

MITSUBISHI SOUND PROCESSORS
M62460FP
 “Super Single Chip” Surround Processor
 with Dolby Pro Logic Decoder

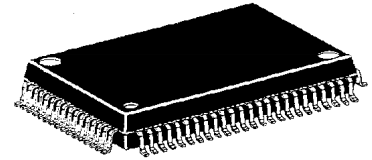
DESCRIPTION

The M62460FP is a “super” single chip LSI supporting the Dolby Pro Logic surround. This LSI contains all sorts of functions including delay circuit function. In addition, it has Digital Space Surround functions (Disco, Hall, Live mode etc.) and echo function for karaoke.

Note: Use of this LSI requires the license of Dolby Laboratories Licensing Corporation

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Outline

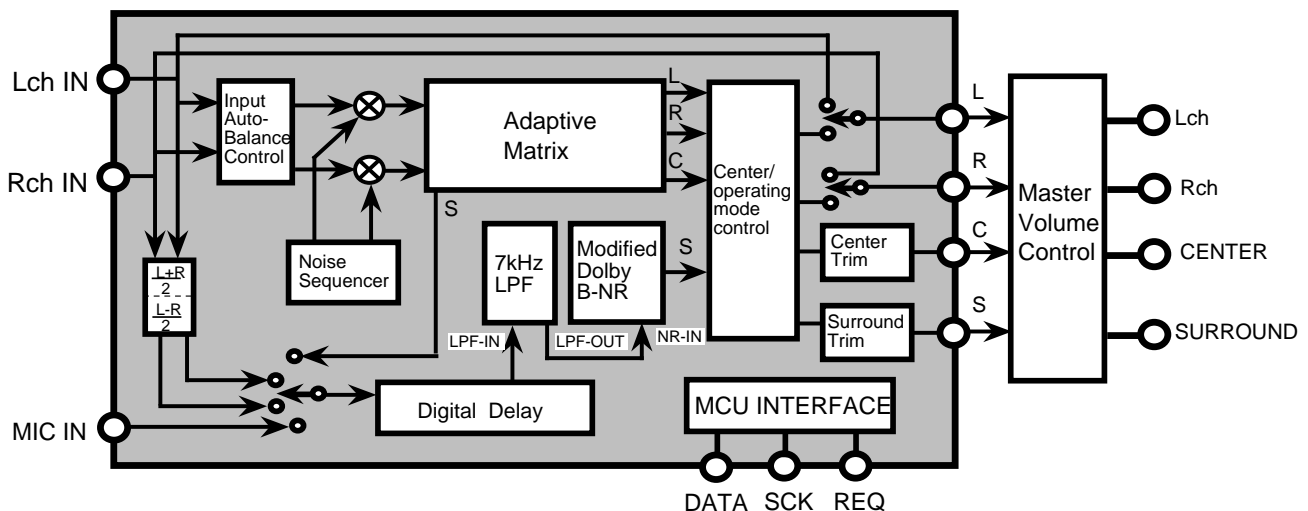


Outline 80P6N
 0.8mm pitch QFP
 (20.0mmX14.0mmX2.8mm)

Features (Mode)

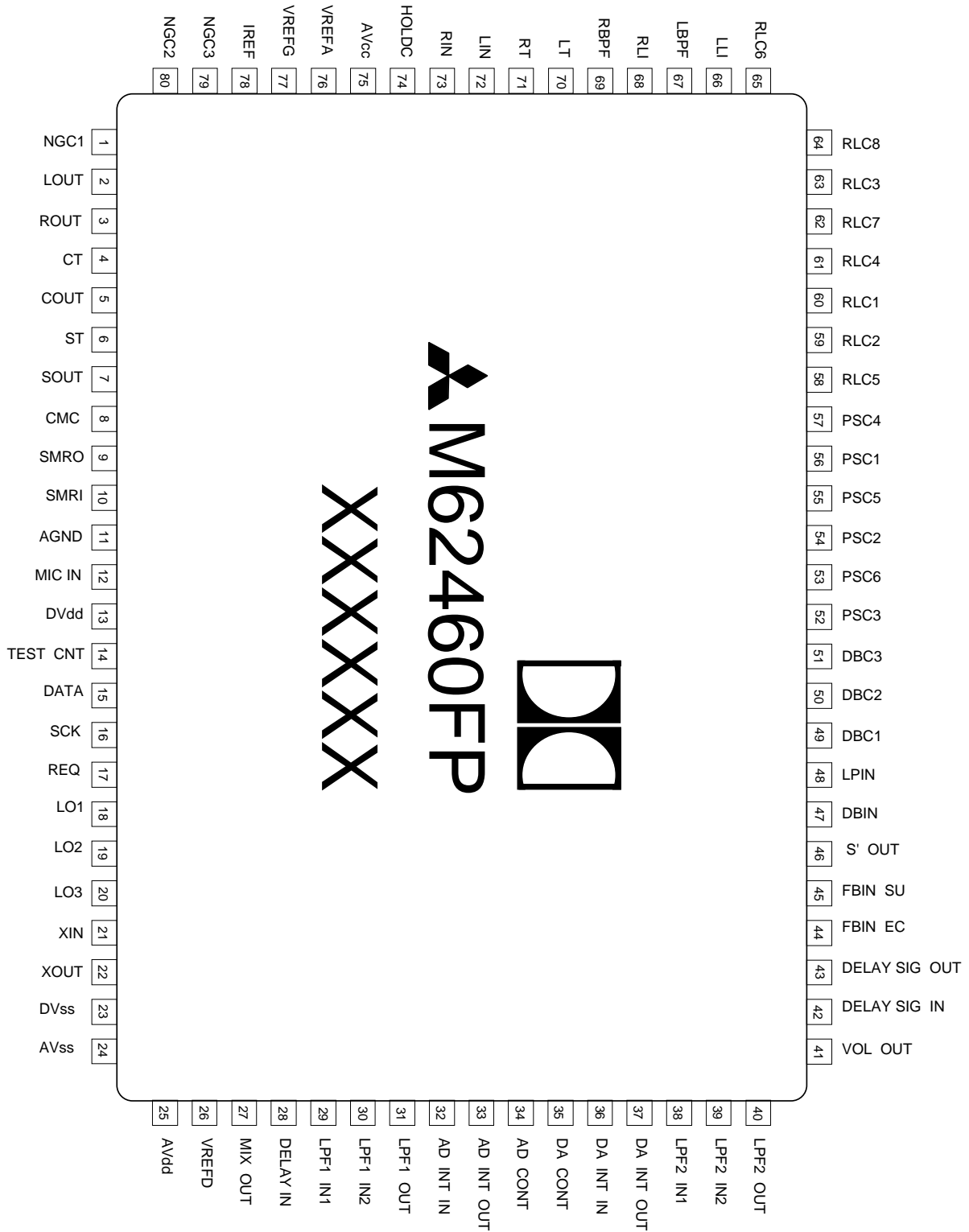
Dolby Pro Logic	Dolby Pro Logic Surround System which includes all of required functions.
Digital Space Surround	DISCO, Hall, LIVE mode and 5 delay time positions
Echo (KARAOKE)	Short echo: td=147.5msec, Long echo: td=196.6msec
BY-PASS	Input signal through mode

System Configuration



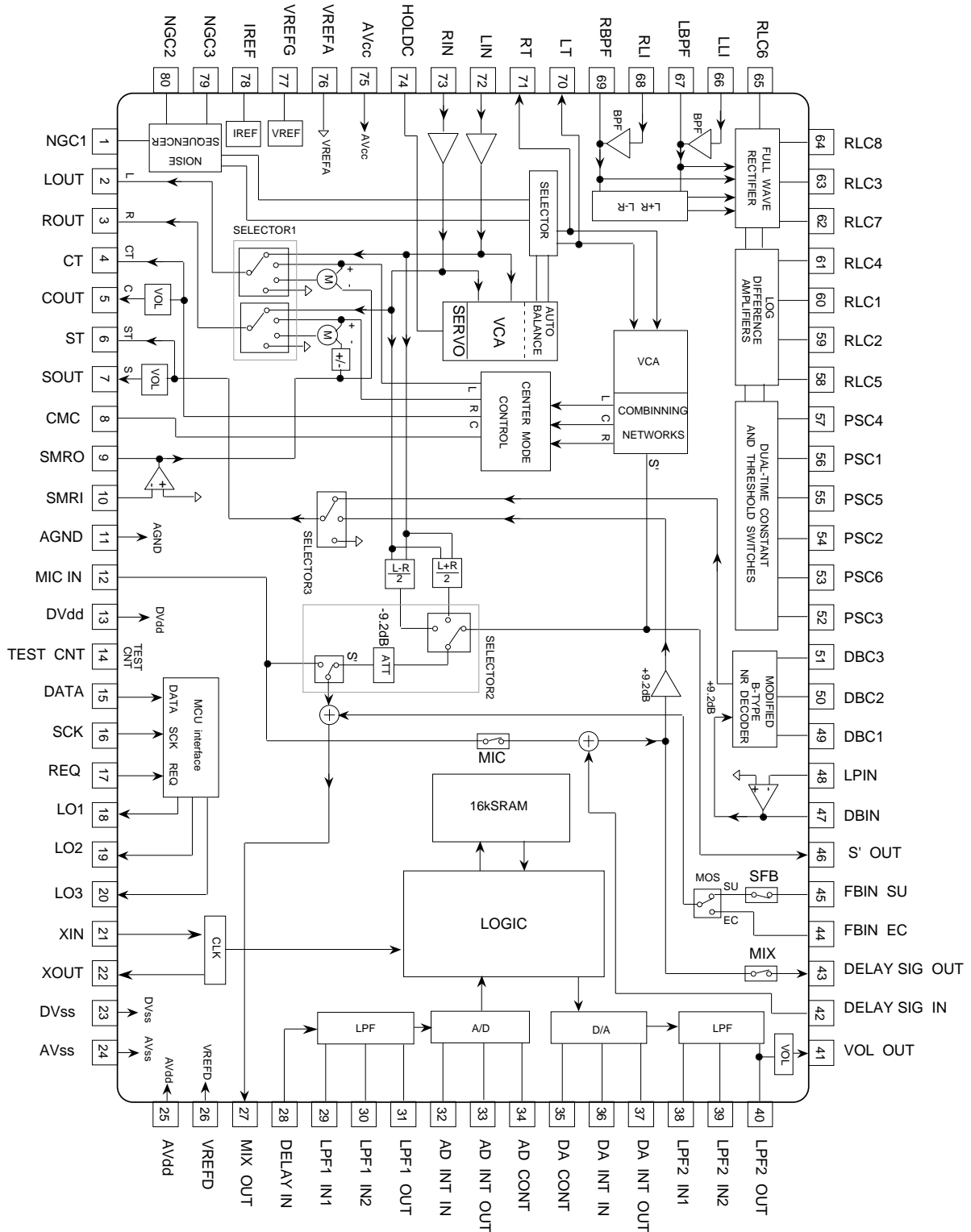
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PIN CONFIGURATION



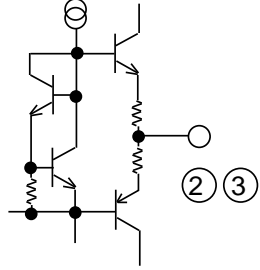
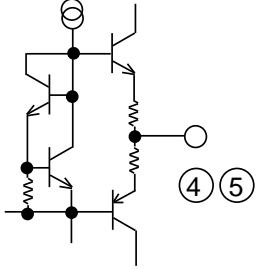
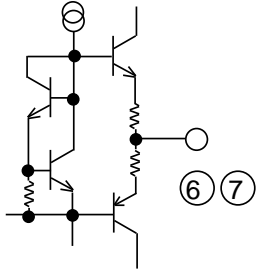
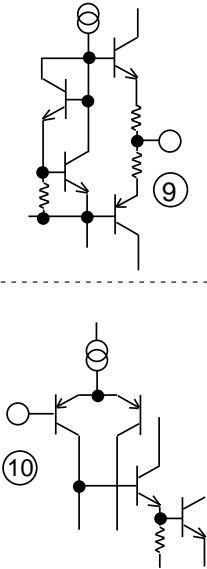
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BLOCK DIAGRAM



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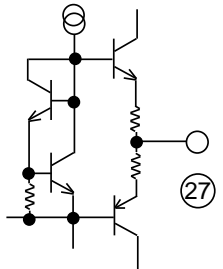
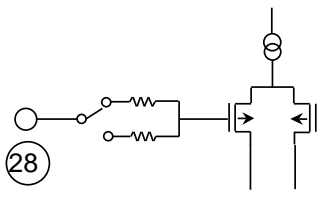
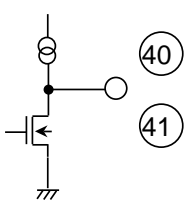
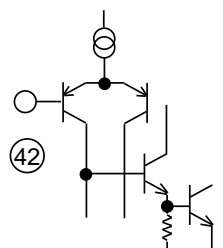
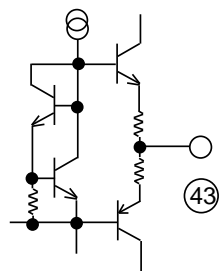
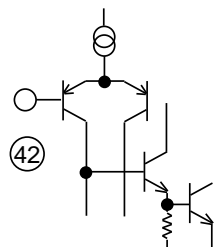
7. Discription of pin

No.	Symbol	Funtion	Voltage	Discription of pin	Equivalent circuit
②	LOUT	Lch output	4V	Direct output R-/L- channel when the operation mode is BY-PASS. When the mode is 4channel,they output Dolby prologic R-/L-channel signals.	
③	ROUT	Rch output			
④	CT	Cch output	4V	No output any signals when the operation mode is centermode is OFF or set to PHANTOM COUT is output from C.Trimmer.	
⑤	COUT	Cch output			
⑥	ST	Sch output	4V	This pin outputs surround signals.Output is selected from BNR out.Dout No output signal when the operation mode is 3 STEREO/MUTE. SOUT is output from S.Trimmer.	
⑦	SOUT	Sch output			
⑨	SMRO	amplifier output	4V	This is a amplifier to control mixed level of surround output with external resistance.	
⑩	SMRI	amplifier input]			

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No.	Symbol	Funtion	Voltage	Discription of pin	Equivalent circuit
⑫	MIC IN	MIC input	4V	Microphone input with ECHO MODE	
⑭	TEST CNT	TEST control	0	Fixed to GND	
⑮	DATA	serial data "DATA" input	—	input via serial data from MCU.	
⑯	SCK	serial data "SCK" input	0		
⑰	REQ	serial data "REQ" input			
⑱	LO1	port output	—	Open collector output pin(NPN Tr)	
⑲	LO2				
⑳	LO3				
㉑	XIN	Osillator input	—	connect a 4 - MHz ceramic resonator	
㉒	XOUT	Osillator output			
㉔	VREFD	reference output	2.5V	1/2 Vcc output. Connect a filter capacitor.	

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M62460FP
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No.	Symbol	Funtion	Voltage	Discription of pin	Equivalent circuit
②7	MIX OUT	S',L+R,L-R and MIC output	4V	Signal output precedent to delay generator that is S',L+R,L-R and MIC output	
②8	DELAY IN	delay input	2.5V	This is s delay input. Please input by AC cupping.	
④0	LPF2 OUT	delay signal output	2.5V	delay signal output	
④1	VOL OUT	output of a delay volum		This is output of a delay volum that possible to control +3dB~	
④2	DELAYSIG IN		4V	Delay signal input to a mixing amplifier	
④3	DELAYSIG OUT	input from mixing amplifier	4V	Delay signal output from a mixing amplifier	
④4	FBIN EC	Feedback signal input	4V	Feedback signal input with ECHO MODE	
④5	FBIN SU			Feedback signal input with SURROUND MODE	

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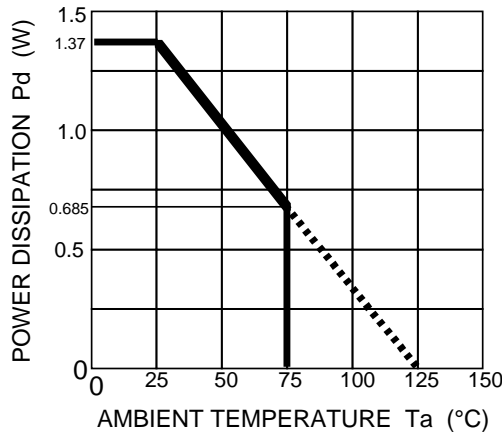
No.	Symbol	Funtion	Voltage	Discription of pin	Equivalent circuit
(46)	S'OUT	Sch output	4V	Sorround channel output to delay generator. Always outputs signals,irrespective of the operation mode (2-/3-/4-channel)	
(47)	LPIN	Negative input of LPF	4V	This amplifier compnent 7KHz-LPF with external resistances and capaciter. LPF output is conected to input of Modifide BNR.	
(48)	DBIN	LPF output			
(72)	LIN	Lch input	4V	Input of Lch and Rch that is non-inverted input type. Please pul-up to VREF by external resistances for DC bias.	
(73)	RIN	Rch input			
(70)	LT	Auto-balance Lch output	4V	Auto-balance output.	
(71)	RT	Auto-balance Rch output			

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ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Test conditions	Limits	Unit
V _{CC}	Supply voltage		10.5	V
V _{DD}			6.5	V
P _d	Power dissipation	standard board	1.37	W
K _θ	Thermal derating	T _a 25°C	13.7	mW/°C
T _{opr}	Operating temperature		-20~+75	°C
T _{stg}	Storage temperature		-40~+125	°C

TERMAL DERATING



* Standard board

- board size 70mmX70mm
- board thickness 1.6mm
- board material glass epoxy
- copper pattern
 - copper thickness 18μm
 - copper size 0.25mm(width)
 - 30mm(length / lead)

RECOMMENDED OPERATING CONDITION

Symbol	Parameter	Conditions	Ratings			Unit
			Min	Typ	Max	
V _{CC}	Analog supply voltage		8.0	9.0	10.0	V
V _{DD}	Digital supply voltage		4.5	5.0	5.5	V
f _{ck}	OSC clock			4		MHz

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ELECTRICAL CHARACTERISTICS (DECODER)

V_{CC}=9V, V_{DD}=5V 0dB Reference=300mV_{rms}/1KHz at C-OUT unless otherwise noted.
(Cch Trimmer=0dB)

Symbol	Parameter	Conditions	Limits			Unit
			Min	Typ	Max	
Overall						
I _{CC}	Circuit Current	Quiescent	—	25	50	mA
I _{DD}	Circuit Current	Quiescent	—	25	50	mA
V _{ref}	Reference Voltage	Quiescent	3.5	4.0	4.5	V
Input Auto Balance						
CPR	Capture Range		—	±5	—	dB
CER	Error Correction		—	±4	—	dB
Adaptive Matrix						
VoL	Output Level Accuracy relative to C ch	L,R,S'ch out	-0.5	0	0.5	dB
MR	Matrix Rejection relative	L,R,C,S'ch out	25	40	—	dB
HRAM	Headroom	L,R,C,S' out	15	17	—	dB
THDAM	Total Harmonic Distortion	L,R,C,S'ch out 4ch mode	—	0.05	0.2	%
		L,Rch out 2ch mode	—	0.002	0.05	
SNAM	Signal to Noise Ratio	R _g =0 ,weighted CCIR/AMR 4ch mode	75	80	—	dB
		L,Rch out 2ch mode	95	100	—	
Noise Sequencer (0dB Reference is input at NR-IN when adjust to 0dB (300mV_{rms}/100Hz) at S out.						
V _{no}	Output Noise Level		-15	-12.5	-10	dB
V _{no}	Output Level Accuracy relative to C ch	L,R,S'ch out	-0.5	0	0.5	dB
Modified B type Noise Reduction						
VGNR	Voltage Gain	V _{in} =0dBd,f=100Hz	—	9.2	—	dB
DEC1	Decode Responce 1	V _{in} =0dBd,f=1.0kHz	-1.6	-0.1	1.4	dB
DEC2	Decode Responce 2	V _{in} =-15dBd,f=1.4kHz	-3.0	-1.5	0	
DEC3	Decode Responce 3	V _{in} =-20dBd,f=1.4kHz	-4.9	-3.4	-1.9	
DEC4	Decode Responce 4	V _{in} =-40dBd,f=5.0kHz	-6.8	-5.3	-3.8	
THDNR	Total Harmonic Distortion	V _{in} =0dBd,f=1kHz	—	0.07	0.3	%
HRNR	Headroom	THD=1%	15	17	—	dB
SNNR	Signal to Noise Ratio	R _g =0 ,weighted CCIR/AMR	73	78	—	dB
C,S ch Trimmer						
ATT-12	attenuation level:-12dB	Digital Input=-12	-14	-12	-10	dB
ATT _{max}	Maximum attenuation	Digital Input=-31	-37	-31	-25	dB
TS	Trimmer step		0.6	1.0	1.4	dB
Surround (L+R,L-R) <MIXOUT>						
THDSU	Total Harmonic Distortion	V _{in} =0dBd,f=1kHz	—	0.05	0.2	%
SNSU	Signal to Noise Ratio	R _g =0 ,weighted CCIR/AMR	85	90	—	dB

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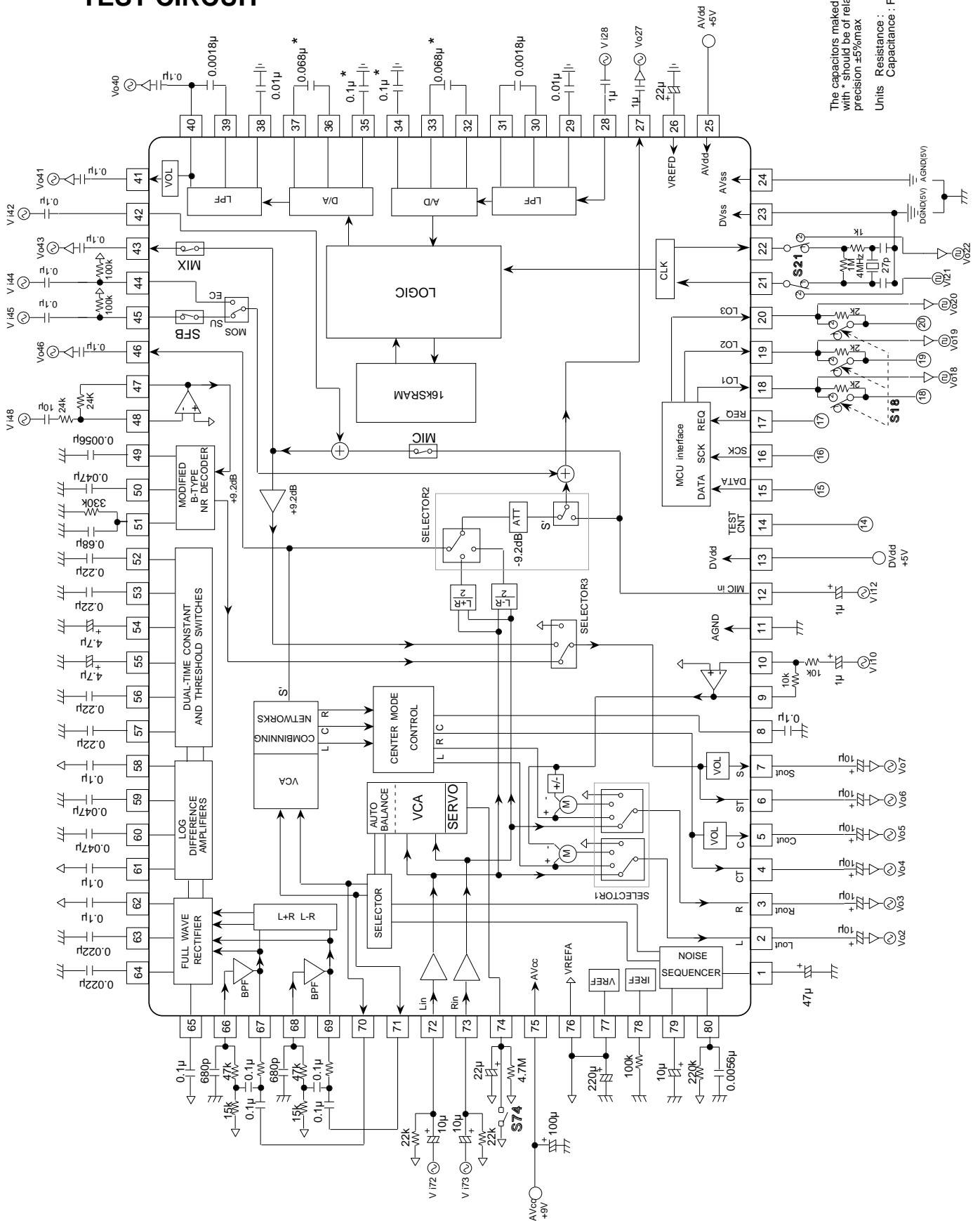
ELECTRICAL CHARACTERISTICS (DIGITAL DELAY)

($T_a=25^\circ\text{C}$, $V_{cc}=9\text{V}$, $V_{DD}=5\text{V}$, $V_{in}=200\text{mVrms}$, $f_{ck}=4\text{MHz}$ unless otherwise noted)

Symbol	Parameter	Conditions	Limits			Unit	
			Min	Typ	Max		
Digital Delay							
Td	Delay time	See Delay time control (14/20) for delay time setting.	12.4	15.4	18.4	ms	
			17.0	20.0	23.0		
			25.6	28.6	31.6		
			38.0	41.0	44.0		
			46.2	49.2	52.2		
			137.5	147.5	157.5		
			186.6	196.6	206.6		
Gv	Input-output gain		-3.0	0	3.0	dB	
THD	Output distortion	30kHz LPF	Td=15.4ms	—	0.3	0.6	%
			Td=20.0ms	—	0.3	0.6	
			Td=28.6ms	—	0.5	1.0	
			Td=41.0ms	—	0.6	1.2	
			Td=49.2ms	—	0.7	1.4	
			Td=147.5ms	—	1.5	3.0	
			Td=196.6ms	—	2.0	4.0	
Vomax	Maximum output voltage	30kHz LPF, THD=10%	0.7	1.0	—	Vrms	
No	Output noise voltage	Rg=620 Vi=0mVrms, IHF-A	Td=15.4ms	—	-92	-80	dBv
			Td=20.0ms	—	-92	-80	
			Td=28.6ms	—	-92	-80	
			Td=41.0ms	—	-90	-75	
			Td=49.2ms	—	-90	-75	
			Td=147.5ms	—	-82	-67	
			Td=196.6ms	—	-77	-62	
Delay Volume (VOL OUT)							
Gv	Input-output gain	Volume max	0	3	6	dB	
ATTmax	Maximum attenuation	Delay off mode, Volume min, IHF-A	—	-70	-60	dB	

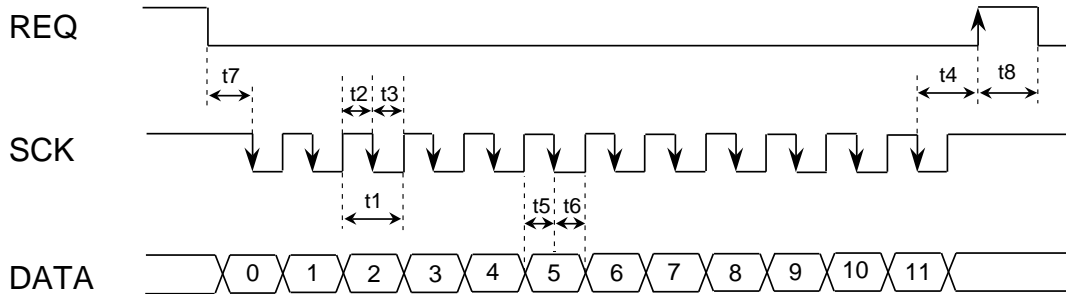
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TEST CIRCUIT



DIGITAL CONTROL SPECIFICATIONS

(1) DATA TIMING



(note1) SCK is not accept when REQ is high
 (Note2)REQ must turn to high after SCK pulse turn to high.

Symbol	Name	Min	Typ	Max	Unit
t1	SCK clock duration	2	—	—	μs
t2	SCK "H" pulse width	0.8	—	—	μs
t3	SCK "L" pulse width	0.8	—	—	μs
t4	REQ hold time	1.6	—	—	μs
t5	DATA setup time	0.8	—	—	μs
t6	DATA hold time	0.8	—	—	μs
t7	SCK setup time	0.8	—	—	μs
t8	REQ "H" pulse width	1.6	—	—	μs

(2) DATA FORMAT

Serial Data Format											
DATA										ADDRESS	
BIT 0	BIT 1	BIT 2	BIT 3	BIT 4	BIT 5	BIT 6	BIT 7	BIT 8	BIT 9	BIT 10	BIT 11
ADD/SUB	NOISE SEQ			SELECTOR1		CENTER MODE		No use		0	0
SELECTOR2		SELECTOR3		MIX	LO1	LO2	LO3	No use		0	1
Cch. TRIMMER					Sch. TRIMMER					1	0
S1	S2	S3	V1	V2	V3	V4	SFB	MOS	MIC	1	1

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(3)DECODER

ADDRESS(BIT10,11)=0,0

ADD/SUB		NOISE SEQ					SELECTOR1			CENTER MODE		
mode	BIT0	mode	BIT1	mode	BIT2	BIT3	mode	BIT4	BIT5	mode	BIT6	BIT7
ADD	0	OFF	0	L	0	0	PRO LOGIC	0	0	WIDE	0	0
SUB	1	ON	1	C	0	1	BY-PASS	0	1	NORMAL	0	1
				R	1	0	OTHER SUR	1	0	PHANTOM	1	0
				S	1	1	L/R MUTE	1	1	OFF	1	1

ADDRESS(BIT10,11)=0,1

SELECTOR2			SELECTOR3			DELAY MIX SWITCH		
mode	BIT0	BIT1	mode	BIT2	BIT3	BIT4(MIX)	DMIXSW	Remarks
S'	0	0	BNR OUT	0	0	0	OFF	Mixing OFF
L+R	0	1	D OUT	0	1	1	ON	Mixing ON
L-R	1	0	3STEREO/MUTE	1	0			
MIC	1	1		1	1			

LO(LOGIC DATA OUT) Open Collector			
mode	BIT5 (LO1)	BIT6 (LO2)	BIT7 (LO3)
OUTPUT DATA "L"	0	0	0
OUTPUT DATA "H"	1	1	1

ADDRESS(BIT10,11)=1,0

Cch. TRIMMER						Sch. TRIMMER					
DATA	BIT0	BIT1	BIT2	BIT3	BIT4	DATA	BIT5	BIT6	BIT7	BIT8	BIT9
0	±0dB	±0dB	±0dB	±0dB	±0dB	0	±0dB	±0dB	±0dB	±0dB	±0dB
1	-1dB	-2dB	-4dB	-8dB	-16dB	1	-1dB	-2dB	-4dB	-8dB	-16dB

Volume code

C(S)ch. TRIMMER											
ATT(dB)	BIT0(5)	BIT1(6)	BIT2(7)	BIT3(8)	BIT4(9)	ATT(dB)	BIT0(5)	BIT1(6)	BIT2(7)	BIT3(8)	BIT4(9)
±0	0	0	0	0	0	-16	0	0	0	0	1
-1	1	0	0	0	0	-17	1	0	0	0	1
-2	0	1	0	0	0	-18	0	1	0	0	1
-3	1	1	0	0	0	-19	1	1	0	0	1
-4	0	0	1	0	0	-20	0	0	1	0	1
-5	1	0	1	0	0	-21	1	0	1	0	1
-6	0	1	1	0	0	-22	0	1	1	0	1
-7	1	1	1	0	0	-23	1	1	1	0	1
-8	0	0	0	1	0	-24	0	0	0	1	1
-9	1	0	0	1	0	-25	1	0	0	1	1
-10	0	1	0	1	0	-26	0	1	0	1	1
-11	1	1	0	1	0	-27	1	1	0	1	1
-12	0	0	1	1	0	-28	0	0	1	1	1
-13	1	0	1	1	0	-29	1	0	1	1	1
-14	0	1	1	1	0	-30	0	1	1	1	1
-15	1	1	1	1	0	-31	1	1	1	1	1

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(4) DELAY

ADDRESS(BIT10,11)=1,1

DELAY TIME CONTROL				
BIT0 (S1)	BIT1 (S2)	BIT2 (S3)	DELAY TIME (Sampling frequency)	DelayLPF (Cut-off frequency)
0	0	0	15.4 ms (1MHz)	7.0kHz
0	0	1	20.0 ms (667kHz)	
0	1	0	28.6 ms (500kHz)	
0	1	1	41.0 ms (400kHz)	
1	0	0	49.2 ms (333kHz)	
1	0	1	147.5 ms (111.1kHz)	3.0kHz
1	1	0	196.6 ms (83.3kHz)	
1	1	1	Delay off mode (clock off)	

VOLUME CONTROL				
BIT3 (V1)	BIT4 (V2)	BIT5 (V3)	BIT6 (V4)	VOL attenuation
1	1	1	1	+3dB
1	1	1	0	0dB
1	1	0	1	-2dB
1	1	0	0	-3dB
1	0	1	1	-4dB
1	0	1	0	-6dB
1	0	0	1	-8dB
1	0	0	0	-9dB
0	1	1	1	-10dB
0	1	1	0	-12dB
0	1	0	1	-15dB
0	1	0	0	-
0	0	1	1	-
0	0	1	0	-
0	0	0	1	-
0	0	0	0	-

FEEDBACK SWITCH		
BIT7(SFB)	SFB SW	Remarks
0	OFF	Feedback OFF
1	ON	Feedback ON

(In surround mode only)

MODE SELECTOR	
BIT8(MOS)	MODESEL
0	SU line
1	EC line

MICROPHONE MIXING SWITCH		
BIT9(MIC)	MICMIXSW	Remarks
0	OFF	Mic mixing OFF
1	ON	Mic mixing ON

(Note) Settings in power-on

When power is turned on, data is setting in under table by power on reset circuit.

DECODER		DELAY	
Mode	Settings	Mode	Settings
ADD/SUB	ADD	DELAY TIME CONTROL	20.0ms
NOISE SEQ	OFF	VOLUME CONTROL	-
SELECTOR1	PRO LOGIC	FEEDBACK SWITCH	OFF
CENTER MODE	WIDE	MODE SELECTOR	SU line
SELECTOR2	S'	DELAY MIX SWITCH	OFF
SELECTOR3	BNR OUT	MICROPHONE MIXING SWITCH	OFF
LO(LOGIC OUT)	"L"		
Cch.TRIMMER	0dB,ATT(-)		
Sch.TRIMMER	0dB,ATT(-)		

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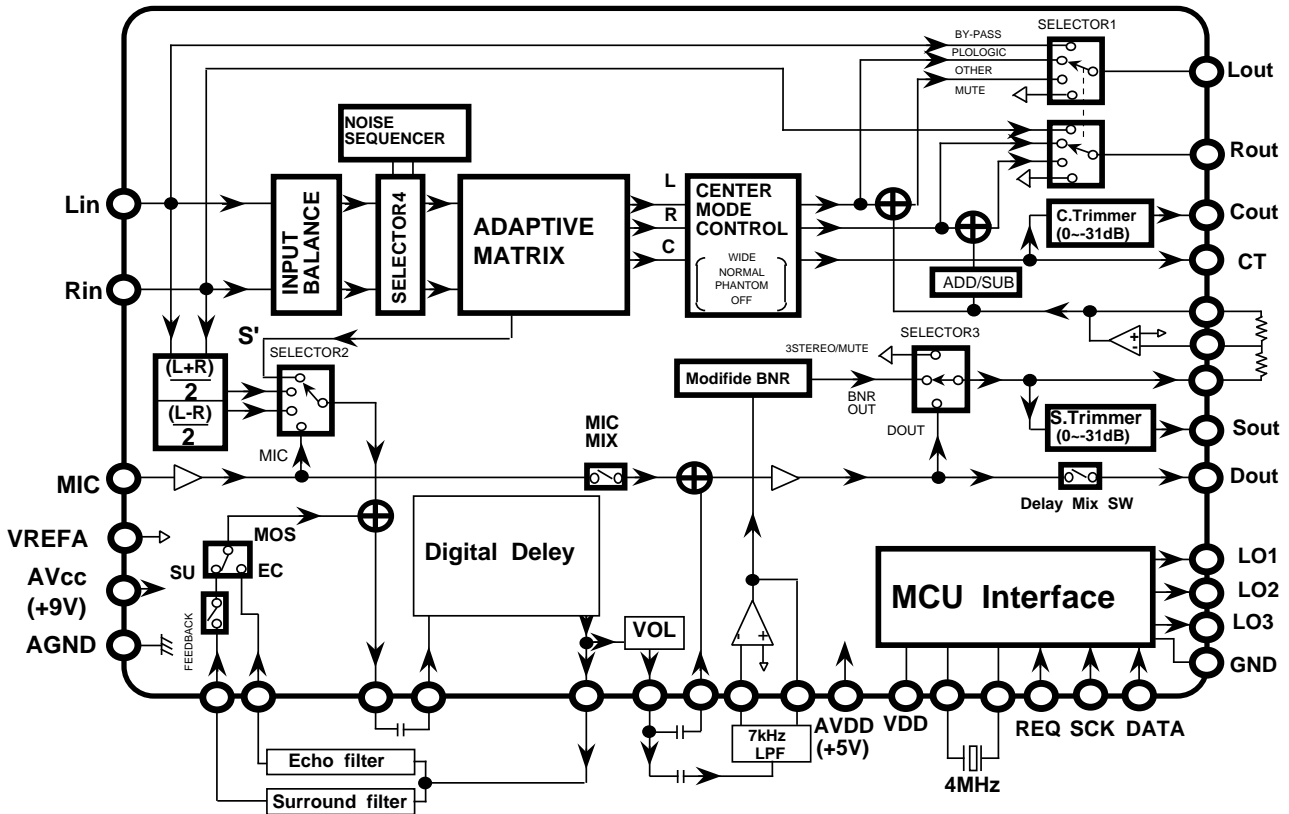
FUNCTION MODE (EXAMPLE)

MODE	SUB-MODE	DIGITAL DELAY	VOLUME LEVEL			SWITCH CONDITION						DIGITAL DELAY INPUT	NOTE							
			Cch Trimmer	Sch Trimmer	Delay VOL	SELECTOR 1	SELECTOR 2	SELECTOR 3	CENTER MODE	ADD/SUB	Delay MIX SW			MODE	FEEDBACK	MIC MIX				
DOLBY PRO LOGIC	WIDE	td=15.4ms, 20.0ms, 28.6ms	0~-31dB 1dB/step	0~-31dB 1dB/step	VOL OFF (0dB)	PLO LOGIC	S'	BNR OUT	WIDE	—	OFF	SU	OFF	OFF	S'	Feedback level can be changed by output port control(see block diagram)				
	NORMAL								NORMAL											
	PHANTOM								3STEREO	PHANTOM										
DIGITAL SPACE SURROUND	DISCO	td=20ms	*Pro Logic decoder function is alive. For example C/S trimmer can be available.			VOL ATT	L-R	DOUT	PHANTOM	SUB	OFF	SU	ON	OFF	(L-R) 2					
	Hall	td=49.2ms				+3dB	OTHER SUR													
		td=28.6ms				0dB	L-R		ADD											
	Option	5step delay time (BW=7kHz,fck=4MHz)				-2dB	BNROUT	WIDE	ADD											
						-3dB	L+R	3STEREO	PHANTOM	SUB										
KARAOKE/ECHO	SHORT ECHO	td=147.5ms	-4dB	MIC	3STEREO	OFF	ADD	ON	EC	OFF	ON	OFF	ON	MIC						
BY-PASS	LONG ECHO	td=196.6ms	-6dB	BY PASS	BY PASS	BY PASS	BY PASS	BY PASS	BY PASS	BY PASS	BY PASS	BY PASS	BY PASS	BY PASS						
	BY-PASS	td=20.0ms	-	BY PASS	BY PASS	BY PASS	BY PASS	BY PASS	BY PASS	BY PASS	BY PASS	BY PASS	BY PASS	BY PASS	S'					

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M62460FP
 “Super Single Chip” Surround Processor
 with Dolby Pro Logic Decoder

14.FUNCTION

Block Diagram



Block name	Function
INPUT BALANCE	Correction of a level error between the input Lch and Rch for optimum decoder performance
NOISE SEQUENCER	A noise sequencer circuit for adjustment of output level
ADAPTIVE MATRIX	Determine the direction and relative magnitude of encoded soundfield.
CENTER MODE CONTROL	Select 4 - center mode position (WIDE,NORMAL,PHANTOM,OFF)
C.Trimmer S.Trimmer	This is the level adjustment volume of Cch and Sch. (0~ -30 dB : 1dB/step)

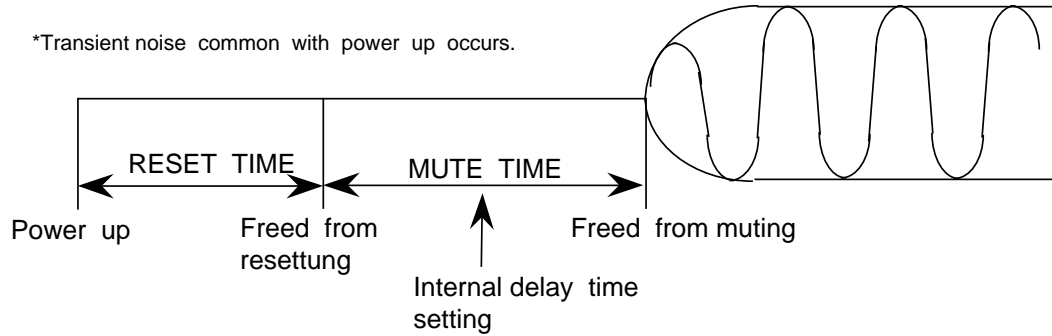
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M62460FP
 “Super Single Chip” Surround Processor
 with Dolby Pro Logic Decoder

Block name	Function
Modifide BNR	This block restores the signal to its original spectrum while reducing noise and certain crosstalk signals in a final stage of the surround chain.
ADD/SUB	Select a positive phase signal or a negative phase signal with DIGITAL SPACE SURROUND MODE.
SELECTOR1	This is a selective switch to select the output signal of Lout and Rout from BY-PASS,PRO LOGIC,OTHER SUR and MUTE .
SELECTOR2	This is a selective switch to select the output signal of Sout from S',L+R,L-R and MIC.
SELECTOR3	This is a selective switch to select the output signal of Sout from BNRout,Dout and 3STEREO/MUTE.
SELECTOR4	This is a switch to connect a noise sequencer output to ADAPTIVE MATRIX stage for level adjustment.
Digital Deley	Make 7 kinds of delay signal s.(15.4msec~196.6msec) The delay function and CLK signal stop at DELAY OFF MODE. This mode is for suppress bad effect of digital noize.
FEEDBACK	This is a switch to select feedback mode(ON/OFF) for SURROUND MODE .
MODE SEL(MOS)	This is a switch to select a feedback signal from surround signal and echo signal.
VOL	Control the ATT level of delay signal from 3dB to - (12-step)
MIC MIX	This is a switch to mix miclophone signal to a main signal (Lch,Rch)
Delay Mix SW	This is a switch to select output or not a mixed signal to DOUT pin.

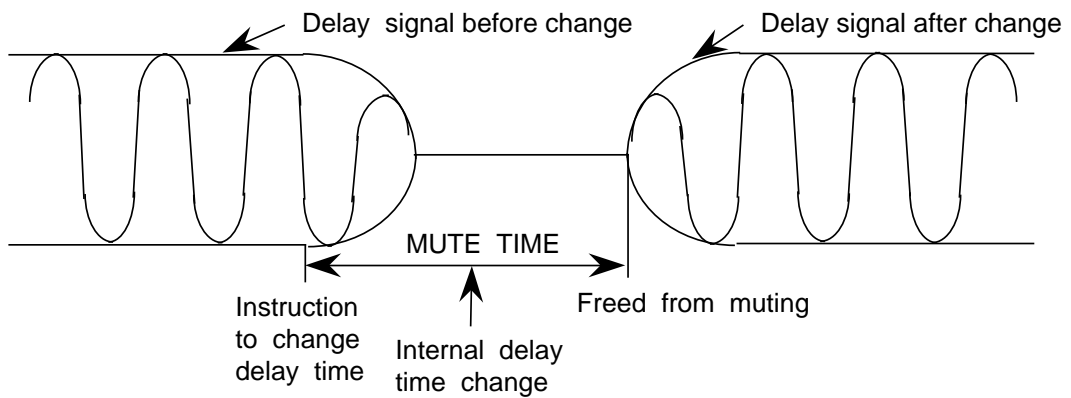
AUTO MUTE FUNCTION

The IC carries out auto mute function at the time of powering up, delay time setting change, and cancelling delay off mode, in order to suppress shock noise that the digital delay may produce.

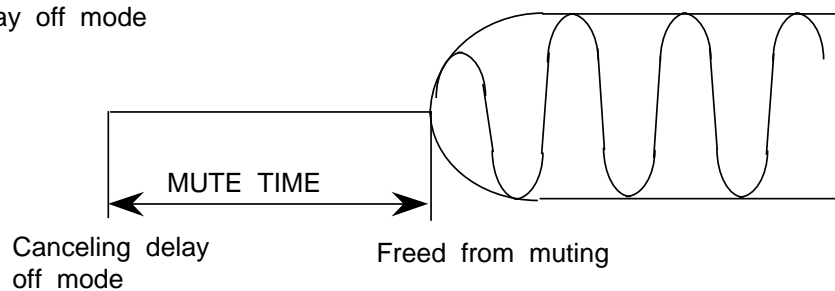
- At power-on



- At delay time setting change



- At canceling delay off mode

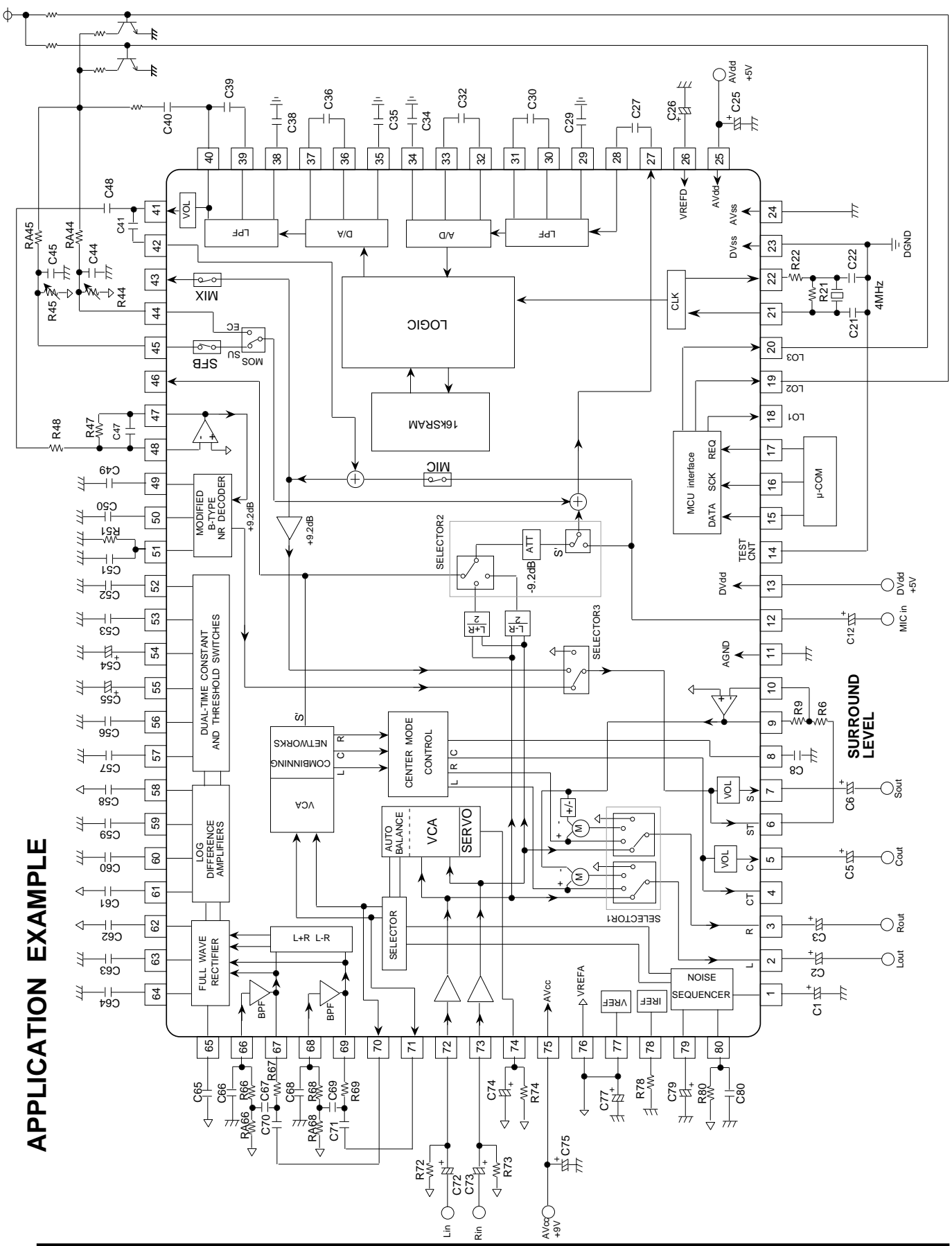


Mute time changes depending on set (or preset) delay time.

DELAY TIME	MUTE TIME
15.4~49.2 ms	123 ms
147.5 , 196.6 ms	492 ms

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M62460FP
 "Super Single Chip" Surround Processor
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APPLICATION EXAMPLE



(EXAMPLE) FEEDBACK LEVEL CONTROL

MITSUBISHI SOUND PROCESSORS
M62460FP
 “Super Single Chip” Surround Processor
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OPTIONAL PARTS LIST

Parts No.	Values	Unit	Tol.	Parts No.	Values	Unit	Tol.
C1	47	μF		C65	0.1	μF	20%
C2	10	μF		C66	680	pF	5%
C3	10	μF		C67	0.1	μF	5%
C5	10	μF		C68	680	pF	5%
C6	10	μF		C69	0.1	μF	5%
C8	0.1	μF	10%	C70	0.1	μF	5%
C12	1	μF		C71	0.1	μF	5%
C21	27	pF		C72	10	μF	
C22	27	pF		C73	10	μF	
C25	100	μF		C74	22	μF	20%
C26	22	μF		C75	100	μF	
C27	1	μF	5%	C77	220	μF	
C29	0.01	μF	5%	C79	10	μF	10%
C30	0.0018	μF	5%	C80	0.0056	μF	5%
C32	0.068	μF	5%				
C34	0.1	μF	5%				
C35	0.1	μF	5%	R6	10	K	
C36	0.068	μF	5%	R9	20	K	
C38	0.01	μF	5%	R21	1	M	
C39	0.0018	μF	5%	R22	1	K	
C40	0.1	μF		RA44	51	K	
C41	0.1	μF		RA45	51	K	
C44	1200	pF		R44	Vol		
C45	470	pF		R45	Vol		
C47	820	pF	10%	R47	24	K	5%
C48	0.1	μF		R48	24	K	5%
C49	0.0056	μF	5%	R51	330	K	10%
C50	0.047	μF	5%	R66	47	K	5%
C51	0.68	μF	10%	RA66	15	K	5%
C52	0.22	μF	10%	R67	7.5	K	5%
C53	0.22	μF	10%	R68	47	K	5%
C54	4.7	μF	20%	RA68	15	K	5%
C55	4.7	μF	20%	R69	7.5	K	5%
C56	0.22	μF	10%	R72	22	K	
C57	0.22	μF	10%	R73	22	K	
C58	0.1	μF	20%	R74	4.7	M	10%
C59	0.047	μF	5%	R78	100	K	1%
C60	0.047	μF	5%	R80	220	K	5%
C61	0.1	μF	20%				
C62	0.1	μF	20%				
C63	0.022	μF	5%				
C64	0.022	μF	5%				