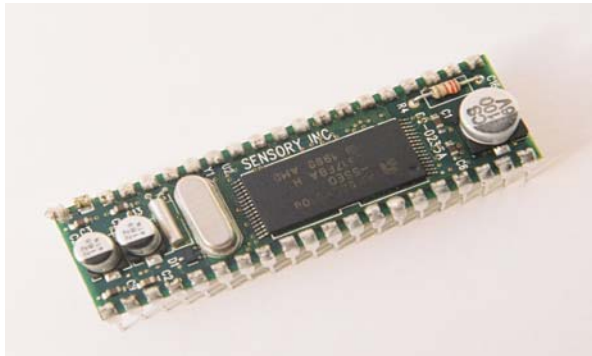


Description

Sensory's **RSC-4x Rapid Prototyping Module** (RSC-4x RPM) simplifies prototyping of products featuring speech technologies by integrating key components into a convenient 40-pin DIP footprint module. With the RSC-4x RPM's 32Mbit Flash



memory, Sensory's entire FluentChip™ library can be utilized including Record and Playback, along with lots of extended speech. The RPM is a prototyping tool designed for developers who will be creating product system designs that feature RSC-4x processor chips.

Using the Module Programming Board (MPB), developers can download application programs into the RSC-4x RPM. The module can then be removed from the MPB and plugged directly into the prototype for real world testing. In-circuit reprogramming is also supported.

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
- ▶ Speech with "SXL" compression
- ▶ Speaker Verification Word Spot (SVWS) - Noise robust voice biometric security
- ▶ 8 voice MIDI-compatible music synthesis
- ▶ Audio Wakeup from sleep
- ▶ Touch Tone (DTMF) output
- ▶ Record and Playback (RP)

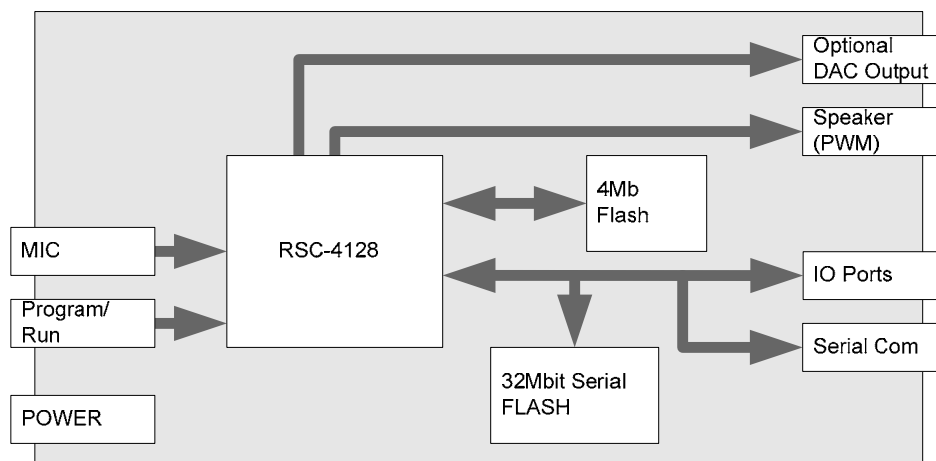
Integrated Solution

- ▶ RSC-4128 Speech processor & 4Mbit Flash
- ▶ 32Mbit serial Flash 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

- ▶ $V_{DD} = 3.0V - 3.6V$
- ▶ $I_{ACT} = 26mA @ 3V$ (typ. for complete module)
- ▶ $I_{SLEEP} = <20\mu A @ 3V$ (typ. for complete module)

RSC-4x RPM Block Diagram



DC Specifications

For details, refer to [RSC-4128 Datasheet \(80-0206\)](#).

Major Components

U3 RSC-4128 IC

An 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 1.8K on-board through-hole microphone source resistor is calibrated for use with a microphone with -44dB sensitivity with 2.2K. This satisfies the -46dB system gain.

U2 4M Bit Flash Memory

This 4Mb Flash memory stores the application binary code.

U4 32M Bit Serial Flash Memory

This 32M bit Serial Flash is designed to store speech templates, Record and Playback data, and application data.

RSC-4x RPM Pin Specification

Pin	Description	Pin	Description
1	Microphone Return (Analog GND)	40	GND
2	Microphone VDD	39	VDD
3	Microphone Input	38	P0.7
4	Microphone Power	37	P0.6 (Serial Flash SO)
5	DAC Output	36	P0.5 (Serial Flash SI)
6	P2.0	35	P0.4 (Serial Flash Clock)
7	P2.1	34	P0.3 (Serial Flash -CE)
8	P2.2	33	P0.2
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: P0.3, P0.4, P0.5 and P0.6 should be reserved for accessing SD/SV recognition and RP data stored in Serial Flash memory.

Note: P0.0 and P0.1 are used for serial download of the binary. P0.1 is also the default pin for output of diagnostic information. Another input pin needs to be assigned as a DiagEnable pin; at reset, diagnostic output is enabled if the pin is low and disabled if the pin is high. After reset, the pin can be used for other purposes.

Reset (-Reset)

Input: A negative going pulse resets the RSC-4x RPM.

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: The RSC-4x RPM 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 the [RSC-4128 Datasheet \(80-0206\)](#).

Microphone Ports

Input: The RSC-4x RPM 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 \(80-0259\)](#).

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.

RSC-4x RPM Schematic

Refer to: [RSC-4x RPM Schematic \(70-0068\)](#).

Developing RSC-4x RPM Applications

What you can develop with the RSC-4x RPM:

- ▶ Speaker Independent Recognition
- ▶ Speaker Dependent Recognition
- ▶ Speaker Verification
- ▶ Record and Playback
- ▶ Speech with SXL compression

Sample Programs

Sample programs in the FluentChip™ Technology Library are a great place to start. Please refer to the [Module Programmer Board Manual \(80-0294\)](#) for the complete list of supported samples.

Creating SI Recognition Sets and Speech Files

For creating Speaker Independent recognition sets, use “Quick T2SI™ (Pat. Pending)”

For creating speech files, use “QuickSynthesis™ 4”

SENSORY Software End User License Agreement

Important: this software end user license agreement ("EULA") is a legal agreement between you and Sensory. Read it carefully before completing the installation process and using the software. It provides a license to use the software and contains warranty information and liability disclaimers. By installing and using the software, you are confirming your acceptance of the software and agreeing to become bound by the terms of this agreement. If you do not agree to be bound by these terms, then select the "cancel" button and do not install the software.

1. Definitions

- (a) "Sensory" means Sensory, Inc. and its suppliers and licensors, if any.
- (b) "Not For Resale (NFR) Version" means a version of the Software, so identified, to be used to review and evaluate the Software, only.
- (c) "Software" means the software program supplied by Sensory herewith, which may also include documentation, associated media, printed materials, and online and electronic documentation.

2. License

This EULA allows you to:

- (a) Install and use the Software on a single computer; OR install and store the Software on a storage device, such as a network server, used only to run or install the Software on your other computers over an internal network, provided you have a license for each separate computer on which the Software is installed or run from the storage device. A license for the Software may not be shared or used concurrently on different computers.
- (b) Make one copy of the Software in machine-readable form solely for backup purposes. You must reproduce on any such copy all copyright notices and any other proprietary legends on the original copy of the Software.

3. License Restrictions

- (a) Other than as set forth in Section 2, you may not make or distribute copies of the Software, or electronically transfer the Software from one computer to another or over a network.
- (b) You may not decompile, reverse engineer, disassemble, or otherwise reduce the Software to a human-perceivable form.
- (c) You may not sell, rent, lease, transfer or sublicense the Software.
- (d) You may not modify the Software or create derivative works based upon the Software.
- (e) You may not export the Software into any country prohibited by the United States Export Administration Act and the regulations there under
- (f) In the event that you fail to comply with this EULA, (1) Sensory may terminate the license and you must destroy all copies of the Software, and (2) You may be held liable for any claims by or damage to Sensory, Inc., whether incidental or consequential.

4. Upgrades

If this copy of the Software is an upgrade from an earlier version of the Software, it is provided to you on a license exchange basis. You agree by your installation and use of this copy of the Software to voluntarily terminate your earlier EULA and that you will not continue to use the earlier version of the Software or transfer it to another person or entity.

5. Ownership

The foregoing license gives you limited rights to use the Software. Sensory and its suppliers retain all right, title and interest, including all copyrights, in and to the Software and all copies thereof. All rights not specifically granted in this EULA, including Federal and International Copyrights, are reserved by Sensory and its suppliers.

6. Limited warranty and disclaimer

- (a) Limited warranty. Sensory warrants that, for a period of ninety (90) days from the date of delivery (as evidenced by a copy of your receipt): (i) when used with a recommended hardware configuration, the software will perform in substantial conformance with the documentation supplied with the software; and (ii) that the physical media on which the software is furnished will be free from defects in materials and workmanship under normal use.
- (b) No other warranty, except as set forth in the foregoing limited warranty, Sensory and its suppliers disclaim all other warranties, either express or implied, or otherwise including the warranties of merchantability and fitness for a particular purpose. Also, there is no warranty of noninfringement, title or quiet enjoyment. If applicable law implies any warranties with respect to the software, all such warranties are limited in duration to ninety (90) days from the date of delivery. No oral or written information or advice given by Sensory, its dealers, distributors, agents or employees shall create a warranty or in any way increase the scope of this warranty.
- (c) Some states (USA only) do not allow the exclusion of implied warranties, so the above exclusion may not apply to you. This warranty gives you specific legal rights and you may also have other legal rights that vary from state to state.

7. Exclusive Remedy

Your exclusive remedy under Section 6 is to return the Software to the place you acquired it, with a copy of your receipt and a description of the problem. Sensory will use reasonable commercial efforts to supply you with a replacement copy of the Software that substantially conforms to the documentation, provide a replacement for defective media, or refund to you your purchase price for the Software, at its option. Sensory shall have no responsibility if the Software has been altered in any way, if the media has been damaged by accident, abuse or misapplication, or if the failure arises out of use of the Software with other than a recommended hardware configuration.

8. Limitation of liability.

- (a) Neither Sensory nor its suppliers shall be liable to you or any third party for any indirect, special, incidental or consequential damages (including damages for loss of business, loss of profits, business, interruption or the like), arising out of the use or inability to use the software or this EULA based on any theory of liability including breach of contract, breach of warranty, tort (including negligence), product liability or otherwise, even if Sensory or its representatives have been advised of the possibility of such damages and even if a remedy set forth herein is found to have failed of its essential purpose.
- (a) Sensory's total liability to you for actual damages for any cause whatsoever will be limited to the greater of \$500 us dollars or the amount paid by you for the software that caused such damage.
- (b) (USA only) some states do not allow the limitation or exclusion of liability for incidental or consequential damages, so the above limitation or exclusion may not apply to you and you may also have other legal rights that vary from state to state.

9. Basis of Bargain

The Limited Warranty, Exclusive Remedies and Limited Liability set forth above are fundamental elements of the basis of the agreement between Sensory and you. Sensory would not be able to provide the Software on an economic basis without such limitations.

10. U.S. GOVERNMENT RESTRICTED RIGHTS LEGEND

This Software and the documentation are provided with "RESTRICTED RIGHTS". Use, duplication, or disclosure by the U.S. Government is subject to restrictions as set forth in this EULA and as provided in DFARS 227.7202-1(a) and 227.7202-3(a) (1995), DFARS 252.227-7013 (c)(1)(ii)(OCT 1988), FAR 12.212(a)(1995), FAR 52.227-19, or FAR 52.227-14, as applicable. Manufacturer: Sensory, Inc., 575 N. Pastoria Ave. Sunnyvale, CA 94085.

11. Consumer End Users Only (outside of the USA)

The limitations or exclusions of warranties and liability contained in this EULA do not affect or prejudice the statutory rights of a consumer, i.e., a person acquiring goods otherwise than in the course of a business.

12. General Provisions

This EULA shall be governed by the internal laws of the State of California. This EULA contains the complete agreement between the parties with respect to the subject matter hereof, and supersedes all prior or contemporaneous agreements or understandings, whether oral or written. All questions concerning this EULA shall be directed to: Sensory, Inc., 575 N. Pastoria Ave. Sunnyvale, CA 94085, attention: General Counsel.

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. It is designed for cost-sensitive consumer-electronic applications such as home electronics, home automation, toys, and personal communication. The product line includes the award-winning RSC-4x general-purpose microcontrollers and tools, the *VR Stamp™* 40 pin DIP module and tools, the SC series of speech and music synthesis microcontrollers. Our suite of software development kits are designed to run on non-Sensory processors and DSP's, and support most popular operating systems.

RSC Microcontrollers and Tools

The RSC product family 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 recording/playback. The family is supported by a complete suite of evaluation and development toolkits.

Speech Recognition Modules and Tools

The VR Stamp™ is a complete speech recognition module based on the RSC-4x and is ideal for fast design and easy production. A low-noise audio channel and standardized 40-pin DIP footprint allow rapid prototyping, less debugging, and shorter time to market. The *VR Stamp Toolkit* includes everything needed to get started today, including VR Stamps, Module Programming Board, sample applications, and a complete set of development tools featuring the Phyton IDE and limited-life C compiler, QuickSynthesis™ 4 and Quick T2SI-Lite™ speech tools.

SC Microcontrollers and Tools

The SC-6x product family 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 processing and control functions. Members of the SC-6x line can store as much as 37 minutes of speech on-chip and include as many as 64 I/O pins for external interfacing. Integrating this broad range of features into 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 a noise-robust, large-vocabulary, speaker-independent solution with continuous digit recognition and word-spotting capabilities. This small-footprint software recognizes up to 5,000 words; runs on non-Sensory processors including Intel XScale, TI OMAP, and ARM9 platforms; and supports operating systems such as MS Windows, Linux, and Symbian.

3Dmsg™ Technology

3Dmsg's (www.3Dmsg.com) Animated Speech technology offers animated avatars with advanced speech recognition and synthesis capabilities for use in smartphones, language trainers, and kiosk applications. Facial expressions can be configured to show emotions and lip synchronization can be automatically driven from voice or text data.

Important notices:

Sensory Incorporated (Sensory, Inc.) reserves the right to make changes, without notice, including circuits, standard cells, and/or software, described or contained herein in order to improve design and/or performance. Sensory, Inc. assumes no responsibility or liability for the use of any of these products, conveys no license or title under any patent, copyright, or mask work right to these products, and makes no representations or warranties that these products are free from patent, copyright, or mask work right infringement, unless otherwise specified. Applications that are described herein for any of these products are for illustrative purposes only. Sensory, Inc. makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Safety Policy:

Sensory, Inc. products are not designed for use in any systems where malfunction of a Sensory, Inc. product can reasonably be expected to result in a personal injury, including but not limited to life support appliances and devices. Sensory, Inc. customers using or selling Sensory Incorporated products for use in such applications do so at their own risk and agree to fully indemnify Sensory, Inc. for any damages resulting from such improper use or sale.



575 N. Pastoria Ave., Sunnyvale, CA 94085
Tel: (408) 625-3300 Fax: (408) 625-3350

© 2006 SENSORY, INC. ALL RIGHT RESERVED.
Sensory is registered by the U.S. Patent and
Trademark Office.

All other trademarks or registered trademarks are the
property of their respective owners.