RAK7213 Datasheet V1.1

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Content

1. General Description

RAK announced a highly integrated with low power low cost module that improves Automatic Speech Recognition (ASR) performance at extended distance with barge-in capability and is optimized for detecting voice commands. The Audio module is specifically designed for set-top boxes and smart speakers, but work equally well in other connected home applications. The module is capable of both voice control and 2-way full duplex audio with voice enhancements such as Acoustic Echo Cancellation (AEC), Noise Reduction (NR) to improve both the intelligibility and subjective quality of voice in harsh acoustic environments.

The module is specifically developed for Set Top Boxes, Smart Speakers, Digital Assistants and Smart Music Box.

2. Features

Features

- DSP with Voice Hardware Accelerator
- SPI or I2C Slave port for host process interface
- Master SPI port for serial Flash interface
- Small size, occupying the least structural space
- Support 2-3 microphone linear arrays for 180degree audio pick up
- Support 3 microphone off-axis or triangular arrays for 360 degree audio pick up
- Full Narrowband and Wideband Acoustic Echo Cancellation (AEC) operation
- Noise reduction
- Far-field microphone processing
- Auto Tuning and Subjective Tuning support
- Configuration parameters allow users to fine tune the overall performance
- Provides visual representations of the audio paths with drop-down menus to program parameters as allowing:
- Control of the audio routing configuration
- Programming of key blocks in the transmit and receive audio paths
- Setting analog and digital gains

3. System Block Diagram

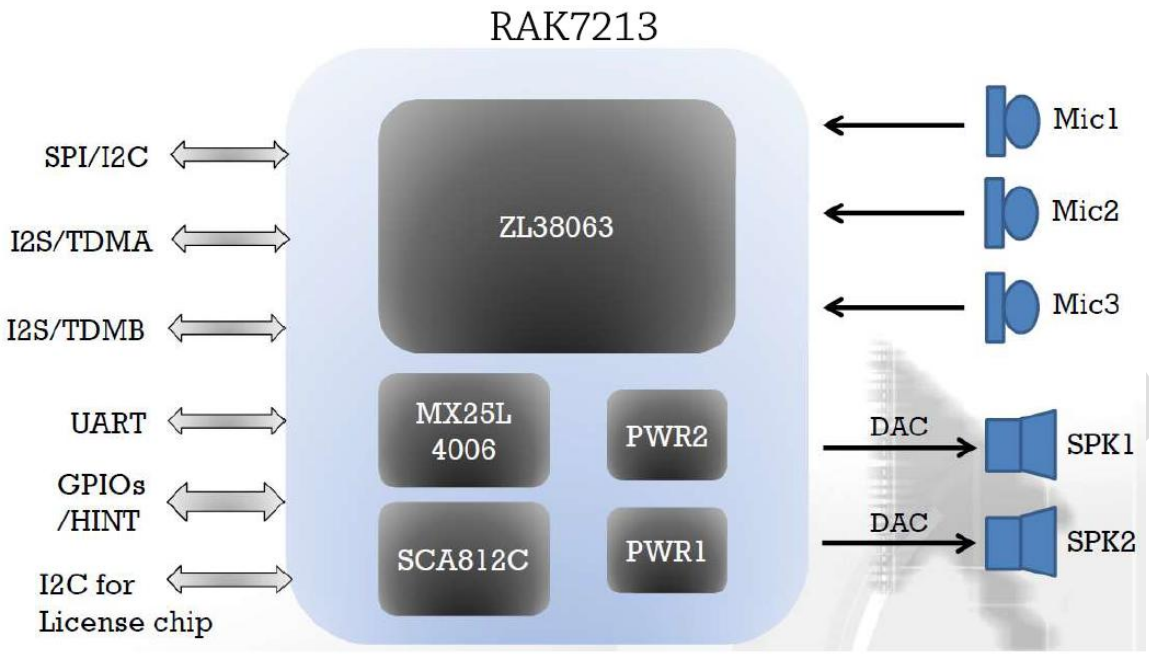


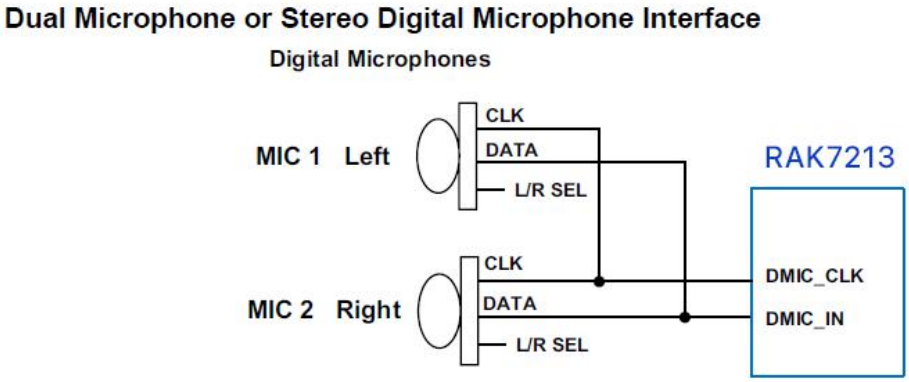
Figure 3-1 System Block Diagram

4. Audio Interfaces

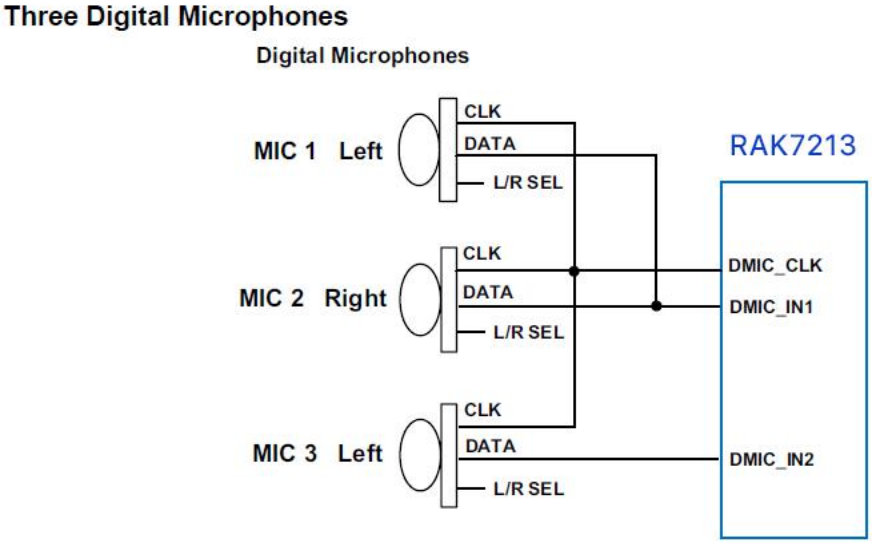
4.1 Digital Microphone Interface

The module of digital microphone clock output (DMIC_CLK) is either 1.024MHz or 3.072MHz depending on the selected TDM-A sample rate. Selecting an 8KHz or 16KHz TDM-A sample rate corresponds to a 1.024MHz digital microphone clock and selecting a 48KHz sample rate corresponds to a 3.072MHz digital microphone clock. Microphone data is decimated and filtered to operate at the 8KHz or 16KHz sample rate of the audio processing block. When there is no TDM-A bus to set the sample rate, the module will operate form the crystal and will pass digital audio form the microphone operating at the 48KHz sampling rate.

Dual Microphone topologies as following figure.

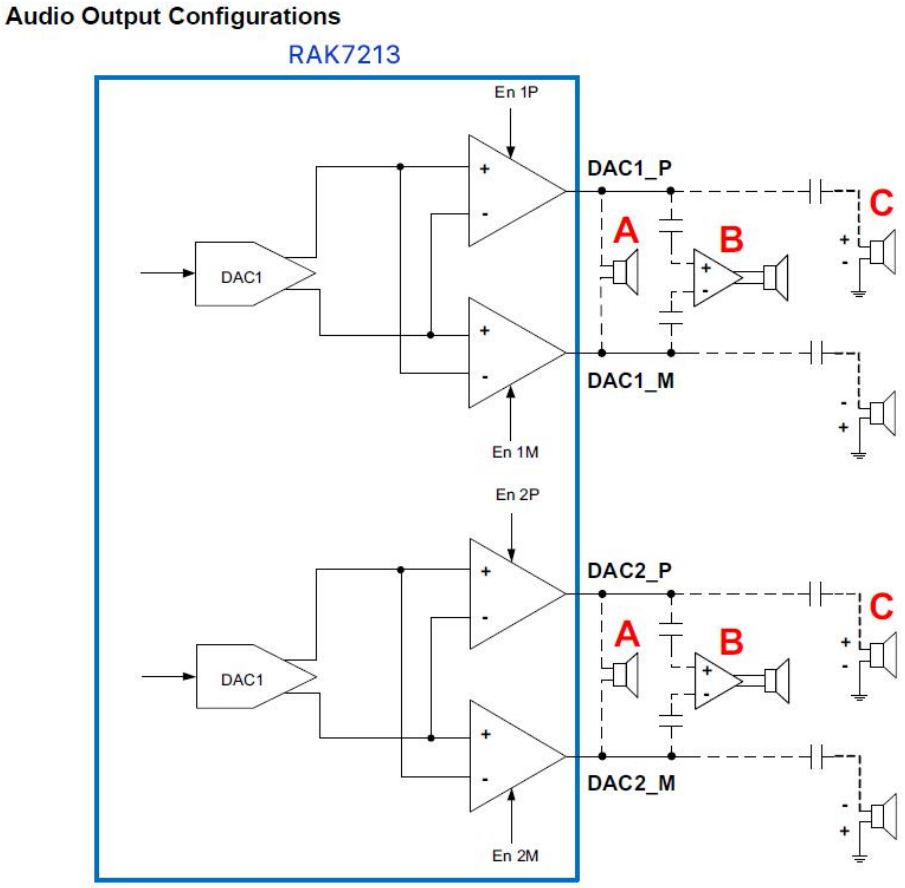


Three Microphone topologies as following figure.



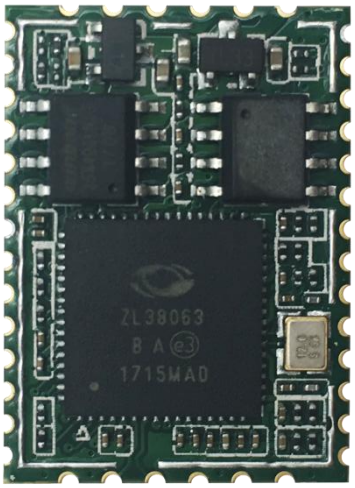
4.2 DAC Output

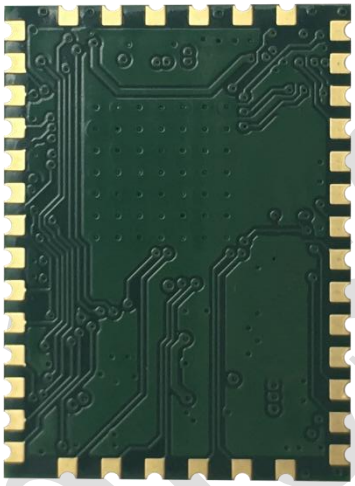
The Two Way Voice Communication Mode supports two 16 bit fully differential delta-sigma digital to analog converters. The two output DACs can driver 2 outputs either single ended or differential. Four analog gain settings on each DAC output are provides and can be set to: 1x, 0.5x, 0.333x, or 0.25x.



5. Product Details

5.1 Product Picture



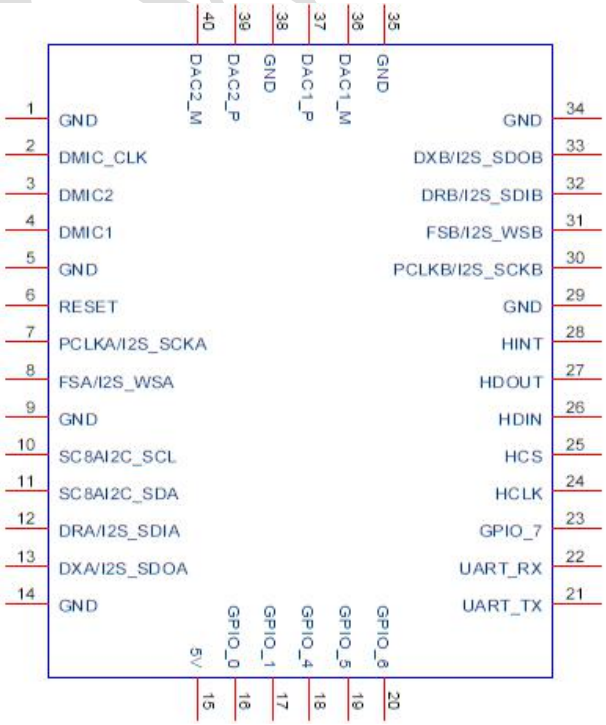


Top View	Bottom View

Figure 4-1 Product Picture

5.2 Pin Outline

<TOP VIEW>



5.3 Interface Definition

NO	Name	Type	Description
1	GND	—	Ground connections
2	DMIC_CLK	O	Clock output for digital microphones
3	DMIC2	I	Digital microphone2 input
4	DMIC1	I	Digital microphone1 input
5	GND	—	Ground connections
6	RESET	I	Reset pin, 0: device OFF ; 1: device ON
7	PCLKA/I2S_SCKA	I/O	PCM Port A Clock/ I2S Port A Serial Clock
8	FSA/I2S_WSA	I/O	PCM Port A Frame Sync/ I2S Port A Word Select
9	GND	—	Ground connections
10	SC8AI2C_SCL	I	Serial Clock
11	SC8AI2C_SDA	I/O	Serial Address/Data I/O
12	DRA/I2S_SDIA	I	PCM Port A Serial Data Stream Input/ I2S Port A Serial Data Input
13	DXA/I2S_SDOA	O	PCM Port A Serial Data Stream Output/ I2S Port A Serial Data Output
14	GND	—	Ground connections
15	5V	P	Main Power 5V input
16	GPIO_0	I/O	GPIO
17	GPIO_1	I/O	GPIO
18	GPIO_4	I/O	GPIO
19	GPIO_5	I/O	GPIO
20	GPIO_6	I/O	GPIO
21	UART_TX	O	UART Transmit serial data output
22	UART_RX	I	UART Receive serial data input
23	GPIO_7	I/O	GPIO
24	HCLK	I	HBI SPI Slave Port Clock Input
25	HCS	I	HBI SPI Slave Chip Select Input
26	HDIN	I	HBI SPI Slave Port Data Input
27	HDOUT	I/O	HBI SPI Slave Port Data Output
28	HINT	O	HBI Interrupt Output
29	GND	—	Ground connections
30	PCLKB_I2S_SCKB	I/O	PCM Port B Clock/ I2S Port B Serial Clock
31	FSB_I2S_WSB	I/O	PCM Port B Frame Sync/ I2S Port B Word Select
32	DRB/I2S_SDIB	I	PCM Port B Serial Data Stream Input/ I2S Port B Serial Data Input
33	DXB/I2S_SDOB	O	PCM Port B Serial Data Stream Output/

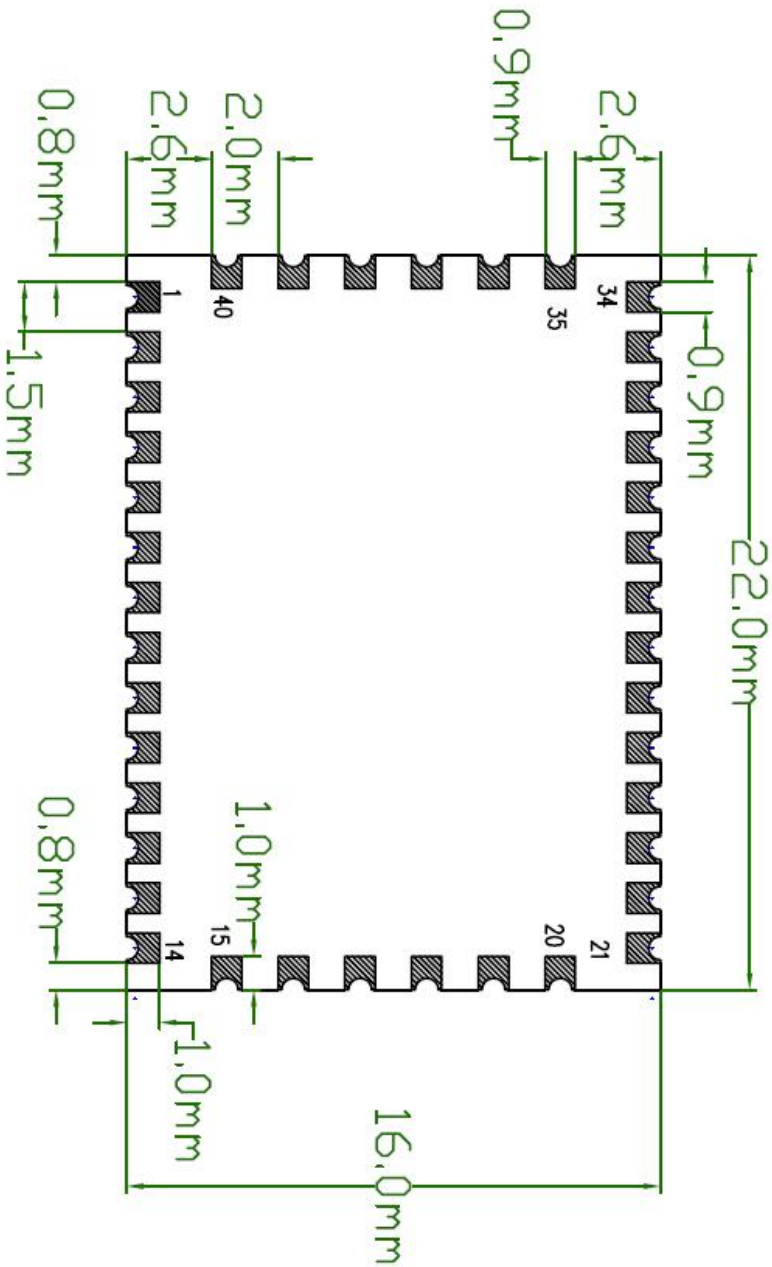
			I2S Port B Serial Data Output
34	GND	—	Ground connections
35	GND	—	Ground connections
36	DAC1_M	O	DAC1 Minus output
37	DAC1_P	O	DAC1 Plus output
38	GND	—	Ground connections
39	DAC2_P	O	DAC2 Plus output
40	DAC2_M	O	DAC2 Minus output

6. General Specification

6.1 Physical Dimensions

(Unit: mm)

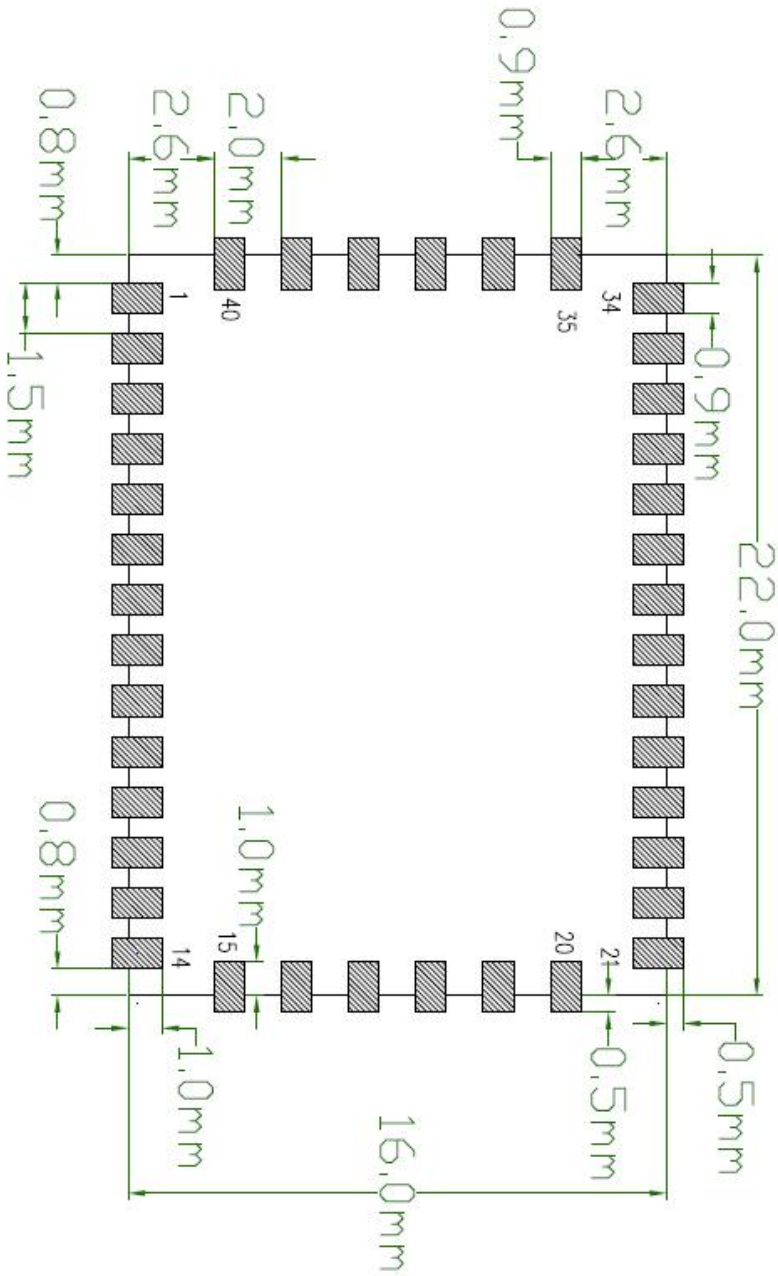
< TOP VIEW >



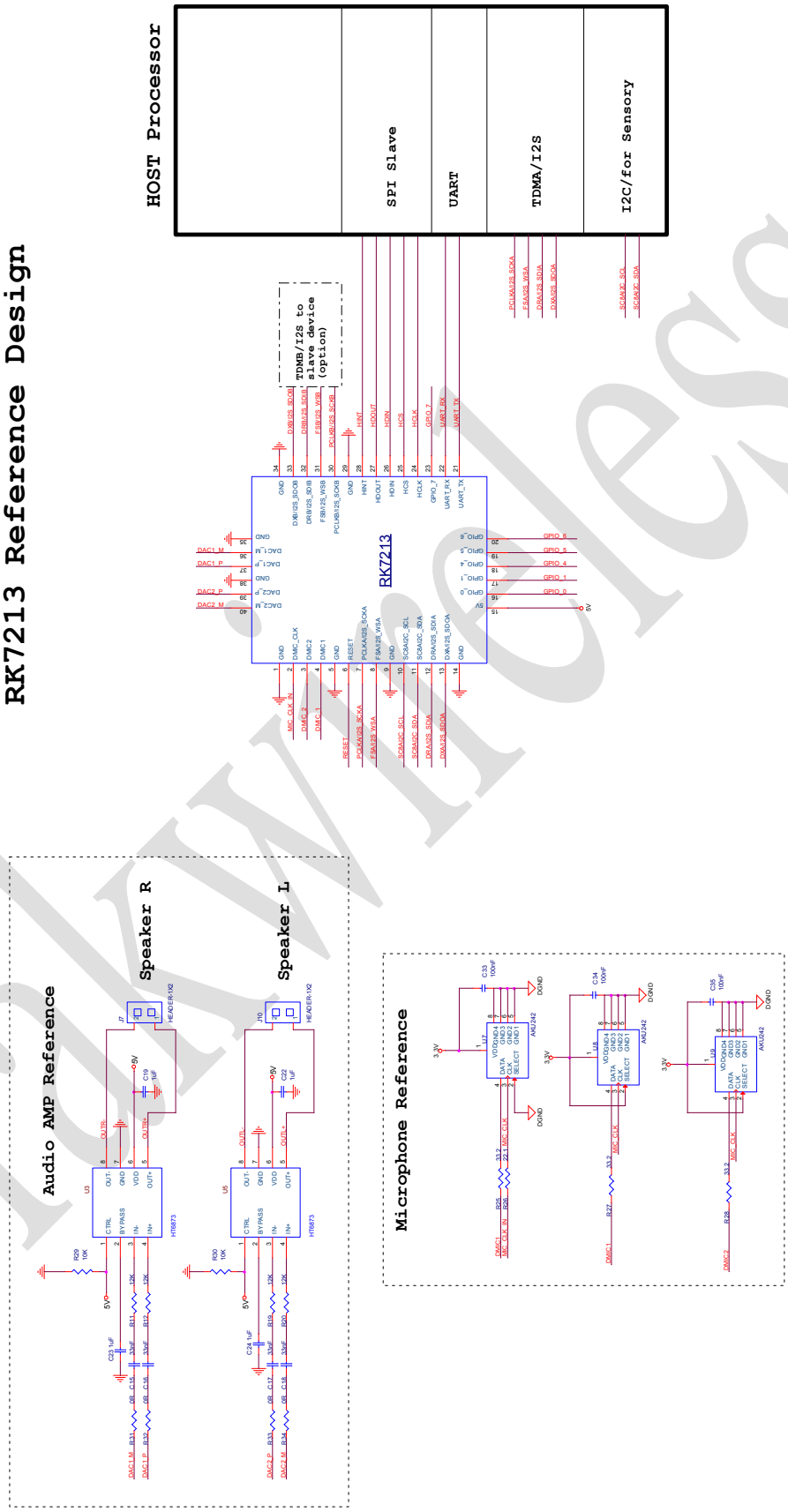
6.2 Layout Recommendation

(Unit: mm)

< TOP VIEW >



6.3 Reference Design

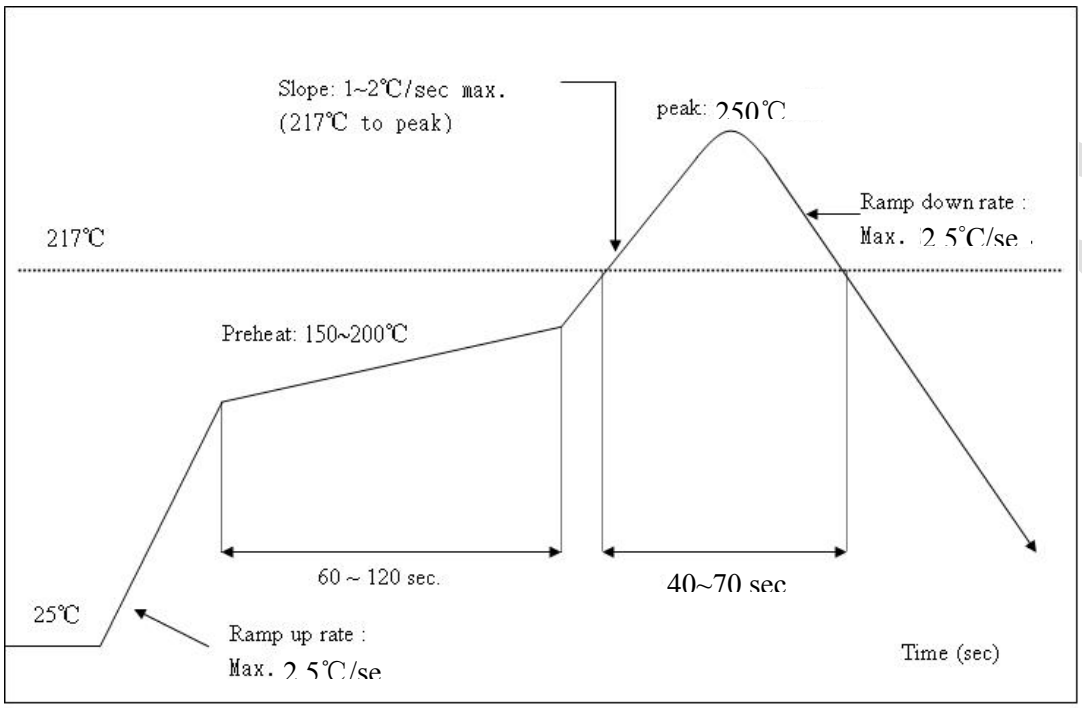


7. Recommended Reflow Profile

Referred to IPC/JEDEC standard.

Peak Temperature : <250°C

Number of Times : ≤2 times



8. Contact information

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9. Change Note

Version	Data	Change
V1.0	2017-11-24	Creator Document
V1.1	2017-12-18	Add Reference Design