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STURDeCAM20



Camera Module Datasheet

Revision 1.3

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1 Revision History

Rev	Date	Description	Author
1.0	23/June/2020	Initial draft	Camera Team
1.1	22/Aug/2020	Product images updated	Camera Team
1.2	29/Aug/2020	Product images updated	Camera Team
1.3	21/Oct/2020	Product images updated	Camera Team



2 Introduction

STURDeCAM20 is a family of STURDeCAM IP67 rugged camera module from e-con Systems with high-speed unified serial interface that carries video data, control data and power in a single coaxial cable. In this product 2 MP camera module is packed in an IP67 rated aluminum enclosures and making this product suitable for any outdoor environments applications.

STURDeCAM20 uses Maxim's Gigabit Multimedia Serial Link (GMSL) interface technology for the serial interface to the camera through single coaxial cable. This serial interface uses coaxial cable that carries high-speed video data from the camera, bidirectional control data between the camera and host controller, and power supply for the camera. The power to the camera is supplied from the host processor through this coaxial cable.

STURDeCAM20 is a 2 MP GMSL camera contains a 1/2.7" AR0230AT CMOS image sensor from onsemi® along with on-board ISP and MCU. STURDeCAM20 can be interfaced with MAX9296A, MAX9296B and MAX96712 GMSL2 deserializers IC from Maxim and also backward compatible with GMSL1 chips.

This document describes about the features of STURDeCAM20 board including the mechanical diagram.

3 Disclaimer

The specifications and features of STURDeCAM20 camera board are provided here as reference only and e-con Systems reserve the right to edit/modify this document without any prior intimation of whatsoever.

4 Description

STURDeCAM20 is an IP67 rated 2 MP low-power, high performance camera module with aluminum enclosure. Inside the STURDeCAM20 enclosure, a 1/2.7" optical form factor AR0230AT image sensor with an electronic rolling shutter from onsemi® along with Image Signal Processor (ISP) and the GMSL2 serializer are packed.

The following figure shows the STURDeCAM20.



Figure 1: STURDeCAM20 Module



STURDeCAM20 enclosure has two slots, one is stranded M12 lens mounting hole with fully threaded and the other is FAKRA male connector for inserting cable. By default, STURDeCAM20 is provided with permanently fixed IP67 rated lens in focused condition, with a focus range of 1m to infinity. The lens specification can be found in STURDeCAM20_CUXVR Lens datasheet. For any customization of Lens please write to www.e-consystems.com.

The serializer inside the STURDeCAM20 is based on Maxim GMSL2 serializer chip and has all the circuitry required for bidirectional data communication, power and data separation. The FAKRA connector is used for the coaxial cable interface.

4.1 Features

The features of STURDeCAM20 are as follows:

- Rugged aluminum enclosure of size 42mm x 42mm
- Water and dust proof camera with IP67 certified
- IP67 Shielded coaxial cable for transmission of both power and data for long distance (up to 15m) and its IP67 nature is supported up to 5 mating cycles
- 1/2.7" Optical form factor, 2 MP camera module
- Uncompressed UYVY format
- Capable of high frame rate uncompressed video
 - VGA (640 x 480) at 60fps
 - QHD (960 x 540) at 58fps
 - HD (1280 x 720) at 45 fps
 - 960p (1280 x 960) at 34 fps
 - FHD (1920 x 1080) at 30 fps
- Light weight, versatile, and portable design
- Operating voltage- 5 to 15V with +/- 5% tolerance.
- Typical power consumption : 2.196W
- Restriction of Hazardous Substances (RoHS) compliant

4.2 CMOS Image Sensor Features

The following table lists the key specifications of STURDeCAM20.

Sensor Specification	
Type / Optical Size	1/2.7" Optical format CMOS image sensor
Resolution	2MP (1920 x 1080)
Sensor Type	10 or 12-Bit RGB format
Pixel Size	3 μ m x3 μ m
Sensor Active Area	1928H x 1088V
Responsivity	4.0 V/lux-sec
NR (max)	41 dB
Dynamic Range	Max. up to 96 dB

Table 1: CMOS Image Sensor Features



4.3 Maximum Frame Rate Supported

The following table lists the maximum frame rate supported by the camera module.

Resolution	Frame Rate (Uncompressed UYVY)	% Crop in FOV	
		Horizontal	Vertical
640 x 480	60 fps	66.67%	55.55%
960 x 540	58 fps	50.00%	50.00%
1280 x 720	45 fps	33.33%	33.33%
1280 x 960	34 fps	33.33%	11.11%
1920 x 1080	30 fps	0.00%	0.00%

Table 2: Maximum Frame Rate Supported

5 Power over Coax (PoC)

The STURDeCAM20 module contains a camera module board (with AR0230AT image sensor and ISP) and a serializer board. The power for these pair of boards is supplied from the host controller side through PoC.

5.1 Power and Signal Flow in PoC

The STURDeCAM20 serializer and Host deserializer communicate using PoC technology. The PoC channel is used for transmitting serialized video from Serializer to deserializer (forward channel) and a lower frequency control channel from deserializer to serializer (reverse/back channel) along with DC power.

The camera module and serializer board are powered from Electronic Control Unit (ECU) containing deserializer and processor. The filter on the ECU side is used to merge DC power with the video and communication data, while the filter on the camera side is to separate the DC power from the video and communication data and powers its internal circuitry.

The following figure shows the power and signal flow in the PoC.

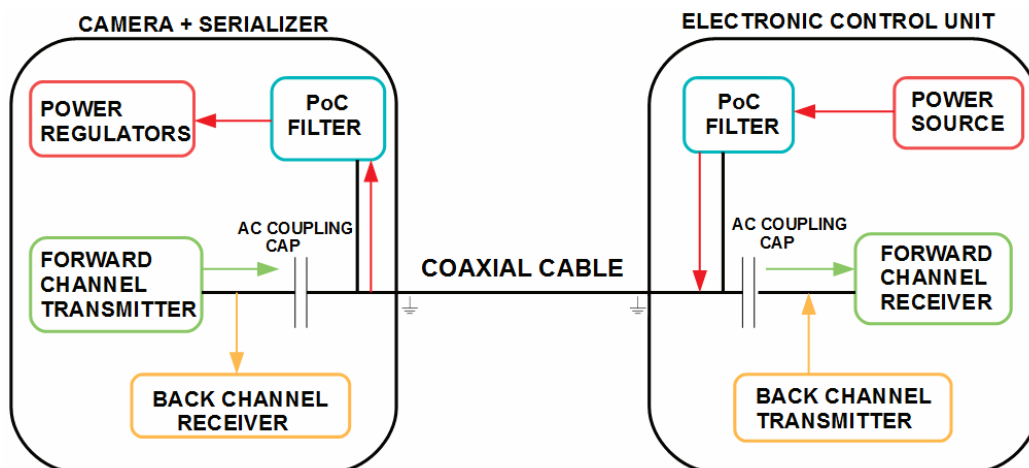


Figure 2: Typical PoC Power and Signal Flow



As a single coaxial cable transmits data with three different frequencies, a filter must be added on both sides of the communication link. Ideally the PoC filter must have low impedance for DC signals and high impedance for back channel and forward channel signals. Hence, inductors are used for the PoC low pass filter construction.

e-con Systems recommends 5V to 15V as standard voltage for STURDeCAM20 PoC line.

5.2 PoC Filter Design

The PoC filter must have high impedance at back and forward channel frequencies to filter the DC power from the coaxial data. As 50Ω termination is used for data channels, a 20x increase in impedance (1KΩ) is required to filter the high frequency content. Every inductor has parasitic capacitance that causes self-resonance and a corresponding drop in impedance at high frequencies. The inductors of different sizes are chosen to filter all the frequency bands of interest.

The following figure shows the series of inductors which are used to filter the high frequencies.

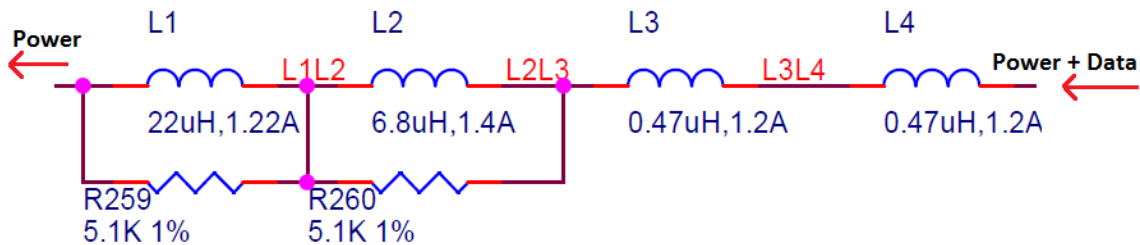


Figure 3: PoC Filter

As the PoC channel also contains required high frequency data, an AC coupling cap is placed near the STURDeCAM20 serializer to extract the data (filtering out DC).

5.3 PCB Layout Guidelines for PoC

The PCB layout guidelines for PoC are listed as follows:

- Route the coaxial trace to a FAKRA connector as a 50Ω single ended trace, with tight impedance control. If the trace is not 50Ω and laid out cleanly, performance issues can arise.
- Place the AC coupling capacitors close to the Serializer/Deserializer.
- Route high speed coaxial trace from the FAKRA connector with the most direct route and minimum trace length as possible. On the path of this high-speed trace, the components must be placed, to minimize the stub length seen by the transmission line.
- Ensure the coaxial trace can carry PoC current without temperature rise.
- Routing highest to lowest SRF inductor on the GMSL line is critical. Highest being positioned directly on the GMSL RF line followed by the next highest and so on.
- Minimize the distance between IC, PoC, and connector.
- Cut out the ground on open coil inductors where the coil is exposed.



Note: Reference Deserializer board schematics and PCB files can be shared based on request.

6 Connector Pin-outs

The following sections describe the pin descriptions of STURDeCAM20 connector.

STURDeCAM20 has a high frequency FAKRA straight plug connector to mate with coaxial cable. The connector on STURDeCAM20 is shown in the below figure.



Figure 4: Connectors on Camera Module Enclosure

The following table lists the pin-outs details of FAKRA plug.

Pin No	Signal	Pin Type	Description
1	Coax	Input / Output	Coaxial signal that carries both power and bidirectional data
2	GND	Power	Ground
3	GND		Ground
4	GND		Ground
5	GND		Ground

Table 3: FAKRA Plug Pin-out Details

Warning: e-con Systems strongly recommend, do not remove the screws given in STURDeCAM20 enclosure, if removed e-con systems don't guarantee the IP67 performance of STURDeCAM20 camera. The location of the enclosure screws location is shown below.





Figure 5: Enclosure Screws Location

7 Electrical Specification

This section lists the electrical specification and recommended operating conditions of STURDeCAM20.

7.1 Recommended Operating Condition

The current consumption values are measured for an ambient level of 128 lux. The following table lists the recommended operating condition of STURDeCAM20.

Parameter	Typical Operating Voltage	Current (mA)	Typical Power Consumption (W)
Idle condition (Lock obtained, but camera not streaming)	12V \pm 250mV	68	0.78
Streaming maximum power at 1920 X 1080 at 30fps		183	2.196

Table 4: Recommended Operating Condition

Note:

- These values 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.
- The above current measured are for continuous device streaming.

7.2 Operating Temperature Range

The following table lists the operating temperature range of STURDeCAM20.

Parameter Description	Temperature Range
Operating temperature range	-40°C to 85°C



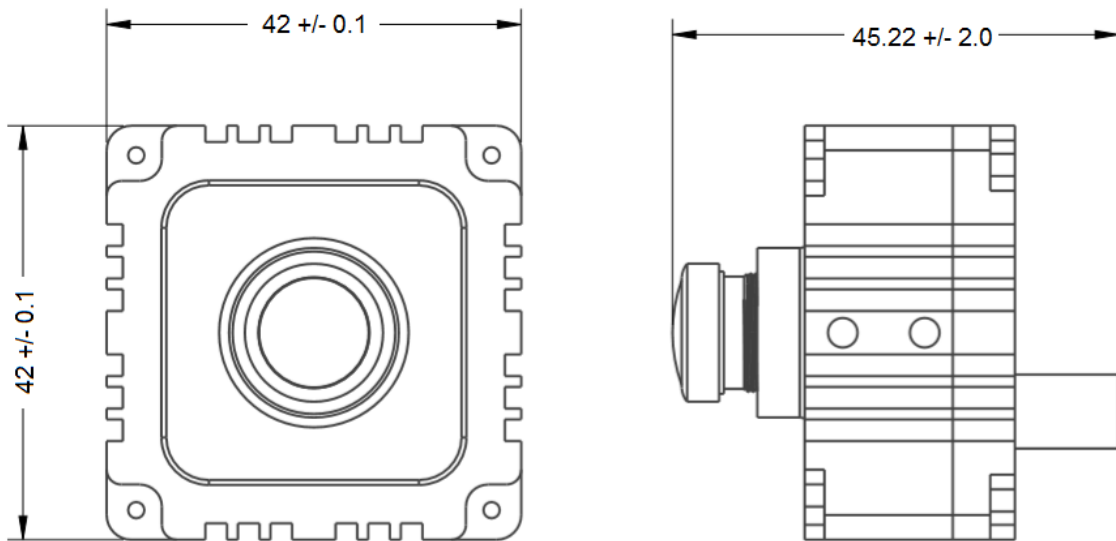
Stable Image Temperature Range	-40°C to 70°C
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Table 5: Operating Temperature Range

Note: The default lens supplied with this camera has an operating range of -30°C to 75°C.

8 Mechanical Specifications

STURDeCAM20 Enclosure dimensions details are shown in the below figure.

**Figure 6: STURDeCAM20 Mechanical Dimensions**

Note: All dimensions are in mm.



Support

Contact Us

If you need any support on STURDeCAM20 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>

