AN3385
Application note

50 W + 50 W dual BTL class-D audio amplifier demonstration board based on the TDA7492

Introduction

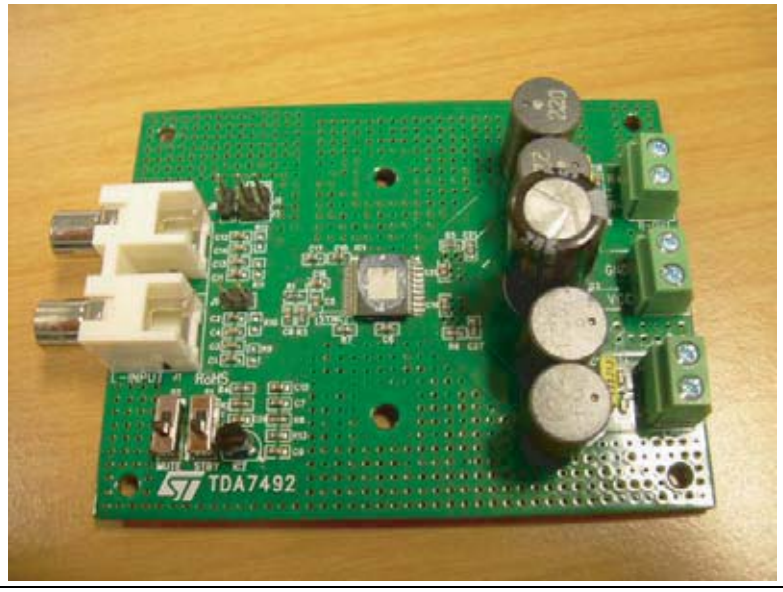
This application note describes the STEVAL-CCA027V1 demonstration board designed for the evaluation of the TDA7492 high-power dual BTL class-D audio amplifier and provides the board specifications and a quick-start list for standalone operation.

Due to the device's high efficiency, the TDA7492, housed in the PSSO-36 package, is capable of dissipating heat with the use of a relatively small heatsink. Jumpers on the board allow the configuration of the amplifier in order to verify the input signal as single-ended or differential and choose the fixed gain settings. Microswitches are also provided to enable the standby and mute functions.

The main features of the TDA7492 include:

- 50 W + 50 W continuous output power at THD = 10%, R_L= 6 Ω, V_{CC} = 25 V
- 40 W + 40 W continuous output power at THD = 10%, R_L = 8 Ω, V_{CC} = 25 V
- Wide-range, single-supply operation (8 V - 26 V)
- High efficiency (η = 90 %)
- Four selectable, fixed gain settings (21.6 dB, 27.6 dB, 31.1 dB and 33.6 dB)
- Differential inputs to minimize common-mode noise
- Standby and mute features
- Short-circuit and thermal overload protections
- Externally synchronizable

Figure 1. STEVAL-CCA027V1 demonstration board



Contents

1 Operation

The TDA7492 demonstration board specifications are as follows:

- Power supply voltage range: 8 V to 26 V
- Number of channels: 2 BTL (Bridge-Tied Load) stereo
- Load impedance: 6 Ω to 8 Ω
- Gain settings: 21.6 dB, 27.6 dB, 31.1 dB, 33.6 dB
- Undervoltage protection (UVP): 8 V
- Overvoltage protection (OVP): 30 V

1.1 Power supply

A single power supply is required to feed the TDA7492 demonstration board via the connector J2 (see layout components in *Figure 2*).

Connect positive voltage of 25 V/ 5 A DC power supply to $+V_{CC}$ pin and negative to GND.

Note: Voltage range 8 V to 26 V = 5 A current capability

1.2 Demonstration board preparation

1. Ensure that the power supply is switched OFF.
2. Connect the regulated power supply adjusted in the device operating range to the connector J2 (observe the polarity).

1.3 Inputs and outputs

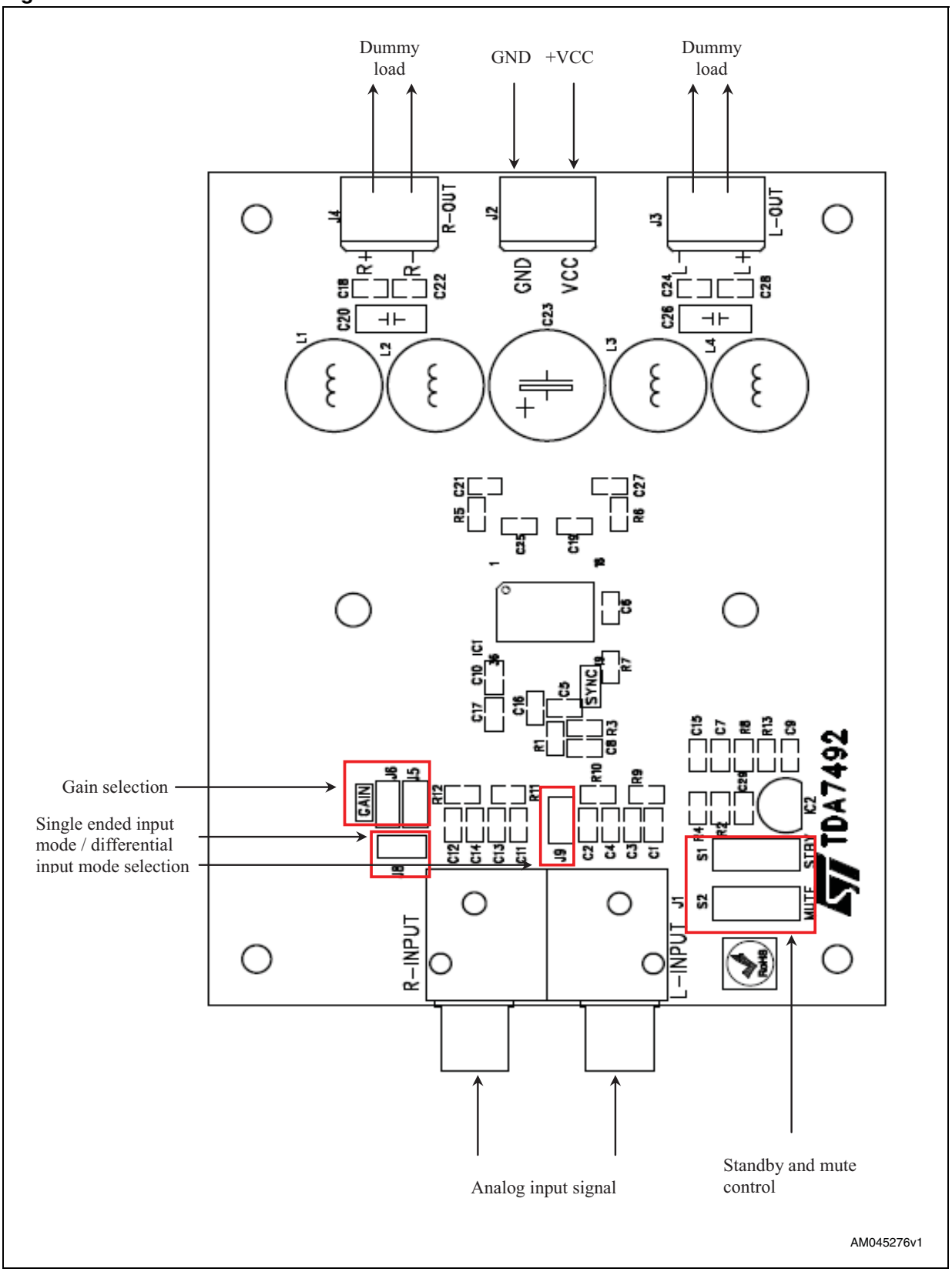
1. Connect the loads across the connectors J3 (LEFT) and J4 (RIGHT), the specified impedance ranges from 6 Ω to 8 Ω.
2. Connect the analog audio inputs, either differential or single-ended, to the L-Input and R-Input RCA plugs (J1).

Table 1. Audio inputs

Input configuration	Jumper J8 (right)	Junper J9 (left)
Differential	Open	Open
Single-ended	Closed	Closed

Refer to *Figure 2: Demonstration board connections on page 4*.

Figure 2. Demonstration board connections



1.4 Powering up

Before powering up the demonstration board, ensure that the TDA7492 is in standby and mute conditions and the gain is set to the desired value (default 21.6 dB) and verify the dedicated switches and jumpers.

Table 2. Standby and mute settings

STBY (S1)	Mute (S2)	Status
L	L	STBY
L	H	STBY
H	L	MUTE
H	H	PLAY

Figure 3. Standby and mute control

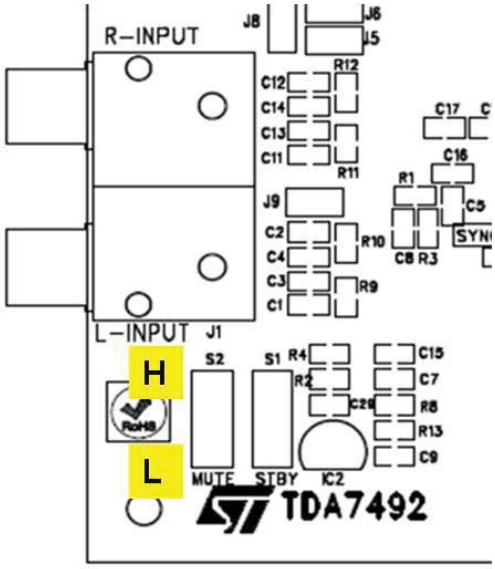


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Table 3. Gain settings

Gain 0 (J5)	Gain 1 (J6)	Gain (dB)
Open (L)	Open (L)	21.6
Open (L)	Closed (H)	27.6
Closed (H)	Open (L)	31.1
Closed (H)	Closed (H)	33.6

2 Board schematic and bill of material

Figure 4 shows the TDA7492 demonstration board schematic diagram, for the complete bill of material refer to *Table 4*.

Figure 4. Schematic diagram

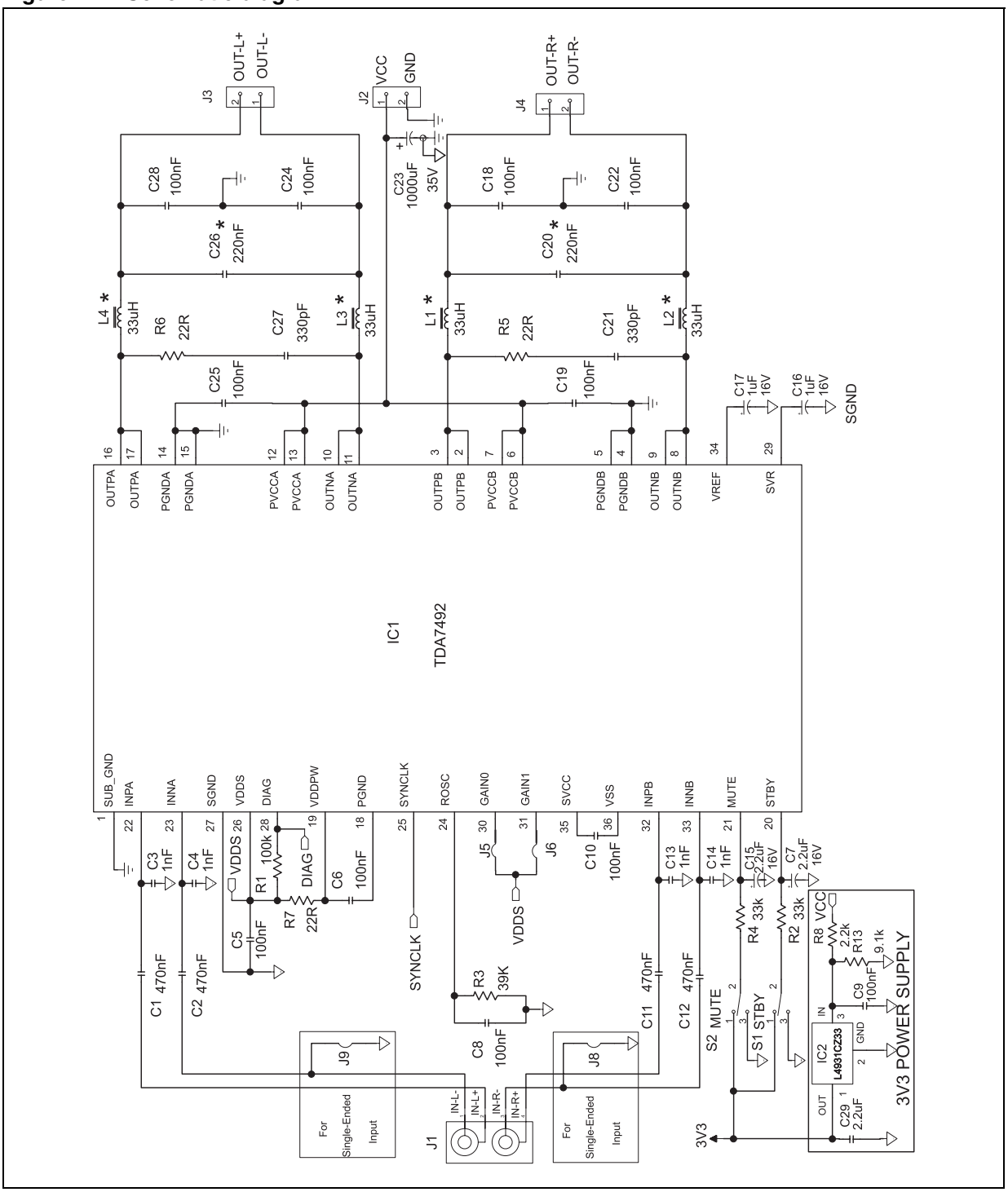


Table 4. Bill of material

Reference	Type	Footprint	Description	Qty	Manufacturer
C21, C27	CCAP	CAP0603	330 pF 50 V NPO ±5%	2	Murata
C3, C4, C13, C14	CCAP	CAP0603	1 nF 50 V ±10%	4	Murata
C5, C6, C8, C9, C10, C18, C19, C22, C24, C25, C28	CCAP	CAP0603	100 nF 50 V ±10%	11	Murata
C1, C2, C11, C12	CCAP	CAP0603	470 nF 50 V ±10%	4	Murata
C7, C15, C29	CCAP	CAP0603	2.2 µF, 16 V, ±10%	3	Murata
C16, C17	CCAP	CAP0603	1 µF, 16 V, ±10%	2	Murata
C23	ECAP	D < 12.0 mm	1000 µF, 35 V, ±10% , pitch = 5.0 mm	1	Rubycon
C20, C26	CAP	Mylar	220 nF, pitch = 5 mm	2	Murata
R5, R6, R7	RES	R0603	22 ohm, ±10%, 1/16W	3	Murata
R8	RES	R0603	2.2k ohm, ±10%, 1/16W	1	Murata
R13	RES	R0603	9.1k ohm, ±10%, 1/16W	1	Murata
R2, R4	RES	R0603	33k ohm, ±10%, 1/16W	2	Murata
R3	RES	R0603	39k ohm, ±10%, 1/16W	1	Murata
R1	RES	R0603	100k ohm, ±10%, 1/16W	1	Murata
IC1	IC	TDA7492	TDA7492 (SSO36) slug up	1	ST
L1, L2, L3, L4	Coil	Inductor	33 µH, type: 7075P-330M	4	Kwangsung
J1	Connector	RCA-2P	RCA socket 2P x 2, type: AV2-8.4-12	1	Songcheng
IC2	Regulator	TO92	L4931CZ33, 3V3 regulator	1	ST
	PCB	90 x 70 mm	TDA7492-UP PCB	1	ST
J2, J3, J4	Terminal	CNN-Terminal	2P, pitch = 5 mm connector terminal	3	Any source
J5, J6, J8, J9	Jumper	2-way jumper	2P, pitch = 2.5 mm jumper	4	Any source
S1, S2	Switch	Slide	3P, pitch = 2.5 mm	2	Any source

3 PCB layout

3.1 Layout views

Figure 5. Top view of PCB layout

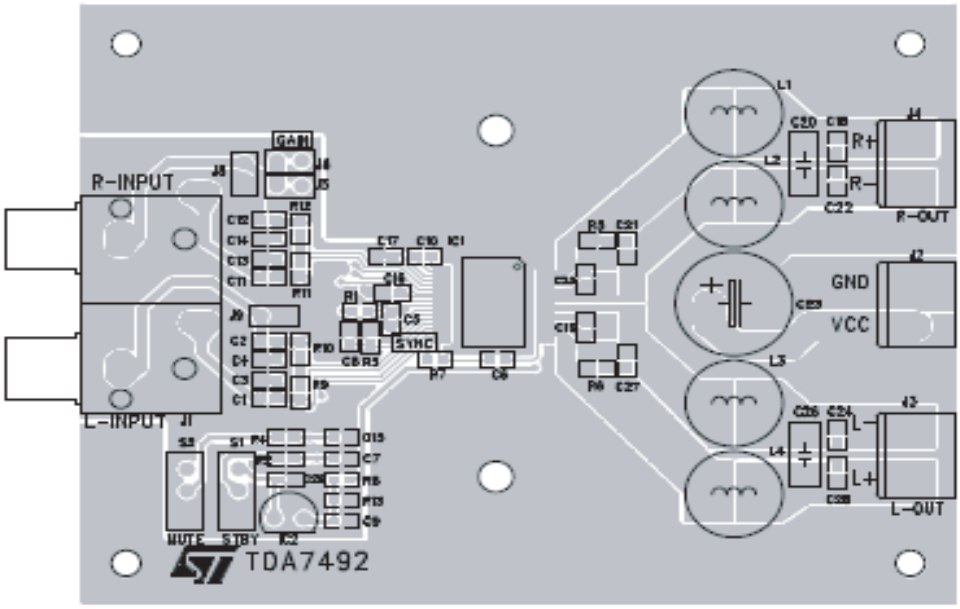
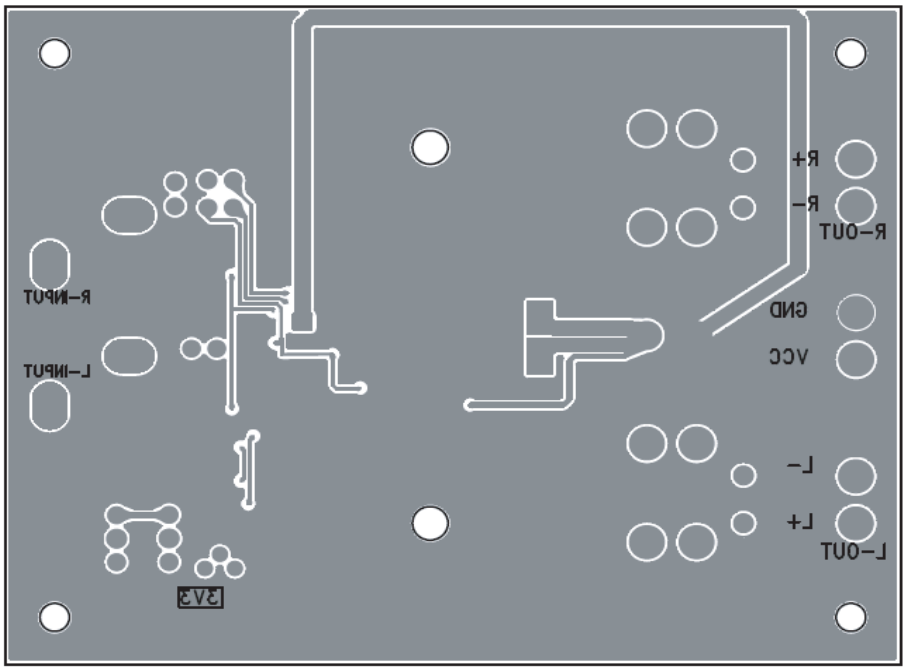


Figure 6. Bottom view of PCB layout

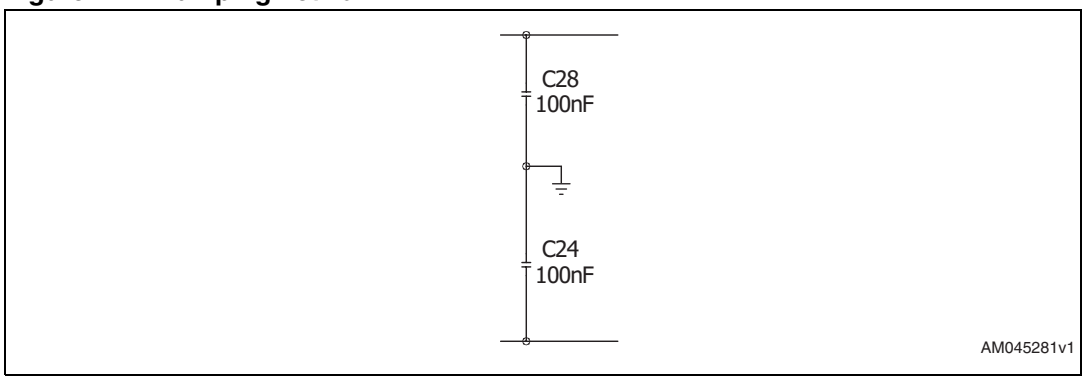


3.2 Design guidelines for PCB schematic and layout

3.2.1 Dumping network

The capacitor is mainly intended for high inductive loads and for common-mode noise attenuation.

Figure 7. Dumping network



3.2.2 Main filter

The main filter is an LC Butterworth based filter. The cutoff frequency must be chosen between the upper limit of the audio band (~20 kHz) and the carrier frequency (310 kHz).

Figure 8. Main filter

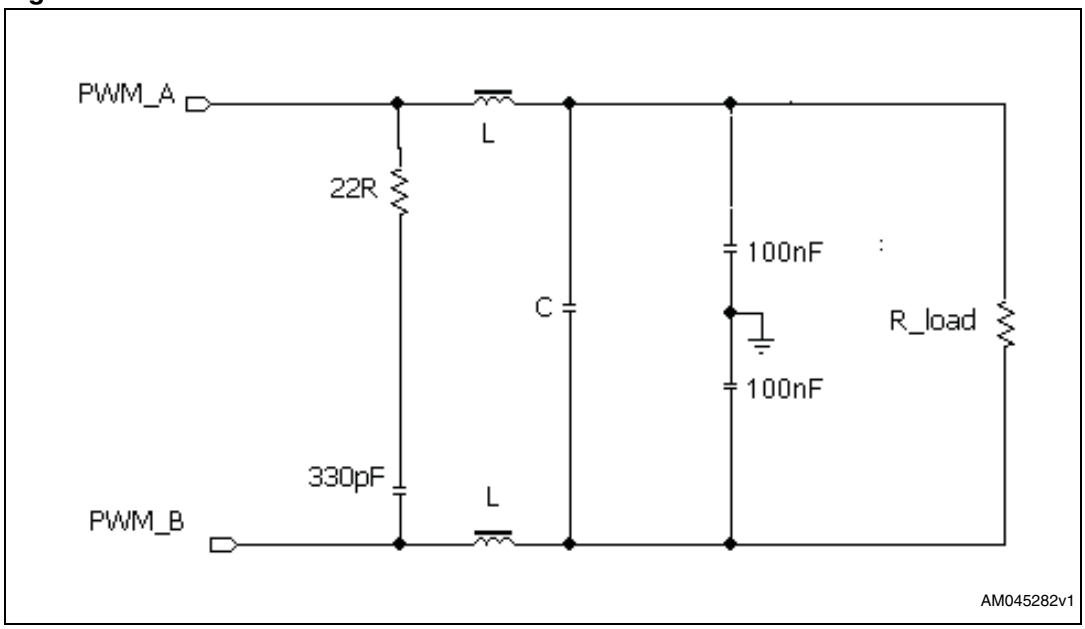


Table 5. Recommended values

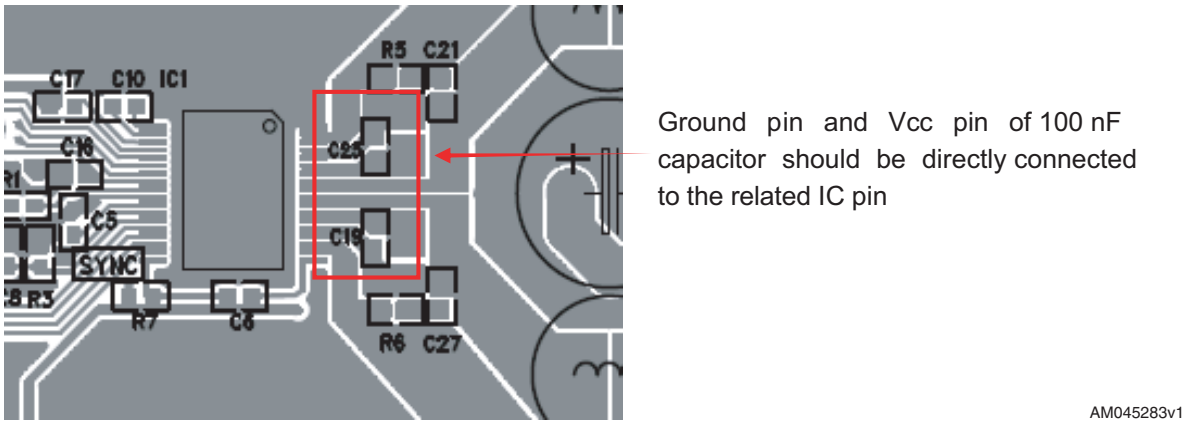
R_{LOAD}	8 Ω	6 Ω
L_{LOAD}	33 µH	22 µH
C_{LOAD}	220 nF	220 nF

3.2.3 Layout recommendations

The following figures illustrate layout recommendations.

Solder the 100 nF bypass capacitors (X7R) as close as possible to the IC V_{CC} pins (recommended distance to be within 3 mm) in order to avoid spikes generated by the stray inductance caused by the copper supply lines.

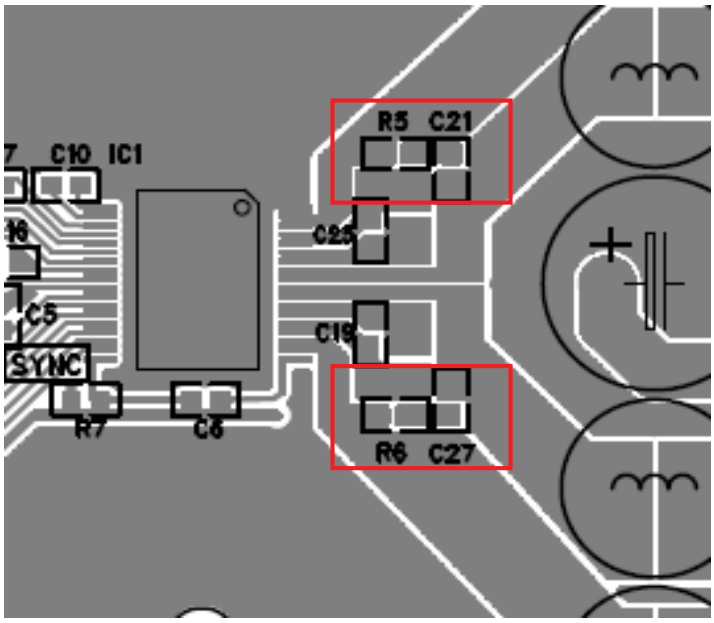
Figure 9. Capacitors soldered as close as possible to V_{CC} pins



Solder the snubber networks as close as possible to the IC related pin.

A voltage spike dangerous for device operation could occur if the snubber network is far from the output pins. It is recommended that the distance between the snubber network and output pins be within 5 mm.

Figure 10. Snubber networks soldered as close as possible to relevant IC pin



A "star route" for V_{CC} supply is recommended in order to avoid interferences between different channels when the audio signals in Left and Right are very different in amplitude.

Figure 11. Electrolytic capacitor to separate V_{CC} paths

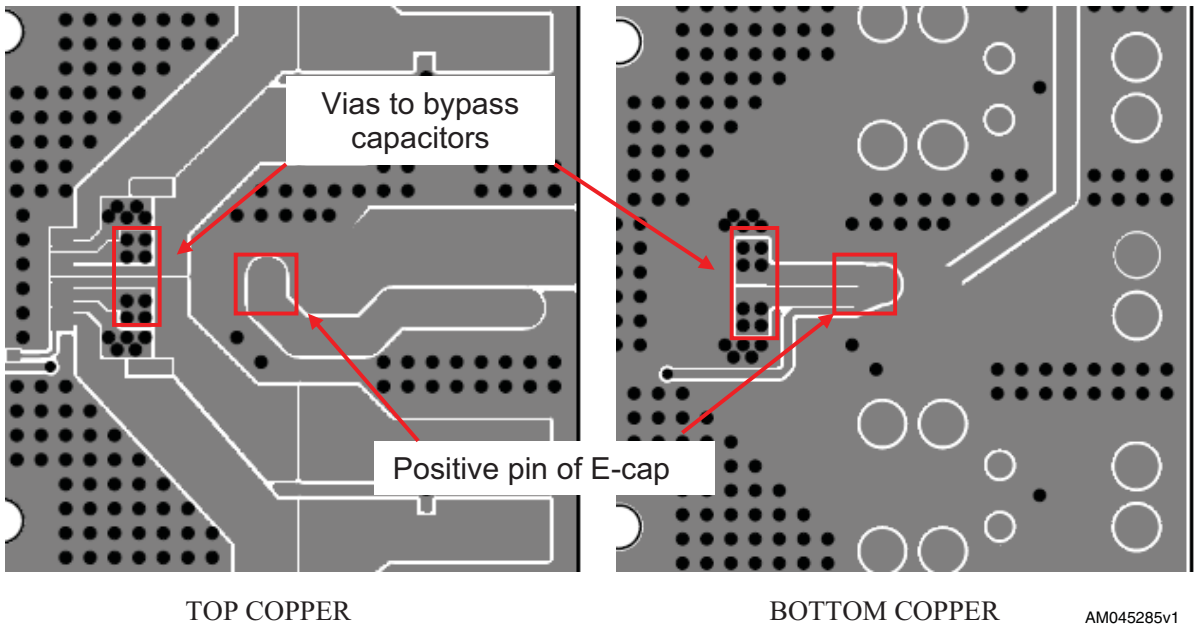


Figure 12. Symmetrical paths created for output stage (for differential applications)

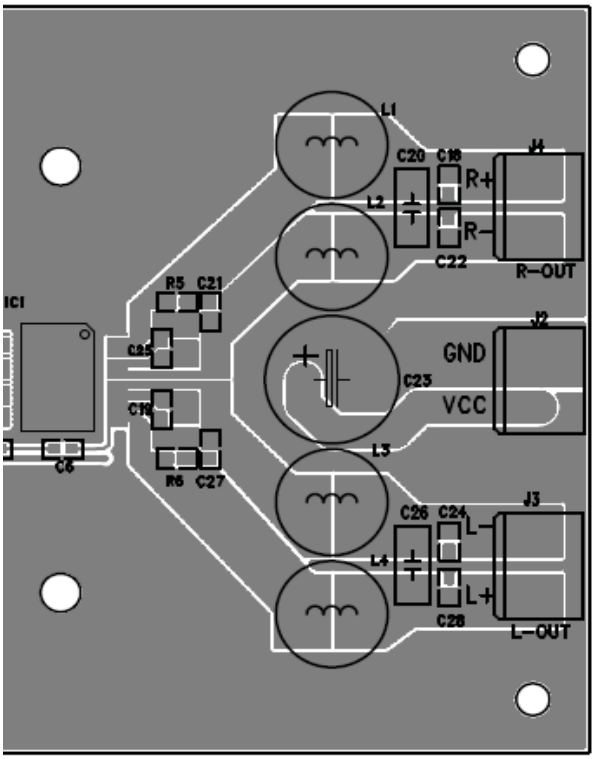


Figure 13. RC filter for ROSC pin placed close to IC

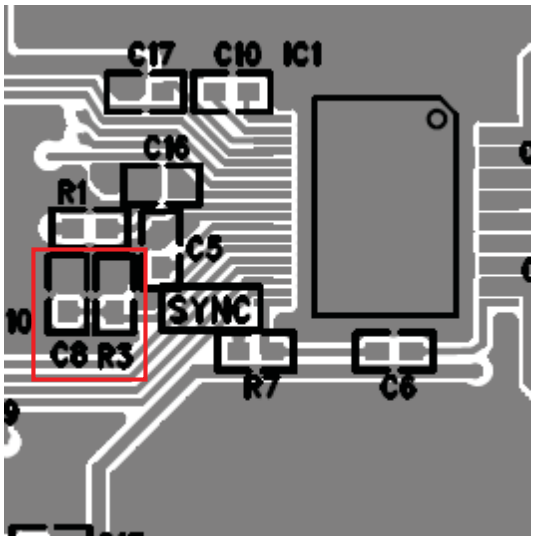
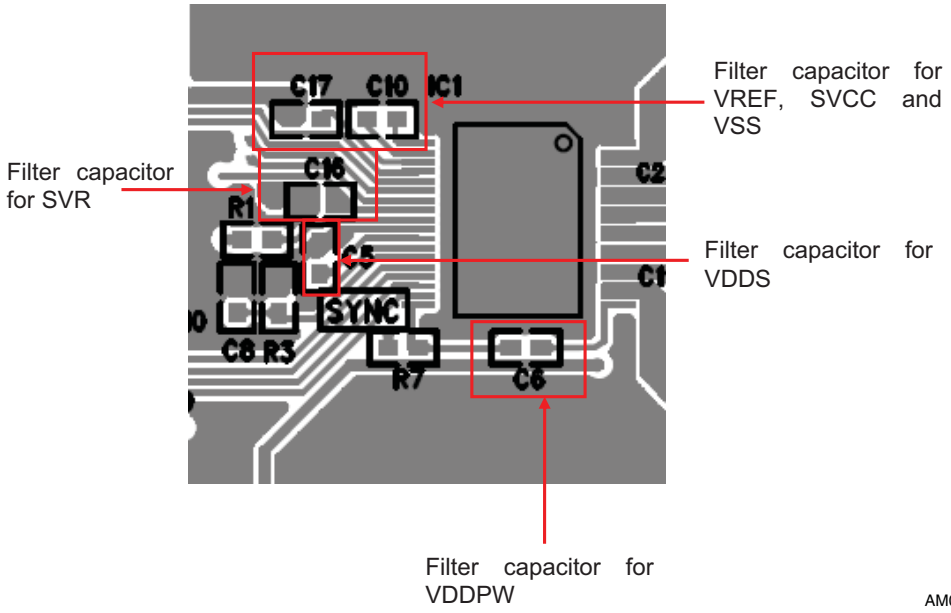
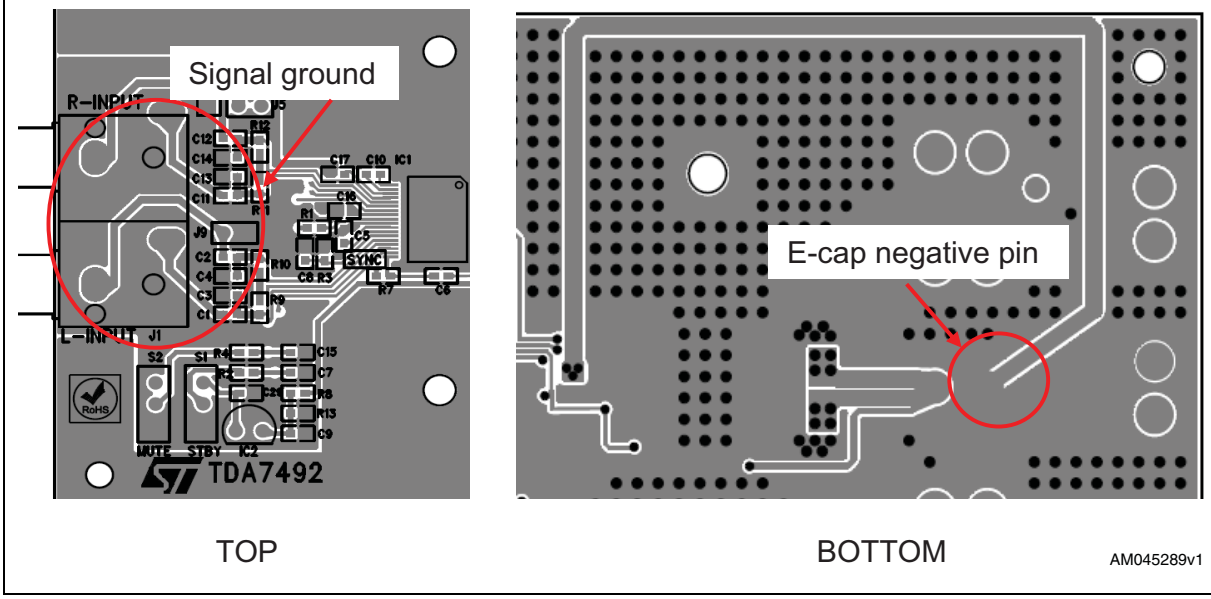


Figure 14. Filter capacitor for SVR, VREF, SVCC, VSS and VDDPW placed close to IC



Signal ground should be directly connected to the bulk capacitor negative terminal.

Figure 15. Signal ground routing



4 Revision history

Table 6. Document revision history

Date	Revision	Changes
01-Oct-2012	1	Initial release.