

**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

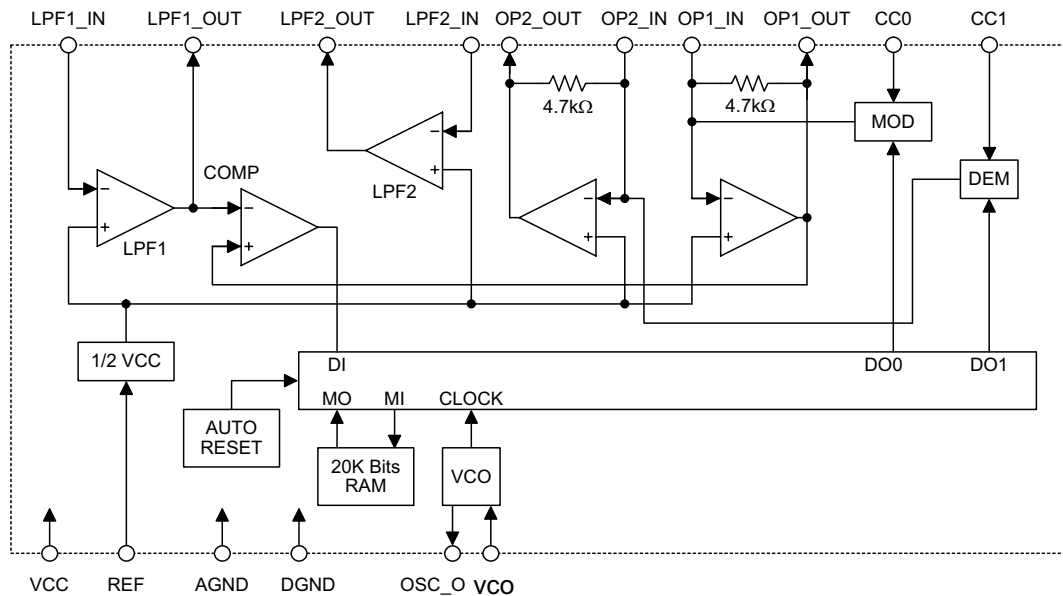
**General Description**

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.

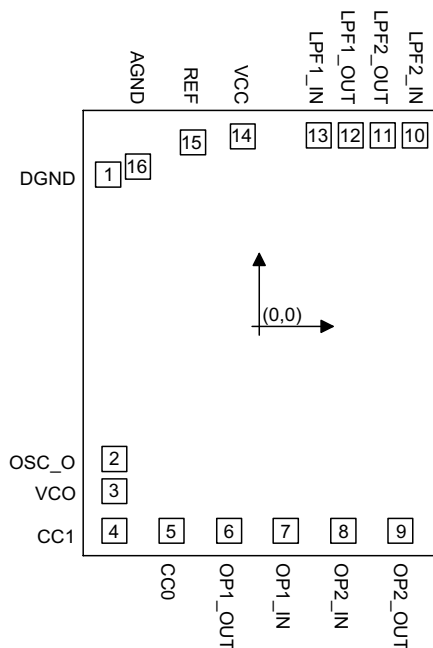
**Block Diagram**



**Pin Assignment**

VCC	1	16	LPF1_IN
REF	2	15	LPF1_OUT
AGND	3	14	LPF2_OUT
DGND	4	13	LPF2_IN
OSC_O	5	12	OP2_OUT
VCO	6	11	OP2_IN
CC1	7	10	OP1_IN
CC0	8	9	OP1_OUT

**HT8970**  
**- 16 DIP/SOP**

**Pad Assignment**


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

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

**Pad Coordinates**

 Unit:  $\mu\text{m}$ 

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

**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      Storage Temperature.....-50°C to 125°C  
 Input Voltage..... $V_{SS}-0.3V$  to  $V_{DD}+0.3V$       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 <sub>DD</sub>	Conditions				
V <sub>CC</sub>	Operating Voltage	—	—	4.5	5.0	5.5	V
I <sub>CC</sub>	Operating Current	5V	—	—	15	30	mA
G <sub>V</sub>	Voltage Gain	5V	R <sub>L</sub> =47kΩ	—	-0.9	2.5	dB
V <sub>OMAX</sub>	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 <sub>O</sub>	Output Noise Voltage	5V	DIN Audio	—	-85	-60	dBV
PSRR	Power Supply Rejection Ratio	5V	ΔV <sub>CC</sub> =-20dBV (0.1Vrms) f=100Hz	—	-40	-30	dB

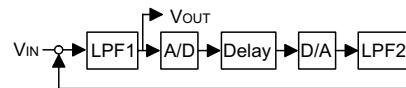
**Functional Description**

The HT8970 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.

- Surround mode



- Echo mode



**Rosc-fosc-Delay\_time-Distortion Cross table**

<b>R<sub>OSC</sub></b>	49.8	38.3	31.9	26.77	23.3	20.54	18.08	kΩ
<b>f<sub>OSC</sub></b>	2M	2.5M	3M	3.5M	4M	4.5M	5M	MHz
<b>T<sub>d</sub></b>	327.6	262	218.4	187.2	163.8	145.6	131	ms
<b>THD</b>	1.6	1.3	1.0	0.72	0.7	0.64	0.5	%

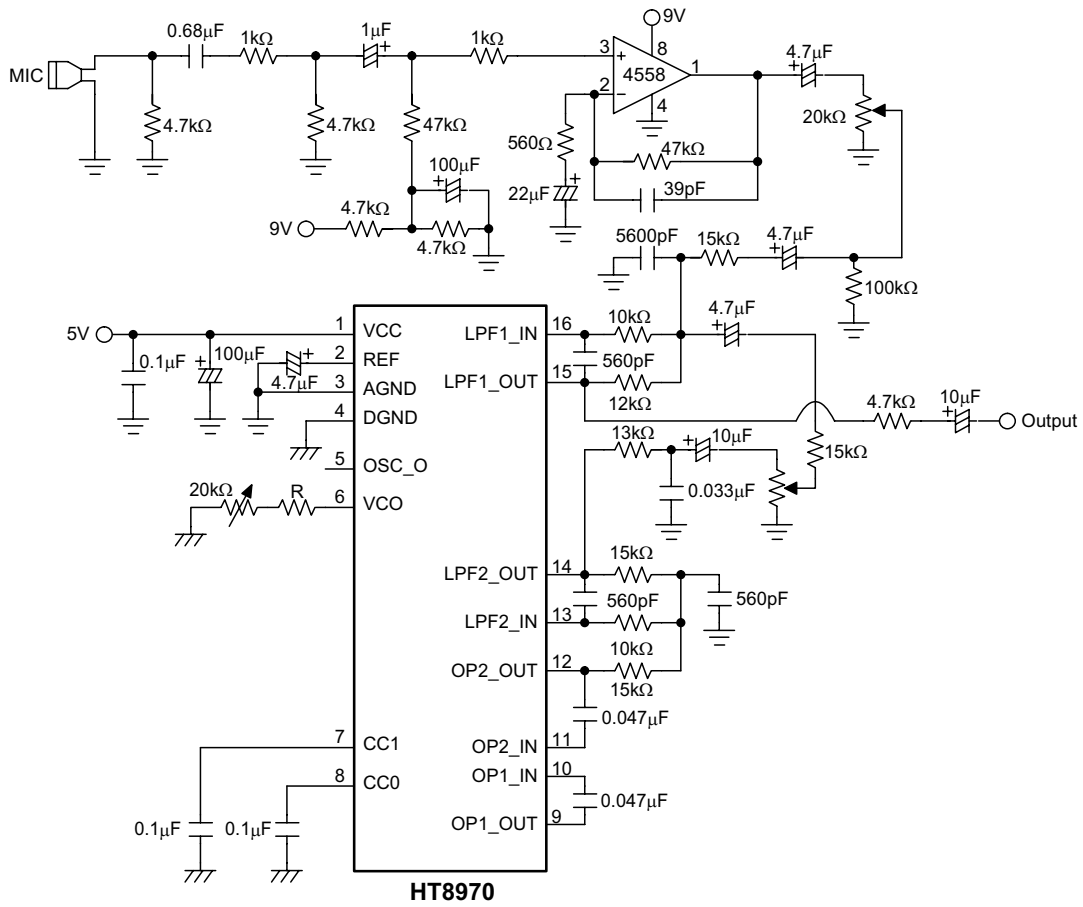
<b>R<sub>OSC</sub></b>	16.07	14.29	12.98	11.97	11	9.99	9.22	kΩ
<b>f<sub>OSC</sub></b>	5.5M	6M	6.5M	7M	7.5M	8M	8.5M	MHz
<b>T<sub>d</sub></b>	119.1	109.2	100.8	93.6	87.36	81.89	77.08	ms
<b>THD</b>	0.47	0.38	0.36	0.35	0.3	0.29	0.28	%



<b>R<sub>OSC</sub></b>	8.5	7.54	6.66	6.12	5.5	4.85	4.4	kΩ
<b>f<sub>OSC</sub></b>	9M	10M	11M	12M	13M	14M	15M	MHz
<b>T<sub>d</sub></b>	72.79	65.52	59.56	54.59	50.39	46.79	43.68	ms
<b>THD</b>	0.25	0.245	0.23	0.22	0.19	0.185	0.165	%

<b>R<sub>OSC</sub></b>	3.98	3.64	3.26	2.92	2.69	2.48	2.28	kΩ
<b>f<sub>OSC</sub></b>	16M	17M	18M	19M	20M	21M	22M	MHz
<b>T<sub>d</sub></b>	40.94	38.54	36.39	34.48	32.75	31.19	29.78	ms
<b>THD</b>	0.165	0.15	0.14	0.14	0.13	0.12	0.11	%

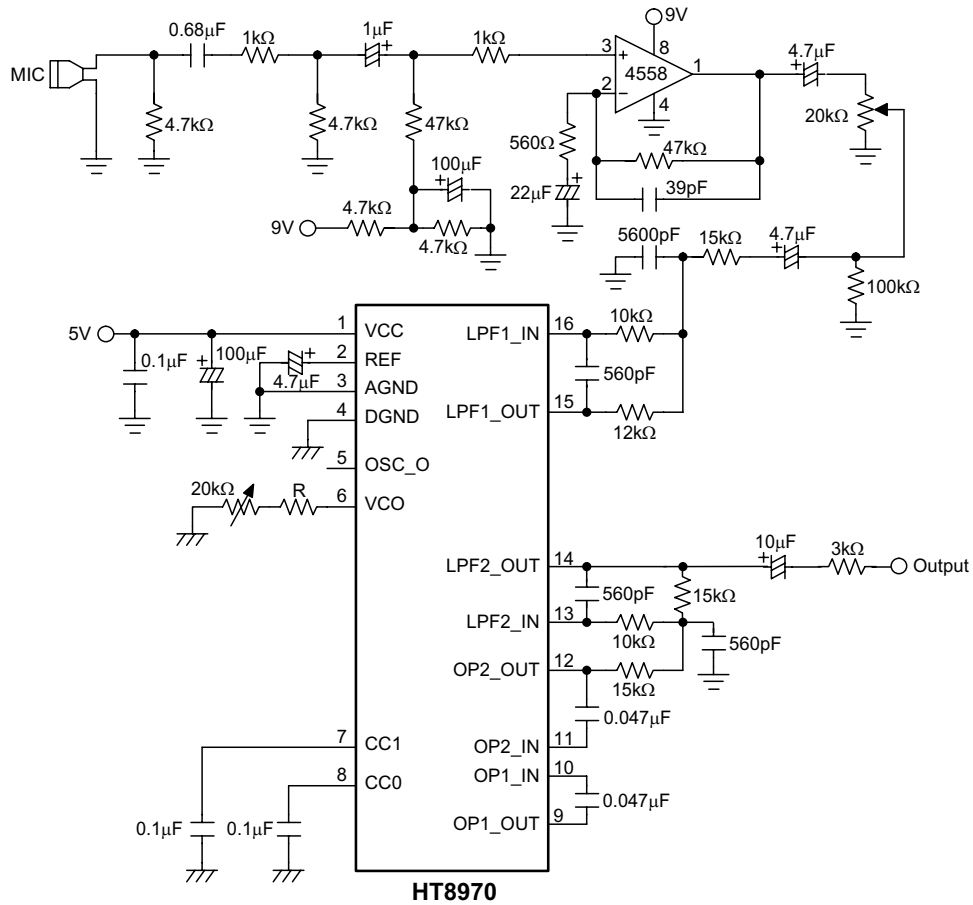
Application Circuits



Echo mode



Note:  : Analog ground,  : Digital ground

Surround mode



Note: : Analog ground, : Digital ground



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