M69032P

DOLBY PRO LOGIC SURROUND DECODER

DESCRIPTION

M69032P IC was developed for dolby pro logic surround systems.

This IC has almost all functions necessary for dolby pro logic surround decoders, such as input autobalance, noise sequencer and adaptive matrix. By combining this IC with M65830BP/FP digital delay IC, a 2 chip dolby prologic surround system can be formed.

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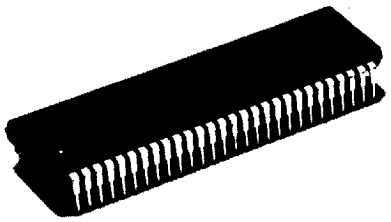
FEATURES

- Has almost all functions necessary for dolby prologic surround decoders
- Input autobalance
- Input buffer
- Noise sequencer ;
  controls noise generator in sequence with 2-bit digital data
- Adaptive matrix
- Center mode control
  Switches between ON and OFF, as well as between NORMAL, PHANTOM and WIDEBAND
- Modified dolby B type noise reduction
- Operation mode control
  4-channel (left, right, center, surround), 3-channel (left, right, and center), 2-channel (input through)
- L + R output and L − R output

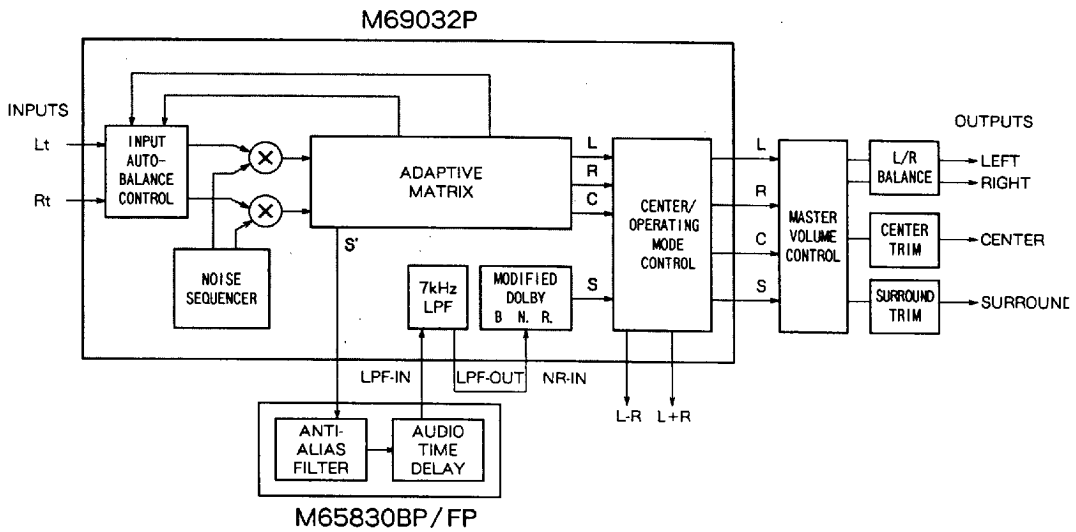


Outline 56SDIP

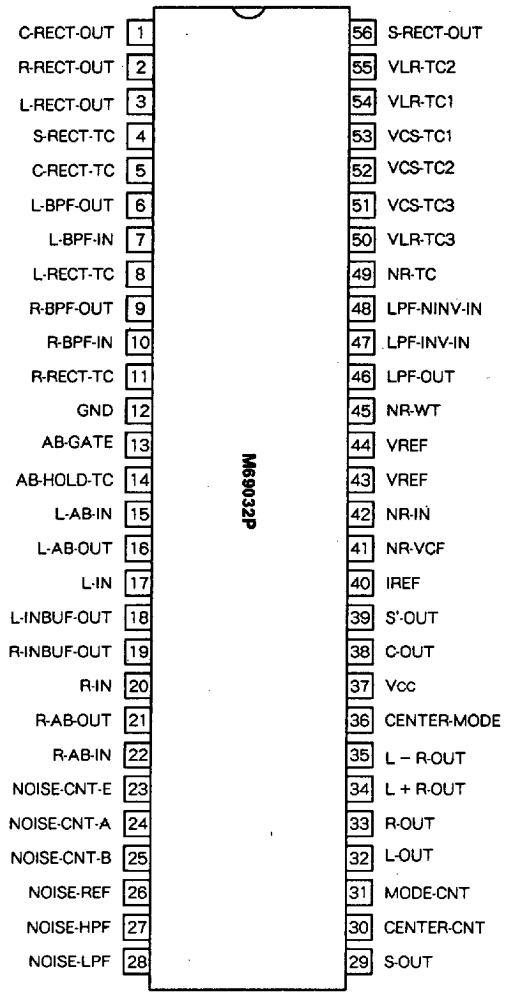
RECOMMENDED OPERATING CONDITIONS

Supply voltage range ..... V_{CC} = 9 to 13V
Rated supply voltage ..... V_{CC} = 12V

SYSTEM CONFIGURATION

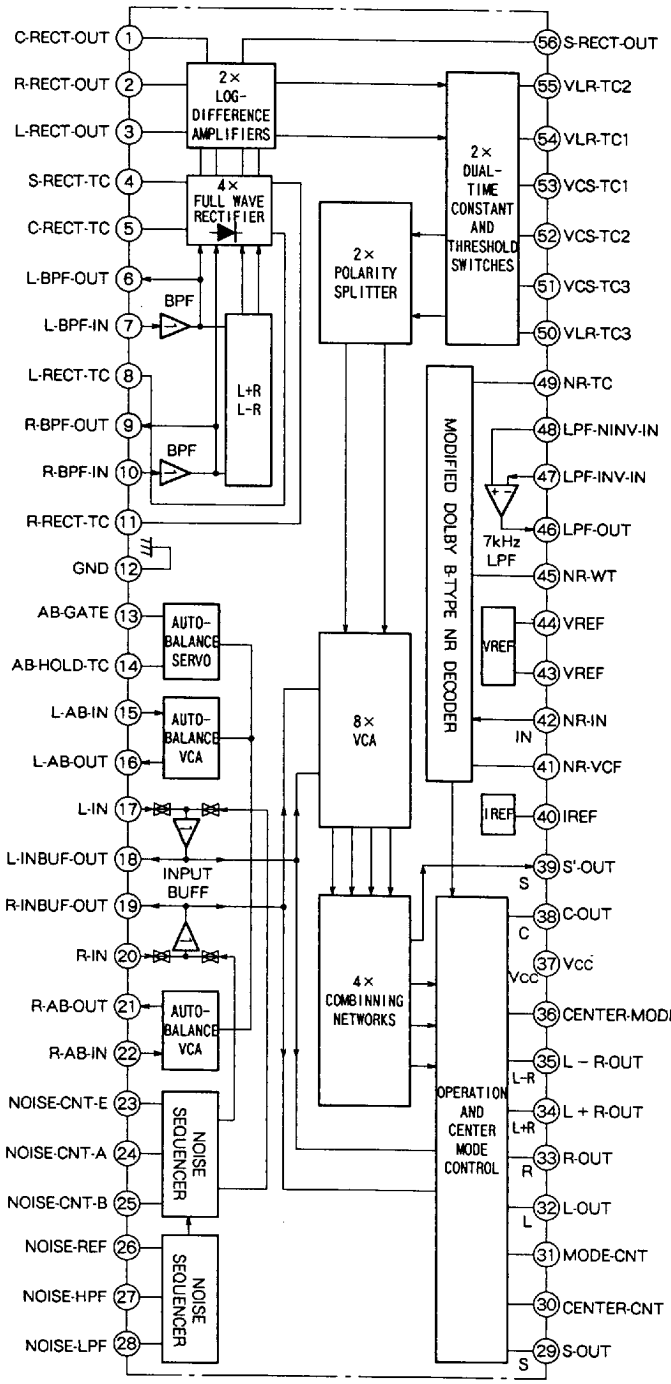


PIN CONFIGURATION (TOP VIEW)



Outline 56SDIP

IC INTERNAL BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS (Ta = 25℃, unless otherwise noted)

Symbol	Parameter	Ratings	Unit
V_{CC}	Supply voltage	15	V
P_d	Power dissipation	700	mW
T_{opr}	Operating temperature	−20 to +75	℃
T_{stg}	Storage temperature	−40 to +125	℃

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter		Test conditions	Limits			Unit
				Min	Typ	Max	
V_{op}	Supply voltage			9.0	12.0	13.0	V
Icc	Circuit current		No signal	−	34.0	40.0	mA
V_{ref}	Reference voltage		No signal	3.5	4.0	4.4	V
V_{o2ch}	Control SW threshold	2ch mode	MODE-CNT PIN	0.0	−	0.8	V
V_{o3ch}		3ch mode	MODE-CNT PIN	−	OPEN	−	−
V_{o4ch}		4ch mode	MODE-CNT PIN	3.8	−	7.0	V
V_{ccon}		Center on/off	CENTER-CNT PIN	2.4	−	7.0	V
V_{ccof}			CENTER-CNT PIN	0.0	−	0.8	V
V_{cnon}		Noise seq. on/off	NOISE-CNT-E PIN	0.0	−	0.8	V
V_{cnof}			NOISE-CNT-E PIN	3.2	−	7.0	V
V_{cnsH}		Noise seq. channel select H	NOISE-CNT-A and NOISE-CNT-B PIN	3.2	−	7.0	V
V_{cnsL}		Noise seq. channel select L	NOISE-CNT-A and NOISE-CNT-B PIN	0.0	−	0.8	V

ELECTRICAL CHARACTERISTICS (Ta = 25℃, Vcc = 12V, 0dB Reference is 300mV/1kHz at C-OUT, unless otherwise noted)

1. MODIFIED B NOISE REDUCTION (0dB Reference is 300mV/100Hz at S-OUT)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
GV-NR	Voltage gain	V_{in} = 0dBd, f = 100Hz	−	9.0	−	dB
Dec1	Decode Responce	V_{in} = 0dBd, f = 1kHz	−1.6	−0.1	1.4	dB
Dec2		V_{in} = −15dBd, f = 1.4kHz	−3.0	−1.5	0.0	dB
Dec3		V_{in} = −20dBd, f = 1.4kHz	−4.9	−3.4	−1.9	dB
Dec4		V_{in} = −40dBd, f = 5kHz	−6.8	−5.3	−3.8	dB
THD-NR	T.H.D	V_{in} = 0dBd, f = 1kHz	−	0.07	0.3	%
HR-NR	Headroom	Vcc = 9V at THD = 1%	15.0	17.0	−	dB
SN-NR	S.N Ratio	R_g = 0Ω, weighted CCIR/ARM	76	82	−	dB

2. NOISE SEQUENCER

Symbol	Parameter		Test conditions	Limits			Unit
				Min	Typ	Max	
V_{no}	Output noise level			−15	−12.5	−10	dB
V_{no}-L	Output noise level accuracy relative to Cch	L ch		−0.5	0.0	0.5	dB
V_{no}-R		R ch		−0.5	0.0	0.5	dB
V_{no}-S'		S' ch		−0.5	0.0	0.5	dB

3. ADAPTIVE MATRIX

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
Vol	Output level accuracy relative to Cch L, R, S'ch out		−0.5	0	0.5	dB
Mr	Matrix rejection relative to Lch R, C, S'ch out		25.0	40.0	−	dB
THD-AM	T.H.D L, R, C, S'ch out		−	0.02	0.20	%
HR-AM	Headroom L, R, C, S'ch out	Vcc = 9V at T.H.D = 1%	15.0	15.7	−	dB
SN-AM	Signal to noise ratio L, R, C, S'ch out	R_g = 0Ω, weighted CCIR/ARM	76	83	−	dB

4. AUTO BALANCE

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
CPR	Capture range		−	±5	−	dB
CER	Error collection		−	±4	−	dB
THD-AB	T.H.D Lt, Rt, out		−	0.03	0.20	%
HR-AB	Headroom Lt, Rt, out	Vcc = 9V at T.H.D = 1%	15.0	17.0	−	dB
SN-AB	S/N Lt, Rt, out	R_g = 0Ω, weighted CCIR/ARM	78	83	−	dB

5. L+R & L−R OUTPUT

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
Vol-OP	Output level accuracy relative to Cch L+R, L−R ch		−1.0	0	1.0	dB
THD-OP	T.H.D		−	0.02	0.20	%
HR-OP	Headroom	Vcc = 9V at T.H.D = 1%	15.0	17.0	−	dB
SN-OP	S/N	R_g = 0Ω, weighted CCIR/ARM	76	92	−	dB

FUNCTION DIAGRAMS

1. OPERATION MODE

Mode \ Pin name (Pin No)	MODE-CNT (Pin ㉛)	Note
2CH (Lt,Rt,S')	L	S' = Lt − Rt or Noise
3CH (L,C,R,S')	High Z	S' = Lt − Rt or Noise
4CH (L,C,R,S'S)	H	

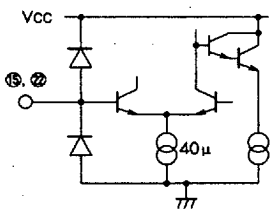
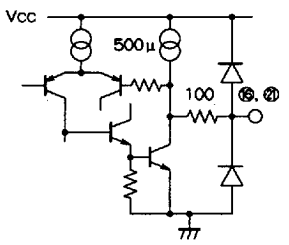
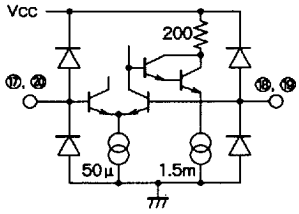
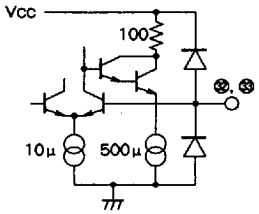
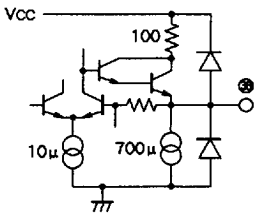
2. CENTER MODE

Mode \ Pin name (Pin No)	CENTER-CNT (Pin ㉚)	CENTER-MODE (Pin ㉘)
Center off	L	X
Normal	H	0.22μF
Phantom	H	OPEN
Wideband	H	10μF

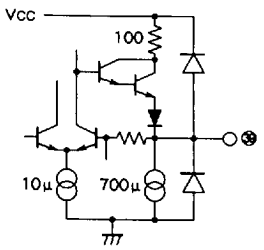
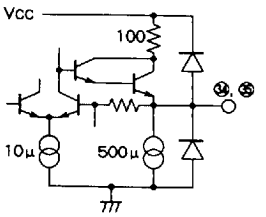
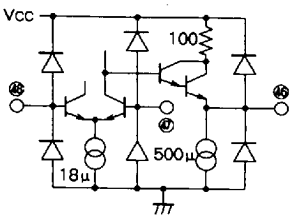
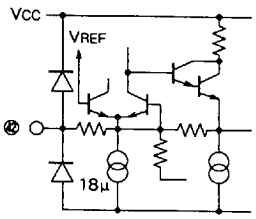
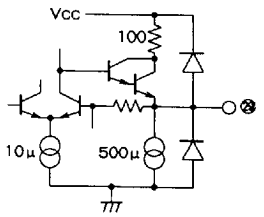
3. NOISE SEQUENCER

Mode \ Pin name (Pin No)	NOISE-CNT-E (Pin ㉓)	NOISE-CNT-A (Pin ㉔)	NOISE-CNT-B (Pin ㉕)
Signal select	H	X	X
Noise L	L	L	L
Noise C	L	L	H
Noise R	L	H	L
Noise S	L	H	H

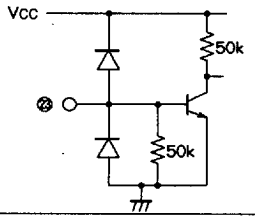
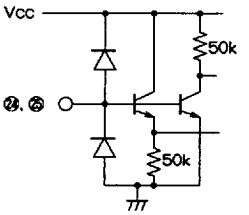
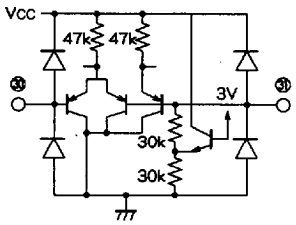
PIN DESCRIPTION

Pin No.	Name	Function	Voltage	Description	Equivalent circuit
⑮	L – AB – IN	Autobalance, L-ch input	4V	Autobalance amplifier input pins Noninverting operational amplifier is applied to these pins. To provide DC bias, pull them up by connecting external resistance (R11.1, 112 : 22kΩ to 75kΩ) to $V_{ref.}$	
㉒	R – AB – IN	Autobalance, R-ch input	4V		
⑯	L – AB – OUT	Autobalance, L-ch output	4V	Autobalance amplifier output pins. They are controlled from adaptive martrix, so that signals are output with the imbalance between right and left corrected. They are normally direct-connected to, respectively, L-IN and R-IN described below.	
㉑	R – AB – OUT	Autobalance, R-ch output	4V		
⑰	L – IN	L-ch input	4V	Adaptive matrix input circuit. Noniverting operational amplifier is applied to the input pins. To provide DC bias, pull them up by connecting external resistance (22kΩ to 75kΩ) to V_{REF} if they are not directly connected to the autobalance output pins described above.	
⑳	R – IN	R-ch input	4V		
⑱	L – INBUF – OUT	L-ch input Buffer output	4V		
⑲	R – INBUF – OUT	R-ch input Buffer output	4V		
㉜	L – OUT	L-ch output	4V	These pins output R-/L-channel inputs as they are when the operation mode is 2-channel. If the mode is 3-channel, these pins output Dolby 3 stereo R-/L-channel signals. When the mode is 4-channel, they output Dolby prologic R-/L-channel signals.	
㉝	R – OUT	R-ch output	4V		
㊳	C – OUT	C-ch output	4V	Does not output any signals when the operation mode is 2-channel or when the center mode is OFF or set to PHANTOM.	

PIN DESCRIPTION (continued)

Pin No.	Name	Function	Voltage	Description	Equivalent circuit
㊳	S'– OUT	Sorround channel output	4V	Sorround channel output precedent to delay generator. Always outputs signals, irrespective of the operation mode (2-/3-/4-channel).	
㊴	L + R – OUT	L-channel and R-channel summing output	4V	Pin L + R – OUT outputs the sum of L-channel and R-channel signals that do not go through adaptive matrix. Pin L + R – OUT outputs the difference between them. These pin always output signals, irrespective of the operation mode (2-/3-/4-channel).	
㊵	L – R – OUT	L-channel and R-channel subtraction output	4V		
㊼	LPF – INV – IN	LPF inverted input	4V	Operational amplifier. This amplifier forms a 7kHz low-pass filter (LPS) with external components. Connect the noninverted input pin to V_{REF} to from an LPS in the inverting amplifier style, and input signals by AC coupling (or by DC coupling if surround output is directly connected to LPS without delay generator).	
㊽	LPF – NINV – IN	LPF noninverted input	4V		
㊻	LPF – OUT	LPF output	4V		
㊷	NR – IN	Modified B-type noise reduction input	4V	B-type noise reduction input pin. Connect directly to LPF-OUT in normal cases as shown in the application example. To input signals directly, connect by AC coupling, because noninverting operational amplifier is applied to this pin. Please note that the input/output phase is inverted at 180° in this case.	
㊸	S – OUT	Surround output	4V	This pin outputs surround signals decoded by modified B-type noise reduction. Outputs signals only when the mode is 4-channel. (Outputs 4-V DC in the 2- or 3-channel mode.) There is a gain of approximately 9dB between this output and noise reduction input. When connecting delay genetator behind modified B-type noise reduction, lower the gain by approximately 9dB at the LPF.	

PIN DESCRIPTION (continued)

Pin No.	Name	Function	Voltage	Description	Equivalent circuit
㉓	NOISE – CNT – E	Signal noise selection		This pin controls the switchover between adjusting noise and signal. Control input voltage should be between 0V to 8V.	
㉔	NOISE – CNT – A	Noise output destination selection		These pin switches adjusting noise output destination according to 2-bit digital data. Control input voltage should be between 0V to 8V.	
㉕	NOISE – CNT – B	Noise output destination selection			
㉚	CENTER – CNT	C-ch channel ON/OFF switching		Controls the center channel (ON/OFF). Control input voltage should be between 0V to 8V.	
㉛	MODE – CNT	2-/3-/4-channel switching		Controls the operation mode (2-/3-/4-channel). Control input voltage should be between 0V to 8V. Set to open in the 3-channel mode.	

TEST CONDITIONS

1) Mode sequence

Noise	PPVI 5	PPVI 6	PPVI 7
OFF	H	X	X
L	L	L	L
C	L	L	H
R	L	H	L
S'	L	H	H

Channel mode	PPVI 3
2ch	L
3ch	Open
4ch	H

CENTER	PPVI 4	K9
OFF	L	X
ON	H	X
P	H	OFF
W	H	ON

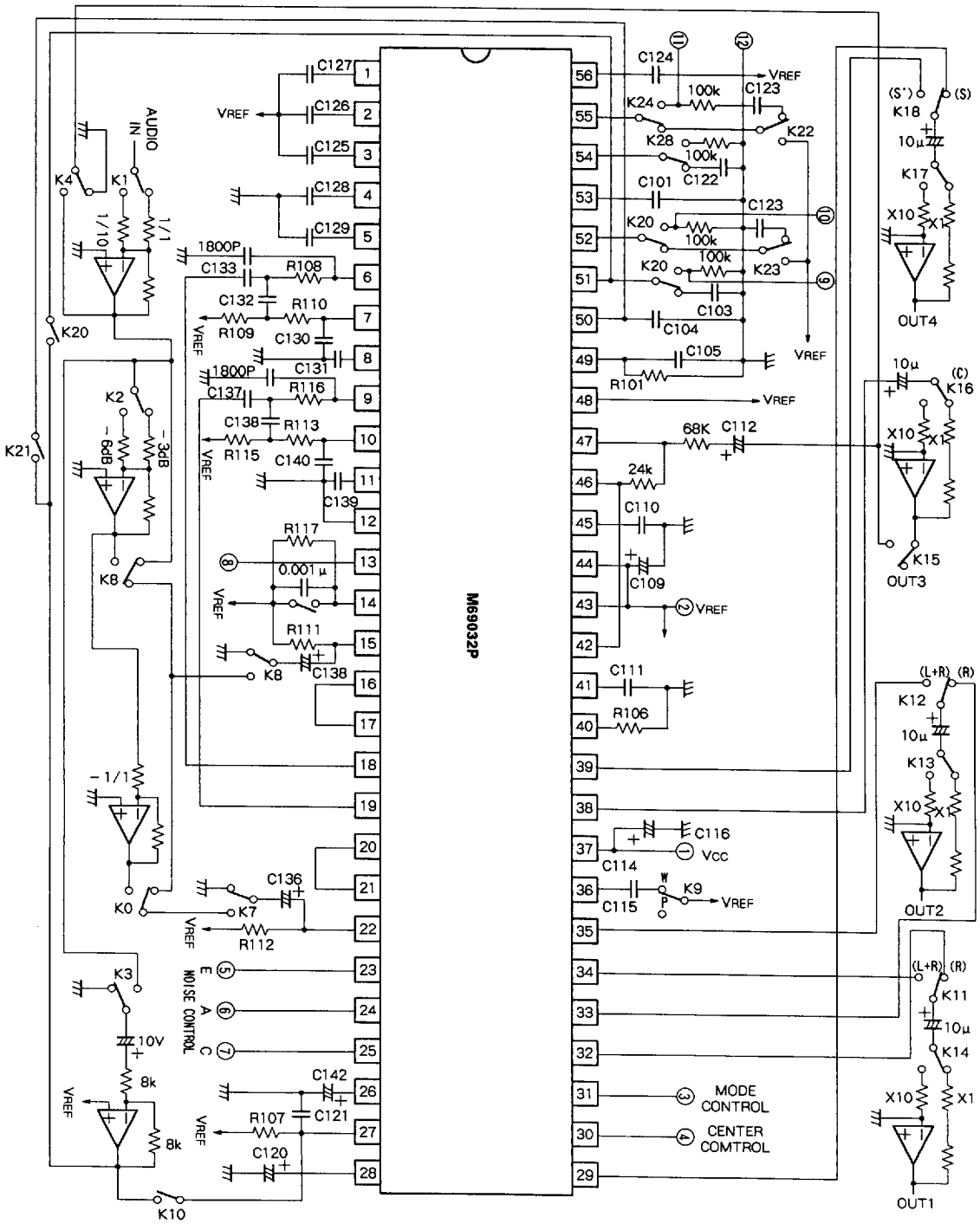
Auto balance	K19
OFF	ON
ON	OFF

Note1. For noise sequencer, set K10 to ON except for V_{NO}(white noise).

2) Input selection switch conditions

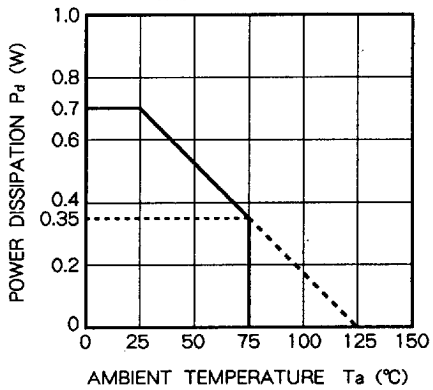
Function	K1	K2	K3	K4	K5	K6	K7	K8	K10	K20	K21
OFF	X	X	X	OFF	X	X	OFF	OFF	OFF	OFF	OFF
ATT 1/1	OFF	X	X	X	X	X	X	X	X	X	X
ATT 1/10	ON	X	X	X	X	X	X	X	X	X	X
L	X	X	X	OFF	OFF	X	OFF	ON	OFF	OFF	OFF
C	X	OFF	X	OFF	ON	OFF	ON	ON	OFF	OFF	OFF
R	X	X	X	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF
S'	X	OFF	X	OFF	ON	ON	ON	ON	OFF	OFF	OFF
S : Dolby	X	X	X	ON	X	X	OFF	OFF	OFF	OFF	OFF
LL : Collection level	X	OFF	X	OFF	ON	ON	ON	ON	OFF	OFF	OFF
CP : Capture range	X	ON	X	OFF	ON	ON	ON	ON	OFF	OFF	OFF
CNT1 : Field through	X	X	ON	OFF	X	X	OFF	OFF	OFF	ON	OFF
CNT2 : Field through	X	X	ON	OFF	X	X	OFF	OFF	OFF	OFF	ON

TEST CIRCUIT

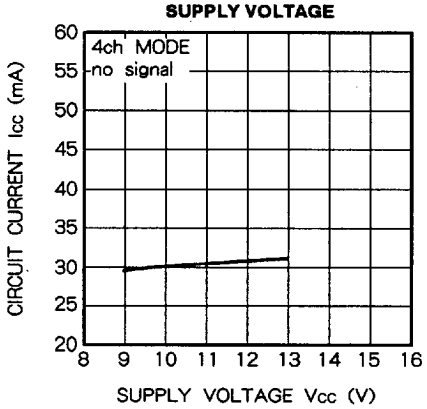


TYPICAL CHARACTERISTICS

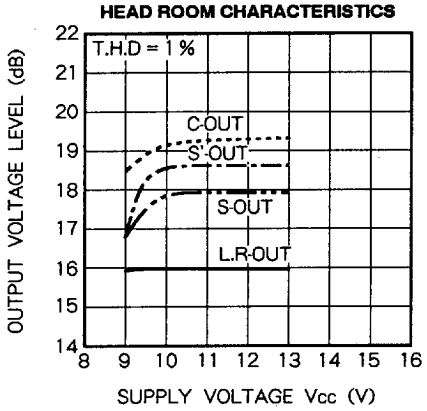
THERMAL DERATING



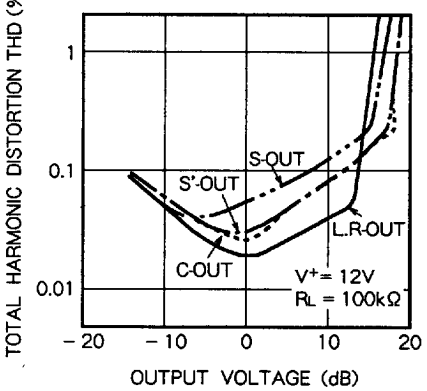
CIRCUIT CURRENT VS. SUPPLY VOLTAGE



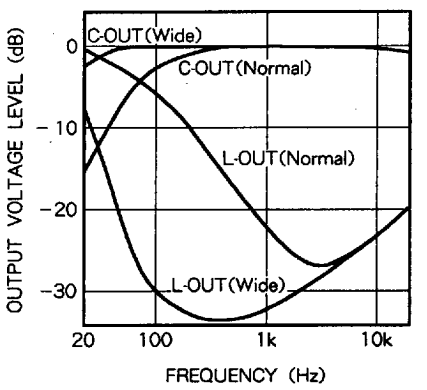
HEAD ROOM CHARACTERISTICS



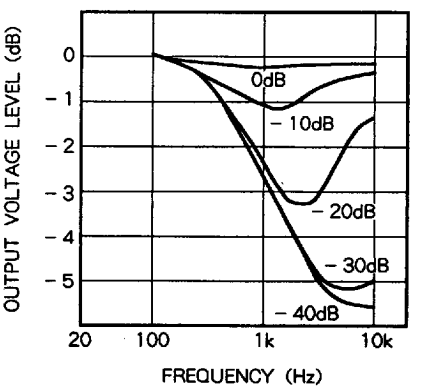
TOTAL HARMONIC DISTORTION VS. SUPPLY VOLTAGE



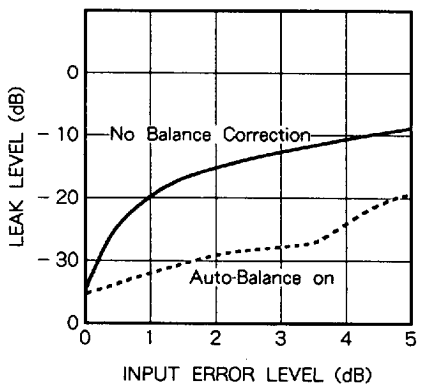
ADAPTIVE MATRIX CHARACTERISTICS (C-IN)



MODIFIED B TYPE NOISE REDUCTION DECODING CHARACTERISTICS



AUTOBALANCE CHARACTERISTICS



OPTIONAL PARTS LIST

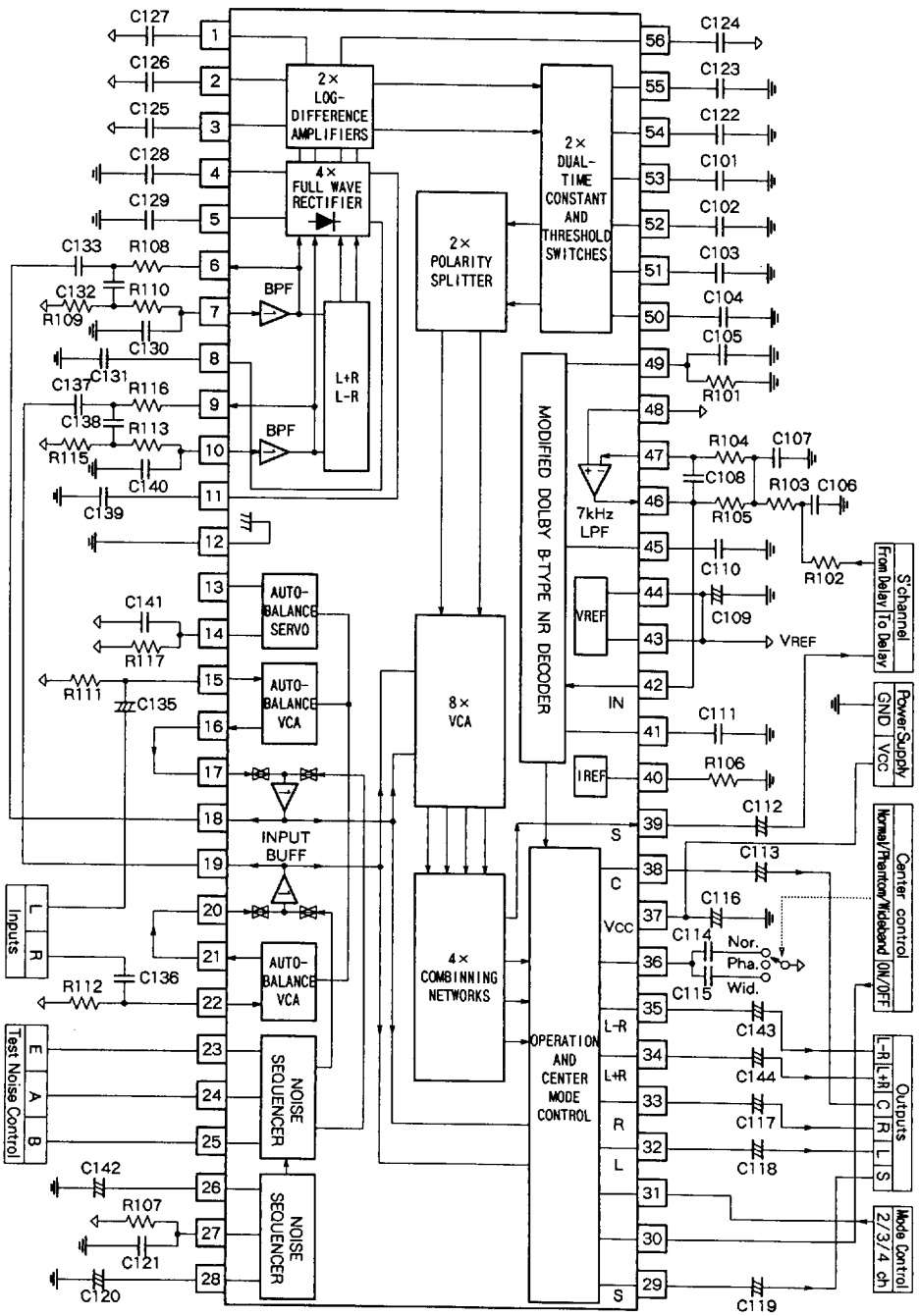
1. M69032P application circuits

PARTS NO.	VALUE	TOL.		PARTS NO.	VALUE	TOL.		PARTS NO.	VALUE	TOL.	
C 101	4.7μF	20%		C 123	0.22μF	10%		R 101	330kΩ	10%	
C 102	0.22μF	10%		C 124	0.1μF	20%		R 102	8.2kΩ		
C 103	0.22μF	10%		C 125	0.1μF	20%		R 103	8.2kΩ	5%	
C 104	0.22μF	10%		C 126	0.1μF	20%		R 104	8.2kΩ	5%	
C 105	0.68μF	10%		C 127	0.1μF	20%		R 105	15kΩ	5%	
C 106	5600pF	10%		C 128	0.022μF	5%		R 106	100kΩ	1%	
C 107	4700pF	10%		C 129	0.022μF	5%		R 107	100kΩ	5%	
C 108	470pF	10%		C 130	680pF	5%		R 108	7.5kΩ	5%	
C 109	220μF	10%	≧150μF	C 131	0.047μF	5%		R 109	15kΩ	5%	
C 110	0.047μF	5%		C 132	0.1μF	5%		R 110	47kΩ	5%	
C 111	5600pF	5%		C 133	0.1μF	5%		R 111	22kΩ		
C 112	10μF			C 135	10μF			R 112	22kΩ		
C 113	10μF			C 136	10μF			R 113	47kΩ	5%	
C 114	0.22μF	10%		C 137	0.1μF	5%		R 115	15kΩ	5%	
C 115	10μF	10%		C 138	0.1μF	5%		R 116	7.5kΩ	5%	
C 116	100μF		≧100μF	C 139	0.047μF	5%		R 117	10MΩ	10%	
C 117	10μF			C 140	680pF	5%					
C 118	10μF			C 141	10μF	20%	Low leak				
C 119	10μF			C 142	10μF						
C 120	22μF	10%		C 143	10μF						
C 121	4700pF	5%		C 144	10μF						
C 122	4.7μF	20%									

2. M69032P & M65830BP/FP application circuits

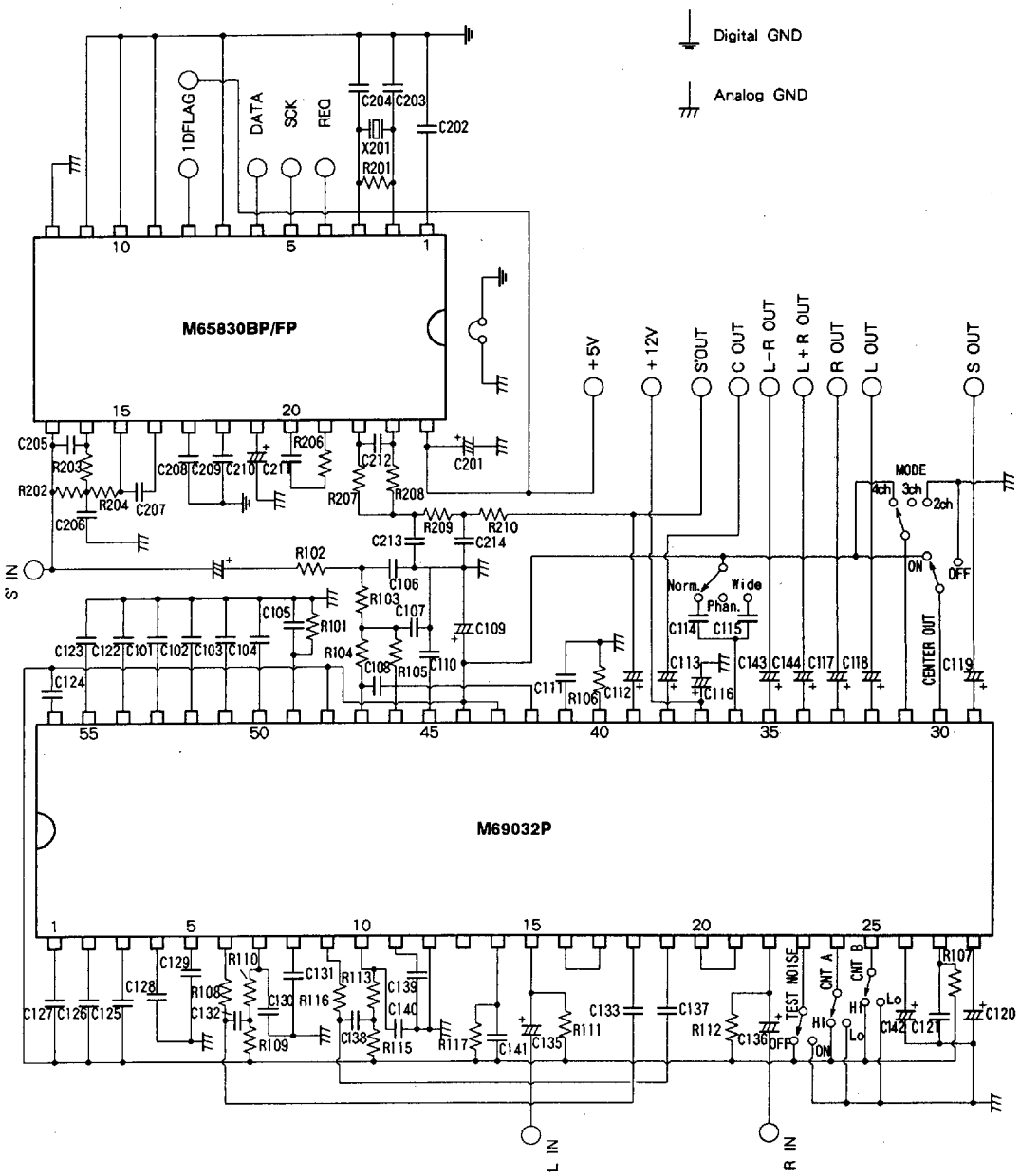
PARTS NO.	VALUE	TOL.		PARTS NO.	VALUE	TOL.		PARTS NO.	VALUE	TOL.	
C 101	4.7μF	20%		C 131	0.047μF	5%		R 101	330kΩ	10%	
C 102	0.22μF	10%		C 132	0.1μF	5%		R 102	short		
C 103	0.22μF	10%		C 133	0.1μF	5%		R 103	15kΩ	5%	
C 104	0.22μF	10%		C 135	10μF			R 104	15kΩ	5%	
C 105	0.68μF	10%		C 136	10μF			R 105	15kΩ	5%	
C 106	open			C 137	0.1μF	5%		R 106	100kΩ	1%	
C 107	2200pF	10%		C 138	0.1μF	5%		R 107	100kΩ	5%	
C 108	470pF	10%		C 139	0.047μF	5%		R 108	7.5kΩ	5%	
C 109	220μF	10%	≧150μF	C 140	680pF	5%		R 109	15kΩ	5%	
C 110	0.047μF	5%		C 141	10μF	20%	Low leak	R 110	47kΩ	5%	
C 111	5600pF	5%		C 142	10μF			R 111	22kΩ		
C 112	1μF			C 143	10μF			R 112	22kΩ		
C 113	10μF			C 144	10μF			R 113	47kΩ	5%	
C 114	0.22μF	10%						R 115	15kΩ	5%	
C 115	10μF	10%						R 116	7.5kΩ	5%	
C 116	100μF		≧100μF	C 201	100μF			R 117	10MΩ	10%	
C 117	10μF			C 202	0.1μF			R 201	1MΩ		
C 118	10μF			C 203	100pF			R 202	15kΩ		
C 119	10μF			C 204	100pF			R 203	18kΩ		
C 120	22μF	10%		C 205	470pF			R 204	15kΩ		
C 121	4700pF	5%		C 206	3300pF			R 205	short		
C 122	4.7μF	20%		C 207	0.068μF			R 206	30Ω		
C 123	0.22μF	10%		C 208	0.1μF			R 207	5.6kΩ		
C 124	0.1μF	20%		C 209	0.1μF			R 208	18kΩ		
C 125	0.1μF	20%		C 210	47μF			R 209	7.5kΩ		
C 126	0.1μF	20%		C 211	0.068μF			R 210	8.2kΩ		
C 127	0.1μF	20%		C 212	470pF						
C 128	0.022μF	5%		C 213	5600pF			X 201	2MHz		
C 129	0.022μF	5%		C 214	5600pF						
C 130	680pF	5%		C 215	1μF						

APPLICATION EXAMPLE



Units Resistance : Ω
Capacitance : F

M69032P & M65830BP/FP APPLICATION EXAMPLE



Units Resistance : Ω
Capacitance : F