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ISSC
創傑科技股份有限公司
ISSC Technologies Corp.

Datasheet of Bluetooth

BM57SPP03MC2 Module

ISSC Technologies Corp.

Revision History

Date	Revision Content	Version
2013/04/23	Modification of wording. typo correction.	1.7
2013/07/25	Modify Some Specifications Error. Refer to Last Page for Detail Revise Information	1.8
2013/08/19	Modify Actual Baud Rate in page_6	1.9

Content

1. Introduction.. 3

1.1. Major Components.. 3
1.2. Features.. 3
1.3. Application.. 3

2. Product Specification.. 4

2.1. Chipset.. 4
2.2. Interfaces.. 4
2.3. Hardware Design Considerations.. 4

3. Hardware Architecture.. 9

4. Compatibility Requirements.. 9

5. Environmental Requirements.. 10

5.1. Temperature.. 10
5.2. Humidity.. 10

Appendix A: Dimension and Foot Print.. 11

Appendix B: Product Image.. 12

Appendix C: PIN Assignment.. 13

Appendix D: Reflow Profile.. 15

Appendix E: Schematic.. 16

Appendix F: Reference Schematic.. 17

Appendix G: Label Information.. 17

Appendix H: Packaging Information.. 17

Appendix I: Reversion History.. 18

1. Introduction

Part Name: ISSC BM57SPP03MC2 Bluetooth module

Part Number: BM57SPP03MC2-xxxxxx

The ISSC BM57SPP03MC2 Bluetooth module is design for standard SPP (Serial Port Profile) electronic accessory via Bluetooth connectivity. It is available in the 2.4GHz ISM band Class 2 Radio, compatible with Bluetooth Core Specification Version 3.0 + EDR.

ISSC IS1657NM single chip solution combines transceiver and baseband function to decrease the external components. It narrows down the module size and minimizes its cost.

The optimized power design minimize power consumption to keep low battery

1.1. Major Components

- ISSC IS1657NM (48 pin QFN, single-chip Bluetooth transceiver and baseband processor)
- Serial EEPROM 8K (1024*8) TSSOP 8P

1.2. Features

- Bluetooth 3.0 EDR compliant
- Low power 1.8V RF operation
- RF transmitter output power Class 2
- RF receiver GFSK typical -90dBm, π/4 PSK typical -90dBm, 8DPSK typical -83dBm
- Internal ROM and 4Mibts of flash
- I2C for external EEPROM.
- 1 LED driver

1.3. Application

- GPS
- Printers
- Electric Scale
- Blood Pressure Monitors
- Bar code Scanner
- Industrial Applications (CNC, PLC, RFID)
- Embedded systems

2. Product Specification

2.1. Chipset

7x7 mm^2 48 pin QFN IS1657NM

2.2. Interfaces

- Multi function GPIO interface
- Bluetooth RF interface
- UART up to 921600 bps
- I2C for external EEPROM
- 2/4 wires SPI interface (master/slave) for external peripherals control. (Optional)

2.3. Hardware Design Considerations

- Power

The module requires either a 3.3V or 5V supply voltage. (3.3V was suggested)

- Power ramp-up timing restriction

1) BAT_IN : ramp-up (0 to 1.6V) < 200ms
2) PMULDO_O : PMU-logic ramp-up (0 to 1.6V) <60ms
3) VCC_RF (1.8V power domain) : RF BPOR ramp-up (0 to 1.6V) < 20ms

- Power on sequence

1) BAT_IN/ BAT_IN_5V: must be first!
2) 3.3V power domain: VDD_IO/ VDD_FIO must power-up early than 1.8V power.
3) 1.8V power domain: 1V8/ VCC_RF/ VDD_XO/ 1V8_U_P
4) RST_N: digital reset released from 0 to 1.6V must be the last one.

- Recommended operating conditions

Rating	Min	Typ	Max
VDD_IO_x,	3.1V		3.63V
SW_BTN	3.2V		4.3V
BAT_IN	3.2V		4.3V

- Clock Sources

A high accuracy crystal with ±10ppm tolerance is connected to the BM57SPP03MC2 clock input pins.

- Serial Flash and Firmware Version

Firmware code is stored on chip internal flash.

- Radio Characteristics

Bluetooth V3.0 + EDR

Frequency Band: 2402-2480 GHz

Number of Channels: 79 1MHz channels

- Current Consumption (It is the average current consumption and measured by FLUKE multi-meter)

Operation Mode	Peak current	AVG current	Unit	Note
Peak current at TX mode	50.357		mA	
Peak current at RX mode	49.413		mA	
Standby mode (Discoverable & connectable mode		2.382	mA	
Deep power down mode		0.276	mA	**Maximum 0.5 mA**
Connected + Sniff, Master (No data)		2.723	mA	No data was transmitted Sniff (40 20 4 0)
Connected + Sniff, Master (No data)		0.673	mA	No data was transmitted Sniff (500 20 4 0)
Connected + Sniff, Slave (No data)		0.745	mA	No data was transmitted Sniff (500 20 3 3) iPhone parameters
Data, Master		17.641	mA	Data transmitted at 115200bps
Data, Slave		18.025	mA	Data transmitted at 115200bps

- Terminal characteristics

Condition : VDD_IO=3.3V	Min	Typ	Max	Unit
I/O voltage levels				
V_{IL} input logic levels low	-0.3		0.8	V
V_{IH} input logic levels high	2.0		3.6	V
V_{OL} output logic levels low			0.4	V
V_{OH} output logic levels high	2.4			V
Reset terminal				
$V_{TH,res}$ threshold voltage		1.6		V
Input and tri-state current with				
Pull-up Resistor		65		Kohm
Leakage current	-10		+10	µA
Vdd supply current				
TX mode			70	mA
RX mode			70	mA
BAT_IN Ripple Tolerance				
V_{ripple}			150	mV

- Baud Rate

Desired baud rate	Clock	Actual Baud rate	Error Rate %
921600	48000000	923077	0.16
460800	48000000	461538	0.16
230400	48000000	230769	0.16
115200	16000000	117647	2.1
57600	16000000	57145	-0.97
38400	16000000	38462	0.16
28800	16000000	28623	-0.62
19200	16000000	19231	0.16
14400	16000000	14480	0.55
9600	16000000	9615	0.16
4800	16000000	4808	0.16
2400	16000000	2399	-0.03

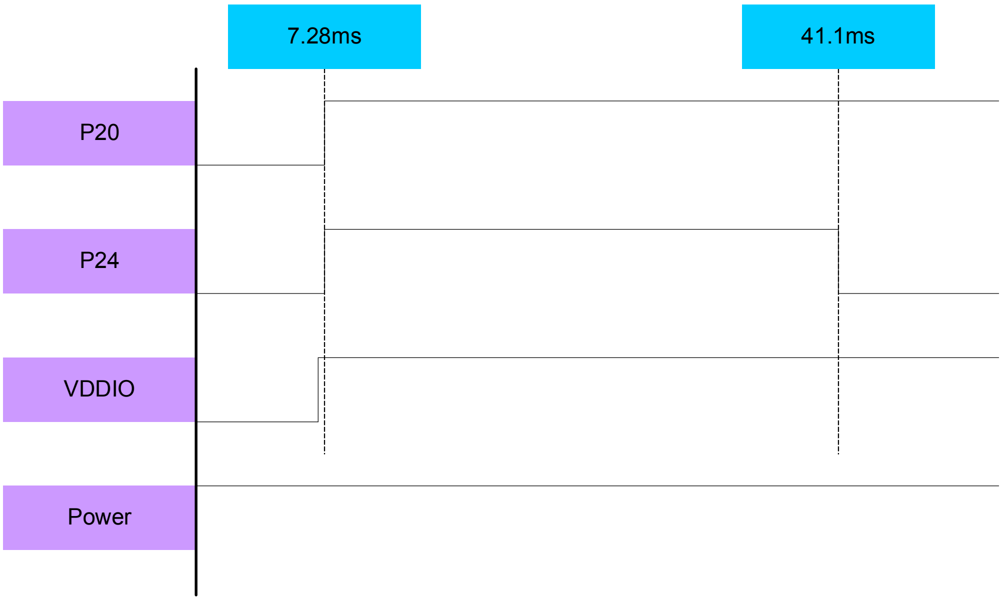
- Testing Criterion

NO.	Testing Item Name	Spec.
1	Device Initialization	
2	System Verify	System Power>1.6V
3	PMU LDO trim	1.8~2.1
4	Calibration LDO18	1.81~1.93V
5	Calibration LDO33	3.1~3.4V
6	RF frequency calibration	< 10k Hz
7	RF TX power verify	> -5 dBm
8	8852 output power	-2dbm~+4dbm
9	Initial carrier test	+/- 30KHz
10	Single slot sensitivity	> -70dbm
11	Multi slot sensitivity	> -70dbm
12	Modulation index test	‘140KHz ≦ f1avg ≦ 175KHz f2max ≧ 115KHz f2/f1avg ≧ 0.8

- Timing Sequence

Timing Sequence for Mode selection Pin (P20, P24) under APP mode

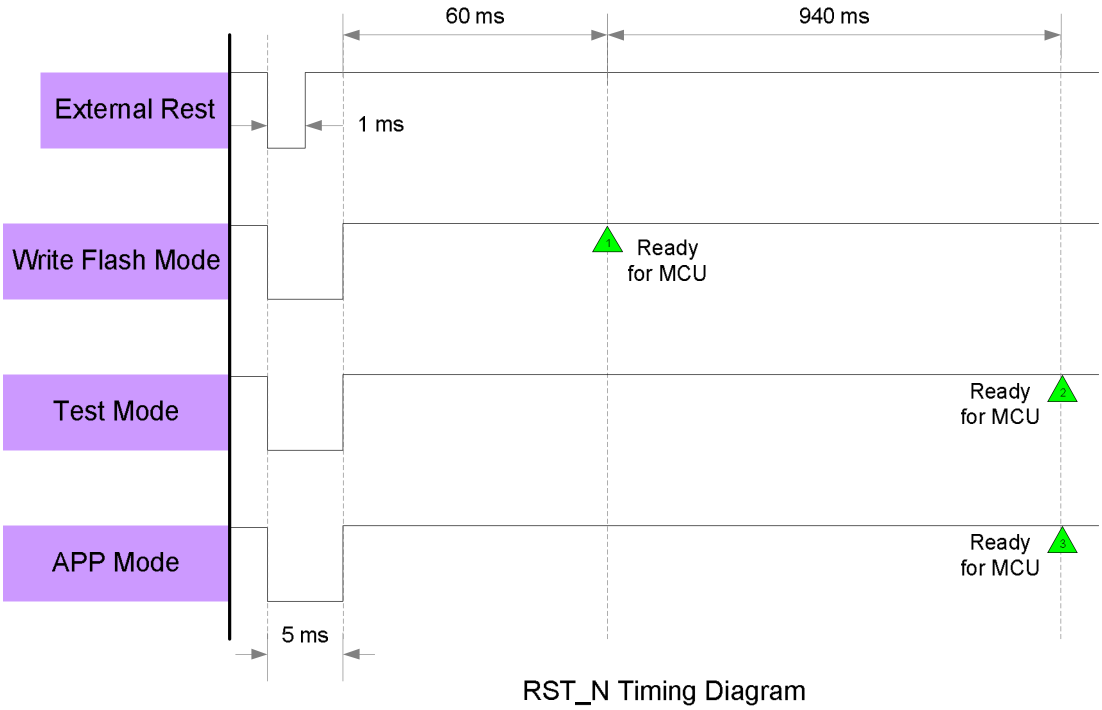
Pin No.	I/O	Name	Description
4	I	BAT_IN	3.3V power input
7	P	VDD_IO	Main power supply
17	I	P20	System configuration, refer to P2_4, MCU do **NOT drive under APP Mode**
18	I	P24	Boot mode selection (MCU **NOT drive under APP Mode**) P2_0/ P2_4: HH → Application LL → Boot mode LH → HCI UART mode for testing and system configuration.



P20, P24 Mode Selection Timing Diagram

Timing Sequence for Rest Pin (RST_N) under different mode

22	I	**RST_N**	**External reset input (Low Active), clock period 62.5n at least.**

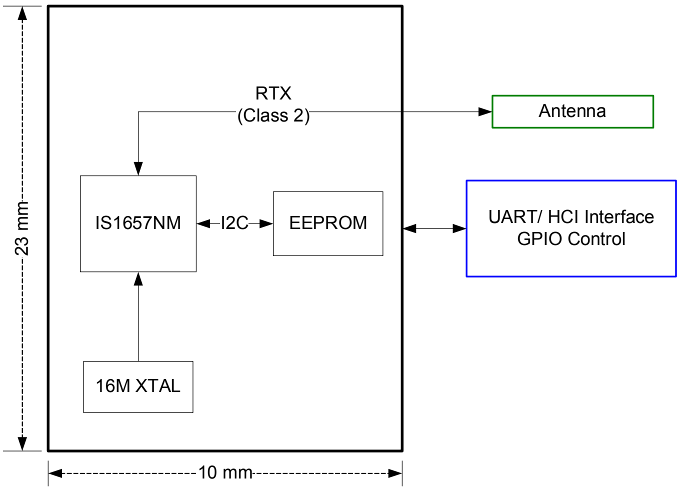

60 ms
940 ms
External Rest
1 ms
Write Flash Mode
1
Ready
for MCU
Test Mode
Ready
for MCU
2
APP Mode
Ready
for MCU
3
5 ms

RST_N Timing Diagram

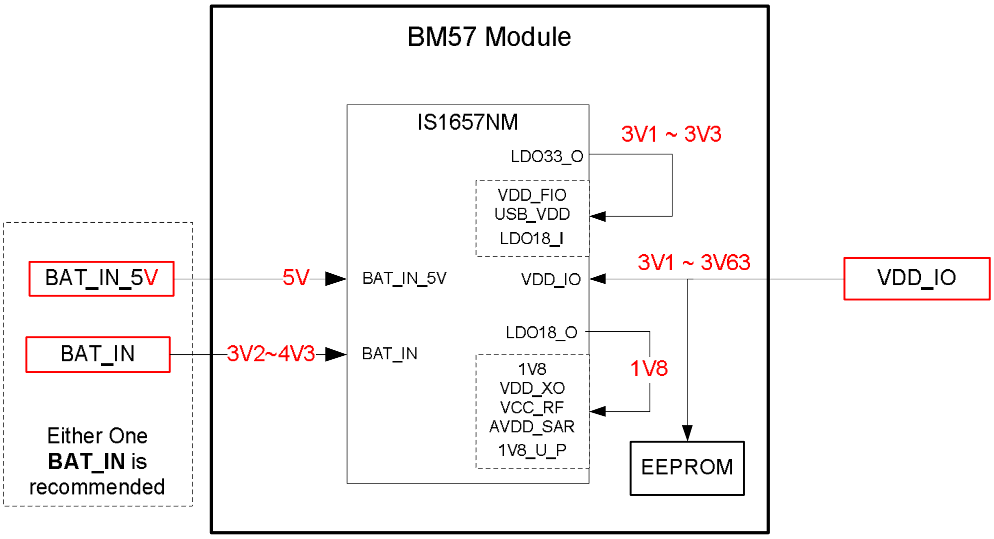
Note : After RESET , the firmware code of module will define attribute of I/O. There will be pulse which exists on I/O pin. Please at least wait for 1s to control Module I/O.

3. Hardware Architecture

Block Diagram


RTX
(Class 2)
Antenna
IS1657NM
I2C
EEPROM
UART/ HCI Interface
GPIO Control
16M XTAL
23 mm
10 mm

Power Tree


BM57 Module
IS1657NM
LDO33_O
3V1 ~ 3V3
VDD_FIO
USB_VDD
LDO18_I
BAT_IN_5V
5V
BAT_IN_5V
VDD_IO
3V1 ~ 3V63
VDD_IO
BAT_IN
3V2~4V3
BAT_IN
LDO18_O
1V8
1V8
VDD_XO
VCC_RF
AVDD_SAR
1V8_U_P
EEPROM
Either One
BAT_IN is
recommended

4. Compatibility Requirements

The BM57SPP03MC2 Bluetooth module shall pass the standard test plan, which includes hardware compatibility and reliability, and software compatibility test.

5. Environmental Requirements

5.1. Temperature

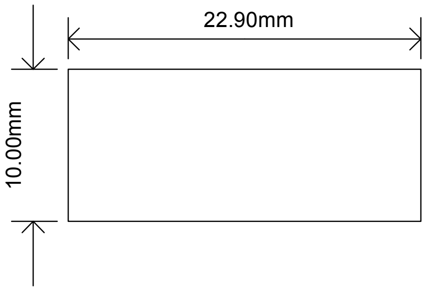
Conditions	Operating Temperature	Non-Operating Temperature
Minimum	-10 ℃	-40℃
Maximum	+70 ℃	+80 ℃

5.2. Humidity

Conditions	Operating Humidity	Non-Operating Humidity
Minimum	10%	5%
Maximum	90%	95%

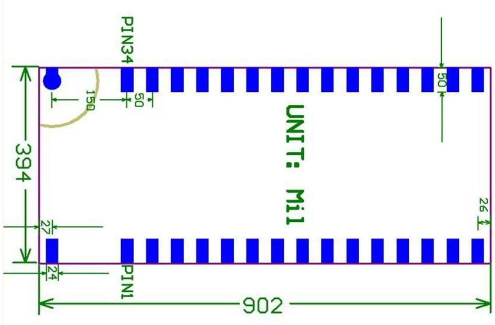
Appendix A: Dimension and Foot Print

1. Dimension


22.90mm
10.00mm

- Dimension: 22.9mm* 10mm* 1.86mm (Length* Width* Height)
- Tolerance: +/- 0.25 mm

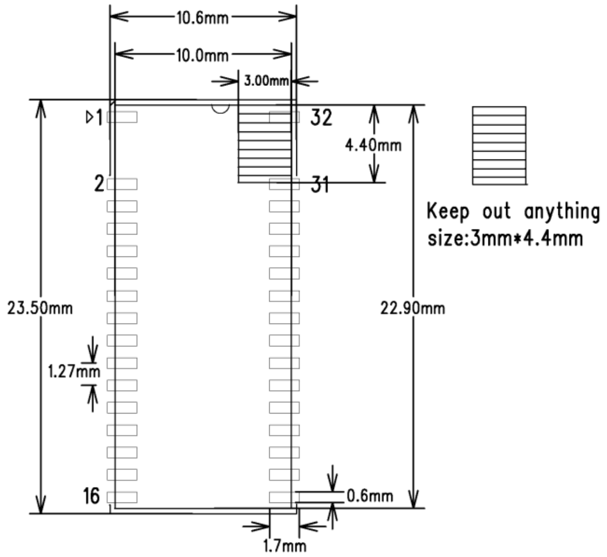
2. Module Foot Print


PIN34
150
50
50
UNIT: Mil
394
27
26
24
PIN1
902

Dimension: 902 mil* 394 mil

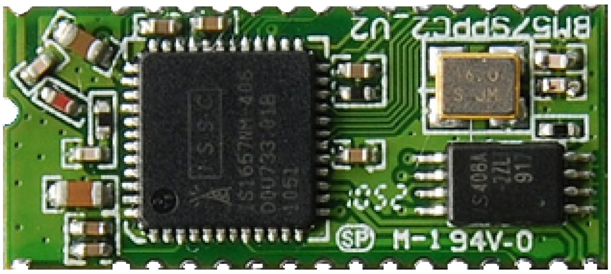
3. Suggested Load Board Foot Print

BM57 MODULE EVB FOOTPRINT

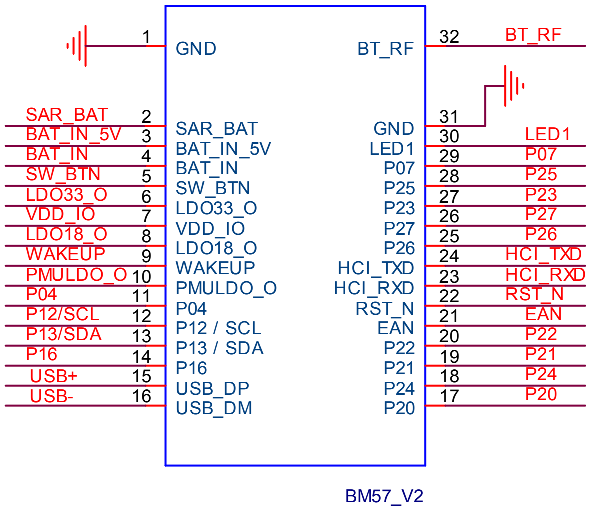

10.6mm
10.0mm
3.00mm
1
32
4.40mm
2
31
Keep out anything
size:3mm*4.4mm
23.50mm
22.90mm
1.27mm
16
0.6mm
1.7mm

module size:10mm*22.9mm
screen outline:10.6mm*23.5mm
pad size:1.7mm*0.6mm
Pad pitch:1.27mm

Appendix B: Product Image


BM57SPPC2_V2
ISSC
IS1657NM-406
D0U733.01B
1051
S408A
22L
917
iSSC
SP
M-1 94V-0

Appendix C: PIN Assignment


1 GND
SAR_BAT 2 SAR_BAT
BAT_IN_5V 3 BAT_IN_5V
BAT_IN 4 BAT_IN
SW_BTN 5 SW_BTN
LDO33_O 6 LDO33_O
VDD_IO 7 VDD_IO
LDO18_O 8 LDO18_O
WAKEUP 9 WAKEUP
PMULDO_O 10 PMULDO_O
P04 11 P04
P12/SCL 12 P12 / SCL
P13/SDA 13 P13 / SDA
P16 14 P16
USB+ 15 USB_DP
USB- 16 USB_DM
BT_RF 32 BT_RF
GND 31
LED1 30 LED1
P07 29 P07
P25 28 P25
P23 27 P23
P27 26 P27
P26 25 P26
HCI_TXD 24 HCI_TXD
HCI_RXD 23 HCI_RXD
RST_N 22 RST_N
EAN 21 EAN
P22 20 P22
P21 19 P21
P24 18 P24
P20 17 P20
BM57_V2

Pin No.	I/O	Name	Description
1	P	GND	Ground
2	I	SAR_BAT	Reserved
3	I	BAT_IN_5V	5V power input
4	I	BAT_IN	3.3V power input
5	I	SW_BTN	Reserved
6	P	LDO33_O	3V3 LDO output
7	P	VDD_IO	Main power supply
8	P	LDO18_O	LDO18 output
9	I	**WAKEUP**	**Wakeup BM57 from Shutdown State. (Low Active)** **It is only valid while BM57 into Shutdown State. Internally Pull High**
10	P	PMULDO_O	Output of PMULDO. Reserved
11	O	**P04**	**UART_TX_IND:** **H: BM57 indicate UART data will be transmitted out after a certain timing (setting by EEPROM, default 5 ms)** **L: Otherwise.** **STATUS_IND_2: BM57 State indication , refer to P22**
12	I/O	P12/ SCL	I2C_SCL, Reserved
13	I/O	P13/ SDA	I2C_SDA, Reserved
14	I/O	P16	EEPROM WP
15	I/O	USB_DP	Reserved
16	I/O	USB_DM	Reserved
17	I	P20	System configuration, refer to P2_4, **No drive under APP Mode**

Pin No.	I/O	Name	Description
18	I	P24	Boot mode selection (**No drive under APP Mode**) P2_0/ P2_4: HH → Application LL → Boot mode LH → HCI UART mode for testing and system configuration.
19	O	P21	Reserved
20	O	**P22**	**STATUS_IND:** **Bluetooth link status indication** **P22/P04: HH → Power default value and Shutdown State.** **P22/P04: HL → Access State.** **P22/P04: LL → Link State w/o UART_TXD.** **P22/P04: LH → Link State with UART_TXD**.
21	I	EAN	ROM/ Flash selection. (**No drive under APP Mode**) H: ROM code; L: Flash code, Internally Pull Low On Module, Please refer to page_16
22	I	**RST_N**	**External reset input (Low Active), clock period 62.5n at least.**
23	I	**HCI_RXD**	UART_RXD , Internally Pull High
24	O	**HCI_TXD**	UART_TXD , , CMOS Output , Initial State is high and different from GPIO.
25	I	**P26**	**UART_CTS:** **UART Flow Control- set HIGH to disables TX transmitter.**
26	O	**P27**	**UART_RTS:** **UART Flow Control- go HIGH to disable host transmitter.**
27	I	**P23**	**LINK_DROP:** Internally Pull High **Host_MCU ask to drop SPP link under Link State;** **One low pulse with 10 ms duration low signal to trigger SPP disconnection.** **Otherwise it will be set as high always.**
28	I	**P25**	**Pairing Key:** Internally Pull High **Device will enter Standby Mode after pull low over 240ms.**
29	I	**P07**	**UART_RX_IND:** Internally Pull High **L: Inform BM57 that UART data will be transmitted out after 1 ms** **H: Others.**
30	O	**LED1**	**LED1 driver**
31	P	GND	Ground
32	RI/O	BT_RF	RF Port

Note : I = Input , O = Output , P = Power , G = Ground

Appendix D: Reflow Profile

1.) Follow: IPC/JEDEC J-STD-020 C

4. Condition:

Average ramp-up rate (217℃ to peak): 1~2℃/sec max.

Preheat：150~200C、60~180 seconds

Temperature maintained above 217℃ : 60~150 seconds

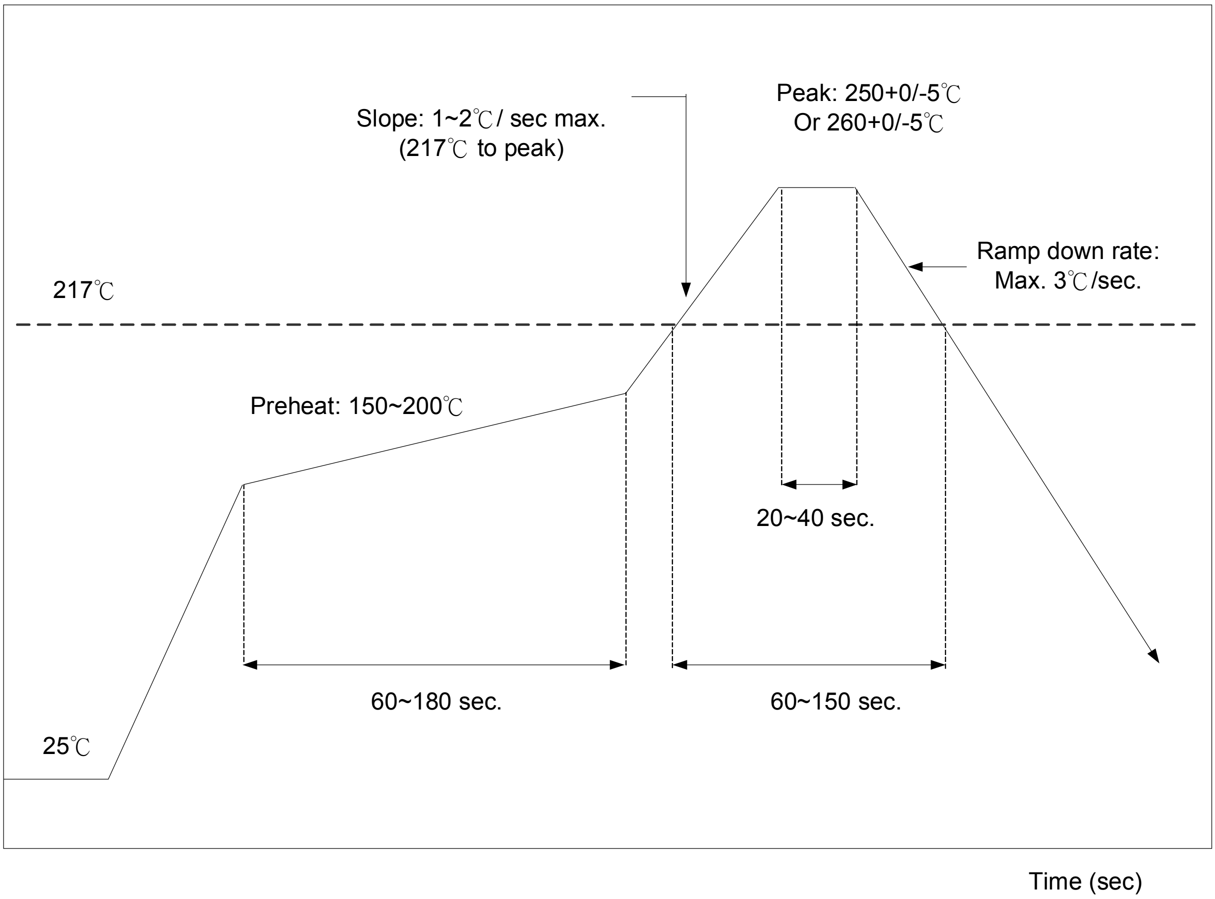
Time within 5℃ of actual peak temperature: 20 ~ 40 sec.

Peak temperature：250+0/-5℃ or 260+0/-5℃

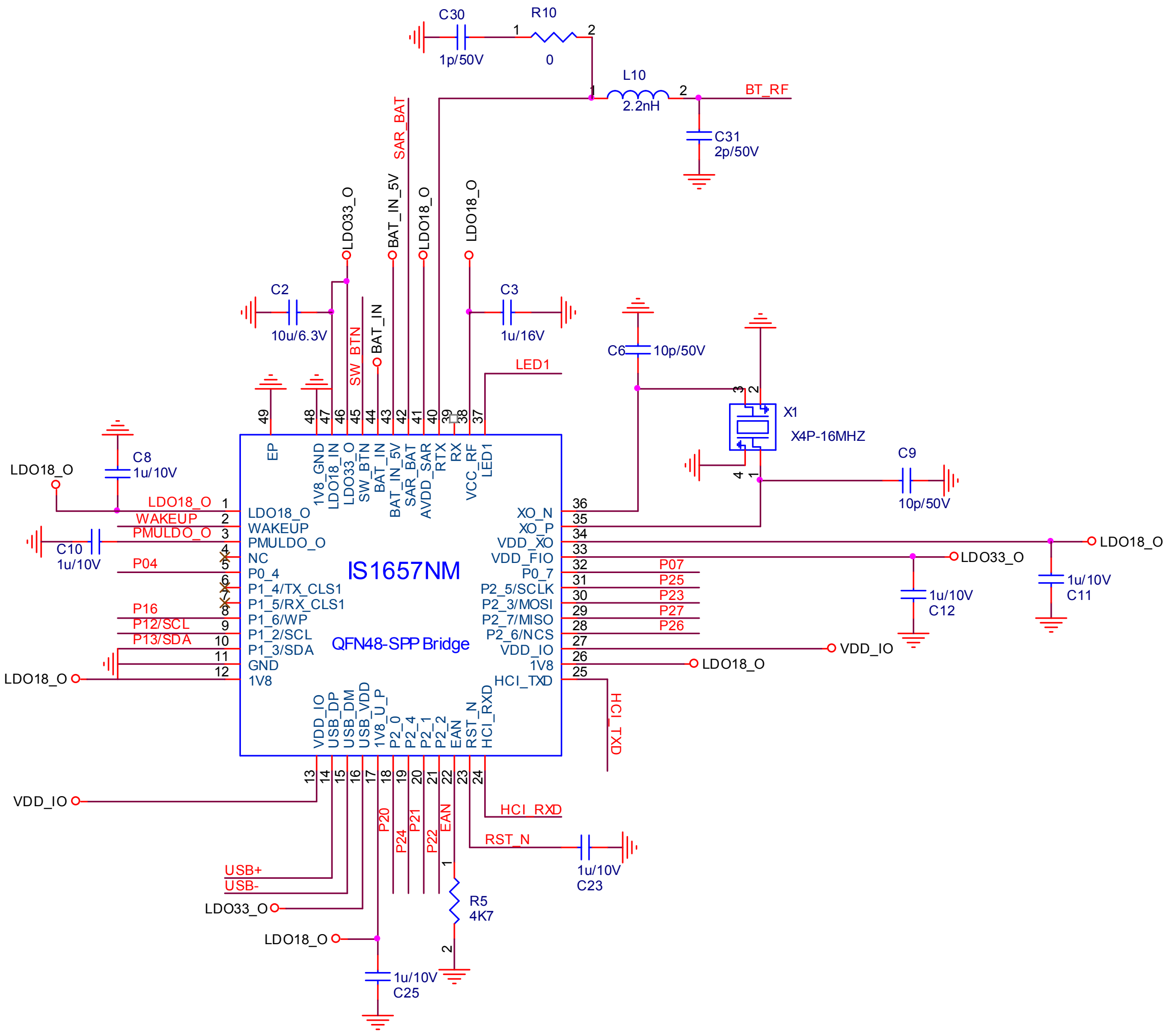
Ramp-down rate : 3℃/sec. max.

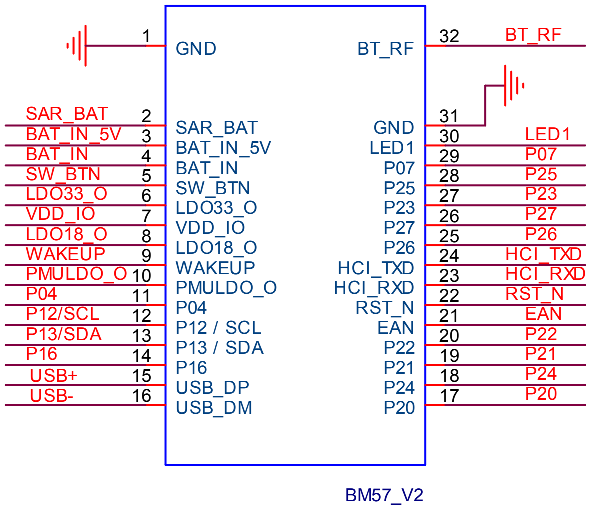
Time 25℃ to peak temperature : 8 minutes max.

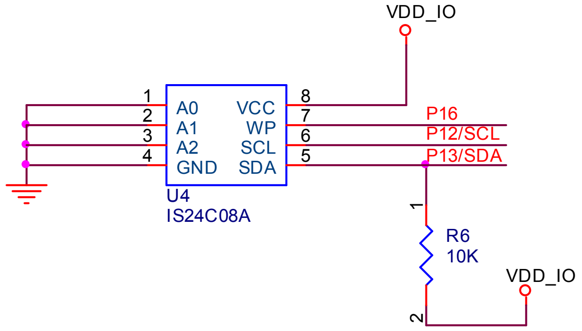
Cycle interval：5 minus



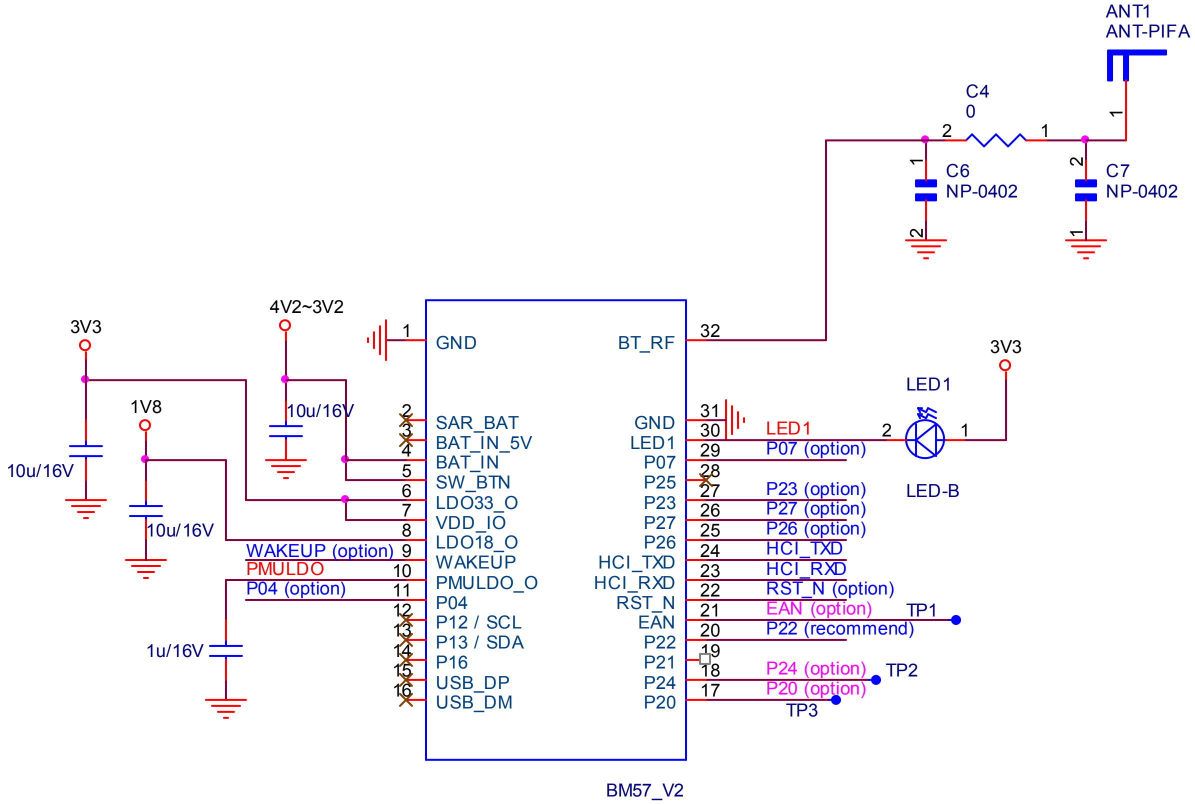
Appendix E: Schematic


IS1657NM
QFN48-SPP Bridge
C30
1p/50V
R10
0
L10
2.2nH
BT_RF
C31
2p/50V
SAR_BAT
LDO33_O
BAT_IN_5V
LDO18_O
LDO18_O
C2
10u/6.3V
C3
1u/16V
SW_BTN
BAT_IN
LED1
C6
10p/50V
X1
X4P-16MHZ
C9
10p/50V
C8
1u/10V
LDO18_O
C10
1u/10V
WAKEUP
PMULDO_O
P04
P16
P12/SCL
P13/SDA
LDO18_O
EP
1V8_GND
LDO18_IN
LDO33_O
SW_BTN
BAT_IN
BAT_IN_5V
SAR_BAT
AVDD_SAR
RTX
RX
VCC_RF
LED1
LDO18_O
WAKEUP
PMULDO_O
NC
P0_4
P1_4/TX_CLS1
P1_5/RX_CLS1
P1_6/WP
P1_2/SCL
P1_3/SDA
GND
1V8
XO_N
XO_P
VDD_XO
VDD_FIO
P0_7
P2_5/SCLK
P2_3/MOSI
P2_7/MISO
P2_6/NCS
VDD_IO
1V8
HCI_TXD
P07
P25
P23
P27
P26
LDO18_O
LDO33_O
1u/10V
C12
1u/10V
C11
VDD_IO
LDO18_O
HCI_TXD
VDD_IO
USB_DP
USB_DM
USB_VDD
1V8_U_P
P2_0
P2_4
P2_1
P2_2
EAN
RST_N
HCI_RXD
VDD_IO
P20
P24
P21
P22
EAN
HCI_RXD
RST_N
1u/10V
C23
USB+
USB-
LDO33_O
LDO18_O
R5
4K7
1u/10V
C25


GND
BT_RF
BT_RF
SAR_BAT
BAT_IN_5V
BAT_IN
SW_BTN
LDO33_O
VDD_IO
LDO18_O
WAKEUP
PMULDO_O
P04
P12/SCL
P13/SDA
P16
USB+
USB-
SAR_BAT
BAT_IN_5V
BAT_IN
SW_BTN
LDO33_O
VDD_IO
LDO18_O
WAKEUP
PMULDO_O
P04
P12 / SCL
P13 / SDA
P16
USB_DP
USB_DM
GND
LED1
P07
P25
P23
P27
P26
HCI_TXD
HCI_RXD
RST_N
EAN
P22
P21
P24
P20
LED1
P07
P25
P23
P27
P26
HCI_TXD
HCI_RXD
RST_N
EAN
P22
P21
P24
P20
BM57_V2


VDD_IO
1
2
3
4
A0
A1
A2
GND
VCC
WP
SCL
SDA
8
7
6
5
P16
P12/SCL
P13/SDA
U4
IS24C08A
1
R6
10K
2
VDD_IO

Appendix F: Reference Schematic


ANT1
ANT-PIFA
1
C4
0
2
1
1
2
C6
NP-0402
2
1
C7
NP-0402
3V3
4V2~3V2
1V8
10u/16V
10u/16V
10u/16V
1u/16V
1
GND
BT_RF
32
2
SAR_BAT
3
BAT_IN_5V
4
BAT_IN
5
SW_BTN
6
LDO33_O
7
VDD_IO
8
LDO18_O
WAKEUP (option)
9
WAKEUP
PMULDO
10
PMULDO_O
P04 (option)
11
P04
12
P12 / SCL
13
P13 / SDA
14
P16
15
USB_DP
16
USB_DM
GND
31
LED1
30
P07
29
P25
28
P23
27
P27
26
P26
25
HCI_TXD
24
HCI_RXD
23
RST_N
22
EAN
21
P22
20
P21
19
P24
18
P20
17
LED1
P07 (option)
P23 (option)
P27 (option)
P26 (option)
HCI_TXD
HCI_RXD
RST_N (option)
EAN (option)
P22 (recommend)
P24 (option)
P20 (option)
TP1
TP2
TP3
3V3
LED1
2
1
LED-B
BM57_V2

Test Point: TP1, TP2, TP3 are recommended for future firmware, EEPROM table update if the module are welded on load board.

Appendix G: Label Information

TBA

Appendix H: Packaging Information

TBA

Appendix I: Reversion History

Version	Date	History
0.6	2011/03/09	1. Add Tuart_r_ind, Tdrop_link timing 2. Add Foot print for layout information 3. Add power sequence information 4. Modify the P07 description 5. Update current consumption table
0.7	2011/05/05	1. Add baud rate error rate 2. Add detail items for power consumption 3. Add suggested load foot print and reference schematic 4. Testing Criterion
0.8	2011/5/30	Add terminal characteristics table
0.9	2011/6/10	Modify reference schematic
1.0	2011/8/4	Add P20, P24 timing sequence, and MCU do not Drive under APP Mode reminder.
1.1	2011/8/10	Add RST_N timing sequence
1.2	2011/11/29	Add P25 Pairing Key define
1.3	2012/02/16	Add tolerance of dimension
1.4	2012/06/08	Add the maximum range of Deep mower Down Mode with 0.5 mA
1.5	2012/9/13	Modified the tolerance of PCB dimension
1.6	2012/12/03	Modify RST_N timing in page_8
1.7	2013/04/23	Modification of wording. typo correction.
1.8	2013/07/25	Modify the recommended operation voltage of VDDIO at page_4 Add power consumption test condition description at page_5 Add BAT_IN Ripple Tolerance Specifications at page_5 Add Note Description at page_8 Modify Power Tree Block Diagram at page_9 Modify Some Pin Description at page_13,14 Add Note Description at page_14
1.9	2013/08/19	Modify Actual Baud Rate in page_6