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2003年4月1日を以って株式会社日立製作所及び三菱電機株式会社のマイコン、ロジック、アナログ、ディスクリート半導体、及びDRAMを除くメモリ(フラッシュメモリ・SRAM等)を含む半導体事業は株式会社ルネサス テクノロジに承継されました。
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注:「高周波・光素子事業、パワーデバイス事業については三菱電機にて引き続き事業運営を行います。」

2003年4月1日
株式会社ルネサス テクノロジ
カスタマサポート部

RENESAS

M62464BFP

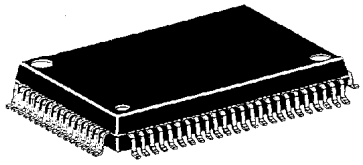
Dolby Pro Logic Surround Decoder with Discrete 5.1ch Analog Input

Dolby Pro Logic Surround Decoder with Discrete 5.1ch Analog Input

Description

The M62464BFP is a Single Chip Dolby Pro Logic Surround Decoder with Discrete 5.1ch Analog Input. This LSI has all of required functions for Dolby Pro Logic Surround and also 5.1ch analog input for Dolby Digital.

Outline

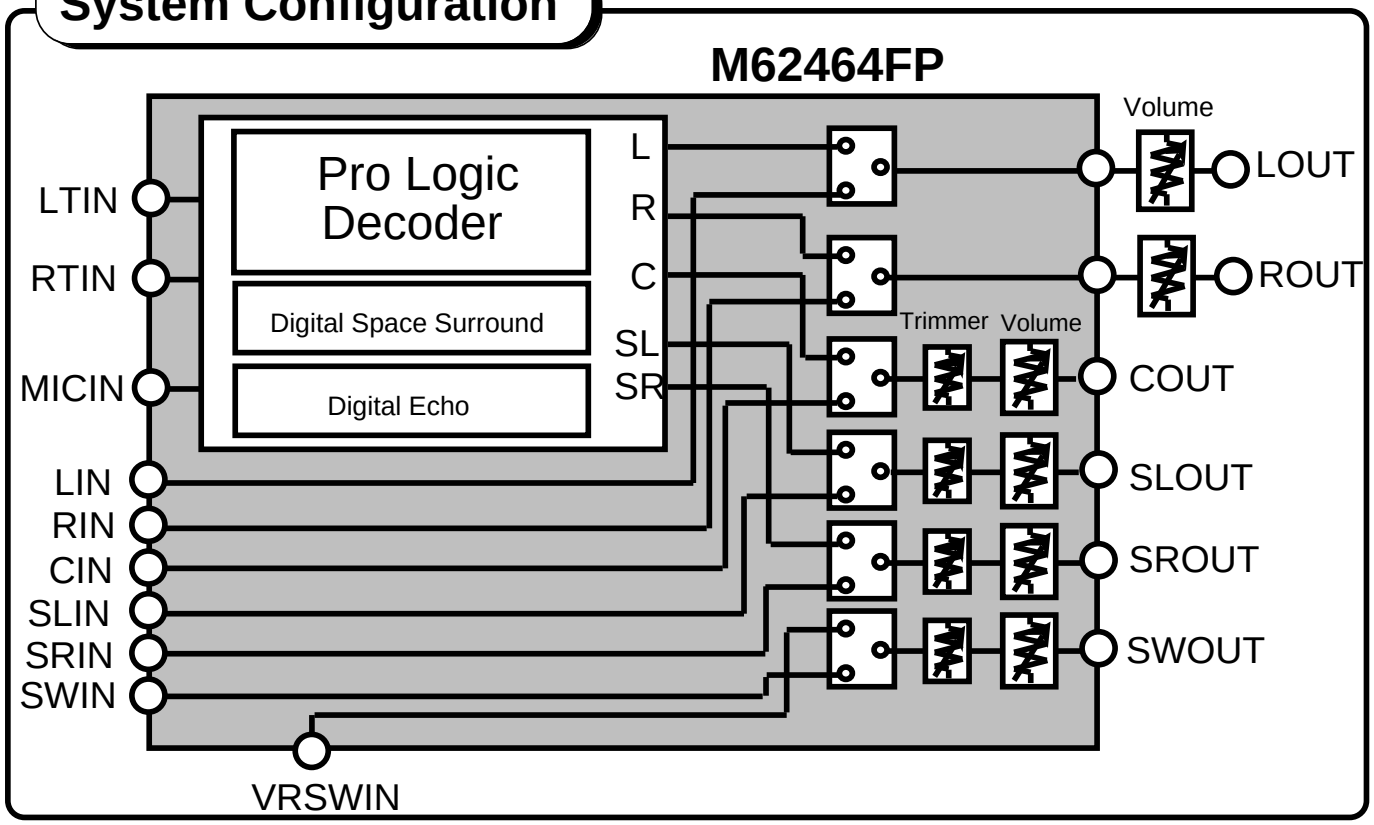


Outline 80P6N
0.8mm pitch QFP
(20.0mmx14.0mmx2.8mm)

Features

- **Includes all functions necessary for Dolby Pro Logic Surround**
- **Includes 5.1ch(L,R,C,SL,SR,SW) analog input for Dolby Digital**
- **4ch(C,SL,SR,SW) Master Volume**
- **Digital Space Surround such as Disco, Hall and Live**
- **Pseudo Stereo Surround for Digital Space Surround**
- **Digital Echo for Karaoke Function Delay time 123,184msec**
- **3-lines MCU control**
- **Current control oscillation circuit for system clock**

System Configuration



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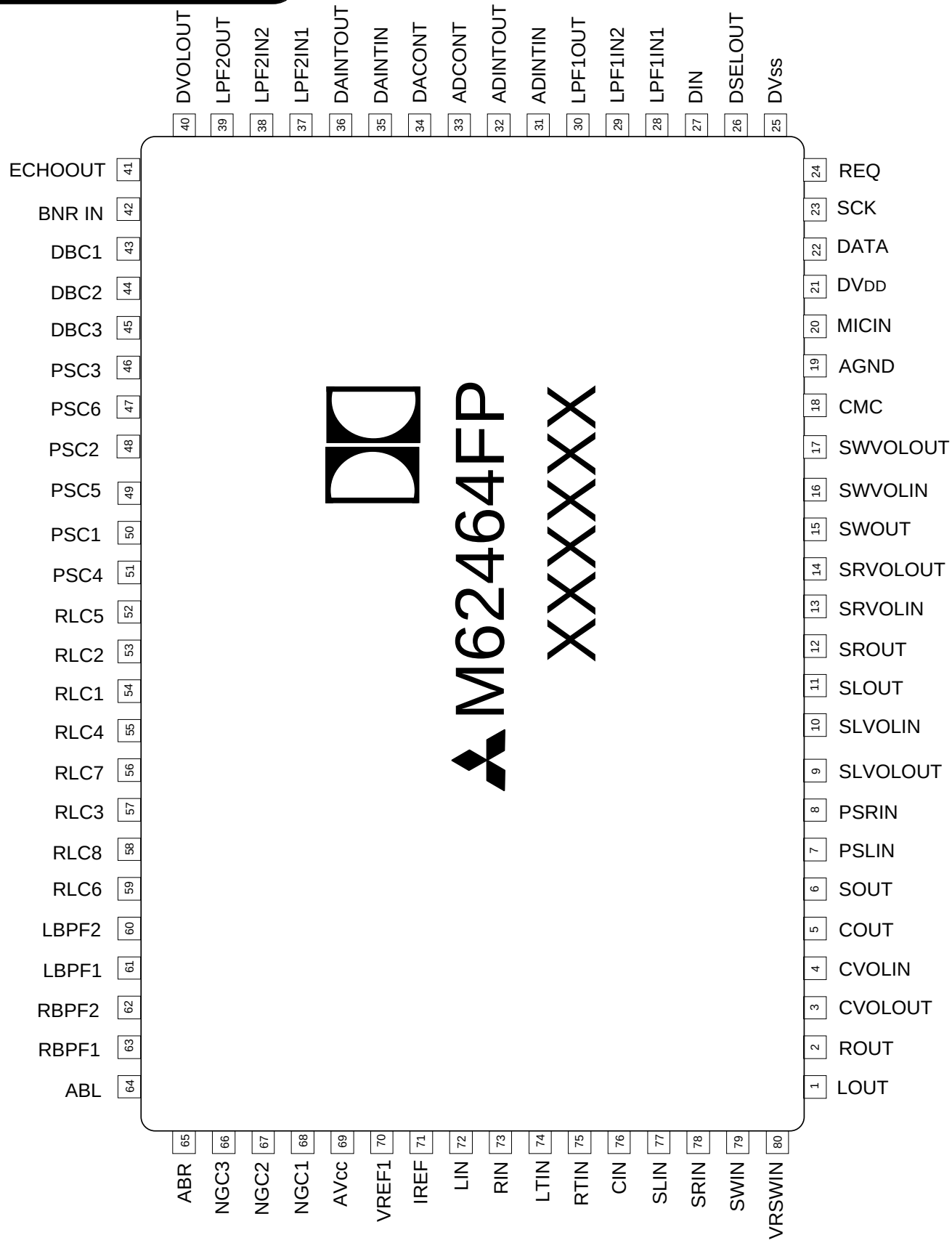
Dolby Pro Logic Surround Decoder with Discrete 5.1ch Analog Input

Pin Configuration



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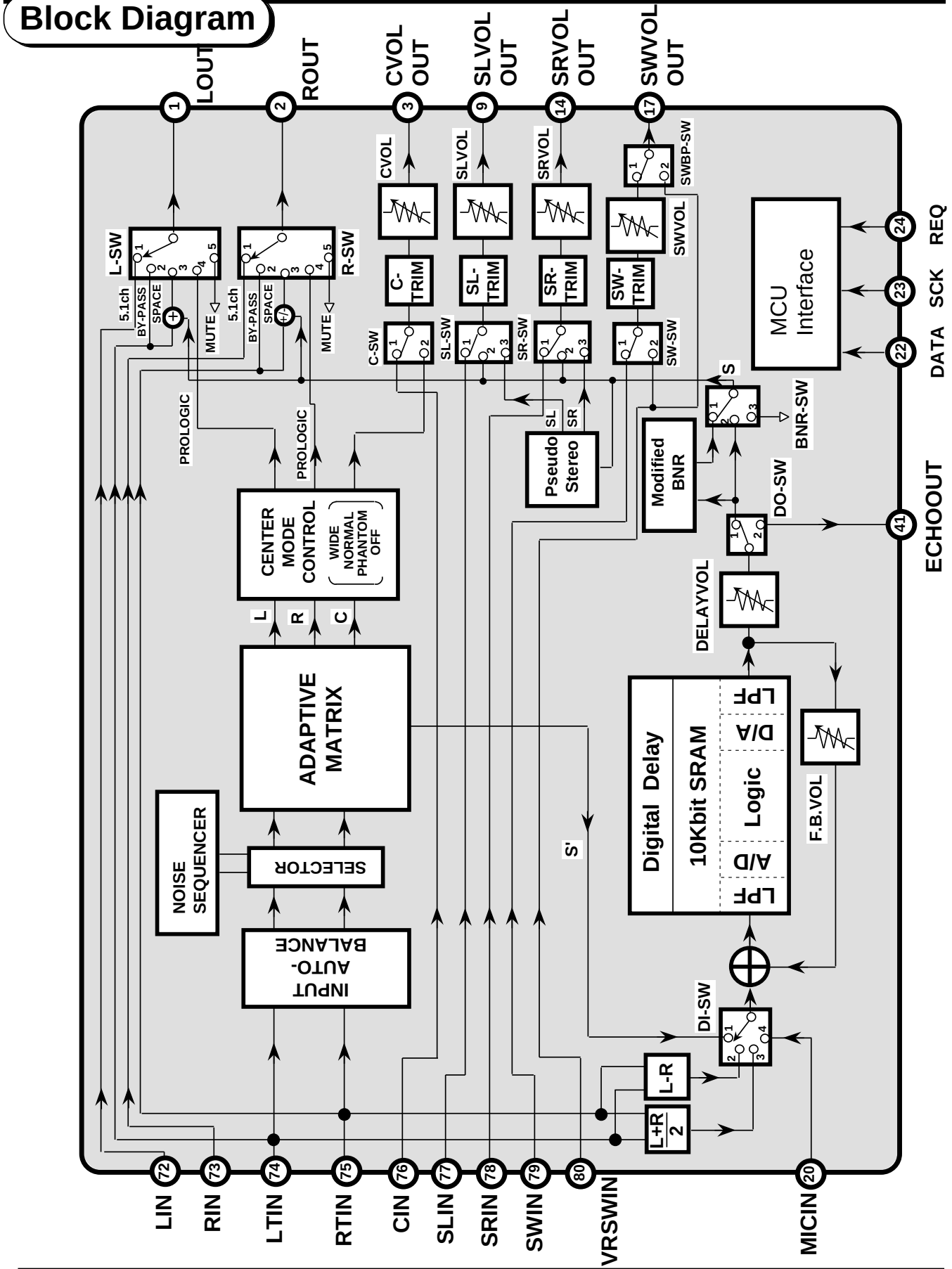
Dolby Pro Logic Surround Decoder with Discrete 5.1ch Analog Input

Block Diagram



FUNCTIONAL DESCRIPTION

	FUNCTION	DESCRIPTION
1	Fundamental function for Dolby Pro Logic Surround Decoder	-Adaptive Matrix -Input Auto-Balance -Noise Sequencer -Center Mode Control ON/OFF WIDE/NORMAL/PHANTOM -Modified Dolby B type Noise Reduction -4ch(L,R,C,S), 3ch(L,R,C) Mode Switch
2	5.1ch Analog Input for Dolby Digital	L,R,C,SL,SR,SW ch Analog Input Support
3	C,SL,SR,SW ch Master Volume	0 to -79dB/1dB step, and -∞
4	C,SL,SR,SW ch Trimmer	0 to -31dB/1dB step
5	RAM for Digital Delay	10K-bit RAM
6	Circuit for Space Surround and Echo	Digital delay circuit can be used for Space Surround such as a Disco, Hall or Live, and Karaoke echo.
7	Pseudo Stereo Surround	Pseudo Stereo Surround is available in Space Surround.
8	Digital Delay Time	Short Delay 15.4, 20.5, 25.6, 29.2, 51.2 msec Long Delay 123, 184 msec
9	Feedback Volume	Delay Signal Feedback Volume -3 to -21 dB/3dB step, and -∞
10	Delay Effect Volume	Delay Signal Effect Volume 0 to -18 dB/3dB step, and - ∞
11	Bypass Switch	Bypass the decode circuit
12	Output Mute	Mute the Lch and Rch output
13	MCU Interface	Controlled by 3-lines serial data from MCU Including the Chip Address (2 bit)
14	Current control oscillation circuit	Including the oscillation circuit without external parts.

ABSOLUTE MAXIMUM RATINGS

(Ta=25°C Unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
Vcc	Supply Voltage		10.5	V
VDD			6.5	V
Pd	Power Dissipation		1.4	W
Topr	Operating Temperature		-20 to +75	°C
Tstg	Storage Temperature		-40 to +125	°C

RECOMMENDED OPERATING CONDITION

Symbol	Parameter	Condition	Limits			Units
			Min	Typ	Max	
Vcc	Supply Voltage		8	9	10	V
VDD			4.5	5	5.5	V
VIL	Input Voltage(L)	22,23,24pin	0	—	0.8	V
VIH	Input Voltage(H)	22,23,24pin	2.2	—	VDD	V

ELECTRICAL CHARACTERISTICS

(Ta=25°C, Vcc=9V, V_{DD}=5V, 0dBd=300mVrms, at COUT, f=1kHz unless otherwise noted)

Symbol	Parameter	Test condition	Limits			Units
			Min.	Typ.	Max.	
Total						
Icc	Circuit current	No signal	—	30	45	mA
I_{DD}	Circuit current	No signal	—	15	25	mA
Auto-Balance						
CPR	Capture range		—	5	—	dB
CER	Error collection		—	4	—	dB
Adaptive Matrix						
ΔVoL	Output level accuracy relative to Cch	L,R,S'ch output	-0.5	0	0.5	dB
MR	Matrix rejection	L,R,C,S'ch output	25	40	—	dB
HRAM	Head room	THD=1%, L,R,Cch output	15	17	—	dB
THDAM	Total harmonic distortion	L,R,Cch output, 30kHz LPF	—	0.05	0.2	%
SNAM	S/N ratio	Rg=0Ω,weighted CCIR/ARM	70	80	—	dB
Noise Sequencer						
Vno	Output noise level	L,R,C,S'ch output	-15	-12.5	-10	dB
ΔVno	Noise level accuracy relative to Cch	L,R,S'ch output	-0.5	0	0.5	dB
Modified B-type Noise Reduction (0dB reference is 300mVrms/100Hz at SOUT)						
VGNR	Gain between input and output	Vin=0dBd,f=100Hz	3.8	6.8	9.8	dB
DEC1	Decode character 1	Vin=0dBd,f=1.0kHz	-1.6	-0.1	1.4	dB
DEC2	Decode character 2	Vin=-15dBd,f=1.4kHz	-3.0	-1.5	0	
DEC3	Decode character 3	Vin=-40dBd,f=5.0kHz	-6.8	-5.3	-3.8	
THDNR	Total harmonic distortion	Vin=0dBd,f=1kHz,30kHz LPF	—	0.07	0.3	%
HRNR	Head room	THD=1%	15	17	—	dB
SNNR	S/N ratio	Rg=0Ω,weighted CCIR/ARM	68	78	—	dB
Cch/SLch/SRch/SWch Master Volume						
ATT_{max}	Maximum attenuation	ATT=-∞,Vi=2Vrms	—	-95	-87	dB
ATT_{min}	Minimum attenuation	ATT=0dB,TRIM=0dB	-3.0	0	3.0	dB
VOLS1	Volume step1	ATT=0 to -40dB,TRIM=0dB	0.5	1.0	1.5	dB
VOLS2	Volume step2	ATT=-40 to -76dB,TRIM=0dB	0.2	1.0	1.8	dB
SNVOL	S/N ratio	ATT=-∞,CCIR/ARM	85	95	—	dB
Cch/SLch/SRch/SWch Trimmer						
$TRIM_{max}$	Maximum attenuation	TRIM=-31dB,VOLATT=0dB	-34	-31	-28	dB
$TRIM_{min}$	Minimum attenuation	TRIM=0dB,VOLATT=0dB	-3.0	0	3.0	dB
TRIMS	Teimmer step	VOLATT=0dB	0.6	1.0	1.4	dB
Line(Bypass)						
THDLN	Total harmonic distortion	30kHz LPF	—	0.002	0.05	%
SNLN	S/N ratio	DIN-AUDIO	95	100	—	dB
CTLN	Line cross-talk		70	80	—	dB
Zi	Input impedance		11	22	44	kΩ

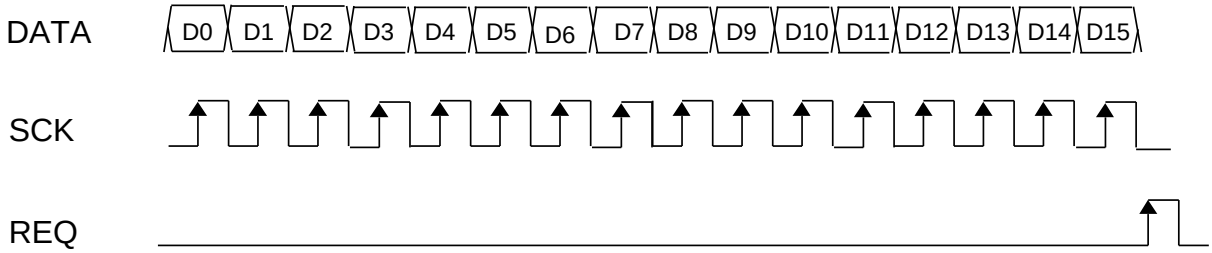
(Ta=25°C, Vcc=9V, V_{DD}=5V, 0dBd=300mVrms at COUT, f=1kHz unless otherwise noted)

Symbol	Parameter	Test conditions		Limits			Units
				Min.	Typ.	Max.	
Digital Delay							
GvD	Input/Output Voltage gain	DIN-DVOLOUT,DVOL=0dB		-3.0	0	+3.0	dB
Td	Delay time	Td=20.5ms		17.4	20.5	23.6	ms
THDD	Total harmonic distortion	30kHz LPF	Td=20.5ms	—	0.5	0.9	%
			Td=51.2ms	—	1.2	2.2	
			Td=184ms	—	3.0	5.6	
NoD	Output noise voltage	Vin=0Vrms JIS-A	Td=20.5ms	—	-92	-80	dBV
			Td=51.2ms	—	-84	-70	
			Td=184ms	—	-80	-65	
Vomax	Maximum output voltage	THD=10%		0.7	1.0	—	Vrms
LPFfc	LPF cut-off frequency	Td=15.4 to 51.2ms Gv=-3dB		6.0	7.0	8.0	kHz
		Td=123 to 184ms Gv=-3dB		—	3.0	—	kHz
Feedback volume							
$FBATT_{max}$	Maximum attenuation	ATT=-∞		—	-70	-60	dB
$FBATT_{min}$	Minimum attenuation	ATT=-3dB		-6.0	-3.0	0	dB
FBVOLS	Volume step			1.5	3.0	4.5	dB
Delay volume							
$DLATT_{max}$	Maximum attenuation	ATT=-∞		—	-70	-60	dB
$DLATT_{min}$	Minimum attenuation	ATT=0dB		-3.0	0	3.0	dB
DLVOLS	Volume step			1.5	3.0	4.5	dB

SERIAL DATA CONTROL FORMAT

(1)Data Input Format

DATA is read at the rising edge of SCK, and loaded last 16 bits at the rising edge of REQ.



D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15
L	L	L		Mode Set			Pro Logic Mode	Center Mode		Auto-Balance	Noise Sequencer			L	H
		H		"L"	Delay Time			Space Surround Mode							
L	H	L	L	Delay Volume			Cch Volume								
		L	H	Feedback Volume			SLch Volume								
		H	L				SRch Volume								
		H	H			SW-VOL Set	SWch Volume								
H	L	L		Cch Trimmer				SWch Trimmer							
		H		SLch Trimmer				SRch Trimmer							
H	H	Test Mode (user inhibit)													

Chip Address

(2)Control condition

Control Mode		Contents
1	Mode Set	5.1ch Input / Normal Stereo / Dolby Pro Logic / Space Surround / Echo / Mute
2	Pro Logic Mode	4ch Pro Logic / 3ch stereo
3	Center Mode	Wide / Normal / Phantom / OFF
4	Delay Time	15.4, 20.5, 25.6, 29.2,51.2 ms (Short delay) 123, 184ms (Long delay)
5	Noise Sequencer	ON / OFF Lch / Rch / Cch / Sch
6	Auto-Balance	Input Auto-Balance ON / OFF
7	Space Surround Mode	L / R Output : Dolby Pro Logic / Space Surround Delay input : S' / L-R / (L+R)/2 / MICIN Delay output mixing, BNR : ON / OFF Surround signal : Monaural / Pseudo Stereo
8	Delay Volume	0 to -18dB / 3dB step & -∞
9	Feedback Volume	-3 to -21dB / 3dB step & -∞
10	Master Volume	C,SL,SR,SWch Master Volume 0 to -79dB / 1dB step & -∞
11	Trimmer	C,SL,SR,SWch Trimmer 0 to -31dB /1dB step
12	SW Volume Set	SW Volume : Volume / Bypass
13	Chip Address	Input data effect or not

(3)Set Condition

a. Mode Set (D0="L",D1="L",D2="L")

D4	D5	D6	Condition
L	L	L	5.1ch Signal Input
L	L	H	Normal stereo (bypass)
L	H	L	Dolby Pro Logic Surround
L	H	H	Space Surround
H	L	L	Echo
H	L	H	Output Mute

b. Pro Logic Mode (D0="L",D1="L",D2="L")

D7	Condition
L	4ch Pro Logic
H	3ch Stereo

c. Center Mode (D0="L",D1="L",D2="L")

D8	D9	Condition
L	L	Wide
L	H	Normal
H	L	Phantom
H	H	OFF

d. Delay Time (D0="L",D1="L",D2="H")

D5	D6	D7	Delay Time	Sampling Frequency	LPF Cut-off Frequency
L	L	L	15.4msec	500kHz	7kHz
L	L	H	20.5msec	500kHz	
L	H	L	25.6msec	400kHz	
L	H	H	29.2msec	333kHz	
H	L	L	51.2msec	200kHz	
H	L	H	123msec	83.3kHz	3kHz
H	H	L	184msec	55.6kHz	

e. Noise Sequencer (D0="L",D1="L",D2="L")

D11	D12	D13	Condition	
L	-	-	Noise Sequencer OFF	
H	L	L	Noise Sequencer ON	Lch
	L	H		Rch
	H	L		Cch
	H	H		Sch

f. Auto-Balance (D0="L",D1="L",D2="L")

D10	Condition
L	Auto-Balance OFF
H	Auto-Balance ON

g. Space Surround Mode (D0="L",D1="L",D2="H")

L / R Output

D8	Condition
L	Dolby Pro Logic
H	Space Surround

Delay Mixing Polarity

D9	Mixing Polarity
L	L+Delay signal / R+Delay signal
H	L+Delay signal / R-Delay signal

Delay Input

D10	D11	Delay Input
L	X	S'
H	L	L-R
H	H	(L+R)/2

X : L or H

BNR

D12	BNR
L	OFF
H	ON

Surround Signal

D13	Surround Signal
L	Monaural
H	Pseudo Stereo

h. Delay Volume
(D0="L",D1="H",D2="L",D3="L")

D4	D5	D6	Volume
L	L	L	0dB
L	L	H	-3dB
L	H	L	-6dB
L	H	H	-9dB
H	L	L	-12dB
H	L	H	-15dB
H	H	L	-18dB
H	H	H	-∞

i. Feedback Volume
(D0="L",D1="H",D2="L",D3="H")

D4	D5	D6	Volume
L	L	L	-3dB
L	L	H	-6dB
L	H	L	-9dB
L	H	H	-12dB
H	L	L	-15dB
H	L	H	-18dB
H	H	L	-21dB
H	H	H	-∞

j. C,SL,SR,SW ch Volume (D0="L",D1="H")

Volume Level	D11	D10	D9	D8	D7
0 dB	L	L	L	L	L
-2 dB	L	L	L	L	H
-4 dB	L	L	L	H	L
-6 dB	L	L	L	H	H
-8 dB	L	L	H	L	L
-10 dB	L	L	H	L	H
-12 dB	L	L	H	H	L
-14 dB	L	L	H	H	H
-16 dB	L	H	L	L	L
-18 dB	L	H	L	L	H
-20 dB	L	H	L	H	L
-22 dB	L	H	L	H	H
-24 dB	L	H	H	L	L
-26 dB	L	H	H	L	H
-28 dB	L	H	H	H	L
-30 dB	L	H	H	H	H
-32 dB	H	L	L	L	L
-34 dB	H	L	L	L	H
-36 dB	H	L	L	H	L
-38 dB	H	L	L	H	H
-40 dB	H	L	H	L	L
-42 dB	H	L	H	L	H
-44 dB	H	L	H	H	L
-48 dB	H	L	H	H	H
-52 dB	H	H	L	L	L
-56 dB	H	H	L	L	H
-60 dB	H	H	L	H	L
-64 dB	H	H	L	H	H
-68 dB	H	H	H	L	L
-72 dB	H	H	H	L	H
-76 dB	H	H	H	H	L
-∞	H	H	H	H	H

Volume Level	D13	D12
0 dB	L	L
-1 dB	L	H
-2 dB	H	L
-3 dB	H	H

SW Volume Setting

D6 (D0="L",D1="H",D2="H",D3="H")	Condition	SWBP-SW
L	SW Volume Bypass	2
H	SW Volume Controlled	1

k. C,SL,SR,SW ch Trimmer (D0="H",D1="L")

Trimmer Level	D8	D7	D6	D5	D4
	D13	D12	D11	D10	D9
0 dB	L	L	L	L	L
-1 dB	L	L	L	L	H
-2 dB	L	L	L	H	L
-3 dB	L	L	L	H	H
-4 dB	L	L	H	L	L
-5 dB	L	L	H	L	H
-6 dB	L	L	H	H	L
-7 dB	L	L	H	H	H
-8 dB	L	H	L	L	L
-9 dB	L	H	L	L	H
-10 dB	L	H	L	H	L
-11 dB	L	H	L	H	H
-12 dB	L	H	H	L	L
-13 dB	L	H	H	L	H
-14 dB	L	H	H	H	L
-15 dB	L	H	H	H	H
-16 dB	H	L	L	L	L
-17 dB	H	L	L	L	H
-18 dB	H	L	L	H	L
-19 dB	H	L	L	H	H
-20 dB	H	L	H	L	L
-21 dB	H	L	H	L	H
-22 dB	H	L	H	H	L
-23 dB	H	L	H	H	H
-24 dB	H	H	L	L	L
-25 dB	H	H	L	L	H
-26 dB	H	H	L	H	L
-27 dB	H	H	L	H	H
-28 dB	H	H	H	L	L
-29 dB	H	H	H	L	H
-30 dB	H	H	H	H	L
-31 dB	H	H	H	H	H

When (Trimmer level)+(Master Volume) is less than -87dB, total attenuation level is set to -87dB.

I. Chip Address

D14	D15	Data Read
L	H	Enable
Others		Unable

Relation between mode setting and switch condition

Mode Setting	Pro Logic Mode (D0=L,D1=L D2=L)	Space Surround Mode (D0=L,D1=L,D2=H)					Switch Condition								
	D7	D8	D10	D11	D12	D13	L-SW	R-SW	C-SW	SL-SW	SR-SW	SW-SW	DI-SW	DO-SW	BNR-SW
5.1ch Signal Input	X	X	X	X	X	X	1	1	1	1	1	1	4	2	3
Normal stereo	L *3	X	L *2	X *2	L *3	L *1	2	2	2	2 *1	2 *1	2	1 *2	1	2 *3
			H	L	H	H				3	3		2		1
	H			H	X								3		3
Dolby Pro Logic Surround	L	X	X	X	X	X	4	4	2	2	2	2	1	1	1
	H														3
Space Surround	X	L *4	L *2	X *2	L *3	L *1	4 *4	4 *4	2	2 *1	2 *1	2	1 *2	1	2 *3
		H	H	L	H	H	3	3		3	3		2		1
				H									3		
Echo	X	X	X	X	X	X	2	2	1	1	1	2	4	2	3
Mute	X	X	X	X	X	X	5	5	1	1	1	2	4	2	3

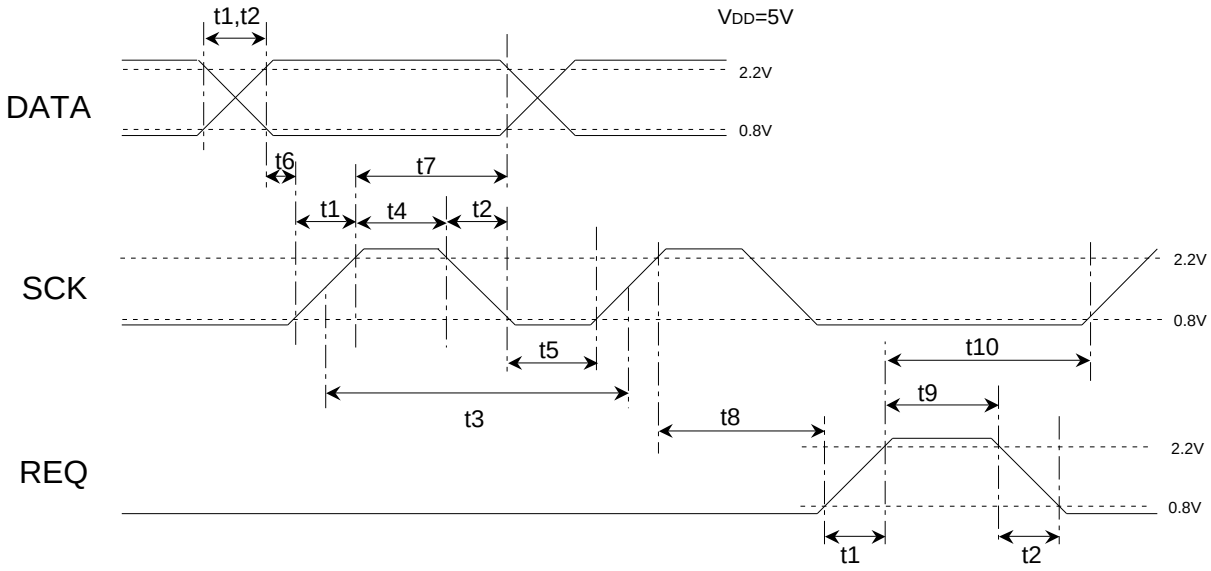
X: L or H

At Bypass or Space Surround Mode, the condition of SL-SW,SR-SW,DI-SW and BNR-SW depend on D7,D10,D11,D12 and D13 settings.

SL-SW,SR-SW : depend on D13 ------> *1
DI-SW : depend on D10 and D11----->*2
BNR-SW : depend on D7 and D12------*3

At Space Surround Mode, the condition of L-SW and R-SW depend on D8.------>*4

(4)Data Timing



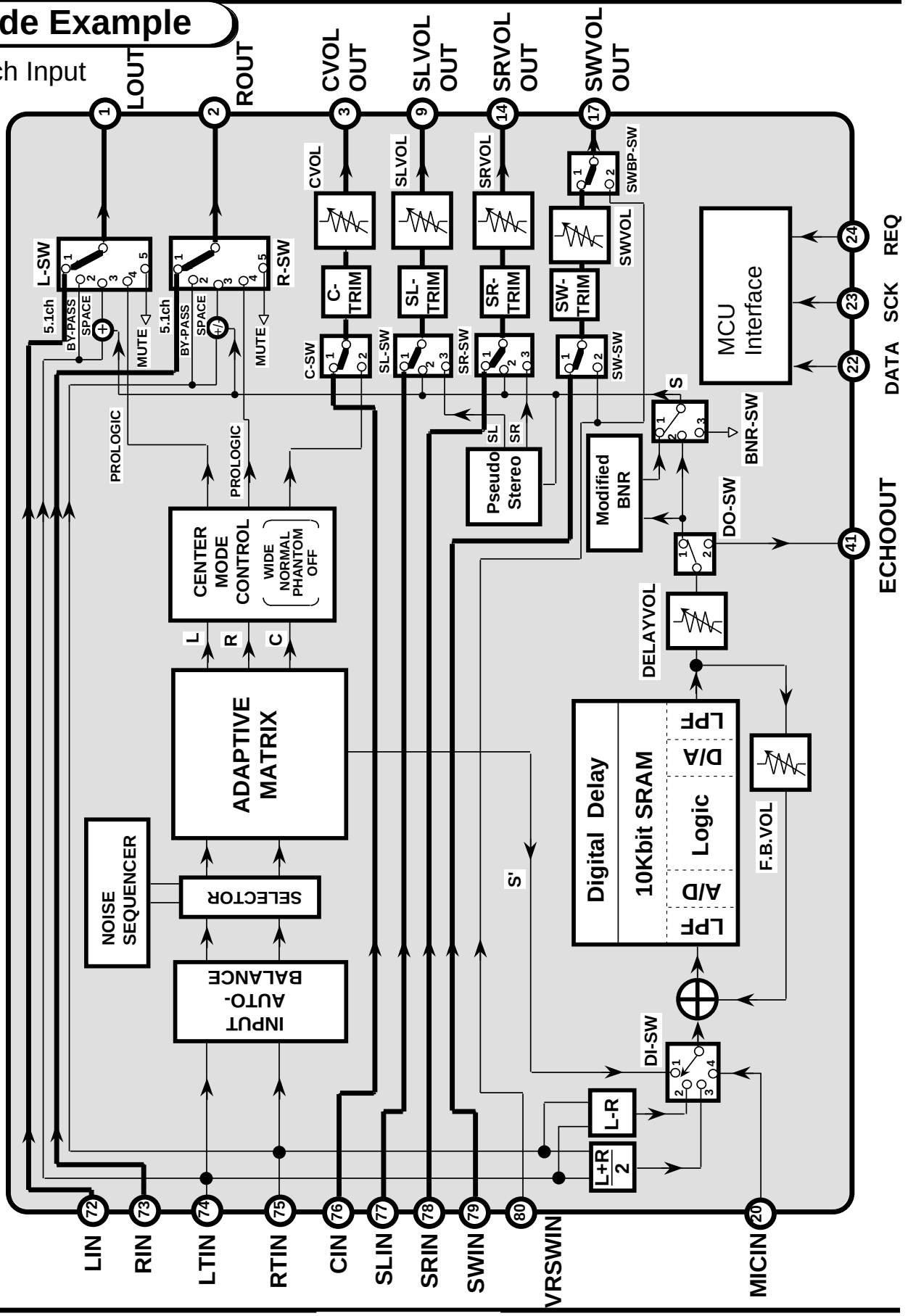
Symbol	Name	Min	Typ	Max	Units
t1	Signal rise time	——	——	0.5	µs
t2	Signal fall time	——	——	0.5	µs
t3	SCK clock width	2	——	——	µs
t4	SCK "H" pulse width	0.8	——	——	µs
t5	SCK "L" pulse width	0.8	——	——	µs
t6	DATA setup time	0.8	——	——	µs
t7	DATA hold time	0.8	——	——	µs
t8	REQ rise hold time	1.6	——	——	µs
t9	REQ "H" pulse width	0.8	——	——	µs
t10	SCK setup time	1.6	——	——	µs

M62464BFP

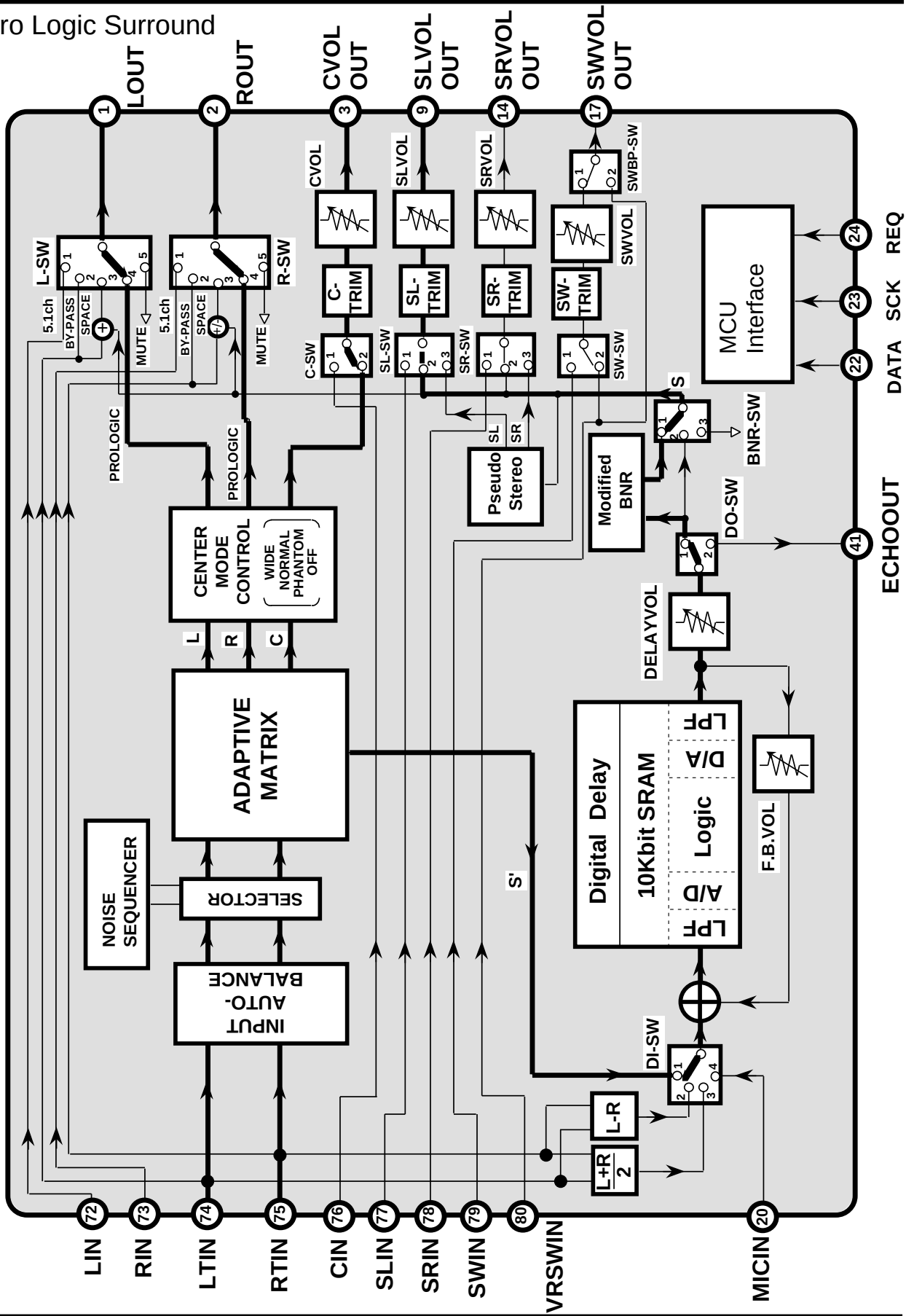
Dolby Pro Logic Surround Decoder with Discrete 5.1ch Analog Input

Mode Example

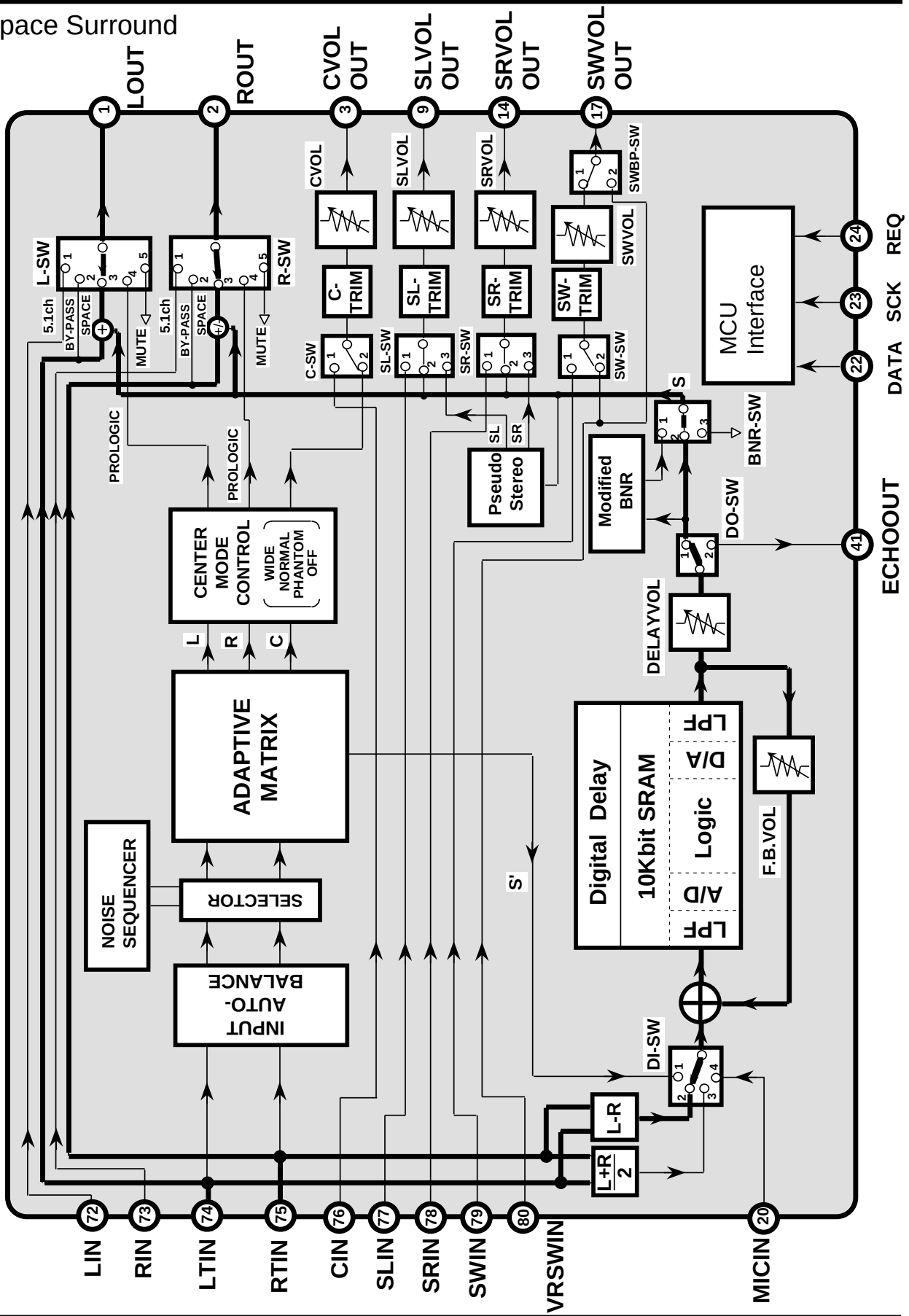
(1)5.1ch Input



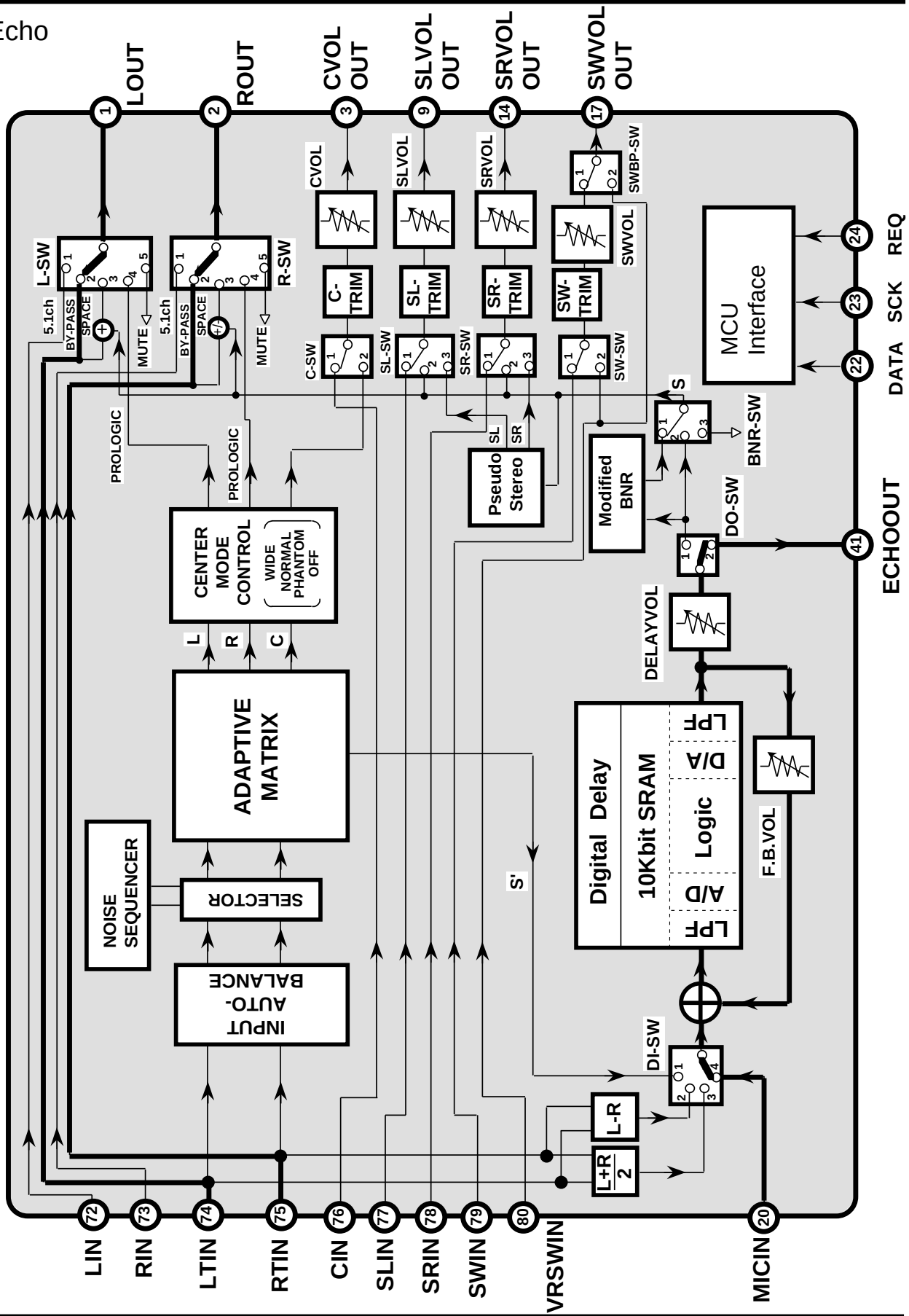
(2)Pro Logic Surround



(3)Space Surround



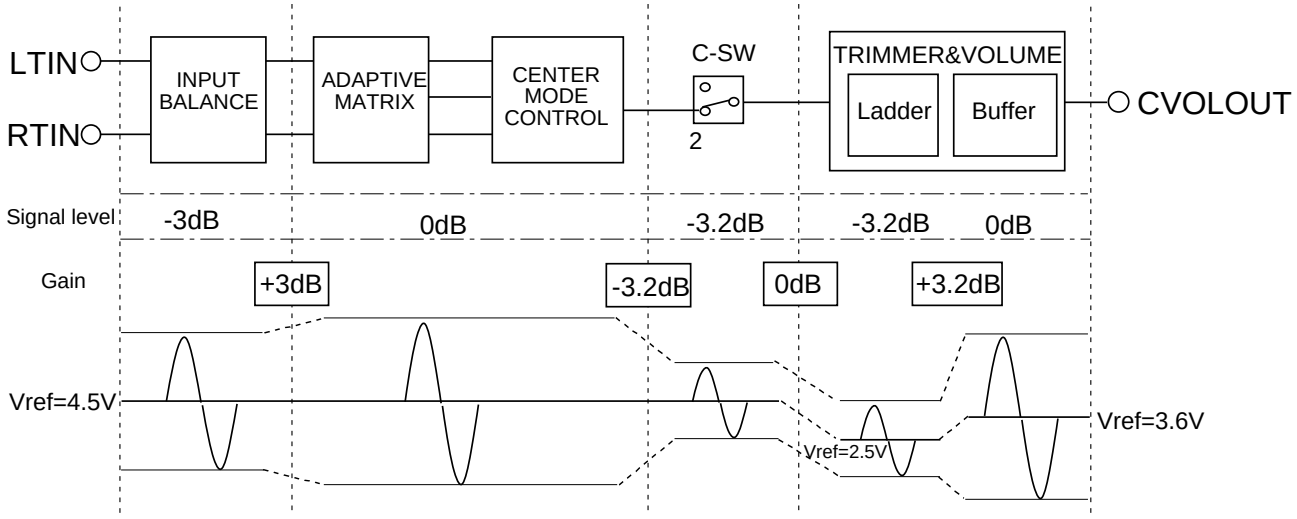
(4)Echo


LOUT
ROUT
CVOL OUT
SLVOL OUT
SRVOL OUT
SWVOL OUT
L-SW
R-SW
5.1ch
BY-PASS
SPACE
MUTE
CVOL
SLVOL
SRVOL
SWBP-SW
SWVOL
C-TRIM
SL-TRIM
SR-TRIM
SW-TRIM
C-SW
SL-SW
SR-SW
SW-SW
MCU Interface
DATA
SCK
REQ
S
BNR-SW
PROLOGIC
Pseudo Stereo
SL
SR
Modified BNR
DO-SW
ECHOOUT
CENTER MODE CONTROL
WIDE
NORMAL
PHANTOM
OFF
L
R
C
DELAYVOL
ADAPTIVE MATRIX
Digital Delay
10Kbit SRAM
LPF
D/A
Logic
A/D
F.B.VOL
NOISE SEQUENCER
SELECTOR
INPUT AUTO-BALANCE
S'
DI-SW
L-R
L+R/2
LIN
RIN
LTIN
RTIN
CIN
SLIN
SRIN
SWIN
VRSWIN
MICIN

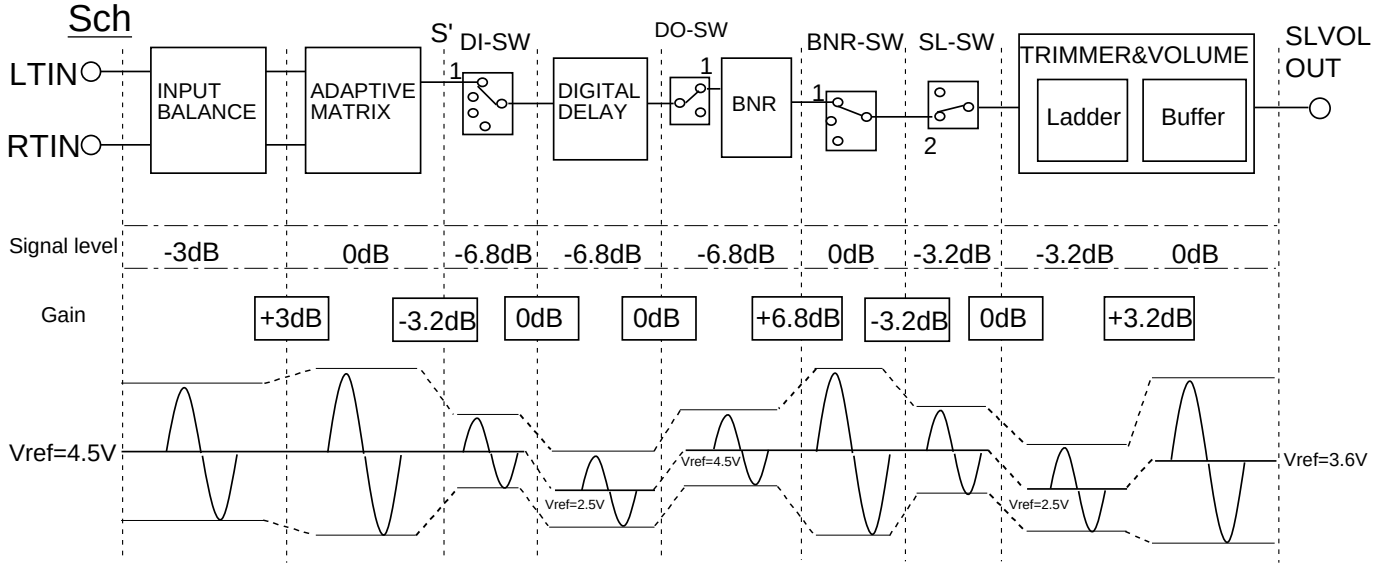
Level Diagram

(1)Dolby Pro Logic Surround Mode

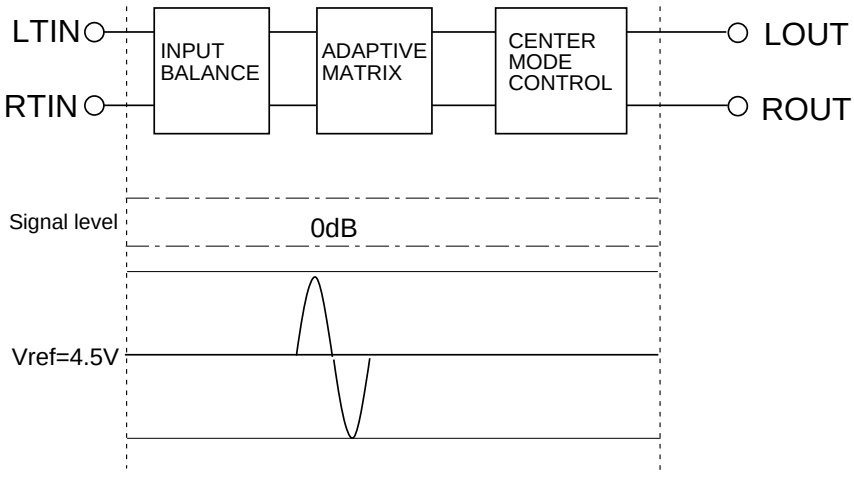
Cch



Sch



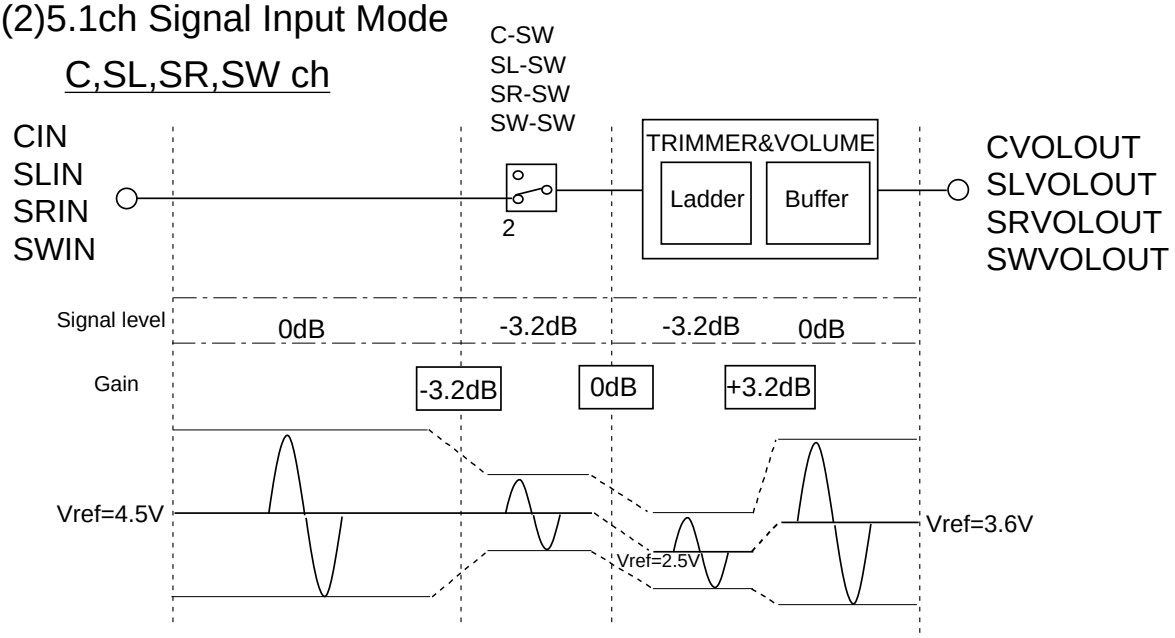
Lch,Rch



Signal level : 0dB=300mVrms(typ.)

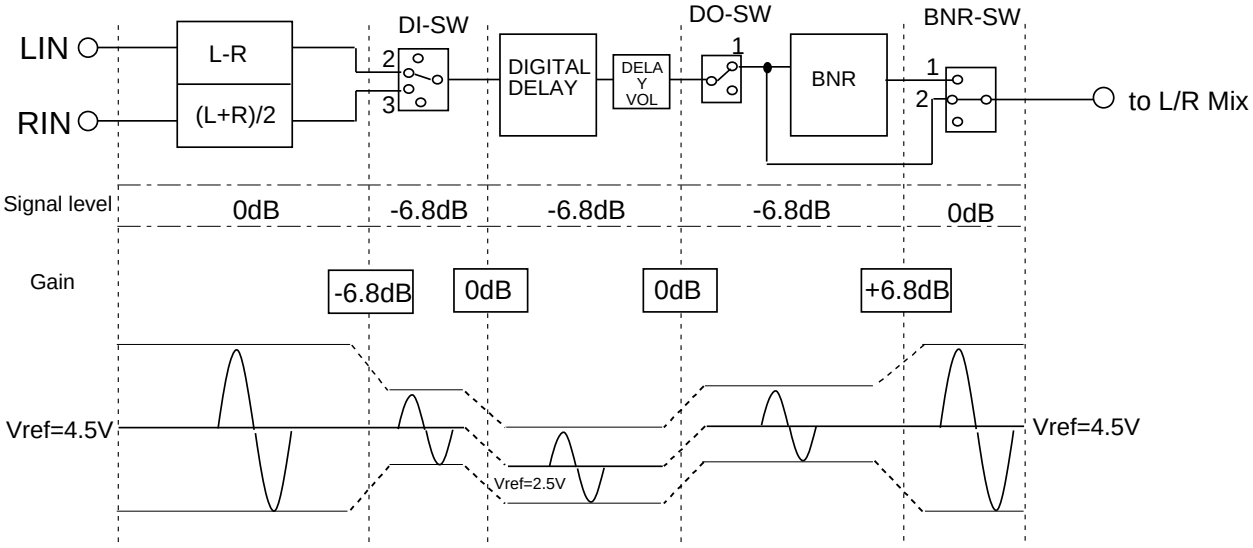
(2)5.1ch Signal Input Mode

C,SL,SR,SW ch

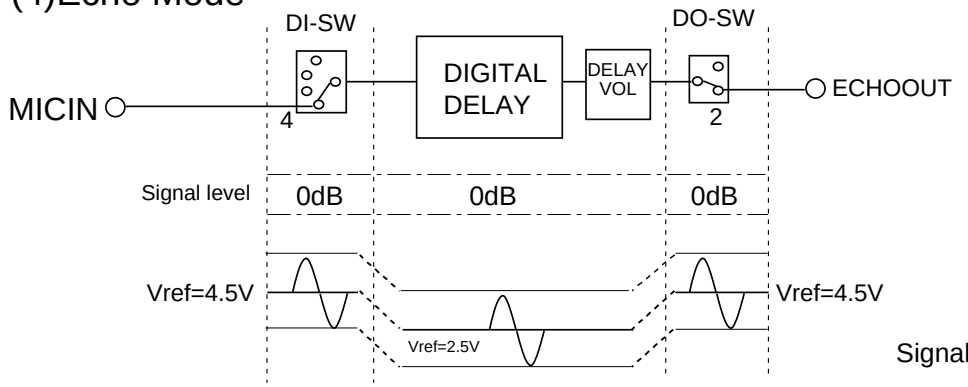


(3)Space Surround Mode

Delay Signal



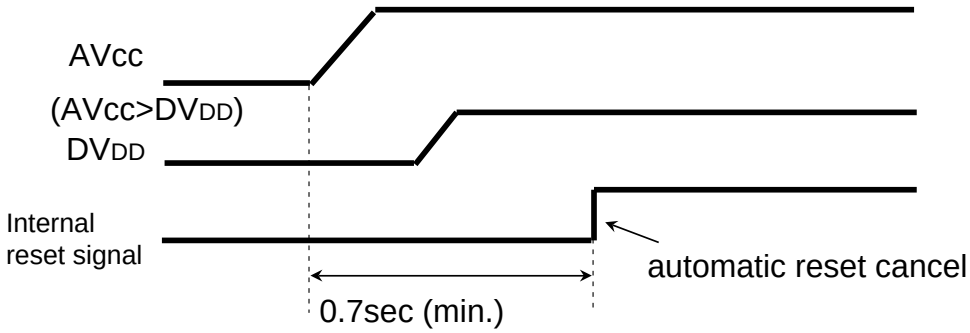
(4)Echo Mode



Signal level : 0dB=300mVrms(typ.)

Notice

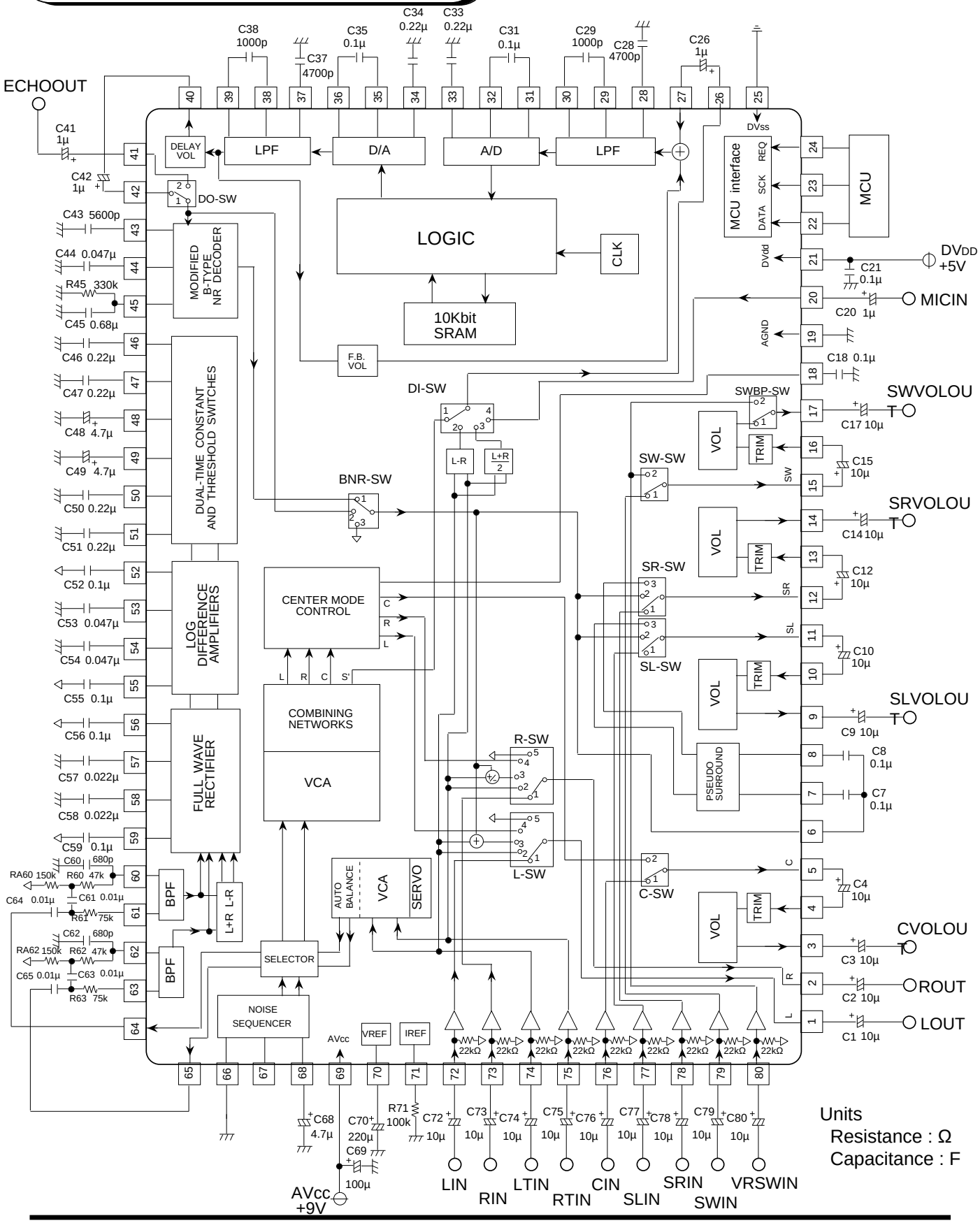
Relation AVcc and DV_{DD} at power supply
Digital V_{DD} must be supplied less than 0.7 seconds from analog Vcc supply.



M62464BFP

Dolby Pro Logic Surround Decoder with Discrete 5.1ch Analog Input

APPLICATION EXAMPLE



Units
Resistance : Ω
Capacitance : F

EXTERNAL PARTS LIST

Parts No.	Values	Unit	Tol.	Parts No.	Values	Unit	Tol.
C1	10	µF		C57	0.022	µF	5%
C2	10	µF		C58	0.022	µF	5%
C3	10	µF		C59	0.1	µF	20%
C4	10	µF		C60	680	pF	5%
C7	0.1	µF		C61	0.01	µF	5%
C8	0.1	µF		C62	680	pF	5%
C9	10	µF		C63	0.01	µF	5%
C10	10	µF		C64	0.01	µF	5%
C12	10	µF		C65	0.01	µF	5%
C14	10	µF		C68	4.7	µF	
C15	10	µF		C69	100	µF	
C17	10	µF		C70	220	µF	
C18	0.1	µF	10%	C72	10	µF	
C20	1.0	µF		C73	10	µF	
C21	0.1	µF		C74	10	µF	
C26	1.0	µF		C75	10	µF	
C28	4700	pF	5%	C76	10	µF	
C29	1000	pF	5%	C77	10	µF	
C31	0.1	µF	5%	C78	10	µF	
C33	0.22	µF	5%	C79	10	µF	
C34	0.22	µF	5%	C80	10	µF	
C35	0.1	µF	5%				
C37	4700	pF	5%				
C38	1000	pF	5%				
C41	1.0	µF					
C42	1.0	µF					
C43	5600	pF	5%				
C44	0.047	µF	5%	R45	330	kΩ	10%
C45	0.68	µF	10%	R60	47	kΩ	5%
C46	0.22	µF	10%	RA60	150	kΩ	5%
C47	0.22	µF	10%	R61	75	kΩ	5%
C48	4.7	µF	20%	R62	47	kΩ	5%
C49	4.7	µF	20%	RA62	150	kΩ	5%
C50	0.22	µF	10%	R63	75	kΩ	5%
C51	0.22	µF	10%	R71	100	kΩ	5%
C52	0.1	µF	20%				
C53	0.047	µF	5%				
C54	0.047	µF	5%				
C55	0.1	µF	20%				
C56	0.1	µF	20%				