

## ACI810601A-2.4G-MD

**2.4GHz RF module specification****With 16KBytes In-system programmable flash 8051 MCU**

V1.1

**Document revision History**

<b>Date</b>	<b>Revision Content</b>	<b>Revised By</b>	<b>Version</b>
2016/2/3	Initial released	David Liao	V1.0
2016/6/7	Update Module Photo	David Liao	V1.1

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## General Description

ACI810601A is a high performance and low cost 2.4GHz FSK/GFSK system-on-chip (SoC) wireless transceiver module. With on chip fraction-N synthesizer, it can support the application of data rate from 4 Kbps to 500 Kbps and frequency hopping system. This device integrates high speed pipeline 8051 MCU, 16KBytes In-system programmable flash memory , 256Bytes internal data RAM, 2KBytes external data RAM, various powerful functions and excellent performance of a leading 2.4GHz FSK/GFSK RF transceiver. A8106 has 16Kbytes flash memory (A8106F4);For details about register setting, please refer to another document A8106 Datasheet

## Application

- Consumer electronics
- Mobile phone accessories
- Sports & Fitness equipment
- HID applications
- Home Automation and Lighting Control
- Alarm and Security
- Electronic Shelf Labeling
- Proximity Tags
- Medical and Healthcare
- Remote Controls
- Wireless Sensor Networks
- BLE Mesh Remote



## Feature

- Package size (QFN5X5, 40 pins).
- High performance pipeline complicated 8051
- Operation clock: 1, 1/2, 1/4, 1/8, 1/16, 1/32, 1/64 of crystal oscillator.
- 16KB Flash memory with copy protection, 2KB SARM
- UART, I<sup>2</sup>C, SPI serial communication
- Three 16/8-bit counter/timers
- Two Channel PWM
- Watchdog timer
- Sleep timer
- In-Circuit Debugger
- In-System programming/ In-Application programming
- 24 GPIO
- RX current consumption with MCU in operation mode :16mA (A8106F4 version)
- TX current consumption with MCU in operation mode : 20mA (@ 2dBm,A8106F4 version).
- Deep sleep current :0.8 uA (PM3 without sleep timer)
- Frequency band: 2400 – 2483.5MHz.
- FSK and GFSK modulation
- High sensitivity:
  - ◆ -99dBm at 500Kbps data rate
  - ◆ -104dBm at 25Kbps data rate
  - ◆ -107dBm at 4Kbps data rate
- Programmable data rate 4K ~ 500Kbps.
- Fast settling time synthesizer for frequency hopping system.
- Built-in thermal sensor for monitoring relative temperature.
- Built-in one channel 8-bits ADC for external analog voltage (0V ~ 1.2V).
- Built-in eight channels 12-bits ADC for general purpose analog input (0V ~ 1.8 V).
- Built-in Low Battery Detector.
- Support low cost crystal 16 MHz.
- Easy to use.
  - ◆ Change frequency channel by ONE register setting.
  - ◆ 8-bits Digital RSSI for clear channel indication.
  - ◆ Auto RSSI measurement.
  - ◆ Auto WOR (wake up when receive RX packet).
  - ◆ Auto WOT (wake up to transmit TX packet).
  - ◆ Auto Calibrations.
  - ◆ Auto IF function.
  - ◆ Auto Frequency Compensation.
  - ◆ Auto CRC Check.
  - ◆ Auto FEC by (7, 4) Hamming code (1 bit error correction / code word).
  - ◆ Data Whitening for encryption and decryption.
  - ◆ Separated 64 bytes RX and TX FIFO.

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**Electrical Specification**

Item	Specification	Remark
Frequency	2400MHz~2480MHz ISM Band	
Data Encryption	Data Whitening for encryption and decryption.	
Antenna Type	Integrated Print circuit board antenna	
Supply voltage	2.0V~3.6V	
Current consumption	0.8uA @PM3 without Sleep timer 3.8mA @Stand-by mode 10mA @PLL mode 16mA @Rx mode	typical
Frequency	2402 – 2480 MHz	ISM band
Transmit output power	4 dBm @ room temperature	Typical <b>Annotation1</b>
Rx sensitivity	-99 dBm (typical) @ 500kbps mode	BER $\leq$ 1E-3
Modulation	GFSK	
Interface	4 pin 1.27mm header X 1 9 pin 1.27mm header X 1 10 pin 1.27mm header X 1	
Dimension ACI810601A-2.4G-MD	23.5mm(L) x 12.5mm(W) with integrated PCB Antenna (PCB thickness is 0.8mm)	
Operating temperature	-40 ~ 85 °C	

**Annotation1:**

1. Tx output power = 4dBm,

Register: [0827] Tx test(TBG: 7, PAC: 3, TXCS: High Current ) value:0X3F.

2. TX output power can be set by Register: [0827] Tx test.

**Absolute Maximum Ratings**

Parameter	With respect to	Rating	Unit
Supply voltage range (VDD)	GND	-0.3 ~ 3.6	V
Digital IO pins range	GND	-0.3 ~ VDD+0.3	V
Voltage on the analog pins range	GND	-0.3 ~ 2.1	V
Input RF level		14	dBm
Storage Temperature range		-55 ~ 125	°C
ESD Rating	HBM	$\pm$ 2K	V
	MM	$\pm$ 100	V

\*Stresses above those listed under “Absolute Maximum Rating” may cause permanent damage to the device. These are stress ratings only; functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

\*Device is ESD sensitive. Use appropriate ESD precautions. HBM (Human Body Mode) is tested under MIL-STD-883F Method 3015.7. MM (Machine Mode) is tested under JEDEC EIA/JESD22-A115-A.

\*Device is Moisture Sensitivity Level III (MSL 3).



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**Electrical Specification in detail**

(Ta=25°C, REG1 = 3.3V, internal regulator voltage = 1.8V, unless otherwise noted)

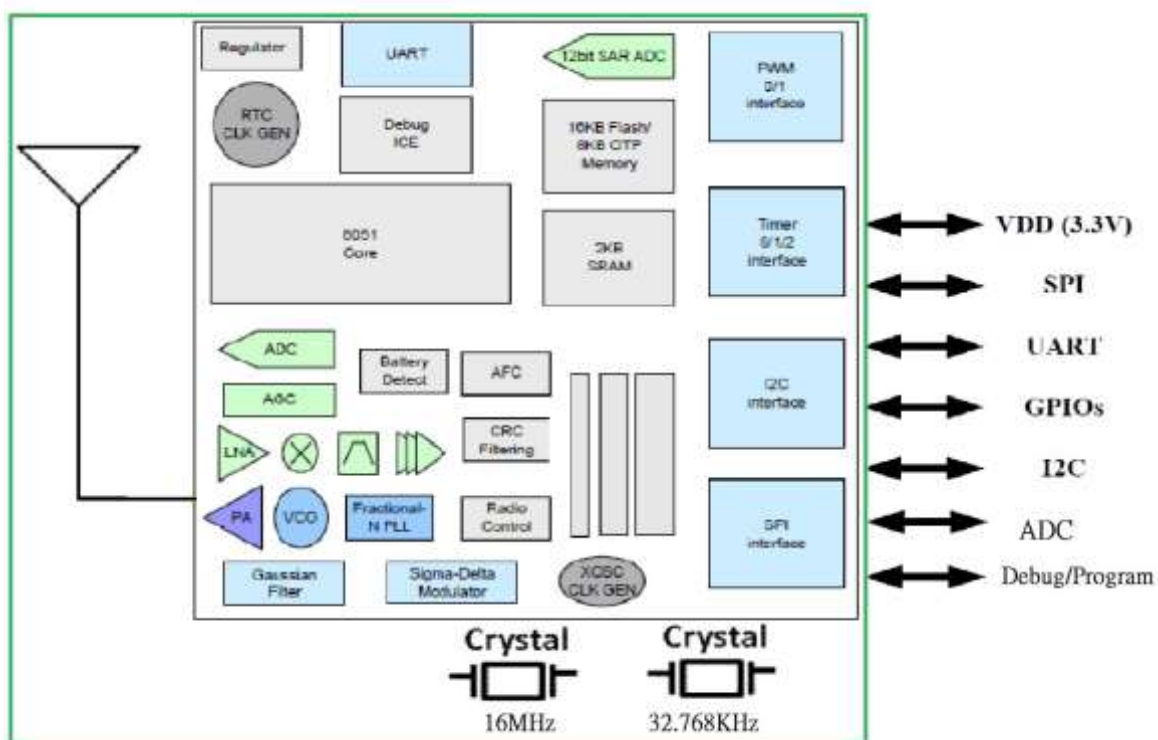
Parameter	Description	Min.	Type	Max.	Unit
<b>General</b>					
Operating Temperature		-40		85	°C
Supply Voltage (VDD)	Regulator supply input	2.0	3.3	3.6	V
Current Consumption (MCU only, RF in sleep mode)	PM3 without Sleep timer		0.8		uA
	PM3 with Sleep timer		2		uA
	PM2 with Sleep timer		3		uA
	PM1 with Sleep timer		3		uA
	Normal		2.5		mA
Current Consumption (RF with MCU in normal mode)	Standby Mode		3.8		mA
	PLL Mode		10		mA
	RX Mode		16		mA
	TX Mode (@-6dBm output)		16.5		mA
	TX Mode (@2dBm output)		20		mA
	TX Mode (@4dBm output)		24		mA
<b>Synthesizer block (includes crystal oscillator, PLL and VCO.)</b>					
Crystal start up time	Idle to standby (Xtal, 49US type, is		0.6		ms
Crystal frequency			16		MHz
Crystal ESR				80	ohm
VCO Operation Frequency		2400		2483.5	MHz
PLL phase noise	Offset 100k Offset 500K Offset 1M		80		dBc
PLL settling time	@Loop BW = 100Khz		75		μS
<b>TX</b>					
Output power range		-10	0	+4	dBm
Out Band Spurious Emission <sup>1</sup>	30MHz~1GHz			-36	dBm
	1GHz~12.75GHz			-30	dBm
	1.8GHz~ 1.9GHz			-47	dBm
	5.15GHz~ 5.3GHz			-47	dBm
Frequency deviation	500Kbps		186K		Hz
	250Kbps		93K		Hz
Data rate		4K		500K	Bps
TX settling time	Loop bandwidth 100K		70		μS
<b>RX</b>					
	Data rate 500K (F <sub>IF</sub> = 1MHz)		-99		dBm
	Data rate 25K (F <sub>IF</sub> = 1MHz)		-104		dBm
	Data rate 4K (F <sub>IF</sub> = 500KHz)		-107		dBm
IF frequency bandwidth			300/600		KHz
IF center frequency			250/1000		KHz
Interference	Co-Channel (C/I <sub>0</sub> )		11		dB
	±1MHz Adjacent Channel		-20		dB
	±2MHz Adjacent Channel		-30		dB
	> ±5MHz Adjacent Channel		-40		dB
	Image (C/I <sub>IM</sub> )		-12		dB
Maximum Operating Input Power	@RF input (BER=0.1%)			0	dBm
Spurious Emission	30MHz~1GHz			-52	dBm
	1GHz~12.75GHz			-47	dBm
RSSI Range with AGC turn on	@RF input	-100		-10	dBm
<b>12Bit SAR ADC</b>					
Input voltage range		0		1.8	V
External reference voltage			1.8		V
Input capacitor			25		pF
Bandwidth			200		KHz
EOB, effective number of bits			10		bit
INL			+/- 2		LSB
DNL			+/-1		LSB
Conversion time		128		8	uS
Current consumption			0.4		mA

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Regulator					
Regulator settling time	Pin 19( P0.2) connected to 1nF		200		μs
Band-gap reference voltage			1.21		V
Regulator output voltage			1.8		V
Digital IO DC characteristics					
High Level Input Voltage (V <sub>IH</sub> )		0.8*VDD		VDD	V
Low Level Input Voltage (V <sub>IL</sub> )		0		0.2*VDD	V
High Level Output Voltage (V <sub>OH</sub> )	@I <sub>OH</sub> = -0.5mA	VDD-0.4		VDD	V
Low Level Output Voltage (V <sub>OL</sub> )	@I <sub>OL</sub> = 0.5mA	0		0.4	V

### SOC Module Block Diagram



### Interface Descriptions

CN1

Pin No.	Symbol	Function Description	Remark
1	GND	Ground	
2	REGI	RF Module supply voltage supply input	
3	P0_0	SPI_SCLK/IN0	
4	P0_1	SPI_MOSI/CS0	

CN2

Pin No.	Symbol	Function Description	Remark
1	P0_2	SPI_MISO/RS0	
2	P0_3	SPI_SSEL/RT0	
3	P0_4	GPIO/ICE mode	
4	P0_5	I2C_SCL	
5	P0_6	I2C_SDA	
6	P0_7	INT2/GIO1	
7	P1_3	INT4/ CKO	
8	P1_4	TTAG_TTDIO	
9	P1_5	TTAG_TTCK	
10	P1_6	PWM0/ADC4	

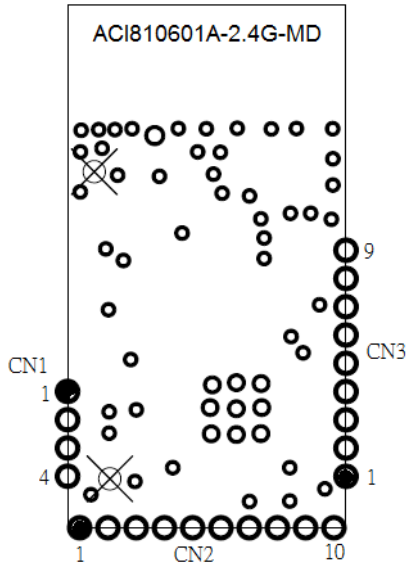
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CN3

Pin No.	Symbol	Function Description	Remark
1	P1_7	PWM1/ADC5	
2	P3_0	UART0_RX/ADC6	
3	P3_1	UART0_TX/ADC7	
4	P3_2	INT0/ADC0	
5	P3_3	INT1/ADC1	
6	P3_4	Timer0_T0/ADC2	
7	P3_5	Timer1_T1/ADC3	
8	NC	NO Connect	
9	RESETN	RESETN	

### Outline TOP View

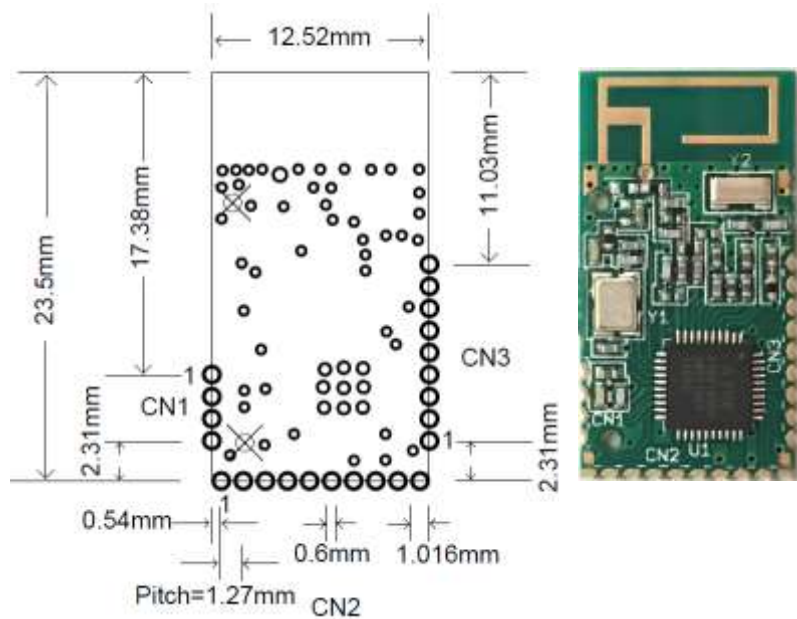


### Dimension information

SOC Module Outline Dimensions(Top View)

MECHANICAL DRAWING	
+	: 0.6
X	: 1
□	: 0.254
◇	: 0.5
⊗	: 0.4

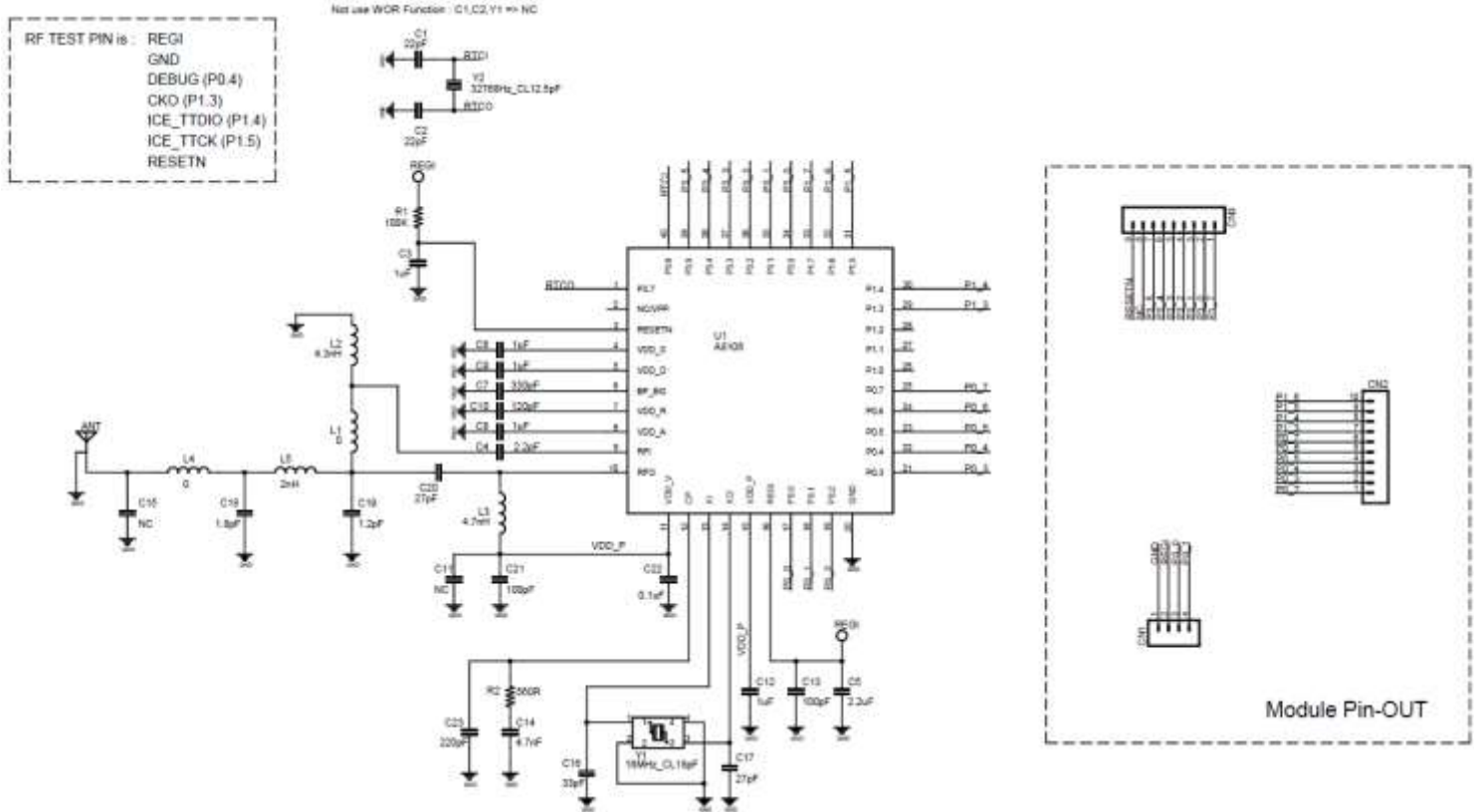
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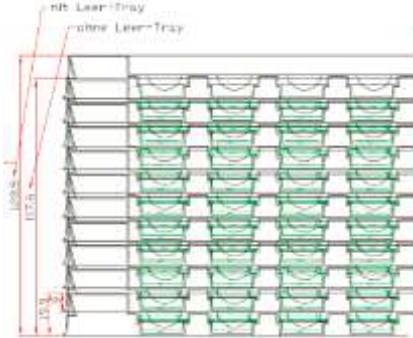

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### Schematic



### Order & Shipping Packing Information

Item	Module Part No.	dimension	N.W	MOQ	Tray	Vacuum Bag	Carton	Remark
1	ACI810601A-2.4G-MD	23.5mm x 12.5mm	mg	1000PCS	100 pcs	1000pcs/10Tray	5000pcs/5 Bag	Integrated PCB Antenna

Module	Tray	Stacked trays(Vacuum Bag)	Packing carton
23.5mm(L) x 12.5mm(W)	290 x 205 x 11(H)mm	290 x 205 x 50(H)mm	380 x 270 x 270(H)mm
			

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