*Application Note*

# *TAS2120 and TAS2320 Shared Boost Feature and Configuration*

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**ABSTRACT**

This document provides an overview of the Shared Boost feature, including the device configuration, performance results, and a reference shared boost system. The document also includes recommendations for stereo and woofer-tweeter implementations, as well as a reference schematic and PCB layout.

Key points mentioned in the document include:

- The TAS2120 has an integrated boost that can be used to power the TAS2320.
- The shared boost feature simplifies system implementation and reduces cost.
- The feature is designed for stereo and woofer-tweeter applications, among other multiple speaker applications.

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## Trademarks

# 1 Introduction

TAS2120 features an integrated boost which is normally used for individual operation. However, this boost can be used to power an accompanying TAS2320 while still taking advantage of the efficiency improving Class-H controller; the total 8W of power delivery from TAS2120 integrated boost is divided for both TAS2120 and TAS2320 operation. The boost sharing mechanism allows woofer-tweeter applications to drive the tweeter with higher peak voltage while using most of the continuous power on the woofer, whereas stereo applications benefit from boost power being dynamically used between left and right channel due to the asymmetric nature of music content.

# 2 Feature Description

In the shared boost configuration, TAS2120 works as the *primary* device receiving PWM data on pin 1 (SEL5_CLH) while TAS2320 is the *secondary* device, sending PWM data out of the same pin 1. TAS2120 uses the TAS2120 playback information and combines this with the PWM data received from TAS2320. The combined data is used to control the integrated Class-H boost. This mechanism makes sure that the boost provides the voltage required by either amplifier individually or both of them simultaneously.

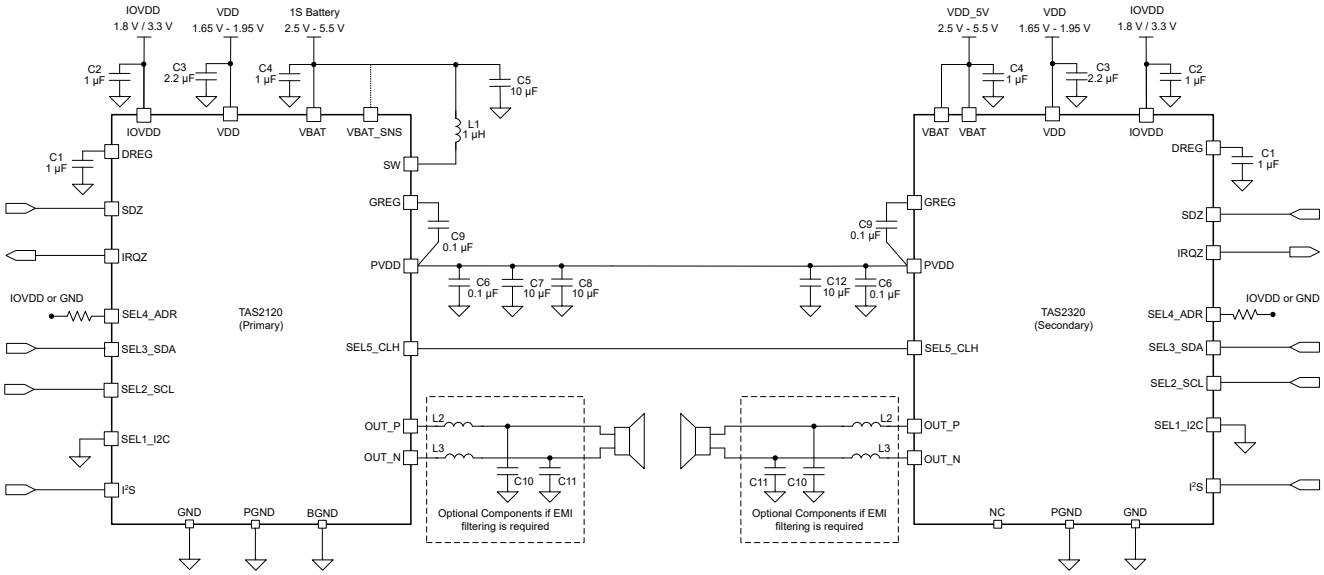


**Figure 2-1. Application Diagram for Boost Share Topology**

To make sure the shared boost feature works as expected, a special clock delay condition must be met between TAS2120 and TAS2320 devices:

- The delay between Rising Edge of SBCLK and Rising Edge of SEL5_CLH must be less than $T_{SBCLK}/2$ (being $T_{SBCLK}$ the period of SBCLK).

The hardware implementation must be designed such that this condition is met. Since TAS2120 and TAS2320 are usually close to each other to connect PVDD between them, this condition is usually met.

## 2.1 EVM Setup for PPC3 Configuration

The shared boost configuration can be tested using TAS2120EVM, TAS2320EVM and the AC-MB controller board provided in either of the EVM kits. With this EVM connection, PPC3 can be used to generate the required command script that is used on the end application for testing and final configuration.

The necessary connections between the boards are described in Figure 2-2.

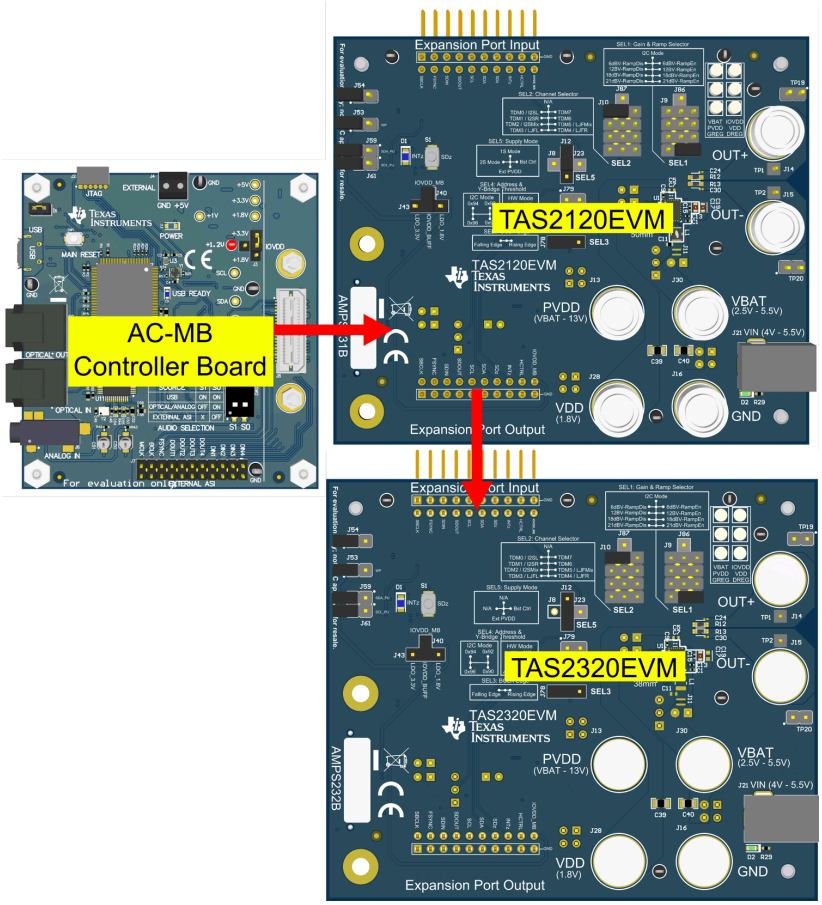


**Figure 2-2. TAS2120 and TAS2320 EVM Setup**

The hardware settings on EVM must be modified as described in Table 2-1.

**Table 2-1. EVM Jumper Configuration for Shared Boost Mode**

| | TAS2120EVM | TAS2320EVM |
|---|---|---|
| J54 (Top) | Open | Short |
| SEL1 (Top) | I2C Mode | I2C Mode |
| SEL2 (Top) | Open | Open |
| SEL3 (Top) | Open / 00 / SDA | Open / 00 / SDA |
| SEL4 (Top) | 0x90 / 0001 | 0x92 / 0010 |
| SEL5 (Top) | Bst Ctrl / 0001 | Bst Ctrl / 0001 |
| PVDD (J13) (Top) | Connect to PVDD on TAS2320EVM | Connect to PVDD on TAS2120EVM |
| VBAT (J30) (Top) | Connect to VBAT on TAS2320EVM | Connect to VBAT on TAS2120EVM |
| External Boost Jumpers (Bottom) J1, J17, J24, J20 | Open | Open |

## 2.2 Device Configuration

PPC3 software has all the required controls to enable the shared boost feature. TAS2120EVM must be connected to a TAS2320EVM so that PPC3 detects the hardware combination.

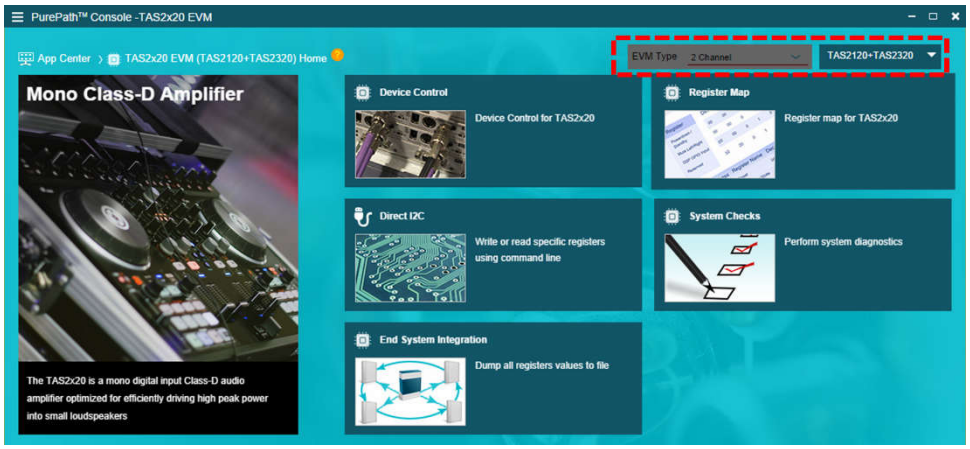


**Figure 2-3. TAS2120+TAS2320 PPC3 Mode**

### *2.2.1 Stereo Implementation Recommendations*

Given that the total 8W of power from TAS2120 boost is shared across TAS2120 and TAS2320, the analog gain of both amplifiers must be reduced such that the total output power is not overloading the boost. For example, when using 8Ω load on both amplifiers, the analog gain (AMP_LVL on register 0x07 at page 0) needs to be set to 15dBV or lower. Similarly, for 4Ω loads the analog gain need to be set to 12dBV or lower.

The gain allocation explained above is considering the worst case where both channels are playing the same signal at full volume, which is not very common for most audio content being music or dialog tracks. This means the gain can be increased in most cases.

For best results, gain needs to be fine-tuned based on the application requirements, speaker sensitivity and intended playback content.

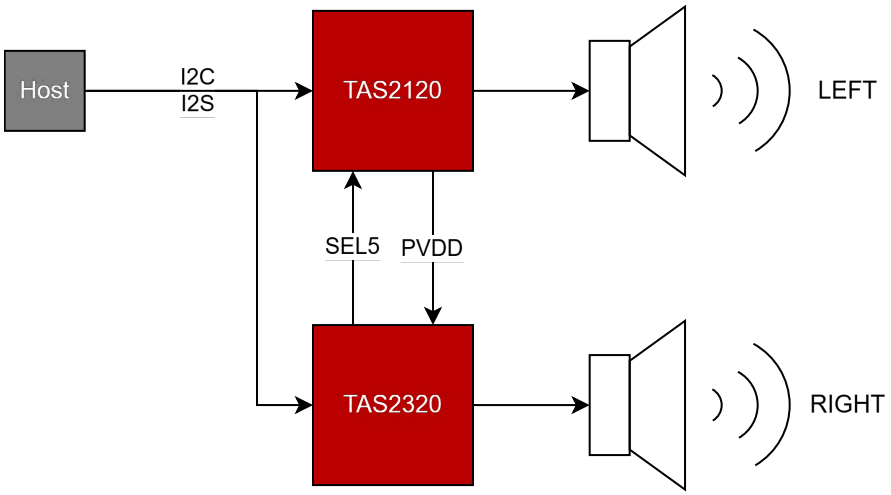


**Figure 2-4. Stereo Application**

### 2.2.2 Woofer-Tweeter Implementation Recommendations

On a Woofer-Tweeter application the power and frequency content can be differentiated between TAS2120 and TAS2320.

For example, TAS2120 is used to drive the Tweeter, using PPC3 the digital high-pass filter can be set to 1kHz and the gain to the maximum 21dBV. TAS2320 is used to drive the Woofer, the high-pass filter can be set to default 2Hz and the gain is also set to maximum 21dBV.

The gain for each amplifier can be fine tuned based on the sensitivity of each speaker.

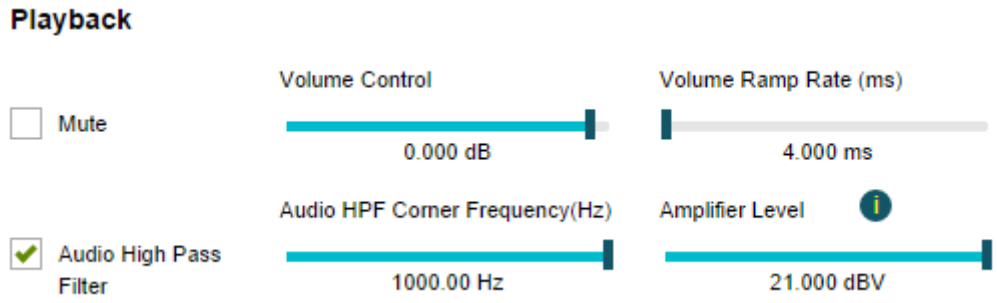


**Figure 2-5. HPF Configuration TAS2120**

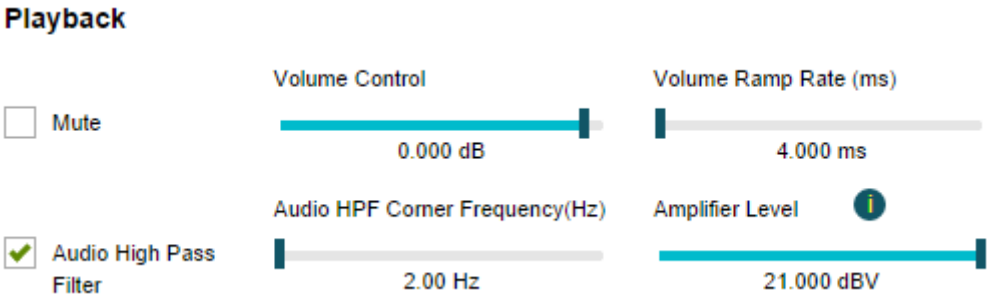


**Figure 2-6. HPF Configuration TAS2320**

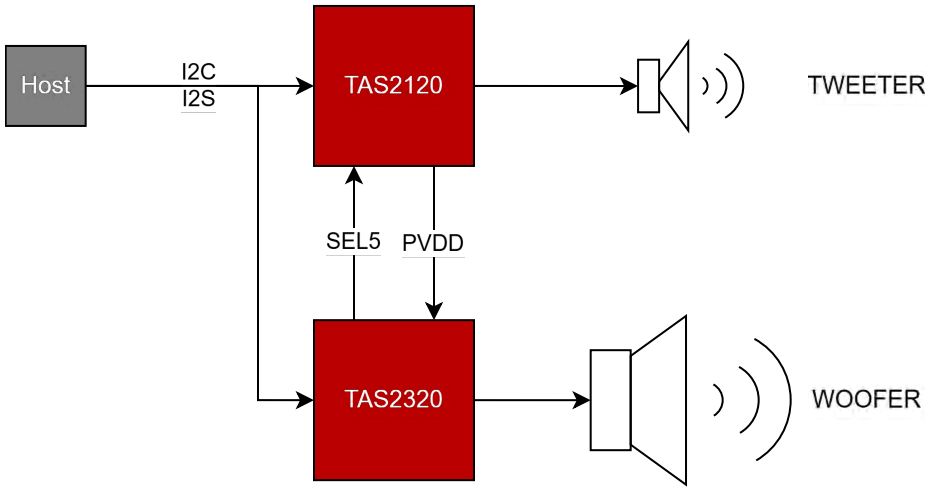


**Figure 2-7. Woofer-Tweeter Application**

# 3 Performance Results

A reference shared boost system was configured for an analog gain of 18dBV on both TAS2120 and TAS2320. The schematic and PCB design information for this hardware implementation is available in Reference Shared Boost System.

Figure 3-1 shows the distortion and output power performance obtained using this setup. This shows that when only one of the amplifiers is driving the speaker, the undistorted output is higher, whereas driving both speakers equally at the same time can split the total power for each channel.

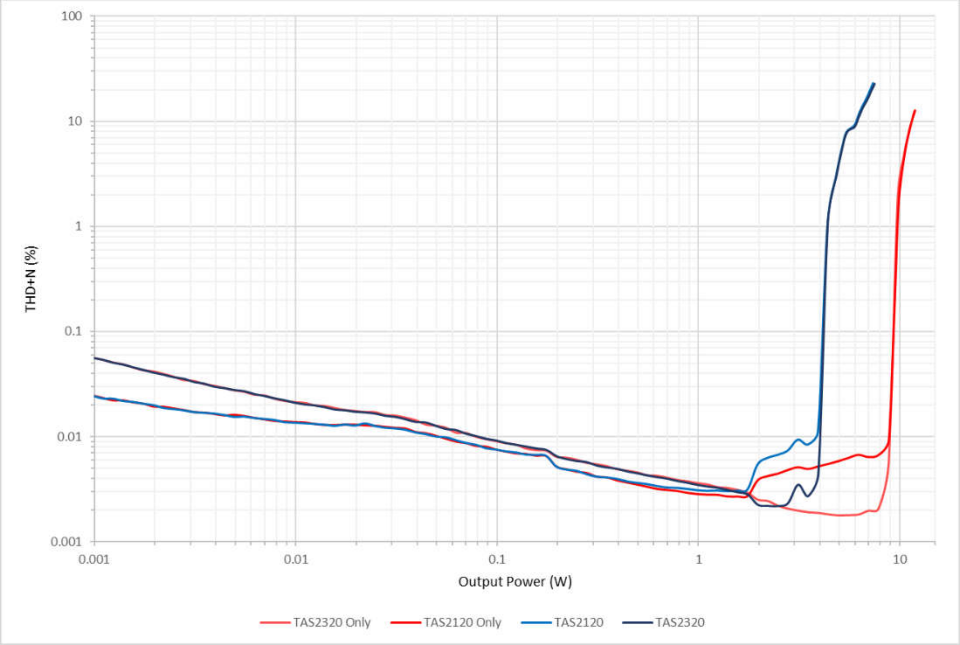


**Figure 3-1. THD+N vs Pout Shared Boost Performance (4Ω)**

# 4 Reference Shared Boost System

This section provides a reference design for a shared boost application. The performance curves included in Section 3 were tested on this reference evaluation platform.

This reference platform is powered from a >45W USB-C adapter. The TPS25730 resistors for ADCINx can be adjusted for different power setups.

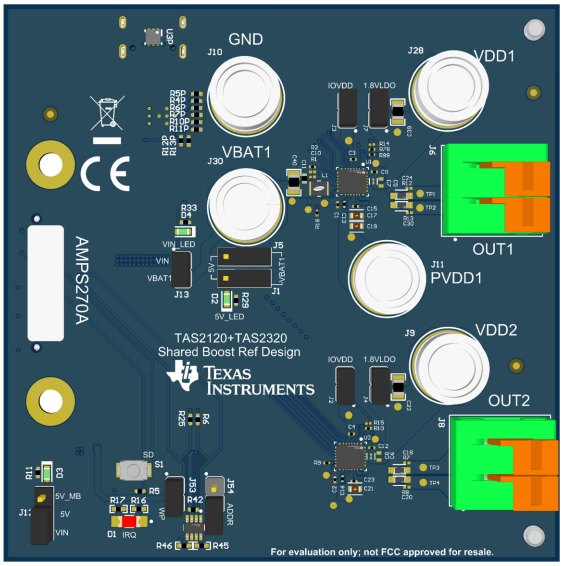


**Figure 4-1. Reference Shared Boost Platform Top View**

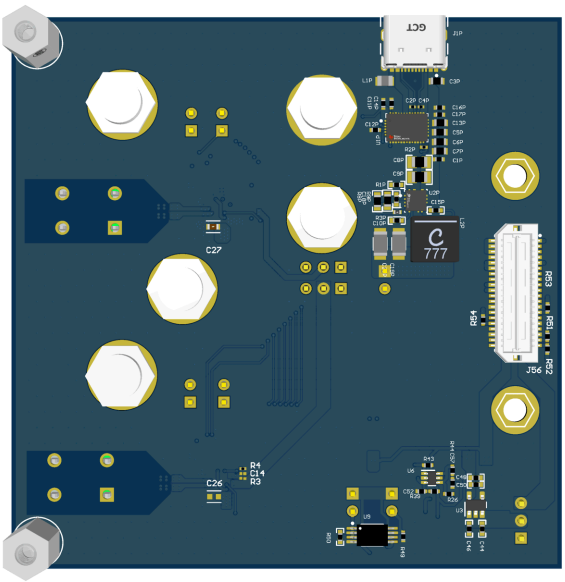

**Figure 4-2. Reference Shared Boost Platform Bottom View**

## 4.1 Reference Schematic

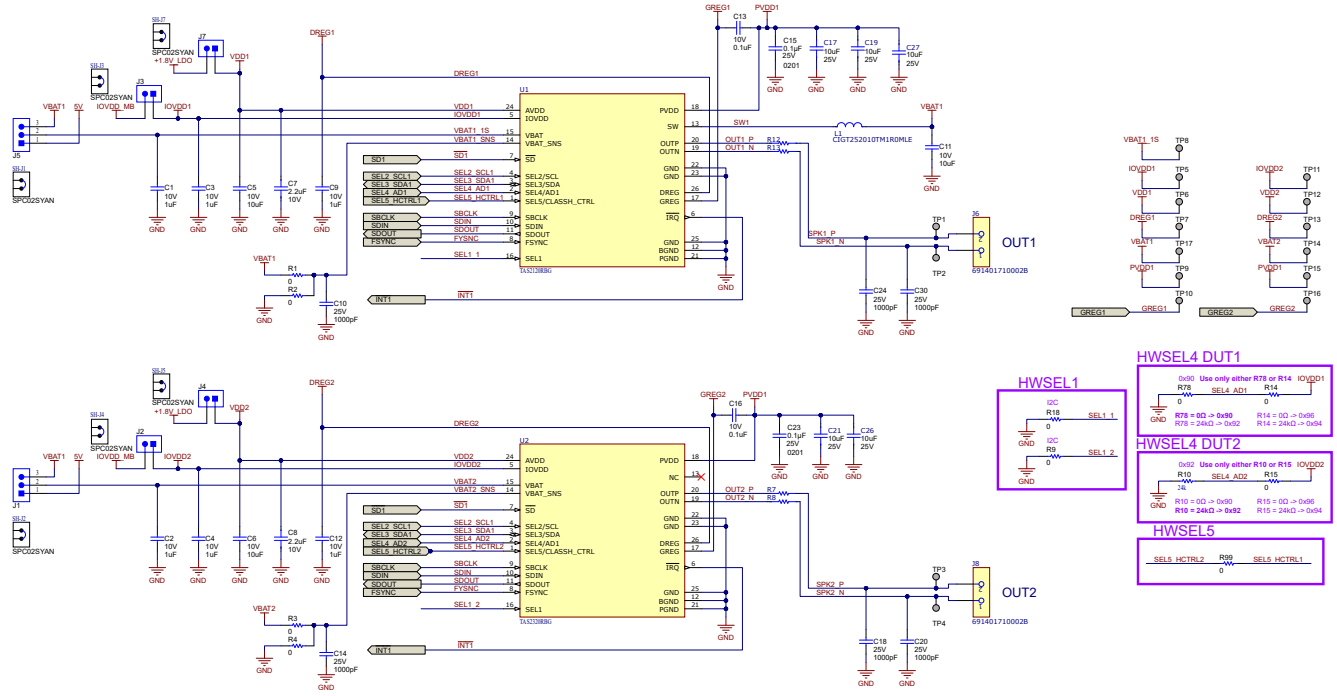


**Figure 4-3. TAS2120 and TAS2320 Schematic**

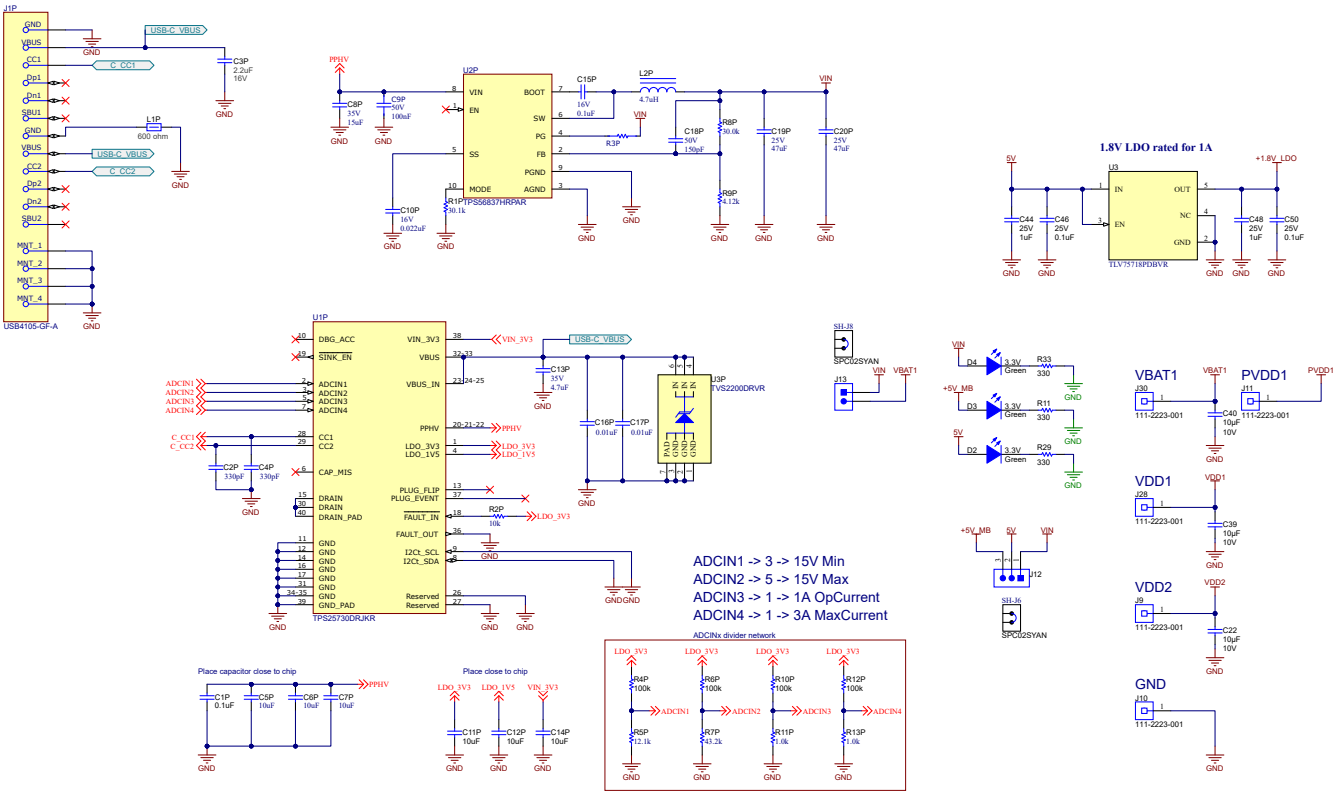


**Figure 4-4. Power Supply Schematic**

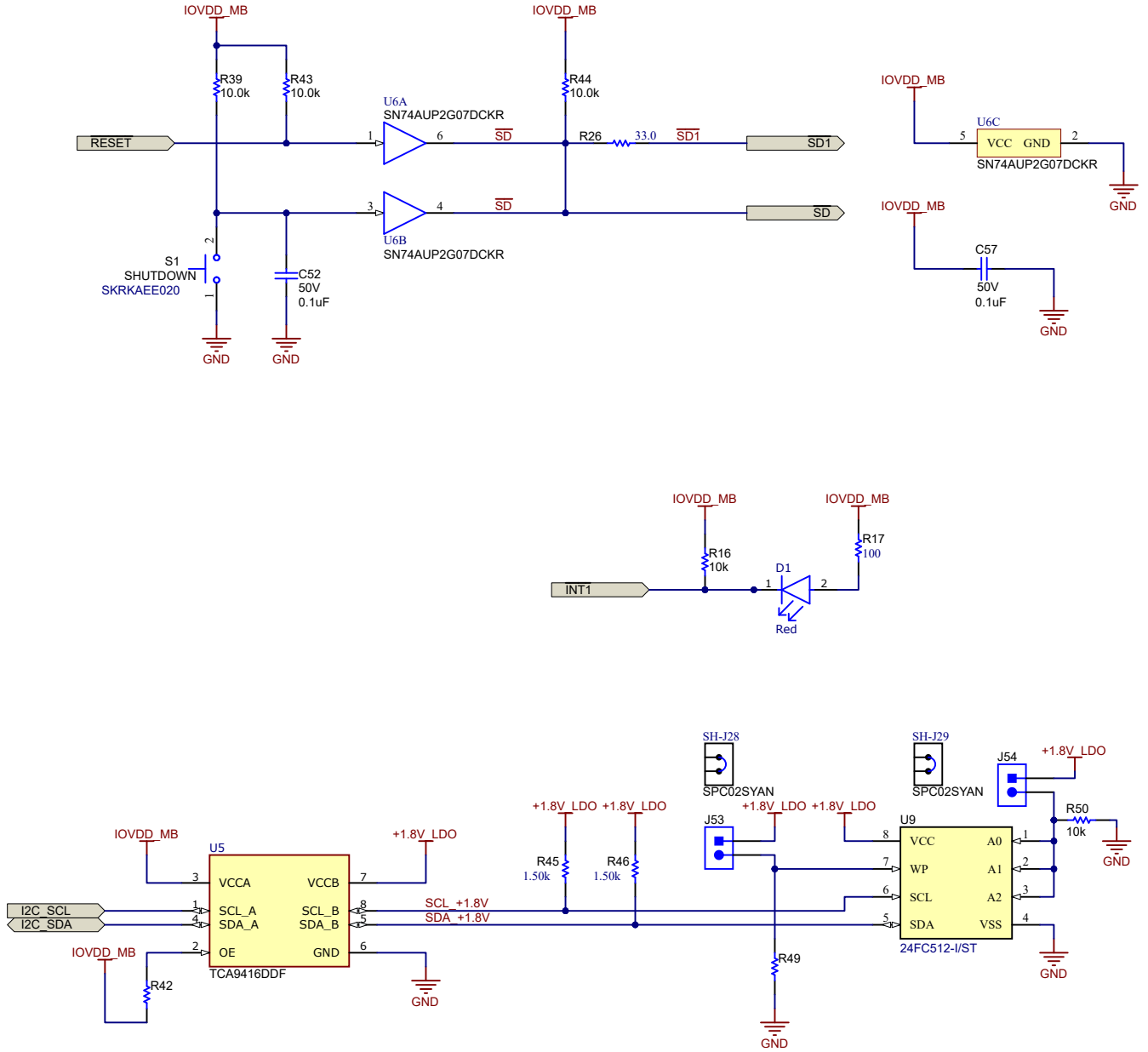


**Figure 4-5. IRQ, SD and EEPROM Schematic**

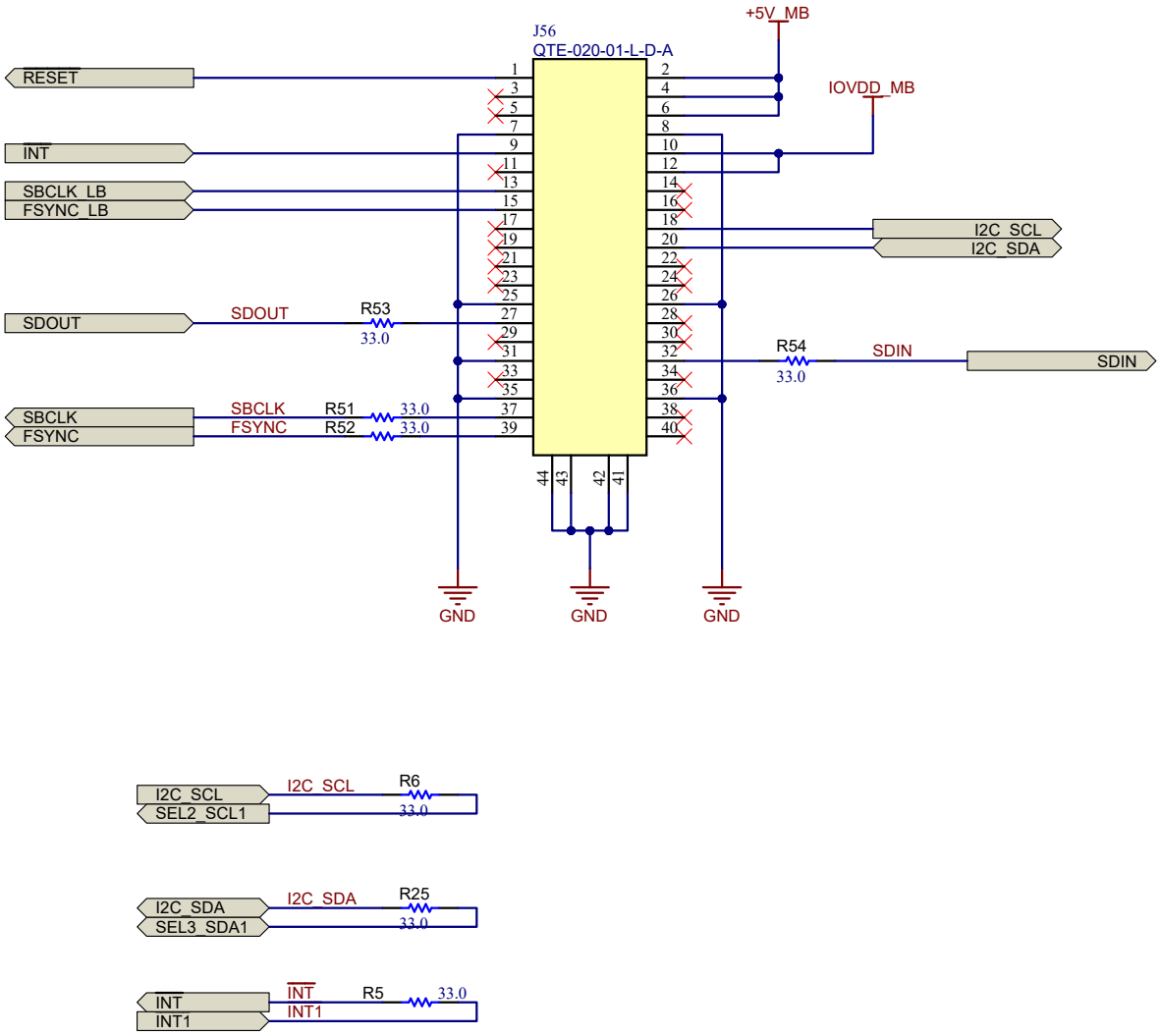


**Figure 4-6. IO Connector Schematic**

## 4.2 Reference PCB Layout

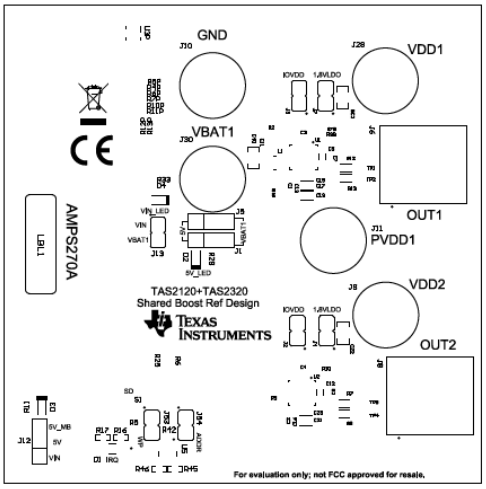


Figure 4-7. Top Overlay

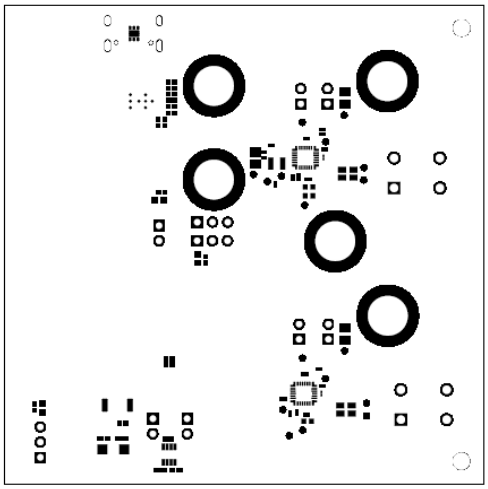

Figure 4-8. Top Solder Mask

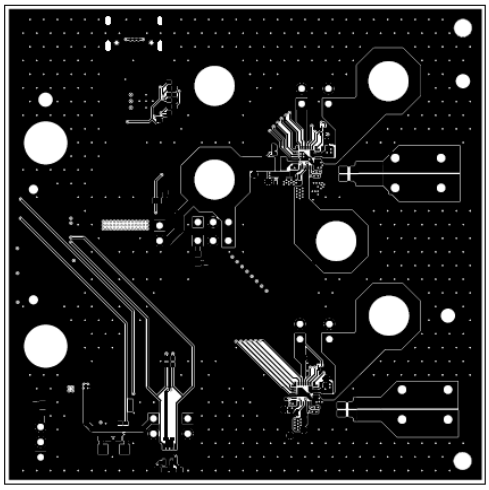

Figure 4-9. Layer 1

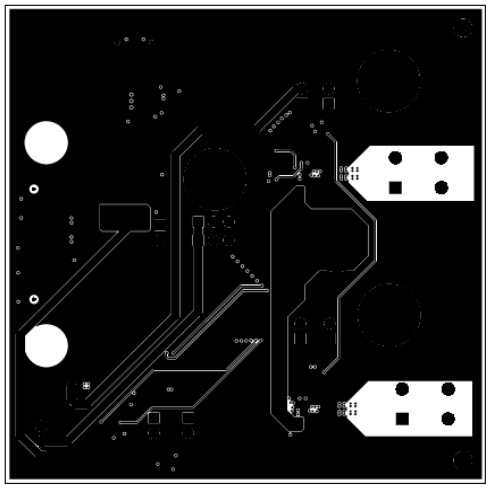

Figure 4-10. Layer 2

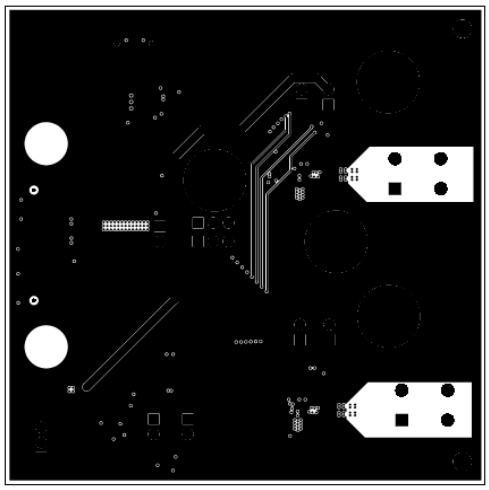

Figure 4-11. Layer 3

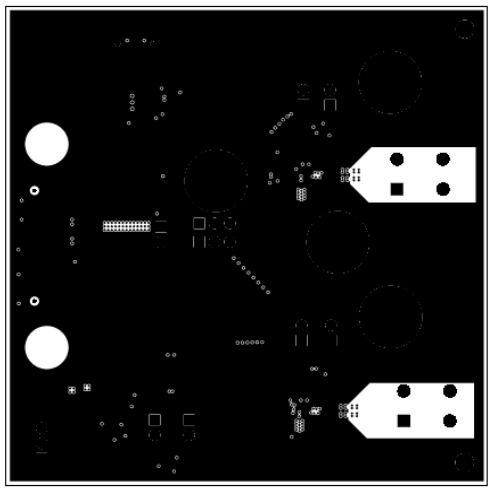

Figure 4-12. Layer 4

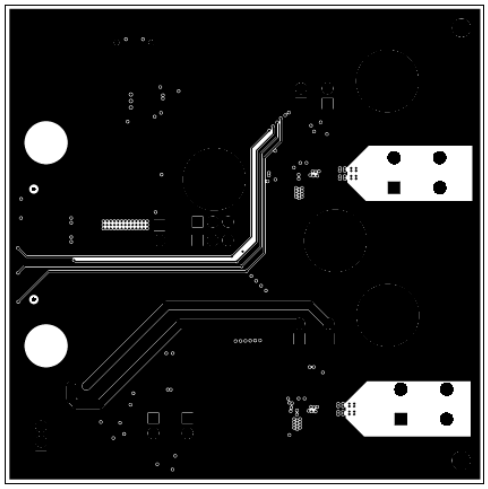

Figure 4-13. Layer 5

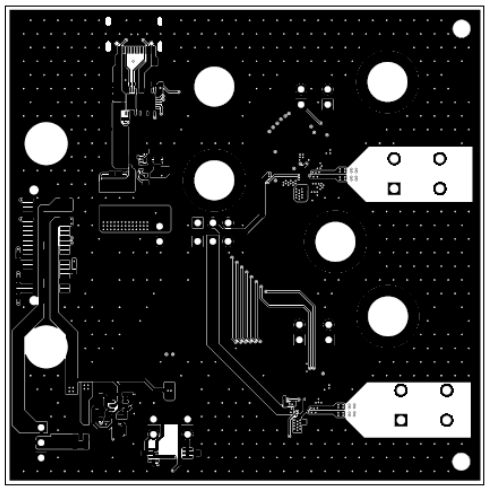

Figure 4-14. Layer 6

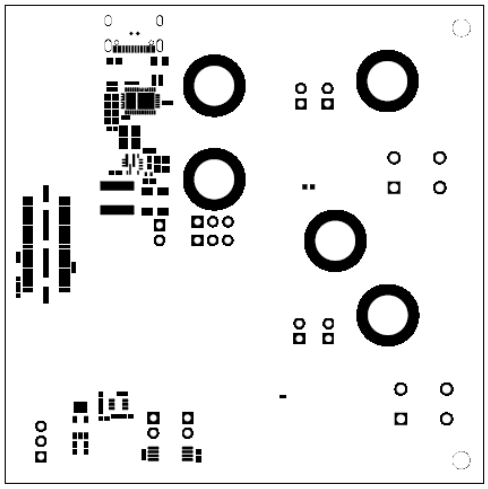

Figure 4-15. Bottom Solder Mask

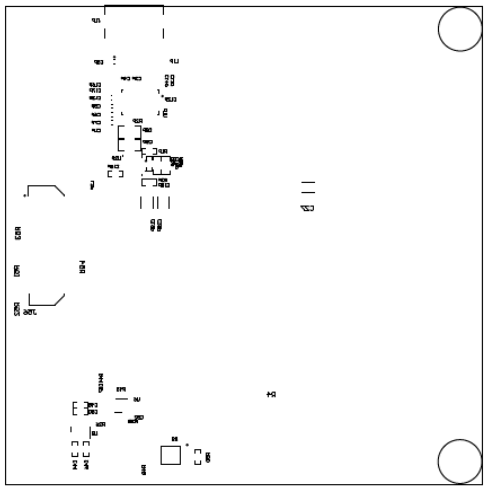

Figure 4-16. Bottom Overlay

## 5 Summary

The flexible configuration of TAS2120 makes it possible to supply a companion TAS2320 using the integrated boost in TAS2120. This greatly simplifies the system implementation for stereo or woofer-tweeter applications, reducing the BOM, design size and cost.

## 6 References

1. Texas Instruments, *TAS2120 8.2W Mono Digital Input Class-D Speaker Amp with Integrated 14.75V Class-H Boost*, data sheet.
2. Texas Instruments, *TAS2320 15W Mono Digital Input Class-D Speaker Amp with 15V Support*, data sheet.

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