Product Specification

Bluetooth v5.0 BLE Single Mode Module

[Generic & Security Tag Version]

BL5032

Version: 1.3

Revision History

Edition #	Reason for revision	Issue Date
1.0	Initial Document	2019/05/03
1.1	Add Reference Circuit	2022/02/25
1.2	Add FCC notice	2022/3/23
1.2	Fix Module Name	2022/3/30

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Technical Support Contact Information

If you encounter any technical issues while using BL5032, do not hesitate to contact us @AtechOEM. Our technical staff will help you resolve the technical issues. You can contact us by email or phone. The following is our technical contact:

- Hours: 9:30AM to 5:30PM (GMT+08:00)
- Email: wifi.support@atechtpe.com.tw
- Phone: +886.2.2377.0282

CONTENTS

1. Overview

BL5032, Bluetooth low energy (BLE) single mode module is targeted for low power sensors, remote control, and accessories. It offers GATT profile as the based lower profile. We could also provide other standard BLE profiles such as proximity, find me … etc. The module provides flexible hardware interfaces to connect sensors.

The single mode radio enables it to connect to the dual mode Bluetooth products already in the market, as well as other Bluetooth low energy devices/ sensors. It can be used in equipment like a heart rate sensors, pedometers, watches, blood pressure meters, weight scales, households sensors, collector devices, security tags, wireless keys, proximity sensors, HID keyboards and mice.

It can be powered directly with 1.8V ~ 3.6V power source, such as a standard 3V coin cell battery. BL5032 only consumes a little energy in different sleep mode, for example 850nA in deep sleep mode.

AtechOEM provides a proprietary GATT-based profile to our customers. The profile is similar to the classic SPP (Serial Port Profile) described in Bluetooth v2.1. Customers could use this special profile to transfer raw data between GATT-based connection in their application. AtechOEM also offer **customized firmware services** to meet specific applications more tightly.

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1. Typical Applications

- ➢ Home automation
- ➢ Sports & fitness
- ➢ Health care & Consumer wellness
- ➢ Sensors & Controls

- ➢ Industrial automation
- ➢ Security & Proximity
- ➢ Mobile phone accessories
- ➢ Data transferring

2. Product Information

■ Product Number : **BL5032**

■ Product Description: **Bluetooth v5.0 Single Mode BLE Module**

■ Product Features:

Chip	Nordic nRF52832 SoC solution
Standard	Bluetooth v 5.0 Single mode / BLE
RAM	64K byte RAM
Internal Flash	512K byte
RF band	2.4~2.4835GHz ISM band
Host Interface	UART
Digital Interface	UART / SPI / I2C
RF Output Power	Up to 6dBm Typically
Sensitivity	>-92.5dBm
Antenna	PCB Antenna
Power voltage	1.7V ~ 3.6V
Dimension	(L) 16 x (W) 10 x (H) 2.2mm
NFC	Type 2 near field communication (NFC-A) tag with wake up-on-field and touch-to-pair capabilities

4. Hardware

BL5032 is a surface-mount module designed to be integrated to a system board and fully compliant with Bluetooth 5.0 standard ,it also support up to 8 BLE connections . The power supply ranges from 1.7VDC to 3.6 VDC, it fast cold boot less than 50ms , and supply current at VBAT 3.0 on TX 7.5mA /RX 5.4mA . Digital I/O and analogue I/O (AI) are supported in BL5032. Following sections describe all hardware specifications and application reference.

4.1. Pin Assignment:

The following picture shows pinouts of BL5032 from the top of the module.
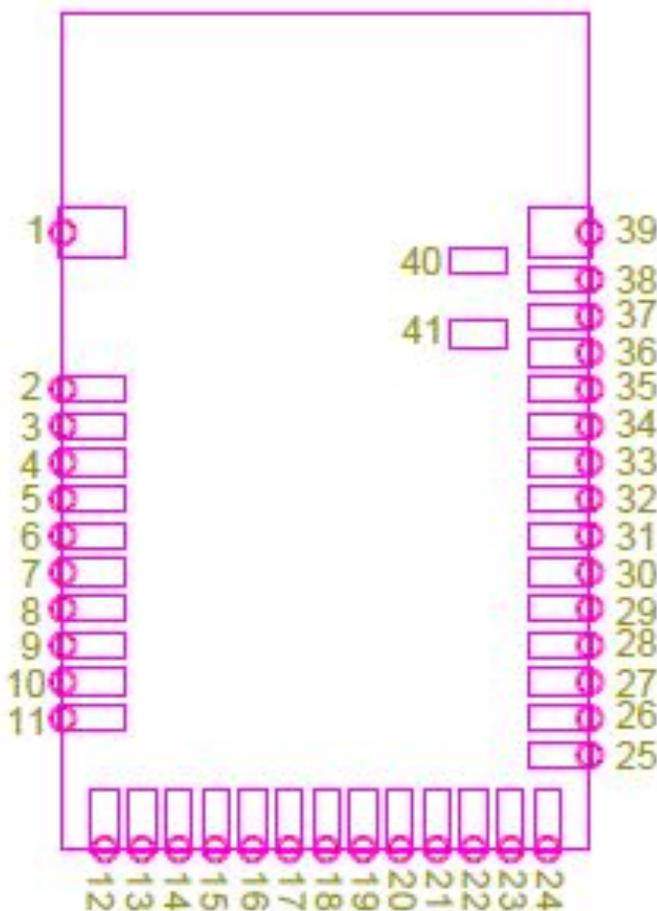
4.1 Pin Definition:

| Pin	Name	Type	Description
1	GND	Ground	The pad must be connected to a solid ground plane
2	P0.25	Digital I/O	General-purpose digital I/O
3	P0.26	Digital I/O	General-purpose digital I/O
4	P0.27	Digital I/O	General-purpose digital I/O
5	P0.28	Digital I/O	General-purpose digital I/O
	AIN4	Analog input	SAADC/COMP/LPCOMP input
6	P0.29	Digital I/O	General-purpose digital I/O
	AIN5	Analog input	SAADC/COMP/LPCOMP input
7	P0.30	Digital I/O	General-purpose digital I/O
	AIN6	Analog input	SAADC/COMP/LPCOMP input
8	P0.31	Digital I/O	General-purpose digital I/O
	AIN7	Analog input	SAADC/COMP/LPCOMP input
9	DEC4	Power	1V3 regulator supply decoupling. Input from DC/DC converter.
10	DCC	Power	DC/DC converter output pin
11	VDD	Power	Power-supply pin
12	GND	Ground	The pad must be connected to a solid ground plane
13	P0.00	Digital I/O	General-purpose digital I/O
	XL1	Analog input	Connection to 32.768khz crystal (LFXO)
14	P0.01	Digital I/O	General-purpose digital I/O
	XL2	Analog input	Connection to 32.768khz crystal (LFXO)
15	P0.02	Digital I/O	General-purpose digital I/O
	AIN1	Analog input	SAADC/COMP/LPCOMP input
16	P0.03	Digital I/O	General-purpose digital I/O
	AIN1	Analog input	SAADC/COMP/LPCOMP input
17	P0.04	Digital I/O	General-purpose digital I/O
	AIN2	Analog input	SAADC/COMP/LPCOMP input
18	P0.05	Digital I/O	General-purpose digital I/O
	AIN3	Analog input	SAADC/COMP/LPCOMP input
19	P0.06	Digital I/O	General-purpose digital I/O
20	P0.07	Digital I/O	General-purpose digital I/O

21	P0.08	Digital I/O	General-purpose digital I/O
22	P0.09	Digital I/O	General-purpose digital I/O
	NFC1	NFC input	NFC antenna connection
23	P0.10	Digital I/O	General-purpose digital I/O
	NFC2	NFC input	NFC antenna connection
24	GND	Ground	The pad must be connected to a solid ground plane
25	P0.11	Digital I/O	General-purpose digital I/O
26	P0.12	Digital I/O	General-purpose digital I/O
27	P0.13	Digital I/O	General-purpose digital I/O
28	P0.14	Digital I/O	General-purpose digital I/O
	TraceData(3)		Trace port output
29	P0.15	Digital I/O	General-purpose digital I/O
	TraceData(2)		Trace port output
30	P0.16	Digital I/O	General-purpose digital I/O
	TraceData(1)		Trace port output
31	P0.17	Digital I/O	General-purpose digital I/O
32	P0.18	Digital I/O	General-purpose digital I/O
	TraceData(0)		Trace port output
33	P0.19	Digital I/O	General-purpose digital I/O
34	P0.20	Digital I/O	General-purpose digital I/O
	TraceCLK		Trace port clock output
35	P0.21	Digital I/O	General-purpose digital I/O
	RESET		Configurable as system RESET pin
36	SWDCLK	Digital input	Serial Wire debug clock input for debug and programming
37	SWDIO	Digital I/O	Serial Wire debug I/O for debug and programming
38	P0.22	Digital I/O	General-purpose digital I/O
39	GND	Ground	The pad must be connected to a solid ground plane
40	P0.24	Digital I/O	General-purpose digital I/O
41	P0.23	Digital I/O	General-purpose digital I/O

4.2. Mechanical Specification

BL5032	
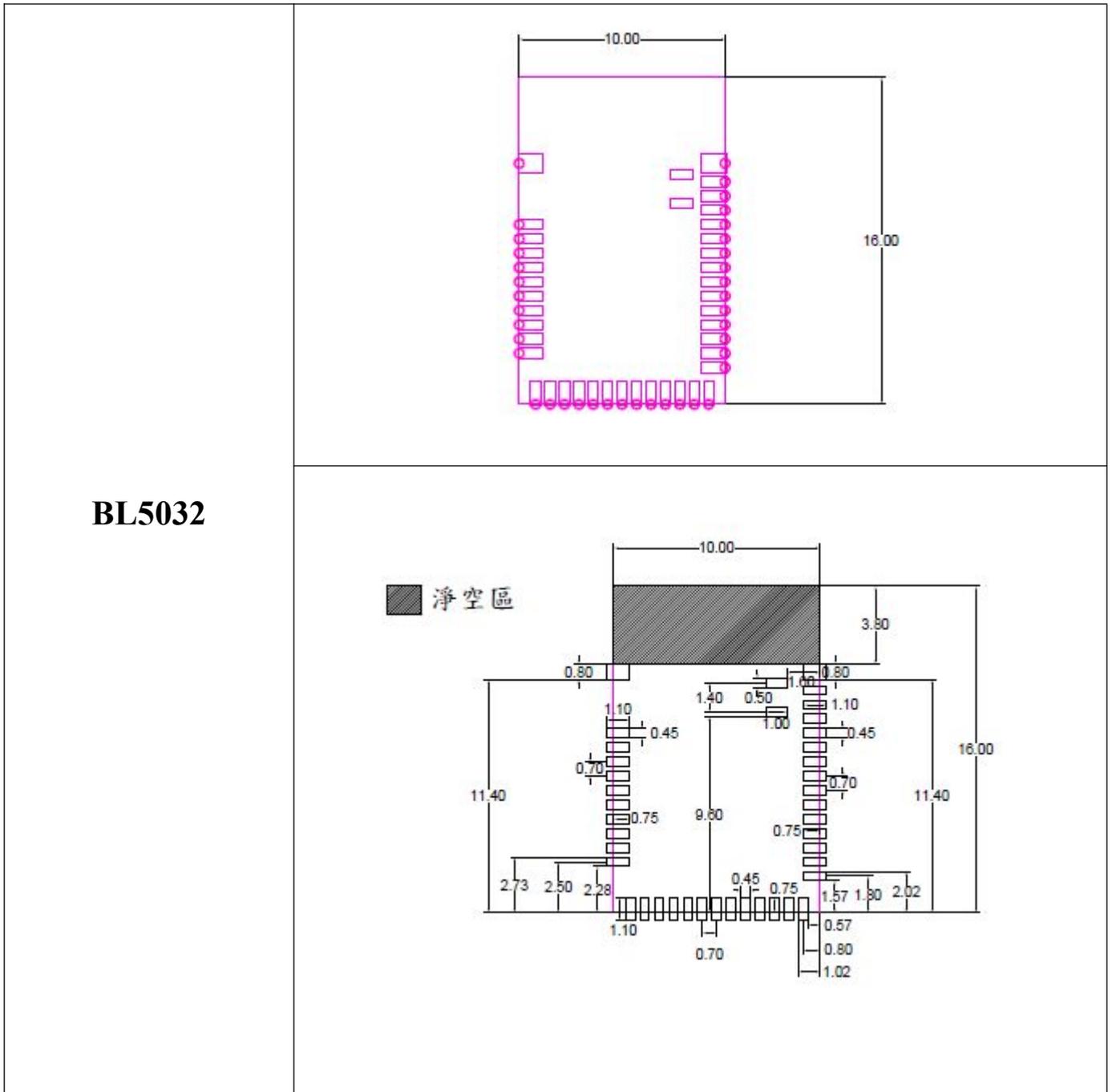
Unit : mm

4.3. PCB Layout Footprint
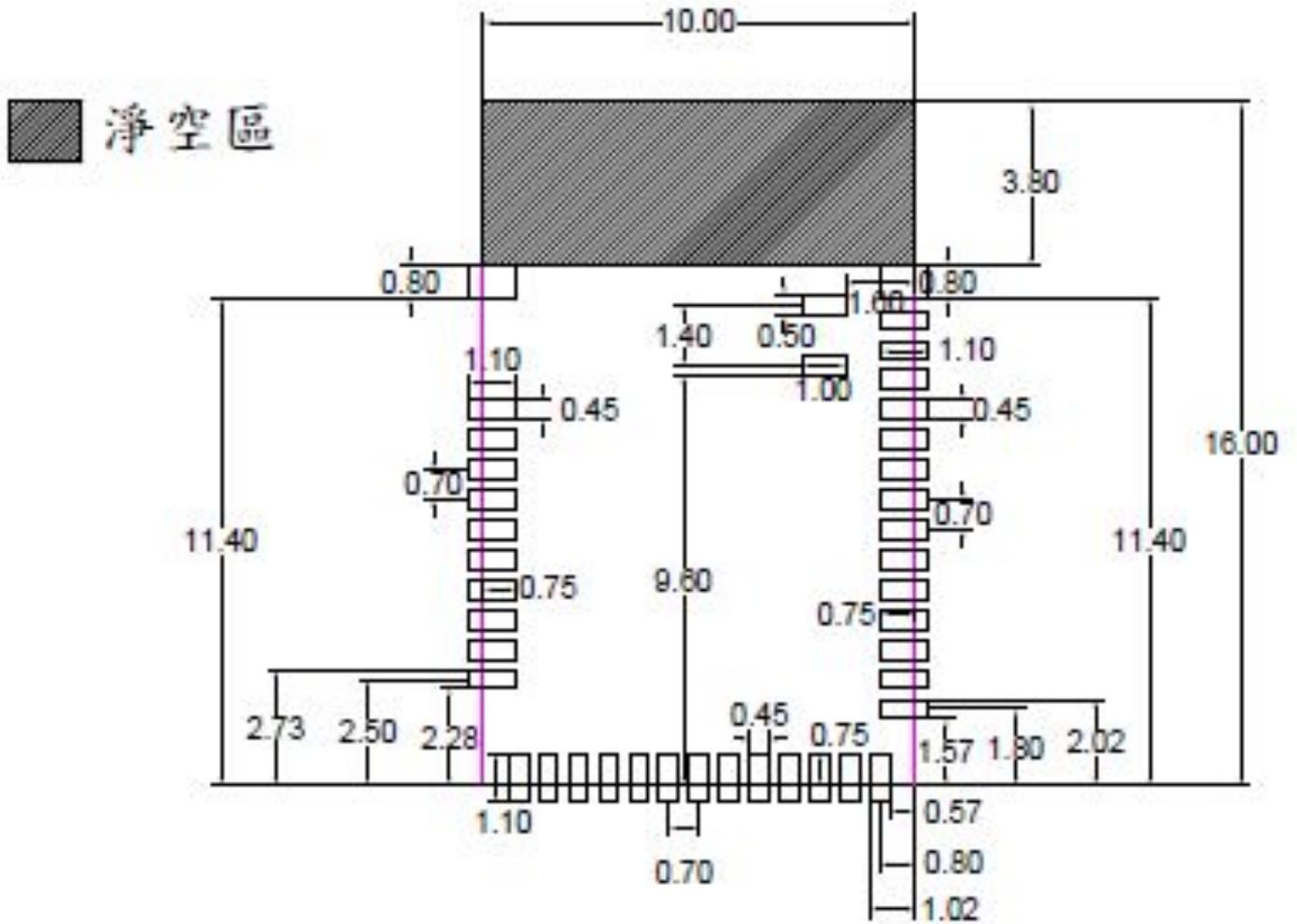
Unit : mm

4.4. Electrical Characteristics

	Min	Typ.	Max.	Unit
Supply Voltage	2.0	3.3	3.3	V
Normal Standby @ 3.3V	-	0.79	-	mA
TX (Normal mode) @ 3.3V	-	-	4.85	mA
RX (Normal mode) @ 3.3V	-	-	4.75	mA
None Sleep @ 3.3V	-	-	780	uA
Extended Sleep @ 3.3V	-	-	3.3	uA
Deep Sleep @ 3.3V	-	0.85	-	uA

■ Operating Conditions

Voltage Range	2.0V ~ 3.3V
Operating Temperature Range	-30 ^{o}C ~ 85 ^{o}C
Storage Temperature Range	-40 ^{o}C ~ 85 ^{o}C
Relative Humidity (Operating)	≤90%
Relative Humidity (Storage)	≤90%

4.5. Radio Characteristics

General RF Characteristic

Symbol	Description	Min.	Typ.	Max.	Units
f_{OP}	Operating frequencies	2360		2500	MHz
$f_{PLL,PROG,RES}$	PLL programming resolution		2		kHz
$f_{PLL,CH,SP}$	PLL channel spacing		1		MHz
$f_{DELTA,1M}$	Frequency deviation @ 1 Msps		±170		kHz
$f_{DELTA,BLE,1M}$	Frequency deviation @ BLE 1Msps		±250		kHz
$f_{DELTA,2M}$	Frequency deviation @ 2 Msps		±320		kHz
$f_{DELTA,BLE,2M}$	Frequency deviation @ BLE 2 Msps		±500		kHz
fsk_{SPS}	On-the-air data rate	1		2	Msps

RF Current Consumption (Tx)

Symbol	Description	Min.	Typ.	Max.	Units
$I_{TX,PLUS4dBM,DCDC}$	TX only run current (DCDC, 3V) P_{RF} =+4 dBm		7.5		mA
$I_{TX,PLUS4dBM}$	TX only run current P_{RF} = +4 dBm		16.6		mA
$I_{TX,0dBM,DCDC}$	TX only run current (DCDC, 3V) P_{RF} = 0dBm		5.3		mA
$I_{TX,0dBM}$	TX only run current P_{RF} = 0dBm		11.6		mA
$I_{TX,MINUS4dBM,DCDC}$	TX only run current DCDC, 3V P_{RF} = –4dBm		4.2		mA
$I_{TX,MINUS4dBM}$	TX only run current P_{RF} = -4 dBm		9.3		mA
$I_{TX,MINUS8dBM,DCDC}$	TX only run current DCDC, 3V P_{RF} = -8 dBm		3.8		mA
$I_{TX,MINUS8dBM}$	TX only run current P_{RF} = -8 dBm		8.4		mA
$I_{TX,MINUS12dBM,DCDC}$	TX only run current DCDC, 3V P_{RF} = -12 dBm		3.5		mA
$I_{TX,MINUS12dBM}$	TX only run current P_{RF} = -12 dBm		7.7		mA
$I_{TX,MINUS16dBM,DCDC}$	TX only run current DCDC, 3V P_{RF} = -16 dBm		3.3		mA
$I_{TX,MINUS16dBM}$	TX only run current P_{RF} = -16 dBm		7.3		mA
$I_{TX,MINUS20dBM,DCDC}$	TX only run current DCDC, 3V P_{RF} = -20 dBm		3.2		mA
$I_{TX,MINUS20dBM}$	TX only run current P_{RF} = -20 dBm		7.0		mA
$I_{TX,MINUS40dBM,DCDC}$	TX only run current DCDC, 3V P_{RF} = -40 dBm		2.7		mA
$I_{TX,MINUS40dBM}$	TX only run current P_{RF} = -40 dBm		5.9		mA
$I_{START,TX,DCDC}$	TX start-up current DCDC, 3V, P_{RF} = 4 dBm		4.0		mA
$I_{START,TX}$	TX start-up current, P_{RF} = 4 dBm		8.8		mA

RF Current Consumption (Rx)

Symbol	Description	Min.	Typ.	Max.	Units
$I_{RX,1M,DCDC}$	RX only run current (DCDC, 3V) 1Msps / 1Msps BLE		5.4		mA
$I_{RX,1M}$	RX only run current 1Msps / 1Msps BLE		11.7		mA
$I_{RX,2M,DCDC}$	RX only run current (DCDC, 3V) 2Msps / 2Msps BLE		5.8		mA
$I_{RX,2M}$	RX only run current 2Msps / 2Msps BLE		12.9		mA
$I_{START,RX,DCDC}$	RX start-up current (DCDC 3V)		3.5		mA
$I_{START,RX,LDO}$	RX start-up current (LDO 3V)		7.5		mA

Transmitter specification

| Symbol	Description	Min.	Typ.	Max.	Units
P_{RF}	Maximum output power		4	6	dBm
P_{RFC}	RF power control range		24		dB
P_{RFCR}	RF power accuracy			±4	dB
$P_{RF1,1}$	1st Adjacent Channel Transmit Power 1 MHz (1 Msps Nordic proprietary mode)		-25		dBc
$P_{RF2,1}$	2nd Adjacent Channel Transmit Power 2 MHz (1 Msps Nordic proprietary mode)		-50		dBc
$P_{RF1,2}$	1st Adjacent Channel Transmit Power 2 MHz (2 Msps Nordic proprietary mode)		-25		dBc
$P_{RF2,2}$	2nd Adjacent Channel Transmit Power 4 MHz (2 Msps Nordic proprietary mode)		-50		dBc
$P_{RF1,2,BLE}$	1st Adjacent Channel Transmit Power 2 MHz (2 Msps BLE mode)		-20		dBc
$P_{RF2,2,BLE}$	2nd Adjacent Channel Transmit Power 4 MHz (2 Msps BLE mode)		-50		dBc

Receiver Sensitivity

Symbol	Description	Min.	Typ.	Max.	Units
C/I$_{1M,co-channel}$	1Msps mode, Co-Channel interference		9		dB
C/I$_{1M,-1MHz}$	1 Msps mode, Adjacent (-1 MHz) interference		-2		dB
C/I$_{1M,+1MHz}$	1 Msps mode, Adjacent (+1 MHz) interference		-10		dB
C/I$_{1M,-2MHz}$	1 Msps mode, Adjacent (-2 MHz) interference		-19		dB
C/I$_{1M,+2MHz}$	1 Msps mode, Adjacent (+2 MHz) interference		-42		dB
C/I$_{1M,-3MHz}$	1 Msps mode, Adjacent (-3 MHz) interference		-38		dB
C/I$_{1M,+3MHz}$	1 Msps mode, Adjacent (+3 MHz) interference		-48		dB
C/I$_{1M,\pm6MHz}$	1 Msps mode, Adjacent (≥6 MHz) interference		-50		dB
C/I$_{1MBLE,co-channel}$	1 Msps BLE mode, Co-Channel interference		6		dB
C/I$_{1MBLE,-1MHz}$	1 Msps BLE mode, Adjacent (-1 MHz) interference		-2		dB
C/I$_{1MBLE,+1MHz}$	1 Msps BLE mode, Adjacent (+1 MHz) interference		-9		dB
C/I$_{1MBLE,-2MHz}$	1 Msps BLE mode, Adjacent (-2 MHz) interference		-22		dB
C/I$_{1MBLE,+2MHz}$	1 Msps BLE mode, Adjacent (+2 MHz) interference		-46		dB
C/I$_{1MBLE,>3MHz}$	1 Msps BLE mode, Adjacent (≥3 MHz) interference		-50		dB
C/I$_{1MBLE,image}$	Image frequency Interference		-22		dB
C/I$_{1MBLE,image,1MHz}$	Adjacent (1 MHz) interference to in-band image frequency		-35		dB
C/I$_{2M,co-channel}$	2Msps mode, Co-Channel interference		10		dB
C/I$_{2M,-2MHz}$	2 Msps mode, Adjacent (-2 MHz) interference		6		dB
C/I$_{2M,+2MHz}$	2 Msps mode, Adjacent (+2 MHz) interference		-14		dB
C/I$_{2M,-4MHz}$	2 Msps mode, Adjacent (-4 MHz) interference		-20		dB
C/I$_{2M,+4MHz}$	2 Msps mode, Adjacent (+4 MHz) interference		-44		dB
C/I$_{2M,-6MHz}$	2 Msps mode, Adjacent (-6 MHz) interference		-42		dB
C/I$_{2M,+6MHz}$	2 Msps mode, Adjacent (+6 MHz) interference		-47		dB
C/I$_{2M,\geq12MHz}$	2 Msps mode, Adjacent (≥12 MHz) interference		-52		dB
C/I$_{2MBLE,co-channel}$	2 Msps BLE mode, Co-Channel interference		7		dB
C/I$_{2MBLE,\pm2MHz}$	2 Msps BLE mode, Adjacent (±2 MHz) interference		0		dB
C/I$_{2MBLE,\pm4MHz}$	2 Msps BLE mode, Adjacent (±4 MHz) interference		-47		dB
C/I$_{2MBLE,\geq6MHz}$	2 Msps BLE mode, Adjacent (≥6 MHz) interference		-49		dB
C/I$_{2MBLE,image}$	Image frequency Interference		-21		dB
C/I$_{2MBLE,image, 2MHz}$	Adjacent (2 MHz) interference to in-band image frequency		-36		dB

Remark: Wanted signal level at PIN = -67 dBm. One interferer is used, having equal modulation as the wanted signal. The input power of the interferer where the sensitivity equals BER = 0.1% is presented.
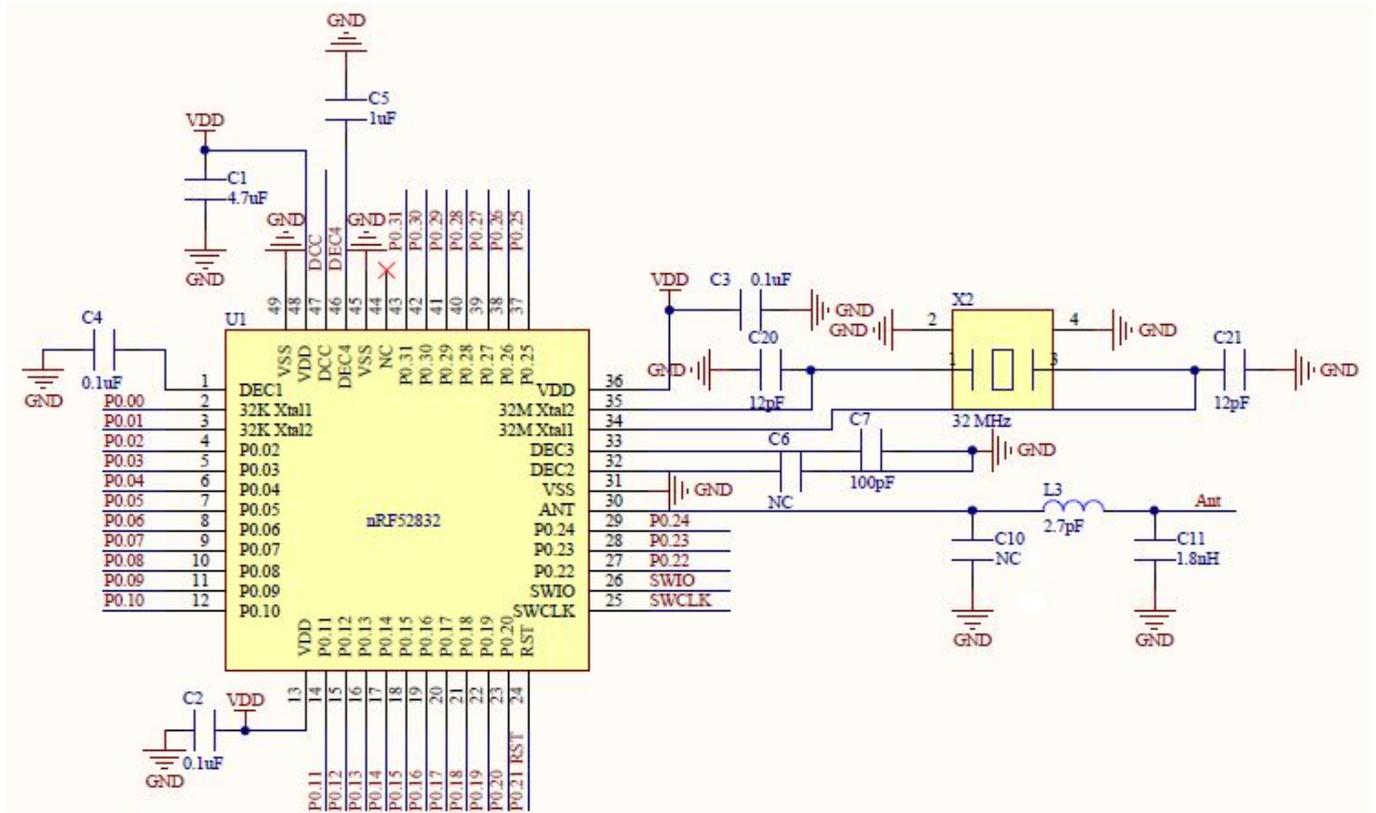
...

4.6. Block Diagram
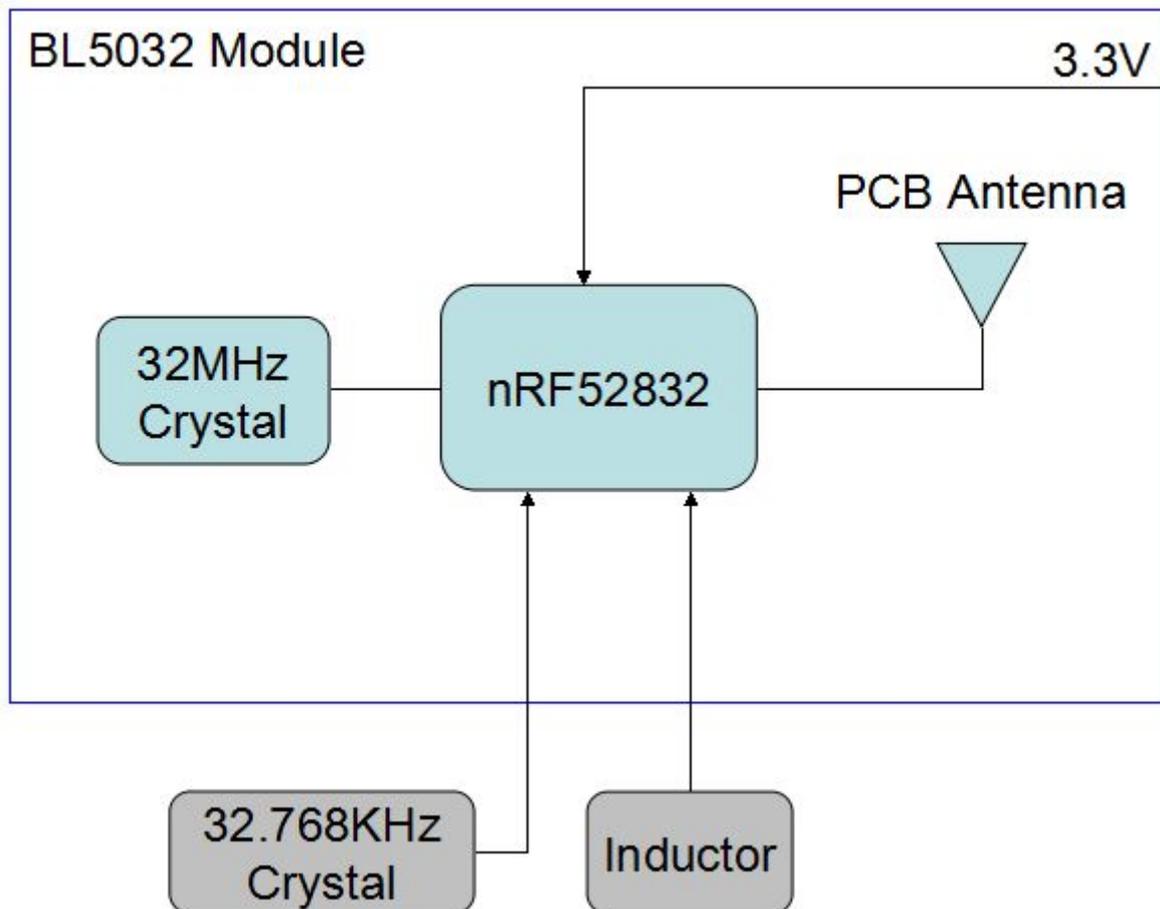
4.7. Reference Circuit
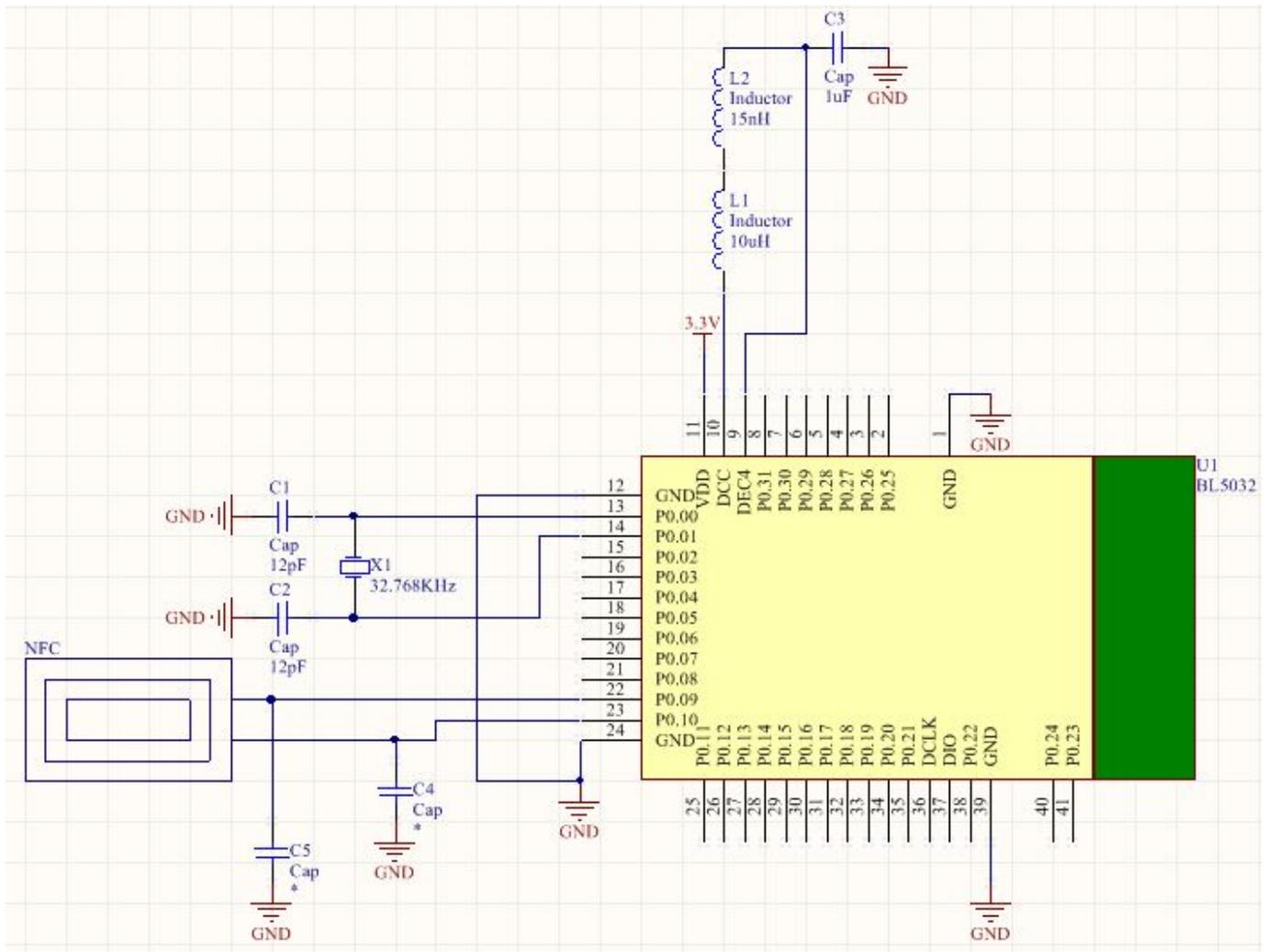
4.8. Module Schematics

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.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 cm between the radiator and a human body.

If the 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, Contains FCC ID: YX6BL5032

Co-location of this module with other transmitters that operate simultaneously are required to be evaluated using the multi-transmitter procedures.

The host integrator must follow the integration instructions provided in this document and ensure that the composite-system end product complies with the requirements by a technical assessment or evaluation to the rules and to KDB Publication 996369.

The host integrator installing this module into their product must ensure that the final composite product complies with the requirements by a technical assessment or evaluation to the rules, including the transmitter operation and should refer to guidance in KDB 996369.

ISED Statement:

This device contains licence-exempt transmitter(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:
(1) this device may not cause interference,
(2) this device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :
(1) L'appareil ne doit pas produire de brouillage;
(2) L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

If the 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, Contains IC: 24050-BL5032
Si le numéro d'identification n'est pas visible lorsque le module est installé à l'intérieur d'un autre appareil, alors l'extérieur de l'appareil dans lequel le module est installé doit également afficher une étiquette faisant référence au module fourni, Contient IC : 24050-BL5032