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See3CAM_CU135



Type-C Datasheet

Revision 1.15
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1 Revision History

Rev	Date	Description	Author
1.0	16-May-2017	Initial draft	Camera Team
1.1	19-May-2017	Reviewed and added changes	Camera Team
1.2	23-May-2017	Added iHDR feature and updated electrical specification details	Camera Team
1.3	26-December-2017	Updated resolution and frame rate table. Added FOV and crop details	Camera Team
1.4	03-July-2018	Updated USB 2.0 frame rate and power measurement details	Camera Team
1.5	03-August-2018	Added note	Camera Team
1.6	03-October-2018	Added idle mode note	Camera Team
1.7	21-June-2019	Updated idle mode note	Camera Team
1.8	14-November-2019	Updated Crop in FOV	Camera Team
1.9	30-December-2019	Reviewed and updated changes	Camera Team
1.10	30-March-2020	Updated Changes	Camera Team
1.11	12-May-2020	Updated Changes	Camera Team
1.12	16-June-2020	Tolerance added to board images	Camera Team
1.13	26-June-2020	Updated alignment	Camera Team
1.14	24-February-2021	Box version added	Camera Team
1.15	18-May-2021	Resolutions details removed from Introduction	Camera Team



2 Introduction

See3CAM_CU135 is a 13.0 MP, color, UVC compliant, USB 3.0 SuperSpeed camera with Type-C connector from e-con Systems, a leading Embedded Product Design Company which specializes in the advanced camera solutions. It is a USB 3.0 SuperSpeed camera product with reversible plug and play Type-C connector interface.

See3CAM_CU135 is a 13.0 MP color camera with the S-mount (also known as M12 board lens) lens holder. The S-mount is one of the most commonly used small form-factor lens mounts for board cameras. See3CAM_CU135 is a two-board solution containing the camera sensor module board with 1/3.2" AR1335 CMOS image sensor from ON Semiconductor® and the USB 3.0 interface board. With USB 3.0 interface to the host PC, this See3CAM_CU135 can support various uncompressed and compressed data formats (refer Table 1).

This See3CAM_CU135 is a UVC compliant USB 3.0 SuperSpeed camera that is also backward compatible with USB 2.0 host ports and it does not require any special camera drivers to be installed in the host PC. When connected to USB 2.0 host ports, See3CAM_CU135 supports all resolutions and at lower frame rates.

See3CAM_CU135 is UVC compliant camera and it does not require any drivers to be installed on the PC. The native UVC drivers of Windows and Linux Operating Systems will be compatible with this camera. e-con Systems also provides the sample application that demonstrates some of the features of this camera. However, this camera can utilize any DirectShow application such as Skype and so on.

This document describes the features of See3CAM_CU135 camera board and the pin-outs of the connectors including with mechanical diagram.

3 Disclaimer

The specifications and features of See3CAM_CU135 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

See3CAM_CU135 is a two-board solution of size 30mm x 30mm x 30.2 mm. The module board has the AR1335 image sensor from ON Semiconductor and the Image Signal Processor (ISP), and the base board has the USB interface controller and the Type-C connector. This See3CAM_CU135 is a Ready-to-Manufacture camera board with all the necessary firmware built-in and is compatible with the USB Video Class (UVC) version 1.0 standard. You can integrate this camera into the products, and this helps to cut short the Time-to-Market. This camera board is UVC compatible and will work with the standard drivers available with Windows and Linux. There is no need for any additional driver installation.

The below table lists the resolution, frames rates and crop details of See3CAM_CU135.



Format	Resolution	Frame Rate		% Crop in FOV	
		USB 3.0	USB 2.0	Horizontal	Vertical
UYVY	VGA (640 x 480)	120 fps and 60 fps	60 fps and 30 fps	1.14	0
	720P (1280 x 720)	60 fps and 30 fps	16 fps and 8 fps	0	24.14
	960P (1280 x 960)	60 fps and 30 fps	12 fps and 6 fps	1.14	0
	1080P (1920 x 1080)	60 fps and 30 fps	8 fps and 4 fps	0	24.14
	1440P (1920 x 1440)	45 fps and 22.5 fps	6 fps and 3 fps	1.14	0
	4K UHD (3840 x 2160)	15 fps and 7.5 fps	2 fps	0	24.14
	2.8K (2880 x 2160)	20 fps and 10 fps	3 fps	1.14	0
	4K Cinema (4096 x 2160)	15 fps and 7.5 fps	2 fps	0	28.88
	13MP (4208 x 3120)	9 fps and 4.5 fps	1 fps	0	0
MJPEG	VGA (640 x 480)	120 fps	120 fps	1.14	0
	720P (1280 x 720)	60 fps	60 fps	0	24.14
	960P (1280 x 960)	60 fps	60 fps	1.14	0
	1080P (1920 x 1080)	60 fps	60 fps	0	24.14
	1440P (1920 x 1440)	60 fps	60 fps	1.14	0
	4K UHD (3840 x 2160)	30 fps	30 fps	0	24.14
	2.8K (2880 x 2160)	30 fps	30 fps	1.14	0
	4K Cinema (4096 x 2160)	30 fps	30 fps	0	28.88
	13 MP (4208 x 3120)	20 fps	20 fps	0	0

Table 1: See3CAM_CU135 Resolution and Frame Rates

The Field of View (FOV) of See3CAM_CU135 is shown below.



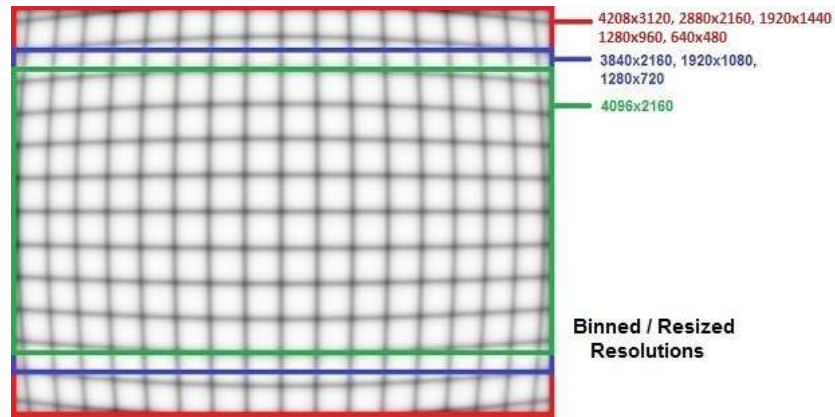


Figure 1: FOV of See3CAM_CU135

The UVC compliant See3CAM_CU135 camera supports FHD (1920 x 1080p) and HD (1280 x 720) resolutions. So, video streaming through UVC is possible without any special drivers on Operating Systems that have built-in support for UVC standards. For example, the See3CAM_CU135 does not require any device drivers to be installed on Windows (both regular PC versions and the embedded versions) as these Operating Systems are provided with the Microsoft supplied UVC drivers built-in. The camera is exposed as DirectShow Capture source to the Windows PC and e-con Systems provides sample DirectShow application that demonstrates the features of this camera. Any DirectShow compliant application such as Skype can work with this camera as webcam.

In Linux, the built-in UVC driver works very well with this camera and there is no need for any additional driver installation. This camera is exposed as a V4L2 camera and e-con Systems also provides a sample application for Linux Operating Systems. You can also develop customized applications for See3CAM_CU135 camera using standard V4L2 APIs.

See3CAM_CU135 camera board has a 10-pin GPIO header that contains signals which can be used for customization requirements. The See3CAM_CU135 has serial I2C Signals (Clock, Data), and Trigger. This functionality is embedded in the UVC firmware which runs on the See3CAM_CU135 camera UVC controller and on the sample PC application. The description of the pins is given in Table-6.

Together with these specific purpose signals, See3CAM_CU135 can be customized for any application and e-con Systems can support them with the necessary technical and programming help.

Note: See3CAM_CU135 is available in two variants, which are, without casing (See3CAM_CU135_CHL_TC) and with casing (See3CAM_CU135_CHL_TC_BX).

The front and rear views of See3CAM_CU135 device with casing (See3CAM_CU135_CHL_TC_BX) and without casing (See3CAM_CU135_CHL_TC) are shown in below figures.





Figure 2: Front View of See3CAM_CU135_CHL_TC

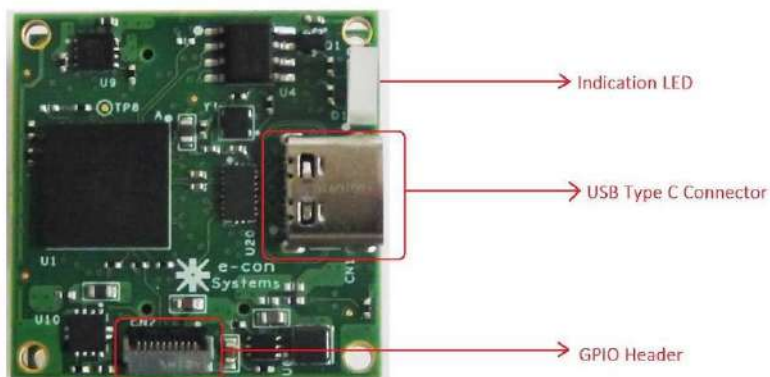


Figure 3: Rear View of See3CAM_CU135_CHL_TC



Figure 4: Front View of See3CAM_CU135_CHL_TC_BX





Figure 5: Rear View of See3CAM_CU135_CHL_TC_BX

4.1 Features

The features of See3CAM_CU135 are as follows:

- Two-board solution of size 30 mm x 30 mm x 30.2 mm (Without enclosure and lens).
- 13.0 MP color camera sensor.
- Uncompressed UYVY format and Compressed MJPEG format.
- Standard M12 lens holder for use with customized optics or lenses for various applications.
- USB 3.0 device with Type-C reversible interface connector.
- Light weight, versatile, and portable design.
- 10-pin GPIO header for standard and custom operations. GPIO pins are accessible from the PC host application.
- Plug-and-Play setup (UVC compliant) for Windows 8.1, 10 and Linux.
- Full resolution (4208 x 3120 - 13 MP) FOV (for the e-con Systems Lens) is 67°.
- Supported interlaced High Dynamic Range (iHDR) feature.
- Imaging applications:
 - True 13.0 MP CMOS image sensor.
 - Still capture support in UYVY and MJPEG formats.
 - Preview format UYVY - VGA, HD (720p), 960P, FHD (1080p), 1440P, Ultra-HD (4K), 2880P, 4K Cinema and 13 MP.
 - Preview format MJPEG - VGA, HD (720p), 960P, FHD (1080p), 1440P, Ultra-HD (4K), 2880P, 4K Cinema and 13 MP.
 - FOV angle is not the same for all preview resolutions.
 - Output video format - UYVY, and MJPEG.
- Operating voltage - 5V +/- 5%, Current - 384mA.
- Restriction of Hazardous Substances (RoHS) compliant.



5 Key Specifications

The below table lists the key specifications of See3CAM_CU135.

Description	Specification
Size (L x W x H)	See3CAM_CU135_CH_TC: 30 mm x 30 mm x 30.2 mm (without lens)
	See3CAM_CU135_CH_TC_BX: 35.30 mm x 35.30 mm x 29 mm (without lens)
Video Format	UYVY, and MJPEG
USB	3.0 and 2.0
Image Resolution	4208 x 3120 (13 MP) and 3840 x 2160 (UHD)
Supported OS	Windows (both 32-bit and 64-bit)
	Linux
UVC Compliant	Yes, compliant with UVC version 1.0
Product ID (PID)	0xC1D1
Vendor ID (VID)	0x2560

Table 2: Key Specifications of See3CAM_CU135

5.1 Maximum Frame Rate Supported

The See3CAM_CU135 supports UVC compliant streaming in bulk transport. The frame rates mentioned are based on assumption that there are no other devices connected to the same USB port. If there are any other USB devices connected to the same USB host controller such as removable mass storage drive and so on, the frame rate will go down and depending on the bandwidth availability, the frame rate may even drop down to zero during those instances.

When the camera is configured for auto exposure, then the frame rate will be determined by the ambient light levels. When the ambient light is low, then the frame rate will drop down accordingly.

Note: The maximum frame rates are assured only in manual exposure. When the exposure value is changed above -6 there will be a drop in the frame rate because the exposure time is more than the time period of camera frame. In auto exposure, maximum frame rate could be achieved with maximum lighting.

5.1.1 When Connected to USB 3.0

Table 1 lists the maximum frame rate supported when connected to the USB 3.0 host controller and on the assumption, that there are no other active USB devices connected to the same USB host controller. These frame rates are achieved under the ambient brightness level of 500 Lux.



5.1.2 When Connected to USB 2.0

Table 1 lists the maximum frame rate supported when connected to the USB 2.0 host controller and on the assumption, that there are no other active USB devices connected to the same USB host controller.

5.2 CMOS Image Sensor Specification

The below table lists the specification of CMOS image sensor used in this See3CAM_CU135 camera board.

Sensor Specification	
Type / Optical Size	1/3.2" Optical format CMOS image sensor
Resolution	13 MP
Sensor Type	Color-UYYVY, MJPEG CMOS Rolling Shutter sensor with Bayer RGB
Pixel Size	1.1 μm x 1.1 μm
Sensor Active Area	4208H x 3120V
Responsivity	4700 e ⁻ /lux-sec
SNR	37 db
Dynamic Range	69 db

Table 3: CMOS Image Sensor Specification

For more information about AR1335 sensor or for *Datasheet*, please contact ON Semiconductor®.

6 Pin Description

See3CAM_CU135 has two connectors namely USB 3.1/Type-C connector and one GPIO Header. The pin description of these connectors is explained below.

6.1 General Purpose Pin Description

The general-purpose pins are used for specific camera image processing and LED control. The GPIO header figure of See3CAM_CU135_CHL_TC is shown below.

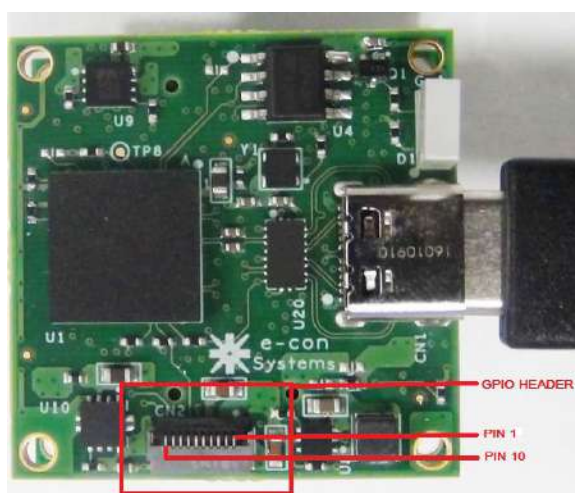


Figure 6: GPIO Header



The below table lists the pin types and description of GPIO header.

CN2 Pin no	Signal Name	Pin Type	Description	Remarks
1	VCC_5V ¹	Power	Supply voltage for external Flash circuit	It can source up to 300mA in USB 3.0. Do not connect any load, when See3CAM_CU135 connected with USB 2.0. Any surge current drawn from this voltage source will affect the camera.
2	VCC_5V			
3	VCC_5V			
4	GND	Power	Ground	
5	GND			
6	I2C_SCL	Output (PU)	Serial Clock of I2C signal	Operating frequency is 400 kHz
7	I2C_SDA	Input or Output (PU)	Serial Data of I2C Signal	
8	GND	Power	Ground	
9	CAM STROBE	Output	Strobe Signal from Camera	
10	TRIG ²	Input	External trigger signal to camera sensor.	Connect to IO voltage through push button switch with necessary de-bouncing circuitry.

Table 4: Pin Types and Description

PU - Internally Pulled-up

PD – Internally Pulled-down

¹**Note on VCC_5V Pin:** 5V can be derived from this pin. This pin is provided directly from the USB VBUS and there is no any internal current control circuit provided. Only when interfaced to USB 3.0 port, this can source maximum current of 300mA. Please do not connect any load to VCC_5V pin when connected to USB 2.0 port. Consuming beyond the maximum current will lead to drop in voltage and affect the performance of sensor.

²**Note on TRIG Pin:** The TRIG pin implements a Hardware snapshot trigger function. This function is done with a still pin that is exposed as DirectShow filter object in Windows Operating Systems. The DirectShow application must be developed to access this still pin of the camera to capture still image. In Trigger mode, the pin acts as sensor trigger.

6.2 USB Type-C Connector Pin Description

The below table lists pin-outs of USB 3.0 connector which is used to connect See3CAM_CU135 board with PC through USB 3.0 Cable. This is a standard USB Type-C connector.

Pin No	Signal	Description	Pin No	Signal	Description
A1	GND	Ground return	B12	GND	Ground return



A2	SSTXp1	SuperSpeed differential pair 1, TX, positive	B11	SSRXp1	SuperSpeed differential pair 2, RX, positive
A3	SSTXn1	SuperSpeed differential pair 1, TX, negative	B10	SSRXn1	SuperSpeed differential pair 2, RX, negative
A4	VBUS	Bus power	B9	VBUS	Bus power
A5	CC1	Configuration channel	B8	SBU2	-
A6	Dp1	Hi-Speed differential pair, position 1, positive	B7	Dn2	Hi-Speed differential pair, position 2, negative
A7	Dn1	Hi-Speed differential pair, position 1, negative	B6	Dp2	Hi-Speed differential pair, position 2, positive
A8	SBU1	-	B5	CC2	Configuration channel
A9	VBUS	Bus power	B4	VBUS	Bus power
A10	SSRXn2	SuperSpeed differential pair 4, RX, negative	B3	SSTXn2	SuperSpeed differential pair 3, TX, negative
A11	SSRXp2	SuperSpeed differential pair 4, RX, positive	B2	SSTXp2	SuperSpeed differential pair 3, TX, positive
A12	GND	Ground return	B1	GND	Ground return

Table 5: USB Type-C Connector Pin Description

7 Connector Part Numbers

The below table lists the connectors used in the See3CAM_CU135 camera board and its compatible mating connectors.

Connector	Description	Manufacturer	Part Number
USB 3.1 Type-C connector	CONN RCPT USB C 3.1 SMT R/A	Molex	105450-0101
GPIO Header (CN8 on See3CAM_CU135 Base Board)	CONN FPC-0.5mm Shrouded 10Pos SMT	Hirose	FH34SRJ-10S-0.5SH (50)
Flex Cable	0.5mm Pitch 10 position FPC Cable, 29.97mm length	Molex	0152660095
Mating Connector on the other side of flex cable	CONN FPC-0.5mm Shrouded 10Pos SMT	Hirose	FH34SRJ-10S-0.5SH (50)

Table 6: Connectors and its Part Number Details

The USB connector is the standard USB 3.1/Type-C connector as specified in the USB 3.1 standards. Any USB standard compliant USB 3.0 Type-A to Type-C cable will be compatible with this connector.

8 Electrical Specification

The electrical specification of See3CAM_CU135 are as follows:

- [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.

8.1 Recommended Operating Condition

The below table lists the recommended operating condition of See3CAM_CU135 under various operating condition.

Parameter	Typical Operating Voltage	Current (mA)	Typical Power Consumption (W)
Streaming Maximum Power 2880 x 2160 at 30 fps MJPEG	5V \pm 250mV	399	1.995
Streaming Minimum Power 4208 x 3120 at 1 fps UYVY		208	1.040
Idle Condition		95	0.475

Table 7: Recommended Operating Condition

Note: The device sets to idle mode, when there is no frame for 10 seconds. When the device comes out of idle condition, the time taken to send out the first frame is more when compared to normal resolution switching. Any UVC and HID controls set in the idle mode will not be reflected in the scene after wake-up.

8.1.1 UYVY with USB 3.0

The below table lists the current consumed by See3CAM_CU135 in UYVY format with USB 3.0.

S. No	Resolution	Frame Rate (fps)	Supply Voltage (V)	Typical Current (mA)	Power Consumption (W)
1	640 x 480	120	5	293	1.465
		60	5	317	1.585
2	1280 x 720	60	5	306	1.530
		30	5	349	1.745
3	1280 x 960	60	5	336	1.680
		30	5	395	1.975
4	1920 x 1080	60	5	331	1.655
		30	5	369	1.845
5	1920 x 1440	45	5	332	1.660
		22.5	5	366	1.830
6	2880 x 2160	20	5	376	1.880
		10	5	303	1.515
7	3840 x 2160	15	5	338	1.690
		7.5	5	290	1.450
8	4096 x 2160	15	5	338	1.690
		7.5	5	291	1.455
9	4208 x 3120	9	5	310	1.550



		4.5	5	281	1.405
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Table 8: UYVY with USB 3.0**8.1.2 MJPEG with USB 3.0**

The below table lists the current consumed by See3CAM_CU135 in MJPEG format with USB 3.0.

S. No	Resolution	Supply Voltage (V)	Typical Current (mA)	Power Consumption (W)
1	640 x 480 at 60 fps	5	281	1.405
2	1280 x 720 at 60 fps	5	297	1.485
3	1280 x 960 at 60 fps	5	314	1.570
4	1920 x 1080 at 60 fps	5	301	1.505
5	1920 x 1440 at 60 fps	5	320	1.600
6	2880 x 2160 at 30 fps	5	399	1.995
7	3840 x 2160 at 30 fps	5	373	1.865
8	4096 x 2160 at 30 fps	5	367	1.835
9	4208 x 3120 at 20 fps	5	357	1.785

Table 9: MJPEG with USB 3.0**8.1.3 UYVY with USB 2.0**

The below table lists the current consumed by See3CAM_CU135 in UYVY format with USB 2.0.

S. No	Resolution	Frame Rate	Supply Voltage (V)	Typical Current (mA)	Power Consumption (W)
1	640 x 480	60	5	280	1.400
		30	5	348	1.740
2	1280 x 720	16	5	269	1.345
		8	5	224	1.120
3	1280 x 960	12	5	266	1.330
		6	5	222	1.110
4	1920 x 1080	8	5	241	1.205
		4	5	210	1.050
5	1920 x 1440	6	5	238	1.190
		3	5	231	1.155
6	2880 x 2160	3	5	217	1.085
7	3840 x 2160	2	5	210	1.050
8	4096 x 2160	1	5	209	1.045
9	4208 x 3120	1	5	208	1.040

Table 10: UYVY with USB 2.0

8.1.4 MJPEG with USB 2.0

The below table lists the current consumed by See3CAM_CU135 in MJPEG format with USB 2.0.

S. No	Resolution	Supply Voltage (V)	Typical Current (mA)	Power Consumption (W)
1	640 x 480 at 60 fps	5	230	1.150
2	1280 x 720 at 60 fps	5	243	1.215
3	1280 x 960 at 60 fps	5	260	1.300
4	1920 x 1080 at 60 fps	5	249	1.245
5	1920 x 1440 at 60 fps	5	267	1.335
6	2880 x 2160 at 30 fps	5	345	1.725
7	3840 x 2160 at 30 fps	5	323	1.615
8	4096 x 2160 at 30 fps	5	313	1.565
9	4208 x 3120 at 20 fps	5	303	1.515

Table 11: MJPEG with USB 2.0

8.2 DC Characteristics

The DC Characteristics of See3CAM_CU135 are as follows:

- [Absolute Maximum for GPIO Pins](#)
- [GPIO Voltage Levels](#)
- [GPIO Driving Strength](#)

8.2.1 Absolute Maximum for GPIO Pins

The below table lists the maximum input voltage for GPIO pins.

Parameter	Description	Value	Units
V _{input} ^a	DC Input voltage to any input pin	2.1	V

Table 12: Absolute Maximum for GPIO Pins

^aExceeding the maximum value can shorten the life of the device or can cause permanent damage to the device.

8.2.2 GPIO Voltage Levels

The below table lists the GPIO voltage levels of See3CAM_CU135.

Digital Input Signals					
Symbol	Parameter	Min	Typical	Max	Unit
V _{IL}	Input voltage LOW	-	-	0.45	V
V _{IH}	Input voltage HIGH	1.4	-	-	V
Digital Output Signals					
Symbol	Parameter	Min	Typical	Max	Unit
V _{OL}	Output voltage LOW			0.18	V
V _{OH}	Output voltage HIGH	1.62			V

Table 13: GPIO Voltage Levels



8.2.3 GPIO Driving Strength

The below table lists the GPIO driving strength of See3CAM_CU135.

Symbol	Parameter	Min	Typical	Max	Unit
I _o	Output current (source current)	-	-	9	mA
I _i	Input current (sink current)	-	-	100	μA

Table 14: GPIO Driving Strength

8.3 Operating Temperature Range

The below table lists the operating temperature range of See3CAM_CU135.

Parameter Description	Temperature Range
Operating Temperature Range ¹	-30°C to 70°C

Table 15: Operating Temperature Range

¹This is the maximum temperature range up to which the camera sensor can be operated. Value measured at junction.

Note: When operating beyond 50°C, the image quality is affected badly with thermal flickering noise all over the image. Continuously operating the camera at 70°C (maximum value) will cause irreparable damage to the camera module. So, you are advised to make necessary arrangements on products to dissipate the heat generated in the module to maintain the operating temperature below 50°C.

9 Mechanical Specifications

See3CAM_CU135_CHL_TC size is 30 mm x 30 mm x 30.2 mm (without Lens). The board drawing and dimensions are described below.

9.1 See3CAM_CU135 Dimensions

The front portion of See3CAM_CU135 module board with mechanical dimensions is shown below.



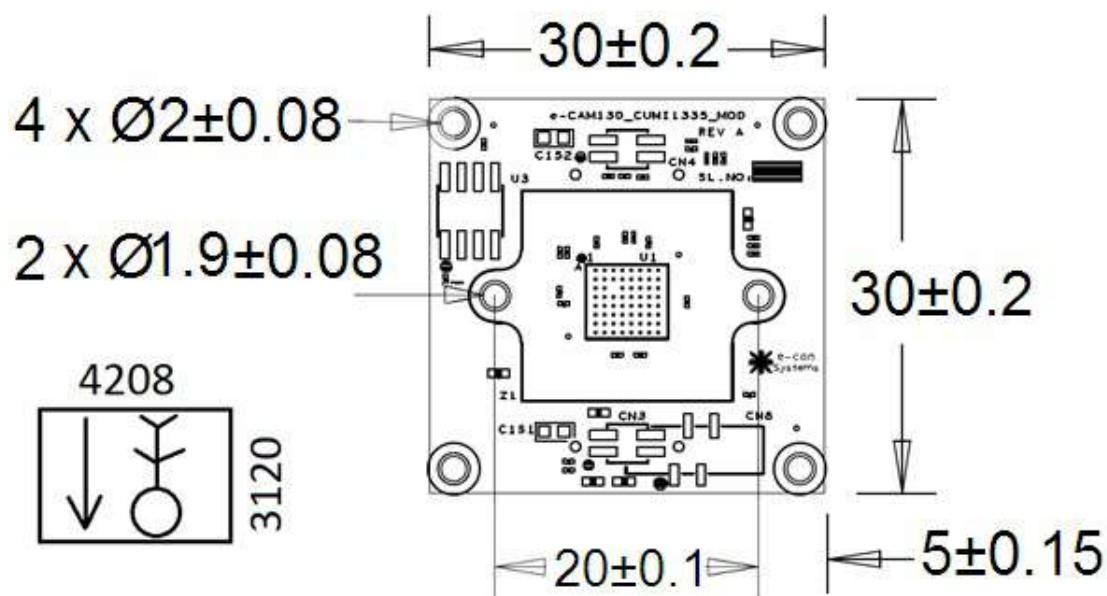


Figure 7: Front Portion of See3CAM_CU135 Module Board Mechanical Dimensions

The rear portion of See3CAM_CU135 module board with mechanical dimensions is shown below.

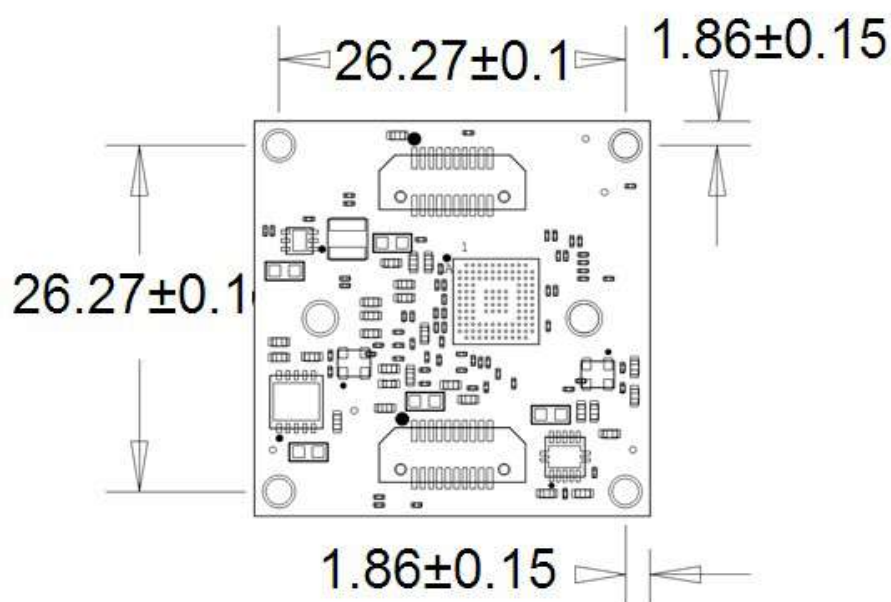


Figure 8: Rear Portion of See3CAM_CU135 Module Board Mechanical Dimensions

The front portion of See3CAM_CU135 base board with mechanical dimensions is shown below.



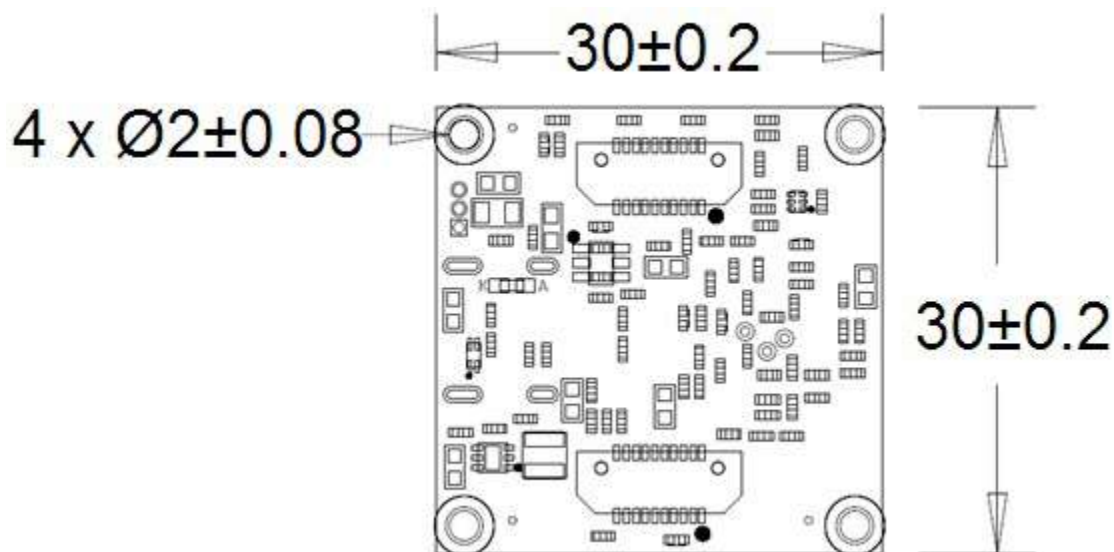


Figure 9: Front Portion of See3CAM_CU135 Base Board Mechanical Dimensions

The rear portion of See3CAM_CU135 base board with mechanical dimensions is shown below.

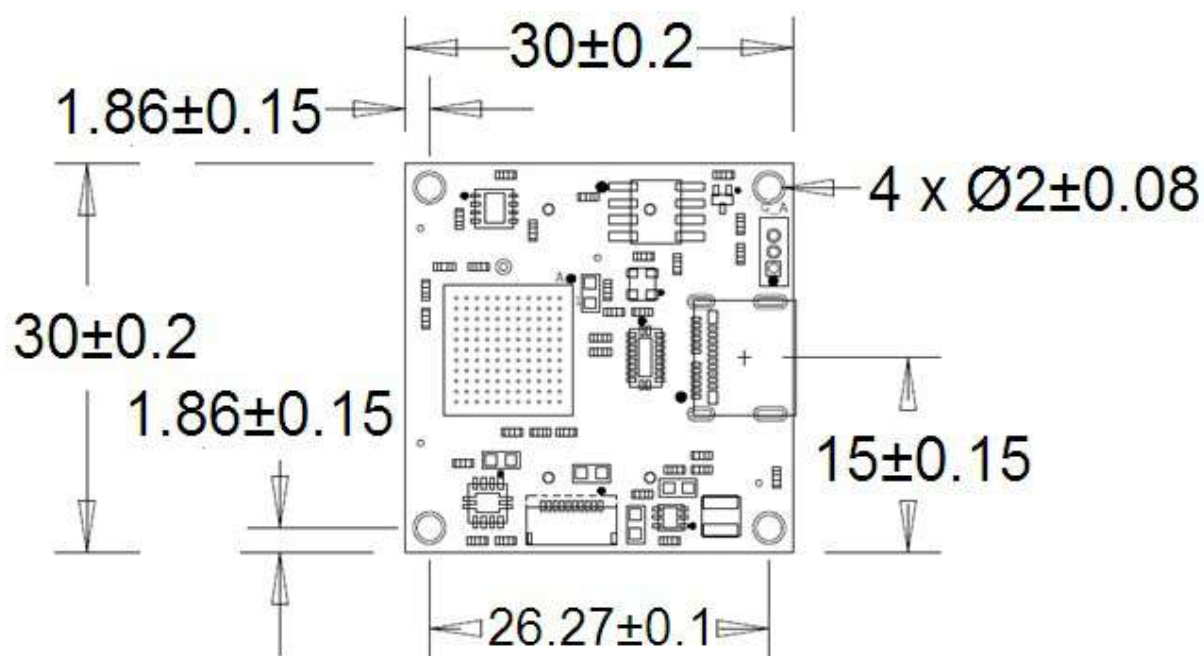


Figure 10: Rear Portion of See3CAM_CU135 Base Board Mechanical Dimensions

Note: All dimensions are in mm.

The mechanical dimension of See3CAM_CU135_CH_TC_BX with enclosure is shown below.



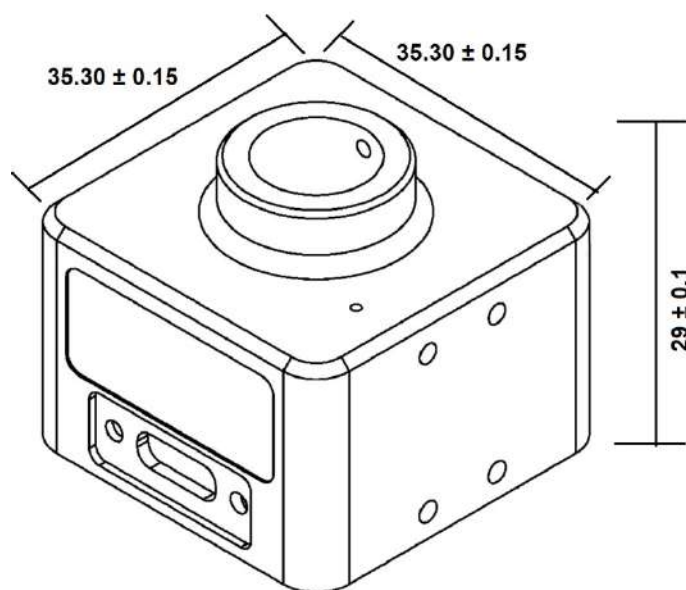


Figure 11: See3CAM_CU135_CH_TC_BX Dimensions (Without lens)

The See3CAM_CU135 camera with and without casing image orientation with respect to USB cable is shown in below figures.

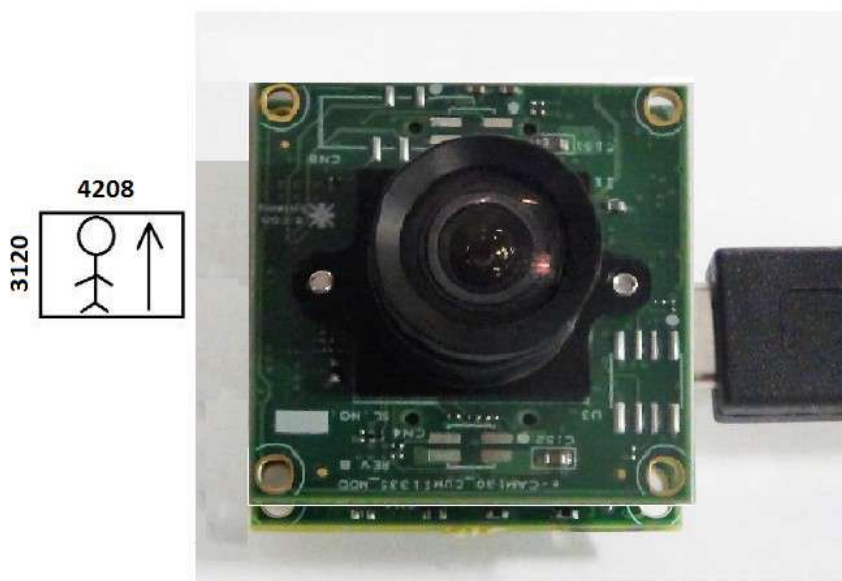


Figure 11: See3CAM_CU135 Camera without Casing Image Orientation with respect to USB Cable





Figure 12: See3CAM_CU135 Camera with Casing Image Orientation with respect to USB Cable

9.2 Lens Holder Dimension

The lens holder with mechanical dimensions is shown below.

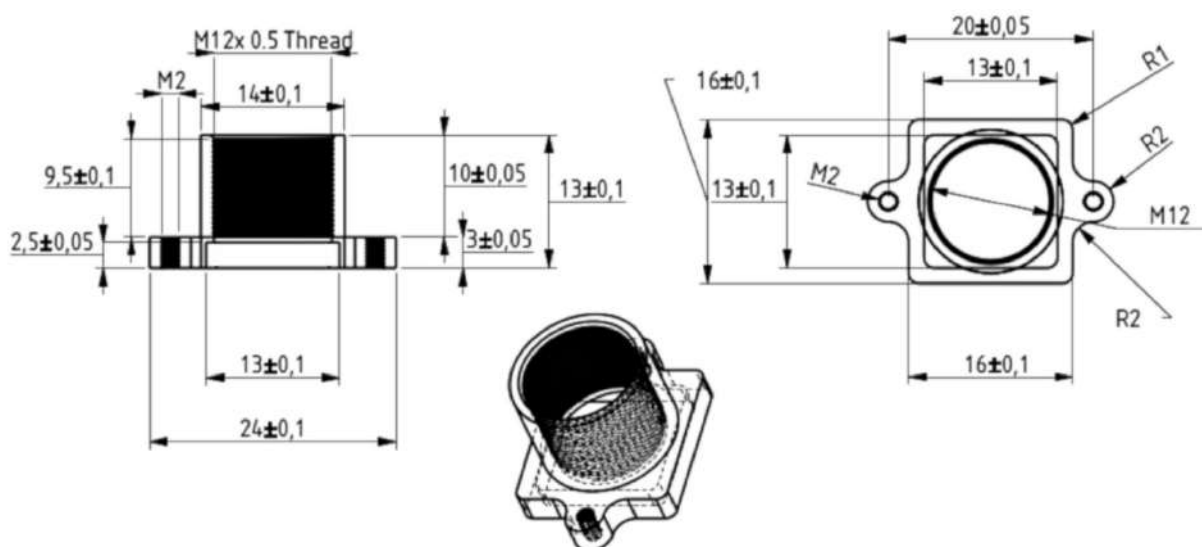


Figure 13: Lens Holder Mechanical Dimensions

Note: All dimensions are in mm.



Support

Contact Us

If you need any support on See3CAM_CU135 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>

