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Approval Sheet

(產品承認書)

產品名稱 (Product) Bluetooth Low Energy Module

解決方案 (Solution) Nordic nRF54L15 QFN Package

產品型號 (Model No.) **AN54L15Q** (Chip Antenna)

Index

1. Overall introduction

Raytac's AN54L15Q is a BT 5.4 stack (Bluetooth low energy or BLE) module designed based on **Nordic nRF54L15 SoC solution**, which incorporates: **GPIO**, **QSPI, SPI**, **UART**, **I2C**, **I2S, PDM, PWM, ADC** and **NFC** interfaces for connecting peripherals and sensors.

Features:

1. Dual Transmission mode of BLE & 2.4GHz RF upon customer's preference.
2. Compact size with **(L) 13.7 x (W) 9.5 x (H) 1.8mm**
3. Low power requirements, ultra-low peak, average and idle mode power consumption.
4. Be compatible with a large installed base of mobile phones, tablets and computers.
5. BLE & RF transmission switching helps products fit all operation system and most hardware.

1.1. Application

- IoT
  - Smart home sensors and actuators
  - Industrial sensors and actuators
  - Gateways and hubs
- Advanced computer peripherals and I/O devices
  - Keyboard
  - Mouse
  - Stylus
- Interactive entertainment devices
  - Remote controls
  - Gaming controllers
- Safety and security
  - Access control
  - Asset tracking
- Wearable health and fitness monitoring
- Lighting control

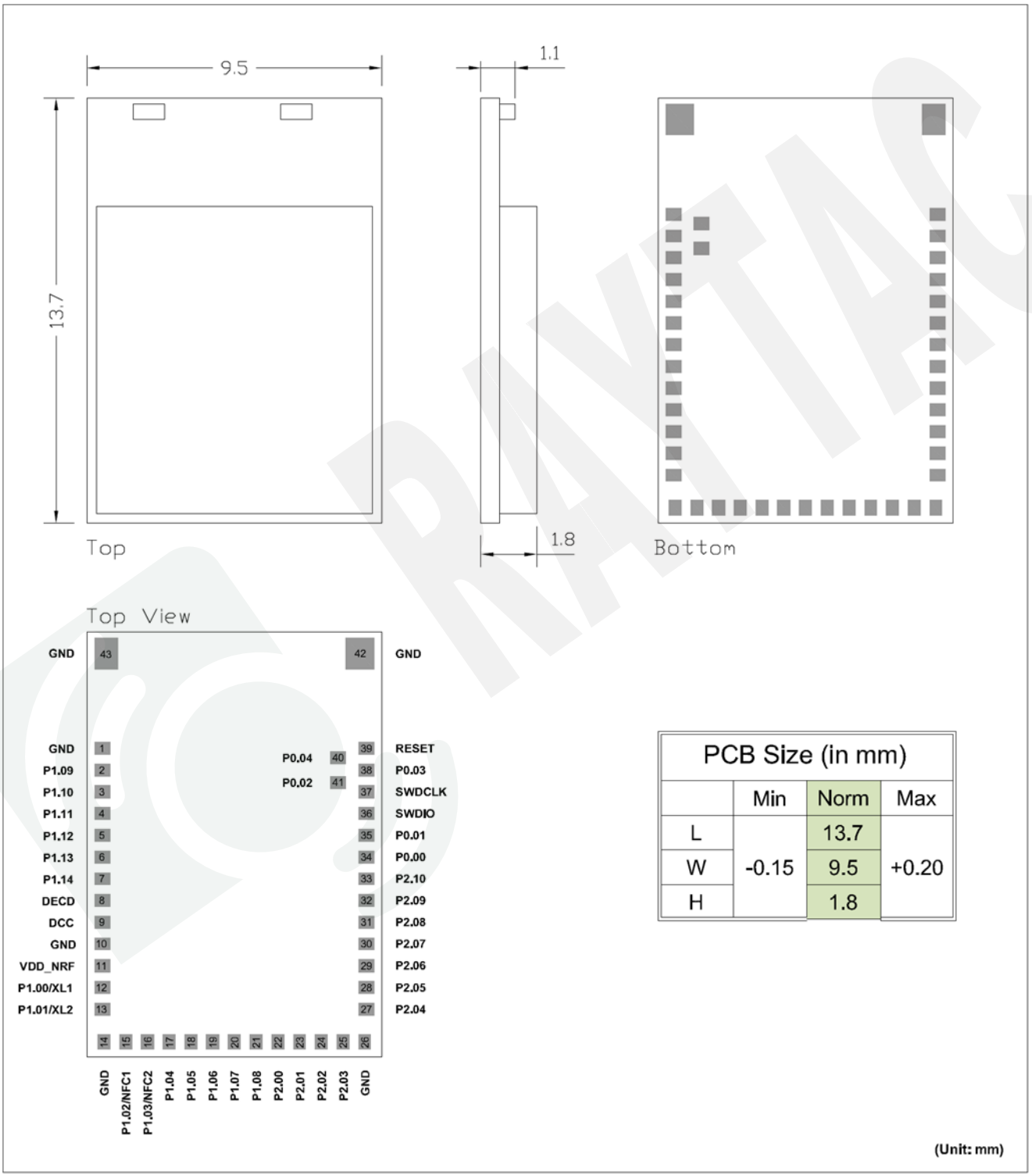
1.2. Features

- Multi-protocol 2.4GHz radio
- 32-bit ARM Cortex - M33 processor
- 1524KB flash programmed memory and 256KB RAM
- Up to +8dBm configurable output power
- RSSI (1dB resolution)
- Up to 31 GPIOs
- I2S
- Fully featured serial interface with EasyDMA support including:
  - SPI
  - I2C
  - UART
- Quadrature decoders(QDEC)
- ADC with up to eight channels
- 128-bit AES / ECB / CCM / AAR co-processor
- Single 32MHz crystal operation
- Wide supply voltage range 1.7V to 3.6V
- Timer counter
  - 7 x 32-bit
  - 2 x 24-bit RTC
- NFC
- 3 x pulse width modulator (PWM) units with EasyDMA
- Operation temperature from -40°C to 105°C

2. Product dimension

2.1. PCB dimensions & pin Indication

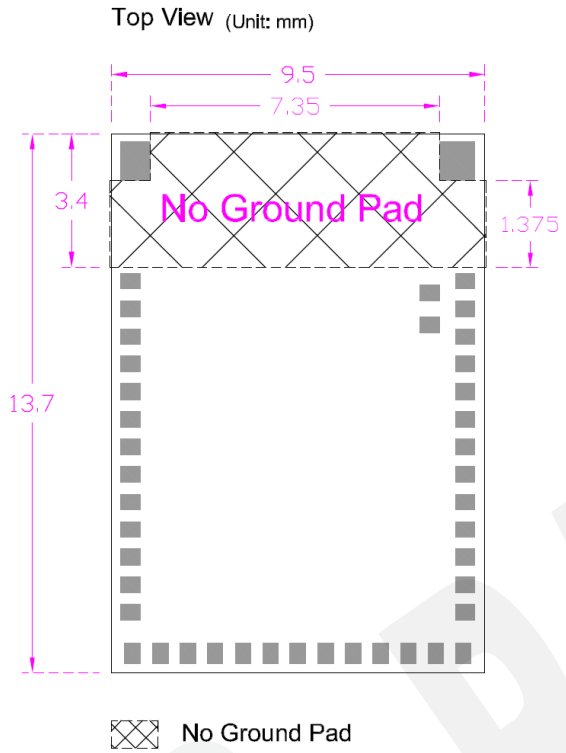
- **AN54L15Q**

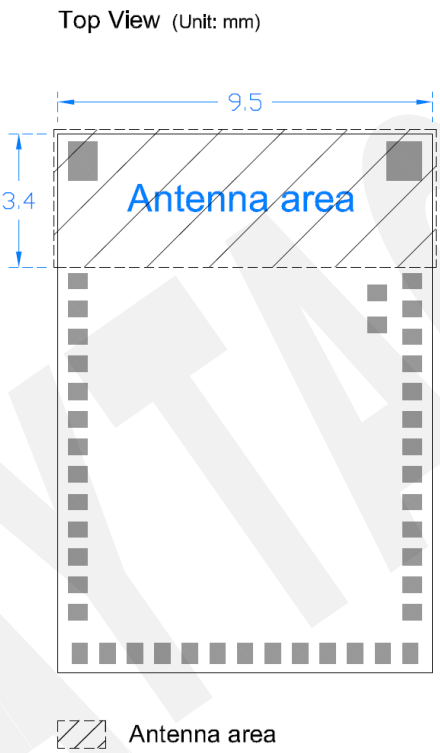


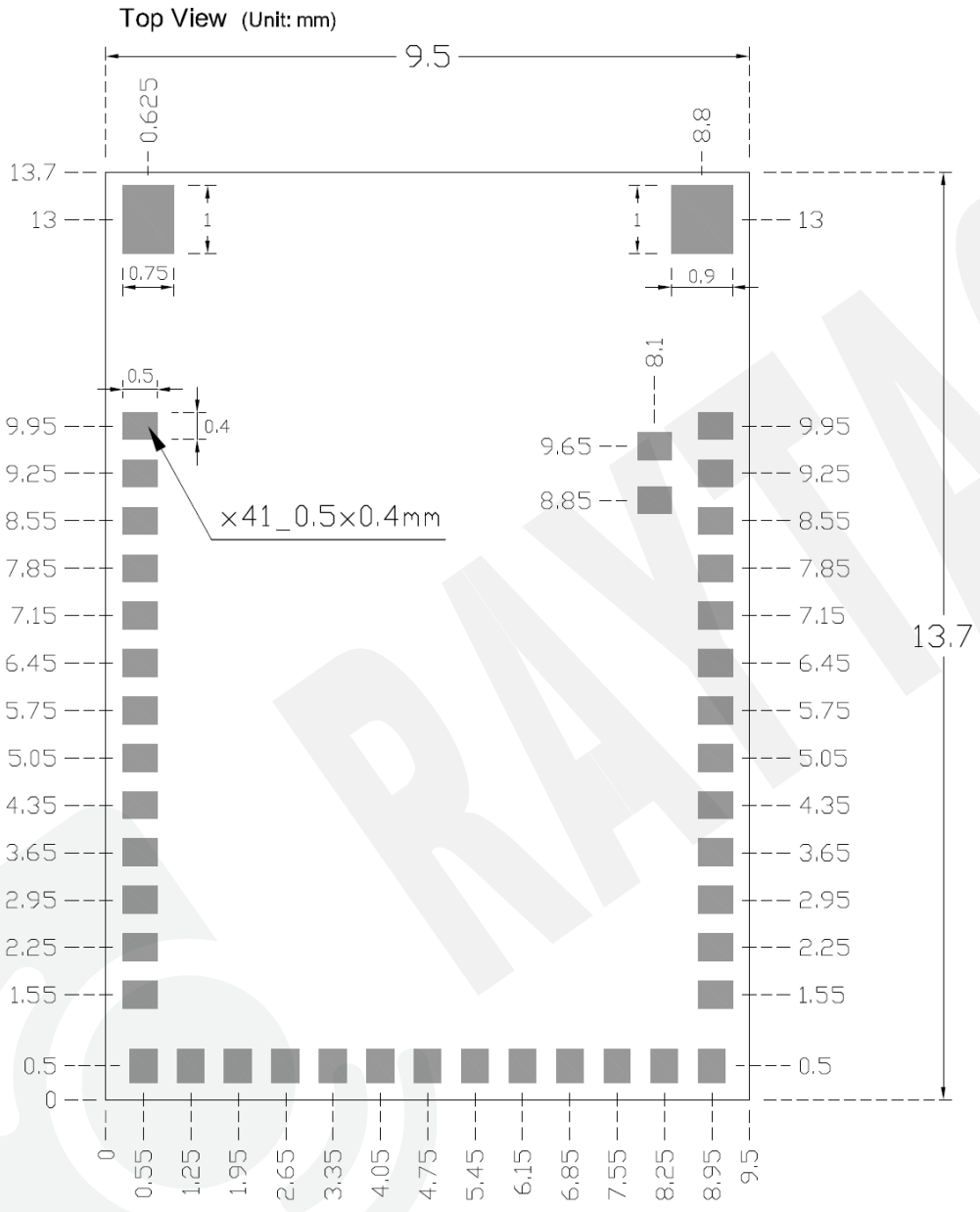
PCB Size (in mm)			
	Min	Norm	Max
L	-0.15	13.7	+0.20
W		9.5	
H		1.8	

2.2. Recommended layout of solder pad

Graphs are all in Top View, Unit in mm.






Top View (Unit: mm)
9.5
0.625
8.8
13.7
13
1
0.75
0.9
0.5
0.4
8.1
×41_0.5×0.4mm
9.95
9.25
8.55
7.85
7.15
6.45
5.75
5.05
4.35
3.65
2.95
2.25
1.55
0.5
0
9.65
8.85
0.55
1.25
1.95
2.65
3.35
4.05
4.75
5.45
6.15
6.85
7.55
8.25
8.95

2.3. RF layout suggestion (AKA, antenna keep-out area)

Please follow the instructions to ensure no ground pad overlaps the 'No Ground-Pad Area.' in the below images. Otherwise, it may cause a short circuit in the module.

Welcome to send us your layout in PDF for review at sales@raytac.com or your contact at Raytac with title “Layout reviewing – Raytac Model No. – YOUR company’s name”.

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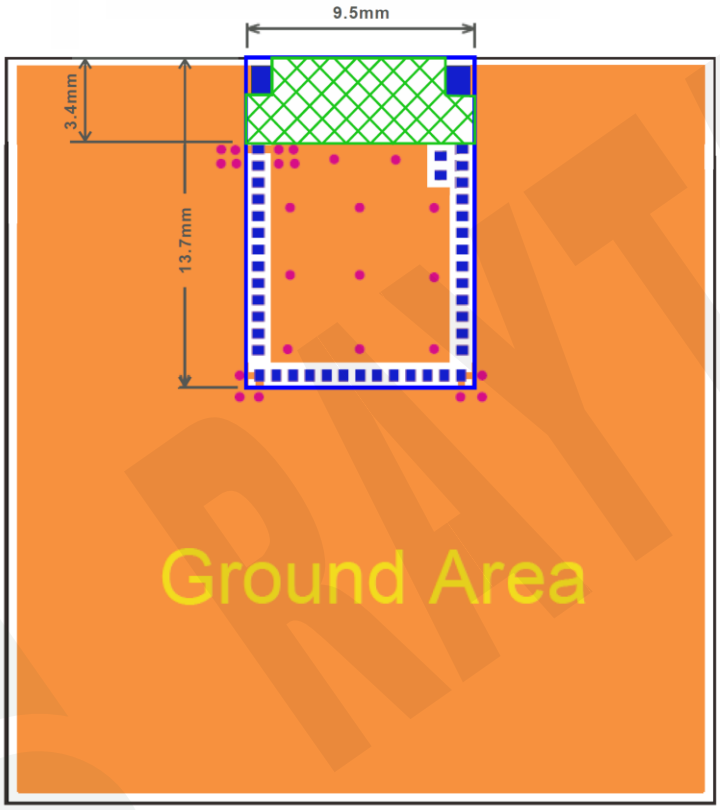
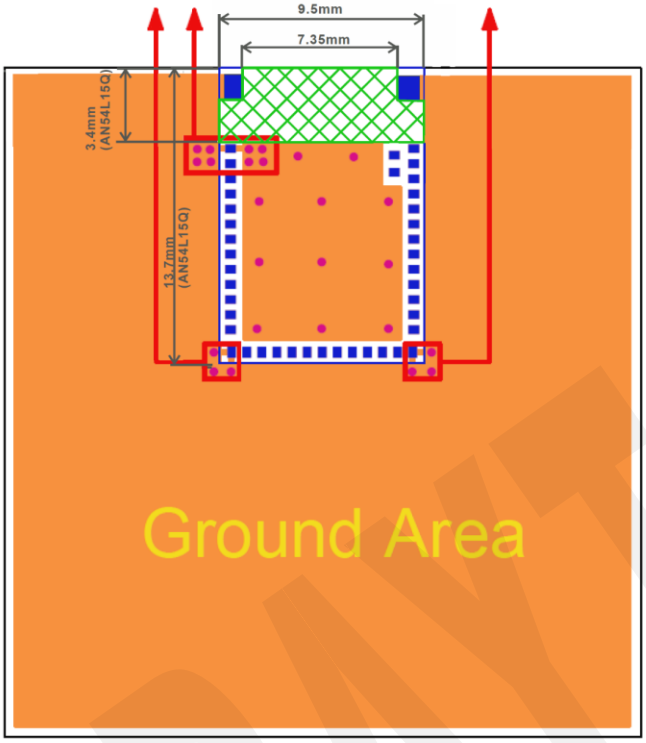


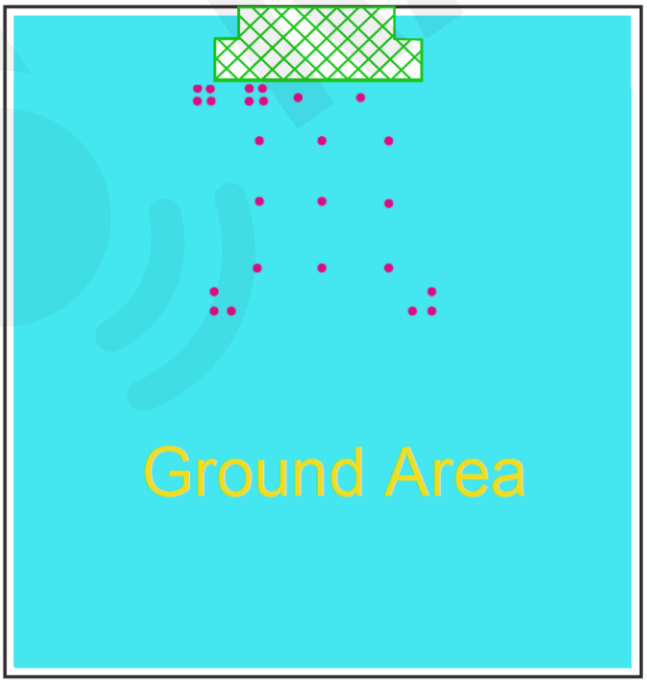
Top View

No Ground Pad Area

Please add vid holes in GROUND area as may as possible, especially around the four corners.



Top View



Perspective View

No Ground Pad Area

2.4. Footprint & design guide

Please visit “Support” page of our website to download. The package includes footprint, 2D/3D drawing, reflow graph and recommended spec for external 32.768kHz.

2.5. Pin assignment

Pin No.	Name	Pin function	Description
(1)	**GND**	Ground	The pad must be connected to a solid ground plane
(2)	**P1.09**	Digital I/O	General-purpose digital I/O
(3)	**P1.10**	Digital I/O	General-purpose digital I/O
(4)	**P1.11**	Digital I/O	General-purpose digital I/O
	AIN4	Analog input	SAADC input
(5)	**P1.12**	Digital I/O	General-purpose digital I/O
	AIN5	Analog input	SAADC input
(6)	**P1.13**	Digital I/O	General-purpose digital I/O
	AIN6	Analog input	SAADC input
(7)	**P1.14**	Digital I/O	General-purpose digital I/O
	AIN7	Analog input	SAADC input
(8)	**DECD**	Digital I/O	0.9 V regulator supply decoupling
(9)	**DCC**	Power	DC/DC converter output pin
(10)	**GND**	Ground	The pad must be connected to a solid ground plane
(11)	**VDD_NRF**	Power	Power-supply pin
(12)	**P1.00**	Digital I/O	General-purpose digital I/O
	XL1	Analog input	Connection to 32.768khz crystal (LFXO)
(13)	**P1.01**	Digital I/O	General-purpose digital I/O
	XL2	Analog input	Connection to 32.768khz crystal (LFXO)
(14)	**GND**	Ground	The pad must be connected to a solid ground plane
(15)	**P1.02**	Digital I/O	General-purpose digital I/O
	NFC1	NFC input	NFC antenna connection
(16)	**P1.03**	Digital I/O	General-purpose digital I/O
	NFC2	NFC input	NFC antenna connection
(17)	**P1.04**	Digital I/O	General-purpose digital I/O
	AIN0	Analog input	SAADC input
(18)	**P1.05**	Digital I/O	General-purpose digital I/O
	AIN1	Analog input	SAADC input
(19)	**P1.06**	Digital I/O	General-purpose digital I/O
	AIN2	Analog input	SAADC input

Pin No.	Name	Pin function	Description
(20)	P1.07	Digital I/O	General-purpose digital I/O
	AIN3	Analog input	SAADC input
(21)	P1.08	Digital I/O	General-purpose digital I/O
(22)	P2.00	Digital I/O	General-purpose digital I/O
(23)	P2.01	Digital I/O	General-purpose digital I/O
(24)	P2.02	Digital I/O	General-purpose digital I/O
(25)	P2.03	Digital I/O	General-purpose digital I/O
(26)	GND	Ground	The pad must be connected to a solid ground plane
(27)	P2.04	Digital I/O	General-purpose digital I/O
(28)	P2.05	Digital I/O	General-purpose digital I/O
(29)	P2.06	Digital I/O	General-purpose digital I/O
(30)	P2.07	Digital I/O	General-purpose digital I/O
(31)	P2.08	Digital I/O	General-purpose digital I/O
(32)	P2.09	Digital I/O	General-purpose digital I/O
(33)	P2.10	Digital I/O	General-purpose digital I/O
(34)	P0.00	Digital I/O	General-purpose digital I/O
(35)	P0.01	Digital I/O	General-purpose digital I/O
(36)	SWDIO	Digital I/O	Serial Wire debug I/O for debug and programming
(37)	SWDCLK	Digital input	Serial Wire debug clock input for debug and programming
(38)	P0.03	Digital I/O	General-purpose digital I/O
(39)	RESET		Configurable as system RESET pin
(40)	P0.04	Digital I/O	General-purpose digital I/O
(41)	P0.02	Digital I/O	General-purpose digital I/O
(42) (43)	GND	Ground	The pad must be connected to a solid ground plane
			(Only for AN54L15Q Model)

3. Main chip solution

RF IC	Crystal Frequency
Nordic NRF54L15 / QFN	**32MHz**

32MHz crystal is already inside the module.

4. Shipment packaging information

Model	Antenna	Photo
AN54L15Q	Chip/Ceramic	
AN54L15Q-P	PCB/Printed	
AN54L15Q-U	U.FL/Connector	

4.1. Order code

Each model has two options of packaging. Please use following part no. when placing order to us.

Model	Tray	Tape & Reel
AN54L15Q	MD-240A8-001	
AN54L15-P	MD-240A8-002	
AN54L15-U	MD-240A8-003	

5. Specification

Any technical spec shall refer to Nordic's official documents as final reference. Contents below are from "nRF54L15 Product Specification v0.8", please click to download full spec.

5.1. Absolute Maximum Ratings

	Min.	Max.	Unit
Supply voltage			
VDD	-0.3	3.6	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 QFN package types			
Storage temperature	-40	+105	°C
Moisture Sensitivity Level (MSL)		2	
ESD Human Body Model (HBM)		1	kV
ESD Charged Device Model (CDM)		500	V
RRAM memory			
Endurance	10,000		write/ rewrite cycles
Retention at 85°C	10		years
Retention at 105°C	2		years

5.2. Electrical Specifications

5.2.1. General Radio Characteristics

Symbol	Description	Min.	Typ.	Max.	Units
f_{OP}	Operating frequencies	2360		2500	MHz
$f_{PLL,CH,SP}$	PLL channel spacing		1.0		MHz
$f_{DELTA,1M}$	Frequency deviation @ 1 Mbps		±170		kHz
$f_{DELTA,BLE,1M}$	Frequency deviation @ Bluetooth LE 1 Mbps		±250		kHz
$f_{DELTA,2M}$	Frequency deviation @ 2 Mbps		±320		kHz
$f_{DELTA,BLE,2M}$	Frequency deviation @ Bluetooth LE 2 Mbps		±500		kHz
fsk_{BPS}	On-the-air data rate	125		4000	kbps
$f_{chip,\ IEEE\ 802.15.4}$	Chip rate in IEEE 802.15.4 mode		2000		kchip/s

5.2.2. Radio Current Consumption (Transmitter)

Symbol	Description	Min.	Typ.	Max.	Units
$_{TX,MaxdBm,DCDC,QFN}$	TX only run current for QFN package, DC/DC, 3 V, P_{RF} at maximum power setting		9.1		mA
$I_{TX,MaxdBm,DCDC,CSP}$	TX only run current for CSP package, DC/DC, 3 V, P_{RF} at maximum power setting		9.7		mA
$I_{TX,0dBM,DCDC}$	TX only run current DC/DC, 3 V, P_{RF} = 0 dBm		3.7		mA
$I_{TX,MINUS4dBM,DCDC}$	TX only run current DC/DC, 3 V, P_{RF} = -4 dBm		2.8		mA
$I_{TX,MINUS8dBM,DCDC}$	TX only run current DC/DC, 3 V, P_{RF} = -8 dBm		2.2		mA
$I_{TX,MINUS12dBM,DCDC}$	TX only run current DC/DC, 3 V, P_{RF} = -12 dBm		1.9		mA
$I_{TX,MINUS16dBM,DCDC}$	TX only run current DC/DC, 3 V, P_{RF} = -16 dBm		1.7		mA
$I_{TX,MINUS40dBM,DCDC}$	TX only run current DC/DC, 3 V, P_{RF} = -40 dBm		1.2		mA
$I_{START,TX}$	TX start-up current, P_{RF} = 4 dBm		..		mA

5.2.3. Radio Current Consumption (Receiver)

Symbol	Description	Min.	Typ.	Max.	Units
$I_{RX,1M,DCDC}$	RX only run current DC/DC, 3 V, 1 Mbps/1 Mbps Bluetooth LE mode		2.1		mA
$I_{RX,2M,DCDC}$	RX only run current DC/DC, 3 V, 2 Mbps/2 Mbps Bluetooth LE mode		2.1		mA
$I_{START,RX,1M,DCDC}$	RX start-up current DC/DC, 3 V, 1 Mbps/1 Mbps Bluetooth LE mode		1.6		mA

5.2.4. Transmitter Specification

Symbol	Description	Min.	Typ.	Max.	Units
$P_{RF,qfn}$	Maximum output power for QFN package		7		dBm
$P_{RF,CSP}$	Maximum output power for CSP package		8		dBm
P_{RFCR}	RF power accuracy	-2		2	dB
$P_{RF1,1}$	1st Adjacent Channel Transmit Power 1 MHz (1 Mbps)		-25[3]		dBc
$P_{RF2,1}$	2nd Adjacent Channel Transmit Power 2 MHz (1 Mbps)		-48[3]		dBc
$P_{RF1,2}$	1st Adjacent Channel Transmit Power 2 MHz (2 Mbps)		-25[4]		dBc
$P_{RF2,2}$	2nd Adjacent Channel Transmit Power 4 MHz (2 Mbps)		-52[4]		dBc
E_{vm}	Error vector magnitude in IEEE 802.15.4 mode		2		%rms
$P_{harm2nd,\ IEEE\ 802.15.4}$	2nd harmonics in IEEE 802.15.4 mode		-63		dBm
$P_{harm3rd,\ IEEE\ 802.15.4}$	3rd harmonics in IEEE 802.15.4 mode		-68		dBm

[3] MODE = Nrf_1Mbit

[4] MODE = Nrf_2Mbit

5.2.5. Receiver Operation

Symbol	Description	Min.	Typ.	Max.	Units
$P_{RX,MAX}$	Maximum received signal strength at < 0.1% PER		0		dBm
$P_{SENS,IT,1M}$	Sensitivity, 1 Mbps nRF mode ideal transmitter [5]		-93		dBm
$P_{SENS,IT,2M}$	Sensitivity, 2 Mbps nRF mode ideal transmitter [5]		-90		dBm
$P_{SENS,IT,4M}$	Sensitivity, 4 Mbps nRF mode ideal transmitter [5]		-90		dBm
$P_{SENS,IT,SP,1M,BLE}$	Sensitivity, 1 Mbps Bluetooth LE ideal transmitter, packet length ≤ 37 bytes BER = 1E-3[6]		-96[7]		dBm
$P_{SENS,IT,LP,1M,BLE}$	Sensitivity, 1 Mbps Bluetooth LE ideal transmitter, packet length ≥ 128 bytes BER = 1E-4		-95		dBm
$P_{SENS,IT,SP,2M,BLE}$	Sensitivity, 2 Mbps Bluetooth LE ideal transmitter, packet length ≤ 37 bytes		-94		dBm
$P_{SENS,IT,BLE\ LE125k}$	Sensitivity, 125 kbps Bluetooth LE mode		-104		dBm
$P_{SENS,IT,BLE\ LE500k}$	Sensitivity, 500 kbps Bluetooth LE mode		-99		dBm
$P_{SENS,IEEE\ 802.15.4}$	Sensitivity in IEEE 802.15.4 mode		-102		dBm
RX selectivity with equal modulation on interfering signal[8]					

[5] Typical sensitivity applies when ADDR0 is used for receiver address correlation. When ADDR[1...7] are used for receiver address correlation, the typical sensitivity for this mode is degraded by 3 dB.

[6] As defined in the *Bluetooth Core Specification v4.0 Volume 6: Core System Package (Low Energy Controller Volume)*.

[7] QFN package sensitivity is degraded by 1dB

[8] Desired signal level at P_{IN} = -67 dBm. One interferer is used, having equal modulation as the desired signal. The input power of the interferer where the sensitivity equals BER = 0.1% is presented.

5.2.6. RX Selectivity

Symbol	Description	Min.	Typ.	Max.	Units
$C/I_{1M,co\text{-}channel}$	1Mbps mode, co-channel interference		9		dB
$C/I_{1M,-1MHz}$	1 Mbps mode, Adjacent (-1 MHz) interference		-4		dB
$C/I_{1M,+1MHz}$	1 Mbps mode, Adjacent (+1 MHz) interference		-9		dB
$C/I_{1M,-2MHz}$	1 Mbps mode, Adjacent (-2 MHz) interference		-28		dB
$C/I_{1M,+2MHz}$	1 Mbps mode, Adjacent (+2 MHz) interference		-40		dB
$C/I_{1M,-3MHz}$	1 Mbps mode, Adjacent (-3 MHz) interference		-39		dB
$C/I_{1M,+3MHz}$	1 Mbps mode, Adjacent (+3 MHz) interference		-43		dB
$C/I_{1M,\pm6MHz}$	1 Mbps mode, Adjacent (≥6 MHz) interference		-48		dB

Symbol	Description	Min.	Typ.	Max.	Units
$C/I_{1MBLE,co\text{-}channel}$	1 Mbps Bluetooth LE mode, co-channel interference		-6		dB
$C/I_{1MBLE,-1MHz}$	1 Mbps Bluetooth LE mode, Adjacent (-1 MHz) interference		-2		dB
$C/I_{1MBLE,+1MHz}$	1 Mbps Bluetooth LE mode, Adjacent (+1 MHz) interference		-6		dB
$C/I_{1MBLE,-2MHz}$	1 Mbps Bluetooth LE mode, Adjacent (-2 MHz) interference		-29		dB
$C/I_{1MBLE,+2MHz}$	1 Mbps Bluetooth LE mode, Adjacent (+2 MHz) interference		-43		dB
$C/I_{1MBLE,>3MHz}$	1 Mbps Bluetooth LE mode, Adjacent (≥3 MHz) interference		-46		dB
$C/I_{1MBLE,image}$	Image frequency interference		-29		dB
$C/I_{1MBLE,image,1MHz}$	Adjacent (1 MHz) interference to in-band image frequency		-39		dB
$C/I_{2M,co\text{-}channel}$	2 Mbps mode, co-channel interference		.10		dB
$C/I_{2M,-2MHz}$	2 Mbps mode, Adjacent (-2 MHz) interference		-5		dB
$C/I_{2M,+2MHz}$	2 Mbps mode, Adjacent (+2 MHz) interference		-9		dB
$C/I_{2M,-4MHz}$	2 Mbps mode, Adjacent (-4 MHz) interference		-27		dB
$C/I_{2M,+4MHz}$	2 Mbps mode, Adjacent (+4 MHz) interference		-42		dB
$C/I_{2M,-6MHz}$	2 Mbps mode, Adjacent (-6 MHz) interference		-38		dB
$C/I_{2M,+6MHz}$	2 Mbps mode, Adjacent (+6 MHz) interference		-45		dB
$C/I_{2M,\geq12MHz}$	2 Mbps mode, Adjacent (≥12 MHz) interference		-50		dB
$C/I_{2MBLE,co\text{-}channel}$	2 Mbps Bluetooth LE mode, co-channel interference		6		dB
$C/I_{2MBLE,-2MHz}$	2 Mbps Bluetooth LE mode, Adjacent (-2 MHz) interference		-2		dB
$C/I_{2MBLE,+2MHz}$	2 Mbps Bluetooth LE mode, Adjacent (+2 MHz) interference		-6		dB
$C/I_{2MBLE,-4MHz}$	2 Mbps Bluetooth LE mode, Adjacent (-4 MHz) interference		-29		dB
$C/I_{2MBLE,+4MHz}$	2 Mbps Bluetooth LE mode, Adjacent (+4 MHz) interference		-44		dB
$C/I_{2MBLE,\geq6MHz}$	2 Mbps Bluetooth LE mode, Adjacent (≥6 MHz) interference		-46		dB
$C/I_{4M,co\text{-}channel}$	4 Mbps mode, co-channel interference		6		dB
$C/I_{4M,-4MHz}$	4 Mbps mode, Adjacent (-4 MHz) interference		-4		dB
$C/I_{4M,+4MHz}$	4 Mbps mode, Adjacent (+4 MHz) interference		-11		dB
$C/I_{4M,-8MHz}$	4 Mbps mode, Adjacent (-8 MHz) interference		-27		dB
$C/I_{4M,+8MHz}$	4 Mbps mode, Adjacent (+8 MHz) interference		-46		dB
$C/I_{4M,-12MHz}$	4 Mbps mode, Adjacent (-12 MHz) interference		-40		dB
$C/I_{4M,+12MHz}$	4 Mbps mode, Adjacent (+12 MHz) interference		-50		dB
$C/I_{4M,\geq24MHz}$	4 Mbps mode, Adjacent (≥24 MHz) interference		-56		dB
$C/I_{2MBLE,image}$	Image frequency interference		-29		dB
$C/I_{2MBLE,image,\ 2MHz}$	Adjacent (2 MHz) interference to in-band image frequency		-38		dB
$C/I_{125k\ BLE\ LR,co\text{-}channel}$	125 kbps Bluetooth LE LR mode, co-channel interference		1		dB
$C/I_{125k\ BLE\ LR,-1MHz}$	125 kbps Bluetooth LE LR mode, Adjacent (-1 MHz) interference		-13		dB
$C/I_{125k\ BLE\ LR,+1MHz}$	125 kbps Bluetooth LE LR mode, Adjacent (+1 MHz) interference		-16		dB
$C/I_{125k\ BLE\ LR,-2MHz}$	125 kbps Bluetooth LE LR mode, Adjacent (-2 MHz) interference		-36		dB
$C/I_{125k\ BLE\ LR,+2MHz}$	125 kbps Bluetooth LE LR mode, Adjacent (+2 MHz) interference		-52		dB
$C/I_{125k\ BLE\ LR,>3MHz}$	125 kbps Bluetooth LE LR mode, Adjacent (≥3 MHz) interference		-55		dB
$C/I_{125k\ BLE\ LR,image}$	Image frequency interference		-36		dB
$C/I_{IEEE\ 802.15.4,-5MHz}$	IEEE 802.15.4 mode, Adjacent (-5 MHz) rejection		-35		dB
$C/I_{IEEE\ 802.15.4,+5MHz}$	IEEE 802.15.4 mode, Adjacent (+5 MHz) rejection		-38		dB
$C/I_{IEEE\ 802.15.4,\pm10MHz}$	IEEE 802.15.4 mode, Alternate (±10 MHz) rejection		--50		dB

5.2.7. RX Intermodulation

Symbol	Description	Min.	Typ.	Max.	Units
$P_{IMD,5TH,1M}$	IMD performance, 1 Mbps, 5th offset channel, packet length ≤ 37 bytes				dBm
$P_{IMD,5TH,1M,BLE}$	IMD performance, Bluetooth LE 1 Mbps, 5th offset channel, packet length ≤ 37 bytes		-19		dBm
$P_{IMD,5TH,2M}$	IMD performance, 2 Mbps, 5th offset channel, packet length ≤ 37 bytes				dBm
$P_{IMD,5TH,2M,BLE}$	IMD performance, Bluetooth LE 2 Mbps, 5th offset channel, packet length ≤ 37 bytes		-16		dBm

RX intermodulation. Desired signal level at P_{IN} = -64 dBm. Two interferers with equal input power are used. The interferer closest in frequency is not modulated, the other interferer is modulated equal with the desired signal. The input power of the interferers where the sensitivity equals BER = 1E-3 is presented.

5.2.8. Radio Timing Parameters

Symbol	Description	Min.	Typ.	Max.	Units
$t_{TXEN,BLE,1M}$	Time between TXEN task and READY event after channel FREQUENCY configured (1 Mbps Bluetooth LE and 150 µs TIFS)		140		µs
$t_{TXEN,FAST,BLE,1M}$	Time between TXEN task and READY event after channel FREQUENCY configured (1 Mbps Bluetooth LE with fast ramp-up and 150 µs TIFS)		40		µs
$t_{TXDIS,BLE,1M}$	When in TX, delay between DISABLE task and DISABLED event for MODE = Nrf_1Mbit and MODE = Ble_1Mbit		2		µs
$t_{RXEN,BLE,1M}$	Time between the RXEN task and READY event after channel FREQUENCY configured (1 Mbps Bluetooth LE)		134		µs
$t_{RXEN,FAST,BLE,1M}$	Time between the RXEN task and READY event after channel FREQUENCY configured (1 Mbps Bluetooth LE with fast ramp-up)		40		µs
$t_{RXDIS,BLE,1M}$	When in RX, delay between DISABLE task and DISABLED event for MODE = Nrf_1Mbit and MODE = Ble_1Mbit		1		µs
$t_{TXDIS,BLE,2M}$	When in TX, delay between DISABLE task and DISABLED event for MODE = Nrf_2Mbit and MODE = Ble_2Mbit		2		µs
$t_{RXDIS,BLE,2M}$	When in RX, delay between DISABLE task and DISABLED event for MODE = Nrf_2Mbit and MODE = Ble_2Mbit		1		µs
$t_{TXEN,IEEE\ 802.15.4}$	Time between TXEN task and READY event after channel FREQUENCY configured (IEEE 802.15.4 mode)		130		µs
$t_{TXEN,FAST,IEEE\ 802.15.4}$	Time between TXEN task and READY event after channel FREQUENCY configured (IEEE 802.15.4 mode with fast ramp-up)		40		µs
$t_{TXDIS,IEEE\ 802.15.4}$	When in TX, delay between DISABLE task and DISABLED event (IEEE 802.15.4 mode)		18		µs
$t_{RXEN,IEEE\ 802.15.4}$	Time between the RXEN task and READY event after channel FREQUENCY configured (IEEE 802.15.4 mode)		130		µs
$t_{RXEN,FAST,IEEE\ 802.15.4}$	Time between the RXEN task and READY event after channel FREQUENCY configured (IEEE 802.15.4 mode with fast ramp-up)		40		µs
$t_{RXDIS,IEEE\ 802.15.4}$	When in RX, delay between DISABLE task and DISABLED event (IEEE 802.15.4 mode)		0.2		µs
$t_{RX\text{-}to\text{-}TX\ turnaround}$	Maximum TX-to-RX or RX-to-TX turnaround time in IEEE 802.15.4 mode		17		µs

5.2.9. RSSI Specifications

Symbol	Description	Min.	Typ.	Max.	Units
$RSSI_{ACC}$	RSSI accuracy in the range -90 to -30 dBm		±2		dB
$RSSI_{RESOLUTION}$	RSSI resolution		1		dB
$RSSI_{PERIOD}$	RSSI sampling time from RSSISTART task		0.25		µs
$RSSI_{SETTLE}$	RSSI settling time after signal level change		15	20	µs

6. Reference circuit

Module is pre-programmed with Raytac's testing code. Default is using "DC-DC mode". Our firmware is set to use external 32.768kHz so please add it to make module work.

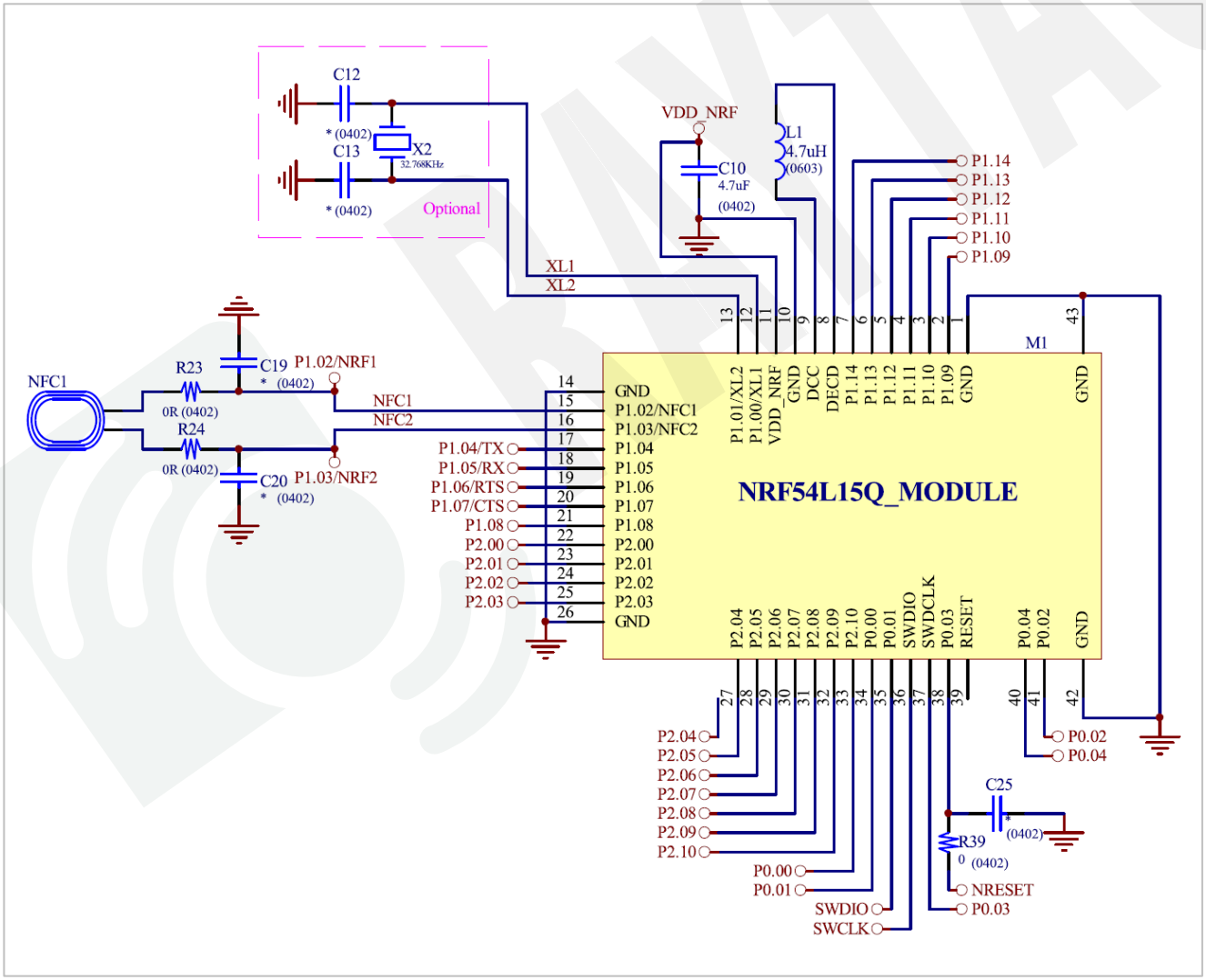
REMARK:

***** DECD decoupling capacitor (2.2μF) is already inside the module. *****

***** When using DC-DC mode, please add L1. *****

***** When NOT using NFC, please remove NFC1 / C19 / C20. *****

***** When using internal 32.768kHz RC oscillator, please remove X2 / C12 / C13. *****



7. Useful links

- Nordic Infocenter: https://docs.nordicsemi.com/
  All the necessary technical files and software development kits of Nordic's chip are on this website.

- Nordic DevZone: https://devzone.nordicsemi.com/questions/
  A highly recommended website for firmware developer. Interact with other developers and Nordic's employees will help with your questions. The site also includes tutorials in detail to help you get started.

Full list of Raytac's WiFi modules

● AN7002Q series (QFN package IC)

Series	Nordic Solution	Raytac No.	IC Ver.	Antenna	Size	Weight
AN7002Q	nRF7002	AN7002Q	1	Chip Antenna	17.1 x 10.8 x 2.1 mm	0.78 (±0.02g)
		AN7002Q-P	1	PCB Antenna	17.1 x 10.8 x 2.1 mm	0.79 (±0.02g)
		AN7002Q-U	1	u.FL Connector	16.4 x 10.8 x 2.1 mm	0.85 (±0.02g)

Full list of Raytac's Bluetooth modules

- **AN54H20 series ~ coming soon**

- **AS1262Q series (QFN package IC) ~ coming soon**

- **AN54L15Q series (QFN package IC)**

Series	Nordic Solution	Raytac No.	IC Ver.	Antenna	RAM	Flash Memory
AN54L15Q	nRF54L15	AN54L15Q	1	Chip Antenna	256 kb	1.5 MB
	nRF54L15	AN54L15Q-P	1	PCB Antenna	256 kb	1.5 MB
	nRF54L15	AN54L15Q-U	1	u.FL Connector	256 kb	1.5 MB

- **MDBT53 series (WLCSP package IC)**

Series	Nordic Solution	Raytac No.	IC Ver.	Antenna	RAM	Flash Memory
MDBT53	nRF5340	MDBT53-1M	1	Chip Antenna	512 kb	1 MB
MDBT53-P	nRF5340	MDBT53-P1M	1	PCB Antenna	512 kb	1 MB
MDBT53-U	nRF5340	MDBT53-U1M	1	u.FL Connector	512 kb	1 MB

- **MDBT53V series (WLCSP package IC)**

Series	Nordic Solution	Raytac No.	IC Ver.	Antenna	RAM	Flash Memory
MDBT53V	nRF5340	MDBT53V-1M	1	Chip Antenna	512 kb	1 MB
MDBT53V-P	nRF5340	MDBT53V-P1M	1	PCB Antenna	512 kb	1 MB

MDBT50 series (QFN package IC)

Series	Nordic Solution	Raytac No.	IC Ver.	Antenna	RAM	Flash Memory
MDBT50	nRF52820	MDBT50-256R	1	Chip Antenna	32 kb	256 kb
	nRF52833	MDBT50-512K	1		128 kb	512 kb
MDBT50-P	nRF52820	MDBT50-P256R	1	PCB Antenna	32 kb	256 kb
	nRF52833	MDBT50-P512K	1		128 kb	512 kb

MDBT50Q series (aQFN package IC)

Series	Nordic Solution	Raytac No.	IC Ver.	Antenna	RAM	Flash Memory
MDBT50Q	nRF52840	MDBT50Q-1MEN	3	Chip Antenna	256 kb	1 MB
	nRF52840	MDBT50Q-1MV2	2			
	nRF52833	MDBT50Q-512K	1		128 kb	512 kb
MDBT50Q-P	nRF52840	MDBT50Q-P1MEN	3	PCB Antenna	256 kb	1 MB
	nRF52840	MDBT50Q-P1MV2	2			
	nRF52833	MDBT50Q-P512K	1		128 kb	512 kb
MDBT50Q-U	nRF52840	MDBT50Q-U1MEN	3	u.FL Connector	256 kb	1 MB
	nRF52840	MDBT50Q-U1MV2	2			
	nRF52833	MDBT50Q-U512K	1		128 kb	512 kb
Dongle	nRF52840	MDBT50Q-RX	1, 2	PCB Antenna	256 kb	1 MB
		MDBT50Q-CX-40	1			
	nRF52833	MDBT50Q-CX-33	1		128 kb	512 kb

MDBT42T series (WLCSP package IC)

Series	Nordic Solution	Raytac No.	IC Ver.	Antenna	RAM	Flash Memory
MDBT42T	nRF52805	MDBT42T-192K	1	Chip Antenna	24 kb	192 K
MDBT42T-P		MDBT42T-P192K		PCB Antenna		

MDBT42TV series (WLCSP package IC)

Series	Nordic Solution	Raytac No.	IC Ver.	Antenna	RAM	Flash Memory
MDBT42TV	nRF52805	MDBT42TV-192K	1	Chip Antenna	24 kb	192 K
MDBT42TV-P		MDBT42TV-P192K		PCB Antenna		

MDBT42 series (WLCSP package IC)

Series	Nordic Solution	Raytac No.	IC Ver.	Antenna	RAM	Flash Memory
MDBT42	nRF52832	MDBT42-512KV2	2	Chip Antenna	64 kb	512 K
MDBT42-P		MDBT42-P512KV2		PCB Antenna		

MDBT42V series (WLCSP package IC)

Series	Nordic Solution	Raytac No.	IC Ver.	Antenna	RAM	Flash Memory
MDBT42V	nRF52832	MDBT42V-512KV2	2	Chip Antenna	64 kb	512 K
MDBT42V-P		MDBT42V-P512KV2		PCB Antenna		

MDBT42Q series (QFN package IC)

Series	Nordic Solution	Raytac No.	IC Ver.	Antenna	RAM	Flash Memory
MDBT42Q	nRF52832	MDBT42Q-512KEN	3	Chip Antenna	64 kb	512 K
	nRF52832	MDBT42Q-512KV2	2			
	nRF52810	MDBT42Q-192KV2	2		24 kb	192 K
	nRF52811	MDBT42Q-192KL	1			
MDBT42Q-P	nRF52832	MDBT42Q-P512KEN	3	PCB Antenna	64 kb	512 K
	nRF52832	MDBT42Q-P512KV2	2			
	nRF52810	MDBT42Q-P192KV2	2		24 kb	192 K
	nRF52811	MDBT42Q-P192KL	1			
MDBT42Q-U	nRF52832	MDBT42Q-U512KEN	3	u.FL Connector	64 kb	512 K
	nRF52832	MDBT42Q-U512KV2	2			

MDBT40 series

Series	Nordic Solution	Raytac No.	IC Ver.	Antenna	RAM	Flash Memory
MDBT40	nRF51822	MDBT40-256V3	3	Chip Antenna	16 kb	256 K
		MDBT40-256RV3			32 kb	256 K
MDBT40-P	nRF51822	MDBT40-P256V3	3	PCB Antenna	16 kb	256 K
		MDBT40-P256RV3			32 kb	256 K

Release Note

- 2025/02/10 Version 0.1: Preliminary.