PRODUCT SPECIFICATION

F89ESSM23

Wi-Fi Single-band 1x1 Module Datasheet

Version:v1.1

F89ESSM23 Module Datasheet

Ordering Information	Part NO.	Description
	FG89ESSM23-W2	RTL8189ES-VB,b/g/n,Wi-Fi,1T1R,12.5X14mm,SDIO

Customer: _____

Customer P/N: _____

Signature: _____

Date: _____

Office: 14th floor, Block B, phoenix zhigu, Xixiang Street, Baoan District, Shenzhen

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Revision History

Version	Date	Contents of Revision Change	Draft	Checked	Approved
V1.0	2022/02/25	New version	FC	LXY	QJP
V1.1	2022/04/07	Add authentication information Change block diagram	FC	LXY	QJP

1. General Description

1.1 Introduction

F89ESSM23 is a highly integrated and excellent performance Wireless LAN (WLAN) SDIO network interface device. High-speed wireless connection up to 150 Mbps.

This WLAN Module design is based on Realtek RTL8189ES. It is a highly integrated single-chip 1*1 SISO Wireless LAN (WLAN) SDIO network interface controller complying with the 802.11n specification. It combines a MAC, a 1T1R capable baseband, and RF in a single chip. It is designed to provide excellent performance with low power Consumption and enhance the advantages of robust system and cost-effective.

1.2 Description

Model Name	F89ESSM23
Product Description	wifi modul
Dimension	L x W x H: 12.5 x 14 x2.0 mm
Wi-Fi Interface	Support SDIO
OS supported	Android /Linux/ Win CE /iOS /XP/WIN7
Operating temperature	0°C to 70°C
Storage temperature	-40°C to 80°C

2. Features

General Features

- Operate at ISM frequency bands (2.4GHz)
- IEEE standardssupport: IEEE 802.11b, IEEE 802.11g, IEEE 802.11n
- Wi Fi I transmitter and I receiver allow data rates supporting up to 150 Mbps

WLAN Interface

- Support Wi-Fi SDIO interface

4. General Specification

4.1 WI-FI Specification

Feature	Description	
WLAN Standard	IEEE 802.11 b/g/n Wi-Fi compliant	
Frequency Range	2.400 GHz ~ 2.4835 GHz (2.4 GHz ISM Band)	
Number of Channels	2.4GHz : Ch1 ~ Ch13	
FCC+IC Output Power	IEEE 802.11b:21.34dBm	
	IEEE 802.11g:20.64dBm	
	IEEE 802.11n(HT20):19.70dBm;	
	IEEE 802.11n(HT40):19.52dBm	
Spectrum Mask	Meet with IEEE standard	
Freq. Tolerance	±20ppm	
Test Items	TYP Test Value	Standard Value
SISO ReceiveSensitivity (11b,20MHz) @8% PER	- 1Mbps　　　　PER @ -88 dBm	≤-83
	- 2Mbps　　　　PER @ -87 dBm	≤-80
	- 5.5Mbps　　　PER @ -85 dBm	≤-79
	- 11Mbps　　　PER @ -82 dBm	≤-76
SISO Receive Sensitivity (11g,20MHz) @10% PER	- 6Mbps　　　　PER @ -86 dBm	≤-85
	- 9Mbps　　　　PER @ -85 dBm	≤-84
	- 12Mbps　　　PER @ -84 dBm	≤82
	- 18Mbps　　　PER @ -82 dBm	≤80
	- 24Mbps　　　PER @ -80 dBm	≤77
	- 36Mbps　　　PER @ -77 dBm	≤-73
	- 48Mbps　　　PER @ -73 dBm	≤-69
	- 54Mbps　　　PER @ -71 dBm	≤-68
SISO Receive Sensitivity (11n,20MHz) @10% PER	- MCS=0　　　　PER @ -83 dBm	≤-85
	- MCS=1　　　　PER @ -82 dBm	≤-82
	- MCS=2　　　　PER @ -80 dBm	≤-80
	- MCS=3　　　　PER @ -78 dBm	≤-77
	- MCS=4　　　　PER @ -75 dBm	≤-73
	- MCS=5　　　　PER @ -71 dBm	≤-69
	- MCS=6　　　　PER @ -69 dBm	≤-68
	- MCS=7　　　　PER @ -67 dBm	≤-67
SISO Receive Sensitivity (11n,40MHz) @10% PER	- MCS=0　　　　PER @ -83 dBm	≤-82
	- MCS=1　　　　PER @ -82 dBm	≤-79

Vendor ID	-
Product ID	-
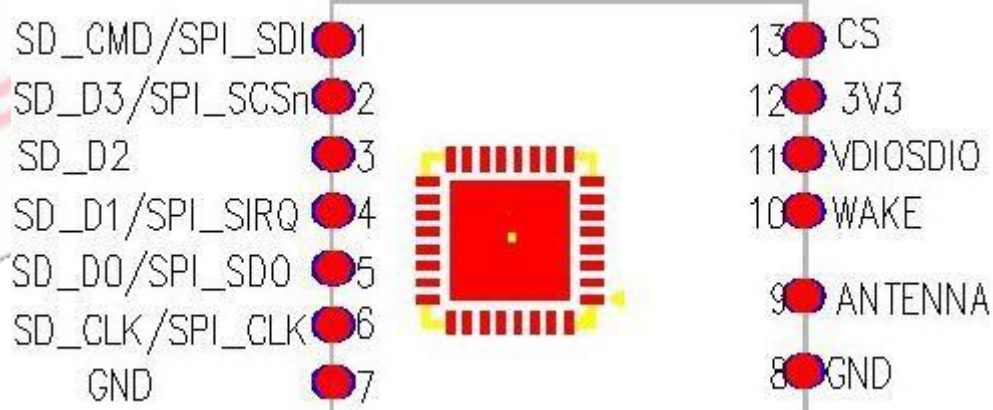
6.2 Pin Definition details

NO.	Name	Type	Description	Voltage
1	SD_CMD	I/O	SDIO Command Input	
2	SD_D3	I/O	SDIO Data Line 3	
3	SD_D2	I/O	SDIO Data Line 2	
4	SD_D1	I/O	SDIO Data Line 1	
5	SD_D0	I/O	SDIO Data Line 0	
6	SD_CLK	I	SDIO Clock Input	
7	GND		Ground connections	
8	GND		Ground connections	
9	ANTENNA		RF OUT	
10	WAKE		Wake Function	
11	VDIOSDIO		SDIO Voltage 1.8V-3.3V	
12	3.3		Power Supply	3.3V
13	CS		PDn, internal pull up, external pull low shutdown chip	

P:POWER   I:INPUT   O:OUTPUT

# 7. Electrical Specifications

7.1 Power Supply DC Characteristics

	MIN	TYP	MAX	Unit
Operating Temperature	0	25	70	deg.C
VCC33	3.0	3.3	3.6	V

7.2 Power Consumption

Mode	Status	Power(mW)	Note
OS Windows XP	Link	3.3Vx70mA =231	20M
		3.3Vx75 mA =248	40M
	RX	3.3Vx75mA =248	20M
		3.3Vx75 mA =248	40M
	TX	3.3Vx100 mA =330	20M
		3.3Vx110 mA=363	40M
	Power save mode	3.3Vx20 mA =66	DTIM=100ms
	Device Disable	3.3Vx25 mA =82.5	
	Radio Off	3.3Vx0 mA =0	

7.3 Interface Circuit time series

7.3.1 SDIO/GSPI Interface Timing
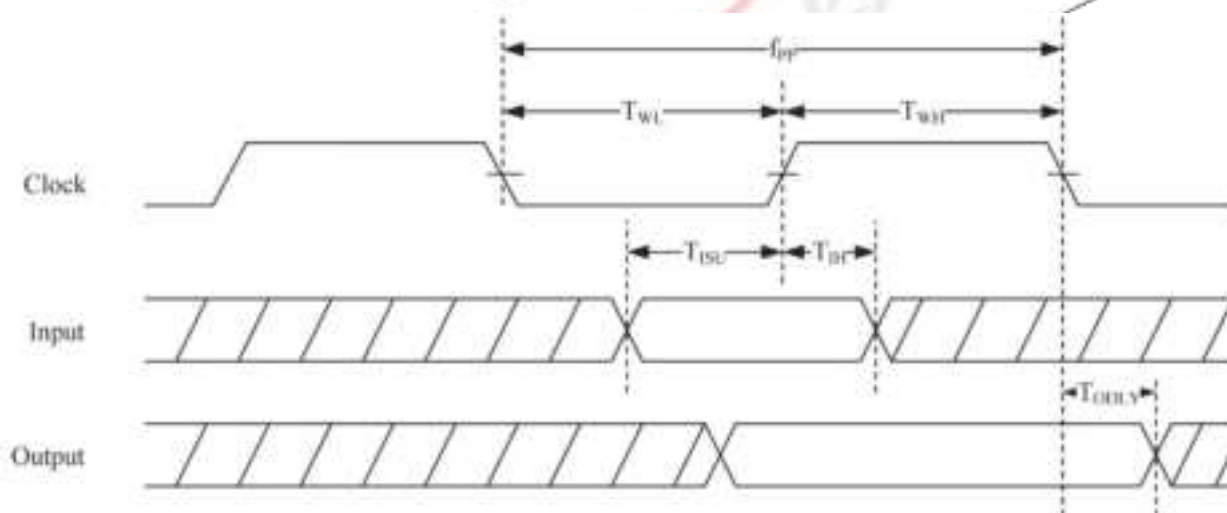
NO	Parameter	Mode	MIN	MAX	Unit
f_{PP}	Clock Frequency	Default	0	25	MHz
		HS	0	50	MHz
T_{WL}	Clock Low Time	DEF	10	-	ns
		HS	7	-	ns
T_{WH}	Clock High Time	DEF	10	-	ns
		HS	7	-	ns
T_{ISU}	Input Setup Time	DEF	5	-	ns

|						
		HS	6	-	ns	
T_{IH}	Input Hold Time	DEF	5	-	ns	
		HS	2	-	ns	
T_{ODLY}	Output Delay Time	DEF	-	14	ns	
		HS	-	14	ns	

7.3.2 SDIO/GSPI Interface Signal Level

The SDIO and GSPI signal level ranges from 1.8V to 3.3V.

The DC characteristics of a typical signal level, 3.3V/2.8V/1.8V are shown in section 6.3.2 Digital IO Pin DC Characteristics, page 9.

7.3.3 SDIO Interface Power-On Sequence

After power-on, the SDIO interface is selected by the RTL8189ES-VB automatically when a valid SDIO command is received. To attain better SDIO host compatibility, the following power-on sequence is recommended:
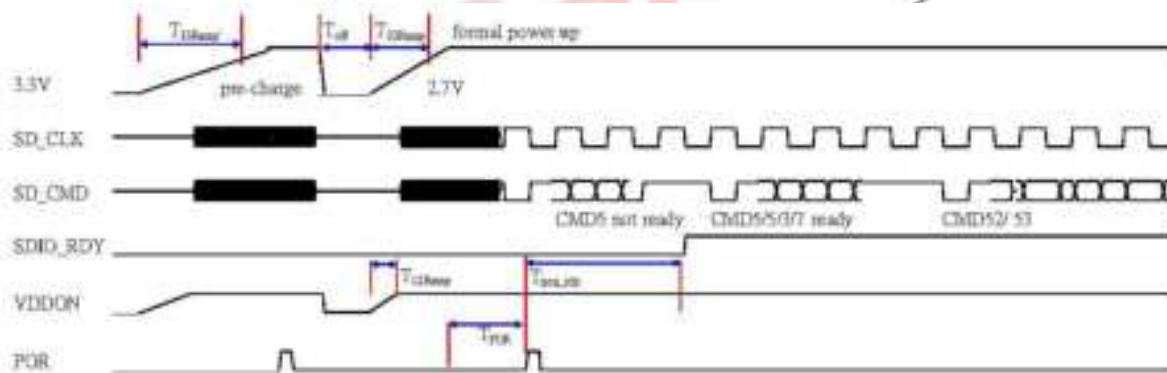
Definitions

T_{33ramp}': The 3.3V power pre-charge ramp up duration before formal power up. We recommend that a 3.3V power-on and then power-off sequence is executed by the host controller before the formal power-on sequence. This procedure can eliminate the host card detection issue when the power ramp up duration is too long or the system warm reboot fails.

T_{off} : The duration 3.3V is cut off before formal power up.

T_{33ramp}: The 3.3V main power ramp up duration.

T_{12ramp}: The internal 1.2V ramp up duration.

T_{POR}: The duration the power-on reset releases, and the power management unit executes power-on tasks. The power-on reset will detect both 3.3V and 1.2V power ramp up after a predetermined duration.

T_{non_rdy}: SDIO not ready duration. In this state the RTL8189ES may respond to commands without the

ready bit set. After the ready bit is set, the host will initiate the full card detection procedure.

Power-On Flow Description

We recommend that the card detection procedures are divided into two phases: a 3.3V power pre-charge

phase and a formal power-up phase.

For the 3.3V power pre-charge phase, the power ramp up duration is not limited. The 3.3V is then cut off

and is turned on after a Toff period. The ramp up time is specified by the T33ramp duration.

After main 3.3V ramp up and 1.2V ramp up, the power management unit will be enabled by the power

ready detection circuit, and will enable the SDIO block. eFUSE is then autoloaded to the SDIO circuits

during the Tnon_rdy duration. After the autoload has completed, the SDIO sets the ready bit. After CMD5/

5/3/7 procedures, card detection is then executed. After the driver has loaded, normal commands 52 and 53

are then used.

A typical timing specification is shown below:

Parameter	Min	Typical	Max	Unit
$T_{33ramp'}$	-	-	No Limit	ms
T_{off}	250	500	1000	ms
T_{33ramp}	0.1	0.5	2.5	ms
T_{12ramp}	0.1	0.5	1.5	ms
T_{por}	2	2	8	ms
$T_{non-rdy}$	1	2	10	ms

7.3.3 GSPI Interface Power-On Sequence

The GSPI interface is enabled automatically when a valid GSPI command is first received. The recommended

power-on sequence is as follows:
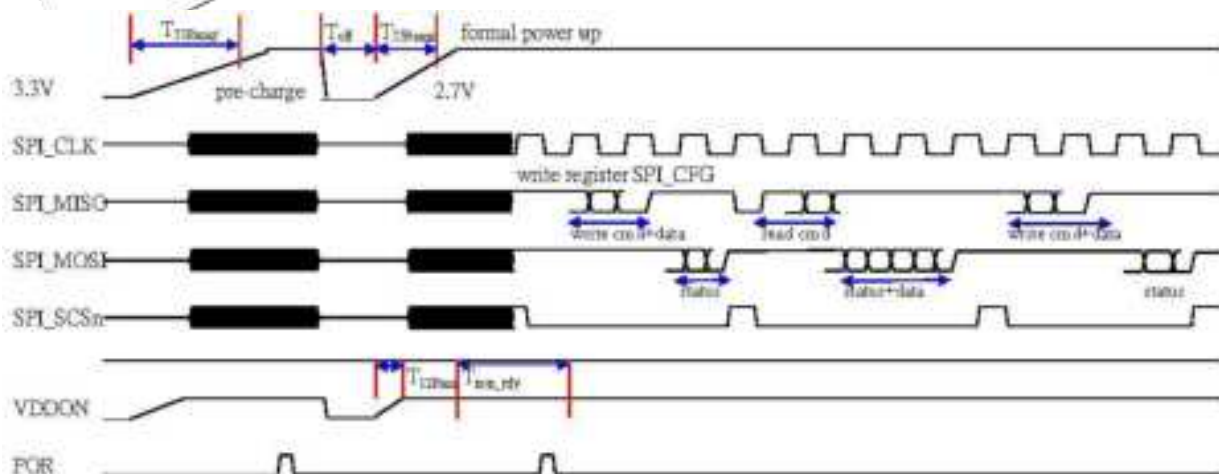
Definitions

T_{33ramp}': The 3.3V power pre-charge ramp up duration before formal power up. We recommend that a 3.3V power-on and then power-off sequence is executed by the host controller before the formal power-on sequence. This procedure can eliminate the host card detection issue when the power ramp up duration is too long or the system warm reboot fails.

T_{off} : The duration 3.3V is cut off before formal power up. T_{33ramp}: The 3.3V main power ramp up duration. T_{12ramp}: The internal 1.2V ramp up duration.

T_{non_rdy}: The duration of SPI device internal initialization. After Tnon_rdy, the SPI host can then send commands to write the SPI_CFG register. The SPI_CFG register controls SPI endian and word length

Power-On Flow Description

We recommend that the card detection procedures are divided into two phases: a 3.3V power pre-charge phase and a formal power-up phase.

For the 3.3V power pre-charge phase, the power ramp up duration is not limited. The 3.3V is then cut off and is turned on after a Toff period. The ramp up time is specified by the T33ramp duration.

After main 3.3V ramp up and 1.2V ramp up, the power management unit will be enabled by the power ready detection circuit, and will enable the SPI block. eFUSE is then autoloaded to the SPI circuits, and the internal power circuits are configured during the Tnon_rdy duration.
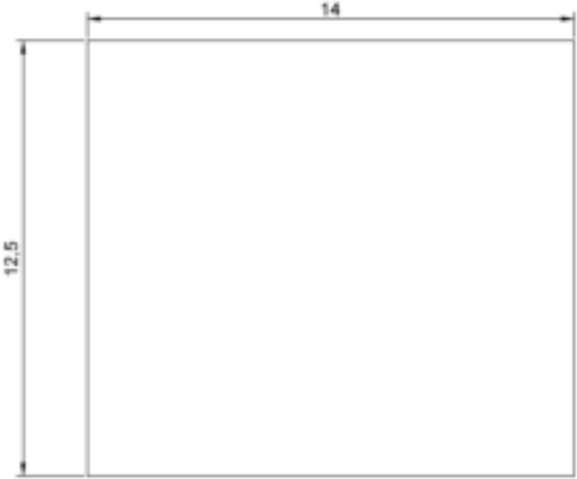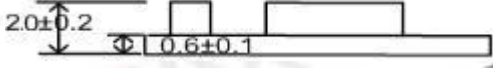
A typical timing specification is shown below:

Parameter	Min	Typical	Max	Unit
T_{33ramp}'	-	-	No Limit	ms
T_{off}	250	500	1000	ms
T_{33ramp}	0.1	0.5	2.5	ms
T_{12ramp}	0.1	0.5	1.5	ms
$T_{non-rdy}$	3	4	18	ms

7.3.4 SDIO Interface

Symbol	Type	Pin	Description
SD_CLK	I	21	SDIO Clock Input
SD_CMD	I/O	22	SDIO Command Input
SD_D0	I/O	19	SDIO Data Line 0
SD_D1	I/O	20	SDIO Data Line 1
SD_D2	I/O	23	SDIO Data Line 2
SD_D3	I/O	24	SDIO Data Line 3

8. Size reference

8.1 Module Picture

L x W : 12.5 x 14 (+0.3/-0.1) mm	
H: 2.0 (±0.2) mm	2.0±0.2 Φ 0.6±0.1
Weight	0.48g

8.2 Physical Dimensions

<TOP View>

8.3 Layout Recommendation

9. The Key Material List
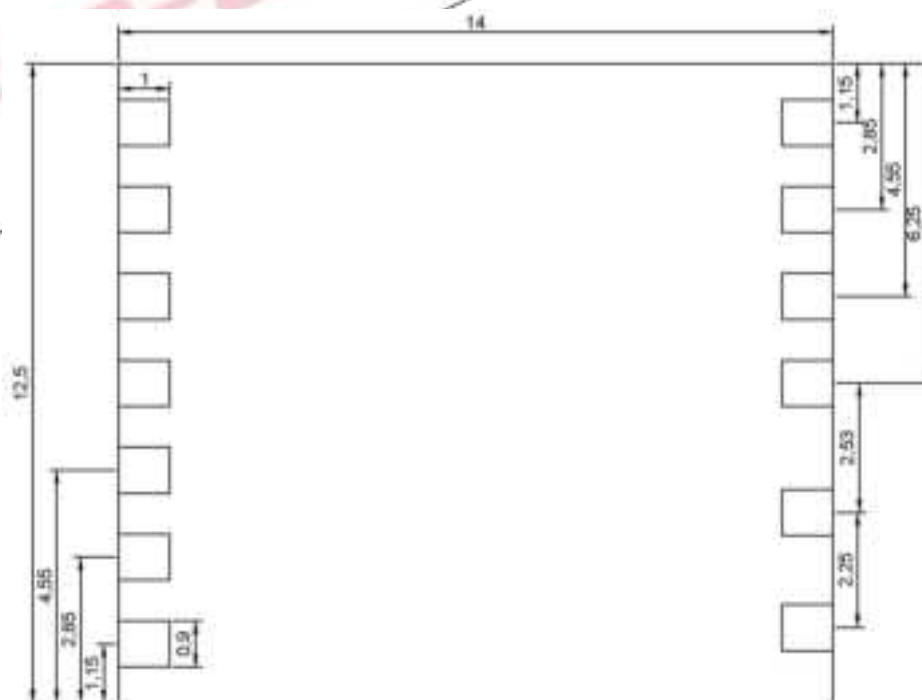
Item	Part Name	Description	Manufacturer
1	PCB	FN-8900 4L,FR4,TG150,14X12.5	XY-PCB, GDKX, Sunlord, SLPCB
2	Crystal	XTAL-SMD 40MHz, CL=15pF, 10ppm	ECEC, Hosonic, TKD, JWT,Siward
3	Chipset	RTL8189ES QFN-32	Realtek
4	Shielding	FN-8900M Shielding	信太，精力通

10. Recommended Reflow Profile
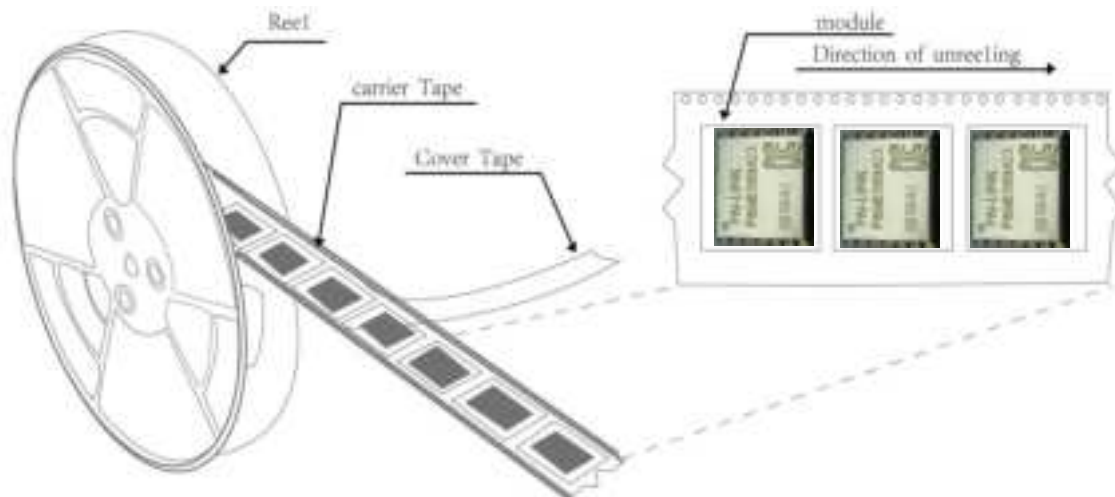
Referred to IPC/JEDEC standard.
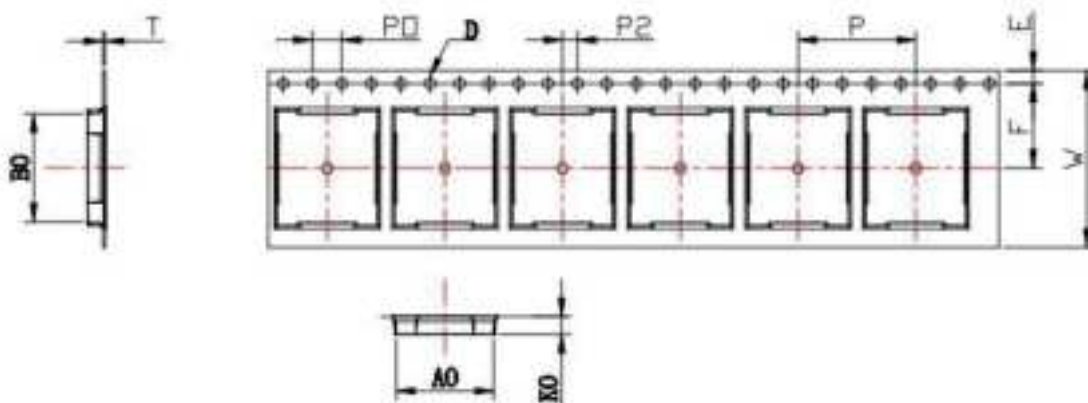
Peak Temperature :<250 ℃

Number of Times :≦ 2 times

SIo 1-2℃/sec aax.
(217℃ to peak)

peak:245+0t-5℃

217℃

Preheat 150-200℃

60-120 sec   40 -60sec

25℃

Ramp up rate
llax. 2℃/sec.

Time(sec)
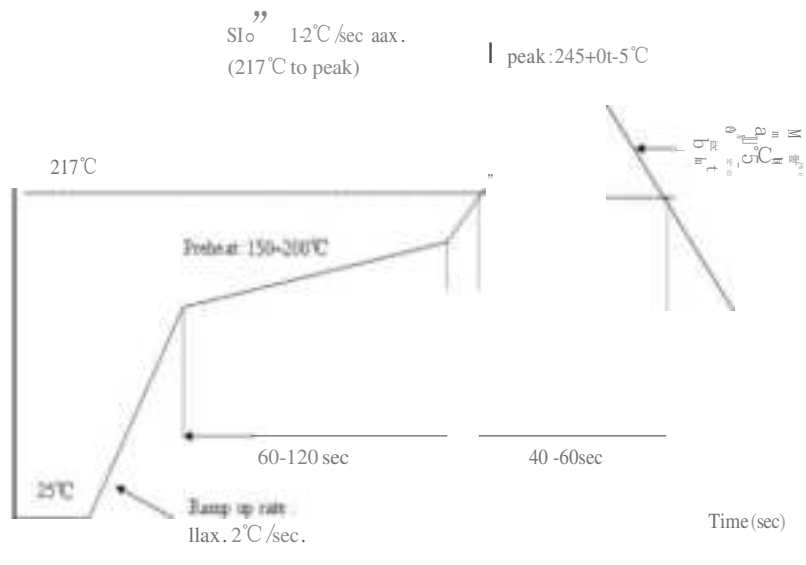
12. Package

12.1 Reel

A roll of 1500pcs

ITEM	W	AO	BO	D	F	E	KO	PO	P2	P	T
DIM	24	12.85	14.35	1.50	11.5	1.75	2.45	4.0	2.0	16.0	0.30
TOLE	+0.3 -0.3	±0.15	±0.15	+0.1 -0.0	+0.1 -0.1	±0.1	±0.10	±0.1	±0.1	±0.1	±0.05

12.2 Packaging Detail

the take-up package

Using self-adhesive tape
Color of plastic disc: blue

NY bag size:460mm*385mm

size ： 350*350*35mm

The packing case size:350*210*370mmg

13. Moisture sensitivity

The Modules is a Moisture Sensitive Device level 3, in according with standard IPC/JEDEC J-STD-020, take care

all the relatives requirements for using this kind of components.

Moreover, the customer has to take care of the following conditions:

a) Calculated shelf life in sealed bag: 12 months at <40°C and <90% relative humidity (RH)

b) Environmental condition during the production: 30°C / 60% RH according to IPC/JEDEC J-STD-033A paragraph 5

c) The maximum time between the opening of the sealed bag and the reflow process must be 168 hours if condition

b) "IPC/JEDEC J-STD-033A paragraph 5.2" is respected

d) Baking is required if conditions b) or c) are not respected

e) Baking is required if the humidity indicator inside the bag indicates 10% RH or more

14. Authentication information

TELEC (Temporarily indicated by XX)
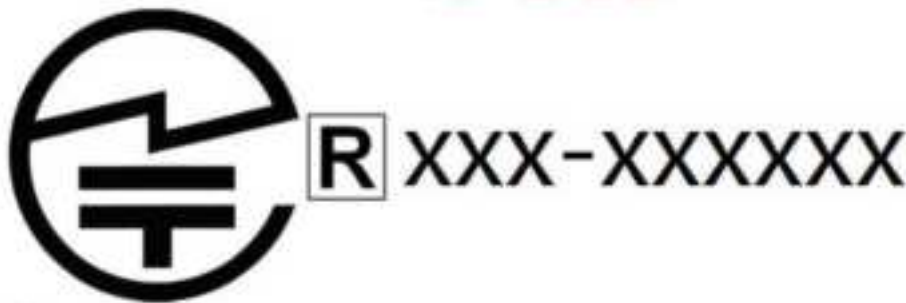
FCC ID: 2AATLF89ESSM23

IC: 12425A-F89ESSM23

FCC/IC Statements

(OEM) Integrator has to assure compliance of the entire end-product incl. the integrated RF Module. For 15 B (§15.107 and if applicable §15.109) compliance, the host manufacturer is required to show compliance with 15 while the module is installed and operating.

Furthermore the module should be transmitting and the evaluation should confirm that the module's intentional emissions (15C) are compliant (fundamental / out-of-band). Finally the integrator has to apply the appropriate equipment authorization (e.g. Verification) for the new host device per definition in §15.101.

Integrator is reminded to assure that these installation instructions will not be made available to the end-user of the final host device.

"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."

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

the Integrator will be responsible to satisfy SAR/ RF Exposure requirements, when the module integrated into the host device.

RF Exposure Warning Statements:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.

This equipment shall be installed and operated with minimum distance 20cm between the radiator & body.

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

(1) This device may not cause interference.

(2) This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence.

L'exploitation est autorisée aux deux conditions suivantes :

(1) L' appareil ne doit pas produire de brouillage;

(2) L' appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d' en

compromettre le fonctionnement.

Radio Frequency Exposure Statement for IC

The device has been evaluated to meet general RF exposure requirements. The device can be used in mobile exposure conditions. The min separation distance is 20cm.

Déclaration d'exposition aux radiofréquences pour IC

L'appareil a été évalué pour répondre aux exigences générales en matière d'exposition aux RF. L'appareil peut être utilisé dans des conditions d'exposition mobiles. La distance de séparation minimale est de 20 cm.

Module statement

The single-modular transmitter is a self-c

ontained, physically delineated, component for which compliance can be demonstrated independent of the host operating conditions, and which complies with all eight requirements of § 15.212(a)(1) as summarized below.

1) The radio elements have the radio frequency circuitry shielded.

2) The module has buffered modulation/data inputs to ensure that the device will comply with Part 15 requirements with any type of input signal.

3) The module contains power supply regulation on the module.

4) The module contains a permanently attached antenna.

5) The module demonstrates compliance in a stand-alone configuration.

6) The module is labeled with its permanently affixed FCC ID label.

7) The module complies with all specific rules applicable to the transmitter, including all the conditions provided in the integration instructions by the grantee.

8) The module complies with RF exposure requirements.

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

Co-location Warning:

This equipment could not be co-located or operating in conjunction with any other antenna or transmitter except in accordance with the FCC multi-transmitter product procedures.

Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01

2.2 List of applicable FCC rules

FCC Part 15.247

2.3 Specific operational use conditions

This transmitter/module and its antenna(s) must not be co-located or operating in conjunction with any transmitter. This information also extends to the host manufacturer's instruction manual.

2.4 Limited module procedures

Applicable

2.5 Trace antenna designs

Not Antenna

2.6 RF exposure considerations

This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This compliance to FCC radiation exposure limits for an uncontrolled environment, and minimum of 20cm separation between antenna and body.

The host product manufacturer would provide the above information to end users in their end-product manuals.

2.7 List of applicable antennas

Chip Antenna; 1.99dBi; 2412MHz ~ 2462MHz, Generally used for car camera

2.8 Label and compliance information

The end product must carry a physical label or shall use e-labeling followed KDB784748D01 and KDB 784748 stating FCC ID: 2AATLF89ESSM23.

2.9 Information on test modes and additional testing requirements

For more information on testing, please contact the manufacturer.

2.10 Additional testing, Part 15 Subpart B disclaimer

The modular transmitter is only FCC authorized for the specific rule parts (FCC Part 15.247) listed on the grant, 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. The final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed when contains digital circuity.

Hereby, FN-LINK TECHNOLOGY LIMITED declare that the radio equipment type wifi module is compliance with Directive 2014/53/EU.

CE

Operating Frequency Range	The maximum RF Output Power
WiFi 2412 - 2472 MHz	17.40dBm

Manufacturer Information：

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