



ALPW-BLEM103 Datasheet 1.0
Bluetooth® Low Energy HCI



FEATURES

- Ready-to-use *Bluetooth*® Low Energy HCI module
- Ultra Small form factor 12mm x 12mm
- Ultra Low Power consumption
- EM Microelectronic EM9301 2.4Ghz *Bluetooth*® Low Energy controller
- Complete connectivity
- LGA footprint for easy integration
- SPI or UART Interface
- Programmable output power
 - from -18dBm to +3dBm

APPLICATIONS

- Medical Devices
- Mobile Accessories
- Sport and Fitness
- Entertainment Devices
- Wireless Sensors
- Consumer Electronics
- Monitoring and Control
- Industrial
- Building Automation

DESCRIPTION

The ALPW-BLEM103 HCI module is a complete single-mode *Bluetooth*® Low Energy compliant solution.

ALPWISE solutions benefit from best in class product from wireless manufacturer leaders. The ALPW-BLEM103 has a low-power hardware architecture and enables the use of *Bluetooth*® Low Energy with any host microcontroller running the ALPWISE *Bluetooth*® Low Energy Protocol stack.



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1 Order codes

Below is an overview on the Alpwise module product line:

Product Order Code	Optional Shielding
ALPW-BLEM103-A REV A	Mounted
ALPW-BLEM103-B REV A	Not Mounted

2 Product Description

The ALPW-BLEM103 HCI *Bluetooth*® Low Energy module embeds a low-power radio controller. The module can be accessed through UART/SPI interface by any host microcontroller running a *Bluetooth*® Low Energy (BLE) protocol Stack.



The ALPW-BLEM03 *Bluetooth*® Low Energy module can work with any microcontroller running the Alpwise *Bluetooth*® Low Energy protocol stack. For more information about Alpwise software solution, please visit our website.

The user has the possibility to select the serial interface (UART or SPI) by pulling the SEL pin the right way (refer to chapter 3.1 for more information).

2.1 Functional Block Diagram

Below is a functional block diagram of the ALPW-BLEM103 module :

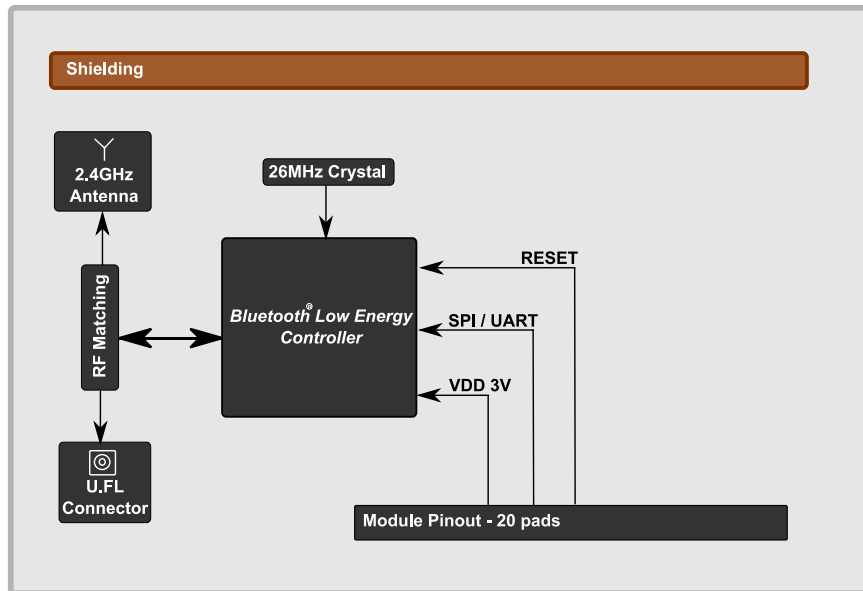


Figure1.: ALPW-BLEM103 block diagram

Below is a typical application diagram, showing how to easily design your own applications around the ALPW-BLEM103.

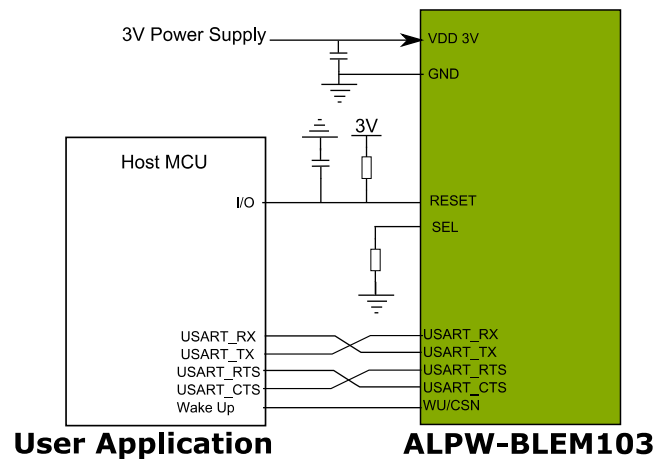


Figure2.: ALPW-BLEM103 UART typical application

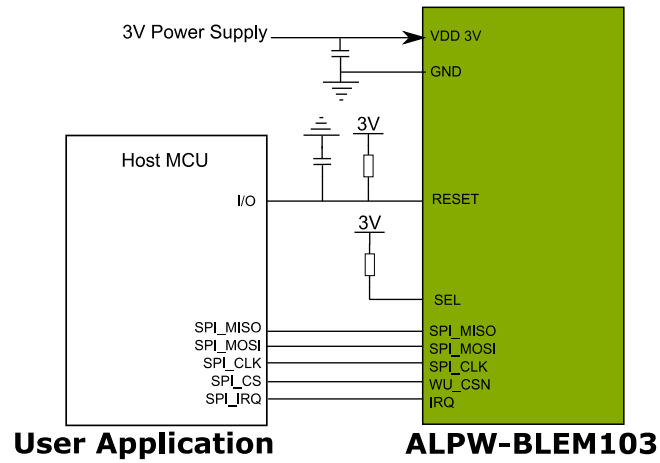


Figure3.: ALPW-BLEM103 SPI typical application

3 Detailed Description

3.1 Module Pin Description

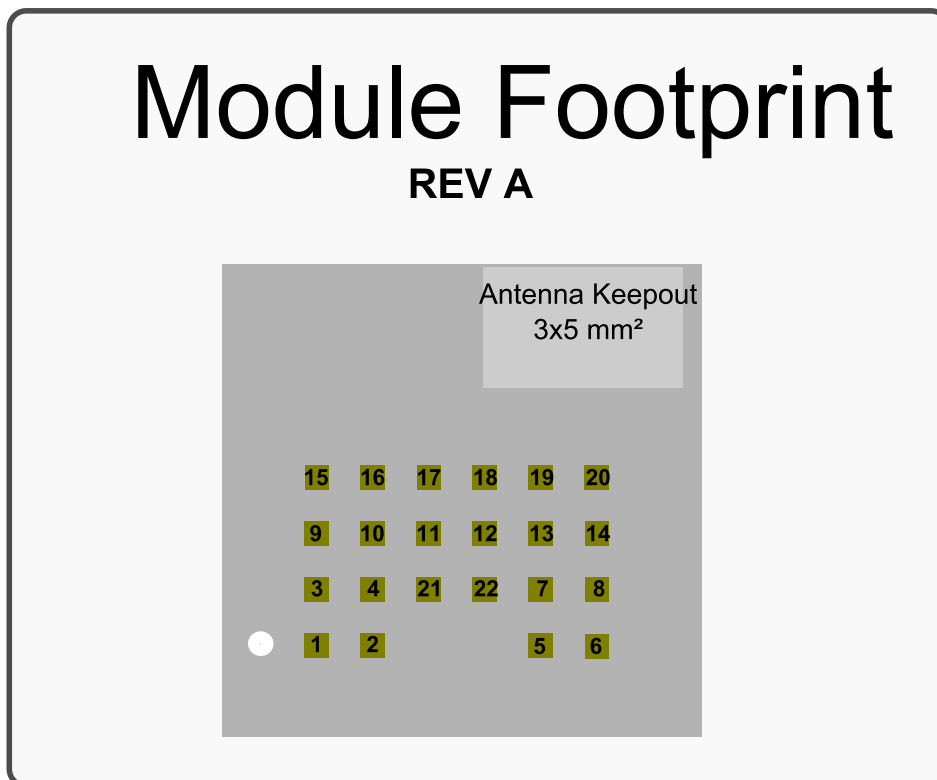


Figure4.: Module pin numbering (Top View)

LGA22 pin	Signal Name	Type	Description
1	GND	Supply	Ground
2	NC	-	
3	NC	-	
4	NC	-	
5	USART_RTS	Digital	USART bus Request to send or data IRQ
6	USART_CTS/SPI_SCK	Digital	USART Clear to Send or SPI clock line
7	WU/CSn	Digital	Wake-up / SPI Chip Select
8	VDD 3,3V	Supply	3.3V supply to the module.
9	GND	Supply	Ground
10	NC	-	-
11	USART_TX / SPI_MISO	Digital	USART bus transmit / SPI Slave data output
12	NC	-	-
13	NC	-	-
14	GND	Supply	Ground
15	BOOT	Digital	BOOT mode selection pin Internally Pulled down
16	USART_RX / SPI_MOSI	Digital	UART bus receive / SPI Slave data input
17	SEL	Digital	Interface Selection USART / SPI 0 : UART 1 : SPI
18	NC	-	-
19	NC	-	-
20	NC	-	-
21	GND	Supply	Ground
22	GND	Supply	Ground

3.2 Power Supply

The module is designed to operate within a 2.3V to 3.6V voltage range. User should ensure a proper filtering of its power supply: a ferrite bead, connected to a shunt capacitor to the ground (10uF typically) is a good practice.

3.3 Clocking

The module embeds a 26MHz for *Bluetooth*[®] Low Energy application.

3.4 Reset

The module reset input is directly connected to the microcontroller, and pulled down (the module has an active high reset signal).

To ensure a proper reset of the radio controller, the reset signal should remain high for at least 10ms.

4 Device operating requirements

4.1 Absolute Maximum Ratings

The absolute maximum ratings listed below have not been tested, and correspond to the main components specifications. Stresses beyond those limits may cause permanent damage to the module.

Symbol	Description	Note	Min	Typ.	Max	Unit
V _{dd-Vss}	Main Supply Voltage		-0.2	-	3.8	V
V _{in}	Input Voltage on any pin		-0.2	-	4.0	V
V _{ssx} – V _{ss}	Voltage difference between all power or ground pins		-	300	-	mV
V _{ESD(HBM)}	Electrostatic discharge (Human Body Model)		-	2000	-	V
T _{storage}	Storage temperature range		-50	-	+105	°C

4.2 Recommended operating conditions

Symbol	Description	Note	Min	Typ.	Max	Unit
V _{dd-Vss}	Supply Voltage		2.0	3.0	3.5	V
V _{in}	Input voltage on any pin		0	-	3.6	V
T°	Operational Temperature Range		-40	-	+85	°C

4.3 Power Consumption

4.3.1 Static current consumption

T= 25°C

Symbol	Description	Note	Min	Typ.	Max	Unit
I _{RX}	RX peak Current		-	-	13	mA
I _{TX}	TX peak Current		-	-	14	mA
I _{idle}	Idle Mode Current		-	200	-	µA
I _{sleep}	Sleep Mode Current		-	20	-	µA
I _{Deep-Sleep}	Deep Sleep Mode Current		-	9	-	µA

4.3.2 Bluetooth® Low Energy Application current consumption

T= 25°C, P_{RFout} = +3dbm

Symbol	Description	Note	Min	Typ.	Max	Unit
I _{ADV}	Average Advertising current consumption	Advertising Interval set to 200ms	-	290	-	µA
I _{CON}	Average current in connected mode	125ms	-	174.3	-	µA
		1.28s	-	88	-	µA
		4.0s	-	73.2	-	µA

4.4 Electrical Characteristics

4.4.1 Digital interface Characteristics

Symbol	Description	Note	Min	Typ.	Max	Unit
UART _{BR}	UART Baud Rate		1.2	115.2	1843.2	KBd/s
SPI _{speed}	SPI Clock speed		-	-	5000	Kb/s

4.4.2 Module Timing Characteristics

Symbol	Description	Note	Min	Typ.	Max	Unit
T _{Start-up}	Start Up time		-	15.5	-	ms
T _{Sleep to idle}	Sleep to Idle Mode time		-	2.6	-	ms
T _{Deep-Sleep to Idle}	Deep-Sleep to Idle Mode time		-	2.7	-	ms

4.4.3 RF General Characteristics

Symbol	Description	Note	Min	Typ.	Max	Unit
F _{RF}	Operating RF Frequency		2400		2484	MHz
DR	On-air Data Rate		-	1000	-	Kbps
B _{ch}	Channel Spacing		-	2	-	MHz

4.4.4 RF Electrical Characteristics

Symbol	Description	Note	Min	Typ.	Max	Unit
Receiver						
Z _{in}	Input Impedance		-	50	-	Ohms
S _{in}	Sensitivity	0.1% BER ¹	-	-80	-	dBm
P _{in max}	Maximum input power	0.1% BER ¹	-	-5	-	dbm
Transmitter						
P _{RF}	Ouput RF Power	Software Programmable	-18	-	+2	dBm
P _{in-band spurious}	In-band spurious emission at a frequency offset f_{off}	$ f_{off} =2\text{MHz}$	-	-	-20 ²	dbm
		$ f_{off} \geq 3\text{MHz}$	-	-	-30 ²	dbm
P _{out-of-band spurious}	Spurious emission at an out-of-band frequency ³	30MHz-88MHz	-	-	TBD	dBm
		88MHz-230MHz	-	-	TBD	dBm
		230MHz-470MHz	-	-	TBD	dBm
		862MHz-960MHz	-	-	TBD	dBm
		960MHz-2396MHz	-	-	TBD	dBm
		2487MHz-12.75GHz	-	-	TBD	dBm

¹ compliant with Bluetooth® V4.0

² as specified in Bluetooth® Core Specifications, V4.0, volume 6, part A, section 3.

³ as specified in ETSI EN 300 440-1 V1.6.1, ETSI EN 300 328 V1.8.1 and FCC Regulations Part 15.

5 Soldering recommendations

To avoid damaging the module components, the following reflow profile should be observed.

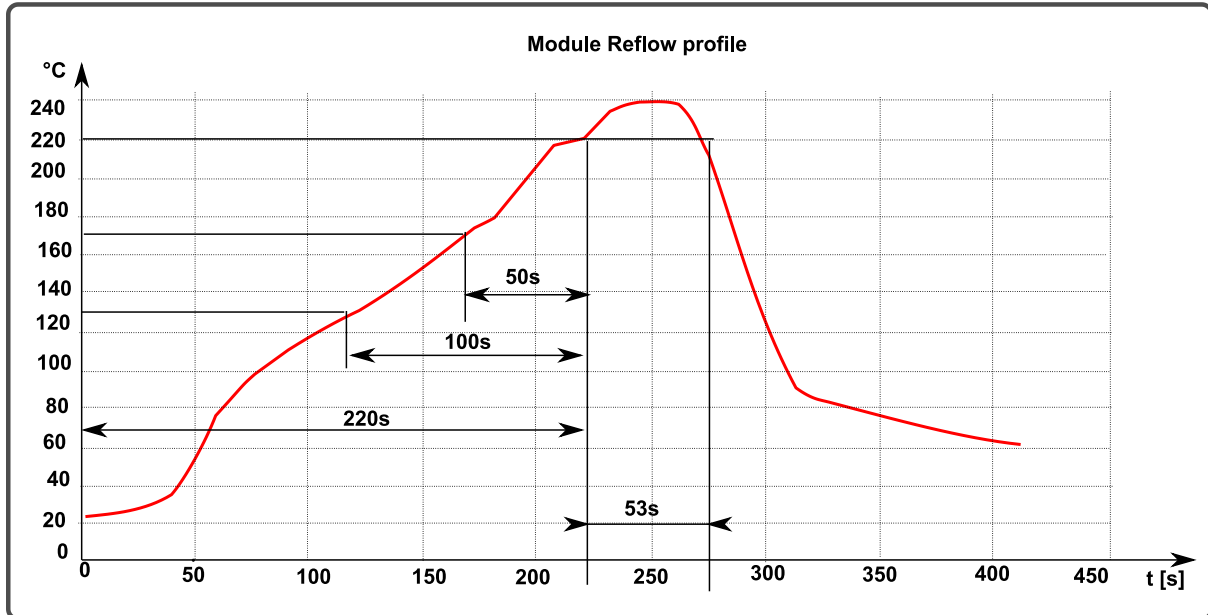


Figure5.: Recommended reflow profile

6 Product Dimensions

6.1 External Dimensions

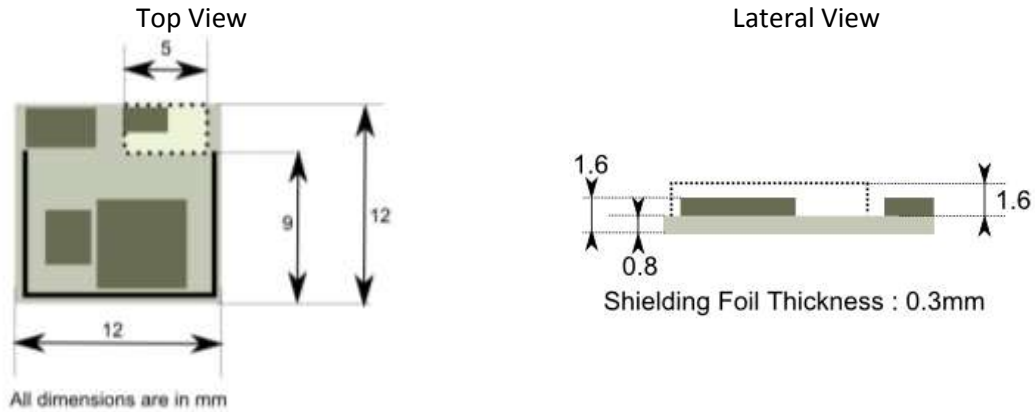


Figure6.: Product dimensions

6.2 Footprint

The module footprint dimensions are detailed below.

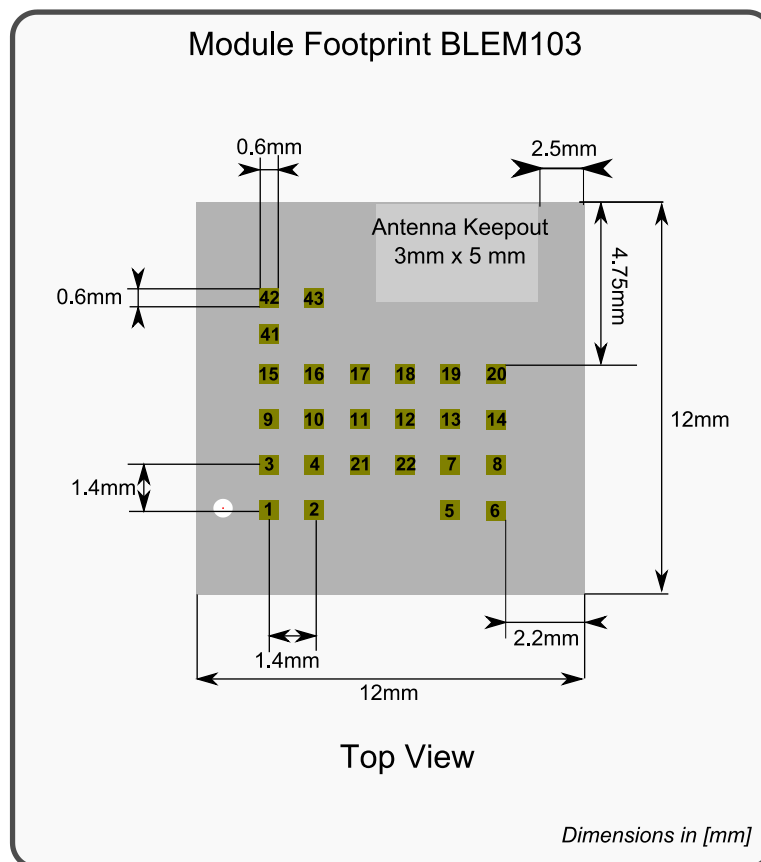


Figure7.: Product footprint

6.3 Top Side marking

The picture below shows the typical product printed codes:

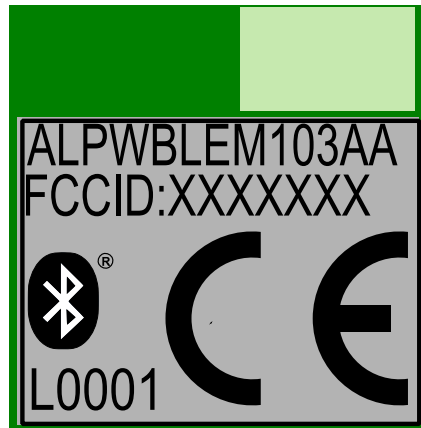


Figure8.: Product top-side marking

Code	Meaning
ALPWBLEM103AA	ALPW-BLEM103, Hardware REV A, option A
FCC ID	FCC mandatory identification - pending

7 Recommended Layout

When implementing the module on a custom PCB, the antenna clearance zone must be respected by all means:

- No ground
- No copper tracks, via, on any layer of the pcb.

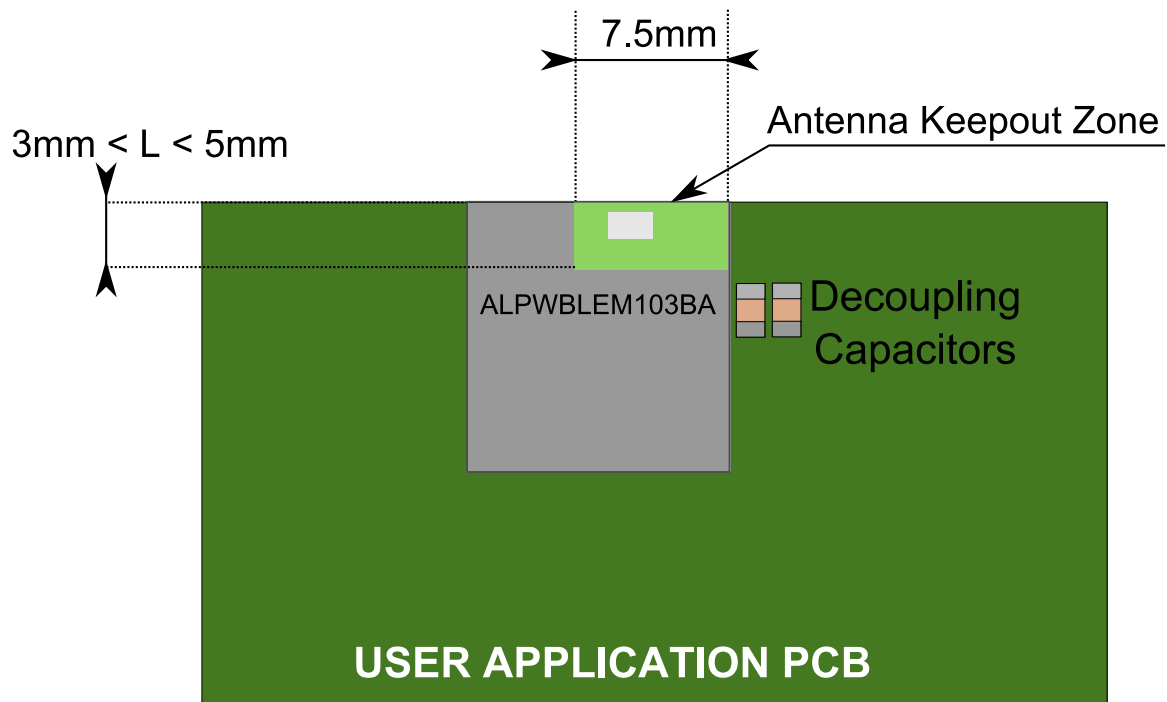


Figure9.: Recommended end-application PCB integration

8 Cautions

8.1 Design notes

The antenna keep out zone must be respected by all means. If the module cannot be implemented as recommended in chapter 7, then the antenna keep out zone must correspond to a no-copper region on every layer of the PCB.

The user must deliver a low-noise power supply to the module, without AC ripple voltage. Noisy supply voltages must come with a decoupling circuit (serial ferrite bead connected to a shunt capacitor to ground).

The product should be mechanically stressed when installed.

Refer to the recommended design when designing a board.

8.2 Installation notes

Reflow soldering is possible, according to the recommendations in chapter 5.

Do not wash the product.

8.3 Usage conditions notes



This product has limited ESD protection. Take measures to protect the unit against static electricity, especially in dry atmosphere.

Follow the operating conditions regarding the power supply applied to the product.

This product is intended for general purpose and standard use in general electronic equipment. For applications in a particular environment, please contact the technical support.

8.4 Storage notes

In order to preserve the performance characteristics of the module, do not store the product in the following conditions:

- Storage in an environment where the temperature may be outside the 5°C to 35°C range
- Storage in an environment where the humidity may be outside the 45% to 85% range
- Storage of the product for more than 1 year after the date of delivery

8.5 Other Cautions

The datasheet document is copyrighted.

Do not use this product for other purposes than those listed

9 Packaging

Individual modules come in anti-electrostatic plastic bag.

For more packaging possibilities, please contact our sales support.

10 ROHS Declaration

Upcoming subcontractor certificate.

11 Regulatory Information

CE / FCC / Canada / Japan certification pending.

Bluetooth® SIG Statement pending.

12 Resources

12.1 Related Documents

Alpwise *Bluetooth*® Low Energy Software Development Kit

Bluetooth® SIG Specification

12.2 Software Resource

SDK supporting *Bluetooth*® Low Energy protocol stack exists. Please contact our sales support to get the right information and find the best solution for your application

12.3 Hardware Resource

The ALPW-BLEM103 is embedded on the ALPW-BLEDVKCM3 Development kit, designed to ensure an easy evaluation of our product, and an easy development of your application.

The kit provides a main board with the ALPW-BLEM103 module mounted on it, connected to a Cortex-M3 microcontroller (1MB Flash size, 72MHz). The kit provides all be connection to build your application.



The ALPW-BLEM103 is also embedded on the ALPW-BLEDVKCM0 Development kit. The *Bluetooth*® Low Energy protocol stack runs on a 64KB Flash, 8KB RAM Cortex M-0 microcontroller and all the peripherals remain accessible.



Furthermore, for sensor application, the ALPW-DVBBLE *Bluetooth*® Low Energy Development board can be connected to the kit. The board integrates an accelerometer, temperature sensor, LEDs and switches to ease sensor application development.

For more information about our product line, please contact our sales support.

12.4 Support

For any technical questions regarding usage of this BT module, please consider the following Email address:

alpwiseales@alpwise.com

12.5 Sales

For any commercial questions regarding access of this BT module, please consider the following Email address:

alpwiseales@alpwise.com

12.6 Contact information

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