MS24-2020D58M4-LDO-B-5D-NLS-FMCW

24GHz Millimeter Wave Radar Sensor Module Data Sheet

MS24-2020D58M4-LDO-B-5D-NLS-FMCW is a miniaturized 24GHz millimeter radar sensor module launched by MoreSense.

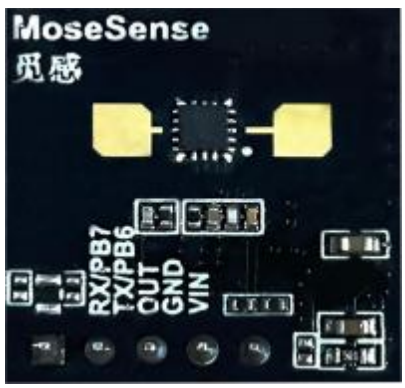
Revision History

Version	Description	Release Date
V1.0	Initial Version	2023-09-19

Catalog

1 Product Description

The MS24-2020D58M4-LDO-B-5D-NLS-FMCW is a highly sensitive 24GHz millimeter wave human presence detection radar module based on the FMCW principle. This radar module is different from traditional radar module. The traditional radar module is detects and accumulates human presence by detecting the human body's large movements or small body movements. The main feature of this module is to determine the presence of a human being by detecting the accumulation of small amplitude movements such as human breathing. Therefore, the detection of human presence is more accurate than traditional motion detection radar and less likely to be missed. Using the FMCW principle, the module can detect the distance, speed, and corresponding status information of the target objects.



2 Product Feature

✯Working Frequency: 24G frequency band;

✯Based on FMCW algorithm,support motion,presence sensing;

✯Can penetrate thin non-metallic materials such as acrylic and glass;

✯ Unaffected by environmental humidity, airflow, dust, noise, brightness and darkness.

3 Application

This module is used for sensor lights, intelligent security, home appliances, smart home and other products which is applied in many places such as corridors, hotels, offices, restrooms that need automatic sensor control.

Smart Human Presence Sensor

Indoor Light

Intelligent Toilet

Office Lighting

Smart Hotel Parking Space Detection

Smart Home

4 Module Parameter

Type	Parameter	Value
RF Parameter	Frequency Range	24.000GHz~24.250GHz
	Transmit Power	3dBm
	Antenna	Built-in;Flat Antenna
Hardware Parameter	Data Interface	GPIO/UART
	Operating Voltage	DC5- 12V(LDO version as default); Optional DC3.3V.
	Operating Current	20mA
	Operating Temperature	-40℃- 55℃
	Storage Temperature	-40℃- 55℃
	Humidity	<85%
	Dimension	20mmx20mm
Default Parameter	Power-On Self-Test Time	2s
	Sensing Output Level	3.3V
	Silent Output Level	0V
	Sensing Output Time	10s
	Customizing the Largest Sensing Distance FOR Motion/Movement	About 6.5m
	Customizing the Largest Sensing Distance FOR Human Presence	3m
	Setting Parameter Method	UART

5 Pin Definition

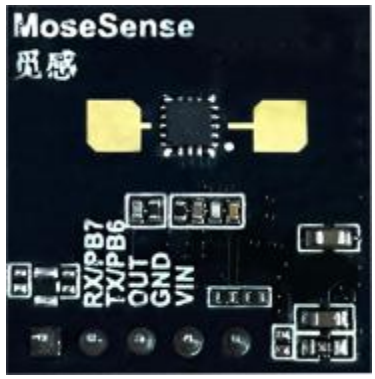
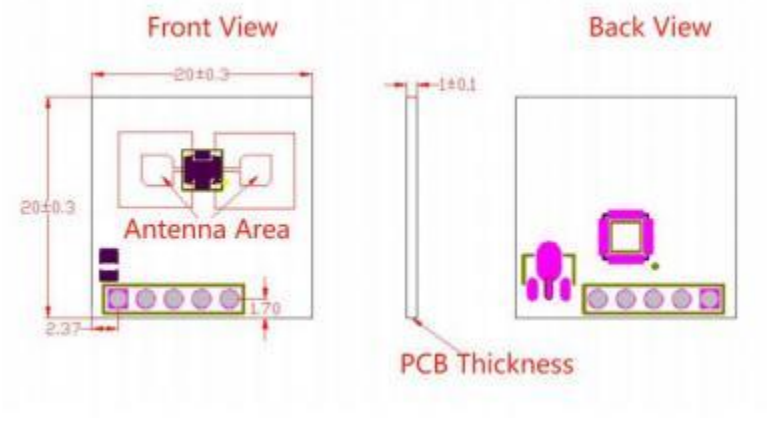


Table 1. MS24-2020D58M4-LDO-B-5D-NLS-FMCW Pin Function Definition

Pin	Name	Type	Description
1	VIN		Power Supply
2	GND		Ground
3	OUT	O	Signal Signal Output
4	TX/PB6	O	UART TX
5	RX/PB7	I	UART RX

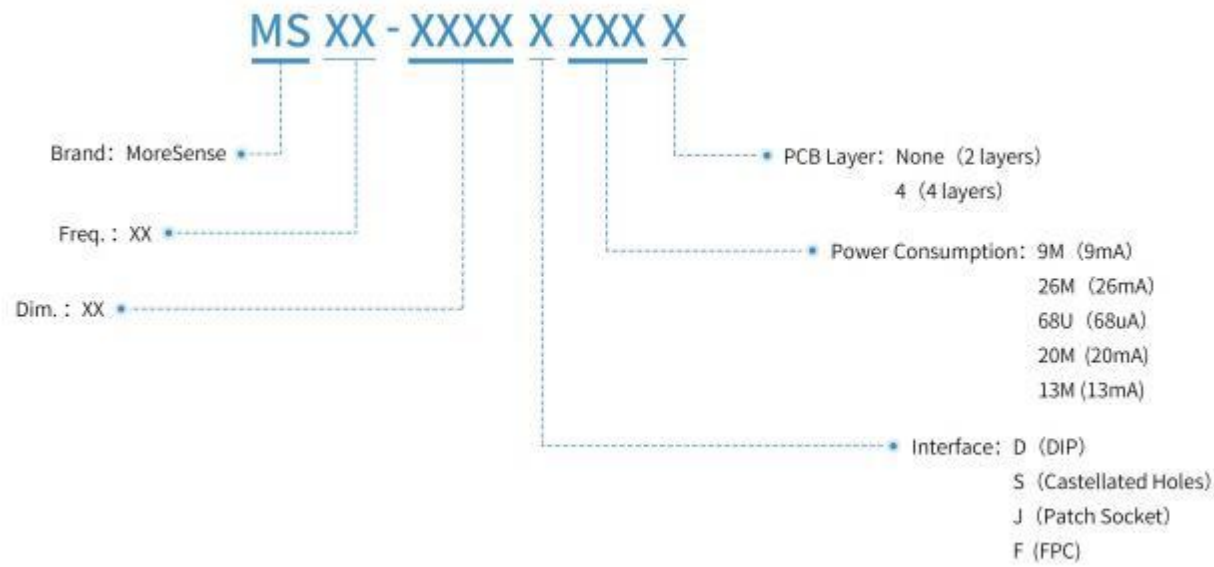
Note: I:Input O:Out

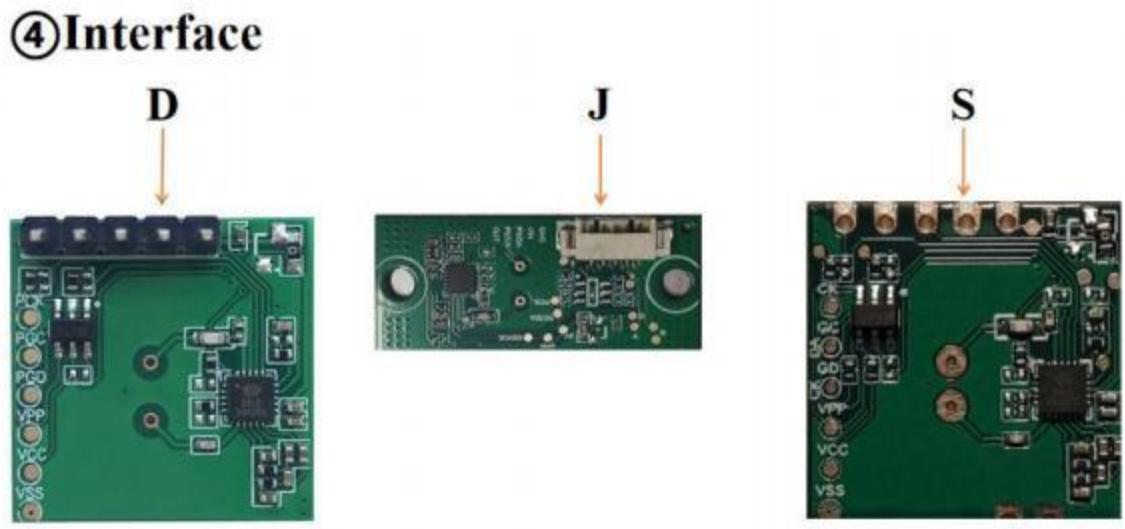
6 Module Dimension



Unit: Millimeter (mm)

7 Name Rule


MS XX - XXXX X XXX X
Brand: MoreSense
Freq.: XX
Dim.: XX
PCB Layer: None (2 layers)
4 (4 layers)
Power Consumption: 9M (9mA)
26M (26mA)
68U (68uA)
20M (20mA)
13M (13mA)
Interface: D (DIP)
S (Castellated Holes)
J (Patch Socket)
F (FPC)


④Interface
D
J
S
PGC
PGD
VPP
VCC
VSS

8 Precautions

※The radar should be operated without metal or other media obstructing the transmission of electromagnetic waves in front of the antenna.

※By different housing materials and distances of the module from the inner surface of the housing, the returned spectral energy and parameter settings will be different. The parameter need to be fine-tuned according to actual conditions. Generally, it is recommended that the module should be 5-6mm away from the housing, which can be adjusted according to the actual conditions.

※We recommend users to test the module according to the default settings of MoreSense firstly. If the result is still not as expected after doing parameter by customers, customer can send the structural parts of the housing to MoreSense who will test and adjust a reference setting.

※When multiple modules are installed at the same time, the distance between modules should be more than 0.5 meters, and avoid the antennas of different modules facing each other.

※The sensitivity can be adjusted according to the user's scenario. Users can adjust the sensitivity according to their actual application scenarios.

※It is recommended to use plastic as the housing, because radar is a very sensitive module. If it is made of high attenuation material, it may affect the detection.

※Avoid air conditioning vents, fans and other objects.

9 Power Supply Requirement

※Isolated power supply must be used. At the same time, the AC rectifier bridge and transformer should avoid direct contact with the module and try not to make the transformer and rectifier face the module, and try not to place the transformer and rectifier directly in front of the module. They can be placed in a staggered position or increase the shielding.

※The ripple of the power supply should be less than 100mV as far as possible to avoid spikes and burrs in the power supply.

※Do not add anti-reverse diodes or other devices in the DC supply link. Adding any device to the DC supply link will increase the power supply noise and lead to the possibility of false alarms.

※The power supply drive current should not be less than the normal operating current of the module.

10 UART Protocol

Module supports AT command to set module parameters, serial port default parameters: 115200,8,1,NONE,NFC.

Setup Instruction:

Function	Command	Return Data	Clarification
Turn on/off motion detection	AT+MOVE_FUNC_ONOFF=onoff\r\n	Succeed: OK\r\n Failed: ERROR\r\n	on off: on/off motion detection function 0: off 1: on
Setting the motion detection distance range	AT+MOVE_RANGE=range_min,range_max\r\n	Succeed: OK\r\n Failed: ERROR\r\n	Unit: cm. default is 10,550. Default is 10,550. range_max must be larger than range_min.
Turn on/off presence detection	AT+BRTH_FUNC_ONOFF=onoff\r\n	Succeed: OK\r\n Failed: ERROR\r\n	on off: On/Off presence detection function 0: off 1: on
Set presence detection distance range	AT+BRTH_RANGE=range_min,range_max\r\n	Succeed: OK\r\n Failed: ERROR\r\n	Unit: cm. default is 10,400. The value of range_max must be larger than range_min.
Set light sensor threshold	AT+LS_TH=ls_th_mv\r\n	Succeed: OK\r\n Failed: ERROR\r\n	Unit: mv. The range of value is 0-3300, otherwise return ERROR. The larger the value, the smaller the lux, set to 0 to turn off the light sensor function.
Set self-test output time	AT+SELFCHECK_TIME=selfcheck_time_ms\r\n	Succeed: OK\r\n Failed: ERROR\r\n	Unit: ms. The configured value must be an integer multiple of 100, otherwise it returns ERROR.
Setting the light-on output time/delay time	AT+ON_TIME=light_on_time_ms\r\n	Succeed: OK\r\n Failed: ERROR\r\n	Unit: ms. The configured value must be an integer multiple of 100, otherwise it returns ERROR.
Setting the light-off protection time	AT+OFF_TIME=light_off_time_ms\r\n	Succeed: OK\r\n Failed: ERROR\r\n	Unit: ms. The configured value must be an integer multiple of 100, otherwise it returns ERROR.
Set OUT invert output	AT+OUT_REVERSE=x\r\n	Succeed: OK\r\n Failed: ERROR\r\n	x: out output mode 0: Positive phase output, output high level when sensing. 1: Inverted phase output, output low level

			when sensing.
Set OUT sensing non-parallel mode	AT+OUT_ONESHOT=mode\r\n	Succeed: OK\r\n Failed: ERROR\r\n	mode: Sense delay mode 0: Delay mode (it means if it is during light-on delay time,when some objects still do movement in the sensing distance range, the set delay time will be re-counted until there is no objects in the set sensing distance range) 1: Non-delay (single) mode
Set UART active report function	AT+AUTO_REPORT=interval_ms \r\n	Succeed: OK\r\n Failed: ERROR\r\n	interval_ms: interval of active reporting, unit: ms. If the value is 0, the active reporting function is disabled; if the value is other than 0, the reporting interval is timed. The configured value must be an integer multiple of 100, otherwise ERROR is returned.
Set UART baud rate	AT+UART=baud\r\n	Succeed: OK\r\n Failed: ERROR\r\n	baud: baud rate. Can be configured as: 9600, 19200, 38400, 57600, 115200. The new baud rate takes effect immediately after configuration, and is restored after reset or reboot. If you need to reset or re-start to take effect, you need to save the parameters.
Save parameter configuration	AT+SAVE\r\n	Succeed: OK\r\n Failed: ERROR\r\n	
Restore factory configuration	AT+RESTORE\r\n	Succeed: OK Failed: ERROR\r\n	
Note: Commands end in \r\n, return data end in \r\n			

Query Instructions:

Function	Command	Return Data	Clarification
Query firmware information	AT+FW_INFO\r\n	OK:MoreSense_xxxx\r\n	Different items can be set up for different project information, which can be used for incoming material inspection
Query software version	AT+VER\r\n	OK:xxx\r\n	Version#
Query chip UUID	AT+UUID\r\n	OK:xxxx\r\n	16 bytes UUID
Query motion detection function switch	AT+MOVE_FUNC_ONOFF\r\n	OK:0\r\n or OK:1\r\n 0：Off 1：On	
Query motion detection range	AT+MOVE_RANGE\r\n	OK:range_min,range_max\r\n	Motion detection minimum and maximum range
Query presence detection function switch	AT+BRTH_FUNC_ONOFF\r\n	OK:0\r\n or OK:1\r\n 0：Off 1：On	
Query presence detection range	AT+BRTH_RANGE\r\n	OK:range_min,range_max\r\n	Presence detection minimum and maximum range
Query the light sensor threshold value	AT+LS_TH\r\n	OK:ls_th_mv\r\n	Unit：mv
Query self-test output time	AT+SELFCHECK_TIME\r\n	OK:selfcheck_time_ms\r\n	Unit：ms
Query light-on output time/delay time	AT+ON_TIME\r\n	OK:light_on_time_ms\r\n	Unit：ms
Query light-off protection time	AT+OFF_TIME\r\n	OK:light_off_time_ms\r\n	Unit：ms。
Query OUT invert output	AT+OUT_REVERSE\r\n	OK:0\r\n or OK:1\r\n 0: Positive phase output 1: Inverted phase output	

Query OUT sensing non-parallel mode	AT+OUT_ONESHOT\r\n	OK:0\r\n 或 OK:1\r\n 0：Delay mode 1：Non-delay (single) mode	
Query UART active report function	AT+AUTO_REPORT\r\n	OK:xx\r\n 0: No reporting Other: active reporting interval	
Query UART baud rate	AT+UART\r\n	OK:baud\r\n	baud：baud rate. 9600、19200、38400、57600、115200
Query radar sensing status	AT+SENSE_STATE\r\n	OK\r\n sense_state=move,distance=xx,mag=xx\r\n or sense_state=brth,distance=xx,mag=xx\r\n or sense_state=nobody\r\n	Move means movement; Brth means presence; Nobody means nobody. Distance denotes distance in cm; Mag denotes signal strength.
Remarks: The instruction ends with \r\n and the return data ends with \r\n. If the instruction returns ERROR, it means that the instruction is wrong			