Analog signal I / O interface for portable audio applications

BH7760KV

The BH7760KV contains the complete audio I / O analog block on a single-chip IC. Therefore, all necessary functions for a DVC audio analog I / O interface are provided on one chip.

●Applications

Portable audio applications

●Features

1) Contains the input amplifier, wind noise deletion filter, ALC, 30kHz LPF, line amplifier, stereo headphone amplifier, and BTL monaural speaker amplifier required to configure a analog signal I / O interface (audio I / O) all on one chip.
2) With the internal 3-line serial control decoder circuit, serial control enables the setting of the various modes for the IC.

●Absolute maximum ratings (Ta = 25°C)

Parameter	Symbol	Limits	Unit
Applied voltage	V_{CC}	+ 7.0	V
Power dissipation	Pd	900*	mW
Operating temperature	Topr	– 10 ~ + 70	°C
Storage temperature	Tstg	– 55 ~ + 125	°C

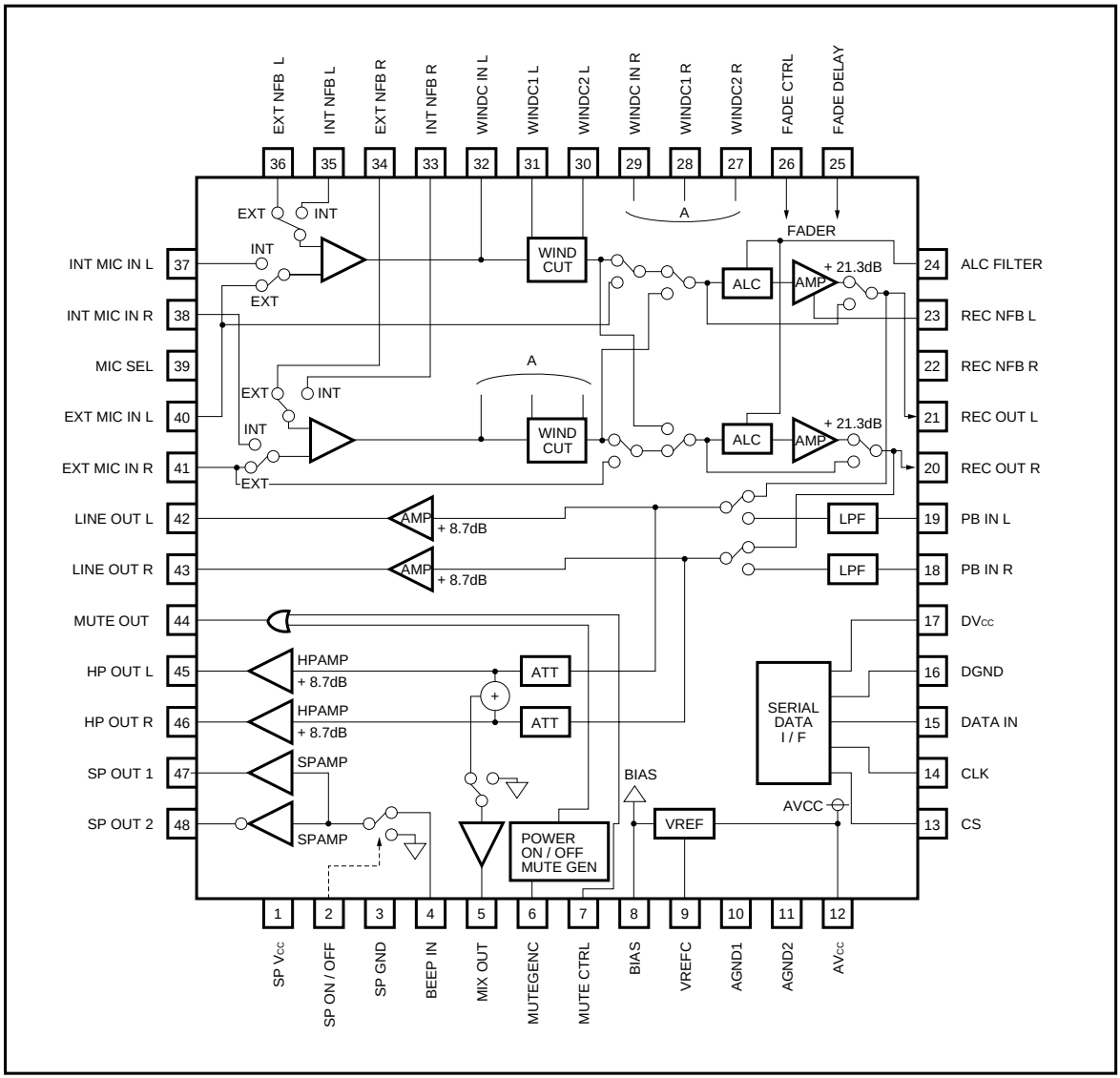
* Reduced by 9.0mW for each increase in Ta of 1°C over 25°C with the IC unmounted.
* When mounted on a 70mm × 70mm × 1.6mm glass epoxy board.

●Recommended operating conditions (Ta = 25°C)

Parameter	Symbol	Limits	Unit
Power supply voltage (analog system)	AVcc	+ 4.0 ~ + 6.0	V
Power supply voltage (for SP)	SPVcc	+ 4.0 ~ + 6.0	V
Power supply voltage (digital system)	DVcc	+ 2.7 ~ + 3.3	V

○ Not designed for radiation resistance.

●Block diagram



●Pin descriptions

Pin No.	Pin name	Function	Pin voltage	Pin type
1	SP V_{CC}	Speaker V_{CC}	5.0V	—
2	SP ON / OFF	SP ON / OFF control	5.0V	100kΩ PULL UP
3	SP GND	Speaker GND	0.0V	—
4	BEEP IN	Speaker input	2.5V	B (NPN)
5	MIX OUT	HP amplifier L / R mixer output	2.5V	EF (NPN)
6	MUTE GENC	POWER ON MUTE delay	2.5V	EF (NPN)
7	MUTE CTRL	Mute control input	—	10kΩ
8	BIAS	Bias	2.5V	EF (NPN)
9	VREFC	V_{CC} / 2 reference	2.5V	100kΩ
10	AGND1	Analog GND1	0.0V	—
11	AGND2	Analog GND2	0.0V	—
12	AV_{CC}	Analog V_{CC}	5.0V	—
13	CS	Serial control CS input	—	G ~ 10kΩ
14	CLK	Serial control CLK input	—	G ~ 10kΩ
15	DATAIN	Serial control DATE input	—	G ~ 10kΩ
16	DGND	Serial control GND	0.0V	—
17	DV_{CC}	Serial control V_{CC}	3.0V	—
19,18	PBIN L / R	PB input	2.5V	75kΩ
21,20	REC OUT L / R	REC output	2.5V	EF (P-P)
23,22	REC NFB L / R	ALC amplifier feedback	2.5V	B (NPN) ~ 3.9kΩ
24	ALC FILTER	ALC constant setting	0.0V	EF (NPN) ~ 200Ω
25	FADE DELAY	FADE delay	—	B (NPN) ~ 1kΩ
26	FADE CTRL	FADE control input	0.0V	B (NPN) ~ 10kΩ
32,29	WIND CIN L / R	WIND CUT FILTER input	2.5V	EF (P-P)
31,28	WIND C1 L / R	WIND CUT FILTER constant 1	2.5V	EF (NPN) ~ 8.2kΩ
30,27	WIND C2 L / R	WIND CUT FILTER constant 2	2.5V	B (NPN)

Note: EF: Emitter follower, P-P: Push-pull, B: Base, G: gate.

●Pin descriptions

Pin No.	Pin name	Function	Pin voltage	Pin type
36, 34	EXT NFB L / R	MIC amplifier feedback (EXT)	2.5V	B (NPN)
35, 33	INT NFB L / R	MIC amplifier feedback (INT)	2.5V	B (NPN)
37, 38	INT MIC IN L / R	INT MIC input	2.5V	75kΩ
39	MIC SEL	MIC SEL control input	5.0V	200kΩ PULL UP
40, 41	EXT MIC IN L / R	EXT MIC input	2.5V	75kΩ
42, 43	LINE OUT L / R	LINE amplifier output	2.5V	EF (NPN)
44	MUTE OUT	MUTE output	—	C (NPN)
45, 46	HP OUT L / R	HP amplifier output	2.5V	EF (NPN)
47	SP OUT 1	BTL speaker output (forward side)	2.5V	EF (NPN)
48	SP OUT 2	BTL speaker output (reverse side)	2.5V	EF (NPN)

Note: EF: Emitter follower, P-P: Push-pull, B: Base, G: gate.

●Electrical characteristics (unless otherwise noted, AV_{CC} = SPV_{CC}, V_{CC} = 5.0V, DV_{CC} = 3.0V, Ta = 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
[Circuit current]						
Circuit current	I_{CC}	6.0	11.0	20.0	mA	No input
Circuit current power save	I_{CCS}	0.8	1.6	3.2	mA	No input and during power save
[MIC amplifier] INPUT: EXT MIC IN L / R, INT MIC IN L / R OUTPUT: REC OUT L / R						
Output voltage level	V_{OREC}	– 21.7	– 18.7	– 15.7	dBV	V_{IN} = – 70.0dBV, with MIC amplifier at 30dB
ALS level	$V_{ORECALC}$	– 10.7	– 6.7	– 2.7	dBV	V_{IN} = – 50.0dBV, with MIC amplifier at 30dB
[Line amplifier (during EE)] INPUT: EXT MIC IN L / R, INT MIC IN L / R OUTPUT: LINE OUT L / R						
Output voltage level	$V_{OLINEEE}$	– 13.0	– 10.0	– 7.0	dBV	V_{IN} = – 70.0dBV, with MIC amplifier at 30dB
Distortion	THD_{LINEEE}	—	0.50	1.50	%	V_{IN} = – 70.0dBV, with MIC amplifier at 30dB*1
Output residual noise	$V_{ONLINEEE}$	—	– 60.0	– 50.0	dBV	With MIC amplifier at 30dB*2
Crosstalk	CT_{LINEEE}	—	– 31.0	– 20.0	dBV	V_{IN} = – 60.0dBV, with MIC amplifier at 30dB*1
Maximum output level	$V_{OMLINEEE}$	– 3.0	2.3	—	dBV	THD = 3%, *1, with ALC OFF
[Line amplifier (during PB)] INPUT: PB IN L / R OUTPUT: LINE OUT L / R						
Output voltage level	$V_{OLINEPB}$	– 12.0	– 10.0	– 8.0	dBV	V_{IN} = – 18.7dBV
Distortion	THD_{LINEPB}	—	0.017	0.20	%	V_{IN} = – 18.7dBV*1
Channel balance	CB_{LINEPB}	– 0.5	0.0	+ 0.5	dB	V_{OLINE} L / R difference
Output residual noise	$V_{ONLINEPB}$	—	– 90.0	– 73.0	dBV	*2

∗1 B.W. = 400Hz to 30kHz
∗2 DIN AUDIO

●Electrical characteristics (unless otherwise noted, AV_{CC} = SP, V_{CC} = 5.0V, DV_{CC} = 3.0V, Ta = 25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
[HP amplifier] INPUT: PB IN L / R OUTPUT: HP OUT L / R						
Output voltage level	V_{OHP}	– 12.5	– 10.0	– 7.5	dBV	V_{IN} = – 18.7dBV
Distortion	THD_{HP}	—	0.7	2.0	%	V_{IN} = – 18.7dBV*1
Maximum output level	V_{OMHP}	– 3.0	– 1.2	—	dBV	THD = 3%*1
Output residual noise	V_{ONHP}	—	– 91.0	– 73.0	dBV	R_g = 1kΩ*2
Crosstalk between channels	CT_{HP}	—	– 87.0	– 70.0	dBV	V_{IN} = – 8.7dBV*2
Muting level	MT_{HP}	—	– 100.0	– 83.0	dBV	V_{IN} = – 8.7dBV, V_7 = H*2
[MIX OUT] INPUT: PB IN L / R OUTPUT: MIX OUT						
Output voltage level	V_{OMIX}	– 12.5	– 10.0	– 7.5	dBV	V_{IN} = – 18.7dBV
[SP amplifier] INPUT: BEEP IN OUTPUT: SP OUT 1 / 2 (BML)						
Output voltage level	V_{OSP}	– 4.5	– 1.0	+ 2.5	dBV	V_{IN} = – 10.0dBV
Distortion	THD_{SP}	—	0.8	2.0	%	V_{IN} = – 10.0dBV*1
Maximum output level	V_{OMSP}	+ 3.0	+ 4.8	—	dBV	THD = 10%*1
Output residual noise	V_{ONSP}	—	– 95.0	– 80.0	dBV	R_g = 1kΩ*2
SP off level	V_{OOFFSP}	—	– 65.0	– 55.0	dBV	V_{IN} = – 6.0dBV*2
[Control mode hold voltage]						
⟨CS⟩						
Low mode hold voltage	V_{H14L}	0.0	—	0.5	V	—
High mode hold voltage	V_{H14H}	1.8	—	DV_{CC}	V	—
⟨CLK⟩						
Low mode hold voltage	V_{H15L}	0.0	—	0.5	V	—
High mode hold voltage	V_{H15H}	1.8	—	DV_{CC}	V	—
⟨DATA IN⟩						
Low mode hold voltage	V_{H16L}	0.0	—	0.5	V	—
High mode hold voltage	V_{H16H}	1.8	—	DV_{CC}	V	—
⟨SP ON / OFF⟩						
SP off hold voltage	V_{H3L}	0.0	—	0.5	V	—
SP on hold voltage	V_{H3H}	2.0	—	AV_{CC}	V	—
⟨MUTE control⟩						
$\overline{\text{MUTE}}$ hold voltage	V_{H7L}	0.0	—	0.5	V	—
MUTE hold voltage	V_{H7H}	2.0	—	AV_{CC}	V	—
⟨FADE control⟩						
FADE off hold voltage	V_{H26L}	0.0	—	0.5	V	—
FADE on hold voltage	V_{H26H}	2.0	—	AV_{CC}	V	—
⟨MIC SEL⟩						
EXT hold voltage	V_{H39L}	0.0	—	0.5	V	—
INT hold voltage	V_{H39H}	2.0	—	AV_{CC}	V	—

*1 B.W. = 400Hz to 30kHz
*2 DIN AUDIO

●Measurement circuit

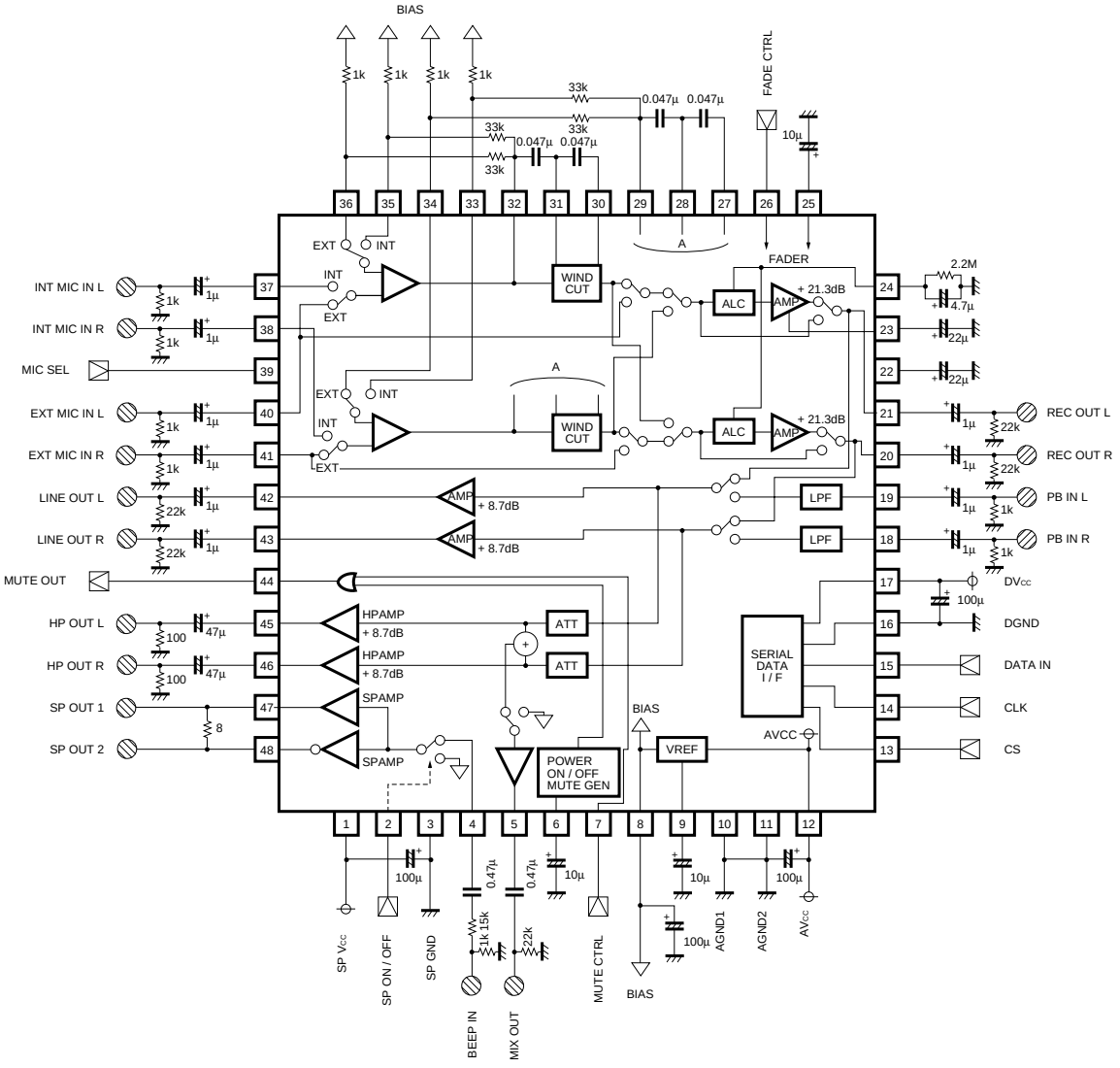
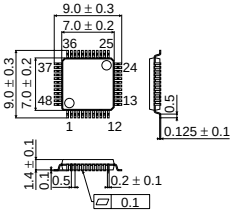


Fig.1

●External dimensions (Units: mm)



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