



# **WT8089-SF1 Datasheet**

V1.0.0

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Wireless-Tag Technology Co., Ltd.



## **About this document**

This document provides users with the technical specifications of WT8089-SF1.

## **Document version**

Please visit Wireless-Tag's official website to download the latest version of the document.

## **Revision history**

Please go to the document revision history page to view the revisions of the document.

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## **Statement**

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### Document Revision History

No.	Version	Changes	Change (+/-) description	Author	Date
1	V1.0.0	C	First release	Fiona	January 19, 2021

\*Changes: C--Create, A--Add, M--Modify, D--Delete

<http://www.wireless-tag.cn/>



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# 1 Overview

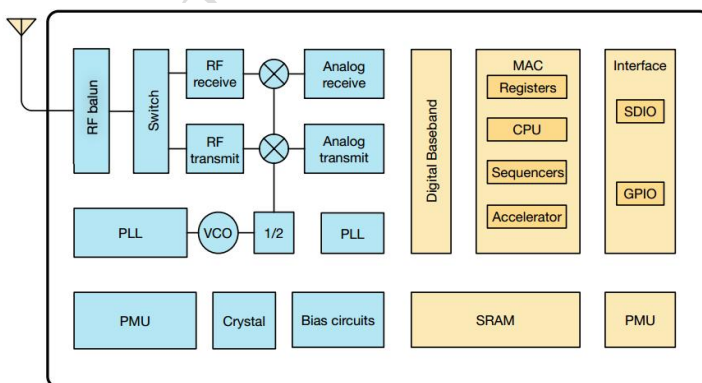
WT8089-SF1 is a Wi-Fi module based on Espressif's ESP8089 SoC developed by Wireless-Tag, which features simple interface, low power consumption, and high power data transmission. WT8089-SF1 supports standard IEEE 802.11 b/g/n protocol; it can achieve communication with external MCU through SPI/SDIO interface or central processor unit AHB bridge interface in terms of hardware.

WT8089-SF1 supports fast switching between sleep/wake mode for energy-efficient VoIP, adaptive radio biasing for low-power operation, advanced signal processing, and spur cancellation and radio co-existence features for cellular/BLE/802.11 interference mitigation. It is widely used in the following fields: home automation, home security, smart home appliances, accessories, drones, OTT boxes, industrial Internet, etc.

## Product features:

- Support standard IEEE802.11 b/g/n protocol
- Support Wi-Fi Direct(P2P), Miracast, SoftAP
- Integrated TR switch, balun, LNA, power amplifier and matching network
- Integrated PLL, regulators and power management units
- +19 dBm output power in 802.11b mode
- Power down leakage current of  $< 10 \mu\text{A}$
- SDIO2.0, SPI interfaces
- STBC, 1x1 MIMO, 2x1MIMO
- A-MPDU & A-MSDU aggregation &  $0.4 \mu\text{s}$  guard interval
- Wake up, connect and transmit data packets within 22ms
- Standby power consumption of  $< 1.0 \text{ mW}$  (DTIM3)

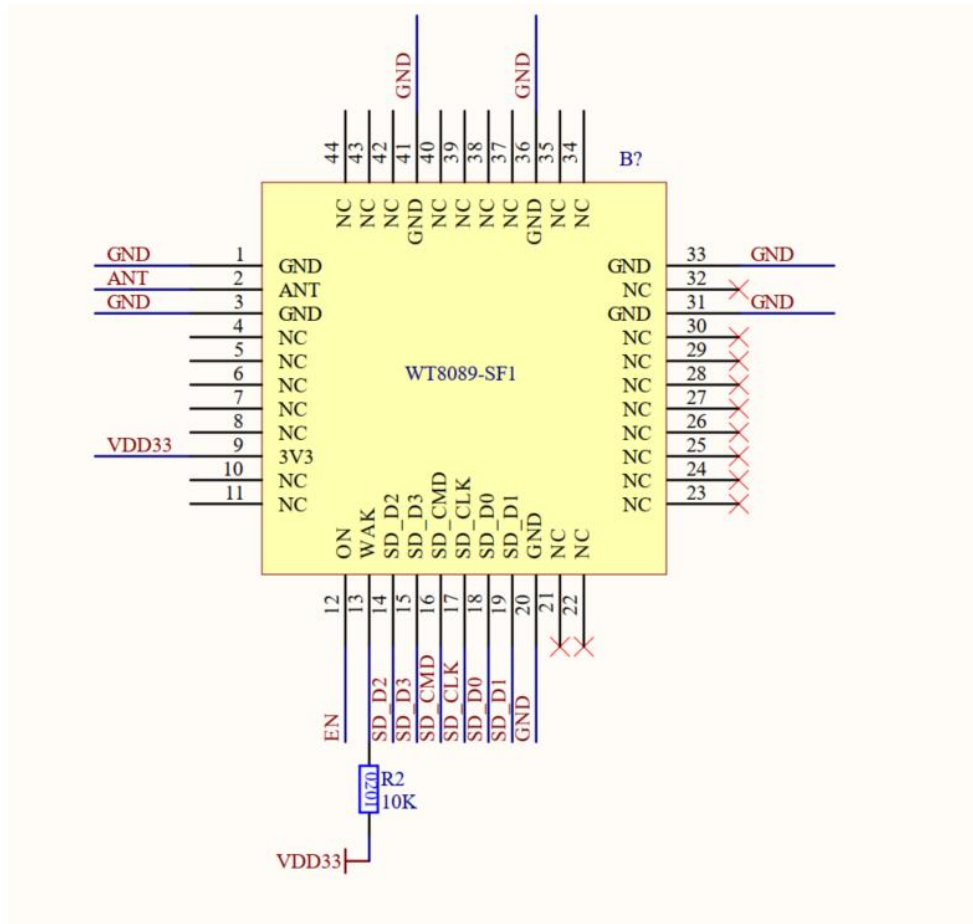
Figure 1. Block Diagram



## 2 Hardware Specifications

### 2.1 Pin Layout

Figure 2. Top View of Pin Layout



### 2.2 Pin Description

The module has a total of 44 pins, as shown in Table 1.

Table 1. Pin Functions

Pin No.	Pin Name	Function Definition	Description
1	GND		GND
2	ANT		ANT
3	GND		GND
4	NC		NC
5	NC		NC
6	NC		NC
7	NC		NC
8	NC		NC
9	VDD33	3V3	Power supply voltage DC: 2.5v-3.6v (3.3V, 500mA or above is recommended)



Pin No.	Pin Name	Function Definition	Description
10	NC		NC
11	NC		NC
12	EN	ON	Enable pin, high level enable (the module has been pulled up to high level by default), which can be connected to the main control IO port.
13	VDD33	WAKE	NC
14	SD_D2		SDIO_DATA_2
15	SD_D3		SDIO_DATA_3
16	SD_CMD		SDIO_CMD
17	SD_CLK		SDIO_CLK
18	SD_D0		SDIO_DATA_0
19	SD_D1		SDIO_DATA_1
20	GND		GND
21	NC		NC
22	NC		NC
23	NC		NC
24	NC		NC
25	NC		NC
26	NC		NC
27	NC		NC
28	NC		NC
29	NC		NC
30	NC		NC
31	GND		GND
32	NC		NC
33	GND		GND
34	NC		NC
35	NC		NC
36	GND		GND
37	NC		NC
38	NC		NC
39	NC		NC
40	NC		NC
41	GND		GND
42	NC		NC
43	NC		NC
44	NC		NC

## 2.3 Parameters

### 2.3.1 Module Parameters

The detailed parameters of WT8089-SF1 module are shown in Table 2.

**Table 2 Module Parameters**

<b>PCB</b>	1. Layer: 4 layers		
	2. Dimensions: 13.5*13*1.8mm		
	3. Interface: Standard 1.5mm half hole pins, directly mounted on circuit boards		
	4. Material: high permittivity and low loss plate for RF		
<b>Module features</b>	1. Operating Voltage: 2.5V-3.6V		
	2. Operating temperature: - 20 °C-85 °C		
	3. Wi-Fi standard: 802.11 b/g/n		
	4. Antenna: stamp hole expansion antenna interface		
	5. Transmit power: maximum +19dBm in 802.11b mode		
	6. Communication interface: SDIO	4-bit 25MHz	SDIO v1.1
4-bit 50MHz		SDIO v2.0	

### 2.3.2 Electrical Characteristics

**Table 3. Electrical Characteristics**

Parameter	Condition	Minimum	Typical	Maximum	Unit
Storage temperature range		-40	Room temperature	125	°C
Maximum welding temperature	IPC/JEDEC J-STD-020	-	-	260	°C
Working voltage VIO	-	2.5	3.3	3.6	V
Arbitrary I/O	VIL/VIH	-	-0.3/0.75VIO	0.25VIO/3.3	V
	VOL/VOH	-	-/0.8VIO	0.1VIO/-	
	I MAX	-	-	-	12
Electrostatic discharge (human body model)	TAMB=25°C	-	-	2	KV
Electrostatic discharge (machine model)	TAMB=25°C	-	-	0.5	KV





### 2.3.3 RF Parameters

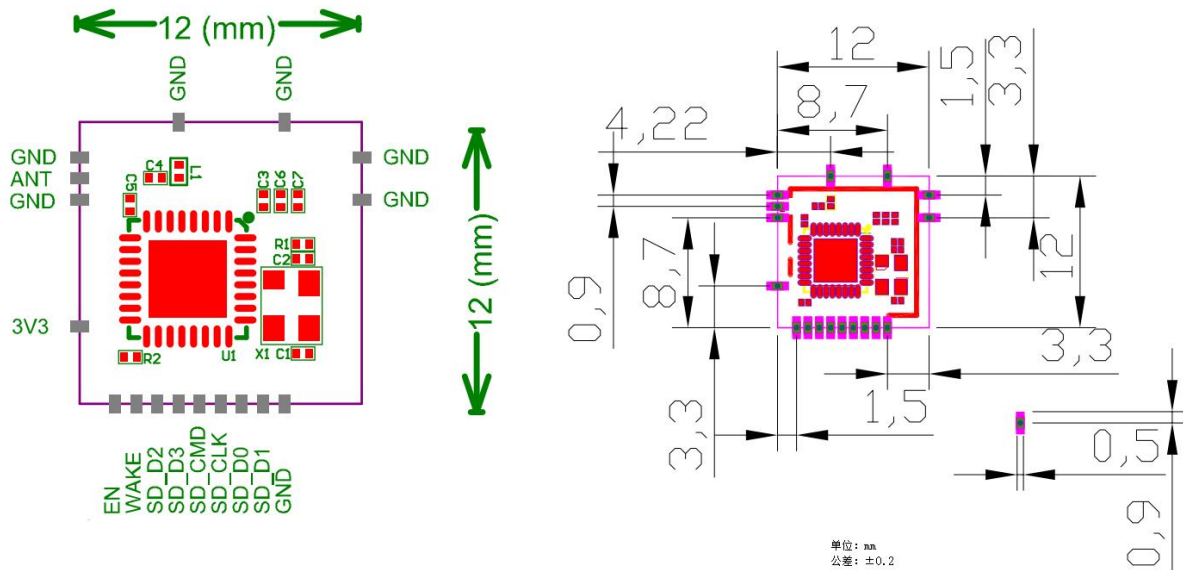
The following parameters are tested under normal temperature and the module voltage is 3.3V. The detailed parameters are shown in Table 4.

**Table 4. RF Parameters**

Parameter	Minimum	Typical	Maximum	Unit
Input frequency	2412		2484	MHz
Input impedance	-	50	-	$\Omega$
PA output power under MCS0	17.2	17.9	18.2	dBm
PA output power under 11M	17.1	18.3	18.5	dBm
<b>Sensitivity</b>				
DSSS, 1Mbps	-	-98	-	dBm
CCK, 11Mbps	-	-91	-	dBm
6Mbps (1/2 BPSK)	-	-93	-	dBm
54Mbps (3/4 64-QAM)	-	-74	-	dBm
HT20, MCS0	-	-92	-	dBm
HT20, MCS7 (65Mbps, 72.2Mbps)	-	-70	-	dBm
<b>Adjacent Channel Rejection</b>				
OFDM, 6Mbps		37		dB
OFDM, 54Mbps		21		dB
HT20, MCS0		37		dB
HT20, MCS7		20		dB
<b>Startup Time</b>				
Crystal startup time		500		$\mu$ S
Crystal frequency deviation	-5	0	2	ppm
Baseband PLL startup time		100		$\mu$ S
RF PLL startup time		200		$\mu$ S
Rx RF startup time		2		$\mu$ S
Tx RF startup time		2		$\mu$ S

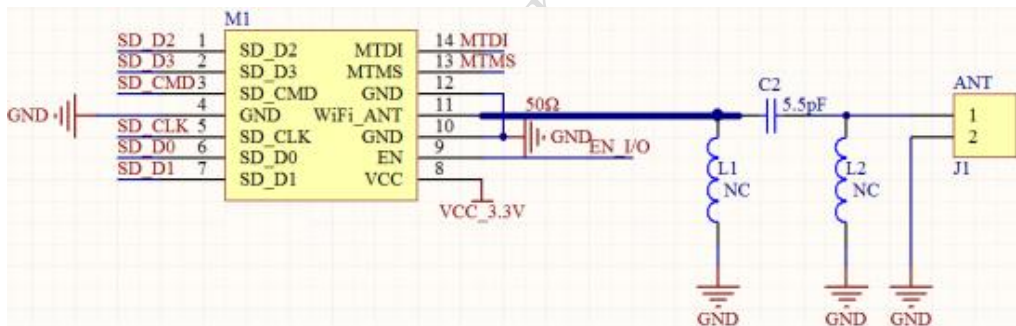
## 2.4 Mechanical Dimensions

Figure 3. Module Dimensions



## 3 Typical Circuit Connection of Wi-Fi Module

Figure 4 Typical Circuit Connection



Notes for PCB layout:

1. The output impedance of Pin11 (WiFi\_ANT) of the module is  $50\Omega$ , so there is no need to match the module. It is recommended to keep the  $\pi$ -type matching network to match the antenna.
2. Pin9 (EN) is active at high level. It is recommended to design according to the above reference circuit, or it can be controlled by the main control I/O port;
3. SDIO wiring should be short;
4. It is recommended not to route wires under the WiFi module on the motherboard, and keep away from sensitive devices (such as crystal oscillators, cameras, etc.);
5. After the module is soldered on the motherboard, antenna matching and RF performance testing are required.



## **Federal Communication Commission Statement (FCC, U.S.)**

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 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.

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 Caution:**

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

### **FCC Radiation Exposure Statement:**

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

## **IMPORTANT NOTES**

### **Co-location warning:**

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

### **OEM integration instructions:**

This device is intended only for OEM integrators under the following conditions:

The transmitter module may not be co-located with any other transmitter or antenna. The module shall be only used with the external antenna(s) that has been originally tested and certified with this module.

As long as the conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

**Validity of using the module certification:**

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization for this module in combination with the host equipment is no longer considered valid and the FCC ID of the module cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

**End product labeling:**

The final end product must be labeled in a visible area with the following: “Contains Transmitter Module FCC ID: 2AFOS-WT8089-SF1”.

**Information that must be placed in the end user manual:**

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.

**Integration instructions for host product manufactures according to KDB 996369 D03****OEM Manual v01****2.2 List of applicable FCC rules**

FCC Part 15 Subpart C 15.247

**2.3 Specific operational use conditions**

The module is a WiFi 2.4G module .

**WiFi Specification:**

Operation Frequency: 2412~2462MHz

Number of Channel: 11

Modulation: DSSS, OFDM

Type: FPC Antenna

Gain: 1.8 dBi

The module can be used for mobile or applications with a maximum 1.8dBi antenna. The host manufacturer installing this module into their product must ensure that the final composit product complies with the FCC requirements by a technical assessment or evaluation to the FCC rules, including the transmitter operation. The host manufacturer 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.



## 2.4 Limited module procedures

Not applicable.

## 2.5 Trace antenna designs

Not applicable. The module has its own antenna, and doesn't need a host's printed board microstrip trace antenna etc.

## 2.6 RF exposure considerations

The module must be installed in the host equipment such that at least 20cm is maintained between the antenna and users' body; and if RF exposure statement or module layout is changed, then the host product manufacturer required to take responsibility of the module through a change in FCC ID or new application. The FCC ID of the module cannot be used on the final product. In these circumstances, the host manufacturer will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization

## 2.7 Antennas

Antenna Specification are as follows:

Type: FPC Antenna

Gain: 1.8 dBi

This device is intended only for host manufacturers under the following conditions: The transmitter module may not be co-located with any other transmitter or antenna; The module shall be only used with the internal antenna(s) that has been originally tested and certified with this module. The antenna must be either permanently attached or employ a 'unique' antenna coupler. As long as the conditions above are met, further transmitter test will not be required. However, the host manufacturer is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.)

## 2.8 Label and compliance information

Host product manufacturers need to provide a physical or e-label stating "Contains Transmitter Module FCC ID: 2AFOS-WT8089-SF1" with their finished product.

## 2.9 Information on test modes and additional testing requirements

### WIFI

Operation Frequency: 2412~2462MHz

Number of Channel: 11

Modulation: DSSS

Host manufacturer must perform test of radiated & conducted emission and spurious emission, etc according to the actual test modes for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product. Only when all the test results of test modes comply with FCC requirements, then the end product can be sold legally.



## 2.10 Additional testing, Part 15 Subpart B disclaimer

The modular transmitter is only FCC authorized for FCC Part 15 Subpart C 15.247 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 circuitry), 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.



Manufacturer's Name: WIRELESS-TAG TECHNOLOGY  
CO., LIMITED

Sample Description: WIFI Module

Trade Mark: Wireless-tag Model  
number: WT8089-SF1

This device was tested for operations. To comply with RF exposure requirements, a minimum separation distance of 20cm must be maintained between the user's body and the radiator, including the antenna.

Accessories that do not meet these requirements may not comply with RF exposure requirements and should be avoided. Use only the supplied or an approved antenna. This device in compliance with the essential requirements and other relevant provisions of Directive 2014/53/EU. All essential radio test suites have been carried out. This restriction will be applied to all Member States of European Union.

1. The device complies with RF specifications when the device used at 20cm from your body Declaration of Conformity

Hereby, WIRELESS-TAG TECHNOLOGY CO., LIMITED declares that the product type WT8089-SF1 is in compliance with Directives 2014/53/EU.



RF specification:

Function	Operation Frequency	Max RF Outputpower (dBm)
2.4GWIFI	2412-2472MHz	17.27

WIRELESS-TAG TECHNOLOGY CO., LIMITED

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