



SPECIFICATION

General Description

eSM Series are single chip Voice/Dual tone Melody/Dual tone Sound Effect synthesizer ICs. It contain one 4-bit input port (provided for eSM005 and above), two 4-bit I/O ports, a tiny controller, and adopt improved algorithm to achieve pure speech. User's applications, such as section combination, trigger modes, control outputs, keyboard matrix, and other logic functions, are easily implemented by programming through its tiny controller

Features

Product	eSM003	eSM005	eSM010	eSM015	eSM020	eSMP020 (OTP)*
Duration (@ 6K sample rate)	3 sec	5 sec	10 sec	15 sec	21 sec	21 sec
ROM (bits)	10Kx10	16Kx10	32Kx10	48Kx10	64Kx10	64Kx10
PROGRAM ROM (bits)	8Kx10					
RAM (bits)	16x4	32x4				
I/O pins	8 I/O	4 I, 8 I/O				
	P2.0 ~ P2.3 P3.0 ~ P3.3	P1.0~P1.3, P2.0~P2.3, P3.0~P3.3				
IR	Yes					
Flash with Volume (pin)	Yes (P3.3)					

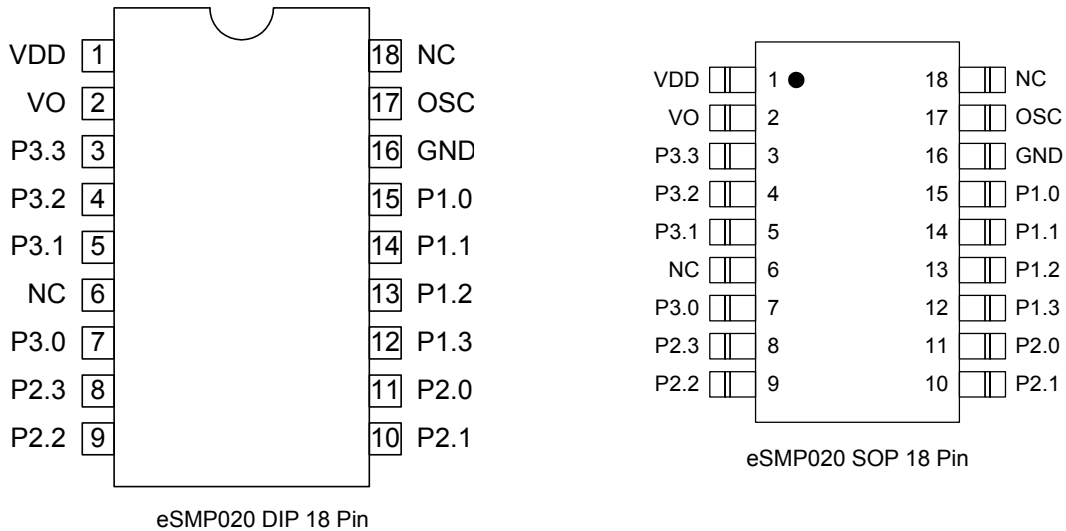
* eSMP020 is a flexible OTP IC which can be programmed to clone any of its smaller sister IC's, i.e., eSM003 ~ eSM020.

- Single power supply 2.4 V ~ 5 V
- One 6-bit timer overflow control
- PCM, ASPCM, and ASPCM+ synthesizer, and dual tone melody/sound effect generator
- 4K~32K Hz playing speed for voice play-back
- Multiple tempos for dual tone melody/sound effect play-back
- Variable beats for dual tone melody/sound effect play-back
- Multiple volume control levels
- Fixed current D/A output to drive external connected transistor for voice output
- Pin P3.2 can be programmed as IR communication pin to generate 38KHZ carrier



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Pin Assignments for eSMP020



Symbol	I/O	Function
P1.0	I	Bit 0 of Port 1 (not applicable for eSM003)
P1.1	I	Bit 1 of Port 1 (not applicable for eSM003)
P1.2	I	Bit 2 of Port 1 (not applicable for eSM003)
P1.3	I	Bit 3 of Port 1 (not applicable for eSM003)
P2.0	I/O	Bit 0 of Port 2
P2.1	I/O	Bit 1 of Port 2
P2.2	I/O	Bit 2 of Port 2
P2.3	I/O	Bit 3 of Port 2
P3.0	I/O	Bit 0 of Port 3
P3.1	I/O	Bit 1 of Port 3
P3.2	I/O	Bit 2 of Port 3 (IR Tx)
P3.3	I/O	Bit 3 of Port 3 (Flash with volume output)
VDD	I	Positive power supply.
OSC	I	Ring oscillator input pin.
VSS	I	Negative power supply
VO	O	Voice Output



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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	°C
Storage Temperature	T_{STG}	-55.0	+125.0	°C

Electrical Characteristics

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

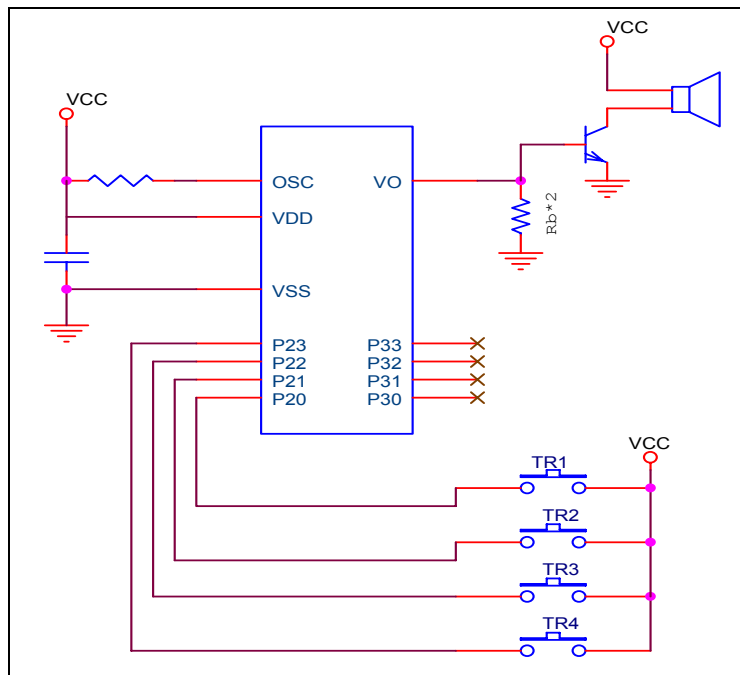
Items	Sym	Min.	Typ.	Max.	Unit	Condition
Operating Voltage	V_{DD}	2.4	3.0	5.1	V	–
Standby Current	I_{DDS}	–	–	1.0	uA	$V_{DD}=3V$
Operating Current	I_{DDO}	–	–	280	uA	$V_{DD}=3V$, no load
P2, P3 Drive Current	I_{OD}	1.0	–	–	mA	$V_{DD}=3V$, $V_O=2.4V$
P2, P3 Sink Current	I_{OS}	1.6	–	–	mA	$V_{DD}=3V$, $V_O=0.4V$
P1 Input Current	I_{IH}	–	3.0	10.0	uA	$V_{DD}=3V$ (not applicable to eSM003)
VO Output Current	I_{VO}	2.0	3.0	4.0	mA	$V_{DD}=3V$, $V_O=0.7V$ (Step 7)
Oscillation Resistor	R	–	470	–	K Ω	$V_{DD}=3V$
Oscillation Frequency	F_{OSC}	–	1.0	–	MHz	$V_{DD}=3V$

Application Circuit

Important notes for the following application circuits:

1. For noisy power supply application, suppress noise by adding a 0.1 μ F ceramic capacitor between ground and power pad.
2. The recommended value of the bypass resistor for button cell application is 750 Ω or less.
3. For heavy loading application, it is recommended that an electrolytic capacitor is added between VDD and ground. The recommended capacitor value for button cell applications is 10 μ F.
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 μ F.

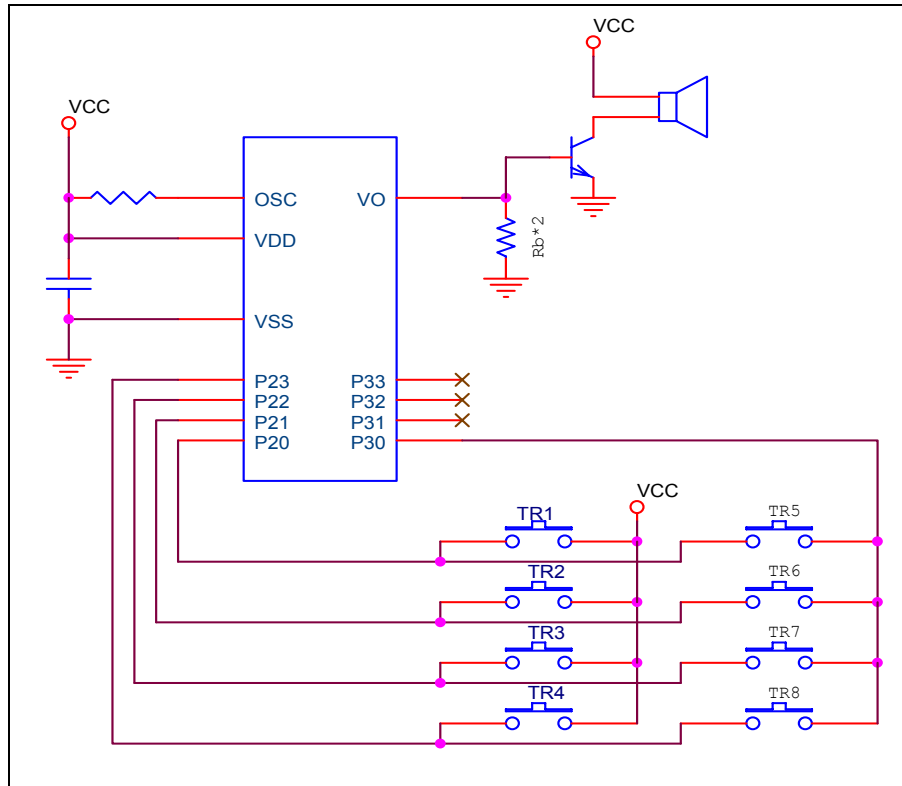
eSM003 Application Circuit for 4-Key



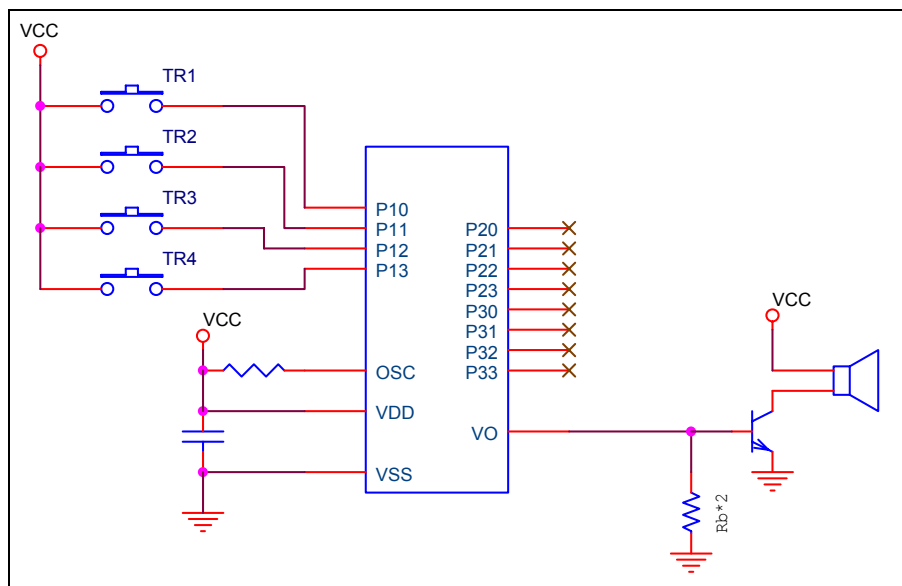


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eSM003 Application Circuit for 8-Key



eSM005 ~ eSM020 Application Circuit for 4-Key



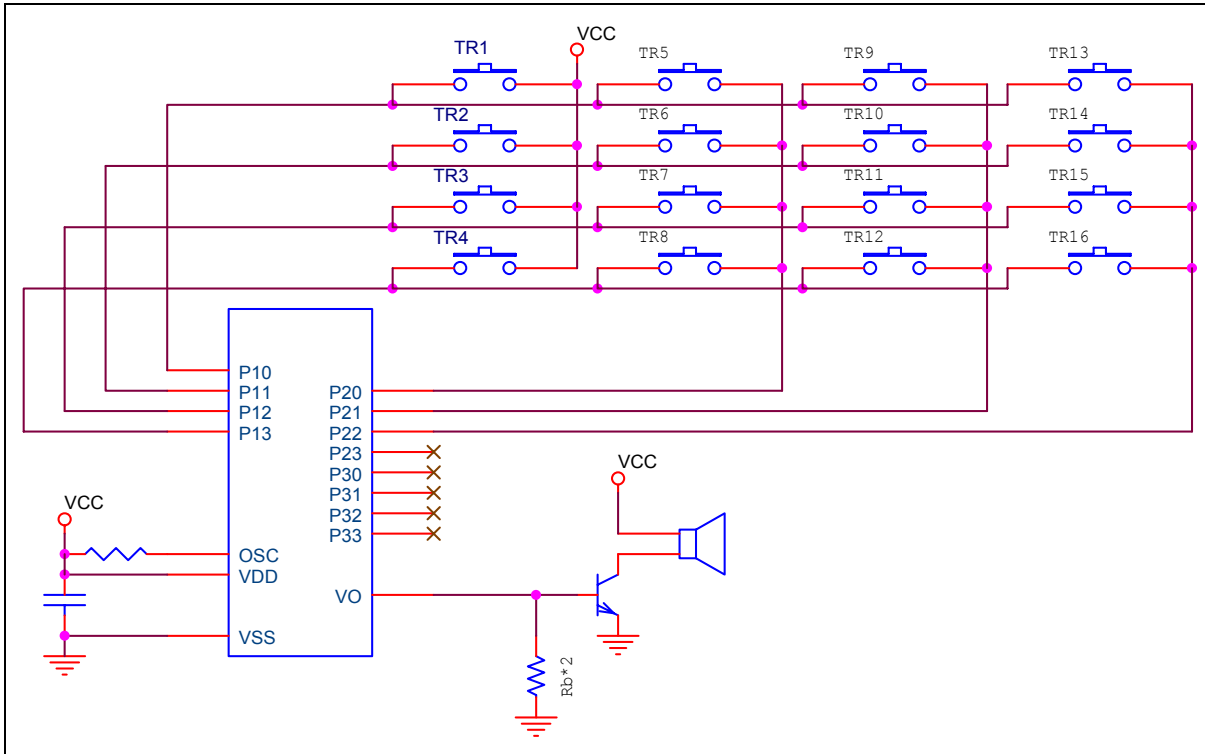


EASY SOUND® – eSM Series

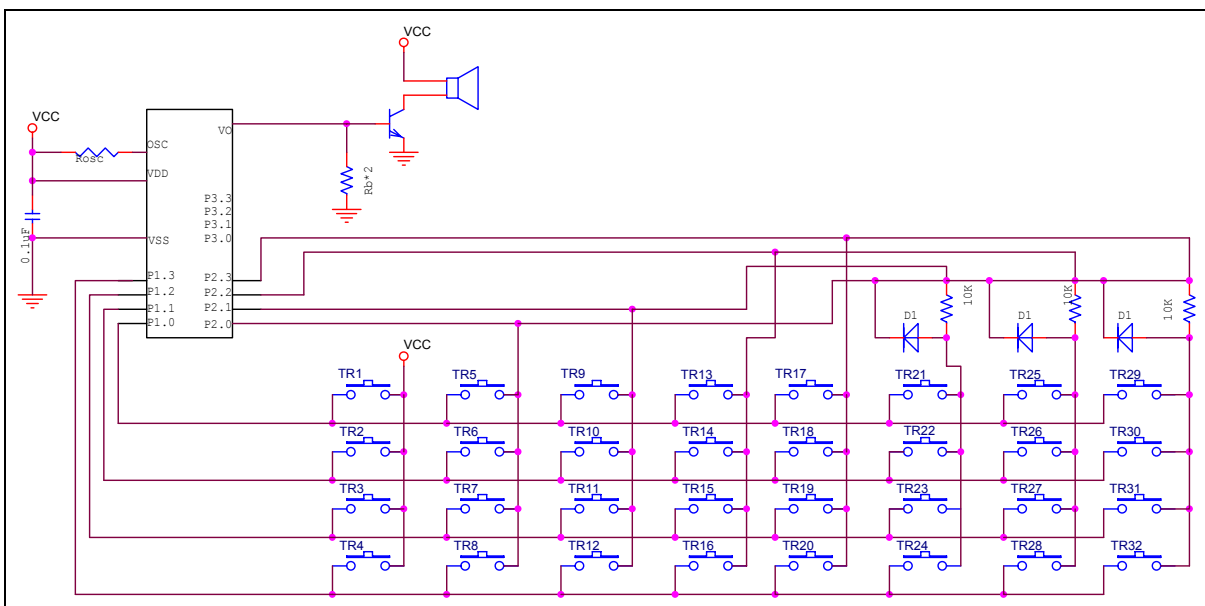
Tiny Controller-Based Speech Synthesizer

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eSM005 ~ eSM020 Application Circuit for 16-Key



eSM005 ~ eSM020 Application Circuit for 32-Key



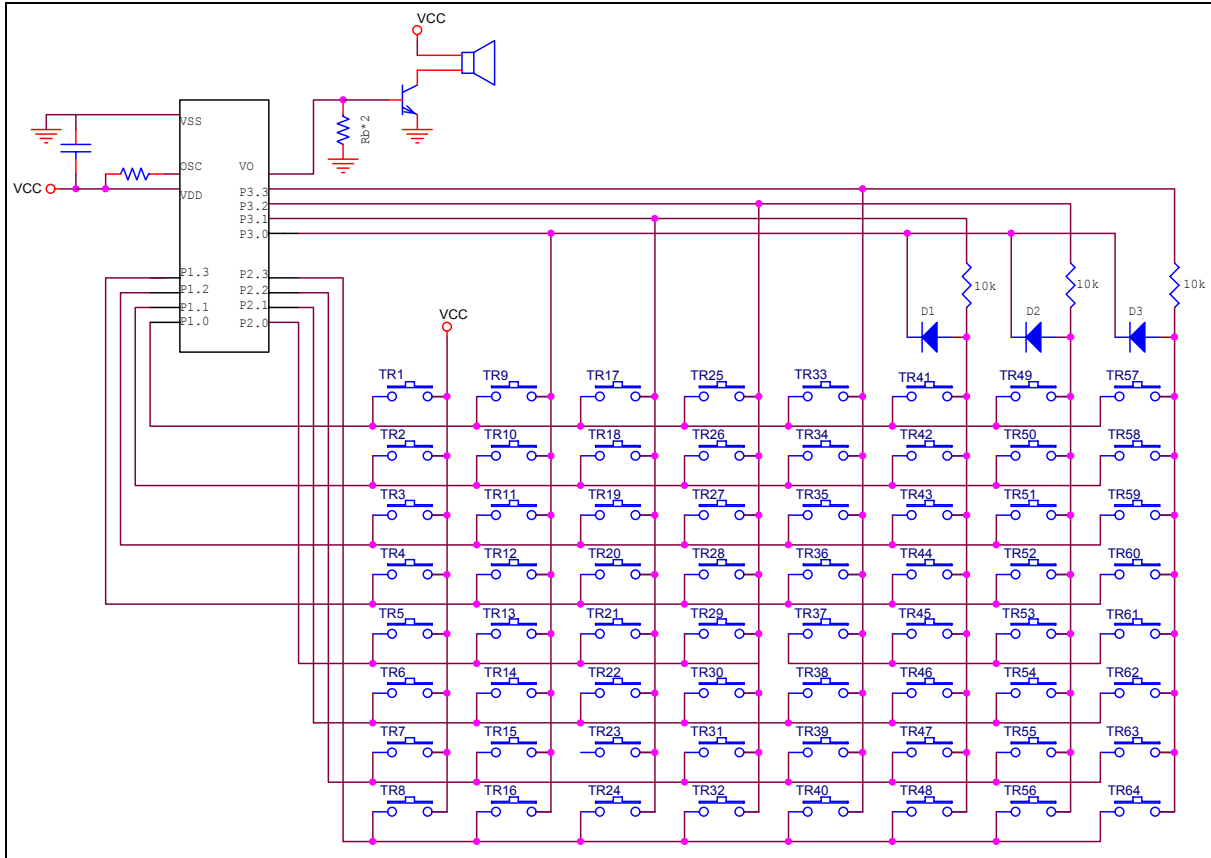


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Tiny Controller-Based Speech Synthesizer

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eSM005 ~ eSM020 Application Circuit for 64-Key



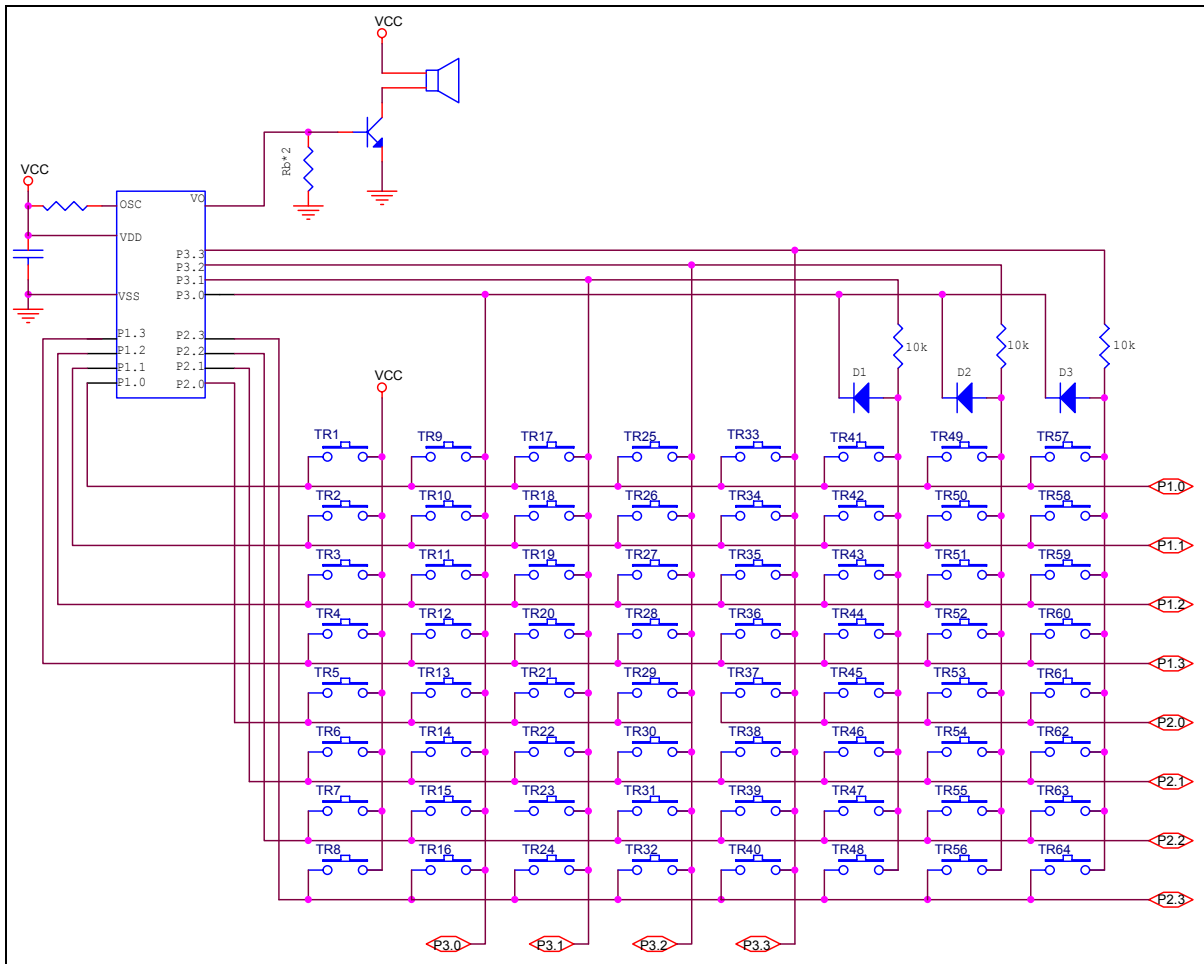


EASY SOUND® – eSM Series

Tiny Controller-Based Speech Synthesizer

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eSM005 ~ eSM020 Application Circuit for 128-Key



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