HT8970
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%

- Built-in 20Kb SRAM
- Automatic reset function
- Package type: 16-pin DIP/SOP

Applications

- Television
- Karaoke systems

- Video disc player
- Sound equipments

General Description

The HT8970 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, VCO or Voltage Control OSC, 20Kb SRAM, A/D and D/A converters as well as delay time control logic.

Its built-in 20Kb SRAM can generate delay time effect and can control the delay time value through the external VCO resistor.

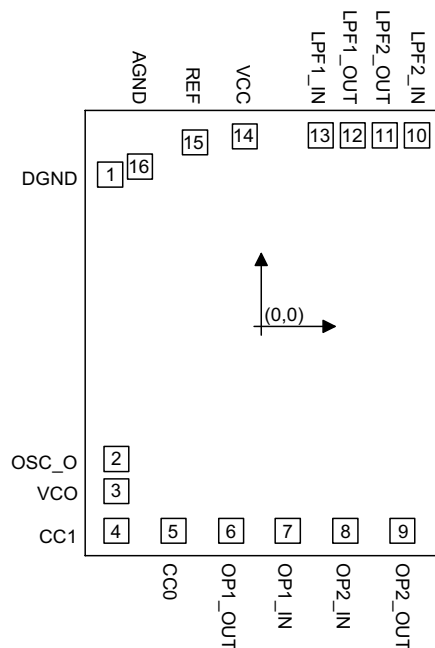The VCO circuit can reduce external components and make it easy to adjust the delay time.
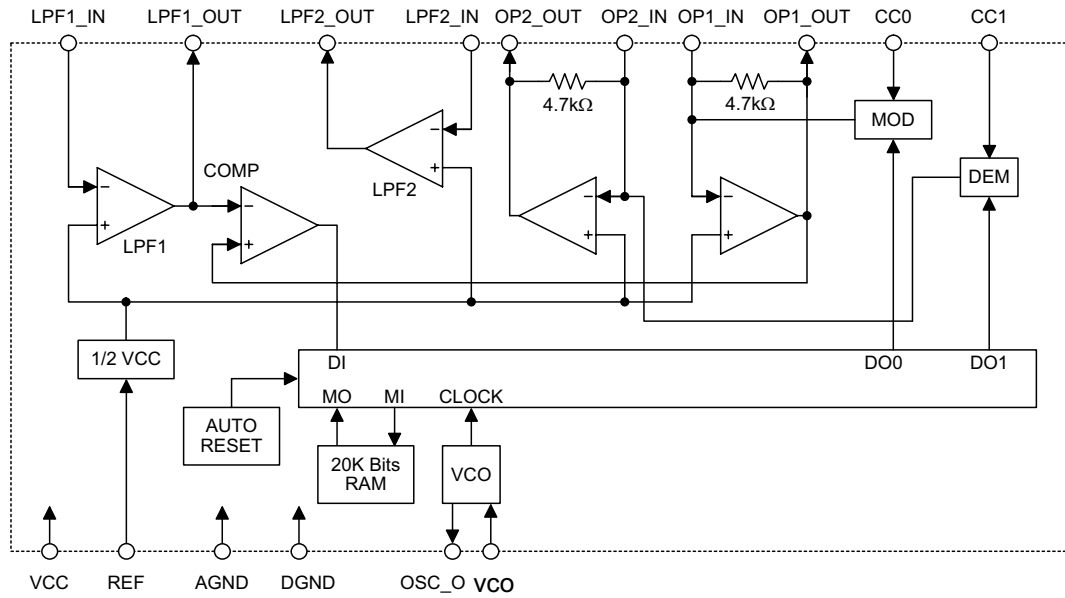
March 14, 2000

Block Diagram

Pin Assignment

HT8970
− 16 DIP/SOP

Pad Assignment

Chip size: $1790 \times 2215 \ (\mu m)^2$

* 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	−698.00	701.70	9	652.85	−945.30
2	−669.25	−614.45	10	720.20	882.55
3	−669.25	−762.85	11	571.80	882.55
4	−669.25	−945.30	12	423.40	882.55
5	−405.55	−945.30	13	275.00	882.55
6	−140.05	−945.30	14	−77.60	877.60
7	123.65	−945.30	15	−306.55	849.95
8	389.15	−945.30	16	−560.95	737.70

March 14, 2000

Pad Description

Pad No.	Pad Name	I/O	Internal Connection	Description
1	DGND	I	—	Digital ground
2	OSC_O	O	—	System oscillator output
3	VCO	I	—	System oscillator input, system frequency adjustable pin
4	CC1	—	—	Current control 1
5	CC0	—	—	Current control 0
6	OP1_OUT	O	—	OP1 output
7	OP1_IN	I	—	OP1 input
8	OP2_IN	I	—	OP2 input
9	OP2_OUT	O	—	OP2 output
10	LPF2_IN	I	—	Low pass filter 2 input
11	LPF2_OUT	O	—	Low pass filter 2 output
12	LPF1_OUT	O	—	Low pass filter 1 output
13	LPF1_IN	I	—	Low pass filter 1 input
14	VCC	I	—	Analog and positive power supply
15	REF	I	—	Analog reference voltage
16	AGND	I	—	Analog 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 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

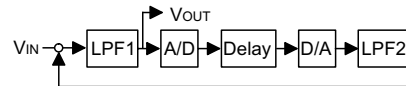| Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
		V_{DD}	Conditions				
V_{CC}	Operating Voltage	—	—	4.5	5.0	5.5	V
I_{CC}	Operating Current	5V	—	—	15	30	mA
G_V	Voltage Gain	5V	R_L=47kΩ	—	−0.9	2.5	dB
V_{OMAX}	Maximum Output Voltage	5V	THD=10%	0.9	1.8	—	Vrms
THD	Total Harmonic Distortion	5V	30kHz L.P.F.	—	0.7	1.5	%
N_O	Output Noise Voltage	5V	DIN Audio	—	−85	−60	dBV
PSRR	Power Supply Rejection Ratio	5V	ΔV_{CC}=−20dBV (0.1Vrms) f=100Hz	—	−40	−30	dB

Functional Description

The HT8970 is an echo/surround effect genera- tor with built-in 20Kb SRAM. It ensures low distortion as well as low noise for processing audio signal delay. The chip provides two play- ing modes (echo and surround) and the playing function block diagrams are shown as follows.

• Surround mode

V_{IN} → LPF1 → A/D → Delay → D/A → LPF2 → V_{OUT}

• Echo mode

V_{IN} → LPF1 → A/D → Delay → D/A → LPF2, V_{OUT}

March 14, 2000

R_{OSC}-f_{OSC}-Delay_time-Distortion Cross table

| R_{OSC}	49.8	38.3	31.9	26.77	23.3	20.54	18.08	kΩ
f_{OSC}	2M	2.5M	3M	3.5M	4M	4.5nm	5M	MHz
Td	327.6	262	218.4	187.2	163.8	145.6	131	ms
THD	1.6	1.3	1.0	0.72	0.7	0.64	0.5	%

| R_{OSC}	16.07	14.29	12.98	11.97	11	9.99	9.22	kΩ
f_{OSC}	5.5M	6M	6.5M	7M	7.5M	8M	8.5M	MHz
Td	119.1	109.2	100.8	93.6	87.36	81.89	77.08	ms
THD	0.47	0.38	0.36	0.35	0.3	0.29	0.28	%

R_{OSC}	8.5	7.54	6.66	6.12	5.5	4.85	4.4	kΩ
f_{OSC}	9M	10M	11M	12M	13M	14M	15M	MHz
Td	72.79	65.52	59.56	54.59	50.39	46.79	43.68	ms
THD	0.25	0.245	0.23	0.22	0.19	0.185	0.165	%

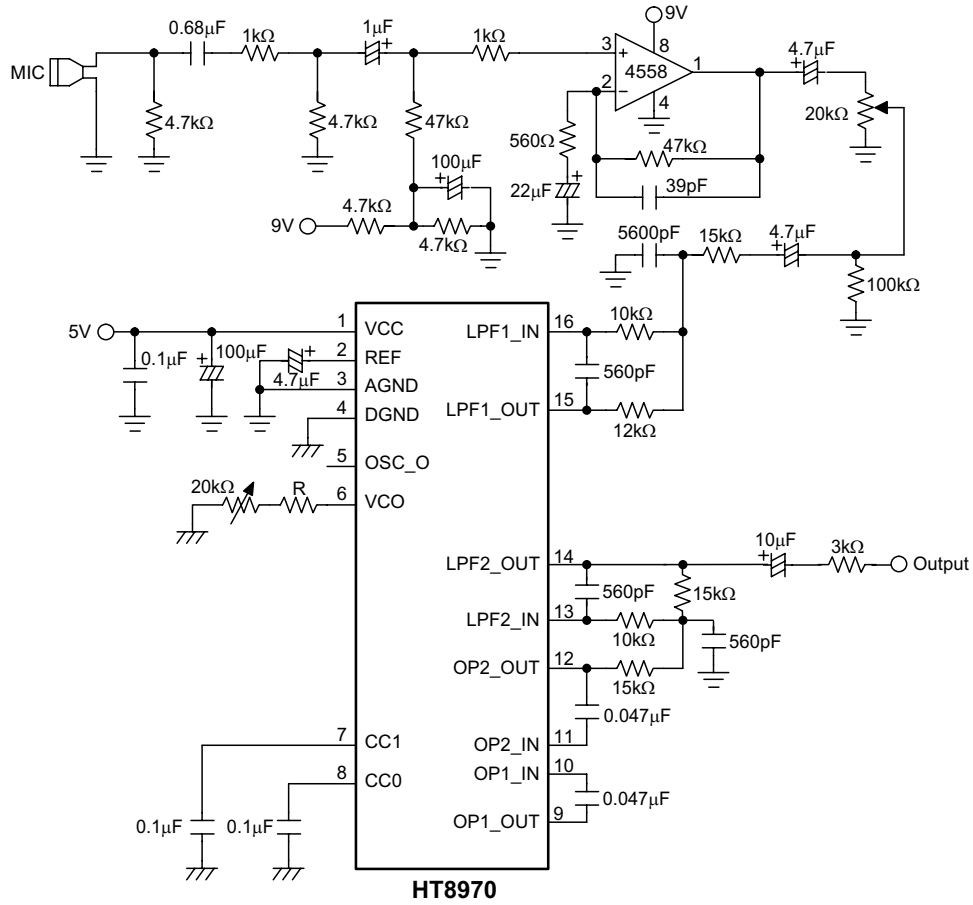| R_{OSC}	3.98	3.64	3.26	2.92	2.69	2.48	2.28	kΩ
f_{OSC}	16M	17M	18M	19M	20M	21M	22M	MHz
Td	40.94	38.54	36.39	34.48	32.75	31.19	29.78	ms
THD	0.165	0.15	0.14	0.14	0.13	0.12	0.11	%

March 14, 2000

## Application Circuits

Echo mode

Note: ⏚ : Analog ground, 777 : Digital ground
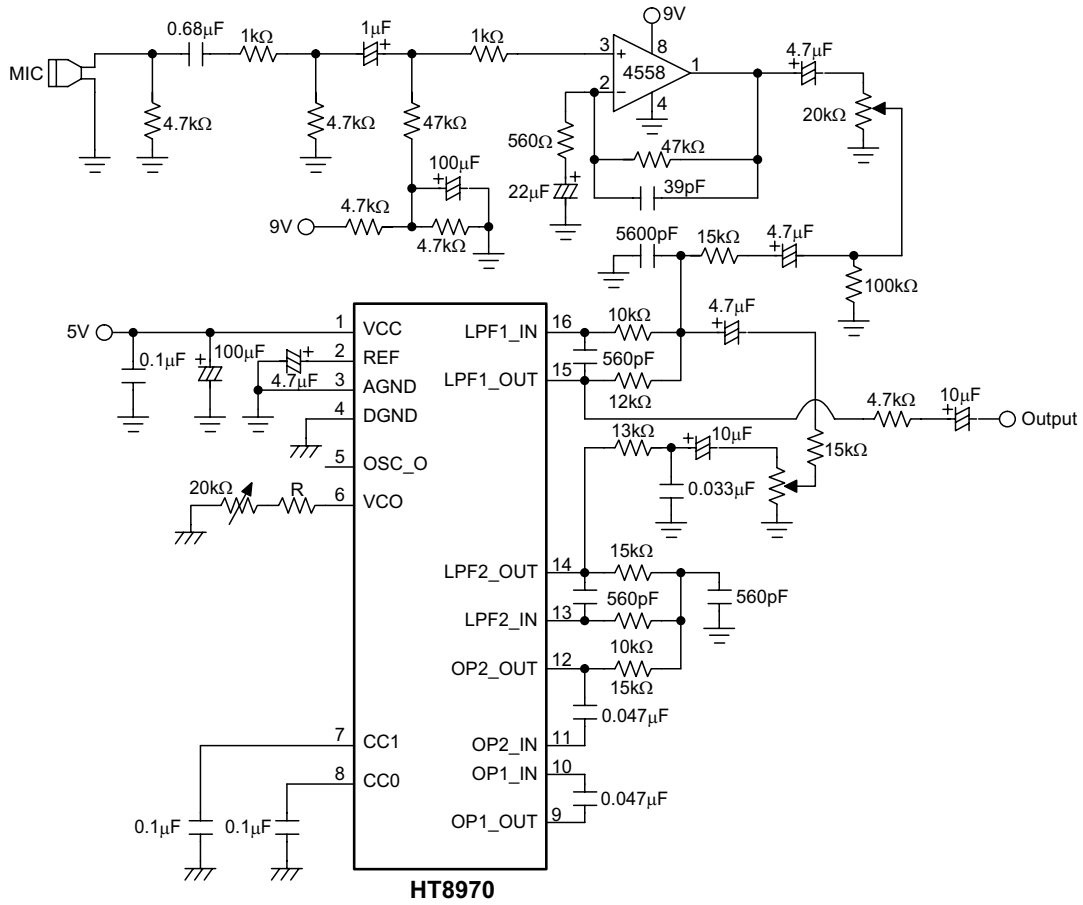
Surround mode

Note: ⏚ : Analog ground,   ⏚ : Digital ground

Holtek Semiconductor Inc. (Headquarters)
No.3 Creation Rd. II, Science-based Industrial Park, Hsinchu, Taiwan, R.O.C.
Tel: 886-3-563-1999
Fax: 886-3-563-1189

Holtek Semiconductor Inc. (Taipei Office)
5F, No.576, Sec.7 Chung Hsiao E. Rd., Taipei, Taiwan, R.O.C.
Tel: 886-2-2782-9635
Fax: 886-2-2782-9636
Fax: 886-2-2782-7128 (International sales hotline)

Holtek Semiconductor (Hong Kong) Ltd.
RM.711, Tower 2, Cheung Sha Wan Plaza, 833 Cheung Sha Wan Rd., Kowloon, Hong Kong
Tel: 852-2-745-8288
Fax: 852-2-742-8657