

# M65844P

## DIGITAL ECHO (DIGITAL DELAY)

### DESCRIPTION

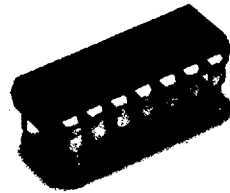
The M65844P is a CMOS IC for generating echo to be added to the voice through a "karaoke" microphone.

It is designed for the lowest price of models in the same series, and is suitable for application to the echo generator of a radio cassette player, mini-component stereo set, TV etc.

Increased master clock frequency assures high-performance short delay, enabling the IC to be used for digital surround.

### FEATURES

- All functions necessary for generating digital echo are contained, enabling production of low-priced echo generator.
- C-R oscillation circuit is provided for a master clock.
- Built-in auto power-ON reset circuit.
- No control signal is required.
- Delay time = 150 msec (with master clock set at 220 kHz)
- Small 14-pin DIP package (14P4)

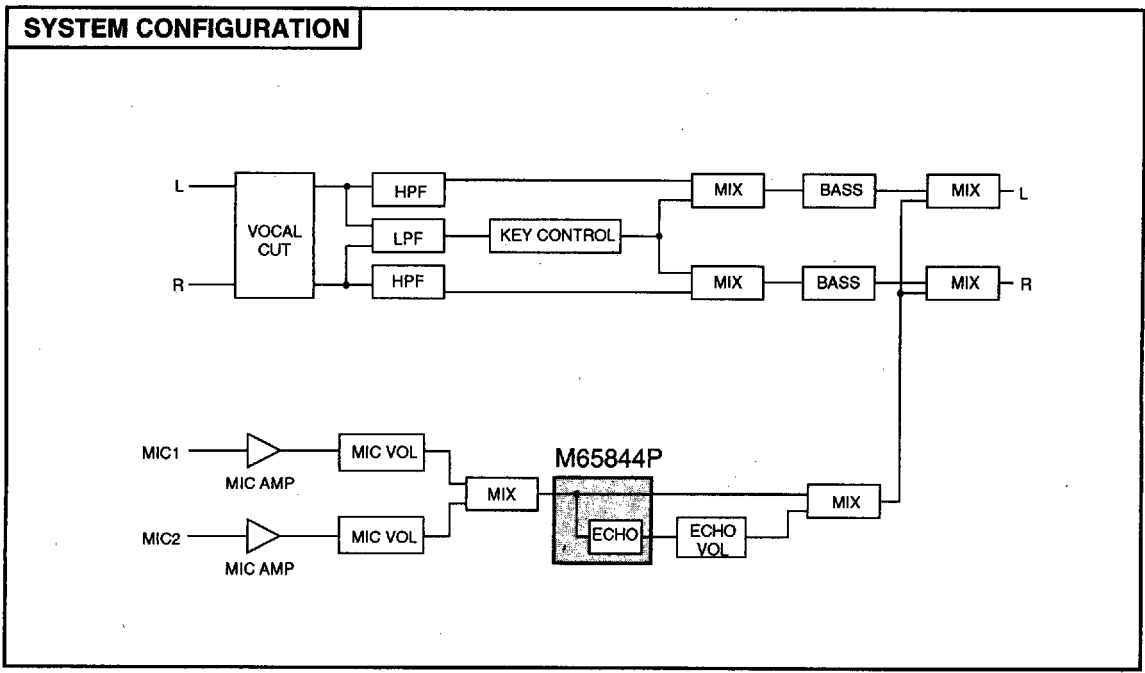


Outline 14P4

2.54mm pitch 300mil DIP  
(6.3mm × 19.0mm × 3.3mm)

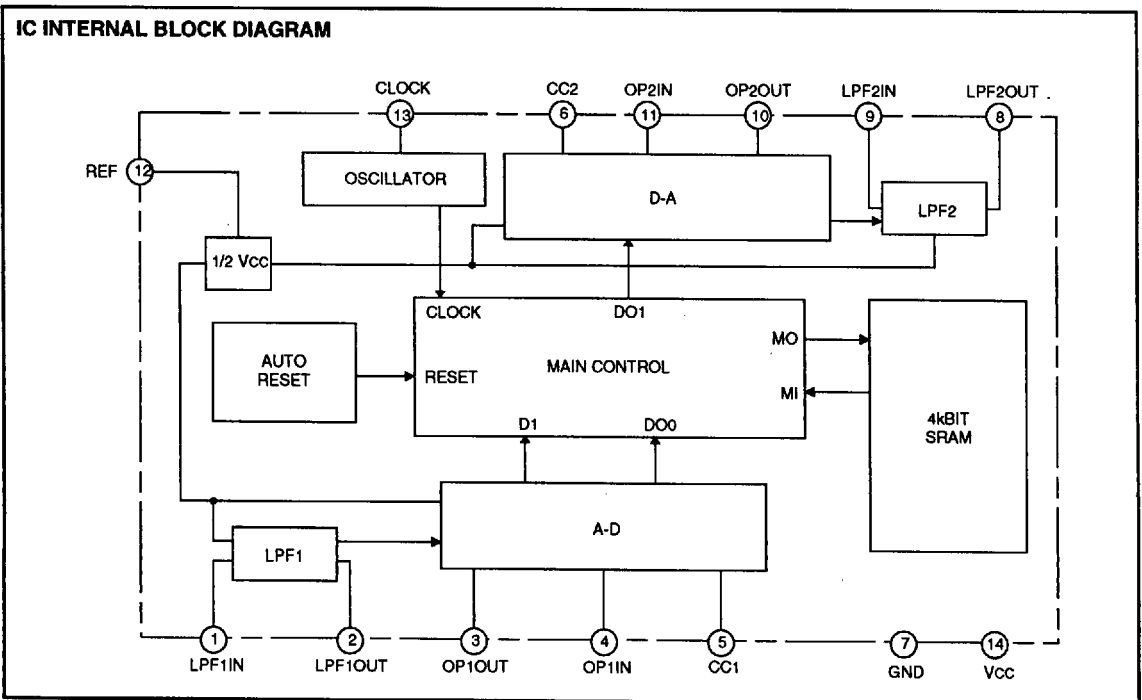
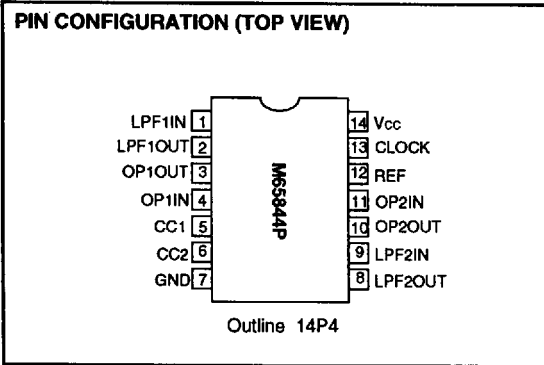
### RECOMMENDED OPERATING CONDITIONS

Supply voltage range ..... 4.5 to 5.5 V  
Rated supply voltage ..... 5 V



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## DIGITAL ECHO (DIGITAL DELAY)

## PIN DESCRIPTION

Pin No.	Symbol	Name	I/O	Function
①	LPF1 IN	Low pass filter 1 input	I	To form input-side low pass filter by connecting external capacitor and resistor
②	LPF1 OUT	Low pass filter 1 output	O	
③	OP1 OUT	Operational amplifier 1 output	O	To form A-D conversion integrator by connecting external capacitor
④	OP1 IN	Operational amplifier 1 input	I	
⑤	CC1	Current control 1	-	ADM control of A-D converter
⑥	CC2	Current control 2	-	ADM control of D-A converter
⑦	GND	GND	-	
⑧	LPF2 OUT	Low pass filter 2 output	O	To form output-side low pass filter by connecting external capacitor and resistor
⑨	LPF2 IN	Low pass filter 2 input	I	
⑩	OP2 OUT	Operational amplifier 2 output	O	To form D-A conversion integrator by connecting external capacitor
⑪	OP2 IN	Operational amplifier 2 input	I	
⑫	REF	Reference	-	Analog reference voltage $\approx 1/2 V_{cc}$
⑬	CLOCK	Clock generator input	I	To form clock generator by connecting external capacitor and resistor (220 kHz typ.)
⑭	Vcc	Supply voltage	-	To apply 4.5 to 5.5 V power (Rated voltage: 5V)

## ABSOLUTE MAXIMUM RATINGS (Ta = 25°C, unless otherwise noted)

Symbol	Parameter	Ratings	Unit
Vcc	Supply voltage	6.5	V
Icc	Circuit current	100	mA
Pd	Power dissipation	1.2	W
Topr	Operating temperature	-20 to 75	°C
Tstg	Storage temperature	-40 to 125	°C

## RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
Vcc	Supply voltage		4.5	5.0	5.5	V
fck	Clock frequency		100	220	2500	kHz

## ELECTRICAL CHARACTERISTICS (Vcc = 5 V, f = 500 Hz, Vi = 100 mVrms, fck = 220 kHz, Ta = 25°C, unless otherwise noted)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
Icc	Circuit current	No signal input	-	30	60	mA
Gv	Voltage gain	RL=47kΩ	-3.5	-0.5	2.5	dB
Vomax	Maximum output voltage	THD=10%	0.7	1.0	-	Vrms
THD	Total harmonic distortion	30kHz LPF	-	5.0	8.0	%
No	Output noise voltage	DIN-AUDIO	-	-75	-55	dBV

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FUNCTION DESCRIPTION

(1) Sampling frequency fs

The sampling frequency can be calculated by the following equation:

$$f_s = \text{Clock frequency}/8 \text{ (Hz)}$$

For clock frequency (fck) = 220 kHz, the calculated sampling frequency is:

$$f_s = 220 \text{ kHz}/8 = 27.5 \text{ kHz}$$

(2) Delay time Td

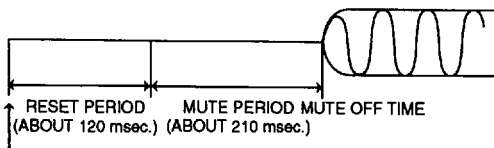
The delay time can be calculated by the equation:

$$T_d = N/f_s \text{ (N = the number of memory bits = 4,096)}$$

When fck = 220 kHz (fs = 27.5 kHz), Td can be set at 150 msec.

(3) Mute

When power is turned on, the mute function works automatically to prevent noise generation. (Here, however, "mute" means the function which prevents noise generation after the reset time.)



POWER ON TIME

(a) WHEN POWER IS ON

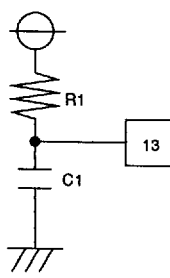
(4) Clock generator circuit

The M65844P includes an oscillation buffer, so that a clock generator circuit can be formed by connecting a resistor and a capacitor, as shown below.

The clock frequency can be calculated using the following equation.

$$\text{Clock frequency (fck)} \approx K/R1 \text{ Hz}$$

K is the coefficient, and changes according to the value for capacitor C1, as shown below.



fck (Hz)	C1 (F)	fck value
100k to 400k	100p	$fck=0.91 \times 10^{10}/R1$
400k to 1M	56p	$fck=1.4 \times 10^{10}/R1$
1M to 2.5M	33p	$fck=2.2 \times 10^{10}/R1$

Also, the typical delay times and constants for the clock generator circuits are as shown below.

Delay time	fck (Hz)	R1 (Ω)	C1 (F)
100msec	320k	27k	100p
150msec	220k	39k	100p

(5) Signal bands

The signal frequency band can be changed by changing the constants for each of the input/output low pass filters (LPF1, LPF2).

Signal frequency band decision circuit

Signal band	External R (R2, 3, 4, 8, 9, 10)
1kHz	33kΩ
2kHz	16kΩ

Examples of application circuit changes

(Changes of output noise voltage and distortion when delay time and signal band have been changed)

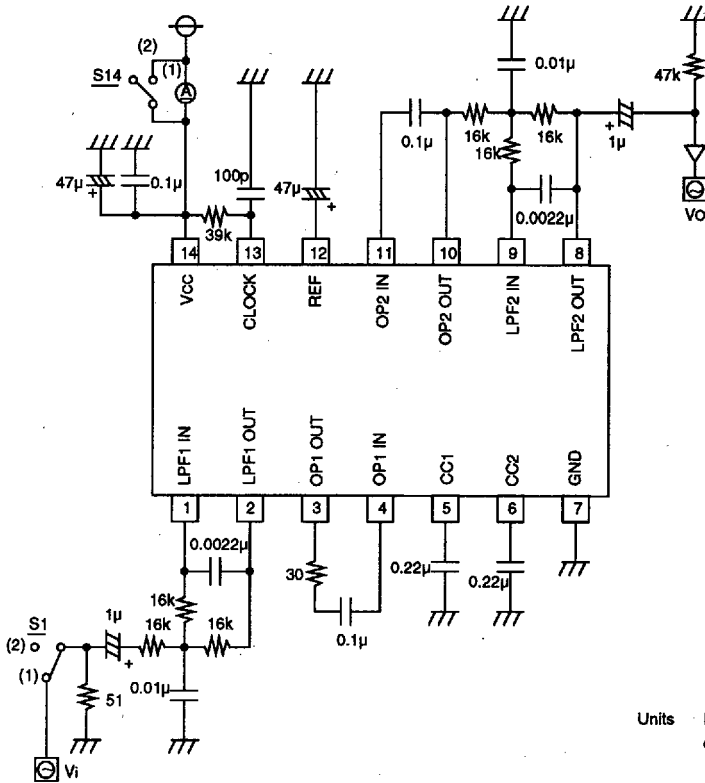
Delay time	1kHz		2kHz	
	Output noise voltage	Distortion	Output noise voltage	Distortion
100msec	-90dBV	2.2%	-85dBV	3.3%
150msec	-80dBV	4.0%	-79.5dBV	5.3%

Test conditions

No.	Parameter	Symbol	S1	S14	Remarks
1	Circuit current	Icc	2	2	No-signal time
2	Voltage gain between input and output	Gv	1	1	$Gv=20 \log (V_o/V_i)$
3	Maximum output voltage	Vomax	1	1	THD=10%
4	Output distortion	THD	1	1	30kHz L.P.F
5	Output noise voltage	No	2	1	DIN AUDIO

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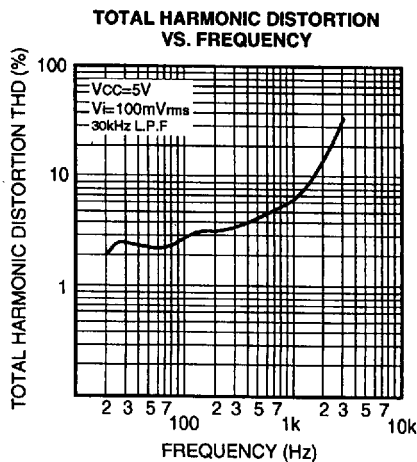
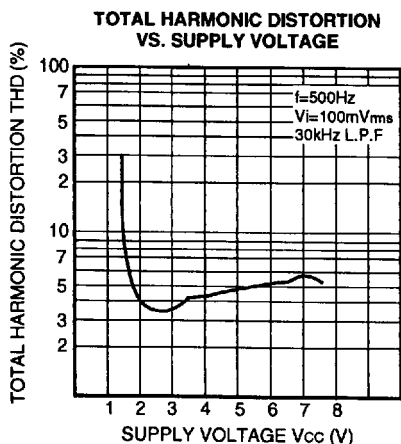
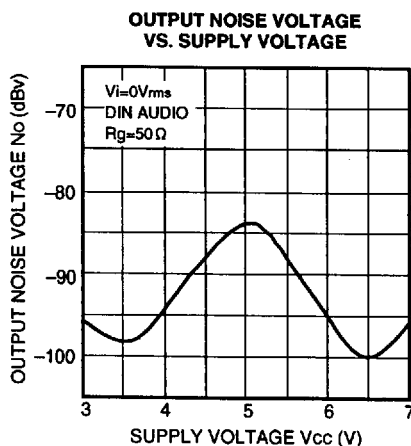
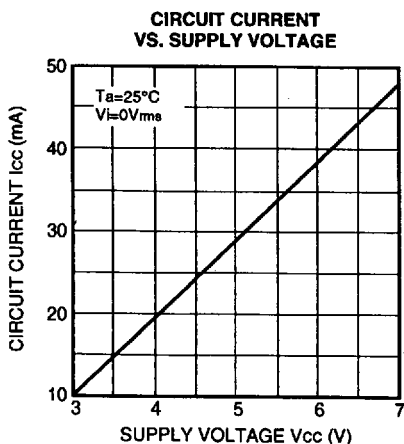
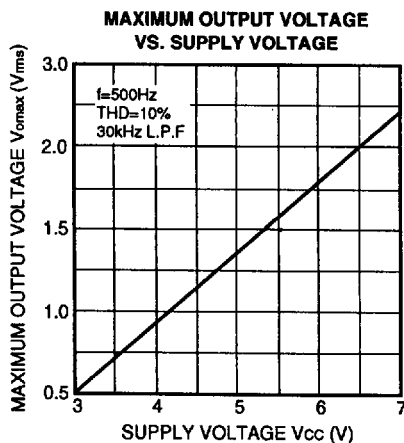
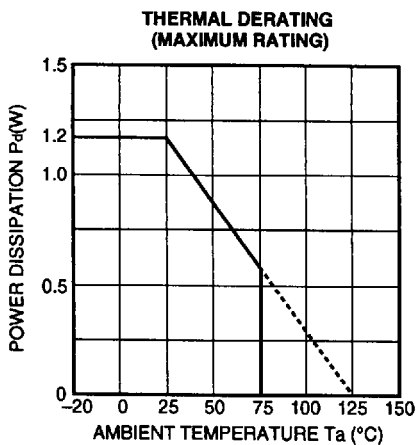
TEST CIRCUIT



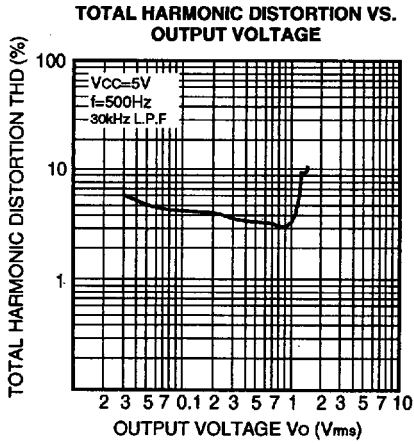
Units Resistance : Ω  
Capacitance : F

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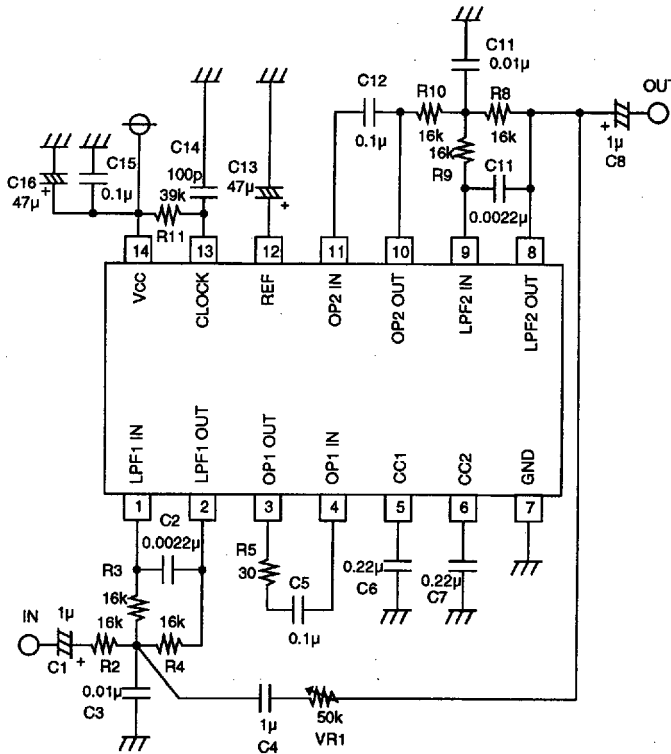
TYPICAL CHARACTERISTICS



DIGITAL ECHO (DIGITAL DELAY)



APPLICATION EXAMPLE



Units Resistance : Ω  
 Capacitance : F