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WS2118-00

**Ultralow Power Sub-1GHz and BLE Wireless MCU Module
STM S2-LP & BlueNRG-1 Solution**

Datasheet

Revision 0.1

Prepared By	Reviewed By	Approved By
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1. OVERVIEW

The WS2118-00 series is a sub-1GHz and Bluetooth® low energy ultralow power wireless MCU module. This module is built-in ST S2-LP and BlueNRG-1 chip.

The module is a cost-effective, high performance, ultra-low power, sub-1GHz and Bluetooth® low energy RF devices. Very low active RF and MCU current and low-power mode current consumption provide excellent battery lifetime and allow for operation on small coin cell batteries and in energy-harvesting applications.

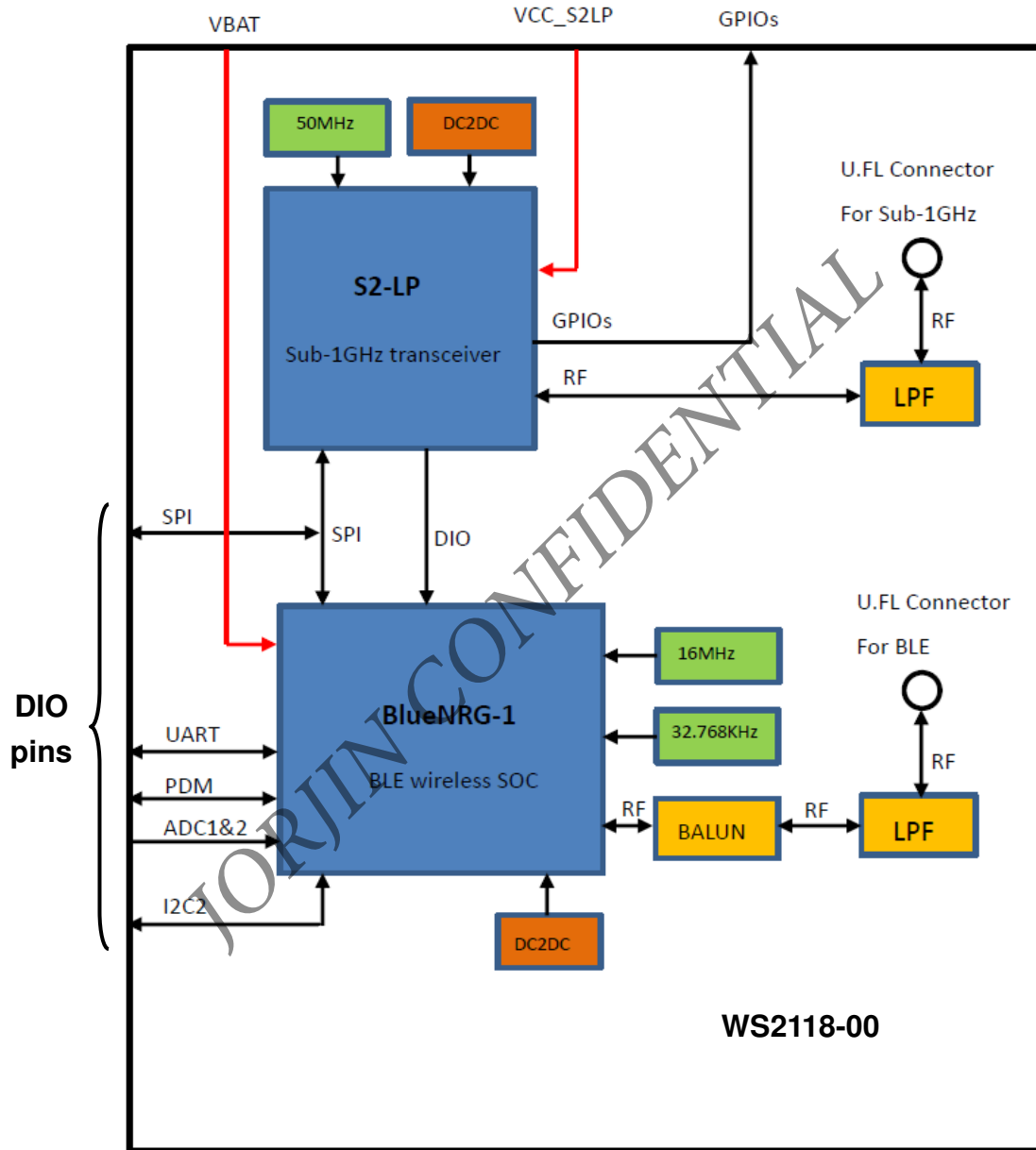
1.1. General Features

- ST BlueNRG-1, S2-LP, 16MHz, 50MHz & 32.768KHz crystals, DC2DC, and U.FL connector on a single module.
- Stamp-hole 38pins package.
- Dimension 22mm(L) x 24mm(W) x 2.8mm(H)
- High performance, ultra-low power Cortex-M0 32-bit Microcontroller
- Programmable 160 KB Flash
- 24 KB RAM with retention (two 12 KB banks)
- Up to +8dBm BLE RF output power, up to +16dBm sub-1GHz RF output power ⁽¹⁾
- Excellent performance of receiver sensitivity. Up to -88dBm (BLE) and -130dBm (Sub-1GHz).
- Low Power and Wide I/O Voltage Range: 1.8 to 3.6V
 - Internal DC-DC converter built-in
- Operating temperature range: -40 °C to +85 °C

(1) In order to comply with ETSI EN 300 328, EN 300 220-1, ARIB STD-T108, Sigfox limits, the maximum RF output power must be reduced. See the 4. MODULE SPECIFICATIONS for details.

2. FUNCTIONAL FEATURES

2.1. Module Block Diagram



2.2. Block Functional Feature

BlueNRG-1 : Bluetooth low energy wireless SOC

- Bluetooth specification compliant master, slave and multiple roles simultaneously, single-mode Bluetooth low energy SOC
- Integrated linear regulator and DC-DC step-down converter
- High performance, ultra-low power Cortex-M0 32-bit based architecture core
- Programmable 160 KB Flash
- 24 KB RAM with retention (two 12 KB banks)
- 1 x UART interface
- 1 x SPI interface
- 1 x I²C interface
- 15 GPIO
- 2 x multifunction timer
- 10-bit ADC
- Watchdog & RTC
- DMA controller
- PDM stream processor
- 16 MHz crystal oscillator built-in.
- 32 kHz crystal oscillator built-in.
- Battery voltage monitor and temperature sensor
- Up to +8 dBm available output power (at antenna connector)
- Excellent RF link budget (up to 96 dB)
- BALF-NRG-01D3 BALUN built-in.
- Accurate RSSI to allow power control

S2-LP Sub-1Ghz transceiver

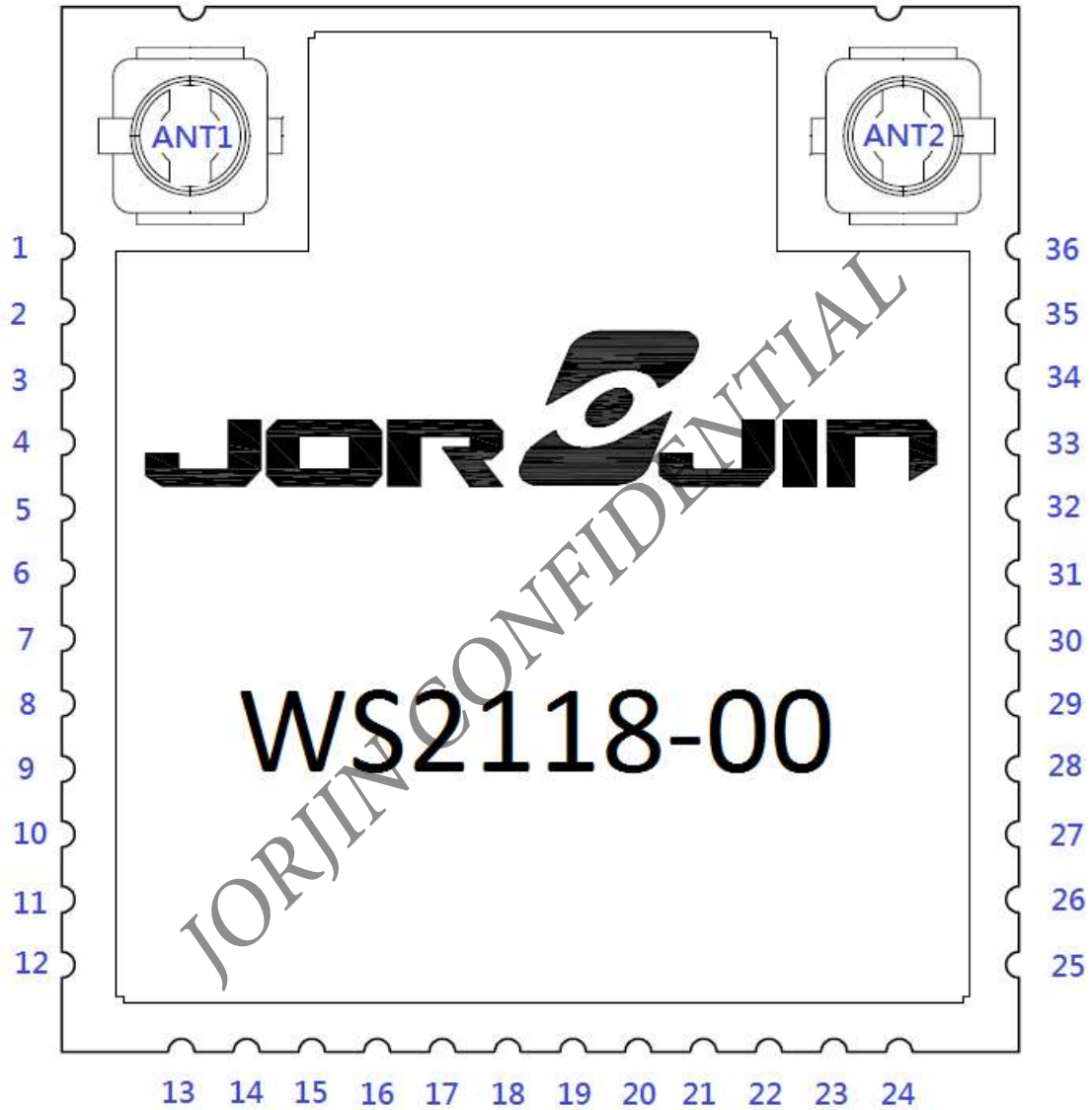
- Narrow band ultra-low power Sub-1GHz transceiver tuned for 860-943 MHz frequency bands.
- Suitable for SigFox applications
- Modulation schemes: 2-FSK, 2-GFSK, 4-FSK, 4-GFSK, OOK, and ASK
- Air data rate from 0.3 to 500 kbps
- Programmable RF output power up to +16 dBm

- Excellent performance of receiver sensitivity: down to -130 dBm
- Programmable RX digital filter
- Programmable channel spacing
- Low duty cycle RX/TX operation mode
- Integrated linear regulator and DC-DC step-down converter

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3. MODULE OUTLINE

3.1. Signal Layout (Top View)



3.2. Pin Description

Table 3-1. Pin Description

Pin No.	Pin Name	Type	Description
1	GND	GND	GND
2	RESETN	Digital Input	System reset
3	DIO13	Digital I/O	General purpose digital I/O of BlueNRG-1 Connected internally to GPIO3 of S2-LP for interrupt.
4	DIO12	Digital I/O	General purpose digital I/O of BlueNRG-1
5	TEST	Digital Input	Test pin put to GND
6	DIO11	Digital I/O	General purpose digital I/O of BlueNRG-1
7	DIO10	Digital I/O	General purpose digital I/O of BlueNRG-1
8	DIO9	Digital I/O	General purpose digital I/O of BlueNRG-1
9	DIO8	Digital I/O	General purpose digital I/O of BlueNRG-1
10	GND	GND	GND
11	VBAT	POWER	Power for BlueNRG-1
12	GND	GND	GND
13	DIO7/BOOT ⁽¹⁾	Digital I/O	Bootloader pin/ General purpose digital I/O of BlueNRG-1
14	DIO6	Digital I/O	General purpose digital I/O of BlueNRG-1
15	DIO5	Digital I/O	General purpose digital I/O of BlueNRG-1
16	DIO4	Digital I/O	General purpose digital I/O of BlueNRG-1
17	DIO3	Digital I/O	General purpose digital I/O of BlueNRG-1 / SPI master input pin connected internally to SDO pin of S2-LP
18	DIO2	Digital I/O	General purpose digital I/O of BlueNRG-1 / SPI master output pin connected internally to SDI pin of S2-LP
19	DIO1	Digital I/O	General purpose digital I/O of BlueNRG-1 / SPI master CS pin connected internally to CS pin of S2-LP Built-in pull-up 10K ohm resistor.
20	DIO0	Digital I/O	General purpose digital I/O of BlueNRG-1 / SPI master CLK pin connected internally to SCLK pin of S2-LP
21	DIO14	Digital I/O	General purpose digital I/O of BlueNRG-1 / Connected internally to SDN pin of S2-LP Built-in pull-down 10K ohm resistor.

22	ANATEST1	Analog Output	Analog output
23	ADC1	Analog Input	ADC input1
24	GND	GND	GND
25	ADC2	Analog Input	ADC input2
26	GND	GND	GND
27	VCC_S2LP	POWER	Power for S2-LP
28	GND	GND	GND
29	GPIO3	Digital I/O	General purpose I/O of S2-LP. Connected internally to DIO13 pin of BlueNRG-1 for interrupt.
30	GPIO2	Digital I/O	General purpose I/O of S2-LP.
31	GPIO1	Digital I/O	General purpose I/O of S2-LP.
32	GPIO0	Digital I/O	General purpose I/O of S2-LP.
33	NC	-	No connection
34	NC	-	No connection
35	NC	-	No connection
36	GND	GND	GND
ANT1	ANT1	RF I/O	2.4 GHz BLE antenna connector
ANT2	ANT2	RF I/O	Sub-1GHz antenna connector

- (1) The pin DIO7/BOOT is monitored by bootloader after power up or hardware Reset and it should be low to prevent unwanted bootloader activation.

4. MODULE SPECIFICATIONS

4.1. Absolute Maximum Ratings

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

Pin	Parameter	MIN	MAX	Unit
11, 27	Power for BlueNRG-1 and S2-LP	-0.3	+3.9	V
3, 4, 5, 6, 7, 8, 9, 13, 14, 15, 16, 17, 18, 19, 20, 21, 29,	DC voltage on digital input/output pins	-0.3	+3.9	V
22, 23, 25,	DC voltage on analog pins	-0.3	+3.9	V
30, 31, 32	DC voltage on digital control pins of PA.	0	+3.6	V
ANT1	Input RF level		+11	dBm
ANT2	Input RF level		+5	dBm
	Storage temperature range	-40	+85	°C

4.2. ESD Ratings

Parameter			Value	Unit
Electrostatic discharge performance	VESD+HBM	BlueNRG-1 pins	±2000	V
	VESD+HBM	S2-LP pins	±500	V
	VESD+HBM	RF pins	±500	V

4.3. Recommended Operating Conditions

Parameter	Conditions	MIN	MAX	Unit
Ambient temperature range		-40	85	°C
V _{BAT}	For BlueNRG-1	+1.7	+3.6 ⁽¹⁾	V
V _{CC_S2LP}	For S2-LP	+1.8	+3.6 ⁽¹⁾	V

(1) The maximum voltage is limited to 3.3V in Sigfox application

4.4. Power Consumption Summary

Ta = 25°C, VBAT=3.0 V, VCC_S2LP=3.0 V with internal DC-DC converter, unless otherwise noted.

Parameter		Test Conditions	Min	Typ	Max	Units	
I _{BAT}	BlueNRG-1 Supply current	Reset		5		nA	
		Standby		500		nA	
		Sleep mode: 32 kHz XO ON (24 KB retention RAM)		0.9		μA	
		Sleep mode: 32 kHz RO ON (24 KB retention RAM)		2.1		μA	
		Active mode: CPU, Flash and RAM on		1.9		mA	
		RX		7.7		mA	
		BLE TX +8 dBm		15.1		mA	
		BLE TX +4 dBm		10.9		mA	
		BLE TX +2 dBm		9		mA	
		BLE TX -2 dBm		8.3		mA	
		BLE TX -5 dBm		7.7		mA	
		BLE TX -8 dBm		7.1		mA	
		BLE TX -11 dBm		6.8		mA	
		BLE TX -14 dBm		6.6		mA	
	Peripheral Current Consumption (Adds to core current for each peripheral unit activated)						
	BlueNRG-1 Peripheral current	GPIO			11.6		μA
		Flash controller			6.3		μA
		System controller			0.2		μA
		UART			82.3		μA
		SPI			46.5		μA
Watchdog				3.6		μA	
ADC				6.3		μA	
I2C1				95.9		μA	
MFT1				5.4		μA	
MFT2				6.2		μA	
RTC				7.5		μA	
DMA				16.3		μA	
RNG				21.7		μA	
PKA				23.7		μA	
I _{VCC_} S2LP	S2_LP Supply current	Shutdown		2.5		nA	
		Standby		30.5		μA	

	Sleep		30.7		μA
	Sleep (FIFOs retained)		31.0		μA
	Ready		450		μA
	RX @ sensitivity level		8		mA
	TX CW @ 14 dBm		20.6		mA
	TX CW @ 10 dBm		11.7		mA
	TX CW @ 16 dBm in Boost ⁽¹⁾		27		mA

(1) SMPS output voltage 1.8 V

4.5. 2.4GHz GFSK (Bluetooth Low Energy) RF Characteristics

RF performance is specified in a single ended 50 ohm reference plane at the U.FL connector with $T_a = 25^\circ\text{C}$, $V_{BAT} = 3.0\text{ V}$, $f_{RF} = 2440\text{ MHz}$, unless otherwise noted. Please see the more detail data in the STM's BlueNRG-1 datasheet.

Parameter	Test Conditions	Min	Typ	Max	Units
Frequency range		2400	-	2483.5	MHz
Channel spacing		-	2	-	MHz
Channel center frequency		2402		2480	MHz
Receiver sensitivity	BER = 10^{-3}		-87		dBm
Receiver saturation	BER = 10^{-3}		11		dBm
Maximum Output Power	At U.FL connector		+8		dBm
Minimum Output Power	At U.FL connector		-15		dBm

(1) The maximum output power must be reduced to 4dBm to meet ETSI EN 300 328 emission limits.

4.6. Sub-1GHz RF Characteristics

RF performance is specified in a single ended 50 ohm reference plane at the U.FL connector with $T_a = 25^\circ\text{C}$, $V_{CC_S2LP} = 3.3\text{ V}$, unless otherwise noted. Please see the more detail data in the STM's S2_LP datasheet.

Parameter	Test Conditions	Min	Typ	Max	Units
Frequency range ⁽¹⁾		860	-	940	MHz
Data rate – 2-(G)FSK		0.3	-	250	kbps
Data rate – 4-(G)FSK		0.6	-	500	kbps
Data rate – OOK/ASK		0.3	-	125	kbps
Frequency deviation FDEV		0.15	-	500	kHz
Sensitivity @ 868MHz, 1% BER @ 2-GFSK BT = 0.5	DR = 0.3 kbps, FDEV = 0.25 kHz, CHF = 1 kHz		-129		dBm
	DR = 1.2 kbps, FDEV = 1.2 kHz, CHF = 4 kHz		-123		dBm
	DR = 38.4 kbps, FDEV = 20 kHz, CHF = 100 kHz		-110		dBm

	DR = 100 kbps, FDEV = 50 kHz, CHF = 200 kHz		-107		dBm
Sensitivity @ 868MHz, 1% BER @ 4-GFSK BT = 0.5	DR = 4.8 kbps, DEV = 2.4 kHz, CHF = 10 kHz		-115		dBm
	DR = 9.6 kbps, DEV = 4.8 kHz, CHF = 20 kHz		-112		dBm
	DR = 19.2 kbps, DEV = 9.6 kHz, CHF = 40 kHz		-110		dBm
Sensitivity @ 868MHz, 1% BER @ OOK	DR = 0.3 kbps, CHF = 1 kHz		-121		dBm
	DR = 1.2 kbps, CHF = 4 kHz		-120		dBm
	DR = 38.4 kbps, CHF = 100 kHz		-106		dBm
	DR = 125 kbps, CHF = 250 kHz		-101		dBm
Sensitivity @ 920MHz, 1% BER @ 2-GFSK BT = 0.5	DR = 0.3 kbps, FDEV = 0.25 kHz, CHF = 1 kHz		-128		dBm
	DR = 1.2 kbps, FDEV = 1.2 kHz, CHF = 4 kHz		-122		dBm
	DR = 38.4 kbps, FDEV = 20 kHz, CHF = 100 kHz		-109		dBm
	DR = 100 kbps, FDEV = 50 kHz, CHF = 200 kHz		-105		dBm
Sensitivity @ 920MHz, 1% BER @ 4-GFSK BT = 0.5	DR = 4.8 kbps, DEV = 2.4 kHz, CHF = 10 kHz		-114		dBm
	DR = 9.6 kbps, DEV = 4.8 kHz, CHF = 20 kHz		-112		dBm
	DR = 19.2 kbps, DEV = 9.6 kHz, CHF = 40 kHz		-108		dBm
Sensitivity @ 920MHz, 1% BER @ OOK	DR = 0.3 kbps, CHF = 1 kHz		-121		dBm
	DR = 1.2 kbps, CHF = 4 kHz		-118		dBm
	DR = 38.4 kbps, CHF = 100 kHz		-105		dBm
	DR = 125 kbps, CHF = 250 kHz		-100		dBm
Maximum Output Power ⁽²⁾	At U.FL connector		+16 ⁽¹⁾		dBm
Minimum Output Power	At U.FL connector		-30		dBm

(1) The frequency range of Sigfox RC-1 and ETSI EN 300 220-1 is 868.055MHz to 868.205MHz

The frequency range of Sigfox RC-3.C and ARIB STD-T108 is 923.125MHz to 923.275MHz.

(2) The maximum output power must be reduced to +10dBm to meet EN 300-220-1, Sigfox RC-1 emission limits.

The maximum output power must be reduced to +12dBm to meet ARIB STD-T108, Sigfox RC-3.C emission limits

4.7. Internal 16-MHz Crystal Oscillator (for BlueNRG-1)

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

Parameter	Test Conditions	Min	Typ	Max	Units
Crystal frequency			16		MHz
Crystal frequency tolerance ⁽¹⁾		-40		+40	ppm

(1) Includes initial tolerance of the crystal, drift over temperature, aging (5 years).

4.8. Internal 32.768-kHz Crystal Oscillator (for BlueNRG-1)

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

Parameter	Test Conditions	Min	Typ	Max	Units
Crystal frequency			32.768		KHz
Crystal frequency tolerance ⁽¹⁾		-40		40	ppm

(1) Includes initial tolerance of the crystal, drift over temperature, aging (5 years).

4.9. Internal 50MHz Crystal Oscillator (for S2-LP)

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

Parameter	Test Conditions	Min	Typ	Max	Units
Crystal frequency			50		MHz
Crystal frequency tolerance ⁽¹⁾		-40		40	ppm
Crystal frequency tolerance ⁽²⁾	Initial frequency is calibrated by software	-20		20	ppm

(1) Includes initial tolerance of the crystal, drift over temperature, aging (5 years).

(2) Includes only drift over temperature, aging (5 years).

4.10. BlueNRG-1 Digital I/O specifications

Ta = 25°C

Parameter	Test Conditions	Min	Typ	Max	Units
Trise	0.1*VDD to 0.9*VDD, CL=50pF	1.4(TC)	-	19(TC2)	ns
Tfall	0.9*VDD to 0.1*VDD, CL=50pF	1.5(TC)	-	22(TC2)	ns
T(RST)L		-	1.5	-	ms
TC		3	3.3	3.6	V
TC1		2.25	2.5	2.75	V
TC2		1.72	1.8	1.98	V
VIL	TC	-0.3	-	0.9	V
	TC1	-0.3	-	0.67	V
	TC2	-0.3	-	0.54	V
VIH	TC	1.95	-	3.6	V
	TC1	1.46	-	2.75	V
	TC2	1.1	-	1.98	V

VOL	TC	-	-	0.4	V
	TC1	-	-	0.42	V
	TC2	-	-	0.45	V
VOH	TC	2.4	-	-	V
	TC1	1.72	-	-	V
	TC2	1.35	-	-	V
IOL (Low drive strength)	TC (VOL = 0.4V)	3.4	5.6	7.9	mA
	TC1 (VOL= 0.42V)	3.8	6.6	10.1	mA
	TC2 (VOL =0.45V)	1.6	3	5	mA
IOL (High drive strength)	TC (VOL = 0.4V)	6.8	11.2	15.8	mA
	TC1 (VOL= 0.42V)	7.6	13.2	20.1	mA
	TC2 (VOL =0.45V)	3.3	6	9.9	mA
IOH (Low drive strength)	TC (VOH = 2.4V)	5.5	10.6	17.6	mA
	TC1 (VOH= 1.72V)	3.7	7.2	12	mA
	TC2 (VOH =1.35V)	1.4	3	5.6	mA
IOH (High drive strength)	TC (VOH = 2.4V)	9.9	19.2	31.7	mA
	TC1 (VOH= 1.72V)	6.7	12.9	21.6	mA
	TC2 (VOH =1.35V)	2.4	5.5	10.1	mA

4.11. S2-LP Digital interface specification

Parameter	Test Conditions	Min	Typ	Max	Units
SPI clock frequency			8	10	MHz
VIH		$VCC_S2LP/2+0.3$	-	-	V
VIL		-	-	$VCC_S2LP/8 +0.3$	V
VOH	IOH = -2.4 mA (-4.2 mA into high output current mode).	$0.625*VCC_S2LP+0.1$	-	-	V
VOL	IOL = +2.0 mA (+4.0 mA into high output current mode).			0.5	V

4.12. More Characteristics

If you need more detail characteristics, please visit STM and Skyworks web site.

BlueNRG-1:

http://www.st.com/content/st_com/en/products/wireless-connectivity/bluetooth-bluetooth-low-energy/bluenrg-1.html

S2-LP:

http://www.st.com/content/st_com/en/products/wireless-connectivity/sub-1ghz-rf/s2-lp.html

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5. DESIGN RECOMMENDATIONS

5.1. GPIO Usage of BlueNRG-1

Because the function of some pins has been used in the module internally, the other functions of these pins can not be defined. Please refer the below table.

Pin Name	Mode "000"		Mode "001"		Mode "100"		Mode "101"		Note
	Type	Signal	Type	Signal	Type	Signal	Type	Signal	
DIO0	I/O	GPIO 0	I	UART_CTS	I/O	SPI_CLK	-	-	To SCLK pin of S2-LP
DIO1	I/O	GPIO 1	O	UART_RTS	I/O	SPI_CS1	I	PDM_DAT	To CS pin of S2-LP
DIO2	I/O	GPIO 2	O	PWM0	O	SPI_OUT	O	PDM_CLK	To SDI pin of S2-LP
DIO3	I/O	GPIO 3	O	PWM1	I	SPI_IN	O	-	To SDO pin of S2-LP
DIO4	I/O	GPIO 4	I	UART_RXD	I/O	I2C2_CLK	O	PWM0	
DIO5	I/O	GPIO 5	O	UART_TXD	I/O	I2C2_DAT	O	PWM1	
DIO6	I/O	GPIO 6	O	UART_RTS	I/O	I2C2_CLK	I	PDM_DAT	
DIO7	I/O	GPIO 7	I	UART_CTS	I/O	I2C2_DAT	O	PDM_CLK	
DIO8	I/O	GPIO 8	O	UART_TXD	I/O	SPI_CLK	I	PDM_DAT	
DIO9	I/O	GPIO 9	I	SWCLK	I	SPI_IN	-	-	
DIO10	I/O	GPIO 10	I	SWDIO	O	SPI_OUT	-	-	
DIO11	I/O	GPIO 11	I	UART_RXD	I/O	SPI_CS1	-	-	
DIO12	OD	GPIO 12	I	-	I/O	I2C1_CLK	-	-	
DIO13	OD	GPIO 13	I	UART_CTS	I/O	I2C1_DAT	-	-	To GPIO3 pin of S2-LP
DIO14	I/O	GPIO 14	I/O	I2C1_CLK	I/O	SPI_CLK	O	-	To SDN pin of S2-LP

5.2. Debug Port

The BlueNRG-1 embeds the ARM serial wire debug (SWD) port. It is two pins (clock and single bi-directional data) debug interface, providing all the debug functionality plus realtime access to system memory without halting the processor or requiring any target resident code.

Pin functionality	Pin Name	Pin description
SWCLK	DIO9	SWD clock signal
SWDIO	DIO10	SWD data signal

The Cortex-M0 subsystem of the BlueNRG-1 embeds two breakpoints and one watchpoint.

5.3. Debugging Tips

There are certain situations where debug access is disabled and the chip cannot be accessed, including:

- application that disables debug pins
- application that set the device in sleep or standby state, in which the debug port is not powered.

These cases are common during application development and device can end up in a state where debug access is no longer possible. To recover this situation, it is recommended to force DIO7 pin high and hardware reset the device in order to force execution of the updater code. The user can then connect with SWD interface and erase the device Flash memory.

5.4. Pre-programmed bootloader

BlueNRG-1 device has a pre-programmed bootloader supporting UART protocol with automatic baudrate detection. Main features of the embedded bootloader are:

- Auto baudrate detection up to 460 kbps
- Flash mass erase, section erase
- Flash programming
- Flash readout protection enable/disable

The pre-programmed bootloader is an application which is stored on the BlueNRG-1 internal ROM at manufacturing time by STMicroelectronics. This application allows upgrading the device Flash with a user application using a serial communication channel (UART).

Bootloader is activated by hardware by forcing IO7 high during power-up or hardware Reset, otherwise, application residing in Flash will be launched.

The customer application must ensure that IO7 is forced low during power up.

5.5. SPI Multiple Use

The SDO pin of S2-LP is always forced to output with an internal low impedance and the pin is not tri-stated when the CSn pin of S2-LP is high. This prevents the BlueNRG-1 to use the same SPI bus

for driving other SPI slaves.

Two actions can be taken:

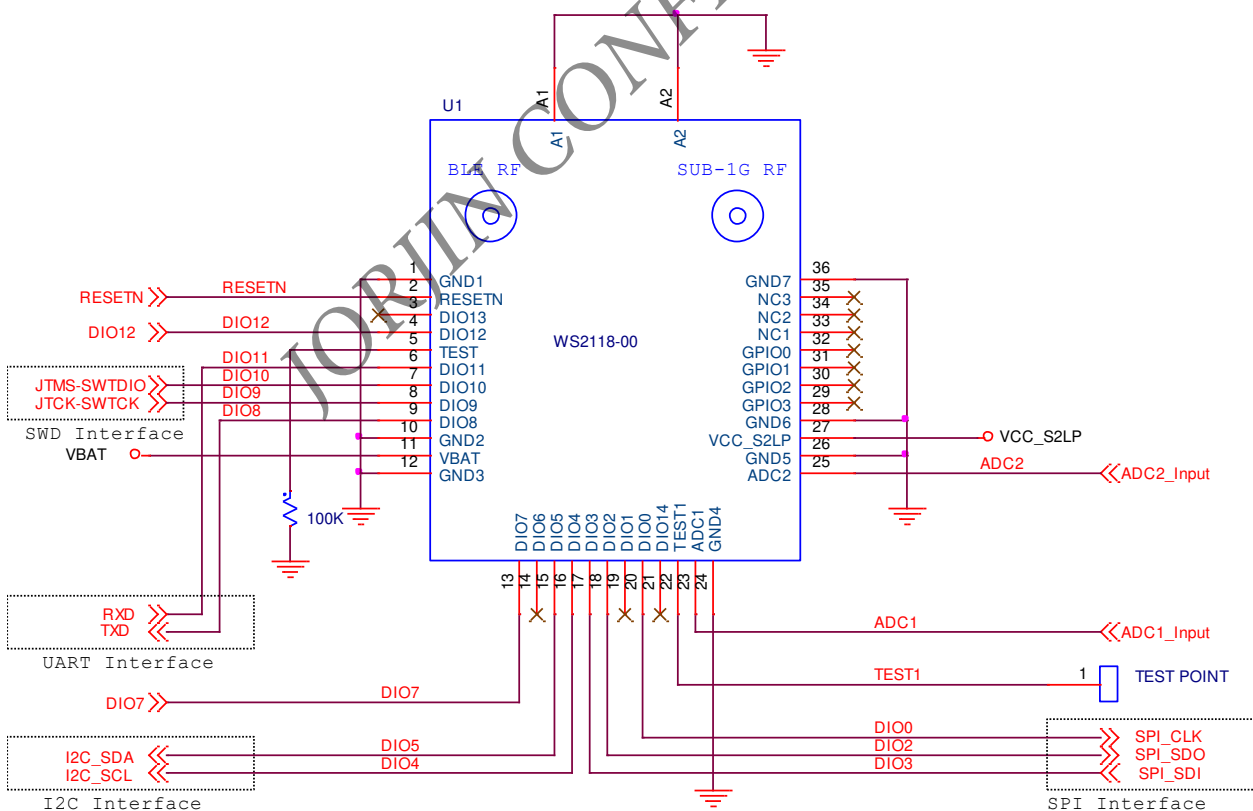
- do not use multiple slaves on the SPI bus.
- each time an application needs to access another SPI slave, turn the S2-LP off via the SDN pin (DIO14 of BlueNRG-1).

5.6. Antenna Selection Guide

There are two U.FL connectors to connect one 2.4GHz antenna and one Sub-1GHz antenna. There is an antenna selection guide from STM. You can download it from the below link.

http://www.st.com/content/ccc/resource/technical/document/application_note/82/38/3f/9f/fd/4d/4f/ab/DM00068254.pdf/files/DM00068254.pdf/jcr:content/translations/en.DM00068254.pdf

5.7. Reference Schematic



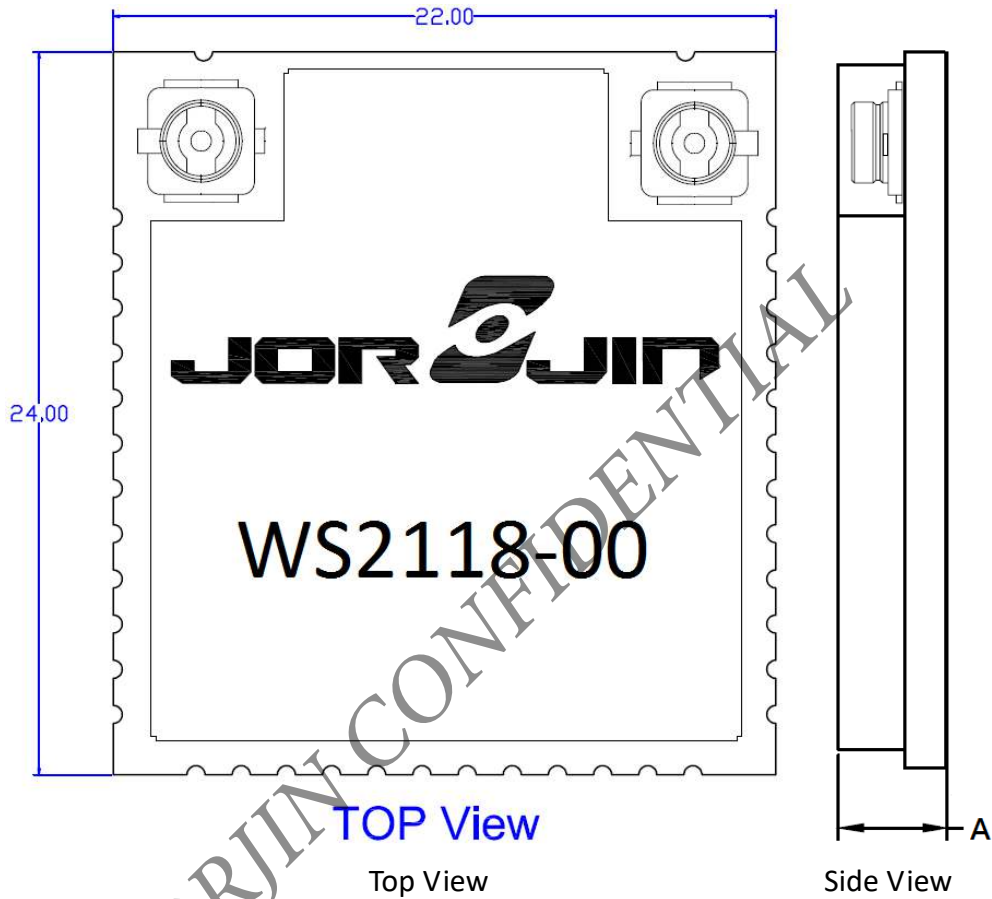
5.8. Module Layout Recommendations

- Power Trace - Power trace for VCC_S2LP should be 25mil wide. VBAT traces should be 15mil wide, at least.

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6. PACKAGE INFORMATION

6.1. Module Mechanical Outline

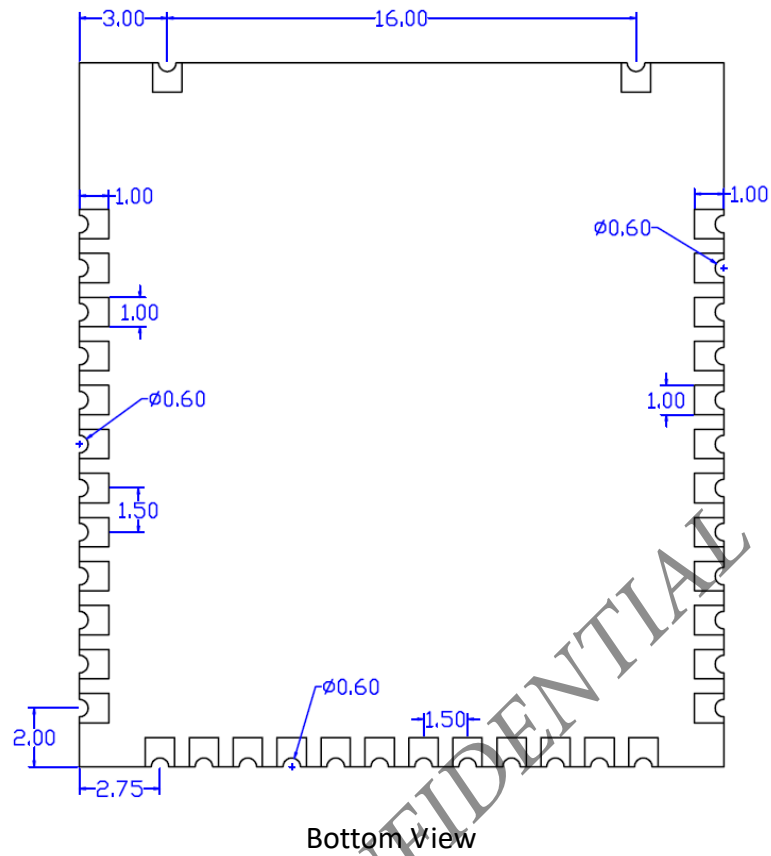


Note:

A: Typical: 2.8mm, Maximum: 3.0mm

Unit: mm

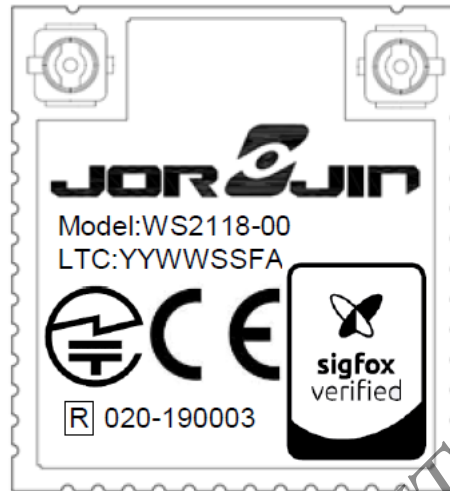
Tolerance: +/- 0.2mm







Note:

- 1> Pad tolerance as $\pm 30\mu\text{m}$
- 2> Unit: mm

6.2. Package Marking



Marking	Description
	Brand name: JORJIN
WS2118-00	Model name
YYWWSSFX	Lot Trace Code: YYWWSSFX YY= Digit of the year, ex: 2017=17 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 X = A for Module version
	CE compliance mark
	Sigfox P1 certified mark
	JRF compliance mark, and ID

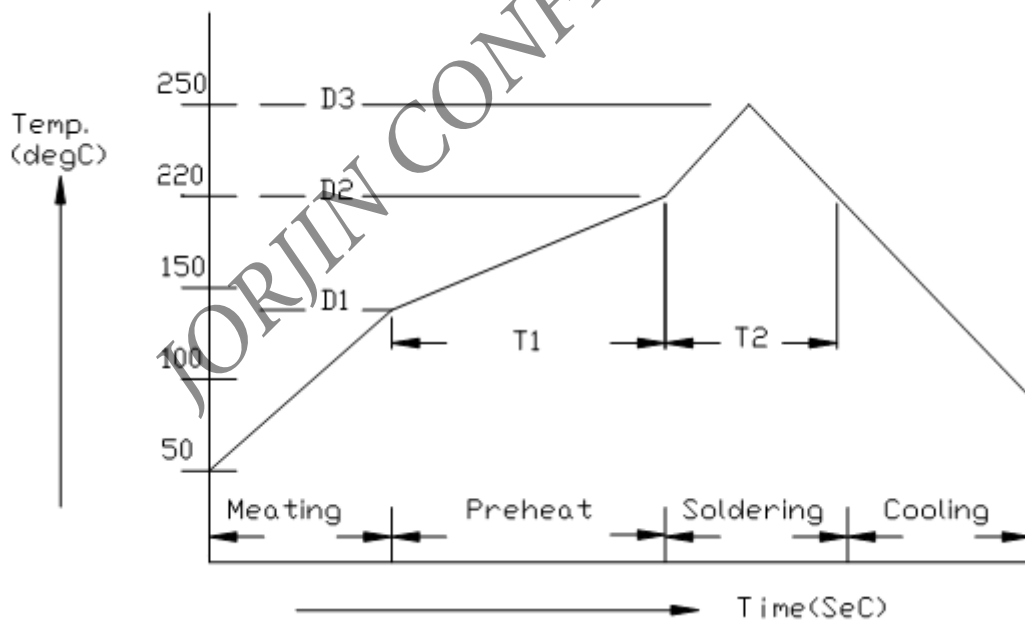
7. SMT AND BAKING RECOMMENDATION

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.

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8. SMT AND BAKING RECOMMENDATION

8.1. Europe

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

The full text of the EU declaration of conformity is available at the following internet address:

<http://www.jorjin.com/product.php?id=164>

The compliance has been verified in the operating frequency band of 2400 MHz to 2483.5 MHz, and 868.055MHz to 868.205MHz. Developers and integrators that incorporate the WS2118-00 or WS2118-G0 RF Module in any end products are responsible for obtaining applicable regulatory approvals for such end product.

The WS2118-00 and WS2118-G0 have been tested in the 2400-GHz to 2483.5-GHz, and 868.055MHz to 868.205MHz ISM frequency band at 3.3 V across the temperature range -40°C to $+85^{\circ}\text{C}$ and tolerance.

Labeling and User Information Requirements

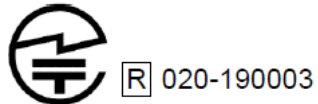
As a result of the conformity assessment procedure described in Annex III of the Directive 2014/53/EC, the end-customer equipment should be labeled as follows:



8.2. Japan

The WS2118-00 is certified as a module with type certification number 020-190003. 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.



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9. HISTORY CHANGE

Revision	Date	Description
D 0.1	2017/10/18	Draft release
D 0.2	2018/02/08	The maximum voltage is limited to 3.3V in Sigfox application.
D 0.3	2018/03/02	The minimum temperature is limited to -30°C in Sigfox application.
D 0.4	2018/03/21	(1) Delete -30°C temperature limit in Sigfox application. (2) Add model number WS2118-G0
D 0.5	2018/05/16	Add "6.2. Package Marking" "8. REGULATORY INFORMATION"
D 0.6	2018/10/26	(1) Correct the current consumption data of S2-LP (2) Add "5.5. SPI Multiple Use"
R 0.1	2019/01/24	Official Released. Add TELEC regulatory information

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