

## UM3512 Series

### Melody Organ IC

#### Features

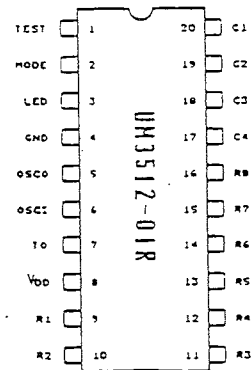
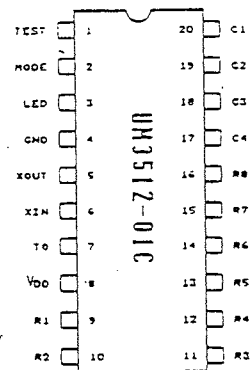
- Typical 3V operation voltage
- Low power consumption
- Total 25 tone keys
- Can replay a tune with real time (max. 47-note memory)
- First key priority
- Built-in demo song. (15 songs, 512-note memory)
- Magnetic speaker can be driven by connecting a transistor
- Oscillation circuit (mask option)  
Mask options for either external resistor or external ceramic crystal as well as capacitors to generate system clock
- One key, one song with auto-stop function, or stop by pressing "RESET" key
- Play all the songs continuously with auto-stop function (1st, 2nd . . . 15th, stop), or stop by pressing "RESET" key
- 8 programmable tempos
- In compose mode the tone memory can be cleared by pressing "RESET" key
- LED flashing by tone
- Key matrix 8 \* 4 (row 8, column 4)
- Piano effect

#### General Description

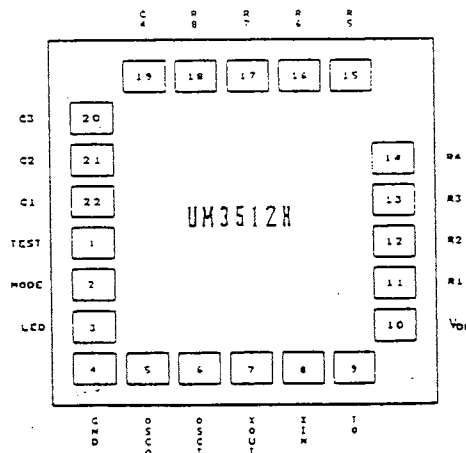
The UM3512 Series are low-cost and low-power CMOS LSI's designed for electronic toy organs. The UM3512 Series has an on chip ROM programmed for musical performance and static RAM used for the organ replay function.

The UM3512 provides keyboard scanning with up to 32 keys, and produces a piano effect. You can easily change tempo rate, tone range and volume by using function keys. The UM3512 Series is packaged in 20 pin DIP or available in CHIP FORM.

#### Pin Configurations

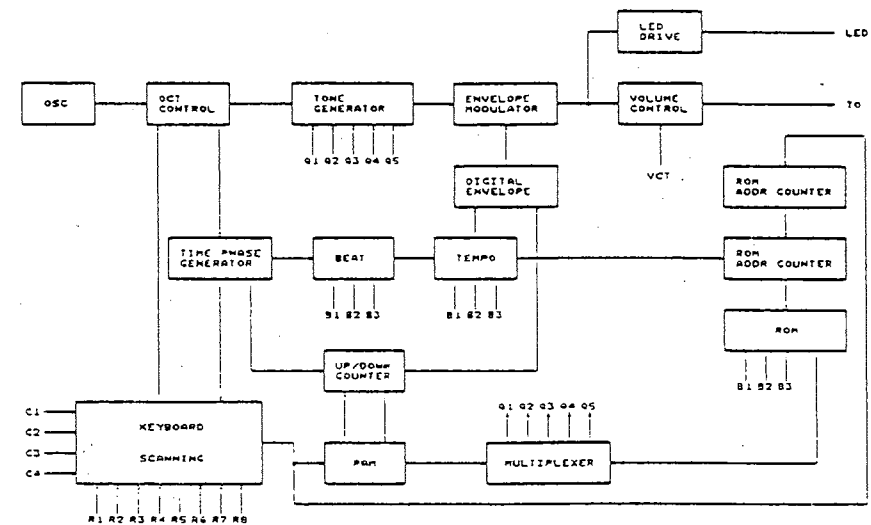


#### Pad Configuration



## UM3512 Series

#### Block Diagram



#### Absolute Maximum Ratings\*

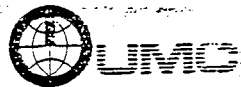
DC Supply Voltage	-0.3V to +3.4V
Input/Output Voltage	GND -0.3V to VDD +0.3V
Operating Ambient Temperature	-10°C to 60°C
Storage Temperature	-50°C to 125°C

#### \*Comments

Stresses 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.

#### DC Electrical Characteristics (VDD = 3V, GND = 0V, TA = 25°C, unless otherwise specified.)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Operation Voltage	VDD	2.4	3	5	V	
Standby Current	I <sub>sb</sub>			5	μA	OSC halting (LED pin connected to GND)
"H" Input Voltage	V <sub>ih</sub>	VDD - 0.2		VDD	V	MODE TEST
"L" Input Voltage	V <sub>il</sub>	GND		GND + 0.2	V	MODE TEST
Frequency Deviation Per Lot	ΔF/F	-10%		+10%		VDD = 3V



DC Electrical Characteristics (continued)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Frequency Stability	$\Delta F/F$			20%		Fosc (3.3V) - Fosc (2.7V)/ Fosc (2.7V)
Output Current	Ito1	1.3	1.7	2.1	mA	Vo = 0.7V, VDD = 3V, 0dB
Output Current	Ito2	2.7	3.2	3.6	mA	Vo = 0.7V, VDD = 4.5V, 0dB
Output Current	Iled	5.0	8.0	12	mA	LED (Vled = VDD - 1.7)

Pin and Pad Descriptions

Pin No.		Pad No.	Designation	Description
UM3512-01C	UM3512-01R			
1	1	1	TEST	This pin is used for testing. In normal operation, this pin should be either open or grounded (built-in pull low)
2	2	2	MODE	Plays a song if this pin is connected to VDD or open (built-in pull high). Composes a song if this pin is connected to VSS
3	3	3	LED	Drives LED, flashing by tone
4	4	4	GND	Ground pin
5		7	XOUT	A 640KHz ceramic resonator is connected between XOUT & XIN as an oscillator
6		8	XIN	
	5	5	OSCO	A resistor is connected between OSCO & OSCI as an oscillator
	6	6	OSCI	
7	7	9	TO	Tone output
8	8	10	VDD	Positive power supply
9	9	11	R1	Keyboard row line 1
10	10	12	R2	Keyboard row line 2
11	11	13	R3	Keyboard row line 3
12	12	14	R4	Keyboard row line 4



Pin and Pad Descriptions (continued)

Pin No.		Pad No.	Designation	Description
UM3512-01C	UM3512-01R			
13	13	15	R5	Keyboard row line 5
14	14	16	R6	Keyboard row line 6
15	15	17	R7	Keyboard row line 7
16	16	18	R8	Keyboard row line 8
17	17	19	C4	Keyboard column line 4
18	18	20	C3	Keyboard column line 3
19	19	21	C2	Keyboard column line 2
20	20	22	C1	Keyboard column line 1

Functional Description

Key matrix : 8 rows and 4 columns.

(1) Compose mode

A single tone is generated as long as the user presses any key in the composing mode. The interval between two keys is memorized in RAM. Maximum interval is 4.6 sec.

- a. Tone key  
UM3512-01C: 25 KEYS. (C3 - C5)  
UM3512-01R: 25 KEYS. (G3 - G5)

b. REPLAY

Plays back the song that was composed in RAM memory.

- c. RES  
Clears all address data.

(2) Play mode

a. One key, one song

UM3512-01C: C3, D3, E3, F4, G4, A4, B4, C4, D4, E4, F5, G5, A5, B5, C5.  
UM3512-01R: G3, A3, B3, C4, D4, E4, F4, G4, A4, B4, C5, D5, E5, F5, G5.

b. TWS

Plays the whole song. (1st..2nd..15th, auto stop)

- c. RES  
Stop function.

(3) Tempo +

Increases the tempo rate.

(4) Tempo -

Decreases the tempo rate

(5) OCT

Adjusts tone range, active as below:

UM3512-01C

power on press  
 \_\_\_\_\_> C3 - C5      \_\_\_\_\_> C2 - C4  
 press press  
 \_\_\_\_\_> C4 - C6      \_\_\_\_\_> C3 - C5 ...

UM3512-01R

power on press  
 \_\_\_\_\_> G3 - G5      \_\_\_\_\_> G2 - G4  
 press press  
 \_\_\_\_\_> G4 - G6      \_\_\_\_\_> G3 - G5 ...

(6) VCT

Volume control

power on press  
 \_\_\_\_\_> med volume      \_\_\_\_\_> max volume  
 press press  
 \_\_\_\_\_> med volume      \_\_\_\_\_> min volume  
 press press  
 \_\_\_\_\_> med volume      \_\_\_\_\_> max volume.

Min Volume = - 12 DB.

Med Volume = - 6 DB.

Max Volume = 0 DB.



Tone Generator (continued)

Tone	Ideal Frequency (Hz)	UM3512 Frequency (Hz)	ERROR %
G3	196.000	195.122	0.4
G3#	207.652	207.792	0.06
A3	220.000	219.178	0.3
A3#	233.082	231.884	0.5
B3	246.942	246.154	0.3
C4	261.626	262.295	0.2
C4#	277.183	275.862	0.5
D4	293.655	296.296	0.9
D4#	311.127	313.725	0.8
E4	329.628	326.530	0.9
F4	349.288	347.826	0.4
F4#	369.994	327.093	0.6
G4	391.995	390.243	0.4
G4#	415.305	410.256	1.2
A4	440.000	444.444	1.0
A4#	466.164	470.588	0.9
B4	493.883	500.000	1.2
C5	523.251	516.129	1.3
C5#	554.364	551.724	0.5
D5	587.330	592.592	0.8
D5#	622.254	615.384	1.1
E5	659.255	666.666	1.1
F5	698.456	695.652	0.4
F5#	739.989	727.272	1.7
G5	783.991	800.000	2.0



- (7) Tempo will be reset to a default value under one of the four listed conditions.
- Power on reset.
  - Press "RESET" key.
  - Press tone key.
  - Press "TWS" key. (every song has a default tempo.)

- 63 beats/min.
- 78 beats/min.
- 85 beats/min.
- 104 beats/min.
- 134 beats/min.
- 156 beats/min.
- 187 beats/min.
- 234 beats/min.

(8) Programming descriptions of demo song

Beat Generator

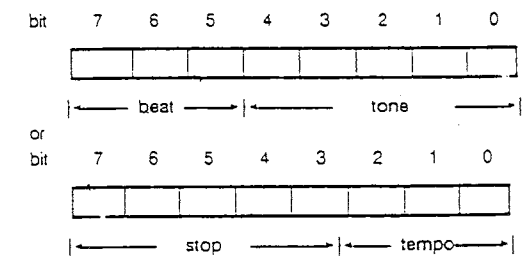
The beat includes eight notes, including the following.

- 1/4 beat
- 1/2 beat
- 3/4 beat
- 1 beat
- 1 1/2 beats
- 2 beats
- 3 beats
- 3 3/4 beats

Melody ROM

The mask ROM can memorize 512 words of 8 bits each. Of these, 5 bits are used for controlling the tone generator and 3 bits are used for controlling the beat generator and program tempo.

Data Format



Tempo

The tempo is the number of beats 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 the following:

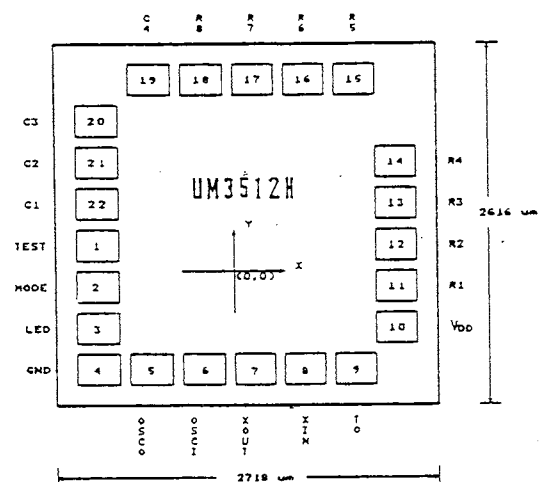
Tone Generator

The tone generator is a programmed divider. 25 scales can be selected. The frequency of each tone is shown below:

Tone	Ideal Frequency (Hz)	UM3512 Frequency (Hz)	ERROR %
C3	130.813	131.148	0.25
C3#	138.591	139.130	0.39
D3	146.832	146.789	0.03
D3#	155.563	155.34	0.14
E3	164.814	164.948	0.08
F3	174.614	193.913	0.4
F3#	185.000	186.046	0.5



Bonding Diagram



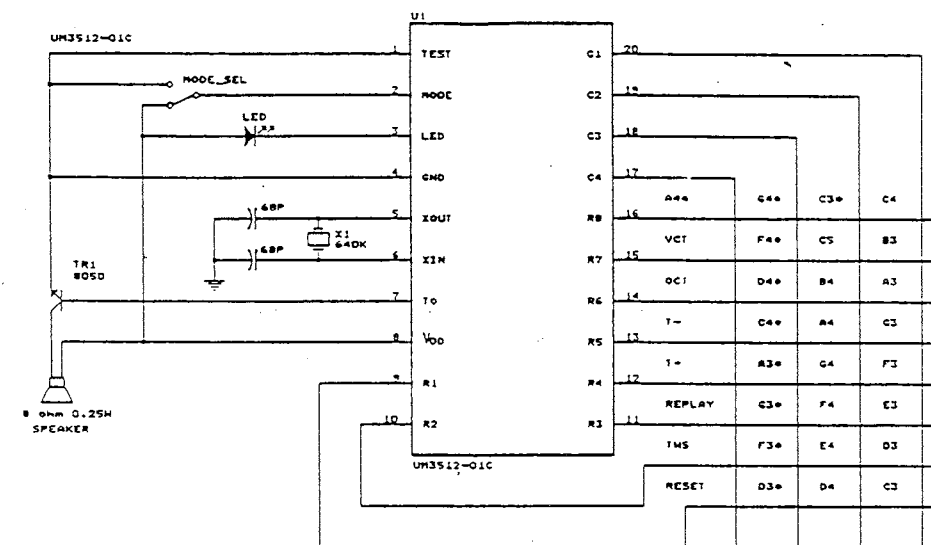
\* Substrate connect to VDD.

Pad No.	Designation	X	Y	Pad No.	Designation	X	Y
1	TEST	-1182	- 211	12	R2	1182	34
2	MODE	-1182	- 525	13	R3	1182	380
3	LED	-1182	- 854	14	R4	1182	724
4	GND	-1122	-1105	15	R5	1058	1123
5	OSCO	- 474	-1114	16	R6	716	1123
6	OSCI	- 148	-1114	17	R7	- 163	1123
7	XOUT	162	-1114	18	R8	- 506	1123
8	XIN	502	-1114	19	C4	- 838	1123
9	TO	928	-1124	20	C3	-1182	739
10	VDD	1209	- 891	21	C2	-1182	422
11	R1	1182	- 403	22	C1	-1182	104
12	R2	1182	34				

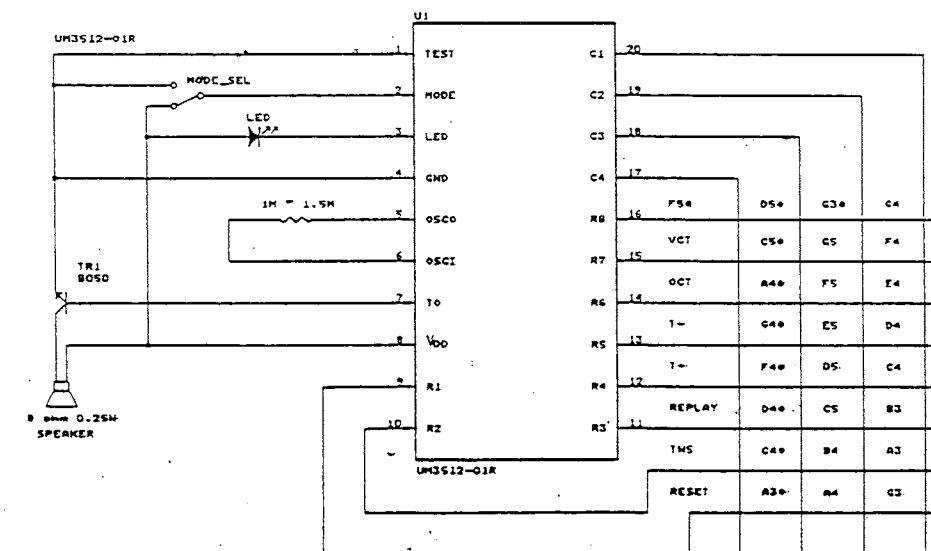


Application Circuits (for reference only)

(1) UM3512-01C. (Ceramic Crystal Oscillation)



(2) UM3512-01R (Resistor Oscillation)

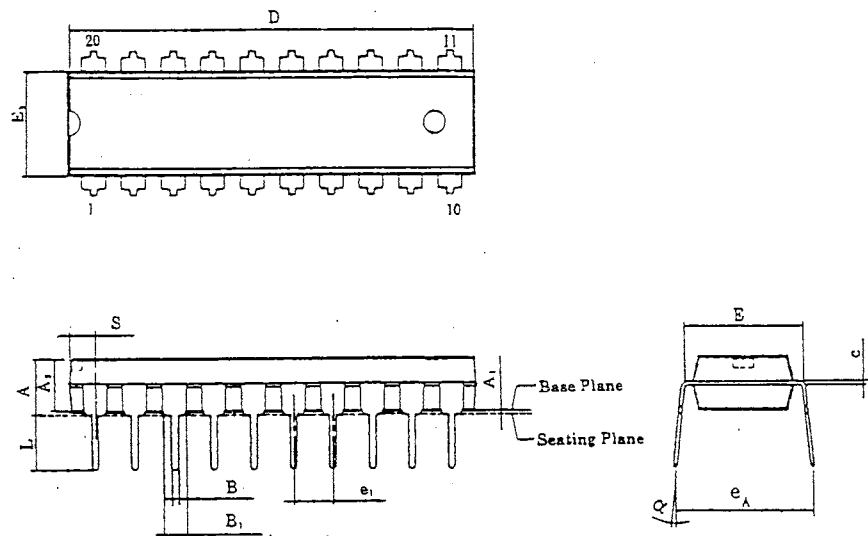




PACKAGING INFORMATION

P-DIP 20L Outline Dimensions

Unit : inches/mm



Symbol	Dimensions in inches	Dimensions in mm
A	0.175 Max.	4.45 Max.
A <sub>1</sub>	0.010 Min.	0.25 Min.
A <sub>2</sub>	0.130±0.010	3.30±0.25
B	0.018 <sup>+0.004</sup> -0.002	0.46 <sup>+0.10</sup> -0.05
B <sub>1</sub>	0.060 <sup>+0.004</sup> -0.002	1.52 <sup>+0.10</sup> -0.05
C	0.010 <sup>+0.004</sup> -0.002	0.25 <sup>+0.10</sup> -0.05
D	1.026 Typ. (1.046 Max.)	26.06 Typ. (26.57 Max.)
E	0.300±0.010	7.62±0.25
E <sub>1</sub>	0.250 Typ. (0.262 Max.)	6.35 Typ. (6.65 Max.)
e <sub>1</sub>	0.100±0.010	2.54±0.25
L	0.130±0.010	3.30±0.25
α	0°-15°	0°-15°
e <sub>A</sub>	0.345±0.035	8.76±0.89
S	0.078 Max.	1.98 Max.

Notes:

1. The maximum value of dimension D includes end flash.
2. Dimension E<sub>1</sub> does not include resin fins.
3. Dimension S includes end flash.

