

M65849CFP

SINGLE CHIP SURROUND PROCESSOR

REJ03F0020-0100Z

Rev.1.00

Sep.04.2003

Description

The M65849CFP is a CMOS IC built-in Digital circuit and mixing amplifiers.

It is suitable for adding effects to Mini Stereo, CD-Radio Cassette and TV.

This IC can be used Dolby Surround.

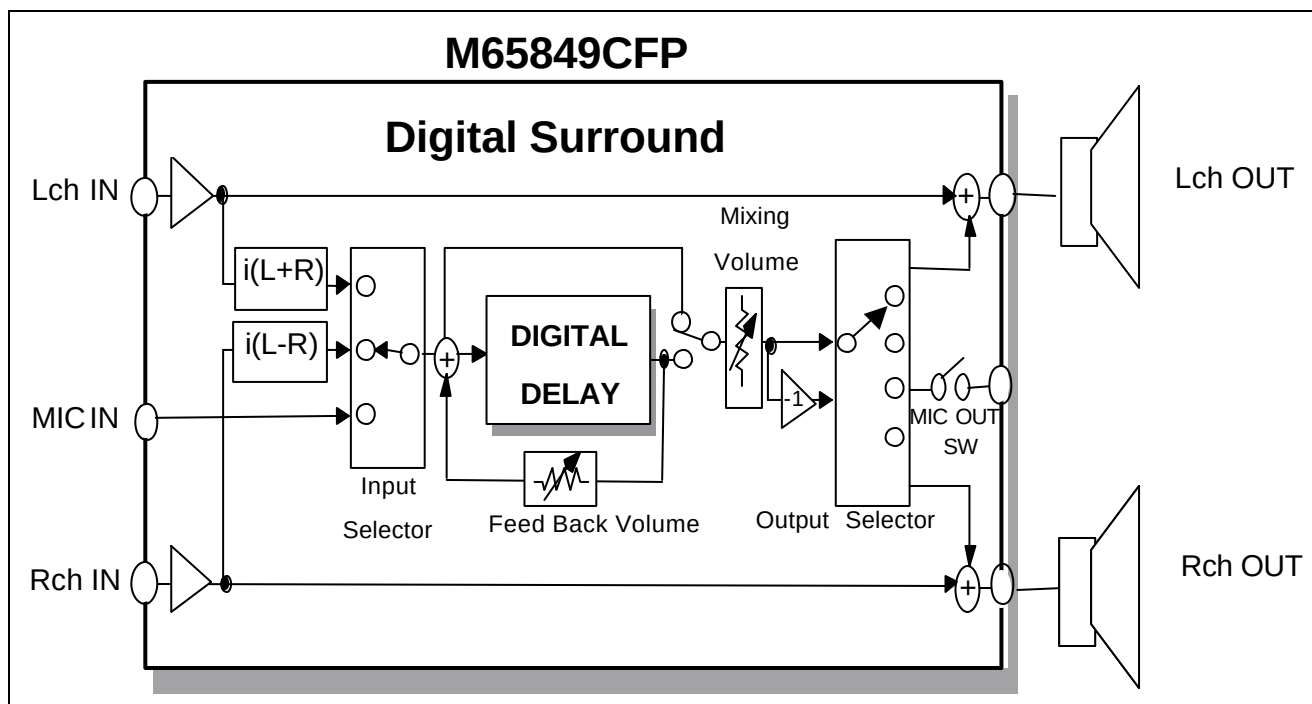
Features

- Built- in digital delay, mixing amplifiers, input output selector
- achieve a surround system with a single chip.
- Delay volume, feedback volume Built-in
- ADM digital delay, 16kbit SRAM Built-in
- Selection of 8 steps delay time in a range between 9.2msec and 196.6msec
- Built- in automatic reset circuit activated with power on
- 5V single power supply

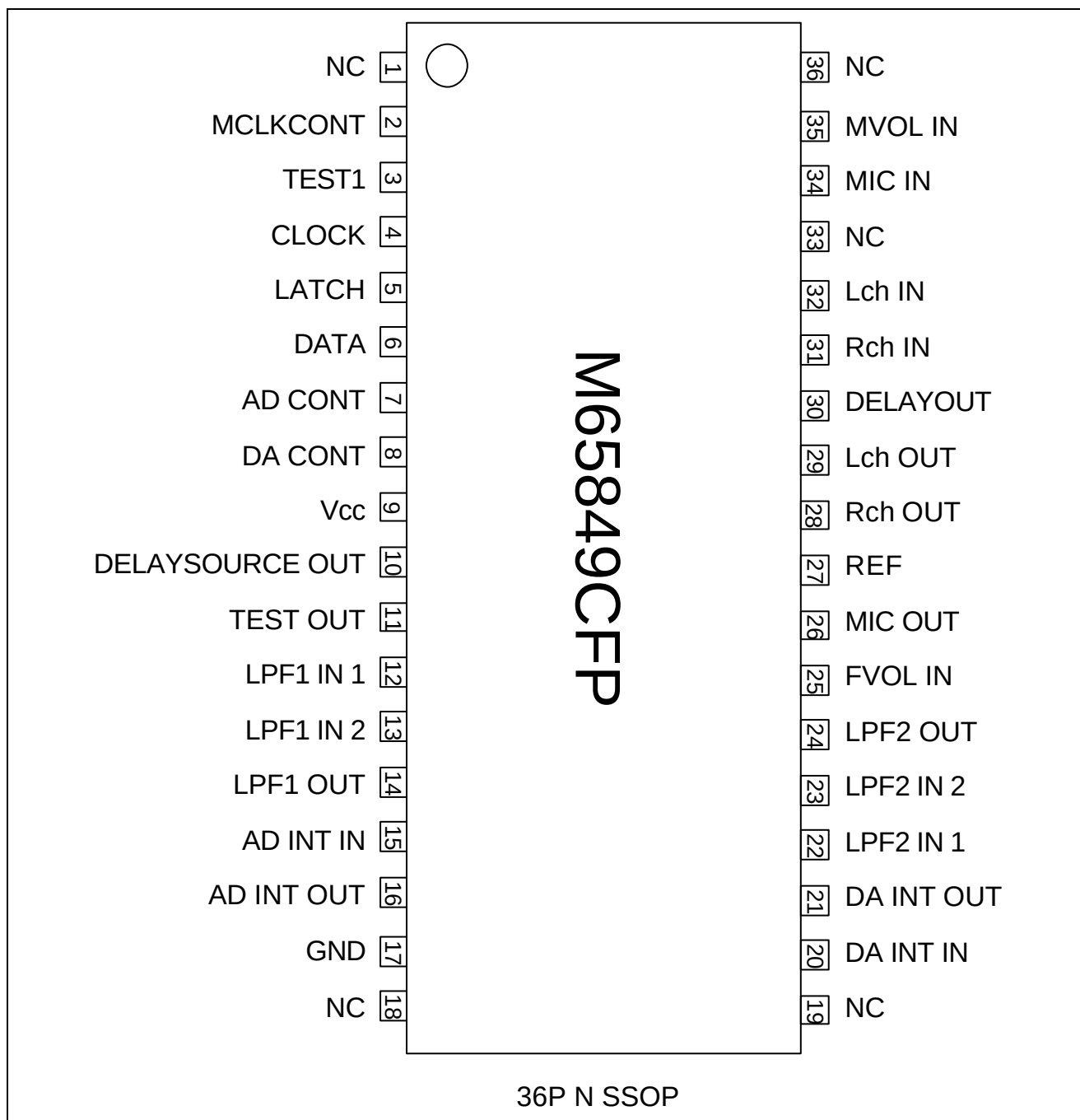
RECOMMENDED OPERATING CONDITION

- Supply voltage range $V_{CC}=4.5$ to $5.5V$

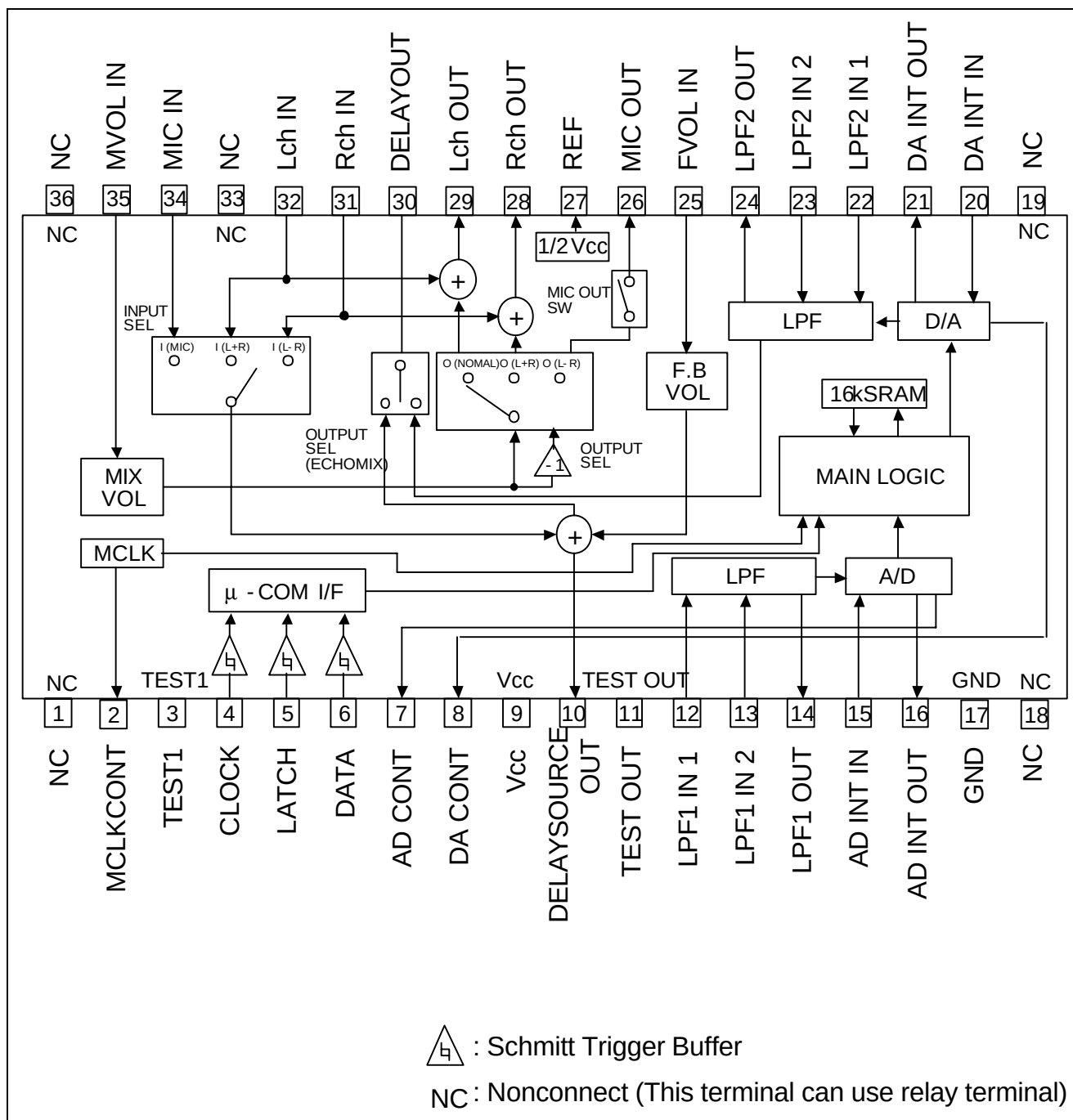
SYSTEM CONFIGURATION



PIN CONFIGURATION



Block Diagram



Pin Description

No.	Symbol	Name	I/O	Function
1	NC	NON CONNECT	—	This terminal can use relay terminal for external
2	MCLKCONT	Oscillator Input	I	Controls built-in clock generation circuit with external R
3	TEST1	Test pin	I	Test mode change "H"Normal/"L"Test (Be sure connect to Vcc at Normal mode)
4	CLOCK	CLOCK	I	Clock input via serial bus
5	LATCH	LATCH	I	Latch input via serial bus
6	DATA	DATA	I	Data input via serial bus
7	AD CONT	A/D Control	—	Decide the time constant of A/D
8	DA CONT	D/A Control	—	Decide the time constant of D/A
9	Vcc	Power Supply	—	
10	DERAYSOURCE OUT	Delay source output	O	L+R)or (L- R)or (MIC)signal Output
11	TEST OUT	Test output	O	Output (Test mode) (Be sure to open at Normal mode)
12	LPF1 IN 1	Low Pass Filter 1 Input 1	I	Prefilter placed before A/D converter for digital delay
13	LPF1 IN 2	Low Pass Filter 1 Input 2	I	
14	LPF1 OUT	Low Pass Filter 1 Output	O	
15	AD INT IN	A/D Integrator Input	I	To form D/A converter Integrator by connecting external capacitor
16	AD INT OUT	A/D Integrator Output	O	
17	GND	GND	—	
18	NC	NON CONNECT	—	This terminal can use relay terminal for external
19	NC	NON CONNECT	—	This terminal can use relay terminal for external
20	DA INT IN	D/A Integrator Input	I	Form Integrator with External C
21	DA INT OUT	D/A Integrator Output	O	
22	LPF2 IN 1	Low Pass Filter 2 Input 1	I	Form Low Pass Filter with External C,R
23	LPF2 IN 2	Low Pass Filter 2 Input 2	I	
24	LPF2 OUT	Low Pass Filter 2 Output	O	
25	FVOL IN	Feedback Volume Input	I	Feedback Volume Input
26	MIC OUT	Microphone Output	O	Microphone Output
27	REF	Reference	—	1/2 Vcc Output,Connect External C
28	Rch OUT	Rch Output	O	Rch Mixing Output
29	Lch OUT	Lch Output	O	Lch Mixing Output
30	DELAYOUT	DELAY Output	O	Delay Signal Output
31	Rch IN	Rch Input	I	Rch Input
32	Lch IN	Lch Input	I	Lch Input
33	NC	NON CONNECT	—	This terminal can use relay terminal for external
34	MIC IN	Microphone Input	I	Microphone Input
35	MVOL IN	Mix Volume Input	I	Mix Volume Input
36	NC	NON CONNECT	—	This terminal can use relay terminal for external

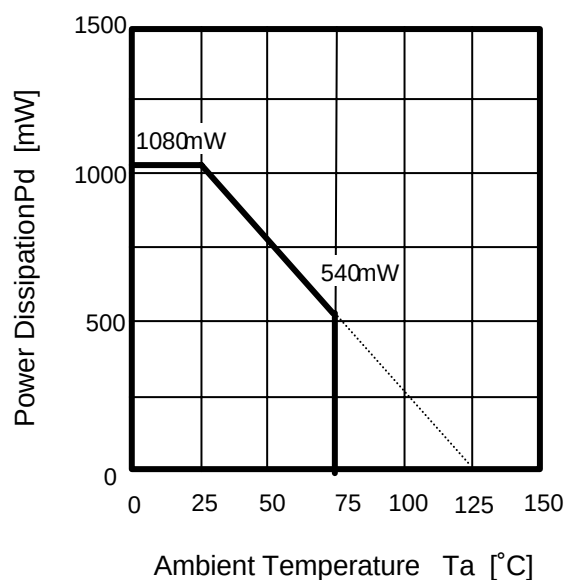
Absolute Maximum Ratings

No.	Parameter	Conditions	Ratings	Units
V _{cc}	Supply voltage		6.5	V
I _{cc}	Circuit Current		50.0	mA
P _d	Power dissipation		325	mW
T _{opr}	Operating Temperature		-20 to +75	°C
T _{stg}	Storage Temperature		-40 to +125	°C

Recommended Operating Conditions

No.	Parameter	Conditions	Limits			Units
			Min.	Typ.	Max.	
V _{cc}	Supply Voltage		4.5	5.0	5.5	V
V _{IH}	High Input Voltage	4, 5, 6	2.4	—	V _{cc}	V
V _{IL}	Low Input Voltage	4, 5, 6	0	—	0.8	V
f _{ck}	CLOCK Frequency		3	4	5	MHz

Thermal Derating



Electrical Characteristics

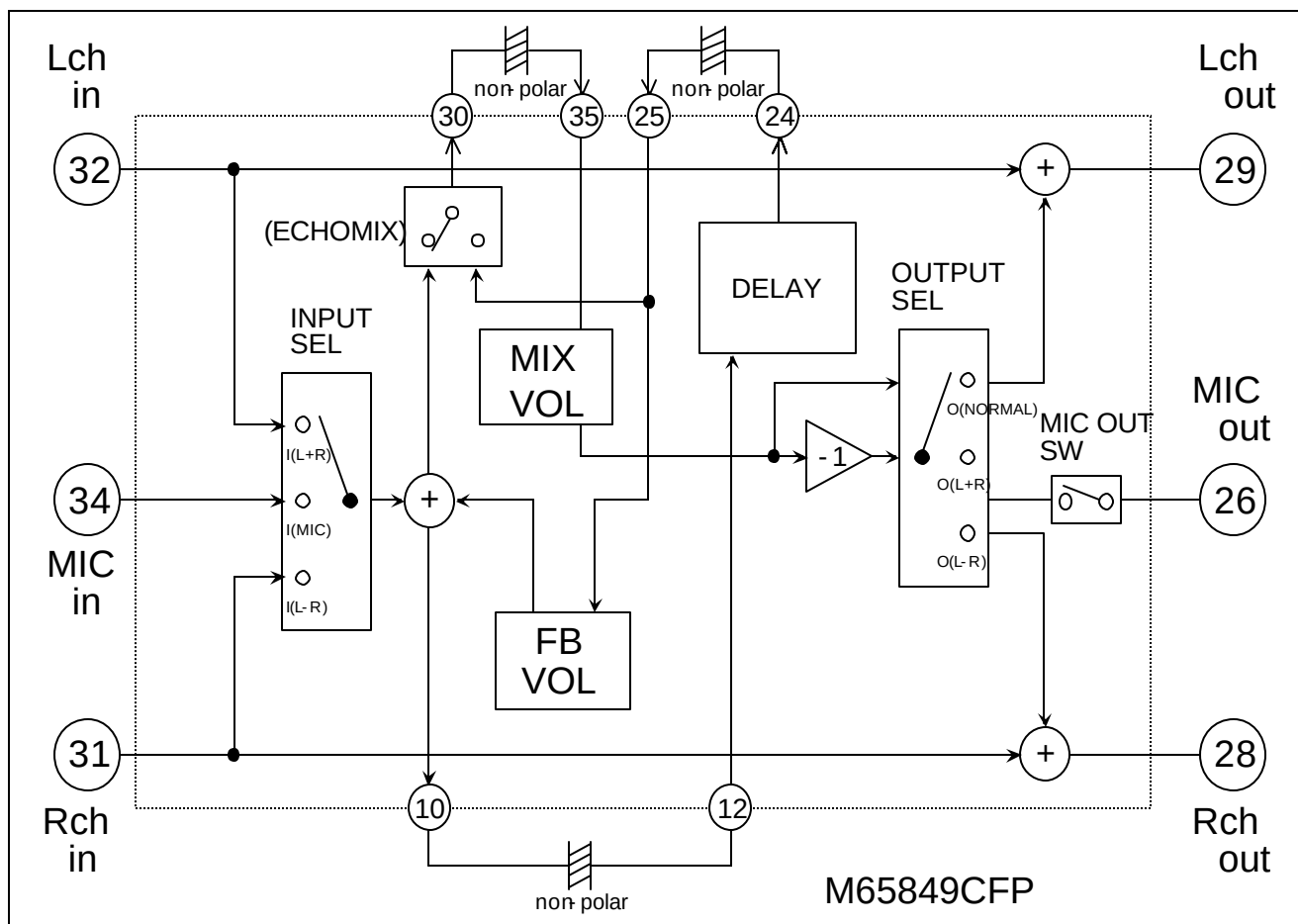
(Ta =25°C, Vcc =5V ,f =1kHz ,Vi =200mVrms Unless Otherwise Noted)

	Symbol	Parameter	Conditions	Limits			Units
				Min.	Typ.	Max.	
Total	Icc	Circuit Current	No Signal	—	32	70	mA
DIGITAL DELAY	Td	Delay Time	Refer to Delay time Control	7.8	9.2	10.6	ms
				13.1	15.4	17.7	
				18.3	21.5	24.7	
				24.5	28.7	33.0	
				41.8	49.2	56.6	
				83.6	98.3	113.0	
				125.4	147.5	169.6	
				167.1	196.6	226.1	
	Gv	Voltage Gain		-3	0	3	dB
	THD	Output Distortion	Td=9.2ms 30kHz LPF	—	0.3	0.6	%
			Td=15.4ms 30kHz LPF	—	0.3	0.6	
			Td=21.5ms 30kHz LPF	—	0.3	0.6	
			Td=28.7ms 30kHz LPF	—	0.5	1.0	
			Td=49.2ms 30kHz LPF	—	0.7	1.4	
			Td=98.3ms 30kHz LPF	—	1.0	2.0	
			Td=147.5ms 30kHz LPF	—	1.5	3.0	
			Td=196.6ms 30kHz LPF	—	2.0	4.0	
	Vomax	Maximum Output Voltage	30kHz LPF THD=10%	0.7	1.0	—	Vrms
No	Output Noise Voltage		Td=9.2ms Rg=620Ω Vi=0mVrms JIS-A	—	-92	-80	dBV
			Td=15.4ms Rg=620Ω Vi=0mVrms JIS-A	—	-92	-80	
			Td=21.5ms Rg=620Ω Vi=0mVrms JIS-A	—	-92	-80	
			Td=28.7ms Rg=620Ω Vi=0mVrms JIS-A	—	-90	-75	
			Td=49.2ms Rg=620Ω Vi=0mVrms JIS-A	—	-90	-75	
			Td=98.3ms Rg=620Ω Vi=0mVrms JIS-A	—	-87	-72	
			Td=147.5ms Rg=620Ω Vi=0mVrms JIS-A	—	-82	-70	
			Td=196.6ms Rg=620Ω Vi=0mVrms JIS-A	—	-77	-62	

(Ta =25°C, Vcc =5V ,f =1kHz ,Vi =200mVrms Unless Otherwise Noted)

	Symbol	Parameter	Conditions	Limits			Units
				Min.	Typ.	Max.	
MIX VOLUME FEEDBACK VOLUME	Gv	Voltage Gain	Volume max	FB VOL -6	-3	0	dB
				Mix VOL 0	3	6	
	ATT MAX	Maximum ATT.	Volume min JIS-A	—	-70	-60	dB
	THD	Output Distortion	Volume max 30kHz LPF RL=47kΩ	—	0.15	0.30	%
	Vomax	Maximum Output Voltage	Volume max 30kHz LPF RL=47kΩ THD=10%	1.1	1.4	—	Vrms
	No	Output Noise Voltage	Volume max JIS-A Rg=620Ω	—	-98	-90	dBV
	Voff	Offset Voltage	Mix Volume Voltage (3dB,0dB)	—	—	±1.6	mV
LINE AMP.	Gv	Voltage Gain		-3	0	-3	dB
	THD	Output Distortion	30kHz LPF	—	0.01	0.03	%
	Vomax	Maximum Output Voltage	30kHz LPF THD=10% RL=10kΩ	1.2	1.8	—	Vrms
	No	Output Noise Voltage	DELAYOFF MODE JIS-A Rg=620 Ω	—	-98	-90	dBV
	CS	Channel Separation	DMIXSW OFF LchIN RchOUT f=400Hz JIS-A	—	- 90	- 60	dB
	Zi	Input Impedance		21	30	—	kΩ

Construction of Diagram

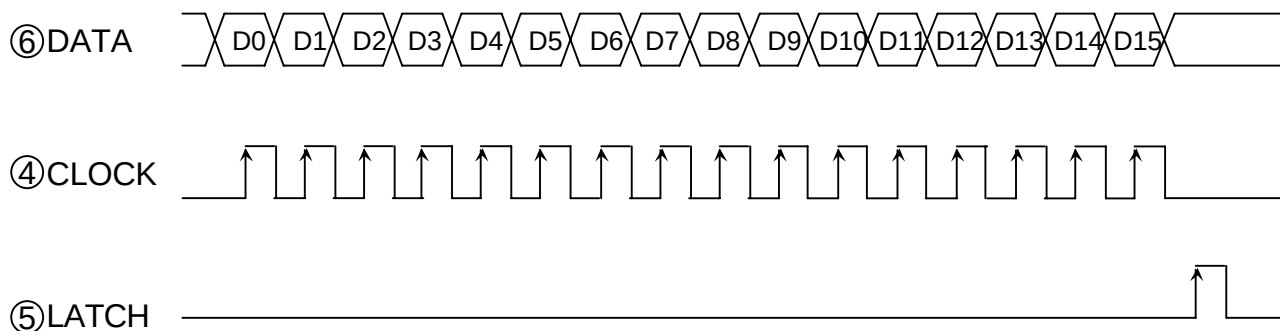


- **DELAY TIME**
There are 8 kinds of Delay Time which are from 9.2ms to 196.6ms.
- **FEEDBACK VOLUME**
There are 8 kinds of ATT. level which are from -3dB to -15dB, -∞dB.
- **MIX VOLUME**
There are 8 kinds of ATT. level which are from +3dB to -15dB, -∞dB.
- **INPUTSELECTOR**
This is the input selector which selects I(CLOCKOFF), I(L+R), I(L- R) or I(MIC).
- **OUTPUTSELECTOR**
This is the output selector which selects O(NORMAL), O(L+R), O(L- R) or O(ECHOMIX).
- **MIC SWITCH**
This is the ON/OFF switch for the Microphone signal.

Operation Mode Settings

Operation mode is controlled by the 16- bit serial data inputted in accordance with the following timing.

- The (DATA is reading at the rising edge of the CLOCK and the last 16- bits are loaded at the rising edge of the LATCH.) Operation Mode Settings



Data No.	Control Block	Control Explanation
D0	DELAY TIME	There are 8 kinds of Delay Time which are from 9.2ms to 196.6ms.
D1		
D2		
D3	INPUT SELECTOR	This is the input selector which selects I(CLKOFF), I(L- R),I(L+R)or I(MIC).
D4		
D5	OUTPUT SELECTOR	This is the output selector which selects NORMAL),O(L+R),O(L - R)or O(ECOMIX)
D6		
D7	MICOUT SW	This is the ON/OFF switch for the Microphone signal.
D8	MIX VOL	There are 8 kinds of ATT.level which are from 3dB to -15dB,-∞dB (3dB step).
D9		
D10		
D11	FEED BACK VOL	There are 8 kinds of ATT.level which are from 3dB or -15dB,- ∞dB (2dB step).
D12		
D13		
D14	ADDRESS	D14=(L),D15=(H)DATA Load,the others cancel.
D15		

Description of Control

Delay Time Control

Control Data			DELAY TIME	The Cut Off Frequency of LPF
D0	D1	D2		
L	L	L	9.2 msec	7.3KHz
H	L	L	15.4 msec	
L	H	L	21.5 msec	
H	H	L	28.4 msec	
L	L	H	49.2 msec	
H	L	H	98.3 msec	3.1KHz
L	H	H	147.5 msec	
H	H	H	196.6 msec	

Input Selector Control

Control Data		INPUT SELECTOR
D3	D4	
L	L	I (L +R)
H	L	I (L -R)
L	H	I (MIC)
H	H	I (CLKOFF)

Output Selector Control

Control Data		OUTPUT SELECTOR
D5	D6	
L	L	O (L + R)
H	L	O (L - R)
L	H	O (ECHOM IX)
H	H	O (NOR MAL)

Microphone Output Switch Control

Control Data	MICOUT SW ITCH
D7	
L	SW OFF
H	SW ON

Mix volume Control

Control Data			DELAY VOL
D8	D9	D10	
L	L	L	+ 3dB
H	L	L	0dB
L	H	L	- 3dB
H	H	L	- 6dB
L	L	H	- 9dB
H	L	H	- 12dB
L	H	H	- 15dB
H	H	H	-∞

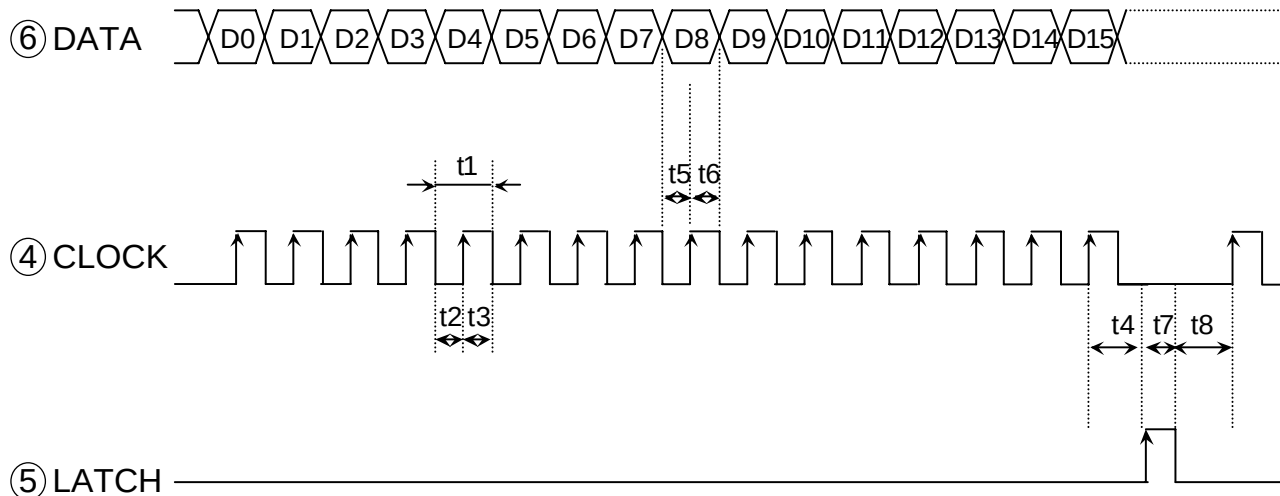
Feedback volume Control

Control Data			FEEDBACK VOLUME
D11	D12	D13	
L	L	L	- 3dB
H	L	L	- 5dB
L	H	L	- 7dB
H	H	L	- 9dB
L	L	H	- 11dB
H	L	H	- 13dB
L	H	H	- 15dB
H	H	H	-∞

Address Control

Control Data		ADDRESS
D14	D15	
L	L	DATA CANCEL
H	L	
L	H	DATA LOAD
H	H	DATA CANCEL

Serial Data Input Timing



Symbol	Name	Min.	Typ.	Max.	Units
t1	CLOCK clock width	1000	—	—	ns
t2	CLOCK "L" pulse width	400	—	—	ns
t3	CLOCK "H" pulse width	400	—	—	ns
t4	LATCH rise hold time	800	—	—	ns
t5	DATA setup time	400	(t1)/2	—	ns
t6	DATA hold time	400	(t1)/2	—	ns
t7	LATCH "H" pulse width	400	—	—	ns
t8	CLOCK setup time	400	—	—	ns

The Power On Reset

When the IC is supplied V_{cc}, the reset circuit is on and after about 120ms ^{*1}(V_{cc}=5V, C₂₇=100 μF) the reset circuit is off automatically.

D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15
L	L	L	H	L	H	H	L	H	H	H	H	H	H	L	L
9.2ms			I(L+R)		NORMAL		MICSW OFF		-∞			-∞		DATA LOAD	

*1 The Reset Time

The reset time depends on the external C of 27 pin and the time can be calculated as follows.

$$\text{The reset time (ms)} = 2.5 \times C (\mu\text{F})$$

example • In the case of C = 47 μF

$$\text{The reset time} = 2.5 \times 47 = 117.5 \text{ (ms)}$$

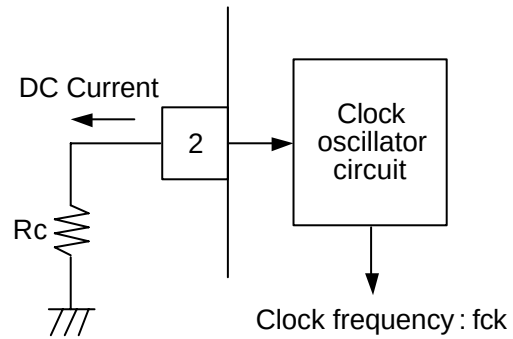
Clock oscillator circuit

This IC incorporates a current control type clock oscillator circuit in it, thus providing circuit configuration just by connecting an R_c for current control pin 2 (CLK).

Fully internal clock supply prevents occurrence of undesired radiation without affecting any external circuit.

The oscillator frequency f_{ck} is following.

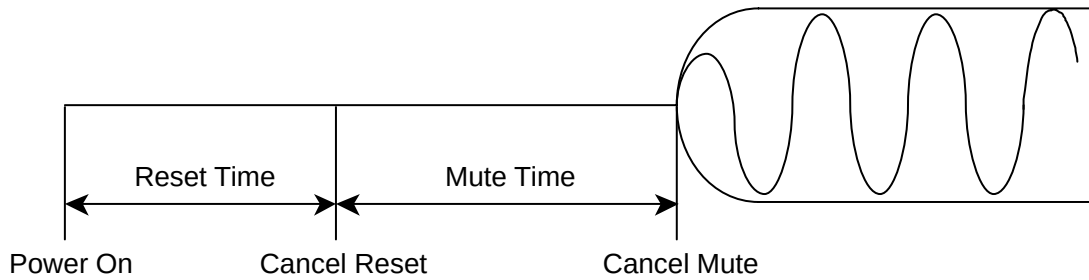
$$f_{ck} = 4\text{MHz} (R_c = 22\Omega)$$



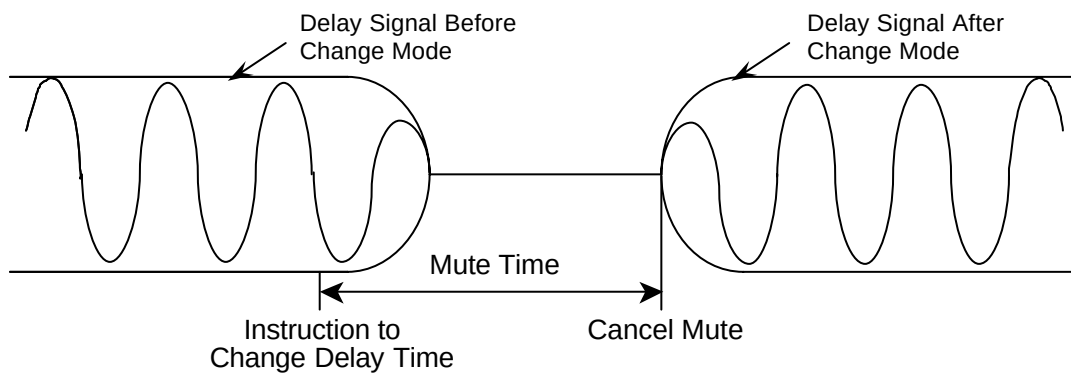
The Auto Muting

The auto muting is active upon the power- on and the changing delay time for rejecting the shock noise.

- Upon Power- on



- Upon Changing Delay Time

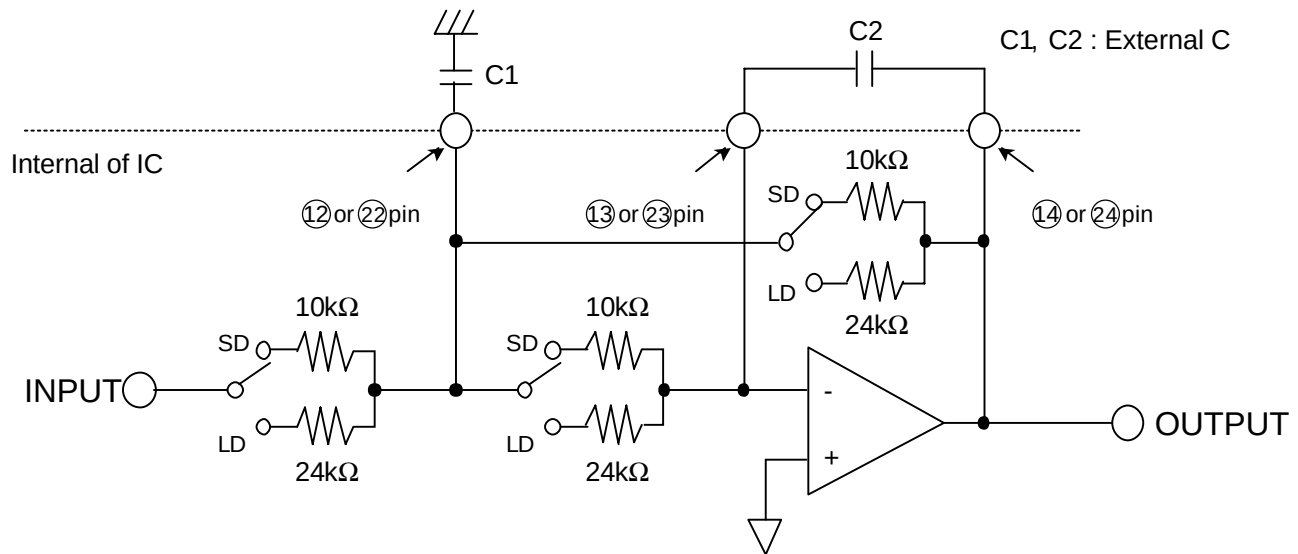


The Mute Time is set by Delay Time as follows.

DELAY TI ME	MUTE TI ME
	Typ
9.2 to 196.6ms	410ms

The LPF Of The Input & Output Stage Of The Digital Delay

The circuit of the LPF is as follows.



The accuracy of the internal resistors are about $\pm 30\%$.

DELAY TIME	SW
9.2 to 49.2 ms	SD (SHORT DELAY)
98.3 to 196.6 ms	LD (LONG DELAY)

* The cut off frequency is calculated by the following formulas.

- Surround

$$f_c = \frac{1}{2\pi \times 10k\Omega \times \sqrt{C1 \times C2}}$$

- Echo

$$f_c = \frac{1}{2\pi \times 24k\Omega \times \sqrt{C1 \times C2}}$$

The quality factor (Q) is as follows under the conditions of both Short Delay & Long Delay.

$$Q = \frac{1}{3} \sqrt{\frac{C1}{C2}}$$

At all the cut off frequency is decided by the external C.

We recommend $C1 = 0.0047 \mu F$, $C2 = 0.001 \mu F$.

Under this condition, f_c and "are as follows.

Surround $f_c = 7.3kHz$ $Q = 0.72$

Echo $f_c = 3.1kHz$

- The Cut Off Frequency of LPF means the cut off frequency of the each stage (A/D & D/A) and doesn't mean the total cut off frequency.

Electrical Characteristics

(Ta = 25°C, Vcc = 5V, f = 1kHz, Vi = 200m Vrms, fck = 4MHz Unless Otherwise Noted)

				Serial data setting condition *NOTE 1			Input	Output	Remark
Symbol	Parameter	Conditions		D0	D1	D2			
Total	Icc	Circuit Current	No Signal	—	—	—	—	—	
DIGITAL DELAY	Td	Delay Time		Td=9.2ms	L	L	L	—	Vo3
				Td=15.4ms	L	L	H		
				Td=21.5ms	L	H	L		
				Td=28.7ms	L	H	H		
				Td=49.2ms	H	L	L		
				Td=98.3ms	H	L	H		
				Td=147.5ms	H	H	L		
				Td=196.6ms	H	H	H		
Gv	Voltage Gain			—	—	—	Vi32	Vo24	
THD	Output Distortion	30kHz LPF		Td=9.2ms	L	L	L	Vi32	Vo24
				Td=15.4ms	L	L	H		
				Td=21.5ms	L	H	L		
				Td=28.7ms	L	H	H		
				Td=49.2ms	H	L	L		
				Td=98.3ms	H	L	H		
				Td=147.5ms	H	H	L		
				Td=196.6ms	H	H	H		
Vomax	Maximum Output Voltage	30kHz LPF THD=10%		—	—	—	Vi32	Vo24	
No	Output Noise Voltage	Rg=620 Ω Vi=0mVrms JIS-A		Td=9.2ms	L	L	L	Vi32	Vo24
				Td=15.4ms	L	L	H		
				Td=21.5ms	L	H	L		
				Td=28.7ms	L	H	H		
				Td=49.2ms	H	L	L		
				Td=98.3ms	H	L	H		
				Td=147.5ms	H	H	L		
				Td=196.6ms	H	H	H		

*NOTE1 Serial Data Setting Condition

D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15
*	*	*	H	L	H	H	L	H	H	H	H	H	H	L	H
			I(L-R)		NORMAL		MICSW OFF	-∞			-∞			DATA LOAD	

(Ta = 25°C, Vcc = 5V, f = 1kHz, Vi = 200mVrms, fck = 4MHz Unless Otherwise Noted)

			Serial data setting condition *NOTE2							
			Conditions							
			MIX VOLUME		D8	D9	D10			
	No.	Parameter	FEEDBACK VOLUME		D11	D12	D13	Input	Output	Remark
MIX VOLUME FEEDBACK VOLUME	Gv	Voltage Gain	Volume max		L	L	L	FB Vi25	FB Vo24	
	ATTMAX	Maximum ATT.	DELAYOFF MODE Volume min JIS- A		H	H	H	Mix Vi35	Mix Vo26	
	THD	Output Distortion	RL=47k Ω 30kHz LPF		L	L	L			
	Vomax	Maximum Output Voltage	Volume max 30kHz LPF THD=10%							
	No	Output Noise Voltage	DELAYOFF MODE JIS- A Rg=620Ω					—	Vo24	
	Voff	Offset Voltage	Mix Volume between +3dB ,-∞dB		+3dB L -∞dB H	L H H H	L H H H	—	Vo26	
	LINE AMP.	Gv	Voltage Gain		Lch	D0 L	D1 L	D2 L	Vi32 Vi31	Vo29 Vo28
				Rch						
THD		Output Distortion		Lch	L	L	L	Vi32 Vi31	Vo29 Vo28	
				Rch						
Vomax		Maximum Output Voltage	RL=10kΩ 30kHz LPF THD=10%	Lch Rch	L L	L L	L L	Vi32 Vi31	Vo29 Vo28	
No		Output Noise Voltage	DELAYOFF MODE JIS-A Rg=620Ω	Lch Rch	L L	L L	L L	— —	Vo29 Vo28	
CS		Channel Separation	DMIXSWOFF LchIN RchOUT f=400Hz JIS-A		L	L	L	Vi31	Vo28	

* NOTE 2 Serial Data Setting Condition

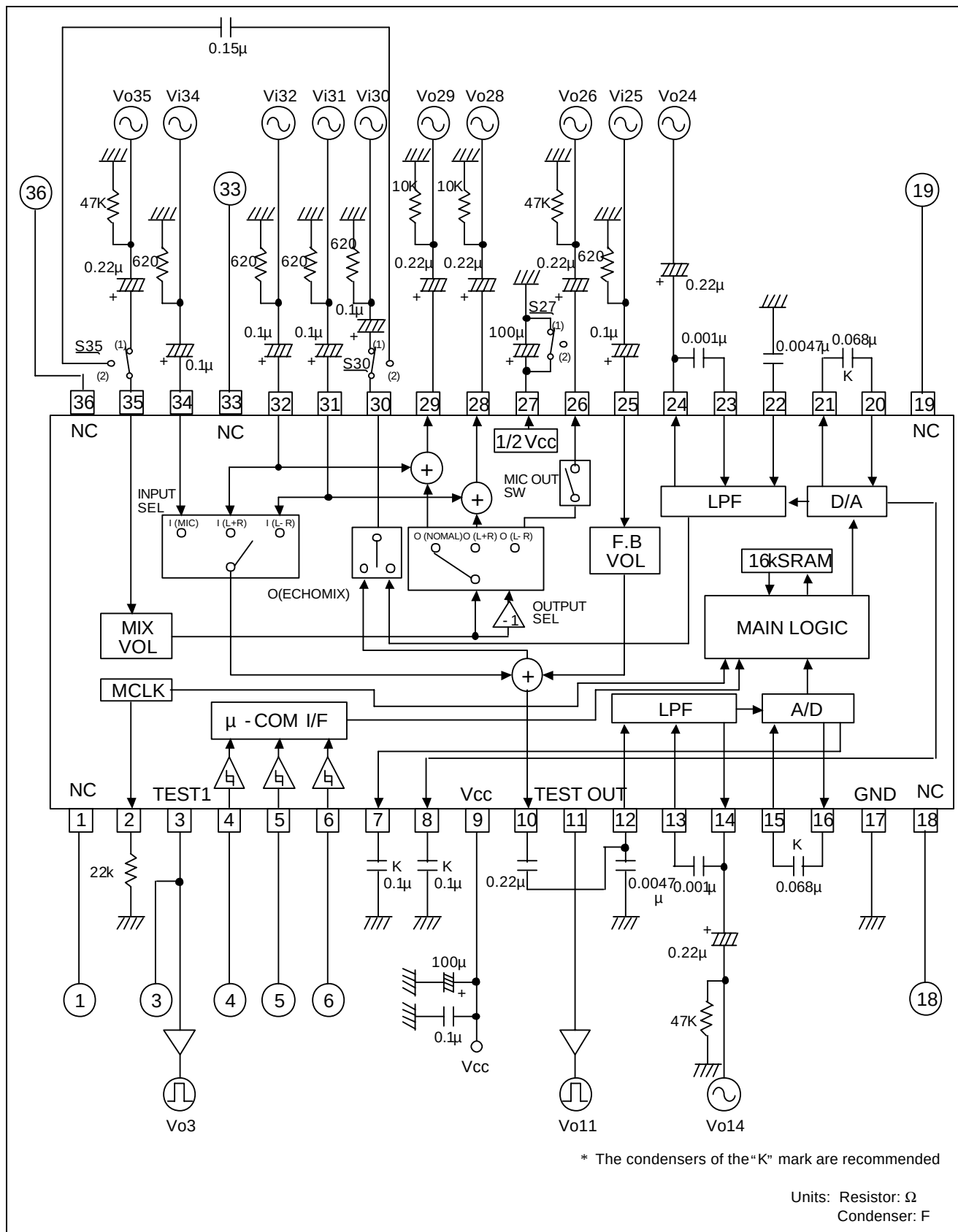
MIX	D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15
VOLUME	H	H	H	L	H	L	H	H	*	*	*	L	L	L	L	H
OFFSET	196.6ms			I(MIC)		ECHOMIX		MICSW ON				-3dB			DATA LOAD	
VOLTAGE																

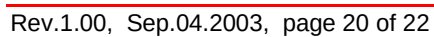
FEEDBACK	D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15
VOLUME	L	L	L	L	H	H	H	H	H	H	H	*	*	*	L	H
	9.2ms			I(MIC)		NORMAL		MICSW ON	-∞						DATA LOAD	

MIX	D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15
VOLUME	L	L	L	L	H	H	H	H	*	*	*	H	H	H	L	H
	9.2ms			I(MIC)		NORMAL		MICSW ON				-∞			DATA LOAD	

LINE AMP.	D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15
	L	L	L	H	H	H	H	L	H	H	H	H	H	H	L	H
	9.2ms			I(CLKOFF)		NORMAL		MICSW OFF	-∞			-∞			DATA LOAD	

Test Circuit

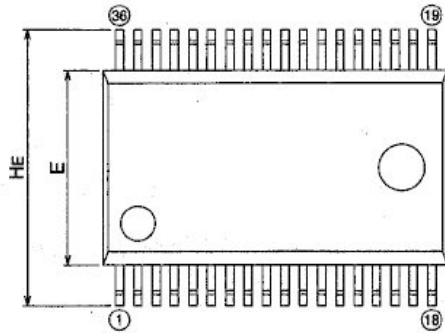
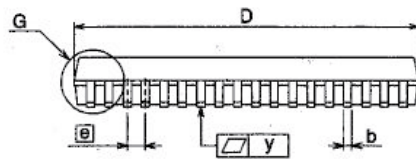
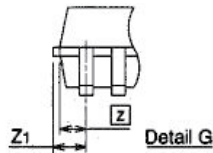
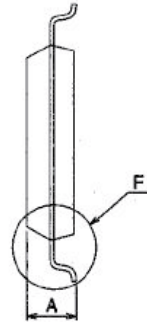
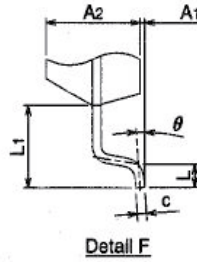
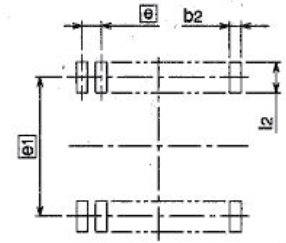




Package Outline

36P2R-D

EIAJ Package Code	JEDEC Code	Weight(g)	Lead Material
SSOP36-P-450-0.80	—	0.53	Cu Alloy

Plastic 36pin 450mil SSOP

Recommended Mount Pad

Symbol	Dimension in Millimeters		
	Min	Nom	Max
A	—	—	2.35
A1	0	0.1	0.2
A2	—	2.05	—
b	0.3	0.35	0.45
c	0.18	0.2	0.25
D	14.8	15.0	15.2
E	8.2	8.4	8.6
e	—	0.8	—
HE	11.63	11.93	12.23
L	0.3	0.5	0.7
L1	—	1.765	—
l2	—	0.7	—
Z1	—	—	0.85
y	—	—	0.15
θ	0°	—	8°
b2	—	0.5	—
e1	—	11.43	—
l2	1.27	—	—

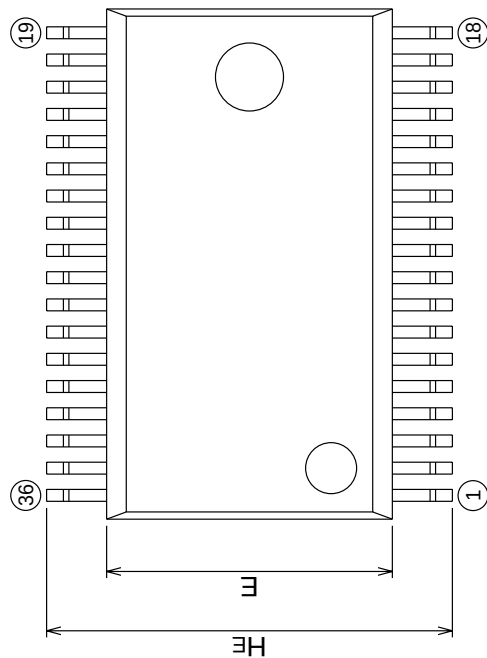
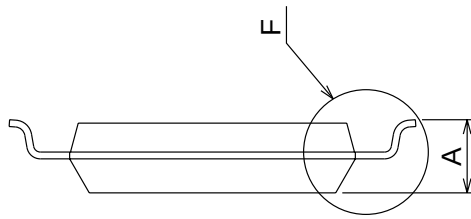
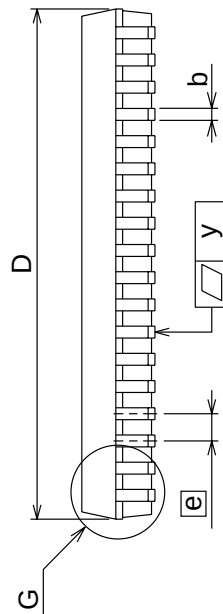
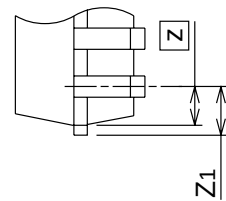
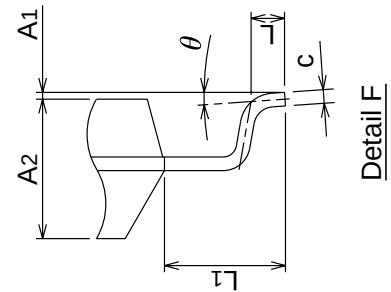
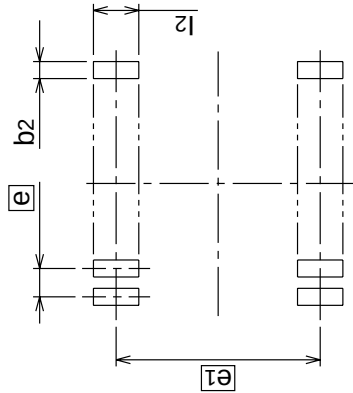
Package Dimensions

36P2R-D

(MMP)

Plastic 36pin 450mil SSOP

EIAJ P	ackage Code	JEDEC Code	Weight(g)	Lead Mater	ial
SSOP36-P-450-0.80	—	—	0.53	Cu Allo	y



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θ	0°	—	8°
b2	—	0.5	—
e1	—	11.43	—
l2	1.27	—	—

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