

**FEATURES:**

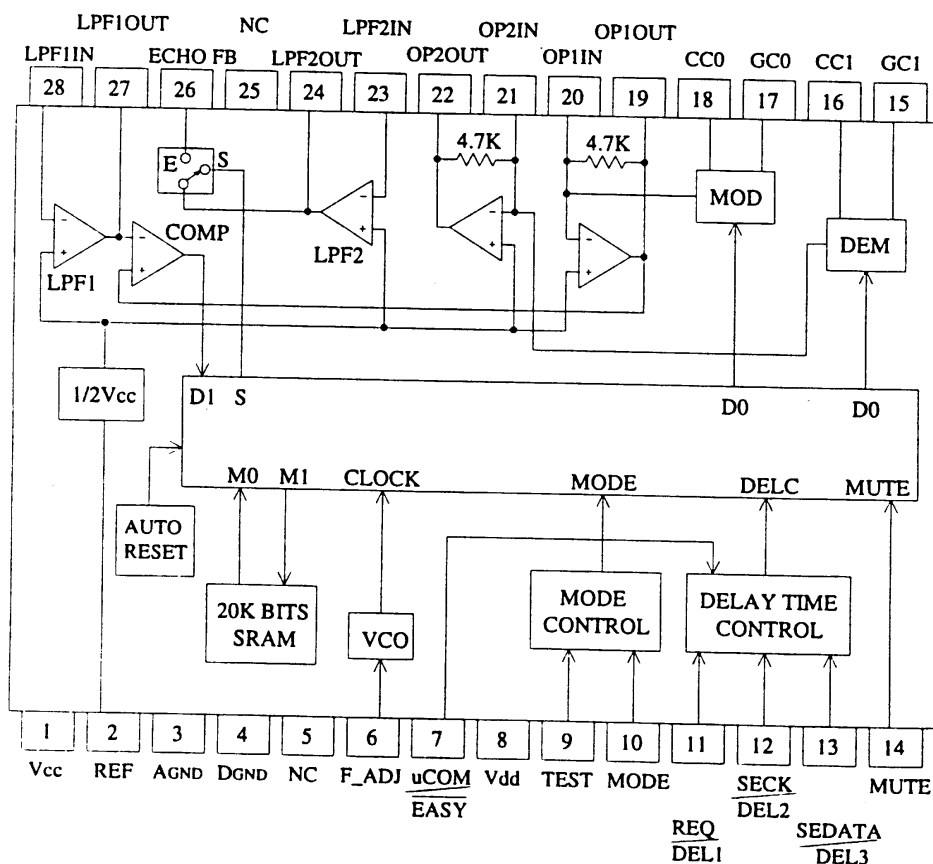
- External adjustable VCO.
  
- Low cost digital delay system.
- Low noise: echo mode:-85dB.  
                  Surround mode:-90dB
- Low distortion: echo mode:1.5%  
                  surround mode:0.3%
- Wide range time delay settings:  
    echo mode:from20.5msec to 163.8msec(8 steps)  
    surround mode:from 4.1 msec to 41 msec(8 steps)
- up/manual control mode setting and time delay
- Auto muting
- Auto reset

**GENERAL DESCRIPTION:**

ES 56028 is a monolithic CMOS echo IC for audio processing. It has an ADC, DAC, and uses digital processing for time delay. Time delay can be controlled by the microcontroller or manual settings. Including an internal VCO circuit for the system clock. It can be adjusted to the suitable frequency. It can be used easily in singing alone, TV, surround processor and electronic instruments.

**APPLICATIONS**

- Video tape recorder
- TV
  
- CD player
  
- Car stereo
  
- Sound processing equipment
- 

**FUNCTION BLOCK DIAGRAM**


## PIN CONFIGURATION

1	V <sub>CC</sub>	LPF1 IN	28
2	REF	LPF1 OUT	27
3	A <sub>GND</sub>	ECHO FB	26
4	D <sub>GND</sub>	NC	25
5	NC	LPF2 OUT	24
6	F_ADJ	LPF2 IN	23
7	uCOM/EASY	LPF2 IN	22
8	V <sub>DD</sub>	OP2 IN	21
9	TEST	OP1 IN	20
10	MODE	OP1 OUT	19
11	REQ/DEL1	CC0	18
12	SECK/DEL2	GC0	17
13	SEDATA/DEL3	CC1	16
14	MUTE	GC1	15

**PIN DESCRIPTION**

Pin	Name	Type	Function
1	Vcc		Analog supply voltage input
2	REF		Analog reference voltage (=1/2 VCC)
3	A <sub>GND</sub>		Analog ground
4	D <sub>GND</sub>		Digital ground
5	NC		No connect
6	F_ADJ	I	Frequency_Adjust
7	uCOM/EASY	I	H=Ucom mode--serial data control L=EASY mode--parallel data control
8	Vdd		Digital supply voltage input
9	TEST	I	L=normal mode
10	MODE	I	H=echo mode L=surround mode
11	REQ/DEL1	I	uCOM mode:inputs data request signal EASY mode:inputs delay time 1
12	SECK/DEL2	I	uCOM mode:inputs serial clock EASY mode:inputs delay time 2
13	SEDATA/DEL3	I	uCOM mode:inputs serial data EASY mode:inputs delay time 3

**PIN DESCRIPTION(continued)**

Pin	Name	Type	Function
14	MUTE	I	H=mute control
15	GC1		Gain control 1
16	CC1		Current control 1
17	GC0		Gain control 1
18	CC0		Current control 0
19	OP1OUT	O	Modulated integrator by connecting capacitor
20	OP1IN	I	Modulated integrator by connecting capacitor
21	OP2IN	I	Demodulated integrator by connecting capacitor
22	OP2 OUT	O	Demodulated integrator by connecting capacitor
23	LPF2IN	I	Low pass filter 2 input
24	LPF2OUT	O	Low pass filter 2 output
25	NC		No connect
26	ECHO FB	O	Echo feedback pin. In echo mode, it can be adjusted the needed echo feedback.
27	LPF1OUT	O	Low pass filter 1 output
28	LPF1IN	I	Low pass filter 1 input

**ABSOLUTE MAXIMUM RATINGS**

(Ta=25°C , unless otherwise noted)

Symbol	Description	Limits	Unit
Vcc	Supply voltage	6.5	V
Icc	Supply current	100	mA
Pd	Power dissipation	1.7	W
Topr	Operation temperature	-20~75	°C
Tstg	Storage temperature	-25~125	°C

**RECOMMENDED OPERATING CONDITIONS**

Symbol	Parameter	Limits			Unit
		Min	Typ	Max	
Vcc	Supply voltage	4.5	5	5.5	V
Fck	Clock frequency		4	5	MHz
V <sub>IH</sub>	"H" input voltage	0.7Vdd			V
V <sub>IL</sub>	"L" input voltage			0.3Vdd	V

**ELECTRICAL CHARACTERISTICS**

(Vcc=5.0V, fin=1 kHz, Vi=100Mv, fck=4MHz

Ta=25°C, unless othrwise noted)

Symbol	Parameter	Test condition		Min	Typ	Maz	Unit
Icco	Supply current				14	20	mA
Gv	Voltage gain	RL = 47 k Ω			-0.5	2.5	dB
Vomax	Maximum output voltage	THD=10%		0.7	1.2		Vrms
THD	Output distortion	30KHz	Echo mode		1.5	3.0	%
		L.P.F.	Surround mode		0.3	1.0	%
No	Output Noise voltage	DIN	Echo mode		-85	-60	dBV
		Audio	Surround mode		-90	-70	dBV
SVRR	Supply voltage	Δ Vcc=-20 dBV			-40	-25	dB
	Rejection ratio	F= 100 Hz					
Tmute	Mute time	Echo mode		490	505	520	msec
		Surround mode		122	127	132	msec

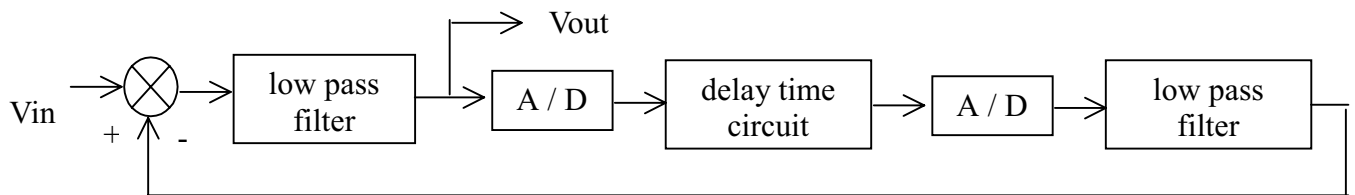
### FUNCTION DESCRIPTION AND OPERATION MODE

**\*MODE**

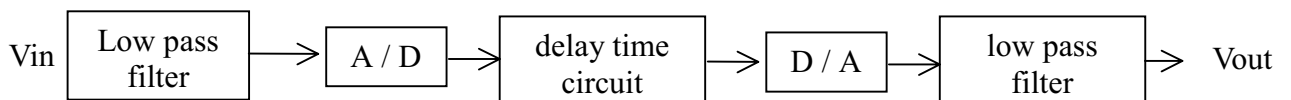
Mode Pin	Mode	Echo FB output
L	Surround mode	Off
H	Echo mode	On

In this moment, the pin 9(TEST pin)should be low.

**Echo mode:**



**Surround mode:**



\*EASY MODE(parallel data input)

When the pin uCOM /  $\overline{\text{EASY}}$  = "low" , then in the easy mode.

Pin name				Surround mode		Echo mode	
uCOM / EASY	DEL1	DEL2	DEL3	Fs	Td	Fs	Td
L	L	L	L	500	4.1	250	20.5
	H	H	L		10.2		41.0
	H	L	L		14.3		61.4
	L	H	L		20.5		81.9
	H	L	H	500	24.6	125	98.3
	L	H	H		30.7		122.9
	L	H	H		34.8		139.3
	H	H	H		41.0		163.8

Fs = Sampling frequency (kHz)

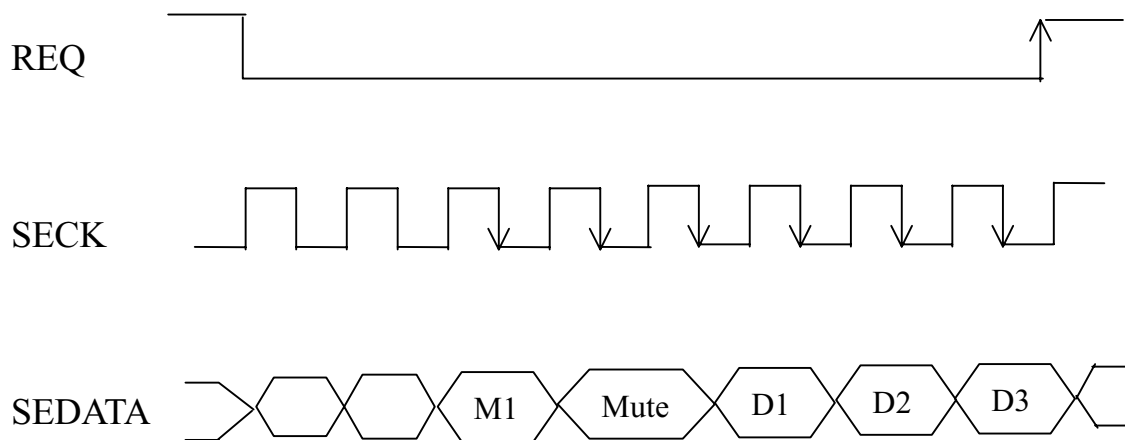
Td = Delay time(msec) , Fck = 4.0 MHz



\* uCOM MODE(serial data input)

When the pin uCOM /  $\overline{\text{EASY}}$  = "high" , then in the uCOM mode.

The timing diagram is shown as belows:



When the REQ signal is low level, the SEDATA signal is latched at the falling edge of the SECK signal , and the last five delay time modes are the rising edge of the REQ signal.

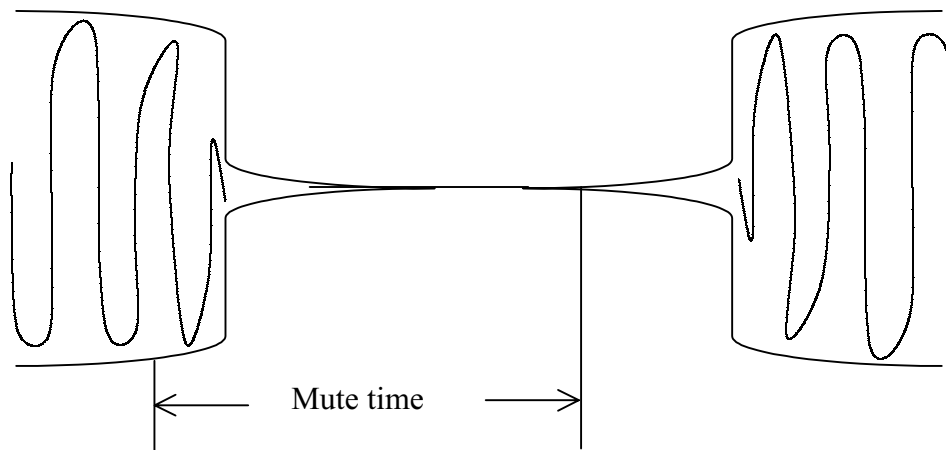
Delay time:D1 = Del 1, D2 = Del 2, D3 = Del 3

Mode:M1 = Mode; Mute(H = Mute)

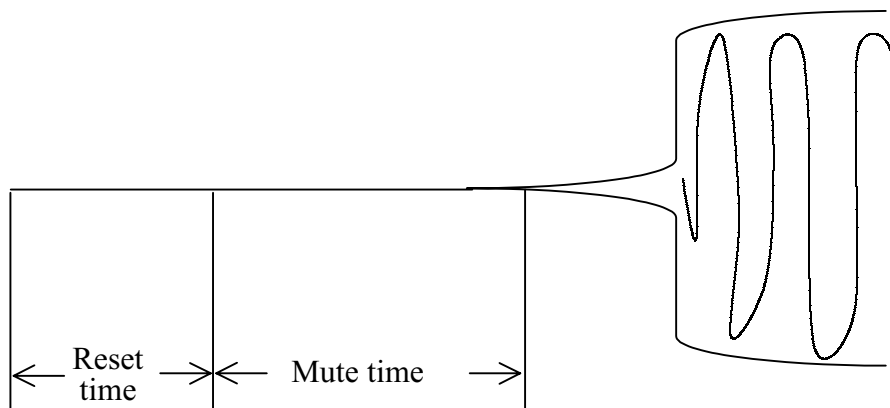
\*MUTING

Delay signal  
before changinf mode

Delay signal  
after changinf mode

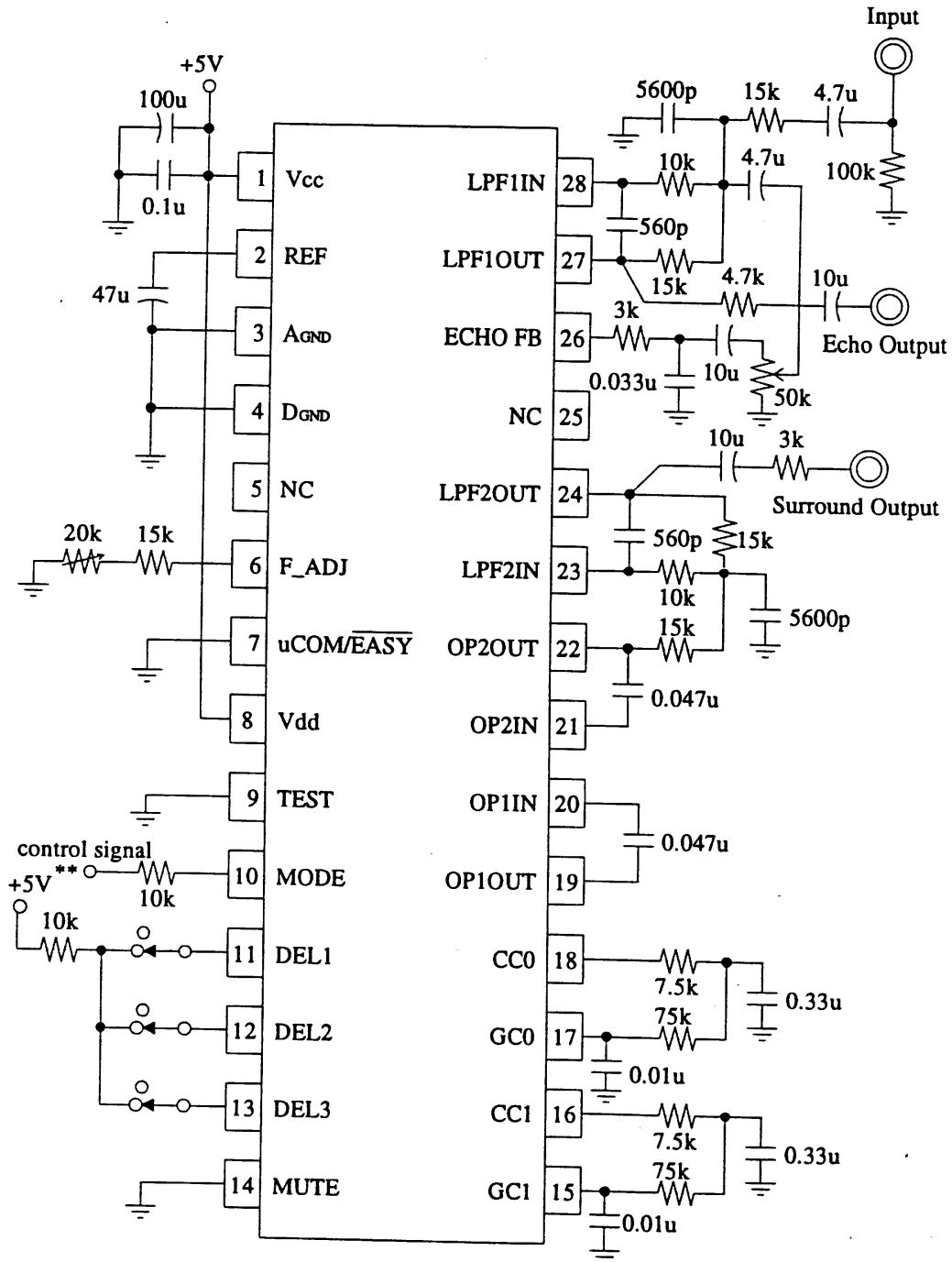


(i) Waveforms of the signal during delay time changing mode



(ii) Waveforms of the signal during power on

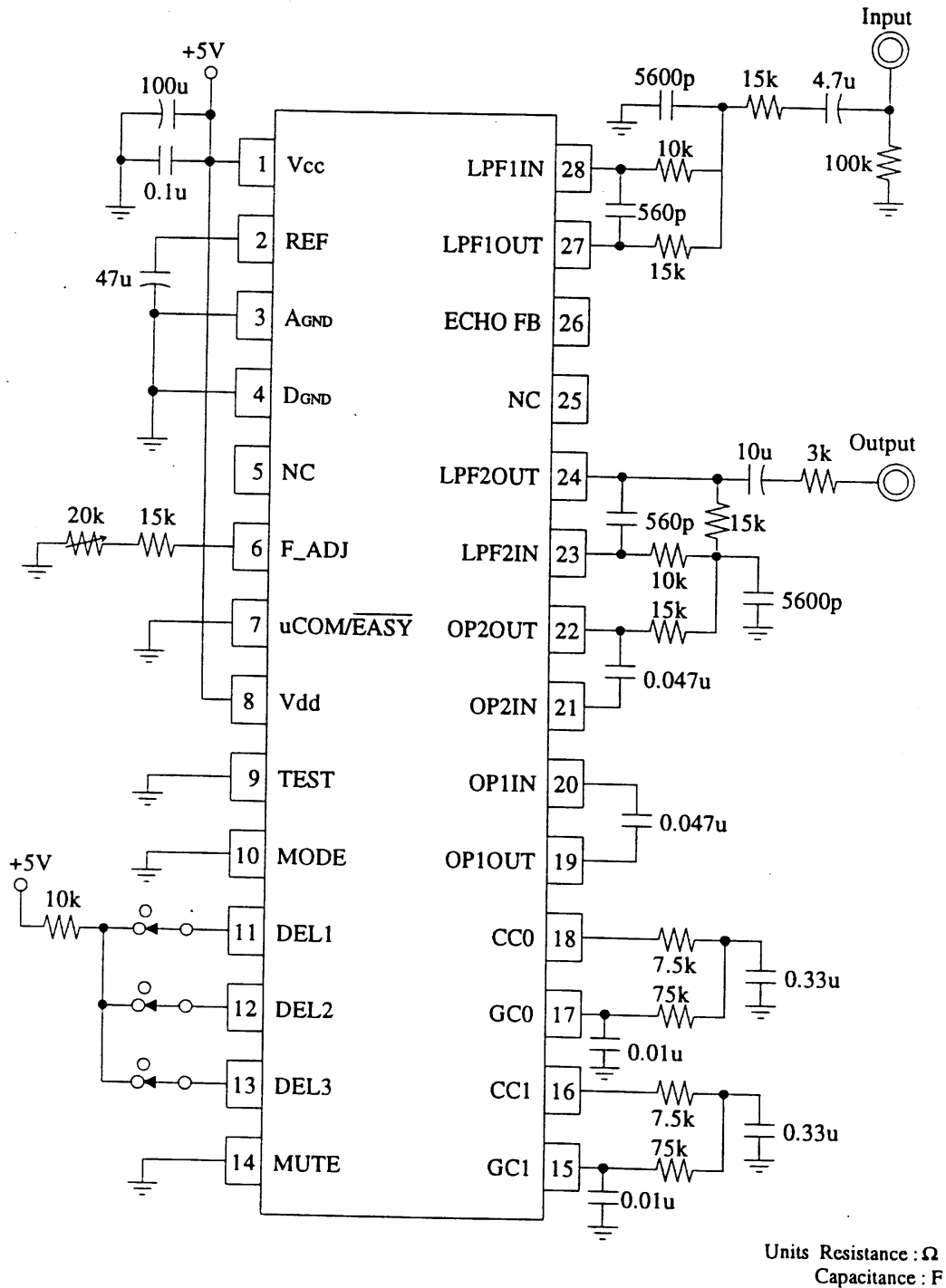
### APPLICATION CIRCUIT



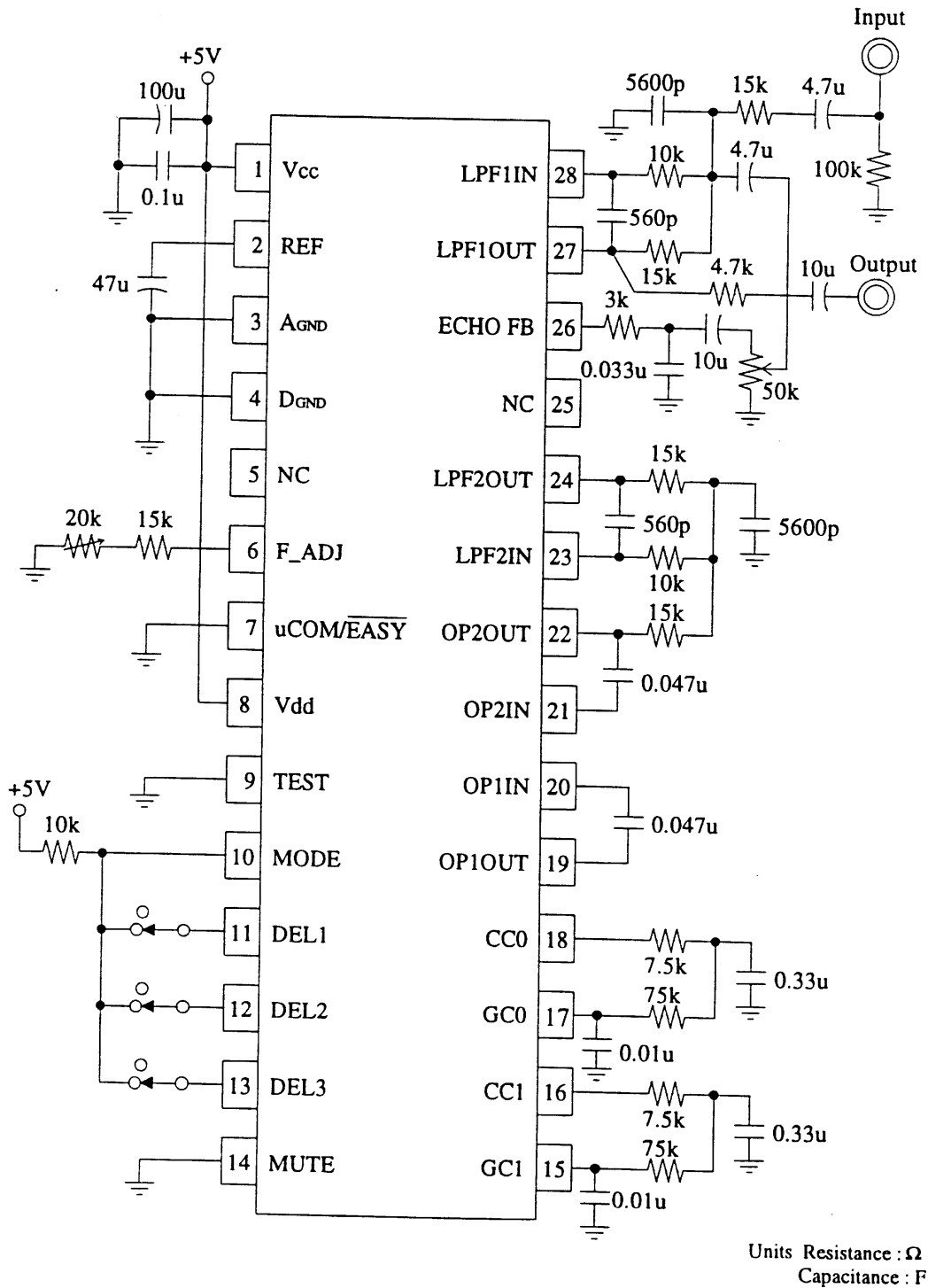
Note : \*\* control signal 5V indicates echo mode ; 0V indicates surround mode  
Echo mode & surround mode can't be operated at the same time .

Units Resistance :  $\Omega$   
Capacitance : F

\* Surround application circuit

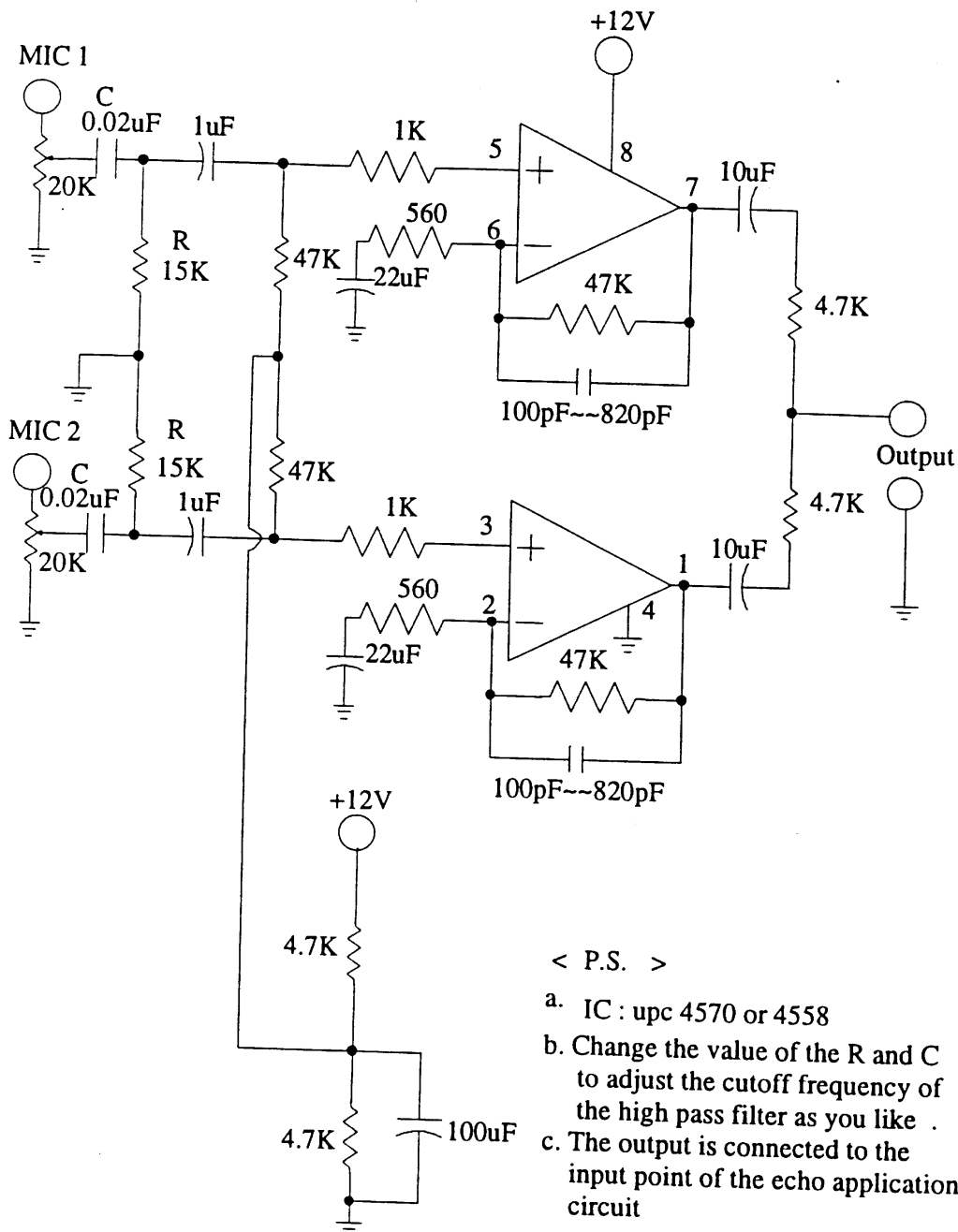


\* Echo application circuit

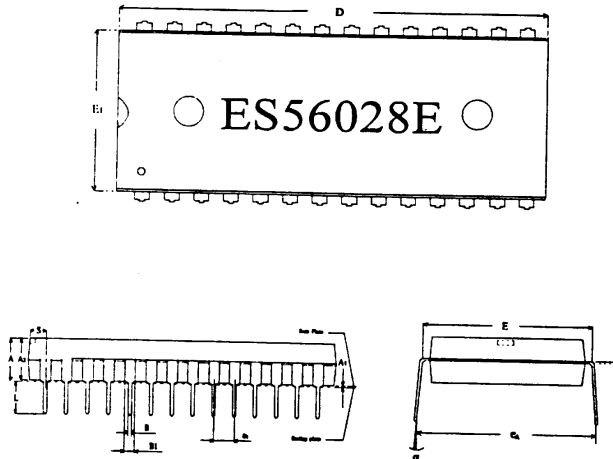


\* Echo application circuit ( continued )

MIC Pre-Amp Application circuit

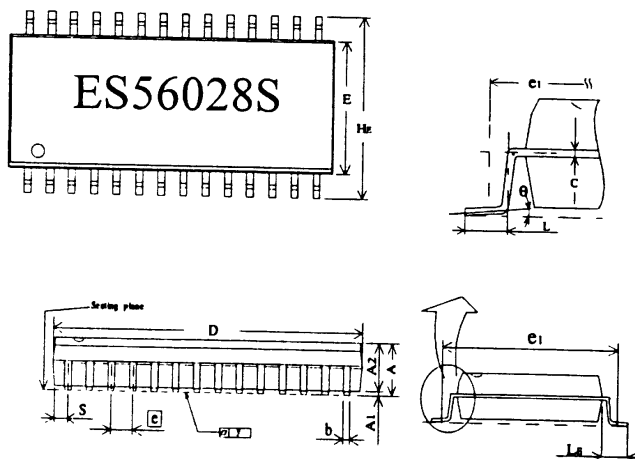


### 28 PINS DIP PACKAGE SIZE



Symbol	Dimension in inch	Dimension in mm
A	0.210 MAX	5.334 MAX
A1	0.010 MIN	0.254 MIN
A2	0.155 +/- 0.005	3.937 +/- 0.127
B	0.018 <sup>+0.004</sup> <sub>-0.002</sub>	0.457 <sup>+0.102</sup> <sub>-0.051</sub>
B1	0.060 <sup>+0.004</sup> <sub>-0.002</sub>	1.524 <sup>+0.102</sup> <sub>-0.051</sub>
C	0.010 <sup>+0.004</sup> <sub>-0.002</sub>	0.254 <sup>+0.102</sup> <sub>-0.051</sub>
D	1.460 TYP (1.470 MAX)	37.084 TYP (37.338 MAX)
E	0.600 +/- 0.010	15.240 +/- 0.254
E1	0.545 +/- 0.005	13.843 +/- 0.127
e1	0.100 +/- 0.010	2.540 +/- 0.254
L	0.130 +/- 0.010	3.302 +/- 0.254
α	0° - 15°	0° - 15°
Cn	0.650 +/- 0.020	16.510 +/- 0.508
S	0.090 MAX	2.286 MAX

### 28 PINS SOP PACKAGE SIZE



Symbol	Dimension in inch	Dimension in mm
A	0.110 MAX	2.794 MAX
A1	0.004 MIN	0.102 MIN
A2	0.093 +/- 0.005	2.362 +/- 0.127
b	0.016 <sup>+0.004</sup> <sub>-0.002</sub>	0.406 <sup>+0.102</sup> <sub>-0.051</sub>
C	0.010 <sup>+0.004</sup> <sub>-0.002</sub>	0.254 <sup>+0.102</sup> <sub>-0.051</sub>
D	0.705 TYP (0.725 MAX)	17.907 TYP (18.415 MAX)
E	0.295 +/- 0.005	7.493 +/- 0.127
E1	0.050 +/- 0.006	1.270 +/- 0.152
e1	0.370 NOM	9.398 NOM
E1e	0.406 +/- 0.012	10.312 +/- 0.305
L	0.036 +/- 0.008	0.914 +/- 0.203
Le	0.055 +/- 0.008	1.397 +/- 0.203
S	0.043 MAX	1.092 MAX
y	0.004 MAX	0.102 MAX
θ	0° - 10°	0° - 10°