BLUETECHNIX
Embedding Ideas

Sentis ToF - P510

Hardware User Manual

Version 1.0

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The information herein is given to describe certain components and shall not be considered as a guarantee of characteristics.

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Information

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

Warning

Due to technical requirements components may contain dangerous substances.

1 General Information

This guide applies to the Sentis ToF - P510 camera platform from Bluetechnix GmbH. Follow this guide chapter by chapter to set up and understand your product. If a section of this document only applies to certain camera parts, this is indicated at the beginning of the respective section.

The document applies to X-Grade product from V0.0.

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 Certification

X-Grade Version

X-Grade version of the products are not intended for sale and have therefore no certifications. The user is responsible for a correct usage in order with federal laws.

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 Electrical connection

Note

The unit must be connected by a qualified electrician.

Device of protection class III (PC III).

The electric supply must only be made via PELV circuits.

The device must only be powered by a limited energy source (≤ 30V; ≤ 8A; ≤ 100VA).

Disconnect power before connecting the unit.

2 Introduction

2.1 Overview

The Sentis ToF - P510 is a depth sensor module, developed by Bluetechnix, operating on the Time-of-Flight (ToF) principle. The Sentis ToF - P510 is based on the ToF sensor 19k-S3 of PMDtec and Freescale i.MX6 processor. The camera consists of different modules from Bluetechnix like the TIM-uP-19k-S3-Spartan-6, LIM-u-LED-850 and CM-i.MX6x.

2.2 Key Features

- 3D depth sensor module TIM-uP-19k-S3-Spartan6 based on PMD PhotonICs® 19k-S3
- 2D sensor module based on Omnivision OV5640
- 2 x light modules LIM-u-LED-850
- Processor module CM-i.MX6Q based on Freescale i.MX6Q
- Up to 160fps, adjustable
- Gigabit Ethernet
- Support for 30°, 60° and 90° FOV (90° default)
- Extension interface
- Power supply connector
- Matlab support
- Software configuration interface
- Ethernet data streaming server
- 3D Depth, amplitude data and 2D color image

3 General Description

3.1 Functional Description

The following image shows the block diagram of the Sentis ToF - P510.

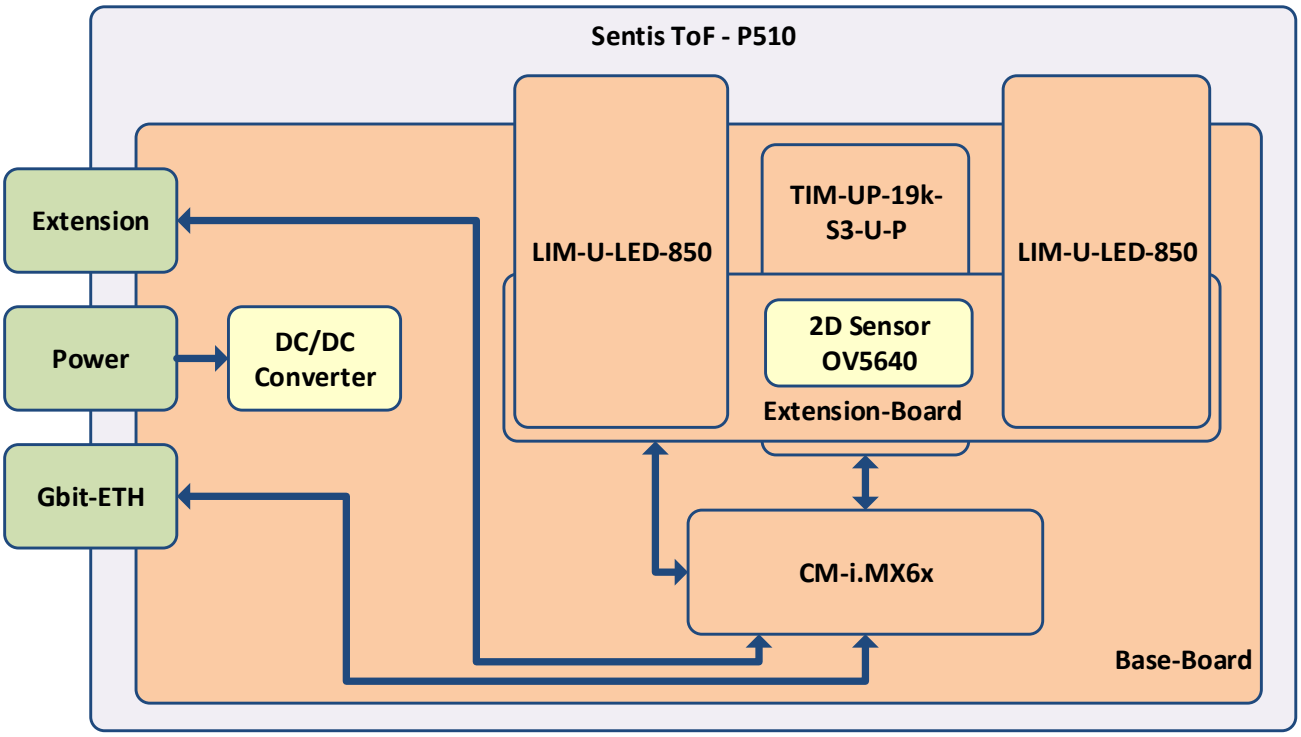

Figure 3-1 Sentis ToF - P510 block diagram

3.2 PCB description

The hardware is based on 6 PCBs. The PCBs are stacked like a sandwich:

- The CM-i.MX6x is mounted on the bottom of the Baseboard
- The TIM-uP-19k-S3-Spartan-6 is mounted on the Baseboard
- The Extension-Board is mounted on the Baseboard
- The two LIM-u-LED-850 are mounted on the Extension-Board

3.3 Interfaces

The following chapters describes the interfaces on the Sentis ToF - P510-Baseboard.

3.3.1 Power connector

The Sentis ToF - P510 must be powered by an external 18V-30V power supply connected to the 2.5mm EH-connector (see chapter 6.1).

3.3.2 GBit-Ethernet

The Gbit-Ethernet interface from CM-i.MX6Q is available on a standard RJ45 connector (see chapter 6.2).

3.3.3 Extension connector

The extension connector provides multiple interfaces to control external units and to trigger the Sentis ToF - P510 (see chapter 6.3).

3.3.4 JTAG connector

A JTAG connector is available for debug purposes (see chapter 6.4).

3.3.5 Reset button

A reset button is available to perform a hardware reset (component **(e)** in Figure 6-1).

3.3.6 RGB LED

A RGB LED is available on the Extension-Board and can be used to show the state of the Sentis ToF - P510 (component **(f)** in Figure 6-1).

The RGB LED is controlled by a Toshiba LED driver (**TCA62724FMG(O,EL)**) connected though the I2C2 interface with the CM-i.MX6x. The I2C slave address is set to 0x55.

3.3.7 Buzzer

A buzzer is available on the Extension-Board and can be used to provide an audible feedback to the user (component **(g)** in Figure 6-1).

The buzzer is connected to the pin DISP0.DAT9 of the CM-i.MX6x.

4 Hardware installation

4.1 Mounting

The Sentis ToF - P510-Baseboard provides 4 x M3 mounting holes to fix it on the enclosure. The positions of the mounting holes is shown in figure 7.1 (3.2mm holes).

Note:

The mounting holes must be electrically connected to the enclosure using metallic screws!

The LIM modules mounted on the Sentis ToF - P510-Baseboard must be fixed to a heatsink or to the enclosure. For more information about the LIM modules see the Hardware User Manual of the LIM-U-LED-850 available from Bluetechnix website. The mounting holes are also visible on the 3D STEP model of the Sentis ToF - P510 camera.

Note:

Gap pads must be used to isolate the LIM module cooling area from the heatsink or enclosure!

The TIM module can also be fixed on the enclosure using the top two M2 holes available on the module. For further information about the TIM module see the Hardware User Manual of the TIM-uP-19k-S3-Spartan6 available from Bluetechnix website. The mounting holes are also visible on the 3D STEP model of the Sentis ToF - P510 camera.

4.2 Cooling areas

The Sentis ToF - P510 must be cooled at several areas to ensure valid operation conditions. The most important cooling areas are:

- LIM modules: each LIM module produces up to 25W of dissipation power that must be cooled mounting a heatsink/enclosure and a gap pad on the bottom of the module (red areas in Figure 4-1).
- CM-i.MX6Q: the processor module produces up to 5W of dissipation power. The main heat sources are the i.MX6Q processor (left dark region in orange area in Figure 4-1) and the PMIC (right dark region in orange area in Figure 4-1).

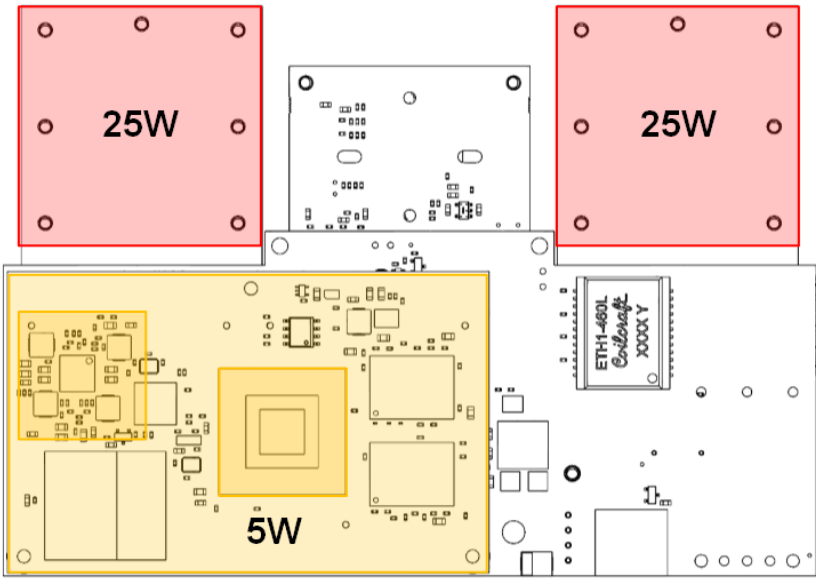

Figure 4-1 Hot Spots of the Sentis ToF - P510 (Bottom View)

4.3 Lenses and objective

The Sentis ToF - P510 is equipped with a 90° objective for the TIM module, 90° objective for the 2D sensor and 90° lenses for the LIM modules. Other objectives/lenses can be provided by Bluetechnix on request.

Note:

Be aware that using different objectives and lenses for other FOVs leads to different objective/lenses height relative to the 3D and 2D sensor.

4.4 Sensor sensitivity

See Hardware User Manual of the TIM-uP-19k-S3-Spartan6 available from Bluetechnix website.

4.5 Optical Isolation

To prevent direct irradiation from the LIMs into the camera lens, an optical barrier has to be applied. There is a component-free area on the TIM module to support an optical barrier down to the PCB (see Hardware User Manual of TIM-uP-19k-S3-Spartan6).

The height of the optical barrier and the distance to the 3D sensor depends from the used objective and FOV. The following picture shows one possibility how to design an appropriate optical barrier (a) for a FOV of 90° with 60mm² objective area (default configuration of the Sentis ToF - P510).

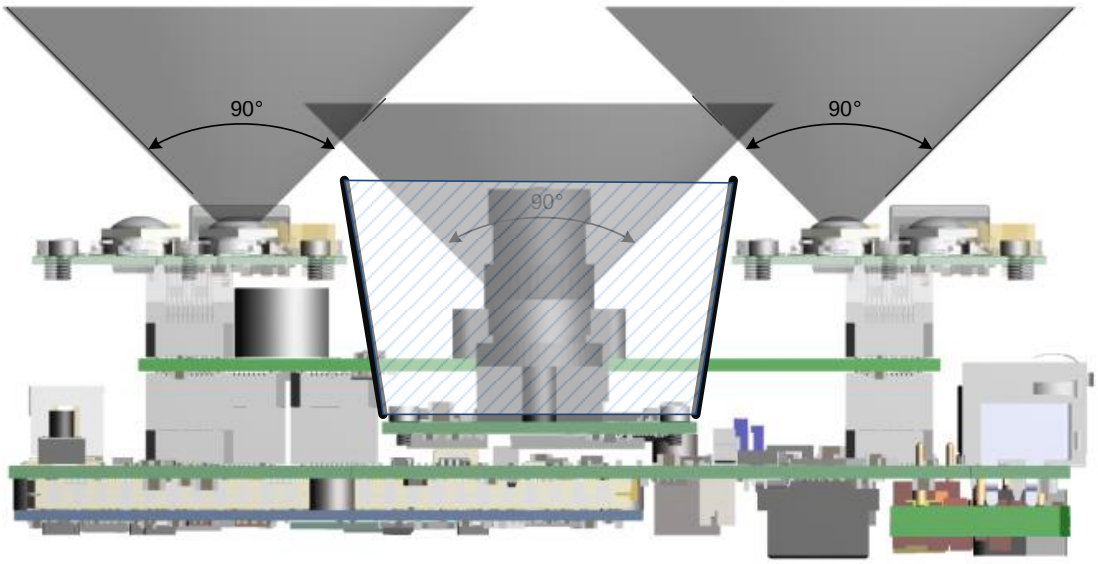

Figure 4-2 Possible optical isolation (Side view)

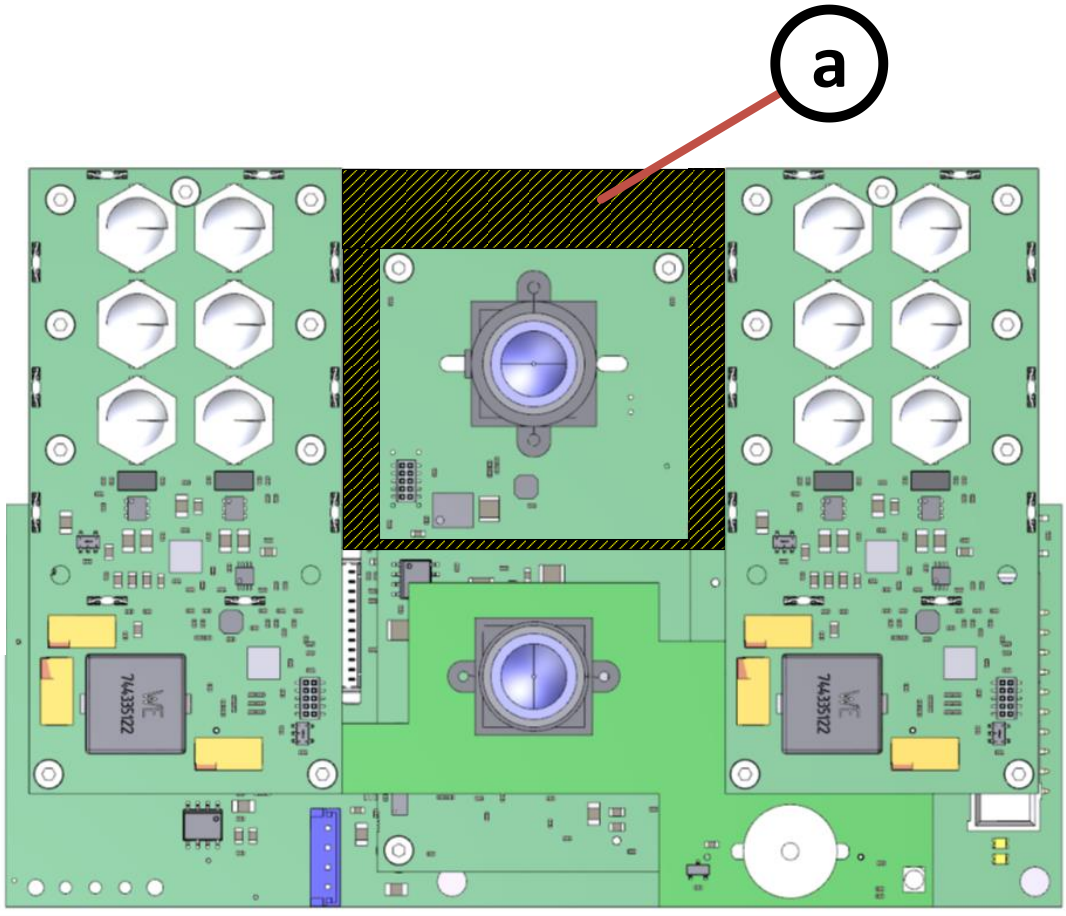

Figure 4-3 Possible optical isolation (Top view)

4.6 Sensor Orientation

See Hardware User Manual of the TIM-UP-19k-S3 USB 2.0 PVI available from Bluetechnix website.

5 Specifications

5.1 Electrical Specifications

5.1.1 Operating Conditions

Symbol	Parameter	Min	Typical	Max	Unit
V_{IN}	Input supply voltage	18	24	30	V
I_{IN}	Input current	-	2	3.5	A
T_{OP}	Operating Temperature	0	-	60[1)]	°C
T_{STG}	Storage Temperature	-65	-	150	°C
FITP	Frame-rate Integration Time Product	-	TBD	-	

Table 5-1 Electrical characteristics

1) Depends on cooling mechanism.

5.1.2 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.

5.1.3 EMC

The system is intended for light industrial environments according to the following normative:

EN55022 class A, EN55024:2010

Only pre-compliance measurements according to the above stated normative will be performed on the system. The customer responsible for the final product is also responsible to fulfill all regulations requested by law.

6 Connector Description

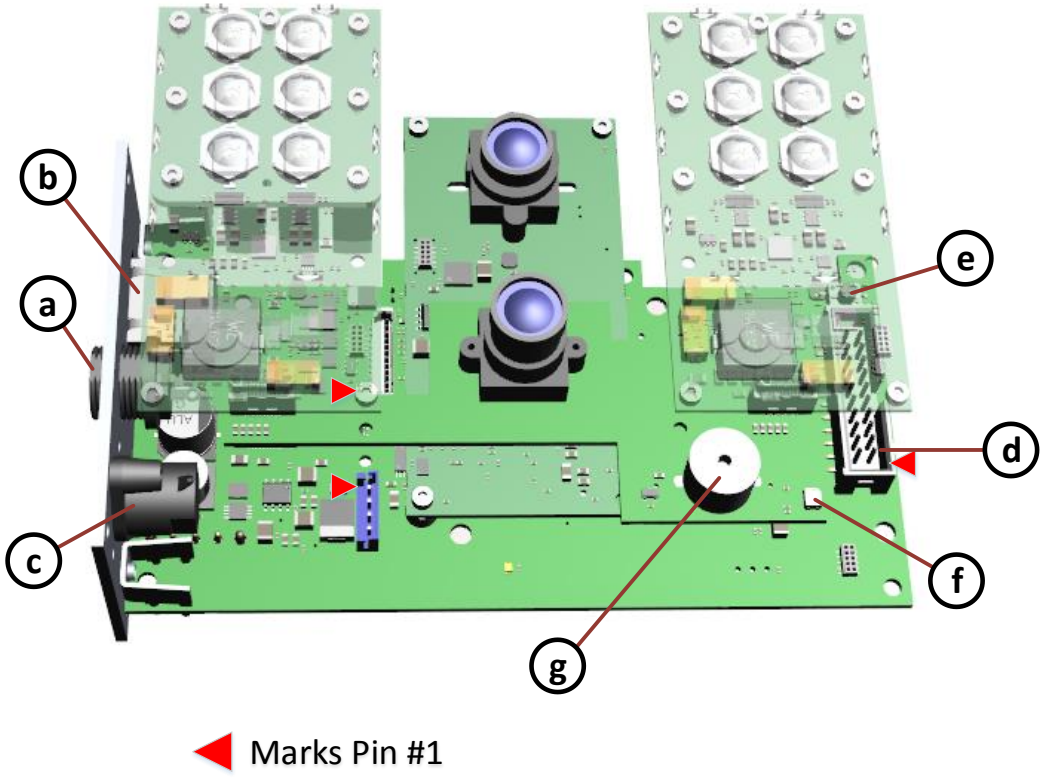

Figure 6-1 Connectors of the Sentis ToF - P510 (top view with transparent LIM-u-LED-850)

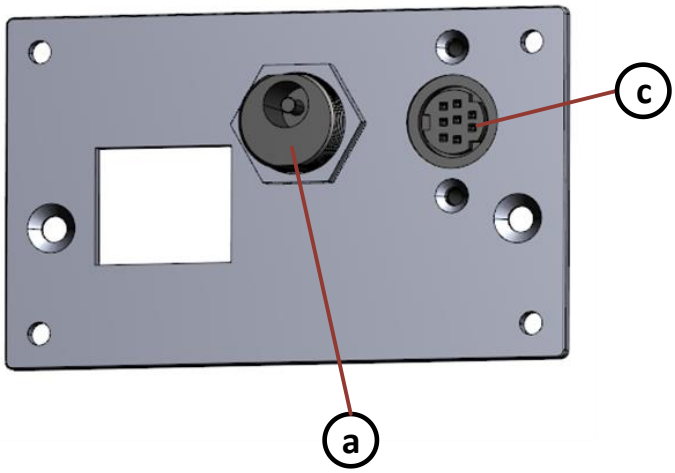

Figure 6-2 Front panel vew

6.1 Power Connector (a)

Pin assignment on the power connector:

Connector Type: 2.1mm ID / 5.5mm OD

Voltage: 18-30V

Polarity:

This pins are protected against wrong polarity.

Note
Use inherently limited power sources only!

6.2 GBit Ethernet Connector (b)

This standard RJ45 connector provides a 10/100/1000 Base-T interface to the Sentis ToF - P510.

6.3 Extension Connector (c)

The Mini-DIN 8 connector provides several interfaces to connect the Sentis ToF - P510 to external devices.

No.	Signal	Type	Description
1	GND	Power	Ground
2	nRESET	Input (100k pu)	Reset input (active low)
3	TRIGGER_IN	Input (100 pd)	Trigger input, 10-30V
4	OWIRE	Output	External OWIRE interface
5	MOD_P	Output	External Light modulation signal, differential, positive
6	MOD_N	Output	External Light modulation signal, differential, negative
7	GPIO	In-/Output	General purpose I/O (galvanic isolated)
8	GPIO_Ref	Power	GPIO reference (galvanic isolated)

Table 6-1: Power connector pinout

Note:

To use the output functionality of the GPIO pin an external pullup resistor is necessary. This pullup must be designed for a minimum current of 13mA. (e.g 1k5 pullup to 20V)

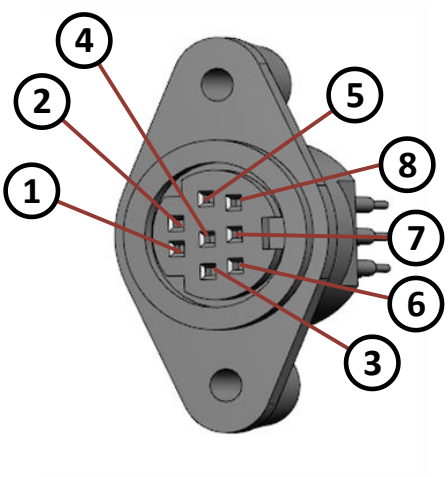

Figure 6-3 Mini-DIN8 pin out

Description	Manufacturer	Part Number
Mini-DIN8 plug, male	CUI Inc	MD-80

Table 6-2: Mating connector

6.4 JTAG Connector (d)

The JTAG interface of the CM-i.MX6x is connected to the 20-pin 2.54mm header connector. The JTAG connector is compliant with any ARM JTAG Emulator. (e.g ARM DSTREAM).

7 Mechanical Outline

A 3D STEP model of the Sentis ToF - P510 can be provided by Bluetechnix on request.

7.1 Top View

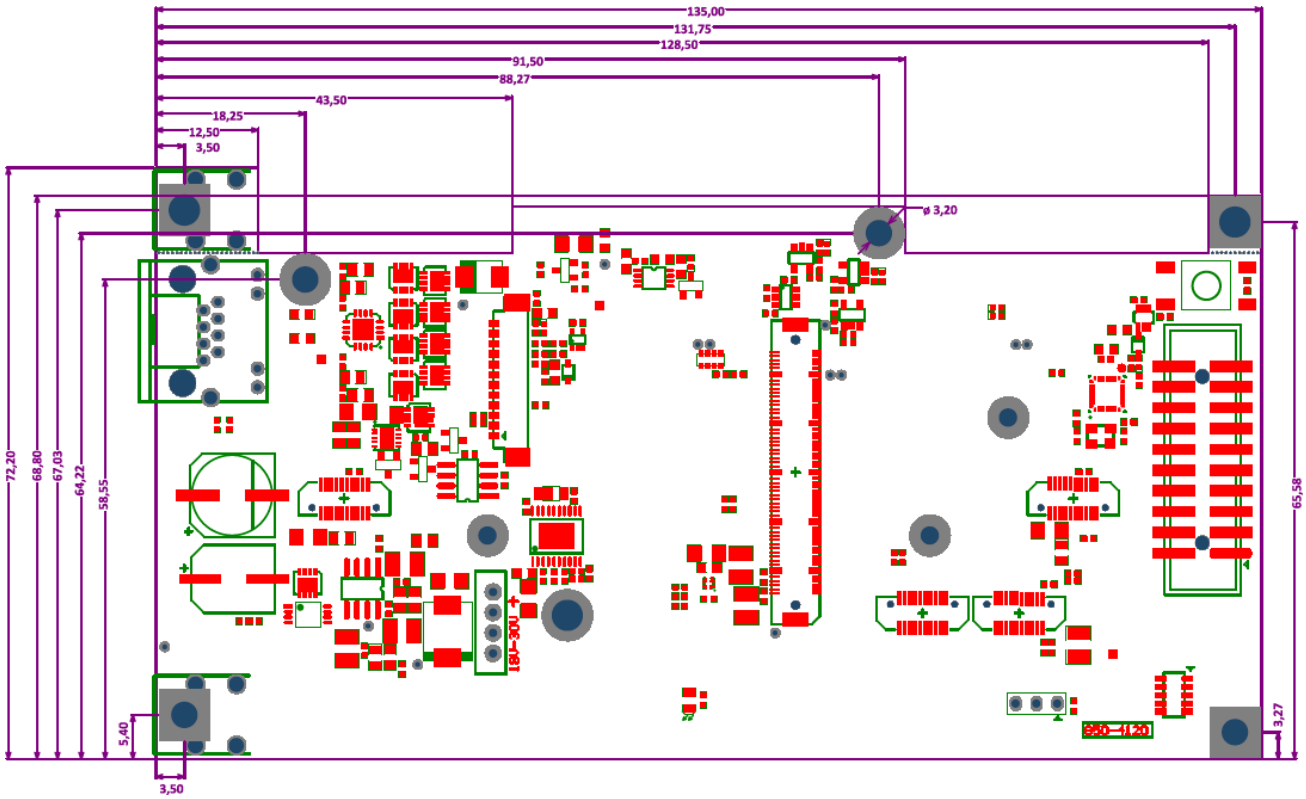

Figure 7-1 Top View of the Sentis ToF - P510-Baseboard

7.2 Bottom View

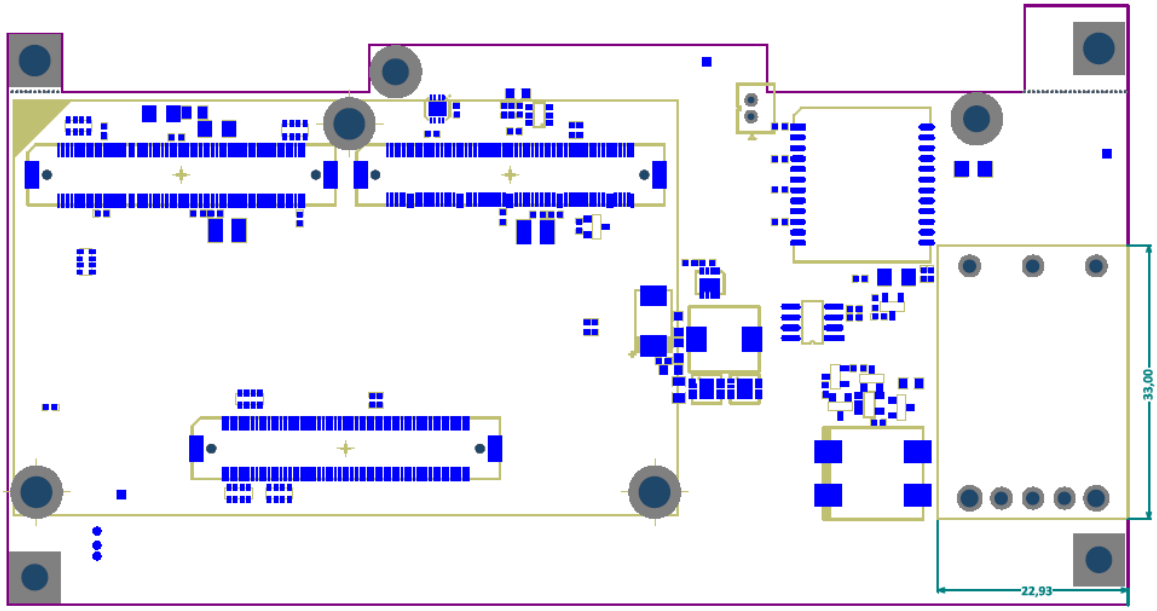

Figure 7-2 Bottom View of the Sentis ToF - P510-Baseboard

7.3 Side View

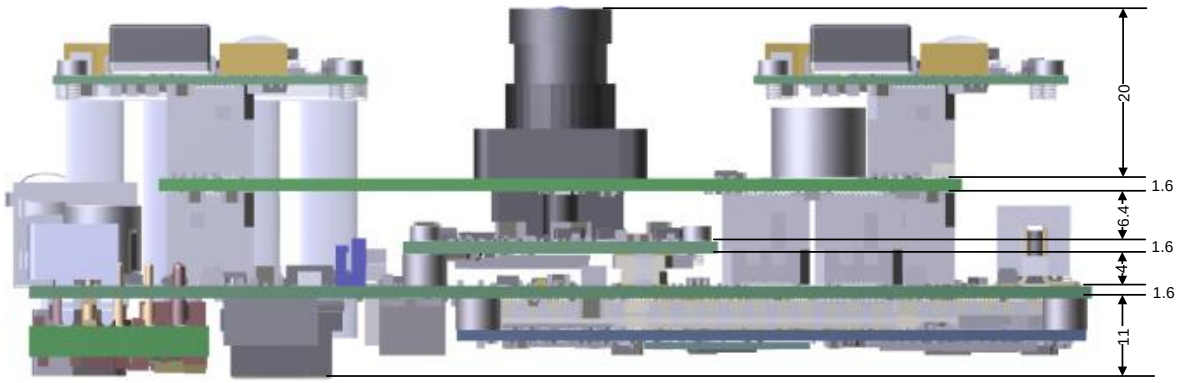

Figure 7-3 Side view of the Sentis ToF - P510-Baseboard

8 Product History

8.1 Version Information

8.1.1 Sentis ToF - P510

Version	Component	Type
1.0.0	TIM	Bluetechnix TIM-uP-19k-S3 V2.0
	LIM	Bluetechnix LIM-U-LED-850 V2.0
	CM-i.MX6Q	Bluetechnix CM-i.MX6Q-C-I-Q24S2048F2N4096 V1.2
	5V Controller	Texas Instruments LM25116MH/NOPB

Table 8-1 Overview Sentis ToF - P510 product changes

8.2 Anomalies

Version	Date	Description
V1.0	2014 09 30	No anomalies reported yet

Table 8-2 Product anomalies

9 Document Revision History

Version	Date	Document Revision
1	2014 09 30	First release V1.0 of the document
2	2014 10 30	Updated mechanical outline and Connector descriptions due to hardware version V1.0
3	2014 14 11	Added front panel connector description
4	2014 12 12	Added information about external pullup resistor on external GPIO
5	2015 03 04	Added GPIO_Ref to pin 8 of Mini Din 8 connector

Table 9-1 Revision history

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