EASY SOUND®

eST Series

Tiny Controller-Based
Speech Synthesizer

Product
Specification

DOC. VERSION 1.2

ELAN MICROELECTRONICS CORP.

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ELAN MICROELECTRONICS CORPORATION

Contents

Specification Revision History

Doc. Version	Revision Description	Date
1.0	Initial version	2004/01/13
1.1	Add eSTM060 and eSTQ060 MTP/QTP chips	2005/03/28
1.2	Change eSTM060 package type from PDIP to QFP	2005/12/30

1   General Description

The eST Series is a 3 to 340 seconds single chip high quality voice synthesizer IC which contains one 4-bit Input port (available with eST005 and above); two or three 4-bit I/O ports; and a tiny controller. eST Series provides strong features and uses improved algorithm to achieve pure speech. By programming through the tiny controller, user's applications, such as section combination, trigger mode, control outputs, keyboard matrix, and other logic functions, can be easily implemented.

2   Features

- Single Power Supply

- Crystal/Ring oscillator option

- 3 ~ 340 seconds voice capacity

- Power down mode for power saving

- Reset pin available

- Single ROM for voice program. 32K maximum program address size

- Readable ROM data

- One 6 bit timer overflow control is provided

- Two stacks for subroutine call

- 5 bits ASPCM + synthesis

- 38KHz modulation for IR transmission

- 15 steps volume control

- Direct Drive/traditional DAC

- 8 bits resolution D/A

- GREEN Voice™

IC Type / Category	eST003	eST004	eST005	eST010	eST015	eST020	eST030	eST040	eST060
Duration (@ 6K sample rate)	3 sec		5 sec	10 sec	15 sec	21 sec	31 sec	42 sec	63 sec
ROM (bits)	10Kx10		16Kx10	32Kx10	48Kx10	64Kx10	96Kx10	128Kx10	192Kx10
PROG. ROM (bits)	8Kx10		32Kx10						
RAM (bits)	32x4		64x4	128x4					
I/O Ports	4 I/O	8 I/O	4 Inputs + 8 I/O						
D/A	Tradition DAC	Direct Drive	Direct Drive / Traditional DAC						
OSC	Ring Type		Ring or Resonator type (optional)						
RESET Pin	No		Yes						

(This specification is subject to change without further notice)

IC Type Category	eST061	eST081	eST120	eST121	eST171	eST251	eST341	eSTM06 0(MTP)[1]	eSTQ060 (QTP)[1]
Duration (@ 6K sample rate)	63 sec	85 sec	127 sec		170 sec	255 sec	340 sec	63 sec	
ROM (bits)	192Kx10	256Kx10	384Kx10		512Kx10	768Kx10	10248Kx1	192Kx10	
PROG. ROM (bits)	32x10								
RAM (bits)	128x4								
I/O Ports	4 Inputs + 12 I/O		4 Inputs + 8 I/O	4 Inputs + 12 I/O					
D/A	Direct Drive / Traditional DAC								
OSC	Ring or Resonator type (optional)								
RESET Pin	Yes								

[1] eSTM060 & eSTQ060 are flexible MTP and QTP IC's respectively which can be programmed to clone any of its smaller sister IC's, i.e., eST003 ~ eST061.

These chips are packaged as follows**:**   COB type – **eSTM060**

Dice type – **eSTM060H, eSTQ060H**

PDIP type – **eSTM060P***

QFP type – **eSTM060AQ**

***PDIP-40 Type eSTM060P is no longer supported starting from January 2006.*
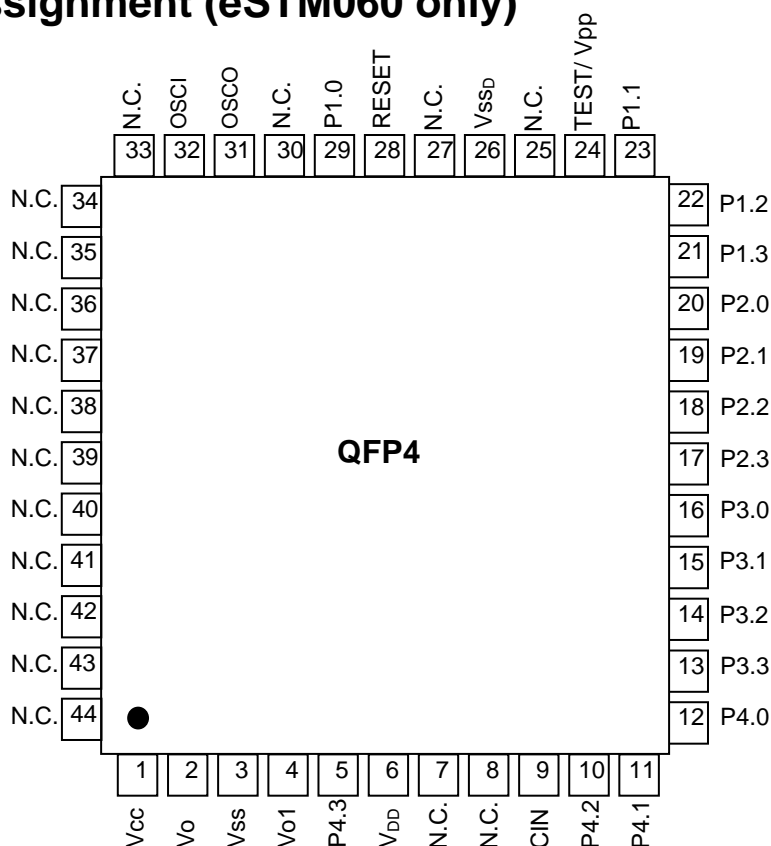
3   Pin Assignment (eSTM060 only)

Figure 3-1 eSTM060 QFP44 Pin Assignment

4   Pin Descriptions

Symbol	I/O	Function
P1.0	I	Bit 0 of Port 1 (not applicable to **eST003** & **eST004**)
P1.1	I	Bit 1 of Port 1 (not applicable to **eST003** & **eST004**)
P1.2	I	Bit 2 of Port 1 (not applicable to **eST003** & **eST004**)
P1.3	I	Bit 3 of Port 1 (not applicable to **eST003** & **eST004**)
P2.0 P2.0/PD0*	I/O	Bit 0 of Port 2 Bit 0 of Port 2 / Program data pin for parallel data Bits 0 & 4*
P2.1 P2.1/PD1*	I/O	Bit 1 of Port 2 Bit 1 of Port 2 / Program data pin for parallel data Bits 1 & 5*
P2.2 P2.2/PD2*	I/O	Bit 2 of Port 2 (not applicable to **eST003**) Bit 2 of Port 2 / Program data pin for parallel data Bits 2 & 6*
P2.3 P2.3/PD3*	I/O	Bit 3 of Port 2 (not applicable to **eST003**) Bit 3 of Port 2 / Program data pin for parallel data Bits 3 & 7*
P3.0 P3.0/RDYB*	I/O	Bit 0 of Port 3 (not applicable to **eST003**) Bit 0 of Port 3 / Program Ready signal*
P3.1 P3.1/WEB*	I/O	Bit 1 of Port 3 (not applicable to **eST003**) Bit 1 of Port 3 / Programming write enable*
P3.2 P3.2/OEB*	I/O	Bit 2 of Port 3 (the pin can generate 38KHz square wave) Bit 2 of Port 3 / Programming output enable*
P3.3 P3.3/ACLK*	I/O	Bit 3 of Port 3 (pin can be treated as LED output) Bit 3 of Port 3 / Programming address increase*
P4.0	I/O	Bit 0 of Port 4 (not applicable to **eST003 ~ eST040, eST060**, & **eST120**)
P4.1	I/O	Bit 1 of Port 4 (not applicable to **eST003 ~ eST040, eST060**, & **eST120**)
P4.2	I/O	Bit 2 of Port 4 (not applicable to **eST003 ~ eST040, eST060**, & **eST120**)
P4.3	I/O	Bit 3 of Port 4 (not applicable to **eST003 ~ eST040, eST060**, & **eST120**)
VDD	I	Positive digital power supply
OSCI OSCI/CLK*	I	Ring oscillator input pin Ring oscillator input pin / Program clock*
RESET	I	Reset Pin (not applicable to **eST003, eST004**, & **eST005**)
OSCO	I	Crystal Output Pin (not applicable to **eST003, eST004**, & **eST005**)
TEST TEST/VPP(MTP power)*	I	Use for testing only (not applicable to **eST003** & **eST004**) Test / Programming power source*
VSSD	I	Negative digital power supply.
VCC	I	Positive analog power supply (not applicable to **eST003**)
VSSC	I	Negative analog power supply (not applicable to **eST003**)
Cin*		Regulator capacitor*
VO	O	Traditional DAC Output / Direct Drive Green Voice Output
VO1	O	Direct Drive Green Output (not applicable to eST003)

*Applicable to eSTM060 & eSTQ060 only. Note that a 0.1μF ceramic capacitor should be added between Cin and ground.

5 Absolute Maximum Ratings

Items	Symbol	Min	Max	Unit
Supply Voltage	V_{DD}-V_{SS}	−0.3	+6.0	V
Input Voltage	V_{IN}	V_{SS} −0.3	V_{DD}+0.3	V
Operating Temperature	T_{OP}	−20.0	+70.0	^{0}C
Storage Temperature	T_{STG}	−55.0	+125.0	^{0}C

6 Electrical Characteristics

(25°C, Vdd=3.0 Volts unless otherwise specified)

Items	Sym	Min.	Typ.	Max.	Unit	Condition
Operating Voltage	VDD	2.2	3.0	5.5	V	-
Standby Current	IDDS	-	-	2.0	uA	VDD=3V
Operating Current	IDDO	-	250	350	uA	VDD=3V, no load, Constant current D/A stopped
			2	4	mA	VDD=3V, no load, Push-pull current D/A running
P2, P3, P4 Drive Current	IOD	2.0	3.0	-	mA	VDD=3V, VO=2.4V
P2 Sink Current (before KEY B)	IOS	-	3.0	10.0	uA	VDD=3V VO=3V
P2 Sink Current (after KEY B)	IOS	2.3	3.5	-	mA	VDD=3V VO=0.4V
P3, P4 Sink Current	IOS	2.3	3.5	-	mA	VDD=3V, VO=0.4V
P1 Input Current	IIH	-	3.0	10.0	uA	VDD=3V
VO Output Current	IVO	4.0	5.2	6.4	mA	VDD=3V, Vo=0.7V
			5.3	6.7	mA	VDD=4.5V, Vo=0.7V
VO, VO1 Output Current	IVO	150	180	-	mA	VDD=3V, Vo=½ VDD
Oscillation Resistor	R	-	470	-	KΩ	VDD=3V (for eST003 ~ eST005 only)
			100	-	KΩ	VDD=3V (for eST010 ~ eST341 only)
Oscillation Freq.	FOSC	1.08	1.2	1.32	MHz	VDD=2.2 ~ 5.5V

7 Application Circuit

Important notes for the following application circuits:

1. For noisy power supply application, suppress noise by adding a 0.1µF ceramic capacitor between–

   ● Ground and power VCC & IC's VCC pad

   ● Ground and power VCC & IC's VDD pad

2. For heavy loading application, it is recommended that an electrolytic capacitor is added between VCC and ground. The recommended capacitor value for button cell applications is 10µF.

3. The recommended value of the bypass resistor for button cell application is 750Ω or less (see eST003 application circuit below for example).

4. The use of spring direct trigger is not recommended. If you must use such trigger, you need to add a ceramic capacitor between trigger pin and ground to debounce the spring noise. The recommended capacitor value is 0.001 ~ 0.01 µF.
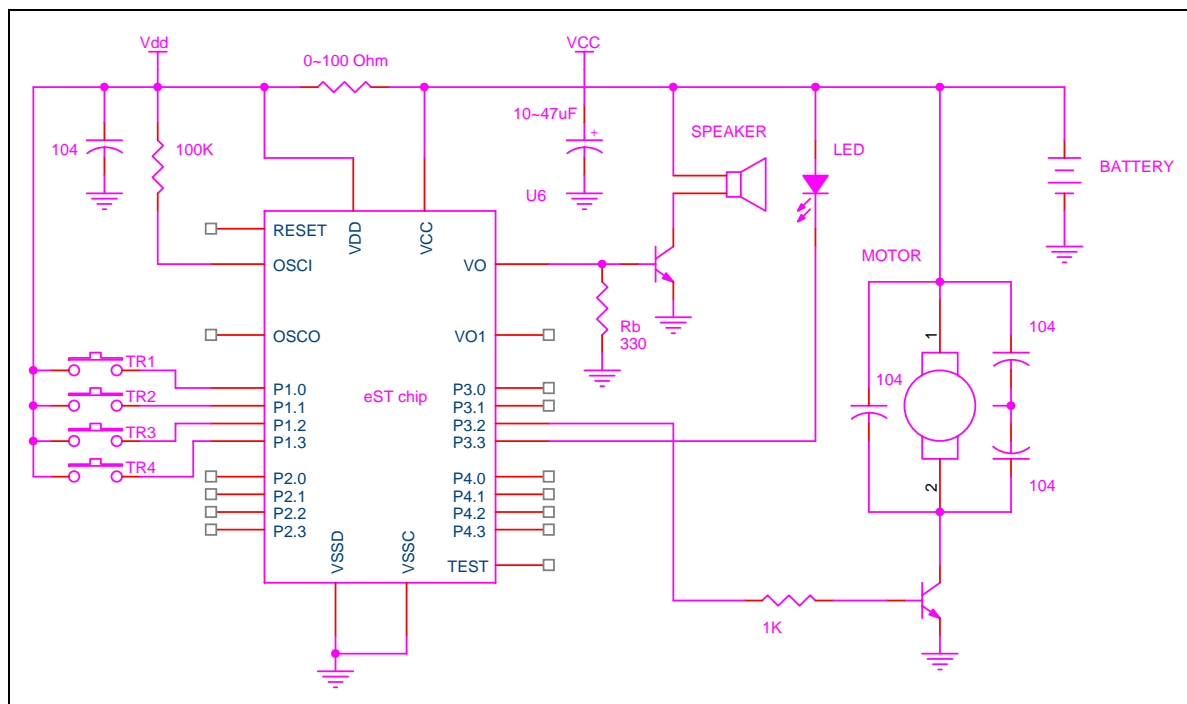

Figure 7-1 eST Series Chips Universal Application Circuit