UMC

UM3511A

ADVANCED PRODUCT DESCRIPTION

Melody Organ Generator

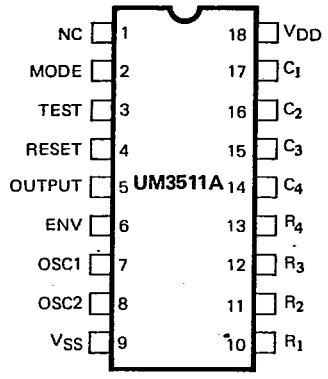
Features

- Typical 3V operating voltage and low power consumption
- Can play a scale with 15 notes (G3-G5)
- Can replay a tune with real time (max. 47-note memory)
- First key priority
- Up to 15 songs can be selected (512-note memory)
- A magnetic buzzer can be driven by connecting an NPN transistor
- 8 kinds of tempo programming
- One key one song (auto-stop)

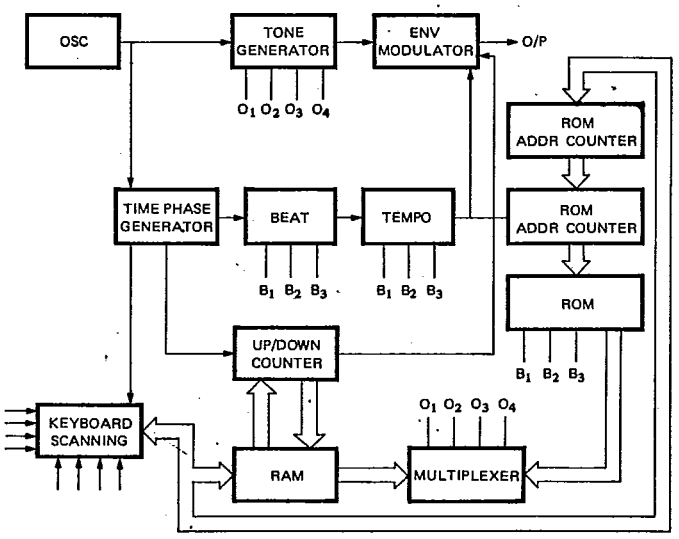
General Description

The UM3511A series is a low-cost, low-power CMOS LSI designed for use in electronic toy organs. The UM3511A has an on-chip ROM programmed for musical performance and a dynamic RAM used for the organ replay function. The integrated circuit provides keyboard scanning with up to 16 keys and produces a piano effect. The UM3511A series is packaged in 18-pin DIPs.

Pin Configuration



Block Diagram



Absolute Maximum Ratings*

Supply Voltage $V_{DD}-V_{SS}$ ..... −0.3V to +5V
Input Voltage ..... V_{SS}−0.2V to V_{DD} +0.2V
Operation Temperature ..... −20°C to +65°C
Storage Temperature ..... −55°C to +125°C

*Comments

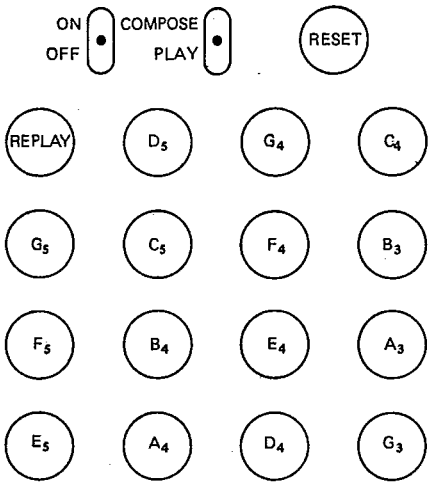
Stress above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only. Functional operation of this device at these or any other conditions above those indicated in the operational sections of this specification is not implied and exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Electrical Characteristics

(V_{DD} = 3V, V_{SS} = 0, T_A = 25°C, unless otherwise specified.)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Operation Voltage	V_{DD}		2.4	3	5	V
Stand-By Current	I_{STB}	OSC halting $V_2 = V_7 = V_{SS}$, $V_6 = V_{DD}$	–	–	10	μA
'H' Input Voltage	V_{IH}		$V_{DD}-0.2$	–	V_{DD}	V
'L' Input Voltage	V_{IL}		V_{SS}	–	$V_{SS}+0.2$	V
Frequency Deviation Per Lot	ΔF/F	V_{DD} = 3V	−10%	–	+10%	
Frequency Stability	ΔF/F	$\frac{F_{OSC}(3.3V) - F_{OSC}(2.7V)}{F_{OSC}(2.7V)}$	–	–	20%	
Output Current	I_O	V_O = 0.8V	200	–	–	μA
ENV Drive Current	I_{ED}	V_{DD} = 2.7V, V_6 = 0.7V	150	–	–	μA

Keyboard Layout



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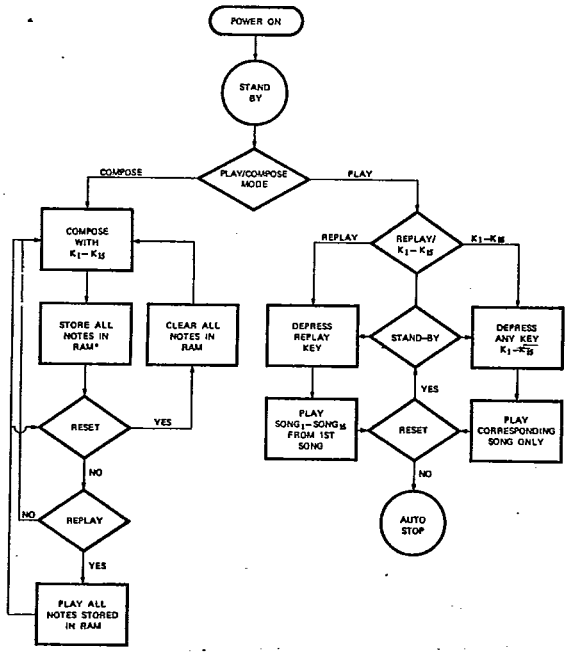
Pin Description

Pin No.	Designation	Description
1	NC	No connection
2	MODE	Plays a song if this pin is connected to V_{DD} Composes a song if this pin is connected to V_{SS}
3	TEST	This pin is used for testing. In normal operation, this pin should be either open or grounded.
4	RESET	Clears all address data if connected to V_{DD}
5	OUTPUT	Organ output
6	ENV	Enveloping circuit terminal
7	OSC 1	A resistor is connected between P7 and P8 as an oscillator
8	OSC 2	
9	V_{SS}	Negative power supply
10	R_1	Keyboard row line 1
11	R_2	Keyboard row line 2
12	R_3	Keyboard row line 3
13	R_4	Keyboard row line 4
14	C_4	Keyboard column line 4
15	C_3	Keyboard column line 3
16	C_2	Keyboard column line 2
17	C_1	Keyboard column line 1
18	V_{DD}	Positive power supply

Operation Chart



* RAM max. 47 notes, additional notes will not be stored in RAM

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Functional Description

Oscillating Circuit

The resistor R_1 is connected externally to set the frequency at 64 KHz. Since the oscillation frequency is used as a time base for the tone, rhythm and tempo generators, its accuracy will affect the quality of the organ.

Keyboard Scanning

These are 4-row and 4-column inputs from the keyboard contacts. Four stages of FLIP-FLOP constitutes the keyboard scanning circuit.

Tone Generator

The tone generator is a programmed divider. Within the organ, 15 scales can be selected. The range of scales is from "G3" to "G5".

Beat Generator

The rhythm includes eight notes, including the following, for example 4/4:

(1) a sixteenth note (a semiquaver rest)
(2) an eighth note (a quaver rest)
(3) a dotted eighth note
(4) a quarter note (a crotchet rest)
(5) a dotted quarter note
(6) a half note (a minimum rest)
(7) a dotted half note
(8) a whole note (a semi-breve rest)

Tempo

Tempo is the number of ♩ in one minute. In the play mode, the tempo generator contains 8 different tempos. One tempo can be selected from the 8 available tempos, including 63, 78, 85, 104, 134, 156, 187, 234 ♩/minute.

Melody ROM

The mask ROM can memorize 512 words of 7 bits each. Of these, 4 bits are used for controlling the tone generator and 3 bits are used for controlling the beat generator and program tempo.

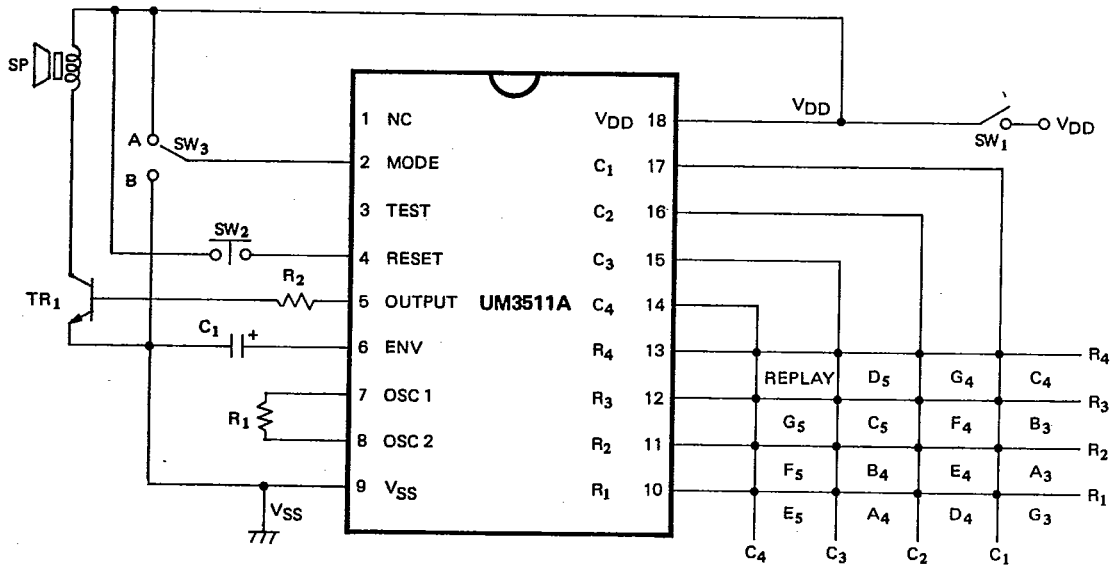
Compose Mode Beat Generator

A single tone is generated as long as the user presses any key in the composing mode. The interval between two keys is memorized is RAM. Maximum interval is 4 sec.

Melody RAM

The melody RAM can memorize 47 words. The melody is generated by pressing the keyboard, and memorizing in RAM. When pressing the replay button, the song composed will be played back from RAM.

Application Circuit



Recommended Value of External Components

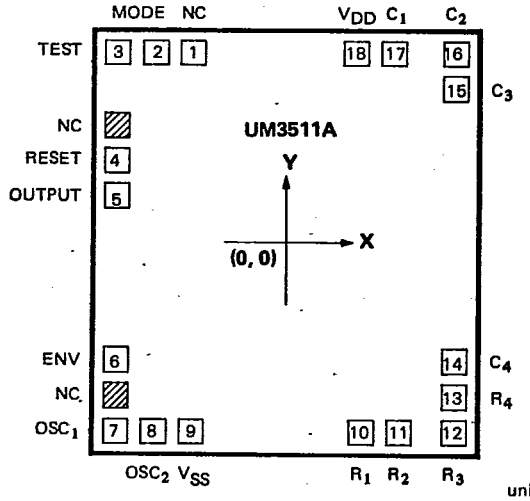
Components	Recommended Value	Unit
C_1	47	μF
R_1	750–800	KΩ
R_2	1	KΩ
TR_1	NPN: 9013	–
SW_1	Toggle Switch	–
SW_2	Push-button Switch	–
SW_3	Toggle Switch	–
SP	8 ohm 0.2W Speaker	–

Note: Switch 3 has two positions: A Play mode B Compose mode. When SW_3 is set in the "A" position, one can listen to any of the 15 available songs.
When SW_3 is set in the "B" position, one can compose a song from "G3" to "G5". By pressing the replay button, the song composed will automatically play back.

Songs Series List

1. Hush Little Baby
2. Twinkle Twinkle Little Star
3. London Bridge Is Falling Down
4. Dream of Home And Mother
5. Christmas Carol
6. Are You Sleeping
7. The Farmer in the Dell
8. In a Persian Market
9. Mary Had a Little Lamb
10. Long Long Ago
11. Santa Lucia
12. Little Brown Jug
13. Butterfly
14. The Train Is Running Fast
15. Close Encounters of the Third Kind

Bonding Diagram



unit: μm

Pad No.	Designation	X	Y
1	NC	–1234.44	1890.78
2	MODE	–1428.50	1890.78
3	TEST	–1620.52	1890.78
4	RESET	–1619.50	1061.72
5	OUTPUT	–1619.50	864.62
6	ENV	–1619.50	–1536.20
7	OSC1	–1619.50	–1890.78
8	OSC2	–1400.05	–1890.78
9	V_{SS}	–1204.98	–1890.78
10	R_1	985.52	–1890.78
11	R_2	1191.77	–1890.78
12	R_3	1592.08	–1890.78
13	R_4	1592.08	–1690.12
14	C_4	1592.08	–1491.49
15	C_3	1576.83	1695.70
16	C_2	1570.74	1890.78
17	C_1	1228.34	1890.78
18	V_{DD}	975.36	1890.78