

9325812 UNITED MICROELECTRONICS

92D 00593

D 7-77-13



UM3521A/22AD/22AM

Paper Organ
(Electronic Keyboard IC)

ADVANCED PRODUCT DESCRIPTION

Features

- Typical 3V operating voltage and low power consumption
- Piezo direct drive capability
- A magnetic speaker can be driven by connection of a PNP transistor
- 64 KHz clock
- Fast test capability
- RC oscillator with one external resistor
- With key priority
- On chip modulator for external RC envelope
- Vibrato effect
- Wide Compass:
 - Direct 14 key application (C5-C6),
Max. 26 key application (C4-C6).
 - Direct 16 key whole tone application
 -UM3522AD (C4-C6) (mask option)
- LED can be driven by connecting an NPN transistor
- Auto-Oscillator — Off function

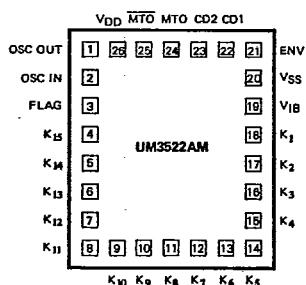
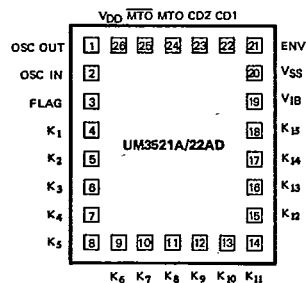
General Description

The UM3521A series are low-cost CMOS LSIs designed for use in keyboard instruments. Features include wide-range compass, maximum of 2 octaves, by piano and organ tone. A number of keyboards can be chosen using pin select options. It has a Preamplifier on chip for

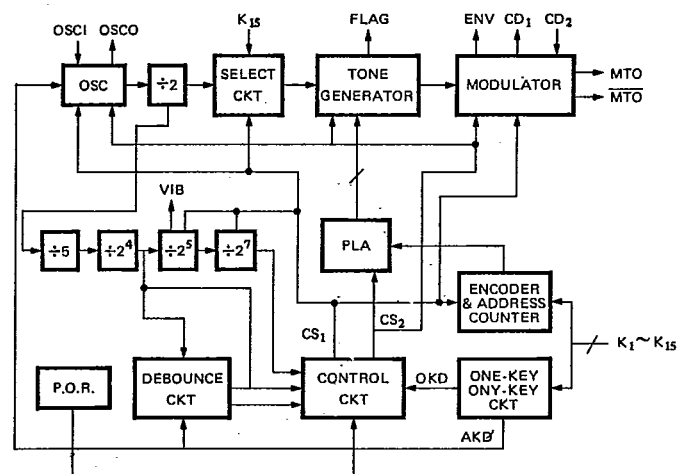
envelope and buzzer can be driven directly.

CMOS technology used to produce these devices results in very low power consumption.

Pad Configuration



Block Diagram



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Absolute Maximum Ratings*

DC Supply Voltage -0.3V to 5.0V
 Input/Output Voltage $V_{SS} - 0.2V$ to $V_{DD} + 0.2V$
 Operating Ambient Temperature -10°C to 60°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

($V_{SS} = 0V$, $T_A = 25^{\circ}\text{C}$, $F_{OSC} = 65536\text{Hz}$, unless otherwise specified.)

Parameter	Symbol	Min.	Typ.	Max.	Condition
Operating Voltage	V_{DD}	2.0V	—	5V	
Operating Current	I_{DD}	—	2.5mA	5 mA	$V_{DD} = 3V$, No Load
Stand-by Current	I_{STB}	—	—	1 μA	$V_{DD} = 3V$, OSC Halting all output pin unload
Input Voltage-High	V_{IH}	$V_{DD} - 0.2V$	—	V_{DD}	
Input Voltage-Low	V_{IL}	V_{SS}	—	$V_{SS} + 0.2V$	
Input Current (1) $K_1 - K_{15}$	I_{I1}	3 μA	—	40 μA	$V_{DD} = 3V$, $V_{(K_1 - K_{15})} = 3V$
MTO Drive Current	I_{MD}	1 mA	—	—	$V_{DD} = 3V$, $V_{OH} = 1.5V$, $CD2 = 3V$
MTO Sink Current	I_{MS}	1 mA	—	—	$V_{DD} = 3V$, $V_{OL} = 1.5V$, $CD2 = 0V$
MTO Drive Current	I_{MD}	1 mA	—	—	$V_{DD} = 3V$, $V_{OH} = 1.5V$, $CD2 = 0V$
MTO Sink Current	I_{MS}	1 mA	—	—	$V_{DD} = 3V$, $V_{OL} = 1.5V$, $CD2 = 3V$
Input Current (2) OSC1	I_{I2}	-30 nA	—	30 nA	$V_{DD} = 3.3V$, $V_{OSC1} = 0 - 3.3V$
OSC2 Drive Current	I_{OSS2}	50 μA	—	—	$V_{DD} = 2V$, $V_{OSC1} = 0V$, $V_{OSC2} = 1.1V$
OSC2 Sink Current	I_{OSS2}	50 μA	—	—	$V_{DD} = 2V = V_{OSC1}$, $V_{OSC2} = 0.5V$
ENV Drive Current	I_{ED}	400 μA	—	—	$V_{DD} = 2V$, $V_{ENV} = 1.1V$
Frequency Deviation Per Lot	$\Delta F/F$	-10%	—	+10%	$V_{DD} = 3V$
Frequency Stability	$\Delta F/F$	—	—	20%	$\frac{F_{OSC}(3.3V) - F_{OSC}(2.7V)}{F_{OSC}(2.7V)}$
FLAG Drive Current	I_{FLAG}	200 μA	—	—	$V_{DD} = 2V$, $V_{FLAG} = 1.1V$

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**UM3521A/22AD/22AM****Pad Description**

Pad No.	Designation	Description
1	OSCO	RC oscillator pad or inverted clock output
2	OSCI	RC oscillator pad
3	FLAG	This pad is used for driving LED
4	K1	Direct key signal input K1
5	K2	Direct key signal input K2
6	K3	Direct key signal input K3
7	K4	Direct key signal input K4
8	K5	Direct key signal input K5
9	K6	Direct key signal input K6
10	K7	Direct key signal input K7
11	K8	Direct key signal input K8
12	K9	Direct key signal input K9
13	K10	Direct key signal input K10
14	K11	Direct key signal input K11
15	K12	Direct key signal input K12
16	K13	Direct key signal input K13
17	K14	Direct key signal input K14
18	K15	Direct key signal & control input
19	VIB	Low frequency signal
20	VSS	Negative power supply
21	ENV	Enveloping circuit terminal
22	CD1	Signal differentiated terminal 1
23	CD2	Signal differentiated terminal 2
24	MTO	Modulated tone signal output 1
25	$\overline{\text{MTO}}$	Modulated tone signal output 2
26	VDD	Positive power supply

Note: For UM3522AM Pad 4 is K₁₅, Pad 5 is K₁₄, Pad 6 is K₁₃, , Pad 17 is K₂, Pad 18 is K₁

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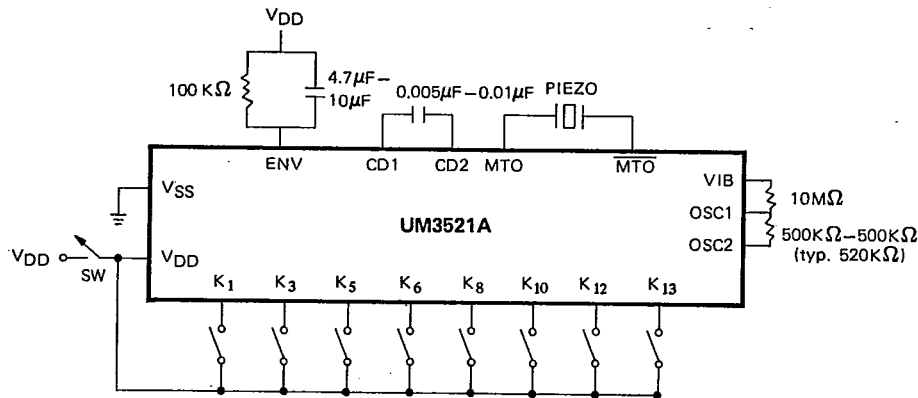
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Application Circuit

(The envelope generator can be disabled by connecting ENV pin to VSS).

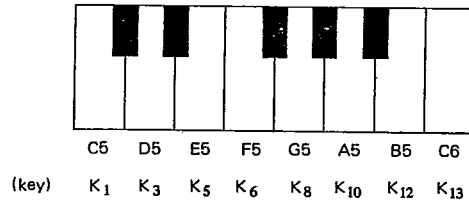
THE UM3521A HAS 6 KINDS OF APPLICATIONS

A. 8 Key Application (8 whole tones)

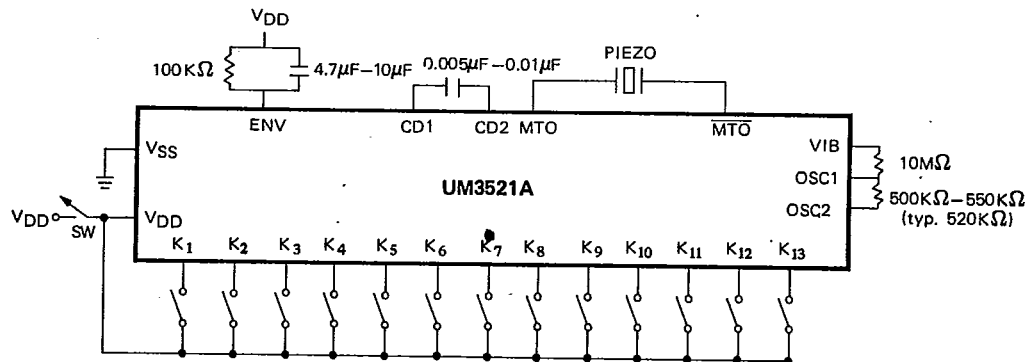


In 8 key application, execute serial connection from low scale to high scale keys such as:

- 1st K₁ to C5
- 2nd K₃ to D5
-
- 7th K₁₂ to B5
- 8th K₁₃ to C6

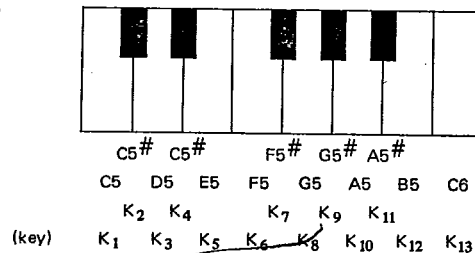


B. 13 Key Application (8 whole tones & 5 semitones)



In 13 key application, execute serial connection from low scale to high scale keys such as:

- 1st K₁ to C5
- 2nd K₂ to C5#
-
- 12th K₁₂ to B5
- 13th K₁₃ to C6



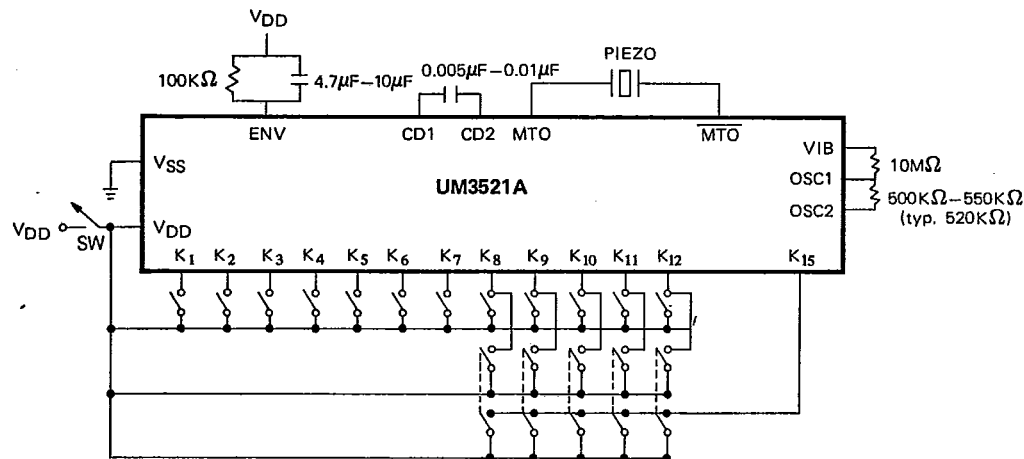
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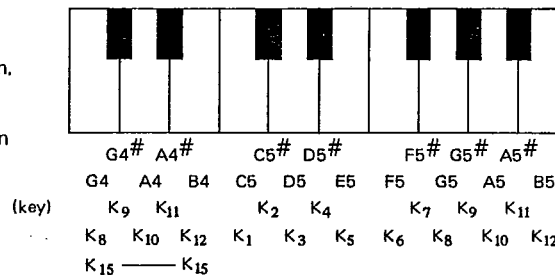
C-1. 17 Key Application (10 whole tones & 7 semitones)



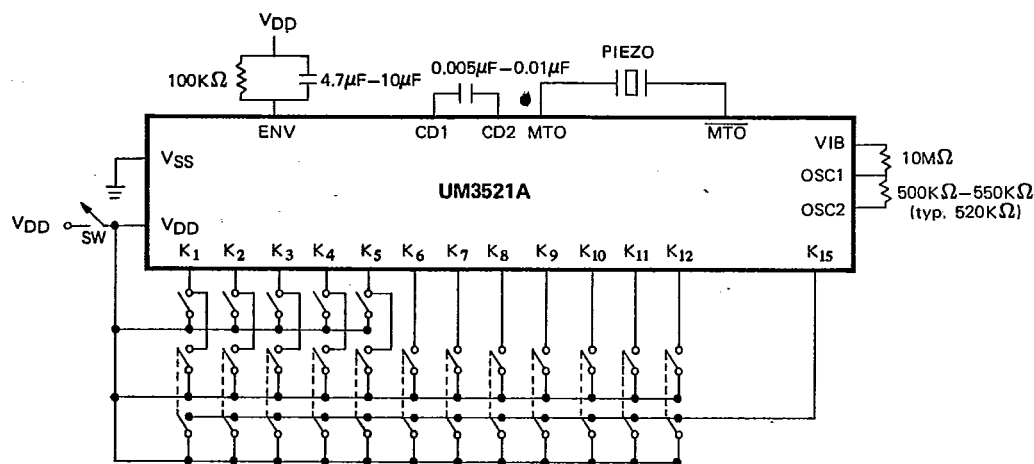
In 17 key application (G4-B5), connect as follows:

1st Same procedure as 13 key application, (K₁₃ is disconnected)

2nd Connect (K₈-K₁₂) to K₁₅ as shown in the application circuit above.



C-2. 17 Key Application (10 whole tones & 7 semitones)



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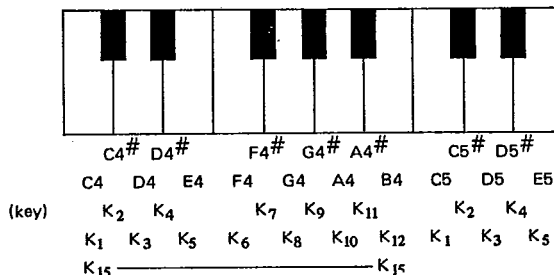
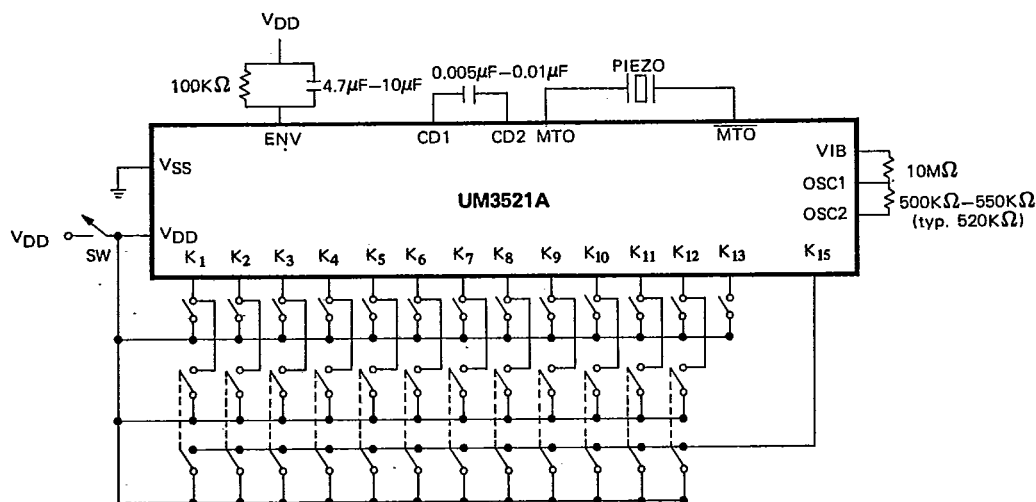
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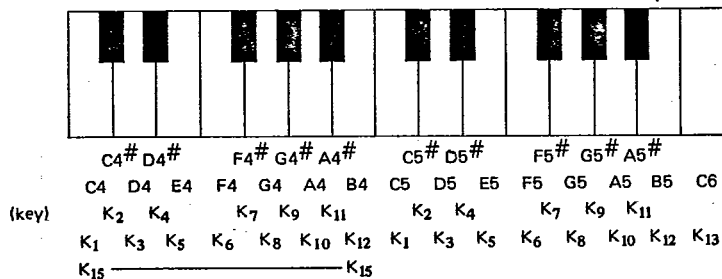
In 17 key application (C4-E5), connect as follows:

- 1st Same procedure as 13 key application. (K₆-K₁₃ are disconnected).
- 2nd Connect all of low keys (12 keys) to K₁₅ as shown in the application circuit above.


D. 25 key Application (15 whole tones & 10 semitones)


In 25 key application, connect as follows:

- 1st Same procedure as 13 key application.
- 2nd Connect all low keys (12 keys) to K₁₅ as shown in the application circuit above.



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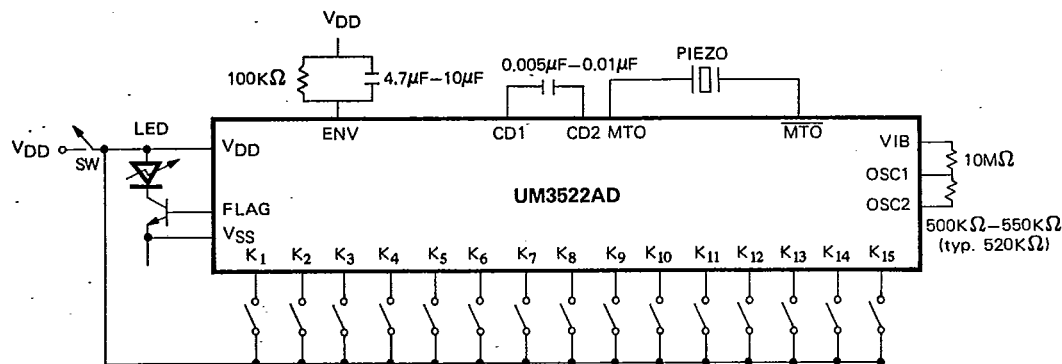
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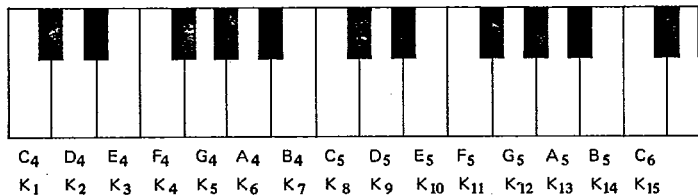
THE UM3522AD HAS 15 KEY WHOLE TONE APPLICATION (MASK OPTION)

15 Key Whole Tone Application (C4-C6)

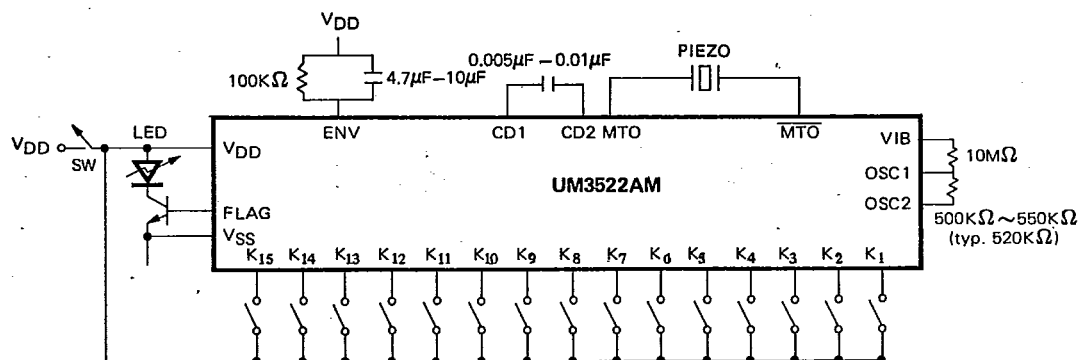


In 15 key application, execute serial connection from low scale to high scale keys such as:

- 1st K₁ to C₄
- 2nd K₂to D₄
- ...
- 14th K₁₄to B₅
- 15th K₁₅to C₆



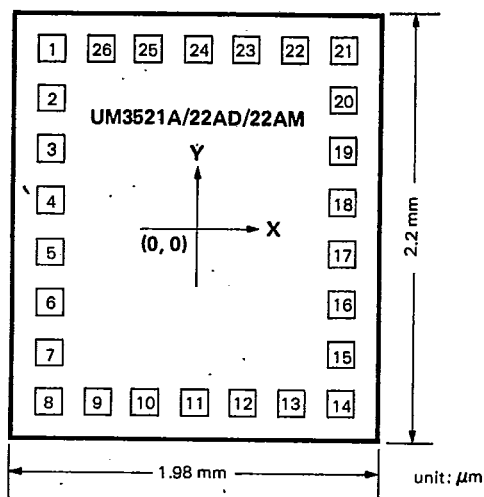
THE UM3522AM HAS 15 KEY WHOLE TONE APPLICATION (MASK OPTION)

UM3522AM is as same as UM3522AD except the sequence of bonding pads (K₁~K₁₅).


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**UM3521A/22AD/22AM****Bonding Diagram**

Pad No.	X	Y
1	-832.10	949.96
2	-815.09	542.04
3	-832.10	341.88
4	-816.10	141.99
5	-816.10	-214.12
6	-816.10	-414.02
7	-837.95	-788.10
8	-848.11	-967.99
9	-492.00	-967.99
10	-292.10	-967.99
11	68.07	-967.99
12	267.97	-967.99
13	611.87	-990.92
14	816.10	-997.97
15	816.10	-638.05
16	816.10	-437.90
17	812.04	-75.95
18	812.04	123.95
19	828.04	389.89
20	830.07	595.88
21	830.07	947.93
22	585.98	963.93
23	356.11	984.00
24	45.97	947.93
25	-309.88	945.90
26	-615.95	981.96

Ordering Information

UM3521A has 8, 13, 17, 25 Key Applications.

UM3522AD is 15 key whole tone Application.

UM3522AM is mirror type of UM3522AD (interchange the pad locations of $K_1 - K_{15}$).