BLUETECHNIX
Embedding Ideas

EPC610-ToF-Module

Hardware User Manual

Version 1.1

Contact

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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 Tiny ToF Development Board from Bluetechnix GmbH. Follow this guide chapter by chapter to set up and understand your product.

The document applies to the X-Grade product.

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.

2 Introduction

2.1 Overview

The Tiny ToF Module is a very new depth sensor fully integrated onto a module of only 25 mm x 40 mm. The three main components ToF sensor, active illumination and processing unit are embedded into a tiny environment accessible via a single connector.

2.2 Key Features

- 8x8 pixel
- Size: 40 x 25mm
- 20-Pin EPC6xx ToF Module Connector
- M12 lens holder
- Debug UART (available on solder pads)
- 5V-24V power supply

2.2.1 Applications

- Range Measurements
- People Counting
- 3D Safety Area
- Navigation
- Touch less Control
- Obstacle detection

3 General Description

3.1 Functional Description

The following image shows the block diagram of the EPC610 ToF Module.

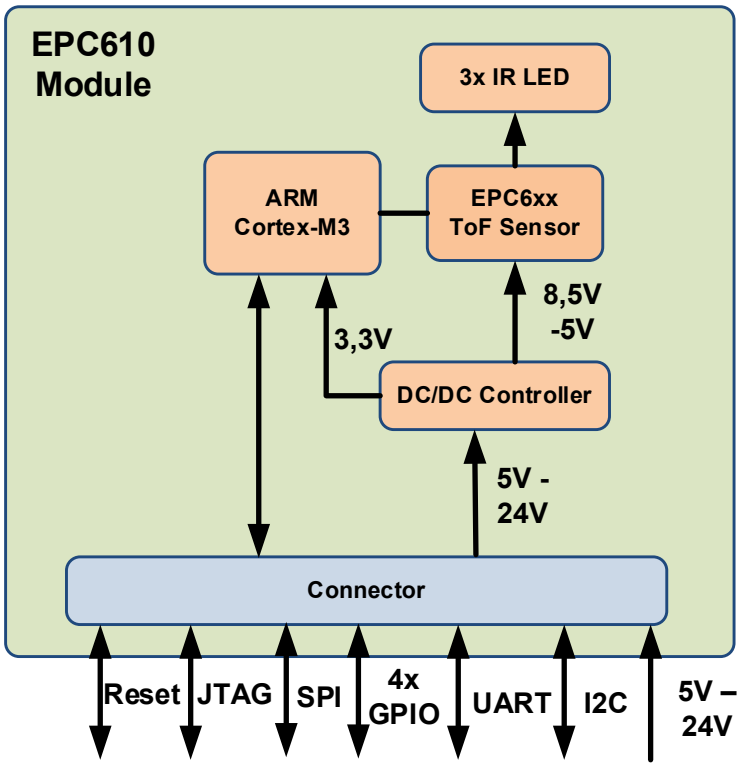

Figure 3-1 EPC610 ToF Module block diagram

3.1.1 Main components EPC610 ToF Module

- ToF Sensor (EPC610)
- ARM Cortex M3 (STM32F100RCT6)
- 3x IR LEDs (Osram SFH4059)

3.2 Interfaces

The following chapters describes the interfaces on the 20-pin EPC6xx connector.

3.2.1 UART

An UART interface is available on the EPC6xx connector. This interface allows to use the EPC610 ToF Module as an UART 3D image stream device. For further information refer to Software User Manual.

3.2.2 I2C

Function is firmware dependent. For further information refer to Software User Manual.

3.2.3 SPI

Function is firmware dependent. For further information refer to Software User Manual.

3.2.4 Serial Wire Debug Interface

The standard ARM serial wire debug interface is available on the EPC6xx connector.

3.2.5 Boot mode Selection

The BOOT0 pin can be used to enable the STM32 internal UART boot loader. The BOOT0 signal is internally pulled low by a 100k resistor.

BOOT0 signal	Function
Low	STM32 starts program from internal flash
High	STM32 internal UART boot loader is active

Figure 3-2 Function of BOOT0 signal

3.2.6 GPIOs

Two inputs and two outputs are available on the EPC6xx connector. Function is firmware dependent. For further information refer to Software User Manual.

3.2.7 Reset

The nRST pin is used to reset the STM32 microprocessor. A short low signal (<2sec) resets only the microprocessor, but a longer low signal (>2sec) restores the factory default settings.

For further information refer to Software User Manual.

4 Hardware installation

4.1 Mounting

The EPC610 ToF Module can be connected to a base board through a standard 20pol. 1.27mm pitch connector or a similar cable. The module provides 2 additional M3 mounting holes to fix it on the base board.

See chapter 7 for more information.

4.2 Lenses

The EPC610 ToF Module provides a M12 lens holder. The module will be equipped with a 3,7° objective. Other objectives can be provided by Bluetechnix on request.

4.3 Sensor sensitivity

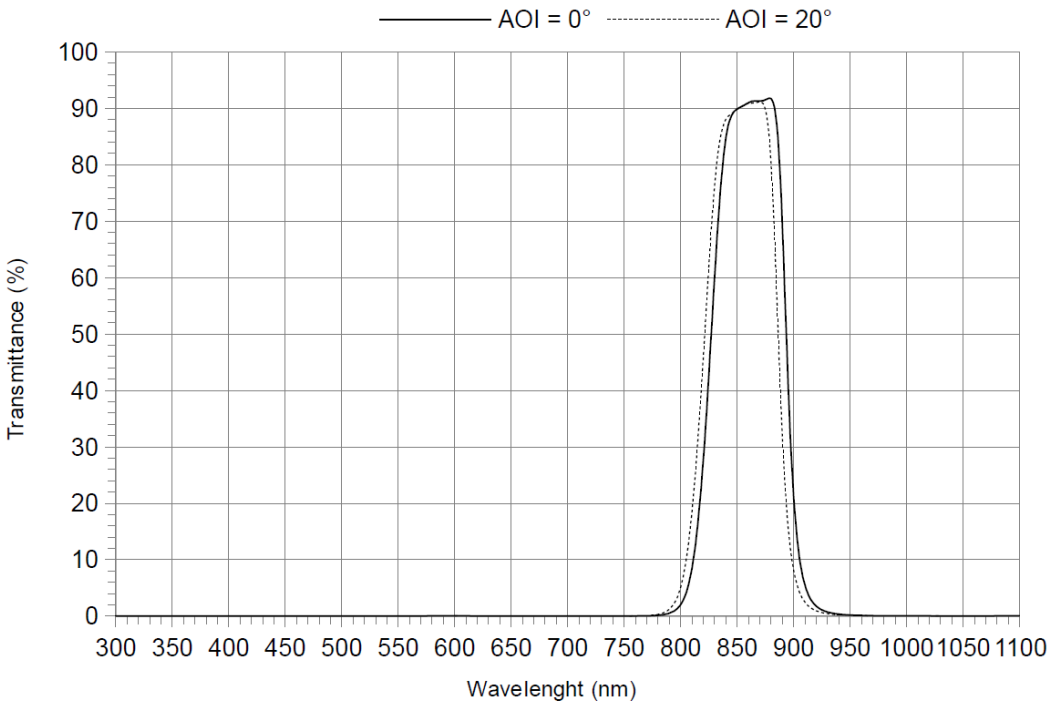

Figure 4-1 Sensor selectivity (AOI: angle of incident)

4.4 Optical decoupling of emitter and receiver

To prevent direct irradiation from the LED into the sensor lens, the mounted lens holder works as an optical barrier.

If the EPC610 ToF module is mounted into an extra case, there must be two separate case windows (one for the ToF sensor and one for the LEDs) with an optical barrier between them. Otherwise reflections inside of the window material will directly couple into the EPC610 sensor.

Figure 4-2 shows the recommended dimension of an optical isolator and the two separate case windows. The barrier between the two windows must go down to the PCB..

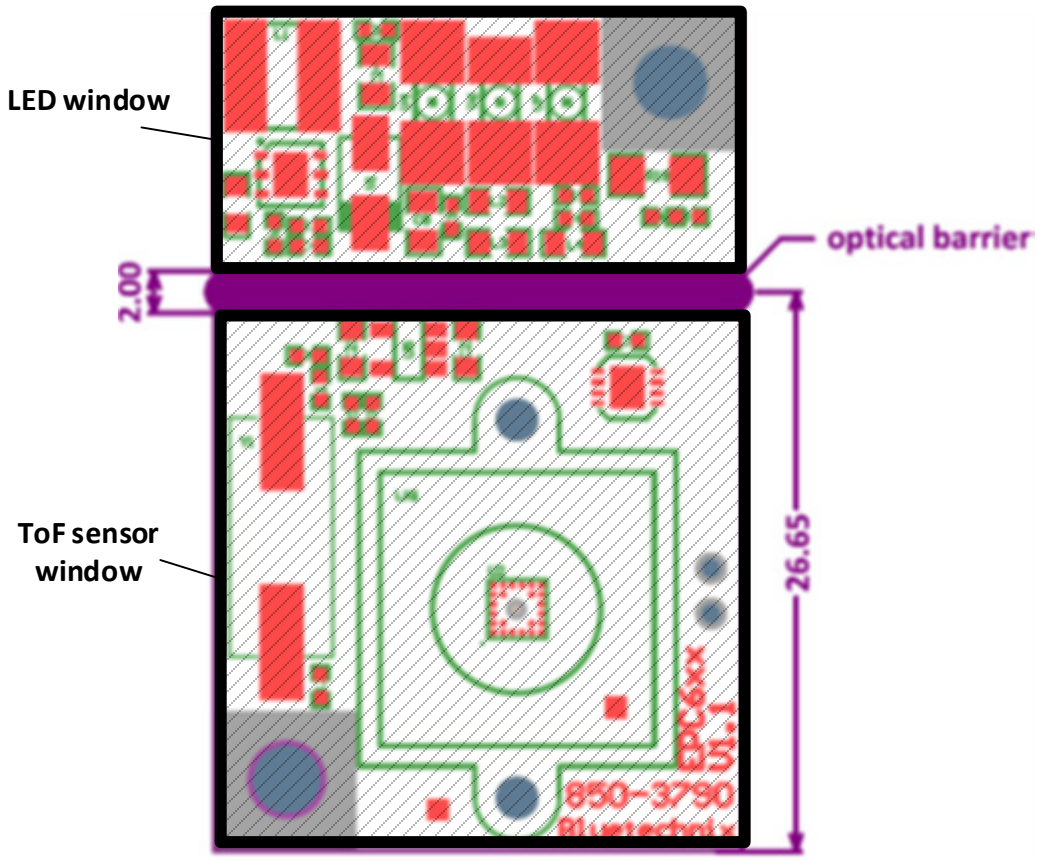

Figure 4-2: Mechanical dimensions for an optical barrier

Caution

The optical barrier has to be completely non-transparent for infrared light. Be aware, that many black materials may be transparent for infrared light!

4.5 Sensor Orientation

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

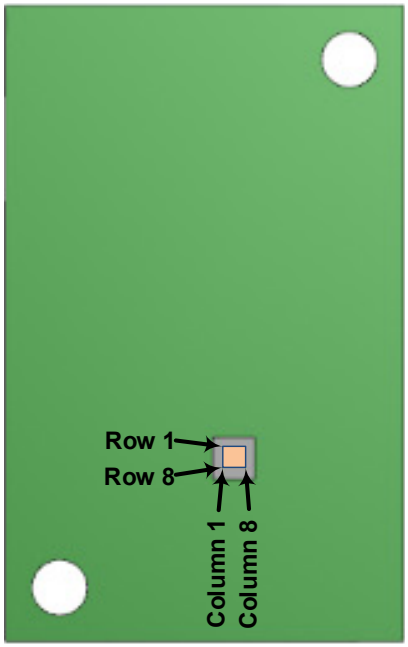

Figure 4-3 Sensor orientation

5 Specifications

5.1 Electrical Specifications

5.1.1 Operating Conditions

Symbol	Parameter	Min	Typical	Max	Unit
V_{IN}	Power supply voltage	4.5	12	24	V
P_{LED}	Power consumption during ToF integration [1)]			1.7	W
V_{IH}	High level input voltage	1.8		3.3	V
V_{IL}	Low level input voltage	0		1.4	V
T_{OP}	Operating temperature	-20		65	°C
φ_{AMB}	Relative ambient humidity (non condensing)	0		90	%

Table 5.1: Electrical characteristics

Note 1) Average power for an integration time of 52ms.

5.1.2 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}	Power supply voltage	-0.3	28	V
T_{AMB}	Ambient temperature	-20	65	°C
T_{STO}	Storage temperature	-55	125	°C
φ_{AMB}	Relative ambient humidity (non condensing)	0	90	%

Table 5.2: Absolute maximum ratings

5.1.3 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.

5.2 Optical Characteristics

Symbol	Parameter	Min	Typical	Max	Unit
#LEDs	Nr. of LEDs		3		
$\Lambda_{CENTROID}$	Centroid-Wavelength of Illumination		850		nm
$\Delta\lambda$	Spectral Bandwidth		30		nm
I_e	Radiant intensity		0,1		W/sr
FoV_H	Horizontal Field of View		3,7		Deg
FoV_V	Vertical Field of View		3,7		Deg

5.3 Measurement Specifications

5.3.1 Measurement Environmental Conditions

All the following measurements have been acquired at the following constant environmental conditions.

Parameter	Value
Temperature	25 °C
Humidity	40%
Ambient light	No
Modulation Frequency	10MHz
Frame-rate	10 fps

Table 5-3: Environmental Specification

5.3.2 Typical Reproducibility

The following table shows the standard deviation over 100 samples.

Measuring range [mm]	White target (90%) [mm]	Accuracy of Distances
250	TBD	TBD
500	TBD	TBD
750	TBD	TBD
1000	TBD	TBD
1250	TBD	TBD
1500	TBD	TBD
1750	TBD	TBD
2000	TBD	TBD
2250	TBD	TBD
2500	TBD	TBD
2750	TBD	TBD
3000	TBD	TBD
3250	TBD	TBD
3500	TBD	TBD
3750	TBD	TBD
4000	TBD	TBD

Table 5-4: Typical Reproducibility

For further information contact Bluetechnix support team. (https:\\support.bluetechnix.at)

6 Connector Description

6.1 EPC610 ToF Module connector

A 20pin connector (pitch 1,27mm) is available on the bottom side of the EPC610 module for connection to an OEM base board (e.g. TinyToF_Dev).

The following table shows the pin-out of the 20-pin EPC610 ToF Module connector:

Pin #	Type	STM32 Signal name	Description
1	PWR	GND	Power Ground
2	PWR	VCC	Input Voltage
3	I	PA10/USART1.RX	UART Receive Data *(10k pull-up)*
4	O	PA9/USART1.TX	UART Transmit Data
5	I/O	PA3	Output [1]
6	I/O	PA2	Output [1]
7	O	PA5/SPI1.SCK	SPI Clock
8	I	PA7/SPI1.MOSI	SPI Master Out Slave In
9	O	PA6/SPI1.MISO	SPI Master In Slave Out
10	I/O	SPI.SS / GPIO1	SPI Slave Select / Output [1]
11	I/O	PA11	PWM Output [1]
12	I/O	PB11/I2C2.SDA	I2C Data *(3k3 pull-up)*
13	I/O	PA13	Input [1]
14	I/O	PB10/I2C2.SCL	I2C Clock *(3k3 pull-up)*
15	PWR	GND	Power Ground
16	I	BOOT0	Boot mode Entry *(100k pull-down)*
17	I	nRST	Module Reset *(10k pull-up)*
18	I	PA14/SWCLK	Serial Wire Debug Clock
19	I/O	PA13/SWDIO	Serial Wire Debug IO
20	O	3V3	3V3 Output (max. 100mA)

Table 6.1 Pin-out of the EPC610 module connector

[1] GPIO type configuration with standard firmware.

7 Mechanical Outline

All Dimensions in the drawings below are given in Millimeters.

7.1 Top View

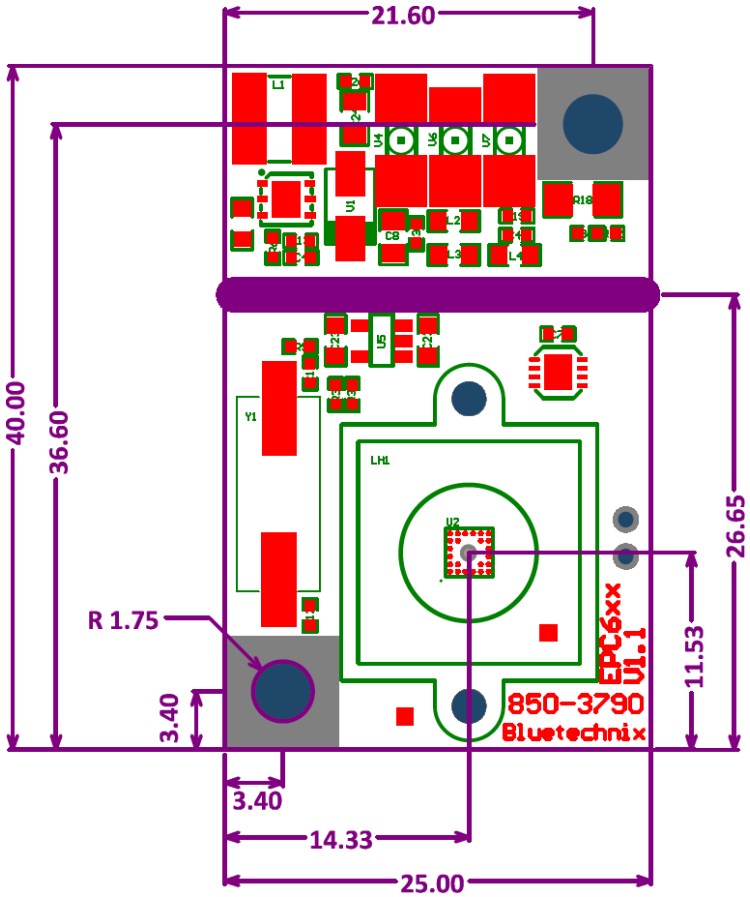

Figure 7-1: Top side Dimensions

7.2 Bottom View

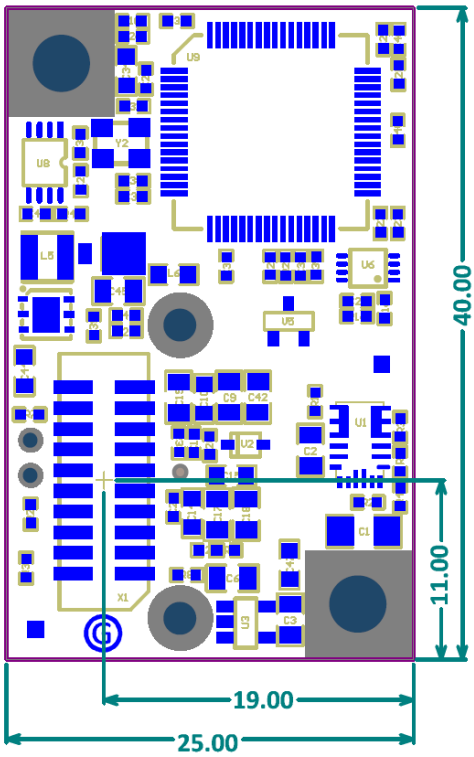

Figure 7-2: Bottom side Dimensions

7.3 Connectors

Connector	Manufacturer	Manufacturer Part No.
Module connector	FCI	20021221-00020T4LF
Matching connector	FCI	20021321-00020T4LF

8 Support

8.1 General Support

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

9 Ordering Information

PON	Name	Note
150-2210-1	EPC610 ToF Module	
150-2401-1	Tiny ToF Development Package	

Table 9.1: Order Information

10 Product History

10.1 Version Information

10.1.1 EPC610 ToF Module

Version	Component	Type
1.1.0		First release

Table 10.1: Overview EPC610 ToF Module product changes

10.2 Anomalies

Version	Date	Description
V1.1	2014 05 06	No anomalies reported yet.

Table 10.2 – Product anomalies

11 Document Revision History

Version	Date	Document Revision
1	2014 06 20	First release V1.0 of the Document

Table 11.1: Revision history

12 List of Abbreviations

Abbreviation	Description
ESD	Electrostatic Discharge
GPIO	General Purpose Input Output
I	Input
I²C	Inter-Integrated Circuit
I/O	Input/Output
MTBF	Mean Time Between Failure
NC	Not Connected
O	Output
PWR	Power
SPI	Serial Peripheral Interface
UART	Universal Asynchronous Receiver Transmitter
USB	Universal Serial Bus

Table 12.1: List of abbreviations

A List of Figures and Tables

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