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See3CAM_12CUNIR

Datasheet

Revision 1.1
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Contents

See3CAM_12CUNIR

1 Revision History

Rev	Date	Description	Author
1.0	03-Oct-2014	Initial Draft	Hardware Team
1.1	06-Oct-2014	Implemented Review Comments	Hardware Team

2 Introduction

The See3CAM_12CUNIR is a 1.3Mega pixel, UVC Compliant, USB3.0 SuperSpeed camera from e-con Systems, a leading embedded Product Design Services company which specializes in the advanced camera solutions. The See3CAM is a new family of USB3.0 UVC SuperSpeed camera products launched by e-con.

The See3CAM_12CUNIR is an electronic rolling shutter, 1.3 Megapixel Monochrome Camera that is based on the Aptina AR0130CS CMOS image sensor. This See3CAM_12CUNIR is a UVC-compliant USB3.0 SuperSpeed Camera that is also backward compatible with USB2.0 host ports and does not require any special camera drivers. The See3CAM_12CUNIR is capable of supporting 720p60 (HD), 1280x960 resolution at 45 fps and 640x480 binned at 45 fps with the pixel depth of 12-bit monochrome data when interfaced to a USB3.0 host port. The pixel depth of 12bits per pixel is useful for applications where high resolution information captured from the camera is required without any processing.

The See3CAM_12CUNIR is a two-board solution containing the camera sensor module board (e-CAM10_CU0130_MOD) containing AR0130CS image sensor and the USB3.0 interface board. The AR0130CS CMOS image sensor used in this See3CAM_12CUNIR is an Electronic Rolling Shutter, 1/3” optical form-factor, CMOS Image sensor from Aptina and this has superior low light performance and excellent Near IR performance. The low light sensitivity and the excellent NIR efficiency makes the See3CAM_12CUNIR camera as an ideal solution for Day/Night Vision Surveillance applications and NIR Imaging applications in medical and biological applications. The See3CAM_12CUNIR is supported with S-mount lens holder for enabling the users to choose the lens and any spectral filter as per their requirements.

e-con provides a sample DirectShow application, called e-CAMView, along with the See3CAM_12CUNIR camera. The e-CAMView is a typical DirectShow camera application, but customized to demonstrate some of the features of See3CAM_12CUNIR.

This document describes about the features and See3CAM_12CUNIR board and the pin-outs of the connectors including with mechanical diagram.

3 Scope

The scope of this document is limited to a description, features of this board including the mechanical diagram. This document serves as the datasheet for See3CAM_12CUNIR with electrical, mechanical and software features supported by it.

4 Disclaimer

The specifications and features of See3CAM_12CUNIR 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

The See3CAM_12CUNIR is a two board solution of size 30mm x 30mm USB3.0 SuperSpeed from e-con Systems. This camera board is based on AR0130 Image sensor from Aptina. This See3CAM_12CUNIR is a Ready-to-Manufacture camera board with all the necessary firmware built in and compatible with the USB Video Class (UVC) version 1.0 standard. Customers can integrate this camera in to their products right away and this helps our customers to cut short the Time-to-Market. This camera board is USB Video Class compatible and this will work with the standard drivers available with Windows and Linux. There is no need for any additional driver installation.

This UVC compliant See3CAM_12CUNIR camera supports 720p60 (HD), 1280x960 resolution at 45 fps and 640x480 binned at 45 fps. This camera also supports a special mode, 640x480 @ 60fps with a partial FOV. 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_12CUNIR does not require any device drivers to be installed on Windows 7 (both regular PC versions and the embedded versions) as these Operating Systems come with the Microsoft supplied UVC drivers built-in. From Windows XP (with Service Pack2), all the Windows OS releases have built in support for UVC drivers and See3CAM_12CUNIR works seamlessly with these OSes. The camera is exposed as DirectShow camera to the Windows PC and e-con provides sample DirectShow application that demonstrates the features of this camera. Please note that, as this camera supports 12bits per pixel, not all the DirectShow cameras can handle this 12bits per pixel format.

In the case of Linux, the built-in UVC driver works very well with this camera and there is no need for any additional driver installation. In Linux this camera is exposed as a V4L2 camera and e-con also provides a sample application for Linux OS as well. Customers can also develop customized applications for the See3CAM_12CUNIR camera using standard V4L2 APIs.

The See3CAM_12CUNIR camera board has an 8-pin GPIO header that contains GPIO signals which can be used for customization requirements. The See3CAM_12CUNIR has one general purpose Input / Output pin (pin 2) controlled through UVC extension control. This additional feature may require a UVC Extension DLL to be installed manually to access these features. Customers can use these signals to control or extend their electronic circuitry from the PC.

In addition there are four more signals that are locked down for specific purposes. This functionality is embedded in the UVC firmware that is running on the See3CAM_12CUNIR camera UVC controller and also on the sample PC application. The description of these signals is given below along with their functionality.

1. Pin No:1 USB VBUS Power Supply (5V) for external flash circuitry (to be developed by the user). Max supply current is 550mA. For more information, refer to General Purpose Pin description
2. Pin No:2 GPIO1 – General purpose Input / Output signal
3. Pin No:3 I2C Serial Clock signal
4. Pin No:4 I2C Serial Data signal
5. Pin No:5 Camera Strobe Signal for LED flash applications where this signal is used for Flash LED illumination
6. Pin No:6 External Trigger Signal to capture a still Image

Together with these specific purpose signals and general purpose I/O signals, this See3CAM_12CUNIR can be customized for any application by our customers and e-con can support them with the necessary technical and programming help.

Figure 1: See3CAM_12CUNIR

5.1 Features

- Two board solution with small form factor of 30 mm x 30 mm
- 1.3 Megapixel camera sensor with excellent NIR performance
- Full 12bits per pixel (12bits of luminance data per pixel)
- Custom lens module board – Standard M12 lens holder
- USB 3.0 device with USB3.0 Micro-B connector.
- Lightweight, versatile, and portable design
- 8 pin GPIO header for standard and custom operations
- Plug-and-Play setup (UVC compliant)for Windows 7, Windows 8 and Linux
- Imaging applications
    - True 1.3 megapixel CMOS Image sensor
    - Still Capture supported resolution – 1.3MP, 720p,VGA (cropped), VGA (binned)
    - Preview format Y16 – VGA (cropped), VGA (binned), HD(720p) and 1.3MP(960p)
    - Automatic and manual exposure control
    - Manual Gain
- Operating Voltage
    - 5V +/- 5%
- ROHS compliant

6 Key Specification

Description	Specification
Size (L X W X H)	30 x 30 x 26 mm (without lens)
Video format	Y16 (12bits per pixel)
USB	3.0 and 2.0
Image Resolution	1280 x 960 (1.3 MP), 1280 x 720 and VGA
Supported OS	Windows7 (both 32bit and 64bit)
	Windows 8 and Linux
USB Video Class (UVC) Compliant	Yes. Compliant with UVC Version 1.0
PID (Product ID)	0xC113
VID (Vendor ID)	0x2560

6.1 Maximum Frame Rate Supported

6.1.1 When Connected to USB3.0

This table lists the maximum frame rate supported when connected to the USB3.0 host controller and on the assumption that there are no other active USB devices connected to the same USB host controller.

Mode / Resolution	**640X480 VGA (binned)**	**640X480 VGA (cropped)**	**1280x720 HD**	**1280x960 1.3MP**
Uncompressed Y16	45	60	60	45

6.1.2 When Connected to USB2.0

This table lists the maximum frame rate supported when connected to the USB2.0 host controller and on the assumption that there are no other active USB devices connected to the same USB host controller.

Mode / Resolution	**640X480 VGA (binned)**	**640X480 VGA (cropped)**	**1280x720 HD**	**1280x960 1.3MP**
Uncompressed Y16	30	30	12	9

6.2 1.3 MP Camera Sensor specification

The following table describes the specifications of the 1.3MP camera sensor used in this See3CAM_12CUNIR camera board. For more information about the AR0130 sensor or for datasheet, please contact Aptina.

Sensor Specification	
Type / Optical Size	1/3” Optical format CMOS Image sensor
Sensor type	Y12, Monochrome
Pixel size	3.75 µm x 3.75 µm

7 Pin Description

See3CAM_12CUNIR has two connectors namely USB 3.0 connector and one GPIO Header.

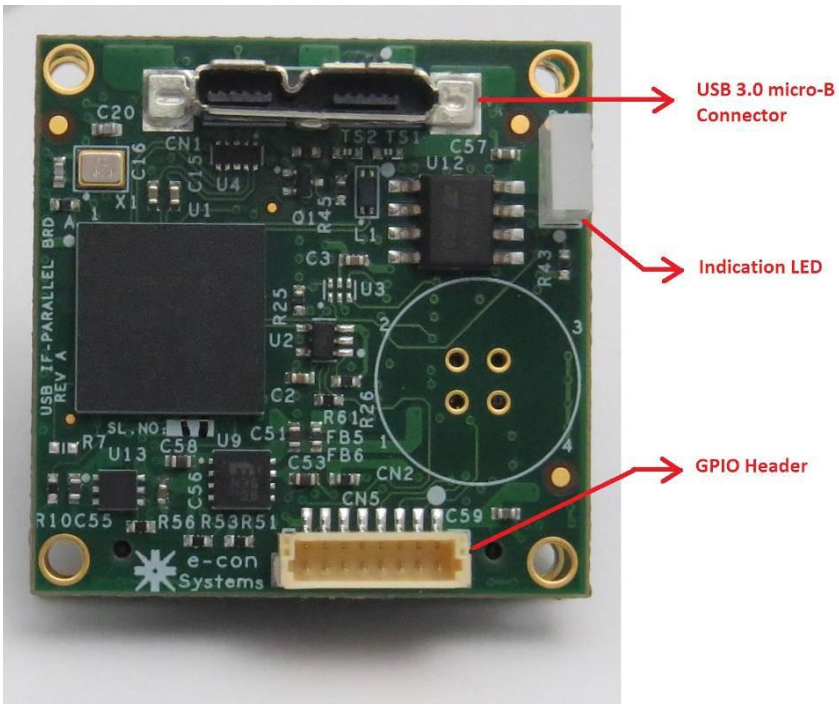

Figure 2: See3CAM_12CUNIR – Rear portion

7.1 General Purpose Pin description

General Purpose pins are used for specific camera image processing and LED control. The description is as follows

CN3 Pin no	Signal name	Pin Type	Description	Remarks
1	**VCC_IN** (1)	Power	Supply voltage for external Flash circuit	It can source up to 250mA only in USB 2.0 550mA in USB 3.0
2	**GPIO1**	Output(PD)	General purpose Output	This can be driven High through UVC extension. By default, this will be pulled low.
3	**CLK_I2C_SCL**	Output	Serial Clock of I2C signal	Operating frequency is 400 kHz
4	**I2C_SDA**	Input / Output	Serial Data of I2C Signal	
5	**CAM_STROBE**	output(PD)	Strobe output from camera sensor	Active high pulse from the camera when strobe request is given. Usually this pin is connected to enable pin of LED driver. It can source upto 100 uA
6	**EXT_TRIGGER**(2)	Input (PD)	Trigger signal to Camera Sensor	Connect to 3.3V through push button switch with necessary de-bouncing circuitry.
7	**GND**	Power	Ground	
8	**GND**	Power	Ground	

PU - Internally Pulled-up
PD - Internally Pulled-down

(1) **NOTE ON VCC_IN PIN:** *5V can be derived from this pin. This comes directly from the USB VBUS and there is no any internal current control circuit provided. When interfaced to USB3.0 port, this can source maximum current of 550mA and when interfaced to USB2.0 port, this can source maximum current of 250mA. Consuming beyond the maximum current will lead to drop in voltage and affect the performance of sensor. Thus the performances are not guaranteed.*

(2) **NOTE ON EXT_TRIGGER PIN**: *The TRIG pin implements a Hardware snapshot trigger function. This is done with a still pin that is exposed as DirectShow filter object in WINDOWS OS. The DirectShow application should be developed to access this still pin of the camera to capture still image.*

7.2 USB micro-B connector pin description

The below table describes the pin-outs of USB 3.0 connector which is used to connect See3CAM_12CUNIR board with PC through USB 3.0 Cable. This is a standard USB3.0 Micro-B connector.

CN1 Pin No	Signal Name	Pin type	Description
1	VCC	Power	Supplies 5V Power to the board
2	D-	I/O	USB Data-
3	D+	I/O	USB Data+
4	OTG ID	-	OTG ID for Identifying lines
5	GND	Power	Ground
6	SSTX-	Output	Superspeed Transmit Data -
7	SSTX+	Output	Superspeed Transmit Data +
8	GND	Power	Ground
9	SSRX+	Input	Superspeed Receive Data +
10	SSRX-	Input	Superspeed Receive Data -

8 Connector Part Numbers

This table below describes the connectors used in the See3CAM_12CUNIR camera board and its compatible mating connectors. The USB3.0 connector is the standard Micro-B connector as specified in the USB3.0 standards. Any USB3.0 standard compliant USB3.0 cable will be compatible with this connector.

Connector	Description	Manufacturer	Part Number
GPIO Header (CN5 on See3CAM_12CUNIR Board)	CONN Header Male - 1mm Shrouded 08 Positions Vertical SMT	JST Sales	BM08B-SRSS-TB(LF)(SN)
Mating connector for GPIO Header (Suggested)	CONN Housing SH Series 08 Positions	JST Sales	SHR-08-V-S
Mating Crimp contact (Suggested)	CONN Term SH Crimp 28-32 AWG TIN	JST Sales	SSH-003T-P0.2

9 Electrical Specification

The following section lists down the electrical specification and recommended operating conditions.

9.1 Recommended Operating Condition

Parameter	Typical Operating Voltage	Power consumption (W)
USB input voltage	5V ± 250mV	1.050

The following table lists down the current consumed by the See3CAM_12CUNIR under various operating conditions. These values are measured in our 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.

9.1.1 USB 3.0 in Y16

S.No	Resolution	Supply Voltage (V)	Typical Current (mA)	Power Consumption (W)
1	640 x 480 at 60 fps (cropped)	5	200	1.000
2	640 x 480 at 45 fps (binned)	5	195	0.975
3	1280 x 720 at 60 fps	5	210	1.050
4	1280 x 960 at 45 fps	5	210	1.050

9.1.2 USB 2.0 Y16

S.No	Resolution	Supply Voltage (V)	Typical Current (mA)	Power Consumption (W)
1	640 x 480 at 30 fps (cropped)	5	140	1.060
2	640 x 480 at 30 fps (binned)	5	171	0.855
3	1280 x 720 at 12 fps	5	130	0.855
4	1280 x 960 at 9 fps	5	130	0.825

9.2 DC Characteristics

ABSOLUTE MAXIMUM FOR GPIO PINS

Parameter	Description	Value	Units
Vinput[a]	DC Input voltage to any input pin	3.5	V

[a] Exceeding the maximum value may shorten the life of the device or cause permanent damage to the device

GPIO VOLTAGE LEVELS (except STROBE)

Symbol	Parameter	Min	Typ	Max	Unit
Digital Input signals					
V_{IL}	Input voltage LOW			0.84	V
V_{IH}	Input voltage HIGH	1.96			V

Digital Output signals					
V_{OL}	Output voltage LOW			0.33	V
V_{OH}	Output voltage HIGH	2.97			V

GPIO DRIVING STRENGTH (except STROBE)

Symbol	Parameter	Min	Typ	Max	Unit
I_O	Output current (source current)			9	mA
I_i	Input current (sink current)			100	uA

STROBE output

Digital Output signals					
V_{OL}	Output voltage LOW			0.4	V
V_{OH}	Output voltage HIGH	2.5			V
I_O	Output current			100	uA

9.3 Operating Temperature range

Parameter Description	Temperature Range
Electrically functional operating range[1]	-30°C to 70°C
Stable image operating range[2]	0°C to 60°C

[1]Sensor functions but image quality may be noticeably different at temperatures outside of stable image range.
[2]Image quality remains throughout this temperature range.

10 Mechanical Specifications

See3CAM_12CUNIR size is 30 mm x 30 mm x 26 mm (without Lens). Board drawing and dimensions are given below.

10.1 See3CAM_12CUNIR Dimension

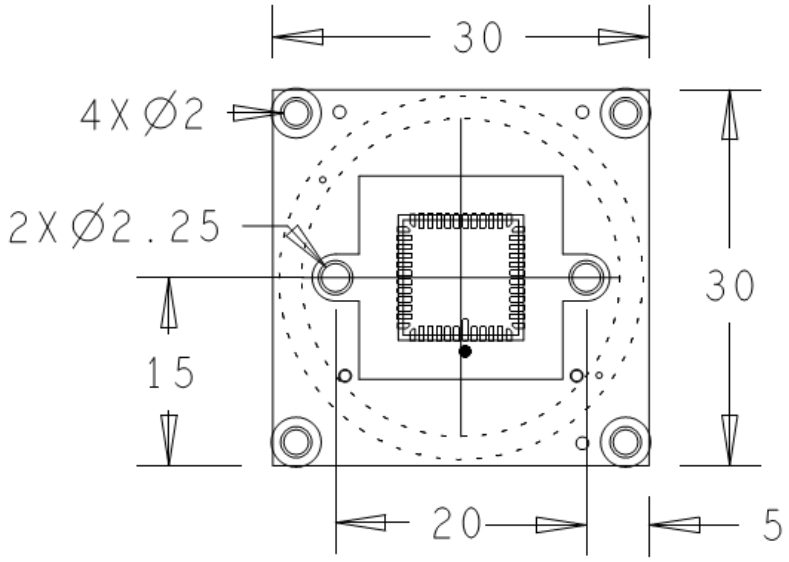

Figure 2: Front Portion of See3CAM_12CUNIR mechanical dimensions

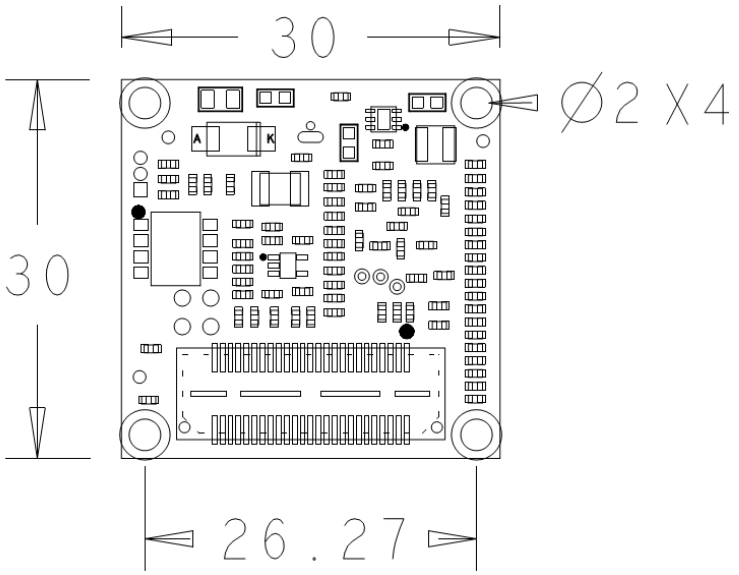

Figure 3: Rear Portion of See3CAM_12CUNIR mechanical dimensions

10.2 Lens Holder Dimension

Lens Mount Mechanical Dimension

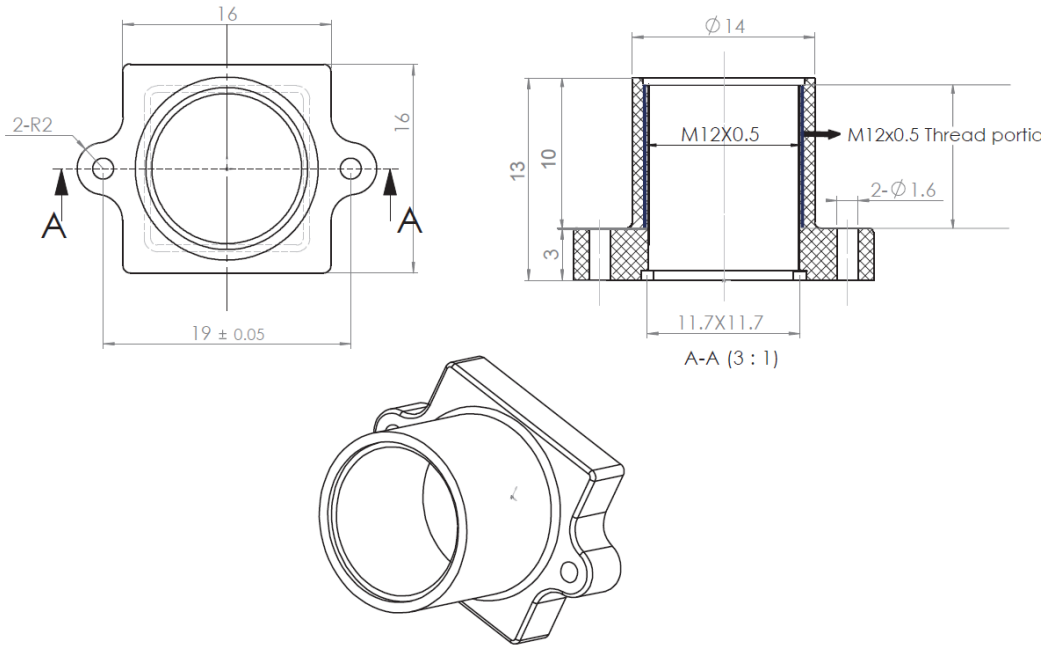

Figure 4: Lens Holder mechanical dimensions

11 Conclusion

This document describes about the features and See3CAM_12CUNIR board and the pin-outs of the connectors including mechanical specifications.