

**TRUEWAVE**  
**TW1318 BLE MODULE**  
**DATASHEET**

**MoMAGIC**  
Data Driven Intelligence

---

*TW1318 Datasheet*  
*Version 1.0*

---

## TABLE OF CONTENTS

<b>1. INTRODUCTION .....</b>	<b>3</b>
<b>2. FEATURES.....</b>	<b>3</b>
<b>3. APPLICATIONS.....</b>	<b>4</b>
<b>4. GENERAL BLOCK DIAGRAM .....</b>	<b>4</b>
<b>4.1 CONTROLLER BLOCK DIAGRAM.....</b>	<b>5</b>
<b>4.2 BLOCK DIAGRAM SHORT DESCRIPTION .....</b>	<b>6</b>
<b>4.3 RF BLOCK DIAGRAM.....</b>	<b>6</b>
<b>4.4. RF BLOCK DIAGRAM SHORT DESCRIPTION.....</b>	<b>7</b>
<b>5. SPECIFICATIONS.....</b>	<b>8</b>
<b>5.1 ABSOLUTE MAXIMUM RATING.....</b>	<b>8</b>
<b>5.2 OPERATING CONDITIONS.....</b>	<b>8</b>
<b>5.3 CRYSTAL SPECIFICATION.....</b>	<b>9</b>
<b>5.4 RF GENERAL CHARACTERISTICS.....</b>	<b>9</b>
<b>5.5 RF TRANSMITTER CHARACTERISTICS.....</b>	<b>9</b>
<b>5.6 RF RECEIVER CHARACTERISTICS .....</b>	<b>10</b>
<b>5.7 CURRENT CONSUMPTION .....</b>	<b>10</b>
<b>6. PIN ASSIGNMENT .....</b>	<b>11</b>
<b>6.1 PIN DETAILS.....</b>	<b>11</b>
<b>6.2 MODULE TOP AND BOTTOM VIEW .....</b>	<b>12</b>
<b>7. MODULE DIMENSION .....</b>	<b>13</b>
<b>8. SOLDER FOOTPRIN/LAND PATTERN .....</b>	<b>14</b>
<b>9. FCC ID: 2A2OT-TW1318 .....</b>	<b>15</b>
<b>9.1 LABELLING INSTRUCTION FOR HOST PRODUCT INTEGRATOR .....</b>	<b>15</b>
<b>9.2 INSTALLATION NOTICE TO HOST PRODUCT MANUFACTURER .....</b>	<b>15</b>
<b>9.3 ANTENNA CHANGE NOTICE TO HOST MANUFACTURER.....</b>	<b>15</b>
<b>9.4 FCC OTHER PARTS, PART 15B COMPLIANCE REQUIREMENTS FOR HOST PRODUCT MANUFACTURER .....</b>	<b>16</b>

## 1. INTRODUCTION

The TW1318 module is an ultra-low power programmable Bluetooth® Low Energy wireless solution. It embeds Arm® Cortex®-M0+ microcontroller that can operate up to 64 MHz and the BlueNRG core co-processor (DMA based) for Bluetooth Low Energy timing critical operations. It is compliant with Bluetooth® Low Energy SIG core specification version 5.3 addressing point-to-point connectivity and Bluetooth Mesh networking and allows large-scale device networks to be established in a reliable way. The TW1318 module is also suitable for 2.4 GHz proprietary radio wireless communication to address ultra-low latency applications.

## 2. FEATURES

- ❖ High performance and ultra-low power Arm® Cortex®-M0+ 32-bit, running up to 64MHz
- ❖ Low Energy system-on-chip supporting Bluetooth 5.3 with 2mbps data rate.
- ❖ Ultra-low power radio performance.
- ❖ The MCU provides On-chip non-volatile Flash memory of 192 kB and On-chip RAM of 24 kB + 4 kB PKA RAM.
- ❖ Operating supply voltage: from 1.7 to 3.6 V
- ❖ Output power up to +8 dBm (at antenna connector)
- ❖ RX sensitivity level: -97 dBm @ 1 Mbps, -104 dBm @ 125 kbps (long range)
- ❖ Embedded MLPF-NRG-01D3 integrated matched balun with harmonic filter.
- ❖ Interfaces
  - 1xUART, 7xGPIO, SWD debug interface
- ❖ Integrated with high performance small form factor chip antenna.
- ❖ Small module form factor: **(L)**11.5mm x **(W)**13.5mm x **(H)** 2.30mm

### 3. APPLICATIONS

1. Internet of Things
2. Smart Home / Smart Lighting
3. Building and industrial Automation
4. Remote and access control
5. Fitness, Wellness and Sports
6. Metering Applications
7. Healthcare, consumer medical
8. Mobile phone and PC peripherals

### 4. GENERAL BLOCK DIAGRAM

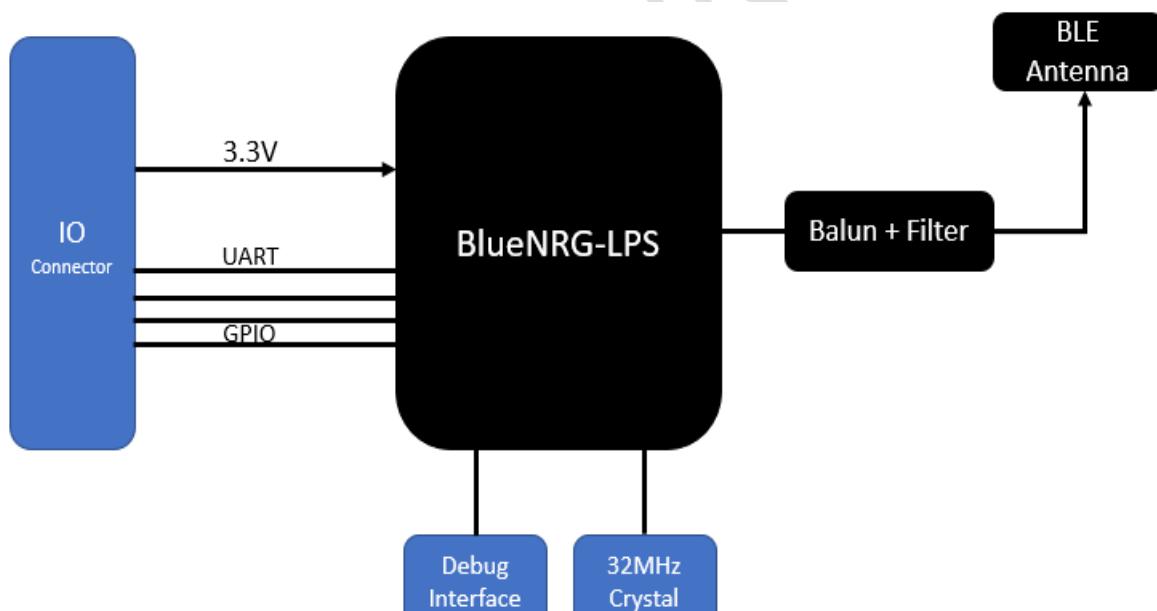
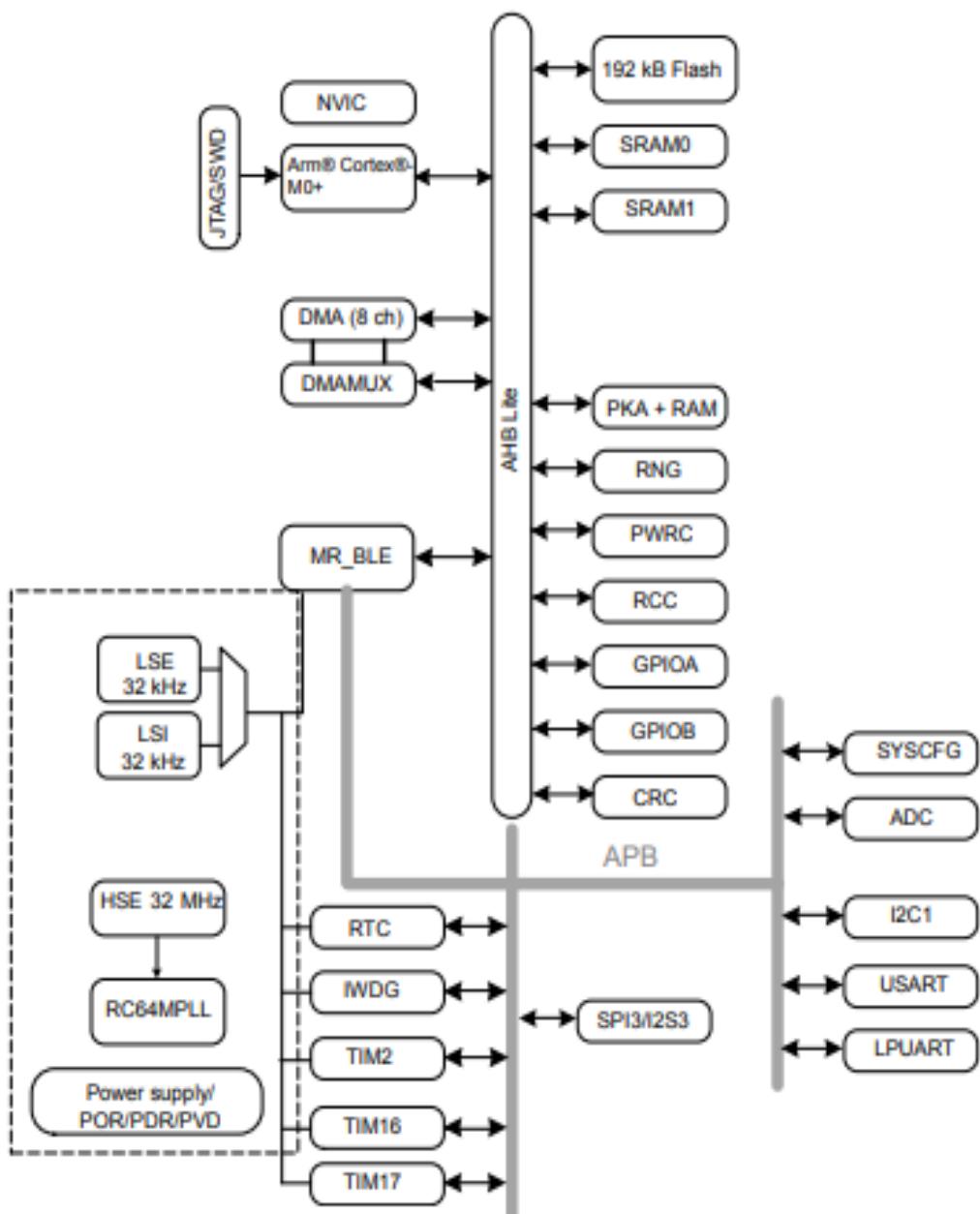


Figure 1. TW1318 Block diagram

## 4.1 CONTROLLER BLOCK DIAGRAM



**Figure 2. BlueNRG-LPS Block diagram**

## 4.2 BLOCK DIAGRAM SHORT DESCRIPTION

- Core and Processing:** Cortex-M0+ microcontroller and Bluetooth Low Energy co-processor.
- Memory:** Flash, RAM, OTP, and ROM memory blocks.
- Communication Interfaces:** SPI/I2S, UART, USART, I2C, and more (TW1318 use UART only)
- Radio and Wireless:** Bluetooth Low Energy 5.3 features and 2.4 GHz proprietary radio.
- Security Hardware:** RNG, AES, PKA, CRC, and unique ID.
- Analog Features:** ADC for external/internal sources, battery monitoring, and temperature sensing.
- Power Management:** SMPS, PDR, RTC, and low-power modes.
- Timers:** General-purpose and low-power timers.

## 4.3 RF BLOCK DIAGRAM

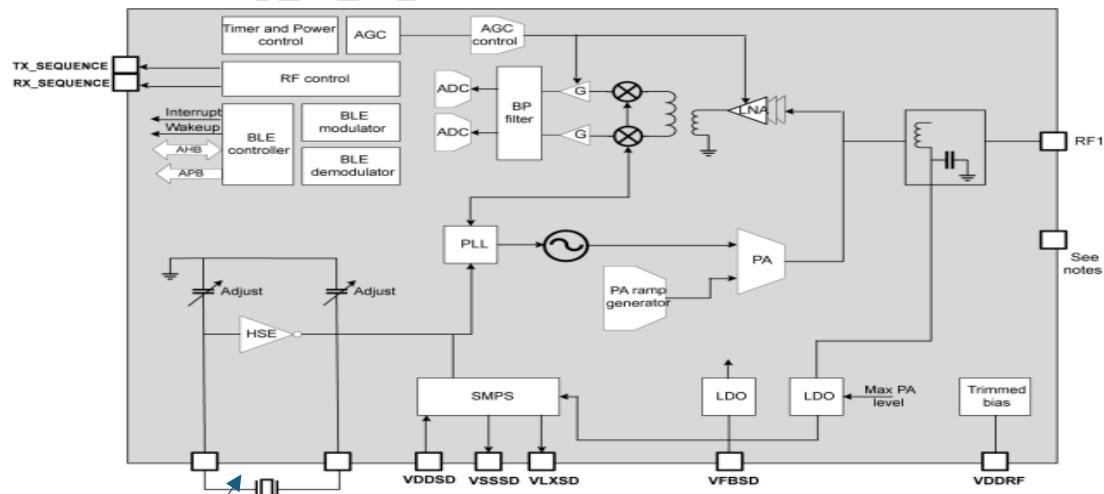


Figure 3. BlueNRG-LPS RF block diagram

## 4.4. RF BLOCK DIAGRAM SHORT DESCRIPTION

### Input and Control:

1. **TX\_SEQUENCE and RX\_SEQUENCE:** Input signals for the transmitter and receiver sequences.
2. **Timer and Power Control:** Manages timing and power distribution for the RF system.
3. **Interrupt & Wakeup Control:** Interfaces with the AHB and APB buses for system management.

### BLE Controller and Modulation:

- **BLE Controller:** Handles the core Bluetooth Low Energy (BLE) control logic.
- **BLE Modulator:** Prepares data for RF transmission.
- **BLE Demodulator:** Processes received RF signals for the BLE stack.

### Analog Front-End:

1. **AGC Control:** Automatic Gain Control for signal optimization.
2. **ADC:** Analog-to-digital converters for sampling signals.
3. **Band-Pass Filter (BP Filter):** Filters the frequency spectrum to isolate the desired signals.
4. **Mixers:** Perform frequency translation for signal modulation/demodulation.

### PLL and Power Amplification:

1. **PLL (Phase-Locked Loop):** Generates precise RF carrier frequencies.
2. **PA (Power Amplifier):** Amplifies the RF signal for transmission.
  - Includes a **PA Ramp Generator** to control signal rise and fall characteristics.
3. **Trimmed Bias:** Provides stable biasing for RF components.

**Power Management:**

- **SMPS (Switched-Mode Power Supply):** Ensures efficient power delivery to various modules.
- **LDO (Low Dropout Regulators):** Stabilize power levels for sensitive components.

**Output:**

- **RF Control:** Manages the output RF signals.
- **RF1:** The primary RF output interface.

**External Connections:**

- **HSE:** 32MHz High-speed external oscillator for frequency reference.
- Multiple power supply connections: VDDSD, VSSSD, VLXSD, VFBSD, and VDDRF.

**5. SPECIFICATIONS****5.1 ABSOLUTE MAXIMUM RATING**

Items	Min.	Max.	Unit
Signals and I/O pin Voltage	-0.3	+3.9	V
DC voltage on RF pin	-0.3	+1.4	V
Operating ambient Temperature	-40	+85	°C
Storage temperature range	-40	+125	°C
Frequency range	2402	2480	MHz

**5.2 OPERATING CONDITIONS**

Items	Min.	Typ.	Max.	Unit
<b>Battery supply voltage</b>	1.7	3.3	3.6	V
<b>Analog supply voltage</b>	1.2	-	1.32	V
<b>RF supply voltage</b>		1.4		V
<b>I/O supply voltage</b>	1.7		3.6	V

### 5.3 CRYSTAL SPECIFICATION

Items	Min.	Typ.	Max.	Unit
<b>Nominal Frequency</b>		32		MHz
<b>Load Capacitance</b>		6		pF
<b>Frequency Stability over Temperature</b>		±10		ppm

### 5.4 RF GENERAL CHARACTERISTICS

All performance data are referred to a  $50\ \Omega$  antenna connector.

Items	Min.	Typ.	Max.	Unit
<b>Frequency range</b>	2400		2483.5	MHz
<b>RF channel centre frequency</b>	2402		2480	MHz
<b>RF channel spacing</b>		2		MHz
<b>Frequency deviation</b>		250		kHz
<b>Frequency deviation average</b>	450		550	kHz
<b>Centre frequency deviation</b>	During the packet and including both initial frequency offset and drift		±150	kHz
<b>On-air data rate</b>	1		2	Mbps
<b>Modulation scheme</b>	GFSK			
<b>Maximum output</b>	At antenna connector, VSMPS = 1.9 V, LDO code		+8	dB
<b>Minimum output</b>	At antenna connector		-20	dB
	@ 27 °C		±1.5	dB
<b>RF power accuracy</b>	All temperatures		±2.5	dB

### 5.5 RF TRANSMITTER CHARACTERISTICS

All performance data are referred to a  $50\ \Omega$  antenna connector at 2Mbps.

Items	Min.	Typ.	Max.	Unit
<b>6 dB bandwidth for modulated carrier</b>	Using resolution bandwidth of 100 kHz	670		kHz
<b>In-band emission at <math>\pm 4\ \text{MHz}</math>, <math>\pm 5\ \text{MHz}</math>, <math>\pm [6+n]\ \text{MHz}</math>, where <math>n=0,1,2</math>.</b>	Using resolution bandwidth of 100 kHz and average detector	-20	-30	dBm
<b>Spurious emission</b>	Harmonics included. Using resolution bandwidth of 1 MHz and average detector		-41	dB
<b>Frequency drift</b>	Integration interval #n – integration interval #0, where $n=2,3, 4\dots k$	-50	+50	kHz
<b>Initial carrier frequency drift</b>	Integration interval #1 – integration interval #0	-23	+23	kHz
<b>Intermediate carrier frequency drift</b>	Integration interval #n – integration interval #(n-5), where $n=6,7, 8\dots k$	-20	+20	kHz
<b>Maximum drift rate</b>	Between any two 20-bit groups separated by 50 $\mu\text{s}$	-20	+20	kHz/ 50 $\mu\text{s}$

Optimum RF load (impedance at RF1 pin)	@ 2440 MHz		40		$\Omega$
--	------------	--	----	--	----------

## 5.6 RF RECEIVER CHARACTERISTICS

All performance data are referred to a  $50 \Omega$  antenna connector at 2 Msym/s.

Items		Min.	Typ.	Max.	Unit
<b>Sensitivity</b>			-97		dBm
<b>Saturation</b>			8		dBm
<b>Optimum RF source (impedance at RF1 pin)</b>	@ 2440 MHz		40		$\Omega$
<b>Co-channel interference C/I</b>	$F_{RX} = F_{interference}$		8		dBc
<b>Adjacent interference C/I</b>	$F_{interference} = F_{RX} \pm 2 \text{ MHz}$		-14		dBc
	$F_{interference} = F_{RX} \pm 4 \text{ MHz}$		-41		dBc
	$F_{interference} = F_{RX} \pm (6+2n) \text{ MHz}$ [n = 0,1,2...]		-45		dBc
<b>Image frequency interference</b>	$F_{interference} = F_{image-2M}$		-25		dBc
<b>Out of band blocking (interfering signal CW) C/I<sub>Block</sub></b>	Interfering signal frequency 30 MHz – 2000 MHz		5		dB
	2003 MHz – 2399 MHz		-5		dB
	2484 MHz – 2997 MHz		-5		dB
	3000 MHz – 12.75 GHz		10		dB
<b>PER report integrity</b>	< 30.8				%

## 5.7 CURRENT CONSUMPTION

Items	Min.	Typ.	Max.	Unit
current in TX (@ 0 dBm, 3.3 V)	-	-	4.3	mA
current in RX (@ sensitivity level, 3.3V)	-	-	3.35	mA
Supply current in DEEPSTOP @ 25 °C	-	-	1.15	uA
Supply current in SHUTDOWN @ 25 °C	-	-	.015	uA
Current under reset condition @ 25 °C	-	-	1.09	mA

## 6. PIN ASSIGNMENT

### Application Interface

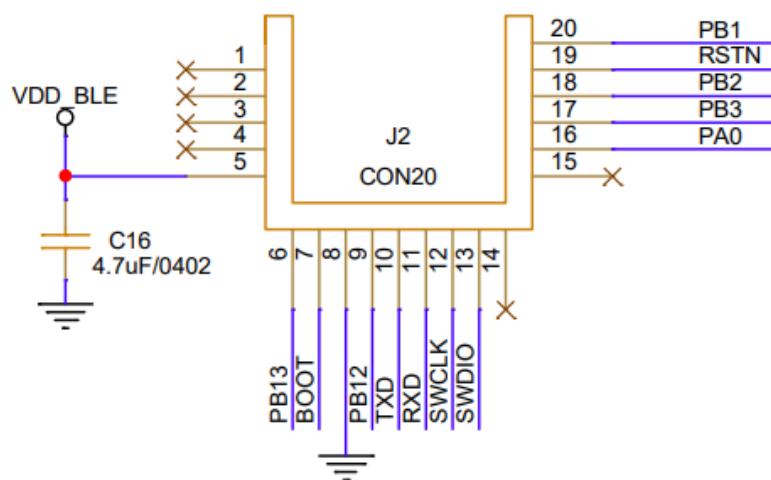


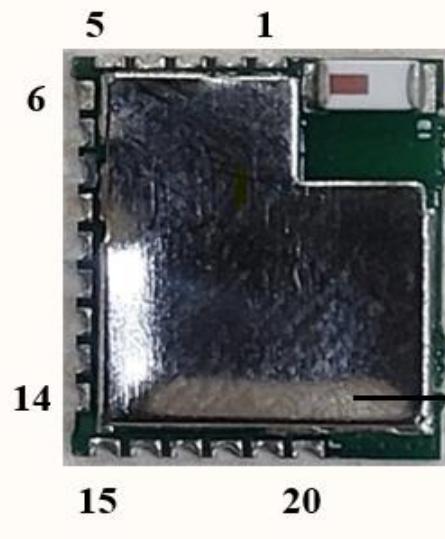
Figure 2. Module Pin Assignment

### 6.1 PIN DETAILS

PIN #	Pin Name	Description	Alternate
1	NC	-	-
2	NC	-	-
3	NC	-	-
4	NC	-	-
5	<b>VDD_BLE</b>	SUPPLY	-
6	<b>PB13</b>	GPIO	-
7	<b>BOOT</b>	BOOT/GPIO	-
8	<b>GND</b>	GROUND	-
9	<b>PB12</b>	GPIO	-
10	<b>TXD</b>	UART Tx	I2C1_SDA
11	<b>RXD</b>	UART Rx	-
12	<b>SWCLK</b>	SWD CLK	-
13	<b>SWDIO</b>	SWD DATA	-
14	NC	-	-
15	NC	-	-
16	<b>PA0</b>	GPIO	I2C1_SCL

17	<b>PB3</b>	GPIO	-
18	<b>PB2</b>	GPIO	-
19	<b>RSTN</b>	RESET	-
20	<b>PB1</b>	GPIO	-

## 6.2 MODULE TOP AND BOTTOM VIEW



**TOP VIEW**



**BOTTOM VIEW**

Figure 3. Module top and bottom

## 7. MODULE DIMENSION

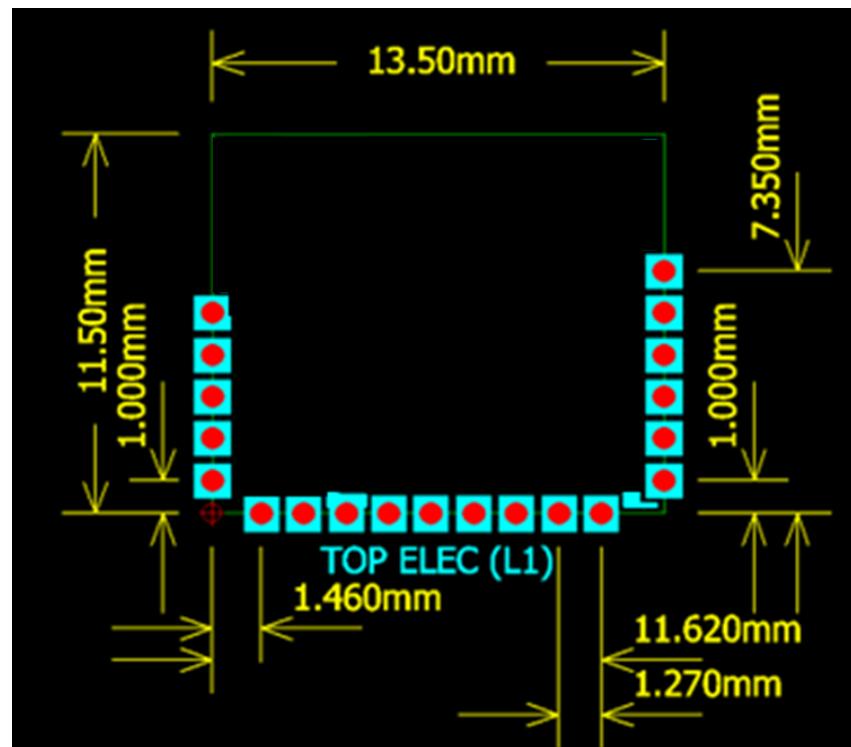


Figure 4. Module Dimension

## 8. SOLDER FOOTPRIN/LAND PATTERN

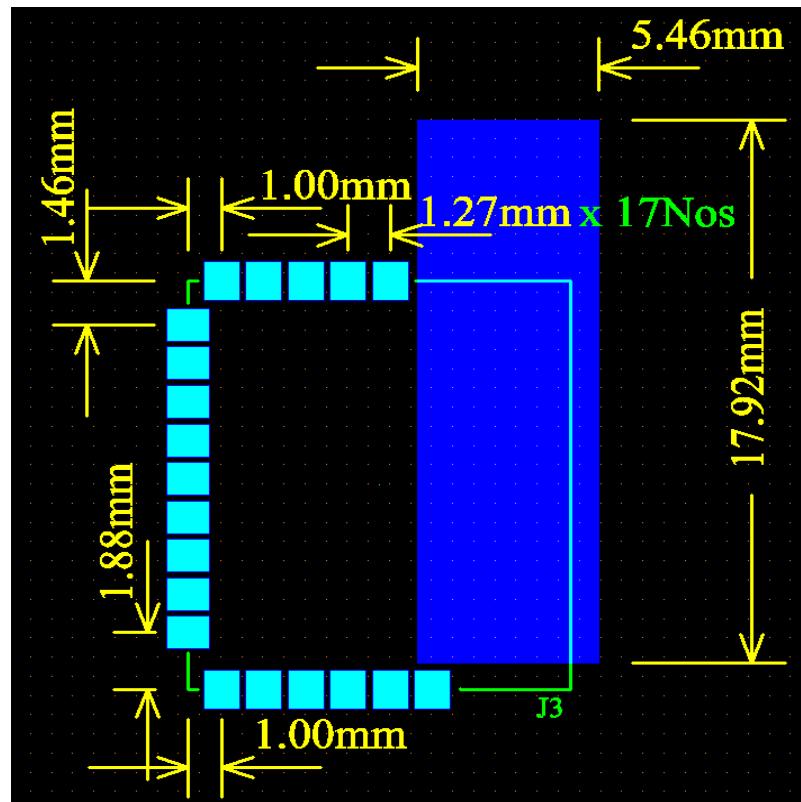


Figure 5. Solder footprint/ Land pattern

## 9. FCC ID: 2A2OT-TW1318

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.
2. This device must accept any interference received, including an interference that may cause undesired operation.

**Caution:**

- Any changes or modifications not expressly approved by the party responsible for compliance could avoid the user's authority to operate this equipment.
- This device has been tested and meets FCC RF exposure guidelines when used with an accessory that contains no metal and that positions the handset a minimum of 20cm from the body. Use of other accessories may not ensure compliance with FCC RF exposure guidelines

### INFORMATION TO THE USER

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.
- If problem is unresolved consult the dealer or an experienced technician for help.

### 9.1 LABELLING INSTRUCTION FOR HOST PRODUCT INTEGRATOR

Please notice that if the FCC and IC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. For FCC, this exterior label should follow “**Contains FCC ID: 2A2OT-TW1318**”. In accordance with FCC KDB guidance 784748 Labelling Guidelines.

### 9.2 INSTALLATION NOTICE TO HOST PRODUCT MANUFACTURER

The OEM integrator is responsible for ensuring that the end-user has no manual instruction to remove or install module. The module is limited to installation in mobile application, a separate approval is required for all other operating configurations, including portable configurations with respect to §2.1091 and difference antenna configurations.

### 9.3 ANTENNA CHANGE NOTICE TO HOST MANUFACTURER

If you desire to increase antenna gain and either change antenna type or use same antenna type certified, a Class II permissive change application is required to be filed by us, or you (host manufacturer) can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive.

## **9.4 FCC OTHER PARTS, PART 15B COMPLIANCE REQUIREMENTS FOR HOST PRODUCT MANUFACTURER**

This modular transmitter is only FCC authorized for the specific rule parts listed on our grant, host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification.

Host manufacturer in any case shall ensure host product which is installed and operating with the module is in compliant with Part 15B requirements.

Please note that For a Class B or Class A digital device or peripheral, the instructions furnished the user manual of the end-user product shall include statement set out in §15.105 Information to the user or such similar statement and place it in a prominent location in the text of host product manual.

#### **IMPORTANT NOTICE\_ PLEASE READ CAREFULLY**

MoMAGIC Technologies and its subsidiaries (“MoMAGIC”) reserve the right to make changes, corrections, enhancements, modifications, and improvements to MoMAGIC products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on MoMAGIC products before placing orders. MoMAGIC products are sold pursuant to MoMAGIC’s terms and conditions of sale in place at the time of order acknowledgement.

No license, express or implied, to any intellectual property right is granted by MoMAGIC herein. Resale of MoMAGIC products with provisions different from the information set forth herein shall avoid any warranty granted by MoMAGIC for such product.

MoMAGIC logo is the trademark of MoMAGIC. All other product or service names are the property of their respective owners. Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

For further details reach us at:

[info@truewave.in](mailto:info@truewave.in) Address: I-9, LGF,

Lajpat Nagar-3, New Delhi, 110024