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e-CAM30A_CUMI0330_MOD

Camera Module Datasheet

Revision 1.1
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Contents

e-CAM30A_CUMI0330_MOD

1. Revision History

Rev	Date	Description	Author
1.0	30-Apr-2019	Initial draft	Hardware Team
1.1	22-May-2019	Caution note added in lens holder section 8.2	Hardware Team

2. Introduction

e-CAM30A_CUMI0330_MOD is a low voltage, small form factor, high performance 3.4 MP pluggable camera module with S-Mount lens holder. It is based on AR0330CS CMOS image sensor from ON Semiconductor®. e-CAM30A_CUMI0330_MOD is designed to connect with any application processor that has MIPI interface. The standard S-Mount lens holder can accommodate a wide range of lenses based on your choice.

This document serves as the datasheet for e-CAM30A_CUMI0330_MOD with electrical, mechanical and software features.

3. Disclaimer

The specifications and features of e-CAM30A_CUMI0330_MOD camera board are provided here as reference only and e-con Systems reserves the right to edit/modify this document without any prior intimation of whatsoever.

5. Description

e-CAM30A_CUMI0330_MOD is a small, low-power, high performance 3.4MP camera module with a built-in ISP. The camera module is based on AR0330CS CMOS image sensor from ON Semiconductor®. The AR0330 is a 1/3” optical form-factor, CMOS Image sensor with an electronic rolling shutter.

e-CAM30A_CUMI0330_MOD is based on the ON Semiconductor® AR0330CS image sensor. It can stream uncompressed VGA at 60 fps, HD at 60 fps (720p60), FHD at 60 fps (1080p60), 3MP (2304 x 1296) at 60 fps and 3.4MP at 50 fps in UYVY formats.

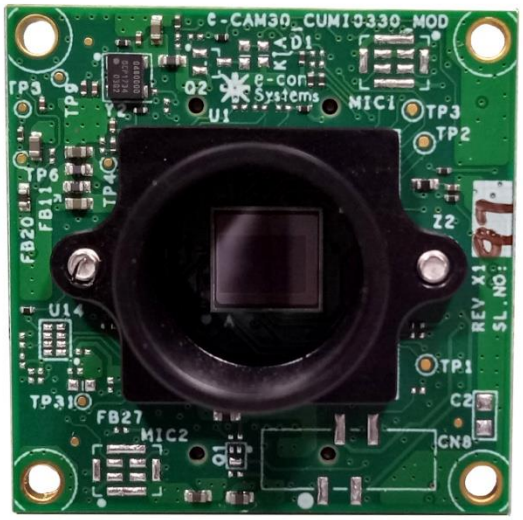

Figure 1: e-CAM30A_CUMI0330_MOD Camera Module

5.1 Camera Module Features

The features of camera module are as follows:

- 1/3” Optical form-factor, 3.4 MP camera.
- 16-bits of UYVY data per pixel.
- MIPI CSI-2 video output.
- Capable of high frame rate uncompressed video.

  - VGA (640x480) at 60 fps
  - HD (1280x720) at 60 fps
  - FHD (1920x1080) at 60 fps
  - 3 MP (2304 x 1296) at 60 fps
  - 3.4MP (2304 x 1536) at 50 fps
- LED control signals and STROBE output signal for firing the illumination LED or mechanical shutter.
- Manual exposure and Auto exposure controls.
- Supports digital zoom control.
- Small form-factor pluggable camera module with S-mount lens holder.
- M12P0.5 (also known as S-Mount) lens holder compatible with off-the-shelf M12 lenses.
- 30mm x 30mm size. Height depends on the lens.
- Restriction of Hazardous Substances (RoHS)compliant.
- Two 20-pin SMT connectors.
- Power consumption: about 300mW while streaming 3.4MP at 24fps.

5.2 CMOS Image Sensor Features

The features of CMOS image sensor are as follows:

- AR0330CS - 3.4 MP RAW-12bit CMOS image sensor from ON Semiconductor®.
- 10-bit or 12-bit of RAW information per pixel.
- 1/3” optical form-factor.
- 2.2µm pixel size.
- Responsivity: 2.0V/lux-sec.
- Dynamic range: 69.5 dB.
- SNR_{MAX}: 39 dB.

5.3 Maximum Frame Rate Supported

The maximum frame rate supported by e-CAM30A_CUMI0330_MOD is listed in following table.

Mode/Resolution	640x480	1280x720HD	1920x1080FHD	3MP	3.4MP
Uncompressed UYVY	60	60	60	60	50

Table 1: Maximum Frame Rate Supported

6. Pin Description

e-CAM30A_CUMI0330_MOD has two dual row, 20-pin connectors. The signal names, pin type, pin numbers and their description are listed in the following tables.

CN1Pin No	Signal Name	Pin type	Description
1	MDN2	OUTPUT	MIPI Data Lane 2 Differential Pair -

2	MDN0	OUTPUT	MIPI Data Lane 0 Differential Pair -
3	MDP2	OUTPUT	MIPI Data Lane 2 Differential Pair +
4	MDP0	OUTPUT	MIPI Data Lane 0 Differential Pair +
5	GND	POWER	Ground signal for digital and analog
6	GND	POWER	Ground signal for digital and analog
7	VCC5	POWER	5V Supply (Input of DVDD regulator section)
8	VCC3P3	POWER	3.3V Supply
9	VCC5	POWER	5V Supply (Input of DVDD regulator section)
10	VCC3P3	POWER	3.3V Supply
11	GND	POWER	Ground signal for digital and analog
12	GND	POWER	Ground signal for digital and analog
13	MDN3	OUTPUT	MIPI Data Lane 3 Differential Pair -
14	MCN	OUTPUT	MIPI Clock Lane Differential Pair -
15	MDP3	OUTPUT	MIPI Data Lane 3 Differential Pair +
16	MCP	OUTPUT	MIPI Clock Lane Differential Pair +
17	GND	POWER	Ground signal for digital and analog
18	VCC1P8	POWER	1.8 V Supply for IO Domain
19	VCC1P8	POWER	1.8 V Supply for IO Domain
20	VCC1P8	POWER	1.8 V Supply for IO Domain

Table 2: e-CAM30A_CUMI0330_MOD CN1 Pin Description

CN2 Pin No	Signal Name	Pin type	Description
1	VCC2P8	POWER	2.8V Supply for Analog Domain
2	MDN1	OUTPUT	MIPI Data Lane 1 Differential Pair -
3	VCC2P8	POWER	2.8V Supply for Analog Domain
4	MDP1	OUTPUT	MIPI Data Lane 1 Differential Pair +
5	GND	POWER	Ground signal for digital and analog
6	GND	POWER	Ground signal for digital and analog
7	SCL	INPUT	1.8V IO Sensor I2C SCL signal (has Internally pull-up of 4.7KΩ resistor)
8	SCLK	INPUT	1.8V IO Serial clock for SPI flash
9	SDA	I/O	1.8V IO Sensor I2C SDA signal (has Internally pull-up of 4.7KΩ resistor)
10	CS	INPUT	1.8V IO Chip select pin for SPI flash
11	nRST	INPUT	1.8V IO Sensor reset control (Active low signal)
12	MOSI	INPUT	1.8V IO Master out slave in pin of SPI flash
13	PWDN	INPUT	1.8V IO Sensor power down control (Active

			high signal)
14	MISO	OUTPUT	1.8V IO Master in slave out pin of SPI flash
15	NC	-	No Connection
16	GND	POWER	Ground signal for digital and analog
17	RSVD	--	Reserved
18	TRIGGER	INPUT	1.8V IO Trigger signal for camera
19	GPIO	I/O	1.8V IO General purpose I/O of camera
20	STROBE	OUTPUT	1.8V IO Strobe signal from Camera

Table 3: e-CAM30A_CUMI0330_MOD CN2 Pin Description

6.1 Mating Connector Detail

The following table lists connectors used in e-CAM30A_CUMI0330_MOD and its compatible mating connector.

Connector	Description	Manufacturer	Part Number
On-board connector	Board - Board, 20-Pin 0.635 mm pitch Vertical SMD. Connector mounted on e-CAM30A_CUMI0330_MOD.	Samtec	LSS-110-01-H-DV-A
Mating connector(suggested)	Board - Board, 20-Pin 0.635 mm pitch Vertical SMD (1 to 2 mating).	Samtec	LSS-110-01-H-DV-A

Table 4: e-CAM30A_CUMI0330_MOD Mating Connector Details

7 Electrical Specification

The values described in this section are measured in e-con Systems lab and this can be used as reference only. The current measurements are typical values and are subject to change for different camera boards under different conditions. However, these values can be taken as a reference for power estimation and power supply design.

The electrical specification of e-CAM30A_CUMI0330_MOD can be defined in the following ways:

- Recommended Operating Condition
- Functional Temperature Range
- DC Characteristics
- I2C Interface Timing Characteristics
- Power-Up Sequence

7.1 Recommended Operating Condition

The typical conditions are EXTCLK = 24 MHz, VDD = 1.8V, VDD_IO = 1.8V, VAA = 2.8V, VAA_PIX = 2.8V, VDD_PLL = 2.8V, Output load = 68.5pF, TJ = 60°C, Data Rate =588 Mbps, DLL set to 0, 2304x1296 at 30 fps.

The recommended operating voltage and current consumption of e-

CAM30A_CUMI0330_MODis listed in following table.

Parameter	Typical Operating Voltage	Current consumption
VCC1P8	1.8V	191mA Typical
VCC2P8	2.8V	141mA Typical
VCC3P3	3.3V	5mA Typical
VCC5	5V	150mA Typical

Table 5: Typical Power Consumption

7.2 Functional Temperature Range

The functional temperature range of e-CAM30A_CUMI0330_MOD is listed in following table.

Temperature Range	Parameter Description
-30°C to 70°C	Electrically functional operating range

Table 6: Operating Temperature Range

Note: As the temperature increases, the noise level also increases.

7.3 DC Characteristics

The typical conditions are EXTCLK = 24 MHz, VDD = 1.8V, VAA = 2.8V, VAA_PIX = 2.8V, VDD_PLL = 2.8V, Output load = 68.5pF, TJ = 60°C, CLK_OP = 98MPixel/s.

The DC characteristics of e-CAM30A_CUMI0330_MOD is listed in the following table.

Symbol	Parameter	Conditions	Min	Typical	Max	Unit
Digital Input signals						
V_{IL}	Input voltage LOW	V_{DD}_IO = 1.8 V	Gnd- 0.3		0.4	V
		V_{DD}_IO = 2.8 V	Gnd- 0.3		0.8	
V_{IH}	Input voltage HIGH	V_{DD}_IO = 1.8 V	1.4		V_{DD}_IO+0.3	V
		V_{DD}_IO = 2.8 V	2.4			
Digital Output signals						
V_{OL}	Output voltage LOW	At specified I_{OL}	-		0.4	V
V_{OH}	Output voltage HIGH	At specified I_{OH}	V_{DD}_IO - 0.4		-	V

Table 7: DC characteristics of e-CAM30A_CUMI0330_MOD

Note: e-con Systems recommends the working voltage levels to be typically 1.8V_{DC} and not to reach the maximum limit.

7.4 I2C Interface Timing Characteristics

The timing diagram of e-CAM30A_CUMI0330_MODSCCB interface is shown below.

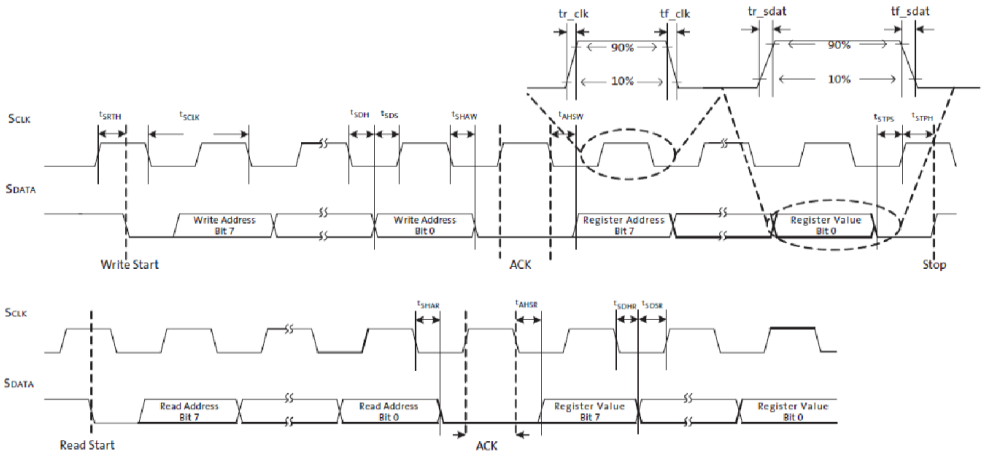

Figure 2: e-CAM30A_CUMI0330_MOD SCCB Interface Timing Diagram

7.4.1 I²C Bus Read Mode

The parameters of I²C bus read mode are listed in following table.

Parameter	Description	Minimum	Maximum	Unit
f_{SCL}	SCL clock frequency	100		kHz
t_{SHAR}	SDA hold to ACK	-	0.3*IOV_{DD}_HMISC	
t_{AHSR}	ACK hold to SDA	-		
t_{SDHR}	Data hold time	10		ns
t_{SDSR}	Data setup time	100		µs
V_{dOL}	Low level data output voltage	-		V
V_{dIH}	High level data output voltage	0.7*IOV_{DD}_SIPS		V

Table 8: I²C Bus Read Mode

7.4.2 I²C Bus Write Mode

The parameters of I²C bus write mode are listed in following table.

Parameter	Description	Minimum	Maximum	Unit
f_{SCLK}	S_{CLK} frequency	0	400	kHz
t_{HIGH}	S_{CLK} high period	0.6	0	µs
t_{LOW}	S_{CLK} low period	1.3		µs
t_{SRTS}	START setup time	0.6	300	µs
t_{SRTHk}	START hold time	0.6	300	µs
t_{SDS}	Data setup time	100	-	ns
t_{SDH}	Data hold time	0	Refer Note	µs
t_{SDV}	Data valid time		0.9	µs
t_{ACV}	Data valid acknowledgment time		0.9	µs
t_{STPS}	STOP setup time	0.6		µs
t_{BUF}	Bus free time between STOP and START	1.3		µs

t_R	S_{CLK} and S_{DATA} rise time		300	ns
t_F	S_{CLK} and S_{DATA} fall time		300	ns

Table 9: I²C Bus Write Mode

Note: Exposure to absolute maximum rating conditions for extended periods may affect reliability.

7.5 Power-Up Sequence

e-CAM30A_CUMI0330_MOD Camera module uses 1.2V for camera's digital core power which is generated from external 5V supply. The I²C activity must not be performed during power-up sequence. The power-up sequence recommended by e-con Systems in the customer design is shown below.

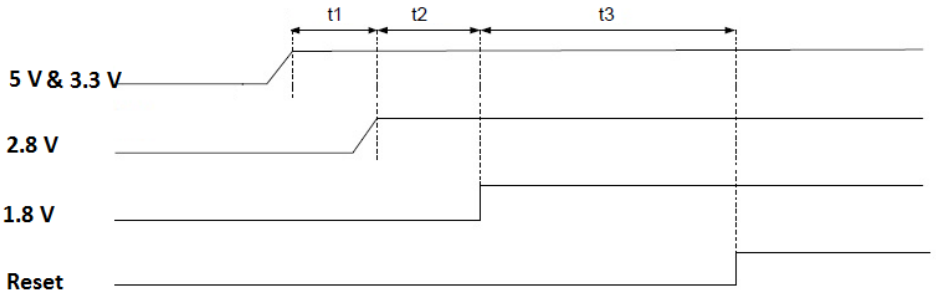

Figure 3: e-CAM30A_CUMI0330_MOD Camera Module Power-up Sequence

The power-up sequence timing parameters are listed in following table.

Symbol	Parameter	Min	Unit
t1	5V to 2.8 V delay	200	µs
t2	2.8 V to 1.8 V (IO voltage) delay	100	µs
t3	IO voltage to reset control delay	1	ms

Table 10: Power-Up Sequence Timing Parameters

8 Mechanical Specification

The module size is 30mm x 30mm and the stack-up height of the board with its mating connector is 6mm. The height of the S-Mount lens holder is 13mm and the actual height of the module above the PCB depends on the selected lens. The datasheets of the connectors, the S-mount lens holder and the modules mechanical drawing in DXF file format are available on request.

The e-CAM30A_CUMI0330_MOD board drawing and dimensions are described in the following section.

8.1 e-CAM30A_CUMI0330_MOD Module Mechanical Drawing

The top and bottom views of e-CAM30A_CUMI0330_MOD mechanical drawing with optical orientation are shown in the following figures.

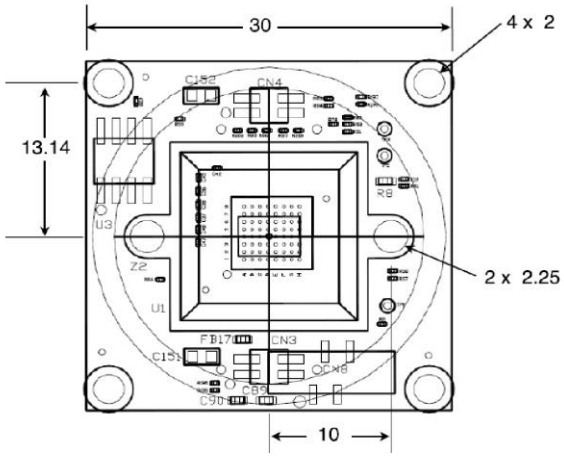

Figure 4: e-CAM30A_CUMI0330_MOD Top View with Optical Orientation

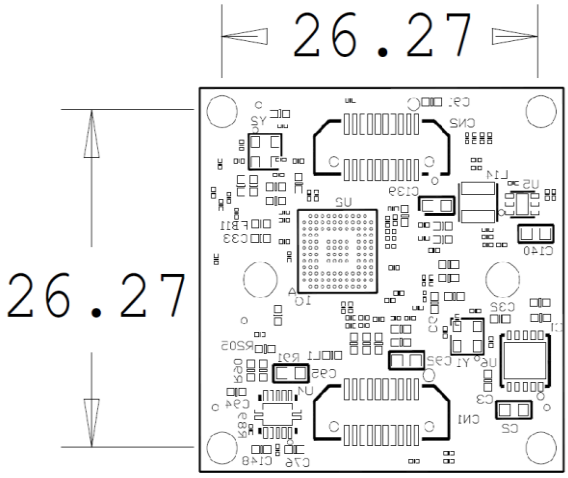

Figure 5: e-CAM30A_CUMI0330_MOD Bottom View(mirrored)

8.2 S-Mount Lens Holder Drawing

The mechanical dimension of the S-mount lens holder is shown in the following figure.

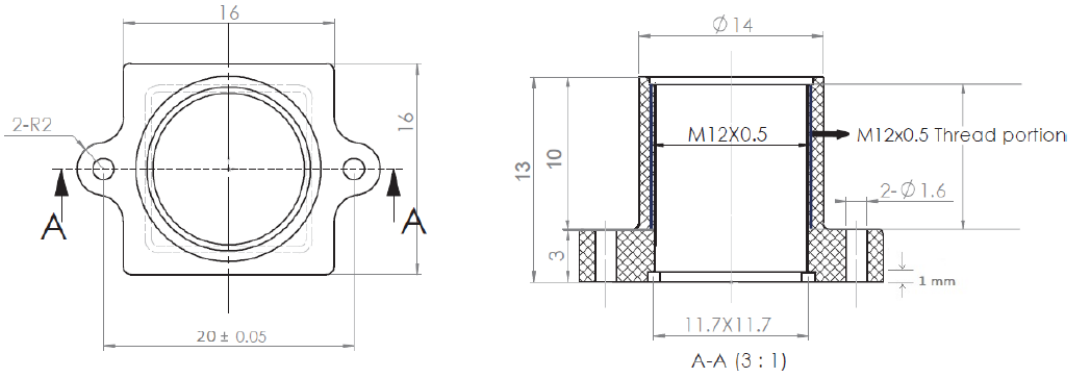

Figure 6: S-Mount holder Outline Dimension

Note: All dimensions are in mm.

Caution: While trying different lens other than the one which is shipped with e-CAM30A_CUMI0330_MOD, please make sure that the lens used, do not touches the Sensor. Some Lens might protrude for Lens filters that could damage the Sensor and also check on the compatibility of the lens with the holder, with respect to the tolerance of lens holder and lens

8.3 Mechanical Part Details

The following table lists the mechanical accessories for e-CAM30A_CUMI0330_MOD camera board.

Part	Quantity	Specification	Comments
Lens Holder	1	Standard S-Mount Lens (M12P0.5) plastic Lens holder mounted on the e-CAM30A_CUMI0330_MOD	
Lens holder screw	2	1.6mm diameter self-tapping screws	
Module connector (LSS-110-01-H-DV-A)	1	Samtec vertical SMD two 20 pin 0.635mm pitch, board-board connector.	

Table 11: Mechanical Parts Details

Support

Contact Us

If you need any support on e-CAM30A_CUMI0330_MOD product, please contact us using the Live Chat option available on our website - https://www.e-consystems.com/

Creating a Ticket

If you need to create a ticket for any type of issue, please visit the ticketing page on our website - https://www.e-consystems.com/create-ticket.asp

RMA

To know about our Return Material Authorization (RMA) policy, please visit the RMA Policy page on our website - https://www.e-consystems.com/RMA-Policy.asp

General Product Warranty Terms

To know about our General Product Warranty Terms, please visit the General Warranty Terms page on our website - https://www.e-consystems.com/warranty.asp