HT8960
Voice Echo

Features

- Operating voltage: 4.5V~5.5V
- ADM algorithm
- Low noise
  - Echo mode: –85dB
  - Surround mode: –90dB
- Low distortion rate
  - Echo mode: 1%
  - Surround mode: 0.2%
- Long delay time
  - Echo mode: 20.5ms~163.8ms, 8 stages
  - Surround mode: 5.1ms~41ms, 8 stages
- Manual/μP control interface
- Built-in 20Kb SRAM
- Automatic mute function
- Automatic reset function
- Package type: 28-pin DIP

Applications

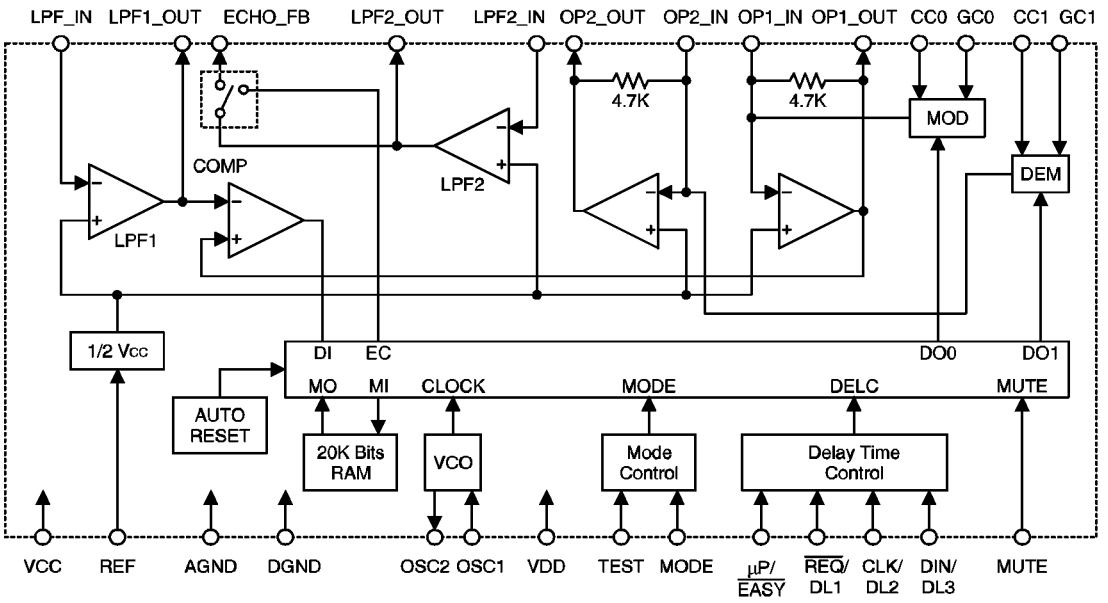
- Television
- Karaoke systems
- Video disc player
- Sound equipments

General Description

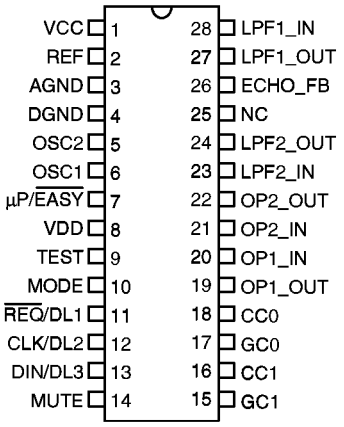
The HT8960 is an echo/surround effect processor. It is designed for various audio systems including karaoke, television, sound equipments, etc. The chip consists of a built-in pre-amplifier, on-chip oscillator, 20Kb SRAM, A/D and D/A converters as well as delay time control logic.

The HT8960 provides manual and μP interface to control echo/surround mode and delay time. It has built-in 20Kb SRAM to generate the effect of delay time and can control the value of delay time through the internal control logic unit. In surround mode the delay time is from 5.1ms to 41ms. On the other hand, the delay time range is from 20.5ms to 163ms in echo mode.

Block Diagram

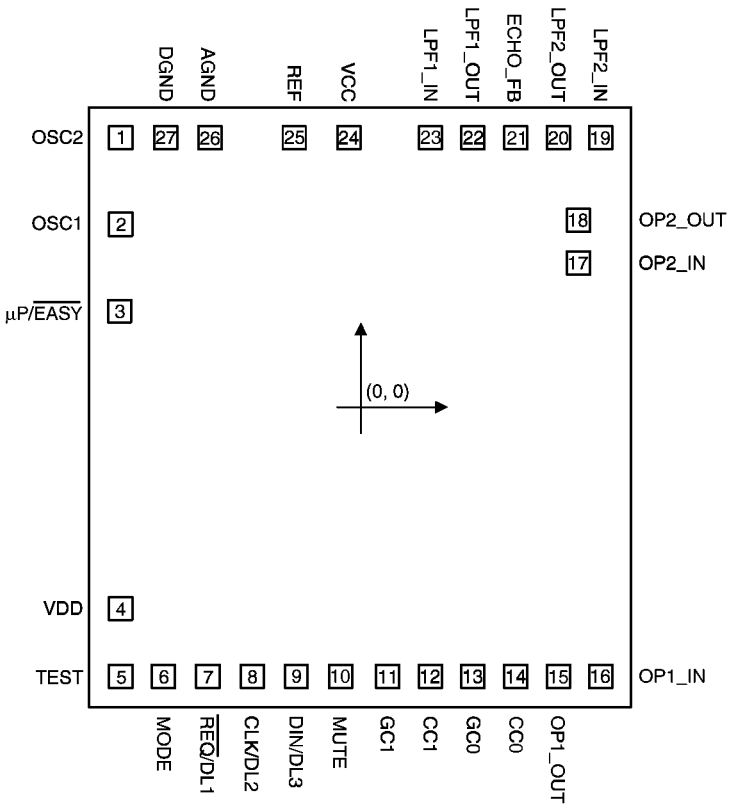


Pin Assignment



HT8960
– 28 DIP

Pad Assignment



Chip size: 2025×2340 $(\mu m)^2$

* 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	–835.80	939.30	15	688.00	–939.25
2	–835.80	637.60	16	836.40	–939.25
3	–840.50	334.15	17	758.85	503.40
4	–835.80	–702.50	18	758.85	651.80
5	–835.80	–939.25	19	836.40	939.20
6	–687.40	–939.25	20	688.00	939.20
7	–533.00	–939.25	21	539.60	939.20
8	–378.60	–939.25	22	391.20	939.20
9	–224.20	–939.25	23	242.80	939.20
10	–70.00	–939.25	24	–41.40	939.25
11	90.40	–939.25	25	–231.40	939.20
12	242.80	–939.25	26	–524.75	939.35
13	391.20	–939.25	27	–679.75	939.35
14	539.60	–939.25			

Pad Description

Pad No.	Pad Name	I/O	Internal Connection	Description
1	OSC2	O	—	System oscillator output
2	OSC1	I	—	System oscillator input
3	µP/$\overline{\text{EASY}}$	I	Pull-low	µP/manual control input 1: µP control mode 0: manual control mode
4	VDD	I	—	Digital and positive power supply
5	TEST	I	Pull-low	Test mode input 1: test mode 0: normal mode
6	MODE	I	Pull-low	Echo/surround mode input 1: echo mode 0: surround mode
7	$\overline{\text{REQ}}$/DL1	I	Pull-low	µP: data request input Manual: delay time 1 input
8	CLK/DL2	I	Pull-low	µP: serial clock input Manual: delay time 2 input
9	DIN/DL3	I	Pull-low	µP: serial data input Manual: delay time 3 input
10	MUTE	I	Pull-low	Mute control input 1: mute 0: normal mode
11	GC1	—	—	Gain control 1
12	CC1	—	—	Current control 1
13	GC0	—	—	Gain control 0
14	CC0	—	—	Current control 0
15	OP1_OUT	O	—	OP1 output
16	OP1_IN	I	—	OP1 input
17	OP2_IN	I	—	OP2 input
18	OP2_OUT	I	—	OP2 output
19	LPF2_IN	I	—	Low pass filter 2 input
20	LPF2_OUT	O	—	Low pass filter 2 output
21	ECHO_FB	O	—	Echo feedback output
22	LPF1_OUT	O	—	Low pass filter 1 output

Pad No.	Pad Name	I/O	Internal Connection	Description
23	LPF1_IN	I	—	Low pass filter 1 input
24	VCC	I	—	Analog and positive power supply
25	REF	I	—	Analog reference voltage
26	AGND	I	—	Analog ground
27	DGND	I	—	Digital ground

Absolute Maximum Ratings*

Supply Voltage .....–0.3V to 6V
Input Voltage..... V_{SS}–0.3V to V_{DD}+0.3V
Storage Temperature.....–50°C to125 °C
Operating Temperature.....–20°C to70 °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

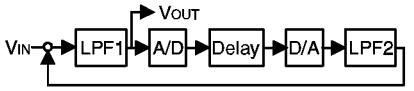
Ta=25°C

Symbol	Parameter	Test Conditions			Min.	Typ.	Max.	Unit
		V_{DD}	Conditions					
V_{CC}	Operating Voltage	—	—		4.5	5.0	5.5	V
I_{CC}	Operating Current	5V	—		—	25	44	mA
G_V	Voltage Gain	5V	R_L=47kΩ		—	–0.5	2.5	dB
V_{OMAX}	Maximum Output Voltage	5V	THD=10%		0.8	1.4	—	Vrms
THD	Total Harmonic Distortion	5V	30kHz L.P.F.	Echo	—	1.5	2.8	%
				Surround	—	0.3	1	%
N_O	Output Noise Voltage	5V	DIN Audio	Echo	—	–85	–60	dBV
				Surround	—	–90	–70	dBV
PSRR	Power Supply Rejection Ratio	5V	ΔV_{CC}=–20dBV (0.1Vrms) f=100Hz		—	–40	–30	dB
T_{MUTE}	Mute Time	5V	Echo		500	515	520	ms
			Surround		125	127	130	ms

Functional Description

The HT8960 is an echo/surround effect generator with built-in 20Kb SRAM. It ensures low distortion as well as low noise for processing audio signal delay. The chip provides two playing modes (echo and surround) and the playing function block diagrams are shown as follows.

- Echo mode (the mode pin is connected to VDD)

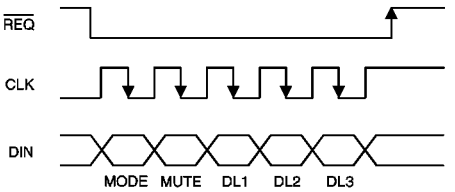


- Surround mode (the mode pin is connected to DGND)

Operating mode

The HT 8960 provides a manual and µP control interface controlled by the µP/$\overline{\text{EASY}}$ pin. The chip can operate at µP mode and communicate with another µP controller through the $\overline{\text{REQ}}$/DL1, CLK/DL2 and DIN/DL3. The serial data of mode selection, mute function and delay time on the DIN/DL3 pin are recognized at the falling edge of the CLK/DL2 signal. The relation is shown in the timing diagram. When the µP/$\overline{\text{EASY}}$ pin connects to DGND, the HT8960 is manipulated at manual mode. The delay time setting is done manually by changing the status of $\overline{\text{REQ}}$/DL1, CLK/DL2 and DIN/DL3. The status of the three pins corresponds to different delay time. The relation is also displayed in the following table.

- µP mode (the µP/$\overline{\text{EASY}}$ is connected to VDD)



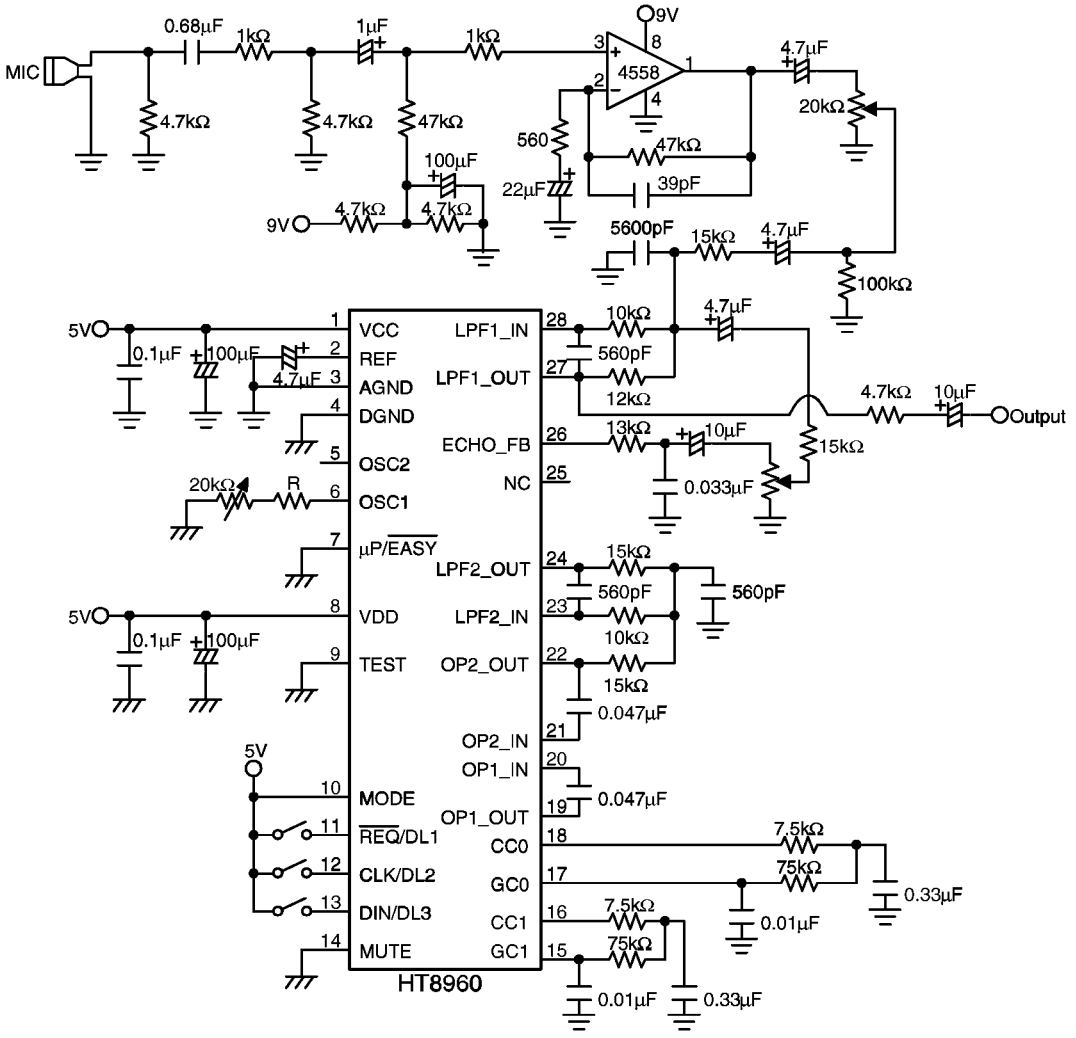
- Manual mode (the µP/$\overline{\text{EASY}}$ is connected to DGND)

Pin Name			Surround Mode		Echo Mode	
DL1	DL2	DL3	F_S	T_d	F_S	T_d
L	L	L	500	5.1	250	20.5
H	H	L		10.2		14
H	L	L		15.4		61.4
L	H	L		20.5		81.9
H	L	H	500	25.6	125	102.4
L	L	H		30.7		122.9
L	H	H		35.8		143.4
H	H	H		41		163.8

Notes: F_S: Sampling frequency (kHz)
T_d: Delay time (ms)
System frequency f_{OSC}=4MHz

Application Circuits

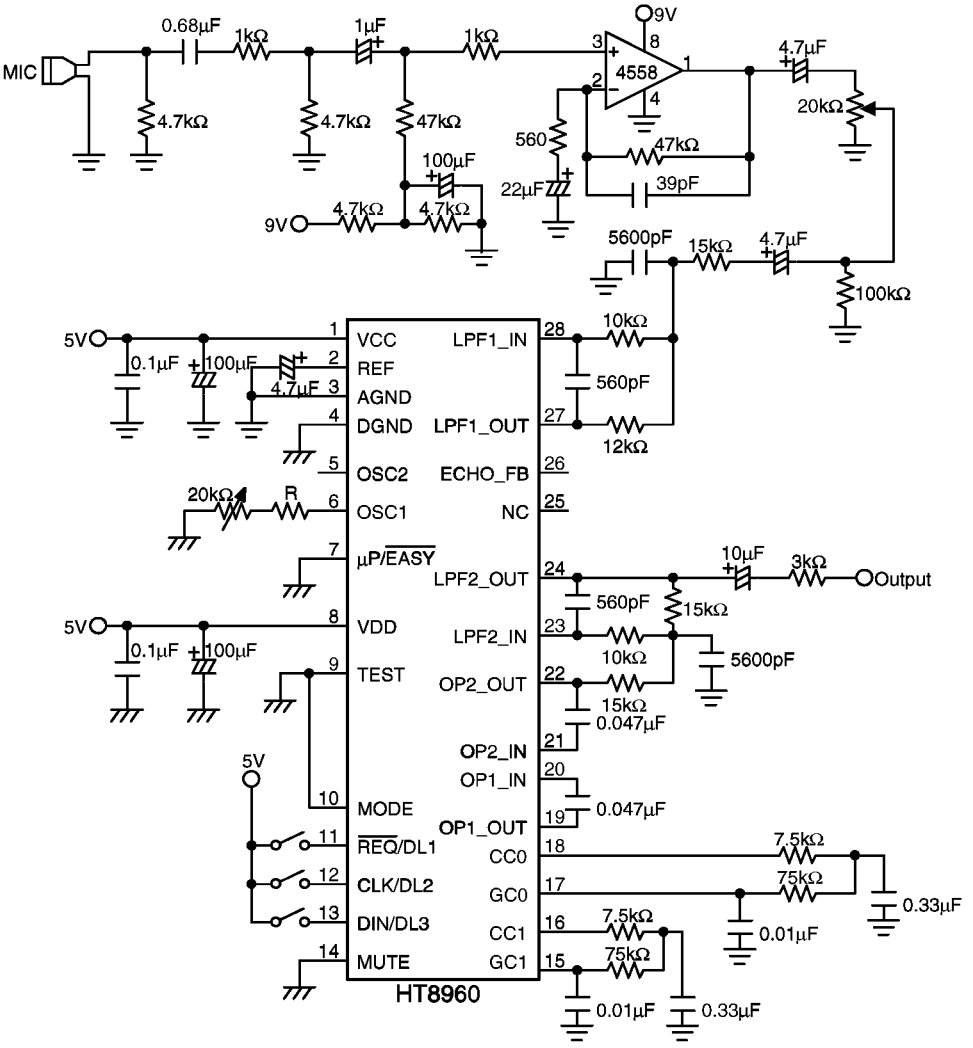
Echo mode



Notes: The external resistor of OSC1 pin is about 15kΩ to 25kΩ

⏚ : Analog ground, ⫽ : Digital ground

Surround mode



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