Document No.   Rev.   2.8

Product Code   WM-G-MR-09
Product No.

Product Specification
of
WM-G-MR-09

Wireless LAN Module

SOURCE ORGANIZATION: USI   WP/RD/WM/HW1

HW Prepared by：   Camus Chen   Date: 2009/01/09

Checked by：   Date:

Approved by：   Date:

Concurrence (MD):   Date:

Concurrence (PM):   Date:

1   REVISION HISTORY

Version No.	Revised Date	Revised by	Description	Notes
1.0	2007-05-03	Jaddy Chen	Preliminary specification released	
1.1	2007-07-03	Jaddy Chen	Add Recommend Footprint	
1.2	2007-07-04	Jaddy Chen	Revise Pin-out and Footprint	
1.3	2007-07-12	Jaddy Chen	Revise Pin-out pad size	
1.4	2007-07-16	Camus Chen	Revise Supply Voltage, Pin-out and Footprint	
1.5	2007-09-14	Camus Chen	Revise Supply Voltage & Pin Definition	
1.6	2007-09-14	Camus Chen	Revise Supply Voltage & Pin Definition	
1.7	2007-10-12	Camus Chen	Change Module Connection to 36pin LGA	
1.8	2007-12-17	Camus Chen	Revise Mechanical Specification	
1.9	2008-01-10	Camus Chen	Revise Rx Sensitivity , Power Consumption & Mechanical Specification	
2.0	2008-06-24	Camus Chen	Add Carrier Frequency Accuracy	
2.1	2008-06-24	Camus Chen	Revise Carrier Frequency Accuracy	
2.2	2008-08-08	Camus Chen	Revise Moisture Sensitive Label	
2.3	2008-08-08	Camus Chen	Add Laser Mark & Pin 1 Location in the Tape/Reel	
2.4	2008-08-18	Camus Chen	Revise Laser Mark	
2.5	2008-09-09	Camus Chen	Add Storage Temperature	
2.6	2008-12-18	Camus Chen	Remove 4 GND pads in the center of recommended footprint. Revise SDIO Timing Data	
2.7	2009-01-07	Camus Chen	6.2.4 Networking Coexistence	
2.8	2009-01-09	Camus Chen	Update 5.2 Recommended Operation Condition Update 6.2.2 SDIP Protocol Timing Update 6.2.3 G-SPI Protocol Timing Update 6.2.6 LED Interface Remove JTAG Specification Remove Power Up Sequence	

Universal Scientific Industrial Corp.	Doc No.	Rev	2.8
	Date.	2009/01/09	Page	3

Description   Product Specification – WM-G-MR-09

INDEX

2   PURPOSE

The purpose of this document is to define the product specification for 802.11b/g WiFi module WM-G-MR-09.

3   SCOPE

- High speed for wireless LAN connection: IEEE802.11b/g up to 54Mbps data rate by incorporating Direct Sequence Spread Spectrum (DSSS) and OFDM data modulation.
- Provide seamless roaming within the IEEE 802.11b/g WLAN infrastructure.
- IEEE 802.11b/g compatible: allow inter-operation among multiple vendors.
- Auto fallback: 54M, 48M, 36M, 24M, 18M, 12M, 9M, 6M (802.11g); 11M, 5.5M, 2M, 1M (802.11b) data rate with auto fallback.
- WPA (Wi-Fi Protected Access)
- Support 802.11i Security standard through implementation of AES / CCMP and WEP with TKIP security mechanism.
- Support 802.11e Quality of Service (QoS)
- Interoperability – Complying with WECA WiFi.
- 3-wire, hardware signaling BT WiFi co-existence supported

4   GENERAL FEATURES

	Item	Description	Notes
802.11b/g	Standard	Complies with the latest IEEE802.11b/g wireless LAN Physical Layer Specification (IEEE 802.11g dated 12/6/2003)	
	Chip Set	Marvell 88W8686	
	Module Interface Type	SDIO (1bit and 4 bit) , SDIO_SPI , G-SPI	
	Module Connection	36pin LGA	
	Co-existence	Supports 3-wire BT coexistence scheme for an external BT solution	
	Data Rate	802.11g: 54, 48, 36, 24, 18, 12, 9, 6 Mbps, auto rate 802.11b: 11, 5.5, 2, 1Mbps, auto rate	
	Modulation	OFDM (54, 48, 36, 24, 18, 12, 9, 6Mbps) CCK (11Mbps, 5.5Mbps) DQPSK (2Mbps) DBPSK (1Mbps)	
	Operating Frequency	2.4GHz ISM band	
	Operating Channels	IEEE Channels 1–14 depending on Regulatory Domain settings	
	Others	Compliance with FCC Class B Part 15.247, R&TTE, TELEC major RF regulatory requirements	

5   ELECTRICAL SPECIFICATION

5.1   SUPPLY VOLTAGE

Symbol	Parameter	Min	Typ	Max	Unit
VDD_33	TR SW, ANT SW, PA_PE	3.0	3.3	3.6	V
VDD_SHI	SDIO, G-SPI, GPIO, RESETn, PDn, SLEEP_CLK, EEPROM	1.62	1.8	1.98	V
		2.97	3.3	3.63	V

5.2   RECOMMENDED OPERATION CONDITIONS

5.2.1   TEMPERATURE, HUMIDITY

Symbol	Parameter	Min	Typ	Max	Unit
Ta	Ambient Operation Temperature	-10	-	65	^{0}C
Ts	Storage Temperature	-40		85	^{0}C
Humidity	Relative Humidity			95	%

5.2.2   DC ELECTRICAL

Symbol	Parameter	Min	Typ	Max	Units
VDD_33	Power supply voltage with respect to GND	3.0	3.3	3.6	V
VDD_SHI	Power supply voltage with respect to GND	1.62	1.8	1.98	V
		2.97	3.3	3.63	

5.3   POWER CONSUMPTION (SDIO MODE)

The power consumption is typical value measured at 25°C temperature

Voltage : VDD3.3		
Operating Voltage	3.0~3.6 Volt	
Current		
Condition	Typical (3.3V, 25 degree C)	Maximum (3.3V, 25 degree C)
Transmit(54Mbps, 12 dBm)	270mA	300mA
Transmit(11Mbps, 14 dBm)	270mA	300mA
Receive(54Mbps, -70 dBm)	180mA	210mA
Receive(11Mbps, -70 dBm)	180mA	210mA
Deep Sleep (Use Labtool command 26 1)	0.5mA	1.0mA

5.4   WIRELESS SPECIFICATIONS

The WM-G-MR-09 module complies with the following features and standards:

Features	Description
WLAN Standards	IEEE 802 Part 11b/g (802.11b/g)
Antenna Port	One antenna port support 802.11b/g
Coexistence	Hardware signaling
Frequency Band	2.400 – 2.484 GHz

5.5   RADIO SPECIFICATION

Over full range of values specified in the "Recommended Operation Condition" unless specified otherwise.

Features	Description
Frequency Band	2.4000 – 2.497 GHz (2.4 GHz ISM Band)
Number of selectable Sub channels	14 channels
Modulation	OFDM, DSSS (Direct Sequence Spread Spectrum), DBPSK, DQPSK, CCK , 16QAM, 64QAM
Supported rates	1, 2, 5.5, 11, 6, 9, 12, 18, 24, 36, 48, 54 Mbps
Maximum receive level	- 10dBm (with PER < 8%)
Output Power	14 dBm +2.0 /-1.5 dBm for 1, 2, 5.5, 11Mbps 12 dBm +2.0 /-1.5 dBm for 6 , 9 and > 12Mbps
Carrier Frequency Accuracy	+/- 25ppm (crystal: 38.4MHz +/-5ppm in 25^0C)

802.11g EVM Requirement

Item	Data Rate (Mbps)	Relative Constellation Error (dB)	EVM (%RMS)
1	6 (BPSK)	-5	56.2
2	9 (BPSK)	-8	39.8
3	12 (QPSK)	-10	31.6
4	18 (QPSK)	-13	22.4
5	24 (16-QAM)	-16	15.8
6	36 (16-QAM)	-19	11.2
7	48 (64-QAM)	-22	7.9
8	54 (64-QAM)	-25	5.6

802.11b EVM

Item	Data Rate (Mbps)	EVM (%RMS)
1	1 (BPSK)	35%
2	2 (QPSK)	35%
3	5.5 (QPSK)	35%
4	11 (QPSK)	35%

Sensitivity

Receiver Characteristics (3.3V, 25 degree C)	Typical	Maximum	Unit
PER <8%, Rx Sensitivity @ 11 Mbps	-85	-83	dBm
PER <8%, Rx Sensitivity @ 1 Mbps	-91	-89	dBm
PER <10%' Rx Sensitivity @ 6 Mbps	-86	-84	dBm
PER <10%, Rx Sensitivity @ 54 Mbps	-70	-68	dBm

	Doc No.		Rev	2.8
Universal Scientific Industrial Corp.	Date.	2009/01/09	Page	9

Description   Product Specification – WM-G-MR-09

6   INTERFACE

6.1   PIN DEFINITION

No	Pin Name	Type	Description
1	GND	GND	Ground
2	RF PORT	O	Antenna Port (50ohm)
3	GND	GND	Ground
4	NC	O	NC
5	SD_D1	I/O	SDIO 4-bit Mode: Data Line Bit [1] G-SPI Mode: G-SPI Data Output
6	SCLK	I	NC This is for Boot setting of ROM.
7	ECSn	O	Boot from SPI EEPROM: Pull down by 100kohm Boot from host Interface: NC
8	GND	GND	Ground
9	VDD_SHI	I	**Host I/F Voltage: 3.3V** Connect to 3.3V power supply **Host I/F Voltage: 1.8V** Connect to 1.8V power supply Not need to prepare external 1.8V power supply by connecting #9 and #17 (1.8V terminal)
10	GPIO_6	I/O	General I/O Port , leave open if no use.
11	GPIO_5	I/O	General I/O Port , leave open if no use.
12	SD_D3	I/O	SDIO 4-bit Mode: Data Line Bit [3]
13	GPIO_2	I/O	General I/O Port , leave open if no use.
14	SD_CLK	I/O	SDIO 4-bit Mode: Clock Input G-SPI Mode: G-SPI Clock Input
15	GPIO_4	I/O	General I/O Port , leave open if no use.
16	GPIO_1	I/O	General I/O Port t , leave open if no use. Default function : LED indicate.
17	VDD_18	POWER	1.8V DC monitor terminal , need 1uF decoupling capacitor
18	VDD_12	POWER	1.2V DC monitor terminal , need 1uF decoupling capacitor
19	GND	GND	Ground
20	SD_CMD	I/O	SDIO 4-bit Mode: Command / Response G-SPI Mode: G-SPI Data Input
21	SD_D0	I	SDIO 4-bit Mode: Data Line Bit [0] G-SPI Mode: G-SPI Chip Select Input (Active Low)
22	SD_D2	I/O	SDIO 4-bit Mode: Data Line Bit [2] G-SPI Mode: G-SPI Interrupt Output (Active Low)

23	IF_SEL_1	O	Select Interface Mode Pin SDIO Mode: No Connect G-SPI Mode: Pull Down by 100kohm
24	IF_SEL_2	O	Select Interface Mode Pin SDIO Mode: No Connect G-SPI Mode: Pull Down by 100kohm
25	VDD18A	POWER	1.8V Analog DC monitor terminal , need 1uF decoupling capacitor
26	GND	GND	Ground
27	VDD_33	POWER	Connect to 3.3V DC supply
28	VDD_33	POWER	Connect to 3.3V DC supply
29	BT_STATE	I	Bluetooth State 0 = normal priority, Rx 1 = high priority, Tx Priority is signaled after BT_PRIORITY has been asserted. After priority signaling, BT_STATE indicated the Tx/Rx mode of the BT radio. Please make it open when do not use it.
30	WL_ACTIVE	O	WLAN Active (Active Low) 2-Wire BCA Mode When high, WLAN is transmitting or receiving packets. 3-Wire BCA Mode 0 = Bluetooth device is allowed to transmit 1 = Bluetooth device is not allowed to transmit Internal 50kohm pull-down. This pin drives low when PDn is asserted. In WLAN Sleep mode, all I/O Pads are powered down. This Pad must stay at a low state even in power down mode. Please make it open when do not use it.
31	PDn	I	Pull up by 100kohm, Full Power Down (Active Low)
32	RESETn	I	Reset (Active Low) , leave open if no use.
33	BT_PRIORITY	I	Bluetooth Priority 2-Wire BCA Mode When high, BT is transmitting or receiving high priority packets. 3-Wire BCA Mode When high, BT is transmitting or receiving packets. Leave open if no use.

34	GPIO_0	I/O	General I/O Port , leave open if no use.
35	SLEEP_CLK	I	Clock Input for External Sleep Clock , leave open if no use.
36	PW_SEL	O	NC

6.1.1 MODULE PIN-OUT

<Bottom View>
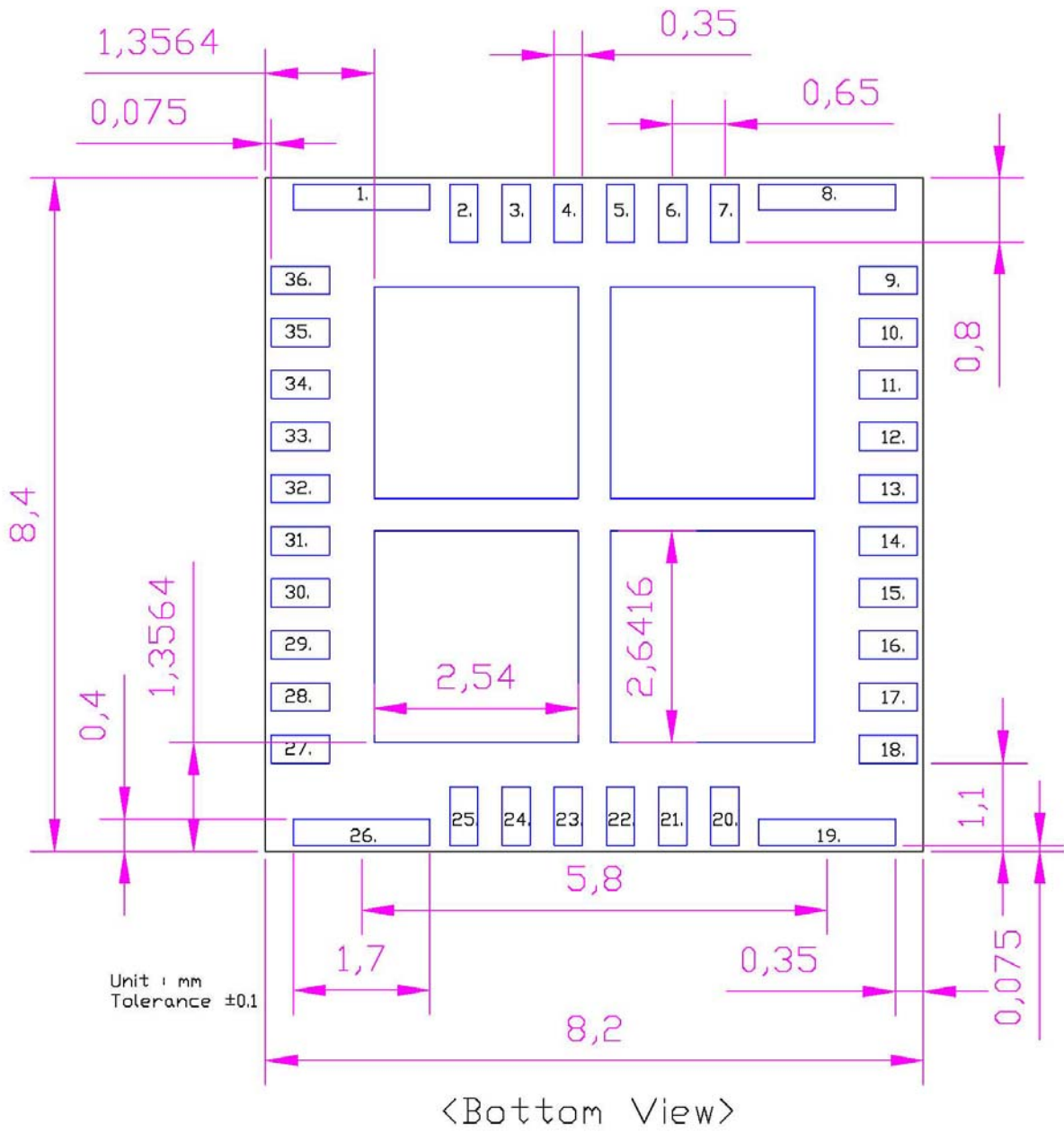
6.2   SPEIFICATIONS AND TIMING DIAGRAM

6.2.1   EXTERNAL SLEEP CLOCK SPECIFICATION

The WM-G-MR-09 external sleep clock pin (SLEEP_CLK) is powered from VDD_SHI Voltage Supply.
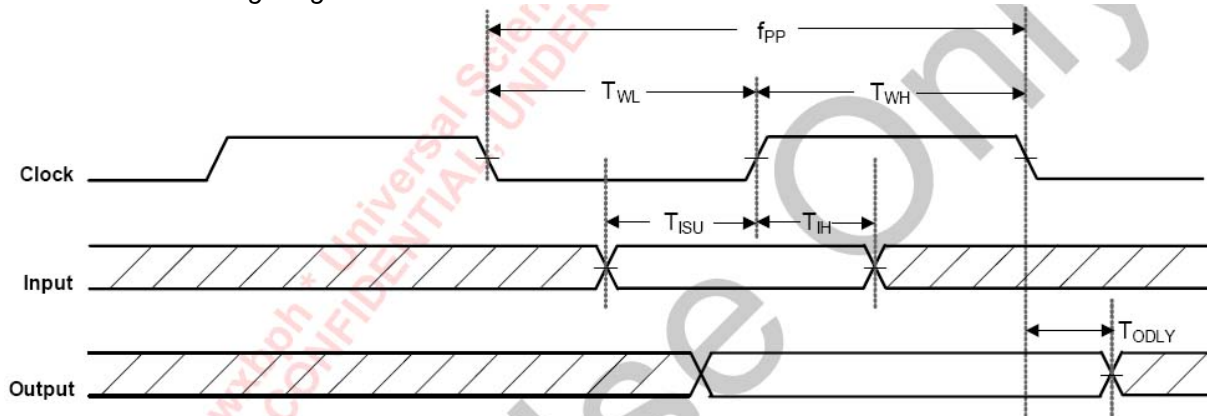
Protocol Timing
NOTE: Over full range of values specified in the Recommended Operating Conditions unless otherwise specified.

Symbol	Parameter	Condition	Min	Typ	Max	Units
CLK	Clock Frequency Range	--	10	100	1000	kHz
T_{HIGH}	Clock high time	--	40	--	--	ns
T_{LOW}	Clock low time	--	40	--	--	ns
T_{RISE}	Clock rise time	--	--	--	5	ns
T_{FALL}	Clock fall time	--	--	--	5	ns

6.2.2   SDIO PROTOCOL TIMING

SDIO Protocol Timing Diagram

SDIO Protocol Timing Diagram – High Speed Mode
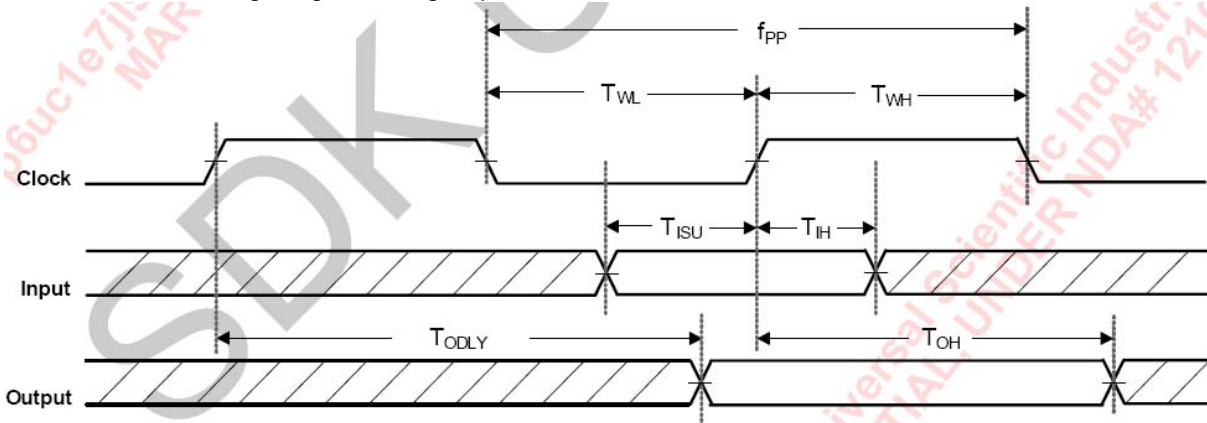
Note

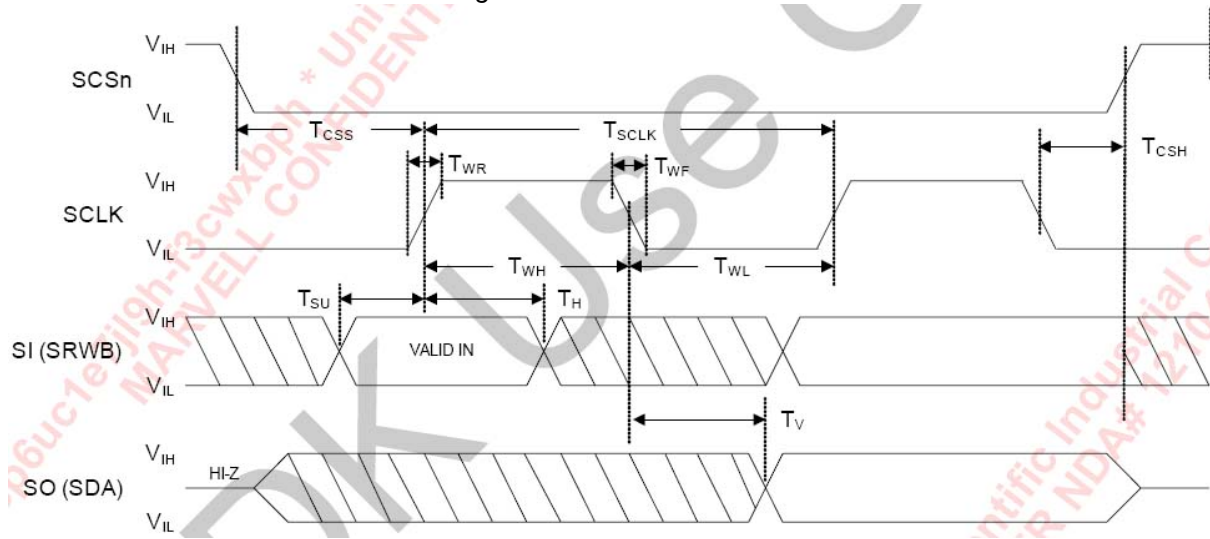The SDIO-SPI CS signal timing is identical to all other SDIO inputs.

SDIO Timing Data

NOTE: Over full range of values specified in the Recommended Operating Conditions unless otherwise specified.
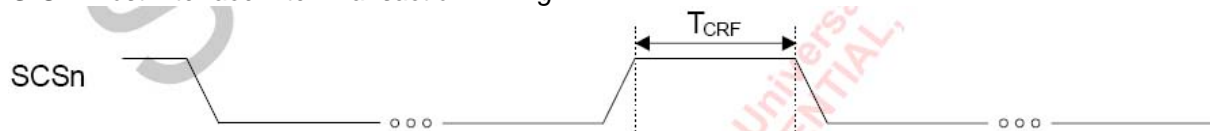
Symbol	Parameter	Condition	Min	Typ	Max	Units
f_{PP}	Clock Frequency	Normal	0	--	25	MHz
		High Speed	0	--	50	MHz
T_{WL}	Clock Low Time	Normal	10	--	--	ns
		High Speed	7	--	--	ns
T_{WH}	Clock High Time	Normal	10	--	--	ns
		High Speed	7	--	--	ns
T_{ISU}	Input Setup Time	Normal	5	--	--	ns
		High Speed	6	--	--	
T_{IH}	Input Hold Time	Normal	5	--	--	ns
		High Speed	2	--	--	
T_{ODLY}	Output Delay Time	--	0	--	14	ns
T_{OH}	Output Hold Time	High Speed	2.5	--	--	ns

6.2.3   G-SPI PROTOCOL TIMING

G-SPI Host Interface Transaction Timing

G-SPI Host Interface Inter-Transaction Timing

SPI Interface Timing Data

NOTE: Over full range of values specified in the Recommended Operating Conditions unless otherwise specified.

Symbol	Parameter	Min	Typ	Max	Units
T_{SCLK}	Clock Period	20	--	--	ns
T_{WH}	Clock High	5	--	--	ns
T_{WL}	Clock Low	9	--	--	ns
T_{WR}	Clock Rise Time	--	--	1	ns
T_{WF}	Clock Fall Time	--	--	1	ns
T_H	SDI Hold Time	2.5	--	--	ns
T_{SU}	SDI Setup Time	2.5	--	--	ns
T_V	SDO Hold Time	5	--	--	ns
T_{CSS}	SCSn Fall to Clock	5	--	--	ns
T_{CSH}	Clock to SCSn Rise	0	--	--	ns
T_{CRF}	SCSn Rise to SCSn Fall	400	--	--	ns

Universal Scientific Industrial Corp.	Doc No.		Rev	2.8
	Date.	2009/01/09	Page	16

Description   Product Specification – WM-G-MR-09

6.2.4   NETWORKING COEXISTENCE

• BT_PRIORITY (BT_RF_ACTIVE)—input signal to inform the SoC that Bluetooth traffic is actively in Tx or Rx mode. The assertion of this signal precedes the actual Bluetooth packet slot time.
• WL_ACTIVE (BT_TX_CONFXn) —output signal from the SoC to the Bluetooth device to indicate permission to Tx. If this output is low, then the Bluetooth device can Tx. This signal stays low for the duration of Bluetooth transmission.
• BT_STATE—input to inform the SoC whether Bluetooth is in Tx or Rx mode and the priority level of the traffic. Priority information on the BT_STATE input pin is signaled after the BT_PRIORITY signal is asserted. The Bluetooth Tx/Rx information on the BT_STATE input pin is signaled after priority information.

The 3WBCA accepts two inputs (BT_RF_ACTIVE, BT_STATE) from the Bluetooth device. The BT_PRIORITY input informs the BCA that the Bluetooth device requests access to the medium. The BT_STATE input informs the BCA of the priority of BT_RF_ACTIVE and the direction of the Bluetooth data (Tx or Rx). When 3WBCA is used in a single antenna system, only priority information is used (direction of Bluetooth data is ignored).

The BCA unit outputs a control (BT_TX_CONFXn or WL_ACTIVE) to the Bluetooth device to signal when the BCA has granted medium access to the Bluetooth device. The Bluetooth device should not attempt to transmit when the BT_TX_CONFXn or WL_ACTIVE signal is high. The 3WBCA determines Rx and Tx priority based on the frame type and register settings.

6.2.5   RESET AND CONFIGURATION TIMING
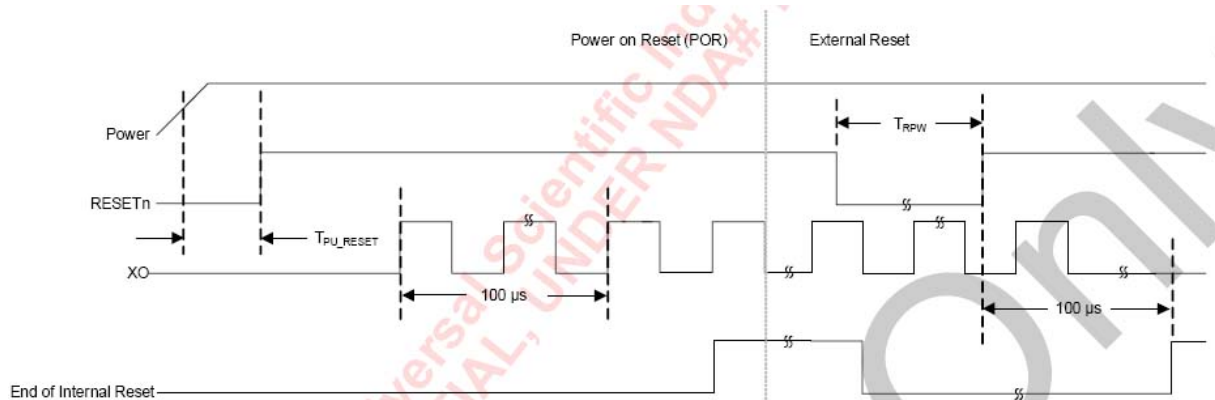
Notes

•   RESETn is not needed for proper operation due to internal power-on reset logic.

External Timing Requirement (RESETn Pin)

NOTE: Over full range of values specified in the Recommended Operating Conditions unless otherwise specified.

Symbol	Parameter	Condition	Min	Typ	Max	Units
T_{PU_RESET}	Valid power to RESETn de-asserted	--	0	--	--	ms
T_{RPW}[1]	RESETn pulse width	--	10^2	100	--	ns

1. For external reset, the device reset time is T_{RPW} + 300 µs.

2. Minimum value guaranteed for a valid reset. Smaller values may trigger the reset circuit.

Internal Reset Timing

NOTE: Over full range of values specified in the Recommended Operating Conditions unless otherwise specified.

Symbol	Parameter	Condition	Min	Typ	Max	Units
--	Negative internal reset pulse width	--	100	100	--	µs

Universal Scientific Industrial Corp.	Doc No.		Rev	2.8
	Date.	2009/01/09	Page	18

Description   Product Specification – WM-G-MR-09

6.2.6   LED INTERFACE

Pin No.	Pin description	Function description
16	GPIO_1	WLAN status LED (Tx power or Rx ready LED

NOTE: Over full range of values specified in the Recommended Operating Conditions unless otherwise specified.

Symbol	Parameter	Condition	Typ	Units
I_{OH}	Switching current high	Tristate on pad (requires pull-up on board)	Tristate when driving high	mA
I_{OL}	Switching current low	@ 0.4V	10	mA

6.2.7   ANTENNA INTERFACE

Antenna diversity is not supported on the Wireless Module.
The output impedance of the antenna port is 50 Ohms.

7   REGULATORY

The WM-G-MR-09 module is tested on module level to comply with following standards (pre-test):

• US/CAN: FCC CFR47 Part 15.247
• Europe: ETS 300-328 V1.6.1

Test setup: laptop plus adaptor card with Marvell Labtool in SDIO mode
Final certification should be completed on system level.
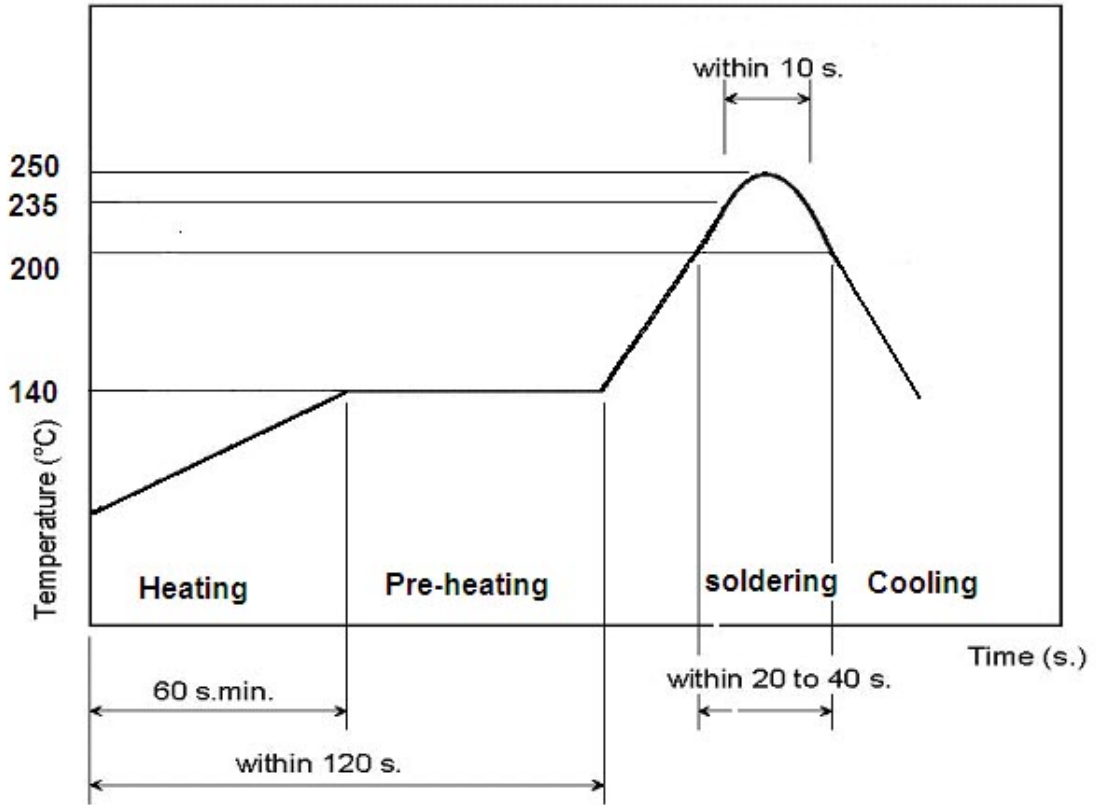
8   MECHANICAL SPECIFICATION
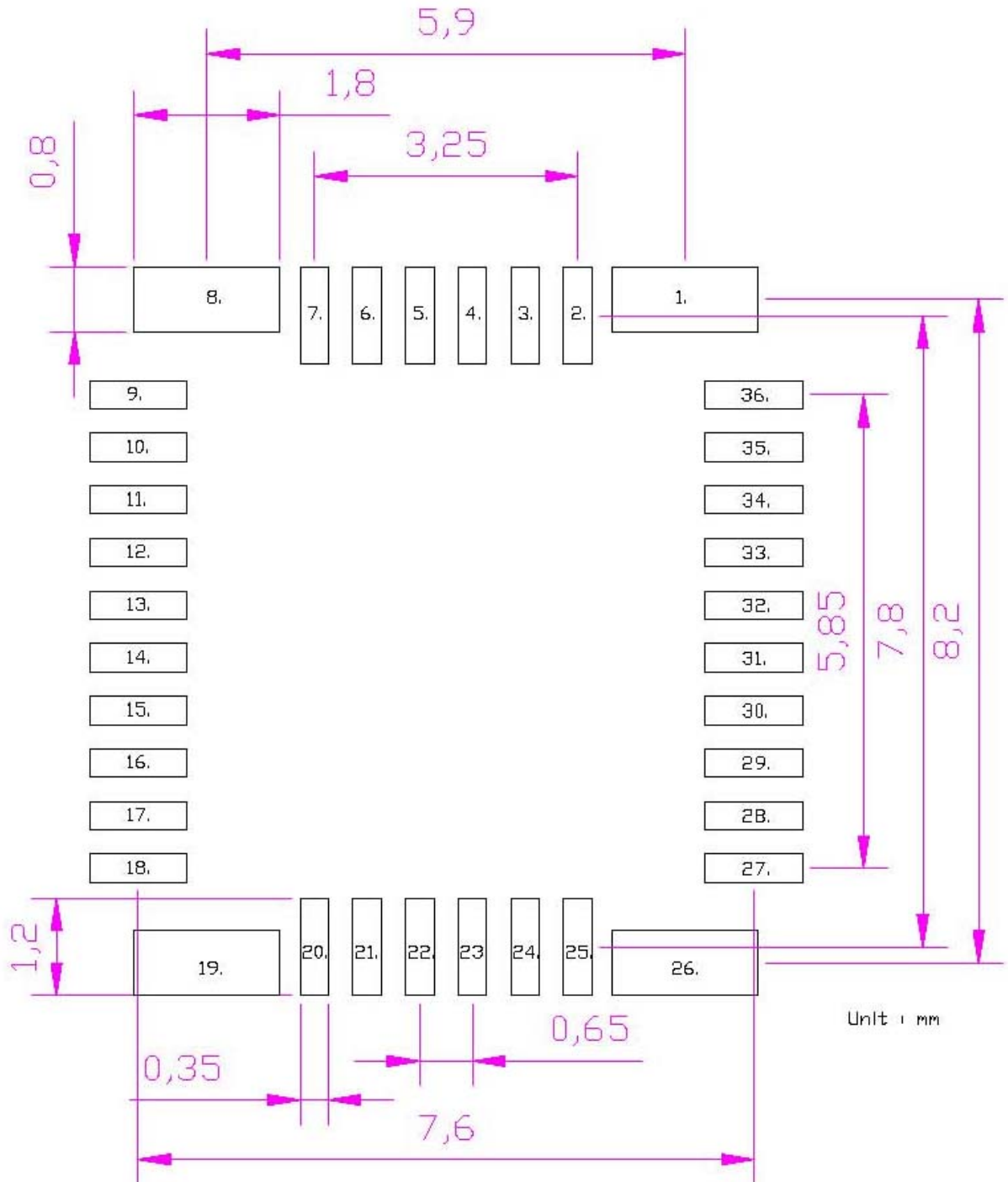
Dimension : 8.2x8.4x1.3 mm

<TOP VIEW>

8,4±0,2

8,2±0,2

1,3±0,18

Pin 1 Mark

Unit : mm

Shielding Case

Universal Scientific Industrial Corp.	Doc No.		Rev	2.8
	Date.	2009/01/09	Page	21

Description   Product Specification – WM-G-MR-09
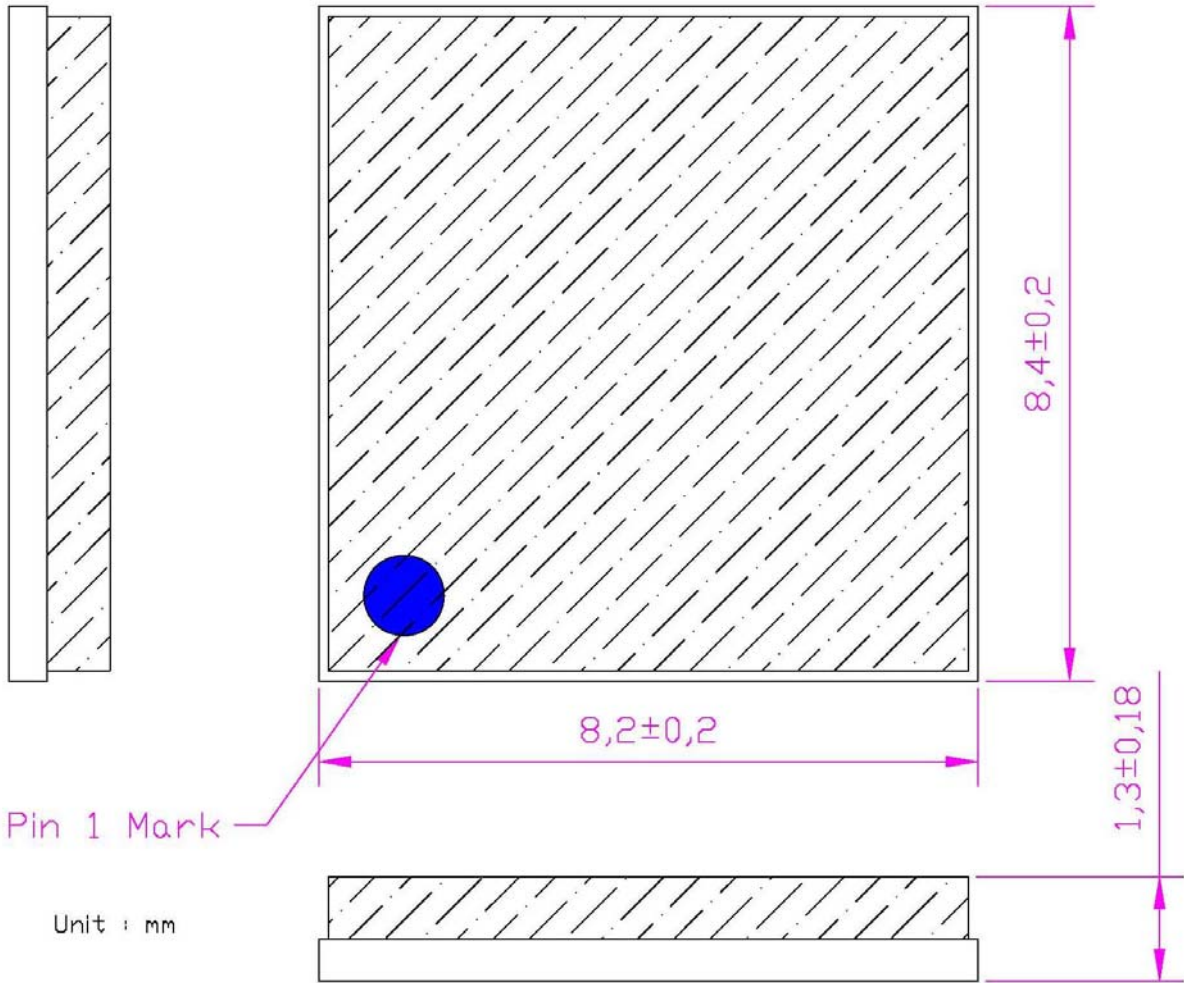
9   RECOMMENDED REFLOW PROFILE

10   RECOMMENDED FOOTPRINT

11   PACKAGE AND STORAGE CONDITION

11.1.1   PACKAGE DIMENSION

11.1.2   LASER MARK
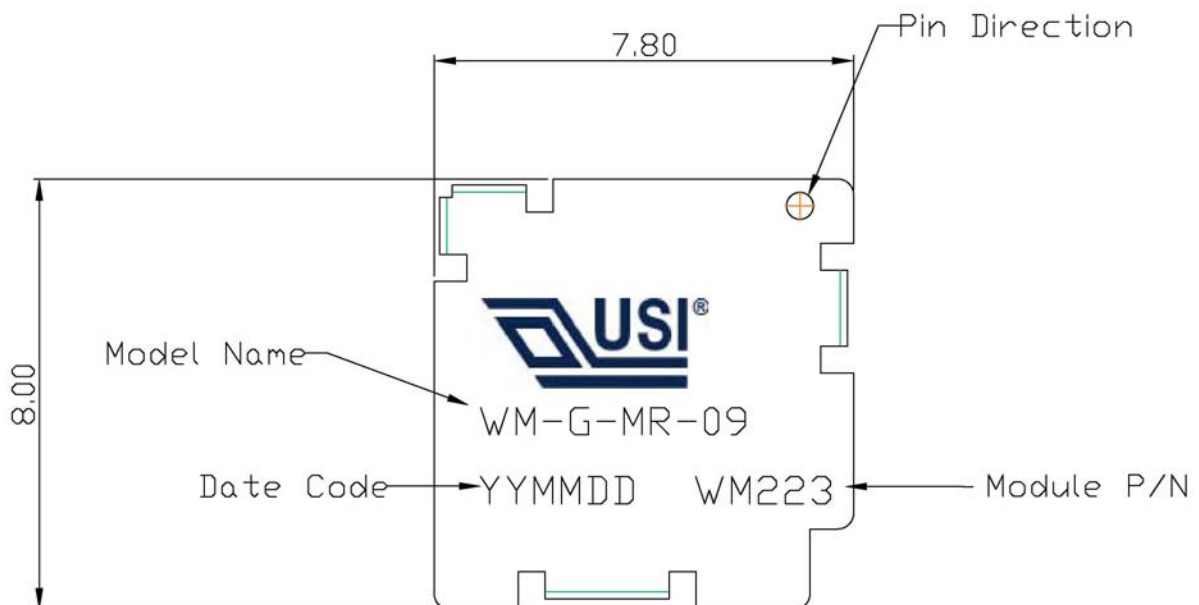
11.1.3   PIN 1 LOCATION IN THE TAPE/REEL
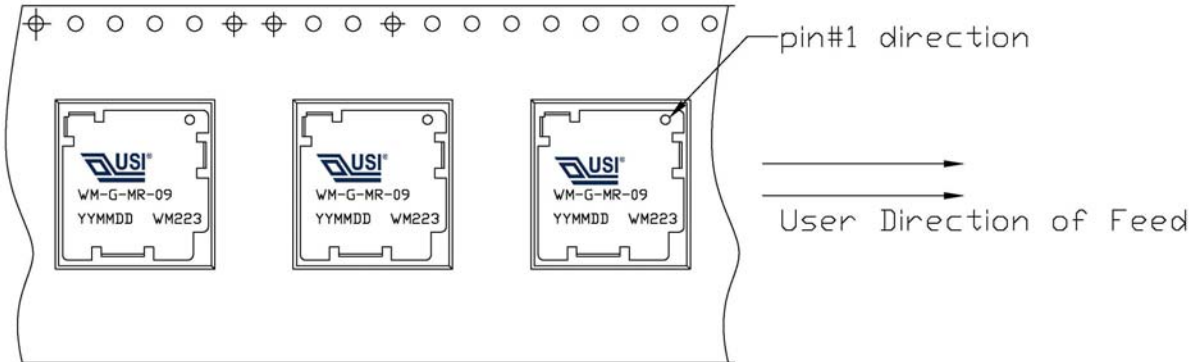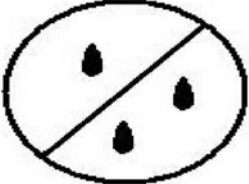
11.1.4   ESD LEVEL

1. Surface Resistivity:
   Interior:109~1011Ω/SQUARE
   EXTERIOR:108~1012Ω/SQUARE
2. Dimension:475*420mm
3. Tolerance:+5,0mm
4. Color:
   Background : Gray
   Text : Red

11.1.5   MOISTURE SENSITIVE LABEL

CAUTION
This bag contains
MOISTURE-SENSITIVE DEVICES

LEVEL
3
If Blank, see ajar cent bar code label

1. Calculated Shelf life in sealed bag: 12 months at < 40℃ and < 90%Relative humidity (RH)
2. Peak package body temperature ____250____ ℃
   If Blank, see adjacent bar code label
3. After bag is opened, Devices that will be subjected to reflow solder or other high temperature process must
   (a) Mounted within:____168____hrs. Of factory conditions≦30℃/60% RH, OR
       If Blank, see adjacent bar code label
   (b) Stored at < 10℃RH.
4. Devices require bake, before mounting, it:
   (a) Humidity indicator Card is >10% when read at 23±5℃
   (b) 3a or 3b not met.
5. If baking is required, Devices may be baked for 24 hrs at 125±5℃
   Note: If device containers cannot be subjected to high temperature
   Or shorter bake times are desired. Reference IPC/JEDEC J–STD–033 for bake procedure
   Bag Seal Date:_____ Note: Level and body temperature defined by IPC/JEDEC J–STD–020
       If Blank, see adjacent bar code label