e-con Systems India Pvt Ltd

7th Floor, RR Tower–IV,

Super A-16 & A-17, Thiru-Vi-Ka Industrial Estate,

Guindy, Chennai - 600032.

www.e-consystems.com

STURDeCAM21

Module Datasheet

Revision 1.0

18th June 2022

Contents

1 Revision History

Rev	Date	Description	Author
1.0	18-JUNE-2022	Initial draft	PMT

2 Introduction

STURDeCAM21 is a full HD HDR camera with LFM support and it is part of the STURDeCAM family of cameras from e-con Systems with high-speed unified serial interface that carries video data, control data and power in a single coaxial cable. It uses serializer-deserializer (SerDes) technology that allows single coaxial cable interface for the camera. With coaxial cable lengths of up to 15m, STURDeCAM21 offers greater flexibility for the system architects to place the cameras in mechanically challenging designs of new generation embedded, automotive and autonomous driving applications. The flexibility of coaxial cable and the ability to carry video data, control data and power in a single cable makes STURDeCAM21 fast (low latency), flexible and yet reliable.It is packed in an IP67 rated aluminum enclosures to make this product suitable for any outdoor environments applications.

STURDeCAM21 uses Maxim's Gigabit Multimedia Serial Link (GMSL) interface technology for the serial interface to the camera. 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. STURDeCAM21 embeds the Maxim's serializer which serializes the high-speed image data and transmits over coaxial cable. The serializer also supports the bidirectional control data communication between the camera and host controller. The on-board electronics of STURDeCAM21 recovers the power supplied from the host controller without contaminating the data transfers.

STURDeCAM21 is a 2 MP GMSL camera contains a 1/2.5" AR0233AT CMOS image sensor from ON Semiconductor® along with on-board ISP. The coaxial cable is connected to Serializer Board through a rugged FAKRA connector. STURDeCAM21 can be interfaced with MAX9296A, MAX9296B and MAX96712 GMSL2 deserializers IC from Maxim's and also backward compatible with GMSL1 chips.

This document describes about the features of STURDeCAM21 board including the mechanical diagram.

3 Disclaimer

The specifications and features of STURDeCAM21 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

STURDeCAM21 is an IP67 rated full HD camera module with aluminum enclosure. Inside the STURDeCAM21 enclosure, a 1/2.5" optical form factor AR0233AT image sensor with an electronic rolling shutter from onsemi ® along with Image Signal Processor (ISP) and the GMSL2 serializer are packed.

Figure 1: STURDeCAM21 Module

This camera is available with M12 metal lens holder allowing customers to choose the lens as per their requirements. This camera contains Maxim GMSL2 serializer chip and has all the circuitry required for bidirectional data communication, power and data separation. The IP67 rated FAKRA connector is used for the coaxial cable interface.

4.1 Features

The features of STURDeCAM21 are as follows:

- 1/2.5" Optical form factor, 2 MP camera module
- Uncompressed UYVY format and compressed MJPEG format
- High Dynamic Range (HDR) with LED Flickering Mitigation (LFM)
- Rugged camera module with aluminum enclosure of size 42mm x 42mm
- Water and dust Proof Camera module 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
- Capable of high frame rate uncompressed video
  - VGA (640x480) at 60fps
  - QHD (960 x540) at 58fps
  - HD (1280x720) at 45 fps
  - FHD (1920x1080) at 30 fps
- Lightweight, versatile, and portable design
- Operating voltage- 5 to 15V with +/- 5% tolerance.
- Typical power consumption: 2.196W
- Operating Temperature: −40°C to 85°C
- Restriction of Hazardous Substances (RoHS) compliant

4.2 CMOS Image Sensor Features

The following table lists the key specifications of STURDeCAM21.

Sensor Specification	
Type / Optical Size	1/2.5” Optical format CMOS Image sensor
Resolution	2MP

Sensor Type	24-Bit RGB Bayer
Pixel Size	3.0 µm x 3.0 µm
Sensor Active Area	2048H x 1280V
Responsivity	30.4 Ke−/lux−sec
Signal to Noise Ratio (SNR)	>43.1 dB
Dynamic Range	Max up to 140 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%
1920 x 1080	30 fps	0.00%	0.00%

Table 2: Maximum Frame Rate Supported

5 Power over Coax (PoC)

The STURDeCAM21 module contains a camera module board (with AR0233AT image sensor and ISP) and a Serializer board. The power for these pair of boards is supplied from the Deserializer through PoC.

5.1 Power and Signal Flow in PoC

The STURDeCAM21_CUXVR Serializer and Deserializer communicate using PoC technology. The PoC channel transmits serialized video channel 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.

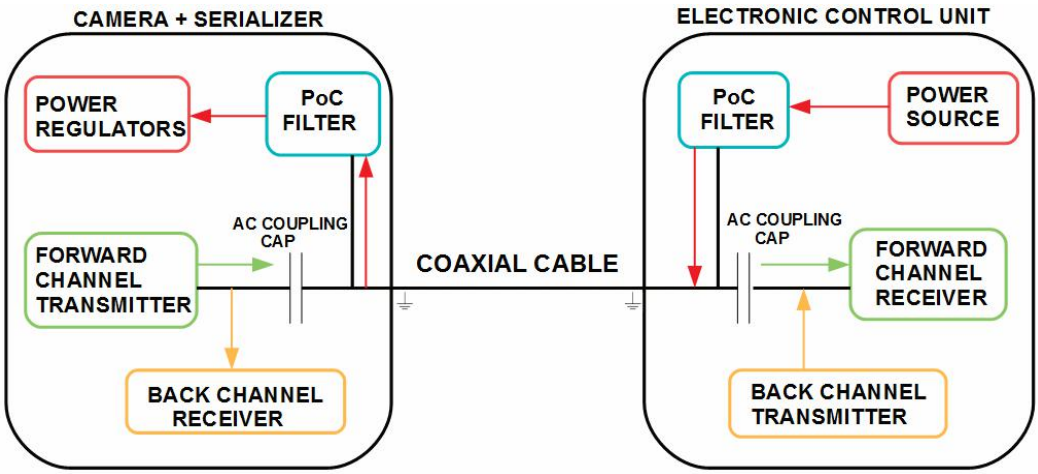

Figure 2: Typical PoC Power and Signal Flow

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 to15V as standard voltage for STURDeCAM21 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.

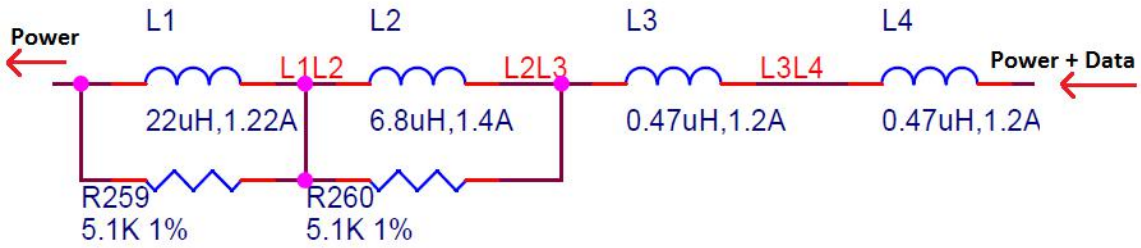

Figure 3: PoC Filter

As the PoC channel also contains required high frequency data, an AC coupling cap is placed near the STURDeCAM21 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. Also, the components on the path of this high-speed trace 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 Pinouts

The below section describes the pin-outs and connector locations of FAKRA connector in STURDeCAM21 enclosure.

Figure 4: Connector on STURDeCAM21 Camera Module

STURDeCAM21 camera module has a high frequency FAKRA straight plug (CN1), to mate with coaxial cable. The same FAKRA straight plug and pin-outs are used in the deserializer board. 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-outs Details

Warning: e-con Systems strongly recommend, do not remove the screws given in STURDeCAM21 enclosure, if removed e-con Systems does not guarantee the IP67 performance of STURDeCAM21 camera. The enclosure screw locations are shown below.

Figure 5: Enclosure Screws location

7 Electrical Specification

This section lists the electrical specification and recommended operating conditions of STURDeCAM21.

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 STURDeCAM21.

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

Table 6: 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 STURDeCAM21.

Parameter Description	Temperature Range
Operating temperature range	-40°C to 85°C
Stable Image Temperature Range	-40°C to 70°C

Table 7: Operating Temperature Range

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

Note: The default lens supplied with this camera has an operating range of -20°C to 85°C. Customers can choose wider operating temperature lens as per their requirements.

8 Mechanical Specifications

STURDeCAM21 enclosure dimension details are shown below

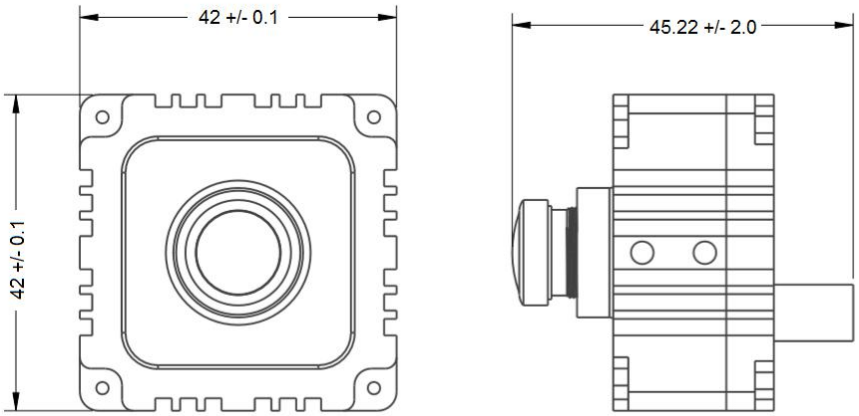

Figure 6: STURDeCAM21 Camera Module dimensions

Support

Contact Us

If you need any support on STURDeCAM21 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