

MANUAL

USL-BLE-35M

(Version 1.0)

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1. Overview

The USL-BLE-35M module was developed based on STMicroelectronics' SoC. The USL-BLE-35M takes the Bluetooth Low Energy module to the next level by supporting Bluetooth 5. It operates with Dual Core, such as ARM Cortex-M4 CPU that operates at 64 MHz and Cortex-M0+ CPU that is responsible for wireless functions, and can handle demanding applications and communication tasks in a short time.

This allows the CPU to process more tasks or quickly switch to power saving mode, which can save battery energy more efficiently.

1.1. Applications

- IoT
 - Smart Home
 - Sensor Network
 - Building Automation
- Personal Area Networks
 - Health / Fitness sensors and monitoring devices
 - Medical devices
 - Smart key, Smart watch
- Interactive entertainment devices
 - Remote control
 - VR/AR
 - Game controller
- Beacons
- A4WP Wireless chargers and devices
- Remote Control toys
- Computer peripherals and I/O devices
 - Mouse + Keyboard
 - Multi-touch trackpad

2. Features

■ Radio

- 2.4 GHz
- RF transceiver supporting Bluetooth® 5.4 specification, IEEE 802.15.4-2011 PHY and MAC, supporting Thread 1.3 and Zigbee® 3.0
- RX sensitivity: -96 dBm (Bluetooth® Low Energy at 1 Mbps), -100 dBm (802.15.4)
- Programmable output power up to +6 dBm with 1 dB steps
- Support for 2 Mbps
- Support GATT caching
- Support EATT (enhanced ATT)
- Support advertising extension
- Dedicated Arm® 32-bit Cortex® M0+ CPU for real-time Radio layer – Accurate RSSI to enable power control
- Suitable for systems requiring compliance with radio frequency regulations ETSI EN 300 328, EN 300 440, FCC CFR47 Part 15 and ARIB STD-T66
- Support for external PA

■ Ultra-low-power platform

- 1.71 to 3.6 V power supply
- – 40 °C to 85 / 105 °C temperature ranges
- 13 nA shutdown mode
- 600 nA Standby mode + RTC + 32 KB RAM – 2.1 µA Stop mode + RTC + 256 KB RAM
- Active-mode MCU: < 53 µA / MHz when RF and SMPS on
- Radio: Rx 4.5 mA / Tx at 0 dBm 5.2 mA

- Core: Arm® 32-bit Cortex®-M4 CPU with FPU, adaptive real-time accelerator (ART Accelerator) allowing 0-wait-state execution from flash memory, frequency up to 64 MHz, MPU, 80 DMIPS, and DSP instructions

■ Clock sources

- 32 MHz crystal oscillator with integrated trimming capacitors (Radio and CPU clock)
- 32 kHz crystal oscillator for RTC (LSE)
- Internal low-power 32 kHz (±5%) RC (LSI1)
- Internal low-power 32 kHz (stability ±500 ppm) RC (LSI2)
- Internal multispeed 100 kHz to 48 MHz oscillator, auto-trimmed by LSE (better than ±0.25% accuracy)
- High speed internal 16 MHz factory trimmed RC (±1%)
- 2x PLL for system clock, USB, SAI, ADC

■ Memories

- 512 MB flash memory with sector protection (PCROP) against R/W operations, enabling radio stack and application
- 96 KB SRAM, including 64 KB with hardware parity check
- 20x 32-bit backup register
- Boot loader supporting USART, SPI, I2C and USB interfaces
- OTA (over the air) Bluetooth® Low Energy and 802.15.4 update
- Quad SPI memory interface with XIP
- 1 Kbyte (128 double words) OTP

■ Rich analog peripherals (down to 1.62 V)

- 12-bit ADC 4.26 Msps, up to 16-bit with hardware oversampling, 200 μ A/Msps
- 2x ultra-low-power comparator
- Accurate 2.5 V or 2.048 V reference voltage buffered output

■ System peripherals

- Inter processor communication controller (IPCC) for communication with Bluetooth® Low Energy and 802.15.4
- HW semaphores for resource sharing between CPUs
- 2x DMA controllers (7x channels each) supporting ADC, SPI, I2C, USART, QSPI, SAI, AES, timers
- 1x USART (ISO 7816, IrDA, SPI Master, Modbus, and Smartcard mode)
- 1x LPUART (low power)
- 1x SPI 32 Mbit/s
- 2x I2C (SMBus/PMBus®)
- 1x SAI (dual channel high quality audio)
- 1x USB 2.0 FS device, crystal-less, BCD and LPM
- Touch sensing controller, up to 18 sensors
- LCD 8x40 with step-up converter
- 1x 16-bit, four channels advanced timer
- 2x 16-bit, two channels timer
- 1x 32-bit, four channels timer
- 2x 16-bit ultra-low-power timer
- 1x independent SysTick
- 1x independent watchdog
- 1x window watchdog

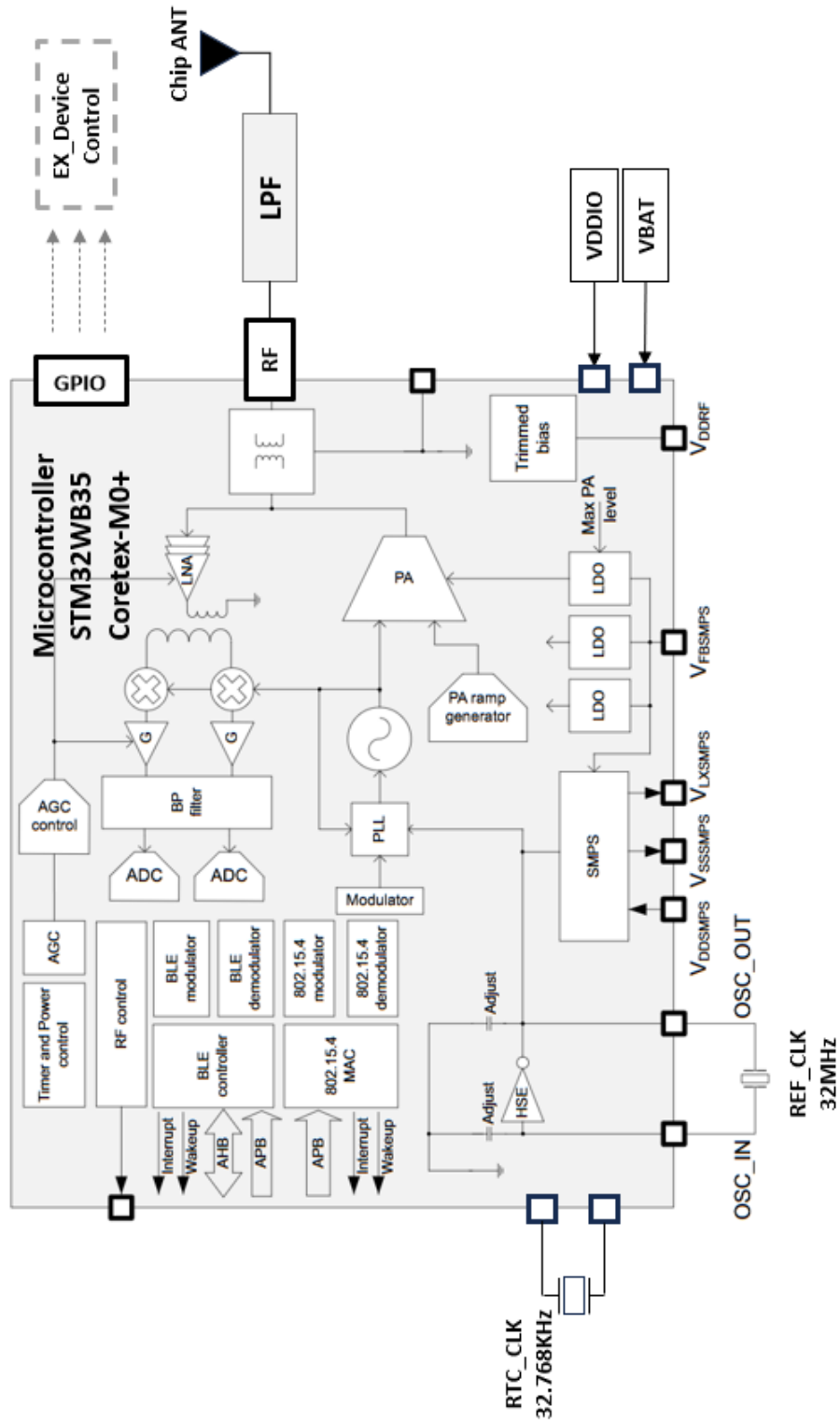
■ Security and ID

- Secure firmware installation (SFI) for Bluetooth® Low Energy and 802.15.4 SW stack

- 3x hardware encryption AES maximum 256-bit for the application, the Bluetooth® Low Energy and IEEE802.15.4
- Customer key storage/manager services
- HW public key authority (PKA)
- Cryptographic algorithms: RSA, Diffie-Helman, ECC over GF(p)
- True random number generator (RNG)
- Sector protection against R/W operation (PCROP)
- CRC calculation unit
- Die information: 96-bit unique ID
- IEEE 64-bit unique ID, possibility to derive 802.15.4 64-bit and Bluetooth® Low Energy 48-bit EUI

3. Specifications

3.1. Module block diagram

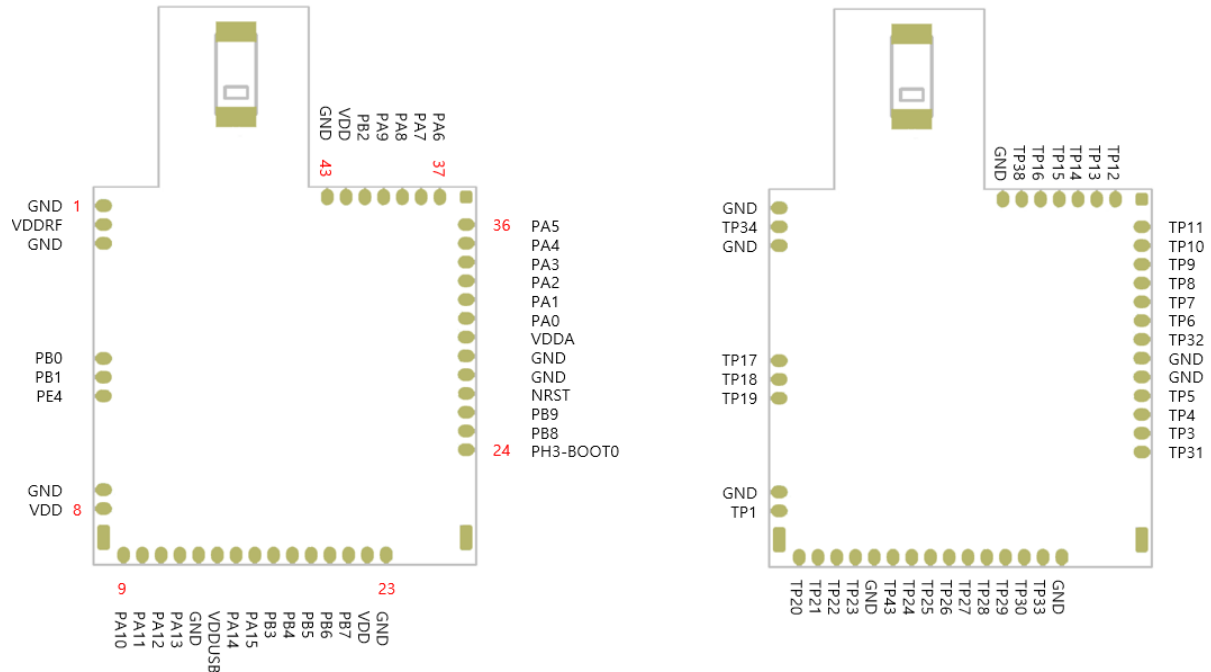


3.2. 사양

Radio	
Band	2.4GHz ISM
On-air data rate	1 Mbps, 2 Mbps (BLE 5.4) / 250 kbps (IEEE 802.15.4)
Output power	up to -30 dBm (1 dB step)
Sensitivity	● -96 dBm (BLE 1 Mbps) ● -100 dBm (802.15.4)
RSSI	Provides precision RSSI (Power controllable)
Radio current consumption with DC/DC at 3V	● RX: 4.5mA, ● TX @ 0 dBm: 5.2 mA
Microcontroller	
CPU	Arm® Cortex®-M4, up to 64 MHz, ART Accelerator, DSP instructions support
Floating Point Unit	support
Memory	● Internal Flash: 512 kBytes ● RAM: 96 kBytes
GPIO	up to 28 I/O
Peripherals	
ADC	12-bit, up to 4.26 Msps (HW oversampling)
Comparators	2 개 (Ultra-low power consumption)
Interfaces	● USART (ISO 7816, IrDA, Smartcard, Modbus 등) x1 ● LPUART x1 ● SPI x1 (up to 32 Mbps) ● I2C x2 (SMBus/PMBus) ● SAI (Dual channel audio) ● USB 2.0 FS (crystals) x1 ● Quad-SPI (XIP support) x1
Security	● AES (up to 256-bit) x3, PKA (Public Key Authority) ● RNG (True random number generator) ● Secure Firmware Installation (SFI) ● ECC, RSA, Diffie-Hellman
Timers/Counters	● Advanced 16-bits Timer x1 ● General 16-bits Timer x2, 32-bits Timer x1 ● Low power 16-bits Timer x2 ● SysTick + Independent WDG + Window WDG
System	

System peripheral bus	AHB/APB Bus structure (DMA, IPCC, HW semaphore included)
Power supply	1.71 ~ 3.6 V (SMPS, VBAT mode support)
System current consumption DC/DC at 3V	● Shutdown: 13 nA ● Standby + RTC + 32 KB RAM: 600 nA ● Stop mode + RTC + 256 KB RAM: 2.1 μA ● Active MCU < 53 μA/MHz (RF + SMPS)

4. Pin map



Name	Abbreviation	Definition
Type	S	Supply pin
	I	Input only pin
	I/O	Input / output pin
Structure	FT	5V tolerant I/O
	TT	3.6V tolerant I/O
	RF	RF I/O
	RST	Bidirectional reset pin with weak pull-up resistor
	Option for TT or FT I/Os	
	_f	I/O. Fm+ capable
	_l	I/O, with LCD function supplied by VLCD
	_u	I/O, with USB function supplied by VDDUSB
	_a	I/O, with Analog switch function supplied by VDDA

Pin	Name	Type	Structure	Alternate functions	Additional Func.
1	GND	-	-	-	-
2	VDDRF	S	-	-	-

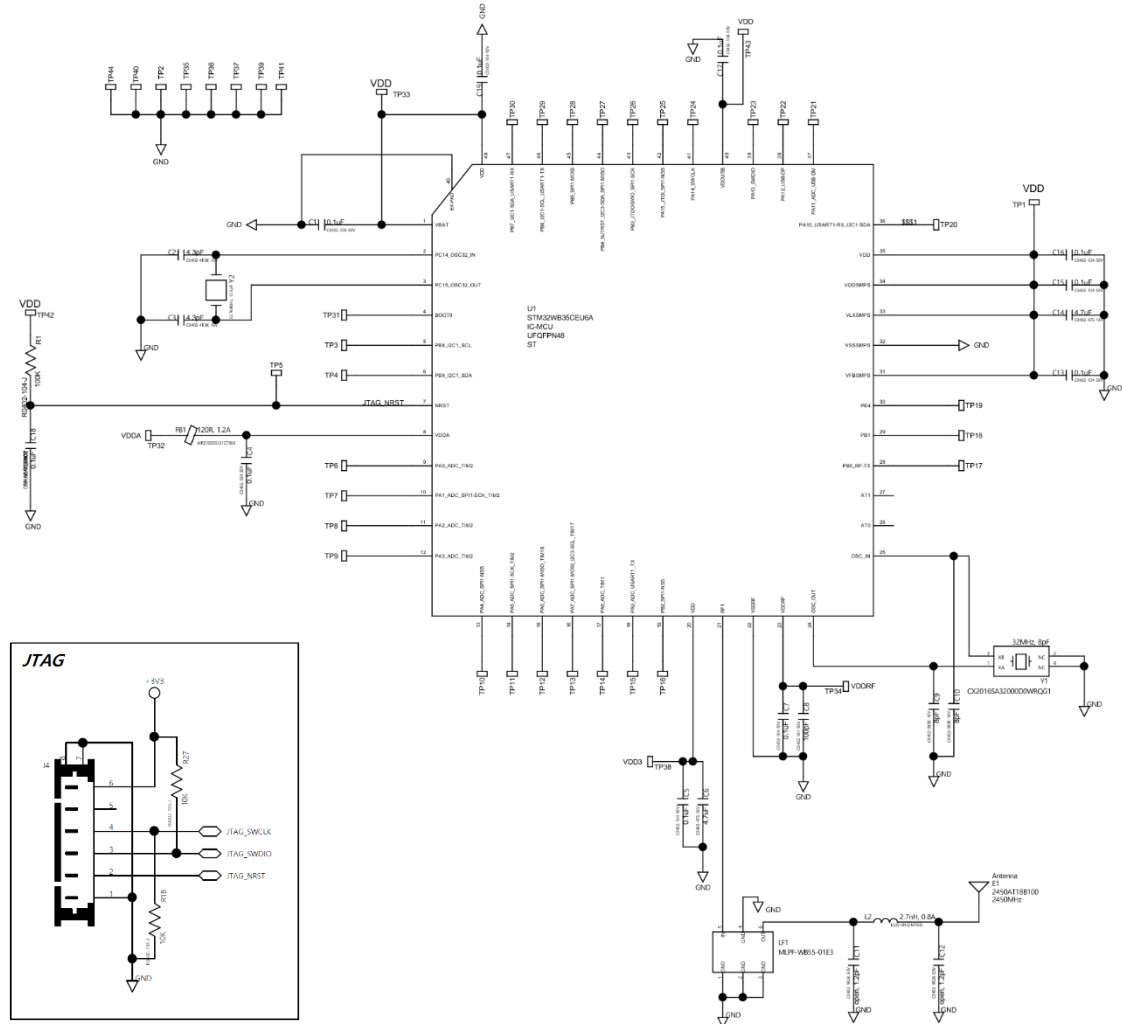
	(TP34)				
3	GND	-	-	-	-
4	PB0 (TP17)	I/O	TT	COMP1_OUT, CM4_EVENTOUT, RF_TX_MOD_EXT_PA	-
5	PB1 (TP18)	I/O	TT	LPUART1_RTS_DE, LPTIM2_IN1, CM4_EVENTOUT	-
6	PE4 (TP19)	I/O	FT	CM4_EVENTOUT	-
7	GND		-	-	-
8	VDD (TP1)	S	-	-	-
9	PA10 (TP20)	I/O	FT_fl	TIM1_CH3, SAI1_PDM_DI1, I2C1_SDA, USART1_RX, USB_CRD_SYNC, SAI1_SD_A, TIM17_BKIN, CM4_EVENTOUT	-
10	PA11 (TP21)	I/O	FT_u	TIM1_CH4, TIM1_BKIN2, SPI1_MISO, USART1_CTS, USB_DM, CM4_EVENTOUT	-
11	PA12 (TP22)	I/O	FT_u	TIM1_ETR, SPI1_MOSI, LPUART1_RX, USART1_RTS_DE, USB_DP, CM4_EVENTOUT	-
12	PA13 (TP23)	I/O	FT	JTMS-SWDIO, IR_OUT, USB_NOE, SAI1_SD_B, CM4_EVENTOUT	-
13	GND	-	-	-	-
14	VDDUSB (TP43)	S	-	-	-
15	PA14 (TP24)	I/O	FT	JTCK-SWCLK, LPTIM1_OUT, I2C1_SMBA, SAI1_FS_B, CM4_EVENTOUT	-
16	PA15 (TP25)	I/O	FT	JTDI, TIM2_CH1, TIM2_ETR, SPI1_NSS, CM4_EVENTOUT, MCO	-
17	PB3 (TP26)	I/O	FT_a	JTDO-TRACESWO, TIM2_CH2, SPI1_SCK, USART1_RTS_DE,	COMP2_INM

				SAI1_SCK_B, CM4_EVENTOUT	
18	PB4 (TP27)	I/O	FT_fa	NJTRST, I2C3_SDA, SPI1_MISO, USART1_CTS, SAI1_MCLK_B, TIM17_BKIN, CM4_EVENTOUT	COMP2_INP
19	PB5 (TP28)	I/O	FT_a	LPTIM1_IN1, I2C1_SMBA, SPI1_MOSI, USART1_CK, LPUART1_TX, COMP2_OUT, SAI1_SD_B, TIM16_BKIN, CM4_EVENTOUT	-
20	PB6 (TP29)	I/O	FT_fa	LPTIM1_ETR, I2C1_SCL, USART1_TX, SAI1_FS_B, TIM16_CH1N, MCO, CM4_EVENTOUT	COMP2_INP
21	PB7 (TP30)	I/O	FT_fa	LPTIM1_IN2, TIM1_BKIN, I2C1_SDA, USART1_RX, TIM17_CH1N, CM4_EVENTOUT	COMP2_INM, PVD_IN
22	VDD (TP33)	S	-	-	-
23	GND	-	-	-	-
24	PH3-BOOT0 (TP31)	I/O	FT	CM4_EVENTOUT, LSCO	-
25	PB8 (TP3)	I/O	FT_fl	TIM1_CH2N, SAI1_PDM_CK1, I2C1_SCL, QUADSPI_BK1_IO1, LCD_SEG16, SAI1_MCLK_A, TIM16_CH1, CM4_EVENTOUT	-
26	PB9 (TP4)	I/O	FT fla	TIM1_CH3N, SAI1_PDM_DI2, I2C1_SDA, SPI2_NSS, IR_OUT, TSC_G7_IO4, QUADSPI_BK1_IO0, LCD_COM3, SAI1_FS_A, TIM17_CH1, CM4_EVENTOUT	-
27	NRST (TP5)	I/O	RST	-	-
28	GND	-	-	-	-
29	GND	-	-	-	-

30	VDDA (TP32)	S	-	-	-
31	PA0 (TP6)	I/O	FT_a	TIM2_CH1, COMP1_OUT, SAI1_EXTCLK, TIM2_ETR, CM4_EVENTOUT	COMP1_INM, ADC1_IN5, RTC_TAMP2/WKUP1
32	PA1 (TP7)	I/O	FT_la	TIM2_CH2, I2C1_SMBA, SPI1_SCK, LCD_SEG0, CM4_EVENTOUT	COMP1_INP, ADC1_IN6
33	PA2 (TP8)	I/O	FT_la	LSCO, TIM2_CH3, LPUART1_TX, QUADSPI_BK1_NCS, LCD_SEG1, COMP2_OUT, CM4_EVENTOUT	COMP2_INM, ADC1_IN7, WKUP4
34	PA3 (TP9)	I/O	FT_la	TIM2_CH4, SAI1_PDM_CK1, LPUART1_RX, QUADSPI_CLK, LCD_SEG2, SAI1_MCLK_A, CM4_EVENTOUT	COMP2_INP, ADC1_IN8
35	PA4 (TP10)	I/O	FT_a	SPI1_NSS, SAI1_FS_B, LPTIM2_OUT, LCD_SEG5, CM4_EVENTOUT	COMP1_INM, COMP2_INM, ADC1_IN9
36	PA5 (TP11)	I/O	FT_a	TIM2_CH1, TIM2_ETR, SPI1_SCK, LPTIM2_ETR, SAI1_SD_B, CM4_EVENTOUT	COMP1_INM, COMP2_INM, ADC1_IN10
37	PA6 (TP12)	I/O	FT_la	TIM1_BKIN, SPI1_MISO, LPUART1_CTS, QUADSPI_BK1_IO3, LCD_SEG3, TIM16_CH1, CM4_EVENTOUT	ADC1_IN11
38	PA7 (TP13)	I/O	FT fla	TIM1_CH1N, I2C3_SCL, SPI1_MOSI, QUADSPI_BK1_IO2, LCD_SEG4, COMP2_OUT, TIM17_CH1, CM4_EVENTOUT	ADC1_IN12
39	PA8 (TP14)	I/O	FT_la	MCO, TIM1_CH1, SAI1_PDM_CK2, USART1_CK, LCD_COM0, SAI1_SCK_A, LPTIM2_OUT, CM4_EVENTOUT	ADC1_IN15
40	PA9 (TP15)	I/O	FT fla	TIM1_CH2, SAI1_PDM_DI2, I2C1_SCL, SPI2_SCK, USART1_TX, LCD_COM1, SAI1_FS_A, CM4_EVENTOUT	COMP1_INM, ADC1_IN16

41	PB2 (TP16)	I/O	FT_a	RTC_OUT, LPTIM1_OUT, I2C3_SMBA, SPI1_NSS, LCD_VLCD, SAI1_EXTCLK, CM4_EVENTOUT	COMP1_INP
42	VDD (TP38)	S	-	-	-
43	GND	-	-	-	-

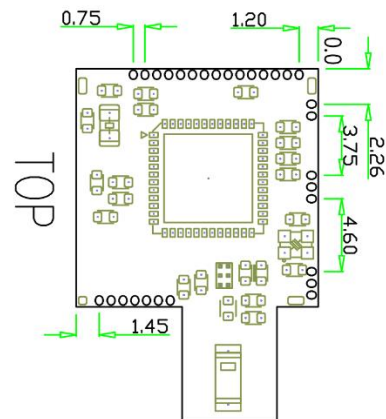
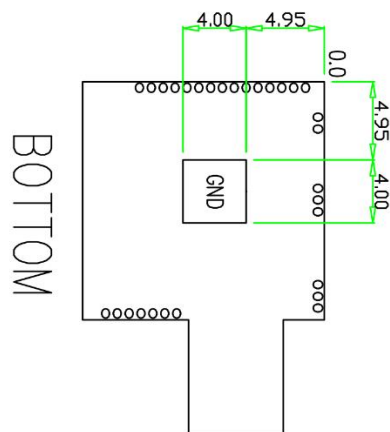
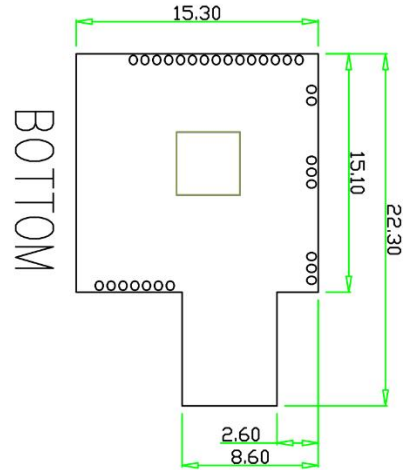
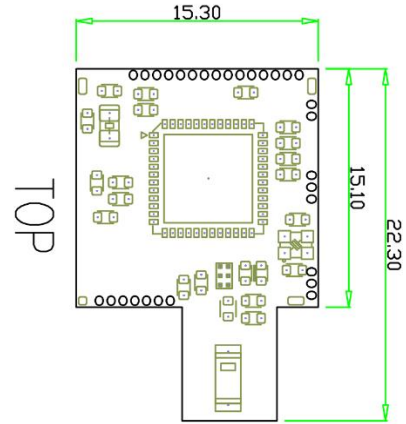
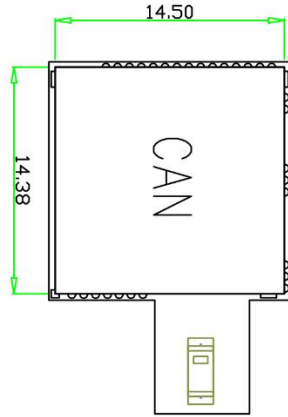
5. Cicuit



5.1. Connect ST-LINK

USL-BLE-35M	ST-LINK V2	Description
VDD	MCU VDD (target voltage measurement)	20pin 커넥터의 1 번 연결
GND	GND	20pin 커넥터의 GND 연결
12 (TP23)	JTCK-SWCLK	20pin 커넥터의 9 번 연결
15 (TP24)	JTMS-SWDIO	20pin 커넥터의 7 번 연결
27 (TP5)	NRST	20pin 커넥터의 15 번 연결

6. Dimension



7. Label

The following items must be marked on the label of the product by means of a label/silk screen. etc.



8. Marking Information

8.1. FCC Information

This device complies with Part 15 of the FCC Results. Operation is subject to the following two conditions:

- 1). This Device may not cause harmful interface, 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 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.

8.2. Warning

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

8.3. Caution : 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.

8.4 Industry CANADA Statement

This device complies with ISSED'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' ISSED 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

8.5 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.

Instruction to Integrator

End Product Labelling

A label must be affixed to the outside of final commercial product with the following statements:

"Contains FCC ID: 2BSZRUSB-BLE-35M, IC: 34657-USL35M01"

RF exposure considerations

Consistent with §2.909(a), the following text must be included within the user's manual or operator instruction guide for the final commercial product This modular complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

This device is only authorized for use in a mobile application. At least 20 cm of separation distance between the module and the user's body must be maintained at all times.

Additional testing, Part 15 Subpart B disclaimer

The final host / module combination may also need to be evaluated against the FCC Part 15B criteria for unintentional radiators in order to be properly authorized for operation as a Part 15 digital device. The FCC Part 15 Statement shall be included in the user manual of final commercial product if applicable.



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Caution Statement for Modifications:

CAUTION: Any changes or modifications not expressly approved could void the user's authority to operate the equipment.