STL 2.4G transceiver module
Technical Manual

General

The modules is a low power radio frequency module operating within the ISM 2.4 GHz frequency band. The radio transceiver is compatible with IEEE.802.15.4 standard with hardware acceleration for both the IEEE 802.15.4 MAC and AES security.. It also incoproates a 32-bit ARM7 core based MCU, 128 Kbyte FLASH memory and 96 Kbyte RAM. It is intended for use as a short range radio module for embedded applications.

Features Summary
- IEEE 802.15.4 standard compliant on-chip transceiver/modem
- 2.4 GHz ISM Band operation
- Programmable transmitter output power (-30 dBm to +4 dBm typical)
- World-class receiver sensitivity
-96 dBm typical receiver sensitivity using DCD mode (<1% PER, 20-byte packets)
-100 dBm typical receiver sensitivity using NCD mode (<1% PER, 20-byte packets)
 Hardware acceleration for IEEE 802.15.4 applications
 MAC accelerator (sequencer and DMA interface)
 Advanced encryption/decryption hardware engine (AES 128-bit)
Supports standard IEEE 802.15.4 signaling with 250 kbps data rate
32-bit ARM7TDMI-S CPU core with programmable performance up to 26 MHz (24 MHz typical)
Extensive on-board memory resources
— 128 Kbyte serial FLASH memory (will be mirrored into RAM)
— 96 Kbyte SRAM
— 80 Kbyte ROM
built in voltage regulator
UART and SPI interface for control and data interface
GPIOs for general control
RF Shield can to reduce interference
3.3V DC supply

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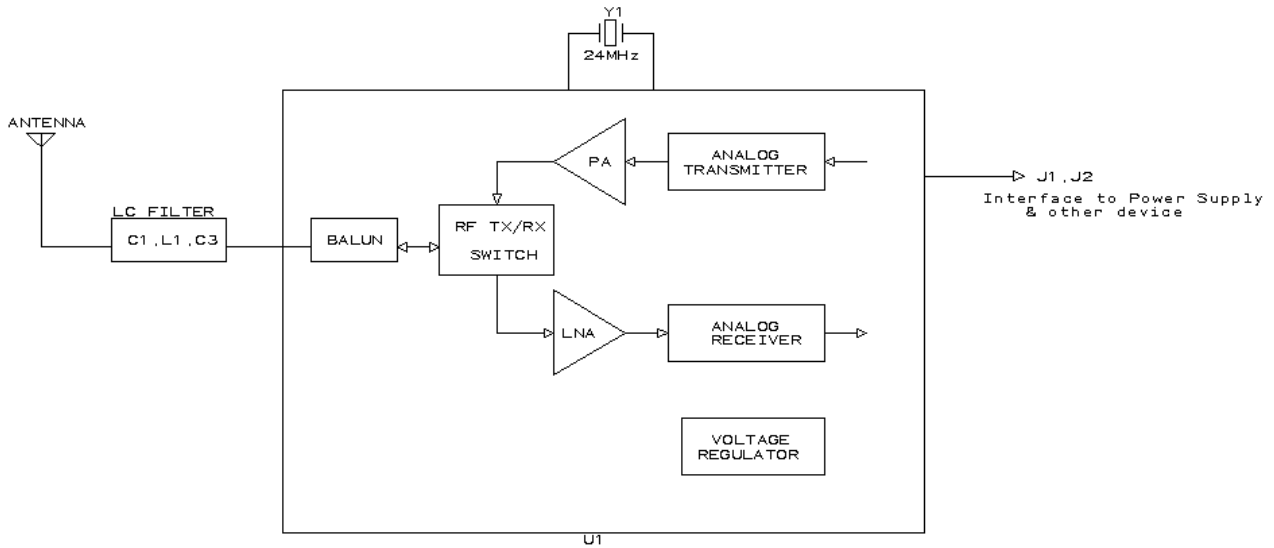
Block Diagram

Fig. 1 Block Diagram

RF Operation

The RF radio interface provides for low cost and the high density as shown in Figure 2. The transceiver is a zero IF radio without intermediate frequency (IF)stage. An onboard balun along with a TX/RX switch allows direct connection to a single-ended 50-Ω antenna. The integrated PA provides programmable output power typically from -30 dBm to +4 dBm, and the RX LNA provides -96 dBm sensitivity. In addition, separate complementary PA outputs allow use of an external PA and/or an external LNA for extended range applications. The device also has onboard bypass capacitors and crystal load capacitors for the smallest footprint in the industry. All components are integrated into the package except the crystal and antenna.
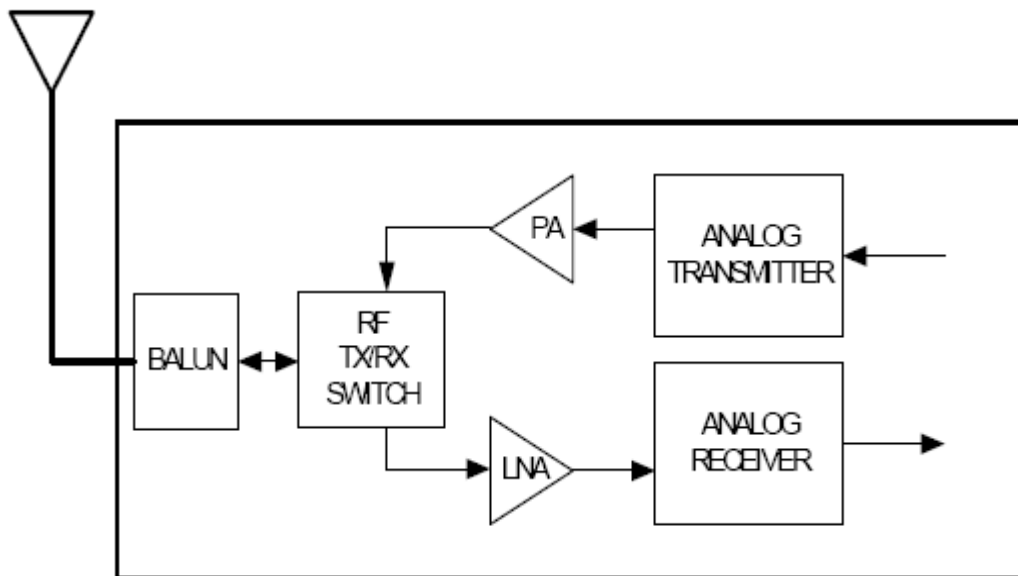

Figure 2. MC13224V RF Radio Interface

Refer to Freescale MC13224V datasheet for details.

Pin Assignements

J1

Pin No.	Name	Direction
1	UART1_RTS	input
2	UART1_CTS	output
3	UART1_RX	input
4	UART1_TX	output
5	KPI_3	input/output
6	KPI_4	input/output
7	KPI_5	input/output

J2

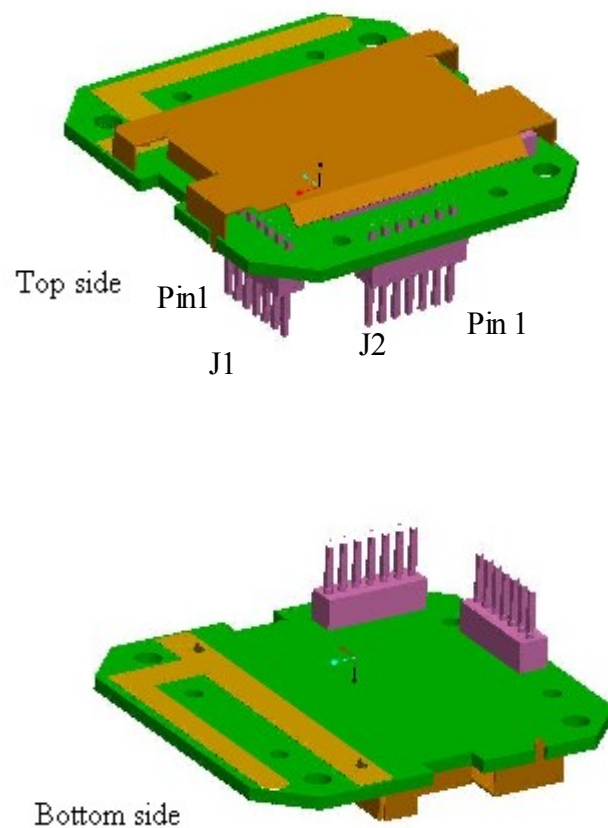| 1	VCC	power
2	GND	ground
3	SPI_SS	input
4	SPI_MISO	output
5	SPI_MOSI	input
6	SPI_CLK	output

Fig. 3 Connectors and Pin Assignments

Electrical Specification

DC
1. Supply voltage: 2.0V – 3.6V
2. Off current: <= 1ma
3. standby current   <=20 ma
4. Transmit current <= 40 ma
5. Receive current   <= 30ma

Receiver
1. Frequency : 2.420 GHz
2. Sensitivity for 1% Packet Error Rate (PER) :
     Non-coherent Differential Chip Detection (DCD) Typical -96 dBm
     Non-coherent Detection (NCD) Typical -100 dBm
3. Saturation (maximum input level) : Typical 10 dBm
4. Channel Rejection for 1% PER (desired signal -82 dBm)
     +5 MHz (adjacent channel) Typical 38 dB
     -5 MHz (adjacent channel) Typical 38 dB
     +10 MHz (alternate channel) Typical 57 dB
     -10 MHz (alternate channel) Typical 57 dB
     >= 15 MHz Typical 65 dB
5. Frequency Error Tolerance : Typical 300 kHz

Transmitter
1. Frequency : 2.420 GHz
2. Nominal Output Power : -2 to +4.5 dBm
3. Error Vector Magnitude
     Pout @ -30 dBm : Typical 13%
     Pout @ 0 dBm : Typical 11%
     Pout @ +4 dBm : Typical 9 %
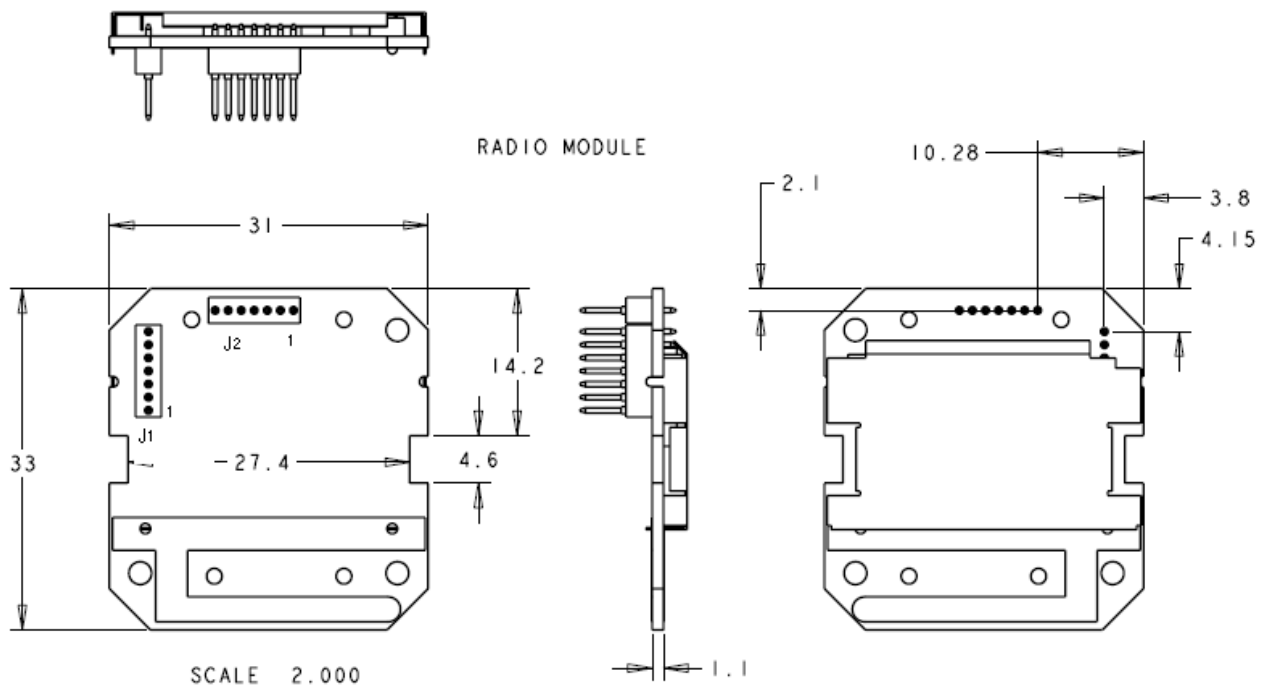4. Output Power Control Range : Typical 35 dB

Mechanical drawing

Fig. 4 Mechanical Dimensions

Installation Guide

1. The module can be mounted to the target product using a socket without soldering.
2. Please follow the pin assignments to connect the module to the socket on the target product.
3. Make sure that the specified supply voltage is not exceeded.
4. Make usre that the supply voltage is clean from noise and ripple.
5. Decoupling capacitor is recommended to be placed next to the Vcc pin.
6. Unused pins should be disconnected.
7. The module is self sufficient to function without the need for external components.
8. PCB traces for Vcc and Ground should be thick and short.
9. Make sure there is no metallic object placed directly on top and below the module after the module is installed.

Federal Communication Commission Interference 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 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 Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

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.

Modular OEM Integrator Notice (FCC)
IMPORTANT NOTE:
This module is intended for OEM integrator. The OEM integrator is still responsible for the FCC compliance requirement of the end product, which integrates this module.
Any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

USERS MANUAL OF THE END PRODUCT:
The end user has to also be informed that any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.
accept any interference received, including interference that may cause undesired operation.

LABEL OF THE END PRODUCT:
The final end product must be labeled in a visible area with the following
" Contains TX FCC ID:RF7POM0001 ".

Important notes to third party user for 2.4G transceiver module

The 2.4G transceiver Module complies with Part 15 of the FCC rules and regulations. Compliance with the labeling requirements, FCC notices and antenna usage guidelines is required. To fulfill FCC Certification, the third party user must comply with the following regulations:

1.The third party user must ensure that the text on the external label provided with this device is placed on the outside of the final product.

Contains FCC ID: *RF7POM0001   The enclosed device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (i.) this device may not cause harmful interference and (ii.) this device must accept any interference received, including interference that may cause undesired operation .*

2.The 2.4G transceiver Module may only be used with the onboard PCB antenna that have been tested and approved for use with this module .

3. The 2.4G transceiver Module have been certified by the FCC for use with other products without any further certification (as per FCC section 2.1091). Modifications not approved by STL could void the user's authority to operate the equipment.

4.Third party users must test final product to comply with unintentional radiators (FCC section 15.107 & 15.109) before declaring compliance of their final product to Part 15 of the FCC Rules.