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 for adding 802.11 functionality to embedded products. Unlike other modules it implements a complete wireless system, including antenna, 802.11b/g radio, wireless network drivers, TCP/IP stack, security (WEP, WPA2, SSL), a web-server, UART, GPIOs, 10 bit ADCs, plus an interpreter with a wireless language and user accessible flash storage for program scripts. It is ideal for integration within M2M applications. It can also be used for remote monitoring with the addition of just a sensor and battery/power supply.

The optimised RF section provides an output of up to +17dBm using the integrated ceramic antenna. Coupled with a receive sensitivity of -84dBm, a range of 100 metres is achievable. A separate u.fl connector is fitted to the module which allows a second antenna to be connected to take advantage of antenna diversity. For most applications the internal antenna is sufficient. It provides a largely omnidirectional distribution and is highly resistant to detuning, allowing the module to be fitted in a wide variety of situations with no degradation of the radio performance.

An integrated ARM processor runs all of the wireless drivers and protocol stack. It includes a web server that can be used to interrogate the variety of interfaces within module. The processor runs EZURiO's high efficiency embedded interpreter, which gives the module its amazing power. Users can write simple scripts for the interpreter, which supports the BASIC language, as well as an extensive range of commands to control the wireless connection. Scripts can be auto-run at power up to turn the module into a self-contained wireless application processor. A low cost development system is available for fast product evaluation and development.

The module contains an industry standard RS-232 UART for connection to a host processor, peripheral device or sensor. This is capable of baud rates up to 921,600 bps for high speed data transfer. Nine General Purpose I/O lines and two 10 bit analogue input lines are also provided. These can be configured using scripts to provide control or monitoring of simple devices such as switches or LEDs without a requirement for any external processing. Both the GPIO and ADC lines can be accessed either via the wired host UART connection, or remotely over the Wireless LAN connection.

For battery and low power operation, support is provided for IEEE powersave modes, which can reduce the current consumption to less than 10mA. This makes the module ideal for battery powered sensor applications.

The Wireless LAN module is supplied in a small pcb form factor (22.0mm x 34.0mm x 7.6mm), that connects to a main pcb using a 40 way Hirose connector. It is pin compatible with the EZURiO Bluetooth Intelligent Serial Module BISMII. The Wireless LAN module is Lead-free and is RoHS compliant and supports an industrial temperature range of -40°C to +85°C.

1.1 Applications

- POS Equipment
- Medical Equipment
- Telematics
- Industrial Automation
- Automotive Applications
- Battery Powered Sensors

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 metres typical
Frequency	2.4 – 2.484 GHz
Channels	11 channels – USA
	13 channels – Europe (excl France)
	14 channels – Japan
	4 channels – France
Max Transmit Power	+15 dBm @ antenna connector.
	+17dBm from integrated antenna
	+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.
	16550 compatible. DTR, DSR, DCD, RI, RTS, CTS
Serial parameters	Default 115200,n,8,1.
	Configurable from 9,600 bps. Default 921,600 bps
Security	WEP encryption 64 and 128 bit options, WPA, WPA2, SSL
Network support	Access Point
I/O	2 x 10bit ADC's
	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	-40°C to +85°C (requires operation in powersave modes)
	-30°C to +60°C (continuous operation)
Supply Voltage	3.3V – 5.0V
Interface Levels	3.0V Logic
Connection	Option: 40 way BISM II pin compatible Hirose connector
Lead free	Lead-free and RoHS compliant
Warranty	2 Years

The features described within this data sheet are those targeted for the first production release of firmware. Note that not all of these features may be available within individual releases of the Engineering Sample firmware. Check with the firmware release notes to determine the supported functionality.

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.

40 Way Hirose C

Micro Controll
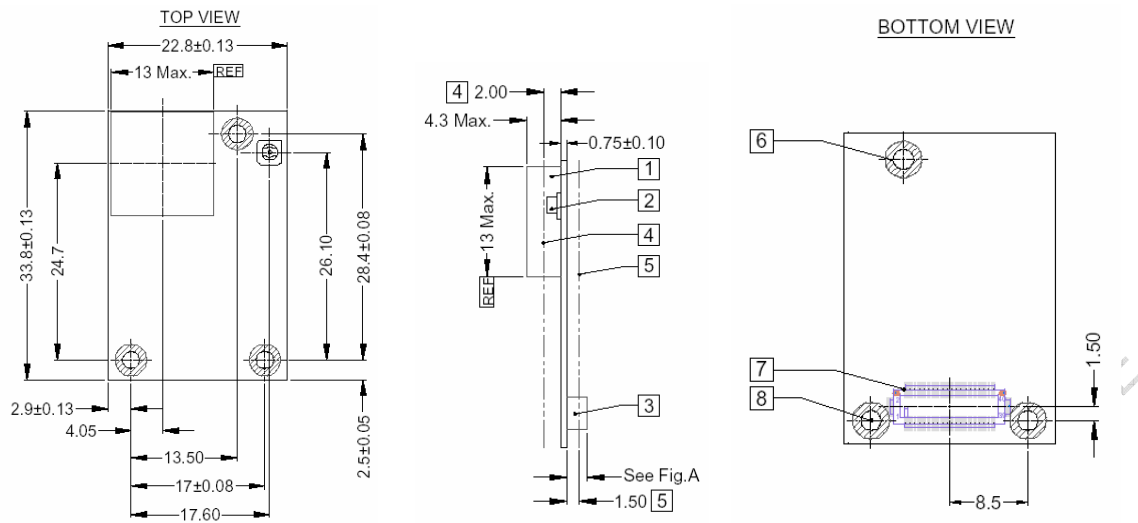
Power
Supply

802.11 Base
Band and RF
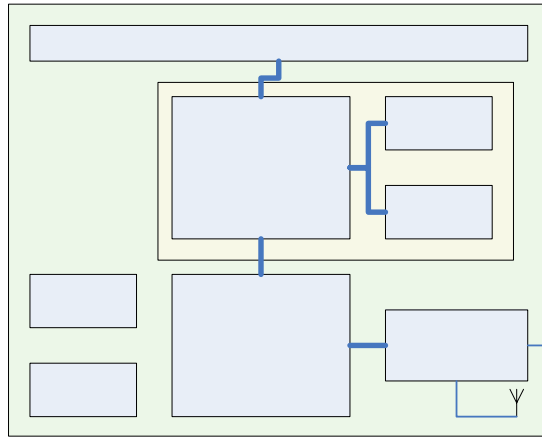
Reset
Circuit

3. Mechanical

Figure 1 Wireless LAN Module Dimensional outline

1	RF antenna	2	Optional RF 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	8	2.2 +/- 0.075 fixing holes X 3

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	Pin No.	Signal	Description
1	ADC 0	1.8v Max	2	GPIO1	I/O for Host.
3	ADC 1	1.8v Max	4	GPIO2	I/O for Host
5	WLAN_ACTIVE	Output	6	UART_RI	'Ring' Input or Output
7	N/C		8	UART_DCD	Input or Output
9	N/C		10	UART_DSR	Input
11	GND		12	GPIO3/UART_DTR	I/O for Host
13	RESET	Reset I/P *	14	GPIO4	I/O for Host
15	GND		16	GPIO5	I/O for Host
17	N/C	Not used	18	GND	
19	UART_CTS	Clear to Send I/P	20	IRQ0	Input
21	UART_TX	Transmit Data O/P	22	WAKEUP	Not used
23	UART_RTS	Request to Send O/P	24	BT_PRIORITY	Input

25	UART_RX	Receive Data I/P	26	N/C	Not used
27	VCC_3V	3.0V Monitor	28	VCC_5v	Input
29	VCC_5V	Input	30	GND	
31	VCC_5V	Input	32	N/C	
33	GPIO6	I/O for Host	34	N/C	
35	GPIO7 **	I/O for Host	36	GND	
37	GPIO8 **	I/O for Host	38	GND	
39	GPIO9	I/O for Host	40	BT_STATE	

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

Signal Name	Pin No	I/O	Voltage level	Comments
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 V_{OH}min=2.8V	
UART_RX	25	I	V_{IL}max=0.8V V_{IH}min=2.1V V_{IH}max=3.3V	
UART_CTS	19	I	V_{IL}max=0.8V V_{IH}min=2.1V V_{IH}max=3.3V	
UART_RTS	23	O	V_{OL}max=0.2V V_{OH}min=2.8V	
UART_DSR	10	I	V_{IL}max=0.8V V_{IH}min=2.1V V_{IH}max=3.3V	
UART_DTR	12	O	V_{OL}max=0.2V V_{OH}min=2.8V	Shared with GPIO3
UART_RI	6	I or O	O/P : V_{OL}max=0.2V V_{OH}min=2.8V I/P : V_{IL}max=0.8V V_{IH}min=2.1V V_{IH}max=3.3V	Direction may be programmed.
UART_DCD	8	I or O	O/P : V_{OL}max=0.2V V_{OH}min=2.8V I/P : V_{IL}max=0.8V V_{IH}min=2.1V 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 V_{OH}min=2.8V I/P : V_{IL}max=0.8V V_{IH}min=2.1V V_{IH}max=3.3V	
AIO_0, AIO_1	1, 3	I	Range 0 – 1.8V	

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

5. Functional Description

The Wireless LAN module is a self-contained product and requires only power to implement full wireless communication. The integrated, high performance antenna together with the RF and Baseband circuitry provides the Wireless LAN connectivity and the UART interface provides a connection to the host system. The module can also be used with a program script that interrogates the GPIO and ADC lines, allowing it to operate as a stand-alone sensor interface.

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 BASIC style language enhanced with commands that simplify the wireless operation 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

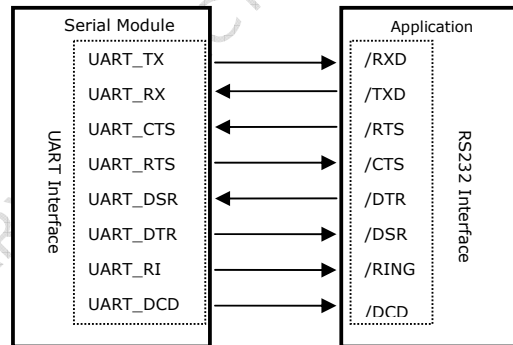> Port /RXD @ application receives data from the module's UART_TX signal line

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.

5.1.3 ADC

The Wireless LAN module provides access to two 10-bit ADCs. These provide an input range of 0mV to 1.8V ADC reference voltage.

Suitable external scaling and over-voltage protection should be incorporated in your design. If read through the UART the ADCs provide 5 samples per second.

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 notes detailing the functions supported with each release.

6.2 TCP/IP

The module implements IPLITE - an Ultra Compact IPv4 solution. IPLITE has a very small footprint and minimal impact on the module's 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 for 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 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 commands relating to wireless operation.

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 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.
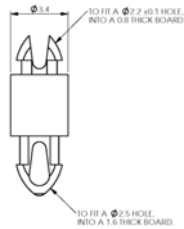
8. Board to Board Connector

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

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

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.

The features described within this data sheet are those targeted for the first production release of firmware. Note that not all of these features may be available within individual releases of the Engineering Sample firmware. Check with the firmware release notes to determine the supported functionality.

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