SDIO PRODUCT SPECIFICATION

IEEE 802.11 b/g/n 2.4GHz 1T1R WiFi Module

BT58189-2

Single Module

Contents

Change History of Revision

Revisio	Date	Contents of Revision Change	Remark
V1.0	2016-11-11		2016-11-11

1.General Description

The Realtek RTL8189FTV is a highly integrated single-chip 802.11n Wireless LAN (WLAN) network SDIO interface (SDIO 1.1/ 2.0 compliant) controller. It is a WLAN MAC, a 1T1R capable WLAN baseband, and WLAN RF in a single chip. The RTL8189FTV provides a complete solution for a high throughput performance integrated wireless LAN device.

The RTL8189FTV WLAN baseband implements Orthogonal Frequency Division Multiplexing (OFDM) with 1 transmit and 1 receive path and is compatible with the IEEE 802.11n specification. Features include one spatial stream transmission, short guard interval (GI) of 400ns, spatial spreading, and transmission over 20MHz and 40MHz bandwidth.

For legacy compatibility, Direct Sequence Spread Spectrum (DSSS), Complementary Code Keying (CCK) and OFDM baseband processing are included to support all IEEE 802.11b and 802.11g data rates. Differential phase shift keying modulation schemes, DBPSK and DQPSK with data scrambling capability, are available, and CCK provides support for legacy data rates, with long or short preamble. The high-speed FFT/IFFT paths, combined with BPSK, QPSK, 16QAM, and 64QAM modulation of the individual subcarriers and rate compatible punctured convolutional coding with coding rate of 1/2, 2/3, 3/4, and 5/6, provide higher data rates of 54Mbps and 150Mbps for IEEE 802.11g and 802.11n OFDM respectively.

The RTL8189FTV WLAN Controller builds in an enhanced signal detector, an adaptive frequency domain equalizer, and a soft-decision Viterbi decoder to alleviate severe multi-path effects and mutual interference in the reception of multiple streams. Robust interference detection and suppression are provided to protect against Bluetooth, cordless phone, and microwave oven interference.

Efficient IQ-imbalance, DC offset, phase noise, frequency offset, and timing offset compensations are provided for the radio frequency front-end. Selectable digital transmit and receive FIR filters are provided to meet transmit spectrum mask requirements and to reject adjacent channel interference, respectively.

The RTL8189FTV WLAN Controller supports fast receiver Automatic Gain Control (AGC) with synchronous and asynchronous control loops among antennas, antenna diversity functions, and adaptive transmit power control function to obtain the better performance in the analog portions of the transceiver.

The RTL8189FTV WLAN MAC supports 802.11e for multimedia applications, 802.11i for security, and 802.11n for enhanced MAC protocol efficiency. Using packet aggregation techniques such as A-MPDU with BA and A-MSDU, protocol efficiency is significantly improved. Power saving mechanisms such as Legacy Power Save, and U-APSD, reduce the power wasted during idle time, and compensates for the extra power required to transmit OFDM. The RTL8189FTV provides simple legacy and 20MHz/40MHz co-existence mechanisms to ensure backward and network compatibility.

2.Features

General
- CMOS MAC, Baseband PHY, and RF in a single chip for IEEE 802.11b/g/n compatible WLAN
- Complete 802.11n solution for 2.4GHz band
- 72.2Mbps receive PHY rate and 72.2Mbps transmit PHY rate using 20MHz bandwidth
- 150Mbps receive PHY rate and 150Mbps transmit PHY rate using 40MHz bandwidth
- Compatible with 802.11n specification
- Backward compatible with 802.11b/g devices while operating in 802.11n mode

Host Interface
- Complies with SDIO 1.1/ 2.0 for WLAN with clock rate up to 100MHz
- GSPI interface for configurable endian for WLAN

Standards Supported
- IEEE 802.11b/g/n compatible WLAN
- IEEE 802.11e QoS Enhancement (WMM)
- 802.11i (WPA, WPA2). Open, shared key,and pair-wise key authentication services
- Switch diversity for DSSS/CCK
- Hardware antenna diversity in per packet base
- Selectable receiver FIR filters
- Programmable scaling in transmitter and receiver to trade quantization noise against increased probability of clipping

WLAN MAC Features
- Frame aggregation for increased MAC efficiency (A-MSDU, A-MPDU)
- Low latency immediate High-Throughput Block Acknowledgement (HT-BA)
- PHY-level spoofing to enhance legacy compatibility
- Power saving mechanism
- Channel management and co-existence
- Transmit Opportunity (TXOP) Short Inter-Frame Space (SIFS) bursting for higher multimedia bandwidth

WLAN PHY Features
- IEEE 802.11n OFDM
- One Transmit and one Receive path (1T1R)
- 20MHz and 40MHz bandwidth transmission
- Short Guard Interval (400ns)
- DSSS with DBPSK and DQPSK, CCK modulation with long and short preamble
- OFDM with BPSK, QPSK, 16QAM, and 64QAM modulation. Convolutional Coding Rate: 1/2, 2/3, 3/4,and 5/6
- Maximum data rate 54Mbps in 802.11g and 150Mbps in 802.11n
- Fast receiver Automatic Gain Control
- (AGC)
- On-chip ADC and DAC

Peripheral Interfaces
- General Purpose Input/Output (4 pins)

3.PRODUCT SPECIFICATIONS

Realtek RTL8189FTV. Functional Specifications

Standards	IEEE 802.11b, IEEE 802.11g, Draft IEEE 802.11n, IEEE 802.11d, IEEE 802.11e, IEEE 802.11h, IEEE 802.11i
Bus Interface	*WiFi:* GSPI/SDIO
Media Access Control	CSMA/CA with ACK
Network Architecture	Ad-hoc mode (Peer-to-Peer) Infrastructure mode Scatter Net
Operating Channel	11: (Ch. 1-11) – United States 13: (Ch. 1-13) – Europe 14: (Ch. 1-14) – Japan
Frequency Range	2.400GHz ~ 2.484 GHz
Security	WPA,WPA-PSK,WPA2,WPA2-PSK,WEP64bit&128bit,IEEE802.11x, IEEE 802.11i
Operating Voltage	3.3 V ±9% I/O supply voltage
OS supported	Windows XP/Win7/Linux/Android

4.DC Characteristics

1） Power Supply Characteristics

Symbol	Parameter	Minimum	Typical	Maximum	Units
VDD33(pin#9)	3.3V Power Supply Voltage	3.0	3.3	3.6	V
IDD33	3.3V Rating Current	-	-	600	mA

2） Digital IO Pin DC Characteristics

Symbol	Parameter		Minimum	Typical	Maximum	Units
VDDIO(pin#22)	3.3V I/O Power Voltage	V_{IH}	2.0	3.3	3.6	V
		V_{IL}	--	0	0.9	V
		V_{OH}	2.97	--	3.3	V
		V_{OL}	0	--	0.33	V
	1.8V I/O Power Voltage	V_{IH}	1.7	1.8	2.0	V
		V_{IL}	--	0	0.8	V
		V_{OH}	1.62	--	1.8	V
		V_{OL}	0	--	0.18	V
CS(PIN#12)	Chip select	V_{IH}	2.0	3.3	3.6	V
		V_{IL}	--	0	0.9	V
WL_HOST_WAKE (PIN#13)	WLAN wake-up HOST	V_{OH}	2.97	--	3.3	V
		V_{OL}	0	--	0.33	V

5.RF Electrical Specifications

1）RF Characteristics for IEEE802.11b （11Mbps mode unless otherwise specified)

Items	**Contents**			
Specification	IEEE802.11b			
Mode	CCK, DQPSK, DBPSK			
Data Rate	11, 5.5, 2, 1 Mbps			
Channel frequency	2412 ~ 2484 MHz			
RX (per≤-85dBm@8%)	-85 dBm			
Freq Err Limit	±13ppm			
TX Characteristics	Min	Typ	Max	Unit
Power Level (17±2 dBm)		17		dBm
EVM (<-18)		-18		dB

2）RF Characteristics for IEEE802.11g （54Mbps mode unless otherwise specified)

Items	**Contents**			
Specification	IEEE802.11g			
Mode	*64 QAM, 16 QAM, QPSK, BPSK*			
Data Rate	54, 48, 36, 24, 18, 12, 9, 6 Mbps			
Channel frequency	2412 ~ 2484 MHz			
RX (per≤-70dBm@10%)	-70 dBm			
Freq Err Limit	±13ppm			
TX Characteristics	Min	Typ	Max	Unit
Power Level (14±2 dBm)		14		dBm
EVM (<-28)		-28		dB

3）RF Characteristics for IEEE802.11n

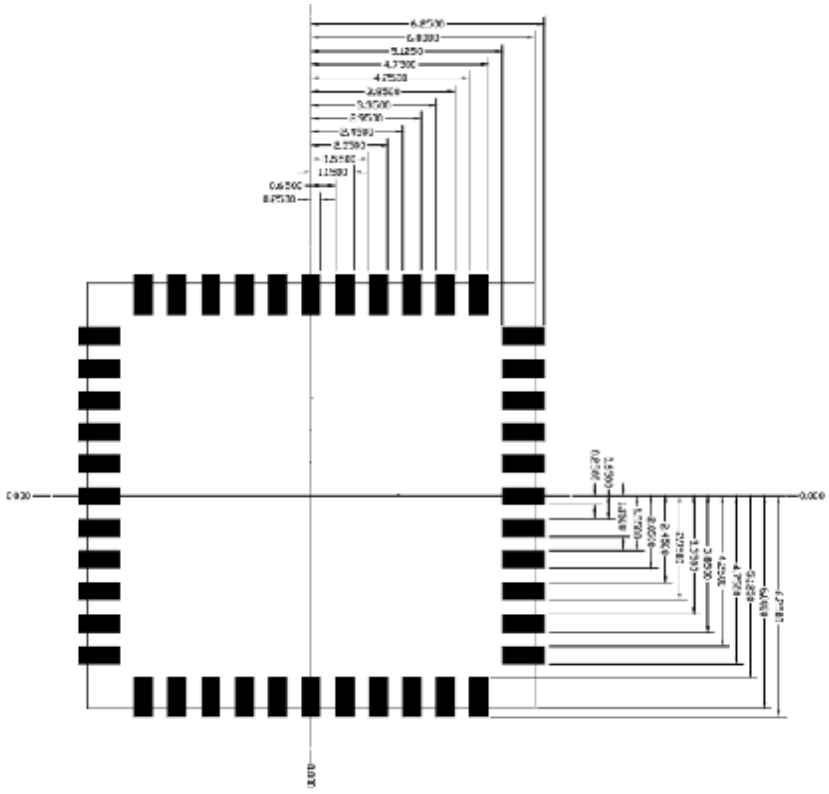
Items	**Contents**			
Specification	IEEE802.11n （ MCS 0 to 7 for HT20MHz ）			
Mode	64 QAM, 16 QAM, QPSK, BPSK			
Data Rate	65 Mbps			
Channel frequency	2412 ~ 2484 MHz			
RX (per≤-65dBm@10%)	-65 dBm			
Freq Err Limit	±13ppm			
TX Characteristics	Min	Typ	Max	Unit
Power Level (13±2 dBm)		13		dBm
EVM (<-28)		-28		dB

4）RF Characteristics for IEEE802.11n

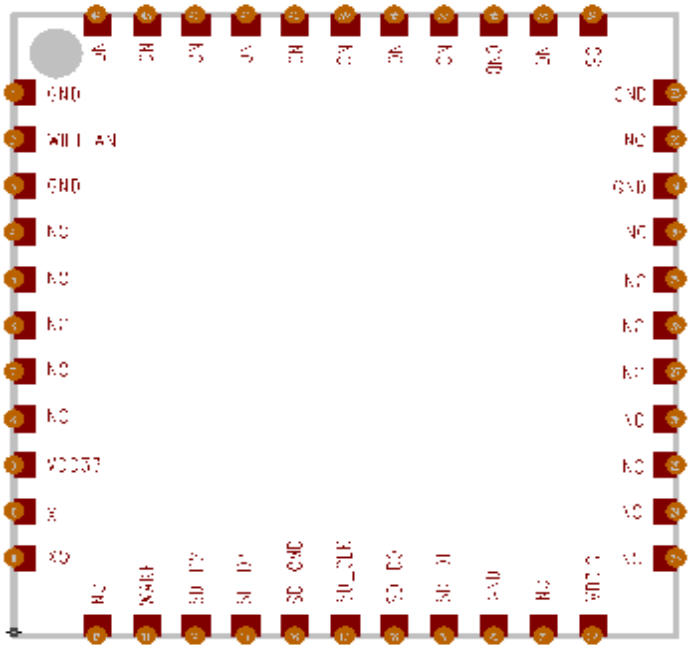
Items	**Contents**			
Specification	IEEE802.11n （MCS 0 to 7 for HT40MHz ）			
Mode	64 QAM, 16 QAM, QPSK, BPSK			
Data Rate	135 Mbps			
Channel frequency	2412 ~ 2484 MHz			
RX (per≤-65dBm@10%)	-65 dBm			
Freq Err Limit	±13ppm			
TX Characteristics	Min	Typ	Max	Unit
Power Level (13±2 dBm)		13		dBm
EVM (<-28)		-28		dB

6.Mechanical

Dimensions (mm)	Length	Width	Height
	12.0 **(Tolerance:±0.2mm)**	12.0 **(Tolerance:±0.2mm)**	1.6 **(Tolerance:±0.2mm)**



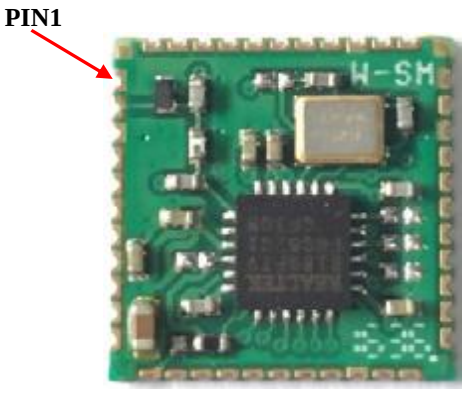
7.Module PIN feet definition figure



Pin Definition

Pin No.	Definition	Description
1	GND	GND
2	WIFI_ANT	RF RX&TX Signal
3	GND	GND
4	NC	NC
5	NC	NC
6	NC	NC
7	NC	NC
8	NC	NC
9	VDD33	Power supply for system（3.3V±0.3V）
10	NC	NC
11	NC	NC
12	NC	NC
13	WL_HOST_WAKE	For WLAN wake-up HOST, Internal pull high to 3.3V at 100KΩ
14	SD_D2	SDIO Data Line 2
15	SD_D3	SDIO Data Line 3
16	SD_CMD	SDIO Command Input
17	SD_CLK	SDIO Clock Input
18	SD_D0	SDIO Data Line 0
19	SD_D1	SDIO Data Line 1
20	GND	GND
21	NC	NC
22	VDDIO	VDD for SDIO Pin, the power supply is same as the signal level of SDIO bus (3.3V ~ 1.8V)
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

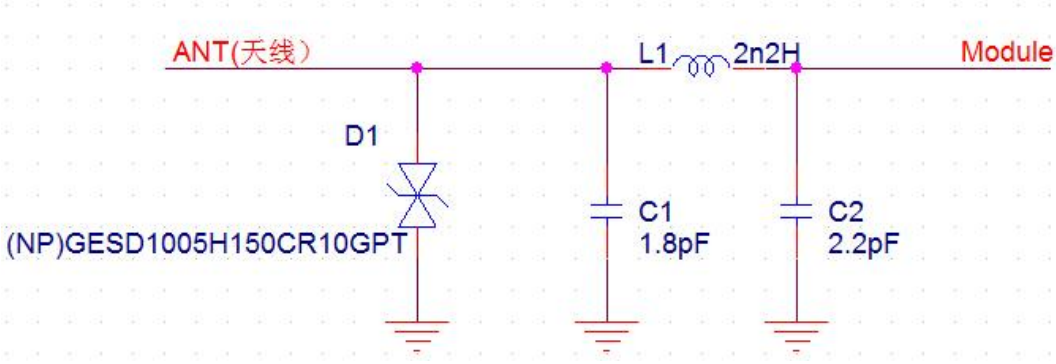
34	CS	Chip select，Activity high；Internal pull high to 3.3V at 100K Ω
35	NC	NC
36	GND	GND
37	NC	NC
38	NC	NC
39	NC	NC
40	NC	NC
41	NC	NC
42	NC	NC
43	NC	NC
44	NC	NC



The picture of top

The picture of bottom

8.1 WIFI\BT RF Circuit reference pictures.

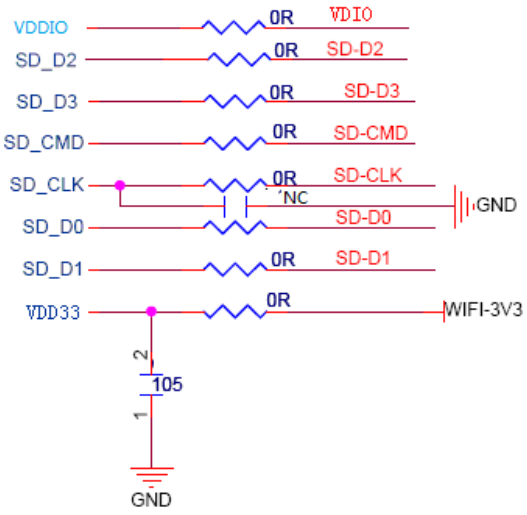


1. Above the dotted box part of the antenna matching is needed, the actual antenna matching electronic parameters shall prevail.

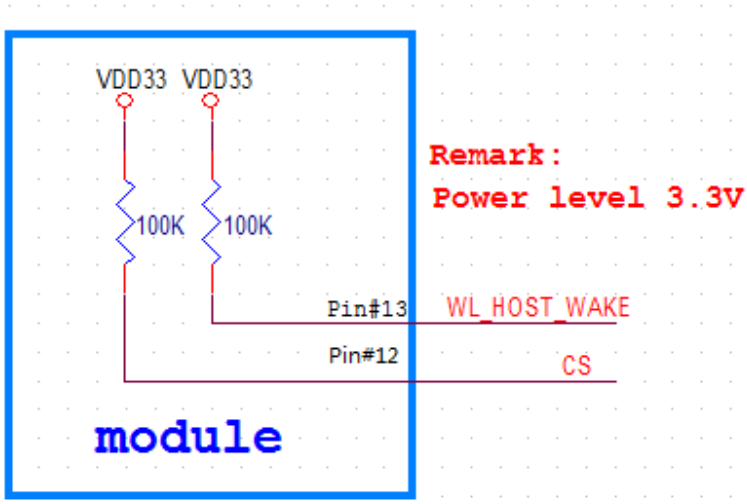
2.For RF part layout to do 50 ohm impedance. can't go on 90° of layout .The line length

can't more than 20 mm.

8.2 SDIO interface Circuit reference pictures.

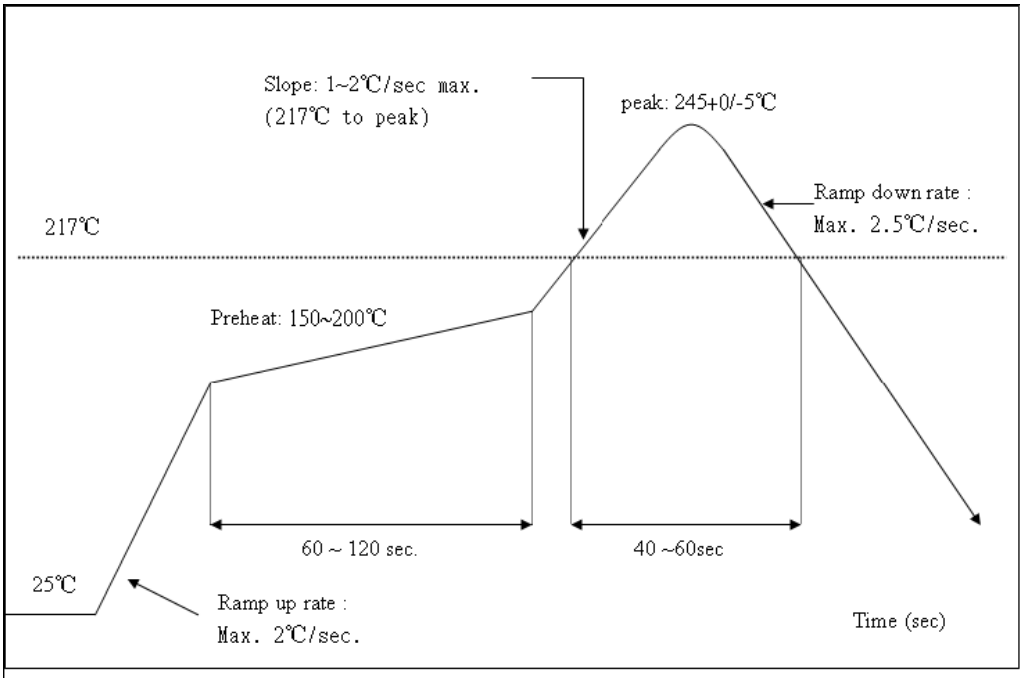


9.3 CS WAKE Reference circuits.



9 .Recommended Reflow Profile.

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



ID SETTING INFORMATION.

Reg Domain	World Wide 13 Channels 1-11 with active scan Channels 12,13 with passive scan Channel 14 with no scan
Reg Domain Code	0x0A
Vendor ID	*WiFi* :0x024C
Device ID	*WiFi* :0x8179
Subsystem Device ID	0x8179 (Realtek demoboard)
Subsystem Vendor ID	0x024C

ENVIRONMENTAL.

Operating

Operating Temperature: 0°C to +60 °C
Relative Humidity: 5-90% (non-condensing)

Storage

Temperature: -10°C to +70°C (non-operating)
Relevant Humidity: 5-95% (non-condensing)

MTBF caculation

Over 150,000hours

10. RoHS compliance.

This product is RoHS compliance.

12.Wireless module before the SMT note:

1.When customers Open stencil must be sure the hole bigger to the Wireless module plate, please press 1 to 1 and 0.7 mm is widened to open outward, the thickness of 0.12 mm.

2.Can't get the wifi module bare hands when needs,must we wear the gloves and static ring.

3.The furnace temperature according to the size of the customer the mainboard ,generally like to stick on a tablet standard temperature of 250 + - 5,can do 260 + - 5.

Storage and use Wifi module control should pay attention to the following matters:

1.Module of the storage life of vacuum packaging:

1-1.Storage life： 12 months. Storage conditions:<40℃. Relative humidity:<90%R.H.

1-2.After this bag is opened , devices that will be subjected to infrared reflow, vapor-phase reflow, or equivalent processing must be :

1-3.Check the humidity card :stored at ≦20%RH.If :30%~40%(pink)or greater than 40%(red).Labeling module has moisture absorption.

① Mounthed within 168 hours at factory conditions of: t≦30%℃, ≦60%R.H.
② Once opened, the workshop the preservation of life for 168 hours.

1-4.If baking is required,devices may be baked for:

① Modules must be to remove module moisture problem.
② Baking temperature: 125 ℃, 8 hours.
③ After baking, put proper amount of desiccant to seal packages.

1-5. The actual number of module vacuum packing which is based on the actual number of packages to the customer requirements.

2.Module reel packaging items as follows.

2-1.Storage life： 12 months. Storage conditions:<40℃. Relative humidity:<90%R.H.

12.Wifi 模块贴片装机前注意事项:

1.客户在开钢网时一定要将 wifi 模块焊盘的孔开大，请按 1 比 1 再向外扩大 0.7mm 比例开钢网，厚度按 0.12mm.

2.有需要拿 wifi 模块时不可以光手去拿，一定要戴上手套以及静电环.

3.过炉温度要根据客户主板的大小而定，一般像平板电脑上的标准温度为250+-5°，也可以做到260+-5°

Wifi 模块储存及使用管制应注意事项如下:

1.模块的真空包装之储存期限:

1-1.保存期限：12个月，储存环境条件：温度在：<40℃，相对湿度：<90%R.H.

1-2.模块包装被拆后，SMT 组装之时限:

1-3.检查湿度卡：显示值应小于30%（蓝色），如：30%~40%(粉红色）或者大于40%（红色）表示模块已吸湿气.

① 工厂环境温度湿度管制:≦30%℃，≦60%R.H。
② 拆封后，车间的保存寿命为 168 小时.

1-4.如在拆封后的 168 个小时内未使用完，需要烘烤，烘烤条件如下:

① 模块须重新烘烤，以除去模块吸湿问题.
② 烘烤温度条件：125℃，8 小时.
③ 烘烤后，放入适量的干燥剂再密封包装.

1-5. 模块真空包装数量以客户要求的实际包装数量为准

2.模块卷盘包装事项如下:

2-1.保存期限：12个月，储存环境条件：温度在：<40℃，相对湿度：<90%R.H.

2-2.模块拆开包装168小时后，如要上线贴片需要重新烘烤，以除去模块吸湿问题，烘烤温度条件：125℃，8小时。

2-2.Module apart packing after 168 hours，To launch patch need to bake, to remove the module hygroscopic, baking temperature conditions：125℃，8hours.

2-3. The actual number of module reel packing which is based on the actual number of packages to the customer requirements.

3.Module pallet packaging items as follows：

3-1.Storage life ： 3 months. Storage conditions:<40℃. Relative humidity:<90%R.H.

3-2.Module if not used within 48 hours, before launch the need for baking, baking temperature: 125 ℃, 8 hours.

3-3. Pallet packaging each plate is 100 PCS.The actual number of module pallet packing which is based on the actual number of packages to the customer requirements

2-3. 模块卷盘包装以客户要求的实际包装数量为准

3.模块托盘包装事项如下：

3-1.保存期限：3个月，储存环境条件：温度在：<40℃，相对湿度：<90%R.H.

3-2.模块如在 48 小时内未使用，在上线之前需要进行烘烤，烘烤温度条件：125℃，8 小时。

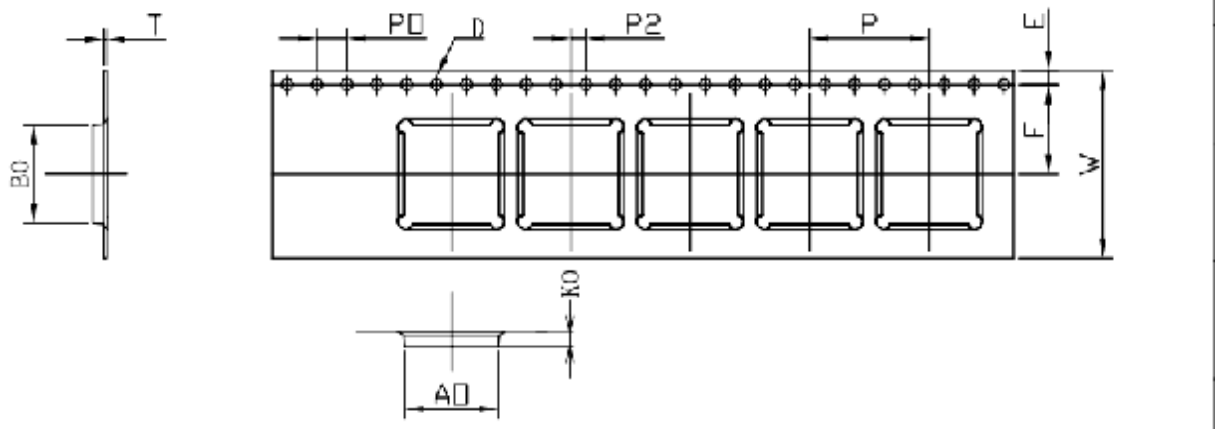
3-3. 托盘包装每盘为 100pcs，模块托盘包装以客户要求的实际包装数量为准.

注：以上包装方式根据客户要求而定，包装以实际出货为准。

Picture<1>

Picture<2>

ITEM	W	AO	BO	D	F	E	KO	PO	P2	P	T
DIM	24	12.56	12.56	1.50	11.5	1.75	1.95	4.0	2.0	16.0	0.30
TOLE	+0.3 −0.2	−0.10	−0.10	+0.1 −0.0	±0.1	±0.1	±0.10	±0.1	±0.1	−0.1	±0.05



Picture<3>

FCC Statement

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.
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, 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 or more 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.
The RF Module of 4K Dash Cam is designed to comply with the FCC statement. FCC ID is WUI-BT58189. The host system using RF Module of 4K Dash Cam Module, should have label indicated it contain modular's FCC ID： WUI-BT58189 . This radio module must not installed to colocate and operating simultaneously with other radios in host system additional testing and equipment authorization may be required to operating simultaneously with other radio.
The RF Module of 4K Dash Cam is deaigned for a compact PCB design .It should be installed and operated with Dash Cam or other minimum distance of 20 centimeters between the radiator and your body." To comply with FCC regulations limiting both maximum RF output power and human exposure to RF radiation, the maximum antenna gain including cable loss in a mobile-only exposure condition must not exceed 6dBi in the 2.4G band. The RF Module of 4K Dash Cam and its antenna must not be co-located or operating in conjunction with any other transmitter or antenna within a host device.
The OEM can use metal antennas or FPC antennas, and the antenna gain is less than 6dBi for this module.
If difference antenna types or host are used, C2PC should be applied.
Notice to OEM integrator
The end user manual shall include all required regulatory information/warning as show in this manual. The OEM integrator is responsible for testing their end-product for any additional compliance requirements required with this module installed.
The device must be professionally installed
The intended use is generally not for the general public.lt is generally for industry/commercial use.
The connector is within the transmitter enclosure and can only be accessed by disassembly of the

transmitter that is not nomally required, the user has no access to the connector.Installation must be controlled. Installation requires special training

This device complies with Part 15, Subpart C, Section 15.247 of the FCC Rules.

RF warning for Mobile device:

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.