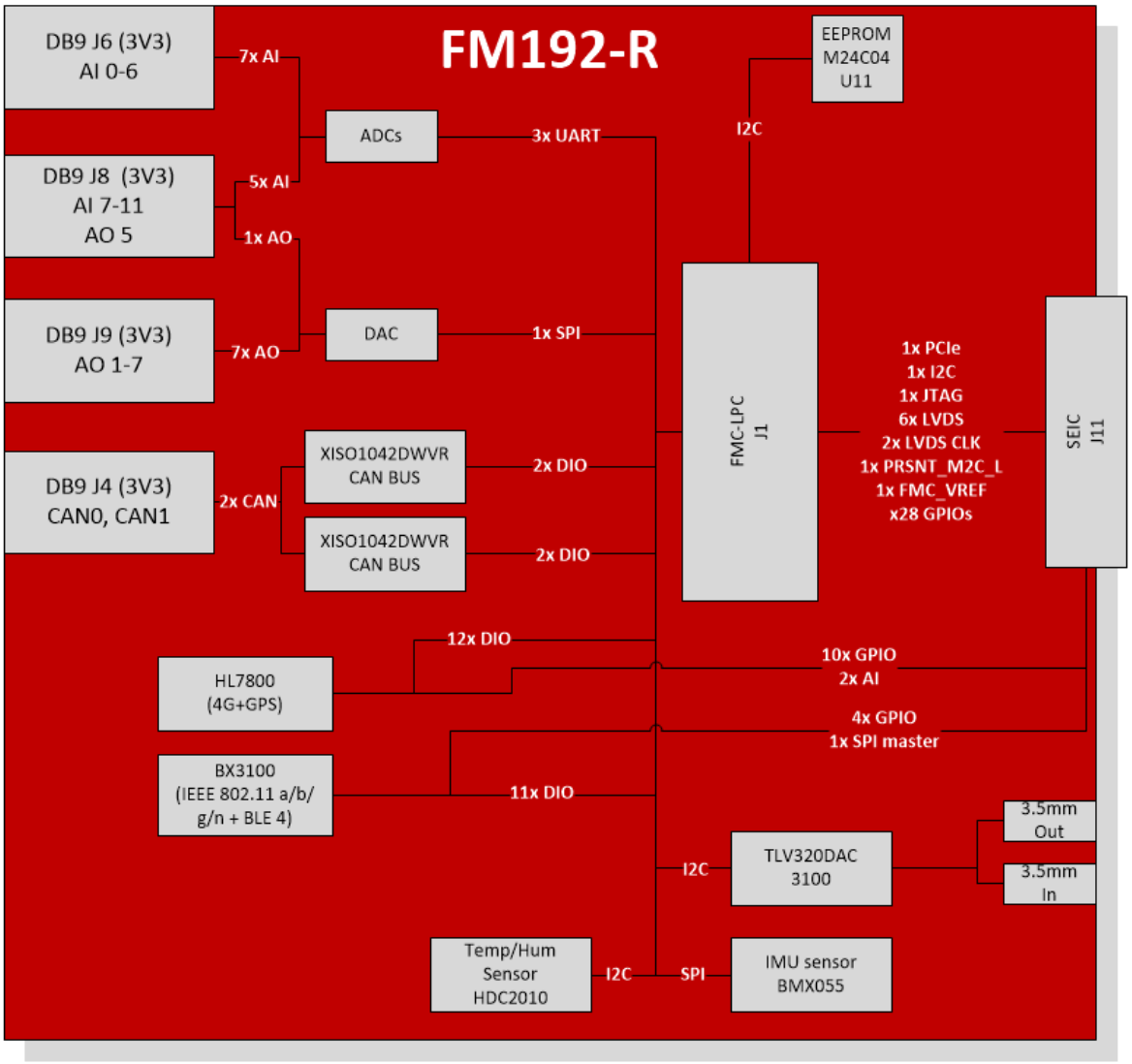


Figure 2: FM192-R block diagram

Optionally, one FM191-U (Figure 3) can be plugged via the SEIC connector and provides 4x USB3.0 ports - type C. Please note that this expansion board is **NOT COMPATIBLE** with the USB3.1. A 40-pin is also available and can be used to provide connectivity to a wide range of RPi/Arduino shields. The 40-pin connector can provide up to 5V@1A (protected by independent fuses) powered by the FM192-R.

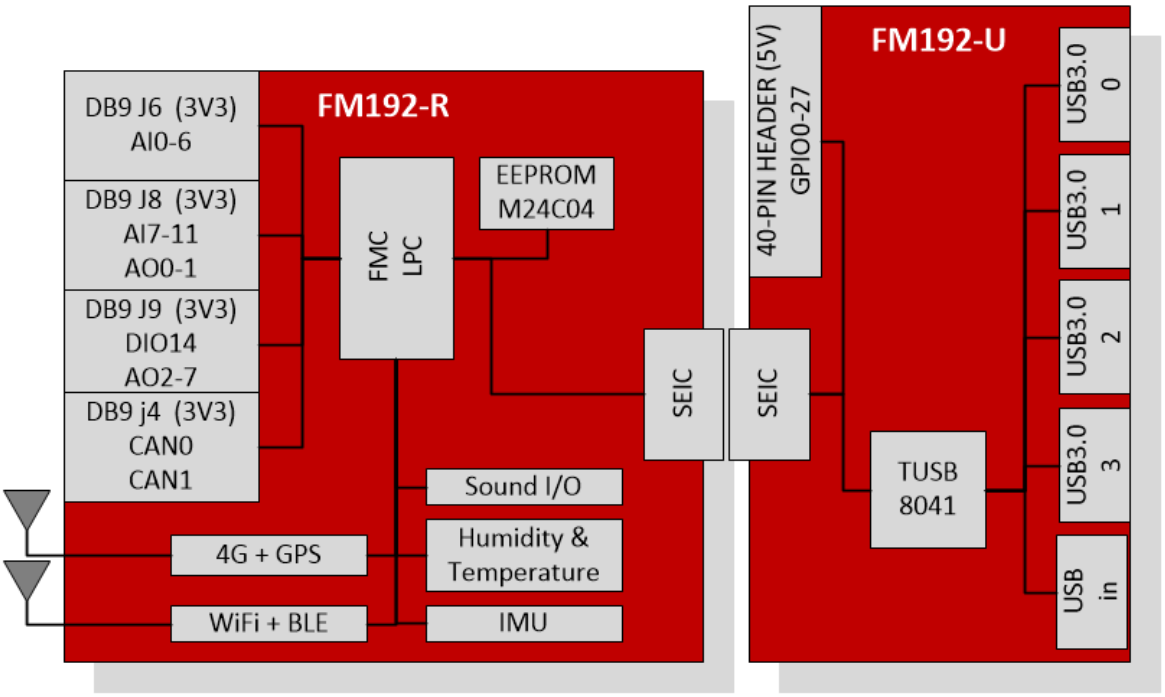


Figure 3: FM192-RU block diagram

4.3 Interface Description

4.3.1 Mechanical Interface

The FM192-RU (**Error! Reference source not found.**) will be installed in the same type of enclosure (Figure 1) as used to accommodate the FM192-RU and EMC²-DP.

Figure 4: Enclosure used for accommodating the FM191 and EMC2-DP

4.3.2 Electrical Interface

The FM192-R electronic interface is represented in Figure 5.

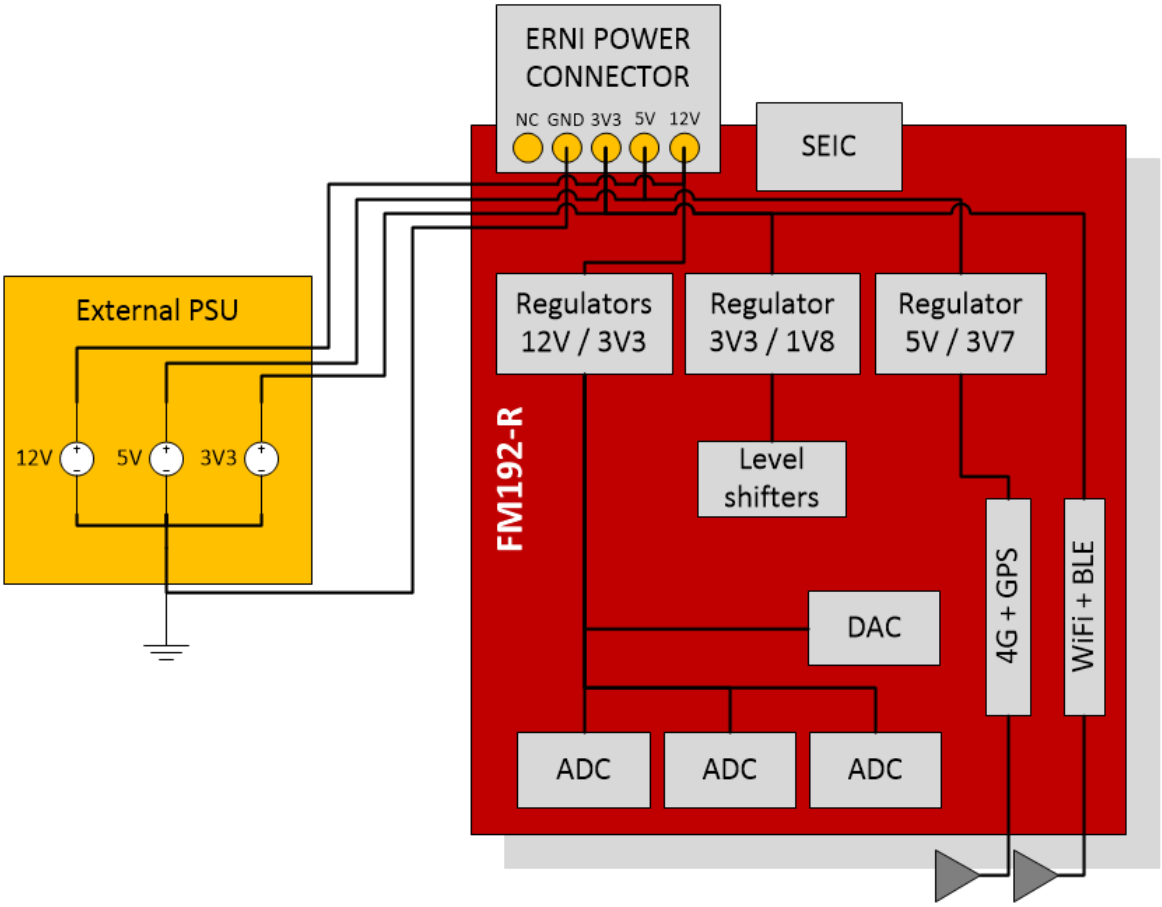


Figure 5: FM192-R electric interface

In Figures 3 and 5, the connectors are as follows:

- ERNI – ERNI 254831 Power connector
- DB9 J[6, 8, 9, 4] – DB9 D-SUB receptacle 9Pos Vertical.

5 Verification Procedures

6 Review Procedures

7 Validation Procedures

8 Gantt Chart

Please refer to the (QCF14)_Design_requirements_FM192.mpp in the repository folder.

9 Circuit Description / Diagrams

9.1 Local and external Power Supplies

One MAX8556 DC-DC step-down converter (FM192-R) is used to create the local voltage of 1.8V@4A, two LM4951 to create the local voltage of 3.3V@0.2A (power the ADCs and DAC) and one TPS7A9101 to generate 3.7V@1A to power the 4G+GPS module.

The FM192-R must be powered (12V@0.5A, 5V@14A and 3.3V@5A) by an external power source unit (e.g the DCX2.180) supply via the J1 5-pin power connector. External sensors and actuators can be powered via the DB9 (3V3@1A [J6, J8, J9, J4]) and 40-pin (2-pins at 3V3@1A and 2-pins 5V@1A) connectors.

The external power cable should be connected on J13, being the pins (left to right from the perspective of the picture below) **NC, GND, 3.3V, 5V, 12V**, in that order.

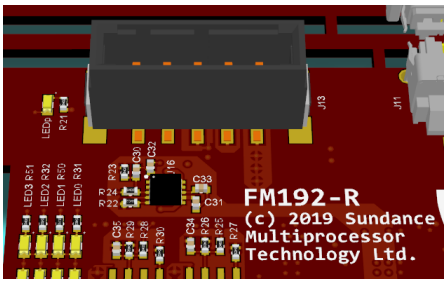


Figure 6: Power connector.

9.2 Level shifters

Seven TI TXS0108E and TXS0104E are used for converting from 1.8V TTL single-ended I/Os to 3V3 [U12, U13, U14, U15, U20, U22, U23, U24 and U25]. All the level shifters on the FM192-R.

9.3 I2C EEPROM

A 512x8bits ST M24C04-F EEPROM is available for storage small amounts of data which can programmed via the I²C bus (Figure 7). This device can be used to store operating parameters separate from the configuration Flash (e.g. Serial Number).

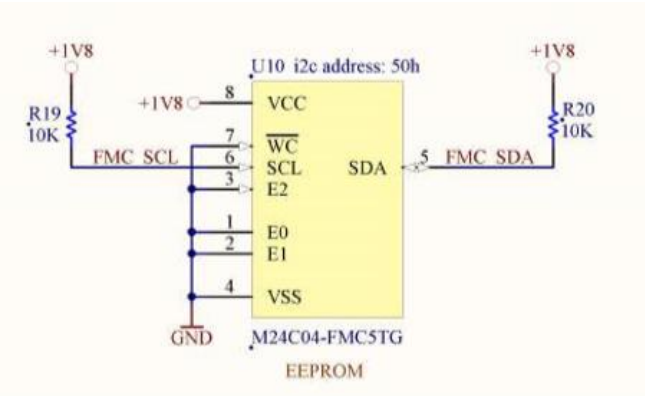


Figure 7: Schematics of the M24C04 EEPROM.

9.4 LEDs

LEDp for sensing power from the ATX and 8 user LEDS (4x accessible from the FPGA, and 4x accessible from HL7800) which can be freely configured by the user (Figure 8).

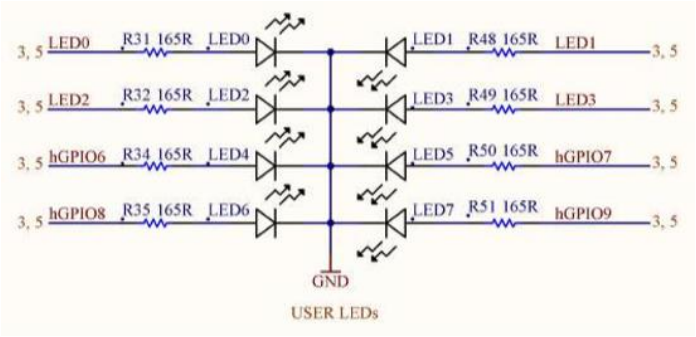


Figure 8: User LEDs

9.5 VITA57.1 FMC-LPC I/O Module

This LPC (low-pin count) variant provides 34 I/O and 2 clocks as differential pairs. I²C and JTAG signals are also present. Background information here. A pin-out is provided at the end of this document. .http://en.wikipedia.org/wiki/FPGA_Mezzanine_Card

9.6 ADC

Three TI ADS122U04 24bit, 4-channel, 2kSPS with UART interface are used for providing the 12x Analogue Inputs 3V3 TTL. The ADCs channels are accessible via the [J6, J8] DB9 connectors. The ADCs are programmed via a dedicated UART ports. Each DB9 (pin 1) supplies up to 3.3V@1A and it is protected with a 1A fuse.

Figure 9 and Figure 10 show the schematics of the DB9s and ADCs.

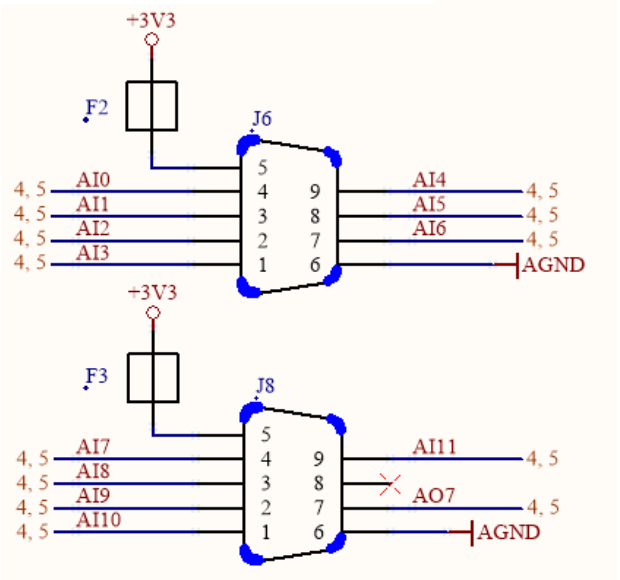


Figure 9: Schematics of the analogue input signals available via the DB9 connectors (J6 and J8)

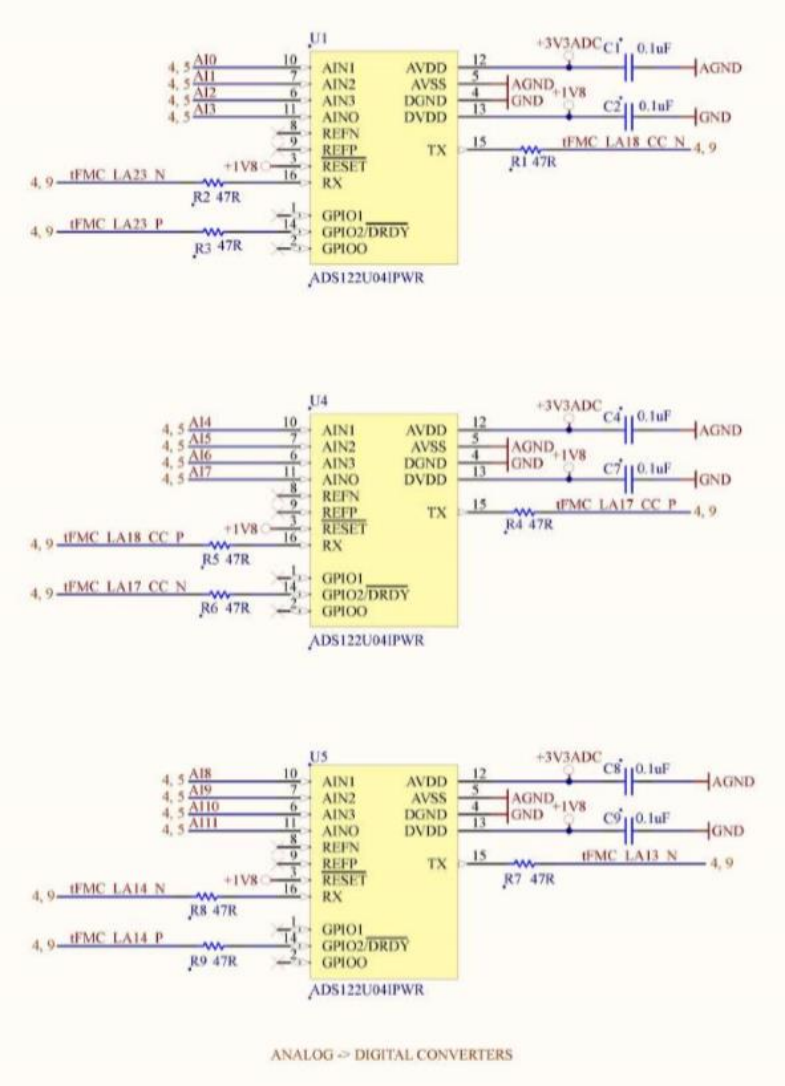


Figure 10: Schematics of the analogue input channels

9.7 DAC

A TI DAC60508 12-BIT, 8 channels with SPI interface is used for providing the 8x Analogue Outputs 5V TTL. The DACs channels are accessible via the J9/J8-PIN7 DB9 connectors. The DACs are programmed via a dedicated UART ports. The J9 DB9 (pin 5) supplies up to 3V3@1A and it is protected with a 1A fuse. Analogue output channels 0 to 7 (AO0-AO7) are accessible via the J9/J8-PIN7 connector.

Figure 11 and Figure 12 show the schematics of the DB9 and DAC.

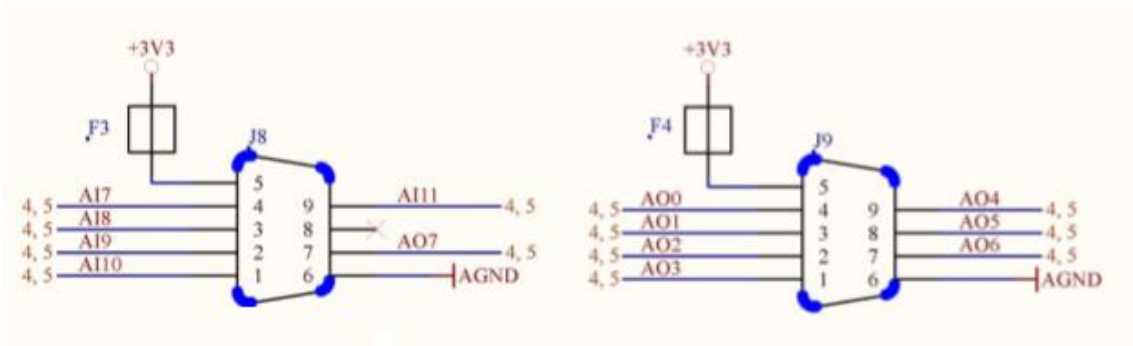


Figure 11: Schematics of the analogue output signals available via the DB9 connectors (J9 and J8)

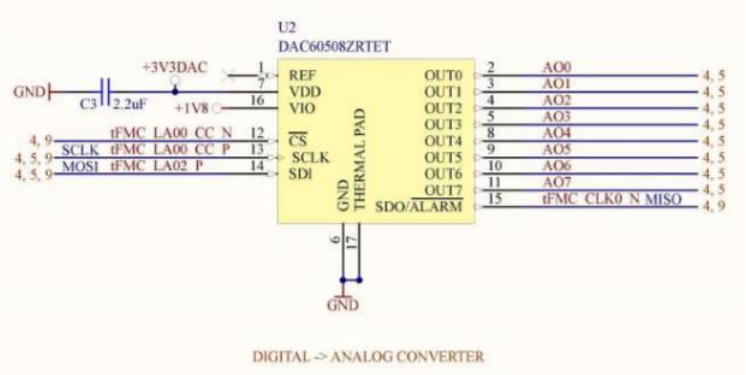


Figure 12: Schematics of the analogue output channels.

9.8 4G + GNSS/GPS

The HL7800 (Figure 14) provides 4G/3G, GPS/GNSS and GPIOs. This module has an external U.FL antenna connector. Includes also a micro-SIM card slot and a mini-USB connector. Data is exchanged via the UART0 and UART1.

The HL7800 was designed to receive 4G+GNS signal from external antennas via the U.FL antenna connector like the antenna showed in Figure 13. A converser from U.FL to SMA (see Figure 16) may be required.

Figure 13: GPS Antenna GPS-TRK/WP SMA

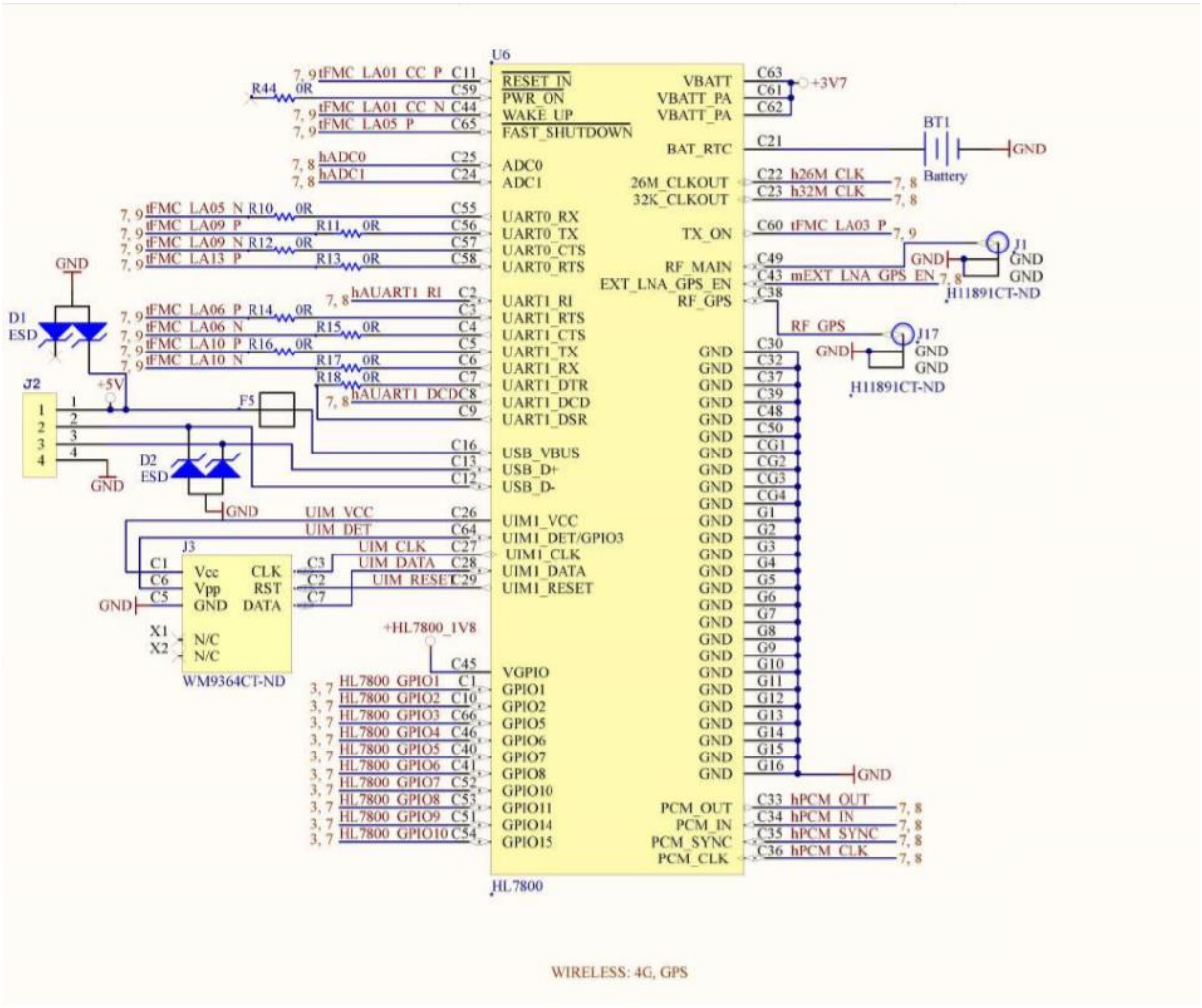


Figure 14: HL7800 schematics

9.9 WiFi IEEE802.11 a/b/g/n + BLE

A WiFi IEEE802.11 a/b/g/n + BLE v4.2 is provided by the BX3100 module (Figure 15). This module includes an external U.FL Antenna connector. Data is exchanged via the SDIO and HCI interfaces.

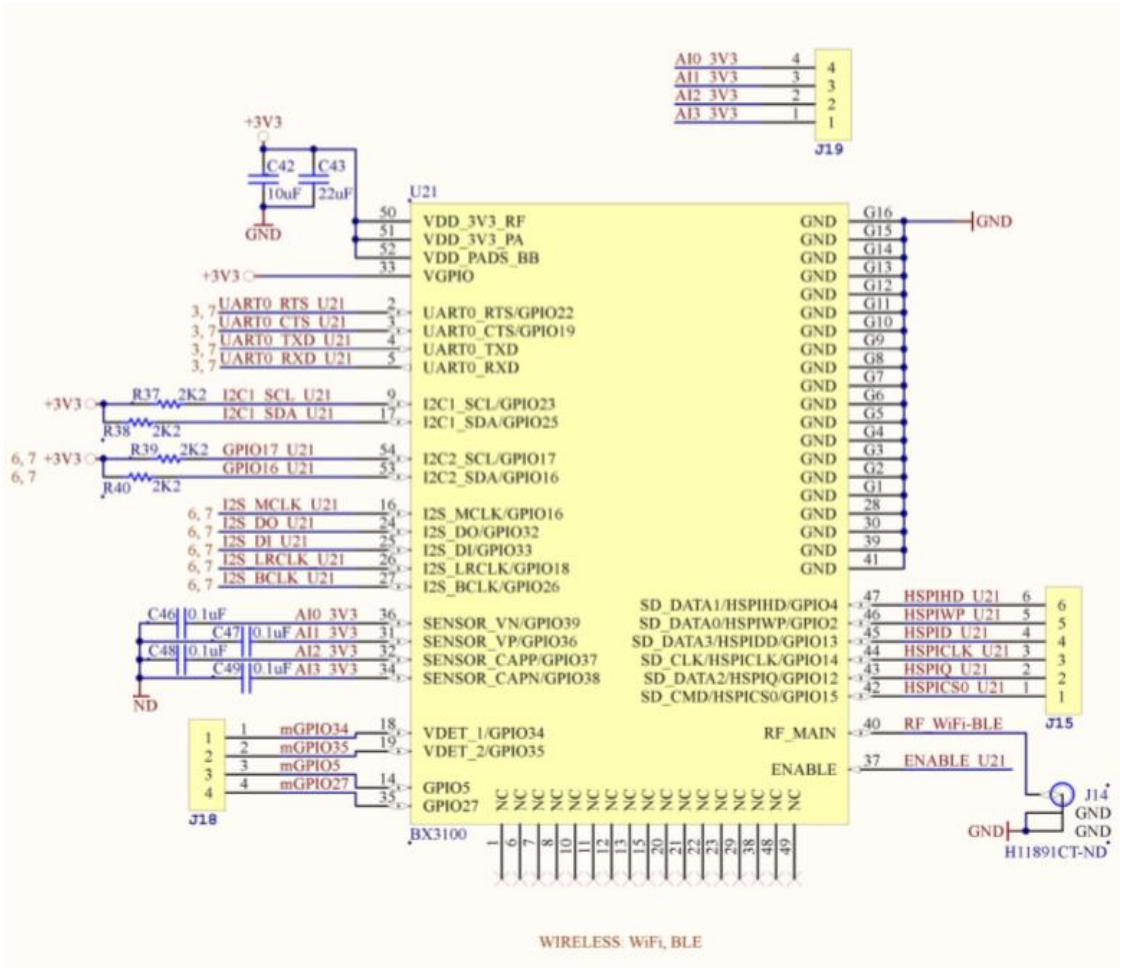


Figure 15: BX3100 schematics

A dipole antenna and U.FL to SMA converter can be used to place an external antenna (Figure 16)

Figure 16: Dipole antenna and a U.FL to SMA antenna

9.10 IMU

The BMX055 (Figure 17), a 9 DOF IMU sensor is used for obtaining the yaw, pitch and roll angles via the SPI interface.

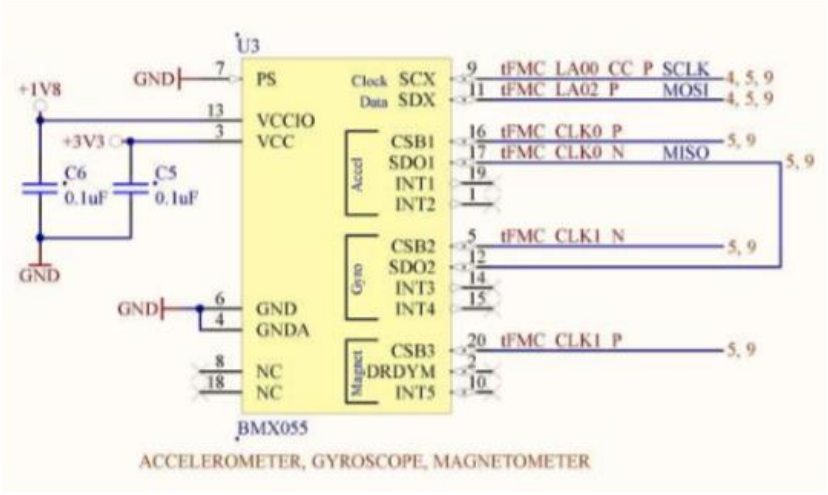


Figure 17: BMX055 schematics

9.11 Humidity and Temperature

The HDC2010 (Figure 18) is an integrated humidity and temperature sensor that will be used for monitoring these physical variables for protecting the electronics. The data is accessible via the I2C protocol.

Figure 18: HDC2010 schematics

9.12 Audio I/O

The TLV320DAC3100 (Figure 19) is a stereo audio DAC with audio processing and mono class D speaker amplifier. The audio data is exchanged via I2C. The external audio devices can be connected via 3.5” jack stereo plugs (Figure 20).

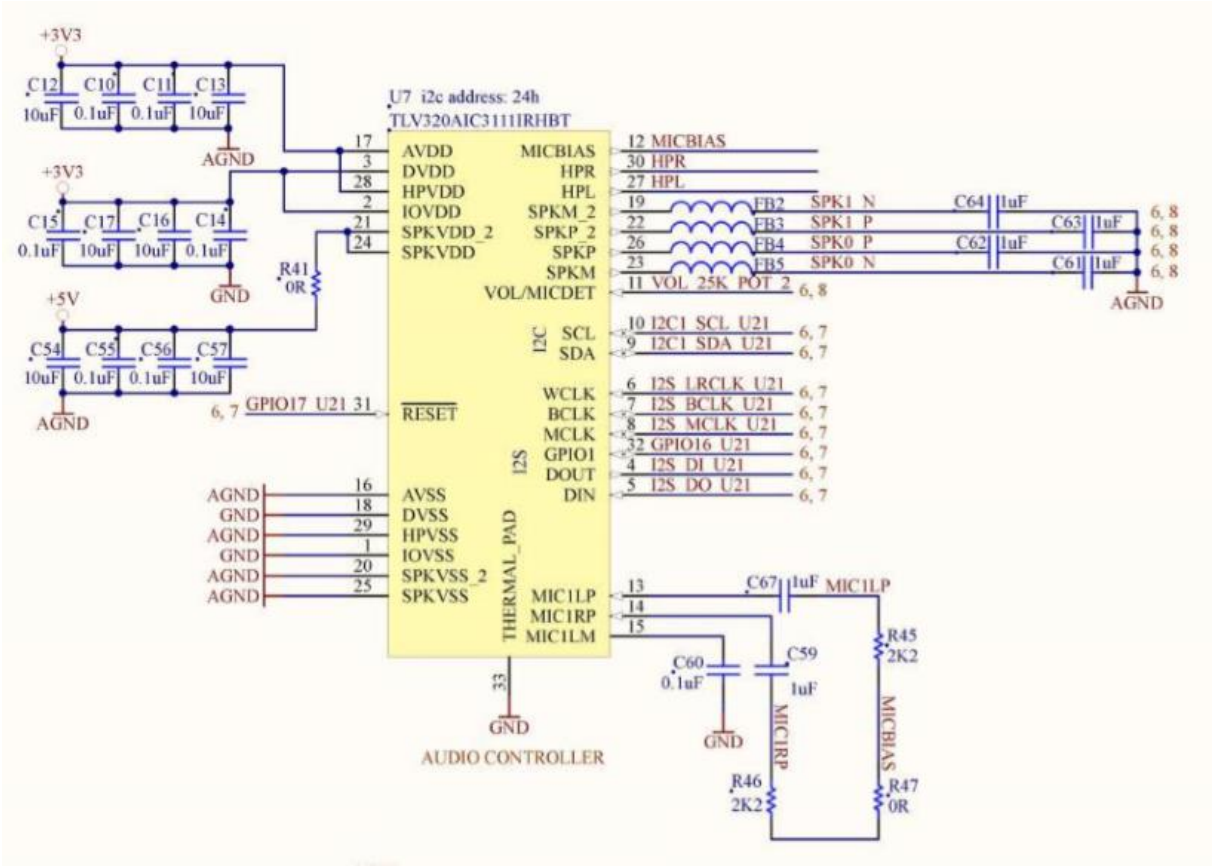


Figure 19: TLV320DAC3100 schematics

The audio connectors (Figure 20) will not be populated in some versions.

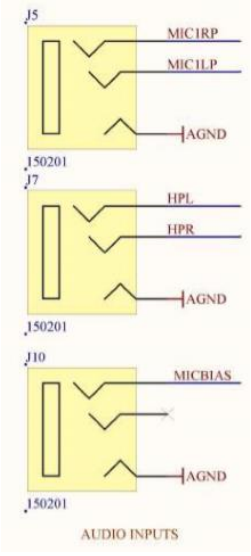


Figure 20: 3.5”Audio connectors

9.13 CAN BUS

Two SN65HVD232 (Figure 21) can BUS transceivers are used to provide 2 CAN buses. The CAN buses provide a 3.3V-TTL interface via the J4 DB9 (Figure 22).

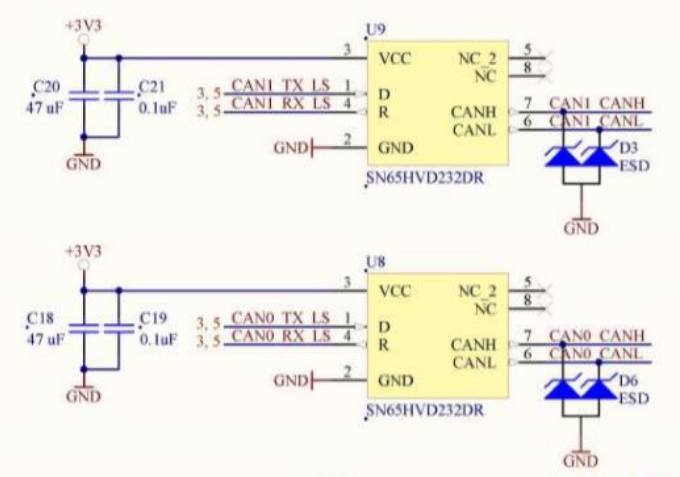


Figure 21: SN65HVD232 schematics

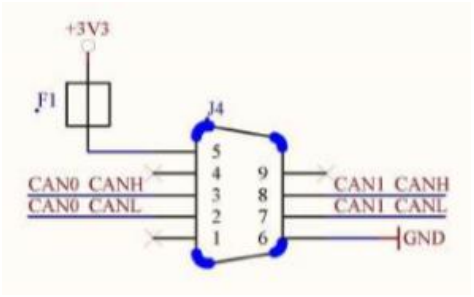


Figure 22: CANs pinout

9.14 4-Port USB 3.0

One TI TUSB8041 4-port USB3.0 is used to provide 4x USB3.0 ports on the FM191-RU. The 4-ports can be accessed via the USB type C connectors. Please note that the FM192-RU is **NOT COMPATIBLE** with the USB3.1.

The TUSB8041 is physical wired to the Programmable Logic (PL) side via the signals tFMC_TRZ_RX_P, tFMC_TRZ_RX_N, tFMC_TRZ_TX_P and tFMC_TRZ_TX_N (see Table 2 for further details).

The USB3.0-C IP67 connector (Figure 24) works in 2-ways and therefore works if the connector is inverted. The USB3.0-C connectors (Figure 26) works only in one-way and therefore the User must connect the cable in the correct way, otherwise the User will have to flip the cable connector/device.

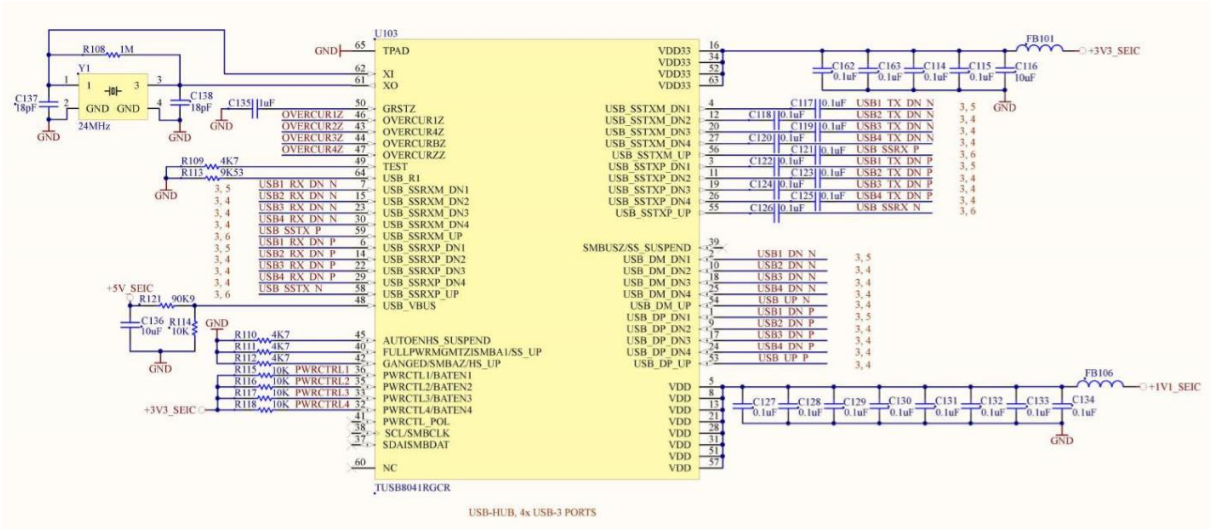


Figure 23: 4-port USB3.0 hub

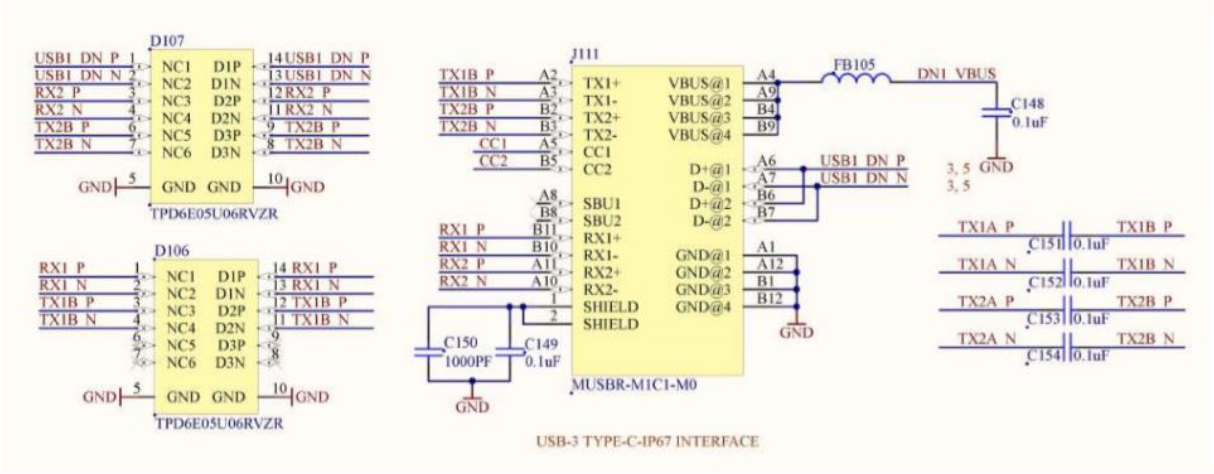


Figure 24: USB type C IP 67

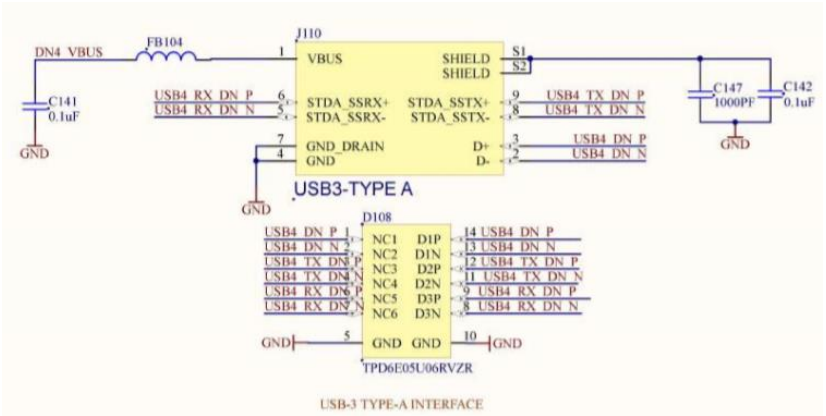


Figure 25: USB3 Type A connector

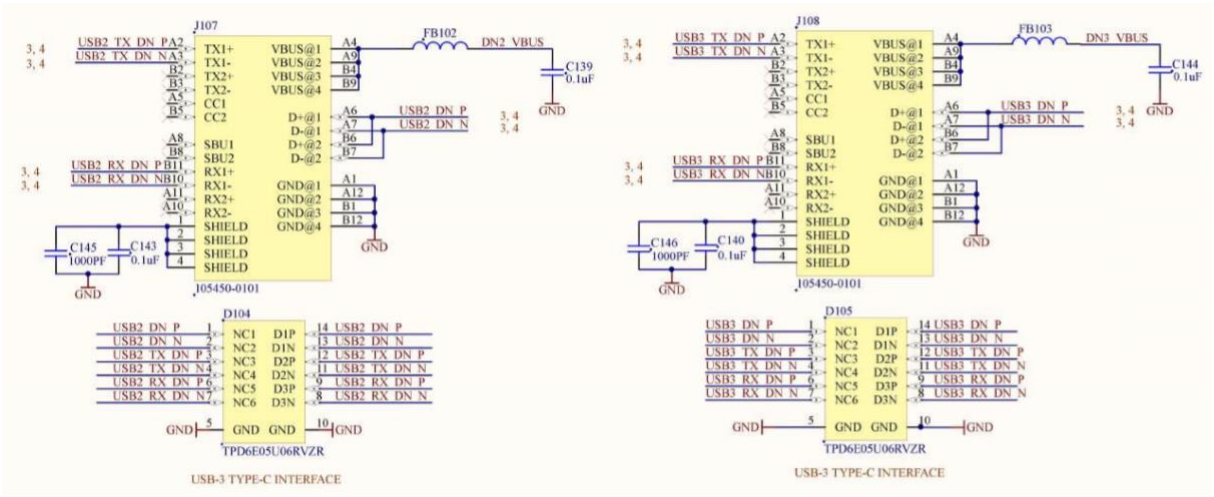


Figure 26: USB type C connectors

The mini-USB 2.0 input is used as an input to the USB3 hub. NOTE: The USB2.0 will only be supported in the USB3.0 output ports if the USB2.0 from EMC2-DP USB is connected to the HUB via the mini-USB port (Figure 27).

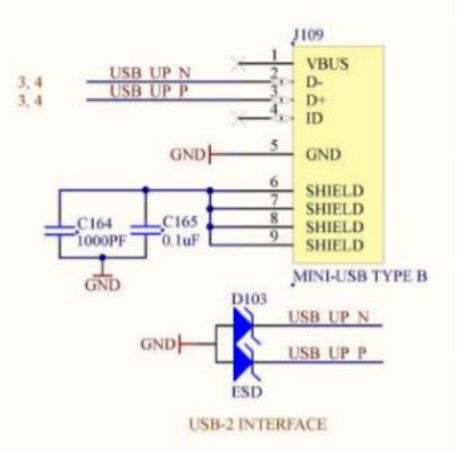


Figure 27: mini-USB2.0 input

9.15 Single-ended I/Os

28x digital I/Os (DIOs) 3.3V TTL are accessible via the J106 connector (FM192-U). 5V@2A can be driven from Pins 1 and 2. Pins 1 and 2 are protected by 1A fuses. The GPIOs 0-27 are wired to the FPGA.

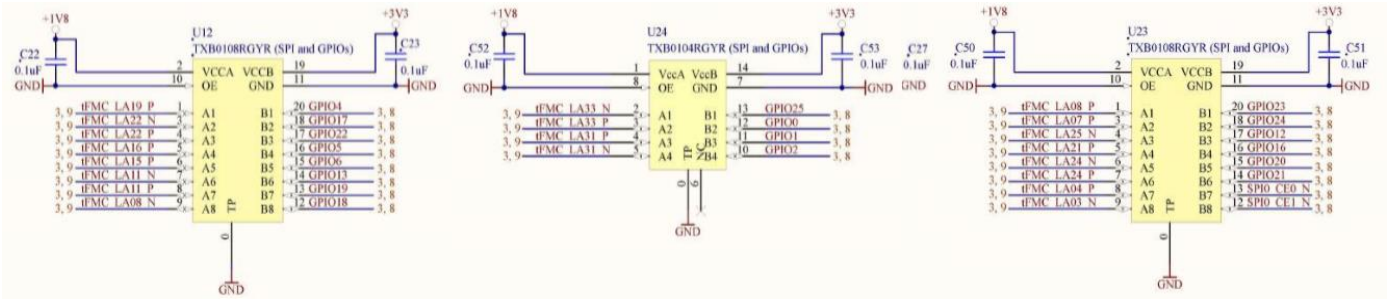


Figure 28: Level shifters.

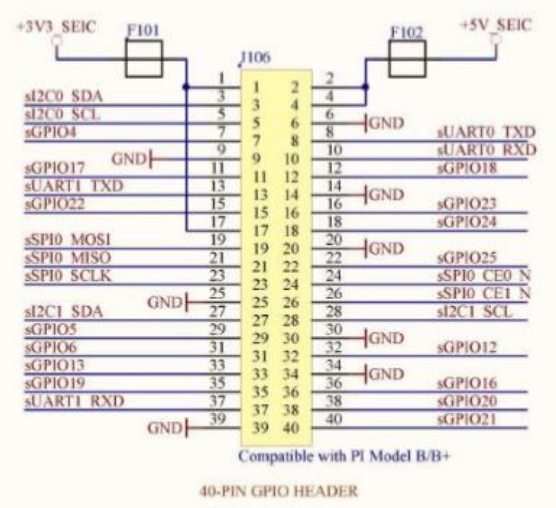


Figure 29: 40-pin GPIO

This 40-pin GPIO header is compatible with Raspberry PI 3, with 3.3V TTL GPIO signals, allowing the user to use any Raspberry PI 3 compatible shield. Sundance provides SPI and I2C compatibility through firmware, although any pin is re-configurable in the FPGA to be used for any desired interface.

9.16 Top View

Figure 30 shows the top view of the FM192-RU:

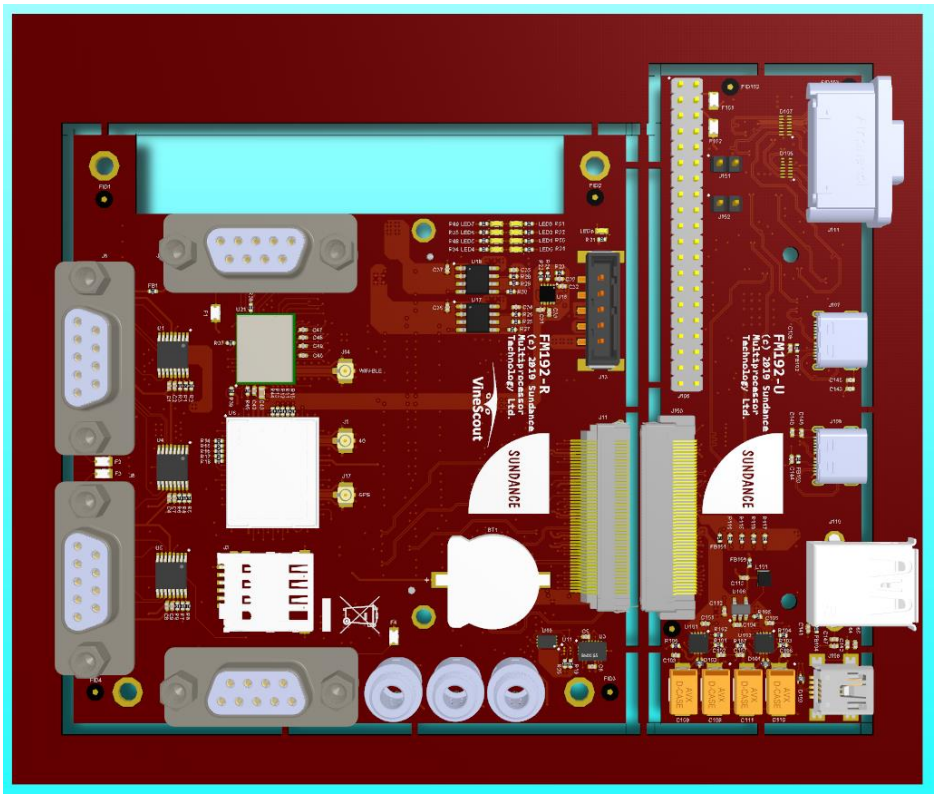


Figure 30: FM191-RU Top view

9.17 Bottom View

Figure 31 shows the bottom view of the FM192-RU:

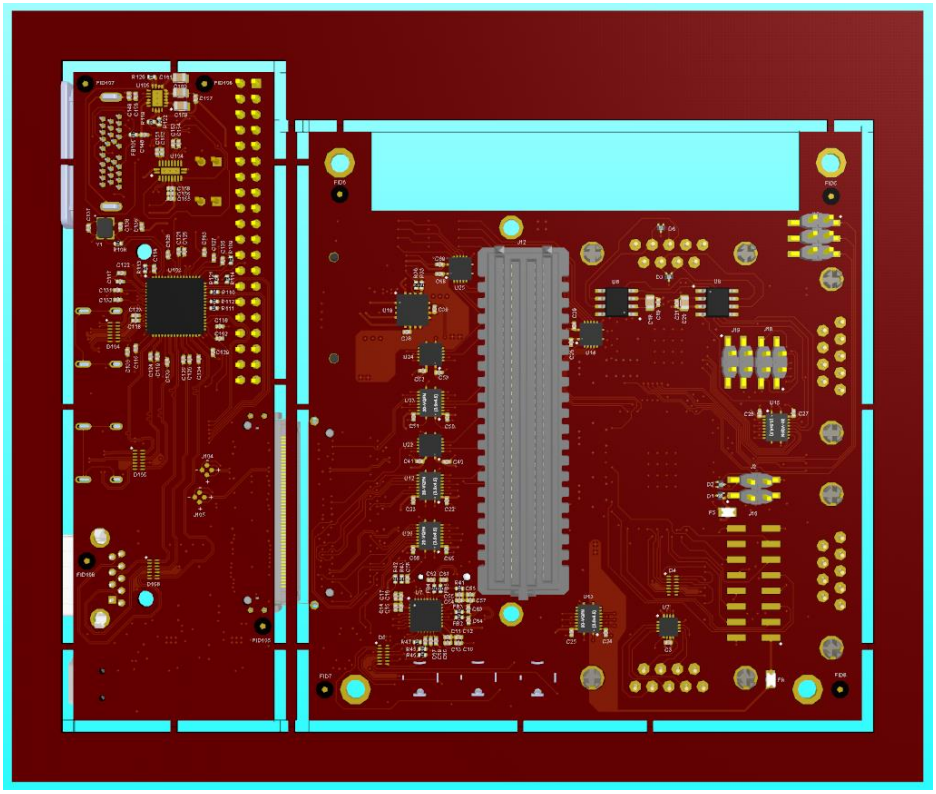


Figure 31 FM191-RU Bottom view

Table 1 lists all the connectors available on the FM192-RU system.

9.18 List of connectors

Table 1: Connectors list

Connector reference	Description
DB9s (J4, J6, J8, J9)	DB9 connectors (top layer)
FMC-LPC (J12)	FMC – LPC connector (bottom layer)
USS-C IP67 (J111)	Reversible USB type C connector (top layer)
USB-c 1:2 (J107, J108)	USB type C connectors (top layer)
USB-A (J110)	USB type A connector (top layer)
40-pin GPIO (J106)	40-pin GPIO connector
ERNI (J13)	Power connector (PN: ERNI 254831)
LSHM-RA (J11)	100x pin's Samtec's LSHM right angle connector
LSHM-RRA (J103)	100x pin's Samtec's LSHM reverse right angle connector
3.5" Audio headers (J5, J7, J10)	Jack 3.5" housing (top layer)
Mini-USB (J109)	USB2.0 INPUT (top layer)
4-pin GPIO	USB2.0 HL7800 debug header (top layer)

10 Pinout

Table 2: EMC2-DP V2 pin map

EMC2-DP V2	JBX	JBX PIN	JMX PIN	JMX	TE0715-30		TE0820		FM192-R
SIGNAL					FPGA PIN	SIGNAL	FPGA PIN	SIGNAL	SIGNAL
FMC_SCL/FMC1A-C30	JB1	32	31	JM1	W12	B13_L3_P	F5	B66_L6_N	FMC_SCL
FMC_SDA/FMC1A-C31	JB1	34	33	JM1	W13	B13_L3_N	G5	B66_L6_P	FMC_SDA
tFMC_LA12_P/FMC1C-G15	JB1	36	35	JM1	U11	B13_L5_P	C8	B66_L22_P	UART0_RXD
tFMC_LA12_N/FMC1C-G16	JB1	38	37	JM1	U12	B13_L5_N	B8	B66_L22_N	UART1_RXD
tFMC_LA03_P/FMC1C-G9	JB1	46	45	JM1	R17	B13_L19_P	B6	B66_L20_N	U6_TX_ON
tFMC_LA03_N/FMC1C-G10	JB1	48	47	JM1	T17	B13_L19_N	C6	B66_L20_P	SPI0_CE1_N
tFMC_LA04_P/FMC1D-H10	JB1	50	49	JM1	V13	B13_L1_P	B1	B66_L7_N	SPI0_CE0_N
tFMC_LA04_N/FMC1D-H11	JB1	52	51	JM1	V14	B13_L1_N	C1	B66_L7_P	SPI0_SCLK
tFMC_LA08_P/FMC1C-G12	JB1	56	55	JM1	AB13	B13_L9_P	D1	B66_L2_N	GPIO23
tFMC_LA08_N/FMC1C-G13	JB1	58	57	JM1	AB14	B13_L9_N	E1	B66_L2_P	GPIO18
tFMC_CLK0_P/FMC1D-H4	JB1	60	59	JM1	Y15	B13_L12_N	D5	B66_L14_N	U3_CSB1
tFMC_CLK0_N/FMC1D-H5	JB1	62	61	JM1	Y14	B13_L12_P	E5	B66_L14_P	U3_SDO1
tFMC_LA01_P/FMC1B-D8	JB1	66	65	JM1	AA15	B13_L11_N	C4	B66_L11_N	U6_RESET_IN
tFMC_LA01_N/FMC1B-D9	JB1	68	67	JM1	AA14	B13_L11_P	D4	B66_L11_P	U6_WAKE_UP
tFMC_LA13_P/FMC1B-D17	JB1	70	69	JM1	AB16	B13_L17_P	G1	B66_L1_P	U6_UART0_RTS
tFMC_LA13_N/FMC1B-D18	JB1	72	71	JM1	AB17	B13_L17_N	F1	B66_L1_N	ADC_U5_TX
tFMC_LA00_P/FMC1C-G6	JB1	76	75	JM1	Y19	B13_L13_N	C2	B66_L12_N	U2_SCLK
tFMC_LA00_N/FMC1C-G7	JB1	78	77	JM1	Y18	B13_L13_P	C3	B66_L12_P	U2_CS
tFMC_LA02_P/FMC1D-H7	JB1	35	36	JM1	U13	B13_L6_P	E9	B66_L18_P	U2_SDI
tFMC_LA02_N/FMC1D-H8	JB1	37	38	JM1	U14	B13_L6_N	D9	B66_L18_N	I2C1_SCL
tFMC_LA11_P/FMC1D-H16	JB1	39	40	JM1	V11	B13_L4_P	G8	B66_L16_P	GPIO19
tFMC_LA11_N/FMC1D-H17	JB1	41	42	JM1	W11	B13_L4_N	F7	B66_L16_N	GPIO13
tFMC_LA06_P/FMC1A-C10	JB1	45	46	JM1	AA11	B13_L7_P	E8	B66_L17_N	U6_UART1_RTS
tFMC_LA06_N/FMC1A-C11	JB1	47	48	JM1	AB11	B13_L7_N	F8	B66_L17_P	U6_UART1_CTS
tFMC_LA05_P/FMC1B-D11	JB1	49	50	JM1	AA12	B13_L8_P	G6	B66_L15_P	U6_FAST_SHUTDOWN
tFMC_LA05_N/FMC1B-D12	JB1	51	52	JM1	AB12	B13_L8_N	F6	B66_L15_N	U6_UART0_RX
tFMC_LA07_P/FMC1D-H13	JB1	55	56	JM1	Y12	B13_L10_P	F2	B66_L3_P	GPIO24
tFMC_LA07_N/FMC1D-H14	JB1	57	58	JM1	Y13	B13_L10_N	E2	B66_L3_N	UART0_TXD
tFMC_LA10_P/FMC1A-C14	JB1	59	60	JM1	V16	B13_L23_P	E4	B66_L5_P	U6_UART1_TX
tFMC_LA10_N/FMC1A-C15	JB1	61	62	JM1	W16	B13_L23_N	E3	B66_L5_N	U6_UART1_RX
tFMC_CLK1_P/FMC1C-G2	JB1	65	66	JM1	AA17	B13_L14_N	D6	B66_L13_N	U3_CSB3
tFMC_CLK1_N/FMC1C-G3	JB1	67	68	JM1	AA16	B13_L14_P	D7	B66_L13_P	U3_CSB2
tFMC_LA14_P/FMC1A-C18	JB1	69	70	JM1	Y17	B13_L24_N	C9	B66_L24_P	ADC_U5_RQ
tFMC_LA14_N/FMC1A-C19	JB1	71	72	JM1	W17	B13_L24_P	B9	B66_L24_N	ADC_U5_RX
tFMC_LA15_P/FMC1D-H19	JB1	75	76	JM1	AA19	B13_L18_P	A8	B66_L23_N	GPIO6
tFMC_LA15_N/FMC1D-H20	JB1	77	78	JM1	AA20	B13_L18_N	A9	B66_L23_P	UART1_TXD
tFMC_LA09_P/FMC1B-D14	JB2	42	41	JM2	E3	B35_L21_N	AB3	B64_L15_N	U6_UART0_TX
tFMC_LA09_N/FMC1B-D15	JB2	44	43	JM2	E4	B35_L21_P	AB4	B64_L15_P	U6_UART0_CTS
tFMC_LA20_N/FMC1C-G22	JB2	46	45	JM2	B6	B35_L8_N	AB2	B64_L17_P	SPI0_MOSI
tFMC_LA20_P/FMC1C-G21	JB2	48	47	JM2	B7	B35_L8_P	AC2	B64_L17_N	SPI0_MISO
tFMC_LA18_P/FMC1A-C22	JB2	52	51	JM2	C6	B35_L11_P	AC4	B64_L14_P	ADC_U4_RX

tFMC_LA18_N/FMC1A-C23	JB2	54	53	JM2	C5	B35_L11_N	AC3	B64_L14_N	ADC_U1_TX
tFMC_LA26_P/FMC1B-D26	JB2	66	65	JM2	C8	B35_L7_P	AE3	B64_L21_P	CAN0_TX_LS
tFMC_LA26_N/FMC1B-D27	JB2	68	67	JM2	B8	B35_L7_N	AF3	B64_L21_N	CAN0_RX_LS
tFMC_LA16_N/FMC1C-G19	JB2	72	71	JM2	G7	B35_L4_N	AE2	B64_L22_P	I2C1_SDA
tFMC_LA16_P/FMC1C-G18	JB2	74	73	JM2	G8	B35_L4_P	AF2	B64_L22_N	GPIO5
tFMC_LA27_P/FMC1A-C26	JB2	76	75	JM2	H3	B35_L19_N	AG6	B64_L10_P	CAN1_TX_LS
tFMC_LA27_N/FMC1A-C27	JB2	78	77	JM2	H4	B35_L19_P	AG5	B64_L10_N	CAN1_RX_LS
tFMC_LA24_P/FMC1D-H28	JB2	82	81	JM2	E5	B35_L5_N	AG4	B64_L19_P	GPIO21
tFMC_LA24_N/FMC1D-H29	JB2	84	83	JM2	F5	B35_L5_P	AH4	B64_L19_N	GPIO20
tFMC_LA28_P/FMC1D-H31	JB2	86	85	JM2	F6	B35_L6_N	AG3	B64_L20_P	U21_UART0_RXD
tFMC_LA28_N/FMC1D-H32	JB2	88	87	JM2	G6	B35_L6_P	AH3	B64_L20_N	U21_UART0_TXD
tFMC_LA32_N/FMC1D-H38	JB2	90	89	JM2	H6	B35_L0	AD6	B64_T0	LED3
tFMC_LA19_P/FMC1D-H22	JB2	51	52	JM2	D3	B35_L14_P	AE5	B64_L12_P	GPIO4
tFMC_LA19_N/FMC1D-H23	JB2	53	54	JM2	C3	B35_L14_N	AF5	B64_L12_N	I2C0_SDA
tFMC_LA17_P/FMC1B-D20	JB2	55	56	JM2	D5	B35_L12_P	AD5	B64_L13_P	ADC_U4_TX
tFMC_LA17_N/FMC1B-D21	JB2	57	58	JM2	C4	B35_L12_N	AD4	B64_L13_N	ADC_U4_RQ
tFMC_LA22_P/FMC1C-G24	JB2	61	62	JM2	F1	B35_L23_N	AG9	B64_L7_P	GPIO22
tFMC_LA22_N/FMC1C-G25	JB2	63	64	JM2	F2	B35_L23_P	AH9	B64_L7_N	GPIO17
tFMC_LA21_P/FMC1D-H25	JB2	65	66	JM2	D6	B35_L2_N	AF8	B64_L8_P	GPIO16
tFMC_LA21_N/FMC1D-H26	JB2	67	68	JM2	D7	B35_L2_P	AG8	B64_L8_N	U21_ENABLE
tFMC_LA23_P/FMC1B-D23	JB2	71	72	JM2	E2	B35_L17_P	AH8	B64_L9_P	ADC_U1_RQ
tFMC_LA23_N/FMC1B-D24	JB2	73	74	JM2	D2	B35_L17_N	AH7	B64_L9_N	ADC_U1_RX
tFMC_LA25_P/FMC1C-G27	JB2	75	76	JM2	H1	B35_L24_P	AE7	B64_L4_N	I2C0_SCL
tFMC_LA25_N/FMC1C-G28	JB2	77	78	JM2	G1	B35_L24_N	AD7	B64_L4_P	GPIO12
tFMC_LA29_P/FMC1C-G30	JB2	81	82	JM2	A6	B35_L9_N	AB7	B64_L5_P	U21_UART0_CTS
tFMC_LA29_N/FMC1C-G31	JB2	83	84	JM2	A7	B35_L9_P	AC7	B64_L5_N	U21_UART0_RTS
tFMC_LA31_P/FMC1C-G33	JB2	85	86	JM2	G2	B35_L22_N	AB6	B64_L6_P	GPIO1
tFMC_LA31_N/FMC1C-G34	JB2	87	88	JM2	G3	B35_L22_P	AC6	B64_L6_N	GPIO2
tFMC_LA30_P/FMC1D-H34	JB2	91	92	JM2	A4	B35_L10_N	AF1	B64_L24_P	LED0
tFMC_LA30_N/FMC1D-H35	JB2	93	94	JM2	A5	B35_L10_P	AG1	B64_L24_N	LED1
tFMC_LA33_P/FMC1C-G36	JB2	95	96	JM2	F4	B35_L20_N	AH2	B64_L23_P	GPIO0
tFMC_LA33_N/FMC1C-G37	JB2	97	98	JM2	G4	B35_L20_P	AH1	B64_L23_N	GPIO25
tFMC_LA32_P/FMC1D-H37	JB2	99	100	JM2	H5	B35_L25	AH6	B64_T1	LED2
tFMC_TRZ_TX_N/FMC1A-C3	JB3	26	25	JM3	Y2	MGT_TX3_N	E25	B505_TX0_P	USB_SSTXM_UP
tFMC_TRZ_TX_P/FMC1A-C2	JB3	28	27	JM3	W2	MGT_TX3_P	E26	B505_TX0_N	USB_SSTXP_UP
tFMC_TRZ_RX_N/FMC1A-C7	JB3	25	26	JM3	Y6	MGT_RX3_N	F27	B505_RX0_P	USB_SSRXM_UP
tFMC_TRZ_RX_P/FMC1A-C6	JB3	27	28	JM3	W6	MGT_RX3_P	F28	B505_RX0_N	USB_SSRXP_UP
tFMC_TRZ_CK_P/FMC1B-D4	JB3	31	32	JM3		CLKIN2_P		CLKIN_P	N/A
tFMC_TRZ_CK_N/FMC1B-D5	JB3	33	34	JM3		CLKIN2_N		CLKIN_N	N/A

11 Support Packages

12 Physical Properties

Dimensions	90mm	96mm
Weight		
Supply Voltages	12V, 5V, 3.3V	
Supply Current	+12V	
	+5V	
	+3.3V	
	-5V	N/A
	-12V	N/A
RH	10-80%	
Temperature	-10 to +40ºC -25 to +80ºC	
MTBF	> 50,000 hours	

13 Safety

This module presents no hazard to the user when in normal use.

14 EMC

This module is designed to operate from within an enclosed host system, which is build to provide EMC shielding. Operation within the EU EMC guidelines is not guaranteed unless it is installed within an adequate host system.

This module is protected from damage by fast voltage transients originating from outside the host system which may be introduced through the output cables.

Short circuiting any output to ground does not cause the host PC system to lock up or reboot.

15 Ordering Information

Order number:

y:

C = Commercial temperature
I = Industrial temperature