

PRELIMINARY
 Notice ; This is not a final specification.
 some parametric limits are subject to change.

MITSUBISHI SOUND PROCESSORS

M62461FP

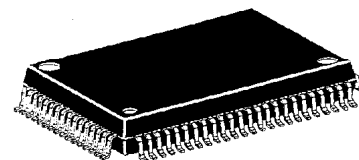
"Super Single Chip " Surround Processor
 with Dolby Pro Logic Decoder

DESCRIPTION

M62461FP is "SUPER SINGLE CHIP" SURROUND LSI for Dolby Pro Logic Surround System which includes all of required functions using analog/digital mixed signal technology. This LSI can also generate "DIGITAL SPACE SURROUND" such as Disco, Hall, Live and "ECHO" for KARAOKE.

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Outline



Outline 80P6N
 0.8mm pitch QFP
 (20.0mmx4.0mmx2.8mm)

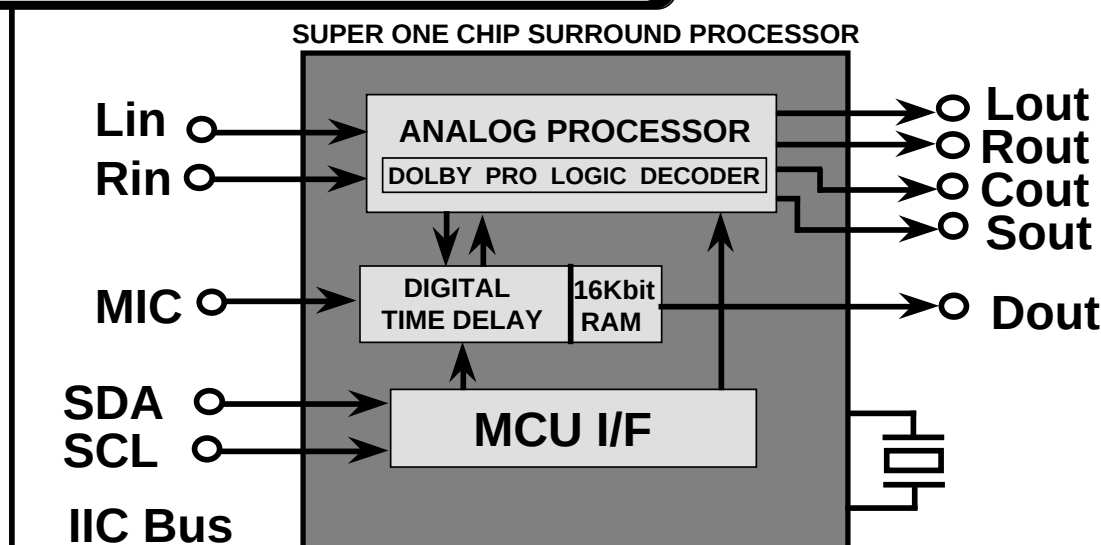
FEATURES

- Includes completed functions for Dolby Pro Logic Surround System
 - <ANALOG>
 - Automatic Input Balance
 - Noise Sequencer
 - Adaptive Active Matrix
 - Center Mode Control
 - Modified B Type Noise Reduction
 - <DIGITAL>
 - Digital Time Delay
- DIGITAL SPACE SURROUND system: Disco, Hall, Live mode etc.
- Echo effect for KARAOKE (Delay time: 200ms)
- IIC Bus Control

RECOMMENDED OPERATING CONDITIONS

Supply voltage range $V_{CC}=8\sim 10V$, $V_{DD}=4.5\sim 5.5V$

SYSTEM CONFIGURATION



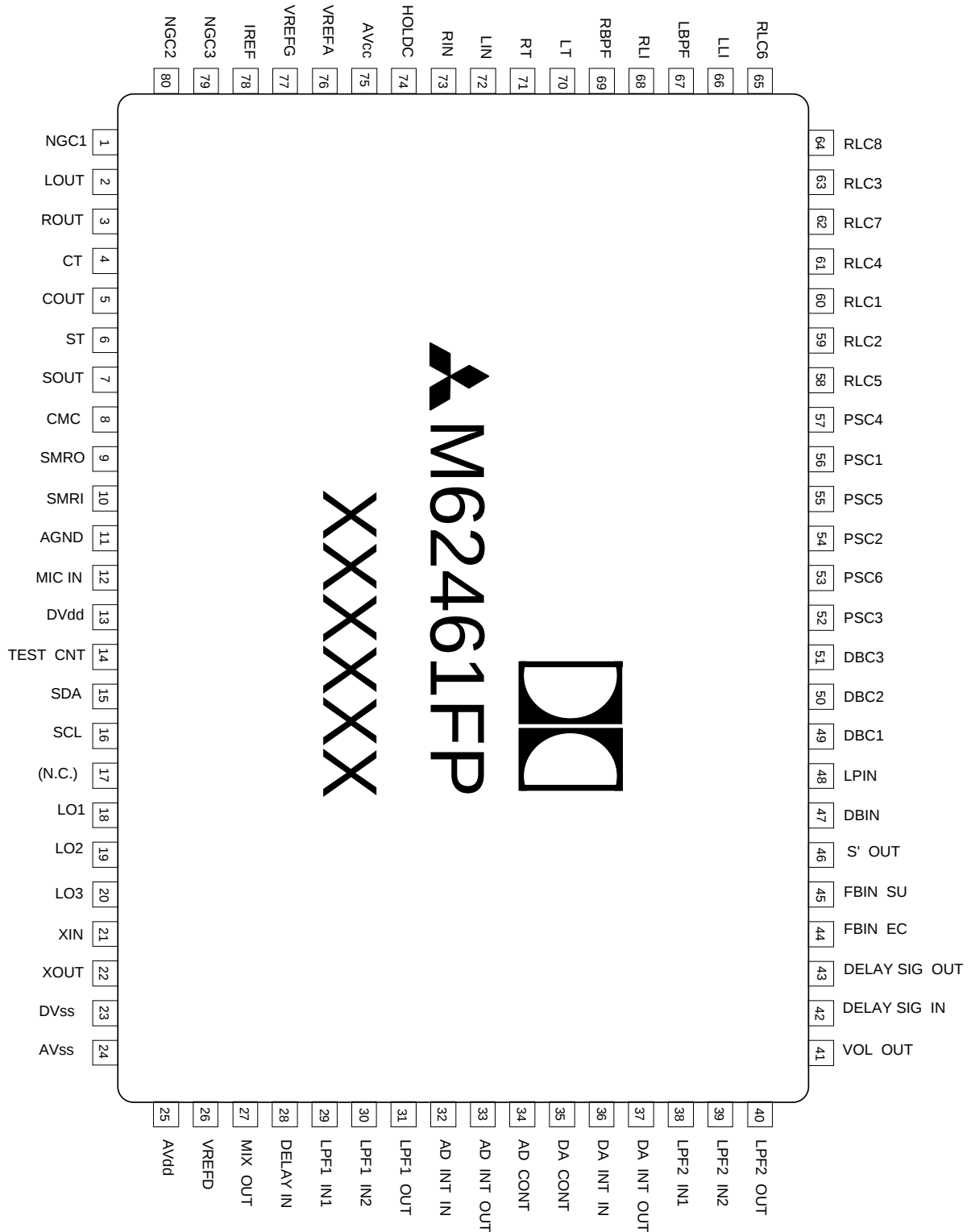
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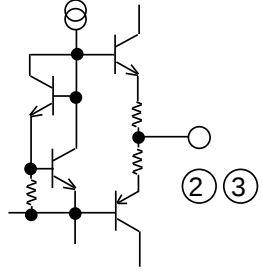
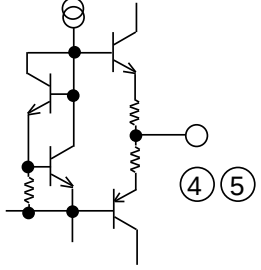
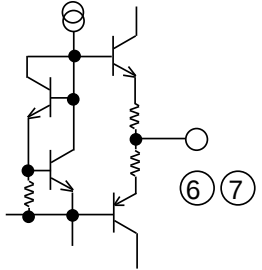
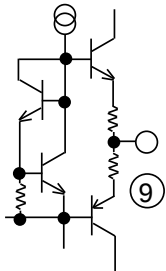
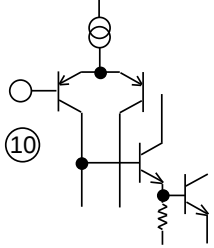
PIN CONFIGURATION



(N.C.) : NO CONNECTION

"Super Single Chip " Surround Processor with Dolby Pro Logic Decoder

■ 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.	
③	ROUT	Rch output		When the mode is 4channel, they output Dolby Pro logic R-/L- channel signals.	
④	CT	Cch output	4V	No output any signals when the operation mode is center mode is OFF, or set to PHANTOM.	
⑤	COUT	Cch output		COUT is output from C.Trimmer.	
⑥	ST	Sch output	4V	This pin outputs surround signals. Output is selected from BNRout, Dout. No output signal when the operation mode is 3 STEREO/MUTE.	
⑦	SOUT	Sch output		SOUT is output from S.Trimmer.	
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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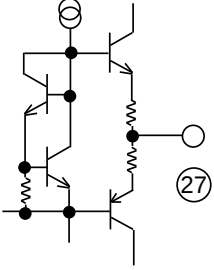
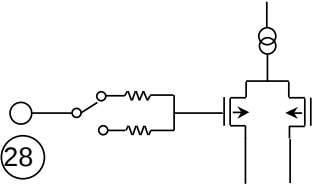
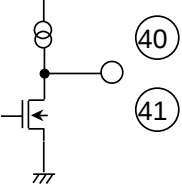
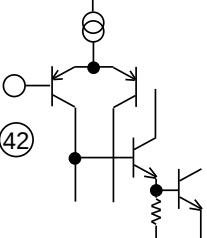
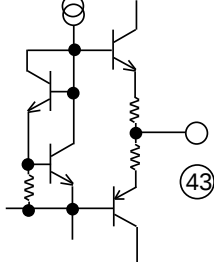
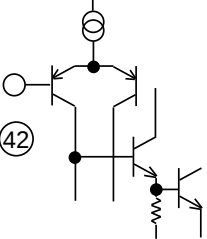
No.	Symbol	Funtion	Voltage	Discription of pin	Equivalent circuit
⑫	MIC IN	MIC input	4V	Microphone input with ECHO MODE	
⑭	TEST CNT	TEST control	0	Fixed to GND	
⑮	SDA	"DATA" input	—	input I2C bus data from MCU.	
⑯	SCL	"CLOCK" input	—		
⑰	N.C.	no connection			
⑱	LO1	port output	—	Open collector output pin (NPN Tr)	
⑲	LO2				
⑳	LO3				
㉑	XIN	Osillator input	—	connect a 4MHz ceramic resonator	
㉒	XOUT	Osillator output			
㉔	VREFD	reference output	2.5V	1/2 Vcc output. Connect a filter capacitor.	

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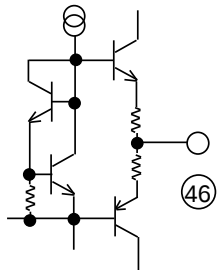
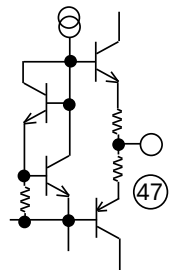
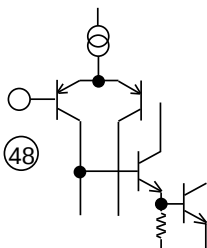
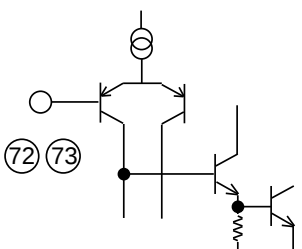
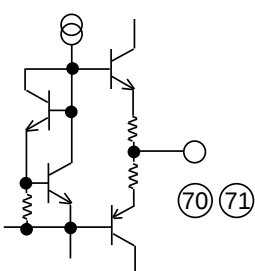
No.	Symbol	Funtion	Voltage	Discription of pin	Equivalent circuit
(27)	MIX OUT	S',L+R,L-R and MIC output	4V	Signal output precedent to delay generator that is S',L+R,L-R and MIC output	
(28)	DELAY IN	delay input	2.5V	This is s delay input. Please input by AC cupping.	
(40)	LPF2 OUT	delay signal output	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 to -•	
(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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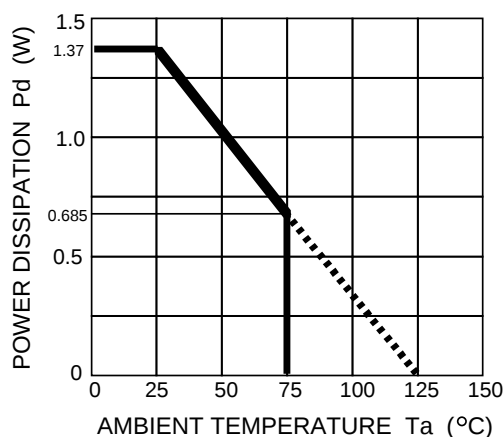
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No.	Symbol	Funtion	Voltage	Discription of pin	Equivalent circuit
(46)	S'OUT	Sch output	4V	Sorround channel output todelay generator. Always outputs signals,irrespective of the operation mode (2-/3-/4-channel)	
(47)	LPIN	Negative input of LPF	4V	This amplifier compornent 7KHz-LPF with external resistances and capacitors. 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			

■ 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	Thermal derating	T _a ≥ 25 °C	13.7	mW/°C
T _{opr}	Operating temperature		-20 to +75	°C
T _{stg}	Storage temperature		-40 to +125	°C

■ THERMAL 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

ELECTRICAL CHARACTERISTICS (DECODER)

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

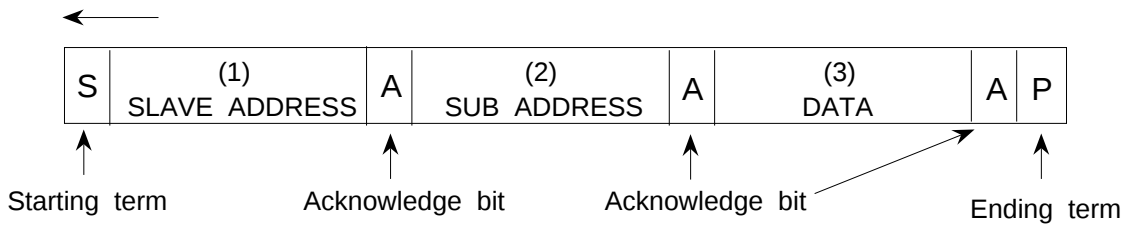
Symbol	Parameter	Conditions	Limits			Unit
			Min	Typ	Max	
Overall						
Icc	Circuit Current	Quiescent	—	25	50	mA
IDD	Circuit Current	Quiescent	—	25	50	mA
Vref	Reference Voltage	Quiescent	3.5	4.0	4.5	V
Input Auto Balance						
CPR	Capture Range		—	5	—	dB
CER	Error Correction		—	4	—	dB
Adaptive Matrix						
DVoL	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	Rg=0W,weighted CCIR/AMR 4chmode	75	80	—	dB
		L,Rch out 2ch mode	95	100	—	
Noise Sequencer (0dBd Reference is input at NR-IN when adjust to 0dB (300mVrms/100Hz) at S out.						
Vno	Output Noise Level		-15	-12.5	-10	dB
DVno	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	Vin=0dBd,f=100Hz	—	9.2	—	dB
DEC1	Decode Responce 1	Vin=0dBd,f=1.0kHz	-1.6	-0.1	1.4	dB
DEC2	Decode Responce 2	Vin=-15dBd,f=1.4kHz	-3.0	-1.5	0	
DEC3	Decode Responce 3	Vin=-20dBd,f=1.4kHz	-4.9	-3.4	-1.9	
DEC4	Decode Responce 4	Vin=-40dBd,f=5.0kHz	-6.8	-5.3	-3.8	
THDNR	Total Harmonic Distortion	Vin=0dBd,f=1kHz	—	0.07	0.3	%
HRNR	Headroom	THD=1%	15	17	—	dB
SNNR	Signal to Noise Ratio	Rg=0W, weighted CCIR/AMR	73	78	—	dB
C,S ch Trimmer						
ATT-12	attenuation level:-12dB	Digital Input=-12	-14	-12	-10	dB
ATTmax	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	Vin=0dBd,f=1kHz	—	0.05	0.2	%
SNSU	Signal to Noise Ratio	Rg=0W, weighted CCIR/AMR	85	90	—	dB

ELECTRICAL CHARACTERISTICS (DIGITAL DELAY)

(Ta=25 °C, Vcc=9V, VDD=5V, Vin=200mVrms, fck=4MHz 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=620W, 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

■ I²C BUS INPUT DATA FORMAT



(1)Slave address

A6	A5	A4	A3	A2	A1	A0	R/W
0	0	1	1	1	1	0	

(2)Sub address

SA7	SA6	SA5	SA4	SA3	SA2	SA1	SA0
EMPTY				BIT11	BIT10	BIT9	BIT8

(3)Data

D7	D6	D5	D4	D3	D2	D1	D0
BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0

(4)Function table

CONTROL	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	
DECODER	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	
DELAY	S1	S2	S3	V1	V2	V3	V4	SFB	MOS	MIC	1	1	

(5)DECODER control table

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	MixingOFF
L+R	0	1	D OUT	0	1	1	ON	MixingON
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 table

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

(6)DELAY control table

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)	

FEEDBACK SWITCH		
BIT7(SFB)	SFBSW	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

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	-.

(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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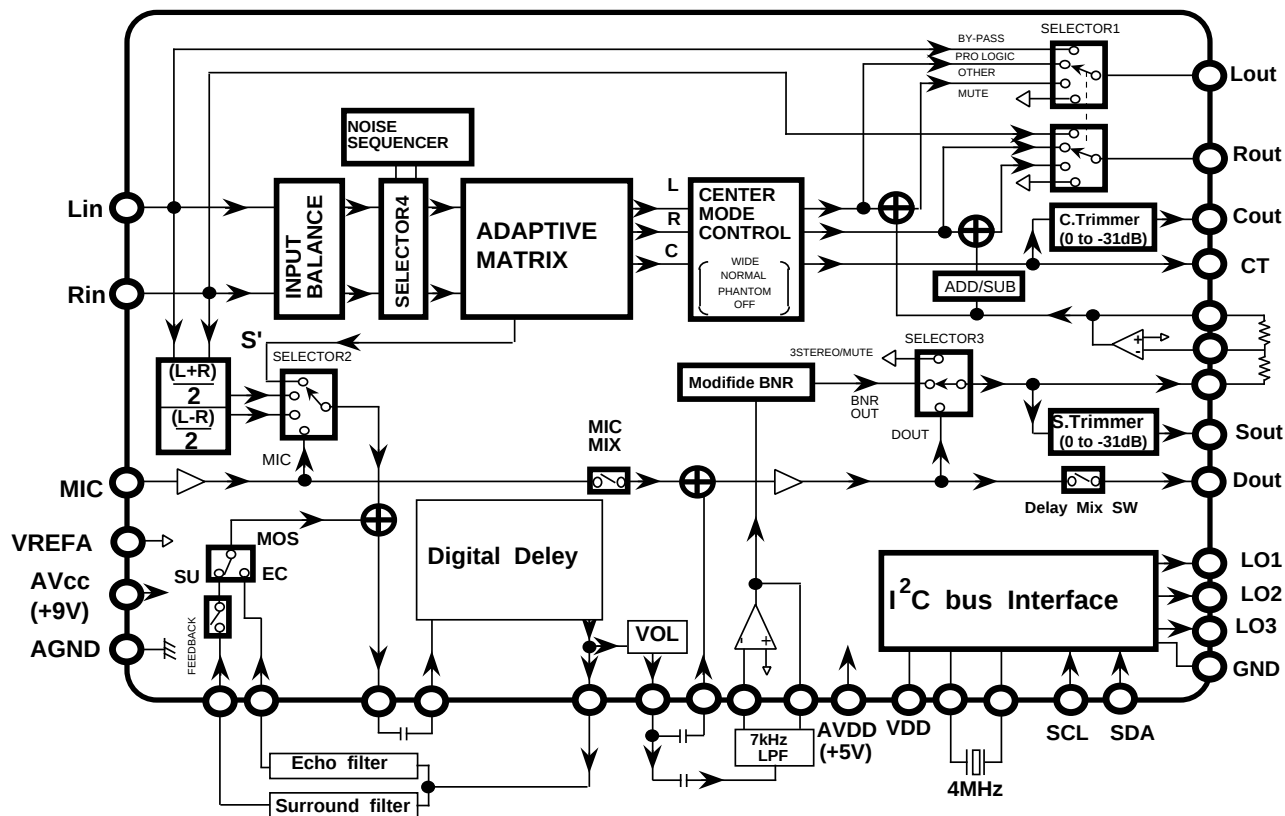
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FUNCTION MODE (EXAMPLE)

MODE	SUB-MODE	DIGITAL DELAY	VOLUME LEVEL			SWITCH CONDITION						DIGITAL DELAY INPUT	NOTE
			Cch Trimmer	Sch Trimmer	Delay VOL	SELECTOR	CENTER MODE	ADD/SUB	Delay MIX SW	MODE	FEEDBACK	MIC MIX	
DOLBY PRO LOGIC	WIDE	td=15.4ms, 20.0ms, 28.6ms				1							Feedback level can be changed by output port control(see block diagram)
	NORMAL					2							
	PHANTOM					3							
DIGITAL SPACE SURROUND						1	PRO LOGIC						Feedback level can be changed by output port control(see block diagram)
						2	S'						
						3	BNR OUT						
							3STEREO						
DIGITAL SPACE SURROUND	DISCO	td=20ms					L-R						Feedback level can be changed by output port control(see block diagram)
	Hall	td=49.2ms					L-R						
	LIVE	td=28.6ms					L-R						
	Option	5step delay time (BW=7kHz,fck=4MHz)					L-R						
KARAOKE/ECHO	SHORT ECHO	td=147.5ms					BNROUT						Feedback level can be changed by output port control(see block diagram)
	LONG ECHO	td=196.6ms					3STEREO						
BY-PASS	BY-PASS	td=20.0ms					BY PASS						Feedback level can be changed by output port control(see block diagram)

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 ajustment 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 ajustment volum of Cch and Sch. (0 to -31 dB : 1dB/step)

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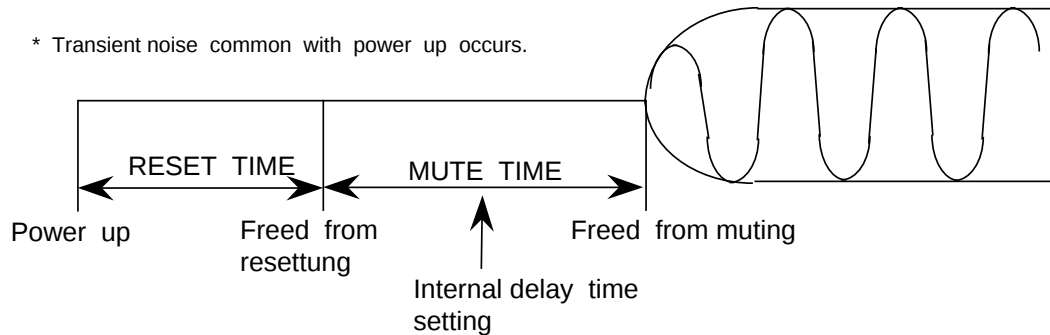
Block name	Function
Modifide BNR	This block restores the signal to its original spectrum while reducing noise and certain crosstalk signals in a final stage of the surround chain.
ADD/SUB	Select a positive phase signal or a negative phase signal with DIGITAL SPACE SURROUND MODE.
SELECTOR1	This is a selective 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 to 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

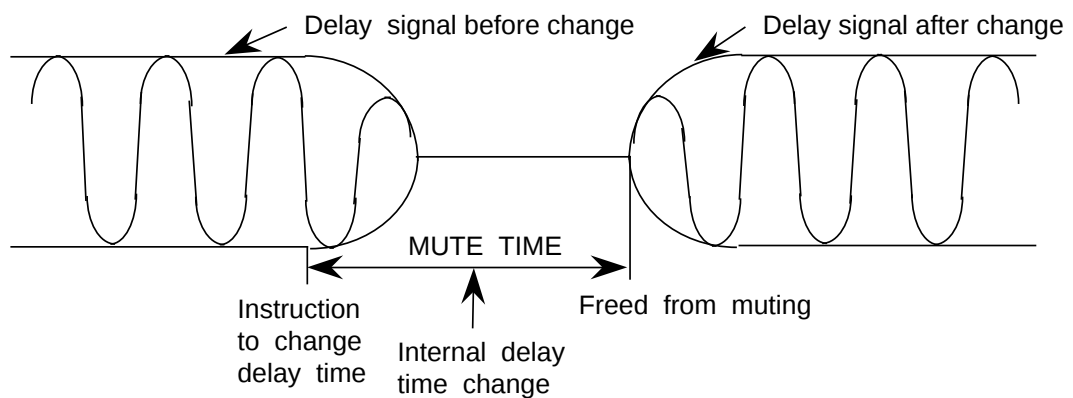
The IC carries out auto mute function at the time of powering up, delay time setting change, and cancelling delay off mode, in order to suppress shock noise that the digital delay may produce.

At power-on

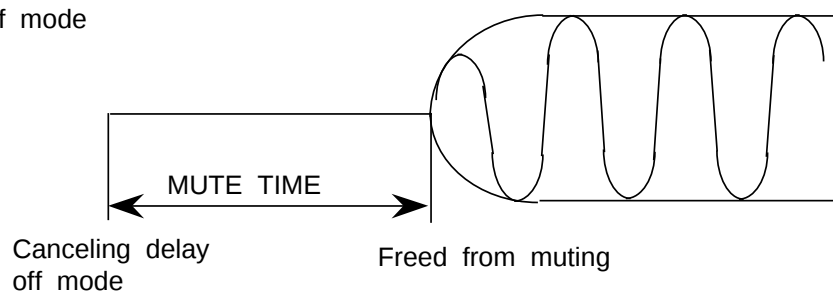
* Transient noise common with power up occurs.



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 to 49.2 ms	123 ms
147.5 , 196.6 ms	492 ms

PRELIMINARY

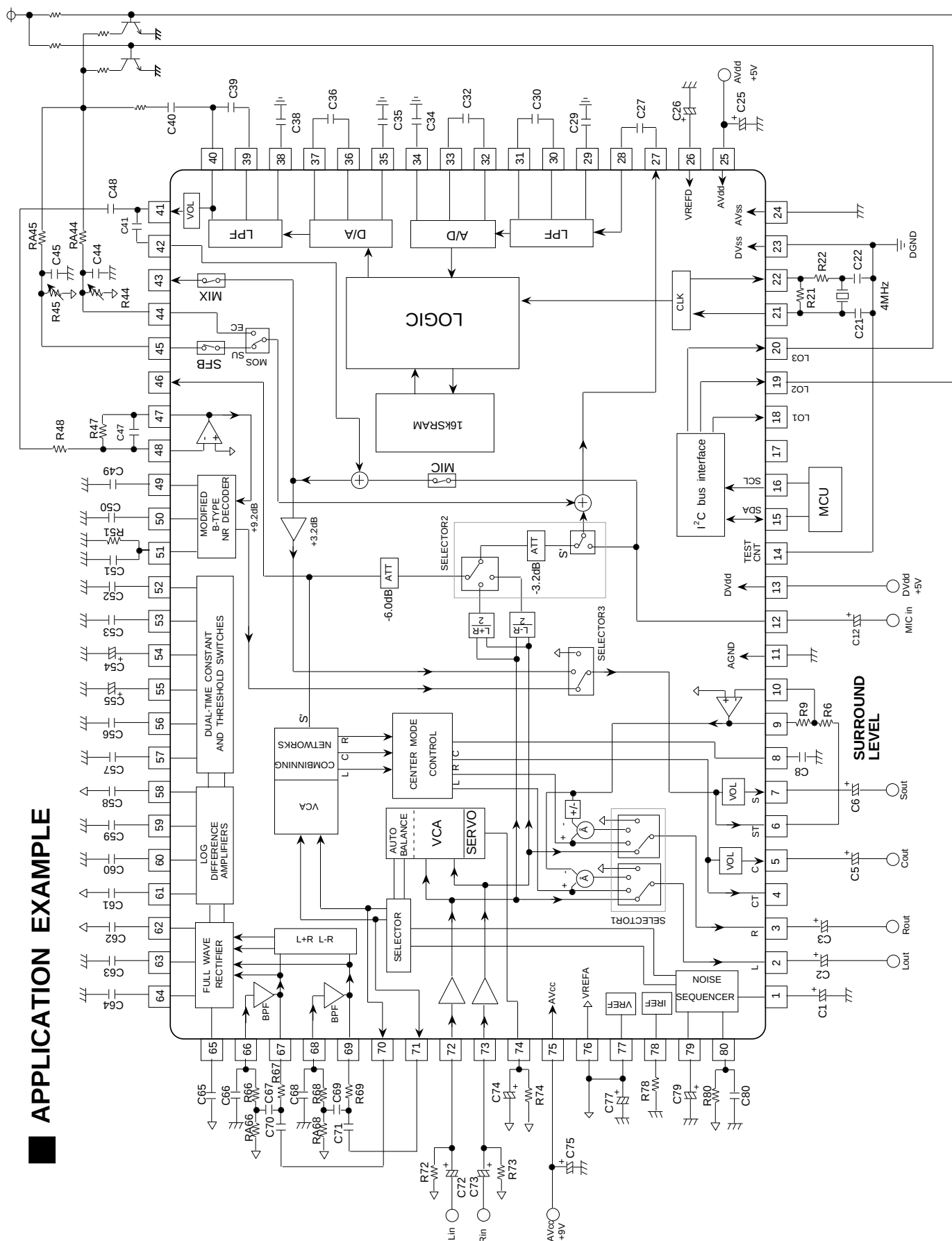
Notice ; This is not a final specification.
some parametric limits are subject to change.

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APPLICATION EXAMPLE



(EXAMPLE) FEEDBACK LEVEL CONTROL

PRELIMINARY
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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	kW	
C36	0.068	μF	5%	R9	20	kW	
C38	0.01	μF	5%	R21	1	MW	
C39	0.0018	μF	5%	R22	1	kW	
C40	0.1	μF		RA44	51	kW	
C41	0.1	μF		RA45	51	kW	
C44	1200	pF		R44	Vol		
C45	470	pF		R45	Vol		
C47	820	pF	10%	R47	24	kW	5%
C48	0.1	μF		R48	24	kW	5%
C49	0.0056	μF	5%	R51	330	kW	10%
C50	0.047	μF	5%	R66	47	kW	5%
C51	0.68	μF	10%	RA66	15	kW	5%
C52	0.22	μF	10%	R67	7.5	kW	5%
C53	0.22	μF	10%	R68	47	kW	5%
C54	4.7	μF	20%	RA68	15	kW	5%
C55	4.7	μF	20%	R69	7.5	kW	5%
C56	0.22	μF	10%	R72	22	kW	
C57	0.22	μF	10%	R73	22	kW	
C58	0.1	μF	20%	R74	4.7	MW	10%
C59	0.047	μF	5%	R78	100	kW	1%
C60	0.047	μF	5%	R80	220	kW	5%
C61	0.1	μF	20%				
C62	0.1	μF	20%				
C63	0.022	μF	5%				
C64	0.022	μF	5%				