



I. Introduction

This document is a checklist of the steps involved in creating mask-programmed RSC-4x ICs and mass-programmed NLP-5x die IC by Sensory. It is intended to guide developers, especially first-timers who may be unfamiliar with the process, through the steps involved in creating new mask and mass programmed parts.

It is very important that these steps be done in a timely order to avoid delays in releasing the product to the market.

II. Sensory ROM Mask and Mass Programming Team

The Sensory ROM Mask and Mass Programming Team are responsible for creating custom ICs for our customers. The team includes the following members:

- A. Sales Admin – Oversees the entire process and is the main liaison between Sensory and the Customer,
- B. Project Manager – Manages the development cycle jointly with the customer's internal project manager.
- C. Review Engineer – Handles the pre-production design review of the customer's application.
- D. Mask Engineer – Provides the part number used when ordering custom ICs, checks and pre-processes the customer's binary file, sends counter code back to the customer (if necessary).

III. ROM Mask and Mass Programming Process Flow

The following is a list of the steps involved in creating custom Sensory ICs.

Step 1: 1-2 weeks before sending firmware code for masking or mass programming, the customer must notify the Sensory Sales Admin, Sensory Project Manager and Sensory Mask Engineer of their intention to create a custom IC.

The customer should also provide the following pre-production design review ("R2 Review") items to the Sensory Review Engineer:

- Application specifications and flowcharts,
- Design schematics,
- PCB gerber files (if available),
- Microphone data sheet,
- Mechanical drawing showing how microphone and speakers are mounted,
- 1st article or sample of the product,
- Program source code (if full source code cannot be released, then release as much as possible, including all sections that relate to voice recognition and program interrupts.)

The design review process is fully described in section VII of the Sensory design guide 80-0073 (Speech Recognition Hardware Design). **Please note: only the Sensory VP of Sales can waive design review requirements.**

Step 2: Request a unique Sensory Part Number. The Sensory Mask Engineer will provide upon request a unique Sensory part number for the customer to use when ordering custom ICs. This number should be written in section D-1 of the checklist and be used on all purchase orders.

Step 3: When the code is ready for masking or mass-programming, the customer must send Sensory the following items:

- The firmware code file(s). They can and should be zipped or otherwise compressed to reduce the chance of corruption during transmission.

Notes:

1. For RSC ROM mask orders. The submitted file must be a binary file (with .BIN extension.) It must be 64KB in length for RSC-464 masks and 128 KB for RSC-4128 masks. The customer can use the SensoryCheck4 program to add the "fixup" byte before sending. If this is done, then no counter code will be sent back to the customer and steps 4-6 below are skipped.
2. For NLP-5x mass programming orders, no fixup byte is needed and therefore no counter code is ever returned to the customer. Steps 4-6 are always skipped for NLP-5x mass programming orders.

- A completed and signed Sensory ROM Mask / Mass Programming Checklist and Software Release Form (see section IV),

- (**RSC Only**) A Masking Purchase Order (PO). Masking PO should include the Sensory Part # assigned to the Customer in Step 2.

1. For RSC mask programming orders, A Masking PO is **always** required.
2. For NLP-5x mass programming orders, a Masking PO is **never** required.

- (**Optional for RSC-4x, Required for NLP-5x**) A Parts Purchase Order. Parts PO should include the Sensory Part # assigned to the Customer in Step 2.

1. For RSC-4x mask programming orders, the Parts PO is **optional**.
2. For NLP-5x mass programming orders, the Parts PO is **required**.

All required items should be sent at a minimum to the Sensory Sales Admin and Mask Engineer, but it is better to send the items to more than one member of the team at Sensory in case one of the members is out of the office that day. If you are unsure who to send the items to, please contact Sensory at +1(408) 625-3330 or by email at: rommaskteam@sensoryinc.com

(NOTE: The Masking PO and the Parts PO may be combined into a single PO. The last 3 items can be scanned and sent as email attachments to the Sensory Sales Admin, or faxed to Sensory at +1 (408) 625-3350.)

(NOTE: If you are a new customer please contact accounting@sensoryinc.com to establish and/or confirm payment terms. If this is not done in a timely manner your order may be delayed.)

Step 4: (Optional – RSC-4x Only) If the submitted binary file does not already have a "fixup" byte, then the Sensory Mask Engineer will add one and send back a Counter Code to the customer to test and verify.

Step 5: (Optional – RSC-4x Only) Customer must test the Counter Code in their prototype hardware and confirm that it is working 100% correctly. This step is important because the Counter Code is what will be mask programmed into the ICs, not the original customer code. If there are any problems that arise as a result of added fixup byte, this is the last opportunity to find and correct them.

Step 6: (Optional – RSC-4x Only) Once the Counter Code is verified by the Customer, the Customer must approve the counter code to give the Sensory Sales Admin the go-ahead (via email) to proceed with creating custom ICs. The ROM Mask will NOT be started until Sensory receives the final counter code approval from the customer.

Step 7: When the firmware code is sent to the chip foundry, and the process of creating custom ICs is underway, the Customer will be notified of the estimated ship out date.

IV. ROM Mask / Mass Programming Checklist and Software Acceptance Instructions

Below is a brief description of the fields on the forms.

A. Customer Information

1. **Company Name** - Enter the name of the company here.
2. **Project Name** - Enter the name of the development project, including major and minor revisions if desired.
3. **Management Contact** - Enter the name and phone number of the contact person in case Sensory has questions regarding billing, PO's and scheduling.
4. **Technical Contact** - Enter the name and phone number of the contact person in case Sensory has technical questions.

B. Part Information

1. **IC and Package** - Enter the type of IC and, if desired, the package type. Not all packages are available for each part type, but bare die is available for all part types. Refer to the following table for package availability:

Part Type	Available In
RSC-464	Die, LQFP100
RSC-4128	Die, LQFP100
NLP-5X	Die only

C. Software Checklist

1. **Binary File Submitted** – Enter the name and checksum of the file submitted for mask / mass programming. The CRC32 checksum can be calculated by the SensoryCheck utility, which is available for download from the Downloads page of Sensory's website.
2. **Software Tools Version Used** – The developer should use the latest version of the development tools for all new projects. The latest publicly released version for the RSC-4x series is available at Sensory's website. Please check with Sensory tech support (techsupport@sensoryinc.com) for information on the most up-to-date version software.
3. **Confirm Software Checked with SensoryCheck4 and Fixup Byte Added** – Before submitting binary code for masking or mass programming, the customer should run it through the SensoryCheck4 utility, which has two primary functions:
 - a) Checks firmware files for problems,
 - b) (**RSC-4x only**) Checks reserved locations and adds "Fixup" byte. Certain memory locations are reserved in RSC files by the ROM masking process and should not be used by the developer. For RSC ROM masks, the reserved byte is at 0xFFFF. It is used to store a "fixup" byte to ensure the simple 8-bit code checksum of the entire file is 0x00. SensoryCheck automatically writes the fixup byte to RSC binary files, thus eliminating the need to send counter code back to the customer and thereby speeding up the process.

Part Type	Reserved Locations and Locations Modified
RSC-464 & RSC-4128	The byte at 0xFFFF is changed to insure the 8-bit checksum of the entire file is 0x00.
NLP-5x	No bytes changed

NOTE: the Sensory RSC development tools (FluentChip v3) automatically keep the necessary locations unused.

4. **Confirm Sensory R2 Design Review** - Sensory offers a free design review service for virtually any product that incorporates the RSC-4x microprocessor. The purpose of an R2 review is to thoroughly examine one or more completed pre-production units prior to mass production. This is a one-time, thoroughly extensive review of the product. **Please note: only the Sensory VP of Sales can waive this R2 review requirement.**

5. **Confirm FluentChip Sleep/Idle Function used (RSC only)** – If developers intend to use sleep or idle mode in RSC masks, they should always use the "GoSleep", "SleepIO", "Goldle" or "IdleT2" functions/macros provided in the Sensory FluentChip library to ensure proper clock configuration when coming out of sleep or idle mode. Failure to do so may result in some initial instructions being improperly executed after wakeup.

Sensory RSC/NLP ROM Mask/Mass Program Checklist and Release Form

A. Customer Information

1.	Company Name:			
2.	Project Name:			
3.	Management Contact:		Phone:	
4.	Technical Contact:		Phone:	

B. Part Information

1.	Choose 1 IC & Package:	RSC-464		RSC-4128		NLP-5x
		Die	LQFP100	Die	LQFP100	Die

C. Software Checklist

1.	Binary File Submitted:		Checksum:	
2.	Software Tools Version Used (FC, QT2SI, QS4, Phython or ZView):			
3.	Confirm Software checked with SensoryCheck4 and Fixup byte added:			
4.	Confirm Sensory R2 Design Review Performed:			
5.	Confirm FluentChip Sleep/Idle Functions Used (RSC-4x only):			

D. Sensory Part Number

1.	Sensory Part Number (assigned by Sensory)	65- _____
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E. Software Acceptance Agreement

Sensory, Inc (Sensory) and _____ (Company) agree to begin creating ICs with custom firmware for use in Company products, under the following mutually agreeable conditions:

- Company has fully reviewed and tested a working prototype with the program file named above in section C-1 on (date)_____.
- Company hereby acknowledges and agrees that Software has been tested and is accepted by Company,
 - In its Entirety,
 - As Final,
 - As Complete,
 - And Without Exception Whatsoever.
- Company assumes all further responsibility for Software including the operation of the software in its product application.
- Sensory shall be responsible for assuring that Software is accurately transferred to masked ROM for RSC-4x chips or mass programmed OTP for NLP-5x chips on all IC's ordered by Company.
- Company accepts full responsibility for IC's ordered with masked ROM or mass programmed OTP containing Software and understands that no returns or cancellations shall be accepted.
- Company agrees and will accept that yield fluctuations may cause fluctuations in delivery quantities of +/- 10% on all custom ICs.

Authorized Signature for Company

Authorized Signature for Sensory

Date

Date

Instructions:

- Sign and date. FAX back to Sensory at +1 (408) 625-3350 for immediate processing.
- Mail hard copy back to: Sensory Inc, 575 N. Pastoria Ave, Sunnyvale, CA 94085

The Interactive Speech™ Product Line

Sensory's **Interactive Speech™** product line makes consumer electronics more intelligent by enabling them to talk, hear, move and interact with the external world using naturally sounding spoken commands—all without training and even in noisy environments! Sensory offers both chip and software solutions that offer advanced speech recognition with hands-free functionality, biometric speaker verification, text-to-speech (TTS) synthesis, high quality stereo music and sound effects, robotics and LCD controls, and interactive sensing capabilities. These technologies are designed for integration into cost-sensitive consumer electronic applications such as home appliances, smart toys, music players and personal communication devices. The hardware line includes the NLP-5x Natural Language Processor, the RSC-4x family of mixed signal processors, and the SC-691 music and speech synthesis slave processor. Embedded software options include the FluentSoft™ Recognizer, which offers speech recognition technologies for non-Sensory processors and DSPs. Sensory's BlueGenie™ Voice Interface, the first speech recognition, TTS and synthesis option for *BlueTooth®* enabled devices, offers hands-free control of headsets, music players and other *BlueTooth®* devices.

NLP-5x Natural Language Processor and Development Tools

The NLP-5x features a high-performance 80MHz 16-bit DSP with on-chip ADC, hi-fidelity stereo DAC, microphone preamplifiers, RAM, OTP code and constant memory, and many kinds of peripheral interfaces and control blocks. With Sensory's FluentChip™ 5 firmware, it provides a single chip solution capable of accurate speech recognition; text-to-speech (TTS) synthesis with morphing; compressed speech; high fidelity music; motor and LCD control; and man-machine interfaces (MMI) with interactive sensors. Sensory offers a complete suite of evaluation and development tools that include the ability to create complex grammars with a natural language interface in multiple languages.

RSC-4x Family of Microcontrollers and Developer Tools

The RSC-4x (**Recognition, Synthesis and Control**) product family contains low-cost 8-bit speech-optimized microcontrollers that are fully integrated and include A/D, pre-amplifier, D/A, RAM, and ROM circuitry. With Sensory's FluentChip™ firmware, the RSC family offers speech recognition, speaker verification, speech and music synthesis, voice recording and playback, and an entire suite of interactive robotic and sonic networking technologies. The family is supported by a complete suite of evaluation and development toolkits that include the ability to quickly create speaker independent recognition sets in many languages.

SC6 Slave Processor and Tools

The SC-691 is a standard slave synthesizer that accepts compressed speech data from other microprocessors or microcontrollers and converts it to speech. The chip operates up to 12.32 MIPS, and provides high-quality, low data-rate speech compression and MIDI music synthesis, with unlimited speech duration using external memory. Sensory offers hardware and software tools for analyzing speech files, editing speech data and generating coded speech.

FluentSoft™ Recognizer

The 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 thousands of words and runs on non-Sensory processors including Intel XScale, TI OMAP, and ARM9, and supports operating systems such as MS Windows, Linux, and Symbian.

BlueGenie™ Voice Interface

The BlueGenie Voice Interface software suite runs on CSR's BC-5 MM Kalimba DSP, and enables manufacturers of *Bluetooth* products to integrate full voice control and synthetic speech output without the need for visual displays or complex user interfacing. It frees designers to pack functionality onto small form factor *Bluetooth* devices and answers consumer demand for a "Truly Hands-Free" experience.

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