

IC for Headphone Stereos (bass boost) Monolithic IC LAG 668

Outline

This IC was developed to provide bass boost functions without deviating from the basic design concept of Mitsumi's LAG665, which is highly regarded for applications in headphone stereos for overseas markets in particular.

Bass boost functions are widely adopted in models for overseas markets as well. However, because of stringent cost constraints, there has been a need for an IC which is simple and inexpensive. This IC can provide bass boost functions simply by adding three resistors and one capacitor (per channel).

Moreover, it has the same pinout as the LAG665, so that by making selective use of set features, a product lineup can be developed without changes to the printed circuit board.

Features

1. Configuration: pre and power amps, motor control, E. VR, bass boost
2. Preamp off function convenient for use in models with radios
3. Independent motor control circuit
 1. Motor noise is effectively suppressed
 2. With motor on/off pin (motor can be stopped easily when radio is in use)
 3. With fast forward pin
4. Bass boost frequency characteristic can be changed simply by changing the resistance multiplier.
5. Well-balanced E. VR circuit
 1. L, R channels variable using a single VR
 2. A-curve can be reproduced using B-curve VR
6. Few external components

Package

- SOP-28B (LAG668F)
- SDIP-30A (LAG668D)

Absolute Maximum Ratings

| Item | Symbol | Ratings | Units |
|-----------------------|----------------------|----------------------|-------|
| Operating temperature | T _{OPR} | -20~+65 | °C |
| Storage temperature | T _{STG} | -40~+125 | °C |
| Power supply current | V _{CC} max. | -0.3~+7.5 | V |
| Power consumption | P _d | DIP : 750, SOP : 450 | mW |
| Operating voltage | V _{op} | +2.0~+5.0 | V |

Electrical Characteristics (Except where noted otherwise, Ta=25°C)

| Item | Symbol | Measurement conditions | Min. | Typ. | Max. | Units |
|--|---------------------|--|------|------|------|-------------------|
| Consumption current | I _{cc} | V _{IN} =0V, I _M =0mA | | 18 | 25 | mA |
| Preamp unit (Ta=25°C) | | | | | | |
| Open-circuit gain | G _{vo} | V _O =-10dBm, R _L =infinite | | 72 | | dB |
| Closed-circuit gain | G _{vc} | V _O =-10dBm | 40 | 42 | 44 | dB |
| Maximum output voltage | V _{om} | THD=10% | 0.45 | 0.6 | | V _{rms} |
| Total harmonic distortion ratio | THD | V _{OUT} =400mV _{rms} | | 0.05 | 0.5 | % |
| Output noise voltage | V _{no} | V _{IN} =0, R _g =2.2k, BPF (30~20kHz) | | 150 | 300 | μV _{rms} |
| Input impedance | Z _{IN} | V _{OUT} =-10dBm | 18 | 22 | | kΩ |
| Crosstalk between channels | C.T | R _g =2.2k, V _{OUT} =-10dBm | 30 | | | dB |
| Output voltage with pre off | V _{ooff} | V _{IN} =100mV _{rms} | | | -50 | dB |
| Output resistance with pre off | R _{ooff} | | | 10 | | kΩ |
| Input resistance on pre off | R _{ioff} | | | 10 | | kΩ |
| Attenuator unit (Ta=25°C) | | | | | | |
| Maximum input voltage | V _{i max.} | | 0.2 | | | V _{rms} |
| Maximum attenuation | V _{a max.} | V _{cont} =min. | 66 | | | dB |
| Attenuation error | V _{aerr} | V _{cont} =max. | | 0 | | dB |
| Input impedance | Z _{IN} | | 200 | | | kΩ |
| Control pin input resistance | Z _{icot} | | 100 | | | kΩ |
| Power amp unit (Ta=25°C) | | | | | | |
| Voltage gain | G _v | P _{OUT} =5mW | 36 | 38 | 40 | dB |
| Voltage gain difference between channels | ΔG _v | V _{cont} =max. | | 0 | 3 | dB |
| Maximum output power I | P _{om1} | THD=10%, R _L =32Ω | 20 | 28 | | mW |
| Maximum output power II | P _{om2} | THD=10%, R _L =16Ω | 30 | | | mW |
| Total harmonic distortion ratio | THD | P _{OUT} =5mW | | 0.5 | 2.0 | % |
| Crosstalk between channels | C.T | P _{OUT} =5mW | 20 | 30 | | dB |
| Output noise voltage | V _n | R _g =2.2k, V _{cont} =max. | | 1.0 | 2.0 | mV _{rms} |
| Ripple rejection | RR | V _{CC} =3V, 100Hz, 100mV _{p-p} | 31 | 37 | | dB |
| Noise of preamp + power amp + B.B. | V _{nto} | V _{IN} =0, R _g =2.2k, V _{cont} =max. *1 | | 3.0 | 6.0 | mV _{rms} |
| Motor control unit (Ta=25°C) | | | | | | |
| Consumption current | IMC | | | 3.0 | 5.0 | mA |
| Startup current | IMS | | 500 | | | mA |
| Reference voltage | V _{ref} | Between RML-ADJ pins | 0.72 | 0.80 | 0.87 | V |
| Reference voltage fluctuation I | V _{ref1} | V _{CC} between 2.1 and 5.0 V | | 0.05 | | %/V |
| Reference voltage fluctuation II | V _{ref2} | I _M between 25 and 250 mA | | 0.01 | | %/mA |
| Reference voltage fluctuation III | V _{ref3} | Ta between -10 and 50°C | | 0.01 | | %/°C |
| Current coefficient | K | | 32 | 38 | 43 | |
| Current coefficient fluctuation I | K1 | V _{CC} between 2.1 and 5.0 V | | 0.5 | | %/V |
| Current coefficient fluctuation II | K2 | I _M between 25 and 250 mA | | 0.05 | | %/mA |
| Current coefficient fluctuation III | K3 | Ta between -10 and 50°C | | 0.02 | | %/°C |
| Output voltage on forced on | VCE _{sa} | I _M =200mA, 14PIN=V _{CC} | | | 0.6 | V |
| Input resistance on forced on | R _{ion} | | | 5.6 | | kΩ |
| Leakage current on forced off | IML | | | | 200 | μA |
| Input resistance on forced off | R _{icon} | | | 33 | | kΩ |

*Conditions unless stated otherwise

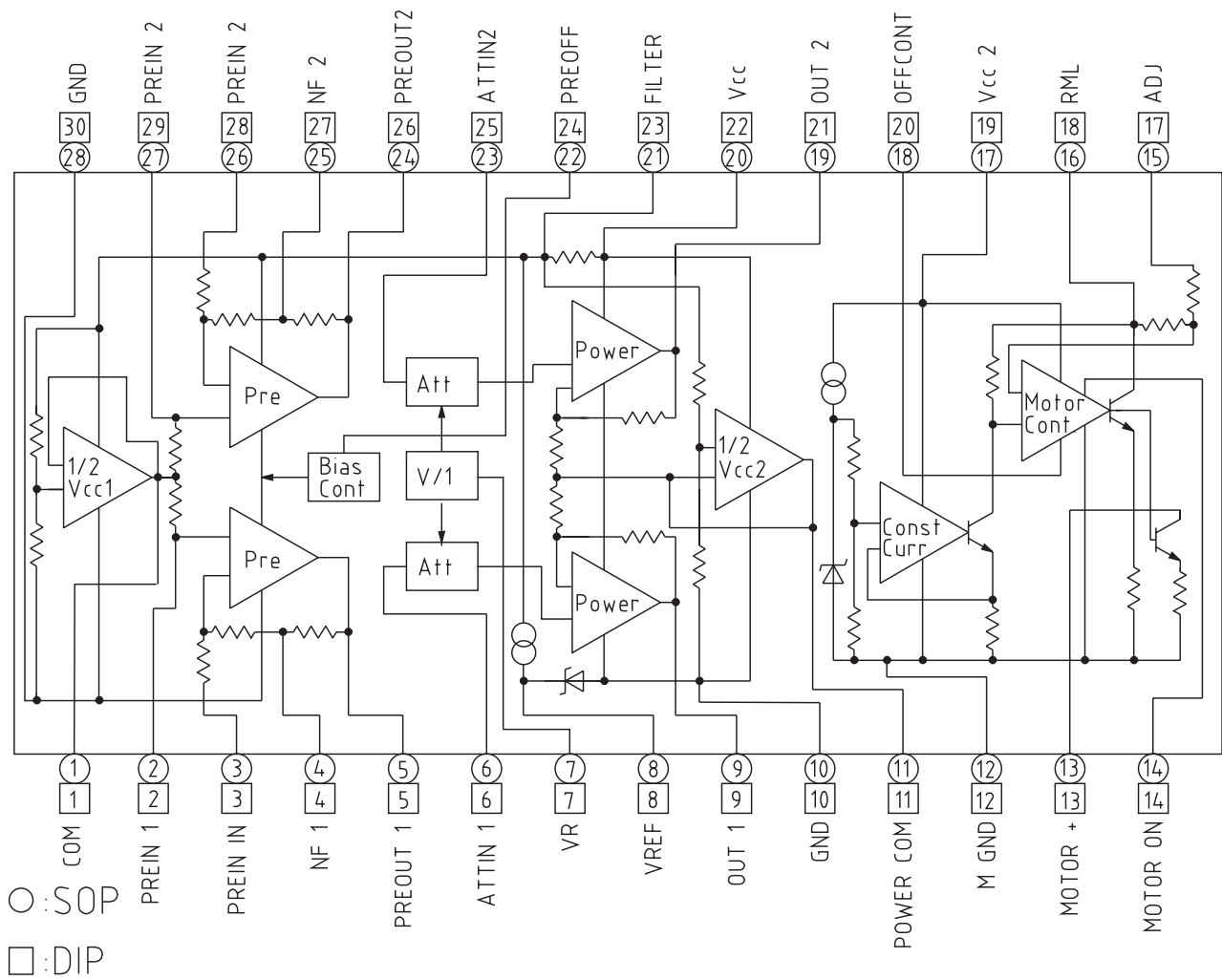
Amp unit: V_{CC}=3.0V, f=1kHz, R_L=16Ω, Pre OFF=OPEN

Motor unit: V_{CC}=3.0V, I_M=100mA, Motor unit: (Mitsumi model)

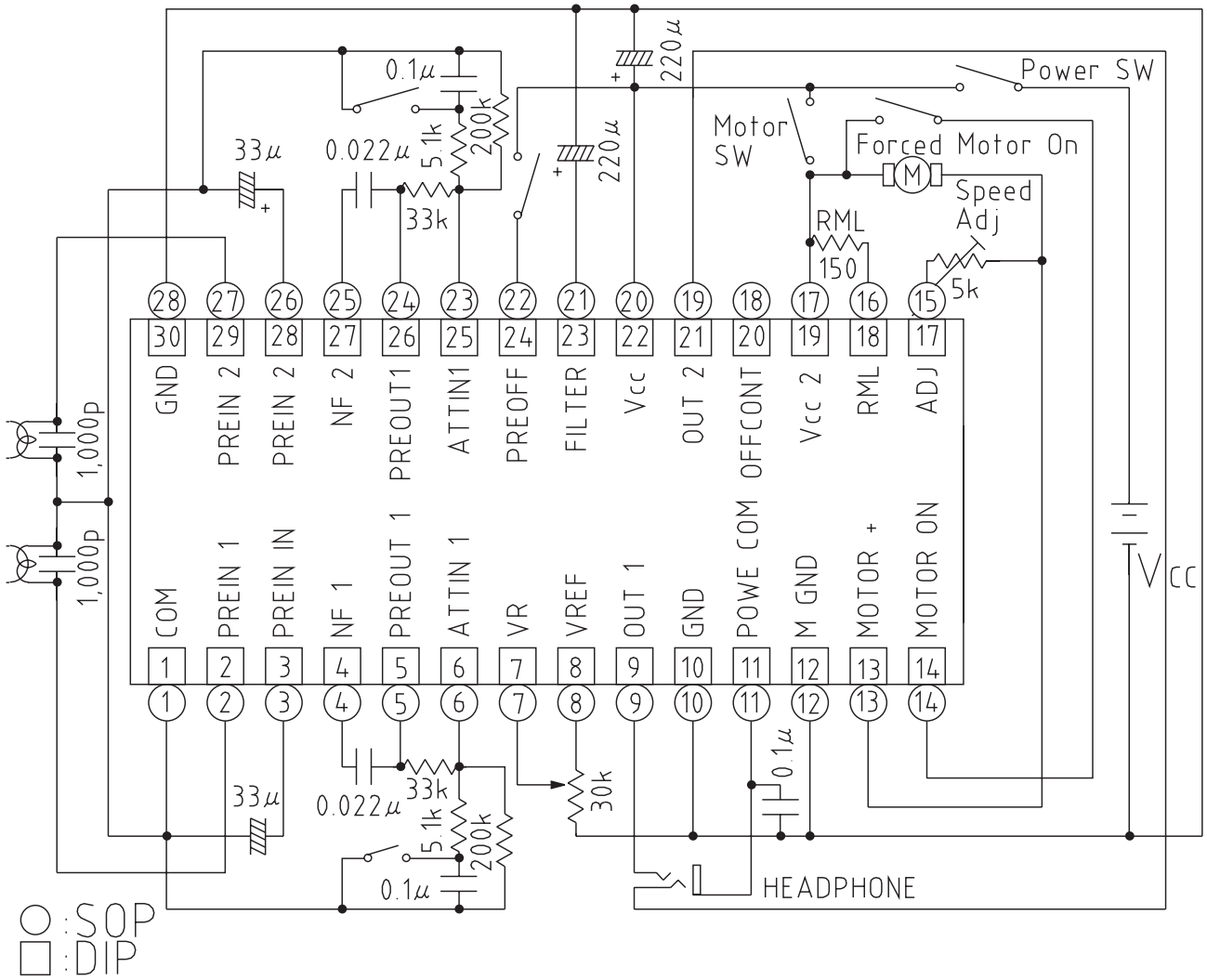
Note 1: Bass boost circuit constants are based on application circuit diagrams.

Note 2: Motor pin voltage fluctuations

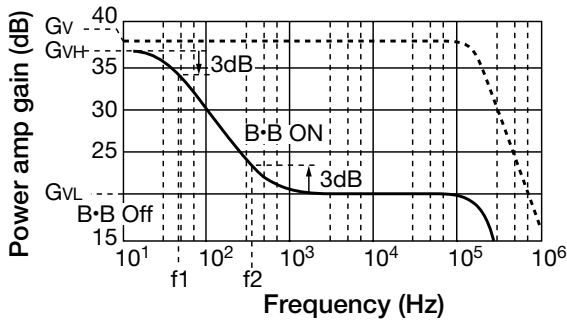
Block Diagram



Application Circuits



Bass Boost Power Amp Gain



Gv : Power amp gain

GvH : Bass boost power amp gain (high level)

GvL : Bass boost power amp gain (low level, or boost off)

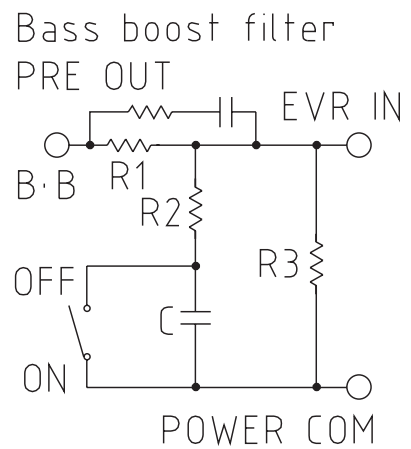
f1, f2: Cutoff frequencies

$$GvH = Gv + 20 \log \left(\frac{R3}{R1 + R3} \right) \text{ (dB)}$$

$$GvL = Gv + 20 \log \left(\frac{R2 / R3 \times R1}{R2 / R3 + R1} \right) \text{ (dB)}$$

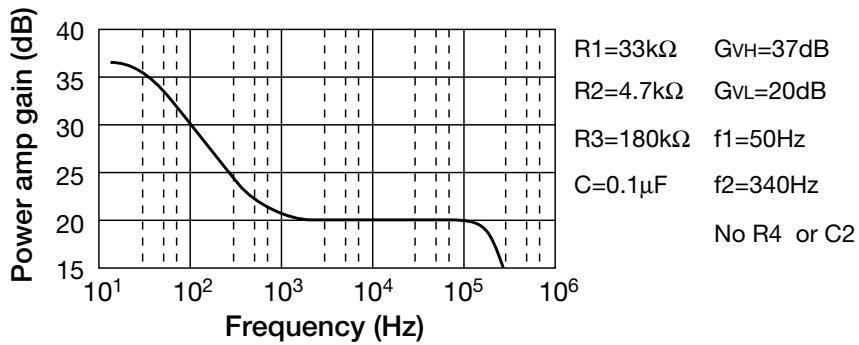
$$f1 = \frac{1}{2\pi ((R1 / R3) + R2) C} \text{ (Hz)}$$

$$f2 = \frac{1}{2\pi R2 C} \text{ (Hz)}$$

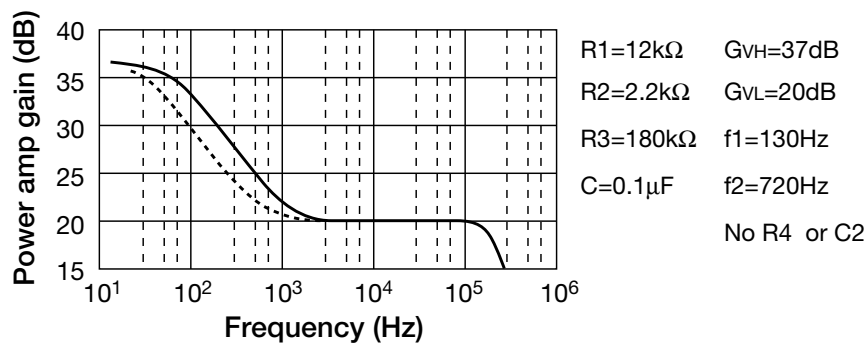


Characteristics (Bass boost)

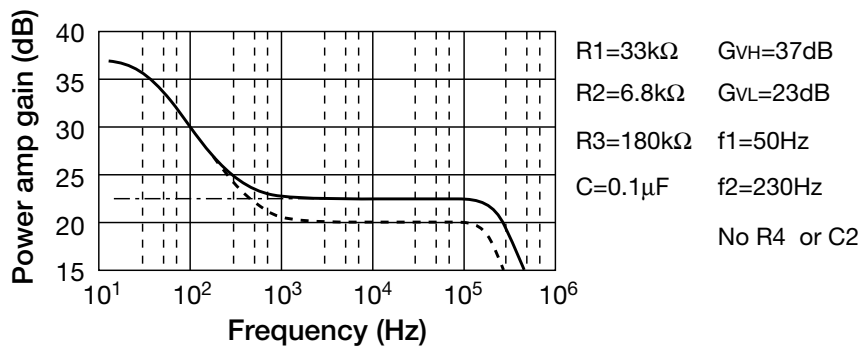
■ Recommended constants



■ Bass boost efficiency



■ Response for poor headphone and cassette head characteristics



■ Bass + treble boost

