Powerful nRF52833 Module MS88SF2 Specification

MS88SF2 is advanced, compact (23.2mm × 17.4mm × 2mm), highly flexible, ultra-low power wireless BLE 5.0 Module based on nRF52833 SoCs. Its powerful 32-bit ARM Cortex-M4 CPU, a 512KB flash memory, a 128KB RAM and integrating a 2.4 GHz transceiver offers the perfect solution for Bluetooth connectivity.

Features

ARM®Cortex®-M4 32-bit processor with FPU, 64 MHz

Complete RF solution with integrated antenna

BLE 5.1 data rate: 2Mbps, 1Mbps, 500kbps,125kbps.

IEEE 802.15.4 Thread and Zigbee data rate: 250kbps

Proprietary 2.4 GHz: 2 Mbps, 1 Mbps

Integrated DC-DC converter, inductors on board.

4.9 mA peak current in TX(0 dBm)

4.6 mA peak current in RX

15 level low-comparator with wake-up from System OFF mode

Over-the-Air(OTA) firmware update

Flash/RAM: 512KB/128KB

GPIO:20

2×UART/4×SPI masters/3×SPI slaves

Operating temperature: -40℃ to +105℃

SoC TX power: programmable +8dBm to -20dBm

SoC Receiver Sensitivity： -96 dBm at 1Mbps

Temperature sensor

Antenna: PCB trace,IPEX/U.FL

Module size: 23.2mm×17.4mm×2mm

Range:

1Mbps: up to 250 meters in open space.

2Mbps: up to 120 meters in open space

Applications

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：D043974

FCC ID: 2ABU6-MS88SF2

TELEC: 208-190045

IC:20896-MS88SF2

CE,RCM,WPC,RoHS & Reach certified

Revision history

Version	Date	Notes	Contributor（s）	Person of Approve
1.0	2020.04.23	New release-- nRF52833 MS88SF2	Eddie	Coral

<div align="center">Index</div>

1. Product introduction

MS88SF2 series are advanced, compact (23.2mm × 17.4mm × 2mm), highly flexible, ultra-low power wireless BLE 5.1 Module based on nRF52833 SoCs. Its powerful 32-bit ARM Cortex-M4 CPU with FPU, 64 MHz, a 512KB Flash memory, a 128KB Ram and integrating a 2.4 GHz transceiver can offers the perfect solution for Bluetooth connectivity.

Fully qualified BLE stacks for nRF52833 are implemented in the S140 SoftDevices which can be freely downloaded. In the meantime, ANT, ZIGBEE and THREAD applications can be supported by nRF52833 with extensive software.

MS88SF2 can meet the most demanding applications, it allow faster time to market with high performance, low power management and reduced development cost. Also, its range is estimated up to 250 meters in open space for 1Mbps data rate; up to 120 meters in open space for 2 Mbps data rate.

1.1 Ordering information

Ordering number	Description
MS88SF21	nRF52833-QIAA BT 5.1 Module, PCB Antenna, reel pack
MS88SF23	nRF52833-QIAA BT 5.1 Module, u.FL connector for external Antenna, reel pack

2. Pin description

2.1 Pin assignment

2.1.1 MS88SF2/PCB Antenna

GND	1		28	PO.10	
P1.05	2		27	PO.09	
PO.19	3		26	SWCLK	
PO.02	4		25	SWDIO	
PO.29	5		24	P1.00	
PO.31	6		23	PO.24	
PO.26	7		22	PO.22	
PO.04	8		21	PO.20	
PO.06	9		20	PO.18	
PO.08	10		19	PO.15	
P1.09	11		18	PO.13	
PO.12	12		17	D+	
GND	13		16	D-	
VDD	14		15	VDDH	

2.1.1 MS88SF2/U.FL Antenna

GND	1		28	PO.10	
P1.05	2		27	PO.09	
PO.19	3		26	SWCLK	
PO.02	4		25	SWDIO	
PO.29	5		24	P1.00	
PO.31	6		23	PO.24	
PO.26	7		22	PO.22	
PO.04	8		21	PO.20	
PO.06	9		20	PO.18	
PO.08	10		19	PO.15	
P1.09	11		18	PO.13	
PO.12	12		17	D+	
GND	13		16	D-	
VDD	14		15	VDDH	
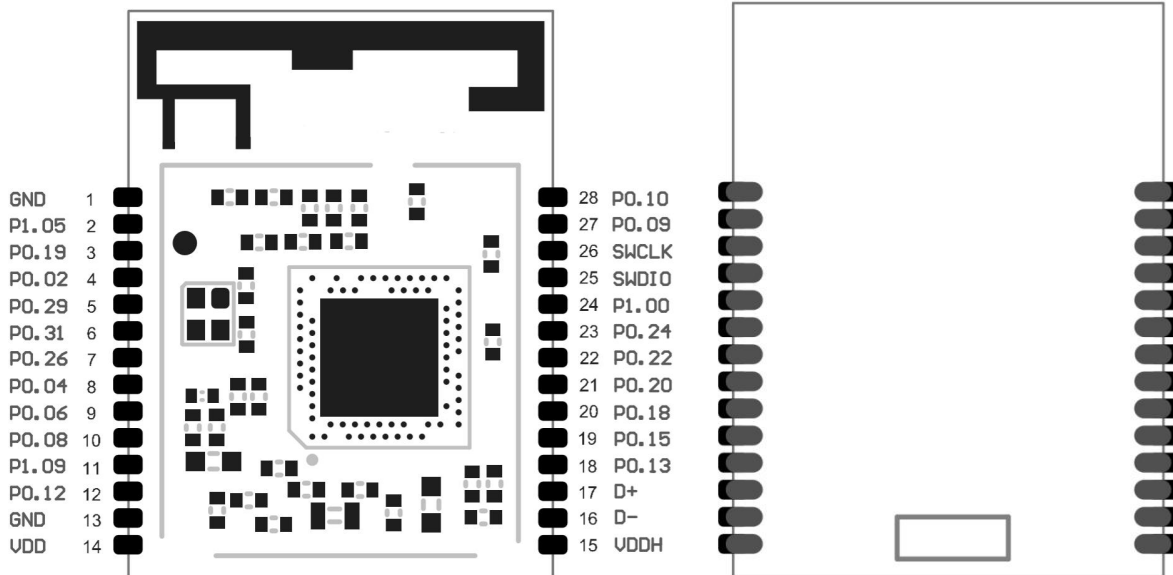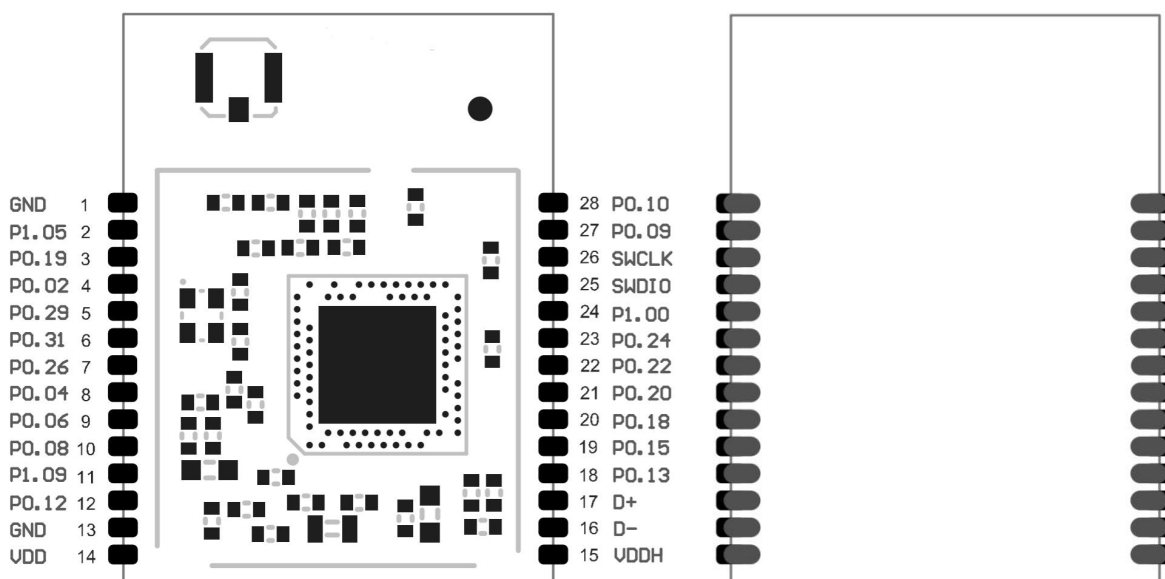
2.2 Pin definition

Symbol	Type	Description
VDD	Power	Power supply
VDDH	Power	Power supply，2.5V-5.5V
GND	Power	Ground
SWDIO	Digital I/O	Hardware debug and flash/programming I/O/programming I/O.
SWCLK	Digital input（debug）	Hardware debug and flash programming I/O
P 0.29	Digital I/O	General purpose I/O
AIN5	Analog input	Analog input
P 0.02	Digital I/O	General purpose I/O
AIN0	Analog input	Analog input
P 1.15	Digital I/O	General purpose I/O
P1.13	Digital I/O	General purpose I/O
P 0.31	Digital I/O	General purpose I/O
AIN7	Analog input	Analog input
P 0.04	Digital I/O	General purpose I/O
AIN2	Analog input	Analog input
P 1.09	Digital I/O	General purpose I/O
TRACEDATA33	Trace data	Trace buffer TRACEDATA[3]
P 0.12	Digital I/O	General purpose I/O
TRACEDATA1	Trace data	Trace buffer TRACEDATA[1]
P 0.10	Digital I/O	General purpose I/O
NFC2	NFC input	NFC antenna connection
P 0.09	Digital I/O	General purpose I/O
NFC1	NFC input	NFC antenna connection
P 1.00	Digital I/O	General purpose I/O
TRACEDATA0	Trace data	Trace buffer TRACEDATA[0]
P 0.18	Digital I/O	General purpose I/O
nRESET		Configurable as system RESET
P 0.26	Digital I/O	General purpose I/O
P 0.06	Digital I/O	General purpose I/O
P 0.08	Digital I/O	General purpose I/O
P 0.24	Digital I/O	General purpose I/O
P 0.22	Digital I/O	General purpose I/O
P 0.20	Digital I/O	General purpose I/O
P 0.15	Digital I/O	General purpose I/O
P 0.13	Digital I/O	General purpose I/O
D+	Digital I/O	USB D+
D-	Digital I/O	USB D-

2.3 Block diagram

2.3.1 MS88SF2/PCB Antenna

Block diagram
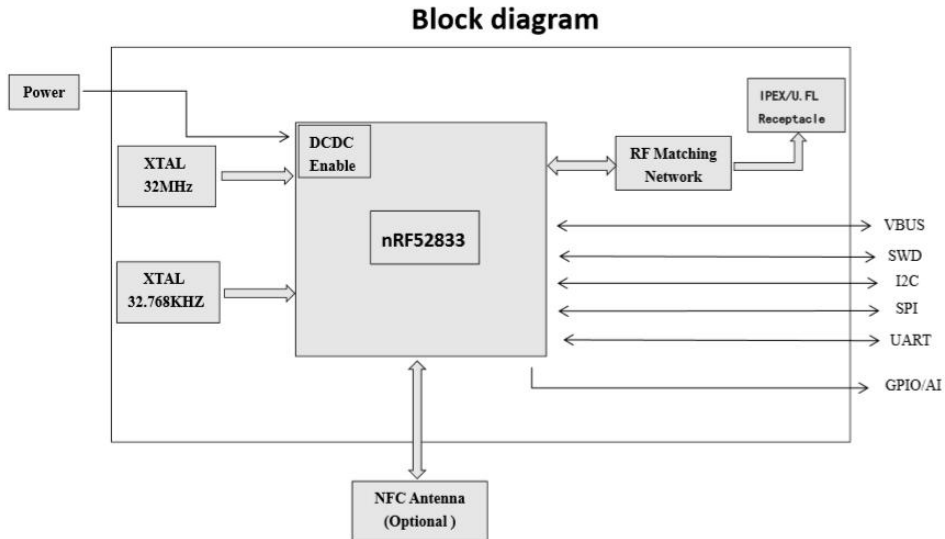
2.4 Mechanical drawing

2.4.1 MS88SF2/PCB Antenna
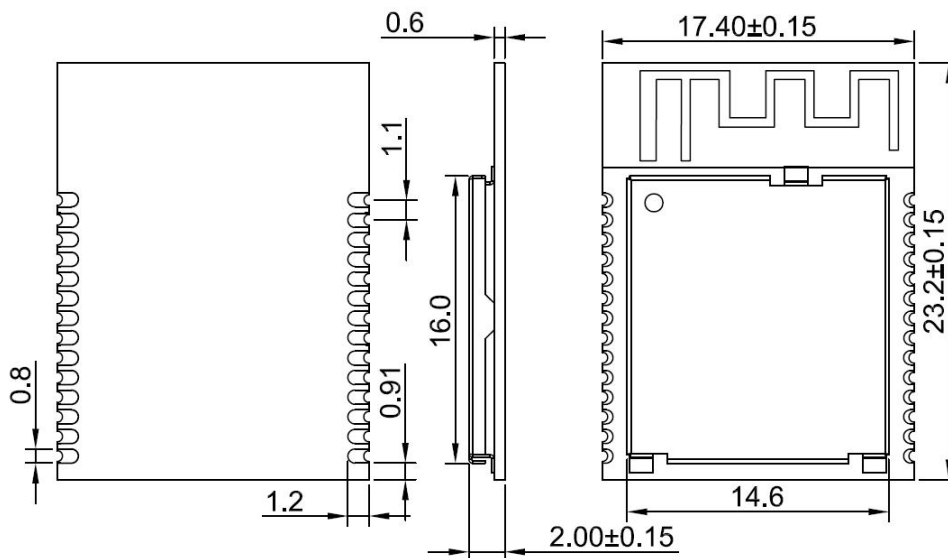
2.4.2 MS88SF2/U.FL Antenna
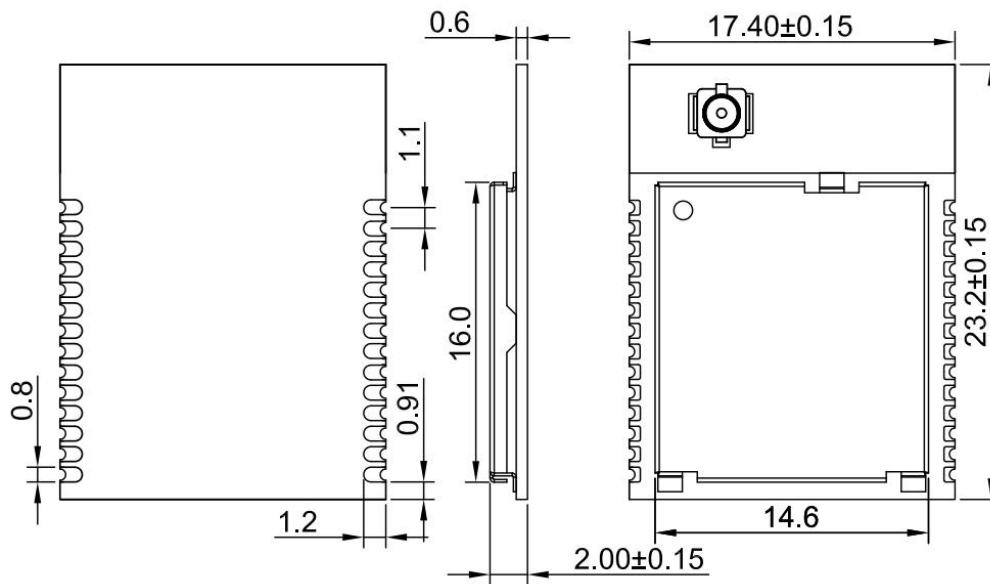
Unit: mm

Tolerance: +/- 0.1, default

3. Electrical specification

The electrical specifications of the module are directly related to the Nordic semiconductor Specifications for the nRF52833 chipset. The below information is only the extract from nRF52833 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

	Note	Min.	Max	Unit
Supply voltages				
VDD		-0.3	+3.9	V
VDDH		-0.3	+5.8	V
VBUS		-0.3	+5.8	V
VSS			0	V
I/O Pin voltage				
$V_{I/0}$,VDD<=3.6V		-0.3	VDD + 0.3V	V
$V_{I/0}$,VDD>3.6V		-0.3	3.9V	V

NFC antenna pin current				
I_{NFC1/2}			80	mA
Environmental (AQFN package)				
Storage temperature		-40	+125	°C
MSL	Moisture Sensitivity Level		2	
ESD HBM	Human Body Model		4	kV
ESD HBM Class	Human Body Model Class		3A	
ESD CDM	Charged Device Model		750	V
Flash Memory				
Endurance			10 000	write/erase cycles
Retention at 85 °C			10	years
Retention at 105 °C	Limited to 1000 write/erase cycles		3	years
Retention at 105 °C-85 °C, execution split	Limited to 1000 write/erase cycles		6.7	years

Notes：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

Symbol	Parameter	Min.	Nom.	Max.	Units
VDD	VDD supply voltage, independent of DCDC enable	1.7	3.0	3.6	V
VDD_{POR}	VDD supply voltage needed during power-on reset	1.75			V
VDDH	VDDH supply voltage,independent of DCDC enable	2.5	3.7	5.5	V
VBUS	VBUS USB supply voltage	4.35	5	5.5	V
t_{R_VDD}	Supply rise time (0 V to 1.7 V)			60	ms
t_{R_VDDH}	Supply rise time (0 V to 3.7 V)			100	ms
TA	Operating temperature	-40	25	85	°C
TA_{EXT}	Extended operating temperature	85		105	°C
T_J	Junction temperature			110	°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.	Nom.	Max.	Units
f_{OP}	Operating frequencies	2360		2500	MHz
$f_{PLL,CH,SP}$	PLL channel spacing		1		MHz
$f_{DELTA,1M}$	Frequency deviation@1 Mbps		±170		kHz
$f_{DELTA,BLE,1M}$	Frequency deviation @ BLE 1Mbps		±250		kHz
$f_{DELTA,2M}$	Frequency deviation @ 2Mbps		±320		kHz
$f_{DELTA,BLE,2M}$	Frequency deviation@ BLE 2Mbps		±500		kHz
fsk_{BPS}	On-the-air data rate	125		2000	kbps
$f_{chip,IEEE\ 802.15.4}$	Chip rate in IEEE 802.15.4 mode		2000		kchipAs

3.3.2 Radio current consumption (Transmitter)

Symbol	Description	Min.	Typ.	Max.	Units
I $_{TX,PLUS8dBM,DCDC}$	TX only run current(DCDC,3V)P_{RF}=+ 8 dBm		14.2		mA
I $_{TX,PLUS8dBM}$	TX only run current P_{RF} =+ 8 dBm		30.4		mA
I $_{TX,PLUS4dBM,DCDC}$	TX only run current(DCDC,3V)P_{RF} =+ 4 dBm		9.6		mA
I $_{TX,PLUS4dBM}$	TX only run current P_{RF} =+ 4 dBm		20.7		mA
I $_{TX,0dBM,DCDC}$	TX only run current (DC/DC, 3 V)PRF =0 dBm		4.9		mA
I $_{TX,0dBM}$	TX only run current P_{RF} = 0 dBm		10.3		mA
I $_{TX,MINUS4dBM,DCDC}$	TX only run current DCDC,3V P_{RF} =-4 dBm		3.8		mA
I $_{TX,MINUS4dBM}$	TX only run current P_{RF} =-4 dBm		8.0		mA
I $_{TX,MINUS8dBM,DCDC}$	TX only run current DCDC,3V P_{RF} =-8 dBm		3.4		mA
I $_{TX,MINUS8dBM}$	TX only run current P_{RF} =-8 dBm		7.1		mA
I $_{TX,MINUS12dBM,DCDC}$	TX only run current DCDC,3V P_{RF} =-12 dBm		3.1		mA
I $_{TX,MINUS12dBM}$	TX only run current P_{RF} =-12 dBm		6.4		mA
I $_{TX,MINUS16dBM,DCDC}$	TX only run current DCDC,3V P_{RF} =-16 dBm		2.9		mA
I $_{TX,MINUS16dBM}$	TX only run current P_{RF} =-16 dBm		5.9		mA
I $_{TX,MINUS20dBM,DCDC}$	TX only run current DCDC,3V P_{RF} =-20 dBm		2.7		mA

I $_{TX,MINUS20dBM}$	TX only run current P_{RF} =-20 dBm		5.5		mA
I $_{TX,MINUS40dBM,DCDC}$	TX only run current DCDC,3V P_{RF} =-40 dBm		2.3		mA
I $_{TX,MINUS40dBM,}$	TX only run current P_{RF} =-40 dBm		4.5		mA
I $_{START,TX,DCDC}$	TX start-up current DCDC,3V P_{RF} =4 dBm		4.3		mA
I $_{START,TX}$	TX start-up current P_{RF} =4 dBm		8.9		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(LDO,3V)1Mbps/1Mbps BLE		9.6		mA
I $_{RX,2M,DCDC}$	RX only run current(DCDC,3V)2Mbps/2Mbps BLE		5.2		mA
I $_{RX,2M,}$	RX only run current(LDO,3V)2Mbps/2Mbps BLE		10.7		mA
I $_{START,RX,1M,DCDC}$	RX start-up current(DCDC,3V)1Mbps/1Mbps BLE		3.4		mA
I $_{START,RX,1M}$	RX start-up current 1Mbps/1Mbps BLE		6.8		mA

3.3.4 Transmitter specification

Symbol	Description	Min	Typ.	Max.	Units
P_{RF}	Maximum output power		8		dBm
P_{RFC}	RF power control range		28		dB
P_{RFCR}	RF power accuracy			±4	dB
$P_{RF1,1}$	1st adjacent channel transmit power 1 MHz(1 Mbps)		-25		dBc
$P_{RF2,1}$	2nd adjacent channel transmit power 2 MHz(1 Mbps)		-54		dBc
$P_{RF1,2}$	1st adjacent channel transmit power 2 MHz(2 Mbps)		-26		dBc
$P_{RF2,2}$	2nd adjacent channel transmit power 4 MHz(2 Mbps)		-54		dBc
E_{vm}	Error Vector Magnitude IEEE 802.15.4		9		%rms
$P_{harm2nd,IEEE\ 802.15.4}$	2nd Harmonics in IEEE 802.15.4 mode		-51		dBm
$P_{harm3rd,IEEE\ 802.15.4}$	3rd Harmonics in IEEE 802.15.4		-51		dBm

3.3.5 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[16]		-93	dBm
$P_{SENS,IT,2M}$	Sensitivity, 2Mbps nRF mode[17]		-89	dBm
$P_{SENS,IT,SP,1M,BLE}$	Sensitivity,1 Mbps BLE ideal transmitter,<=37 bytes BER=1E-3[20]		-96	dBm
$P_{SENS,IT,LP,1M,BLE}$	Sensitivity,1 Mbps BLE ideal transmitter,>=128 bytes BER=1E-4[21]		-94	dBm
$P_{SENS,IT,SP,2M,BLE}$	Sensitivity, 2 Mbps BLE ideal transmitter, Packet length <=37 bytes		-92	dBm
$P_{SENS,IT,BLE}$ LE125K	Sensitivity,125kbps BLE mode		-103	dBm
$P_{SENS,IT,BLE}$ LE500K	Sensitivity, 500kbps BLE mode		-98	dBm
$P_{SENSE,IEEE}$ 802.15.4	Sensitivity in IEEE 802.15.4 mode		-100	dBm

3.3.6 RX selectivity

Symbol	Description	Min	Typ.	Max.	Units
$C/I_{1M,co-channel}$	1Mbps mode, Co-Channel interference		10		dB
$C/I_{1M,-1MHz}$	1 Mbps mode, Adjacent (-1 MHz) interference		-5		dB
$C/I_{1M,+1MHz}$	1 Mbps mode, Adjacent (+1 MHz) interference		-14		dB
$C/I_{1M,-2MHz}$	1 Mbps mode, Adjacent (-2 MHz) interference		-19		dB
$C/I_{1M,+2MHz}$	1 Mbps mode, Adjacent (+2 MHz) interference		-42		dB
$C/I_{1M,-3MHz}$	1 Mbps mode, Adjacent (-3 MHz) interference		-37		dB
$C/I_{1M,+3MHz}$	1 Mbps mode, Adjacent (+3 MHz) interference		-47		dB
$C/I_{1M,\pm6MHz}$	1 Mbps mode, Adjacent (≥6 MHz) interference		-52		dB
$C/I_{1MBLE,co-channel}$	1 Mbps BLE mode, Co-Channel interference		6		dB
$C/I_{1MBLE,-1MHz}$	1 Mbps BLE mode, Adjacent (-1 MHz) interference		-2		dB
$C/I_{1MBLE,+1MHz}$	1 Mbps BLE mode, Adjacent (+1 MHz) interference		-10		dB
$C/I_{1MBLE,-2MHz}$	1 Mbps BLE mode, Adjacent (-2 MHz) interference		-23		dB
$C/I_{1MBLE,+2MHz}$	1 Mbps BLE mode, Adjacent (+2 MHz) interference		-45		dB
$C/I_{1MBLE,>3MHz}$	1 Mbps BLE mode, Adjacent (≥3 MHz) interference		-54		dB
$C/I_{1MBLE,image}$	Image frequency Interference		-24		dB
$C/I_{1MBLE,image,1MHz}$	Adjacent (1 MHz) interference to in-band image frequency		-37		dB

$C/I_{2M,co\text{-}channel}$	2Mbps mode, Co-Channel interference		10	dB
$C/I_{2M,-2MHz}$	2 Mbps mode, Adjacent (-2 MHz) interference		-4	dB
$C/I_{2M,+2MHz}$	2 Mbps mode, Adjacent (+2 MHz) interference		-16	dB
$C/I_{2M,-4MHz}$	2 Mbps mode, Adjacent (-4 MHz) interference		-19	dB
$C/I_{2M,+4MHz}$	2 Mbps mode, Adjacent (+4 MHz) interference		-46	dB
$C/I_{2M,-6MHz}$	2 Mbps mode, Adjacent (-6 MHz) interference		-41	dB
$C/I_{2M,+6MHz}$	2 Mbps mode, Adjacent (+6 MHz) interference		-48	dB
$C/I_{2M,\geq12MHz}$	2 Mbps mode, Adjacent (≥12 MHz) interference		-52	dB
$C/I_{2MBLE,co\text{-}channel}$	2 Mbps BLE mode, Co-Channel interference		7	dB
$C/I_{2MBLE,-2MHz}$	2 Mbps BLE mode, Adjacent (-2 MHz) interference		-2	dB
$C/I_{2MBLE,+2MHz}$	2 Mbps BLE mode, Adjacent (+2 MHz) interference		-12	dB
$C/I_{2MBLE,-4MHz}$	2 Mbps BLE mode, Adjacent (-4 MHz) interference		-22	dB
$C/I_{2MBLE,+4MHz}$	2 Mbps BLE mode, Adjacent (+4 MHz) interference		-46	dB
$C/I_{2MBLE,\geq6MHz}$	2 Mbps BLE mode, Adjacent (≥6 MHz) interference		-52	dB
$C/I_{2MBLE,image}$	Image frequency interference		-22	dB
$C/I_{2MBLE,image,\ 2MHz}$	Adjacent (2 MHz) interference to in-band image frequency		-37	dB
$C/I_{125k\ BLE\ LR,\ co\text{-}channel}$	125 kbps BLE LR mode, Co-Channel interference		3	dB
$C/I_{125k\ BLE\ LR,-1MHz}$	125 kbps BLE LR mode, Adjacent (-1 MHz) interference		-9	dB
$C/I_{125k\ BLE\ LR,+1MHz}$	125 kbps BLE LR mode, Adjacent (+1 MHz) interference		-16	dB
$C/I_{125k\ BLE\ LR,-2MHz}$	125 kbps BLE LR mode, Adjacent (-2 MHz) interference		-27	dB
$C/I_{125k\ BLE\ LR,+2MHz}$	125 kbps BLE LR mode, Adjacent (+2 MHz) interference		-54	dB
$C/I_{125k\ BLE\ LR,>3MHz}$	125 kbps BLE LR mode, Adjacent (≥3 MHz) interference		-60	dB
$C/I_{125k\ BLE\ LR,image}$	Image frequency Interference		-27	dB
$C/I_{IEEE\ 802.\ 15.4,\ -5MHz}$	IEEE 802.15.4 mode, Adjacent (-5 MHz) rejection		-33	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		-49	dB

3.3.7 RX intermodulation

Symbol	Description	Min	Typ.	Max.	Units
$P_{IMD,5TH,1M}$	IMD performance, 1 Mbps, 5th offset channel, packet length $\leqq$ 37 bytes		-34		dBm
$P_{IMD,5TH,1M,BLE}$	IMD performance, BLE 1 Mbps, 5th offset channel, packet length $\leqq$ 37 bytes		-32		dBm
$P_{IMD,5TH,2M}$	IMD performance, 2 Mbps, 5th offset channel, packet length $\leqq$ 37 bytes		-33		dBm
$P_{IMD,5TH,2M,BLE}$	IMD performance, BLE 2 Mbps, 5th offset channel, packet length $\leqq$ 37 bytes		-32		dBm

3.3.8 Radio timing

| Symbol	Description	Min	Typ.	Max.	Units
$t_{TXEN,BLE,1M}$	Time between TXEN task and READY event after channel FREQUENCY configured	140		140	us
$t_{TXEN,FAST,BLE,1M}$	Time between TXEN task and READY event after channel FREQUENCY configured (Fast Mode)	40		40	us
$t_{TXDIS,BLE,1M}$	When in TX, delay between DISABLE task and DISABLED event for MODE = Nrf_1Mbit and MODE = Ble_1Mbit	6		6	us
$t_{TXDIS,BLE,1M}$	Time between the RXEN task and READY event after channel FREQUENCY configured (1 Mbps BLE)	140		140	us
$T_{rxen,FAST,BLE,1M}$	Time between the RXEN task and READY event after channel FREQUENCY configured (1 Mbps BLE with fast ramp-up)	40		40	us
$t_{RXDIS,BLE,1M}$	When in RX, delay between DISABLE task and DISABLED event for MODE = Nrf_1Mbit and MODE = Ble_1Mbit	0		0	us
$t_{TXDIS,BLE,2M}$	When in TX, delay between DISABLE task and DISABLED event for MODE = Nrf_2Mbit and MODE = Ble_2Mbit	4		4	us
$t_{RXDIS,BLE,2M}$	When in RX, delay between DISABLE task and DISABLED event for MODE = Nrf_2Mbit and MODE = Ble_2Mbit	0		0	us
$t_{TXEN,IEEE\ 802.15.4}$	Time between TXEN task and READY event after channel FREQUENCY configured (IEEE 802.15.4)	130		130	us
$t_{TXEN,FAST,IEEE\ 802.15.4}$	Time between TXEN task and READY event after channel FREQUENCY configured (IEEE 802.15.4 with fast ramp-up)	40		40	us
$t_{TXDIS,IEEE\ 802.15.4}$	When in TX, delay between DISABLE task and DISABLED event (IEEE 802.15.4)	21		21	us

$t_{RXEN,IEEE\ 802.15.4}$	Time between the RXEN task and READY event after channel FREQUENCY configured (IEEE 802.15.4)	130		130	us
$t_{RXEN,FAST,IEEE\ 802.15.4}$	Time between the RXEN task and READY event after channel FREQUENCY configured (IEEE 802.15.4 with fast ramp-up)	40		40	us
$t_{RXDIS,IEEE\ 802.15.4}$	When in RX, delay between DISABLE task and DISABLED event (IEEE 802.15.4)	0.5		0.5	us
$t_{RX\text{-}to\text{-}TX\ turnaround}$	Maximum TX-to-RX or RX-to-TX turnaround time in IEEE 802.15.4 mode		40		us

3.3.9 Received signal strength indicator (RSSI) specifications

Symbol	Description	Min	Typ.	Max.	Units
$RSSI_{ACC}$	RSSI accuracy [22]		± 2		dB
$RSSI_{RESOLUTION}$	RSSI resolution		1		dB
$RSSI_{PERIOD}$	RSSI sampling time from RSSI_START task		0.25		us
$RSSI_{SETTLE}$	RSSI settling time after signal level change		15		us

# 4. Electrical schematic

Default is using "DC-DC mode". Our hardware is set to use external 32.768khz.
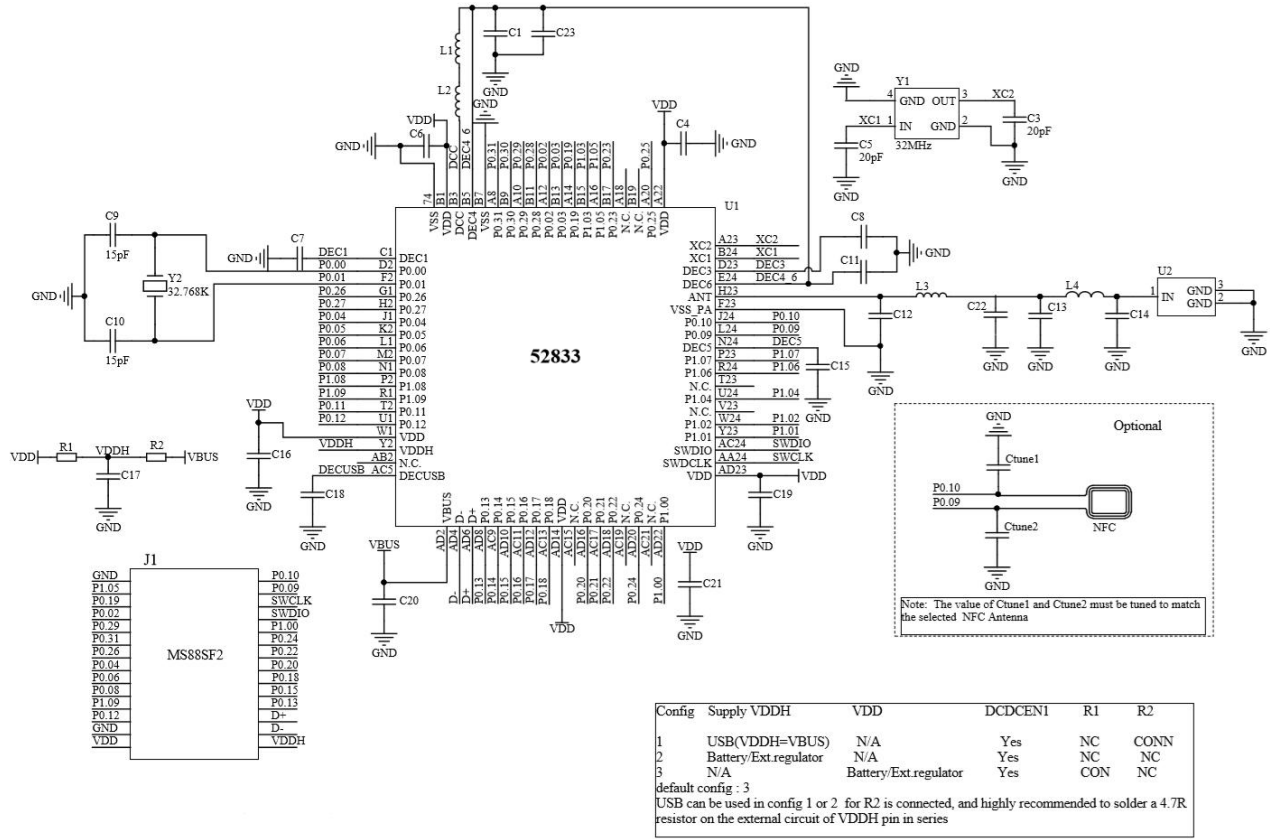
Config	Supply VDDH	VDD	Extsupply	DCDCEN0	DCDCEN2	USB	R1	R2	L5	L1&L2
1	USB (VDDH=VBUS)	N/A	Yes	No	No	Yes	NC	CONN	NC	NC
2	Battery/Ext. regulator	N/A	Yes	No	No	Yes	NC	NC	NC	NC
3	N/A	Battery/Ext. regulator	No	No	No	Yes	CONN	NC	NC	NC
4	Battery/Ext. regulator	N/A	Yes	Yes	Yes	Yes	NC	NC	CONN	CONN
5	N/A	Battery/Ext. regulator	No	No	Yes	Yes	CONN	NC	NC	CONN
6	N/A	Battery/Ext. regulator	No	No	No	No	CONN	NC	NC	NC

5. Package information

5.1 Package dimension
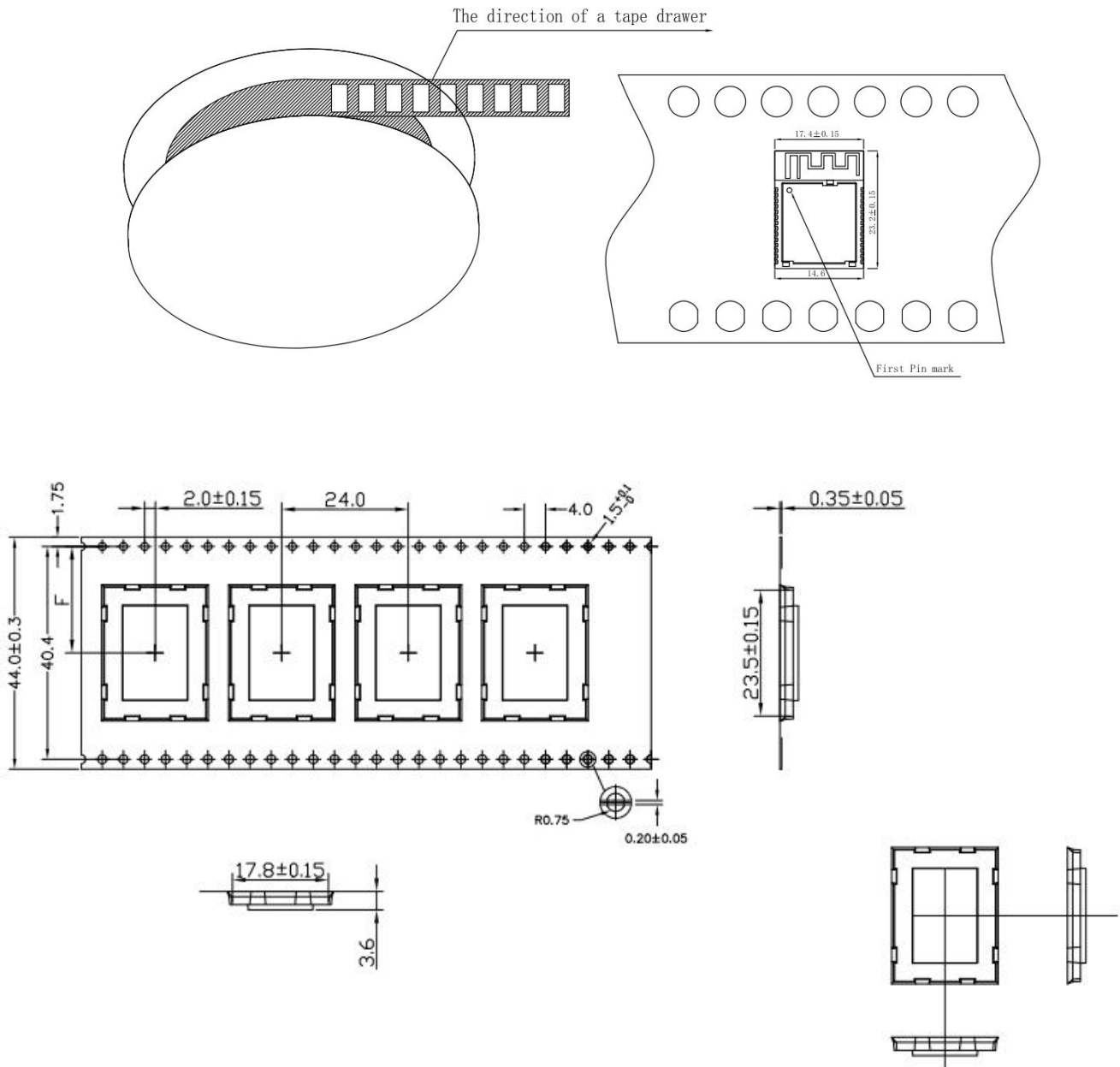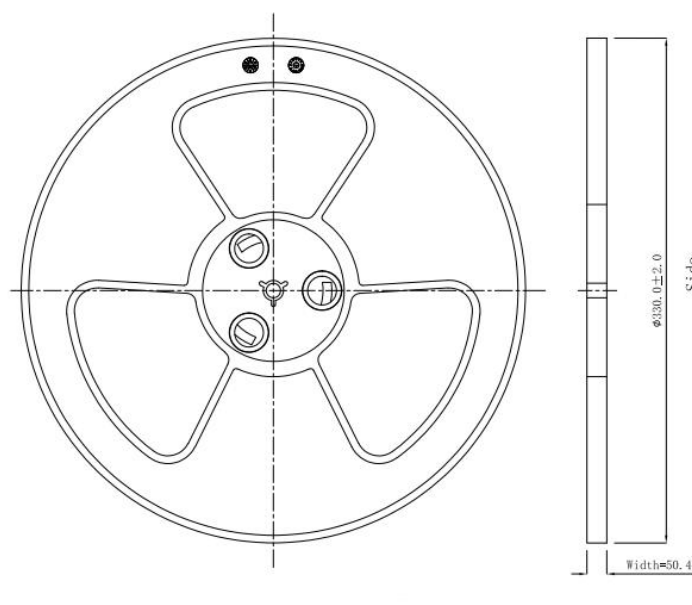
Unit: mm

Tolerance: +/- 0.1, default

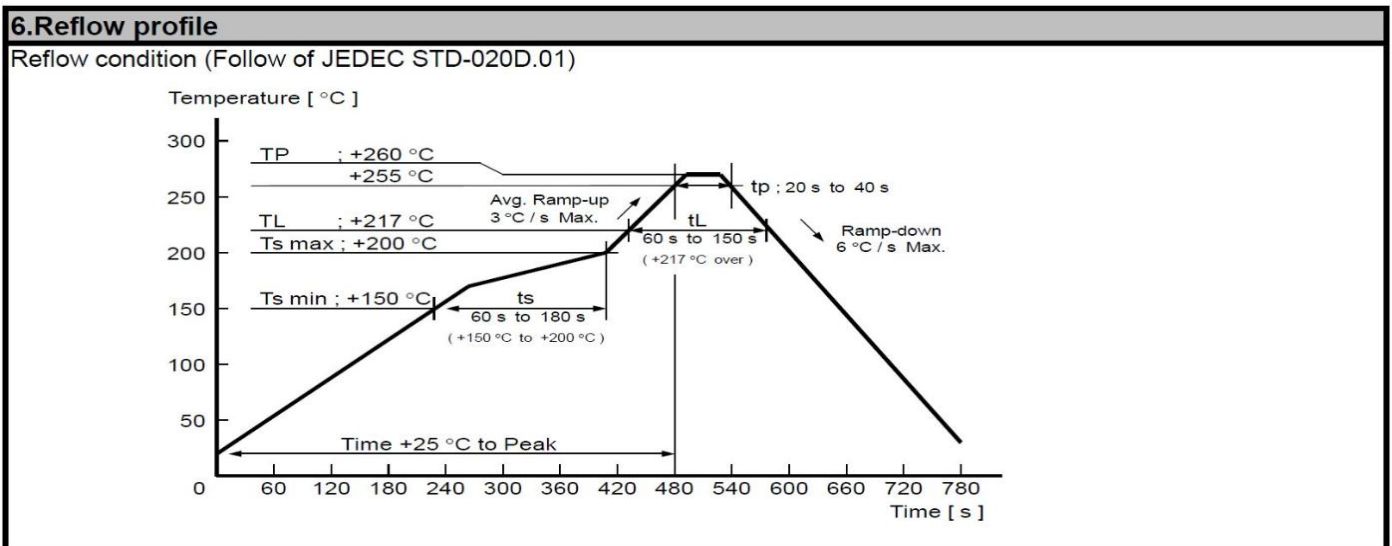| Details	Reel
Quantity(module)	650PCS
Tape Weight	460g
Single module Weight	1.1g
Gross Weight	1200g
Dimension	W：44mm　T：0.35mm

5.2 Marking on metal shield

5.2.1 MS88F2 PCB Antenna
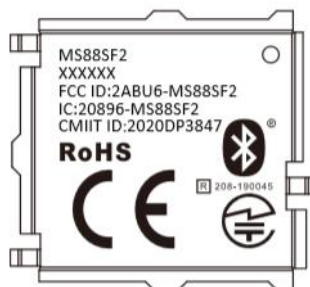
5.2.1 MS88F2 u.FL Antenna
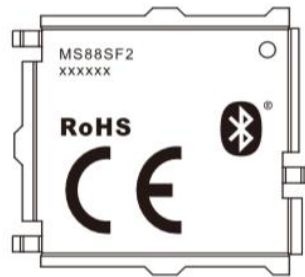
6. Reflow and soldering

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

7.1 Full Bluetooth Declaration ID

Please kindly check the DID number for MS88SF2: D043974.

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)

MS88SF2 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 MS88SF2: 2ABU6-MS88SF2.

MS88SF2 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 MS88SF2: 20896-MS88SF2.

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, MS88SF2 is assigned the IC ID number: 20896-MS88SF2

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 MS88SF2: 208-190045.

The MS88SF2 is approved for use in the Japanese market.

7.6 Australia / New Zealand (RCM)

The MS88SF2 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 MS88SF2 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

MS88SF2 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

MS88SF2 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. Hardware

8.1 USB interface

Modules based on nRF52810, nRF52811 and nRF52832 with no USB interface whereas modules based on nRF52840 and nRF52833 is with USB interface.

8.1.1 USB operating conditions

Symbol	Description	Min	Typ.	Max.	Units
V_{BUS}	Supply voltage on VBUS pin.	4.35	5	5.5	V
V_{DPDM}	Voltage on D+ and D- lines	VSS-0.3V		VUSB33+	V

8.1.2 USB regulation specifications

Symbol	Description	Min	Typ.	Max.	Units
$I_{USB,QUIES}$	USB regulator quiescence current drawn from Vbus（USBD enabled）		170		µA
$t_{USBPWRRDY}$	Time from USB enabled to USBPWRRDY event triggered, V_{BUS} supply provided		1		ms
V_{USB33}	On voltage at the USB regulator put(DECUSB pin)	3.0	3.3	3.6	V
$R_{SOURCE,VBUS}$	Maximum source resistance on Vbus,incl.cable			2	Ω

9. 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.

9.1 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.

9.2 Layout notes

To make sure wireless performance is at its best condition, please layout the 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.
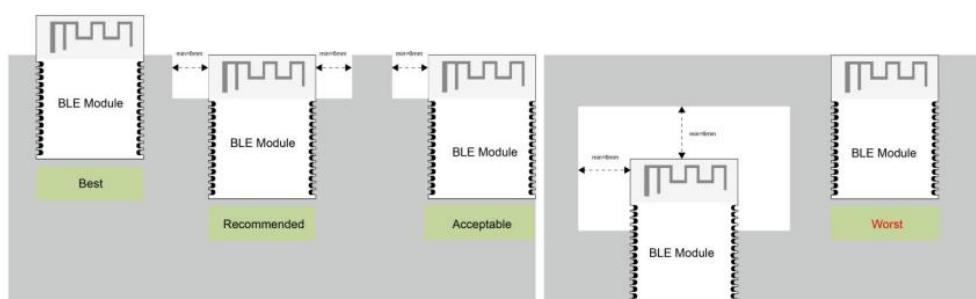
*The Grey area above is Carrier board.

9.3 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.

9.4 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.

9.5 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.

10. 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.

11. Contact information

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