MAN-00015

Subeca BLINC S2 User Manual

Bluetooth LoRa Integrated Network Communication

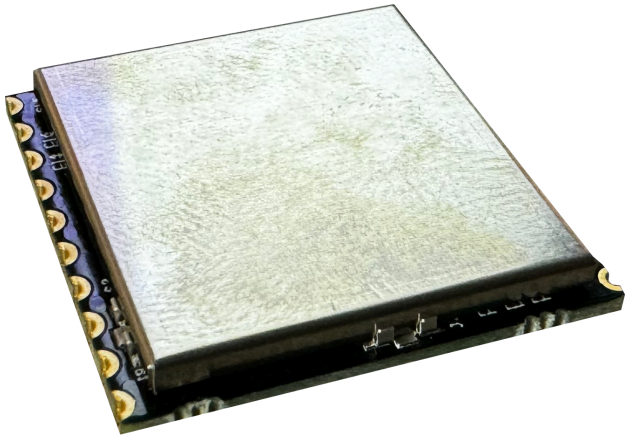


Table of Contents

Change Log

Date	Revision	Author	Description
2/2/24	1.0	MAF	Initial Release
8/15/24	1.1	MAF	Updated Antenna Info

Specifications

Item	Min	Nominal	Max	Description
RF				
Short Range Protocol		BLE 5.4		
Bluetooth Range	10	30	300	Meters
Bluetooth Antenna Type				U.FL Connector
Bluetooth update rate		900		ms
Long Range Protocol		LoRa		
LoRa Frequencies	860	902-928	930	MHz
LoRa Antenna Type				U.FL Connector
Environment				
Operating Temperature	-10		55	Celcius
Storage Temperature	-10		55	Celcius
Mechanical				
Weight				Pounds
Dimensions		1 x 1		Inches
Electrical				
Input Voltage	3.1	3.6	6	V
Current draw	0.05		100	mA
Digital Logic Voltage		3		V
Firmware				
Processor Family				STM32
Programmer				ST-Link V2

FCC Information

FCC ID: 2AS4H-BLINC3
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.

RF exposure considerations

This module complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.
RF Exposure - This device is only authorized for use in a mobile application. At least 20 cm of separation distance between the module and the user's body must be maintained at all times.

Instruction to Integrator

Labeling
A label must be affixed to the outside of final commercial product with the following statements:
This device contains FCC ID: 2AS4H-BLINC3

Antenna
The antenna gain of a new antenna should be of the same type as the originally approved antenna and the antenna gain should not be higher than the antenna gain of the originally tested antenna. The list of originally approved PCB antennas is the following

- P/N: Taoglas PC91.07.0100A.db (915MHz PCB antenna, peak gain: 2.67 dBi)
- P/N: Taoglas ILA.09 (915MHz Ceramic loop antenna, peak gain: 1.57 dBi)
- P/N: Molex 1461530100 (BLE Balance Flex antenna, peak gain: 3.0 dBi)
- P/N: Abracon AMCA31-2R450G-S1F-T3 (BLE chip antenna, peak gain: 2.3 dBi)

RF exposure considerations
Consistent with §2.909(a), the following text must be included within the user's manual or operator instruction guide for the final commercial product:
This module complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.
This device is only authorized for use in a mobile application. At least 20 cm of separation distance between the module and the user's body must be maintained at all times.

Additional testing, Part 15 Subpart B disclaimer
The final host / module combination may also need to be evaluated against the FCC Part 15B criteria for unintentional radiators in order to be properly authorized for operation as a Part 15 digital device. The FCC Part 15 Statement shall be included in the user manual of the final commercial product if applicable.

Caution Statement for Modifications

CAUTION: Any changes or modifications not expressly approved could void the user's authority to operate the equipment.

Introduction

Subeca's BLINC Mini is a multi-comms IoT module designed to be integrated into third party products to enable wireless connectivity to the cloud. With Amazon Sidewalk, Bluetooth Low Energy (BLE) and LoRaWAN connections, as well as a full end-to-end IoT stack, the BLINC offers flexibility, ease of integration, and speed to market for our partners.

Features and Benefits

- Full stack IoT offering (end-to-end)
- Long range IoT connection (LoRaWAN/Sidewalk)
- Can connect to and control up to 10 devices with edge network functionality
- Sophisticated current draw optimization (long battery life)
- Managed supply chain for resiliency and security
- ST Micro chipset
- Cutting edge security (designed for critical infrastructure)

Full IoT Solution

Most wireless module providers provide just that, the hardware. Subeca's offering is unique, providing an entire IoT stack that can be deployed with minimal customization for each customer, and comes pre-provisioned from our factory in Texas. In keeping with our commitment to make things easy for our customers, we have developed the full technology stack, and optimized it across all elements so that they can focus on their core capabilities.

Firmware

Subeca's team of RF firmware engineers has specifically designed the BLINC Mini firmware stack to be highly flexible for various end-device profiles, very low current draw (for battery powered applications) and optimized wireless protocols to limit bandwidth consumption over the air (to save airtime costs). Various algorithms have been developed during the firmware development that are catered specifically to this full IoT system stack.

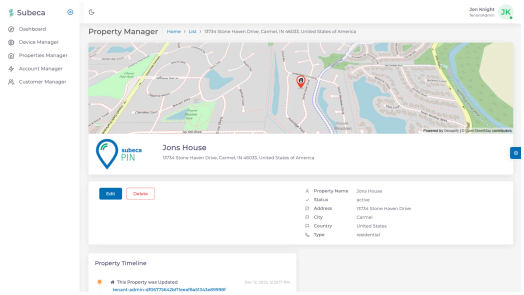
Wireless Protocols

Subeca has custom-designed various wireless protocols that define the BLINC Mini communications between various system modules. Our Lerna protocol is a custom BLE protocol defining our advertising packet structure and connectable characteristics used in the communications between BLE devices. The Argolis protocol describes the packet structure and schema for LPWAN (LoRaWAN and Sidewalk) communications. In addition, there are various custom protocols that define our inter-chip communication format (STM32WBA-STM32WLE).

Web App

With a professionally designed and heavily scrutinized AWS (Amazon Web Services) back-end, Subeca can offer the core structure for a third party web application. All of the core elements are highly portable to our customers to decrease time to market and resources needed to get a full solution out the door.

We have also developed several front-end, customer-facing GUIs that require minimal modification when white-labeling to our customers.



Smartphone Apps

Subeca offers various smartphone apps, across all major platforms (Android, iPhone), for end-customer interaction, device configuration and field deployment.

Manufacturing

Subeca provisions the BLINC Mini at our factory in Texas. Various automated procedures have been developed to produce reliable, secure modules at scale. We have custom programming fixtures, automated test procedures, various connections between the hardware and software assembly systems and a QR tracking system along the way. All security keys are managed and deployed on-site here in the USA by Subeca personnel.

Security

The entire BLINC Mini stack was designed with security and interoperability in mind, from the top down. Most IoT stacks in this space were started before certain systems reached maturity, resulting in a somewhat disconnected system. With a top-down approach, full stack interoperability and security have been optimized to provide a cohesive system, rather than various siloed modules.

Designed for Critical Infrastructure

Given the world-wide supply chain challenges and geopolitical instability, we've designed our products with European-made chips, US/Mexico assembled circuit boards and US-provisioned modules.

End-to-end Security

End-to-end security was a main focus during development and deployment. Our customers require modern security standards from hardware production/provisioning all the way through the IoT technology stack. Subeca follows all recommended security standards for the various modules in our system (LoRaWAN, BLE, Sidewalk, AWS and smartphone apps). These standards provide inherent security regarding data transfer and personnel authorization. In addition to these standards, Subeca uses other common security procedures for user access

Communications

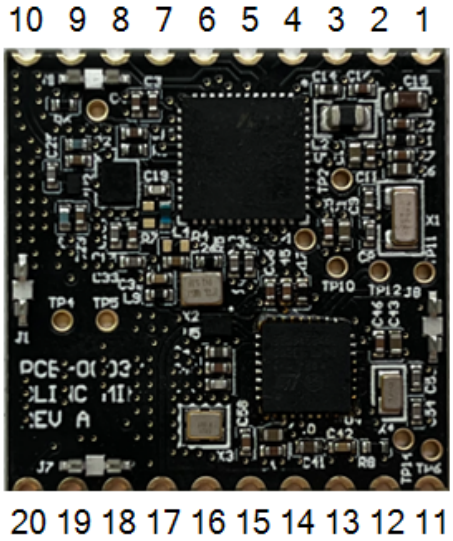
A true "multi-comms" system, the BLINC is designed to use Sidewalk, LoRaWAN, BLE and any mix of these protocols. It can also be configured to automatically fall back to LoRaWAN if Sidewalk coverage is lost.

Sidewalk is designed for low-bandwidth, long range, battery-powered IoT systems, so our target customers include water/electrical/gas utilities, all of which require small bits of data sent throughout the day. Typical use cases do not require 100% message reliability. Sidewalk and LoRaWAN both use the public ISM band so messages can collide and fail to get through a small percentage of the time. Subeca has designed custom protocols to guarantee message integrity on the application layer for important messages such as alerts.

LoRaWAN and Sidewalk both use the 900 MHz ISM band in the US. Subeca uses the ST-provided front-end balun for RF matching so changing to other frequency bands for ISM bands in other countries would require no hardware change, just a simple firmware update.

The BLINC wireless protocols were designed around the Sidewalk and LoRaWAN specs. Sidewalk allows 1 message every 15 minutes in a static configuration (not mobile) so that is the fastest TX setting in the BLINC, allowing up to 19 bytes of data in each payload.

Electronics

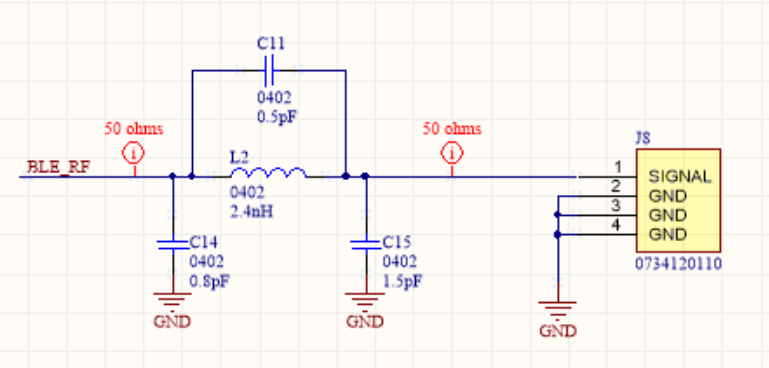


Comms	#
SPI	1
AI	4
DIO	15
Int	10
UART	2
USART	1
I2C	3

BLINC Mini Port	BLINC Mini Header Pin	EXTI	ADC	UART	SPI	I2C	DIO
PA0	8	0, WKUP					DIO1
PA2	14	2		UART2_TX			DIO2
PA3	19	3		UART2_RX			DIO3
PA7	20	7				I2C3-SCL	DIO4
PA11	13		AIN7		SPI1-MISO	I2C2-SDA	DIO5
PA12	12		AIN8			I2C2-SCL	DIO6
PA15	18	11	AIN11				DIO7
PB2	16	2	AIN4				DIO8
PB4	3	4	AIN3			I2C3-SDA	DIO9
PB5	4	5		USART1-CK (S)	SPI1-MOSI		DIO10
PB6	5	6		USART1-TX		I2C1-SCL	DIO11
PB7	6	7		USART1-RX		I2C1-SDA	DIO12
PA1	7	8			SPI1-SCK		DIO13
PB12	15	12					DIO14
PC13	11	13					DIO15
GND	1						
VIN	2						

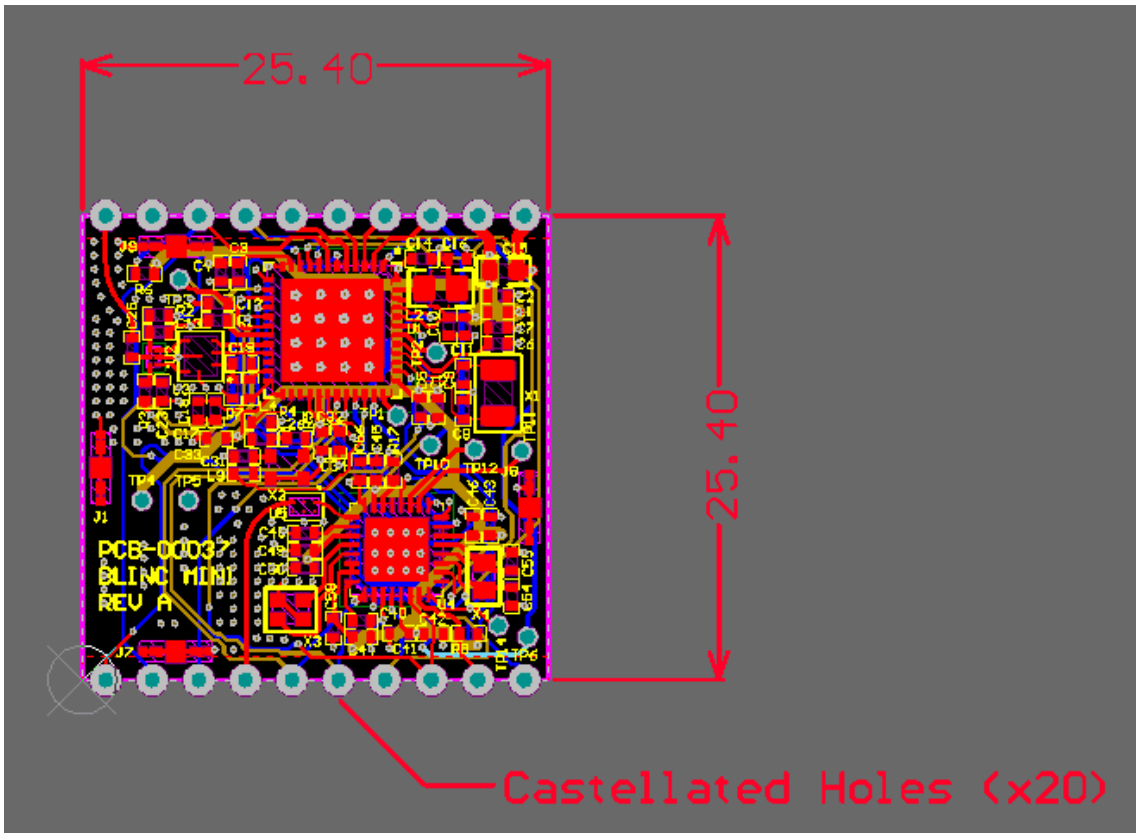
Antennas and Matching Circuits

The BLINC Mini does not have antenna connectors on the module itself, so customers will need to design them into their main PCB, as well as any required matching circuits. The BLINC Mini has 2 castellated holes to pass the BLE and LoRa RF signals at a 50 ohm impedance. Designs must match the antenna impedance with 50 ohms for best signal integrity. An example of this matching circuit is shown below:



Mechanical Dimensions

The BLINC Mini measures 1 x 1 Inches and the pins are 0.1” on center.



Device Table

Each BLINC Mini can communicate with up to 10 BLE devices. The first 5 controls are onboard the BLINC Mini and devices 6-15 are configurable BLE-connected devices. This table is stored in non-volatile memory on the BLINC Mini and can be accessed through the Bluetooth connection.

Index	Device Type	ID
0	This device	AA:BB:CC:DD:EE:FF **
1*	Local sensor	AA:BB:CC:DD:EE:FF **
2*	Output 1	AA:BB:CC:DD:EE:FF **
3*	Output 2	AA:BB:CC:DD:EE:FF **
4*	Output 3	AA:BB:CC:DD:EE:FF **
5*	Output 4	AA:BB:CC:DD:EE:FF **
6	BLE Device 1	AA:BB:CC:DD:EE:FF
7	BLE Device 2	AA:BB:CC:DD:EE:FF
8	BLE Device 3	AA:BB:CC:DD:EE:FF
9	BLE Device 4	AA:BB:CC:DD:EE:FF
10	BLE Device 5	AA:BB:CC:DD:EE:FF
11	BLE Device 6	AA:BB:CC:DD:EE:FF
12	BLE Device 7	AA:BB:CC:DD:EE:FF
13	BLE Device 8	AA:BB:CC:DD:EE:FF
14	BLE Device 9	AA:BB:CC:DD:EE:FF
15	BLE Device 10	AA:BB:CC:DD:EE:FF

* the first 5 devices are internal to the device

** this address matches the device's BLE MAC

Power

Power Systems

The BLINC Mini is designed to last many years from a single battery. As with any IOT device, power systems must be carefully designed to ensure proper operation and a long lifetime. All power sources are monitored by the processor to enable smart control of these power systems. For example, when the solar panel is producing sufficient power, it is possible to achieve faster wireless transceiver times because the device is not draining extra power from the batteries.

Power Input

Vin is the power input line and supports 3.1V - 6V inputs. The power supply should be able to handle 100mA of input current but the device normally sleeps at about 300uA. This power input should be regulated through an LDO.

Sleep Modes

Sleeping is crucial to the extended lifetime of any battery powered product. In order to last 10+ years from a single battery, the BLINC Mini, and any device it is integrated into, must sleep for most of its life. The device sleeps until a timer triggers various operations such as a LoRa transmission or a reading session. It then wakes up to transmit each message to complete a full communication session and also sleeps in between each LoRa message. The LoRa update rate is settable through both the Bluetooth smartphone/tablet app and Argolis (LoRa) protocol. The Subeca Link also wakes up intermittently to check local Bluetooth devices for alarm conditions and initiates an off-schedule communication session if an alarm is triggered. The rest of the time, it goes into deep-sleep mode.

Setup

Configuration Mode

The BLINC Mini can connect to tablets and smartphones (and PCs) using BLE to configure settings and update the firmware on both (LoRa and BLE) processors. Remaining setup can then be accomplished via the Subeca App. Certain parameters can be set over LoRa as well.

Differential Firmware Updates

The BLINC system was designed to use a custom differential firmware update algorithm to reduce bandwidth of over the air (OTA) firmware updates. This dramatically reduces the airtime required to perform updates to the firmware.