AFM201T 2.4GWi-Fi + Bluetooth 4.2

Single Chip 802.11b/g/n 1T1R WLAN+Bluetooth SOC

Ver.1.1

2019.04.25

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Introduction

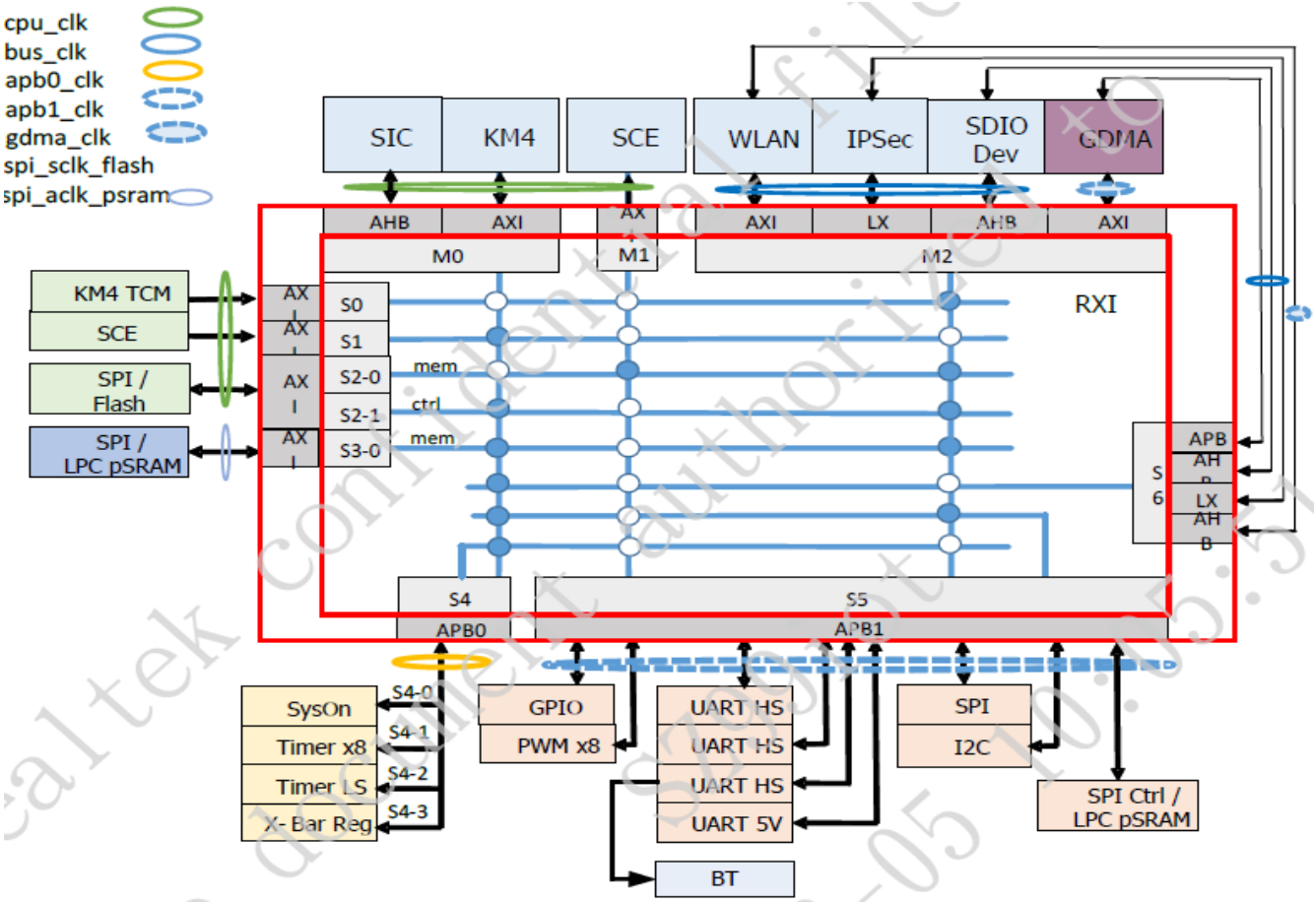
AFM201T is highly integrated single-chip low power 802.11n Wireless LAN, small-volume, few peripheral devices embedded Wi-Fi+Bluetooth module developed by ifLabel.It combines a KM4 MCU. It has large storage (FLASH: 2MB ROM: 384KB) (FLASH: can be128MB), operation space (SRAM: 256KB) and abundant peripheral resources.MCU carries the RTOS system platform and the lightweight LWIP protocol. The Nine-nine IoT can satisfy a variety of embedded wireless communication applications by encapsulating and optimizing the SDK.

1 Basic parameters

1.1 Main performance parameters

- ARM Cortex-M4 processing core, basic frequency of 100MHz.
- 3.3V、5V , DC single power supply.
- Package: 23Pin Stamp hole, small size of 24 × 15 × 3.0mm

1.2 AFM201T Structure



1.3 WLAN、Bluetooth parameters

- Standard：802.11 b/g/n 1x1
- Transmitting power：11b：18dBm / 11g：16dBm / 11n：15dBm
- Receiving sensitivity：11b：-93dBm / 11g：-82dBm / 11n：-76dBm
- Communication rate：11Mbps @11b / 54Mbps @11g / 150Mbps @11n
- Working mode：STA、AP、STA+AP、Buletooth
- Hardware encryption：WPA/WPA2
- Antenna: outer antenna, IPEX antenna interface, onboard antenna
- Power consumption： Deep sleep：20uA Standby:100uA（can be waken up intermittently） Run mode: 120mA

1.4 Product characteristics

- Complete Internet of Things solution (SDK, cloud service, APP).
- Supporting the complete secondary development of AT+ application set.
- Supporting the secondary development of C-SDK.
- Supporting OTA wireless upgrading.
- Support Bluetooth Config, Airkiss Config function.
- Industrial application design, 4-layer PCB design, guarantee of performance consistency
- Complying with FCC/CE standard and RoHS standard

1.5 Software characteristics

- Built-in IPV4/IPV6 protocol stack
- Built-in FreeRTOS management system
- Support for low power BLE 4.0
- Supporting HTTP / HTTPS (SSL) encryption
- Connected Ayla Amazon, Jingdong cloud, Ali cloud
- Being able to support customized private cloud or user private cloud
- Supporting the secondary development, flexible and convenient secondary integration

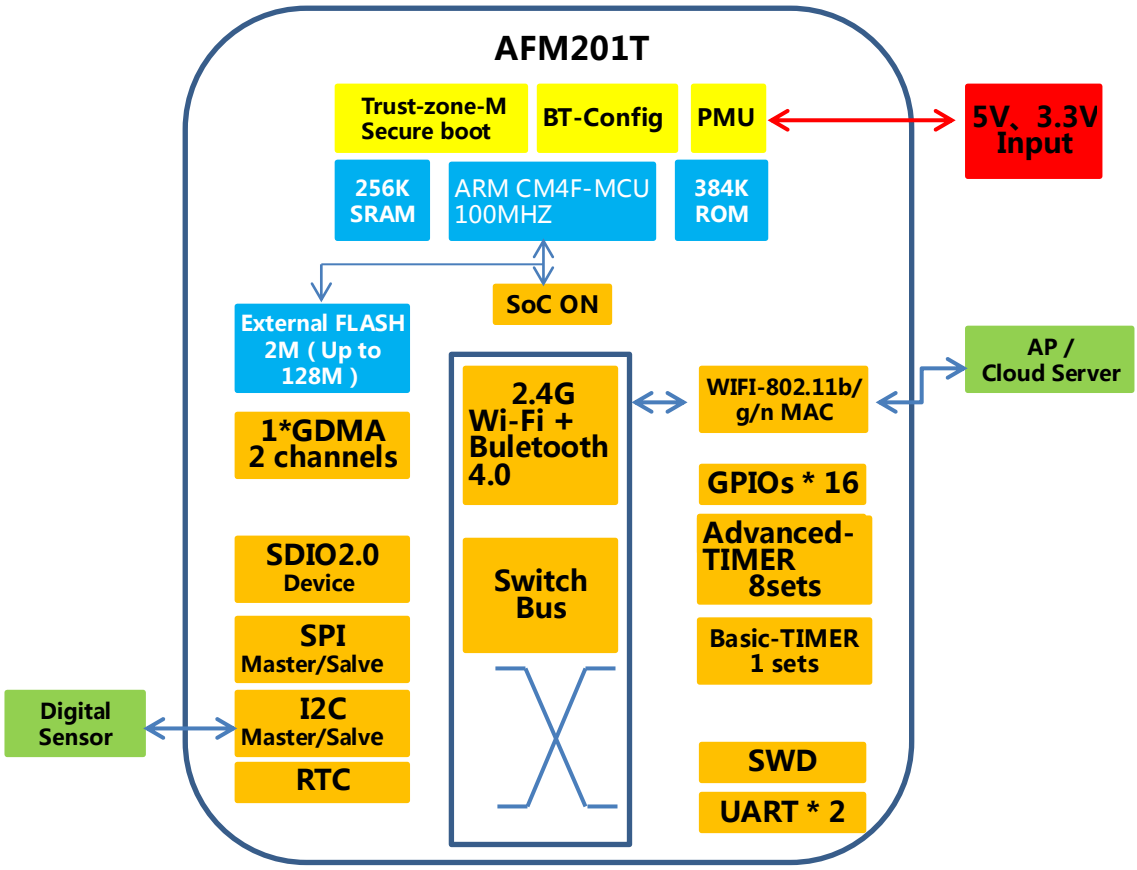
2 Module framework

Applications

- Intelligent lighting
- Intelligent socket
- Industrial control
- Smart Appliances
- Internet of Things applications
- Thermal printer
- LED control card
- POS

Module type

Module name	Module description
AFM201TI	PCB onboard antenna
AFM201TO	IPEX outer antenna
AFM201TP	RF-PinExternal antenna

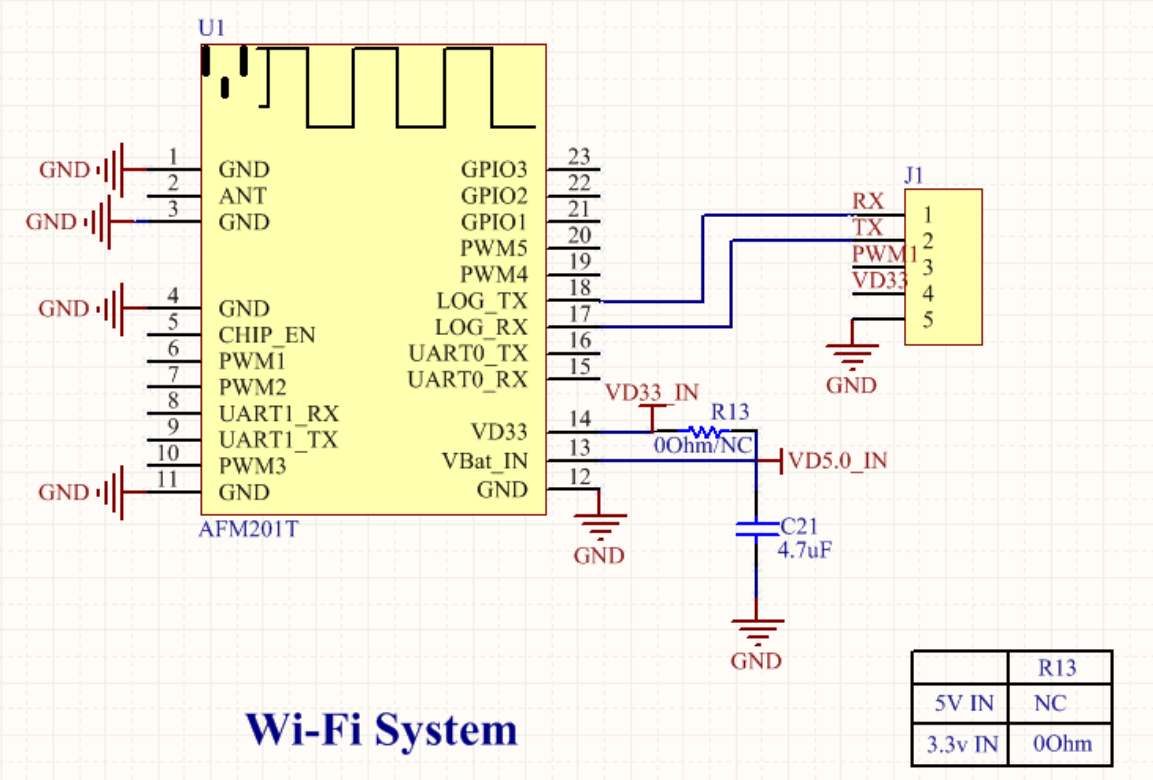


3 Pin definition

3.1 Pin schematic

AFM201T has two rows of pins，23Pin Stamp hole, small size of：

24mm（W）x 15mm（L）x 3mm。



3.2 Pin function

引脚	名称/主功能	I/O	类型	引脚功能
1	GND		P(1)	
2	ANTENA(3)		O	
3	GND		P	
4	GND		P	
5	CHIP_EN(2)（RESET）		I	Reset（Active low, internal pull-up resistor 10K）
6	PWM1(7)	GPIOA_0	I/O(1)	JTAG_CLK/UART1_RX/EXT_32K/PWM0
7	PWM2(7)	GPIOA_1	I/O	JTAG_TMS/UART1_TX/BT_LED/PWM1
8	UART1_RX	GPIOA_2	I/O	UART1_RX/JTAG_TDO/SPI_CSn/I2C_SCL/PWM2
9	UART1_TX	GPIOA_3	I/O	UART1_TX /JTAG_TDI/SPI_SCL/I2C_SDA/PWM3
10	PWM3	GPIOA_4	I/O	JTAG_TRST/UART1_CTS/SPI_MOSI/PWM4

11	GND		P	
12	GND		P	
13	VBat_IN(4)		P	5V Input : 5V MCU
14	VD33(4)		P	3.3V Input : 3.3V MCU
15	UART0_RX(6)	GPIOA_13	I/O	UART0_RX/PWM7
16	UART0_TX(6)	GPIOA_14	I/O	UART0_TX/SDIO_INT/PWM2
17	LOG_RX(5)	GPIOA_15	I/O	UART2_RX/SD_D2/SPI_CSn/I2C_SCL/PWM3
18	LOG_TX(5)	GPIOA_16	I/O	UART2_TX/SD_D3/SPI_SCL/I2C_SDA/PWM4
19	PWM4	GPIOA_17	I/O	SD_CMD/PWM5
20	PWM5	GPIOA_18	I/O	SD_CLK/PWM6
21	GPIO1	GPIOA_19	I/O	SD_D0/SPI_MOSI/I2C_SCl/PWM7
22	GPIO2	GPIOA_20	I/O	SD_D1/SPI_MISO/I2C_SDA/PWM0
23	GPIO3(7)	GPIOA_23	I/O	PWM7

Description:

1、P is the power pin, I / O is the input and output pin,and CHIP_EN is the module hardware reset pin.It does not clear the WiFi network information.

2、Please keep CHIP_EN or other pins floating if they are not used

3、The ANTENA pin is a module antenna output pin that can be connected to an external antenna.

4、PIN13 and PIN14 are 5V and 3.3v input pins respectively:
When connected to a 5V MCU, PIN13 is directly supplied with 5V voltage, and PIN14 is directly suspended.
When connected to a 3.3V MCU, PIN13 and PIN14 are directly shorted and connected to 3.3V.

5、PIN17 and 18 pins are module download I/O and debug ports.

6、5V power supply, only PIN15, 16 can be configured as 5V UART, other PINs are 3.3v level

7、PIN6, PIN7, and PIN23 are used as IO ports and can only be used as output. PIN6 is used as Download auxiliary pin, which needs to be short-circuited to power on to enter Download mode.

4 Electrical characteristics

4.1 Rated limit

Symbol	Interpretation	Minimum	Representative	Maximum	Unit
V_{D33}	Supply voltage	3.0	3.3	3.6	V
V_{Bat_IN}	5V supply voltage	4.8	5		
V_{IO_IN}	Pin input voltage	3.0	3.3	3.6	V

Symbol	Parameter	Maximum	Unit
I_{VDD}	Rated current for 3.3V	450	mA
I_{DD-IO}	Total rated current of I/O pin	200	mA
$I_{DD-IO-3.3}$	Total rated current of 3.3V I/O pin	50	mA
I_{IO}	Pull-up current of I/O pin	20	mA
	Output current of I/O pin	20	mA

4.2 Working condition

Symbol	Parameter	Condition	Representative	Unit
I_{PK}	Peak operating current	Connecting transmission	150	mA
I_{STB}	Standby current	Deep sleep	20	uA

4.3 I/O pin characteristic

4.3.1 Pin input level

Symbol	Parameter	Condition	Minimum	Maximum	Unit
V_{IL}	Input low level	$3.0V \le V_{DD} \le 3.6V$	——	0.8	V
V_{IH}	Input high level	$3.0V \le V_{DD} \le 3.6V$	2.1	——	V

4.3.2 Pin output level

Symbol	Parameter	Condition	Minimum	Maximum	Unit
V_{OL}	Output low level	I_{IO} = +20mA $3.0V \le V_{DD} \le 3.6V$	——	0.4	V
V_{OH}	Output high level		2.4	——	V

4.4 ESD performance

Symbol	Parameter	Condition	Grade	Maximum	Unit
VESD - HB	ESD voltage (HBM)	TAMB = +25℃ (JESD22 - A114)		2000	V
VESD - CD	ESD voltage (CDM)	TAMB = +25℃ (JESD22 - C101)		500	V

5 Power mode and power consumption

5.1 Summary of power mode and representative power consumption parameters

Power mode	Power consumption		
	Representative	Maximum	Unit
Deep Sleep Mode	15	20	uA
Deep Standby Mode	70	100	uA
Run mode	30	43	mA

5.2 Functional status

Mode	Deep Sleep Mode	Deep Standby Mode
Cortex-M4 core	OFF	OFF
System Clock	OFF	OFF
SRAM	OFF	OFF
Peripherals	OFF	OFF
Backup register	OFF	OFF
low precision timer	ON	ON
Wake pin	ON	ON
System timer	---	ON

6 RF characteristics

6.1 Wi-Fi Basic parameters

Parameter	Index
Working frequency	2.412 - 2.484GHz CH1~CH14
Wi-Fi standard	IEEE 802.11 b/g/n
Communication Interface	UART、SDIO、SPI
Modulation mode	802.11b：DSSS 或 CCK； 802.11g：OFDM； 802.11n：OFDM（MIMO-OFDM technique）
Communication rate	11Mbps @802.11b； 54Mbps @802.11g； 72Mbps @802.11n
Antenna type	Onboard antenna(Gain 2dBi) or outer antenna (IPEX antenna socket)

6.2 Bluetooth Basic parameters

Parameter	Index
Working frequency	2.402 - 2.480GHz 79 channels
Bluetooth standard	Bluetooth V4.0 of 1, 2 and 3 Mbps.
Communication Interface	UART
Modulation mode	DPSK, DQPSK
Communication rate	1Mbps @ BER=0.1%， -86dBm； 2Mbps @ BER=0.01%， -86dBm； 3Mbps @ BER=0.01%， -80dBm；
Antenna type	Onboard antenna(Gain 2dBi) or outer antenna (IPEX antenna socket)

6.3 Performance requirements of outer antenna

- Frequency band: 2400~2500MHz
- Antenna gain ≥3dBi: antenna of 3dBi does good to the signal within 5 meters and the pond-shape in which it sends out signal is similar to the shape of two brackets ().
- Impedance of 50 ohm：50 ohm in practical application takes account of voltage withstanding, power transmission and consumption, etc.
- Standing-wave ratio ≤2: refers to whether the antenna matches the radio transmitting station, equaling to 1 means no emission of radio wave to antenna, greater than 1 means parts of the radio waves are reflected back.

6.4 TX parameters

6.4.1 Transmission characteristics of IEEE802.11b

Parameter characteristics of CCK_11M in IEEE802.11b mode

Channel	Power(dBm)	EVM (dB)	FreqErr(ppm)
1	18.51dBm	-23.3dB	-0.07ppm
7	18.55dBm	-23.42dB	-0.11ppm
13	18.61dBm	-23.43dB	-0.16ppm

6.4.2 Transmission characteristics of IEEE802.11g

Parameter characteristics of OFDM_54M in IEEE802.11 mode

Channel	Power(dBm)	EVM (dB)	FreqErr(ppm)
1	15.71dBm	-35.78dB	-0.2ppm
7	15.52dBm	-35.93dB	-0.15ppm
13	15.09dBm	-35.55dB	-0.27ppm

6.4.3 Transmission characteristics of IEEE802.11n HT20

Parameter characteristics of HT20MHZ-MCS7 in IEEE802.11n mode

Channel	Power(dBm)	EVM (dB)	FreqErr(ppm)
1	14.75dBm	-35dB	-0.10ppm
6	14.58dBm	-34.72dB	-0.27ppm
11	14.68dBm	-34.93dB	-0.23ppm

6.5 RX parameters

Receiving sensitivity characteristics of IEEE802.11b

Receiving sensitivity parameter characteristics of 11MHZ in IEEE802.11b mode（bandwidth 20M）

Channel	Pwr(dBm)
1	-91dBm
7	-93dBm
13	-88dBm

Receiving sensitivity characteristics of IEEE802.11g

Receiving sensitivity parameter characteristics of 54MHZ in IEEE802.11g mode （bandwidth 20M）

Channel	Pwr(dBm)
1	-84dBm
7	-84dBm
13	-83dBm

Receiving sensitivity characteristics of IEEE802.11n

Receiving sensitivity parameter characteristics of HT20-MSC7 in IEEE802.11n mode （bandwidth 20M）

Channel	Pwr(dBm)
1	-76dBm
6	-75dBm
11	-77dBm

7 Working sequence

7.1 Power-on sequence

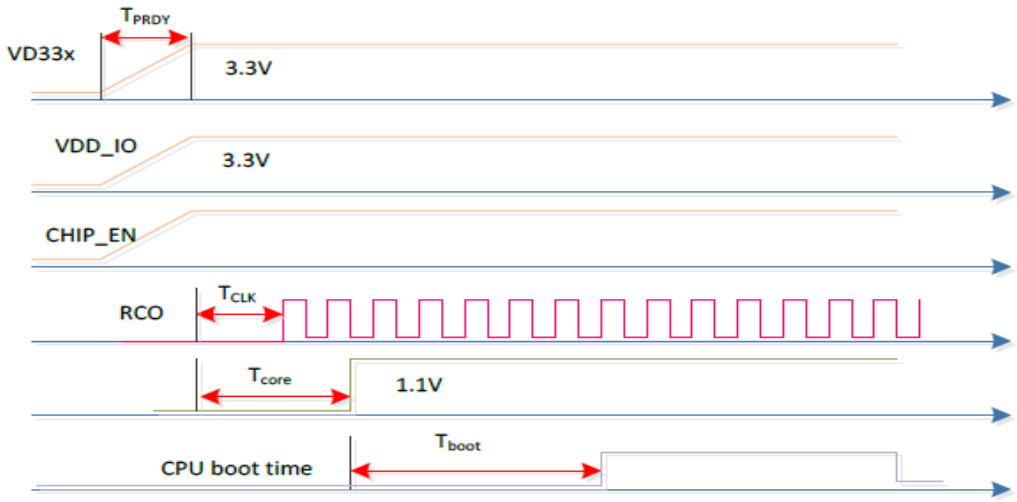


Figure 12 Power-On Sequence

7.2 Standby Wake up

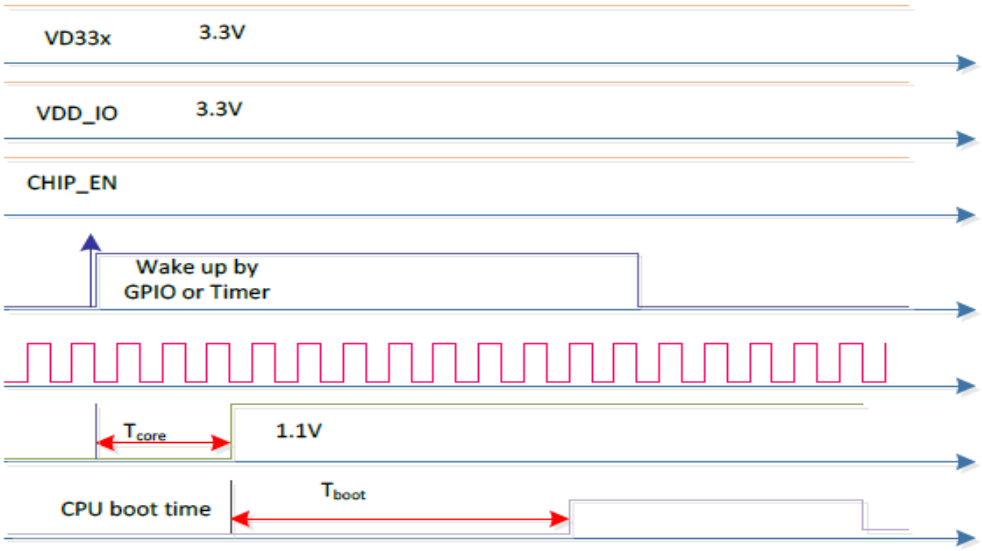
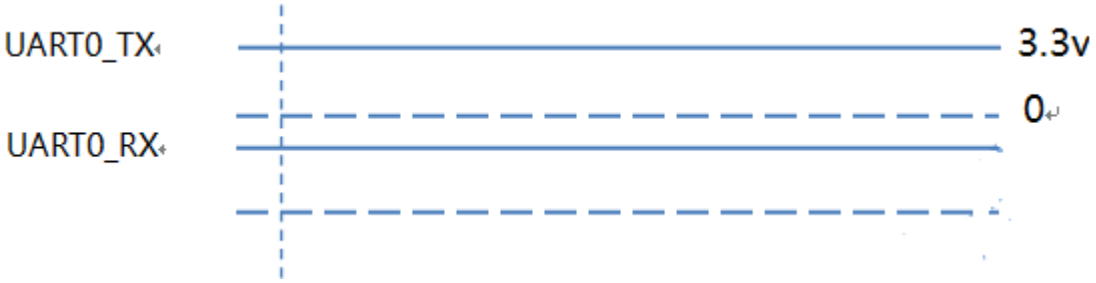


Figure 13 Timing Sequence of Resume from Standby

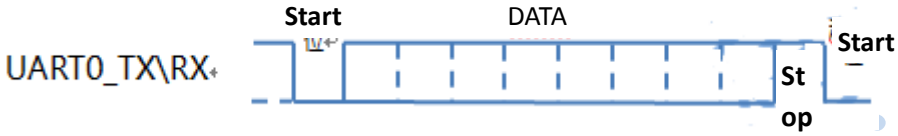
Symbol	Parameter	Minimum	Typical	Maximum	Unit
T_{PRDY}	3.3V ready time	0.6	0.6	1	ms
T_{CLK}	Internal ring clock stable time after 3.3V ready	1			ms
T_{core}	Core power ready time	1.5	1.5		ms
T_{boot}	Application ready time				ms
V_{RST}	Shutdown occurs after CHIP_EN lower than this voltage	0	0	1.65	V
T_{RST}	The require time that CHIP_EN lower than V_{RST}	--	10	--	us

7.3 UART

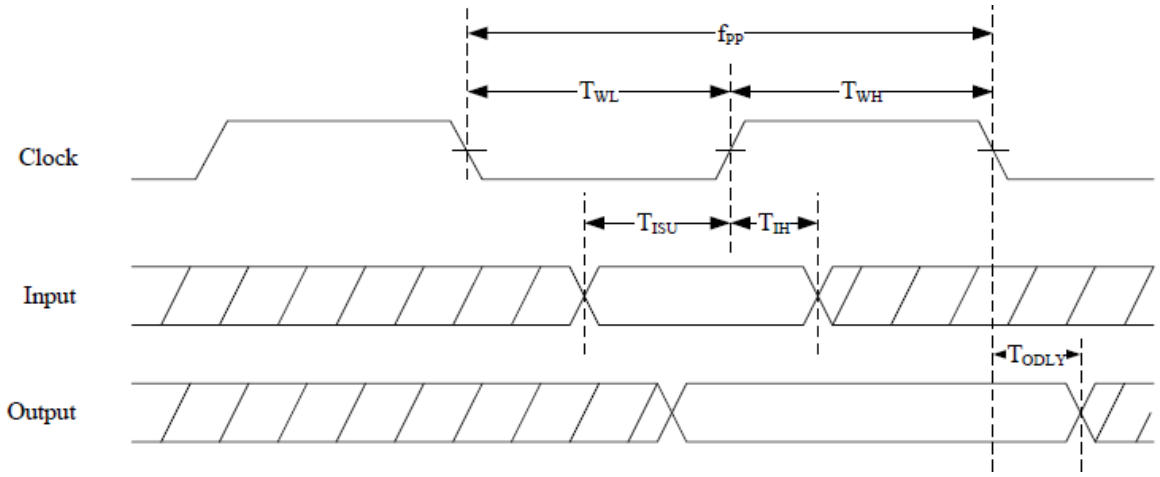
Normal no data transmission status



Data transfer status

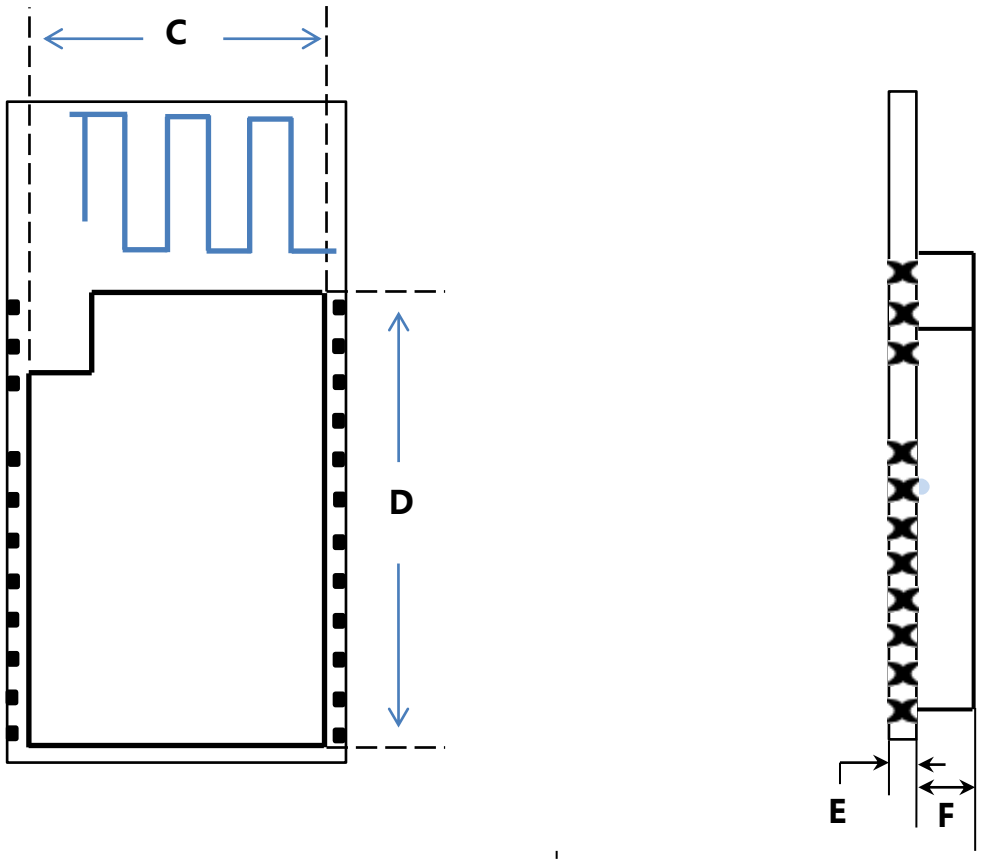


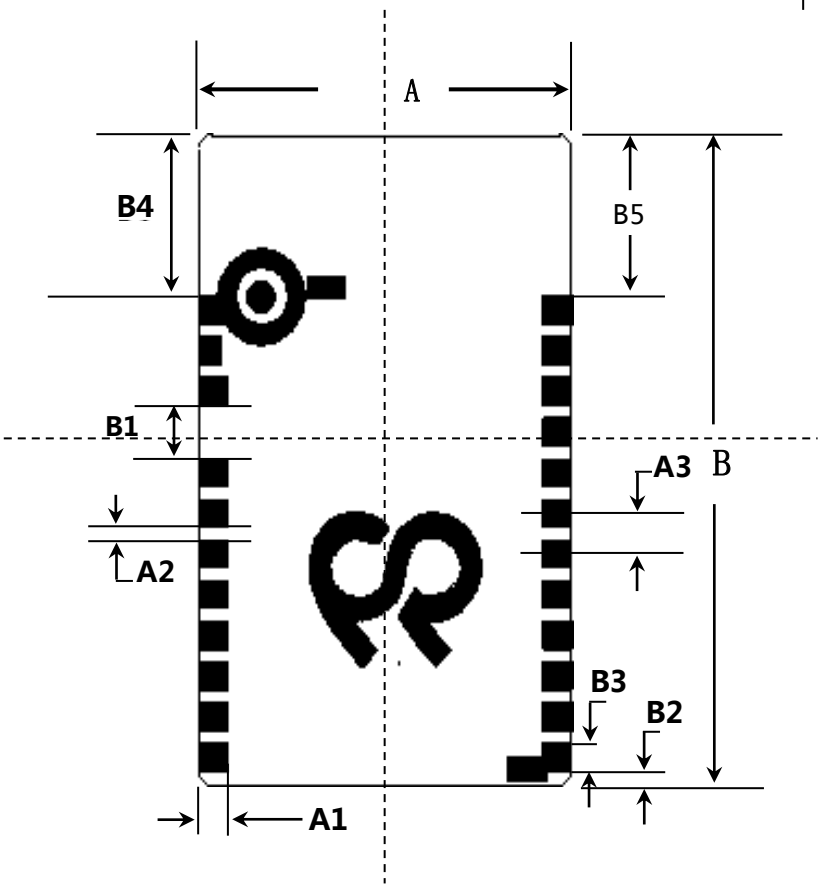
7.4 SDIO device



NO	Parameter	MODE	MIN	MAX	Unit
f_{PP}	Clock Frequency	Default	0	25	MHz
		HS	0	50	MHz
T_{WL}	Clock Low Time	DEF	10	——	ns
		HS	7	——	Ns
T_{WH}	Clock High Time	DEF	10	——	ns
		HS	7	——	ns
T_{ISU}	Input Setup Time	DEF	5	——	ns
		HS	6	——	ns
T_{IH}	Input Hold Time	DEF	5	——	ns
		HS	2	——	ns
T_{ODLY}	Output Delay Time		——	14	ns

8 Dimensions, antenna matching





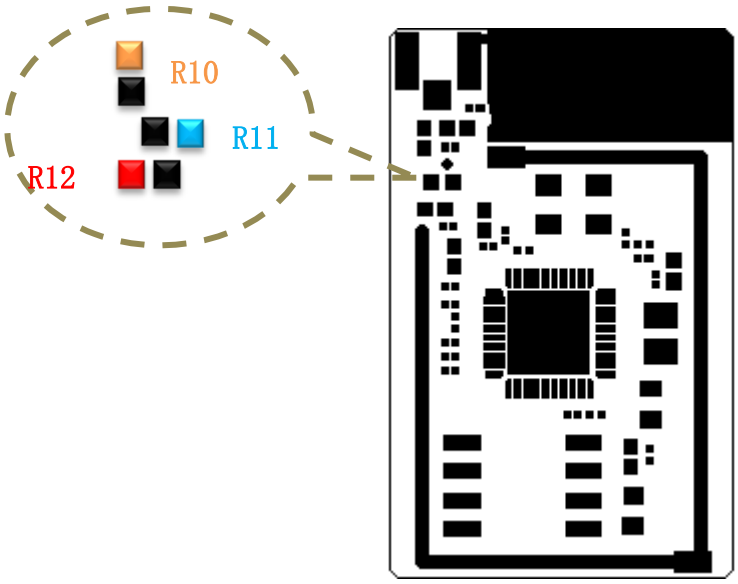
Size

Symbol	Unit (mm)			Symbol	Unit (mm)		
	Min	Norm	Max		Min	Norm	Max
A	14.95	15.00	15.10	B	23.95	24.00	24.10
C	12.18	12.20	12.21	D	17.78	17.80	17.82
E	0.75	0.80	0.85	F	1.95	2.00	2.05
A1	1.05	1.10	1.13	A2	0.48	0.50	0.52
A3	1.47	1.50	1.53	B1	1.98	2.00	2.02
B2	0.58	0.60	0.65	B3	0.98	1.00	1.02
B4	5.88	5.90	5.94	B5	5.88	5.90	5.94

Size description

Pin pad itself consists of a half hole and a rectangular bottom pad with a hole diameter of 1.0 mm and a rectangular width of 1.1 mm.

PIN 脚	说明
1~3	PIN to PIN Length between center distances 1.5mm
4~11	PIN to PIN Length between center distances 1.5mm
12~23	PIN to PIN Length between center distances 1.5mm



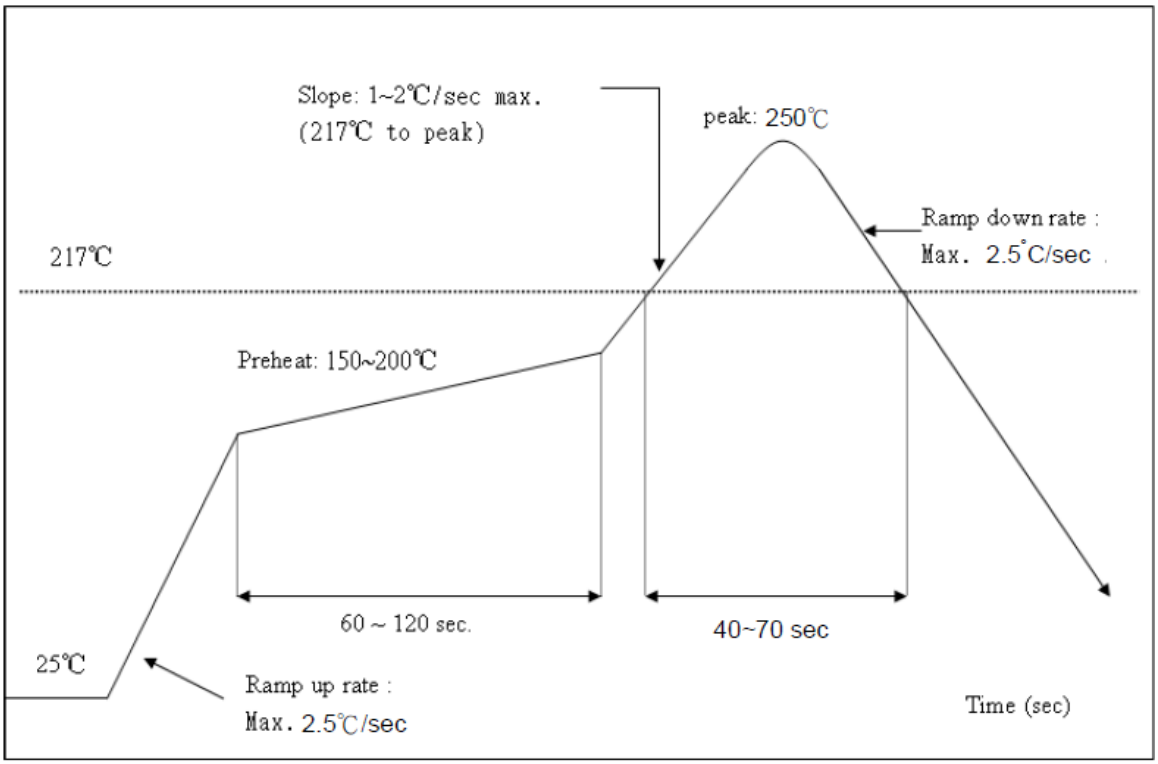
Module type	Antenna type	Gated resistance
AFM201TO	External antenna (through IPEX pedestal)	R10
AFM201TI	PCB onboard antenna	R11
AFM201TP	RF-PinExternal antenna	R12

9 Production guide

9.1 Recommended furnace temperature curve

Referred to IPC/JEDEC standar.

Peak Temperature:<250℃.Number of Times: ≤2 times



9.2 Factory module storage conditions

A、The moisture barrier bag must be stored in an environment where the temperature is <30 ° C and the humidity is <85% RH.

B、For dry-packed products, the shelf life should be 6 months from the date the package is sealed.

Precautions:

A、In the whole process of production, the operator of each station must wear an electrostatic ring.

B、When operating, prevent the module from getting wet or dirty.

Historical version update instructions

Revision	Release Data	Summary
V1.0	2019/04/13	**Initial draft**
V1.1	2019/04/25	Modify package size, pin number modification

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Date: 2019-04-14

10 Purchase and support

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