

BR-RFX100

User Manual

DESCRIPTION

The BR-RFX100 is an ultralow power, high performance Sub-1GHz IEEE 802.15.4 radio frequency transceiver and microcontroller with on board sensory devices. The BR-RFX100 utilizes an ultralow power Sub-1-GHz Wireless MCU with very low active RF, MCU current, and low-power mode current consumption. The wireless MCU device combines a flexible, very low power RF transceiver with a powerful 48-MHz Cortex-M3 microcontroller in a platform supporting multiple physical layers and RF standard. A dedicated Radio Controller (Cortex-M0) handles low level RF protocol commands that are stored in ROM or RAM. The BR-RFX100 has the capability to either use the PCB trace antenna or an external dipole antenna using the U.FL connector and cable.

FEATURES

- Microcontroller
 - Powerful ARM Cortex-M3 with 48-MHz Clock Speed
 - 128-KB of In-System Programming flash
 - 8-KB of SRAM for Cache
 - Supports Over-the-Air Upgrade
- Peripherals
 - 8 GPIO
 - UART
 - SPI
- RF Section
 - Sub-1GHz IEEE 802.15.4 Complaint RF Transceiver
 - +14 dBm Output Power
 - Long Range
 - PCB Trace Antenna
 - U.FL Connector for External Dipole Antenna
- Several sensory devices

SPECIFICATIONS

Absolute Maximum Ratings

Over operating free-air temperature range (unless otherwise noted)⁽¹⁾⁽²⁾

Rating	Min	Max	Unit
Power supply voltage	0	4.1	V _{DC}
Voltage on any digital pin	-0.3	VBATT + 0.3, max 4.1	V _{DC}
RF input Power		+10	dBm
Storage temperature range	-40	150	°C

(1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions* is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

(2) All voltage values are within respect to VBATT, unless otherwise noted.

ESD Ratings

Rating		Pins	Value	Unit
V _{ESD} Electrostatic discharge	Human body model per ANSI/ESDA/JEDEC JS001	DP1-DP9	+15000	V _{DC}
		All other	+3500	V _{DC}
	Charged device model, per JESD22-C101	DP1-DP9	+12000	V _{DC}
		All others	+1250	V _{DC}

Recommended Operating Conditions

Characteristics	Min	Max	Unit
Ambient temperature	-40	+85	°C
Operating supply voltage	1.8	3.8	V
RF frequency range	902	928	MHz
RF output power		+14	dBm

PIN DESCRIPTIONS

Input Power Interface (J2/J5)

PIN	PIN NAME	PIN TYPE	DESCRIPTION
1	VBATT	Power	Input power (3.3V typical)
2	GND	Power	Ground

Peripheral Interface (J3)

PIN	PIN NAME	PIN TYPE	DESCRIPTION
1	DP6	Digital/Analog I/O	GPIO, Analog
2	V_SWITCH	Power	3.3V typical power
3	UART_RX	Digital I/O	GPIO
4	nRESET	Digital Input	Reset, active low
5	UART_TX	Digital I/O	GPIO
6	DP1	Digital/Analog I/O	GPIO, Analog
7	SPI_MISO	Digital I/O	GPIO
8	GND	Power	Ground
9	SPI_MOSI	Digital I/O	GPIO
10	DP2	Digital/Analog I/O	GPIO, Analog
11	SPI_CLK	Digital I/O	GPIO
12	DP3	Digital/Analog I/O	GPIO, Analog
13	SPI_CS	Digital I/O	GPIO
14	GND		Ground
15	DP8/TDO	Digital I/O	GPIO
16	DP4	Digital/Analog I/O	GPIO, Analog
17	DP9/TDI	Digital I/O	GPIO
18	DP5	Digital/Analog I/O	GPIO, Analog
19	DP7	Digital/Analog I/O	GPIO, Analog
20	VBATT	Power	3.3V typical power

ANTENNA

The BR-RFX100 has a Helical PCB trace antenna, but can also be populated with an optional U.FL connector to for an external dipole antenna. The antenna selection is performed with installing a resistor on the board; therefore, only one antenna can operate at a time. The regulatory testing has been completed with PCB trace antenna, as well as an external antenna with cable. Antennas and cable information is a below.

Helical PCB Antenna:

- Type: Helical PCB Antenna
- Manufacturer: Texas Instruments
- Model: DN038
- Gain: 2.33dBi

Dipole Antenna:

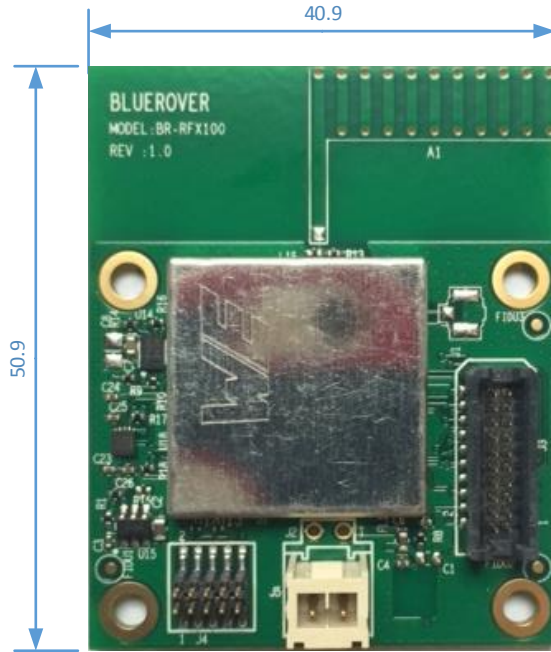
- Manufacturer: Pulse Electronics
- Part Number: W1063
- Gain: 3dBi

U.FL to RP-SMA Cable:

- Manufacturer: Samtec
- Part Number: MH113-MH1RP-01BJ2-0150

DIMENSIONS

All dimensions are in millimeters, unless otherwise no



FIRMWARE

The BR-RFX100 is pre-programmed with either frequency hopping spread spectrum (FHSS) firmware for transmission data rate of 50 kbps or Digital Transmission System (DTS) firmware for data rate of 250kbps. The Firmware Version Identification Number (FVIN) for FHSS and DTS is BH-PH and BR-PH2, respectively.

NOTICE

You are cautioned that changes or modifications not expressly approved by the party responsible for the compliance could void the user's authority to operate this 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 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.

This radio transmitter (IC: 21230-X100) has been approved by *Industry Canada* to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Pulse Electronics, 3 dBi Dipole Antenna, Model W1063,
Texas Instruments, 2.33dBi Helical PCB Antenna, Model DN038

This device complies with Industry Canada's licence-exempt RSSs. 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.

RF Exposure Information

Standalone

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

FCC Co-Location

The maximum calculated MPE ratio for the EUT with 3 dBi dipole antenna is 0.017, this configuration can be co-located with other antennas provided the sum of the MPE ratios for all the other simultaneous transmitting antennas incorporated in a host device is $\leq 1.0 - 0.017 \leq 0.983$

IC Co-Location

The maximum calculated MPE ratio at 20 cm distance for BR-RFX100 with 3 dBi dipole antenna is 0.036, this configuration can be co-located with other antennas provided the sum of the MPE ratios for all the other simultaneous transmitting antennas incorporated in a host device is $\leq 1.0 - 0.036 \leq 0.964$.

Labelling Requirements for the Host device

The host device shall be properly labelled to identify the modules within the host device. The certification label of the module shall be clearly visible at all times when installed in the host device, otherwise the host device must be labelled to display the FCC ID and IC of the module, preceded by the words "Contains transmitter module", or the word "Contains", or similar wording expressing the same meaning, as follows:

Contains FCC ID: 2AHHP-X100

Contains IC: 21230-X100

Integrator Responsibility to comply with FCC and Industry Canada Regulations

The BR-RFX100 has been certified for integration into products only by integrators under the following conditions:

1. The antenna(s) must be installed such that a minimum separation distance of 20cm is maintained between the radiator (antenna) and all persons at all times.
2. The transmitter module can be co-located with other antenna or operating in conjunction with other antenna or transmitter as long it is in compliance with the co-location requirement listed in the FCC co-location and IC co-location section above.

As long as the two conditions above are met, further transmitter testing will not be required. However, the 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.).

In the event that these conditions cannot be met (for certain configurations or co-location with another transmitter), then the FCC and Industry Canada authorizations are no longer considered valid and the FCC ID and IC certification Number cannot be used on the final product. In these circumstances, the integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC and Industry Canada authorization.