

USER MANUAL

VERSION HISTORY

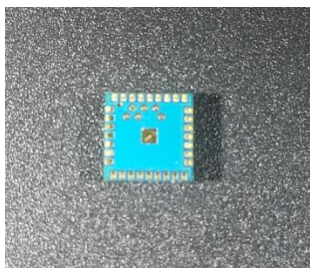
REVISION	AMENDMENT	DATE	
01.1	Initial version		
01.2	Minor change		
01.3	Dimension Change		
01.4	Dimension Change		

DESCRIPTION

is a Bluetooth Low Energy Module. UTO-NBL-52 integrates all features of Bluetooth radio, software stack, GATT based profiles and host end user applications, which means no external micro controller. It provides a Bluetooth Low Energy fully compliant system for a data communication. At +4 dBm TX Power and -93dBm RX Sensitivity has best RF performance.

APPLICATION

- Commercial
- Sports and fitness
- Healthcare
- Medical sensors
- Home entertainment
- Mobile accessories
- Watch
- Human interface devices

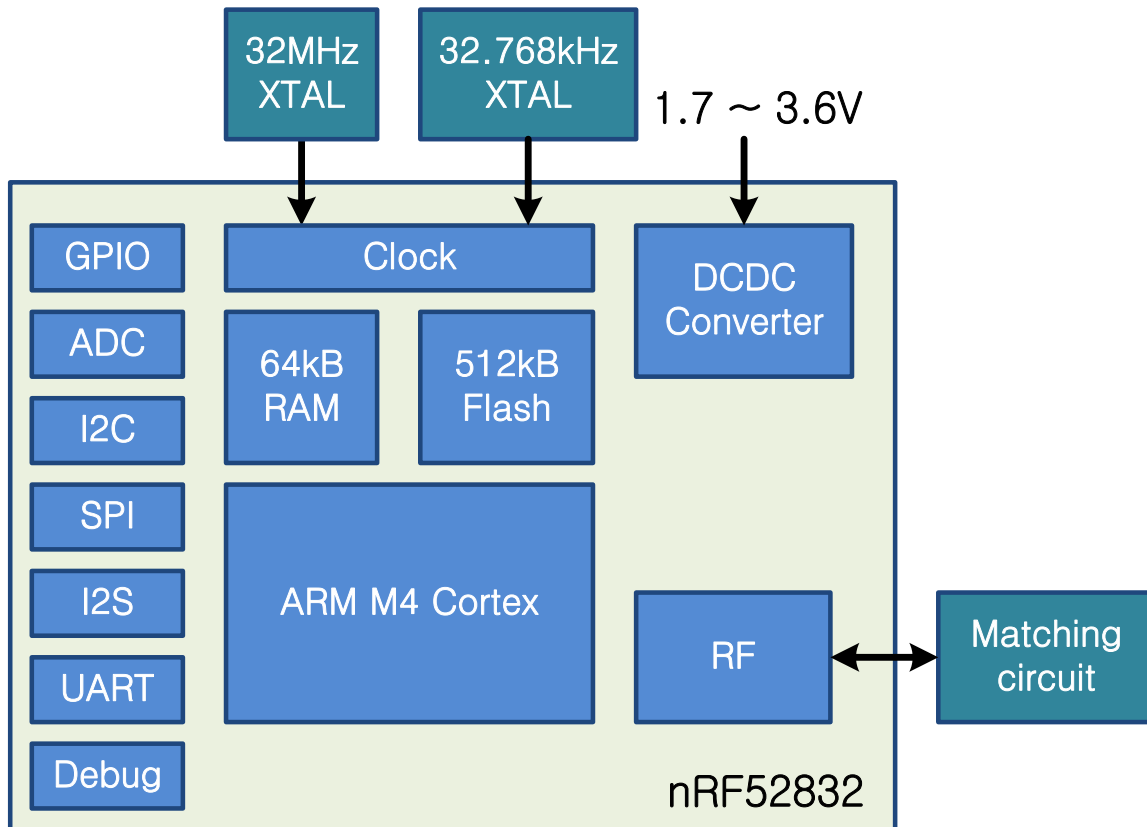


FEATURE

- Bluetooth v4.2 Single Mode Compliant
- Integrated Bluetooth Smart Stack
 - . GAP, GATT, L2CAP and SMP
 - . Bluetooth Smart profiles
- RF Performance
 - . Transmit power : +4 dBm (-20 dBm ~ +4 dBm)
 - . Receiver sensitivity : -96 dBm
- Low Power Consumption
 - . Transmit : 7.5 mA peak
 - . Receiver : 12.9 mA peak
 - . Sleep mode : 0.5 uA
- Peripheral Interfaces
 - . UART/SPI(Master/Slave)/I2C
 - . GPIO
 - . 12-bit ADC
 - . I2S and PDM
 - . Timer
 - . Temperature Sensor
- Power supply : 1.7 ~ 3.6 V
- Dimension : 5.9 x 5.9 x 1.6 mm (W x L x H)

1. Block Diagram

block diagram is illustrated in Figure 2 below.



CPU and Memory

The Main core is **ARM Cortex-M4**. The processor implements several features that enable energy-efficient arithmetic and high-performance signal processing including "digital signal processing", "Single-cycle multiply and accumulate instructions", "hardware divide", "8 and 16-bit single instruction multiple data instructions" and "Single-precision floating-point unit"

The ARM Cortex Microcontroller Software Interface Standard (CMSIS) hardware abstraction layer for the ARM Cortex processor series is implemented and available for the M4 CPU.

Real-time execution is highly deterministic in thread mode, to and from sleep modes, and when handling events at configurable priority levels via the Nested Vectored Interrupt Controller (NVIC).

The floating point unit (FPU) may generate exceptions when used due to e.g. overflow or underflow. These exceptions will trigger the FPU interrupt.

The **64-KB SRAM** of 1024 byte page size and **512-KB flash** of 8-KB block size memory are provided.

Power management

UTO-NBL-52 supports two different power supply alternatives of Internal LDO mode and Low voltage mode. In **internal LDO mode**, the system power is generated directly from the supply voltage VDD. In **low voltage mode**, the system power is supplied by 1.8V.

The module's power management features are System OFF mode and System ON mode. In **system OFF mode**, the module is in deepest power saving mode. The system's core functionality is powered down and all ongoing tasks are terminated.

In **system ON mode**, the module is fully operational and CPU and selected peripherals can be brought into a state where they are functional and more or less responsive depending on the sub-power mode selected by Low power or Constant latency.

Clock management

The module has a 32 MHz main crystal oscillator and 32.768 kHz RTC crystal oscillator.

Peripherals

The **general GPIO** is organized as one port with up to 30 I/Os enabling access and control of up to 30 pins through one port. Each GPIO can be accessed individually with the following user configurable features.

- Input/output direction
- Output drive strength
- Internal pull-up and pull-down resistors
- Wake-up from high or low level triggers on all pins
- Trigger interrupt on all pins
- All pins can be used by the PPI task/event system. The maximum number of pins that can be interfaced through the PPI at the same time is limited by the number of GPIOTE channels
- All pins can be individually configured to carry serial interface or quadrature demodulator signals.

The **transceiver** receives and transmits data directly to and from system memory for flexible and efficient packet data management. The module's transceiver has the following features.

- General modulation features
 - . GFSK modulation
 - . Data whitening
 - . On-air data rates (250 kbps/1 Mbps/2 Mbps)
- Transmitter with programmable output power of +4 dBm to -20 dBm, in 4 dB step
- RSSI function (1 dB resolution)
- Receiver with integrated channel filters achieving maximum sensitivity

- Baseband controller
 - . EasyDMA RX and TX packet transfer directly to and from RAM
 - . Dynamic payload length
 - . On-the-fly packet assembly/disassembly and AES CCM payload encryption
 - . 8 bit, 16 bit and 24 bit CRC check

The **timer** runs on the high-frequency clock source (HFCLK) and includes a four-bit (1/2X) prescaler that can divide the timer input clock from the HFCLK controller. Clock source selection between PCLK16M and PCLK1M is automatic according to TIMER base frequency set by the prescaler. The TIMER base frequency is always given as 16 MHz divided by the prescaler value.

The PPI system allows a TIMER event to trigger a task of any other system peripheral of the device. The PPI system also enables the TIMER task/event features to generate periodic output and PWM signals to any GPIO. The number of input/outputs used at the same time is limited by the number of GPIOTE channels.

The **temperature sensor** measures die temperature over the temperature range of the device with 0.25 degree resolution.

The **SPI** is implemented with EasyDMA support for ultra low power serial communication from an external SPI master. EasyDMA in conjunction with hardware-based semaphore mechanisms removes all real-time requirements associated with controlling the SPI slave from a low priority CPU execution context.

The **TWI** slave with EasyDMA (TWIS) is compatible with I2C operating at 100 kHz and 400 kHz. The TWI transmitter and receiver implement EasyDMA.

The Universal asynchronous receiver/transmitter with EasyDMA (**UART**) offers fast, full-duplex, asynchronous serial communication with built-in flow control (CTS, RTS) support in hardware at a rate up to 1 Mbps, and EasyDMA data transfer from/to RAM.

The **ADC** supports up to eight external analog input channels, depending on package variant. It can be operated in a one-shot mode with sampling under software control, or a continuous

conversion mode with a programmable sampling rate. The analog inputs can be configured as eight single-ended inputs, four differential inputs or a combination of these. Each channel can be configured to select AIN0 to AIN7 pins, or the VDD pin. Channels can be sampled individually in one-shot or continuous sampling modes, or, using scan mode, multiple channels can be sampled in sequence. Channels can also be oversampled to improve noise performance.

The **I2S** (Inter-IC Sound) module, supports the original two-channel I2S format, and left or right-aligned formats. It implements EasyDMA for sample transfer directly to and from RAM without CPU intervention. The I2S peripheral has the following main features :

- Master and Slave mode
- Simultaneous bi-directional (TX and RX) audio streaming
- Original I2S and left- or right-aligned format
- 8, 16 and 24-bit sample width
- Low-jitter Master Clock generator
- Various sample rates

2. Electrical Characteristics

2.1 Absolute Maximum Ratings

Rating	Min	Max	Unit
Storage Temperature	-40	+120	Degree
VDD, VDD_RF	-0.3	3.9	V
Other Terminal Voltages	-0.3	VDD+0.3	V

<Table 1 : Absolutes Maximum Ratings>

2.2 Recommended Operating Conditions

Rating	Min	Max	Unit
Operating Temperature	-40	+85	Degree
VDD, VDD_RF*	1.7	3.6	V

<Table 2 : Recommended Operating conditions>

*) normal supply voltage is 3.0 ~ 3.3V

2.3 Current consumption

Power mode	Condition	Min	Typ	Max	Unit
Transmit	Pout = +4 dBm		7.5		mA
	Pout = 0 dBm		5.3		mA
Receive	At 1 Mbps		11.7		mA
	At 2 Mbps		12.9		mA

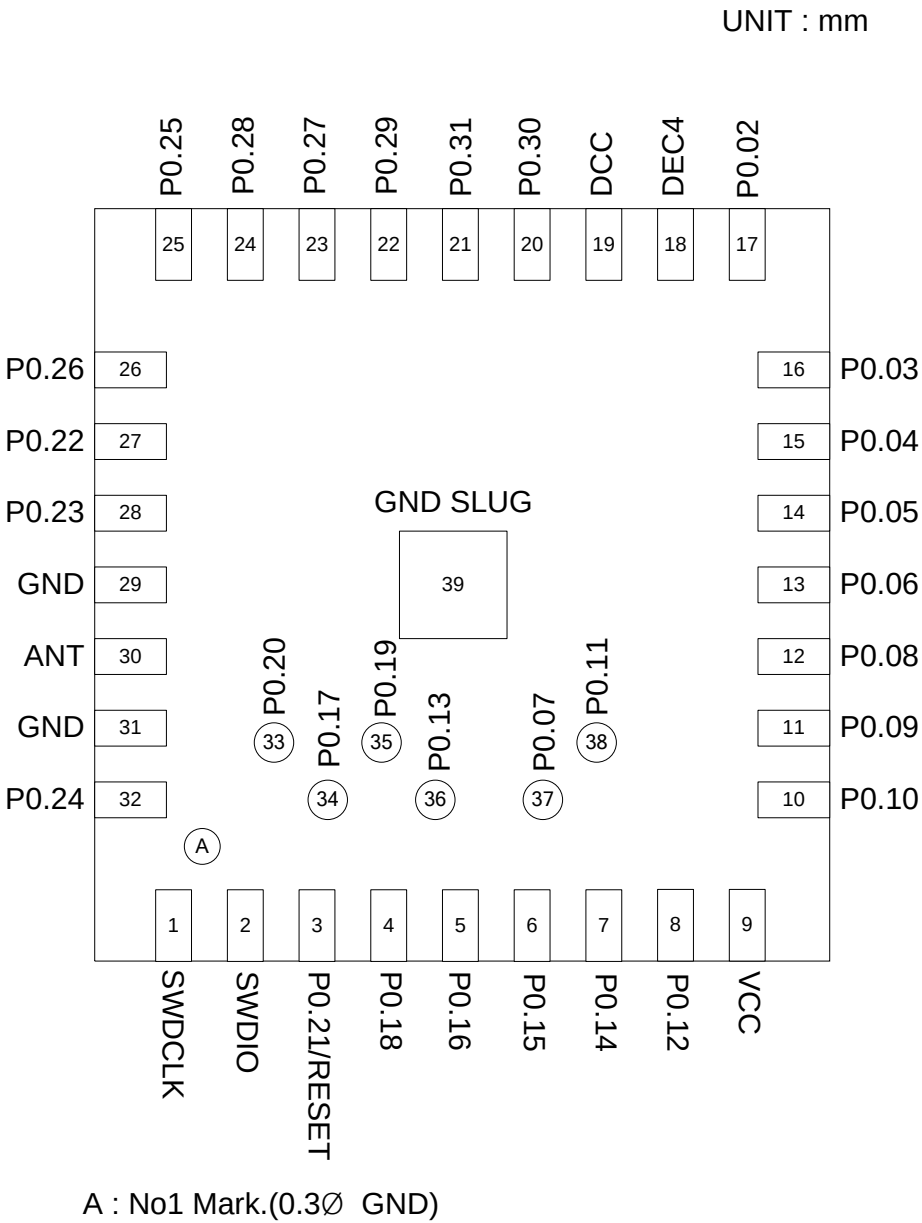
<Table 3 : Current consumption>

2.4 RF Characteristics

Rating	Min	Typ	Max	Unit
Operating frequencies	2360		2500	MHz
TX Maximum output power		4		dBm
TX RF power control range	20	24		dB
TX RF power accuracy			+/-4	dB
TX 1 st Adjacent Channel Transmit Power (2 Mbps)		-25		dBc
TX 2 nd Adjacent Channel Transmit Power (2 Mbps)		-50		dBc
TX 1 st Adjacent Channel Transmit Power (1 Mbps)		-25		dBc
TX 2 nd Adjacent Channel Transmit Power (1 Mbps)		-50		dBc
RX maximum received signal strength at < 0.1% PER		0		dBm
RX Sensitivity (0.1% BER) at 2 Mbps		-89		dBm
RX Sensitivity (0.1% BER) at 1 Mbps		-93		dBm
RX RSSI accuracy (-90 dBm to -20 dBm)		+/-2		dB
RX RSSI resolution		1		dB
RX RSSI sample period		8		us

3. Pin Description

PIN descriptions are summarized in Figure 3 and Table 5 below.

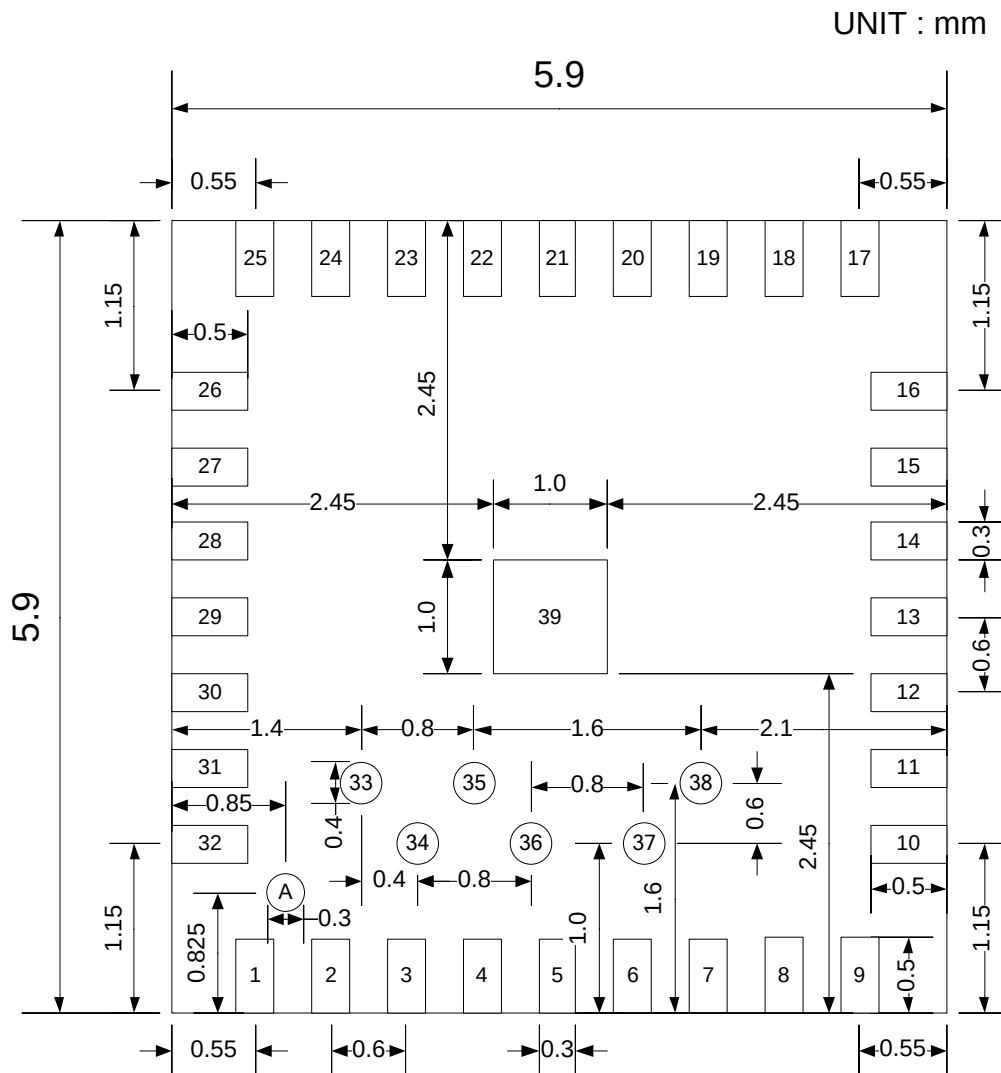


● Top View (Bottom pad)

Num.	PIN Name	Type	Description
1	SWDCLK	DEBUG	Debug/Program
2	SWDIO	DEBUG	Debug/Program
3	P0.21/RESET	I/O	RESET(Default)/Configurable I/O
4	P0.18	I/O	Configurable I/O
5	P0.16	I/O	Configurable I/O
6	P0.15	I/O	Configurable I/O
7	P0.14	I/O	Configurable I/O
8	P0.12	I/O	Configurable I/O
9	VCC	Supply Voltage	1.8V or 3.3V power supply
10	P0.10	I/O	Configurable I/O
11	P0.09	I/O	Configurable I/O
12	P0.08	I/O	Configurable I/O
13	P0.06	I/O	Configurable I/O
14	P0.05	I/O	Configurable I/O
15	P0.04	I/O	Configurable I/O
16	P0.03	I/O	Configurable I/O
17	P0.02	I/O	Configurable I/O
18	DEC4	Supply Voltage	1.3V Regulator supply decoupling input from DC/DC Converter. Output from 1.3V LDO
19	DCC	Power out	DC/DC output voltage to external LC filter
20	P0.30	I/O	Configurable I/O
21	P0.31	I/O	Configurable I/O
22	P0.29	I/O	Configurable I/O
23	P0.27	I/O	Configurable I/O
24	P0.28	I/O	Configurable I/O
25	P0.25	I/O	Configurable I/O
26	P0.26	I/O	Configurable I/O
27	P0.22	I/O	Configurable I/O
28	P0.23	I/O	Configurable I/O
29	GND	GND	Ground
30	ANT	RF	Antenna RF
31	GND	GND	Ground
32	P0.24	I/O	Configurable I/O
33	P0.20	I/O	Configurable I/O
34	P0.17	I/O	Configurable I/O

35	P0.19	I/O	Configurable I/O
36	P0.13	I/O	Configurable I/O
37	P0.07	I/O	Configurable I/O
38	P0.11	I/O	Configurable I/O
39	GND SLUG	GND	Ground PAD

4. Physical Dimensions

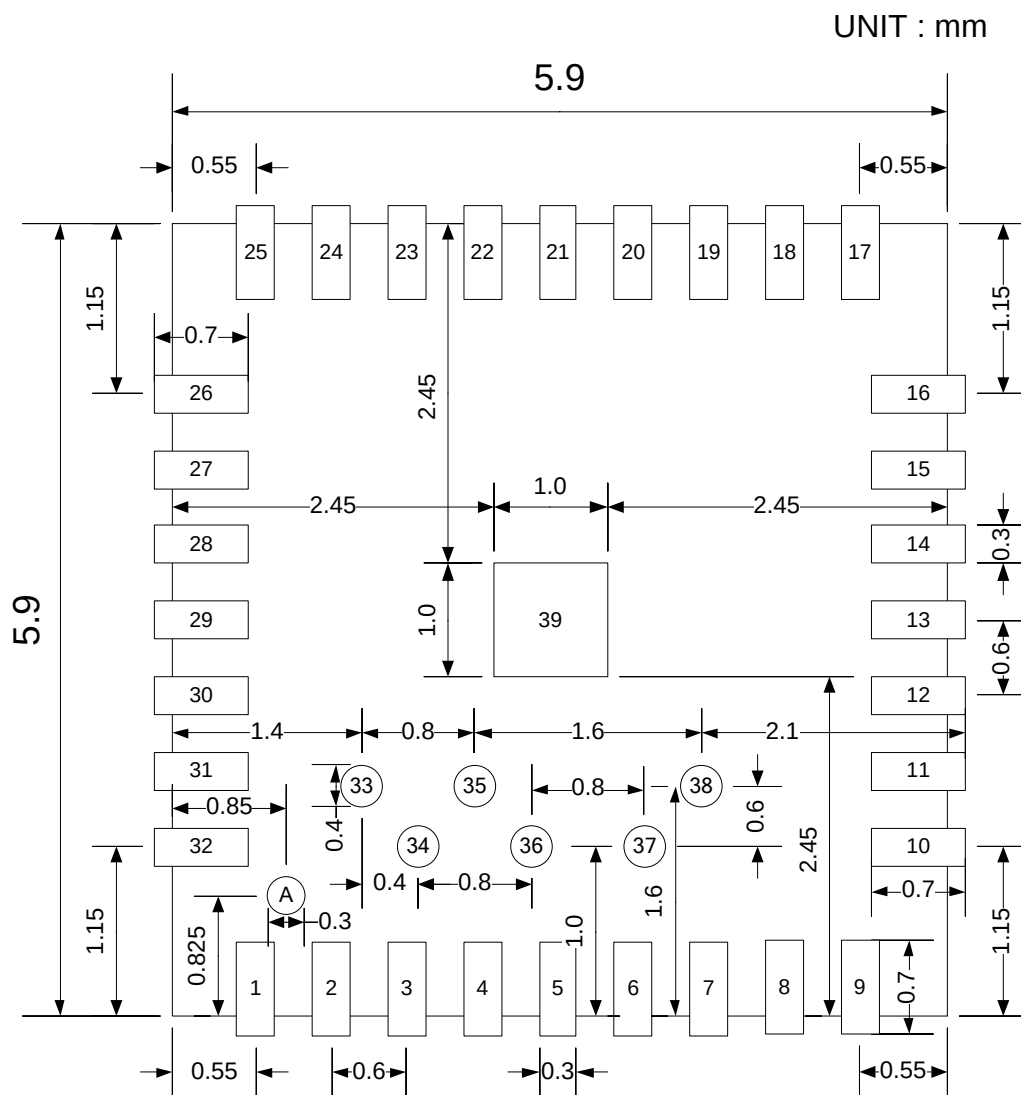


A : No1 Mark.(0.3Ø GND)

33,34,35,36,37,38 PAD : 0.4Ø

● Top View (Bottom pad)

5. Layout



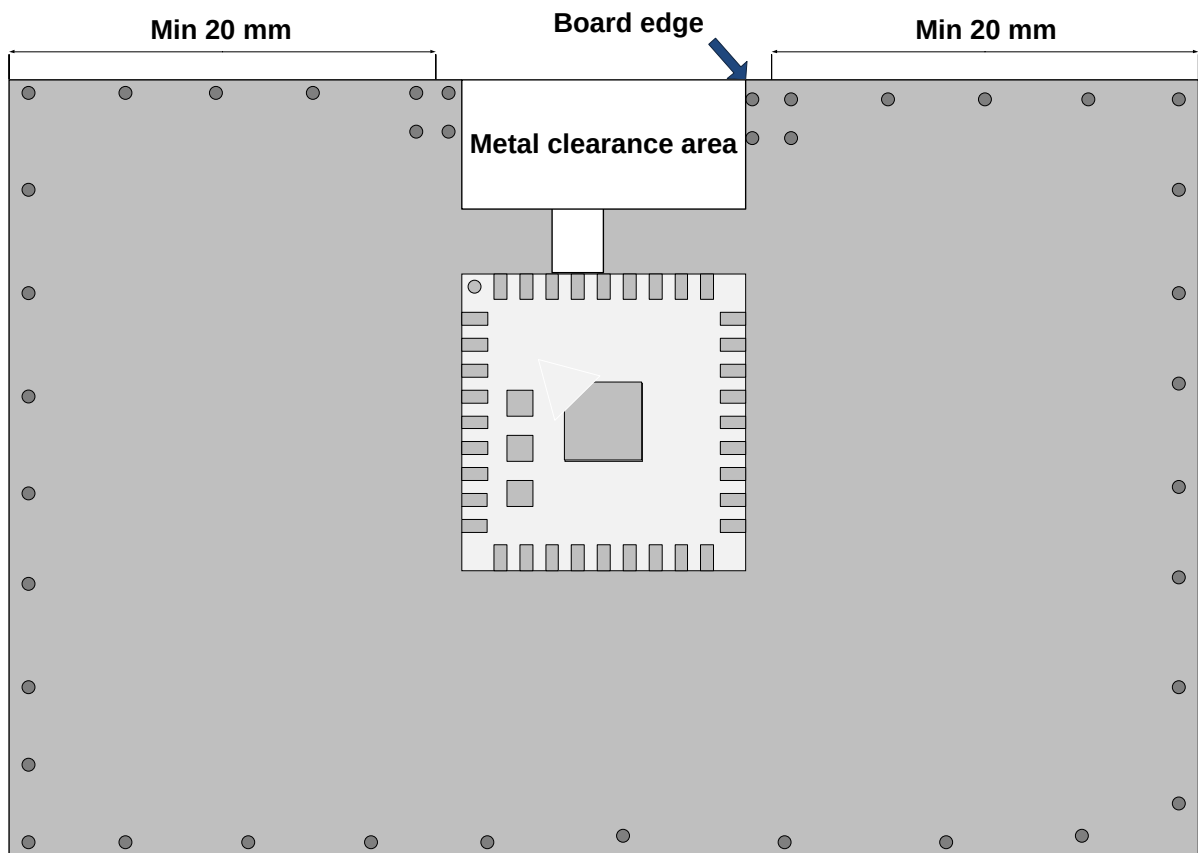
A : No1 Mark.(0.3Ø GND)

PIN 33,34,35,36,37,38 Size 0.4Ø 1:1 PAD

● Top View (Bottom pad)

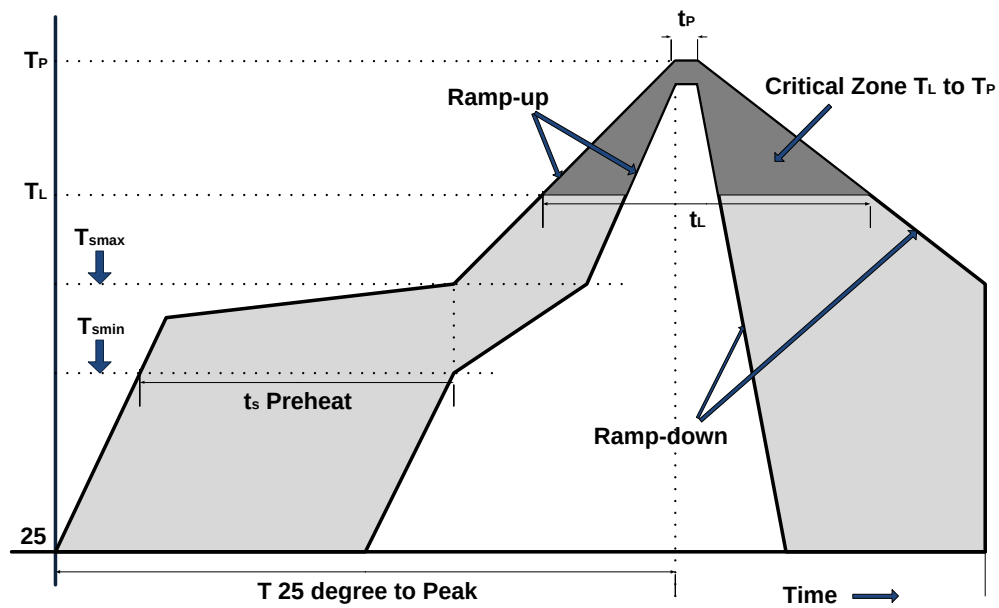
5.1 Layout Guide

To achieve best radio performance for UTO-NBL-52, it is recommended to use the module at the edge of the PCB as shown in Figure 6. Do not place any metal (traces, components, etc.) within the clearance area of the antenna. Connect all the GND pins directly to a solid GND plane. Place the GND vias as close to the GND pins as possible. Do not place plastic or any other dielectric material in touch with the antenna.



6. Re-flow Temperature time profile

The data here is given only for guidance on solder and has to be adapted to your process and other re-flow parameters for example the used solder paste. The paste manufacturer provides a re-flow profile recommendation for his product.



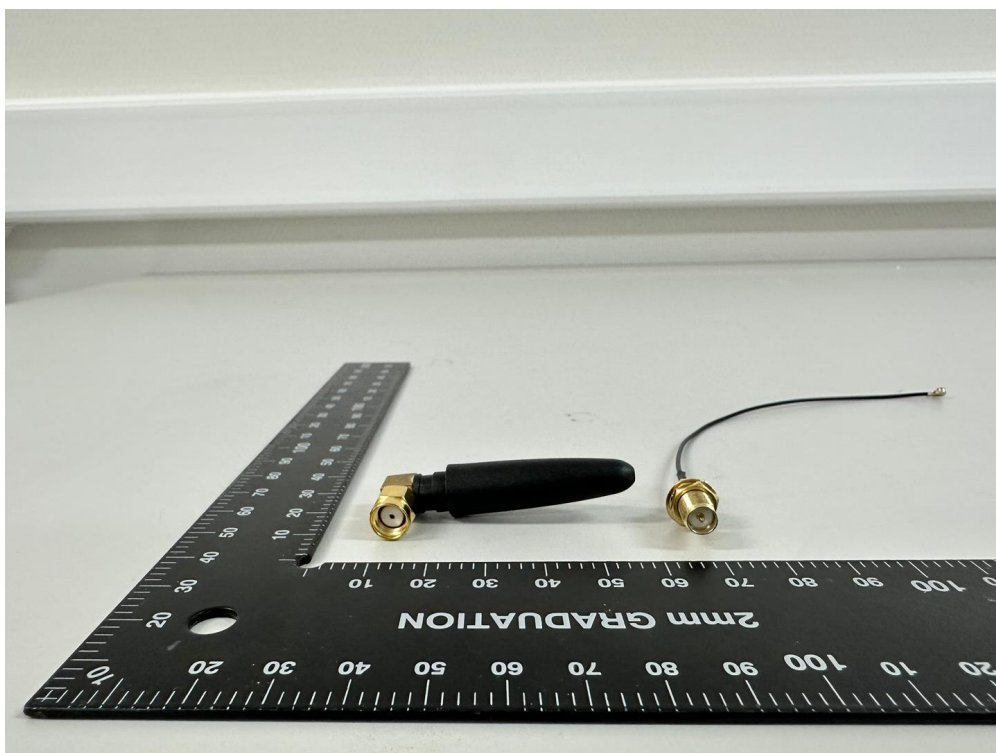
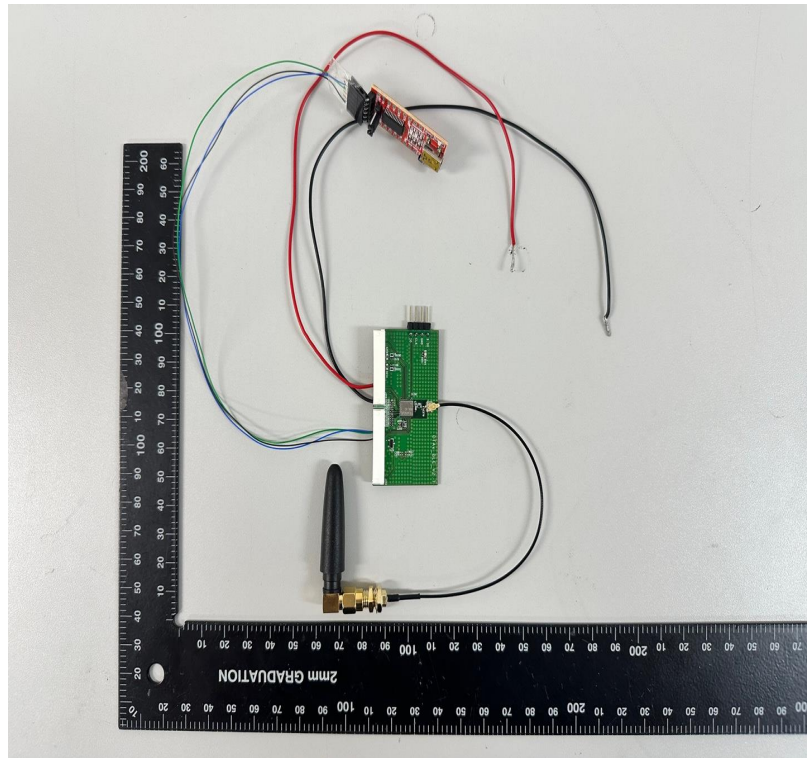
Preheat		Main Heat		Peak	
T _{smax}		T _{Lmax}		t _{pmax}	
Temperature	Time	Temperature	Time	Temperature	Time
Degree	sec	Degree	sec	Degree	sec
150	100	217	90	260	10
		230	50		
Parameter				Value	Unit
Average ramp-up rate				3	Degree/sec
Average ramp-down rate				6	Degree/sec
Max. Time 25 degree to Peak Temperature				8	Min.

Opposite side re-flow is prohibited due to module weight. Devices will withstand the specified profile and will withstand up to 1 re-flows to a maximum temperature of 260 degree. The re-flow soldering profile may only be applied if the resides on the PCB side looking up. Heat above the solder eutectic point while is mounted facing down may damage the module permanently.

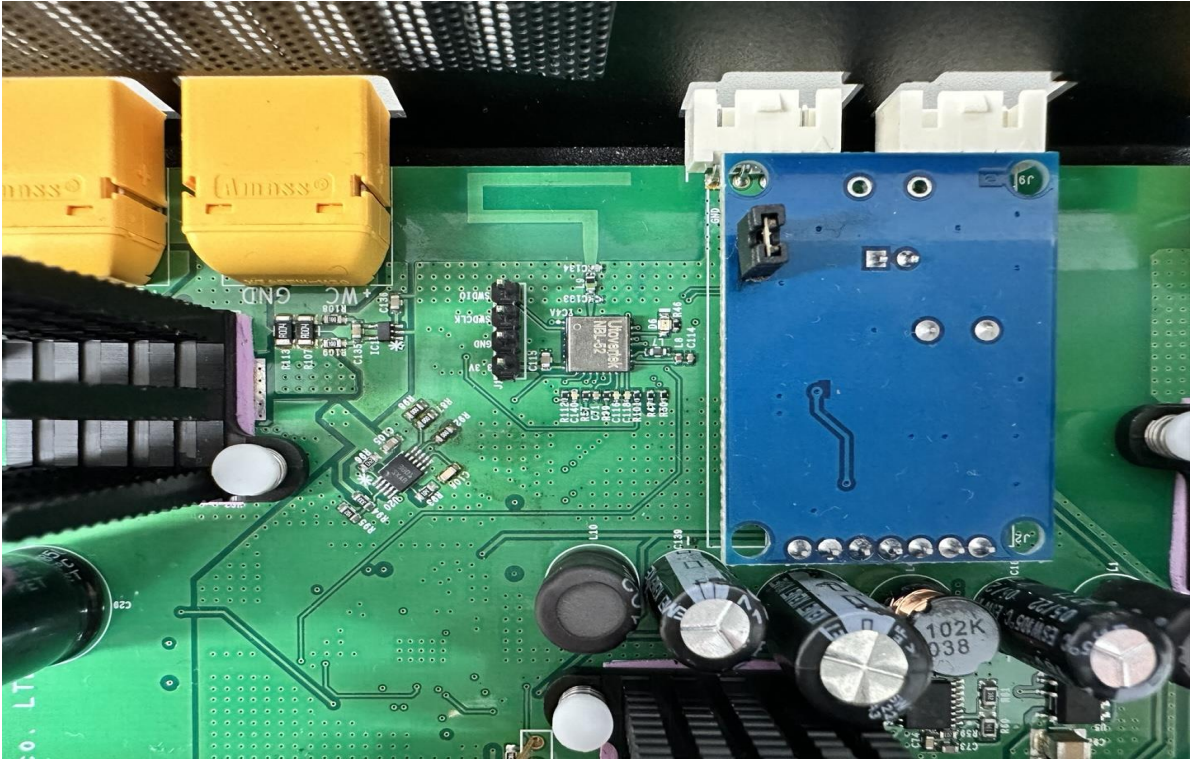
7. Antenna details

7.1 Dipole Antenna (Part No. TE-2402TO-C3)

The dipole antenna uses a fixed RP-SMA connector, which is considered a unique coupling method. The RP-SMA connector prevents substitution with standard SMA antennas. The antenna is not intended for user replacement.



7.2 PCB Antenna



FCC Statement

This equipment has been tested and found to comply with the limits for CLASS B digital device, pursuant to Part 15 FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. 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 correct the interference by one or more of the following measures ;

- 1.1. Reorient or relocate the receiving antenna.
- 1.2. Increase the separation between the equipment and receiver.
- 1.3. Connect the equipment into an outlet on a circuit different from that to which receiver is connected.
- 1.4. Consult the dealer or experienced radio/TV technician for help.

Caution

Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

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.

Exposure to Radio Frequency Radiation.

To comply with FCC's RF exposure limits for general population / uncontrolled exposure, the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

FCC ID: 2BO6O-NBL52

IC: 33929-NBL52

KC: R-R-Eta-UTO-NBL-52

Industry CANADA Statement

This device complies with ISED's licence-exempt RSSs. 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.

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be chosen so that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

Le présent appareil est conforme aux CNR d'ISED applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

le dispositif ne doit pas produire de brouillage préjudiciable, et
ce dispositif doit accepter tout brouillage reçu, y compris un brouillage susceptible de provoquer un fonctionnement indésirable.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radio électrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante

Déclaration d'IC sur l'exposition aux radiations:

Cet équipement est conforme aux limites d'exposition aux radiations définies par le Canada pour des environnements non contrôlés. Cet équipement doit être installé et utilisé à une distance minimum de 20 cm entre l'antenne et votre corps

Cet émetteur ne doit pas être installé au même endroit ni utilisé avec une autre antenne ou un autre émetteur.

E-MAIL: contact@etaelec.com

TEL +82-70-5222-5628 / FAX +82-70-5222-5629

[HQ] 2514, Globalventure-dong, Gyeongbuktechnopark, 27, Sampung-ro, Gyeongsan-si, Gyeongsangbuk-do, Republic of Korea

[R&D] 6F, 271, Wonhyo-ro, Yongsan-gu, Seoul, Republic of Korea