Bluetooth® + Wireless LAN Combo Module
MBH7BWZ04 (ES2) DataSheet

Rev 1.0
Oct 2009

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1 Introduction

This datasheet describes the MBH7BWZ04 Bluetooth® + Wireless LAN module.

This MBH7BWZ04 operates in the 2.4GHz ISM (Industrial, Scientific, and Medical) band.

This is compliant with the specification version 2.1+EDR of Bluetooth wireless technology. Transfer rate can be tripled in using 3Mbps EDR (Enhanced Data Rate), compared to using Basic Rate. MBH7BWZ04 also has IEEE802.11b/g Wireless LAN functionality. Wireless LAN block has security functions - "64/128-bit WEP, WPA (TKIP), WPA2 (AES-CCMP)". This block controls "RF antenna switch" for actualizing BT+WLAN-coexistence.

2 Features

Common

- Power Supply : 3.0～3.4V DC
- Bluetooth Coexistence support
- Surface mount, LGA type (60pin+Center GND pin)
- Compatible with Pb-free solder processing
- RoHS Compliant
- Miniaturized package: 10.0 x 11.2 x 1.4 mm
- Antenna port: Single RF I/O port
- Built-in Oscillator
- Low power consumption

Bluetooth

- Bluetooth® Specification Version 2.1+EDR Compliant
- Cambridge Silicon Radio BlueCore™4-ROM (A07)
- Transmit Power Class2 (4dBm MAX)
- Host Interface: UART(H4,H5,BCSP), USB(H2)
- RF Channels: f=2402+k MHz, k=0,…,78 (79ch)
- Modulation: 0.5 BT Gaussian-filtered 2FSK(Basic Rate 1Mbps)

    Modulation index: 0.25 - 0.3
- Symbol Rate: 1Mbps (Basic Rate),2Mbps (EDR 2Mbps),3Mbps (EDR 3Mbps)

Wireless LAN

- IEEE standard 802.11b/802.11g Compliant
- Frequency Range: 2400 – 2497 MHz

 (1 – 13 channel (IEEE802.11/11b/11g))
- Modulation Technique: Direct Sequence Spread Spectrum (CCK, DQPSK, DBPSK)

 Orthogonal Frequency Division Multiplexing (64QAM, 16QAM, DQPSK, DBPSK)
- Transmission Rate: 1 Mbps, 2 Mbps (802.11), 5.5 Mbps, 11 Mbps (802.11b)

6 Mbps, 9 Mbps, 12 Mbps, 18 Mbps, 24 Mbps, 36 Mbps, 48 Mbps, 54 Mbps (802.11g)

- Host Interface: SDIO / Generic SPI (G-SPI)
- Security: 64/128-bit WEP, WPA (TKIP), WPA2 (AES-CCMP)

３ Block diagram
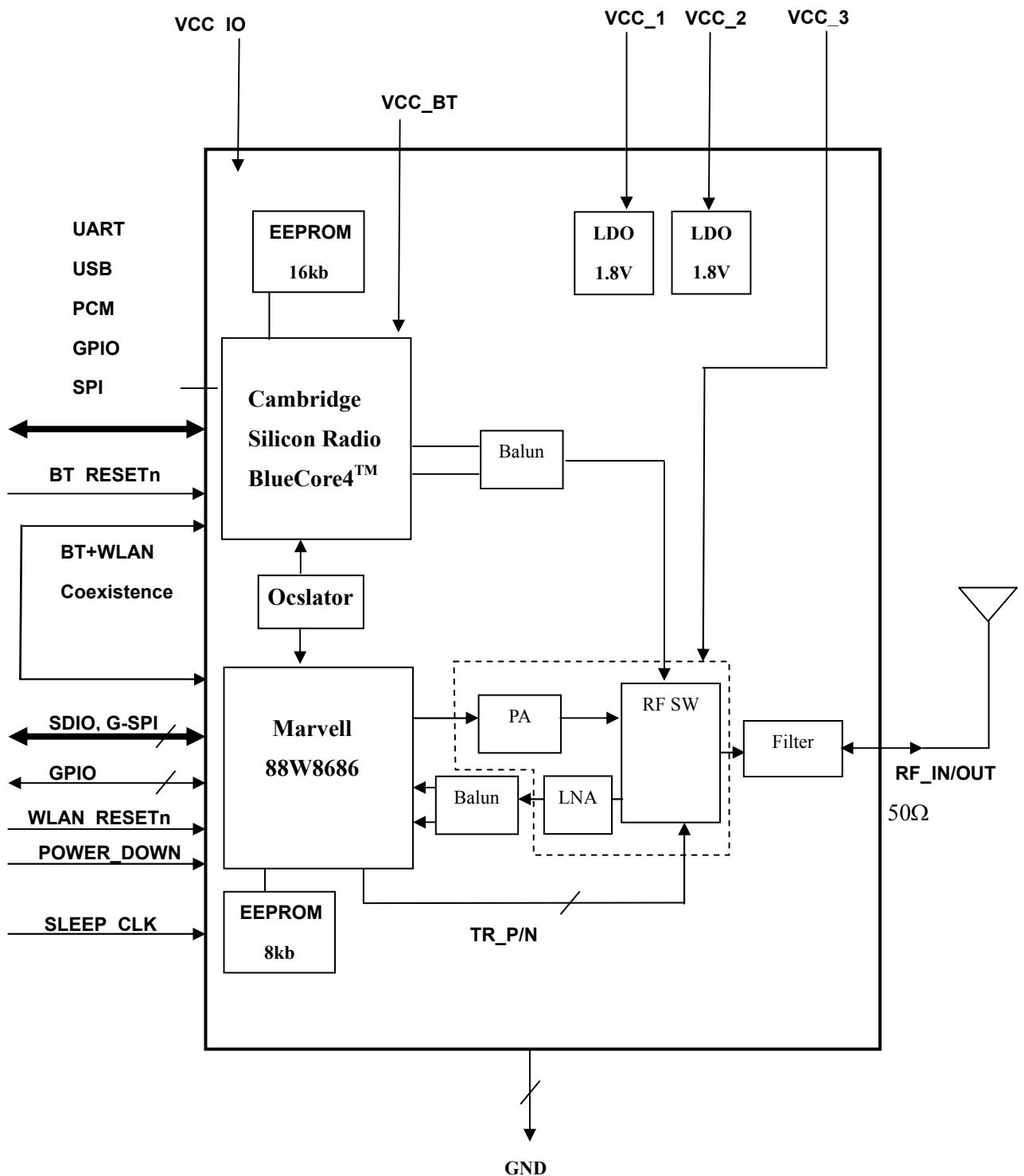
4 Electrical Characteristics

4 - 1   Absolute Maximum Rating

Symbol	Parameter	Min	Typ	Max	Unit
VCC_3	Power Supply Voltage with respect to GND	---	---	3.5	V
VCC_1, VCC_2	Power Supply Voltage with respect to GND	---	---	5.0	V
VCC_BT	Power Supply Voltage with respect to GND	---	---	5.0	V
VCC_IO	Power Supply Voltage with respect to GND	---	---	3.5	V
$T_{STORAGE}$	Storage Temperature	-40	---	+85	°C

4 - 2   Recommendable Operating Condition

Symbol	Parameter	Min	Typ	Max	Unit
VCC_3	Power Supply Voltage with respect to GND	2.95	3.3	3.4	V
VCC_1, VCC_2	Power Supply Voltage with respect to GND	2.9	3.3	3.6	V
VCC_BT	Power Supply Voltage with respect to GND	2.9	3.3	3.6	V
VCC_IO *Note.4-2-1	Power Supply Voltage with respect to GND	1.7	1.8or3.3	3.4	V
T_A	Ambient operating temperature	-20	+25	+70	°C

*Note.4-2-1: USB specification dictates that minimum output high voltage for USB data line is 2.8V.
When USB is selected as Bluetooth host interface, VCC_IO supply terminal must be 2.8V – 3.4V.
When the EEPROM for Bluetooth is configured (write operation), VCC_IO must be 2.7V - 3.4V.

4 - 3　I/O Terminal Characteristics

<div align="right">Vcc=3.3V, Ta=25±2°C</div>

Symbol	Parameter	Min	Typ	Max	Unit
V_{IL}	Input logic level Low	-0.3	-	0.6	V
V_{IH}	Input logic level High	0.7VCC_IO	-	VCC_IO+0.3	V
V_{OL}	Output logic level Low $I_{O=}$4mA	-	-	0.4	V
V_{OH}	Output logic level High I_O=-4mA	1.22(1.8V) 2.57(3.3V)	-		V

4-4 Bluetooth Part Specification

4-4-1. Transmitter   ~Basic Data Rate~

Vcc=3.3V, Ta=25±2°C

Items	Condition	Min	Typ	Max	Unit
RF transmit power	Maximum output	-6		4	dBm
RF power control range		-	30	-	dB
RF power range control resolution		-	5	-	dB
20dB bandwidth for modulated carrier		-	-	1	MHz
Initial Carrier Frequency Tolerance	DH1 mode	-75	-	+75	KHz
Carrier Frequency Drift	1 Slot	-25	-	+25	kHz
	3 Slot	-40	-	+40	kHz
	5 Slot	-40	-	+40	kHz
Modulation Characteristics	8 bit sequence 01010101	±115	-	-	KHz
	8 bit sequence 00001111 (Avg)	±140	-	±175	KHz
Adjacent Channel Power	|M-N|=2	-	-	-20	dBm
	|M-N|>=3	-	-	-40	dBm
Out of Band Spurious Emissions	30MHz --- 1GHz	-	-	-36	dBm
	1GHz --- 12.75GHz	-	-	-30	dBm
	1.8GHz --- 1.9GHz	-	-	-47	dBm
	5.15GHz --- 5.3GHz	-	-	-47	dBm

*Defined by the Bluetooth specification.

4-4-2. Transmitter ~Enhanced Data Rate~

Vcc=3.3V,Ta=25±2°C

Items	Condition	Min	Typ	Max	Unit
Maximum RF transmit power		-6	-	4	dBm
Relative transmit power		-4	-	1	dB
Carrier frequency stability		-	-	10	kHz
Modulation Accuracy	RMS DEVM	-	-	13	%
	99% DEVM	-	-	20	%
	Peak DEVM	-	-	25	%

*Defined by the Bluetooth specification.

4-4-3. Receiver   ~Basic Data Rate~

Vcc=3.3V, Ta=25±2°C

Items	Condition	Min	Typ	Max	Unit
Sensitivity at 0.1% BER	DH1 mode	-	-	-70	dBm
Sensitivity (single slot packets)	Input level = -70dBm DH1 mode	-	-	0.1	%
Sensitivity (multi-slot packets)	Input level = -70dBm DH5 mode	-	-	0.1	%
Maximum Input Level	Input level = -20dBm	-	-	0.1	%

*Defined by the Bluetooth specification.

4-4-4. Receiver   ~Enhanced Data Rate~

Vcc=3.3V, Ta=25±2°C

Items	Condition	Min	Typ	Max	Unit
Sensitivity at 0.01% BER	π/4 DQPSK	-	-	-70	dBm
	8DPSK	-	-	-70	dBm
Maximum received signal at 0.1% BER	π/4 DQPSK	-20	-	-	dBm
	8DPSK	-20	-	-	dBm

*Defined by the Bluetooth specification.

4-5 Wireless LAN Part Specification

Vcc=3.3V, Ta=25±2°C

Items		Condition	Min	Typ	Max	Unit
Transmit power levels	Channel 1-13	54 Mbps (64QAM) 48 Mbps (64QAM)	-	12.0	-	dBm
		36 Mbps (16QAM) 24 Mbps (16QAM) 18 Mbps (DQPSK) 12 Mbps (DQPSK) 9 Mbps (DBPSK) 6 Mbps (DBPSK)	-	15.0	-	dBm
		11 Mbps (CCK) 5.5Mbps (CCK) 2 Mbps (DQPSK) 1 Mbps (DBPSK)	-	16.0	-	dBm
802.11b Transmit spectrum mask	1st Side Lobe	1 Mbps (DBPSK)	-	-	-30	dBr
	2nd Side Lobe		-	-	-50	dBr
802.11g Transmit spectrum mask	11 MHz offset	6 Mbps (DBPSK)	-	-	-20	dBr
	20 MHz offset		-	-	-28	dBr
	30 MHz offset		-	-	-40	dBr
Transmit center frequency tolerance		54 Mbps (64QAM)	-25	-	25	ppm
Symbol clock frequency tolerance		54 Mbps (64QAM)	-25	-	25	ppm
Transmit power-on ramp		11 Mbps (CCK)	-	-	2	μs
Transmit power-down ramp		11 Mbps (CCK)	-	-	2	μs
RF carrier suppression		2 Mbps (DQPSK)	15	-	-	dB
EVM (Peak)		11 Mbps (CCK)	-	-	35	%
		1 Mbps (DBPSK)	-	-	35	%
EVM (RMS)		54 Mbps (64QAM)	-	-	-25	dB
		6 Mbps (DBPSK)	-	-	-5	dB
Receiver minimum input level sensitivity		54 Mbps (64QAM)	-	-	-65	dBm
		6 Mbps (DBPSK)	-	-	-82	dBm
		11 Mbps (CCK)	-	-	-76	dBm
		1 Mbps (DBPSK)	-	-	-85	dBm
Receiver maximum input level		54 Mbps (64QAM)	-20	-	-	dBm
		11 Mbps (CCK)	-10	-	-	dBm
Receiver adjacent channel rejection		54 Mbps (64QAM)	-1	-	-	dB
		11 Mbps (CCK)	35	-	-	dB

5 Pin Description

Bluetooth Part

Name	No.	Function	Type	External Connection
BT_UART_TX	52	UART data output (active high)	CMOS output,tri-stable (weak internal pull-up) I/O Voltage: VCC_IO	UART RxD (or NC)
BT_UART_RX	55	UART data input (active high)	CMOS input (weak internal pull-down) I/O Voltage: VCC_IO	UART TxD (or NC)
BT_UART_CTS	53	UART Clear To Send (active low)	CMOS input (weak internal pull-down) I/O Voltage: VCC_IO	UART RTS (or NC)
BT_UART_RTS	48	UART Request To Send (active low)	CMOS output,tri-statable (weak internal pull-up) I/O Voltage: VCC_IO	UART CTS (or NC)
BT_PCM_IN	44	PCM Synchronous data input	CMOS input (weak internal pull-down) I/O Voltage:1.8V(VDD_1.8VD_LDO1)	PCM output (Codec) or NC
BT_PCM_CLK	50	PCM Synchronous data clock	Bi-directional (weak internal pull-down) I/O Voltage:1.8V(VDD_1.8VD_LDO1)	PCM Clock (Codec) or NC
BT_PCM_SYNC	54	PCM Synchronous data sync	Bi-directional (weak internal pull-down) I/O Voltage:1.8V(VDD_1.8VD_LDO1)	PCM Frame SYNC (Codec) or NC
BT_PCM_OUT	56	PCM Synchronous output	CMOS output,tristatable (waek internal pull-down) I/O Voltage:1.8V(VDD_1.8VD_LDO1)	PCM input (Codec) or NC
BT_SPI_CSB	10	SPI chip select (active low)	CMOS input (weak internal pull-up) I/O Voltage:1.8V(VDD_1.8VD_LDO1)	SPI chip select output or NC
BT_SPI_MISO	12	SPl data output from MBH7BWZ04	CMOS output,tristatable (waek internal pull-down) I/O Voltage:1.8V(VDD_1.8VD_LDO1)	SPI data output or NC
BT_SPI_CLK	9	SPI clock	CMOS input (weak internal pull-down) I/O Voltage:1.8V(VDD_1.8VD_LDO1)	SPI clock output or NC
BT_SPI_MOSI	11	SPI data input into MBH7BWZ04	CMOS input (weak internal pull-down) I/O Voltage:1.8V(VDD_1.8VD_LDO1)	SPI clock output or NC
BT_RESETn	43	Reset input for Bluetooth	CMOS input (weak internal pull-up)	Reset if "Low". Input debounced so must be low for 5 ms or more to cause a reset
BT_USB_D+	51	USB Data+ (Bluetooth host interface)	Bi-directional I/O Voltage: VCC_IO	USB Data+ or NC
BT_USB_D-	49	USB Data- (Bluetooth host interface)	Bi-directional I/O Voltage: VCC_IO	USB Data- or NC
BT_GPIO_0	7	Programmable Line For Bt+WLAN Coexistence	Bi-directional (programmable strength internal pull-up/pull-down) I/O Voltage: VCC_IO	Refer to section 6

Name	No.	Function	Type	External Connection
BT_GPIO_1	8	Programmable Line	Bi-directional (programmable strength internal pull-up/pull-down) I/O Voltage: VCC_IO	Programmable Line or NC
BT_GPIO_4	19	Programmable Line For BT+WLAN Coexistence	Bi-directional (programmable strength internal pull-up/pull-down) I/O Voltage:1.8V(VDD_1.8VD_LDO1)	Programmable Line or NC
BT_GPIO_7	3	Programmable Line For BT+WLAN Coexistence	Bi-directional (programmable strength internal pull-up/pull-down) I/O Voltage:1.8V(VDD_1.8VD_LDO1)	Refer to section 6

*) SPI (Bluetooth) is used for accessing to EEPROM, for debugging, or for recovering module. Putting the connecting terminal of SPI is recommended.

Wireless LAN Part

Name	No.	Function	Type	External Connection
WLAN_SD_CMD/ SPI_SDI/	23	G-SPI mode: G-SPI Data Input SDIO 4-bit mode: Command/Response SDIO 1-bit mode: Command Line SDIO SPI mode: Data Input	Bi-directional I/O Voltage: VCC_IO	SDIO Bus interface or G-SPI Device interface
WLAN_SD_CLK/ SPI_CLK/	27	G-SPI mode: G-SPI Clock Input SDIO 4-bit mode: Clock Input SDIO 1-bit mode: Clock Input SDIO SPI mode: Clock Input	Bi-directional I/O Voltage: VCC_IO	SDIO Bus interface or G-SPI Device interface
WLAN_SD_DAT0/ SPI_SCSn	26	G-SPI mode: G-SPI Chip Select Input (active low) SDIO 4-bit mode: Data Line Bit [0] SDIO 1-bit mode: Data Line SDIO SPI mode: Data Output	Bi-directional I/O Voltage: VCC_IO	SDIO Bus interface or G-SPI Device interface
WLAN_SD_DAT1/ SPI_SDO	22	G-SPI mode: G-SPI Data Output SDIO 4-bit mode: Data Line Bit [1] SDIO 1-bit mode: Interrupt SDIO SPI mode: Reserved	Bi-directional I/O Voltage: VCC_IO	SDIO Bus interface or G-SPI Device interface
WLAN_SD_DAT2/ WLAN_SPI_SINTn	25	G-SPI mode: G-SPI Interrupt Output (active low) SDIO 4-bit mode: Data Line Bit [2] or Read Wait (optional) SDIO 1-bit mode: Read Wait (optional) SDIO SPI mode: Reserved	Bi-directional I/O Voltage: VCC_IO	SDIO Bus interface or G-SPI Device interface
WLAN_SD_DAT3	24	SDIO 4-bit mode: Data Line Bit [3] SDIO 1-bit mode: Reserved SDIO SPI mode: Card Select (active low)	Bi-directional I/O Voltage: VCC_IO	SDIO Bus interface
WLAN_GPIO_1/ WLAN_LED	32	General Purpose Input/Output Wireless LAN LED output (strap pin). Transmit power or receive ready LED.	Bi-directional (Internal pull-up) I/O Voltage: VCC_IO	Programmable Line or LED, NC
WLAN_GPIO_2	35	General Purpose Input/Output	Bi-directional (Internal pull-up) I/O Voltage: VCC_IO	Programmable Line or NC
WLAN_GPIO_3	37	General Purpose Input/Output	Bi-directional (Internal pull-up) I/O Voltage: VCC_IO	Programmable Line or NC
WLAN_GPIO_4 / WLAN_Module_wake_up	28	General Purpose Input/Output WLAN MAC wake-up from deep-sleep input / Interrupt input	Bi-directional (Internal pull-up) I/O Voltage: VCC_IO	Programmable Line or NC
WLAN_GPIO_6	36	General Purpose Input/Output	Bi-directional (Internal pull-up) I/O Voltage: VCC_IO	Programmable Line or NC
WLAN_WL_ACTIVE	20	Bluetooth WLAN Active For BT+WLAN Coexistence	Output I/O Voltage: 1.8V	NC For monitor terminal of co-existence.
WLAN_BT_PRIORITY	4	Bluetooth WLAN Active For BT+WLAN Coexistence	Input **I/O Voltage: 1.8V**	Refer to section 6

Name	No.	Function	Type	External Connection
WLAN_BT_STATE	21	Bluetooth WLAN Active For BT+WLAN Coexistence	Input I/O Voltage: 1.8V	NC For monitor terminal of co-existence.
WLAN_RESETn	39	Reset for wireless LAN	Input (active low, Internal pull-up) I/O Voltage: VCC_IO	Programmable Line or Connect to GND through 0.1uF capacitor
WLAN_PDn	41	Full power down	Input (active low, Internal pull-up) I/O Voltage: VCC_IO	Programmable Line or NC
WLAN_SLEEP_CLK	38	Clock Input for External Sleep Clock NOTE: SLEEP_CLK is used by the WLAN. The input clock frequency is typically 32.768 kHz.	Input I/O Voltage: VCC_IO	NC or Slow clock Line When this pin is NC, internal slow clock can be used.

RF part, Power Supply, and GND

Name	No.	Function	Type	External Connection
RF_IO	58	Antenna RF port (50Ω)	RF	Antenna (50Ω)
VCC_IO	34	1.8V/3.3V Host Supply For UART/USB/SDIO/SPI(WLAN)	Power Supply	3.3V or 1.8V Power Supply for Host Interface
VCC1	40	3.3V Power Supply for internal voltage regulator. (WLAN analog power supply)	Power Supply	3.3V Power Supply
VCC2	13	3.3V Power Supply for internal voltage regulator. (WLAN digital & VCC_BT_PADS_OUT)	Power Supply	3.3V Power Supply
VCC3	46	3.3V Power Supply for WLAN PA.	Power Supply	3.3V Power Supply
VCC_BT	5	3.3V Power Supply for BT	Power Supply	3.3V Power Supply
VCC_1.8VD_LDO2	15	1.8V Internal Regulator output	Power Output	Connect to GND via 1uF capacitor.
VCC_1.8VD_LDO1	14	1.8V Internal Regulator output	Power Output	Connect to GND via 1uF capacitor.
NC	2,18,29,30, 33,59, 60			
GND	1, 6, 16, 17, 31, 42,45, 47, 57, 61-90	Ground	Ground	GND

\<Bottm View\>
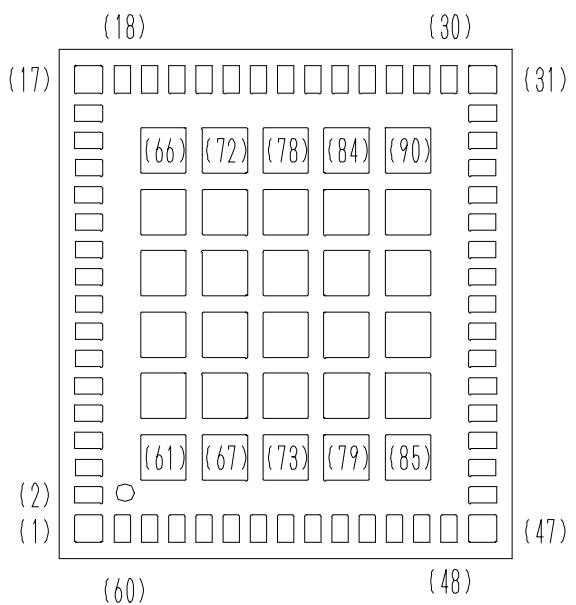
6 The Connecting Diagram for BT+WLAN Coexistence

6-1 3-wire (PTA) mode

3-wire (PTA: Packet traffic arbitration ／ IEEE 802.15.2) mode is standard BT+WLAN Coexistence scheme.
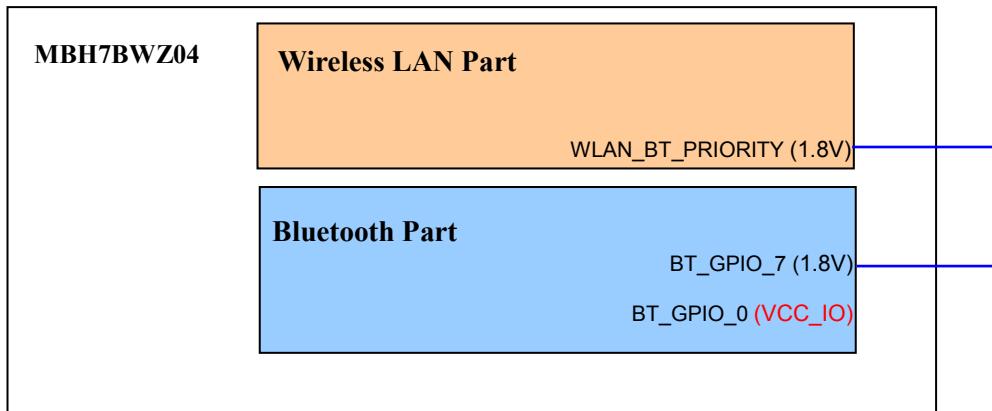

Figure 6-1. 3-wire (PTA) mode wire connection

7 Reset Timing

7-1 WLAN part Reset Timing (1)

When host controls RESETn pin (Recommended)

VCC_IO (Pin No.34)

VCC1-3 (Pin No.40,13,46)

RESETn (Pin No.39)

More than **550 msec**   T1

1 msec < T1 < 20 msec
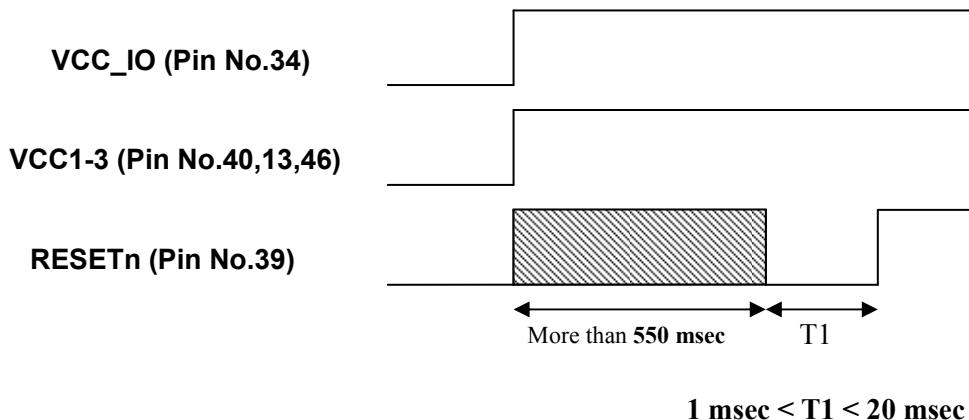
7-2 WLAN part Reset Timing (2)

When host does not control RESETn pin

VCC_IO (Pin No.34)

**VCC1-3 (Pin No.40,13,46)**

RESETn (Pin No.39)

T2

T2 >600 usec
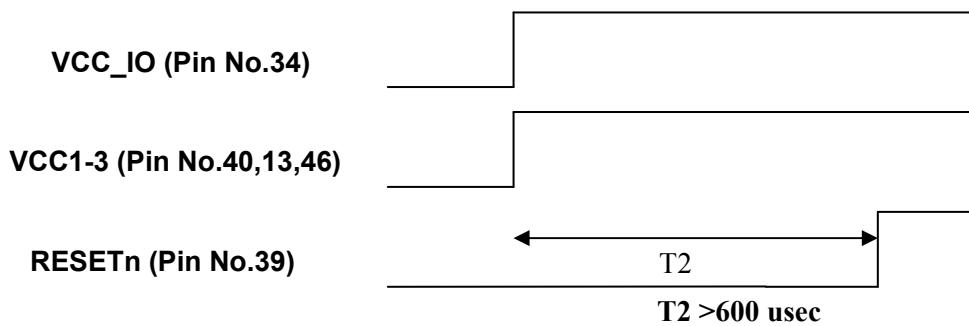
*Note: **If host cannot access the RESETn, the T2 delay should be added with a 0.1uF capacitor to ground. See sample schematic below.**

RESETn (39pin)

MBH7BWZ04
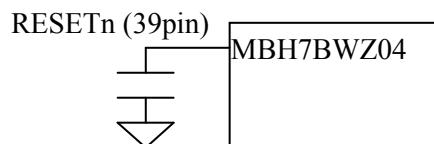
Sample schematic

7 - 3　Bluetooth part Reset Timing (1)

<u>Power on RESET</u>

VCC_IO (Pin No.34)

VCC_BT (Pin No.5)

Power on reset when VCC_BT=1.5~1.7V
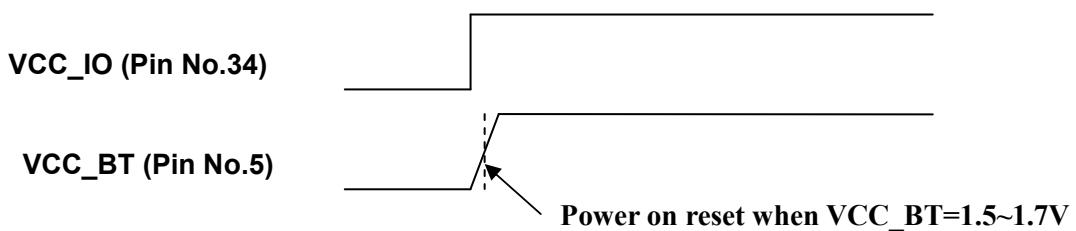
*After VCC_IO is supplied, power-on reset must occur.

7 - 4　Bluetooth part Reset Timing (2)

<u>When host controls RESETn pin</u>

VCC_IO (Pin No.34)

VCC_BT (Pin No.5)

BT_RESETn (Pin No.43)

T3

T3 > 5 msec
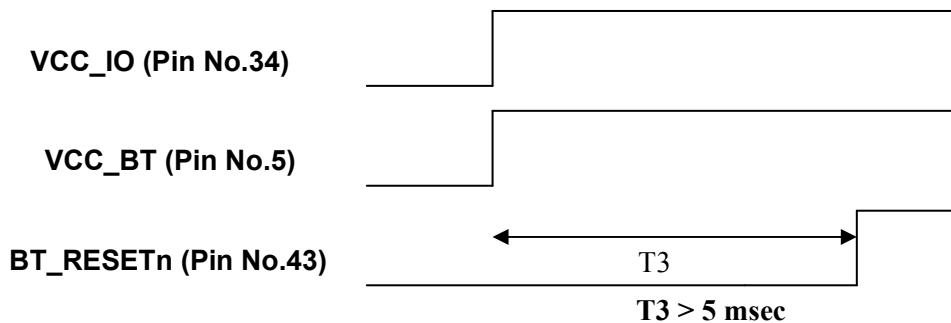
*BT_RESETn must be low for >5msec to cause a reset.

8 Mechanical Characteristics

8 - 1　Appearance and Dimensions
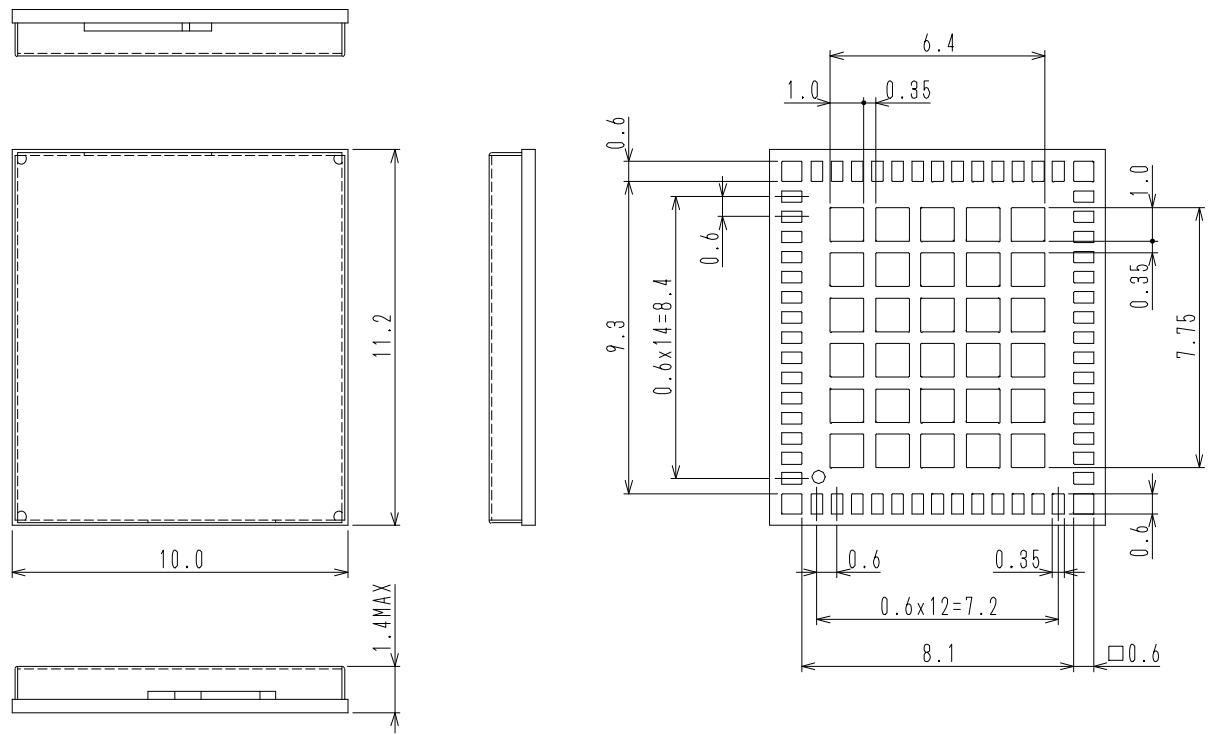
Unit:　mm

９ Reflow profile
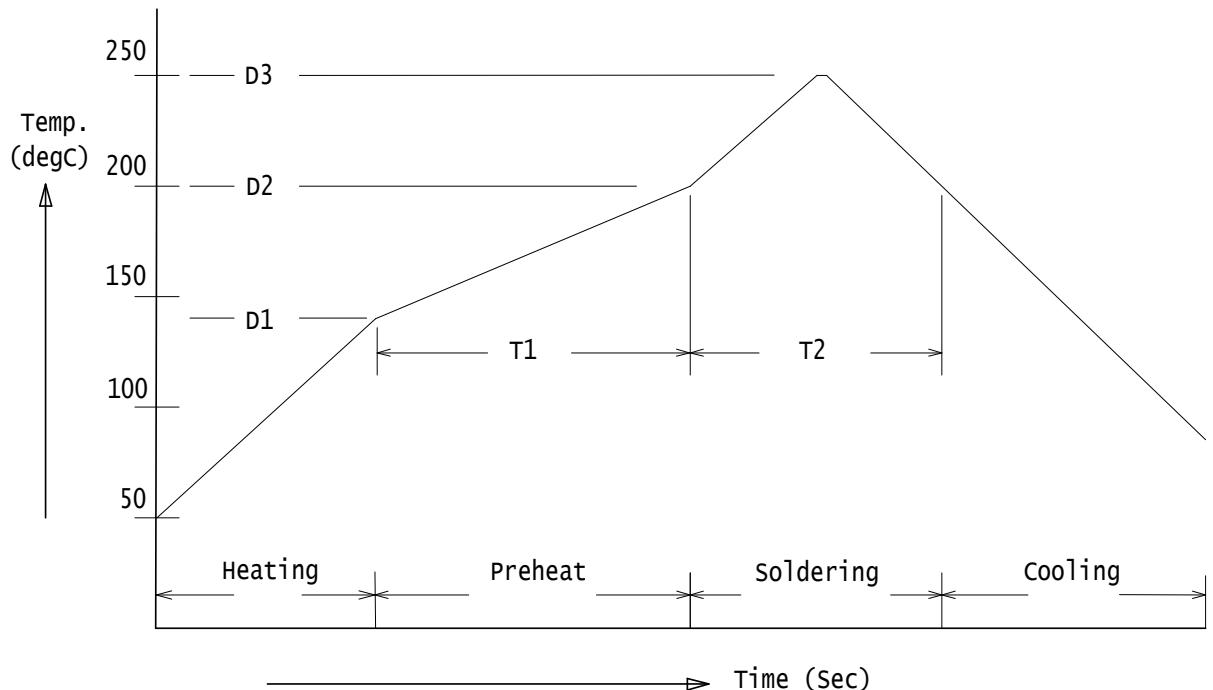
Note: * Reflow soldering is recommended two times maximum.

* If your soldering conditions are different from our recommendation, consult with us.

No	Item	Temperature (°C)	Time (sec)
1	Pre-heat	D1: 140 ~ D2: 200	T1: 60 ~ 120
2	Soldering	D2: >= 200	T2: 80 max
3	Peak-Temp	D3: 250°C max	

１０ Abbreviations

Abbreviation	Definition
BT	Bluetooth low energy wireless technology
WLAN	Wireless LAN

1 1   Version History

Version	Contents change	Date
0.1	Preliminary Edition	10 Nov 2008
0.2	Updated for ES2 design	28 Jul 2009
0.2-2	Correction of clerical error (company name)	11 Sep 2009
1.0	Delete TBD Added Reset Timing and Reflow Profile	14 Oct 2009