S E N S O R Y ®

VR Stamp™
With Serial EEPROM
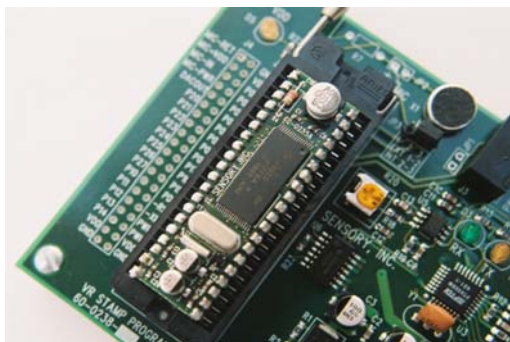## Speech Recognition Module

Data sheet

Description

VR Stamp™ simplifies the design of speech recognition products by integrating all key components into a convenient 40-pin DIP footprint module. A low-noise audio channel and standardized footprint allow rapid prototyping, less debugging and shorter time to market.

Using the VR Stamp™ Toolkit, application programs can be downloaded into the VR Stamp™. VR Stamp™ can then be removed from the VR Stamp Programmer™ and plugged directly into the final product. In-circuit reprogramming is also supported.

VR Stamp™ offers 24 I/O lines, as well as connections for a power, ground, microphone, speaker, and logic-level RS232 interface.

Features

FluentChip™ Capabilities

- Noise-robust Speaker Independent (SI) and Speaker Dependent (SD) recognition
- Many language models now available for international use
- High quality, 2.4-7.8 kbps speech synthesis & sound effects with Sensory "SX" synthesis technology
- Speaker Verification (SVWS) - Noise robust voice biometric security
- 8 voice MIDI-compatible music synthesis
- Audio Wakeup from sleep
- Touch Tone (DTMF) output

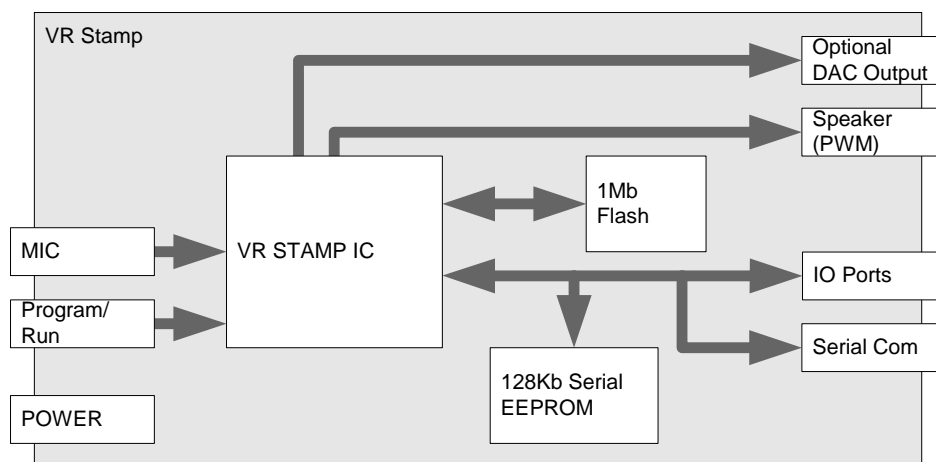### Integrated Solution

- RSC-4128 Speech processor & 1Mbit Flash
- 128Kb serial EEPROM for data
- 14MHz (main) & 32kHz (time keeping) clocks
- 24 I/O lines
- Microphone preamplifier
- Pulse Width Modulator (PWM) for Speaker and optional DAC output

Low Power Requirements

- V_{DD} = 2.70V – 3.6V
- I_{ACT} = 26mA @ 3V (typ. for complete module)
- I_{SLEEP} = <20uA @ 3V (typ. for complete module)

VR Stamp™ Block Diagram

DC Specifications

For details, refer to **RSC-4128 Data Sheet: 80-0206.**

Major Components

U3 *RSC-4128 IC*
The RSC-4128 Integrated Circuit is the central speech processor.

Y1 *Crystal*
A 3.57 MHz crystal drives a 14.3MHz phase lock loop (PLL) in the RSC-4128 to create the system clock. Timer 1 is used for all speech recognition functions, and should only be used by the application programmer who is not using speech recognition. Timer 3 is reserved for the application programmer.

Y2 *Crystal*
A 32.768 KHz crystal establishes the frequency of Timer 2 on the RSC-4128 IC. Timer 2 is useful for timekeeping applications since it is not interrupted, unlike Timer 1.

R4 *Microphone Source (gain) Resistor*
A 1.2K on-board through-hole microphone source resistor is calibrated for use with a microphone with -44dB sensitivity with 2.2K. This satisfies the -49dB system gain.

U2 *1M Bit Flash Memory*
This 1Mb Flash memory stores the application binary code.

U4 *128K Bit Serial EEPROM Memory*
This 128K bit serial EEPROM is designed to store speech templates and application data.

VR Stamp™ Pin Specification

Pin	Description	Pin	Description
1	Microphone Return (Analog GND)	40	GND
2	Microphone VDD	39	VDD
3	Microphone Input	38	P0.7 (Serial EEPROM SDA)
4	Microphone Power	37	P0.6
5	DAC Output	36	P0.5
6	P2.0	35	P0.4 (Serial EEPROM SCL)
7	P2.1	34	P0.3
8	P2.2	33	P0.2 (Serial Com -Shutdown)
9	P2.3	32	P0.1 (Serial Com TXD)
10	P2.4	31	P0.0 (Serial Com RXD)
11	P2.5	30	P1.7
12	P2.6	29	P1.6
13	P2.7	28	P1.5
14	P1.0	27	Power Down (PDN)
15	P1.1	26	-Reset
16	P1.2	25	Program/-Run (-XM)
17	P1.3	24	PWM 1 (Speaker Output)
18	P1.4	23	PWM 0 (Speaker Output)
19	VDD	22	VDD
20	GND	21	GND

Note, P0.4 and P0.7 are used for Serial EEPROM, so they should not be used in applications that use SD recognition.
Note, The default pins used for the Technology debug outputs are P0.0 and P0.1. Although they are configurable in the application, since these pins are already used for downloading the binary, keep these pins for the serial communication is recommended.

Reset (-Reset)
Input. A negative going pulse resets the VR Stamp™.

Program/-Run (-XM)
Input. To run the application, leave this pin unconnected. To download application binary, pull this pin high with a 100 Ohms resistor.

Power Down (PDN)
Output. The Power Down pin is an active high output, and it is controlled by the application firmware.

General Purpose I/O
Bidirectional. VR Stamp™ has 24 general purpose I/O pins. Each line can be programmed as an input with a weak pull-up resistor, input with a strong pull-up resistor, input without pull-ups, or as an output. For more details, refer to **RSC-4128 Data Sheet: 80-0206-x.**

Microphone Ports
Input. VR Stamp™ is designed so that you can use the on-board 1.2K microphone source resistor or external custom microphone source resistor. Use the on-board microphone resistor if the microphone sensitivity provides -49dB system gain with 1.2K. Use the external microphone source resistor otherwise. For more information on microphones, refer to Design Note - Selecting a Microphone: 80-0259.doc.

NOTE: Sleep Current is 100uA (typ.) with a microphone.

Speaker Output (PWM0, PWM1)
Output. PWM ports can be directly connected to the speaker.

DAC Output
Output. An optional DAC output for the speaker is provided. To use DAC output, you need to provide the external audio amplifier. Refer to page 4 of VR Stamp Programmer schematic, 70-0069.

VR Stamp Schematic
Refer to: 70-0066.

Developing VR Stamp Applications

What you can develop with VR Stamp:
- Speaker Independent Recognition
- Speaker Dependant Recognition

What you can not develop with VR Stamp:
- Record and Playback feature

Sample programs in the FluentChip Technology Library are the great places to start. Because VR Stamp's memory size for code is limited to 1Mbit, and there is no data flash for storing the Record and Playback data, not all sample programs can be used with VR Stamp. For this reason, VR Stamp compatible sample programs are listed below.

- clock
- music
- pwrdown
- sdcl
- sdf
- sdws
- sdws4
- svsleep
- svws
- sx
- t2si
- t2simath
- tt
- wdt

The sample programs in FluentChip Technology Library version 1.0 are compatible with the RSC-4x Demo/Evaluation board, 60-0208-x. To run most of sample programs, you need to connect switches and LEDs to the port 1 of VR Stamp. For more details on connections, refer to the sample schematic, 70-0070-x.

Creating SI Recognition Sets and Speech Files
For creating SI recognition sets, use "Quick T2SI™ (Pat. Pending) Toolkit".
For creating speech files, use "Quick Synthesis 4™ Toolkit".

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The Interactive Speech™ Product Line

The Interactive Speech line of ICs and software was developed to "bring life to products" through advanced speech recognition and audio technologies. The Interactive Speech Product Line is designed for consumer telephony products and cost-sensitive consumer electronic applications such as home electronics, personal security, and personal communication. The product line includes the award-winning RSC-4x general-purpose microcontrollers and tools, the SVC line of speaker verification chips, the SC series of speech and music synthesis microcontrollers, and our suite of software development kits designed to run on non-Sensory processors and DSP's supporting most popular operating systems.

RSC Microcontrollers and Tools

The RSC product line contains low-cost 8-bit speech-optimized microcontrollers designed for use in consumer electronics. All members of the RSC family are fully integrated and include A/D, pre-amplifier, D/A, ROM, and RAM circuitry. The RSC family can perform a full range of speech/audio functions including speech recognition, speaker verification, speech and music synthesis, and voice record/playback. The family is supported by a complete suite of evaluation tools and development kits.

SVC Microcontrollers and Tools

The SVC product line combines text-dependent speaker verification password biometrics with low-cost 8-bit microcontrollers designed for use in consumer electronics. All members of the SVC family are fully integrated for speech applications and include A/D, pre-amplifier, D/A, ROM, and RAM circuitry. The SVC family performs noise robust speaker verification password security functions and speech synthesis. The family is supported by a complete suite of evaluation tools and development kits.

SC Microcontrollers and Tools

The SC-6x product line features the highest quality speech synthesis ICs at the lowest data rate in the industry. The line includes a 12.32 MIPS processor for high-quality low data-rate speech compression and MIDI music synthesis, with plenty of power left over for other processor and control functions. Members of the SC-6x line can store as much as 37 minutes of speech on chip and include as much as 64 I/O pins for external interfacing. Integrating this broad range of features onto a single chip enables developers to create products with high quality, long duration speech at very competitive price points.

FluentSoft™ Technology

FluentSoft™ Recognizer is the engine powering the FluentSoft™ SDK. It provides noise and echo cancellation, performs word spotting for natural language usage; offers telephone barge-in; and provides continuous digit recognition. This small footprint software recognizes up to 50,000 words, runs on non-Sensory processors including Intel XScale and ARM9 platforms, and supports operating systems such as Windows and Linux.

FluentSoft™ Animated Speech offers animated avatars with advanced speech recognition and synthesis capabilities for use in Smart Phones and Kiosk applications. Facial expressions can be configured for different emotions, and the technology offers text-to-speech synthesis in either male or female voices.

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