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e-CAM20_CUXVR

Datasheet

Revision 1.2
05th Aug 2019

Contents

Revision History

Rev	Date	Description	Author
1.0	17-May-2019	Initial draft	Camera Team
1.1	09-July-2019	**In Section 3,** • Product variants are removed. • Operational flow chart is removed. • 4-Lane and 2-Lane MIPI configurations are removed. • Asynchronous and synchronous mode are added. **In section 5,** Pin-out details of camera connector CAM B (CN3) is removed. **In section 6,** • Power consumption details of e-CAM20_CUXVR variants are removed. • Power consumption details for asynchronous and synchronous modes are added.	Camera Team
1.2	05-Aug-2019	TX2 support is added	Camera Team

1   Introduction

e-con Systems is a leading Embedded Product Design Services Company, which is specialized in designing the multi-camera synchronous solution for Jetson platforms. In continuation to multi-camera solutions, e-con Systems has developed a new multi-camera board called e-CAM20_CUXVR board. This multi-camera board targets the NVIDIA® Jetson AGX Xavier™ and TX2™ development kits. It can be directly interfaced with Jetson AGX Xavier™ development kit through a J509 connector or with Jetson TX2™ development kit through a J22 connector.

e-CAM20_CUXVR board connects one or four 2 MP custom lens camera modules based on IMX290 CMOS image sensor from Sony®. This 2 MP color camera has 1/2.8" optical form-factor with electronic rolling shutter and utilizes Jetson platforms in-built ISP. This camera module is provided with S-mount lens holder (also known as M12 board lens), which is the most commonly used small form-factor lens mounts for board cameras and offers customized optics.

This document describes the features of e-CAM20_CUXVR board and the pin-outs of the connectors including the mechanical diagram.

2   Disclaimer

The specifications and features of e-CAM20_CUXVR camera board are provided here as reference only and e-con Systems reserves the right to edit or modify this document without any prior intimation of whatsoever.

3   Description

e-CAM20_CUXVR is a multi-board multi-camera solution for Jetson platforms, which is compatible with Xavier™ and TX2™ development kits. When e-CAM20_CUXVR is interfaced with Xavier™ development kit, it supports four cameras with 4-Lane MIPI configuration and when interfaced with TX2™ development kit, it supports same four cameras with 2-Lane MIPI configuration.

e-CAM20_CUXVR is a multi-board solution, which has three boards as follows:

- Camera base board (e-CAM30_HEXCUXVR_BASE_BRD)
- Adaptor board (e-CAM130_TRICUTX2_ADAPTOR)
- Module board (e-CAM21_CUMI290_MOD)

The below figures show the camera base board, adaptor board and module board.

Figure 1: Camera Base Board

Figure 2: Adaptor Board

Figure 3: Module Board

The module board is based on IMX290 CMOS image sensor from Sony®. These MIPI camera modules can be streamed in maximum of FHD resolution at 120 fps, which will be best for high end multi-camera solution.

The e-CAM20_CUXVR camera base board has one 120-pin connector (CN1) that can be directly mated with Jetson platform development kit and six 30-pin micro-coaxial connectors (CN2 (CAM A), CN3 (CAM B), CN4 (CAM C), CN5 (CAM E), CN6 (CAM D), and CN7 (CAM F)) for interfacing with camera modules through 30 cm micro-coaxial cable. Among which, only CN2 (CAM A), CN4 (CAM C), CN5 (CAM E), CN7 (CAM F) are used for connecting four camera modules and other two CN3 (CAM B) and CN6 (CAM D) are reserved by econ Systems and left unconnected. The camera connector positions in the e-CAM20_CUXVR board is shown below.
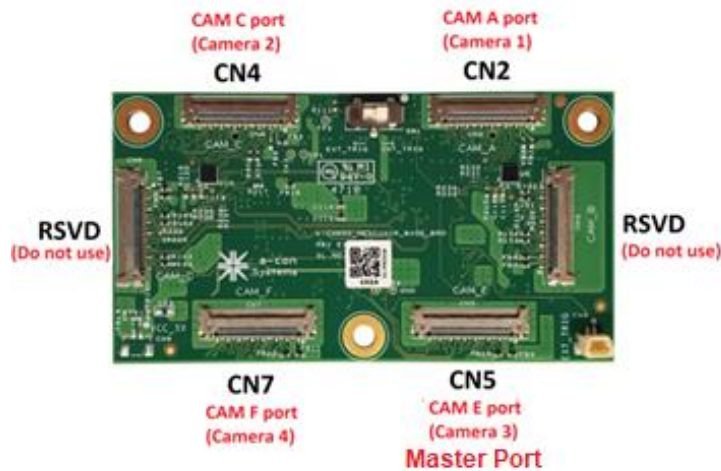

Figure 4: Camera Connector Positions in e-CAM20_CUXVR Board

For detailed interfacing of the e-CAM20_CUXVR camera board, please refer to the *e-CAM20_CUXVR_Getting_Started_Manual.pdf*.

e-CAM20_CUXVR operates in two modes as follows:

- Asynchronous Mode
- Synchronous Mode

3.1 Asynchronous Mode

The asynchronous mode is the normal streaming mode. In this mode, all four cameras can be controlled individually. The below table lists the supported frame rates in asynchronous mode.

Platform	Resolution	Frame Rate (fps) in 10-bit Output	Frame Rate (fps) in 12-bit Output
With Xavier	HD (1280 x 720)	120	60
	FHD (1920 x 1080)	120	60
With TX2	HD (1280 x 720)	--	60
	FHD (1920 x 1080)	--	60

Table 1: Maximum Frame Rates in Asynchronous Mode

3.2 Synchronous Mode

Synchronization is a special feature of e-CAM20_CUXVR board, in which output of each camera is frame synchronized. In synchronization state, CAM E (CN5) port acts as master, which provides sync signal for all other cameras. So, camera must be connected to CAM E port, if synchronization is needed. The below table lists the supported frame rates in synchronous mode.

Platform	Resolution	Frame Rate (fps) in 10-bit Output	Frame Rate (fps) in 12-bit Output
With Xavier	HD (1280 x 720)	30	30
	FHD (1920 x 1080)	30	30
With TX2	HD (1280 x 720)	30	30
	FHD (1920 x 1080)	30	30

Table 2: Maximum Frame Rates in Synchronous Mode

Note:
- Synchronous Mode is supported for only more than two cameras.
- Ensure CAM E port is connected in order to use synchronization feature.

3.3 Features

The features of e-CAM20_CUXVR are as follows:
- Multi-board solution.
- Compactable with Xavier and TX2 platforms.
- One or four 2 MP cameras are supported.
- Standard M12 lens holder for use with customized optics or lenses for various applications.
- Light weight, versatile, and portable design.
- Asynchronous and synchronous states.
- Control for individual cameras and numbers of cameras to be streamed is selectable.
- Imaging applications:

- 2 MP CMOS image sensor with RGB 10-bit/12-bit output format.
- Still capture supported resolution - HD and FHD.
- Preview supported resolution - HD and FHD.
- Field of View (FOV) angle is not the same for all preview resolutions.
- Operating power – 1.94W (Four cameras streaming condition).
- Operating temperature -30°C to +85°C.
- Restriction of Hazardous Substances (RoHS) compliant.

4   Key Specifications

The below table lists the key specifications of e-CAM20_CUXVR.

Description	Specification
Base Board Size (L x W)	75.03 mm x 40.69 mm
Video Format	YUV 420
Image Resolution	1920 x 1080 (2 MP)
Supported OS	Linux

Table 3: Key Specifications of e-CAM20_CUXVR

4.1 CMOS Image Sensor Specification

The below table lists the specification of CMOS image sensor used in e-CAM20_CUXVR board.

Sensor Specification	
Type/Optical Size	1/2.8" Optical format CMOS image sensor
Resolution	2 MP
Sensor Type	RAW 10-bit/12-bit
Pixel Size	2.9 µm x 2.9 µm
Total Number of Pixels	1945H x 1109V
Sensor Effective Area	1945H x 1097V
G Sensitivity	1.3V at 12-bit HCG mode
	0.65V at 12-bit LCG mode

Table 4: CMOS Image Sensor Specification

For more information about IMX290 CMOS image sensor or for *Datasheet*, please contact Sony®.

5   Pin Description

The e-CAM20_CUXVR base board has seven connectors such as interface connector (CN1), CAM A (CN2), CAM B (CN3), CAM C (CN4), CAM D (CN6), CAM E (CN5) and CAM F (CN7) connectors. CAM B (CN3) and CAM D (CN6) are reserved by e-con Systems and are not used in e-CAM20_CUXVR board. The pin description of connectors is explained below.

5.1 Pin-out Details of CAM A Camera Connector (CN2)

The below table lists the pin-out details of CAM A connector.

Pin No	Signal Name	Pin Type	Description
1	VCC_3P3	POWER	3.3V Power supply for camera and adaptor boards
2	VCC_3P3	POWER	3.3V Power supply for camera and adaptor boards
3	VCC_1P8	POWER	1.8V Power supply for camera and adaptor boards

4	GND	POWER	Ground signal for digital and analog
5	GND	POWER	Ground signal for digital and analog
6	PWDN	OUTPUT	Camera Power down signal
7	I2C_SCL	OUTPUT	I2C Clock signal
8	I2C_SDA	I/O	I2C Data Signal
9	GND	POWER	Ground signal for digital and analog
10	MIPI_D2_N	INPUT	MIPI Data Lane 2 Differential Pair -
11	MIPI_D2_P	INPUT	MIPI Data Lane 2 Differential Pair +
12	TRIGGER	OUTPUT	Camera trigger signal
13	RSVD	-	Reserved
14	GND	POWER	Ground signal for digital and analog
15	MIPI_D1_N	INPUT	MIPI Data Lane 1 Differential Pair -
16	MIPI_D1_P	INPUT	MIPI Data Lane 1 Differential Pair +
17	GND	POWER	Ground signal for digital and analog
18	GND	POWER	Ground signal for digital and analog
19	MIPI_D0_N	INPUT	MIPI Data Lane 0 Differential Pair -
20	MIPI_D0_P	INPUT	MIPI Data Lane 0 Differential Pair +
21	RESET	OUTPUT	Camera reset signal (Active low)
22	GND	POWER	Ground signal for digital and analog
23	RSVD	-	Reserved
24	MIPI_CLK_N	INPUT	MIPI Clock Lane Differential Pair -
25	MIPI_CLK_P	INPUT	MIPI Clock Lane Differential Pair +
26	GND	POWER	Ground signal for digital and analog
27	MIPI_D3_N	INPUT	MIPI Data Lane 3 Differential Pair -
28	MIPI_D3_P	INPUT	MIPI Data Lane 3 Differential Pair +
29	FLASH	INPUT	Camera Flash signal
30	RSVD	-	Reserved

Table 5: Pin-out Details of CAM A Connector

Note: The above camera connector pin-out details remain same for CAM C (CN4), CAM E (CN5) and CAM F (CN7).

5.2 Connector Part Numbers

The below table lists connectors used in e-CAM20_CUXVR and its compatible mating connectors.

Connector	Description	Manufacturer	Part Number
e-CAM20_CUXVR base board mating connector (CN1) with Xavier™	120-pin SMT connector with 0.5 mm pitch	Samtec	QTH-060-01-H-D-A-K
e-CAM20_CUXVR headers (CN2, CN3, CN4, CN5, CN6, CN7) for mating base board with adaptor boards	30-pin receptacle connector with 0.4 mm pitch fully shielded	I-PEX	20682-030E-02
Micro-coaxial cable assembly to connect base board and adaptor board	30 cm length micro-coaxial cable with pin 1 to 1 compatible	I-PEX	81214-530B-300-1

Table 6: Connector Part Numbers

6 Electrical Specification

The electrical specification of e-CAM20_CUXVR are as follows:

- Functional Temperature Range
- Recommended Operating Condition
- Power Consumption Details in Asynchronous Mode
- Power Consumption Details in Synchronous Mode

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.

6.1 Functional Temperature Range

The functional temperature range of e-CAM20_CUXVR is listed in the following table.

Temperature Range	Parameter Description
-30°C to 85°C	Electrically functional operating range

Table 7: Operating Temperature Range

Note: The default lens (optional) supplied with this camera has operating temperature range of -20°C to +60°C. You can choose wider operating temperature lens as per your requirements.

6.2 Recommended Operating Condition

The below table lists the recommended operating condition of e-CAM20_CUXVR.

Development Kit	Typical Operating Voltage	Typical Power Consumption
With Xavier	3.3 V	1.940 W
With TX2	5 V	

Table 8: Recommended Operating Condition

6.3 Power Consumptions Details in Asynchronous Mode

The below table lists the power consumption details of *e*-CAM20_CUXVR for four camera modules in asynchronous mode.

Mode	Resolution	Power Consumption (W)
Asynchronous	HD at 120 fps	1.650
	FHD at 120 fps	1.940

Table 9: Power Consumption of e-CAM20_CUXVR in Asynchronous Mode

6.4 Power Consumptions Details in Synchronous Mode

The below table lists the power consumption details of *e*-CAM20_CUXVR for camera modules in synchronous mode.

Mode	Resolution	Power Consumption (W)

Synchronous	HD at 30 fps	1.033
	FHD at 30 fps	1.195

Table 10: Power Consumption of e-CAM20_CUXVR in Synchronous Mode

7 Mechanical Specifications

e-CAM20_CUXVR base board size is 75.03 mm x 40.69 mm. The board drawing and its dimensions are described in the following section.

7.1 e-CAM20_CUXVR Dimension

The front portion of e-CAM20_CUXVR base board with mechanical dimensions is shown below.
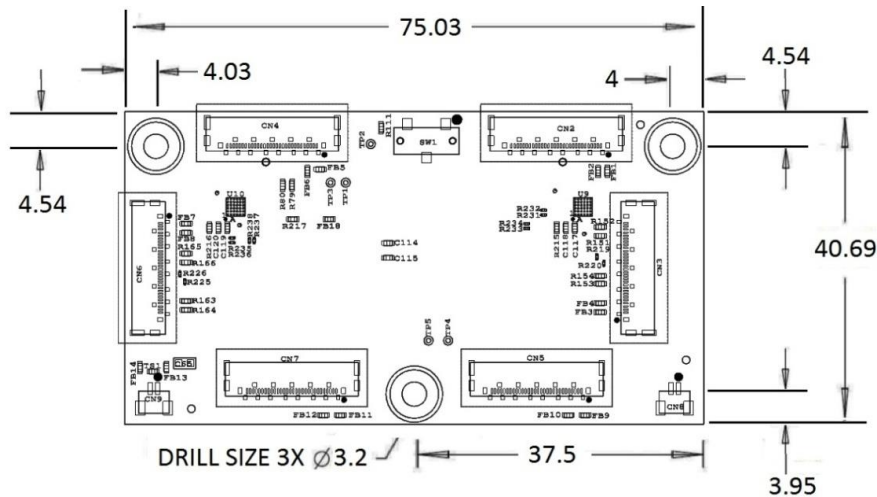

Figure 5: Front Portion of e-CAM20_CUXVR Base Board Mechanical Dimensions

The e-CAM20_CUXVR adaptor board with mechanical dimensions is shown below.
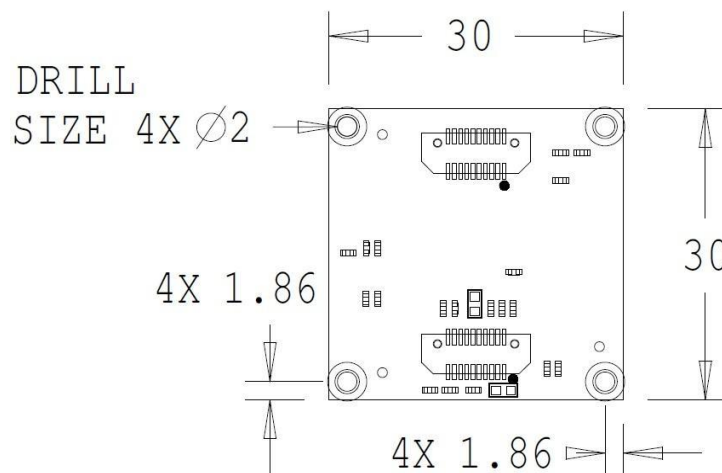

Figure 6: e-CAM20_CUXVR Adaptor Board Mechanical Dimensions

Note: All dimensions are in mm.

For e-CAM20_CUXVR module board mechanical dimension information, please refer to the *e-CAM21_CUMI290_MOD_Datasheet.pdf*.

Support

Contact Us

If you need any support on e-CAM20_CUXVR 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