Radio(((ontrolli
Wireless Modules

Lora Wireless Module STM32WLE5 based

RC-WLE5-868 is an ultra low power long range device designed by RadioControlli. The module is based on STM32WLE5JC device from STMicroelectronics.
Multiprotocol LPWAN 32bit Arm®Cortex® M4 MCUs, LoRa®, (G)FSK, (G)MSK, BPSK .
The main applications of this module are Internet of Things devices and wireless sensor networks , especially battery powered low power consumption long range.
Operative Frequency bands : 868MHz.

Ready for use SMD mounting (13 x 14.5mm) - Metal shield.

For more information and details, please refer to the STM32WLE5J datasheet (www.st.com).
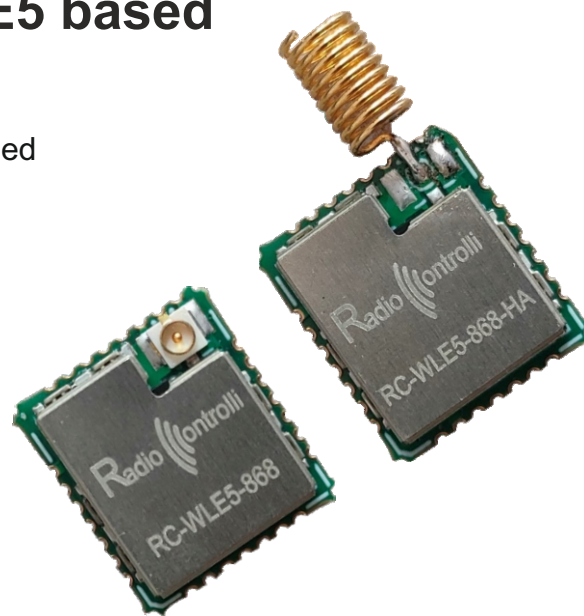
Module Information :

RC-WLE5-868 ⟶ **Standard Version (UFL Connector)**

RC-WLE5-868-HA ⟶ **Helical Antenna Version**

RC-WLE5-868 is designed to be easily integrated into your hardware application, we provide 2 versions:

1) Standard version with UFL connector
You can use the UFL connector where you can directly connect the antenna. The RF output signal is also present on a 50 ohm pin (pin 15) in case you want to create your own antenna project on your pcb.

2) Version with helical antenna (full version)

Applications:

- Smart meters
- Wireless security systems
- Home and Building automation
- 6LoWPAN systems
- Automatic Measure Reading
- Low-Power Wireless Systems

- Wireless Sensor Networks
- Remote Control
- Street Lights System
- Parking Sensors
- Environmental Sensors
- Smart Grid and Automatic Meter Reading

DESCRIPTION

The **RC-WLE5-XXX** long-range wireless and ultra-low-power devices embed a powerful and ultra-low-power radio compliant LPWAN radio solution : LORA (only available in STM32WLE5) , (G(FSK,(H)MSK and BPSK.

The devices embed high-speed memories (Flash memory up to 256 Kbytes, SRAM up to 64 Kbytes),
and an extensive range of enhanced I/Os and peripherals. The devices also embed several protection mechanisms for embedded Flash memory and SRAM: readout protection, write protection and proprietary code readout protection. These devices offer a 12-bit ADC, a 12-bit DAC low-power sample-and-hold, two ultra-low-power comparators associated with a high-accuracy reference voltage generator. The devices embed a low-power RTC with a 32-bit sub-second wakeup counter, one 16-bit single-channel timer, two 16-bit four-channel timers (supporting motor control), one 32-bit four-channel timer and three 16-bit ultra-low-power timers.

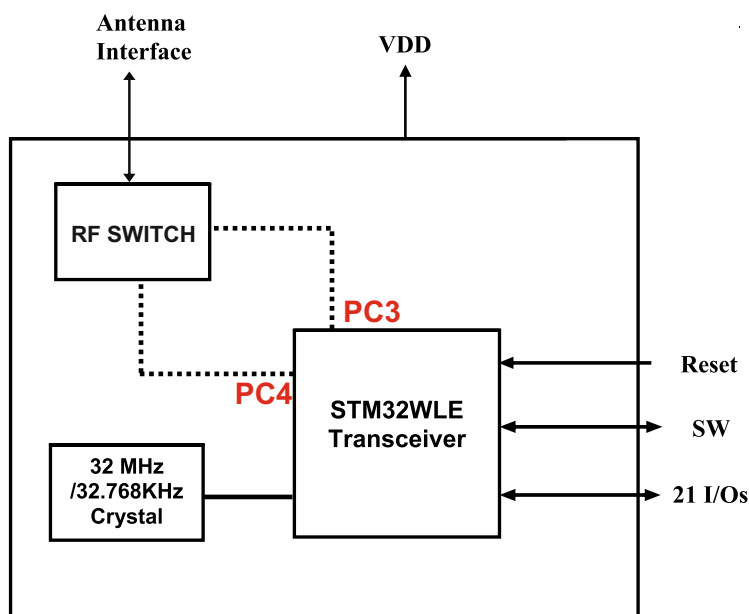**CORE** : STM32WLE5JC
SIZE   : 14.5 x 13 x 2.8mm

TECHNICAL CHARACTERISTICS

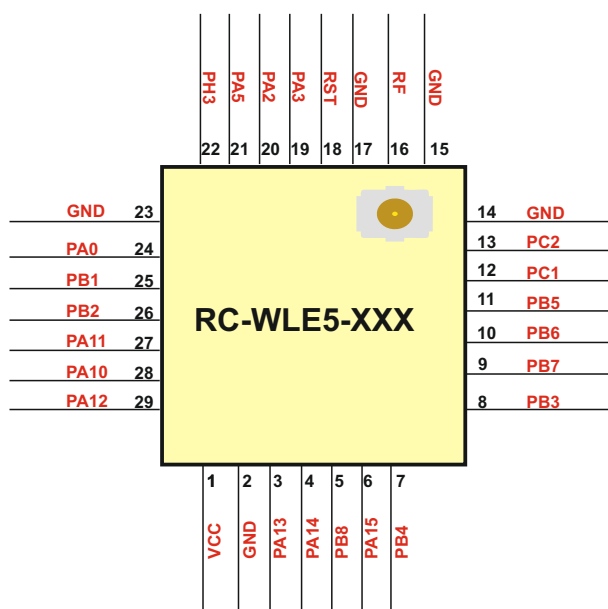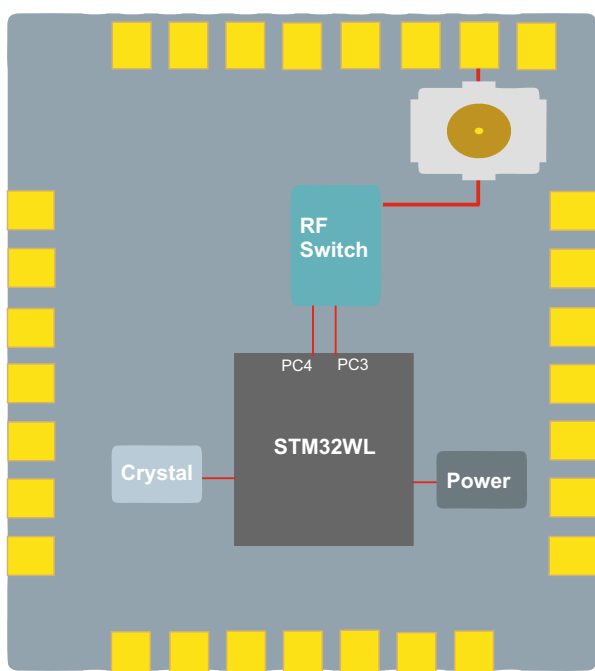|	Characteristics	MIN	TYP	MAX	UNIT
V_{CC}	Supply Voltage	2.5	3.3	3.7	Vdc
I_S	Supply Current (Sleep mode)		2.0		uA
I_{S1}	Supply Current (Receive mode)		5.0		mA
I_{S2}	Supply Current (Transmit mode)		120.0		mA
F	Frequency		868.0		Mhz
T	RF TX Power			18.5	dBm
S	RX Sensitivity		140		dBm
TE	Operating Temperature Range	-20		+70	°C

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RC-WLE5-868
RC-WLE5-868-HA

BLOCK DIAGRAM

The module denominated RC-WLE5-XXX is based on STM32WL5Jx device which integrates :
- ARM Cortex M4 processor
- Sx126x LoRa transceiver
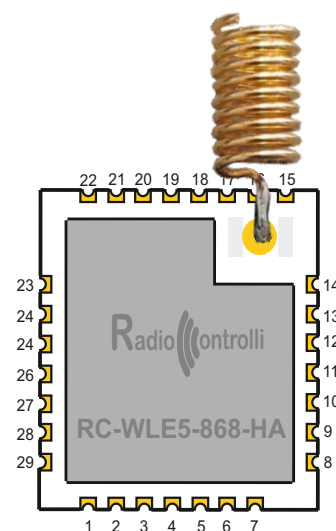on the same chip.

RF Switch Control	PC3	PC4	RF Mode
	1	0	TX
	0	1	RX

RC-WLE5-868
RC-WLE5-868-HA

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Wireless Modules

PINOUT   Main System Peripherals and GPIOs

SW Upgrade	PA3	19
SW Upgrade	PA2	20
	PA5	21
BOOT0	PH3	22

18	RESET
17	GND
16	RF
15	GND

RF Switch

Pc4   PC3

STM32WL

Crystal   Power

GND	23
PA0	24
PB1	25
PB2	26
PA11	27
PA10	28
PA12	29

14	GND
13	PC2
12	PC1
11	PB5
10	PB6
9	PB7
8	PB3

VCC	1
GND	2
PA13	3
PA14	4

7	PB4
6	PA15
5	PB8

Standard Version

RC-WLE5-868

Helical Antenna Version

RC-WLE5-868-HA

RC-WLE5-XXX
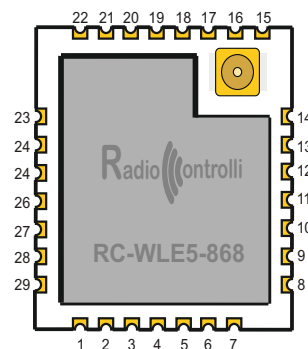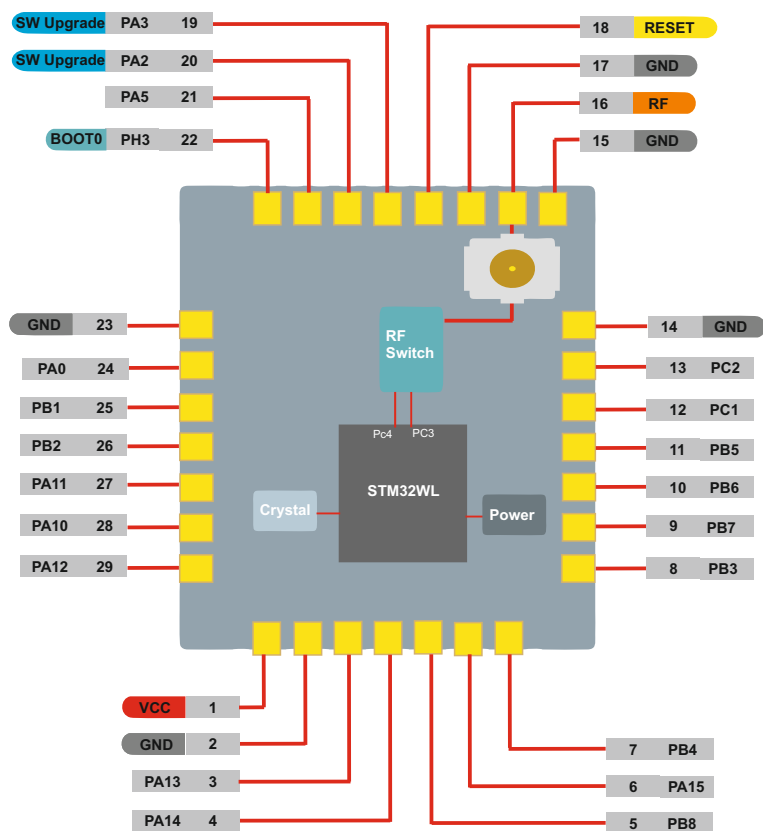
Pin Descriptions

Pin Number	Name	I/O	Description
01	VCC	-	Supply Voltage
02,14,15,17,23	GND	-	Ground
03	PA13	I/O	Input / Output pin
04	PA14	I/O	Input / Output pin
05	PB8	I/O	Input / Output pin
06	PA15	I/O	Input / Output pin
07	PB4	I/O	Input / Output pin
08	PB3	I/O	Input / Output pin
09	PB7	I/O	Input / Output pin
10	PB6	I/O	Input / Output pin
11	PB5	I/O	Input / Output pin
12	PC1	I/O	Input / Output pin
13	PC2	I/O	Input / Output pin
16	RF	O	Antenna RF Out
18	RST	I	Reset trigger input
19	PA3	I/O	USART2 RX - Input / Otput / firmware upgrade
20	PA2	I/O	USART2 TX - Input / Otput / firmware upgrade
21	PA5	I/O	Input / Output pin
22	PH3	I/O	BOOT0 - Startup Mode Selection
24	PA0	I/O	Input / Output pin
25	PB1	I/O	Input / Output pin
26	PB2	I/O	Input / Output pin
27	PA11	I/O	Input / Output pin
28	PA10	I/O	Input / Output pin
29	PA12	I/O	Input / Output pin
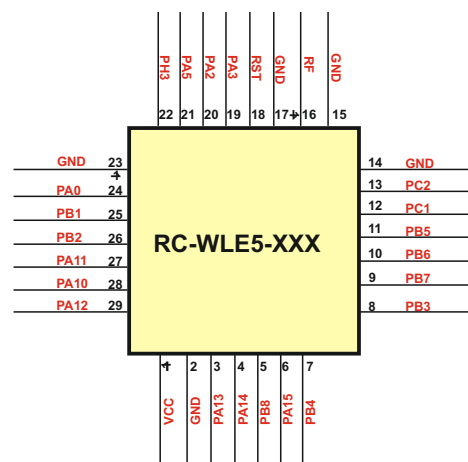
REFERENCE SCHEMATICS

Software Upgrade through USART

Normally BOOT0 (PH3) must be connected to GND
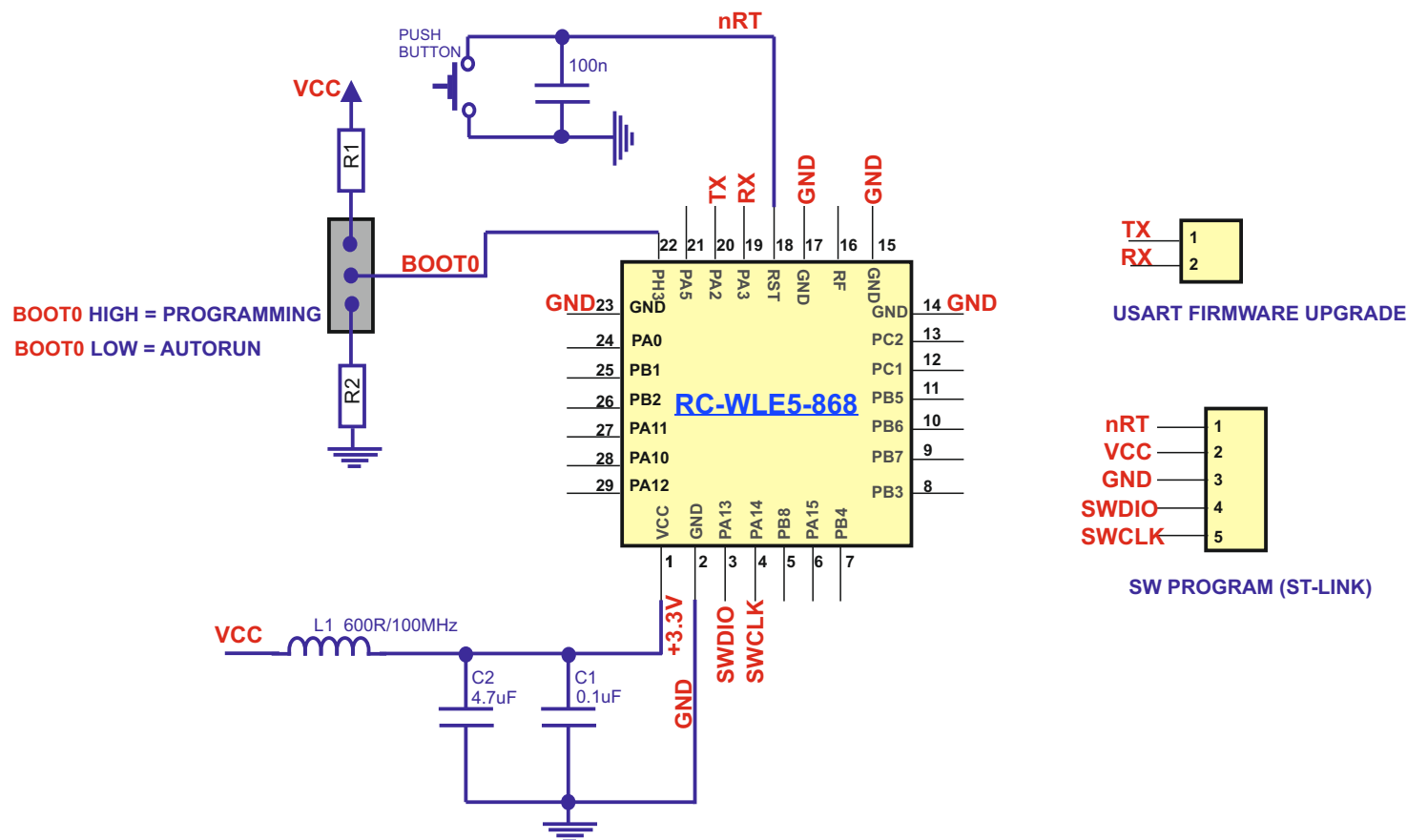When is necessary to make an USART firmware upgrade, the BOOT0 (PH3) must be connected to VCC.

Software Program through ST-LINK
While programming through ST-LINK it's not necessary to connect BOOT0 to VCC.
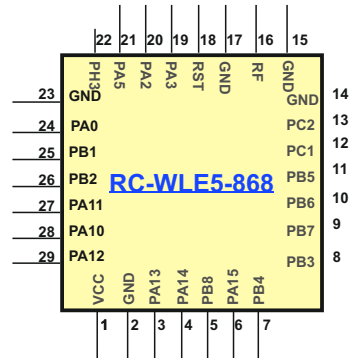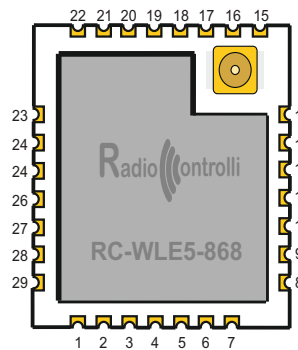
RF Switch Control
The RF Switch that select the TX/RX of the module is controlled by the STM32WL5 using two GPIO (PC3 and Pc4). These GPIO aren't output in the module footprint, must be driven through the firmware (see table below).

RF Switch Control	PC3	PC4	RF Mode
	1	0	TX
	0	1	RX

BOOT0 HIGH = PROGRAMMING
BOOT0 LOW = AUTORUN

RC-WLE5-868

USART FIRMWARE UPGRADE
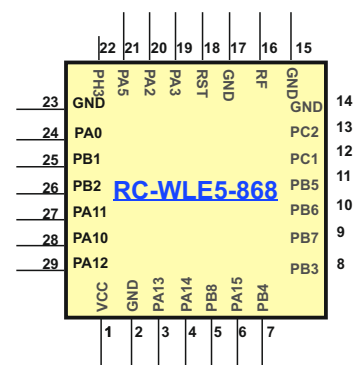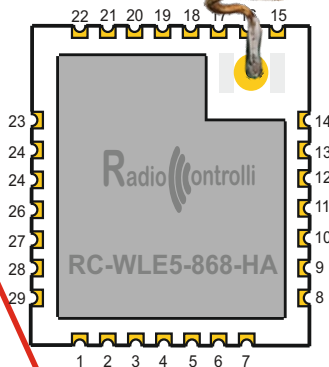
SW PROGRAM (ST-LINK)

VERSIONS:

STANDARD Version = **RC-WLE5-868**

Antenna Connection throught UFL connector

ANTENNA VERSION = **RC-WLE5-868-HA**

868MHz Helical Antenna
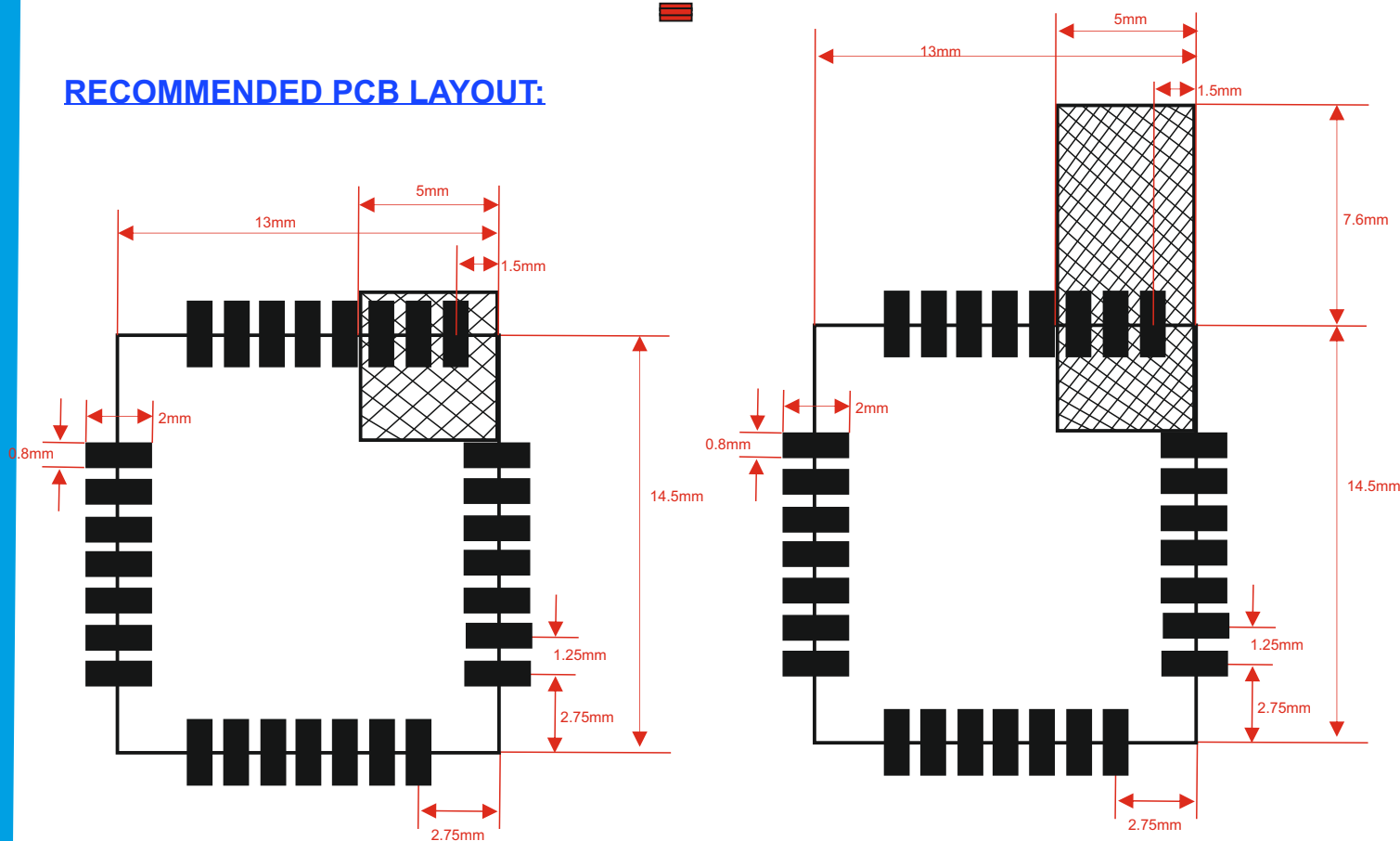
RC-WLE5-868
RC-WLE5-868-HA

MECHANICAL DIMENSIONS:

Tolerance ±0.5mm
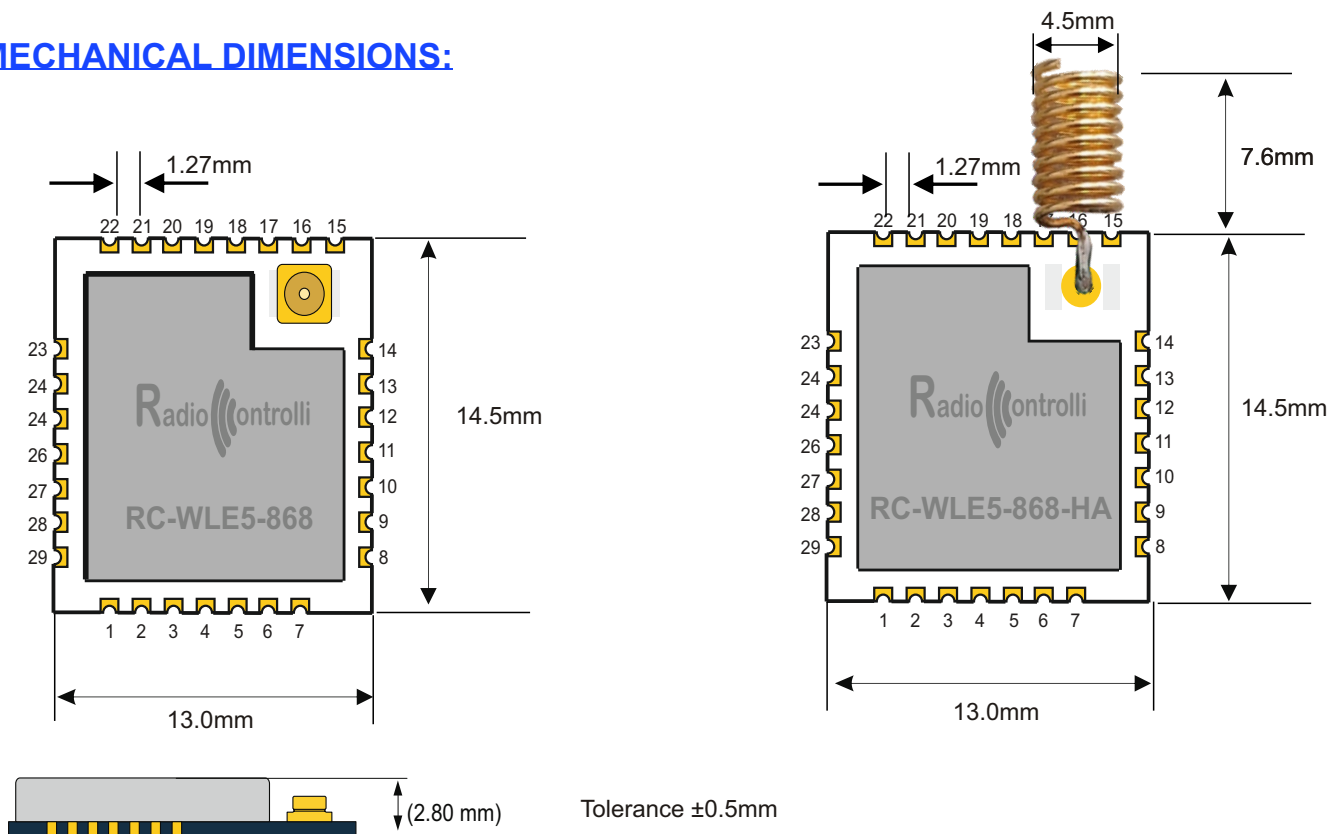
RECOMMENDED PCB LAYOUT:

Note :
Make sure in the shadow area shall without any wiring or ground.

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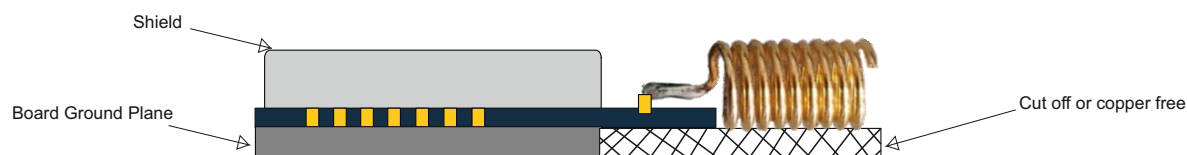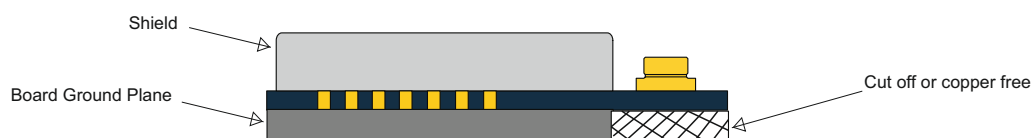## RECOMMENDED HARDWARE DESIGN:

1) Hardware
All unused pins should be left floating; do not ground.
All GND pins must be well grounded.
Traces should not be routed underneath the module.

2) Power Supply
The transceiver module must be powered from a regulated voltage.
It is recommended to keep the power supply line for VCC as short and low impedence
as possible.   Near the power pins it is recommended to insert a ceramic the decoupling
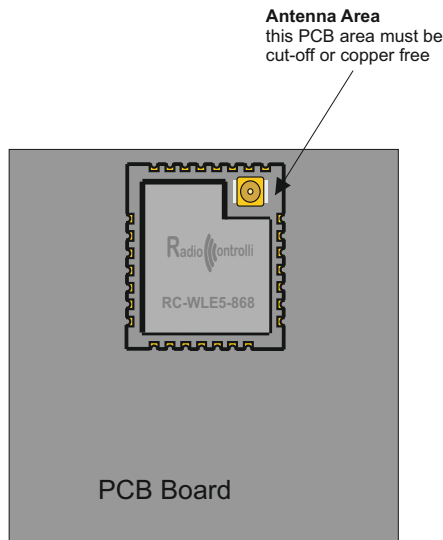capacitor (100nF).

3) Ground Plane
It is recommended to have a copper ground plane under the shielded zone of the
module. The ground plane should be unbroken and unifed flood as possible especially
on top and botton layer.
Use a a lot of grounding vias as possible.
Make sure there are no wires or earth in the shaded area, even better if this part isn't
there (it's cut off).

Shield

Board Ground Plane

Cut off or copper free

Shield

Board Ground Plane

Cut off or copper free

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4) Module Placement

The antenna on the PCB has an omnidirectional radiation pattern. To maximize antenna efficiency, an adequate grounding plane must be provided under the module. Instead the areas underneath and surrounding the antenna area must be free of copper.
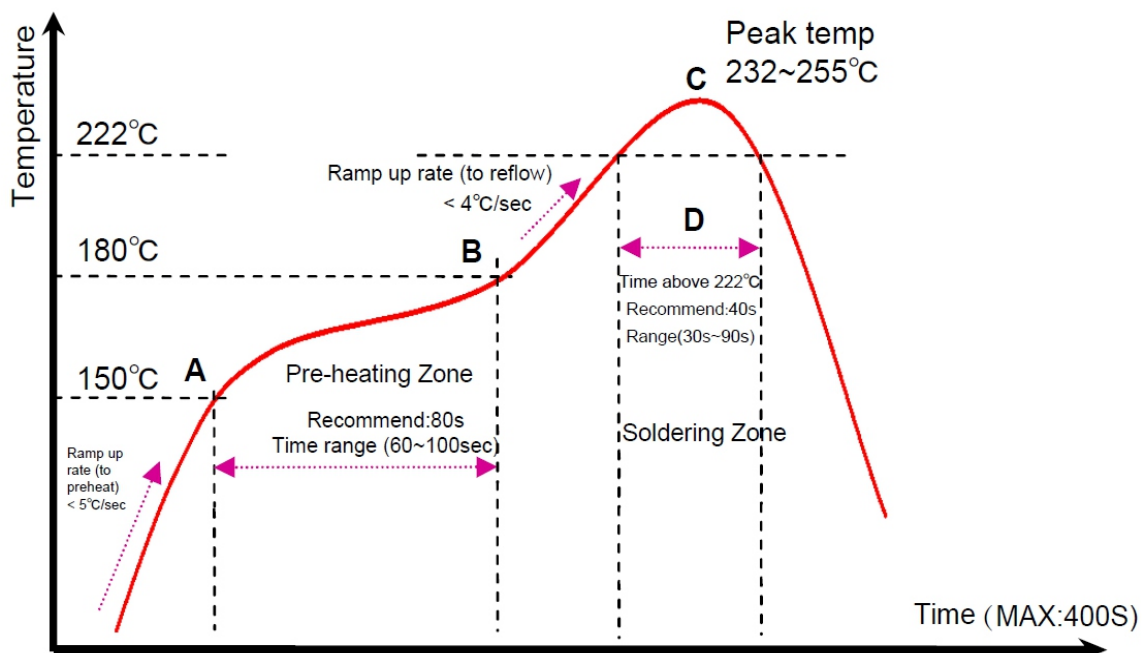
Antenna Area
this PCB area must be cut-off or copper free

PCB Board

Recommended location XY plane

PCB Board
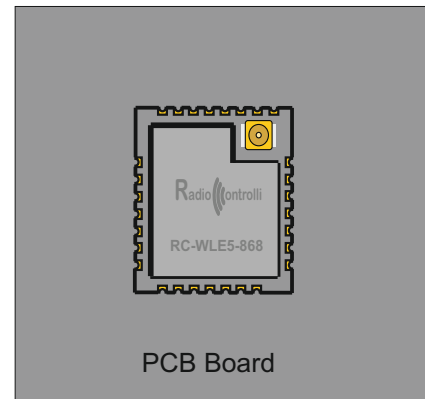
Not Recommended location XY plane

RECOMMENDED REFLOW PROFILE (LEAD FREE SOLDER)

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PACKAGE

TAPE AND REEL (Helical Antenna module exception)

Note : For package, we have three package types :
- Reel
- Tray
- Simple way for choosing
depend on customer's request or quantity request.

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