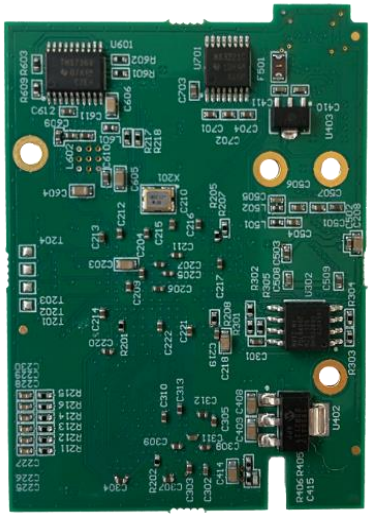
Vision & Innovation

LVDS to Analog & HDMI

Technical Manual



P/N – TV10 0070: LVDS to Analog & HDMI interface board for Tamron zoom cameras

P/N – TV50 0015: Mounting kit for TV10 0070 – LVDS to Analog & HDMI I/F board
Includes: 30-way micro-coax camera cable, 10-way cable (Power supply/TTL/Analog output), 3-way cable (RS232), 7-way cable (GPIOs), screws and plastic spacers

Table of content

Revision History

Date	Revision	Description	Modified by	Note
05/07/19	A	Creation of the document	NMA	
10/01/20	B	Modification of video formats for HDMI, SD and HD analogue outputs	NMA	
11/04/23	C	Update board and kit references	CBO	
05/03/25	D	Change document graphical chart	CBO	

Key features

- YPbPr analog HD video output (up to 1080p30)
- Digital HDMI video output (up to 1080p60)
- Analog video output selectable:
  - Composite video (CVBS)
  - S-Video (Y/C)
  - Component video (YPbPr)
- PAL and NTSC compliant output with multiple format possibilities: Letter box, Squeeze or Crop
- Communication UART – RS232/TTL using VISCA
- Power supply 8V-12VDC
- Operating temperature [0°C; 60°C]

General description

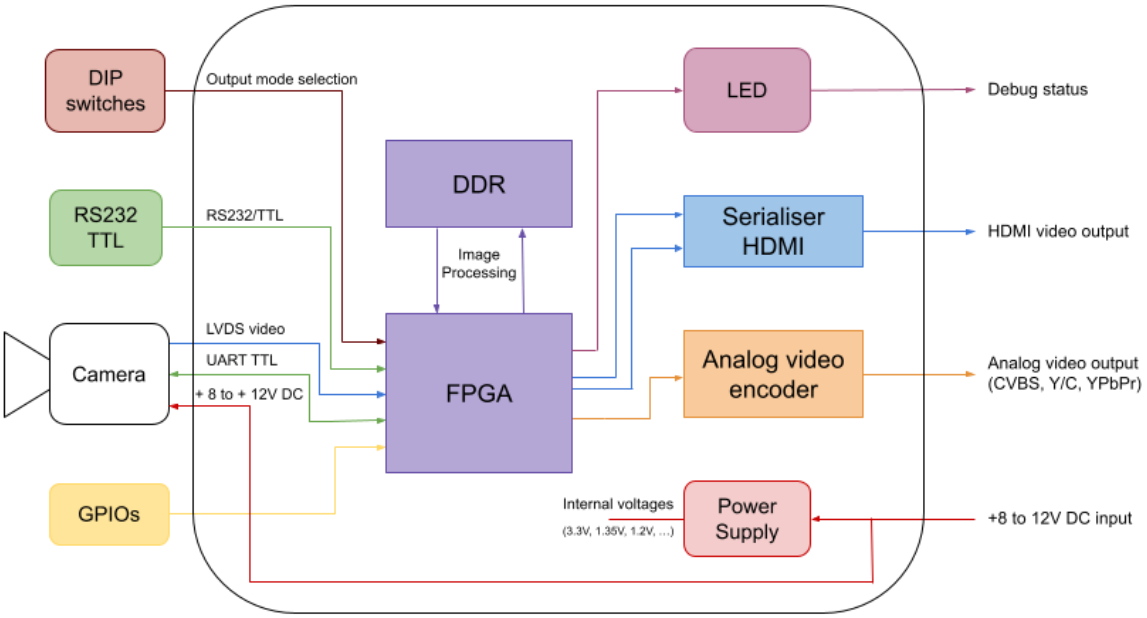
This board converts a LVDS video signal to component YPbPr or composite SD (PAL or NTSC) or HDMI output.
Analog video standard is old and reliable, still used in a lot of applications like drones, surveillance, inspection, medical, defense… The different possible outputs make it compatible with a lot of displays and a very versatile board.

This board is dedicated to Tamron cameras, its strategic form factor allows easy hardware integration on the side of the camera.

Benefits of this solution

- One single board, different output standards available
- Analog output generated even if the camera does not provide analog format
- PAL/NTSC compatibility
- RS232/TTL serial communication
- GPIOs connector to easily send basic VISCA commands (zoom in / out, freeze on / off, focus)
- Compact solution

Block diagram



Video acquisition

The main components are the FPGA for video acquisition and the DDR for video processing.
The board acquire LVDS video from the camera block to provide uncompressed HDMI or analog video output.
The DDR2 allows high speed image processing for analog video output in CVBS, Y/C or YPbPr. Real time scaling to allow 4:3 SD video in Letterbox, Squeeze or Crop mode is available.

Communication

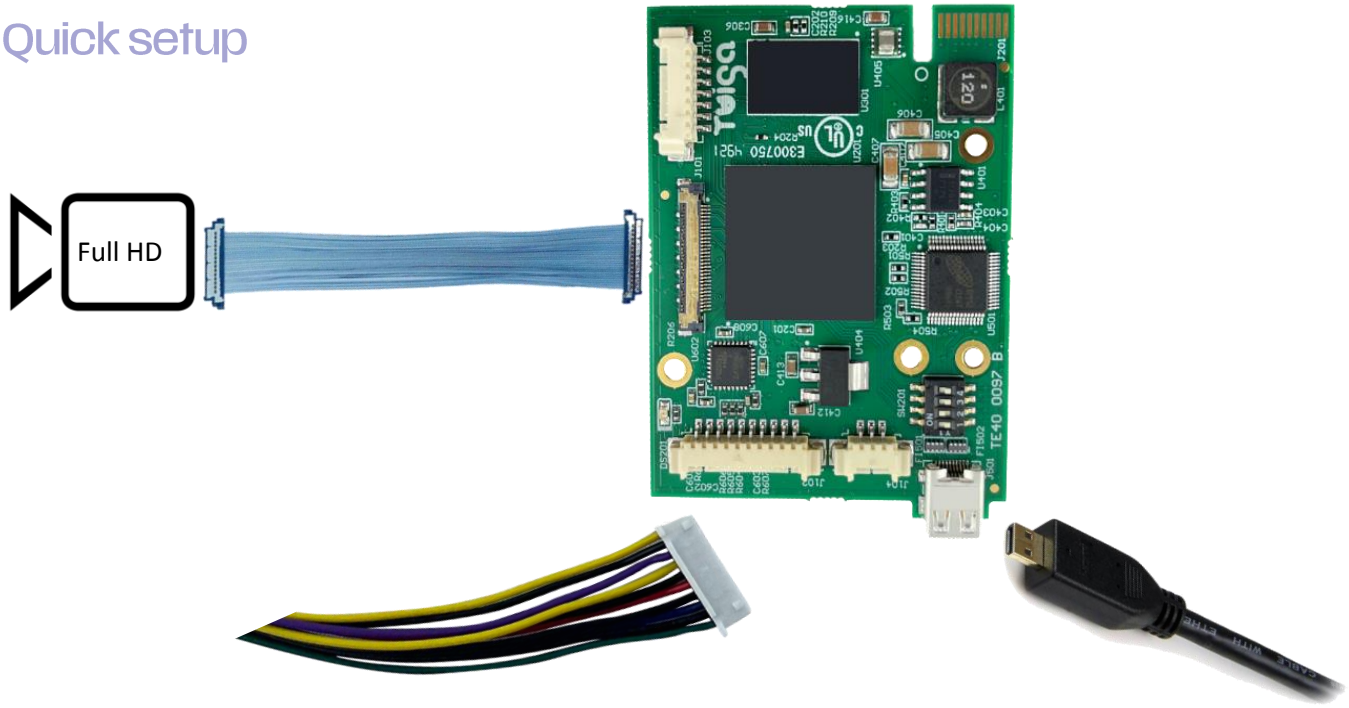
RS232 and UART TTL 3V3 are available on two different connectors to give flexibility.
A LED helps to know in which state the board is, it is quick feedback to be sure no error happened.

Power supply

The power input through the 10-way connector J102 supports from 8V to 12V (1,5A). The camera is powered by the board.
The board is protected against shortcut and reversed cables.

Accessing the video

Quick setup



Installation steps:

1. Connect the KEL cable between the board J101 and the camera.
2. Connect the output cable you need (Micro HDMI or 10-way cable for analog) to your monitor.
3. Connect the 10-way power supply cable on J102 connector. Power input of the board is 8V to 12V (1,5A).
4. Now you can power the board.

Video characteristics

Introduction on video formats

You have two video format types:

- Progressive: displays both the even and odd scan lines (the entire video frame) at the same time. The video formats are listed with the letter 'p'.
- Interlaced: displays even and odd scan lines as separate fields. The even scan lines are drawn on the screen, then the odd scan lines are drawn on the screen. Two of these even and odd scan line fields make up one video frame. The video formats are listed with the letter 'i'.

Notion of LVDS mode:

- It is controlled by the register 74 of the camera (0x00: Single mode, 0x01: Dual mode).
- It is used to increase the video output from 4x LVDS data lines to 8x LVDS data lines. The output clock frequency is still 74,25MHz but with twice more date lanes.
- It is needed to process video formats 1080p50, 1080p59.94 and 1080p60. If the camera itself does not have 4x additional LVDS data lanes, it will output data at 148,5MHz for video formats 1080p50, 1080p59.94 and 1080p60.

On LVDS Full HD cameras blocks you can have several video formats available:

- Full HD Interlaced 1920x1080i: it can be at 50, 59.94 or 60 FPS, the camera must be in Single mode.
- Full HD Progressive 1920x1080p: it can be at 25, 29.97 or 30 FPS, the camera must be in Single mode. It can also be at 50, 59.94 or 60 FPS, with these video formats only, the camera must be in Dual mode to be able to send more data.
- HD Progressive 1280x720p: it can be at 25, 29.97, 30, 50, 59.94 or 60 FPS, the camera must be in single mode.

LVDS video input supported resolutions

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

	25	29.97	30	50	59.94	60
1280x720p				✓	✓	✓
1920x1080p	✓	✓	✓	✓*	✓*	✓*
1920x1080i				✓	✓	✓

* The video formats 1080p50, 1080p59.94 and 1080p60 require the camera configured in dual lane: register 74 set to 0x01. The others video formats require the register 74 set to 0x00 for single lane.

HDMI video output

The output is a HDMI 1.3 available on the Micro HDMI connector J501. The output video format is the same as the camera (see LVDS video input resolutions supported upper).

Analog video output

The analog video output is selectable:

- Analog SD:
  - Composite video (CVBS)
  - S-video (Y/C)
- Analog HD:
  - Component video (YPbPr)

The selection is done via the DIP switches. The analog video output is available on a 10-pin Molex connector J102.

According to the analog format you selected you must set the camera in specific video format:

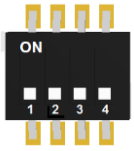
Output video format	**Analog HD (YPbPr)**	**Analog SD (CVBS and Y/C)**
Input video format supported	✓ 720p50 ✓ 720p59,94 ✓ 720p60 ✓ 1080p25 ✓ 1080p29,97 ✓ 1080p30	PAL output: ✓ 1080p25 ✓ 1080p50 NTSC output: ✓ 1080p29,97 ✓ 1080p30 ✓ 1080p59,94 ✓ 1080p60

Analog SD video output quality can depend on the camera aperture configuration. Please refer to the datasheet of your camera and use the command "CAM_Aperture" to optimize the video quality.

Output modes selection

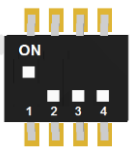
HDMI output

When SW1 = OFF and SW2 = OFF
Warning: HDMI is not available with all cameras



YPbPr output

When SW1 = ON and SW2 = OFF



SD output

When SW2 = ON and SW1 = OFF

SW3 and SW4 select the 16/9 to 4/3 conversion mode:

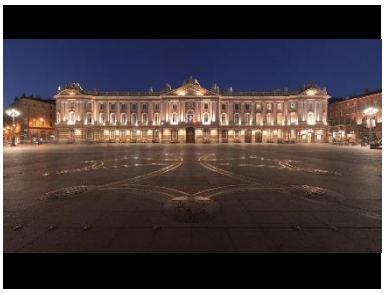


Figure 1: Letterbox

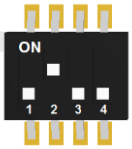
Figure 2: Squeeze

Figure 3: Crop

- "Letter box" aspect ratio:

No part of HD view is cut, black horizontal bars are added on top and bottom of SD output.

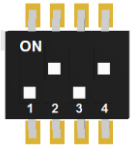
This mode is selected when SW4 switch is OFF



- "Crop" aspect ratio:

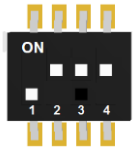
Left and right sides of HD view are cut, whole high is preserved on SD output.

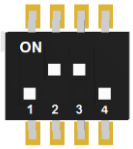
This mode is selected when SW4 switch is ON



- "Squeeze" aspect ratio

16/9 HD video content converted to 4/3 SD output resulting in vertical elongation.

This mode is selected when SW3 switch is ON 

or 

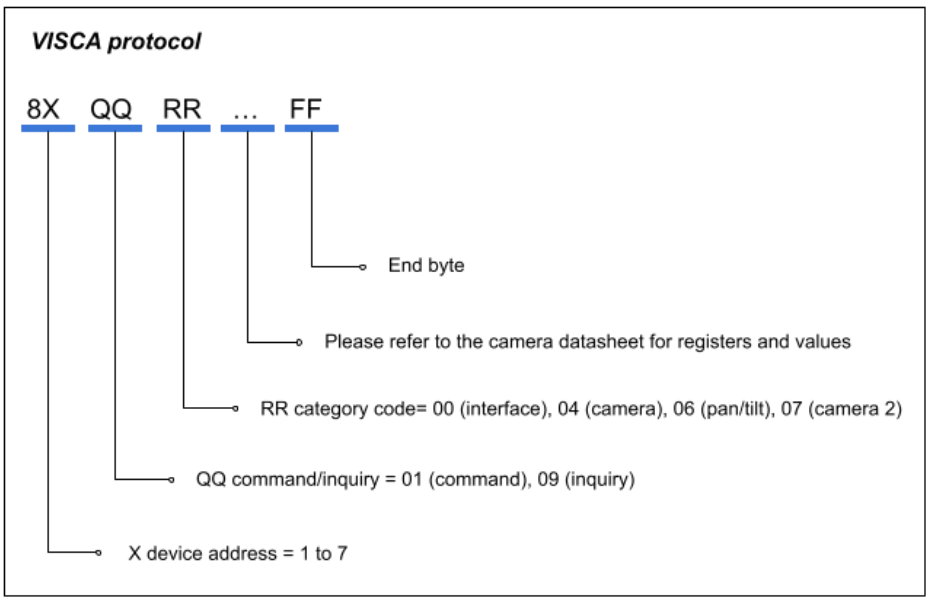
System configuration

Communication

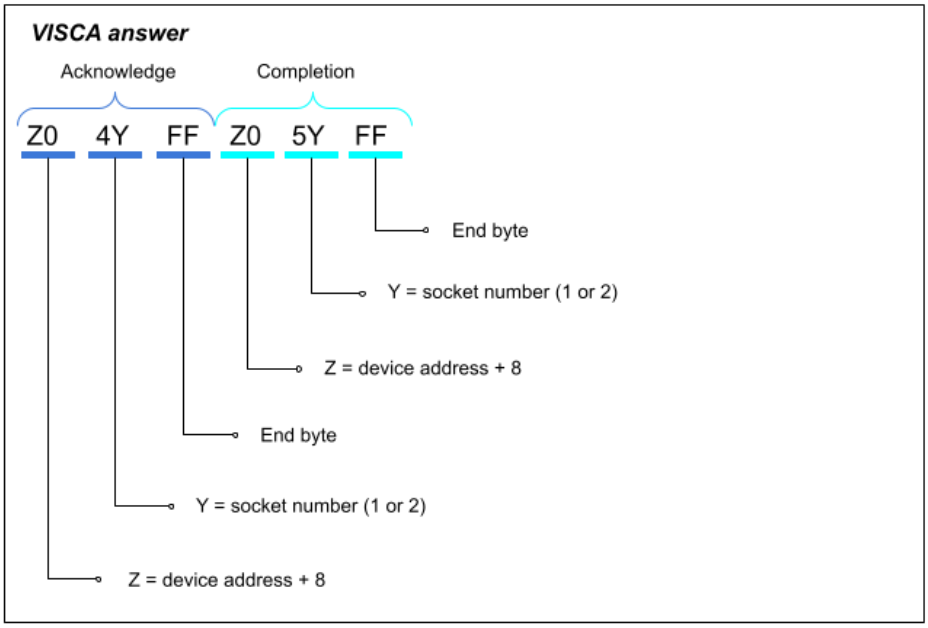
Communication with the camera can be done through J102 connector (UART TTL 3V3) and through J104 (RS232).
Both ways are available by default on the board.

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:

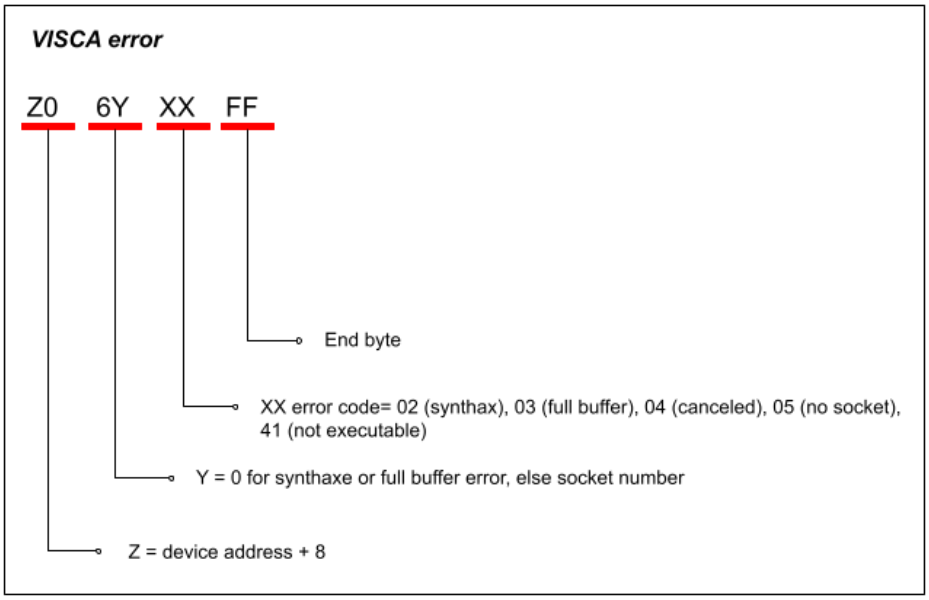


The camera answer follows this structure:



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.

GPIOs

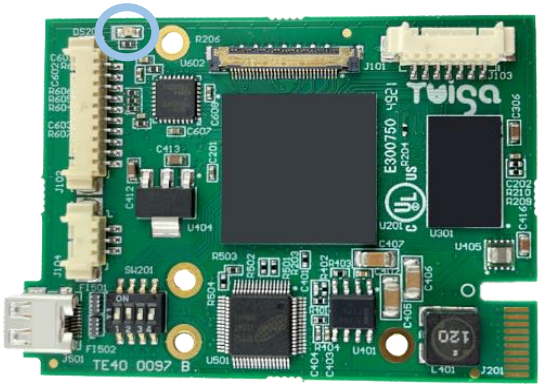
Six GPIOs are available on J901 connector, each one is dedicated to a specific camera function:

Pin	Action	Control	VISCA command sent
Ctrl1	Press Release	Zoom + Zoom stop	0x81 01 04 07 26 FF 0x81 01 04 07 00 FF
Ctrl2	Press Release	Zoom – Zoom stop	0x81 01 04 07 36 FF 0x81 01 04 07 00 FF
Ctrl3	Press Release	Focus Auto / Manual	0x81 01 04 38 10 FF
Ctrl4	Press Release	Focus near Focus stop	0x81 01 04 08 33 FF 0x81 01 04 08 00 FF
Ctrl5	Press Release	Focus far Focus stop	0x81 01 04 08 23 FF 0x81 01 04 08 00 FF
Ctrl6	Press Release	Image freeze toggle	0x81 01 04 62 02 FF 0x81 01 04 62 03 FF

To activate it you need to connect the pin to the ground. ESD filters and anti-bounce have been added. You can use existing keyboard to easily control them.

Board status

A led is available on the board to indicate the status:



The led displays the system state every 2 second. The number of blinks indicates the current state.

Status	Blinks number
Serial communication initialization	1
Waiting for camera answer	2
Camera baudrates configuration	3
Camera identification	4
Initialization done	5

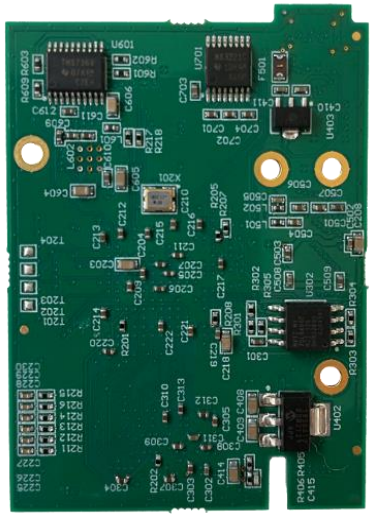
Connectors

J501	Micro HDMI
HDMI 1.3 video output	

J104	RS232 communication
1	GND
2	Tx
3	Rx

J102	Analog HD/SD output + COM
1	CVBS / Y
2	GND
3	Rx (TTL 3V3)
4	Tx (TTL 3V3)
5	GND
6	+8 to + 12V
7	GND
8	C / Pr
9	GND
10	Y / Pb

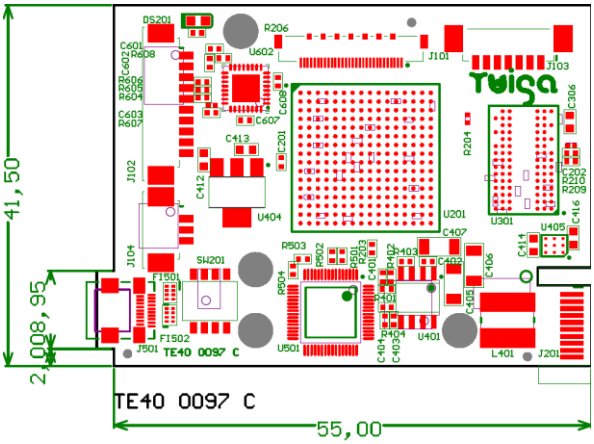
J901	GPIOs
1	GND
2	Zoom +
3	Zoom -
4	Focus Auto/Manual
5	Focus Near
6	Focus Far
7	Freeze On/Off



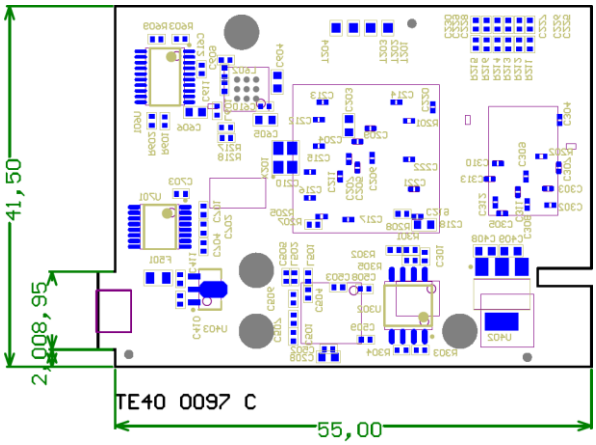
J101	LVDS input
1	TX4-
2	TX4+
3	TX5-
4	TX5+
5	Reset
6	NC
7	TX6-
8	TX6+
9	TX7-
10	TX7+
11	GND
12	GND
13	VCAM
14	VCAM
15	VCAM
16	VCAM
17	VCAM
18	RxD (TTL camera input)
19	TxD (TTL camera input)
20	GND
21	TX0-
22	TX0+
23	TX1-
24	TX1+
25	TX2-
26	TX2+
27	TXCLKOUT-
28	TXCLKOUT+
29	TX3-
30	TX3+

Form factor

TOP



BOTTOM



55mm (H) x 41,5mm (W) x 4,5mm (D)

4 holes Ø 2mm

13g

Troubleshooting

Get hardware and software version

The hardware version is a letter written close to the reference of the board TV10 0070. The software version is written on a green sticker stuck on the top side of the board.

Software version

Hardware version

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
- The DIP switch position is correct according to the video output you want to display
- Try with another LVDS 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.