802.11g Wireless LAN SiP Module (WM-G-MR -04)

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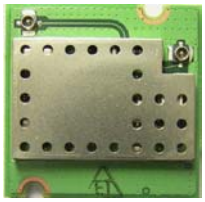
PRODUCT SPECIFICATION
of 802.11g
WM-G(B)-MR -04 B2B Wireless Lan Module

802.11g SPI Wireless LAN SiP Module V1.0

Introduction



The 802.11 Wireless SiP module WM-G-MR-04 which refers as “SiP-g module” is a full function 54 Mbps wireless networking module that provides SPI host interface via 60 pins B2B connector for direct assembly. The board to board interface provides flexibility for system assembly.

The small size & low profile physical design make it easier for system design to enable high performance wireless connectivity without space constrain . The low power consumption **(Sleep mode: 1.2 mA)** and excellent radio performance make it the best solution for OEM customers who require embedded 802.11g Wi-Fi features, such as, Wireless PDA, Scanner , Web Camera , Smart phone, Media player Notebook, barcode ,mini-Printer, VoIP phone etc.

For hardware feature, Marvell “Libertas” chipset solution is used. The Radio architecture & high integration MAC/BB chip provide excellent sensitivity with rich system performance.

In addition to WEP 64/128, WPA and TKIP, AES is supported to provide the latest security requirement on your network.

For the software and driver development, USI provides extensive technical document and reference software code for the system integration under the agreement of Marvell International Ltd.

Hardware evaluation kit and development utilities will be released base on listed OS and processors to OEM customers.

Features

- Lead Free design which supporting Green design requirement.
- Small size suitable for low volume system integration.
- Low power consumption & excellent power management performance, extend battery life.
- 2.412-2.484 GHz two SKUs for worldwide market.
- Easy for integration into mobile and handheld device with flexible system configuration and antenna design.

Change Sheet

Rev.	Date	Description of change			Approval & Date
		Page	Par	Change(s)	
1.0	02/01/05	All	All	Draft version for Review	
1.0	10/03/05	All	All	DVT	
1.1	11/08	16	11.2	Pin29 Definition	

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1. EXECUTIVE SUMMARY

The WM-G-MR-04 module - is one of the product families in USI's product offering, targeting for system integration requiring a smaller form factor. It also provides the standard migration to high data rate to USI's current SIP customers. The WM-G-MR-04 module providing B to B type connector is provided as option for customers, who want to have Board to board type assembly.

This document outlines the product requirements for a "system in Package" 802.11g/(b) module – here after referred as WM-G-MR-04 Module.

This product is targeted for mass production by **1Q 2006** and is designated for use in embedded applications mainly in the mobile device, which required, small size and high data rate wireless connectivity. The application such as, Wireless PDA, DSC, Media Adapter, Barcode scanner, mini-Printer, VoIP phone, Data storage device could be the potential application for wireless WM-G-MR-04.

2. DELIVERABLES

The following products and software will be part of the product.

- WM-G-MR-04 Module with packaging
- Evaluation kits, including application (SPI/SDIO, SDIO, 2 RF connectors for antenna diversity),
- Software utility which supporting customer for integration, performance test, and homologation. Capable of testing, loading (firmware) and configuring (MAC, CIS) for the WM-G-MR-04 module.
- Unit Test / Qualification report
- Product Specifications.
- Agency certification pre-test report base on adapter boards

3. REFERENCE DOCUMENTS

C.I.S.P.R. Pub. 22	"Limits and methods of measurement of radio interference characteristics of information technology equipment." International Special Committee on Radio Interference (C.I.S.P.R.), Third Edition, 1997.
CB Bulletin No. 96A	"Adherence to IEC Standards: "Requirements for IEC 950, 2nd Edition and Amendments 1 (1991), 2(1993), 3 (1995) and 4(1996). Product Categories: Meas, Med, Off, Tron." IEC System for Conformity Testing to Standards for Safety of Electrical Equipment (IECEE), April 2000.
CFR 47, Part 15-B	"Unintentional Radiators". Title 47 of the Code of Federal Regulations, Part 15, FCC Rules, Radio Frequency Devices, Subpart B.
CFR 47, Part 15-C	"Intentional Radiators". Title 47 of the Code of Federal Regulations, Part 15, FCC Rules, Subpart C. URL: http://www.access.gpo.gov/nara/cfr/waisidx_98/47cfr15_98.html
CSA C22.2 No. 950-95	"Safety of Information Technology Equipment including Electrical Business Equipment, Third Edition." Canadian Standards Association, 1995, including revised pages through July 1997.
EN 60 950	"Safety of Information Technology Equipment Including Electrical Business Equipment." European Committee for Electrotechnical Standardization (CENELEC), 1996, (IEC 950, Second Edition, including Amendment 1, 2, 3 and 4).
IEC 950	"Safety of Information Technology Equipment Including Electrical Business Equipment." European Committee for Electrotechnical Standardization, Intentional Electrotechnical Commission. 1991, Second Edition, including Amendments 1, 2, 3, and 4.
IEEE 802.11	"Wireless LAN Medium Access Control (MAC) And Physical Layer (PHY) Specifications." Institute of Electrical and Electronics Engineers. 1999.

4. TECHNICAL SPECIFICATION

The WM-G-MR-04 is a B2B type assembly part, technical supporting.

4.1. ABSOLUTE MAXIMUM RATING

Supply Power	Max +3.6 Volt	
Non Operating Temperature	- 40° to 85° Celsius	
Voltage ripple	+/- 2%	Max. Values not exceeding Operating voltage

4.2. RECOMMENDABLE OPERATION CONDITION

4.2.1. TEMPERATURE, HUMIDITY

WM-G-MR-04 module supports the operational requirements as listed in the table below.

Operating Temperature	-10° to 60° Celsius	
Humidity range	Max 95%	Non condensing, relative humidity

4.2.1. VOLTAGE AND CURRENT

Power supply for the WM-G-MR-04 module will be provided by the host via the power pins

Voltage : VDD

Operating Voltage	3.3 Volt	+- 10%

Current

Transmit	480 mA	Typical @ 12dbm RF output power
Receive	275 mA	
Sleep connected	1.2 mA	Min.

The power consumption is standard related.

4.3. WIRELESS SPECIFICATIONS

The WM-G-MR-04 module comply with the following features and standards;

Features	Description
WLAN Standards	IEEE 802 Part 11g/b
Antenna	No Antenna diversity supported
Data Rates	1,2,5.5, 11, 6,12,24,36,48,54 Mbps
Medium Access Protocol	CSMA/CA (Collision Avoidance) with ACK
Network Access	Ad-hoc, Infrastructure

4.4. RADIO SPECIFICATIONS 802.11G

The Radio specification need to compliance with the spec of 802.11g and be competitive in RF performance.

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, 5.5,11,6,9,12,24,36,48,54 Mbps
Maximum receive level	- 10dBm (with PER < 8%)
Output Power @ antenna connector	12 dBm +/- 1 dBm 802.11g. 14 dBm +/- 1 dBm 802.11b

4.5. RADIO CHARACTERISTICS

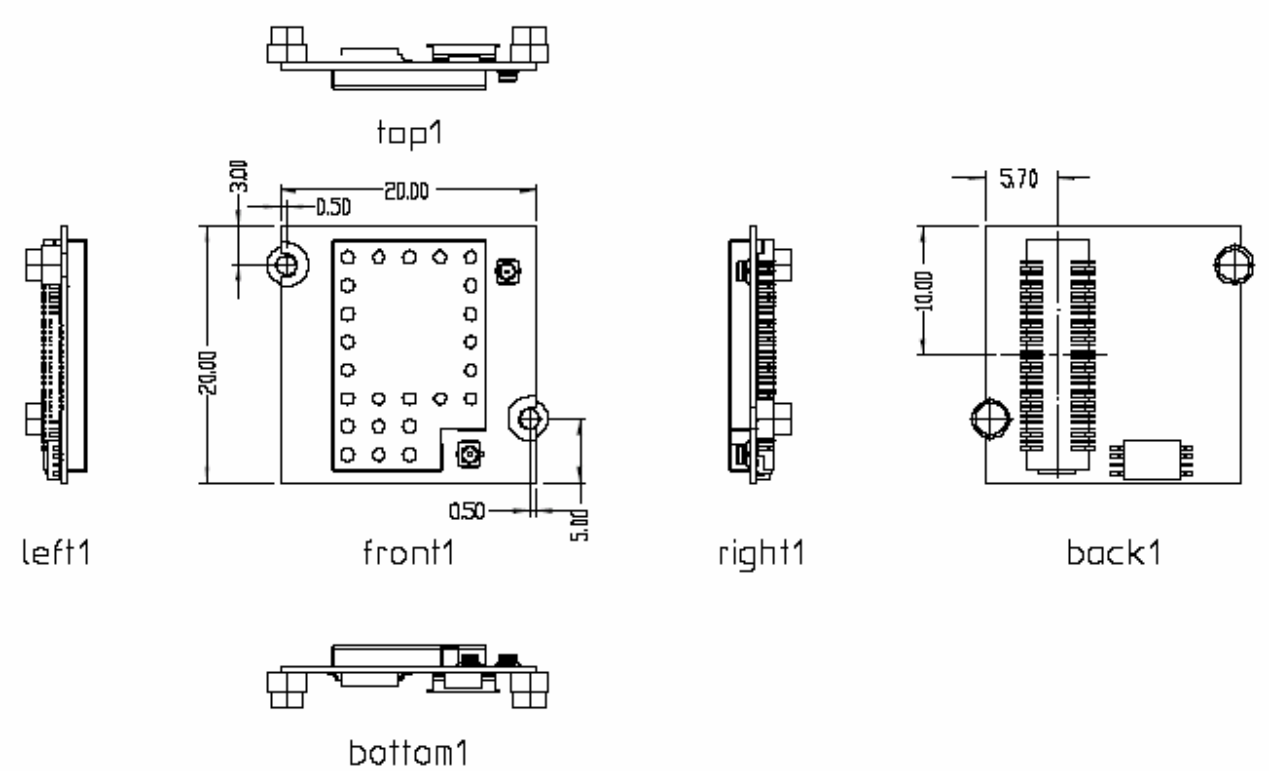
Receive Sensitivity	Data Rate
-72 dBm	54Mbps
	48 Mbps
	36Mbps
	24Mbps
	18Mbps
	12Mbps
- 87 dBm	11 Mbps
	9 Mbps
	6 Mbps
- 89 dBm	5.5 Mbps
- 92 dBm	1.0 Mbps

4.6. DIMENSIONS, WEIGHT AND MOUNTING

The following paragraphs provide the requirements for the size, weight and mounting of the WM-G-MR-04 module.

4.6.1. DIMENSIONS

The size and thickness of the WM-G-MR-04 module is listed below:



4.6.2. WEIGHT

Weight less than 10 gram including the shielding.

4.6.3. MOUNTING

The WM-G-MR-04 module is B2B mounted type component. The B2B connector and additional screw hole provide mounting mechanism to secure the WM-G-MR-04 module against vibration and shock on the host system.

4.7. SHOCK AND VIBRATION

All shock and vibration test is performed by using an interface adapter card. Additional shock and vibration tests can be performed – on request – by using the real host being PDA, Textbook or any other application.

Vibration

Operating	Frequency sweep from 3-150-3 Hz with a constant 0.25 G input
Non-Operational	Frequency sweep from 3-150-3 Hz with a constant 0.5 G input

Shock

Operational	25 G peak within 3.75 msec in normal base position
Non-Operational	65 G peak in 3.75 msec in normal base position. 30 G within 8 msec square or trapezoidal shock in + and - direction along the 3 axis. (Total 6 shocks)

Note: Above tests are executed without packaging material.

5. COMPATIBILITY AND INTEROPERABILITY

5.1. WI-FI LOGO

There is no module level WiFi applied for WM-G-MR-04 module.
Wi-Fi certification is dependent on the OS capability and application of the host system. The certification will be base on customer's request.

5.2. WHQL COMPLIANCE

Not required for WM-G-MR-04 module

6. CONFIGURABILITY

No user configuration needed. The CIS and MAC Address will be loaded during production of the WM-G-MR-04 module.

7. SECURITY

The WM-G-MR-04 module supports WEP64/128,WPA , AES-CCM which including TKIP (full version TKIP SSN /WPA) . Refer to Marvell Libertas solution.

8. OPERATING SYSTEM COMPATIBILITY

Drivers are supported for the following OS:

- Windows CE 3.0 /.NET , Win CE 5.0 (2005)
- Linux.

- Pocket PC 2003.2004

9. LEGAL, REGULATORY & OTHER TECHNICAL CONSTRAINTS

The WM-G-MR-04 module is pre-tested to ensure that all requirements met as set forth in the following sections.

Final certification (module certification) requires the antenna of targeted system with a lead-time of 6 weeks. The product deliverable shall be a pre-tested WM-G-MR-04 module. No module level certification on WM-G-MR-04 module.

9.1. EMC

The module will be pre-tested to ensure that we can certify the product in the following countries when final certification will be performed on products and or platforms.

- US. FCC CFR47 Part 15-B, Class B
- Canada. CSA C22.2, Class B
- Europe. 89/336/EEC, EMC Directive, including CE Mark
- ETS300 826, EMC standard for 2.4GHz wideband transmission systems
- EN55022, Class B (Emissions)
  EN50082-1 (Immunity)
  EN61000-3-2 (Harmonic AC current emissions)
- Japan. VCCI Standard, Class 2 (Emissions)
- Korea (MIC)

9.2. COMPONENT SPECIFICATION

All components used in this device meet the following component approval requirements.

PRINTED WIRING BOARDS: The printed wiring boards shall be Underwriters Laboratories Inc. "Recognized Component" (ZPMV2) under the category for Printed Wiring Boards, and shall be flammability rated 94V-1 or less flammable. The board material shall be rated 130°C minimum.

CONNECTORS: Any connectors, if used, shall be Underwriters Laboratories, Inc. "Recognized" (ECBT2/RTRT2) in accordance with the requirements in the UL Standard for Safety, UL 498. Any polymeric connector housing shall be molded of plastics rated UL 94V-2 or less flammable when tested to UL 94.

WIRING: Any wiring material, if used, shall be UL Recognized Component Appliance Wiring Material (AVLV2). Wire shall be minimum rated 30V, 105°C.

PLASTIC PARTS - Any plastic parts used shall be molded of plastics that are UL "Recognized" (QFMZ2) and rated UL 94V-2 or less flammable when tested to UL 94.

"PB FREE" - The entire component Suppliers has to support Green requirement base on USI's policy. All of the components which including process and materials has to be Lead Free.

9.3. RADIO REQUIREMENTS AND APPROVALS

The WM-G-MR-04 module is tested with adapter card to comply with following standard.
The testing is to assure the performance of regulatory requirement on module. Final certification will be conducted on system level:

- US/CAN: FCC CFR47 Part 15.247
- Japan: TELEC
- Korea: MIC

9.4. PRODUCT MARKING

The Module is marked which containing the following information:

Description:	WM-G-XX-XX
Serial number:	yyllwkxxxx
Revision:	format to follow USI revision level in PDM System

For the serial number the following format will be followed:
yy = last two digits of current year
ll = Assembly Location:
UT = USI Taiwan
UM = USI Mexico
UC = USI China
wk = current week (week period = starting on Monday)
xxxx = consecutive number, starting at 0000 at beginning of each week.

9.5. ENVIRONMENTALLY SAFE MATERIAL RESTRICTIONS

The use of polychlorinated biphenyls (PCB's) is prohibited (specifically) as dielectric in capacitors or transformers.
Electrolytic capacitors shall not be composed of any quaternary salt ammonium and/or gamma-butyrolactone ***(i.e. no el caps allowed).***
No CFC's (chlorofluorocarbons) shall be used anywhere in the manufacture of this product.
The use of tantalum capacitors should be minimized in any product of the product family [including the power-supply]. Where the use of tantalum caps cannot be avoided, provisions must be made in the manufacturing process to prevent reverse polarization.

The WM-G-MR-04 module hardware design should take the safety of operation into consideration and prevent the potential risk on Labor safety for manufacturing process.

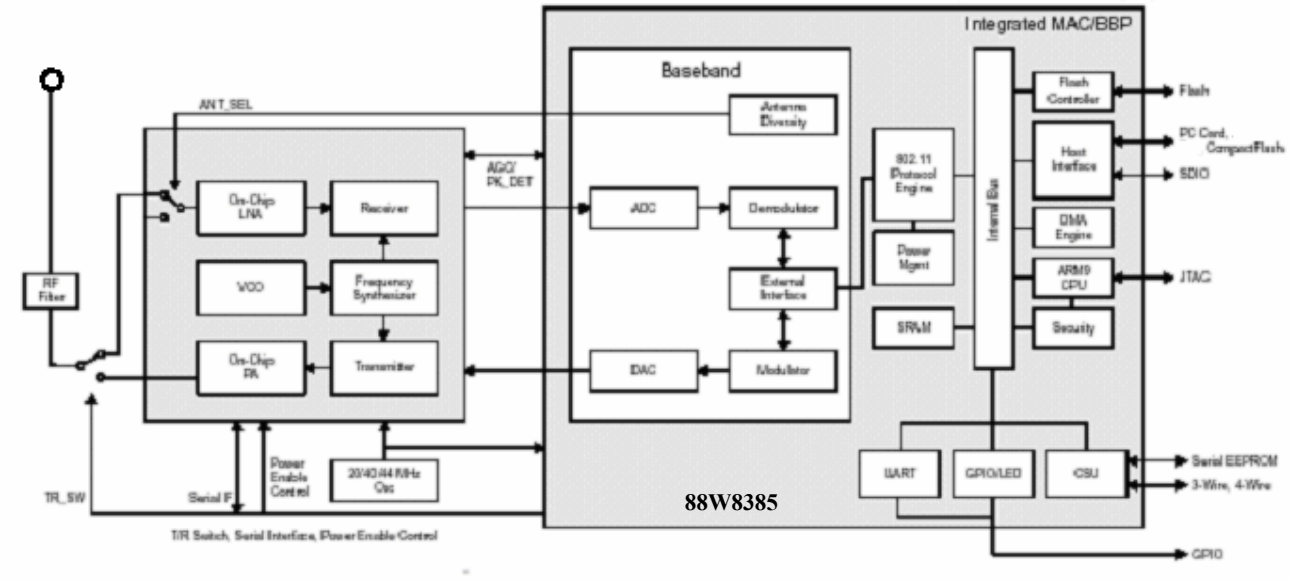
10. FUNCTIONAL DESCRIPTION

The WM-G-MR-04 module provides and interfaces between SPI, which suitable for wide range high-end processors or other similar type of processors.

The core of the WM-G-MR-04 module is the Marvell 88W83 Chipset solution.

The module is design base on the Marvell Libertas solution which contain the flip chip package MAC/BB chip - 88W8385 , The transceiver 88W8015 low profile package IC to reduce the size of module. All the other components can be implement by all means to reach the mechanical specification.

A simplified block diagram of the WM-G-MR-04 module is depicted in the Fig. below.



11. INTERFACE

11.1 CONNECTOR TYPE

60-pin board-to-board type connector

On Board connector

Matsusita AXK6F60345J [Socket, 60 pins, with positioning protection, 1.5mm or 2.0mm stack height]

Host System:

Matsusita
AXK5F60345J [Header, 60 pins, with positioning protection, 1.5mm stack height]
AXK5F60545J [Header, 60 pins, with positioning protection, 2.0mm stack height]

11.2 PIN DEFINITION

Pin definition

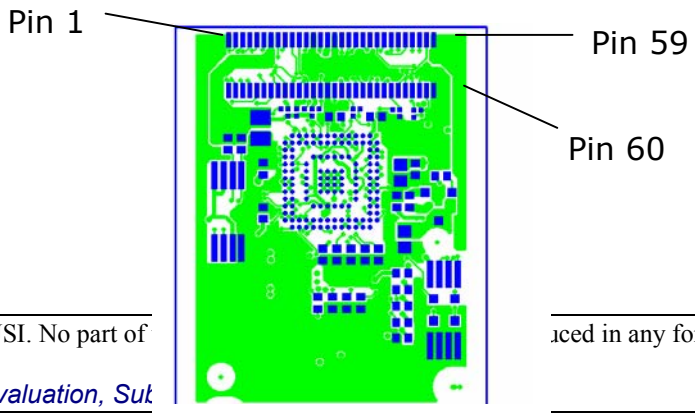
[…] means optional function of the pin.
PD : Signal pull down internally in the chip by 50K ohm after initialization.
PU : Signal pull up internally in the chip by 100K ohm after initialization.
xxx_B : Signal pins end with _B are "active Low"

Pin Number	Definition	Draft Descriptions		Type
WM-G-MR-01	CF+ interface			
1	GND	GND	GND	
2	D03	HD3	CompactFlash Data bit[3]	IO, PU, 4mA
3	D04	HD4	CompactFlash Data bit[4]	IO, PU, 4mA
4	D05	HD5	CompactFlash Data bit[5]	IO, PU, 4mA
5	D06	HD6	CompactFlash Data bit[6]	IO, PU, 4mA
6	D07	HD7	CompactFlash Data bit[7]	IO, PU, 4mA
7	-CE_1	HCE1_B	Card Enable1 is driven by the host system and is used as select strobe in both I/O and memory mode. Enables even numbered address bytes.	Input, PU
8	A10	HA10	CompactFlash Address bit [10]. See address bit [0] description.	Input, PU
9	-OE SD_CMD	HOE_B	OUTPUT ENABLE is driven by the host during a memory Read Access. SD_CMD : SDIO Command Line	Input, PU
10	A09 SD_DAT2	HA9	CompactFlash Address bit [9]. See address bit [0] description. SD_DATA2 : SDIO DATA LINE 2	Input, PU
11	A08	HA8	CompactFlash Address bit [8]. See address bit [0] description.	Input, PU
12	A07	HA7	CompactFlash Address bit [7]. See address bit [0] description.	Input, PU
13	VCC	VCC_WLAN	3.3V supply voltage for WLAN	Input 3.3 Volt
14	A06	HA6	CompactFlash Address bit [6]. See address bit [0] description.	Input, PU
15	A05	HA5	CompactFlash Address bit [5]. See address bit [0] description.	Input, PU

16	A04	HA4	CompactFlash Address bit [4]. See address bit [0] description.	Input, PU
17	A03	HA3	CompactFlash Address bit [3]. See address bit [0] description.	Input, PU
18	A02	HA2	CompactFlash Address bit [2]. See address bit [0] description.	Input, PU
19	A01	HA1	CompactFlash Address bit [1]. See address bit [0] description.	Input, PU
20	A00	HA0	CompactFlash Address bit [0]. The address lines A[10:00] along with the REG signal are used to select the following: • The I/O port address register • The memory mapped port address register • A byte in the card's information structure (CIS)	Input, PU
21	D00	HD0	CompactFlash Data bit[0]	IO, PU 4mA
22	D01	HD1	CompactFlash Data bit[1]	IO, PU, 4mA
23	D02	HD2	CompactFlash Data bit[2]	IO, PU, 4mA
24	-IOIS16	HIOIS16_B	I/O port is 16bits	Out, 6mA
25	-CD2	CD2	Normal operation, this pin is functionally for card detection.	Out, 6mA
26	N/A	VAUX	Reserved for the Vaux DC power to support WOL application. Suggest to keep the connection to VCC on host system if WOL is not required.	Input 3.3 Volt
27	N/A	N/A	Reserved.	Input 3.3 Volt
28	N/A	N/A	Reserved. Keep connection open on Host side	N/A
29	N/A	N/A		N/A
30	GND	GND		
31	GND	GND		
32	D10	HD10	CompactFlash Data bit[10]	IO, PU, 4mA
33	D09	HD9	CompactFlash Data bit[9]	IO, PU, 4mA
34	D08	HD8	CompactFlash Data bit[8]	IO, PU, 4mA
35	-STSCHG	HSTSCHG_B	Card status changed	Output, 4mA
36	-SPKR	BTACT	Control signal for WIFI & Bluetooth coexistence which indicate the activity of Bluetooth module.	Input PD, 4mA
37	-REG	HREG_B	Register select and I/O enable	Input, PU
38	-INPACK	HINPACK_B	INPUT ACKNOWLEDGE is driven by WM-G-MR-01. Is asserted when the device is selected and the device is responding to an I/O Read command.	Output, 2mA
39	-WAIT	HWAIT_B	HWAIT_B is driven by WM-G-MR-01 and allows for extending the memory or I/O cycle	Output, 4mA
40	RESET	HRESET	Used to asynchronously reset WLAN. High active.	Input, PU
41	N/A	N/A	Reserved. Keep connection open on Host side	N/A
42	N/A	WLAN_LED_B	WLAN LED control signal, driven the LED indicating the link status of WLAN. Active low.	Output, 4mA

43	N/A	WLAN_active	Control signal for WIFI & Bluetooth coexistence which indicate the activity of WM-G-MR-01 WiFi module.	Output, PD, 4mA
44	IREQ	IREQ_B	Ready/Busy or Interrupt request. In memory mode, this signal indicates the ready or busy status of the card. When held high, the card is ready to accept a new data transfer. When held low the card is busy. In I/O mode, this signal is used to indicate an interrupt condition.	Output, 4mA
45	-WE	HWE_B	WRITE ENABLE is driven by the host during a memory Write Access	Input, PU
46	-IOWR SD_DAT3	HIOWR_B	I/O Write Strobe is driven by the host and is asserted when the host wants to write to an on-chip I/O register SD_DAT3 : SDIO DATA LINE 3	Input, PU
47	-IORD SD_DAT1	HIORD_B	I/O Read Strobe is driven by the host and is asserted when the host wants to read from an on-chip I/O register SD_DAT1 : SDIO DATA LINE 1	Input, PU
48	-VS1	-VS1	This pin is connected to Ground on module to indicate the voltage of this module is 3.3V card.	GND
49	-CE2 SD_CLK	HCE2_B	CARD ENABLE2 is driven by the host system and is used as select strobe in both I/O and memory mode. Enables odd numbered address bytes SD_CLK : SDIO CLOCK	Input, PU
50	D15	HD15	CompactFlash Data bit[15]	IO, PU, 4mA
51	D14	HD14	CompactFlash Data bit[14]	IO, PU, 4mA
52	D13	HD13	CompactFlash Data bit[13]	IO, PU, 4mA
53	D12	HD12	CompactFlash Data bit[12]	IO, PU, 4mA
54	D11	HD11	CompactFlash Data bit[11]	IO, PU, 4mA
55	N/A	N/A	Reserved. Keep connection open on Host side	N/A
56	N/A	N/A	Reserved. Keep connection open on Host side	N/A
57	N/A	N/A	Reserved. Keep connection open on Host side	N/A
58	SD_DAT0		Reserved. Keep connection open on Host side if SDIO is not used SD_DAT0 : SDIO DATA LINE 0	I/O
59	N/A	N/A	Reserved. Keep connection open on Host side	N/A
60	GND	GND		

Connector orientation



11.3 LED INTERFACE

The Wireless Module provides one control signals to the host. The control signal is capable to drive an LED to indicate the connectivity and operating status.
The signaling will reflect status / activity as described in the table below.

Pin No	Pin description	Function description
42	**WLAN_LED**	Check firmware specification of GPIO(1) with Marvell

11.4 ANTENNA INTERFACE

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

Antenna Connector: *Hirose W-FL-R-SMT(10)*

11.5 BLUETOOTH INTERFACE

There are 2 control signals available to provide coexistence between the 802.11b/g WLAN module and external 802.15 Bluetooth modules.

The co-existence system is: 2-wire arbitration mode. For more information please refer to "Application Note: Marvell® 8385/8381 BlueTooth coexistence"

The control signals are provided via the 60 pins B2B connector with the interface defined as below:

Symbol	**Interface**	**"Signal name" & description**
BTACT	2 Wire-CSR	**"BT _Priority"** This pin indicates to WLAN BCA device that BT module is active or will soon be active to TX/RX

		stage.
WLAN_active	2 Wire-CSR	"Wlan_Active", **This pin indicates to BT module that WLAN is active or will soon be active to TX/RX stage.**

12. SOFTWARE SPECIFICATION

FEATURES

- 802.11 b/g
- WEP Encryption (64bit/128bit)
- IEEE power save mode
- Deep Sleep Mode
- Infrastructure & Ad-Hoc Mode
- Rate adaptation
- WPA TKIP security
- WPA2 (Linux ready)
- 802.1x support
  - AES

OPERATING SYSTEMS

- WinCE 4.2/5.0, Windows Mobile 2003, Windows Mobile 5.0
  Certification tool support
  Configuration Utility support

- Linux: Slakeware 9.1, Fedora Core 1.0
  Kernel: 2.4.22 & above
  Certification tool support
  Configuration Utility support (Wireless extension support)

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