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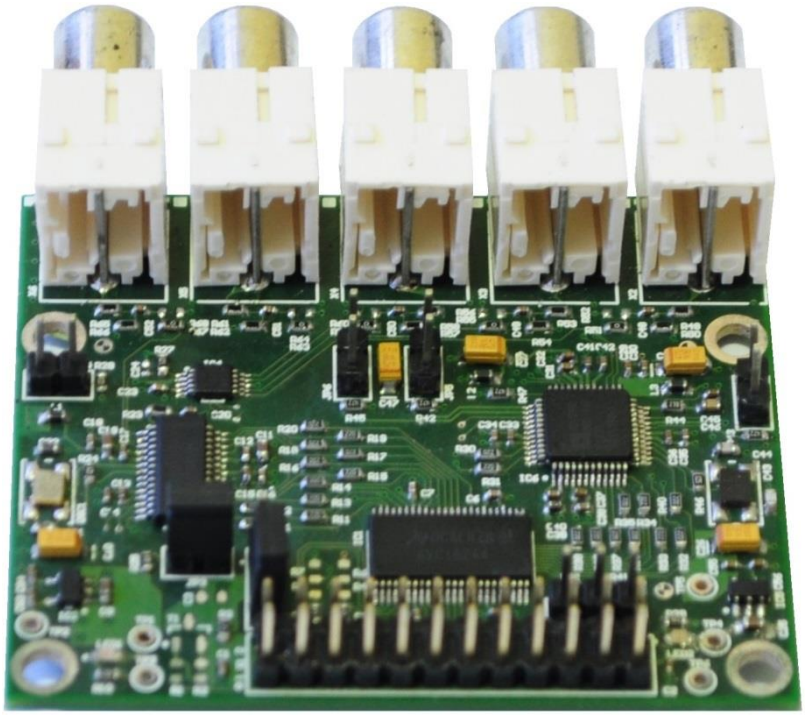
Analogue Camera Module

Datasheet



Revision History

Date	Doc. Rev.	ACM Version	Changes
10-July-13	Rev. 1.0	V1.1	Preliminary Release
27-August- 2013	Rev 1.1	V1.1	Section 1.0: Introduction edited. Section 2.1: Block diagram, Section 3.2.1: Signal Name (CAM1_XX → CIF_D_X) , Added notes for CIF_D_10 and CIF_D_11 signals. Section 3.2.2, 3.2.3, 4.0: default assembly and jumper settings.
16-Oct-13	Rev 1.2	V1.1	Section 1.2, Block Diagram: Added comments for ADV7180 as assembly option.
26-May-14	Rev 1.3	V1.1	Section 3.2.3, MAX9526/ADV7180 Power Control (JP2): Updated pin details: Pin 1 → VDD_3V3_B and Pin 3 → VDD_3V3_A Section 6, Pin Mapping: Added section to describe pin mapping details with respect to Apalis Eval. Board and Ixora Carrier Board.
26-May-15	Rev 1.4	V1.1	Section 6, Pin Mapping: Updated section to describe pin mapping details with respect to Colibri Evaluation Board V3.2
10-Oct-16	Rev 1.5	V1.1	Section 6, Pin Mapping: Reformatted section.
13-Feb-17	Rev 1.6	V1.1	Removed document meta-data.

Contents

1. Introduction

The Analogue Camera Module (ACM) is an interface board that has been designed to allow composite video cameras with NTSC/PAL output to be interfaced with the Colibri and Apalis evaluation boards using the parallel camera interface. It decodes NTSC/PAL video signals to 8 bit parallel digital output with external H/V sync signals.

1.1. Reference Documents

For detailed technical information about suitable computer modules, please refer to the documents listed below.

1.1.1 Colibri Computer Modules

An overview of the Colibri product family:

http://www.toradex.com/products/colibri-arm-modules

1.1.2 Apalis Computer Modules

An overview of the Apalis product family:

http://www.toradex.com/products/apalis-arm-computer-modules/apalis-t30

1.1.3 Colibri Carrier Board

An overview of the Colibri carrier board product family:

http://developer.toradex.com/hardware-resources/arm-family/colibri-carrier-boards

1.1.4 Apalis Carrier Board

An overview of the Apalis carrier board product family:

http://developer.toradex.com/hardware-resources/arm-family/apalis-carrier-boards

1.2. Features

1.2.1 Overview

The ACM provides the following features:

- Uses MAX9526 decoder by default (ADV7180 decoder as assembly option).
- Analogue Input : 5 multiplexed video input channels, supporting NTSC or PAL composite video signals.
- Parallel data output format:

  8-Bit Parallel ITU-R BT.656 with Separate HS and VS
- No external power supply required.

NOTE:

With default assembly option, MAX9526 decoder is enabled. In order to use ADV7180 decoder, 5 zero ohm resistors need to be changed using manual soldering process.
Refer Section 4 (Assembly Options) for more details.

2. Architecture Overview

2.1. Block Diagram

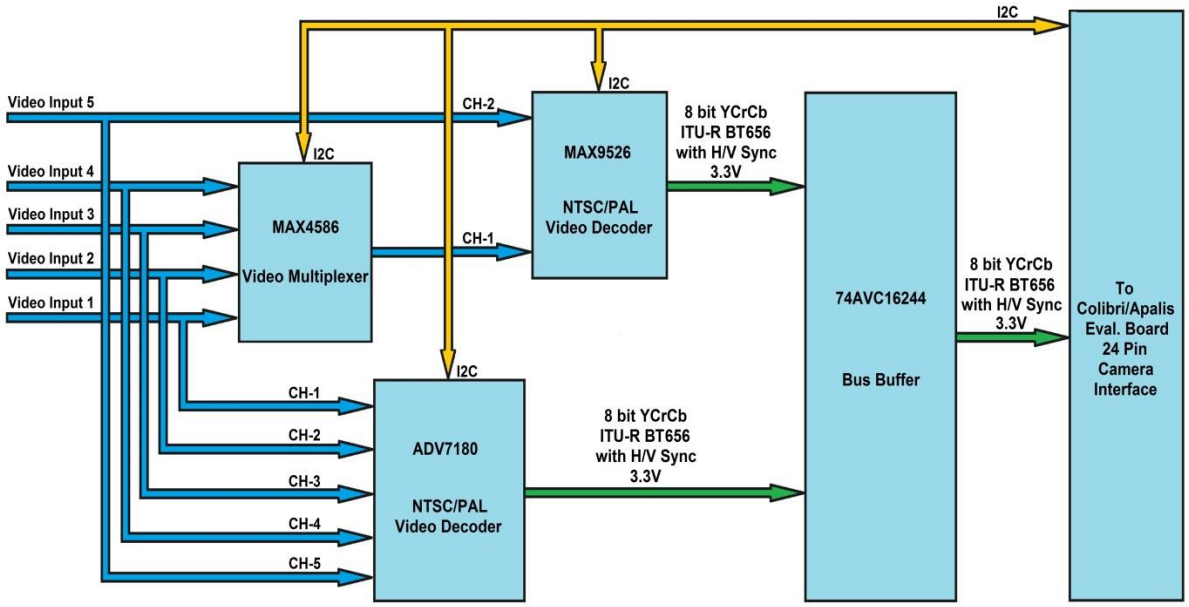


Fig.1 ACM Block Diagram

2.2. Installation

Follow these steps for a quick start:

1. Connect analogue camera module (ACM) connector (X1) with Colibri evaluation board connector (X22) using 24 wire flat cable.

   In order to connect ACM to Apalis evaluation board or Ixora carrier board, a custom connector will be required. Refer Section 6, Pin Mapping for more details.

2. Plug in composite video (NTSC/PAL) output to any of the RCA Phono connectors (X2, X3, X4, X5 and X6) on analogue camera module (ACM).

3. Refer pin assignment details for settings:

   Top Side Connectors: Pin Assignments

4. Power-On the Colibri/Apalis evaluation board. One of the LEDs on analogue camera module will light to indicate the presence of the 3.3V as per jumper setting (JP2).

5. Refer article “How to use Analogue Camera Module ” for getting stated with Analogue Camera Module (ACM):

   http://developer.toradex.com/knowledge-base/how-to-use-analogue-camera-module-on-wince

   http://developer.toradex.com/knowledge-base/how-to-use-analogue-camera-module-on-embedded-linux

3. ACM Interfaces

3.1. Top Side Connectors: Physical Drawing

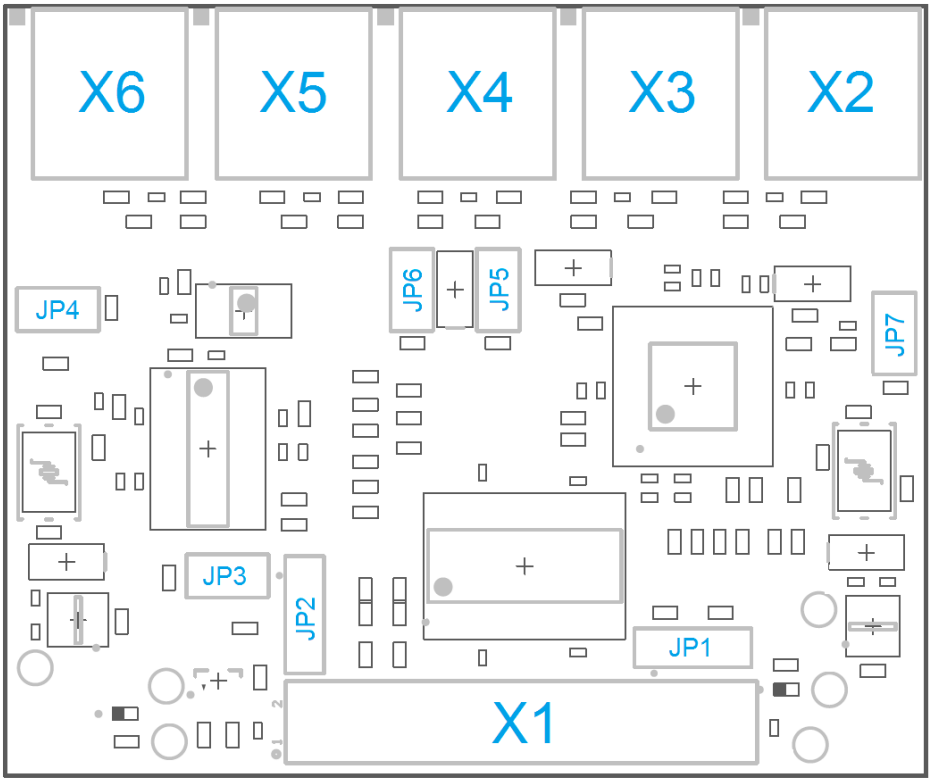


Fig.2 ACM connectors – Top Side

Ref	Device	Description
X1		Parallel Camera Output
X2		Video Input 1
X3		Video Input 2
X4		Video Input 3
X5		Video Input 4
X6		Video Input 5
JP1		Hardware Interrupt Output
JP2		MAX9526/ADV7180 Power Control (Selection)
JP3	MAX9526	I2C Device Address Select Input
JP4	MAX4586	I2C Device Address Select Input
JP5	ADV7180	Reset Input
JP6	ADV7180	I2C Device Address Select Input
JP7	ADV7180	Power Down Input

3.2. Top Side Connectors/Jumpers:

3.2.1 Parallel Camera (X1)

Type: 2x12Pin Header Male, 2.54mm

Pin No.	Signal Name	IO Type	Voltage	Pullup/Pulldown	Remark
1	+3.3	PWR			
2	+3.3	PWR			
3	CIF_MCLK	IO	+3V3		
4	CIF_PCLK	IO	+3V3		
5	CIF_HSYNC	IO	+3V3		
6	CIF_VSYNC	IO	+3V3		
7	CIF_D_0	IO	+3V3		
8	CIF_D_1	IO	+3V3		
9	CIF_D_2	IO	+3V3		
10	CIF_D_3	IO	+3V3		
11	CIF_D_4	IO	+3V3		
12	CIF_D_5	IO	+3V3		
13	CIF_D_6	IO	+3V3		
14	CIF_D_7	IO	+3V3		
15	I2C_SCL	IO	+3V3	1.8k to +3V3	
16	I2C_SDA	IO	+3V3	1.8k to +3V3	
17	CIF_D_8	IO	+3V3		
18	CIF_D_9	IO	+3V3		
19	GND	PWR			
20	GND	PWR			
21	CIF_D_10	IO	+3V3		Hardware Interrupt Signal
22	CIF_D_11	IO	+3V3		Power Control
23	+3.3V	PWR			
24	+5V	PWR			

Notes 1:

1) Hardware Interrupt Signal at CIF_D_10:
   a. CIF_D_10 can be used to receive an interrupt signal from the MAX9526 or ADV7180 decoder.
   b. Refer to section 3.2.2 Hardware Interrupt Output (JP1), for the jumper setting.

2) Power Control at CIF_D_11:
   a. Move zero-ohm resistor on the Analogue Camera Module from R3 to R1.
   b. If the signal CIF_D_11 is high, the power is OFF and if the signal CIF_D_11 is low, the power is ON.

3.2.2 Hardware Interrupt Output (JP1)

Type: 1x3Pin Header Male, 2.54mm

Pin No.	Signal Name	IO Type	Voltage	Pullup/Pulldown
1	IRQ_MAX9526#	O	+3V3	Pulled up
2	CIF_D_10	O	+3V3	
3	IRQ_ADV7180#	O	+3V3	Pulled up

To select MAX9526 Hardware Interrupt: Place Jumper between Pin-1 and Pin-2
To select ADV7180 Hardware Interrupt: Place Jumper between Pin-3 and Pin-2
Note: By default the Jumper is placed between Pin-1 and Pin-2.

3.2.3 MAX9526/ADV7180 Power Control (JP2)

Type: 1x3Pin Header Male, 2.54mm

Pin No.	Signal Name	IO Type	Voltage	Pullup/Pulldown
1	VDD_3V3_B	PWR	+3V3	
2	VDD_3V3	PWR	+3V3	
3	VDD_3V3_A	PWR	+3V3	

To select ADV7180 Decoder: Place Jumper between Pin-1 and Pin-2
To select MAX9526 Decoder: Place Jumper between Pin-3 and Pin-2
Note: By default the Jumper is placed between Pin-3 and Pin-2.

3.2.4 MAX9526, I2C Device Address Select Input (JP3)

Type: 1x2Pin Header Male, 2.54mm

Pin No.	Signal Name	IO Type	Voltage	Pullup/Pulldown
1	MAX9526, DEVADR (Pin 9)	PWR	+3V3	Pulled up
2	GND	PWR	0V	

Short Circuit (active low on DEVADR (Pin 9), Device Address: 0x42
Open Circuit (active high on DEVADR (Pin 9), Device Address: 0x40

3.2.5 MAX4586, I2C Device Address Select Input (JP4)

Type: 1x2Pin Header Male, 2.54mm

Pin No.	Signal Name	IO Type	Voltage	Pullup/Pulldown
1	MAX4586, A (Pin 2)	PWR	+5V	Pulled up
2	GND	PWR	0V	

Short Circuit (active low on A (Pin 2), Device Address: 0x6A
Open Circuit (active high on A (Pin 2), Device Address: 0x6E
Note: 3.3V supply can also be used to pull-up MAX4586, I2C Device Address Select Input.

3.2.6 ADV7180, I2C Device Address Select Input (JP6)

Type: 1x2Pin Header Male, 2.54mm

Pin No.	Signal Name	IO Type	Voltage	Pullup/Pulldown
1	ADV7180, ALSB (Pin 38)	PWR	+3V3	Pulled up
2	GND	PWR	0V	

Short Circuit (active low on ALSB (Pin 38), Device Address: 0x40
Open Circuit (active high on ALSB (Pin 38), Device Address: 0x42

3.2.7 ADV7180, Reset Input (JP5)

Type: 1x2Pin Header Male, 2.54mm

Pin No.	Signal Name	IO Type	Voltage	Pullup/Pulldown
1	ADV7180, $\overline{RESET}$ (Pin 37)	PWR	+3V3	Pulled up
2	GND	PWR	0V	

To reset ADV7180 decoder, short circuit JP5 (active low on $\overline{\mathbf{RESET}}$ pin)

3.2.8 ADV7180, Power down Input (JP7)

Type: 1x2Pin Header Male, 2.54mm

Pin No.	Signal Name	IO Type	Voltage	Pullup/Pulldown
1	ADV7180, $\overline{PWRDWN}$ (Pin 21)	PWR	+3V3	Pulled up
2	GND	PWR	0V	

To power-down ADV7180 decoder, short circuit JP7 (active low on $\overline{\mathbf{PWRDWN}}$ pin)

3.3. LEDs

There are two LEDs on the top side of the PCB; they are tuned on if the power supply circuit is correctly providing 3.3 (VDD_3V3_A) and 3.3 (VDD_3V3_B) power rails.

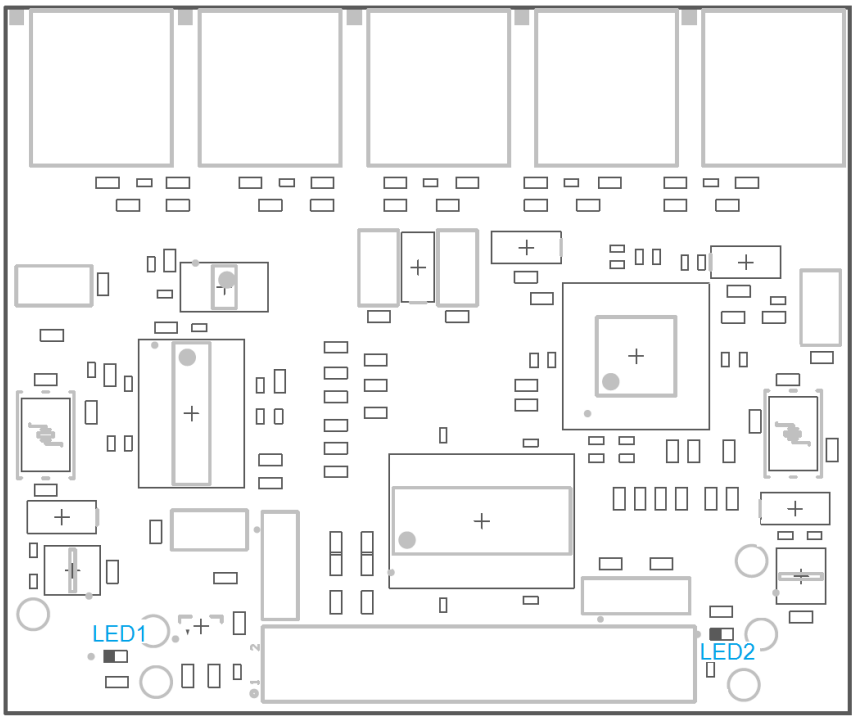


Fig.3 LED Positions

Ref.	Description	Remark
LED1	3.3V	Power indication for MAX9526 decoder
LED2	3.3V	Power indication for ADV7180 decoder

4. Assembly Options

This section describes the assembly options that can be used to configure different functional options.

The following table lists all the assembly options for the design:

Solution Selected	Assembly option	PCB side
Use MAX9526 decoder and MAX4586 Multiplexer	Assemble 0 Ω resistors: R51, R55, R59, R63, R67	Top
Use ADV7180 Decoder	Assemble 0 Ω resistors: R52, R56, R60, R64, R68	Top

The above assembly option provides decoder selection. Use of both the decoder simultaneously at any time is not recommended.

In case of MAX9526 decoder - resistors R51, R55, R59, R63 and R67 need to be assembled.

In case of ADV7180 decoder - resistors R52, R56, R60, R64 and R68 need to be assembled.

Note: By default, resistors R51, R55, R59, R63 and R67 are assembled.

4.1. ACM Assembly Options - Top

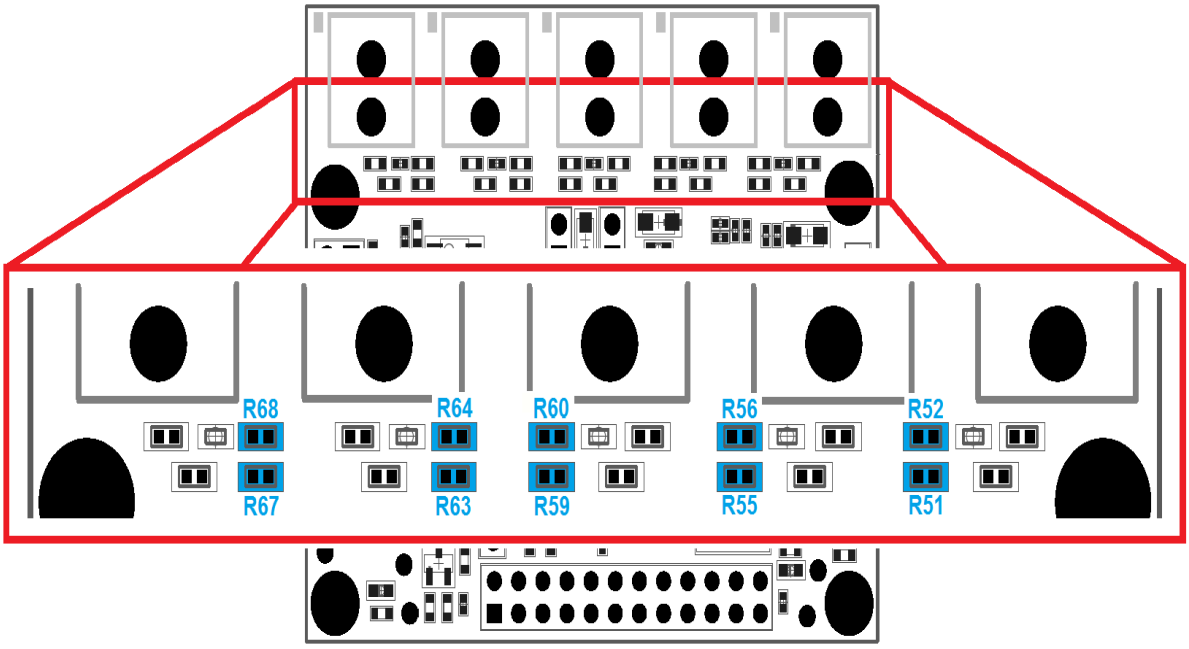


Fig.4 ACM Assembly Options – Top Side

5. Mechanical Data

5.1. Dimensions

5.1.1 ACM Dimensions Top

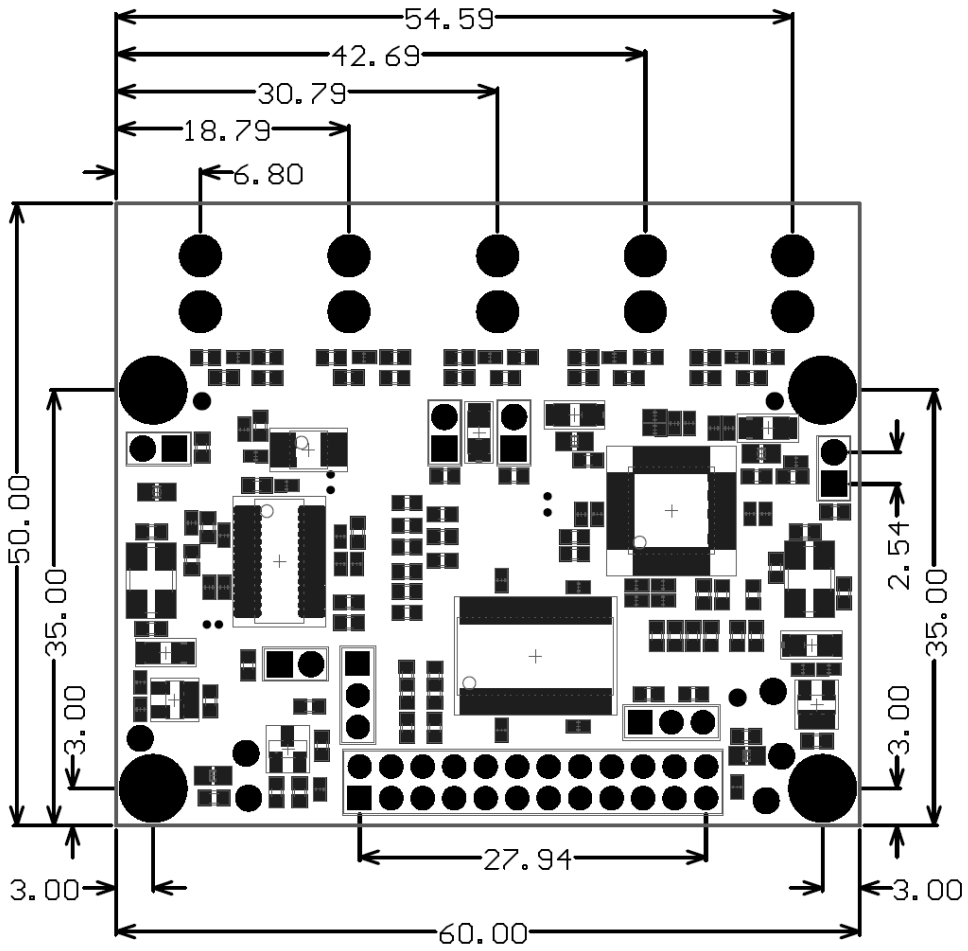


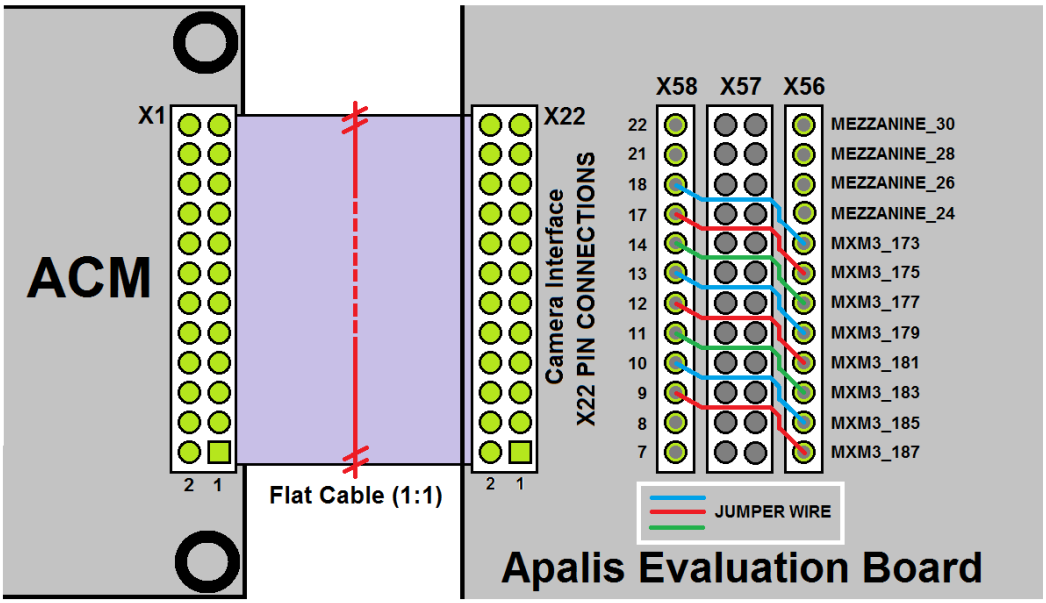
Fig.5 ACM Dimensions – Top Side (All Dimensions are in mm)

6. Pin Mapping

The 24 pins connector (X1) on the Analogue Camera Module (ACM) V1.1 is used to connect the ACM with the Toradex Carrier boards. A 24 ways IDC ribbon cable connector or custom cable can be used to connect the ACM with the Toradex Carrier boards.

6.1. Interface ACM with Apalis Evaluation Board

On Apalis Evaluation Board, User need to change the jumper settings to correctly map the parallel camera signals from the ACM. It can be done using the connectors X56, X57, and X58 on the Apalis evaluation board, as shown in figure below.



The following table describes the wiring between the connectors (X58 and X56) on the Apalis evaluation board:

Connector (X58)		Connector (X56)	Remarks
PIN_7			
PIN_8			
PIN_9	⟷	**MXM3_187 / CAM1_D0**	
PIN_10	⟷	**MXM3_185 / CAM1_D1**	
PIN_11	⟷	**MXM3_183 / CAM1_D2**	
PIN_12	⟷	**MXM3_181 / CAM1_D3**	
PIN_13	⟷	**MXM3_179 / CAM1_D4**	
PIN_14	⟷	**MXM3_177 / CAM1_D5**	
PIN_17	⟷	**MXM3_175 / CAM1_D6**	
PIN_18	⟷	**MXM3_173 / CAM1_D7**	
PIN_21			
PIN_22			

6.2. Interface ACM with Ixora Carrier Board

A custom cable will be required to interface ACM with the Ixora carrier board due to the difference in pin mapping between the Ixora carrier board connector (X14) and the ACM connector (X1).

The following table describes the wiring between the ACM connectors (X1) and the Ixora carrier board connector (X56):

ACM Connector (X1)		Ixora Carrier Board Connector (X14)	Remarks
PIN_1 / +3.3V	⟷	PIN_1 / +3.3V	
PIN_2 / +3.3V	⟷	PIN_2 / +3.3V	
PIN_3 / CIF_MCLK			
PIN_4 / CIF_PCLK	⟷	PIN_4 / CAM1_PCLK	
PIN_5 / CIF_HSYNC	⟷	PIN_5 / CAM1_HSYNC	
PIN_6 / CIF_VSYNC	⟷	PIN_6 / CAM1_VSYNC	
PIN_7 / CIF_D_0			
PIN_8 / CIF_D_1			
PIN_9 / CIF_D_2 (Data_Bit_0)	⟷	PIN_7 / CAM1_D0	
PIN_10 / CIF_D_3 (Data_Bit_1)	⟷	PIN_8 / CAM1_D1	
PIN_11 / CIF_D_4 (Data_Bit_2)	⟷	PIN_9 / CAM1_D2	
PIN_12 / CIF_D_5 (Data_Bit_3)	⟷	PIN_10 / CAM1_D3	
PIN_13 / CIF_D_6 (Data_Bit_4)	⟷	PIN_11 / CAM1_D4	
PIN_14 / CIF_D_7 (Data_Bit_5)	⟷	PIN_12 / CAM1_D5	
PIN_15 / I2C_SCL	⟷	PIN_15 / I2C_CAM1_SCL	
PIN_16 / I2C_SDA	⟷	PIN_16 / I2C_CAM1_SDA	
PIN_17 / CIF_D_8 (Data_Bit_6)	⟷	PIN_13 / CAM1_D6	
PIN_18 / CIF_D_9 (Data_Bit_7)	⟷	PIN_14 / CAM1_D7	
PIN_19 / GND	⟷	PIN_19 / GND	
PIN_20 / GND	⟷	PIN_20 / GND	
PIN_21 / CIF_D_10 (HW_IRQ), *Refer Notes 1*			
PIN_22 / CIF_D_11 (PWR_CTRL), *Refer Notes 1*			
PIN_23 / +3.3V			
PIN_24 / +5V			

6.3. Interface ACM with Colibri Evaluation Board V3.2

On Colibri Evaluation Board V3.2, the Parallel Camera Interface header (X22) pinout has been updated to maintain the compatibility with the Apalis Evaluation Board. Thus a custom connector will be required to connect the ACM V1.1 to the Colibri Evaluation Board V3.2.

The following table describes the wiring between the ACM connectors (X1) and the Colibri Evaluation Board V3.2 connector (X22):

ACM Connector (X1)		Colibri Evaluation Board V3.2 Connector (X22)	Remarks
PIN_1 / +3.3V	⟷	PIN_1 / +3.3V	
PIN_2 / +3.3V	⟷	PIN_2 / +3.3V	
PIN_3 / CIF_MCLK			
PIN_4 / CIF_PCLK	⟷	PIN_4 / CIF_PCLK	
PIN_5 / CIF_HSYNC	⟷	PIN_5 / CIF_HSYNC	
PIN_6 / CIF_VSYNC	⟷	PIN_6 / CIF_VSYNC	
PIN_7 / CIF_D_0			
PIN_8 / CIF_D_1			
PIN_9 / CIF_D_2 (Data_Bit_0)	⟷	PIN_7 / CIF_D_2	
PIN_10 / CIF_D_3 (Data_Bit_1)	⟷	PIN_8 / CIF_D_3	
PIN_11 / CIF_D_4 (Data_Bit_2)	⟷	PIN_9 / CIF_D_4	
PIN_12 / CIF_D_5 (Data_Bit_3)	⟷	PIN_10 / CIF_D_5	
PIN_13 / CIF_D_6 (Data_Bit_4)	⟷	PIN_11 / CIF_D_6	
PIN_14 / CIF_D_7 (Data_Bit_5)	⟷	PIN_12 / CIF_D_7	
PIN_15 / I2C_SCL	⟷	PIN_15 / I2C_SCL	
PIN_16 / I2C_SDA	⟷	PIN_16 / I2C_SDA	
PIN_17 / CIF_D_8 (Data_Bit_6)	⟷	PIN_13 / CIF_D_8	
PIN_18 / CIF_D_9 (Data_Bit_7)	⟷	PIN_14 / CIF_D_9	
PIN_19 / GND	⟷	PIN_19 / GND	
PIN_20 / GND	⟷	PIN_20 / GND	
PIN_21 / CIF_D_10 (HW_IRQ) *Refer Notes 1*	⟷	PIN_21 / CIF_D_10	
PIN_22 / CIF_D_11 (PWR_CTRL) *Refer Notes 1*	⟷	PIN_22 / CIF_D_11	
PIN_23 / +3.3V	⟷	PIN_23 / +3.3V	
PIN_24 / +5V	⟷	PIN_24 / +5V	

6.4. Interface ACM with Colibri Evaluation Board V3.1

ACM connector (X1) pinout is 1:1 mapped with the Colibri Evaluation Board V3.1 connector X22. A 24 ways IDC ribbon cable connector (1:1) can be used to connect the ACM with the Colibri Evaluation Board V3.1.

7. Design Data

The Analogue Camera Module (ACM) design data is available in Altium Designer Release 10 format and includes schematics, layout and component libraries.

Refer to the following link to download design data:

http://developer.toradex.com/product-selector/analogue-camera-module/

http://developer.toradex.com/hardware-resources/arm-family/carrier-board-design