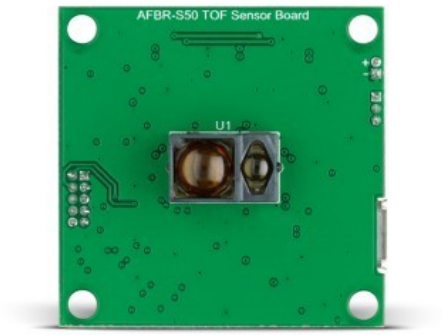
MIKROELEKTRONIKA D.O.O, Batajnički drum 23, 11000 Belgrade, Serbia
VAT: SR105917343 Registration No. 20490918
Phone: + 381 11 78 57 600 Fax: + 381 11 63 09 644 E-mail: office@mikroe.com
www.mikroe.com

BDC-AFBR-S50 TOF Sensor Board



PID: MIKROE-4910

AFBR-S50 ToF Sensor Board represents an integrated solution based on the Broadcom AFBR-S50 medium-range 3D multipixel Time-of-Flight (ToF) sensor for distance and motion measurement. The AFBR-S50 has been optimized to measure various distances working equally well on white, black, colored, and metallic reflective surfaces. It provides an ideal solution for robotics and industrial applications requiring precise 3D information and an extended range like drones or AMR/AGV. The AFBR-S50 ToF Sensor Board includes a 32-bit MCU and a VCSEL-based ToF sensor (Laser Class 1 eye safety), mounted on a compact-sized PCB, measuring only 35mm×35mm in size, alongside a 4-pin standard CAN connections compatible with Pixhawk®, a popular general-purpose flight controller. The size of the entire PCB allows users to realize an easy-to-implement subsystem and be used as a complete ToF module in an out-of-the-box manner, cutting the time to market.

How does it work?

AFBR-S50 ToF Sensor Board as its foundation uses 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 ambient light suppression, use in outside environments is possible in direct sunlight and also 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.

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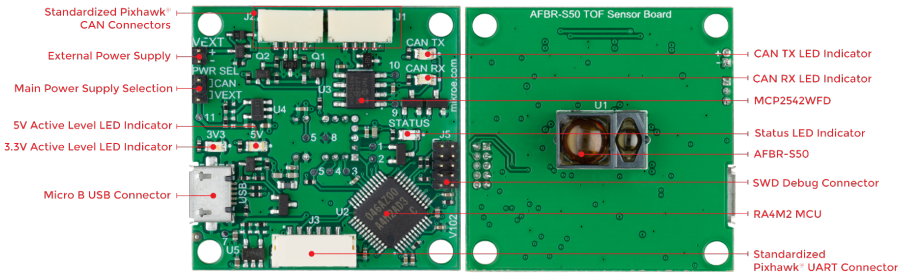

This board represents an integrated solution consisting of a 32-bit MCU, RA4M2 group of Renesas MCU with Arm® Cortex®-M33 core, and a ToF sensor with an integrated infrared laser light source (850nm) mounted on a compact-sized PCB that measures 35mm×35mm. In addition to an SPI-compatible interface for data transferring to the 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.

As mentioned before, this board has two 4-pin CAN connectors, J1 and J2, controllable through onboard CAN controller MCP2542WFD, which allows the connection of additional external sensors in the company with one standard 2.54mm 6-pin male connector labeled as J3, exposing the UART interface. 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. 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.

It offers complete debugging and programming capabilities supported through an additional header marked with J5. 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 Board via bootloader very simply. You can complete the programming procedure following the easy steps described in the attached Flash Start Guide document.

The ToF sensor requires a single power supply of 5V. For this reason, the user can choose how to power the board itself and the ToF sensor. The first way is to connect an external power supply to the connector marked with VEXT in the range of 2.5 to 16V, while the second is a level of 5V obtained from active CAN connectors (channels). The desired power supply can be selected by populating the preferred option on the PWR SEL header.

Bearing in mind that for communication with the MCU, the AFBR-S50 requires a level of 3.3V, there are two LDO regulators on the board, the SPX3819. One of them is used for the realization of 5V, necessary for the AFBR-S50 main power supply from an external power supply, while the other regulator serves to create a voltage of 3.3V essential for the proper operation of the MCU. Also, for the active voltage levels, 5V and 3.3V, green and blue LED indicators visually show such existence.

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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 GitHub repository under https://github.com/Broadcom/AFBR-S50-API/releases (latest)
- Connect the MIKROE-4910 board 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 as an easy-to-implement subsystem and a complete ToF module in an out-of-the-box manner ideal 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
Programming	Bootloader, External
Supply Voltage	USB,External

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Onboard settings and indicators

Label	Name	Default	Description
LD1	5V	-	5V Active Level LED Indicator
LD2	3V3	-	3V3 Active Level LED Indicator
LD3	STATUS	-	Status LED Indicator
LD4	CAN TX	-	CAN Transmitted Signal LED Indicator
LD5	CAN RX	-	CAN Received Signal LED Indicator
J1-J2	J1-J2	Populated	Standardized Pixhawk® CAN Connectors
J3	J3	Populated	Standardized Pixhawk® UART Connector
J4	PWR SEL	Lower	External Power Supply Selection CAN/VEXT: Upper position CAN, Lower position VEXT
J5	J5	Populated	SWD Interface Debug Connector
J6	VEXT	Populated	External Power Supply Connector
TP1-TP11	1-11	-	Testpoints

BDC-AFBR-S50 TOF sensor options

					
TOF Sensor:	S50MV85I	S50MV85G	S50LV85D	S50LX85D	S50MV68B
MIKROE PID	MIKROE-5631	MIKROE-5630	MIKROE-4910	MIKROE-5628	MIKROE-5629
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)
	850 nm (IR)	850 nm (IR)	850 nm (IR)	850 nm (IR)	680 nm (red)

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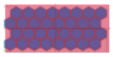
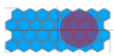
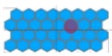
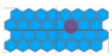
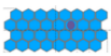
TOF Sensor:	S50MV85I	S50MV85G	S50LV85D	S50LX85D	S50MV68B
Light Source					
Illuminated Pixels	32 	7-16 (32) 	1-2 (32) 	1-2 (32) 	1 (32) 
Usable Sensor FoV	12.4°x5.4°	4°x4°	2°x2°	2°x2°	0.4°x0.4°
Beam spot size 1m	23cm x 10cm	7 m	3.5 m	3.5 m	0.7 m
Typ. Application	AMR/AGV, Factory Automation	Factory Automation, 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	2.5	-	16	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	2.5	-	16	V
Measurement Range	10	-	30.000	mm
Emission Wavelength	-	850	-	nm
Ambient Light Illuminance Suppression	-	100	200	klx
Accuracy	-	±1	-	%
Distance Resolution	-	0.1	-	mm
Precision	0.5	10	-	mm

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AFBR-S50MV68B ToF Sensor electrical specifications

Description	Min	Typ	Max	Unit
External Power Supply Voltage	2.5	-	16	V
Measurement Range	10	-	10.000	mm
Emission Wavelength	-	680	-	nm
Ambient Light Illuminance Suppression	-	50	100	klx
Accuracy	-	±1	-	%
Distance Resolution	-	0.1	-	mm
Precision	0.5	10	-	mm

BDC-AFBR-S50LX85D ToF Sensor electrical specifications

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

BDC-AFBR-S50MV85G ToF Sensor electrical specifications

Description	Min	Typ	Max	Unit
Supply Voltage	3.3	-	5	V
Measurement Range	10	-	10.000	mm
Emission Wavelength	-	850	-	nm
Ambient Light Illuminance Suppression	-	100	200	klx
Relative Distance Accuracy	-	±1	-	%
Distance Resolution	-	0.1	-	mm
Precision	0.5	10	-	mm

Recommended interface connectors and cables

- 4-wire (CAN) male - connector (GHR-04V-S)
- 6-wire (UART) male - connector (GHR-06V-S)
- Customized cables

Resources

Reference Board Page

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Applications Overview

CAN Application Page

Getting Started

GitHub Repo

Latest Release

Downloads

MCP2542WFD datasheet

RA4M2 MCU datasheet

BDC-AFBR-S50 TOF Sensor 2D and 3D files

AFBR-S50LV85D datasheet

How to flash the reference design via bootloader

AFBR-S50MV85I datasheet

AFBR-S50MV68B datasheet

AFBR-S50LX85D datasheet

AFBR-S50MV85G-DS107 datasheet