

# Technical Description

The Equipment Under Test (EUT) is the wireless Subwoofer Unit of Sound Bar Speaker System. The audio signal can be sent via the 2.4GHz Digital wireless modules, which are incorporated in both soundbar unit and subwoofer unit. The EUT is powered by 120VAC mains.

**2.4GHz Digital Wireless Module: (The module contains two identical antenna)**

**Modulation Type: FSK**

**Antenna Type: Integral, Internal, RF output power is set at -12dBm (both antenna)**

**Frequency Range: 2404.5MHz - 2479.5MHz, 5MHz channel spacing, 16 channels**

**The functions of main ICs are mentioned below:**

## **1. 2.4GHz Digital Wireless module:**

- 1) U5 (A7125) acts as the FSK transceiver of the digital wireless module.
- 2) U7 (XL9618) is the MCU (RISC) of the digital wireless module.
- 3) Y1 provides system clock (oscillation frequency 16MHz) for U7.
- 4) U4 (RT9193) is 3.3V regulator for the system.
- 5) U2 (AS179) is GaAs medium RF power switcher for the two antenna.
- 6) U8 (ES7144) is 24bit resolution, 192kHz sampling rate sigma-delta digital-to-analog converter which provides audio output to the subwoofer amplifier.

## **2. Amplifier Module:**

- 1) U701 (TAS5611PHD) acts as the digital power amplifier for the subwoofer.
- 2) SU703 (D4558 dual op-amp) acts as input buffer for power amplifier (U701).
- 3) SL18 (common-mode inductor), SL717-SL720 (differential-mode inductor) and SC841-SC844 (capacitor) act as output filter of digital power amplifier (U701).

## **3. Power Supply Module:**

The power supply employs switching-mode PWM technology.

For the 34VDC portion (for digital power amplifier)

- 1) U101 (FAN7554) is a current-mode PWM controller.
- 2) T2 (ECRL35) is high frequency transformer using flyback topology.
- 3) Q3 (MDF13N65B) is 600V, 10A power MOSFET as the switching element.
- 4) U1 (EL817C) is an optocoupler providing isolated-ground feedback signal.

For the 12VDC portion (for other digital part)

- 1) U14 is a PWM controller with built-in switching element.
- 2) T2 (EE16/5+5) is high frequency transformer using flyback topology.
- 3) U6 (AP9435P) is power MOSFET for standby power control.
- 4) U3 (EL817C) is an optocoupler providing isolated-ground feedback signal

## 2.4GHz Digital wireless module (channel table)

Channel	Frequency
1	2.4045GHz
2	2.4095GHz
3	2.4145GHz
4	2.4195GHz
5	2.4245GHz
6	2.4295GHz
7	2.4345GHz
8	2.4395GHz
9	2.4445GHz
10	2.4495GHz
11	2.4545GHz
12	2.4595GHz
13	2.4645GHz
14	2.4695GHz
15	2.4745GHz
16	2.4795GHz

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## GWK5A3R 2.4GHz Wireless Audio Receiver

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### 1. General Description

GWK5A3R is the analog audio interface version of Gigawit GWK5 family wireless digital audio products. It can connect to the analog input and output the analog audio directly, and act as a plug and play wireless audio solution.

Inheriting from its GWK5 family, GWK5A3R features both good wireless performance and audio performance. GWK5A3R has good RF co-existence and robust link quality, can combat the most interference from the crowded 2.4G ISM band. GWK5A3R uses non-compression PCM signal thus delivering very low THD audio. By adopting advance forward error correction and error concealment algorithm, GWK5A3R can reach <15ms latency, this makes it ideal for the Video synchronization, Home Theater applications.

GWK5A3R's built-in high-speed 32bit processor also offers some added value functions such as Volume, Treble/Bass, Balance, 2-way Remote control and etc. It will help customers to reduce the total system cost.

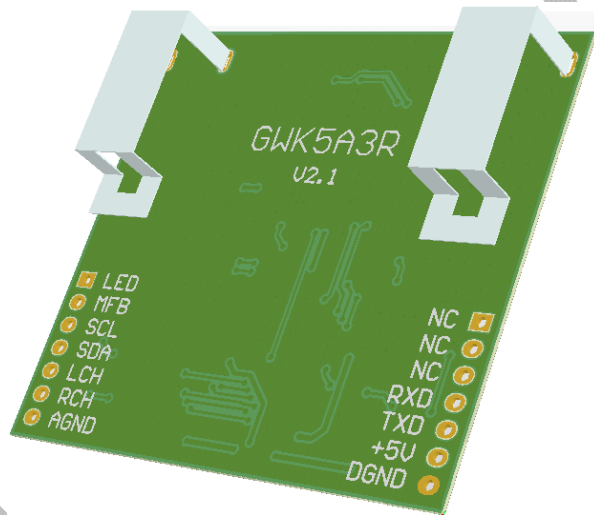
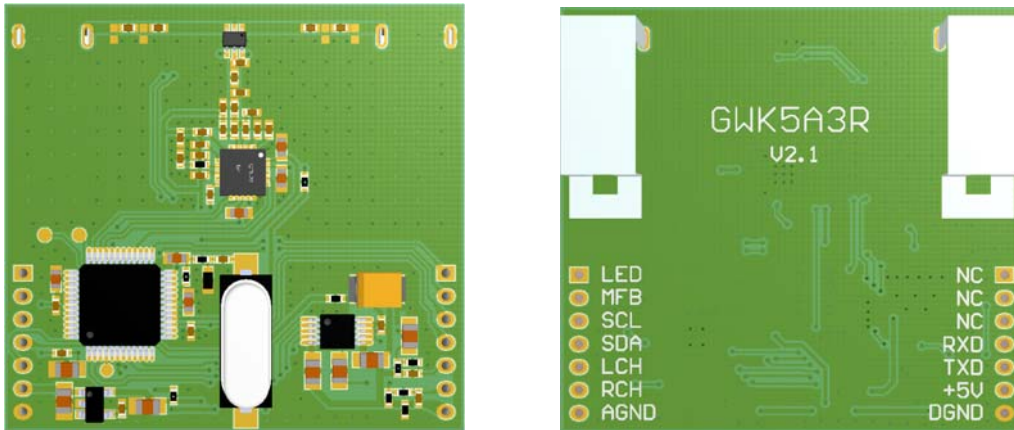
### 2. Applications

- 5.1 Speakers
- Headphones
- Surround Speakers
- Microphones
- CD Player, DVD Player
- Stereo Audio Dongles

### 3. Features

- Small RF foot-print (2MHz bandwidth) and frequency agility scheme enables better 2.4GHz co-existence
- Antenna diversity, forward error correction and error concealment for robust audio link
- None-compression wireless audio transmission with very low THD
- <15ms low latency, ideal for video synchronization applications
- Low Power Consumption: 50mA @3.3V ARX
- 20+m RF indoor range
- Dedicated 2-way logical data channel for remote control
- Power management functions for battery powered applications
- Auto muting function when suffering interference or at poor receiving conditions
- Built-in Treble/Bass, Volume, Balance Control
- Flexible design, custom functions supported

#### 4. GWK5A3R Form Factor



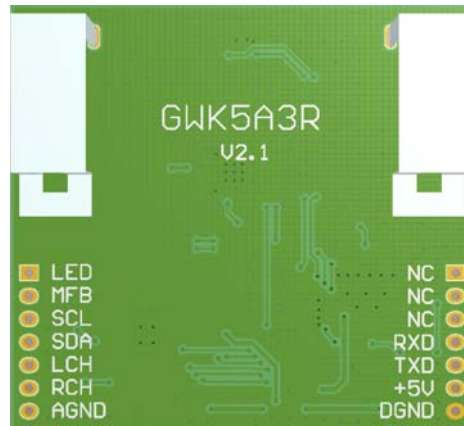
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## 5. Electrical Specification

	Description	Typical
<b>General</b>	Operation voltage	+5V DC
	Supply current	RX: 75mA
	Operation temperature	-10 ~ +60°C
<b>RF</b>	RF Frequency	2400 ~ 2483MHZ
	Modulation	GFSK
	Data rate	2M bps
	TX Power	+3dBm
	RX Sensitivity	-90dBm
	RF Range (indoor)	20+m
<b>Audio</b>	Frequency Response	20~600Hz(-3dBm)
	S/N	>85dB @ 20~600Hz
	THD+N	< 0.01% @ 20~600Hz
	Dynamic range	80dB
	Output level	1.0Vrms
	Output impedance	<1K Ohm
	Output/input gain	1:1

Table [1]: Electrical Specification

## GWK5A3R Pin Assignments



Pin #	Pin name	Type	Description
1	LED	I/O	Status LED output
2	MFB	I/O	Power or pairing Key input, press long than 3s to turn on or off the module, press long than 10s to enter pairing mode.
3	SCL /MUTE	I/O	I2C Clock or MUTE Control, firmware configurable. When used as I2C, External 4.7K pull-up resistor required.
4	SDA /STANDBY	I/O	I2C Data or Standby Control, firmware configurable. For Standby mode, A low level will be asserted when no TX signal >5min. When used as I2C, External 4.7K pull-up resistor required.
5	LCH	A	Left Channel Output
6	RCH	A	Right Channel Output
7	AGND	P	Analog ground
8	DGND	P	Digital ground
9	VCC	P	+5V DC input
10	TXD	O	UART TX
11	RXD	I	UART RX
12	NC		No connection
13	NC		No connection
14	NC		No connection

Table [3]: GWK5A3R Pin Assignment

## 6. Application Schematic

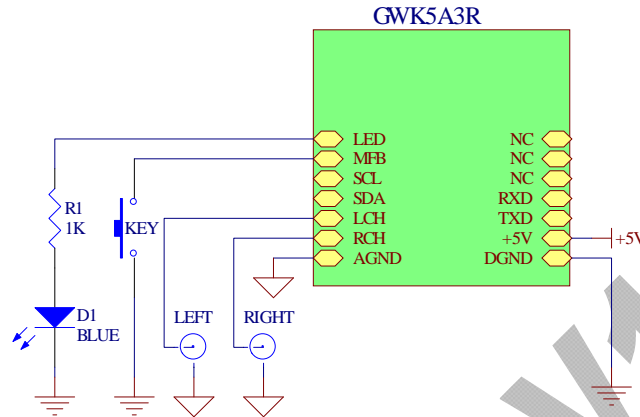


Figure [1]: GWK5A3R Application

## 7. ISP Firmware Updating

GWK5NO\_SW support ISP firmware updating through UART, Connect the download tool as Figure [8] then restart the module, GWK5NO\_SW will enter the ISP mode.

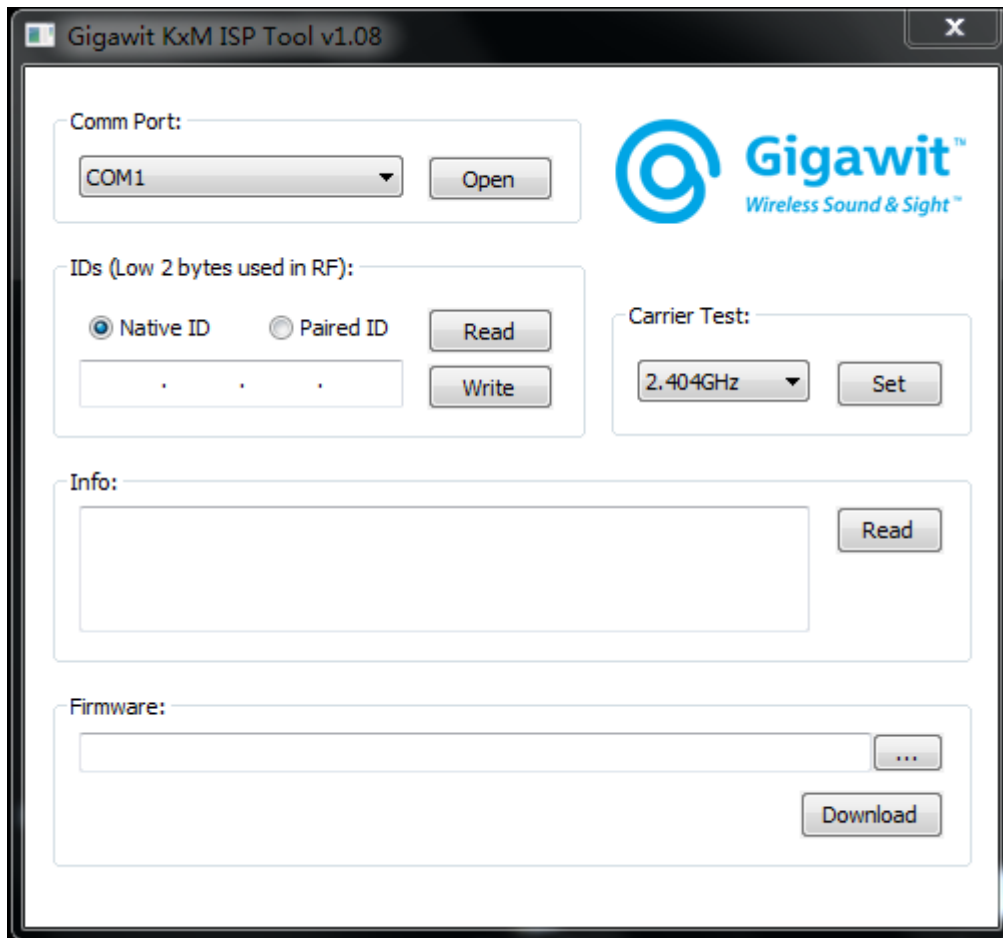


Figure [3]: Gigawit ISP tool

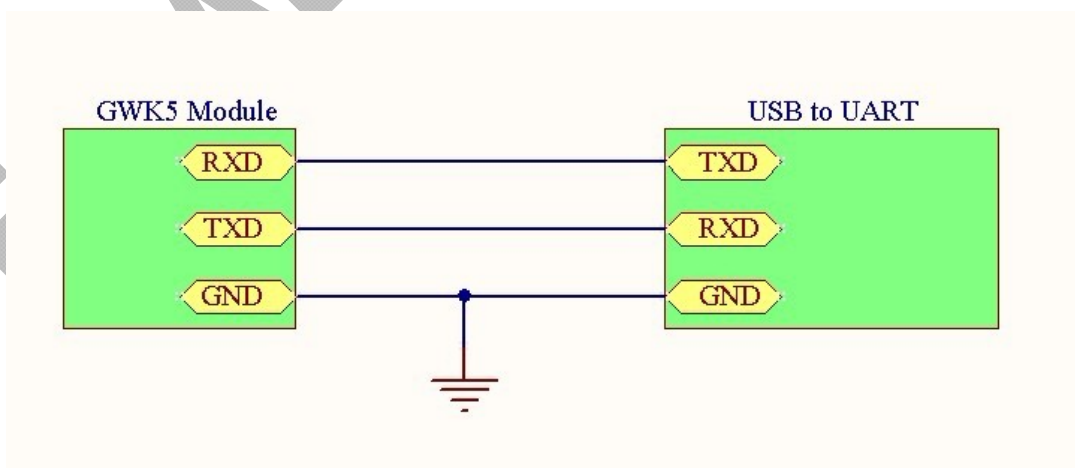


Figure [4]: Gigawit ISP Connection



## 8. Pairing

GWK5A3T/R support ID matching to enable multi TX/RX operating in a same area. The RX will only receive the paired TX audio signals. To pair the TX and RX module, follow the below steps:

- 1) Power on the TX and RX Module. The TX/RX LED will keep solid for 5 seconds, and then turn into Idle Mode and flash slowly.
- 2) Press the TX key long than 10 seconds Until the LED change into flashing fast. Release the key. After this, The TX Module will stay into Pairing Mode for 30 seconds until it find the RX (the RX must be in Pairing Mode in 30 seconds, see Step 3). If the TX found the RX in 30 seconds and paired, the LED will turn to solid and quit the Pairing Mode, or it will be time out after 30 seconds and turn the Pairing Mode into the Idle Mode.
- 3) Press the RX key long than 10 seconds Until the LED change into flashing fast. Release the key. After this, The RX Module will stay into Pairing Mode for 30 seconds until it find the TX (the TX must be in Pairing Mode, see Step 2) If the RX found the RX in 30 seconds and paired, the LED will turn to solid and quit the Pairing Mode, or it will be time out after 30 seconds and turn the Pairing Mode into the Idle Mode.
- 4) When the TX and the RX are paired, The TX/RX LED will stay in solid .the RX can receive the TX signal.

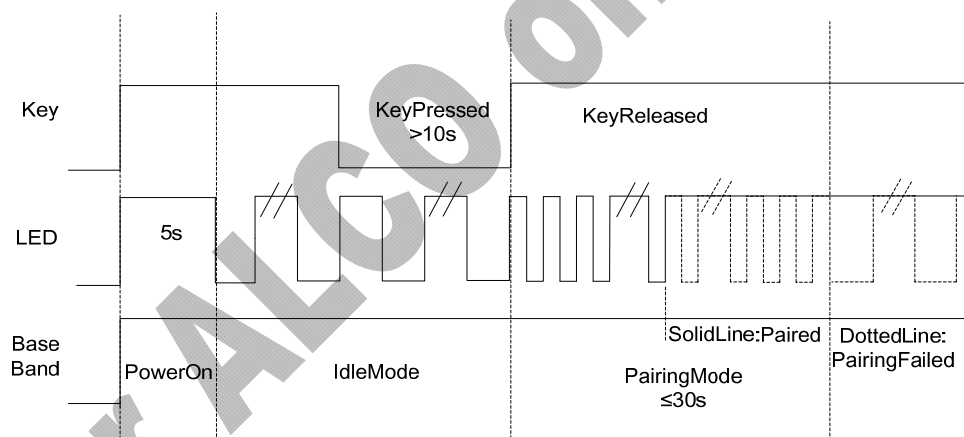


Figure [5]: Key and LED Timing at pairing mode

## 9. Mounting Requirements

GWK5A3T/R is the sensitive RF part. Need to mount them at the corner of the mother circuit board and reserve some keep out space to the components on the mother board. Try to keep them away with metal components like Speakers, Transformers, Batteries, Big Aluminum Capacitors, Heat Sinks and Metal Panels.

The figure below illustrates how to mount the GWK5 module. **Improper mounting will decrease the RF performance dramatically.**

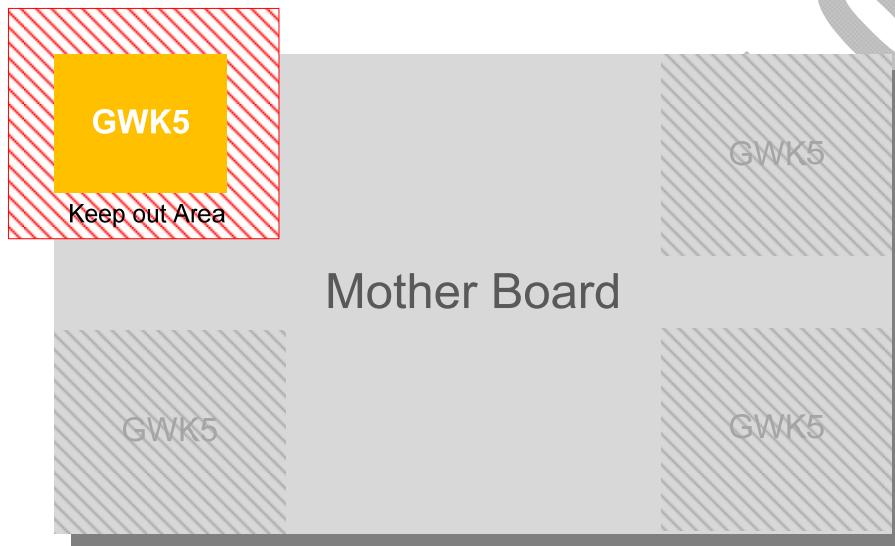


Figure [6]: GWK5A3T/R Mounting Rule

## 10. GWK5A3R Physical Dimension

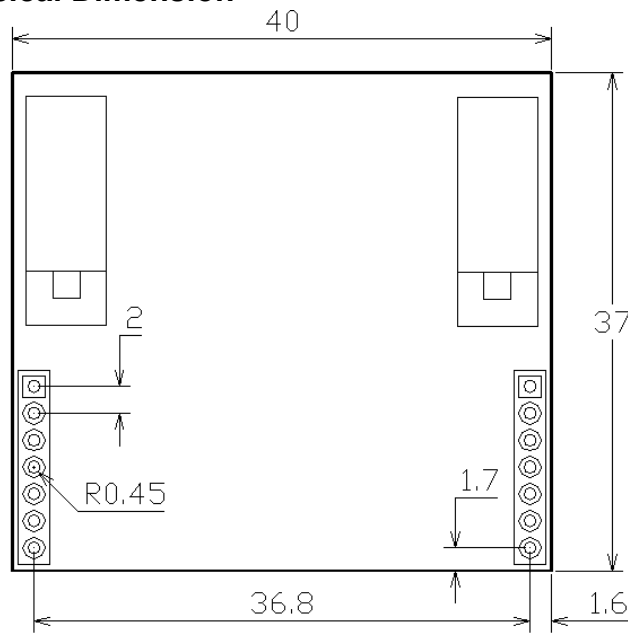
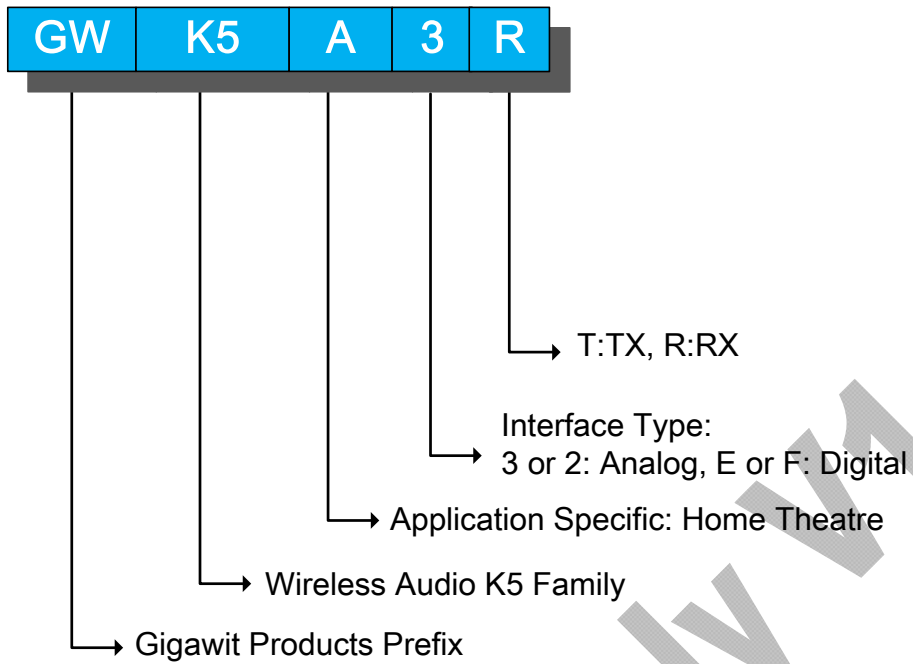


Figure [8]: GWK5A3R Dimension

## 11. Naming Rule



## 12. Ordering Information

Gigawit ID.	Description
GWK5A3T	Wireless Audio Transmitter with Analog Interface
GWK5A3R	Wireless Audio Receiver with Analog Interface

## 13. Contact

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<http://www.gigawit.com>

## 14. Revision History

2012-3-14            Version 1.0, Original version  
2012-04-16        Version 1.01, modify some description about STANDBY PIN

### 1. Typical Application

- 2.4GHz ISM band Communication System
- 2.4GHz Remote Control
- Wireless Keyboard and Mouse
- Wireless Intelligent sports
- Wireless Toy and Gaming
- Wireless Audio/Video Streaming

### 2. General Description

A7125 is a high performance and low cost 2.4GHz ISM band wireless transceiver. It integrates high sensitivity receiver (-90dBm @2Mbps), high efficiency power amplifier (up to 3dBm), frequency synthesizer and base-band modem. In typical system, A7125 is used together with MCU (microcontroller) with very few external passive components. A7125 supports both FIFO mode and direct mode that contains clock recovery circuit CKO pin to MCU.

A7125 supports very fast settling time (90 us) for frequency hopping system. For packet handling, A7125 has built-in separated 64-bytes TX/RX FIFO (could be extended to 256 bytes) for data buffering and burst transmission, CRC for error detection, FEC for 1-bit data correction per code word, RSSI for clear channel assessment, data whitening for data encryption/decryption, thermal sensor for monitoring relative temperature. Those functions are very easy to use while developing a wireless system. All features are integrated in a small QFN 4X4 20 pins package.

A7125's data rate is up to 2Mbps and can be easily programmed to 1Mbps or 2 Mbps via 3-wire or 4-wire SPI bus. For power saving, A7125 supports sleep mode, idle mode, standby mode. For easy-to-use, A7125 has an unique SPI command set called **Strobe command** that are used to control A7125's state machine. Based on Strobe commands, from power saving, TX delivery, RX receiving, channel monitoring, frequency hopping to auto calibrations, MCU only needs to define A7125's control registers and send Strobe commands via SPI bus. In addition, A7125 supports two general purpose I/O pins, GIO1 and GIO2, to inform MCU its status so that MCU could use either polling or interrupt scheme to do radio control. Therefore, it is very easy to monitor transmission between MCU and A7125 because of its digital interface.

### 3. Feature

- Small size (QFN 4X4, 20 pins).
- Support 2400 ~ 2483.5 MHz ISM band.
- FSK modulation.
- Programmable data rate to 1Mbps or 2Mbps.
- Low current consumption: RX 17mA, TX 15.7mA (at 0dBm output power).
- Low sleep current (1.5uA).
- Programmable RF output power -20dBm ~ 3dBm.
- Very High sensitivity (-90dBm@2Mbps, -92dBm@1Mbps).
- On chip regulator, supports input voltage 2.0 ~ 3.6V.
- Easy to use
  - ◆ Support 3-wire or 4-wire SPI.
  - ◆ Unique Strobe command via SPI.
  - ◆ Change frequency channel by ONE register setting.
  - ◆ 8-bits Digital RSSI for clear channel indication.
  - ◆ Fast exchange mode during TRX role switching.
  - ◆ Auto RSSI measurement.
  - ◆ Auto Calibrations.
  - ◆ Auto IF function.
  - ◆ 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.
  - ◆ Easy FIFO / Segment FIFO / FIFO Extension (up to 256 bytes).
  - ◆ Support direct mode with recovery clock output to MCU.
  - ◆ Support direct mode with frame sync signal to MCU.
- Support low cost crystal (6 / 8 / 12 / 16MHz).
- Support low accuracy crystal within  $\pm 50$ ppm.
- Support Auto Frequency Compensation.
- Support crystal sharing, (1 / 2 / 4 / 8MHz) to MCU.
- Fast settling time synthesizer for frequency hopping system.
- Built-in thermal sensor for monitoring relative temperature.
- Built-in Battery Detector.