

# **SIA2420 2.4GHz Wireless Module**

## **Product Description**

The SIA2420 combines an industry-standard 802.15.4 radio with WIA-Mesh Protocol to enable low-power wireless sensors and actuators with highly reliable wireless mesh networking. The SIA2420 is tailored for use in battery- and line-powered wireless devices for applications that demand proven performance, scalability, and reliability.

The SIA2420 uses the IEEE standard 802.15.4 radio, which operates in the global license-free 2.4GHz band. The SIA2420 offers a range of up to 500 meters outdoors, while advanced power management techniques keep power consumption down to as low as 30 $\mu$ A in a typical network deployment. The combination of extremely high reliability and low power consumption enables applications that require very low installation cost and low-maintenance, long-term deployments.

The standard serial and discrete input/output (I/O) interfaces of the SIA2420 give it flexibility to be used in a wide variety of different applications, from industrial process control to security, to lighting. When integrated into a product, the SIA2420 acts like a network interface card—it takes a data packet and makes sure that it successfully traverses the network. By isolating the wireless mesh networking protocols from the user, the SIA2420 simplify the development process and reduce development risk.

## **Key Features**

- IEEE standard 802.15.4 radio, global 2.4 GHz license-free band
- High reliability, >99.9% typical network reliability
- Direct-sequence spread spectrum (DSSS) for additional interference rejection
- Mesh networking for built-in redundancy
- High integration level. Microcontroller, RF IC, power amplifier (PA) and low

noise amplifier (LNA) integrated

- Down to 30 $\mu$ A typical power consumption
- Security, AES-128 encryption algorithm
- – 95dBm receiver sensitivity
- Outdoor range > 500 m typical

## **Applications**

- OEM products development
- Intelligent home/building
- Remote Control and Telemetry
- Industrial Control
- Wireless sensor networks
- Consumer Electronics

## Absolute Maximum Ratings

The absolute maximum ratings shown below should under no circumstances be violated. Permanent damage to the device may be caused by exceeding one or more of these parameters.

**Table 1 Absolute Maximum Ratings**

Parameter	Min	Typ	Max	Units	Comments
Supply voltage	-0.3		3.6	V	(Vcc to GND)
Voltage on digital I/O pin	-0.3		3.6	V	
Input RF level			10	dBm	Input power at antenna connector
Storage temperature range	-40		+85	°C	
Lead temperature			+230	°C	For 10 seconds
VSWR of antenna			3:1		

**\* All voltages are referenced to GND**



The SIA2420 can withstand an electrostatic discharge of up to 2kV Human Body Model (HBM) or 200V Machine Model (MM) applied to any header pin, except the antenna connector. The antenna input can withstand a discharge of 50V.

## Normal Operating Conditions

**Table 2 Normal Operating Conditions**

Parameter	Min	Typ	Max	Units	Comments
Operational supply voltage range	2.8		3.3	V	(between Vcc and GND)
Peak current			120	mA	Vcc=3.3V, 25°C
Transmit current		100	120	mA	Vcc=3.0V, 25°C
Receive Current		35	40	mA	Vcc=3.0V, 25°C

Sleep Current	10	15	25	uA	Vcc=3.0V, 25°C
Storage and operating temperatures	-40		+85	°C	
Operating humidity	10		90	%RH	

## Electrical Specifications

**Table 3 Digital I/O**

Parameter	Min	Typ	Max	Units	Comments
V <sub>IH</sub> (logical high input)	0.8 x Vcc	Vcc	Vcc + 0.3	V	
V <sub>IL</sub> (logical low input)	GND – 0.3	GND	GND + 0.6	V	
V <sub>OH</sub> (logical high output)	0.7 x Vcc	Vcc	Vcc	V	
V <sub>OL</sub> (logical low output)	GND	GND	0.25 x Vcc	V	
I <sub>IKG</sub> (Input leakage current)			50	nA	
I <sub>OH</sub> (Output source current)		1.5		mA	Vcc=3.0V, 25°C
I <sub>OL</sub> (Output sink current)		1.5		mA	Vcc=3.0V, 25°C

**Table 4 ADC Input**

Parameter	Min	Typ	Max	Units	Comments
V <sub>REF+</sub> (reference voltage output)	1.44	1.5	1.56	V	REF2_5V = 1 for 2.5 V
	2.4	2.5	2.6	V	REF2_5V = 0 for 1.5 V
I <sub>REF+</sub> (load current out of V <sub>REF+</sub> terminal)			1	mA	Vcc = 3V
Analog input impedance			2000	Ω	Vcc = 3V
Analog input voltage	0		Vcc	V	

## Detailed Radio Specifications

**Table 5 Radio Specifications**

Parameter	Min	Typ	Max	Units	Comments
Operating frequency	2.400		2.4835	GHz	
Number of channels		15			
Channel separation		5		MHz	
Occupied channel bandwidth		2.7		MHz	At-20dBc
Modulation					IEEE 802.15.4 DSSS
Raw data rate		250		kbps	
Receiver sensitivity	-92	-95	-98	dBm	At 1% PER, Vcc=3.3V, 25°C
Output power, EIRP			18dBm		Vcc=3.3V, 25°C,(+3dBi antenna)
Range	Outdoor		500	m	25°C, 50% RH, 1.5 meters above ground, +3dBi
	Indoor		200	m	omni-directional antenna

## Antenna Specifications

A MMCX-compatible male or an uFI-compatible female connector is provided on board for the antenna connection. The antenna must meet specifications in Table 6.

**Table 6 Antenna Specifications**

Parameter	Value
Frequency range	2.400~2.4835 GHz
Impedance	50Ω
Maximum Gain	+6dBi
Maximum VSWR	3: 1

Connector	MMCX (SIA2420-M)
	uFI (SIA2420-U)

When the mote is placed inside an enclosure, the antenna should be mounted such that the radiating portion of the antenna protrudes from the enclosure, and connected using a MMCX connector or an uFI connector on a coaxial cable. For optimum performance, allow the antenna to be positioned vertically when installed.

# Application Circuit

The following schematic shows how the SIA2420 mote is used in a circuit.

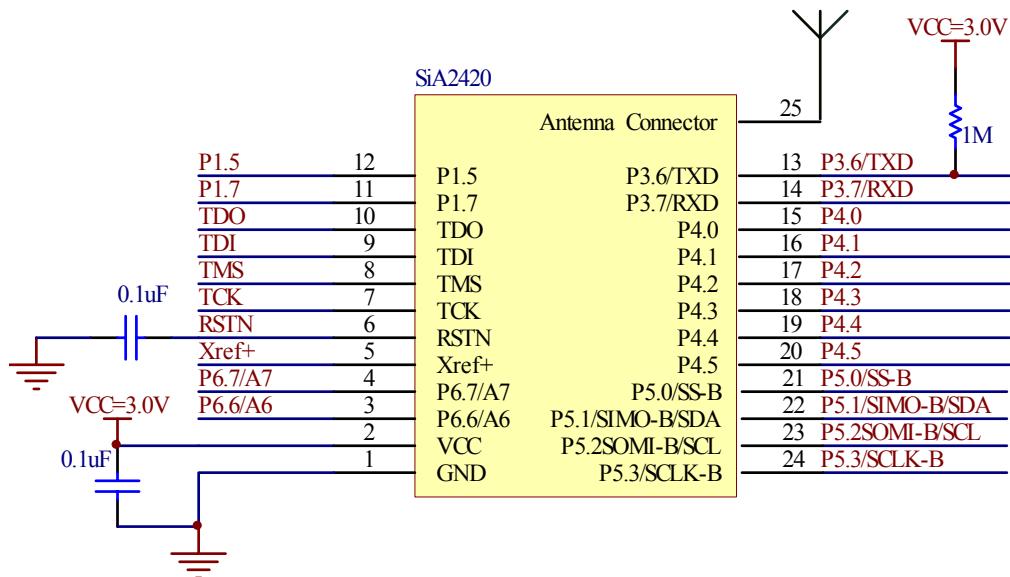


Figure 1 SIA2420 Mote in Application Circuit

## Pinout

The SIA2420 have two 12-pin Samtec MTMM-112-04-G-S-175 (or equivalent) connectors on the bottom side for handling all of the I/O.

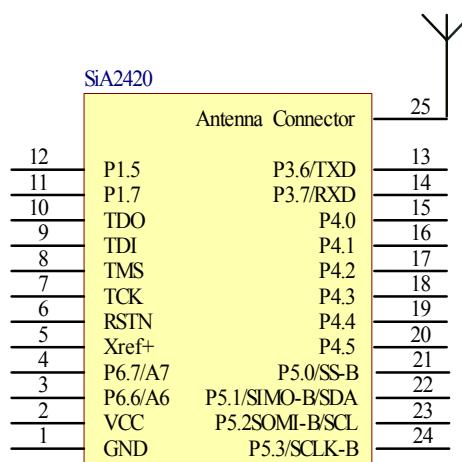


Figure 2 SIA2420 Package with Pin Labels

**Table 7 Pinout**

Pin	Name	Direction	Pin Description
1	GND	I	Supply voltage, negative terminal
2	VCC	I	Supply voltage, positive terminal
3	P6.6/A6	I/O	I/O port, 12-bit ADC input
4	P6.7/A7	I/O	I/O port, 12-bit ADC input
5	X <sub>ref+</sub>	O	Output of positive terminal of the ADC reference voltage
6	RSTN	I	Reset
7	TCK	I	Test clock
8	TMS	I	Test mode select
9	TDI	I	Test data input
10	TDO	O	Test data output
11	P1.7	I/O	I/O port
12	P1.5	I/O	I/O port
13	P3.6/TXD	I/O	I/O port, UART transmit data out
14	P3.7/RXD	I/O	I/O port, receive data in
15	P4.0	I/O	I/O port
16	P4.1	I/O	I/O port
17	P4.2	I/O	I/O port
18	P4.3	I/O	I/O port
19	P4.4	I/O	I/O port
20	P4.5	I/O	I/O port
21	P5.0/SS-B	I/O	I/O port, SPI chip select
22	P5.1/ SIMO-B/SDA	I/O	I/O port, SPI master output, I <sup>2</sup> C data
23	P5.2/SOMI-B/SCL	I/O	I/O port, SPI master input, I <sup>2</sup> C clock
24	P5.3/SCLK-B	I/O	I/O port, SPI clock
25	Antenna Connector	I/O	Antenna Connector

The RSTN input pin is internally pulled up by a 47kohm resistor. It is recommended

to connect a  $0.1\mu\text{F}$  capacitor to this pin to stabilize the process of power-up reset.

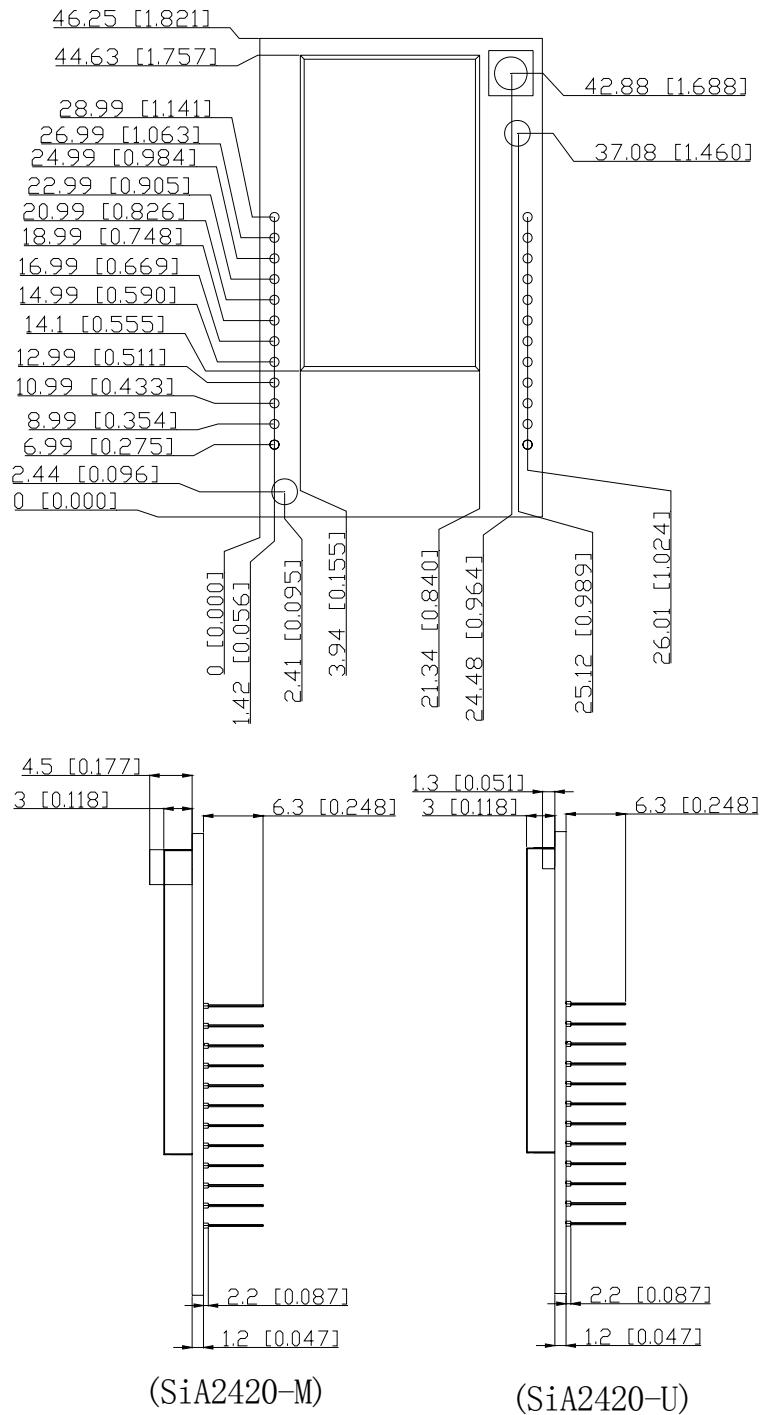
## Internal Pins Assignments

The microcontroller in the SIA2420 (MSP430F1611) interfaces to the RF IC (CC2420) and the LNA using functional pins.

**Table 8 Microcontroller Pins Assignments**

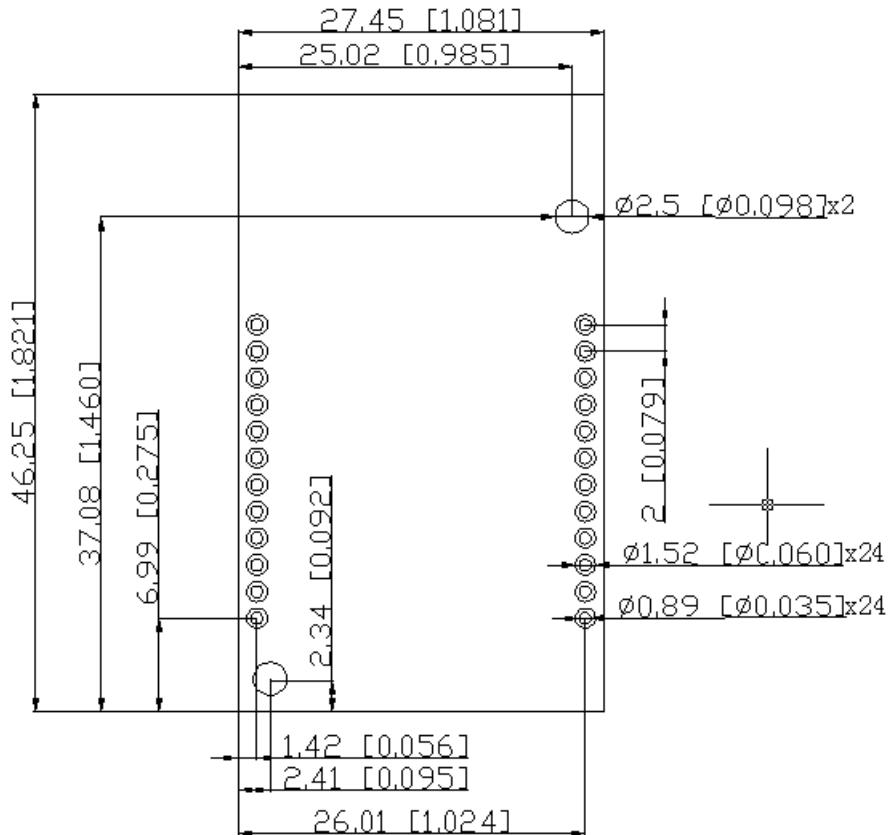
Interconnection between MSP430F1611 and CC2420			
MSP430F1611		CC2420	
Pin	Name	Pin	Name
18	P1.6	21	RESETn
15	P1.3	27	SFD
14	P1.2	28	CCA
13	P1.1	29	FIFOP
12	P1.0	30	FIFO
28	P3.0	31	CSn
31	P3.3	32	SCLK
29	P3.1	33	SI
30	P3.2	34	SO
32	P3.4	41	VREG_EN
MSP430F1611 pin for enabling LNA			
33	P3.5	Pin for enabling LNA, active low	
External clock source for MSP430F1611			
8	XIN	A 32.768KHz crystal is connected to XT1	
9	XOUT		
52	X2OUT	A 8MHz crystal is optional to be connected to XT2	
53	X2IN		

## Packaging Description



Units: mm [inch]

**Figure 3 SIA2420 Mote --- Mechanical Drawing**



Units: mm [inch]

**Figure 4 SIA2420 Mote Footprint --- Mechanical Drawing**

The SIA2420 can be hand soldered with a soldering iron at 230°C. The soldering iron should be in contact with the pin for 10 seconds or less. The SIA2420 is also suitable for eutectic PbSn reflow.

## CE Compliance

**CE2200!**

## Industrial Environment Operation

The SIA2420 is designed to meet the specifications of harsh industrial environments which include:

- Shock and Vibration:

- Hazardous Locations:
- Temperature Extremes: The SIA2420 is designed for industrial storage and operational temperature range of  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ .

## Ordering Information

SiA2420-M: Long-range 2.4 GHz SIA2420 motes with MMCX Antenna connector

SiA2420-U: Long-range 2.4 GHz SIA2420 motes with uFI Antenna connector

## Declaration

- This device is to be used only for fixed and mobile applications. If the final product after integration is intended for portable use, a new application and CE/FCC is required. Further testing will be required on host equipment incorporating the above module in order to ensure compliance with safety, RF exposure, EMC and any other relevant R&TTE standards.  
The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20cm from all persons and 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.
- Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
- Some electronic devices are susceptible to electromagnetic interference sent by this equipment if inadequately shielded. Please use this equipment at least 20cm or as far as you

can from TV set, radio and other automated office equipment so as to avoid interference.

- This device is a radio transmitter and receiver. It is designed and manufactured not to exceed limits for exposure to radio frequency (RF) energy set by the Federal Communications Commission (FCC) of the U.S. Government. These limits are part of comprehensive guidelines and establish permitted levels of RF energy for the general population. The guidelines are based on standards that were developed by independent scientific organizations through periodic and thorough evaluation of scientific studies. The standards include a substantial safety margin designed to assure the safety of all persons, regardless of age or health.
- 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.
- When the module is installed into a host device, the FCC ID label must be visible through a window on the final device or it must be visible when an access panel, door or cover is easily removed. If not, a second label must be placed on the outside of the final device that contains the following text: "Contains FCC ID: YZIWIA-SIA2420"

## Declaration of Conformity

We

Shenyang Institute of Automation Chinese Academy of Sciences

(Manufacturer's name)

of

114 Nanta Street, Shenhe District, Shenyang, 110016, China

(address)

Declare under our sole responsibility that the product

Product Name: 2.4GHz Wireless Module

Product Model: SIA2420

(detailed description of product including name, type, model and supplementary information such as lot, batch or serial number, sources and number of items)

to which this declaration relates, is in conformity with the following standards and/or other normative documents.

SAFETY (art 3.1.a): EN 60950-1:2006

EMC (art 3.1.b): ETSI EN 301 489-1 v1.8.1 ETSI EN 301 489-17 v2.1.1

SPECTRUM (art 3.2): ETSI EN 300 328 v1.7.1

HEALTH (art 3.1.a): EN 50383:2002 EN 50385:2002

We hereby declare that (all essential radio test suites have been carried out and that) the above named product is in conformity to all the essential requirements of Directive 1999/5/EC.

The Conformity assessment procedure referred to in Article 10 and detailed in Annex [III] or [IV] of Directive 1999/5/EC has been followed with the involvement of the following Notified Body(ies):

**SIEMIC ,2206 Ringwood Avenue, San Jose, CA, USA**

Identification mark: 2200

(Notified Body number)

The equipment will also carry the

class 2 equipment identifier

(delete if not applicable)

The technical documentation relevant to the above equipment will be held at:

Shenyang Institute of Automation Chinese Academy of Sciences

114 Nanta Street, Shenhe District, Shenyang, 110016, China

(name and address of EU representative)

Zhao Xuefeng

(name)

Engineer

(title)



November 15, 2010

(signature of authorized person)

(date)