



a module solution provider

WG1400-00

TI CC3100 IEEE 802.11 b/g/n

Datasheet

Draft 0.5

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Prepared By	Reviewed By	Approved By

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1. OVERVIEW

1.1. General Features

- **WIFI Network Processor Subsystems**
 - Featuring Wi-Fi Internet-On-a-Chip™
 - Wi-Fi Driver and Multiple Internet Protocols in ROM
 - 802.11 b/g/n Radio, Baseband, and MAC, Wi-Fi Driver, and Supplicant
 - Powerful Crypto Engine for Fast, Secure Wi-Fi and Internet Connections with 256-Bit AES Encryption for TLS and SSL Connections
 - Station, AP, and Wi-Fi Direct Modes
 - WPA2 Personal and Enterprise Security
 - SimpleLink Connection Manager for Autonomous and Fast Wi-Fi Connections
 - Smart Config™ Technology, AP Mode, and WPS2 for Easy and Flexible Wi-Fi Provisioning
 - Application Throughput
 - UDP : 16 Mbps
 - TCP : 12 Mbps
- **Host Interface**
 - Interfaces with 8-, 16-, and 32-bit MCU or ASICs Over SPI or UART Interface
 - Low External Host Driver Footprint: Less Than 7 KB of Code Memory and 700 B of RAM Memory Required for TCP Client Application
- **SimpleLink Advanced Features**
 - Embedded Wi-Fi Connection Manager with No Host Processor involvement
 - Smart Config Provisioning Utility to Configure Headless Devices Using a Smart Phone with a Single Click
 - BSD Socket APIs for Standard and Easy Internet Applications Development
 - Powerful HW Crypto Engine for Fast State- of-the-Art Wi-Fi and Internet Security
 - Programmable Packet Filters in MAC and IP Layer to Optimize Power Consumption
- **Power Management Subsystem**
 - Integrated DC-DC Supports a Wide Range of Supply Voltage:
 - V_{BAT} Wide-Voltage Mode : 2.3 to 3.6 V

- Advanced Low-Power Modes
 - Hibernate with RTC: 4 μ A
 - Low-Power Deep Sleep (LPDS): 115 μ A
 - RX Traffic (MCU Active): 53 mA @ 54 OFDM
 - TX Traffic (MCU Active): 223 mA @ 54 OFDM, Maximum Power
 - Idle Connected: 690 μ A @ DTIM = 1
- Clock Source
 - 40.0-MHz internal built-in crystal
 - 32.768-kHz external clock source
- Package and Operating Temperature
 - 23.5mm*23.5mm*2.4mm
 - Ambient Temperature Range: -30°C to 85°C

1.2. Applications

For Internet-of-Things applications, such as:

- Home Automation and Security
- Cloud Connectivity
- Smart Energy
- Industrial Control
- Access Control
- Smart Plug and Metering
- Wireless Audio
- IP Network Sensor Nodes

2. MODULE BLOCK DIAGRAM

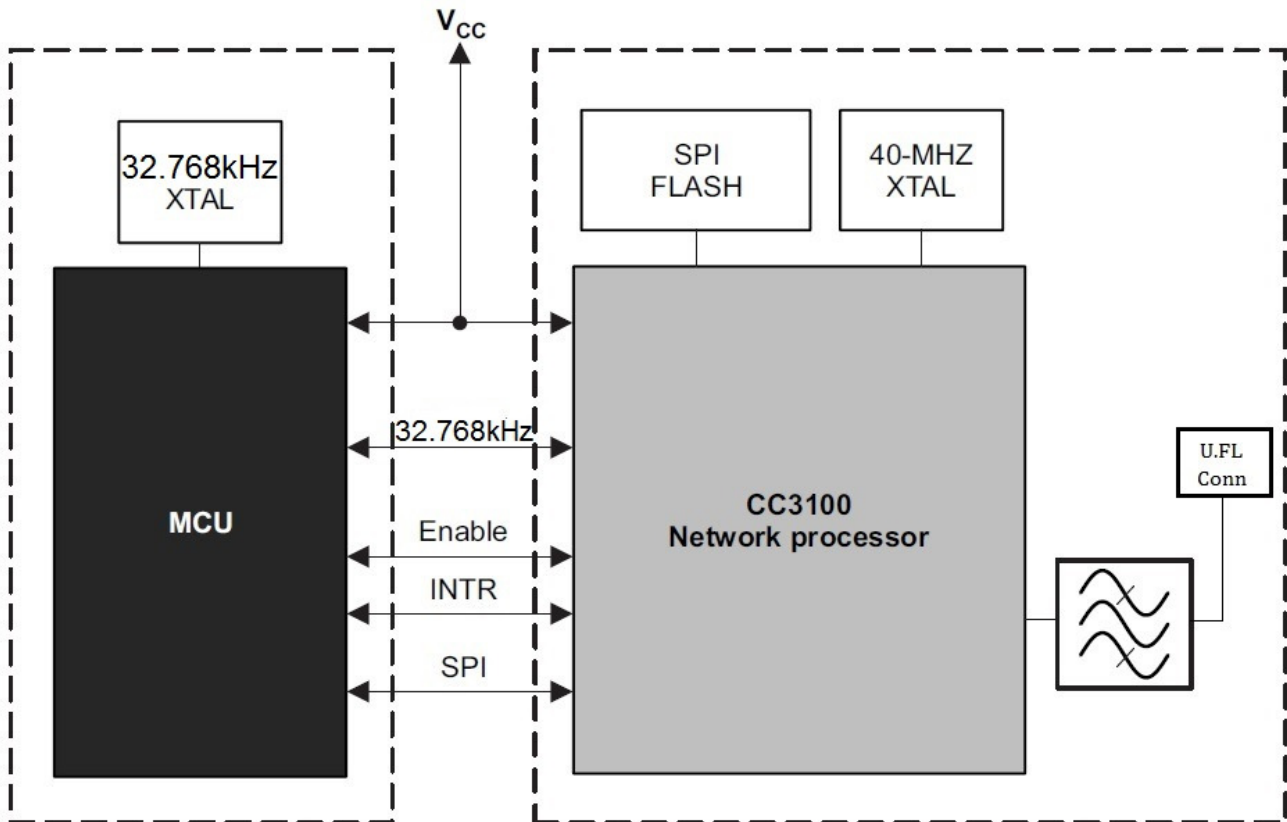


Fig 2.1 WG1400-00 module block diagram

3. PRODUCTION SPECIFICATIONS

3.1. Absolute Maximum ratings

- Over operating free-air temperature range

PARAMETERS	PINS	MIN	MAX	UNIT
V _{BAT}	3,4,6	-0.5	3.8	V
Digital inputs		-0.5	V _{BAT} +0.5	V
RF pins		-0.5	2.1	V
Analog pins (Clock input)		-0.5	2.1	V
Operating temperature range (T _A)		-30	+85	°C

3.2. Recommended Operating Conditions

- Over operating free-air temperature range (1)

PARAMETERS	PINS	CONDITIONS(2)	MIN	TYP	MAX	UNIT
V _{BAT}	3,4,6	Direct battery connection	2.3	3.3	3.6	V
Ambient thermal slew			-20		20	°C /minute

(1) Operating temperature is limited by crystal frequency variation.

(2) To ensure WLAN performance, ripple on the 2.1- to 3.3-V supply must be less than ± 300 mV.

3.3. Electrical characteristics

- 3.3 V, 25°C

PARAMETER	MIN	NOM	MAX	UNIT
C _{IN} Pin capacitance		4		pF
V _{IH} High-level input voltage	$0.65 \times V_{BAT_IN}$		$V_{BAT_IN} + 0.5$ V	V
V _{IL} Low-level input voltage	-0.5		$0.35 \times V_{BAT_IN}$	V
I _{IH} High-level input current		5		nA
I _{IL} Low-level input current		5		nA
V _{OH} High-level output voltage (V _{BAT_IN} = 3.0V)	2.4			V
V _{OL} Low-level output voltage			0.4	V

(V _{BAT_IN} = 3.0V)					
I _{OH}	High-level source current, V _{OH} = 2.4	6			mA
I _{OL}	Low-level sink current, V _{OH} = 0.4	6			mA
Pin internal Pull up and Pull down (25°C)					
PARAMETER		MIN	NOM	MAX	UNIT
I _{OH}	Pull-Up current, V _{OH} = 2.4 (V _{BAT_IN} = 3.0V)	5		10	μA
I _{OH}	Pull-Down current, V _{OL} = 0.4 (V _{BAT_IN} = 3.0V)	5			μA

3.4. WLAN RF Specifications

➤ WLAN Receiver Characteristics

Parameter	Condition (Mbps)	Min	Typ	Max	Units
Sensitivity (8% PER for 11b rates, 10% PER for 11g/11n rates)(10% PER)	1 DSSS		-92.5		dBm
	11 CCK		-86.3		
	6 OFDM		-86.1		
	54 OFDM		-71.2		
	MCS0		-84.1		
	MCS7		-67.3		
Maximum input level (10% PER)	802.11b		-4.0		
	802.11g		-10.0		

➤ WLAN Transmitter Characteristics

Parameter	Condition	Min	Typ	Max	Units
Maximum RMS output power measured at 1 dB from IEEE spectral mask or EVM	1 DSSS		16.0		dBm
	11 CCK		16.0		
	6 OFDM		15.5		
	54 OFDM		12.5		
	MCS0		15.0		
	MCS7		11.0		
Output power accuracy		-2		2	dB
Transmit center frequency accuracy		-25		25	ppm

(1) Channel-to-channel variation is up to 2dB. The edge channels (2412 and 2472MHz) have reduced TX power to meet FCC emission limits.

3.5. SPI Interface

➤ Host SPI Interface timing

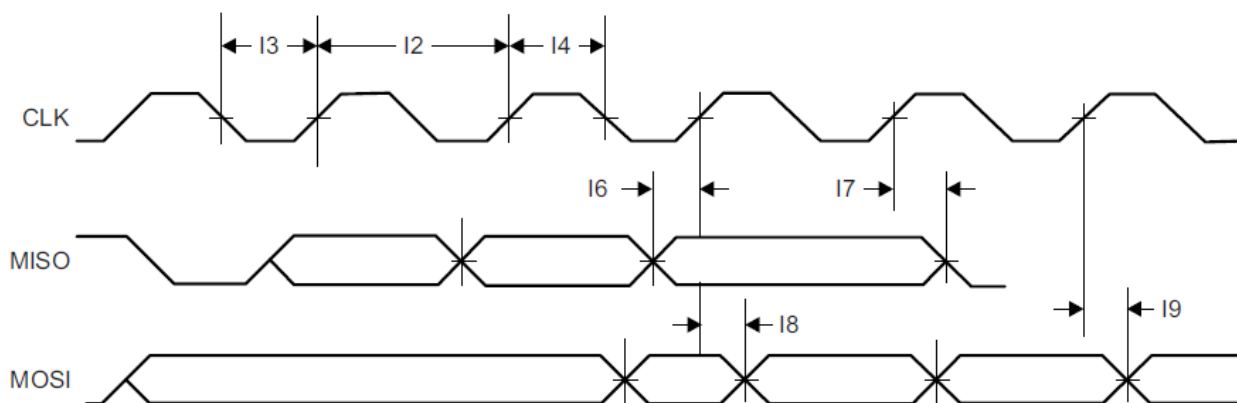


Fig 3.5.1 Host SPI interface timing

Table 3.5.1 Host SPI interface timing parameter

Parameter Number	Parameter (1)	Parameter Name	Min	Max	Unit
I1	F	Clock frequency @ V _{BAT} = 3.3V		20	MHz
I2	t _{dk}	Clock period	50		ns
I3	t _{LP}	Clock low period		25	ns
I4	t _{HT}	Clock high period		25	ns
I5	D	Duty cycle	45	55	%
I6	t _{IS}	RX data setup time	4		ns
I7	t _{IH}	RX data hold time	4		ns
I8	t _{OD}	TX data output delay		20	
I9	t _{OH}	TX data hold time		24	ns

(1) The timing parameter has a maximum load of 20 pF at 3.3 V.

3.6. Input Clocks/Oscillators

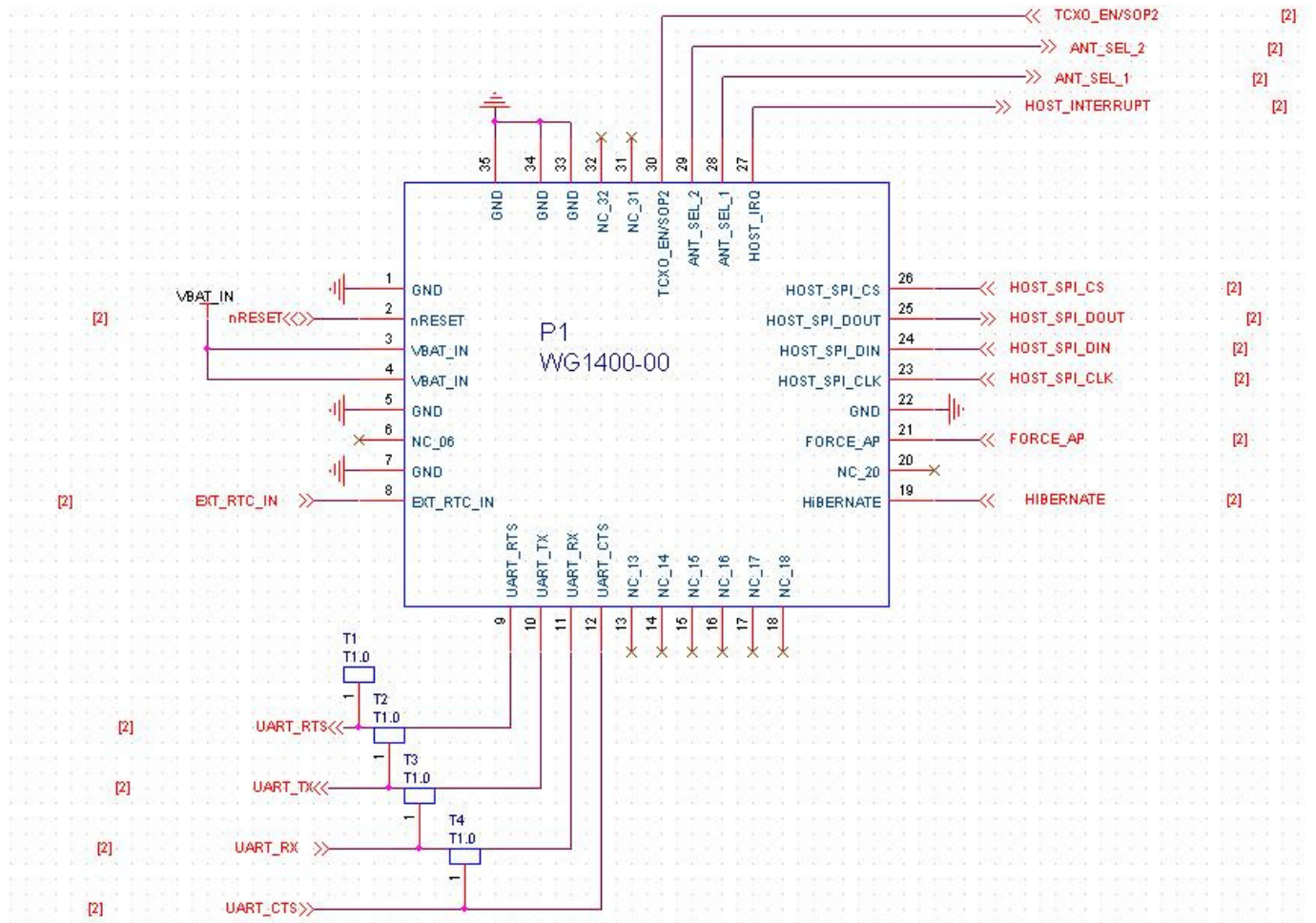
Table 3.6.1 External RTC Digital Clock Requirements

CHARACTERISTICS	CONDITION	SYM	MIN	TYP	MAX	UNIT
Frequency				32768		Hz
Frequency accuracy (Initial + temp + aging)					±150	ppm
Input transition time t_r/t_f (10% to 90%)		t_r/t_f			100	ns
Frequency input duty cycle			20	50	80	%
Slow clock input voltage limits	Square wave, DC coupled	V_{ih}	$0.65 \times V_{BAT}$		V_{BAT}	V
		V_{il}	0		$0.35 \times V_{BAT}$	V_{peak}
Input impedance			1			MΩ
					5	pF

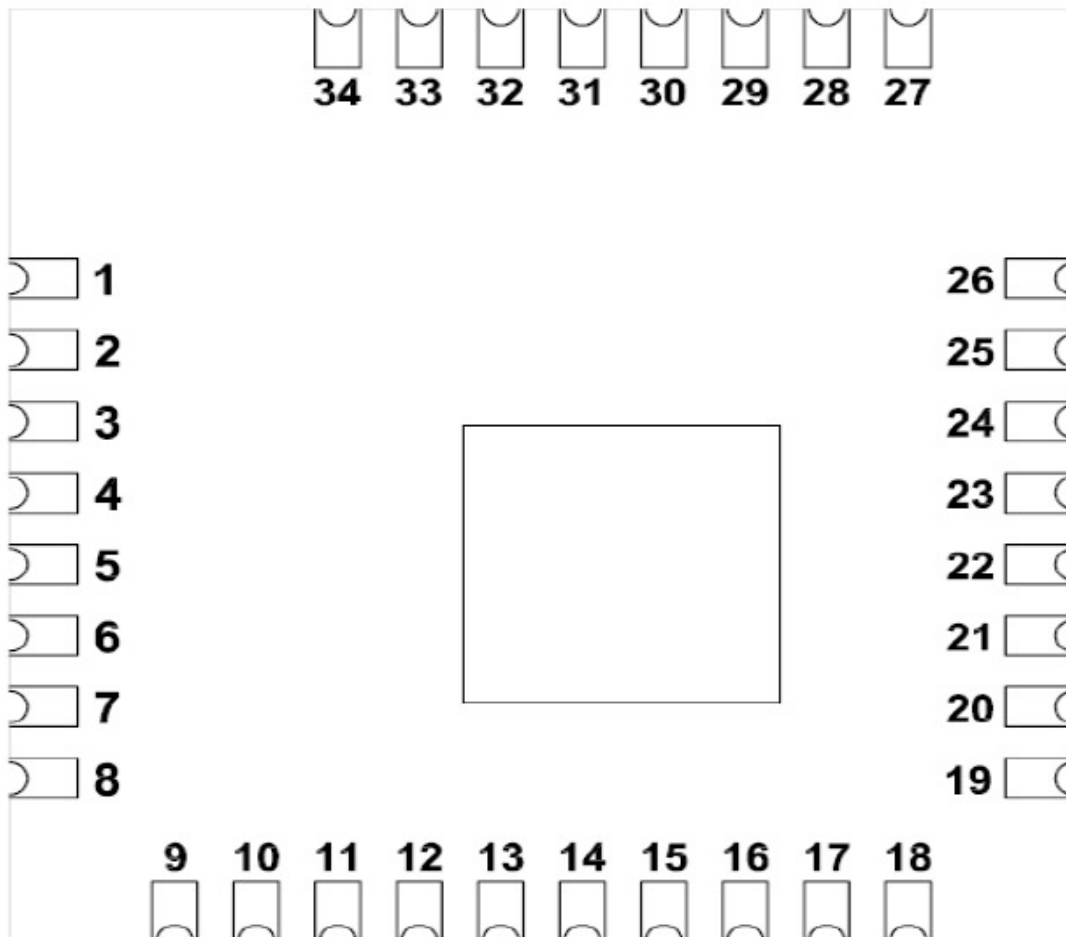
3.7. Current Consumption

Mode	Condition	Typical Current at 3.3V
Active Mode	11 Mbps TX at 16dBm	240mA
	54 Mbps TX at 12.5dBm	185mA
	RX at 54Mbps	51mA
Low Power Mode	LPDS (low-power deep sleep)	100μA
	Hibernate	4μA

4. REFERENCE SCHEMATICS



5. PIN OUT (TOP VIEW)



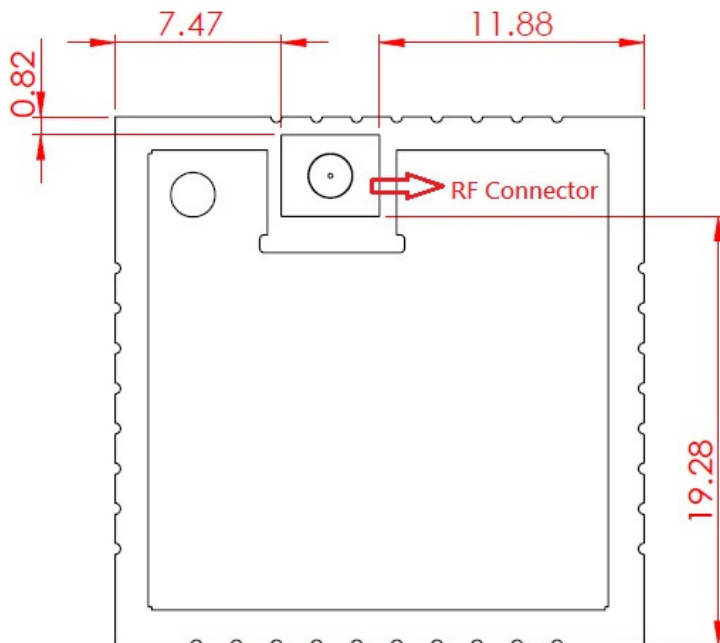
5.1. Pin Description

Pin No.	Signal Name	State at Reset	Type	Description
1	GND	GND	GND	Ground.
2	nRESET	HI-Z	I	RESET input for the device. Active low input. The RC circuit (100K 0.1μF) has been built in internal for power reset.
3	VBAT_IN	POW	POW	Power supply input, 2.1 to 3.6V.
4	VBAT_IN	POW	POW	Power supply input, 2.1 to 3.6V.
5	GND	GND	GND	Ground.
6	NC_06	HI-Z	NA	Unused. Leave unconnected.
7	GND	GND	GND	Ground.
8	EXT_RTC_IN	HI-Z	Analog	32.768-KHz / External clock input.
9	UART_RTS	HI-Z	O	UART host interface. Connect to test point on prototype for flash programming.
10	UART_TX	HI-Z	O	UART host interface. Connect to test point on prototype for flash programming.
11	UART_RX	HI-Z	I	UART host interface. Connect to test point on prototype for flash programming.
12	UART_CTS	HI-Z	I	UART host interface. Connect to test point on prototype for flash programming.
13	NC_13	HI-Z	NA	Unused. Leave unconnected.
14	NC_14	HI-Z	NA	Unused. Leave unconnected.
15	NC_15	HI-Z	NA	Unused. Leave unconnected.
16	NC_16	HI-Z	NA	Unused. Leave unconnected.
17	NC_17	HI-Z	NA	Unused. Leave unconnected.
18	NC_18	HI-Z	NA	Unused. Leave unconnected.
19	HIBERNATE	HI-Z	I	Hibernate signal input to the NWP (active low). If the Hibernate function

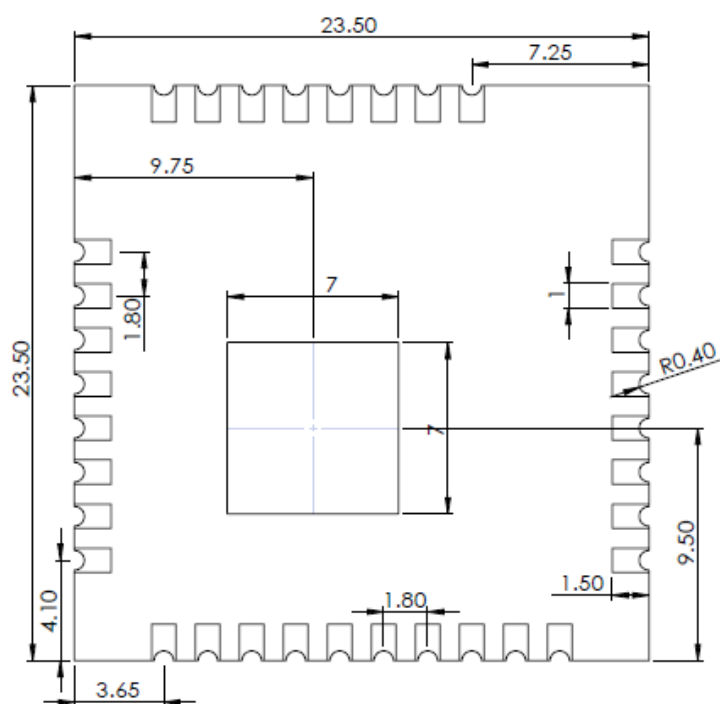
				is not used, connect to VBAT using 100K for pulling-up.
20	NC_20	HI-Z	NA	Unused. Leave unconnected.
21	FORCE_AP	HI-Z	I	For forced AP mode, pull high on the board using 100K resistor. Otherwise, pull down to ground using 100K resistor.
22	GND	GND	GND	Ground.
23	HOST_SPI_CLK	HI-Z	O	Host interface SPI clock.
24	HOST_SPI DIN	HI-Z	I	Host interface SPI data input.
25	HOST_SPI_DOUT	HI-Z	O	Host interface SPI data output.
26	HOST_SPI_CS	HI-Z	I	Host interface SPI chip select.
27	HOST_IRQ	HI-Z	O	Interrupt output.
28	ANT_SEL_1	HI-Z	O	Antenna selection control. For future use only.
29	ANT_SEL_2	HI-Z	O	Antenna selection control. For future use only.
30	TCXO_EN/SOP2	HI-Z	O	Pull down to ground using 100K resistor
31	NC_31	HI-Z	NA	Unused. Leave unconnected.
32	NC_32	HI-Z	NA	Unused. Leave unconnected.
33	GND	GND	GND	Ground.
34	GND	GND	GND	Ground.
35	GND	GND	GND	Ground.

5.2. Package Information

➤ **Top view (Unit: mm)**



➤ **Bottom view (Unit: mm)**



5.3. RF Connector

- P/N : U.FL-R-SMT-1 (U.FL Series) from HIROSE.

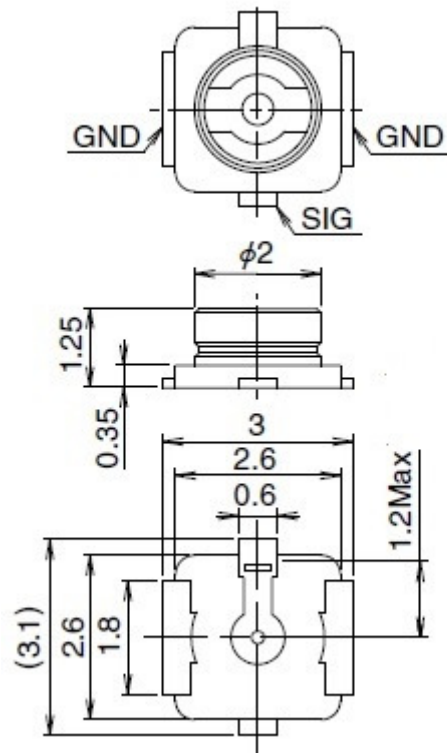


Fig 5.3.1 RF connector drawing

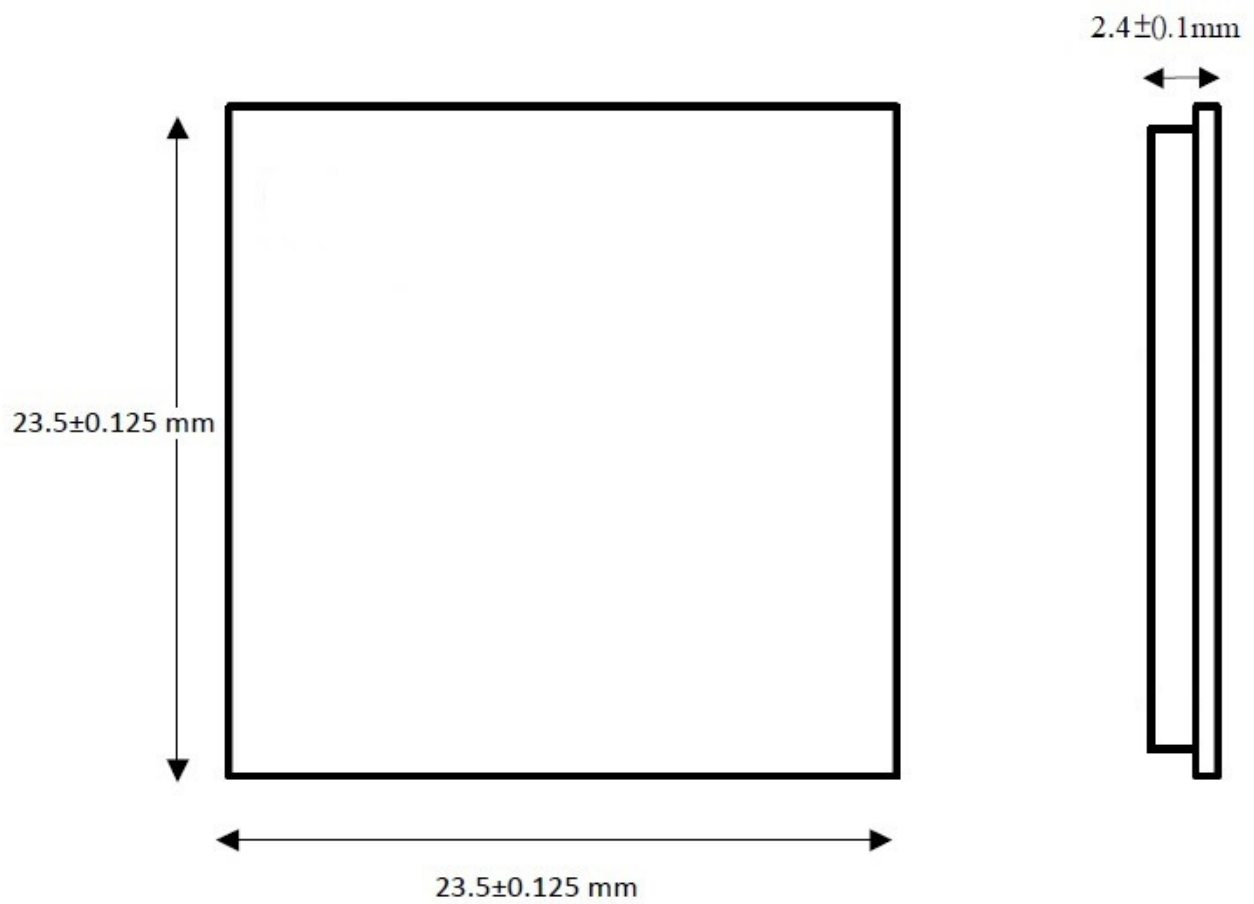
- Table for Filed Antenna

Group 1					
Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	WIESON	N/A	Dipole	I-PEX	2.45

Group 2					
Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	 Unicttron	H2B1BE1A1B0200	PCB	I-PEX	4.13

Group 3					
Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	N/A	N/A	Printed	N/A	-8.78

6. MODULE MECHANICAL OUTLINE



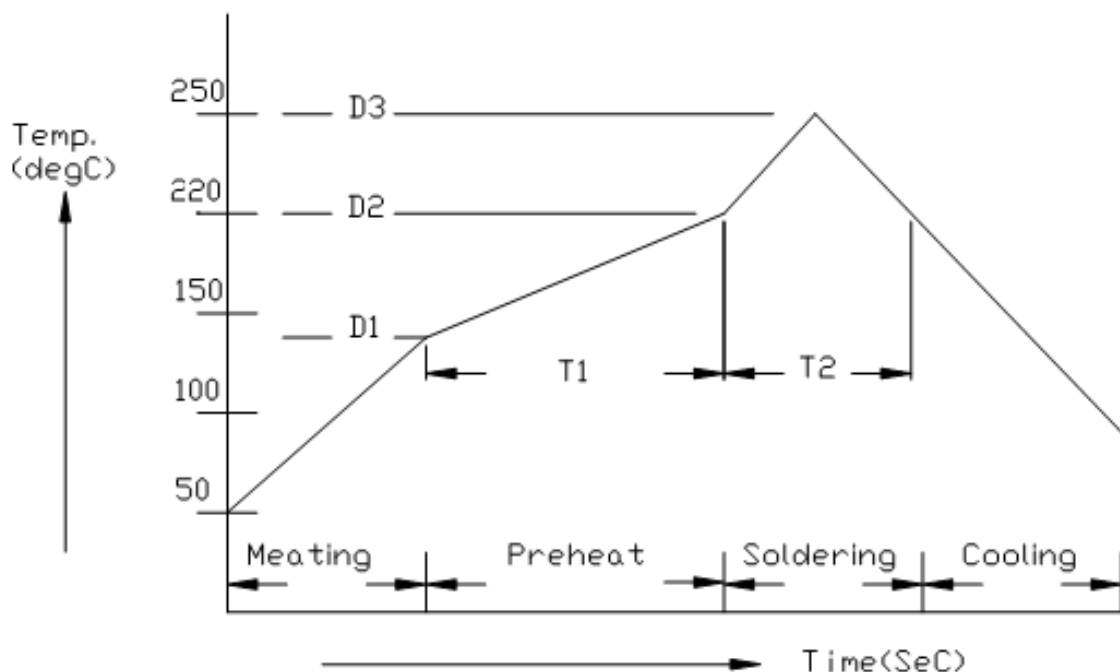
7. SMT AND BAKING RECOMMENDATION

7.1. Baking Recommendation

- Baking condition :
 - Follow MSL Level 4 to do baking process.
 - After bag is opened, devices that will be subjected to reflow solder or other high temperature process must be
 - a) Mounted within 72 hours of factory conditions <30°C/60% RH, or
 - b) Stored at <10% RH.
 - Devices require bake, before mounting, if Humidity Indicator Card reads >10%
- If baking is required, Devices may be baked for 8 hrs. at 125 °C.

7.2. SMT Recommendation

- Recommended Reflow profile :



No.	Item	Temperature (°C)	Time (sec)
1	Pre-heat	D1: 140 ~ D2: 200	T1: 80 ~ 120
2	Soldering	D2: = 220	T2: 60 +/- 10
3	Peak-Temp.	D3: 250 °C max	

Note: (1) Reflow soldering is recommended two times maximum.
 (2) Add Nitrogen while Reflow process : SMT solder ability will be better.

✧ **Stencil thickness** : 0.1~ 0.13 mm (Recommended)

✧ **Soldering paste (without Pb)** : Recommended SENJU N705-GRN3360-K2-V can get better soldering effects.

8. HISTORY CHANGE

Revision	Date	Description
0.1	2014/10/14	Initial Released
0.2	2015/03/13	1. Revise RF Specifications. 2. Redraw reference schematic. 3. Add Recommended Operating Conditions. 4. Add SMT AND BAKING RECOMMENDATION
0.3	2015/04/24	Revise the Ambient Temperature Range
0.4	2015/05/06	1. Add RF connector. 2. Revise the Recommended Operating Conditions.
0.5	2015/11/25	1. Add FCC statement.

FCC 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 Radiation Exposure Statement

This device complies with FCC radiation exposure limits set forth for an uncontrolled environment and it also complies with Part 15 of the FCC RF Rules. This equipment must be installed and operated in accordance with provided instructions and the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. End-users and installers must be provided with antenna installation instructions and consider removing the no-collocation 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.

This device is intended only for OEM integrators under the following conditions:

- 1) The antenna must be installed such that 20cm is maintained between the antenna and users, and
- 2) The transmitter module may not be co-located with any other transmitter or antenna,
- 3) For all products market in US, OEM has to limit the operation channels in CH1 to CH11 for 2.4Gband by supplied firmware programming tool. OEM shall not supply any tool or info to the end-user regarding to Regulatory Domain change.

As long as 3 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

IMPORTANT NOTE:

In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

End Product Labelling

The final end product must be labelled in a visible area with the following:

“Contains FCC ID:WS2-WG1400-00.

Manual Information to the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user’s manual of the end product which integrates this module.

Caution!

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

Canada Statement

This device complies with Industry Canada's licence-exempt RSSs. Operation is subject to the following two conditions:

- (1) This device may not cause interference; and
- (2) This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie 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'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

The device meets the exemption from the routine evaluation limits in section 2.5 of RSS 102 and compliance with RSS-102 RF exposure, users can obtain Canadian information on RF exposure and compliance.

Le dispositif rencontre l'exemption des limites courantes d'évaluation dans la section 2.5 de RSS 102 et la conformité à l'exposition de RSS-102 rf, utilisateurs peut obtenir l'information canadienne sur l'exposition et la conformité de rf.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body.

Cet émetteur ne doit pas être Co-placé ou ne fonctionnant en même temps qu'aucune autre antenne ou émetteur. Cet équipement devrait être installé et actionné avec une distance minimum de 20 centimètres entre le radiateur et votre corps.

This device is intended only for OEM integrators under the following conditions:

- 1) The antenna must be installed such that 20cm is maintained between the antenna and users, and
- 2) The transmitter module may not be co-located with any other transmitter or antenna,
- 3) For all products market in Industry Canada, OEM has to limit the operation channels in CH1 to CH11 for 2.4Gband by supplied firmware programming tool. OEM shall not supply any tool or info to the end-user regarding to Regulatory Domain change.

As long as 3 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

Cet appareil est conçu uniquement pour les intégrateurs OEM dans les conditions suivantes:

- 1) L'antenne doit être installée de telle sorte que 20 cm est maintenue entre l'antenne et les utilisateurs, et
- 2) Le module émetteur peut pas être co-localisé avec un autre émetteur ou antenne,
- 3) Pour tout marché des produits d'Industrie Canada, OEM doit limiter les canaux de coopération dans CH1 à CH11 pour 2.4Gband par l'outil de programmation du firmware fourni. OEM ne doit pas fournir un outil ou d'information à l'utilisateur final en ce qui concerne le changement de domaine réglementaire.

Tant que 3 conditions ci-dessus sont remplies, autre test de l'émetteur ne sera pas nécessaire. Cependant, l'intégrateur OEM est toujours responsable de tester leur produit final pour toutes les exigences de conformité supplémentaires nécessaires avec ce module installé.

IMPORTANT NOTE:

In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the IC authorization is no longer considered valid and the IC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate IC authorization.

Dans le cas où ces conditions ne peuvent être remplies (par exemple certaines configurations d'ordinateurs portables ou de co-localisation avec un autre émetteur), puis l'autorisation IC est plus considéré comme valide et l'ID IC ne peut pas être utilisé sur le produit final. Dans ces circonstances, l'intégrateur OEM sera chargé de réévaluer le produit final (y compris l'émetteur) et l'obtention d'une autorisation IC séparée.

End Product Labelling

This transmitter module is authorized only for use in device where the antenna may be installed such that 20cm may be maintained between the antenna and users. The final end product must be labelled in a visible area with the following:

"Contains IC: 10462A-WG140000"

Ce module émetteur est autorisé uniquement pour une utilisation dans le dispositif où l'antenne peut être installée de telle sorte que 20cm peut être maintenue entre l'antenne et les utilisateurs. Le

produit final doit être étiqueté dans un endroit visible par le texte suivant:

"Contient IC: 10462A-WG140000"

Manual Information to the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

L'intégrateur OEM doit être conscient de ne pas fournir des informations à l'utilisateur final sur la façon d'installer ou de supprimer ce module RF dans le manuel de l'utilisateur du produit final qui intègre ce module.