Powerful nRF52840 Module MS88SF2 Specification

MS88SF2 is based on Nordic nRF52840 and it is a compact and very small size Bluetooth 5.0 module with the metal cover shield and compliance with IEEE 802.14.4 standard. Technically, MS88SF2 is advanced, higher flexibility, ultra-low power and multi-protocol SOM and it lowers the cost of building network nodes

Features

Frequency: 2400 to 2483 MHz
Max. Output power: +8dBm
Single power supply: 1.8 – 3.9V
Range: 10-100m (BER<0.1%, open space)
Chip: nRF52840 (Nordic)
GPIO Quantity: 20
1MB Flash and 256kB RAM
Module size: 23.2 x 17.4 x 2.0 mm
ARM Cortex-M4F processor
Metal shielding with marking
Supports USB data interface
50Ω PCB antenna type
Operating temperature range: -25 to 85 degree Celsius
IEEE 802.15.4 with Thread and Zigbee support

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

CE Certification
FCC ID: 2ABU6-MS88SF2
QDID, TELEC, WPC, RCM, IC, RoHS, Reach is in coming soon (Feb, 2019).

Revision history

Version	Date	Notes	Contributor（s）	Person of Approve
1.5	2018.01.09	**Add：** Cover Reflow and soldering, Contact information, Notes&caution. **Improvement:** Pin assignment, Electrical specification, Electrical schematic, Package information, Certification, Disclaimer.	Lynn	
1.4	2018.12.07	1. The font of specification adjust to“Boldface” type. 2. Electrical parameter: for the working voltage: 2-3.6V revised by 3.0-3.6V.	Liv	
1.3	2018.11.02	1. The adjustment of packaging information. 2. The improvement of content; warranty of quality and disclaim of right.	Aliee	

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1. Product introduction

MS88SF2 is based on Nordic nRF52840 and it is a compact and very small size Bluetooth 5.0 module with the metal cover shield and compliance with IEEE 802.14.4 standard. Technically, MS88SF2 is advanced, higher flexibility, ultra-low power and multi-protocol SOM and it lowers the cost of building network nodes. With the flexible power management, it has On-chip DC/DC and LDO regulators with automated low current modes. The module has RF transceiver with ARM Cortex-M4F processor and the core speed is up to 64MHz. Moreover, MCU has a faster running speed. In that circumstances, it can achieve more powerful computing power and floating-point computing technology to complete very complex algorithms.

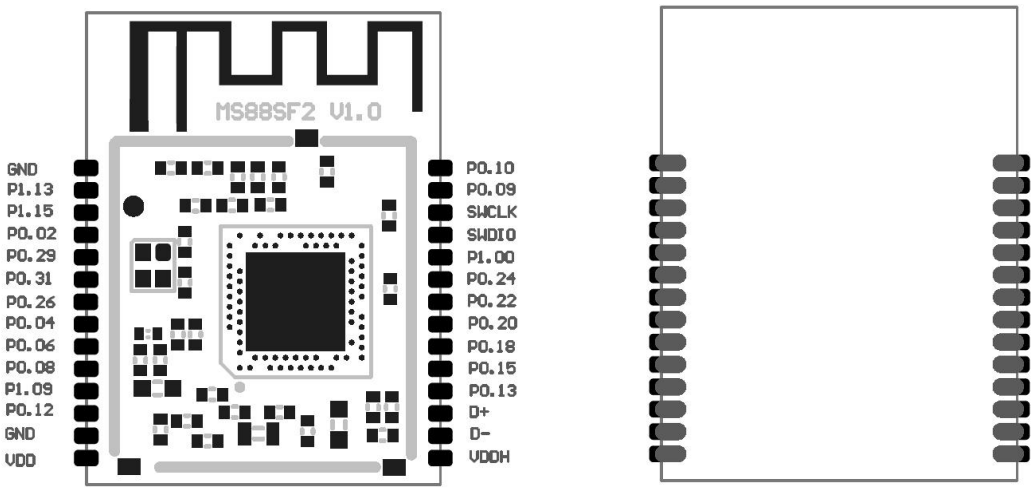
The BLE module MS88SF2 is highly integrated that contains all the necessary components from radio to a different antenna and a completely implemented Bluetooth protocol stack.

1.1 Ordering information

Ordering number	Description
MS88SF2	306030063, nRF52840-QIAA BT 5.0 Module, PCB Antenna, reel pack

2. Pin description

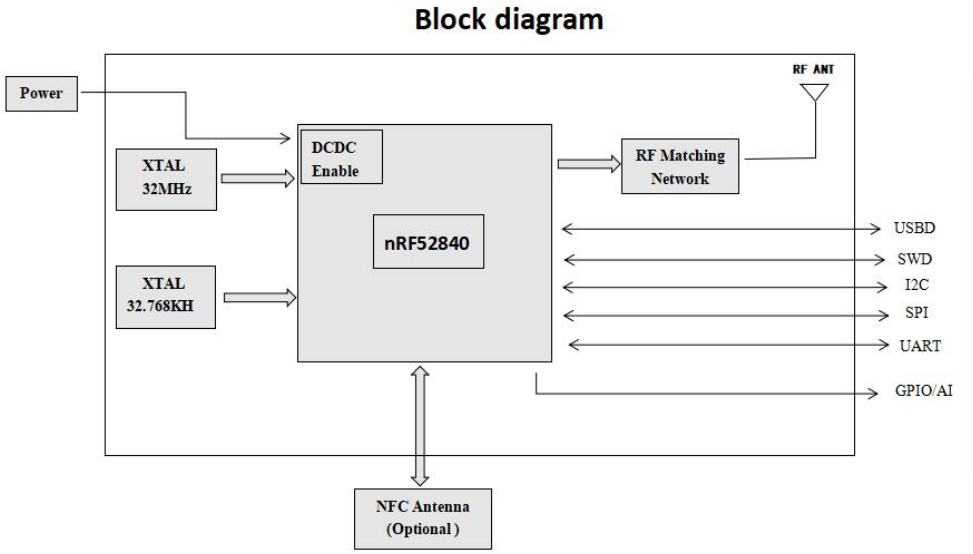
2.1 Pin assignment



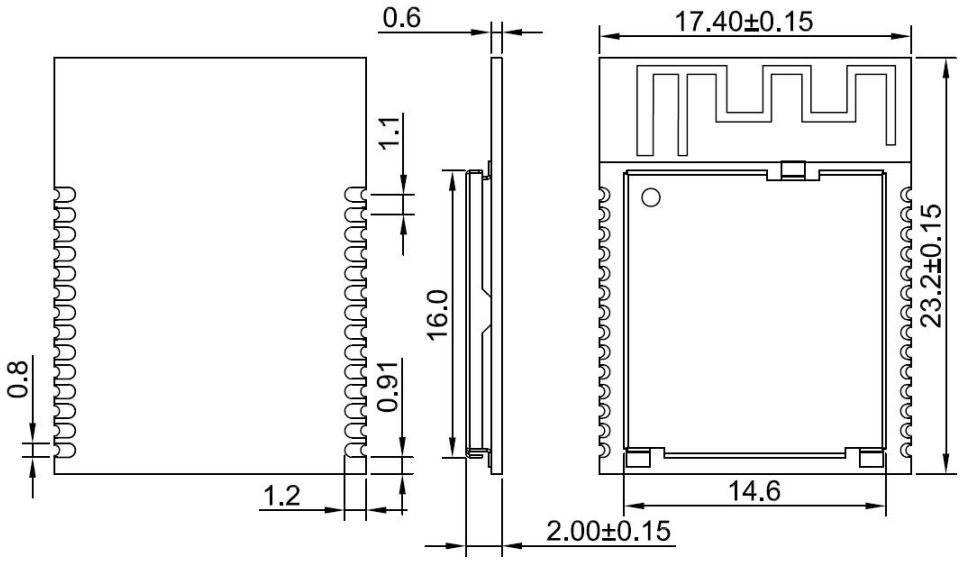
2.2 Pin definition

Symbol	Type	Description
VDD	Power	Power supply
VDDH	Power	Power supply，2.5V-5.5V
GND	Power	Ground
SWDIO	Digital I/O	System reset (active low). 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



2.4 Mechanical drawing



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 nRF52840 chipset. The below information is only the extract from nRF52840 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				
$V_{I/O}$,VDD<=3.6V		-0.3	VDD + 0.3V	V
$V_{I/O}$,VDD>3.6V		-0.3	3.9V	V
NFC antenna pin current				
$I_{NFC1/2}$			80	mA
Radio				
RF input level			10	dBm
Environmental (AQFN package)				
Storage temperature		-40	+125	°C
MSL	Moisture Sensitivity Level		2	
ESD HBM	Human Body Model		4	KV
ESD CDM_{QF}	Charged Device Model (AQFN73,7×7mm package)		750	V

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	1.75			V

	reset				
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

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
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		kchipA s

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		14.1		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		9.3		mA
$I_{TX,PLUS4dBM}$	TX only run current P_{RF} =+ 4 dBm		18.9		mA
$I_{TX,0dBM,DCDC,5V,REG0}$	TX only run current (DCDC,5V,REGO out=3.3V)P_{RF} =0 dBm		6.0		mA
$I_{TX,0dBM,DCDC,5V,REG0LO}$	TX only run current(DCDC,5V,REGO out=1.8V)P_{RF} =0 dBm		5.2		mA
$I_{TX,0dBM,DCDC}$	TX only run current(DCDC,3V)P_{RF} =0 dBm		4.9		mA
$I_{TX,0dBM}$	TX only run current P_{RF} = 0 dBm		10.2		mA
$I_{TX,MINUS4dBM,DCDC}$	TX only run current DCDC,3V P_{RF} =-4 dBm		3.4		mA

$I_{TX,MINUS4dBM}$	TX only run current P_{RF} =-4 dBm		7.3		mA
$I_{TX,MINUS8dBM,DCDC}$	TX only run current DCDC,3V P_{RF} =-8 dBm		3.0		mA
$I_{TX,MINUS8dBM}$	TX only run current P_{RF} =-8 dBm		6.4		mA
$I_{TX,MINUS12dBM,DCDC}$	TX only run current DCDC,3V P_{RF} =-12 dBm		2.7		mA
$I_{TX,MINUS12dBM}$	TX only run current P_{RF} =-12 dBm		5.7		mA
$I_{TX,MINUS16dBM,DCDC}$	TX only run current DCDC,3V P_{RF} =-16 dBm		2.5		mA
$I_{TX,MINUS16dBM}$	TX only run current P_{RF} =-16 dBm		5.3		mA
$I_{TX,MINUS20dBM,DCDC}$	TX only run current DCDC,3V P_{RF} =-20 dBm		2.3		mA
$I_{TX,MINUS20dBM}$	TX only run current P_{RF} =-20 dBm		5.0		mA
$I_{TX,MINUS40dBM,DCDC}$	TX only run current DCDC,3V P_{RF} =-40 dBm		2.0		mA
$I_{TX,MINUS40dBM,}$	TX only run current P_{RF} =-40 dBm		4.0		mA
$I_{START,TX,DCDC}$	TX start-up current DCDC,3V P_{RF} =4 dBm		5.2		mA
$I_{START,TX}$	TX start-up current P_{RF} =4 dBm		11.0		mA
$I_{0dBm(DCDC, 3V)}$	TX current(DCDC,3V)1Mbps BLE measured from VBAT with PRF =0 dBm		6.4		mA
$I_{2dBm(DCDC, 3V)}$	TX current(DCDC,3V)1Mbps BLE measured from VBAT with P_{RF} =2 dBm		8.9		mA
$I_{4dBm(DCDC, 3V)}$	TX current(DCDC,3V)1Mbps BLE measured from VBAT with P_{RF} =4 dBm		10.6		mA
$I_{9dBm(DCDC, 3V)}$	TX current(DCDC,3V)1Mbps BLE measured from VBAT with P_{RF} =9 dBm		15.5		mA
$I_{0dBm(3V)}$	TX current(3V)1Mbps BLE measured from VBAT with P_{RF} =0 dBm		11.2		mA
$I_{9dBm(3V)}$	TX current(3V)1Mbps BLE measured from VBAT with P_{RF} =9 dBm		30.7		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		4.8		mA
$I_{RX,1M}$	RX only run current(LDO,3V)1Mbps/1Mbps BLE		10.3		mA
$I_{RX,2M,DCDC}$	RX only run current(DCDC,3V)2Mbps/2Mbps BLE		5.4		mA
$I_{RX,2M,}$	RX only run current(LDO,3V)2Mbps/2Mbps BLE		11.6		mA
$I_{START,RX,1M,DCDC}$	RX start-up current(DCDC,3V)1Mbps/1Mbps BLE		3.7		mA
$I_{START,RX,1M}$	RX start-up current 1Mbps/1Mbps BLE		6.7		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)		-23		dBc
$P_{RF2,1}$	2nd adjacent channel transmit power 2 MHz(1 Mbps)		-50		dBc
$P_{RF1,2}$	1st adjacent channel transmit power 2 MHz(2 Mbps)		-24		dBc
$P_{RF2,2}$	2nd adjacent channel transmit power 4 MHz(2 Mbps)		-50		dBc
E_{vm}	Error Vector Magnitude IEEE 802.15.4				%rms
$P_{harm2nd,IEEE\ 802.15.4}$	2nd Harmonics in IEEE 802.15.4 mode				dBm
$P_{harm3rd,IEEE\ 802.15.4}$	3rd Harmonics in IEEE 802.15.4				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[13]		-93		dBm
$P_{SENS,IT,SP,1M,BLE}$	Sensitivity,1 Mbps BLE ideal transmitter,<=37 bytes BER=1E-3[14]		-95		dBm
$P_{SENS,IT,LP,1M,BLE}$	Sensitivity,1 Mbps BLE ideal transmitter,>=128 bytes BER=1E-4[15]		-95		dBm
$P_{SENS,IT,2M}$	Sensitivity, 2Mbps nRF mode[16]		-89		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		-99		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
$C/I_{1M,co\text{-}channel}$	1Mbps mode, Co-Channel interference		9		dB
$C/I_{1M,-1MHz}$	1 Mbps mode, Adjacent (-1 MHz) interference		-2		dB
$C/I_{1M,+1MHz}$	1 Mbps mode, Adjacent (+1 MHz) interference		-10		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		-38		dB
$C/I_{1M,+3MHz}$	1 Mbps mode, Adjacent (+3 MHz) interference		-48		dB
$C/I_{1M,\pm6MHz}$	1 Mbps mode, Adjacent (≥6 MHz) interference		-50		dB
$C/I_{1MBLE,co\text{-}channel}$	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		-9		dB
$C/I_{1MBLE,-2MHz}$	1 Mbps BLE mode, Adjacent (-2 MHz) interference		-22		dB
$C/I_{1MBLE,+2MHz}$	1 Mbps BLE mode, Adjacent (+2 MHz) interference		-46		dB
$C/I_{1MBLE,>3MHz}$	1 Mbps BLE mode, Adjacent (≥3 MHz) interference		-50		dB
$C/I_{1MBLE,image}$	Image frequency Interference		-22		dB
$C/I_{1MBLE,image,1MHz}$	Adjacent (1 MHz) interference to in-band image frequency		-35		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		6		dB
$C/I_{2M,+2MHz}$	2 Mbps mode, Adjacent (+2 MHz) interference		-19		dB
$C/I_{2M,-4MHz}$	2 Mbps mode, Adjacent (-4 MHz) interference		-20		dB
$C/I_{2M,+4MHz}$	2 Mbps mode, Adjacent (+4 MHz) interference		-44		dB
$C/I_{2M,-6MHz}$	2 Mbps mode, Adjacent (-6 MHz) interference		-42		dB
$C/I_{2M,+6MHz}$	2 Mbps mode, Adjacent (+6 MHz) interference		-42		dB
$C/I_{2M,\geq12MHz}$	2 Mbps mode, Adjacent (≥12 MHz) interference		-52		dB
C/I`$_{125k\ BLE\ LR,co\text{-}channel}$	125 kbps BLE LR mode, Co-Channel interference				dB
$C/I_{125k\ BLE\ LR,-1MHz}$	125 kbps BLE LR mode, Adjacent (-1 MHz) interference				dB
$C/I_{125k\ BLE\ LR,+1MHz}$	125 kbps BLE LR mode, Adjacent (+1 MHz) interference				dB
$C/I_{125k\ BLE\ LR,-2MHz}$	125 kbps BLE LR mode, Adjacent (-2 MHz) interference				dB
$C/I_{125k\ BLE\ LR,+2MHz}$	125 kbps BLE LR mode, Adjacent (+2 MHz) interference				dB
$C/I_{125k\ BLE\ LR,>3MHz}$	125 kbps BLE LR mode, Adjacent (≥3 MHz) interference				dB
$C/I_{125k\ BLE\ LR,image}$	Image frequency Interference				dB
$C/I_{500k\ BLE}$	500 kbps BLE LR mode, Co-Channel interference				dB

$C/I_{LR,co\text{-}channel}$					
$C/I_{500k\ BLE\ LR,-1MHz}$	500 kbps BLE LR mode, Adjacent (-1 MHz) interference				dB
$C/I_{500k\ BLE\ LR,+1MHz}$	500 kbps BLE LR mode, Adjacent (+1 MHz) interference				dB
$C/I_{500\ k\ BLE\ LR,-2MHz}$	500 kbps BLE LR mode, Adjacent (-2 MHz) interference				dB
$C/I_{500k\ BLE\ LR,+2MHz}$	500 kbps BLE LR mode, Adjacent (+2 MHz) interference				dB
$C/I_{500k\ BLE\ LR,>3MHz}$	500 kbps BLE LR mode, Adjacent (≥3 MHz) interference				dB
$C/I_{500k\ BLE\ LR,image}$	Image frequency Interference				dB

3.3.7 RX intermodulation

Symbol	Description	Min	Typ.	Max.	Units
$P_{IMD,1M}$	IMD performance, 1 Mbps, 3rd, 4th, and 5th offset channel		-29		dBm
$P_{IMD,1M,BLE}$	IMD performance, BLE 1 Mbps, 3rd, 4th, and 5th offset channel		-30		dBm
$P_{IMD,2M}$	IMD performance, 2 Mbps, 3rd, 4th, and 5th offset channel		-30		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 1Mbps		6		us
$t_{TXDISABLE,2M}$	Time between DISABLE task and DISABLED event when the radio was in TX and mode is set to 2Mbps				us

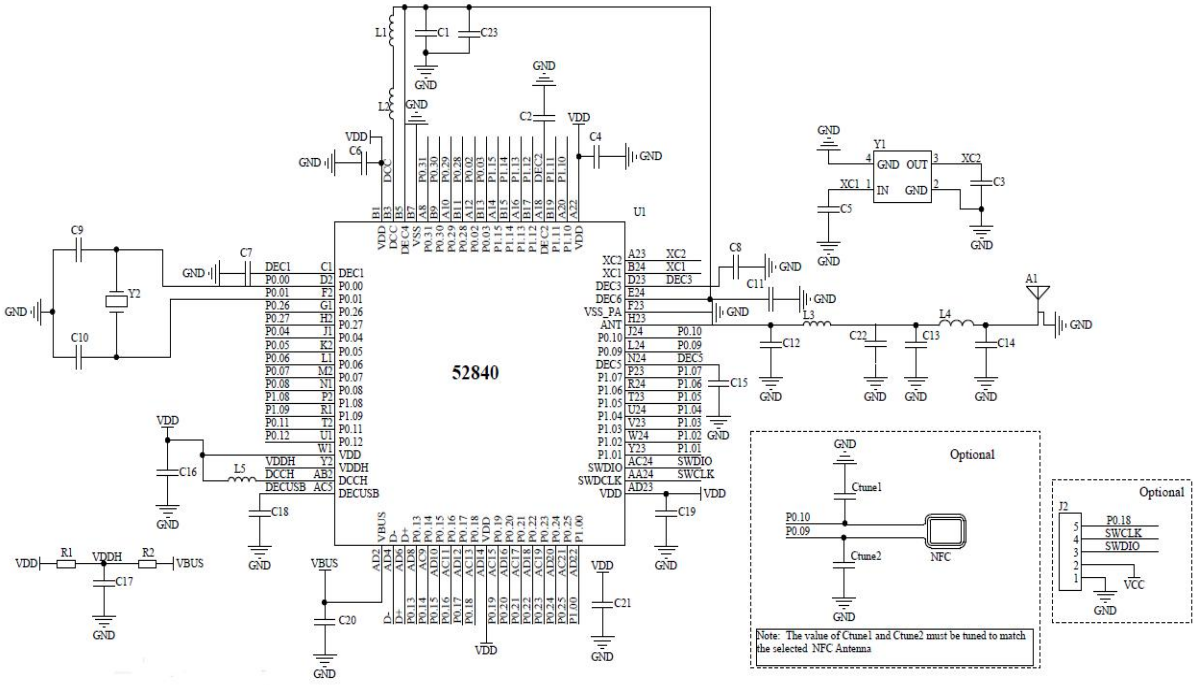
t_{RXEN}	Time between the RXEN task and READY event after channel FREQUENCY configured in default mode		140		us
$t_{RXEN,FAST}$	Time between the RXEN task and READY event after channel FREQUENCY configured in fast mode		40		us
$t_{RXDISABLE}$	Time between DISABLE task and DISABLED event when the radio was in RX		0		us
$t_{TXCHAIN}$	TX chain delay		0.6		us
$t_{RXCHAIN}$	RX chain delay		9.4		us
$t_{RXCHAIN,2M}$	RX chain delay in 2Mbps mode		5		us
$t_{RXCHAIN,LR\ 125k}$	RX chain delay in BLE LR125kbps mode				us
$t_{RXCHAIN,LR\ 500k}$	RX chain delay in BLE LR500kbps mode				us
$t_{RX\text{-}to\text{-}TX\ turnaround}$	Maximum TX-to-RX or RX-to-TX turnaround time in IEEE 802.15.4 mode				us

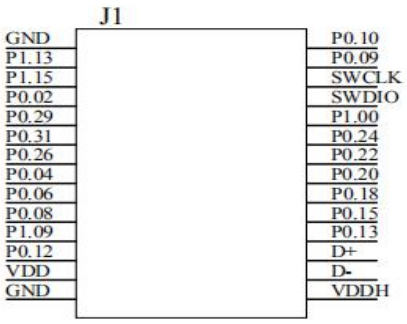
3.3.9 Received signal strength indicator (RSSI) specifications

Symbol	Description	Min	Typ.	Max.	Units
$RSSI_{ACC}$	RSSI Accuracy Valid range -90 to -20 dBm		-2		dB
$RSSI_{RESOLUTION}$	RSSI resolution		1		dB
$RSSI_{PERIOD}$	Sample period		8		us
$RSSI_{min,IEEE\ 802.15.4}$	Minimum RSSI sensitivity in 802.15.4 mode				dBm

4. Electrical schematic

Default is using “DC-DC mode”. Our firmware is set to use external 32.768khz.

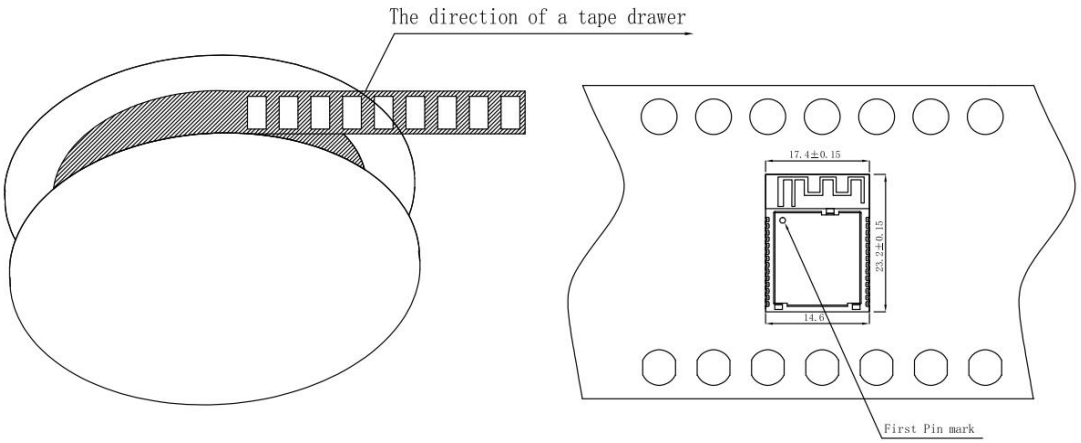


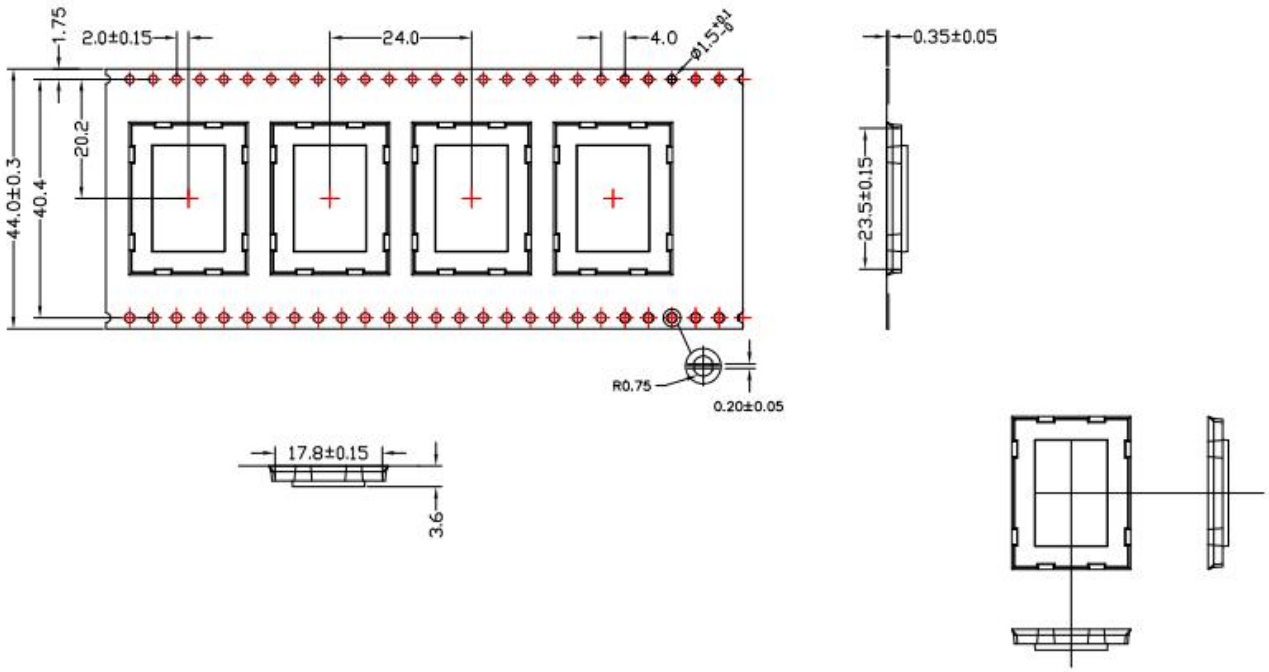


Config	Supply VDDH	VDD	Extsupply	DCDCEN0	DCDCEN2	USB	R1	R2	L5	L1&L2
1	USB (VDDH=VBUS)	N/A	Yes	No	No	Yes	NC	CONN	NC	NC
2	Battery/Ext. regulator	N/A	Yes	No	No	Yes	NC	NC	NC	NC
3	N/A	Battery/Ext. regulator	No	No	No	Yes	CONN	NC	NC	NC
4	Battery/Ext. regulator	N/A	Yes	Yes	Yes	Yes	NC	NC	CONN	CONN
5	N/A	Battery/Ext. 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

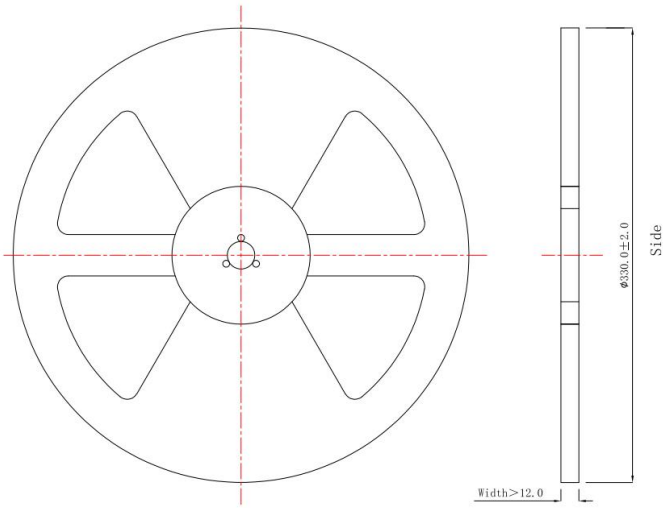
5.1 Package dimension





Unit: mm

Tolerance: +/- 0.1, default



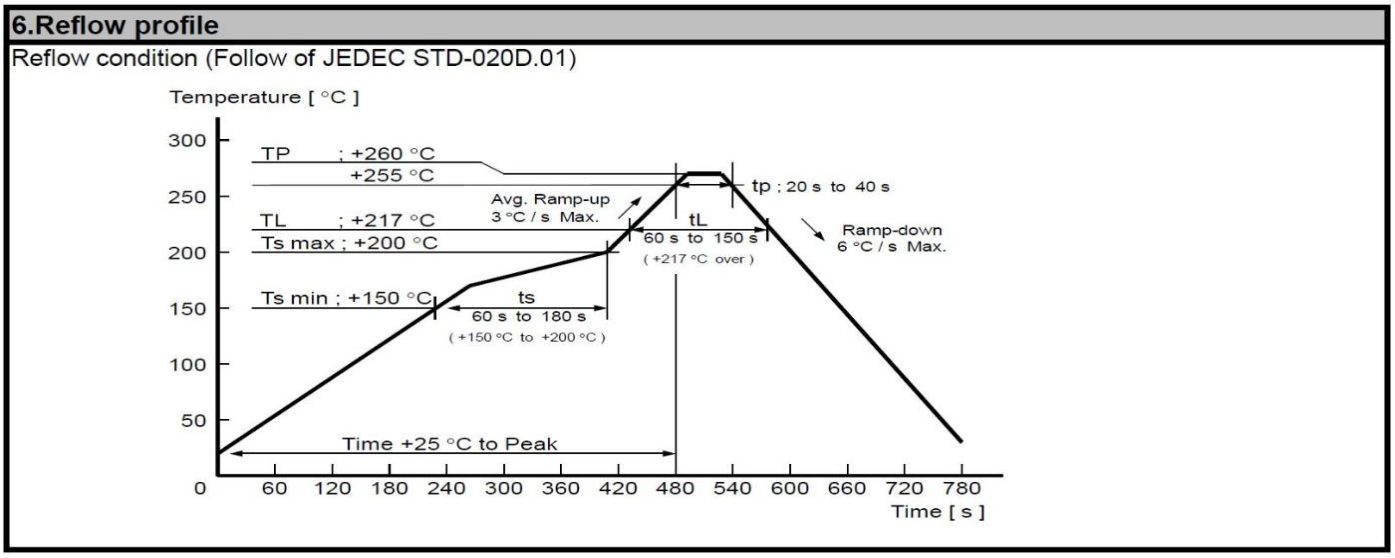
Unit: mm

Tolerance: +/- 0.1, default

Details	Reel
Quantity(module)	700PCS
Tape Weight	460g
Single module Weight	1.1g
Gross Weight	1290g
Dimension	W：44mm　T：0.35mm

5.2 Marking on metal shield

6. Reflow and soldering



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

7. Certification

• CE Certification

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.

• FCC Certification (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, 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. Hardware

8.1 USB interface

Modules based on nRF52810, nRF52822 and nRF52832 with no USB interface whereas modules based on nRF52840 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

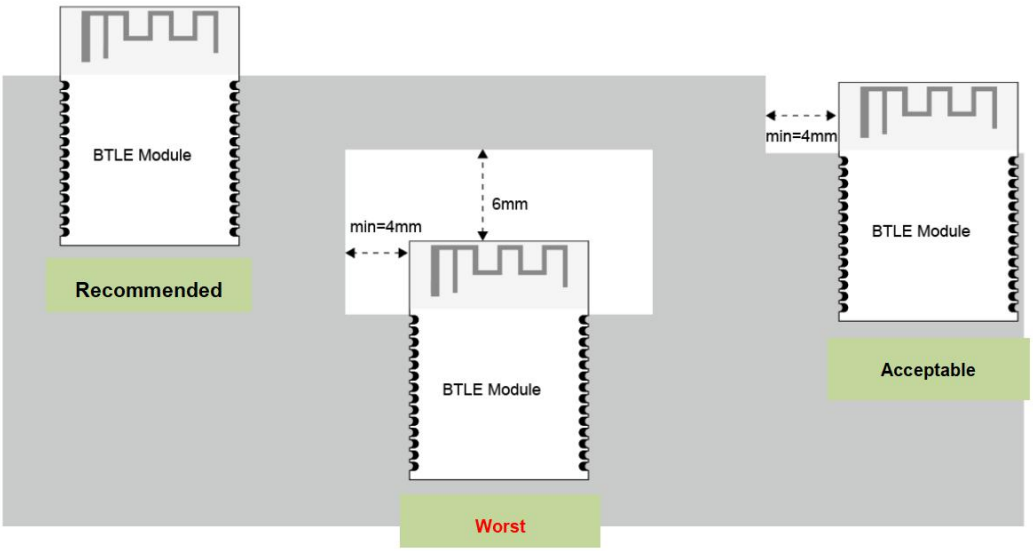
The antenna area of module shall lay clearance completely and should not be blocked by the metal. Otherwise it will have effect on antenna performance (As the picture indicated below).

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 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.

11. Contact information

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