BLUETECHNIX
Embedding Ideas

TIM-UP-19k-S3 Ethernet

Hardware User Manual

Version 5

Contact

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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 Introduction

1.1 Overview

The TIM-UP-19k-S3 Ethernet features 3D point cloud streaming via Ethernet. It has a standard field of view of 90° and provides a 3D point cloud data via UDP stream. For this product there is a variety of lenses available.

This product is no standalone product. You need at least one Light Module (LIM) and one interface board (IF)!

1.2 Key Features

- ToF-Module based on PMD PhotonICs® 19k-S3
- Size: 80 x 40mm
- Ethernet interface
- LIM interface
- Support CS- and M12-lense holder
- Support for firmware updates
- 5V single supply

1.3 Applications

- Range measurements
- Object counting
- 3D safety areas
- Map building
- Robot navigation
- Obstacle detection
- Touch less control
- HMI for industrial Robots
- People counting
- Safety access control

2 General Description

2.1 Functional Description

The following image shows the block diagram of the TIM-UP-19k-S3 Ethernet.

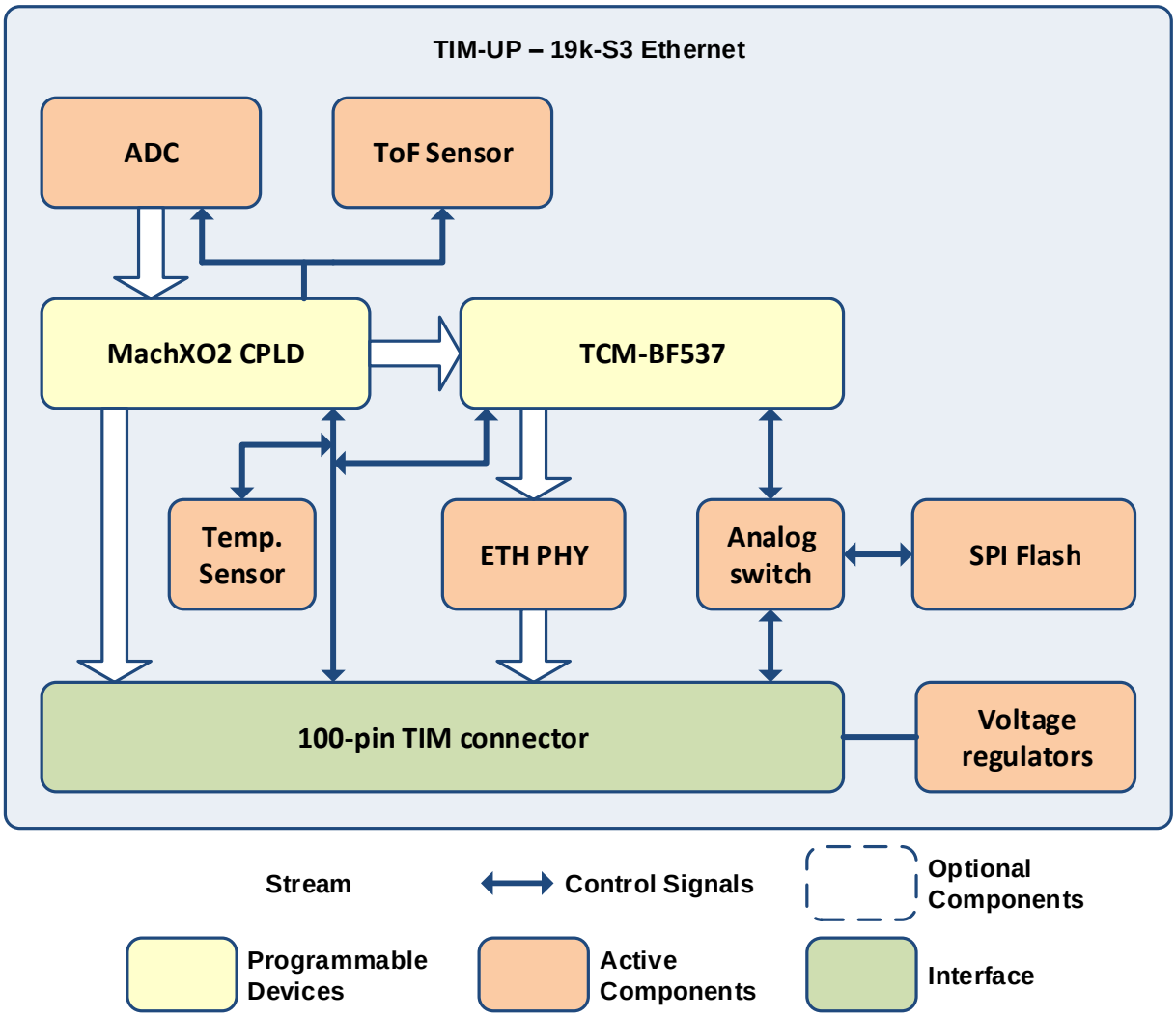

Figure 2-1 TIM-UP-19k-S3 Ethernet block diagram

2.2 Interfaces

The following chapter describes the interfaces, which are available on the 100-pin TIM connector.

2.2.1 Ethernet

The Ethernet interface offers a 10/100Base-T link to the base board. This interface allows to use the TIM-UP-19k-S3 Ethernet as Ethernet video stream device.

2.2.2 LIM

The LIM interface must be used in conjunction with an external LIM module. This interface consists of two 1-wire interfaces (LED.IO1 and LED.IO2) or I2C (I2CM.SCL/I2CM.SDA) and the light modulation signal (differential: LED.MOD, single-ended: LED.SMOD).

Note:

Keep the connection between the TIM and LIM as short as possible.
If multiple LIMs are connected to one TIM then the modulation signals to each LIM must be length matched.

The LED.MOD signals must be routed with a differential impedance of 100 Ohm.
The LED.SMOD signal must be routed and terminated with an impedance of 50 Ohm.

2.2.3 EXTSPI

The EXTSPI interface provides a fast serial interface to the FPGA as well as an interface to the on-board SPI Flash for firmware updates.

The EXTSPI interface of the TIM connector can be routed by the on-board analog switch to the on-board SPI Flash using the ISM.nRESET signal. The ISM.nRESET signal is internally pulled up by a 10kΩ resistor. The EXTSPI.nCS signal is internally pulled up when connected to the SPI Flash.

ISM.nRESET signal	Function
LOW	On-board SPI Flash connected to EXTSPI (Firmware update mode) TIM module is in reset mode
HIGH	On-board SPI Flash connected to FPGA SPI interface of TIM connector connected to FPGA

Table 2-1 Function of ISM.nRESET signal

2.2.4 UART

Function is firmware dependent. For further information refer to Software User Manual or contact Bluetechnix support.

2.2.5 CAN

Function is firmware dependent. For further information refer to Software User Manual or contact Bluetechnix support.

2.2.6 GPIOs

Function is firmware dependent. For further information refer to Software User Manual or contact Bluetechnix support.

2.2.7 I2CM

Function is firmware dependent. For further information refer to Software User Manual or contact Bluetechnix support.

2.2.8 PEN

The PEN signal (Power Enable signal) can be used to shut down the TIM module. The PEN signal is internally pulled up by a 10kΩ resistor.

PEN signal	Function
LOW	TIM module power supply disabled
HIGH	TIM module power supply enabled.

Table 2-2 Function of PEN signal

3 Hardware installation

3.1 Mounting

The TIM-UP-19k-S3 Ethernet must be connected to a base board through a FX-10A-100P/10SV connector from Hirose (see chapter 6.4). The module provides 4 additional M2 mounting holes to fix it on the base board.

See chapter 6.4 for more information.

3.2 Processor cooling

In harsh environment or when the TIM-UP-19k-S3 Ethernet is used within a case without appropriate cooling it may be necessary to provide a heat sink on the top-side for the TCM.

The module provides also the possibility to cool the 3D sensor by applying a heat sink on the bottom side of the board below the sensor. This might be useful to increase the accuracy of the sensor at high temperatures.

Note:

The cooling area for the 3D sensor is spread from solder mask and connected to GND. Take care if using non-isolated heat sinks!

See figure 6.2 for more information.

3.3 Lenses

The TIM-UP – 19k-S3- Ethernet provides a M12 lens holder as well as a CS-mount holder on request. The module will be equipped with a 90° objective. Other objectives can be provided by Bluetechnix on request.

3.4 Sensor sensitivity

Following diagrams shows the spectral sensitivity of the 19k-S3 sensor chip depending from the IR-cut filter mounted on the sensor chip.

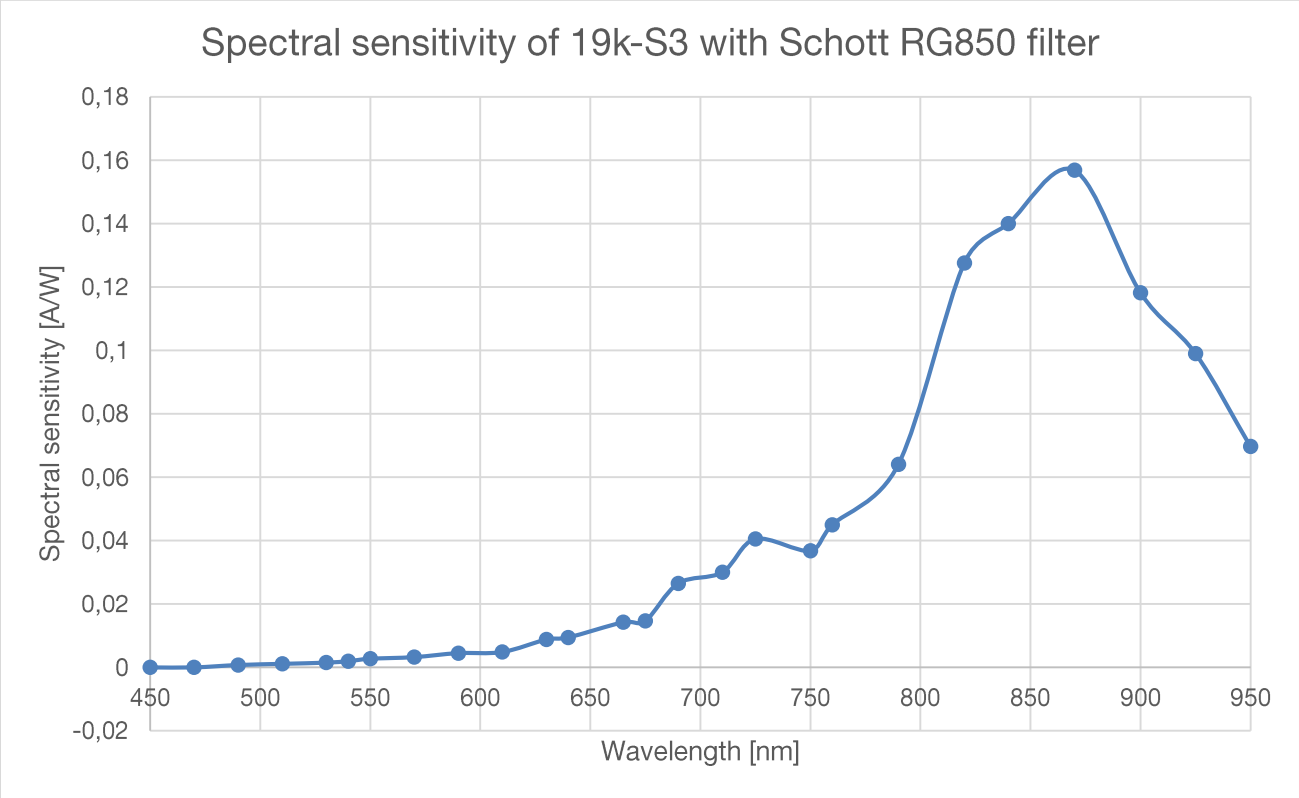

Figure 3-1 Spectral sensitivity of 19k-S3 with Schott RG850 filter

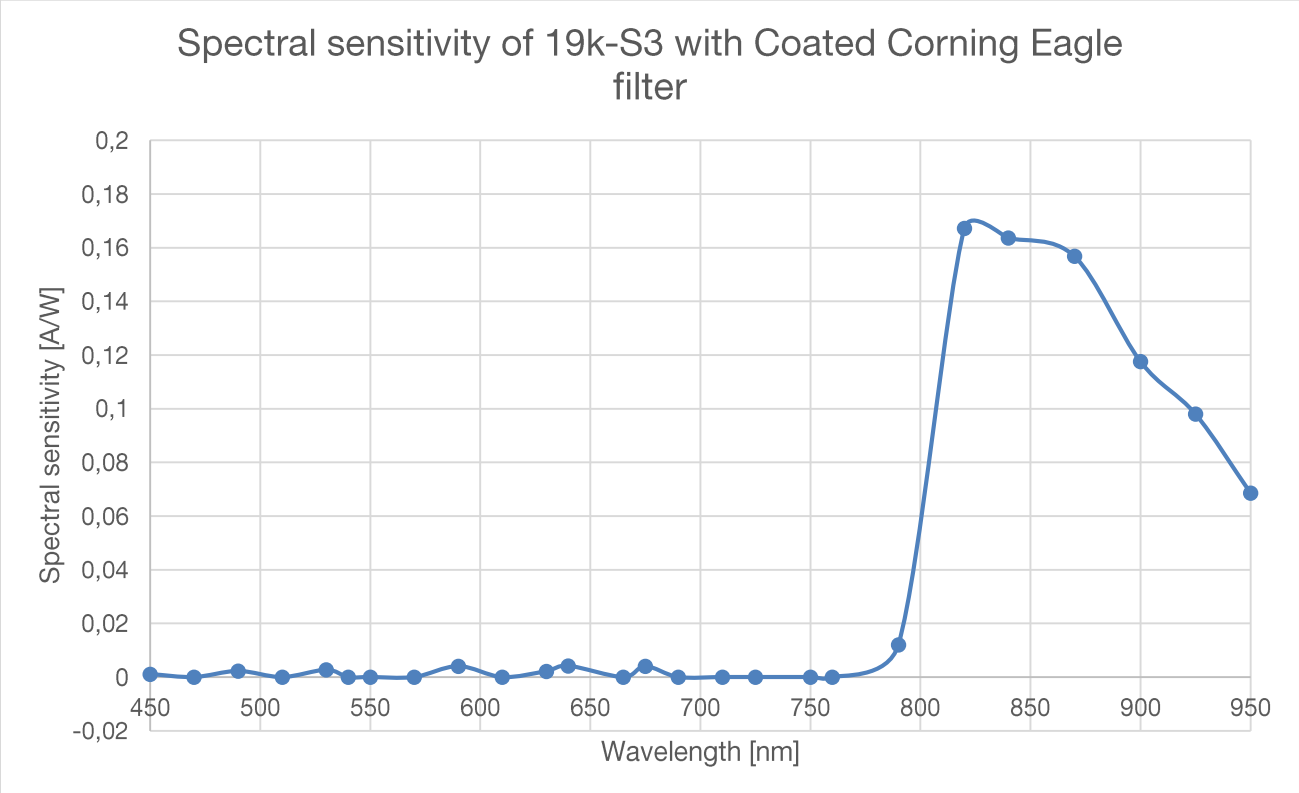

Figure 3-2 Spectral sensitivity of 19k-S3 with Coated Corning Eagle filter

3.5 Optical Isolation

To prevent direct irradiation from the Light Module into the sensor objective lens, an optical barrier has to be applied. There is a component-free area on the PCB to support an optical barrier down to the PCB.

The height of the optical barrier and the distance to the 3D sensor depends from the used objective and FOV. The following picture shows the field of view and the height of a 90° objective lens with 60mm² objective area.

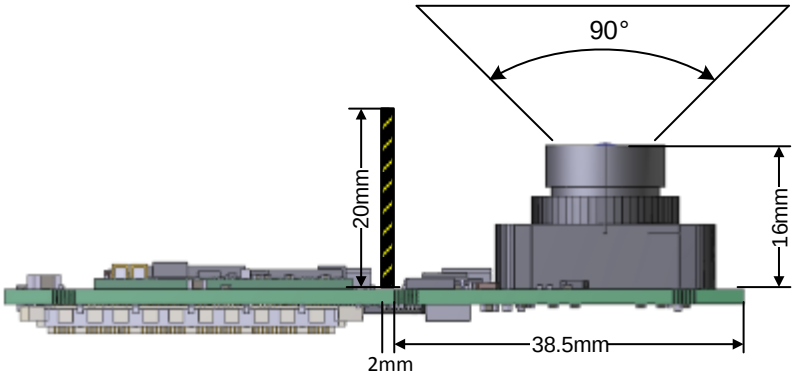

Figure 3-3: Optical isolation (side view)

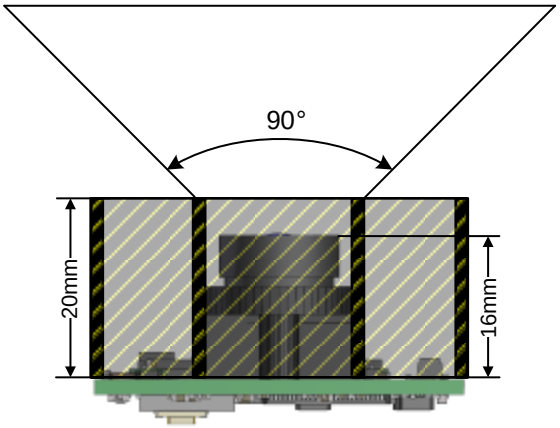

Figure 3-4 Optical isolation (front view)

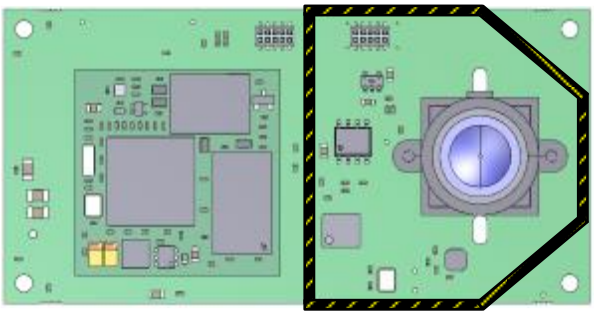

Figure 3-5 Optical isolation (top view)

3.6 Sensor Orientation

The 3D sensor is mounted in portrait mode as shown in Figure 3-6. For further information about the data format see Software User Manual.

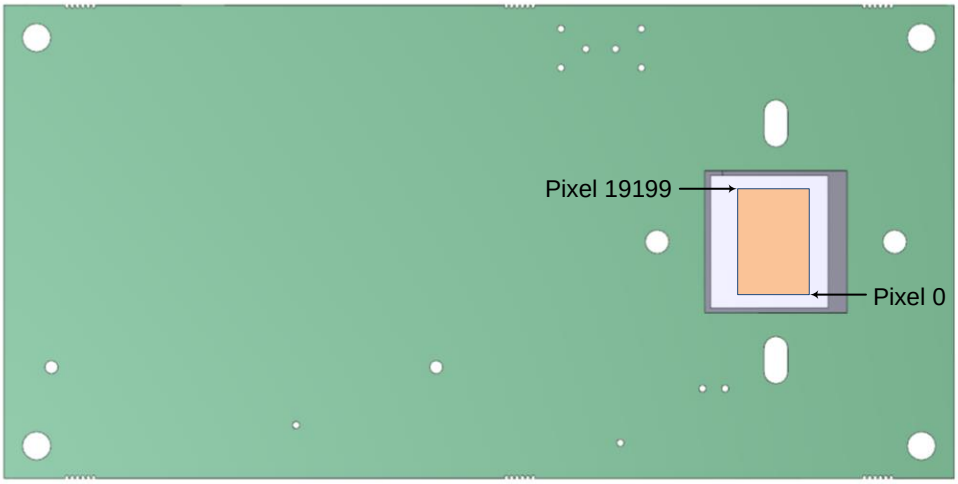

Figure 3-6 Sensor orientation

4 Specifications

4.1 Electrical Specifications

4.1.1 Operating Conditions

Symbol	Parameter	Min	Typical	Max	Unit
V_{IN}	Input supply voltage	4.9	5.0	5.1	V
I_{IN}	Input current	-	TBD	TBD	mA
V_{OH}	High level output voltage	3.0	3.3	3.45	V
V_{OL}	Low level output voltage	0.0		0.4	V
T_{OP}	Operating Temperature	-20	-	60	°C
T_{STG}	Storage Temperature	-65	-	150	°C
FITP	Frame-rate Integration Time Product	-	TBD	-	

Table 4-1: Electrical characteristics

4.1.2 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_{IO}	Input or output voltage	-0.6	3.95	V
V_{IN}	Input supply voltage	4.5	5.5	-
I_{OH}/I_{OL}	Current per pin	0	12	mA
T_{AMB}	Ambient temperature	-20	60	°C
T_{STO}	Storage temperature	-40	85	°C
φ_{AMB}	Relative ambient humidity	-	90	%

Table 4-2: Absolute maximum ratings

4.1.3 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 Connector Description

5.1 TIM Connector

The following table shows the pin-out of the 100-pin TIM connector:

Pin #	Type	Signal name	Description
1	I	ISM.nDE	ISM Output enable
2	NC		
3	NC		
4	NC		
5	NC		
6	PWR	GND	Power ground
7	NC		
8	NC		
9	NC		
10	NC		
11	PWR	GND	Power ground
12	NC		
13	NC		
14	NC		
15	NC		
16	NC		
17	NC		
18	NC		
19	NC		
20	NC		
21	NC		
22	PWR	GND	Power ground
23	NC		
24	I/O	ISM.SDA	ISM Configuration bus data signal
25	I	ISM.SCL	ISM Configuration bus clock signal
26	I	ISM.nRESET	ISM Reset signal
27	NC		
28	I	ISM.SADDR	ISM Slave address
29	PWR	GND	Power ground
30	NC		
31	NC		
32	PWR	GND	Power ground
33	NC		
34	NC		
35	PWR	GND	Power ground
36	NC		
37	NC		
38	PWR	GND	Power ground
39	NC		
40	NC		
41	PWR	GND	Power ground
42	NC		
43	NC		

Pin #	Type	Signal name	Description
44	O	I2CM1.SCL	I2C Master Clock signal
45	I/O	I2CM1.SDA	I2C Master Data signal
46	I	UART.RX[1)]	UART Receive
47	O	UART.TX[1)]	UART Transmit
48	I	CAN.RX[1)]	CAN Receive
49	O	CAN.TX[1)]	CAN Transmit
50	NC		
51	O	LED.SMOD	LIM Single ended mod signal
52	I/O	LED.IO1[1)]	LIM one-wire communication bus 1
53	PWR	GND	Power ground
54	O	LED.MOD_N	LIM Differential pair mod signal – negative
55	O	LED.MOD_P	LIM Differential pair mod signal – positive
56	PWR	GND	Power ground
57	I/O	GPIO.3[1)]	GPIO 3
58	I/O	GPIO.2[1)]	GPIO 2
59	I/O	GPIO.1[1)]	GPIO 1
60	I/O	LED.IO2[1)]	LIM Single-wire communication bus 2
61	NC	ETH.SPEED	Speed LED for the Ethernet (connect the LED using a 220 ohm resistor to 3V3)
62	NC	ETH.ACTIVITY	Activity LED for the Ethernet (connect the LED using a 220 ohm resistor to 3V3)
63	PWR	GND	Power ground
64	I/O	ETH.TX_N	Ethernet differential pair A (100Mbit TX_N)
65	I/O	ETH.TX_P	Ethernet differential pair A (100Mbit TX_P)
66	I/O	ETH.RX_N	Ethernet differential pair B (100Mbit RX_N)
67	I/O	ETH.RX_P	Ethernet differential pair B (100Mbit RX_P)
68	PWR	GND	Power ground
69	NC		
70	NC		
71	PWR	GND	Power ground
72	NC		
73	NC		
74	I	PEN	Module power enable
75	NC		
76	O	SPI.SCLK[2)]	SPI Clock signal
77	I/O	SPI.SIO0[2)]	SPI Data 0
78	I/O	SPI.SIO1[2)]	SPI Data 1
79	O	SPI.nCS[2)]	SPI Chip select
80	NC		
81	NC		
82	NC		
83	PWR	GND	Power ground
84	NC		
85	NC		
86	NC		
87	NC		
88	PWR	GND	Power ground
89	NC		
90	NC		
91	NC		

Pin #	Type	Signal name	Description
92	NC		
93	O	I2CM.SCL[1)]	I2C Master Clock signal
94	O	I2CM.SDA[1)]	I2C Master Data signal
95	PWR	GND	Power ground
96	PWR	GND	Power ground
97	PWR	VIN	5V Power supply
98	PWR	VIN	5V Power supply
99	PWR	VIN	5V Power supply
100	PWR	VIN	5V Power supply
101	PWR	GND	Power ground
102	PWR	GND	Power ground
103	PWR	GND	Power ground
104	PWR	GND	Power ground
105	PWR	GND	Power ground
106	PWR	GND	Power ground
107	PWR	GND	Power ground
108	PWR	GND	Power ground
109	PWR	GND	Power ground
110	PWR	GND	Power ground

Table 5-1 Pin-out of the TIM-UP-19k-S3 Ethernet connector

[1)] Function is firmware dependent. For further information refer to Software User Manual or contact Bluetechnix support.

[2)] Function is firmware dependent when ISM.nRESET=1. If ISM.nRESET=0 then EXTSPI can be used for firmware updates. See chapter 2.2.3 for further information.

6 Mechanical Outline

6.1 Top View

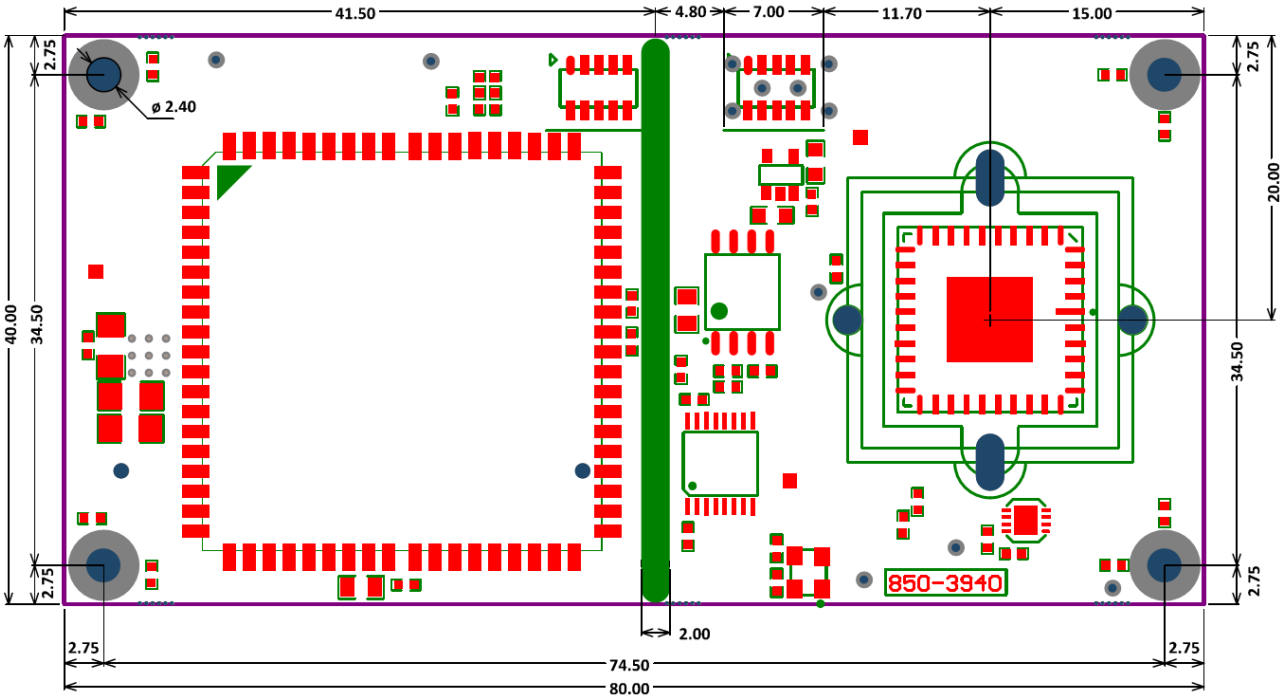

Figure 6-1 Top View of the TIM-UP-19k-S3 Ethernet

6.2 Bottom View

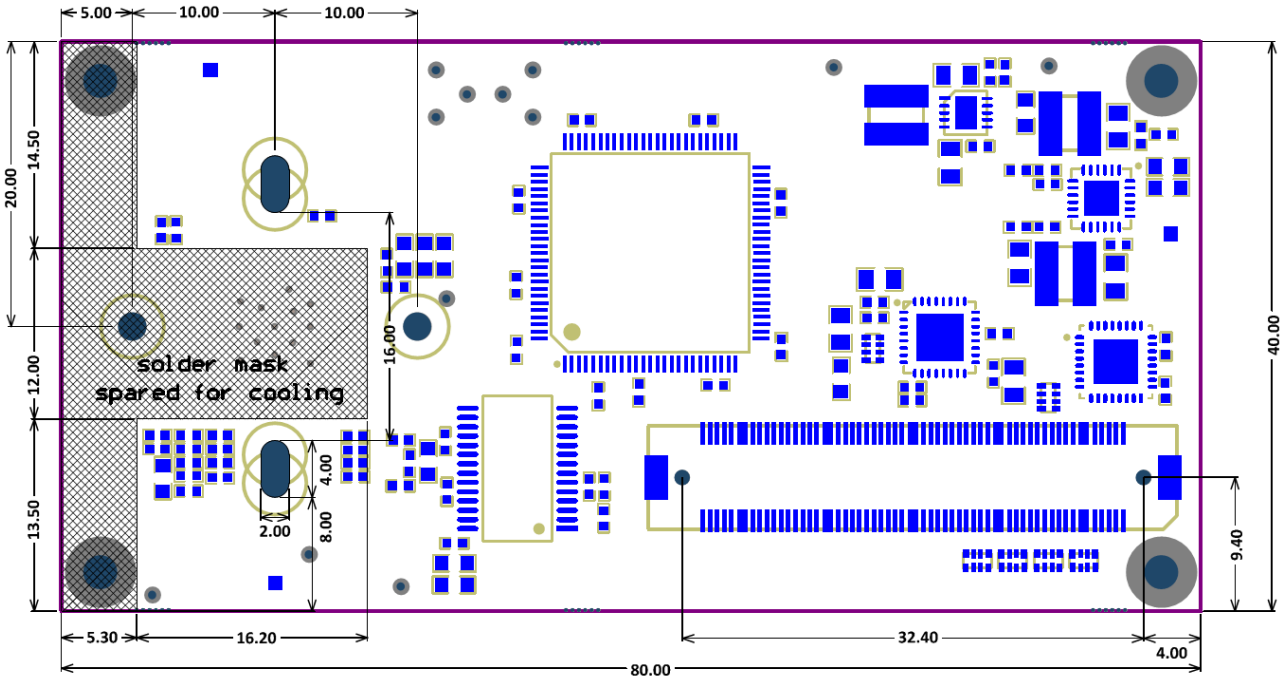

Figure 6-2 Bottom View of the TIM-UP-19k-S3 Ethernet

6.3 Side View

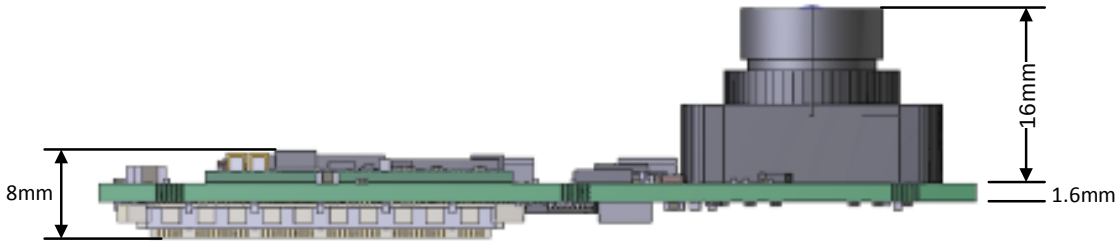

Figure 6-3 Side view of the TIM-UP-19k-S3 Ethernet

The objective lens is not considered in this drawing. A 3D-STEP file is available on request.

6.4 Footprint

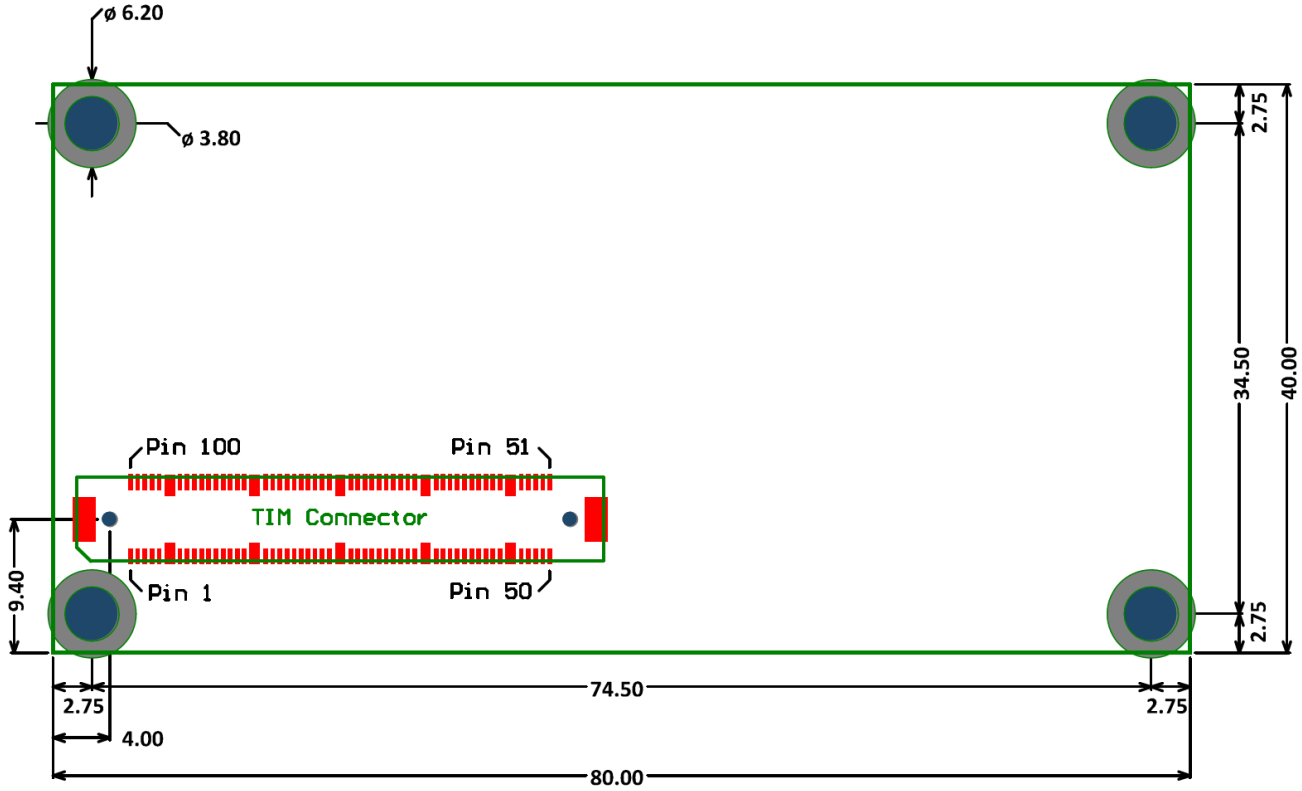

Figure 6-4 Footprint of the TIM-UP-19k-S3 Ethernet

The footprint for Altium Designer is available on request. The used connector is FX-10A-100P/10SV from Hirose. For detailed dimensions of the connectors please see the datasheet from the manufacturer's web site.

The mounting holes are designed for reflow solder able spacers SMTSO-M2-4 from PEM. For further details regarding dimensions and paste expansion please refer the manufacturer's website. If simple holes are desired on the base board, identical ones as on the TIM-UP-19k-S3 Ethernet are recommended.

6.5 Connectors

Connector	Manufacturer	Manufacturer Part No.
Module connector	Hirose	FX-10A-100S/10SV
Matching connector	Hirose	FX-10A-100P/10SV

Table 6-1: Connector types

7 Support

7.1 General Support

General support for products can be found at Bluetechnix' support site https://support.bluetechnix.at/wiki

7.2 Board Support Packages

Board support packages and software downloads are for registered customers only
https://support.bluetechnix.at/software/

7.2.1 Upcoming Products and Software Releases

Keep up to date with all product changes, releases and software updates of Bluetechnix at http://support.bluetechnix.com.

8 Ordering Information

Article Number	Name	Note
150-2206-1	TIM-UP - 19k-S3 Ethernet 90 25	**Default Version with 90° lens**
150-2207-1	TIM-UP - 19k-S3 Ethernet 30 25	30° Version
150-2208-1	TIM-UP - 19k-S3 Ethernet 60 25	60° Version

Table 8-1: Ordering information

NOTE: Custom specifications are available on request! Please contact Bluetechnix (office@bluetechnix.com) if you are interested in custom Core Modules.

9 Product History

9.1 Version Information

9.1.1 TIM-UP-19k-S3 Ethernet

Version	Component	Type
1.x.y	Sensor	PMDTech 19k-S3 with RG850 filter
	DSP	Analog Devices ADSP BF537
	CPLD	Lattice LCMXO2-1200HC-4TG100I

Table 9-1: Overview TIM-UP-19k-S3 Ethernet product changes

9.2 Anomalies

Version	Date	Description
V1.0.x	2014 09 17	ISM.nRESET (Pin#26) will be driven by the module instead of being input only. But a low active pulse can be applied to perform a Reset of the module. Use an ‘Open Drain’ or ‘Open Collector’ transistor to apply the pulse.
V1.1.x	2014 10 12	ISM.nRESET (Pin#26) will be driven by the module instead of being input only. But a low active pulse can be applied to perform a Reset of the module. Use an ‘Open Drain’ or ‘Open Collector’ transistor to apply the pulse.
V1.2.x	2014 12 05	No internal pullup on ISM.nRESET (Pin#26). External pullup required.
V1.3.x	2014 03 19	No anomalies reported yet.

Table 9-2 – Product anomalies

10 Document Revision History

Version	Date	Document Revision
1	2014 08 23 DST	First draft.
2	2014 12 05 ROB	Small modifications and fixed typos. Anomaly list added.
3	2014 12 05 WAC	Optical isolation update in chapter 3.5 Side view update in chapter 6.3
4	2015 02 05 ROB	Ethernet LED description added to 100 pol connector description
5	2015 03 19 ROB	Product anomalies updated

Table 10-1: Revision history

11 List of Abbreviations

Abbreviation	Description
ADI	Analog Devices Inc.
AI	Analog Input
AMS	Asynchronous Memory Select
AO	Analog Output
CM	Core Module
DC	Direct Current
DSP	Digital Signal Processor
eCM	Enhanced Core Module
EBI	External Bus Interface
ESD	Electrostatic Discharge
GPIO	General Purpose Input Output
I	Input
I²C	Inter-Integrated Circuit
I/O	Input/Output
ISM	Image Sensor Module
LDO	Low Drop-Out regulator
MTBF	Mean Time Between Failure
NC	Not Connected
NFC	NAND Flash Controller
O	Output
OS	Operating System
PPI	Parallel Peripheral Interface
PWR	Power
RTOS	Real-Time Operating System
SADA	Stand Alone Debug Agent
SD	Secure Digital
SoC	System on Chip
SPI	Serial Peripheral Interface
SPM	Speech Processing Module
SPORT	Serial Port
TFT	Thin-Film Transistor
TISM	Tiny Image Sensor Module
TSC	Touch Screen Controller
UART	Universal Asynchronous Receiver Transmitter
USB	Universal Serial Bus
USBOTG	USB On The Go
ZIF	Zero Insertion Force

Table 11-1: List of abbreviations

A List of Figures and Tables

Figures

Tables