a module solution provider

WG7A51-01

2.4/5GHz Wi-Fi 6 + BLE 5.4 Transceiver Module
TI CC3351 Solution

pin-to-pin compatible with WG7837-V0 (TI WL1837MOD)

Datasheet

D01

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1. OVERVIEW

The WG7A51-01 is a Dual band (2.4 / 5GHz) Wi-Fi 6 and Bluetooth low energy 5.4 combination SiP (System in Package) module to support 1×1 IEEE 802.11a/b/g/n/ax WLAN standards and BLE 5.4, enabling seamless integration of WLAN/BLE and low-energy technology.

The WG7A51-01 offers Wi-Fi 6 while maintaining compatibility with Wi-Fi 4 (802.11 a/b/g/n) and Wi-Fi 5 (802.11ac).

The WG7A51-01 module is based on TI CC3351 single-die chip that WLAN function is connected to the host processor via a SDIO interface, and the Bluetooth is connected via a UART interface. The WG7A51-01 is ideal for use in cost-sensitive embedded applications with a Linux or RTOS host running TCP/IP.

WG7A51-01 brings the efficiency of Wi-Fi 6 to embedded device applications for the internet of things (IoT), with a small PCB footprint and highly optimized bill of materials.

1.1. General Features

- Wi-Fi 6
  - Dual band 2.4/5 GHz, 20 MHz, single spatial stream
  - MAC, baseband, and RF transceiver with support for IEEE 802.11 a/b/g/n/ax
  - Target wake time (TWT), OFDMA, MU-MIMO (Downlink), Basic Service Set Coloring, and trigger frame for improved efficiency
  - Hardware-based encryption and decryption supporting WPA2 and WPA3
- Bluetooth Low Energy 5.4
  - LE Coded PHYs (Long Range), LE 2M PHY (High Speed) and Advertising Extension
  - Host controller interface (HCI) transport with option for UART or shared SDIO
- Enhanced Security
  - Secured host interface
  - Firmware authentication
  - Anti-rollback protection
- Multirole support (for example, concurrent STA and AP) to connect with Wi-Fi devices on different RF
- 3-wire or 1-wire PTA for external coexistence with additional 2.4-GHz radios (for example, Thread or Zigbee)
- Small packages:
  - Dimension 13.4mm(L) x 13.3mm(W) x 2.14mm(H)
  - Pin 2 pin compatible with WG7837-V0 and Tri band (2.4 / 5 / 6GHz) SiP Modules.
- RoHS Compliance

2. FUNCTIONAL FEATURES

2.1. Module Block Diagram

Figure 2-1 shows a basic system diagram for the WG7A51-01

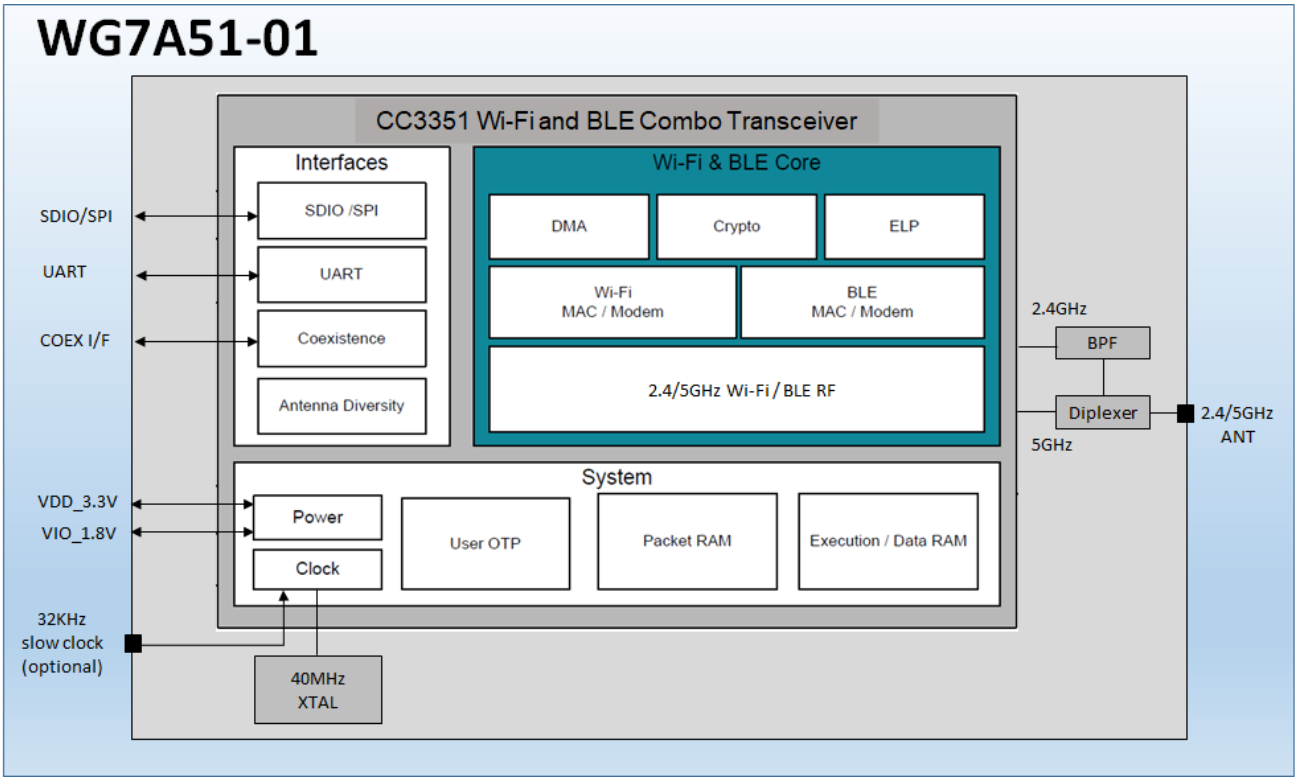


Figure 2-1. WG7A51-01 Block Diagram

3. MODULE OUTLINE

3.1. Signal Layout (Bottom View)

Figure 3-1 shows pin assignments for the 100-pin LGA package.

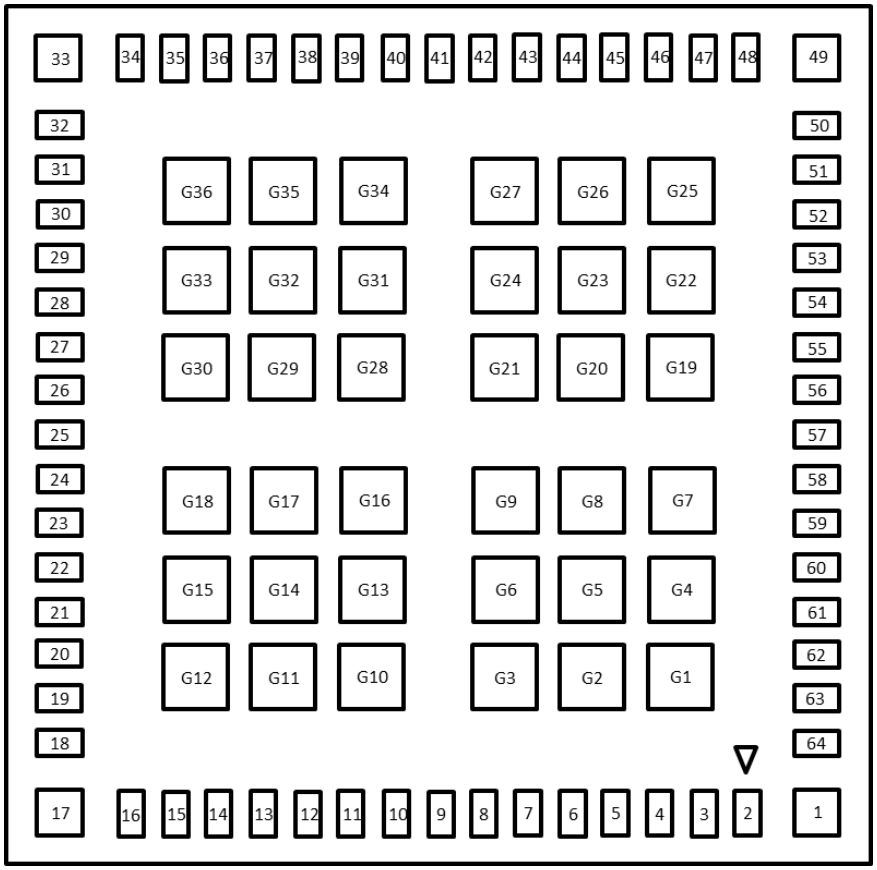


Figure 3-1. Module Pin Out (Bottom View)

3.2. Pin Description

Table 3-1. Pin Description

Pin No.	Pin Name	Type	DIR (I/O)	VOLTAGE LEVEL	SHUTDOWN STATE	STATE AFTER POWERUP	Description
1	GND	GND					Ground
2	IRQ_BLE (3)	Digital	O	V_{IO}	PD	PD	Interrupt request to host for

							BLE (in shared SDIO mode)
3	COEX_REQ (2)	Digital	I	V_{IO}	PU	PU	External coexistence interface - request
4	COEX_GRANT (2)	Digital	O	V_{IO}	PD	PD	External coexistence interface - grant
5	COEX_PRIORITY (2)	Digital	I	V_{IO}	PU	PU	External coexistence interface - priority
6	SDIO_CMD	Digital	I/O	V_{IO}	HiZ	HiZ	SDIO command or SPI PICO
7	GND	GND					Ground
8	SDIO_CLK	Digital	I	V_{IO}	HiZ	HiZ	SDIO clock or SPI clock
9	GND	GND					Ground
10	SDIO_D0	Digital	I/O	V_{IO}	HiZ	HiZ	SDIO data D0 or SPI POCI
11	SDIO_D1	Digital	I/O	V_{IO}	HiZ	HiZ	SDIO data D1
12	SDIO_D2	Digital	I/O	V_{IO}	HiZ	HiZ	SDIO data D2
13	SDIO_D3	Digital	I/O	V_{IO}	HiZ	PU	SDIO data D3 or SPI CS
14	IRQ_WL(3)	Digital	O	V_{IO}	PD	0	Interrupt request to host for WLAN
15	GND	GND					Ground
16	GND	GND					Ground
17	GND	GND					Ground
18	NC						
19	GND	GND					Ground
20	GND	GND					Ground
21	SWCLK	Digital	I	V_{IO}	PD	PD	Serial wire debug clock
22	SWDIO	Digital	I/O	V_{IO}	PU	PU	Serial wire debug I/O
23	GND	GND					Ground
24	GND	GND					Ground
25	NC						
26	NC						
27	NC						
28	GND	GND					Ground
29	GND	GND					Ground
30	GND	GND					Ground

31	GND	GND					Ground
32	ANT	RF	I/O				Bluetooth Low Energy and WLAN 2.4GHz / 5GHz RF port
33	GND	GND					Ground
34	GND	GND					Ground
35	GND	GND					Ground
36	SLOW_CLOCK_IN	Digital	I	V_{IO}	PD	PD	32.768-kHz RTC clock input
37	GND	GND					Ground
38	VIO	POW					1.8 V supply for IO, SRAM, digital, analog domain
39	GND	GND					Ground
40	nRESET	Digital	I	V_{IO}	PD	PD	Reset line for enabling or disabling device (active low)
41	NC						
42	LOGGER (3)	Digital	O	V_{IO}	PU	PU	Tracer (UART TX debug logger)
43	NC						
44	GND	GND					Ground
45	GND	GND					Ground
46	VDD	POW					3.3-V supply for PA
47	VDD	POW					3.3-V supply for PA
48	GND	GND					Ground
49	GND	GND					Ground
50	UART_RTS	Digital	O	V_{IO}	PU	PU	Device RTS signal - flow control for BLE HCI
51	UART_CTS	Digital	I	V_{IO}	PU	PU	Device CTS signal - flow control for BLE HCI
52	UART_TX	Digital	O	V_{IO}	PU	PU	UART TX for BLE HCI
53	UART_RX	Digital	I	V_{IO}	PU	PU	UART RX for BLE HCI
54	GND	GND					Ground
55	GND	GND					Ground
56	NC						
57	NC						
58	NC						

59	GND	GND					Ground
60	NC						
61	GND	GND					Ground
62	ANT_SEL (2)	Digital	O	V_{IO}	PD	PD	Antenna select control line
63	GND	GND					Ground
64	NC						
G1~G36	GND	GND					Ground

1. All digital I/O's (with the exception of SDIO signals) are Hi-Z when the device is in shutdown mode with internal PU/PD according to the "shutdown state" column.
2. See software release notes for support level.
3. LOGGER and HOST_IRQ_WL pins are sensed by the device during boot, see CC33xx Hardware Integration.

4. MODULE SPECIFICATIONS

We reserve the right to amend the design and/or specifications of our products without notice. Typical values are measured with nominal device at 25°C.

4.1. Absolute Maximum Ratings

Over operating free-air temperature range (unless otherwise noted) (1)

Table 4-1. Absolute Maximum Ratings

Parameter	Conditions	MIN	MAX	Unit
VDD	VDD PA Voltage	-0.5	4.2	V
VIO	Main supply voltage for analog and digital - VDD_MAIN_IN, VDDA_IN1, VDDA_IN2	-0.5	2.1	
	VDD IO Voltage	-0.5	2.1	
	Input Voltage to all digital pins	-0.5	V_{IO}+0.5	
	HFXT_P Input Voltage	-0.5	2.1	
	VPP OTP Voltage	-0.5	2.1	
TA	Operating Ambient Temperature	-40	85	°C
Tstg	Storage temperature	-40	125	°C

1. Stresses beyond those listed under Absolute Maximum Rating may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Condition. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

4.2. Recommended Operating Conditions

Over operating free-air temperature range (unless otherwise noted)

Parameter	Conditions	MIN	Typ..	MAX	Unit
VDD	DC supply rail for PA	3	3.3	3.6	V
VIO	DC supply rail for main analog and input / output	1.62	1.8	1.98	V
T_A	Operating ambient temperature	-40		85	°C
	Maximum power dissipation			2	W

4.3. Electrical Characteristics:

Parameter	Conditions	MIN	Typ..	MAX	Unit
V_{IH}	IO high level input voltage	0.65 x V_{IO}		V_{IO}	V
V_{IL}	IO low level input voltage	0		0.35 x V_{IO}	V
V_{OH}	IO high level output voltage at 4mA	V_{IO} - 0.45		V_{IO}	V
V_{OL}	IO low level output voltage at 4mA	0		0.45	V

4.4. WLAN Characteristics:

PARAMETER	Description
Standards	IEEE 802.11a/b/g/n/ax (1T1R)
Communication Interface	Support for 4 bit SDIO or SPI host interfaces
Data Rate	802.11b: 1、2、5.5、11Mbps 802.11g: 6、9、12、18、24、36、48、54Mbps 802.11n: MCS0~7 (20MHz) 802.11ax: MCS0~7 (20MHz)
Operating Frequency rates	2.4GHz ISM Bands 2.412 ~ 2.472 GHz 5GHz UNII Bands 5.180-5.825 GHz
Number of Channels	**2.4GHz:** ▪ 2.400 至 2.500GHz (ISM)，CH1 ~ CH13 **5GHz:** ▪ 5.150 至 5.250GHz (U-NII-1)，CH 36、40、44、48 ▪ 5.250 至 5.350GHz (U-NII-2A)，CH 52、56、60、64 ▪ 5.470 至 5.725GHz (U-NII-2C)，CH 100、104、108、112、116、120、124、128、132、136、140、144 ▪ 5.725 至 5.850GHz (U-NII-3)，CH 149、153、157、161、165
WLAN Modulation	802.11b: DSSS (DBPSK, DQPSK, CCK) 802.11a/g: OFDM (BPSK, QPSK, 16-QAM, 64-QAM) 802.11n: OFDM (BPSK, QPSK, 16-QAM, 64-QAM) 802.11ax: OFDM (BPSK, QPSK, 16-QAM, 64-QAM)
Throughput	50 Mbps
Extended Features	Target wake time (TWT), OFDMA, MU-MIMO (Downlink), Basic Service Set Coloring, and trigger frame for improved efficiency

Security	Hardware-based encryption and decryption supporting WPA2 and WPA3

4.5. WLAN 2.4GHz Receiver Characteristics:

Over operating free-air temperature range (unless otherwise noted)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Operation frequency range		2412		2472	MHz
Sensitivity: 8% PER for 11b rates, 10% PER for 11g/n/ax rates	1 Mbps DSSS		-95.5		dBm
	2 Mbps DSSS		-92.6		
	11 Mbps CCK		-87.6		
	6 Mbps OFDM		-90.8		
	54 Mbps OFDM		-73.3		
	HT MCS0 MM 4K		-90.3		
	HT MCS7 MM 4K		-70.0		
	HE MCS0 4K		-89.6		
	HE MCS7 4K		-70.0		

4.6. WLAN 2.4GHz Transmitter Characteristics:

Over operating free-air temperature range (unless otherwise noted)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Operation frequency range		2412		2472	MHz
Maximum output power at VPA > 3.0 V	1 Mbps DSSS		16.3		dBm
	11 Mbps CCK		16.3		
	6 Mbps OFDM		16.8		
	54 Mbps OFDM		14.8		
	HT MCS0 MM		16.8		
	HT MCS7 MM		14.7		
	HE MCS0		16.5		
	HE MCS7		14.5		

4.7. WLAN 5GHz Receiver Characteristics:

Over operating free-air temperature range (unless otherwise noted)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Operation frequency range		5150		5950	MHz

Sensitivity: 20-MHz bandwidth (10% PER for 11a/n/ax rates)	6 Mbps OFDM	-88.8	dBm
	9 Mbps OFDM	-87.5	
	12 Mbps OFDM	-86.1	
	18 Mbps OFDM	-83.6	
	24 Mbps OFDM	-80.8	
	36 Mbps OFDM	-77.5	
	48 Mbps OFDM	-73.1	
	54 Mbps OFDM	-71.6	
	HT MCS0 MM	-88.5	
	HT MCS7 MM	-69.3	
	HE MCS0 20MHz	-88.3	
	HE MCS7	-68.8	

4.8. WLAN 5GHz Transmitter Characteristics:

Over operating free-air temperature range (unless otherwise noted)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Operation frequency range		5150		5950	MHz
Maximum output power at VPA > 3.0 V	6 Mbps OFDM		14.0		
	54 Mbps OFDM		10.2		
	HT MCS0 MM		13.4		
	HT MCS7 MM		10.2		
	HE MCS0 20MHz		13.7		
	HE MCS7 20MHz		10.0		

4.9. Bluetooth Low Energy Characteristics:

The WG7A51-01 module support BLE TX setting 0, 5, 10 or 20 dBm.

PARAMETER	Description
Standards	Low Energy 5.4
Communication Interface	Host controller interface (HCI) transport with option for UART or shared SDIO
Frequency Rage	2402MHz ~ 2480MHz
Max output power	16.9 dBm
Modulation	GFSK
Data Rate	125Kbps (LE Coded), 500Kbps (LE Coded), 1Mbps (LE 1M), 2Mbps (LE 2M)
Security	AES

4.10. Bluetooth Receiver Characteristics:

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
BLE 125Kbps (LE Coded)	PER <30.8%		-101.8		dBm
BLE 500Kbps (LE Coded)	PER <30.8%		-99.6		dBm
BLE 1Mbps (LE 1M)	PER <30.8%		-96.6		dBm
BLE 2Mbps (LE 2M)	PER <30.8%		-93.4		dBm

4.11. Bluetooth Transmitter Characteristics:

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
BLE 125Kbps (LE Coded)	Power Set: 20dBm		16.0		dBm
BLE 500Kbps (LE Coded)	Power Set: 20dBm		16.1		dBm
BLE 1Mbps (LE 1M)	Power Set: 20dBm		16.3		dBm
BLE 2Mbps (LE 2M)	Power Set: 20dBm		16.4		dBm

4.12. Slow Clock Using an External Clock:

PARAMETER	Description	SYMBOL	MIN	TYP	MAX	UNIT
Input slow clock frequency	Square wave			32768		Hz
Frequency accuracy	Initial + temperature + aging				±250	ppm
Input Duty cycle			30	50	70	%
Rise and fall time	10% to 90% (rise) and 90% to 10% (fall) of digital signal level	T_r/T_f			100	ns
Input low level		V_{IL}	0		0.35 x V_{IO}	V
Input high level		V_{IH}	0.65 x V_{IO}		1.95	V
Input impedance			1			MΩ
Input capacitance					5	pF

4.13. Power Consumption – 2.4GHz WLAN Static Modes

All results are based on measurements taken using the RadioTool evaluation application (typ values are taken with nominal devices at room temp).

Parameter	CONDITION	SUPPLY	TYP	MAX	Unit

Continuous TX(1)	1 DSSS	VIO	92		mA
		VDD	270	310(1)	
	6 OFDM	VIO	110	170(1)	
		VDD	270	320(1)	
	54 OFDM	VIO	115		
		VDD	215		
	HT MCS0	VIO	110		
		VDD	270		
	HT MCS7	VIO	115		
		VDD	215		
	HE MCS0	VIO	110		
		VDD	270		
	HE MCS7	VIO	115		
		VDD	215		
Continuous RX		VIO	62		
		VDD	0		

1. Peak current VDD can hit 450mA during device calibration.

   Peak current VIO of 300mA including periperhals and internal cortex

4.14. Power Consumption – 5GHz WLAN Static Modes

All results are based on measurements taken using the RadioTool evaluation application (typ values are taken with nominal devices at room temp).

Parameter	CONDITION	SUPPLY	TYP	MAX	Unit
	6 OFDM	VIO	170	220(1)	mA
		VDD	250	290(1)	
	54 OFDM	VIO	175		
		VDD	190		
	HT MCS0	VIO	170		
		VDD	250		
	HT MCS7	VIO	175		
		VDD	190		
	HE MCS0	VIO	170		
		VDD	250		
	HE MCS7	VIO	175		
		VDD	190		

Continuous RX		VIO	88		
		VDD	0		

(1). Peak current VDD can hit 450mA during device calibration.

Peak current VIO of 300mA including peripherals and internal CPU

4.15. Power Consumption – BLE Static Modes

Parameter	CONDITION	SUPPLY	TYP	MAX	Unit
TX, Max Duty Cycle	TX power = 0 dBm	VIO	105		mA
		VDD	50		
	TX power = 10 dBm	VIO	105		
		VDD	130		
	TX power = 20 dBm	VIO	110		
		VDD	270		
RX		VIO	62		
		VDD	0		

4.16. Power Consumption – Device States

MODE	DESCRIPTION	SUPPLY	TYP	Unit
Shutdown	External supplies are available, device held in reset (nReset is low)	VIO	10	µA
		VDD	2	
Sleep	Low power mode - RAM in retention	VIO	330	
		VDD	2	

4.17. Timing and Switching Characteristics

4.17.1 Power Supply Sequencing

For proper operation of the WG7A51-01 module, perform the recommended power-up sequencing as follows:

1. All supplies (VDD, VIO) must be available before nReset is released.
2. For an external slow clock, ensure that the clock is stable before nReset is deasserted (high).
3. The nReset pin should be held low for at least 10 µs after stabilization of the external power supplies.

4.17.2 Clocking Specifications

The WG7A51-01 module uses two clocks for operation:

• A fast clock running at 40 MHz for WLAN/BLE functions

• A slow clock running at 32.768 kHz for low power modes

The slow clock can be generated internally or externally. The fast clock must be generated externally.

4.17.2.1 Slow Clock Generated Internally

In order to minimize external components, the slow clock can be generated by an internal oscillator. However, this clock is less accurate and consumes more power than sourcing the slow clock externally. For this scenario the Slow_CLK_IN pin should be left not connected.

4.17.2.2 Slow Clock Using an External Oscillator

For optimal power consumption, the slow clock can be generated externally by an oscillator or sourced from elsewhere in the system. The external source must meet the requirements listed below. This clock should be fed into the WG7A51-01 pin Slow_CLK_IN and should be stable before nReset is deasserted and device is enabled.

4.17.2.2.1 External Slow Clock Requirements

PARAMETER		DESCRIPTION	MIN	TYP	MAX	UNIT
	Input slow clock frequency	Square wave		32768		Hz
	Frequency accuracy	Initial + temperature + aging			±250	ppm
	Input Duty cycle		30	50	70	%
Tr/Tf	Rise and fall time	10% to 90% (rise) and 90% to 10% (fall) of digital signal level			100	ns
VIL	Input low level		0		0.35xVIO	V
VIH	Input high level		0.65xVIO		1.95	V
	Input impedance		1			MΩ
	Input capacitance				5	pF

4.18. Interface Timing Characteristics:

4.18.1 SDIO Timing Specifications

SDIO is the main host interface for WLAN, and it supports a maximum clock rate of 52 MHz. The WG7A51-01 module also supports shared SDIO interface for both BLE and WLAN.

4.18.1.1 SDIO Timing Diagram - Default Speed

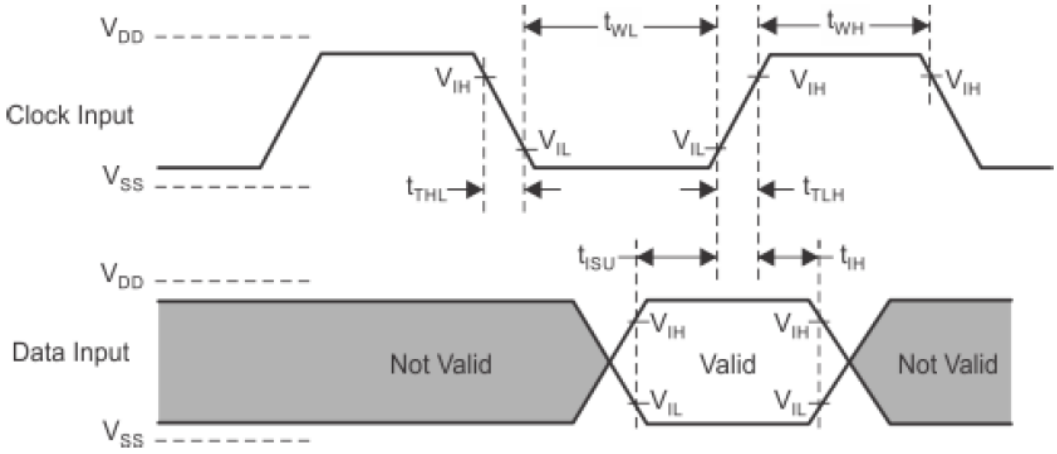


Figure 4-1. SDIO Default Input Timing

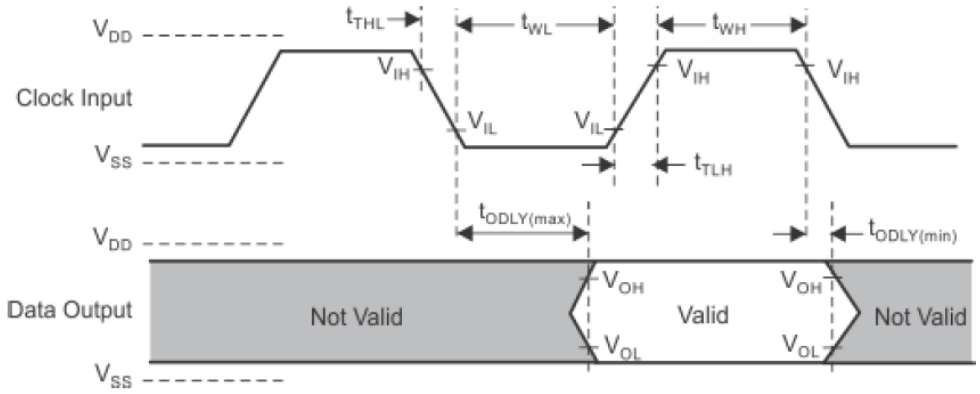


Figure 4-2. SDIO Default Output Timing

4.18.1.2 SDIO Timing Parameters - Default Speed

PARAMETER	DESCRIPTION	MIN	MAX	UNIT
fclock	Clock frequency, CLK		26	MHz
tHigh	High Period	10		ns
tLow	Low Period	10		ns
tTLH	Rise time, CLK		10	ns
tTHL	Fall time, CLK		10	ns
tISU	Setup time, input valid before CLK ↑	5		ns
tIH	Hold time, input valid after CLK ↑	5		ns
tODLY	Delay time, CLK ↓ to output valid	2	14	ns
CL	Capacitive load on outputs	15	40	pF

4.18.1.3 SDIO Timing Diagram - High Speed

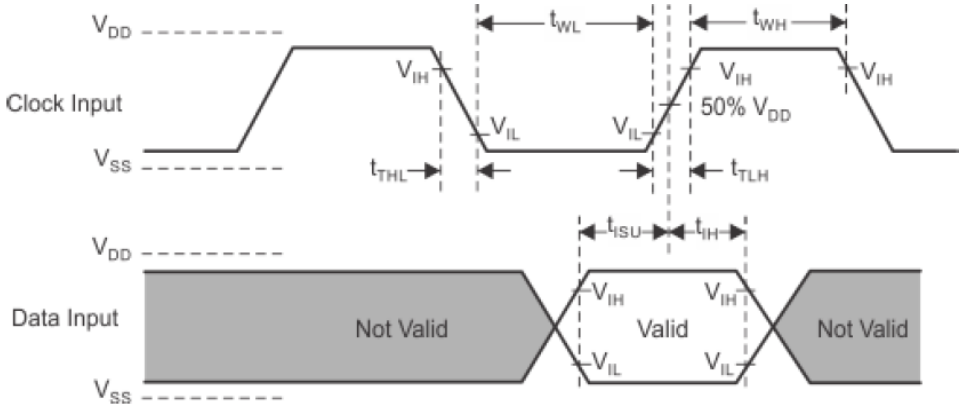


Figure 4-3. SDIO HS input timing

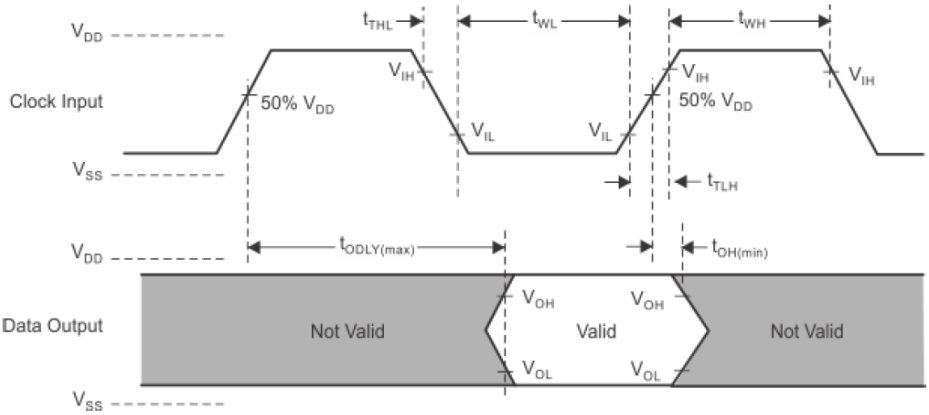


Figure 4-4. SDIO HS output timing

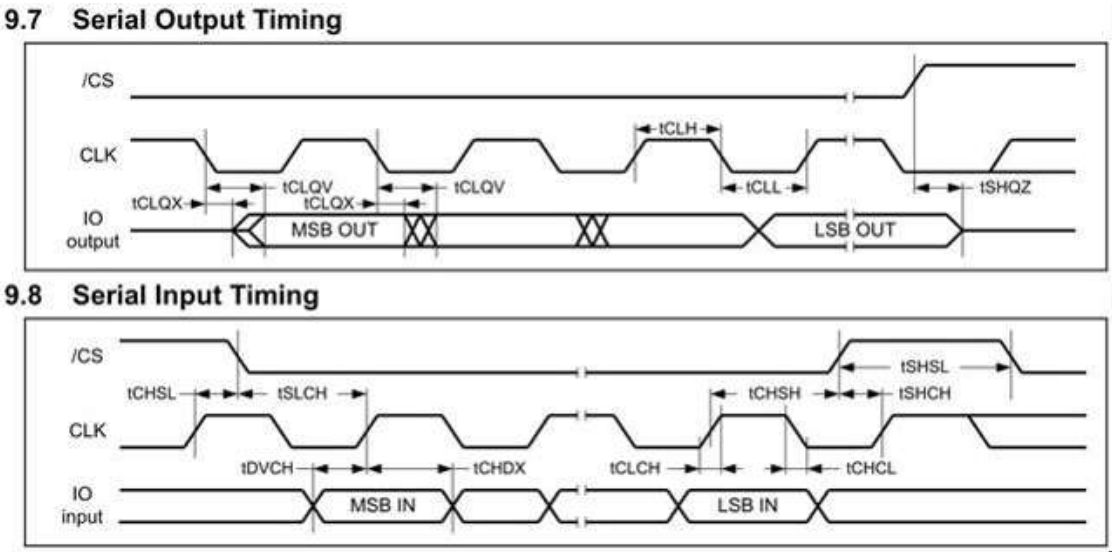
4.18.1.4 SDIO Timing Parameters - High Speed

PARAMETER		MIN	MAX	UNIT
fclock	Clock frequency, CLK		52	MHz
tHigh	High Period	7		ns
tLow	Low Period	7		ns
tTLH	Rise time, CLK		3	ns
tTHL	Fall time, CLK		3	ns
tISU	Setup time, input valid before CLK ↑	6		ns
tIH	Hold time, input valid after CLK ↑	2		ns
tODLY	Delay time, CLK ↓ to output valid	2	14	ns
CI	Capacitive load on outputs	15	40	pF

4.18.2 SPI Timing Specifications

SPI is another host interface for WLAN. The WG7A51-01 module also supports shared SPI interface for both BLE and WLAN.

4.18.2.1 SPI Timing Diagram



PARAMETER		MIN	MAX	UNIT
fclock	Clock frequency, CLK		26	MHz
tHigh	High Period	10		ns
tLow	Low Period	10		ns
tTLH	Rise time, CLK		3	ns
tTHL	Fall time, CLK		3	ns
tCSsu	CS Setup time, CS valid before CLK ↑	3		ns
tISU	PICO, input valid before CLK ↑	3		ns
tIH	PICO Hold time, input valid after CLK ↑	3		ns
tDr, tDf - Active	Delay time, CLK ↑/↓ to output valid	2	10	ns
tDr, tDf - Sleep	Delay time, CLK ↑/↓ to output valid		12	ns
CI	Capacitive load on outputs	15	40	pF

4.18.3 UART 4-Wire Interface

UART is the main host interface for BLE, which supports host controller interface (HCI) transport layer.

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Baud rate		37.5		4364	Kbps
Baud rate accuracy per byte	Receive/Transmit	-2.5		1.5	%
Baud rate accuracy per bit	Receive/Transmit	-12.5		12.5	%
CTS low to TX_DATA on		0	2		µs
CTS high to TX_DATA off	Hardware flow control			1	Byte
CTS High Pulse Width		1			bit

RTS low to RX_DATA on		0	2		µs
RTS high to RX_DATA off	Interrupt set to 1/4 FIFO			16	Bytes

5. REFERENCE SCHEMATICS

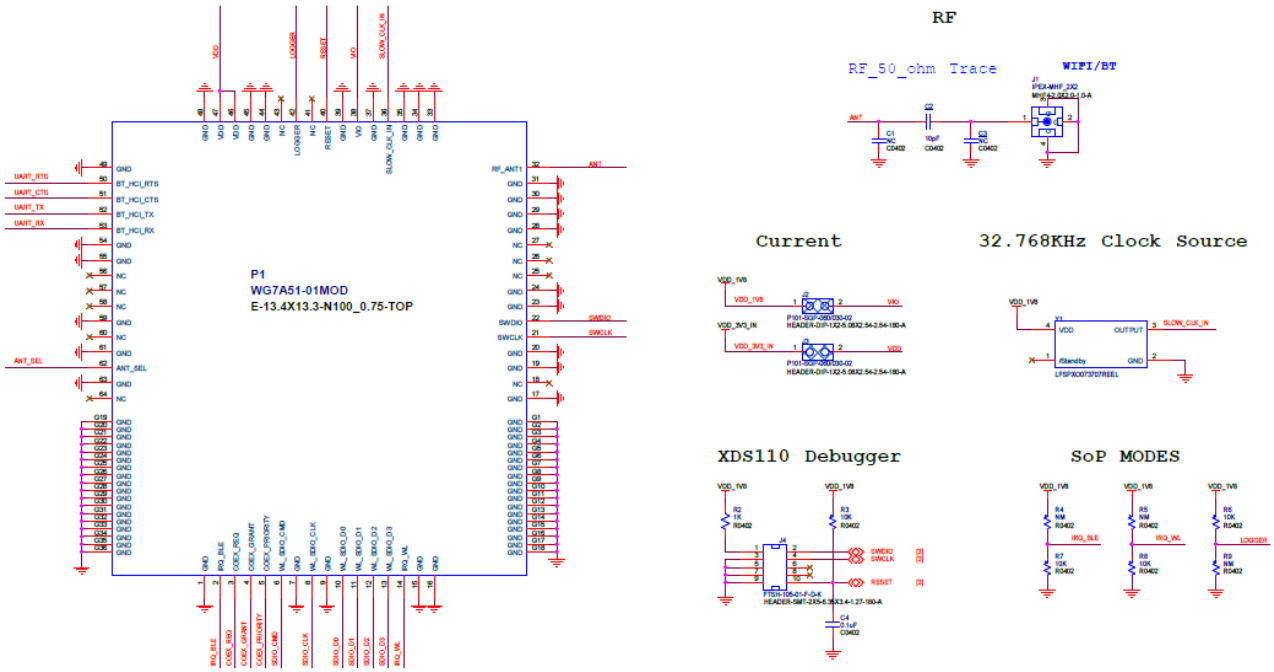


Figure 5-1. Module reference circuit

Important notice for the WG7A01-01 module:

Power-Up Sequence:

- All supplies (VDD_3V3 and VIO_1V8) must be available before Reset is deasserted (high).
- Reset pin should be held low for ~10 µs after stabilization of all external power supplies.
- When having an external slow clock, ensure that the clock is stable before Reset is deasserted (high).

SOP Modes:

The Logger (pin 42), IRQ_BLE (pin 2) and IRQ_WL (pin 14) signals are considered to be Sense on Power pins. When connecting these pins to host, ensure, IRQ_BLE (pin 2) and IRQ_WL (pin 14) stay at logic level Low during power-up, and Logger (pin 42) stays at logic level High during power-up.

If the SOP pins are connected to a host that may affect the logic level of these lines, consider adding an optional pull-down/pull-up resistor(s).

Reset:

Reset (pin 40), an active low signal, should be connected and controlled by the host. If using an unhosted setup, Reset should be pulled High after power supplies are stable. For further information on power-up sequence.

When Reset is low, the device enters an active shutdown mode. After the device is re-enabled, firmware must be re-downloaded for proper operation.

DESCRIPTION	PART NO.	PACKAGE	REFERENCE	QTY	MFR
2.4/5GHz Wi-Fi 6 + BLE 5.4 Transceiver Module	WG7A51-01	13.4 × 13.3 × 2.0 mm	P1	1	Jorjin
32.768 kHz XO (Standard) CMOS Oscillator 1.8V Enable/Disable 4-SMD, No Lead	830207370701	2.0 × 1.6 × 0.8 mm	Y1	1	Wurth
MHF4 Ultra-Small Surface Mount Coaxial Con	20449-001E	MHF4-2.0X2.0-1.0-A	J1	1	I-PEX
Header, 2.54 mm, 2x1, Gold, TH	61300211121	Header, 2.54mm, 2x1, TH	J2,J3	1	Wurth
Header, 1.27 mm, 5x2, Gold, TH	FTSH-105-01-F-D-K	Header, 1.27 mm, 5x2, TH	J4	1	Samtec
CAP 0201 / 10pF / COG / 50V / ±5% / HF	GRM0335C1H100J	0201	C2	1	MuRata
CAP 0402 / 0.1uF / 10V / X7R / ±10% / HF	0402B104K100CT	0402	C4	1	Walsin
RES 0402 / 10K / ±5%	WR04X103 JTL	0402	R2,R3,R6,R7, R8	5	Walsin

Table 5-1. Bill of Materials

6. DESIGN RECOMMENDATIONS

6.1. Module Layout Recommendations

Follow these module layout recommendations:

- **Supply and Interface**
  - The power trace for VDD must be at least 40-mil wide.
  - The 1.8-V trace must be at least 18-mil wide.
  - Make VBAT traces as wide as possible to ensure reduced inductance and trace resistance.
  - If possible, shield VBAT traces with ground above, below, and beside the traces.
  - SDIO signals traces (CLK, CMD, D0, D1, D2, and D3) must be routed in parallel to each other and as short as possible. **(Less than 12cm) Besides, every trace length must be the same as the others.** In addition, every trace length must be the same as the others. There should be enough space between traces – greater than 1.5 times the trace width or ground – to ensure signal quality, especially for the SDIO_CLK trace. Remember to keep these traces away from the other digital or analog signal traces. TI recommends adding ground shielding around these buses.
  - SDIO and digital clock signals are a source of noise. Keep the traces of these signals as short as possible. If possible, maintain a clearance around them
- **RF Trace & Antenna**
  - The RF trace antenna feed must be as short as possible beyond the ground reference. At this point, the trace starts to radiate.
  - The RF trace bends must be gradual with an approximate maximum bend of 45 degrees with trace mitered. RF traces must not have sharp corners.
  - RF traces must have via stitching on the ground plane beside the RF trace on both sides.
  - RF traces must have constant impedance (microstrip transmission line).
  - For best results, the RF trace ground layer must be the ground layer immediately below the RF trace. The ground layer must be solid.
  - There must be no traces or ground under the antenna section.
  - RF traces must be as short as possible. The antenna, RF traces, and modules must be on the edge of the PCB product. The proximity of the antenna to the enclosure and the enclosure material must also be considered.
- **RF prohibited areas**
  - The prohibited areas is where the module RF Via passes (pin 32_ANT)
  - The prohibited area is mainly PCB layer 1
  - It is not recommended to lay GND copper foil in prohibited areas (see the Figure 6-1)
  - If the restricted area is covered with GND copper foil, the TX Power in the 5GHz band will be reduced by 0.5-1.5dBm, while the 2.4GHz band will not be affected.

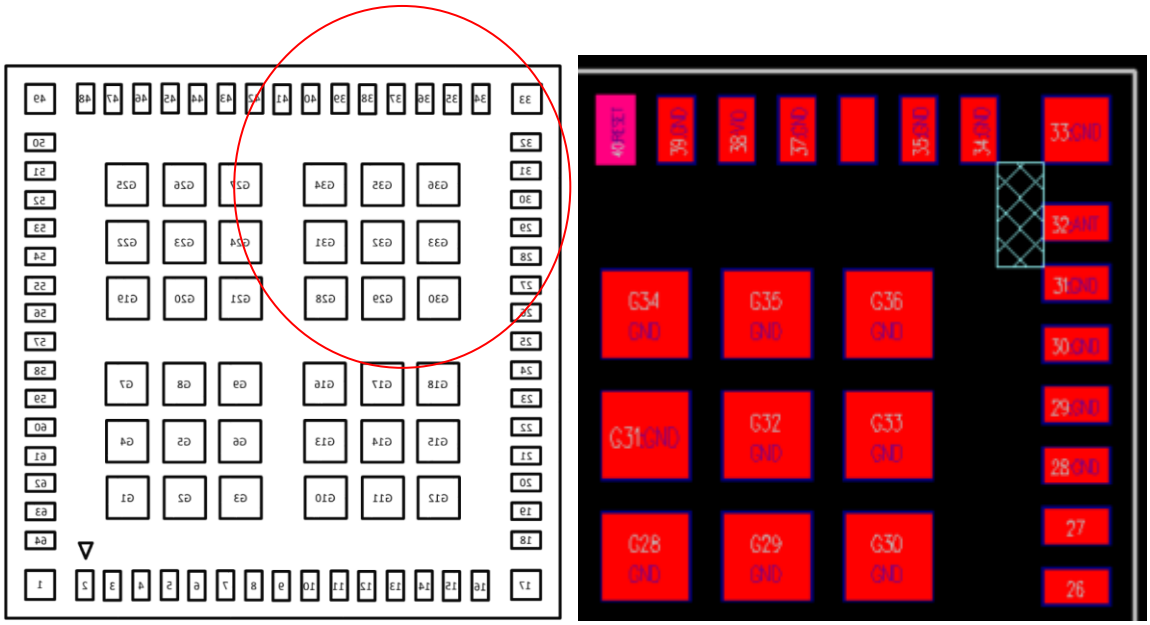
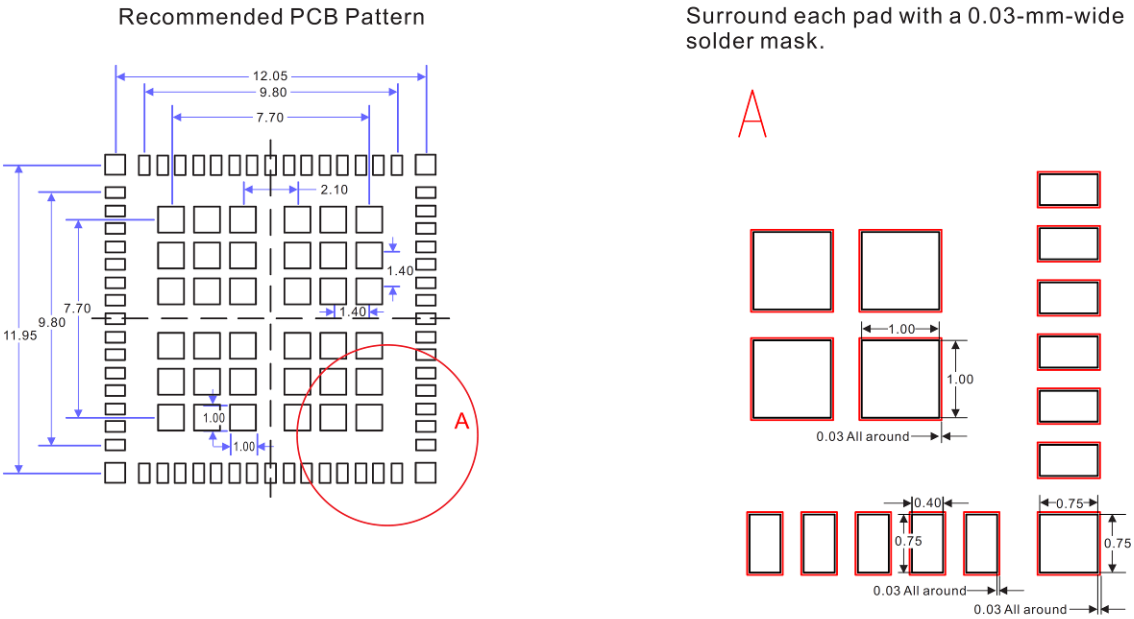


Figure 6-1. RF prohibited areas

6.2. Layout Pattern and stencil Recommendations



NOTE: 1. Module size: 13.4 mm × 13.3 mm
2. Signal pad size: 0.75 mm × 0.40 mm
3. 4 x corner ground size: 0.75 mm × 0.75 mm
4. Central ground pin size: 1.00 mm × 1.00 mm
5. Pitch: 0.7 mm

Figure 6-2. Recommended PCB Pattern

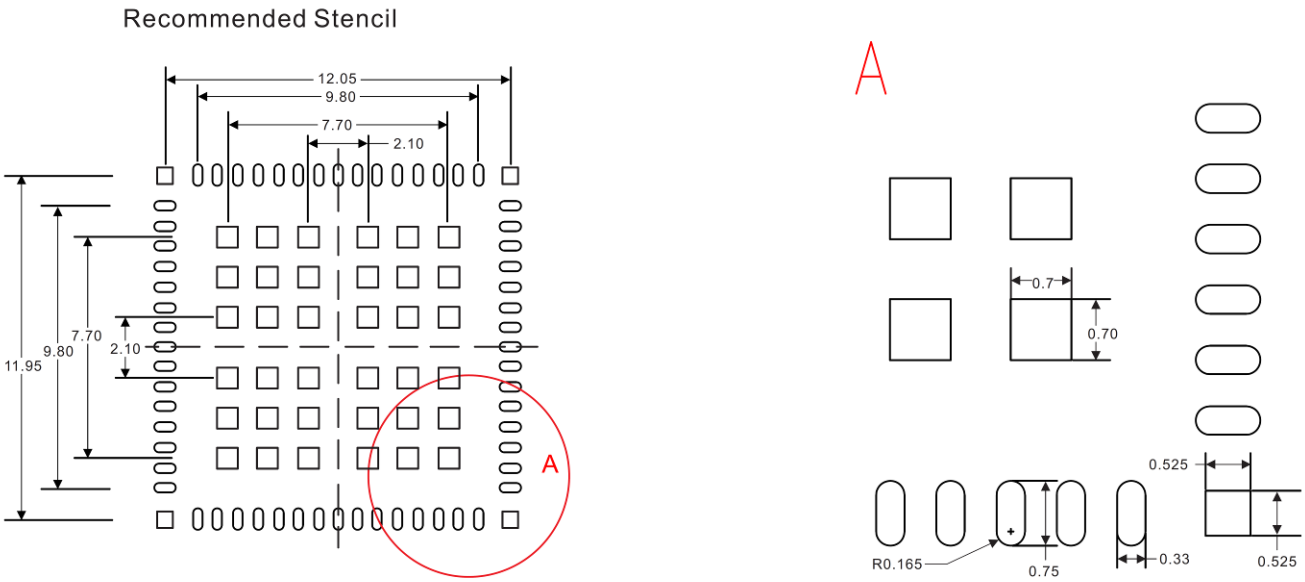


Figure 6-3. Recommended Stencil Outline

7. PACKAGE INFORMATION

7.1. Module Mechanical Outline

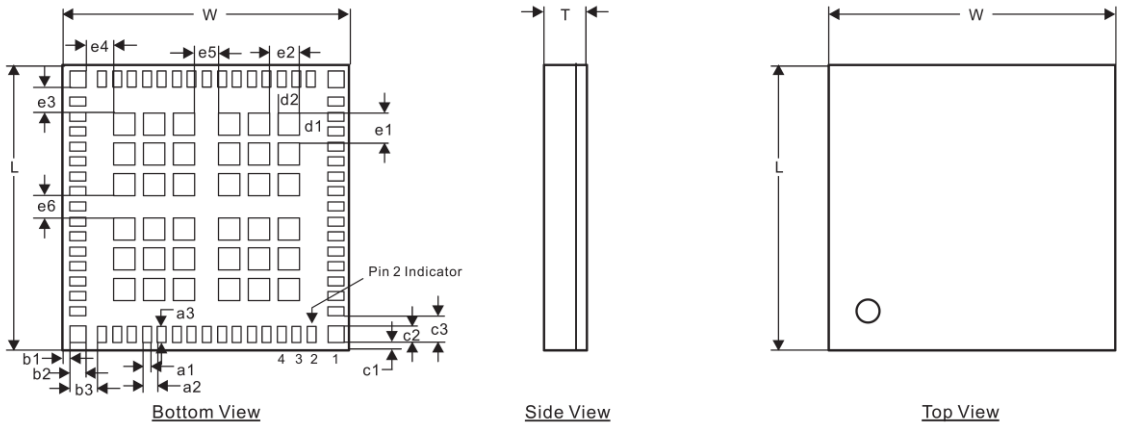


Figure 7-1. Module mechanical outline

MARKING	MIN (mm)	NOM (mm)	MAX (mm)	MARKING	MIN (mm)	NOM (mm)	MAX (mm)
L (body size)	13.20	13.30	13.40	c2	0.65	0.75	0.85
W (body size)	13.30	13.40	13.50	c3	1.15	1.25	1.35
T (thickness)	2.13	2.14	2.15	d1	0.90	1.00	1.10
a1	0.30	0.40	0.50	d2	0.90	1.00	1.10
a2	0.60	0.70	0.80	e1	1.30	1.40	1.50
a3	0.65	0.75	0.85	e2	1.30	1.40	1.50
b1	0.20	0.30	0.40	e3	1.15	1.25	1.35
b2	0.65	0.75	0.85	e4	1.20	1.30	1.40
b3	1.20	1.30	1.40	e5	1.00	1.10	1.20
c1	0.20	0.30	0.40	e6	1.00	1.10	1.20

Table 7-1 Dimensions for Module Mechanical Outline

7.2. Ordering Information

Order Number	Package
WG7A51-01	LGA-100

7.3. Module Marking

Marking	Description
JORJIN	Brand name
WG7A51-01	Model name
YYWWSSF	Lot Trace Code: YYWWSSF YY = Digit of the year, ex: 2019=19 WW = Week (01~52) SS = Serial number from 01~98 match to MFG's lot number, or 99 to repair control code. F = Reverse for internal use.

7.4. Tape / Reel / Shipping Box Specification

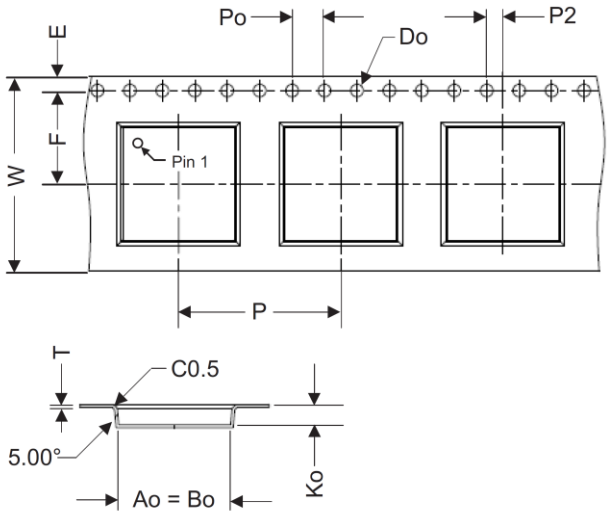


Figure 7-2. Tape Specification

ITEM	W	E	F	P	Po	P2	Do	T	Ao	Bo	Ko
DIMENSION (mm)	24.00 (±0.30)	1.75 (±0.10)	11.50 (±0.10)	20.00 (±0.10)	4.00 (±0.10)	2.00 (±0.10)	2.00 (±0.10)	0.35 (±0.05)	13.80 (±0.10)	13.80 (±0.10)	2.50 (±0.10)

Table 6-2. Dimensions for Tape Specification

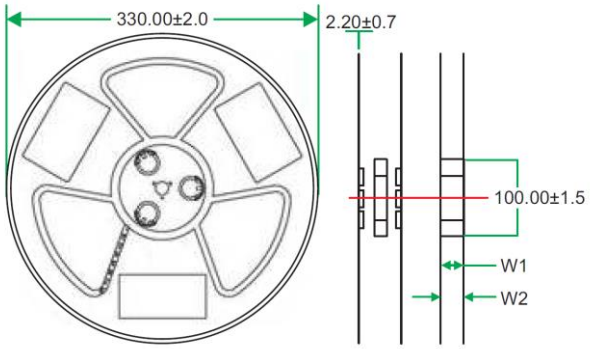


Figure 7-3. Reel Specification

ITEM	W1	W2
DIMENSION (mm)	24.4 (+1.5, –0.5)	30.4 (maximum)

Table 7-3. Dimensions for Reel Specification

The reel is packed in a moisture barrier bag fastened by heat-sealing. Each moisture-barrier bag is packed into a reel box.

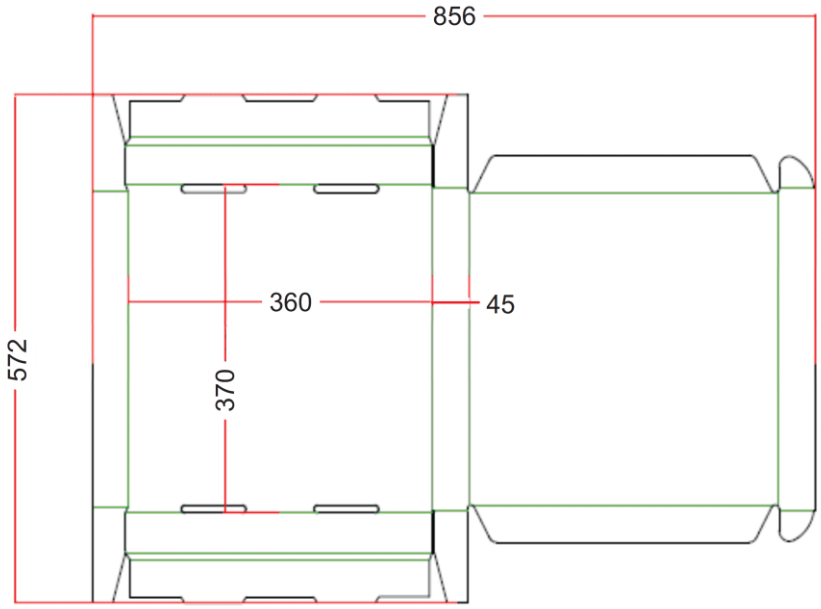


Figure 7-4. Reel Box

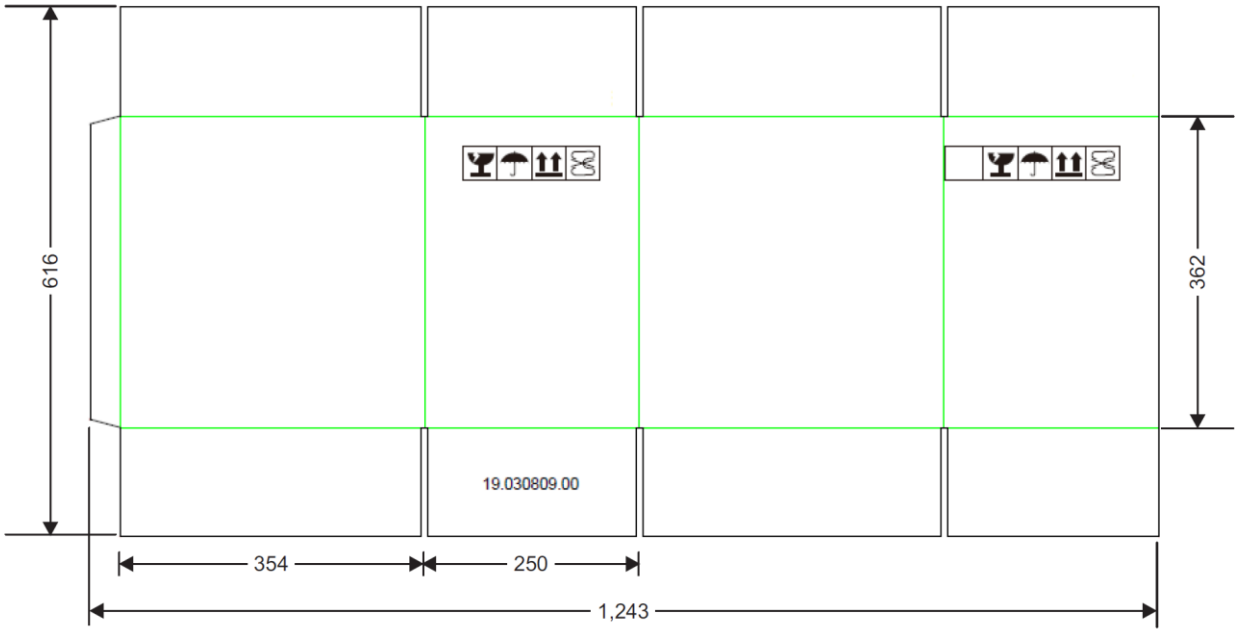


Figure 7-5. Shipping Box

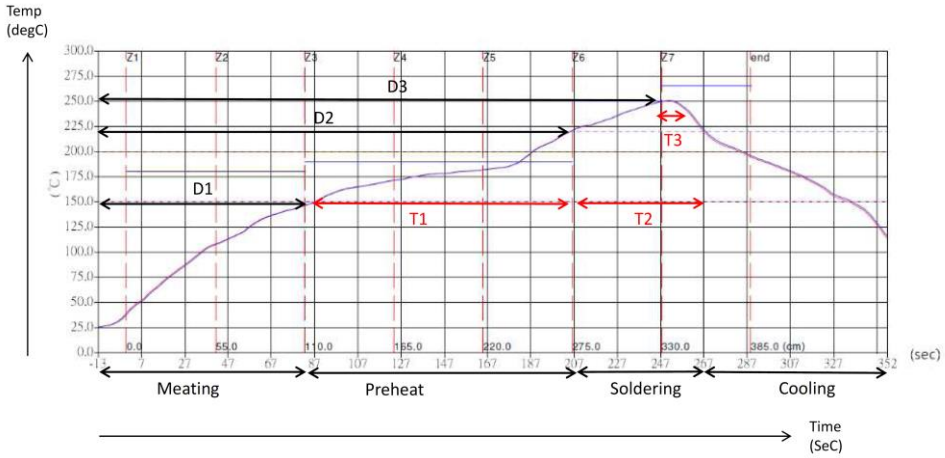
8. SMT AND BAKING RECOMMENDATION

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：



Item	Temperature (°C)	Time (sec)
Pre-heat	D1 to approximately D2: 140 to 200	T1: 80 to approximately 120
Soldering	D2: 220	T2: 60 ± 10
Peak-Temp.	D3: 250 maximum	T3: 10

- **Stencil thickness**： 0.1~ 0.15 mm (Recommended)
- **Soldering paste (without Pb)**：Recommended SENJU M705-GRN3360-K2-V can get better soldering effects.

9. REGULATORY INFORMATION

This section outlines the regulatory information for the following countries:

- United States
- Canada
- Japan
- Europe

8.1 United States

TBD

8.2 Canada

TBD

8.3 Japan

TBD

8.4 Europe

TBD

10. HISTORY CHANGE

Revision	Date	Description
Draft	2024.07.23	Draft version
D01	2024.09.30	Release version