REYAX
TECHNOLOGY CORPORATION, LTD

RYLR993

868/915MHz LoRaWAN® & Proprietary Dual Mode Transceiver Module

Datasheet

13mm*13mm*2.2mm

PRODUCT DESCRIPTION

The RYLR993 868/915MHz LoRaWAN® Transceiver Module feature the LoRa long range modem that provides ultra-long range spread spectrum communication and high interference immunity whilst minimising current consumption.

FEATURES

- ST STM32WLE5CCU6 256KB flash Industrial LoRa® SOC Engine.
- Customized firmware design service is available.
- AT Command over UART interface
- High sensitivity.
- Temperature sensor.
- Low power consumption.
- AES128 CCM Data encryption
- LoRaWAN® class A, B & C support
- LoRaWAN® and LoRa® Proprietary selection.
- Support bands : US915, EU868, AS923, IN865, KR920, RU864
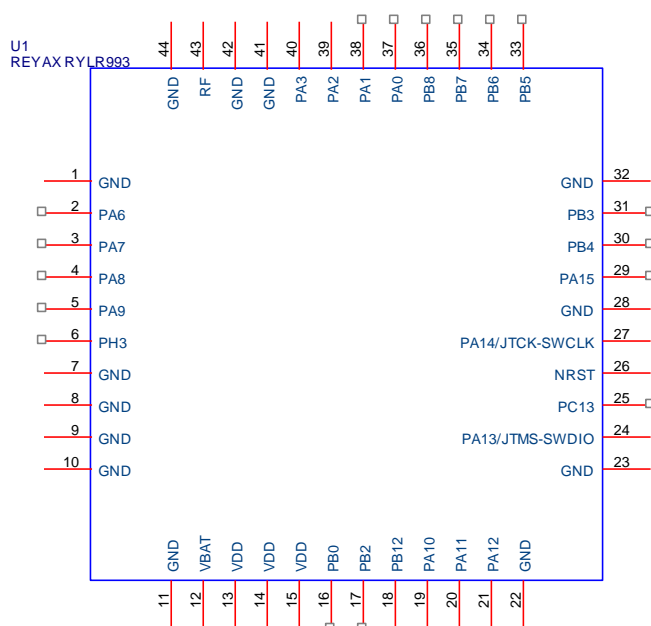- Support REYAX RYLR998 proprietary mode

APPLICATIONS

- IoT Applications
- Mobile Equipment
- Home Security
- Industrial Monitoring and Control Equipment
- Car Alarm

CERTIFICATION
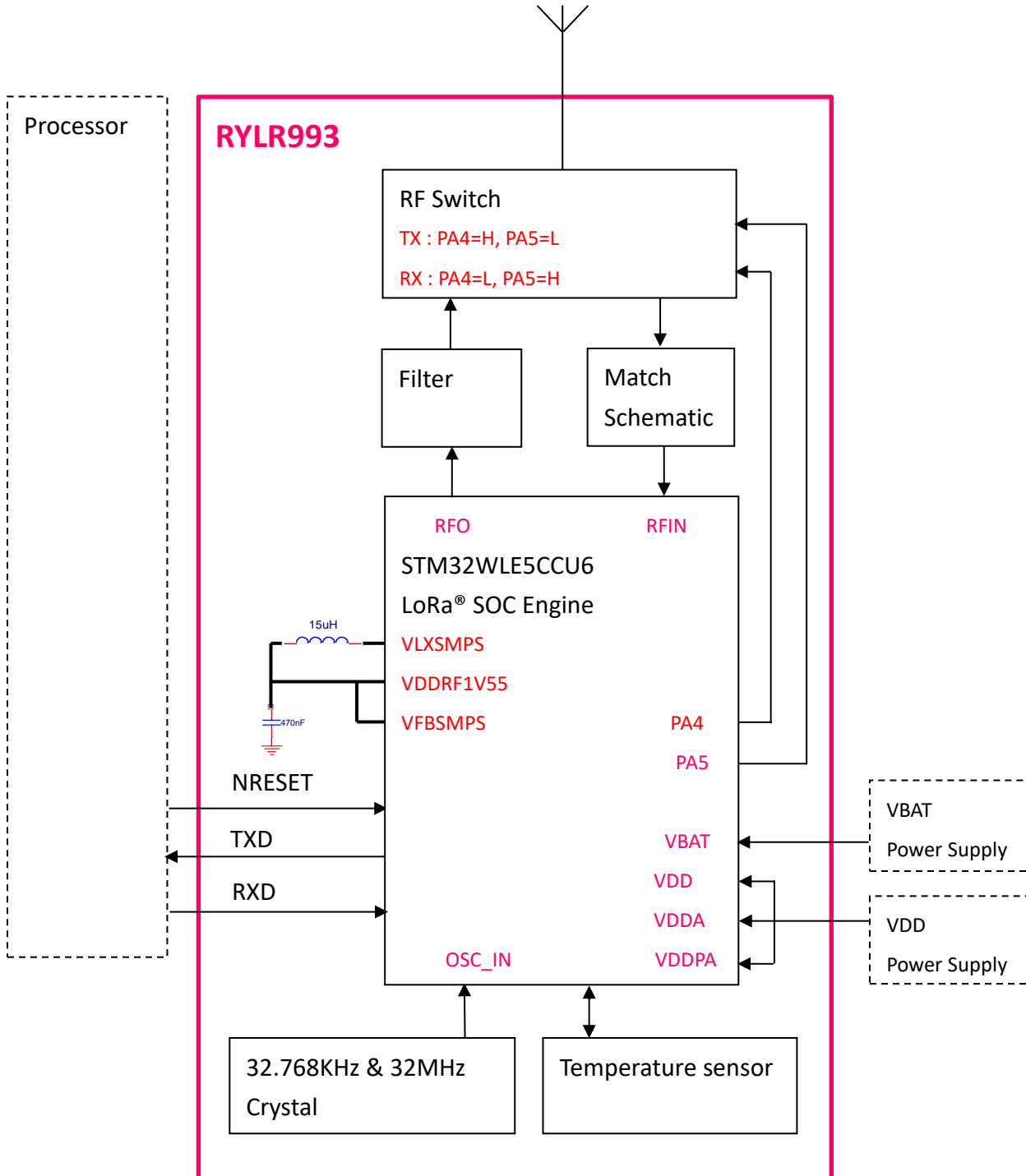
- CE RED
- FCC
- MIC Japan
- NCC

PIN DESCRIPTION

Pin	Name	I/O	Condition
1	GND	-	Ground
2	PA6	I/O	Not Connected, Reserved for future applications
3	PA7	I/O	Not Connected, Reserved for future applications
4	PA8	I/O	Not Connected, Reserved for future applications
5	PA9	I/O	Not Connected, Reserved for future applications
6	PH3	I	Add a 10KΩ resistor between GND and PH3.
7	GND	-	Ground
8	GND	-	Ground
9	GND	-	Ground
10	GND	-	Ground
11	GND	-	Ground
12	VBAT	I	The RTC and the backup registers power supply
13	VDD	I	VDD, VDDA, VDDPA Power supply
14	VDD	I	VDD, VDDA, VDDPA Power supply
15	VDD	I	VDD, VDDA, VDDPA Power supply
16	PB0	I/O	Not Connected, Reserved for future applications
17	PB2	I/O	Not Connected, Reserved for future applications

18	PB12	I/O	Not Connected, Reserved for future applications
19	PA10	O	RF_RX_ACTIVE Indicator, When data is received, This pin will output high for 500 ms.
20	PA11	O	RF_TX_ACTIVE Indicator, When data is transmitted, This pin will output high for 500 ms.
21	PA12	O	LoRaWAN Link indicator, When the RYLR993 not connect to LoRa gateway, This pin will output Hi 500ms and Low 500ms continuously.
22	GND	-	Ground
23	GND	-	Ground
24	PA13/JTMS-SWDIO	I/O	Not Connected, Reserved for future applications
25	PC13	I/O	Not Connected, Reserved for future applications
26	NRST	I	Low reset trigger input
27	PA14/JTCK-SWCLK	I/O	Not Connected, Reserved for future applications
28	GND	-	Ground
29	PA15	I/O	Not Connected, Reserved for future applications
30	PB4	I/O	Not Connected, Reserved for future applications
31	PB3	I/O	Not Connected, Reserved for future applications
32	GND	-	Ground
33	PB5	I/O	Not Connected, Reserved for future applications
34	PB6	I/O	Not Connected, Reserved for future applications
35	PB7	I/O	Not Connected, Reserved for future applications
36	PB8	I/O	Not Connected, Reserved for future applications
37	PA0	I/O	Not Connected, Reserved for future applications
38	PA1	I/O	Not Connected, Reserved for future applications
39	PA2/TXD	O	UART Data Output
40	PA3/RXD	I	UART Data Input
41	GND	-	Ground
42	GND	-	Ground
43	RF	I/O	RF Input/Output
44	GND	-	Ground

BLOCK DIAGRAM

SPECIFICATION

Item	Min.	Typical	Max.	Unit	Condition
VDD Power Supply	1.8	3.3	3.6	V	
VBAT Power Supply	1.55	3.3	3.6	V	
Frequency Accuracy		±10		ppm	at 25°C ±3°C
RF Output Power Range	-4	20	22	dBm	
RF Harmonic			-36	dBm	
RF sensitivity	-148			dBm	
RF Input Level			10	dBm	
Filter insertion loss	1	2	3	dB	
Frequency Range	820	868/915	960	MHz	
Transmit Current		140		mA	RFOP = +22 dBm
Class A Current		5		uA	
Class B & C Current		5		mA	
Baud rate		9600		bps	8, N, 1
Temperature sensor Accuracy		2		°C	
Digital input level high	0.8		VDD	V	VIH
Digital input level low			0.2	V	VIL
Digital output level high	0.9			V	VOH Imax = 1 mA
Digital output level low			0.1	V	VOL Imax = -1 mA
Operating Temperature	-40	25	+85	°C	
Dimensions					13mm*13mm*2.2mm
Weight		0.71		g	

TRANSMIT POWER CONSUMPTION TEST

(PROPRIETARY MODE)

AT+CRFOP (dBm)	Typical Current (mA) VDD=3.3V	
0	44.9	
1	47.6	
2	51.4	
3	54.0	
4	58.4	
5	61.2	
6	64.7	
7	68.8	
8	72.9	
9	77.2	
10	81.5	
11	85.9	
12	91.1	
13	97.1	
14	102.5	
15	107.5	
16	111.8	
17	115.5	
18	119.5	
19	123.2	
20	126.9	
21	130.0	
22	135.5	

APPLICATION SCHEMATIC
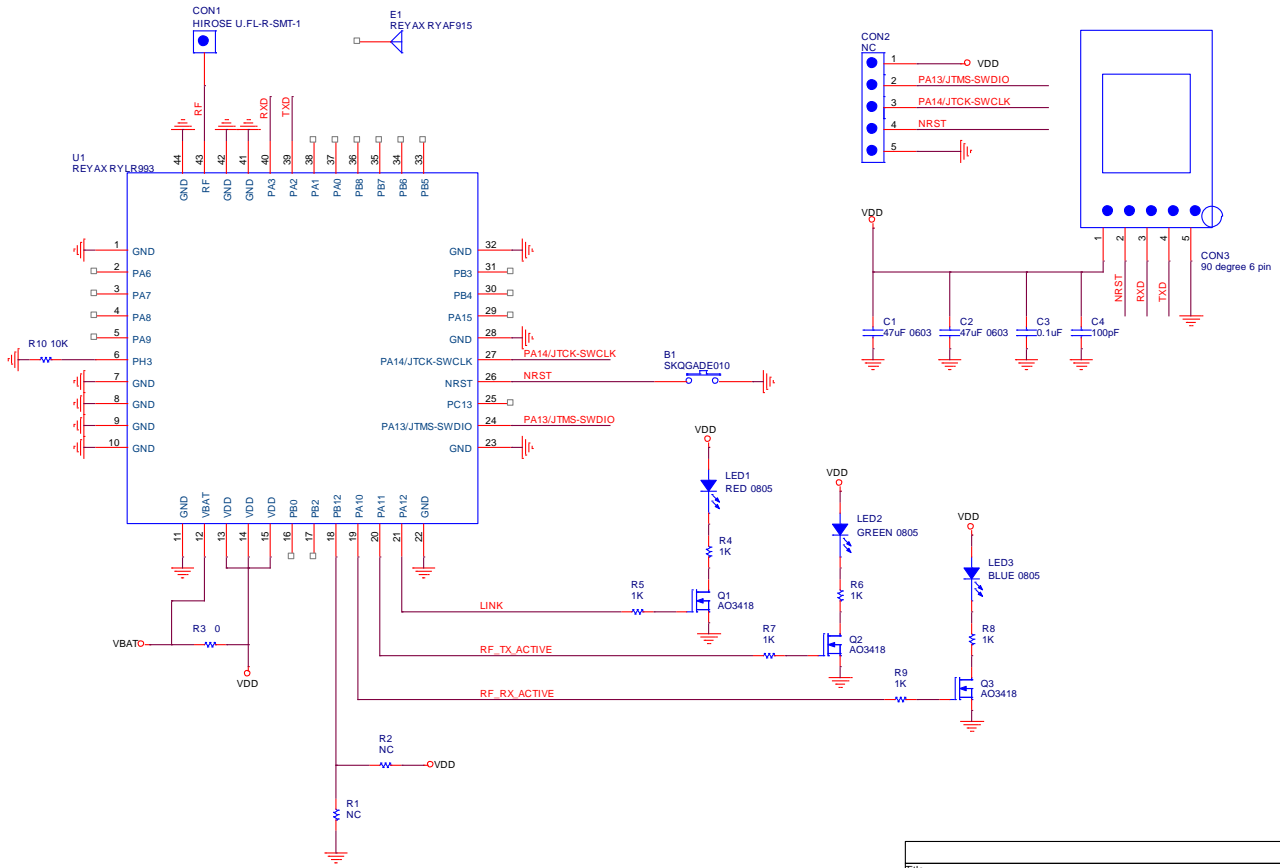
Title			
	RYLR993_Lite		
Size CustomxDoc>	Document Number		Rev 1.2
Date:	Tuesday , August 09, 2022	Sheet 1 of 1	

REFLOW SOLDERING

Consider the "IPC-7530 Guidelines for temperature profiling for mass soldering (reflow and wave) processes, published 2001. **Only single reflow soldering processes are recommended for REYAX modules. Repeated reflow soldering processes and soldering the module upside down are not recommended.**

Preheat phase

Initial heating of component leads and balls. Residual humidity will be dried out. Please note that this preheat phase will not replace prior baking procedures.

- Temperature rise rate: max. 3 °C/s If the temperature rise is too rapid in the preheat phase it may cause excessive slumping.
- Time: 60 - 120 s If the preheat is insufficient, rather large solder balls tend to be generated.
  Conversely, if performed excessively, fine balls and large balls will be generated in clusters.
- End Temperature: 150 - 200 °C If the temperature is too low, non-melting tends to be caused in
  areas containing large heat capacity.

Heating/ Reflow phase

The temperature rises above the liquidus temperature of 217°C. Avoid a sudden rise in temperature as the slump of the paste could become worse.

- Limit time above 217 °C liquidus temperature: 40 - 60 s
- Peak reflow temperature: 245 °C

Cooling phase

A controlled cooling avoids negative metallurgical effects (solder becomes more brittle) of the solder and possible mechanical tensions in the products. Controlled cooling helps to achieve bright solder fillets with a good shape and low contact angle.

- Temperature fall rate: max 4 °C/s To avoid falling off, the REYAX module should be placed on the topside of the motherboard during soldering.
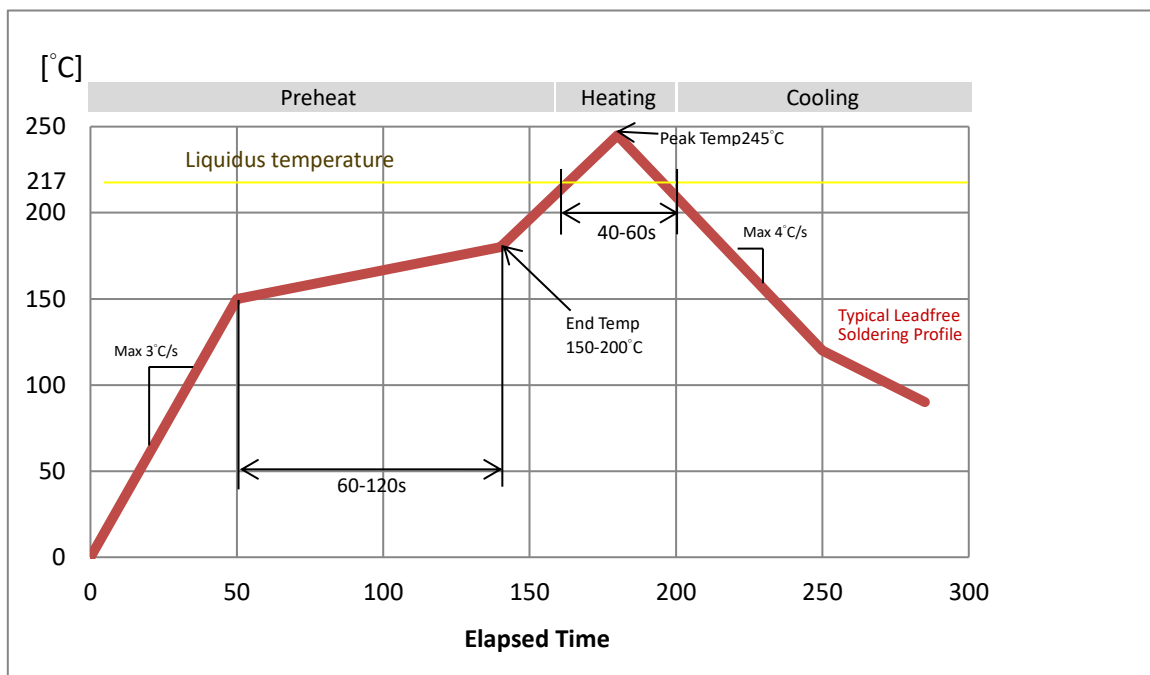
Recommended soldering profile

CERTIFICATIONS

ETSI EN 300 220-1 V3.1.1 (2017-02)

ETSI EN 300 220-2 V3.2.1 (2018-06)

- **FCC Statement:**

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.

NOTE: 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 or more 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.
Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

LABEL OF THE END PRODUCT:
The final end product must be labeled in a visible area with the following " Contains TX FCC ID : QLY-RYLR993 ". If the size of the end product is larger than 8x10cm, then the following FCC part 15.19 statement has to also be available on the label: This device complies with Part 15 of 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.

 QLYRYLR993

- **MIC Japan compliance**

 020-230271
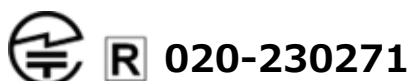
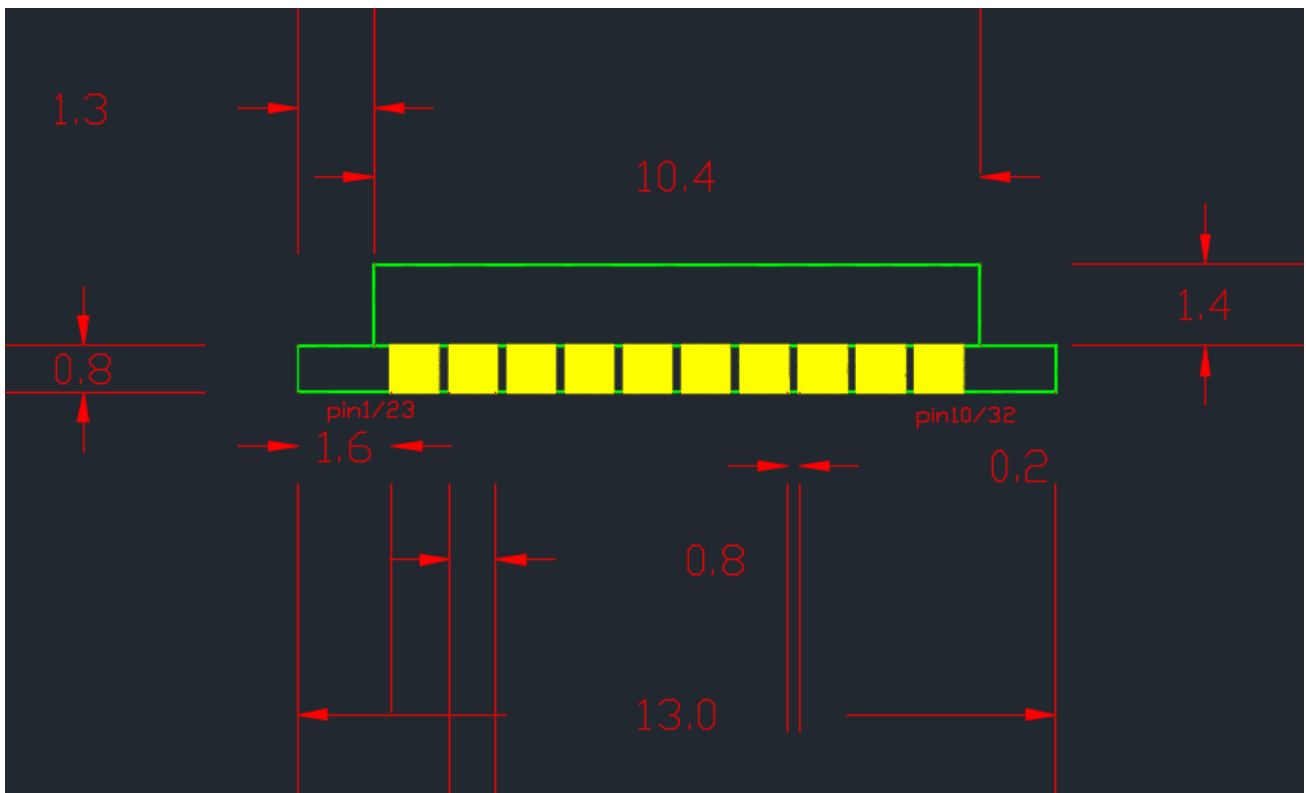上記のとおり、電波法第 38 条の 24 第 1 項の規定による特定無線設備の工事設計についての認証を行ったものであることを証する。

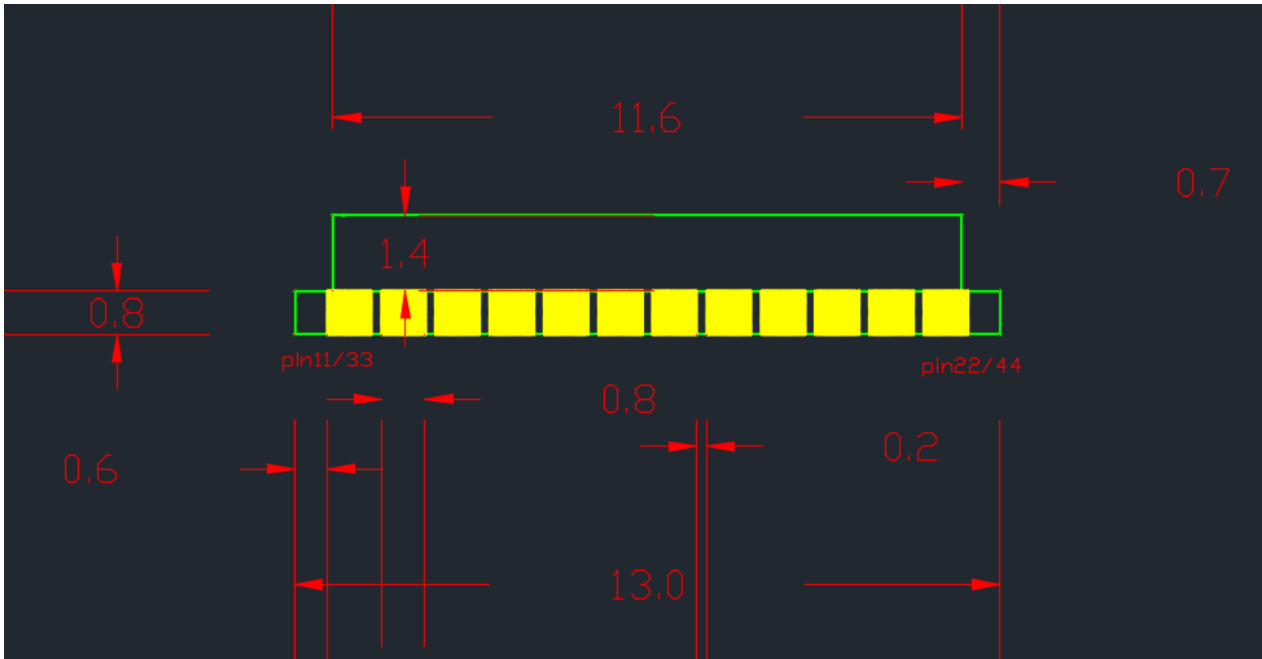- **Taiwan NCC Statement** 低功率電波輻射性電機管理辦法:

第十二條 經型式認證合格之低功率射頻電機，非經許可，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。

第十四條 低功率射頻電機之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。前項合法通信，指依電信法規定作業之無線電通信。低功率射頻電機須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。
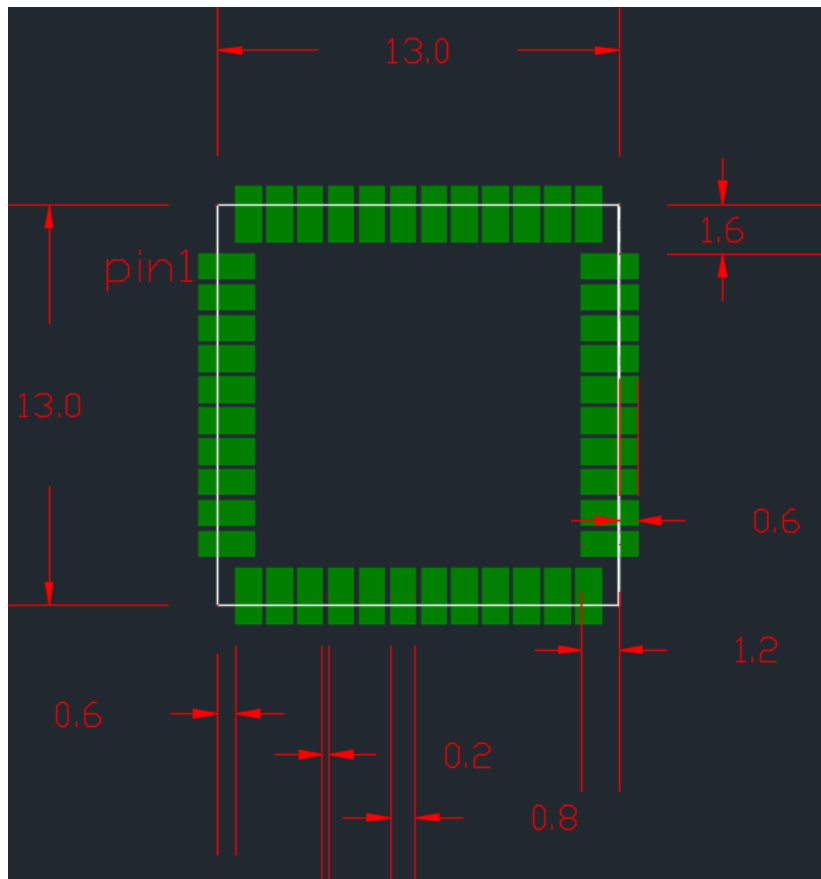
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DIMENSIONS

Unit : mm

LAYOUT FOOTPRINT RECOMMENDATIONS

Unit : mm

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