HT3378
37 Key Melody Piano

Features

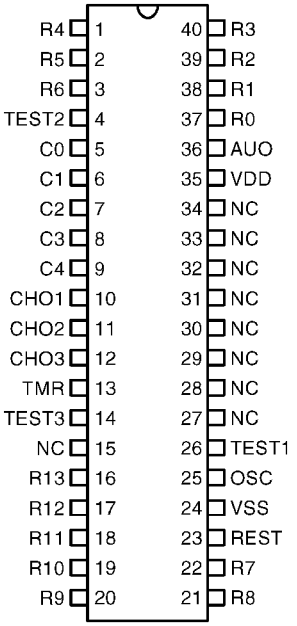
- Operating voltage: 3.3V~5.2V
- System Frequency: 3.58MHz
- 37 key inputs
- Compass range from F3~F6
- Auto power off
- Key scanning with 5 outputs
- Key scanning with 14 inputs
- 16 timbres
- 16 rhythms
- 14 percussions
- 22 melodies
- 8-bit D/A audio outputs
- One channel of percussion
- 2 channels of melody output
- Tempo adjustable
- Record function with 32 recordable notes
- Vibrato function
- Sustain effect
- Chord triggered by a single key
- Chord triggered by keys synchronously pressed
- 5 LED indicators: REC, Single, Sync, Rhmsel, and Timsel
- 40 DIP enclosed

General Description

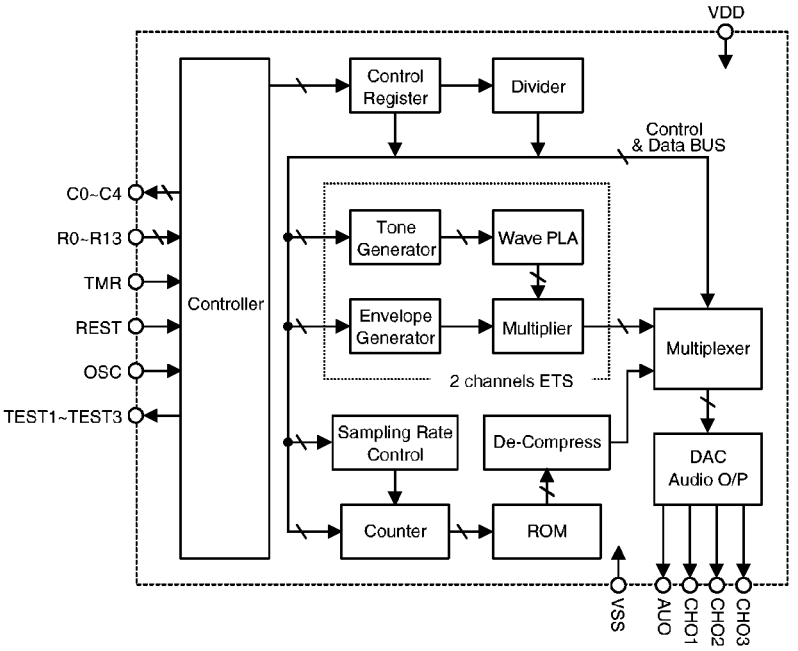
The HT3378 is a CMOS VLSI chip designed for use in 37-key melody pianos. It is built with a controller as well as an ETS (Electronic Tone Synthesizer). The chip consists of built-in melodies, rhythms, timbres, and percussion outputs. The status of the operating system is indicated by 5 LEDs.

The HT3378 provides an auto bass chord function, and a record function in addition to basic playing functions.

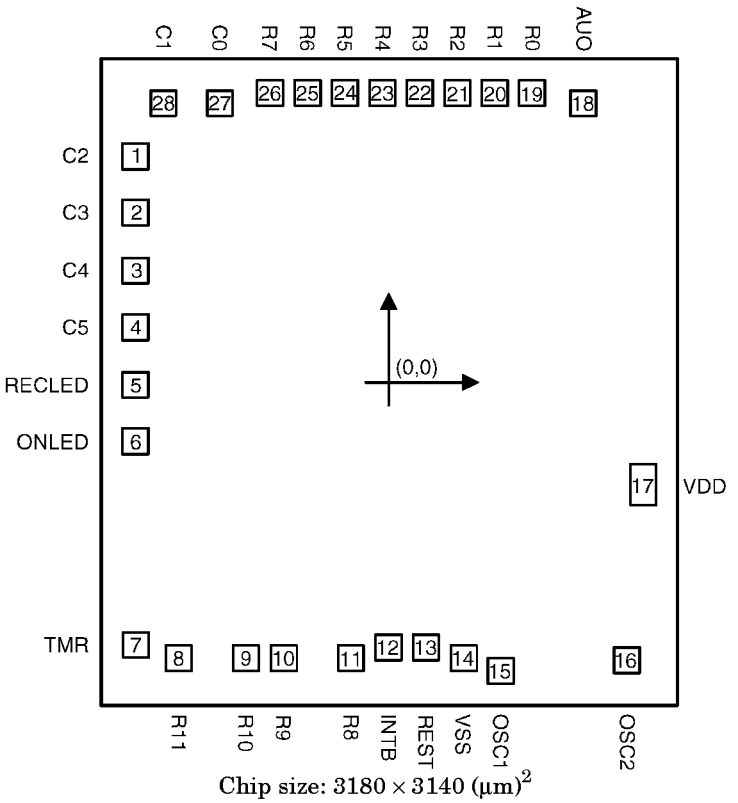
Pin Assignment



Block Diagram



Pad Coordinates



Chip size: $3180 \times 3140\ (\mu m)^2$

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

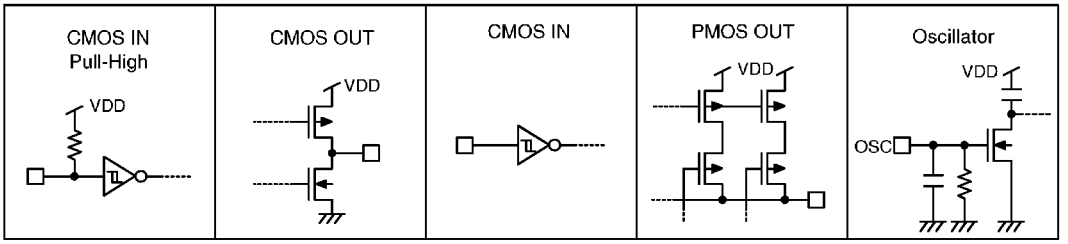
Unit: μm

Pad No.	X	Y	Pad No.	X	Y
1	–1405.30	1114.35	17	365.30	–1410.15
2	–1405.30	849.75	18	748.50	–1410.15
3	–1405.30	578.95	19	1337.80	–1360.75
4	–1405.30	314.35	20	1161.40	1385.25
5	–1405.30	43.55	21	708.80	1362.05
6	–1405.30	–221.05	22	449.20	1410.15
7	–1402.30	–1244.45	23	274.20	1410.15
8	–1175.70	–1410.15	24	99.20	1410.15
9	–1003.20	–1410.15	25	–75.80	1410.15
10	–831.70	–1410.15	26	–250.80	1410.15
11	–659.20	–1410.15	27	–425.80	1410.15
12	–487.70	–1410.15	28	–600.80	1410.15
13	–315.20	–1410.15	29	–775.80	1410.15
14	–143.70	–1410.15	30	–1010.50	1363.15
15	28.80	–1410.15	31	–1275.10	1363.15
16	200.30	–1410.15			

Pin Description

Pin No.	Pin Name	I/O	Internal Connection	Description
1~3, 16~22, 37~40	R0~R13	I	CMOS Pull-High	Keyboard scanning inputs
4,14,26	TEST1~TEST3	O	CMOS	For IC test only The TEST1 pin generates a quarter of the system operating frequency 3.58 MHz.
5~9	C0~C4	O	CMOS	Keyboard scanning outputs & LED drive output, active low
10~12	CHO1~CHO3	O	CMOS	Audio signal output The output of the AUO pin is of a current type D/A. CHO1~CHO3 are all inverter outputs. These four pins drive a power amplifier for application. CHO1~CHO3 are accompaniment to the demo song. CHO1 is the bass output. CHO2 and CHO3 are the homonic tone with different keys. AUO is the theme of the demo song, the output of key tone and the percussion.
36	AUO	O	PMOS	
13	TMR	I	CMOS	Connect this pin to VDD for normal application.
15, 27~34	NC	—	—	No connection
23	REST	I	CMOS	System reset input, active low Connect this pin to VDD or pull-high for normal application.
24	VSS	I	—	Power supply (negative)
25	OSC	I	—	Oscillator input Connect a resister (91 KΩ) to VDD for an internal system clock.
35	V_{DD}	I	—	Power supply (positive)

Approximate internal connection circuits



Absolute Maximum Ratings

Supply Voltage ..... –0.3V to 6V
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

Symbol	Parameter	Test Condition		Min.	Typ.	Max.	Unit
		V_{DD}	Condition				
V_{DD}	Operating Voltage	—	—	2.4	3	5.2	V
I_{STB}	Stand-by Current	4.5V	—	—	0.2	3	μA
I_{DD}	Operating Current	4.5V	No load F_{OSC}=3.58MHz	—	2.2	4.5	mA
I_{AUO}	Max. AUO Output Current	4.5V	V_{OH}=0.6V	–2.2	–3.7	—	mA
I_{OL}	Output Sink Current (for C0~C4)	4.5V	V_{OL}=0.4V	4.2	7	—	mA
I_{IL}	Input Current (for R0~R13, REST)	4.5V	V_{IL}=0V	48	73	120	μA
F_{OSC}	System Frequency	4.5V	R_{OSC}=91KΩ	—	3.58	—	MHz

Functional Description

The functions of the HT3378 are described below:

Initial status

When power is first supplied, the system starts operating and its initial status is as shown:

- No tone or percussion is stored
- Timbre is Tim1 (Piano)
- Rhythm is Rhm1 (Pops)
- No chord effect
- Tempo is 120 beats per minute
- Melody1 (Little short man in the woods) is ready for playing (after the Demo key is pressed)
- Percussion sound is ready for playing

Matrix control key position:

	C0	C1	C2	C3	C4
R0	K1	K15	K29	Tim1	Rhm6
R1	K2	K16	K30	Tim2	Rhm7
R2	K3	K17	K31	Tim3	Rhm8
R3	K4	K18	K32	Tim4	Start /Stop
R4	K5	K19	K33	Tim5	Sync
R5	K6	K20	K34	Tim6	Single
R6	K7	K21	K35	Tim7	REC
R7	K8	K22	K36	Tim8	Play
R8	K9	K23	K37	Rhmsel	Demo
R9	K10	K24	Tmpo+	Rhm1	Percu
R10	K11	K25	Tmpo–	Rhm2	—
R11	K12	K26	Vibrato	Rhm3	—
R12	K13	K27	Sustain	Rhm4	—
R13	K14	K28	Timsel	Rhm5	—

Key function table:

Key	Function
K1~K37	Key tone Compass range: F3~F6
Start/Stop	Rhythm starts playing or stops
Timsel	To toggle switch the timbre between page 1 and page 2 (Timsel LED lit)
Rhmsel	To toggle switch the Rhythm between page 1 and page 2 (Rhmsel LED lit)
Tim1~Tim16	16 built-in timbre names: Page 1 Page 2 Tim1: Piano Clavi Tim2: Guitar Harp Tim3: E. piano Banjo Tim4: Trumpet Organ Tim5: Violin 1 Ban pipe Tim6: Saxophone Violin 2 Tim7: Clarinet Reed organ Tim8: Brass String
Rhm1~Rhm16	16 built-in rhythm names: Page 1 Page 2 Rhm1: Pops Country Rhm2: Latin Reggae Rhm3: March Rumba Rhm4: Disco Tango Rhm5: Bossa nova Beguine Rhm6: Waltz Swing Rhm7: 16 beat Samba Rhm8: Rock Cha-cha
Percu	After the Percu key is pressed, the tonic keys from K15~K27 decide the percussion mode.
Demo	After the Demo key is pressed the tonic keys from K1~K37 decide the melody type. There are totally 22 melodies.
Tmpo+, Tmpo–	Tempo speed adjustment: Tmpo+: Tempo speed increment Tmpo–: Tempo speed decrement
Sync	Synchronize chord to rhythm

Key	Function
Single	Single fingering chord Press a key to induce a chord from K1~K14.
REC	Record tones from the pressed keys
Play	Play the stored tones
Vibrato	Vibrato effect enable/disable input
Sustain	Sustain effect enable/disable input
Reset	System reset input

Key tone

There are totally 37 keys to be played. The compass range is from F3 to F6 (Piano timbre).

16 timbres & Timsel key

Pressing the Timsel key to select the timbre from page 1 or page 2, and press one of the Tim1~Tim8 keys to select the timbre to play. The timsel LED is lit if page 2 is chosen.

Key	Timbre Name	
	Page 1	Page 2
Tim1	Piano	Clavi
Tim2	Guitar	Harp
Tim3	E. piano	Banjo
Tim4	Trumpet	Organ
Tim5	Violin 1	Ban pipe
Tim6	Saxophone	Violin 2
Tim7	Clarinet	Reed organ
Tim8	Brass	String

16 Rhythms & Rhmsel key

Press the Rhmsel key to select rhythm from page 1 or page 2, and press one of the Rhm1~Rhm8 key to select the rhythm to play. The Rhmsel LED is lit if page 2 is chosen.

Key	Rhythm Name	
	Page 1	Page 2
Rhm1	Pops	Country
Rhm2	Latin	Reggae
Rhm3	March	Rumba
Rhm4	Disco	Tango
Rhm5	Bossa nova	Beguine
Rhm6	Waltz	Swing
Rhm7	16 beat	Samba
Rhm8	Rock	Cha-cha

14 Percussions & Percu key

After the Percu key is pressed, The following keys all functions as the tonic demo of the percussion. At this moment, pressing one of the keys plays the according percussion sound.

The following table lists the names of the percussion.

Key	Per Name	Key	Per Name
K15	Bass Drum	K27	High Hat Open
K17	Snare Drum 1	K29	High Hat Close
K19	Snare Drum 2	K31	Shaker
K20	Low TOM	K32	Hand Clap
K22	Middle TOM	K34	Claves
K24	High TOM	K36	Castanet
K25	Cabasa	K37	Cow bell

22 Demo melodies & Demo key

If the Demo key is pressed, the first melody come in to play. Pressing one of the keys listed in the following table selects and starts the corresponding demo melodies to play.

Key	Melody Name
K1	Little short man in the woods
K3	CANON
K5	Last rose of summer
K7	Symphony No.9
K8	Turkish march
K10	Go Go bach
K12	Fly me to the moon
K13	Marche royale du lion
K15	Romanize
K17	Peter and the wolf
K19	Valse lente
K20	Allegro
K22	Le cygne
K24	Long live love
K25	Etude OP.10 No.3
K27	Young prince and princess
K29	Copacabana
K31	Skip to my Lou
K32	Song of india
K34	Humoresque
K36	London bridge is falling down
K37	Waltz of the flowers

Tempos

There are totally 16 speeds to be selected, namely 40~ 280 bpm (beats per minute).

Pressing the Tmpo+ key increases the speed while pressing the Tmpo–key reduces it until the maximum or minimum speed is reached. Whenever the Tmpo+/Tmpo– key is pressed a key tone is generated. If Tmpo+/Tmpo– is pressed subsequently to the maximal or minimal level, no key tone can be generated.

Sustain

Pressing the Sustain key toggle-controls the enable/disable status of the sustain effect. The sustenance can be extended as long as the sustain effect is enabled.

Vibrato

Pressing the Vibrato key toggle-switches the on/off status of the vibrato effect. The variation of the frequency modulation is 6.2Hz.

Record and playback

The system enters the recording mode after the REC key is pressed. The notes of the pressed keys (K1~K37) are all recorded in the memory (the maximum number of the notes recordable is 32). Once the memory is full, the REC LED is turned off. At this point, any further key inputs are all ignored.

When the system is in the record status, pressing the REC or Stop key quits the current status and returns to the normal playing mode. Whether the system is in the record or the playback status is indicated by the REC LED.

Pressing the Play key plays the stored notes once. After the Play key is pressed, the REC LED is lit and the stored notes start to play. Once the playing notes are completed the REC LED turns out dark. At this time, if the memory is empty (no note is stored), pressing the Play key plays no tone, and the REC LED is dark still.

Single & Sync function

K1~K14 decide the chord type. After the Single key is pressed, K1~K14 control the chord type and K15~K37 decide the tone type.

To play a chord, first press the Single key. The single LED indicator is lit. Next, press the Sync key to synchronize the chord to the rhythm that was previously selected by the Rhm1~Rhm8 keys along with the Rhmsel key. Finally, press a key of K1~K14 to start playing a chord. The system will then enter the auto-bass-chord

mode, i.e., the chord will repeat playing unless the user changes the playing chord by pressing a key of K1~K14. To terminate the rhythm output, press the Stop key.

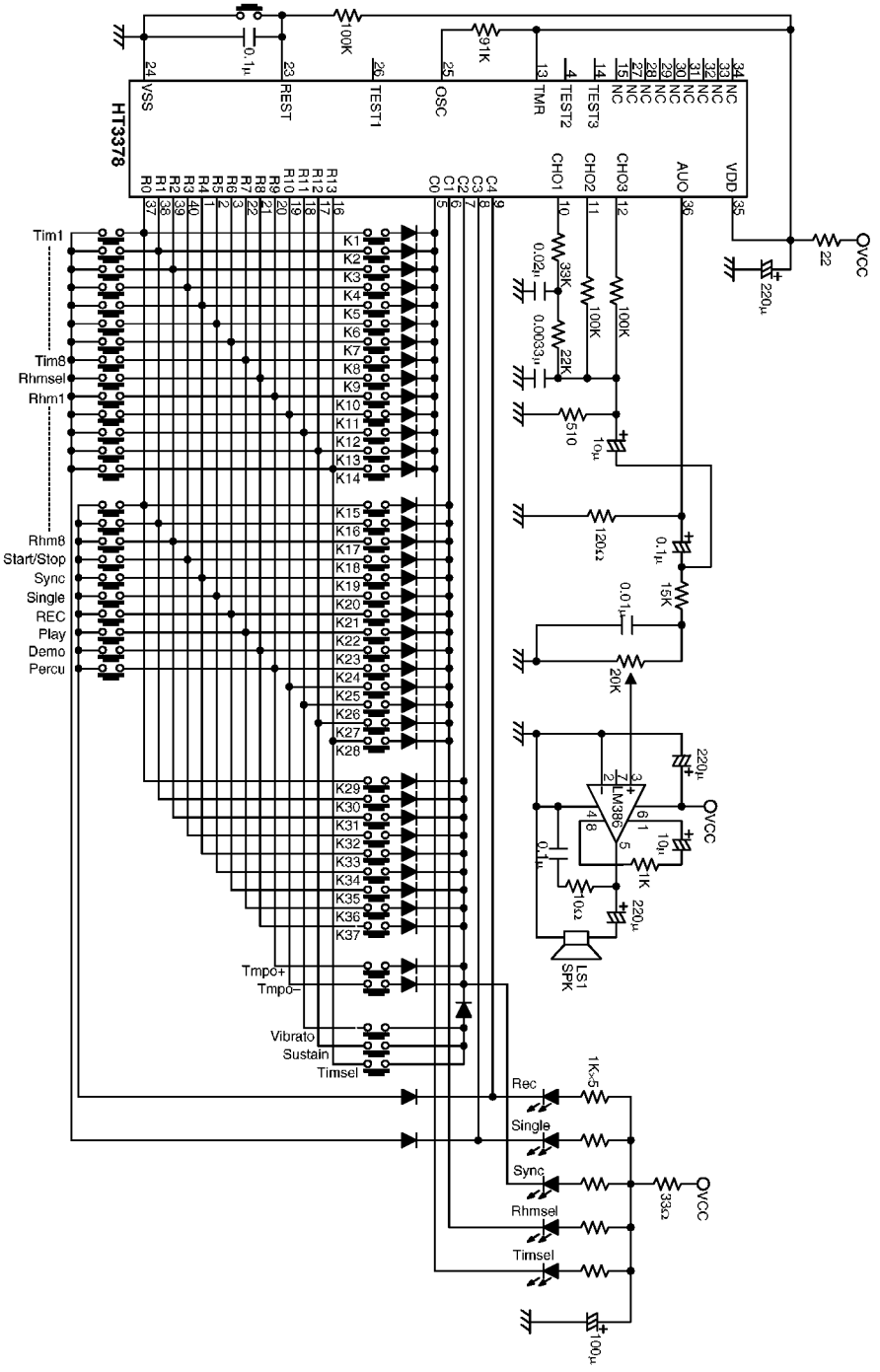
Auto-power off

If no key is triggered within 3 minutes, the system will enter the stand-by mode automatically.

Start/Stop key

The Start/Stop key is pressed to start/stop the playing melody, rhythm. and memoried tones.

Application Circuit 1



Application Circuit 2

(Reduced LED driving noise)