Nucleo 4 WiFi Module

Version V1.0

Datasheet

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0. Version History

Version	ECN#	Date	Notes	Revised By	Verified By
V1.0	-	01-11-21	Initial Release Version	Shashank S.	Gaurav P.

1. Introduction

Nucleo 4 is a WiFi module developed by IoTfy Solutions Private Limited. The core processor of the module ESP8285 integrates Tensilica L106 ultra-low-power 32-bit micro MCU in a smaller package with 16-bit reduced mode. The main frequency supports 80 MHz and 160 MHz, supports RTOS, and integrates WiFi MAC / BB / RF / PA / LNA.

Nucleo 4 WiFi module supports standard IEEE 802.11 b/g/n protocol and complete TCP/IP protocol stack. Users can use this module to add networking capabilities to existing equipment or build stand-alone network controllers.

ESP8285 is a high-performance wireless SoC that provides maximum practicality at the lowest cost, providing unlimited possibilities for WiFi functionality to be embedded in other systems.

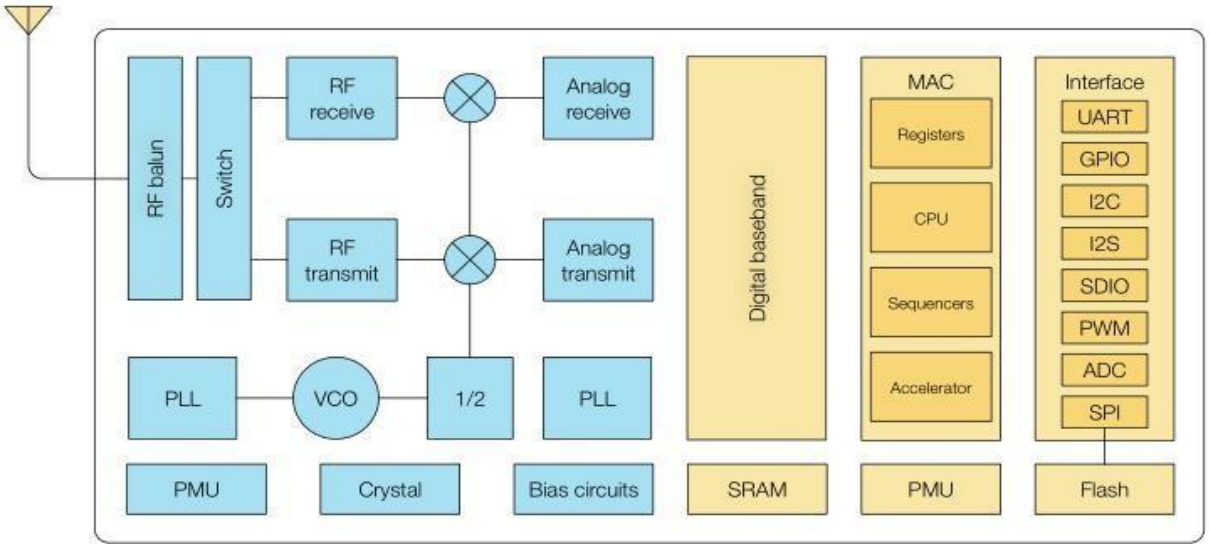

Figure 1: ESP8285 Architecture

ESP8285 has a complete and self-contained WiFi network function, which can be used independently or run as a slave on other host MCUs. ESP8285 has built-in 2MB Flash, and the external circuit design is simple. The built-in cache memory helps improve system performance and optimizes the storage.

Another case is that ESP8285 can be used as a WiFi adapter only through SPI / SDIO interface or UART interface, and can be applied to any microcontroller-based design.

ESP8285's powerful on-chip processing and storage capabilities make it possible to integrate sensors and other application-specific equipment through the GPIO port, greatly reducing the cost of early development.

1.1. Features

- Complete 802.11b/g/n WiFi SoC module
- Built-in Tensilica L106 ultra-low-power 32-bit CPU, the main frequency supports 80 MHz and 160 MHz, and supports RTOS
- Built-in 10-bit high-precision ADC
- Built-in Flash
- Supports UART/GPIO/I2C/PWM/ADC interface
- SMD-16 package
- Integrated WiFi MAC/ BB/RF/PA/LNA
- Supports multiple sleep modes, deep sleep current as low as 20uA
- Serial port speed up to 4Mbps
- Embedded lwIP protocol stack
- Supports STA/AP/STA+AP working mode
- Smart Config support for Android and IOS
- Supports serial local upgrade and remote firmware upgrade (FOTA)
- General AT command can get started quickly
- Supports secondary development, integrated Windows, Linux development environment

1.2. Specification

Model name	Nucleo 4
Package	SMD-16
Size	16*24*2.8(±0.2)mm
SPI Flash	2MB Flash
Interface	UART/GPIO/ADC/PWM
IO ports	9
UART Baud Rate	Support 110 ~ 4608000 bps, Default 115200 bps
Frequency range	2400 ~ 2483.5MHz
Antenna	PCB antenna
Transmit Power	802.11b: 16±2 dBm (@11Mbps) 802.11g: 14±2 dBm (@54Mbps) 802.11n: 13±2 dBm (@HT20, MCS7)
Receiving Sensitivity	CCK, 1 Mbps : -90dBm CCK, 11 Mbps: -85dBm 6 Mbps (1/2 BPSK): -88dBm 54 Mbps (3/4 64-QAM): -70dBm HT20, MCS7 (65 Mbps, 72.2 Mbps): -67dBm
Power **(Typical Values)**	Continuous Transmission=>Average: 71mA, Peak: 500mA Modem Sleep: 20mA Light Sleep: 2mA Deep Sleep: 0.02mA
WiFi Security Modes	WEP/WPA-PSK/WPA2-PSK
Power supply	Voltage 3.0V ~ 3.6V, Current >500mA
Working temperature	-40°C ~ 105°C
Storage temperature	-40°C ~ 85°C, < 90% RH

2. Pin Definition

Nucleo 4 module has the following pin outs.

2.1. Pin diagram

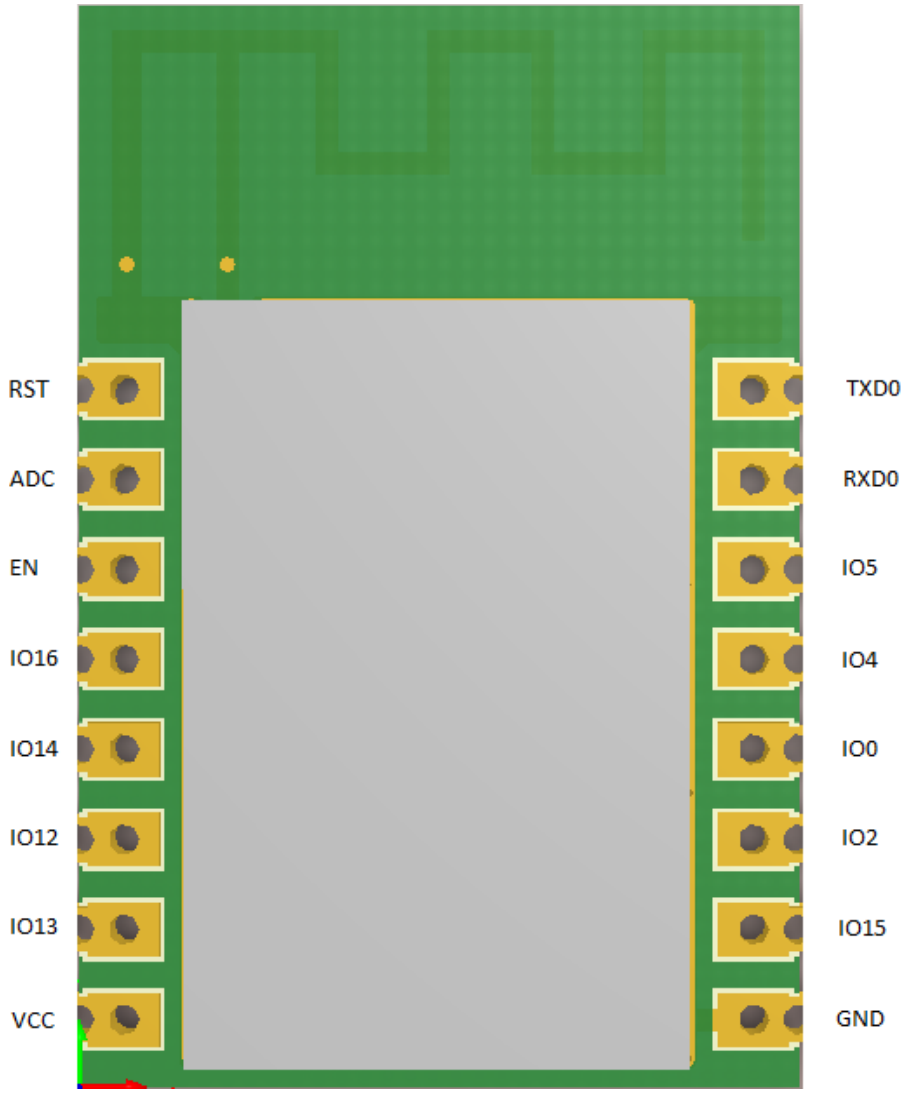

Figure 2: Pinouts of Nucleo 4

2.2. Pin function definition

Pin No.	IO	Function description
1	RST	Reset Pin, Active Low
2	ADC	AD conversion, Input voltage range 0~1V, the value range is 0-1024
3	EN	Chip Enabled Pin, Active High
4	IO16	Connect with RST pin to wake up Deep Sleep
5	IO14	GPIO14; HSPI_CLK
6	IO12	GPIO12; HSPI_MISO
7	IO13	GPIO13; HSPI_MOSI; UART0_CTS
8	VCC	Module power supply pin, Voltage 3.0V ~ 3.6V
9	GND	Ground
10	IO15	GPIO15; MTDO; HSPICS; UART0_RTS
11	IO2	GPIO2; UART1_TXD
12	IO0	GPIO0;HSPI_MISO;I2SI_DATA
13	IO4	GPIO4
14	IO5	GPIO5;IR_R
15	RXD	UART0_RXD; GPIO3
16	TXD	UART0_TXD; GPIO1

Module startup mode description

Mode	CH_PD(EN)	RST	GPIO15	GPIO0	GPIO2	TXD0
Download	High	High	Low	Low	High	High
Running	High	High	Low	high	High	High

Note: *Some pins have been pulled up or pulled down internally, please refer to the schematic diagram*

3. Electrical Parameters

3.1. Electrical Characteristics

Parameter		Condition	Min	Typical	Max	Unit
Maximum soldering temperature		IPC/JEDEC J-STD-020	-	-	260	°C
Voltage		VDD	3.0	3.3	3.6	V
I/O	V_{IL}/V_{IH}	-	-0.3/0.75V_{IO}	-	0.25V_{IO}/3.6	V
	V_{OL}/V_{OH}	-	N/0.8V_{IO}	-	0.1V_{IO}/N	V
	I_{MAX}	-	-	-	12	mA

3.2. RF performance

Description	Min	Typical	Max	Unit
Input Frequency	2400	-	2484	MHz
Input Reflection	-	-	-10	dB
Output power				
PA output power at 72.2 Mbps	15.5	16.5	17.5	dBm
PA output power in 11b mode	19.5	20.5	21.5	dBm
Receiving sensitivity				

CCK, 1 Mbps			<=-90	dBm
CCK, 11 Mbps			<=-88	dBm
6 Mbps (1/2 BPSK)			<=-88	dBm
54 Mbps (3/4 64-QAM)			<=-75	dBm
HT20 (MCS7)			<=-70	dBm
Adjacent channel rejection				
OFDM, 6 Mbps			37	dBm
OFDM, 54 Mbps			21	dBm
HT20, MCS0			37	dBm
HT20, MCS7			20	dBm

3.3. Power consumption

The following power consumption figures are based on a 3.3V power supply, 25 °C ambient temperature, and measured using an internal voltage regulator.

- All measurements are performed at the antenna interface without a SAW filter.
- All transmission data is measured based on 90% duty cycle in continuous transmission mode.

Mode	Min	Typical	Max	Unit
Tx 802.11b, CCK 11Mbps, P_{OUT}=+17dBm	-	170	-	mA
Tx 802.11g, OFDM 54Mbps, P_{OUT} =+15dBm	-	140	-	mA

Tx 802.11n, MCS7, P_{OUT} =+13dBm	-	120	-	mA
Rx 802.11b, packet length is 1024 bytes, -80dBm	-	50	-	mA
Rx 802.11g, packet length is 1024 bytes, -70dBm	-	56	-	mA
Rx 802.11n, packet length is 1024 bytes, -65dBm	-	56	-	mA
Modem-Sleep *	-	20	-	mA
Light-Sleep **	-	2	-	mA
Deep-Sleep ***	-	20	-	uA
Power Off	-	0.5	-	uA

Notes

***** Modem-sleep is used in applications that require the CPU to be always on, such as PWM or I2S applications. When the WiFi connection is maintained, if there is no data transmission, the WiFi Modem circuit can be turned off according to the 802.11 standard (such as U-APSD) to save power. For example, in DTIM3, every 300 ms of sleep and 3 ms of wake up to receive the Beacon packet of the AP, etc., the overall average current is about 20 mA.

****** Light-sleep is used for CPU suspendable applications, such as WiFi switches. When maintaining WiFi connection, if there is no data transmission, you can save power by turning off the WiFi Modem circuit and suspending the CPU according to the 802.11 standard (such as U-APSD). For example, in DTIM3, every 300 ms of sleep and 3 ms of wake-up to receive the Beacon packet of the AP, the overall average current is about 2 mA.

******* Deep-sleep is used for applications that do not need to keep WiFi connection for a long time, such

as a sensor that measures temperature every 100s. For example, after waking up from 300s to 0.3s ~ 1s to connect to the AP to send data, the overall average current can be much less than 1 mA. The current value of 20 µA was measured at 2.5V.

For Deep-sleep applications, it is recommended to use a 470Ω resistor in series with the Reset Pin.

4. Dimensions

All dimensions are in mm. Tolerance ±0.2mm

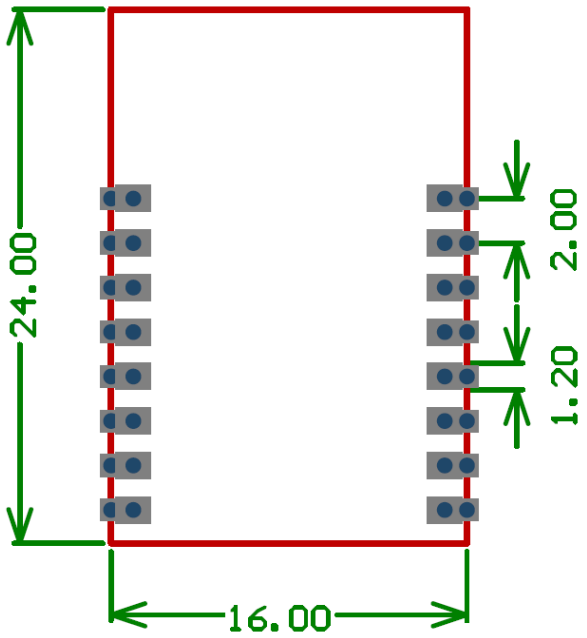

Figure 3: Dimensions of Nucleo 4

5. Schematic

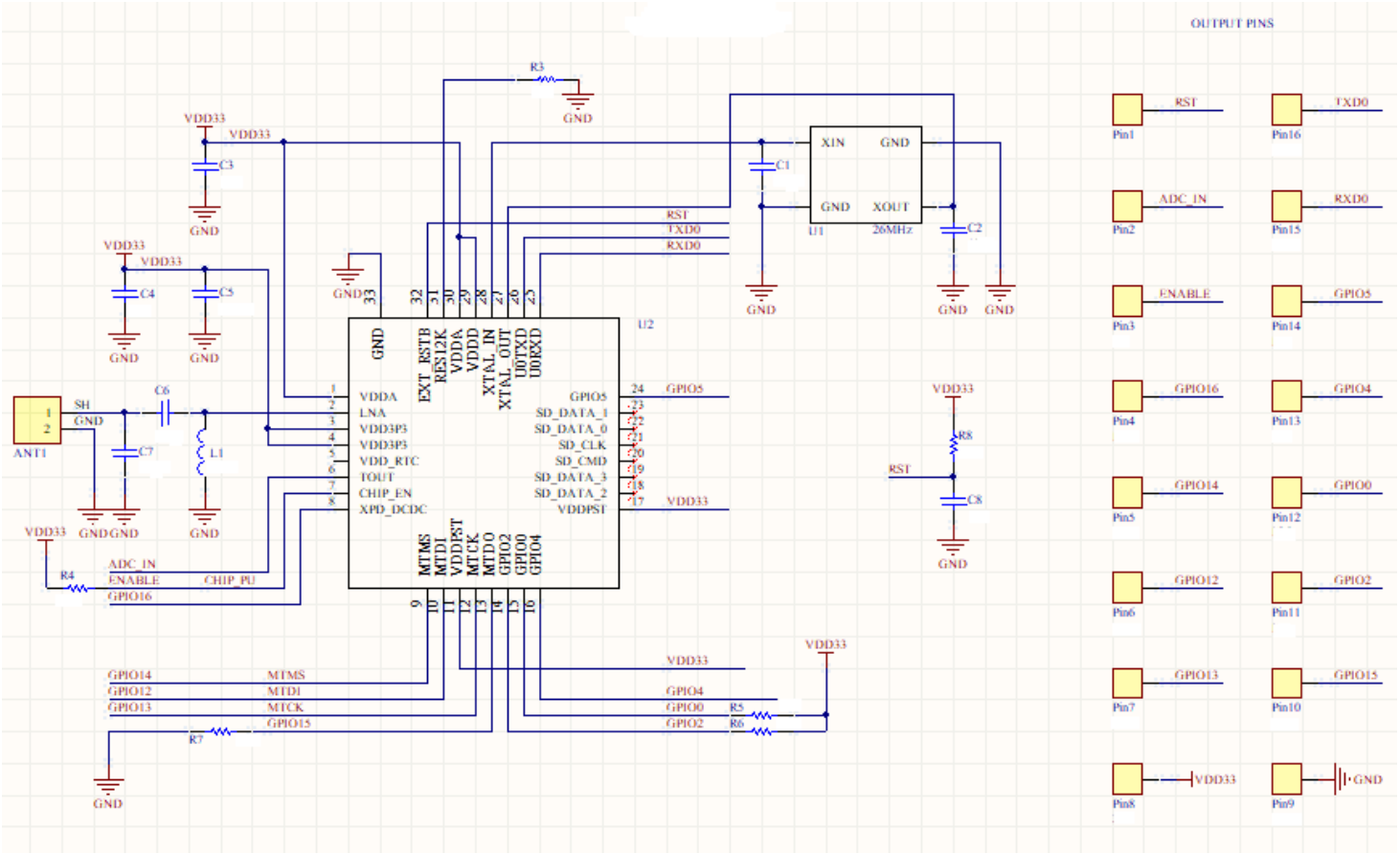

Figure 4: Schematics of Nucleo 4 Module

5.1. Application circuit

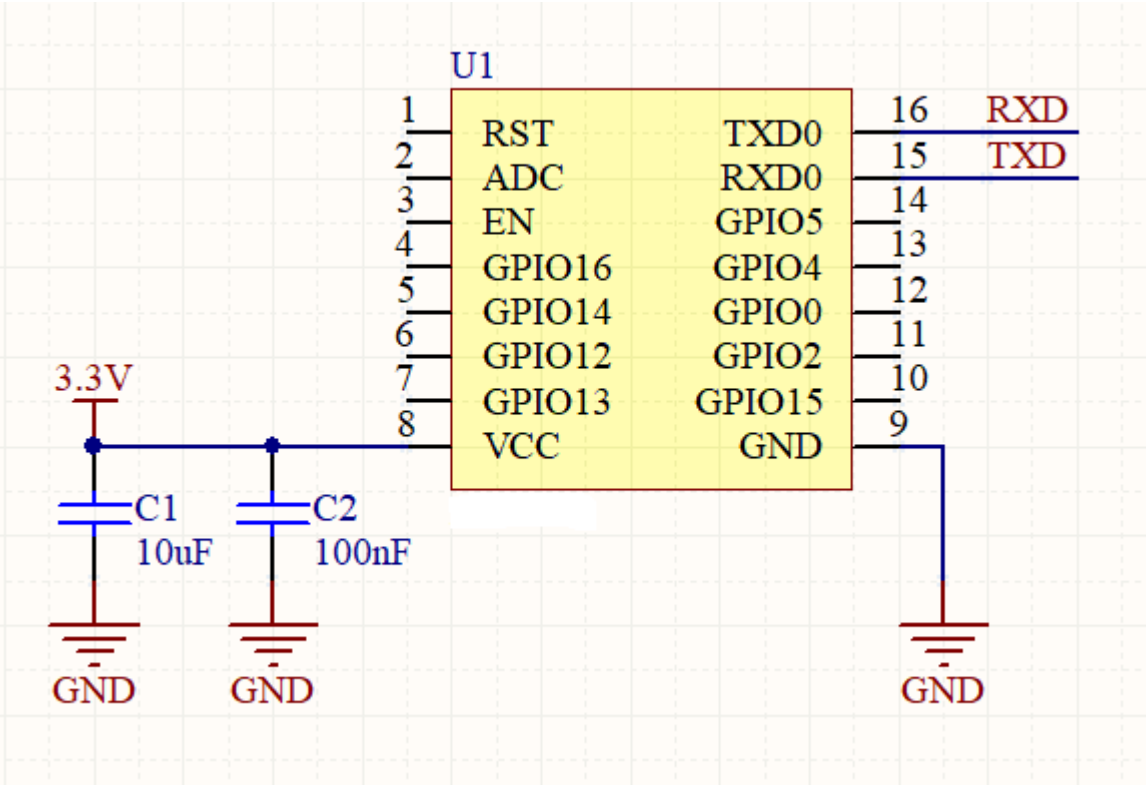

Figure 5: Typical Application circuit for Nucleo 4 Module

5.2. Antenna Layout Requirements

For the installation position on the PCB, the following two methods are recommended:

Solution 1: Place the module on the edge of the motherboard, and the antenna area extends beyond the edge of the motherboard.

Solution 2: Place the module on the edge of the motherboard, and the edge of the motherboard hollows out an area at the antenna position.

In order to meet the performance of the on-board antenna, it is forbidden to place metal parts around the antenna and keep it away from high-frequency devices.

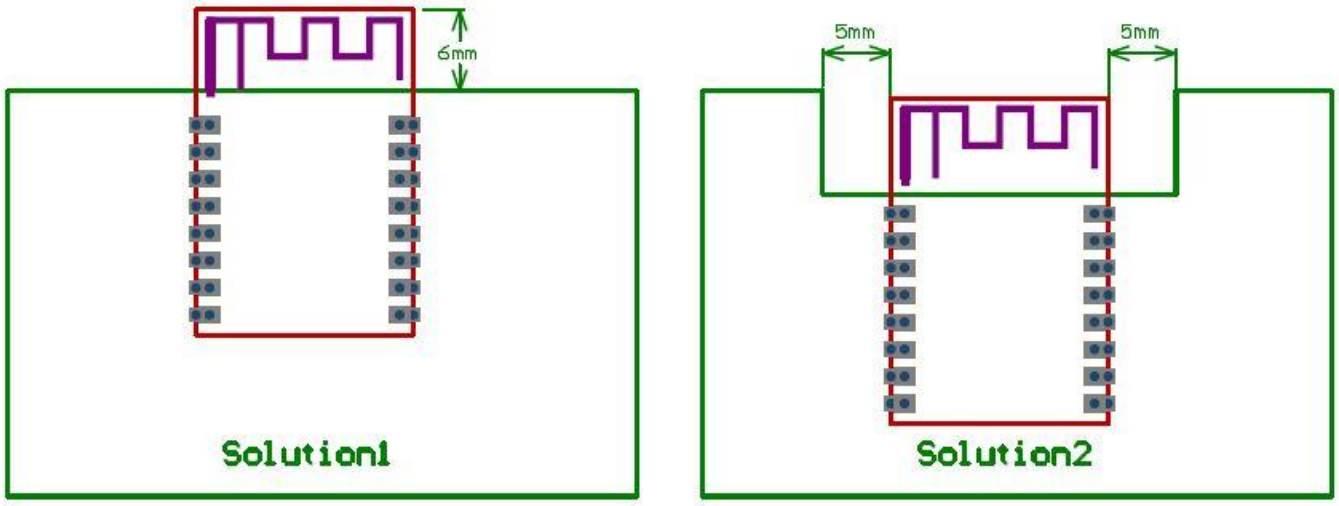

Figure 6: Recommended Installation Positions

5.3. Power supply

- Recommended 3.3V voltage, peak current above 500mA
- It is recommended to use LDO power supply; if using DC-DC, it is recommended to control the ripple within 30mV.
- The DC-DC power supply circuit is recommended to reserve the position of the dynamic response capacitor, which can optimize the output ripple when the load changes greatly.
- 3.3V power interface is recommended to add ESD devices.

5.4. Use of GPIO ports

Some GPIO ports are led out of the module. If you need to use a 10-100 ohm resistor in series with the IO port. This can suppress overshoot, and the levels on both sides are more stable. This helps in both EMI and ESD.

The special IO port is pulled up and down, please refer to the instruction manual of the specification, this will affect the startup configuration of the module.

The IO port of the module is 3.3V. If the IO level of the main control and the module does not match, a level conversion circuit needs to be added.

If the IO port is directly connected to a peripheral interface, or a pin or other terminal, it is recommended to reserve an ESD device near the terminal of the IO trace.

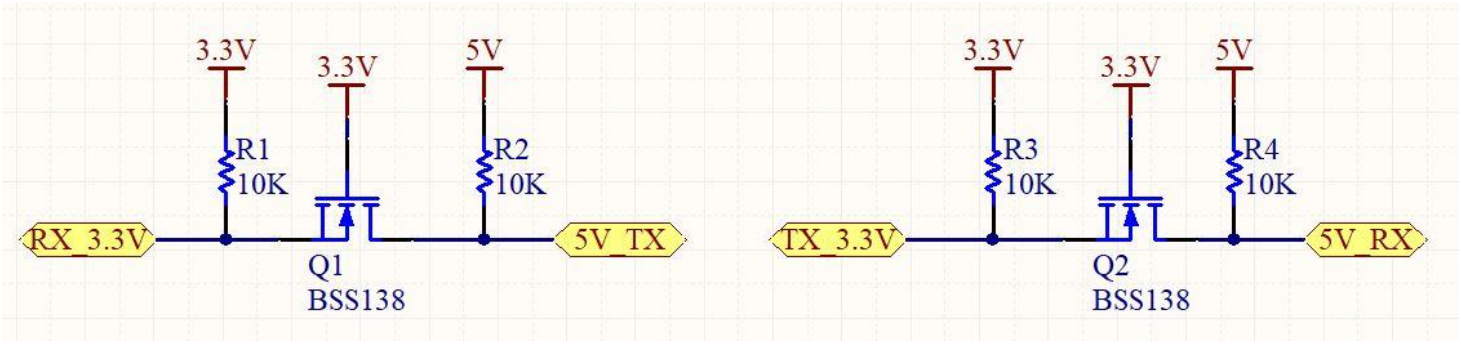

Figure 7: Reference Level Shifting Circuit

6. Reflow Profile

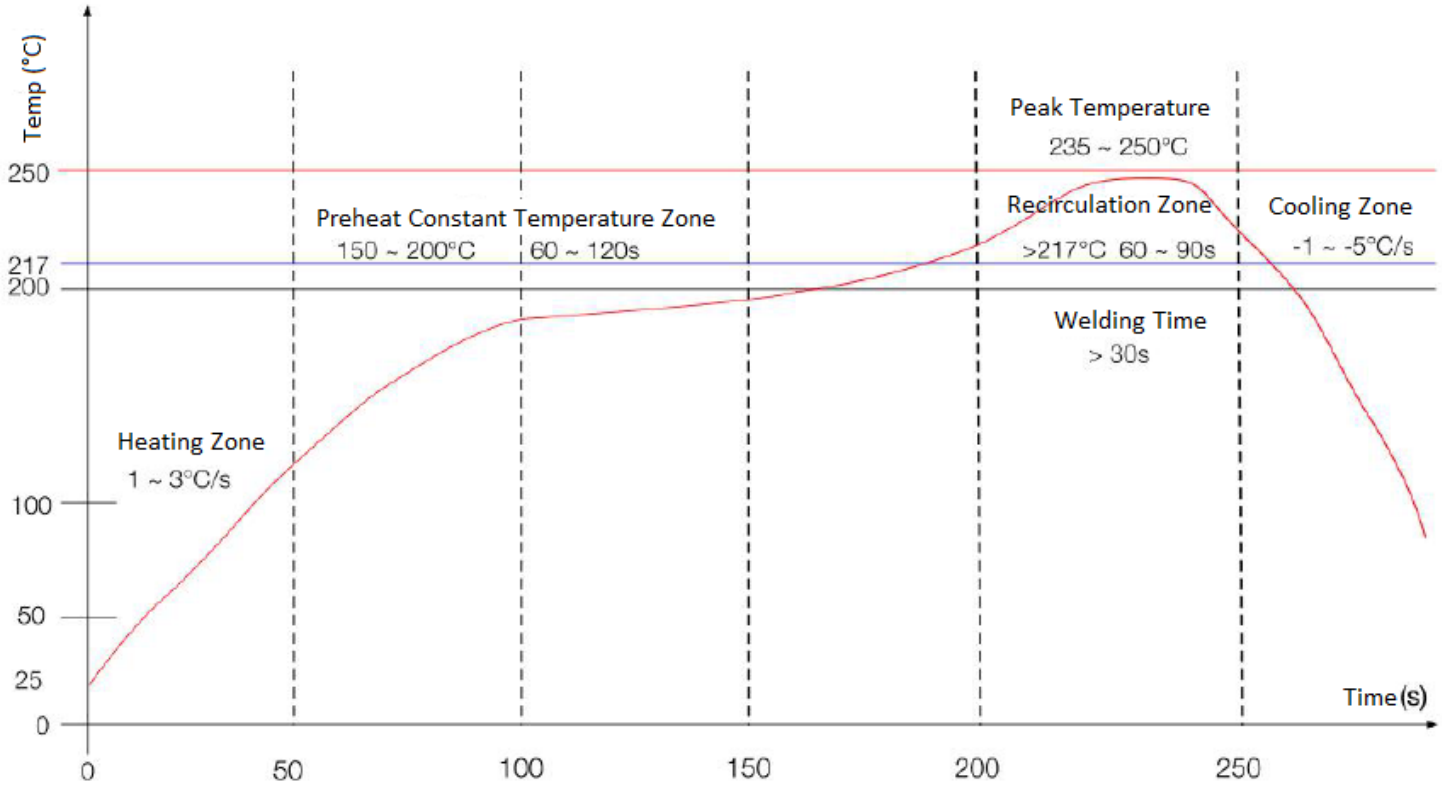

Figure 8: Reflow Profile

Heating Zone	Temperature: 25~150°C	Time: 60-90 sec	Heating Slope: 1-3°C/sec
Preheating Constant Temperature Zone	Temperature: 150~200°C	Time: 60-120 sec	
Reflow Soldering Zone	Temperature>217°C Peak Temp: 235~250°C	Time: 60-120 sec Time:30~70 sec	
Cooling Zone	Peak Temp: 180°C	Cooling Slope: -5°C/sec	

7. Packaging

The packaging of Nucleo 4 is in tray form.

8. Contact Us

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