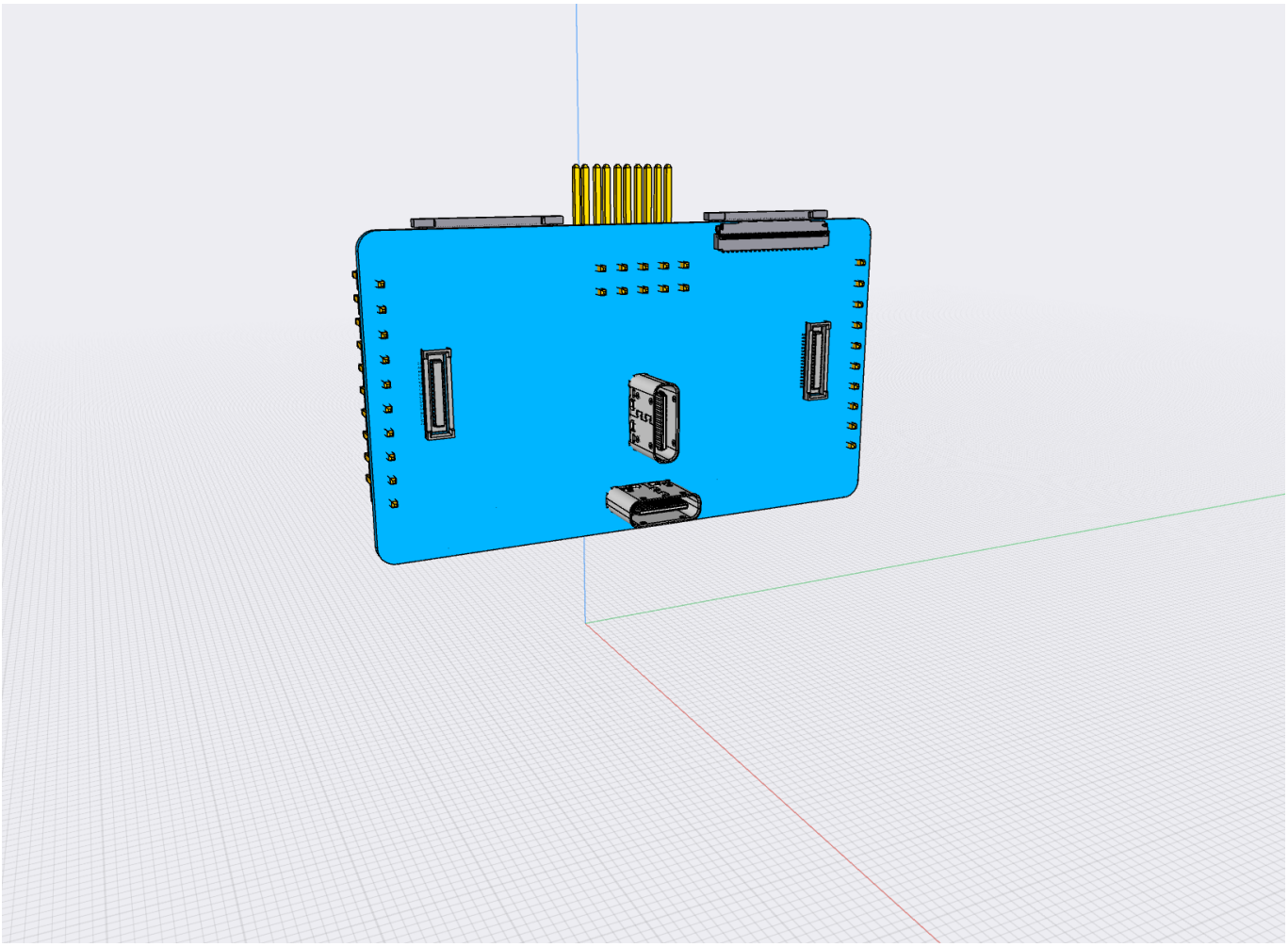
Bridge Board 909

The 909 is a Bridge Board version made for testing and experiementation with the Ziloo attachments without attaching the i.MX8 board. The setup enables connecting a Compulab SB-UCM-iMX8PLUS development board. Alternately a board like Raspberry Pi can be connected to test components via development connectors. Not all the 909 connectors will be mounted on the 801 production bridge board that mounts the i.MX8 board.

- Some of the UCM-iMX8M-Plus carrier board interface pins are multifunctional. Up to 4 functions (ALT modes) are accessible through each multifunctional pin.
- All of the UCM-iMX8M-Plus digital interfaces operate at 3.3V voltage levels unless noted otherwise.
- NOTE: RGMII ENET1 signals operate at 1.8V voltage level
- NOTE: SD/SDIO port #2 can be configured to operate at 3.3V or 1.8V voltage levels. Voltage level is controlled by SoC pin GPIO1_IO04.

TODO

- Check if the 22 pin connectors can be bidirectional
- Signal voltage PD Controller?
- Camera modules are signal voltage 1.8V
- Review if camera 1.8V, 2.8V should come from camera input connector or power connector.
- Dynamic Voltage/Frequency Design options?
- Evaluate the need for additional pinouts from TPS65982 (TPS PD Controller Dev PSIL091B(002).PDF)



USB Power

If one of the USB-C connectors supplies power it is managed by the USB PD Controller circuit and routed to the 10-pin Power Connnector as VIN.

The power connector sends the power from USB-C connectors away from the board to be used and sent back as regulated 5V.

The regulated 5V is used to supply attached USB devices that do not themselves provide power. The regulated 5V is also downregulated to 3V3, 2V8 and 1V8.

The bridge board is powered via 5V from the 10-pin Power connector, and its downregulated variants.

Power supply TI chipset

TPS65982 USB Type-C® and USB PD Controller, Power Switch, and High-Speed Multiplexer

The TPS65982 device is a stand-alone USB Type-C and Power Delivery (PD) controller providing cable-plug and orientation detection at the USB Type- C connector. Upon cable detection, the TPS65982 device communicates on the CC wire using the USB PD protocol. After successful USB PD negotiation is complete, the TPS65982 enables the appropriate power path and configures alternate mode settings for internal and (optional) external multiplexers.

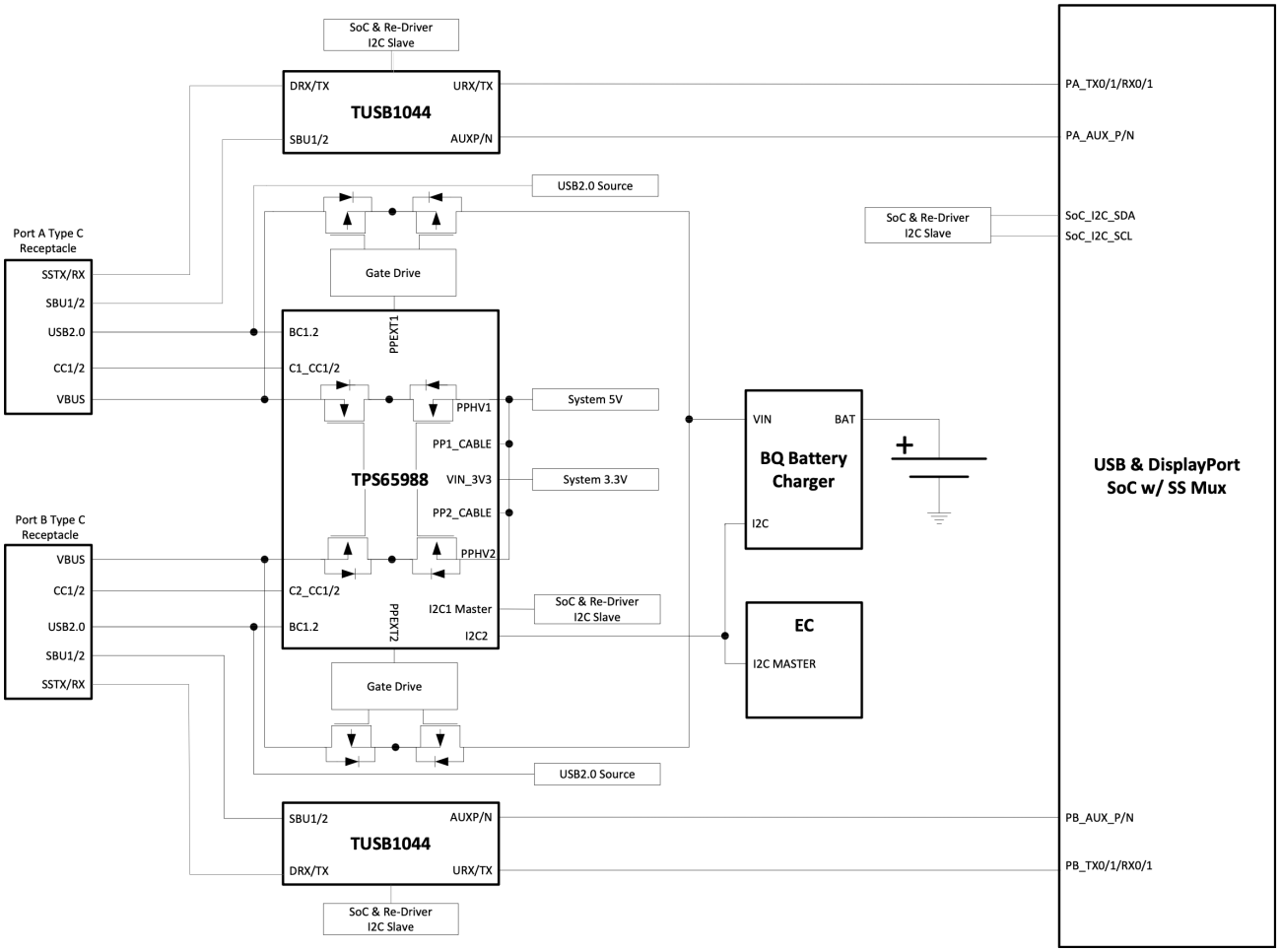


Figure 9-10. TPS65988 and SoC & Redriver I2C

A minimal version of this setup should be placed on the 909 to handle power. I.E. No TUSB1044

The 10 pin power connector can be used to test the chipset and USB devices attached.

Handling USB Connectors

The two USB ports may power the board. The powering is negotiated and handled by by TPS65988 (in future TPS65994AE). They also deliver data lanes

Power regulators receive power from USB connectors and supply the 12V & 5V power for development carrier board. The USB-C connectors can power the carrier board 12V by upregulating, which would be done on the In-Between board.

8.1 Carrier Board Design Guidelines

APPLICATION NOTES from UCM-iMX8M-Plus Reference guide.

- Ensure that all V_SOM and GND power pins are connected.
- Major power rails - V_SOM and GND must be implemented by planes, rather than traces. Using at least two planes is essential to ensure the system signal quality because the planes provide a current return path for all interface signals.
- It is recommended to put several 10/100uF capacitors between V_SOM and GND near the mating connectors.

- Except for a power connection, no other connection is mandatory for UCM-iMX8M-Plus operation. All power-up circuitry and all required pullups/pulldowns are available onboard UCM-iMX8M-Plus.
- If for some reason you decide to place an external pullup or pulldown resistor on a certain signal (for example - on the GPIOs), first check the documentation of that signal provided in this manual. Certain signals have on-board pullup/pulldown resistors required for proper initialization. Overriding their values by external components will disable board operation. For details please refer to section Error! Reference source not found..
- You must be familiar with signal interconnection design rules. There are many sensitive groups of signals. For example:
- PCIe, Ethernet, USB and more signals must be routed in differential pairs and by a controlled impedance trace.
- Audio input must be decoupled from possible sources of carrier board noise.
- The following interfaces should meet the differential impedance requirements with manufacturer tolerance of 10%:
- USB2.0: DP/DM signals require 90 ohm differential impedance.
- All single-ended signals require 50 ohm impedance.
- PCIe TX/RX data pairs and PCIe clocks require 85 ohm differential impedance.
- Ethernet, MIPI-CSI and MIPI-DSI signals require 100 ohm differential impedance.
- The carrier board interface connectors provide 3mm mating height. Bear in mind that there are components on the bottom side of UCM-iMX8M-Plus. It is not recommended to place any components underneath the UCM-iMX8M-Plus module.
- Refer to the SB-UCMIMX8PLUS carrier board reference design schematics.
- It is recommended to send the schematics of the custom carrier board to Compulab support team for review.

V_SOM is recommended between 3.45 and 4.4 volt, typical 3.7

Connectors

Connectors placed on the board are,

- 2 * Molex 22PIN 0.5mm pitch 54548-2271
- 2 * I-PEX 30PIN 0.4mm pitch 20525-030E-02
- 2 * Hirose USB-C CX80B1-24P
- 1 * TE Connectivity 45PIN 0.3MM 571-4-2328724-5 FPC 3-2328724-5 $0.41
- 2 * Hirose DF40C-34DS-0.4V (Mouser)

The two 100 pin Hirose connectors are not mounted but are in 3D design for reference. It will connect the MCU board on the 801.

Wiring the connectors within the board

The 22 pin connectors are connected directly to the equivalent lines on the 30 pins. The CSI lanes on 34 pins connector is connected directly to the equivalent lines on the 30 pins. This assumes that a camera is connected to either a 34 pins connector or a 22 pins connector, not both.

The data lines from the two USB-C connectors are connected to the equivalent lines on the T-USB direct connector. The Power pins on USB-C connectors go to the TPS65988 as well as VIN on 10 pins Connector. TPS65988 is fed 5V and 3V3 from the 10 pins Connector.

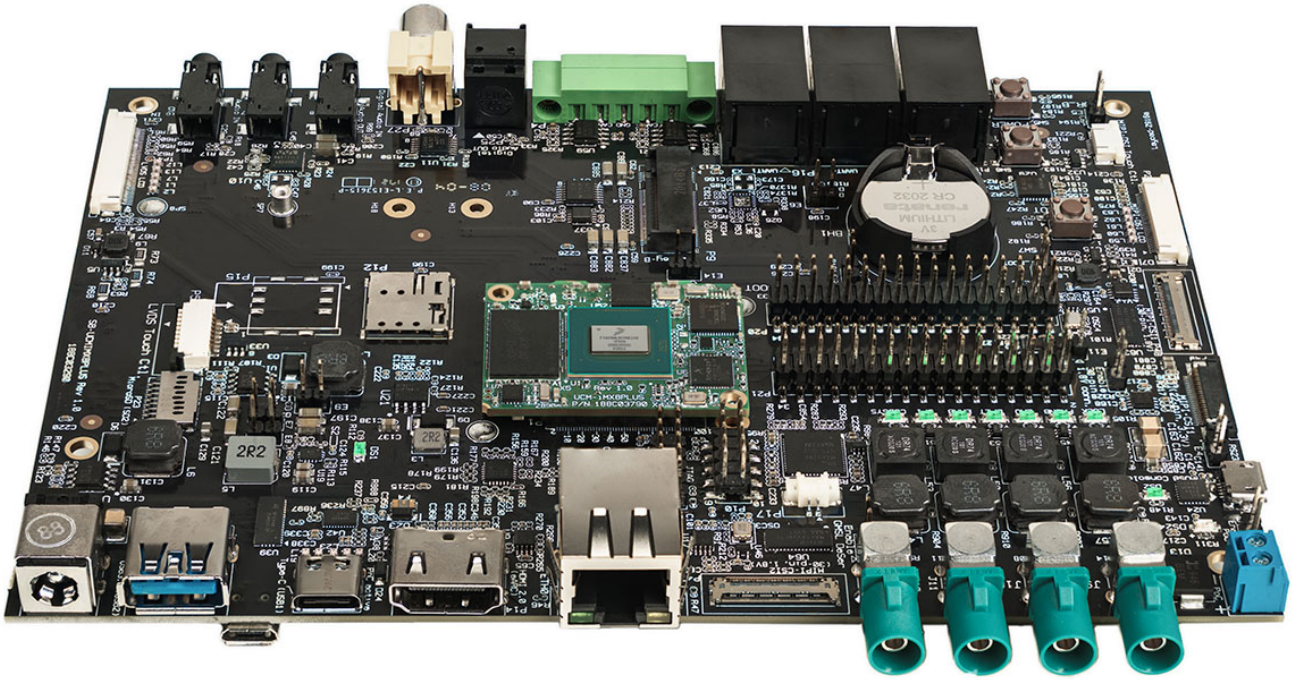
GND connected from everywhere as normal.

If power isn't connected over the USB-C plugs, and is power is not supplied by the 10-pin Power connector, the camera modules should be powered over the MIPI CSI connectors. In this case it should be possible to use either the 22 pin connectors or the 30 pin connectors for inputting the signal and power. This means that the 22 pin connectors can be used to input or output MIPI CSI lanes.

Signal voltage level

- 201 Camera Module uses 1.8V signals
- IMX477 sensor uses 1.8V for signals
- Does RPi cam module level shift the signals?
- UMC iMX8PLUS module uses 3.3V for signals by default
- UMC iMX8PLUS module RGMII ENET1 signals operate at 1.8V voltage level
- iMX8M plus is documented to use VDD_MIPI_1P8 power group for CSI1 & CSI2
- iMX8M plis is documented to use VDD_HDMI_1P8 power group for HDMI
- NVCC_SAI1_SAI5 power group?
- What will the I2C 5+6 power group be?
- USB 1 & 2 uses VDD_USB_3P3 power group

Conencting the SB-UCM-iMX8PLUS carrier board



For further details see Product Page.

- 2 * I-PEX connector directly between UCM carrier board and bridge board
- 45 pins connected to Inbetween breakout boards
- 10 pins power connector to Inbetween breakout boards
- USB-C connector to Inbetween breakout boards
- USB-A connector to Inbetween breakout boards

- HDMI female to Inbetween breakout boards

USB-C to USB-C connector mapping

Two USB-C connectors are arranged in a T shape and the normal way to use it is with a combined connector attached. This means that the wires will normally be connected in a particular orientation. The system takes advantage of this by detecting when both USBs are connected in the normal arrangement.

The USB connectors are named H (Host) and O (OTG). Host is the top of the T, OTG is the vertical base. To specify a specific pin H or O is prefixed I.E. OTX1+, HSBU2.

Where possible data pins are not combine but carried through individually.

The GND/VBUS pins are connected to the power charging circuit as normal. The system should accept charging power from either connector.

No.	Pin	Description	To
1	A1	GND	
2	A2	TX1+	T-USB direct, do not combine
3	A3	TX1-	T-USB direct, do not combine
4	A4	VBUS	
5	A5	CC1	TPS65988
6	A6	D+	TPS65988 & T-USB direct
7	A7	D-	TPS65988 & T-USB direct
8	A8	SBU1	T-USB direct
9	A9	VBUS	TPS65988 & Power regulators
10	A10	RX2-	T-USB direct, do not combine
11	A11	RX2+	T-USB direct, do not combine
12	A12	GND	
13	B1	GND	
14	B2	TX2+	T-USB direct, do not combine
15	B3	TX2-	T-USB direct, do not combine
16	B4	VBUS	TPS65988 & Power regulators
17	B5	CC2	TPS65988
18	B6	DX+	TPS65988 & T-USB direct, do not combine
19	B7	DX-	TPS65988 & T-USB direct, do not combine
20	B8	SBU2	T-USB direct

No.	Pin	Description	To
21	B9	VBUS	TPS65988 & Power regulators
22	B10	RX1-	T-USB direct, do not combine
23	B11	RX1+	T-USB direct, do not combine
24	B12	GND	

The USB Type-C connector has 24 pins. Figures 1 and 2, respectively, show the pins for the USB Type-C receptacle and plug.

 USB-C Receptacle Figure 1. The USB Type-C receptacle. Image courtesy of Microchip.

 USB-C Plug Figure 1. The USB Type-C plug. Image courtesy of Microchip.

For later revision

Only **one side** of the connectors are connected to the matching USB connector that leads to the Dev Board.

The following pins are connected to the extras connector: TX2+, TX2-, SBU1, SBU2, RX-, RX1+, DX+, DX-

The following pins are treated as normally USB-C connection pins: A1-A7, A9-A12, B5.

Board Power 10 pins Connector

No.	Pin	Description
1		Reserved
2	5V	Board Power 5V
3	GND	GND
4	GND	GND
5	VIN	Voltage Input from USB-C
6	VIN	VIN
7	PD_I2C1_SCL	I2C1_SCL(pullup resistor 2.2K)
8	PD_I2C1_SDA	I2C1_SDA(pullup resistor 2.2K)
9	PD_I2C2_SCL	I2C2_SCL(pullup resistor 2.2K)
10	PD_I2C2_SDA	I2C2_SDA(pullup resistor 2.2K)

Max. Current per pin 3.0A

IRQZ pins for the two I2Cx

T-USB direct connector

This connector(only on the 909 model) enables experimentation with alternate modes and directional pins.

Pin	Code	Description
1	GND	
2	HSBU1	Host alt SBU1
3	HSBU2	Host alt SBU2
4	GND	
5	HD+	Host alt D+
6	HD-	Host alt D-
7	GND	
8	HDX+	Host alt DX+
9	HDX-	Host alt DX-
10	GND	
11	HTX1+	Host alt TX1+
12	HTX1-	Host alt TX1-
13	GND	
14	HTX2+	Host alt TX2+
15	HTX2-	Host alt TX2-
16	GND	
17	HRX2-	Host alt RX2-
18	HRX2+	Host alt RX2+
19	GND	
20	HRX1-	Host alt RX1-
21	HRX1+	Host alt RX1+
22	GND	
23	OSBU1	OTG alt SBU1
24	OSBU2	OTG alt SBU2
25	GND	
26	OD+	OTG alt D+
27	OD-	OTG alt D-
28	GND	
29	ODX+	OTG alt DX+

Pin	Code	Description
30	ODX-	OTG alt DX-
31	GND	
32	OTX1+	OTG alt TX1+
33	OTX1-	OTG alt TX1-
34	GND	
35	OTX2+	OTG alt TX2+
36	OTX2-	OTG alt TX2-
37	GND	
38	ORX2-	OTG alt RX2-
39	ORX2+	OTG alt RX2+
40	GND	
41	ORX1-	OTG alt RX1-
42	ORX1+	OTG alt RX1+
43	GND	

Camera breakout connector

These connectors will not normally be mounted, but instead be breakout throughholes.

The two breakouts are spaced 58.42mm (22 * 2.54mm)

RPI FPC 22 pins

Raspberry Pi connectors

- 1-7342485-5 TE Connectivity 15 pins vertical Pi Board A/B
- 54548-2271 Molex 22 pins Right angle Pi Zero & Compute module
- SFW15R-2STE1LF Amphenol FCI 15 pins Right angle Camera Module

Pin	Code	Type	Details	Voltage
1	GND	Power	Ground	
2	CAM_D0_N	Data	MIPI Data Lane 0 Negative	
3	CAM_D0_P	Data	MIPI Data Lane 0 Positive	
4	GND	Power	Ground	
5	CAM_D1_N	Data	MIPI Data Lane 1 Negative	
6	CAM_D1_P	Data	MIPI Data Lane 1 Positive	

Pin	Code	Type	Details	Voltage
7	GND	Power	Ground	
8	CAM_CK_N	Data	MIPI Clock Lane Negative	
9	CAM_CK_P	Data	MIPI Clock Lane Positive	
10	GND	Power	Ground	
11	CAM_D2_N	Data	MIPI Data Lane 2 Negative	
12	CAM_D2_P	Data	MIPI Data Lane 2 Positive	
13	GND	Power	Ground	
14	CAM_D3_N	Data	MIPI Data Lane 3 Negative	
15	CAM_D3_P	Data	MIPI Data Lane 3 Positive	
16	GND	Power	Ground	
17	CAM_IO0	Power	Power Enable	
18	CAM_IO1	LED	LED Indicator	
19	GND	Power	Ground	
20	SCL	I2C	I2C SCL	
21	SDA	I2C	SCCB serial Interface data IO	
22	VCC	Power	3.3V Power Supply	

NVIDIA FPC 30 pins

The connector is an I-PEX type 20525-030E-02 with 0.4mm pitch & 30 pins. Data pins are 1.8V level.

Pin	Code	Details
1	CAM_3V3	3.3V Power Input
2	CAM_3V3	
3	CAM_1V8	1.8V Power Input
4	GND	
5	GND	
6	PWR DWN	PWRDN on 34pin
7	I2C SCL	
8	I2C SDA	
9	GND	
10	CSI D2-	

Pin	Code	Details
11	CSI D2+	
12	TRIGGER	
13	MCLK	EXTCLK on 34pin
14	Reserved	
15	CSI D1-	
16	CSI D1+	
17	GND	
18	GND	
19	CSI D0-	
20	CSI D0+	
21	RESET	RESET on 34pin
22	GND	
23	Reserved	
24	CSI CLK-	
25	CSI CLK+	
26	GND	
27	CSI D3-	
28	CSI D3+	
29	Flash	
30	Reserved	

Refs

- https://www.leopardimaging.com/product/accessories/cables/faw-1233-03/
- https://www.mouser.com/datasheet/2/233/LI-TX1-CB-6CAM_datasheet-1395894.pdf
- https://connecttech.com/ftp/pdf/ASG006_Spacely.pdf
- https://www.i-pex.com/product/cabline-ca

Ziloo Camera Module 34 pin connector

Just to be clear: All CSI lanes are laid out on one side of the connector with GND between.

Pin 1 is indicated on the board by a dot.

Toward thin part with microphone and other sensors

Pin	Code	Type	Details	Voltage

Pin	Code	Type	Details	Voltage
1	AF_VDD	Power	Reserved for Autofocus	3.3V
2	AVDD_2V8	Power	Analog, Max 500mA	2.8V
3	DOVDD	Power	Power for I/O circuit, Max 500mA	1.8V
4	VCC_1V8	Power	1.8V ,MAX 200mA	1.8V
5	GND	Power	GND	
6	CAM_FSIN	I/O	Frame sync input	
7	CAM_STROBE	I/O	Frame sync output	
8	EXTCLK	Input	External Clock Input (MCLK)	
9	ATT_INT	Output	Interrupt Attached Sensor, Active L	1.8V?
10	ATT_XSHUT	Input	Attached Sensor XSHUTDOWN	1.8V
11	Reserved	AF/PWM	PWM Motor control (NC)	
12	I2C_SCL	I/O	I2C1_SCL(pullup resistor 2.2K)	1.8V
13	I2C_SDA	I/O	I2C1_SDA(pullup resistor 2.2K)	1.8V
14	BCLK / SCK	I2S	Bit clock line	1.8V
15	WS / LRCLK	I2S	Word clock line	1.8V
16	SDATA1	I2S	Input data 1	1.8V
17	SDATA2	I2S	Input data 2 (NC)	1.8V

Towards image sensors

Pin	Code	Type	Details	Voltage
34	AGND	Power	Analog ground	
33	RESET	Input	Camera Reset, Active Low (RSTB)	
32	PWRDN	Input	Camera Power Down	
31	Reserved			
30	Reserved			
29	-		GND	
28	CSI_RX_D0P	Camera	MIPI_CSI_RX_D0+	1.8V
27	CSI_RX_D0N	Camera	MIPI_CSI_RX_D0-	1.8V
26	-		GND	
25	CSI_RX_D1P	Camera	MIPI_CSI_RX_D1+	1.8V

Pin	Code	Type	Details	Voltage
24	CSI_RX_D1N	Camera	MIPI_CSI_RX_D1-	1.8V
23	-		GND	
22	CSI_RX_D2P	Camera	MIPI_CSI_RX_D2+	1.8V
21	CSI_RX_D2N	Camera	MIPI_CSI_RX_D2-	1.8V
20	-		GND	
19	CSI_RX_CLKP	Camera	MIPI_CSI_RX_CLK+	1.8V
18	CSI_RX_CLKN	Camera	MIPI_CSI_RX_CLK-	1.8V