
eSPA Series

**Embedded OTP Memory
Four Channel
Sound Process**

Product Specification

DOC. VERSION 1.3

ELAN MICROELECTRONICS CORP.


September 2008



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Specification Revision History

Doc. Version	Revision Description	Date
1.0	eSPA Series initial specification	2006/02/20
1.1	Format Modification only	2006/04/14
1.2	Add eSP080A	2006/6/6
1.3	Add EZ Writer-U programming pins	2008/9/17

1 General Description

eSPA Series ICs are 4-bit micro-controller based sound processor embedded with audio functions, i.e., multi-channel speech and multi-channel melody. The series is capable of performing all the functions available from ELAN's eSA, eSB, and eSC Series ICs. The eSPA Series are also embedded with an OTP (One Time Programmable) ROM.

2 Features

- **System Clock**
 - Crystal:
 - * 3.58MHz @2.4 volts ~ 5.5 volts (supports eSA/eSB/eSC functions)
 - * 4MHz @2.4 volts ~ 5.5 volts (supports eSA/eSB/eSC functions)
 - * 6MHz @2.4 volts ~ 5.5 volts (supports eSB/eSC functions)
 - Embedded RC oscillator:
 - * 3.58MHz @2.4 volts ~ 5.5 volts (supports eSA/eSB/eSC functions)
 - * 4MHz @2.4 volts ~ 5.5 volts (supports eSA/eSB/eSC functions)
 - External RC oscillator:
 - * 6MHz @2.4 volts ~ 5.5 volts (supports eSB/eSC functions)
- **Input/Output Ports**
 - One Input port (P1) with software controlled pull low resistor
 - Three input/output ports (P2 ~ P4)
 - 4 steps (1/2, 1/4, 1/8, and 1/16) light flashing with volume level options
- **MCU Mode**
 - Sleep mode for power saving (less than 1 μ A@3V standby current)
 - Green mode for reduced but continues operation at very low power consumption (less than 15 μ A@3V)
- **Sound Output**
 - Auto option: 8 bits PWM / 10 bits traditional current DA
 - 128 steps volume control for each channel (for eSA function only); 16 steps DA current control for mixer output
 - Software PCM/4bits, ADPCM/5bits, & ADPCM algorithm for speech synthesis, are transparent to users
 - Channel definition (refer eSC/eSB/eSA spec)
 - * eSC: 1 channel speech
 - * eSB: 2 channels speech
 - * eSA: 4 channels speech/music

3 Parts List

IC Type	Time (Sec)	Stack	Program Size (Words)	ROM (Bits)	RAM (Bits)	I/O (x4)	Cryst /Rst	IR
eSP020A	20	8	32K	32K x 16	192 x 4	P1,P2,P3,P4	Yes	Yes
eSP040A	40	8	32K	64K x 16	192 x 4	P1,P2,P3,P4	Yes	Yes
eSP080A	80	8	32K	128K x 16	192 x 4	P1,P2,P3,P4	Yes	Yes

NOTE
eSB015~eSB040 & eSC015~eSC040 bodies do not support P4.0 ~P4.3

4 Package Pin-out (DIP28L, SKINNY28L, SOP28L)

NOTE
eSP080A only support DIP28L and SOP28L packaging

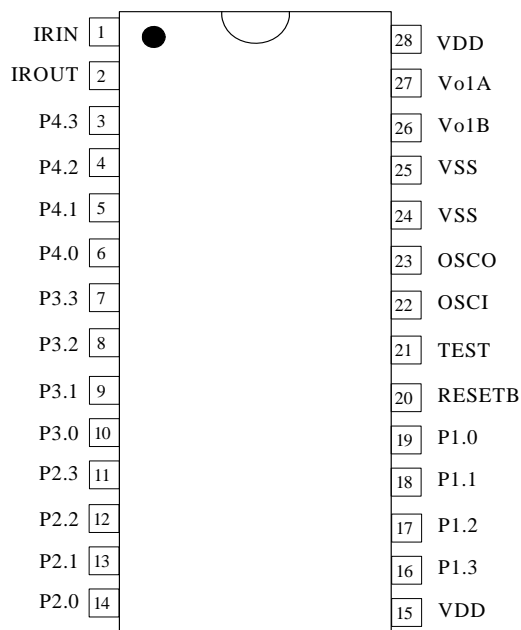


Figure 4-1 eSPA Series 28-Pin DIP Pin-out



5 Pin Descriptions

Pin No.	Symbol	I/O	Function Description
1	IRin	I	IR receiver pad / Input
2	IRout	O	IR Transmit pad / Output
3	P4.3	I/O	Bit 3 of Port 4 *
4	P4.2	I/O	Bit 2 of Port 4 *
5	P4.1	I/O	Bit 1 of Port 4 *
6	P4.0	I/O	Bit 0 of Port 4 *
7	P3.3	I/O	Bit 3 of Port 3
8	P3.2	I/O	Bit 2 of Port 3
9	P3.1	I/O	Bit 1 of Port 3
10	P3.0	I/O	Bit 0 of Port 3
11	P2.3	I/O	Bit 3 of Port 2
12	P2.2	I/O	Bit 2 of Port 2
13	P2.1	I/O	Bit 1 of Port 2
14	P2.0	I/O	Bit 0 of Port 2
15	VDD0	I	VDD for Digital
16	P1.3	I	Bit 3 of Port 1
17	P1.2	I	Bit 2 of Port 1
18	P1.1	I	Bit 1 of Port 1
19	P1.0	I	Bit 0 of Port 1
20	RESETB	I	Reset pin (internal pull-high)
21	TEST	–	Test pin
22	OSCI	I	Crystal oscillator in / RC oscillator in (Normal mode, only for eSB/eSC function)
23	OSCO	O	Crystal oscillator out / RC oscillator in (Green mode)
24	VSS0	I	For I/O, controller logic, oscillator circuit ground
25	VSS1	I	For PWM/DAC ground
26	VO1B	O	PWM voice output
27	VO1A	O	PWM voice output/Traditional DA
28	VDD1	I	VDD for Analog

* eSB015~eSB040 & eSC015~eSC040 bodies do not support P4.0 ~P4.3 I/O pins

NOTE

1. The Speech-Writer (printer port) uses Port1, Port2.0, TEST, VSS0, VSS1, VDD0, & VDD1 pins. The translation board must use the eSP-W1.
2. The EZ Writer-U (USB port) uses Port1, Port2, Port3, TEST, VSS0, VSS1, VDD0, & VDD1 pins. The translation board must use the eSP-W3.

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	-20°C to 70°C
Storage Temperature	-55°C to 125°C

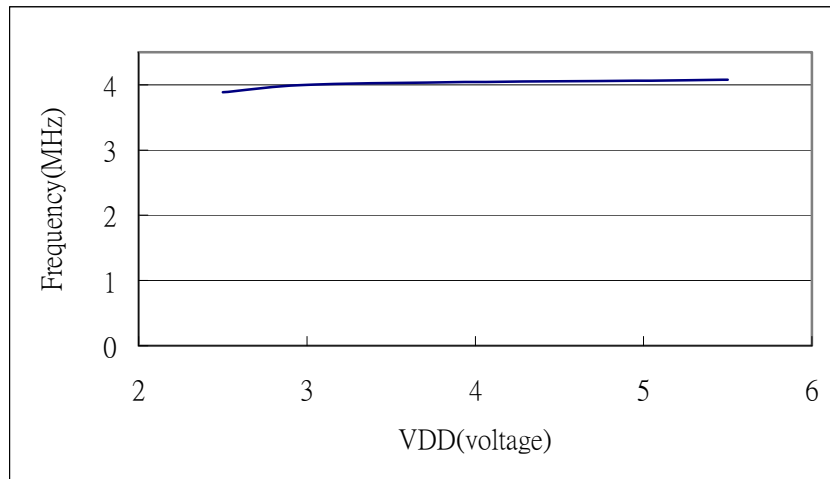
6.2 Electrical Characteristics

VDDx=3V, Vssx=0V, Ta= 25°C unless otherwise specified

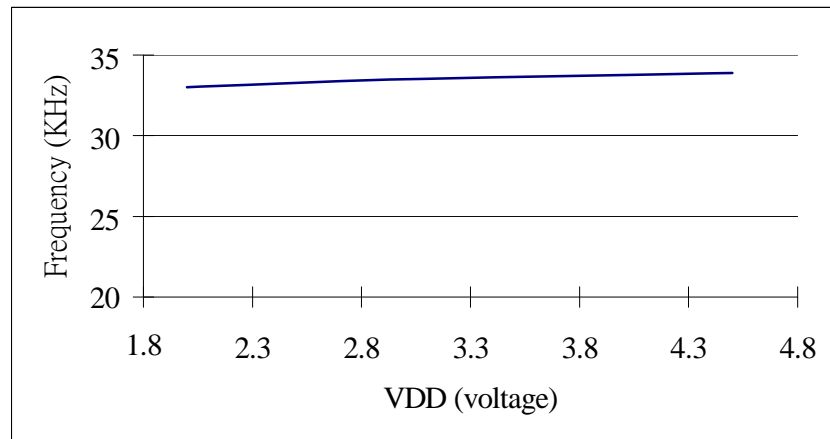
Items	Sym.	Min	Typ.	Max.	Unit	Condition
Operating voltage	V _{DDx}	2.4	3.0	5.5	V	
Standby current	I _{DDs}	-	-	1.0	μA	Sleep mode, no load
Operating mode current	I _{green}	-	10	15	μA	Green mode, no load (F= Flo = 32KHz)
	I _{op}	-	1.5	3	mA	no load, D/A stop, (F= FHigh = 4M Hz)
Drive current of P2, P3, P4, IRout	I _{OD}	2.0	5.0	-	mA	VOD=2.4V
Sink current of P2, P3, P4, IRout	I _{OS}	2.3	6.0	-	mA	VOS=0.4V
Input current of P1, P2, P3, P4, IRin	I _{IH}	-	3.0	5	μA	
Output current of VO1A	I _{VO1A}	-	3	-	mA	VVO1A=0.7V (traditional current DA)
Output current of VO1A, VO1B	I _{VO1A/B}	-	200	-	mA	Vvo1A/B=1/2 VDD (PWM DA)
Oscillation frequency	F _{osc}	3.25	3.58	3.9	MHz	Normal mode, VDD=3V
		3.8	4	4.2	M Hz	Normal mode, VDD=3V
		5.6	6	6.4	M Hz	Normal mode, VDD=3V external resistor=100k Ω
	F _{green}	27	32	37	K Hz	Green mode

7 Oscillator Frequency Deviation

7.1 Oscillator Frequency vs. VDD (Embedded RC Oscillation Freq.=4MHz)

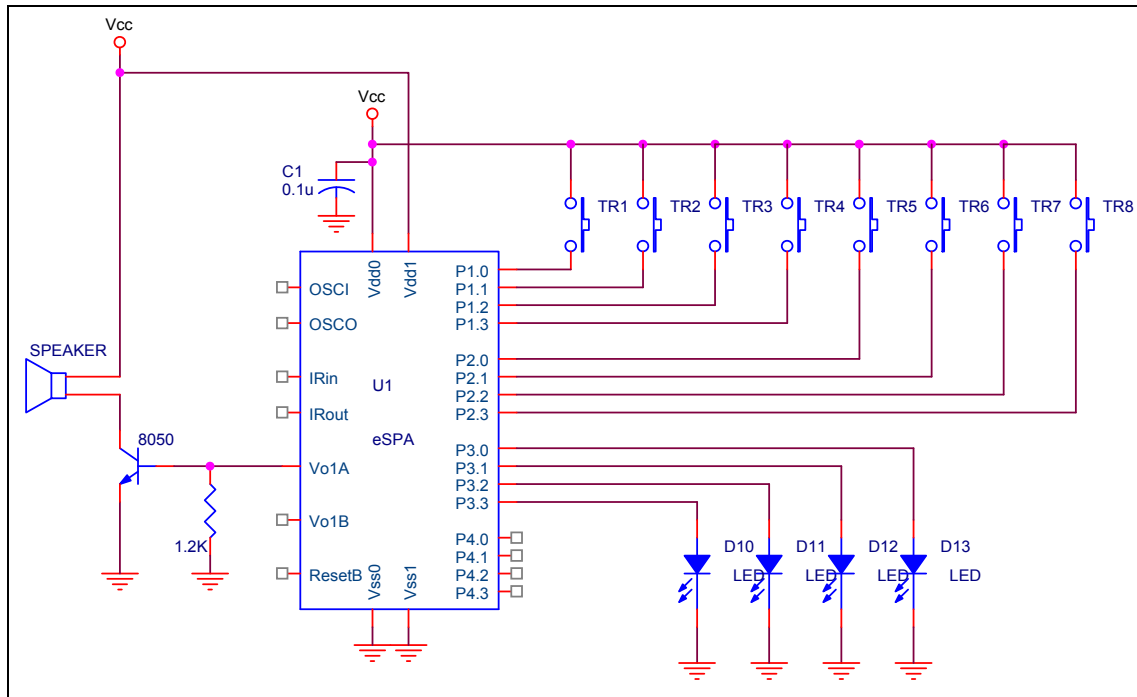


7.2 Oscillator Frequency vs. VDD (Green Mode, R_{osc}=1M Ω)

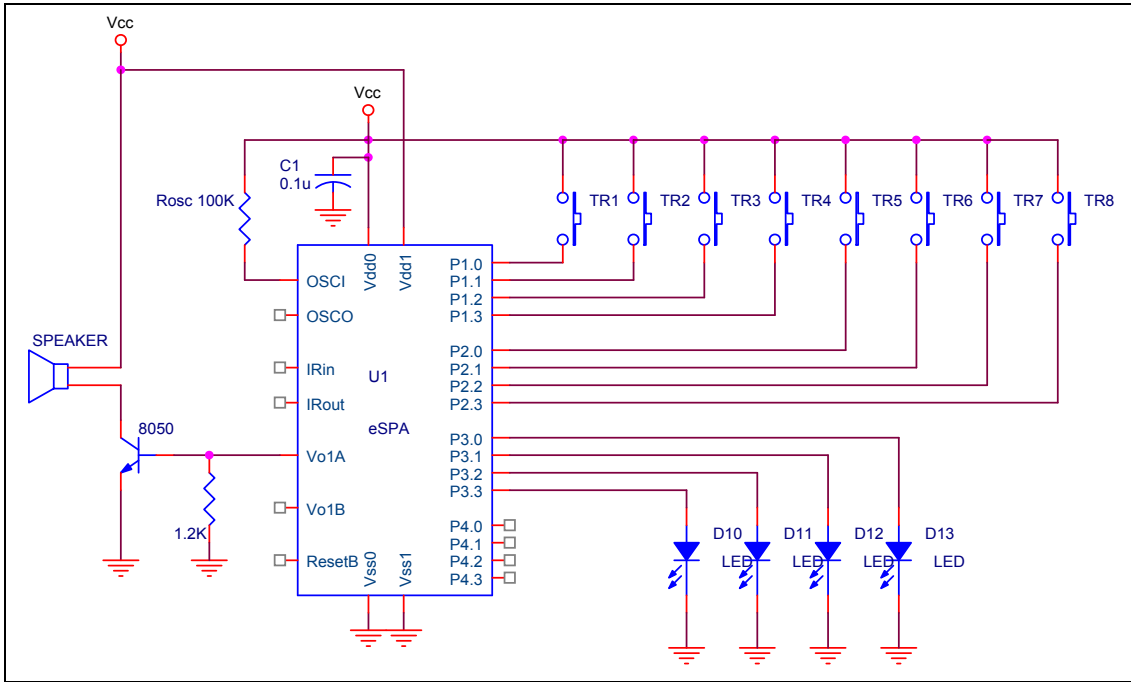


8 Application Circuit

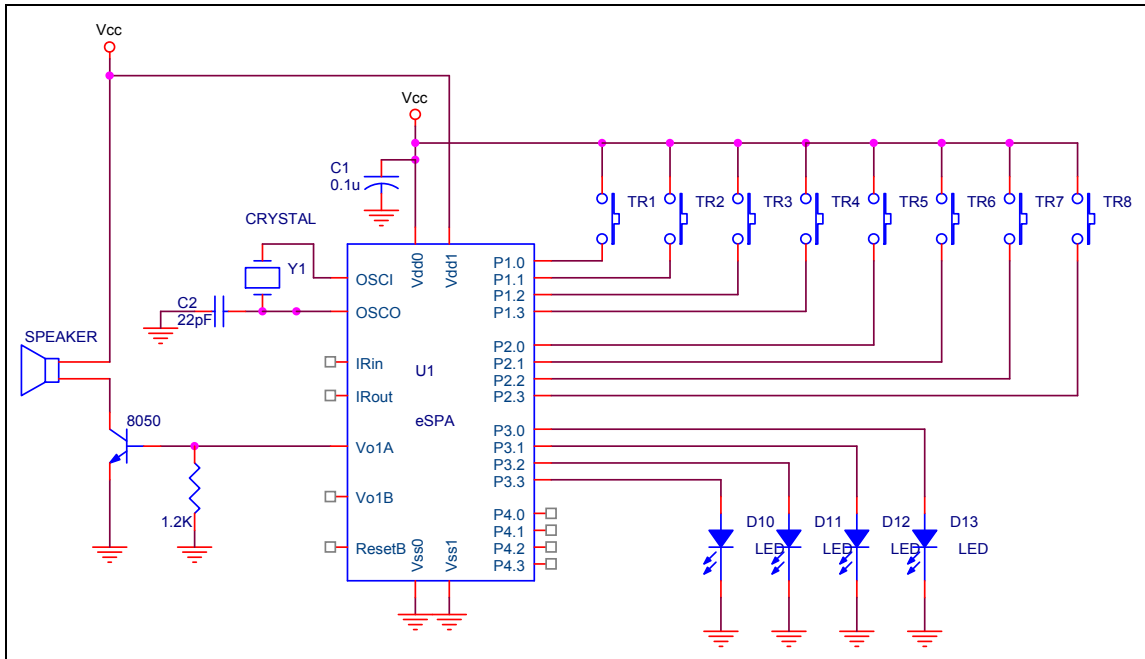
8.1 3.58/4MHz R Oscillator in Normal Mode (Without Green Mode)



8.2 6MHz R Oscillator in Normal Mode (Without Green Mode)

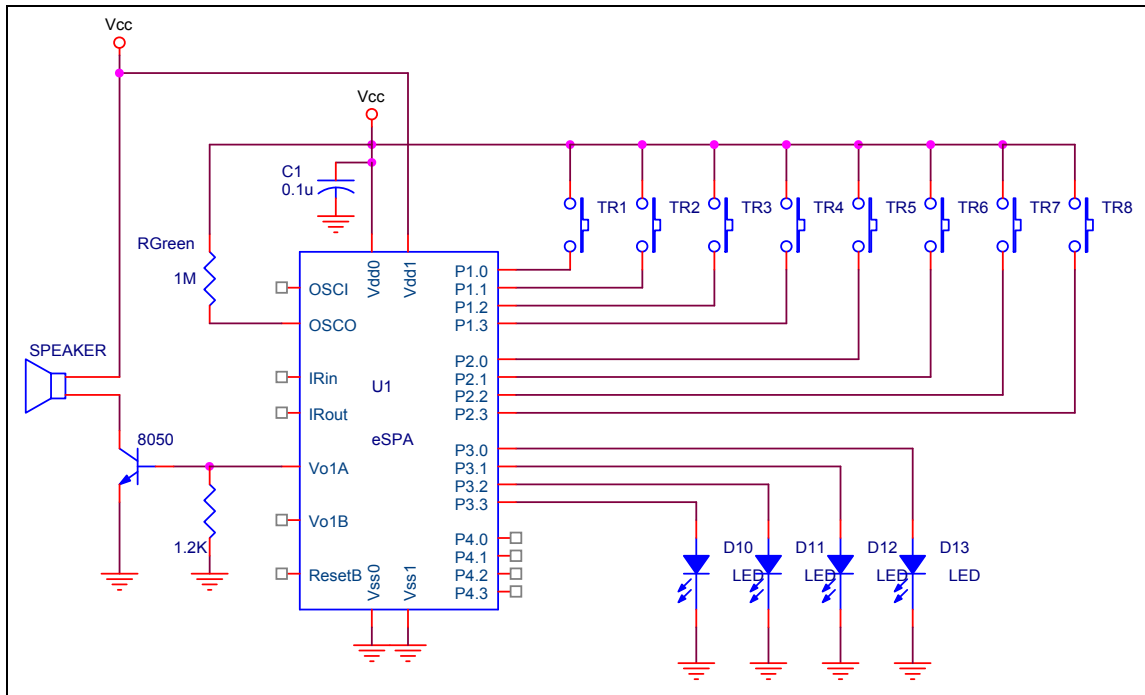


8.3 Crystal Oscillator in Normal Mode (Without Green Mode)

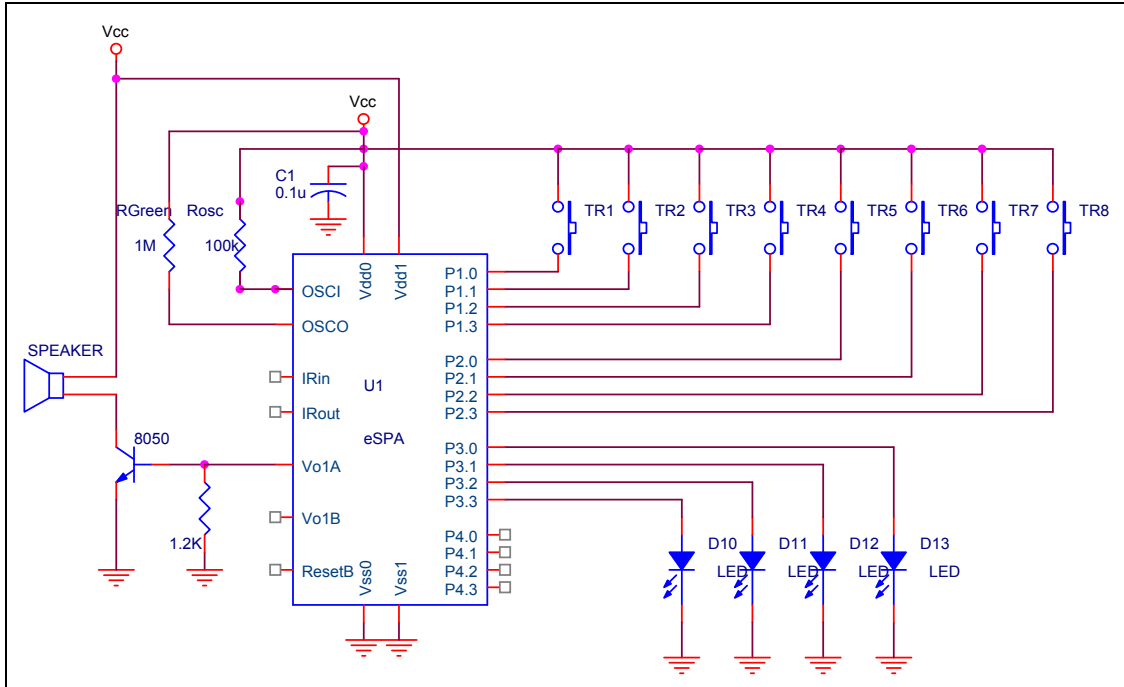


8.4 3.58/4MHz R Oscillator in Normal Mode and Green Mode

The circuit under Green mode should add a 1MΩ resistor to OSCO pin.



8.5 6MHz R Oscillator in Normal Mode and Green Mode



8.6 Crystal Oscillator in Normal Mode & R Oscillator in Green Mode

The circuit with Green mode should add a 1MΩ resistor to OSCO pin.

