Manual
Part # : LM2400-PR

2.4GHz ZigBee RF Module with High Sensitivity and Programmable Tx Power

Part Number	RF Output Power	Antenna Type
LM2400-PR	14dBm	MMCX

GENERAL DESCRIPTION

LM2400 is a ZigBee RF module based on the 2.4GHz unlicensed Industrial, Science and Medical(ISM) frequency band.

The module consists of RF Transceiver, RF circuitry and 8051-compatible MCU and external components. ZigBee certified stack software and 802.15.4 MAC protocol integrated.

LM2400 has several application interfaces such as 2 UARTs, 4-channel ADC, 10 GPIOs and 2 external interrupts.

The integrated 802.15.4 MAC (Medium-Access Control) and ZigBee stack protocol firmware support multi-hop routing for reliable wireless communication.

KEY FEATURES

- 2.4GHz ZigBee RF module
- Programmable communication channel
- Programmable TX power (~14dBm)
- High RX sensitivity (~ -99dBm)
- RSSI output
- Integrated AES encryption/decryption engine
- Integrated CCM* data authentication engine
- QPSK data modulation
- Scalable data rate (250Kbps / 500Kbps)
- Star, Cluster Tree and Mesh network support
- VCC: 3.0V (2.7 ~ 3.6V)
- 30-pin connector
- Selectable Antenna
- Operation temperature: -40 ~ +85

APPLICATIONS

- Home automation and security
- Automatic meter reading
- Factory automation and motor control
- Replacement for legacy wired UART
- Remote keyless entry
- Low power telemetry
- Health-care equipments
- PC peripherals and toys

2. Features

RF Transceiver

- Single-chip 2.4GHz RF Transceiver
- Low Power Consumption
- Low Operating Voltage of 1.5V
- High Sensitivity of –99dBm
- No External T/R Switch and Filter
- On-chip VCO, LNA and PA
- Direct Sequence Spread Spectrum
- O-QPSK Modulation
- RSSI Monitoring
- IEEE802.15.4 Certified

Hardwired MAC

- Two 128 byte FIFOs
- FIFO management
- CCM* Security Engine
- CRC-16 Computation and Check

Clock & Power management

- 16MHz Crystal for System Clock
- On-Chip RTC Oscillator
- 1.5V(Core)/3.0V(I/O) Operation
- Power Management Scheme
- On-chip Voltage Regulator
- On-Chip Battery Monitor

i8051- Microcontroller & Peripherals

- High Performance 8051 (12X)
- 64KB Program Memory
- 4KB Data Memory
- 128 byte CPU dedicated Memory
- 1KB Boot ROM
- 2 UART
- 4 Timers/2 PWM
- Watchdog Timer
- Real-time Clock
- 10 General Purpose I/O
  (Not Including UART & Ext. Interrupt)
- On-Chip RC oscillator for RTC
- On-chip Power-on-Reset
- 4-channel 10-bit ADC
- On-Chip Temperature Sensor
- ISP (In System Programming)

3. Specification

3.1. General

Supply Voltage	DC 2.7 ~ 3.6 V
Frequency	ISM 2.4GHz
Operating Temperature	-40 ~ +85 C (Industrial)
Antenna Option	Chip, Dipole and Cable-form antenna
Data Rate	250Kbps for ZigBee application 500Kbps for Proprietary application
Network Topology	Star, Cluster Tree and Mesh network Routing support
Number of Channel	16 Direct Sequence Channels (Software selectable)

3.2. DC Characteristics

Current Consumption @ RF Receive Mode

1	Conditions : All Port is in static mode, RF in Receive Mode		
	LM2400-PR	29mA	External Regulator

Current Consumption @ RF Transmit Mode

1	Conditions : All Port is in static mode, RF in Continuous TX Mode		
	LM2400-PR	95 mA (Max.14dBm)	ExternalRegulator

Current Consumption @ Sleep Mode

1	Conditions : EXT Interrupt & RTC Timer working, others are in sleep mode		
	LM2400-PR	18.0uA	External Regulator

※ This module has limited built-in ESD protection, therefore, must be carefully handled

3.3. RF Characteristics

No.	Items	Specification	Remarks
1	RF Frequency Range	2400 ~ 2483.5 MHz	
2	Output Power	14dBm	Ext. Power Amp.
3	Channel width	2 MHz	
4	Frequency offset	< ±30ppm	
5	Transmit Data Rate	250Kbps,500Kbps	
6	Receiver Sensitivity	-99dBm	PER <1%
7	Maximum Input Level	0dBm	
8	RF In/Out Impedance	50 ohm	TXRF, RXRF
9	Spurious(2^{nd} Harmonics)	< -30dBm	

4. PIN Description

4.1. IO Description

Table-1 and Table-2 describe the interface signals to be used to communicate with external devices.

[Table-1] Odd numbered pins

Pin	Name	Type	Description
1	VCC1.5V	OUT	1.5V Regulator Voltage Output
3	P0_0	IN/OUT	General Purpose IO (8051 Port P0.0)
5	P0_1	IN/OUT	General Purpose IO (8051 Port P0.1)
7	P0_2	IN/OUT	General Purpose IO (8051 Port P0.2)
9	P0_3	IN/OUT	General Purpose IO (8051 Port P0.3)
11	P0_4	IN/OUT	General Purpose IO (8051 Port P0.4)
13	P0_5	IN/OUT	General Purpose IO (8051 Port P0.5)
15	P0_6	IN/OUT	General Purpose IO (8051 Port P0.6)
17	P0_7	IN/OUT	General Purpose IO (8051 Port P0.7)
19	ACH1	ANALOG IN	1.5V Level Analog ADC0 Input
21	ACH2	ANALOG IN	1.5V Level Analog ADC1 Input
23	ACH3	ANALOG IN	1.5V Level Analog ADC2 Input
25	ACH4	ANALOG IN	1.5V Level Analog ADC3 Input
27	RESET#	IN	Active Low RESET# Input
29	GND	Ground	Ground

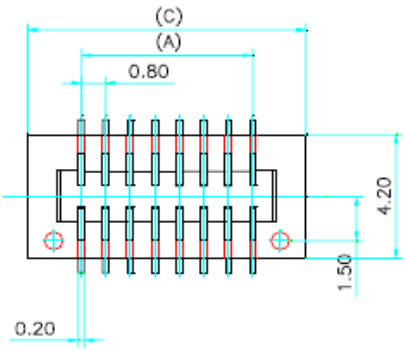
[Table-2] Even numbered pins

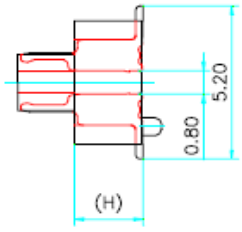
Pin	Name	Type	Description
2	VCC	3.0V	Power (3.0V)
4	RXD1/P1_0	IN/OUT	UART RXD1 General Purpose IO (P1.0)
6	TXD1/ P1_1	IN/OUT	UART TXD1 General Purpose IO (P1.1)
8	P1_2	IN/OUT	General Purpose IO (8051 Port P1.2)
10	P1_3	IN/OUT	General Purpose IO (8051 Port P1.3)
12	NC		Not Connected
14	NC		Not Connected
16	RXD0/P3_0	IN/OUT	UART RXD0 / General Purpose IO (P3.0)
18	TXD0/ P3_1	IN/OUT	UART TXD0 / General Purpose IO (P3.1)
20	INT0#/P3_2	IN/OUT	External Active Low Interrupt Input General Purpose IO (P3.2)
22	INT1#/P3_3	IN/OUT	External Active Low Interrupt Input General Purpose IO (P3.3)
24	ISP	IN	Active Low In-System-Programming INPUT
26	GND	Ground	Ground
28	/CS#	OUT	Boot Sequence Monitoring LED
30	GND	Ground	Ground

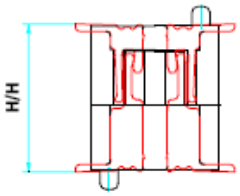
5. Connector Dimension

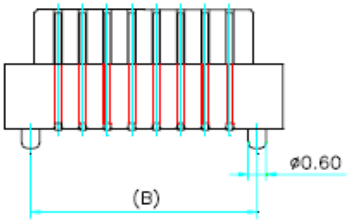
LM2400 integrates 30-pin female-type connector. For the application reference, the dimension for 30-pin male connector is also attached.

- **30-Pin male connector dimension**



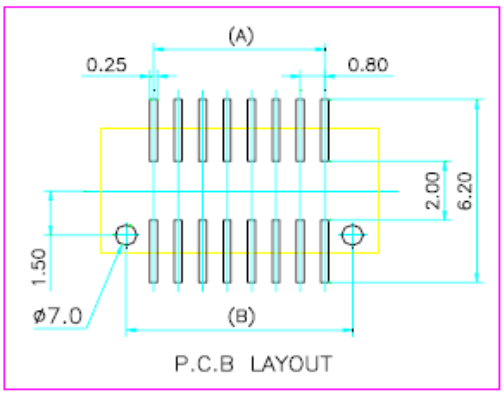






※DIMENSION

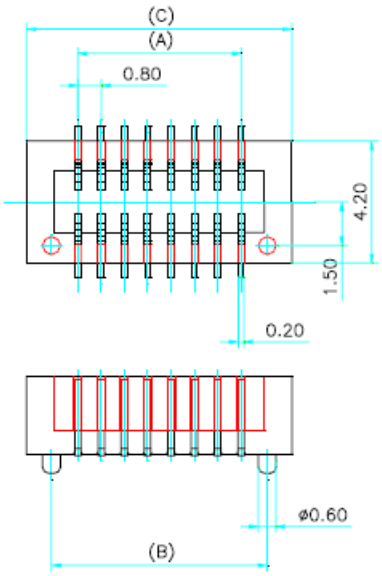
Pin	A	B	C
10	3.20	5.00	6.70
16	5.60	7.40	9.10
18	6.40	8.20	9.90
20	7.20	9.00	10.70
30	11.20	13.00	14.70
40	15.20	17.00	18.70
50	19.20	21.00	22.70

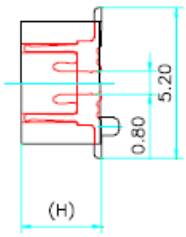


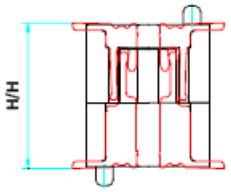
※STACKING HEIGHT OVERVIEW

H/H	Plug(H)	Socket(H)
4.0	1.25	2.75
4.5	1.75	2.75
5.0	2.25	2.75
5.5	1.75	3.75
6.0	2.25	3.75

- **30-Pin female connector dimension**







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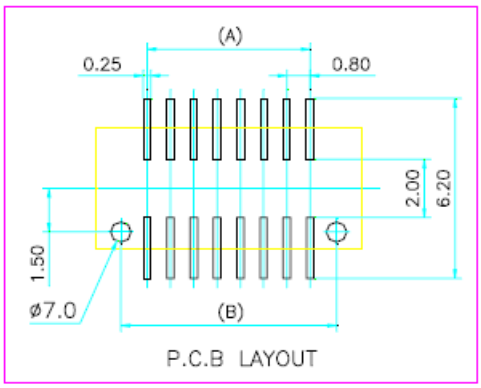
40	15.20	17.00	18.70
50	19.20	21.00	22.70

※STACKING HEIGHT OVERVIEW

H/H	Plug(H)	Socket(H)
4.0	1.25	2.75
4.5	1.75	2.75
5.0	2.25	2.75
5.5	1.75	3.75
6.0	2.25	3.75



FCC Compliance Statement

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

Information to User

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.

RF exposure compliance: The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

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RadioPulse is a Being Wireless solution provider offering wireless communication & network technologies and developing next generation wireless networking technologies. The new wireless networking solutions envisioned by RadioPulse enable user to enjoy wireless technologies with easy interface.

Founded in April of 2003, the company maintains it headquarters and R&D center in Seoul, Korea.

About RadioPulse Inc.