

# VCR Hi-Fi audio signal processing system

## BH7778AK

The BH7778AK is a Hi-Fi audio signal processing system IC comprised of a peak-noise reduction (PNR) processor, an FM modulator/demodulator circuit, an input/output switch circuit, an automatic FM detector circuit, an FM band-pass filter, and a regulator circuit. The IC runs of a dual  $\pm$  power supply which allows a large reduction in the number of external components required.

● Applications

Video cassette recorders

● Features

- 1) Operates off dual  $\pm$  power supply which allows a large reduction in the number of coupling capacitors required. A built-in regulator makes it easy to construct a power supply system.
- 2) Two input switch systems are provided (tuner and line). LEFT/RIGHT/STEREO and HiFi/MIX/NORMAL switches are built-in.
- 3) The PNR processor and FM modulation/demodulation circuit provide reverse characteristics at recording and playback to allow combined adjustment of FM deviation and playback level.
- 4) Peak-level compression circuit suppresses abnormal noise generation due to pulsating noise sources.
- 5) Switching noise is reduced by a slope-control type differential compensation circuit.
- 6) Built-in FM band-pass filter connects directly to the playback amplifier and excels at attenuation of the other channel. The FM recording output circuit has a high-performance high-frequency cutoff filter that produces a sine wave output.
- 7) Built-in envelope detector circuit and noise-detecting automatic FM detector circuit.

● Absolute maximum ratings (Ta=25°C)

Parameter	Symbol	Limits	Unit
Applied voltage	V <sub>IN</sub>	23, 24, 25, 48, 49, 61, 63 pin...+6.5	V
	V <sub>IN</sub>	60pin.....-6.0	V
	V <sub>IN</sub>	Other than the pins above...+6.0	V
Power dissipation	P <sub>d</sub>	800*	mW
Operating temperature	T <sub>opr</sub>	-10~70	°C
Storage temperature	T <sub>stg</sub>	-55~125	°C

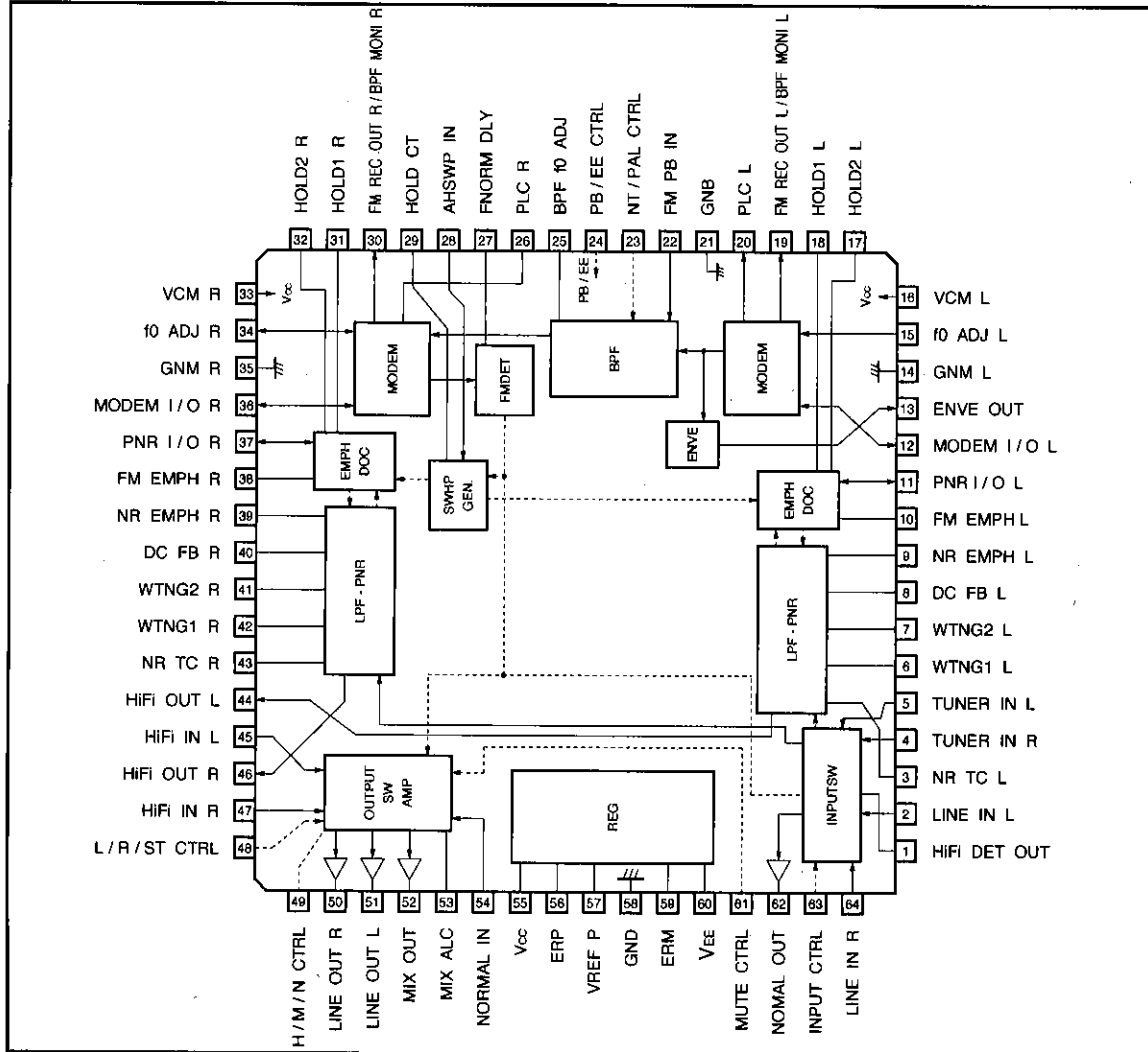
\* When IC is stand alone, reduced by 8.0mW for each increase in Ta of 1°C over 25°C. When mounted on 70mm<sup>2</sup> x 70mm<sup>2</sup>, t = 1.6mm glass epoxy PCB, P<sub>d</sub> = 1.1W (reduced by-11mW for each increase in Ta of 1°C over 25°C).

● Recommended operating conditions (Ta=25°C)

Parameter	Symbol	Range	Unit
Power supply voltage	UNREG - V <sub>CC</sub>	+7.0~*	V
Power supply voltage	UNREG - V <sub>EE</sub>	+7.0~*	V

\* The built-in regulator in this IC outputs +5.0V from pin 55, and -5.0V from pin 60. The supply voltage range given above is the voltage to be applied to UNREG V<sub>CC</sub> and UNREG V<sub>EE</sub> pins in the test circuit to obtain regulator output. Therefore, the upper limit of the voltage range is set by the externally connected transistor that forms the regulator circuit, and not by the IC itself. Note, also, that the lower limit will change depending on the value of the resistor connected between the collector and base of the transistor.

● Block diagram



Single-chip Hi-Fi audio signal processors

VCR components

## ● Pin descriptions

Pin No.	Pin Name	Function	Pin Voltage	I/O Circuit
1	HiFi DET OUT	FM detector signal output	EE : 5.0V PB : 5.0V 0.0V	5.0V : 26k $\Omega$ 0.0V : 1k $\Omega$
2, 64	LINE IN L, R	Line input (L and R). GND bias resistor required.	0.0V	B (NPN)
3, 43	NR TC L, R	PNR attack and recovery time setting. Attack R: 530 $\Omega$ , recovery R: 6.5k $\Omega$ .	-5.0V	—
4, 5	TUNER IN L, R	Tuner input (L and R). GND bias resistor required.	0.0V	B (NPN)
6, 42	WTNG1 L, R	Waiting characteristic setting.	0.0V	10k $\Omega$
7, 41	WTNG2 L, R	Waiting high-frequency time constant setting (external C = 0.022 $\mu$ F)	0.0V	1.1k $\Omega$
8, 40	DC FB L, R	PNR operating reference potential.	0.0V	11.5k $\Omega$
9, 39	NR EMPH L, R	NR emphasis time constant setting. R = 18k $\Omega$ , 5.6k $\Omega$ (external C = 0.01 $\mu$ F)	0.0V	—
10, 38	FM EMPH L, R	FM emphasis time constant setting. R = 11k $\Omega$ , 6.2k $\Omega$ (external C = 3300pF)	0.0V	—
11, 37	PNR I/O L, R	PNR processor input/output (EE: compressed output, PB: expanded input)	0.0V	EE : EF (NPN) PB : 50k $\Omega$
12, 36	MODEM I/O L, R	MODEM input/output (EE: modulated input, PB: demodulated output)	2.5V	EE : 50k $\Omega$ PB : EF (NPN)
13	ENVE OUT	FM input Lch signal component envelope output.	EE : 0.8V PB : 1.0V	EE : 50k $\Omega$ PB : EF (NPN)
14, 35	GND <sub>M</sub> (GNM) L, R	GND for PNR and MODEM. Both L and R unconnected.	0.0V	—
15, 34	f <sub>0</sub> ADJ L, R	VCO control current input.	2.5V	EF (NPN)
16, 33	V <sub>CCM</sub> (VCM) L, R	V <sub>CC</sub> for MODEM.	5.0V	—
17, 32	HOLD2 L, R	For connection of slope control differential holding capacitor.	0.0V	EF (NPN) ~1k $\Omega$
18, 31	HOLD1 L, R	For connection of previous value holding capacitor.	0.0V	200 $\Omega$
19, 30	FM REC OUT L, R (BPF MONITOR L, R)	Recording FM input pin. Sine wave output. BPF output monitor pin.	EE : 2.7V PB : 2.7V	EF (NPN) ~200 $\Omega$
20	PLC L	EE: PLC time constant setting. PB: Connect C for FM detector carrier filter.	EE : 0.0V PB : 1.8V	EE : EF (NPN)~50k $\Omega$ PB : EF (P - P)~400 $\Omega$
21	GND <sub>B</sub> (GNB)	FM BPF GND.	0.0V	—
22	FM PB IN	Playback FM input. 650mV <sub>r-p</sub> Typ. No input coupling capacitor (GND to V <sub>CC</sub> ).	0.0V	33k $\Omega$
23	NT / PAL CTRL	FM BPF, DEV NTSC/PAL switching	2.5V	B (PNP)
24	PB / EE CTRL	EE mode/PB mode control.	—	B (PNP)
25	BPF f <sub>0</sub> ADJ.	FM BPF center frequency adjustment.	1.8V	EF (NPN) ~200 $\Omega$
26	PLC R	EE: PLC time constant setting. PB: FM ALC time constant setting.	EE : 0.0V PB : 0.0V	EE : EF (NPN)~50k $\Omega$ PB : EF (NPN)~2.5k $\Omega$
27	F - NORM DLY	Forced normal signal return delay time setting. Set the time constant with C and R.	—	OPEN - C (NPN)
28	AHWP IN	Audio head switching pulse input.	—	B (NPN)
29	HOLD CT	Hold time setting	—	OPEN - C (NPN)
44, 46	HiFi OUT L, R	PNR audio output	0.0V	EF : (P - P)
45, 47	HiFi IN L, R	HiFi input for output switch	0.0V	47k $\Omega$
48	L / R / ST CTRL	LEFT/RIGHT/STEREO switch control	—	B (PNP)
49	H / M / N CTRL	HiFi/MIX/NORMAL switch control	—	B (PNP)
50, 51	LINE OUT L, R	Line output	0.0V	330 $\Omega$

\* I/O circuit ; EF: emitter follower, P-P: push pull, B: base, and C: collector.  
All numerical values are standardized values.

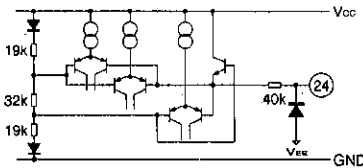
●Pin descriptions

Pin No.	Pin Name	Function	Pin Voltage	I/O Circuit
52	MIX OUT	Mixer amplifier output for RF converter.	0.0V	EF (NPN)
53	MIX ALC	ALC time constant setting for mixer amplifier. Attack and recovery time setting.	-5.0V	EF (NPN) ~500Ω
54	NORMAL IN	Switch input for normal output.	0.0V	B (NPN)
55	V <sub>CC</sub>	V <sub>CC</sub> regulator.	5.0V	—
56	ERP	V <sub>CC</sub> regulator error output.	5.0V	C (NPN)
57	VREF P	V <sub>CC</sub> /2 reference voltage. With power on detect and precharge function.	2.5V	10kΩ
58	GND	Input/output switch GND.	0.0V	—
59	ERM	V <sub>EE</sub> regulator error output.	-5.0V	C (NPN)
60	V <sub>EE</sub>	V <sub>EE</sub> regulator.	-5.0V	—
61	MUTE CTRL	Line output mute control input.	—	3kΩ (2.5V or more)
62	NORMAL OUT	Switch output for normal input.	0.0V	B (NPN)
63	INPUT CTRL	TUNER/BIL/LINE input selection control.	—	B (PNP)

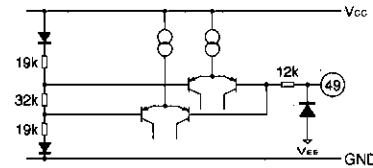
\* EF: emitter follower, P-P: push pull, B: base, and C: collector.  
All numerical values are standardized values.

●Input / output circuits

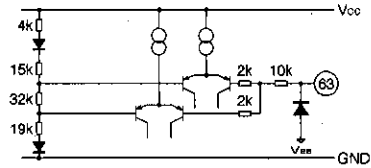
PB / EE CTRL



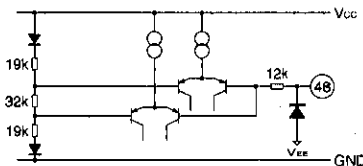
HiFi / MIX / NORMAL CTRL



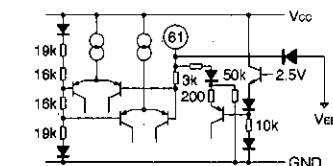
INPUT CTRL



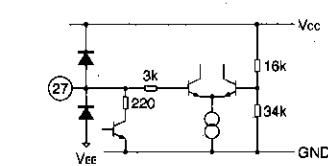
LEFT / RIGHT / STEREO CTRL



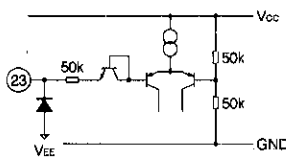
MUTE CTRL



FNORM DLY



NT / PAL CTRL



Single-Chip Hi-Fi audio signal processors

VCR components

●Electrical characteristics (Unless otherwise specified: UNREG  $V_{CC}=+10V$ , UNREG  $V_{EE}=-10V$ , and  $T_a=25^{\circ}C$ )

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	
<b>(REGULATOR)</b>							
EE circuit current (+supply)	$I_{QP REC}$	22.3	31.8	45.4	mA	EE Mode, no input $f_0$ and BPF setting resistor: Typ.	
PB circuit current (+supply)	$I_{QP PB}$	33.3	47.5	67.9	mA	PB Mode, no input, FNORM $f_0$ and BPF setting resistor: Typ.	
EE circuit current (-supply)	$I_{QM REC}$	8.4	12.0	17.1	mA	EE Mode, no input $f_0$ and BPF setting resistor: Typ.	
PB circuit current (-supply)	$I_{QM PB}$	9.2	13.2	18.9	mA	PB Mode, no input, FNORM $f_0$ and BPF setting resistor: Typ.	
Regulator pin voltage (+)	$V_{CC}$	4.60	5.00	5.40	V		
Regulator pin voltage (-)	$V_{EE}$	-5.38	-4.98	-4.58	V		
<b>(EE THROUGH) (INPUT : TU L/R IN, LINE L/R IN, OUTPUT : LINE L/R OUT)</b>							
Line output level (Typ.)	$V_{OEE}$	-11.4	-10.2	-9.0	dBV	$V_{IN} = -20dBV$	
Distortion	THDEE	-	0.015	0.10	%	$V_{IN} = -20dBV$ *1	
Maximum output level	$V_{OMEE}$	8.5	10.7	-	dBV	THD=1% *1	
Output residual noise	$V_{ONEE}$	-	-97.1	-88.1	dBV	$R_g=1k\Omega$ *2	
Crosstalk	CTEE	-	-	-75.0	dBV	$V_{IN} = -9.9dBV$ *2	
Muting level	MT <sub>EE</sub>	-	-116.0	-90.0	dBV	$V_{IN} = -9.9dBV$ *2	
<b>(INPUT : TU L/R IN, LINE L/R IN, OUTPUT : NORMAL OUT)</b>							
Normal out output level	$V_{ONORM}$	-20.7	-20.0	-19.3	dBV	$V_{IN} = -20dBV$ , simultaneous L & R input	
<b>(MIX AMP) (INPUT : TU L/R IN, LINE L/R IN, OUTPUT : MIX OUT)</b>							
Output level	$V_{OMIX}$	-13.3	-12.1	-10.9	dBV	$V_{IN} = -22dBV$ , simultaneous L & R input	
MIX ALC level	$V_{ALCMIX}$	-12.8	-9.8	-6.8	dBV	$V_{IN} = -17dBV$ , simultaneous L & R input	
<b>(PNR ENCODE MODE) (INPUT : TU L/R IN, LINE L/R IN, OUTPUT : PNR L/R OUT)</b>							
Encode output level	$V_{OENC}$	-17.0	-15.5	-14.0	dBV	$V_{IN} = -20dBV$	
Compression characteristic	CMP	-27.0	-25.0	-23.0	dB	$V_{IN} = -20dBV$ to $-70dBV$ , output level differential	
Encode distortion	THD <sub>ENC</sub>	-	0.15	0.35	%	$V_{IN} = -20dBV$ *1	
Output residual noise	$V_{ONENC}$	-	-59.0	-54.0	dBV	$R_g=1k\Omega$ *2	
<b>(PNR DECODE MODE) (INPUT : PNR L/R IN, OUTPUT : LINE L/R OUT)</b>							
Output voltage level	$V_{ODEC}$	-11.7	-9.7	-7.7	dBV	$V_{IN} = -15.5dBV$	
Expansion characteristic	EXP	-53.5	-50.5	-47.5	dB	$V_{IN} = -15.5dBV$ to $-40.5dBV$ , output level differential	
Decode distortion	THD <sub>DEC</sub>	-	0.10	0.25	%	$V_{IN} = -15.5dBV$ *1	
<b>(MODEM REC MODE) (INPUT : TU L/R IN, LINE L/R IN, OUTPUT : FM REC L/R OUT)</b>							
Time constant setting resistor	Lch	$R_{OL}$	12.5	15.0	17.5	k $\Omega$	No input
	Rch	$R_{OR}$	9.5	11.5	13.5	k $\Omega$	
Frequency deviation (NTSC)	Lch	DEV <sub>NL</sub>	43.0	49.5	56.0	kHz	$V_{IN}$ (TU, LINE IN) = $-20dBV$
	Rch	DEV <sub>NR</sub>	43.2	49.7	56.2	kHz	
Frequency deviation (PAL)	Lch	DEV <sub>PL</sub>	42.9	49.4	55.9	kHz	$V_{IN}$ (TU, LINE IN) = $-20dBV$ NT / PAL CTRL : H
	Rch	DEV <sub>PR</sub>	43.1	49.6	56.1	kHz	
FM output level	Lch	$V_{OFML}$	320	370	430	mV <sub>PP</sub>	
	Rch	$V_{OFMR}$	315	365	425	mV <sub>PP</sub>	

## ●Electrical characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	
(MODEM PB MODE) (INPUT : FM PB IN, OUTPUT : LINE L/R OUT) Carrier setting resistance, after BPF frequency adjustment, $V_{IN} = 660mV_{P-P}$ , 1.30MHz, 1.70MHz MIX IN							
Demodulated output level NTSC	Lch	$V_{ODNL}$	-12.0	-9.8	-7.6	dBV	DEV=±50kHz
	Rch	$V_{ODNR}$	-12.1	-9.9	-7.7	dBV	
Demodulated output level PAL	Lch	$V_{ODPL}$	-12.0	-9.8	-7.6	dBV	DEV=±50kHz NT/PAL CTRL : H
	Rch	$V_{ODPR}$	-12.1	-9.9	-7.7	dBV	
Demodulation distortion	Lch	THD2 DL	—	0.10	0.35	%	DEV=±50kHz *1
	Rch	THD2 DR	—	0.10	0.35	%	
Demodulation noise level	Lch	$V_{ONDL}$	—	-100.1	-87.6	dBV	Unmodulated *2
	Rch	$V_{ONDR}$	—	-100.1	-87.6	dBV	
(Recording → playback total characteristics) (REC · · · INPUT : TU L/R IN, LINE L/R IN, OUTPUT : LINE L/R OUT) (PB · · · INPUT : FM PB IN, OUTPUT : LINE L/R OUT)							
Line output recording / playback level difference	Lch	$V_{RPL}$	-1.2	0.0	1.2	dB	EE mode : $V_{IN} = -20dBV$ , with $R_o$ adjusted, PB mode : Input $FMPBIN = 660mV_{P-P}$ , DEV=DEV <sub>L,R</sub> (frequency deviation above). Input ( $V_{IN} = -20dBV$ ) EE/PB line out level difference.
	Rch	$V_{RPR}$	-1.2	0.0	1.2	dB	
(FM BPF) (INPUT : FM PB IN, OUTPUT : BPF MONITOR L/R)							
BPF center frequency setting resistance value	$R_{OBPF}$	18.9	25.2	31.5	kΩ	$f = 1.505MHz$ , $V_{IN} = 200mV_{P-P}$ R and L output level the same.	
Lch, Rch mix input signal level, 660mV <sub>P-P</sub> (RATIO 1 : 1)							
NTSC Lch							
1.30MHz insertion loss	$ATT_{NLC}$	-15.1	-11.1	-7.1	dB	1.30MHz+1.70MHz FM ALC ON	
1.70MHz insertion loss	$ATT_{NL}$ <sub>1.70</sub>	—	—	$ATT_{NLC}$ -30.0	dB	1.30MHz+1.70MHz	
NTSC Rch							
1.70MHz insertion loss	$ATT_{NRC}$	-16.3	-12.3	-8.3	dB	1.30MHz+1.70MHz FM ALC ON	
1.30MHz insertion loss	$ATT_{NR}$ <sub>1.30</sub>	—	—	$ATT_{NRC}$ -30.0	dB	1.30MHz+1.70MHz	
PAL Lch							
1.40MHz insertion loss	$ATT_{PLC}$	-13.9	-9.9	-5.9	dB	1.40MHz+1.80MHz FM ALC ON	
1.80MHz attenuation	$ATT_{PL}$ <sub>1.80</sub>	—	—	$ATT_{PLC}$ -30.0	dB	1.40MHz+1.80MHz	
PAL Rch							
1.80MHz insertion loss	$ATT_{PRC}$	-15.3	-11.3	-7.3	dB	1.40MHz+1.80MHz FM ALC ON	
1.40MHz attenuation	$ATT_{PR}$ <sub>1.40</sub>	—	—	$ATT_{PRC}$ -30.0	dB	1.40MHz+1.80MHz FM ALC ON	
(DO detector circuit)							
DO detector level	$V_{DDO}$	76.5	83.0	88.5	dBμ	Input level to give DO due to attenuation.	
(Hold-pulse generator circuit)							
Hold delay time	$\tau_{D\text{ HOLD}}$	—	0.60 0.75	1.30	μs	Time from Audio Head PULSE edge to HOLD start.	
Hold time	$\Delta \tau_{\text{ HOLD}}$	5.50	6.70	7.90	μs		
(Envelope output circuit) (INPUT : FM PB IN, OUTPUT : ENVE OUT) 0dB=660mV <sub>P-P</sub> , 1.3MHz & 1.7MHz MIX INPUT							
Envelope output level SP0	$V_{ENVSP0}$	0.65	1.05	1.45	V	No signal, SP MODE	
Envelope output level SP1	$V_{ENVSP1}$	2.23	2.73	3.23	V	$V_{IN} = 0dB$ , SP MODE	

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
(Control system mode holding voltage)						
PB / EE CTRL						
EE holding voltage	V <sub>H24H</sub>	3.90	—	V <sub>CC</sub>	V	PB / EE CTRL : H
BPF MONISTOP holding voltage	V <sub>H24M</sub>	2.25	—	2.85	V	PB / EE CTRL : M, H
PB holding voltage	V <sub>H24L</sub>	0	—	0.90	V	PB / EE CTRL : L
INPUT CTRL						
TU holding voltage	V <sub>H63L</sub>	0	—	0.90	V	
TU (BIL) holding voltage	V <sub>H63M</sub>	2.25	—	2.85	V	
LINE holding voltage	V <sub>H63H</sub>	3.90	—	V <sub>CC</sub>	V	
H / M / N CTRL						
HiFi holding voltage	V <sub>H49H</sub>	3.90	—	V <sub>CC</sub>	V	
MIX holding voltage	V <sub>H49M</sub>	2.25	—	2.85	V	
NORMAL	V <sub>H49L</sub>	0	—	0.90	V	
L / R / ST CTRL						
STEREO holding voltage	V <sub>H48L</sub>	0	—	0.90	V	
Rch holding voltage	V <sub>H48M</sub>	2.25	—	2.85	V	
Lch holding voltage	V <sub>H48H</sub>	3.90	—	V <sub>CC</sub>	V	
MUTE CTRL						
MUTE	V <sub>H7L</sub>	0	—	1.00	V	
DC MUTE	V <sub>H7L</sub>	3.90	—	V <sub>CC</sub>	V	
FNORM CTRL						
FNORM holding voltage	V <sub>H43</sub>	0	—	2.00	V	
PAL / NTSC CTRL						
NTSC	V <sub>H23L</sub>	0	—	2.00	V	
PAL	V <sub>H23H</sub>	3.20	—	V <sub>CC</sub>	V	

Unless otherwise specified, the following measurement conditions apply:

INPUT control (INPUT CTRL pin 63) : — (ALL MODE)  
 HiFi/MIX/NORMAL control (INPUT CTRL pin 49) : High (HiFi)  
 LEFT/RIGHT/STEREO control (L/R/ST CTRL pin 48) : Low (STEREO)  
 MUTE control (MUTE CTRL pin 61) : Low (MUTE)  
 Forced NORMAL control (FNORM CTRL pin 27) : Pulled to V<sub>CC</sub> via R (330k $\Omega$ )  
 PB/EE control (PB/EE CTRL pin 24) : High (EE)  
 NTSC/PAL control (NT/PAL pin 23) : Low (NTSC)

※ With regard to the control system voltages, refer to the mode holding voltage range.  
 ※ Do not input more than 660mV<sub>PP</sub> (standard input) + 5dB.

Signal frequency f = 1kHz

MODEM carrier frequency NTSC L channel 1.30MHz  
 MODEM carrier frequency NTSC R channel 1.70MHz

\* 1 B.W. = 0.4 to 30kHz  
 \* 2 DIN AUDIO

The measurement circuit is shown in Fig. 1.

● Measurement circuit

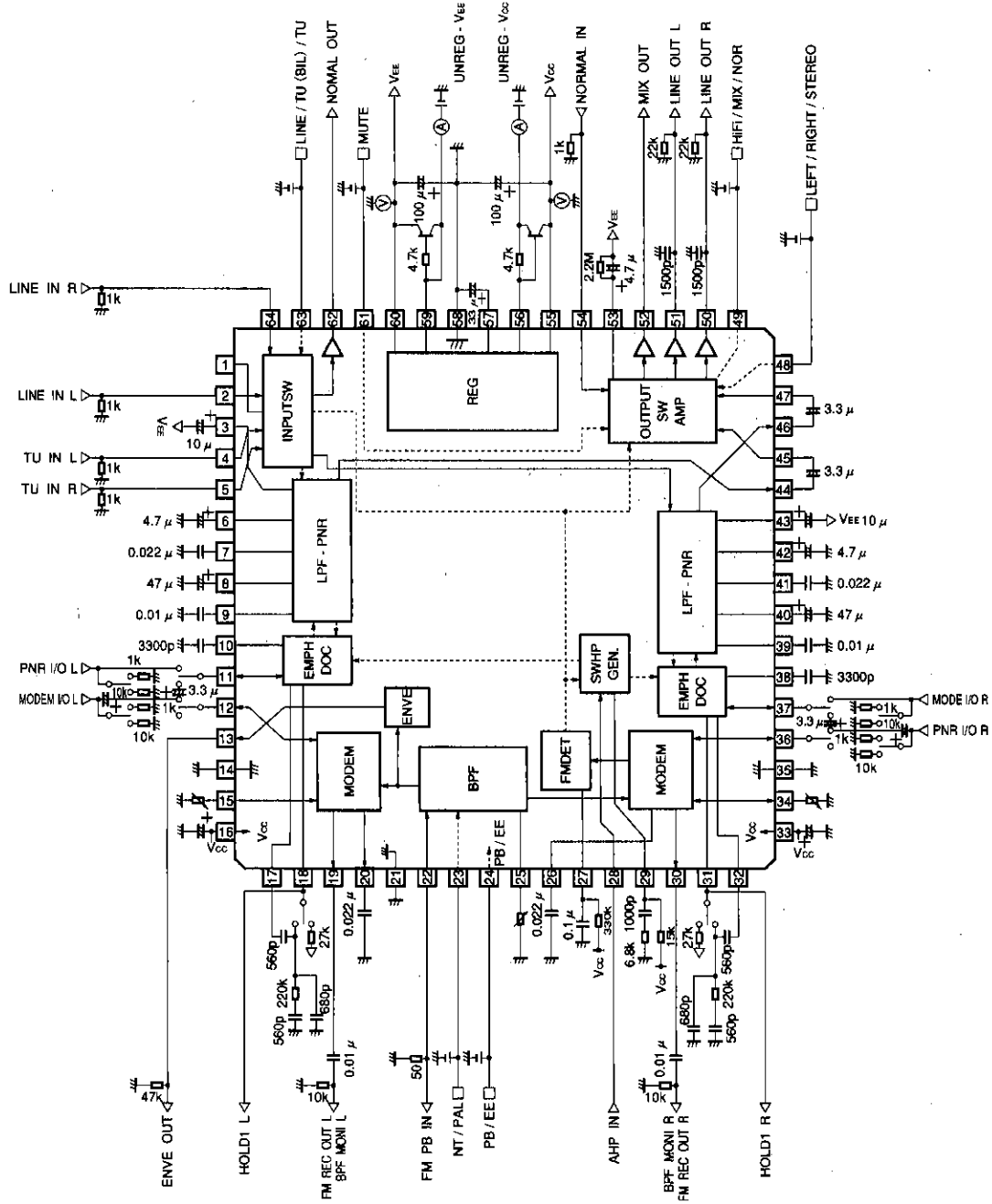


Fig.1



## ● Circuit operation

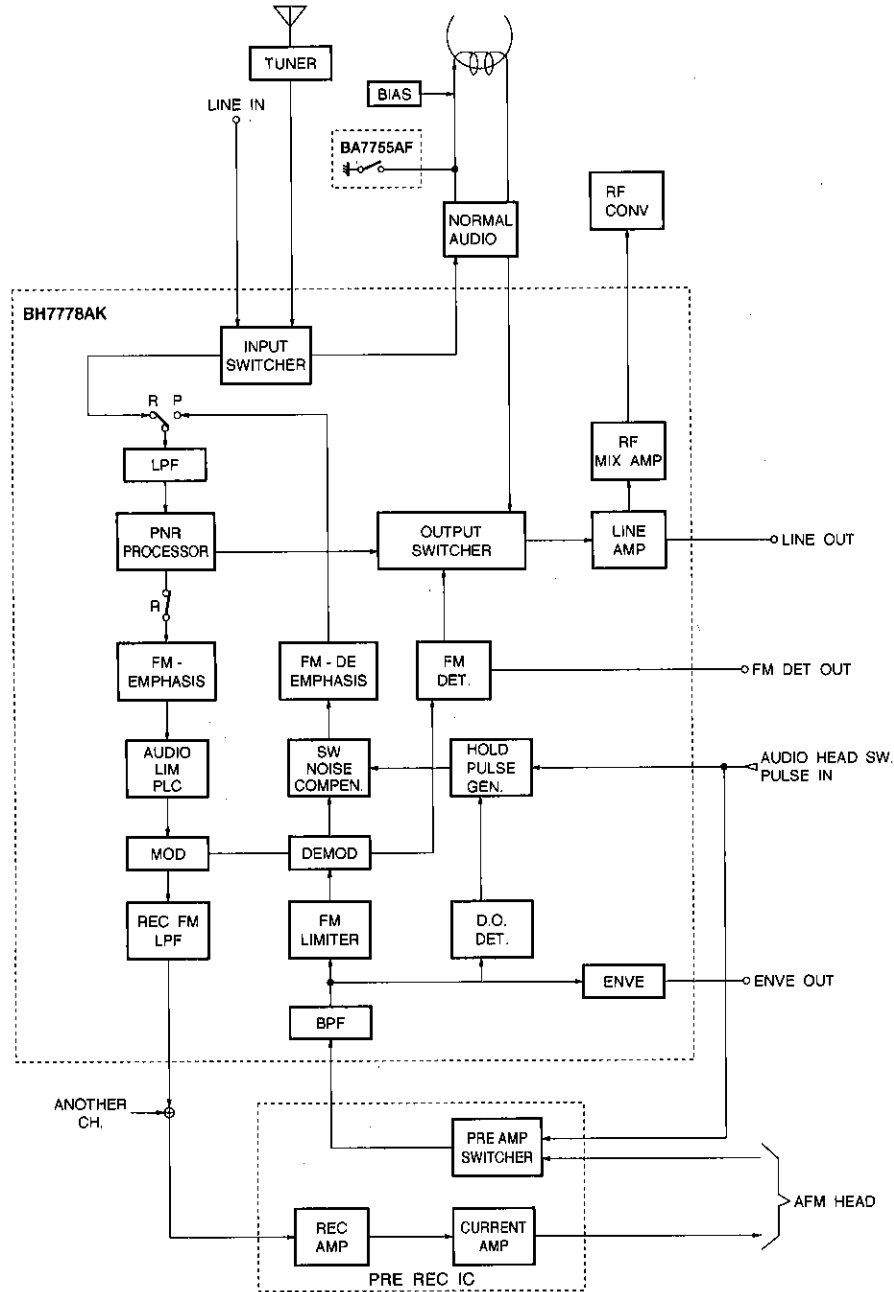
## 1-1 Function table

The BH7778AK IC incorporates the following functions.

No.	Block name	Main function	Pin number	Power supply
1	Regulator	<ul style="list-style-type: none"> <li>• <math>\pm 5V</math> regulator (<math>V_{CC}</math> and <math>V_{EE}</math>)</li> <li>• Anti-pop circuit (ANTI - POP)</li> </ul>	55~60	UNREG - $V_{CC}$ : +10V UNREG - $V_{EE}$ : -10V GND : 58pin
2	Input switcher	<ul style="list-style-type: none"> <li>• TUNER/LINE switching circuit</li> <li>• TUNER/BILINGUAL/LINE switching circuit</li> <li>• Normal out</li> </ul>	2, 4, 5, 62~64	+ $V_{CC}$ (internally connected) - $V_{EE}$ (internally connected) GND : 58pin
3	Output switcher	<ul style="list-style-type: none"> <li>• Line out: 9.8dB (LINE AMP)</li> <li>• LEFT/RIGHT/STEREO switching circuit</li> <li>• HiFi/MIX/NORMAL switching circuit</li> <li>• Normal in</li> <li>• Mute switch</li> <li>• RF mixer amplifier with ALC (MIX AMP)</li> </ul>	44~54, 61	+ $V_{CC}$ (internally connected) - $V_{EE}$ (internally connected) GND : 58pin
4	PNR processor	<ul style="list-style-type: none"> <li>• 20kHz line low-pass filter (20kHz LPF)</li> <li>• PNR processor (MOA, CCA, WTNG, DET)</li> <li>• Fixed emphasis/de-emphasis (EMPH/DEEMPH)</li> <li>• Switching noise slope control-type differential compensation circuit</li> </ul>	3,6~12 36~43	+ $V_{CC}$ (internally connected) - $V_{EE}$ (internally connected) GND : 58pin
5	Modulation/demodulation	<ul style="list-style-type: none"> <li>• FM modulator/demodulator circuit</li> <li>• Recording FM high-frequency cutoff filter (FM LPF)</li> <li>• Over-modulation limiter (AUDIO LIM)</li> <li>• PLC circuit (PLC)</li> <li>• Playback FM limiter (FM LIM)</li> </ul>	13~19 30~35	$V_{CC}$ : 16,33pin GND : 14,35pin
6	FM detector control	<ul style="list-style-type: none"> <li>• D.O. detect circuit (D.O. DET)</li> <li>• Noise-detect method automatic FM detector circuit (FM DET)</li> <li>• Hold pulse generator</li> <li>• Envelope detector circuit (ENVE)</li> </ul>	1, 13, 26~29	$V_{CC}$ : 16,33pin GND : 14,35pin
7	FM BPF	<ul style="list-style-type: none"> <li>• Lch and Rch FM band-pass filter</li> <li>• Input level adjustment circuit (FM ALC)</li> </ul>	19,30 21~23, 25	$V_{CC}$ : 16, 33pin GND : 21pin

●Circuit operation

1-2 HiFi and normal audio system flowchart



Single-chip Hi-Fi audio signal processors

VCR components

Fig.2

2. Signal flow and level diagram  
2-1 HiFi audio signal flow for recording (EE through)

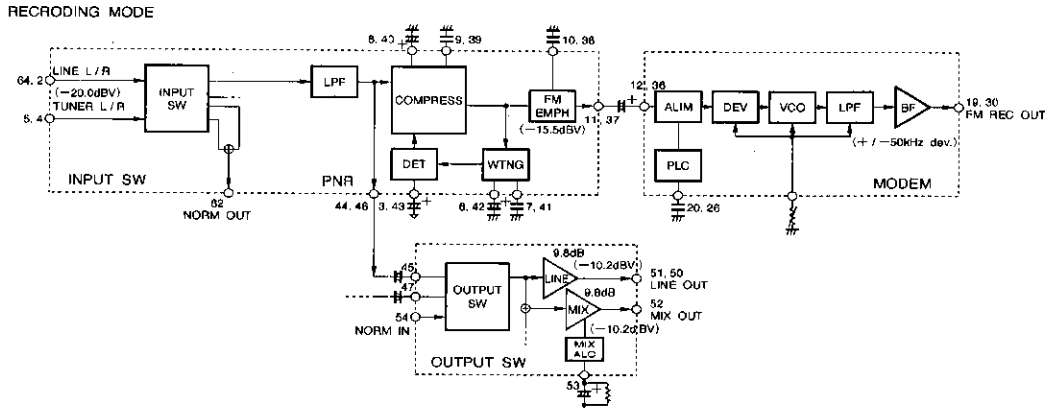


Fig.3

2-2 HiFi audio signal flow for playback

PLAYBACK MODE

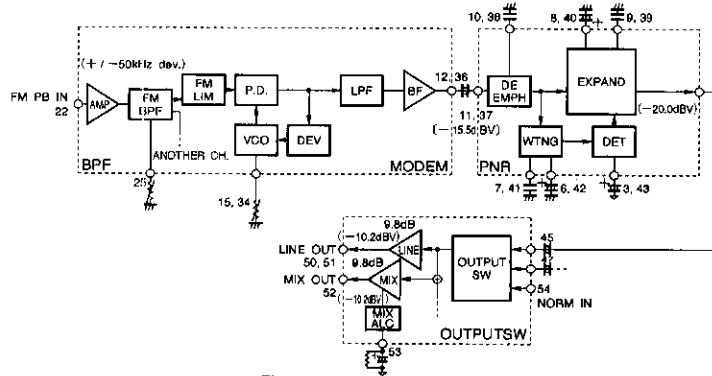


Fig.4

2-3 HiFi audio level diagram

Signal levels for the signals passing through the blocks are shown below (for recording and playback). f=1kHz and standard level.

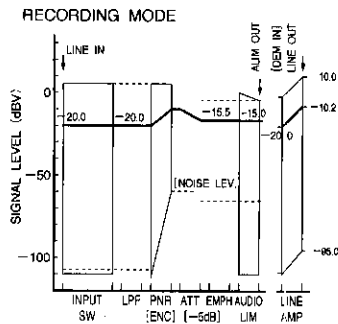


Fig.5

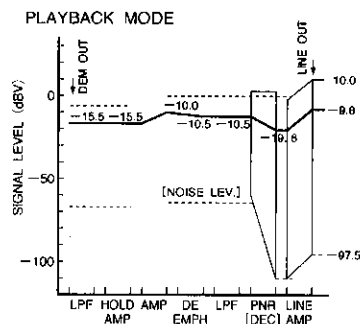


Fig.6

● Circuit operation

3. Control terminals

3-1 Control terminals

• The IC has the following seven control terminals.

(1) Recording/playback control (PB / EE CTRL: pin 24)

Switches between EE, PB, BPF and MONITOR modes

Mode	Control signal	Notes
PB	L	PB mode
BPF MONI OFF	M	PB mode, BPF MONITOR output off
EE	H	EE mode

(2) Forced normal control (FNORM DLY: pin 27)

During playback, regardless of the line output mode setting, it is possible to force the output switch to the normal output mode setting (except when mute is "H").

Mode	Control signal	Notes
FNORM	H (OPEN)	Follows the detect state of the auto FM detect circuit.
FNORM	L	Forced normal.

Note: This is also used for the time constant setting function for the automatic FM signal detector circuit (FNORM DLY), when a time constant circuit is connected, leave FNORM mode OPEN.

(3) Output switch HiFi / MIX / NORMAL control (H / M / N CTRL: pin 49)

Output switcher HiFi / MIX / NORMAL switching.

Mode	Control signal	Notes
NORMAL	L	NORMAL mode
MIX	M	HiFi+NORMAL mode
HiFi	H	HiFi mode

(4) Output switch LEFT / RIGHT / STEREO control (L / R / ST CTRL: pin 48)

Output switcher LEFT / RIGHT / STEREO switching.

Mode	Control signal	Notes
STEREO	L	LINE OUT L: Lch output, LINE OUT R: Rch output
RIGHT	M	LINE OUT L: Rch output, LINE OUT R: Rch output
LEFT	H	LINE OUT L: Lch output, LINE OUT R: Lch output

(5) Mute control (MUTE CTRL: pin 61)

Stops line output and MIX output.

Mode	Control signal	Notes
MUTE	L	
MUTE	H	Line mute and DC mute operates.

Note: Be certain to set mute to H at power on and power off.



● Operation notes

The VCO oscillation frequency, frequency deviation, and BPF center frequency are all directly effected by the temperature characteristics of the adjustment resistor.

● Electrical characteristic curves

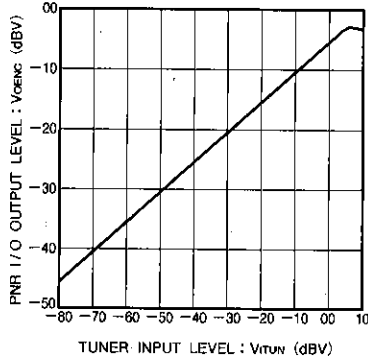


Fig. 8 PNR ENCODE MODE input/output characteristics (f = 1kHz)

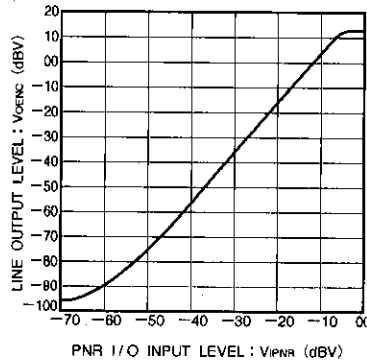


Fig. 9 PNR DECODE MODE input/output characteristics (f = 1kHz)

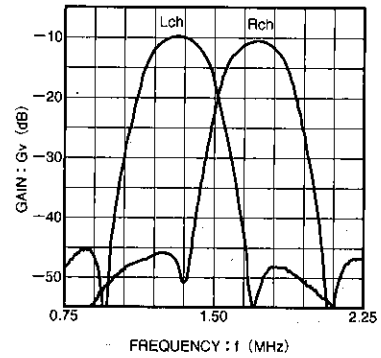
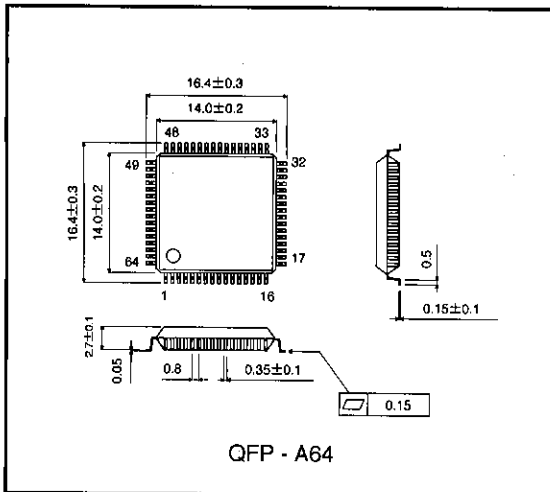


Fig. 10 FM BPF standard characteristic (NTSC)

● External dimensions (Units: mm)



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