WFM50-SFP2501

2.4GHz/5GHz
WLAN(IEEE 802.11a/b/g/n)
Stand-alone Module

I&C TECHNOLOGY

April.04, 2016

Rev.0.1

TABLE OF CONTENTS

1. Application

This specification is applied to the 2.4GHz/5GHz WLAN(802.11a/b/g/n) Stand-Alone module of

I&C TECHNOLOGY.

2. Quality

Quality should meet each condition which are mentioned on this specification. However, items which are not mentioned on this specification should follow the inspection agreements and standards which are agreed with both companies.

3. Appearance and Characteristics

3.1 Appearance

Appearance should not be contaminated by harmful materials and have cracks etc.
Mechanical dimension should meet the contents of clause 7.

3.2 Characteristics

Electrical characteristics should meet the contents of clause 12.

4. Application of 2.4GHz/5GHz WLAN(802.11a/b/g/n) Stand-Alone Module

WFM50-SFP2501 is a 2.4GHz/5Ghz WLAN(802.11a/b/g/n) Stand-Alone Module for IoT(Internet of Things) such as Home electronic appliance, Room controller, Smart plug, etc. But, this module is not designed for Life Support Application.

Also it is recommended that this module should be mounted by reflow soldering.

5. Absolute Maximum Rating

		Min.	Max.	Unit
Storage Temperature		-40	+85	deg.C
Supply Voltage	VBAT_A, B	-0.5	+4.6	V
	VDDIO_1,2,RF	-0.5	+4.0	
	VDD_MEM	-0.5	+4.0	
	VDD_FEM	-0.3	+5.0	

6. Test

Electrical characteristics are tested for every product. However, if there are any objections in judgment, it should be treated with agreements of companies.

IEEE 802.11 a/b/g/n standalone module

I&C TECHNOLOGY

7. Mechanical Dimension

Dimension	38.0mm× 19.0mm × 2.7mm(Max.)

Figure 1 and Figure 2 show the Bottom Layer (Top View) and the side dimension of WFM50-SFP2501 package outline
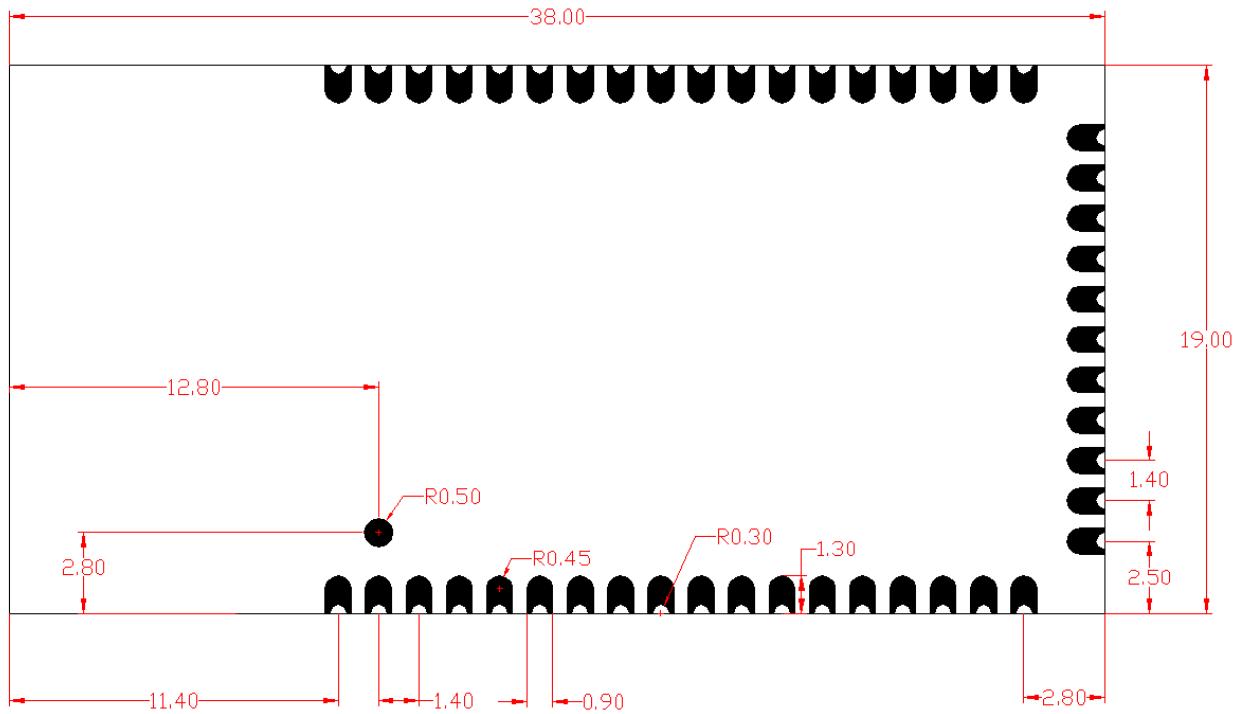
Figure 1. Package Outline (Top View)
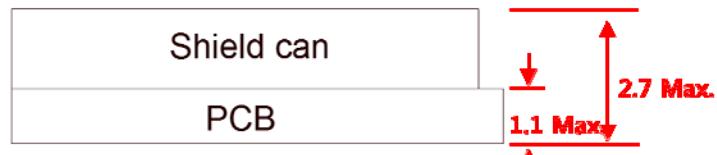
Figure 2. Package Outline (Side View)

# 8. Recommended Land Patterns (Top View)
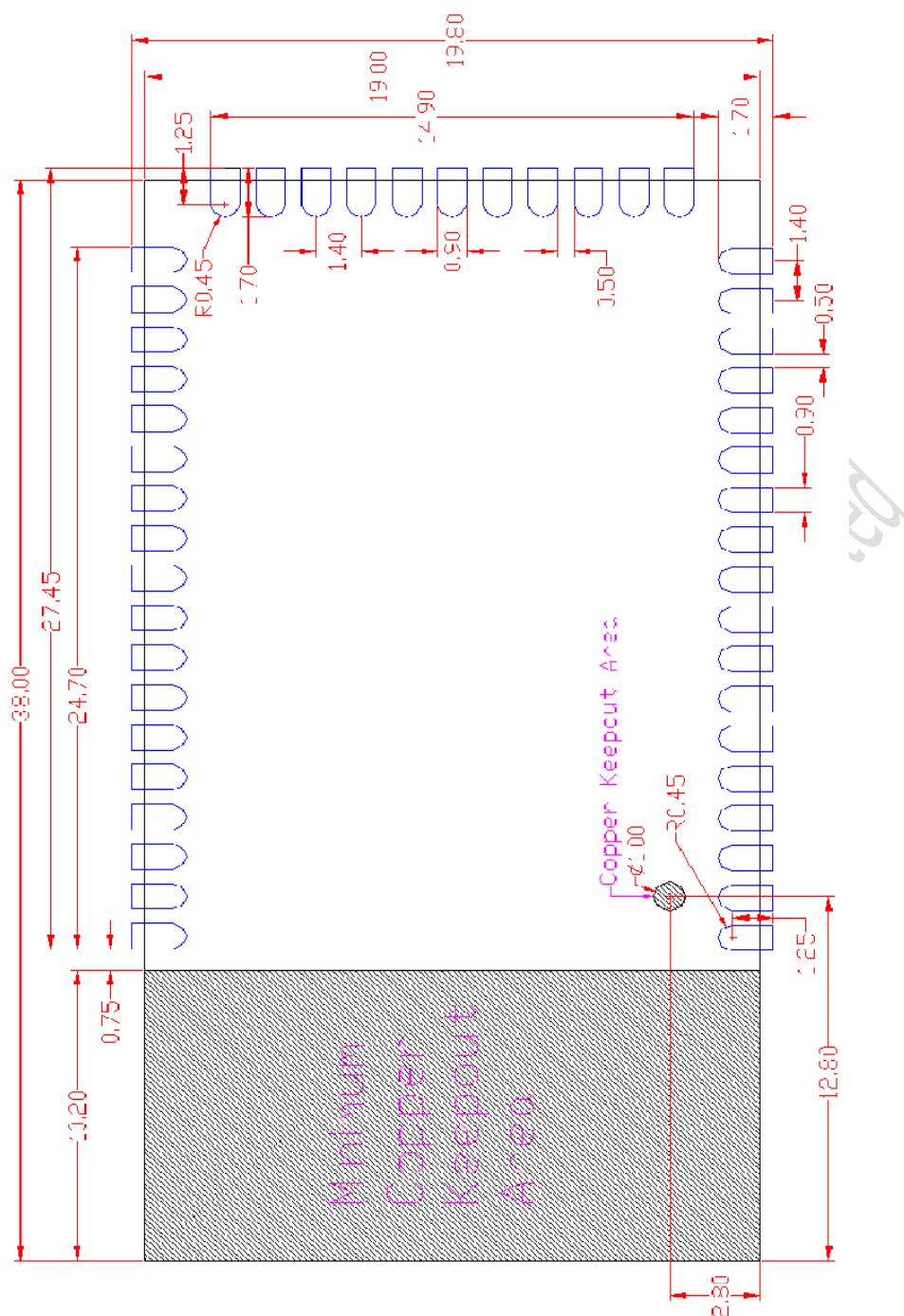
Figure 3. Recommend Land Patterns

9. General Description

WFM50-SFP2501 is a compact size and low power System-in-Package (SiP) for 2.4GHz/5GHz WLAN(802.11a/b/g/n) aimed at embedded and IOT applications.

WFM50-SFP2501 can be available as 47 pin. (34.5mm x 19.0mm x Max. 2.7mm)

10. External Clock Reference

10.1 External LPO Signal Requirement

Parameters	External LPO Clock	Unit
Nominal input frequency	32.768	kHz
Frequency accuracy	±200	ppm
Input signal amplitude*	VDDIO	mVp-p
Signal type	Square-wave or sine-wave	-
Input impedance	> 100k < 5 When power is applied or power is off	Ω pF

11. Input/Output DC Terminal Characteristics

	Parameters	Conditions	Min.	Typ.	Max.	Unit
V_{IH}	High Level Input Voltage	VDDIO=3.3V	0.7xVDDIO			V
V_{IL}	Low Level Input Voltage	VDDIO=3.3V			0.3xVDDIO	V
V_{OH}	High Level Output Voltage	@100uA, 3.3V	VDDIO-0.3			V
		@2mA, 3.3V	VDDIO-0.35			V
V_{OL}	Low Level Output Voltage	@100uA, 3.3V			0.4	V
		@2mA, 3.3V			0.4	V
C_{IN}	Input Capacitance				5	pF

12. Electrical Characteristics

12.1 Operating Condition\

		Min.	Typ.	Max.	Unit
Operating Temperature		-30	25	+85	deg.C
Supply Voltage	VBAT_A,B	3.3	3.6	4.5	V
	VDDIO_1,2,RF	3.0	3.3	3.6	
	VDD_MEM	3.0	3.3	3.6	
	VDD_FEM	3.2	3.6	4.4	

* The optimal RF performance specified in this datasheet is guaranteed for temperatures from -20℃~+70℃

12.2 2.4GHz Tx Characteristics

All measurements are made under nominal supply voltage,

(VBAT_A,B = 3.3V, VDDIO_1,2, RF=3.3V, VDD_MEM=3.3V) and room temperature (25℃)condition.

Parameters	Conditions	Spec.			Unit
		Min.	Typ.	Max.	
Frequency Range		2400	-	2500	MHz
Output Power (VBAT=3.3V, spectral mask, EVM compliance)	802. 11b, EVM = -9 dB		16.5		dBm
	OFDM , BPSK, EVM = -8 dB		15		
	OFDM, QPSK, EVM = -13 dB		15		
	OFDM, 16QAM, EVM = -19 dB		15		
	OFDM, 64QAM $^{3/4}$, EVM = -25 dB		13		
	OFDM, 64QAM $^{5/6}$, EVM = -28 dB		13		

12.3 2.4Ghz Rx Characteristics

All measurements are made under nominal supply voltage,

(VBAT_A,B = 3.3V, VDDIO_1,2, RF=3.3V, VDD_MEM=3.3V) and room temperature (25℃)condition.

Parameters	Conditions	Spec.			Unit
		Min.	Typ.	Max.	
Frequency Range		2400	-	2500	**MHz**
11b, Rx Sensitivity (8% PER for 1024 octet PSDU)	CCK, 1 Mbps		-96.5		dBm
	CCK, 2 Mbps		-94.5		
	CCK, 5.5 Mbps		-92.5		
	CCK, 11 Mbps		-89.5		
11g, Rx Sensitivity (10% PER for 1024 octet PSDU)	OFDM, 6 Mbps		-93.5		
	OFDM, 9 Mbps		-91.5		
	OFDM, 12 Mbps		-90.5		
	OFDM, 18 Mbps		-88.5		
	OFDM, 24 Mbps		-86.5		
	OFDM, 36 Mbps		-82.5		
	OFDM, 48 Mbps		-79.5		
	OFDM, 54 Mbps		-77.5		
11n, Rx Sensitivity (10% PER for 4096 octet PSDU)	HT20, MCS0		-93.5		
	HT20, MCS1		-89.5		
	HT20, MCS2		-87.5		
	HT20, MCS3		-84.5		
	HT20, MCS4		-81.5		
	HT20, MCS5		-77.5		
	HT20, MCS6		-76.5		

IEEE 802.11 a/b/g/n standalone module

	HT20, MCS7		-74.5		
Adjacent Channel Rejection	CCK, 1 Mbps (signal; -74dBm)	35	-		dB
	CCK, 11 Mbps (signal; -70dBm)	35	-		
	OFDM, 6 Mbps (signal; -79dBm)	16	-		
	OFDM, 54 Mbps (signal; -62dBm)	-1	-		
Max Input level	11b 1M,2M		0		dBm
	11b 5.5M, 11M		0		
	11g		-10		
	11n		-10		

12.4 5GHz band Tx Characteristics

All measurements are made under nominal supply voltage,

(VBAT_A,B = 3.3V, VDDIO_1,2, RF=3.3V, VDD_MEM=3.3V, , VDD_FEM=3.3V)

and room temperature (25℃)condition

Parameters	Conditions	Spec.			Unit
		Min.	Typ.	Max.	
Frequency Range		4900	-	5845	MHz
Output Power (VBAT, VDD_FEM=3.3V, spectral mask, EVM compliance)	11a, OFDM, 64QAM 3/4, EVM = -25 dB		13		dBm
	11n, OFDM, 64QAM 5/6, EVM = -25 dB		13		

12.5 5GHz Rx Characteristics

All measurements are made under nominal supply voltage,

(VBAT_A,B = 3.3V, VDDIO_1,2, RF=3.3V, VDD_MEM=3.3V, , VDD_FEM=3.3V)

and room temperature (25℃)condition

Parameters	Conditions	Spec.			Unit
		Min.	Typ.	Max.	
Frequency Range		4900	-	5845	MHz
11a, Rx Sensitivity (10% PER for 1024 octet PSDU)	OFDM, 6 Mbps		-92.5		dBm
	OFDM, 9 Mbps		-90.5		
	OFDM, 12 Mbps		-89.5		
	OFDM, 18 Mbps		-87.5		
	OFDM, 24 Mbps		-84.5		
	OFDM, 36 Mbps		-81.5		
	OFDM, 48 Mbps		-77.5		
	OFDM, 54 Mbps		-76		
11an, Rx Sensitivity (10% PER for 4096 octet PSDU)	HT20, MCS0		-91.5		
	HT20, MCS1		-89.5		
	HT20, MCS2		-86		
	HT20, MCS3		-83		
	HT20, MCS4		-80		

IEEE 802.11 a/b/g/n standalone module

	HT20, MCS5		-75.5	
	HT20, MCS6		-73.5	
	HT20, MCS7		-73	
Adjacent Channel Rejection	11a, OFDM, 64QAM 3/4 (Signal : -62dBm)			dBm
	11a, OFDM, 64QAM 5/6 (Signal : -62dBm)			
Max Input level	11a/n		-20	dBm

13. Pin Assignment (Top View, Bottom Layer)
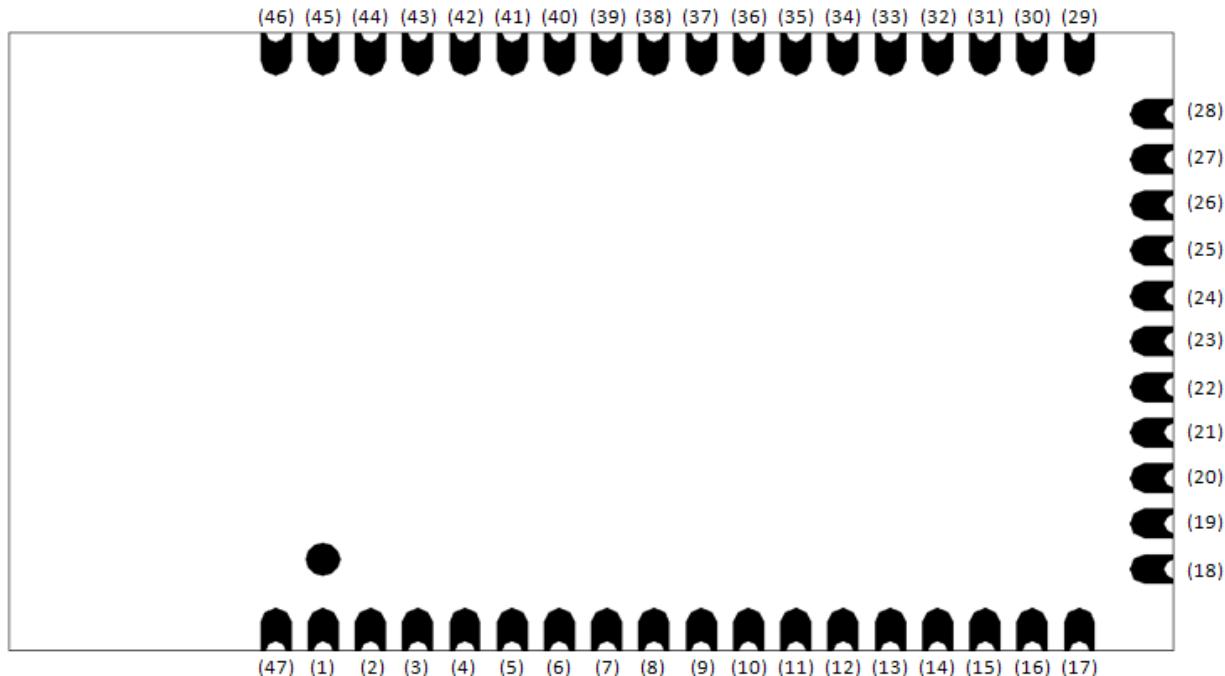
No.	Pin Name	No.	Pin Name	No.	Pin Name
1	GND	17	GND	33	SD_CLK
2	GND	18	PMIC_EN	34	SD_D0
3	GND	19	GP12	35	SD_D1
4	GND	20	GND	36	GND
5	GND	21	GP13	37	GP05
6	GND	22	VBAT_B	38	GP07
7	VDDIO_1	23	CLK_RTC	39	GND
8	RSTN	24	GP09	40	GP11
9	GP14	25	GP08	41	GP10
10	SF_SEL	26	GP06	42	GND
11	VDDIO_2	27	GP04	43	GND
12	JTAG_SEL	28	VDD_MEM	44	VDD_FEM
13	VDDIO_RF	29	GND	45	GND

IEEE 802.11 a/b/g/n standalone module

14	VBAT_A	30	SD_D2	46	GND
15	GND	31	SD_D3	47	GND
16	GND	32	SD_CMD		

14.Pin Description

Pin Num.	Pin Name	Description
1	GND	Module Ground
2	GND	
3	GND	
4	GND	
5	GND	
6	GND	
7	VDDIO_1	GP5~GP15 IO PWR(JTAG, SDIO etc)
8	RSTN	RESET input
9	GP14	PMIC reset out/GPIO, Before Booting High level
10	SF_SEL	Serial Flash boot select
11	VDDIO_2	GP5~GP15 IO PWR(JTAG, SDIO etc)
12	JTAG_SEL	JTAG Debug select
13	VDDIO_RF	GP00/GP01 IO PWR(Internal RF SW control)GP02/GP03 IO PWR
14	VBAT_A	Internal 1.4V DC_DC POWER input(3.3V~4.7V)
15	GND	Module Ground
16	GND	
17	GND	
18	PMIC_EN	INTERNAL PMIC PWR EN
19	GP12	UART2 TXD/GPIO
20	GND	
21	GP13	UART2 RXD/GPIO
22	VBAT_B	Internal 2.5V LDO, 3.3V LDO POWER input(3.3V~4.7V)
23	CLK_RTC	Low speed clock input
24	GP09	UART0 RXD/GPIO
25	GP08	UART0 TXD/GPIO
26	GP06	SF_SIO0/JTAG TMS/GPIO
27	GP04	SF_SCLK/JTAG TCK/GPIO
28	VDD_MEM	Internal Flash Memory Power input

IEEE 802.11 a/b/g/n standalone module

29	GND	Module Ground
30	SD_D2	SDIO Data 2
31	SD_D3	SDIO Data 3/SDIO SPI Mode CS
32	SD_CMD	SD CMD/SDIO SPI Mode DI
33	SD_CLK	SDIO Clock (~50 MHz)/SDIO SPI Mode CLK(~50MHz)
34	SD_D0	SD Data 0/SDIO SPI Mode DO
35	SD_D1	SD Data 1/SDIO SPI Mode IRQ
36	GND	Module Ground
37	GP05	SF_CSN/JTAG TDI/GPIO
38	GP07	SF_SIO1/JTAG TDO/GPIO
39	GND	Module Ground
40	GP11	GPIO
41	GP10	GPIO
42	GND	Module Ground
43	GND	
44	VDD_FEM	Internal 5GHz FEM Power input
45	GND	Module Ground
46	GND	
47	GND	

Figure 4. Block Diagram

15. Power Sequence
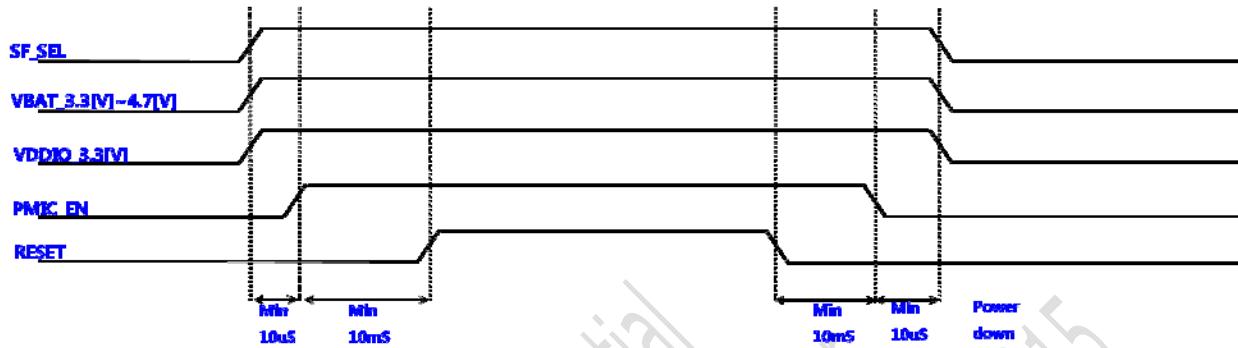
※ **When VCC is below 3.0V, it must be reset.**

16. Packing Information

16.1 Carrier dimension

(단위:mm)

항목	A	B	C
SPEC	330±1	80±1	13±0.5

EIAJ - RRM Ø330							
RRM08D -56D							
품명	08D	12D	16D	24D	32D	44D	56D
규격	08	12	16	24	32	44	56
c(±0.5)	9	13	17	25	33	44.8	57
W2(±1)	13	17.5	21	29	37	49	61

IEEE 802.11 a/b/g/n standalone module
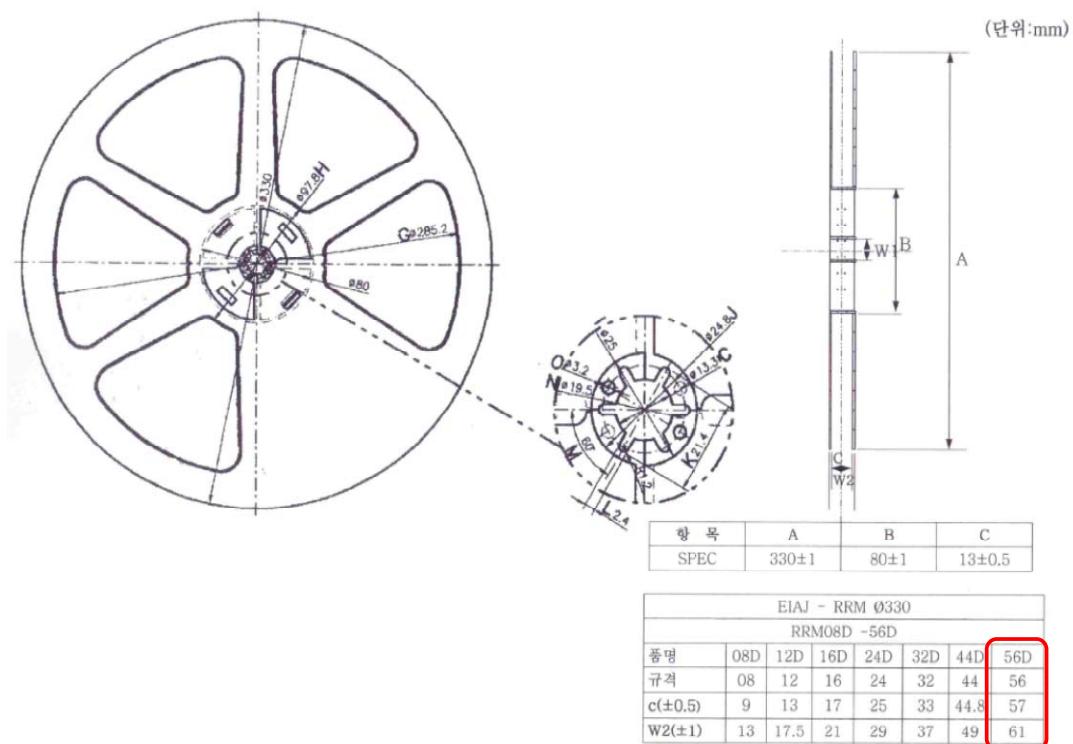
16.2 **Carrier tape dimension**

Packing Quantity
650(600)pcs / reel

A0	19.45±0.20	E	1.75±0.10
B0	38.45±0.20	F	26.20±0.10
K0	4.40±0.20	t	0.40±0.05
D0	1.55±0.05	w	56.00±0.30

Unit : mm
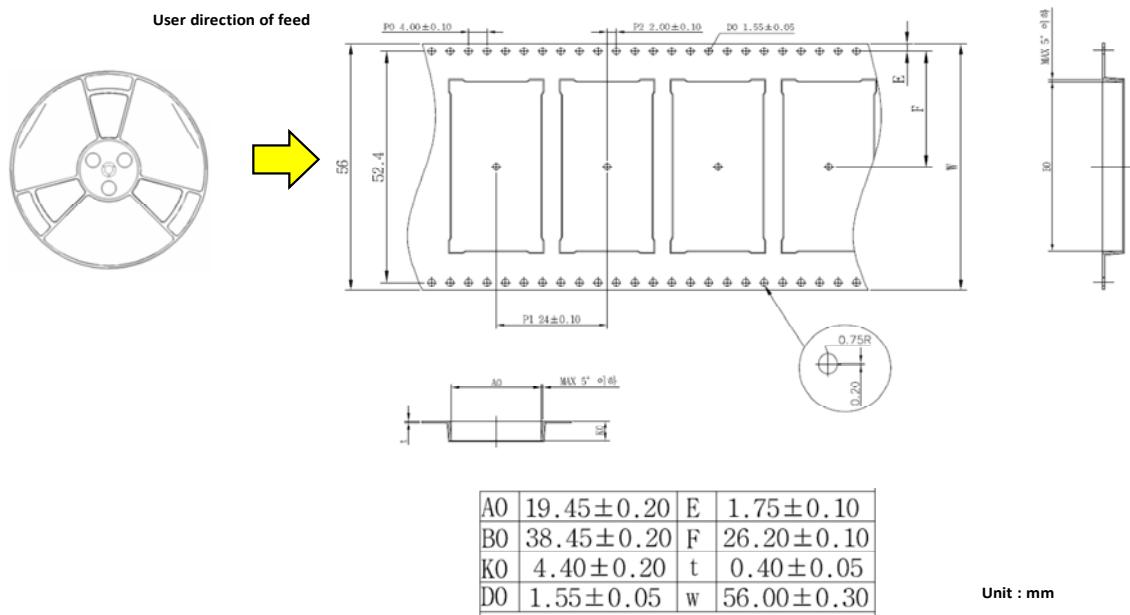
17. Reflow Profile

• Refer to the IPC/JEDEC standard.

• Peak Temperature : <250℃>

• Number of Times : ≤2 times

IEEE 802.11 a/b/g/n standalone module

Copyright© 2016, I&C TECHNOLOGY

18.   Certification label

I&C TECHNOLOGY
WFM50-SFP2501
Indoor use only
0001-16 U   AA:BB:CC:DD:EE:FF

KC CE [R] 001-A07739
3.6 === [T] D16-0089001

KC : MSIP-CRM-iNc-WFM50-SFP2501
IC : 12641A-WFM5SFP2501
FCC ID : 2ADXS-WFM50-SFP2501

IEEE 802.11 a/b/g/n standalone module

I&C TECHNOLOGY
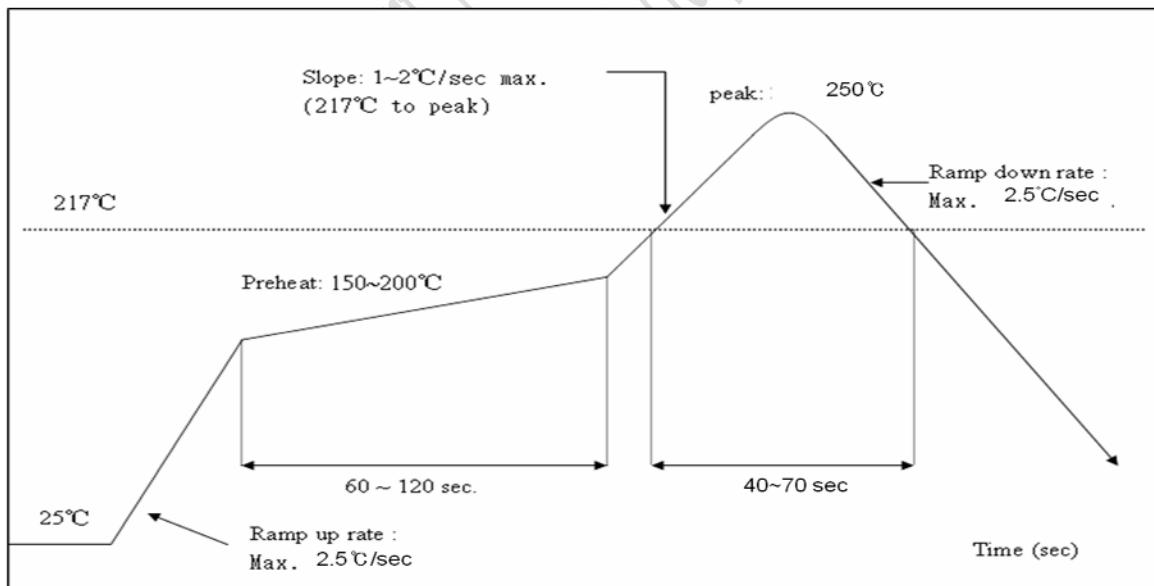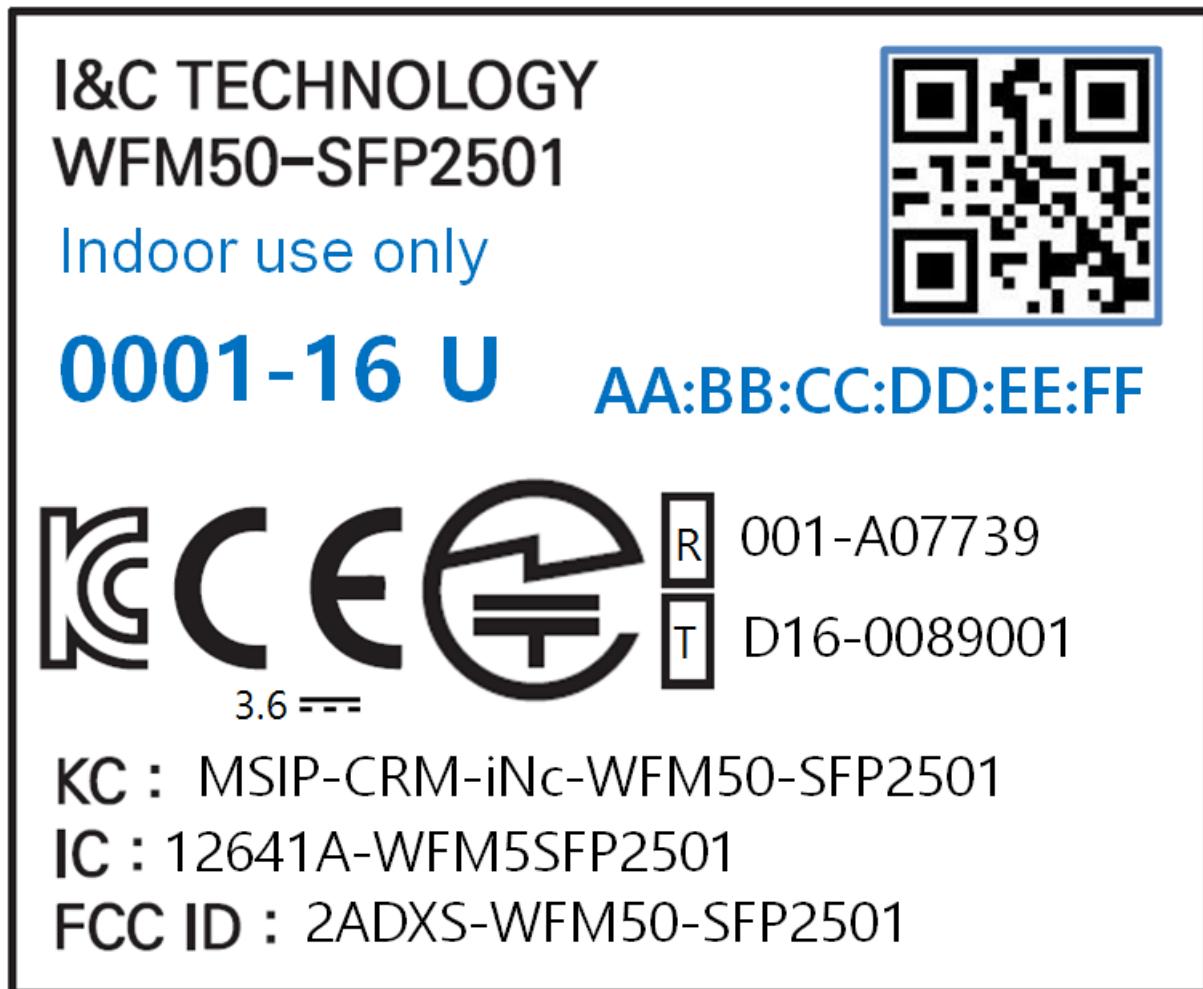
19. Revision History

Ver.	Comment	Date	Author	Approver
0.1	Initial release	Apr, 04, 2016	H.Y.Kim	
	15			

IEEE 802.11 a/b/g/n standalone module

FCC REGULATORY DISCLOSURES

This device complies with Part 15 of the FCC`s 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 undesirable operation

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.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the transmitter's radiating structure(s) and the body of the user or nearby persons.

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

INDUSTRY CANADA REGULATORY DISCLOSURES

INDUSTRY CANADA STATEMENT

This device complies with Industry Canada license-exempt RSS standard(s). 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.

Cet appareil est conforme avec Industrie Canada exempts de licence standard RSS (s). L'opération est soumise aux deux conditions suivantes:(1) cet appareil ne peut causer d'interférences, et
(2) cet appareil doit accepter toute interférence, y compris les interférences qui peuvent causer un mauvais fonctionnement de l'appareil.

INDUSTRY CANADA RADIATION EXPOSURE STATEMENT AND LIMITATIONS ON USE

This equipment complies with IC RSS-102 radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator and your body.   This equipment should be installed and must not be co-located or operating in conjunction with any other antenna or transmitter.

RF du FCC d'exposition aux radiations: Cet équipement est conforme à l'exposition de la FCC rayonnements RF limites établies pour un environnement non contrôlé. L'antenne pour ce transmetteur ne doit pas être même endroit avec d'autres émetteur sauf conformément à la FCC procédures de produits Multi-émetteur.

The end product must be labeled to display the Industry Canada certification number of the module.
"Contains IC: 12641A-WFM5SFP2501"
Le dispositif d'accueil doivent être étiquetés pour afficher le numéro de certification d'Industrie Canada du module.
Contient IC : **12641A-WFM5SFP2501**

IEEE 802.11 a/b/g/n standalone module

OEM instructions

I.   "Module is limited to OEM installation **ONLY** "

II.   "OEM integrators is responsible for ensuring that the end-user has no manual instructions to remove or install module"

III. "FCC RF Exposure requirements: Module is limited to installation in mobile or fixed applications, according to Part 2.1091(b). Separate FCC approval is required for all other operating configurations, including portable configurations with respect to Part 2.1093 and different antenna configurations."

IV.   "If (1) the module's FCC ID is not visible when installed in the host, or (2) if the host is marketed so that end users do not have straightforward commonly used methods for access to remove the module so that the FCC ID of the module is visible; then an additional permanent label referring to the enclosed module: "Contains Transmitter Module FCC ID: 2ADXS-WFM50-SFP2501" or "Contains FCC ID: 2ADXS-WFM50-SFP2501" must be used. The host OEM user manual must also contain clear instructions on how end users can find and/or access the module and the FCC ID."

V.   "A host product is required to comply with all applicable FCC equipment authorizations regulations, requirements and equipment functions not associated with the transmitter module portion. For example, compliance must be demonstrated to regulations for other transmitter components within the host product; to requirements for unintentional radiators (Part 15B), such as digital devices, computer peripherals, radio receivers, etc.; and to additional authorization requirements for the non-transmitter functions on the transmitter module (i.e., Verification, or Declaration of Conformity) (e.g., Bluetooth and WiFi transmitter modules may also contain digital logic functions) as appropriate.

VI.   To ensure compliance with all non-transmitter functions the host manufacturer is responsible for ensuring compliance with the module(s) installed and is fully operational. For example, if a host was previously authorized as an unintentional radiator under the Declaration of Conformity procedure without a transmitter certified module and a module is added, the host manufacturer is responsible for ensuring that after the module is installed and operational the host continues to be compliant with the Part 15B unintentional radiator requirements. Since this may depend on the details of how the module is integrated with the host, the grantee (the party responsible for the module grant) shall provide guidance to the host manufacturer for compliance with the Part 15B requirements."

IEEE 802.11 a/b/g/n standalone module