LM2470B-EM Datasheet

(No. ADS0405)
V1.0

REVISION HISTORY

Version	Date	Description
VER.1.0	2011.12.19	▪ First version release.

CONTENTS

1. INTRODUCTION

The LM2470B-EM is a module applied by the MG2470-F48(Rev.B), System-on-Chip (SOC) of RadioPulse. It is designed for IEEE802.15.4 and RF4CE to realize low power and low cost application.
Basically it is used on ISM band of 2.405~2.48GHz, and it supports multiple data-rate modes(31.25Kbps ~ 1Mbps) applied with channel coding beside IEEE802.15.4 data-rate.

2. DEFINITIONS

MG2470-F48(Rev.B): 2.4GHz System-on-Chip developed by RadioPulse.

LM2470B-EM: 2.4GHz Evaluation module(2-Layer) applied to ZigBee, IEEE802.15.4, and RF4CE.

3. APPLICATIONS

- 2.4 GHz IEEE 802.15.4 Applications
- RF4CE Remote Control Systems
- Lighting Systems
- Voice Applications
- Home/Building Automation
- Industrial Control and Monitoring
- Energy Management
- Low Power Wireless Sensor Networks
- Consumer Electronics
- Health-care equipments
- Toys

4. FEATURES

RF Transceiver

- Single-chip 2.4GHz RF Transceiver
- Low Power Consumption
- High Sensitivity of –98dBm
- No External T/R Switch or Filter needed
- On-chip VCO, LNA, and PA
- Programmable Output Power up to +9dBm
- Direct Sequence Spread Spectrum
- O-QPSK Modulation
- Scalable Data Rate including 250Kbps specified in IEEE802.15.4: 31.25Kbps ~ 1Mbps
- RSSI Measurement
- Compliant to IEEE802.15.4

Hardwired MAC

- Two 256-byte circular FIFOs
- FIFO management
- AES Encryption/Decryption Engine(128 bit)
- CRC-16 Computation and Check

8051-Compatible MCU

- 8051 Compatible (single cycle execution)
- 64KB Embedded Flash Memory
- 6KB Data Memory
- 128-byte CPU dedicated Memory
- 1KB Boot ROM
- Dual DPTR Support
- I2S/PCM Interface with two 256-byte FIFOs
- μ-law/a-law/ADPCM Voice Codec
- Two High-Speed UARTs with Two 16-byte FIFOs(up to 1Mbps)
- Four Timer/Counters
- 5 PWM channels
- Watchdog Timer
- Sleep Timer using the 32KHz RC-OSC clock
- Quadrature Signal Decoder
- 22 General Purpose I/Os for MG2470-F48B
- Internal 32KHz RC oscillator for Sleep Timer
- 16 MHz High Speed RC oscillator for the fast start-up from reset & power-down mode
- On-chip Power-on-Reset and Brown-out detector
- 4-channel 12-bit ADC(ENOB > 10-bit)
- SPI Master/Slave Interface with two 16-byte FIFOs
- Programmable IR(Infra-Red) Modulator
- ISP (In System Programming)
- External clock output function(500KHz, 1/2/4/8/16/32 MHz selectable)

Clock Inputs

- 32MHz Crystal for System Clock

Power

- 1.8V(Core)/2.0~3.6V(I/O) Operation
- Power Management Scheme with Deep Sleep Mode
- Separate On-chip Regulators for Analog and Digital Circuitry.
- Power Supply Range for Internal Regulator(2.0V(Min) ~ 3.6V(Max))

Package

- Lead-Free 48-pin QFN Package (7mm x 7mm)

5. HARDWARE DESCRIPTION

LM2470B-EM is a ZigBee module using MG2470-F48. The components of LM2470-EM are as follows;

- MG2470-F48B : RadioPulse ZigBee System-on-Chip (SOC)
- Crystal : 32MHz Crystal
- RF Connector : SMA Type RF Connector
- CON(20PIN) : 20-Pin Connector*2 with 1.27mm pin pitch

In addition, this module needs only few components such as resistors and capacitors.

5.1. Block Diagram

As shown in [Figure 1], LM2470B-EM includes the following features.

- MG2470: ZigBee Single chip embedded with 2.4GHz RF transceiver, base-band modem, a hardwired MAC, 64KB internal flash memory, 8051 microcontroller, 6KB data RAM, voice codec block, I2C, and 5-channel PWM.
- SMA type Antenna.
- 22 General Purpose I/Os, 4-channel 10-bit ADC, various peripherals such as Two High-Speed UARTs etc.
- Firmware downloading by UART1 in ISP mode (In-System-Programming) mode.

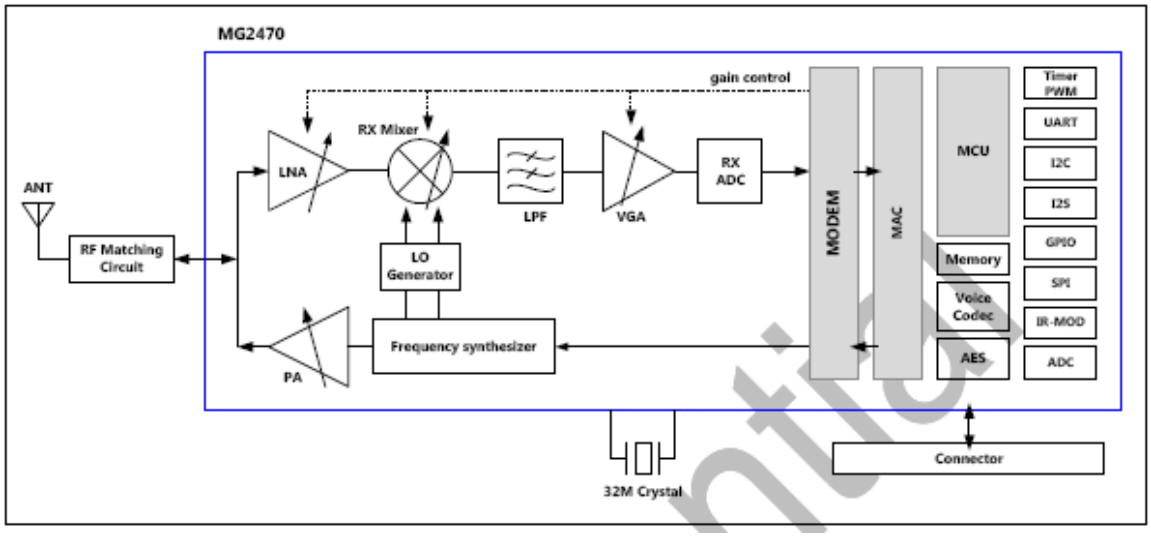


Figure 1. LM2470B–EM Block Diagram

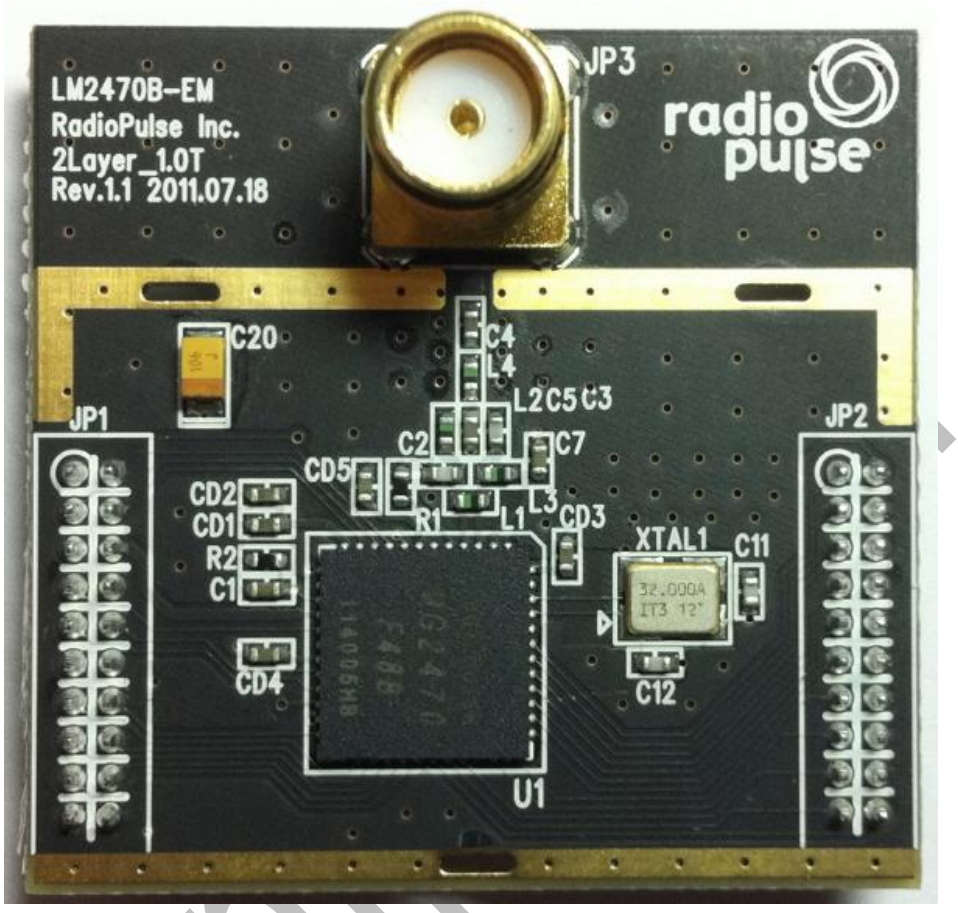
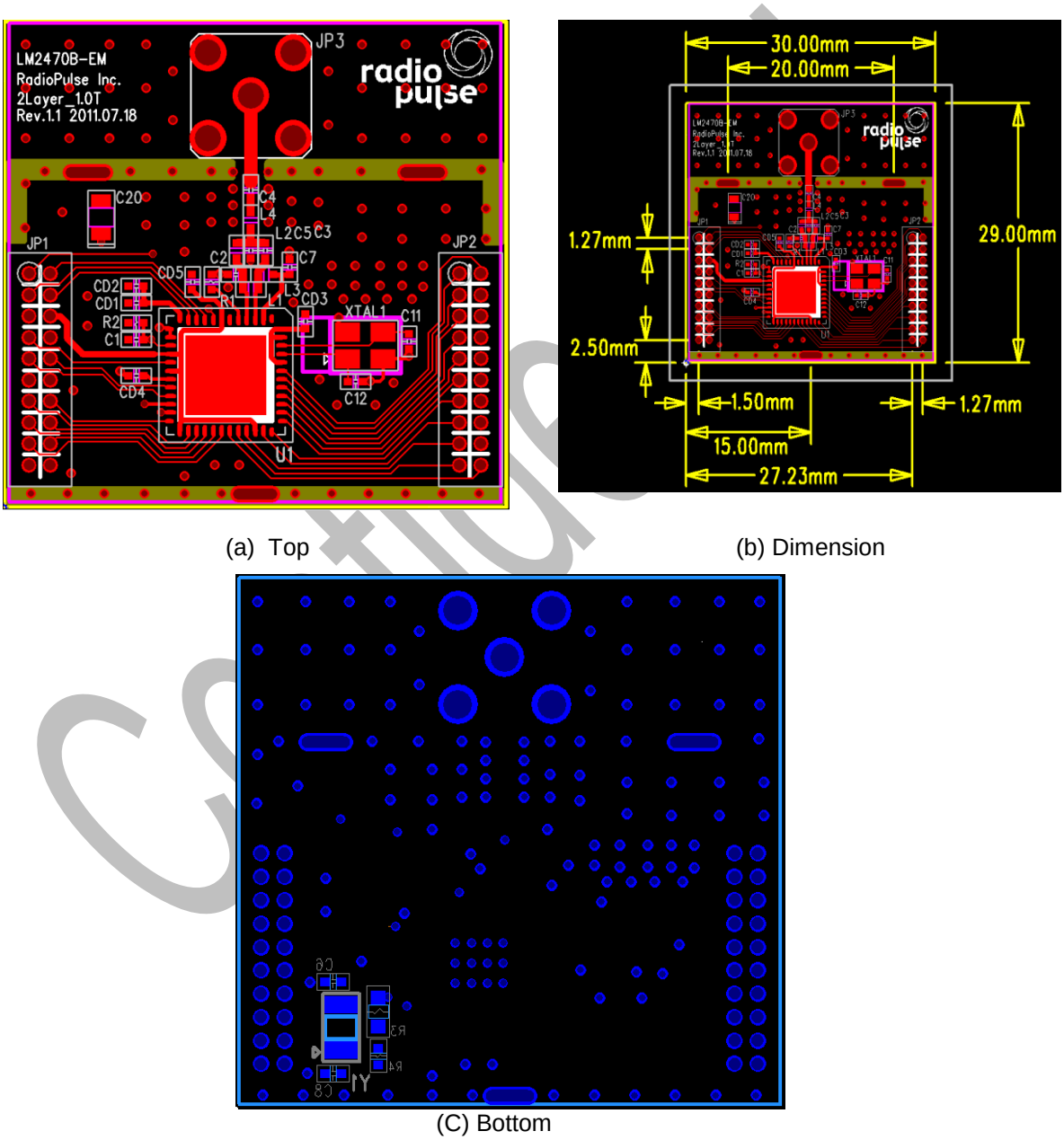


Figure 2. Appearance of LM2470B-EM

5.2. Module Dimension

The following [Figure 3] shows the dimension of the LM2470B-EM module. (a), (c) in [Figure 3] shows the component placement. (b) in [Figure 3] shows the dimension of LM2455-EM and placement for the connector pin. Two 20-pin connectors are located at the bottom.



(a) Top (b) Dimension

(C) Bottom

Figure 3. LM2470B-EM

5.3. Antenna Matching Circuitry

[Figure 4] shows the recommended RF matching circuit. For PCB pattern, please refer to the [Figure 5].

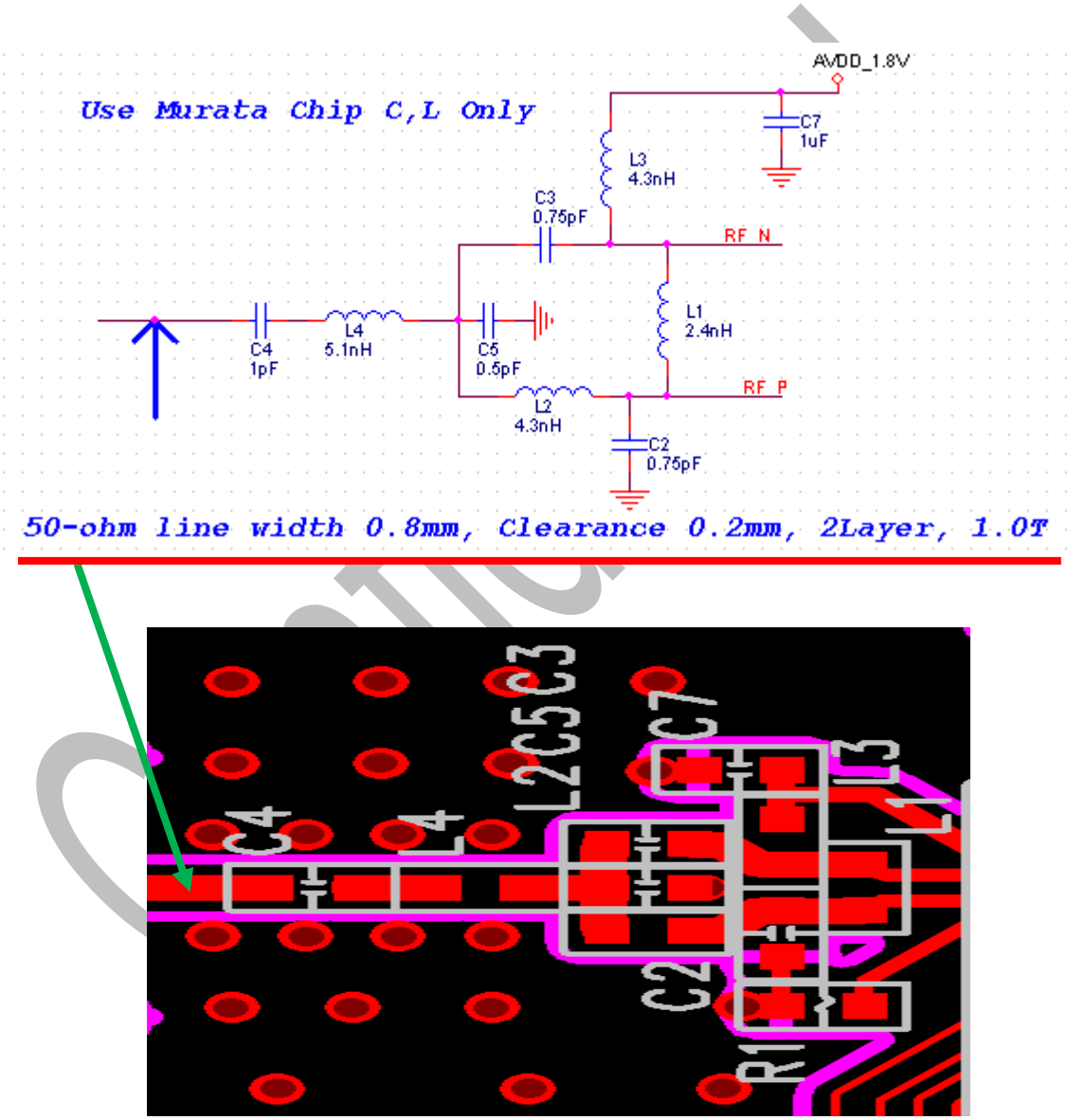


Figure 4. Antenna Matching Circuit

RF Matching Procedure

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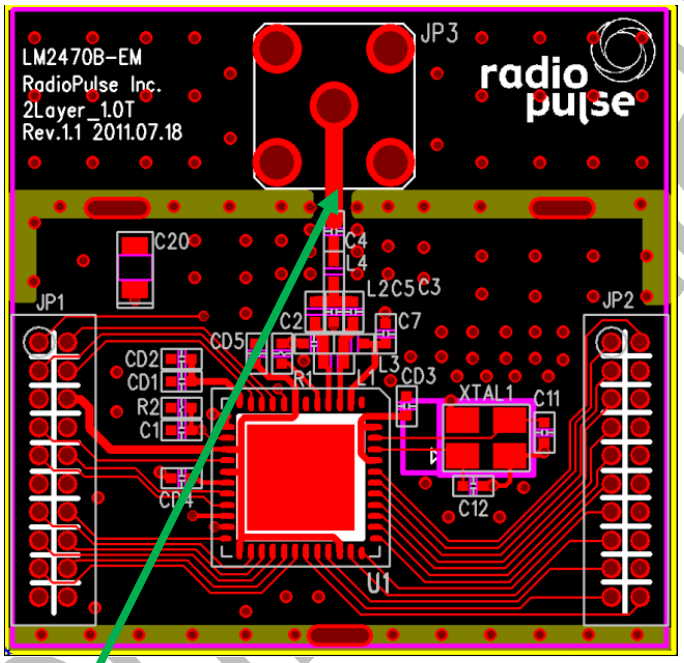
① The value of L2/C2/L4/C4 is adjusted to 2.4GHz.
② L4 and C4 are fixed value to organize Narrow Band-Filter.
③ Adjust L1 and C5 value to maximize output level.
④ Adjust L4 and C4 to minimize 2nd and 3rd harmonic.



***PCB Thickness: 1mm /0.5 OZ(2-Layer)**

Figure 5. Antenna PCB Pattern

Table 1. PCB Thickness 50ohm Line Width

H(mm)	W(mm)	Z0(Ohm)
0.4	0.5	49.487
0.8	0.7	50.514
1.0	0.8	49.798
1.2	0.8	50.821
1.6	0.9	50.192

6. SPECIFICATION

6.1. Absolute maximum ratings

Symbol	Parameter	Rating	Unit
3V_IN	AVDD3V1,AVDD3V2,DVDD3V1,DVDD3V2	-0.3 to 3.6	V
Core	ADCOUPL1,ADCOUPL2,ADCOUPL3,AVDD18V,DVDD,DXOSC18V	-0.3 to 2	V
RF_{IN}	Input RF level	10	dBm
T_{STG}	Storage Temperature	-40 to 85	℃

6.2. DC Characteristics

Symbol	Parameter	Min	Typ.	Max	Unit
3V_IN	AVDD3V1,AVDD3V2,DVDD3V1,DVDD3V2	2	3.0	3.6	V
V_{IH}	High level input voltage	2.5			V
V_{IL}	Low level input voltage			0.4	V
V_{OH}	High level output voltage	2.5			V
V_{OL}	Low level output voltage			0.4	V
T_A	Air temperature	-40		85	℃

6.3. RF Characteristics (25℃)

6.3.1. Electrical specifications

Condition: EVM Board, at 25℃, 3V_IN=3.0V, F_{req}=2.45GHz, Chip rate =2MCPS

Item		Spec	Remark
Frequency Range		2400 ~ 2480MHz	
Frequency Tolerance		<±20ppm	
Occupied B.W		2MHz	
Output Power (Normal)		9dBm (±1dB)	Min. 7dBm
VSWR		<2.0 : 1	
Flatness		<1.5 dB	
Spurious Emissions 1GHz Under 1GHz ~ 2.4GHz ~ 12GHz		 <-50dBm <-50dBm <-50dBm	
2nd Harmonic		<-42dBm	
3rd Harmonic		<-45dBm	
Inband Spurious		<-45dBm	
Adjacent Channel Rejection	±3.5MHz	>30dBc	
Secondary Radiated Emission		<-59dBm	Limit of secondary radiated emissions.
Phase Noise	100KHz	-80dBc / Hz	
	1MHz	-103dBc / Hz	
	2MHz	-111dBc / Hz	
	3MHz	-113dBc / Hz	
Rx Sensitivity		<-96dBm	
Max. Input Power Level		0 dBm	Per 1% condition
Error Vector Magnitude		<10%	

7. PIN DESCRIPTION

The following [Table 2] and [Table 3] describe the interface signals to be used to communicate with external devices.

Table 2. Left Pin Header(JP1) pins

Pin	Name	Type	Description
1	ACH0	ANALOG IN	(0~VCC) Level Analog ADC0 Input
2	ACH1	ANALOG IN	(0~VCC) Level Analog ADC1 Input
3	ACH2	ANALOG IN	(0~VCC) Level Analog ADC2 Input
4	ACH3	ANALOG IN	(0~VCC) Level Analog ADC3 Input
5	VCC	3.0V	POWER(3.0V)
6	VCC	3.0V	POWER(3.0V)
7	RESETB	INPUT	Active Low RESETB Input
8	ISP	INPUT	Active High In-System-Programming Input
9	P1_6	IN/OUT	General Purpose IO (Port P1.6 / I2C_SCL)
10	P1_7	IN/OUT	General Purpose IO (Port P1.7 / I2C_SDA)
11	P1_3	IN/OUT	General Purpose IO Port P1.3/QUADZA/PTC_GATE3/IR_TX/CLK_OUT
12	P1_4	IN/OUT	General Purpose IO Port P1.4/QUADZB/EXT_RTC_CLK/PTC_GATE4
13	P1_0 / RXD1	IN/OUT	General Purpose IO (8051 Port P1.0) UART1 RXD1
14	P1_1 / TXD1	IN/OUT	General Purpose IO (8051 Port P1.1) UART1 TXD1
15	P3_6	IN/OUT	General Purpose IO (Port P3.6/RTS1/SPICLK)
16	P3_7	IN/OUT	General Purpose IO (Port P3.7/CTS1/SPICSN)
17	P3_4	IN/OUT	General Purpose IO Port P3.4/RTS0/QUADYA/SPIDI/T0
18	P3_5	IN/OUT	General Purpose Port P3.5/CTS0/QUADYB/SPIDO/T1
19	GND	Ground	Ground
20	GND	Ground	Ground

*** Digital I/O : 16mA drive capability

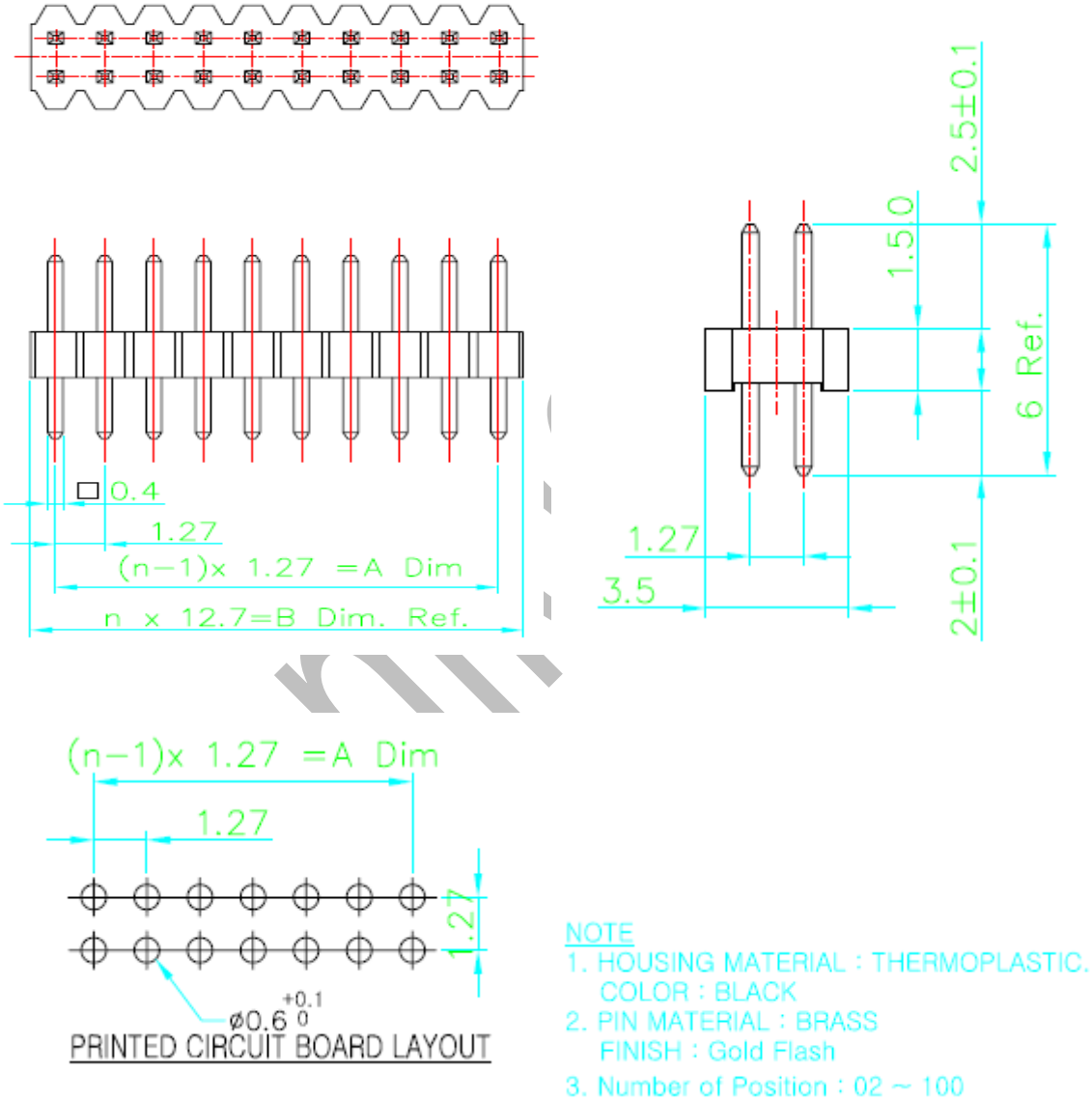
Table 3. Right Pin Header(JP2) pins

Pin	Name	Type	Description
1	P0_1	IN/OUT	General Purpose IO Port P0.1/I2SRX_LRCLK/PWM1
2	P0_0	IN/OUT	General Purpose IO Port P0.0/I2SRX_DI/PWM0
3	P0_2	IN/OUT	General Purpose IO Port P0.2/I2SRX_BCLK/PWM2
4	GND	Ground	Ground
5	P0_3	IN/OUT	General Purpose IO Port P0.3/I2SRX_MCLK/PWM3
6	NC		
7	P0_4	IN/OUT	General Purpose IO Port P0.4/I2STX_DO/PWM4
8	NC		
9	P0_5	IN/OUT	General Purpose IO Port P0.5/I2STX_LRCLK/PTC_GATE0
10	NC		
11	P0_6	IN/OUT	General Purpose IO Port P0.6/I2STX_BCLK/PTC_GATE1
12	NC		
13	P0_7	IN/OUT	General Purpose IO Port P0.7/I2STX_MCLK/PTC_GATE2
14	NC		
15	P3_0 / RXD0	IN/OUT	General Purpose IO (8051 Port P3.0) UART0 RXD0
16	NC		
17	P3_1 / TXD0	IN/OUT	General Purpose IO (8051 Port P3.1) UART0 TXD0
18	GND	Ground	Ground
19	P3_2 / INT0#	IN/OUT	General Purpose IO (8051 Port P3.2) External Active Low Interrupt Input
20	P3_3 / INT1#	IN/OUT	General Purpose IO (8051 Port P3.3) External Active Low Interrupt Input

*** Digital I/O : 16mA drive capability

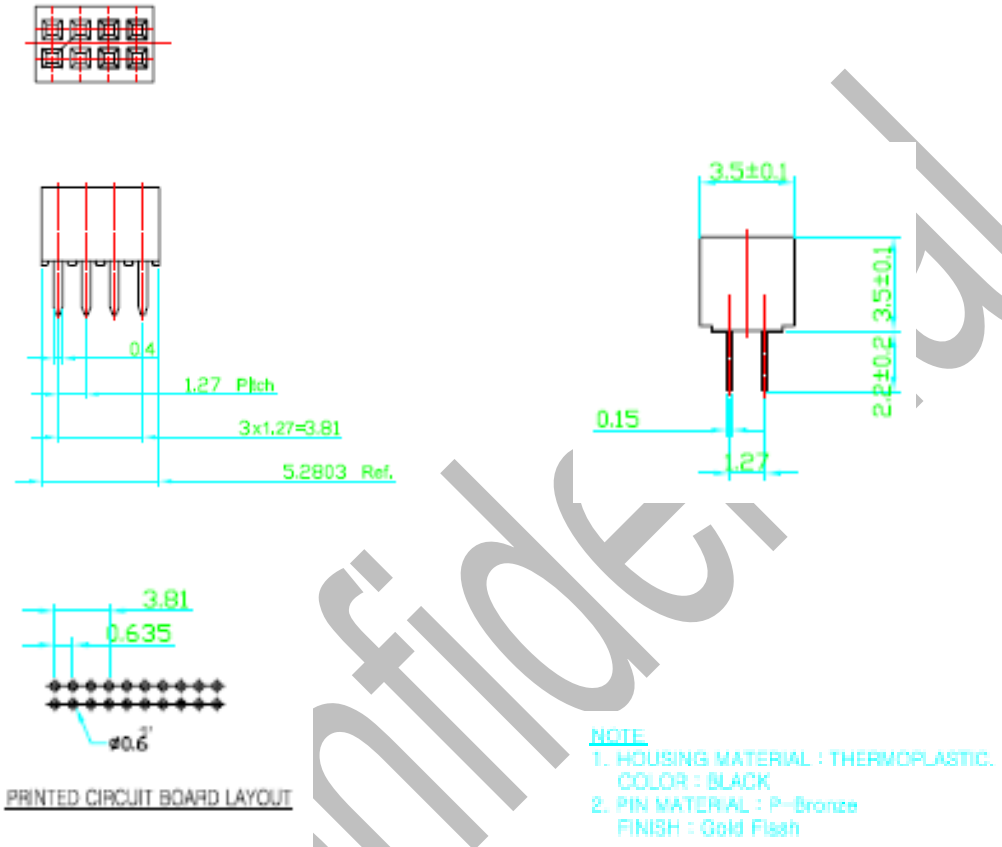
8. CONNECTOR DIMENSION

■ **20-Pin male Connector**

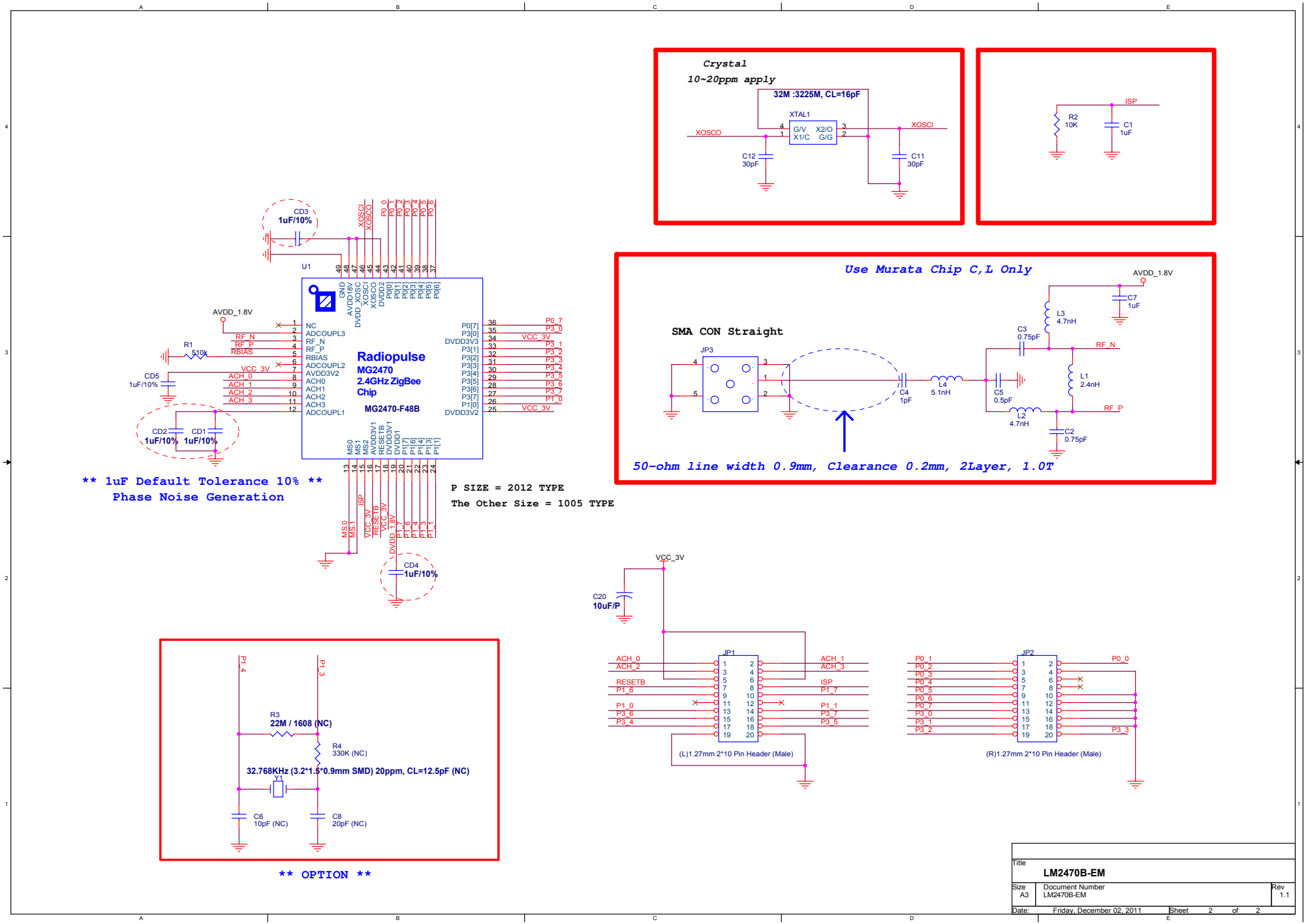


NOTE
1. HOUSING MATERIAL : THERMOPLASTIC.
   COLOR : BLACK
2. PIN MATERIAL : BRASS
   FINISH : Gold Flash
3. Number of Position : 02 ~ 100

■ **20-Pin Female Connector**



9. SCHEMATIC



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About RadioPulse Inc.

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 will 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.