SightLine APPLICATIONS

ICD-1500-OEM

PN: ICD-1500-OEM

12/12/2018

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Alerts

The following notifications are used throughout the document to help identify important safety and setup information to the user:

⚠ **CAUTION:** Alerts to a potential hazard that may result in personal injury, or an unsafe practice that causes damage to the equipment if not avoided.

ⓘ **IMPORTANT:** Identifies crucial information that is important to setup and configuration procedures.

Used to emphasize points or reminds the user of something. Supplementary information that aids in the use or understanding of the equipment or subject that is not critical to system use.

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Revision History

Date	Description
12/12/2018	Updated Thermal Management section with temperature related commands in the IDD.
9/10/2018	Added voltage and power to spec table. Added supply voltage level compatibility statement for camera boards.
8/1/2018	Added caution statement in the Connector section for powering up specific types of interface boards.
7/26/2018	Added Appendix C - Analog Input Noise Shielding
6/12/2018	Added Ethernet magnetics information.
3/16/2018	Added default direction and values of GPIO pins.
3/6/2018	Minor updates to VIOSEL.
2/27/2018	Updated SOM section.
12/20/2017	Updated Thermal Management section.
12/5/2017	Updated document to new format and edited for clarity. Created new ICD document for 1500-OEM adapter boards. See ICD-1500-Adapters.
10/5/2017	Split document into ICD-1500-OEM and ICD-1500-ADAPTERS. Minor diagrams, text, and tables syntax edits.
8/24/2017	Cross reference power definitions, added clarification to serial port # and pin names as well a cross references for easy lookup.
7/18/2017	Updated power input requirements.
4/12/17	Fixed J4 pinout. Added more details regarding the serial port.
8/15/2016	Schematics moved to separate files, added Rev E information.
10/19/2015	Added 1500-mAB section
9/17/2015	Updated 1500-AB connectors, added 1500-Sony table captions, added illustrations for 1500-Sony J3 Pin 1
9/15/2015	Updated hardware overview, added IO block diagram, added accessories summary section, updated connector details for 1500-Sony, corrected copyright.
5/11/2015	Formatting, minor text and table edits, fix 1500-AB J3 table, Copyright dates, added Revision History, Figures and Table indexes.

1 Overview

Describes power requirements, thermal management, interface specifications, and connector pin-outs for the 1500-OEM video processing board.

1.1 Associated Documents

EAN-Startup Guide 1500-OEM: Describes steps for connecting, configuring, and testing the 1500-OEM video processing board on the 1500-AB accessory board.

EAN-File Recording: Describes how to record video or snap shots to either the onboard MicroSD card or to an external FTP drive.

Interface Command and Control (IDD): Describes the native communications protocol used by the SightLine Applications product line. The IDD is also available as a local download on the Software Download page.

ICD-1500 Adapter Boards: Describes power requirements, thermal management, interface specifications, and connector pin-outs for the 1500-OEM associated camera interface boards.

EAN-Panel Plus User Guide: Provides descriptions of all the settings in the Panel Plus application. (Located in the Panel Plus application in the *Help* menu.)

1.2 Software Compatibility

Windows 7, 8, or 10 required for use with the Panel Plus software.

1.3 SightLine Software Requirements

ⓘ **IMPORTANT:** The Panel Plus software version should match the firmware version running on the board.

2 Safe Device Handling

⚠ **CAUTION:** To prevent damage to hardware boards, use a conductive wrist strap attached to a good earth ground. Before picking up an ESD sensitive electronic component, discharge built up static by touching a grounded bare metal surface or approved antistatic mat.

3 1500-OEM Overview

The 1500-OEM from SightLine Applications is a very small, low power, single-channel on-board video processor for unmanned airborne or ground vehicles in ISR applications.

The system is capable of processing and streaming HD video outputs up to 720P. This product is designed to add advanced capabilities to camera systems. It operates on video right at the source, which is key for low latency performance and best video quality.

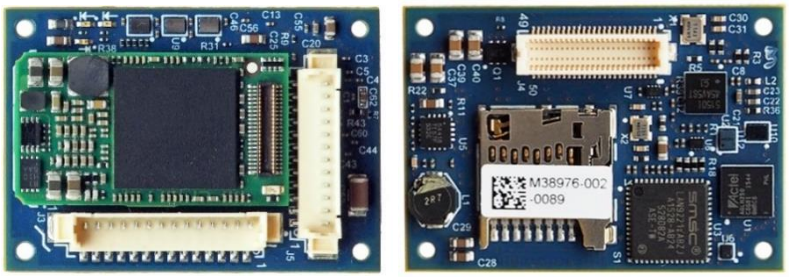

Figure 1: 1500-OEM Overview

3.1 1500-OEM Specifications

Revision:	E
Dimensions:	1.48 in x 1.04 in (26.5 mm x 37.7 mm)
Weight:	7.6 grams
Voltage:	4.5 - 6.5 VDC OEM (5V nom)
Power:	3 W (max) 2.5W (typical)
Drawing:	1500-OEM Rev E
	1500-OEM Rev C
STEP File:	OEM Board Rev E STEP
	OEM Board Rev C STEP

All mounting holes shall support M1.6 screws.

IMPORTANT: The supply voltage level must be compatible with the camera adapter board and connected cameras.

3.2 Hardware Revisions

Board Revision	Changes	
Rev E	• Fixed USB connectivity (J5) • Added 2 GPIO ports on (J5) - GP144 and 145 • Onboard FPGA programming no longer requires external JTAG emulator hardware	• Improved boot-time by 3 seconds • Replaced MicroSD card with smaller version • Added 4th mounting hole

3.3 Interface Protocol

The 1500-OEM shares the same interface protocol as other SLA video processing boards. The protocol is a packet-based command and control interface and the protocol document is available from the SightLine website.

The ARM core on the DM8148 is only lightly utilized in the SLA implementation. This provides customers with a processor to implement other processing functions or protocol conversions (to allow communications via a customer's proprietary protocol).

3.4 Primary Input / Output

- 4.5 - 6.0 VDC [5 VDC nominal] (see below)
- Analog Video In (x2)
- 10/100Base-T Ethernet
- 7 GPIO
- USB 2.0
- Digital Video Input (16-bits + clocks)
- TTL Serial Ports (x3)
- I2C (3.3V)
- On-board FPGA for advanced video signal processing
- MicroSD Card

3.5 Functional Block Diagram

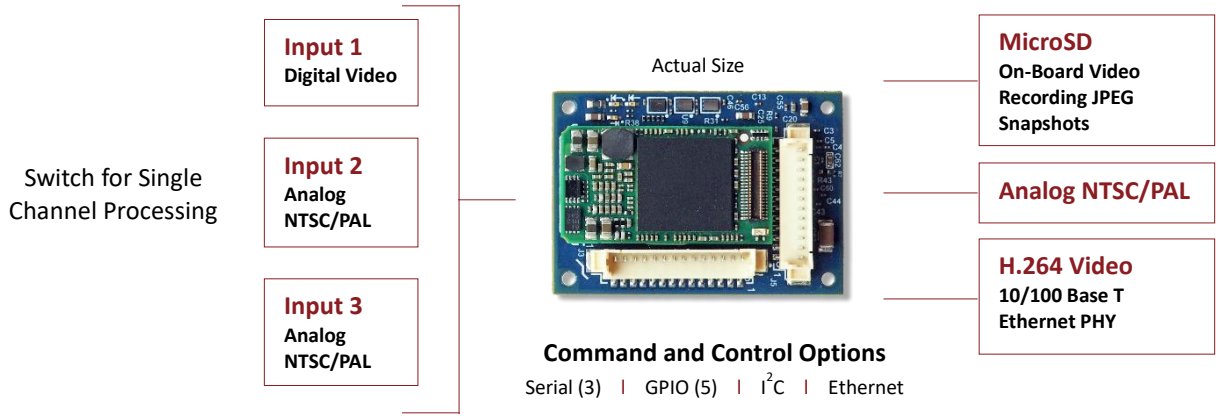

Figure 2: 1500-OEM Functional Block Diagram

3.6 1500-SOM

The SOM hardware is a small profile (15 x 27 mm) and low power (2.25W) LogicPD Torpedo 3730 System-on-Module (p/n: SOMDM3730-20-1780AGIR).

ⓘ **IMPORTANT:** Do not remove the 1500-SOM from the 1500-OEM board.

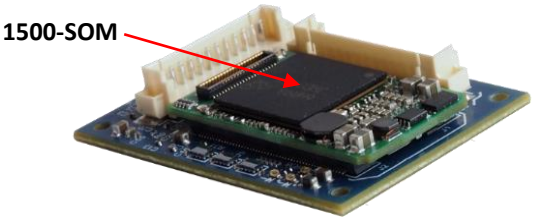

Figure 3: 1500-SOM Orientation

3.6.1 Design Support

SightLine actively supports customer development of new interface circuit boards that will optimize integration of our video processors into production designs. The 1500-SOM is the smallest form factor option to incorporate SightLine video processing functions into customer designs. Access to reference design files for 1500-SOM carrier board (1500-OEM board) is provided under the terms of a simple Hardware Design IP Agreement document. Contact Sales for more information.

4 Thermal Management

4.1 Heatsink Guidelines

- Component temp range: -40°C to 85°C
- All hardware uses some form of mechanical heatsink.
- The 1500-OEM consumes approximately 2.5 watts of power. Most of the power used is by the DSP + memory PoP (Part-on-Part) on the SOM.
- A blue stick-on heatsink to facilitate bench and early testing is provided by SightLine. It supports convective cooling when there is airflow.

ⓘ **IMPORTANT:** The blue stick-on heatsink is not intended for long term vehicle integration use.

- If designing a custom heatsink for integration, it should provide a direct conducted path to a significant thermal mass (typically the wall of a gimbal or housing).
- If there is enough airflow, multiple finned options are available including thermal epoxy for mounting. Fin design should be selected based on airflow and available space.
- The 1500-OEM does not have an automatic thermal processor shutdown. The operating temperature of the unit can be read through the **SLAGetVersionNumber (0x00)** command. The temperature can also be reported continually using the **System Status Message (0x87)** command. See the IDD for more information.

4.2 Gap Filler (Thermal Grease)

When possible use some form of thermally conductive liquid gap filling material such as Arctic Silver rather than an adhesive. Do not use thermal grease in conjunction with gap pads.

4.3 Gap Pads

Use some form of thermally conductive material for filling gaps between the hot components and the heat sink. Examples such as the Bergquist VO Ultra Soft are recommended. Do not use gap pads in conjunction with thermal grease.

5 Connector Summary

Table 1: Connector Summary

Label	MFG Part Number	Function	Mates with:
J3	Molex 53398-1471	Analog video in/out, power, serial, Ethernet	Molex 51021-1400
J4	Hirose DF12B(5.0) 50DP-0.5V(86)	Serial, digital video, I2C, etc.	Hirose DF12B-50DS-0.5V(86)
J5	Molex 53398-1271	FPGA JTAG, USB, GPIO	Molex 51021-1200
S1	JEA ST9S008V4AR1500	J Micro SD socket	Any Micro SD card

5.1 Connector J3

Analog Video, Power, Serial, Ethernet

Table 2: 1500-OEM J3 Pinout

Pin	Signal	Description	Pin	Signal	Description
1	Video In 0	Analog video input	8	Vin	Input 4.5 - 6.0 VDC
2	AGND		9	Vin	
3	Video Out	Analog video output	10	DGND	
4	AGND		11	RX-	10/100BaseT Ethernet
5	TX0	Serial port 0	12	RX+	
6	RX0		13	TX+	
07	DGND		14	TX-	

CAUTION: On some interfaces, e.g., 1500-Sony / Tamron board, power to the 1500-OEM board is provided through J4 on pins 48 and 50. In these cases do not apply power to J3 pins 8 and 9. Powering the OEM through the J3 power pins and through the J4 power pins can damage the OEM.

5.1.1 Analog Video Input

Supports the following analog video formats:

- NTSC-J, M
- PAL-B, D, G, H, I
- PAL-M
- Converts luminance and chrominance channels to 8-bit ITU−R BT.656 interface with embedded sync output and extended coding range of values
- Y, U, and V range from 1 to 254

IMPORTANT: See Appendix C for more information on minimizing noise on analog input.

5.1.2 Analog Video Out

Composite TV Out

Supports composite DC coupled full-scale voltage output: minimum 1.2 Vpp with a 75-Ω parallel termination. The following video standards are supported:

- NTSC-J, M
- PAL-B, D, G, H, I
- PAL-M

A 75 Ohm parallel resistor (to ground) is required on the TV-out for proper signal quality. Video traces should be routed with 75 Ohm characteristic impedance.

5.1.3 Ethernet

On connector J3, pin 11 through pin 14 represent the Ethernet connection. Currently only 10/100BASE-T has been implemented.

TX+/ TX- is sending info from Sightline product., RX+/ RX- is receiving.

The 1500-OEM uses the embedded Ethernet approach. This consists of 0.033uF capacitors placed in series on the Ethernet lines (AC coupled) onboard. There are no Ethernet magnetics on the 1500-OEM. If the distance is less than a few meters and there is a common ground, there should not be any issues with Ethernet connectivity (even in EMI testing).

IMPORTANT:

If the Ethernet needs to be changed to use external magnetics, the OEM board should be modified by changing the board capacitors (and possibly other passives) to zero-ohm jumpers. Contact Support for modification assistance.

5.2 Connector J4

Digital Camera, Serial, Power Default

This connector is designed to allow the 1500-OEM to mate with the FLIR TAU 640 or other SLA accessory boards. This is a generic camera input supporting up to 12-bits video data. The 1500-SOM can accept many types of digital video input. For optimal processing performance, the height and width of the image should be a multiple of 16.

CAUTION: On some interfaces, e.g., 1500-Sony / Tamron board, power to the 1500-OEM board is provided through J4 on pins 48 and 50. In these cases do not apply power to J3 pins 8 and 9. Powering the OEM through the J3 power pins and through the J4 power pins can damage the OEM.

Table 3: 1500-OEM J4 Pinout

Pin	Description	Signal Level	Pin	Description	Signal Level
1	RX2	VIOSEL	2	TX2	VIOSEL
3	CAMD14 / CAMXCLKA	VIOSEL	4	CAMD15 / CAMXCLKB	VIOSEL
5	DGND		6	DGND	
7	I2C SCL	VIOSEL	8	I2C SDA	VIOSEL
9	GPIO175	VIOSEL	10	CAMFLD	VIOSEL
11	CAMVS	VIOSEL	12	CAMHS	VIOSEL
13	GPIO174	VIOSEL	14	GPIO173	VIOSEL
15	RX1	VIOSEL	16	TX1	VIOSEL
17	DGND		18	TAUDET	
19	GPIO178	3.3V	20	CAMD13	VIOSEL
21	EXTSYNC (Future Use)	VIOSEL	22	CAMD12	VIOSEL
23	CAMD11	VIOSEL	24	CAMD10	VIOSEL
25	CAMD09	VIOSEL	26	CAMD08	VIOSEL
27	DGND		28	DGND	
29	CAMD07	VIOSEL	30	CAMD06	VIOSEL
31	CAMD05	VIOSEL	32	CAMD04	VIOSEL
33	CAMD03	VIOSEL	34	CAMD02	VIOSEL
35	CAMD01	VIOSEL	36	CAMD00	VIOSEL
37	DGND		38	DGND	
39	CAMPCLK	VIOSEL	40	GPIO172	VIOSEL
41	DGND		42	DGND	
43	Analog Video In 1		44	Analog Ground	
45	DGND		46	VIOSEL	below
47	Power Return		48	Alternate Power In/Out	5V
49	Power Return		50	Alternate Power In/Out	5V

Power	Analog Video	Digital Video	12C	Serial	GPIO	Ground

5.3 Internal Pullup

The pullup drive strength is equal to: minimum = 50µA, typical = 100 µA, maximum = 250 µA (unless otherwise specified).

5.4 Connector J5: FPGA JTAG, USB, GPIO

The USB_VBUS connection can supply a maximum of 100mA. Devices that require more than 100mA will need an external power source.

Table 4: 1500-OEM (Rev E) J5 Pinout

Pin	Description	Pin	Description
1	USB_VBUS	7	FPGA JTAG TMS
2	USB-	8	FPGA JTAG TDI
3	USB+	9	GPIO145
4	USBID	10	FPGA JTAG TRST
5	DGND	11	FPGA JTAG TDO
6	FPGA JTAG TCK	12	GPIO144

5.5 Socket S1: MicroSD

- Push in to place, push out to eject
- 10,000 Mating cycles
- 3.3 mm card eject length
- Works with most MicroSD cards

On Rev E boards use an adhesive to hold the microSD card in place to prevent ejection during hard aircraft landings or other shocks to the board.

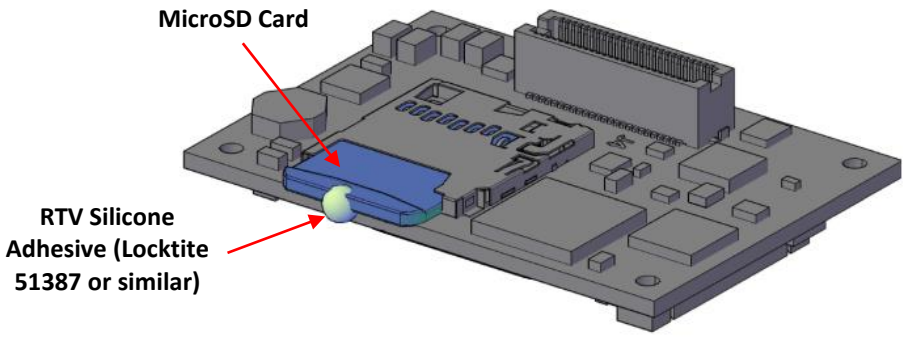

Figure 4: Example - 1500-OEM (Rev E) Adhesive Placement on MicroSD Card

5.6 Power

Apply 5V to either J3 (Pin 8 and 9) or J4 (Pin 48 and 50). Do not apply power to both. Do not exceed 3.3V on VIOSEL.

Table 5: 1500-OEM Power Supply Pins

Connector/Pin	Name	Range	Tolerance
J4 Pin 46	VIOSEL	1.8, 2.5V, 3.3V	± 0.1V
J4 Pin 48 & 50	P5V	4.5 – 5.5V	
J3 Pin 8 & 9	P5V	4.5 – 5.5V	

5.7 VIOSEL

Pin 46 VIOSEL powers and sets the voltage level of the signals with names starting with CAM, as well as the GPIOs, RX1/TX1 and RX2/TX2. VIOSEL can be set to 1.8V, 2.5V, or 3.3V. Do not exceed 3.3V. All signals besides the CAM signals use the bidirectional level converter TXB0108, which has a weak steady state drive strength.

5.8 LEDS

Table 6: 1500-OEM LED Status

Label	Description	LED Color
D1	Power Indicator	Green
D2	GPIO179	Green
D3	Network Status	Green

5.9 UARTS

To use serial port 1 and serial port 2, external power must be applied to VIOSEL to set the IO voltage level. Serial port 0 operates at 3.3V. If an application requires a different IO voltage for serial port 0, it is important to use a level shifter that is not a bidirectional, i.e., an automatic direction sensing type of level shifter.

ⓘ **IMPORTANT**: It is not necessary to apply power to VIOSEL when using a SightLine accessory board other than 1500-AB development board that implements serial 1 and/or serial 2. These boards have a DC-to-DC converter that provides 3.3V to VIOSEL. Powering VIOSEL through both the internal regulator and an external source can have unpredictable results and potentially damage the OEM and accessory boards.

Table 7: 1500-OEM Serial Ports

Serial Port	Reference Voltage	Connector	Linux	Common Use
0	3.3V	J3:P5/6	/dev/ttyO0	Command and Control, DEBUG
2	VIOSEL (J4:P46)	J4:P1/2	/dev/ttyO2	Camera Control Passthrough
1	VIOSEL (J4:P46)	J4:P15/16	/dev/ttyO1	Generic Passthrough

The Torpedo SOM hardware uses a different nomenclature in the documentation. The SOM serial port (A, B, C) maps to the SLA serial port (0, 1, 2) as follows:

SLA Port Number	SOM Port Number
0	A
1	C
2	B

5.10 Test Points

Table 8: 1500-OEM Test Points

Label	Description	Label	Description
TP1	Ground	TP3	FPGA Pin B9
TP2	3.3V	TP4	FPGA Pin C8

5.11 General Purpose Input / Output (GPIO)

Table 9: 1500-OEM Generic (Optional) GPIO

Label	Reference Voltage	Description/Location	Default State	Default value (may change)
GPIO129	1.8V	LAN9221 Pin 43		
GPIO171	1.8V	FPGA A9		
GPIO172	VIOSEL	J4 Pin 40	Output	Low
GPIO173	VIOSEL	J4 Pin 14	Input	High
GPIO174	VIOSEL	J4 Pin 13 May toggle on startup	Input	High
GPIO175	VIOSEL	J4 Pin 9	Input	High
GPIO178	3.3V	J4 Pin 19	Input	Low
GPIO179	3.3V	LED D2		
GPIO144	1.8V	J5 Pin 12	Input	Low
GPIO145	1.8V	J5 Pin 9	Input	Low

6 Questions and Additional Support

If you are still having issues and require additional support, please contact Technical Support. Additional support, documentation and Engineering Application Notes (EANs) can be found on the Support pages of the SightLine Applications website.

Appendix A - Missing Driver Chip

Some REV C boards were shipped without the U7 driver chip installed will not have I2C capability on J4. This was done to allow to direct connection to the back of a FLIR Tau 640. See EAN-FLIR Cameras for alternative solutions.

The top board in Figure A1 has the chip installed, the board below does not. If the chip is not installed, contact Support for more information.

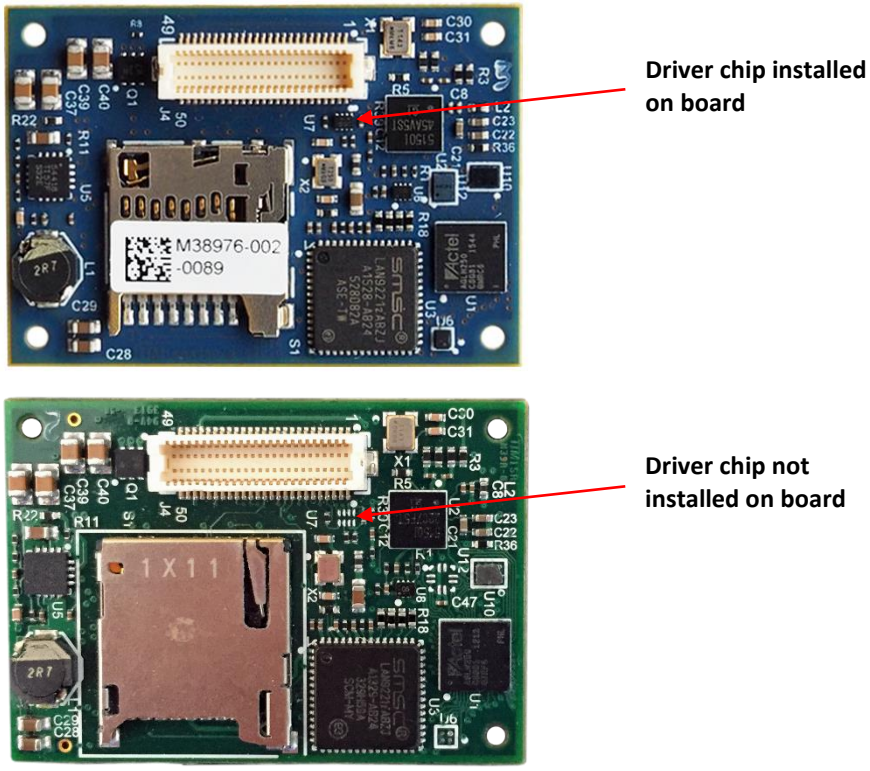

Figure A1: U7 Driver Chip Location

Appendix B - Anti-Alias Filter

If the incoming video source does not include anti-aliasing, then an anti-alias filter should be added to each analog video input to help improve video quality. Figure B2 shows the recommended location of anti-aliasing filter input circuit. This filter is not present on the 1500-OEM.

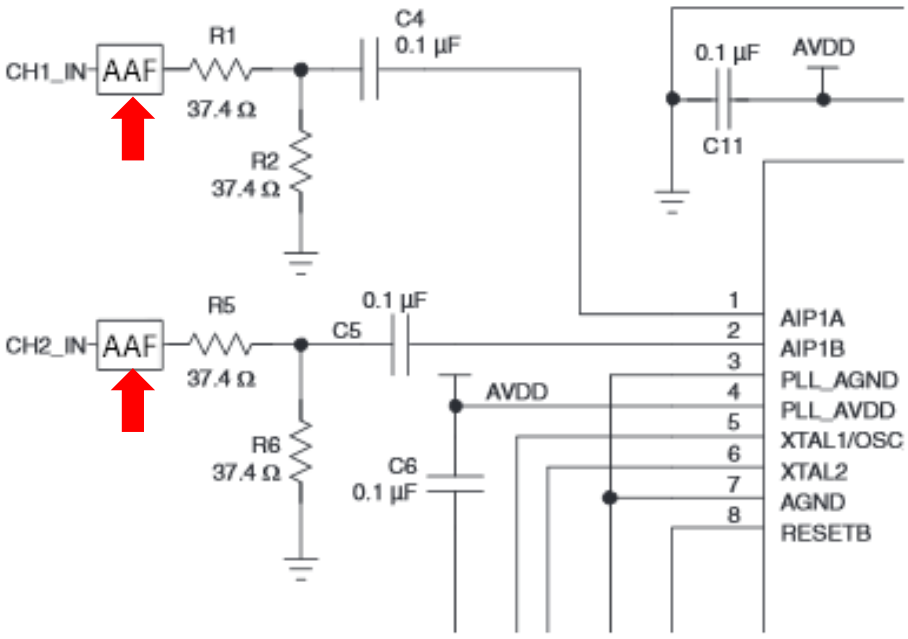

Figure B1: Anti-Aliasing Filter Input Circuit

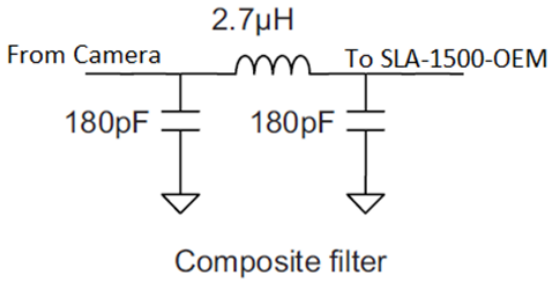

Figure B2: Recommended Anti-Aliasing Filter for Analog Inputs

Appendix C - Analog Input Noise Shielding

The analog input connection to the 1500-OEM should use coax or other shielded cable.

Keeping the analog and AGND wires close together and away from noisy sources (cables carrying digital video) and minimizing cable distance and ground loops can help.

Twisting the analog and analog ground on the input to the 1500-OEM can be very effective. In the example setup shown below, shielding was done by twisting the two wires in the center without detaching the pins from the connectors. This keeps the two wires away from noisy sources, i.e., the white flat cable carrying digital video.

Using the analog output of the 1500-OEM connected to an analog monitor will show high frequency noise better than on H.264 compressed network video. This is a more effective setup for testing shielding effects since the change in quality is more apparent.

Sending setup pictures to Support can help identify issues more quickly.

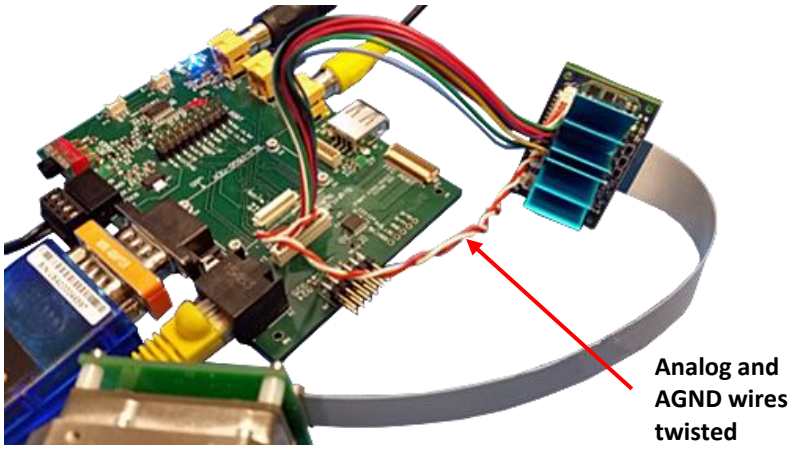

Figure C1: Analog Input Wire Twisting Example