泰芯半导体
TaiXin Semiconductor

TaiXin Semiconductor 802.11ah TX-AH-Rx00P Series Module Technical Specification

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Revision History

Date	Version	Revision Notes	Reviser
2024-05-21	V6.4.1	Deleted R900PNR，added R900PTR;	WY
2024-03-30	V6.4	Modified tolerance description;	LPX/ZF
2024-03-12	V6.3.1	Corrected typo for IOB0;	LPX/ZF
2024-01-09	V6.3	Revised description for 1.3V; Updated to support up to 31 nodes at most;	LPX/ZF
2024-11-16	V6.2	Added packaging information；	LPX/ZF
2023-09-02	V6.0	Modified VCC power supply range to 3.1-3.3V;	LPX/ZF
2023-07-20	V5.9	Added description for SDIO: only supports 4-wire, not 1-wire;	LPX/ZF
2023-07-17	V5.8	Removed description for 700M module;	LPX/ZF
2023-05-23	V5.7	Modified description for supported number of nodes;	LPX/ZF
2023-05-19	V5.6	Added diagram for module with shielding cover; Revised SPI interface description, added pull-up description; Modified module dimension tolerance;	LPX/ZF
2023-04-03	V5.5	Modified STA low-power wake-up description; Modified AP low-power description;	LPX/ZF
2023-02-22	V5.4	Modified frequency range for 700P;	LPX/ZF
2022-11-14	V5.3	Added image for 900P;	WY
2022-10-28	V5.2	Modified AP low-power description; Added temperature description; Added SNIFFER description; Added note on 700M frequency point affected by 5G interference;	WY
2022-10-15	V5.1	Updated reflow soldering curve;	WY
2022-09-27	V5.0	Updated module images to V1.3;	WY
2022-09-23	V4.9	Modified pin description for SPI1;	WY
2022-09-08	V4.8	Added description for maximum transmission power;	WY
2022-07-30	V4.7	Added description for Mode key;	WY
2022-7-14	V4.6	Added description for dual antennas; Modified reference circuit for power supply; Modified reference circuit for UART;	WY

2022-07-05	V4.5	Corrected typo; Added description for automatic relay mode;	WY
2022-06-23	V4.4	Modified description for 1.3V IO;	WY
2022-06-20	V4.3	Updated module images to V1.2; Added images for bridge/board/test box;	WY
2022-05-19	V4.2	Updated module power supply description;	WY
2022-04-12	V4.1	Updated module certification status;	WY
2022-03-23	V4.0	Updated description for TCP/UDP peak traffic;	WY
2021-11-22	V3.3	Added description for ADKEY; Added pairing button for SDIO/USB interface;	WY
2021-10-28	V3.2	Added description for CCA and other mechanisms;	WY
2021-08-31	V3.1	Modified module dimension diagram;	WY
2021-08-13	V3.0	Modified reference schematic for UART;	WY
2021-07-22	V2.7	Added description for roaming function;	WY
2021-07-09	V2.5	Added RF layout precautions; Added features: AP low power, relay, multicast;	WY
2021-04-25	V2.2	Modified low power current values; Modified reference circuit for low power;	WY
2021-03-29	V2.1	Modified reference circuit for Ethernet PHY;	WY
2021-03-16	V1.9	Updated development and testing sections for solutions;	WY
2021-03-10	V1.8	Modified RF power supply current;	WY
2021-03-09	V1.7	Added development and testing subsections;	WY
2021-02-25	V1.6	Modified SPI interface description;	WY
2021-02-05	V1.5	Modified low power circuit reference design;	WY
2020-12-07	V1.0	Create;	WY

Table of Contents

1. General Description1

TX-AH-Rx00Pxx series of module designed by TaiXin Semiconductor (referred to as TX-AH-Rx00P hereafter) is an industry leading Wi-Fi module compliant with IEEE 802.11ah standard. It provides an optimized solution for wide range of IOT applications.

The TX-AH-Rx00P integrates the TXW83xx 802.11ah SOC, which operates in a frequency range of 730M to 950M to provide wider extended transmission ranges than 2.4GHz and 5GHz Wi-Fi at the same transmission power. The module supports channel bandwidths of 1/2/4/8MHz, and offers physical throughput ranging from 150Kbps to 32.5Mbps, supporting applications ranging from low-rate sensors to multi-stream high-rate surveillance camera.

The TX-AH-Rx00P module employs Clear Channel Assessment (CCA), Carrier Sense Multiple Access with Collision Detection (CSMA_CD), Automatic Frequency Selection (ACS), Automatic Transmission Power Control (ATPC) and other techniques to enhance the network transmission performance.

TX-AH-Rx00P can be interfaced with the application processor via USB, SDIO, SPI, UART and other custom interfaces. Example applications include wireless IP camera, drone video streaming, smart home and smart grid. It also provides an RMII interface for low-cost wireless network bridge application by a single module.

TX-AH-Rx00P supports low power mode. Keep-alive current is as low as 200uA in STA mode. Low power mode is also supported in AP Mode, with a keep-alive current not exceeding 5mA.

Tx-AH-Rx00P supports relay (APSTA) to expand wireless coverage. STA roaming is also supported. Module can also operate in multicast mode for data multicast applications.

Tx-AH-Rx00P supports dual antenna, by selecting the antenna with strongest reception automatically. Tx-AH-Rx00P can also support single antenna.

The internal architecture and external connection diagrams of the chip/module are shown in Fig.1-1.

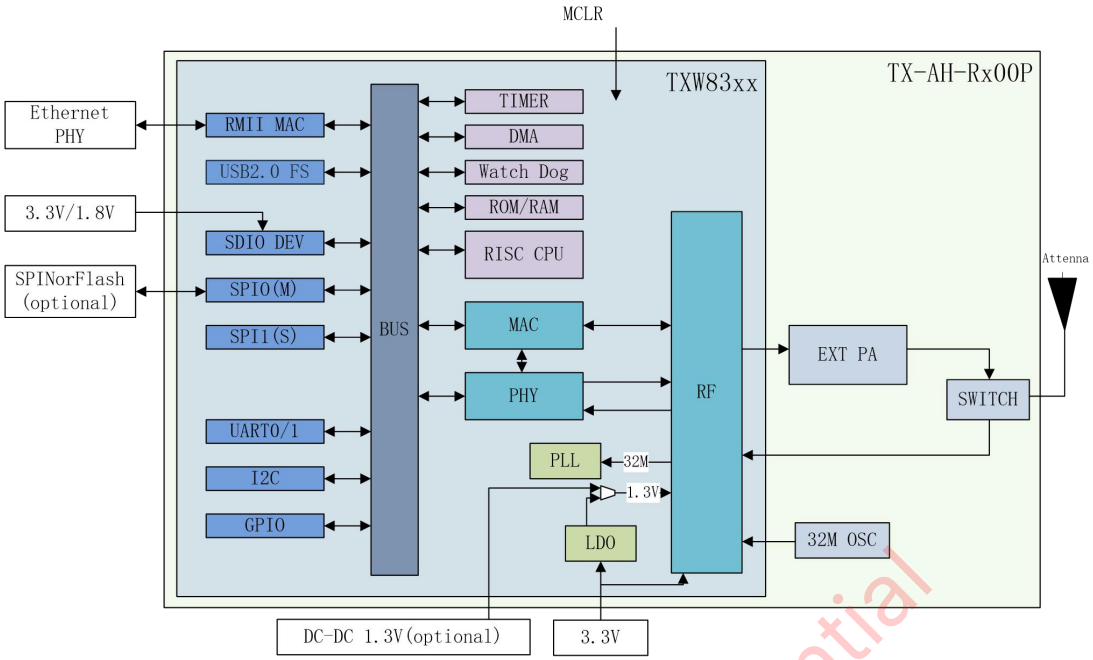


Fig.1-1 Internal Architecture and External Connection Diagram of Chip/Module

The appearance of the module is illustrated in Fig.1-2. Fig.1-2(a) shows the TX-AH-R900PTR-S, with a shielding cover. Fig.1-2(b) shows the TX-AH-R900P, without a shielding cover. Fig.1-2(c) shows the TX-AH-R900PNR-860M-S, with a shielding cover.

Fig.1-2(a) Appearance of TX-AH-Rx00Pxx Module (Illustrated with TX-AH-R900PTR-S)

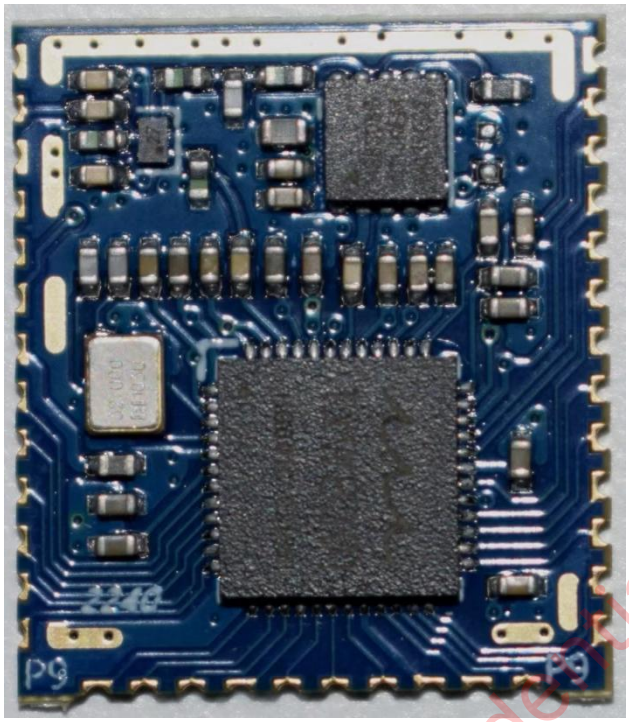


Fig.1-2(b) Appearance of TX-AH-Rx00Pxx Module (Illustrated with TX-AH-R900P)

Fig.1-2(c) Appearance of TX-AH-Rx00Pxx Module (Illustrated with TX-AH-R900PNR-860M-S)

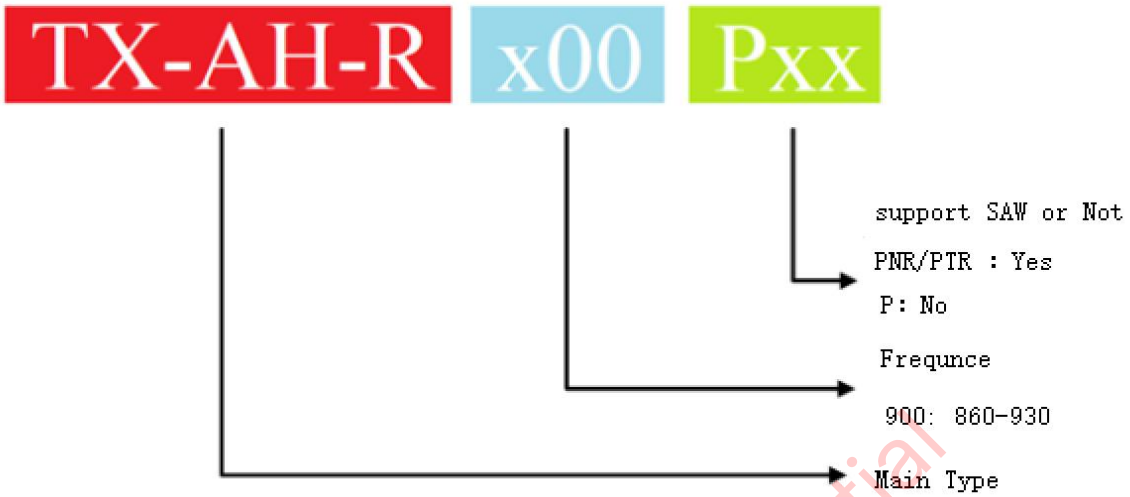
Note: The module PCB numbering is for internal inventory management use only and may vary between batches. TaiXin Semiconductor is not obligated to notify customer for change in marking unless it also imposes specification change.

Table 1-1. TX-AH-Rx00P Parameter Table

Category	Parameter	Description
Wireless Parameters	Wi-Fi Protocol	802.11ah
	Frequency Range	Different sub-types use different frequency points, please refer to Table 2-1
Hardware Parameters	Data Interface	SDIO/USB/SPI/RMII/UART/I2C
	VCC Working Voltage	3.1 V ~ 3.3 V
	VCC Supply Current	>= 150mA
	RF Working Voltage	3.1 V ~ 3.3 V
	RF Supply Current	>= 450mA
	Working Temperature	-20 °C ~ 70 °C[1]
	Storage Temperature	-20 °C ~ 70 °C[1]
	Dimension	(17.00±0.40)mm×(15.00±0.25)mm×(2.40±0.20)mm
Software Parameters	Security Mode	WPA2-PSK
	Encryption Type	AES
	Firmware Upgrade	Over the Air Upgrade（OTA）/ UART(Xmodem)
	HOST Wi-Fi Driver	Provides Linux/RTOS/Non-OS Wi-Fi drivers for HOST

[1] Temperature refers to the surface temperature of the module.

2. Product Sub-types Comparison



TX-AH-Rx00P has sub-types listed in table 2-1, please select the correct sub-type according to your application requirement.

Module Name	Front Marking	Certification	Note
TX-AH-R900P	Left bottom: R9 Right bottom: R9	FCC/CE certification available	Supports 860MHz ~ 928MHz
TX-AH-R900PTR	Left bottom: R9 Right bottom: TR	FCC certification available	Supports 902MHz ~ 928MHz, with 915MHz Saw to improve reception performance
TX-AH-R900PNR-860M	Left bottom: 86 Right bottom: NR	CE certification available	Supports 859MHz ~ 894MHz, with 875M Saw to improve reception performance

Table 2-1.Sub-type of TX-AH-Rx00P

Notes:

1） The difference between the P series modules and the earlier A series modules is as follows:

P series modules bottom left marking starts with P, while that of the A series starts with R.

PIN4/5 of the P series modules require power supply, while those of the A series do not.

2） Module is without shielding covers by default. If shielding covers are required, please remark it when ordering. Modules with shielding covers are denoted by the suffix -S in the module name, where S stands for "Shield".

3. Pin Description

The pinout diagram for the TX-AH-Rx00P surface-mount module is illustrated in Fig.3-1.

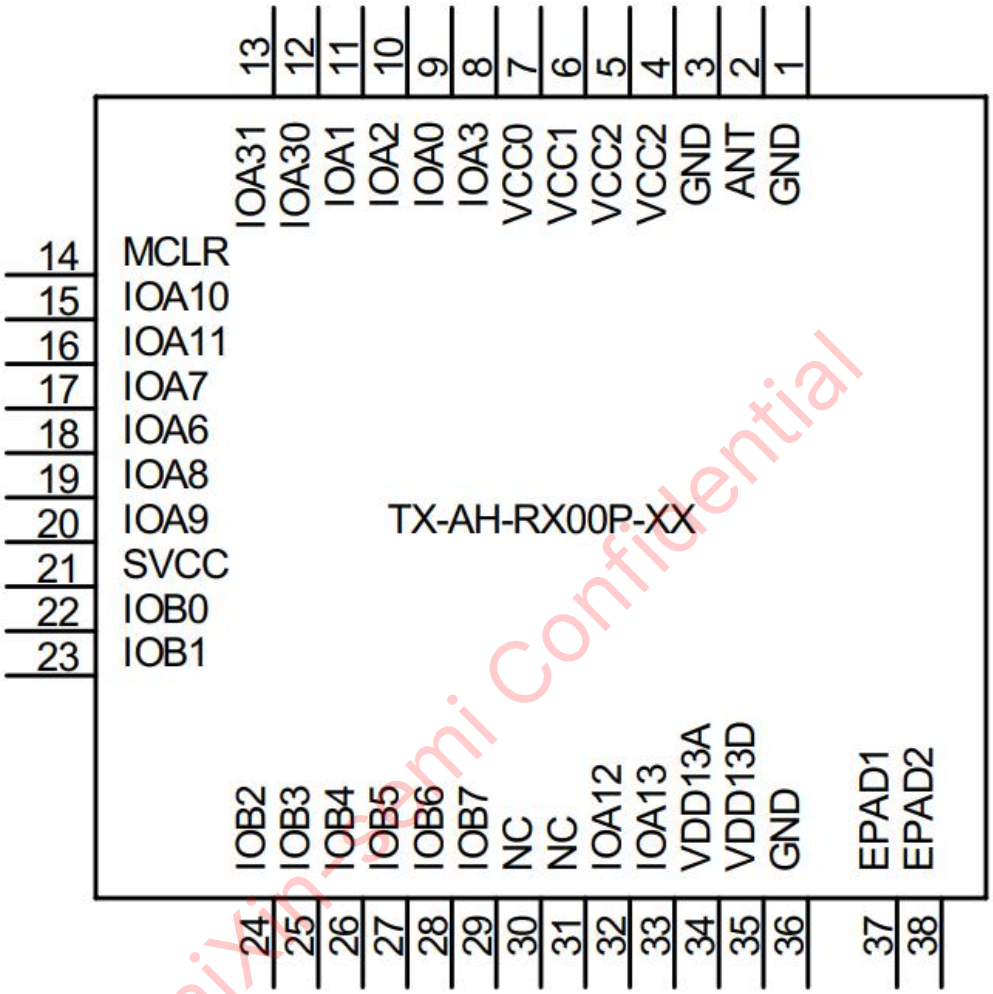


Fig.3-1.Pinout Diagram of the TX-AH-Rx00P Module

TX-AH-Rx00P has 38 pins (include 2 EPAD pins). Function description is listed in table 3-1.

Table 3-1.TX-AH-Rx00P Pin Description

Index	Name	Function
1	GND	Ground
2	ANT	RF antenna
3	GND	Ground
4	VCC2	RF power supply 2, nominal 3.3V, range 3.1-3.3V
5	VCC2	
6	VCC1	RF power supply 1, nominal 3.3V, range 3.1-3.3V, use of ferrite bead is recommended
7	VCC0	Main control VCC supply, nominal 3.3V, range 3.1-3.3V, use of

		ferrite bead is recommended
8	IOA3	SPI0_MISO/GPIOA3, connects to MISO with external NorFlash
9	IOA0	SPI0_CS/I2C_SCL/GPIOA0, connects to CS with external NorFlash
10	IOA2	SPI0_MOSI/GPIOA2, connects to MOSI with external NorFlash
11	IOA1	SPI0_CLK/I2C_SDA/GPIOA1, connects to CLK with external NorFlash
12	IOA30	Default function: Debug IO pin, can be GPIO if debug is disabled in firmware
13	IOA31	Default function: Debug Clock pin, can be GPIO if debug is disabled in firmware
14	MCLR	Reset/Wake-up
15	IOA10	SD_D2/SPI1_IO2/UART0_RX/RMII_MDIO/GPIOA10
16	IOA11	SD_D3/SPI1_IO3/SPI1_CS/UART0_TX/RMII_MDC/GPIOA11
17	IOA7	SD_CMD/SPI1_CLK/SPI1_MOSI/GPIOA7
18	IOA6	SD_CLK/SPI1_CS/SPI1_CLK/GPIOA6
19	IOA8	SD_D0/SPI1_IO0/SPI1_MISO/GPIOA8
20	IOA9	SD_D1/SPI1_IO1/SPI1_INTIO/GPIOA9
21	SVCC	SDIO power supply (1.8V/3.3V optional), connected to the SDIO Host's power supply; if IOA6~IOA11 are used for other functions, SVCC also needs to be powered, sharing the same power source with VCC0;
22	IOB0	RMII_REF_CLKIN/AH_WAKEUP_MCU/GPIOB0
23	IOB1	GPIOB1
24	IOB2	RMII_RXD0/GPIOB2
25	IOB3	RMII_RXD1/GPIOB3
26	IOB4	RMII_TXD0/GPIOB4
27	IOB5	RMII_TXD1/GPIOB5
28	IOB6	RMII_CRS_DV/GPIOB6
29	IOB7	RMII_TX_EN/GPIOB7
30	NC	NC
31	NC	NC, keep floating; if an external PA is needed, it can be used as PA-EN, active high;
32	IOA12	USB_DM/UART1_RX/ADKEY
33	IOA13	USB_DP/UART1_TX
34	VDD1V3A	1.3V power supply input (recommended range 1.3-1.35V); Note：By default, the module internally converts the 3.3V input to 1.3V using an LDO. In this case, these two pins need to be left floating. For energy-sensitive scenarios, 1.3V can be externally powered by DC-DC to improve efficiency, in which case these two pins need to be connected to the output of the 1.3V DC-DC; the output current is recommended to be not less than 200mA.
35	VDD1V3D	
36	GND	Ground
37	EPAD1	Ground
38	EPAD2	Ground

4. Hardware Function Description

4.1. MCU

TXW83xx SoC integrated a 32-bit high-performance RISC processor, with a CPU clock speed of up to 192MHz.

4.2. Memory

4.2.1.SPI Nor FLASH

TX-AH-Rx00P does not have built-in SPI Nor Flash. For cases requiring external Nor Flash, please refer to the Firmware Boot Mode section.

The SPI NOR capacity should not be less than 8Mbit.

4.3. Crystal Oscillator

TX-AH-Rx00P uses a 32M crystal oscillator.

4.4. Reset/Wake-up

The MCLR pin can perform both reset and wake-up functions.

In non-deep sleep mode, the module can be reset by pulling the MCLR low and then high; the low level duration of MCLR should not be less than 2ms.

When the AH module enters deep sleep mode, it can be awakened by pulling the MCLR low and then high; the low level duration of MCLR should be approximately 500uS.

4.5. ADKEY

IOA12 can be used as ADKEY with a sampling bit-width of 10 bits, to sample low-speed signals such as key voltage.

The full range is 1.1V.

4.6. Interfaces Description

Table 4-1.TX-AH-Rx00P Interface Description

Interface Name	Pin	Function Description
SDIO(slave)	IOA6(SD_CLK), IOA7(SD_CMD), IOA8(SD_D0), IOA9(SD_D1), IOA10(SD_D2), IOA11(SD_D3)	Supports SDIO 2.0 protocol, up to 50MHz clock, supports only four-wire mode (one-wire mode is not supported), supports SDIO mode and SPI mode.
USB(slave)	IOA12(USB_DM), IOA13(USB_DP)	Supports USB 2.0 FS protocol, typical interface communication rate is 5Mbps.
SPI0(master)	IOA0(SPI0_CS), IOA1(SPI0_CLK), IOA2(SPI0_MOSI), IOA3(SPI0_MISO)	Supports external SPI Flash (supports NOR BOOT), connection to other external SPI devices is not recommended.
SPI1(slave)	IOA6(SPI1_CLK), IOA7(SPI1_MOSI), IOA8(SPI1_MISO), IOA9(SPI1_INTIO), IOA11(SPI1_CS)	Supports external SPI devices (does not support NOR BOOT), multiplexed with SDIO pin (SDIO in SPI mode).
RMII	IOB0(RMII_REF_CLKIN), IOB2(RMII_RXD0), IOB3(RMII_RXD1), IOB4(RMII_TXD0), IOB5(RMII_TXD1), IOB6(RMII_CRS_DV), IOB7(RMII_TX_EN), IOA10 (RMII_MDIO), IOA11(RMII_MDC)	Ethernet MAC speed up to 100Mbps, IOA10/IOA11 multiplex with UART0 pins. If UART0 is required, RMII_MDIO/MDC can be remapped to IOA7/IOA8.
UART0	IOA10(UART0_RX), IOA11(UART0_TX)	Multiplexed with SDIO/SPI1 pins. If SDIO or SPI is enabled, use UART1 instead.
UART1	IOA12(UART1_RX), IOA13(UART1_TX)	Multiplexed with USB pins. If USB is enabled, use UART0 instead.
I2C(master)	IOA0(I2C_SCL), IOA1(I2C_SDA) or IOA12(I2C_SCL),	Single I2C master interface IOA0/IOA1 are multiplexed with SPI0, IOA12/IOA13 are multiplexed with USB/UART So if SPI0 is enabled, use IOA12/IOA13.

	IOA13(I2C_SDA)	If USB or UART is enabled, use IOA0/IOA1.

5. Software Function Description

5.1. Working Mode

TX-AH-Rx00P module can operate in two modes: Module + Application Processor HOST, or Single-module mode.

5.1.1. Module + HOST Mode

In applications such as IP camera and drone video transmission, TX-AH-Rx00P requires an external application processor (HOST) to perform functions such as video encoding/decoding. Module drivers for Linux/RTOS(Rtthread, Liteos, etc)/Non-OS are available.

5.1.2. Single-module Mode

In applications such as wireless bridges, TX-AH-Rx00P can use its RMII interface to connect to an external Ethernet PHY to implement a wireless bridge without the need of an external host controller.

If the wireless bridge application has multiple client (STA). The module acting as AP may not have sufficient processing power for high performance application. An application processor may still be required for the AP module to achieve the targeted performance.

5.2. Firmware Boot Method

TX-AH-Rx00P supports several firmware loading methods, including SDIO device boot/USB device boot/SPI NorFlash boot.

When the module communicates with the HOST via SDIO or USB, SDIO device boot or USB device boot can be considered. In this case, the module can operate without an external SPI NorFlash. However, these boot methods are slower than SPI NorFlash boot. For applications with high boot speed requirements, SPI NorFlash boot is recommended.

In Single-module Mode, SPI NorFlash boot is required.

5.3. Networking Modes

TX-AH-Rx00P supports several networking modes:

1） AP-STA mode: Basic star network, where one AP connects to multiple STAs. The maximum number of supported STAs can be configured via firmware. By default, the firmware supports up to 8 STAs, and it can be configured to support up to 31 STAs (requires firmware modification).

2） AP-Relay-STA mode: Adds relay nodes to the basic star network to extend the range. However, the maximum throughput will be halved. Currently, only single-level relaying is supported.

3） Roaming: Supports STA roaming between Aps, with STAs automatically select APs based on signal strength.

4） Automatic relay mode: Combines roaming and relaying to enable STAs to automatically relay in the network.

5） Multicast mode: Transmits data using multicast, suitable for scenarios with a large number of nodes but not large data volumes.

5.4. Low-power Modes

The module supports two low-power modes: STA Low Power and AP Low Power.

5.4.1.Low-power Mode for STA

STA Low Power requires an external 1.3V DC-DC converter to power the module's 1.3V power supply pins (PIN34/35).

It supports standby functionality, with adjustable DTIM duration.

If the module's PIN4/5/6/7 are all connected to a constant 3.3V power supply, the power consumption can be reduced to about 400uA during DTIM10.

For even lower standby current, PIN4/5/6 and PIN7 can be powered separately. When PIN4/5/6 are disconnected during sleep, the standby current can be reduced to within 200uA. Please refer to section 7.9 for specific low-power reference circuits.

5.4.2. Low-power Mode for AP

AP Low Power requires an external 1.3V DC-DC converter to power the module's 1.3V power supply pins (PIN34/35); the module's PIN4/5/6/7 are all connected to a constant 3.3V power supply.

If the interface to host is turned off, the power consumption can be reduced to about 5mA, and the host controller cannot wake up the AH module through the interface. If the interface is not turned off, the power consumption is about 10mA, and the main controller can wake up the AH module through the interface.

6. Parameters

Note: No special instructions, test conditions are 3.3V power input, 1.3V supplied by internal LDO, and temperature is 25°C.

6.1. Wi-Fi Parameters

Table 6-1.Wi-Fi Parameters

Parameter	Typical Value	Unit
Working Parameter		
Working Frequency	Refer to Table 2-1	MHz
Channel BW	1,2,4,8	MHz
Modulation Scheme	BPSK, QPSK,16QAM,64QAM	
Supported MCS	0~7 (1/2/4/8M mode),10 (1M mode)	
Physical Layer Data Rate		
1M MCS10	150	Kbps
8M MCS7	32.5	Mbps
The Maximum Data Rate of Protocol layer (1)		
TCP	~15	Mbps
UDP	~16	Mbps
Communication Distance (Transmission Power +20dBm,One-to-One TCP Flow) (2)		
1MhzFrequencyBandwidth	TBD	
2MhzFrequencyBandwidth	1200m, >2Mbps	
4MhzFrequencyBandwidth	1200m, >3Mbps	
8MhzFrequencyBandwidth	1200m, >4Mbps	
Transmit Parameters		
Transmit Power	+20 (3)	dBm
Transmit Error Vector Magnitude (MCS7)	<= -27	dB
Receive Parameters		
Receive Sensitivity（10%PER）		
1M PPDU MCS=10	-105	dBm
8M PPDU MCS=0	-95	dBm
8M PPDU MCS=7	-81	dBm
Adjacent Channel Suppression		
Receive Adjacent Channel Suppression (MCS10)	28	dBc
Non-Adjacent Channel Suppression (MCS10)	35	dBc
Out-of-Band Interference Tolerance	-20	dBm
Other		
Maximum Input Signal Strength	-10	dBm

Notes:

1） The traffic limit is tested with a bandwidth of 8M and a maximum aggregation count of

16.

2） The communication distance is tested in an ideal unobstructed environment; actual environments may affect test results due to interference.

3） 20dBm is the maximum transmit power to meet Tx-EVM <= -27. If sacrificing Tx-EVM is acceptable, the maximum transmit power can be increased to 25dBm.

6.2. Power Consumption

Table 6-2.TX-AH-Rx00P Module Power Consumption

Mode	Typical Value	Unit
Continuous Transmission Mode (100% Duty Cycle), Pout=+20dBm	300	mA
Continuous Reception Mode (1.3V provided by internal LDO from 3.3V)	100	mA
Continuous Reception Mode (1.3V provided externally, converted to 3.3V)	55	mA
Deep-sleep	110[1]	uA
DTIM10	195[2]	uA
DTIM20	160[2]	uA
DTIM30	145[2]	uA
AP Low Power	5[3]	mA

[1] Refers to STA low power with 2M bandwidth;1.3V supplied by DCDC, RF supply (VCC1/VCC2) controlled automatically by the module for power on and off (if RF is not individually powered off during sleep, it will add an additional leakage of about 200uA at most);

[2] Standby power consumption for 2M bandwidth mode;

[3] With 1.3V supplied by DCDC, interfaces to HOST turned off.

6.3. Reflow Soldering Temperature Curve

Referred IPC/JEDEC standard.
Peak Temperature : <250°C
Number of Times : 2 times

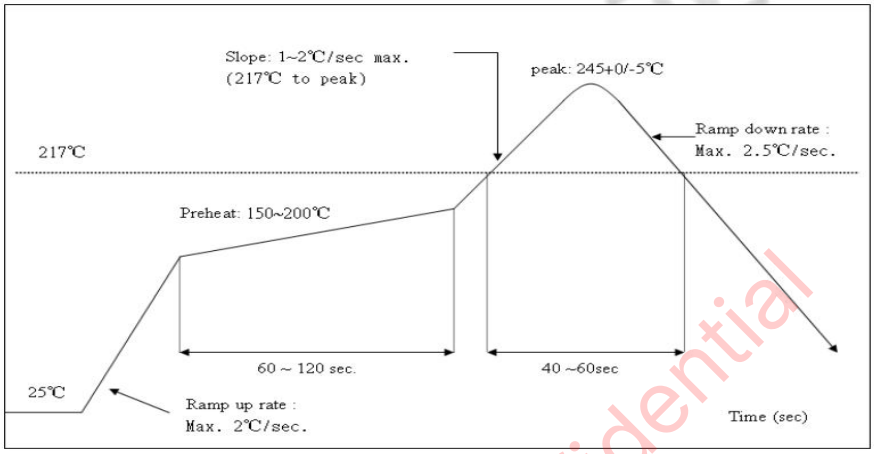


Fig.6-1. Reflow Soldering Temperature Curve for TX-AH-Rx00P

Table 6-3. Reflow Soldering Parameters for TX-AH-Rx00P Module

Parameter	Standard Profile	Limit Profile
Pre-heat	150 - 200°C,60 - 120 sec	
Heat	Above 217°C,40 - 60 sec	
Peak temperature	245+0/-5°C	250 °C
Cycle of reflow	2 times	

6.4. Flatness Parameters

Table 6-4.Module Flatness Parameters for TX-AH-Rx00P

Parameter	Typical Value	Maximum Value	Unit
Warpage	0.23	0.46	%
Diagonal Warpage	0.06	0.12	mm

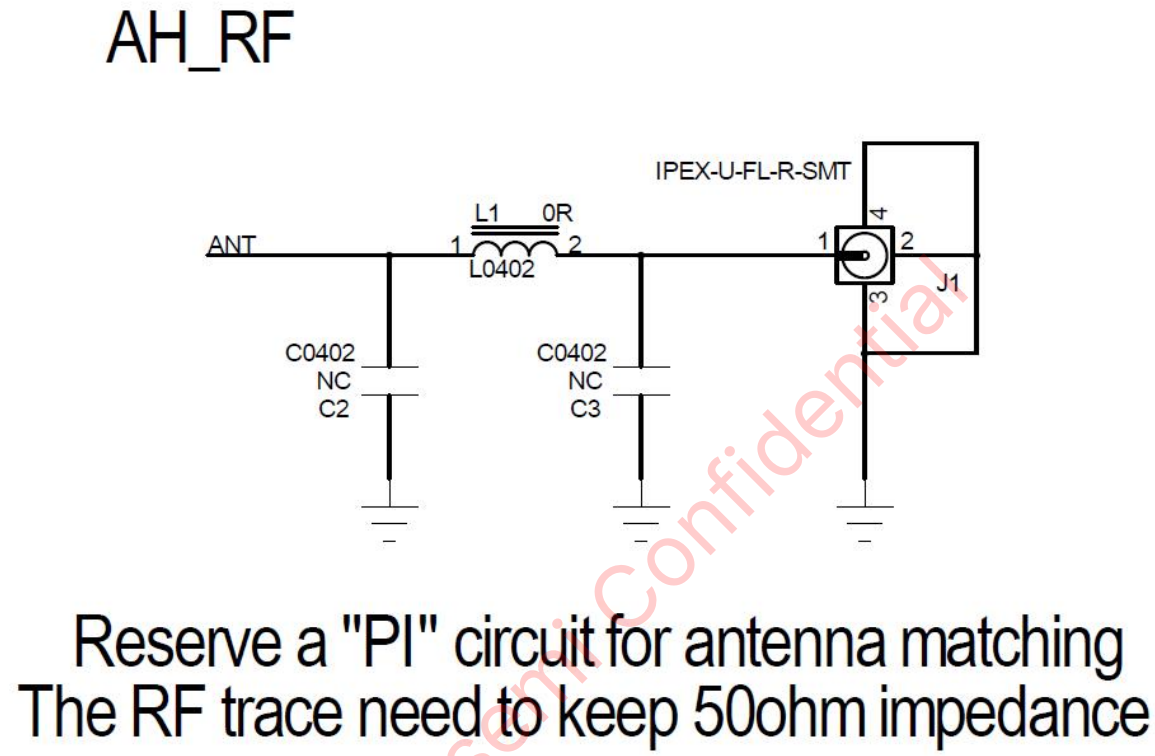
6.5. ESD Parameters

Table 6-5.ESD Parameters for TX-AH-Rx00P

ESD Model	Condition	Maximum Value	Unit
HBM	25°C	2	kV

7. Peripheral Circuit Schematic

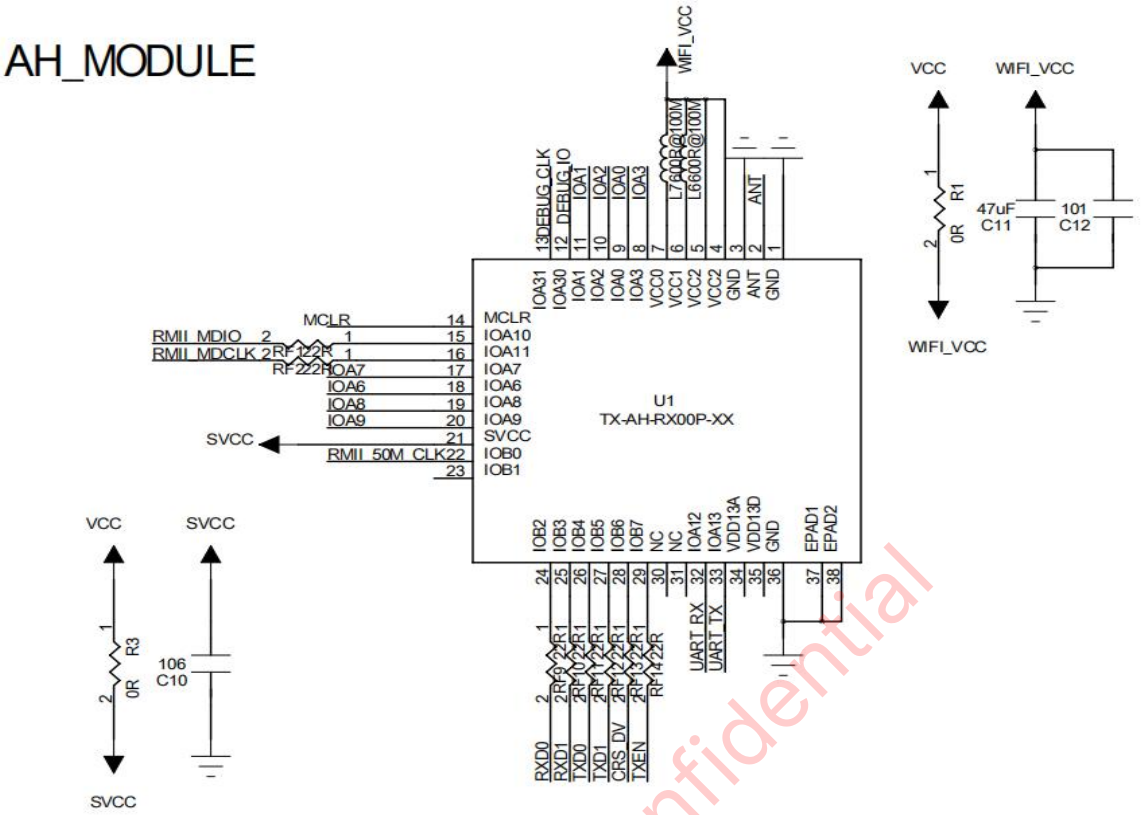
7.1. RF Part Reference Schematic



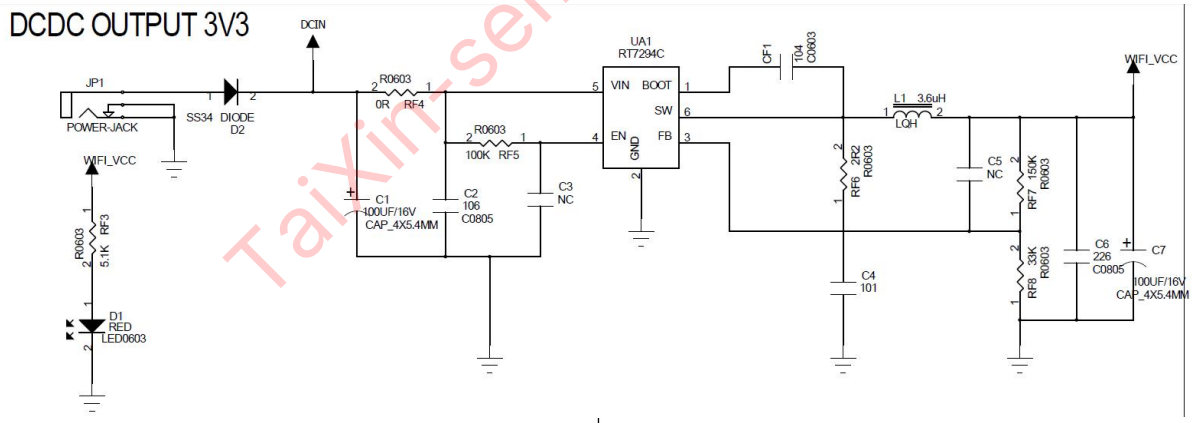
7.2. RMII Reference Schematic

Currently supported Ethernet PHYs: IP101GR, RTL8201F, please contact our FAE if you need to use other Ethernet PHY.

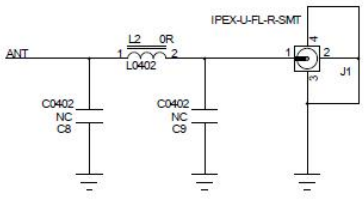
Below is a reference schematic using IP101GR. For RTL8201F reference schematic, please contact our FAE.



VCC(3V3) Input current at least 500mA,V_ripple<30mv

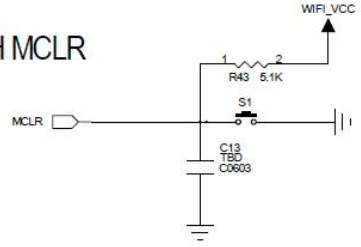


AH_RF

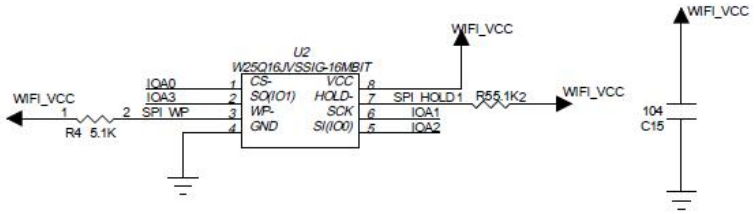


Reserve a "PI" circuit for antenna matching
The RF trace need to keep 50ohm impedance

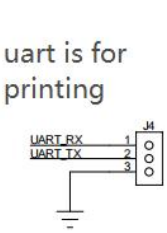
AH MCLR



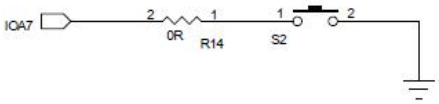
SPI BOOT



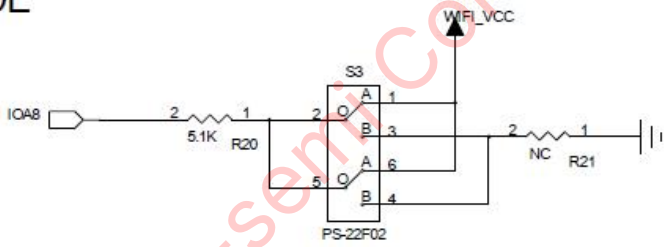
AH UART



CONNECT KEY

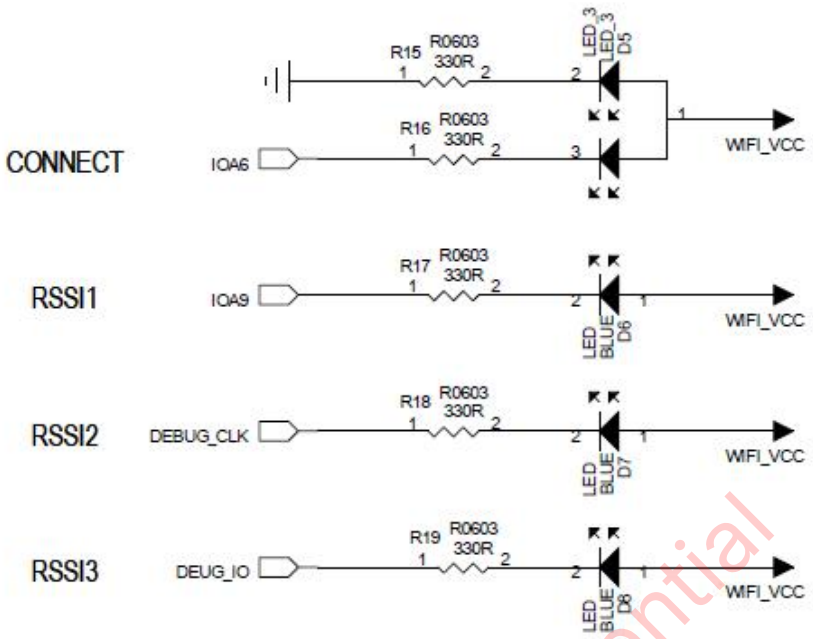


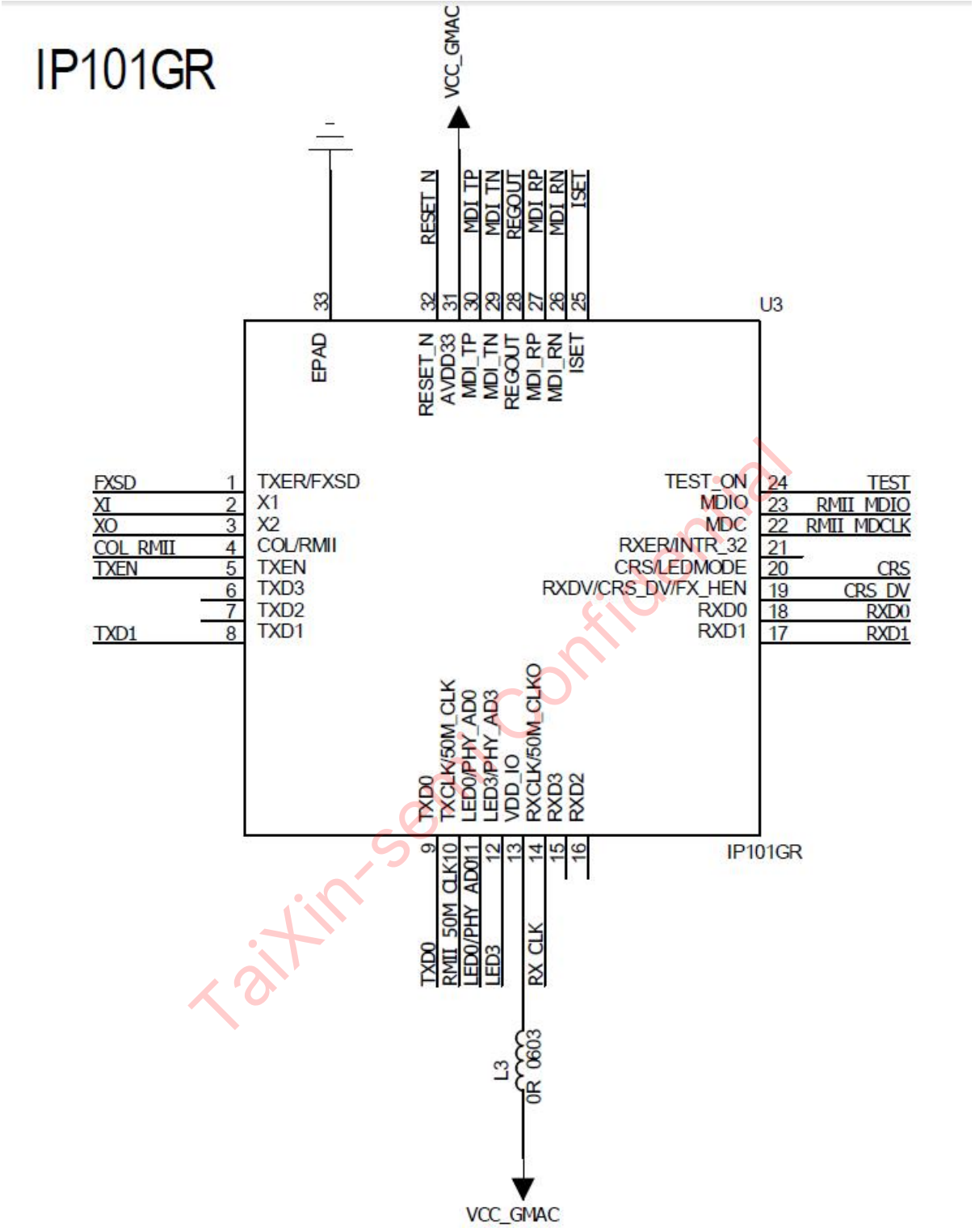
AP/STA MODE



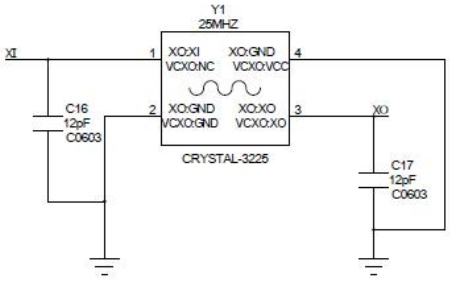
Mode IO pulled low is STA (default), pulled high is AP;

Note: Roles/pairing can also be set via serial command, physical button and switch can be omitted if not required.

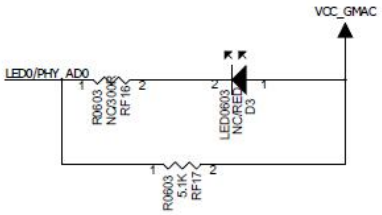




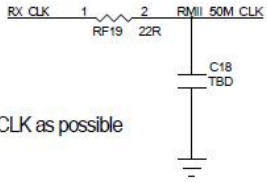
25MHZ CRYSTAL



LED

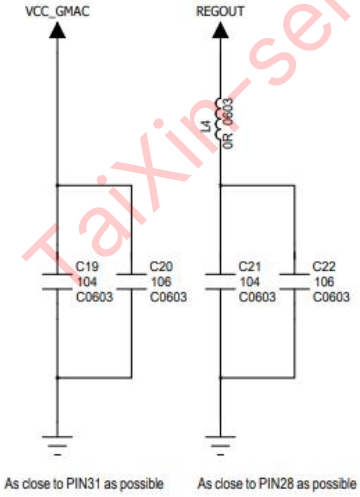


50MHZ CLK



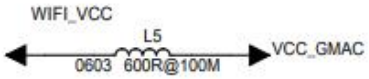
As close to chip RX_CLK as possible

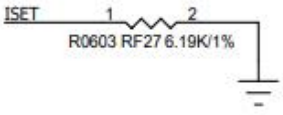
BYPASS CAPACITOR



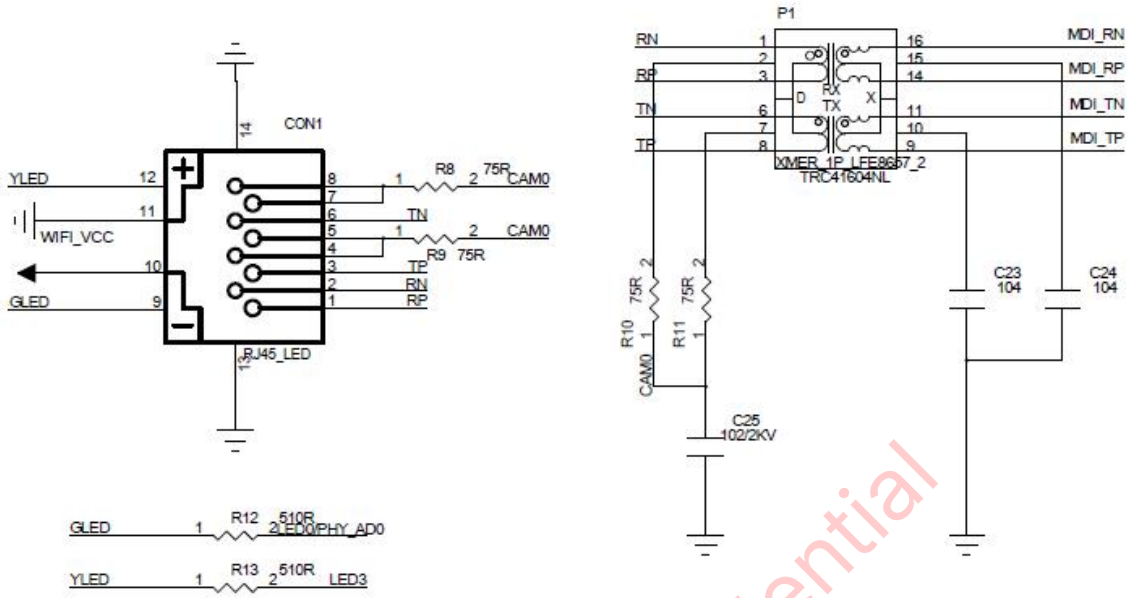
As close to PIN31 as possible

As close to PIN28 as possible

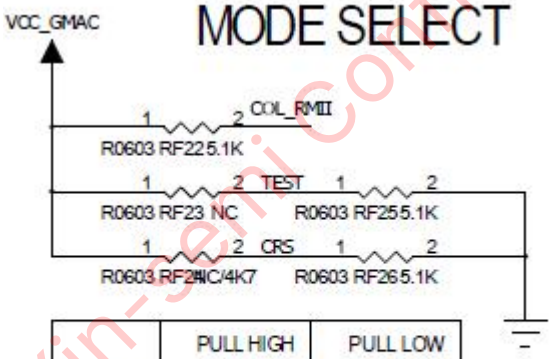




ETHERNET INTERFACE

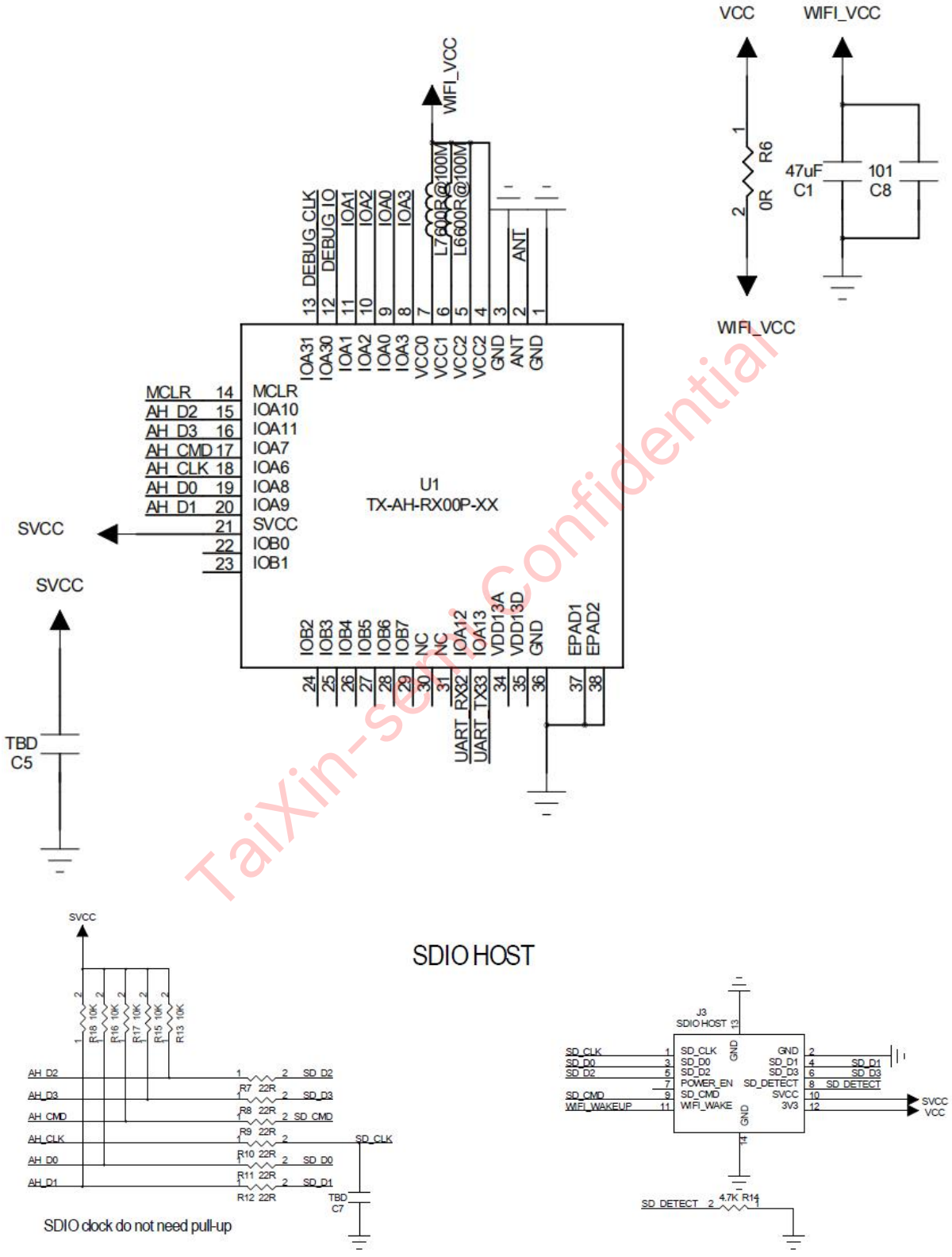


MODE SELECT



	PULL HIGH	PULL LOW
COL/RMII	RMII MODE	MII MODE
TEST	TEST MODE	NORMAL MODE
CRS	LED MODE1	LED MODE0

7.3. SDIO device boot Reference Schematic

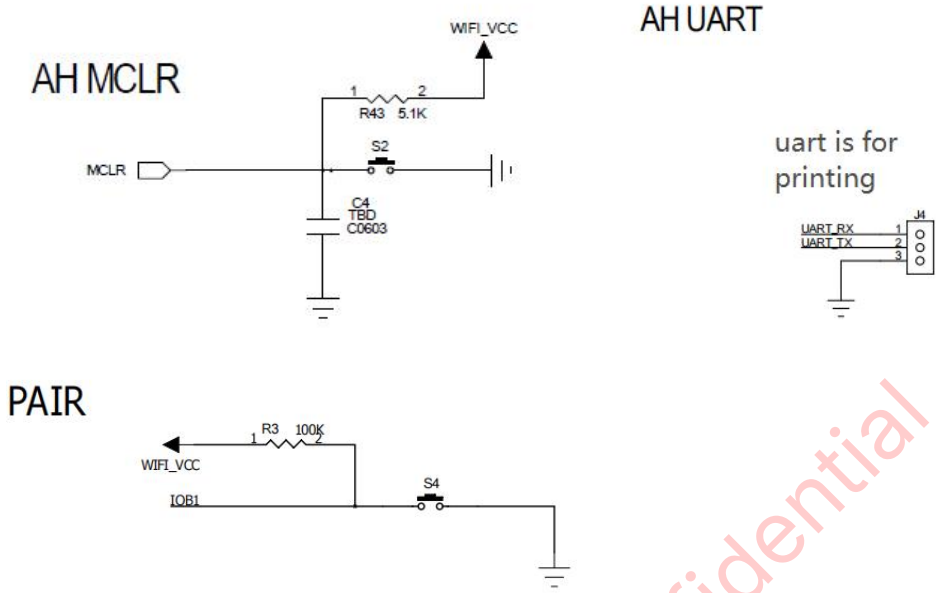


Note:

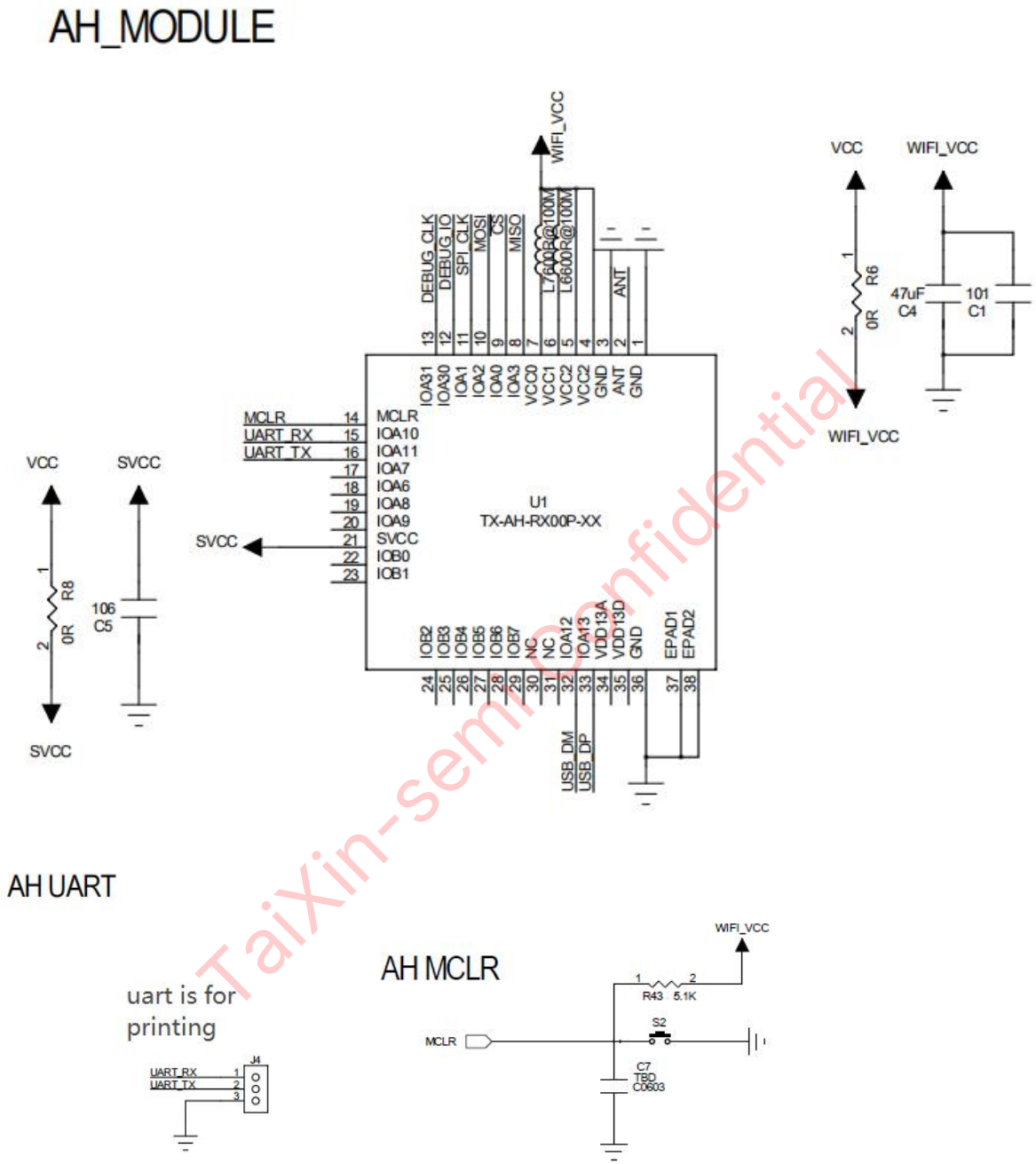
CMD/D0~D3 of SDIO require external pull-ups, CLK does not; it's recommended to power

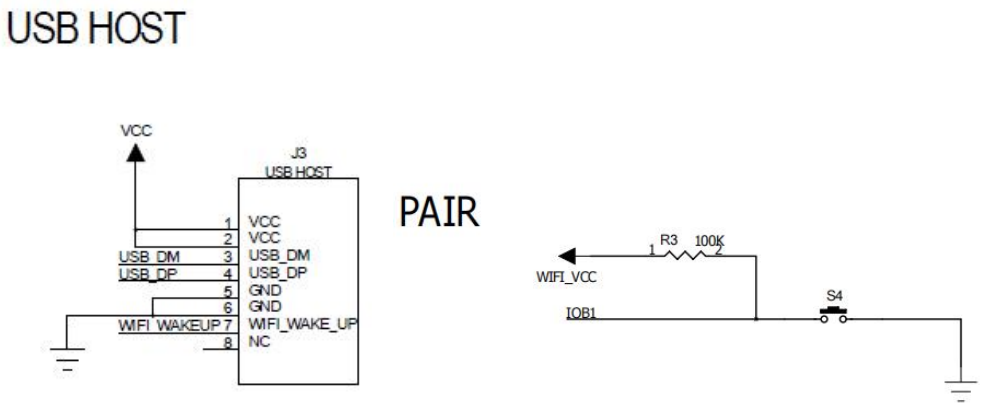
the SVCC from the host controller.

SDIO only supports four-wire mode, not one-wire mode.



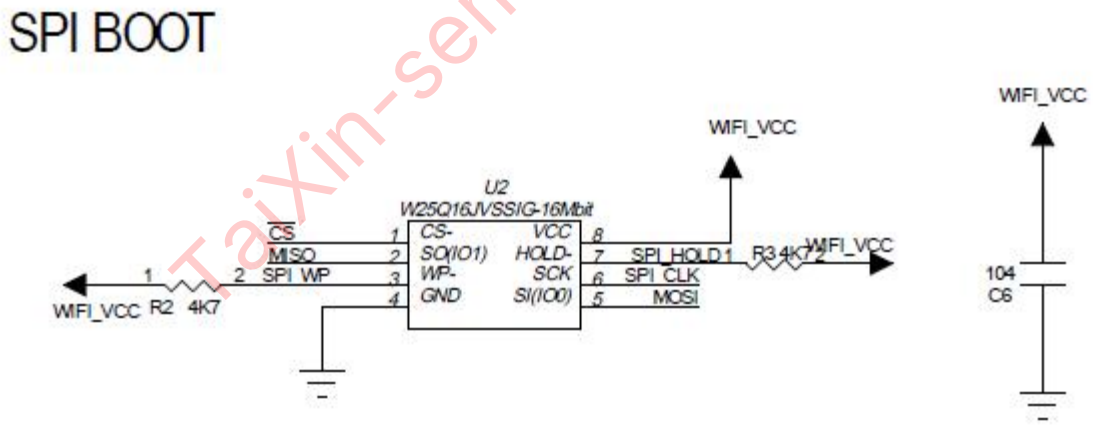
7.4. USB device boot Reference Schematic





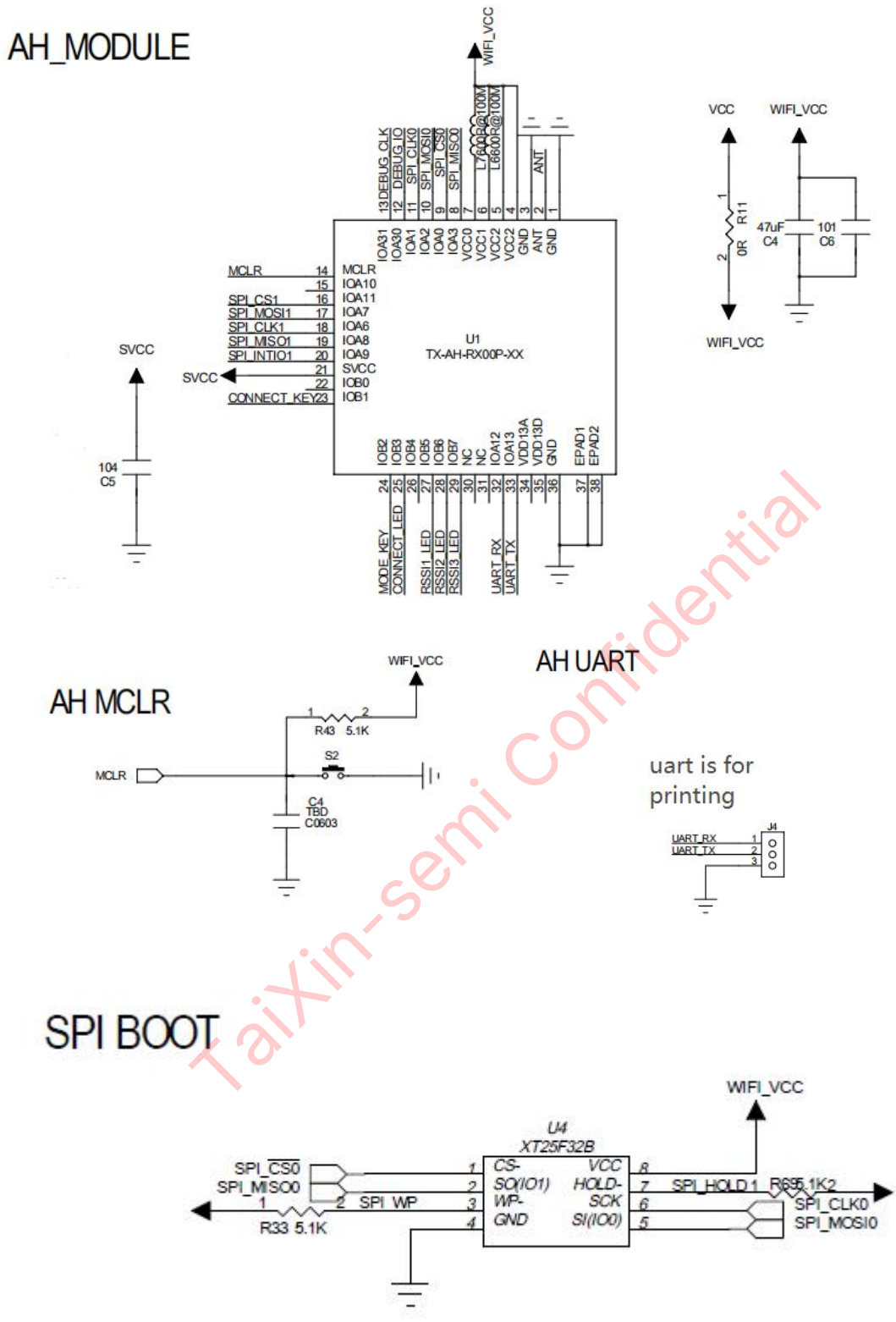
7.5. SPI NorFlash boot Reference Schematic

When interfaced with a HOST controller, if fast AH startup is required, you can consider using SPI Nor boot instead of SDIO/USB boot. Add the following circuit to your application. All standalone module application will require Nor flash for firmware storage. UART interface also require Nor flash. For SPI interface it is possible to not equip Nor flash. The minimum capacity of Nor flash is 8Mbit.



7.6. SPI Interface Communication Reference Schematic

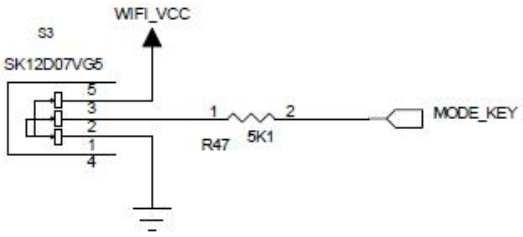
TX-AH-Rx00P can communicate with the Host MCU as an SPI slave (implemented through the SPI mode of the SDIO interface). Note that SVCC is powered from the host. Pay attention to pull-ups for MOSI, MISO, and INTIO in the external circuit.



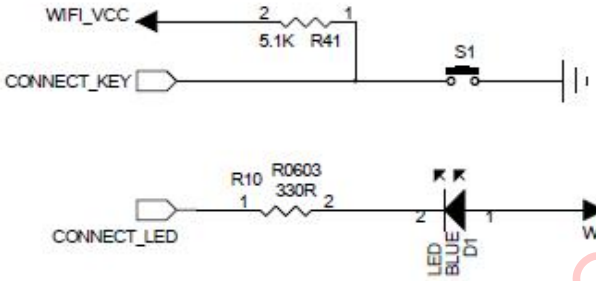
If key presses are required for character selection and key pairing, this can be achieved with the following circuit.

If needs Keys & Leds, adopt this part

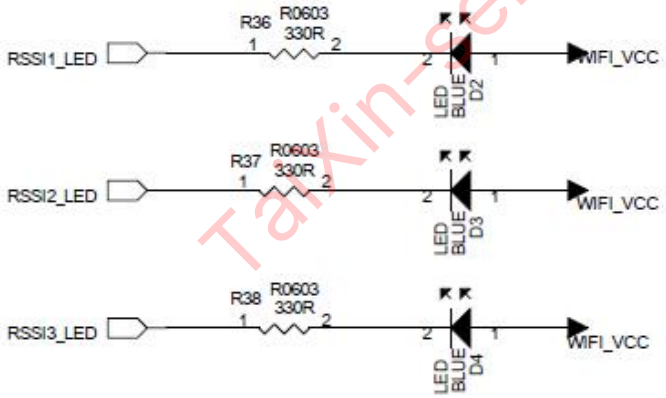
MODE KEY



CONNECT KEY/LED

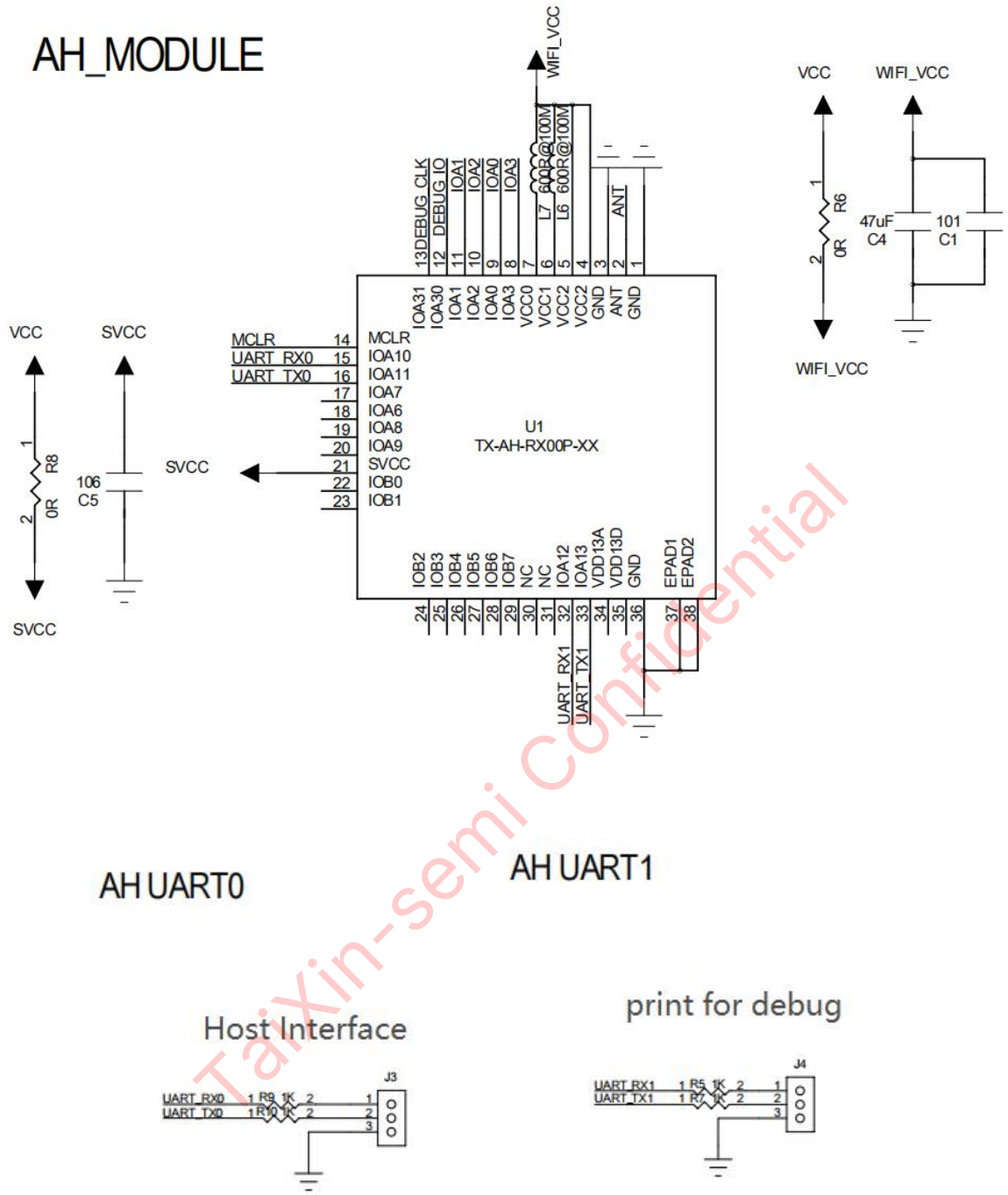


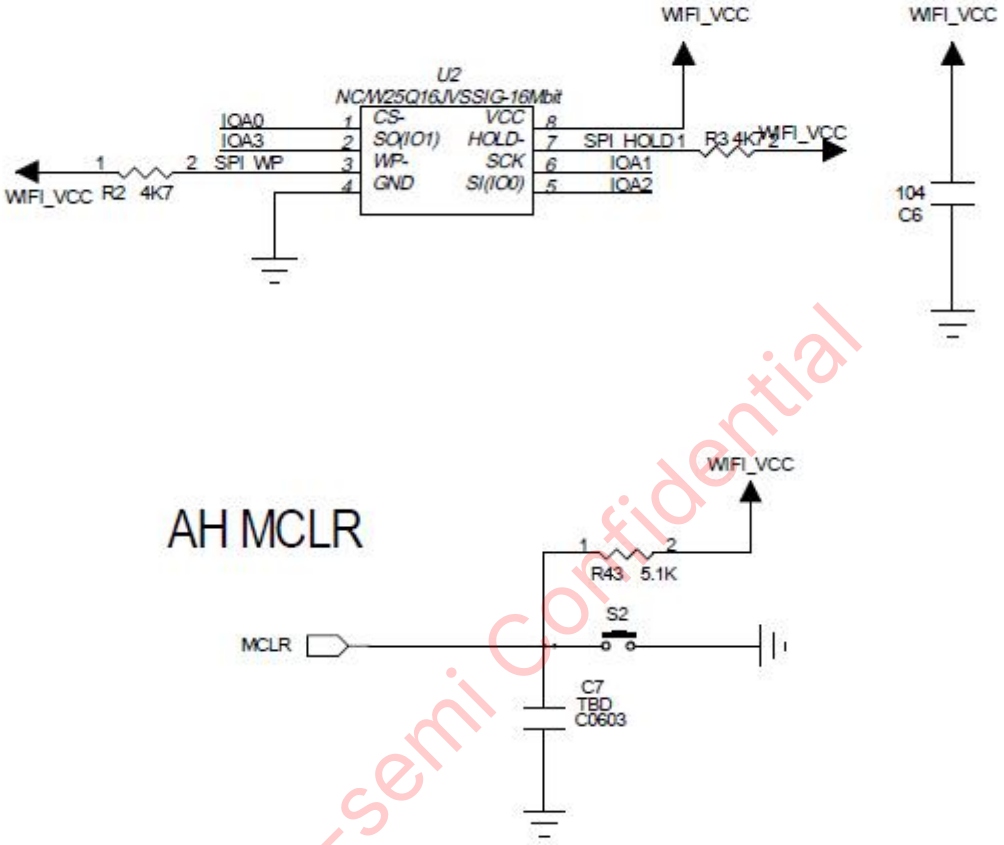
RSSI LED



7.7. UART Interface Communication Reference Schematic

When using the UART interface for HOST connection, UART0 serves as the data transmission interface, while UART1 serves as the debugging print interface.



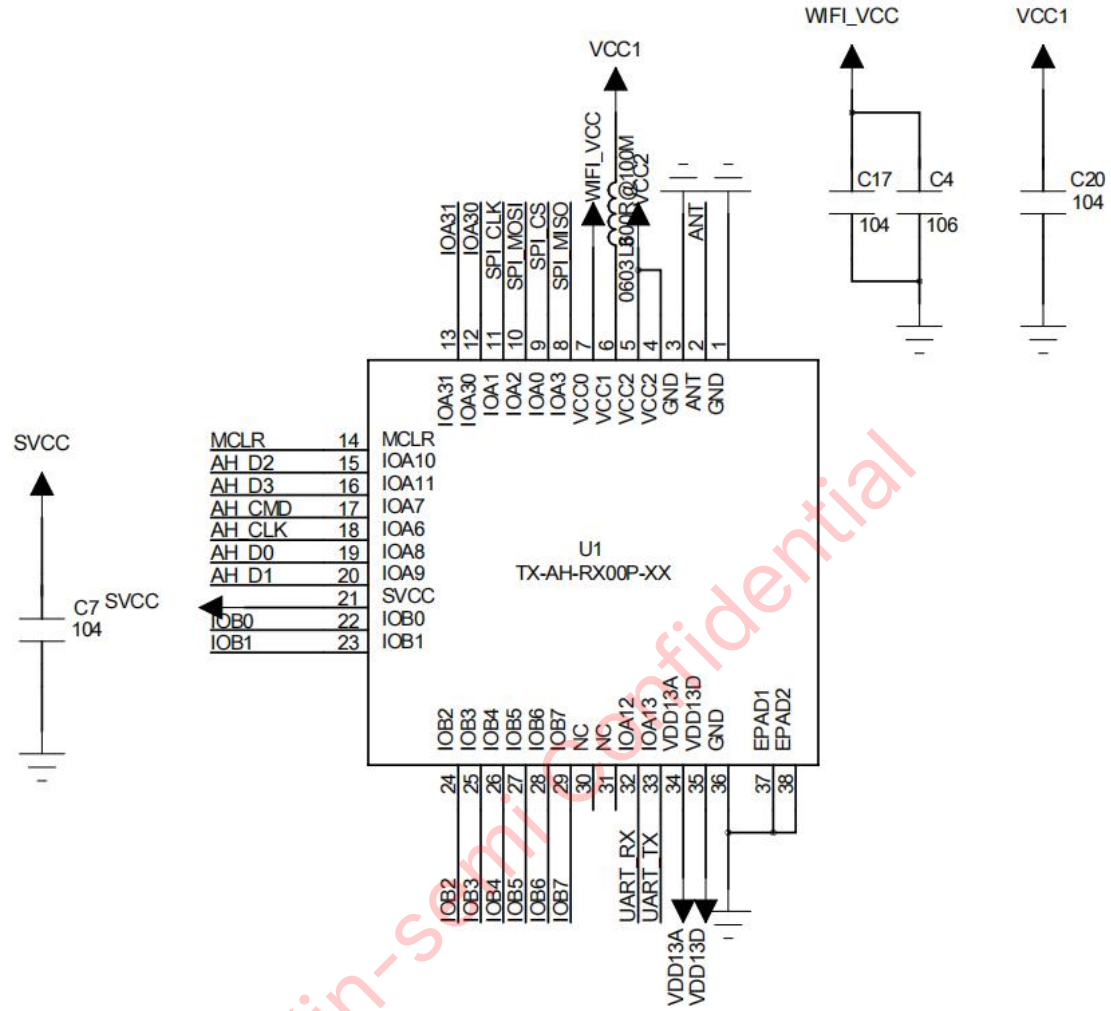


7.8. Low Power Consumption Reference Schematic

This reference schematic is for module using SDIO interface for HOST connection.

Unlike the reference schematics in the standard application chapter, the low power consumption schematics separate the power supply for the MCU (VCC0) from the RF power supply (VCC1, VCC2).

AH_MODULE

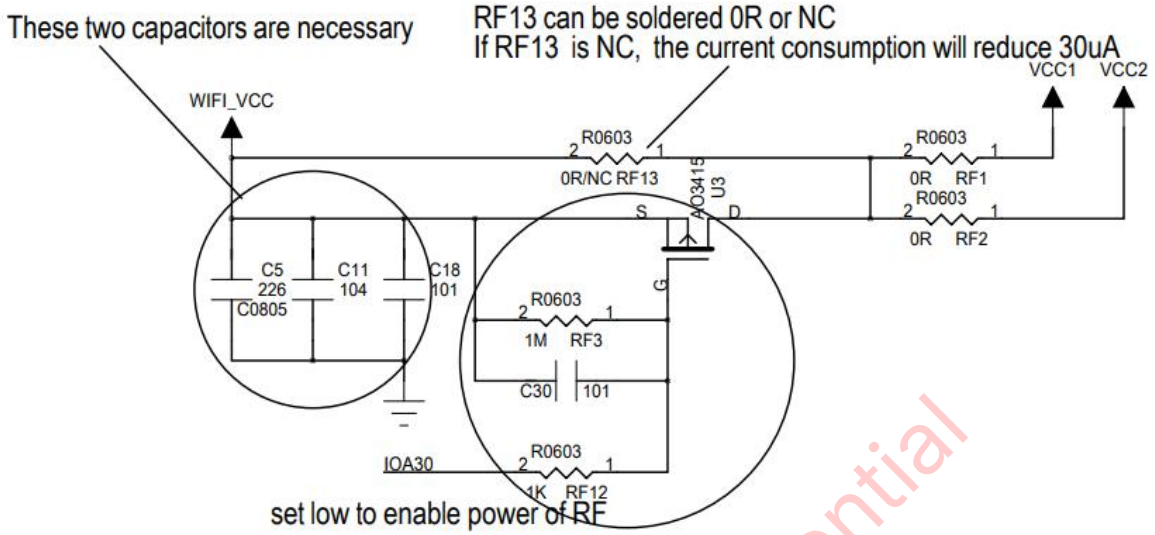


Without turning off the RF power supply, it will consume up to 200uA more power than that when turning off.

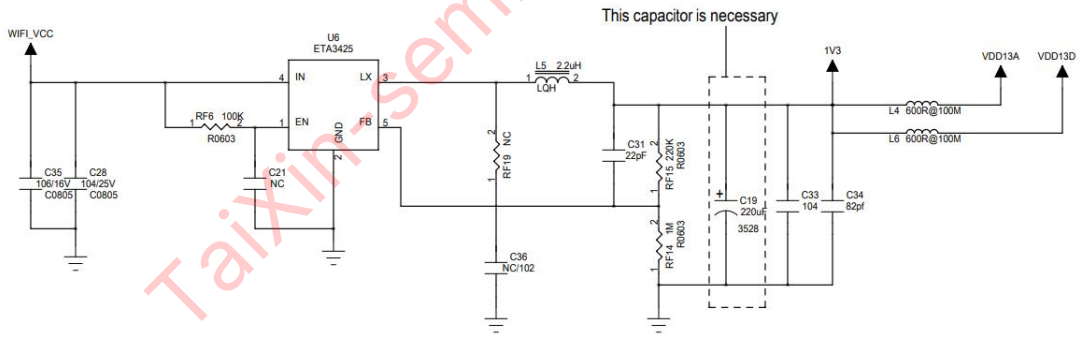
If a higher sleep current is acceptable in your application, you can bridge the RF13 pad with a 0R resistor, then no need to implement the circuit circled in the schematic below.

If very low sleep current is required, you can disconnect RF13 pad, and implement the circled circuit in the schematic below. Module will Pull down IOA30 to enable power supply to RF, and pull up IOA30 to cut power supply to RF when the device enters deep sleep.

AH LOW PWR MODE CONTROL



To achieve a lower operating power consumption, use a 1.3V DC-DC converter to supply power to the module's 1.3V power supply.

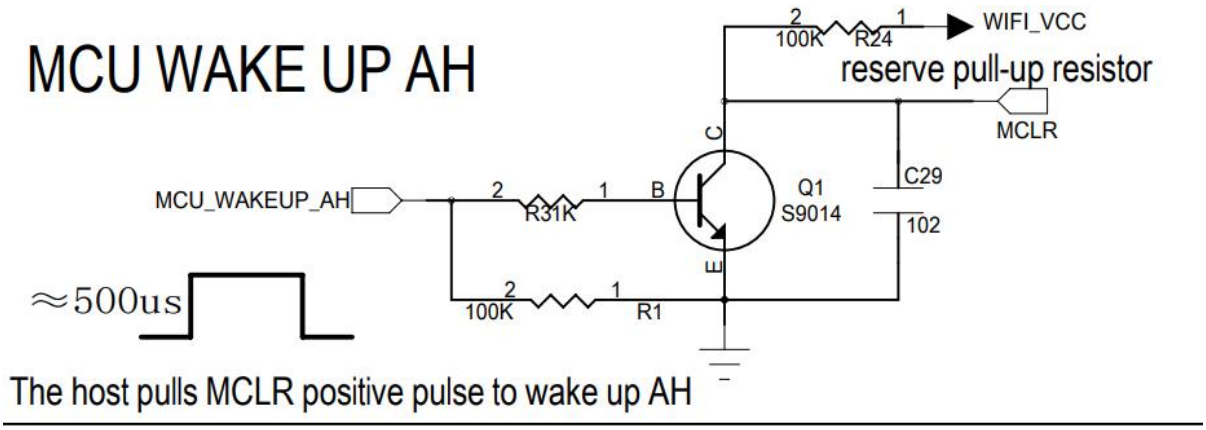


If use this dcdc, no need to cut-off power due to very low leakage

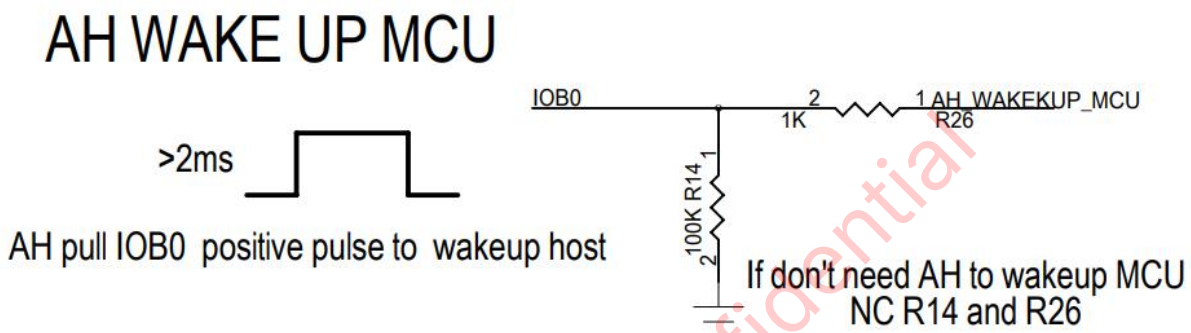
VDD13(1.3V) current at least 200mA. ripple<30mV

If the DC-DC IC has a large static leakage, consider cutting off the DC-DC supply with external IO control when entering sleep;

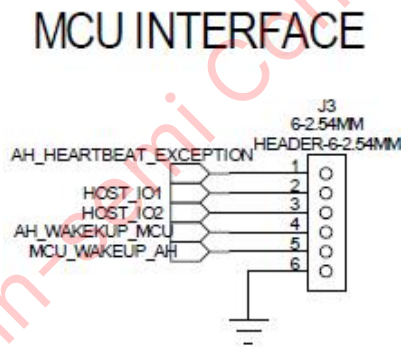
In this example schematic, the ETA3425 DC-DC IC has low quiescent-current. So it is not necessary to power off DC-DC circuit.



The host pulls MCLR positive pulse to wake up AH



AH pull IOB0 positive pulse to wakeup host



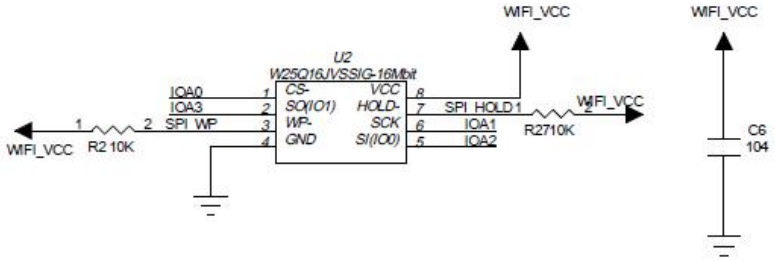
HOST wake AH module:

The HOST controller needs to drive an IO to pull down the MCLR pin for about 500uS to wake up the AH module in deep-sleep mode(the above schematic implemented an inverter circuit, so HOST pulls a positive pulse instead).

AH module wake-up HOST:

AH module will pull up IOB0 for 2ms to generate a positive pulse.

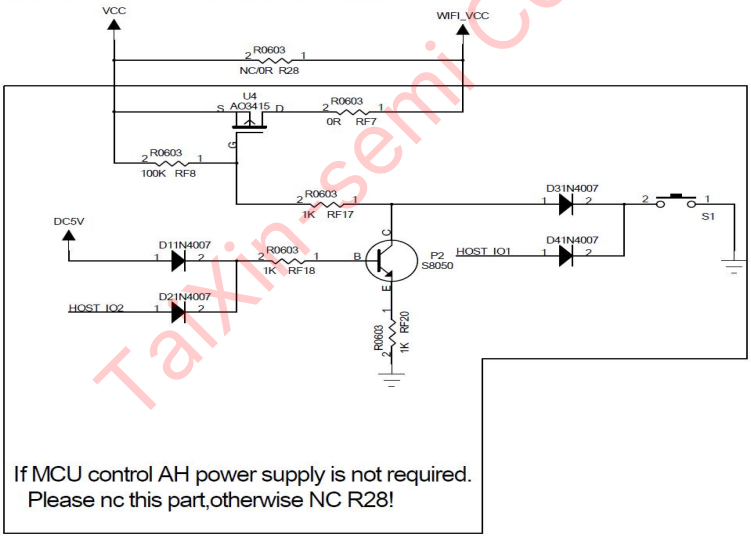
SPI BOOT



Need NOR-Flash in low power applications

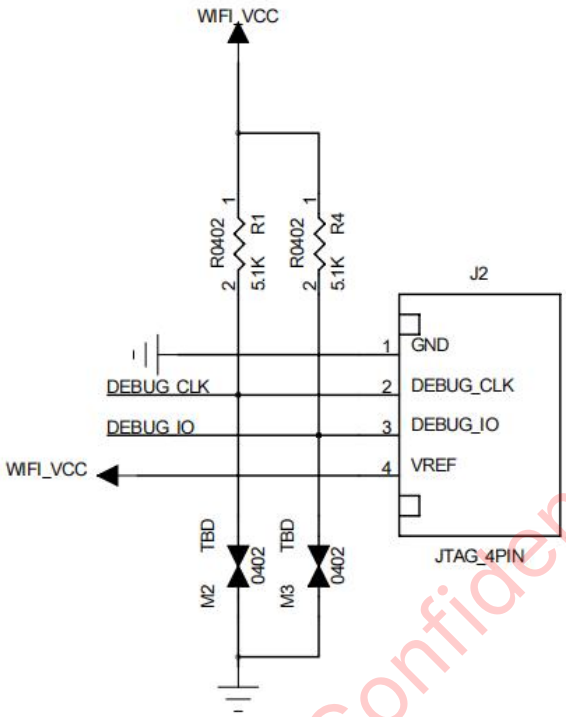
Low power application generally requires rapid startup, so it is recommended to use the Nor flash boot method. (SDIO/SPI/USB boot is much slower as it requires the host controller to send firmware to AH module)

HOST CONTROL AH MODULE PWR



If a soft shutdown circuit is required, it can be implemented using the above circuit, with the MCU controlling the AH power switch.

7.9. Debug Port Reference Schematic



If further firmware development is required, consider adding the debug IO circuit above. Remember not to omit the TVS diode.

8. PCB Related Information

8.1. Module Dimension Diagram

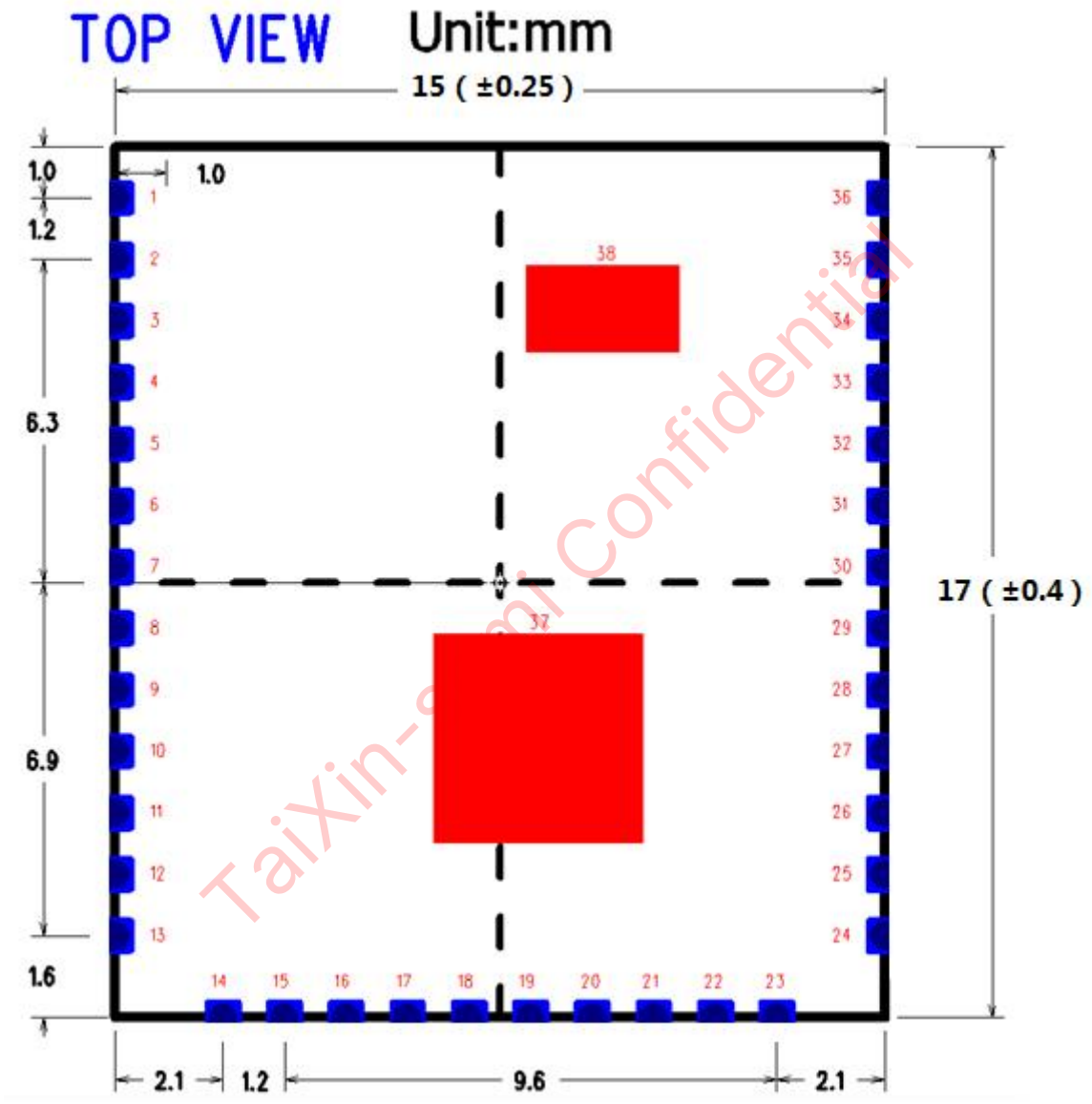


Fig.8-1.TX-AH-Rx00Pxx Module Top View

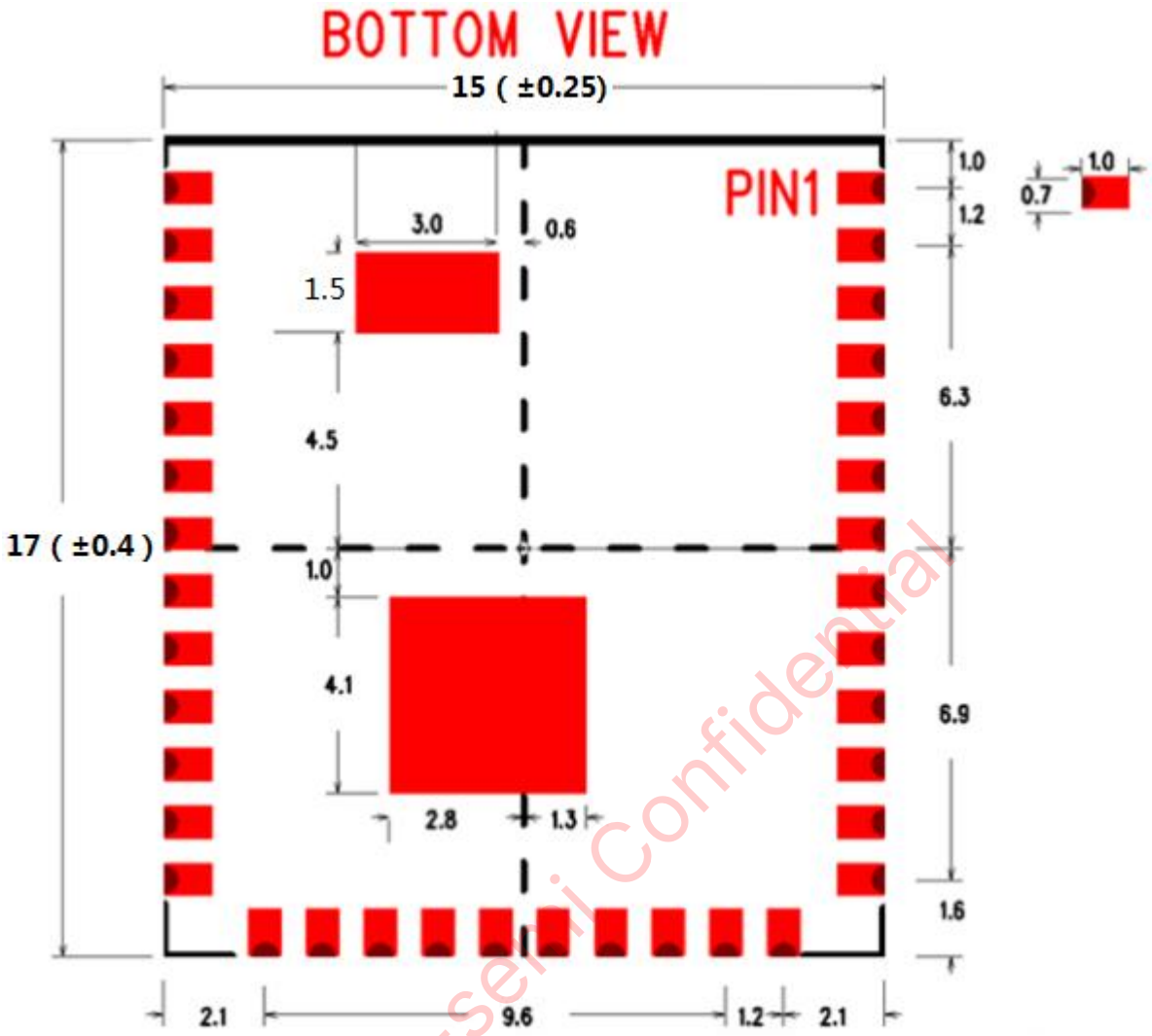


Fig.8-2.TX-AH-Rx00Pxx Module Bottom View

8.2. PCB Package Dimension

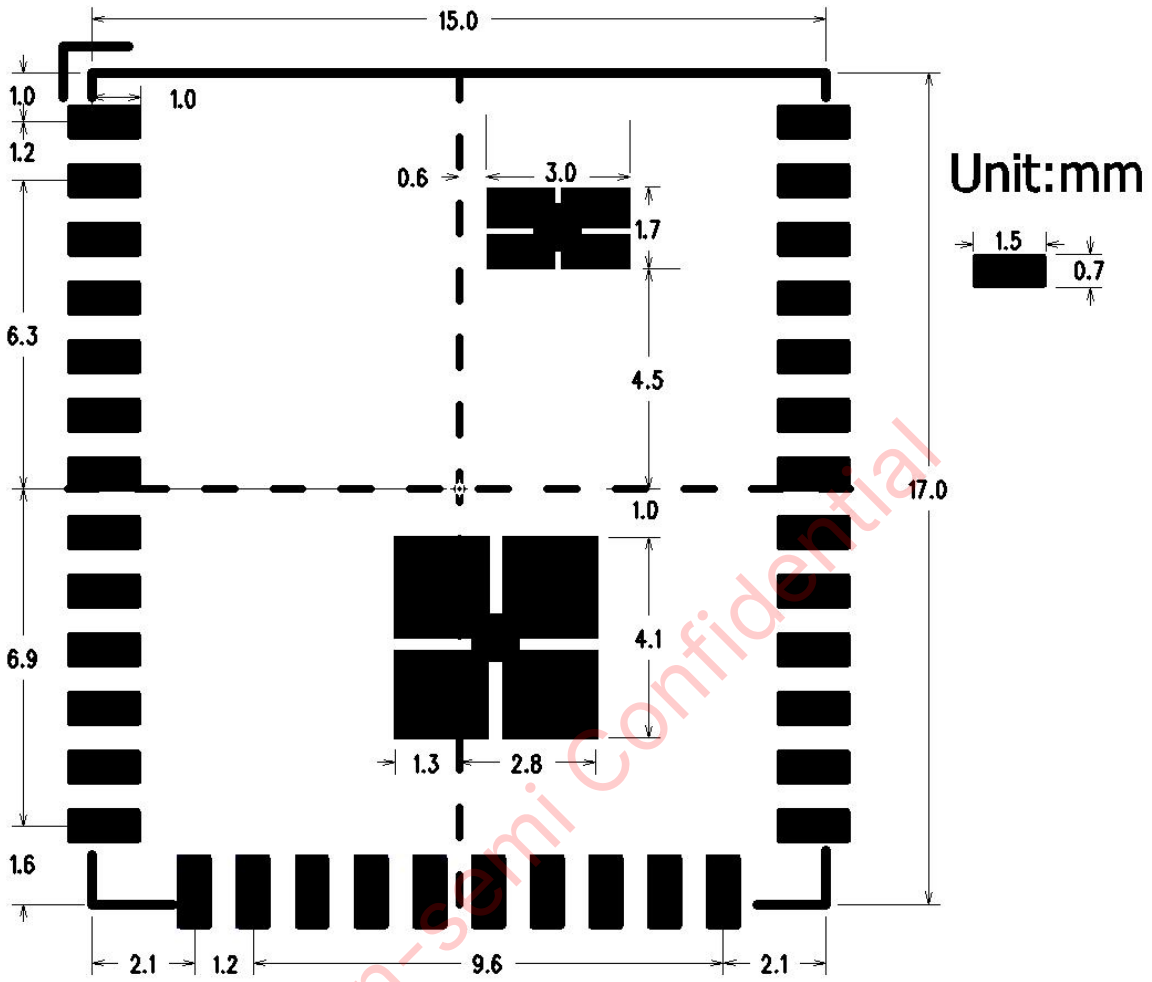


Fig.8-3.TX-AH-Rx00Pxx Module PCB Package Dimension

8.3. Layout Considerations

1） Make as many via holes as possible on the EPAD under the module for better heat dissipation.

2） The routing of the module's RF lines should maintain a 50-ohm impedance, keep the lines as short as possible, avoid via, use curves instead of right angles, and ensure impedance continuity.

3） If there is a DC-DC power supply, try to distance it from the AH module to prevent crosstalk from the noise ripple of the DC-DC power supply.

4） Pay attention to grounding around the RX_CLK routing of the Ethernet PHY to reduce its impact on RF performance by its 50MHz clock and harmonic.

5） The module RF performance could potentially be degraded by EMI from power supply circuit or host controller. In such case consider adding EMI shielding on the host controller and/or the power supply circuit.

9. Packaging Information

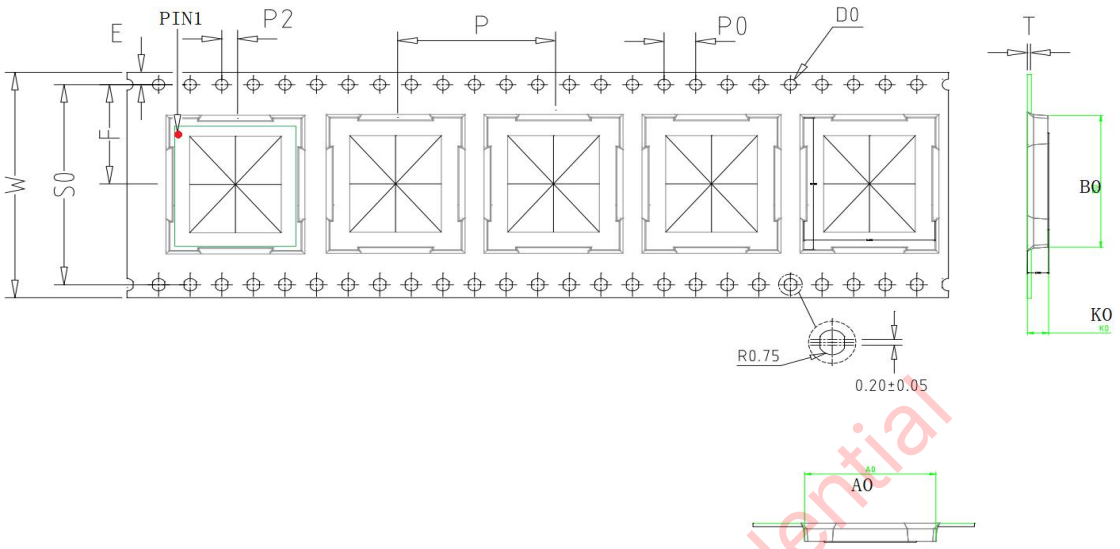


Fig.9-1 Module Packaging Dimension Diagram

Table 9-1 Module Packaging Dimensions (unit: mm)

ITEM	W	A0	B0	K0	K1	P	F
DIM	32.00 +/- 0.30	16.20 +/-0.15	18.30 +/-0.15	2.85 +/-0.15	/	20.00 +/- 0.10	14.20 +/-0.15
ITEM	E	S0	D0	D1	P0	P2	T
DIM	1.75 +/-0.10	28.40 +/-0.10	1.50 +0.10/-0.00	0.00 +/-0.00	4.00 +/-0.10	2.00 +/- 0.10	0.30 +/-0.05

Notes:

1） 10 sprocket hole pitch cumulative tolerance +/-0.20mm.

2） Carrier camber not to exceed 1mm in 250mm.

3） A0 and B0 measured on a plane 0.3mm above the bottom of the packet.

4） K0 measured from a plane on the inside bottom of the packet to the top surface of the carrier.

5） All dimensions meet EIA-481-D requirements.

6） Material: PS. Black(YHD-BK-300).

7） Thickness:0.30+/-0.05mm.

8） Packing length per reel: 20.4Meters.

9） Component loader per reel: 1000 Pcs.(1000Pcs per roll）

10. About Solution Development and Testing

- To facilitate customers in evaluating the performance of our AH product, our company provides wireless bridge demonstration kit (with plastic casing). If customers need smaller evaluation kit for integration, we have 38mm*38mm small PCB boards available for sale.

Fig.10-1 TaiXin AH Bridge Demo

- To expedite customers' development progress, our company offers AH development boards for sale. It provides interfaces such as SDIO/USB/SPI/UART and test points for low power solution development.

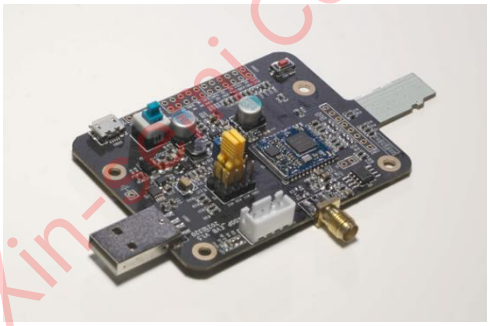


Fig.10-2 TaiXin AH Development Board

- To facilitate customers' quality control during production, our company offers AH production test box for sale.

Fig.10-3 TaiXin AH Test Box

- To facilitate customers' development of AH product, our company provides AH

SNIFFER. For specific inquiries, please consult our FAE.

11. Other Considerations

1） When using this module, frequency and power settings must comply with the wireless regulations of the sales region.

2） The 700MHz band currently experiences interference from 5G signals in China, please take appropriate measures to avoid it.