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RF Digital Corp.

is a subsidiary of HEPTAGON which is now

Member of the ams Group

The technical content of this RF Digital Corporation (a subsidiary of HEPTAGON) document is still valid.

For any information on Simblee products, please contact support@rfdigital.com

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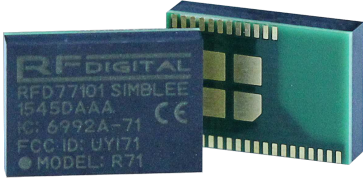
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e-Mail: ams_sales@ams.com

Please visit our website at www.ams.com



Only 7mm x 10mm

Simblee™ Bluetooth® Smart Module RFD77101

DATASHEET

Features

- Bluetooth® Smart Stack built-in
- Fully encapsulated and hermetically sealed
- Long range
- Simblee™ interference immunity
- 3ms latency
- 10us accuracy (jitter)
- Physical range adjustable from a few inches to hundreds of feet
- Build iPhone and Android apps without Xcode or the Android SDK
- Built-in AES encryption engine
- 7mm x 10mm x 2.2mm
- 29 GPIOs (flexible pin configuration)
- <4uA ULP with clock running (run for years on a coin cell)
- 600nA ULP Sleep mode
- 8mA TX @ 0dBm, 12mA TX @ +4dBm
- 10mA RX
- -93dBm receiver sensitivity
- -55dBm to +4dBm TX power
- ARM® Cortex M0 processor
- Flash code space available for user application (no need for external controller)
- 6x ADC inputs, 4x PWM outputs, 2x SPI master/slave, 2x I2C, 1 x UART
- Temperature sensor
- Battery/Supply voltage monitoring
- On-chip UART bootloader
- OTA programming (optional)
- Operating Voltage: 1.8 – 3.6V
- Integrated 16 MHz crystal and 32KHz precision crystal
- Integrated antenna
- Integrated shield
- CE, ETSI, IC, FCC Approved
- Easy to pick and place
- Patents Pending

1. Overview of the Simblee[™] RFD77101

1.1 Introduction

The Simblee RFD77101 is a high performance, professional grade Bluetooth® Smart radio transceiver with a built-in ARM® Cortex M0 microcontroller that can be programmed using the simple-to-use Arduino IDE using Simblee extensions. Simblee is IoT for connecting Everyone and Everything (IoT4EE).

It incorporates Mobile, Bluetooth® Smart, Mesh, Cloud and other forms of wireless connectivity.

Simblee is high-quality, cutting-edge and performance focused.

Using the Simblee mobile browser on a phone or tablet, anyone can interact with Simblee enabled devices instantly without needing to download additional apps for each device.

In just hours you can create functional IoT applications using the Simblee development environment.

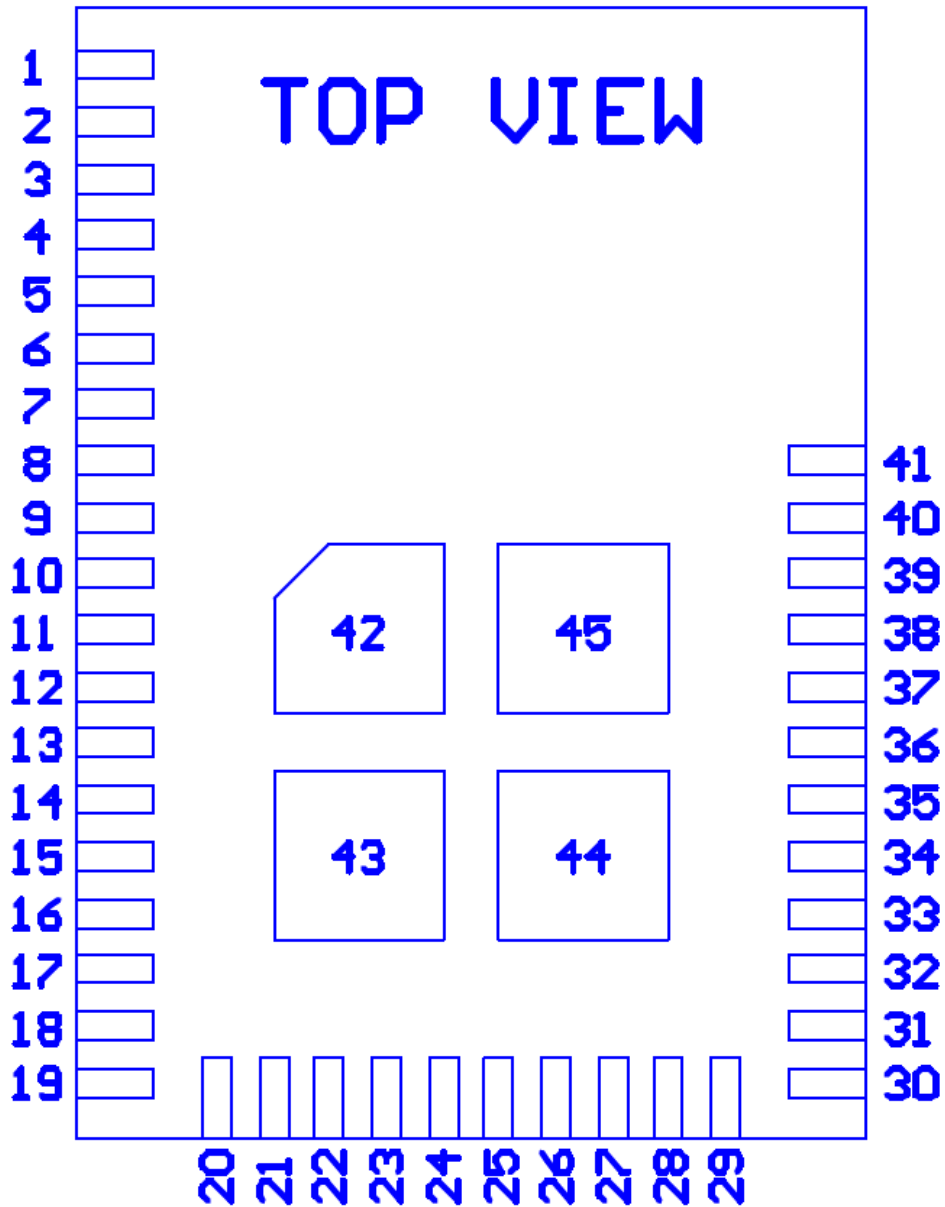
Developers can start developing mobile apps without having to first learn Xcode or Android SDKs.

1.2 Basic Operation

Simblee is programmed using the Arduino IDE. Code is loaded using the on-chip UART bootloader or via OTA (over the air) programming.

2. Pinout

2.1 45-pin LGA 0.5mm pitch

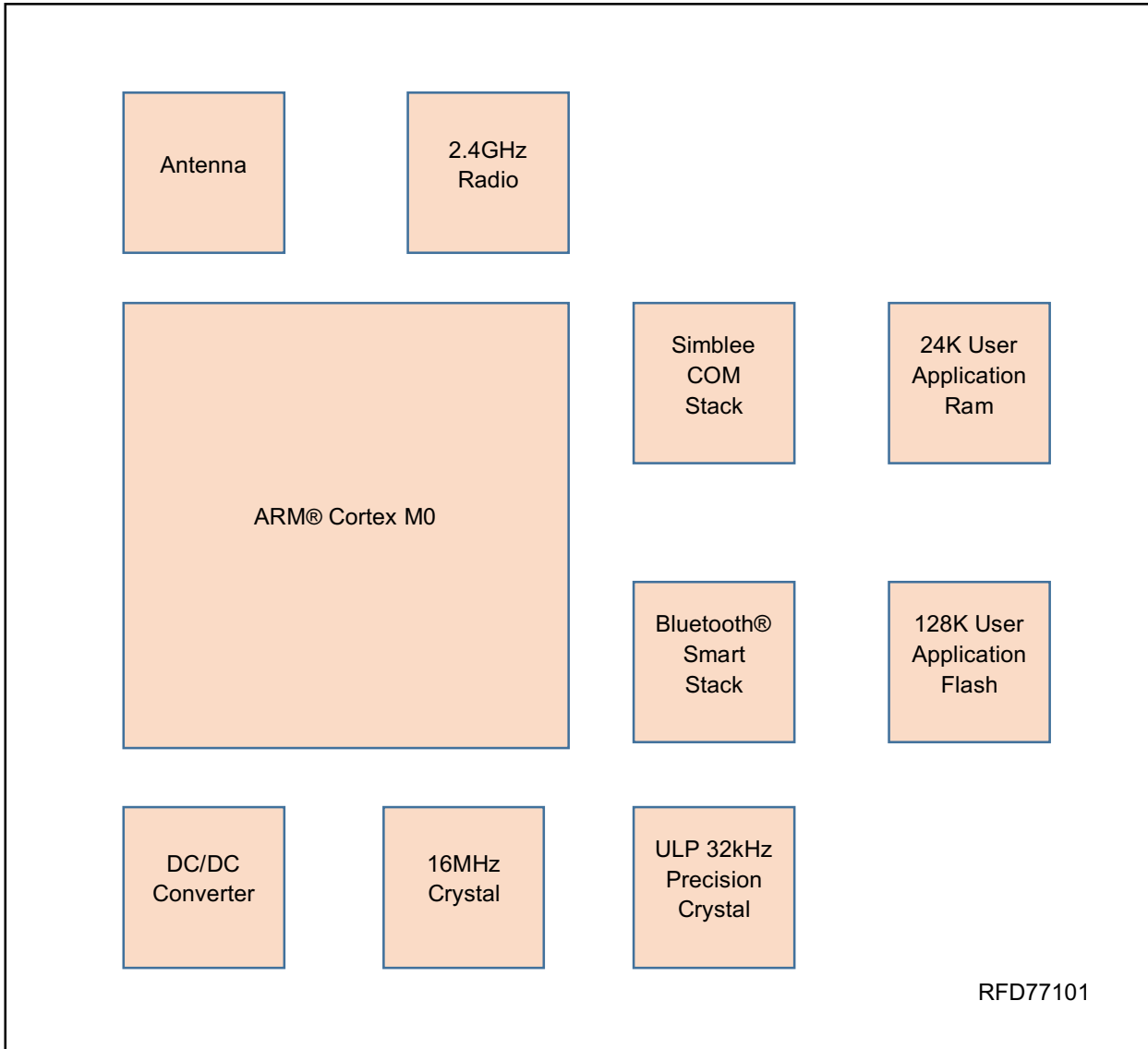


2.2 Pin Descriptions

Name	Pin	Type	Signal	Comments
1	GND	P	Supply ground	
2	GND	P	Supply ground	
3	DNC	X	DO NOT CONNECT	
4	GND	P	Supply ground	
5	DNC	X	DO NOT CONNECT	
6	GND	P	Supply ground	
7	VDD	P	1.8 – 3.6V Supply	
8	RST/SWDIO	I/O	Reset / SWDIO	
9	FACT/SWDCLK	I	Factory / SWDCLK	
10	DNC	X	DO NOT CONNECT	
11	P0.19	I/O	GPIO 19	
12	P0.17	I/O	GPIO 17	
13	P0.18	I/O	GPIO 18	
14	P0.16	I/O	GPIO 16	
15	P0.15	I/O	GPIO 15	
16	P0.12	I/O	GPIO 12	
17	P0.11	I/O	GPIO 11	
18	P0.09	I/O	GPIO 9	
19	GND	P	Supply ground	
20	P0.08	I/O	GPIO 8	
21	P0.05	I/O	GPIO 5 / ANALOG 6	
22	P0.03	I/O	GPIO 3 / ANALOG 4	
23	P0.01	I/O	GPIO 1 / ANALOG 2	
24	P0.02	I/O	GPIO 2 / ANALOG 3	
25	P0.00	I/O	GPIO 0 / AREF 0	
26	P0.07	I/O	GPIO 7	
27	P0.10	I/O	GPIO 10	
28	P0.13	I/O	GPIO 13	
29	P0.14	I/O	GPIO 14	
30	GND	P	Supply ground	
31	P0.06	I/O	GPIO 6 / AREF 1 / ANALOG 7	
32	P0.04	I/O	GPIO 4 / ANALOG 5	
33	P0.20	I/O	GPIO 20	
34	P0.23	I/O	GPIO 23	
35	P0.24	I/O	GPIO 24	
36	P0.21	I/O	GPIO 21	
37	P0.22	I/O	GPIO 22	
38	P0.25	I/O	GPIO 25	
39	P0.28	I/O	GPIO 28	
40	P0.29	I/O	GPIO 29	
41	P0.30	I/O	GPIO 30	
42	GND	P	Supply ground	
43	GND	P	Supply ground	
44	GND	P	Supply ground	
45	GND	P	Supply ground	

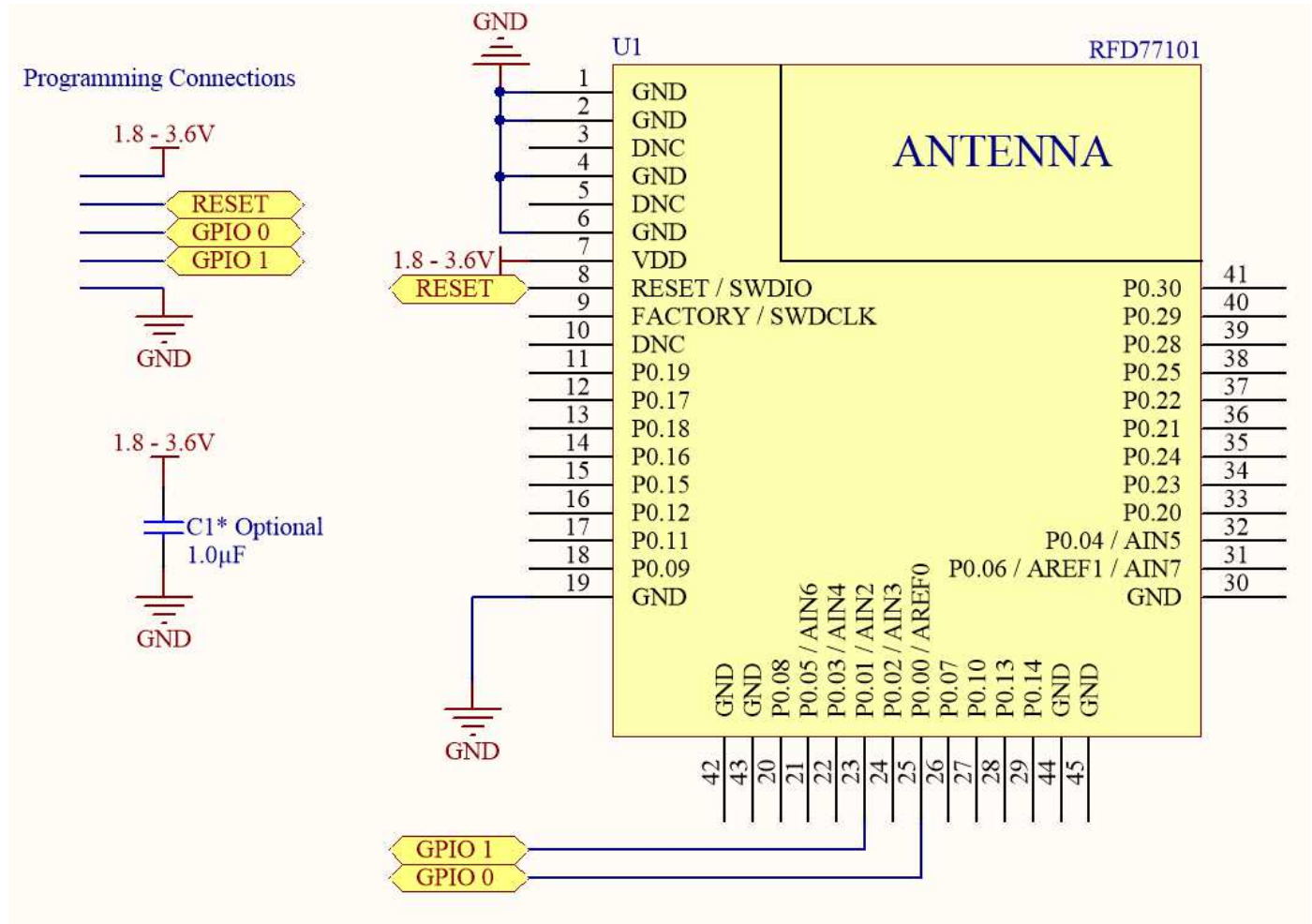
I Input only O Output only, push-pull I/O Input/output
X DO NOT CONNECT P Ground or power

3. Block Diagram



4. Example Circuit Diagrams

4.1 Basic Circuit with programming interface



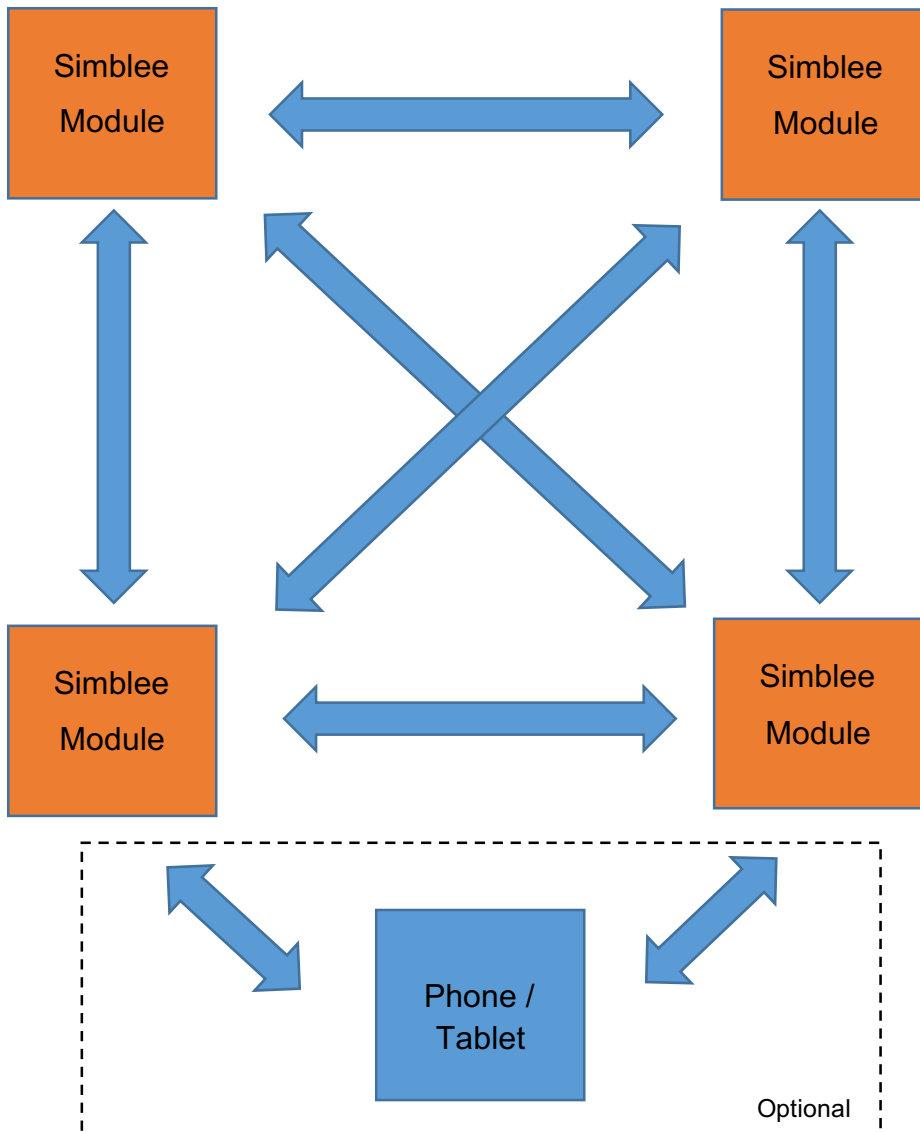
Note: A bypass capacitor C1 is recommended and should be placed close to pin 7.

5. Modes of Use

Bluetooth Low Energy bi-directional communication with smart phone or tablet



Simblee COM ad-hoc bi-directional communication between any number of devices



6. Specifications

6.1 Absolute Maximum Specifications

V_{DD} **0 to +3.7 V**

Max continuous pin current, any control or drive pin	±5 mA
I/O Voltage	-0.3V to VDD + 0.3
ESD Human Body Model	4 kV
ESD Charged Device Model	500 V

CAUTION: Maximum ratings are the extreme limits the chip can be exposed to without causing permanent damage. Exposure to absolute maximum ratings for prolonged periods of time may affect the reliability of the chip.

6.2 Recommended Operating Conditions

V_{DD} **+1.8 to 3.6 V**

Operating temperature	-40°C to +85°C
Power supply rise time (0V to VDD)	100ms maximum

6.3 Radio Specifications

Parameter	Description	Min	Typ	Max	Units	Notes
F _{OP}	Operating Frequency	2400		2481	MHz	1 MHz channel spacing
BPS _{Fsk}	On-Air data rate	250		2000	kbps	
T _{Xpower}	TX Power	-55		+4	dBm	
T _{XIDC+4dBm}	TX Current at +4dBm w/ DC/DC		12		mA	
T _{XI+4dBm}	TX Current at +4dBm w/o DC/DC		16		mA	
R _{XIDC}	RX Current w/ DC/DC		10		mA	
R _{XI}	RX Current w/o DC/DC		13		mA	
R _{Xs250}	Receiver sensitivity at 250kbps		-96		dBm	
R _{Xs1000}	Receiver sensitivity at 1000kbps		-90		dBm	
R _{Xs2000}	Receiver sensitivity at 2000kbps		-85		dBm	
R _{XsBLE}	Receiver sensitivity at BLE		-93		dBm	

6.4 Simblee COM Specifications

Parameter	Description	Min	Typ	Max	Units	Notes
RF_{T1}	End-to-end latency high speed		3		ms	
RF_{T2}	End-to-end latency long range		12		ms	
RF_J	Jitter / Accuracy		10		us	

6.5 GPIO Specifications

Parameter	Description	Min	Typ	Max	Units	Notes
V_{IH}	Input high voltage	0.7VDD		VDD	V	
V_{IL}	Input low voltage	VSS		0.3VDD	V	
GPIO_{IHD}	GPIO high drive sink/source		5		mA	3 pins max
GPIO_{ISD}	GPIO standard drive sink/source		0.5		mA	
R_{PU}	Internal pull-up resistance	11	13	16	kΩ	
R_{PD}	Internal pull-down resistance	11	13	16	kΩ	

6.6 ADC Specifications

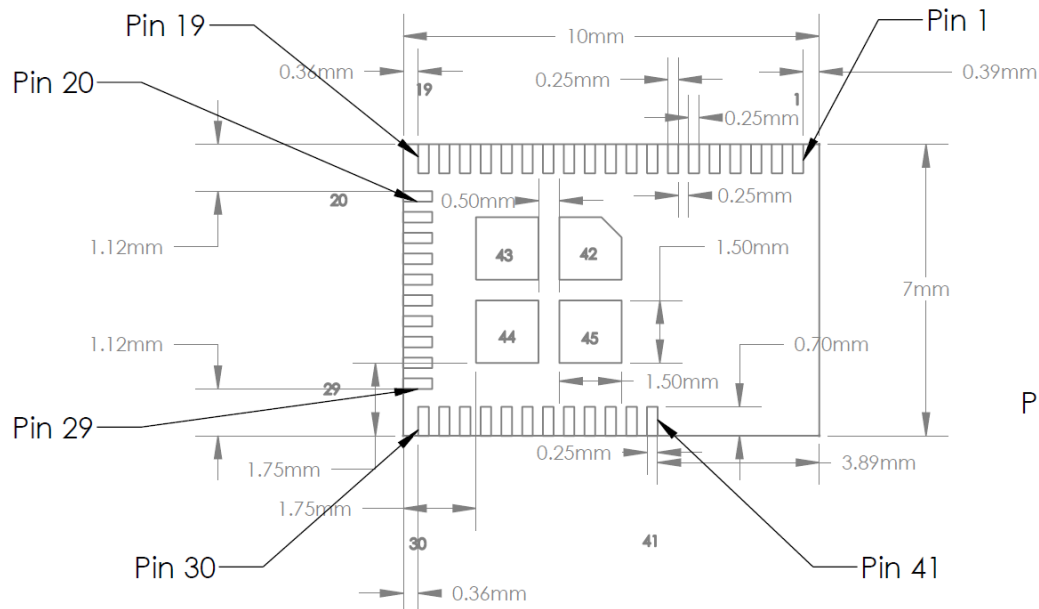
Parameter	Description	Min	Typ	Max	Units	Notes
ADC_{enob}	ADC bits		10		bit	
ADC_{ose}	Offset error	-2		+2	%	
ADC_{ge}	Gain error	-2		+2	%	
ADC_{ref}	Internal Band Gap reference error	-1.5		+1.5	%	1.2V Band Gap voltage
ADC_{rev_ext}	External reference voltage	0.83	1.2	1.3	V	
ADC_{t10}	Conversion time for 1 sample		68		us	10bit sample
ADC impedance	Prescaling 1/1 Prescaling 2/3 Prescaling 1/3		129.7 194.6 389.2		kohm kohm kohm	Deviation 2.74k Deviation 4.1k Deviation 8.2k

6.7 I2C, SPI and UART Specifications

Parameter	Description	Min	Typ	Max	Units	Notes
I2C_{rate}	I2C bit rate	100		400	kbps	
SPI_{rate}	SPI master bit rate	0.125		4	Mbps	
SPI_{Srate}	SPI slave bit rate	0.125		2	Mbps	
UART_{rate}	UART bit rate	1.2		1000	kbps	

7. Mechanical Specifications

7.1 Physical Dimension

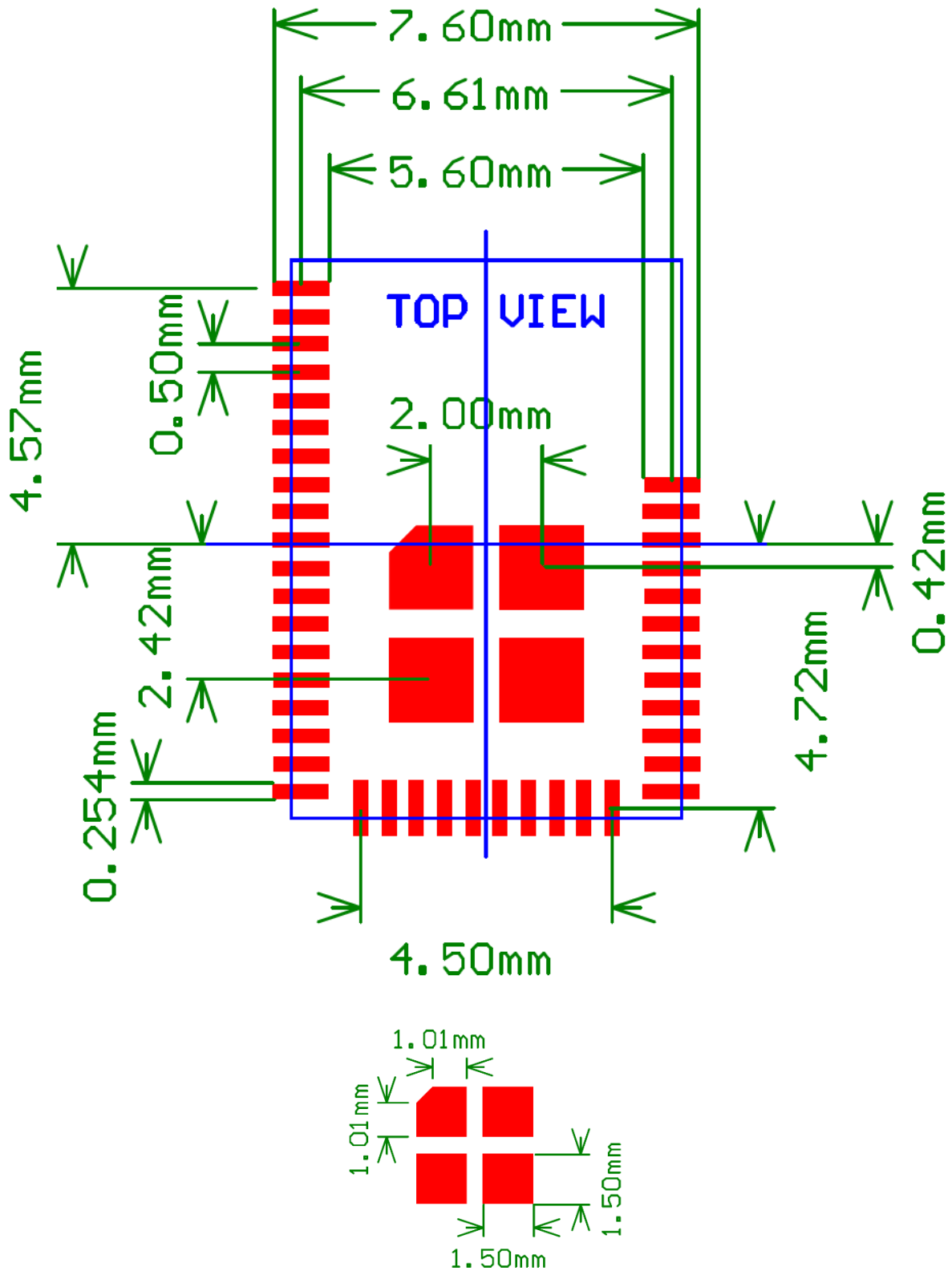


TOP VIEW

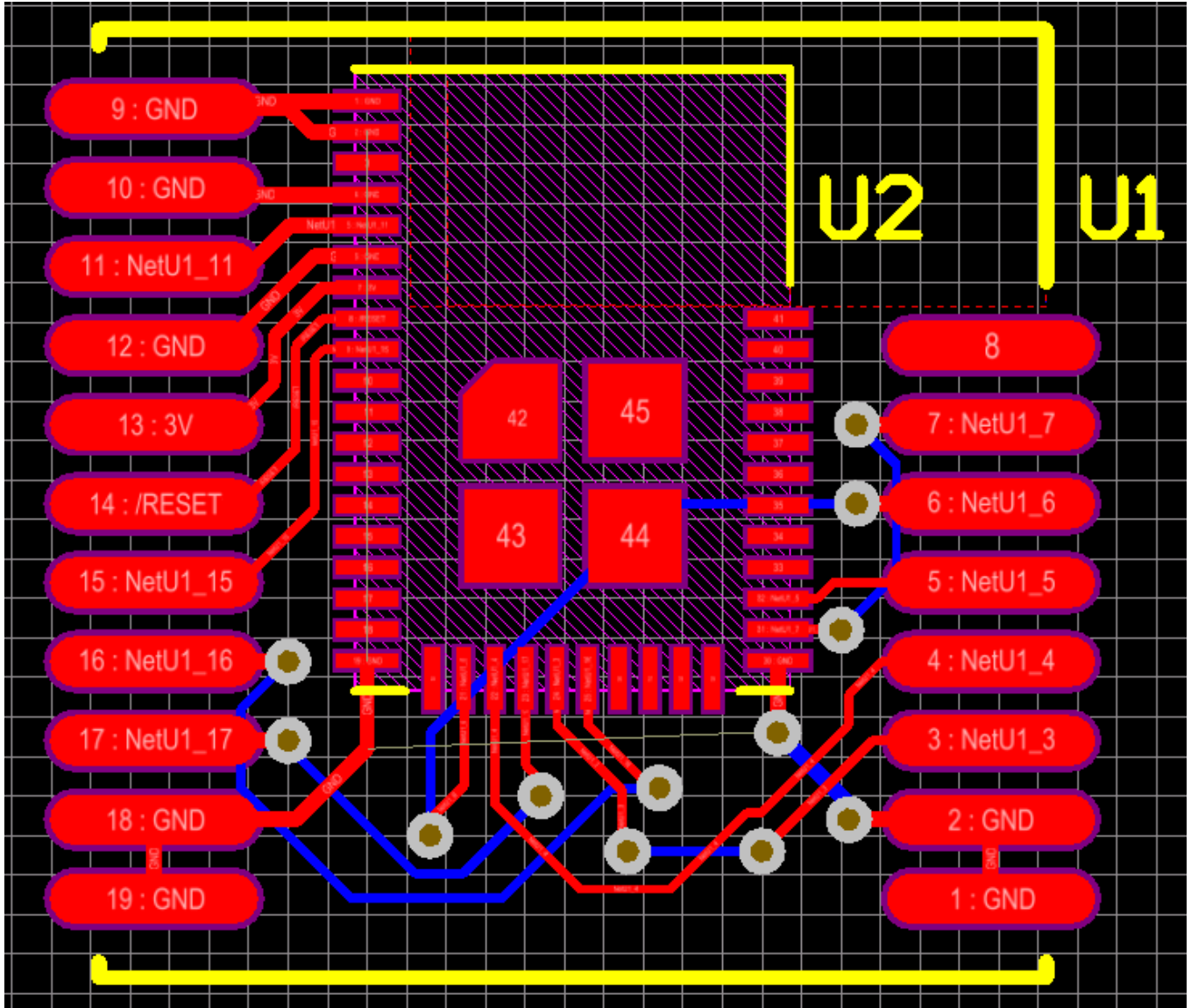
All dimension in mm

Package height - 2.2 mm

7.2 PCB Land Pattern

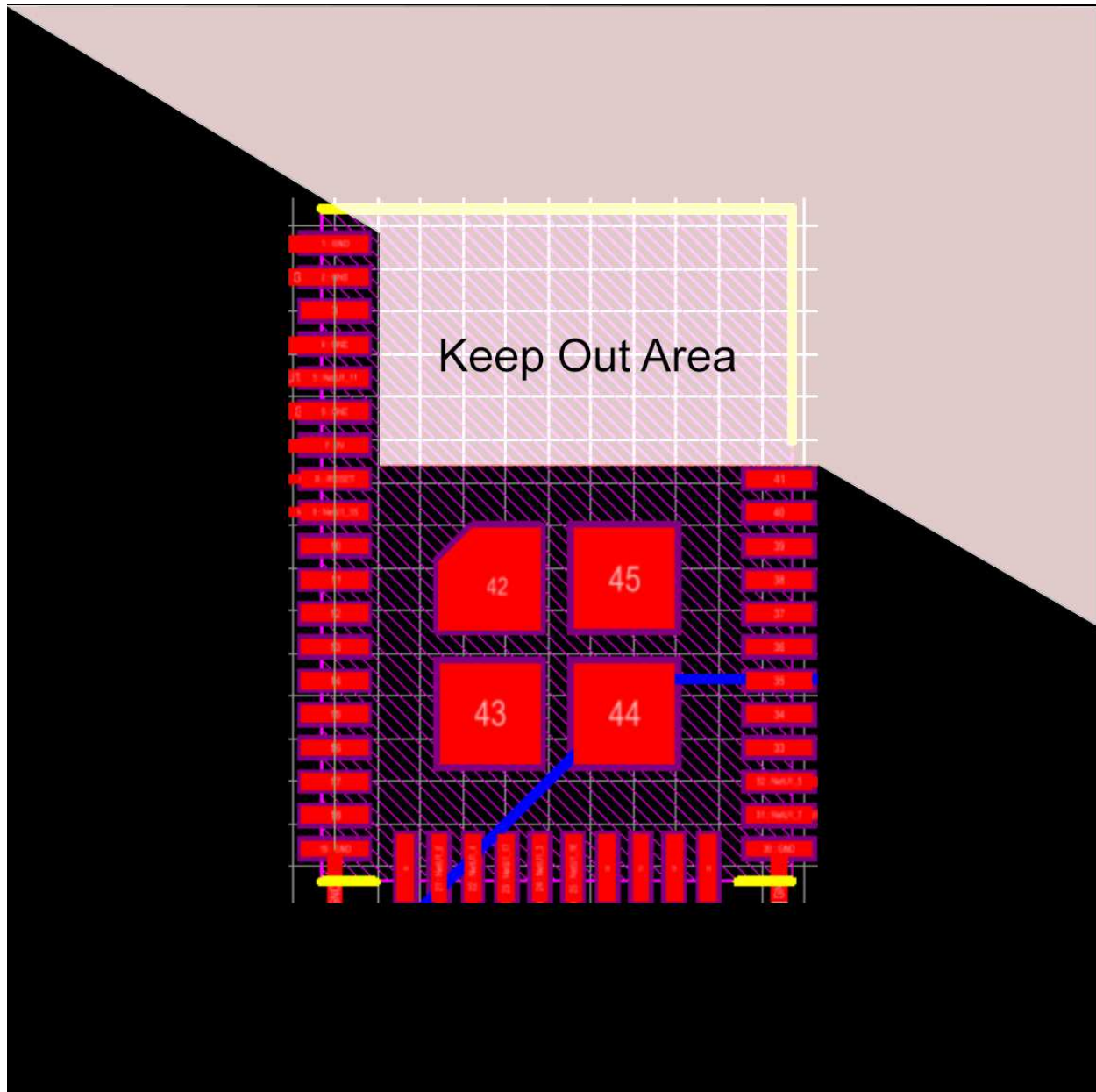


7.3 For RFduino users, Simblee / RFduino dual footprint



7.4 RFD77101 Keep Out Area - Example

It is highly recommended that you locate the module in the corner of the enclosure / PCB so it will be as far away from your other components on the PCB and as close to free airspace as possible. The gray area shows where to keep free from copper and components. In addition, you want to locate the module in a position in your product where it will have as much free airspace as possible near the antenna when in use. For example, if it will be placed against a wall, it is preferred to locate the module so it will be in a location in your product where it will be on the side of the product where it will be further away from the wall, rather than directly next to it, so the RF signal can have as much free airspace to give you the best range performance possible. (Note: If you plan on using a metal enclosure, you cannot locate the module inside of the enclosure or it will have very limited range.)



8. Miscellaneous

8.1 Ordering information

Part Number	Description
RFD77101	Simblee Radio Module

8.2 Assembly information

MSL Rating	Peak Body Temperature	Specifications
6	260°C	IPC/JEDEC J-STD-020

8.3 Associated Documents

For additional information, visit www.simblee.com

8.4 Certifications

Certification	Date	Status
IC	08.14.2015	Approved
FCC	09.29.2015	Approved
CE: RED (2014/53/EU)	08.17.2017	Approved
TELEC/MIC	11.01.2016	Approved
RoHS Directive 2011/65/EU Annex II	07.18.2016	Approved
Halogen Free	07.18.2016	Approved

8.5 Export Compliance

The RFD77101 Module can be exported as ECCN 5A991.b and the mobile browser as ECCN 5D992.c. They can both be exported or reexported No License Required to all countries other than Cuba, Iran, North Korea, Sudan, Syria, and the Crimea Region of the Ukraine. They should not be exported or reexported to any prohibited end-users.

Industry Canada Information

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.

IC LABEL Relating to Model Number R71 (RFD Part Number: RFD77101) The unit should have a permanently attached label in a conspicuous location with the following statement:

Contains IC:6992A-71

NOTES: 1. Industry Canada does not specify the size of the label or the lettering thereon. The only requirement is that the text be legible.

FCC NOTICE

Relating to Model Number R71 (RFD Part Number: RFD77101)

INSTRUCTION TO THE USER (if device DOES NOT contain a digital device) The user is cautioned that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

INSTRUCTION TO THE USER (if device contains a digital device) 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. In order to maintain compliance with FCC regulations, shielded cables must be used with this equipment. Operation with non-approved equipment or unshielded cables is likely to result in interference to radio and TV reception. The user is cautioned that changes and modifications made to the equipment without the approval of manufacturer could void the user's authority to operate this equipment.

FCC LABEL Relating to Model Number R71 (RFD Part Number: RFD77101)

The unit should have a permanently attached label in a conspicuous location with the following statement:

Contains FCC ID: UYI71

- (1) This device may not cause harmful interference and
- (2) This device must accept any interference received, including interference that may cause undesired operation.

NOTES: 1. The FCC does not specify the size of the label or the lettering thereon. The only requirement is that the text be legible. 2. If the entire label can not be placed on the unit due to space constraint, only FCC ID may be displayed on the unit. In such cases, the compliance statement will have to be included in the "user's manual". NOTE: Device must be smaller than a man's palm. ** If the unit also interfaces with phone line, it requires additional information on the label - refer to part 68 information **

Important: To comply with FCC RF exposure requirements, this device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

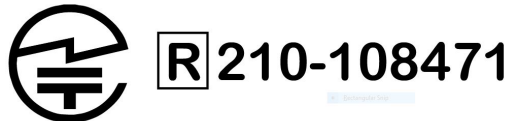
Japan (MIC) Compliance

The RFD77101 received type certification and is labeled with its own technical conformity mark and certification number as required to conform to the technical standards regulated by the Ministry of Internal Affairs and Communications (MIC) of Japan pursuant to the Radio Act of Japan. Integration of this module into a final end product does not require additional radio certification provided installation instructions are followed and no modifications of the module are allowed. Additional testing may be required:

- If the host product is subject to electrical appliance safety (for example, powered from an AC mains), the host product may require Product Safety Electrical Appliance and Material (PSE) testing. The integrator should contact their conformance laboratory to determine if this testing is required.
- There is a voluntary Electromagnetic Compatibility (EMC) test for the host product administered by VCCI:
http://www.vcci.jp/vcci_e/index.html

The label on the final end product which contains the RFD77101 module must follow the MIC marking requirements. Labeling requirements for Japan available at the Ministry of Internal Affairs and Communications (MIC) website:
<http://www.tele.soumu.go.jp/e/index.htm>.

The RFD77101 module is labeled with its assigned technical conformity mark and certification number. The final end product in which this module is being used must have an external label referring to the type certified module inside:



CE (RED) Compliance

RF Digital declares that part number

- RFD77101

complies with

ETSI EN 301 328 v2.1.1

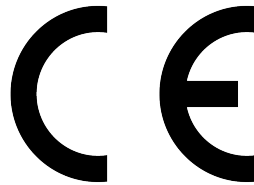
EN 301 489-1 v2.20,

EN 301 489-17 v3.20,

EN 60950-1: 2006

as called out in the RED (2014/53/EU) Directive

RF Digital
RFD77101



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Hermosa Beach, CA 90254
United States

Function	Frequency	Maximum Output Power (EIRP)
Bluetooth	2402 – 2480 MHz	4 dBm

Technical documents for the above mentioned part numbers are held at

RF Digital Corporation
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Hermosa Beach, CA 90254

8.5 Revision History

Revision No.	Date	Notes
2.2	12.07.2017	Compliance, MSL info
2.1	08.17.2017	Compliance info
2.0	03.13.2017	General Updates
1.2	11.01.2016	Compliance info
1.1	07.01.2016	ESD specs
1.0	11.07.2015	Layout Revisions
0.2	09.09.2015	Compliance info
0.11	07.22.2015	Grammatical correction
0.1	03.27.2015	Initial release

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with detailed project information
to: support@rfdigital.com

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Limited Product Warranty

RF Digital warrants that RF Devices manufactured by RF Digital are free from defects in material and workmanship, for Ninety (90) Days from date of delivery. RF Devices covered by this warranty and returned to RF Digital within the Ninety Day Warranty Period will be eligible for replacement, repair, or credit, limited to the amount RF Digital was paid for the RF Device. To obtain a remedy under this Warranty, the following conditions must be met: (1) Customer must notify RF Digital in writing promptly on discovery of the deficiency with reasonable detail within the Warranty Period; (2) Customer must return the RF Devices to RF Digital promptly upon receipt of an RMA from RF Digital, at Customer's risk and expense; and (3) RF Digital confirms the claimed deficiency is present. If all of these conditions are met, RF Digital, at its sole option, will either replace or repair the RF Device or credit Customer's account for the amount the Customer paid to RF Digital for the RF Device.