HT8950/HT8950A
Voice Modulator

Features

- Operating voltage: 2.4V~4.0V
- On-chip SRAM
- Robot function
- Vibrato function
- 8kHz sampling rate
- 7-step level shifting
- 8-bit A/D and D/A converters
- LED indicator with voice level
- Push button selection or electronic mode
- Minimal external components
- HT8950: 18-pin DIP package
  HT8950A: 16-pin DIP package

Applications

- Educational Toys/leisure products
- Mixers
- Recorders
- Audio system
- Speech system
- Telephone system

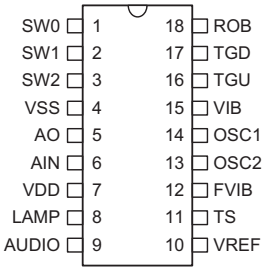
General Description

The HT8950/HT8950A are single chip CMOS LSI voice modulator ICs which provide seven steps to shift the frequency of an input voice, producing a dramatic change in the output.

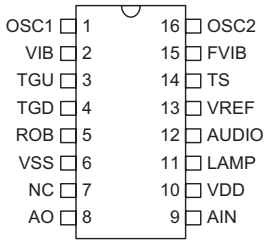
The HT8950/HT8950A provide two special effects: Vibrato and Robot. The Vibrato effect is generated by alternating the frequency of an input signal up and down at a rate of 8Hz. The Robot function, on the other hand, converts an input voice into a Robot voice. Both effects can be selected depending on which pin is triggered, either ROB or VIB. For the output frequency level shifting, the chips provide seven steps which can be selected from the two groups of pins namely, SW0, SW1 and SW2 for electronic direct selection and ROB, TGD, TGU and VIB for push button selection.

The HT8950/HT8950A include a built-in microphone amplifier with an internal bias, an 8-bit A/D converter, a built-in SRAM as well as a current output type 8-bit D/A converter. The 8-bit A/D and D/A converters with a sampling rate of 8kHz ensures a high quality and high S/N ratio output voice. The chips provide an LED indicator which flashes in accordance with the volume of the input voices.

Pin Assignment

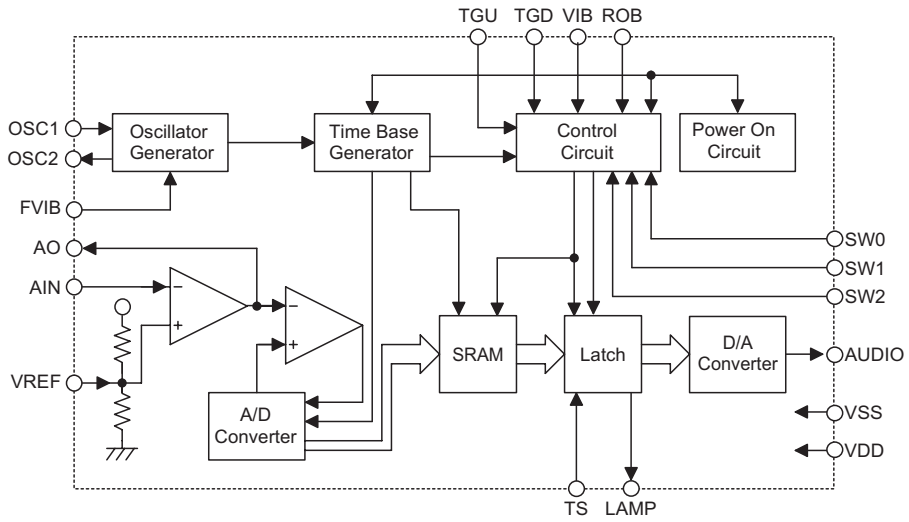


HT8950
18 DIP-A



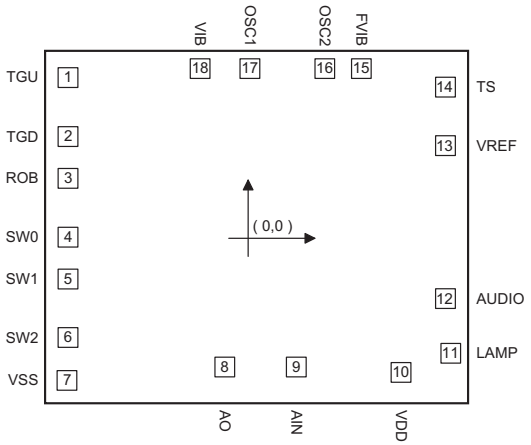
HT8950A
16 DIP-A

Block Diagram



Pad Coordinates

Unit: μm



Pad No.	X	Y	Pad No.	X	Y
1	–957.0	720.5	10	732.0	–774.0
2	–957.0	423.5	11	984.0	–675.0
3	–957.0	210.0	12	956.5	–400.0
4	–957.0	–87.0	13	956.5	374.5
5	–957.0	–299.5	14	956.5	671.5
6	–957.0	–596.5	15	530.5	765.5
7	–962.0	–815.0	16	345.50	765.5
8	–161.5	–747.5	17	–33.50	765.5
9	200.5	–747.5	18	–287.50	765.5

Chip size: 2350×2080 $(\mu m)^2$

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

Pin Description (HT8950)

Pin No.	Pin Name	I/O	Internal Connection	Description
1~3	SW0~SW2	I	Pull-High	Function setting pin (for electronic setting)
4	VSS	I	—	Negative power supply, ground
5	AO	O	—	Internal amplifier output
6	AIN	I	—	Internal amplifier input (inverted)
7	VDD	O	—	Positive power supply
8	LAMP	O	NMOS Open Drain	Lamp output (the brightness changes with the voice volume)

Pin No.	Pin Name	I/O	Internal Connection	Description
9	AUDIO	O	PMOS Open Drain	Audio output
10	VREF	I	—	Internal amplifier reference voltage
11	TS	I	—	For IC test only
12	FVIB	O	—	Vibrato frequency control
13	OSC2	O	—	Oscillator output
14	OSC1	I	—	Oscillator input
15	VIB	I	Pull-High	Switch to Vibrato mode (toggle)
16	TGU	I	Pull-High	Switch to Upward step mode
17	TGD	I	Pull-High	Switch to Downward step mode (internal pull-high)
18	ROB	I	Pull-High	Switch to Robot mode (internal pull-high)

Absolute Maximum Ratings

Supply Voltage ..... V_{SS}–0.3V to V_{SS}+4.5V
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	3.0	4.0	V
I_{OP}	Operating Current	3V	No load, f_{OSC}=640kHz	—	2.0	10	mA
V_{IN}	Input Signal	3V	—	—	—	580	mV
I_{LAMP}	Lamp Sink Current	3V	V_{OL}=1.3V	5.0	9.5	—	mA
A_V	OPA Gain Value	3V	Open loop	—	2000	—	
I_O	Audio Output Voltage	3V	During silence	—	–1	—	mA
V_{IH}	High Input Voltage	—	—	$0.7V_{DD}$	—	—	V
V_{IL}	Low Input Voltage	—	—	—	—	$0.3V_{DD}$	V
f_{OSC}	Oscillating Frequency	3V	R_{OSC}=47kΩ	—	512	—	kHz

Functional Description

The HT8950/HT8950A are single chip LSIs designed for voice modulation. These devices provide seven steps to shift the frequency of an input voice signal up and down. The chips are also equipped with two special effects; Vibrato and Robot.

The HT8950/HT8950A include a built-in amplifier, 8-bit A/D converter and current output type of 8-bit D/A converter in addition to a built-in SRAM. The brightness of the LED indicator changes with the volume of the input voice signal.

Power on Initial

The HT8950/HT8950A enter the Robot state right after power is initially switched on.

Robot State

The system goes into the Robot state after the ROB pin is triggered or power is turned on. In this mode, an input voice can be converted into a robot voice.

Vibrato

An output voice will be generated with a vibrato effect when the VIB pin is triggered, regardless of what state the system is in. The vibrato effect is toggle activated. In other words, when a voice output is playing with a vibrato effect, this effect can be eliminated by retriggering the VIB pin. The rate of vibrato effect can be changed by adjusting the resistance of the external resistor between the OSC2 and FVIB pins.

Voice Modulation

The HT8950/HT8950A provide an 8-bit A/D and D/A converters with a sampling rate of 8kHz, ensuring a high quality voice output and with a high S/N ratio. The chips include seven steps to shift the frequency of an input signal. The voice modulation is selected and determined by the SW0~SW2 inputs.

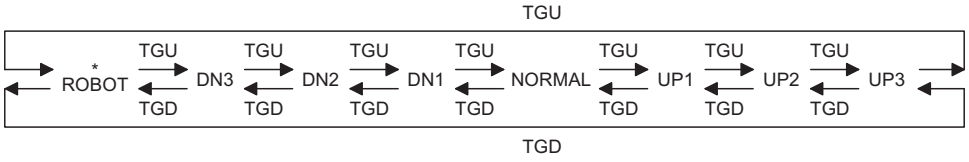
Input			Step Mode	Speed Ratio
SW2	SW1	SW0		
1	1	1	Controlled by TGU and TDG	Notes
1	1	0	UP3	2
1	0	1	UP2	8/5
1	0	0	UP1	4/3
0	1	1	NORMAL	1
0	1	0	DN1	8/9
0	0	1	DN2	4/5
0	0	0	DN3	2/3

Notes: The TGU switch increments by one step mode, and the TGD switch, on the other hand, decrements by one step mode, step by step as shown:

- The system changes to the Robot state after the ROB pin is triggered, regardless of what state the system is in.
- A voice output is accompanied with a vibrato effect after the VIB pin is triggered, regardless of what state the system is in.

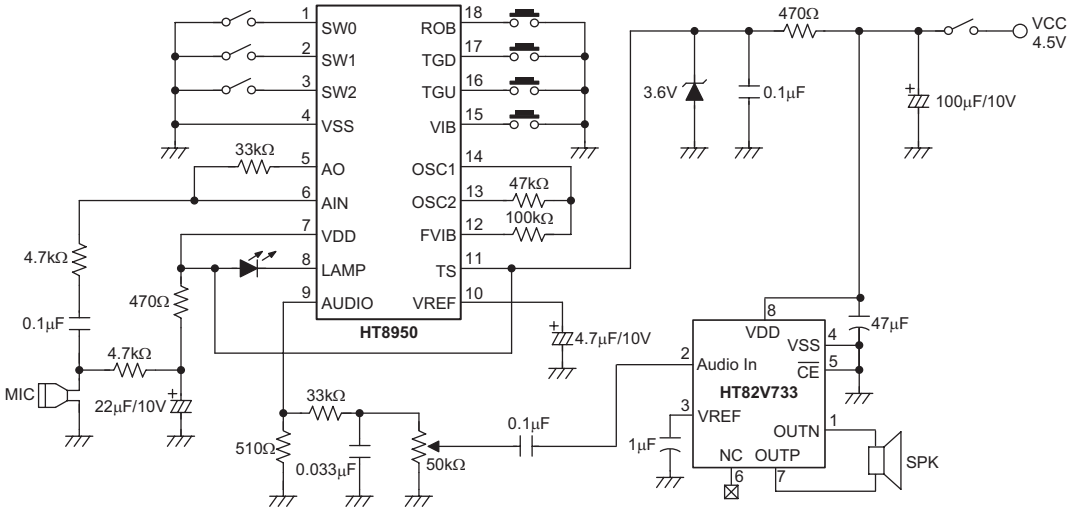
LED Indicator

The HT8950/HT8950A provide a LAMP pin to drive an external LED. The brightness of the LED changes with the volume of the input voice signal.

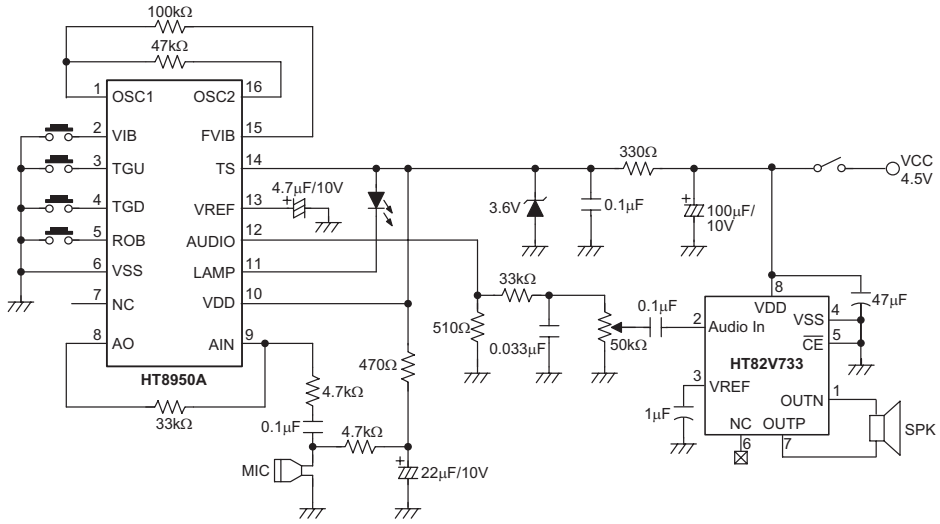


Application Circuits

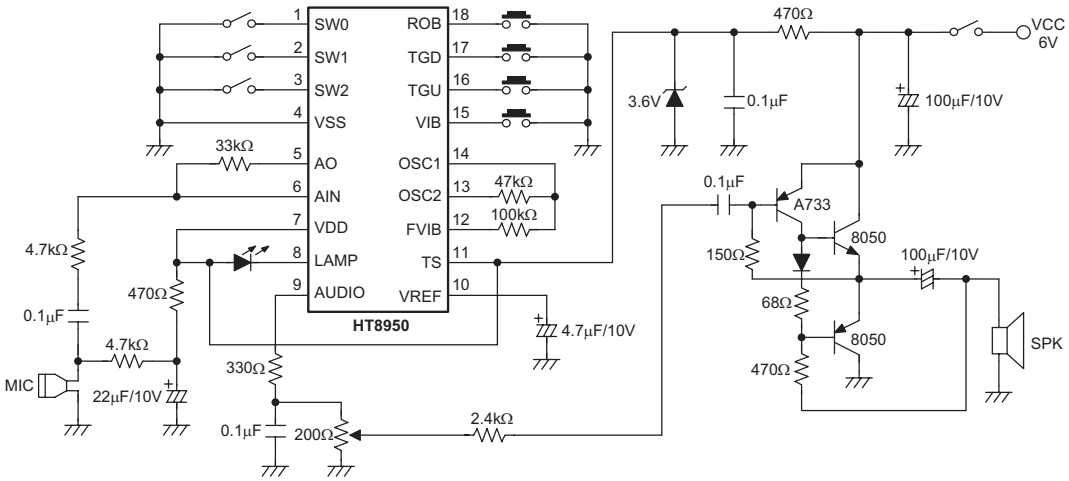
HT8950 with HT82V733 Power Amplifier and a 6V Power Supply



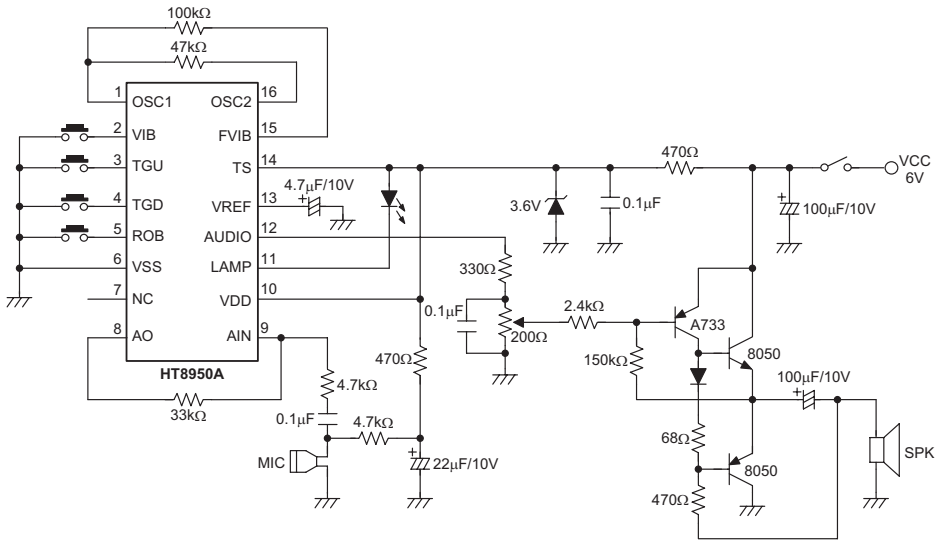
HT8950A with HT82V733 Power Amplifier and a 6V Power Supply



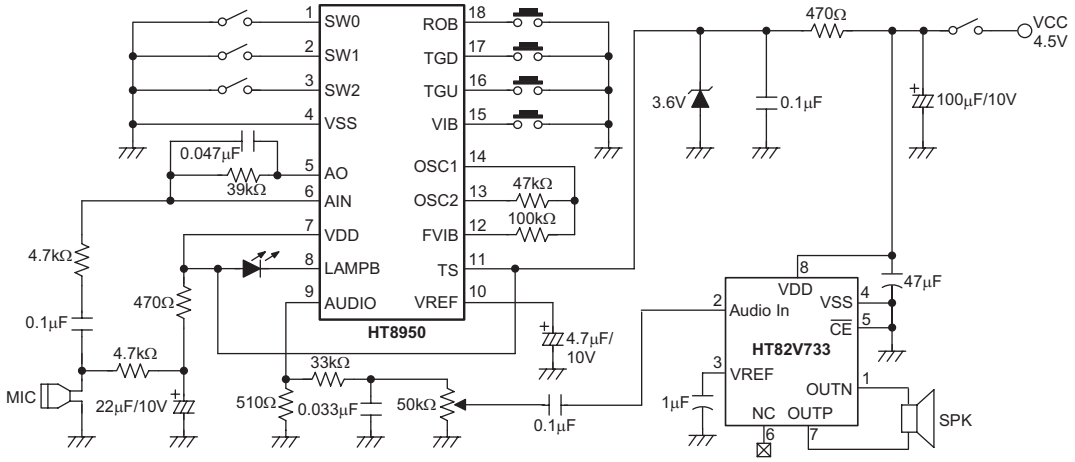
HT8950 with a Transistor Output Stage and a 6V Power Supply



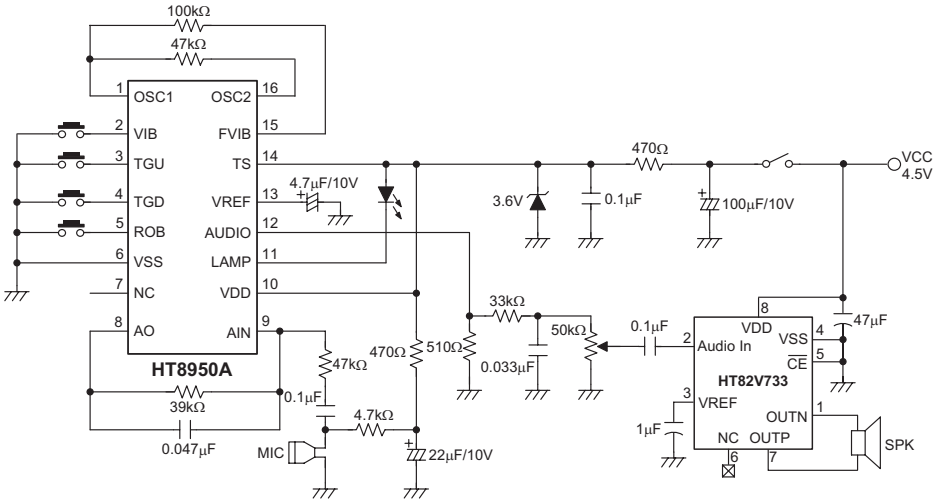
HT8950A with a Transistor Output Stage and a 6V Power Supply



HT8950 with HT82V733 Power Amplifier and a 6V Power Supply

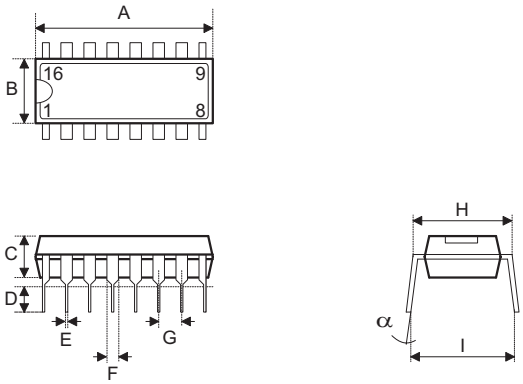


HT8950A with HT82V733 Power Amplifier and a 6V Power Supply



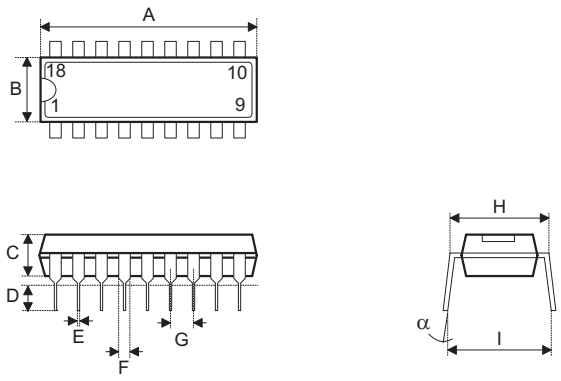
Package Information

16-pin DIP (300mil) Outline Dimensions



Symbol	Dimensions in mil		
	Min.	Nom.	Max.
A	745	—	775
B	240	—	260
C	125	—	135
D	125	—	145
E	16	—	20
F	50	—	70
G	—	100	—
H	295	—	315
I	335	—	375
α	0°	—	15°

18-pin DIP (300mil) Outline Dimensions



Symbol	Dimensions in mil		
	Min.	Nom.	Max.
A	895	—	915
B	240	—	260
C	125	—	135
D	125	—	145
E	16	—	20
F	50	—	70
G	—	100	—
H	295	—	315
I	335	—	375
α	0°	—	15°

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