RFM97C

RFM97C is an ultra-low-power, high-performance LoRa transceiver for various frequency of 902-928 MHz wireless applications. It is part of the SEMTECH RF product line, which includes complete transmitters, receivers and transceivers. The high integration of RFM97C simplifies the peripheral materials needed in the system design. The sensitivity up to - 138 dBm which can optimize the link performance of applications.In addition, RFM97C also supports Duty-Cycle operation mode, channel intercepti on, high-precision RSSI, power-on reset, noise output and other more functions, which makes the application design more flexible thus to achieve product differentiation design. The working voltage of RFM97C is 1.8V~3.7V. When the sensitivity is reaching -138 dBm, it only consumes 9.9 mA current. This ultra-low power mode can further reduce the power consumption of the chip.

Features

- Frequency Range: 903.0MHz~927.5MHz For DTS
  902.3 MHz~914.9MHz For DSS
- Modulation: LoRa
- Voltage Range: 1.8~3.7 V
- Receiving Current: 12.5 mA
- Supports Ultra Low Power Receiving Mode
- 4-wire SPI Interface
- Supports Full-automatic Independent Working Mode

APPLICATIONS

- Automated Meter Reading.
- Home and Building Automation.
- Wireless Alarm and Security Systems.
- Industrial Monitoring and Control
- Long range Irrigation Systems

Applications

Crystal Resonator Specification

Table 43 shows the crystal resonator specification for the crystal reference oscillator circuit of the RFM97C(W). This specification covers the full range of operation of the RFM97C(W) and is employed in the reference design.

Symbol	Description	Conditions	Min	Typ	Max	Unit
FXOSC	XTAL Frequency		-	32	-	MHz
RS	XTAL Serial Resistance		-	30	TBC	ohms
C0	XTAL Shunt Capacitance		-	2.8	TBC	pF
CFOOT	External Foot Capacitance	On each pin XTA and XTB	8	15	22	pF
CLOAD						

Notes - the initial frequency tolerance, temperature stability and ageing performance should be chosen in accordance with the target operating temperature range and the receiver bandwidth selected.

- the loading capacitance should be applied externally, and adapted to the actual Cload specification of the XTAL.

Receiver Restart Methods

The options for restart of the receiver are covered below. This is typically of use to prepare for the reception of a new signal whose strength or carrier frequency is different from the preceding packet to allow the AGC or AFC to be re-evaluated.

Restart Upon User Request

In Receive mode the user can request a receiver restart - this can be useful in conjunction with the use of a Timeout interrupt following a period of inactivity in the channel of interest. Two options are available:

- No change in the Local Oscillator upon restart: the AFC is disabled, and the *Frf* register has not been changed through SPI before the restart instruction: set bit *RestartRxWithoutPllLock* in *RegRxConfig* to 1.
- Local Oscillator change upon restart: if AFC is enabled (*AfcAutoOn*=1), and/or the *Frf* register had been changed during the last Rx period: set bit *RestartRxWithPllLock* in *RegRxConfig* to 1.

Note ModeReady must be at logic level 1 for a new RestartRx command to be taken into account.

Automatic Restart after valid Packet Reception

The bits *AutoRestartRxMode* in *RegSyncConfig* control the automatic restart feature of the RFM97C(W) receiver, when a valid packet has been received:

- If *AutoRestartRxMode* = 00, the function is off, and the user should manually restart the receiver upon valid packet reception
- If *AutoRestartRxMode* = 01, after the user has emptied the FIFO following a *PayloadReady* interrupt, the receiver will automatically restart itself after a delay of *InterPacketRxDelay*, allowing for the distant transmitter to ramp down, hence avoiding a false RSSI detection on the 'tail' of the previous packet.
- If *AutoRestartRxMode* = 10 should be used if the next reception is expected on a new frequency, i.e. *Frf* is changed after the reception of the previous packet. An additional delay is systematically added, in order for the PLL to lock at a new frequency.

Pin Description

Table 2 Pin Description

Number	Name	Type	Description Description Stand Alone Mode
1	ANA	-	RF signal output/input.
2	GND	-	Ground
3	NSS	I	SPI Chip select input
4	MOSI	I	SPI Data input
5	MISO	O	SPI Data output
6	SCK	I	SPI Clock input
7	RESET	I/O	Reset trigger input
8	DIO5	I/O	Digital I/O, software configured
9	DIO4	I/O	Digital I/O, software configured
10	DIO3	I/O	Digital I/O, software configured
11	DIO2	I/O	Digital I/O, software configured
12	DIO1	I/O	Digital I/O, software configured
13	DIO0	I/O	Digital I/O, software configured
14	3.3V	-	Supply voltage
15	GND	-	Ground
16	GND	-	Ground

Electrical Characteristics

ESD Notice

The RFM97C(W) is a high performance radio frequency device. It satisfies:

- Class 2 of the JEDEC standard JESD22-A114-B (Human Body Model) on all pins.
- Class III of the JEDEC standard JESD22-C101C (Charged Device Model) on all pins

It should thus be handled with all the necessary ESD precautions to avoid any permanent damage.

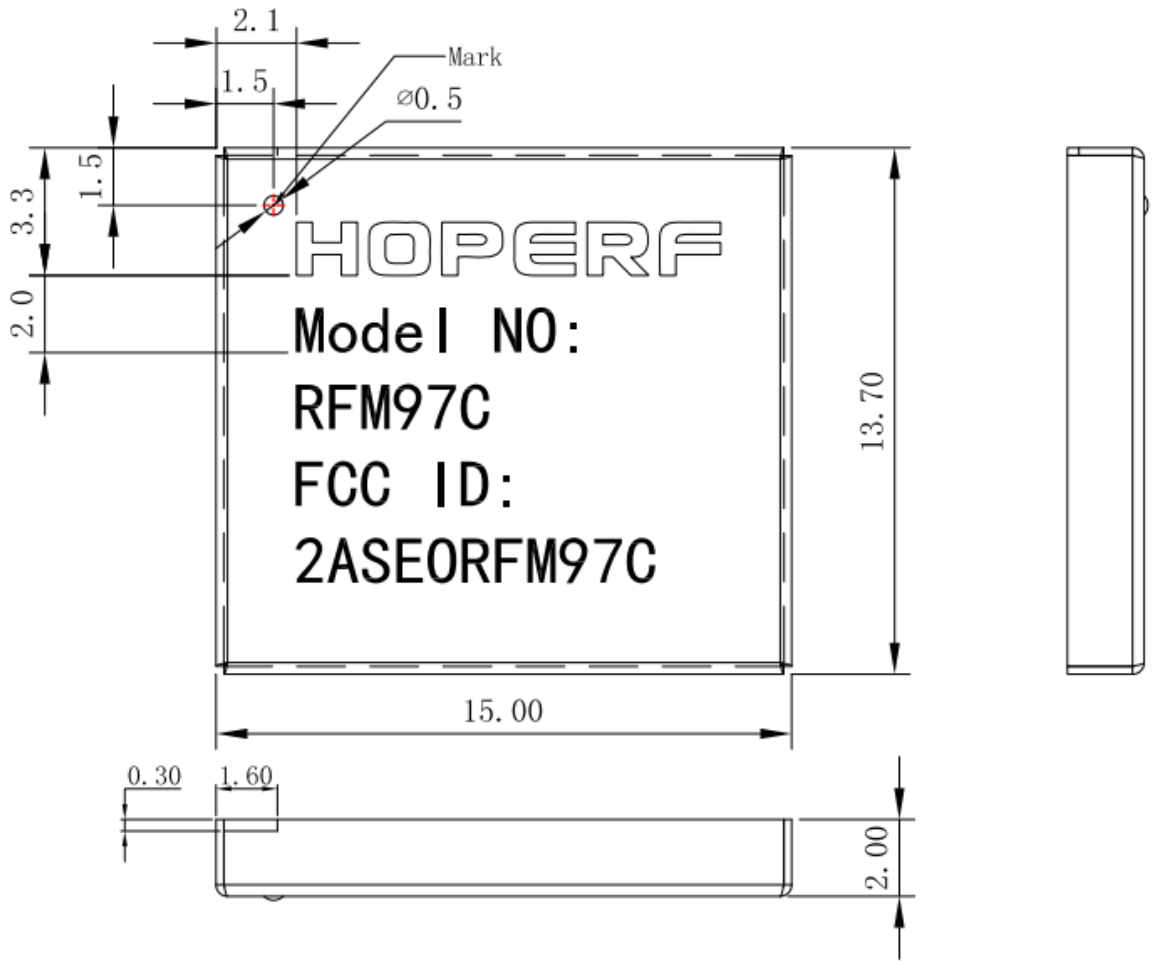
Absolute Maximum Ratings

Stresses above the values listed below may cause permanent device failure. Exposure to absolute maximum ratings for extended periods may affect device reliability.

Table 3 Absolute Maximum Ratings

Symbol	Description	Min	Max	Unit
VDDmr	Supply Voltage	-0.5	3.9	V
Tmr	Temperature	-55	+115	° C
Tj	Junction temperature	-	+125	° C
Pmr	RF Input Level	-	+10	dBm

Module Label Size



Unit: mm

Pic2.

INTEGRATION INSTRUCTIONS

FCC rules

The RFM97C is an LoRa Wireless module with frequency hopping using an LoRa modulation. It operates on the 902-928 MHz band and, therefore, is within U.S. FCC part 15.247 standard.

Modular installation instruction

RFM97C Integrates high-speed GPIO and peripheral interface. Please pay attention to the installation direction (pin direction).

If the application requires the disconnection of VDD from the RFM97C, despite of the extremely low Sleep Mode current, the user should wait for 10 ms from of the end of the POR cycle before commencing communications over the SPI bus. Pin 7 (NRESET) should be left floating during the POR sequence.

Trace antenna designs

Not Applicable

RF exposure considerations

To maintain compliance with FCC’s RF Exposure guidelines, This equipment should be installed and operated with minimum distance between 20cm the radiator your body: Use only the supplied antenna.

Antennas

The RFM97C is an LoRa Wireless module beams signals and communicates with its antenna, which is Reverse SMA interface Rubber Bar antenna andSpring antenna . The both Antenna gain is 2.15dBi

LABEL OF THE END PRODUCT

The final end product must be labeled in a visible area with the following " Contains FCC ID: 2ASEORFM97C. If the size of the end product is larger than 8x10cm, then the following FCC part 15.19 statement has to also be available on the label: This device complies with Part 15 of 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.

Information on test modes and additional testing requirements

Data transfer module demo board can control the EUT work in RF test mode at specified test channel.

Additional testing, Part 15 Subpart B disclaimer

The module without unintentional-radiator digital circuit, so the module does not required an evaluation by FCC Part 15 Subpart B. The host should be evaluated by the FCC Subpart B.

FCC WARNING

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.

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

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 generate, 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.

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