

**77G millimeter-wave radar**

**SYV77B1**

**People counting radar**

**Data Book v1.1**

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**Notes:**

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**1. Product introduction****1.1 Product introduction**

The SYV77B1 scene monitoring and people counting radar module employs 77 G millimeter-wave technology and enhanced FMCW system to realize real-time monitoring on the position and trajectory of human bodies. This module realizes dynamic monitoring on people's positions through body motion sensing and background interference elimination, and is capable of counting people, creating trajectories, sensing scene situation, etc.

Radar frequency band	77G millimeter-wave radar
Number of antennas	2T4R
Detection mechanism	FMCW
Active detection	People counting
	Real-time monitoring on positions and trajectories of people
Parameter settings	N/A

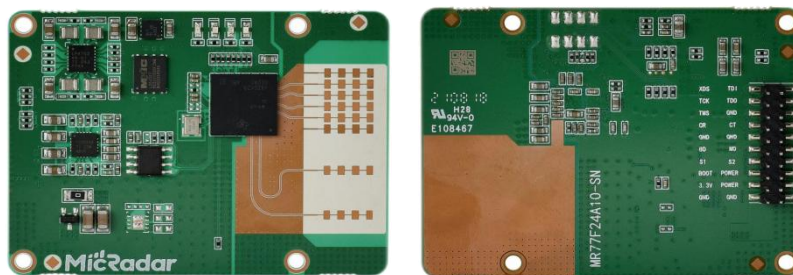


Fig. 1: Front and back sides of the radar

**1.2 Theory of operation**

The radar antenna transmits electromagnetic wave signals, and synchronically receives reflected echo signals. Then, the radar analyzes the phase difference and energy change between waveform parameters of the echo signals from varying antennas, and gives feedback on subtle motion power change, distance, orientation, speed, and other information of the target. This makes it possible to detect the motion state and chest expansion frequency / status of the target.

### 1.3 Product features

- 77 GHz radar sensor
- Realizing 2D regional sensing of people’s dynamics based on enhanced FMCW radar technology
- People counting, and real-time monitoring of distribution and trajectories
- Real-time sensing of scene situation
- Max. sensing distance  $\geq 20$  m
- Monitoring area  $\geq 300$  m<sup>2</sup>
- Width of antenna beams:  $\pm 50^\circ$
- Structured data output. Supporting wireless connection
- Immune from temperature, humidity, noise, air flow, dust, lighting, etc., and hence applicable to severe environments

### 1.4 Applications

- Security for public areas of community
- Regional security
- Business hall monitoring
- Hotel management

## 2. Product encapsulation diagram

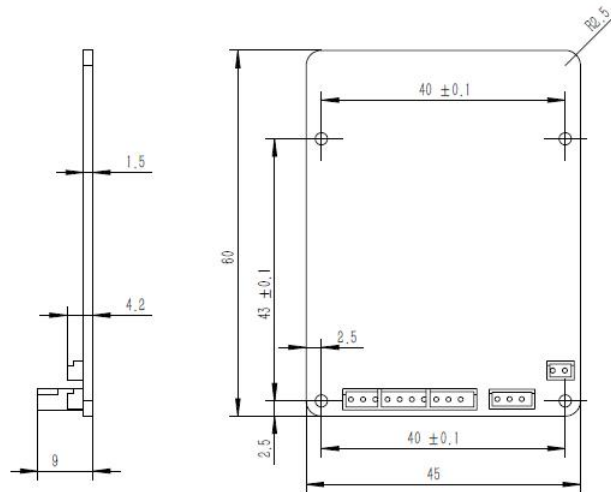


Fig. 2: Schematic diagram for radar module frame

- Volume:  $\leq 60$  mm \* 45 mm \* 5 mm
- Interface: UART / CAN

### 3. Pin parameter explanation

Pin	Notes	Remarks

1	CRX	Configuration send port	This is the port for radar control by the host. It doesn't have to be connected, in which case the radar will run with default parameters.
2	CTX	Configuration receive port	
3	MD	Data output port	The port for data output by the radar.
4	+5V	Input +5.0 power supply	The input end of radar power supply. Working current of radar $\geq 600$ mA
5	V33	Output +3.3 V	External power supply port, current $\leq 150$ mA

	Pin	Description	Typical value	Remarks
Data interface	1	Rx		Control interface (reserved)
	2	GND		
	3	Tx		
	4	GND		Data interface, TTL
	5	Data		
Power interface 1	1	Vcc	+5V	
	2	GND	GND	
Power interface 2	USB			MicroUSB

#### 4. Product features

The SYV77B1 scene monitoring and people counting radar module employs 77 G millimeter-wave technology and enhanced FMCW system to realize

real-time monitoring on the position and trajectory of human bodies. This module realizes dynamic monitoring on people's positions through body motion sensing and background interference elimination, and is capable of counting people, creating trajectories, sensing scene situation, etc.

This module features the following:

- This radar module realizes 2D regional sensing of people's dynamics based on 77 G millimeter-wave radar technology.

- This radar module is capable of eliminating fixed targets in the monitoring area and focusing on moving targets only, so as to realize monitoring on stream of people in complex scenarios.
- This radar module is capable of counting people and analyzing thermal distribution of the stream, both in real time.
- This module senses the distribution, trajectories and other motion-related parameters of people in real time, and is hence capable of realizing real-time scene analysis and judgement for the monitored area.
- This module outputs structured data, which makes it easier for secondary development and processing platform
- The module is immune to temperature, lighting, dust and other factors while bearing extensive detection distance and high sensitivity, making it applicable in a variety of scenarios.

## 5. Parameter description

Parameter	Minimum	Typical value	Maximum	Unit
Performance				
Max. distance of detection		10	15	m
Distance precision		0.2		m
Range of detection angle		±50		degrees (°)
Angle resolution		10		degrees (°)
Max. measurement speed		5		m/s
Speed measurement precision		0.1		m/s
Max. number of tracking		10	16	persons
Precision of people counting		1		persons
Target refresh rate		10		Hz
Working Parameters				
Working voltage (VCC)		5.0	5.5	V
Working current (ICC)		400	500	mA
Transmission parameter				
Working frequency (fTX)	77	78		GHz

Transmission power (Pout)	+8	+10	+12	dBm
Parameters of antenna				
Antenna gain (GANT)		11		dB
Horizontal beam (-3 dB)		±50		degrees (°)
Vertical beam (-3 dB)		±20		degrees (°)
Other parameters				
Working temperature (TOP)	-20		+60	°C
Storage temperature (TST)	-40		+80	°C
Size		60×45×7		mm
Weight		20		g

## 6. Data interface

### 6.1 Data output interface

The SYV77B1 scene monitoring and people counting radar module provides an interface for UART data. The speed of UART interface for board-level communication is 961,200 bps, and the target refresh rate 10 Hz - 15 Hz.

## 7. Operating range and mounting methods

### 7.1 Operating range

The beam coverage of this radar module is shown in Fig. 3. The coverage of the radar is a three-dimensional sector 100° horizontally and 40° vertically, allowing real-time sensing on people in it.

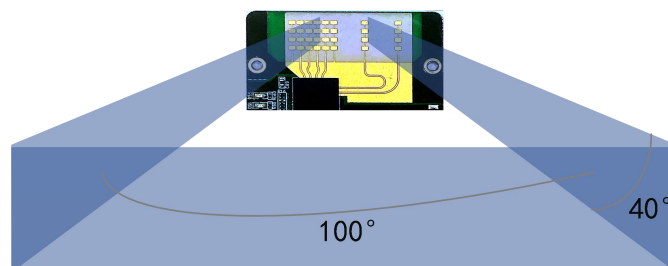


Fig. 3 Coverage of radar

Affected by the characteristics of radar beams, the operating distance along the normal line to the antenna face is greater, while the one displacing from it is smaller.

## 7.2 Installation method

This radar should be mounted at a height of 2 m - 2.5 m from the ground and inclined by 5° - 15° downwards.

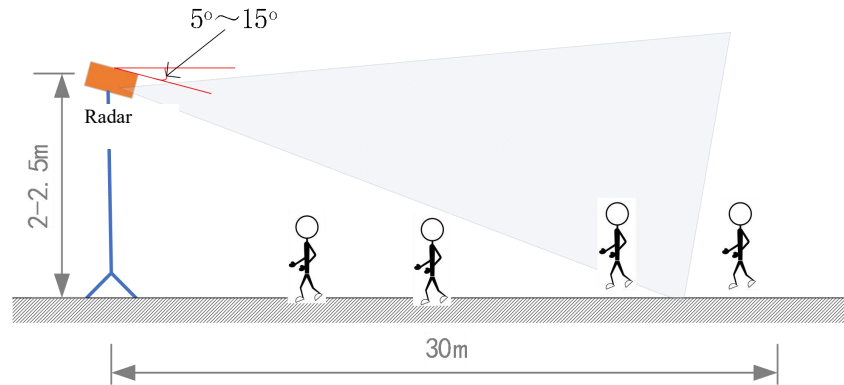


Fig. 4 Diagram of radar mounting

Note:

1. The radar should be installed in a way that no noticeable obstacle lies in front or vicinity of the radar, especially metallic ones;
2. If the tilt angle of mounting is too big, the detection distance will be reduced.

## 7.3 Applications

This product is capable of monitoring distribution / stream / trajectories of people in the monitoring area in real time, and hence applicable to the following scenarios:

- Monitoring of stream of people in the public
- Monitoring of distribution of people in business halls such as a bank
- Hotel management
- Regional security
- Other applications

## 8. Notes

### 8.1 Start-up time

The module needs to fully reset its internal circuits and performs a full assessment on ambient noise when it is powered on and starts to work, so as to ensure the module can work properly. As a result, the module requires a stabilizing time  $\geq 30$  s upon powering on to ensure the effectiveness of parameters output subsequently.



## 9.2 Effective distance of detection

The distance of detection of the radar module depends mainly on target RCS and environmental factors, and might vary with the environment and the target. This module is not provided with distance measurement feature for now, and hence it's normal for the effective distance of detection to fluctuate in a certain range.

## 9.3 Power source

The radar module has requirements higher than regular low-frequency circuits on power source quality. When supplying power to the module, the power source is required to be free from any threshold glitches or ripples, and can effectively shield power supply noise from accessories.

The radar module requires proper grounding. Ground noise from other circuits might compromise the performance or even cause an anomaly in the module. A reduced distance of detection or increased false alarm rate is one of the commonest.

To ensure the VCO circuit inside the module works properly, power supply to this module should be +5V - +6V, with ripple voltage  $\leq 100$  mV.

External power supply must be able to provide sufficient current output and transient response capacity.

## 9. Disclaimer

To our best knowledge, the description in the document is accurate when it was released. Considering the technical complexity of products and the differences in working environments, it's impracticable to eliminate each and every inaccurate or imperfect description. On this account, this document is for reference by the user only. We reserve the right to make any changes to the product without a prior notice to the user. We make no commitments nor guarantees on the legal level. We encourage the customers to give valuable opinions on the latest update on the product and its supportive tools.

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## 12. Revision history

Revision	Release Data	Summary	Author
V1.0 02-27	2/27/2023	First draft	Lucas
V1.1 02-27	3/15/2023	Adjusted the composition of the front portion of the document	Annie