EZURiO

# 802.11b/g Wireless LAN – TCP/IP (BISM II Pin Compatible)

# Part Number: WISMC01BI

# 1. General Description

EZURiO's Wireless LAN Module is a fully integrated and qualified solution unlike other modules all the drivers and antenna are integrated. This makes certain the module is designed for lowest cost of integration and ownership for designers wishing to incorporate Wireless LAN functionality into their products.

The Wireless LAN module is one of the most compact complete Wireless LAN solutions, incorporating all the required 802.11b/g drivers and an Ultra Compact TCP/IP and the EZURiO UWScript language embedded directly into the module, making it ideal to integrate into Machine 2 Machine applications.

The EZURiO Wireless LAN module contains all of the hardware, firmware and embedded drivers for a complete Wireless LAN solution, requiring no further components. The Module has an integrated, high performance antenna which is matched with the Wireless LAN RF and baseband circuitry. The firmware integrated into the module interfaces with the host via a UART which carries control and data frames. The TCP/IP stack requires minimal operating overheads from the operating system and allows simple passing of control frames contain simple commands used to configure and monitor the module operation into EZURiO's command interpreter.

The feature rich command set abstracts the Wireless LAN protocol from the host application, saving many months of programming and integration time. A low cost development system is available for fast product evaluation and development.

In addition to the Wireless LAN functionality, the module provides access to 9 General I/O lines and 2 analogue input lines. These can be configured using scripts to provide control or monitoring of simple devices such as switches or LEDs without requiring any external processing. Both the GPIO and ADC lines can be accessed using scripts over either via the wired host UART connection, or remotely over the Wireless LAN connection.

The Wireless LAN module is supplied in a small pcb form factors (22.0mm x 34.0mm x 7.6mm), that connects to a main pcb using a 40 way Hirose connector which is pin compatible with the EZURiO Bluetooth Intelligent Serial Module BISMII. The module includes a high sensitivity, high gain antenna which provides excellent range. Typical open field performance provides ranges of over 100 metres.

Support is provided for low power modes that make the Wireless LAN module particularly applicable to battery powered installations. The Wireless LAN module is Lead-free and is RoHS compliant and supports an industrial temperature range of -40°C to +85°C.

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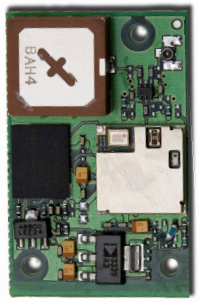
## 1.1 Applications

- POS Equipment
- Medical Equipment
- Telematics
- Industrial Automation
- Automotive Applications



# 2. Features

| Feature | Implementation |
|---|---|
| Wireless LAN Transmission | Complete stand alone device with on board flash |
| Drivers | Embedded 802.11b/g |
| Protocol | TCP/IP IPv4 and DHCP |
| Range | 100 meters typical |
| Frequency | 2.4 – 2.484 GHz |
| Channels | 11 channels – USA<br>13 channels – Europe (excl France)<br>14 channels – Japan<br>4 channels – France |
| Max Transmit Power | +15 dBm @ antenna connector.<br>+17dBm from integrated antenna<br>+10 dBm limit for France and Hungary |
| Receive Sensitivity | -84dBm @ 2Mbps |
| Interface | UART Interface |
| Programmable | Real-time scripting engine |
| Data Transfer rate | Up to 2 Mbps (determined by UART) |
| Serial Interface | RS-232 bi-directional for commands and data.<br>16550 compatible. |
| Serial parameters | Default 115200,n,8,1<br>Configurable from 9,600 bps. Default 115,200 bps<br>DTR, DSR, DCD, RI, RTS, CTS |
| Security | WEP encryption 64 and 128 bit options |
| Network support | Access Point |
| I/O | 2 x 10bit ADC's<br>9 GPIO |
| Current consumption | Less than 250mA (this depends on the data rate – 250mA is at 115kbaud) during data transfer with a configurable low power mode |
| Temperature Range | Normal operation: -30°C to +60°C<br>Limited functionality: -40°C to +85°C |
| Supply Voltage | 3.3V – 5.0V |
| Interface Levels | 3.0V Logic |
| Connection | Option: 40 way BISM II pin compatible Hirose connector<br>Or 50 way Hirose Connector with industrial standard pin configuration |
| Lead free | Lead-free and RoHS compliant |
| Warranty | 2 Years |

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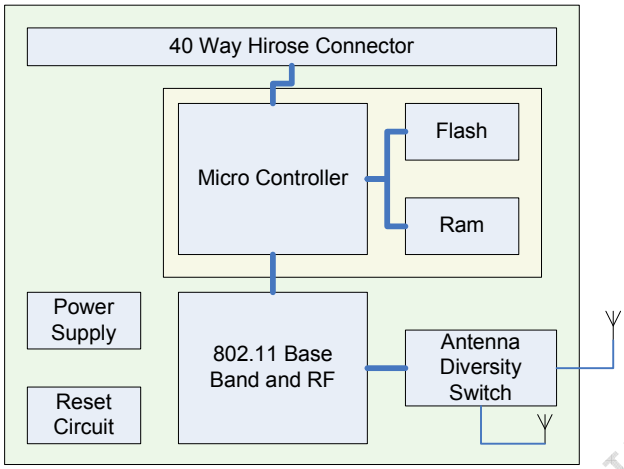
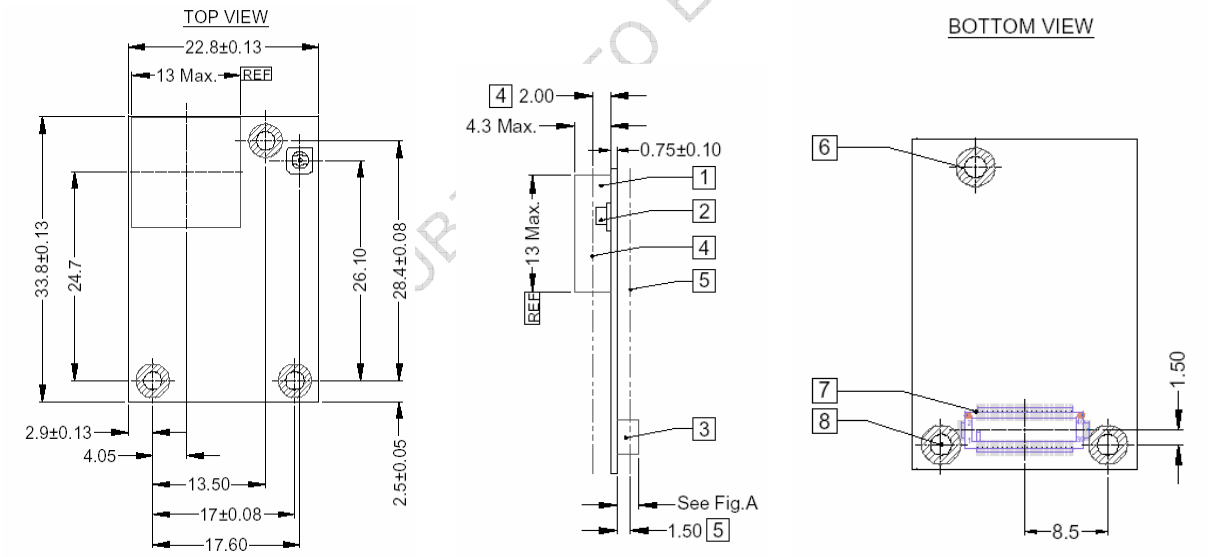
## 2.1 Block Diagram

The module will have 40 way Hirose connector which will have a compatible pin out to the EZURiO Bluetooth Intelligent Serial Module, BISM II Hirose connector.




# 3. Mechanical

**Figure 1 Wireless LAN Module Dimensional outline**




| | | | |
|---|---|---|---|
| 1 | RF antenna | 2 | Optional FR connector (Hirose U.FL-R-SMT) |
| 3 | Board to board connector (Hirose connector) | 4 | 2MM maximum top side component height (excluding antenna) |
| 5 | 1.5MM maximum bottom side component height | 6 | 3.8 max. pcb clearance for fixings body (top and bottom) |
| 7 | 40 way connector footprint | 8 | 2.2 +/- 0.075 fixing holes X 3 |

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## 3.1 40 way Hirose Pin Descriptions

The Hirose DF12C board-to-board connector on the module is a 40-pin double-row receptacle.

The table below defines the pin functions. Note that this pin-out is as viewed from the underside of the Module.

| Pin No. | Signal | Description |
|---|---|---|
| 1 | ADC 0 | 1.8v Max |
| 3 | ADC 1 | 1.8v Max |
| 5 | WLAN_ACTIVE | Output |
| 7 | N/C | |
| 9 | N/C | |
| 11 | GND | |
| 13 | RESET | Reset I/P * |
| 15 | GND | |
| 17 | N/C | Not used |
| 19 | UART_CTS | Clear to Send I/P |
| 21 | UART_TX | Transmit Data O/P |
| 23 | UART_RTS | Request to Send O/P |
| 25 | UART_RX | Receive Data I/P |
| 27 | VCC_3V | 3.0V Monitor |
| 29 | VCC_5V | Input |
| 31 | VCC_5V | Input |
| 33 | GPIO6 | I/O for Host |
| 35 | GPIO7 ** | I/O for Host |
| 37 | GPIO8 ** | I/O for Host |
| 39 | GPIO9 | I/O for Host |

| Pin No. | Signal | Description |
|---|---|---|
| 2 | GPIO1 | I/O for Host. |
| 4 | GPIO2 | I/O for Host |
| 6 | UART_RI | 'Ring' Input or Output |
| 8 | UART_DCD | Input or Output |
| 10 | UART_DSR | Input |
| 12 | GPIO3/UART_DTR | I/O for Host |
| 14 | GPIO4 | I/O for Host |
| 16 | GPIO5 | I/O for Host |
| 18 | GND | |
| 20 | IRQ0 | Input |
| 22 | WAKEUP | Not used |
| 24 | BT_PRIORITY | Input |
| 26 | N/C | Not used |
| 28 | VCC_5v | Input |
| 30 | GND | |
| 32 | N/C | |
| 34 | N/C | |
| 36 | GND | |
| 38 | GND | |
| 40 | BT_STATE | |

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Notes:

* The reset circuitry within the module incorporates a brown-out detector. The reset line has a fixed 10kOhm pull down resistor to ground.

GPIO lines can be configured through software to be either inputs or outputs. At reset, all GPIO lines are configured as inputs.

UART_RX, UART_TX, UART_CTS, UART_RTS, UART_RI, UART_DCD and UART_DSR are all 3.0v level logic. For example, when RX and TX are idle they will be sitting at 3.0V. For handshaking pins CTS, RTS, RI, DCD, DSR, 0v is treated as an assertion.

Pin 8 (UART_DCD) is active low. It is normally 3.0v. When a connection is live this pin is low. This means that when this pin is converted to RS232 voltage levels it will have the correct voltage level for assertion.

Pin 10 (UART_DSR) is an input, with active low logic. It should be connected to the DTR output of the host.

Pin 27 (VCC_3V monitor) may only be used for monitoring purposes. It must not be used as a current source.

ADC inputs (pins 1 and 3) are read using UW script functions.

## 3.2 Electrical Specifications

### 3.2.1 Absolute Maximum ratings

Absolute maximum ratings for supply voltage and voltages on digital and analogue pins of the Module are listed below; exceeding these values will cause permanent damage.

| Parameter | Min | Max | Unit |
|---|---|---|---|
| Peak current of power supply | | 550 | mA |
| Voltage at digital pins | -0.3 | 3.3 | V |
| Voltage at POWER pin | 3.3 | 5 | V |

### 3.2.2 Recommended Operating Parameters

#### 3.2.2.1 Power Supply

| Signal Name | Pin No | I/O | Voltage level | Comments |
|---|---|---|---|---|
| Vcc | 29 | I | 3.3V to 5.0V | $I_{typ}$ = 250mA |
| GND | 11, 15, 18, 30, 36, 38 | | | 6 Ground terminals to be attached in parallel |
| VCC_3V0 | 27 | O | 3.0V typical | For monitoring only. No current source |

#### 3.2.2.2 RS-232 Interface

| Signal Name | Pin No | I/O | Signal level | Comments |
|---|---|---|---|---|
| UART_TX | 21 | O | $V_{OL}$max=0.2V<br>$V_{OH}$min=2.8V | |
| UART_RX | 25 | I | $V_{IL}$max=0.8V<br>$V_{IH}$min=2.1V<br>$V_{IH}$max=3.3V | |
| UART_CTS | 19 | I | $V_{IL}$max=0.8V<br>$V_{IH}$min=2.1V<br>$V_{IH}$max=3.3V | |
| UART_RTS | 23 | O | $V_{OL}$max=0.2V<br>$V_{OH}$min=2.8V | |
| UART_DSR | 10 | I | $V_{IL}$max=0.8V<br>$V_{IH}$min=2.1V<br>$V_{IH}$max=3.3V | |
| UART_DTR | 12 | O | $V_{OL}$max=0.2V<br>$V_{OH}$min=2.8V | Shared with GPIO3 |

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| | | | | |
|---|---|---|---|---|
| UART_RI | 6 | I or O | O/P : $V_{OL}$max=0.2V<br>$V_{OH}$min=2.8V<br>I/P : $V_{IL}$max=0.8V<br>$V_{IH}$min=2.1V<br>$V_{IH}$max=3.3V | Direction may be programmed. |
| UART_DCD | 8 | I or O | O/P : $V_{OL}$max=0.2V<br>$V_{OH}$min=2.8V<br>I/P : $V_{IL}$max=0.8V<br>$V_{IH}$min=2.1V<br>$V_{IH}$max=3.3V | Direction may be programmed. |

#### 3.2.2.3 General Purpose I/O and ADC

| Signal Name | Pin No | I/O | Signal level | Comments |
|---|---|---|---|---|
| GPIO 1 - 9 | 2,4,12, 14,16, 33, 35, 37, 39 | I or O | O/P : $V_{OL}$max=0.2V<br>$V_{OH}$min=2.8V<br>I/P : $V_{IL}$max=0.8V<br>$V_{IH}$min=2.1V<br>$V_{IH}$max=3.3V | |
| AIO_0, AIO_1 | 1, 3 | I | Range 0 – 1.8V | |

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# 4. DC Characteristics

## 4.1 RF Performance

### 4.1.1 Transmit Power (802.11g)

| | |
|---|---|
| **Conducted Transmit Power** | Typ: +13 dBm |
| **Antenna Gain (Integrated Antenna)** | +2dBi typ. |
| **Effective Transmit Power** | Typ:+15dBm |

### 4.1.2 Transmit Power (802.11b)

| | |
|---|---|
| **Conducted Transmit Power** | Typ: +15 dBm |
| **Antenna Gain (Integrated Antenna)** | +2dBi typ. |
| **Effective Transmit Power** | Typ:+17dBm |

### 4.1.3 Receive Sensitivity (802.11b)

| | |
|---|---|
| **Receive Sensitivity (11Mbps)** | Typ: -84dBm |
| **Antenna Gain (Integrated Antenna)** | +2dBi typ |
| **Effective Receive Sensitivity** | -86dBm |

### 4.1.4 Receive Sensitivity (802.11g)

| | |
|---|---|
| **Receive Sensitivity (6Mbps)** | Typ: -82dBm |
| **Antenna Gain (Integrated Antenna)** | +2dBi typ |
| **Effective Receive Sensitivity** | -84dBm |

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# 5. Functional Description

The Wireless LAN module is a self-contained product and requires only power to implement full communication. The integrated, high performance antenna together with the RF and Base-band circuitry provides the Wireless LAN connectivity and the UART interface provides a connection to the host system.

The complexity and flexibility of configuration are made simple for the design engineer by the integration of a extremely comprehensive scripting language, UWScript. UWScript provides a simple basic style language with constructed commands that simplify the connectivity of the module.

To provide the widest scope for integration a range of different physical host interfaces are provided:

## 5.1 Interfaces

### 5.1.1 UART interface

UART_TX, UART_RX, UART_RTS and UART_CTS form a conventional asynchronous serial data port with handshaking. The interface is designed to operate correctly when connected to other UART devices such as the 16550A. The signalling levels are nominal 0V and 3.0V and are inverted with respect to the signalling on an RS232 cable. The interface is programmable over a variety of bit rates; no, even or odd parity; stop bit and hardware flow control. The default condition on power-up is pre-assigned in the external Flash. Two-way hardware flow control is implemented by UART_RTS and UART_CTS. UART_RTS is an output and is active low. UART_CTS is an input and is active low. These signals operate according to normal industry convention.

The module communicates with the customer application using the following signals:

RS-232

Port /TXD @ application sends data to the module's UART_RX signal line

Port /RXD @ application receives data from the module's UART_TX signal line

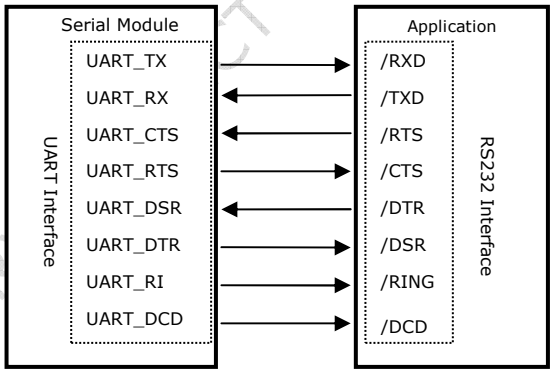


Figure 6.1 : UART interfaces

Note that the serial module output is at 3.0V CMOS logic levels. Level conversion must be added to interface with an RS-232 level compliant interface.

### 5.1.2 GPIO Port

Nine lines of programmable bi-directional input/outputs (I/O) are provided that can be accessed either via the UART port using UWscript functions. These can be used as data inputs or to control external equipment.

Each of the GPIO pins can be independently configured to be either an Input or Output. A selection of ports can be accessed synchronously.

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### 5.1.3 ADC

The Wireless LAN module provides access to two 10-bit ADCs. These provide an input range of 0mV to ADC reference voltage.

Suitable external scaling and over-voltage protection should be incorporated in your design. The module provides 5 samples per second at the UART with a baud rate of 115200 or above.

# 6. Firmware Features

## 6.1 Command Set

The Wireless LAN module has an integrated high level language UWScript. UWScript provides both the command set and an structured programming language for the module, this revolutionary software interface is described in detail in the UWScript Core Language and the UWScript Wireless LAN specific extension documents. Accompanying these are release notes specific to each module and firmware release detailing the functions supported with each release.

## 6.2 TCP/IP

The module has implemented IPLITE an Ultra Compact IPv4. IPLITE has a very small footprint and minimal impact on the modules processing and is designed specifically for the embedded environment. The stack fully supports raw IP, UDP and TCP BSD sockets as well as providing an underlying support infrastructure or the implementation of IP Security and is designed for minimum footprint and maximum performance.

## 6.3 DHCP

With the Dynamic Host Configuration Protocol - DHCP - the process of configuring devices on a network gets automated. With very little administrator intervention it is easy to accommodate new devices to a network. Another big advantage of DHCP is that it allows for easy connection of mobile devices. DHCP-enabled modules can move from one place to another with no disturbances. The TCP/IP stack automatically gets an IP address and configuration suitable for the network segment it is currently attached to.

## 6.4 Power Saving

The module supports the Wireless LAN IEEE power saving function. When this power saving mode is enabled, the wireless LAN chipset goes to sleep when it is not actively receiving from the access point. The chipset wakes up on a regular basis to receive broadcast messages from the AP or to transmit or receive unicast messages. By using this technique the average power consumption of the chipset is reduced from around 250mA in active receive to <10mA (TBC) when IEEE power save is in use. The EZURiO module offers IEEE power save operation in two different modes:

- Powersave mode 1: The wireless LAN chipset operates in IEEE powersave mode and the module microcontroller remains fully awake and ready to receive commands and data from the host. This mode of power saving reduces the average consumption of the module to <35mA (TBC).
- Powersave mode 2: The wireless LAN module operates in IEEE powersave mode and the module microcontroller is put into a very low power standby mode. The average current consumption in this mode is reduced to <5mA (TBC). In power save mode 2, /DSR (TBD) is used by the host to indicate that the module can enter the low power state. When /DSR (TBD) is de-asserted, the module microcontroller enters low power standby. The microcontroller will re-start when either a packet is received from the AP or the host requests it by asserting /DSR (TBD).
- Powersave mode 5: The modules default mode of start up is in powersave mode5. At start up the module automatically enters Power Save 5 mode. The average current consumption in this mode is reduced to <25mA (TBC). In this mode the module powers

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down the WLAN chipset, and awaits commands from the host or from a script running on the module. While in powersave mode 5 the host or scripts cannot send the following commands:

- SEARCH
- ATTACH
- SECURITY
- AUTHENTICATE
- KEY
- DETACH

To gain access to all commands the module must first be changed from powersave mode 5 to either powersave 1 or powersave 0 mode.

# 7. Application Information

## 7.1 External Antenna

A variety of manufacturers can supply external antennae suitable for use with the WISM module as a diversity or prime antenna. Users should be aware that the choice of antenna will affect the qualification of the module.

To ensure that the qualification is not affected, the TOTAL GAIN of the external antenna, including insertion loss of the connectors and cable must be less than 3dBi. If a higher gain is employed, then the pre-qualified status of the module will be lost. It is the customer's responsibility to ensure that an external antenna does not negate the qualification.

## 7.2 Power Supply Considerations

The power supply for the Module has to be a single voltage source of Vcc within the range of 3.3 V to 5.0 V. It must be able to provide sufficient current in a transmit burst. This can rise to 550mA.

The Module includes regulators to provide local 3.0V. This rail is accessible on connector J2 for monitoring purposes only. Under no circumstances should this pin be used to source current.

Power (Vcc) can be provided via the board-to-board connector Pins 28, 29 and 31.

## 7.3 Power-On-Reset

The Module is provided with an active high reset pin (Hirose 40way DF12C connector pin 13). Upon the application of power, the Power On Reset circuit built into the Module will ensure that the unit starts correctly. There is no need for an external power reset monitor.

## 7.4 Operational Temperature

The Wireless LAN module is designed to meet an operational temperature of -40°C to +85°C in the standard mode where it is running in IEEE power save mode.

If the module is run in a mode that results in more frequent receive and transmit activity the operating temperature will need to be derated to ensure that overall module power dissipation limits are not exceeded. When the ambient temperature rises above 60°C the module should only be operated in powersave mode 1 or higher.

## 7.5 Mounting the Module onto the application platform

There are many ways to properly install the Module in the host device. An efficient approach is to mount the PCB to a frame, plate, rack or chassis. Fasteners can be M1.8 or M2 screws plus suitable

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washers, circuit board spacers, or customized screws, clamps, or brackets in 2.2mm diameter holes. Note that care should be taken to ensure the head of the fixing does not interfere with the circuit. Nylon fixings are recommended. In addition, the board-to-board connection can also be utilized to achieve better support.

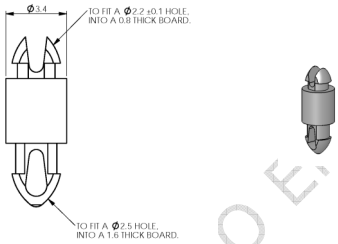
The antenna (Brown square component on top side of PCB) must not be influenced by any other PCBs, components or by the housing of the host device. The proximity of the antenna to large metallic objects can affect the range and performance of the system. Designers should carefully consider the location of the Module and the type of enclosure material that is used.

To prevent mechanical damage, be careful not to force, bend or twist the Module. Be sure it is positioned flat against the host device.

### 7.5.1 Fixing Pillars

EZURiO in conjunction with Richco has designed a mounting pillar for use with the Wireless LAN Module. This allows the module to be securely held to a primary pcb using snap fit details. A variety of different heights are available to accommodate different variants of Hirose stacked connectors. Pillars supporting a 3.5mm stacked board height can be supplied by EZURiO. These and alternative spacings can also be ordered directly from Richco.

Customer designs using these pillars should use 2.5mm diameter holes on a 1.6mm thick PCB. in conjunction with the 3.6 mm stacked height Hirose if they are to take advantage of this.




See http://www.hirose.co.jp/cataloge_hp/e53700036.pdf for detail information on the PCB socket.

## 7.6 Stacking Height

Mating headers from Hirose are available in different stacking heights, allowing the spacing between the Wireless LAN Module and carrier pcb to be changed from 3.5mm to 5.0mm.

| Item | Part number | Stacking height | HRS number |
|---|---|---|---|
| Receptacle on Module | DF12C-50DS-0.5V(86) | 3.5 mm – 5 mm | CL537-0009-2-86 |
| Headers DF12 series | DF12(3.5)-50DP-0.5V(86) | 3.5 mm | CL537-0034-0-86 |
| | DF12(4.0)-50DP-0.5V(86) | 4.0 mm | CL537-0059-0-86 |
| | DF12(5.0)-50DP-0.5V(86) | 5.0 mm | CL537-0159-5-86 |

Notes: The headers listed above are with boss and metal fitting.
Suffix -86 denotes RoHS compliance.

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# 8. Board to Board Connector

This chapter provides specifications for the 40-pin board-to-board connector which serves as physical interface to the host application. The receptacle assembled on the Module is Hirose type DF12C. Details are available at: http://www.hirose.co.jp/cataloge_hp/e53700036.pdf

## 8.1 Stacking Height

Mating headers from Hirose are available in different stacking heights, allowing the spacing between the BISM2 and carrier pcb to be changed from 3.5mm to 5.0mm.

Notes: The headers listed above are with boss and metal fitting.
Suffix -86 denotes RoHS compliance.

| Item | Part number | Stacking height | HRS number |
|---|---|---|---|
| Receptacle on Module | DF12C-40DS-0.5V(86) | 3.5 mm – 5 mm | CL537-0007-7-86 |
| Headers DF12 series | DF12(3.5)-40DP-0.5V(86) | 3.5 mm | CL537-0032-4-86 |
| | DF12(4.0)-40DP-0.5V(86) | 4.0 mm | CL537-0057-5-86 |
| | DF12(5.0)-40DP-0.5V(86) | 5.0 mm | CL537-0157-0-86 |

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## 8.2 Hirose Connector general specification

| Parameter | Specification (40 pin Board to Board connector) |
|---|---|
| Number of Contacts | 40 |
| Quantity delivered | 2000 Connectors per Tape & Reel |
| Voltage | 50V |
| Current Rating | 0.5A max per contact |
| Resistance | 0.05 Ohm per contact |
| Dielectric Withstanding Voltage | 500V RMS min |
| Operating Temperature | -45°C...+125°C |
| Contact Material | phosphor bronze (surface: gold plated) |
| Insulator | Material PA , beige natural |
| Stacking height | 3.0 mm ; 3.5 mm ; 4.0 mm ; 5.0 mm |
| Insertion force | 21.8N |
| Withdrawal force 1st | 10N |
| Withdrawal force 50th | 10N |
| Maximum connection cycles | 50 |

# 9. Disclaimers

EZURIO'S WIRELESS PRODUCTS ARE NOT AUTHORISED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE MANAGING DIRECTOR OF EZURIO LTD.

The definitions used herein are:

a) Life support devices or systems are devices which (1) are intended for surgical implant into the body, or (2) support or sustain life and whose failure to perform when properly used in accordance with the instructions for use provided in the labelling can reasonably be expected to result in a significant injury to the user.

b) A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

EZURiO does not assume responsibility for use of any of the circuitry described, no circuit patent licenses are implied and EZURiO reserves the right at any time to change without notice said circuitry and specifications.

## 9.1 Data Sheet Status

This data sheet contains preliminary data for use with Engineering Samples. Supplementary data will be published at a later date. EZURiO Ltd reserve the right to change the specification without prior notice in order to improve the design and supply the best possible product.

Please check with EZURiO Ltd for the most recent data before initiating or completing a design.

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