

RAiO

RA8906

**8-Bit
Micro-Controller**

Version 2.1

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RAiO Technology Inc.

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Overview

The RA8906 is an 8-bit downloadable micro-controller with 64K-byte embedded Flash ROM. It supports multiple timer/counter sources, versatile interrupt-handling architecture and two built-in DAC's (Digital-to-Analog Converters). It provides a complete speech interface and 32K-bps ADPCM solution that make this chip an excellent choice as the embedded micro-controller for educational game or toy speech products.

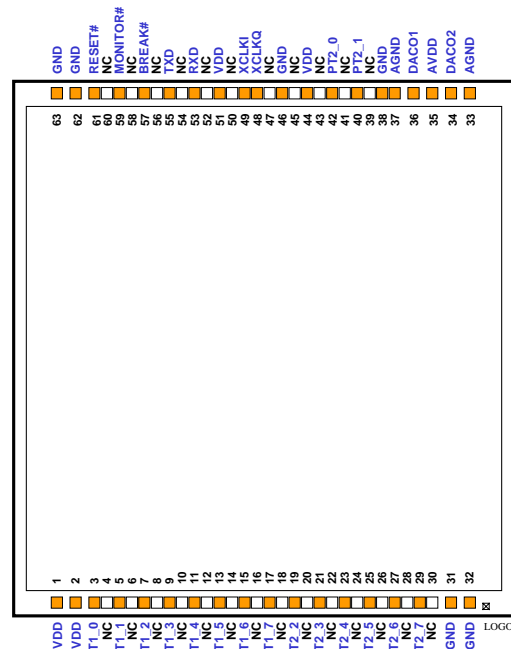
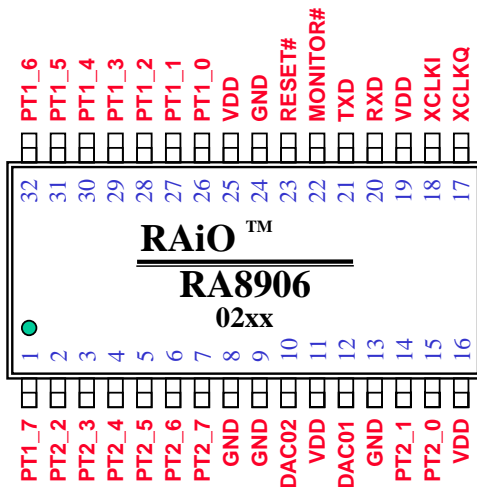
The built-in 4K-bytes ROM support the on-chip RAiO ICE Monitor program which controls the UART and enables the RS232 connection between the RA8906 and a PC host. The RA8906 support the ISP(In-System Programming) and ISD(In-System Debugging) functions. Users can download their programs as well as data from a PC host to the embedded Flash ROM of RA8906.

RAiO also support a windows based ICE driver for customers to very easy programming & debugging their program. Using RS232 connection between a speech toy to a PC host running RAiO's download utility program, toy makers are able to implement the Internet Game/Speech download features easily and give the toys multiple attractive characteristics.

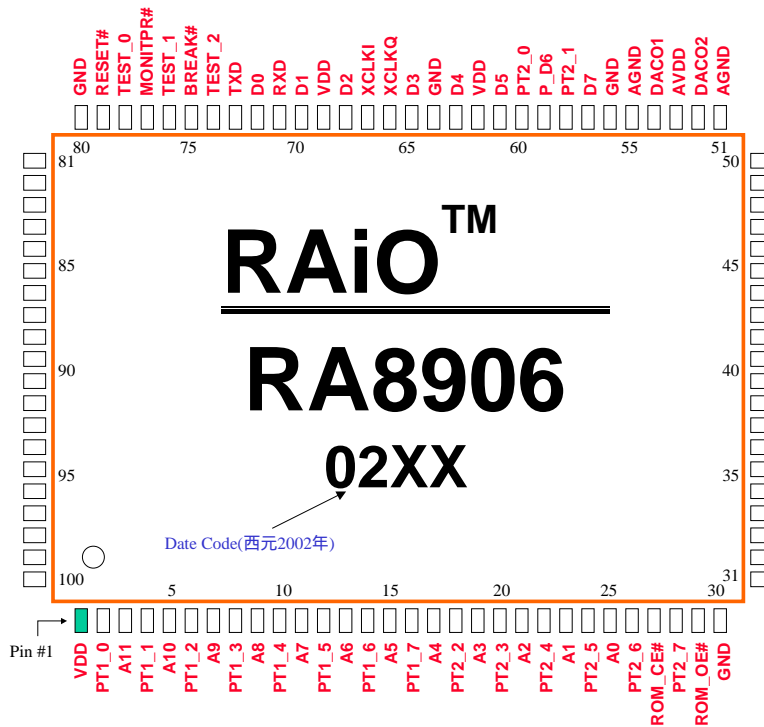
Feature

- ◆ 8-bit Micro Processor
- ◆ 64K-byte Embedded Flash ROM
- ◆ 80-byte User SRAM
- ◆ Two 8-bit General Purpose I/O Ports
- ◆ Three 12-bit Timers
- ◆ Three Fixed Time-Bases (2KHz, 500Hz, 62Hz)
- ◆ Two 8-bit Current Mode DACs
- ◆ Support One Watch Dog Timer
- ◆ Low Power Consumption at Sleep Mode
- ◆ On-Chip ICE and ISP(In-System Programming) Supporting Programs.
- ◆ Support 32K bps ADPCM Solution
- ◆ Operating Voltage: 4.5V ~ 6V
- ◆ System Clock: 2/4/6MHz

Package/Die Form



Package (PQFP-100Pin)

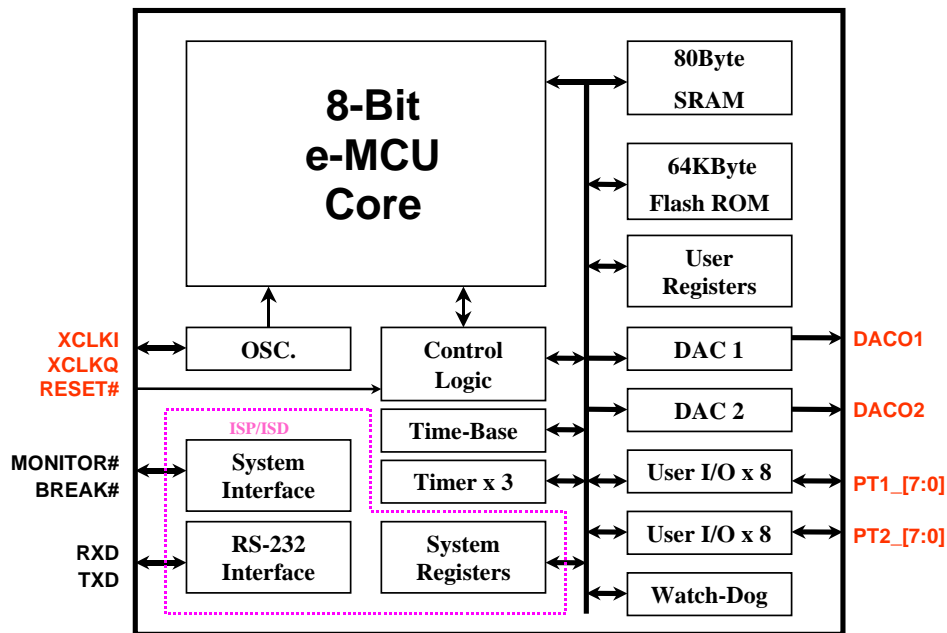


PAD X/Y Coordinate

| Order | PIN Name | X | Y |
|-------|----------|----------|----------|
| 1 | VDD | -1509.25 | -2084.50 |
| 2 | VDD | -1369.75 | -2084.50 |
| 3 | PT1_0 | -1230.25 | -2084.50 |
| 5 | PT1_1 | -1047.25 | -2084.50 |
| 7 | PT1_2 | -864.25 | -2084.50 |
| 9 | PT1_3 | -681.25 | -2084.50 |
| 11 | PT1_4 | -498.25 | -2084.50 |
| 13 | PT1_5 | -315.25 | -2084.50 |
| 15 | PT1_6 | -132.25 | -2084.50 |
| 17 | PT1_7 | 50.75 | -2084.50 |
| 19 | PT2_2 | 233.75 | -2084.50 |
| 21 | PT2_3 | 416.75 | -2084.50 |
| 23 | PT2_4 | 599.75 | -2084.50 |
| 25 | PT2_5 | 782.75 | -2084.50 |
| 27 | PT2_6 | 965.75 | -2084.50 |
| 29 | PT2_7 | 1148.75 | -2084.50 |
| 31 | GND | 1379.75 | -2084.50 |
| 32 | GND | 1519.25 | -2084.50 |

| Order | PIN Name | X | Y |
|-------|----------|----------|---------|
| 33 | AGND | 1570.80 | 2084.50 |
| 34 | DACO2 | 1413.70 | 2084.50 |
| 35 | AVDD | 1270.10 | 2084.50 |
| 36 | DACO1 | 1126.49 | 2084.50 |
| 37 | AGND | 969.40 | 2084.50 |
| 38 | GND | 871.00 | 2084.50 |
| 40 | PT2_1 | 688.00 | 2084.50 |
| 42 | PT2_0 | 505.00 | 2084.50 |
| 44 | VDD | 322.00 | 2084.50 |
| 46 | GND | 139.00 | 2084.50 |
| 48 | XCLKQ | -60.50 | 2084.50 |
| 49 | XCLKI | -180.50 | 2084.50 |
| 51 | VDD | -363.50 | 2084.50 |
| 53 | RXD | -546.50 | 2084.50 |
| 55 | TXD | -729.50 | 2084.50 |
| 57 | BREAK# | -912.50 | 2084.50 |
| 59 | MONITOR# | -1095.50 | 2084.50 |
| 61 | RESET# | -1278.50 | 2084.50 |
| 62 | GND | -1418.00 | 2084.50 |
| 63 | GND | -1557.50 | 2084.50 |

Block Diagram



Pin Description

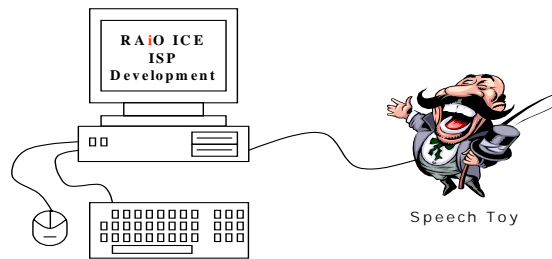
| Signal | I/O | Description |
|------------------------------|-----|--|
| RESET# | IN | External Hardware Reset, active low. This pin is used to reset the system. |
| BREAK# | IN | User Program Break, active low. This signal is used to break the user's program from the ISD mode. |
| MONITOR# | IN | Monitor Program Select, active low. This signal is used to select the system boot from monitor program(ROM) or user program(Flash). This signal has to pull low when user wants to download the data from PC or enter the ISP/ISD mode. |
| PT1_[7:0] | I/O | 8-bit I/O of Port 1. These signals are used as general-purpose I/O port. PT1_[7:0] provide 8mA driving current. |
| PT2_[7:0] | I/O | 8-bit I/O of Port 2. These signals are used as general-purpose I/O port. PT2_[7:2] provide 4mA driving current. PT2_[1:0] provide 16mA driving current. |
| DACO1 DACO2 | OUT | DAC1/2 Current Output. In the DAC mode, this pin is the current output of DAC1 and DAC2. In the PWM mode, this pin is the output of PWM. |
| RXD | IN | Receive Data. This is the received data input of UART. Normally it's connected to the RS232's TX of PC. |
| TXD | OUT | Transmit Data. This signal is the transmitted data output of UART. Normally it's connected to the RS232's RX of PC. |
| XCLKI | IN | Oscillator Input. This is the input signal of internal oscillator. |
| XCLKQ | OUT | Oscillator Output. This is the output signal of internal oscillator. |
| A[11:0] | OUT | Address Bus. These pins are used for external system ROM address. Normally, users will not use these pins. |

| | | |
|-------------------|-----|---|
| D[7:0] | IN | Data Bus. These pins are used for external system ROM data. Normally, users will not use these pins. |
| ROM_CE# | OUT | ROM Chip Enable. These pins are used for external system ROM chip enable. Normally, users will not use these pins. |
| ROM_OE# | OUT | ROM Output Enable. These pins are used for external system ROM output enable. Normally, users will not use these pins. |
| TEST_[2:0] | IN | Test Pins. These are for RAiO's internal testing purpose used in testing IC and ROM status. Normally, users will not use these pins. |
| VDD, AVDD | PWR | Power Supply Voltage and Analog Power Supply Voltage. |
| GND, AGND | PWR | Ground and Analog Ground. |

Development

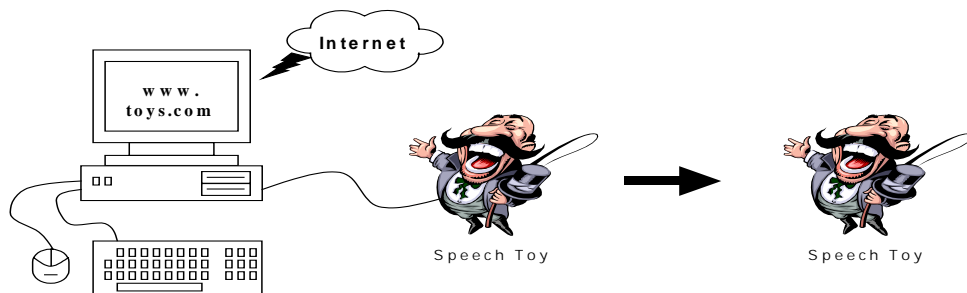
The RA8906 support the ISP(In-System Programming) and ISD(In-System Debugging) functions for customer to develop their system. Users can download their programs as well as data from a PC host to the embedded Flash ROM of RA8906.

-ISP/ISD Mode is entered when the MONITOR# pin having been pulled down to ground voltage level. The on-chip Monitor program together with RAiO's ICE(RICE) Utility Program running on a PC will be executed to support ICE debugging and ISP download of user programs from the PC Host.



Develop Program from ISP Mode
(Customers)

-User Mode is entered when the MONITOR# pin has been pulled up to logic high voltage level. User application programs can be executed only in this mode. The end-user can download the application program or data from the customer's website through the PC interface. Because the program/data was stored in the flash so the application device of customer(such as speech toy) will operate independent that after disconnect with the PC.



Download from Internet
(End-Users)

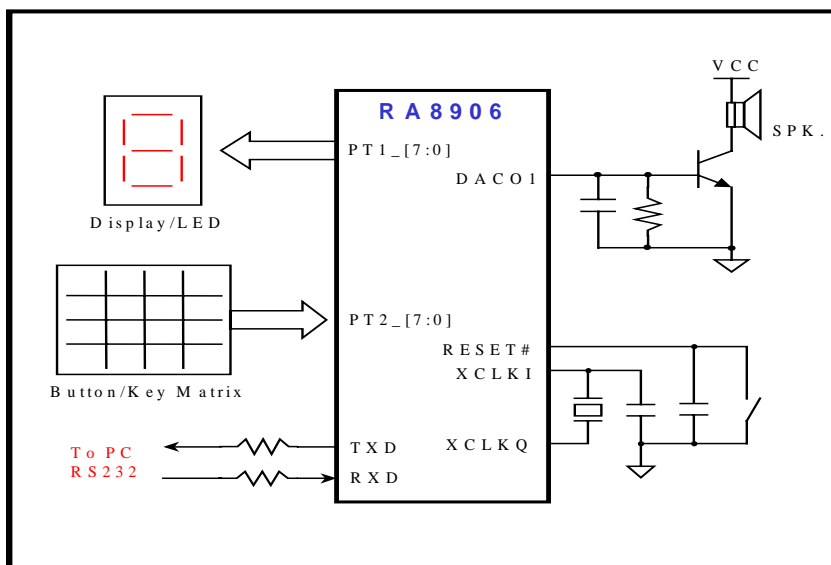
A Portable Speech Toy

RICE-2000 (RICE for short) is a full-completed environment developed by RAiO especially for RA89XX series. The major reason for developing RICE is give fully convenience to program designers who are using RA89XX IC, and let them enjoy consistent and friendly design environment at planning, designing and debugging. In RICE environment, it saves a great deal of developing time by not only providing Editor for users to do direct coding, but also providing many Hot-Key functions for users to do direct compiling, linking, and downloading. Since RA89XX series carry e-MCU micro-processor and a framework of ISP(In-System-Programming), ISD(In-System Debugging), then this simple and reliable environment of RICE can let program designers to proceed design and debug in Real Chip. Moreover, the mass-production ICs is ready for clients to do planning and designing directly without diverse traits happened between developing time and mass production period.

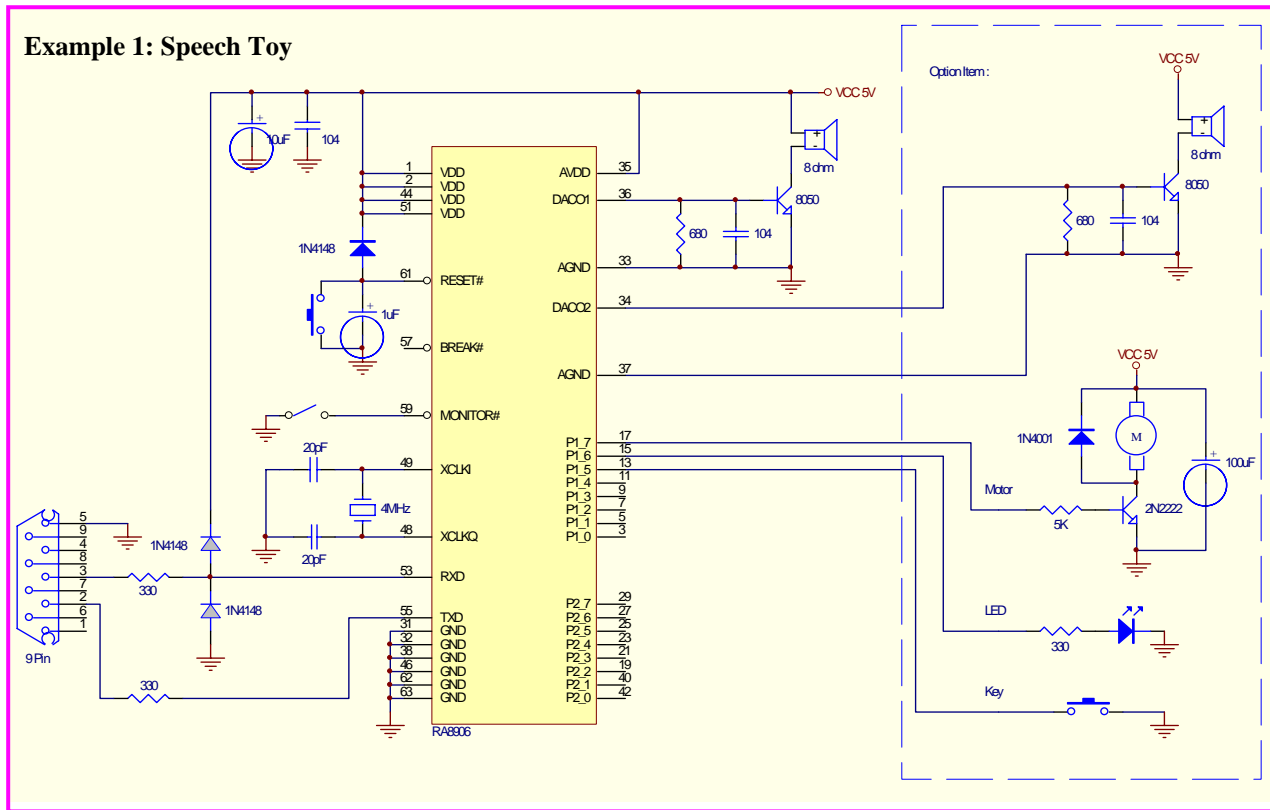
In the meanwhile, in order to support integrated speech interface, RICE provides a solution of 32K-bps ADPCM for programmers to easily combine programs and speech files. If you want to have more information and program design skills of RA8906, please refer to the user manual of RICE-2000.

Application

The following block diagram is the basic application circuit of RA8906. We also give three examples on the user manual of RICE-2000 to let users have more understanding of RA8906 and the develop environment of RICE-2000, and then start to proceed program designing and product developing. The examples have one simple I/O control and two speech samples. Please refer to the user manual of RICE-2000 if you needed.



Example 1: Speech Toy



Example 2: English e-Book

