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## **LM2420-EM Datasheet**

**(No. ADS0703)  
V1.0**

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Confidential

## REVISION HISTORY

Version	Date	Description
VER.1.0	2013.10.24	• First version release

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## 1. INTRODUCTION

The LM2420-EM is a module applied by the MG2420, Low Power Transceiver Chip of RadioPulse. It is designed for IEEE802.15.4 and ZigBee application to realize low power and low cost application.

LM2420-EM is controlled by external MCU through SPI and supports datarate of 250Kbps ~ 3Mbps.

### 1.1. Definitions

**MG2420:** Transceiver Chip developed by RadioPulse, applied to ZigBee, IEEE802.15.4-2003, 2006.

**LM2420-EM:** 2.4GHz Transceiver Evaluation module applied to ZigBee, IEEE802.15.4-2003,2006.

## 2. APPLICATIONS

- Home Automation and Security
- Automatic Meter Reading
- Factory Automation and Motor Control
- Energy Management
- Remote Keyless Entry with Acknowledgement
- Low Power Telemetry
- Health-care equipments
- PC peripherals
- Toy and Gaming peripherals
- Voice and Video Applications

### 3. FEATURES

#### RF Transceiver

- Single-chip 2.4GHz RF Transceiver
- Low Power Consumption
  - 15.4mA at RX mode
  - 16.1mA at TX mode with 0dBm output
  - 28.4mA at TX mode with +9dBm output
- High RX Sensitivity
  - -97dBm@ 250kbps (2Mcps Mode)
  - -93dBm@ 1Mbps (2Mcps Mode)
  - -90dBm@ 2Mbps (4Mcps Mode)
  - -86dBm@3Mbps (4Mcps Mode)
- No External T/R Switch and Filter needed
- On-chip VCO, LNA, and PA
- Programmable Output Power up to +9dBm
- Excellent TX EVM: 6% for 2Mcps mode, 8% for 4Mcps mode
- Direct Sequence Spread Spectrum
- O-QPSK Modulation
- Channel coding with various rates of 1/2, 3/4
- Scalable Data Rate
  - 250kbps for IEEE 802.15.4 and ZigBee applications
  - 1Mbps for applications beyond IEEE 802.15.4 with RF bandwidth of 2MHz
  - 2~3Mbpsfor applications beyond IEEE 802.15.4 with RF bandwidth of 4MHz
- Digital RSSI Output
- Compliant to IEEE802.15.4

#### Integrated MAC

- Two 256-byte circular FIFOs
- FIFO management
- AES-128 Engine
- CRC-16 Computation and Check
- Automatic ACK transmission

#### Clock Inputs

- 32MHz Crystal for System Clock

**Power**

- 1.2V(Core)/1.8~3.6V(I/O) Operation
- Several On-chip Voltage Regulator for Analog part and Digital part separately.
- Power Supply Range for Internal Regulator(1.8V(Min) ~ 3.6V(Max))
- Power Management Scheme with Deep Sleep Mode Support; Current consumption under 1 $\mu$ A

**Package**

- Lead-Free /RoHS 28-pin QFN Package (4mm × 4mm x 0.85mm )

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## 4. HARDWARE DESCRIPTION

LM2420-EM is a ZigBee module using MG2420. The components of LM2420-EM are as follows;

- MG2420 : RadioPulse ZigBee RF Transceiver Chip
- 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.

### 4.1. Block Diagram

As shown in [Figure 1], LM2420-EM includes the following features.

- MG2420: 2.4GHz RF Transceiver Chip
- SMA type Antenna.
- 6 General Purpose Digital I/Os
- High Speed SPI(Serial Peripheral Interface)

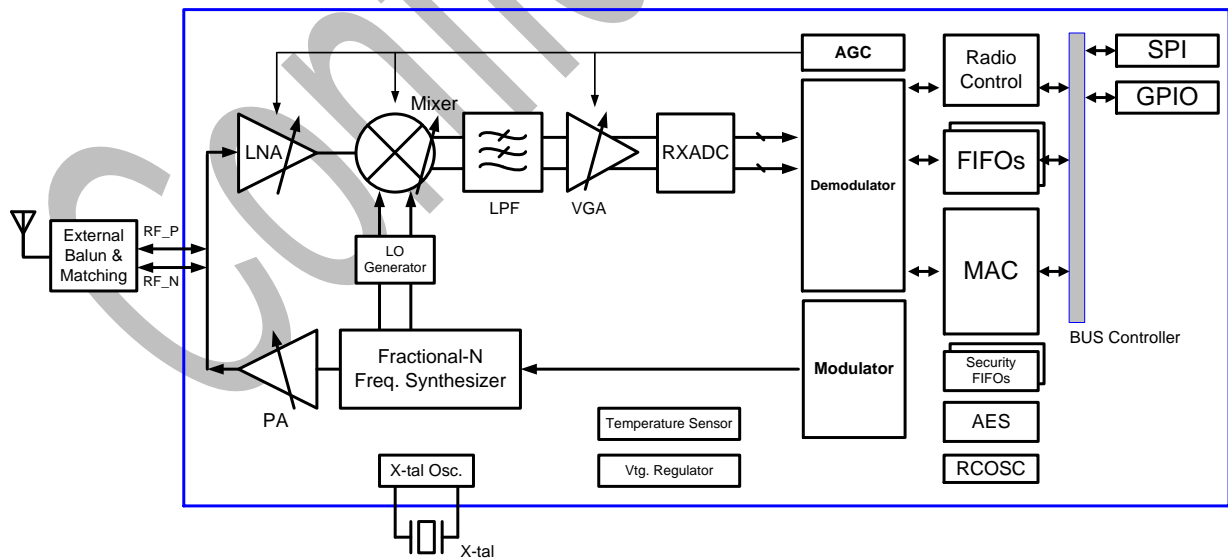


Figure 1. LM2420-EM Block Diagram

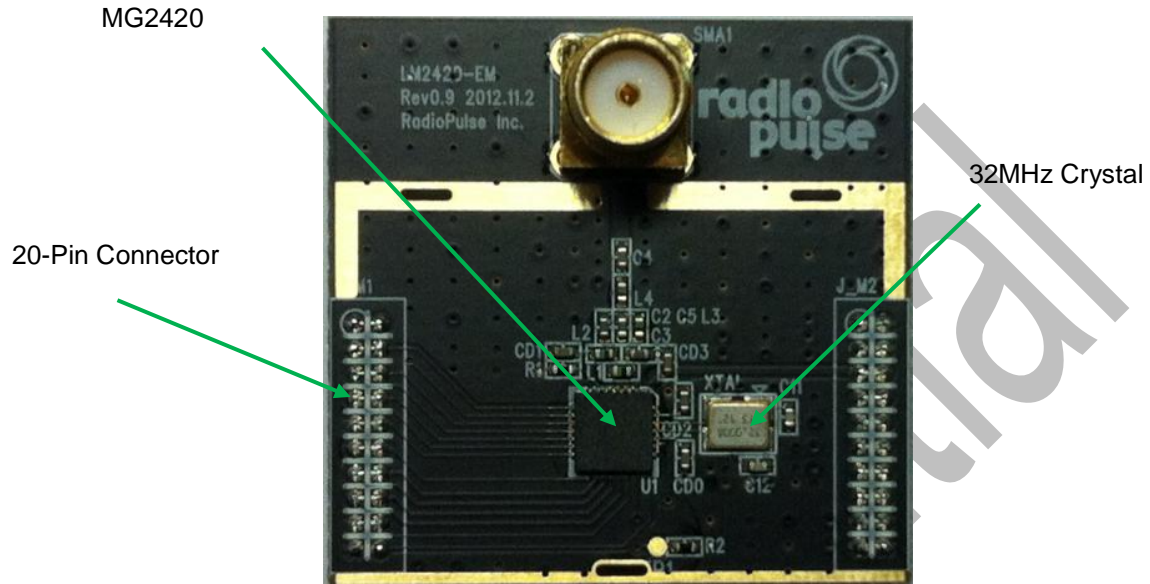


Figure 2. LM2420-EM



### 4.2. Module Dimension

The following [Figure 3] shows the dimension of the LM2420-EM module. (a) in [Figure 3] shows the component placement and (b) shows the dimension of LM2420-EM and connector placement. Two 20-pin connectors are located at the bottom.

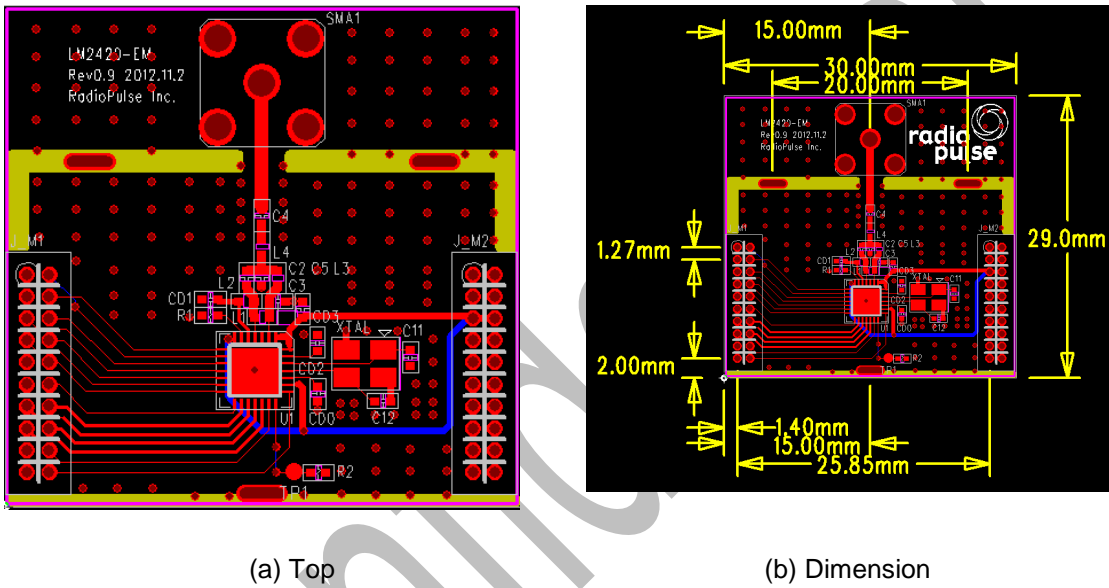


Figure 3. LM2420-EM

### 4.3. Antenna Matching Circuitry

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

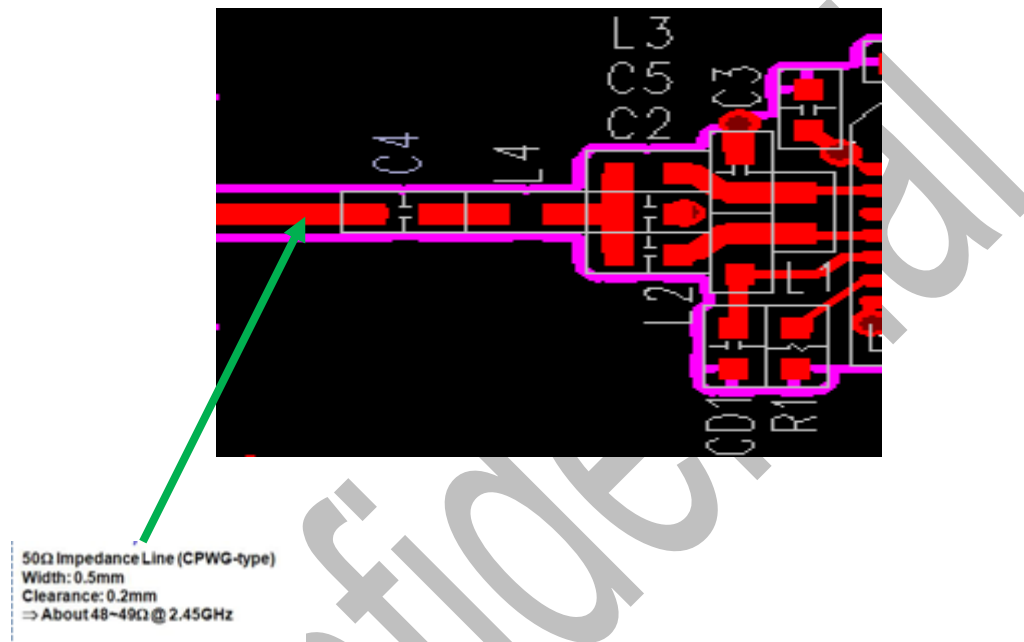


Figure 4. Antenna Matching Circuit

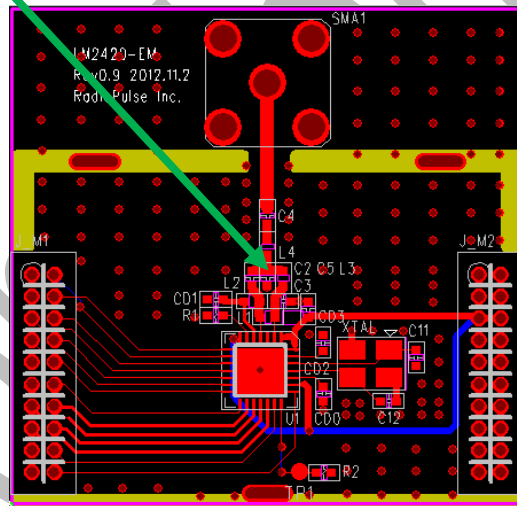
**RF Matching Procedure**

- ① The value of L2/C2/L4/C4 is adjusted to 2.4GHz.
- ② L4 and C4 are default value organizing narrow band-filter.
- ③ Adjust L1 and C5 value to maximize output level.
- ④ Adjust L4 and C4 to minimize 2<sup>nd</sup> and 3<sup>rd</sup> harmonic.

**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

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



**Figure 5. Antenna PCB Pattern**

## 5. SPECIFICATION

### 5.1. Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit
3V_IN	I/O supply voltage	-0.3 to 3.6	V
RF <sub>IN</sub>	Input RF level	10	dBm
T <sub>STG</sub>	Storage Temperature	-40 to 85	°C

### 5.2. DC Characteristics

Symbol	Parameter	Min	Typ.	Max	Unit
3V_IN	I/O supply voltage(V <sub>DDIO</sub> )	1.8	3.0	3.6	V
V <sub>IH</sub>	High level input voltage	0.7x V <sub>DDIO</sub>		V <sub>DDIO</sub>	V
V <sub>IL</sub>	Low level input voltage	-0.3		0.3x V <sub>DDIO</sub>	V
V <sub>OH</sub>	High level output voltage	V <sub>DDIO</sub> -0.2			V
V <sub>OL</sub>	Low level output voltage			0.2	V
T <sub>A</sub>	Air temperature	-40		85	°C

### 5.3. RF Characteristics (25 °C)

#### 5.3.1. Electrical specifications

(Condition: EVM Board, at 25 °C, 3V\_IN=3.0V, F<sub>rf</sub> =2.45GHz, Chip rate =2MCPS)

Parameter	Min	Typ.	Max	Unit
<b>Current consumption (Data rate=250kbps)</b>				
TX Mode				
@+9dBm output power		28.4		mA
@+8dBm output power		24.7		
@+7dBm output power		22.1		
@+6dBm output power		21.1		
@+5dBm output power		20.5		
@+4dBm output power		19.1		
@+3dBm output power		18.5		
@+2dBm output power		17.4		
@+1dBm output power		16.4		
@+0dBm output power		16.1		
RX Mode		15.4		mA
Deep Sleep Mode			1	uA
Analog Temperature Sensor		0.06		uA

Condition: EVM Board, at 25 °C, 3V\_IN=3.0V, Frf =2.45GHz, Chip rate =2MCPS

Parameter	Min	Typ.	Max	Unit
<b>RF Characteristics(Data rate=250kbps)</b>				
RF Frequency Range	2.405		2.480	GHz
TX output power		9		dBm
Spurious Radiation				dBm
30-1000MHz		-60		
1-12.75GHz		-60		
Received RF Bandwidth (Chip Rate)		2		MHz
Channel Bandwidth		5		MHz
Receiver sensitivity				dBm
250kbps		-97		
Max. input Level(250kbps)		-2		dBm
Adjacent Channel Rejection				dB
+5MHz(+10MHz)		30		
-5MHz(-10MHz)		31		
Alternate Channel Rejection				dB
+10MHz(+20MHz)		53		
-10MHz(-20MHz)		56		
Co-Channel Rejection		-6.6		dB
Wi-Fi IEEE 802.11n Rejection		47		dB

Condition: EVM Board, at 25 °C, 3V\_IN=3.0V, F<sub>rf</sub> =2.45GHz, Chip rate =2MCPS

Parameter	Min	Typ.	Max	Unit
<b>RF transmit Section(Data rate=250kbps)</b>				
Transmit chip rate RF BW=2MHz		2		Mcps
Error Vector Magnitude Offset EVM 2MHz		6		%
Harmonics 2 <sup>nd</sup> 3 <sup>rd</sup>		-45 -45	-43 -41	dBm
Spurious Emission 30Hz~1GHz 1GHz~2.5GHz 2.5GHz~12.7GHz 5.15GHz~5.3GHz		-60 -60 -60 -60		dBm
Phase Noise @±100KHz offset @±1MHz offset @±2MHz offset @±3MHz offset @±5MHz offset		-82.2 -110.3 -117.0 -119.5 -123.3		dBc/Hz
PLL Lock Time			80	usec

Condition: EVM Board, at 25°C, 3V\_IN=3.0V, F<sub>rf</sub>=2.45GHz, Chip rate =2MCPS

Parameter	Min	Typ.	Max	Unit
<b>Crystal Oscillator</b>				
Crystal Frequency		32		MHz
Crystal Frequency Accuracy Requirement	-40		+40	ppm
ESR				Ω
Recommend C <sub>0</sub>		5		pF
Recommend C <sub>L</sub>		16		pF
Temperature coefficient				mV/°C
Current consumption				mA



## 6 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(JM1) pins**

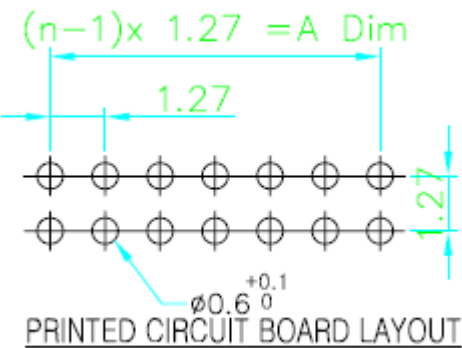
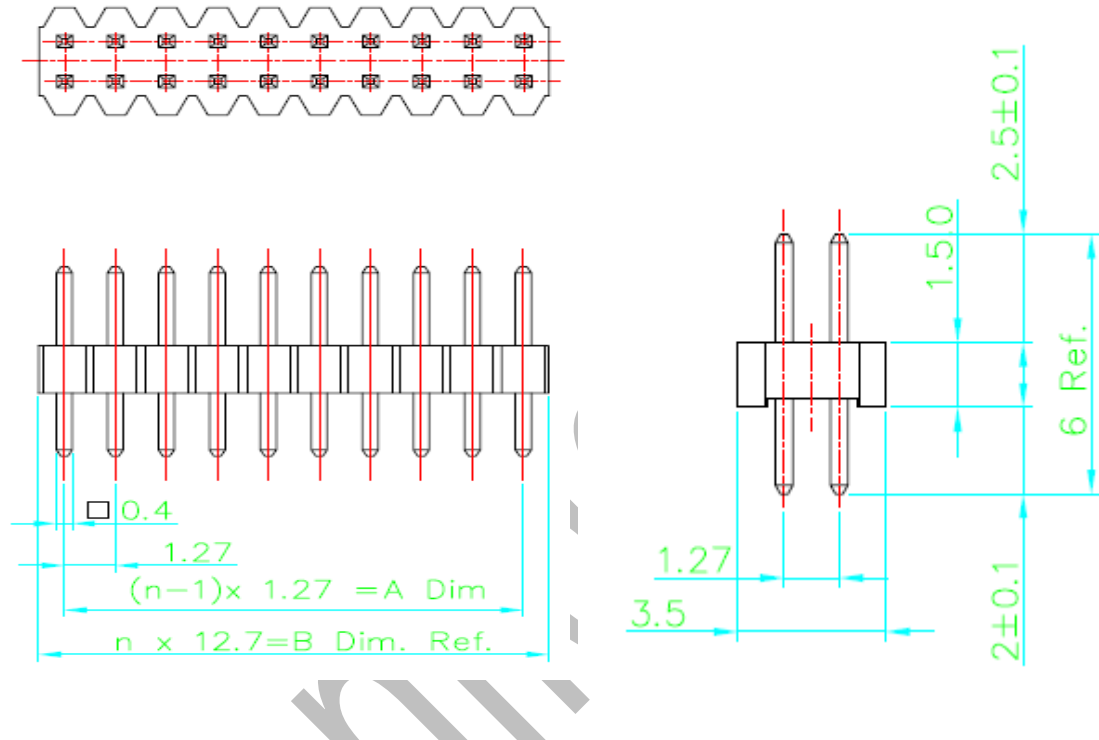
Pin	Name	Type	Description
1	GND	Ground	Ground
2	NC	NC	NC
3	GND	Ground	Ground
4	ATEST0	ANALOG OUT	Analog test signal output
5	P0_1	Digital I/O	General Purpose Digital I/O
6	P0_0	Digital I/O	General Purpose Digital I/O
7	P0_3	Digital I/O	General Purpose Digital I/O
8	P0_2	Digital I/O	General Purpose Digital I/O
9	GND	Ground	Ground
10	P0_4	Digital I/O	General Purpose Digital I/O
11	GND	Ground	Ground
12	P0_5	Digital I/O	General Purpose Digital I/O
13	SI	Digital I	SPI Interface: Serial In
14	CSn	Digital I	SPI Interface: Chip Select. Active low
15	SCLK	Digital I	SPI Interface: Serial Clock
16	SO	Digital O	SPI Interface: Serial Out
17	GND	Ground	Ground
18	RESETB	Digital I	External reset pin. Active Low
19	GND	Ground	Ground
20	DVREGEN	Digital I	Digital VREG enable input When high, digital voltage regulator is active.

Table 3. Right Pin Header(JM2) pins

Pin	Name	Type	Description
1	GND	Ground	Ground
2	GND	Ground	Ground
3	GND	Ground	Ground
4	GND	Ground	Ground
5	VCC3V	3V	3V
6	VCC3V	3V	3V
7	NC	NC	NC
8	NC	NC	NC
9	NC	NC	NC
10	NC	NC	NC
11	NC	NC	NC
12	NC	NC	NC
13	NC	NC	NC
14	NC	NC	NC
15	NC	NC	NC
16	NC	NC	NC
17	GND	Ground	Ground
18	GND	Ground	Ground
19	GND	Ground	Ground
20	GND	Ground	Ground

## 7 CONNECTOR DIMENSION

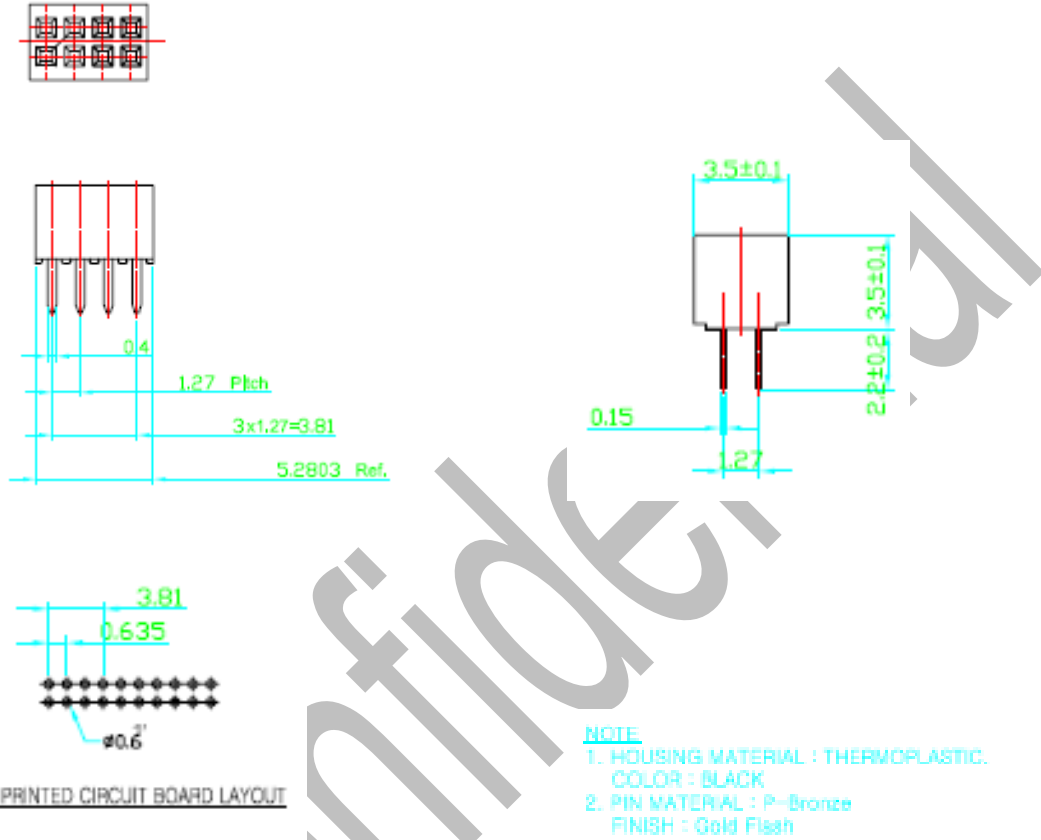
### ■ 20-Pin male Connector



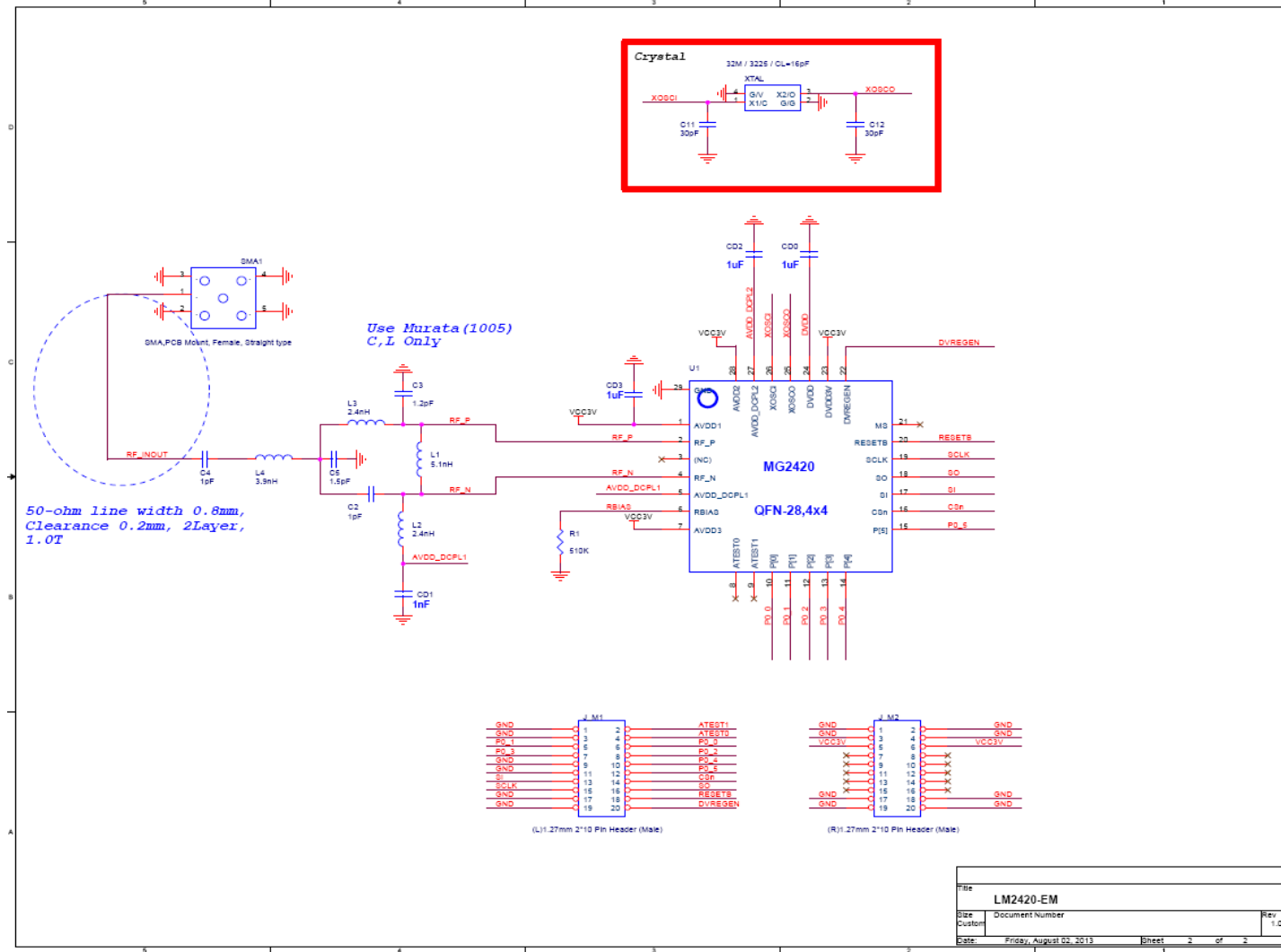
#### NOTE

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

■ 20-Pin Female Connector



# 8 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.

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