TIME-IOT
TM9001 2.4G Rf Module

TIME-IOT TM9001 2.4G Rf Module User Guide

Contents

TIME-IOT

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Specifications

- **Product Name**: TM9001 2.4G RF Module
- **Version:** V1.10
- **Manufacturer:** Shanghai Gangji Electronic Technology Co., Ltd.
- **Size:** 16*24mm
- **Power Output**: Maximum +10dBm
- **Operating Voltage:** 1.9V – 3.6V
- **Frequency Range:** 2.4GHz
- **Data Rates:** 2 Mbps, 1 Mbps, 500 Kbps, 250 Kbps
- **Channels:** 125

Product Description

Tm9001 is a low-power and low-cost RF module designed for short-range wireless transmission. It features a 32-bit RISC core MCU, 2.4G radio module, 8KB RAM, 16KB OTP, and rich peripheral resources.

Features

- Small form factor with dimensions of 16*24mm
- The high power output of up to +10dBm
- Support for ISM 2.4GHz frequency band
- Support for multiple data rates (2 Mbps, 1 Mbps, 500 Kbps, 250 Kbps)
- 125 channels available
- Support for secondary development
- Operating voltage range of 1.9V to 3.6V
- 32-bit RISC core with support for secondary development
- On-board antenna design

DESCRIPTION

PRODUCT DESCRIPTION

Tm9001 is a low-power and low-cost RF module developed by Shanghai Gangji Electronic Technology Co., Ltd. for short-range wireless transmission. It integrates a 32-bit RISC core MCU, 2.4G radio module, 8KB RAM, 16kb OTP, and rich peripheral resources.

Appearance size&Pin define

Pin define

Figure 1 Pin define

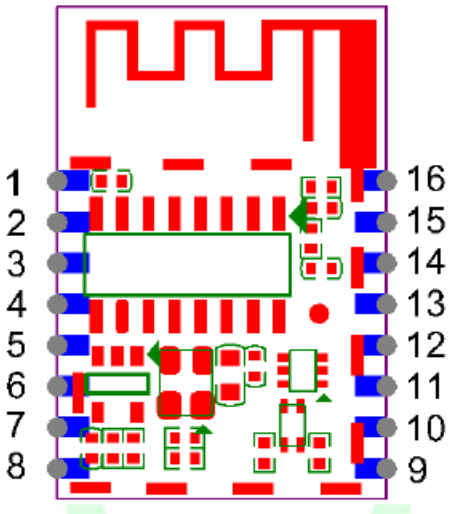
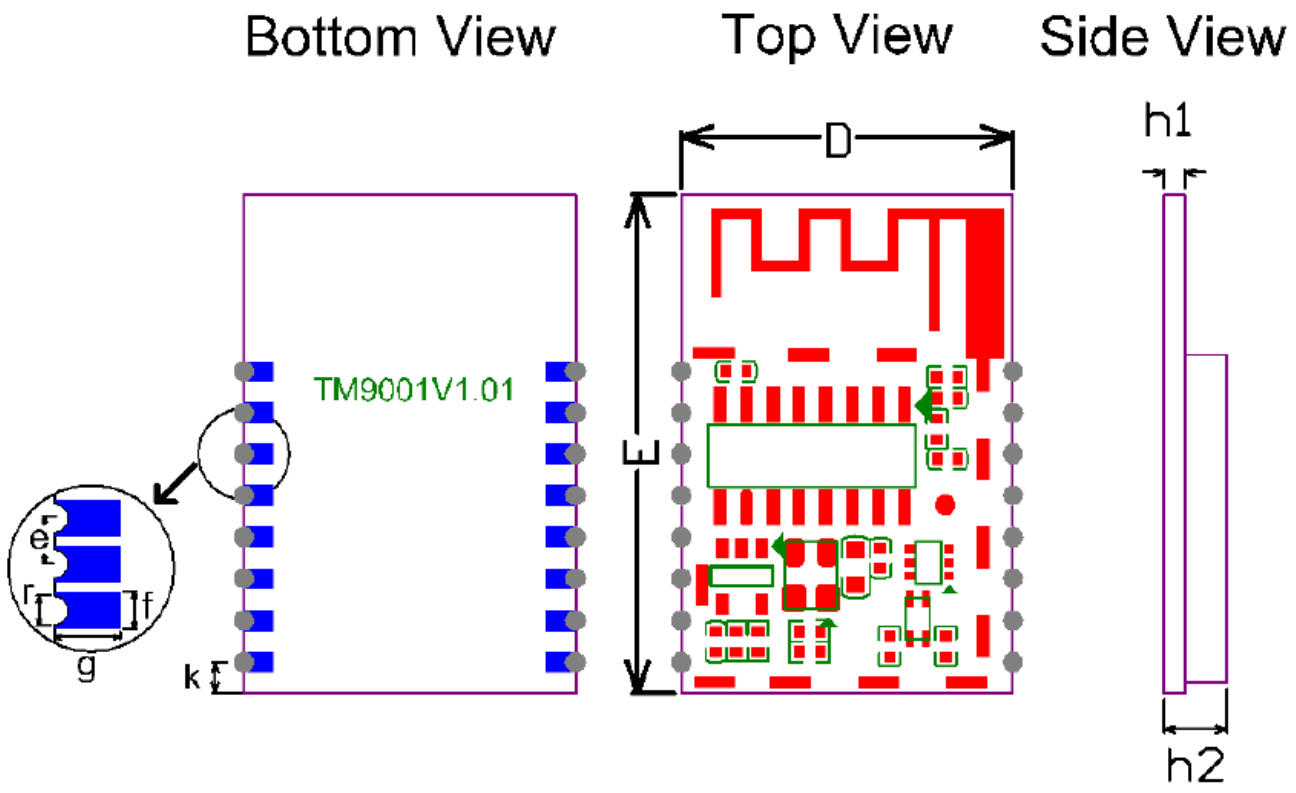


Table Pin define

Pin	Symbol	Type	Description
1	reserve	DIO	reserve
2	NC		NC
3	VPP	Power	Programming power
4	PD2	DIO	LED PIN
5	PB3	DIO	LED PIN
6	PC7/SWS	DIO	Debug PIN
7	NC		NC
8	VCC	Power	Power in
9	GND	Power	Ground
10	NC		NC
11	NC		NC
12	NC		NC
13	NC		NC
14	NC		NC
15	UART_RXD	DI	UART_Data_input
16	UART_TXD	DO	UART_Data_output

Appearance size



ELECTRICAL PARAMETERS

Electrical characteristics

Item	Symbol	Min	Typical	Max	Unit	
Power supply voltage	VDD	1.9	3.3	3.6	V	
Operating temperature	TOpr	-40		85	oC	
Operating humidity				95%		
Transmit mode	ITx		14.5		mA	TX@0dBm
			25		mA	TX@8dBm
Receive mode	IRx		13.6		mA	
Suspend mode	ISusp		6.8		uA	
Deep sleep mode	IDeep		2.0		uA	

Note: All test items are at (T=25℃).

RF performance

Item	Symbol	Min	Typical	Max	Unit	
Frequency range	Freq	2400		2480	MHz	
Data rate		0.25		2	Mbps	
Receive sensitivity	Rsen		-86		dBm	@1Mbps
Transmit power	Pout	-20		7	dBm	
ANT Gain	Gain		1.5		dBi	

static electricity						
VEST				2000	V	HBM
VEST				500	V	CDM

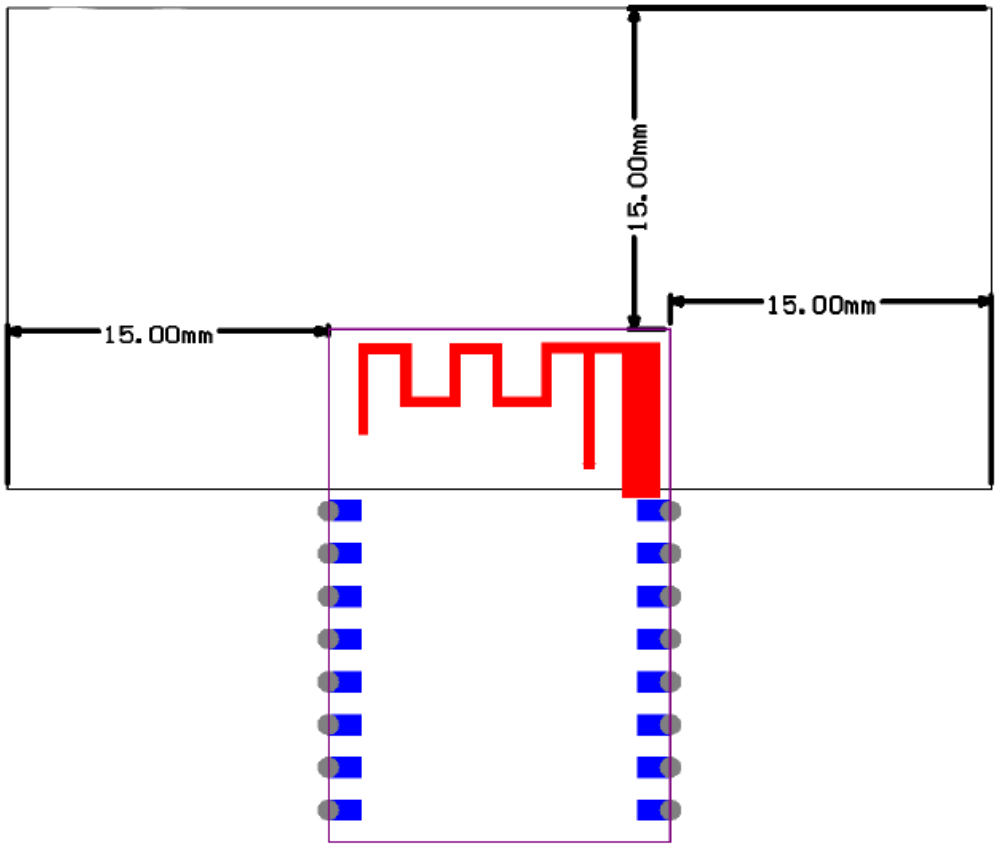
Design reference

Hardware design consideration

- It is recommended to use DC regulated power supply to supply power to the module. The ripple coefficient of the power supply shall be as small as possible, and the module shall be reliably grounded
- If the positive and negative polarity of the power supply module is correctly connected, please note that it may cause permanent damage check the power supply to ensure that it is between the recommended power supply voltage. Exceeding the maximum value will cause permanent damage to the module
- Please check the stability of the power supply. The voltage cannot fluctuate greatly and frequently
- When designing the power supply circuit for the module, it is often recommended to reserve more than 30% margin, which is conducive to the long-term and stable operation of the whole machine
- The module shall be as far away from the power supply, transformer, high-frequency wiring, and other parts with large electromagnetic interference as far as possible
- The high-frequency digital wiring, high-frequency analog wiring, and power wiring must avoid the lower part of the module. If it is necessary to pass under the module, it is assumed that the module is welded on the top layer, and the copper is laid on the top layer of the contact part of the module (all copper is laid and well-grounded). It must be close to the digital part of the module and routed in the bottom layer
- Assuming that the module is welded or placed in the top layer, it is also wrong to randomly route in the bottom layer or other layers, which will affect the stray and receiving sensitivity of the module to varying degrees
- It is assumed that there are devices with large electromagnetic interference around the module, which will also greatly affect the performance of the module. According to the intensity of interference, it is recommended to stay away from the module properly, and if the situation allows, appropriate isolation and shielding can be done
- It is assumed that there are wires with large electromagnetic interference around the module (high-frequency digital, high-frequency analog, and power wiring) which will also greatly affect the performance of the module. According to the intensity of interference, it is recommended to stay away from the module properly, and appropriate isolation and shielding can be done if the situation allows
- Keep away from some physical layers as far as possible, also 2 4GHz TTL protocol, such as USB3 0
- The antenna installation structure has a great impact on the performance of the module. Make sure that the antenna is exposed, preferably vertically upward. When the module is installed inside the shell, the high-quality antenna extension cable can be used to extend the antenna to the outside of the shell. It must not be installed inside the metal shell
- A professional antenna should be used. Pay attention to the impedance matching betweenantenna and ant pin. Impedance mismatch will greatly weaken the signal strength.

Antenna clearance area

- When using a PCB antenna on a Bluetooth module, it is necessary to ensure that the distance between the mainboard PCB and other metal devices is at least 15mm. The marked area in the black box in the figure below needs to be far away from metal devices, sensors, interference sources, and other materials that may cause signal interference.



Problem

Short distance

- When there is a straight-line communication obstacle, the communication distance will be attenuated accordingly
- Temperature, humidity, and co-frequency interference will increase the packet loss rate of communication
- The ground absorbs and reflects radio waves, and the test effect near the ground is poor;
- Seawater has a strong ability to absorb radio waves, so the seaside test effect is poor
- If there are metal objects near the antenna or placed in a metal shell, the signal attenuation will be very serious
- At room temperature, the low voltage of the power supply is lower than the recommended value. The lower the voltage, the smaller the power
- Antenna impedance mismatch the

module is easily damaged

- Please check the power supply to ensure that it is between the recommended power supply voltage. Exceeding the maximum value will cause permanent damage to the module: ※ Please check the stability of the power supply. The voltage cannot fluctuate too much
- Please ensure anti-static operation during installation and use, and high-frequency devices are sensitive to static electricity
- Please ensure that the humidity is not too high during installation and use, and some components are humidity-sensitive devices
- If there are no special requirements, it is not recommended to use it at too high or too low temperature
- Production operation instruction

Preservation and baking of modules

- The modules delivered by our company are packaged in disk and vacuum electrostatic bag.
- It shall be stored in an environment with a temperature < 30
- C and humidity < 85% RH
- For modules exposed to air for more than 24 hours or in a high humidity environment, the baking operation shall be carried out before production.
- Bake temperature 125℃±5℃
- Alarm temperature:130℃
- SMT patch can be carried out after cooling to 36 ℃ under natural conditions
- Drying times ≤1
- If it is not used for more than 12 hours after baking, please bake again
- The module shall be used as soon as possible after unpacking. If the unpacking time is more than 3 months, please do not use the SMT process to weld this batch of modules. Due to the PCB gold deposition process, the pad oxidation is serious after more than 3 months, and the SMT patch is likely to lead to false soldering and missing soldering. Our company will not bear the corresponding responsibility for the problems caused by this.

Attention

- In the whole process of production, the operators of each station must wear electrostatic gloves
- The baking time shall not exceed the baking time
- It is forbidden to add explosive, combustible, and corrosive substances during baking
- When baking, the module shall be put into the oven with a high-temperature tray to maintain air circulation between each module and avoid direct connection between the module and the inner wall of the oven when baking, please close the oven door to ensure that the oven is closed to prevent temperature leakage and affect the baking effect
- Try not to open the oven door when the oven is running. If it must be opened, try to shorten the opening time
- After baking, the module shall be cooled to < 36 ℃ naturally before being taken out with electrostatic gloves to avoid scalding
- During operation, the bottom surface of the module shall be strictly prevented from being contaminated with water or dirt

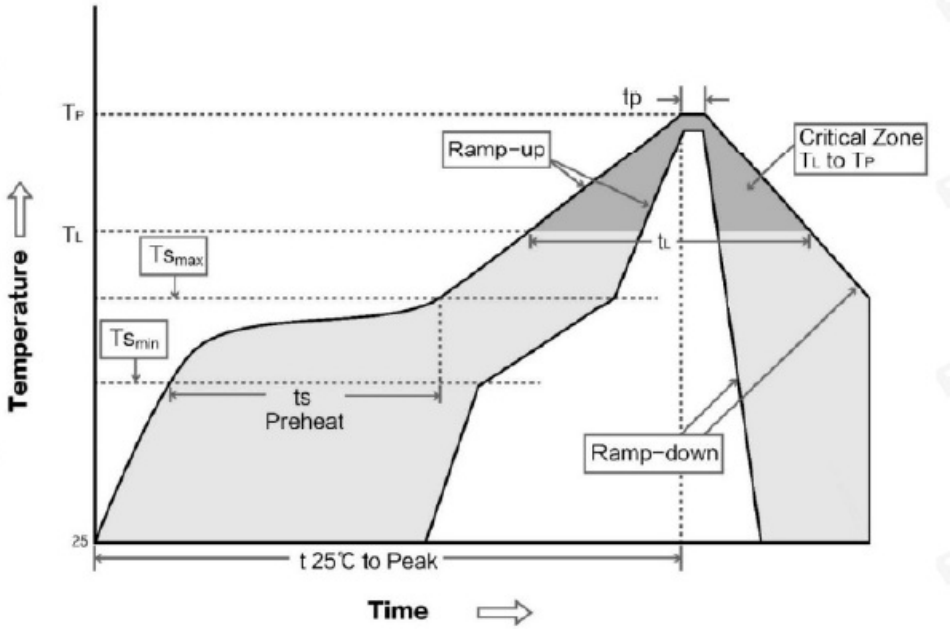
SMT temperature

Profile Feature
Solder Paste
Preheat Temperature min (Tsmin)
Preheat temperature max (Tsmax)
Preheat Time (Tsmin to Tsmax)(ts)
Average ramp-up rate(Tsmax to Tp)
Liquidous Temperature (TL)
Time (tL) Maintained Above (TL)
Peak temperature (Tp)
Aveage ramp-down rate (Tp to Tsmax)
Time 25℃ to peak temperature

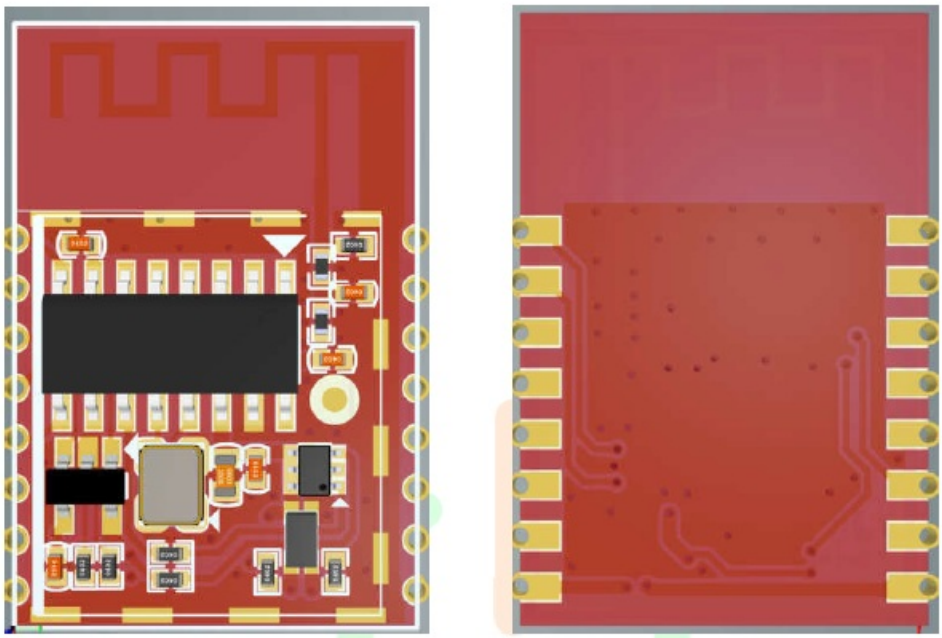
Sn-Pb Assembly	Pb-Free Assembly
Sn63/Pb37	Sn96.5/Ag3/Cu0.5
100℃	150℃
150℃	200℃
60-120 sec	60-120 sec
3℃/second max	3℃/second max
183℃	217℃
60-90 sec	30-90 sec
220-235℃	230-250℃
6℃/second max	6℃/second max
6 minutes max	8 minutes max

SMT temperature curve

Figure 6 SMT temperature curve



3D VIEW



Appendix:

IC warning
This device contains license-exempt transmitter(s)/receiver(s) that comply with Innovation, Science, and Economic Development Canada's license-exempt RSS(s). Operation is subject to the following two conditions:

- this device may not cause interference, and
- this device must accept any interference, including interference that may cause undesired operation of the device.
- This equipment complies with IC RSS-102 radiation exposure limits set forth for an uncontrolled environment.
- This equipment should be installed and operated with a minimum distance of 20cm between the radiator & your body.
    - The module is limited to OEM installation ONLY.
    - The OEM integrator is responsible for ensuring that the end user has no manual instructions to remove or install the module.
    - That module is limited to installation in mobile or fixed applications, according to Part 2.1091(b).
    - That separate approval is required for all other operating configurations, including portable configurations concerning Part 2.1093 and different antenna configurations.
    - 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, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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

- **Note:**

  This equipment has been tested and found to comply with the limits for a Class B digital device, under part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a

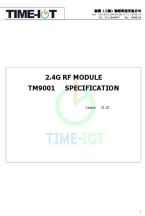
residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used by the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this 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 the receiver.
- Connect the equipment to 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.
- This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.
- This equipment should be installed and operated with a minimum distance of 20cm between the radiator & your body.
- The OEM must comply with the FCC labeling requirements.
- If the module's label is not visible when installed, then an additional permanent label must be applied on the outside of the finished product which states: "Contains transmitter module FCC ID: 2BGGF-TM9001"

Frequently Asked Questions

- **Q: What is the recommended power supply voltage for the TM9001 module?**
  A: The recommended power supply voltage range for the TM9001 module is between 1.9V to 3.6V.
- **Q: Can I exceed the maximum power supply voltage specified?**
  A: Exceeding the maximum power supply voltage may cause permanent damage to the module. It is important to stay within the specified range.

Documents / Resources

	TIME-IOT TM9001 2.4G Rf Module [pdf] User Guide TM9001 2.4G Rf Module, TM9001, 2.4G Rf Module, Rf Module, Module

References

- User Manual