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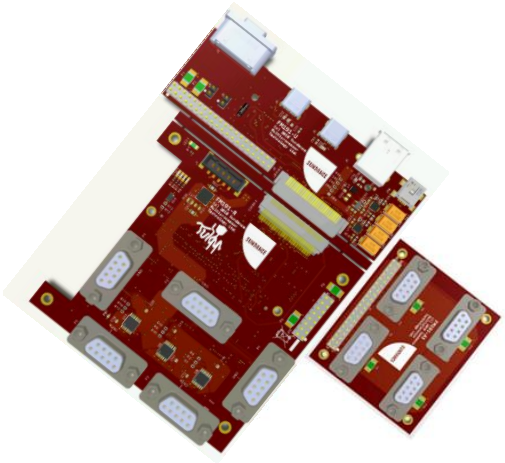
Product Specification
FM191-RUA1

VITA57.1 FMC™-LPC I/O Module w. ADCs/DACs + USB3.0 ports



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Certificate Number FM55022

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1.2	Applied changes	19/04/2018	PM
1.3	Updated FM191-A1 features	12/05/2018	PM
1.3.1	Updated DB9 and GPIO diagrams	16/06/2018	PM
1.3.2	Updated the USB circuitry for the FM191-U revision B	15/09/2018	PM

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1 Introduction

This document describes the hardware features and some operational details of the FM191-RUA1 I/O Module. The FM191-RUA1 has a VITA57.1 FMC-LPC connector and follow the electronics specification and recommendation of the standard but is **NOT** form-factor compatible and will **NOT** fit all FMC carriers. Two versions are available. The FM191-R main features are a daughter card which provides 5V-TTL-compatible Analogue and Digital GPIOs that are suitable for robotics, motors and sensor application. The FM191-U is an expansion board which can be added to the FM191-R for delivering 4-port USB3.0 (2x USB type C, 1x IP67 USB Type C and 1x USB Type A) connectivity and more I/O pins on a 40-way header that follows Raspberry-PI pin-out. The additional board FM191-A1 provides easy connections to interface the 40 pin GPIO header.

The FM191-RUA1 is 100% compatible with the EMC²-xxxx PCIe/104 OneBank board that has different FPGAs SoM (System-on-Modules) from Xilinx or Microsemi. FM191-RUA1 does not have any PC/104 compatible bus interfaces, like PCIe or PCI. The FM191-RUA1 can safely be used with ANY carrier board that has a FMC connector, either directly onto the connector or via Samtec SeaRay cable, as long as it supports 1.8V Standards. No power is derived from the carrier and power has to be connected to the FM191-RUA1 with a suitable power-cable (supplied)

1.1 Main Features

1.1.1 Hardware

The FM191-R board is designed to fan out the FMC-LPC connector parallel I/Os and high-speed SerDes to five DB9 connectors and one SEIC connector.

The FM191-R was specially designed for the Sundance EMC² and other FPGA systems that have available a VITA57.1 FMC-LPC interface, for robotic/mobile applications.

The FM191-R provides connectivity to a wide range of 5V TTL sensors/actuators which are exposed to vibrations accessible via 5x DB9 connectors.

The FM191-U provides 4x USB3.0 ports(2x USB type C, 1x IP67 USB Type C and 1x USB Type A) for interfacing with high-speed sensors (e.g. depth sensors) or external storage (HDD/SSD) devices and provides 28 digital I/Os accessible via one 40-pin General Propose Input Output (GPIOs) connector.

The FM191-A1 fans-out the digital 40-pin GPIO I/Os from the FM191-U to 4x DB9 connectors.

1.1.2 Common Features

The common features of the FM191-RUA1 are:

- FMC LPC connector with I/O and single high-speed serial.
- Single +5 and +3.3V (external ATX connector) for powering external sensors via the DB9 connectors.
- 100-way SEIC peripheral interface connector.
- 15x single-ended digital I/Os 5V TTL are accessible via 3x DB9 (P3-P5).
- 12x analogue Inputs 5V TTL, with a resolution of 24-bits@2kSPS via 2x DB9 (P1-P2).
- 8x analogue Outputs 5V TTL, with a resolution of 12-bits via 2x DB9 (P2 and -P5).

- 4x USB3.0 connections (2x USB type C, 1x IP67 USB Type C and 1x USB Type A) and 28x single-ended digital I/Os 5V TTL 40-pin GPIO connectors available via the expansion FM191-U board.
- 28x single-ended digital I/Os 5V TTL accessible 4x DB9 (P6-P9) via the expansion board FM191-A1
- 4x DB9 connectors (P6-P9) to interface the 40 pin GPIO header via the expansion FM191-A1 board.

1.2 Notes

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

2 Related Documents

2.1 Referenced Documents

2.2 Applicable Documents

3 Acronyms, Abbreviations and Definitions

3.1 Abbreviations / Definitions

ADC	Analog to Digital Converter
DAC	Digital to Analogue Converter
EEPROM	Also called E²PROM (or just E²). Electrically erasable and programmable ROM.
FPGA	Field Programmable Gate Array.
GPIO	General Purpose Input Output.
I²C	Inter-integrated Circuit. A two wire low speed serial interface.
SEIC	Sundance External Interface Connector.
SPI	Serial Peripheral Interface

3.2 Definitions

4 Functional Description

4.1 Block Diagram

The FM191-RUA1 system is composed of 3 boards, namely, the FM191-R, FM191-U and FM191-A1. Figure 1 shows a representation of the FM191-RUA1 board.

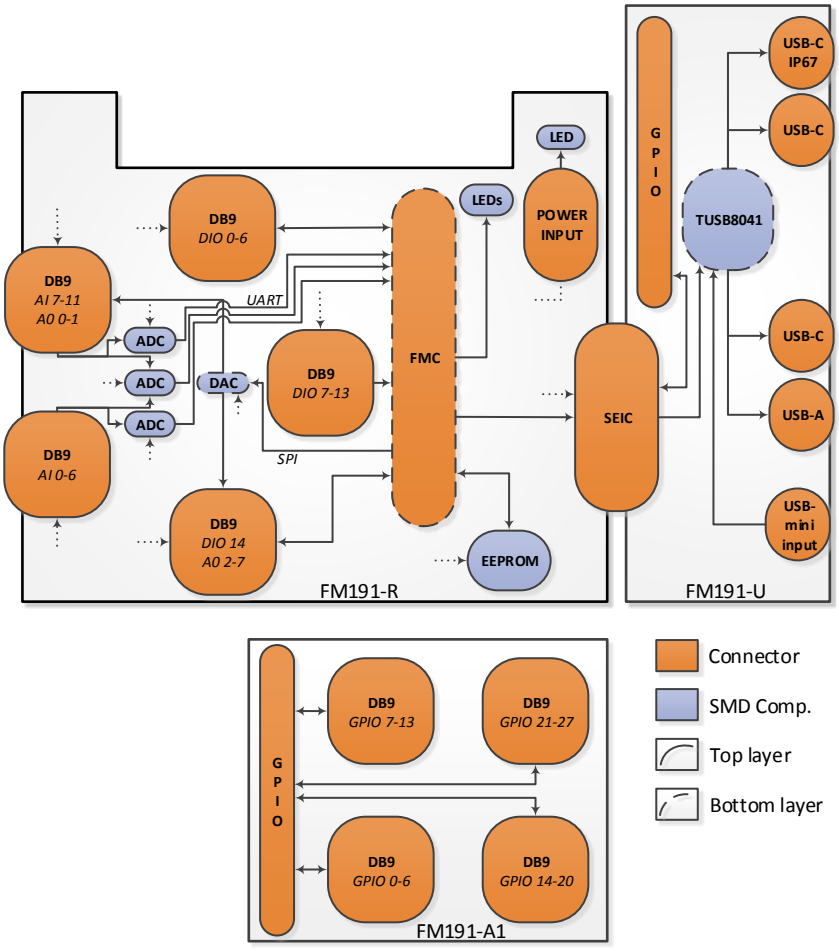


Figure 1: FM191-RUA1 block diagram

4.2 Module Description

The main connectors of the FM191-R (Figure 1) are the 5x DB9 connectors (P1-P5). DB9 connectors were chosen because of their reliability, low-price and mechanic locking which is desirable in applications exposed to high level of vibrations.

Supplied by external 5V, the DIOs are shifted down to 1.8V before the FMC interface.

Similarly, both ADC outputs to the FMC and DAC inputs from the FMC are under 1.8V, shifted from 5V (ADC) and to 5V (DAC). These 5V are independent from both converters and managed from two regulators which take external 12V.

The FMC connector not only interacts with the DB9s providing I/Os flexibility, but also supplying to the SEIC connector FMC-JTAG, FMC-I2C and some differential pairs. These features are not connected in FM191-U, but are present for other possible expansions in the future. Also, the pinout of the SEIC connector is compatible with the expansion board of EMC2-DP, which means that any I2C device in it could be used (HDMI). Equally, FM191-U can be used with EMC2-DP, having UART available at the GPIO header.

Apart from those signals, USB3.0 and GPIO are interconnected from the FMC.

The FM191-U is 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 GPIO (compatible with the Raspberry PI V3) is also available and can be used to provide connectivity to a wide range of R-PI/Arduino shields. The 40-pin and DB9

connectors can provides up to 5V@2A (protected by an independent fuse) powered by the FM191-R.

The user may opt to use EMC2-DPV2 with FM191-U. **WARNING**: Please contact Sundance before attempting to connect the FM191-U to the EMC2-DPV2.

Users must be aware of the following when connecting the FM191-R to the EMC2-DPV2:

- The GPIO signals are 1.8V TTL, and therefore, injecting 5V TTL to any digital I/O would damage the FPGA module on the EMC2-DPV2;
- The USB3 chip is powered using 5V, which is not provided by the EMC2-DPV2 to the FM191-U.

These 2 issues can be solved using the jumpers J9 (1.8V) and J8 (5V) are available at FM191-U. **NOTE**: that 5V must be externally supplied via J8 or the USB3.0 will not work.

The FM191-A1 fans-out the 28x digital I/Os available on the FM191-U to 4x DB9 (P6-P9). This board was designed for providing an high flexibility to users and therefore the FM191-A1 can be connected to the FM191-U using any of the connection types shown in Figure 2 to Figure 5:

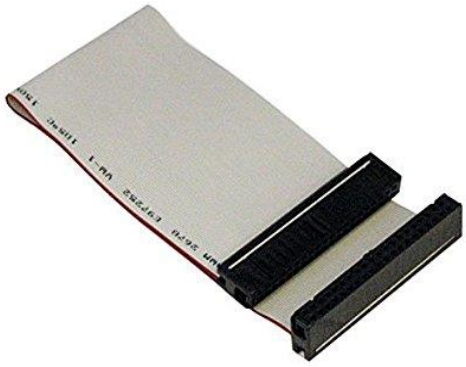


Figure 2: Standard flat 40-pin IDE PATA cable

Figure 3: Round 40-pin IDE PATA cable

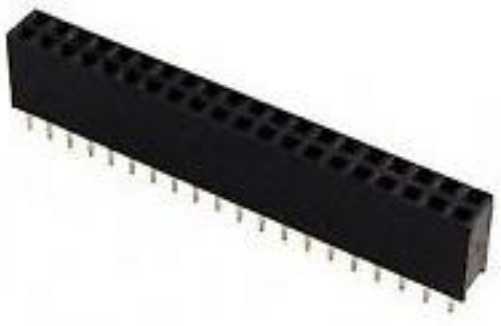


Figure 4: Stacked up by replacing 40-pin male by a female connector

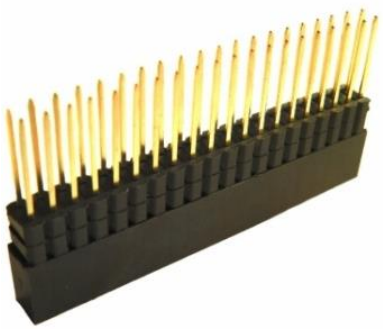


Figure 5: Stacked up by soldering the FM191-A1 to FM191-U using long 40-pin male connector.

Please contact Sundance to select the best stack up configuration for the target application.

4.3 Interface Description

4.3.1 Mechanical Interface

4.3.1.1 External Power Supply connector

The FM191-R is powered directly from an external power source via J1 connector (ERNI 254831).

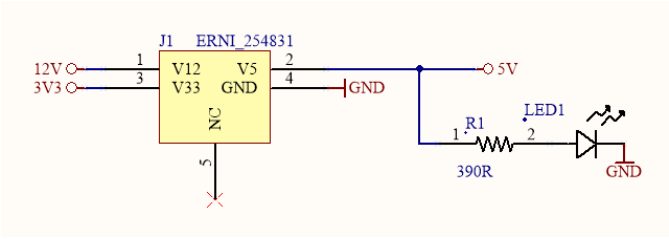


Figure 6: Schematics of the power connector.

4.3.1.2 SEIC Connector

The FM191-U is plugged to the FM191-R via the SEIC connector. One Samtec's LSHM-150-01-L-DH-A-S-TR is used in the FM191-R and one LSHM-150-01-L-RH-A-S-TR is used in the FM191-U. All the remaining pins in the FMC are routed to the SEIC connector, increasing the flexibility and enabling the possibility of creating future SEIC boards. Figure 7 shows the pin-map of the SEIC connectors for both boards.

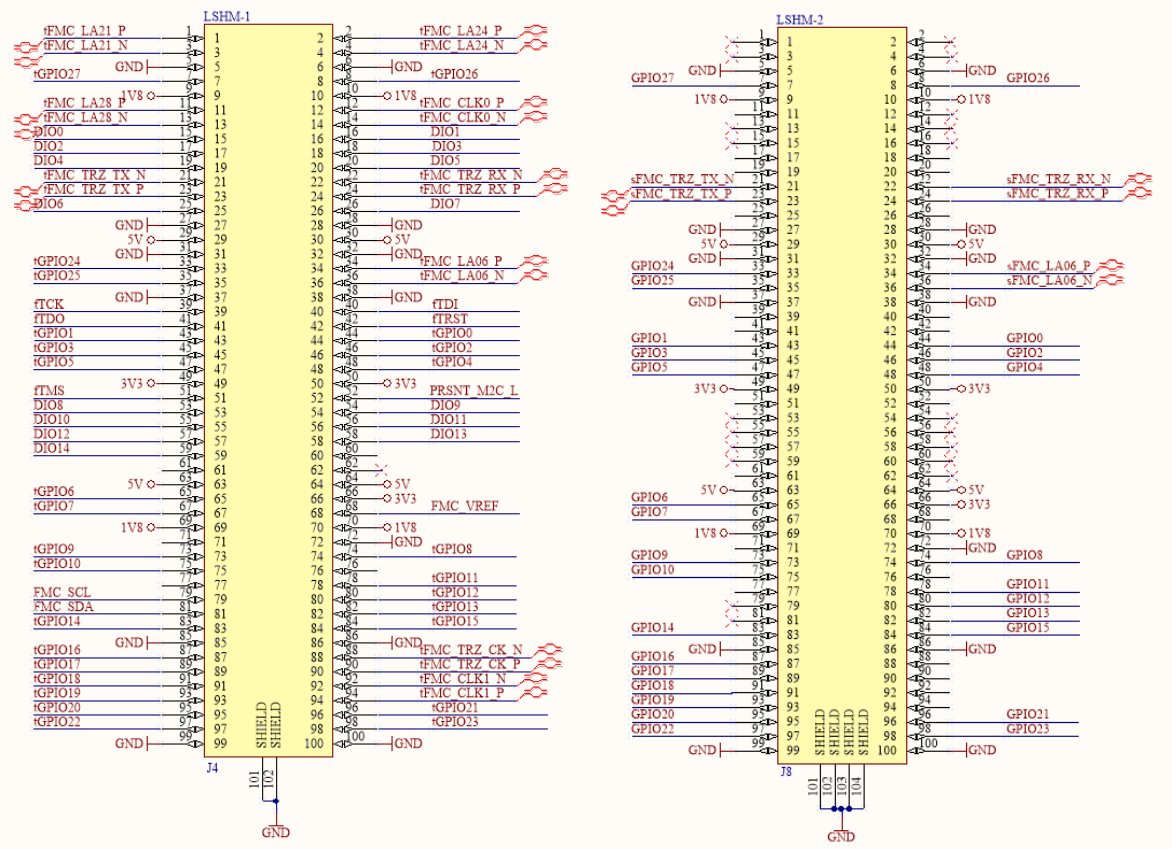


Figure 7: SEIC pin map in the FM191-R (left) and FM191-U (right)

4.3.1.3 USB connectors

4.3.2 Electrical Interface

4.3.2.1 Local and external Power Supplies

One MAX8556 DC-DC step-down converter (FM191-R) is used to create the local voltage of 1.8V@4A and one LM3674 to create the local voltage of 1.1V@0.6A.

The FM191-R must be powered (5V@14A and 3.3V@5A) by an external power source unit (e.g the DCX6.360) supply via the J1 5-pin power connector. External sensors and actuators can be powered via the DB9 (5V@2A per connector) and 40-pin (2-pins at 5V@2A and 2-pins 3.3V@2A) connectors.

ADCs and DAC are supplied with independent 5V each, from linear regulators (LP4951C) supplied with 12V input.

4.3.2.2 Level shifters

Seven TI TXS0108E are used for converting from 1.8V TTL single-ended I/Os to 5V. All the level shifters on the FM191-R.

4.3.2.3 I2C EEPROM

A 512x8bits ST M24C04-F EEPROM is available for storage small amounts of data which can programmed via the I²C bus (Figure 8). This device can be used to store operating parameters separate from the configuration Flash (e.g. Serial Number).

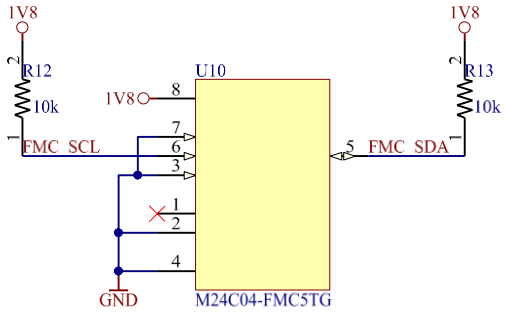


Figure 8: Schematics of the M24C04 EEPROM.

4.3.2.4 LEDs

LED 1 for sensing power from the ATX and 4 user LEDS (LED2-5) which can be freely configured by the user (Figure 9).

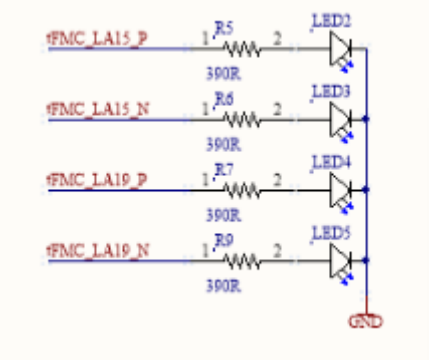


Figure 9: User LEDs

4.3.2.5 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 FM191-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).

4.3.3 VITA57.1 FMC-LPC I/O Module

The LPC (low-pin count) variant provides 34 differential I/O or 68x single-ended I/Os 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 and the signal names is shown in Figure 10.

Further details about the FMC-LPC module can be found in the following link http://en.wikipedia.org/wiki/FPGA_Mezzanine_Card.

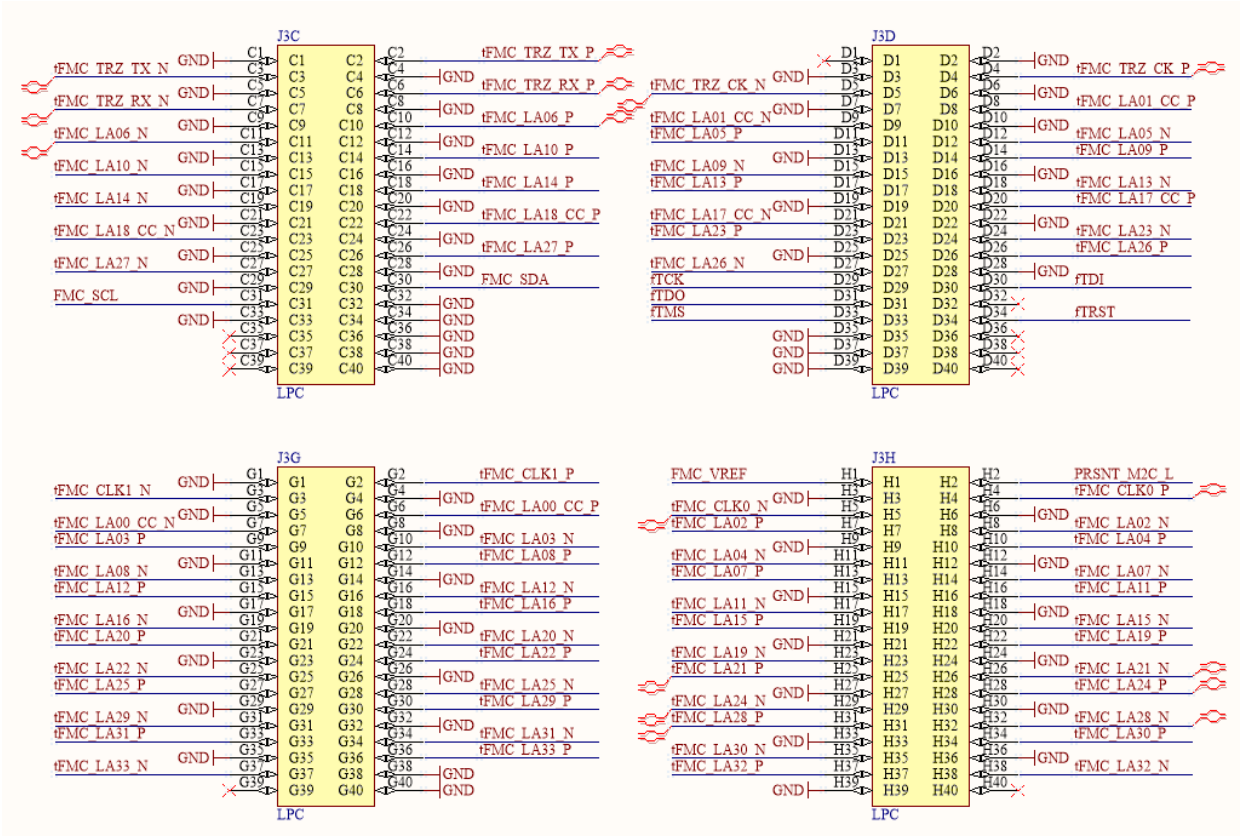


Figure 10: FMC-LPC pinout

4.3.4 ADC

Three TI ADS122U04 24bit, 4-channel, 2kSPS with UART interface are used for providing the 12x Analogue inputs 5V TTL. The ADCs channels are accessible via the P1 and P2 DB9 connectors. Analogue channels 0 to 6 (AO0-AO6) are accessible via P1 and AO7-AO11 via P2 connectors. Each ADC IC is programmed via a dedicated UART ports (UART1 to UART3).

Each DB9 (pin 1) supplies up to 5v@2A and it is protected with a fuse. Figure 11, Figure 12 and Figure 13 show the schematics of the signals of the level shifters, connectors and ADC ICs.

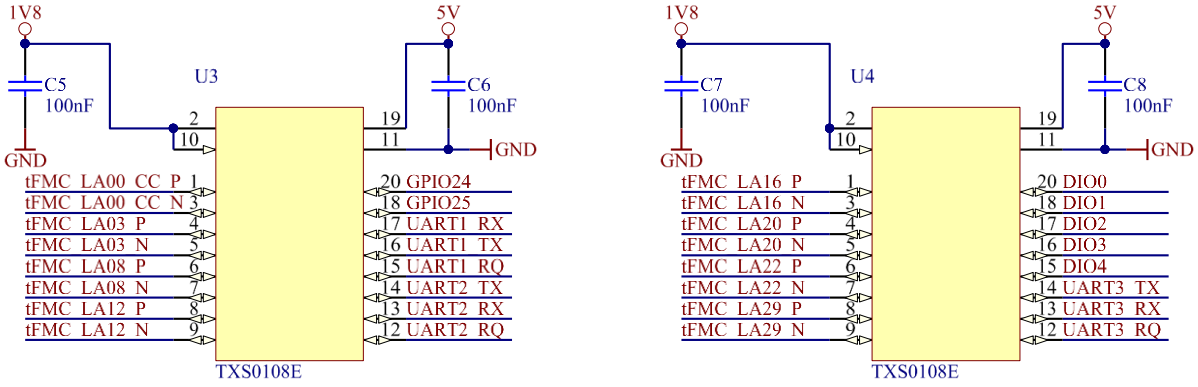


Figure 11: Schematics of the level shifters and pin-map of the UART ports.

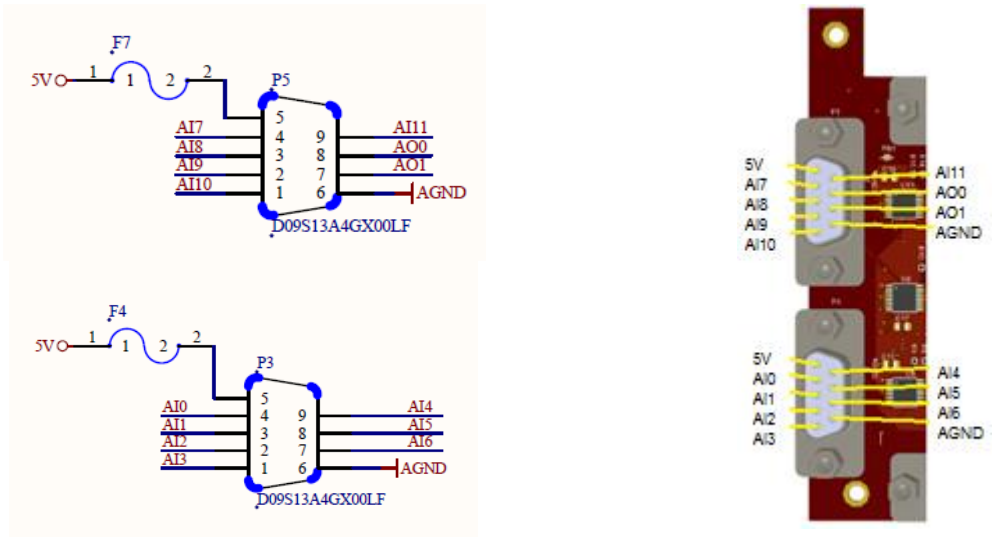


Figure 12: Schematics of P3 and P5 DB9 connectors (AIs)

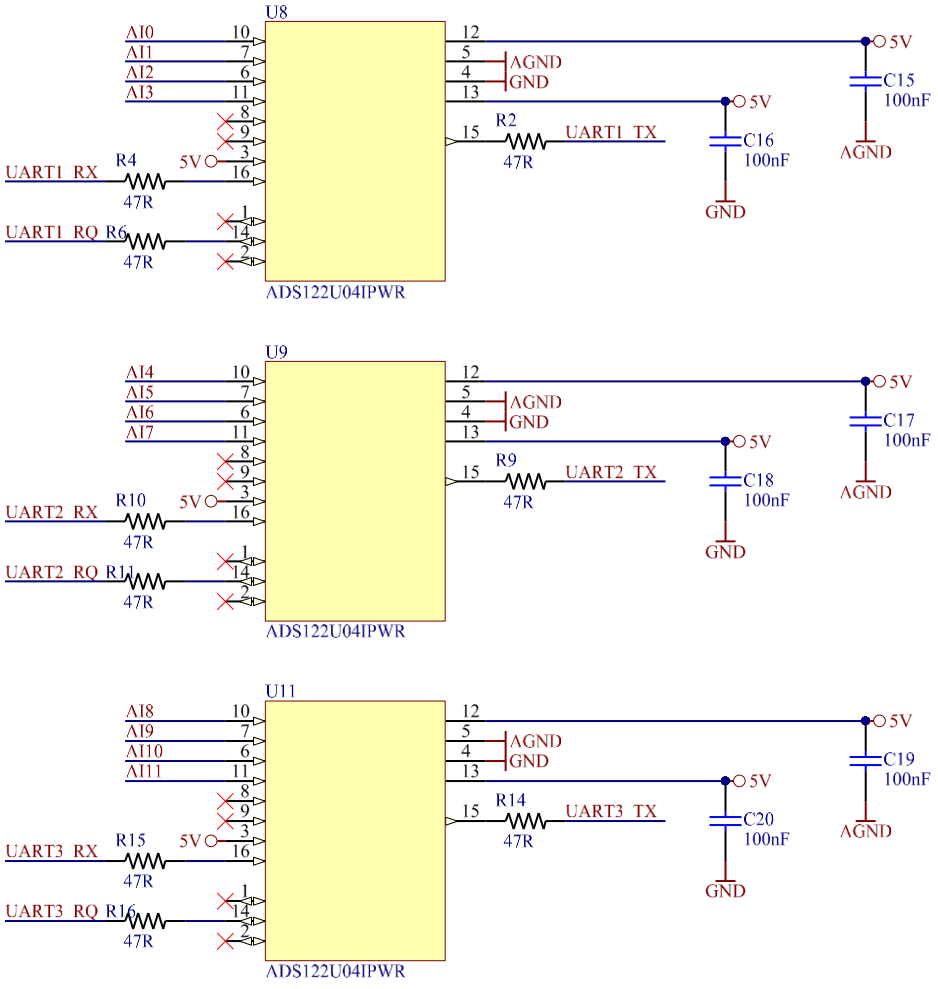


Figure 13: Schematics of the Analogue channels

4.3.5 DAC

One TI DAC60508Z 12bit, 8-channel with SPI interface is used for providing the 8x Analogue Outputs 5V TTL. The DACs channels are accessible via the P2 and P5 DB9 connectors. Analogue channels 0 to 1 (AO0-AO1) are accessible via P2 and AO2-A7 via P5 connectors. The DAC is programmed via a dedicated SPI ports.

Each DB9 (pin 1) supplies up to 5v@2A and it is protected with a fuse. Figure 14, Figure 15, Figure 16 show the schematics of the signals of the level shifters, connectors and DAC IC.

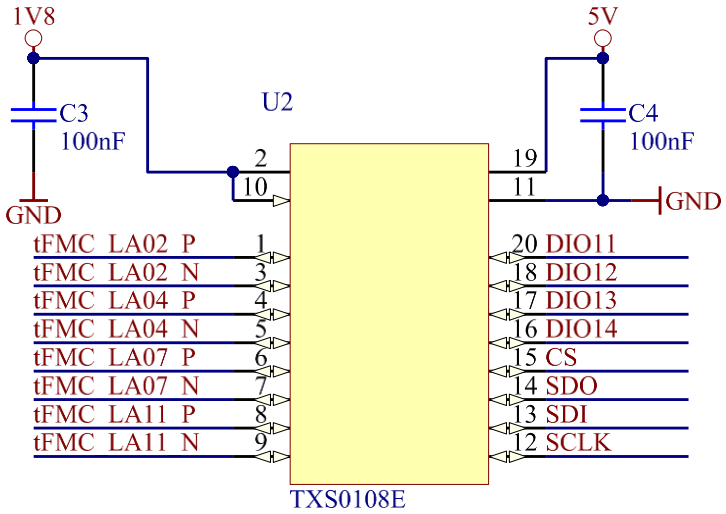


Figure 14: Schematics of the level shifters and pin-map of the SPI signals (CS, SDO, SDI, SDO).

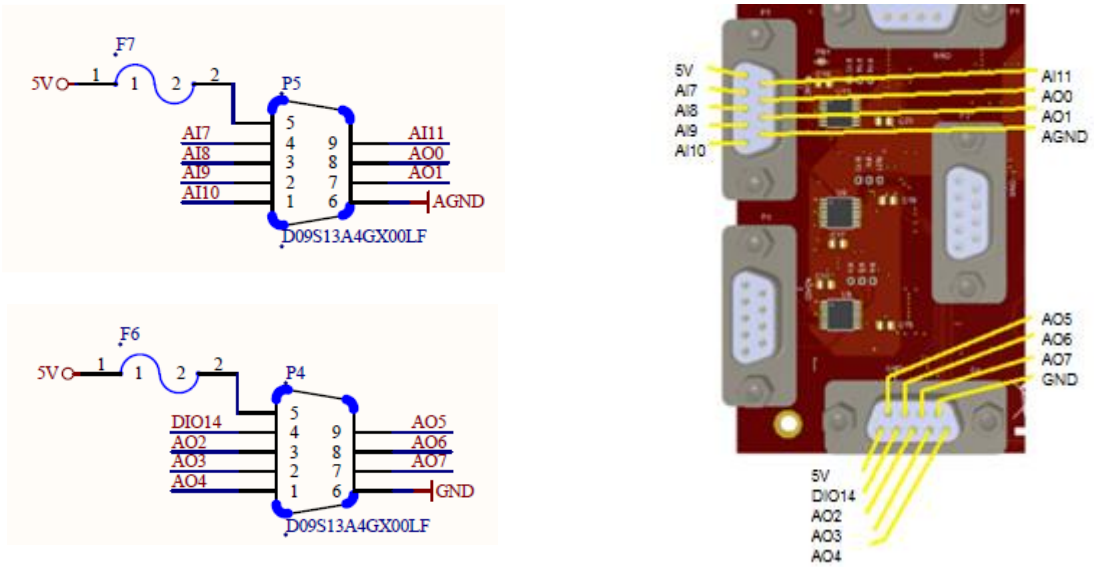


Figure 15: Schematics of P5 and P4 DB9 connectors (AOs)

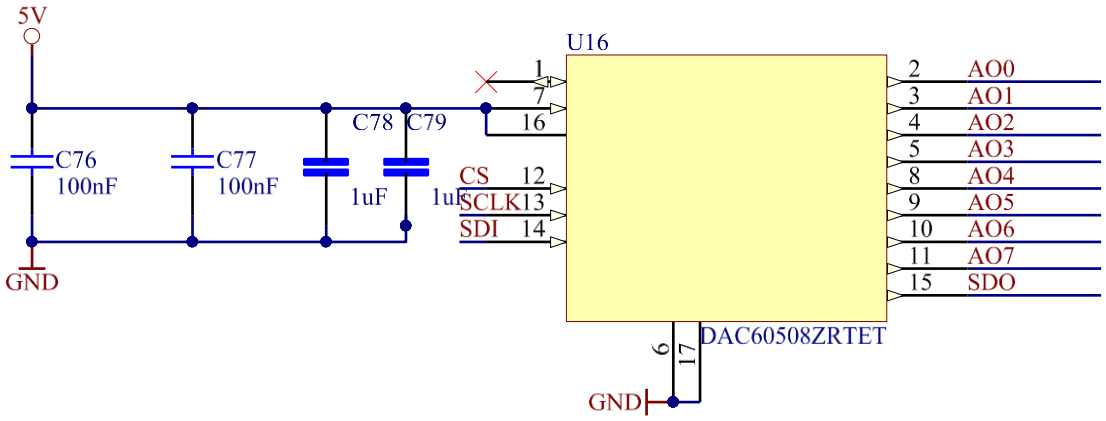
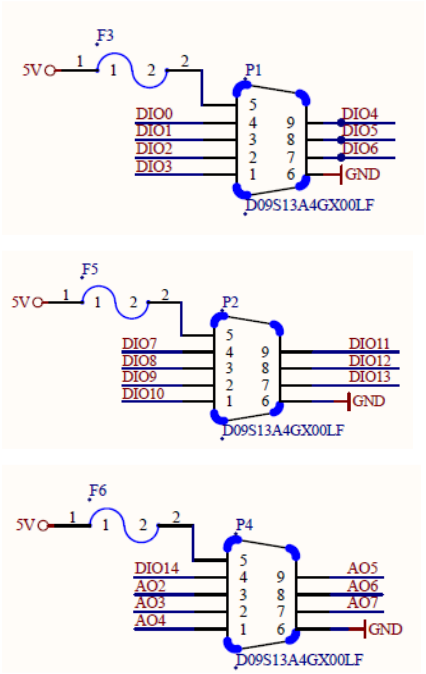


Figure 16: Schematics of the DAC

4.3.6 Single ended I/Os

15x digital I/Os (DIOs) 5V TTL are accessible via the P3, P4 and P5 DB9 connectors. P3 provides access to D0-D6, P4 to D7 – D13 and P4 to D14. Each DB9 (pin 1) supplies up to 5V@2A (per pin) and it is protected with a fuse.

28x general propose I/Os (GPIO0-GPIO27) 5V TTL are accessible via the 40-pin GPIOs. 5V@2A (per pin) can be driven from Pins 1 and 3 and 3V3@2A (the absolute maximum for both pins is 3A) from pins 2 and 4 and the pins are protected by fuses (Figure 17, Figure 18, Figure 19, Figure 20, Figure 21 and Figure 22).



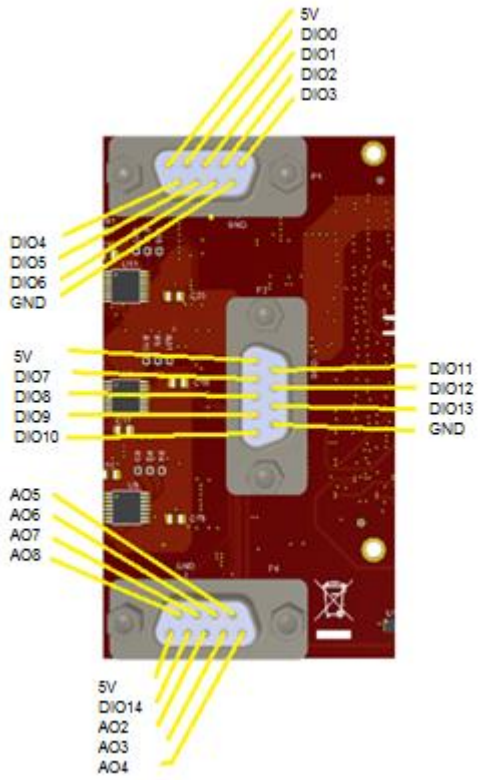


Figure 17: Digital I/Os available via the DB9 connectors.

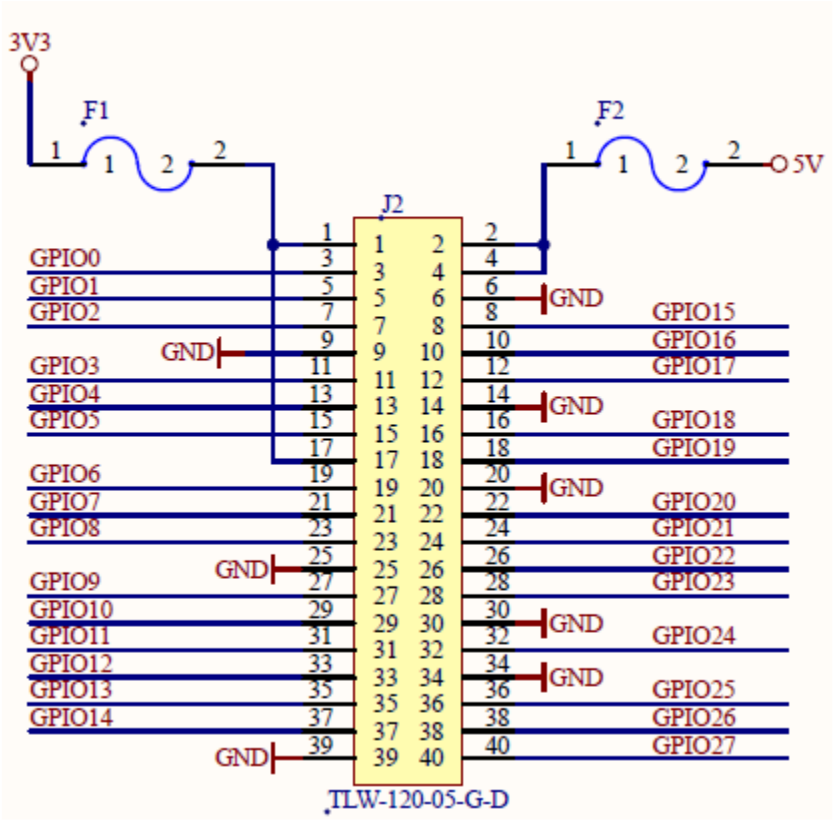


Figure 18: Schematics of the 40-pin GPIO at the FM191-U

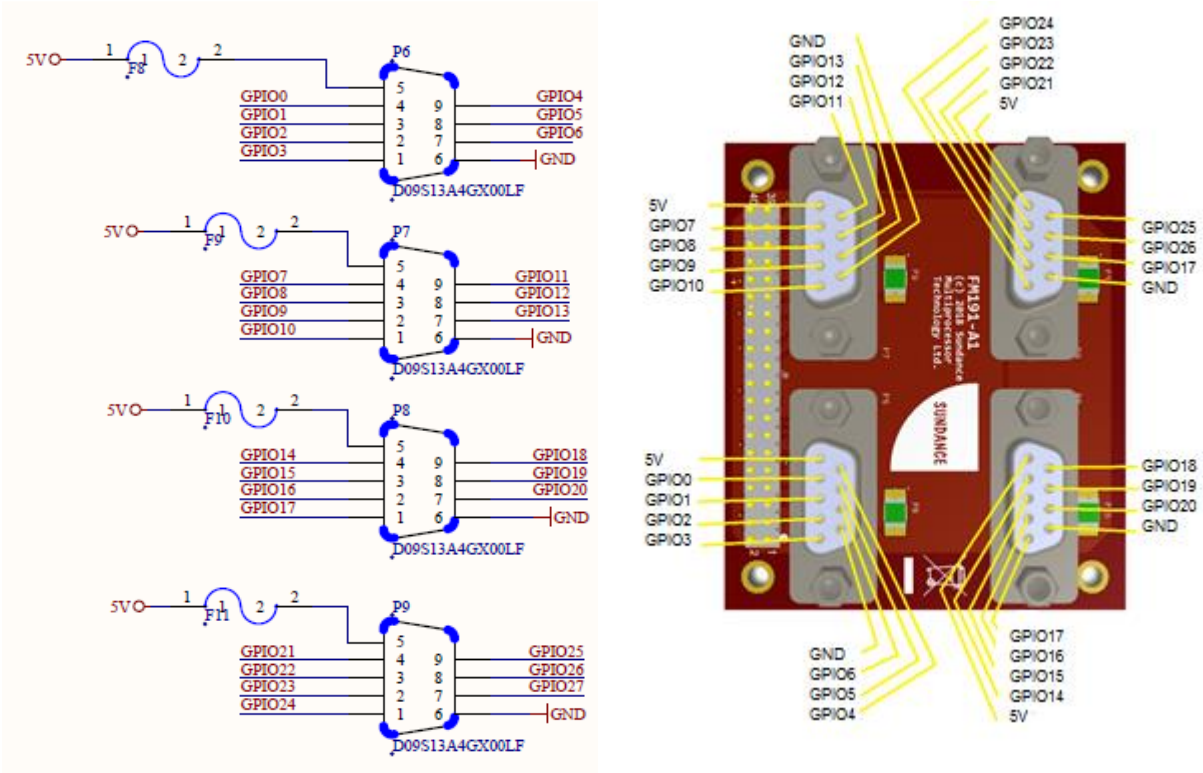


Figure 19: 40-pin GPIO connector schematics, and DB9s at FM191-A1

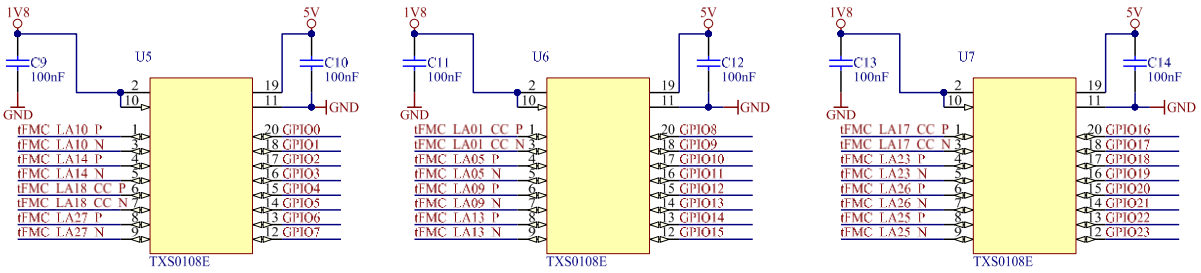


Figure 20: Level shifters and digital signals mapping (1/3)

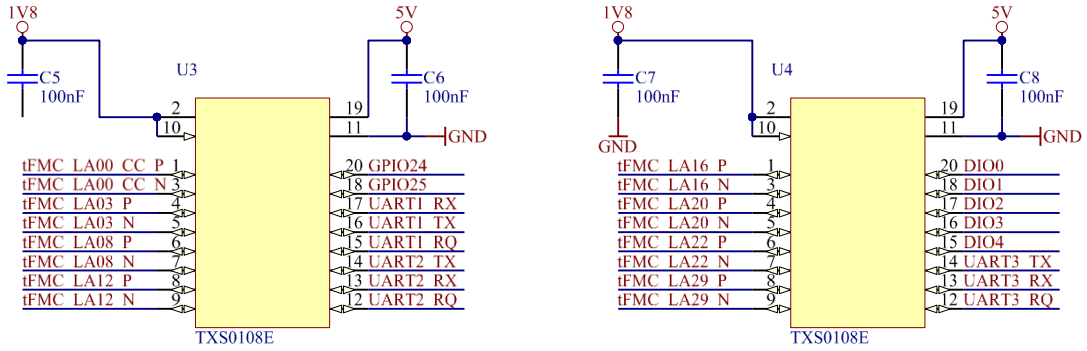


Figure 21: Level shifters and digital signals mapping (2/3)

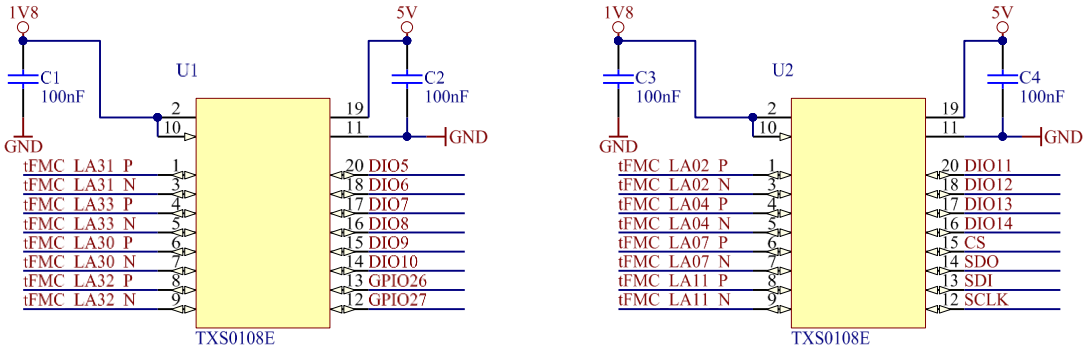


Figure 22: Level shifters digital signals mapping (3/3)

Board parts

Figure 23 shows the top view of the FM191-RU:

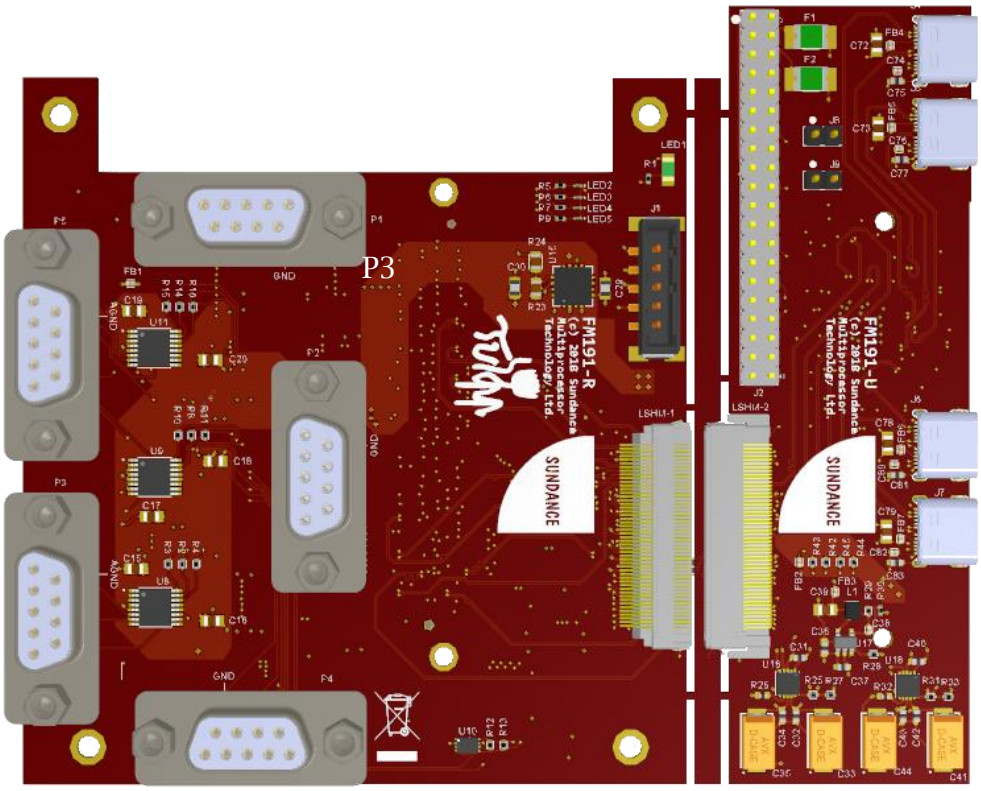


Figure 23: FM191-RU Top view

Figure 24 shows the bottom view of the FM191-RU:

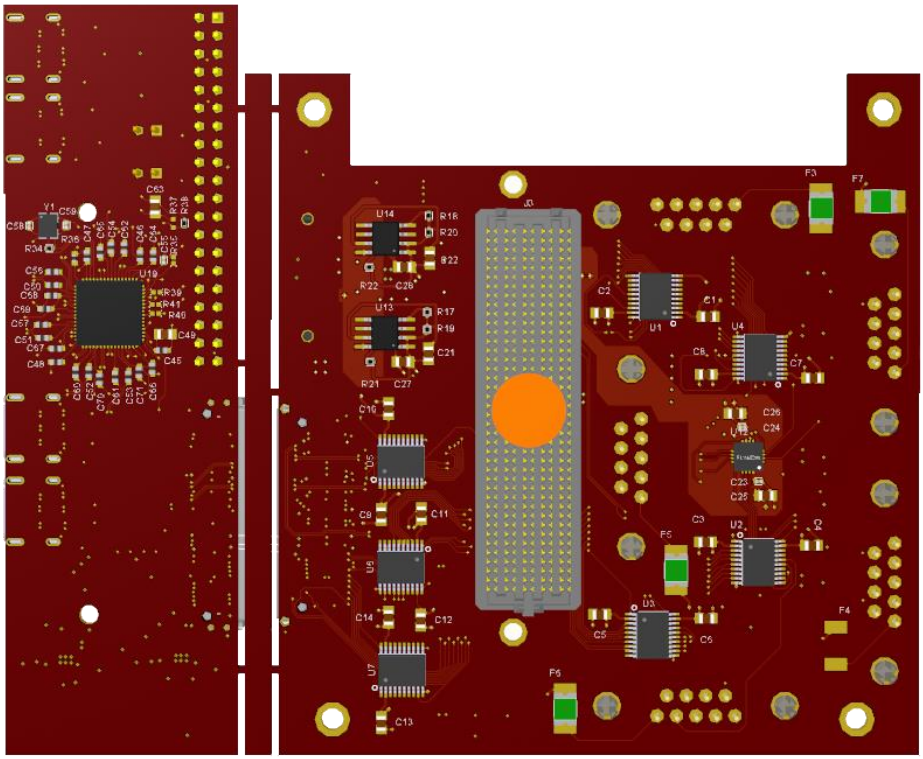


Figure 24 Bottom View of FM191-RU

Figure 25 shows the top/bottom view of the FM191-A1:

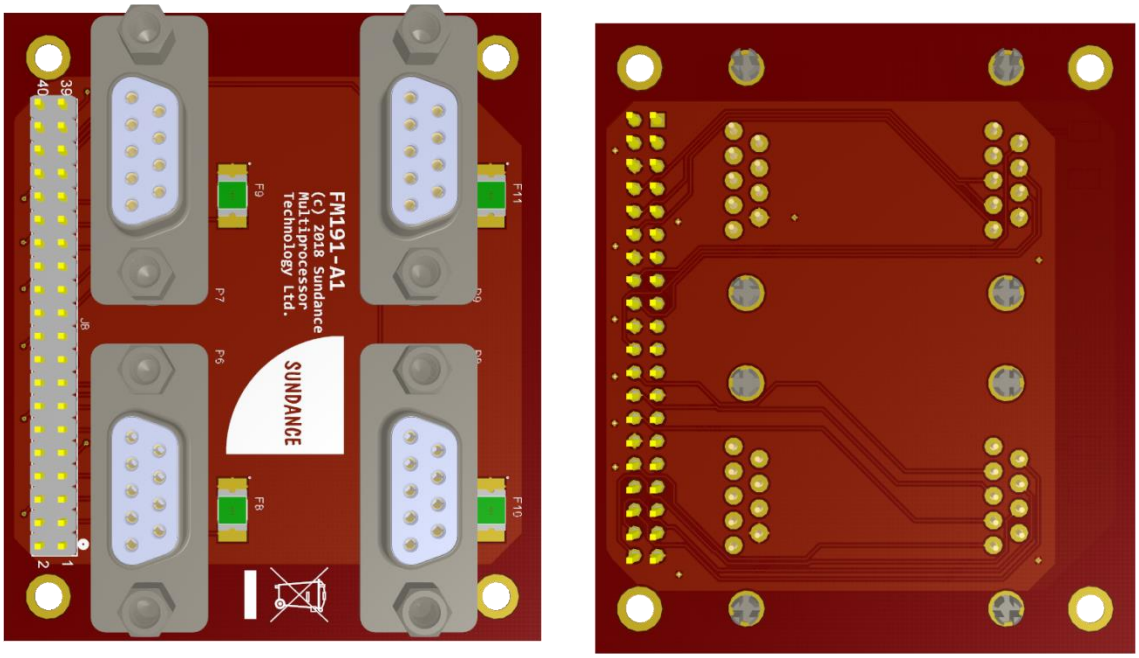


Figure 25 Top/Bottom View of FM191-A1

Table 1 lists all the connectors available on the FM191-RUA1 system.

Table 1: Connectors list

Connector reference	Description
P 1:9	DB9 connectors (top layer)
FMC-LPC	FMC – LPC connector (bottom layer)
USB-c 0:3	USB type c connectors (top layer)
GPIO	40-pin GPIO connector
ERNI	Power connector (PN: ERNI 254831)
LSHM-RA	100x pin's Samtec's LSHM right angle connector
LSHM-RRA	100x pin's Samtec's LSHM reverse right angle connector

5 Physical Properties

FM191-R Dimension	90mm	96mm
FM191 -U Dimension	33mm	106mm

Weight	

Voltage	Power (estimate)

RH	10-80%
Temperature range	-10 to +50ºC

MTBF	> 50,000 hours

6 EMC2-DP-V2 FMC Pin-Out

Table 2: EMC2-DP V2 – FM191-RUA1 pin map

EMC2-DP V2	JBX	JBX PIN	JMX PIN	JMX	TE0715-30		TE0820		FM191-RUA1
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	UART2_RX
tFMC_LA12_N/FMC1C-G16	JB1	38	37	JM1	U12	B13_L5_N	B8	B66_L22_N	UART2_RQ
tFMC_LA03_P/FMC1C-G9	JB1	46	45	JM1	R17	B13_L19_P	B6	B66_L20_N	UART1_RX
tFMC_LA03_N/FMC1C-G10	JB1	48	47	JM1	T17	B13_L19_N	C6	B66_L20_P	UART1_TX
tFMC_LA04_P/FMC1D-H10	JB1	50	49	JM1	V13	B13_L1_P	B1	B66_L7_N	DIO13
tFMC_LA04_N/FMC1D-H11	JB1	52	51	JM1	V14	B13_L1_N	C1	B66_L7_P	DIO14
tFMC_LA08_P/FMC1C-G12	JB1	56	55	JM1	AB13	B13_L9_P	D1	B66_L2_N	UART1_RQ
tFMC_LA08_N/FMC1C-G13	JB1	58	57	JM1	AB14	B13_L9_N	E1	B66_L2_P	UART2_TX
tFMC_CLK0_P/FMC1D-H4	JB1	60	59	JM1	Y15	B13_L12_N	D5	B66_L14_N	N/A
tFMC_CLK0_N/FMC1D-H5	JB1	62	61	JM1	Y14	B13_L12_P	E5	B66_L14_P	N/A
tFMC_LA01_P/FMC1B-D8	JB1	66	65	JM1	AA15	B13_L11_N	C4	B66_L11_N	GPIO8
tFMC_LA01_N/FMC1B-D9	JB1	68	67	JM1	AA14	B13_L11_P	D4	B66_L11_P	GPIO9
tFMC_LA13_P/FMC1B-D17	JB1	70	69	JM1	AB16	B13_L17_P	G1	B66_L1_P	GPIO14
tFMC_LA13_N/FMC1B-D18	JB1	72	71	JM1	AB17	B13_L17_N	F1	B66_L1_N	GPIO15
tFMC_LA00_P/FMC1C-G6	JB1	76	75	JM1	Y19	B13_L13_N	C2	B66_L12_N	GPIO24
tFMC_LA00_N/FMC1C-G7	JB1	78	77	JM1	Y18	B13_L13_P	C3	B66_L12_P	GPIO25
tFMC_LA02_P/FMC1D-H7	JB1	35	36	JM1	U13	B13_L6_P	E9	B66_L18_P	DIO11
tFMC_LA02_N/FMC1D-H8	JB1	37	38	JM1	U14	B13_L6_N	D9	B66_L18_N	DIO12
tFMC_LA11_P/FMC1D-H16	JB1	39	40	JM1	V11	B13_L4_P	G8	B66_L16_P	SDI
tFMC_LA11_N/FMC1D-H17	JB1	41	42	JM1	W11	B13_L4_N	F7	B66_L16_N	SCLK
tFMC_LA06_P/FMC1A-C10	JB1	45	46	JM1	AA11	B13_L7_P	E8	B66_L17_N	-
tFMC_LA06_N/FMC1A-C11	JB1	47	48	JM1	AB11	B13_L7_N	F8	B66_L17_P	-
tFMC_LA05_P/FMC1B-D11	JB1	49	50	JM1	AA12	B13_L8_P	G6	B66_L15_P	GPIO10
tFMC_LA05_N/FMC1B-D12	JB1	51	52	JM1	AB12	B13_L8_N	F6	B66_L15_N	GPIO11
tFMC_LA07_P/FMC1D-H13	JB1	55	56	JM1	Y12	B13_L10_P	F2	B66_L3_P	CS
tFMC_LA07_N/FMC1D-H14	JB1	57	58	JM1	Y13	B13_L10_N	E2	B66_L3_N	SDO
tFMC_LA10_P/FMC1A-C14	JB1	59	60	JM1	V16	B13_L23_P	E4	B66_L5_P	GPIO0
tFMC_LA10_N/FMC1A-C15	JB1	61	62	JM1	W16	B13_L23_N	E3	B66_L5_N	GPIO1
tFMC_CLK1_P/FMC1C-G2	JB1	65	66	JM1	AA17	B13_L14_N	D6	B66_L13_N	N/A
tFMC_CLK1_N/FMC1C-G3	JB1	67	68	JM1	AA16	B13_L14_P	D7	B66_L13_P	N/A
tFMC_LA14_P/FMC1A-C18	JB1	69	70	JM1	Y17	B13_L24_N	C9	B66_L24_P	GPIO2
tFMC_LA14_N/FMC1A-C19	JB1	71	72	JM1	W17	B13_L24_P	B9	B66_L24_N	GPIO3
tFMC_LA15_P/FMC1D-H19	JB1	75	76	JM1	AA19	B13_L18_P	A8	B66_L23_N	LED2
tFMC_LA15_N/FMC1D-H20	JB1	77	78	JM1	AA20	B13_L18_N	A9	B66_L23_P	LED3
tFMC_LA09_P/FMC1B-D14	JB2	42	41	JM2	E3	B35_L21_N	AB3	B64_L15_N	GPIO12
tFMC_LA09_N/FMC1B-D15	JB2	44	43	JM2	E4	B35_L21_P	AB4	B64_L15_P	GPIO13
tFMC_LA20_N/FMC1C-G22	JB2	46	45	JM2	B6	B35_L8_N	AB2	B64_L17_P	DIO3
tFMC_LA20_P/FMC1C-G21	JB2	48	47	JM2	B7	B35_L8_P	AC2	B64_L17_N	DIO2

tFMC_LA18_P/FMC1A-C22	JB2	52	51	JM2	C6	B35_L11_P	AC4	B64_L14_P	GPIO4
tFMC_LA18_N/FMC1A-C23	JB2	54	53	JM2	C5	B35_L11_N	AC3	B64_L14_N	GPIO5
tFMC_LA26_P/FMC1B-D26	JB2	66	65	JM2	C8	B35_L7_P	AE3	B64_L21_P	GPIO20
tFMC_LA26_N/FMC1B-D27	JB2	68	67	JM2	B8	B35_L7_N	AF3	B64_L21_N	GPIO21
tFMC_LA16_N/FMC1C-G19	JB2	72	71	JM2	G7	B35_L4_N	AE2	B64_L22_P	DIO1
tFMC_LA16_P/FMC1C-G18	JB2	74	73	JM2	G8	B35_L4_P	AF2	B64_L22_N	DIO0
tFMC_LA27_P/FMC1A-C26	JB2	76	75	JM2	H3	B35_L19_N	AG6	B64_L10_P	GPIO6
tFMC_LA27_N/FMC1A-C27	JB2	78	77	JM2	H4	B35_L19_P	AG5	B64_L10_N	GPIO7
tFMC_LA24_P/FMC1D-H28	JB2	82	81	JM2	E5	B35_L5_N	AG4	B64_L19_P	N/A
tFMC_LA24_N/FMC1D-H29	JB2	84	83	JM2	F5	B35_L5_P	AH4	B64_L19_N	N/A
tFMC_LA28_P/FMC1D-H31	JB2	86	85	JM2	F6	B35_L6_N	AG3	B64_L20_P	N/A
tFMC_LA28_N/FMC1D-H32	JB2	88	87	JM2	G6	B35_L6_P	AH3	B64_L20_N	N/A
tFMC_LA32_N/FMC1D-H38	JB2	90	89	JM2	H6	B35_L0	AD6	B64_T0	GPIO27
tFMC_LA19_P/FMC1D-H22	JB2	51	52	JM2	D3	B35_L14_P	AE5	B64_L12_P	LED4
tFMC_LA19_N/FMC1D-H23	JB2	53	54	JM2	C3	B35_L14_N	AF5	B64_L12_N	LED5
tFMC_LA17_P/FMC1B-D20	JB2	55	56	JM2	D5	B35_L12_P	AD5	B64_L13_P	GPIO16
tFMC_LA17_N/FMC1B-D21	JB2	57	58	JM2	C4	B35_L12_N	AD4	B64_L13_N	GPIO17
tFMC_LA22_P/FMC1C-G24	JB2	61	62	JM2	F1	B35_L23_N	AG9	B64_L7_P	DIO4
tFMC_LA22_N/FMC1C-G25	JB2	63	64	JM2	F2	B35_L23_P	AH9	B64_L7_N	UART3_TX
tFMC_LA21_P/FMC1D-H25	JB2	65	66	JM2	D6	B35_L2_N	AF8	B64_L8_P	N/A
tFMC_LA21_N/FMC1D-H26	JB2	67	68	JM2	D7	B35_L2_P	AG8	B64_L8_N	N/A
tFMC_LA23_P/FMC1B-D23	JB2	71	72	JM2	E2	B35_L17_P	AH8	B64_L9_P	GPIO18
tFMC_LA23_N/FMC1B-D24	JB2	73	74	JM2	D2	B35_L17_N	AH7	B64_L9_N	GPIO19
tFMC_LA25_P/FMC1C-G27	JB2	75	76	JM2	H1	B35_L24_P	AE7	B64_L4_N	GPIO22
tFMC_LA25_N/FMC1C-G28	JB2	77	78	JM2	G1	B35_L24_N	AD7	B64_L4_P	GPIO23
tFMC_LA29_P/FMC1C-G30	JB2	81	82	JM2	A6	B35_L9_N	AB7	B64_L5_P	UART3_RX
tFMC_LA29_N/FMC1C-G31	JB2	83	84	JM2	A7	B35_L9_P	AC7	B64_L5_N	UART3_RQ
tFMC_LA31_P/FMC1C-G33	JB2	85	86	JM2	G2	B35_L22_N	AB6	B64_L6_P	DIO5
tFMC_LA31_N/FMC1C-G34	JB2	87	88	JM2	G3	B35_L22_P	AC6	B64_L6_N	DIO6
tFMC_LA30_P/FMC1D-H34	JB2	91	92	JM2	A4	B35_L10_N	AF1	B64_L24_P	DIO9
tFMC_LA30_N/FMC1D-H35	JB2	93	94	JM2	A5	B35_L10_P	AG1	B64_L24_N	DIO10
tFMC_LA33_P/FMC1C-G36	JB2	95	96	JM2	F4	B35_L20_N	AH2	B64_L23_P	DIO7
tFMC_LA33_N/FMC1C-G37	JB2	97	98	JM2	G4	B35_L20_P	AH1	B64_L23_N	DIO8
tFMC_LA32_P/FMC1D-H37	JB2	99	100	JM2	H5	B35_L25	AH6	B64_T1	GPIO26
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

7 Design Release & Quality

The full schematic will be available Sundance as will the FPGA reference designs to interface the FM191 to a EMC²-Z7030 Zynq Module and a software package that will allow control of EMC² + FM191 from any Ethernet port. The framework will be http://www.ros.org/ compatible.

All components on FM191-RUA1 are extended temperature range, suitable for industrial applications in terms of temperature, but does not comply to any IP rating for moisture.

Verification, Review & Validation Procedures to be carried out in accordance with the Sundance Quality Procedures (ISO9001-2015).

8 Safety

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

9 EMC

The FM191-RUA1 system is designed to operate from within an enclosed host system, which is built to provide EMC shielding. Operation within the EU EMC guidelines is not guaranteed unless it is installed within an adequate enclosure.

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.

10 Ordering Information

Order number:

FM191-R	ADC Input, DAC Output and Digital I/O
FM191-RU	As above, but added SEIC with I/O + USB3.0
FM191-RUA1	As above, but added the GPIO extension board
oi928-Z7030-R	EMC²-Z7030 + FM191-R
oi928-Z7030-RU	EMC²-Z7030 + FM191-RU
oi928-Z7030-RUA1	EMC²-Z7030 + FM191-RUA1