M65849CFP

SINGLE CHIP SURROUND PROCESSOR

REJ03F0020-0100Z
Rev.1.00
Sep.04.2003

Description

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

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

This IC can be used Dolby Surround.

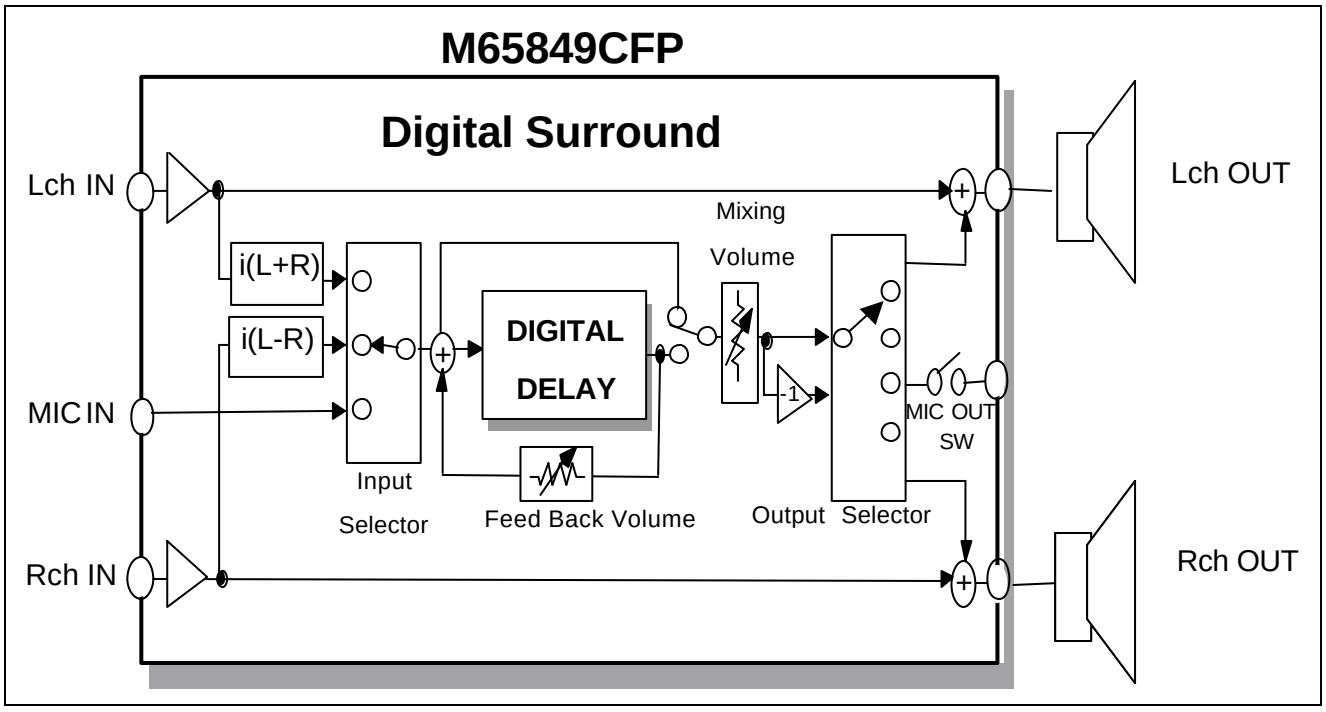
Features

- 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

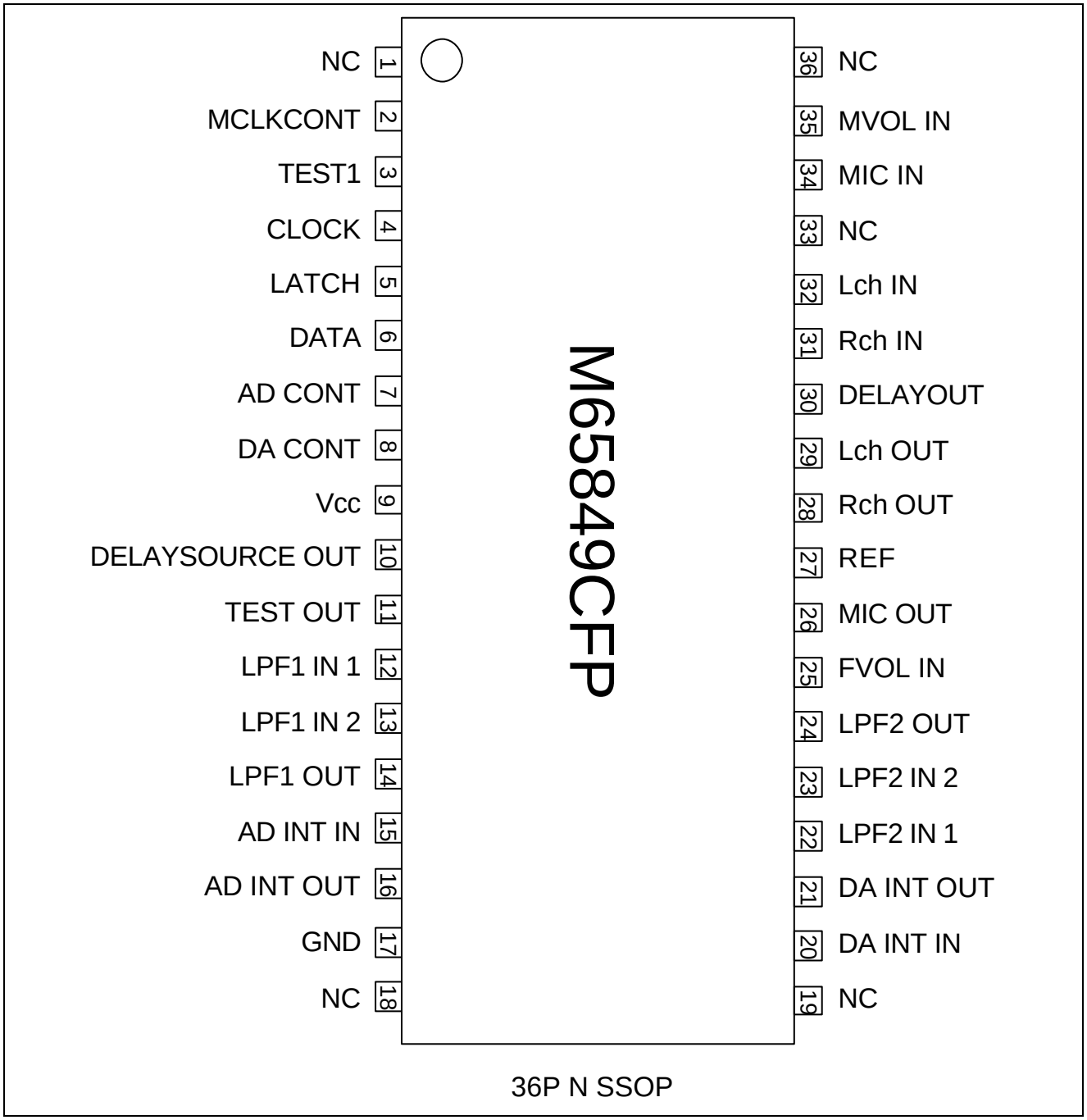
RECOMMENDED OPERATING CONDITION

- Supply voltage range …….Vcc=4.5 to 5.5V

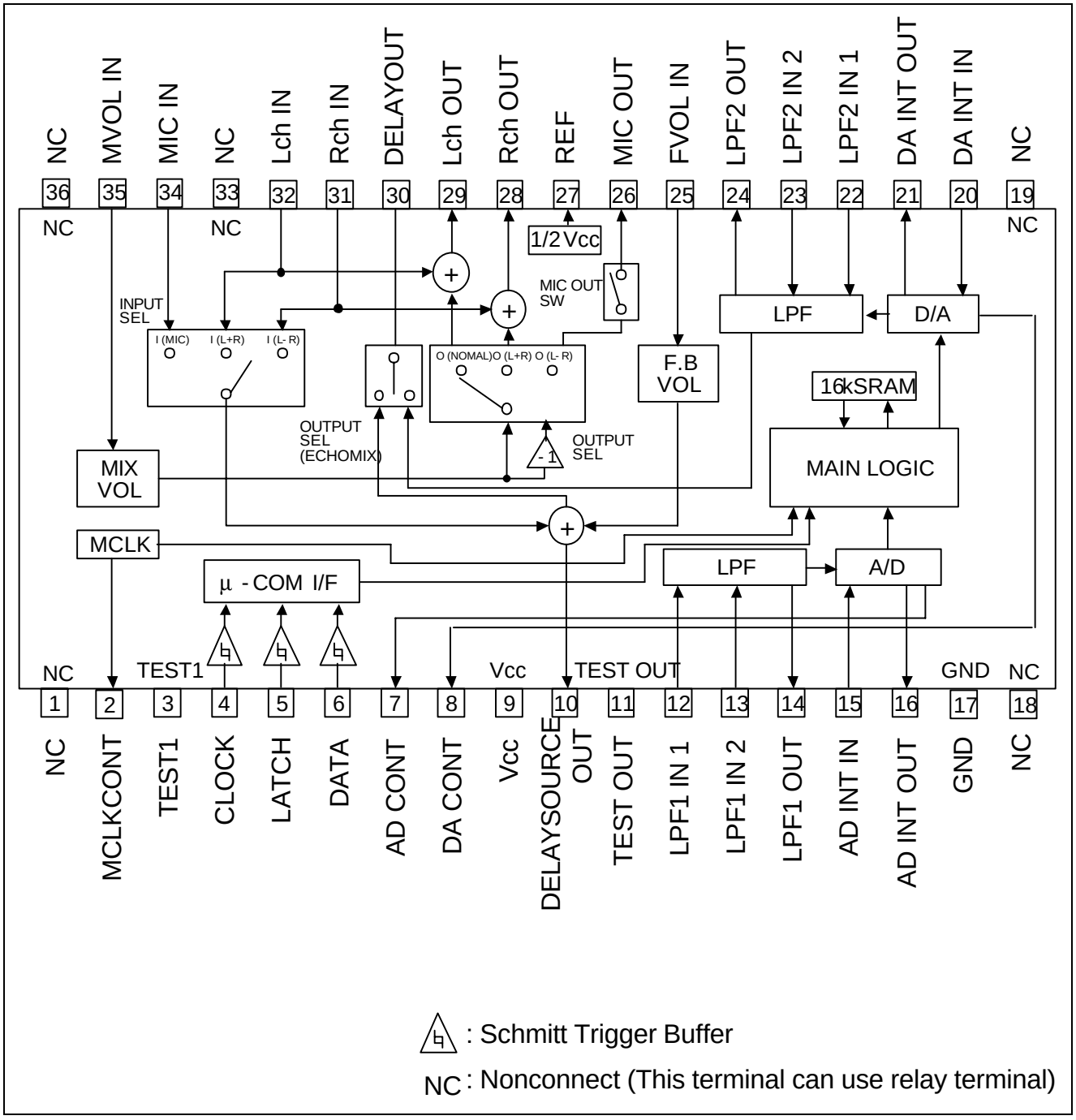
SYSTEM CONFIGURATION



PIN CONFIGURATION



Block Diagram



Pin Description

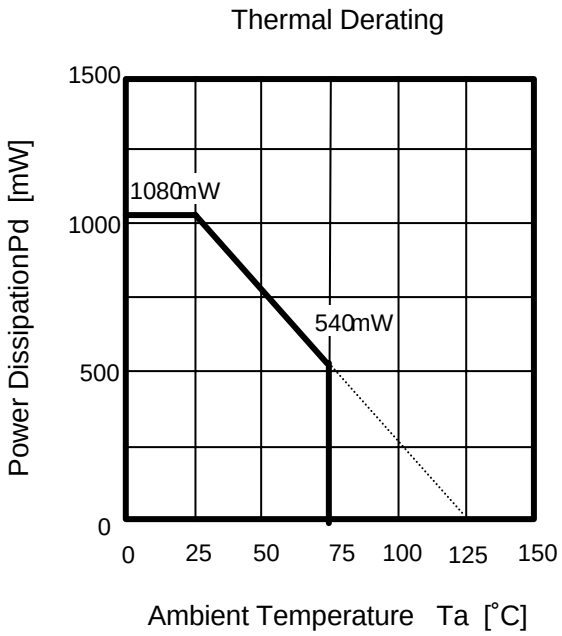
No.	Symbol	Name	I/O	Function
1	NC	NON CONNECT	—	This terminal can use relay terminal for external
2	MCLKCONT	Oscillator Input	I	Controls builts- in clock generation circuit with external R
3	TEST1	Test pin	I	Test mode change “H ”Normal/“L ”Test (Be sure connect to Vcc at Normal mode)
4	CLOCK	CLOCK	I	Clock input via serial bas
5	LATCH	LATCH	I	Latch input via serial bas
6	DATA	DATA	I	Data input via serial bas
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
Vcc	Supply voltage		6.5	V
Icc	Circuit Current		50.0	mA
Pd	Power dissipation		325	mW
Topr	Operating Temperature		-20 to +75	°C
Tstg	Storage Temperature		-40 to +125	°C

Recommended Operating Conditions

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



Electrical Characteristics

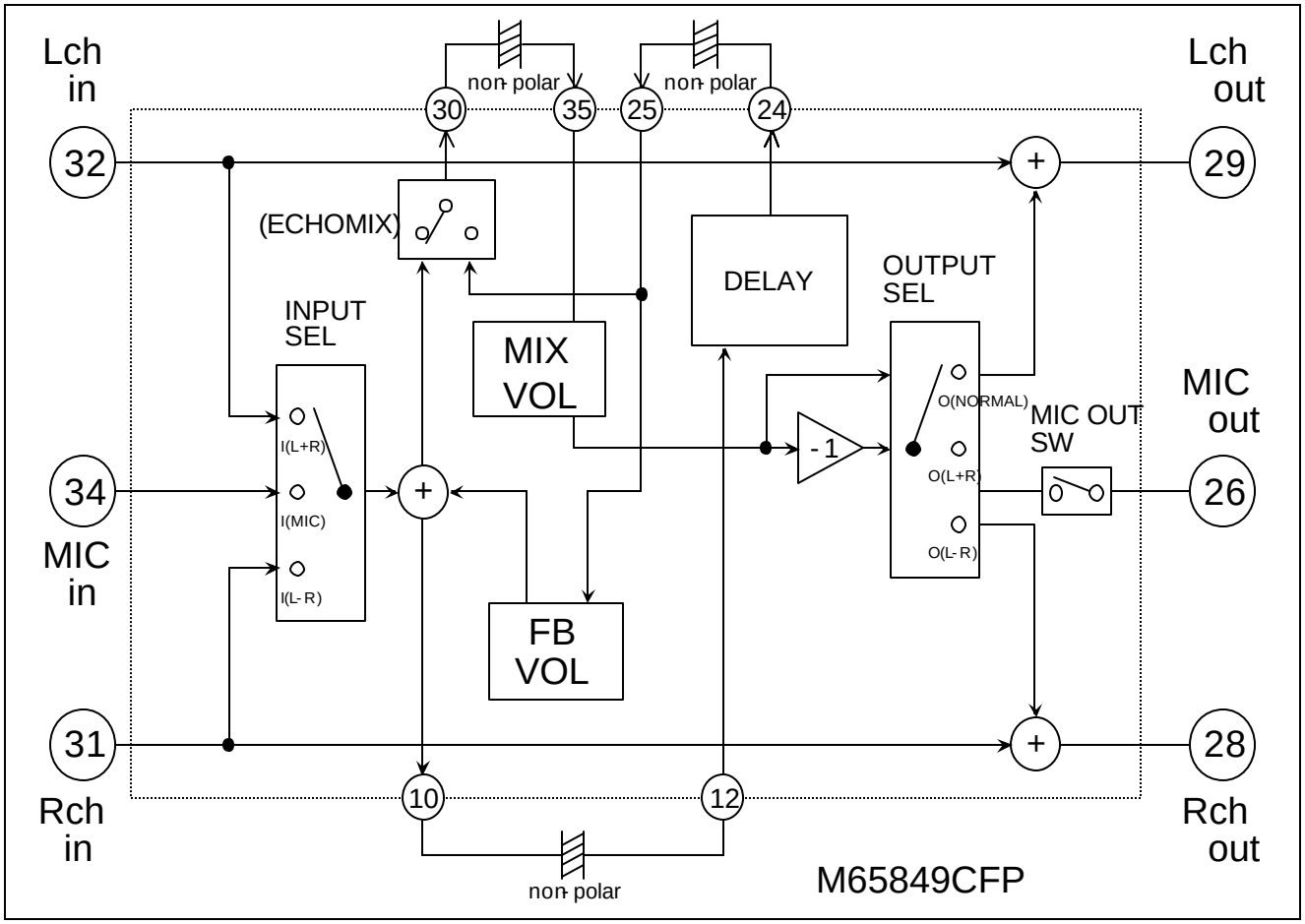
(Ta =25°C, Vcc =5V ,f =1kHz ,Vi =200mVrms Unless Otherwise Noted)

	Symbol	Parameter	Conditions		Limits Min.	Typ.	Max.	Units
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 Vi=0mVrms	Rg=620Ω JIS-A	—	-92	-80	dBV
			Td=15.4ms Vi=0mVrms	Rg=620Ω JIS-A	—	-92	-80	
			Td=21.5ms Vi=0mVrms	Rg=620Ω JIS-A	—	-92	-80	
			Td=28.7ms Vi=0mVrms	Rg=620Ω JIS-A	—	-90	-75	
			Td=49.2ms Vi=0mVrms	Rg=620Ω JIS-A	—	-90	-75	
			Td=98.3ms Vi=0mVrms	Rg=620Ω JIS-A	—	-87	-72	
			Td=147.5ms Vi=0mVrms	Rg=620Ω JIS-A	—	-82	-70	
			Td=196.6ms Vi=0mVrms	Rg=620Ω JIS-A	—	-77	-62	

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

	Symbol	Parameter	Conditions	Limits Min.	Typ.	Max.	Units
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) +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

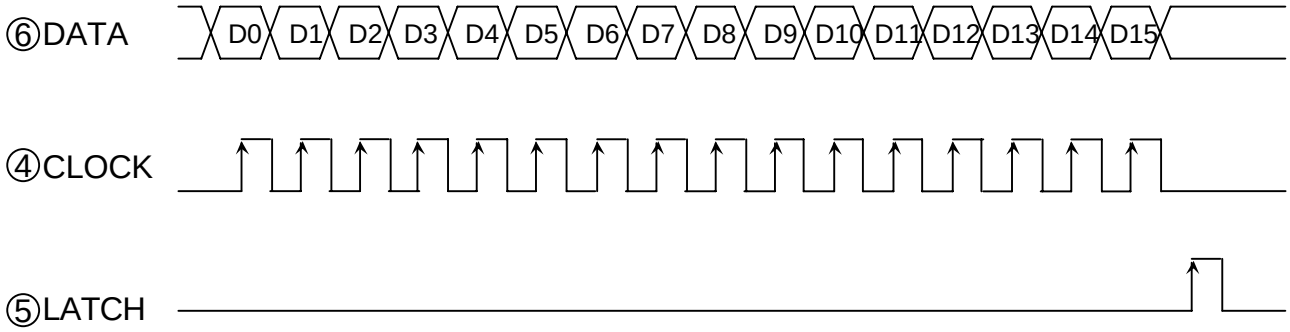


- DELAY TIME
  There are 8 kinds of Delay Time which are from 9.2ms to 196.6ms.
- FEEDBACK VOLUME
  There are 8 kinds of ATT. level which are from –3dB to –15dB,-∞dB.
- MIX VOLUME
  There are 8 kinds of ATT. level which are from +3dB to –15dB,-∞dB.
- INPUTSELECTOR
  This is the input selector which selects 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 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	

IInput 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	-∞

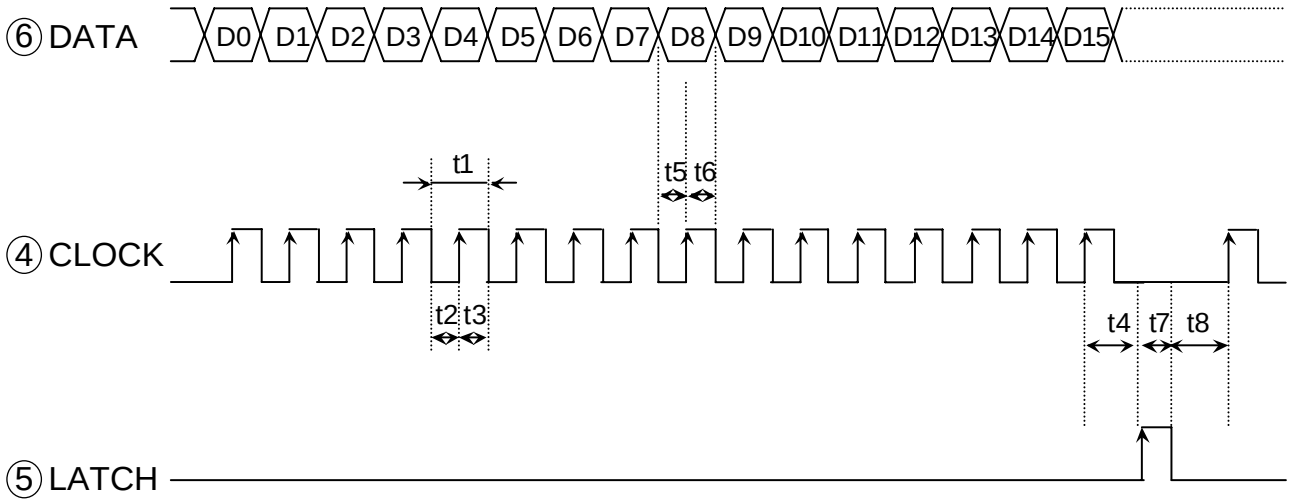
Feedback volume Control

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	CLOCKsetup time	400	—	—	ns

The Power On Reset

When the IC is supplied Vcc,the reset circuit is on and after about 120ms *[1](Vcc=5V, C 27 =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 rest time depends on the external C of 27 pin and the time can be calculated as follows.

The reset time (ms) = 2.5 × C (µF)

example • In the case of C = 47 µF

The reset time = 2.5 × 47 =117.5 (ms)

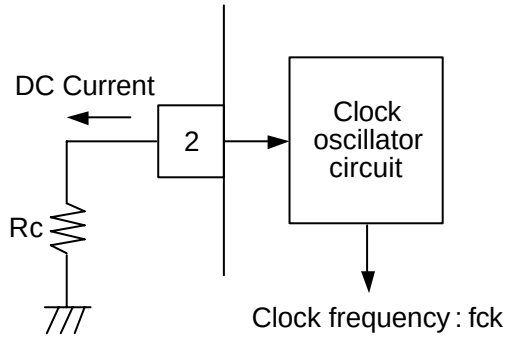
Clock oscillator circuit

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 2 (CLK).

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

The oscillator frequency fck is following.

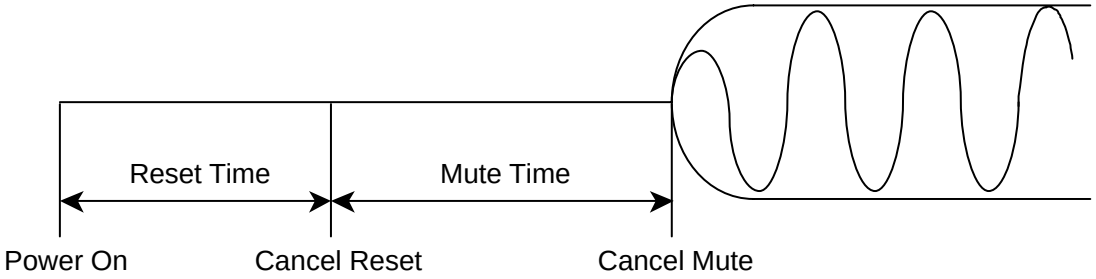
fck = 4MHz (Rc = 22Ω)



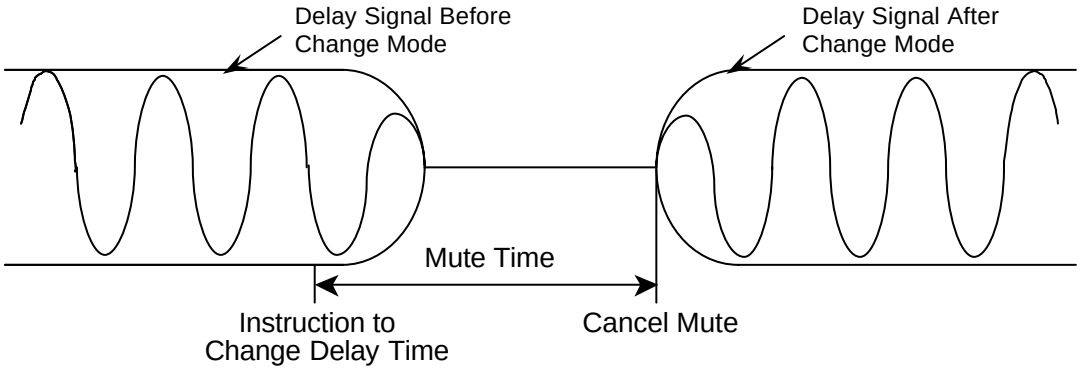
The Auto Muting

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

- Upon Power- on



- Upon Changing Delay Time

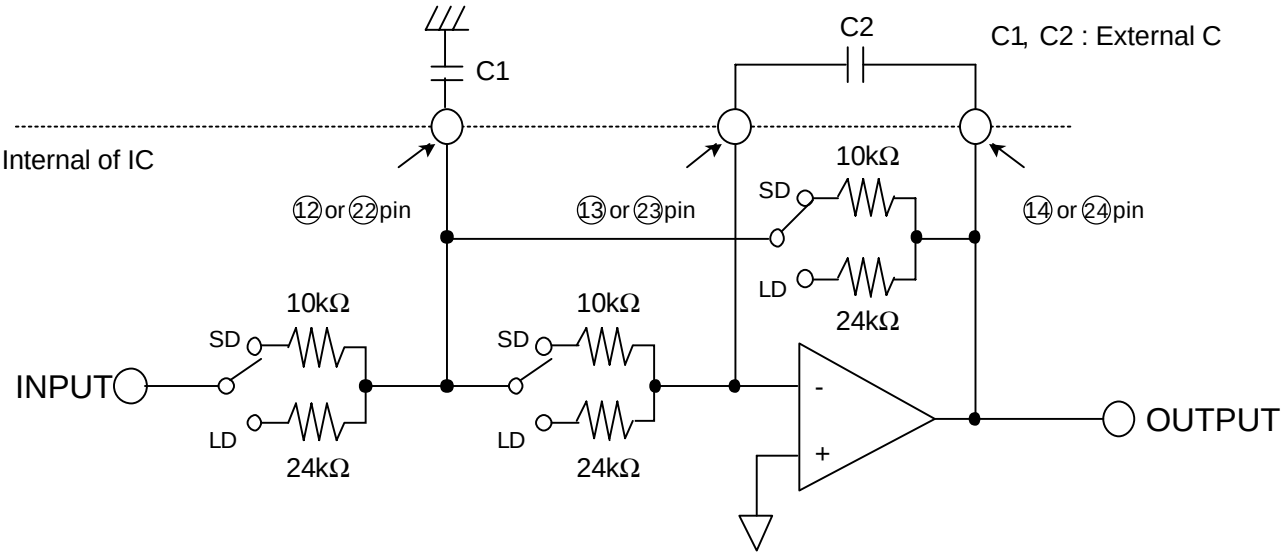


The Mute Time is set by Delay Time as follows.

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 resisters are about ±30%.

DELAY TI ME	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

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

- Echo

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

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 µF,C2=0.001 µF.

Under this condition,fc and “are as follows.

Surround fc = 7.3kHz Q = 0.72

Echo fc = 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)

	Symbol	Parameter	Conditions		Serial data setting condition *NOTE 1 D0	D1	D2	Input	Output	Remark
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)

			Conditions		Serial data setting condition *NOTE2					
			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	L	L	—	Vo26	
					$^{-\infty dB}$H	H	H			
LINE AMP.	Gv	Voltage Gain		Lch	D0	D1	D2	Vi32	Vo29	
					L	L	L	Vi31	Vo28	
				Rch						
	THD	Output Distortion		Lch	L	L	L	Vi32	Vo29	
				Rch				Vi31	Vo28	
	Vomax	Maximum Output Voltage	RL=10kΩ 30kHz LPF THD=10%	Lch	L	L	L	Vi32	Vo29	
				Rch				Vi31	Vo28	
	No	Output Noise Voltage	DELAYOFF MODE JIS-A Rg=620Ω	Lch	L	L	L	—	Vo29	
				Rch				—	Vo28	
	CS	Channel Separation	DMIXSWOFF LchIN RchOUT f=400Hz JIS-A		L	L	L	Vi31	Vo28	

* NOTE 2 Serial Data Setting Condition

MIX VOLUME OFFSET VOLTAGE

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

FEEDBACK VOLUME

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

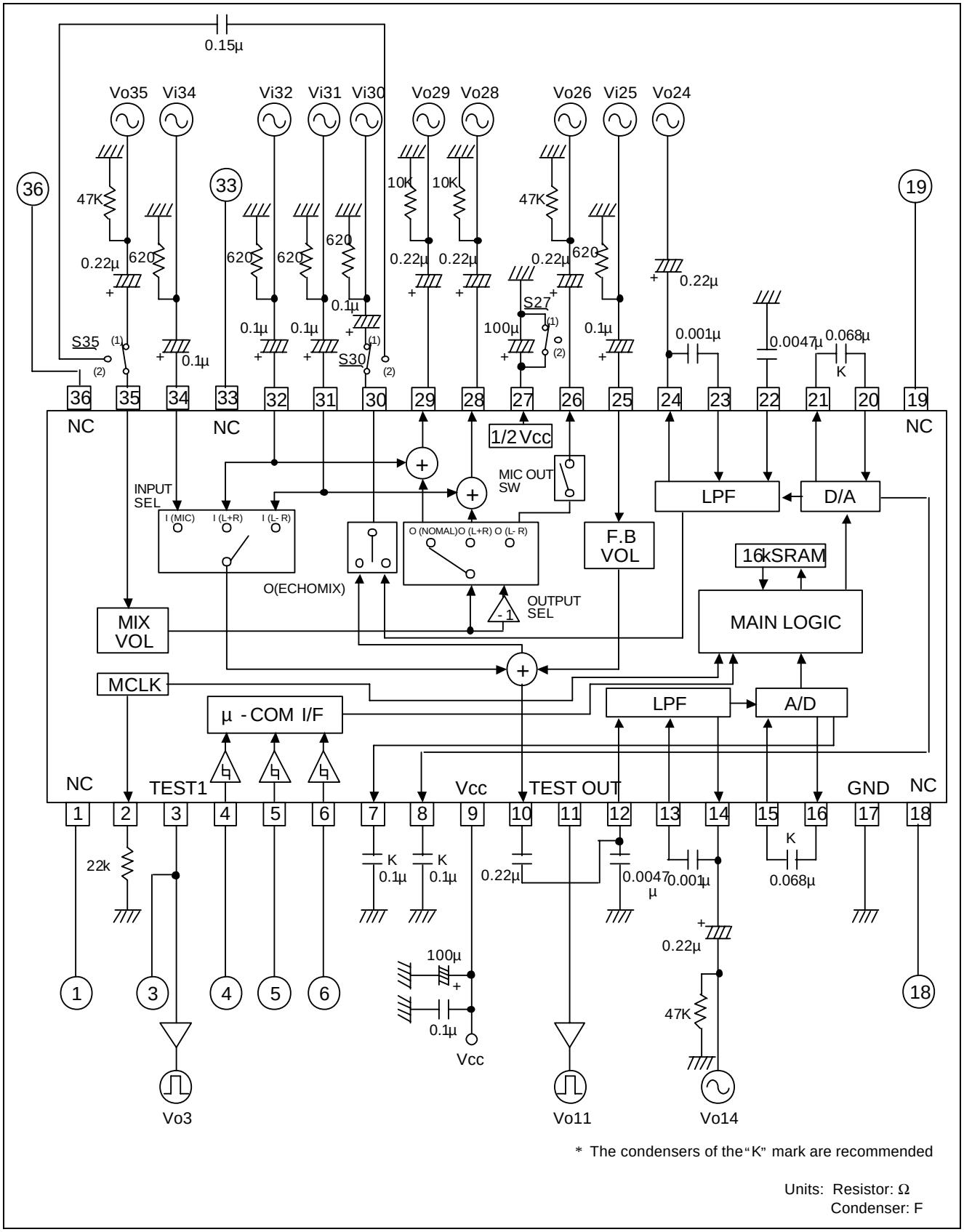
MIX VOLUME

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

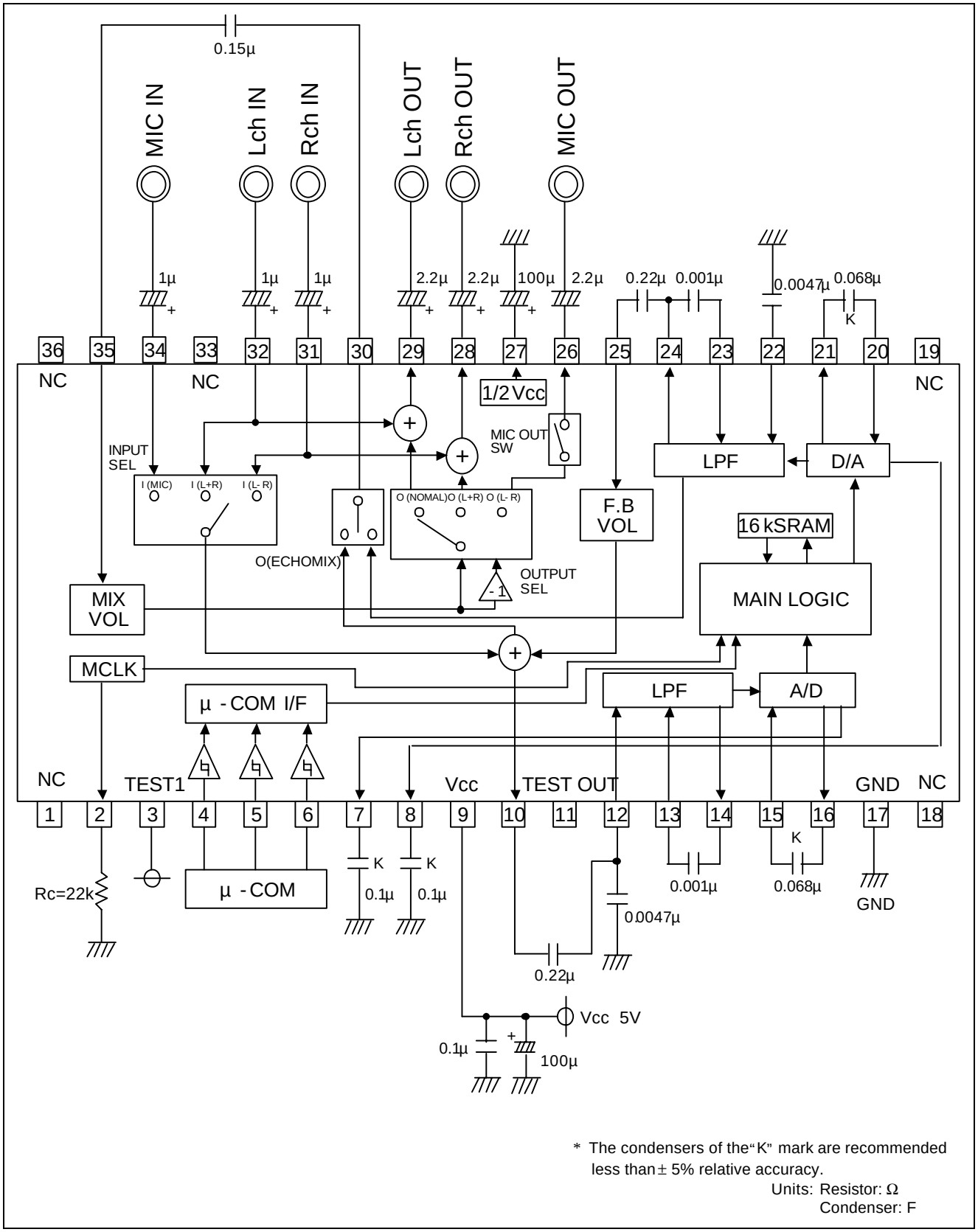
LINE AMP.

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



The Application Example



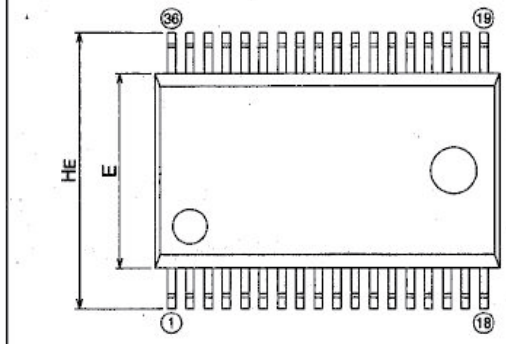
* The condensers of the "K" mark are recommended less than ± 5% relative accuracy.

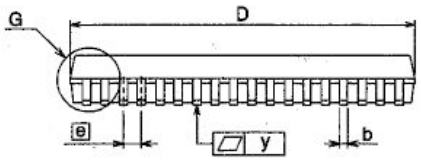
Units: Resistor: Ω
Condenser: F

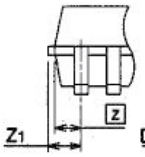
Package Outline

36P2R-D — **Plastic 36pin 450mil SSOP**

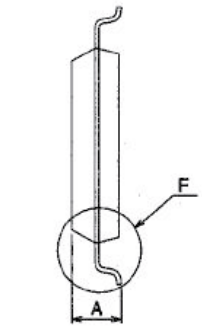
EIAJ Package Code	JEDEC Code	Weight(g)	Lead Material
SSOP36-P-450-0.80	–	0.53	Cu Alloy

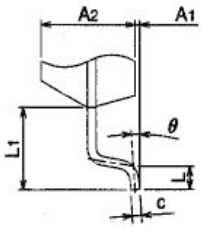




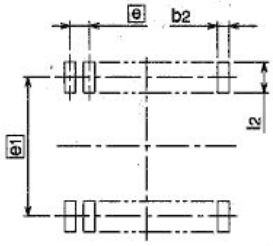


Detail G





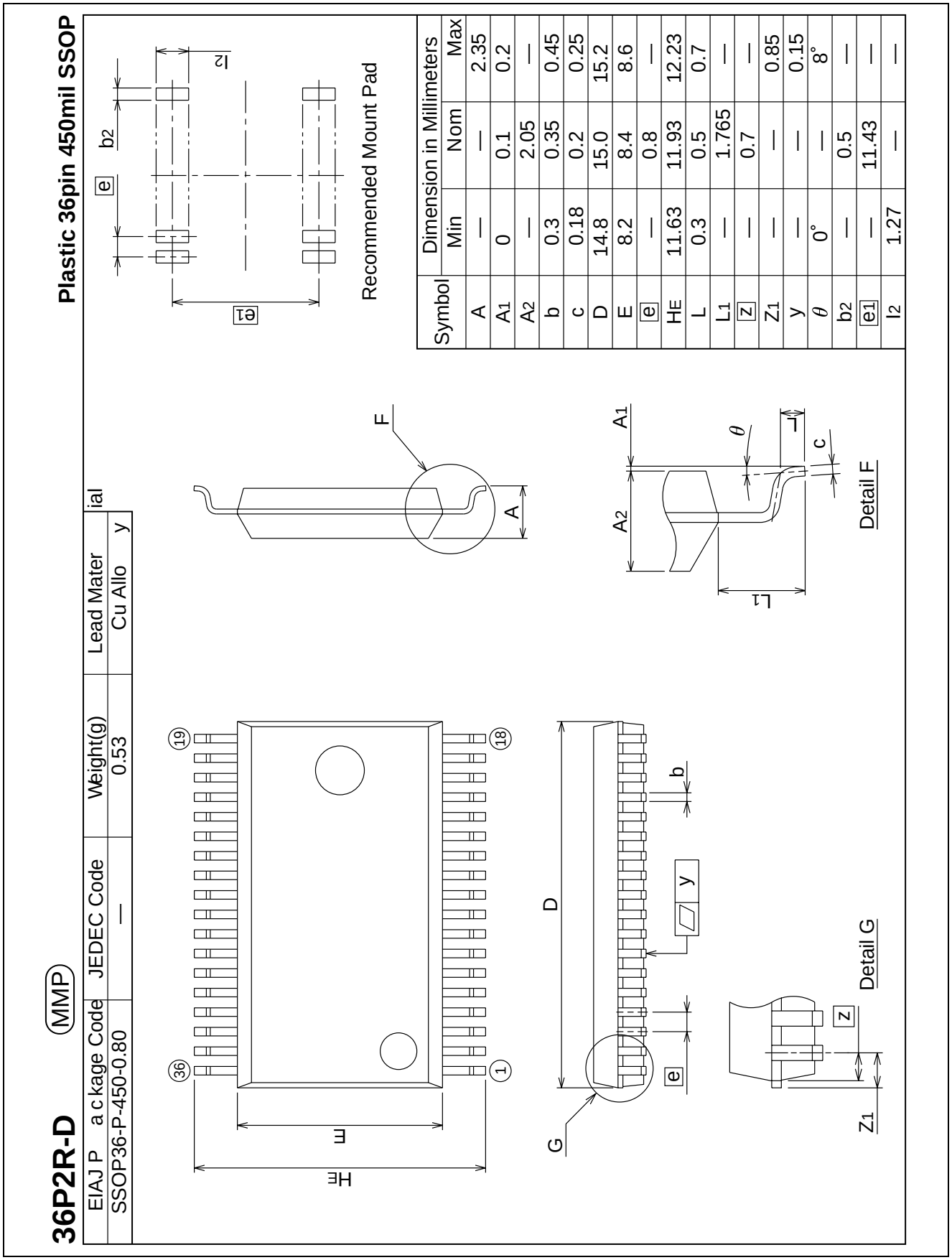
Detail F



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	–
Z	–	0.7	–
Z1	–	–	0.85
y	–	–	0.15
θ	0°	–	8°
b2	–	0.5	–
e1	–	11.43	–
l2	1.27	–	–

Package Dimensions



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