

**LA4802T****Headphone Stereo Power Amplifier****Overview**

The LA4802T is a headphone stereo power amplifier for portable CD and MD players. It features a high signal-to-noise ratio, a high ripple rejection ratio, low distortion, and low current drain.

Functions

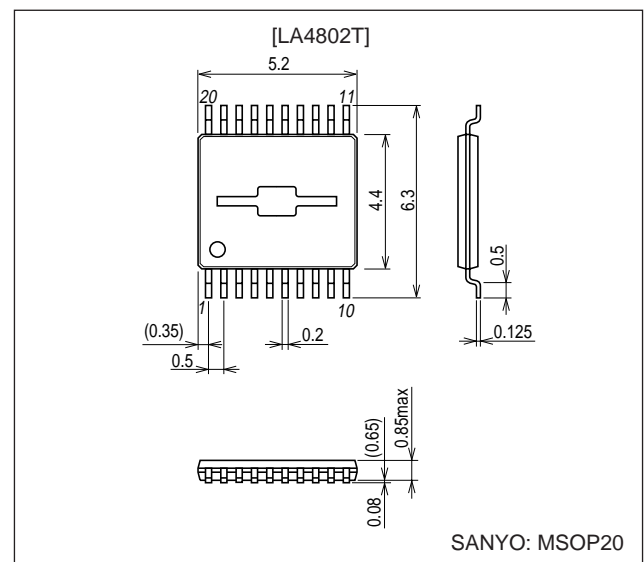
- Headphone stereo power amplifier
- Power switch
- Muting switch
- Beep tone function control input pin (The beep tone function can be used regardless of whether the mute function is on or off.)

Features

- High signal-to-noise ratio (100 dB typical at 7.5 μ V)
- High ripple rejection ratio (70 dB typical)
- Low current drain (950 μ A typical)
- On-chip bass compensation circuit (Compensates for bass frequency attenuation due to the output capacitors and achieves flat frequency characteristics.)
- Ultraminiature package (MSOP-20)

Package Dimensions

unit: mm

3262-MSOP20**Specifications****Maximum Ratings at Ta = 25°C**

| Parameter | Symbol | Conditions | Ratings | Unit |
|-----------------------------|--------------|--|-------------|------------------|
| Maximum supply voltage | V_{CC} max | | 4.5 | V |
| Allowable power dissipation | P_d max | When mounted, $T_a = 80^\circ\text{C}$ | 375 | mW |
| Operating temperature | T_{opr} | | -20 to +80 | $^\circ\text{C}$ |
| Storage temperature | T_{stg} | | -40 to +150 | $^\circ\text{C}$ |

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Operating Conditions at $T_a = 25^\circ\text{C}$

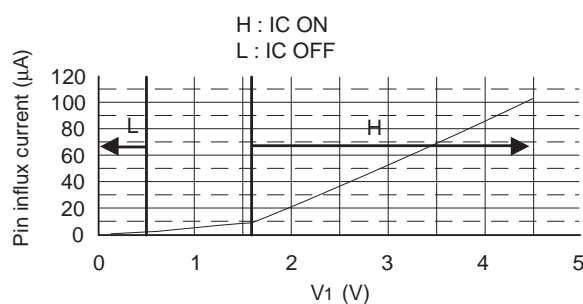
| Parameter | Symbol | Conditions | Ratings | Unit |
|--------------------------------|--------------------|------------|------------|----------|
| Recommended supply voltage | V_{CC} | | 2.4 | V |
| Operating supply voltage range | $V_{CC\text{ op}}$ | | 1.8 to 3.6 | V |
| Recommended load resistance | R_L | | 16 to 32 | Ω |

Electrical Characteristics at $T_a = 25^\circ\text{C}$, $V_{CC} = 2.4\text{ V}$, $f_{IN} = 1\text{ kHz}$, $R_L = 16\ \Omega$

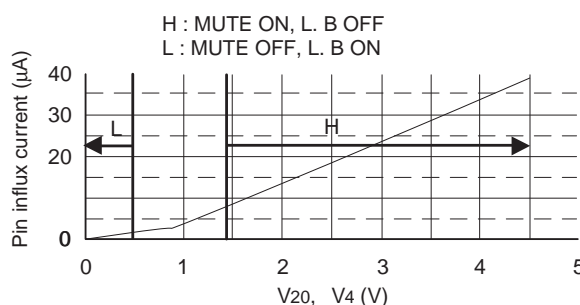
| Item | Symbol | Conditions | Ratings | | | Unit |
|--|---------------------|---|---------|-------|------|---------------|
| | | | min | typ | max | |
| Quiescent current | I_{CCO1} | Current when ST is off (with L.B. on and muting off) | | 0.05 | 1 | μA |
| | I_{CCO2} | Current when muting is on (with ST on and L.B. on) | | 530 | 900 | μA |
| | I_{CCO3} | Current when ST is on (with L.B. on and muting off) | | 950 | 1500 | μA |
| Operating current drain | I_{CC1} | $P_O = 0.1\text{ mW}$ (With 2 channels driven) | | 3.2 | 3.7 | mA |
| Voltage gain | VG | $V_O = -10\text{ dBm}$ | 6.8 | 7.8 | 8.8 | dB |
| Channel balance | ΔVG | $V_O = -10\text{ dBm}$ | -1 | 0 | +1 | dB |
| Output power | P_O | THD = 10% | 25 | 38 | | mW |
| Total harmonic distortion | THD | $V_O = -8\text{ dBm}$, 20 kHz LPF | | 0.03 | 0.1 | % |
| Output noise voltage | V_{NO} | $R_g = 10\text{ k}\Omega$, IHF A | | -100 | -90 | dBm |
| Crosstalk | CT | $T_{UN}1\text{ kHz}$, $V_O = -10\text{ dBm}$ | 70 | 80 | | dB |
| Ripple rejection ratio | SVRR | $f_r = 100\text{ kHz}$, $V_r = -20\text{ dBm}$, $T_{UN}100\text{ Hz}$ | 60 | 70 | | dB |
| Peak output voltage | V_{OBEEP} | $V_{IN} = 2.4\text{ V}_{p-p}$, $f = 1\text{ kHz}$, MUTE OFF | 1.0 | 2.7 | | mV |
| Muting attenuation | V_{OFF} | THD = 1%, $T_{UN}1\text{ kHz}$ | -100 | -120 | | dB |
| Power on voltage sensitivity | $V_{1\text{ ON}}$ | Power on threshold voltage | 1.6 | | | V |
| Power off voltage sensitivity | $V_{1\text{ OFF}}$ | Power off threshold voltage | | | 0.5 | V |
| Mute on voltage sensitivity | $V_{20\text{ ON}}$ | Muting on threshold voltage | 1.4 | | | V |
| Mute off voltage sensitivity | $V_{20\text{ OFF}}$ | Muting off threshold voltage | | | 0.5 | V |
| Boost on voltage sensitivity | $V_{4\text{ ON}}$ | Boost on threshold voltage | | | 0.5 | V |
| Boost off voltage sensitivity | $V_{4\text{ OFF}}$ | Boost off threshold voltage | 1.4 | | | V |
| $T_a = 25^\circ\text{C}$, $V_{CC} = 2.7\text{ V}$, $f_{IN} = 1\text{ kHz}$, $R_L = 47\text{ k}\Omega$ (Characteristics when used as a line output), L.B OFF | | | | | | |
| Operating current drain | I_{CC2} | $V_O = 0\text{ dBm}$ (With 2 channels driven) | | 1.5 | 2.0 | mA |
| Total harmonic distortion | THD2 | $V_O = 0\text{ dBm}$, 20 kHz LPF | | 0.005 | 0.05 | % |
| Output noise voltage | V_{NO2} | $R_g = 10\text{ k}\Omega$, IHF A | | -100 | -90 | dBm |
| Crosstalk | CT2 | $T_{UN}1\text{ kHz}$, $V_O = -10\text{ dBm}$ | 80 | 90 | | dB |
| Ripple rejection ratio | SVRR2 | $f_r = 100\text{ kHz}$, $V_r = -20\text{ dBm}$, $T_{UN}100\text{ Hz}$ | 65 | 78 | | dB |

Switch Threshold Voltages and Pin Influx Currents

- Standby switch (pin 1)



- Mute switch (pin 20), boost switch (pin 4)



Notes on the Beep Tone Output Function

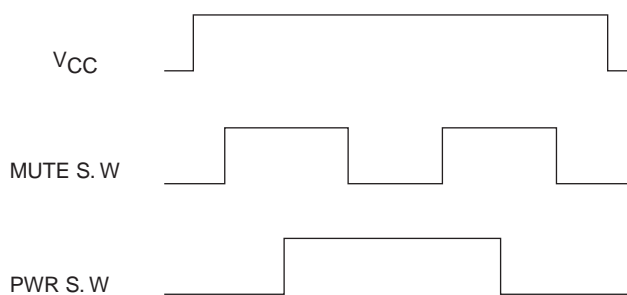
- This function provides a beep tone output under control of the system microcontroller.
- The beep tone can be provided regardless of the on/off state of the muting function.
- The recommended beep input signal level is a square wave with $V_{IN} = 2.4 V_{p-p}$. When the muting function is off, the beep tone output, V_{OBEEP} , will be 2.7 V rms, and when muting is on, the output will be 1.3 Vrms.

Notes on the Muting Time

- The muting on time and the muting off time can be modified by changing the value of the external capacitor C4 connected to pin 6. The recommended value for C4 is 1 μF . With lower values, impulse noise levels will increase.
- The on/off times will change as shown below when the value of C4 is varied.

| C4 | On time | Off time |
|--------------|---------|----------|
| 0.1 μF | 0.2 ms | 9 ms |
| 0.47 μF | 1 ms | 40 ms |
| 1 μF | 2 ms | 80 ms |

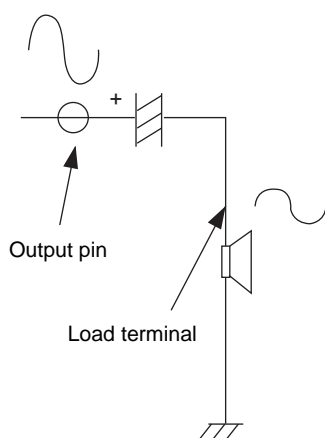
- We recommend operating the mute switch at the same time as the power on/off switch (pin 1) to minimize impulse noise at power on and off.



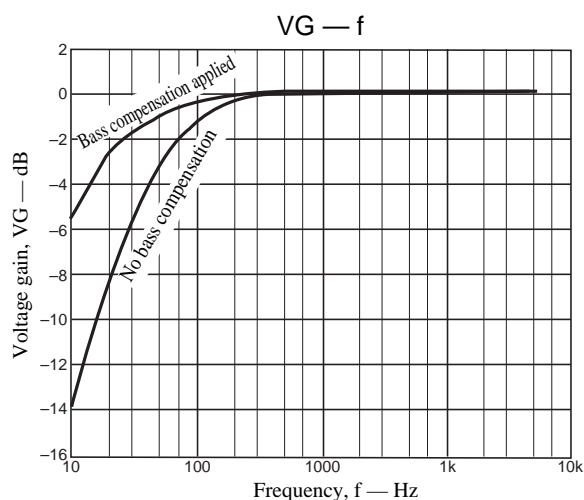
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Notes on the Bass Compensation Circuit

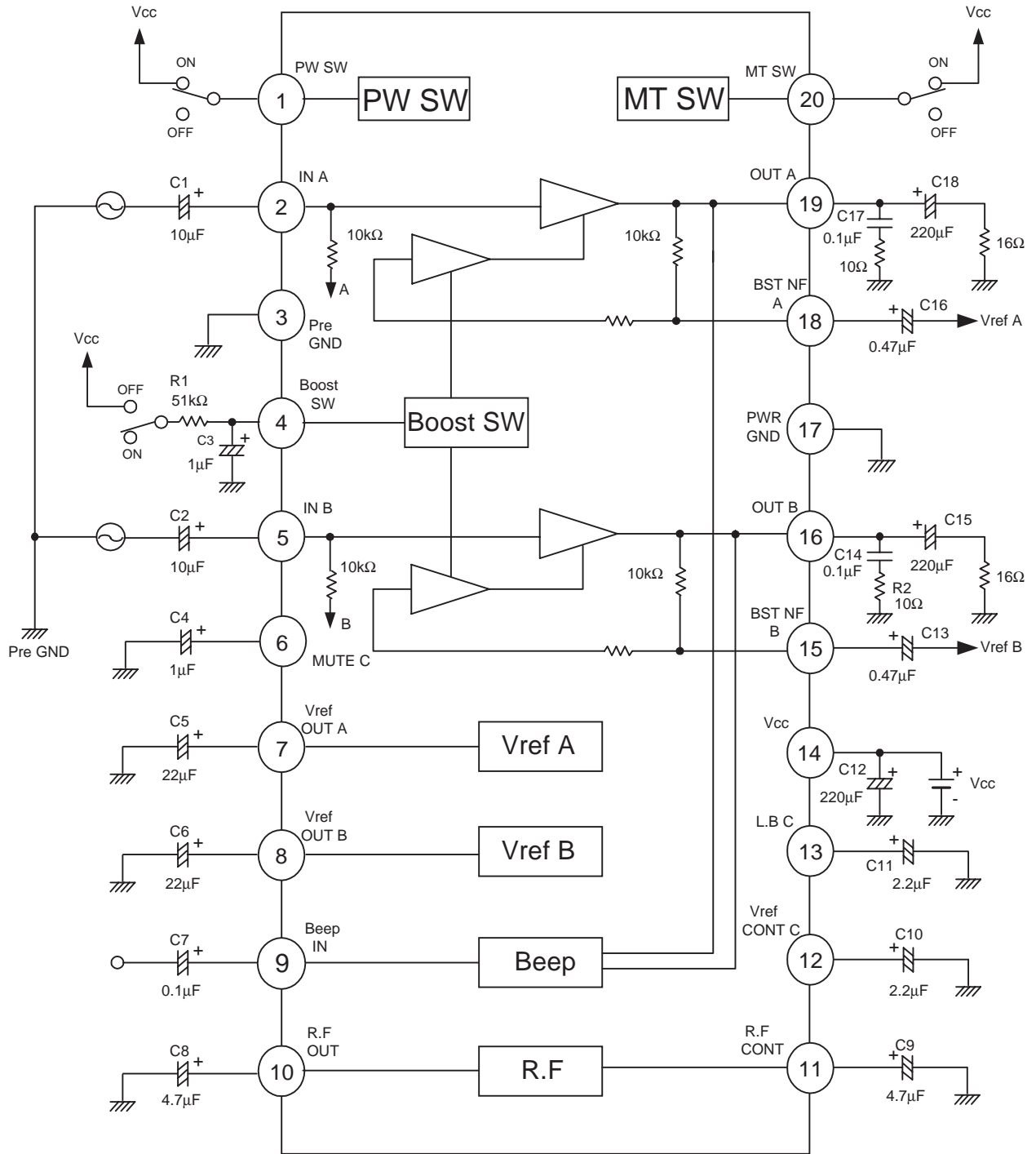
- When the headphone load is connected to the output, the low frequencies will be attenuated due to the output capacitors. This circuit compensates for that attenuation and creates frequency response characteristics that are close to flat.
- This function can be turned on or off from pin 4. When used as a line output, the load will be less than 16 Ω , and the bass frequency characteristics will be somewhat increased. Therefore we recommend leaving the bass compensation circuit off in this case.



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Block Diagram and Test Circuit



* Package : MSOP-20

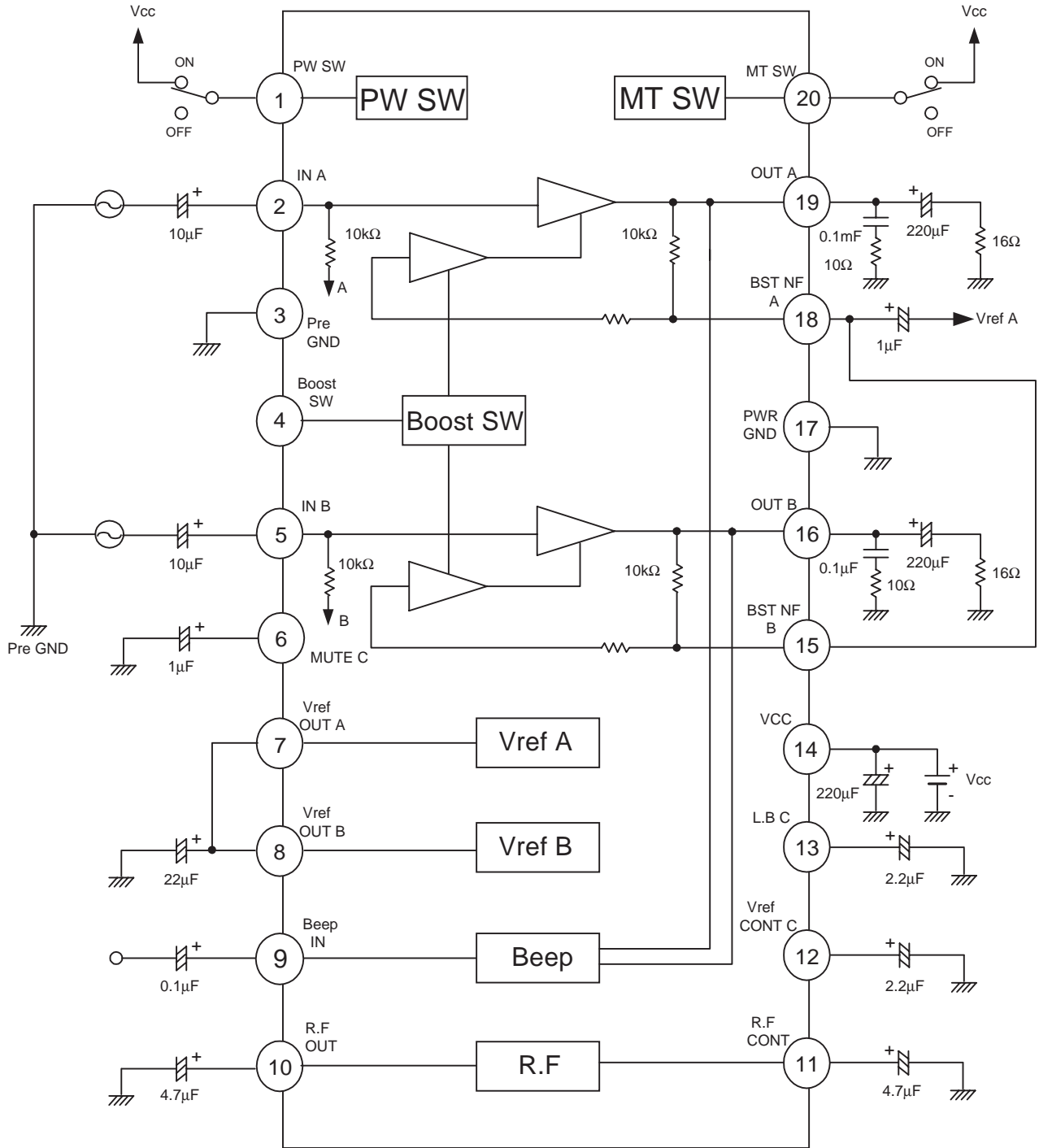
Top view

External Components (Values in parentheses are recommended values.)

- C1, C2 (1 to 10 μF)
Input coupling capacitors.
- C3 (0.47 to 2.2 μF)
Boost switch on/off impulse noise reduction capacitor.
- C4 (1 μF)
Mute switch on/off impulse noise reduction capacitor.
- C5, C6 (10 to 22 μF)
Reference bias (V_{REF}) decoupling capacitors.
- C7 (0.1 to 1 μF)
Beep input coupling capacitor. Be careful not to attenuate the beep tone signal.
- C8, C9 (2.2 to 4.7 μF)
Ripple filter capacitors.
- C10 (2.2 to 4.7 μF)
Reference bias (V_{REF}) decoupling capacitors.
- C11 (1 to 2.2 μF)
Boost switch on/off impulse noise reduction capacitor.
- C12 (220 μF)
Power supply line decoupling capacitor.
- C13, C16 (0.47 μF)
Low pass filter capacitor in the bass boost circuit. The amount of bass boost depends on the value of this capacitor.
- C14, C17 (0.1 μF)
Output oscillation prevention capacitors. We recommend using Mylar capacitors. Since the oscillation stability varies depending on the PCB layout and other factors, we recommend a value of at least 0.1 μF for these capacitors.
- C15, C18 (220 to 470 μF)
Output capacitors. Low band attenuation increases with lower capacitances.
- R1 (24 to 51 $\text{k}\Omega$)
Smoothing resistor for the boost switch on/off transition. Note that using a smaller value will increase the idling current when the boost switch is off.
- R2, R3 (10 Ω)
Output oscillation prevention resistors.

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Application that does not use the line outputs (The bass compensation circuit is always on.)



* Package : MSOP-20

Top view

Pin Descriptions

| Pin No. | Pin name | Pin voltage (V) | Pin description | Equivalent circuit |
|---------|----------------------|-----------------|--|--------------------|
| 1 | POWER SW | | <ul style="list-style-type: none"> • IC on/off switch • 0 to 0.5 V: IC off • 1.4 to 4.5 V: IC on | |
| 2 5 | POWER IN | 1.21 | <ul style="list-style-type: none"> • Power input | |
| 3 | PRE GND | | | |
| 4 | BOOST SW | | <ul style="list-style-type: none"> • Bass compensation circuit on/off switch • 0 to 0.5 V: Boost on • 1.4 to 4.5 V: Boost off | |
| 6 | MUTE C | 1.27 | <ul style="list-style-type: none"> • Connection for the mute switch on/off impulse noise reduction capacitor | |
| 7 8 | V _{REF} OUT | 1.21 | <ul style="list-style-type: none"> • V_{REF} amplifier reference | |

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| Pin No. | Pin name | Pin voltage (V) | Pin description | Equivalent circuit |
|---------|-------------------------|-----------------|--|--------------------|
| 9 | BEEP IN | 1.21 | • Beep input | |
| 10 | RF OUT | 2.15 | • Ripple filter output | |
| 11 | RF CONT | 2.15 | • Ripple filter reference | |
| 12 | V _{REF} CONT C | 1.21 | • V _{REF} amplifier reference | |
| 13 | L. B C | 1.33 | • Connection for the bass compensation circuit switch on/off impulse noise reduction capacitor | |
| 14 | V _{CC} | | | |

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| Pin No. | Pin name | Pin voltage (V) | Pin description | Equivalent circuit |
|----------|-----------|-----------------|---|--------------------|
| 15 18 | L. B NF | 1.23 | <ul style="list-style-type: none"> • Bass compensation circuit low-pass filter connection • The amount of bass boost depends on the capacitance used. | |
| 16 19 | POWER OUT | 1.23 | <ul style="list-style-type: none"> • Power outputs | |
| 20 | MUTE SW | | <ul style="list-style-type: none"> • Muting on/off switch • 0 to 0.5 V: Muting off • 1.4 to 4.5 V: Muting on | |

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