MicRadar

24G Biosensing Radar

Human Presence - R24A

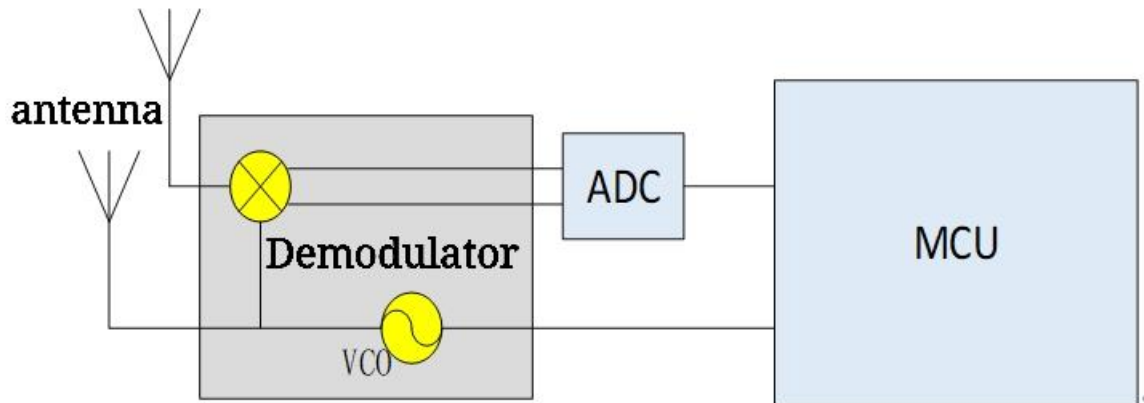User Manual(Ver.1.1)Reference

Contention

Overview

This document mainly describes the use of the radar, the problems that need to be paid attention to at each stage, as far

as possible to reduce the design cost and increase the stability of the product, and improve the completion efficiency of the project 。

From the hardware circuit reference design, radar antenna and shell layout requirements, how to distinguish interference and multi-functional standard UART protocol output.

This radar is a self-contained airborne sensing sensor, a module composed of a radio frequency antenna, a radar chip and a high-speed main frequency MCU. It relies on a stable, flexible and superior algorithm architecture core to solve the user's various scene detection needs. It can be equipped with a host computer or host to flexibly output detection status and data, and meet several sets of GPIOs for users to customize and develop.

1. Working principle

    The radar transmits the 24G frequency band millimeter wave signal, the electromagnetic wave signal reflected by the measured target, and performs demodulation processing at the transmitting signal, and then proceeds through the amplification, filtering, ADC, etc., to obtain the echo demodulation signal data.

    The amplitude, frequency and phase of the echo signal are calculated in the MCU unit, and finally realize the target parameters (breathing, motion, micromotion, etc.) measurement and scene evaluation.

2. Hardware design considerations

    The rated power supply voltage of the radar shall meet 4.9-6V, with a rated current of over 200mA under normal operation. Power design, power ripple requires ≤ 100mv.

2.1. Power supply can refer to the following circuit design

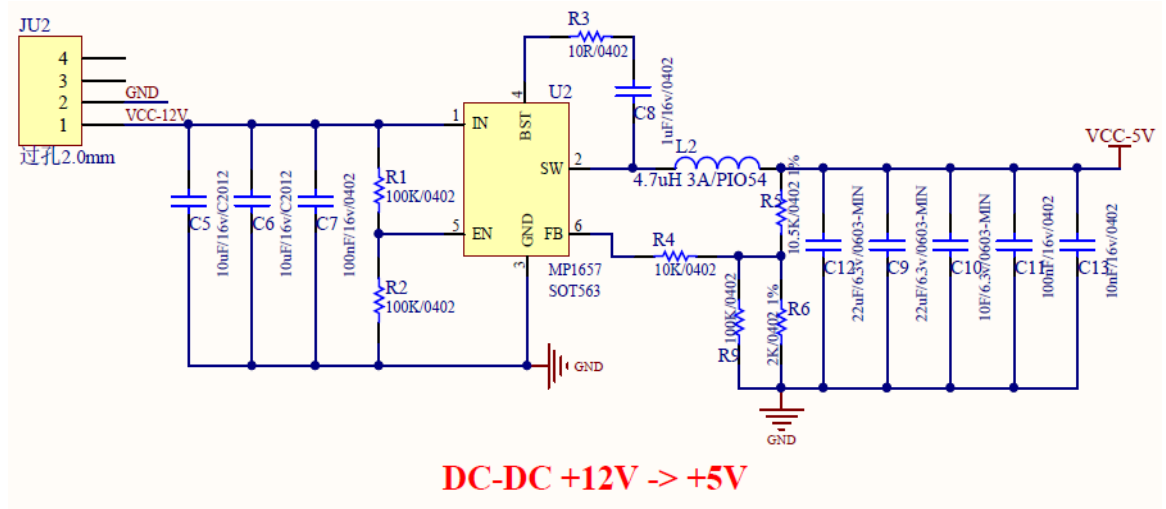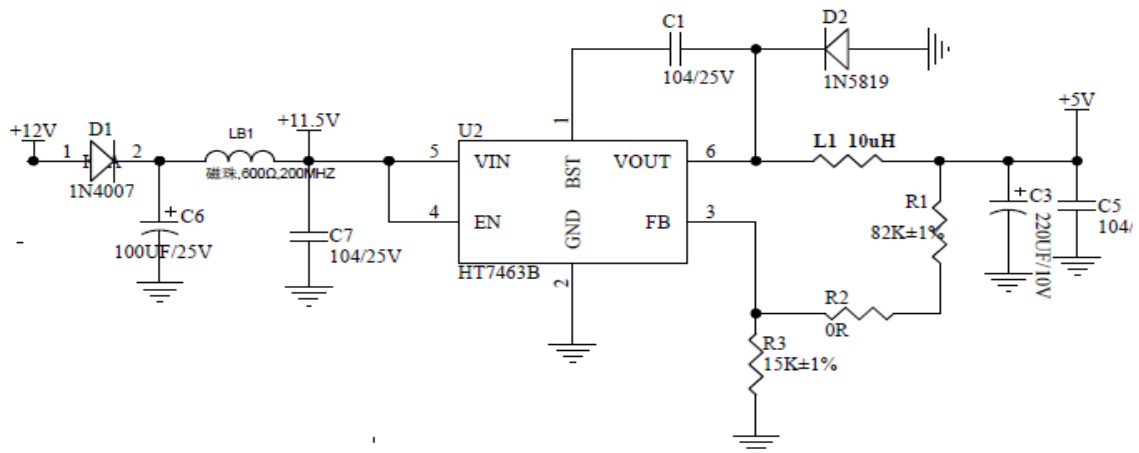

DC-DC +12V -> +5V

Figure 1

Figure 2

2.2. Use the wiring diagram

Figure 3 Schematic diagram of the radar module and the peripheral connection

3. Layout requirements for the antenna and enclosure

PCBA: needs to maintain radar patch higher than other devices ≥ 1mm

Housing structure: Keep radar antenna surface at 2-5mm distance

Shell detection surface: non-metallic shell, need to be straight to avoid bending surface and affect the performance of the whole sweep area.

图 4

4. Electrostatic protection

Radar products have an electrostatic sensitive circuit, which is prone to electrostatic hazards. Therefore, it is necessary to fully do electrostatic protection in the process of transportation, storage, work and pickup, do not touch the radar module antenna surface and connector feet with hand, but only touch its edge part.

Try to bring anti-static gloves when operating the radar sensor.

5. Function interference items

5.1 Unmanned state, the abnormal output of someone

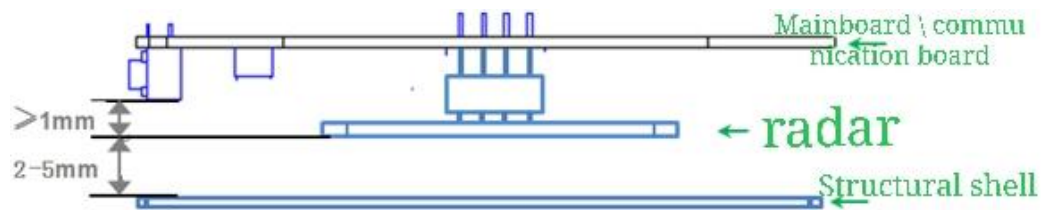In the normal state, the radar will accurately judge the human sitting state and the existence of sleep, and output falls, breathing, vital signs and other information

A. Radar scanning area is large, the door, next door to the plank wall movement was detected

Adjustment method: Reduce the radar sensitivity, and the radar provides the scene setting

B. Under the radar square pair running air conditioning, fan

Adjustment method: adjust the radar position, do not directly face the air conditioner, the fan

C. Objects shaking caused by the air-conditioning wind

Adjustment method: cotton, non-metal items will not cause false alarm, metal items need to be fixed

D. The radar is not fixed, and the vibration causes false positives

Avoid support shaking and vibration

E. Pets, birds, and other occasional moving objects

This interference cannot be excluded due to radar measurements and high sensitivity

F. Power interference, resulting in an occasional misjudgment

Try to maintain the power supply current stable, to reduce the ripple

5.2 Someone status, the abnormal output is unmanned

Radar is sent and received through electromagnetic waves to determine the existence of the human body. The closer to the radar, the higher the accuracy.

A. The human body is outside the radar range

Radar scanning range, and adjust the installation angle.Radar measurement range, in different environments, the electromagnetic wave reflected area is different, the scanning area will have small differences.

B. Metal occlusion causes an incorrect output

Overthick office tables and chairs, metal seats.It will block the electromagnetic wave penetration, causing misjudgment.

C. Scan angle difference

The radar was not scanned to the trunk position.Cause a miscarriage of judgment.

D. Radar sensitivity is too low

Radar provides parameter adjustment to increase sensitivity improvement.

6. Functional details

6.1. Function point description

Function point	Status change time / function explanation
DP1：Someone / nobody	No one arrived, reported within 0.5s Someone to no one, 1-2 minutes or so output no state， 0.5s
DP2：Someone is still / someone is active	Static dynamic switch, reported within 0.5 seconds
DP3：Someone is close to the equipment / Someone moves away from the device / someone moving without direction	Output the status once in 2 seconds
DP4：Body motion amplitude parameter 0 – 100	Output the data once in 5 seconds Refer to (Description of the bulk motion amplitude parameter output)
DP5：Sensitivity is set in gear 0-9	In default scenario mode, 10 gear adjustments are supported

DP7: Scene mode (bed, bathroom, hotel, Bedroom, Office, Default mode)	Adapt to different scenes according to the size of the face shell
DP8: No false alarm confirmation prompt	

6.2. Description of body amplitude parameters

Parameter of the bulk motion amplitude		
0%	No one else	No one is left in the environment
1%	Still (sleep)	Only breathing and no body movement
2%-30%	Micro-action	Only minor head or limb small movement
31%-60%	Move / fast limb movement	More slow body movement
61%-100%	Running / close range	Quick body movement

7. Agreement description

This protocol is applied to the communication between the 24G mm-wave sleep detection radar and the upper plane.

This protocol introduces the radar workflow, the interface protocol, and provides control commands and data for radar work. The serial port communication is defined as follows：

- ✧ Interface level：TTL
- ✧ The Porter rate: 9600bps
- ✧ Stop the bit: 1
- ✧ Data bit: 8
- ✧ Parity check: None

8. Communication command and parameter definition

8.1. Frame structure definition and description

A、Frame structure definition

Start code	Data length		Function code	Address code 1	Address code 2	Data	Check the code	
0X55	Lenth_L	Lenth_H	Command	Address_1	Address_2	Data	Crc16_L	Crc16_H
1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	1 Byte	n Byte	1 Byte	1 Byte

B、Frame structure description

    a. Start code: 1Byte, is fixed to 0X55。

    b. Data length: 2 Byte, low bytes in front, high bytes in back
- Length = data length + function code + address code 1 + address code 2 + data + check code。

    c. Function code：1Byte
- Read r command：0X01
- Write command：0X02
- Passive report command：0X03
- Active reporting command：0X04

    d. Address code: Address code 1 indicates the function classification, and the address code 2 indicates the specific function. See the address allocation and data information description。

    e. data：n Byte

    f. Check the code：2 Byte，Low bytes in front, high bytes in back。

9. FCC Notice:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1)
This device may not cause harmful interference. (2) This device must accept any interference received,
including interference that may cause undesired operation.
NOTE: 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.

WARNING: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

RF exposure considerations

It is essential for module grantees to clearly and explicitly state the RF exposure conditions that permit a host product manufacturer to use the module. Two types of instructions are required for RF exposure information: (1) to the host product manufacturer, to define the application conditions (mobile, portable – xx cm from a person's body);
and (2) additional text needed for the host product manufacturer to provide to end users in their end-product manuals. If RF exposure statements and use conditions are not provided, then the host product manufacturer is required to take responsibility of the module through a change in FCC ID (new application).

End Product labeling
The final end product must be labeled in a visible
area with the following: "Contains FCC ID: 2A3G8-R24A". The grantee's FCC ID can be used only when all FCC compliance requirements are met.

Manual Information to the End User
The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.
The modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules 15.249) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuity), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

List of applicable FCC rules
List the FCC rules that are applicable to the modular transmitter. These are the rules that specifically establish the bands of operation, the power, spurious emissions, and operating fundamental frequencies. DO NOT list compliance to unintentional-radiator rules (Part 15 Subpart B) since that is not a condition of a module grant that is extended to a host manufacturer. See also Section 2.10 below concerning the need to notify host manufacturers that further testing is required.