Voice Dialer
Speech Recognition Dialing IC

Speaker Dependent IC for Voice Dialing Applications

GENERAL DESCRIPTION

The Voice Dialer IC, from the Interactive Speech family of products, is an application specific standard product (ASSP) designed for cost-sensitive telephony applications. This IC features speech recognition technology that allows users to dial phone numbers by saying the name of the person they want to call. With Voice Dialer IC a complete dialing system can be built with minimal components.

The Voice Dialer IC is designed for use as a slave chip controlled by an external host processor. The external host sends commands to perform dialing and directory functions, such as adding names to the directory, dialing a name, and playing back a phone number. The Voice Dialer manages a full telephone directory of names, speech recognition templates and telephone numbers.

The Voice Dialer IC employs a sophisticated neural network to recognize trained names with high accuracy. Its advanced technology delivers accurate recognition in difficult noise environments, such as automobiles, and adjusts for recognition over different distances - ideal for speakerphone applications.

Voice Dialer can be integrated into existing products or used to develop new innovative applications. Voice dialing is now possible for all consumer telephony products!

FEATURES

Complete Dialing Solution

- 60 name telephone directory
- Speaker dependent speech recognition for dialing by name
- User-friendly speech prompts
- Digital recording and playback of directory entries
- DTMF generation

Powerful Functionality

- Add, modify, delete directory commands
- Multiple directories
- Multiple telephone numbers per name
- Language localization and custom synthesis options
- On chip A/D, D/A and pulse width modulator

Easy to Implement

- Simple 3-wire host interface
- Interfaces to Flash memory
- High level commands
- Minimal external components required

Voice Dialer Block Diagram
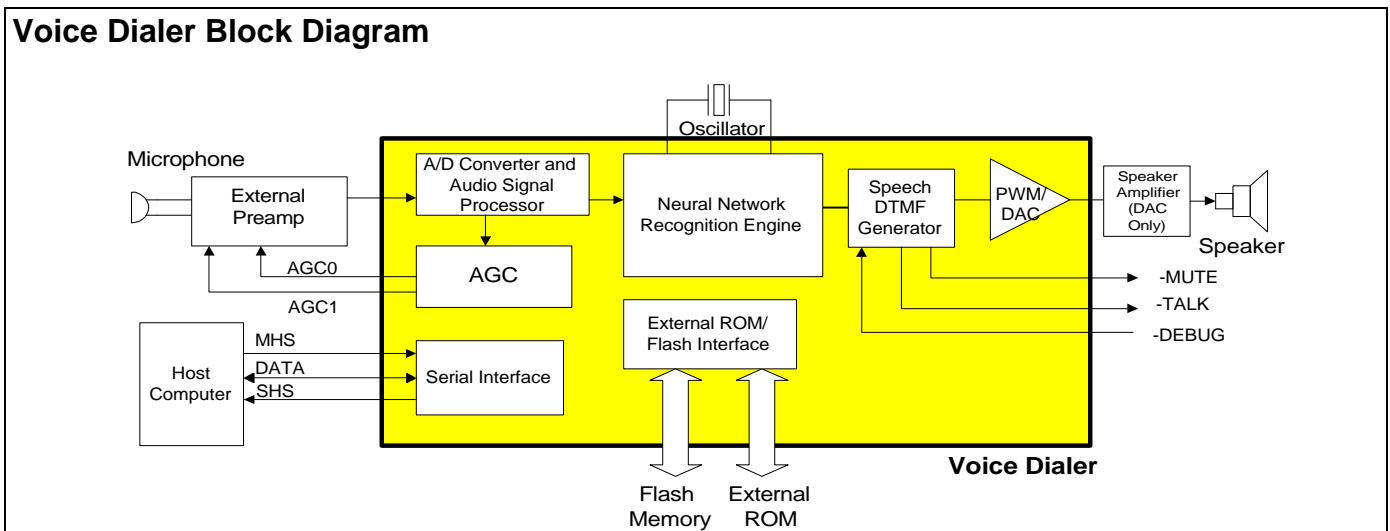
FEATURE OVERVIEW

The Voice Dialer is a single-chip CMOS device. The Voice Dialer uses sophisticated speech recognition technology to map spoken commands to phone numbers. Using easy-to-learn, intuitive techniques, end users train the Voice Dialer, which performs speaker-dependent (SD) speech recognition, speech prompting, and DTMF (Dual Tone Multi-Frequency) synthesis. The Voice Dialer is available in IC, IC Module, and Evaluation Board formats.

EXTERNAL HOST CONTROLLER

Sensory's Voice Dialer operates as a slave chip, receiving and processing commands from a host controller or Master CPU (Host) and returning status information and data. The Voice Dialer has private access to its own control program, to an optional language/extended speech ROM, and to a non-volatile external read/write Flash memory. Either 1 or 2 megabits of flash memory are supported – the size reflects application-specific requirements for the phone directory. Communication with the Host is through a 3-wire serial bus.

The Voice Dialer includes a rich command set allowing the programmer to implement complex voice recognition functions with a minimum of Host overhead. This allows the application software to focus on providing an intuitive and efficient user interface.

DIALING DIRECTORY MANAGEMENT
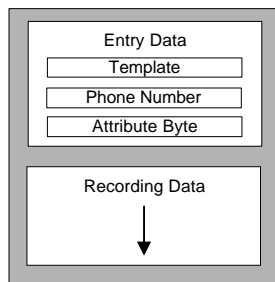
The Voice Dialer maintains a dialing directory with the following information for each entry:

- A speaker-dependent speech template - a patterned of the trained name
- A voice recording of the name – the system plays the recording for confirmation
- Four 0-30 digit strings – the telephone numbers associated with name
- An attribute byte – to identify the kind or type of entry during searches

Depending on the memory selected Voice Dialer can store either 30 or 60 names. Using attribute bytes, applications can also create multiple directories.

Users can access all data associated with a name entry either by voice recognition or sequentially. Users can also organize multiple directories or categories.

SPEECH PROMPTS

Voice Dialer provides an internal English vocabulary with more than 100 phrases of general-purpose Standard English, developed for telephony applications.

The onboard standard word list can be replaced with a customized word list for English or foreign languages via an external ROM chip.

INPUT AUDIO AMPLIFIER AND FILTER

Voice Dialer requires an external pre-amplifier to condition the input signal. When used with an inexpensive omni-directional electret microphone, the input audio amplifier and filter must provide approximately 58 dB of low-noise mid-band gain, 2-bit AGC controllability, and a first order bandpass response with 3dB points at roughly 700 Hz and 3300 Hz.

AUDIO OUTPUT

Voice Dialer can directly drive a 32-Ohm speaker from the PWM0 and PWM1 pins providing approximately 0.15W of audio power, or an output amplifier and speaker can be connected to the DACOUT pin.
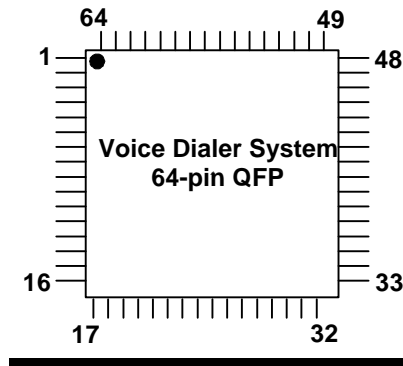
FLASH MEMORY

The Voice Dialer uses non-volatile memory (Atmel AT29C010/ SST29EE010- 1Mbit or SST29EE020-2 Mbit) to store speech templates and phone numbers. Flash memory is included in the Voice Dialer Module.

ASSP MODULE

The Voice Dialer solution is also available as a complete module. The module is a single 2" x 2" PCB that includes all external components (e.g., preamplifier, flash memory) required by Voice Dialer, except microphone and speaker. This module is ideal for prototype development or small production runs.

IC PIN DESCRIPTIONS

```
     64              49
     |||||||||||||||
  1 ─┤●           ├─ 48
     ┤            ├
     ┤            ├
     ┤ Voice Dialer System ├
     ┤  64-pin QFP ├
     ┤            ├
     ┤            ├
 16 ─┤            ├─ 33
     |||||||||||||||
     17              32
```

Name	QFP Pin	Description	I/O
GND	9, 22 41, 56	Digital Ground, CPU core (pins 1 and 33) and I/O (pins 18and 52)	-
VDD	23	Digital Supply Voltage (core)	-
AGND	52	Analog Ground. For noise reasons, analog and digital grounds should connect together only at the VDS	-
AVDD	55	Analog Voltage. For noise reasons, keep this supply independent of digital circuitry.	-
VDD	10, 40	Digital Supply Voltage (I/O line)	-
-RESET	21	Reset	I
SH	49	Sample and Hold. Connect a 470 pF capacitor from here to AGND.	I
XO1	19	Oscillator 1 output (high frequency)	O
XI1	20	Oscillator 1 input	I
AIN0	51	Analog In, low gain. (range AGND to AVDD/2.)	I
AIN1	50	Analog In, hi gain (8X input amplitude of AIN0, same range)	I
AGC0	33	Audio pre-amplifier Automatic Gain Control line 0	O
AGC1	32	Audio pre-amplifier Automatic Gain Control line 1	O
PWM0	53	Pulse Width Modulator Output0	O
-TE1/PWM1	54	Test Mode *or* Pulse Width Modulator Output1 (multiplexed)	I *or* O
DACOUT	48	Analog Output (unbuffered).	O
-MUTE	30	Audio mute signal. Active low during DTMF output	O
-TALK	31	Audio talk signal. Active low during speech synthesis	O
A[15:0]	1-8, 11-18	External ROM/Flash Memory Address Bus	O
A16	36	External ROM/Flash Memory Address line A16 ROM A15	O
A17	35	External Flash Memory Address line A17	O
D[7:0]	57-64	External ROM/Flash Data Bus	I/O
-RDC	42	External Code Read Strobe	O
-RDD	44	External Data Read Strobe	O
-WRC	43	External Code Write Strobe	O
-WRD	45	External Data Write Strobe	O
MHS	39	Master Handshake. Driven by host.	I
SHS	25	Slave Handshake. Driven by Voice Dialer.	O
DATA	24	Serial Data between Master and Slave. Bi-directional	I/O
DEBUG	34	Enable Debug Diagnostic speech	I
-XMH	46	Default/Custom Speech Select	I
-XML	47	Unused. Must be tied high	I
	26-29, 37-38	Unused	-

ABSOLUTE MAXIMUM RATINGS

ELECTRICAL SPECIFICATIONS

OPERATING CONDITIONS -20°C to +70°C;
V_{cc}=3.5-5.0V;
V_{ss} =0V

ABSOLUTE MAXIMUM RATINGS

Maximum voltage	7.5V
Minimum voltage on any pin	V_{ss}-0.6V
Maximum voltage on any pin	V_{dd}+0.6V
Any pin to GND	~0.1V to +7.5V
Operating temperature (T_O)	-20°C to +70°C
Soldering temperature	260°C for 10 sec

WARNING*:*

Stressing the Voice Dialer beyond the "Absolute Maximum Ratings" may cause permanent damage. These are stress ratings only. Operation beyond the "Operating Conditions" is not recommended and extended exposure beyond the "Operating Conditions" may affect device reliability.

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 technology. The Interactive Speech Product Line was designed for consumer telephony products and cost-sensitive consumer electronic applications such as home electronics, personal security, and personal communication.

RSC Microcontrollers

The RSC family of microcontrollers (RSC164, RSC264T, RSC364) are low-cost 8-bit microcontrollers designed for use in consumer electronics. All members of the RSC family are fully integrated and include A/D, D/A, ROM, and RAM circuitry on chip. The RSC264T and RSC364 also include on chip pre-amplification. The RSC family of microcontrollers can perform a full range of speech/audio functions including speech recognition, speaker verification, speech and music synthesis, and voice record/playback.

Voice Direct™

The Voice Direct™ TSSP provides cost-sensitive products with speaker-dependent speech recognition, speech synthesis and DTMF tone generation. This easy-to-use, pin-configurable chip requires no custom programming and can recognize up to 60 trained words.

Voice Dialer Software

The Voice Dialer software provides advanced speech technology on a variety of microcontroller and DSP platforms. A complete speech API and flexible design allows manufacturers to easily integrate into telephony products.

IMPORTANT NOTICES

Sensory reserves the right to make changes to or to discontinue any product or service identified in this publication at any time without notice in order to improve design and supply the best possible product. Sensory does not assume responsibility for use of any circuitry other than circuitry entirely embodied in a Sensory product. Information contained herein is provided gratuitously and without liability to any user. Reasonable efforts have been made to verify the accuracy of this information but no guarantee whatsoever is given as to the accuracy or as to its applicability to particular uses. Applications described in this data sheet are for illustrative purposes only, and Sensory makes no warranties or representations that the RSC series of products will be suitable for such applications. In every instance, it must be the responsibility of the user to determine the suitability of the products for each application. Sensory products are not authorized for use as critical components in life support devices or systems.

Sensory conveys no license or title, either expressed or implied, under any patent, copyright, or mask work right to the RSC series of products, and Sensory makes balance between recognition and synthesis no warranties or representations that the RSC series of products are free from patent, copyright, or mask work right infringement, unless otherwise specified. Nothing contained herein shall be construed as a recommendation to use any product in violation of existing patents or other rights of third parties. The sale of any Sensory product is subject to all Sensory Terms and Conditions of Sales and Sales Policies.

S E N S O R Y

521 East Weddell Drive
Sunnyvale, CA 94089
www.SensoryInc.com
TEL: (408) 744-9000
FAX: (408) 744-1299