



# Advanced nRF52810 Module MS50SFB Specification



**The MS50SFB is a compact and small size Bluetooth 5.0 module with ultra-low power consumption and optional antenna types; The module has the large number of GPIOs and excellent RF performance**

## 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: 32  
192KB Flash and 24KB RAM  
Module size: 20.0 x 12.0 x 2.0 mm  
ARM Cortex-M4 processor  
Metal shielding with marking  
UART communication protocol (Slave optional)  
2 optional antenna types: PCB antenna, chip antenna  
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

Full Bluetooth Declaration ID: D039669  
FCC ID:2ABU6-MS50SFB  
TELEC: 208-190043  
IC: 20896-MS50SFB  
CE, RCM, WPC, RoHS & REACH certified

## Revision history

| Version | Date       | Notes   | Contributor (s) | Person of Approve |
|---------|------------|---|-----------------|-------------------|
| 1.1     | 2020.05.20 | <b>Improvement:</b><br>Pin assignment and Block Diagram | Eddie           | Coral             |
| 1.0     | 2020.04.13 | First edition   | Eddie           | Coral             |

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## 1. Product introduction

The MS50SFB is a compact and small size Bluetooth 5.0 module with ultra-low power consumption and optional antenna types; The module has the large number of GPIOs and excellent RF performance. Therefore, it can apply to a wide range of Bluetooth connected products. With an ARM Cortex™ M4 MCU, up to 192KB flash, 24KB RAM, embedded 2.4GHz, MS50SFB can save the R&D and time cost.

The module is highly integrated that contains all the necessary components from radio to a different antenna and a completely implemented Bluetooth protocol stack and programming UART communication protocol.

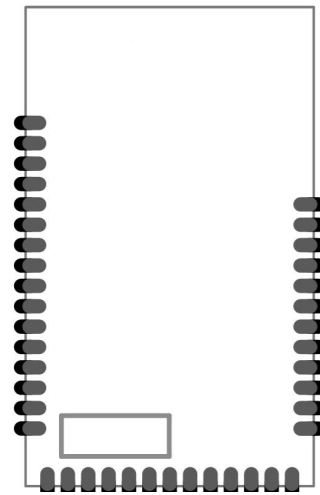
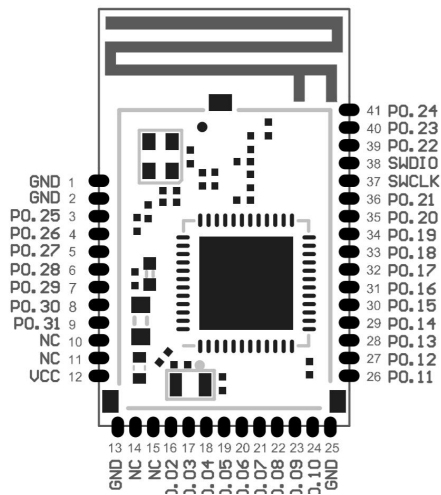
### 1.1 Ordering information

| Ordering number | Description  |
|-----------------|--|
| MS50SFB1        | nRF52810-QFAA BT 5.0 Module, with 32.768K, PCB Antenna         |
| MS50SFB2        | nRF52810-QFAA BT 5.0 Module, with 32.768K, Chip Antenna        |
| MS50SFB3        | nRF52810-QFAA BT 5.0 Module, with 32.768K, u.FL/IPEX connector |

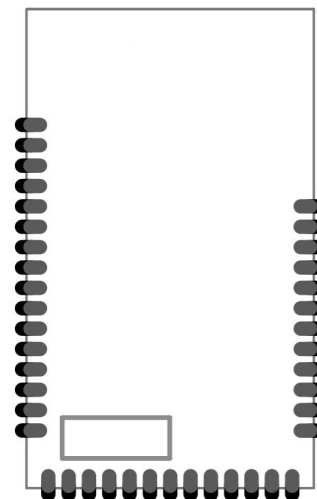
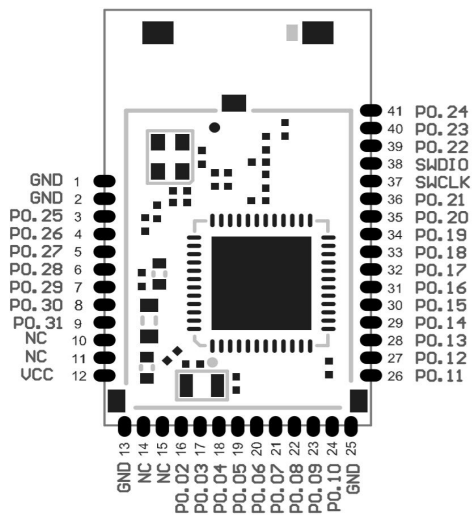
## 2. Pin description

### 2.1 Pin assignment

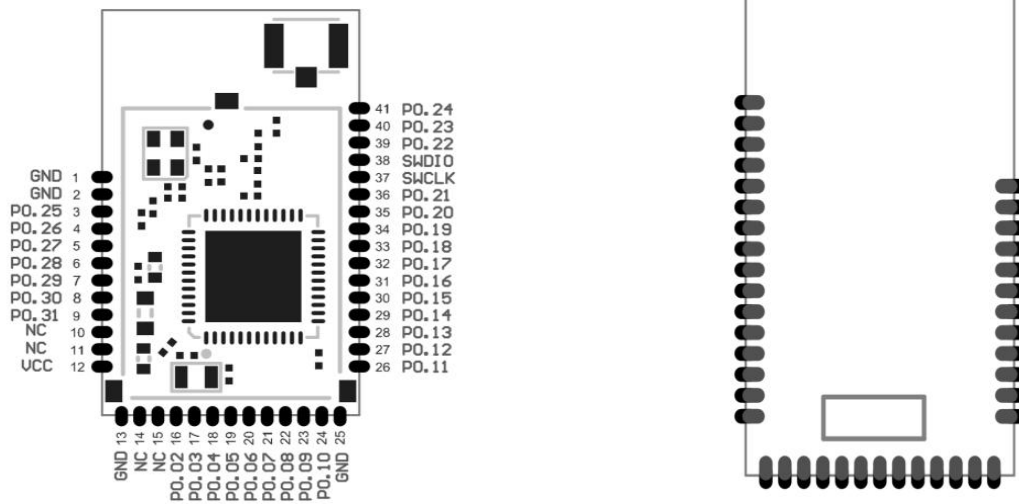
#### 2.1.1 MS50SFB/PCB antenna



#### 2.1.2 MS50SFB/Ceramic chip antenna



#### 2.1.3 MS50SFB/u.FL/IPEX connector



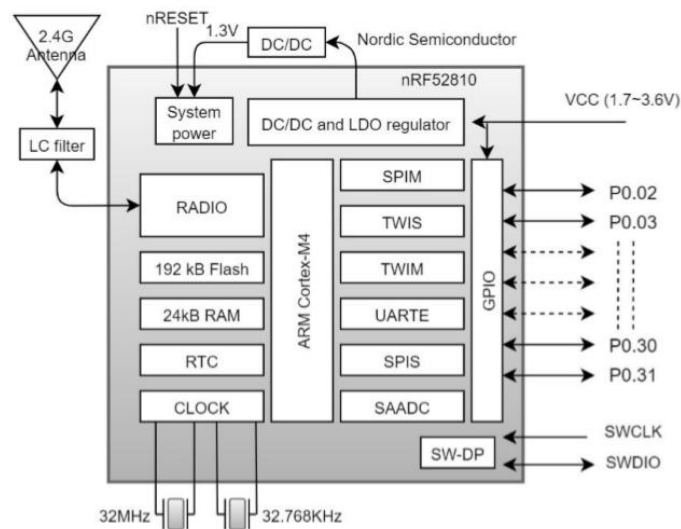
## 2.2 Pin definition

| Symbol | Type         | Description                              |
|--------|--------------|--|
| P0.00  | Digital I/O  | General purpose I/O                      |
| XL1    | Analog input | Connection for 32.768 kHz crystal (LFXO) |
| P0.01  | Digital I/O  | General purpose I/O                      |
| XL2    | Analog input | Connection for 32.768 kHz crystal (LFXO) |
| P0.02  | Digital I/O  | General purpose I/O                      |
| AIN 0  | Analog input | SAADC/COMP/LPCOMP input                  |
| P0.03  | Digital I/O  | General purpose I/O                      |
| AIN 1  | Analog input | SAADC/COMP/LPCOMP input                  |
| P0.04  | Digital I/O  | General purpose I/O                      |
| AIN 2  | Analog input | SAADC/COMP/LPCOMP input                  |
| P0.05  | Digital I/O  | General purpose I/O                      |
| AIN 3  | Analog input | SAADC/COMP/LPCOMP input                  |
| P0.06  | Digital I/O  | General purpose I/O                      |
| P0.07  | Digital I/O  | General purpose I/O                      |
| P0.08  | Digital I/O  | General purpose I/O                      |
| P0.09  | Digital I/O  | General purpose I/O                      |

|                             |                             |  |
|-----------------------------|-----------------------------|--|
| P0.10                       | Digital I/O                 | General purpose I/O  |
| GND                         | Ground                      |  |
| P0.11                       | Digital I/O                 | General purpose I/O  |
| P0.12                       | Digital I/O                 | General purpose I/O  |
| P0.13                       | Digital I/O                 | General purpose I/O  |
| P0.14<br>TRACEDATA[3]       | Digital I/O                 | General purpose I/O<br>Trace port output                       |
| P0.15<br>TRACEDATA[2]       | Digital I/O                 | General purpose I/O<br>Trace port output                       |
| P0.16<br>TRACEDATA[1]       | Digital I/O                 | General purpose I/O<br>Trace port output                       |
| P0.17                       | Digital I/O                 | General purpose I/O  |
| P0.18<br>TRACEDATA[0] / SWO | Digital I/O                 | General purpose I/O<br>Single wire output<br>Trace port output |
| P0.19                       | Digital I/O                 | General purpose I/O  |
| P0.20<br>TRACECLK           | Digital I/O                 | General purpose I/O<br>Trace port clock output                 |
| P0.21<br>nRESET             | Digital I/O                 | General purpose I/O<br>Configurable as pin reset               |
| P0.22                       | Digital I/O                 | General purpose I/O  |
| P0.23                       | Digital I/O                 | General purpose I/O  |
| P0.24                       | Digital I/O                 | General purpose I/O  |
| P0.25                       | Digital I/O                 | General purpose I/O  |
| P0.26                       | Digital I/O                 | General purpose I/O  |
| P0.27                       | Digital I/O                 | General purpose I/O  |
| P0.28<br>AIN4               | Digital I/O<br>Analog input | General purpose I/O<br>SAADC/COMP/LPCOMP input                 |
| GND                         | Ground                      |  |

|       |               |   |
|-------|---------------|---|
| P0.29 | Digital I/O   | General purpose I/O                                     |
| AIN5  | Analog input  | SAADC/COMP/LPCOMP input                                 |
| P0.30 | Digital I/O   | General purpose I/O                                     |
| AIN6  | Analog input  | SAADC/COMP/LPCOMP input                                 |
| P0.30 | Digital I/O   | General purpose I/O                                     |
| AIN7  | Analog input  | SAADC/COMP/LPCOMP input                                 |
| SWCLK | Digital input | Serial wire debug clock input for debug and programming |
| SWDIO | Digital I/O   | Serial wire debug I/O for debug and programming         |
| DCC   | Power         | DC/DC regulator output                                  |
| VCC   | Power         |   |

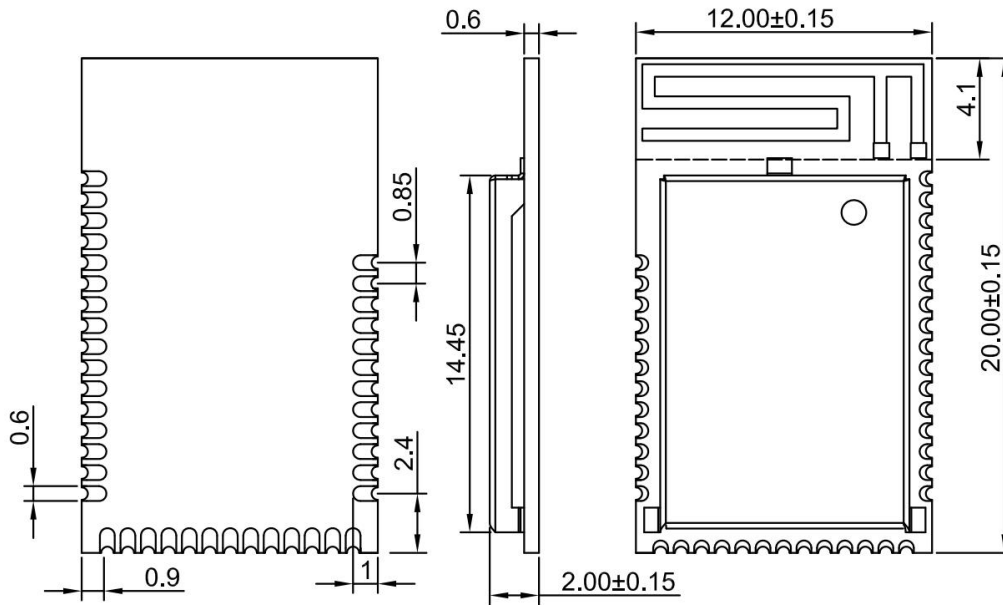
## 2.3 Block diagram



## 2.4 Mechanical drawing

### 2.4.1 MS50SFB/PCB antenna

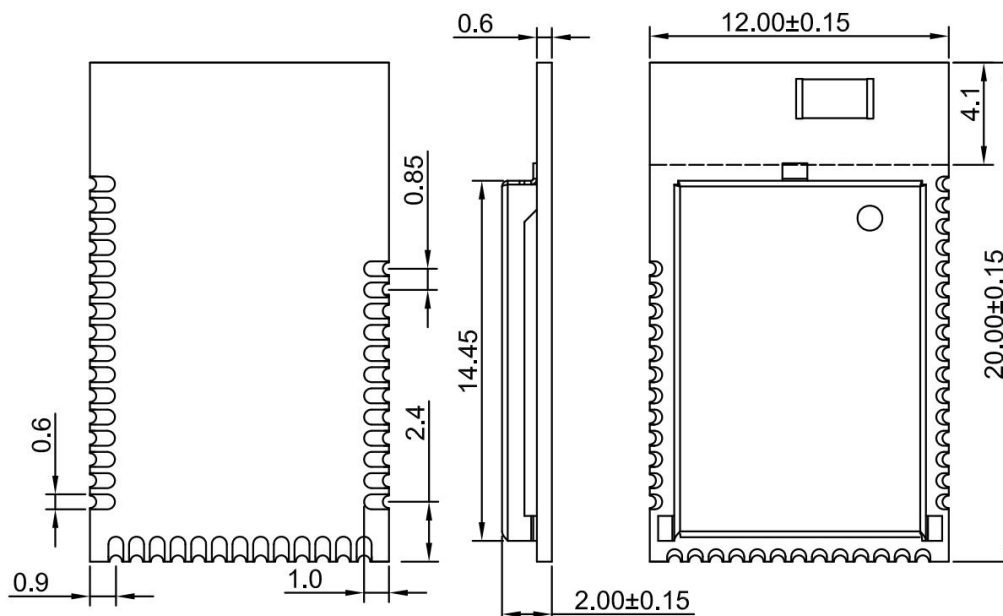




Unit: mm

Tolerance: +/- 0.1, default

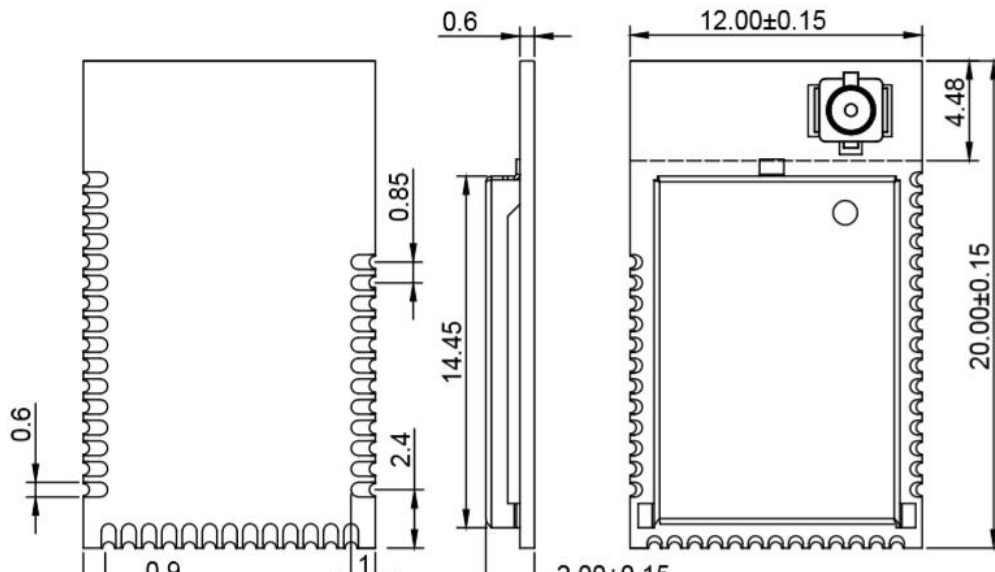
### 2.4.2 MS50SFB/Ceramic chip antenna



Unit: mm

Tolerance: +/- 0.1, default

### 2.4.3 MS50SFB/u.FL/IPEX connector



## 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 |
|-----------------------------------|------|-----------------------|------|
| <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    |

|  |      |      |     |
|--|------|------|-----|
| $V_{I/O}$ , $V_{DD} > 3.6\text{ V}$        | -0.3 | 3.9V | V   |
| 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 HBM Class                              |      | 3A   |     |
| ESD CDM                                    |      | 1    | KV  |

**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     |      | $\pm 170$ |      | 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   |
| $fsk_{SPS}$       | 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) 1Mbps / 1Mbps BLE  |      | 4.6  |      | mA    |
| $I_{RX,1M}$            | RX only run current 1Mbps / 1Mbps BLE             |      | 10.0 |      | mA    |
| $I_{RX,2M,DCDC}$       | RX only run current (DCDC, 3V) 2Mbps / 2Mbps BLE  |      | 5.2  |      | mA    |
| $I_{RX,2M}$            | RX only run current 2Mbps / 2Mbps BLE             |      | 11.2 |      | mA    |
| $I_{START,RX,1M,DCDC}$ | RX start-up current (DCDC 3V) 1 Mbps / 1 Mbps BLE |      | 3.5  |      | mA    |
| $I_{START,RX,1M}$      | RX start-up current 1 Mbps / 1 Mbps BLE           |      | 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  |      |      | $\pm 4$ | 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   |

### 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 mode <sup>14</sup>                                   |      | -93  |      | dBm   |
| $P_{SENS,IT,SP,1M,BLE}$ | Sensitivity, 1Msps BLE ideal transmitter, <=37 bytes BER=1E-3 <sup>15</sup> |      | -96  |      | dBm   |
| $P_{SENS,IT,LP,1M,BLE}$ | Sensitivity, 1Msps BLE ideal transmitter >=128 bytes BER=1E-4 <sup>16</sup> |      | -95  |      | dBm   |
| $P_{SENS,IT,2M}$        | Sensitivity, 2 Mbps nRF mode <sup>17</sup>                                  |      | -89  |      | dBm   |
| $P_{SENS,IT,SP,2M,BLE}$ | Sensitivity, 2 Mbps BLE ideal transmitter, Packet length <=37bytes          |      | -93  |      | 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

| Symbol                  | Description  | Min. | Typ. | Max. | Units |
|-------------------------|--|------|------|------|-------|
| $P_{SENS,IT,LP,1M,BLE}$ | Sensitivity, 1Msps BLE ideal transmitter >=128 bytes BER=1E-4 <sup>3</sup>             |      | -95  |      | dBm   |
| $P_{SENS,IT,2M}$        | Sensitivity, 2Msps nRF mode <sup>4</sup>   |      | -89  |      | dBm   |
| $P_{SENS,IT,SP,2M,BLE}$ | Sensitivity, 2Msps BLE ideal transmitter, Packet length<=37bytes                       |      | -93  |      | dBm   |
| $P_{SENS,DT,SP,2M,BLE}$ | Sensitivity, 2Msps BLE dirty transmitter, Packet length<=37bytes<br>(proprietary mode) |      | -93  |      | dBm   |
| $P_{SENS,IT,LP,2M,BLE}$ | Sensitivity, 2Msps BLE ideal transmitter >= 128bytes                                   |      | -92  |      | dBm   |
| $P_{SENS,DT,LP,2M,BLE}$ | Sensitivity, 2Msps BLE dirty transmitter, Packet length >= 128bytes                    |      | -92  |      | dBm   |

<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 |
|---------------------------|--|------|------|------|-------|
| $C/I_{1M,co-channel}$     | 1Msps mode, Co-Channel interference                      |      | 9    |      | dBm   |
| $C/I_{1M,-1MHz}$          | 1 Msps mode, Adjacent (-1 MHz) interference              |      | -2   |      | dBm   |
| $C/I_{1M,+1MHz}$          | 1 Msps mode, Adjacent (+1 MHz) interference              |      | -10  |      | dBm   |
| $C/I_{1M,-2MHz}$          | 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    |
| $C/I_{1M BLE,+1MHz}$      | 1Msps BLE mode, Adjacent (+1 MHz) interference           |      | -9   |      | dB    |
| $C/I_{1M BLE,-2MHz}$      | 1Msps BLE mode, Adjacent (-2 MHz) interference           |      | -22  |      | dB    |
| $C/I_{1M BLE,+2MHz}$      | 1Msps BLE mode, Adjacent (+2 MHz) interference           |      | -46  |      | dB    |
| $C/I_{1M BLE,>3MHz}$      | 1Msps 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    |
| $C/I_{2M,co-channel}$     | 2Msps mode, Co-Channel interference                      |      | 10   |      | dB    |
| $C/I_{2M,-2MHz}$          | 2 Msps mode, Adjacent (-2 MHz) interference              |      | 6    |      | dB    |
| $C/I_{2M,+2MHz}$          | 2 Msps mode, Adjacent (+2 MHz) interference              |      | -14  |      | dB    |
| $C/I_{2M,-4MHz}$          | 2 Msps mode, Adjacent (-4 MHz) interference              |      | -20  |      | dB    |
| $C/I_{2M,+4MHz}$          | 2 Msps mode, Adjacent (+4 MHz) interference              |      | -44  |      | dB    |
| $C/I_{2M,-6MHz}$          | 2 Msps mode, Adjacent (-6 MHz) interference              |      | -42  |      | dB    |
| $C/I_{2M,+6MHz}$          | 2 Msps mode, Adjacent (+6 MHz) interference              |      | -47  |      | dB    |
| $C/I_{2M,\geq 12MHz}$     | 2 Msps mode, Adjacent ( $\geq 12$ MHz) interference      |      | -52  |      | dB    |

### 3.3.7 RX intermodulation

| Symbol   | Description  | Min. | Typ. | Max. | Units |
|--|--|------|------|------|-------|
| $P_{\text{IMD},5\text{TH},1\text{M}}$            | IMD performance, 1 Msps, 5th offset channel, Packet length $\leq$ 37 bytes     |      | -33  |      | dBm   |
| $P_{\text{IMD},5\text{TH},1\text{M},\text{BLE}}$ | IMD performance, BLE 1 Msps, 5th offset channel, Packetlength $\leq$ 37 bytes  |      | -30  |      | dBm   |
| $P_{\text{IMD},5\text{TH},2\text{M}}$            | IMD performance, 2 Msps, 5th offset channel, Packet length $\leq$ 37 bytes     |      | -33  |      | dBm   |
| $P_{\text{IMD},5\text{TH},2\text{M},\text{BLE}}$ | IMD performance, BLE 2 Msps, 5th offset channel, Packet length $\leq$ 37 bytes |      | -31  |      | dBm   |

### 3.3.8 Radio timing

| Symbol                           | Description   | Min. | Typ. | Max. | Units |
|----------------------------------|---|------|------|------|-------|
| $t_{\text{TXEN}}$                | Time between TXEN task and READY event after channel FREQUENCY configured. Compatible with old devices. | 140  |      | 140  | us    |
| $t_{\text{TXEN,FAST}}$           | Time between TXEN task and READY event after channel FREQUENCY configured (Fast Mode)                   | 40   |      | 40   | us    |
| $t_{\text{TXDISABLE},1\text{M}}$ | Time between DISABLE task and DISABLED event when the radio was in TX and mode is set to 1Mbit          | 6    |      | 6    | us    |
| $t_{\text{TXDISABLE},2\text{M}}$ | Time between DISABLE task and DISABLED event when the radio was in TX and mode is set to 2Mbps          | 4    |      | 4    | us    |
| $t_{\text{RXEN}}$                | Time between the RXEN task and READY event after channel FREQUENCY configured in default mode           | 140  |      | 140  | us    |
| $t_{\text{RXEN,FAST}}$           | Time between the RXEN task and READY event after channel FREQUENCY configured in fast mode              | 40   |      | 40   | us    |
| $t_{\text{SWITCH}}$              | The minimum time taken to switch from RX to TX or TX to RX (channel FREQUENCY unchanged)                |      | 20   |      | us    |

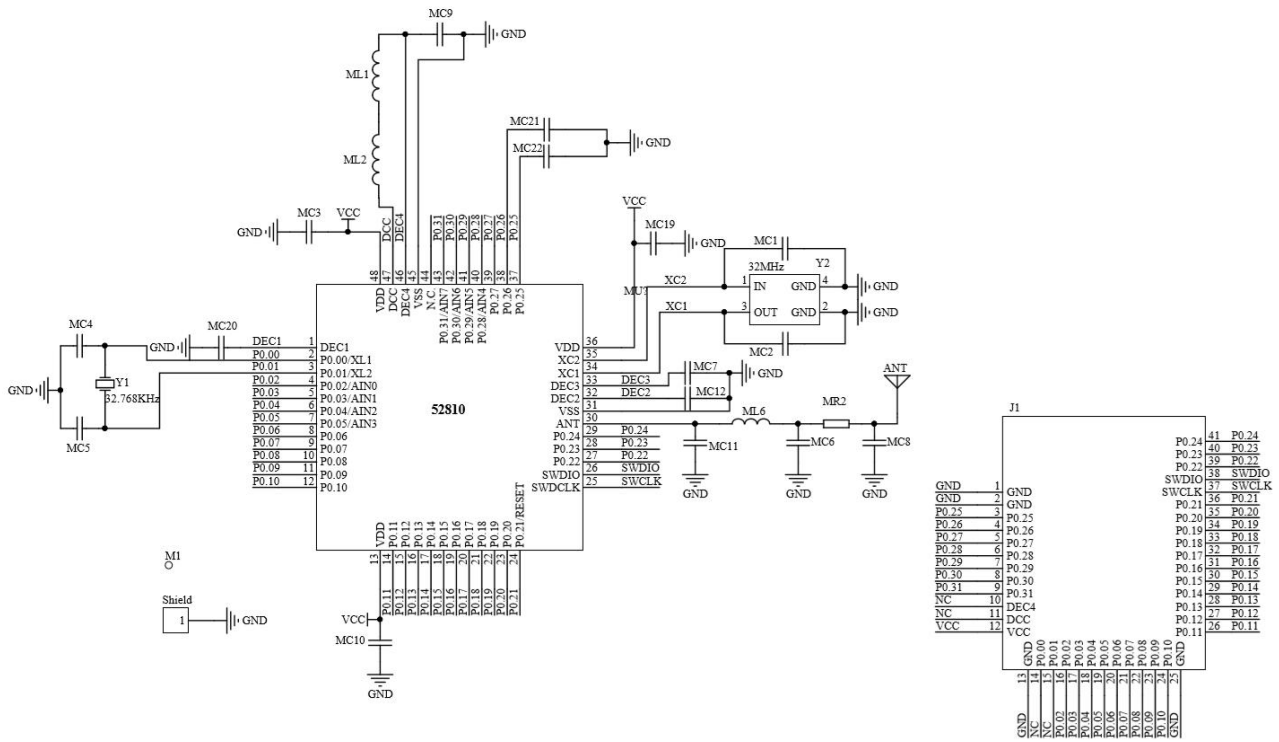


|                  |   |   |     |   |    |
|------------------|---|---|-----|---|----|
| $t_{RXDISABLE}$  | Time between DISABLE task and DISABLED event when the radio was in RX | 0 |     | 0 | us |
| $t_{TXCHAIN}$    | TX chain delay  |   | 0.6 |   | us |
| $t_{RXCHAIN}$    | RX chain delay  |   | 9.4 |   | us |
| $t_{RXCHAIN,2M}$ | RX chain delay in 2Msps mode  |   | 5   |   | us |

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

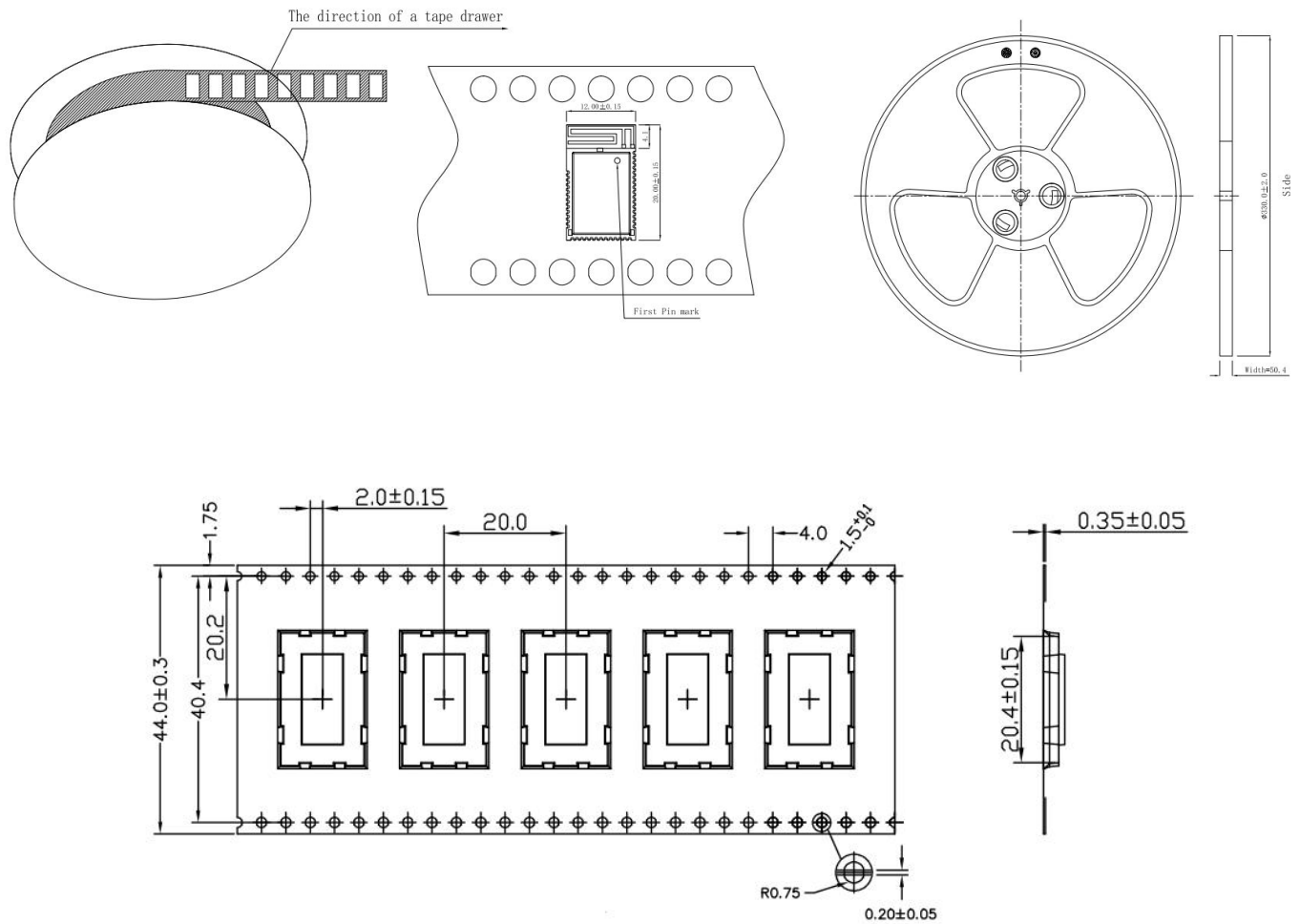
| Symbol              | Description                              | Min. | Typ.    | Max. | Units |
|---------------------|--|------|---------|------|-------|
| $RSSI_{ACC}$        | RSSI Accuracy Valid range -90 to -20 dBm |      | $\pm 2$ |      | dB    |
| $RSSI_{RESOLUTION}$ | RSSI resolution    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

## 4. Electrical schematic



## 5. Package information

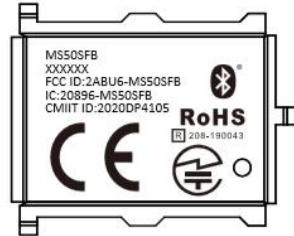
### 5.1 Package dimension



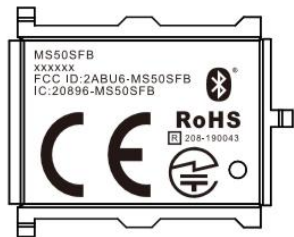
| Details              | Reel-MS50SFB1     | Reel-MS50SFB2 | Reel-MS50SFB3 |
|----------------------|-------------------|---------------|---------------|
| Quantity(module)     | 850PCS            | 850PCS        | 850PCS        |
| Tape Weight          | 515g              | 515g          | 515g          |
| Single module Weight | 0.68g             | 0.7g          | 0.72g         |
| Gross Weight         | 1120g             | 1130g         | 1150g         |
| Dimension            | W: 44mm T: 0.35mm |               |               |

## 5.2 Mark on metal shield

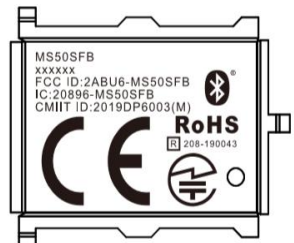
### 5.2.1 MS50SFB1



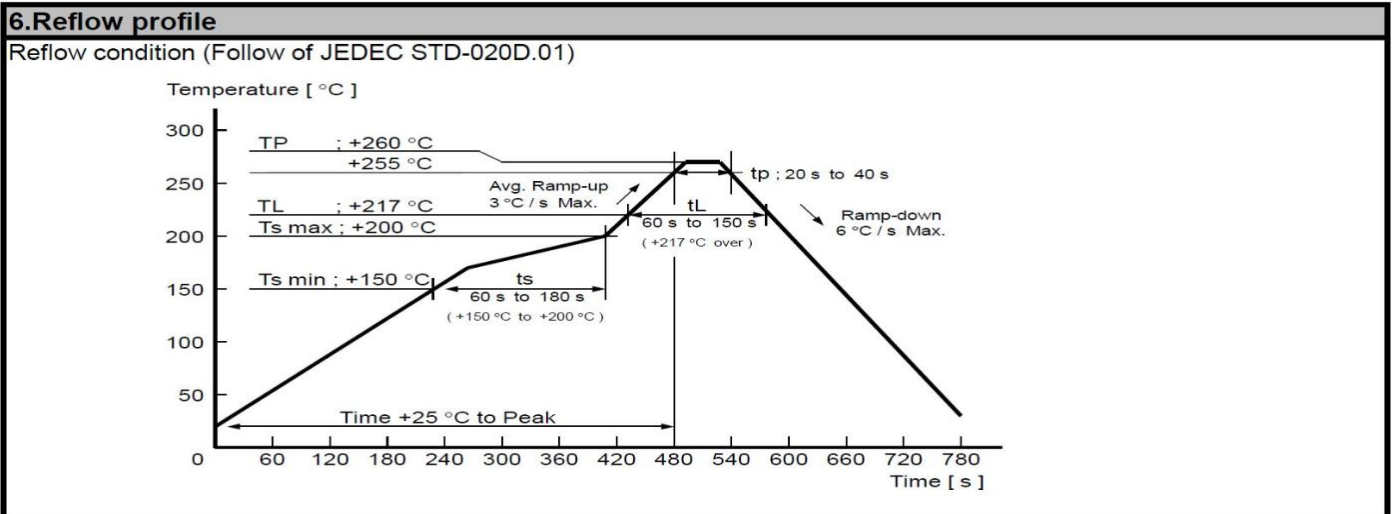
### 5.2.1 MS50SFB2



### 5.2.1 MS50SFB3



## 6. Reflow and soldering



| Profile Feature                      | Sn-Pb Assembly | Pb-Free Assembly |
|--------------------------------------|----------------|------------------|
| Solder Paste                         | Sn63/Pb37      | Sn96.5/Ag3/Cu0.5 |
| Preheat Temperature min (Tsmín)      | 100°C          | 150°C            |
| Preheat Temperature max (Tsmáx)      | 150°C          | 200°C            |
| Preheat Time (Tsmín to Tsmáx)(ts)    | 60-120 sec     | 60-120 sec       |
| Average ramp-up rate (Tsmáx 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 Tsmáx) | 6°C/second max | 6°C/second max   |
| Time 25°C to peak temperature        | 6 minutes max  | 8 minutes max    |

## 7. Certification

### 7.1 Full Bluetooth Declaration ID

Please kindly check the DID number for MS50SFB: D039669.

Minew technologies meet the bluetooth specification maintained by Bluetooth SIG, and all the product produced by Minew is properly tested and comply with the Bluetooth license agreements.

Minew is one of the associate member of Bluetooth SIG. The requirement of listing products by companies is become the members of the SIG and also pay the listed fees for each product required.

Please Kindly check the below Link to know more info:

<https://www.bluetooth.com/develop-with-bluetooth/qualification-listing>.

The Minew Bluetooth Low Energy modules based on Nordic Semiconductor SoCs are listed as a “End product”.

## 7.2 Europe (CE)

MS50SFB 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.

## 7.3 United States (FCC)

**Please kindly check the FCC ID for MS50SFB: 2ABU6-MS50SFB.**

MS50SFB 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.

## 7.4 Canada (IC)

**Please kindly check the IC ID for MS50SFB: 20896-MS50SFB.**

Minew's modules have been certified for use in Canada under Industry Canada (IC) Radio Standards Specification (RSS) RSS-210 and RSSGen. Modular approval permits the installation of a module in a host device without the need to rectify the device.

As for the labeling & user Information Requirements, MS50SFB is assigned the IC ID number: 20896-MS50SFB

Labeling Requirements for the Host Device (from Section 3.2.1, RSS-Gen, Issue 3, December 2010): The host device shall be properly labeled to identify the module within the host device.

User Manual Notice for License-Exempt Radio Apparatus (from Section 7.1.3 RSS-Gen, Issue 3, December 2010): User manuals for license-exempt radio apparatus shall contain the following or equivalent notice in a conspicuous location in the user manual or alternatively on the device or both:

This device complies with Industry Canada license exempt RSS standard(s).

Operation is subject to the following two conditions:

- (1) this device may not cause interference,
- and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Transmitter Antenna (from Section 7.1.2 RSS-Gen, Issue 3, December 2010): User manuals for transmitters shall display the following notice in a conspicuous location:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

## 7.5 Japan (TELEC)

**Please kindly check the TELEC ID for MS50SFB: 208-190043.**

The MS50SFB is approved for use in the Japanese market.

## 7.6 Australia / New Zealand (RCM)

The MS50SFB has been tested to comply with the AS/NZS 4268:2017, Radio equipment and systems –Short range devices – Limits and methods of measurement. It may be used as evidence in obtaining permission to use the Regulatory Compliance Mark (RCM).

Information on registration as a Responsible Party, license and labeling requirements may be found at the following websites:

Australia: <http://www.acma.gov.au/theACMA/radiocommunications-short-range-devices-standard-2004>.

New Zealand: <http://www.rsm.govt.nz/compliance>.

Only Australian-based and New Zealand-based companies who are registered may be granted permission to use the RCM. An Australian-based or New Zealand-based agent or importer may also register as a Responsible Party to use the RCM on behalf of a company not in Australia or New Zealand.

## 7.7 India (WPC)

The MS50SFB has been tested to comply with the wireless planning & coordination (WPC) Wing of the Ministry of

Communications standard. WPC created in 1952, is the National Radio Regulatory Authority responsible for Frequency Spectrum Management, including licensing and caters for the needs of all wireless users (Government and Private) in the country.

It exercises the statutory functions of the Central Government and issues licenses to establish, maintain and operate wireless stations. WPC is divided into major sections like Licensing and Regulation (LR), New Technology Group (NTG) and Standing Advisory Committee on Radio Frequency Allocation (SACFA). SACFA makes the recommendations on major frequency allocation issues, formulation of the frequency allocation plan, making recommendations on the various issues related to International Telecom Union (ITU), to sort out problems referred to the committee by various wireless users, Siting clearance of all wireless installations in the country etc.

## 7.8 Environmental

### 7.8.1 RoHS

MS50SFB 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.

### 7.8.2 Reach

MS50SFB modules listed below do not contain the 191 SVHC (Substance of Very High Concern), as defined by Directive EC/1907/2006 Article according to REACH Annex XVII.

## 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

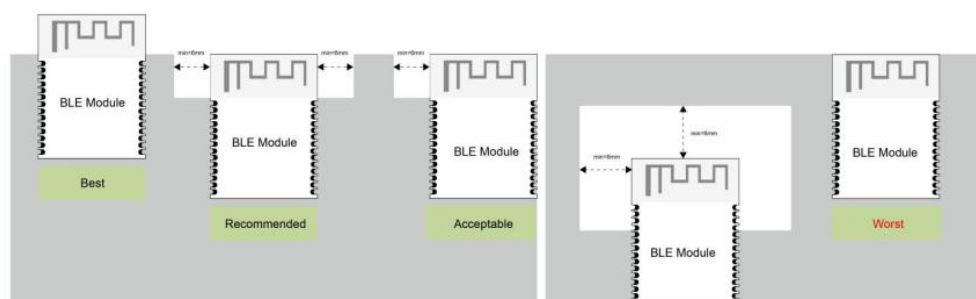
The antenna area of module shall lay clearance completely and should not be blocked by the metal. Otherwise it will have effect on antenna performance (As the picture indicated below).

### (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 OAHS18000 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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