

ALX850B manual

1. Introduction.....	2
1.1 overview.....	2
1.2 Hardware Architecture.....	2
1.3 Interface and Peripherals.....	2
1.4 PIN Assignment.....	3
1.5 PIN Description.....	3
2. Feature Highlights.....	4
2.1 MCU.....	4
2.2 Memories.....	5
2.3 Wi-Fi.....	5
2.4 Security.....	5
2.5 SoftAP.....	5
2.6 Network Connection Indication.....	5
2.7 Multi-Socket of TCP/UDP.....	6
2.8 Low Power Mode.....	6
2.9 Fast Network Configuration –Flashlink.....	6
2.10 Fast Roaming.....	7
2.11 ACM.....	8
2.11.1 Host Control Interface.....	8
2.11.2 ACM Bus.....	9
3. Wi-Fi Specification.....	9
3.1 Wireless Specification.....	9
3.2 Tx Power.....	9
3.3 Rx Sensitivity.....	10

1. Introduction

1.1 overview

Alinket ALX85X Controller Family, which has Wi-Fi 802.11a/b/g/n functionalities, is a portfolio of low-powered, self-contained, embedded wireless module solutions that address the connectivity demands of machine to machine applications.

ALX85X supports either an on-board ceramic antenna or a U.FL connector which provides the flexibility for customer to pick up its own proper external antenna.

Here then, ALX85X product family has mainly two types in terms of antenna configuration.

Table 1 ALX85X Product Family

ALX850A	Wi-Fi 2.4GHz& 5GHz, Dual Band IoT Controller, On-Board Antenna
ALX850B	Wi-Fi 2.4GHz& 5GHz, Dual Band IoT Controller, External Antenna, Support U.FL

1.2 Hardware Architecture

ALX85X integrates an ARM® 32-bit Cortex®-M4 micro-controller, a Wi-Fi BB/MAC/RF SoC, a RF front end, and an On-Board SPI Flash into the small factor module.

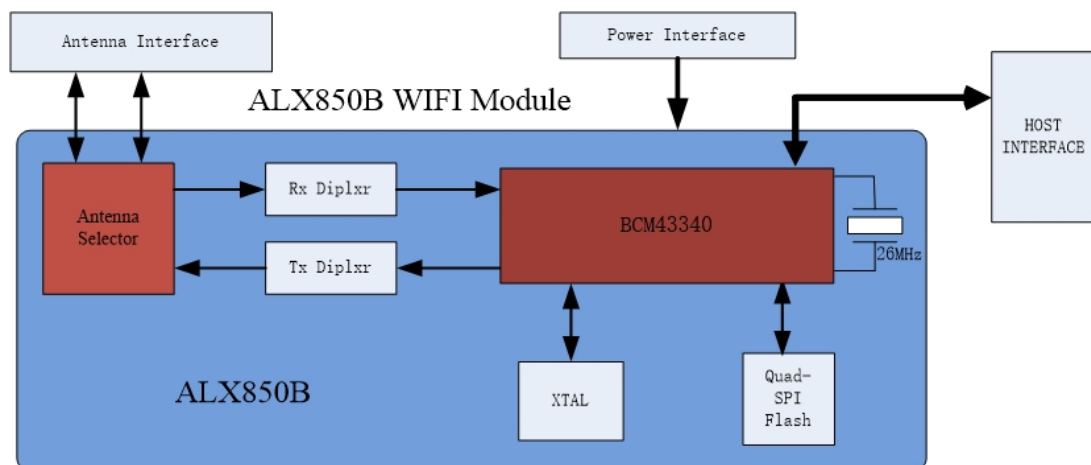


Figure 1 Block Diagram

1.3 Interface and Peripherals

The controller family includes various different host interfaces to communicate with Host CPU.

Below table lists the basic descriptions of the MCU, Wi-Fi SoC and the interfaces.

Table 2 MCU and Interfaces

Model		ALX85X
Wi-Fi Technology		IEEE802.11 a/b/g/n
Frequency Band		2.4GHz & 5GHz, Dual Band
MCU	Core	ARM® Cortex®- M4 @100MHz
	RAM	128KB
	ROM	512KB

Flash (On-Board)		1MB
Host Interfaces	UART x 2	Up to 6.25Mbps
	SPI x 1	50MHz, multiplexing with USB & UART1
	USB x 1	UAB 2.0, Full Speed - 12Mbps
Peripherals	I2C x 1	Support 100KHz, 400KHz & 1MHz
	ADC x 2	12 bit, 16 channel, multiplexing with GPIO
	GPIO x 10	Max., multiplexing with interface & peripherals

Note: SPI, USB interfaces are for customized projects only, not for standard product, please contact your local Alinket sales office or distributors for more information.

1.4 PIN Assignment

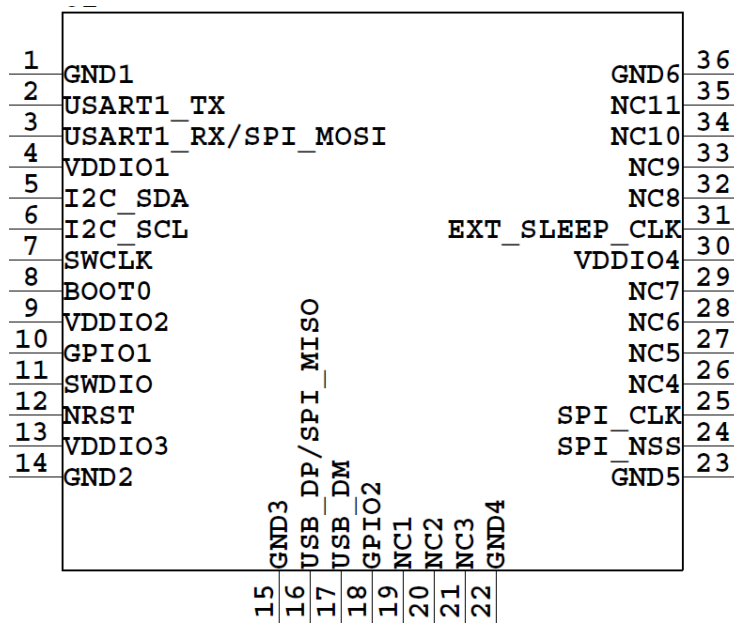


Figure 2 Ball Maps

1.5 PIN Description

Table 3 Pin Descriptions

Pins	Type	Main function	Alternate functions	PIN connection (when not using)
1	S	GND		
2	I/O	USART1_TX	GPIO	floating
3	I/O	USART1_RX/SPI_MOSI	GPIO	floating
4	S	VDDIO	3.3V	
5	I/O	I2C_SDA	GPIO	floating
6	I/O	I2C_SCL	GPIO	floating
7	I/O	SWCLK	JTCK-SWCLK	floating
8	I	BOOT0		floating
9	V	VBAT	3.3V	
10	I/O	GPIO1	GPIO	floating
11	I/O	SWDIO	JTCK-SWDIO	floating
12	I	NRST	Active-low reset input	floating
13	V	VDDIO	3.3V	
14	S	GND		
15	S	GND		
16	I/O	USB_DP/SPI_MISO	GPIO/USART1_RTS/USART2_RX	floating
17	I/O	USB_DM	GPIO/USART1_CTS/USART2_TX	floating
18	I/O	GPIO2	GPIO	floating
19				floating
20				floating
21				floating
22	S	GND		
23	S	GND		
24	I/O	SPI_NSS	GPIO/ADC	floating
25	I/O	SPI_CLK	GPIO/ADC	floating
26				floating
27				floating
28				floating
29				floating
30	V	VDDIO	3.3V	
31	I/O	EXT_sleep_clk	Input pin for 32.768kHz or GND	
32				floating
33				floating
34				floating
35				floating
36	S	GND		

2. Feature Highlights

2.1 MCU

ALX85X family has a dedicated microcontroller to enhance the Wi-Fi function or applications. The MCU has an ARM® 32-bit Cortex®-M4 core with FPU, adaptive real-time accelerator (ART Accelerator™) allowing 0-wait state execution from Flash memory, frequency 100MHz, memory protection unit, 125 DMIPS/1.25 DMIPS/MHz(Dhrystone2.1), and DSP instructions.

2.2 Memories

- 512 Kbytes of Flash memory
- 128 Kbytes of SRAM
- 1M Bytes of Built-in Serial Flash

2.3 Wi-Fi

- WLAN IEEE802.11a/b/g/n, 2.4GHz & 5GHz dual band.
- Flexible country code and channel configuration for worldwide market.
- Integrated WLAN CMOS power amplifier with internal power detector and closed-loop power control, ensures the high performance on RF sensitivity and stability.
- Supports per packet RX Antenna diversity

2.4 Security

- AES and TKIP in hardware for faster data encryption
- WEP, WPA and WPA2 support for powerful encryption and authentication
- Enterprise security: IEEE802.1X authentication includes EAP-TLS, PEAP-GTC, PEAP-MSCHAPV2.

2.5 SoftAP

- SoftAP and STA can be implemented on same hardware by switching with specified command.
- Fast SoftAP and STA switch, time <3s, no reset required.
- Parameters of both SoftAP and STA can be set/read by Alinket unique ACM command.

2.6 Network Connection Indication

- Indications include:
 - AP connecting
 - AP connected
 - AP disconnected
 - Server connecting (no indication because only 67ms, too short to indicate)
 - Server connected

- Server disconnected
- Support below two methods
 - In transparent mode, through GPIO to connect LEDs, LED On –connected, LED Off disconnected, LED Flashing –connecting.
 - Report the connection status to customer Host through Alinket ACM command.

2.7 Multi-Socket of TCP/UDP

Max.4 TCP sockets + 4 UDP sockets supported to connect to different networks. Those connections can be used for either of below two types of services or mixed circumstances.

- To connect to different servers for various cloud services.
- To connect to same server or cloud for different services such as system, event, control and service.

The figure below describes the use of the multi-socket TCP or UDP connections.

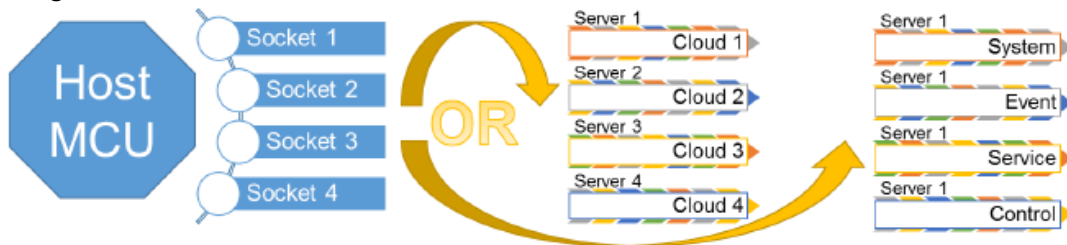


Figure 3 Multi-Socket Connections for TCP/UDP

2.8 Low Power Mode

ALX85X family supports low power mode to meet various industry and applications. The typical implementation is to use two GPIOs.

- 1st GPIO for enter/quit low power mode
- 2nd GPIO to indicate the status, normal or low power mode.

2.9 Fast Network Configuration –Flashlink

Flashlink is a fast network configuration tool especially for those ALX85Xcustomer devices which without an UI display. It is an APP software which can be installed on mobile phone or PAD.

Flashlink can help customer to configure below network parameters.

- AP
 - Wi-Fi SSID
 - Wi-Fi Password
 - Wi-Fi Security
- Server
 - Server URL
 - Server Username
 - Server Password

There will be a configuration notification status in the bottom field of the configuration page.

Flashlink is the industry only Wi-Fi fast network configuration tool support AP and Server one time configuration. It supports both Android and IOS.



2.10 Fast Roaming

ALX85X family supports fast roaming between two APs which managed by the same AC. A typical Wi-Fi roaming environment are as follows.

- An AC (AP Controller) to manage the APs connected to it. The AC manages its network DHCP and equalizer.
- All APs connected to above AC have same SSID, Password and Security (WEP, WPA or WPA2 etc.).
- The IP address assigned to ALX85Xcontroller is managed by AC, not AP.

Unlike network disconnection and reconnection from one AP to another AP (usually taking 5s ~ 10s), Alinket ALX85X is a true roaming, with its latest technology, ALX85X roams from original AP to destination AP only take less than 0.5s period.

ALX85X roaming technology is managed by Alinket unique ACM system. ALX85X controller scans the available AP RSSI, calculates the delta and triggers the roaming activity. Below figure describes the roaming mechanism of ALX85X.

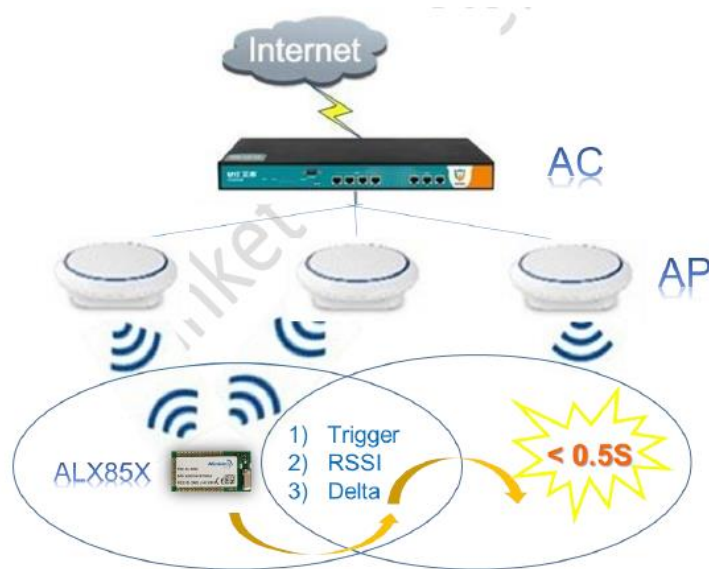


Figure 4 Fast Roaming < 0.5s

2.11 ACM

ACM (Alinket Controller Message) is a message system and protocol for the communications between customer host MCU and Alinket IoT controllers. It is developed by Alinket itself and is applicable to all Alinket controllers including ALX85Xfamily.

ACM system works with the host control interfaces between customer host MCU and Alinket controllers.

2.11.1 Host Control Interface

The host control interfaces are used for transferring ACM messages, Flow Control signal and Power Save signal between customer host MCU and Alinket IoT controllers.

Below figure shows the connections between customer host and ALX85Xfamily.

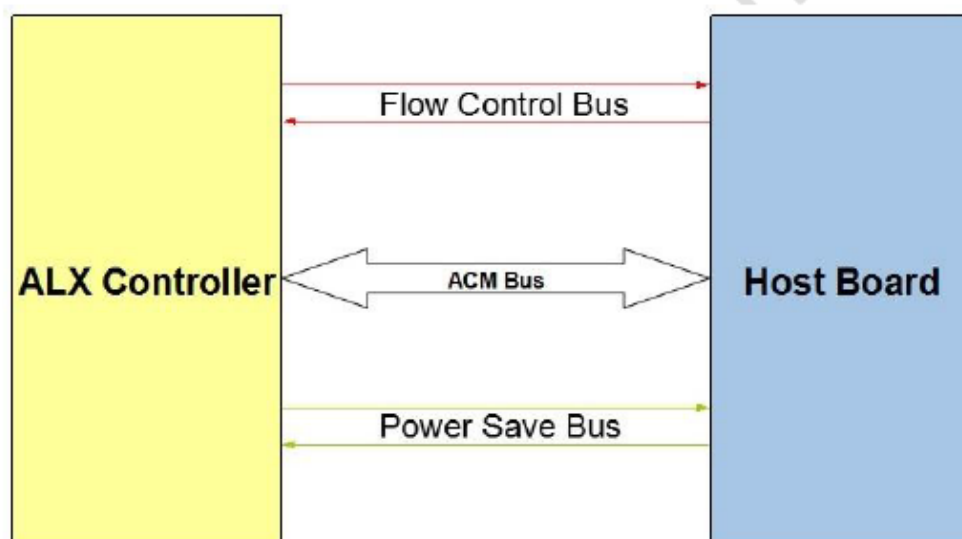


Figure 5 Host Control Interface

2.11.2 ACM Bus

ACM Bus is the interface to exchange the message between customer host MCU and Alinket controller. It can be UART, SPI interface from hardware point of view.

The messages include host control commands, controller command response, and alarm events from Alinket controller as well.

Detailed message definition, the implementation of message Flow Control and Power Save functions can be found in documents of *Alinket Controller Message Specification* and *Alinket Host Control Interface Guide*. (Note: Please contact your local Alinket sales office or distributors to get the related documents.)

3. Wi-Fi Specification

3.1 Wireless Specification

Table 4 2.4GHz Wireless Specification

Features	Specification
WLAN Standards	IEEE802.11 b/g/n
Antenna Port	Single Antenna
Frequency Band	2.412GHz –2.484 GHz ETSI: 2412Mhz-2472Mhz FCC:2412Mhz-2462Mhz
Modulation	DSSS, CCK, OFDM, BPSK, QPSK, QAM
Support data rates	802.11b: 1, 2, 5.5, 11(Mbps) 802.11g: 6, 9, 12, 18, 24, 36, 48, 54 (Mbps) 802.11n: 6.5,13,19.5,26,39,52,58.5,65(Mbps)

Table 5 5GHz Wireless Specification

Features	Specification
WLAN Standards	IEEE802.11 a/n
Antenna Port	Single Antenna
Frequency Band	5.17GHz–5.31GHz,5.490-5.835GHz ETSI: 5180Mhz-5240Mhz FCC:5180Mhz-5240Mhz,5260Mhz-5320Mhz, 5500Mhz-5700Mhz, 5745Mhz-5825Mhz
Modulation	OFDM, BPSK, QPSK, QAM
Support data rates	802.11a: 6, 9,12, 18,24,36,48,54(Mbps) 802.11n: 6.5,13,19.5,26,39,52,58.5,65(Mbps)

3.2 Tx Power

Table 6 2.4GHz TX Power

RF Characteristics	TYP.	Unit
--------------------	------	------

RF TX Power@11b, 1Mbps	19.5	dBm
RF TX Power@11g, 54 Mbps	21.9	dBm
RF TX Power@11n, 65 Mbps	21.8	dBm

Table 7 5GHz TX Power

RF Characteristics	TYP.	Unit
RF TX Power@11a, 6Mbps	14.1	dBm
RF TX Power@11n, 65 Mbps	14.2	dBm

3.3 Rx Sensitivity

Table 8 2.4GHz Rx Sensitivity

Receiver Characteristics	TYP.	Unit
PER <8%, Rx Sensitivity @ 1Mbps DSSS	-95	dBm
PER < 8%, Rx Sensitivity @ 11 Mbps CCK	-89	dBm
PER < 10%, Rx Sensitivity @ 6 Mbps OFDM	-92	dBm
PER < 10%, Rx Sensitivity @ 54 Mbps OFDM	-77	dBm
PER < 10%, Rx Sensitivity @ MCS0	-92	dBm
PER < 10%, Rx Sensitivity @ MCS7	-73	dBm

Table 9 5GHz Rx Sensitivity

Receiver Characteristics	TYP.	Unit
PER <10%, Rx Sensitivity @ 6Mbps OFDM	-90.5	dBm
PER < 10%, Rx Sensitivity @ 54 Mbps OFDM	-73.5	dBm
PER < 10%, Rx Sensitivity @ MCS0	-90.5	dBm
PER < 10%, Rx Sensitivity @ MCS7	-70.5	dBm

Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01

2.2 List of applicable FCC rules

FCC Part 15 Subpart C 15.247 & 15.209 & 15.407.

2.3 Specific operational use conditions

The module can be used for mobile applications with a maximum 4.84dBi antenna. The host manufacturer installing this module into their product must ensure that the final product complies with the FCC requirements by a technical assessment or evaluation to the FCC rules, including the transmitter operation. The host manufacturer has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as shown in this manual.

2.4 Limited module procedures

Not applicable. The module is a Single module and complies with the requirement of FCC Part 15.212.

2.5 Trace antenna designs

Not applicable. The module has its own antenna, and doesn't need a host. sprinted board microstrip trace antenna etc.

2.6 RF exposure considerations

The module must be installed in the host equipment such that at least 20cm is maintained between the antenna and users' body; and if RF exposure statement or module layout is changed, then the host product manufacturer required to take responsibility of the module through a change in FCC ID or new application. The FCC ID of the module cannot be used on the final product. In these circumstances, the host manufacturer will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

2.7 Antennas

Antenna Specification are as follows:

Type: FPC Antenna

Gain: 4.84dBi Max.

This device is intended only for host manufacturers under the following conditions:

The transmitter module may not be co-located with any other transmitter or antenna;

The module shall be only used with the internal antenna(s) that has been originally tested and certified with this module. The antenna must be either permanently attached or employ a „unique“ antenna coupler.

As long as the conditions above are met, further transmitter test will not be required.

However, the host manufacturer is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

2.8 Label and compliance information

Host product manufacturers need to provide a physical or e-label stating “Contains FCC ID: SMQALX850B” with their finished product

2.9 Information on test modes and additional testing requirements

Host manufacturer must perform test of radiated & conducted emission and spurious emission, e.t.c according to the actual test modes for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product.

Only when all the test results of test modes comply with FCC requirements, then the end product can be sold legally.

2.10 Additional testing, Part 15 Subpart B disclaimer

The modular transmitter is only FCC authorized for FCC Part 15 Subpart C 15.247 & 15.209 & 15.407 and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuitry), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

Federal Communication Commission Statement (FCC, U.S.)

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

FCC Caution:

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

IMPORTANT NOTES

Co-location warning:

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

OEM integration instructions:

This device is intended only for OEM integrators under the following conditions:

The transmitter module may not be co-located with any other transmitter or antenna. The module shall be only used with the external antenna(s) that has been originally tested and certified with this module.

As long as the conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

Validity of using the module certification:

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization for this module in combination with the host equipment is no longer considered valid and the FCC ID of the module cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

End product labeling:

The final end product must be labeled in a visible area with the following: “Contains Transmitter Module **FCC ID: SMQALX850B**”.

Information that must be placed in the end user manual:

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.