HTG12530
22-Second Music Voice

Features

- Operating voltage: 2.4V~5.0V
- Directly drives an external transistor
- Low standby current (1μA typ. for V_{DD}=3V)
- Minimum external components
- 509 notes (max.) for table ROM
- Programmable silence length (0~4 secs)
- 22-second voice capacity
  (Based on a sampling rate of 6kHz)
- Two flag outputs
  - BUSYB: Busy output
  - Sound level: Volume level display
  - Flash: 2/3/4Hz flash output
- Key options (Four independent function keys)
  - KEY1: Retriggerable/non-retriggerable
  - KEY2: Microphone/toggle/retriggerable
  - KEY3: Level hold/CDS/retriggerable
  - KEY4: Retriggerable
  - Key debounce time: 22ms or 44ms
  - Pull-high resistance: 50kΩ or 100kΩ
- 16-pin DIP package

Applications

- Leisure products
- Alarm clocks
- Public address system
- Alert and warning system
- Sound effect generators
- Products with a voice interface

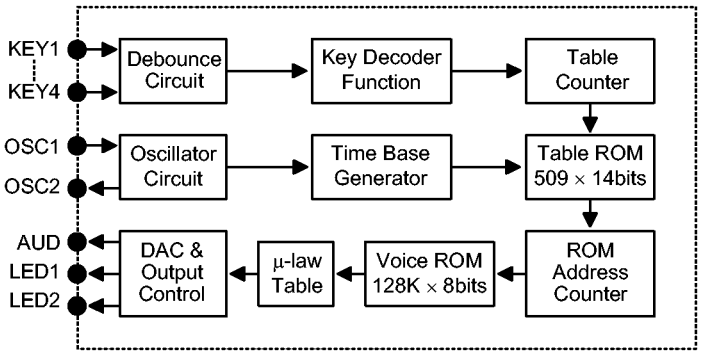
General Description

The HTG12530 is a single-chip PCM voice synthesis LSI with 22-second voice capacity at 6kHz sampling rate. The 22-second capacity can be divided into sections of arbitrary length. The chip includes an on-chip ROM for voice data storage, a current mode D/A converter, a table ROM for playing sequentially programmed sounds and a μ-law table for higher quality.

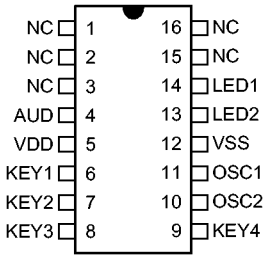
The HTG12530 provides four kinds of trigger keys and two output flags. With 2.4V~5.0V power supply, a complete synthesized voice playback system can be easily built with very few external components.

The customer's voice sources are recorded section by section into an internal mask ROM. The instructions of sectional playback arrangement of each key are stored in the table ROM. The IC is offered in a 16 DIP or dice form.

Block Diagram

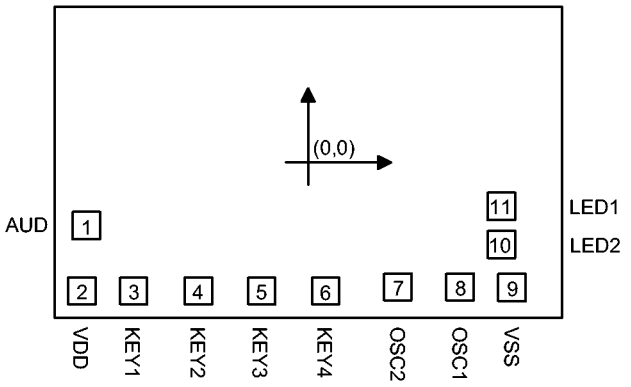


Pin Assignments



HTG12530
–16 DIP

Pad Assignment



Chip size: 2315 × 1480 $(\mu m)^2$

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

Pad Coordinates

Unit: μm

Pad No.	X	Y	Pad No.	X	Y
1	–986.50	–282.40	7	399.90	–555.85
2	–1007.50	–572.80	8	675.40	–555.85
3	–776.30	–572.80	9	906.25	–556.40
4	–490.80	–572.80	10	858.45	–365.00
5	–207.10	–572.80	11	858.45	–196.40
6	78.40	–572.80			

Pin Description

Pin No.	Pin Name	I/O	Internal Connection	Description
1~3, 15, 16	NC	—	—	No connection
4	AUD	O	PMOS Open Drain	Voice output for driving an external transistor
5	VDD	—	—	Positive power supply
6	KEY1	I	Pull-high	Trigger key. There are two kinds of key functions, non-retriggerable or retriggerable (Refer to the functionaldescription)
7	KEY2	I	Pull-high	Trigger key. There are three kinds of key functions, microphone/toggle/retriggerable (Refer to the functional description)
8	KEY3	I	Pull-high	Trigger key. There are three kinds of key functions, level hold/cds/retriggerable (Refer to the functional description)
9	KEY4	I	Pull-high	Retrigger key or option pad.*
10	OSC2	O	—	Oscillator output pin
11	OSC1	I	—	Oscillator input pin
12	VSS	—	—	Negative power supply
13	LED2	O	NMOS Open Drain	Active low, programmable display mode (Refer to the functional description)
14	LED1	O	NMOS Open Drain	Active low, programmable display mode (Refer to the functional description)

*Note: When code option is selected to one song/multi-key, key 4 is used as an option pad, otherwise it is a retrigger key.

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 .....–20°C to 70°C

Note: These are stress ratings only. Stresses exceeding the range specified under "Absolute Maximum Ratings" may cause substantial damage to the device. Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device reliability.

Electrical Characteristics

Ta=25°C

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V_{DD}	Conditions				
V_{DD}	Operating Voltage	—	—	2.4	—	5.0	V
I_{DD}	Operating Current	3V	No load, f_{OSC}=170kHz	—	3	—	mA
I_{STB}	Standby Current	3V	—	—	1	3	μA
I_{AUD}	Max. AUD Output Current	3V	V_{OH}=0.6V	—	–2	—	mA
I_{OL}	LED1, LED2 Sink Current	3V	V_{OL}=0.3V	1.5	5.0	—	mA
R_{PH1}	KEY2 Pull-high Resistance (When KEY2 is in the Microphone Trigger Function)	3V	V_{IL}=0V	100	200	300	kΩ
R_{PH2}	KEY3 Pull-high Resistance (When KEY3 is in the CDS Trigger Function)	3V	Non-active	50	100	150	kΩ
			Active	600	1000	1500	kΩ
V_{IH}	"H" Input Voltage	—	KEY1~KEY4	1.6	—	V_{DD}	V
V_{IL}	"L" Input Voltage	—	KEY1~KEY4	0	—	1.3	V
V_H	KEY3 High Trigger Voltage (When KEY3 is in CDS Trigger Function)	3V	—	2.0	—	3	V
V_L	KEY3 Low Trigger Voltage (When KEY3 is in CDS Trigger Function)	3V	—	0	—	0.8	V
f_{OSC}	System Frequency	3V	—	96	—	320	kHz

Functional Description

The HTG12530 is a mask ROM type voice synthesizer with 22-second voice capacity. A group of pre-recorded voice sections are played upon receipt of key trigger input signals. Two flag signals are output when playing voices.

The 22-second capacity can be divided into sections of arbitrary length. (Notice that the silence length is not included in the memory.)

By using Holtek's programming tools, the contents and arrangement of sections as well as key features are all programmable before device fabrication.

Key features

There are two kinds of key trigger mode that can be selected by code option.

- One song/multi-key
  The IC provides three key inputs (KEY1~KEY3). Only one of the three KEYs can be used at a time. Each key represents a different trigger function decided by KEY4.
  - KEY4 connected to VDD

	KEY1	KEY2	KEY3
Trigger	Non-retrigger	MIC (non-retrigger)	Level Hold
Debounce	22/44ms	0	22/44ms
Pull-high	50/100kΩ	50/100/200kΩ	50/100kΩ

  - KEY4 connected to VSS

	KEY1	KEY2	KEY3
Trigger	Retrigger	Toggle	CDS
Debounce	22/44ms	22/44ms	22/44ms
Pull-high	50/100kΩ	50/100kΩ	100/1000kΩ

- Four songs/four-keys
  The IC provides four key inputs (KEY1~KEY4). All the key trigger functions are set to retriggerable. The key-in pull-high resistors are selected by mask option as shown.
  - 50kΩ
  - 100kΩ

  The key debounce time is also selected by mask option as shown.
  - 22ms
  - 44ms

System oscillator

The HTG12530 is built with an RC oscillator which requires only one external resistor for normal applications. The oscillator frequency is 170kHz for an external resistor of 280kΩ. Nonetheless, the required oscillator frequency may vary with different sampling rates for voice programming. As a result, the values of the oscillator resistor may be different for different items.

The oscillator is turned on when triggered by an input key. After playing, the oscillator is turned off and the chip goes into the standby state.

Voice ROM

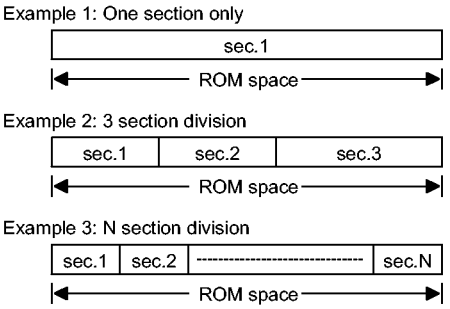
The voice ROM is originally designed to continuously record the 22-second voice data at 6kHz sampling rate. A higher sampling rate will generate sounds of good playback quality but shortens the total recording time. On the other hand, a lower sampling rate will result in longer recording time but sacrifice the voice quality.

By taking advantage of coding efficiency, silence playing, section repeating and section cascade, the playback time can be significantly extended.

- Section
  Section is the basic element of the contents of the voice ROM. During programming, the customer's voice sources can be divided into as many sections as required. A section can be composed of a voice or an interval of silence. The silence length will not be counted in voice ROM. The total number of sections included should be less than 509 due to the space limitations of the function table ROM. As for the total length of the sections included, it is limited by the voice ROM.

  A section when triggered by a key input can be played once, repeatedly or cascaded with other sections depending on the key function table instructions. The following are some ex-

amples of section division:



- Group

  The HTG12530 provides a group. The group can be made up of one or more sections. When a key is triggered, the group is played immediately.

- Key function table

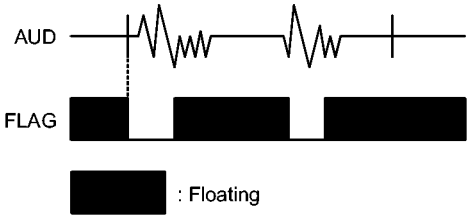
  Sections in the voice ROM are played according to the instructions in the key function table. The function table contains group information and the playing order of the sections in the group. Notice that the total amount of the voice sections included in groups should be less than 509 – the space limitation of the function table ROM. When the code option is four songs/four-key mode, all of the four keys are set as retrigger key and each key's voice section should be less than 128, the space limitation of the function table ROM.

Status display

The HTG12530 provides two kinds of outputs, indicating the LSI status.

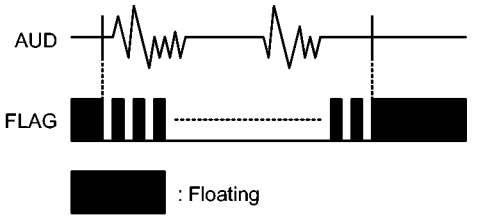
- Volume level display

  The brightness of the LED varies with the volume.



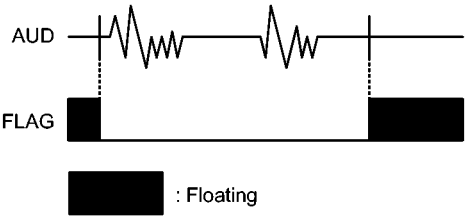
- LED flash output

  The FLAG LED flashes at a 2/3/4Hz or $\overline{2}/\overline{3}/\overline{4}$Hz according to the option, and the ON-OFF duty is always 50%, when there are voice output.



- Busy output

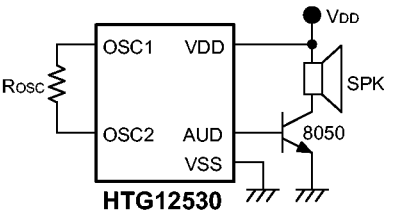
  When voices are playing, the BUSYB output is turned low, indicating that the chip is busy.



AUD

The AUD pin is a PMOS open drain structure. It outputs voice signals to drive a speaker through an external NPN transistor when the chip is active. However, the AUD pin becomes floating when the chip is in the standby state.

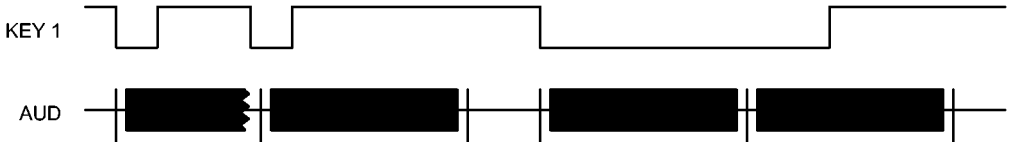
The 8050 type transistor with $h_{FE} \cong 150$ is recommended for an output driver.



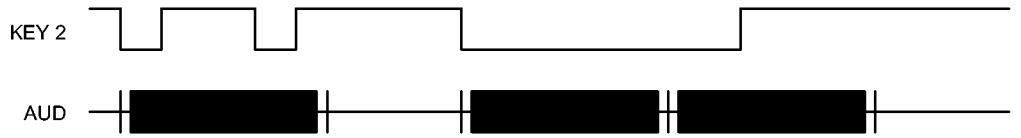
Timing Diagrams

Key operation

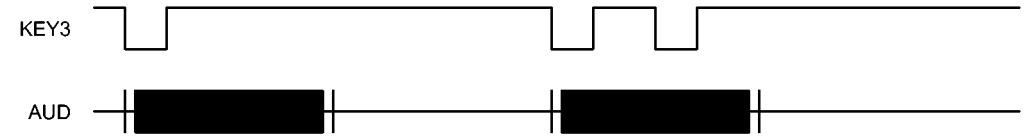
• Retriggerable



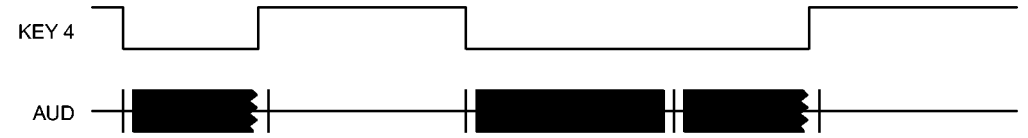
• Non-retriggerable



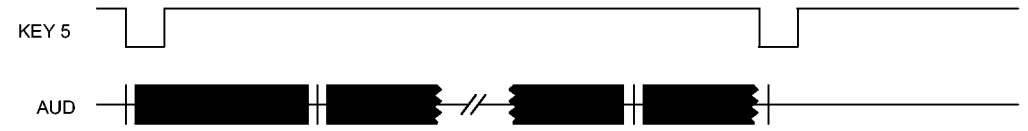
• Microphone trigger



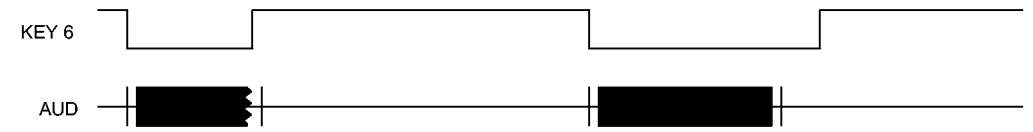
• Level-hold trigger



• Toggle trigger

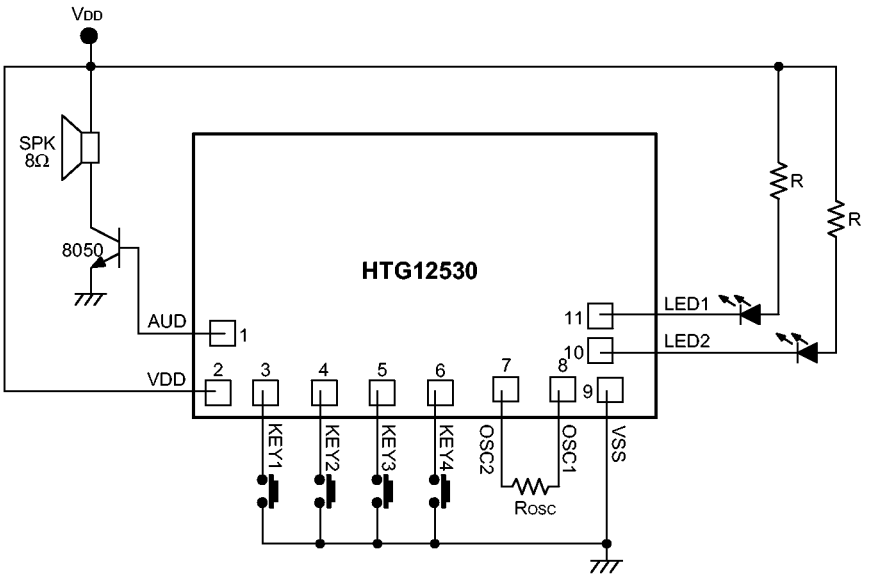


• CDS trigger



Application Circuits

Four songs/four-keys trigger application



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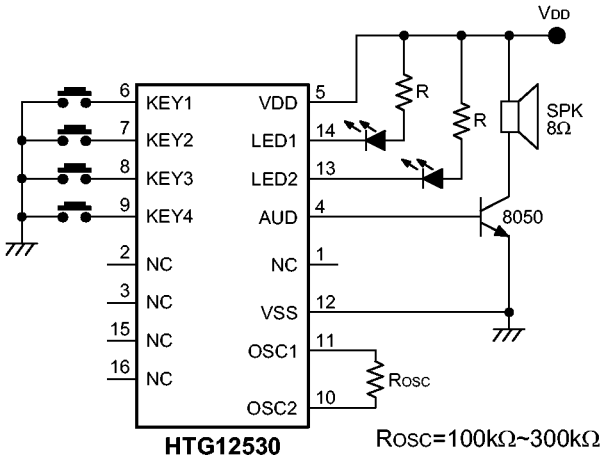
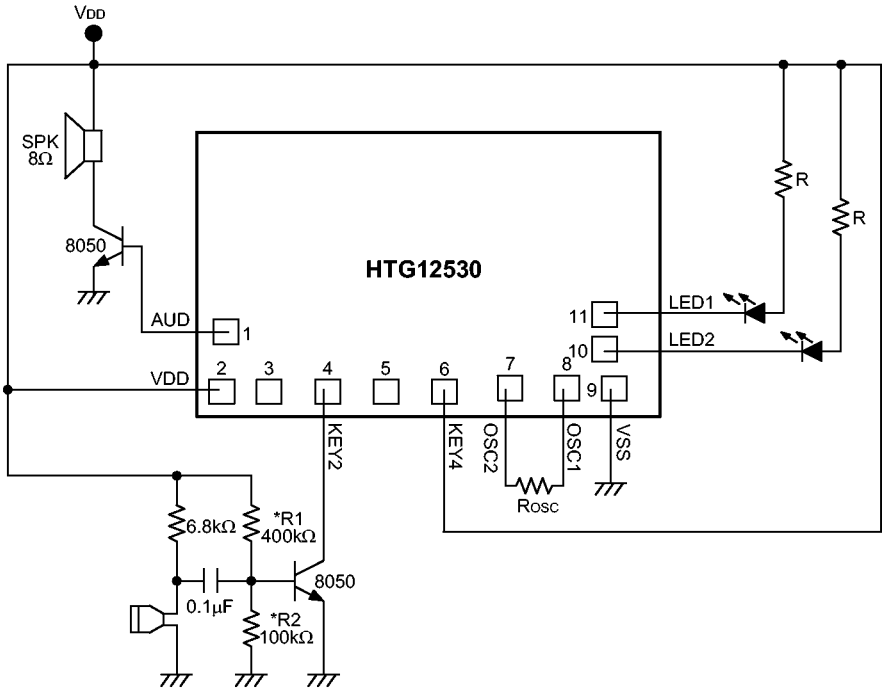


Microphone trigger application



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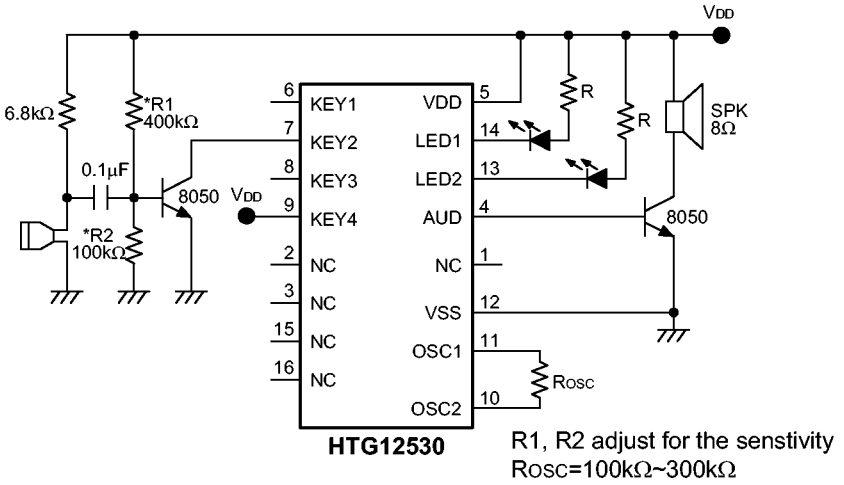
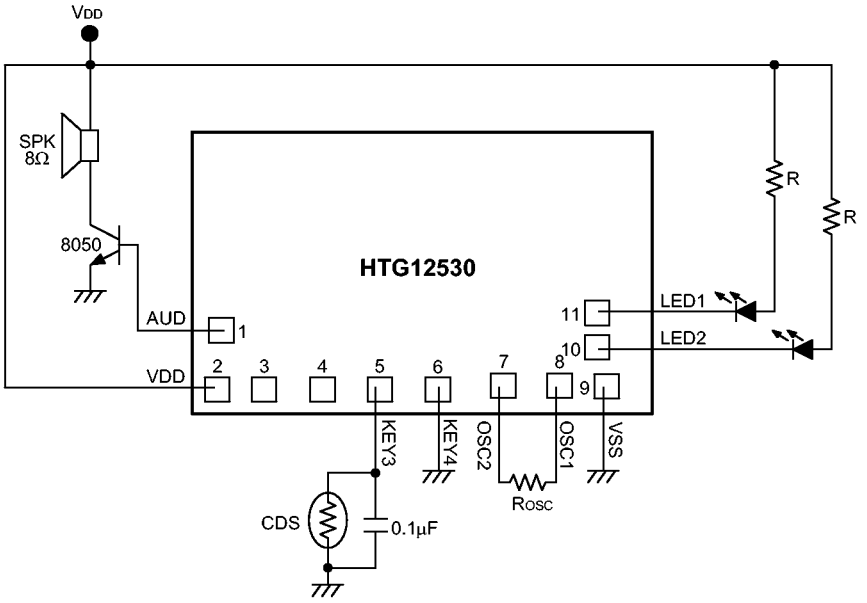


R1, R2 adjust for the senstivity
ROSC=100kΩ~300kΩ

CDS trigger application



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