

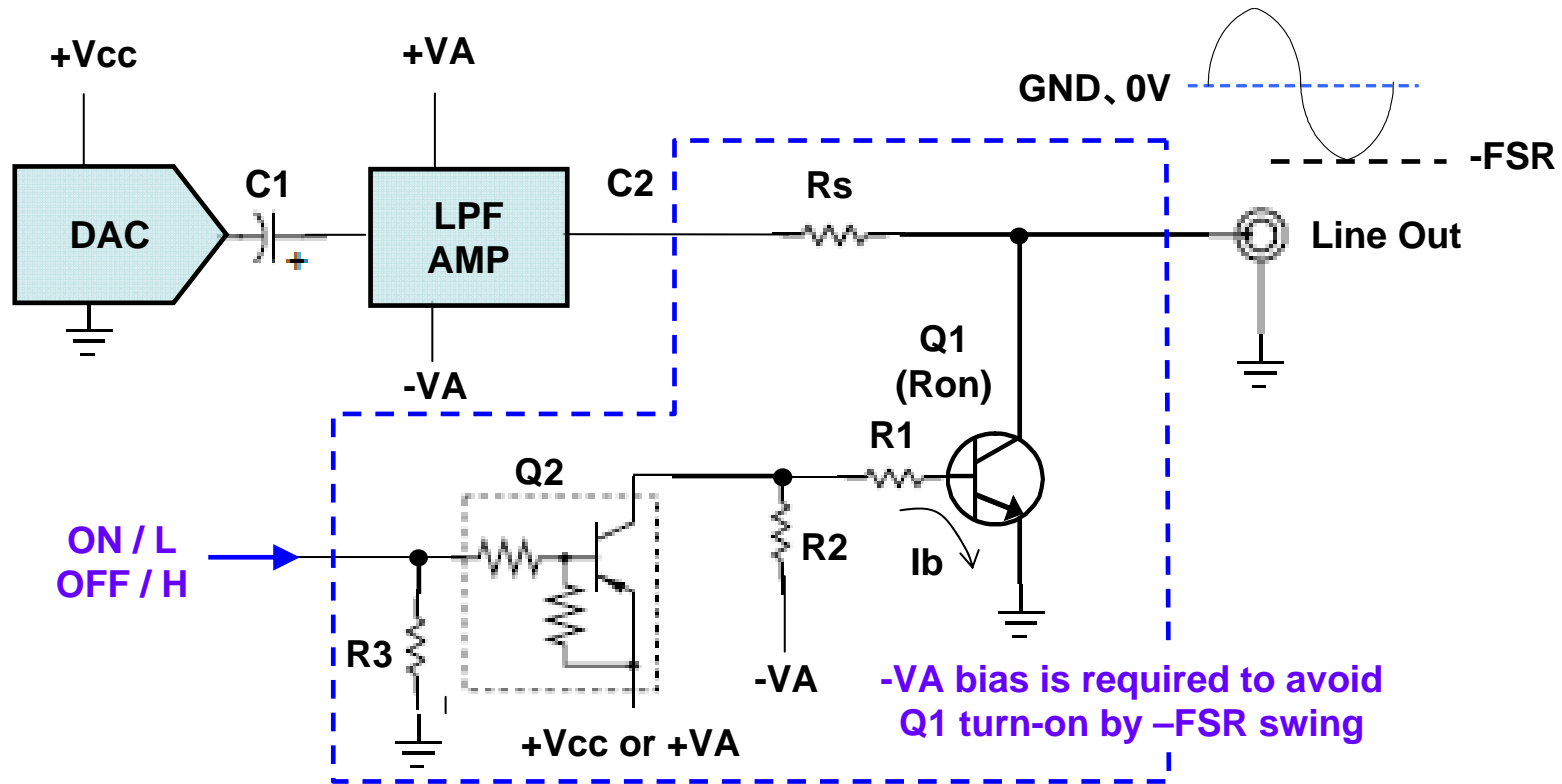
Application Report

Designing Analog Mute Circuit for D/A System



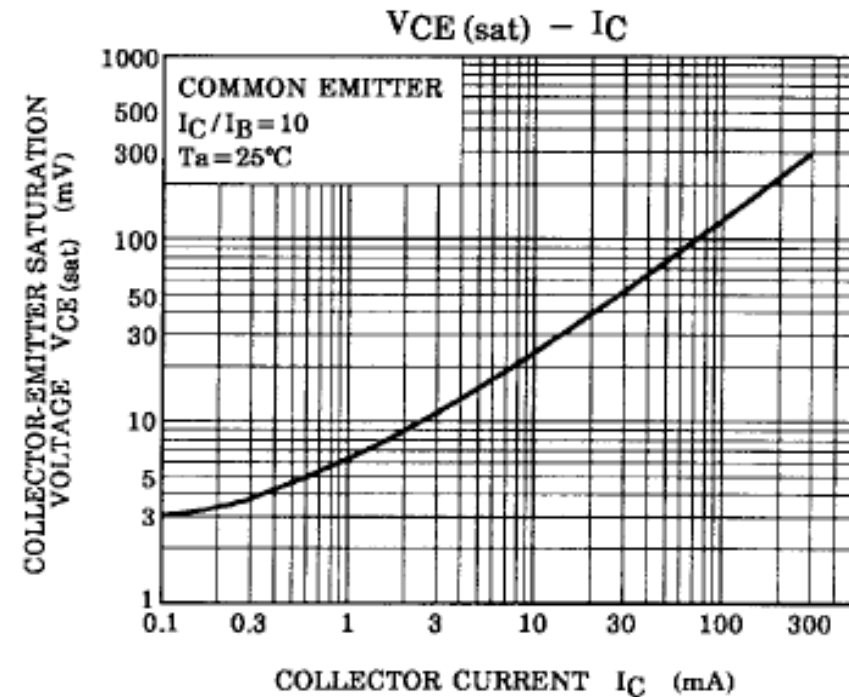
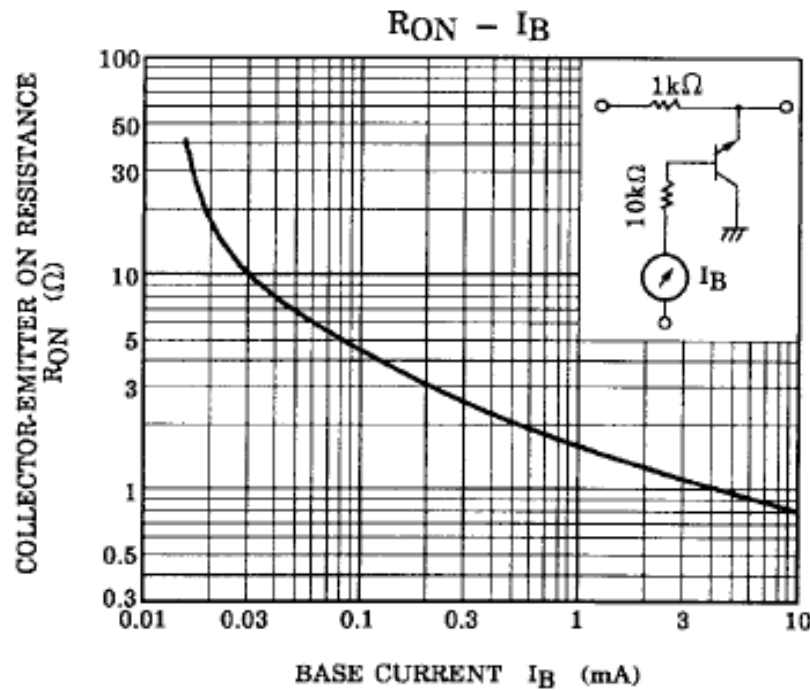
May. 2010
AIP Audio Converters, HPA
Texas Instruments

1. Mute Circuit-2 Example for Bipolar Power Supply Application



C1: AC Coupling capacitor
Rs : Resistor for Mute level setting
R1, R2, R3 : Bias resistor for Q1 switching (R1,R2) and Q2 Switching (R3)
Q1 : Mute Transistor (Low VCE saturation, Low On-Resistor)
Q2 : Digital Transistor for level shift and switching

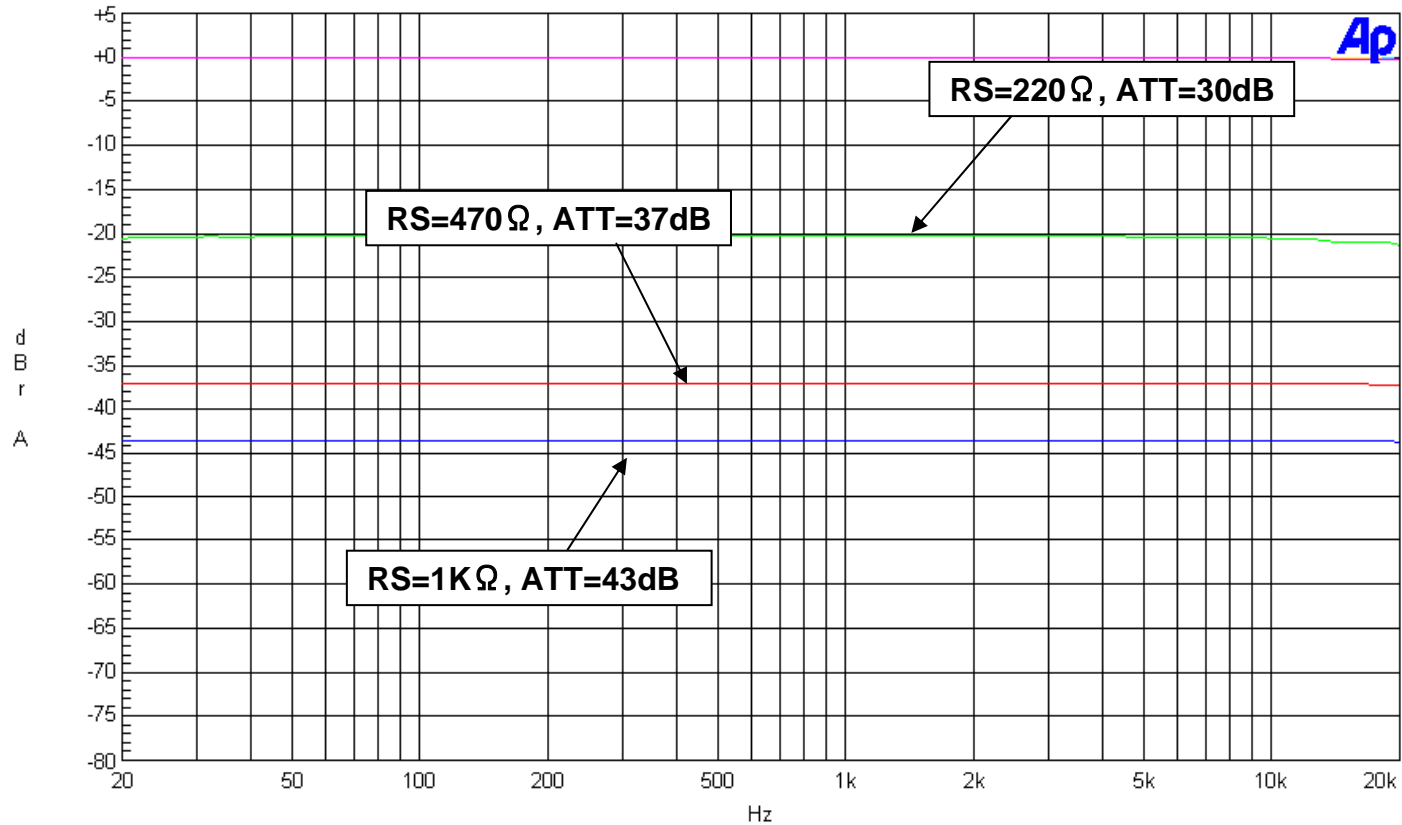
2. Mute Transistor Selection



- * Key specification for mute transistor is Low VCE saturation, Low Ron and high switching speed.
- * The most important is Ron. Ron is given by designing of base current.
- * Typical performance curve for VCE(sat) and Ron by 2SC2878 is shown.

3. Mute Level by Mute Circuit-2 ($I_b=0.1mA$)

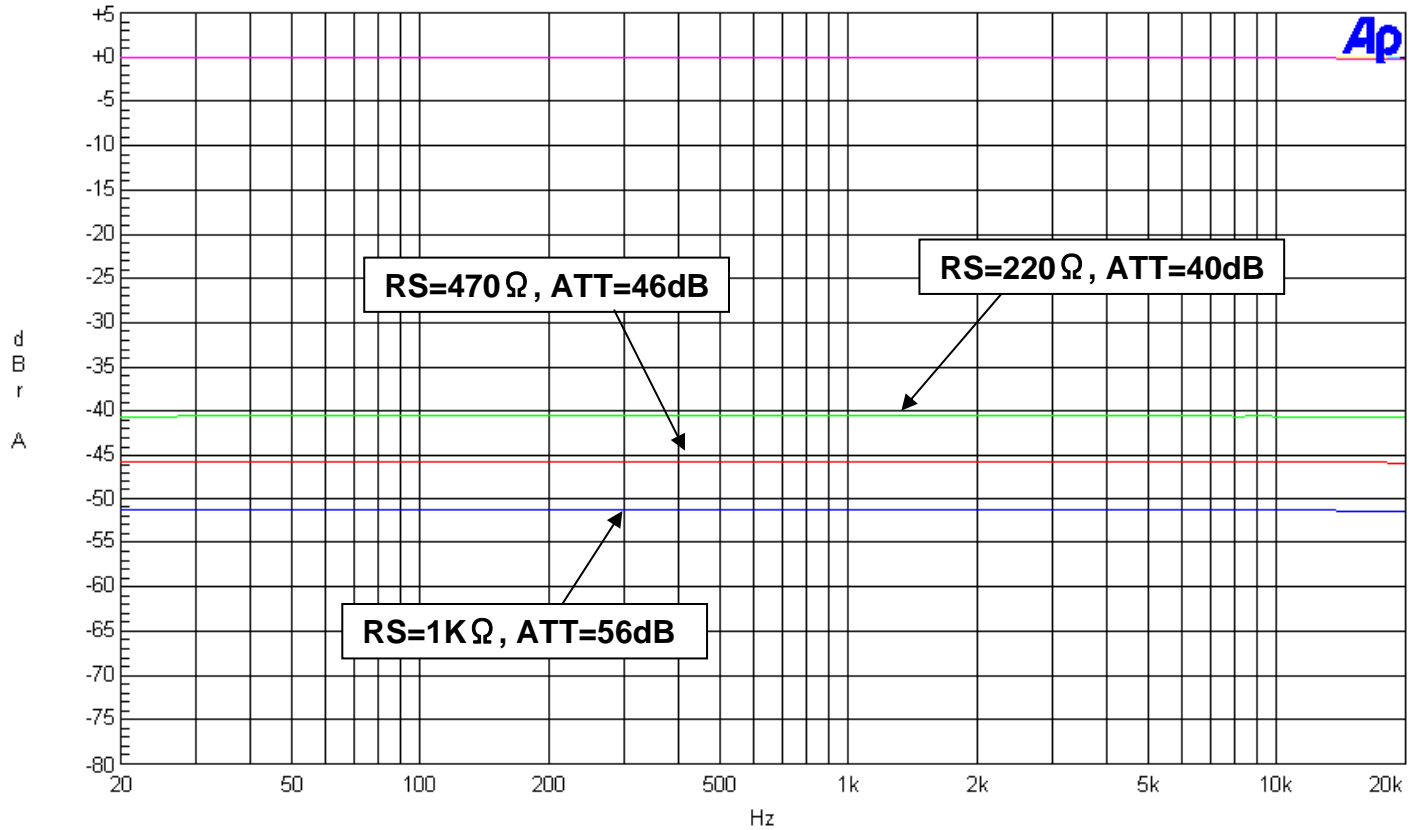
Audio Precision



- * $R1=150K$ ($I_b=0.1mA$, $R_{on}=4.5\Omega$), $R2=10K$
- * $R_S= 220, 470, 1K$
- * Flat frequency response

4. Mute Level by Mute Circuit-2 ($I_b=1mA$)

Audio Precision



- * $R1=15K$ ($I_b=1mA$, $R_{on}=4.5\ \Omega$), $R2=10K$
- * $RS= 220, 470, 1K$
- * Flat frequency response

5. Summary

- **Analog Mute circuit is very effective solution to remove any click/pop noise on D/A system.**
- * **Bias of mute circuit is difference by power supply of analog section as single power supply or bipolar power supply.**
- * **R-ON (On-Resistor) of mute transistor is key factor for mute attenuation level, 2SC2878 is one of recommended transistor for mute circuit.**
- * **R-ON performance is given by base current design, at least 1mA base current is recommended.**
- **Series resistor RS value is depends on acceptable output impedance of application. 470-ohm to 1K-ohm is recommended as high attenuation factor.**
- * **Mute control timing should be considered for any transient status operation.**