



# Small-sized nRF52832 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 nRF52832 SoCs; Its powerful 32-bit ARM Cortex™ M4F CPU, a 512kB flash memory, a 64 KB 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: nRF52832 (Nordic)  
GPIO Quantity: 13  
512kB Flash and 64kB RAM (nRF52832)  
Module size: 15.8 x 12.0 x 2.0 mm  
ARM Cortex-M4F processor  
Metal shielding with marking  
UART communication protocol (Slave / Master optional)  
Antenna: PCB, Ceramic  
Operating Temperature range: -40 to 80 degree Celsius

## Certification

FCC ID:2ABU6-MS50SFA  
BQB, CE, KC certified

## 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

## Revision history

Version	Date	Notes	Contributor (s)	Person of Approve
2.4	2020.5.14	Modification of Ceramic antenna	Eddie	Coral
2.3	2019.04.11	Modification in Ordering information	Lynn	
2.2	2019.04.08	Modification in range and operating temperature.	Lynn	
2.1	2019.03.07	<p><b>Add:</b> Cover, reflow and soldering, contact information, notes&amp;caution.</p> <p><b>Improvement:</b> Pin description, electrical specification, electrical schematic, package information, certification, disclaimer.</p>	Lynn	
1.3	2018.12.07	<p>1. The font of specification adjust to“Boldface” type.</p> <p>2. The product feature: the fastest speed for transmission rate: 6.5kB/s revised by 4kB/s</p> <p>3. Electrical parameter: for the working voltage: 1.8-3.6V revised by 3.0-3.6V</p>	Liv	
1.2	2018.11.02	<p>1. The adjustment of package information</p> <p>2. quality assurance-disclaimer</p> <p>3. Improvement of the content</p>	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 nRF52832 SoCs; Its powerful 32-bit ARM Cortex™ M4F CPU, a 512kB flash memory, a 64 KB RAM and integrating a 2.4 GH 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.

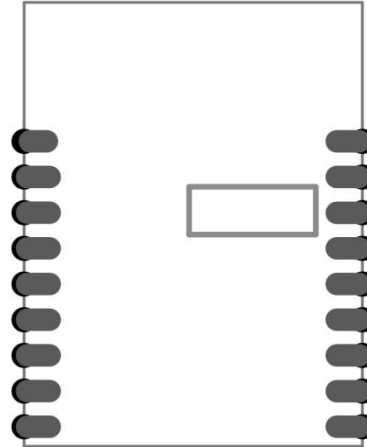
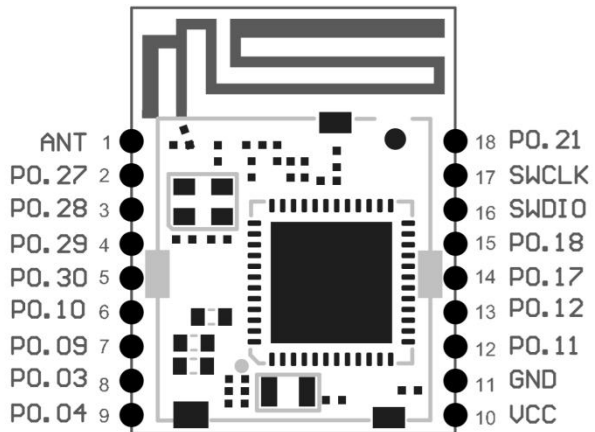
### 1.1 Ordering information

Ordering number	Description
MS50SFA1-026	306030100, nRF52832-QFAA BT 5.0 Module, PCB Antenna, Reel pack
MS50SFA2-012	306030102, nRF52832-QFAA BT 5.0 Module, Ceramic Antenna, Reel pack

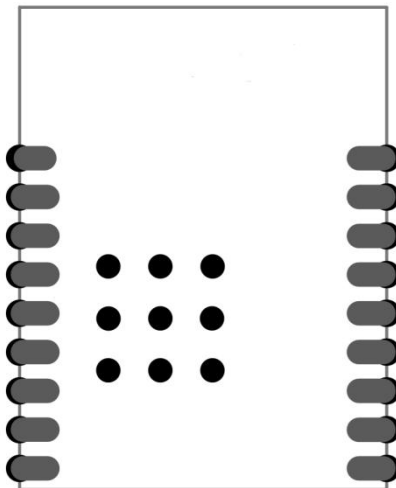
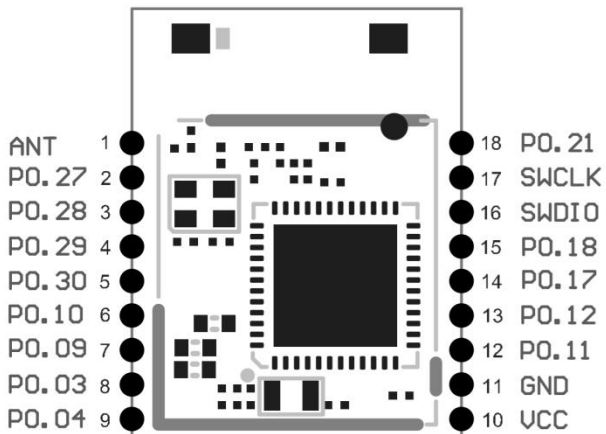
## 2. Pin description

### 2.1 Pin assignment

#### 2.1.1 MS50SFA PCB Antenna



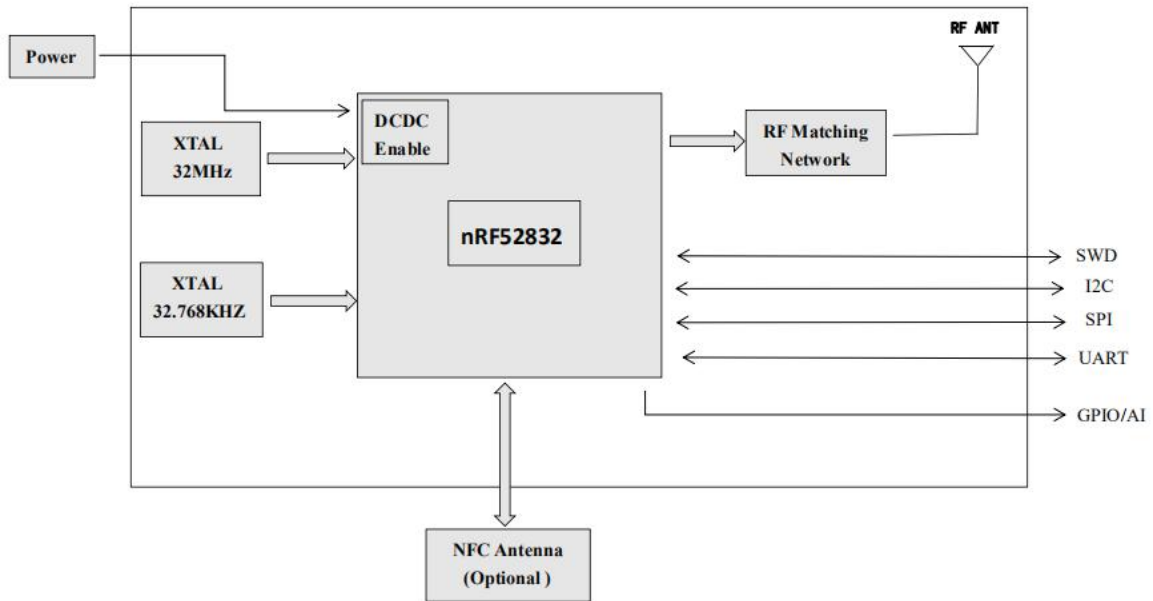
#### 2.1.2 MS50SFA Ceramic Antenna



## 2.2 Pin definition

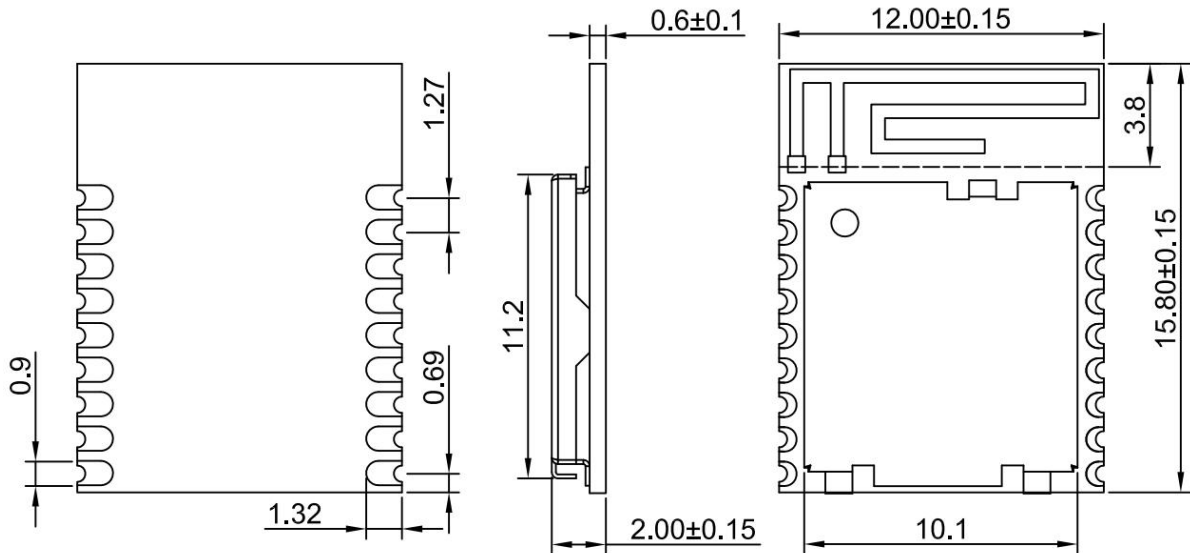
Symbol	Definition	Description
ANT	RF	Single-ended radio antenna connection
P0.27	Digital I/O	General purpose I/O <sup>2</sup>
P0.28	Digital I/O	General purpose I/O <sup>2</sup>
AIN4	Analog input	SAADC/COMP/LPCOMP input
P0.29	Digital I/O	General purpose I/O <sup>2</sup>
AIN5	Analog input	SAADC/COMP/LPCOMP input
P0.30	Digital I/O	General purpose I/O <sup>2</sup>
AIN6	Analog input	SAADC/COMP/LPCOMP input
VCC	Positive pole	Connecting positive pole, the Voltage is 3.0-3.6V
P0.03	Digital I/O	General purpose I/O
AIN1	Analog input	SAADC/COMP/LPCOMP input
P0.04	Digital I/O	General purpose I/O <sup>1</sup>
AIN2	Analog input	SAADC/COMP/LPCOMP input
NFC1	NFC input	NFC antenna connection
P0.09	Digital I/O	General purpose I/O <sup>1</sup>
NFC2	NFC input	NFC antenna connection
P0.10	Digital I/O	General purpose I/O <sup>1</sup>
P0.21	Digital I/O	General purpose I/O <sup>1</sup>
nRESET		Configurable as pin reset
SWDCLK	Digital input	Serial wire debug clock input for debug and programming
SWDIO	Digital I/O	Serial wire debug I/O for debug and programming
P0.18	Digital I/O	General purpose I/O
TRACEDATA[0] / SWO		Single wire output / Trace port output
P0.17	Digital I/O	General purpose I/O
P0.12	Digital I/O	General purpose I/O
P0.11	Digital I/O	General purpose I/O

## 2.3 Block diagram

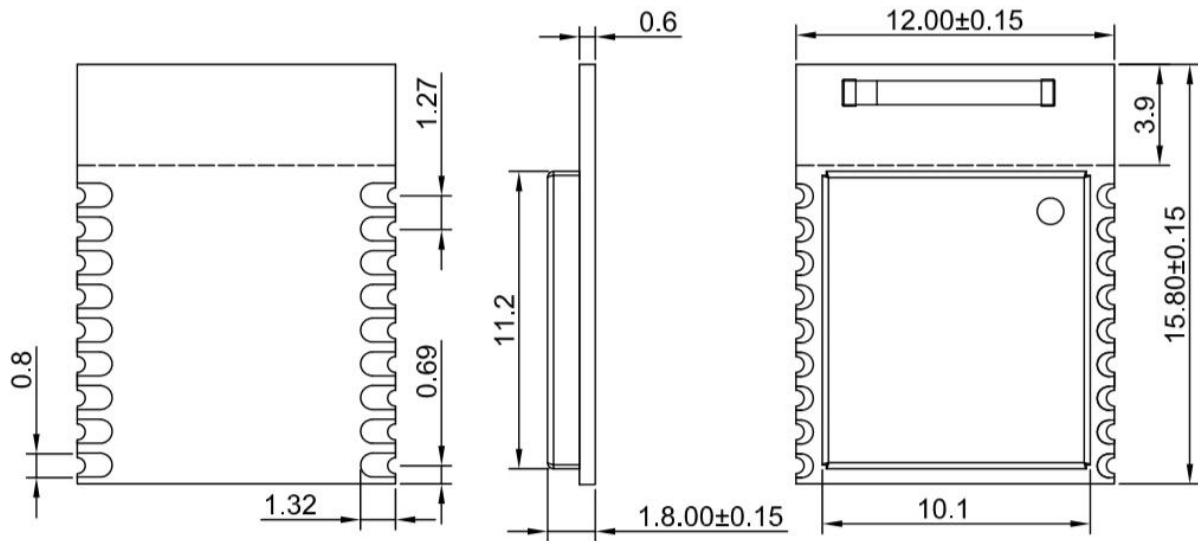


## 2.4 Mechanical drawing

### 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 nRF52832 chipset. The below information is only the extract from nRF52832 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
<b>Supply voltages</b>			
VDD	-0.3	+3.9	V
VSS		0	V
<b>I/O pin voltage</b>			
$V_{I/O}, VDD \leq 3.6 \text{ V}$	-0.3	$VDD + 0.3 \text{ V}$	V
$V_{I/O}, VDD > 3.6 \text{ V}$	-0.3	3.9V	V
<b>NFC antenna pin current</b>			



$I_{NFC1/2}$		80	mA
Radio			
RF input level		10	dBm
<b>Environmental QFN48, 6×6 mm package</b>			
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
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$f_{OP}$	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		$\pm 170$		kHz
$f_{DELTA,BLE,1}$	Frequency deviation @ BLE 1 Msps		$\pm 250$		kHz
$f_{DELTA,2M}$	Frequency deviation @ 2 Msps		$\pm 320$		kHz
$f_{DELTA,BLE,2}$	Frequency deviation @ BLE 2 Msps		$\pm 500$		kHz
$f_{skSPS}$	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		7.5		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) $P_{RF}=0$ dBm		5.3		mA
$I_{TX,0dBm}$	TX only run current $P_{RF}=0$ dBm		11.6		mA
$I_{TX,MINUS4dBm,DC}$	TX only run current DCDC,3V $P_{RF}=-4$ dBm		4.2		mA
$I_{TX,MINUS4dBm}$	TX only run current $P_{RF}=-4$ dBm		9.3		mA
$I_{TX,MINUS8dBm,DC}$	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
$I_{TX,MINUS12dBm,DC}$	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
$I_{TX,MINUS16dBm,DC}$	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
$I_{TX,MINUS20dBm,DC}$	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
$I_{TX,MINUS40dBm,DC}$	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 only run current DCDC,3V $P_{RF}=4$ dBm		4.0		mA
$I_{START,TX}$	TX only run current $P_{RF}=4$ dBm		8.8		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		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

### 3.3.4 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			$\pm 4$	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

### 3.3.5 Receiver operation

Symbol	Description	Min.	Typ.	Max.	Units
P <sub>RX,MAX</sub>	Maximum received signal strength at < 0.1% BER		0		dBm
P <sub>SENS,IT,1M</sub>	Sensitivity, 1Msps nRF mode <sup>1</sup>		-93		dBm
P <sub>SENS,IT,SP,1M,BLE</sub>	Sensitivity, 1Msps BLE ideal transmitter, <=37 bytes		-96		dBm
P <sub>SENS,IT,LP,1M,BLE</sub>	Sensitivity, 1Msps BLE ideal transmitter >=128 bytes		-95		dBm
P <sub>SENS,IT,LP,1M,BLE</sub>	Sensitivity, 1Msps BLE ideal transmitter >=128 bytes		-95		dBm
P <sub>SENS,IT,2M</sub>	Sensitivity, 2Msps nRF mode <sup>4</sup>		-89		dBm
P <sub>SENS,IT,SP,2M,BLE</sub>	Sensitivity, 2Msps BLE ideal transmitter, Packet		-93		dBm
P <sub>SENS,DT,SP,2M,BLE</sub>	Sensitivity, 2Msps BLE dirty transmitter, Packet length<=37bytes		-93		dBm
P <sub>SENS,IT,LP,2M,BLE</sub>	Sensitivity, 2Msps BLE ideal transmitter >= 128bytes		-92		dBm
P <sub>SENS,DT,LP,2M,BLE</sub>	Sensitivity, 2Msps BLE dirty transmitter, Packet length >= 128bytes		-92		dBm

<sup>1</sup> 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.

<sup>2</sup> As defined in the Bluetooth Core Specification v4.0 Volume 6: Core System Package (Low Energy Controller Volume)

<sup>3</sup> Equivalent BER limit < 10E-04

<sup>4</sup> 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 <sub>1M,co-channel</sub>	1Msps mode, Co-Channel interference		9		dBm
C/I <sub>1M,-1MHz</sub>	1 Msps mode, Adjacent (-1 MHz) interference		-2		dBm
C/I <sub>1M,+1MHz</sub>	1 Msps mode, Adjacent (+1 MHz) interference		-10		dBm

$C/I_{1M,-2MHz}$	1 Msps mode, Adjacent (-2 MHz) interference		-19		dBm
$C/I_{1M,+2MHz}$	1 Msps mode, Adjacent (+2 MHz) interference		-42		dBm
$C/I_{1M,-3MHz}$	1 Msps mode, Adjacent (-3 MHz) interference		-38		dBm
$C/I_{1M,+3MHz}$	1 Msps mode, Adjacent (+3 MHz) interference		-48		dB
$C/I_{1M,\pm 6MHz}$	1 Msps mode, Adjacent ( $\geq 6$ MHz) interference		-50		dB
$C/I_{1M BLE, co-channel}$	1 Msps BLE mode, Co-Channel interference		6		dB
$C/I_{1M BLE, -1MHz}$	1 Msps BLE mode, Adjacent (-1 MHz) interference		-2		dB
$C/I_{1M BLE, +1MHz}$	1 Msps BLE mode, Adjacent (+1 MHz) interference		-9		dB
$C/I_{1M BLE, -2MHz}$	1 Msps BLE mode, Adjacent (-2 MHz) interference		-22		dB
$C/I_{1M BLE, +2MHz}$	1 Msps BLE mode, Adjacent (+2 MHz) interference		-46		dB
$C/I_{1M BLE, >3MHz}$	1 Msps BLE mode, Adjacent ( $\geq 3$ MHz) interference		-50		dB
$C/I_{1M BLE, image}$	Image frequency Interference -22 dB		-22		dB
$C/I_{1M BLE, image, 1MHz}$	Adjacent (1 MHz) interference to in-band image frequency		-35		dB
$C/I_{2M, co-channel}$	2 Msps 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
$C/I_{2M, \geq 12MHz}$	2 Msps mode, Adjacent ( $\geq 12$ MHz) interference		-52		dB
$C/I_{2M BLE, co-channel}$	2 Msps BLE mode, Co-Channel interference		7		dB
$C/I_{2M BLE, \pm 2MHz}$	2 Msps BLE mode, Adjacent ( $\pm 2$ MHz) interference		0		dB
$C/I_{2M BLE, \pm 4MHz}$	2 Msps BLE mode, Adjacent ( $\pm 4$ MHz) interference		-47		dB
$C/I_{2M BLE, \geq 6MHz}$	2 Msps BLE mode, Adjacent ( $\geq 6$ MHz) interference		-49		dB
$C/I_{2M BLE, image}$	Image frequency Interference		-21		dB

$C/I_{2M, BLE, image, 2MHz}$	Adjacent (2 MHz) interference to in-band image frequency		-36		dB
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### 3.3.7 RX intermodulation

Symbol	Description	Min.	Typ.	Max.	Units
$P_{IMD, 1M}$	IMD performance, 1Msps (3MHz, 4MHz, and 5MHz offset)		-33		dBm
$P_{IMD, 1M, BLE}$	IMD performance, BLE 1Msps (3MHz, 4MHz, and 5MHz offset)		-30		dBm
$P_{IMD, 2M}$	IMD performance, 2Msps (6MHz, 8MHz, and 10MHz offset)		-33		dBm
$P_{IMD, 2M, BLE}$	IMD performance, BLE 2Msps (6MHz, 8MHz, and 10MHz offset)		-32		dBm

### 3.3.8 Radio timing

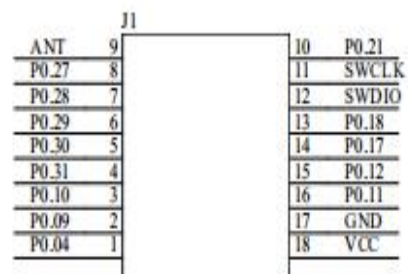
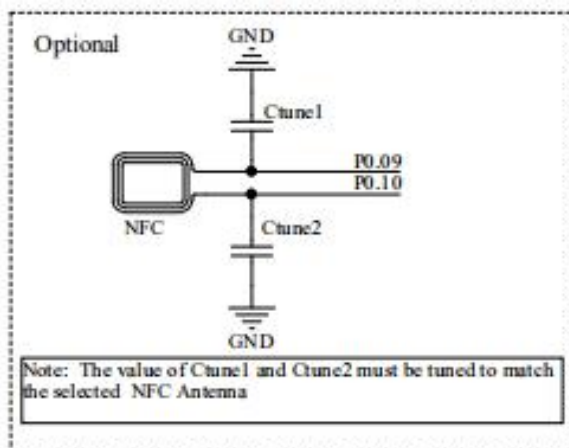
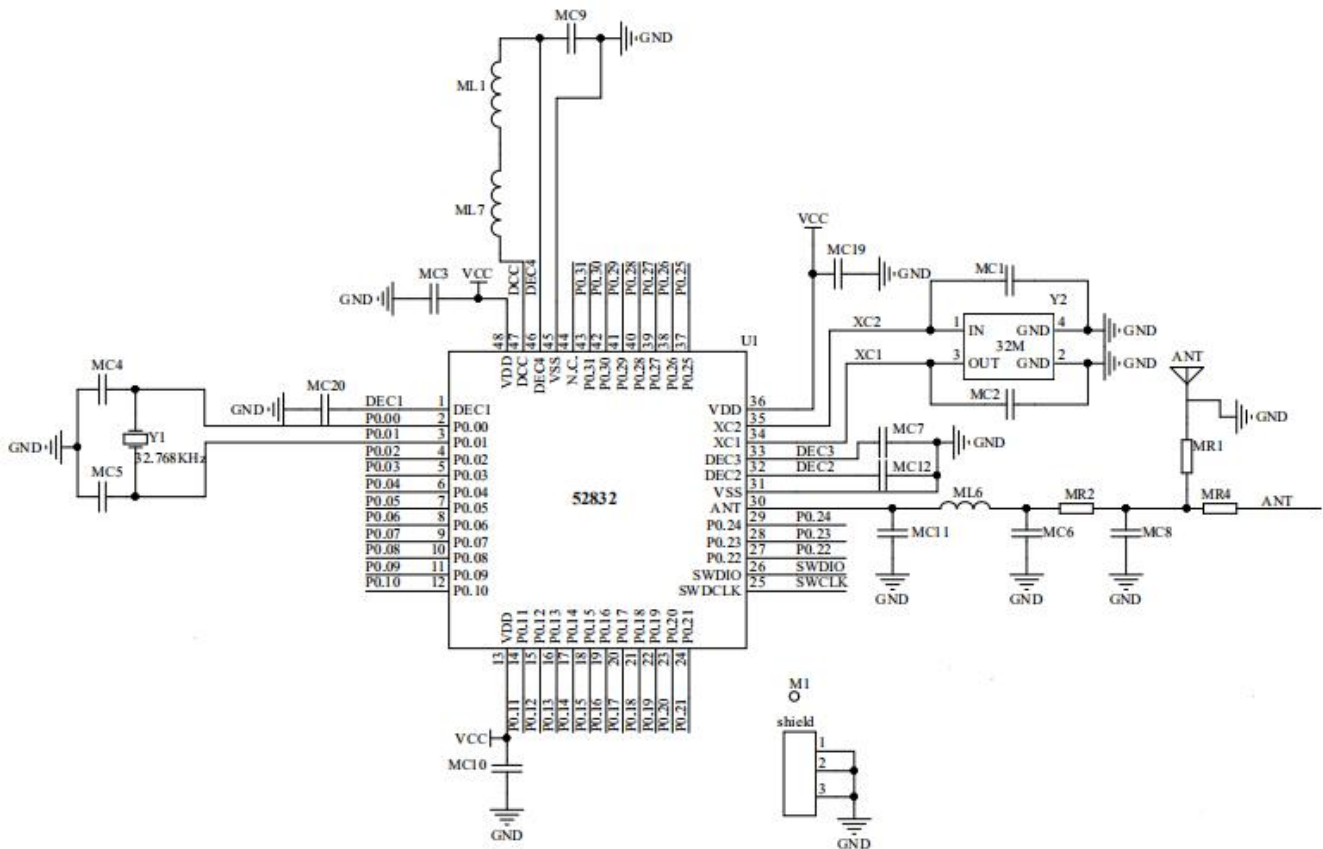
Symbol	Description	Min.	Typ.	Max.	Units
$t_{TXEN}$	Time between TXEN task and READY event after channel FREQUENCY configured		140		us
$t_{TXEN, FAST}$	Time between TXEN task and READY event after channel FREQUENCY configured (Fast Mode)		40		us
$t_{TXDISABLE}$	Time between DISABLE task and DISABLED event 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

$t_{\text{SWITCH}}$	The minimum time taken to switch from RX to TX or TX to RX (channel FREQUENCY unchanged)		20		us
$t_{\text{RXDISABLE}}$	Time between DISABLE task and DISABLED event when the radio was in RX		0		us
$t_{\text{TXCHAIN}}$	TX chain delay		0.6		us
$t_{\text{RXCHAIN}}$	RX chain delay		9.4		us
$t_{\text{RXCHAIN,2M}}$	RX chain delay in 2Msps mode		5		us

### 3.3.9 Received signal strength indicator (RSSI) specifications

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

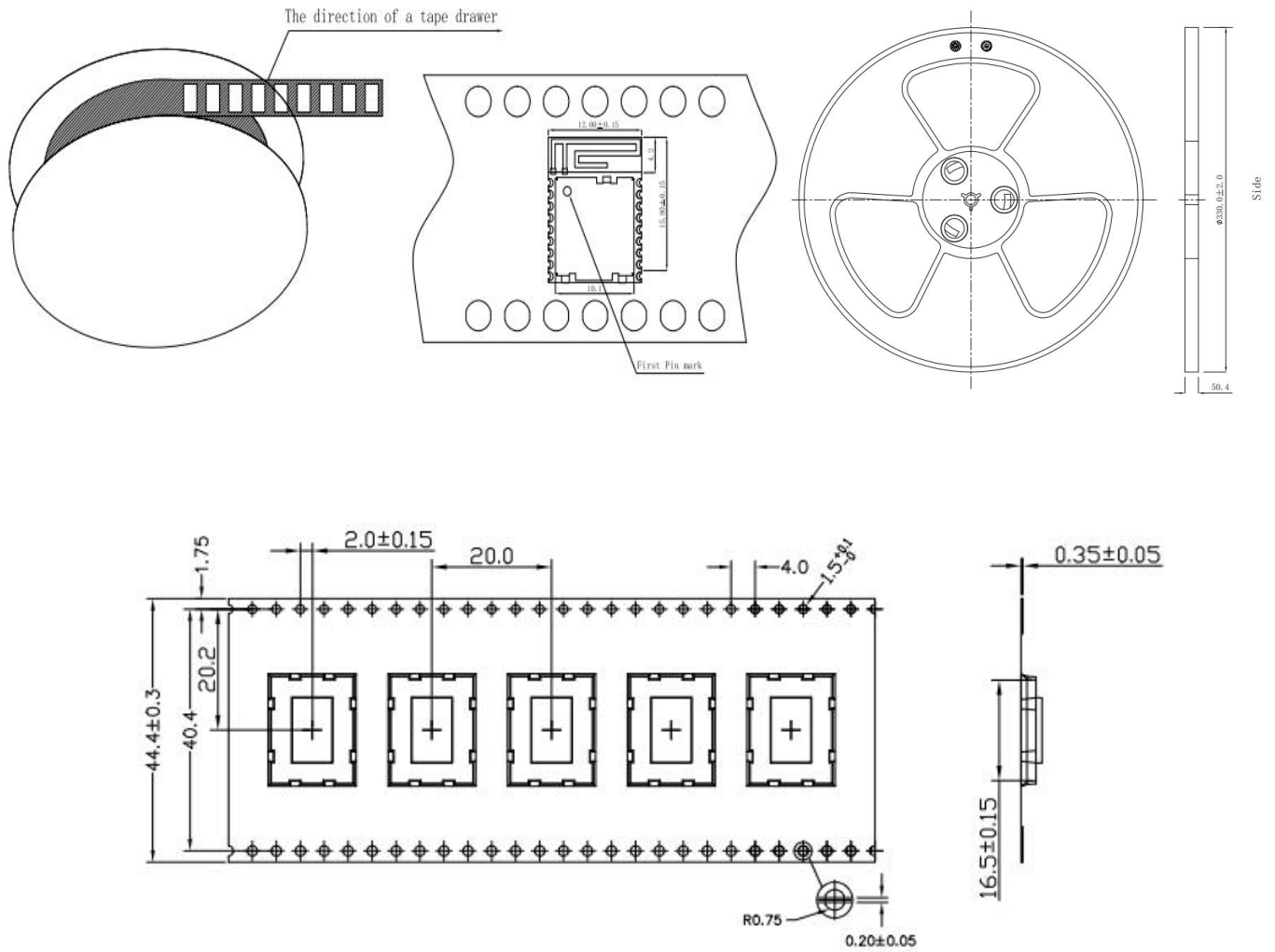
## 4. Electrical schematic





## 5.Package information

### 5.1 Package dimension



Details	Reel-MS50SFA	Reel-MS50SFA
Quantity(module)	850PCS	850PCS
Tape Weight	515g	515g
Single module Weight	0.5g	0.51g
Gross Weight	1000g	1000g
Dimension	W: 44mm T: 0.35mm	W: 44mm T: 0.35mm

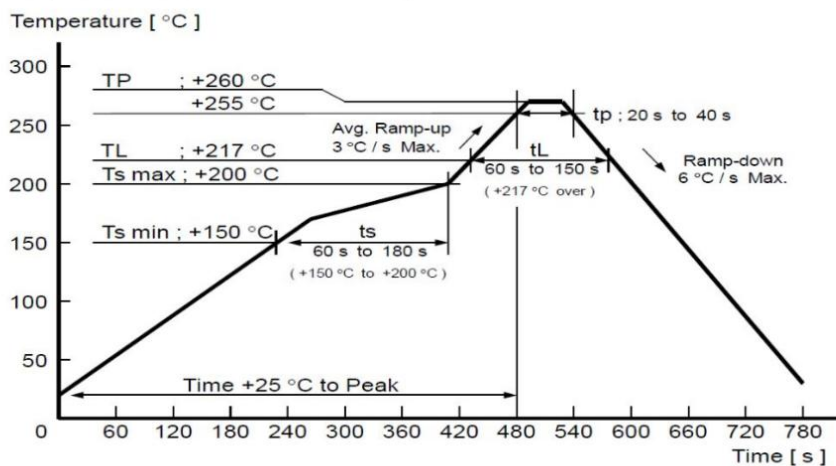
## 5.2 Mark on metal shield



## 6. Reflow and soldering

### 6.Reflow profile

Reflow condition (Follow of JEDEC STD-020D.01)



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

### 7.1 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.

### 7.2 FCC Certification ( 2ABU6-MS50SFA)

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

### 7.3 Environmental

#### 7.3.1 RoHs

MS50SFA modules are in compliance with Directive 2011/65/EU, 2015/863/EU of the European Parliament and the Council on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

#### 7.3.2 Reach

MS50SFA modules listed below do not contain the 191 SVHC (Substance of Very High Concern), as defined by Directive EC/1907/2006 Article according to REACHAnnex XVII.

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, and

(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 MS50SFB1 and MS50SFB2 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).

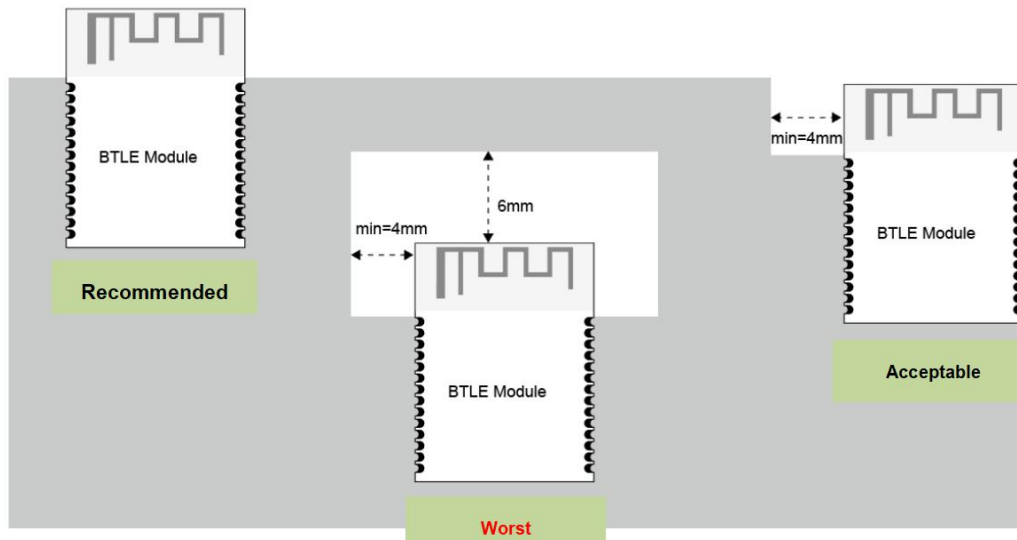
(2) Placement of top-layer

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  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$  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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