MN54L-C15

Bluetooth® Low Energy Module

Datasheet Version A

Ordering Code

MN54L-C15 module for Box packaging: MN-L15Q1-01A-CB

BLE Solution: Nordic NRF54L15

RF IC	Crystal	Chip antenna
Nordic NRF54L15/V1	32MHz/20ppm/CL=8PF Embedded	Embedded

Overview and Benefits

Overview

The MN54L-C15 from Aradconn is a highly flexible, ultra-low power, Bluetooth Low Energy module based on the nRF54L15 SoC from Nordic Semiconductor. With an Arm® Cortex®-M33 with FPU 32-bit processor, embedded 2.4GHz transceiver, and integrated chip antenna. Providing full use of the nRF54L15's capabilities and peripherals, which include I2C, SPI,QSPI, UART, I2S, ADC, GPIO, PWM, and NFC interfaces.

Benefits

- **Bluetooth qualification and Regulatory certification reduce the burden to enter the market.**
- **Complete RF solution with no additional RF design, allowing faster time to launch a new product, and providing long working distance.**

  MN54L-C: up to 500 meters in open space. @1 Mbps
- **Compact size: (L) 14.5 x (W) 9.3 x (H) 2.1mm.**
- **Provides flexibility in the OEM's application development choice with full support for using Nordic SDK and firmware tools.**

Contents

1. Features

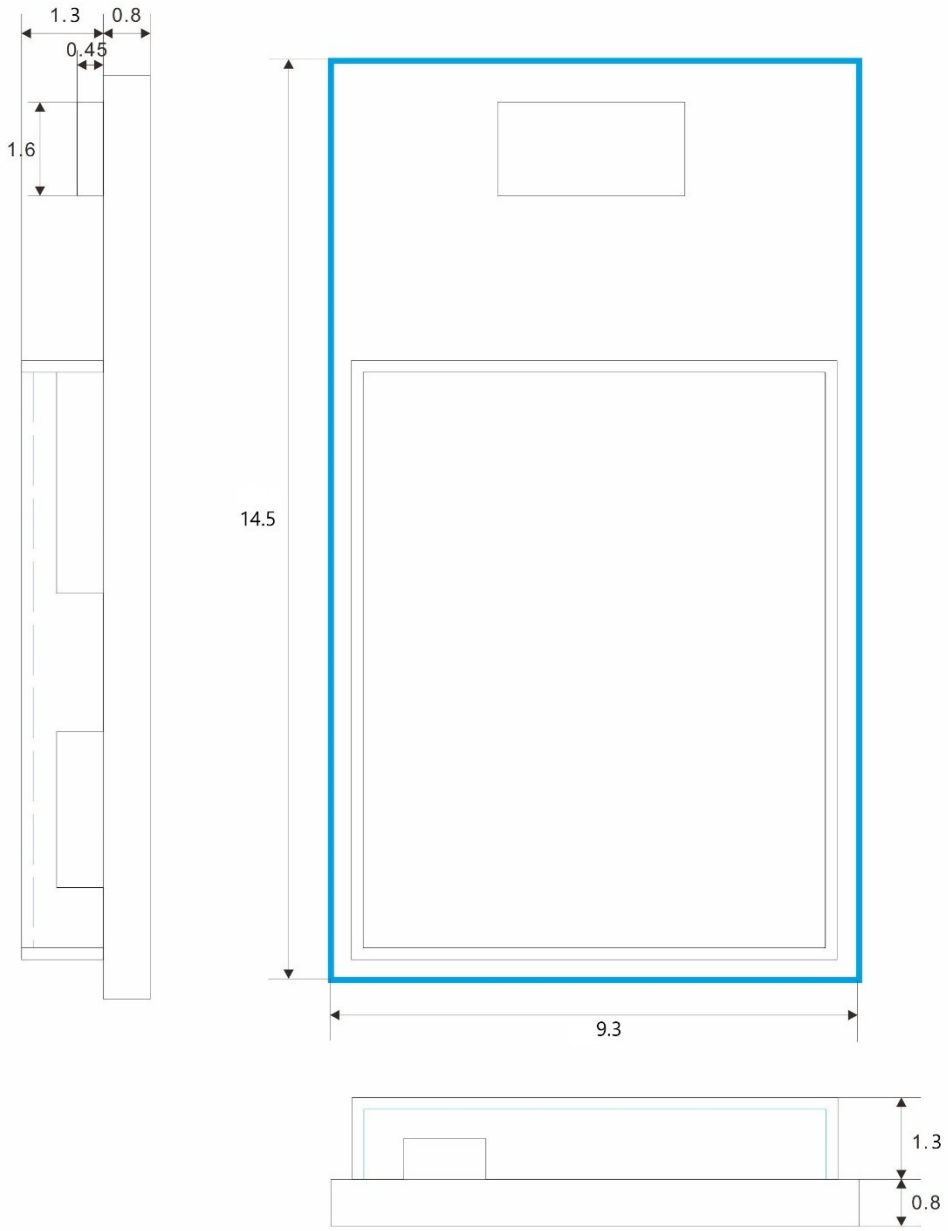
1.1 Features

- **2.4 GHz transceiver**
  - -96 dBm sensitivity in 1Mbps Bluetooth® low energy mode
  - -104 dBm sensitivity in 125kbps Bluetooth® low energy mode(long range)
  - -8 to +8dBm TX power, configurable in 1 dB steps
  - Supported data rates:
    - Bluetooth® 5 – 2 Mbps, 1 Mbps, 500 kbps, and 125 kbp
    - IEEE 802.15.4-2020 – 250 kbps
    - Proprietary 2.4 GHz –4Mbps, 2 Mbps, 1 Mbps
  - 9.1 mA/ @3V DC/DC peak current in TX (7 dBm)
  - 2.1 mA/@3V DC/DC peak current in RX
  - RSSI (1 dB resolution)
- **Arm® Cortex®-M33 32-bit processor with TrustZone® technology, 128 MHz**
  - 500 EEMBC CoreMark® score running from non-volatile memory
  - Single-precision floating-point unit (FPU)
  - Memory protection unit (MPU)
  - Digital signal processing (DSP) instructions
  - Serial wire debug (SWD)
- **Operating condition**
  - 1.7 V to 3.6 V supply and I/O voltage
  - Single 32 MHz crystal operation
  - Optional 32.768 kHz clock
  - Operating temperature from -40°C to 85°C
- **Memory**
  - 1.524MB NVM/256 kB RAM
- **Peripherals**
  - RISC-V 128MHZ Coprocessor
  - 31 general purpose I/O pins
  - Global RTC (GRTC) that can run in System OFF mode and implement a shared system timer
  - Seven 32-bit timers with counter mode
  - Up to five fully featured serial interfaces with EasyDMA, supporting I2C, SPI controller/peripheral, and UART
    - One high-speed SPIM up to 32 MHz, four up to 8 MHz
    - I2C up to 400 kHz

- Three pulse width modulator (PWM) units with EasyDMA
- I2S two channel Inter-IC sound interface
- ADC with up to eight programmable gain channels.
  14-bit at 31.25ksps, 12-bit at 250 ksps, and up to 10-bit at 2 Msps.
- Pulse density modulation (PDM) interface
- Near field communication (NFC)
- Up to two quadrature decoders (QDEC)
- Comparator and low-power comparator with wake-up from System OFF mode
- Temperature sensor

2. Mechanical specifications

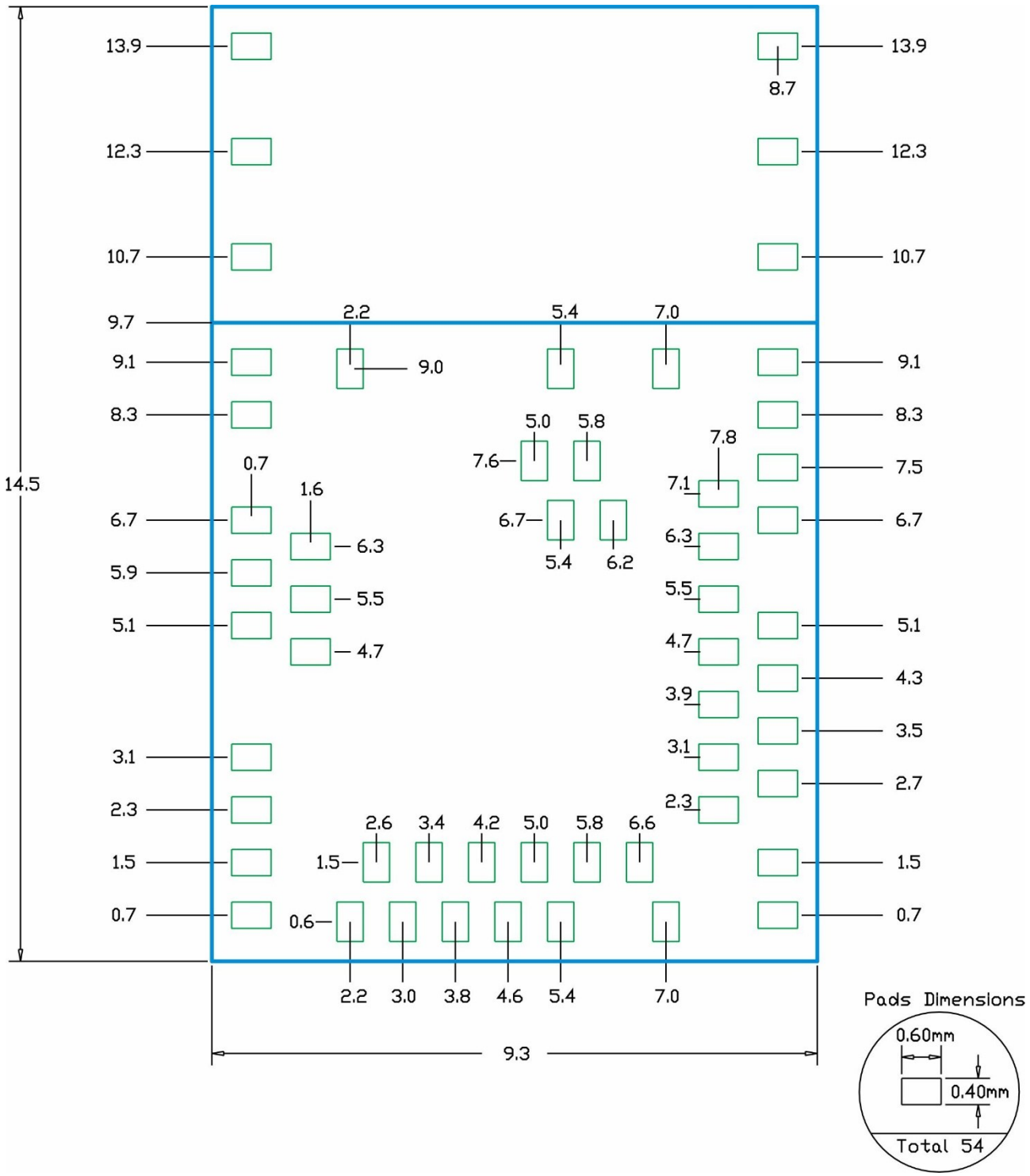
2.1 Dimensions



All dimensions are in millimeters.

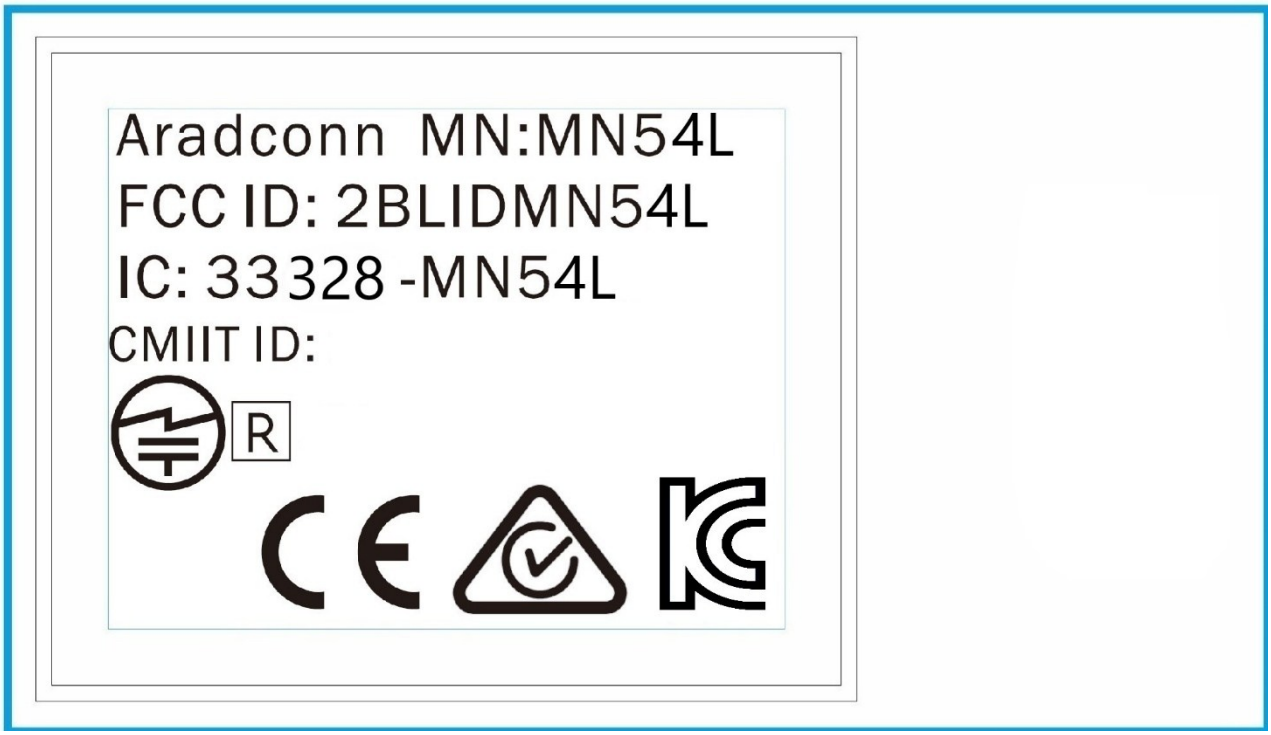
Item	Dimension	Tolerance
Length	14.5mm	±0.30 mm
Width	9.3mm	±0.30mm
Height	2.1mm	±0.30mm

2.2 Footprint

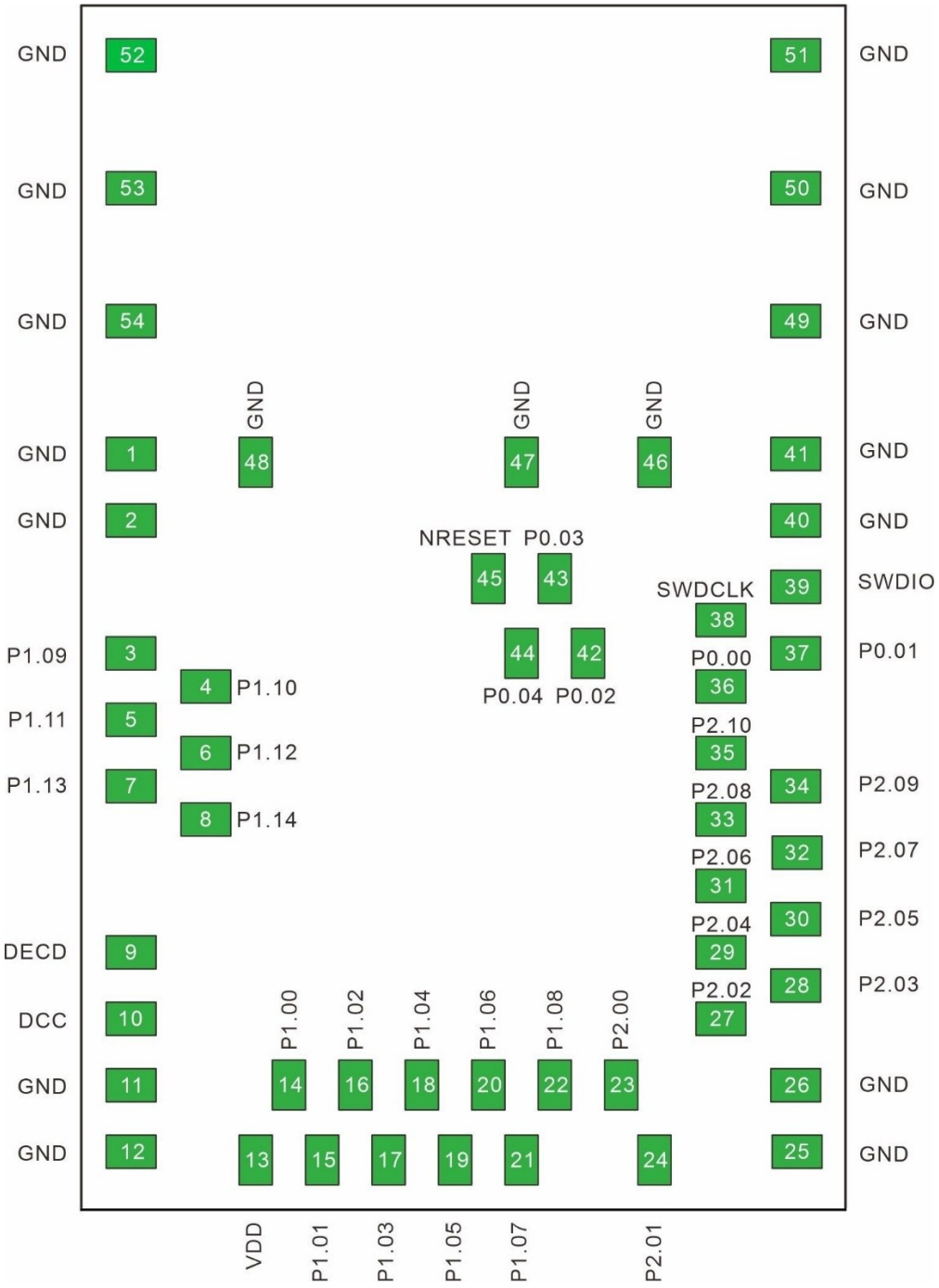


All dimensions are in millimeters.

2.3 Module Marking



3. Pin Assignment



Pin No.	Name	Pin function	Description
(1)	GND	Ground	The pad must be connected to a solid ground plane
(2)	GND	Ground	The pad must be connected to a solid ground plane
(3)	P1.09	Digital I/O	General-purpose I/O
	Radio 0	Digital I/O	DFEGPIO : Direction Finding Antenna select GPIO
(4)	P1.10	Digital I/O	General-purpose I/O
	Radio 1	Digital I/O	DFEGPIO : Direction Finding Antenna select GPIO
(5)	P1.11	Digital I/O	General-purpose I/O
	Radio 2	Digital I/O	DFEGPIO : Direction Finding Antenna select GPIO
	AIN4	Analog input	Analog input
		Clock pin	Can be set as TWI
(6)	P1.12	Digital I/O	General-purpose I/O
	Radio 3	Digital I/O	DFEGPIO : Direction Finding Antenna select GPIO
	AIN5	Analog input	Analog input
		Clock PIN	Can be set as TWI
(7)	P1.13	Digital I/O	General-purpose I/O
	Radio 4	Digital I/O	DFEGPIO : Direction Finding Antenna select GPIO
	AIN6	Analog input	Analog input
(8)	P1.14	Digital I/O	General-purpose I/O
	Radio 5	Digital I/O	DFEGPIO : Direction Finding Antenna select GPIO
	AIN7	Analog input	Analog input
(9)	DECD	Power	0.9 V regulator supply decoupling
(10)	DCC	Power	DC/DC regulator output
(11)	GND	Ground	The pad must be connected to a solid ground plane
(12)	GND	Ground	The pad must be connected to a solid ground plane
(13)	VDD	Power	Power supply
(14)	P1.00	Digital I/O	General-purpose I/O
	XL1	Analog input	Connection to 32.768kHz crystal (LFXO)
(15)	P1.01	Digital I/O	General-purpose I/O
	XL2	Analog input	Connection to 32.768kHz crystal (LFXO)
(16)	P1.02	Digital I/O	General-purpose I/O
	NFC1	NFC input	NFC antenna connection
(17)	P1.03	Digital I/O	General-purpose I/O
	NFC2	NFC input	NFC antenna connection
		Clock pin	Can be set as TWI when NFC is unused
(18)	P1.04	Digital I/O	General-purpose I/O
	AIN0	Analog input	Analog input
		Clock PIN	Can be set as TWI when NFC is unused
(19)	P1.05	Digital I/O	General-purpose I/O
	Radio 6	Digital I/O	DFEGPIO : Direction Finding Antenna select GPIO
	AIN1	Analog input	Analog input
(20)	P1.06	Digital I/O	General-purpose I/O
	AIN2	Analog input	Analog input
(21)	P1.07	Digital I/O	General-purpose I/O
	AIN3	Analog input	Analog input

Pin No.	Name	Pin function	Description
(22)	P1.08	Digital I/O	General-purpose I/O
	CLK16M	Clock PIN	GRTC HF clock output
	EXTREF	Analog input	External reference for SAADC
(23)	P2.00	Digital I/O	General-purpose I/O
		Digital I/O	SPIM DCX
		Digital I/O	UARTE RXD
		Digital I/O	QSPI D3
(24)	P2.01	Digital I/O	General-purpose I/O
		Clock PIN	SPIM SCK
		Clock PIN	SPIS SCK
		Clock PIN	QSPI SCK
(25)	GND	Ground	The pad must be connected to a solid ground plane
(26)	GND	Ground	The pad must be connected to a solid ground plane
(27)	P2.02	Digital I/O	General-purpose I/O
		Digital I/O	SPIM SDO
		Digital I/O	SPIS SDO
		Digital I/O	UARTE TXD
		Digital I/O	QSPI D0
(28)	P2.03	Digital I/O	General-purpose I/O
		Digital I/O	QSPI D2
(29)	P2.04	Digital I/O	General-purpose I/O
		Digital I/O	SPIM SDI
		Digital I/O	SPIS SDI
		Digital I/O	UARTE CTS
		Digital I/O	QSPI D1
(30)	P2.05	Digital I/O	General-purpose I/O
		Digital I/O	SPIM CS
		Digital I/O	UARTE RTS
		Digital I/O	QSPI CS
(31)	P2.06	Digital I/O	General-purpose I/O
		Clock PIN	SPIM SCK
		Clock PIN	SPIS SCK
(32)	P2.07	Digital I/O	General-purpose I/O
		Digital I/O	SPIM DCX
(33)	P2.08	Digital I/O	General-purpose I/O
		Digital I/O	SPIM SDO
		Digital I/O	SPIS SDO
		Digital I/O	UARTE TXD
(34)	P2.09	Digital I/O	General-purpose I/O
		Digital I/O	SPIM SDI
		Digital I/O	SPIS SDI
		Digital I/O	UART CTS

Pin No.	Name	Pin function	Description
(35)	P2.10	Digital I/O	General-purpose I/O
		Digital I/O	SPIM CS
		Digital I/O	UARTE RTS
(36)	P0.00	Digital I/O	General-purpose I/O
(37)	P0.01	Digital I/O	General-purpose I/O
(38)	SWDCLK	Debug	Serial wire clock. Input with onchip pull-up.
(39)	SWDIO	Debug	Serial wire data. Bidirectional with standard-drive and on-chip pull-down.
(40)	GND	Ground	The pad must be connected to a solid ground plane
(41)	GND	Ground	The pad must be connected to a solid ground plane
(42)	P0.02	Digital I/O	General-purpose I/O
(43)	P0.03	Digital I/O	General-purpose I/O
	GRTCPWM	Clock PIN	GRTC PWM output
(44)	P0.04	Digital I/O	General-purpose I/O
	GRTCLFCLKOUT	Clock PIN	GRTC LF clock output
(45)	nRESET	Reset	Pin reset with on-chip pull-up
(46)	GND	Ground	The pad must be connected to a solid ground plane
(47)	GND	Ground	The pad must be connected to a solid ground plane
(48)	GND	Ground	The pad must be connected to a solid ground plane
(49)	GND	Ground	The pad must be connected to a solid ground plane
(50)	GND	Ground	The pad must be connected to a solid ground plane
(51)	GND	Ground	The pad must be connected to a solid ground plane
(52)	GND	Ground	The pad must be connected to a solid ground plane
(53)	GND	Ground	The pad must be connected to a solid ground plane
(54)	GND	Ground	The pad must be connected to a solid ground plane

3.1 GPIO Recommended usage

Module PIN N0.	NRF54L15 GPIO	Recommended usage
QSPI		
23	P2.00	QSPI D3
24	P2.01	QSPI SCK
27	P2.02	QSPI D0
28	P2.03	QSPI D2
29	P2.04	QSPI D1
30	P2.05	QSPI CS
TWI	(Note: TWIM and TWIS must use clock pins for both SDA and SCL)	
5	P1.11	TWI
6	P1.12	TWI
17	P1.03	Can be set as TWI when NFC is unused
18	P1.04	Can be set as TWI when NFC is unused
43	P0.03	Can be set as TWI when PWM output is unused
44	P0.04	Can be set as TWI when LF Clock output is unused
UARTE 00/20		
23	P2.00	RXD
27	P2.02	TXD
29	P2.04	CTS
30	P2.05	RTS
UARTE 00/21		
32	P2.07	RXD
33	P2.08	TXD
34	P2.09	CTS
35	P2.10	RTS
SPI 00/20		
23	P2.00	SPIM DCX
24	P2.01	SPIM/SPIS SCK
27	P2.02	SPIM/SPIS SDO
29	P2.04	SPIM/SPIS SDI
30	P2.05	SPIM CS
SPI 00/21		
31	P2.06	SPIM/SPIS SCK
32	P2.07	SPIM DCX
33	P2.08	SPIM/SPIS SDO
34	P2.09	SPIM/SPIS SDI
35	P2.10	SPIM CS

NFC		
17	P1.03	NFC1
18	P1.04	NFC2
PWM		
43	P0.03	PWM
Clock Output		
22	P1.08	GRTC HF clock output(16MHZ)
44	P0.04	GRTC LF clock output (32.768KHZ)
Analog Input		
19	P1.05	AIN1
20	P1.06	AIN2
21	P1.07	AIN3
22	P1.08	External reference for SAADC
5	P1.11	AIN4
6	P1.12	AIN5
7	P1.13	AIN6
8	P1.14	AIN7
Radio (Direction Finding Antenna select GPIO)		
3	P1.09	Radio 0
4	P1.10	Radio 1
5	P1.11	Radio 2
6	P1.12	Radio 3
7	P1.13	Radio 4
8	P1.14	Radio 5

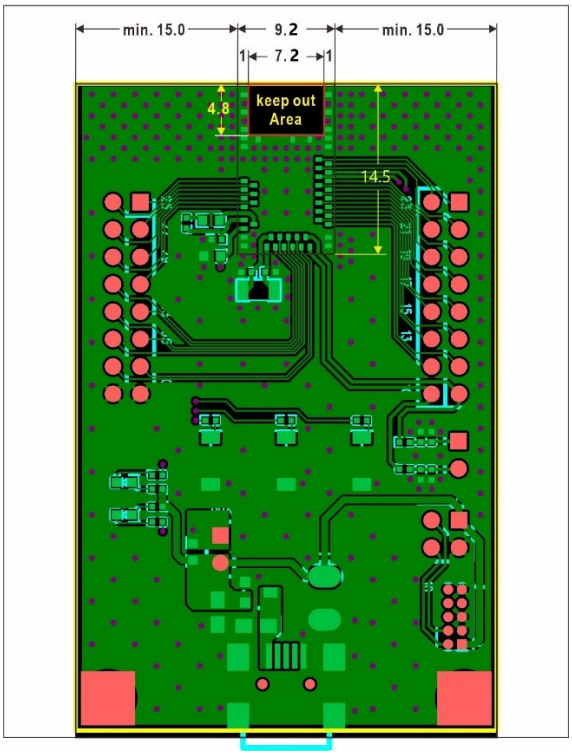
4 Layout design notes

4.1 Recommended RF layout and ground plane

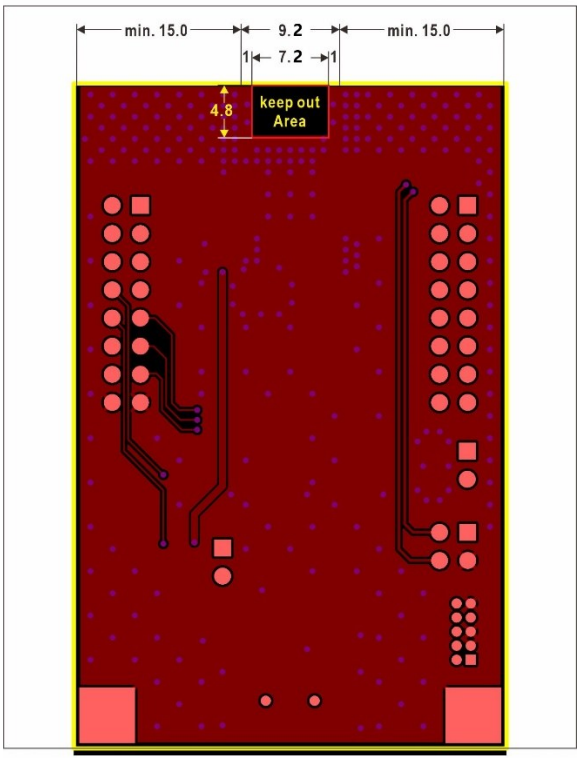
It is recommended to place the module:

- In the center (horizontal) of any mother PCB edge, with GND planes to the left and right
- Keep out Area should be included in the corresponding position of the antenna in each layer.
- Add via hole around GND pads on the mother PCB as many as you can, especially on the four corners and antenna area.

TOP VIEW

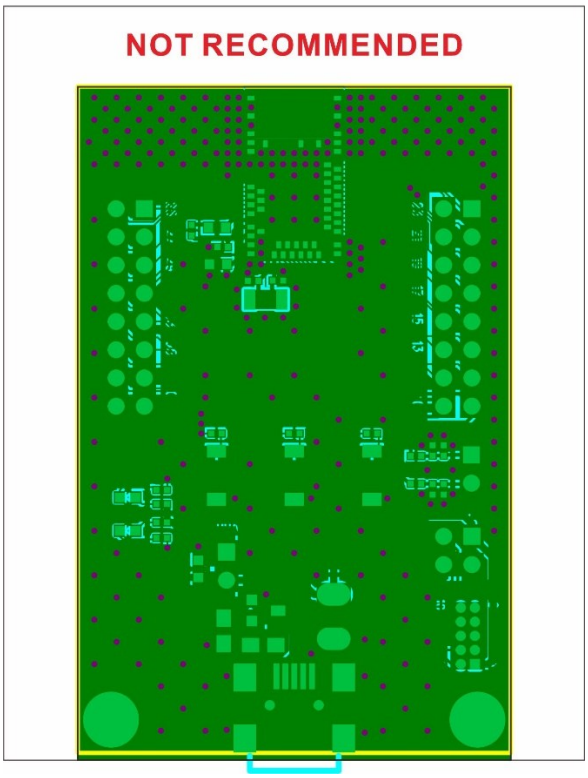


Bottom VIEW

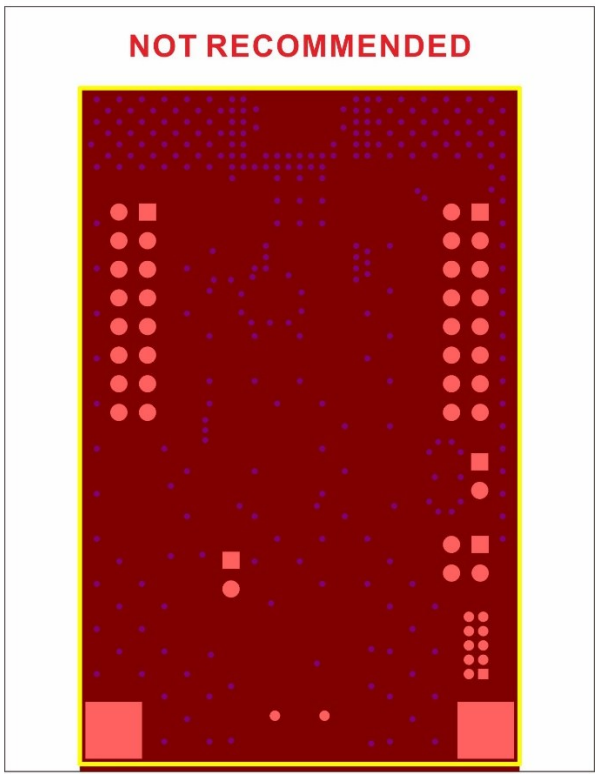


4.2 Not Recommended RF layout and ground plane

TOP VIEW



Bottom VIEW



4.3 Antenna keep out when proximity to Metal

• The minimum safe distance for metals without seriously compromising the antenna tuning is 4cm (bottom, top, left, right).

• Metal close to the antenna (bottom, top, left, right) will degrade RF performance. Any metal closer than 2 cm will significantly degrade RF performance.

5. Electrical Specification

5.1 Absolute Maximum Ratings

Maximum ratings are the extreme limits to which the chip can be exposed for a limited amount of time without causing permanent damage. Prolonged exposure to absolute maximum ratings may affect the device's reliability.

Parameter	Min.	Max.	Unit
Supply voltage			
VDD	-0.3	+3.6	V
VSS		0	V
I/O pin voltage			
$V_{I/O}$, VDD ≤3.5 V	-0.3	VDD+0.3	V
$V_{I/O}$, VDD >3.5 V		3.6	V
Environmental			
Storage temperature	-40	+105	°C
MSL (moisture sensitivity level)		2	
ESD HBM (human body model)		1	KV
ESD CDM (charged device model)		500	V
Flash memory			
Endurance		10000	Write/erase cycles
Retention		10 years at 85°C	

5.2 Operation Conditions

Parameter	Min.	Nom.	Max.	Units
VDD (independent of DCDC)	1.7		3.5	V
VDD during power on reset	1.75			V
Operating temperature	-40	25	85	°C

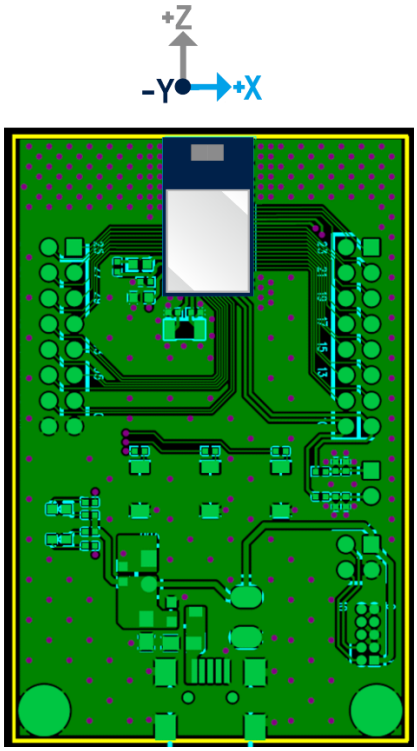
5.3 Radio Specifications

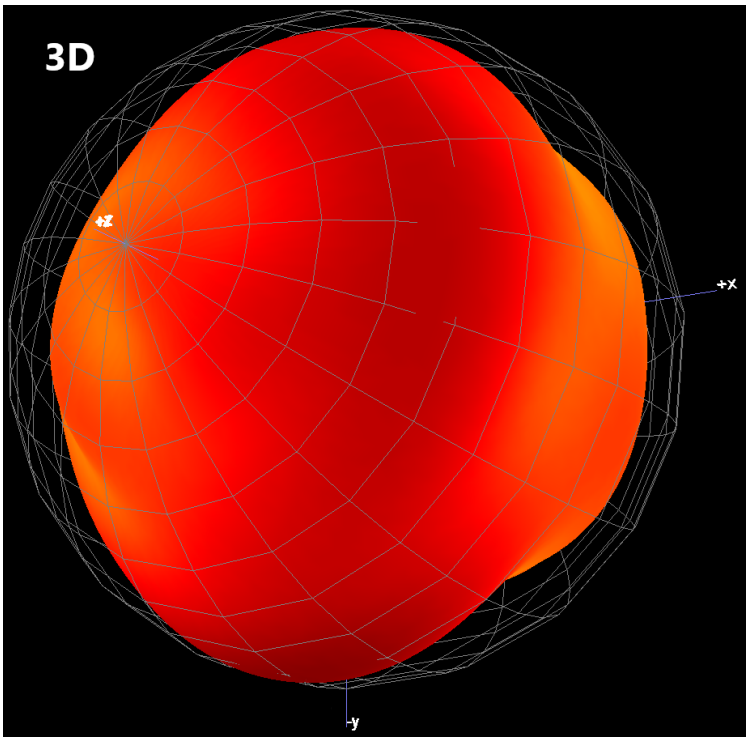
Parameter	Description	Min.	Typ.	Max.	Unit
Operating frequencies	BLE	2402		2480	MHz
Channel spacing	BLE		2		MHz
Frequency deviation	BLE 1Mbps		±250		kHz
	BLE 2Mbps		±500		kHz
On-the-air data rate		125		4000	kHz
Transmitter					
TX power	Setting at +7dBm		+7		dBm
RF power control range	-8 ~+8dBm, in 1db step	-16		+7	dBm
TX current (TX only)	DCDC@3V/+7 dBm		9.1		mA
Receiver					
Receive Sensitivity	1Msps BLE ideal transmitter Packet <=37bytes BRE=0.1%		-96		dBm
	2Msps BLE ideal transmitter Packet <=37bytes BRE=0.1%		-94		dBm
	125ksps BLE ideal transmitter Packet <=37bytes BRE=0.1%		-104		dBm
RX current (RX only)	DCDC@3V/1Msps BLE		2.1		mA
	DCDC@3V/2Msps BLE		2.2		mA
RSSI	RSSI Accuracy Valid range	-90		-30	dBm
	RSSI resolution		1		dB
	Sample period		0.25		us
Antenna gain			1.05		dBi

5.4 Antenna information

The antenna test report is based on the BN54L-C15 with a ground plane size of 60 mm x 40 mm.

5.4.1 The orientation of Antenna

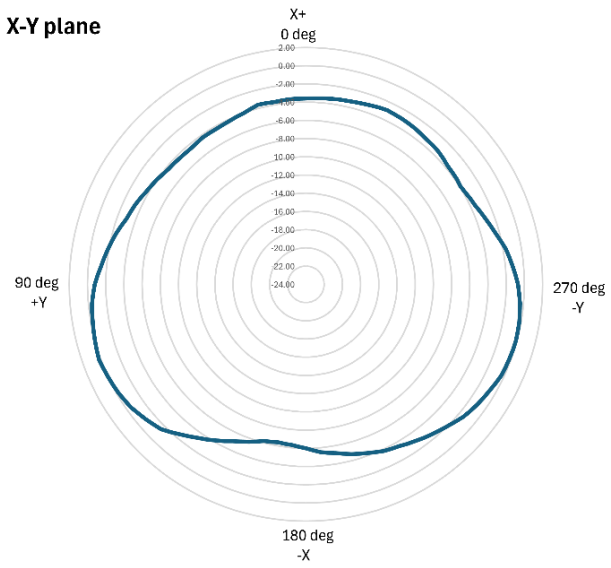


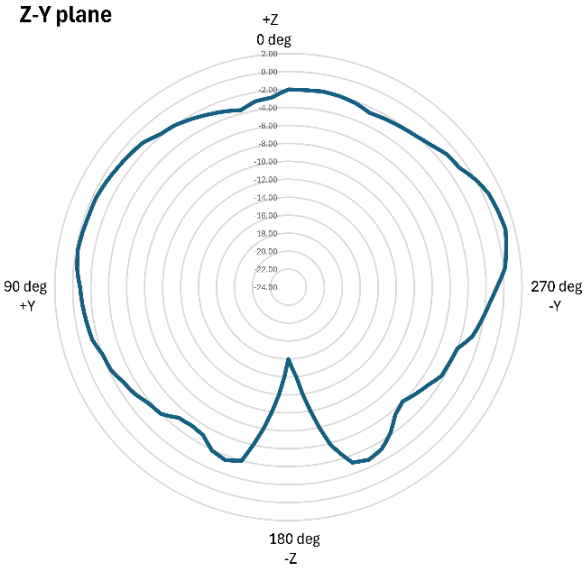


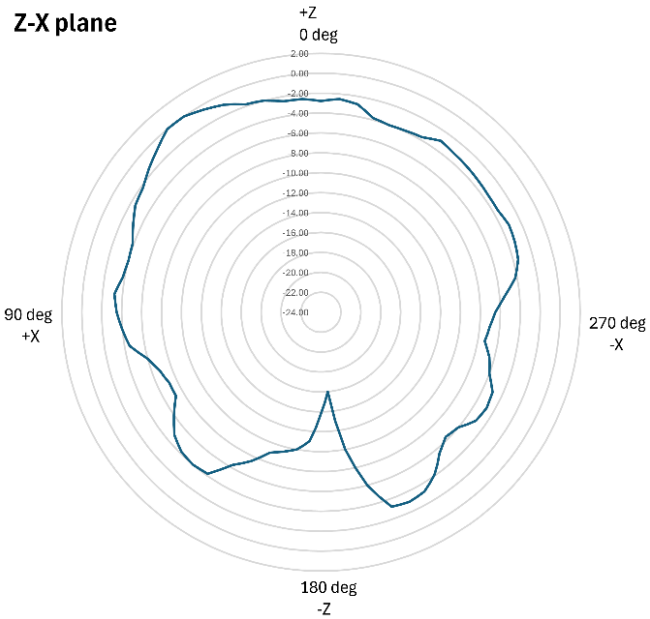
5.4.2 Antenna Gain and Efficiency

Frequency	Gain(dBi)	Efficiency
2400MHZ	-0.21	42
2410MHZ	0.22	45
2420MHZ	0.52	47
2430MHZ	0.92	50
2440MHZ	1.05	51
2450MHZ	0.87	50
2460MHZ	0.62	48
2470MHZ	0.43	44
2480MHZ	0.19	40
2490MHZ	-0.27	35

5.4.3 Antenna Pattern 2D







5.5 CPU Specifications

The ARM® Cortex®-M33 processor with floating-point unit (FPU) has a 32-bit instruction set.

128 MHz RISC-V coprocessor : VPR RISC-V is a small, efficient CPU developed by Nordic Semiconductor.

Memory	NVM	RAM			
	1522KB	256KB			
Parameter	Description	Min.	Typ.	Max.	Unit
CoreMark	running from flash, cache enabled		500		CoreMark
CoreMark /MHz	running from flash, cache enabled		3.9		CoreMark/ MHz
CPU current	Running Coremark@128MHz from NVM, cache enabled		2.6		mA
	running Coremark@128MHz from RAM, cache disabled		2.9		mA

5.6 Power Management

Parameter	Description	Min.	Typ.	Max.	Unit
System OFF	No RAM retention, Wake on pin		0.6		uA
	No RAM retention, Wake on pin +GRTC ,LFXO		0.8		uA
System ON	No RAM retention, Wake on pin		0.7		uA
	Full RAM retention, Wake on pin		3.0		uA
	Full RAM retention, Wake on pin + GRTC ,LFXO		3.1		uA
	Full RAM retention, Wake on pin + GRTC ,LFRC		3.7		uA

5.7 System Clock

The MN54L series requires two clocks, a high frequency clock and a low frequency clock.

- The high frequency clock (HFCLK)

HFCLK is provided on-module by a high-accuracy 32 MHz/±20 ppm/CL=8PF crystal for radio and CPU operation.

- The low frequency clock (LFCLK)

LFCLK can be provided internally by an RC oscillator (±250 ppm) with calibration, or externally by a 32.768 kHz crystal.

Internal 32.768 kHz RC oscillator (LFRC)

Description	Min.	Typ.	Max.	Unit
Nominal frequency		32.768		kHz
Frequency tolerance for LFRC after calibration (calibration performed at least every 8 seconds)			±500	ppm
Run current for 32.768 kHz RC oscillator		0.7		uA
Startup time for 32.768 kHz RC oscillator		1000		us

External 32.768 kHz crystal oscillator (LFXO)

Parameter	Description	Min.	Typ.	Max.	Unit
	Crystal frequency		32.768		kHz
	Frequency tolerance requirement for BLE stack			±500	ppm
	Frequency tolerance requirement for ANT stack			±50	ppm
	Run current for 32.768 kHz crystal oscillator		0.23		uA
CL	Load capacitance	6		9	pF

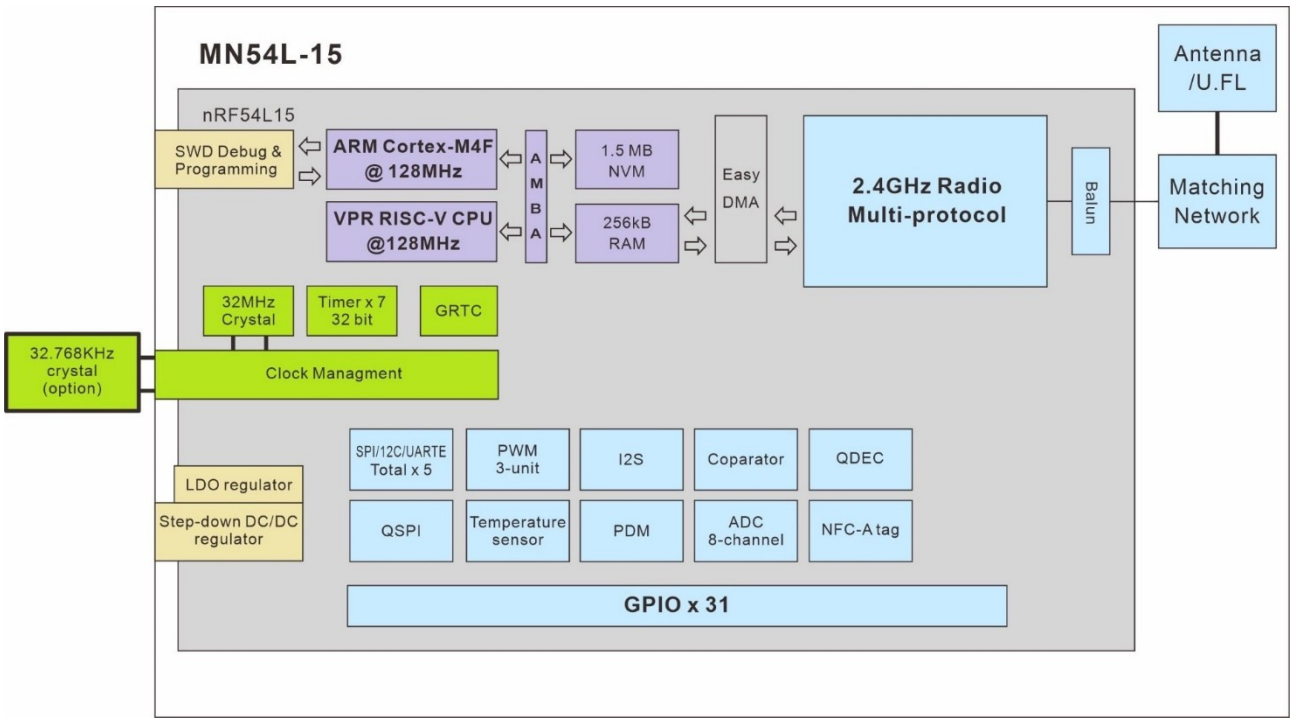
An external crystal provides the lowest power consumption and greatest accuracy.

Using the internal RC oscillator with calibration provides acceptable performance for BLE stack at a reduced cost and slight increase in power consumption.

Important:

- The ANT protocol requires the use of an external crystal for high accuracy.
- Nordic SDK example program P1.00/P1.01 as external LFXO, you need an external crystal to work.
- Nordic SDK example program P1.00/P1.01 as external LFXO, if you would like to reduce material cost, save layout space or requires 2 more GPIO for application. you need program P1.00/P1.01 as internal LFRC.

5.8 Block Diagram



6. BN54L-C15 evaluation board

6.1 BN54L-C15 component placement

BN54L-C15 is a full-featured evaluation board for MN54L-C15 that supports:

M1:MN54L-C15 module

J6: A power over Type C USB

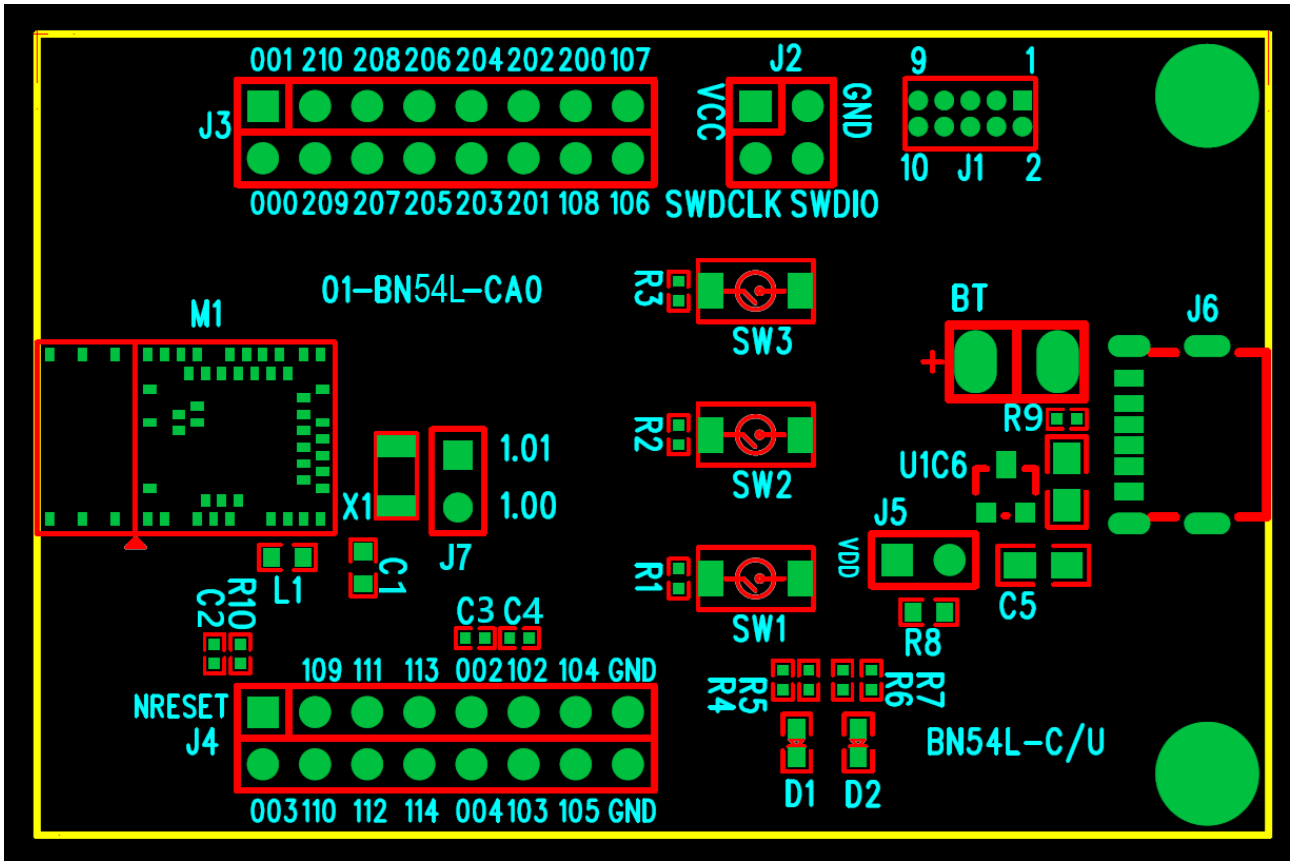
J3/J4: Complete I/O pinout to headers

J1/J2: On-board programming and debugging interface

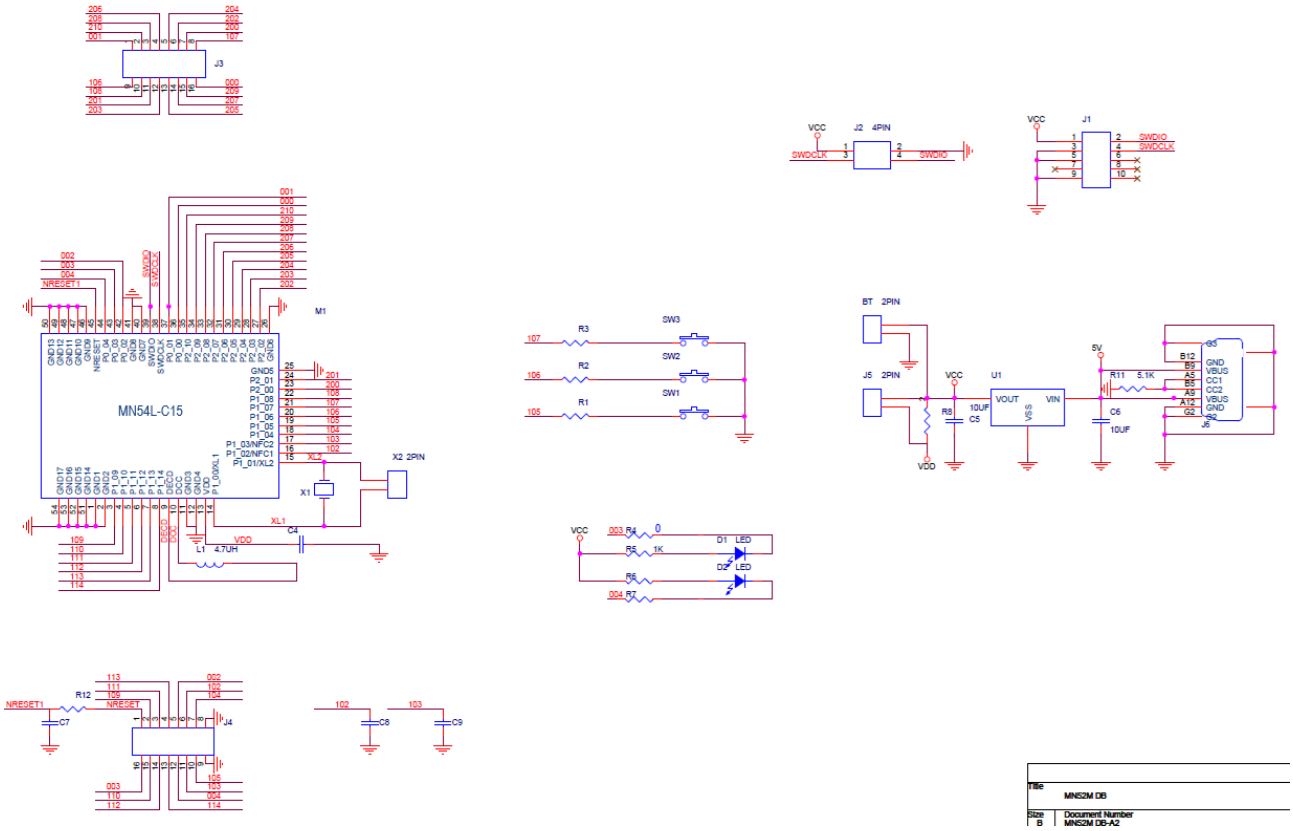
X1:32.768 kHz crystal

D1: One user LED

SW1/SW2/SW3: Three user buttons



6.2 BN54L-C15 schematic



REMARK:

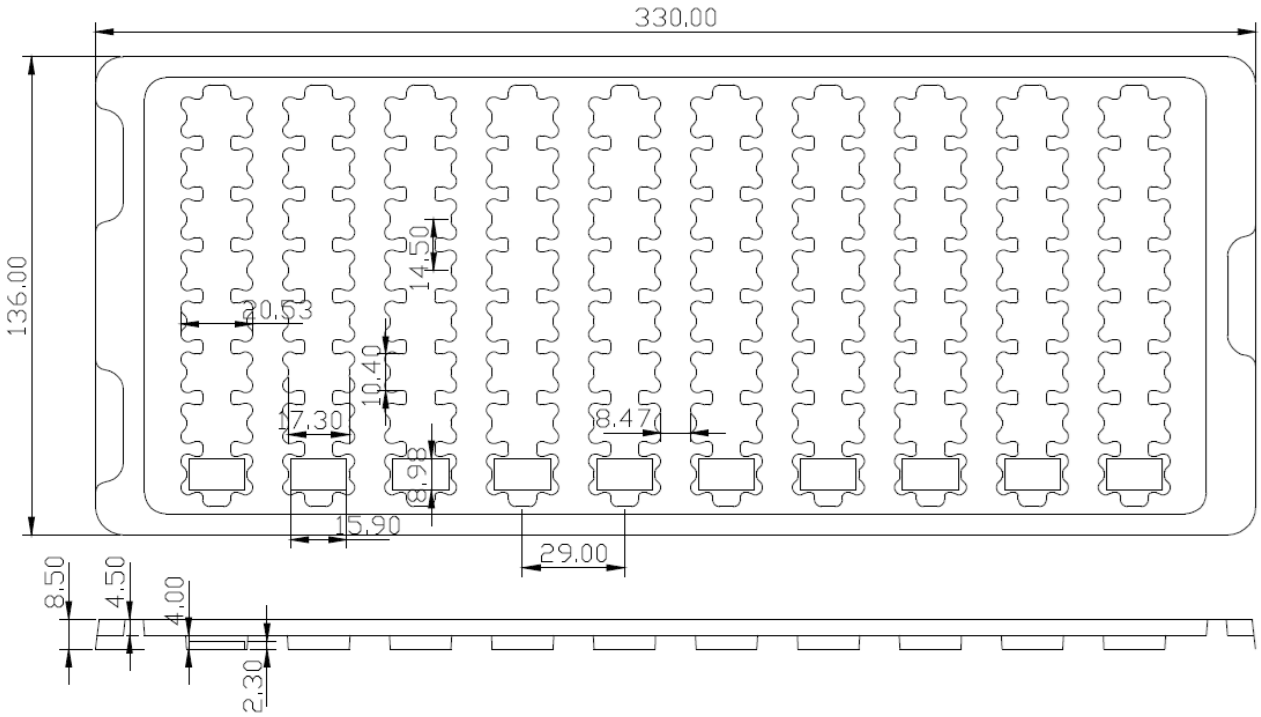
- **When using internal 32.768kHz RC oscillator, please remove X1 and calibration performed at least every 8 seconds.**

7. Product Information

7.1 Mass production information

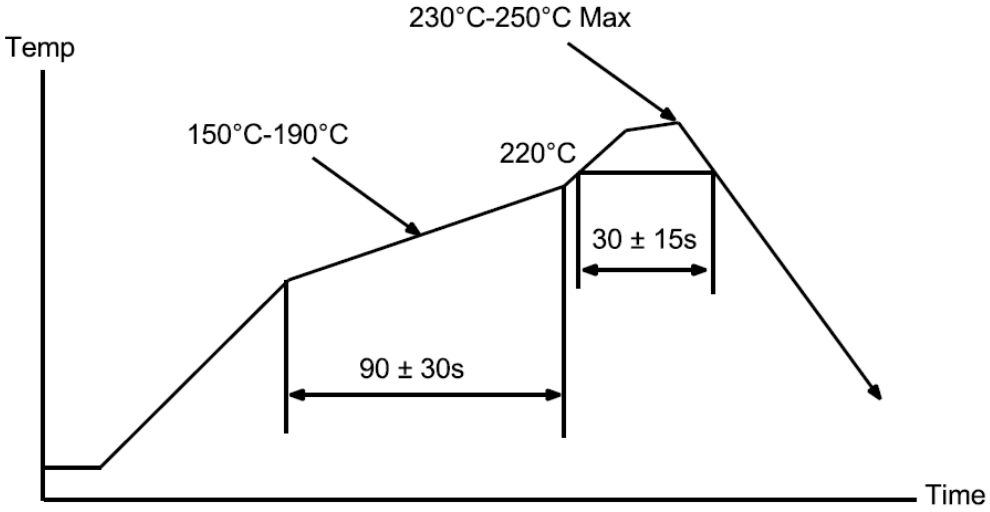
7.1.1 Tray Packaging:

Material: anti-static PET
PET thickness: 0.8mm
Dimension: 322mm x 136mm x 8.5mm



The tray is designed for direct use on a SMT automatic machine.

7.1.2 Reflow Parameters



7.2 Packing information

Type	Quantity	Dimension (L)x(W)x(H)	Gross Weight
Tray	80 pcs per tray	322x136x8.5mm	
Carton	1040 pcs(13 trays)	36x20x12cm	3.0Kg

7.3 Ordering Code

Model	Ordering code	Photo
MN54L-C15	MN-L15Q1-01A-CB	

Ordering code: MN-L15Q1-01A-CB

MN: Module/Nordic

L15Q1: NRF54L15/QFN/V1

01A: Aradconn standard module without customer code

CB: Chip antenna/Box packing

MN54L Series

Model	IC/Version	Antenna	Ordering code	Quantity
MN54L-C15	NRF54L15/V1	Chip	MN-L15Q1-01A-CB	1040
MN54L-C10	NRF54L10/V1		MN-L10Q1-01A-CB	1040
MN54L-C05	NRF54L05/V1		MN-L05Q1-01A-CB	1040
MN54L-P15	NRF54L15/V1	PCB	MN-L15Q1-01A-PB	1040
MN54L-P10	NRF54L10/V1		MN-L10Q1-01A-PB	1040
MN54L-P05	NRF54L05/V1		MN-L05Q1-01A-PB	1040
MN54L-U15	NRF54L15/V1	U.FL Connector	MN-L15Q1-01A-UB	1040

8. Bluetooth qualification& Regulatory certification

8.1 Bluetooth qualification

The MN54L-C15 Bluetooth Low Energy module is based on Nordic Semiconductor's NRF54 series SOC and listed on the Bluetooth SIG website as a qualified End Product.

Model	Bluetooth Version	DID	QDID	Company
MN54L-C15	5.4	Q331704	183532 (Nordic) 228005 (Nordic)	Arad Connectivity

8.2 USA (FCC Certificate)

8.2.1 FCC ID and Labeling requirements

The MN54L series hold full modular certification, are assigned the

FCC ID number: 2BLIDMN54L

If the FCC ID is not visible when the module is installed inside OEM device, then the outside of the finished product must also display a label referring to the enclosed module. The end product must in any case be labelled on the exterior with:

Contains FCC ID: 2BLIDMN54L

8.2.2 FCC Notice:

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.

8.2.3 CAUTION:

The OEM should have their device which incorporates the MN54L series tested by a qualified test Lab to verify compliance with FCC Part 15 Subpart B limits for unintentional radiators.

8.2.4 RF Exposure Statement:

This module is approved for installation into mobile and/or portable host platforms.

This device is intended only for OEM integrators under the following conditions:
(1) The transmitter module may not be co-located with any other transmitter or antenna.
(If the condition above is met, further transmitter test will not be required.)

(2) The OEM integrator is still responsible for testing their end-product for any additional compliance requirements required for satisfying RF Exposure compliance when this module installed.

8.3 Canada (IC Certificate)

8.3.1 IC ID and Labeling requirements

The MN54L series hold full modular certification, are assigned the

IC ID number: 33328-MN54L

If the IC ID is not visible when the module is installed inside OEM device, then the outside of the finished product must also display a label referring to the enclosed module. The end product must in any case be labelled on the exterior with:

Contains IC ID: 33328-MN54L

8.3.2 IC Notice:

This device complies with Industry Canada license-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.

Le présent appareil est conforme aux CNR d'Industrie 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'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

8.3.3 RF Exposure Statement:

This module is approved for installation into mobile and/or portable host platforms.

This device is intended only for OEM integrators under the following conditions:
(1) The transmitter module may not be co-located with any other transmitter or antenna.
(If the condition above is met, further transmitter test will not be required.)

(2) The OEM integrator is still responsible for testing their end-product for any additional compliance requirements required for satisfying RF Exposure compliance when this module installed.

8.4 European Union (CE)

8.4.1 Labeling requirements

The label on the final products which contain the MN54L series module must follow CE marking requirements, should be labelled as follows:

CE logo: 

The OEM should consult with a qualified test Lab before entering their device into an EU member country to make sure all regulatory requirements have been met for their complete device.

8.4.2 Radio Equipment Directive (RED)

The MN54L series module complies with the essential requirements and other relevant provisions of Radio Equipment Directive (RED) 2019/07

8.5 Australia / New Zealand (RCM)

The MN54L series has been tested to comply with the AS/NZS 62368.1:2022

RCM logo : 

8.6 NCC Certificate (Taiwan)

8.6.1 NCC ID and Labeling requirements

MN54L 系列依天線不同,可分為 3 種型式 , 認證為 3 個不同的 NCC ID
MN54L-C NCC ID number:
MN54L-P NCC ID number:
MN54L-U NCC ID number:

請依下列標籤式樣自製標籤，標貼或印鑄於器材(產品)本體明顯處，始得販賣或公開陳列。

NCC logo and NCC ID

MN54L-C:

MN54L-P:

MN54L-U:
NCC 平台政策下的完全模組: 須符合平台政策才能適用完全模組
「平台」定義如下：若器材無安裝型式認證之模組仍具備其它複合性功能，該器材得視為平台，若無其它複合性功能，則不能視為平台。

NCC 警語:
「取得審驗證明之低功率射頻器材，非經核准，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。低功率射頻器材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。前述合法通信，指依電信管理法規定作業之無線電通信。低功率射頻器材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。」

9. RoHS & REACH Report

MN54L series modules comply with EU RoHS Directive 2011/65/EU, 2015/863/EU and do not contain or over the threshold value of SVHC (Substance of Very High Concern), as defined by Directive EC/1907/2006 Article according to REACH Annex XVII.

10. Life support warning

This module is not designed for use in life support appliances, devices, or systems where malfunction can reasonably be expected to result in a significant personal injury to the user, or as a critical component in any life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety.

Revision history

Version	Date	Notes	Name
1.0	2025/05/01	Initial Release	