BLUETECHNIX
Embedding Ideas

multi-tof front end

Hardware User Manual

Version 2

Contact

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Information

For further information on technology, delivery terms and conditions and prices please contact BECOM BLUETECHNIX (http://www.bluetechnix.com).

Warning

Due to technical requirements components may contain dangerous substances.

1 Introduction

The multi-tof front end is part of the multi-tof platform, which is designed to process the stream of up to four multi-tof front end time-of-flight sensors. This document describes the front end with phantom power option.

1.1 Symbols Used

This guide makes use of a few symbols and conventions:

Warning

Indicates a situation which, if not avoided, could result in minor or moderate injury and/or property damage or damage to the device.

Caution

Indicates a situation which, if not avoided, may result in minor damage to the device, in malfunction of the device or in data loss.

Note

Notes provide information on special issues related to the device or provide information that will make operation of the device easier.

Procedures

A procedure always starts with a headline

1. The number indicates the step number of a certain procedure you are expected to follow. Steps are numbered sequentially.

This sign ➤ indicates an expected result of your action.

References

This symbol indicates a cross reference to a different chapter of this manual or to an external document.

1.2 Eye Safety

Illumination: Laserdiodes	**Wavelength**	850nm (typ) 17W peak	

Caution

The device emits invisible IR radiation! Don't steer into the laser diodes beam! The device emits an optical power within the specification for laser class 1 according to IEC 60825-1:2014, Edition 3. Nevertheless, it is not fully certified, therefore the user of the device is responsible for correct handling.

1.3 Safety instructions

Important

This manual is part of the device and contains information and illustrations about the correct handling of the device and must be read before installation or use. Observe the operating instructions. Non-observance of the instructions, operation which is not in accordance with use as prescribed below, wrong installation or handling can affect the safety of people and machinery.

The installation and connection must comply with the applicable national and international standards. Responsibility lies with the person installing the unit.

1.4 Overview

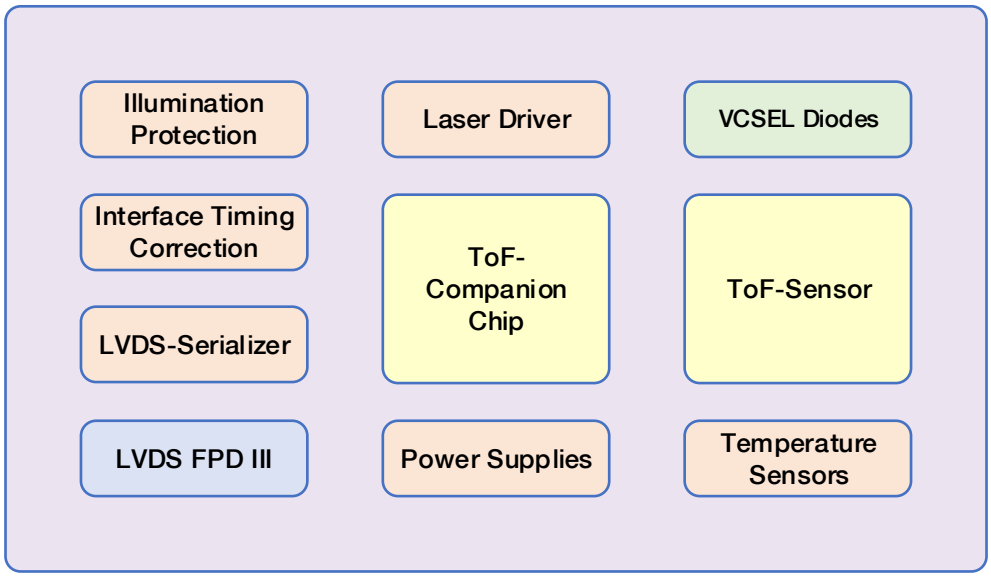


Figure 1-1 main components and interfaces

1.5 Key Features

- ToF-Sensor (Melexis **MLX75023**)
- ToF-CC (Melexis **MLX75123**)
- 2 FPD Link III serializer (Texas Instruments **DS90UB933**)
- CPLD (Xilinx **XC2C32A**)
- FET-Driver (Michrochip **MD1210K6-G**)
- Cortex-M0+ Controller (NXP **MKL04Z16**)
- VCSEL Diode (Princeton Optronics **PCW-SMV-2-W0850-D110**)

- Power Supplies (Texas Instruments **LMR23615, LP873222, LM3671, LM27761, TPS40170, LMR16006**)
- Temperature Sensors (Texas Instruments **TMP108**)

1.6 Applications

- Automotive
  - Driver surveillance
  - Telematics
- Consumer
  - People counting
  - Human Machine Interface (HMI)
- Industrial
  - Process monitoring
  - Security and alarms systems

2 General Description

The multi-tof front ends are capable to deliver raw data of a 3D scene captured by the incorporated ToF-sensor and illumination. They are designed to stream the pixel data to the CamHub in 12bit raw mode via a FPD III serializer.

The illumination is based on two VCSEL laser diodes. The VCSEL driver consist of two stages, a high speed FET drive and a N-MOSFET.

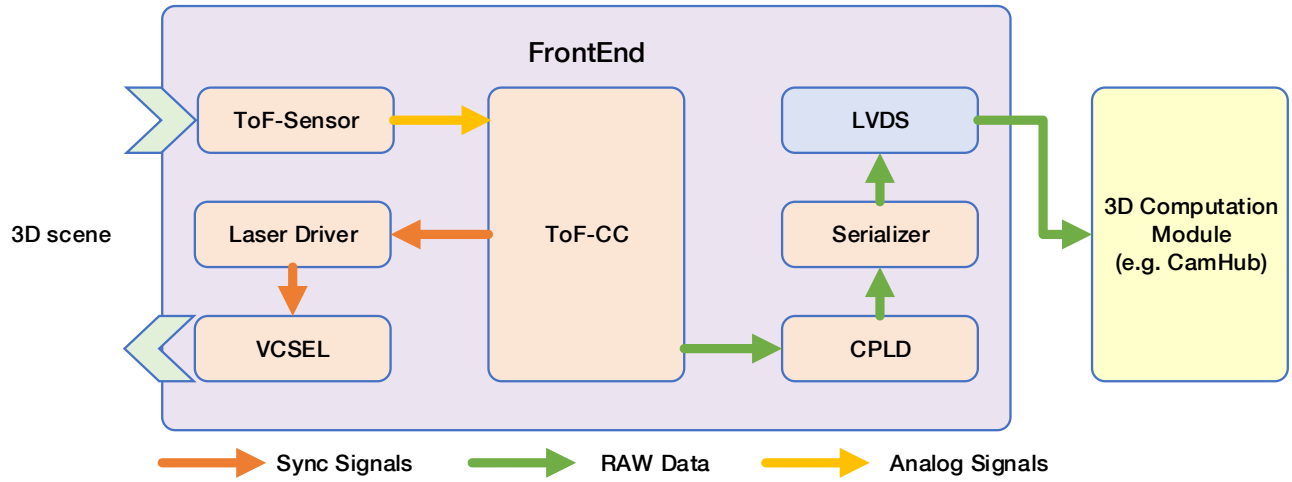


Figure 2-1 Processing chain

2.1 Components

The multi-tof-Front end consists of the following main components

2.1.1 ToF-Sensor

The incoming light is captured by the MLX75023 ToF sensor. He is only capable of delivering the analog pixel value at the currently addressed pixel.

2.1.2 ToF-CC (Companion Chip)

The MLX75123 ToF-CC has many functions. During the integration phase, he generates the modulation signals for the sensor as well as for the illumination.

Afterwards he captures the analog values of the ToF-sensor with its integrated 12-bit ADC. The digital value will be streamed via a 12-bit parallel interface.

2.1.3 VCSEL

There are two VCSEL laser diodes that are needed to illuminate the 3D scene.

2.1.4 Laser Driver

The laser driver consists of two stages. The first stage is a high-speed FET-driver (MD1210K6-G). The second stage are two M-channel MOSFETs, which each driving a laser diode.

2.1.5 Illumination Surveillance

If for some reason the illumination should fail, e.g. permanent lighting, the illumination surveillance needs to disable the driver to prevent the module from over-heating and more important for eye-safety reasons.

Therefore, the analog modulation signal on the VCSEL is monitored, as well as the PCB temperature next to the lasers.

Following fail operation modes are detected:

- Permanent Illumination
- No Illumination
- Over-Temperature
- Wrong laser diode voltage

2.1.6 Serializer

A DS90UB933 serialize is used, to transform the parallel RAW-pixel-data into a LVDS FPD-III stream.

2.2 Functional Description

Figure 2-2 shows the interconnection and data flow between all components on the CamHub.

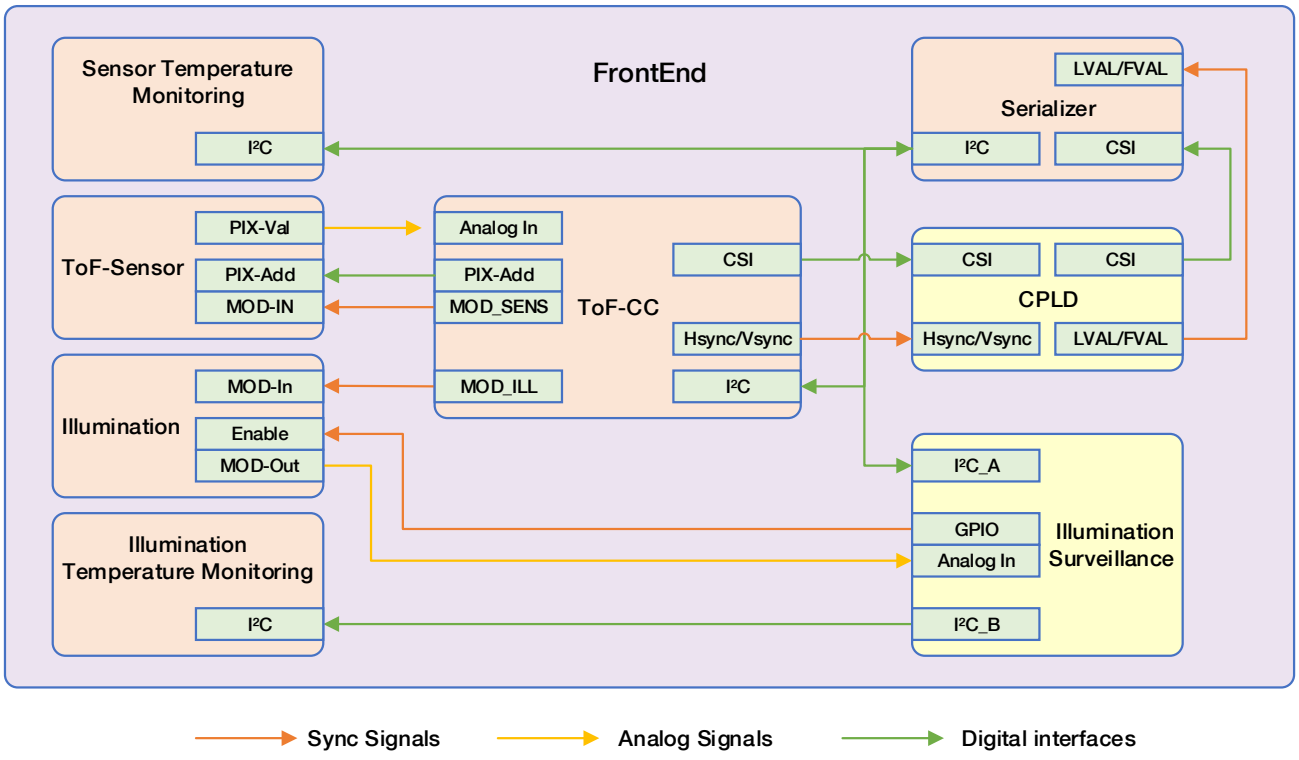


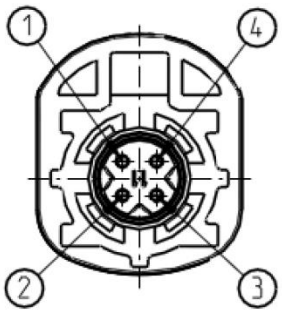
Figure 2-2 Front end interconnection diagram

2.3 Connectors

The front end has three connectors, but for normal operation just the Rosenberger high speed differential connector is needed. The other are for programming purposes and auxiliary power supply.

2.3.1 HSD Connector

The used connectors are D4S20L-40MA5-C from Rosenberger. The LVDS signals are routed to the DS90UB933 serializer. the Power-over-Cable (PoC) feature can be used, if phantom powering is supported by the host interface.



Pin Numper	Description
1	LVDS_N / power supply
2	GND
3	LVDS_P / power supply
4	GND

Table 2-1 HSD connector pin description

2.3.2 AUX Power

If the host doesn't provide power-over-cable the Front end can be powered over an auxiliary power connector. A Molex-PicoSPOX two pin header is used for this purpose. Pin number 1 is the positive supply voltage, pin number two (in close proximity to the HSD connector) is power ground.

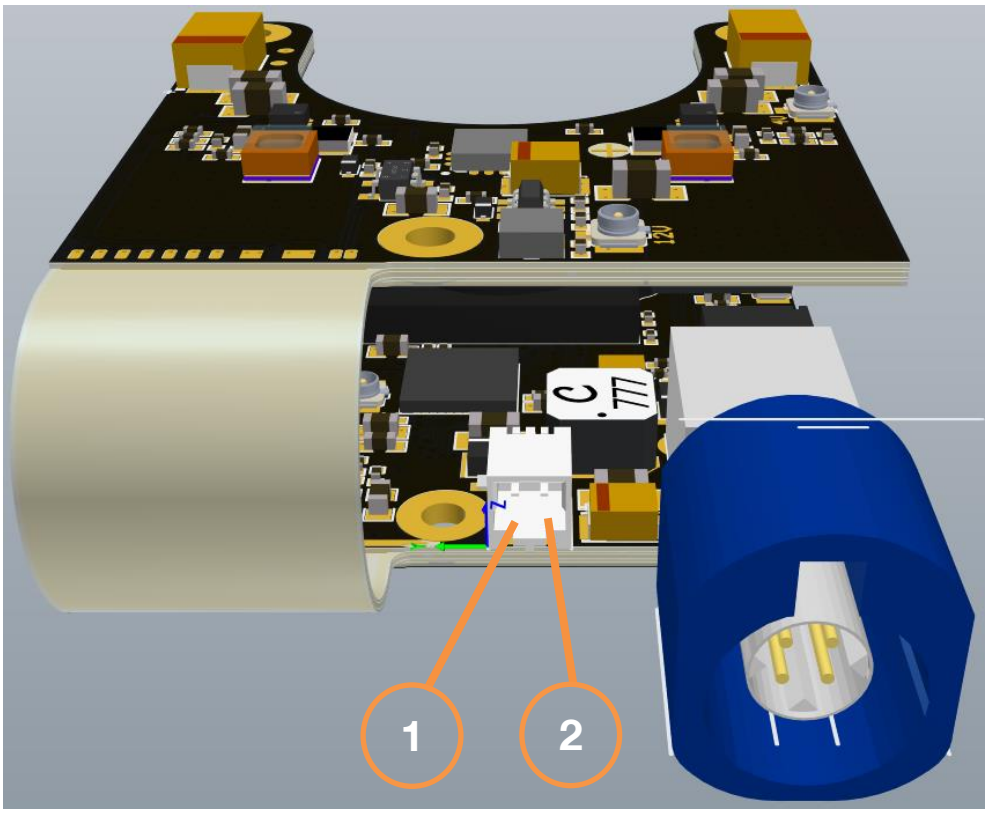


Figure 2-3 Auxiliary Power Connector

3 Specifications

3.1 Absolute Maximum Ratings

Stressing the device above the rating listed in the absolute maximum ratings table may cause permanent damage to the device. These are stress ratings only. Operation of the device at these or any other conditions greater than those indicated in the operating sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Symbol	Parameter	Min	Max	Unit
V_{IN}	Input supply voltage	-0.3	28	V
T_{AMB}	Ambient temperature	-20	85	°C
T_{STO}	Storage temperature	-40	105	°C
φ_{AMB}	Relative ambient humidity		90	%

Table 3-1 Absolute maximum ratings

3.2 ESD Sensitivity

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

3.3 Operating Conditions

Symbol	Parameter	Min	Typical	Max	Unit
V_{IN}	Input supply voltage[1)]	16	24	28	V
P	Average Board Power Consumption[2)]	TBD	-	TBD	W
I_{PK}	Peak input Current during Integration	-	-	2	A

Table 3-2 Electrical characteristics

[1)] If the input voltage sinks below the specified minimum value, the protection circuit immediately turns off all voltage rails. The Board turns on again, when the supply voltage returns within specified parameters.

[2)] The Power consumption refers to a front end running with a modulation frequency of 40 MHz, a frame rate of 20 fps and an integration time of 600 µs.

3.4 Power distribution

The board is designed to work with a regulated 24 V power supply. The input voltage range is 16 V to 28 V.

The following diagram shows the power distribution on the board. The power source for the serializer (1.8 V) is always on, all other supplies, besides the illumination power, are enabled by the host via I²C.

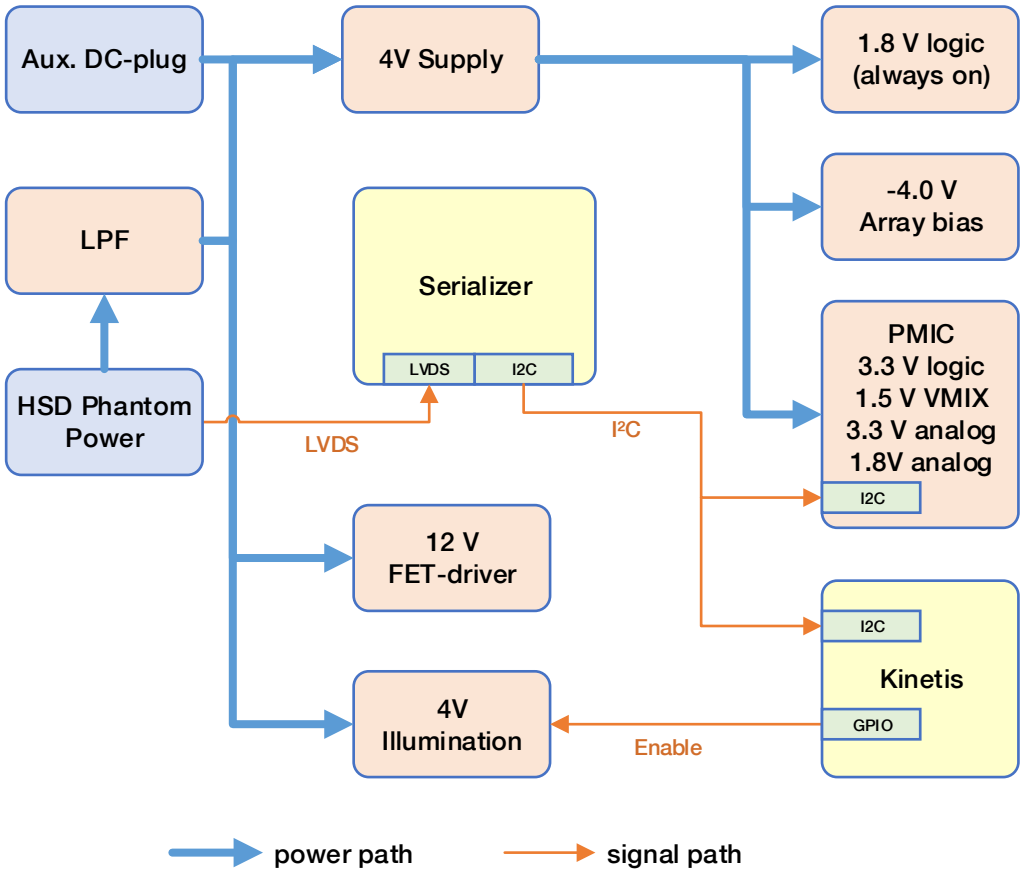


Figure 3-1 power distribution

3.5 Optical Characteristics

Illumination:

Symbol	Parameter	Min	Typical	Max	Unit
#LDs	Nr. of Laser Diodes		2		
$\Lambda_{CENTROID}$	Centroid-Wavelength of Illumination	840	850	860	nm
$\Delta\lambda$	Spectral Bandwidth		20[1)]		nm
I_e	Radiant intensity				W/sr

Table 3-3 Characteristics of illumination

[1)] The higher bandwidth is caused by a temperature drift of the emitted wavelength.

Sensor:

Symbol	Parameter	Min	Typical	Max	Unit
3D FoVH	Horizontal Field of View		110		Deg
3D FoV_V	Vertical Field of View		82		Deg

Table 3-4 Characteristics of sensor lens

4 Mechanical Outline

This section shows the mechanical outline of the front end when it is unfolded. All dimensions are given in mm.

4.1 Top View

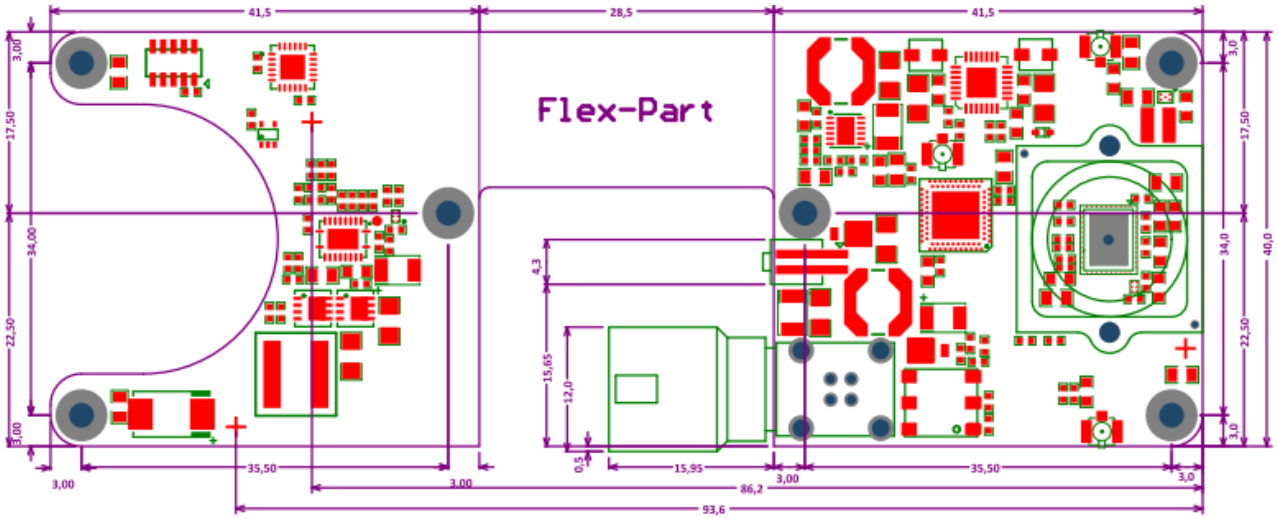


Figure 4-1 Mechanical outline top view

4.2 Bottom View

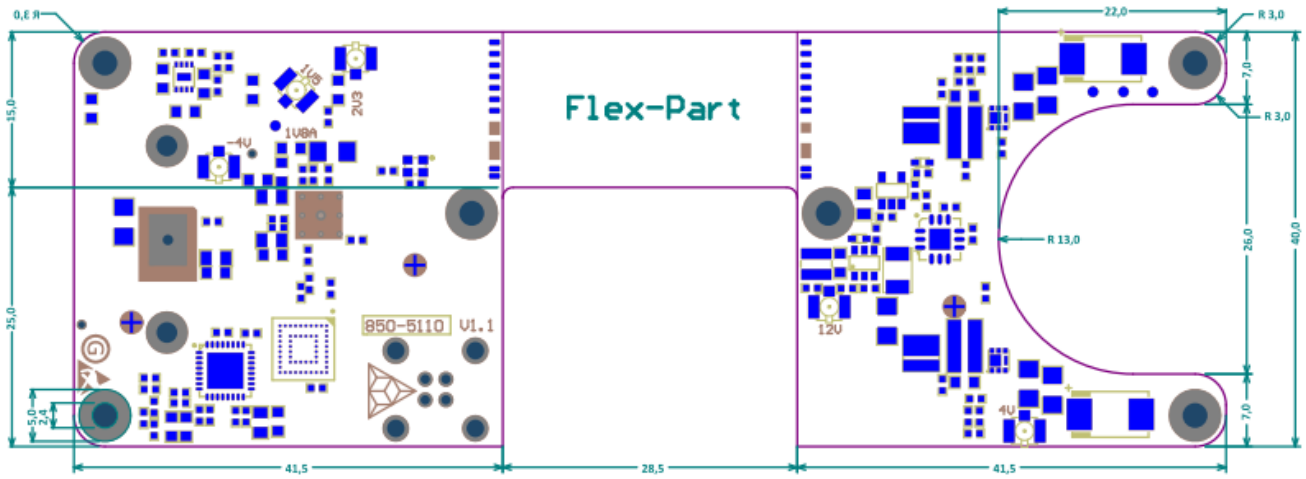


Figure 4-2 Mechanical outline bottom view

4.3 Cooling Plate

For normal operation, the front end needs a cooling plate. The default plate, with which the device is equipped, is a 4 mm aluminum plate with following outline.

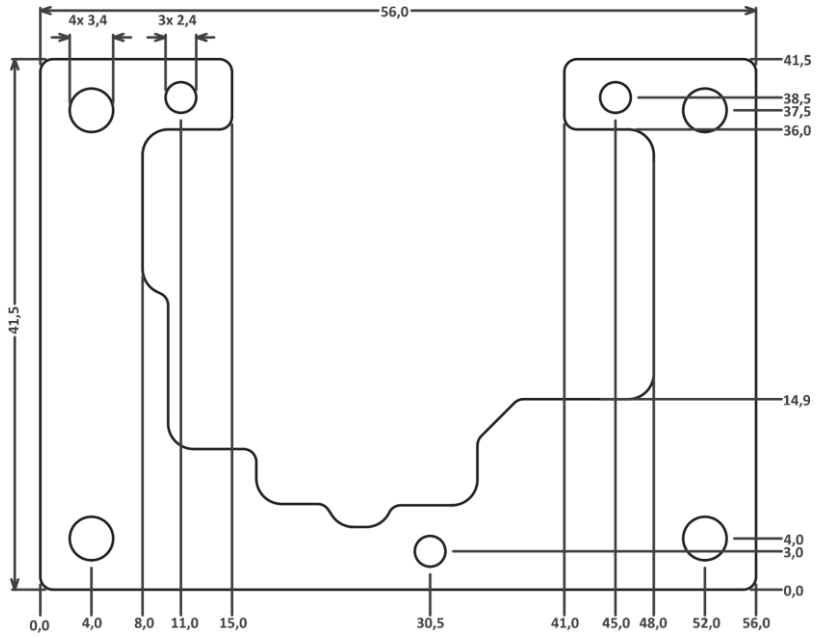


Figure 4-3 Cooling plate dimensions

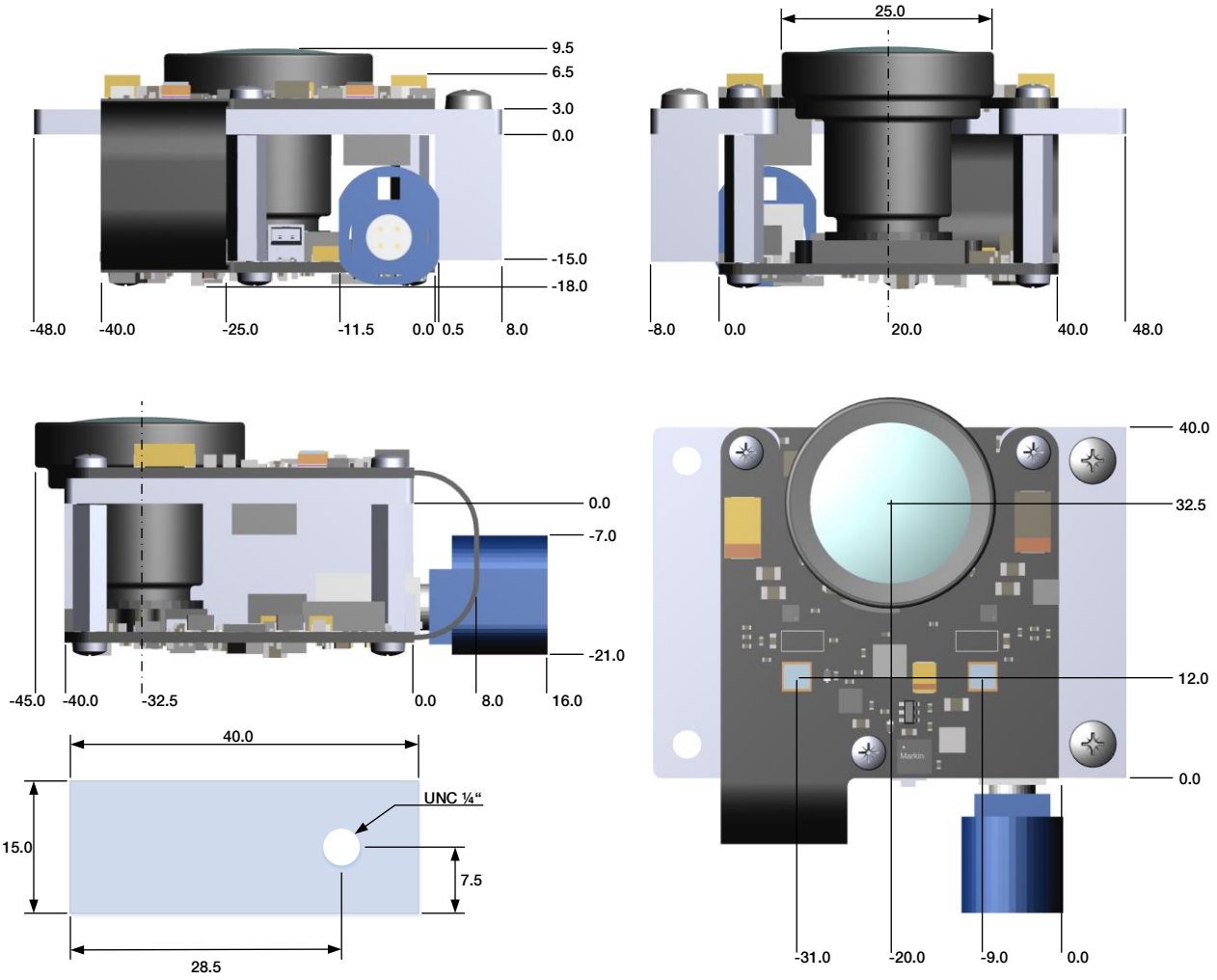


Figure 4-4 Front end outline dimensions

The standard package of the front end contains also a fixation beam with a ¼”- 20 UNC female thread for standard camera tripods.

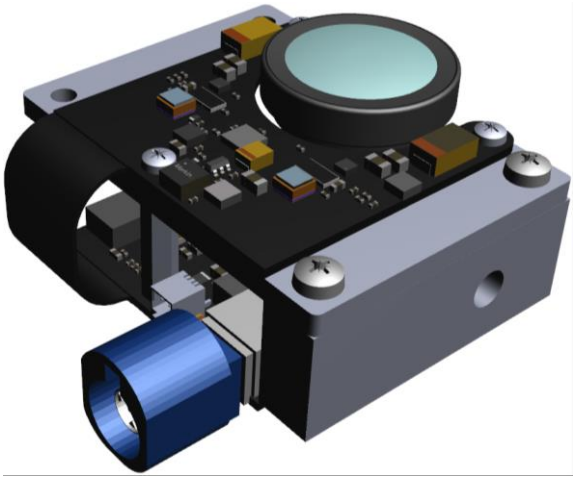


Figure 4-5 Front end with camera fixation beam dimensions

5 Support

Please refer to support.bluetechnix.com for further information or write to support@bluetechnix.com.

6 Product History

6.1 Version Information

Version	Component	Type
1.1.0	multi-tof front end	x-grade

Table 6-1 Overview of multi-tof front end product changes

6.2 Anomalies

Version	Date	Description

Table 6-2 Product anomalies

7 Document Revision History

Version	Date	Document Revision
1	2018 03 15	First Draft V1.0 of the Document
2	2018 07 10	Drawings added. Some typos corrected.

Table 7-1 Revision history

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