MITSUBISHI SOUND PROCESSOR ICs

M65845AFP

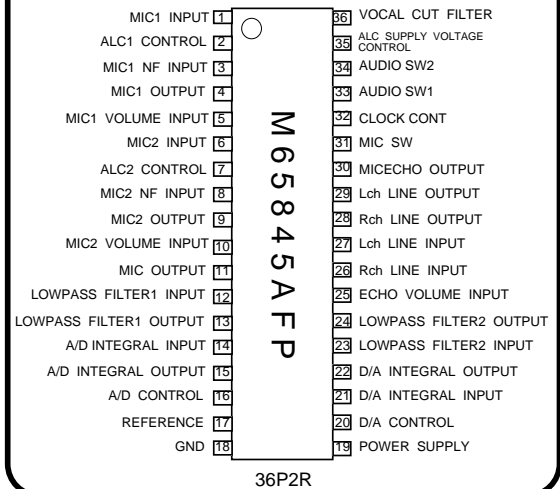## DIGITAL ECHO WITH MICROPHONE MIXING CIRCUIT

DESCRIPTION

● The M65845AFP is a CMOS IC built-in Digital Echo function with microphone peripheral circuits for "Karaoke" equipment packed in a single chip.

● It is suitable for "Karaoke" equipments such as Video CD Player,Mini Stereo, CD-Radio cassette,TV or VCR.

● Being pin compatible with the M65845FP,the M65845AFP is suitable for upgrading the series.

FEATURES

• High performance digital echo circuit thanks to 16Kbit memory

• Two microphone-mixing lines,vocal cut circuit,digital echo, and line-mixing amplifier are contained,enabling single-chip package of microphone peripheral circuit of "Karaoke" equipment.

• ALC-equipped microphone amplifiers permit excessively high-input. ALC operating voltage can be set as desired.

• Vocal cut circuit of complete stereo construction

• Compatibility with the M65845FP

• Built-in current-control oscillation circuit

• Built-in automatic reset circuit activated with power on

• Single power supply (5V)

PIN CONFIGURATION

Pin	Left		Right	Pin
1	MIC1 INPUT		VOCAL CUT FILTER	36
2	ALC1 CONTROL		ALC SUPPLY VOLTAGE CONTROL	35
3	MIC1 NF INPUT		AUDIO SW2	34
4	MIC1 OUTPUT		AUDIO SW1	33
5	MIC1 VOLUME INPUT		CLOCK CONT	32
6	MIC2 INPUT		MIC SW	31
7	ALC2 CONTROL		MICECHO OUTPUT	30
8	MIC2 NF INPUT		Lch LINE OUTPUT	29
9	MIC2 OUTPUT		Rch LINE OUTPUT	28
10	MIC2 VOLUME INPUT		Lch LINE INPUT	27
11	MIC OUTPUT		Rch LINE INPUT	26
12	LOWPASS FILTER1 INPUT		ECHO VOLUME INPUT	25
13	LOWPASS FILTER1 OUTPUT		LOWPASS FILTER2 OUTPUT	24
14	A/D INTEGRAL INPUT		LOWPASS FILTER2 INPUT	23
15	A/D INTEGRAL OUTPUT		D/A INTEGRAL OUTPUT	22
16	A/D CONTROL		D/A INTEGRAL INPUT	21
17	REFERENCE		D/A CONTROL	20
18	GND		POWER SUPPLY	19

M65845AFP

36P2R

RECOMMENDED OPERATING CONDITION

Supply voltage range•••••••••••Vcc=4.5~5.5V

Rated supply voltage••••••••••• Vcc=5V

SYSTEM CONFIGURATION
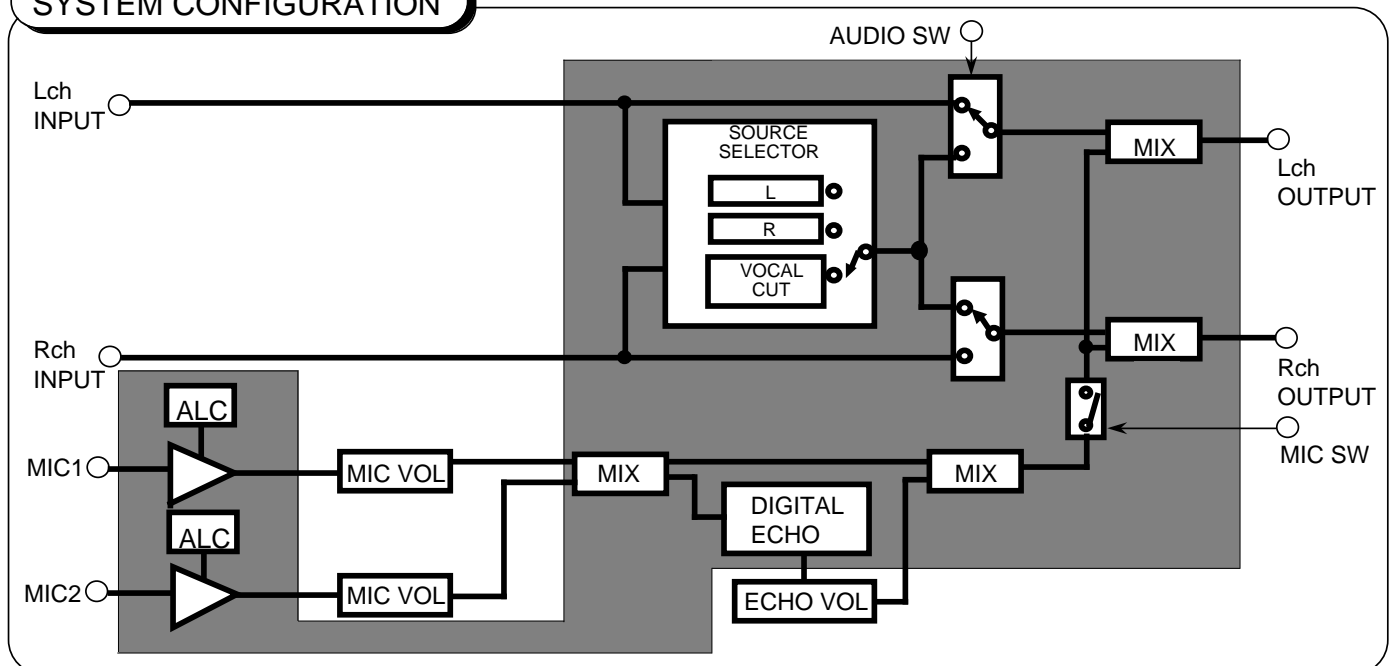
PRELIMINARY
Notice ; This is not a final specification.
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IC INTERNAL BLOCK DIAGRAM

PRELIMINARY
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PIN DESCRIPTION

No	Symbol	Pin Name	Function
1	MIC1IN	MIC1 INPUT	Connect MIC1
2	ALC1	ALC1 CONTROL	Connect C which determine recovery time
3	MIC1NFIN	MIC1 NF INPUT	Set up MIC1 amp gain for feedback circuit
4	MIC1OUT	MIC1 OUTPUT	
5	MIC1VOLIN	MIC1 VOLUME INPUT	Connect microphone volume which turn down input signal
6	MIC2IN	MIC2 INPUT	Connect MIC 2
7	ALC2	ALC2 CONTROL	Connect C which determine ALC attack ,recovery time
8	MIC2NFIN	MIC2 NF INPUT	Forms MIC 2 amp gain with feedback
9	MIC2OUT	MIC2 OUTPUT	
10	MIC2VOLIN	MIC2 VOLUME INPUT	Connect microphone volume which turn down input signal
11	MICOUT	MIC OUTPUT	Mixing output with MIC 1 and MIC 2
12	LPF1 IN	LOWPASS FILTER1 INPUT	Forms the front lowpass filter with external CR for digital echo
13	LPF1 OUT	LOWPASS FILTER1 OUTPUT	
14	ADINTIN	A/D INTEGRAL INPUT	Forms integrator with external C and R
15	ADINTOUT	A/D INTEGRAL OUTPUT	
16	ADCONT	A/D CONTROL	ADM A/D adaptive control
17	REF	REFERENCE	1/2Vcc, connect filter C
18	GND	GND	
19	Vcc	POWER SUPPLY	
20	DACONT	D/A CONTROL	ADM A/D adaptive control

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MITSUBISHI SOUND PROCESSOR ICs

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DIGITAL ECHO WITH MICROPHONE MIXING CIRCUIT

No	Symbol	Pin name	Function
21	DAINTIN	D/A INTEGRAL INPUT	Forms integrator with external C
22	DAINTOUT	D/A INTEGRAL OUTPUT	
23	LPF2 IN	LOWPASS FILTER'2 INPUT	Forms post lowpass filter with external CR for digital echo
24	LPF2 OUT	LOWPASS FILTER2 OUTPUT	
25	ECHOVOLIN	ECHO VOLUME INPUT	Connect microphone volume which turn down input signal
26	RLINEIN	Rch LINE INPUT	
27	LLINEIN	Lch LINE INPUT	
28	RLINEOUT	Rch LINE OUTPUT	Mixing output with line and microphone
29	LLINEOUT	Lch LINE OUTPUT	
30	MICECHOOUT	MIC ECHO OUTPUT	Mixing output with microphone and echo
31	MICSW	MIC SW	L; Microphone OFF H; Microphone ON
32	CLOCK CONT	CLOCK CONTROL	Controls built-in clock generation circuit with external R
33	AUDSW1	AUDIO SW1	Changing source sound signal
34	AUDSW2	AUDIO SW2	
35	VALC	ALC SUPPLY VOLTAGE CONTROL	Forms ALC operation voltage with control voltage
36	VCFIL	VOCAL CUT FILTER	Through frequency under vocal level

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ABSOLUTE MAXIMUM RATINGS

(Ta=25°C,unless otherwise noted)

Symbol	Parameter	Conditions	Rations	Unit
Vcc	Supply voltage		6.0	V
Icc	Circuit current		85	mA
Vi	Input voltage		-0.3~Vcc+0.3	V
Pd	Power dissipation		860	mW
Topr	Operating temperature		-20~+75	°C
Tstg	Storage temperature		-40~+125	°C

RECOMMENDED OPERATING CONDITION

Symbol	Parameter	Conditions	Limits			Unit
			Min	Typ	Max	
Vcc	Supply voltage		4.5	5	5.5	V
V_{iL}	L input voltage	33,34PIN	0	—	1	V
V_{iH}	H input voltage		4	—	Vcc	V

M65845AFP

DIGITAL ECHO WITH MICROPHONE MIXING CIRCUIT

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ELECTRICAL CHARACTERISTICS

(Vcc=5V,f=1kHz,Vi=100mVrms,fck=2MHz,Ta=25°C ,unless otherwise noted)

	Symbol	Parameter	Conditions	Limits			Unit
				Min	Typ	Max	
T/L	Icc	Circuit current	No signal	25	34	70	mA
MICROPHONE AMPLIFIER	G_{VO}	Voltage gain	Vo=-17dBV	44	47	50	dB
	THD1	Distortion1	Vo=-17dBV,without ALC	—	0.5	1.5	%
	THD2	Distortion2	Vi=-27dBV,ALC operate	—	3.0	6.0	%
	V_{oALC}	ALC voltage	at -10 ~ +3dBV	-3	0	+3	dB
	T_{ALCAT}	ALC Attack time	at C=4.7µF	25	40	55	ms
	T_{ALCRE}	ALC Recovery time	at C=4.7µF	1.0	1.5	2.0	s
	V_{oMAX}	Maximum output voltage	THD=10%	-1	2	—	dBV
	No	Noise Voltage	Gv=47dB,JIS-A,VI=0Vrms	—	-68	-57	dBV
	Zi	input impedance		5	10	20	k
ECHO	Td	Delay Time	Rc=51k	167	197	226	ms
	Gv	Voltage gain		-3.0	0	3.0	dB
	THD	Distortion		—	2.0	4.0	%
	V_{oMAX}	Maximum output voltage	THD=10%	-3	1.0	—	dBV
	No	Noise voltage	JIS-A	—	-82	-67	dBV
LINE	Gv	Voltage gain		-3	0	+3	dB
	THD	Distortion		—	0.02	0.1	%
	V_{oMAX}	Maximum output voltage	THD=10%	1	4	—	dBV
	No	Noise voltage	JIS-A,MICSW=off	—	-97	-88	dBV
	Zi	Input impedance		10	20	40	k
VOCAL CUT	No	Noise voltage	JIS-A,Vocal cut ON	—	-95	-72	dBV
	Gv	Voltage gain	input one side channel	-3	0	+3	dB
	V_{oMAX}	Maximum output voltage	THD=10%	1	4	—	dBV
	G_{REJ}	Vocal rejection ratio		14	18	—	dB

MITSUBISHI ELECTRIC

FUNCTION DESCRIPTION

(1) Microphone amplifier

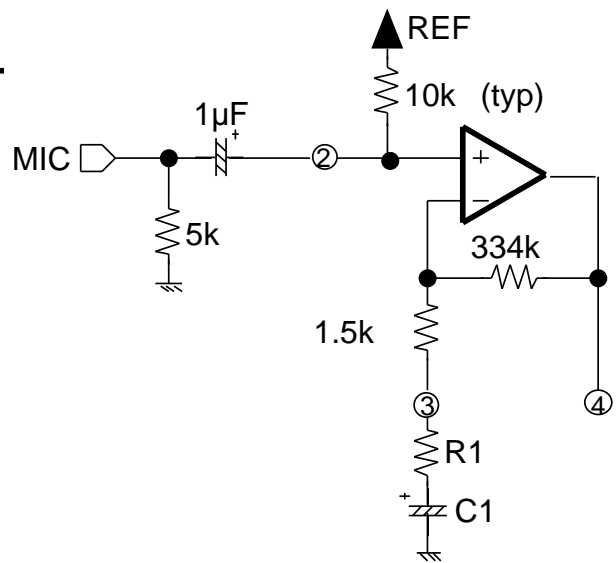   The gain(Gv) and low cut-off frequency(fcl) of microphone amplifier are expressed as follows.

$$Gv = 20\log \bullet \frac{R1+1.5K+334K}{R1+1.5K} \qquad fcl = \frac{1}{2 \bullet (R1+1.5K) \bullet C1}$$

Gv(max)=47dB,fcl=50Hz
R1=0 ,C1=2.2µF

Assuming Gv=37dB, fcl=15Hz,for instance,
the constants take the following values.

R1=3.3K ,C1=2.2µF

<< Attention point when M65845FP is replaced with M65845AFP >>

R3 and C4 are required for the
M65845FP, not for the M65845AFP.
As mentioned above, the gain of
microphone amplifier can set it up
with R1.
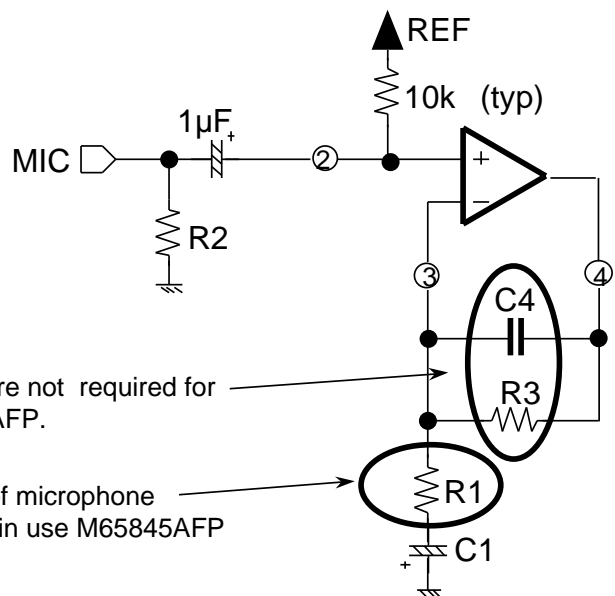
R3 and C4 are not required for
the M65845AFP.

R1 for the gain of microphone
amplifier setting in use M65845AFP

Recommended circuit In use M65845FP

PRELIMINARY
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(2) ALC level block diagram

ALC supply voltage control limits

It is set 47dB for microphone amplifier gain.

$V_O(dBV)$

$V_i(dBV)$
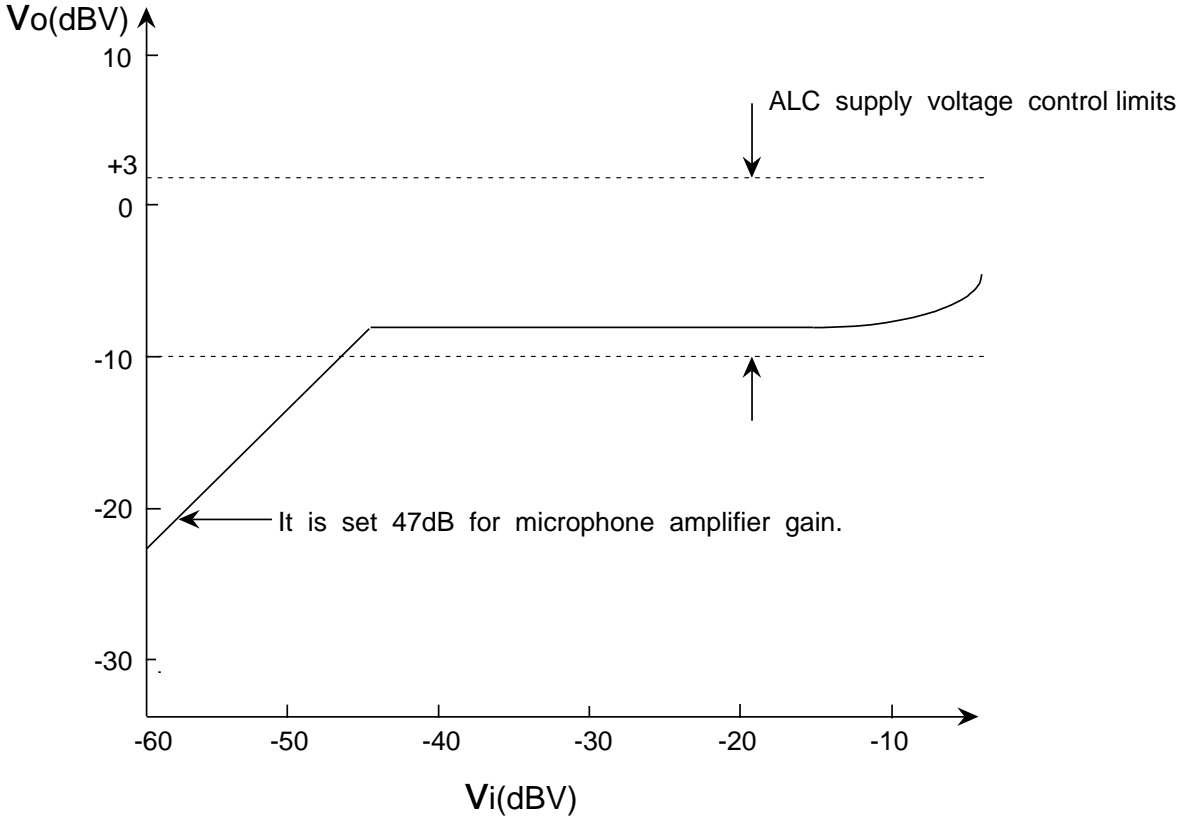
(3) ALC operation voltage control

ALC operation voltage can be formed within the limits of -10 to +3 dBV controlled by DC control voltage which connect 35 pin.

(Setting up forms)

$2.5V(\frac{1}{2}Vcc)$

internal direct bias

half peak voltage V_{po}

35 pin control voltage V_{ALC}

0V
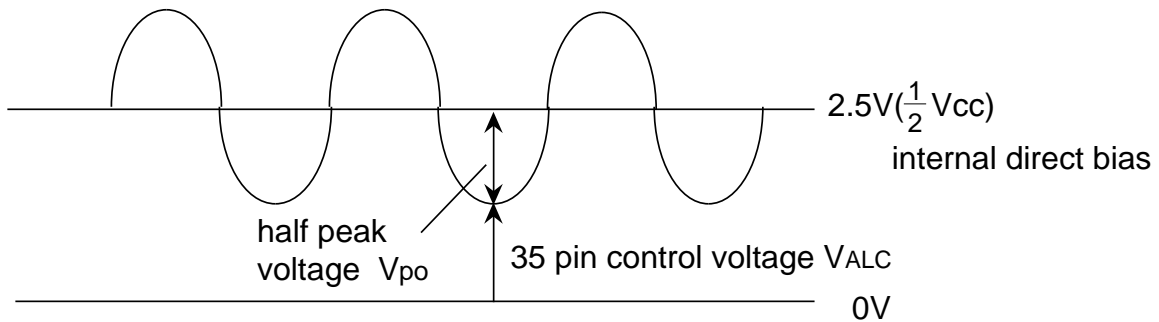
$V_{ALC}=\frac{1}{2}Vcc-V_{po}$

When ALC operation voltage is -5dBV
(at Vcc=5V)

-5dBV=0.56Vrms=1.59Vp-p=0.80Vp-o
$V_{ALC}=2.5-0.8=1.7V$

are concerned.

Input impedance to 35 pin is so high (1M) that ALC base voltage can be determined by division resistance.
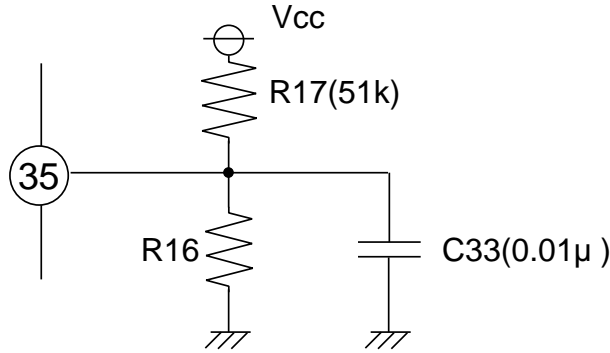
at Vcc=5V

ALC operation voltage (dBV)	35 pin control voltage VALC (V)	resistance R16 ( )
+3	0.50	5.6k
0	1.09	15k
-2	1.38	20k
-4	1.61	24k
-6	1.79	27k
-8	1.94	33k
-10	2.05	36k

(4) MIC SW

Input low level to 31 pin (MIC SW) ,then microphone and echo signal can be cut.

31 pin (MIC SW)	MIC SW	ECHO SIGNAL OUTPUT
H or OPEN	ON	ON
L	OFF	MUTE

(5) Audio source select

Changing the switch ,sound source changes four patterns matching with KARAOKE soft.

㉝ AUDSW1;D1	㉞ AUDSW2;D2	Movements
L	L	Stereo
L	H	Lch monaural
H	L	Rch monaural
H	H	vocal cut

① Stereo

Under the conditions usual 2channels are played back to each outputs.

② Lch monaural

Under the conditions Lch source is played back to 2ch outputs and suitable for KARAOKE reproduction of multiple KARAOKE soft and main sound reproduction of laser disks.

③ Rch monaural

Under the conditions Rch source is played back to 2ch outputs and suitable for reference vocal reproduction of multiple KARAOKE soft and sub sound reproduction of laser disks.

④ Vocal cut

It is a method turned down Lch and Rch input having the same phase and sound .
Lowpass cut off frequency fc is determined by a capacitance which connect to 36 pin
(vocal cut filter).
It is also having a function which through frequency under vocal level for supplying a
lack of low level sound.

Rvc=20k typ

36

C34

$$fc = \frac{1}{2\ Rvc C34}$$
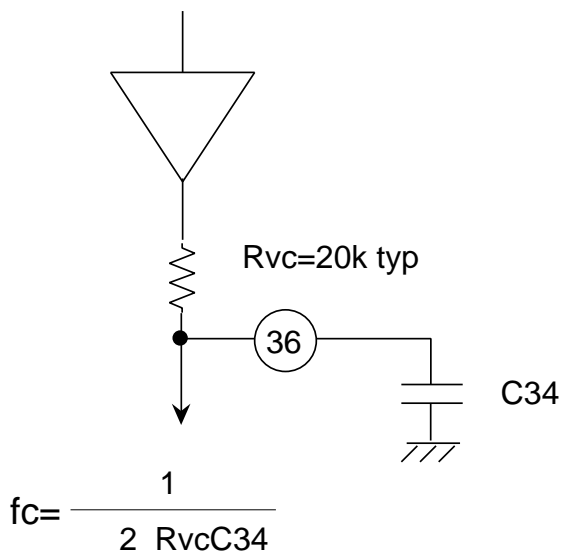
at fc=50Hz, C34=0.15µF   is determined.

Caution; Inside resistance is changeable one by one which rate is ±30%.

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(6) Digital Echo

① Clock oscillator circuit

This IC incorporates a current control type clock oscillator circuit in it, thus providing circuit configuration just by connecting an Rc for current control pin 32 (CLOCK CONT).
Fully internal clock supply prevents occurrence of undesired radiation without affecting any external circuit.
The oscillator frequency fck is following.

$$fck = 2 MHz(Rc=51K)$$

Rc ⟋ DC Current
32 → Clock oscillator circuit
Clock frequency:fck
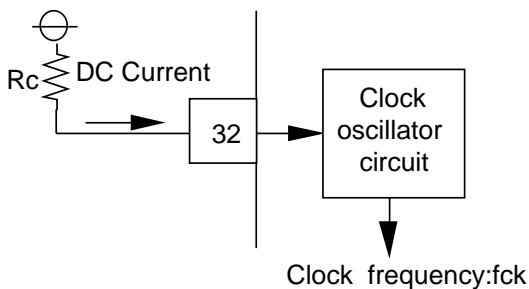
Note:
The delay time(Td) for echo is determined by the clock frequency(fck).

Delay time=1/fck X 24 X N
(N=the number of memory bits = 16384

fck = 2 MHz(Rc=51K) : Delay time=197msec
fck = 2.6MHz(Rc=39K) : Delay time=150msec
fck = 3.9MHz(Rc=24K) : Delay time=100msec

②@Auto mute function

The IC carries out auto mute function at the time of powering up and switching on MIC SW in order to suppress shock noise that the digital delay may produce.
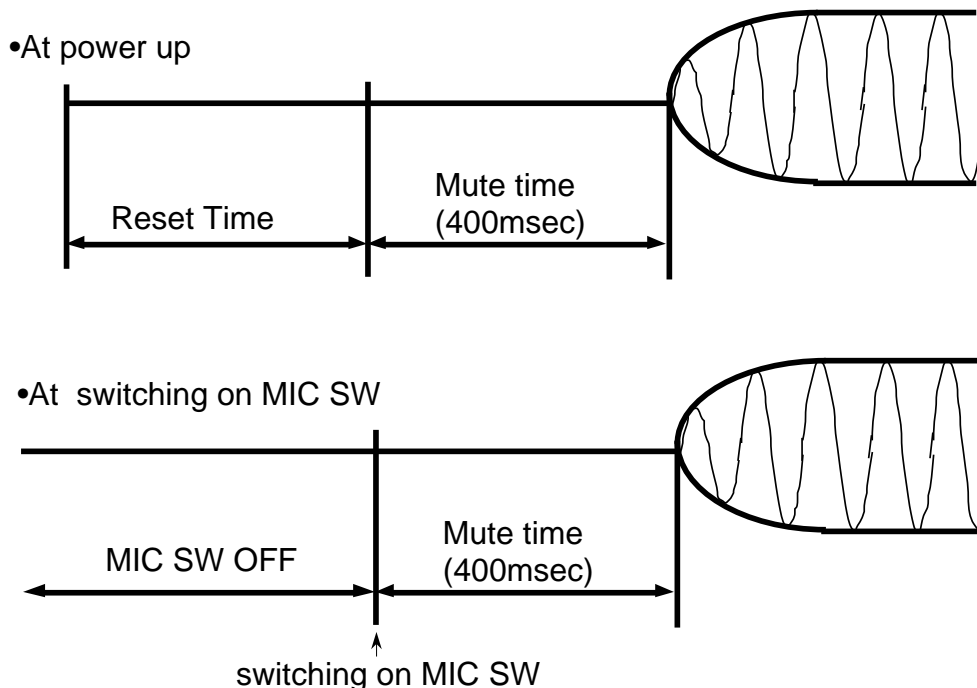
•At power up

Reset Time | Mute time (400msec)

•At switching on MIC SW

MIC SW OFF | Mute time (400msec)

switching on MIC SW

③ Input and output LPF

Signal through frequency fsig is also determined by LPF of Digital Echo cut off frequency.
2 degree LPF of Digital Echo is formed by external resistance and capacitor .
(refer to next figure) So, cut off frequency is determined by next formula.

$$fsig = \frac{1}{2\pi\sqrt{R8 \cdot R9 \cdot C13 \cdot C14}}$$
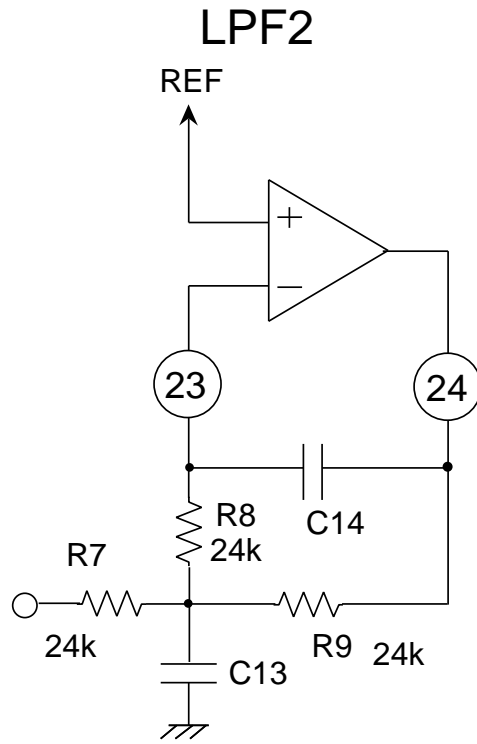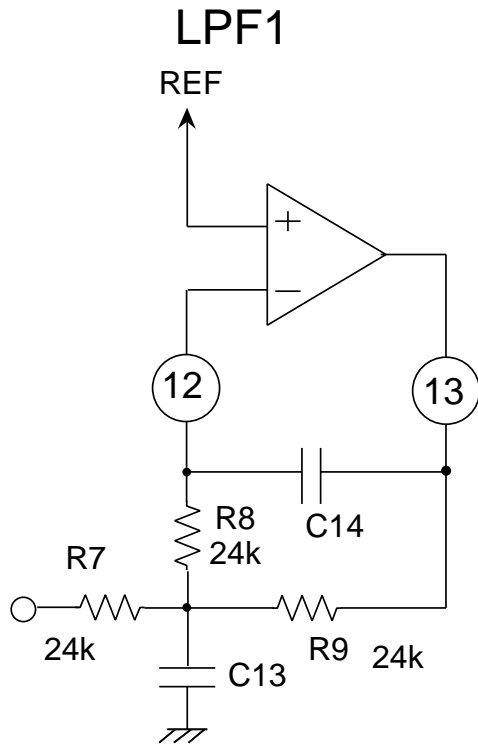
LPF1

REF

12   13

R8
24k   C14

R7

24k   R9   24k

C13

LPF2

REF

23   24

R8
24k   C14

R7

24k   R9   24k

C13

COMPATIBILITY WITH M65845FP

<APPLICATION EXAMPLE IN USE M65845FP>

Units Resistance :
Capacitance:F
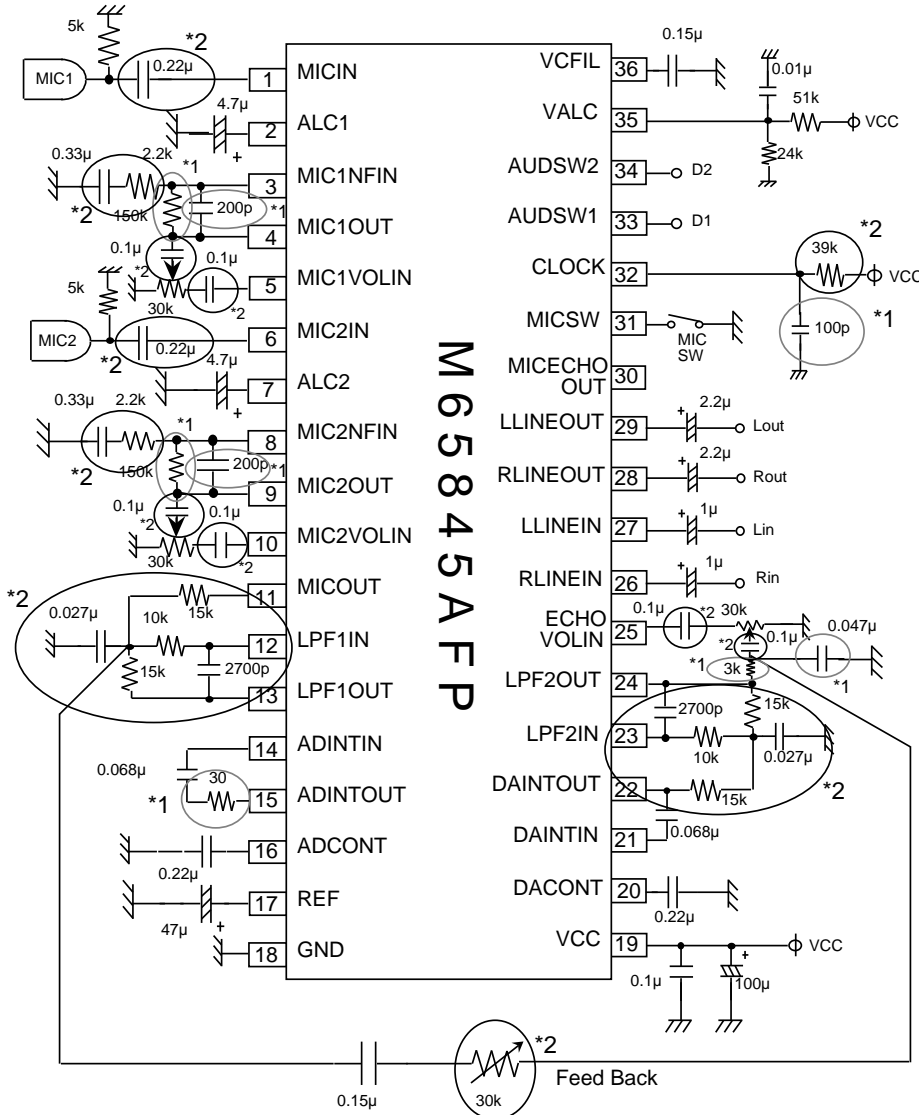
As mentioned above, the M65845AFP can be replaced with the M65845FP without changing the board.

Note *1: The components marked with a circle are required for the M65845FP, not for the M65845AFP.

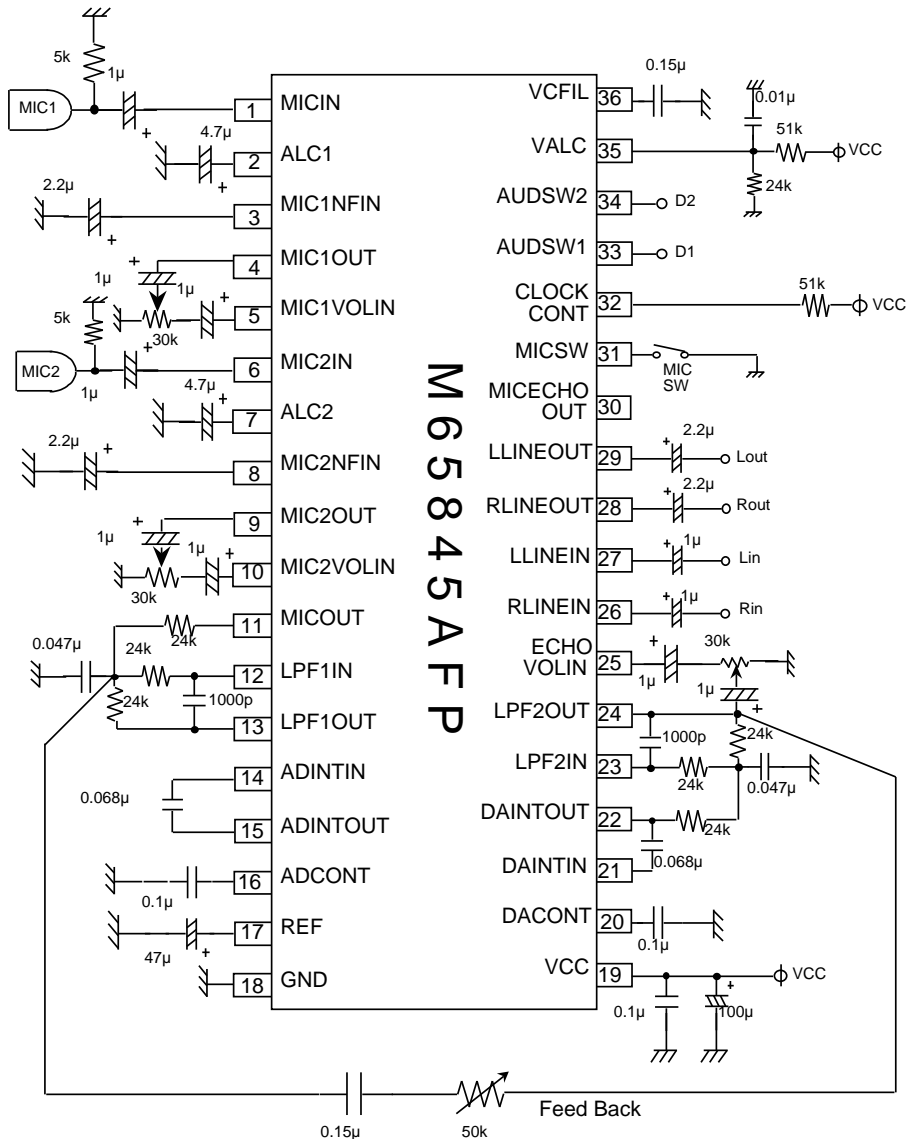*2: The M65845AFP is different from the M65845FP a part of the components marked with a circle.

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DIGITAL ECHO WITH MICROPHONE MIXING CIRCUIT

APPLICATION EXAMPLE

Microphone amplifier : Gv=47dB,fcl=50Hz
ALC operating voltage -4dBV
ECHO : Delay time 197ms (fs=83.3kHz)
Cut-off frecuency 3.1kHz

Units Resistance :
Capacitance:F