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WG6031-00 WLAN Module

Realtek RTL8189 IEEE 802.11b/g/n

1T/1R Solution with SDIO/SPI Interface

Datasheet

Revision 6.0

Prepared By	Reviewed By	Approved By

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1. HISTORY CHANGE

Revision	Date	Description
Draft 0.1	2017-06-05	Initial Document creation.
Draft 0.2	2017-11-01	<ol style="list-style-type: none">1. Updated SDIO information.2. Corrected RF Performance.3. Updated Module Size tolerance.4. Added Module Package Marking and Regulatory Information.5. Add RF design and Antenna information.
Revision 1.0	2017-12-28	Official Released.
Revision 2.0	2018-08-15	<ol style="list-style-type: none">1. Updated Pin10/11 description.2. Updated reference design and BOM of SPI and SDIO.
Revision 3.0	2018-08-30	Add 5.3. Power Current information.
Revision 4.0	2020-10-15	Add Tape Reel information
Revision 5.0	2021-03-26	Modify Module description
Revision 6.0	2021-08-26	Corrected number of modules per reel to 1200pcs

2. GENERAL DESCRIPTION

The WG6031-00 is a 802.11b/g/n 1T1R Wireless LAN SiP (system in package) module with SDIO/SPI interface. The WG6031-00 provides a complete solution for a high throughput performance integrated wireless LAN device.

2.1. Features

- Dimension 13mm(L) x 13mm(W) x 2.35mm(H).
- LGA-20 pin package.
- CMOS MAC, Baseband PHY, and RF in a single chip for 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 device while operating in 802.11n mode.
- Operating temperature: 0°C to 70°C

3. MODULE BLOCK DIAGRAM

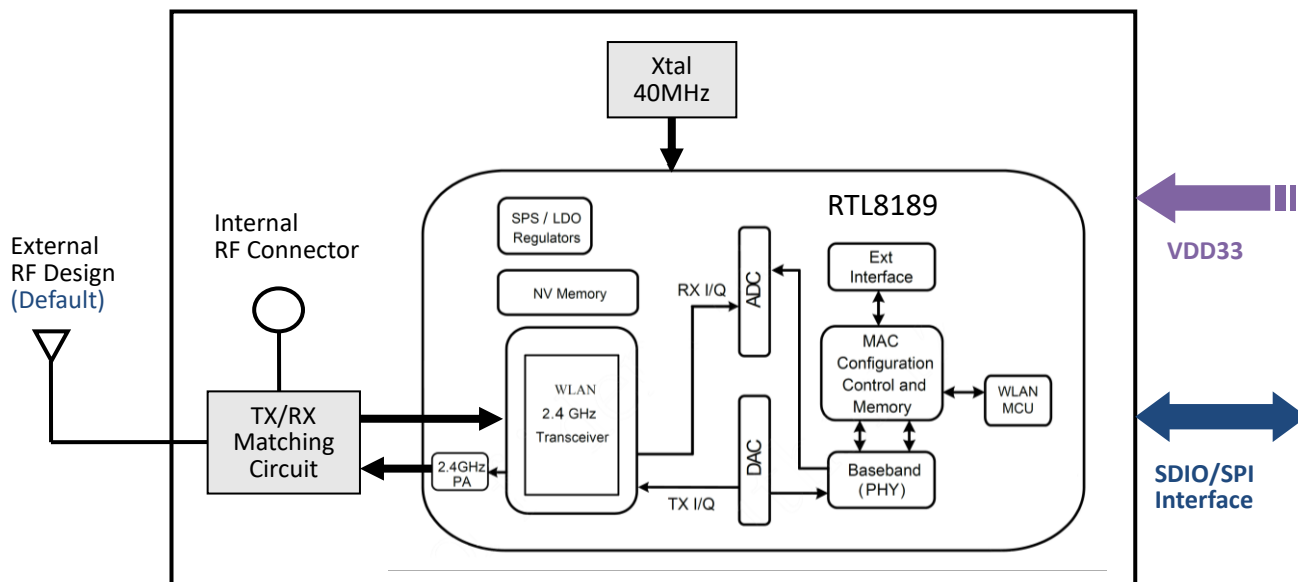


Figure 3-1. WG6031-00 Block Diagram

4. MODULE OUTLINE

4.1. Signal Layout (Top View)

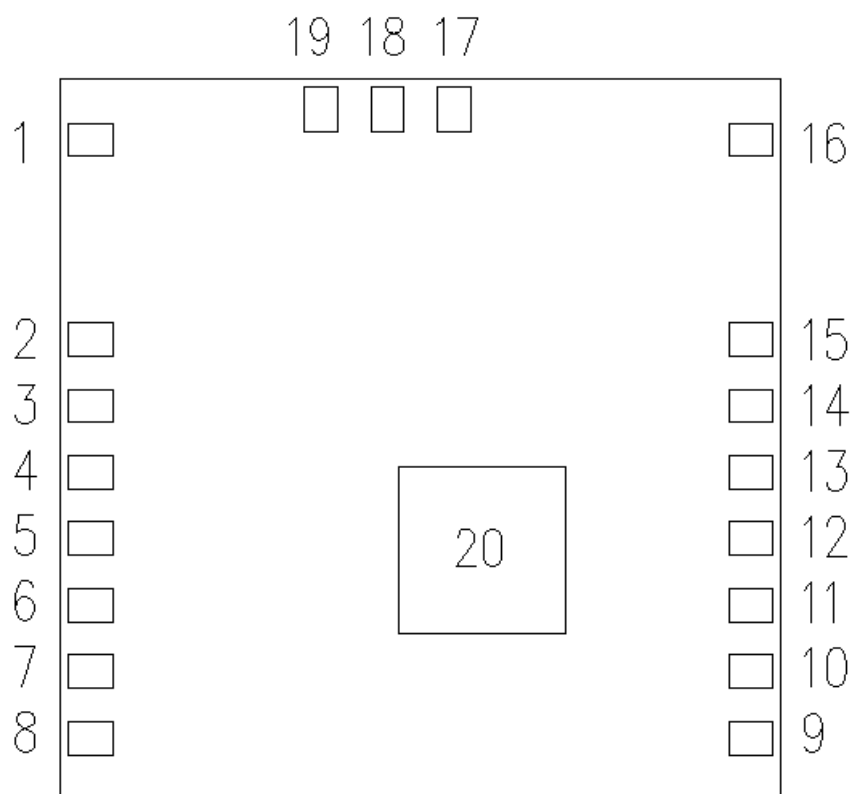


Figure 4-1 Device pins (Top View)

4.2. Pin Description

Pin	Signal Name	Type	Description
1	GND	Power	Ground
2	GND	Power	Ground
3	GND	Power	Ground
4	NC ⁽¹⁾	I/O	SPI not Connection / SDIO D3
5	SPI_IRQ	O	SPI Interrupt Output / SDIO D2
6	SPI_SS	I	SPI Slave Select / SDIO D1
7	SPI_MISO	O	SPI Master in Slave out / SDIO D0
8	SPI_MOSI	I	SPI Master out Slave in / SDIO Command Input
9	SPI_CLK	I	SPI Clock Input / SDIO Clock Input
10	RESET	I	Hardware Reset. NC if not used.
11	GPIO	I/O	General Purpose Input / Output Pin. NC if not used.
12	GND	Power	Ground
13	VDD	Power	Power supply input. Typical 3.3V.
14	VDD	Power	Power supply input. Typical 3.3V.
15	GND	Power	Ground.
16	GND	Power	Ground.
17	GND	Power	Ground.
18	RF_OUT	RF	WLAN 2.4GHz External RF port.
19	GND	Power	Ground.
20	PGND	Power	Ground. Module Thermal PAD.

(1) SPI interface: this pin is no used. / SDIO interface: this pin is defined SDIO_D3.

5. MODULE SPECIFICATION

5.1. General Module Requirements and Operation

5.1.1 Temperature Limit Ratings

Parameter	Min	Max	Units
Storage Temperature	-40	+125	°C
Ambient Operating	0	+70	°C

5.1.2 DC Power Supply Characteristics

Parameter	Condition	Min	Typical	Max	Units
VDD	DC supply Voltage	3.0	3.3	3.6	V

5.1.3 Digital IO DC Characteristics

Parameter	Condition	Min	Normal	Max	Units
V _{IH}	Input high voltage	2.0	3.3	3.6	V
V _{IL}	Input low voltage	-	0	0.9	V
V _{OH}	Output high voltage	2.97	-	3.3	V
V _{OL}	Output low voltage	0	-	0.33	V

5.2. WLAN RF Performance

5.2.1 WLAN 2.4-GHz Receiver Characteristics

Parameter		Condition	Min	Typ	Max	Units
Operation frequency range			2412		2484	MHz
Sensitivity	At < 8% PER limit	1 Mbps DSSS		-95		dBm
		11 Mbps CCK		-86		
	At < 10% PER At < 10% PER limit	6 Mbps OFDM		-91		
		54 Mbps OFDM		-74		
		MCS0 MM		-90		
		MCS7 MM		-71		
		MCS0 MM 40MHz		-87		
		MCS7 MM 40MHz		-68		

5.2.2 WLAN 2.4-GHz Transmitter Power

Parameter	Condition	Min	Typ	Max	Units
Output Power	11 Mbps CCK		17	-	dBm
	54 Mbps OFDM		15	-	
	MCS7 MM		14	-	
	MCS7 MM 40MHz		14	-	
Frequency Accuracy		-20		+20	ppm

5.3. WLAN Power Current

Mode Description		Test Conditions	Typical	Unit
Continuous TX mode ⁽¹⁾	IEEE802.11b 11Mbps	VBAT 3.3V TX Output 17dBm @25°C	270	mA
	IEEE802.11g 54Mbps	VBAT 3.3V TX Output 15dBm @25°C	255	mA
	IEEE802.11n 65Mbps	VBAT 3.3V TX Output 14dBm @25°C	245	mA
Receive mode		VBAT 3.3V	80	mA
Standby mode		VBAT 3.3V	53	mA

(1) The power current test that based on Renesas S5D9 platform with WG6031P00 Pmod board..

6. REFERENCE DESIGN

6.1. Module SPI Reference Schematic

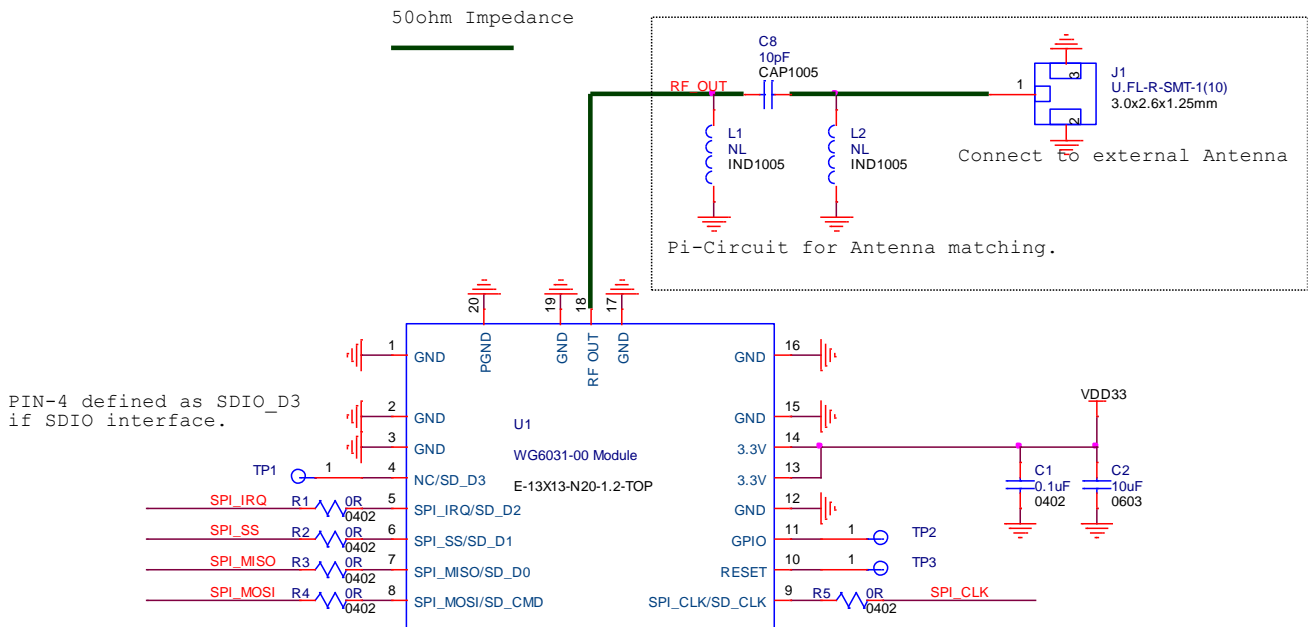


Table 6-1 lists the BOM for the SPI reference.

Table 6-1. Pin Description

Item	Description	Part Number	Reference	Qty	Manufacturer
1	RTL8189 WiFi Module	WG6031-00A	U1	1	Jorjin
2	Mini RF Header Receptacle	U.FL-R-SMT-1(10)	J1	1	Hirose
3	CAP 0402 / 10pF / 50V / NPO / ±5%	GRM1555C1H100JA01D	C8	1	Murata
4	CAP 0402 / 0.1uF / 10V / X7R / ±10%	0402B104K100CT	C1	1	Walsin
5	CAP 0603 / 10uF / X5R / 10V / ±10%	GRM188R61A106KE69D	C2	1	Murata
6	RES 0402 / 0R / Jumper	WR04X000 PTL	R1,R2,R3,R4,R5	5	Walsin

6.2. Module SDIO Reference Schematic

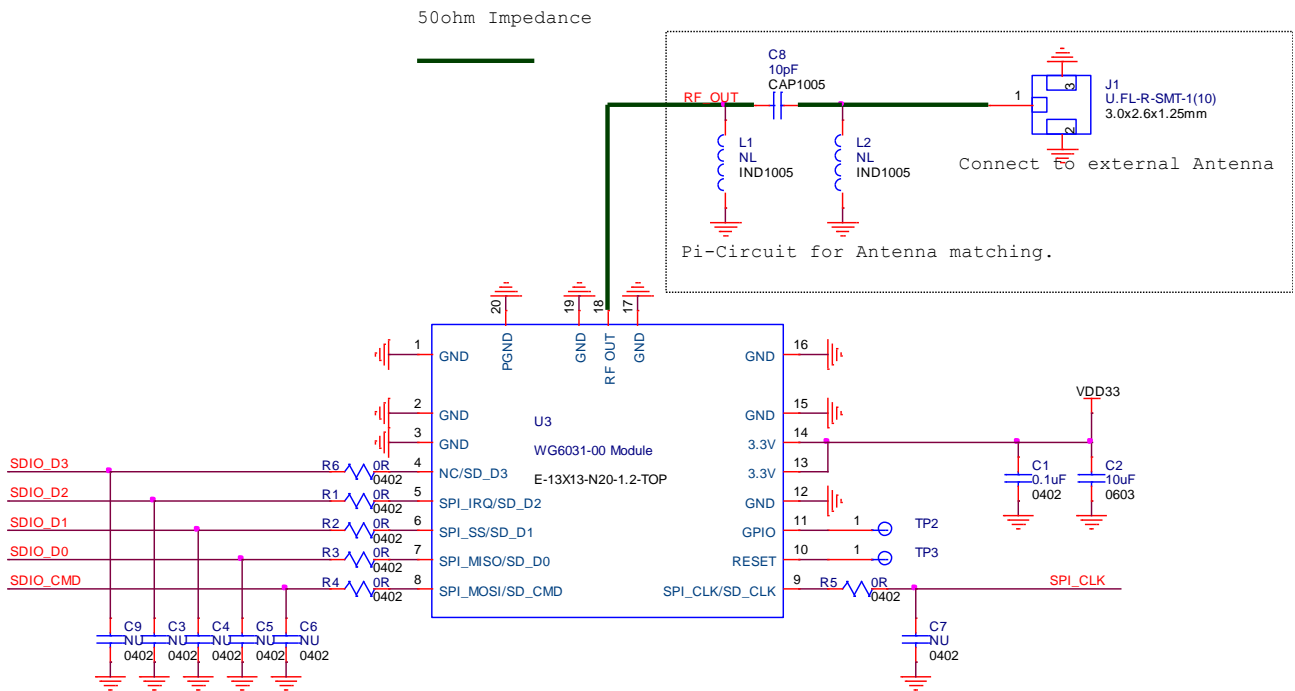


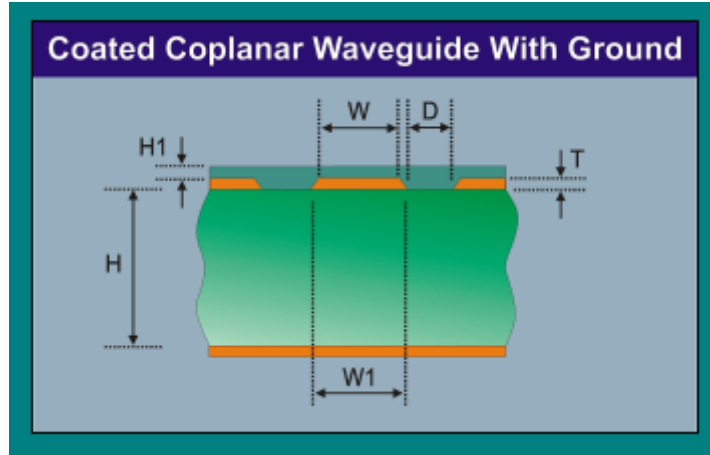
Table 6-2 lists the BOM for the SDIO reference.

Table 6-1. Pin Description

Item	Description	Part Number	Reference	Qty	Manufacturer
1	RTL8189 WiFi Module	WG6031-00A	U1	1	Jorjin
2	Mini RF Header Receptacle	U.FL-R-SMT-1(10)	J1	1	Hirose
3	CAP 0402 / 10pF / 50V / NPO / ±5%	GRM1555C1H100JA01D	C8	1	Murata
4	CAP 0402 / 0.1uF / 10V / X7R / ±10%	0402B104K100CT	C1	1	Walsin
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6	RES 0402 / 0R / Jumper	WR04X000 PTL	R1,R2,R3,R4,R5,R6	6	Walsin

6.3. Reference RF design

The RF trace routing from the WiFi module must have 50Ω impedance. Reference 50Ω impedance trace design of the PCB layout :



- Height Between L1 and L2 **(H)**: 42.0 mil
- Trace **(W)**: 22.0 mil
- (W1)**: 23.0 mil
- Thickness **(T)**: 1.4 mil
- GND Separation **(D)**: 5.0 mil
- Dielectric **(Er)**: 4.3

6.4. Antenna information of PMOD



Brand	Model Name	Antenna Type	Connector	Gain (dBi)
WIESON	GPOT155-002	Dipole	SMA	2.0

7. PACKAGE INFORMATION

7.1. Module mechanical outline

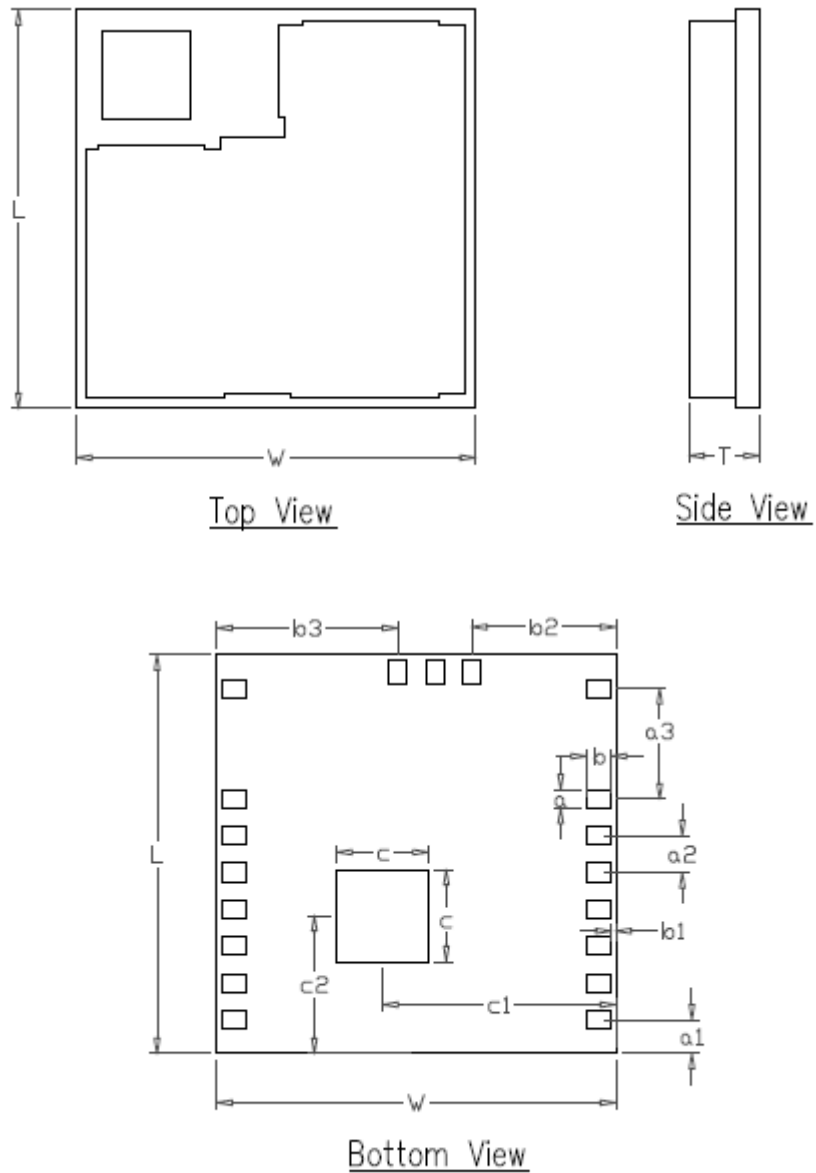


Figure 6-1 Module Pad Dimensions

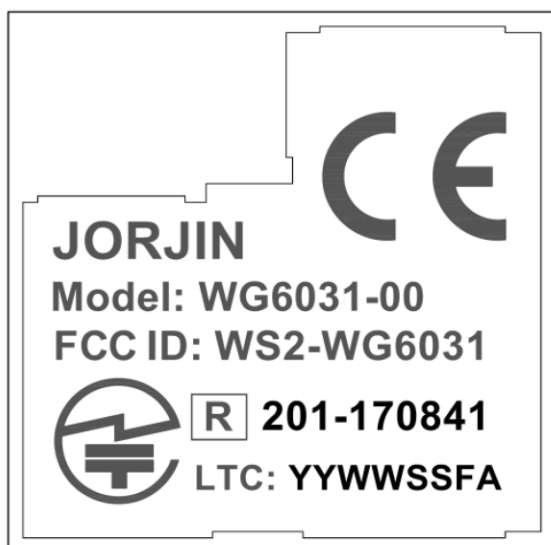
Marking	Min	Nom	Max	Marking	Min	Nom	Max
L (Body size)	12.85	13.00	13.15	b	0.75	0.80	0.85
W (Body size)	12.85	13.00	13.15	b1	0.10	0.15	0.20
T (Thickness)	2.15	2.35	2.55	b2	4.65	4.70	4.75
a	0.55	0.60	0.65	b3	5.85	5.90	5.95
a1	1.05	1.10	1.15	c	2.95	3.00	3.05
a2	1.15	1.20	1.25	c1	7.55	7.60	7.65
a3	3.55	3.60	3.65	c2	4.45	4.50	4.55

Table 7-1. Dimensions for Module Mechanical Outline

7.2. Ordering Information

Part number:	WG6031-00A
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7.3. Module Marking



LTC : Date Code , YYWWSSFA

YY = Digit of the year, ex: 2017=17

WW = Week (01~52)

SS = Serial number from 01 ~99 match to manufacture's lot number.

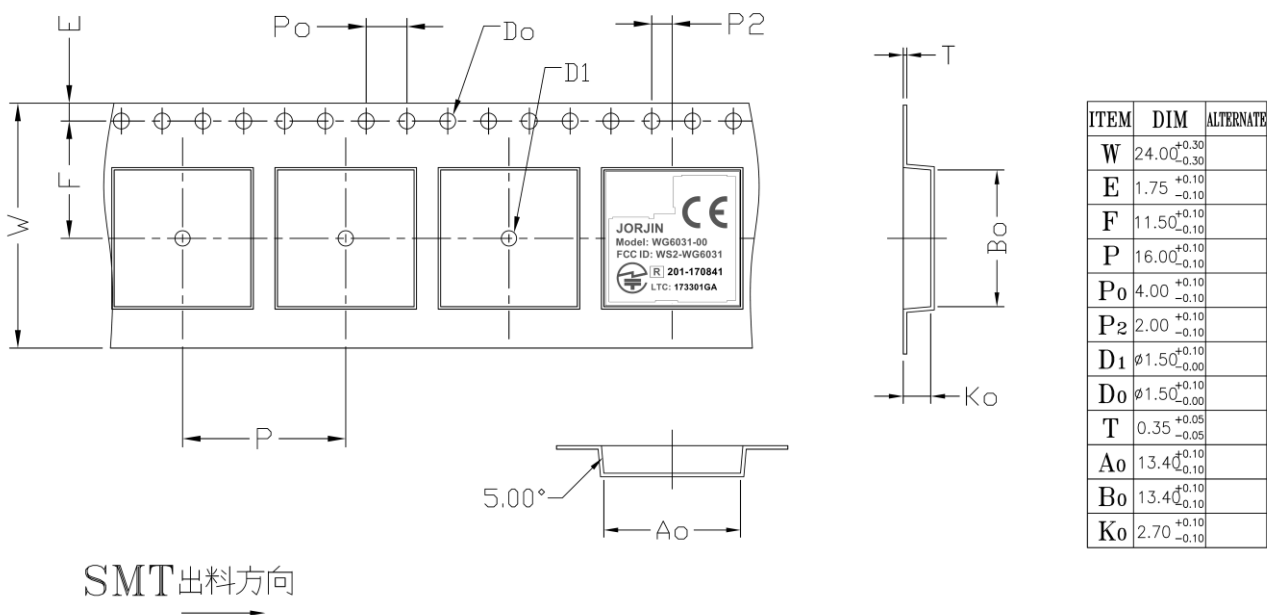
F = Reserve for internal use.

A = Module version.

7.4. Certification Information

- FCC : WS2-WG6031, FCC grant ID
- TELEC : **R** 201-170841, TELEC grant ID and compliance mark
- CE : CE compliance mark

7.5. Tape Reel information



Reel : 1200 pcs per reel



Pizza Box : 1 reel per pizza box

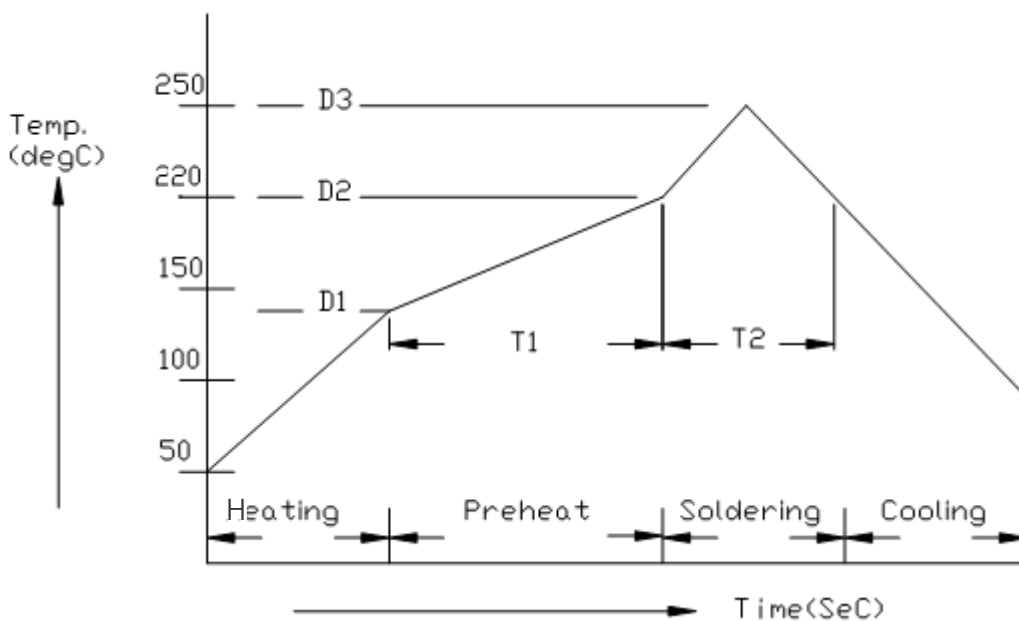
8. SMT AND BAKING RECOMMENDATION

8.1. 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.**

8.2. 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.

(1) Add Nitrogen while Reflow process : SMT solder ability will be better.

- **Stencil thickness** : 0.1~ 0.15 mm (Recommended)
- **Soldering paste (without Pb)** : Recommended SENJU N705-GRN3360-K2-V can get better soldering effects.

9. REGULATORY INFORMATION

This section outlines the regulatory information for the following countries:

- United States
- Europe
- Japan

9.1. United States

Federal Communications Commission 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 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.

FCC RF 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 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 cannot 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 cannot 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 Labeling:

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

“Contains FCC ID: WS2-WG6031”.

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.

9.2. Europe

Hereby, Jorjin Technologies Inc. declares that the radio equipment type RF module is in compliance with Directive 2014/53/EU.

The compliance has been verified in the operating frequency band of 2400 MHz to 2483.5 MHz. Developers and integrators that incorporate the WG6031-00 RF Module in any end products are responsible for obtaining applicable regulatory approvals for such end product.

The WG6031-00 has been tested in the 2400-GHz to 2483.5-GHz ISM frequency band at 3.3 V with a maximum peak power of 19.87 dBm EIRP across the temperature range 0°C to +70°C and tolerance.

Labeling and User Information Requirements

As a result of the conformity assessment procedure described in Annex III of the Directive 2014/53/EC, the end-customer equipment should be labeled as follows:



9.3. Japan

The WG6031-00 is certified as a module with type certification number 201-170841. End products that integrate this module do not need additional MIC Japan certification for the end product.

End product can display the certification label of the embedded module.

