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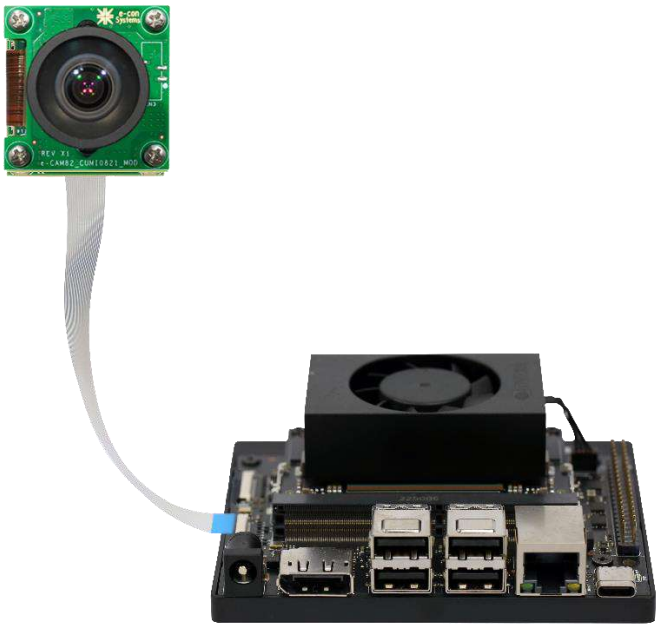
# e-CAM81_CUONX



# Datasheet

**Revision 1.1**
20th December 2023

# Contents

# 1 Revision History

| Rev | Date | Major Changes | Author |
|---|---|---|---|
| 1.0 | 06-June-2023 | Initial draft | Camera Team |
| 1.1 | 20-Dec-2023 | Supported two lane configurations and updated power consumption details | Camera Team |

# 2 Introduction

The e-CAM81_CUONX is a camera board which is designed and developed by e-con Systems, a leading Embedded Product Design Services Company which specializes in the advanced camera solutions. This camera board targets the NVIDIA® Jetson Orin Nano™/Orin NX™ development kits and can be directly interfaced with it through a CAM1 connector on 4 lane configuration and both connectors in 2 lane configurations.

e-CAM81_CUONX is an HDR, 8 MP custom lens camera module based on 1/1.7" AR0821 CMOS image sensor from onsemi™. It is a color camera which supports UYVY image format and provided with S-mount (also known as M12 board lens) lens holder. The S-mount is small form-factor lens mount for camera boards. e-con Systems provides the sample applications that demonstrates the features of this camera. However, this camera can also be utilized by any Video for Linux version 2 (V4L2) application.

This document describes about the features of e-CAM81_CUONX board and the pinouts of the connectors including the mechanical diagram.

# 3 Disclaimer

The specifications and features of e-CAM81_CUONX 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.

# 4 Description

Jetson Orin Nano™/Orin NX™ is a small size, low power, AI system-based evaluation boards developed by NVIDIA® which supports one 4-lane MIPI CSI-2 camera connection and two individual 2-lane MIPI CSI-2 camera connections. e-CAM81_CUONX uses this 4-lane MIPI CSI for connecting 8 MP camera module.

e-CAM81_CUONX is a multi-board solution, which has two boards as follows:

- Camera module (e-CAM82_CUMI0821_MOD)
- Adaptor board (ACC-RB-WTB-ADP)

The camera module is a small, low-power, high performance 8 MP camera with a built-in ISP. It is based on AR0821 CMOS image sensor from onsemi™. The AR0821 is a 1/1.7" optical form-factor, CMOS image sensor with a rolling shutter.

The following table lists the supported frame rates of e-CAM81_CUONX camera module.

| Resolution | Day HDR Frame Rate (fps) | Night HDR Frame Rate (fps) | Linear Frame Rate (fps) |
|---|---|---|---|
| 1280 x 720 | 30 | 60 | 60 |
| 1920 x 1080 | 30 | 60 | 60 |
| 3840 x 2160 | 16 | 16 | 16 |

**Table 1: Supported Resolution and Frame Rates in 2 Lane**

| Resolution | Day HDR Frame Rate (fps) | Night HDR Frame Rate (fps) | Linear Frame Rate (fps) |
|---|---|---|---|
| 1280 x 720 | 30 | 60 | 60 |
| 1920 x 1080 | 30 | 60 | 60 |
| 3840 x 2160 | 30 | 30 | 30 |

**Table 2: Supported Resolution and Frame Rates in 4 Lane**

The e-CAM81_CUONX camera module has a dual row 26-pin Samtec connector (CN2) for mating with the ACC-RB-WTB-ADP adapter board. This adapter board acts as a bridge between the camera module and the Jetson Orin Nano™/Jetson Orin NX™ development kits. It supplies the voltages required for camera module. e-CAM81_CUONX adapter board consists of a 22-pin FFC connector (CN1) through which e-CAM81_CUONX is connected to Jetson Orin Nano™/Jetson Orin NX™ development kit using the 15 cm FPC cable. The adapter board also has GPIO connector (CN3) to support external trigger.

## 4.1 Features

The features of e-CAM81_CUONX are as follows:

- Multi-board solution
- 8 MP rolling shutter camera sensor with uncompressed UYVY format
- Compatible with Jetson Orin Nano™/Jetson Orin NX™ development kit
- Standard M12 lens holder for use with customized optics or lenses for various applications
- Light weight, versatile, and portable design
- Imaging applications
  - 8 MP CMOS image sensor with 1/1.7" optical form-factor
  - Still capture supported resolution: HD (1280 x 720), FHD (1920 x 1080), 3840 x 2160
  - Video streaming supported resolution: HD (1280 x 720), FHD (1920 x 1080), 3840 x 2160
- Linux camera driver (V4L2) for 8 MP MIPI CSI-2 camera module is supported
- Maximum power consumed: 1.5W
- Operating temperature range: − 30°C to 70°C
- RoHS compliant
- External Trigger is supported

# 5 Key Specifications

The following table lists the key specifications of e-CAM81_CUONX.

| Description | Specification |
|---|---|
| Size (L x W) | 30 mm × 30 mm |
| Video format | UYVY |
| Maximum image resolution | 3840 x 2160 |
| Supported OS | Linux |

**Table 3: Key Specifications of e-CAM81_CUONX**

## 5.1 CMOS Image Sensor Specifications

The following table lists the specifications of the CMOS image sensor used in the e-CAM81_CUONX camera board.

| Sensor Specification | |
|---|---|
| Type/Optical size | 1/1.7" optical format CMOS image sensor |
| Resolution | 8 MP |
| Image Format | UYVY-Electronic rolling shutter |
| Pixel size | 2.1 µm |
| Sensor active area | 3848 (H) x 2168 (V) |
| SNR | 41.8 dB |
| Dynamic range | >140 dB |

**Table 4: CMOS Image Sensor Specification**

For more information about the AR0821 sensor or for datasheet, please contact onsemi™.

# 6 Pin Description

e-CAM81_CUONX adapter board has three connectors CN1, CN2 and CN3. The CN2 is dual row 26-pin Samtec connector, used for direct mating with the camera module, whereas CN1 is a single row 22-pin connector, used for connecting with Jetson Orin Nano™/Orin NX™ development kit through the FPC cable. The dual row connector is 1 to 1 mating type connectors. The CN3 is a 4-pin board to cable connector, used to give external trigger input to the camera.

The connectors on e-CAM81_CUONX adapter board are shown in the following figure.

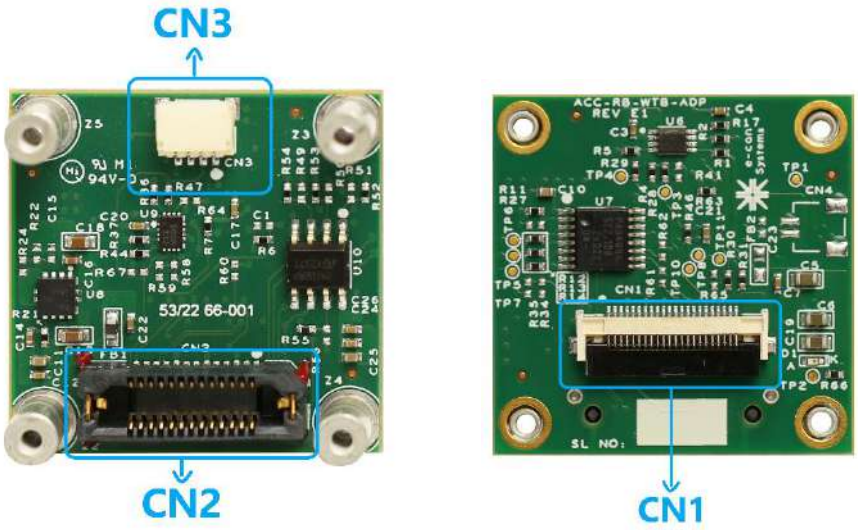



**Figure 1: Connectors in CAM81_CUONX Adapter Board**

The pin descriptions of connectors are explained in the following sections.

- Pin-out Details of Adapter Board Dual Row Connector (CN2)

## 6.1 Pin-out Details of Adapter Board Dual Row Connector (CN2)

The following table lists the pin-out details of CN2 connector.

| CN2 Pin No | Signal Name | Pin Type | Description |
|---|---|---|---|
| 1 | MIPI_CLK_N | INPUT | MIPI clock lane differential pair - |
| 2 | MIPI_DATA0_N | INPUT | MIPI data lane 0 differential pair - |
| 3 | MIPI_CLK_P | INPUT | MIPI clock lane differential pair + |
| 4 | MIPI_DATA0_P | INPUT | 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 | MIPI_DATA2_N | INPUT | MIPI data lane 2 differential pair - |
| 8 | I2C_SCL | INPUT | 1.8V I/O I2C clock signal |
| 9 | MIPI_DATA2_P | INPUT | MIPI data lane 2 differential pair + |
| 10 | I2C_SDA | I/O | 1.8V I/O I2C data signal |
| 11 | GND | POWER | Ground signal for digital and analog |
| 12 | CAM_RESET | OUTPUT | 1.8V I/O active low reset signal for camera module with internal 4.7K pull up resister |
| 13 | MIPI_DATA3_N | INPUT | MIPI data lane 3 differential pair - |
| 14 | CAM_BOOT0 | OUTPUT | 1.8V I/O Boot Signal for camera module with internal 470K pull down resister |
| 15 | MIPI_DATA3_P | INPUT | MIPI data lane 3 differential pair + |
| 16 | GND | POWER | Ground signal for digital and analog |
| 17 | GND | POWER | Ground signal for digital and analog |
| 18 | Reserved | RSVD | Reserved for future use |
| 19 | MIPI_DATA1_N | INPUT | MIPI data lane 1 differential pair - |
| 20 | NC | - | NC |
| 21 | MIPI_DATA1_P | INPUT | MIPI data lane 1 differential pair + |
| 22 | NC | - | NC |
| 23 | GND | POWER | Ground signal for digital and analog |
| 24 | TRIGGER | OUTPUT | 1.8V I/O Trigger signal for sensor |
| 25 | Reserved | RSVD | Reserved for future use |
| 26 | VCC_3P3 | POWER | 3.3V power supply for camera boards |

**Table 5: Adapter Board CN2 Connector Pin Description Details**

## 6.2 Pin-out Details of Adapter Board FPC Connector (CN1)

The following table lists the pin-out details of CN1 connector.

| CN1 Pin No | Signal Name | Pin Type | Description |
|---|---|---|---|
| 1 | GND | POWER | Ground signal for digital and analog |
| 2 | MIPI_DATA0_N | OUTPUT | MIPI data lane 0 differential pair - |
| 3 | MIPI_DATA0_P | OUTPUT | MIPI data lane 0 differential pair + |
| 4 | GND | POWER | Ground signal for digital and analog |
| 5 | MIPI_DATA1_N | OUTPUT | MIPI data lane 1 differential pair - |
| 6 | MIPI_DATA1 _P | OUTPUT | MIPI data lane 1 differential pair + |
| 7 | GND | POWER | Ground signal for digital and analog |
| 8 | MIPI_CLK_N | OUTPUT | MIPI clock lane differential pair - |
| 9 | MIPI_CLK_P | OUTPUT | MIPI clock lane differential pair + |
| 10 | GND | POWER | Ground signal for digital and analog |
| 11 | MIPI_DATA2_N | OUTPUT | MIPI data lane 2 differential pair - |
| 12 | MIPI_DATA2_P | OUTPUT | MIPI data lane 2 differential pair + |
| 13 | GND | POWER | Ground signal for digital and analog |
| 14 | MIPI_DATA3_N | OUTPUT | MIPI data lane 3 differential pair - |
| 15 | MIPI_DATA3_P | OUTPUT | MIPI data lane 3 differential pair + |
| 16 | GND | POWER | Ground signal for digital and analog |
| 17 | Reserved | RSVD | Reserved for future use |
| 18 | Reserved | RSVD | Reserved for future use |
| 19 | GND | POWER | Ground signal for digital and analog |
| 20 | I2C_3P3_SCL | INPUT | 3.3V I/O I2C SCL signal |
| 21 | I2C_3P3_SDA | I/O | 3.3V I/O I2C SCL signal |
| 22 | VCC_3P3 | POWER | 3.3V input power supply for camera board |

**Table 6: Adapter Board CN1 Connector Pin Description Details**

## 6.3 Pin-out Details of Adapter Board Trigger Connector (CN3)

The following table lists the pin-out details of CN3 connector.

| CN3 Pin No | Signal Name | Pin Type | Description |
|---|---|---|---|
| 1 | VCC_3P3 | POWER | 3.3V power supply for external circuitry |
| 2 | TRIGGER | INPUT | 3.3V I/O active high trigger input with internal 4.7K pull down resister |
| 3 | Reserved | RSVD | Reserved for future use |
| 4 | GND | POWER | Ground signal for digital and analog |

**Table 7: Adapter Board CN3 Connector Pin Description Details**

## 6.4 Connector Part Numbers

The following table lists the connectors and cables used in e-CAM81_CUONX and its compatible mating connector and cable.

| Connector | Description | Manufacturer | Part Number |
|---|---|---|---|
| e-CAM81_CUONX adapter board dual row connector (CN2) for mating with e-CAM81_CUONX camera module | CONN board to board receptacle outer shroud contacts P-0.80mm 26Pos dual row vertical SMT | Samtec | ERF8-013-05.0-L-DV-L-K-TR |
| Mating connector of e-CAM81_CUONX adapter board (CN2) connector details | CONN board to board header center strip contacts P-0.80mm 26Pos dual row vertical SMT | Samtec | ERM8-013-03.0-L-DV-L-K-TR |
| e-CAM81_CUONX FFC connector (CN1) for connecting with Jetson Orin Nano™/Orin NX™ development kit through FPC cable | CONN FPC top contacts P-1mm 22Pos right angle SMT | Molex | 5051102291 |
| FPC cable used for connecting e-CAM81_CUONX with Jetson Orin Nano™/Orin NX™ development kit | 22 position FFC, FPC cable 1mm pitch, 152mm length | Molex | 0151660237 |
| e-CAM81_CUONX adapter GPIO connector (CN3) for connecting with external trigger circuit | CONN header male P-1mm shrouded 4Pos right angle SMT | JST Sales America Inc | SM04B-SRSS-TB(LF)(SN) |
| Mating cable for connecting e-CAM81_CUONX CN3 GPIO connector | Cable assembly rectangular socket to socket 4 position length-152.40mm | JST Sales America Inc. | A04SR04SR30K152A |

**Table 8: e-CAM81_CUONX Connector Details**

# 7 Electrical Specification

The following sections list the electrical specification, recommended operating conditions and power consumption details of e-CAM81_CUONX.

- Recommended Operating Condition
- DC Characteristics
- Operating Temperature Range

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.

## 7.1 Recommended Operating Condition

The following table lists the recommended operating condition of e-CAM81_CUONX.

| Parameter | Typical Operating Voltage | Typical Power Consumption (W) |
|---|---|---|
| Input voltage | 3.3V | 1.5W |

**Table 9: Recommended Operating Condition**

e-CAM81_CUONX does not require any power sequence since it required only 3.3V power supply for operation.

### 7.1.1 Power Consumption Details

The following table lists the nominal power consumption details of e-CAM81_CUONX for various resolution and frame rates.

| S. No | Resolution | Day HDR Frame Rate (fps) | Supply Voltage (V) | Typical Current (mA) | Power Consumption (W) |
|---|---|---|---|---|---|
| 1 | 1280 x 720 | 30 | 3.3 | 0.495 | 1.63W |
| 2 | 1920 x 1080 | 30 | 3.3 | 0.501 | 1.65W |
| 3 | 3840 x 2160 | 16 | 3.3 | 0.366 | 1.20W |

**Table 10: Power Consumption Details for Day HDR in 2 Lane**

| S. No | Resolution | Night HDR Frame Rate (fps) | Supply Voltage (V) | Typical Current (mA) | Power Consumption (W) |
|---|---|---|---|---|---|
| 1 | 1280 x 720 | 30 | 3.3 | 0.426 | 1.40W |
| 2 | 1920 x 1080 | 30 | 3.3 | 0.430 | 1.42W |
| 3 | 3840 x 2160 | 16 | 3.3 | 0.338 | 1.11W |

**Table 11: Power Consumption Details for Night HDR in 2 Lane**

| S. No | Resolution | Linear Frame Rate (fps) | Supply Voltage (V) | Typical Current (mA) | Power Consumption (W) |
|---|---|---|---|---|---|
| 1 | 1280 x 720 | 60 | 3.3 | 0.372 | 1.22W |
| 2 | 1920 x 1080 | 60 | 3.3 | 0.372 | 1.22W |
| 3 | 3840 x 2160 | 16 | 3.3 | 0.320 | 1.05W |

**Table 12: Power Consumption Details for Linear in 2 Lane**

| S. No | Resolution | Day HDR Frame Rate (fps) | Supply Voltage (V) | Typical Current (mA) | Power Consumption (W) |
|---|---|---|---|---|---|
| 1 | 1280 x 720 | 30 | 3.3 | 0.500 | 1.65W |
| 2 | 1920 x 1080 | 30 | 3.3 | 0.505 | 1.66W |
| 3 | 3840 x 2160 | 30 | 3.3 | 0.492 | 1.62W |

**Table 13: Power Consumption Details for Day HDR in 4 Lane**

| S. No | Resolution | Night HDR Frame Rate (fps) | Supply Voltage (V) | Typical Current (mA) | Power Consumption (W) |
|---|---|---|---|---|---|
| 1 | 1280 x 720 | 30 | 3.3 | 0.431 | 1.42W |
| 2 | 1920 x 1080 | 30 | 3.3 | 0.434 | 1.43W |
| 3 | 3840 x 2160 | 30 | 3.3 | 0.436 | 1.43W |

**Table 14: Power Consumption Details for Night HDR in 4 Lane**

| S. No | Resolution | Linear Frame Rate (fps) | Supply Voltage (V) | Typical Current (mA) | Power Consumption (W) |
|---|---|---|---|---|---|
| 1 | 1280 x 720 | 60 | 3.3 | 0.376 | 1.24W |
| 2 | 1920 x 1080 | 60 | 3.3 | 0.376 | 1.24W |
| 3 | 3840 x 2160 | 30 | 3.3 | 0.404 | 1.33W |

**Table 15: Power Consumption Details for Linear in 4 Lane**

## 7.2 DC Characteristics

The DC Characteristics of e-CAM81_CUONX are as follows:

- Absolute Maximum for GPIO Pins
- Voltage Levels for Trigger

### 7.2.1 Absolute Maximum for GPIO Signals

The following table lists the maximum voltage for CN3 connector IO signals.

| Parameter | Description | Value | Units |
|---|---|---|---|
| Vinput | DC Input voltage | 3.6 | V |
| Voutput | DC output voltage | 3.6 | V |

**Table 16: Absolute Maximum Values for GPIO Pins**

Exceeding the maximum value may shorten the life of the device or cause permanent damage to the device.

### 7.2.2 Voltage Levels for Trigger

The following table lists the trigger input signal voltage levels of e-CAM81_CUONX.

| Symbol | Parameter | Min | Typical | Max | Unit |
|---|---|---|---|---|---|
| $V_{IL}$ | Input voltage LOW | - | - | 0.8 | V |
| $V_{IH}$ | Input voltage HIGH | 2 | - | - | V |

**Table 17: Voltage Levels for Trigger**

## 7.3 Operating Temperature Range

The following table lists the operating temperature range of e-CAM81_CUONX.

| Parameter Description | Temperature Range |
|---|---|
| Operating temperature range[1] | −30°C to 70°C |

**Table 18: Operating Temperature Range**

[1]This is the maximum temperature range up to which the camera sensor can be operated.

**Note**: The default lens supplied with this camera has an operating range of −20°C to 80°C. You can choose wider operating temperature lens as per your requirements.

# 8 Mechanical Specification

The camera and adapter boards of e-CAM81_CUONX are 30 mm x 30 mm in dimension. The front and rear views of the e-CAM81_CUONX module and adapter boards with its dimensions are shown in the following figures.

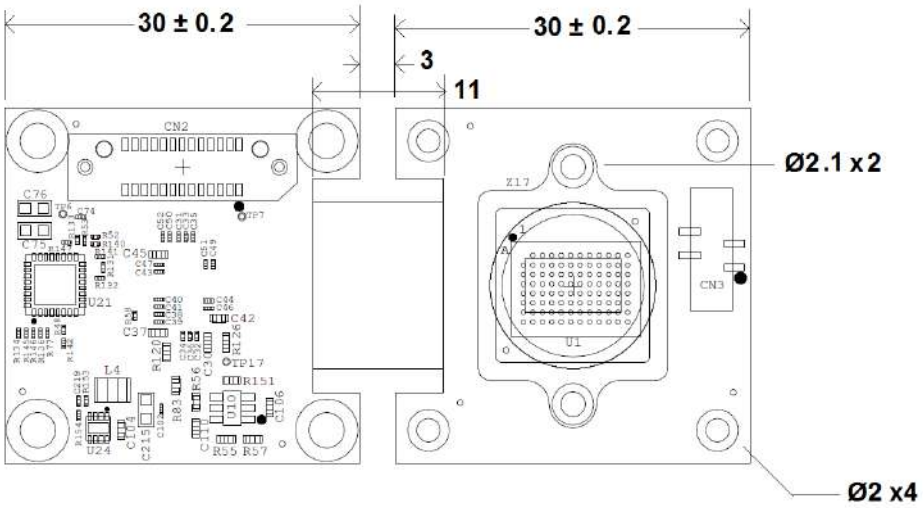



**Figure 2: Front View of e-CAM81_CUONX Module Board Mechanical Dimensions**

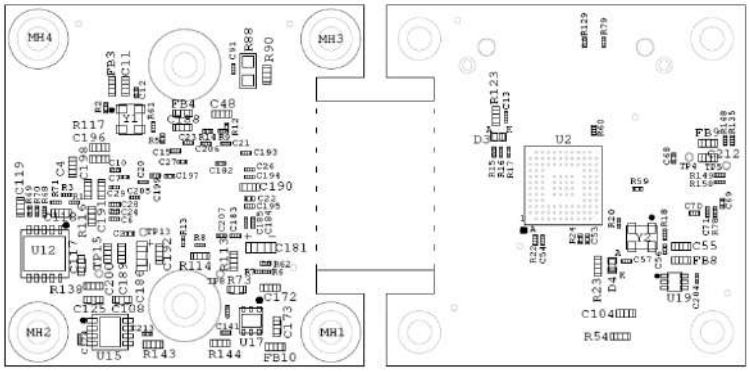


**Figure 3: Rear View of e-CAM81_CUONX Module Board Mechanical Dimensions**

**Note:** e-CAM81_CUONX module board is two board solution connected with rigid flex cable. However, it will be given as folded condition.

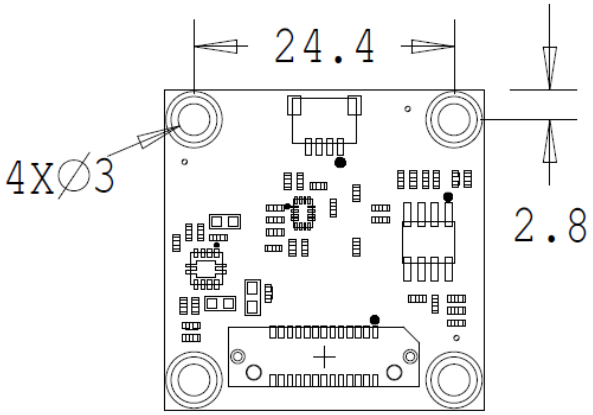



**Figure 4: Front View of e-CAM81_CUONX Adapter Board Mechanical Dimensions**

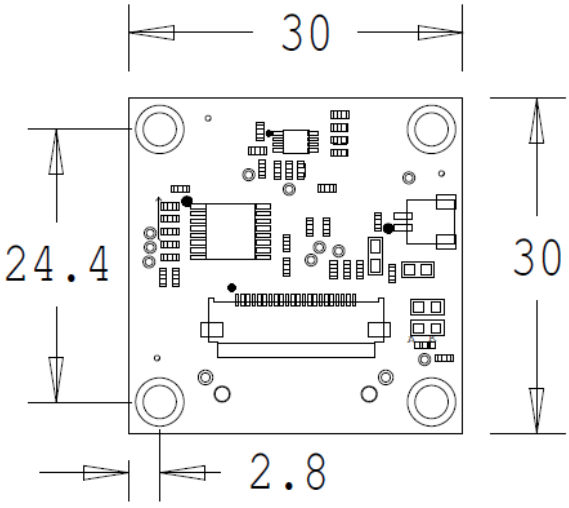



**Figure 5: Rear View of e-CAM81_CUONX Adapter Board Mechanical Dimensions**

**Note**:

- All dimensions are in mm.
- Board outline dimension tolerance is +/- 0.2mm

# 9 Lens Holder Dimensions

The following figure shows the dimension details of S-Mount lens holder.

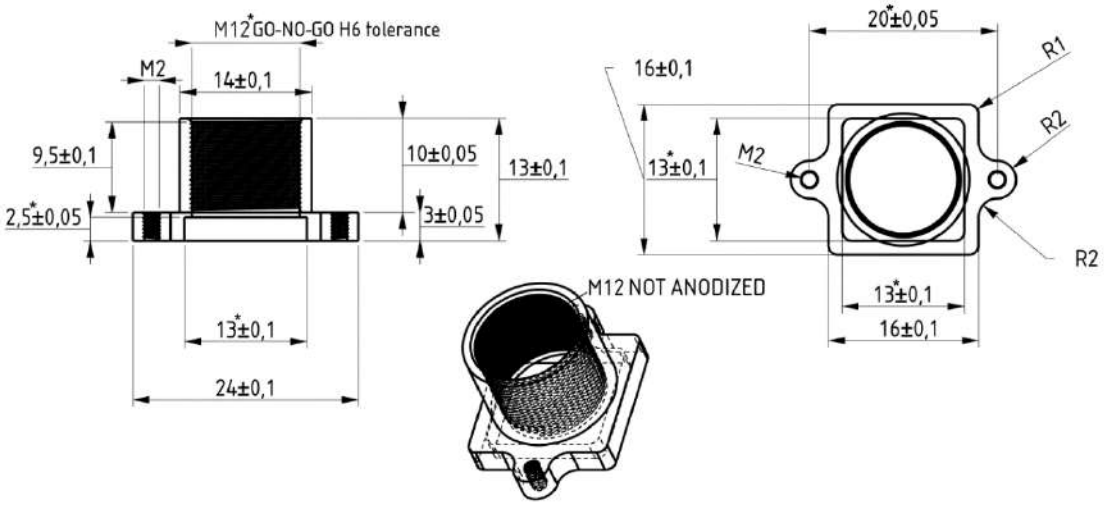



**Figure 6: S-Mount Lens Holder Outline Dimension**

**Note**: All dimensions are in mm.

# Support

## Contact Us

If you need any support on e-CAM81_CUONX 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