



## 60G Radar Module for Falling Detection (FDS) IR60FD1A

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## Overview

This document mainly describes the use of the radar, the problems that need to be paid attention to at each stage, Minimize design costs and increase product stability to improve project completion efficiency rate

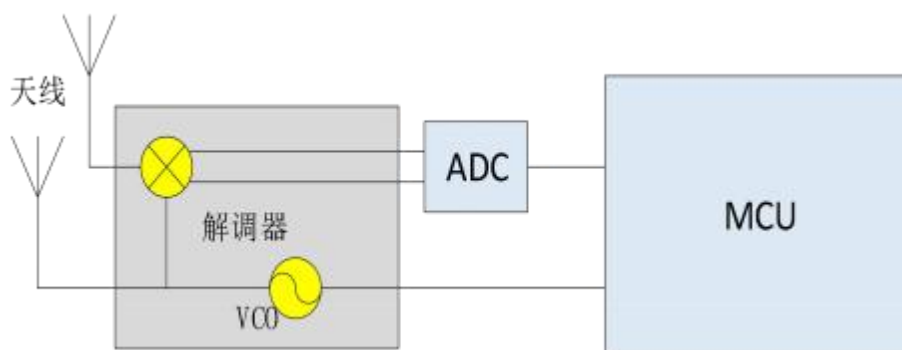
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From the hardware circuit reference design, the layout requirements of the radar antenna and the housing, how to distinguish the dry Scrambling and multi-function standard UART protocol output.

This radar is a self-contained space sensing sensor, consisting of a radio frequency antenna, a radar core A module composed of a chip and a high-speed main frequency MCU, relying on stable, flexible and superior computing The core of the legal architecture , to solve the user's various scene detection needs, can be equipped with a host computer or The host can flexibly output detection status and data, and meet several groups of GPIOs, which can be customized by users. hair

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## 1 . Working principle



Radar transmits millimeter-wave signals in the 60 G frequency band, and the measured target reflects the electromagnetic wave signals and transmits the signals at the same time. Perform demodulation processing, and then through amplification, filtering, ADC and other processing to obtain echo demodulated signal data . The amplitude, frequency and phase of the echo signal are calculated in the MCU unit, and the goal is finally achieved. parameter (falls, stationary dwelling, motion, fretting, etc.) measurement and scene evaluation.

## 2. Hardware Design Considerations

The rated supply voltage of the radar should meet 4.9 – 6 V , under normal working conditions, the rated current should be Find an input above 200 mA . Power supply design, power supply ripple should be  $\leq 100$  mv.

### 2.1. The power supply can refer to the following circuit design

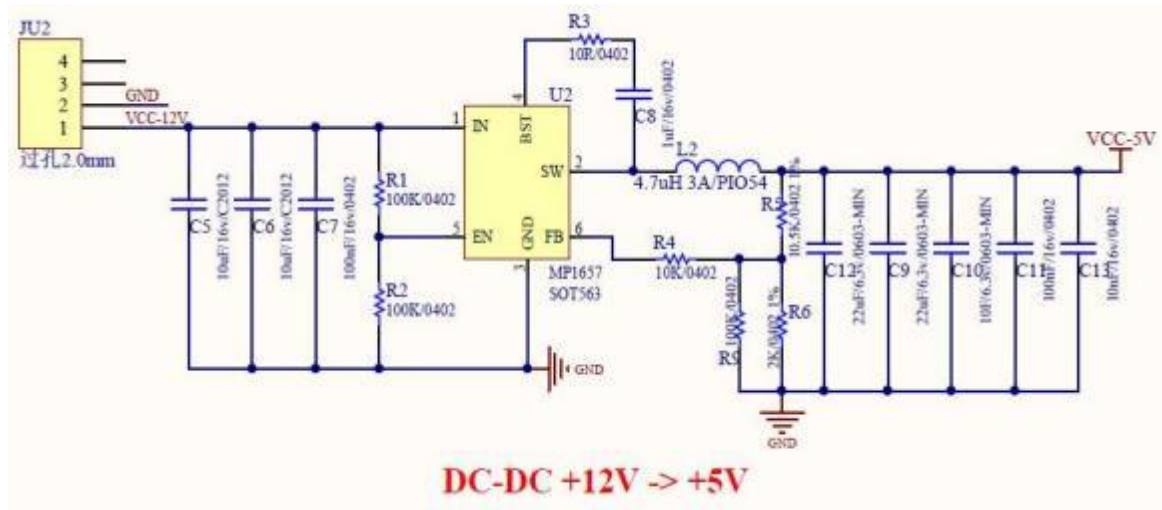


figure 1

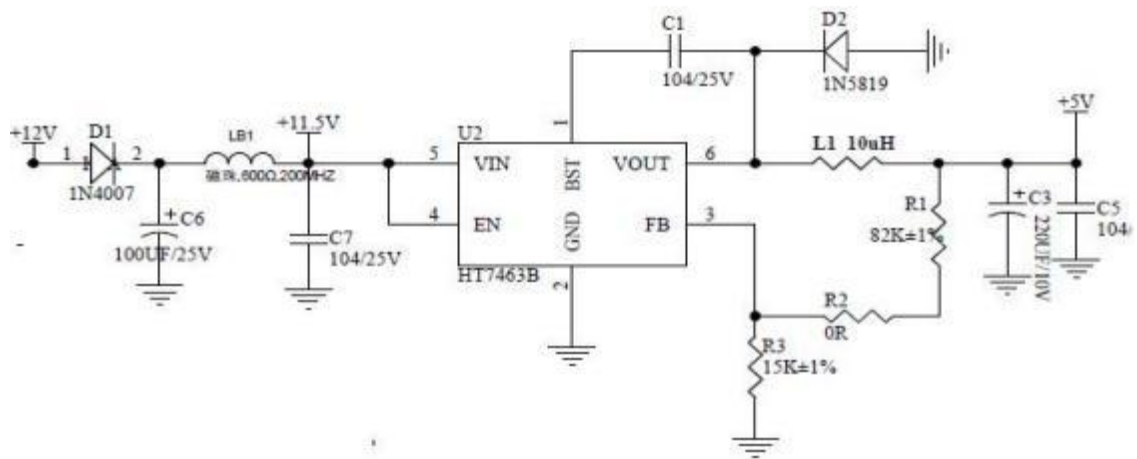
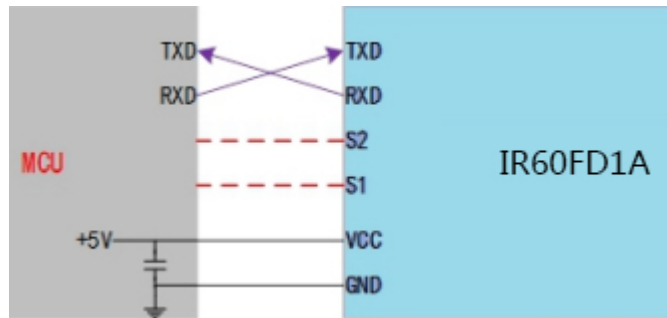


figure 2

## 2.2 . Use wiring diagrams



picture 3

Schematic diagram of radar module and peripheral connection

## 3 .Layout Requirements for Antenna and Housing

PCBA : Need to keep the height of the radar patch  $\geq 1$  mm

higher than other devices

Housing structure: It is necessary to maintain a distance of 2 - 5 mm between the radar antenna surface and the housing surface

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

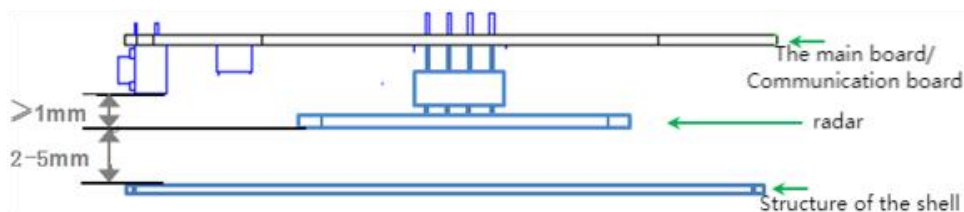


Figure 4

## 4. Static protection

Radar products have electrostatic sensitive circuits inside, which are prone to electrostatic hazards, so they need to be transported, Do a good job of electrostatic protection in the process of storage , work and handling, and do not touch the grasping lightning with your hands. Only touch the corners of the antenna surface and connector pins of the module.

the radar sensor, please wear anti-static gloves as much as possible.

## 5. Detailed function

### 5.1. Function point description

Function point	State change time/function explanation
DP 1 : Man/No Man	No one to someone, report within 0.5s From someone to no one, the output will be stateless in about 30 s
DP 2: Fall Alarm	When it is judged that the fall alarm conditions are met, it will be reported immediately
DP 3: Stationary park alarm	Abnormally remain still for 5 minutes and report the still park alarm

## 6 . Protocol description

This protocol is applied to the communication between the 60 G millimeter wave fall detection radar and the host computer.

This protocol outlines the radar workflow, briefly introduces the structure of the interface protocol, and The control commands and data required for the relevant radar work are given , and the serial communication is defined as follows:

Interface level: TTL  
Baud rate : 115200 bps  
stop bit: 1

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Data bits: 8

Parity : none

## 7. Communication command and parameter definition

### 7.1. Frame structure definition and description



## A , frame structure definition

frame header	control word	command word	length identification		data	check code	end of frame
0 X 53 0 X 59	Control _	Command _	Lenth_H _ _	Lenth_H _ _	Data a	Sum	0 X 54 0 X 4 3
2 Byte	1 Byte	1 Byte	1 Byte	1 Byte	n Byte	1 Byte	2 Byte

## B , frame structure description

- Frame header: 2 Byte , fixed at 0 X 53 , 0 X 59;
- Control word: 1 Byte  
(0 x 01 - Heartbeat Packet ID, 0 x 02 - Product Information, 0 x 03 - OTA Upgrade, 0 x 05 - Working Status, 0 x 06 - Mounting method, 0 x 80 - human presence, 0 x 83 - fall detection)
- Command word: 1 Byte (identify the current data content)
- Length identification: 2 Byte , equal to the specific byte length of the data
- Data: nByte , defined according to the actual function
- Check code: 1 Byte ,  
(Check code calculation: frame header + control word + command word + length identifier + data) After summing, take the lower eight bits )
- Frame end: 2 Byte , fixed at 0 X 54 , 0 X 43;

## 7.2. Address allocation and data information description

product category	Function description	Transmission direction	frame header	control word	command word	length identification	data	check field	end of frame	Remarks
System	Heartbeat packet query	Issued	5 359	01	01	0001	0 F	sum	5 443	
		Reply	5 359	01	01	0001	0 F	sum	5 443	

	Module reset	Issued	5 359	01	02	0001	0 F	sum	5 443	
		report	5 359	01	02	0001	0 F	sum	5 443	

Information query										
	Product model query	Issued	5 359	02	A 1	0001	0 F	sum	5 443	
		Reply	5 359	02	A 1	len	len Product information	sum	5 443	
	product id query	Issued	5 359	02	A 2	0001	0 F	sum	5 443	
		Reply	5 359	02	A 2	len	len B product i d	sum	5 443	
	Hardware model query	Issued	5 359	02	A3 _	0001	0 F	sum	5 443	
		Reply	5 359	02	A3 _	len	len BHardware model	sum	5 443	
	Firmware version query	Issued	5 359	02	A 4	0001	0 F	sum	5 443	
		Reply	5 359	02	A 4	len	len B firmware version Book	sum	5 443	
	Initialization complete information	report	5 359	05	01	0001	0 f	sum	5 443	

		Radar failure upload	report	5 359	05	02	0001	0 1: Radar chip abnormal 0 2: Encryption exception ---	sum	5 443	
		Reporting of working hours	report	5 359	05	03	0004	4 B working hours	sum	5 443	Reporting method: one point bell reported once Value range: 0 -0 xffffffff unit: seconds Not yet defined report by default 0 x 0 0000000

	parameter query										
	Whether the initialization completes the query	Issued	5 359	05	8 1	0001	0 F	Sum	5443		
		Reply	5 359	05	8 1	0001	01: Completed 00: not completed	Sum	5443		
Parameter setting											
Radar Installation Information	Installation angle	Issued	5 359	06	01	0x00 -- 06	2 B X-axis angle+ 2 B Y-axis angle+ 2 BZ axis angle	sum	5 443		
		Reply	5 359	06	01	0x00 -- 06	2 B X-axis angle+ 2 B Y-axis angle+ 2 BZ axis angle	sum	5 443		
	installation height	Issued	5 359	06	02	0002	2 B height information	sum	5 443	unit of height is cm and the step is 1 cm	
		Reply	5 359	06	02	0002	2 B height information	sum	5 443		
	parameter query										
	Installation information query	Installation angle query	Issued	5 359	06	8 1	0001	0 F	sum	5 443	Installation angle query
Reply			5 359	06	8 1	0006	2 B X-axis angle+ 2 B Y-axis angle+ 2 BZ axis angle	sum	5 443		
Installation height query		issued	5 359	06	8 2	0001	0 F	sum	5 443	Installation height query	
		Reply	5 359	06	8 2	0002	2 B height information	sum	5 443		

human body report										
human body function	switch human presence Function	Issued	5 359	8 0	00	0001	0 1: On 0 0: off	sum	5 443	
		Reply	5 359	8 0	00	0001	0 1: On 0 0: off	sum	5 443	
	active presence of information report	report	5 359	8 0	01	0001	0 0: no one 0 1: Someone	sum	5 443	Reporting method: status Report when changes
	Active sports information report	report	5 359	8 0	02	0001	0 0: None 0 1: Still 0 2: Active	sum	5 443	Reporting method: status Report when changes
	Active body motion parameters report	report	5 359	8 0	03	0001	1 B body motion parameters	sum	5 443	Reporting method : on l s report once Value range: 0- 100
	Information query									
	human presence switch Inquire	Issued	5 359	8 0	8 0	0001	0 F	sum	5 443	
		Reply	5 359	8 0	8 0	0001	0 1: On 0 0: off	sum	5 443	
	Existence information query	Issued	5 359	8 0	8 1	0001	0 F	sum	5 443	
		Reply	5 359	8 0	8 1	0001	0 0: no one 0 1: Someone	sum	5 443	

	Sports information query	Issued	5 359	8 0	8 2	0001	0 F	sum	5 443	
		Reply	5 359	8 0	8 2	0001	0 0: None 0 1: Still 0 2: Active	sum	5 443	
	Body Motion Parameter Query	Issued	5 359	8 0	8 3	0001	0 F	sum	5 443	
		Reply	5 359	8 0	8 3	0001	1 B body motion parameters	sum	5 443	Value range: 0- 100

Fall detection active reporting and setting										
Fall detection function	Fall switch monitoring Function	Issued	5 359	8 3	00	0001	0 1: On 0 0: off	sum	5 443	
		Reply	5 359	8 3	00	0001	0 1: On 0 0: off	sum	5 443	
	fall state	report	0x53 -- 0x59 --	8 3	01	0001	00: did not fall 0 1: fall	sum	5 443	Reporting method: status Report when changes
	Fall time settings	Issued	0x53 -- 0x59 --	8 3	0C	0004	4B duration	sum	5443	Numerical time range:  5-180s  Unit: second
		Reply	0x53 -- 0x59 --	8 3	0C	0004	4B duration	sum	5443	
	stationary state	report	0x53 -- 0x59 --	8 3	05	0x00 -- 01	00: no stationary Keep 01: There is a stationary station Keep	sum	5 443	Report when status changes
	Dwell time settings	Issued	5 359	8 3	0 A	0004	4 B duration	sum	5 443	Value range: 60-3600 Unit: second
		Reply	5 359	8 3	0 A	0004	4 B duration	sum	5 443	
	Park switch settings	Issued	5 359	8 3	0 B	0001	1B switch	sum	5 443	0 : off 1: on
		Reply	5 359	8 3	0 B	0001	1B switch 0 1: On 0 0: off	sum	5 443	
Information query										



		Query fall detection switch	Issued	5 359	8 3	8 0	0001	0 F	sum	5 443	
			Reply	5 359	8 3	8 0	0001	0 1: On 0 0: off	sum	5 443	
		Fall status query	Issued	5 359	8 3	8 1	0001	0 F	sum	5 443	
		Fall time query	Issued	5359	83	8C	0001	0F	sum	5443	
			Reply	5359	83	8C	0004	4B duration	sum	5443	
			Reply	5 359	8 3	8 1	0001	00: did not fall 0 1: fall	sum	5 443	
		stationary state query	Issued	5 359	8 3	8 5	0001	0 F	sum	5 443	
			Reply	5 359	8 3	8 5	0001	0 0: no stationary Keep 0 1: There is still parking Keep	sum	5 443	
		Dwell time query	Issued	5 359	8 3	8A _	000 1	0 F	sum	5 443	
			Reply	5 359	8 3	8A _	0004	4B _ duration	sum	5 443	
		still park switch Inquire	Issued	5 359	8 3	8 B	0001	0 F	sum	5 443	
			Reply	5 359	8 3	8 B	0 001	1 B switch 0 1: On 0 0: off	sum	5 443	

OTA _										
O T A	Start OTA upgrade	Issued	5 359	03	01	0013	4 B firmware package size + 15B firmware version number	sum	5 443	
		Reply	5 359	03	01	0004	4 B per frame transmissi on Upgrade package size	sum	5 443	The host computer will follow this of the reply to be downloaded every frame the firmware package? informatio n
	Upgrade package transfer	Issued	5 359	03	02	len + 4	4 B pack offset ground address + len B number packet _	sum	5 443	
		Reply	5 359	03	02	0001	0 1: Received successfully 0 2: Failed to receive	sum	5 443	
	End OTA upgrade	Issued	5 359	03	03	0x00 -- 01	0 1: Firmware package sent send completed 0 2: Firmware package sending has not been completed	sum	5 443	
		Reply	5 359	03	03	0x00 -- 01	0 f	sum	5 443	

## appendix 1: About the data command generation routine

Example: Existence information query :

The data structure that confirms the existence of information query through the above protocol table is:

Frame header : 0 X 53 0 X 59

Control word: 0 X 80

Command word: 0 X 81

Length ID: 0 X 00 0 X 01

Data : 0 X 0 F

Check code: 1 Byte ( SUM )

frame : 0 X 54 0 X 43

Combined into a complete command:

5 3 59 80 81 00 01 0 F sum 54 43

Check code sum :

( 0 X 53+0 X 59+0 X 80+0 X 81+0 X 00+0 X 01+0 X 0 F ) = 0 X 01 BD

Take the low byte to get sum = 0 XBD

Therefore , the complete existence information query command is: 53 59 80 81 00 01 0 F BD 54 43

## 8 . Historical version update instructions

Revision _	Release e Date	Summary _
V 1.0_0613	2 022/06/13	first draft
V 1.1_0712	2022/ 7/12	perfect agreement
V1.2_0916	2022 / 9/1 6	Add time setting interface protocol