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LightRanger 7 Click



PID: MIKROE-5842

LightRanger 7 Click is a compact add-on board capable of precise distance measurement and motion tracking. This board features the AFBR-S50, a medium-range 3D multipixel Time-of-Flight (ToF) sensor from Broadcom. Besides a VCSEL-based ToF sensor (Laser Class 1 eye safety), optimized to measure various distances working equally well on white, black, colored, and metallic reflective surfaces, this board also includes a 32-bit MCU, RA4M2 group of Renesas MCU with Arm® Cortex®-M33 core, alongside a 4-pin standard CAN connections compatible with Pixhawk®, a popular general-purpose flight controller. This Click board™ makes the perfect solution for robotics and industrial applications requiring precise 3D information and an extended range like drones or AMR/AGV.

LightRanger 7 Click is supported by a mikroSDK compliant library, which includes functions that simplify software development. This Click board™ comes as a fully tested product, ready to be used on a system equipped with the mikroBUS™ socket.

NOTE: This Click board™ can also be found in a customized version for all AFBR-S50 sensors, which can be used as a complete ToF solution in an out-of-the-box manner, cutting the time to market. For more information, please visit the AFBR-S50 ToF Sensor Board product page.

How does it work?

LightRanger 7 Click is based on the AFBR-S50, a multi-pixel optical distance and motion measurement sensor module based on the Time-of-Flight principle from Broadcom. The AFBR-S50 is developed with a particular focus on applications with the need for the highest speed and accuracy at medium distance ranges with low power consumption. Due to its best-in-class

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ambient light suppression, use in outside environments is possible in direct sunlight and on white, black, colored, metallic, and retroreflective surfaces. This feature makes it suitable for optical distance measurements requiring precise 3D information and extended range like drones or AMR/AGV.

This board represents an integrated solution consisting of a 32-bit MCU, RA4M2 group of Renesas MCU with Arm® Cortex®-M33 core, and a ToF sensor with an integrated infrared laser light source mounted on a compact-sized PCB. In addition to an SPI-compatible interface for data transferring to the RA4M2 MCU, the AFBR-S50 also has an interrupt line through which the MCU can register the data-ready event. Also, such conditions and other interrupts can be visually represented using the yellow LED indicator marked with STATUS. The RA4M2 interfaces with a host MCU through UART communication via commonly used RX and TX mikorBUS™ pins.

Since the AFBR-S50 is known to be used in both robotics and drones, it is essential to note that this ToF sensor is compatible with Pixhawk®, a popular general-purpose flight controller, accessible via two 4-pin CAN connectors, J1 and J2, and controllable through onboard CAN controller, the MCP2542WFD from Microchip. Also, there is a clear visual indication of the execution of the communication itself; more precisely, the user can catch the operation of CAN communication/signal transfer via orange LED indicators provided for indication of received and transmitted CAN signals.

In addition, this board also offers complete debugging and programming capabilities supported through an additional header marked with J3. With this header, the user can use a Serial Wire Debug interface for programming and debugging, available through the SWD interface pins. Besides, it also has a Micro B USB connector, allowing the board to be powered and configured by a personal computer (PC). This way, it is possible to flash the AFBR-S50 ToF sensor via bootloader simply.

NOTE: Unlike the BDC-AFBR-S50 TOF Sensor board, which works with the corresponding code that supports USB and CAN communication, this Click board™ comes with a code version that supports USB and UART communication as default, while CAN communication is left as an option for the user. Thanks to the mentioned bootloader, the user can upgrade/degrade the example code and use the code version of the BDC-AFBR-S50 TOF Sensor board on the Click board™.

This Click board™ uses both mikroBUS™ power rails, 3.3V, and 5V. 5V is necessary to power the ToF sensor, while all unnecessary communication and data transfer is done using 3.3V logic. Thanks to the onboard LDO regulator, the SPX3819, even in the standalone CAN configuration, both voltages are provided: 5V through the CAN connector, while the regulator creates a voltage of 3.3V essential for the proper operation of the MCU. Also, this Click board™ comes equipped with a library containing easy-to-use functions and an example code that can be used as a reference for further development.

AFBR-Explorer GUI

Procedure:

- Download the AFBR-Explorer (AFBR.S50.SDK.vx.x.x-basic.msi) from the Broadcom homepage under https://docs.broadcom.com/docs/12398582 or from the Broadcom

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GitHub repository under https://github.com/Broadcom/AFBR-S50-API/releases (latest)
- Connect the LightRanger 7 Click via the USB cable with your PC/Laptop
- Start the AFBR-S50 Explorer and your measurements right away

For further information on the Explorer check out the Getting Started Guide.

Specifications

Type	Optical
Applications	Can be used for robotics and industrial applications requiring precise 3D information and an extended range like drones or AMR/AGV, human machine interface, automation and control, and more
On-board modules	AFBR-S50 - Time-of-Flight sensor module for distance and motion measurement from Broadcom
Key Features	High speed and accuracy at medium distance ranges with low power consumption, best-in-class ambient light suppression, multipixel for 3D motion detection, Laser Class 1 eye safe ready, compatible with Pixhawk® general-purpose flight controller, various communication interfaces, full debugging and programming capabilities, and more
Interface	CAN,SWD,UART,USB
ClickID	Yes
Compatibility	mikroBUS™
Click board size	L (57.15 x 25.4 mm)
Input Voltage	3.3V,5V,5V (via USB)

Pinout diagram

This table shows how the pinout on LightRanger 7 Click corresponds to the pinout on the mikroBUS™ socket (the latter shown in the two middle columns).

Notes	Pin	mikroBUS				Pin	Notes
	NC	1	AN	PWM	16	NC	
Reset	**RST**	2	RST	INT	15	NC	
ID COMM	**CS**	3	CS	RX	14	**TX**	UART TX
	NC	4	SCK	TX	13	**RX**	UART RX
	NC	5	MISO	SCL	12	NC	
	NC	6	MOSI	SDA	11	NC	
Power Supply	**3.3V**	7	3.3V	5V	10	**5V**	Power Supply
Ground	**GND**	8	GND	GND	9	**GND**	Ground

Onboard settings and indicators

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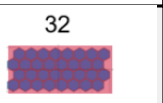
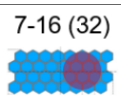
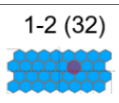
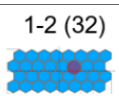
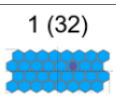
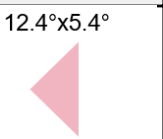
Label	Name	Default	Description
LD1	PWR	-	Power LED Indicator
LD2	CAN TX	-	CAN Transmitted Signal LED Indicator
LD3	CAN RX	-	CAN Received Signal LED Indicator
LD4	STATUS	-	Status LED Indicator
L1-L2	CAN	Populated	Standardized Pixhawk® CAN Connectors
J3	J3	Populated	SWD Interface Debug Connector

Lightranger 7 click sensor options

					
TOF Sensor:	S50MV85I	S50MV85G	S50LV85D	S50LX85D	S50MV68B
MIKROE PID	MIKROE-5824	MIKROE-5680	MIKROE-5841	MIKROE-5877	MIKROE-5840
Typ. Range	5 m	10 m	30 m	50 m	10 m
Range white @1klx	12 m	36 m	61 m	78 m	36 m
Range white @10klx	4 m	12 m	20 m	30 m	15 m (50klx)
Laser Light Source	850 nm (IR)	850 nm (IR)	850 nm (IR)	850 nm (IR)	680 nm (red)
Illuminated Pixels					
Usable Sensor FoV					
Beam spot size 1m	23cm x 10cm	7 m	3.5 m	3.5 m	0.7 m

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TOF Sensor:	S50MV85I	S50MV85G	S50LV85D	S50LX85D	S50MV68B
Typ. Application	AMR/AGV, Factory Automation	Factory Automation, Fill Level	UAV, factory automation, Fill Level	UAV	Factory Automation

AFBR-S50MV85I ToF Sensor electrical specifications

Description	Min	Typ	Max	Unit
External Power Supply Voltage	3.3	-	5	V
Measurement Range	10	3.000	6.000	mm
Emission Wavelength	-	850	-	nm
Ambient Light Illuminance Suppression	-	100	200	klx
Accuracy	-	±1.5	-	%
Distance Resolution	-	0.1	-	mm
Precision	0.5	5	-	mm

AFBR-S50LV85D ToF Sensor electrical specifications

Description	Min	Typ	Max	Unit
External Power Supply Voltage	3.3	-	5	V
Measurement Range	10	-	6.000	mm
Emission Wavelength	-	850	-	nm
Ambient Light Illuminance Suppression	-	100	200	klx
Accuracy	-	±1.5	-	%
Distance Resolution	-	0.1	-	mm
Precision	0.5	5	-	mm

AFBR-S50MV68B ToF Sensor electrical specifications

Description	Min	Typ	Max	Unit
External Power Supply Voltage	3.3	-	5	V
Measurement Range	10	-	10.000	mm
Emission Wavelength	-	680	-	nm
Ambient Light Illuminance Suppression	-	50	100	klx
Accuracy	-	±1.5	-	%
Distance Resolution	-	0.1	-	mm
Precision	0.5	10	-	mm

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AFBR-S50MV85G ToF Sensor electrical specifications

Description	Min	Typ	Max	Unit
External Power Supply Voltage	3.3	-	5	V
Measurement Range	10	-	10.000	mm
Emission Wavelength	-	850	-	nm
Ambient Light Illuminance Suppression	-	100	200	klx
Accuracy	-	±1.5	-	%
Distance Resolution	-	0.1	-	mm
Precision	0.5	10	-	mm

AFBR-S50LX85D ToF Sensor electrical specifications

Description	Min	Typ	Max	Unit
External Power Supply Voltage	3.3	-	5	V
Measurement Range	50	-	50.000	mm
Emission Wavelength	-	850	-	nm
Ambient Light Illuminance Suppression	-	100	200	klx
Accuracy	-	±2	-	%
Distance Resolution	-	0.1	-	mm
Precision	0.5	10	-	mm

Software Support

We provide a library for the LightRanger 7 Click as well as a demo application (example), developed using MIKROE compilers. The demo can run on all the main MIKROE development boards.

Package can be downloaded/installed directly from NECTO Studio Package Manager(recommended way), downloaded from our LibStock™ or found on Mikroe github account.

Library Description

This library contains API for LightRanger 7 Click driver.

Key functions

- lightranger7_reset_device This function resets the device by toggling the rst pin state.
- lightranger7_generic_write This function writes a desired number of data bytes by using UART serial interface.
- lightranger7_generic_read This function reads a desired number of data bytes by using UART serial interface.

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Example Description

This example demonstrates the use of LightRanger 7 click board by processing the incoming data and displaying them on the USB UART.

The full application code, and ready to use projects can be installed directly from NECTO Studio Package Manager(recommended way), downloaded from our LibStock™ or found on Mikroe github account.

Other Mikroe Libraries used in the example:

- MikroSDK.Board
- MikroSDK.Log
- Click.LightRanger7

Additional notes and informations

Depending on the development board you are using, you may need USB UART click, USB UART 2 Click or RS232 Click to connect to your PC, for development systems with no UART to USB interface available on the board. UART terminal is available in all MIKROE compilers.

mikroSDK

This Click board™ is supported with mikroSDK - MIKROE Software Development Kit. To ensure proper operation of mikroSDK compliant Click board™ demo applications, mikroSDK should be downloaded from the LibStock and installed for the compiler you are using.

For more information about mikroSDK, visit the official page.

Resources

mikroBUS™

mikroSDK

Click board™ Catalog

Click boards™

ClickID

Downloads

LightRanger 7 click example on Libstock

AFBR-S50MV85I datasheet

AFBR-S50MV85G datasheet

AFBR-S50LV85D datasheet

AFBR-S50MV68B datasheet

LightRanger 7 click 2D and 3D files

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LightRanger 7 Click schematic

RA4M2 MCU datasheet

AFBR-S50LX85D datasheet

How to flash the reference design via bootloader

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