UM2187
User manual

TDA756X power amplifier families' evaluation board

Introduction

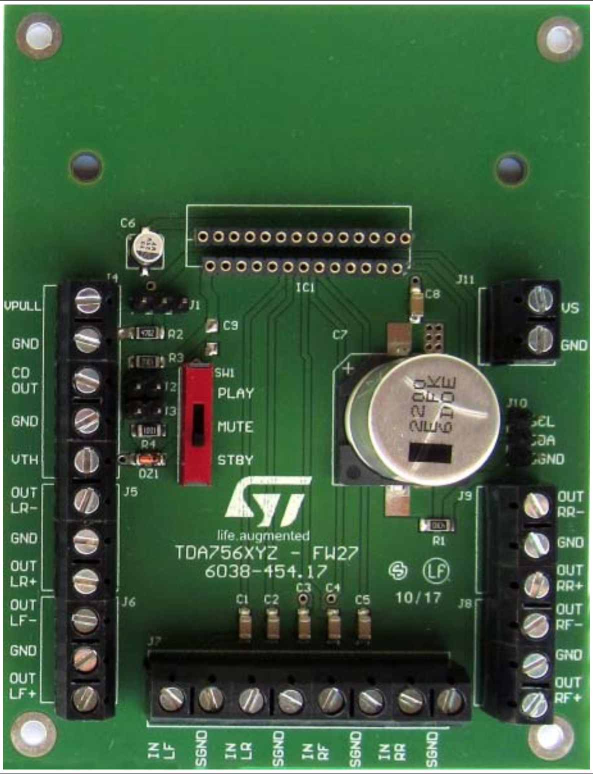
EVAL-TDA756X is an evaluation board compatible with the following intelligent analog input class AB/SB power amplifiers: TDA7569BLV, TDA75610SLV, TDA75612LV, TDA75613LV and TDA75616LV.

The demo board is compatible only with Flexiwatt27 package.

This document describes how to use the evaluation board in order to check devices' performance.

Please refer to the datasheets for a description of the various power amplifiers and their electrical characteristics (see *Appendix A: References on page 13*).

Figure 1. Evaluation board



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1 Board description

The basic application diagram is shown in *Figure 2*.

A key components description and a suggestion how to choose the right components, are shown in *Table 1*.

Figure 2. Application circuit

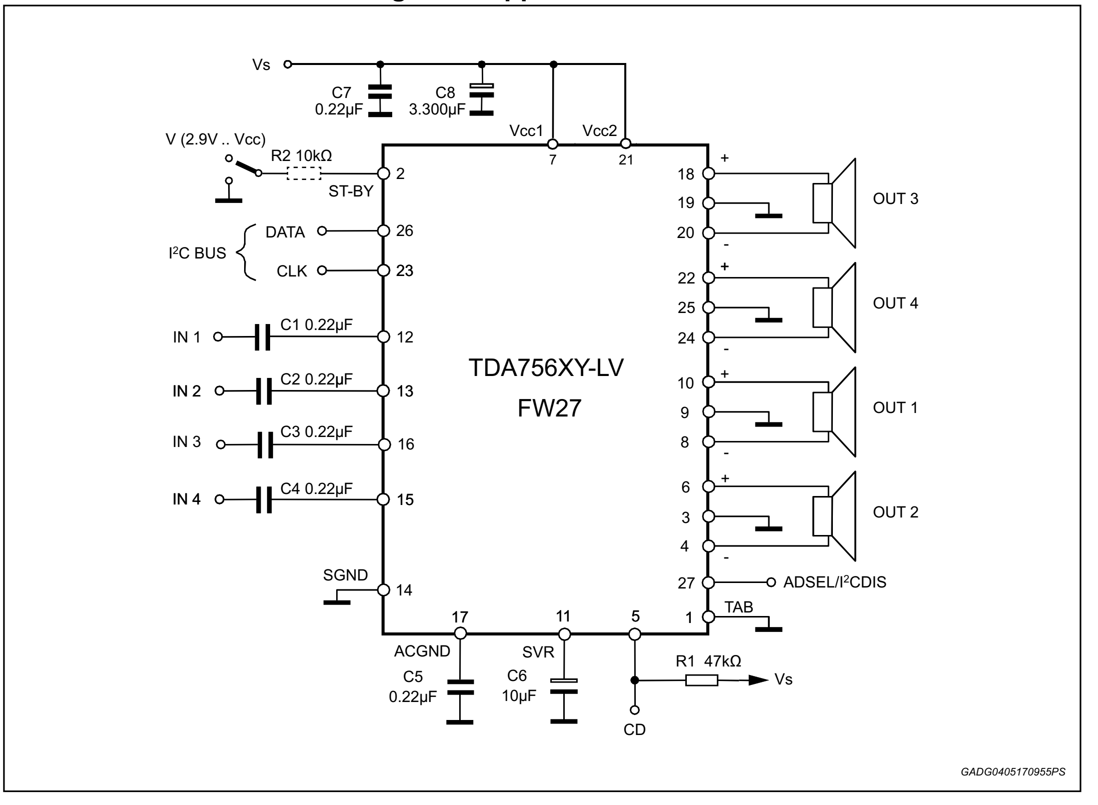


Table 1. Component selection guide

Component Name	Recomm. value	Min/Max value	Purpose	Lower than recomm.	Higher than recomm.	Notes
C1 ... C4 (C_{IN})	0.22 µF	47nF / 1µF ± 10%	Input DC decoupling Defines low-frequency cut-off (12 Hz @ -3 dB). Must be matched with C5 for Voffset / pop optimization (C1…C4 = C5).	Higher low freq. cut-off. Pop if mismatched with C5.	Lower low freq. cut-off. Pop if mismatched with C5.	Influence sound quality (inductive types not recommended).
C5 ($C_{AC\text{-}GND}$)	0.22 µF	47 nF / 1µF ± 10%	Must be matched with C5 for Voffset / pop optimization (C5= C1…C4).	Pop if mismatched.	Worse turn-on pop.	To be placed on a signal-GND path.
C6 (C_{SVR})	10 µF	4.7µF / 47µF ± 20%	Supply ripple rejection Turn ON/OFF transient control (pop optimization).	Worse supply ripple rejection at low freq. Worse turn on/off pop.	Longer turn on/off sequence.	Modifies edges of turn-on diag pulse. To be placed on a signal-GND path.
C7	0.22 µF	0.1µF / 0.47µF ± 20%	Vbatt HF filter.	Danger of high frequency instabilities.	Lower HF suppression.	Low ESR type (e.g. X7R). Placed very close to the IC.
C8	3,300 µF	1,000 µF min	Vbatt LF filter.	Higher ripple.	Audio performance improvement.	Standard Electrolytics / 25 V. Reasonably close to the IC.

Connectors VPULL and VTH, available on the board, should not be used, since jumpers J1 and J2 are in place and they provide, respectively, the pull-up for the clipping detection and the stand-by function through the switch.

2 Board operation

Before any operation, please insert the power amplifier in the socket provided with the board.
A heat-sink (not provided) has to be used. Please refer to *Section 3: Power dissipation / Heat-sink* to choose the right heat-sink.

A supply voltage (battery voltage or equivalent) on VS-GND connectors, between 6 V and 18 V, is needed to operate on the board.

Please refer to datasheet (see *Section Appendix A: References*) to understand load impedance compatibility of power amplifiers, then connect speakers to OUT1, OUT2, OUT3, OUT3 connectors and all GND to ground.

Four analog input audio signals can be provided at IN1, IN2, IN3, IN4 connectors.

Mute and standby should be disabled (both are active low).

These power amplifiers can operate in legacy mode (I^2C inactive) or with I^2C bus active in order to use diagnostics functions.

PIN27 is used for I^2C bus address selection (ADSEL) and to move to legacy mode (I^2C bus disabled, full-analogue operation).

If PIN27 is left open (> 120 kΩ) the power amplifier operates in legacy mode. This demonstration board comes with PIN27 soldered to GND, then the I2C address is fixed to 1101100x and a I2C cable should be inserted in the connector J10.

TDA7569BLV, TDA75610SLV and TDA75613LV can work in high efficiency mode too (refer to *Section 4: High efficiency output waveforms*). This operating mode can be selected through I^2C or acting on with PIN23 (CK/SCL) at jumper J10, when in legacy mode (PIN27 open):

- If PIN23 is connected to GND, the amplifier works in standard mode
- If PIN23 is connected to a voltage between 3 V and 5 V, the amplifier works in high-efficiency mode

TDA7569BLV, TDA75610SLV and TDA75616LV have two different selectable gains for speaker or line driver mode, 26 dB and 16 dB, while TDA75612LV and TDA75613LV offer a selectable gain of 30 dB and 16 dB. The gain can be chosen through I^2C or acting on PIN26 (DATA/SDA) with jumper J10, when it is in legacy mode:

- If PIN26 is connected to GND, the higher gain is selected
- If PIN26 is connected to a voltage between 3 V and 5 V, the lower gain is selected.

Please refer to datasheet for I^2C instructions.

3 Power dissipation / Heat-sink

The heat-sink size / characteristics largely depend on the operating conditions and consequently power dissipation levels are implied. Dissipation can be higher if sine test tones are used instead of music or audio-simulation signals (e.g. Pink Noise).

Considering the standard car-radio conditions (V_s = 14 V, R_L= 4 Ω, 4-CH operation), power dissipation levels are as follows:

- SINE WAVE: P_{diss} = 40 / 35 W (STD / HI-EFF) $R_{th\ htsk}$ = 1.5 – 1.8 °C/W
- PINK NOISE: P_{diss} = 30 / 20 W (STD / HI-EFF) $R_{th\ htsk}$ = 2.3 – 3.6 °C/W

A heat-sink with R_{th} = 2.5 °C/W makes the board suitable for PINK NOISE / 4 Ω (4-CH operation), T_{amb} ≤ 70 °C, HI-EFF or to STD mode. Rth values around 2.5 °C/W are those used in real application environments.

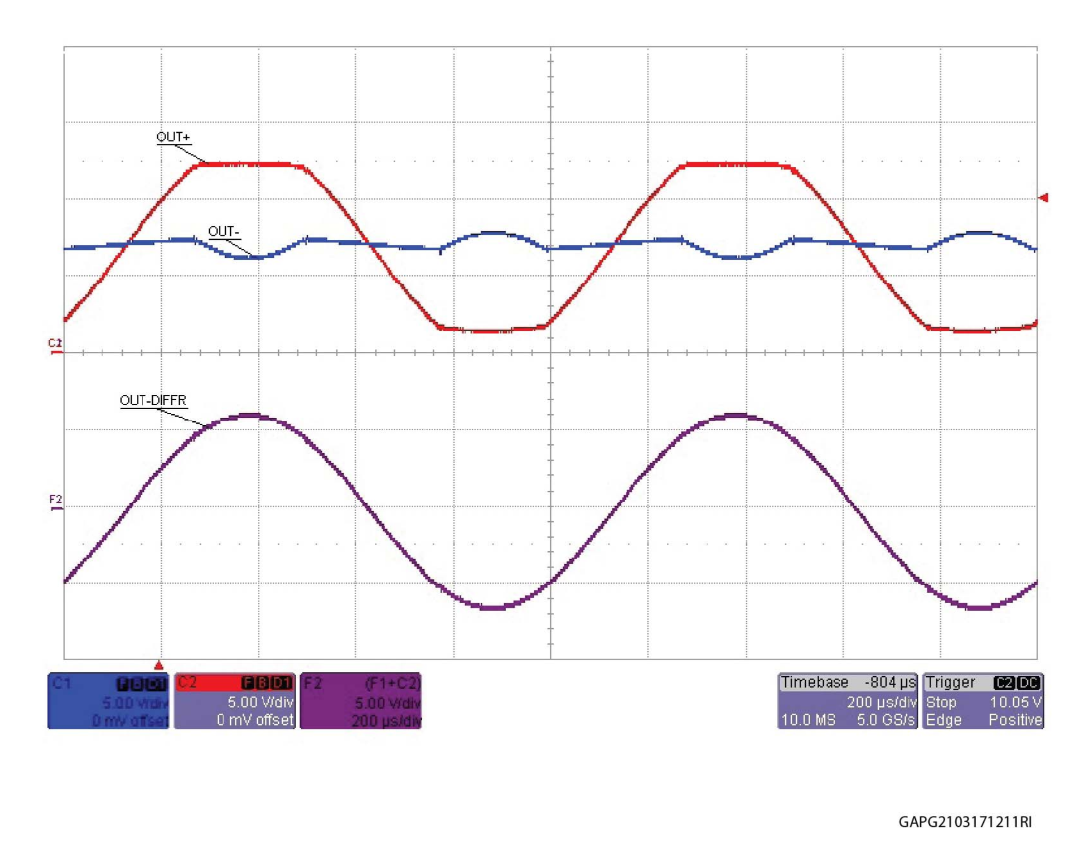
If sine-wave trials (especially with 4-CH operation / R_L= 2 Ω) are to be run, then the heatsink has to be replaced by a larger / lower-R_{th} one.

4 High efficiency output waveforms

In high efficiency mode, the output differential signal (OUT-OUT) is the sum of the signals at OUT+ and OUT- pins, which are not sinusoidal (in STD mode they are).

Here below is an oscilloscope showing the output waveforms in HI-EFF mode (@ P_o > 2.5 W / 4 Ω).

Figure 3. Output signals in high efficiency mode



5 Demo board schematic and BOM

Figure 4 shows the demo board schematic, while *Table 2* shows the list of the mounted components.

Figure 4. Demo board schematic

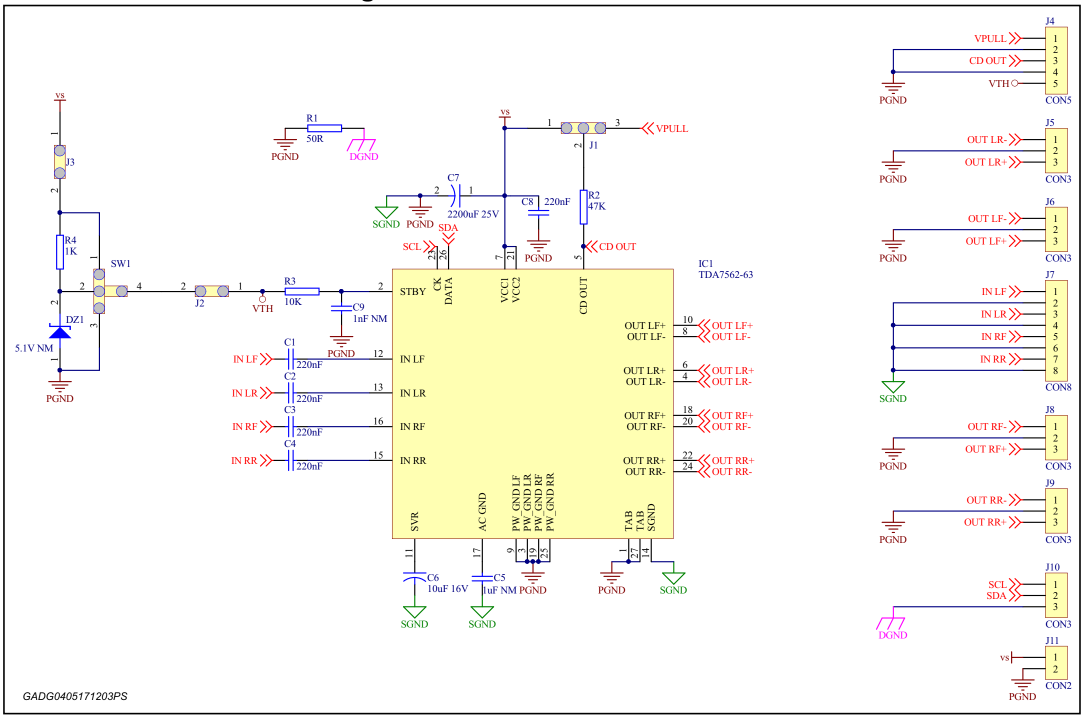


Table 2. Bill of material

Quantity	Designator	Comment	Footprint
5	C1, C2, C3, C4, C5, C8	220 nF	1206_C
1	C5	1 µF	1206_C
1	C6	10 µF, 16 V	CAPPOL4DX6.3H
1	C7	2200 µF, 25 V	CAPPOL16D
1	C9	1 nF NM	1206_C
1	DZ1	3.9 V zener	MELF ZENER DIODE
1	IC1	TDA756XY	Flexiwatt27 vertical
1	J1	JUMPER 3CH	3-CH JUMPER
2	J2, J3	JUMPER 2CH	JUMPER
1	J4	CON5	5-POLE CONNECTOR
4	J5, J6, J8, J9	CON3	3-POLE CONNECTOR
1	J7	CON8	8-POLE CONNECTOR
1	J10	CON3	JUMPER 3CH

Table 2. Bill of material (continued)

Quantity	Designator	Comment	Footprint
1	J11	CON2	2-POLE CONNECTOR
1	R1	50 Ω	1206_R
1	R2	47 kΩ	1206_R
1	R3	10 kΩ	1206_R
1	R4	1 kΩ	1206_R
1	SW1	JUMPER 4CH	ON ON ON DEVIATOR

6 Information on board use

This evaluation board/kit is intended to be used for ENGINEERING DEVELOPMENT, DEMONSTRATION OR EVALUATION PURPOSES ONLY and it is not considered by ST Microelectronics (ST) to be a finished end product fit for general consumer use. People handling the product(s) must have electronics training and observe good engineering practice standards. As such, the goods being provided are not intended to be complete in terms of required design-, marketing- and/or manufacturing-related protective considerations, including product safety and environmental measures typically found in end products that incorporate such semiconductor components or circuit boards. This evaluation board/kit does not fall within the scope of the European Union directives regarding electromagnetic compatibility, restricted substances (RoHS), recycling (WEEE), FCC, CE or UL, and therefore they may not meet the technical requirements of these directives or other related directives.

Appendix A References

- TDA7569BLV, *4 x 50 W power amplifier with full I2C diagnostics, high efficiency and low voltage operation* (Datasheet DocID023498)
- TDA75610SLV, *4 x 45 W power amplifier with full I2C diagnostics, high efficiency and low voltage operation* (Datasheet DocID025599)
- TDA75612LV, *4 x 45 W power amplifier with full I2C diagnostics, SSR and low voltage operation* (Datasheet DocID025639)
- TDA75613LV, *4 x 45 W power amplifier with full I2C diagnostics, high efficiency, SSR and low voltage operation* (Datasheet DocID025640)
- TDA75616LV, *4 x 45 W power amplifier with full I2C diagnostics, high efficiency, SSR and low voltage operation* (Datasheet DocID025642)

Revision history

Table 3. Document revision history

Date	Revision	Changes
12-Jun-2017	1	Initial release.