Manuals+ — User Manuals Simplified.

BOSCH Board 3.0 Sensortec Sensor Prototyping Platform User Guide

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BOSCH Board 3.0 Sensortec Sensor Prototyping Platform
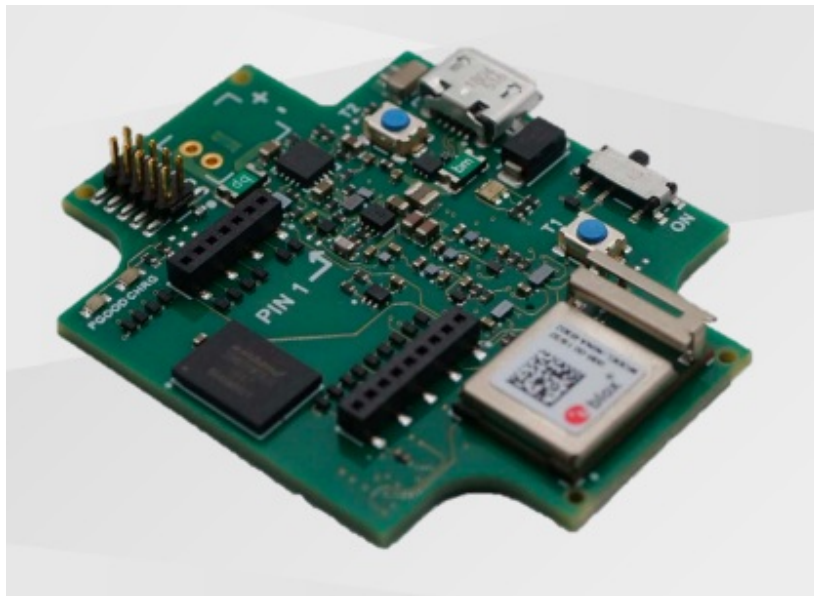
Abbreviations

- **ESD :** Electrostatic Discharge
- **FCC :** Federal Communications Commission USB 2.0 : Universal Serial Bus 2.0
- **LED :** Light Emitting Diode
- **Li-ion :** Lithium-Ion
- **KB :** Kilobyte
- **MB :** Megabyte
- **Gb :** Gigabit
- **BLE :** Bluetooth Low Energy
- **MTP :** Media Transfer Protocol
- **RGB LED :** Red Green Blue Light Emitting Diode

About this document

This document describes the operating procedures of the Application Board 3.0 and additional details about the board itself. To ensure that the Application Board 3.0 is working correctly, follow these instructions carefully before using it.

Definition of special notices

Warning: Indicates a hazard that could lead to minor or moderate injuries. Always follow these instructions.
Note: Points of emphasis and reminders of operational peculiarities for the device that could affect performance. Always follow these instructions.

Definition of general notices

INFO: General information and instructions that must be followed

TIP: Practical advices

Safety and environment

Electrostatic Discharge Caution: ESD (electrostatic discharge) sensitive device. Improper handling may damage the Application Board 3.0 resulting in total or intermittent failures. Use the Application Board 3.0 only in an ESD protected environment and follow ESD-prevention procedures. To prevent ESD damage use an ESD wrist or ankle strap connected to an unpainted metal surface.

Radio frequency radiation exposure and further information

The radiated output power of the device is far below the FCC radio frequency exposure limits. Nevertheless, the device should be used in such a manner that the potential for human contact during normal operation is minimized.

Disposal

Disposing of this product correctly will help save valuable resources and prevent any potential negative effects on human health and the environment, which could otherwise arise from inappropriate waste handling.
Please contact your local authority for further details of your nearest designated collection point.
Penalties may be applicable for incorrect disposal of this waste, in accordance with your national legislation.

Introduction and intended use

The Application Board 3.0 is a versatile and sensor independent development platform, enabling a fast and easy experience with Bosch Sensor Tec's sensors. A wide variety of Bosch Sensor Tec's sensors can be connected to the platform as Shuttle Board 3.0s. The combination of the Application Board 3.0 and Shuttle Board 3.0 can be used to evaluate the sensors and make prototypes to test use-cases.

Intended use

The Application Board 3.0 operates according to the information provided in this document. Validation and testing of any use or operation, which requires specific requirements and standards, which are not already explicitly mentioned in this document, is under the responsibility of the user.

Warning: For professional use only. The Application Board 3.0 shall be used by trained personnel only. Improper operation or handling may cause damage to the user or the device itself.

Scope of delivery

- Application Board 3.0
- Supporting documentation material (User Guide)

Note: Shuttle Board 3.0s are sold separately
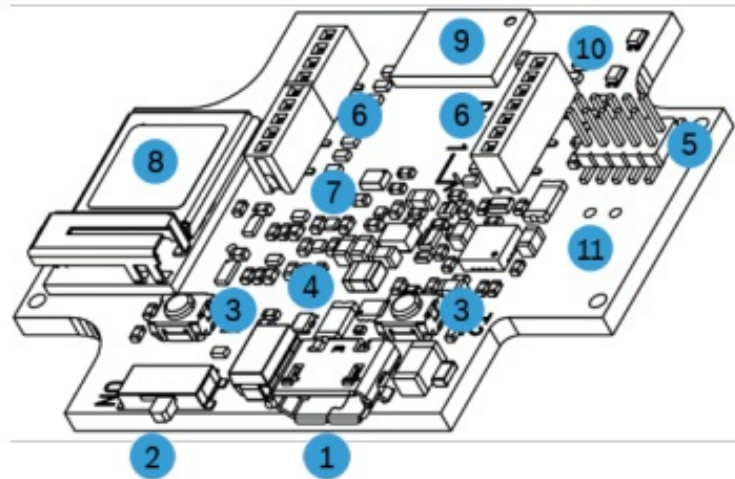
Application Board 3.0

Overview

4.1 Overview

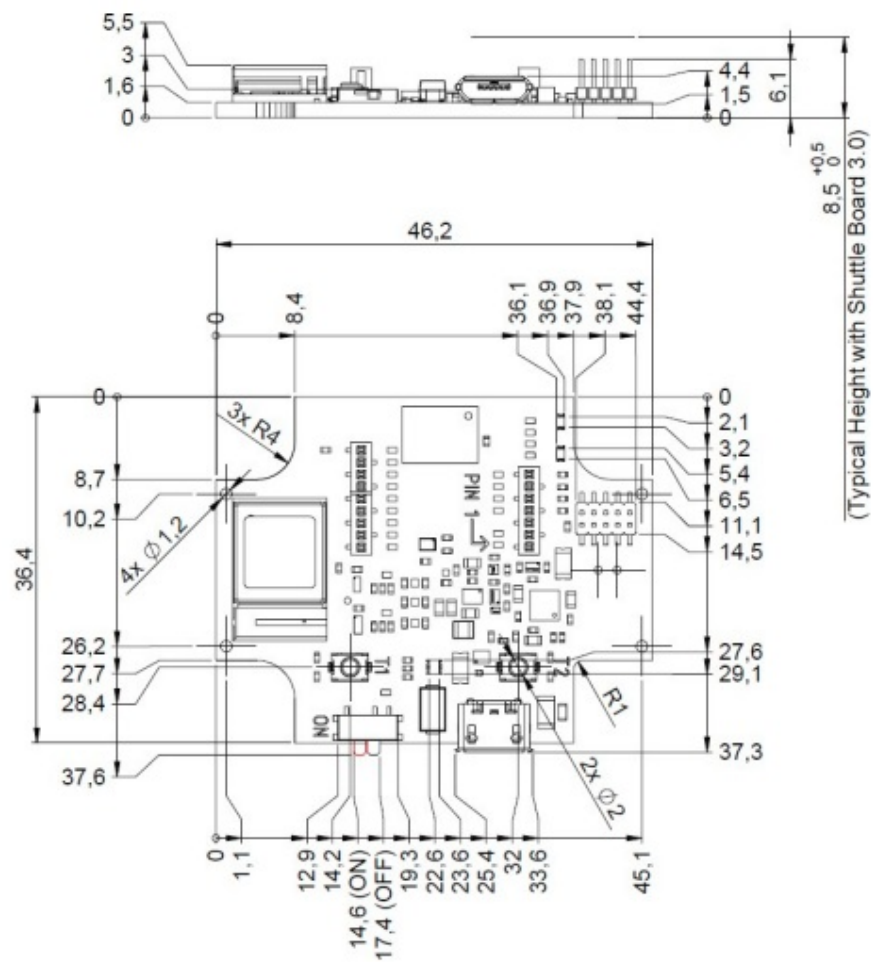Figure 1 Application Board 3.0 Overview

4.2 Dimensions

Figure 2 Application Board 3.0 dimensions

Device specification

Attribute	Nominal Values
Dimensions	Length 37 mm x Width 47 mm x Height 7 mm
Supply voltage	5V DC USB, 3.7V Li-ion Battery
Memory capacity (user data memory)	256 KB RAM, 1MB internal flash, 2Gb external flash
Communication	BLE 5.0 / USB 2.0
Bluetooth Low energy frequency band	2.4GHz, 40 channels
Typical conducted output power	+0 dBm
Radiated output power (EIRP)	+2 dBm

Operating conditions

Attribute	Value
Operating temperature range	25 degree Celsius
Storage temperature range	25 degree Celsius
Storage humidity range	JEDEC MSL 1

Block Diagram

The following shows a simplified block diagram of the Application Board 3.0.
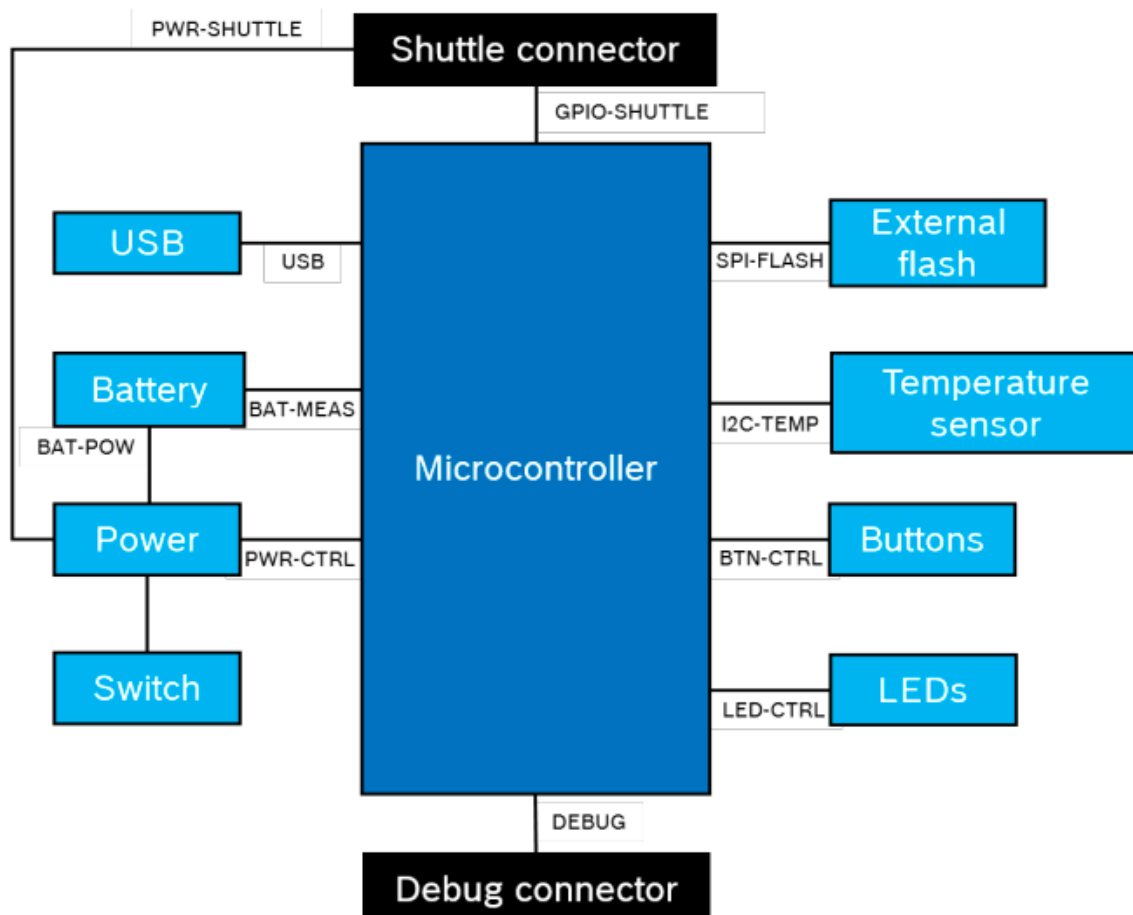
Module descriptions

Main switch
The switch controls the connection between the power source (battery or USB) and the power regulation domains.

Programmable push buttons
Two programmable push buttons are connected to Ground individually through a 360ohm resistor. It is expected that the internal pull-ups of the microcontroller pins connected to the buttons are enabled to use the button with a falling- edge active-low configuration. The buttons are named BTN-T1 and BTN-T2.

Debugger connector
This connector helps with recovery of a board with a corrupted nRF52840 while loading custom applications or similar. Debugging is possible with the connection of a Serial-Wire-Debug interface connector.
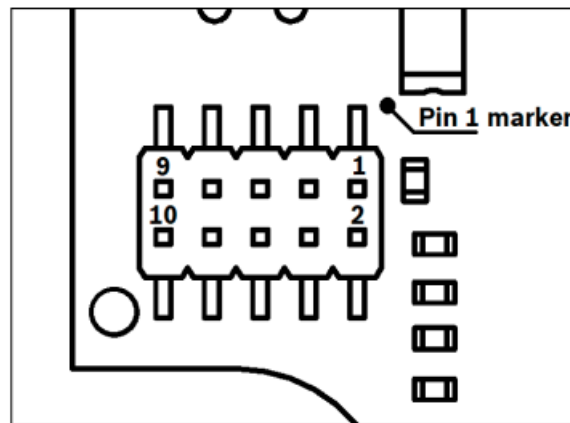

Figure 4 Debugger connector

An ARM Cortex-M4 compatible debugger can be connected using the standard ARM Cortex 10-pin, 2 row, 1.27mm pitch connector.

Pin index	Name	Description	Pin index	Name	Description
1	Vcc/Vref	Set to 1.8V when the main switch is set to ON	2	SWDIO	Data I/O pin
3	Gnd	Ground	4	SWDCLK	Clock pin
5	Gnd	Ground	6	SWO	Trace output pin
7	Key	Not connected	8	NC	Not connected
9	Gnd Detect	Ground	10	nRESET	Active low hardware Reset

Shuttle Board 3.0 connector
The Shuttle Board 3.0 connector allows for the connection of a Shuttle Board 3.0 to be able to prototype one or more sensors (depending on the Shuttle Board 3.0). Details of the Shuttle Board 3.0 connector can be found under 5.

Temperature sensor

A digital temperature sensor, the Texas Instruments TMP112 is used to be able to measure the temperature of the board. The sensor can be accessed with the I2C-TEMP bus. Details on how to operate the sensor can be found in the datasheet.

Microcontroller

The Application Board 3.0 uses the uBlox NINA-B302 Bluetooth low energy module based on the nRF52840 chipset from Nordic Semiconductor. The nRF52840 among other features supports USB2.0 and Bluetooth Low Energy 5.0 Details about the module and the chipset can be found in the NINA-B302 datasheet and nRF52840 product specification respectively.

External flash

A Winbond W25M02GW 2Gbit NAND Flash is connected to the Microcontroller using SPI. The external flash is used primarily for storing files, particularly sensor data log files. The files can be accessed from a host by switching the device to the pre-loaded MTP firmware mode and connecting via USB.

Status LEDs

The microcontroller controls the RGB LED. Details on the LED is controlled is found in Table 2 Application Board 3.0 pin description under the LED-CTRL bus.

Power Good and Charging LEDs

The microcontroller does not control these LEDs, however they indicate the status of the board. The Power Good or PGOOD for short indicates that the board is powered over USB. The Charge LED indicates the charge status connected Li-ion battery. If a battery is not present or if the charging is complete, the LED is turned off.

Li-Ion battery connector

The Li-ion battery connector allows for the connection of a Lithium Ion or Lithium Polymer battery. Do not connect any other type of batteries as this could damage the circuitry of the board and lead to an unexpected behavior, and possibly heating or a fire.

Pin descriptions

Bus name	Pin name	NINA-B302 pin	nRF52840 pin	Description
SHUTTLE-GPIO	GPIO0	GPIO_2	P0.14	Shuttle pin 4
	GPIO1	GPIO_1	P0.13	Shuttle pin 5
	GPIO2/INT1	GPIO_35	P1.01	Shuttle pin 6
	GPIO3/INT2	GPIO_34	P1.08	Shuttle pin 7
	CS	GPIO_5	P0.24	Shuttle pin 8
	SCK/SCL	GPIO_4	P0.16	Shuttle pin 9
	SDO	GPIO_3	P0.15	Shuttle pin 10
	SDI/SDA	GPIO_43	P0.06	Shuttle pin 11
	GPIO4/OCSB	GPIO_37	P1.03	Shuttle pin 12
	GPIO5/ASCx	GPIO_36	P1.02	Shuttle pin 13
	GPIO6/OSDO	GPIO_39	P1.11	Shuttle pin 14
	GPIO7/ASDx	GPIO_38	P1.10	Shuttle pin 15
	PROM-RW	GPIO_27	P0.05	Shuttle pin 16, 470ohm pull-up resistor
SPI-FLASH	SPI-FLASH-MISO	GPIO_48	P0.21	
	SPI-FLASH-MOSI	GPIO_50	P0.20	
	SPI-FLASH-SCK	GPIO_52	P0.19	
	SPI-FLASH-CS	GPIO_51	P0.17	
	SPI-FLASH-HOLD	GPIO_47	P0.23	
	SPI-FLASH-WP	GPIO_49	P0.22	
I2C-TEMP	I2C-TEMP-SDA	GPIO_23	P0.29	4.7kohm pull-up
	I2C-TEMP-SCL	GPIO_42	P0.26	4.7kohm pull-up

BTN-CTRL	BTN-T1	GPIO_33	P1.09	Active low. When activated, connected to ground through a 360ohm resistor
	BTN-T2	GPIO_7	P0.25	Active low. When activated, connected to ground through a 360ohm resistor
LED-CTRL	LED-RED	GPIO_45	P0.07	Active low. Connected to 2.8V through a 100ohm resistor
	LED-BLUE	GPIO_46	P0.12	Active low. Connected to 2.8V through a 33ohm resistor
	LED-GREEN	GPIO_32	P0.11	Active low. Connected to 2.8V through a 10ohm resistor
PWR-CTRL	VDD-SEL	GPIO_44	P0.27	When low, 1.8V is routed to Vdd and 2.8V when high
	VDD-EN	GPIO_16	P0.03	Routes selected Vdd voltage to the Shuttle's Vdd pin when high and routes Ground when low
	VDDIO-EN	GPIO_17	P0.28	Routes 1.8V to the Shuttle's VddIO pin when high and routes Ground when low
BAT-MEAS	VBAT-MON-EN	GPIO_18	P0.02	Active low. When activated, connects the Li-ion anode to the voltage divider
	VBAT-MON	GPIO_20	P0.31	Output of the voltage divider. 3V is read as 1.125V and 4.2V as 1.575V. R1 is 300kohm and R2 is 180kohm

Shuttle Board 3.0

Dimensions

The following figure describes the typical dimensions of the Shuttle Board 3.0 for standard shuttles.
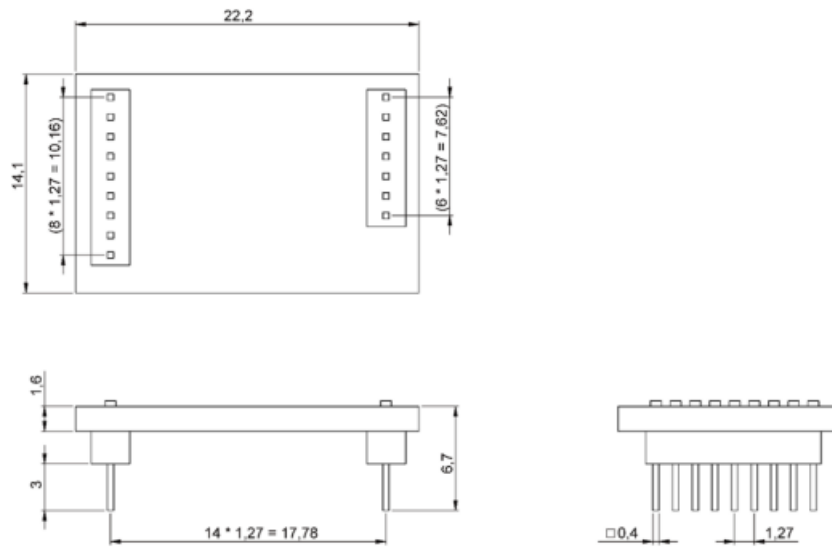
Figure 5 Standard Shuttle Board 3.0 dimensions
The following figure describes the typical dimensions of the Shuttle Board 3.0 for multi-sensor shuttles.
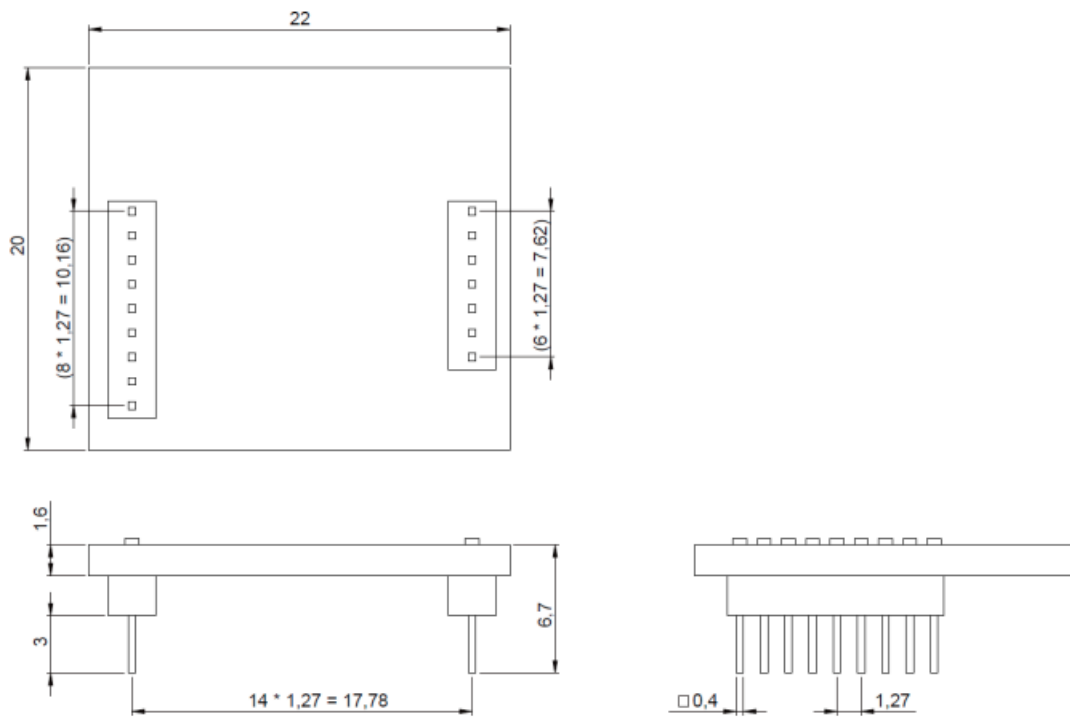

Figure 6 Multi-sensor Shuttle Board 3.0 dimensions

Pin descriptions

Shuttle Row 1 pin index	Function	Shuttle Row 2 pin index	Function
(1) Vdd	Powers the sensor. When enabled by VDD-EN it is either 2.8V or 1.8V depending on VDD-SEL.	(1) CS	Typically used as the Chip Select for the SPI bus.
(2) VddIO	Provide reference IO voltage to some sensors and a power domain to other. When VDDIO-EN is enabled, the pin is connected to 1.8V.	(2) SCK/SCL	Typically used as the Clock for the SPI or I2C buses.
(3) Gnd	Ground	(3) SDO	Typically used as the Data-out line of the sensor.
(4) GPIO0	Assigned depending on Shuttle design.	(4) SDI/SDA	Typically used as the Data-in line of the sensor.
(5) GPIO1	Assigned depending on Shuttle design.	(5) GPIO4/OCSB	Assigned depending on Shuttle design. Typically reserved as the Chip Select for the Optical Image Stabilization (OIS) interface.
(6) GPIO2/INT1	Assigned depending on Shuttle design. Typically reserved for Interrupt 1.	(6) GPIO5/ASCx	Assigned depending on Shuttle design. Typically reserved as the Clock for the Optical Image

			Stabilization (OIS) interface or Auxiliary I2C interface.
(7) GPIO3/INT2	Assigned depending on Shuttle design. Typically reserved for Interrupt 2.	(7) GPIO6/OSDO	Assigned depending on Shuttle design. Typically reserved as the sensor Data-out for the Optical Image Stabilization (OIS) interface.
		(8) GPIO7/ASDx	Assigned depending on Shuttle design. Typically reserved as the Data-in for the Optical Image Stabilization (OIS) interface or Data for the Auxiliary I2C interface.
		(9) PROM-RW	This pin is used to connect to the 1-Wire EEPROM to identify the Shuttle Board 3.0 connected.

Software description

Overview

Brief description of the memory layout for the Application Board 3.0

### Nordic Semiconductor's SoftDevice S140

Feature-rich Bluetooth Low Energy protocol stack
160kB reserved space
Key features
Bluetooth 5.0.

USB MTP Firmware

Media Transfer Protocol over USB enables the transfer of files to and from the device removing the need of any additional hardware for data transfer
32kB reserved space

Default Application / User Application

The Default Application enables the use of the board as a USB to SPI/I2C/GPIO bridge with some specialized features for event- based data captures from the sensor. A custom User Application using the COINES SDK can be loaded onto the board for custom tests, prototypes or demos.
768kB reserved space

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00000h
28000h
30000h

F0000h
FFFFFh
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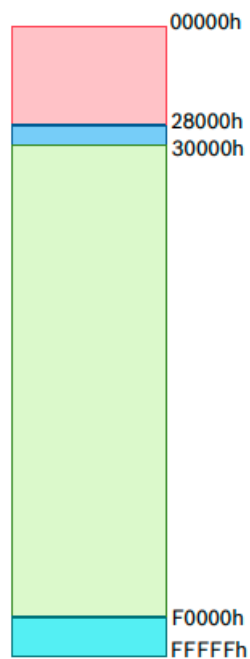
Getting started

Setup overview

It is recommended to use an ESD safe environment to operate the Application Board 3.0 as depicted in the image.
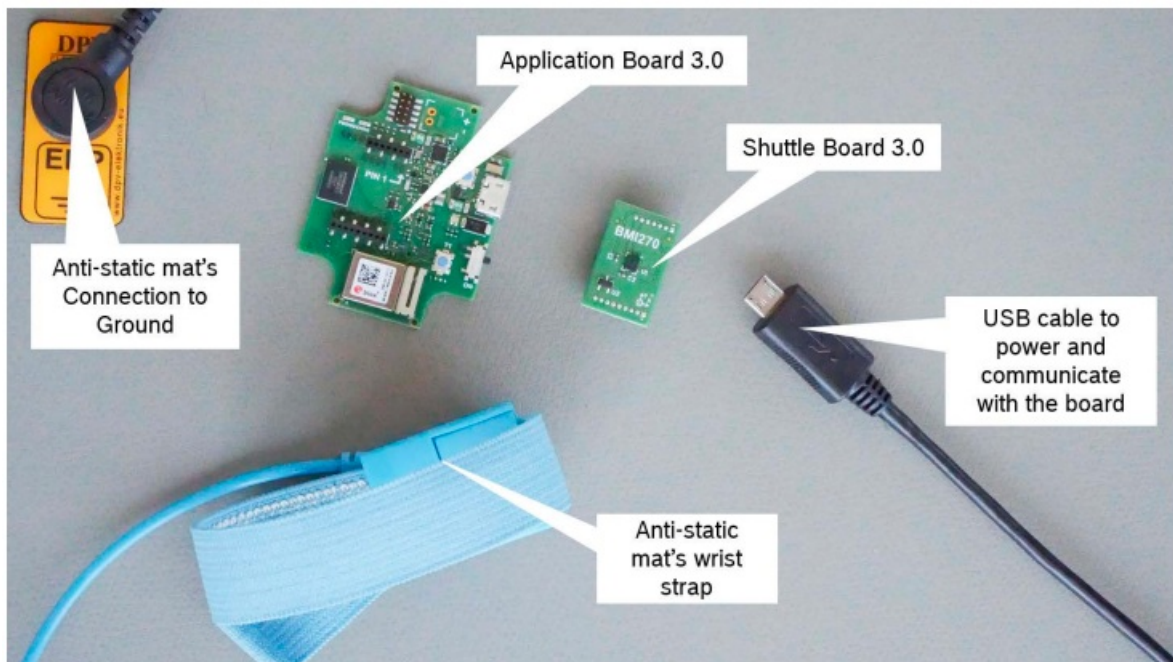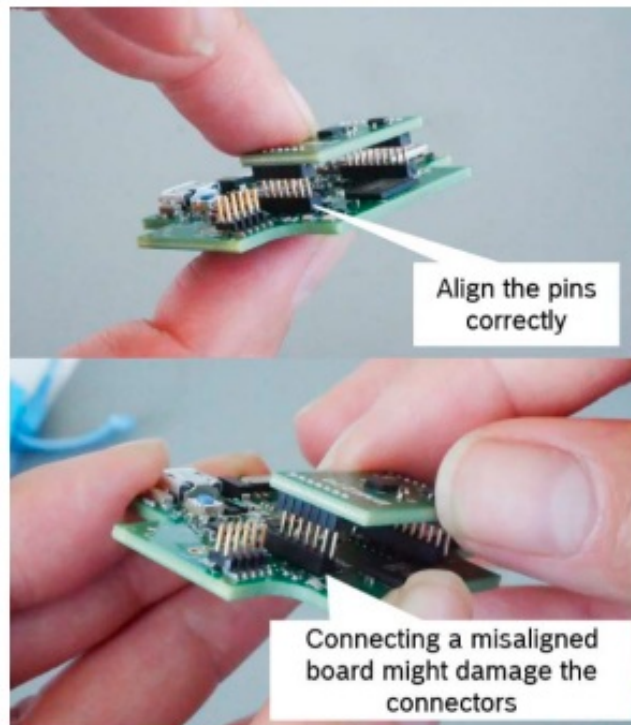

Figure 7 Application Board 3.0 setup

Connecting a Shuttle Board 3.0 board

Make sure that the pins are aligned correctly to avoid damaging the connector or bending the pins.

Once aligned, press down on the board with both thumbs to fit the Shuttle Board 3.0 onto the Application Board 3.0.
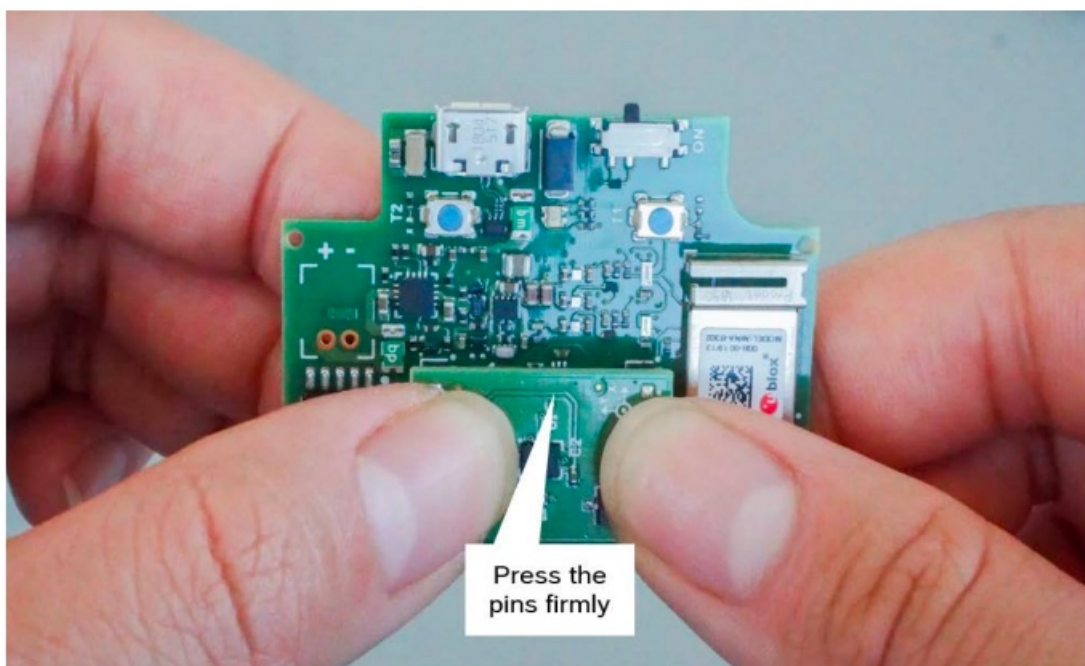

Figure 9 Connecting the Shuttle Board 3.0

Connecting to the Application Board 3.0 using USB

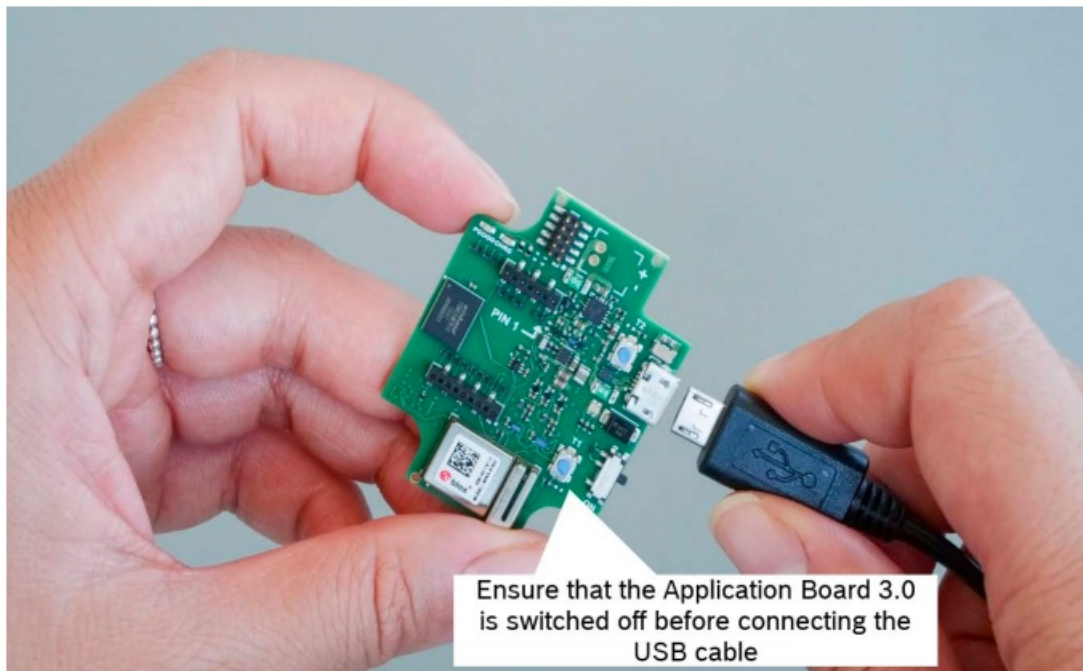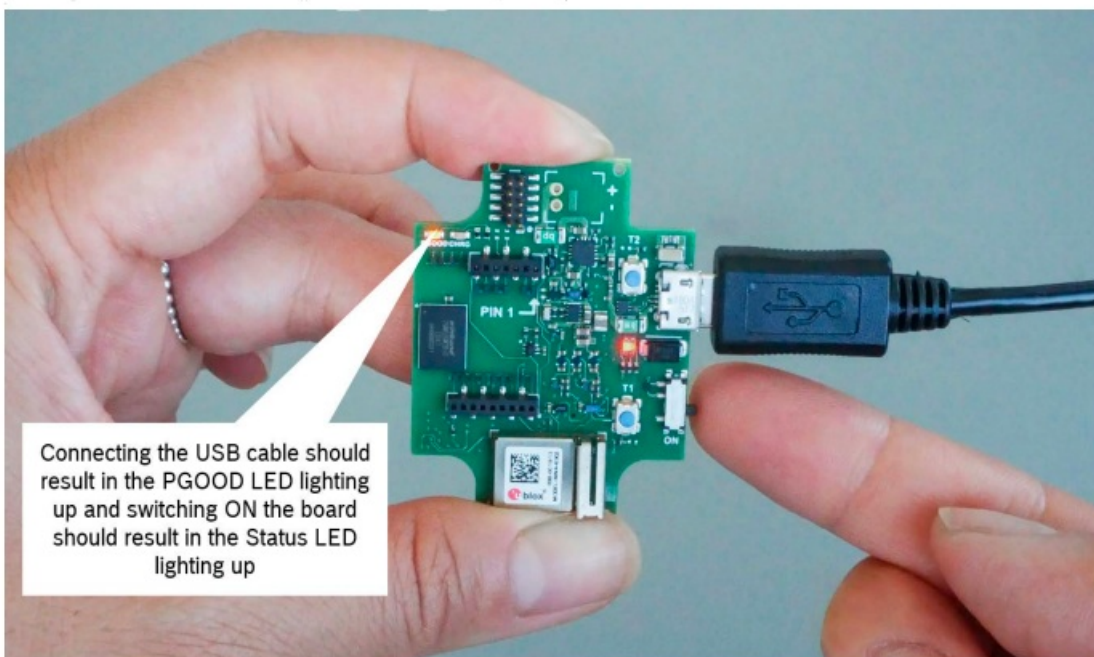Before connecting the USB cable, ensure that board is switched off.

Ensure that the Application Board 3.0 is switched off before connecting the USB cable

Figure 10 Connecting the USB cable

Powering on the Application Board 3.0

To power on the board slide the main switch into the ON position.

Connecting the USB cable should result in the PGOOD LED lighting up and switching ON the board should result in the Status LED lighting up

Removing the Shuttle Board 3.0

Tug the Shuttle Board 3.0 back and forth to remove the Application Board 3.0. Avoid twisting and turning as this may dislodge the connector from the Application Board 3.0.
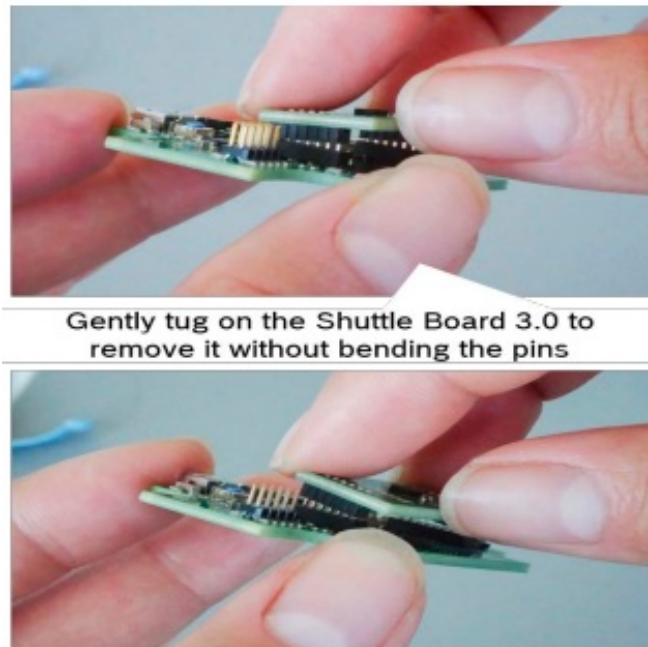
Gently tug on the Shuttle Board 3.0 to remove it without bending the pins

Figure 12 Removing the Shuttle Board 3.0

Maintenance

Warning: Damage to materials can cause risk of fire! Liquid entering the device can cause short circuits and damage the device. This could cause fire, data loss and incorrect measurements.

Further Product Related Information

Please find all product related documents and user guides on our website: **https://www.bosch-sensortec.com/**

Regulatory and legal information about the Application Board 3.0

European Union notices

European Union notices Radio Equipment Directive

Hereby, Bosch Sensortec GmbH declares that the radio equipment type "Application Board 3.0" is in compliance with Directive 2014/53/EU (Radio Equipment Directive). The full text of the EU declaration of conformity is available at the Bosch Sensortec internet address.

RoHS

The Application Board 3.0 meets the requirements of the Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS Directive). The certification for the European Union only applies to Application Board 3.0 devices with the CE printed on the housing. The user shall verify before using the Application Board 3.0 in the European Union.

FCC Statement

FCC has issued an EQUIPMENT AUTHORIZATION to Bosch Sensortec GmbH for Application Board 3.0 according to FCC rule parts 15 C with the FCC ID: 2AO4I-APP30.

Note: Changes or modifications not expressly approved by Bosch Sensortec GmbH could void the FCC certificate and therefore user's authority to operate the equipment."
The radiated output power of the device is far below the FCC radio frequency exposure limits. Nevertheless, the

device shall be used in such a manner that the potential for human contact during normal operation is minimized. The device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. The device may not cause harmful interferences, and
2. This device must accept any interferences received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Use of the Application Board 3.0 is subject to validation and observation of local legal regulation by the customer. For information on other certifications which gradually may be issued over time – please, contact our Application Board 3.0 support at contact**@bosch-sensortec.com**.

Canada: ISED license exemption

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference; and
2. This device must accept any interference, including interference that may cause undesired operation of the device. Additional information:
   CAN ICES-003(B)/NMB-003(B)
   IC:26413-APP30

Bluetooth

The Application Board 3.0 supports Bluetooth 5.0.

Disposal

The unit, accessories and packaging should be sorted for environmental-friendly recycling. Do not dispose of the device into household and industrial waste! According to the European Guideline 2012/19/EU, electric and electronic devices that are no longer usable must be collected separately and disposed of in an environmentally correct manner.

Restrictions of use

The Application Board 3.0 application board is developed for professional use only. It may only be used within the

parameters of this product data sheet. Bosch Sensortec products are not fit for use in life sustaining or security sensitive systems. Security sensitive systems are those for which a malfunction is expected to lead to bodily harm or significant property damage. In addition, they are not fit for use in products which interact with motor vehicle systems.

The resale and/or use of products are at the purchaser's own risk and his own responsibility. The examination of fitness for the intended use is the sole responsibility of the purchaser.

The purchaser shall indemnify Bosch Sensortec from all third-party claims arising from any product use not covered by the parameters of this product data sheet or not approved by Bosch Sensortec and reimburse Bosch Sensortec for all costs in connection with such claims. Bosch Sensortec shall not be held liable for any damages resulting from any use of the Application Board 3.0 outside/beyond the certified types of operation and/or defined field of application.

The purchaser must monitor the market for the purchased products, particularly with regard to product safety, and inform Bosch Sensortec without delay of all security relevant incidents.

Legal disclaimer

1. **Engineering samples**

   Engineering Samples are marked with an asterisk (*), (E) or (e). Samples may vary from the valid technical specifications of the product series contained in this data sheet. They are therefore not intended or fit for resale to third parties or for use in end products. Their sole purpose is internal client testing. The testing of an engineering sample may in no way replace the testing of a product series. Bosch Sensortec assumes no liability for the use of engineering samples. The Purchaser shall indemnify Bosch Sensortec from all claims arising from the use of engineering samples.

2. **Product use**

   Bosch Sensortec products are developed for the consumer goods industry. They may only be used within the parameters of this product data sheet. They are not fit for use in life-sustaining or safety-critical systems. Safety-critical systems are those for which a malfunction is expected to lead to bodily harm, death or severe property damage. In addition, they shall not be used directly or indirectly for military purposes (including but not limited to nuclear, chemical or biological proliferation of weapons or development of missile technology), nuclear power, deep sea or space applications (including but not limited to satellite technology).

   Bosch Sensortec products are released on the basis of the legal and normative requirements relevant to the Bosch Sensortec product for use in the following geographical target market: BE, BG, DK, DE, EE, FI, FR, GR, IE, IT, HR, LV, LT, LU, MT, NL, AT, PL, PT, RO, SE, SK, SI, ES, CZ, HU, CY, US, CN, JP, KR, TW. If you need further information or have further requirements, please contact your local sales contact.

   The resale and/or use of Bosch Sensortec products are at the purchaser's own risk and his own responsibility. The examination of fitness for the intended use is the sole responsibility of the purchaser.

   The purchaser shall indemnify Bosch Sensortec from all third party claims arising from any product use not covered by the parameters of this product data sheet or not approved by Bosch Sensortec and reimburse Bosch Sensortec for all costs in connection with such claims.

   The purchaser accepts the responsibility to monitor the market for the purchased products, particularly with regard to product safety, and to inform Bosch Sensortec without delay of all safety-critical incidents.

3. **Application examples and hints**

   With respect to any examples or hints given herein, any typical values stated herein and/or any information regarding the application of the device, Bosch Sensortec hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights or copyrights of any third party. The information given in this document shall in no event be regarded as a

guarantee of conditions or characteristics. They are provided for illustrative purposes only and no evaluation regarding infringement of intellectual property rights or copyrights or regarding functionality, performance or error has been made.

Document history and modification

Rev. No	Chapter	Description of modification/changes	Date
0.4	–	Initial release	October 2020
1.0	–	Disclaimer update	November 2020
1.0	6	Added Software description	December 2020

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Modifications reserved
Preliminary – specifications subject to change without notice Document number: BST-DHW-AN008-00

Documents / Resources

BOSCH Board 3.0 Sensortec Sensor Prototyping Platform [pdf] User Guide
APP30, 2AO4I-APP30, 2AO4IAPP30, Board 3.0 Sensortec Sensor Prototyping Platform, Board 3.0, Sensortec Sensor Prototyping Platform

References

- ○ **Sensortec AS**
- ⊞ **Bosch MEMS Technology | Bosch Sensortec**
- ⊞ **Bosch MEMS Technology | Bosch Sensortec**

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