OVERVIEW

This note describes the usage precautions and a typical application for the SM6453AB headphone amplifier with built-in electronic volume control.

USAGE PRECAUTIONS

The analog circuit power supply and digital circuit power supply are independent, and the wiring pattern provides sufficient power supply separation. Furthermore, the analog circuit power supply comprises an EVR power supply and headphone amplifier power supply, which provides even further power supply separation.

If the muting operation is controlled by microcontroller commands, all other settings are maintained, so it is important not to change other parameter settings when setting and releasing muting. Muting is released when the power is applied with the following timing.

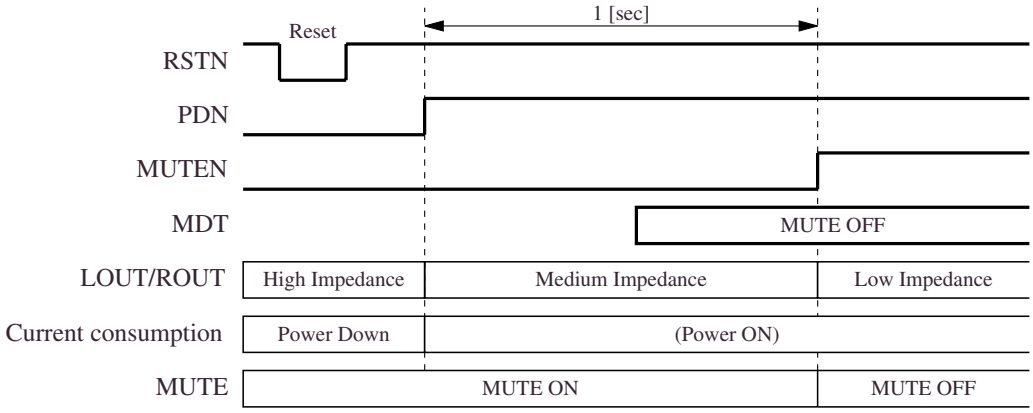


Figure 1. Mute release timing when power is applied

BASS BOOST and AGC

The bass boost frequency response is determined by the external capacitance connected to pins BSTC, BSTN, and BSTO. The following frequency response examples are given below for reference. Unless otherwise noted, the input coupling capacitance C_{IN} = 1µF, output coupling capacitance C_{OUT} = 220µF, and output load = 16Ω.

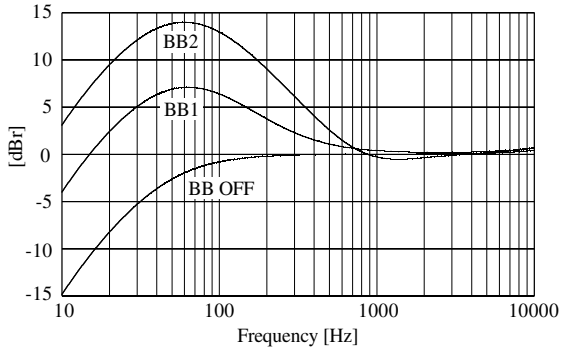


Figure 2. C1 = 0.1µF, C2 = 2200µF

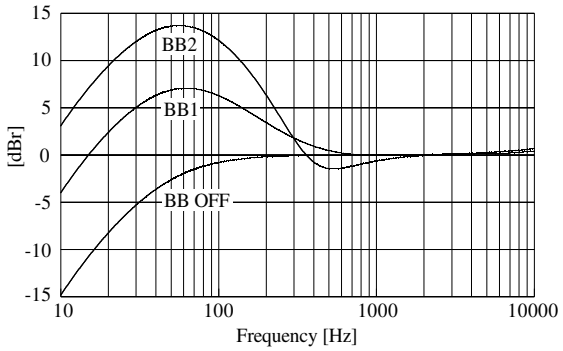


Figure 3. C1 = 0.1µF, C2 = 0.01µF

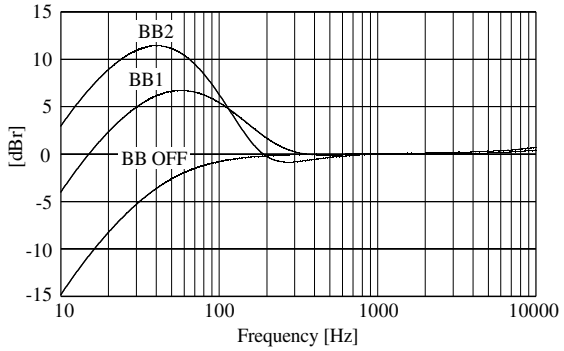


Figure 4. C1 = 0.1µF, C2 = 0.047µF

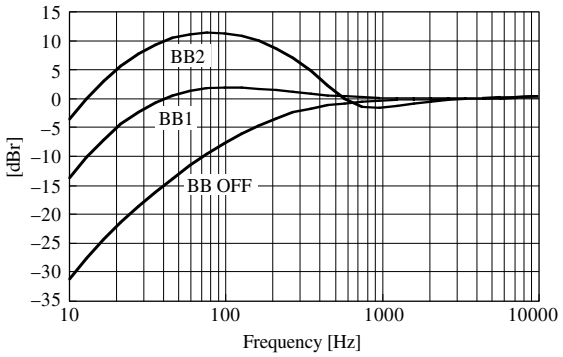
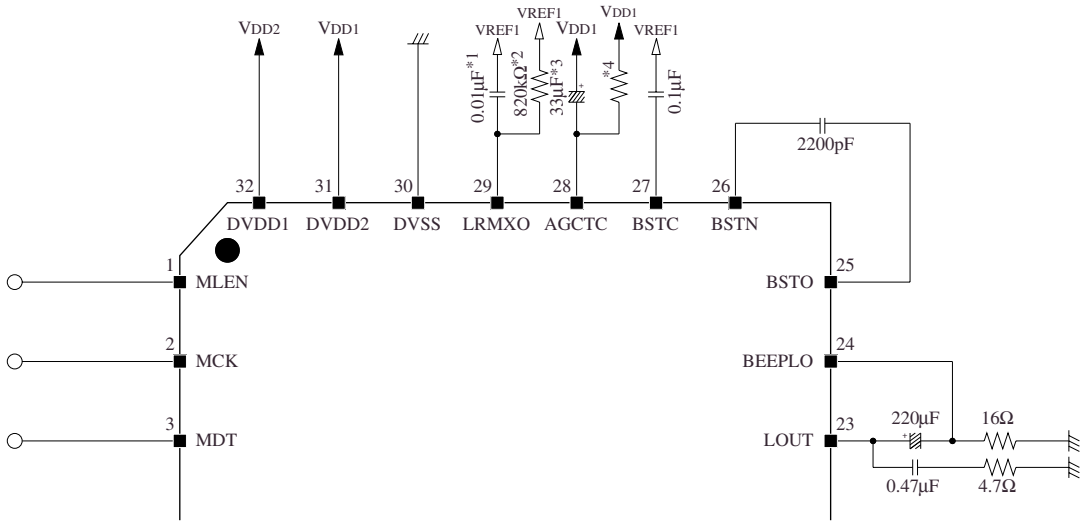


Figure 5. C1 = 0.22µF, C2 = 6800pF, 2.7k Ω connected between BSTN and VREF1, C_{OUT} = 47µF

In bass boost mode, the built-in AGC function detects the output voltage, and if higher than a default predefined voltage, reduces the bass boost amplifier gain and increases the headphone amplifier output low-frequency clip margin. The AGC circuit time constant is determined by the RC components *1 to *4 in figure 6.



*1 to *4: AGC time constant setting components. *4 is not connected during measurement.

Figure 6. AGC circuit time constant setting

The AGC level typical characteristics are shown by the graph in figure 7.

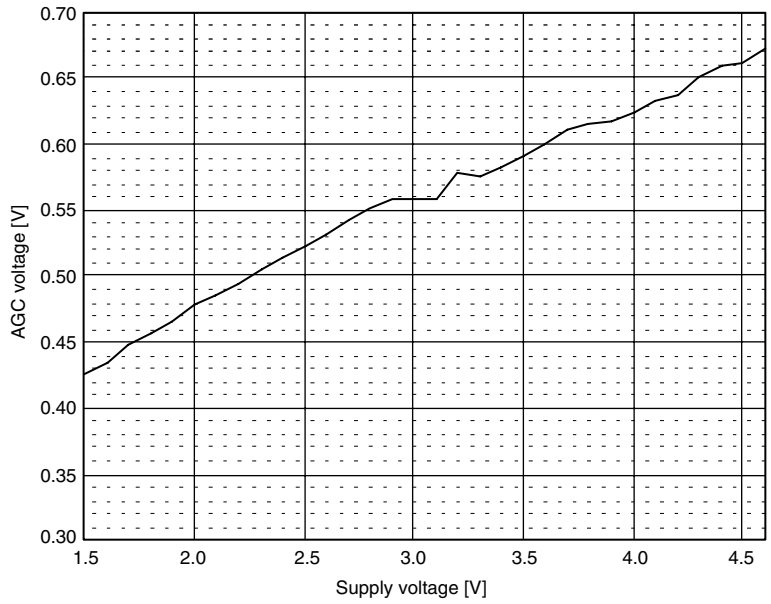


Figure 7. Supply voltage vs. AGC level

HEADPHONE AMPLIFIER

The built-in headphone amplifier uses a special bias circuit to obtain high output power with low current consumption. The supply voltage vs. output power characteristics with 4Ω load are shown in figure 8, together with a 16Ω load speaker drive for reference purposes. During actual use, the output range must not exceed the absolute maximum rating for the output current (I_O = 100mA).

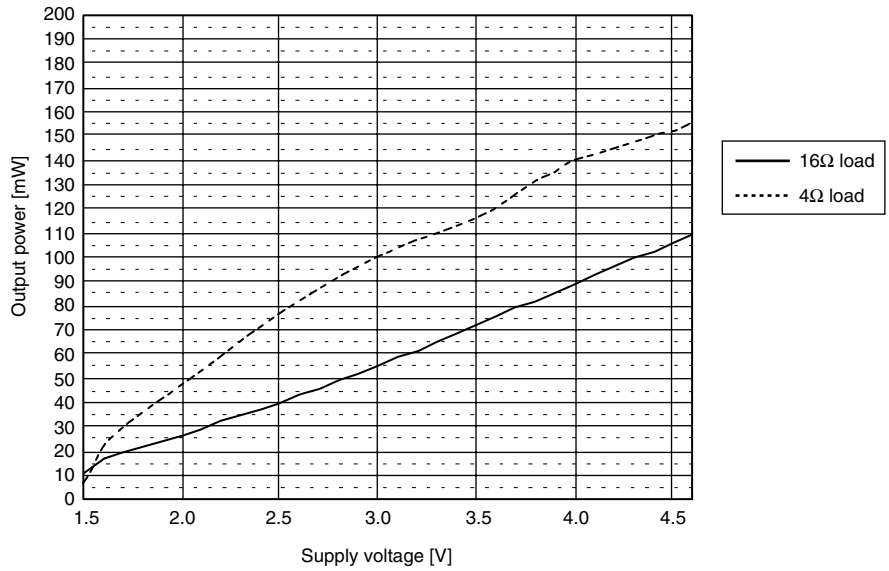


Figure 8. Supply voltage vs. maximum output power (THD+N = 10%, no LPF)

INPUT SELECTOR FUNCTION

The SM6453AB can switch output between two input signals under microcontroller command control. When switching, use the following muting process timing to prevent output noise.

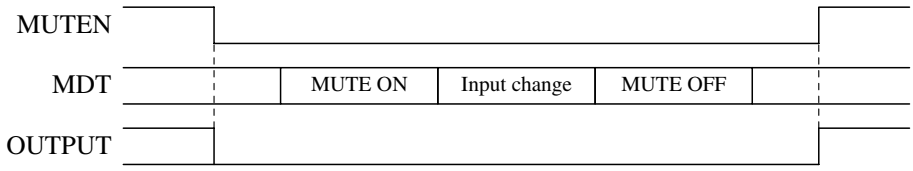


Figure 9. Input switch timing

BEEP INPUT/OUTPUT

The beep output constant-current amplifier, which is independent of all other circuits, detects the presence of the beep input in order to output a beep tone. The beep is output on pins BEEPLO and BEEPRO with a constant-current signal that is not dependent on either the supply voltage or BEEPI input level. Note that if the beep signal input is not used, BEEPI should be connected to VSS, and the outputs BEEPLO and BEEPRO should be connected to AVDD2 and AVDD3.

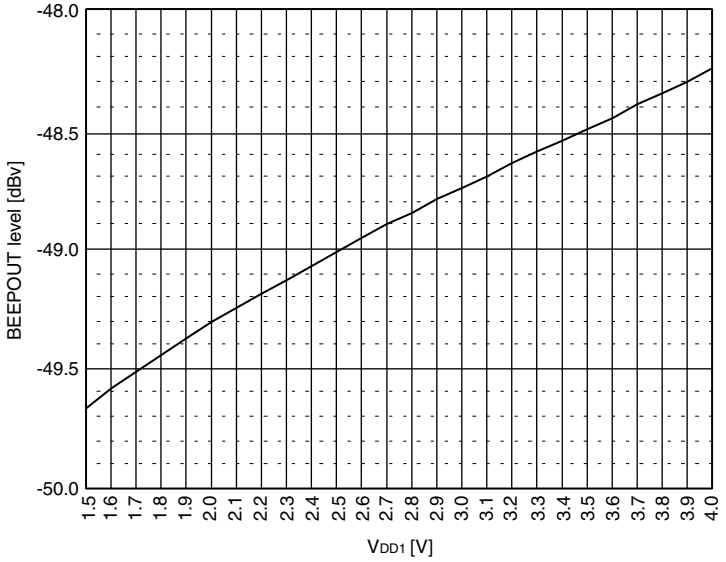


Figure 10. BEEPIO characteristic (BEEPI input voltage = 2.0V)

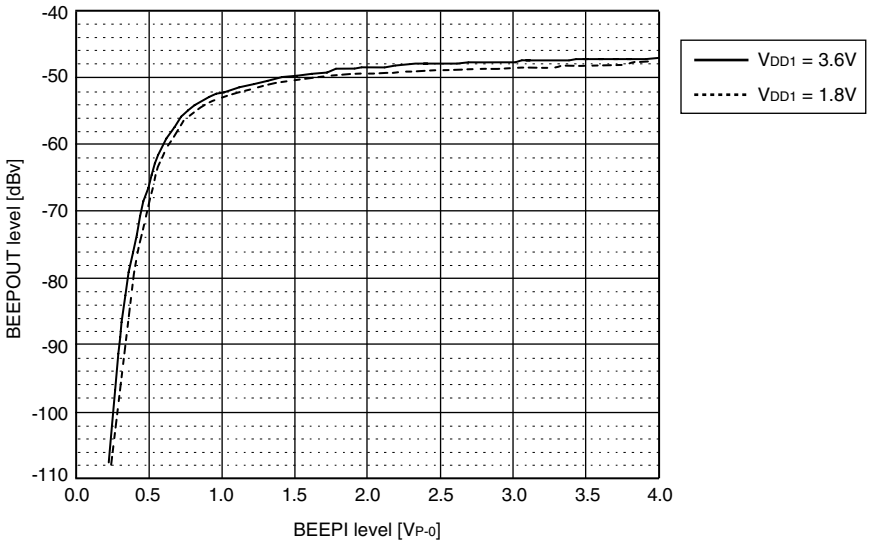


Figure 11. BEEPI level vs. BEEPOUT level

SAMPLE APPLICATION

- Sample application circuit with minimized output coupling capacitance by utilizing the chip capacitance as peripheral components, and low resistance for reduced mounting surface area

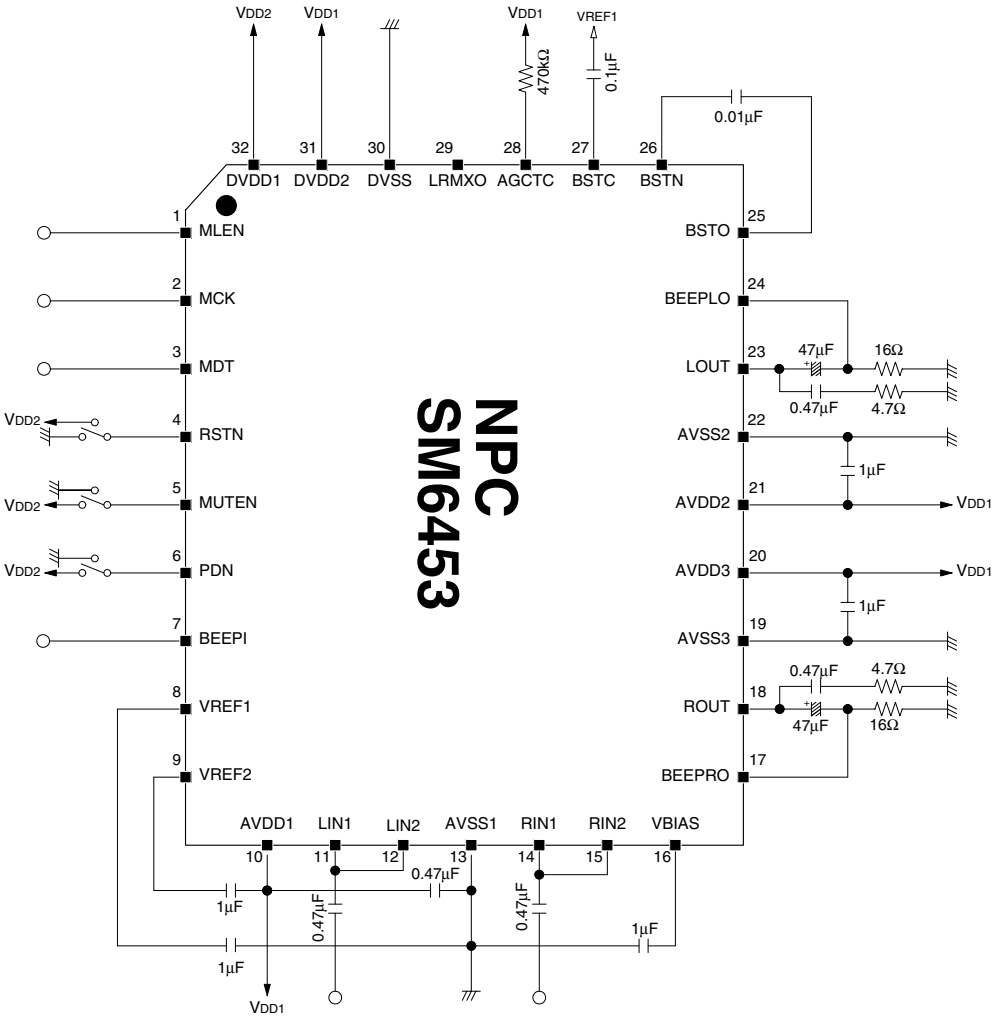
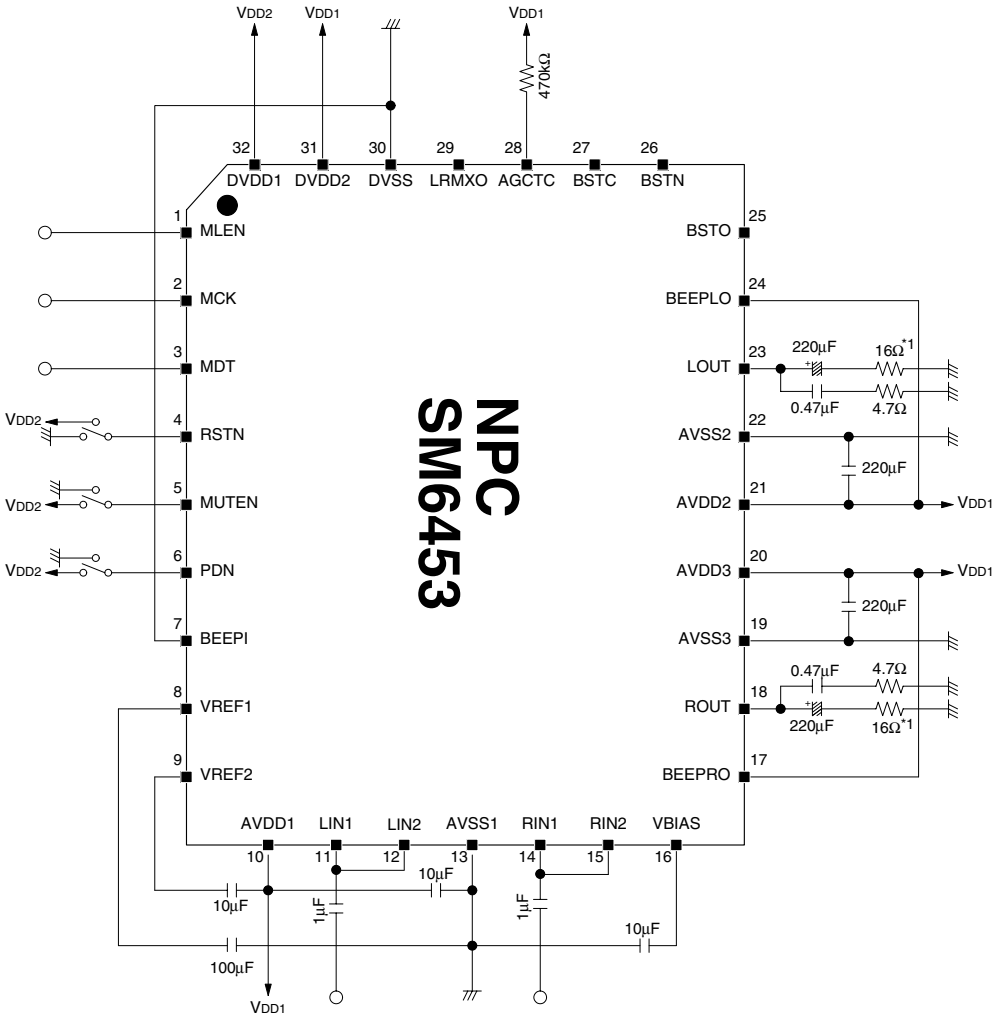


Figure 12. Sample application 1

■ Sample application circuit with LIN1+RIN1 input only (1 system) with no beep, bass boost function or AGC function



*1: 16Ω headphone load standard

Figure 13. Sample application 2

1. A 0.47µF input capacitance can also be used.
2. There is a correlation between the output coupling capacitance and capacitance between pins VREF1-AVSS1, VBIAS-AVSS1, and VREF2-AVDD1, and the return time after device power down and pop noise. The minimum capacitance is determined by the operating environment. With minimized capacitance, the rise time is faster, and the pop noise frequency component is shifted into the audio band.
3. The number of external components in the main circuit diagram is 15. The capacitors between AVDD2-AVSS2 and AVDD3-AVSS3 can be removed.
4. The output capacitor determines the low-frequency (bass) cutoff frequency, and is recommended should be made as large as possible.

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