Small-sized nRF52810 Module MS50SFA Specification

MS50SFA is a compact (15.8 x 12.0 x 2.0 mm), highly flexible, ultra-low power wireless BLE 5.0 Module based on nRF52810 SoCs; Its powerful 32-bit ARM Cortex™ M4 CPU, a 192KB Flash memory, a 24KB RAM and integrating a 2.4 GHz transceiver can offer the perfect solution for Bluetooth connectivity.

Features

Frequency: 2402 to 2480 MHz

Max. Output power: +4dBm

Single power supply: 1.8 – 3.6V

Range: up to 60 meters in open space

Chip: nRF52810 (Nordic)

GPIO Quantity: 13

192KB Flash and 24KB RAM (nRF52810)

Module size: 15.8 x 12.0 x 2.0 mm

ARM Cortex-M4 processor

Metal shielding with marking

UART communication protocol (Slave optional)

Antenna：PCB, Ceramic

Operating Temperature range: -40 to 80 degree Celsius

Application

Medical devices

Heart rate monitor

Blood pressure monitor

Blood glucose meter

Thermometer

Sport facilities

Weighing machine

Sports and fitness sensors

Accessories

3D glasses and gaming controller

Mobile accessories

Remote controllers / Toys

Electronic devices

Cycle computer

Certification

FCC ID:2ABU6-MS50SFA

CE certified

Revision history

Version	Date	Notes	Contributor（s）	Person of Approve
2.3	2020.05.14	**Improvement:** Pin assignment of MS50SFA1	Eddie	Coral
2.2	2019.04.08	Modification in range and operating temperature. Ordering information Pin definition	Lynn	
2.1	2019.03.07	**Add:** Cover, reflow and soldering, contact information, notes&caution. **Improvement:** Pin description, electrical specification, electrical schematic, package information, certification, disclaimer.	Lynn	
1.3	2018.12.07	1. The font of specification adjust to"Boldface" type. 2. The product feature: the fastest speed for transmission rate: 6.5kB/s revised by 4kB/s 3. Electrical parameter: for the working voltage: 1.8-3.6V revised by 3.0-3.6V	Liv	
1.2	2018.11.02	1. The adjustment of package information 2. quality assurance-disclaimer 3. Improvement of the content	Aliee	

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1. Product introduction

MS50SFA is a compact (15.8 x 12.0 x 2.0 mm), highly flexible, ultra-low power wireless BLE 5.0 Module based on nRF52810 SoCs; Its powerful 32-bit ARM Cortex^{TM} M4 CPU, a 192KB Flash memory, a 24KB RAM and integrating a 2.4 GHz transceiver can offer the perfect solution for Bluetooth connectivity.

MS50SFA can meet the most demanding applications, it allows faster time to market with high performance,low power management and reduced development cost. Also, its range is estimated up to 60 meters in open space.

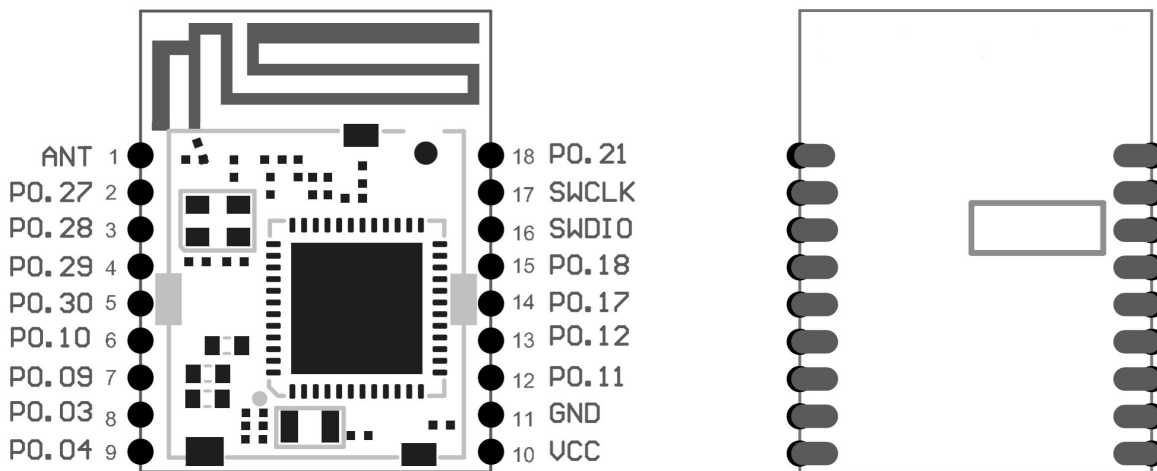## 1.1 Ordering information

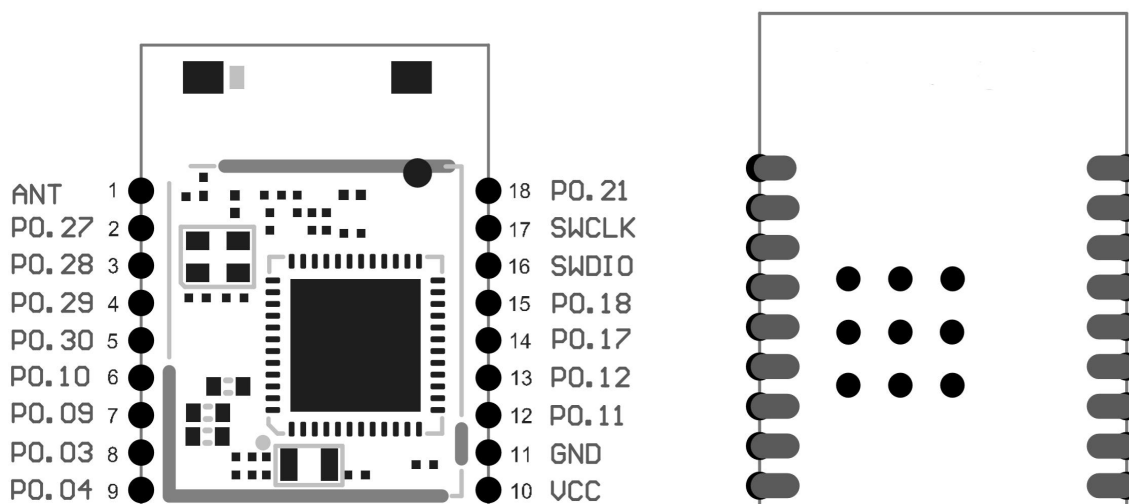| Ordering number	Description
MS50SFA1-028	306030110, nRF52810-QFAA , PCB ANT, with 32.768K, UART Slave, Reel pack
MS50SFA2-031	306030119, nRF52810-QFAA, Ceramic ANT, with 32.768K, UART Slave, Reel pack

2. Pin description

2.1 Pin assignment

2.1.1 MS50SFA PCB Antenna
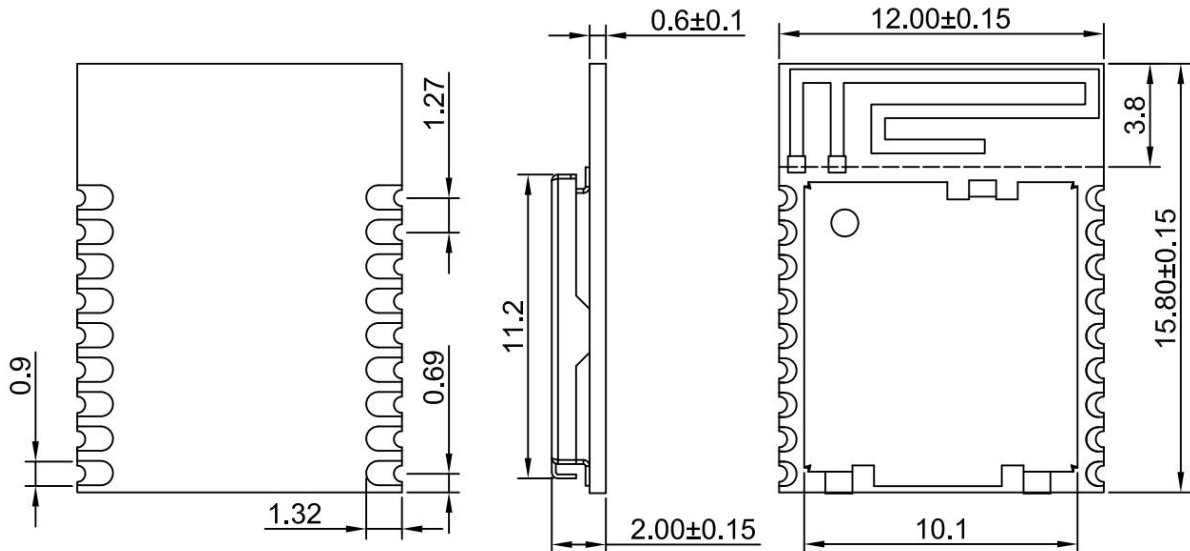

2.1.2 MS50SFA Ceramic Antenna

2.2 Pin definition

Symbol	Definition	Description	Notes
VCC	Power positive pole		
GND	Power negative pole		
P0.04	BRX	UART receive	RX of Bluetooth module
P0.03	BTX	UART transmit	TX of Bluetooth module
P0.17	SLP	Sleep/arouse	Sleep is high electrical level, arouse is low electrical level
P0.11	LED1	Indicator lighting	Sleep condition(low electrical level), idle condition(flicker once a second, that is, 800ms high electrical lever, 200ms is low electrical lever in circle), working condition(high electrical level); Idle condition: broadcasting condition; Working condition: The module have connected with the device.
P0.18	BTDATA	Host device send data	As the request of sending data(used in wake up the module). 0:host device send the data, module will waiting for receiving the data from host device, module will not sleep in this time. 1:host device have no data to send or finished the data sending, the module should place this signal line in 1.
P0.12	FIFO-FULL	Transmission space is full	How to judge a transmission space is ready to use. 0: Bluetooth module have available space to use and ready to transmission. 1: host device stop transmitting and waiting for the available space.

2.3 Block diagram
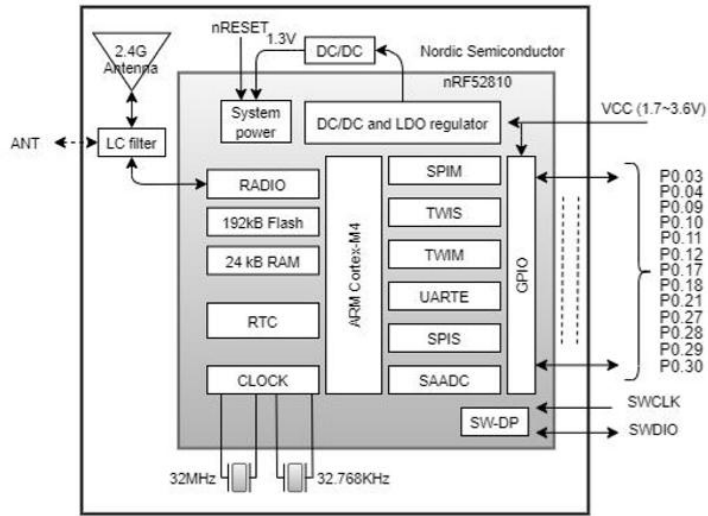
2.4 Mechanical drawing

2.4.1 MS50SFA PCB Antenna

2.4.2 MS50SFA Ceramic Antenna
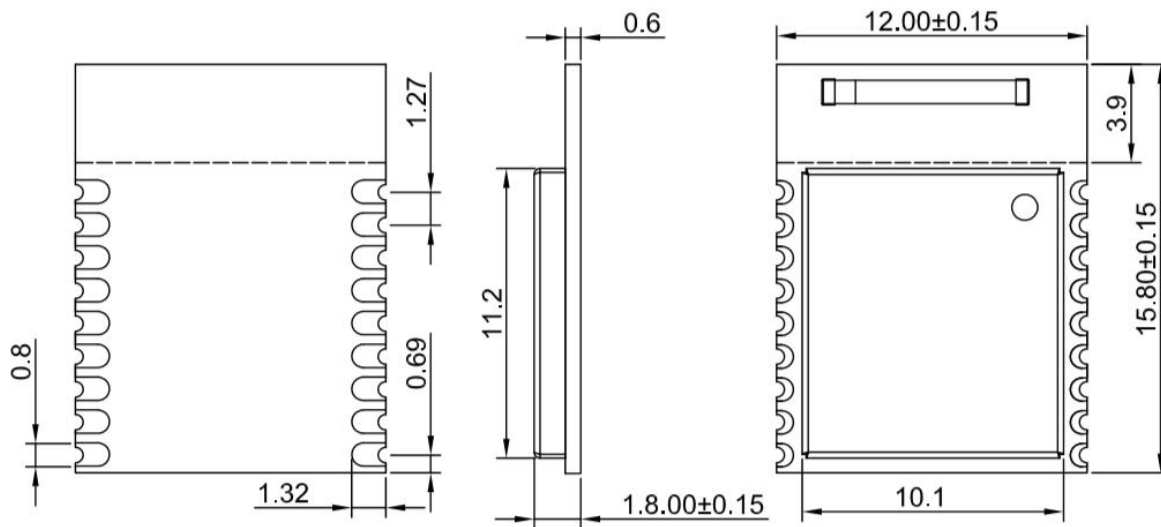
Unit: mm

Tolerance: +/- 1.0, default

3. Electrical specification

The electrical specifications of the module are directly related to the Nordic semiconductor Specifications for the nRF52810 chipset. The below information is only the extract from nRF52810 specification. For more detailed information, please refer to the up-to-date specification of the chipset available on the Nordic semiconductor website

3.1 Absolute maximum ratings

	Min.	Max.	Unit
Supply voltages			
VDD	-0.3	+3.9	V
VSS		0	V
I/O pin voltage			
$V_{I/O}$, VDD≤3.6 V	-0.3	VDD+0.3V	V
$V_{I/O}$, VDD>3.6 V	-0.3	3.9V	V

NFC antenna pin current				
I_{NFC1/2}			80	mA
Radio				
RF input level			10	dBm
Environmental QFN48, 6×6 mm package				
Storage temperature		-40	+125	°C
MSL(moisture sensitivity level)			2	
ESD HBM			4	kV
ESD CDM(charged device model)			1000	V

Important: Maximum ratings are the extreme limits to which the chip can be exposed for a limited amount of time without permanently damaging it. Exposure to absolute maximum ratings for prolonged periods of time may affect the reliability of the device.

3.2 Recommended operating conditions

The operating conditions are the physical parameters that the chip can operate within.

Symbol	Parameter	Notes	Min.	Nom.	Max.	Units
VDD	Supply voltage, independent of DCDC enable		1.7	3.0	3.6	V
T_{R_VDD}	Supply rise time (0 V to 1.7 V)				60	ms
TA	Operating temperature		-40	25	85	°C

Important: The on-chip power-on reset circuitry may not function properly for rise times longer than the specified maximum.

3.3 Electronic characteristic

3.3.1 General radio characteristics

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

3.3.2 Radio current consumption (Transmitter)

Symbol	Description	Min.	Typ.	Max.	Units
$I_{TX,PLUS4dBM,DCD}$	TX only run current(DCDC,3V)P_{RF}=+4 dBm		7.0		mA
$I_{TX,PLUS4dBM}$	TX only run current P_{RF}=+4 dBm		15.4		mA
$I_{TX,0dBM,DCDC}$	TX only run current(DCDC,3V)P_{RF}=0 dBm		4.6		mA
$I_{TX,0dBM}$	TX only run current P_{RF}=0 dBm		10.1		mA
$I_{TX,MINUS4dBM,DC}$	TX only run current DCDC,3V P_{RF}=-4 dBm		3.6		mA
$I_{TX,MINUS4dBM}$	TX only run current P_{RF}=-4 dBm		7.8		mA
$I_{TX,MINUS8dBM,DC}$	TX only run current DCDC,3V P_{RF}=-8 dBm		3.2		mA
$I_{TX,MINUS8dBM}$	TX only run current P_{RF}=-8 dBm		6.8		mA
$I_{TX,MINUS12dBM,DC}$	TX only run current DCDC,3V P_{RF}=-12 dBm		2.9		mA
$I_{TX,MINUS12dBM}$	TX only run current P_{RF}=-12 dBm		6.2		mA
$I_{TX,MINUS16dBM,DC}$	TX only run current DCDC,3V P_{RF}=-16 dBm		2.7		mA
$I_{TX,MINUS16dBM}$	TX only run current P_{RF}=-16 dBm		5.7		mA
$I_{TX,MINUS20dBM,DC}$	TX only run current DCDC,3V P_{RF}=-20 dBm		2.5		mA
$I_{TX,MINUS20dBM}$	TX only run current P_{RF}=-20 dBm		5.4		mA
$I_{TX,MINUS40dBM,DC}$	TX only run current DCDC,3V P_{RF}=-40 dBm		2.1		mA
$I_{TX,MINUS40dBM}$	TX only run current P_{RF}=-40 dBm		4.3		mA

3.3.3 Radio current consumption (Receiver)

Symbol	Description	Min.	Typ.	Max.	Units
$I_{RX,1M,DCDC}$	RX only run current (DCDC, 3V) 1Msps / 1Msps BLE		4.6		mA
$I_{RX,1M}$	RX only run current 1Msps / 1Msps BLE		10.0		mA
$I_{RX,2M,DCDC}$	RX only run current (DCDC, 3V) 2Msps / 2Msps BLE		5.2		mA
$I_{RX,2M}$	RX only run current 2Msps / 2Msps BLE		11.2		mA
$I_{START,RX,DCDC}$	RX start-up current (DCDC 3V)		3.5		mA
$I_{START,RX,LDO}$	RX start-up current (LDO 3V)		6.7		mA

3.3.4 Transmitter specification

Symbol	Description	Min.	Typ.	Max.	Units
P_{RF}	Maximum output power		4	8	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

3.3.5 Receiver operation

Symbol	Description	Min.	Typ.	Max.	Units
$P_{RX,MAX}$	Maximum received signal strength at < 0.1% BER		0		dBm
$P_{SENS,IT,1M}$	Sensitivity, 1Msps nRF mode1		-93		dBm
$P_{SENS,IT,SP,1M,BLE}$	Sensitivity, 1Msps BLE ideal transmitter, <=37 bytes		-96		dBm

$P_{SENS,IT,LP,1M,BLE}$	Sensitivity, 1Msps BLE ideal transmitter >=128 bytes		-95		dBm
$P_{SENS,IT,LP,1M,BLE}$	Sensitivity, 1Msps BLE ideal transmitter >=128 bytes		-95		dBm
$P_{SENS,IT,2M}$	Sensitivity, 2Msps nRF mode[4]		-89		dBm

[1] 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 3dB.

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

[3] Equivalent BER limit < 10E-04

[4] 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 3dB

3.3.6 RX selectivity

Symbol	Description	Min.	Typ.	Max.	Units
$C/I_{1M,co\text{-}channel}$	1Msps mode, Co-Channel interference		9		dBm
$C/I_{1M,\text{-}1MHz}$	1 Msps mode, Adjacent (-1 MHz) interference		-2		dBm
$C/I_{1M,+1MHz}$	1 Msps mode, Adjacent (+1 MHz) interference		-10		dBm
$C/I_{1M,\text{-}2MHz}$	1 Msps mode, Adjacent (-2 MHz) interference		-19		dBm
$C/I_{1M,+2MHz}$	1 Msps mode, Adjacent (+2 MHz) interference		-42		dBm
$C/I_{1M,\text{-}3MHz}$	1 Msps mode, Adjacent (-3 MHz) interference		-38		dBm
$C/I_{1M,+3MHz}$	1 Msps mode, Adjacent (+3 MHz) interference		-48		dB
$C/I_{1M,\pm6MHz}$	1 Msps mode, Adjacent (≥6 MHz) interference		-50		dB
$C/I_{1MBLE,co\text{-}channel}$	1 Msps BLE mode, Co-Channel interference		6		dB
$C/I_{1MBLE,\text{-}1MHz}$	1 Msps BLE mode, Adjacent (-1 MHz) interference		-2		dB
$C/I_{1MBLE,+1MHz}$	1Msps BLE mode, Adjacent (+1 MHz) interference		-9		dB
$C/I_{1MBLE,\text{-}2MHz}$	1Msps BLE mode, Adjacent (-2 MHz) interference		-22		dB
$C/I_{1MBLE,+2MHz}$	1Msps BLE mode, Adjacent (+2 MHz) interference		-46		dB

C/I$_{1MBLE,>3MHz}$	1Msps BLE mode, Adjacent (≥3 MHz) interference		-50		dB
C/I$_{1MBLE,image}$	Image frequency Interference -22 dB		-22		dB
C/I$_{1MBLE,image,1MHz}$	Adjacent (1 MHz) interference to in-band image frequency		-35		dB
C/I$_{2M,co-channel}$	2 Msps mode, Co-Channel interference		2-CO		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$_{2M,≥12MHz}$	2 Msps mode, Adjacent (≥12 MHz) interference		-52		dB

3.3.7 RX intermodulation

Symbol	Description	Min.	Typ.	Max.	Units
P$_{IMD,5TH,1M}$	IMD performance, 1 Msps, 5th offset channel, Packet length<= 37 bytes		-33		dBm
P$_{IMD,5TH,1M,BLE}$	IMD performance, 1 Msps, 5th offset channel, Packet length<= 37 bytes		-30		dBm
P$_{IMD,5TH,2M}$	IMD performance, 2 Msps, 5th offset channel, Packet length<= 37 bytes		-33		dBm
P$_{IMD,5TH,2M,BLE}$	IMD performance, 2 Msps, 5th offset channel, Packet length<= 37 bytes		-31		dBm

3.3.8 Radio timing

| Symbol	Description	Min.	Typ.	Max.	Units

|				
t_{TXEN}	Time between TXEN task and READY event after channel FREQUENCY configured		140	us
$t_{TXEN,FAST}$	Time between TXEN task and READY event after channel FREQUENCY configured (Fast Mode)		40	us
$t_{TXDISABLE}$	Time between DISABLE task and DISABLED event when the radio was in TX and mode is set to 1Msps		6	us
$t_{TXDISABLE,2M}$	Time between DISABLE task and DISABLED event when the radio was in TX and mode is set to 2Msps		4	us
t_{RXEN}	Time between the RXEN task and READY event after channel FREQUENCY configured in default mode		140	us
$t_{RXEN,FAST}$	Time between the RXEN task and READY event after channel FREQUENCY configured in fast mode		40	us
t_{SWITCH}	The minimum time taken to switch from RX to TX or TX to RX (channel FREQUENCY unchanged)		20	us
$t_{RXDISABLE}$	Time between DISABLE task and DISABLED event when the radio was in RX		0	us
$t_{TXCHAIN}$	TX chain delay		0.6	us
$t_{RXCHAIN}$	RX chain delay		9.4	us
$t_{RXCHAIN,2M}$	RX chain delay in 2Msps mode		5	us

3.3.9 Received signal strength indicator (RSSI) specifications

Symbol	Description	Min.	Typ.	Max.	Units
$RSSI_{ACC}$	RSSI Accuracy Valid range -90 to -20 dBm		±2		dB
$RSSI_{RESOLUTION}$	RSSI resolution		1		dB
$RSSI_{PERIOD}$	Sample period		0.25		us

4. Electrical schematic
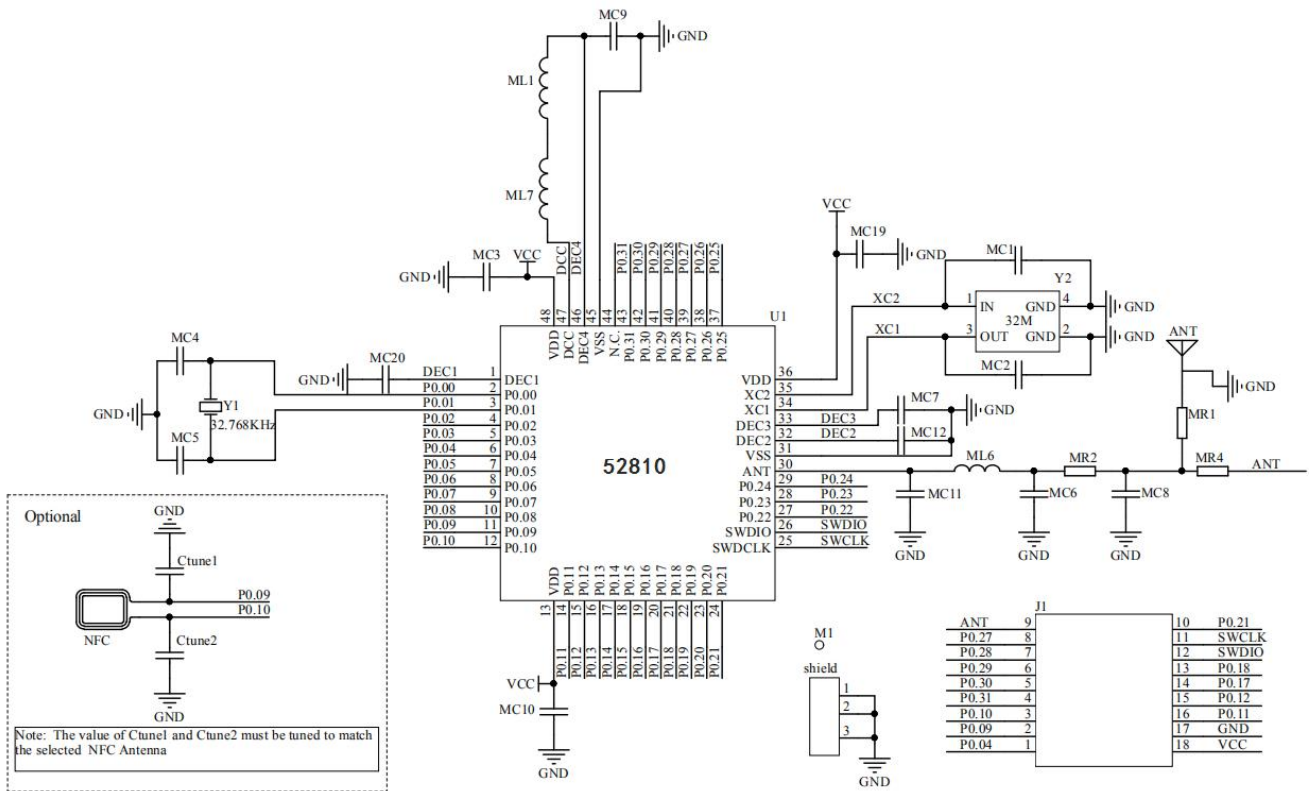
5. Package information

5.1 Package dimension
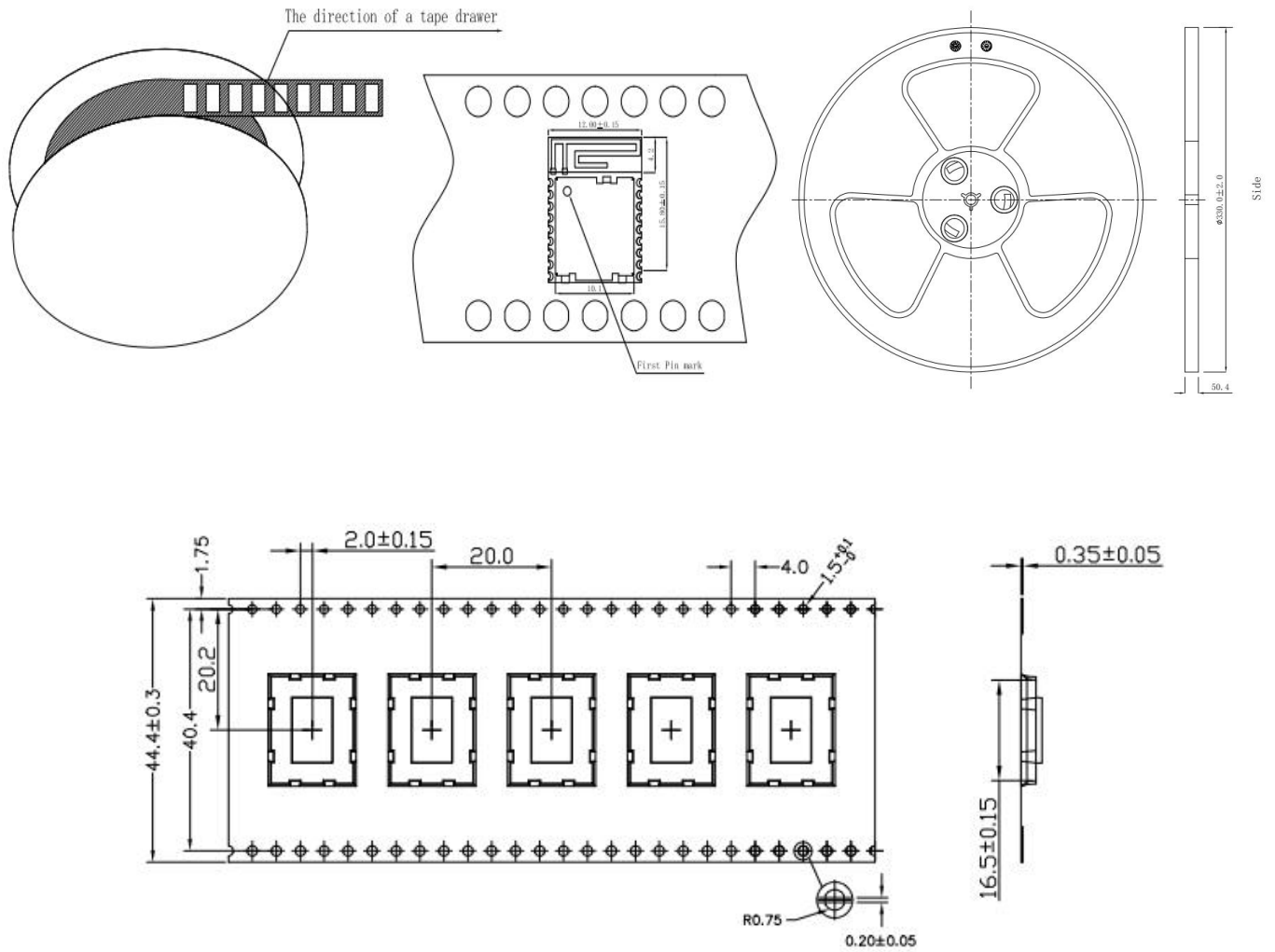
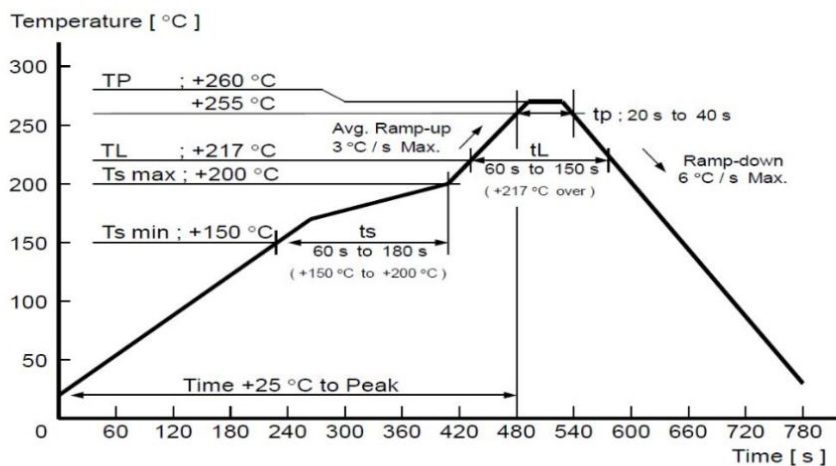| Details	Reel-MS50SFA
Quantity(module)	850PCS
Tape Weight	515g
Single module Weight	0.5g
Gross Weight	1000g
Dimension	W：44mm　T：0.35mm

5.2 Mark on metal shield

6. Reflow and soldering

Profile Feature	Sn-Pb Assembly	Pb-Free Assembly
Solder Paste	Sn63/Pb37	Sn96.5/Ag3/Cu0.5
Preheat Temperature min (Tsmin)	100°C	150°C
Preheat Temperature max (Tsmax)	150°C	200°C
Preheat Time (Tsmin to Tsmax)(ts)	60-120 sec	60-120 sec
Average ramp-up rate (Tsmax to Tp)	3°C/second max	3°C/second max
Liquidous Temperature (TL)	183°C	217°C
Time (tL)Maintained Above (TL)	60-90 sec	30-90 sec
Peak Temperature (Tp)	220-235°C	230-250°C
Average ramp-down rate (Tp to Tsmax)	6°C/second max	6°C/second max
Time 25°C to peak temperature	6 minutes max	8 minutes max

7. Certification

• CE Certification

MS50SFA module is being tested and is expected to be compliant against the EU-Radio Equipment standards. OEM integrator should consult with qualified test house to verify all regulatory requirements have been met for their complete device.

• FCC Certification (2ABU6-MS50SFA)

MS50SFA module is being tested and is expected to be compliant against the Federal Communications Commission standards.

As for the OEM integration:
Only OEM integrator have right to intend this device under the following conditions:
Any other transmitter or antenna must not be co-located with the antenna and transmitter. The module shall be only used with the integral antenna(s)that has been originally tested and certified with this module.
As long as the two conditions below are met,further transmitter testing will not be required.
(1)This device may not cause harmful interference.
(2)This device must accept any interference received, including interference that may cause undesired operation.
However, the OEM integrator shall test their end-product for any additional compliance requirements with this module installed (for example,digital device emission, PC peripheral requirements, etc.).
If these conditions cannot be met (for example certain laptop configuration or co-location with another transmitter), then the FCC authorization for this module in combination with the host equipment is no longer considered valid and the final product shall not use the FCC ID of the module. In these circumstances, the OEM integrator shall be re-evaluating the end product(including the transmitter) and obtaining a separate FCC authorization.
The OEM shall be verifying end product compliance with FCC Part 15, sub-part B limits for unintentional radiators through an accredited test facility.

8. Notes & cautions

We cannot assure that the specification has no errors and omission even though this specification is under collate and check strictly.

This specification is under the protection of laws and regulations of copyright, please do not copy and duplicate at any form, or do not transmit part or full of this specification in any wire and wireless network in any form, or do not edit or translate to any other format, word, code, etc.

8.1 Design notes

(1) It is critical to following the recommendations of this document to ensure the module meets the specifications.

(2) The module should be placed at the edge of the circuit board as far as possible to keep away from other circuits.

(3) Antenna should be kept away from other circuits. It can prevent low radiation efficiency and the normal use of other circuits from being affected.

(4) The landing of components should be appropriate and that is better for reducing the parasitic inductance.

(5) Please refuse to supply voltage that is not within the range of specification.

(6) Please make sure the module or its surface may not suffer from the physical shock or extreme stress.

8.2 Layout notes

To make sure wireless performance is at its best condition, please layout the MS50SFA1 and MS50SFA2 module on the carrier board as below instructions and picture.

(1) Placement of the antenna
The antenna area of module shall lay clearance completely and should not be blocked by the metal. Otherwise it will have effect on antenna performance (As the picture indicated below).
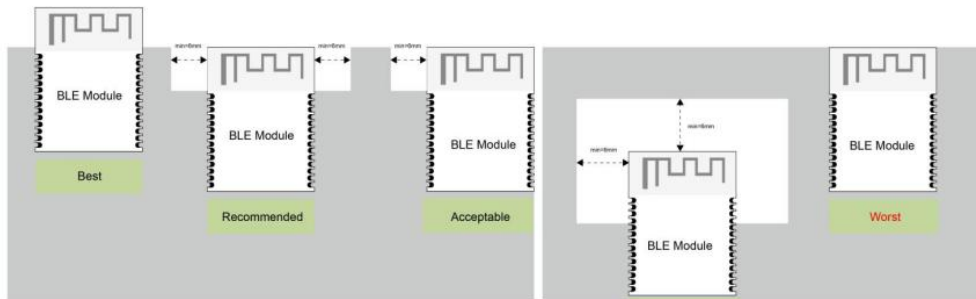
(2) Placement of top-layer
The placement of top-layer in carrier board shall be lay copper completely to reduce the signal line in carrier board or other interference.

(3) Clearance
The upper and below area of antenna (including the case) shall have 4mm or more than 4mm

clearance to reduce the influences for antenna.

*The Grey area above is Carrier board.

8.3 Installation and soldering

(1) Please do not lay copper under the module antenna. It can prevent the influence of signal radiation and the transmission distance from being affected.

8.4 Handling and storage

(1) Due to the fact that CMOS components are included in the module, it is better to eliminate static electricity at any methods when transporting or working with the module. Moreover, it is strongly recommended adding anti-ESD components to circuit design to hinder damage from real-life ESD events. Anti-ESD methods can be also used in mechanical design.

(2) Please store the modules within -40℃ to +125℃ before and after installation and make sure the modules is away from the direct sunlight exposure for a long duration. Modules should be far away from humid and salty air conditions, and any corrosive gasses or substances.

(3) Please not to wash the module. No-Clean Paste is used in production. The metal shield may be oxidized by the washing process and may lead to chemistry reaction with No-Clean Paste. If modules goes through the washing process, functions of the module may not guaranteed.

8.5 Life support applications

(1) The module is not design for life support device or system and not allowed to be used in destructive devices or system in any direct, or indirect ways. Minew is not responsible for compensation of any losses when applying modules under such application as described above.

(2) Minew shall not responsible for the customer's products or application.

9. Disclaimer

The factory has passed the ISO9001 quality management system, ISO14001 environmental management system and OAHS18001 occupational health and safety assessment . Each product has been rigorously tested (transmission power test, sensitivity test, power consumption test, stability test, aging test, etc.).

* NOTICES:
   (1) The Bluetooth trade mark is owned by the Bluetooth SIG Inc. USA.
   (2) All other trademarks listed herein are owned by their respective owners.
   (3) All specifications are subject to change without notice.
   (4) Please do not use this specification for produce, sell or illegal purpose without Minew's authorization.
   (5) Minew have right to interpret all the items above.

10. Contact information

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      Shenzhen 518109,
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