

M905 Bluetooth 4.2 LE SiP Module

Data Sheet-Preliminary

Dec 2, 2016 Rev1.0.0

Product Specification of M905 Bluetooth 4.2 LE SiP Module

Preliminary

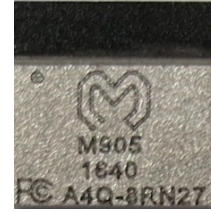
1 Description

The SiP module M905 is a small size module with antenna inside. The module provides full function of Bluetooth 4.2 Low Energy in a tiny module via 52 pins LGA Foot Print. The M905 module provides everything required to create Bluetooth 4.2 Low Energy product with RF, baseband, MCU, qualified Bluetooth v4.2 stack and customer application running on a single IC.

M905 enables ultra-low power connectivity and basic data transfer for applications previously limited by the power consumption, size constraints and complexity of other wireless standards. The low power consumption and excellent radio performance make it the best solution for OEM /ODM customers who require embedded Bluetooth 4.2 Low Energy feature, such as, IP camera, car key, sport and fitness watch, mouse, led light bulb etc.

For the software and driver development, we provide extensive technical document and reference software code for the system integration.

Hardware evaluation kit and development utilities will be released base on listed OS and processors to OEM customers.



2 Features

- Embedded high performance antenna
- Bluetooth® v4.2 BLE radio technology
- Supports concurrent Bluetooth low energy/ANT protocol operation
- On-chip NFC tag for Out-of-Band (OOB) pairing
- Up to +4dBm output power
- -96dBm sensitivity, Bluetooth low energy
- Thread safe and run-time protected
- Event driven API
- 2 data rates (2Mbps/1Mbps)
- PPI - maximum flexibility for power-efficient applications and code simplification
- SPI Master/Slave
- Automated power management system with automatic power management of each peripheral
- Configurable I/O mapping for analog and digital I/O
- 3 x Master/Slave SPI
- 2 x Two-wire interface (I²C)
- UART (RTS/CTS)
- 3 x PWM
- AES HW encryption
- Real Time Counter (RTC)
- Digital microphone interface (PDM)
- Antenna On Package (AoP)
- LGA-52 package, 6.5 x 6.5 mm

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Revision History					
Rev.	Date	Description of change			Approval & Date
		Page	Chap	Change(s)	
1.0.0	02/12/16	All	All	Draft version for Review	Maxim Lin

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4 TECHNICAL SPECIFICATION

4.1 Absolute Maximum Ratings

The M905 module has to withstand the operational requirements as listed in the table below

No	Description	Value	Unit	
Ratings Over Operating Free-Air Temperature Range				
1	Supply voltage	All supply pins must have the same voltage	-0.3 to 3.9	V
2	Voltage on any digital pin		-0.3 to 3.9	V
4	Storage temperature range		-40 to 125	°C
5	Bluetooth RF output		4	dBm

4.2 Operation Condition

Power supply for the M905 module will be provided by the host via the power pins

Operating Condition	Min.	Typ.	Max.
VCC	1.7	3.3	3.6
Operating ambient temperature range	-20°C		70°C

4.3 Wireless Specifications

The M905 module compliance with the following features and standards

Features	Description
Bluetooth Standards	Bluetooth core v4.2 Low Energy
Antenna Port	Support Single Antenna for Bluetooth
Frequency Band	2.402 – 2.480 GHz

4.4 Radio Specifications Bluetooth 4.2 Low Energy

Features	Description
Frequency Band	2.402– 2.480 GHz (2.4 GHz ISM Band)
Number of selectable Sub channels	40 channels
Modulation	GFSK
Supported rates	<2Mbps
Maximum receive level	-10dBm (with PER <30. 8%)

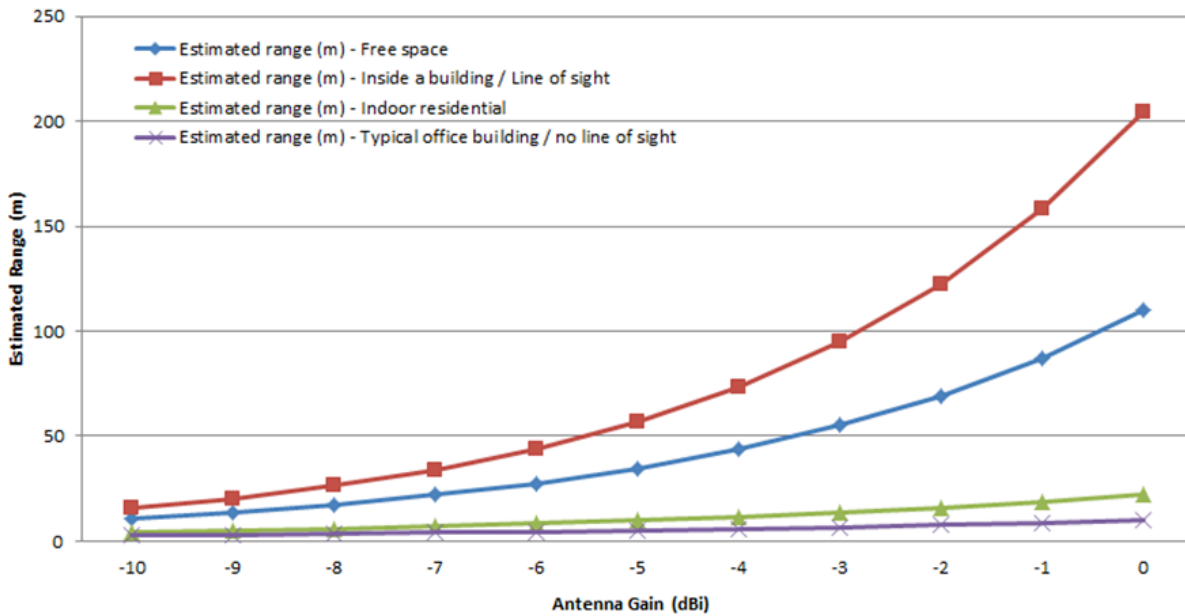
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Parameter	Mode and Conditions	Min.	Typ.	Max.	Unit.
RX sensitivity		-	-92	-	dBm
Maximum input			-	-10	dBm
Frequency range		2402	-	2480	MHz
Output power adjustment ranger		-20	-	4	dBm
Output power		-	0	-	dBm
Output power variation		-	4	-	dB

4.5 AoP Antenna Performance

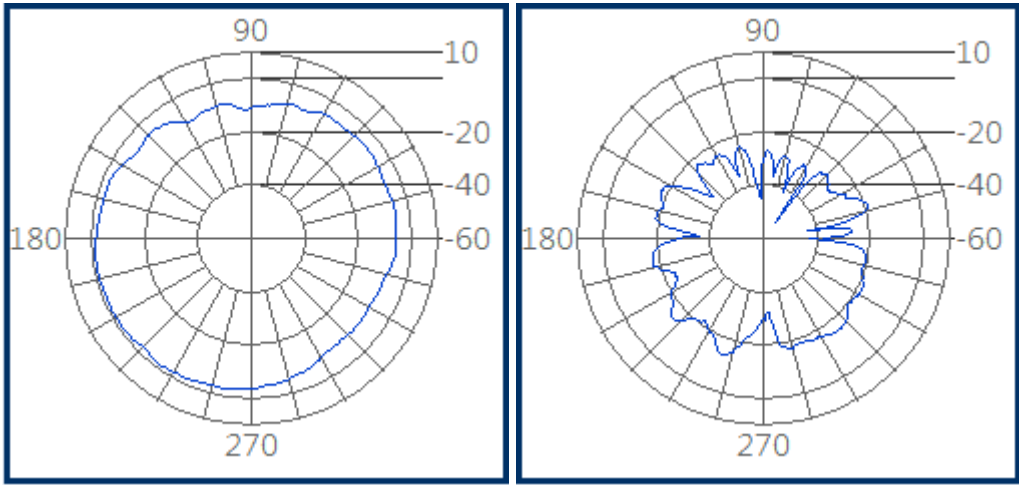
Items	Freq. band	Gain	Return Loss	VSWR
Spec.	2.4~2.5GHz	>-5 dBi	<-6dB	3 max
Items	Impedance	Polarization	Directivity	Efficiency
Spec.	50 ohm	Linear	Omni-directional	>30%

2-Way Communication Range at ISM-Band 2440MHz (Tx: 0dBm; Rx=-90dBm; Fm:9dB)

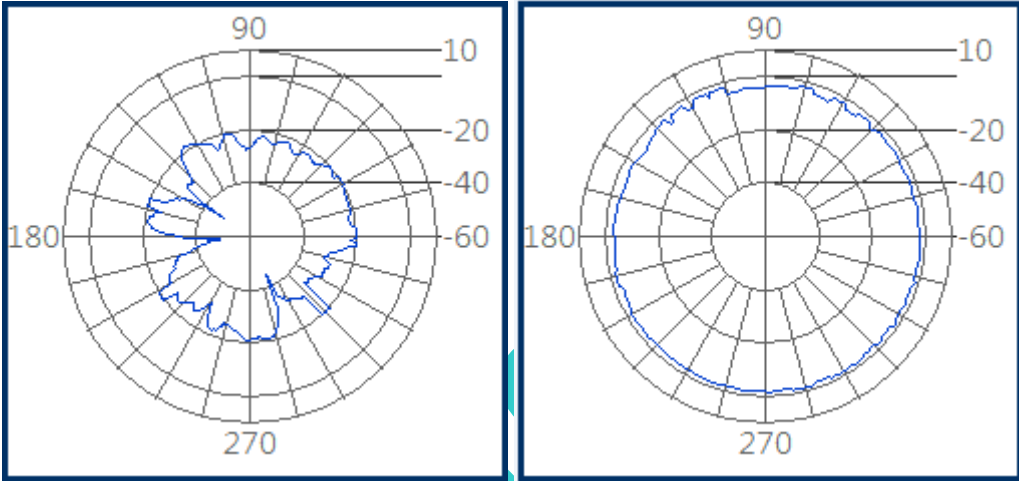


4.5.1 Antenna Pattern

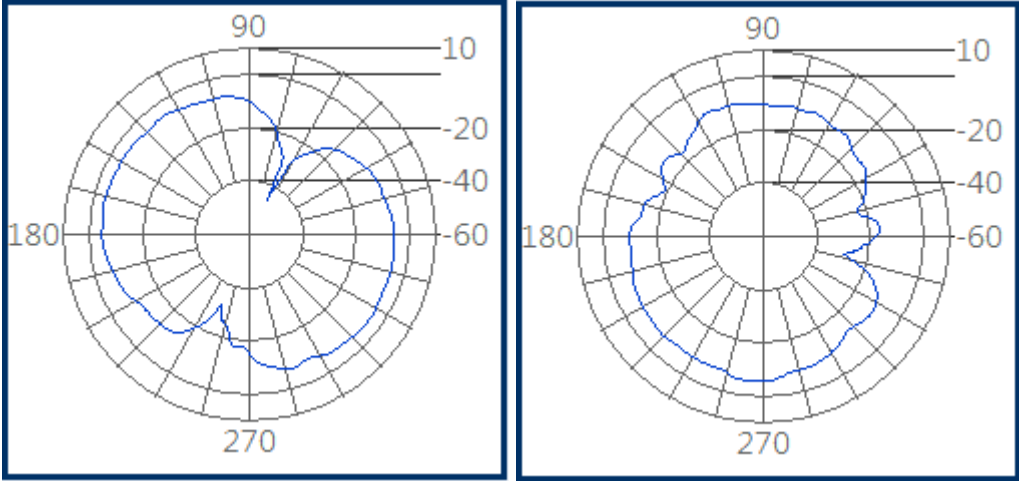
Omnidirectional Radiation (Center Edge)



a. x-Axis H-Polarization & V-Polarization

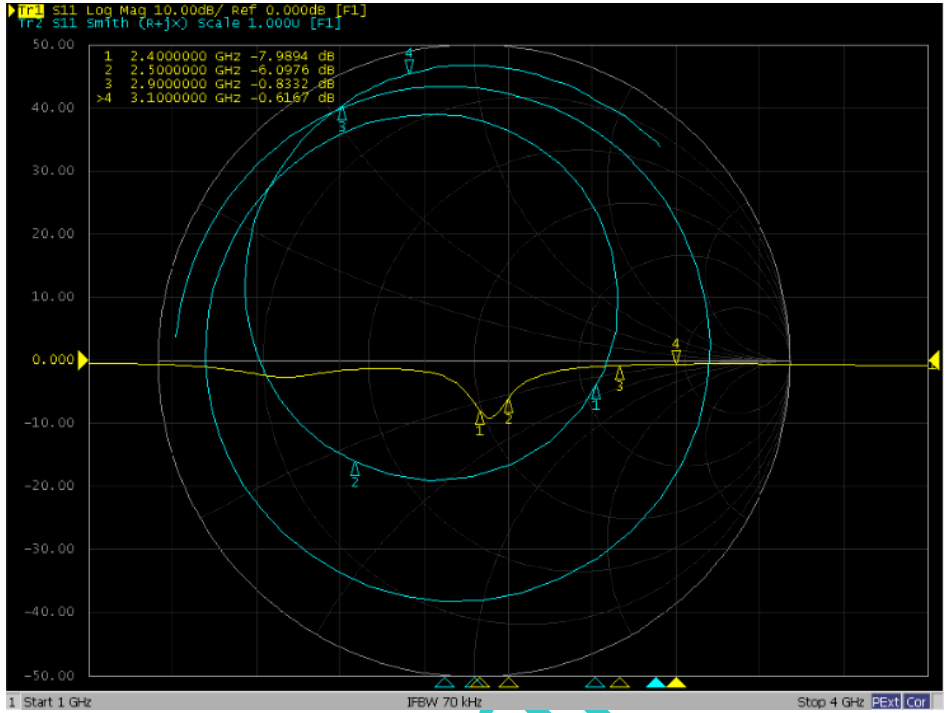


b. y-Axis H-Polarization & V-Polarization



c. z-Axis H-Polarization & V-Polarization

4.5.2 Antenna Return Loss:

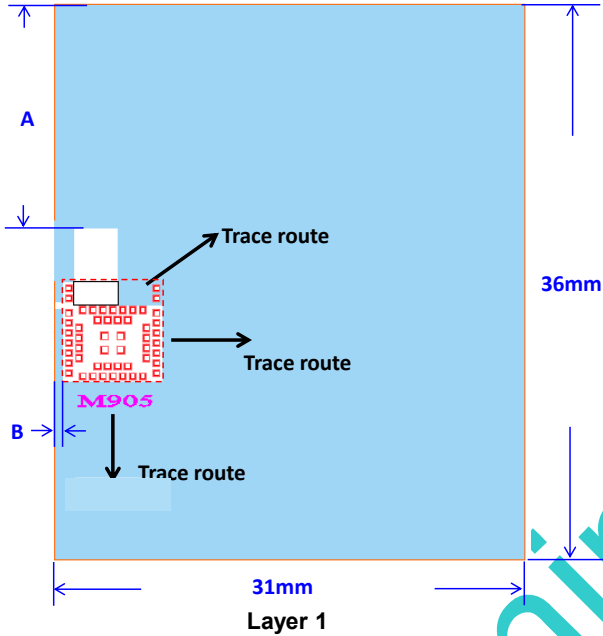


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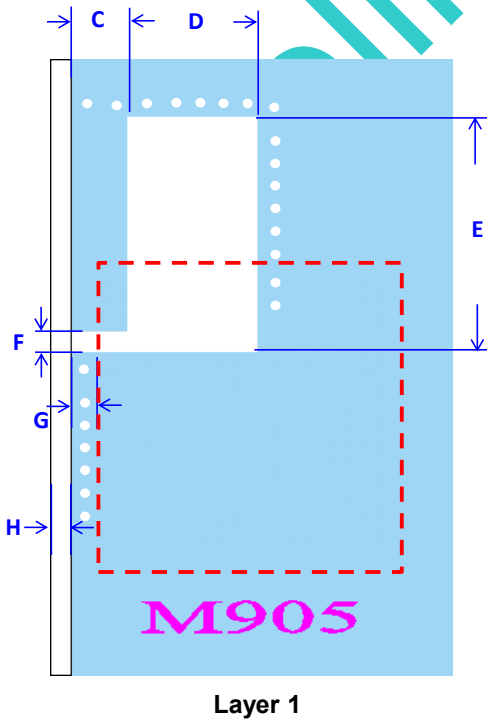
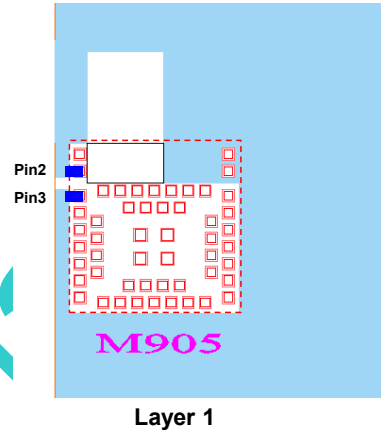
4.5.3 Antenna Design Guide

Center Edge:

- Keep $A \geq 10.5\text{mm}$, $B \geq 0.55\text{mm}$
- Connect Pin 2 to Upper GND, Pin 3 to lower GND
- Don't route signal trace across antenna clearance area

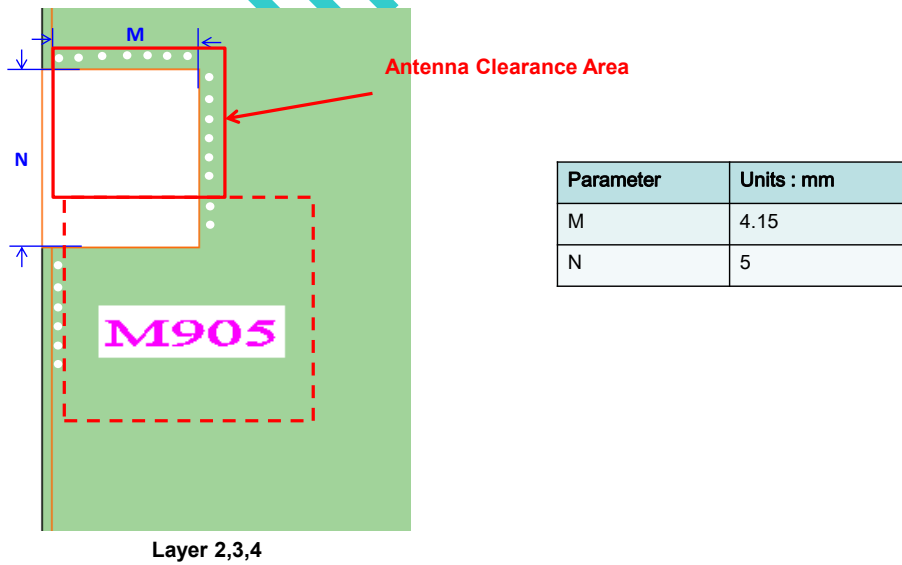
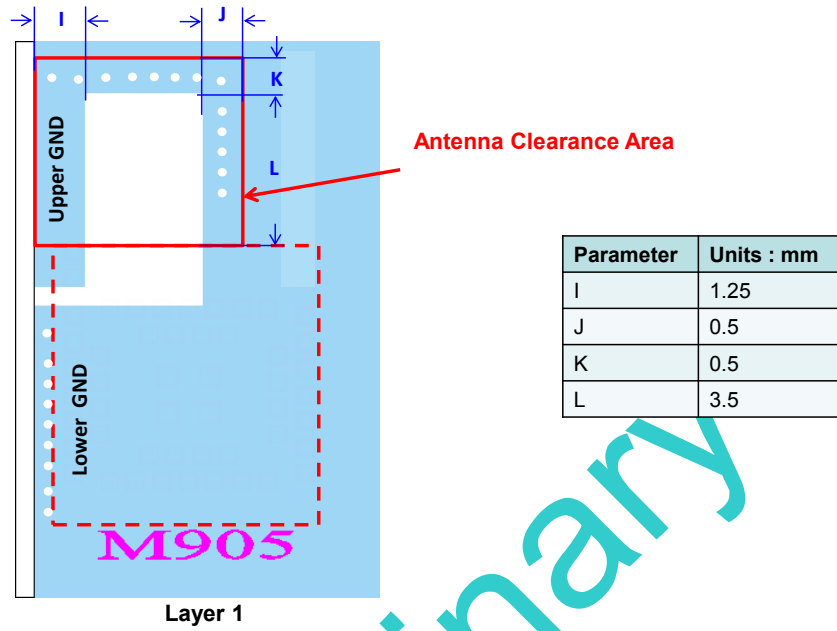


Parameter	Units : mm
A	≥ 10.5
B	0.55



Parameter	Units : mm
C	1.25
D	2.9
E	5
F	0.38
G	0.55
H	0.25

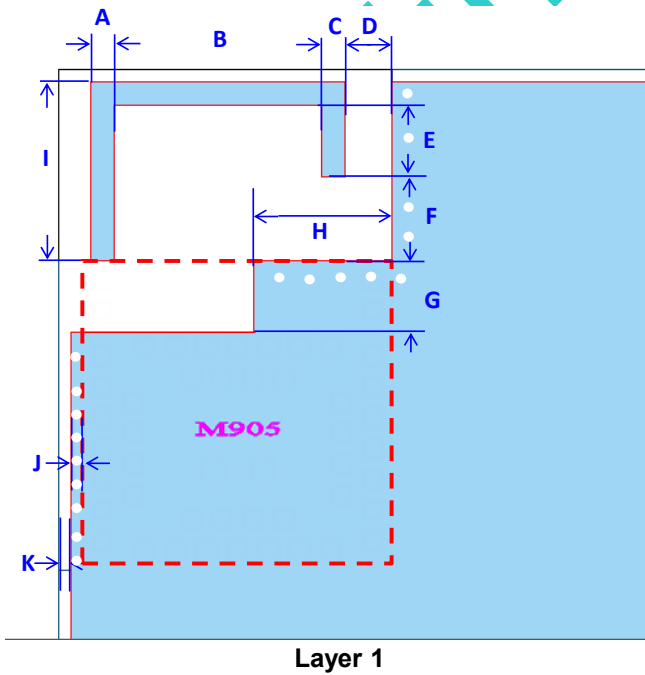
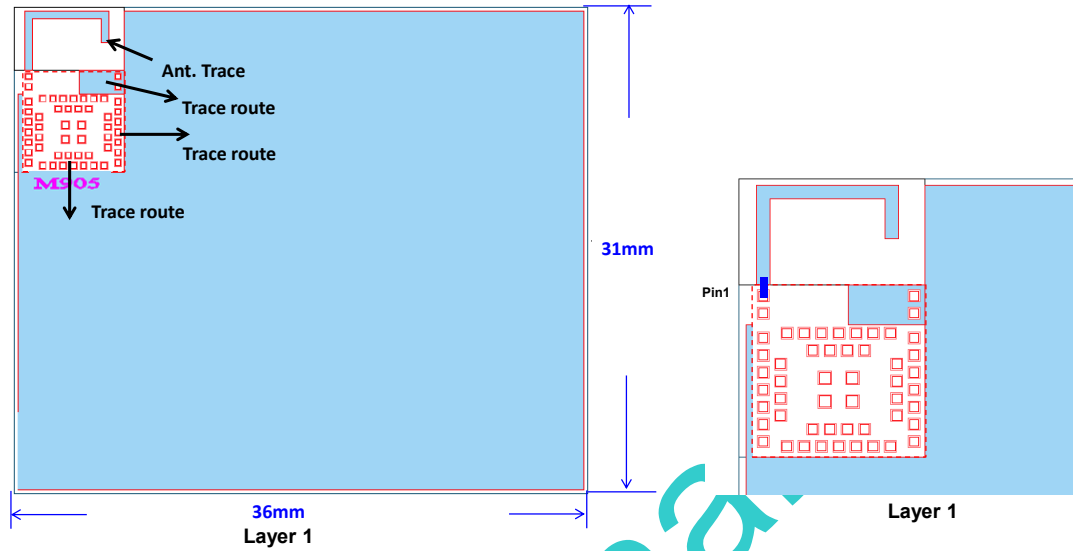
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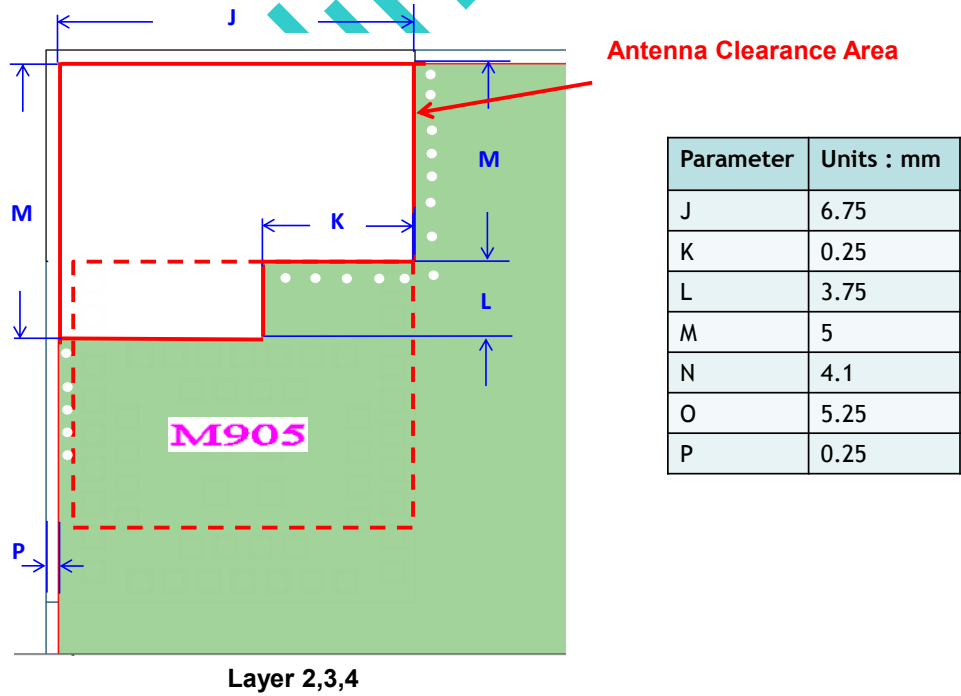
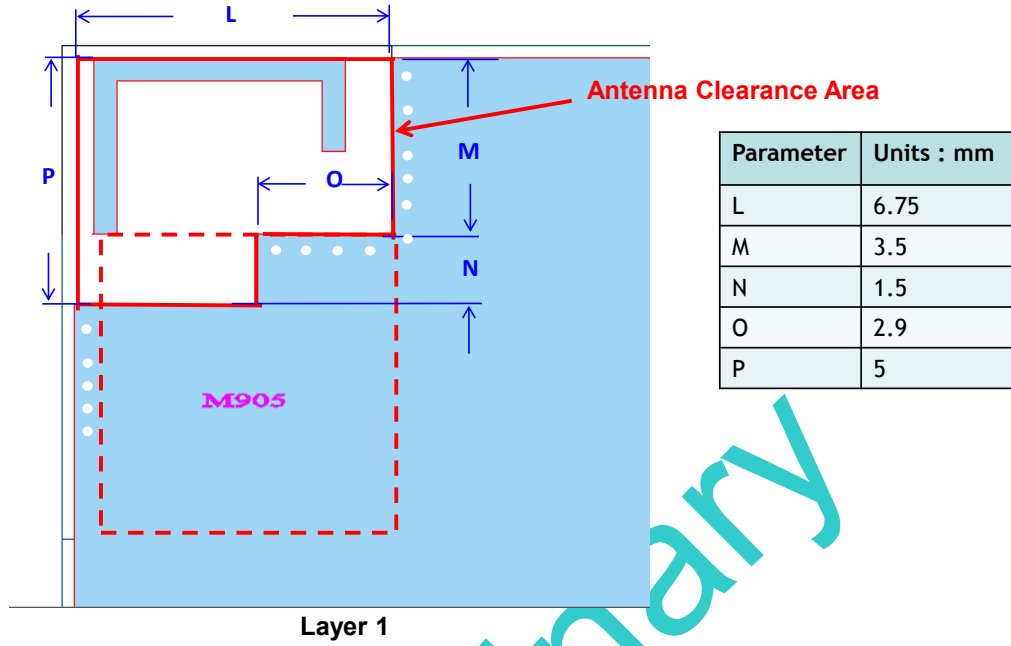
Coner :

- a. Connect Pin 1 to Ant. trace
- b. Don't route signal trace across antenna clearance area



Parameter	Units : mm
A	0.5
B	4.34
C	0.5
D	1
E	1
F	2
G	1.5
H	0.29
I	3.5
J	0.25
K	0.25

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4.6 Power Consumption

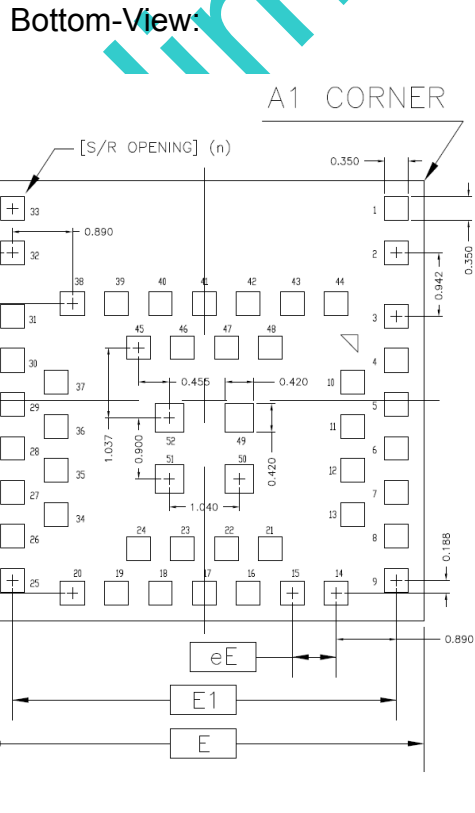
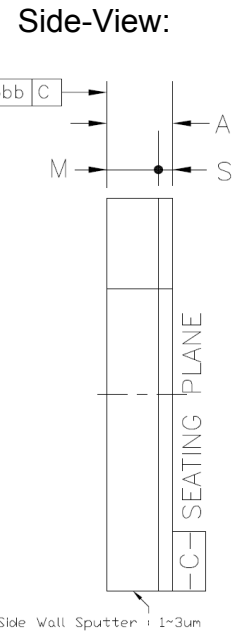
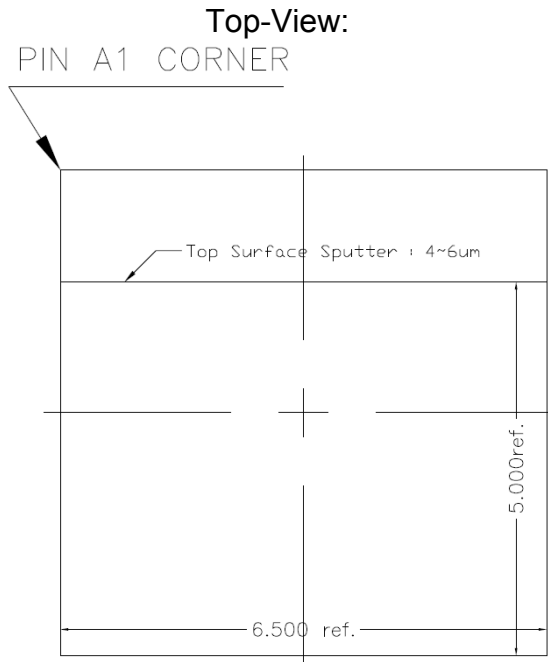
Item	Condition	Typ.
Tx mode	3.3V	12.06
	1.8V	
Rx mode	3.3V	15.32
	1.8V	
System ON Constant Latency	Sleep Mode	

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5. Dimensions

The size and thickness of the M905 module 6.5mm (W) x 6.5mm (L) x 1.3mm (H):



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Dimensions

		Symbol	Common Dimensions
Package :			PIM
Body Size:	X	E	6.500
	Y	D	6.500
Lead Pitch :	X	eE	0.650
	Y	eD	0.650
Total Thickness :		A	1.100±0.100
Mold Thickness :		M	0.860 Ref.
Substrate Thickness :		S	0.240 Ref.
S/R Opening :			0.350*0.350 / 0.420*0.420
Stand Off :		A1	---- ~ ----
Ball Width :		b	---- ~ ----
Package Edge Tolerance :		aaa	0.100
Mold Flatness :		bbb	0.100
Coplanarity:		ddd	----
Ball Offset (Package) :		eee	----
Ball Offset (Ball) :		fff	----
Lead Count :		n	52
Edge Lead Center to Center :	X	E1	5.680
	Y	D1	5.680

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6. PIN DEFINITION

The foot print dimension and pin definition is defined as below

No	Pin Name	Pin Type	Description
1	Antenna Leg	RF	Scenario B
2	GND A1	RF	Scenario A
3	GND A2	RF	Scenario A
4	GND	Power	Ground (0V)
5	ANT	RF	Single-ended radio antenna connection
6	RF	RF	Single-ended radio antenna connection
7	GND	Power	Ground (0V)
8	GND	Power	Ground (0V)
9	VDD	Power	Power supply
10	GND	Power	Ground (0V)
11	GND	Power	Ground (0V)
12	P0.21/nRESET	Digital I/O	General purpose I/O pin. Configurable as system RESET pin
13	P0.14/TRACEDATA[3]	Digital I/O	General purpose I/O pin. Trace port output
14	P0.15/TRACEDATA[2]	Digital I/O	General purpose I/O pin. Trace port output
15	P0.16/TRACEDATA[1]	Digital I/O	General purpose I/O pin. Trace port output
16	P0.18/TRACEDATA[0]	Digital I/O	General purpose I/O pin. Trace port output
17	P0.00/XL1	Digital I/O Analog input	General purpose I/O pin. Connection for 32.768kHz crystal (LFXO)
18	P0.01/XL2	Digital I/O Analog input	General purpose I/O pin. Connection for 32.768kHz crystal (LFXO)
19	P0.03/AIN1	Digital I/O Analog input	General purpose I/O pin. SAADC/COMP/LPCOMP input
20	P0.02/AIN0	Digital I/O Analog input	General purpose I/O pin. SAADC/COMP/LPCOMP input
21	P0.09/NFC1	Digital I/O NFC input	General purpose I/O pin. NFC antenna connection
22	P0.10/NFC2	Digital I/O NFC input	General purpose I/O pin. NFC antenna connection
23	P0.05/AIN3	Digital I/O Analog input	General purpose I/O pin. SAADC/COMP/LPCOMP input
24	P0.04/AIN2	Digital I/O Analog input	General purpose I/O pin. SAADC/COMP/LPCOMP input
25	P0.31/AIN7	Digital I/O Analog input	General purpose I/O pin. SAADC/COMP/LPCOMP input
26	P0.30/AIN6	Digital I/O Analog input	General purpose I/O pin. SAADC/COMP/LPCOMP input
27	P0.29/AIN5	Digital I/O Analog input	General purpose I/O pin. SAADC/COMP/LPCOMP input
28	P0.28/AIN4	Digital I/O Analog input	General purpose I/O pin. SAADC/COMP/LPCOMP input
29	P0.27	Digital I/O	General purpose I/O pin
30	P0.25	Digital I/O	General purpose I/O pin
31	P0.26	Digital I/O	General purpose I/O pin

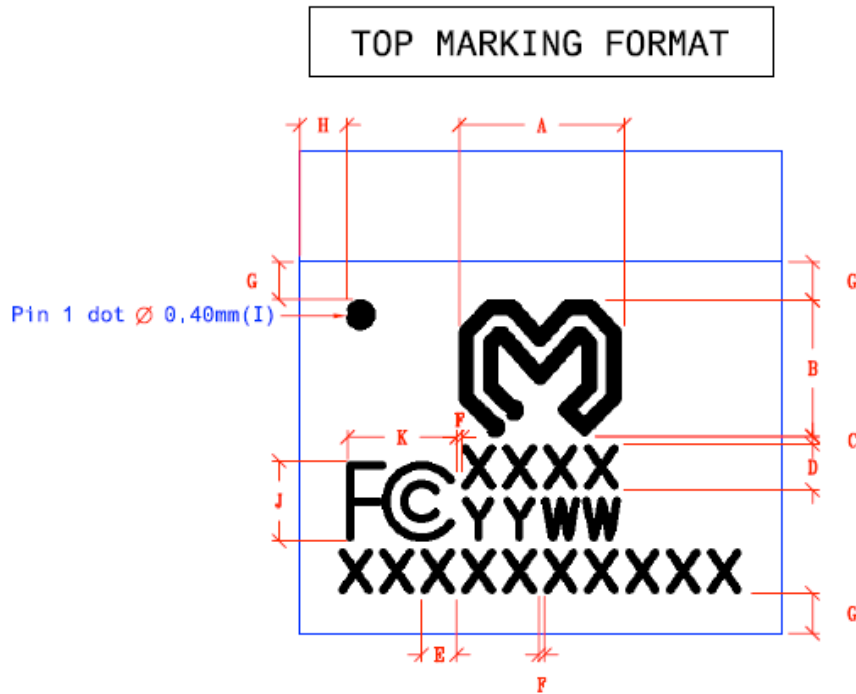
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No	Pin Name	Pin Type	Description
32	GND	Power	Ground (0V)
33	GND	Power	Ground (0V)
34	P0.11	Digital I/O	General purpose I/O pin
35	P0.19	Digital I/O	General purpose I/O pin
36	P0.22	Digital I/O	General purpose I/O pin
37	P0.23	Digital I/O	General purpose I/O pin
38	P0.24	Digital I/O	General purpose I/O pin
39	SWDCLK	Digital input	Serial wire debug clock input for debug and programming
40	SWDIO	Digital I/O	Serial wire debug I/O for debug and programming
41	GND	Power	Ground (0V)
42	GND	Power	Ground (0V)
43	GND	Power	Ground (0V)
44	GND	Power	Ground (0V)
45	P0.20/TRACECLK	Digital I/O	General purpose I/O pin. Trace port clock output
46	GND	Power	Ground (0V)
47	GND	Power	Ground (0V)
48	GND	Power	Ground (0V)
49	GND	Power	Ground (0V)
50	GND	Power	Ground (0V)
51	GND	Power	Ground (0V)
52	GND	Power	Ground (0V)

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7. RECOMMEND FOOTPRINT

SMD Design:



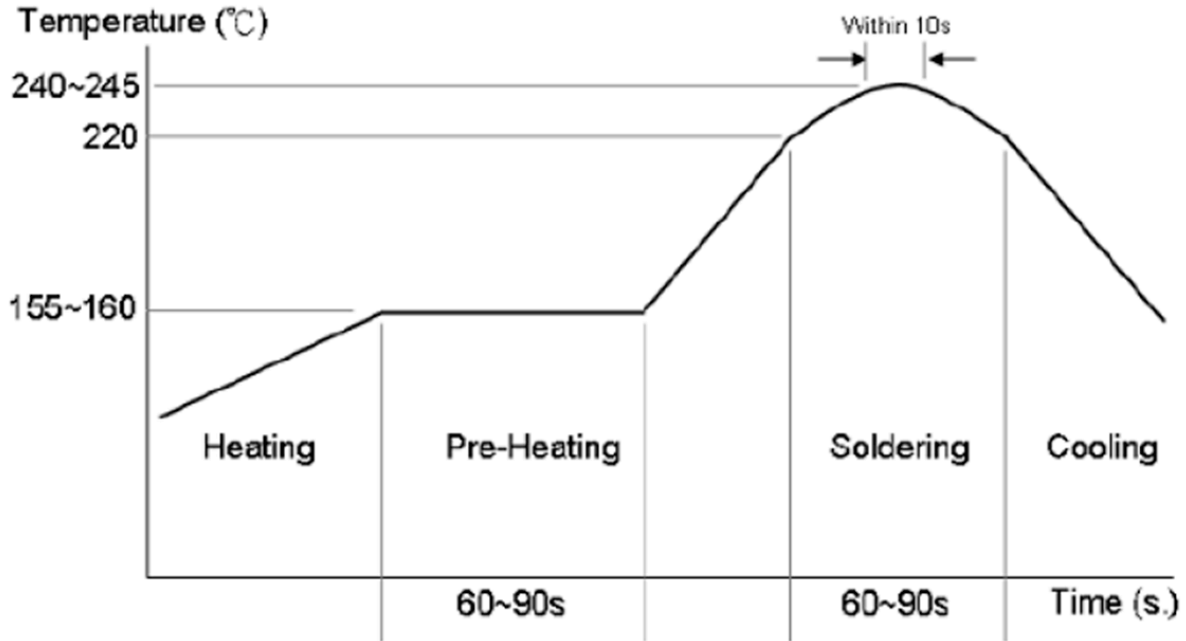
蓋印時,Logo或最長字串需與產品左右置中對齊。
The logo or longest line should be horizontally aligned to center of package.

Font size tolerance: $\pm 0.20\text{mm}$
Marking shift depend on ASE standard

Unit : mm	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Customer (SPEC)			0.1					0.6	0.4					
ASE (Actually)	2.23	1.87	0.10	0.61	0.46	0.10	0.50 \pm 0.4	0.60	0.40	1.08	1.48			

	Content	Description	Fixed / Dynamic	Alignment	Font Type
Line 1	Pin 1 dot	Pin 1 dot	Fixed	Left	N/A
	LOGO	Logo		Center	
Line 2	XXXX	Device name	Dynamic	Center	N1453CL
Line 3	LOGO	Logo	Fixed	Left	N/A
	YYWW	Date code		Center	
Line 4	XXXXXXXXXX	FCC ID	Dynamic	Center	N1453CL

9. RECOMMEND REFLOW PROFILE



Pro:

- b. Between 155~160°C: 60~90 sec.
- c. Above 220°C: 60~90 sec.
- d. Peak Temperature: 240~245 (<10 sec.)

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Federal Communication Commission Interference Statement

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.

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

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.

This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

IMPORTANT NOTE:

FCC Radiation Exposure Statement:

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.

IMPORTANT NOTE:

This module is intended for OEM integrator. The OEM integrator is still responsible for the FCC compliance requirement of the end product, which integrates this module.

Appropriate measurements (e.g. 15 B compliance) and if applicable additional equipment authorizations (e.g. Verification , Doc) of the host device to be addressed by the integrator/manufacturer.

IMPORTANT NOTE:

This module is intended for OEM integrator. The OEM integrator is still responsible for the FCC compliance requirement of the end product, which integrates this module.

20cm minimum distance has to be able to be maintained between the antenna and the users for the host this module is integrated into. Under such configuration, the FCC radiation exposure limits set forth for an population/uncontrolled environment can be satisfied.

Any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

USERS MANUAL OF THE END PRODUCT:

In the users manual of the end product, the end user has to be informed to keep at least 20cm separation with the antenna while this end product is installed and operated. The end user has to be informed that the FCC radio-frequency exposure guidelines for an uncontrolled environment can be satisfied. The end user has to also be informed that any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment. If the size of the end product is smaller than the palm of the hand, then additional FCC part 15.19 statement is required to be available in the users manual: This device complies with Part 15 of 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.

LABEL OF THE END PRODUCT:

The final end product must be labeled in a visible area with the following " Contains TX FCC ID: 2AJ9P-M905". If the size of the end product is larger than the palm of the hand, then the following FCC part 15.19 statement has to also be available on the label: This device complies with Part 15 of 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.