



ALPW-BLEDVKCM3 User's Guide
Bluetooth® Smart Cortex M3 Development kit



FEATURES

- Complete development kit to implement *Bluetooth®* Low Energy Technology
- Built around the ALPW-BLEM103 *Bluetooth®* Low Energy HCI Module
- Embedded Cortex M3 Microcontroller
- Kit Contains :
 - ALPW-DVBCM3 Board
 - ALPW-BLEM103 Module soldered
 - User Guide

APPLICATIONS

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

DESCRIPTION

THE ALPW-BLEDVKCM3 is a complete development kit to ease application prototyping and implementing *Bluetooth®* Low Energy technology. The powerful and energy efficient Cortex M3 microcontroller enables a full integration of the ALPWISE *Bluetooth®* Low Energy stack and user application.

The board embeds an ALPW-BLEM103 *Bluetooth®* Low Energy HCI module, accessible through SPI or UART.

The kit can be powered with two AAA batteries, allowing the development of standalone demonstration.



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1 Order codes

Below is an overview on the Alpwis *Bluetooth*[®] Low Energy development kit.

- Mother board : ALPW-DVBCM3
- *Bluetooth*[®] Module : ALPW-BLEM103
- Optional development board: ALPW-DVBBLE

The optional ALPW-DVBBLE board can be connected on the ALPW-DVKCM3. This board integrates an accelerometer, a temperature sensor and user interfaces (LEDs, switches and buzzer). Furthermore, the board can be powered by a super capacitor, thus allowing an autonomous demonstration of the *Bluetooth*[®] Low Energy possibilities.

2 Product Description

2.1 Module

The ALPW-BLEM103 module features low power architecture with powerful power management, along with an embedded secure engine and a Host Controller Interface (HCI).

The module is accessible through a SPI or USART interface, selectable with jumpers on the main board.



The module is soldered on the development board.

2.2 Development board

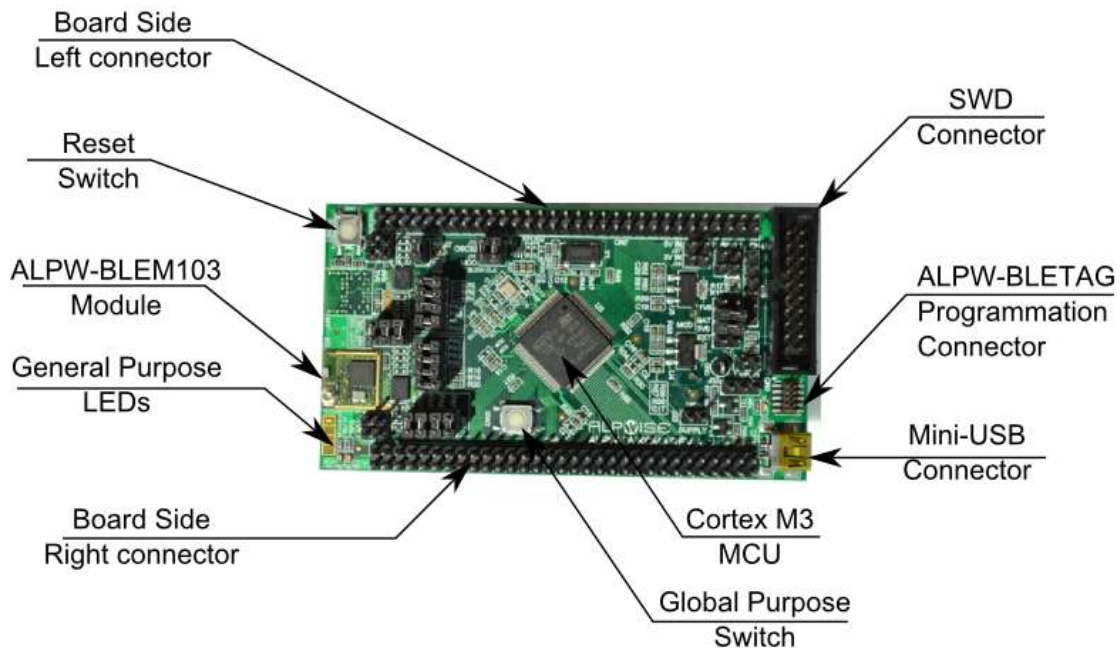


Figure1.: ALPW-DVKCM3 board description

Board side Left & Right Connectors	62 pins, 2 rows header connectors (2.54mm pitch). Used to connect the optional development board, or for user application.
Reset Switch	When connected to the microcontroller (see the jumper configuration), this switch is used to reset the microcontroller.
ALPW-BLEM103 Module LEDs and Switch	Alpwise <i>Bluetooth</i> ® Low Energy HCI module General purpose LEDs and switch can be used
Cortex M3 Microcontroller	72MHz (90MIPS), 1MByte flash size and 128kByte SRAM cortex M3 microcontroller, STM32F1x.
Mini-USB Connector	Used as main power source, and for data communication with the microcontroller.
ALPW-BLETAG Programming Connector	This connector is used as an SWD adaptor to program the ALPW-BLETAG.
SWD Connector	Standard 20-pin connector for MCU programming and debug.

The ALPW-DVBCM3 is a complete *Bluetooth*® Low Energy Technology development board, built around a powerful M3 cortex microcontroller; this product allows to the user a full integration of the *Bluetooth*® Low Energy protocol stack with his own application.

2.3 Functional Block Diagram

Below is a functional block diagram.

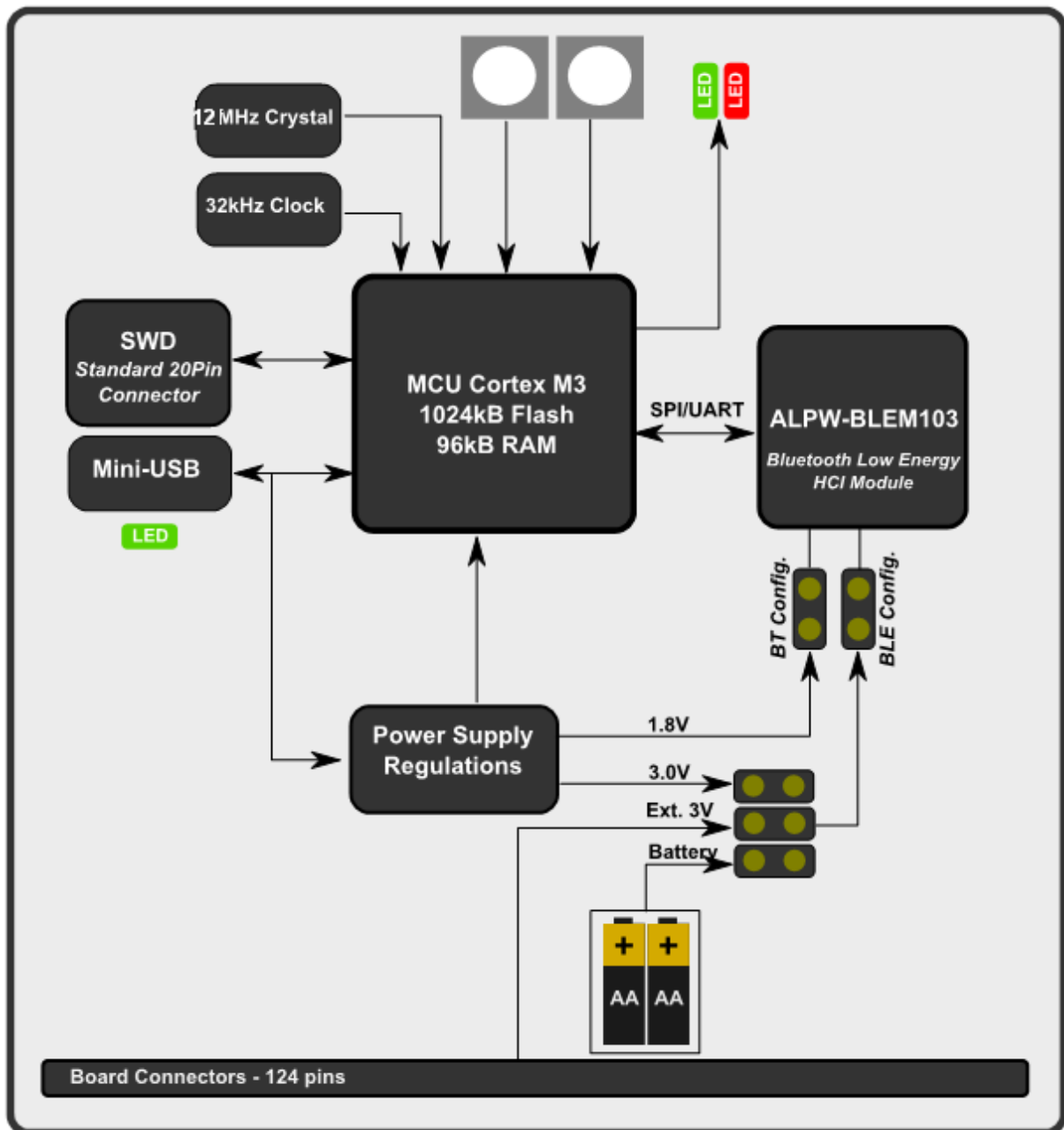


Figure2.: ALPW-BLEDVK block diagram

3 Detailed Description

3.1 Board Side Connectors Pin Description

Pin N°	Signal Name	Type	Description
Left Connector			
1	VBUS USB	Supply	5V Supply from USB
2	VDD 1.8V	Supply	Regulated 1.8V output
3	GND	Supply	
4	GND	Supply	
5	PA14	I/O	I/O Default connection : SWD CLK
6	PA15	I/O	I/O SPI3 NSS
7	PC10	I/O	General Purpose I/O
8	PC11	I/O	General Purpose I/O
9	PC12	I/O	General Purpose I/O
10	PD0	I/O	General Purpose I/O
11	PD1	I/O	General Purpose I/O
12	PD2	I/O	General Purpose I/O
13	PD3	I/O	General Purpose I/O
14	PD4	I/O	General Purpose I/O
15	PD5	I/O	General Purpose I/O
16	PD6	I/O	General Purpose I/O
17	PD7	I/O	General Purpose I/O
18	PB3	I/O	General Purpose I/O
19	PB4	I/O	General Purpose I/O
20	PB5	I/O	General Purpose I/O
21	PB6	I/O	I2C1 SCL
22	PB7	I/O	I2CA SDA
23	BOOT0	I/O	Microcontroller BOOT pin Internally pulled down to ensure a proper startup from user flash.
24	PB8	I/O	General Purpose I/O
25	PB9	I/O	General Purpose I/O
26	PE0	I/O	General Purpose I/O
27	PE1	I/O	General Purpose I/O
28	GND	Supply	
29	VDD_MCU	Supply	Regulated power supply output Depending on jumper configuration, can be 3V or 1,8V. Will be the same as the microcontroller supply
30	PE2	I/O	General Purpose I/O
31	PE3	I/O	General Purpose I/O
32	PE4	I/O	General Purpose I/O
33	PE5	I/O	General Purpose I/O
34	PE6	I/O	General Purpose I/O

35	VBAT/VCLD_MCU	Supply	Battery Supply Controller input
36	PC13	I/O	General Purpose I/O
37	PC14	I/O	General Purpose I/O For I/O use, refer to the board configuration
38	PC15	I/O	General Purpose I/O For I/O use, refer to the board configuration
39	GND	Supply	
40	VDD_MCU	Supply	Regulated power supply output Depending on jumper configuration, can be 3V or 1,8V. Will be the same as the microcontroller supply
41	PH0	I/O	General Purpose I/O For I/O use, refer to the board configuration
42	PH1	I/O	General Purpose I/O For I/O use, refer to the board configuration
43	NRST	I/O	Microcontroller Active low Reset
44	PC0	I/O	General Purpose I/O
45	PC1	I/O	General Purpose I/O
46	PC2	I/O	General Purpose I/O
47	PC3	I/O	Module SPI IRQ
48	VDD_MCU	Supply	Regulated power supply output Depending on jumper configuration, can be 3V or 1,8V. Will be the same as the microcontroller supply
49	VREF-/VSSA_MCU	Supply	Analogue Converters negative reference voltage
50	VREF+_MCU	Supply	Analogue Converters positive reference voltage
51	VDDA_MCU	Supply	Analogue power supply for the microcontroller
52	PA0	I/O	USART2_CTS Used for module interface
53	PA1	I/O	USART2_RTS Used for module interface
54	PA2	I/O	USART2_TX Used for module interface
55	DO NOT CONNECT	I/O	
56	DO NOT CONNECT	I/O	
57	DO NOT CONNECT	I/O	
58	DO NOT CONNECT	Supply	
59	DO NOT CONNECT	I/O	
60	GND	Supply	
61	DO NOT CONNECT	I/O	
62	GND	Supply	
Right Connector			
1	VDD_3V0	Supply	3V Regulated power supply
2	VEXT_3V0	Supply	Input for 3V power supply
3	VDD_MCU	Supply	Regulated power supply output Depending on jumper configuration, can be 3V or 1,8V. Will be the same as the microcontroller supply

4	GND	Supply	
5	PH2	I/O	General Purpose I/O
6	PA13	I/O	General Purpose I/O Default Connection : SWD DATA
7	PA12	I/O	General Purpose I/O Default Connection : USBDP
8	PA11	I/O	General Purpose I/O Default Connection : USBDM
9	PA10	I/O	General Purpose I/O
10	PA9/SPI_NSS	I/O	General Purpose I/O Default Connection : SPI1 NSS Used for module interface
11	PA8	I/O	Master Clock Output
12	PC9	I/O	General Purpose I/O
13	PC8	I/O	General Purpose I/O Switch Input
14	PC7	I/O	General Purpose I/O Green LED output
15	PC6	I/O	General Purpose I/O Red LED output
16	PD15	I/O	General Purpose I/O
17	PD14	I/O	General Purpose I/O
18	PD13	I/O	General Purpose I/O
19	PD12	I/O	General Purpose I/O
20	PD11	I/O	General Purpose I/O
21	PD10	I/O	General Purpose I/O
22	PD9	I/O	General Purpose I/O
23	PD8	I/O	General Purpose I/O
24	PB15	I/O	General Purpose I/O
25	PB14	I/O	General Purpose I/O
26	PB13	I/O	General Purpose I/O
27	PB12	I/O	General Purpose I/O
28	VDD_MCU	Supply	Regulated power supply output Depending on jumper configuration, can be 3V or 1,8V. Will be the same as the microcontroller supply
29	GND	Supply	
30	PB11	I/O	General Purpose I/O
31	PB10	I/O	General Purpose I/O
32	PE15	I/O	General Purpose I/O
33	PE14	I/O	General Purpose I/O
34	PE13	I/O	General Purpose I/O
35	PE12	I/O	General Purpose I/O
36	PE11	I/O	General Purpose I/O
37	PE10	I/O	General Purpose I/O
38	PE9	I/O	General Purpose I/O
39	PE8	I/O	General Purpose I/O
40	PE7	I/O	General Purpose I/O

41	PB2	I/O	BOOT1 Pin Pulled Down
42	PB1	I/O	General Purpose I/O
43	PB0	I/O	General Purpose I/O
44	PC5	I/O	General Purpose I/O
45	PC4	I/O	General Purpose I/O
46	PA7	I/O	SPI MOSI Used for module interface
47	PA6	I/O	SPI MISO Used for module interface
48	PA5	I/O	SPI SCK Used for module interface
49	PA4/DAC1	I/O	Digital to Analogue Converter output
50	VDD_MCU	Supply	Regulated power supply output Depending on jumper configuration, can be 3V or 1,8V. Will be the same as the microcontroller supply
51	GND	Supply	
52	PA3	I/O	USART2_RX Used for module interface
53	ALPW_WLAN1	I/O	WLAN Coexistence
54	ALPW_PCM_CLK	I/O	Module PCM bus Clock
55	ALPW_WLAN2	I/O	WLAN Coexistence
56	ALPW_PCM_SYNC	I/O	Module PCM bus Sync
57	ALPW_WLAN3	I/O	WLAN Coexistence
58	ALPW_PCM_A	I/O	Module PCM bus data
59	ALPW_WLAN4	I/O	WLAN Coexistence
60	ALPW_PCM_B	I/O	Module PCM bus data
61	VDD_ALPW_MODULE	Supply	Module Power Supply
62	GND	Supply	

3.2 Power Supply

The board is mainly powered through USB.

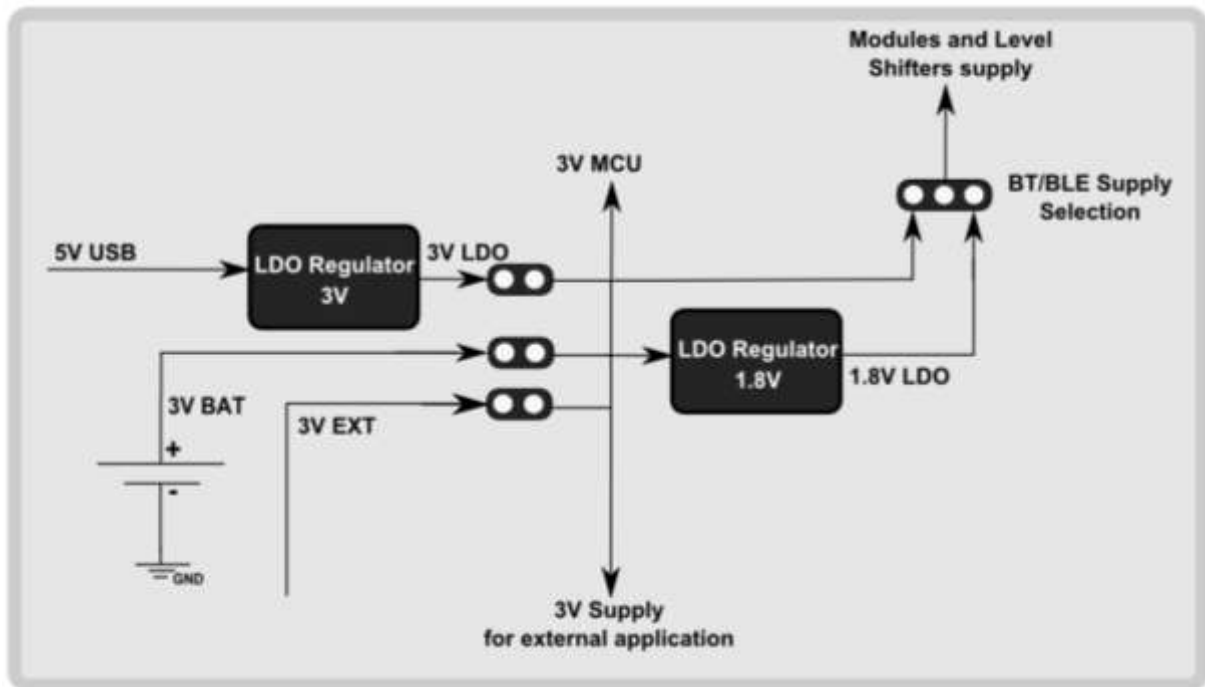
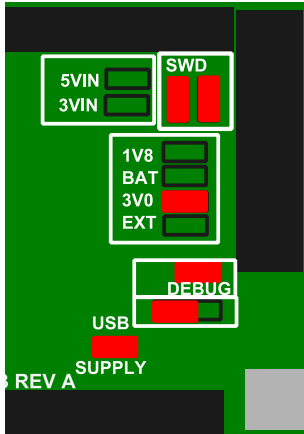


Figure3.: ALPW-BLEDVK power supply tree

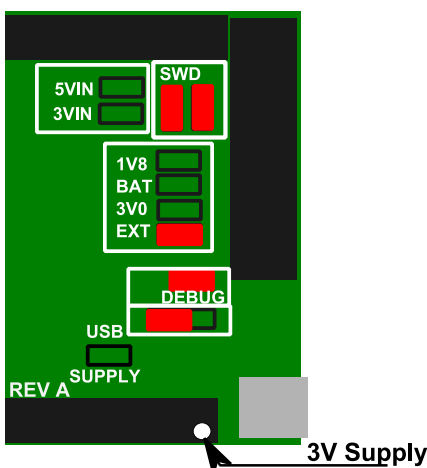
3.3.2 Power Supply Configuration

- **Default**



The USB is chosen as main supply source (USB SUPPLY jumper is set). The 3V voltage is issued from the LDO regulator.

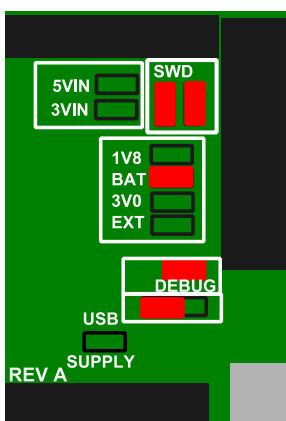
- **External 3V supply**



The USB supply is not used. The 3V voltage is issued from an external power source, connected to the right connector, pin 2.

Note: The external power supply input is not protected, the user should take measure against over-voltages or over-current.

- **Battery 3V supply**



The USB supply is not used. The 3V voltage is issued from the two AA batteries, on the bottom on the board.

- **Module Power supply**

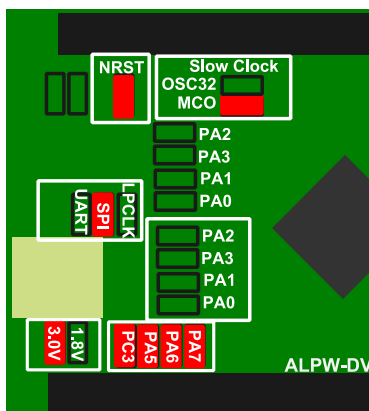


The ALPW-BLEM103 module must have a 3V power source. The jumper must stay set on 3.0V configuration, as shown on the picture.

3.3.3 Module Interface Configuration

- **SPI Configuration**

The module can be accessed through SPI. To place the board in this configuration, you must have the following jumpers configuration :



Select the microcontroller interface pins: PA5, PA6, PA7 and PC3. This corresponds to the SPI1 bus connection.

Note: PA0, PA1, PA2 and PA3 correspond to the UART interface, those jumpers must be unplugged for proper operation.

Place the “SEL SPI” jumper.

- **UART Configuration**

The module can be accessed through UART. To place the board in this configuration, you must have the following jumpers configuration:

- **MCU Reset**

The “NRST3 jumper must be set to connected the switch to the reset input of the microcontroller. Is the jumper is unset, the switch will be unused and the microcontroller reset signal is accessible on pin 43 of the left connector.

3.4 Clocking

3.4.1 Microcontroller High Speed Clock

The 12MHz crystal on the board provides the clock source for the microcontroller PLL. Once locked, the PLL can run at 72MHz.

3.4.2 Microcontroller Slow Clock

The 32.768 kHz oscillator on the board provides the clock source for low power applications.

3.5 Reset

The microcontroller can be reset by pressing the Reset switch or via the reset signal available on the board connectors.

4 Software Description

4.1 ALPWISE Bluetooth® Low Energy SDK

The ALPW-BLEDVKCM3 is delivered with the ALPW-BLESDK for Cortex M3 software.

The Alpwise core stack is based on a HCI transport link (through SPI or UART). The following protocols are supported:

- SMP : Service Manager Protocol
- ATT : Attribute Protocol
- L2CAP : Logical Link Control and Adaptation Protocol

For more information about the ALPWISE Bluetooth® Low Energy SDK, please visit our website.

4.2 Getting started with firmware development

The following section describes how to get your firmware development starting, using the ALPW-BLEDVKCM3 kit.

- **SPI Configuration**

Refer to chapter 3 to place the board in the correct configuration to use the SPI interface.

1. I/O configuration

Signal	GPIO	Type
SPI1 MOSI	PA7	Output
SPI1 MISO	PA6	Input
SPI1 SCK	PA5	Output
SPI1 CS	PA9	Output
SPI IRQ	PC3	Input
BLEM103 Reset	PC4	Input

2. MCU Configuration

Set up the microcontroller to run for an external 12MHz reference crystal (HSE), lock the PLL at 72MHz.

Configure the SPI1 bus up to 10MHz speed, with an interrupt on PC3. The interrupt will ring to indicate incoming SPI data.

3. API description

For more information about available API's, contact us.

5 Device operating requirements

5.1 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_{ext_3V}	External Supply Voltage		-0.3	-	3.5	V
V_{in}	Input Voltage on any pin		-0.3	-	4.0	V
$ V_{ssx} - V_{ss} $	Voltage difference between all power or ground pins		-	-	50	mV
$V_{ESD(HBM)}$	Electrostatic discharge (Human Body Model)		-	-	2000	V
V_{RF_IN}	Input RMS voltage to RF pin		-10	-	+85	V
$T_{storage}$	Storage temperature range		-65	-	+150	°C

5.2 Recommended operating conditions

Symbol	Description	Note	Min	Typ.	Max	Unit
V_{USB}	USB Supply Voltage		4.75	5.0	5.25	V
V_{bat}	Battery Voltage		2.5	3.0	3.2	V
I_{max}	Overall maximum USB Input current	USB 2.0	-	-	500	mA
		USB 3.0	-	-	900	
I_{supply}	Supply Current for external application		-	-	800	mA
T°	Operational Temperature Range		-10	-	+85	°C

¹Using USB 2.0. When using other USB standard, the maximum sink current drops to 500mA.

5.3 Electrical Characteristics

5.3.1 RF Electrical Characteristics

Please refer to the documentation of the ALPW-BLEM103 module for detailed RF characteristics.

5.3.2 Digital Characteristics

Symbol	Description	Note	Min	Typ.	Max	Unit
F_{max}	Max MCU clock Frequency		-	-	72	MHz
D_{MIPS}	Maximum Dhrystone MIPS performance	@72MHz	-	-	90	DMIPS
T_{flash}	Flash memory size		-	1024	-	kB
T_{RAM}	SRAM memory size			96		kB

6 Packaging

The ALPW-BLEDVKCM3 kit package contains:

- An ALPW-DVBCM3, with an ALPW-BLEM103 *Bluetooth*® module mounted.
- User Guide

7 Resources

7.1 Related Documents

- ST Microelectronics STM32F2103VG Cortex M3 datasheet
- ALPW-BLEM103 *Bluetooth*® Low Energy HCI Module Datasheet

7.2 Support

For any technical questions regarding usage of this BLE Evaluation Kit, please consider the following Email address:

alpwiseales@alpwise.com

7.3 Sales

For any commercial questions regarding access of this BLE Evaluation Kit, please consider the following Email address:

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7.4 Contact information

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