



MosArt

MAB4F2_BLE_Module

2016.08.02

Version 0.1

MosArt

SEMICONDUCTOR CORP.

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Overview

Module Description

The MAB4F2 module is a complete module designed to be soldered to the main host board.

Such selections will guarantee that all height restrictions of the component area are maintained. Designs should be completed with the physical dimensions shown in the mechanical drawings. All dimensions are in millimeters (mm).

Table 1 Module Design Dimensions

Dimension Item		Specification
Module dimensions	Length (X)	10.50 ± 0.15 mm
	Width (Y)	10.50 ± 0.15 mm
Antenna location dimensions	Length (X)	10.50 ± 0.15 mm
	Width (Y)	4.15 ± 0.15 mm
PCB thickness	Height (H)	0.80 ± 0.10 mm
Maximum component height	Height (H)	0.80 mm typical
Total module thickness (bottom of module to highest component)	Height (H)	1.60 mm typical

Power Supply Connections and Recommended External Components

Power Connections

The MAB4F2 contains two power supply connections, VBLUE1 and VDD1V2. The VDD1V2 connections supply power for the digital device operation, it will generate by internal line regulator. VBLUE1 supplies power for the device.

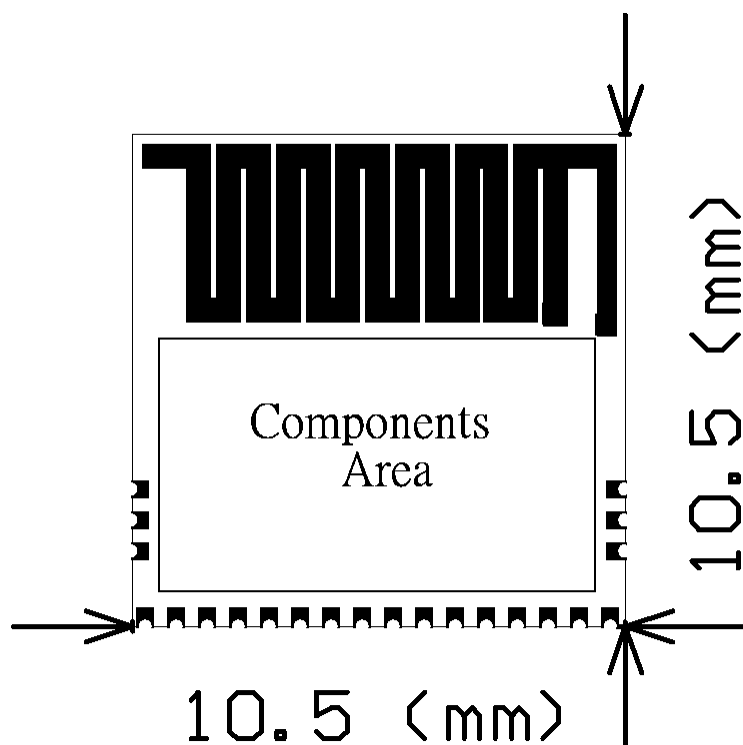
VBLUE1 accept a supply range of 1.7V to 3.6V. The maximum power supply ripple for both power connections on the module is 100 mV.

External Component Recommendation

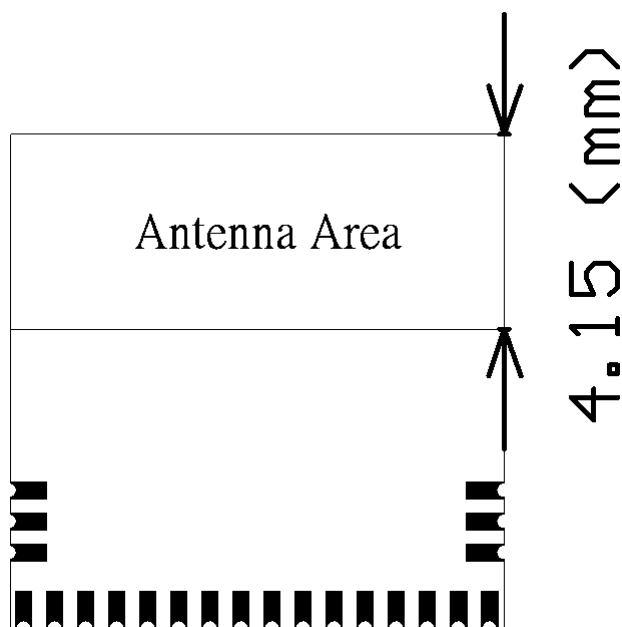
In either connection scenario, it is recommended to place an external ferrite bead between the supply and the module connection. The ferrite bead should be positioned as close as possible to the module pin connection.

The recommended ferrite bead value is 330ohm, 100MHz.

PCB Outline Dimension

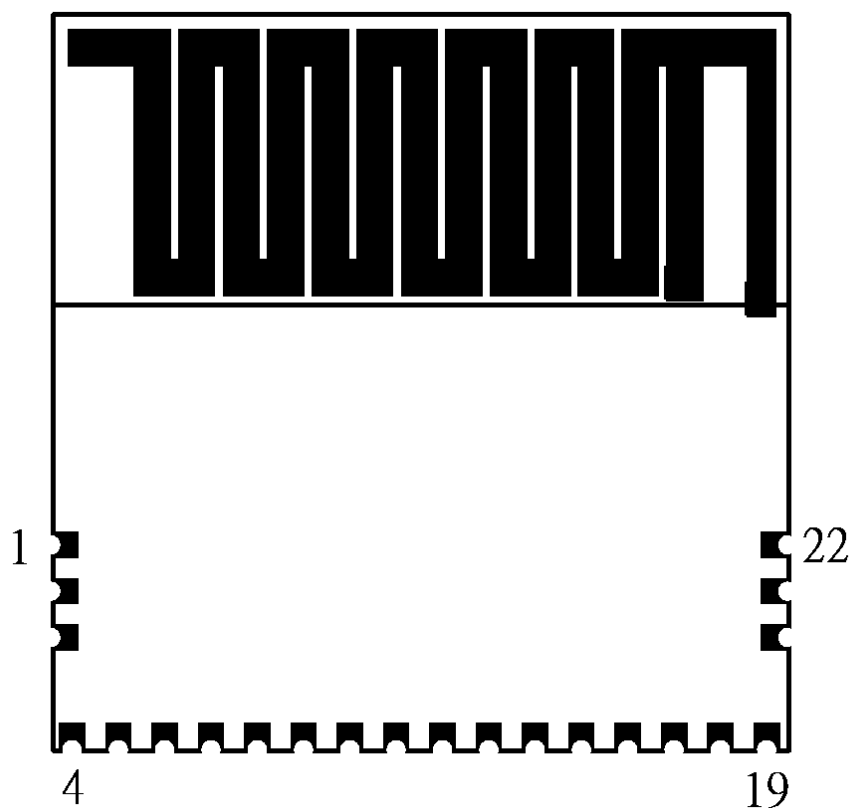


Top View

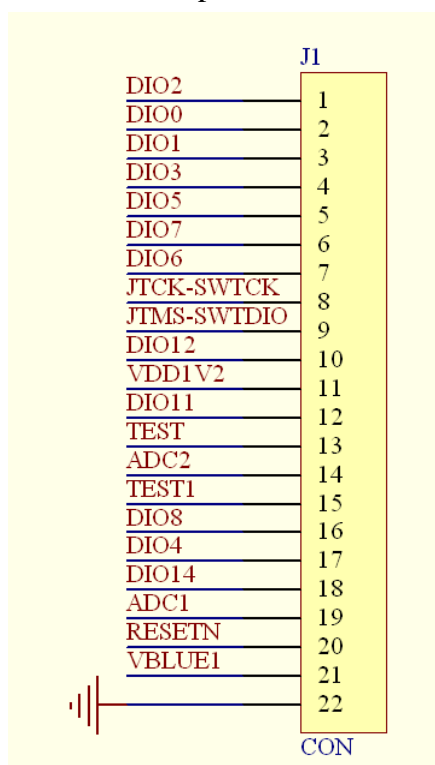


Bottom View

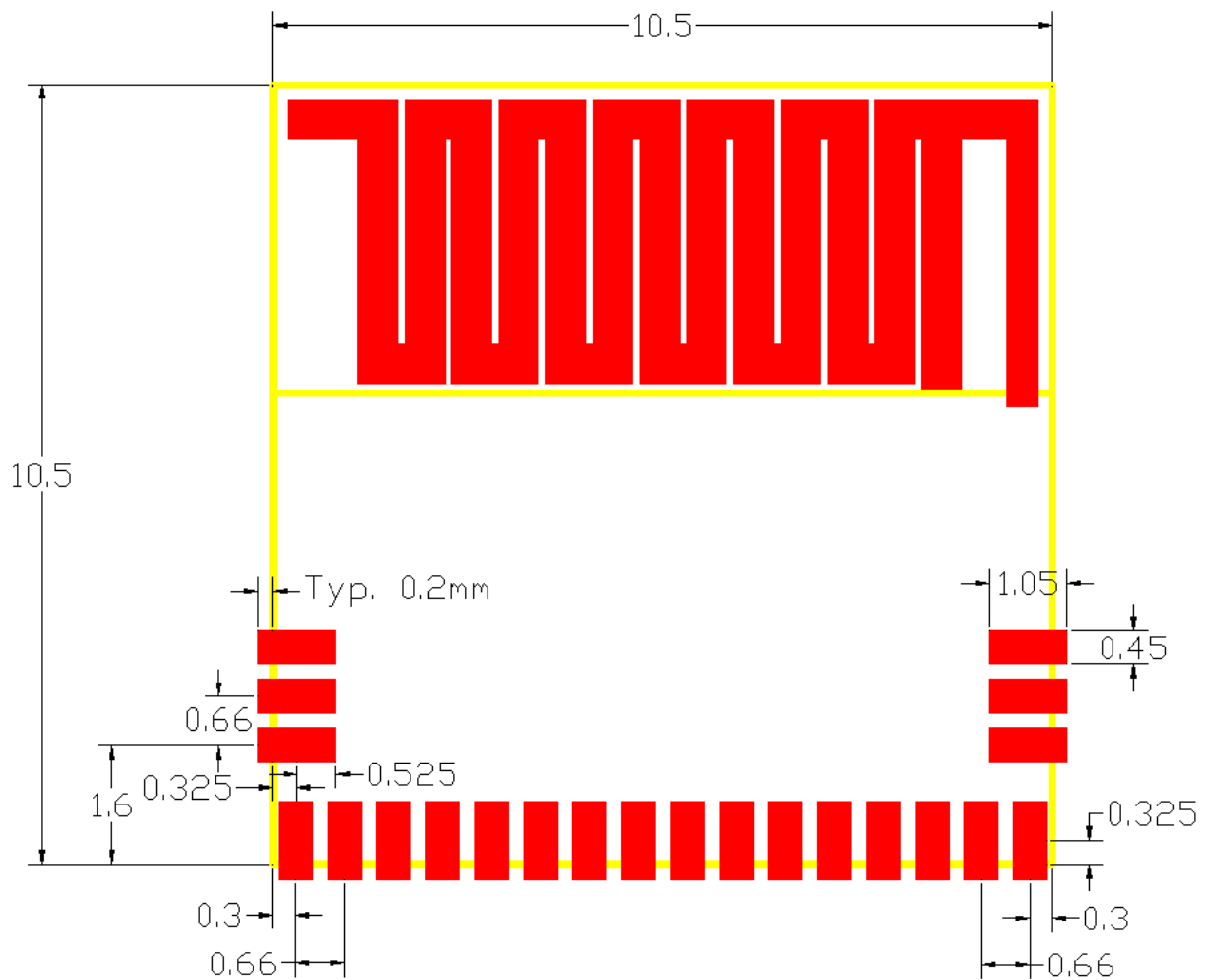
Module Pad Assignment



Top View



Module Solder Pad



Top View

The schematic diagram illustrates the electrical connections for the BlueLEI board. The central component is the BlueNRG-134 module (U1), which is connected to a J1 connector. The module's pins are labeled with their functions: DIO0-DIO14, ANATEST0-ANATEST1, ADC0-ADC2, VDD1V2, SMPSFILT1, SMPSFILT2, RESETN, VBATT, SXTAL0, SXTAL1, RF0, RF1, EXTAL0, and EXTAL1. The J1 connector has 22 pins, with the following connections: DIO02 to pin 1, DIO00 to pin 2, DIO01 to pin 3, DIO03 to pin 4, DIO05 to pin 5, DIO07 to pin 6, DIO06 to pin 7, JTM5-SWTDIO to pin 8, DIO12 to pin 9, DIO10 to pin 10, DIO11 to pin 11, TEST to pin 12, ADC2 to pin 13, TEST1 to pin 14, DIO8 to pin 15, DIO4 to pin 16, DIO14 to pin 17, ADC1 to pin 18, RESETN to pin 19, VBATT to pin 20, and VBLUEI to pin 21. The diagram also shows the internal components of the BlueNRG-134 module, including capacitors (C1-C7, C15-C21), resistors (R1, R2, R5), inductors (L1, L5, L6), and a balun (U2). The connections for the J1 connector are as follows: DIO02 to pin 1, DIO00 to pin 2, DIO01 to pin 3, DIO03 to pin 4, DIO05 to pin 5, DIO07 to pin 6, DIO06 to pin 7, JTM5-SWTDIO to pin 8, DIO12 to pin 9, DIO10 to pin 10, DIO11 to pin 11, TEST to pin 12, ADC2 to pin 13, TEST1 to pin 14, DIO8 to pin 15, DIO4 to pin 16, DIO14 to pin 17, ADC1 to pin 18, RESETN to pin 19, VBATT to pin 20, and VBLUEI to pin 21.

Electrical Specification

Absolute Maximum Ratings

Parameter	Description	Min	Typ	Max	Unit
V _{BLUES}	V _{BLUES} supply relative to V _{SS}	-0.3	–	3.9	V
V _{DD1V2}	Direct digital core voltage input relative to V _{SS}	-0.3	–	1.4	V
V _{DD_RIPPLE}	Maximum power supply ripple for V _{BLUES}	–	–	100	mV
V _{GPIO_ABS}	GPIO voltage	-0.3	–	V _{DD} +0.3	V
T _{STG}	Storage temperature range	-40	–	125	°C

DC Specifications

Parameter	Description	Min	Typ	Max	Unit
V _{BLUES}	Power supply input voltage	1.7	–	3.6	V
I _{RESET}	Reset (T=25°C, V _{DD} =3.30V)	–	5	–	nA
I _{SLEEP1}	Sleep 32KHz crystal on (T=25°C, V _{DD} =3.0V)	–	0.9	–	uA
I _{SLEEP2}	Sleep 32KHz RO on (T=25°C, V _{DD} =3.0V)	–	2.1	–	mA
I _{DD1}	CPU, flash and RAM off (T=25°C, V _{DD} =3.0V)	–	2.3	–	mA
I _{RX1}	RX mode with DC-DC active (T=25°C, V _{DD} =3.0V)	–	7.7	–	mA
I _{TX1}	TX+8dBm mode with DC-DC active (T=25°C, V _{DD} =3.0V)	–	15.1	–	mA
I _{TX2}	TX+4dBm mode with DC-DC active (T=25°C, V _{DD} =3.0V)	–	10.9	–	mA
I _{TX3}	TX+2dBm mode with DC-DC active (T=25°C, V _{DD} =3.0V)	–	9.0	–	mA
I _{TX4}	TX-2dBm mode with DC-DC active (T=25°C, V _{DD} =3.0V)	–	8.3	–	mA
I _{TX5}	TX-14dBm mode with DC-DC active (T=25°C, V _{DD} =3.0V)	–	6.6	–	mA
I _{RX1-1}	RX mode without DC-DC active (T=25°C, V _{DD} =3.0V)	–	14.5	–	mA
I _{TX1-1}	TX+8dBm mode without DC-DC active (T=25°C, V _{DD} =3.0V)	–	28.8	–	mA
I _{TX2-1}	TX+4dBm mode without DC-DC active (T=25°C, V _{DD} =3.0V)	–	20.5	–	mA
I _{TX3-1}	TX+2dBm mode without DC-DC active (T=25°C, V _{DD} =3.0V)	–	17.2	–	mA
I _{TX4-1}	TX-2dBm mode without DC-DC active (T=25°C, V _{DD} =3.0V)	–	15.3	–	mA
I _{TX5-1}	TX-14dBm mode without DC-DC active (T=25°C, V _{DD} =3.0V)	–	12.0	–	mA

RF Performance Characteristics

Parameter	Description	Min	Typ	Max	Unit
RF _O	RF output power on ANT	-14	–	+8	dBm
F _R	Module frequency range	2400	–	2483.5	MHz
F _C	Channel spacing	–	2	–	MHz
RF _{Ch}	RF channel center	2402	–	2480	MHz
G _P	Peak gain	–	0.5	–	dBi
G _{Avg}	Average gain	–	-0.5	–	dBi
RL	Return loss	–	-10	–	dB

BLE Subsystem

Parameter	Description	Min	Typ	Max	Unit
RF Receiver Specification					
RXS	RX sensitivity with BER<0.1%	–	-88	–	dBm
CI1	Co-channel interface, Wanted signal at -67dBm, BER<0.1%	–	6	–	dBc
CI2	Adjacent channel interface, Wanted signal at -67dBm, BER<0.1% and Interferer at FRX±1MHz	–	0	–	dBc
CI3	Adjacent channel interface, Wanted signal at -67dBm, BER<0.1% and Interferer at FRX±2MHz	–	-40	–	dBc
CI4	Adjacent channel interface, Wanted signal at -67dBm, BER<0.1% and Interferer at FRX±3MHz	–	-47	–	dBc
CI5	Adjacent channel interface, Wanted signal at -67dBm, BER<0.1% and Interferer at ≥FRX±4MHz	–	-46	–	dBc
CI6	Adjacent channel interface, Wanted signal at -67dBm and Interferer at Image frequency (F _{IMAGE})	–	-16	–	dBc
CI7	Adjacent channel interface, Wanted signal at -67dBm and Interferer at Image frequency (F _{IMAGE} ±1MHz)	–	0	–	dBc
OBB1	Out-of-band blocking Wanted signal at -67dBm and Interferer at F=30–2000MHz	–	–	-30	dBm
OBB2	Out-of-band blocking Wanted signal at -67dBm and Interferer at F=2003–2399MHz	–	–	-35	dBm
OBB3	Out-of-band blocking Wanted signal at -67dBm and Interferer at F=2484–2997MHz	–	–	-35	dBm
OBB4	Out-of-band blocking Wanted signal at -67dBm and Interferer at F=3000–12750MHz	–	–	-30	dBm
IMD	Inter-modulation performance, Wanted signal at -64dBm and 1Mbps BLE, third, fourth, and fifth offset channel	–	-34	–	dBm

Parameter	Description	Min	Typ	Max	Unit
RF Transmitter Specification					
DR	Air data rate	–	1	–	Mbps
TXP, Range	RF power control range	-14	–	+8	dB
TXP, Range	RF power control range	-14	–	+8	dB
P _{RFC}	RF power accuracy	–	–	±2	kHz
P _{RF1}	1 st Adjacent channel transmit power 2MHz using BT of 100kHz	–	–	-20	dBm
P _{RF2}	2 nd Adjacent channel transmit power >3MHz using BT of 100kHz	–	–	-20	dBm
P _{SPUR}	Spurious emissions (average) using BT of 1MHz	–	–	-41	dBm
CF _{dev}	Center frequency deviation	-150	–	150	kHz
FTX, MAXDR	Maximum frequency drift	-50	–	50	kHz
FTX, INITDR	Initial frequency drift	-20	–	20	kHz
FTX, DR	Maximum drift rate	–	–	400	Hz/μs
General RF Specifications					
FREQ	RF operating frequency	2400	–	2482	MHz
CHBW	Channel spacing	–	2	–	MHz
DR	On-air data rate	–	1000	–	kbps

FCC Statement

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.

To assure continued compliance, any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment. (Example-use only shielded interface cables when connecting to computer or peripheral devices).

FCC Radiation Exposure Statement

This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body.

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 of the device.

End Product Labeling

This transmitter module is authorized only for use in device where the antenna may be installed such that 5mm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following:

Contains FCC ID: 2ALRL-MAB4F2

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 shown in this manual.

End Product Labeling

This transmitter module is authorized only for use in device where the antenna may be installed such that 5mm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following:

Contains IC ID: 22606-MAB4F2

Instructions to OEM Integrators

A User manual provided to the end user must indicate the operating requirements and conditions that must be observed to ensure compliance with the above-mentioned IC RF Exposure guideline. If this module is intended for use in a portable device, integrators are responsible for separate evaluation and/or approval to satisfy IC RF Exposure requirements.

The antenna used this module is as follows;

Antenna Type: PCB antenna

Antenna Gain: -0.5dBi

Canada, Industrie Canada (IC)

This device complies with Industry 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*

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

- (1) l'appareil ne doit pas produire de brouillage, et*
- (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.*

Caution: Exposure to Radio Frequency Radiation.

To comply with RSS 102 RF exposure compliance requirements, a separation distance of at least 20 cm must be maintained between the antenna of this device and all persons.

Pour se conformer aux exigences de conformité CNR 102 RF exposition, une distance de séparation d'au moins 20 cm doit être maintenue entre l'antenne de cet appareil et toutes les personnes