

# 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 <sub>cc</sub>  | + 7.0        | V    |
| Power dissipation     | P <sub>d</sub>   | 900*         | mW   |
| Operating temperature | T <sub>opr</sub> | – 10 ~ + 70  | °C   |
| Storage temperature   | T <sub>stg</sub> | – 55 ~ + 125 | °C   |

\* Reduced by 9.0mW for each increase in Ta of 1°C over 25°C with the IC unmounted.

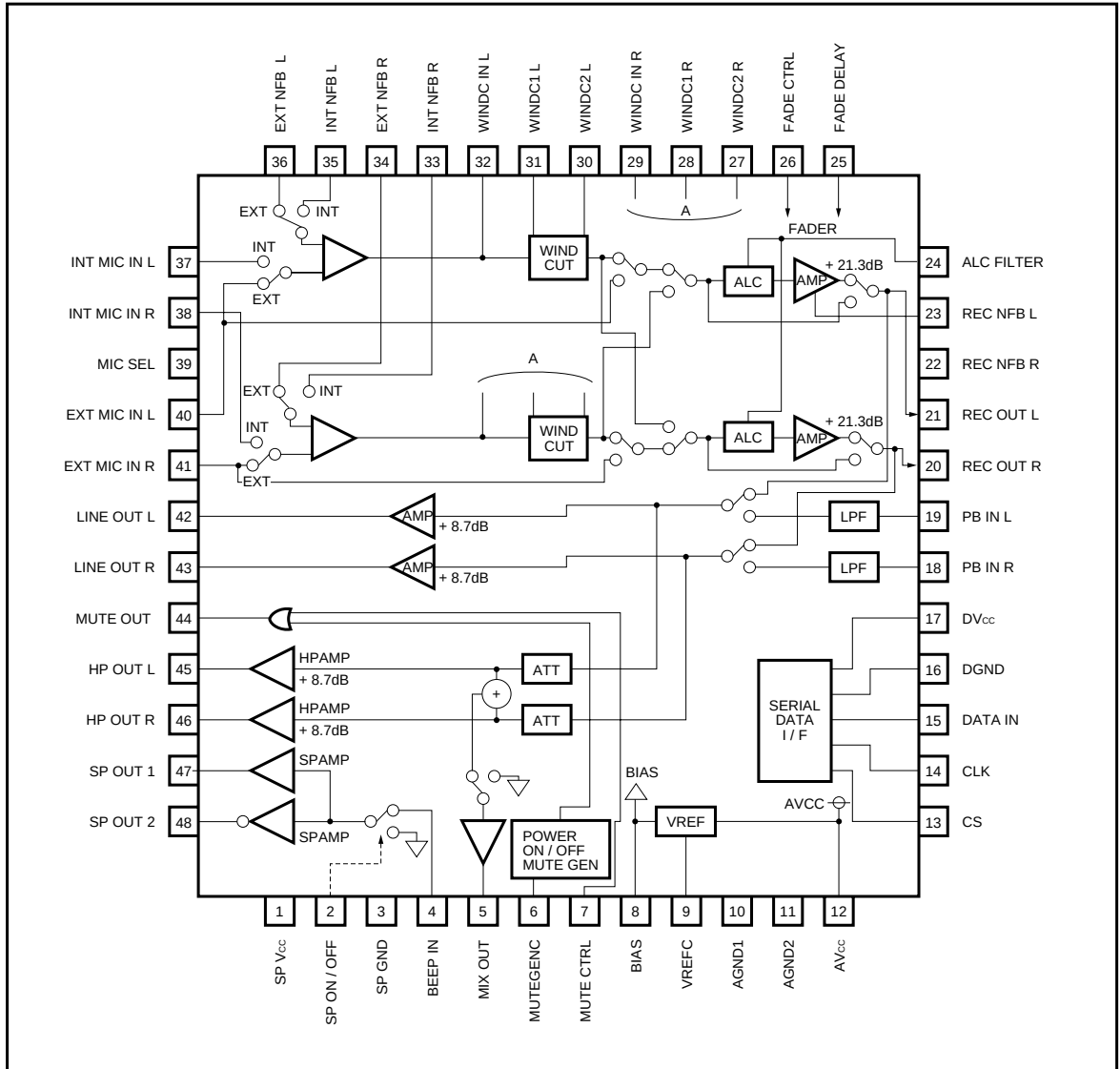
\* When mounted on a 70mm × 70mm × 1.6mm glass epoxy board.

### ●Recommended operating conditions (Ta = 25°C)

| Parameter                             | Symbol            | Limits        | Unit |
|---------------------------------------|-------------------|---------------|------|
| Power supply voltage (analog system)  | AV <sub>cc</sub>  | + 4.0 ~ + 6.0 | V    |
| Power supply voltage (for SP)         | SPV <sub>cc</sub> | + 4.0 ~ + 6.0 | V    |
| Power supply voltage (digital system) | DV <sub>cc</sub>  | + 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 <sub>cc</sub> | Speaker V <sub>cc</sub>         | 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 <sub>cc</sub> / 2 reference   | 2.5V        | 100kΩ            |
| 10      | AGND1              | Analog GND1                     | 0.0V        | —                |
| 11      | AGND2              | Analog GND2                     | 0.0V        | —                |
| 12      | AV <sub>cc</sub>   | Analog V <sub>cc</sub>          | 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 <sub>cc</sub>   | Serial control V <sub>cc</sub>  | 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        | 75k $\Omega$          |
| 39      | MIC SEL          | MIC SEL control input             | 5.0V        | 200k $\Omega$ PULL UP |
| 40, 41  | EXT MIC IN L / R | EXT MIC input                     | 2.5V        | 75k $\Omega$          |
| 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<sub>CC</sub> = SPV<sub>CC</sub>, V<sub>CC</sub> = 5.0V, DV<sub>CC</sub> = 3.0V, Ta = 25°C)

| Parameter                                                                                     | Symbol                | Min.   | Typ.   | Max.   | Unit | Conditions                                                            |
|-----------------------------------------------------------------------------------------------|-----------------------|--------|--------|--------|------|-----------------------------------------------------------------------|
| [Circuit current]                                                                             |                       |        |        |        |      |                                                                       |
| Circuit current                                                                               | I <sub>CC</sub>       | 6.0    | 11.0   | 20.0   | mA   | No input                                                              |
| Circuit current power save                                                                    | I <sub>CCS</sub>      | 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 <sub>OREC</sub>     | − 21.7 | − 18.7 | − 15.7 | dBV  | V <sub>IN</sub> = − 70.0dBV, with MIC amplifier at 30dB               |
| ALS level                                                                                     | V <sub>ORECALC</sub>  | − 10.7 | − 6.7  | − 2.7  | dBV  | V <sub>IN</sub> = − 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 <sub>OLINEEE</sub>  | − 13.0 | − 10.0 | − 7.0  | dBV  | V <sub>IN</sub> = − 70.0dBV, with MIC amplifier at 30dB               |
| Distortion                                                                                    | THD <sub>LINEEE</sub> | —      | 0.50   | 1.50   | %    | V <sub>IN</sub> = − 70.0dBV, with MIC amplifier at 30dB* <sup>1</sup> |
| Output residual noise                                                                         | V <sub>ONLINEEE</sub> | —      | − 60.0 | − 50.0 | dBV  | With MIC amplifier at 30dB* <sup>2</sup>                              |
| Crosstalk                                                                                     | CT <sub>LINEEE</sub>  | —      | − 31.0 | − 20.0 | dBV  | V <sub>IN</sub> = − 60.0dBV, with MIC amplifier at 30dB* <sup>1</sup> |
| Maximum output level                                                                          | V <sub>OMLINEEE</sub> | − 3.0  | 2.3    | —      | dBV  | THD = 3%, * <sup>1</sup> , with ALC OFF                               |
| [Line amplifier (during PB)] INPUT: PB IN L / R OUTPUT: LINE OUT L / R                        |                       |        |        |        |      |                                                                       |
| Output voltage level                                                                          | V <sub>OLINEPB</sub>  | − 12.0 | − 10.0 | − 8.0  | dBV  | V <sub>IN</sub> = − 18.7dBV                                           |
| Distortion                                                                                    | THD <sub>LINEPB</sub> | —      | 0.017  | 0.20   | %    | V <sub>IN</sub> = − 18.7dBV* <sup>1</sup>                             |
| Channel balance                                                                               | CB <sub>LINEPB</sub>  | − 0.5  | 0.0    | + 0.5  | dB   | V <sub>OLINE</sub> L / R difference                                   |
| Output residual noise                                                                         | V <sub>ONLINEPB</sub> | —      | − 90.0 | − 73.0 | dBV  | * <sup>2</sup>                                                        |

\*<sup>1</sup> B.W. = 400Hz to 30kHz

\*<sup>2</sup> DIN AUDIO

●Electrical characteristics (unless otherwise noted, AV<sub>CC</sub> = SP, V<sub>CC</sub> = 5.0V, DV<sub>CC</sub> = 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                                     | VOHP              | − 12.5 | − 10.0  | − 7.5            | dBV  | V <sub>IN</sub> = − 18.7dBV                      |
| Distortion                                               | THD <sub>HP</sub> | —      | 0.7     | 2.0              | %    | V <sub>IN</sub> = − 18.7dBV*1                    |
| Maximum output level                                     | VOMHP             | − 3.0  | − 1.2   | —                | dBV  | THD = 3%*1                                       |
| Output residual noise                                    | VONHP             | —      | − 91.0  | − 73.0           | dBV  | R <sub>g</sub> = 1kΩ*2                           |
| Crosstalk between channels                               | CT <sub>HP</sub>  | —      | − 87.0  | − 70.0           | dBV  | V <sub>IN</sub> = − 8.7dBV*2                     |
| Muting level                                             | MT <sub>HP</sub>  | —      | − 100.0 | − 83.0           | dBV  | V <sub>IN</sub> = − 8.7dBV, V <sub>7</sub> = H*2 |
| [MIX OUT] INPUT: PB IN L / R OUTPUT: MIX OUT             |                   |        |         |                  |      |                                                  |
| Output voltage level                                     | VOMIX             | − 12.5 | − 10.0  | − 7.5            | dBV  | V <sub>IN</sub> = − 18.7dBV                      |
| [SP amplifier] INPUT: BEEP IN OUTPUT: SP OUT 1 / 2 (BML) |                   |        |         |                  |      |                                                  |
| Output voltage level                                     | VOSP              | − 4.5  | − 1.0   | + 2.5            | dBV  | V <sub>IN</sub> = − 10.0dBV                      |
| Distortion                                               | THD <sub>SP</sub> | —      | 0.8     | 2.0              | %    | V <sub>IN</sub> = − 10.0dBV*1                    |
| Maximum output level                                     | VOMSP             | + 3.0  | + 4.8   | —                | dBV  | THD = 10%*1                                      |
| Output residual noise                                    | VONSP             | —      | − 95.0  | − 80.0           | dBV  | R <sub>g</sub> = 1kΩ*2                           |
| SP off level                                             | VOOFFSP           | —      | − 65.0  | − 55.0           | dBV  | V <sub>IN</sub> = − 6.0dBV*2                     |
| [Control mode hold voltage]                              |                   |        |         |                  |      |                                                  |
| (CS)                                                     |                   |        |         |                  |      |                                                  |
| Low mode hold voltage                                    | V <sub>H14L</sub> | 0.0    | —       | 0.5              | V    | —                                                |
| High mode hold voltage                                   | V <sub>H14H</sub> | 1.8    | —       | DV <sub>CC</sub> | V    | —                                                |
| (CLK)                                                    |                   |        |         |                  |      |                                                  |
| Low mode hold voltage                                    | V <sub>H15L</sub> | 0.0    | —       | 0.5              | V    | —                                                |
| High mode hold voltage                                   | V <sub>H15H</sub> | 1.8    | —       | DV <sub>CC</sub> | V    | —                                                |
| (DATA IN)                                                |                   |        |         |                  |      |                                                  |
| Low mode hold voltage                                    | V <sub>H16L</sub> | 0.0    | —       | 0.5              | V    | —                                                |
| High mode hold voltage                                   | V <sub>H16H</sub> | 1.8    | —       | DV <sub>CC</sub> | V    | —                                                |
| (SP ON / OFF)                                            |                   |        |         |                  |      |                                                  |
| SP off hold voltage                                      | V <sub>H3L</sub>  | 0.0    | —       | 0.5              | V    | —                                                |
| SP on hold voltage                                       | V <sub>H3H</sub>  | 2.0    | —       | AV <sub>CC</sub> | V    | —                                                |
| (MUTE control)                                           |                   |        |         |                  |      |                                                  |
| MUTE hold voltage                                        | V <sub>H7L</sub>  | 0.0    | —       | 0.5              | V    | —                                                |
| MUTE hold voltage                                        | V <sub>H7H</sub>  | 2.0    | —       | AV <sub>CC</sub> | V    | —                                                |
| (FADE control)                                           |                   |        |         |                  |      |                                                  |
| FADE off hold voltage                                    | V <sub>H26L</sub> | 0.0    | —       | 0.5              | V    | —                                                |
| FADE on hold voltage                                     | V <sub>H26H</sub> | 2.0    | —       | AV <sub>CC</sub> | V    | —                                                |
| (MIC SEL)                                                |                   |        |         |                  |      |                                                  |
| EXT hold voltage                                         | V <sub>H39L</sub> | 0.0    | —       | 0.5              | V    | —                                                |
| INT hold voltage                                         | V <sub>H39H</sub> | 2.0    | —       | AV <sub>CC</sub> | V    | —                                                |

\*1 B.W. = 400Hz to 30kHz

\*2 DIN AUDIO

## ● Measurement circuit

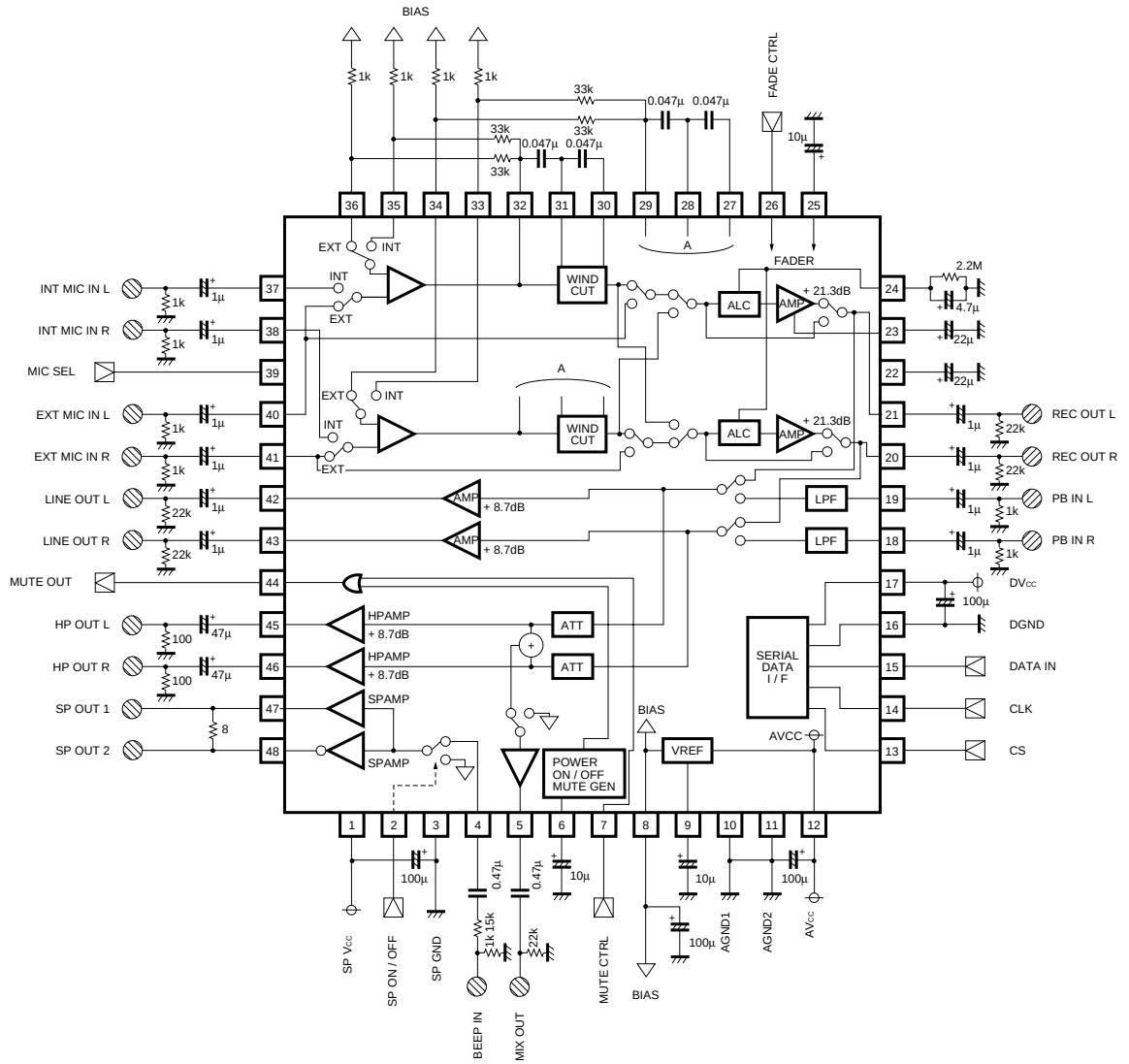
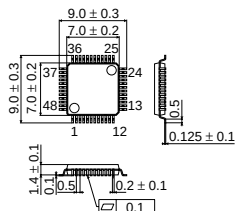


Fig.1

## ● External dimensions (Units: mm)



VQFP48C