Introduction

The STEVAL-CCA043V1 is a demonstration board designed for the evaluation of the TDA7491MV mono BTL class-D audio amplifier. This application note provides the board specifications and a quick-start list for standalone operation. Also included are the schematic, printed circuit board layout and bill of material.

Due to its high efficiency, the device, assembled in the PSSO36 (slug-down) package, is capable of dissipating heat without a 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 TDA7491MV include:

- 25 W continuous output power at THD = 10%, $R_L = 6 \, \Omega$, $V_{CC} = 16 \, V$
- 20 W continuous output power at THD = 10%, $R_L = 8 \, \Omega$, $V_{CC} = 18 \, V$
- Wide-range, single-supply operation (5 V - 18 V)
- High efficiency ($\eta = 90\%$)
- Four selectable, fixed gain settings (20 dB, 26 dB, 30 dB and 32 dB)
- Differential inputs to minimize common-mode noise
- Filterless operation up to 15 W, $R_L = 8 \, \Omega$, $V_{CC} = 18 \, V$
- Standby and mute features
- Short-circuit and thermal overload protections
-Externally synchronizable

Figure 1. STEVAL-CCA043V1
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1 Operation

The TDA7491MV demonstration board specifications are as follows:
- Power supply voltage range: 5 V to 18 V
- Number of channels: 1 BTL (Bridge-Tied Load)
- Load impedance: 4 Ω to 8 Ω
- Gain settings: 20 dB, 26 dB, 30 dB, 32 dB
- Undervoltage protection (UVP): 4.5 V

1.1 Power supply

A single power supply is required to feed the TDA7491MV demonstration board via the connector J2 (see Figure 2).

Connect the positive voltage of the 25 V/3 A DC power supply to the +Vcc pin and the negative to GND.

Note: Voltage range 5 V to 18 V = 3 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 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. Input configuration

<table>
<thead>
<tr>
<th>Input configuration</th>
<th>Jumper J8 (right)</th>
<th>Jumper J9 (left)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Differential</td>
<td>Open</td>
<td>Open</td>
</tr>
<tr>
<td>Single-ended</td>
<td>Closed</td>
<td>Closed</td>
</tr>
</tbody>
</table>

Refer to Figure 2: Demonstration board connections on page 4.
1.4 Powering up

Before powering up the demonstration board, ensure that the TDA7491MV is in standby and mute conditions and the gain is set to the desired value (default 20 dB). Verify also the dedicated switches and jumpers.

Table 2. Standby and mute settings

<table>
<thead>
<tr>
<th>STBY (S1)</th>
<th>MUTE (S2)</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>L</td>
<td>STBY</td>
</tr>
<tr>
<td>L</td>
<td>H</td>
<td>STBY</td>
</tr>
<tr>
<td>H</td>
<td>L</td>
<td>MUTE</td>
</tr>
<tr>
<td>H</td>
<td>H</td>
<td>PLAY</td>
</tr>
</tbody>
</table>

Figure 3. Standby and mute switches
1.5 Gain settings

Table 3. Configuration of jumpers J5 and J6

<table>
<thead>
<tr>
<th>Gain 0 (J5)</th>
<th>Gain 1 (J6)</th>
<th>Gain (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open (L)</td>
<td>Open (L)</td>
<td>20</td>
</tr>
<tr>
<td>Open (L)</td>
<td>Closed (H)</td>
<td>26</td>
</tr>
<tr>
<td>Closed (H)</td>
<td>Open (L)</td>
<td>30</td>
</tr>
<tr>
<td>Closed (H)</td>
<td>Closed (H)</td>
<td>32</td>
</tr>
</tbody>
</table>

Figure 4. Jumpers J5 and J6

1.6 Single-ended or differential input

Jumper J9 is used to modify the input signal configuration.

Table 4. Configuration of jumper J9

<table>
<thead>
<tr>
<th>Input configuration</th>
<th>Jumper (J9)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Differential</td>
<td>Open</td>
</tr>
<tr>
<td>Single-ended</td>
<td>Closed</td>
</tr>
</tbody>
</table>

Figure 5. Jumper J9
1.7 Board schematic and bill of material

Figure 6. STEVAL-CCA043V1 schematic
### Table 5. Bill of material

<table>
<thead>
<tr>
<th>Package</th>
<th>Description</th>
<th>Qty</th>
<th>Reference</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>C0603</td>
<td>330 pF 50 V NPO ±5%</td>
<td>1</td>
<td>C27</td>
<td>Murata</td>
</tr>
<tr>
<td>C0603</td>
<td>1 nF 50 V ±10%</td>
<td>2</td>
<td>C3, C4</td>
<td>Murata</td>
</tr>
<tr>
<td>C0603</td>
<td>100 nF 50 V ±10%</td>
<td>8</td>
<td>C5, C6, C8, C9, C10, C24, C25, C28</td>
<td>Murata</td>
</tr>
<tr>
<td>C0603</td>
<td>470 nF 50 V ±10%</td>
<td>2</td>
<td>C1, C2</td>
<td>Murata</td>
</tr>
<tr>
<td>C0603</td>
<td>2.2 µF, 16 V ±10%</td>
<td>3</td>
<td>C7, C15, C29</td>
<td>Murata</td>
</tr>
<tr>
<td>C0603</td>
<td>1 µF, 16 V ±10%</td>
<td>2</td>
<td>C16, C17</td>
<td>Murata</td>
</tr>
<tr>
<td>E-cap</td>
<td>1000 µF, 25 V ±10%, pitch = 5.0 mm</td>
<td>1</td>
<td>C23</td>
<td>Rubycon</td>
</tr>
<tr>
<td>C1206</td>
<td>10 µF, 25 V, ±20%, Y5V</td>
<td>4</td>
<td>C30, C31, C32, C33</td>
<td>Murata</td>
</tr>
<tr>
<td>Mcap</td>
<td>220 nF, 50 V ±10% PITCH=5.0 mm</td>
<td>1</td>
<td>C26</td>
<td>Murata</td>
</tr>
<tr>
<td>R0603</td>
<td>22 ohm, ±10%, 1/16 W</td>
<td>2</td>
<td>R6, R7</td>
<td>Murata</td>
</tr>
<tr>
<td>R0603</td>
<td>2.2k ohm, ±10%, 1/16 W</td>
<td>1</td>
<td>R8</td>
<td>Murata</td>
</tr>
<tr>
<td>R0603</td>
<td>9.1k ohm, ±10%, 1/16 W</td>
<td>1</td>
<td>R13</td>
<td>Murata</td>
</tr>
<tr>
<td>R0603</td>
<td>33k ohm, ±10%, 1/16 W</td>
<td>2</td>
<td>R2, R4</td>
<td>Murata</td>
</tr>
<tr>
<td>R0603</td>
<td>39k ohm, ±10%, 1/16 W</td>
<td>1</td>
<td>R3</td>
<td>Murata</td>
</tr>
<tr>
<td>R0603</td>
<td>100k ohm, ±10%, 1/16 W</td>
<td>1</td>
<td>R1</td>
<td>Murata</td>
</tr>
<tr>
<td>PSSO36 slug-down</td>
<td>TDA7491MV (SSO36) slug-down</td>
<td>1</td>
<td>IC1</td>
<td>STMicroelectronics</td>
</tr>
<tr>
<td>Coil 10X10</td>
<td>33 µh 2 A Type:7075P-330M(1)</td>
<td>2</td>
<td>L1, L2</td>
<td>Kwan Sung</td>
</tr>
<tr>
<td>RCA-2P</td>
<td>RCA socket 1X2P, type AV2-8.4-4</td>
<td>1</td>
<td>J1</td>
<td>Songcheng</td>
</tr>
<tr>
<td>TO92</td>
<td>L4931CZ33, 3V3 regulator</td>
<td>1</td>
<td>IC2</td>
<td>STMicroelectronics</td>
</tr>
<tr>
<td>CNN-Terminal</td>
<td>2P, pitch = 5 mm connector terminal</td>
<td>3</td>
<td>J2, J3</td>
<td>Any source</td>
</tr>
<tr>
<td>2-way jumper</td>
<td>2P, pitch = 2.5 mm jumper</td>
<td>4</td>
<td>J5, J6, J9</td>
<td>Any source</td>
</tr>
<tr>
<td>Slide switch</td>
<td>3P, pitch = 2.5 mm</td>
<td>2</td>
<td>S1, S2</td>
<td>Any source</td>
</tr>
</tbody>
</table>

1. Alternate part MSS1246/MSS1260
2 PCB layout

2.1 Layout views

Figure 7. Top view of PCB layout

Figure 8. Bottom view of PCB layout
2.2 Design guidelines for PCB schematic and layout

2.2.1 Dumping network

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

Figure 10. Dumping network
2.2.2 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 11. Main filter

Table 6. Recommended values

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value 1</th>
<th>Value 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_{LOAD}$</td>
<td>8 Ω</td>
<td>6 Ω</td>
</tr>
<tr>
<td>$L_{LOAD}$</td>
<td>33 µH</td>
<td>22 µH</td>
</tr>
<tr>
<td>$C_{LOAD}$</td>
<td>220 nF</td>
<td>220 nF</td>
</tr>
</tbody>
</table>
2.2.3 Layout recommendations

The following figures illustrate layout recommendations.

Solder the 100 nF bypass capacitor (X7R) as close as possible to the IC V\textsubscript{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 12. Capacitor soldered as close as possible to V\textsubscript{CC} pins](image1.jpg)

Solder the snubber network as close as possible to the related IC 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 the output pins be within 5 mm.

![Figure 13. Snubber network soldered as close as possible to relevant IC pin](image2.jpg)
Place the RC filter for the ROSC pin close to the IC.

**Figure 14. RC filter**

- Place the filter capacitor for SVR, VREF, SVCC, VSS and VDDPW close to the IC.

**Figure 15. Filter capacitor**
# Revision history

<table>
<thead>
<tr>
<th>Date</th>
<th>Revision</th>
<th>Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>13-Nov-2012</td>
<td>1</td>
<td>Initial release.</td>
</tr>
</tbody>
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