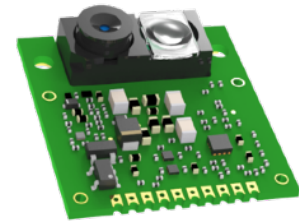# iPin–DRB221
MiniLidar — iTOF Laser Distance Measurement Module

Description

iPin-DRB221 MiniLidar is a miniaturized, long range, precise, easy to use, single point laser distance measurement / sensing module. It utilizes i-TOF laser light phase shift detection technology for obtaining the distance, which is featured in long distance accurate measurement.

Specially designed short focal length optics allows the sensor to have the thinnest structure as its kind. The module is good for integrated with mobile devices such as handheld computers, industrial tablet, etc. Visible red laser light is convenient for installing the sensor.

Features

1. Max range up to 20m
2. Max operable ambient light up to 3kLux
3. Sensor height less than 7mm
4. Typical accuracy tolerance ±3mm
5. Class II laser eye safety rating

Applications

1. Distance measurement
2. Robotics
3. Automation and control
4. Security surveillance
5. Displacement sensing

Technical Specifications

1. Absolute Maximum Ratings

Description	Symbol	Min.	Typ.	Max.	Unit	Notes
Supply voltage	VDD	−0.3	5	5.5	V	
Storage temperature range	T_{stor}	−25	—	60	ºC	
Operating temperature range	T_{op}	−20	—	50	ºC	a
Ambient light illumination	Ev	—	—	3000	Lux	

(a) Operating the product outside the max rated ambient temperature range may compromise its reliability.

2. Recommended Operating Conditions

Description	Symbol	Min.	Typ.	Max.	Unit	Notes
Supply voltage	VDD	3.8	5	5.5	V	
UART signal level	V_s	—	3.3	—	V	
Storage temperature range	T_{stor}	–20	—	50	^{o}C	
Operating temperature range	T_{op}	0	25	40	^{o}C	
Ambient light illumination	Ev	—	—	500	Lux	
Target remission	Rm	18	90	—	%	

3. Electrical and Optical Characteristics (Single-shot mode, $T_c = 25^o$C)

Description	Symbol	Min.	Typ.	Max.	Unit	Notes
Average working power consumption	P_{aw}	—	0.26	—	W	a
Standby power consumption	P_{sb}	—	0.20	—	W	b
Laser emission wavelength	λ	650	655	660	nm	
Measurement range	d_{m0}	0.05	—	3	m	c
	d_{m1}	0.05	—	10	m	
	d_{m2}	0.05	—	20	m	
Distance resolution	d_{res}	—	1	—	mm	
Distance tolerance	Δd	—	3	—	mm	d
Measurement time / single shot	t_m	—	1.5	—	sec	e
Measurement freq. / sync. mode (C0)	f_{m0}	20	—	30	Hz	f

(a) Under Measurement mode C0.

(b) Laser is off in standby status.

(c) Under typical recommended operating conditions. dm0, dm1 and dm2 can be preset by measurement mode commands.

(d) This is a 95% confidence level (2σ) tolerance at a distance less than 5m. For distance over 5m, the extra 0.25mm/m deterioration need to be added on the typical value, assuming under the stationary, recommended operating conditions.

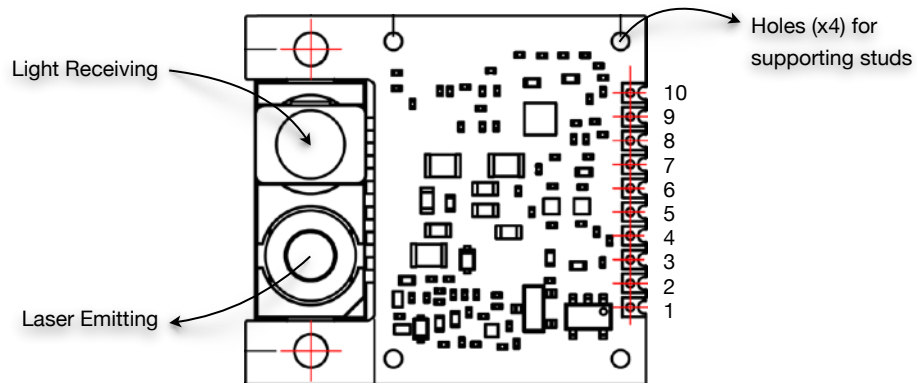(e) This is a typical time needed for a single shot measurement under the measurement mode A and B.

(f) The frequency of continuous measurements is defined under mode C0 in the typical recommended operating conditions and the target moving speed under 250cm/s.

4. Outline Drawing

4.1. Dimensions
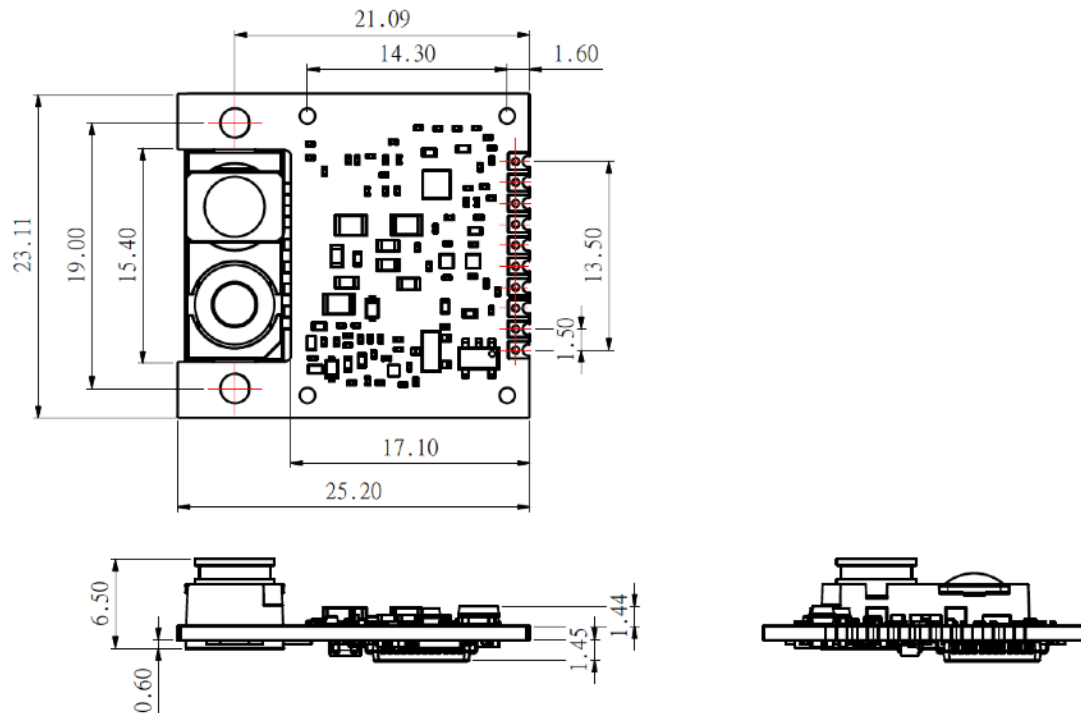
4.2. Pinout Definitions

Pinout #	Symbol	Definitions
1	UART_RX	Module receives (data input)
2	UART_TX	Module Transmits (data output)
3	GND	Electric ground
4	VDD	Supply voltage
5	EN	Module power enable pin; Set to high (VDD) to turn on; Set to low (GND) to turn off.
6~10	NC	Not connected

5. Serial Port Communication Protocols

5.1. Data Communication Protocol

Interface(s)	UART
Default baud rate	115200
Data bit	8
Stop bit	1
Parity check	None

5.2. Command Sending (to module) and Data Receiving (from module) in the Normal Condition

5.2.1. Request firmware version

	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8	Byte 9
Send	0xCD	0x01	**0x02**	0x03						
Receive	0xFA	0x00	0x07	0xPP	0xQQ	0xRR	0xXX	0xYY	0xZZ	Cksum
Note	Header	Data length from Byte 3~ Cksum		Firmware Version= 0xPPQQRRXXYYZZ						Sum of Byte1~ 8

5.2.2. Turn on laser (ready to measure)

	Byte 0	Byte 1	Byte 2	Byte 3
Send	0xCD	0x01	**0x03**	0x04
Receive	0xFA	0x00	0x01	0x01

5.2.3. Turn off laser

	Byte 0	Byte 1	Byte 2	Byte 3
Send	0xCD	0x01	**0x04**	0x05
Receive	0xFA	0x00	0x01	0x01

5.2.4. Measurement mode A (Single-shot, max range = d_{m2})

Start measurement—> get distance—> turn off laser

	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
Send	0xCD	0x01	**0x05**	0x06				
Receive	0xFA	0x00	0x05	0xZZ	0xYY	0x00	0x00	Cksum
Note	Header	Data length from Byte 3~ Cksum		Measurement result = 0x0000YYZZ (mm) (little–endian)				Sum of Byte1~6

5.2.5. Measurement mode B (Retained, max range = d_{m2})

Start measurement—> get distance—> ready for next command (laser stays on)

	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
Send	0xCD	0x01	**0x06**	0x07				
Receive	0xFA	0x00	0x05	0xZZ	0xYY	0x00	0x00	Cksum
Note	Header	Data length from Byte 3~ Cksum		Measurement result = 0x0000YYZZ (mm) (little–endian)				Sum of Byte1~6

Default zero position

Measurement result: Distance (mm)
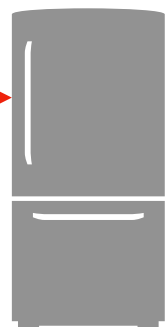
5.2.6. Measurement mode type C0~2[a] (Synchronized)

Start measurement—> get distances continuously until "Turn off laser" command received.

| Byte	0	1	2[a]	3	4	5	6	7	8	9	10	11	12	13	14	15
Send	0xCD	0x04	0xXX[a]	T_S: Epoch time on sending command In milliseconds represented as uint64								Cksum 1~10				
Receive	0xFA	0x00	0x0D	0xZZ	0xYY	0x00	0x00									Cksum
Note	Header	Data length from Byte 3~ Cksum		Measurement result = 0x0000YYZZ (mm) (little–endian)				T_R: (little–endian) Epoch time on receiving the distance result. In milliseconds. Represented as uint64								Byte 1~14

Note (a):

Byte 2 in "Send" command:

Measurement mode	Byte 2	Measurement Range	Measurement Frequency
C0	0x00	d_{m0}	f_{m0}
C1	0x01	d_{m1}	f_{m1} (TBD)
C2	0x02	d_{m2}	f_{m2} (TBD)

5.3. Error codes received from the sensor in abnormal conditions

Format	Byte 0	Byte 1	Definitions
Explanation	**0x0E** Header	0x81	Checksum error
		0x82	Command not found
		0x83	The measured distance is out of max range.
		0x84	The parameters following command is out of permitted range
		0x85	Laser not turned on before measurement.
		0x89	Low SNR
		0x8B	Wrong command header, or header with wrong address

Install the Module

1. Fix the module to an **<u>electrically insulated</u>** base. Refer to the figures below.


<u>Insulated</u> material

Keep here **<u>insulated</u>**
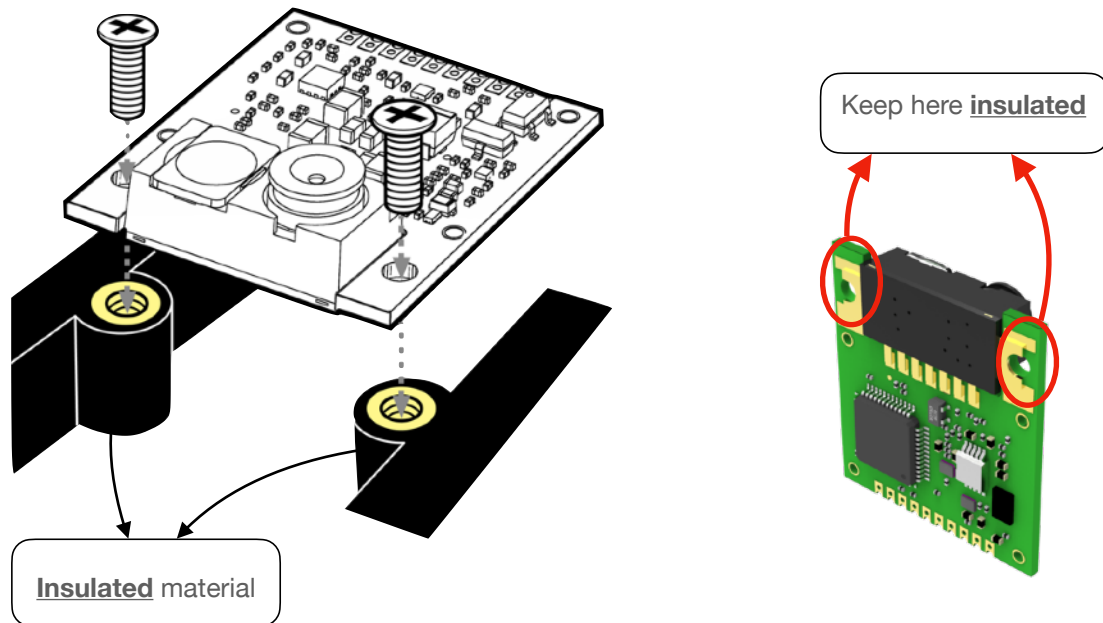
2. Connecting the interface wires of UART ports between the module and the master.

UART

ARDUINO

RaspberryPi

PLC
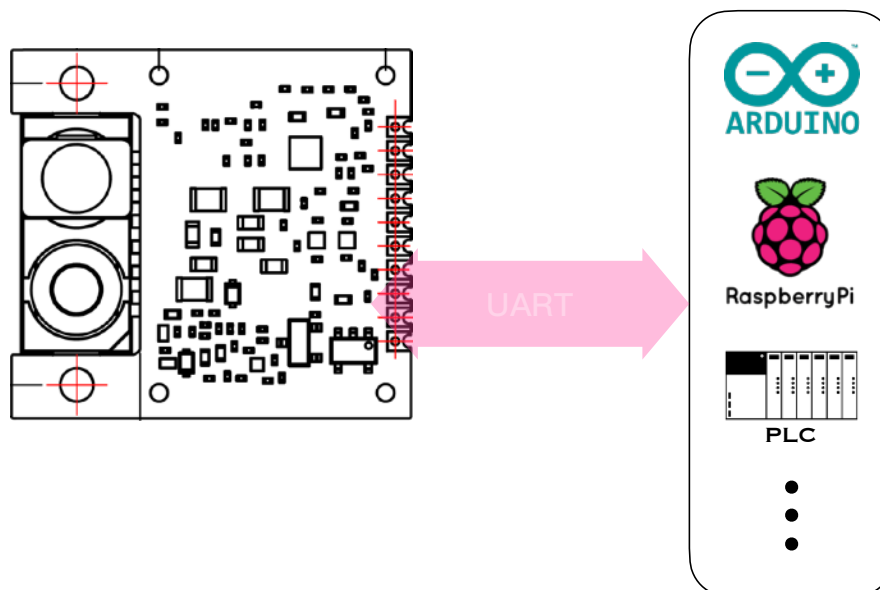
3. Mobile computer integration design guide

    3.1.   Place the laser measure module as close to the camera lens as possible.

    3.2.   Select high transmittance (T > 96% preferred) and hard-coated covers for both emitting and receiving sides, in case the dust/water-proof protection needed.

    3.3.   Place the emitting side cover in a tilt angle $\geq 6^{o}$ to preventing dual laser spots due to multiple reflections.

    3.4.   A minimum 4.0mm diameter of the light receiving aperture is required otherwise the measurement performance maybe compromised.

    3.5.   Emitting cover and receiving cover should be separated by opaque material to avoid the laser light leakage to the receiver side.
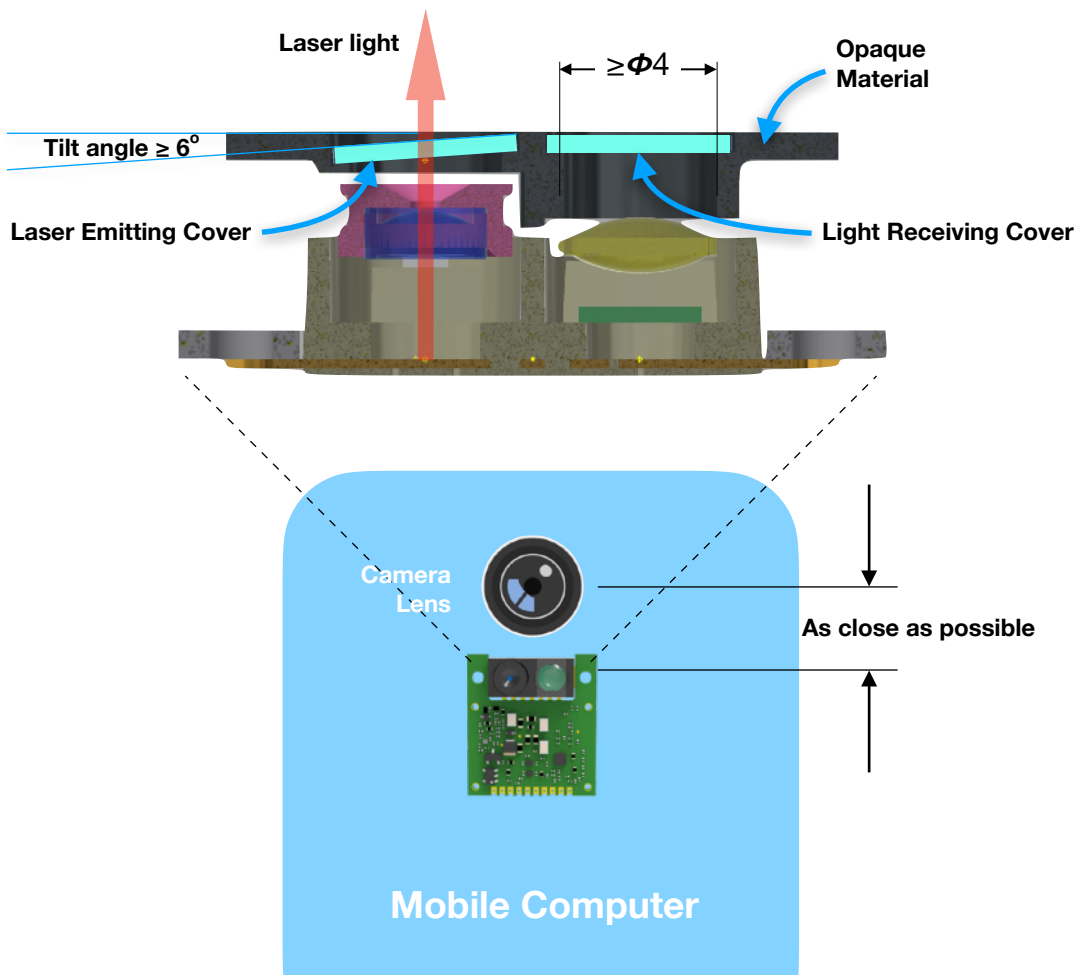
Precautions

1. Do not stare directly into the laser beam by human eye since it may cause eye damage.

2. The transparent cover on laser measure is an optical element. Do not contaminate the optical cover by soil, oil or chemicals.

3. Avoid any mechanical impact to prevent from malfunction or measurement deviations.

Revision History

No.	Date	Changes	Page	FW ver.
1	Dec. 31, 2021	Update to ver. 1.3 1. Add "Absolute Maximum Ratings". 2. Add "Recommended Operating Conditions" 3. Update "Electrical and Optical Characteristics" 4. Update "Outline Drawing", increase width to 23.11mm 5. Update "Pinout #5" to "NC" 6. Remove Function Block Diagram" 7. Update "Default Command Sending Formats" 8. Update "Command sending (to module) and data receiving (from module) in the normal condition" 9. Update "Error codes received from the sensor in abnormal conditions" 10. Add "Install the module"	1 2 2 3 3 4 5 6 7	FW-v2
2	Jan. 4, 2022	Update to ver. 1.4 Add test software user guide.	8-9	FW-v2
3	Jan. 5, 2022	Update to ver. 1.4.x 1. Fix wrong command receive formats at get FW version and measure mode. 2. Fix wrong page number	5	FW-v2
4	May. 31, 2022	Update to ver. 1.5 1. Remove 5.2 Default Command Sending Formats (to the module) 2. Fix 5.3.1 Byte 9 Cksum Note: Sum of Byte 1~8 3. Fix 5.3.6 Byte 5 Cksum Note: Sum of Byte 1~4 4. Fix 5.3.7 Byte 5 Cksum Note: Sum of Byte 1~4 5. Add Measurement mode C (Synchronized) 6. Add Error 2 codes 7. Add Mobile computer integration design guide	4 5 5 5 7 9	FW-v2.9c
5	Jun. 13, 2022	Update to ver. 1.5.1 1. Add Note (e) explanation. 2. Add 3.4 of Mobile computer integration design guide and modify the figure. 3. Remove "Serial Port Testing Program"	2 9	FW-v2.9c

No.	Date	Changes	Page	FW ver.
6	Jun. 20, 2022	Update to ver. 1.5.3 1. Add Measurement range d_{m0}~d_{m2} 2. Add Measurement freq.: f_m max 30Hz and Note (f) explanation. 3. Measurement mode A (Single-shot, max range = d_{m2}) 4. Measurement mode B (Retained, max range = d_{m2}) 5. Modify 5.2.6 Measurement mode C —> C0	2 2 5 5 5	FW-v2.9d
7	Jun. 24, 2022	Update to ver. 1.5.4 1. Add UART signal level V_s = 3.3V 2. Measurement freq. / sync. mode (C0): min f_m = 20Hz @ target speed < 250 cm/s 3. Add 5.2.7 and 5.2.8 Measurement mode C1, C2	2 6	FW-v2.9d
8	Aug. 29, 2022	Update to ver. 1.6.0 1. Define power consumptions instead of current consumptions. 2. Pinout Definitions: #5 Power Enable Pins 3. Combine commands "5.2.6~8" 4. Remove commands "5.2.9 and 5.2.10".	2 3 6 7	FW-v2.9d
9	Nov. 2, 2022	Update to ver. 1.6.1 1. Update power consumptions. 2. Correct the mode A, B and C0~2 receiving byte 3~6 format as "little-endian".	2 5, 6	FW-v2.9d

* Wiseome reserves the right to make the document change without prior notice