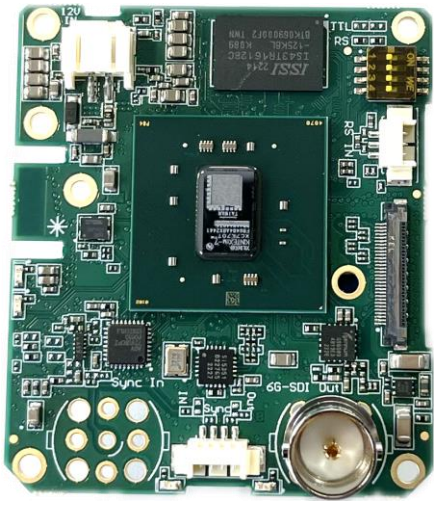
Vision & Innovation

6G-SDI

Technical Manual



P/N – TV10 0080: 6G-SD interface board for Sony FCB-4K camera range

P/N – TV50 0023: Mounting kit for TV10 0080 – 6G-SDI I/F board
Includes: 30-way micro-coax camera cable, 2-way cable (power supply), 3-way cable (RS232/TTL), 4-way cable (synchro), right angle black anodized bracket, screws and spacers

P/N – TV50 0008: Cable kit for TV10 0080 – 6G-SDI I/F board
Includes: 30-way micro-coax camera cable, 2-way cable (power supply), 3-way cable (RS232/TTL)

Available connectors: Default (BNC), VOPTEM02 (MCX connector), VOPTEM04 (No connector), VOPTEM37 (Add external sync connector)

Table of content

Revision History

Date	Revision	Description	Modified by	Note
28/09/20	A	Creation of the document	CBO	
04/02/21	B	Added video format compatibility list	RGA	
20/01/22	C	Added additional information	RGA	
03/10/22	D	Remove outdated information for heatsink compatibility	RGA	
11/04/23	E	Update board and kit references	CBO	
28/02/25	F	Change document organization and graphical chart	CBO	

Key features

- 6G-SDI SMPTE ST-2081, HD-SDI 292 M
- Video resolution up to 2160p30
- Support Sony ES8230, EW9500H and ER camera range
- Support External Sync Input (for the camera Sony ER8550)
- Communication UART – RS232/TTL using VISCA
- Video mode selection by DIP switches
- Power supply 6V-12VDC
- Consumption 6W with camera
- BNC or MCX optional connector for SDI output and External Synchro Input
- Add-on connector for custom functionalities
- Operating temperature [-10°C; 60°C]

General description

6G-SDI technology is an established standard providing sufficient bandwidth to transmit uncompressed 4K video signals from camera to screen.

The 6G-SDI converts the HDMI video signal from 4K TMDS camera blocks to 6G-SDI. Based on a powerful Kintex-7 FPGA, it takes advantage of a high-quality SDI stream where performance is a premium.
Combined with i2S's expertise, custom complex image processing functions can be embedded on real time video flow such as colorimetry tests, measurements, reticules, contrast enhancement, ROI extraction, OSD and even more functions to fit your applications.

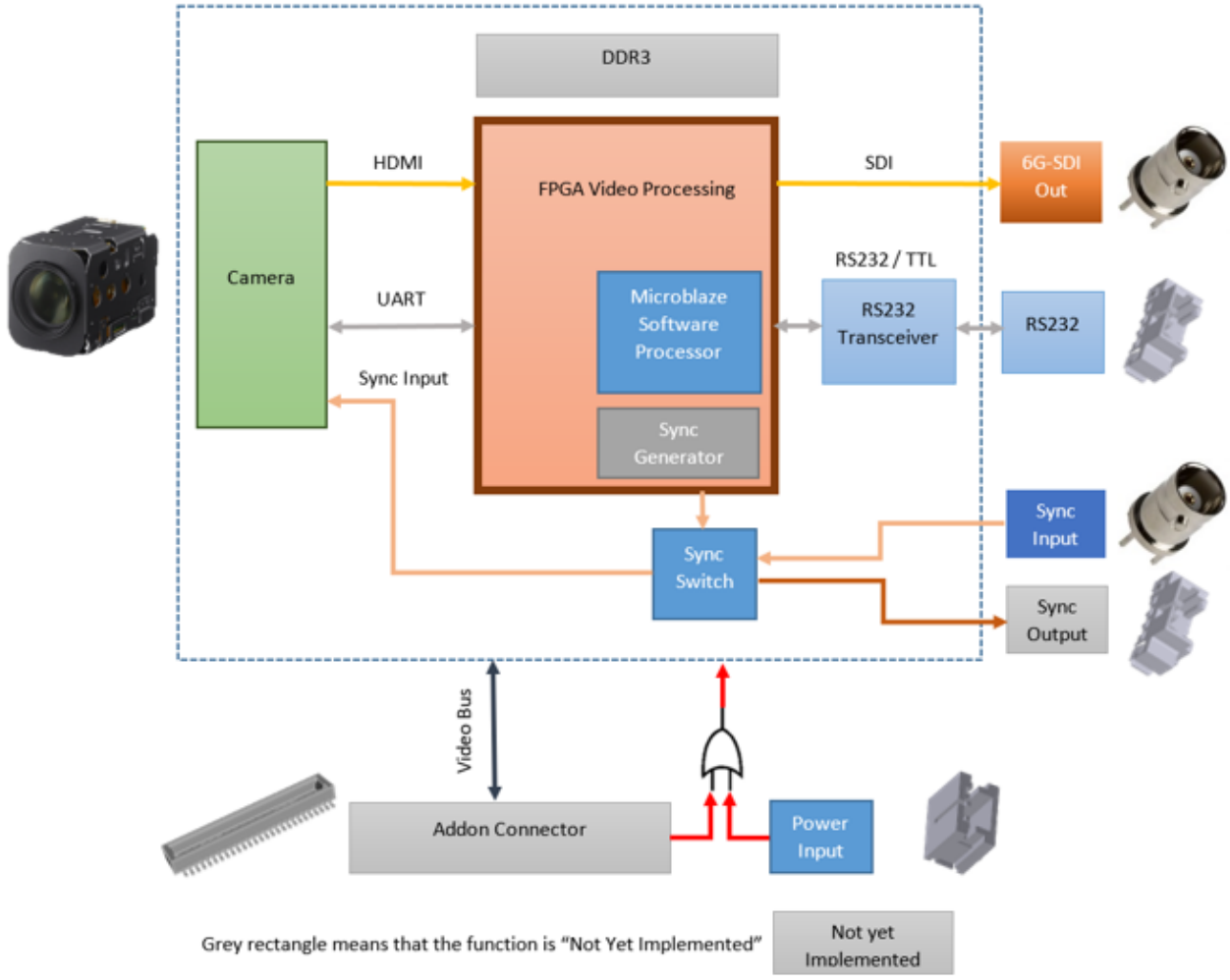
An external synchronization input is available on the board. It provides benefits to users in a multi-camera environment: broadcast application, image stitching, pulsed lighting sync or thermal/visible image overlapping.

The add-on connector on the back side offers an infinity of new functionalities. The 6G-SDI can be directly mounted onto the back side of a Sony 4K camera thanks to its compact form factor.

Benefits of this solution

- Video format supported from HD to Ultra HD up to 2160p30
- Supports external synchronization input for the ER8550 camera
- RS232 / TTL serial communication easy switch by moving two resistors
- Designed to be mounted on 4K Sony camera
- Addon connector for custom needs
- Connectors choice between BNC and MCX

Block diagram



Video acquisition

The main component is the FPGA for video acquisition.
The board acquires HDMI video from the 4K camera block and convert it to provide uncompressed SDI video output. Video output keeps the same format as the camera and can go from HD to ultra-HD.

Communication

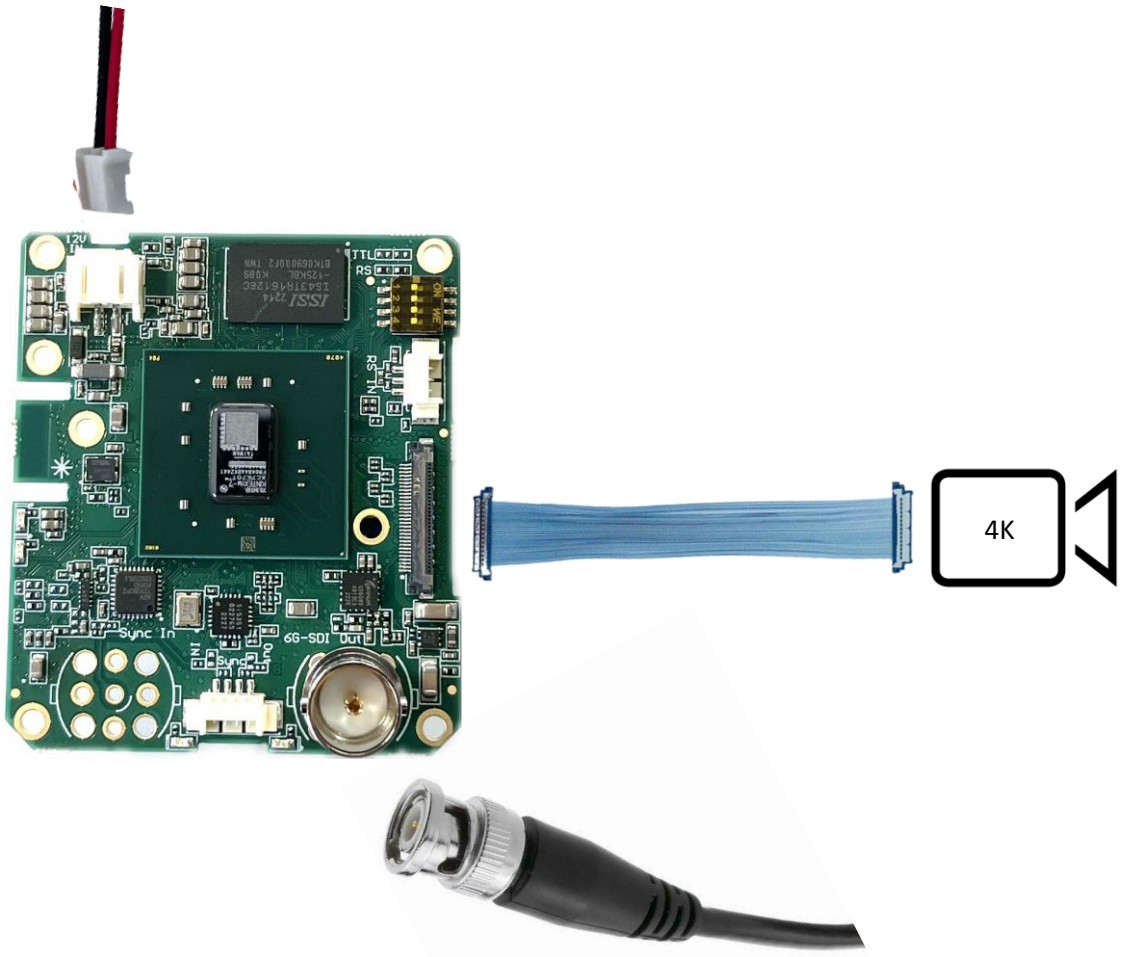
By default, the board is configured in RS232. It is possible to switch to UART TTL 3V3 communication but that requires hardware modifications. For more information, please contact us at info@i2s.fr and we will ensure that you are able to do the changes. The board can be ordered in UART TTL 3V3 configuration if requested.

Power supply

The power input through the 2-way connector J300 supports from 6V to 12V (1,5A). The camera is powered by the board.

Accessing the video

Quick setup



Installation steps:

1. Connect the KEL cable between the board J301 and the 4K camera.
2. Connect the SDI cable to the output connector of the board J1700 and to the SDI monitor.
3. Connect the 2-way power supply cable on J300 connector. Power input of the board is 6V to 12V (1,5A), red wire is for V+ and black wire is for the ground.
4. Now you can power the board.

Video characteristics

TMDS video input supported resolutions

	25	29.97	30	50	59.94	60
1280x720p				✓	✓	✓
1920x1080p	✓	✓	✓	✓	✓	✓
3840x2160p	✓	✓	✓			

The video format from the 4K camera can be configured by sending VISCA command using the register 72.

SDI video output

The output is high-speed SDI signal with 75-ohm impedance. It is compliant with SMPTE ST-2081 (6G-SDI) and SMPTE 292 M (HD-SDI). The output video format is the same as the camera (see TMDS video input resolutions supported upper).
Different output connector types are available: BNC or MCX. Please specify the connector you need in the order.

BNC  **MCX** 

System configuration

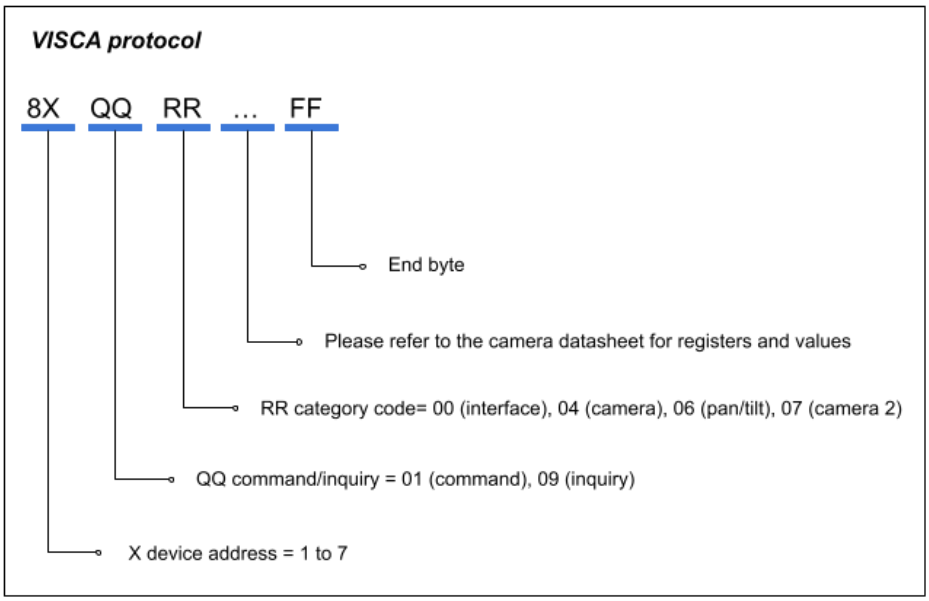
Communication

Communication with the camera can be done through J1701 connector. Communication can be set to either RS232 mode (default) or TTL mode (UART with 3.3V compatibility). It allows you to send VISCA commands to the camera. To switch from RS232 to TTL configuration some hardware modifications are needed. Please contact us at info@i2s.fr for more information.

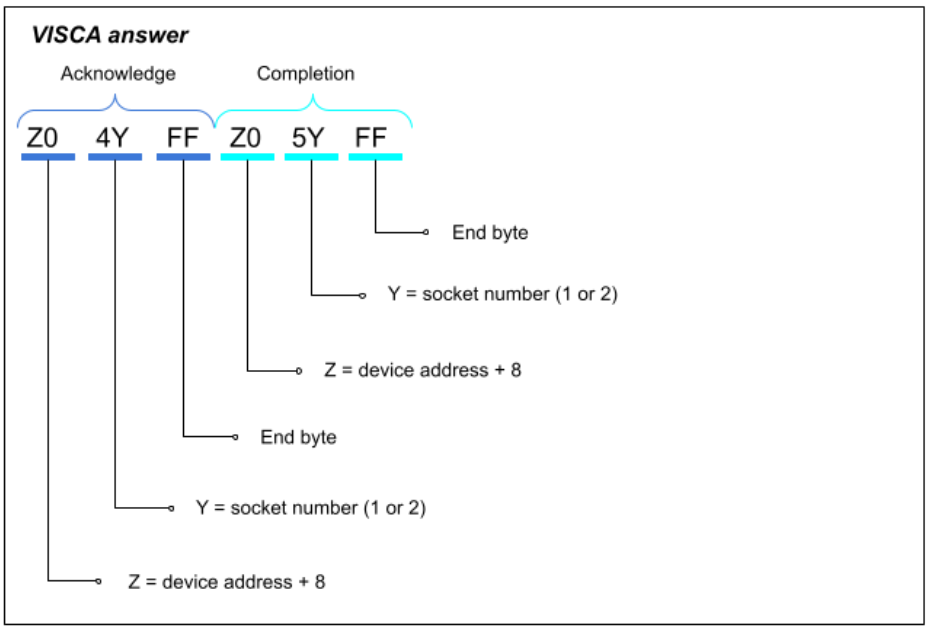
The baud rate of the serial interface will follow the baud rate configured in the camera.

To the camera

The camera communication uses VISCA protocol and will follow camera specifications. It is a standard protocol for camera blocks following this structure:

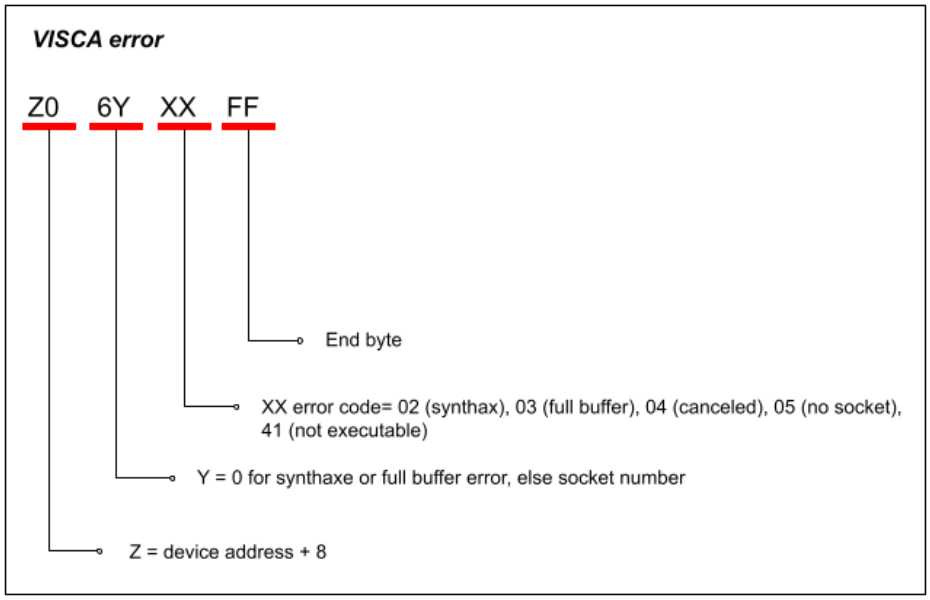


The camera answer follows this structure:



The time between the acknowledgement and the completion packet depends on the command. The answer for an inquiry is Z0 5Y followed by the information requested with FF as end byte.

If an error occurs, here the answer structure:



Example: Zoom In command with a speed of 7 is 0x81 01 04 07 27 FF and the expected answer is 0x90 41 FF followed by 0x90 51 FF.

You can communicate using communication software like Termite or the camera brand communication tool like Sony FCB Control software.

Control camera video format

Four DIP switches are used to select the video format of the camera. The value is checked each time power is issued to the camera and the camera format is automatically set accordingly. Because not all supported cameras have the same formats available, please refer to the table below to change format:

1	2	3	4	Configuration
OFF	OFF	OFF	OFF	Default camera format
ON	OFF	OFF	OFF	1920×1080p29.97
OFF	ON	OFF	OFF	1920×1080p25
ON	ON	OFF	OFF	1920×1080i59.94
OFF	OFF	ON	OFF	1920×1080i50
ON	OFF	ON	OFF	1280×720p59.94
OFF	ON	ON	OFF	1280×720p50
ON	ON	ON	OFF	1920x1080p29.97 **ePT***
OFF	OFF	OFF	ON	1920x1080p25 **ePT***
ON	OFF	OFF	ON	3840×2160p29.97
OFF	ON	OFF	ON	3840×2160p25
ON	ON	OFF	ON	1920×1080p50
OFF	OFF	ON	ON	1920×1080p59.94
ON	OFF	ON	ON	Reserved
OFF	ON	ON	ON	1920x1080p23.98 **ePT***
ON	ON	ON	ON	3840×2160p23.98

Please note that video formats can depend on the camera model used.
* **ePT** is the Electronic Pan / Tilt, you can move the 1920x1080 displayed window in the full 3840x2160 image. It corresponds to the CAM_ePT parameter.

External synchronization

The external synchronization allows the user to use a real-time source generator to synchronize in parallel many devices. An input for an external synchronization signal is available on a simple 4pts connector (J1702) or on a coaxial connector (J1703). The synchronization signal is directly forwarded to the camera. The Sync Input LED indicates that the synchronization process is done with the external sync input and the camera.

Note: The external synchronization feature is **only** available with the **ER8550 camera**. The external synchronization signal format must match the camera's format.

Sony ER8550 incorporates internal synchronization module which follows the following specifications:

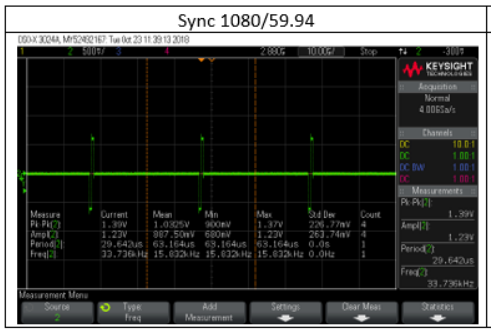
- Tri-State Sync: partial part of SMPTE 240M/274M
- NTSC Black burst: EBU N14/SMPTE RP-154
- PAL Black burst: ITU-R BT.470-6
-

Note: The H phase adoption function is not available on Sony Camera.

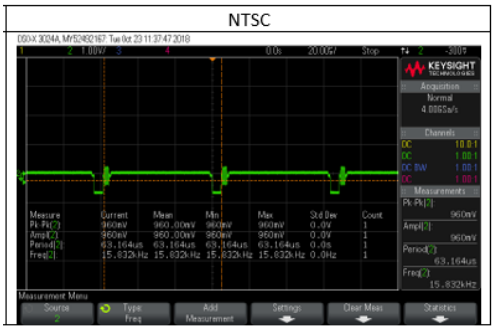
Valid synchronizations signals:

Input External Signal format / Camera Mode	Tri-State Sync			NTSC Black burst	PAL Black burst
	1080/59.94i	1080/50i	1080/47.95i		
3840×2160/29.97p	○	×	×	○	×
3840×2160/25p	×	○	×	×	○
3840×2160/23.98p	×	×	○	×	×
1920×1080/59.94p	○	×	×	○	×
1920×1080/59.94i	○	×	×	○	×
1920×1080/50p	×	○	×	×	○
1920×1080/50i	×	○	×	×	○
1920×1080/29.97p	○	×	×	○	×
1920×1080/25p	×	○	×	×	○
1920×1080/23.98p	×	×	○	×	×
1280×720/59.94p	○	×	×	○	×
1280×720/50p	×	○	×	×	○
720×480/59.94p	○	×	×	○	×
720×576/50p	×	○	×	×	○

Sync 1080/59.94

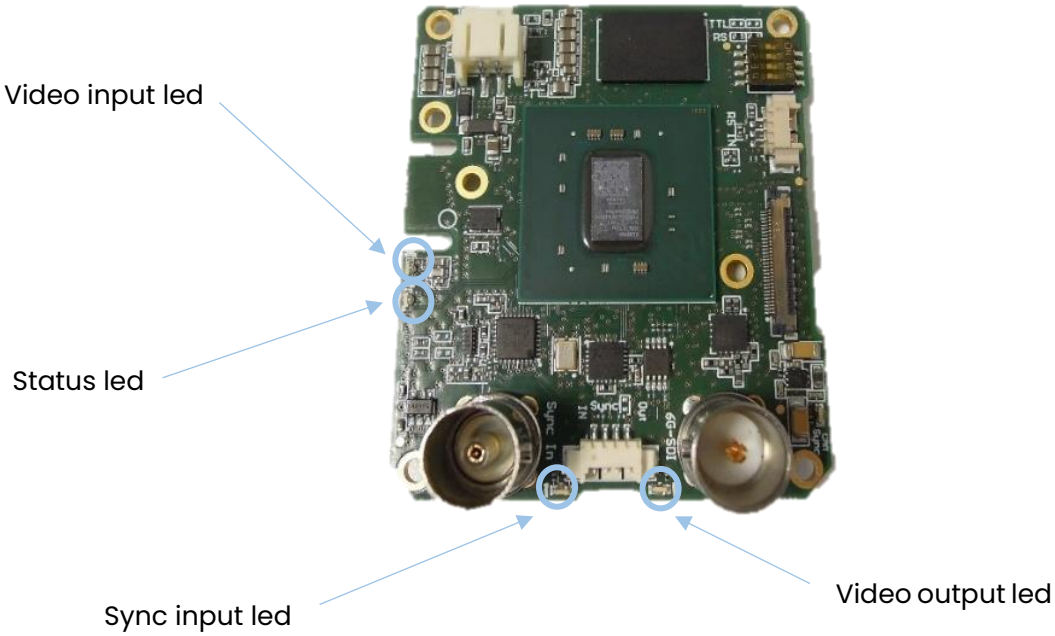


NTSC



Board status

Several leds are available on the board to indicate different status:



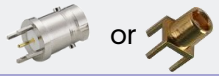
The video input led indicates if an invalid video format is detected from the camera.
The status led displays the system state every 2 second. The number of blinks indicates the current state.

Status	Blinks number	Description
System started	1	System initialization done
System initialized	2	System Configuration done
Searching camera	3	The system tries to detect camera
Video format found	4	Camera ready
System is Configured	5	System Ready
Running mode	6	Normal operation

The sync input led indicates that the synchronization process is done with the external sync input and the camera.
The video output led indicates a valid video on SDI output.

Connectors

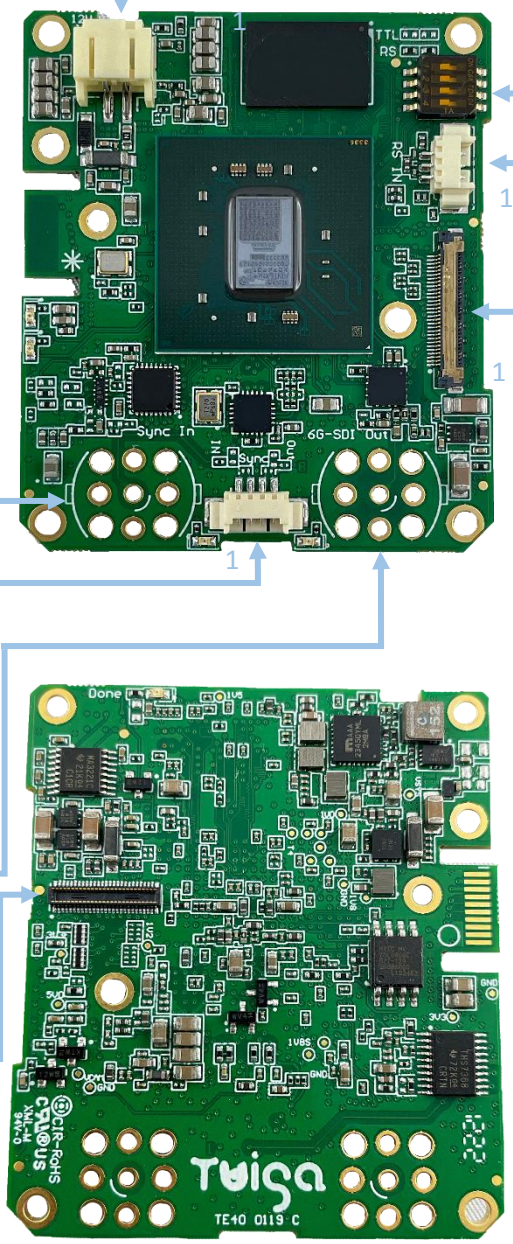
J300	Power supply
1	6 to 12 VDC
2	GND

J1703	External sync connector
VOPTEM37	

J1702	External sync connector
1	GND
2	Sync input
3	Sync output
4	GND

J1700	Video output connector
	

J1400	Board to Board connector
Extended functionalities	

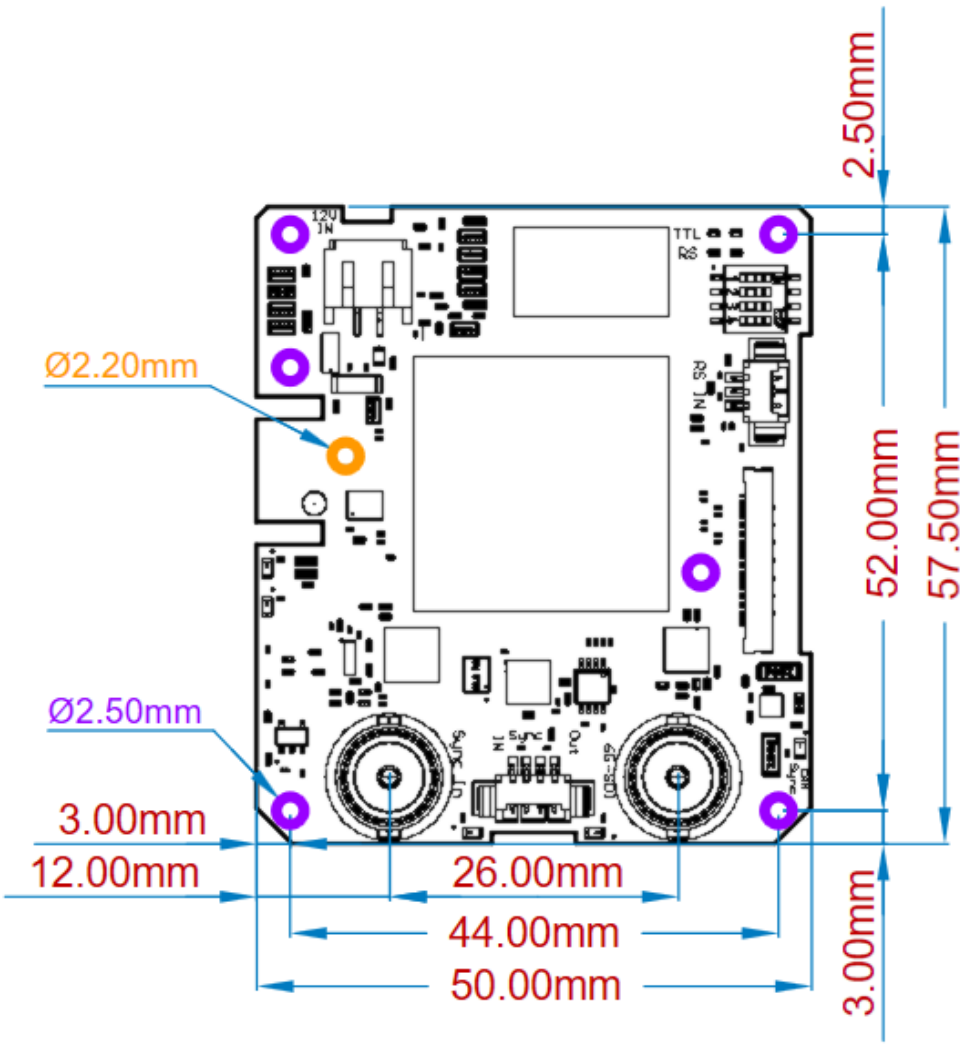


DIP switches				Configuration
1	2	3	4	
OFF	OFF	OFF	OFF	External
ON	OFF	OFF	OFF	1080p29.97
OFF	ON	OFF	OFF	1080p25
ON	ON	OFF	OFF	1080i59.94
OFF	OFF	ON	OFF	1080i50
ON	OFF	ON	OFF	720p59.94
OFF	ON	ON	OFF	720p50
ON	ON	ON	OFF	1080p29.97 ePT
OFF	OFF	OFF	ON	1080p25 ePT
ON	OFF	OFF	ON	2160p29.97
OFF	ON	OFF	ON	2160p25
ON	ON	OFF	ON	1080p50
OFF	OFF	ON	ON	1080p59.94
ON	OFF	ON	ON	Reserved
OFF	ON	ON	ON	1080p23.98 ePT
ON	ON	ON	ON	2160p23.98

J1701	Communication
1	GND
2	Tx
3	Rx

J301	4K TMDS camera input
1	DC_IN
2	DC_IN
3	DC_IN
4	DC_IN
5	RESET
6	UART_TX
7	UART_RX
8	GND
9	USB_D +
10	USB_D -
11	GND
12	USB_VBUS
13	+5.0V OUT
14	Hot Plug Detect
15	EXT_SYNC_LOCK
16	EXT_SYNC
17	XSD0_ACC_LED
18	GND
19	TMDS Data 2 +
20	TMDS Data 2 -
21	GND
22	TMDS Data 1 +
23	TMDS Data 1 -
24	GND
25	TMDS Data 0 +
26	TMDS Data 0 -
27	GND
28	TMDS Clock +
29	TMDS Clock -
30	GND

Form factor



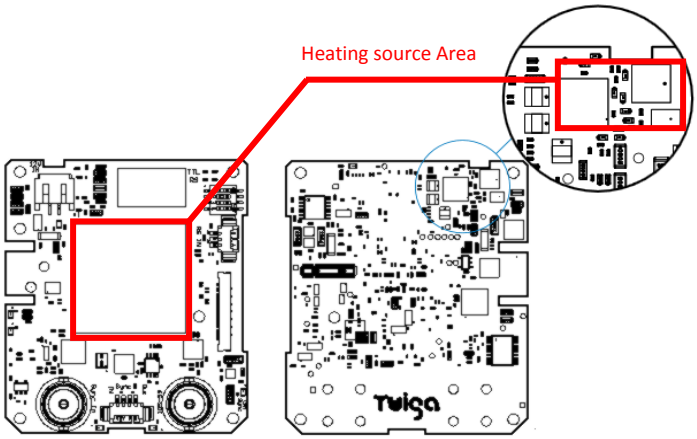
57,5mm (H) x 50mm (W) x 18mm (D)

6 holes Ø 2,5mm

23g

Thermal recommendations

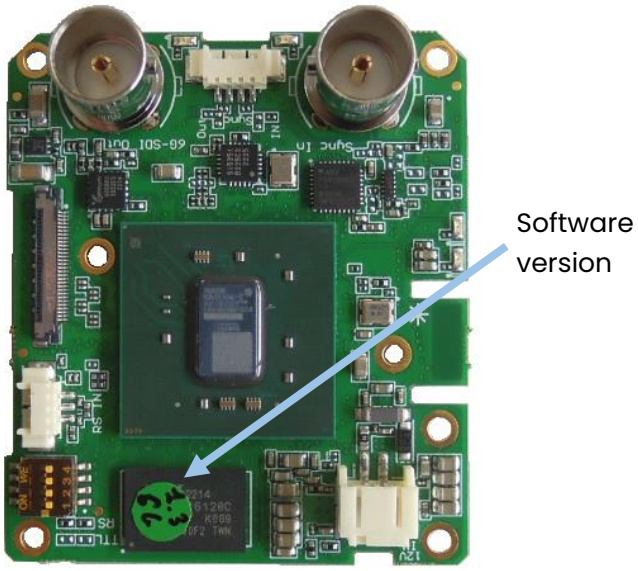
Due to the tiny size of the board, there may need to use an external gap-pad between the heating source and the housing or to use a dissipator. The main source of the heat is the FPGA core, therefore an additional gap pad on the power chip would improve the dissipation of the heat.

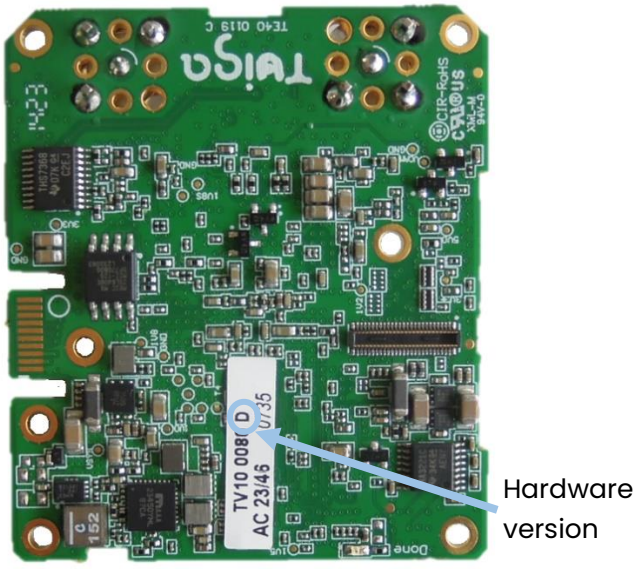


Troubleshooting

Get hardware and software version

The hardware version is a letter written close to the reference of the board TV10 0080 on the bottom side of the board. The software version is written on a green sticker stuck on the top side of the board.





Common issues

If you have any problem getting the video, here some points you need to check:

- Power supply is correctly connected to the board, no consuming issue or overheating of the board.
- No damaged cable, you can check using other 30-way Kel cable, if possible, check the output cable used to get the video
- Check your display compatibility with the video format you want to read
- The video format of the camera is correct and supported by the board
- Try with another HDMI 4K compatible camera to be sure the issue is not coming from the camera

If you are not able to find the cause of the issue, please contact us at info@i2s.fr and we will give you support. Explain us the problem you are facing with as much details as possible and please add the hardware and software version of your board.