Features

- Operating voltage: 3.3V~5.1V
- On-chip crystal oscillator: 3.58MHz
- 49-key instrument and compass range from C2~C6
- 15 outputs for key scanning
- 8 inputs for key scanning
- 32 percussion/voice space for rhythm programming
- 100 timbers
- 100 rhythms
- 5 percussions/voices
- 10 melodies
- 8-bit D/A audio outputs
- 4 percussion/voice channels output
- 8 melody channels output
- Tempo adjustable
- Memory function with 26 notes recordable
- Auto-bass-chord function
- Transpose function
- 5-chord effect
- Vibrato function
- Sustain effect
- Fill-in effect
- Chord with single or multi-keys pressed
- Chord with a key synchronously pressed
- 2 seven-segment LEDs to display operation status
- Indicator for chord operation
- 40 DIP enclosed

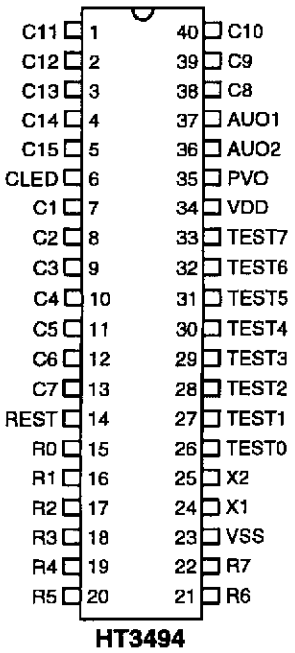
General Description

The HT3494 is a CMOS VLSI designed for musical instruments, especially 49-key multi-function instruments. The HT3494 is built-in with a controller and an ETS (Electrical Tone Synthesizer).

The HT3494 provides built-in melodies, rhythms, timbers and percussion/voice outputs. The status of operating system is displayed through 2 seven-segment LEDs.

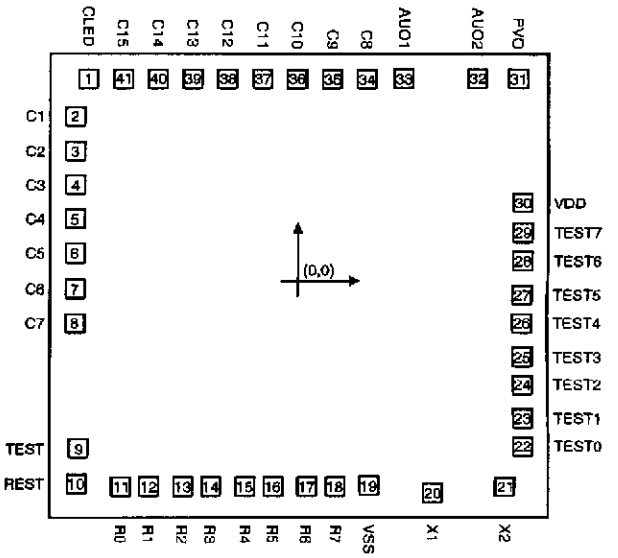
The HT3494 also provides an auto-bass-chord function, memory function as well as programmable rhythm in addition to basic playing functions.

Pin Assignment



HT3494

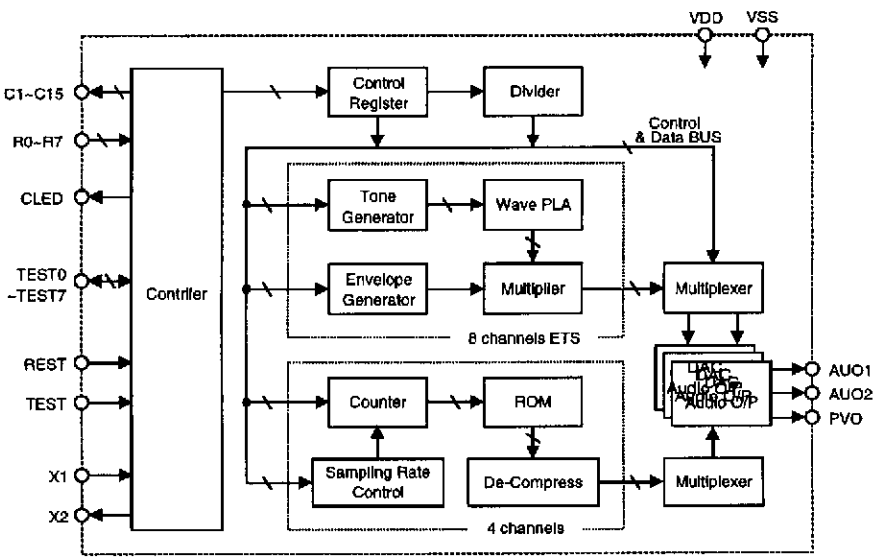
Pad Assignment



Chip size: 3920 × 3730 $(\mu m)^2$

* The IC substrate should be connected to VSS in the PCB layout artwork.

Block Diagram



Pad Coordinates

Unit: μm

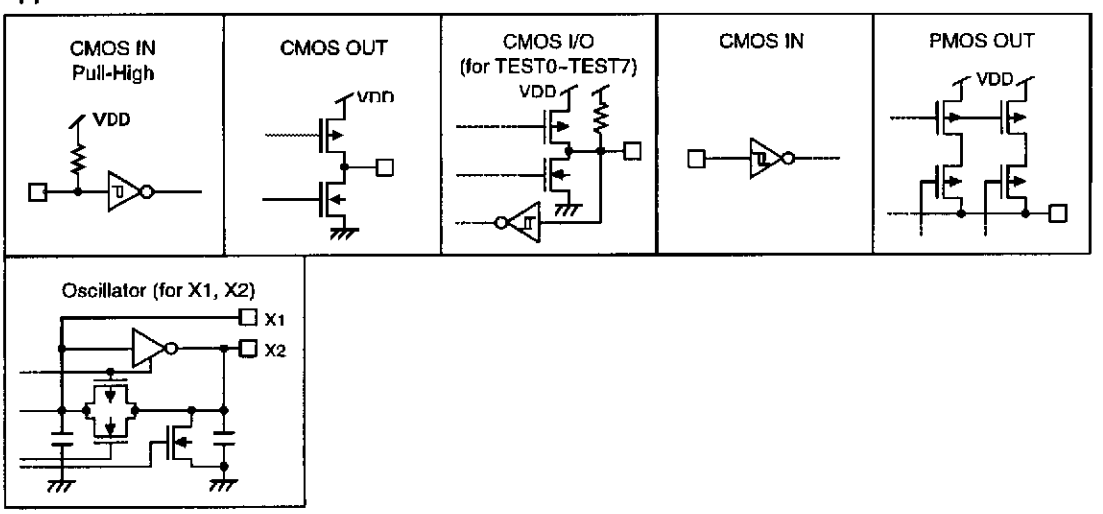
Pad No.	X	Y	Pad No.	X	Y
1	-1679.00	1649.45	22	1781.30	-1323.25
2	-1781.30	1335.25	23	1781.30	-1098.45
3	-1781.30	1054.45	24	1781.30	-827.65
4	-1781.30	779.85	25	1781.30	-602.85
5	-1781.30	499.05	26	1781.30	-332.05
6	-1781.30	224.45	27	1781.30	-107.25
7	-1781.30	-56.35	28	1781.30	163.55
8	-1781.30	-330.95	29	1781.30	388.35
9	-1754.90	-1333.75	30	1777.80	633.55
10	-1767.90	-1625.55	31	1742.70	1654.45
11	-1414.90	-1647.50	32	1419.50	1654.45
12	-1190.10	-1647.45	33	834.10	1654.45
13	-919.30	-1647.45	34	542.60	1649.45
14	-694.50	-1647.45	35	268.00	1649.45
15	-423.70	-1647.45	36	-12.80	1649.45
16	-198.90	-1647.45	37	-287.40	1649.45
17	71.90	-1647.45	38	-568.20	1649.45
18	296.70	-1647.45	39	-842.80	1649.45
19	564.80	-1638.55	40	-1123.60	1649.45
20	1069.80	-1699.45	41	-1398.20	1649.45
21	1640.10	-1650.05			

Pin Description

Pin No.	Pin Name	I/O	Internal Connection	Description
38~40, 1~5	C8~C15	O	CMOS	Keyboard scanning outputs These pins are also used to drive 7-segment LED display. The LED display segments: "b", "dot", "a", "c", "f", "d", "g" and "e" are driven by C8~C15 individually.
6	CLED	O	CMOS	Chord indication output This pin directly drives an LED for applications.
7~13	C1~C7	O	CMOS	Keyboard scanning outputs C6 and C7 are used as common pins to generate a scanning drive signal for 7-segment LED display. C6 drives the left digit and C7 the right digit of 7-segment display (see the application circuit).
14	REST	I	CMOS	System reset input, active low Connect this pin to VDD (or pull-high) for normal applications.

Pin No.	Pin Name	I/O	Internal Connection	Description
15~22	R0~R7	I	CMOS Pull-High	Keyboard scanning inputs
23	VSS	I	—	Power supply (negative)
24, 25	X1, X2	I,O	—	Oscillator input/output X1 and X2 are connected to a 3.58MHz crystal for an internal system clock.
26~33	TEST0~TEST7	I/O	CMOS	For IC test only
34	VDD	I	—	Power supply (positive)
35	PVO	O	PMOS	Percussion or voice signal output The output of this pin is of a current type D/A. A power amplifier is driven for applications.
36, 37	AUO2, AUO1	O	PMOS	Audio signal outputs The output of this pin is of a current type D/A. A power amplifier is driven for applications.

Approximate internal connection circuits



Absolute Maximum Ratings

Supply Voltage ..... −0.3V to 5.5V
Input Voltage..... V_{SS}−0.3V to V_{DD}+0.3V
Storage Temperature..... −50°C to 125°C
Operating Temperature..... 0°C to 70°C

Electrical Characteristics

(Ta=25°C)

Symbol	Parameter	Test Condition		Min.	Typ.	Max.	Unit
		V_{DD}	Condition				
V_{DD}	Operating Voltage	—	—	3.3	4.5	5.1	V
I_{DD}	Operating Current	4.5V	No load, F_{OSC}=3.58MHz	—	3.5	7.0	mA
I_{AUO}	Max. Output Current (for AUO1, AUO2 Pin)	4.5	V_{OH}=0.6V	-540	-900	—	μA
I_{PVO}	Max. Output Current (for PVO Pin)	4.5V	V_{OH}=0.6V	-540	-900	—	μA
I_{OL}	Output Sink Current (for C1-C15. CLED)	4.5V	V_{OL}=0.45V	3.4	5.6	—	mA
I_{OH}	Output Source Current (for C1-C15, CLED)	4.5V	V_{OH}=4.05V	-2.7	-4.6	—	mA
I_{IL}	Input Current (for R0~R7)	4.5V	V_{IL}=0V	80	130	325	μA
F_{OSC}	System Frequency	4.5V	3.58MHz crystal oscillator	—	3.58	—	MHz

Functional Description

The functions of the HT3494 are described in the following:

Initial status

When power is initially supplied, the system starts operating. The beginning status of the system is illustrated below:

- No tone or percussion/voice is stored
- Normal play mode
- Timber is number 0 (Piano 1)
- Rhythm is number 0 (Rhumba 1)
- Chord off
- First chord (Cho1) is ready for playing
- Percussion sound is ready for playing
- No transposition
- Tempo is 120 bpm
- Accompaniment is level 2 (-3dB, display "02")
- Vibrato off
- Sustain disable

Matrix control key position

	R0	R1	R2	R3	R4	R5	R6	R7
C1	Tim/Rhm	+	0	1	2	3	4	5
C2	6	7	8	9	–	Fill-in	Sync	Single
C3	Finger	Off Chord	Start/Stop	Percu/Voice	PV1	PV2	PV3	PV4
C4	PV5	Null/Play	Prog	Cho1	Cho2	Cho3	Cho4	Demo
C5	REC	Play	Sustain	—	—	—	—	—
C6	—	—	—	—	—	—	—	—
C7	—	—	—	—	—	—	—	—
C8	—	—	—	—	—	—	—	—
C9	K1	K2	K3	K4	K5	K6	K7	K8
C10	K9	K10	K11	K12	K13	K14	K15	K16
C11	K17	K18	K19	K20	K21	K22	K23	K24
C12	K25	K26	K27	K28	K29	K30	K31	K32
C13	K33	K34	K35	K36	K37	K38	K39	K40
C14	K41	K42	K43	K44	K45	K46	K47	K48
C15	K49	Tran+	Tran–	Tmpo+	Tmpo–	Acc+	Acc–	Vibrato

Keys	Functions
K1~K49	Key tone, compass range: C2~C6
Tim/Rhm	Timber or rhythm selection input
+,–	Select the next (+)/last (–) timber or rhythm.
0~9	Press a digital key to select an assignment timber, rhythm or demo song for operation.
Fill-in	Fill-in effect addition
Sync	Chord synchronizes with the pressed key.
Single	Single-fingering chord. Press a key to induce the chord.
Finger	Multi-fingering chord. Press 3 keys to induce the chord.
Off Chord	Disable the chord effect
Start/Stop	Rhythm starts playing or stops.
Percu/Voice	Percussion or animal's sound selection input
Null/Play	Play null tone (in rhythm programming) or the user's rhythm
Prog	User's rhythm programming
Cho1–Cho4	4 built-in chord selection inputs

Keys	Functions
Demo	Enter the demo mode and play the melodies in sequence.
PV1~PV5	5 built-in percussion or voice (animal) sounds PV1: Bass drum/Dog PV2: Snare drum/Duck PV3: Hit hat open/Pig PV4: Hit hat close/Bird PV5: Cymbal/Frog
REC	Record the tones from the pressed keys
Play	Play the stored tones
Sustain	Sustain effect enable/disable input
Tran↑,Tran↓	Transpose function Tran↑: Transpose a chromatic scale upper Tran–: Transpose a chromatic-scale under
Tmpo+, Tmpo–	Tempo adjustment Tmpo+: Tempo increases. Tmpo–: Tempo decreases.
Acc+,Acc–	Accompaniment volume adjustment Acc+: Accompaniment volume increases. Acc–: Accompaniment volume decreases.
Vibrato	Vibrato effect enable/disable input

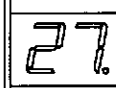
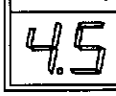
Key tone

There are 49 keys to be played. The compass range is from C2 to C6 (Piano 1).

Timber/Rhythm selection input

Tim/Rhm is used to switch the selection mode between timber and rhythm. That is to say, pressing the Tim/Rhm key switches the mode from timber to rhythm or vice versa. After that, the exact type of timber/rhythm can be selected by pressing the corresponding digital key (0–9), or by pressing the "+" or "–" keys to select the next or previous type of timber/rhythm, respectively.

In the play mode, the currently displayed number indicates which type of timber or rhythm is selected. The dot position displays the selection of timber or rhythm.

	Dot Position	Timber/Rhythm	Example
	Right	Rhythm	no. 27 rhythm
	Left	Timber	no. 45 timber

The chosen rhythm starts playing or the playing rhythm is stopped by pressing the Start/Stop key. When the rhythm is playing, the left or right dot will take turn to be lit with a variation of tempo speed.

The following two tables illustrate 100 types of timber as well as of rhythm.

No.	Timber	No.	Timber	No.	Timber
00	Piano 1	34	Synth Piano 3	68	Space 5
01	Piano 2	35	Synth Piano 4	69	Space 6
02	Piano 3	36	Synth Organ 1	70	Space 7
03	Piano 4	37	Synth Organ 2	71	Space 8
04	Piano 5	38	Synth Organ 3	72	Aero String 1
05	Piano 6	39	Synth Organ 4	73	Aero String 2
06	Piano 7	40	Synth Flute	74	Aero String 3
07	Piano 8	41	Synth Trumpet	75	Aero String 4
08	Organ 1	42	Synth Saxophone	76	Aero String 5
09	Organ 2	43	Synth Brass 1	77	Aero String 6
10	Organ 3	44	Synth Brass 2	78	Aero String 7
11	Organ 4	45	Synth Brass 3	79	Aero String 8
12	Flute	46	Synth Brass 4	80	Piano Organ 1
13	Trumpet	47	Synth Brass 5	81	Piano Organ 2
14	Saxophone	48	String 1	82	Piano Organ 3
15	Brass	49	String 2	83	Piano Organ 4
16	Violin 1	50	String 3	84	Piano Violin 1
17	Violin 2	51	String 4	85	Piano Violin 2
18	Violin 3	52	String 5	86	Piano Violin 3
19	Violin 4	53	String 6	87	Piano Violin 4
20	Harp	54	String 7	88	Aero Piano 1
21	Mandolin	55	String 8	89	Aero Piano 2
22	Marimba	56	Synth Harp	90	Aero Piano 3
23	Xylophone	57	Synth Mandolin	91	Aero Piano 4
24	Pad 1	58	Synth Marimba	92	Aero Piano 5
25	Pad 2	59	Synth Xylophone	93	Aero Piano 6
26	Pad 3	60	Electronic Harp	94	Aero Piano 7
27	Pad 4	61	Electronic Mandolin	95	Aero Piano 8
28	Pad 5	62	Electronic Marimba	96	Space Harp
29	Pad 6	63	Electronic Xylophone	97	Space Mandolin
30	Pad 7	64	Space 1	98	Space Marimba
31	Pad 8	65	Space 2	99	Space Xylophone
32	Synth Piano 1	66	Space 3		
33	Synth Piano 2	67	Space 4		

HOLTEK

HT3494

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The HT3494 also provides an auto-bass-chord function, memory function as well as programmable rhythm in addition to basic playing functions.

No.	Rhythm	No.	Rhythm	No.	Rhythm
00	Rhumba 1	34	Bosanova 3	68	Rock & Roll 5
01	Rhumba 2	35	Bosanova 4	69	Rock & Roll 6
02	Rhumba 3	36	Bosanova 5	70	Rock & Roll 7
03	Rhumba 4	37	Bosanova 6	71	Rock & Roll 8
04	Rhumba 5	38	Bosanova 7	72	Swing 1
05	Rhumba 6	39	Bosanova 8	73	Swing 2
06	Rhumba 7	40	March 1	74	Swing 3
07	Rhumba 8	41	March 2	75	Swing 4
08	Pops 1	42	March 3	76	Swing 5
09	Pops 2	43	March 4	77	Swing 6
10	Pops 3	44	March 5	78	Swing 7
11	Pops 4	45	March 6	79	Swing 8
12	Pops 5	46	March 7	80	Latin 1
13	Pops 6	47	March 8	81	Latin 2
14	Pops 7	48	16 Beat 1	82	Latin 3
15	Pops 8	49	16 Beat 2	83	Latin 4
16	Disco 1	50	16 Beat 3	84	Latin 5
17	Disco 2	51	16 Beat 4	85	Latin 6
18	Disco 3	52	16 Beat 5	86	Latin 7
19	Disco 4	53	16 Beat 6	87	Latin 8
20	Disco 5	54	16 Beat 7	88	Waltz 1
21	Disco 6	55	16 Beat 8	89	Waltz 2
22	Disco 7	56	Country 1	90	Waltz 3
23	Disco 8	57	Country 2	91	Waltz 4
24	Polka 1	58	Country 3	92	Waltz 5
25	Polka 2	59	Country 4	93	Waltz 6
26	Polka 3	60	Country 5	94	Waltz 7
27	Polka 4	61	Country 6	95	Waltz 8
28	Polka 5	62	Country 7	96	Slow Waltz 1
29	Polka 6	63	Country 8	97	Slow Waltz 2
30	Polka 7	64	Rock & Roll 1	98	Slow Waltz 3
31	Polka 8	65	Rock & Roll 2	99	Slow Waltz 4
32	Bosanova 1	66	Rock & Roll 3		
33	Bosanova 2	67	Rock & Roll 4		

5 Percussions/Voices

Key	Percussion	Voice
PV1	Bass drum	Dog
PV2	Snare drum	Duck
PV3	Hit hat open	Pig
PV4	Hit hat close	Bird
PV5	Cymbal	Frog

PV1~PV5 represent 5 percussion/voice sounds individually. The power-on initial status is the percussion sound. Press the Percu/Voice key to toggle select the percussion or voice sound for playing. The selected rhythm starts playing or the playing rhythm is stopped by pressing the Start/Stop key.

Rhythm programmable

"P." is displayed on the LED after the Prog key is pressed. At this time, the system accepts any percussion/voice key (PV1~PV5) or Null/Play key (no voices) the user presses, and saves it in the memory. The total amount of recordable tones is 32 notes, and can be recorded with a combination of percussion and voice. Once the memory is full, the LED display resumes at the status before programming.

Pressing the Prog key allows the user to program his/her rhythms, or to quit the programming mode.

Note that the Null/Play key stands for a null tone in rhythm programming. In other words, pressing the Null/Play key starts playing the user-programmed rhythm repeatedly in the normal situation. (The included 32 tones will all be played no matter whether or not the memories of the 32 tones are all used.)

To terminate the user's rhythm playing, press the Start/Stop key.

Transpose

The transpose function (Tran+, Tran– keys) makes it possible to shift the pitch of the HT3494 up (maximal display value is "09") or down (minimal display value is "–3") in semitone intervals up to a maximum of 12 semitones (an octave).

Compass	A4	G#4	G4	F#4	F4	E4	D#4	D4	C#4	C4	B3	A#3	A3
Display Value	09	08	07	06	05	04	03	02	01	00	–1	–2	–3

The above table demonstrates an example of the transpose function. The display value "00" means the current compass. If the user presses the Tran+ key continuously, with "07" shown on the display, the compass of C4 changes to G4. When Tran+ and Tran– are simulatanеously pressed, the value of transpose is reset to original compass.

It is useful to transpose the pitch and makes it easier to play in a difficult key signature. The user can then easily match the pitch of the key with the range of a singer or other instrumentalists.