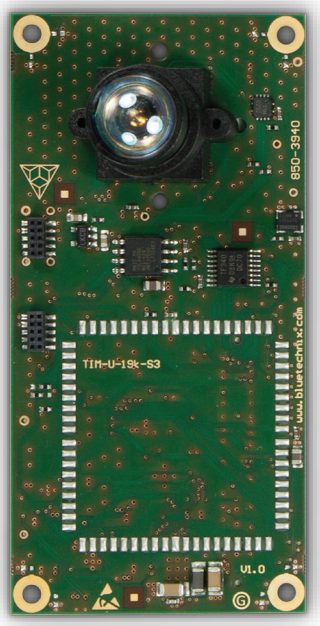
BLUETECHNIX
Embedding Ideas

TIM-U-19k-S3 PVI-r



Hardware User Manual

Version 2.1

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-U-19k-S3 PVI-r features 3D raw data (phase data) streaming. It has a FoV of 90 ° and enables 3D raw data streaming via an 8 bit parallel interface. For this product there is a variety of lenses available (Details see Sensor Accessories). Further interfaces like Ethernet can be realized in combination with an interface board and a processor module.

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
- ISM interface
- LIM interface
- Support CS- and M12-lense holder
- 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-U-19k-S3 PVI-r.

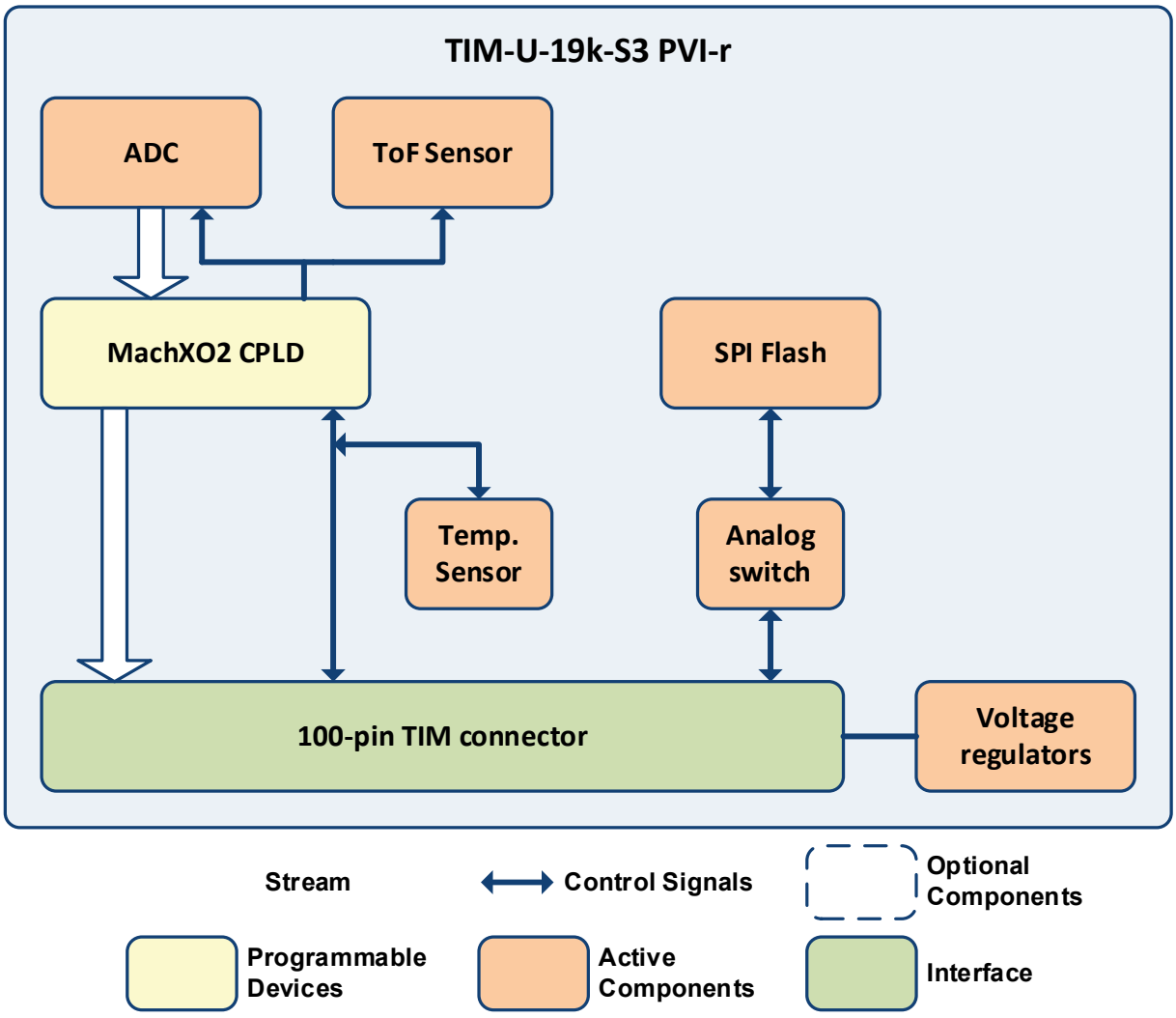

Figure 2-1 TIM-U-19k-S3 PVI-r block diagram

The following list shows the main components of the TIM-U-19k-S3 PVI-r:

- CPLD (Lattice **LCMXO2-1200HC-4TG100I**)
- ToF-Sensor (PMDtec **19k-S3**)
- ADC (Analog Devices **AD9826KRSZ**)
- Temperature sensor **ADT7408CCPZ**
- SPI Flash (Macronix **MX25L6406EM2I-12G**)
- Voltage regulators **ADP2503ACPZ-R7** and **ADP5034ACPZ-R7**

2.2 Interfaces

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

2.2.1 ISM

The ISM interface provides an 8-bit parallel video stream interface and all necessary control signals as well as an I2C interface to configure the module.

2.2.2 LIM

The LIM interface must be used in conjunction with an external LIM module. This interface consists of the light modulation signals (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 on-board SPI Flash for calibration data storage.

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 GPIOs

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

2.2.5 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-U-19k-S3 PVI-r must be connected to a base board through a FX-10A-100P/10SV connector from Hirose (see chapter 7.4). The module provides 4 additional M2 mounting holes to fix it on the base board.

See chapter 7.4 for more information.

3.2 Sensor cooling

The module provides 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 7.2 for more information.

3.3 Lenses

The TIM-U-19k-S3 PVI-r 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.

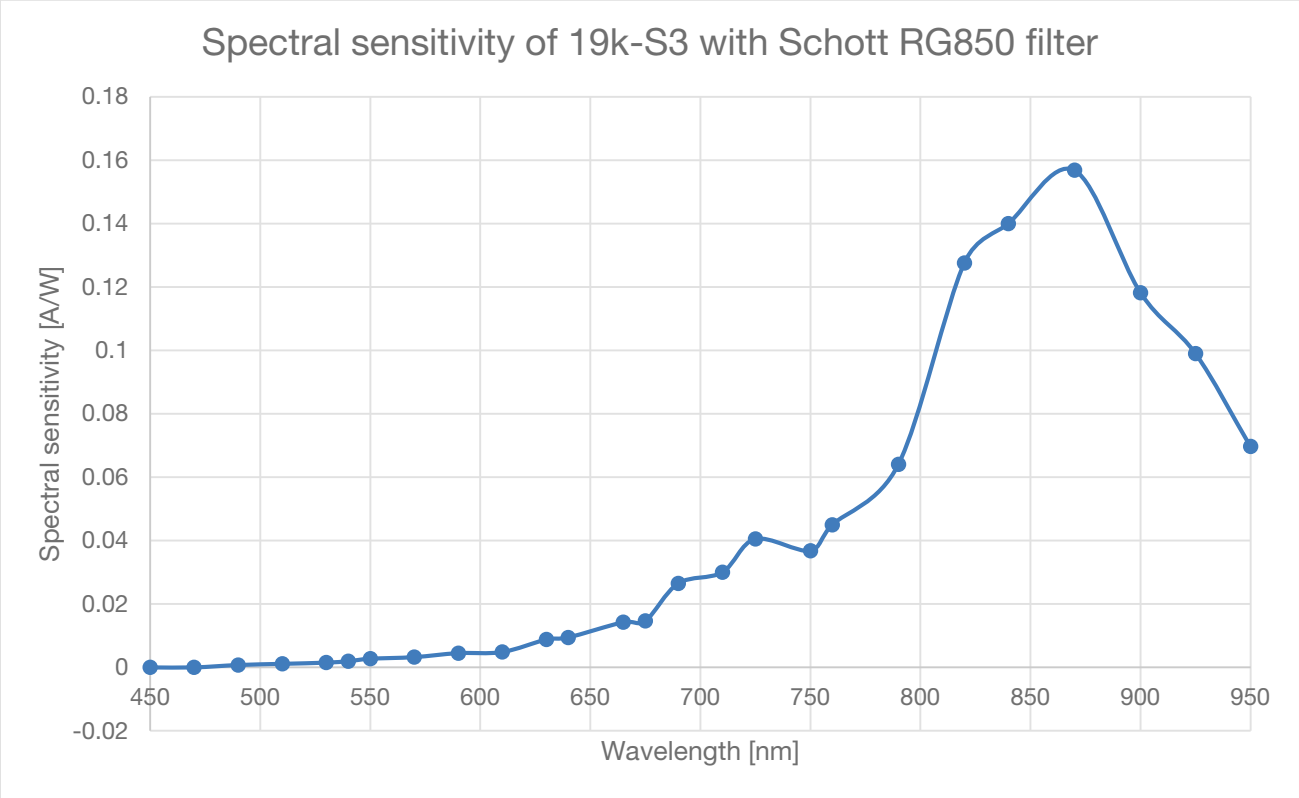

Figure 3-1 Spectral sensitivity of 19k-S3 with Schott RG850 filter

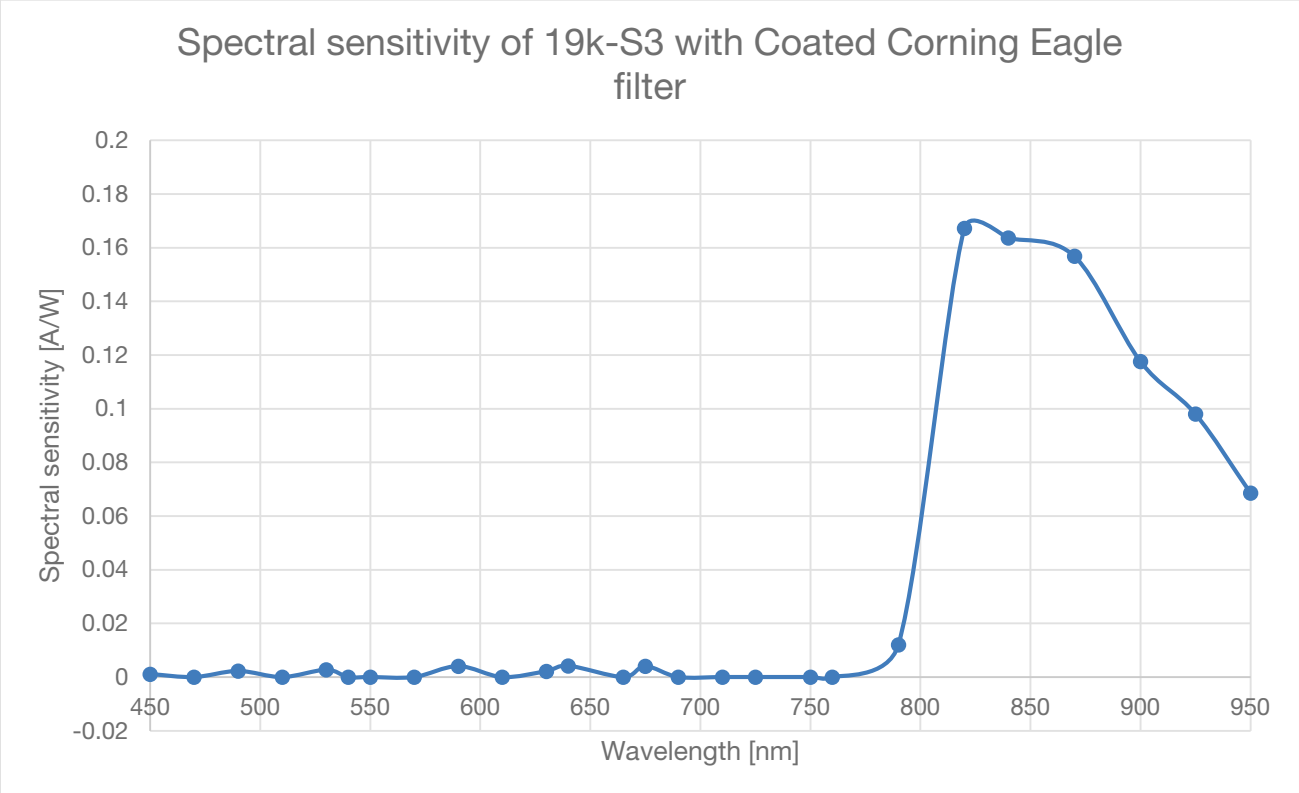

Figure 3-2 Spectral sensitivity of 19k-S3 with Coated Corning Eagle filter

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.

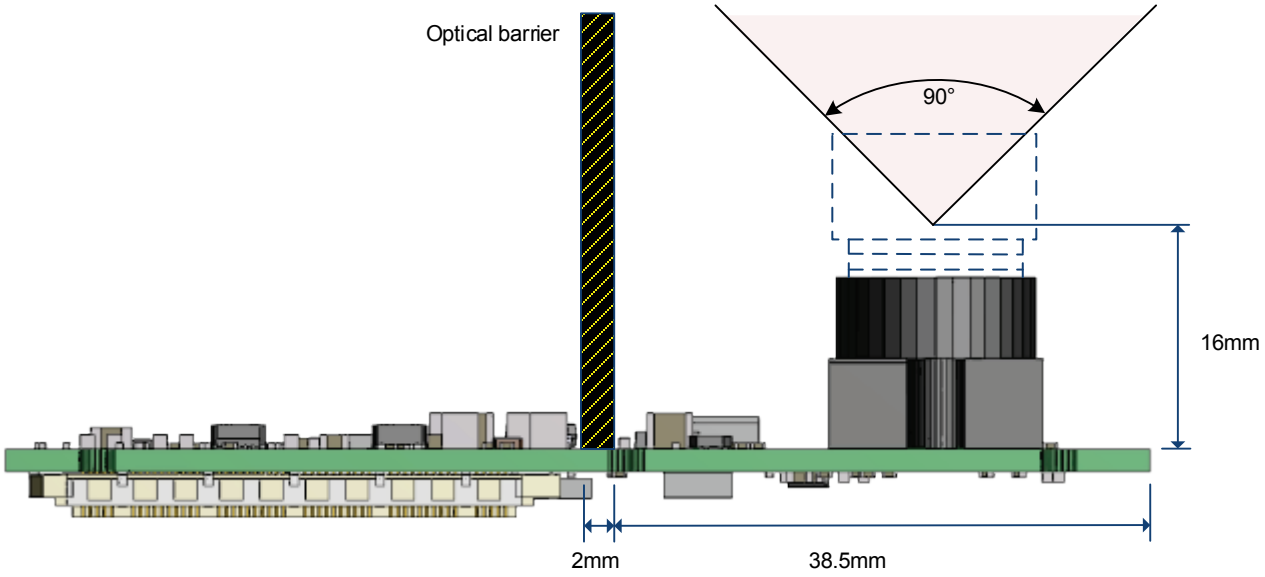

Figure 3-3: Optical isolation

3.6 Sensor Orientation

The 3D sensor is mounted in portrait mode as shown in Figure 3-4. For further information about the data format see Software User Manual.

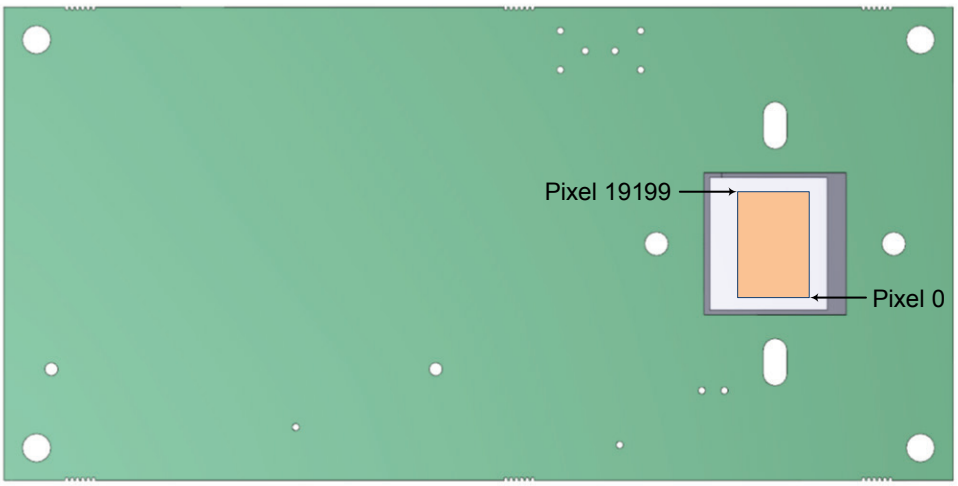

Figure 3-4 Sensor orientation

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	-65	150	°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	O	ISM.D7	ISM Data Bit 7 (MSB)
8	O	ISM.D6	ISM Data Bit 6
9	O	ISM.D5	ISM Data Bit 5
10	O	ISM.D4	ISM Data Bit 4
11	PWR	GND	Power ground
12	NC		
13	O	ISM.D3	ISM Data Bit 3
14	O	ISM.D2	ISM Data Bit 2
15	O	ISM.D1	ISM Data Bit 1
16	O	ISM.D0	ISM Data Bit 0 (LSB)
17	O	ISM.STROBE	ISM Strobe signal
18	I	ISM.TRIGGER	ISM Trigger signal
19	O	ISM.HSYNC	ISM Frame valid (HSYNC)
20	O	ISM.VSYNC	ISM Line valid (VSYNC)
21	O	ISM.PCLK	ISM Pixel clock
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	NC		
45	NC		
46	NC		
47	NC		
48	NC		
49	NC		
50	NC		
51	O	LED.SMOD	LIM Single ended mod signal
52	NC		
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	NC		
61	NC		
62	NC		
63	PWR	GND	Power ground
64	NC		
65	NC		
66	NC		
67	NC		
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		
92	NC		
93	NC		

Pin #	Type	Signal name	Description
94	NC		
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-U-19k-S3 PVI-r 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 Application Information

See Application manual.

7 Mechanical Outline

7.1 Top View

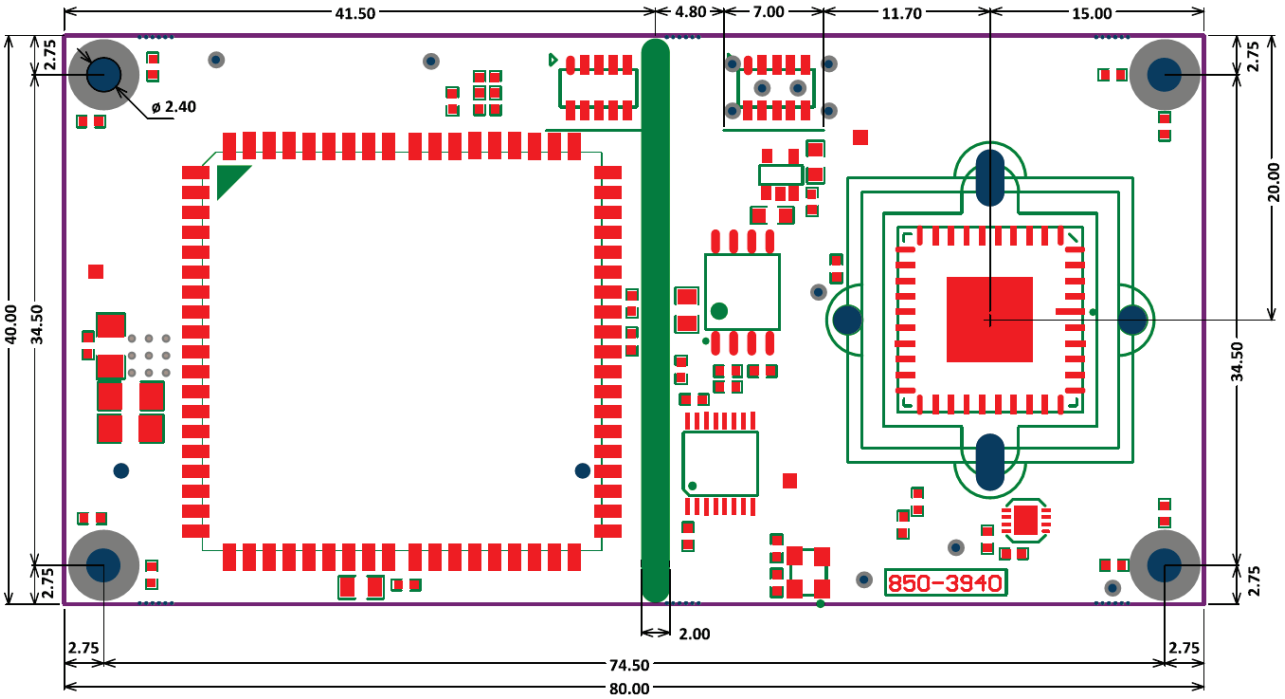

Figure 7-1 Top View of the TIM-U-19k-S3 PVI-r

7.2 Bottom View

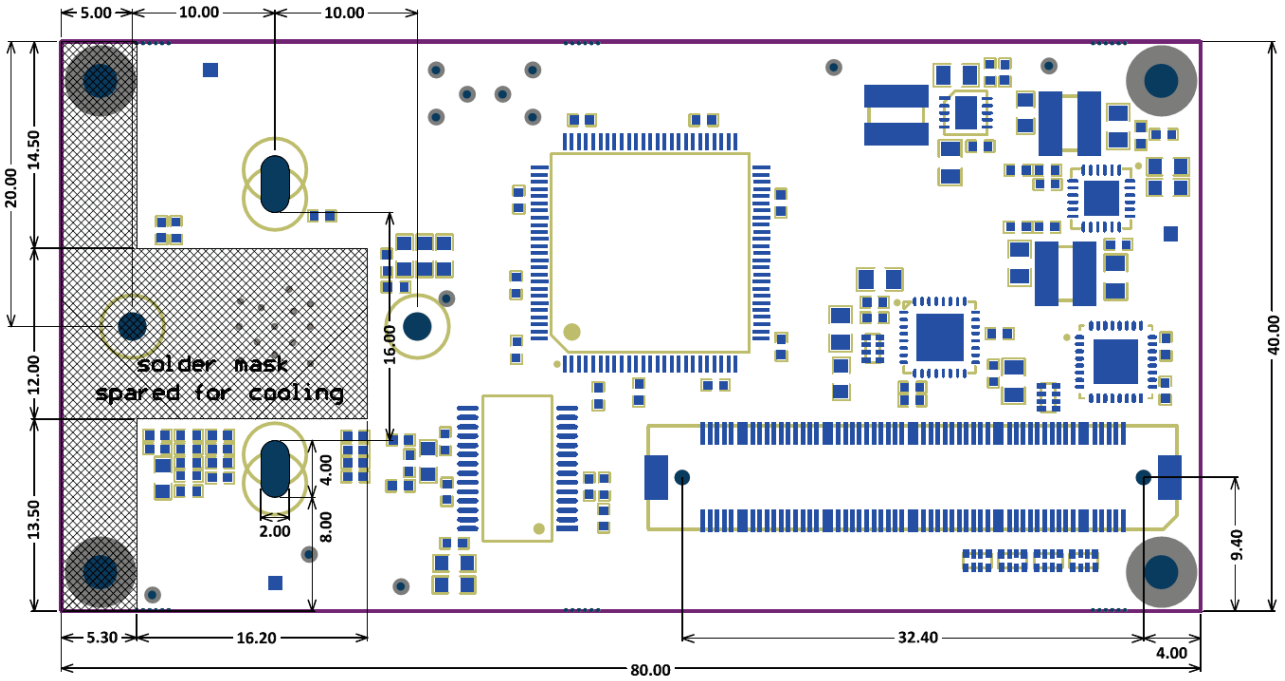

Figure 7-2 Bottom View of the TIM-U-19k-S3 PVI-r

7.3 Side View

Figure 7-3 Side view of the TIM-U-19k-S3 PVI-r

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

7.4 Footprint

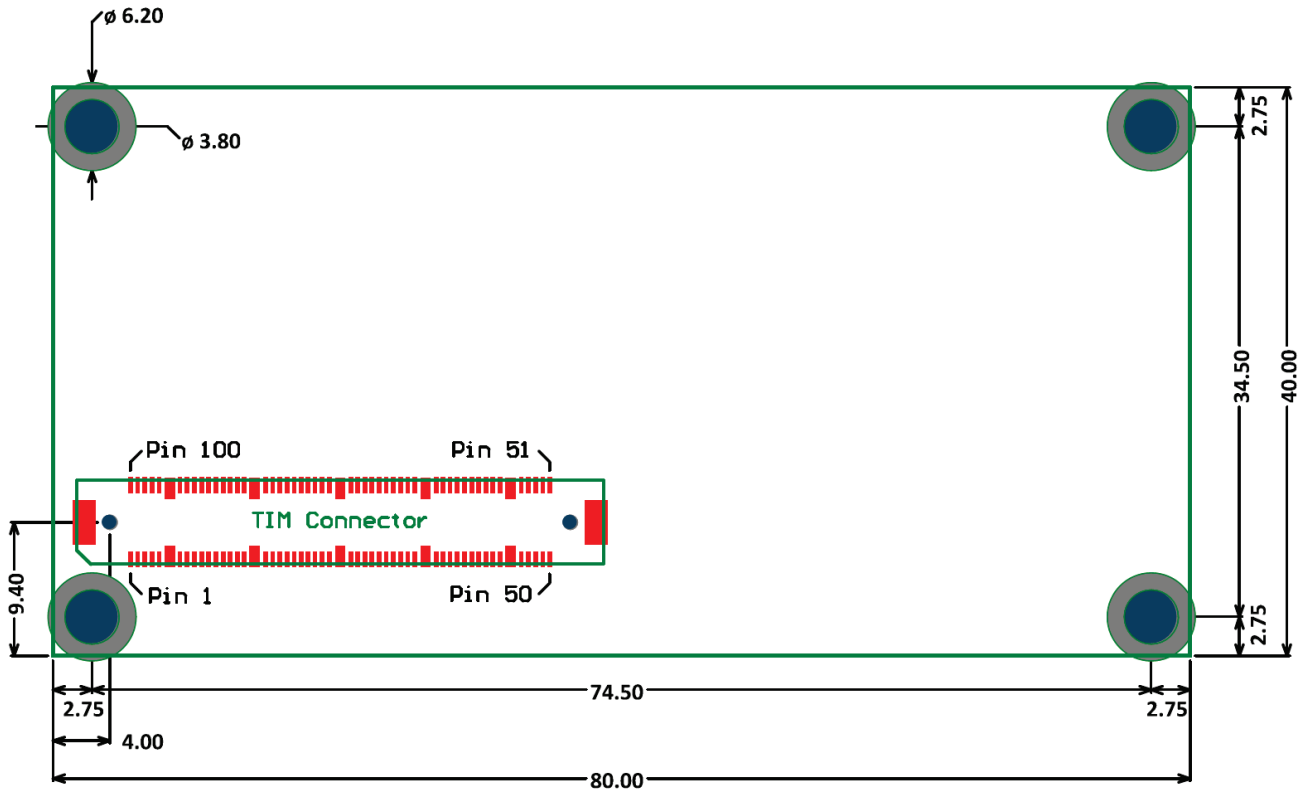

Figure 7-4 Footprint of the TIM-U-19k-S3 PVI-r

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-U-19k-S3 PVI-r are recommended.

7.5 Connectors

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

Table 7-1: Connector types

8 Support

8.1 General Support

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

8.2 Board Support Packages

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

8.2.1 Upcoming Products and Software Releases

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

9 Ordering Information

Article Number	Name	Note
150-2200-2	TIM-U-19k-S3 PVI-r	**Default Version with 90° lens**

Table 9-1: Ordering information

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

10 Product History

10.1 Version Information

10.1.1 TIM-U-19k-S3 PVI-r

Version	Component	Type
2.0.0	Sensor CPLD	PMDTech 19k-S3 with RG850 filter Lattice LCMXO2-1200HC-4TG100I

Table 10-1: Overview TIM-U-19k-S3 PVI-r product changes

10.2 Anomalies

Version	Date	Description
V2.0	2014 05 27	No anomalies reported

Table 10-2 – Product anomalies

11 Document Revision History

Version	Date	Document Revision
1	2014 07 23 DST	First release V1.0 of the document

Table 11-1: Revision history

12 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 12-1: List of abbreviations

A List of Figures and Tables

Figures

Tables