Removing "Pop" Noise in TAS570X Power-Up

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INTRODUCTION

This Application Report describes the causes of the "pop" noise during the power-up sequence of TAS570X devices, and a circuit that can be applied to eliminate the noise. The TAS570X devices covered in this report are the TAS5704, TAS5705, TAS5706, TAS5707, TAS5708, TAS5709, TAS5710, and TAS5716. Devices after the TAS5710, except for the TAS5716, do not experience the "pop" noise during power-up.

DISCUSSION

Cause of "Pop" Noise

Two known issues with TAS570X devices can cause the "pop" noise. In both cases, the "pop" noise results from glitches on the VALID signal. The VALID signal which comes from the PWM modulator die holds the power stage in reset upon power up.

The "pop" noise in a TAS570X device can occur when PVDD is applied to the device before the 3.3V line has reached its specified value. The root cause is a leakage current problem with the 3.3V output drivers. The output drivers require a 1.8V and a 3.3V supply to operate. The 1.8V supply comes from the pin VR_ANA, and the 3.3V supply comes from AVDD. If the VR_ANA supply is not present, but the AVDD supply is present and ramping up to 3.3V, leakage currents charge up the internal nodes of the driver, starting the driver and driving AVDD to the output pad. During this time the state of VALID signal is unstable and can turn on the power stage briefly causing the "pop".

The "pop" noise can also occur because of a bug in the digital reset logic. The VALID line to the output stage glitches when RESETZ=1 during power up. The recommended use model for TAS570X devices offers a solution. It states that holding the RESETZ line low for at least 100us after AVDD/DVDD reach the UVLO 3V level will solve the problem.

The circuit described in this document remedies the first cause of the "pop" noise.

Description of De-"pop" Circuit

The first cause for the "pop" noise is current leakage while the VR_ANA supply is absent. The circuit described in this section offers a way to keep the VR_ANA supply present while AVDD ramps to its operating value.

The de-"pop" circuit shown in Figure 1 is a voltage divider for AVDD. The resistor R1 is placed between AVDD and VR_ANA, and the resistor R2 is placed between VR_ANA and AVSS. The voltage between VR_ANA and AVSS across R2 should be 1.5V when AVDD reaches 3.3V. This is found by voltage division. When AVDD is at 3.3V, the voltage at the VR_ANA node needs to be

$$\frac{R_2}{R_1 + R_2} \cdot 3.3V = \frac{1.5\text{k}\Omega}{1.8\text{k}\Omega + 1.5\text{k}\Omega} \cdot 3.3V = 1.5V\ .$$

This voltage across R2 acts as a bias voltage for the pin VR_ANA as AVDD ramps up to 3.3V.

The capacitor in the circuit from VR_ANA to AVSS filters out 3.3V supply noise.

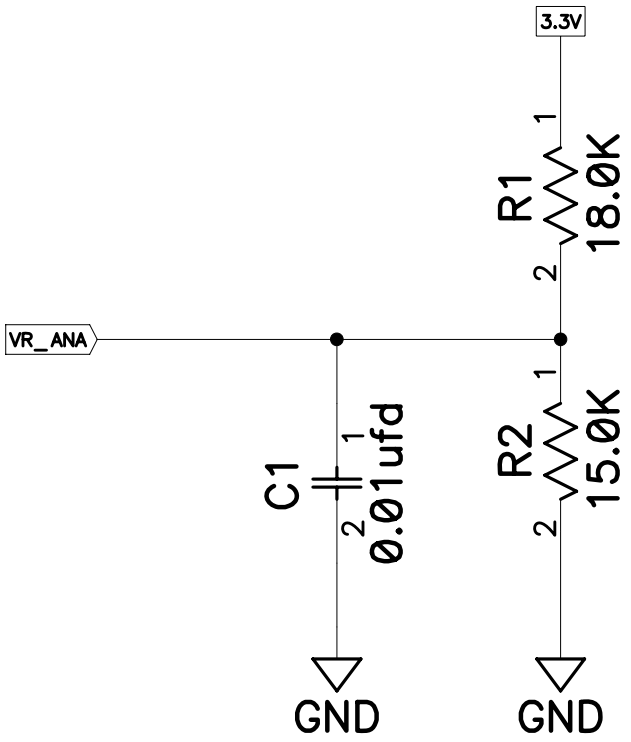

Figure 1: De-"pop" Circuit

Effects of De-“pop” Circuit

Application of the De-“pop” circuit to a TAS570X system eliminates the power-on “pop” noise. The VR_ANA supply will ramp at approximately the same rate as the AVDD supply, because the two supplies come from the same source. A voltage on VR_ANA will be present while AVDD is ramping, but still below 3V. This means that even though the voltage regulator for VR_ANA is off for AVDD less than 3V, the biased voltage on VR_ANA will prevent current leakage to the output drivers. Since the circuit prevents the current leakage to the output drivers, the circuit prevents the “pop” noise.

CONCLUSION

This report has explained the cause for the “pop” noise in TAS570X devices during power-up. It described a circuit that can be appended to the TAS570X device to eliminate the “pop” noise. The report then explained how application of the de-“pop” circuit eliminates the “pop” noise. The de-“pop” circuit solution solves the supply voltage root cause for the “pop” noise. Systems using the TAS570X products should still follow the recommended use model of holding RESETZ low for 100us after AVDD has reached 3V. TAS5711 and later TAS57XX devices do not have this issue.