e-con Systems India Pvt Ltd

7th Floor, RR Tower – IV,
Super A-16 & A-17, Thiru-Vi-Ka Industrial Estate,
Guindy, Chennai - 600 032.
www.e-consystems.com

See3CAM_CU40

Datasheet

Revision 1.0
Friday, July 10, 2015

Contents

See3CAM_CU40

1   Revision History

Rev	Date	Description	Author
1.0	10-July-2015	Initial Draft	Camera Team

2 Introduction

The See3CAM_CU40 is a 4.0 Mega pixel, RAW, colour, 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_CU40 is the latest member of the See3CAM family of USB3.0 SuperSpeed camera products launched by e-con.

The See3CAM_CU40 is a 4.0 MP colour RAW RGB-IR 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. The See3CAM_CU40 is a two-board solution containing the camera sensor module board containing 1/3" OV4682 CMOS image sensor from Omni Vision® and the USB3.0 interface board. With USB3.0 interface to the host PC, this See3CAM_CU40 can stream 672x380 @ 256 fps, HD@ 90 fps (720p90), FHD @ 40 fps (1080p40) at Bayer 10-bit RAW format. This can also stream the uncompressed 2688 x 1520 at 14 fps when connected to the USB3.0 host PC.

This See3CAM_CU40 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 to be installed in the host PC. When connected to USB2.0 host ports, the See3CAM_CU40 supports fewer resolutions and at lower frame rates.

In both the USB2.0 and USB3.0, the 4MP (2688x1520) still image capture is possible.

The See3CAM_CU40 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 shall be compatible with this camera. e-con also provides the sample application that demonstrates some of the features of this camera. However, this camera can be utilized any DirectShow application such as Skype etc.

This document describes about the features and See3CAM_CU40 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_CU40 with electrical, mechanical and software features supported by it.

4 Disclaimer

The specifications and features of See3CAM_CU40 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_CU40 is a two board solution of size 30mm x 30mm . This camera board is based on OV4682 Image sensor from Omni Vision®. The other board, has the USB interface controller and the USB3.0 connector. This See3CAM_CU40 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_CU40 camera supports Full-HD (1920x1080p) and HD (1280x720) 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_CU40 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_CU40 works seamlessly with these OSes. The camera is exposed as DirectShow Capture source to the Windows PC and e-con provides sample DirectShow application that demonstrates the features of this camera. Any DirectShow compliant application such as Skype can work with this camera like any other webcam.

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_CU40 camera using standard V4L2 APIs.

The See3CAM_CU40 also supports all the features with a USB 2.0 fallback. However, in USB 2.0, See3CAM_CU40 can stream uncompressed video of 672 x 380 resolution at 64 fps, 720p17, 1080p9 and 2688x1520 at 4 fps in Bayer 10-bit RAW format. All these frame rates are the maximum supported frame rates by this camera.

The See3CAM_CU40 camera board has a 10-pin GPIO header that contains signals which can be used for customization requirements. The See3CAM_CU40 has serial I2C Signals Clock and Data and Strobe from Sensor.

This functionality is embedded in the UVC firmware that is running on the See3CAM_CU40 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, 2 & 3 Power Supply for external flash circuitry (to be developed by the user). Refer to the Pin Description Table for maximum current that can be sourced.
2. Pin No: 4,5 Ground
3. Pin No: 6 I2C Serial Clock
4. Pin No: 7 I2C Serial Data (Both Clock and Data pulled up to 1.8V)
5. Pin No: 8 Ground
6. Pin No: 9 STROBE signal for LED flash applications where this signal is used for Flash LED illumination
7. Pin No: 10 No Connect

Together with these specific purpose signals this See3CAM_CU40 can be customized for any application by our customers and e-con can support them with the necessary technical and programming help.
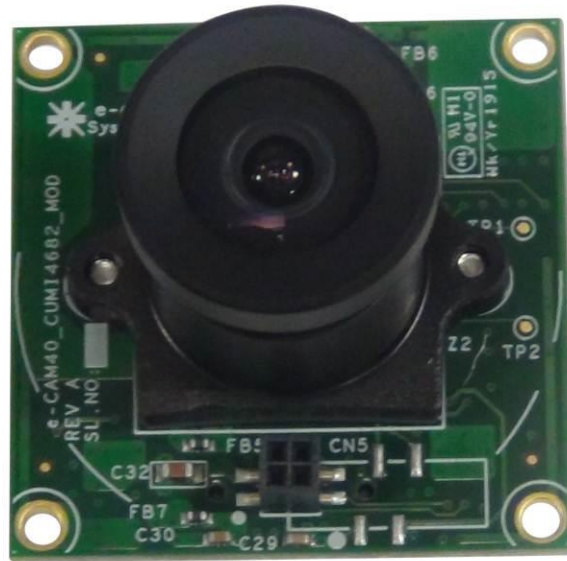
Figure 1: Front View of See3CAM_CU40

Figure 2: Rear View of See3CAM_CU40

5.1 Features

- Two Board Solution of size 30mm x 30mm
- 4.0 Megapixel RAW RGB-IR colour camera sensor
- Uncompressed Bayer 10 bit RAW format
- Standard M12 lens holder for use with customized optics or lenses for various applications
- USB3.0 device with USB3.0 Micro-B connector. Our Standard camera board will have USB3.0 Micro-B connector.
- Lightweight, versatile, and portable design

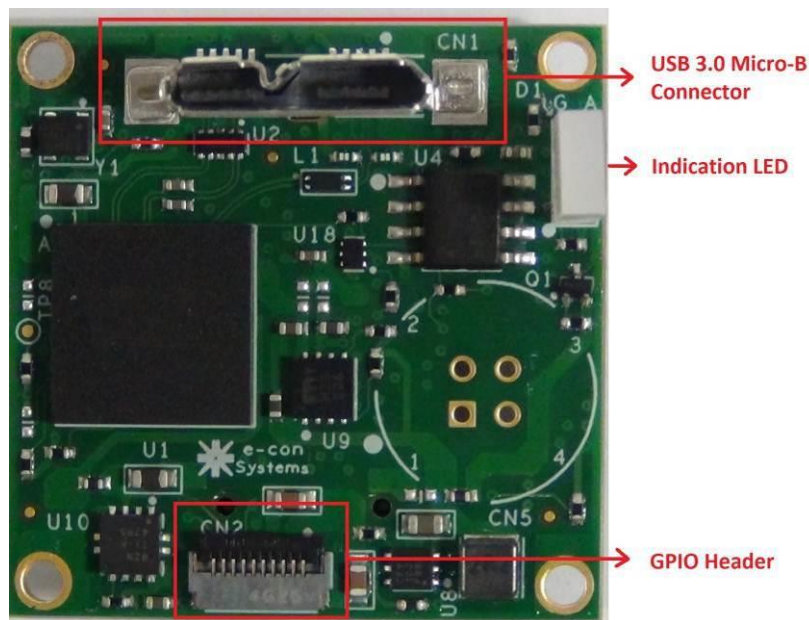- 10 pin GPIO header for standard and custom operations. GPIO pins accessible from the PC host application
- Plug-and-Play setup (UVC compliant)for Windows 7, Windows 8/8.1 and Linux
- Imaging applications
  - True 4.0 megapixel CMOS Image sensor
  - Still Capture supported resolution
    Bayer 10-bit RAW – 672x380, 1280x720, 1920x1080 and 2688x1520
    Preview – 672x380, HD(720p), Full-HD (1080p) and 2688x1520
  - Output Video format – Bayer 10-bit RAW
- Operating Voltage - 5V +/- 5%, Current - 220mA
- RoHS compliant

6   Key Specification

Description	Specification
Size (L X W X H)	30 x 30 x 30.2 mm (without lens)
Video format	Bayer 10-bit RAW
USB	3.0 and 2.0
Image Resolution	2688x1520 (4 MP), FHD, HD and 672x380
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)	0xC140
VID (Vendor ID)	0x2560

6.1   Maximum Frame Rate Supported

Please note that the See3CAM_CU40 supports UVC-compliant streaming in Bulk Transport only. The frame rates mentioned below are based on the 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 etc., the frame rate will go down and depending on the bandwidth availability, the frame rate may even drop down to zero during those instances.

Note: The maximum frame rates are assured only in manual exposure. When the exposure value is changed greater than -8 (3.9 milli seconds) there will be a drop in the frame rate because the exposure time period is more than the time period of camera frame.

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. These frame rates are achieved under the ambient brightness level of 500 Lux

Mode / Resolution	672x380	1280X720 HD	1920x1080 FHD	2688x1520 4M
Bayer 10 bit RAW	256	90	40	14

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	672x380	1280X720 HD	1920x1080 FHD	2688x1520 4M
Bayer 10 bit RAW	64	17	9	4

6.2 CMOS Image Sensor specification

The following table describes the specifications of the CMOS Image sensor used in this See3CAM_CU40 camera board. For more information about the OV4682 sensor or for datasheet, please contact Omni Vision.

Sensor Specification	
Type / Optical Size	1/3" Optical format CMOS Image sensor
Resolution	4MP
Sensor type	Colour – 10 bit Bayer RGB
Pixel size	2 µm x 2 µm
Sensor Active Area	2688H x 1520V
Responsitivity	1.9 V/lux-sec
SNR	38.3 dB
Dynamic Range	64.6 dB

7   Pin Description

See3CAM_CU40 has two connectors namely USB 3.0 connector and one GPIO Header.

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_5V [1]	Power	Supply voltage for external Flash circuit	It can source up to 500mA and 300mA when See3CAM_CU40 is connected with USB3.0 and USB2.0 respectively. 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 / Output (*PU)	Serial Data of I2C Signal	
8	GND	Power	Ground	
9	STROBE	Output(*PD)	Strobe output from camera sensor	
10	NC	-	No Connect	

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

(1) **NOTE ON VCC_5V 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. Only when interfaced to USB3.0 port, this can source maximum current of 500mA. When connected to USB2.0 port, VCC_5V will source maximum current of 300 mA. Consuming beyond the maximum current will lead to drop in voltage and affect the performance of sensor. Thus the performances are not guaranteed.*

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_CU40 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_CU40 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 (CN8 on See3CAM_CU40 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)

9 Electrical Specification

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

9.1 Recommended Operating Condition

Parameter	Typical Operating Voltage	Typical Power consumption (W)
USB input voltage	5V ± 250mV	1.1

The following table lists down the current consumed by the See3CAM_CU40 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   USB3.0 – Bayer RAW

S.No	Resolution	Supply Voltage (V)	Typical Current (mA)	Power Consumption (W)
1	672 x 380 at 256 fps	5	220	1.1
2	1280 x 720 at 90 fps	5	215	1.075
3	1920 x 1080 at 40 fps	5	210	1.050
4	2688 x 1520 at 14 fps	5	205	1.025

9.1.2   USB2.0 – Bayer RAW

S.No	Resolution	Supply Voltage (V)	Typical Current (mA)	Power Consumption (W)
1	672 x 380 at 64 fps	5	160	0.800
2	1280 x 720 at 17 fps	5	160	0.800
3	1920 x 1080 at 9 fps	5	160	0.800
4	2688 x 1520 at 4 fps	5	160	0.800

9.2   DC Characteristics

ABSOLUTE MAXIMUM FOR GPIO PINS

Parameter	Description	Value	Units
Vinput[a]	DC Input voltage to any input pin	2.1	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			0.45	V
V_{IH}	Input voltage HIGH	1.4			V
Digital Output signals					
V_{OL}	Output voltage LOW			0.18	V
V_{OH}	Output voltage HIGH	1.62			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				0.18	V
V_{OH}	Output voltage HIGH	1.62				V
I_O	Output current (Source Current)				100	uA

9.3 Operating Temperature range

Parameter Description	Temperature Range
Operating temperature range(for applications up to 90 fps)[1]	-30°C to 85°C
Stable Image Temperature[2]	0ºC to 60ºC

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

NOTE: *When operating beyond 60°C, the image quality is affected badly with thermal flickering noise all over the image. Continuously operating the camera at 85°C (maximum value) will cause irreparable damage to the camera module. Customers are advised to make necessary arrangements on their products to dissipate the heat generated in the module to maintain the operating temperature below 60°C*

10 Mechanical Specifications

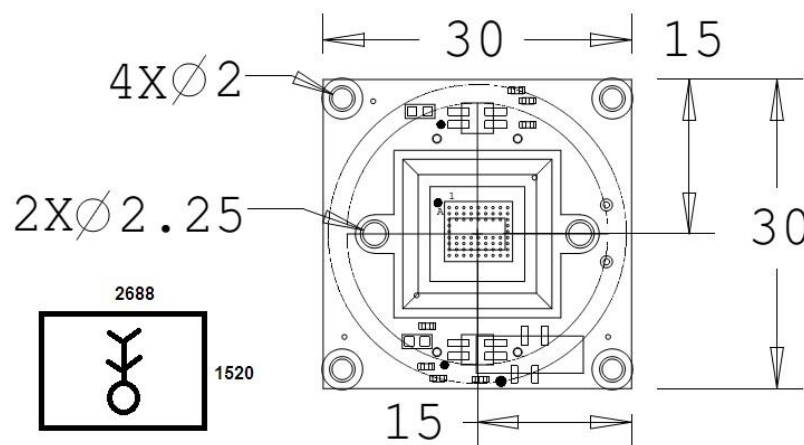See3CAM_CU40 size is 30 mm x 30 mm x 30.2 mm (without Lens). Board drawing and dimensions are given below.

10.1 See3CAM_CU40 Dimension

Figure 3: Front Portion of See3CAM_CU40 Module Board mechanical dimensions – the image will be upside down when the board is placed as shown above
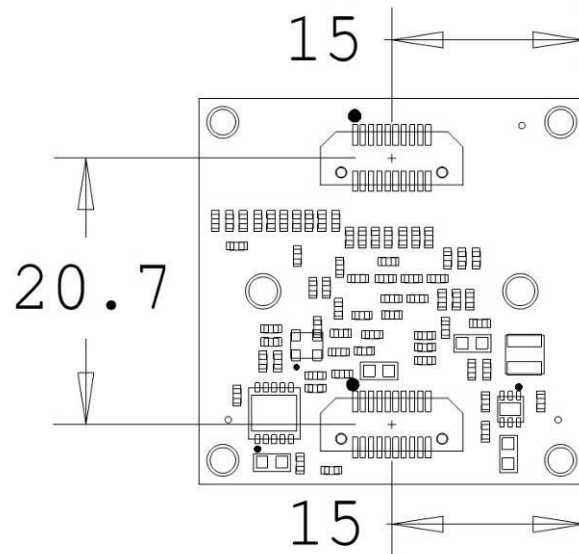
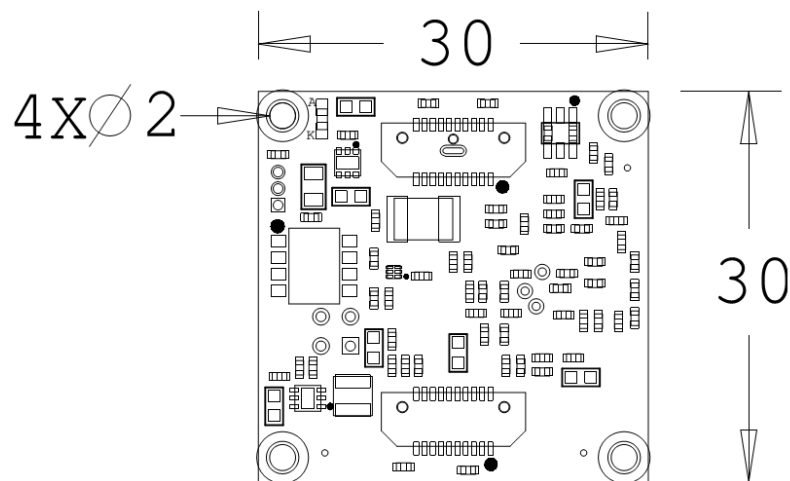*Figure 4: Rear Portion of See3CAM_CU40 Module Board mechanical dimensions*

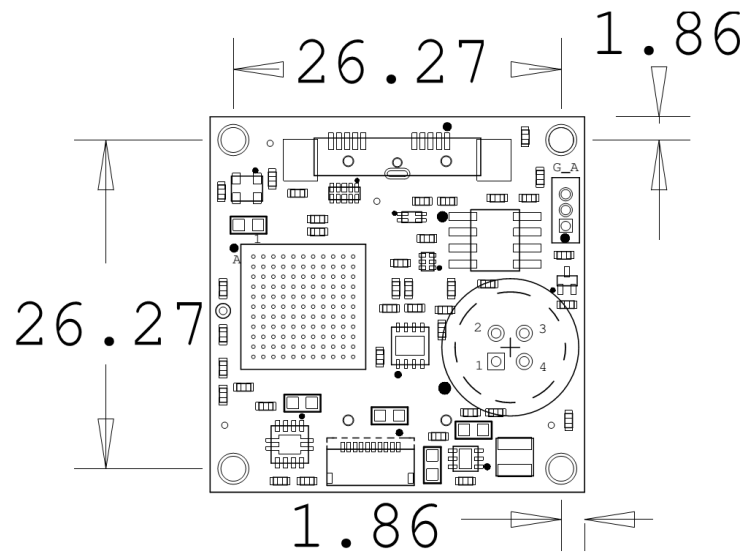*Figure 5: Front Portion of See3CAM_CU40 Base Board mechanical dimensions*

Figure 6: Rear Portion of See3CAM_CU40 Base Board mechanical dimensions

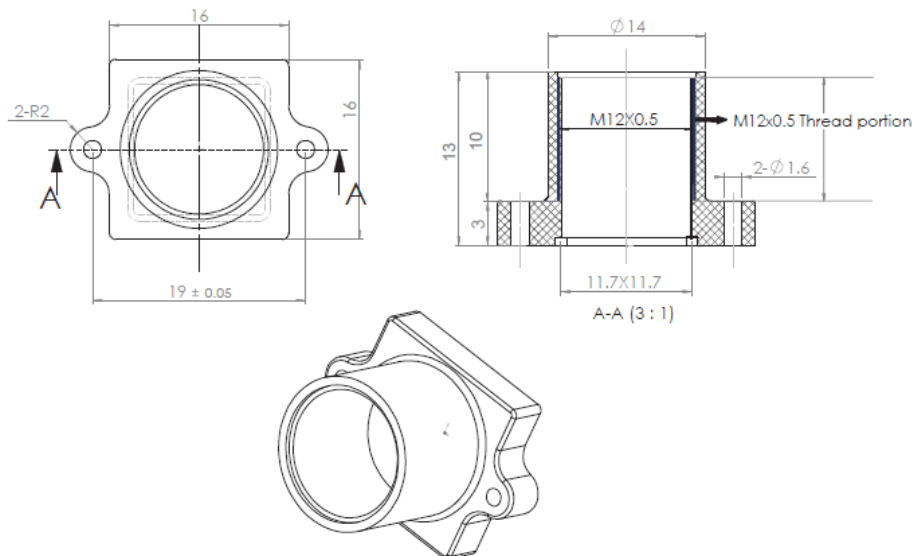## 10.2 Lens Holder Dimension

Lens Mount Mechanical Dimension

Figure 7: Lens Holder mechanical dimensions

11 Conclusion

This document describes about the features and See3CAM_CU40 board and the pin-outs of the connectors including mechanical specifications.