MSER-FPD 1.00

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1 Introduction

This document describes the function of the MSER-FPD MIPI CSI-2 serializer board which is based on the Texas Instruments MIPI-CSI-2-to-FPD-Link III serializer chip, DS90UB953-Q1. The camera-side serializer board and platform-side deserializer board enable distances of up to 15m between any TISMIPI sensor and embedded system using a coaxial cable. The connection of these components is shown below:
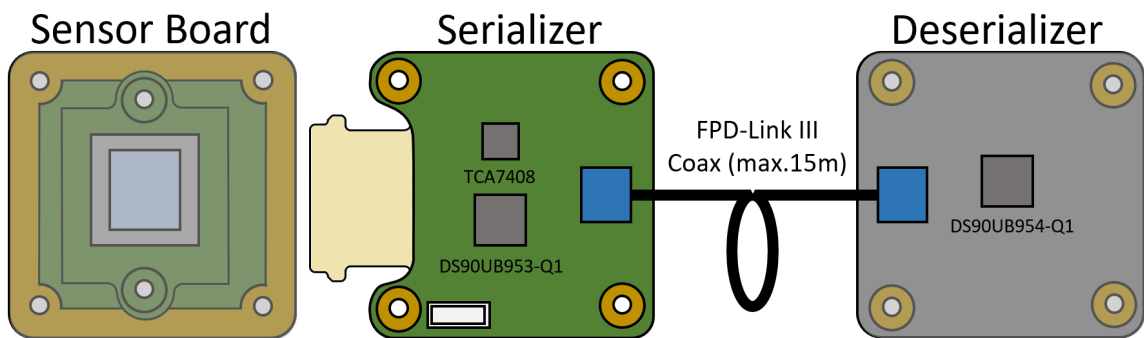
The document "Deserializer Design Recommendations" contains important information required to create a custom deserializer design using the TI DS90UB954-Q1 chip.

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The MSER-FPD board (Rev 1.00) is shown below:
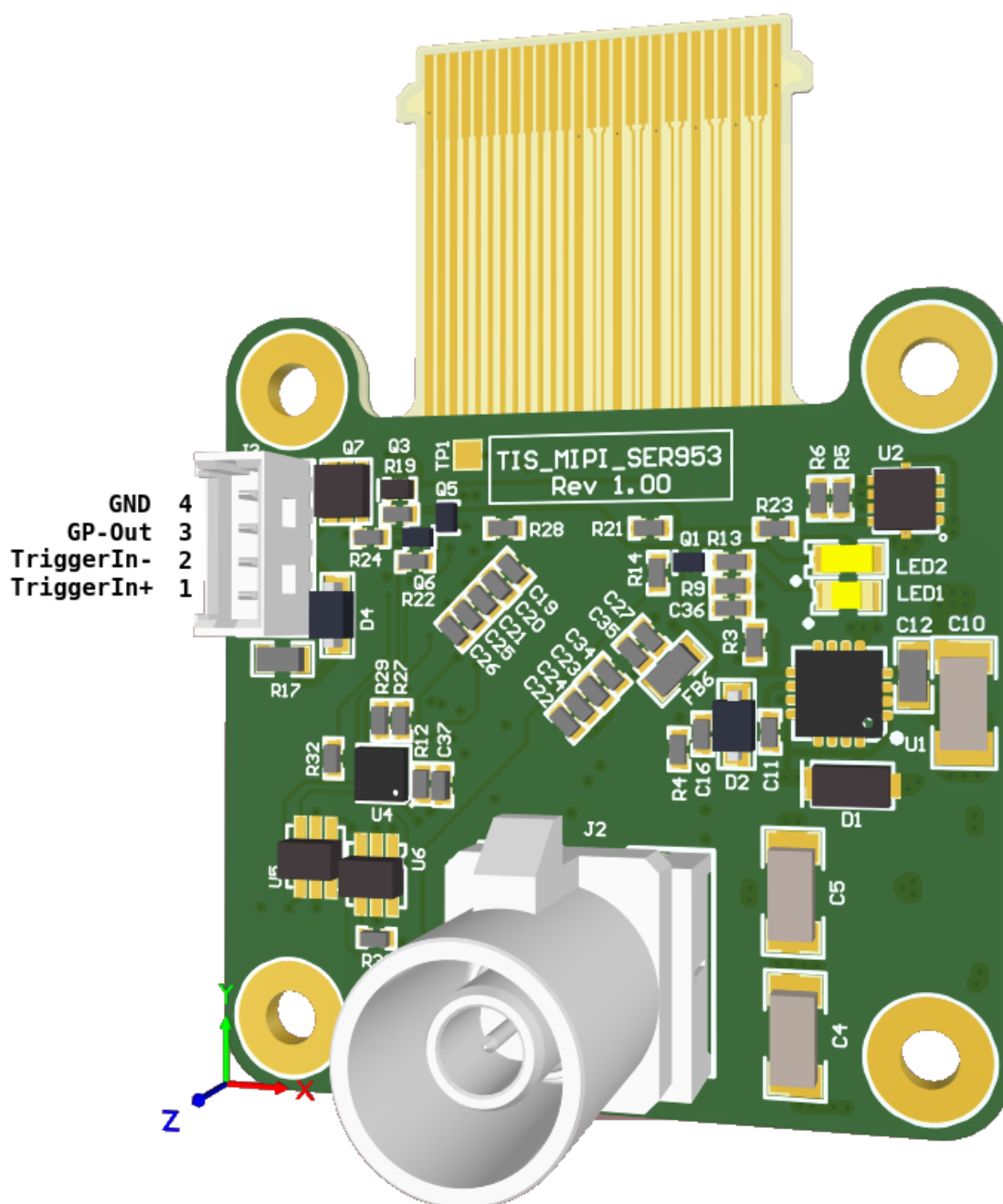
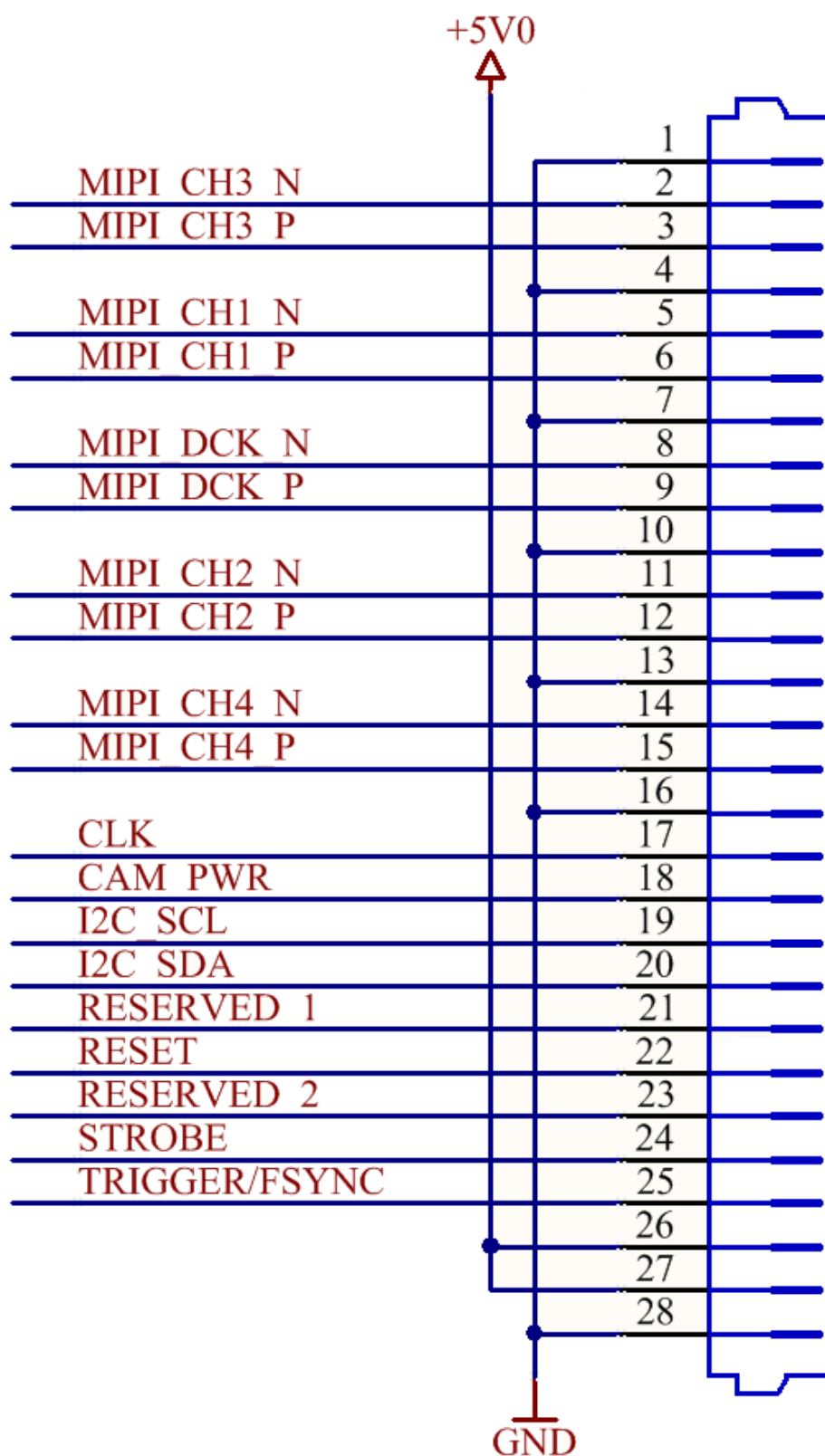

2.1 FAKRA Connector

The manufacturer part number of the Amphenol RF FAKRA connector is 2FA1-NZSP-PCBB6. The recommended cable type is RG-174 with 50 Ohm impedance. Please contact The Imaging Source for available assembled cables.

2.2   Flex Cable Connection with Stiffener on the MSER-FPD

The flex cable connection with stiffener has the following pinout:

#	Name	Type	Description
1	GND	GND	Ground
2	MIPI_CH3_N	I	MIPI CSI-2 input
3	MIPI_CH3_P	I	MIPI CSI-2 input
4	GND	GND	Ground
5	MIPI_CH1_N	I	MIPI CSI-2 input
6	MIPI_CH1_P	I	MIPI CSI-2 input
7	GND	GND	Ground
8	MIPI_DCK_N	I	MIPI CSI-2 input
9	MIPI_DCK_P	I	MIPI CSI-2 input
10	GND	GND	Ground
11	MIPI_CH2_N	I	MIPI CSI-2 input
12	MIPI_CH2_P	I	MIPI CSI-2 input
13	GND	GND	Ground
14	MIPI_CH4_N	I	MIPI CSI-2 input
15	MIPI_CH4_P	I	MIPI CSI-2 input
16	GND	GND	Ground
17	CLK	O	Reference clock output
18	CAM_PWR	O	High active camera power enable signal
19	I2C_SCL	I/O	I2C serial clock
20	I2C_SDA	I/O	I2C serial data
21	RESERVED_1	I/O	Reserved pin 1
22	RESET	O	Reset sensor to default state when low
23	RESERVED_2	I/O	Reserved pin 2
24	STROBE	I	CMOS sensor strobe signal input
25	TRIGGER/FSYNC	O	Trigger signal output
26	+5V_VDD	PWR	5V (±10%) power supply

#	Name	Type	Description
27	+5V_VDD	PWR	5V (±10%) power supply
28	GND	GND	Ground

2.3 I/O Signals of MSER-FPD

The connected I/O signals on the serializer chip DS90UB953-Q1 (Texas Instruments) are listed in the following table:

Pin	Name	Dir	Description
17 (GPIO0)	STROBE	I	Strobe signal from sensor board
18 (GPIO1)	TRIGGER_SER	I	External trigger signal from serializer board
27 (GPOI2)	TRIGGER	O	Trigger signal from deserializer board
28 (GPOI3)	RESERVED1_GPIO3	I/O	Reserved signal

Because the DS90UB953-Q1 serializer chip does not have enough free I/O-pins, an I2C I/O expander (Texas Instruments TCA7408) has been placed on the board. The following table shows which I/O signals on the flex cable connection are connected directly to the DS90UB953-Q1 and which signals are controlled by the I2C I/O expander:

pin	Name	Dir	Description	Pin at DS90UB953	Pin at I2C I/O Expander
17	CLK	O	CMOS sensor clock	CLK_OUT (19)	
18	CAM_PWR	O	Camera power enable, active high		GPIO0 (D2)
19	I2C_SCL	I/O	I2C-Bus, clock	I2C_SCL (24)	
20	I2C_SDA	I/O	I2C-Bus, data	I2C_SDA (23)	
21	RESERVED_1	I/O	Reserved	GPIO3 (28)	
22	RESET	O	CMOS sensor reset signal, active low		GPIO1 (D3)
23	RESERVED_2	I/O	Reserved		GPIO7 (A2)
24	STROBE	I	CMOS sensor strobe signal	GPIO0 (17)	
25	TRIGGER	O	CMOS sensor trigger signal	GPIO2 (27)	

All I/Os have the same I/O voltage of 1.8V.

2.4   I2C I/O Expander Configuration

The I/O expander TCA7408 has the 7-bit I2C-Address 0x20. The table below shows which signals can be controlled using this expander:

I/O Pin	Name	Dir	Description
GPIO0	CAM_PWR	O	Enable CMOS sensor power supply 0: Sensor power disabled 1: Sensor power enabled
GPIO1	RESET	O	CMOS sensor reset signal 0: Sensor is in reset state 1: Sensor is in operational state
GPIO2	GPOUT_LEVEL	O	GPOUT (PicoBlade) output level selection IF GPOUT_PUSHPULL = 0 (open-drain mode): --->0: GPOUT is connected to GND --->1: GPOUT high impedent IF GPOUT_PUSHPULL = 1 (TTL/push-pull mode): --->0: GPOUT has a low level --->1: GPOUT has a high level
GPIO3	GPOUT_PUSHPULL	O	GPOUT (PicoBlade) type selection 0: GPOUT is configured as open-drain-output 1: GPOUT is configured as TTL/push-pull-output
GPIO4	LED1	O	Controls on-board LED1 0: LED1 off 1: LED1 on
GPIO5	TRIGGER_LEVEL	O	Controls the polarity of the trigger input on the PicoBlade connector. 0: Trigger source level polarity is not inverted 1: Trigger source level polarity is inverted
GPIO6	TRIGGER_SOURCE	O	Controls the source of the trigger signal that is forwarded to the sensor. 0: Sensor is triggered by the trigger signal coming from the FPD-Link / deserializer board 1: Sensor is triggered by the trigger signal that is applied to the PicoBlade I/O connector
GPIO7	RESERVED_2	O	Reserved

2.5   I/O Connector

The serializer also has a user GPIO connector with the following pinout:
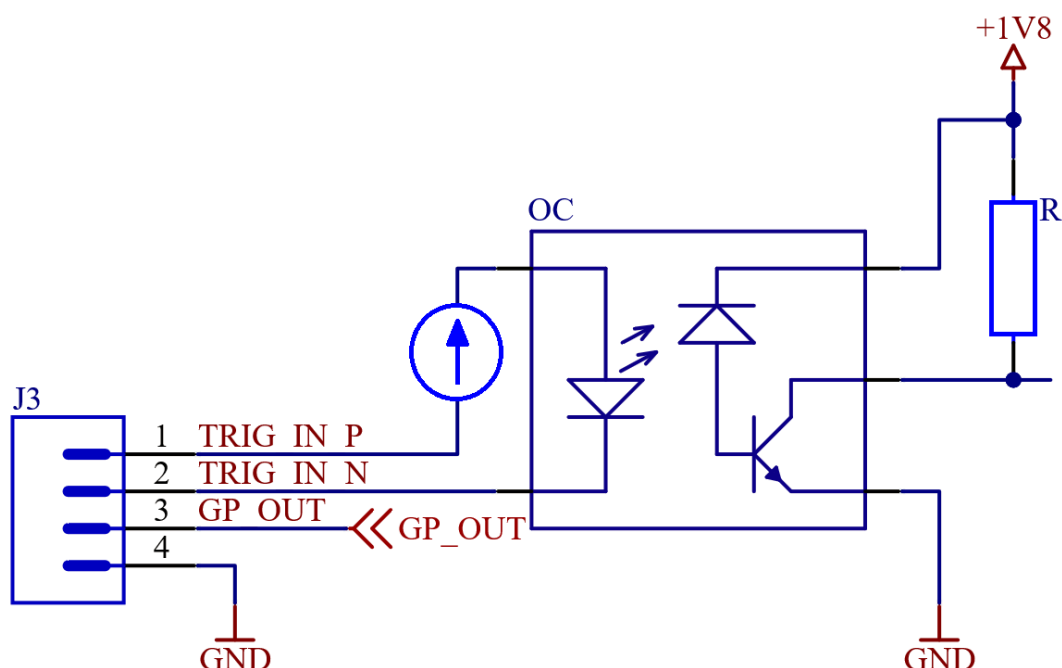
Pin	Name	Description
1	TRIGGER_IN_P	Opto-decoupled trigger input, anode of IR-LED
2	TRIGGER_IN_N	Opto-decoupled trigger input, cathode of IR-LED
3	GP_OUT	General purpose output, referenced to GND
4	GND	System ground

The user GPIO connector is a Molex PicoBlade connector 53047-0410. The mating part for cable assembly is 510210400.

The trigger input is opto-decoupled. To drive the trigger input, a voltage must be applied to pins 1 and 2. Note: pin 1 is the positive input; pin 2 is the negative input.

Pin 3 is a general-purpose output pin that can be controlled via software. The pin can be configured for TTL mode output or open drain output. LED2 indicates a possible overcurrent.

The recommended operating conditions of the user GPIO connector J3 are displayed in the following tables. CAUTION: Functional operation beyond the recommended operating conditions is not assumed.

Parameter	Min	Max
Trigger input voltage	3.3V ± 5%	24V ± 5%

Parameter	Min	Max
TTL-mode high voltage	-	250mA @ 4V
TTL-mode low voltage	-	250mA @ 0.05V

Parameter	Min	Max
Open-drain-mode voltage	-	24V
Open-drain-mode current	-	250mA

Please make sure that enough additional power is provided via the embedded system to operate the connected devices at the user GPIO connector (J3).

2.6 On-board LEDs

There are two, status LEDs on the serializer board:

Name	Color	Description
LED1	Green	Controlled through GPIO4 pin on the I/O expander
LED2	Red	Indicates overcurrent flowing out of GP_OUT in TTL/push-pull mode.

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All weights and dimensions are approximate. Unless otherwise specified, the lenses shown in the context of cameras are not shipped with these cameras.

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