eSHS Series

Tiny Controller with Single Speech Channel

Product Specification

DOC. VERSION 1.2

ELAN MICROELECTRONICS CORP.

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Specification Revision History

Doc. Version	Revision Description	Date
1.0	Initial Release of the Specification	2007/12/27
1.1	Modify Program ROM & RAM size. Add eSH012/eSH020 two bodies.	2007/12/31
1.2	Add the frequency range	2008/09/15

1 General Description

The eSHS series IC's are 4-bit microcontroller based sound processors. The series is equipped with a synthesized speech feature to obtain good quality voice. The series also offers two 4-bit I/O ports (except for eSHS007/012/015 which do not support P2.3/P3.0). By programming through the microcontroller, applications, such as section combination, trigger mode, output control, keyboard matrix, and other logic functions are easily put into effect.

2 Features

- System clock: 2 MHz @2.4V ~ 5.5V
- 7~60 seconds voice capacity are provided (@6kHz sample rate)
- Sleep mode to conserve power, less than 2μA@3V standby current
- RC oscillator
- Built in 4-bit tiny controller
- Input/Output ports:
  - Two input/output ports (P2 ~ P3)
    P2 is software controlled with pull-low resistor
    eSHS007/012/015 only provide P2.0~P2.2 / P3.1~P3.2
  - I/O Pin P3.2 can be modulated with 38.5kHz carry signal to implement IR function
  - I/O Pin P3.3 can be configured as flash with volume application
- Single ROM for voice program with a maximum of 32K program addressing size
- Reset pin is available
- Readable ROM data is available
- 4-level stack for subroutine nesting
- Built-in PWM Direct Drive
- PCM, 5-bit eDPCM, and 6-bit eDPCM algorithms are available for speech synthesis (to provide silence compression). These are transparent to user.
- Supports self-test function for checking IC status
- Waveform Mark function and Waveform Control Port (WCP) are provided to control operation that synchronizes with voice
- Support EASY/Assembly language for developing codes

- Full-fledged development systems:
  - User-friendly GUI environment
  - Download system with USB port
  - EMMeSH (Emulation Module board)
  - EMFeSH (Emulation Flash board)

3 Selection Table

The eSHS Series integrates an extensive range of features, most of which are common to all devices, except for some distinctive features like, Program Memory capacity, Data ROM, Data RAM, I/O count, Oscillator, Reset, Timer, and PWM functions. For your convenience in choosing the most suitable microcontroller for your application, refer to the following table:

IC Type	Time (Sec)	Stack	Program Size (Bits)	ROM (bits)	RAM (Bits)	I/O	OSC	IR	Reset	PWM/ DAC
eSHS007	7	4	16K × 10	24K × 10	48 x 4	6 I/O	RC	Yes	Yes	PWM
eSHS012	12	4	32K × 10	40K × 10	64 x 4	6 I/O	RC	Yes	Yes	PWM
eSHS015	15	4	32K × 10	48K × 10	64 x 4	6 I/O	RC	Yes	Yes	PWM
eSHS020	20	4	32K × 10	64K × 10	64 x 4	8 I/O	RC	Yes	Yes	PWM
eSHS030	30	4	32K × 10	96K × 10	64 x 4	8 I/O	RC	Yes	Yes	PWM
eSHS040	40	4	32K × 10	128K × 10	64 x 4	8 I/O	RC	Yes	Yes	PWM
eSHS060	60	4	32K × 10	192K × 10	64 x 4	8 I/O	RC	Yes	Yes	PWM

NOTE: *Each IC is only equipped with one* ***voice channel for speaker***

4 Applications

- Voice playback devices
- Educational learning equipments

5 Pin Description

Symbol	I/O	Function Description
OSCI	I	RC oscillator input
P2.0~P2.3	I/O	Bits 0 ~ 3 of Port 2 [1] (eSHS007/012/015 do not support P2.3)
P3.0~P3.3	I/O	Bits 0 ~ 3 of Port 3 (eSHS007/012/015 do not support P3.0)
VO1A	O	PWM voice output
VO1B	O	PWM voice output
VDD	I	Digital Power
VSSD	I	Digital Ground
VCC	I	Analog Power
VSSC	I	Analog Ground
TRS	I	Test/Reset pin (internal pull-low, active high)

[1] *When IC enters standby mode, if the pins have pull-low resistors, suggest not to connect Pins P2.0 ~ P2.3 to pull-high level to minimize power consumption.*

6 Specifications

6.1 Absolute Maximum Ratings

Parameter	Specification
Supply voltage (VDDx – Vssx)	-0.3V to +6.0V
Input voltage	Vssx – 0.3V to VDDx + 0.3V
Operating Temperature	0°C to 70°C
Storage Temperature	-55°C to 125°C

6.2 Electrical Characteristics

V_{DD}=3V, Vssx=0V, Ta= 25°C unless otherwise specified

Items	Sym.	Condition	Min	Typ.	Max.	Unit
Operating Voltage	V_{DDx}	–	2.4	3.0	5.5	V
Standby current	I_{DDS}	V_{DD}=3V , no load	–	2	4	μA
Operating mode current	I_{op}	V_{DD}=3V, no load, speech stop	–	700	–	μA
Drive current of P2	I_{OD}	V_{DD}=3V, V_{OD}=2.4V	–	5.5	–	mA
Sink current of P2	I_{OS}	V_{DD}=3V, V_{OS}=0.4V	–	6.5	–	mA
Drive current of P3	I_{OD}	V_{DD}=3V, V_{OD}=2.4V	–	8	–	mA
Sink current of P3	I_{OS}	V_{DD}=3V, V_{OS}=0.4V	–	10	–	mA
Input current of P2	I_{IH}	V_{DD}=3V,	–	3.0	–	μA
Drive current of VO1A, VO1B	I_{VOD}	V_{DD}=3V,V_{OD}=2.4V	–	85	–	mA
Sink current of VO1A, VO1B	I_{VOS}	V_{DD}=3V, V_{OD}=0.4V	–	85	–	mA
Oscillation resistor	R_{osch}	V_{DD}=3V	150	100	56	KΩ
Freq. operate range.	F_{High}	V_{DD}=3V	1.5	2	4	MHz
Freq. Deviation	*	V_{DD}=3V, Fosc=2MHz	-	5	7	%

*
ΔFosc/Fosc

7 Oscillator Frequency Deviation

7.1 Oscillator Frequency vs. Rosc (VDD=3.0V)

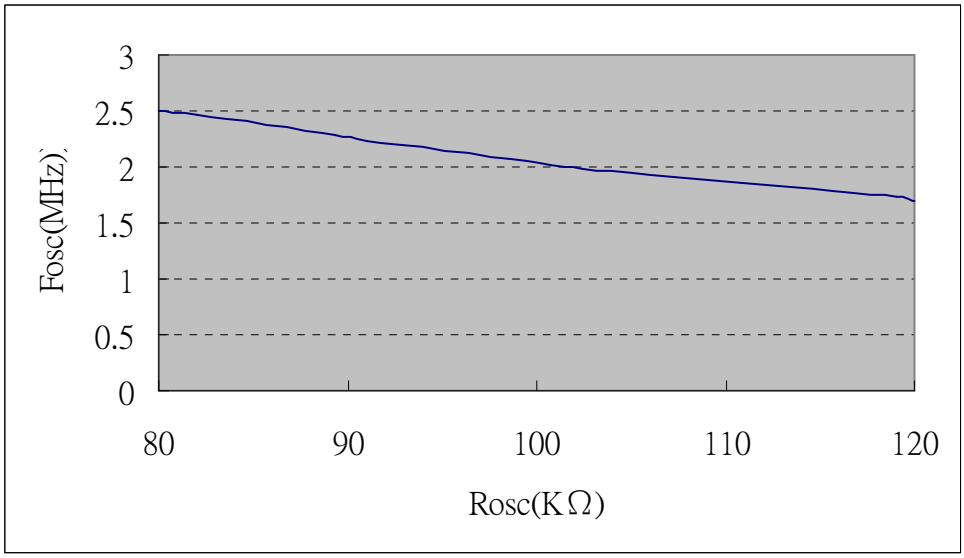

Figure 7-1 Oscillator Frequency vs. Rosc Deviation

7.2 Oscillator Frequency vs. VDD (Rosc=100KΩ)

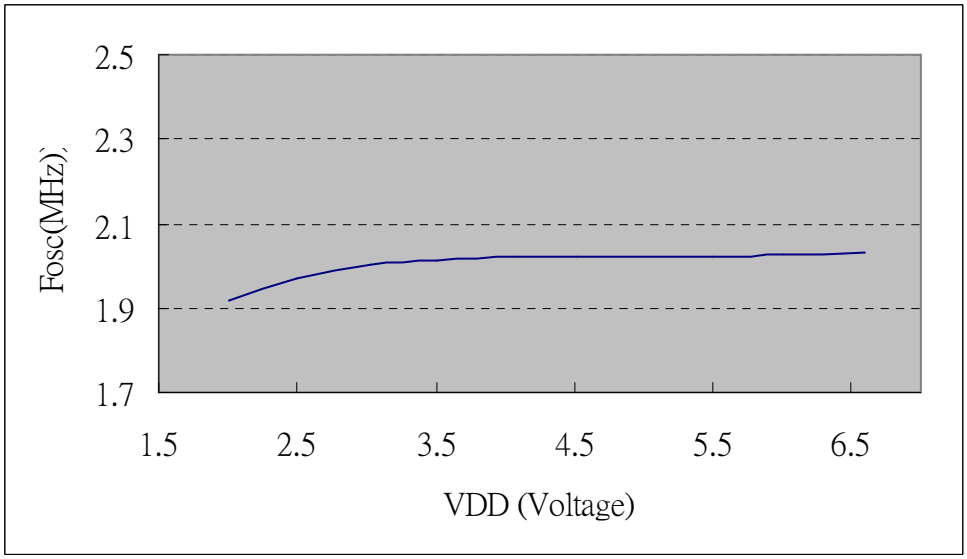

Figure 7-2 Oscillator Frequency vs. VDD Deviation

8 Application Circuit

The following notes apply to all conditions illustrated in the application diagrams below:

1. For noisy power supply application, adding a ceramic capacitor between VCC and ground near the IC's VDD pad is recommended. The recommend capacitor value is 0.1μF.
2. For heavy loading application, adding an electrolytic capacitor between VCC and ground is recommended. The recommended capacitor value for button cell application is 10μF.

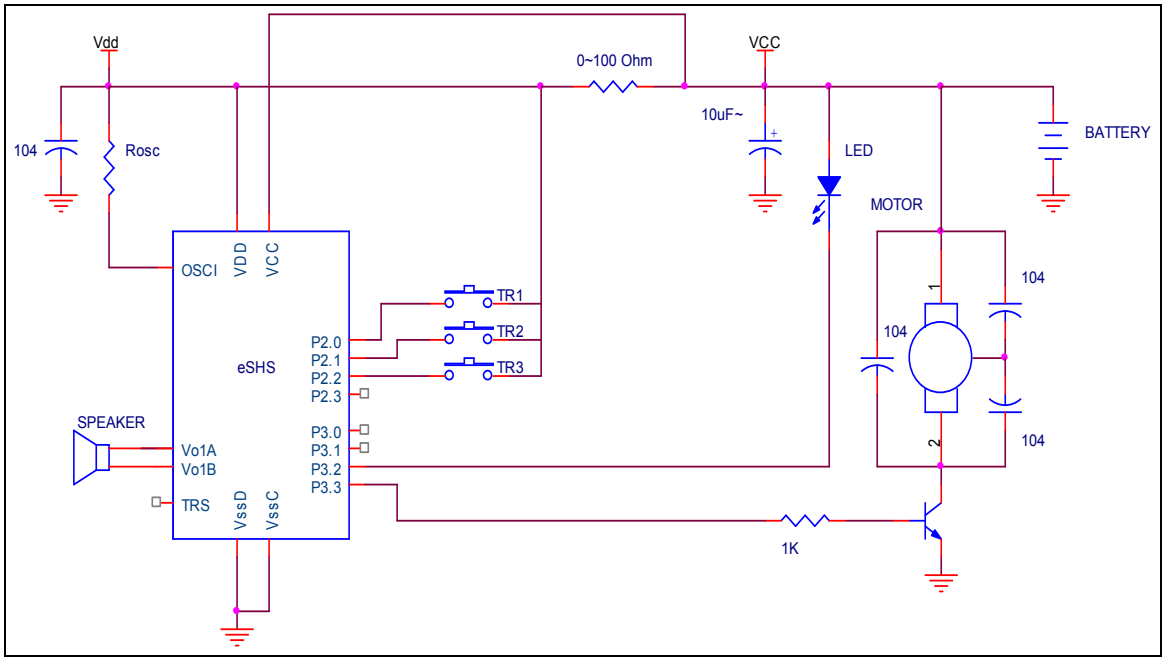

Figure 8-1 eSHS Series Application Circuits for Large Loading