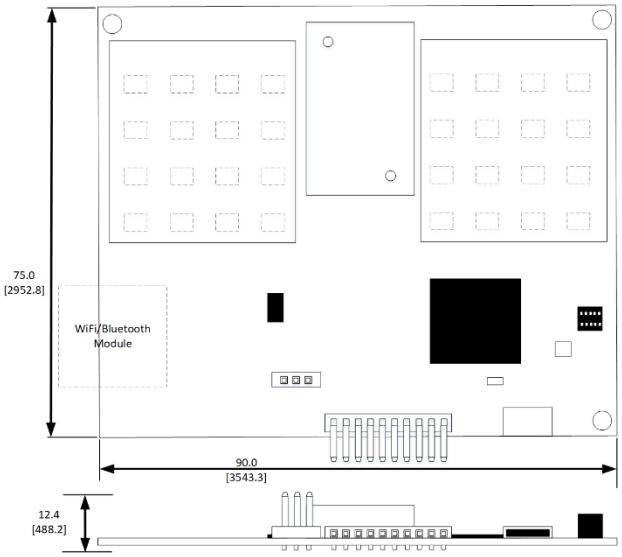
OPS243 Short Range Radar Sensor

Feature Set

- 1-100m (3-328') detection range
- Speed reporting in excess of 222 kph (138mph)
- Speed accurate to within ± 0.5%
- Direction reporting (Inbound/Outbound)
- Range reporting from 1-60m (3-197')
- Narrow 20° (horizontal) or 24° (vertical) beam width (-3 dB)
- Simple API control, no coding required
- WiFi/Bluetooth Wireless interface to Cloud
- FCC/IC modular approval (OPS243-C pending)
- CE certification (OPS243-C pending)
- Wide operating input voltage, 5-24V
- 1.8W Active, 0.8W Idle, and 0.2W Hibernate power
- Wide temperature operating range, -40°C to +85°C
- Small form factor 75 x 90 x 12 mm, 15g



The OPS243 is a small form factor, single board radar sensor capable of detecting objects up to 100m away. The sensor is ideal for applications such as security, traffic monitoring, drone collision avoidance, robotics, and as an IoT sensor. All radar signal processing is embedded in the sensor and a simple API eases system integration. Data is communicated over wired interfaces such as USB, UART, and RS-232. A wireless interface is also available for communication to the cloud and remote sensing. A simple API provides control over the output format of the data (units, digits, etc.). Data reported includes motion detection, speed, direction (inbound/outbound), and range. Speed data is accurate to within ± 1 mph, meeting police radar gun standards. Range information is accurate to within ± 10% of actual distance.

Two versions of the OPS243 are available, a speed reporting Doppler sensor (OPS243-A) or a combined Doppler and FMCW (range reporting) sensor (OPS243-C). The OPS243-C uses additional circuitry with a tighter frequency lock to measure both the speed and range information.

Table 1. OPS243 Sensors

Sensor	Type	Motion	Speed	Direction	Range
OPS243-A	Doppler	●	●	●	
OPS243-C	Doppler & FMCW	●	●	●	●

The detection range of the OPS243 covers a narrow 20° azimuth (horizontal) and 24° altitude (vertical) beam width (measured at -3dB point). Detection range is 10-20 m (82 ft) for a person and 50-100 m (328 ft) for large metal objects such as a vehicle. The API provides control over the transmit power which enables custom control over the detection range. Control over the transmit duty cycle is also provided enabling lower power operation. At full continuous power the module consumes 1.7W and idle power (RF disabled) is 0.8W. Duty cycling can enable active modes with power consumption in between these values. A very low power Hibernate mode can reduce power to an average of 100-300mW.

Connecting an OPS243 to a PC (Windows or Mac), Android phone/tablet, Arduino, Raspberry Pi, or other embedded processor is easily managed. By default, data is sent as a number in ASCII characters. All other messages are provided in JSON format for easy parsing and manipulation (speed or range can also be sent by JSON). The JSON output is compatible with emerging IoT standards and technologies such as Node-RED which is standard on Raspberry Pi distributions. This makes the module ready to plug into hybrid solutions that use multiple sensors and inter-operate with IoT cloud-based solutions.

The WiFi version of the OPS243 allows for directly sending data to the cloud for visualization, storage, or processing. An app (download from **Google Playstore**) is provided to configure the wireless connection, configure the sensor, and see the data.

The sensor comes in a very small form factor of 75 x 90 x 12 mm (96mm for WiFi version). Utilizing the 24GHz millimeter spectrum, the module can easily be placed behind plastic enclosures and still function properly.

Description

Operating Principle

The OPS243 is a simple, short range radar sensor which provides motion detection, speed, direction, and range information. All radar signal processing is handled by the on-board ARM processor. The basic principle of the sensor utilizes the Doppler frequency shift to detect speed and direction and FMCW time of flight (TOF) to detect range.

On power-up, the embedded firmware initializes the sensor for radar signal processing. After initialization is completed, the green LED will start to blink on a 1 second duty cycle. The default operation is set for data streaming over the UART or RS-232 interface (rev D boards allow for selection via API). If the sensor is connected to a USB interface, it will complete the enumeration triggered by the host and data on the UART or RS-232 data will be turned off. The red LED will be lit until the enumeration is complete. If the USB enumeration has not been successful, the red LED will stay lit.

The WiFi version of the OPS243 powers up with the Bluetooth active and looking for a smartphone or tablet to pair with. The app can then be used to connect it to a WiFi network. If it had been connected to an available WiFi network in the past the connection will be made automatically. Once connected to WiFi, the sensor will stream its data to the cloud and to the app for visualization.

When initialization is complete, the firmware will enable the RF device to start generating the appropriate transmit signal. Two modes of controlling the transmit frequency are used. On the OPS243-A, an internal algorithm in the ARM processor is used to sense the VCO frequency and make adjustments to the VCO Control signal. On the OPS243-C, an on board PLL is used to control the VCO frequency.

The ARM processor controls the RF device signal transmission through on-board transmit patch antennas. If an object is detected in the field of view, the transmitted signal will bounce back and be detected by the on-board receive patch antennas. The received signal is mixed with the transmitted signal to down convert to an IF signal which represents either the Doppler frequency of the moving object or a time shift based on the distance to the object. This signal is filtered and provided to the internal A/D converter of the ARM processor. The radar signal processing converts this signal into speed, direction, or range information which is then output over the appropriate interface. If the object is moving towards the module, the red LED will light, and if away, the blue LED. If direction has been turned off via the API, the green LED will light whenever motion is detected.

A simple interrupt can be used to monitor motion detection or object detection. The API provides a means of filtering detected speed, range, and signal magnitude to trigger the interrupt. See the **AN-10 API Interface** for more information.

A watchdog timer is implemented in firmware. The timer is serviced every 1 second. Upon 2 missed services, the third miss will trigger a board reset. The sensor can be queried for the reason for the reset.

A simple API allows control of the sensor and information that it provides. See Application Note **AN-010 API Interface** for full details on using the API. The default settings of the OPS243-A provide speed/direction readings at approximately 5-6 per second. The OPS243-C provides speed and range information at approximately 13-14 reports per second. Faster reporting can be achieved by increasing the sample frequency or reducing the buffer size.

Note the speed reported by the OPS243 is not automatically compensated for the cosine error. See **AN-011 Cosine Error Adjustment** to understand how to correct the speed for the angle to the detected object.

Block Diagram

The block diagram of the OPS243 is show in Figure 1. The key components shown are the RF, IF filtering, ARM processor, and interface for communication.

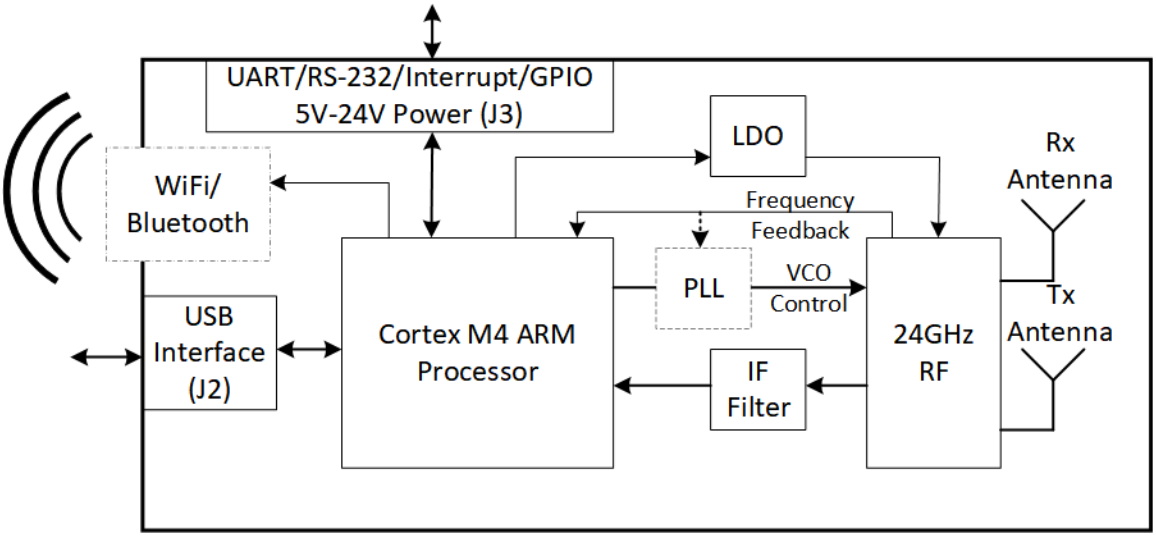


Figure 1. OPS243 Block Diagram

Interface

The OPS243 sensor provides five interfaces, USB, UART, RS-232, WiFi/Bluetooth, simple interrupt, and LEDs. The USB, UART, RS-232, and WiFi interfaces provide detailed information and control of the sensor via the API, while the simple interrupt and LEDs provide a quick check as to how the sensor is functioning or presence of a detected object.

USB

The sensor has a USB 2.0 interface for providing the processed radar information and control over the sensor via the API. A standard micro USB connector is used (J1). The USB interface is also used to power the sensor. An alternate means of providing 5V power to the module is through header J3 which should be used when using UART or RS-232 interfaces.

UART

The sensor provides a 3.3V UART interface over the J3 header. Table 2 lists the pin assignment for the TxD and RxD. The detected speed values stream out over the UART pins upon power-on and can be configured using the same API that is utilized for USB. The default baud rate is 19,200 with options for 9,600 through 115,200. The default configuration is 8-bit, no parity, one stop bit.

RS-232

An RS-232 interface option is available for applications that need the sensor placed far from the embedded processor consuming the data. Distances as far as 15m (50 ft.) between the sensor

and embedded processor and data rates up to 250kbps are supported. The default baud rate is 19,200 with options for 9,600 through 115,200. The default configuration is 8-bit, no parity, one stop bit. The signal levels used are ±5V. Note the position of the RS-232 interface has been changed between the revision C and D board versions. Execute the ?P command to confirm the version of board. In revision D boards, the UART is the default interface and RS-232 can be selected by setting the IS command (Is to set UART). Use the persistent memory command, A!, to save the RS-232 setting if so desired.

Starting with board revision D2, the UART/RS-232 is selected via a jumper placed on header J8. The sensor is shipped from the factory with UART selected per Figure 2. If notified and shipping directly from OmniPresense, sensors can be configured for RS-232 as the default.

Figure 2. Rev D2 Board UART/RS-232 Selection

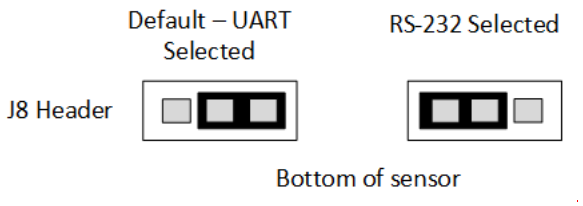


Table 2. J3 Header Pins Revision A, B and C Boards

(all signals 3.3V except for RS-232, Power, and Ground)

Pin	Direction	Pin Name	Pin Description
1	Input/Output	GPIO	General purpose I/O
2	Input/Output	GPIO	General purpose I/O
3	Output	Host Interrupt	Interrupt from OPS243 to system
4	Input	/Reset	System reset of OPS243 (active low)
5	Input	SPI SEL	SPI device select
6	Input	RxD/SPI MOSI	UART or RS-232 receive/SPI input
7	Output	TxD/SPI MISO/SDA	UART or RS-232 transmit/SPI data output/I^2C data
8	Input	SCL/SCK	SPI/I^2C clock
9	-	5-24V*	Power
10	-	Ground	Ground

*Rev C sensors support 24V, earlier revision A and B sensors are limited to 12V. Issue the P? API command to check the sensor version.

Table 3. J3 Header Pins Revision D Boards

(all signals 3.3V except for RS-232, Power, and Ground)

Pin	Direction	Pin Name	Pin Description
1	Input/Output	GPIO	General purpose I/O
2	Input/Output	GPIO	General purpose I/O
3	Output	Host Interrupt	Interrupt from OPS243 to system
4	Input	/Reset	System reset of OPS243 (active low)
5	Input	RS2_RxD	RS-232 RxD (non -WB sensors)
6	Input	UART_RxD	UART RxD (non -WB sensors)
7	Output	UART_TxD	UART TxD (non -WB sensors)
8	Output	RS2_TxD	RS-232 TxD (non -WB sensors)
9	-	5-24V**	Power
10	-	Ground	Ground

*Rev D sensors support 24V, earlier revision A and B sensors are limited to 12V. Issue the P? API command to check the sensor version.

WiFi/Bluetooth

A WiFi/Bluetooth option is available with the OPS243. Data is automatically sent to the WiFi module for communication to a nearby network. An app is available to connect the sensor to the WiFi network. Data is automatically routed to the cloud and available on the app for visualization. See AN-20 IoT Radar Sensor with WiFi Interface for further information. The WiFI interface supports 802.11b/g/n (802.11n 2.4GHz). The Bluetooth interface is compliant with Bluetooth v4.2 BR/EDR and BLE specifications.

Simple Motion Interrupt

A simple interrupt is provided for motion detection. The signal comes out to pin 3 (Host Interrupt) on the J3 header and is 3.3V tolerant. It is enabled by the API command “IG”. The signal is high when no object is detected and low when an object is detected. See **AN-15 Simple Motion Detection Interrupt** for further explanation of the usage of this signal and how to filter speed and magnitude.

Reset

A Reset pin is provided on the J3 header to reset the OPS243 radar sensor. The pin is active low with a required low time of 200ns to be active. After releasing the pin, the processor will start up within 2µs. The code will start to execute and in default mode initial data will be available to start streaming after 300ms.

GPIO

Two general purpose I/O pins are provided on the OPS243. These are used for various functions based on the firmware and API settings (Table 4). Pin 1 is provided to trigger (active Low) whenever the sensor is sampling data. This may allow synchronization with cameras taking pictures or videos. Starting in v1.1.9 OPS243-A code and v1.2.3 OPS243-C code, pin 1 and 2 are used for Alert level triggers. If an Alert setting is set in the API, pin 1 converts from reporting active sampling to a Low speed or range alert (active Low). Pin 2 is used to trigger High speed or range alerts (active Low). See **AN-10 API Interface and AN-23 Alerts and Data Capture Synchronization** application notes for more details about using these pins and its applications.

Table 4. Header J3 GPIO and INT Pin Functions

Pin	Name	No Alert Setting	High or Low Alert Setting
1	P4_0_GPIO	Active Sampling	Low Alert Trigger
2	P4_1_GPIO	N/A	High Alert Trigger

Host Interrupt

A Host Interrupt pin is used by the OPS243 to signal the host system when an object is detected. This signal is turned on with the IG API command. When enabled, anytime valid data that meets the filter settings (speed, direction, range, magnitude) is available, the signal will trigger active Low. See **AN-23 Alerts and Data Capture Synchronization** for more details about using this pin and its applications.

LED

LEDs are provided to give a quick understanding of the module operation. There are four LEDs on the module, red, green, orange, and an RGB LED. The LEDs functions are listed in Table 5. Some variations on the LED operation may be made based on the version of code used. Check the API application note AN-10 for the latest descriptions.

Table 5. LED Functions

LED	Function	Reference	Notes
Green	Heartbeat timer	D2	1 second duty cycle
RGB	Red – Inbound direction Blue – Outbound direction Green – Motion detection	D10	Green only used if direction detection turned off via API

Power

Power is provided either from the USB interface or separate pins on the J3 header if UART or RS-232 is used. If UART or RS-232 is used, pin 9 on header J3 can accept a 5-24V (12V for sensors shipped from OmniPreSense before August 2020) to power the sensor. On-board regulators provide the appropriate power for the sensor operation.

Hibernate Mode

Starting with v1.0.5 for the OPS243-A and v1.1.1 for the OPS243-C, a special low power Hibernate mode has been enabled. In this mode, overall power consumption is reduced by 83% from full active power consumption. This allows use in battery backed applications.

Hibernate mode is only available when using the UART or RS-232 interface. In Hibernate mode, the sensor spends the majority of its time in a very low power state to minimize current consumption. At a set programmable time period, the sensor wakes up, scans for any objects in its field of view, and if nothing is detected goes back down into its low power state. If an object is detected, the sensor will stay awake reporting information until the object is no longer in its field of view. In the default configuration, the sensor hibernates for 1 second. This value is programmable via the API.

Antenna Pattern

The OPS243 antenna designs provides a narrow beam width of 20° (-3 dB point) in the azimuth (horizontal) and 24° (-3 dB point) in altitude (vertical). Minimal signal is transmitted behind the module due to its construction which helps eliminate false detections. The narrow antenna pattern coverage is shown in Figure 3.

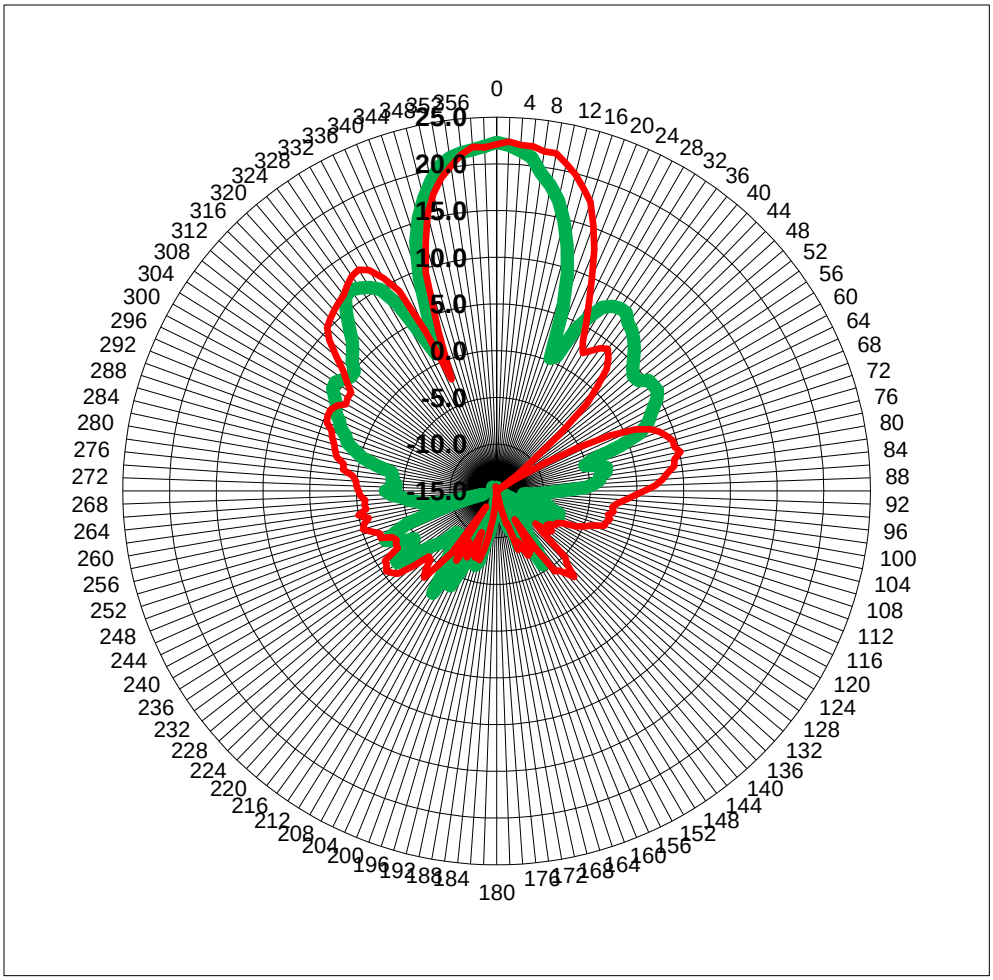


Figure 3. Antenna Pattern

Detection Range

The detection range of the OPS243 is dependent on the object to be detected and its RCS (radar cross section). Generally, the OPS243 will detect human movement up to 10-20m out and a large object (higher RCS value) such as a vehicle at 75-100m for the OPS243-A and 50-60m out for the OPS243-C. As the object moves more to the right or left of the module center, the detection range will decrease.

Electrical Specifications

Absolute Maximum Ratings

T_A = -40 °C to 85 °C with all voltages with respect to ground.

Parameter	Symbol	Min	Typ	Max	Units	Notes
Supply Voltage	V_{dd}	4.75		5.25	V	USB interface, per USB specification
Supply Voltage	V_{dd}	4.75		24.0*	V	Pin 9 on header J3
Power Dissipation	P_{max}			1.8	W	
Operating Temperature	T_a	-40		85	°C	
Storage Temperature	T_{stg}	-40		105	°C	

*Rev C and D sensors. Check the board version with the P? command. Prior sensors are limited to 13.2V max.

Operating Metrics

T_A = -40 °C to 85 °C with all voltages with respect to ground.

Parameter	Symbol	Min	Typ	Max	Units	Notes
Transmit Frequency	F_{tx}	24		24.25	GHz	
Transmit Power	P_{tx}	6	11	15	dBm	24GHz ≤ F_{tx} ≤ 24.25GHz
Transmit Power Adjustment	P_{txadj}	3	9		dB	Adjustable via API
Idle Transmit Power	P_{txadj}			-30	dBm	Not transmitting
Antenna Gain	G_{ant}		11		dBi	
Transmit Antenna Azimuth	RA_{azi}		20		°	-3 dB beam width
Transmit Antenna Altitude	RA_{alt}		24		°	-3 dB beam width
Active Current Consumption (OPS243-A)	I_{cc}		300	338	mA	5V input
			65	72	mA	24V input
Active Current Consumption (OPS243-C)	I_{cc}		330	375	mA	5V input
			390	450	mA	5V input, WiFi
			70	85	mA	24V input
			90	105	mA	24V input, WiFi
Idle Current Consumption	I_{idl}		140	158	mA	5V input
			180	200	mA	5V input, WiFi
			30	35	mA	24V input
Hibernate Current Consumption (OPS243-A)	I_{hib}		19		mA	1 second duty cycle*, 5V input
Hibernate Current Consumption (OPS243-C)	I_{hib}		34		mA	1 second duty cycle*, 5V input
			24		mA	1 second duty cycle*, 24V input
Reset Time	T_{RST}	200			ns	
Startup Time	T_{SRT}			2	µs	Processor startup time after release of T_{RST}

*Average current consumption based on default sample rate, buffer size

WiFi/Bluetooth

T_A = -40 °C to 85 °C with all voltages with respect to ground.

Parameter	Symbol	Min	Typ	Max	Units	Conditions
Operating Frequency	F_{txwb}	2.412		2.484	GHz	WiFi, Bluetooth
Transmit Power	P_{txw}	13		20.5	dBm	WiFi 802.11b/g/n
Sensitivity	S_{rxw}	-70		-98	dBm	WiFi 802.11b/g/n
Transmit Power	P_{txb}	-12	0	9	dBm	Bluetooth
Sensitivity	S_{rxb}		-94		dBm	Bluetooth @0.1% BER
Sensitivity	S_{rxble}		-97		dBm	Bluetooth @30.8% PER, BLE

/RESET Pin

T_A = -40 °C to 85 °C with all voltages with respect to ground.

Parameter	Symbol	Min	Typ	Max	Units	Conditions
HIGH Level Input Voltage	V_{IH}	2.475			V	
LOW Level Input Voltage	V_{IL}			0.99	V	
Input Leakage Current	I_{IN}			34	µA	
Input Capacitance	C_{IN}		5		pF	

Input SPI SEL, SPI MOSI/RxD, SCL/SCK Pins

T_A = -40 °C to 85 °C with all voltages with respect to ground.

Parameter	Symbol	Min	Typ	Max	Units	Conditions
HIGH Level Input Voltage	V_{IH}	2.0		3.6	V	
LOW Level Input Voltage	V_{IL}	-0.3		1.18	V	
Input Leakage Current	I_{IN}	-1		1	µA	
Input Capacitance	C_{IN}		10		pF	

Output HOST INT, SPI MISO/SDA/TxD Pins

T_A = -40 °C to 85 °C with all voltages with respect to ground.

Parameter	Symbol	Min	Typ	Max	Units	Conditions
HIGH Level Output Voltage	V_{OH}	2.9			V	I_{OH} ≥-1.4mA
		2.4			V	I_{OH} ≥-2mA
Low Level Output Voltage	V_{OL}			0.4	V	I_{OL} ≤ 2mA
Motion Detect Time[1]	T_{MOL}	2 x T_{PROC}			ms	

[1]T_{PROC} is the time one report takes to process which is dependent on the sample rate and the buffer size setting. The default setting, 10ksps and 1024 buffer size, has a T_{PROC} of approximately 156ms and T_{MOL} minimum time is 312ms.

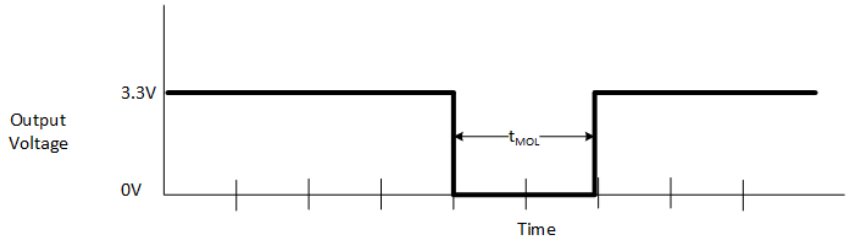


Figure 4. Host Interrupt Minimum Low Time

Output RS-232 (TxD) Pins

T_A = -40 °C to 85 °C with all voltages with respect to ground.

Parameter	Symbol	Min	Typ	Max	Units	Conditions
HIGH Level Output Voltage	V_{OH}	5	5.4		V	
LOW Level Output Voltage	V_{OL}	-5	-5.4		V	
HIGH Level Input Current	I_{IH}		±0.1	±1	µA	
LOW Level Input Current	I_{IL}		±0.1	±1	µA	
Output Resistance	r_O	300	10M		Ω	
Data Rate		150	250		kbps	C_L = 1000 pF, R_L = 3kΩ

Input RS-232 (RxD) Pins

T_A = -40 °C to 85 °C with all voltages with respect to ground.

Parameter	Symbol	Min	Typ	Max	Units	Conditions
Receiver Input Voltage	V_I	-25		25	V	
Positive-going Input Threshold Voltage	V_{IT+}		1.8	2.4	V	
Negative-going Input Threshold Voltage	V_{IT-}	0.8	1.4		V	
Input Hysteresis (V_{IT+} - V_{IT-})	I_{IN}		0.5		µA	
Input Resistance	r_i	3	5	7	kΩ	

Mechanical Specifications

The mechanical outline drawing for the OPS243 is shown in Figure 5. All units are in mm [mils].

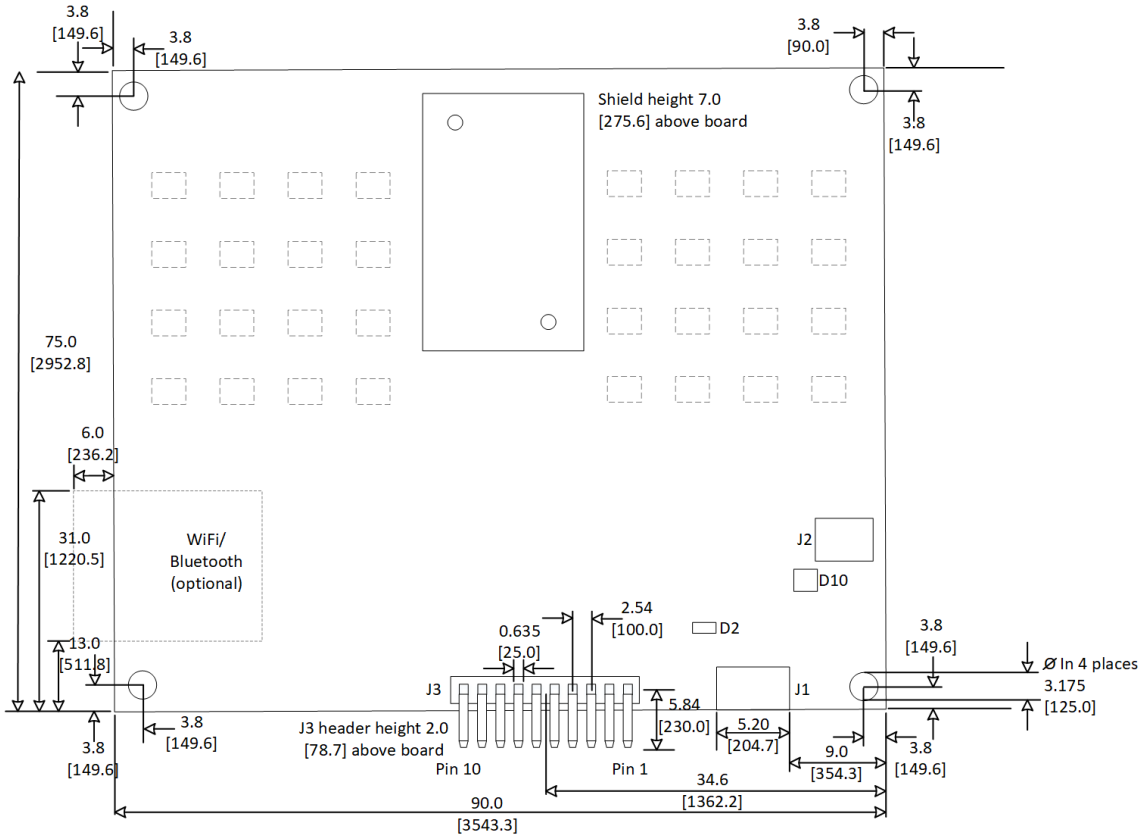


Figure 5. Mechanical Specifications (board rev A thru D1)

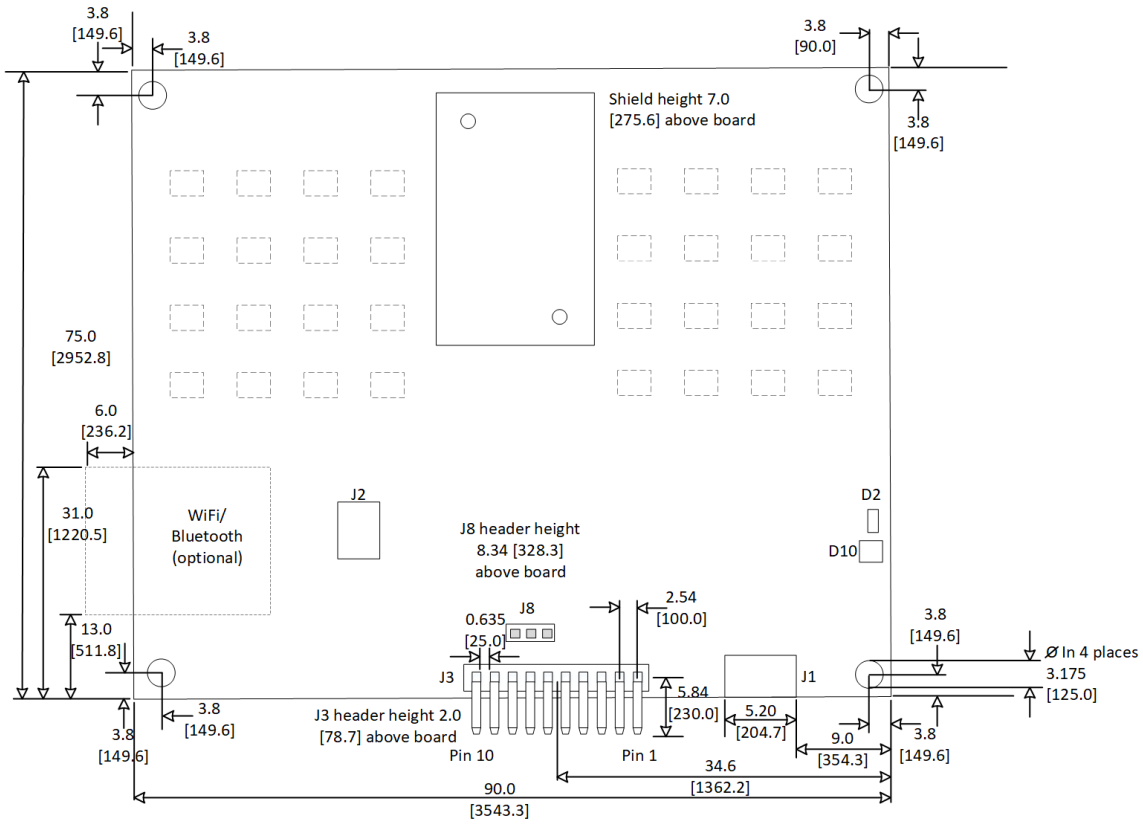


Figure 6. Mechanical Specifications (board rev D2)

Ordering Information

The full part numbers for the OPS243 module is listed in Table 6. Please use these part numbers when submitting orders.

A 3D printed enclosure is available for the OPS243. Order part number OPS243-A-CW-ENC. The WiFi version takes a unique bottom piece for the enclosure. Advise if that is required.

Table 6. Ordering Part Numbers

Sensor	Interface	Ordering Part Number
OPS243-A	UART, RS-232, USB	OPS243-A-CW-RP
OPS243-A	WiFi/Bluetooth, USB	OPS243-A-CW-WB
OPS243-C	UART, RS-232, USB	OPS243-C-FC-RP
OPS243-C	WiFi/Bluetooth, USB	OPS243-C-FC-WB

FCC Notice and Liability Disclaimer

FCC 15B Statement

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.

FCC 15C Statement

This device complies with Part 15 of the FCC Rules. 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.

FCC RF Exposure Statement

This transmitter must be installed to provide a separation distance of at least 20cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. End-users must be provided with transmitter operation conditions for satisfying RF exposure compliance.

IC Statement (English and French)

This device complies with ISED Canada license-exempt RSS standard(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.

Le présent appareil est conforme aux CNR d'ISED Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radio électrique subi, même si le brouillage est susceptible d'en comprom-ettre le fonctionnement.

Non-modification Statement

OmniPresense Corporation has not approved any changes or modifications to this device by the user. Any changes or modifications could void the user's authority to operate the equipment.
The final product containing the modular transmitter must be labeled with the following statement:
"Contains FCC ID: 2ALLL243A"
"Contains IC: 24107-243A"

The OPS243-C sensor is currently not FCC approved and will be going through the approval process shortly. The sensor is designed to comply with FCC Part 15 Rules and Regulations. The sensor is in a finished product form. OmniPreSense Corporation is not responsible for special, incidental, or consequential damages resulting from any breach of warranty, or under any legal theory, including lost profits, downtime, goodwill, damage to or replacement of equipment or property, and any costs of recovering, reprogramming, or reproducing any data stored in or used with OmniPreSense products.

CE Statement

The OPS243-A conforms to the CE mark and conforms to the requirements of the applicable European Directives as follows:

- EN 55032:2015,Class A
- EN 55035:2017
- EN 301 489-1 V2.2.3(2019-11)
- EN 301 489-3 V2.1.1 (2019-03)
- AS/NZ CISPR32
- AS/NZ CISPR35
- EN 61000-3-2:2014, Class {A/D}
- EN 61000-3-3:2013
- EN61000-4-2:2009
- EN61000-4-3:2006 +A1:2008 +A2:2010
- EN61000-4-4:2012
- EN61000-4-5:2014
- EN61000-4-6:2014
- EN 61000-4-8:2009
- EN61000-4-11:2004+A1:2017
- EN 300 440 V2.1.1 (2017-03)

Revision History

Version	Date	Notes
A	June 21, 2019	Initial release.
B	August 30, 2019	Updated information to include OPS243-C FMCW & Doppler operation.
C	November 20, 2019	Updated FCC statement for OPS243-A. Updated input voltage max at 13.2V. Updated block diagram.
D	December 18,2019	Updated power consumption with Hibernate mode operation for OPS243-A.
E	January 31, 2020	Updated power consumption with Hibernate mode operation for OPS243-C and improved for OPS243-A.
F	August 20, 2020	Added RS-232 interface and electrical specifications Updated input voltage to 5-24V (rev C and D boards) Clarified current at different voltages
G	December 18, 2020	Added WiFi/Bluetooth interface, electrical, and mechanical specifications
H	February 12, 2021	Added OPS243-C rev D. board support with combination UART and RS-232 interface on J3 header.
J	September 30, 2021	Added OPS243-A with WiFi/Bluetooth interface.
K	February 8, 2022	Added details of WiFi/Bluetooth standard support, OPS243-A current consumption at 24V, and pin designator on mechanical outline drawing.
L	April 11, 2022	Updated information for board revision D2. • Information about mechanical jumper to select RS-232 or UART output. • Updated mechanical dimensions Updated RS-232 Rx interface spec adding ±25V capability Updated mechanical dimensions to include WiFi/Bluetooth module and rev D2 changes.
M	June 6, 2023	Added OPS243-A information on CE regulatory certification. Added GPIO and Host Interrupt pin function explanations.