60G Milimeter wave Bio-sensing radar

R60ABD1-Respiratory sleep radar using guide

Please read the product instructions carefully before use and keep them properlyV1.0

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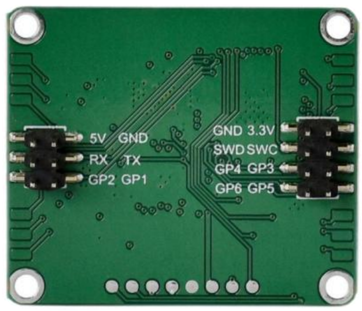
1. Product description

Based on the millimeter wave radar system, the breathing and sleep radar realizes the perception of human biological existence and human movement, continuously records the existence of the human body, and judges the sleep state and breathing and heartbeat frequency of the target in real time according to the changes in the amplitude of body movement and the changes in breathing and heart rate during sleep. , output sleep score after a period of sleep process, and combine the output of relevant sleep parameters into the application of health and wellness. This product is installed on the top of the room. Sleep breathing function detection is not affected by factors such as temperature, humidity, noise airflow, dust, light, and complete stillness of the human body.

2. Appearance introduction

Antenna Structure



Pins

3. Main performance description

3.1. Main functions of radar

function points	State change time/function explanation
DP1: Someone/Nobody	No one to someone, report within 0.5s From someone to no one, 40 s output no one state
DP2: Someone is stationary / Someone is active	Static and dynamic switching, reporting within 0.5 seconds
DP3: Heartbeat rate	Output data once every 3 seconds, the unit is

	times/minute
DP4: Body Motion Amplitude Parameter 0 - 100	Output data once every 5 seconds [Reference: Description of Body Motion Amplitude Parameter Output]
DP5: Getting in/Out of bed	From getting out of bed to getting in bed, someone exists to report within 1 minute From bed entry to bed exit, the exit state is output in about 40s
DP6: Sleep state (awake/light/deep)	When in bed, judge and report the sleep state once every 10 minutes
DP7: Sleep Quality Score	At the end of the sleep process, report the score of this segment of sleep, with a score ranging from 0 to 100 points.
DP8: Respiratory/Heart Rate Rate	Output data once every 3 seconds, the unit is times/minute

3.2. Body Motion Amplitude Parameter Output Description

Body Motion Parameter		
0%	unmanned	unmanned environment
1%	still (sleep)	Only breathing without limb
2%-30%	micro-motion	Only slight head or limb movement
31%-60%	Ambulation/rapid	slower body movement
61%-100%	running/close range	rapid body movement

4. Module pin description

interface	pin	describe	Typical value	illustrate
interface 1	1	5V	5.0V	Power input positive terminal
	2	GND		land
	3	RX	3.3v	Serial receive
	4	TX	3.3v	Serial send

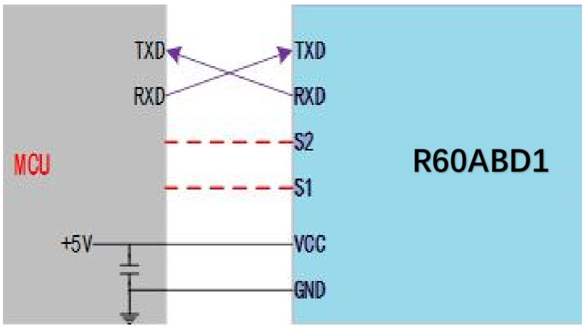
	5	GP2		Spare expansion pins
	6	GP1		Spare expansion pins
interface 2	1	3V3	3.3V	input power
	2	GND		land
	3	SL		reserve
	4	SD		reserve
	5	GP3		Spare expansion pins
	6	GP4		Spare expansion pins
	7	GP5		Spare expansion pins
	8	GP6		Spare expansion pins

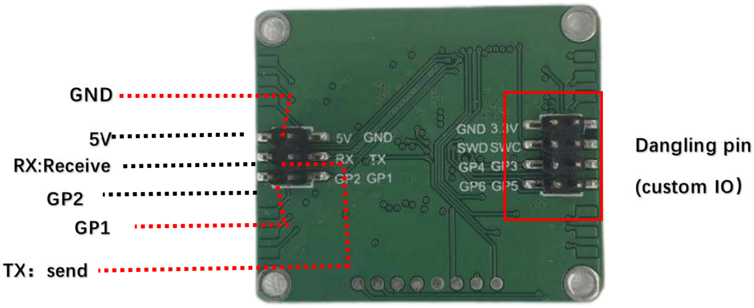
Pin Description

Note:

1) GP1~GP4 are parameter selection control terminals, which can be redefined according to user needs.

2) The output signals of this interface are all 3.3VTTL level.





Use wiring diagrams

Module wiring diagram

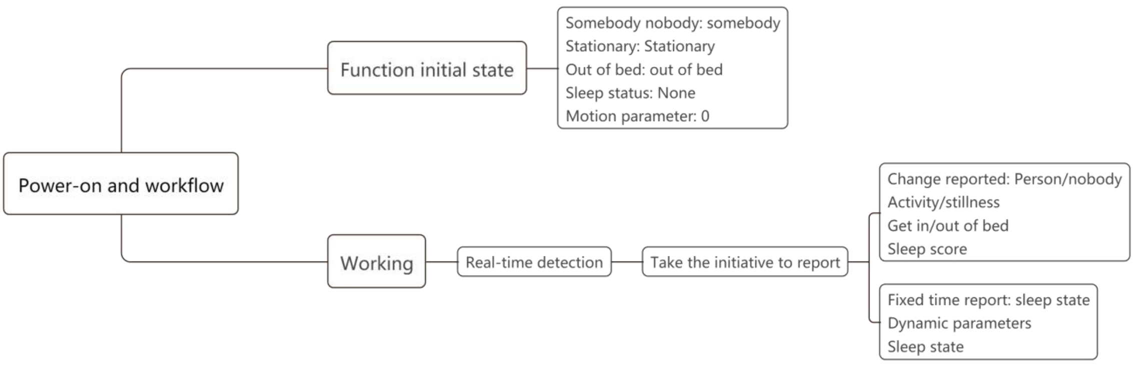
5. Tool preparation

5.1TTL serial port tool, DuPont line, PC computer, serial port assistant terminal

5.2Radar-EVB demo board (default Tuya platform, you can freely adapt your own communication module)

5.3 Radar User Manual (Protocol)

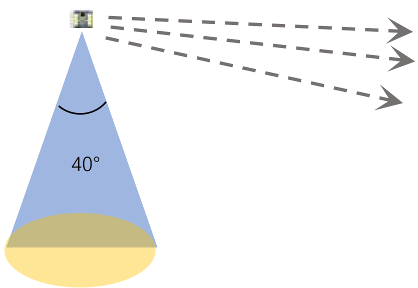
6. Power-up and data rules

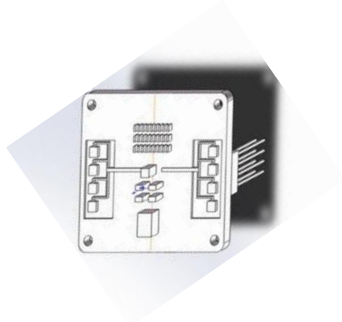


7. Radar Installation Instructions

7.1. Radar module working range

The beam coverage of the R60ABD1 radar module is shown in the figure below. The radar coverage is a three-dimensional sector area of 40° in the horizontal and 40° in the elevation.





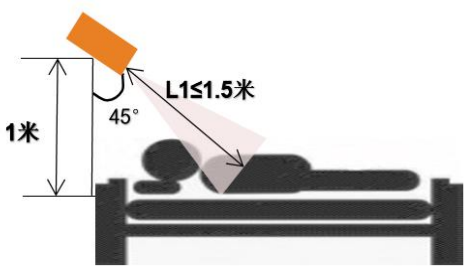
Schematic diagram of R60ABD1 radar coverage area

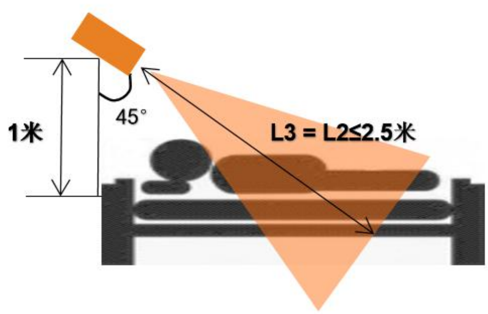
7.2. Radar installation direction and detection range

Inclined installation:

＊To ensure the accuracy of radar detection, it is recommended to install it above the head of the bed and install it downward at a 45° angle!

The radar is installed obliquely, at a tilt angle of 45°, and is installed above the head of the bed. The radar installation height is recommended to be 1m higher than the bed surface; ensure that the main beam of the radar covers the detection area; there are no obvious obstructions and coverings in front of the radar. Affected by the radar installation height and radar beam range, in this installation mode, the maximum distance for human presence detection is L3 ≈ 2.5 meters; the maximum distance for sleep detection is L2 ≈ 2.5 meters; the maximum distance for human respiratory rate detection is L1 ≈ 1.5 meters.





8. Key Functional Testing Guidelines

8.1 Sleep quality state judgment test:

8.1.1 Sleep quality status test:

When a sleep test is performed within the radar detection range, the radar will immediately report the relevant status in "awake/light/deep sleep" every 10 minutes

carry out testing Simulate sleep for 10 minutes with immobility within range	When 10 minutes later, the radar sleep state is successfully judged from awake -> light sleep record radar sleep state If the output can be judged normally, it means **"pass"**

Example test table format:

Testing frequency	test location	Whether to report normal sleep state	pass
the first time	front of the radar	Yes	pass

8.1.2 Judgment test of entering and leaving bed state:

When no one enters the radar detection range, it will respond immediately and report the state of entering bed

Install the radar according to the installation requirements of the sleep scene, Keep approaching the sleeping area at a speed of at least 0.7m/s	When the radar state changes from getting out of bed - "into bed, it stops at the moment Whether the recording and radar can trigger the bed-in state normally If it can be triggered normally, it means **"pass"**

Example test table format:

Testing frequency	Whether entering the detection range normally triggers the bed entry state	pass
the first time	Yes	pass

8.1.3 Judgment test of getting out of bed:

When there is no one in the radar detection range, the radar will detect whether there is no human movement, breathing and other actions within the range for a period of time, and output the state of getting out of bed when it is confirmed that there is no one. (It is normal to enter the unmanned state within 5 minutes in a normal environment)

Stay at least 3m away from the sleep detection area to avoid interference There are no people moving around in the environment and no interference from sources of interference start the timer	When the radar state changes from entering the bed/someone is still -> leaves the bed and stops for a moment Records radar entry and exit times When reporting "Get out of bed" within 5 minutes, it means **"Pass"**

Example test table format:

Testing frequency	Report the time to leave bed	pass
the first time	2min10s	pass

8.2 Respiratory rate test:

8.2.1 Respiratory rate test:

When the person sits still in front of the radar detection area and the distance is kept within 1.5m, a 3-minute static calm test and a 40-s breath-holding test are performed, and the radar will output the value change of breathing in real time. When it exists, it will report the breath as 0, and report the abnormal breath hold alarm

Sit still in the specified test position, and breathe calmly for 1 minute. After 1 minute, hold your breath for 30s~40s to see the change of radar status.	When the radar breathing rate normally outputs the value 1min before, and the breathing value can be reported as 0 times/min after holding the breath for about 30s~40s, and the abnormal breath holding alarm is reported, it means **"passed"**

Example test table format:

Testing frequency	Confirm that the breathing rate has the correct numerical change	pass
the first time	Yes	pass

8.2.2 Heartbeat frequency test:

When the person sits still in front of the radar detection area and the distance is kept within 1.5m, a 3-minute static calm test is performed, and the radar will judge and output the heart rate value in real time.

Sit still in the prescribed test position And take calm breathing for 3 minutes Check whether the heartbeat value of the radar is reported normally	When the radar heartbeat frequency is normal, the output value means **"pass"**

Example test table format:

Testing frequency	Confirm whether the heartbeat frequency has the correct numerical change	pass
the first time	Yes	pass

9. Guide to the actual installation steps of the radar

Step 1: Confirm the main activity and stay area of the person (above the head of the bed in the sleeping area), and 1m above the head of the bed is the installation position of the radar

Step 2: Tilt the installation angle of the radar downward by 45° to ensure that the detection range of the radar can normally cover the rest area

Step 3: Confirm whether there is an interference source within the radar detection range , and remove the interference source that may affect

Step 4: Follow the steps to confirm the final installation location for normal use

Example:

Space size: 10 m² - 20 m²

Interference source: air conditioner outdoor unit/blackout

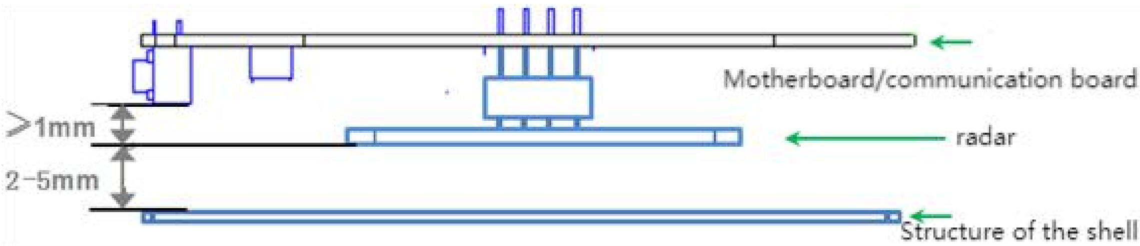
curtain/partition wall

10. Layout Requirements for Antenna and Housing

PCBA: Need to keep the height of the radar patch ≥ 1mm than other devices

Shell structure: It is necessary to maintain a distance of 3mm between the radar antenna surface and the shell surface

Shell detection surface: non-metallic shell, need to be straight, avoid curved surface, affect the performance of the entire scanning area.



11. Common problem

Interference factors: Radar is an electromagnetic wave detection sensor, and active non-living will cause false alarms. The movement of metals, liquids, can lead to false positives. Usually, electric fans, pets close to the radar, and the shaking of metal curtains can cause false positives. Radar needs to be planned in terms of installation angle.

Non-interfering factors: radar electromagnetic waves will penetrate human clothing, curtains, thin wood, and glass. The installation angle and performance of the radar need to be determined according to the application.

Semi-interference factor: Radar judges the existence of human body and is not suitable for directly facing the air conditioner. The motor inside the air conditioner can cause the radar to misjudge. It is required that the radar product does not directly face the air conditioner. Or in the same direction as the air conditioner.

12. Historical version update instructions

Revision	Release Data	Summary
V1.0_0520	2022/05/20	first draft