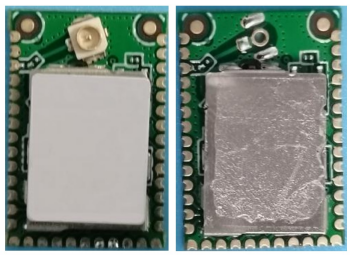
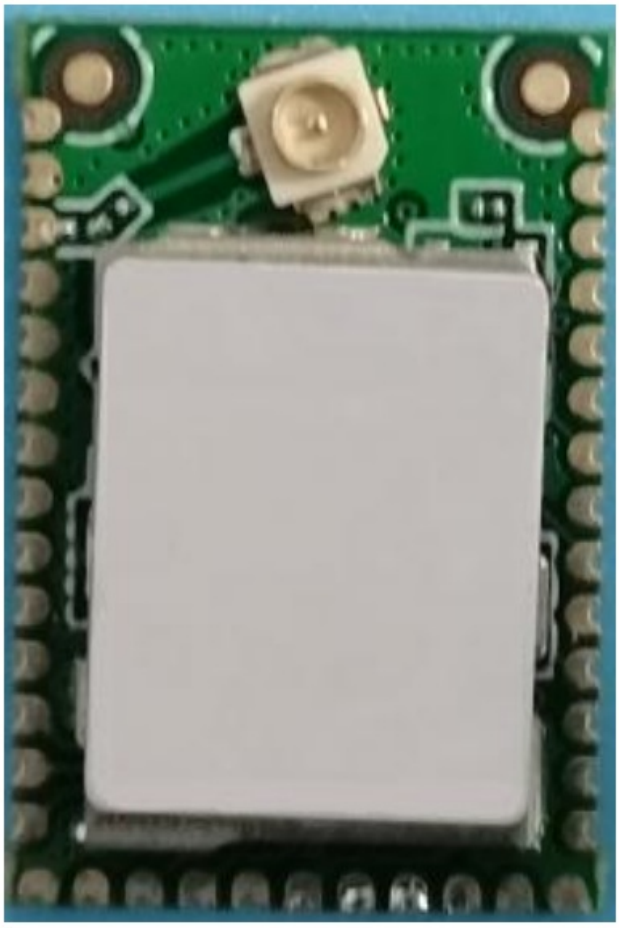


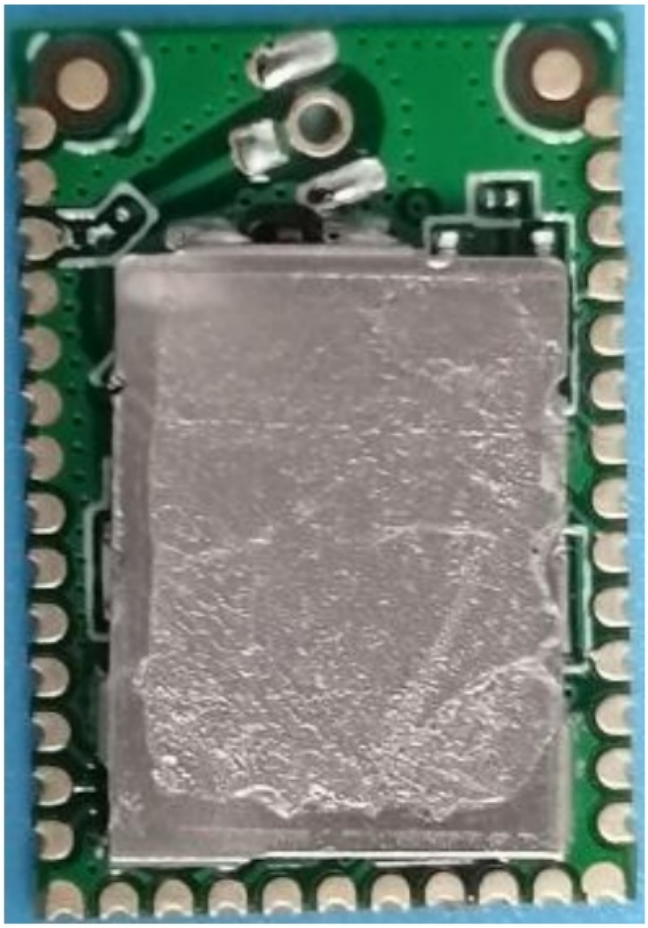
avi-on AVIBG21A BLE Modules Instruction Manual

avi-on AVIBG21A BLE Modules

AVIBG21AUFL



AVIBG21AVIA



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Introduction

The AVIBG21A BLE Modules are RF Modules built on the EFR32BG21A chipset, which provide a single-chip solution to controlling all types of lighting and other devices, whether line-connected or battery-powered.

Controlling host and radio interfaces, the on-chip micro-controller runs both the Bluetooth Stack and the Avi-on

Bluetooth Mesh (or SIG Mesh) Application Stack. The on chip RF transceiver includes the complete receiver and transmitter functions and integrated antenna or external antenna options.

There are two versions of the AVIBG21A BLE Modules available:

- AVIBG21AUFL (includes male U.FL connector for use with external antennas)
- AVIBG21AVIA (supports external antenna through via; includes additional ground via for isolation)

Powered by Avi-on™ Platform & Firmware

Modules ship pre-loaded with standard Powered by Avi-on™ firmware suitable for prototype builds and testing of lighting and control devices. The complete app-cloud-module-support package enables manufacturers to design and ship products in less than six months.
Firmware customization for PW!¼ 12(UAR?; SP£ TRIAC ADC DAC and other dimming protocols is available upon request.

Avi-on Module Features

- One step integration using Powered by Avi-on™ platform of app-cloud-firmware-support. Includes plug-and-play interoperability with the Powered by Avi-on™ product ecosystem
- Compatible with UART, I2C, SPI, and PWM dimming interfaces
- Up to +8S°C operating temp; higher temp versions available upon request
- Internal EEPROM memory provides storage for the Bluetooth software parameter and application parameter
- Electrical:
  - DC Supply: 1.8V ~3.6V
  - Low current consumption: <20mA @3.3VDC
- Flexible Antenna options with the U.FL and RF VIA versions of the Module

Detailed Specifications

Characteristic	Detailed Description
RF Technology	• Frequency Hopping Spread Spectrum
RF Frequency	• 2400 to 2483.5 MHz USA/EUROPE/JAPAN
Modulation Schemes	• 0.5 BT, GFSK • Index: 0.28 – 0.35.
Operating Frequency	• 2400 ~ 2483.5 MHz ISM band
Channel Numbers	• 40 (f=2402+k*2 MHz, k=0, 1, 2, …39)

Data Rate	• 1 Mbps • 2 Mbps
Transmitter Output Power	• 0 dBm or 10 dBm
Receiver Sensitivity	• -97.5 dBm sensitivity @ 1 Mbit/s GFSK • -94.4 dBm sensitivity @ 2 Mbit/s GFSK
Antenna Type	• External via U.FL or RF VIA
Operating Voltage	• 1.8V ~ 3.6VDC Possible • 3.0V ~ 3.6VDC Recommended • For MAX TX Power Vcc must be >3.0VDC • Brownout: 1.65V
Current Consumption	• 2.5mA @3V active mode (peripherals off) • 5uA @3V sleep mode • TX extra current 16mA • RX extra current 9mA
Size	• 18mm x 12mm x 2.3mm (L x W x H) • Size does not include antenna
Operating Temp	• -40°C to +85°C

Regulatory Certifications

Feature	Detailed Description
USA	• **FCC ID: 2AFZI-AVIBG21** • FCC Part 15, Subpart C (15.247) • 15.203, 15.205, 15.207, 15.209
EU	• **CE:** (TBD) • **Model:** AVIBG21A • **RoHS:** 2011/65/EU
Canada	• **IC: 20544-AVIBG21** • RSS-247 Issue 2, Feb. 2017 • RSS-Gen Issue 5, Apr. 2018
BQB	• **DID:** (TBD) • **Qualified Design ID:** (TBD)

Default Pin Assignments

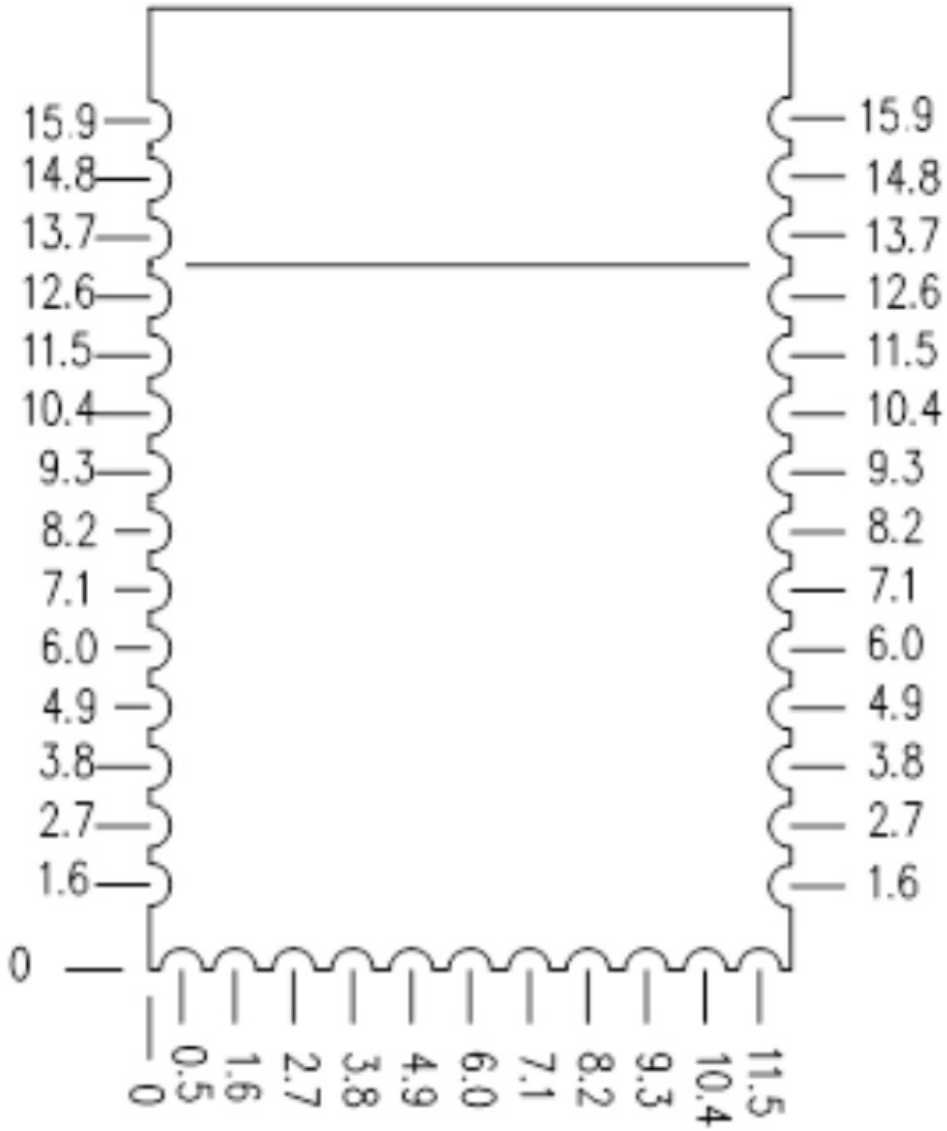
Pins	Name	Function	Description
1	nRESET	Reset	Active low reset (SWD: Reset)
2	GND	Ground	Supply ground
3	EXT_ANT	Antenna	External Antenna for AVIBG21AVIA
4	GND	Ground	Supply ground
5	GND	Ground	Supply ground
6	GND	Ground	Supply ground
7	GND	Ground	Supply ground
8	PIO18	I/O	Not implemented (No Not Connect)
9	PIO19	I/O	Not implemented (No Not Connect)
10	PIO20	I/O	Not implemented (No Not Connect)
11	PIO21	I/O	Not implemented (No Not Connect)

12	AIO[2] / PIO25	I/O	Programmable I/O – Analog Recommended
13	AIO[1] / PIO26	I/O	Programmable I/O – Analog Recommended
14	AIO[0] / PIO27	I/O	Programmable I/O – Analog Recommended
15	GND	Ground	Supply ground
16	PIO0	I/O	Programmable I/O
17	PIO1	I/O	Programmable I/O
18	PIO3	I/O	Programmable I/O
19	VDD	Power	Positive supply (SWD: Target voltage)
20	PIO4	I/O	Programmable I/O
21	PIO5 / SWCLK	I/O	Programmable I/O (SWD: SWCLK)
22	PIO6	I/O	Programmable I/O
23	PIO7 / SWDIO	I/O	Programmable I/O (SWD: SWDIO)
24	PIO8 / SWO	I/O	Programmable I/O (SWD: SWO)
25	GND	Ground	Supply ground (SWD: Target ground)
26	PIO22	I/O	Not implemented (No Not Connect)
27	PIO9	I/O	Programmable I/O
28	PIO10	I/O	Programmable I/O
29	PIO11	I/O	Programmable I/O
30	PIO12	I/O	Programmable I/O
31	PIO13	I/O	Programmable I/O
32	VDD	Power	Positive supply
33	PIO14	I/O	Programmable I/O
34	PIO15	I/O	LFXTALO (32kHz internal crystal)
35	PIO16	I/O	LFXTALI (32kHz internal crystal)

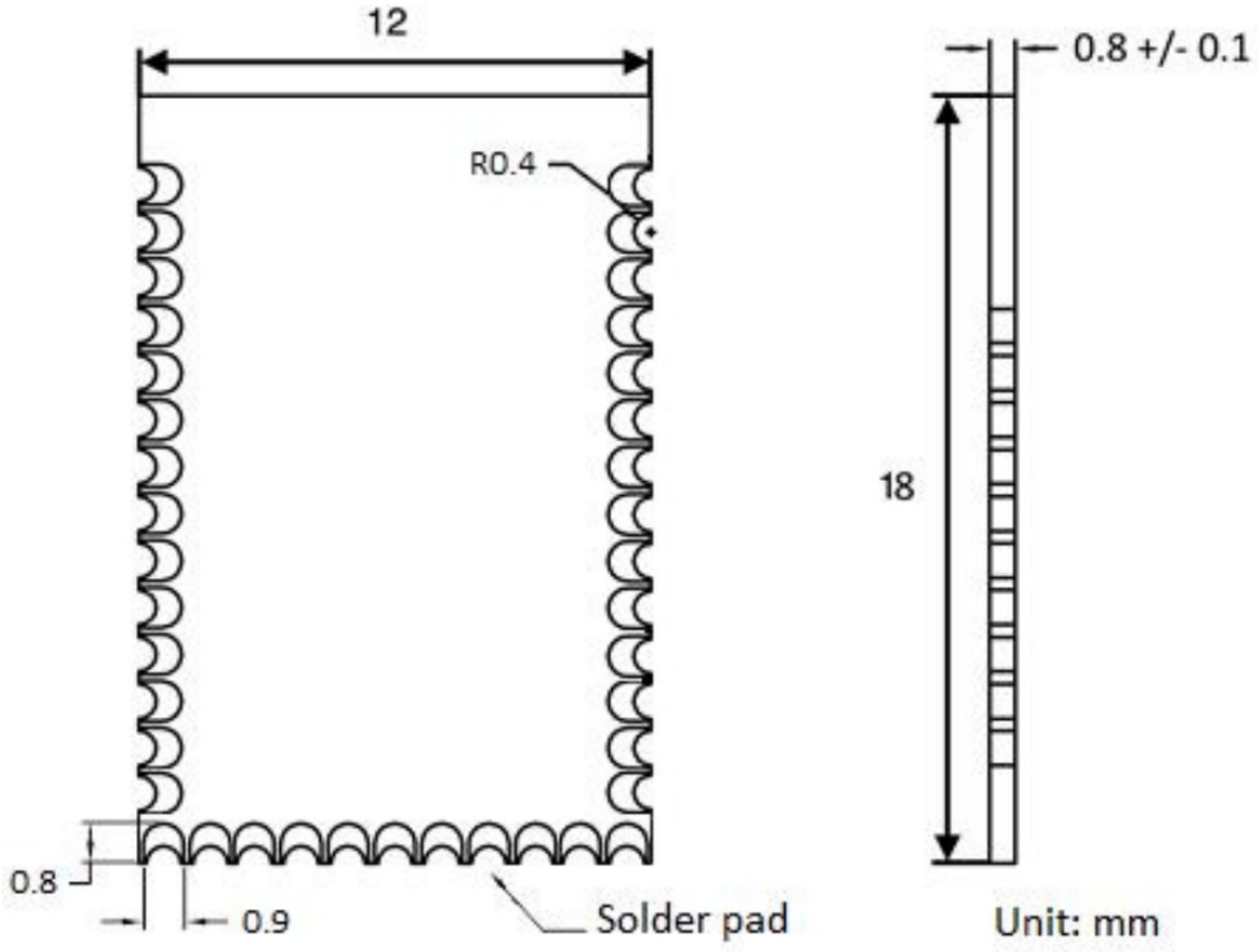
36	PIO17	I/O	Programmable I/O
37	PIO23	I/O	Not implemented (No Not Connect)
38	PIO24	I/O	Not implemented (No Not Connect)
39	GND	Ground	Supply ground

Mechanicals

Top View

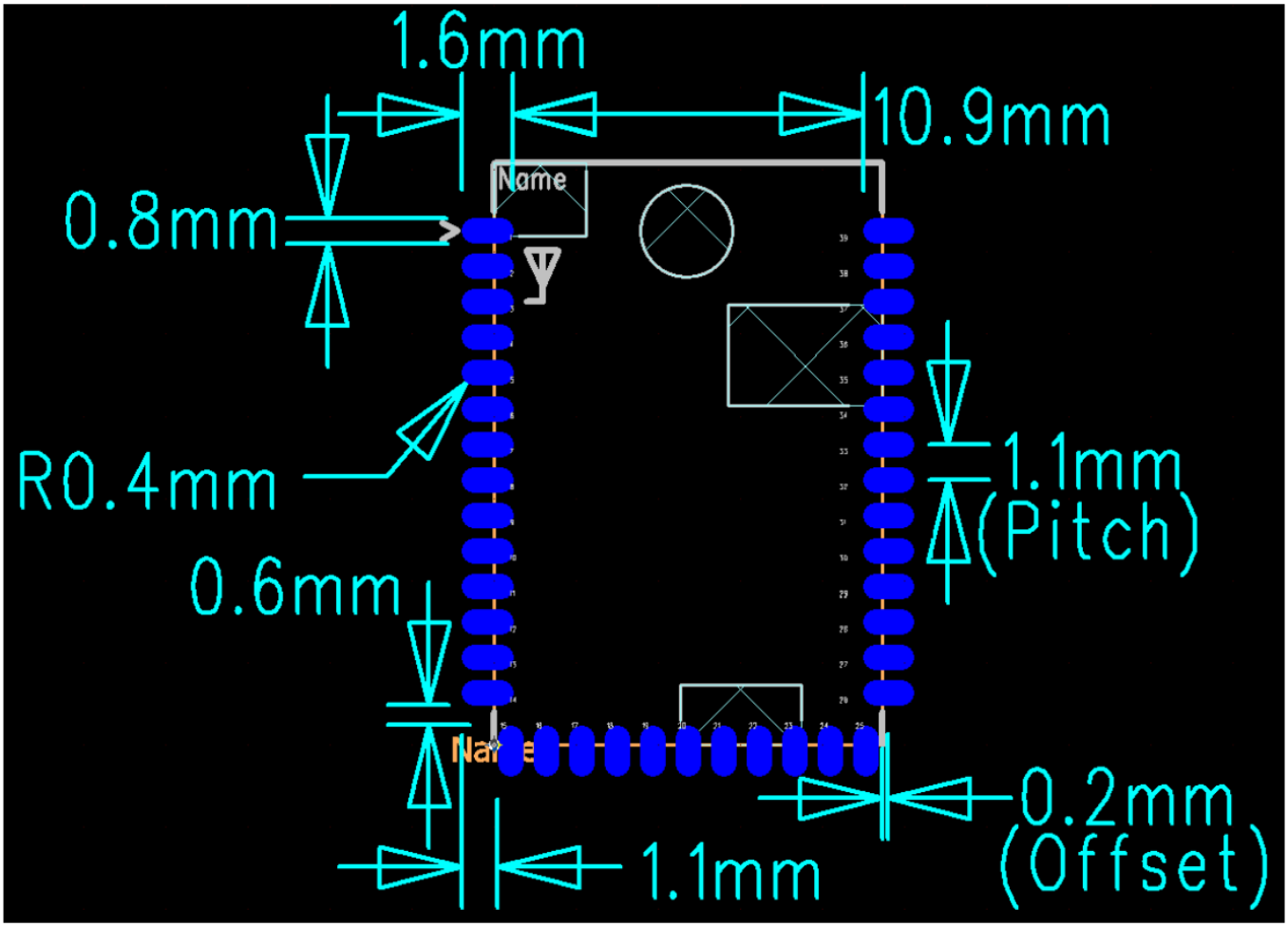


Bottom and Lateral View

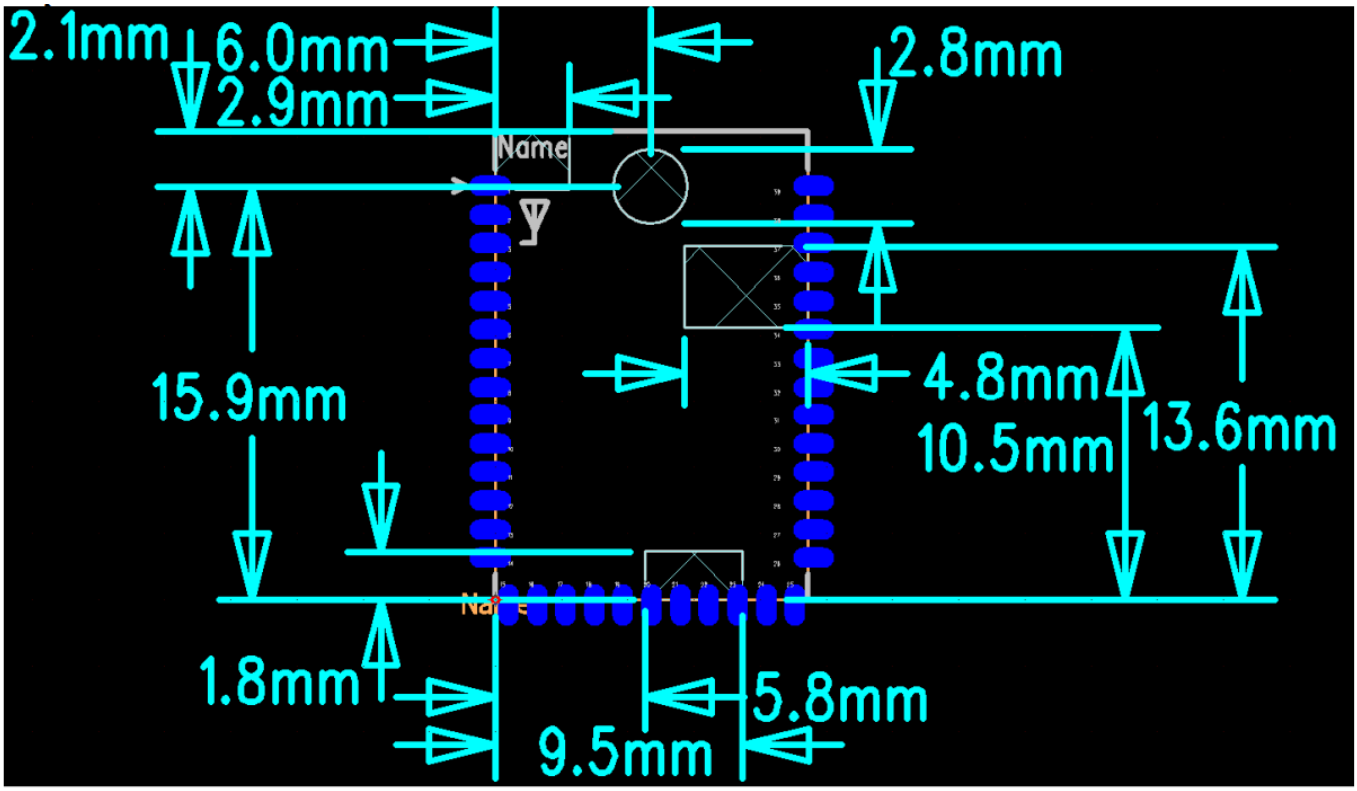


Pads Layout

SMD Land Pattern



Keepout



Antennas

The AVIBG21A series of Modules are all functionally the same, with the exception of antenna design. In both module configurations, there are multiple antenna options. Avi-on has pre certified several antennas for use with

the AVIBG21AUFL Modules, customized for various lighting applications.

Based on the specific application, Avi-on can provide recommendations based on cost and performance qualifications. We also offer the Avi-on Certification Program, which:

- Benchmarks your product's RF performance versus other devices
- Provides feedback and recommendations about how to improve
- Provides a professional test report
- Enables you to use the Powered by Avi-on logo on your products

Packaging

The standard shipment of production AVI1BG21A Modules arrive in trays, but Avi-on provides the option for tape and reel packaging (AVIBG21Axxx-TR), for additional costs. Please contact Avi-on for details.

Avi-on Integration Kit

This kit is designed to enable manufacturers to quickly develop lighting and power controls using the Powered by Avi-on™ app-cloud-firmware platform. The daughter board comes with an AVIBG21AUFL Module and is loaded with Avi-on's standard PWM firmware.
Board details plus other firmware and dimming protocols available upon request

Document Record

Date	Revision	Reason for Change
03/19/2020	0.1	Document Created
04/01/2020	0.2	Changed footprint images
05/06/2020	0.3	Marked not implemented PIOs Renamed PIO1-2 to PIO0-1
05/19/2020	0.4	Update Temp Range to -40°C ~ 85°C
04/06/2021	0.5	Added PCB Footprint Keepout & TP Locations
05/11/2022	0.6	Updated all MPN to AVIBG21A Updated Module Variants to UFL and VIA Versions Updated Section 1 Detailed Specifications Table Updated Section 2 Regulatory Certifications Table Updated Section 3 Default Pin Assignments Table Updated Section 7 SMD Land Pattern & Keepout Diagrams Updated Section 8 Antennas

FCC Caution

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

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

IMPORTANT NOTE

Note: 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 or more 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.

FCC Radiation Exposure Statement:
This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment .This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

Integration instructions for host product manufacturers according to KDB 996369 D03 OEM
Manual vOl
2.2 List of applicable FCC rules
CFR 47 FCC PART 15 SUBPART Chas been investigated. It is applicable to the modular. 2.3 Specific operational use conditions
This module is stand-alone modular. If the end product will involve the Multiple simultaneously transmitting condition or different operational conditions for a stand-alone modular transmitter in a host, host manufacturer have to consult with module manufacturer for the installation method in end system.

Limited module procedures
Not applicable
Trace antenna designs
Not applicable
RF exposure considerations
To maintain compliance with FCC RF Exposure guidelines, This equipment should be installed and operated with minimum distance of 20cm from your body.
Antennas
This radio transmitter FCC ID: 2AFZI-AVIBG21 has been approved by Federal Communications Commission to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.
For model AVIBG21AVIA, the EUT has one monopole antenna arrangement which was permanently attached:

ANT No.	Antenna Type	Antenna Connecto r	Antenna Gain	Impedance	Frequency Range
1	Monopole	G-S-G RF through h ole (Pins 2, 3 & 4)	0dBi	50Ω	2.4~2.5GHz

For model AVIBG21AUFL, the EUT has been test using five types of antenna:

ANT No.	ANT Mode	Antenna Type	Antenna Connector	Antenna Gain	Impedance	Frequency Range
1	6012ANT	Monopole	Unique Connector	3.0dBi	50Ω	2.4~2.5GHz
2	6015ANT	Dipole	Unique Connector	2.13dBi	50Ω	2.4~2.5GHz
3	6016ANT	Dipole	Unique Connector	2.13dBi	50Ω	2.4~2.5GHz
4	6211 ANT	Monopole	Unique Connector (Connected via RP SMA Cable)	3.0dBi	50Ω	2.4~2.5GHz

Label and compliance information
The final end product must be labeled in a visible area with the following" Contains FCC ID: 2AFZI-AVIBG21"
Information on test modes and additional testing requirements
Host manufacturer is strongly recommended to confirm compliance with FCC requirements for the transmitter when the module is installed in the host.
Additional testing, Part 15 Subpart B disclaimer
Host manufacturer is responsible for compliance of the host system with module installed with all other applicable requirements for the system such as Part 15 B

ISEDC Warning

This device complies with Innovation, Science, and Economic Development Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:

1. this device may not cause interference, and
2. this device must accept any interference, including interference that may cause undesired operation of the device.

The device is compliance with RF exposure guidelines, users can obtain Canadian information on RF exposure and compliance.The minimum distance from body to use the device is 20cm.
This Class B digital apparatus complies with Canadian ICES-003."
This device is intended only for OEM integrators under the following condition : The transmitter module may not be co-located with any other transmitter or antenna. As long as the condition above is 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.

Important Note:
In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the Canada authorization is no longer considered valid and the ISED 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 Canada authorization.
Any company of the host device which install this modular with limit modular approval should perform the test of radiated emission and spurious emission according to RSS-247 and RSS-Gen requirement, only if the test result comply with RSS-247 and RSS-Gen requirement, then the host can be sold legally.

End Product Labeling
The final end product must be labeled in a visible area with the following:
Contains IC: 20544-AVIBG21.

Manual Information to the End User

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.

This radio transmitter [IC: 20544-AVIBG21] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below:
For model AVIBG21AVIA, the EUT has one monopole antenna arrangement which was permanently attached:

ANT No.	Antenna Type	Antenna Connector	Antenna Gain	Impedance	Frequency Range
1	Monopole	G-S-G RF through h ole (Pins 2, 3 & 4)	0dBi	50Ω	2.4~2.5GHz

For model AVIBG21AUFL, the EUT has been test using five types of antenna:

ANT N o.	ANT Mode	Antenna T ype	Antenna Connector	Antenna Gain	Impedance	Frequency Range
1	6012 ANT	Monopole	Unique Connecto r	3.0dBi	50Ω	2.4~2.5GHz
2	6015 ANT	Dipole	Unique Connecto r	2.13dBi	50Ω	2.4~2.5GHz
3	6016 ANT	Dipole	Unique Connecto r	2.13dBi	50Ω	2.4~2.5GHz
4	6211 ANT	Monopole	Unique Connecto r (Connected via RPSMA Cable)	3.0dBi	50Ω	2.4~2.5GHz

Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Documents / Resources

	avi-on AVIBG21A BLE Modules [pdf] Instruction Manual AVIBG21, AVIBG21A, AVIBG21A Bluetooth Modules, Bluetooth Modules, Modules

References

- Home - Avi-on Labs | Lighting Controls and Wireless Energy Efficient Lighting Solutions