# Contents

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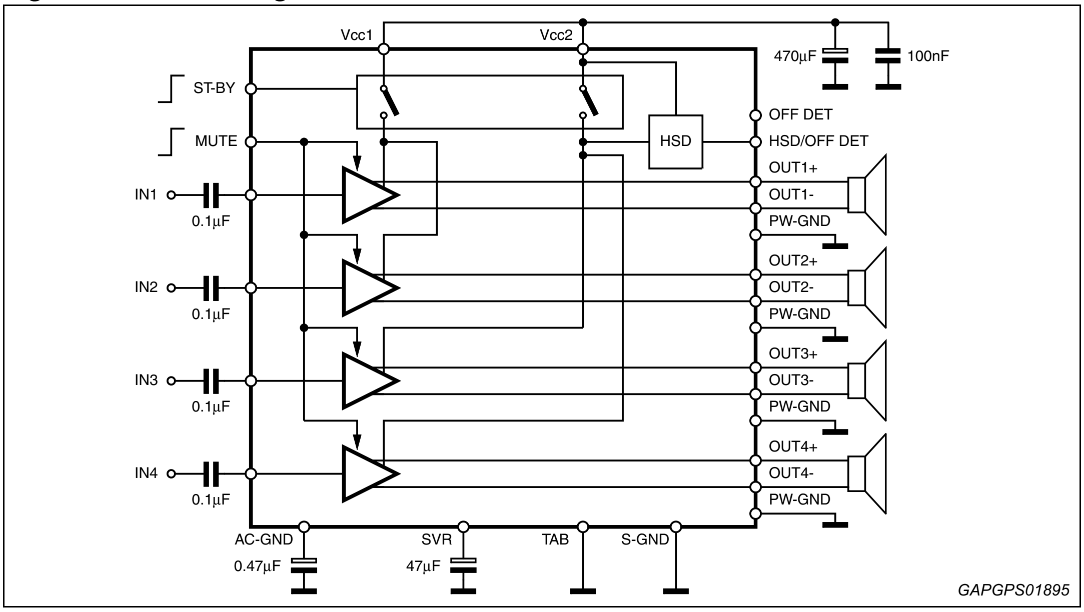
# 1 Block diagram and application circuit

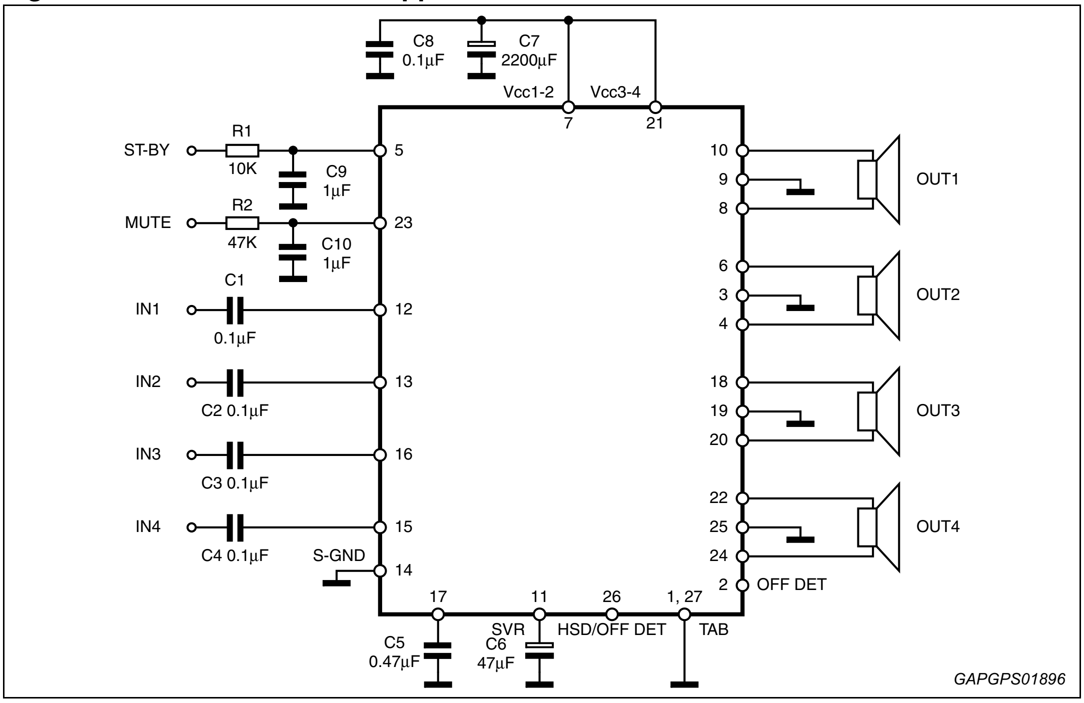
## 1.1 Block diagram

**Figure 1. Block diagram**



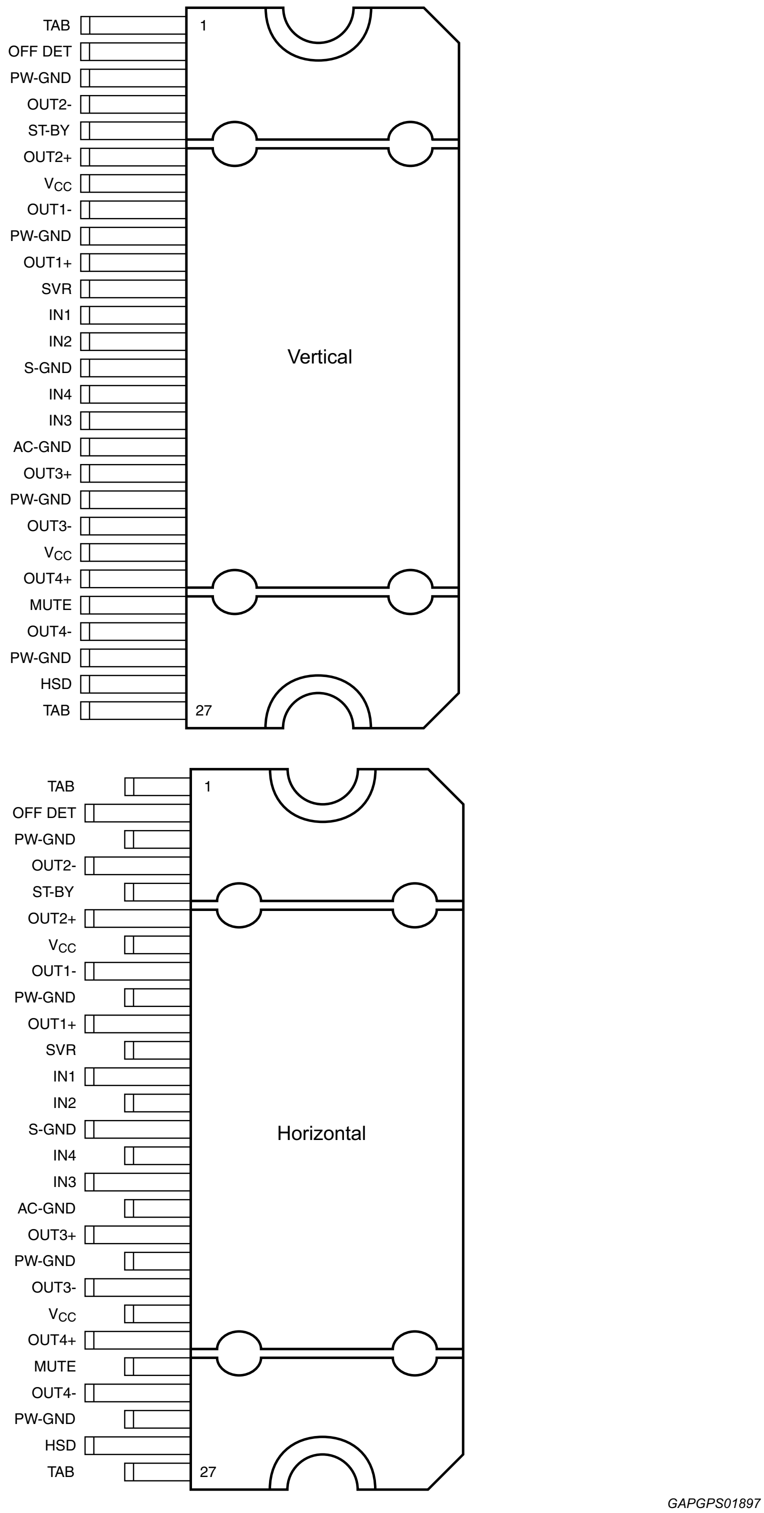

## 1.2 Standard test and application circuit

**Figure 2. Standard test and application circuit**



# 2 Pin description

**Figure 3. Pin connections (top view)**



# 3 Electrical specifications

## 3.1 Absolute maximum ratings

**Table 2. Absolute maximum ratings**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_S$ | Operating supply voltage | 18 | V |
| $V_{S\ (DC)}$ | DC supply voltage | 28 | V |
| $V_{S\ (pk)}$ | Peak supply voltage (for t = 50 ms) | 50 | V |
| $I_O$ | Output peak current<br>repetitive (duty cycle 10 % at f = 10 Hz)<br>non repetitive (t = 100 µs) | <br>9<br>10 | <br>A<br>A |
| $P_{tot}$ | Power dissipation $T_{case}$ = 70 °C | 80 | W |
| $T_j$ | Junction temperature | 150 | °C |
| $T_{stg}$ | Storage temperature | -55 to 150 | °C |

## 3.2 Thermal data

**Table 3. Thermal data**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $R_{th\ j\text{-}case}$ | Thermal resistance junction-to-case Max. | 1 | °C/W |

## 3.3 Electrical characteristics

Refer to the test and application diagram, $V_S$ = 14.4 V; $R_L$ = 4 Ω; $R_g$ = 600 Ω; f = 1 kHz; $T_{amb}$ = 25 °C; unless otherwise specified.

**Table 4. Electrical characteristics**

| Symbol | Parameter | Test condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{q1}$ | Quiescent current | $R_L = \infty$ | 100 | 180 | 280 | mA |
| $V_{OS}$ | Output offset voltage | Play mode - Mute mode | - | - | ±50 | mV |
| $dV_{OS}$ | During mute ON/OFF output offset voltage | ITU R-ARM weighted see *Figure 18* | -10 | - | +10 | mV |
| | During St-By ON/OFF output offset voltage | | -10 | - | +10 | mV |
| $G_v$ | Voltage gain | - | 25 | 26 | 27 | dB |
| $dG_v$ | Channel gain unbalance | - | - | - | ±1 | dB |

**Table 4. Electrical characteristics (continued)**

| Symbol | Parameter | Test condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $P_o$ | Output power | $V_S$ = 13.2 V; THD = 10 %<br>$V_S$ = 13.2 V; THD = 1 %<br>$V_S$ = 14.4 V; THD = 10 %<br>$V_S$ = 14.4 V; THD = 1 % | 23<br>16<br>28<br>20 | 25<br>19<br>30<br>23 | - | W |
| | | $V_S$ = 14.4 V; THD = 10 %, 2 Ω | 50 | 55 | | W |
| $P_{o\ max.}$ | Max. output power[1] | $V_S$ = 14.4 V; $R_L$ = 4 Ω<br>$V_S$ = 14.4 V; $R_L$ = 2 Ω | - | 50<br>85 | - | W |
| THD | Distortion | $P_o$ = 4 W<br>$P_o$ = 15 W; $R_L$ = 2 Ω | - | 0.006<br>0.015 | 0.02<br>0.03 | % |
| $e_{No}$ | Output noise | "A" Weighted<br>Bw = 20 Hz to 20 kHz | - | 35<br>50 | 50<br>70 | µV |
| SVR | Supply voltage rejection | f = 100 Hz; $V_r$ = 1 Vrms | 50 | 75 | - | dB |
| $f_{ch}$ | High cut-off frequency | $P_O$ = 0.5 W | 100 | 300 | - | KHz |
| $R_i$ | Input impedance | | 80 | 100 | 120 | KΩ |
| $C_T$ | Cross talk | f = 1 kHz; $P_O$ = 4 W<br>f = 10 kHz; $P_O$ = 4 W | 60<br>- | 70<br>60 | -<br>- | dB |
| $I_{SB}$ | Standby current consumption | $V_{ST-BY}$ = 1.5 V | - | - | 20 | µA |
| | | $V_{ST-BY}$ = 0V | - | - | 10 | |
| $I_{pin5}$ | Standby pin current | $V_{ST-BY}$ = 1.5V to 3.5V | - | - | ±1 | µA |
| $V_{SB\ out}$ | Standby out threshold voltage | (Amp: ON) | 2.75 | - | - | V |
| $V_{SB\ in}$ | Standby in threshold voltage | (Amp: OFF) | - | - | 1.5 | V |
| $A_M$ | Mute attenuation | $P_{Oref}$ = 4W | 80 | 90 | - | dB |
| $V_{M\ out}$ | Mute out threshold voltage | (Amp: Play) | 3.5 | - | - | V |
| $V_{M\ in}$ | Mute in threshold voltage | (Amp: Mute) | - | - | 1.5 | V |
| $V_{AM\ in}$ | $V_S$ automute threshold | (Amp: Mute)<br>Att ≥ 80 dB; $P_{Oref}$ = 4 W<br>(Amp: Play)<br>Att < 0.1 dB; $P_O$ = 0.5 W | 6.5 | 7<br><br>7.5 | 8 | V |
| $I_{pin23}$ | Muting pin current | $V_{MUTE}$ = 1.5 V<br>(Sourced Current) | 7 | 12 | 18 | µA |
| | | $V_{MUTE}$ = 3.5 V | -5 | - | 18 | µA |
| **HSD section** | | | | | | |
| $V_{dropout}$ | Dropout voltage | $I_O$ = 0.35 A; $V_S$ = 9 to 16 V | - | 0.25 | 0.6 | V |
| $I_{prot}$ | Current limits | - | 400 | - | 800 | mA |

**Table 4. Electrical characteristics (continued)**

| Symbol | Parameter | Test condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **Offset detector (Pin 26)** | | | | | | |
| $V_{M\_ON}$ | Mute voltage for DC offset detection enabled | $V_{ST\text{-}BY} = 5$ V | 8 | - | - | V |
| $V_{M\_OFF}$ | | | - | - | 6 | V |
| $V_{OFF}$ | Detected differential output offset | $V_{ST\text{-}BY} = 5$ V; $V_{mute} = 8$ V | ±2 | ±3 | ±4 | V |
| $V_{26\_T}$ | Pin 26 voltage for detection = TRUE | $V_{ST\text{-}BY} = 5$ V; $V_{mute} = 8$ V $V_{OFF} > \pm 4$ V | 0 | - | 1.5 | V |
| $V_{26\_F}$ | Pin 26 voltage for detection = FALSE | $V_{ST\text{-}BY} = 5$ V; $V_{mute} = 8$ V $V_{OFF} > \pm 2$ V | 12 | - | - | V |

1. Saturated square wave output.

## 3.4 Electrical characteristic curves

**Figure 4. Quiescent current vs. supply voltage**

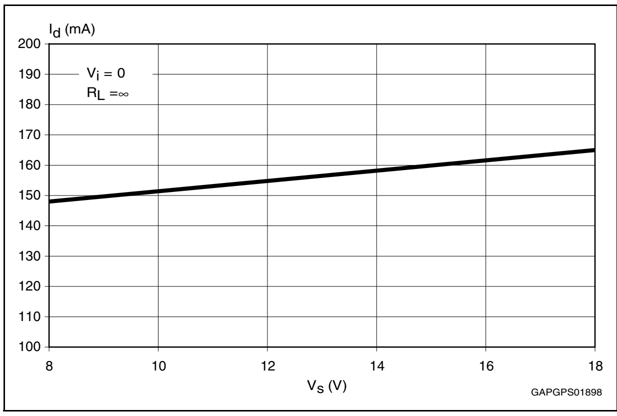



**Figure 5. Output power vs. supply voltage ($R_L = 4\ \Omega$)**

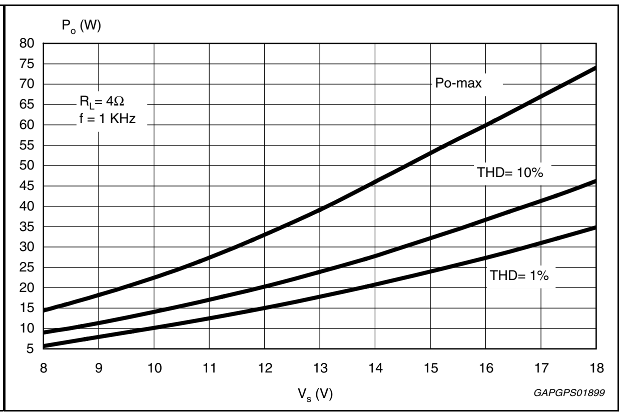



**Figure 6. Output power vs. supply voltage ($R_L = 2\ \Omega$)**

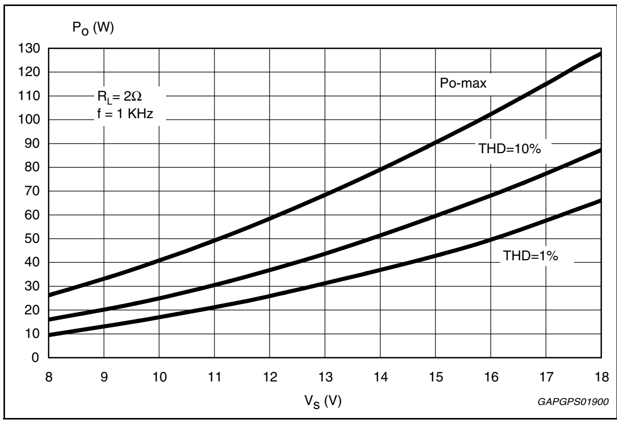



**Figure 7. Distortion vs. output power ($R_L = 4\ \Omega$)**

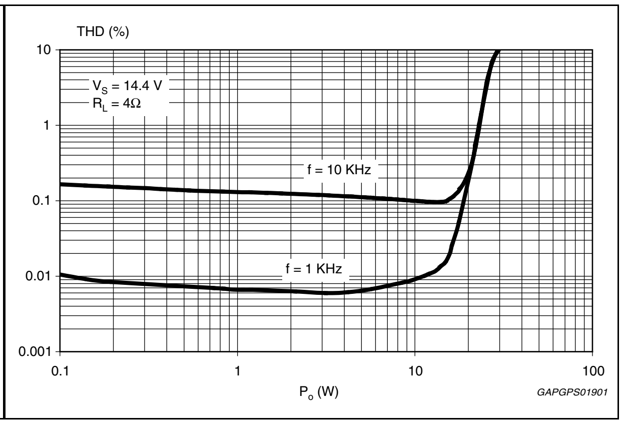


**Figure 8. Distortion vs. output power ($R_L$ = 2 Ω)**

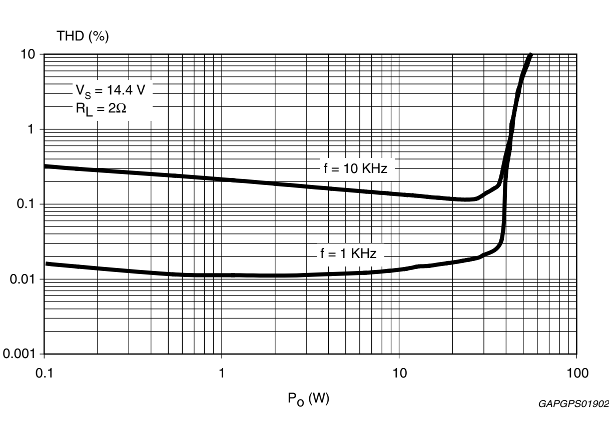



**Figure 9. Distortion vs. frequency ($R_L$ = 4 Ω)**

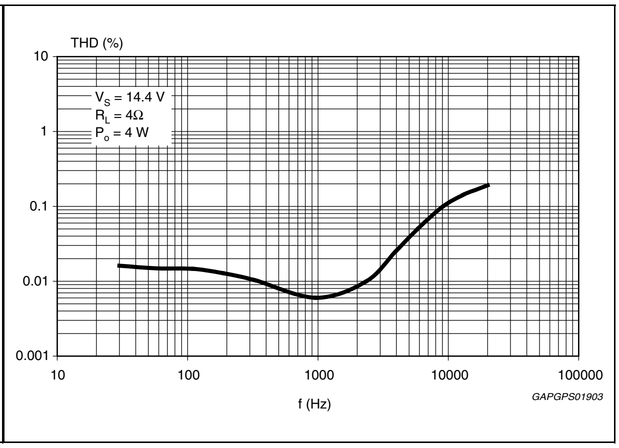



**Figure 10. Distortion vs. frequency ($R_L$ = 2 Ω)**

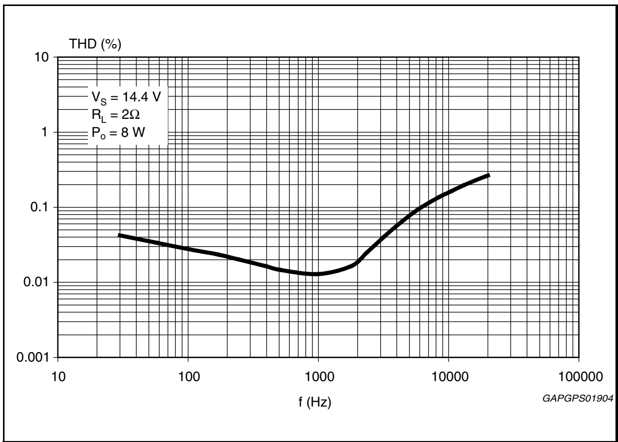



**Figure 11. Crosstalk vs. frequency**

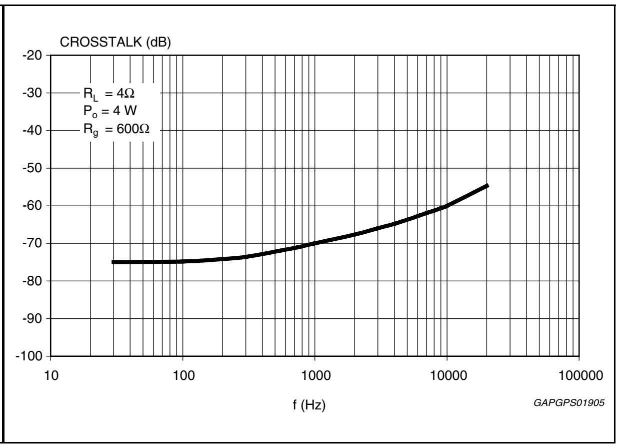



**Figure 12. Supply voltage rejection vs. frequency**

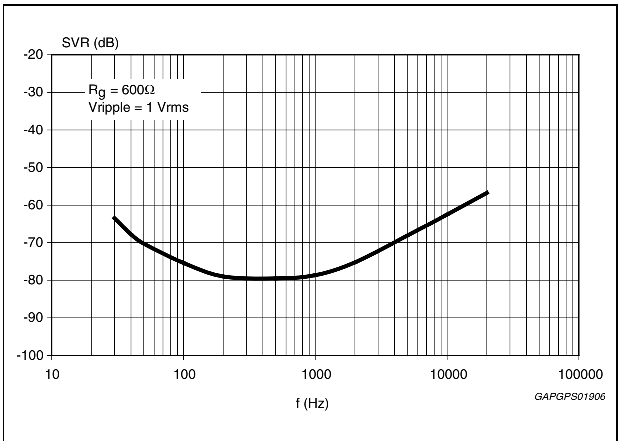



**Figure 13. Output attenuation vs. supply voltage**

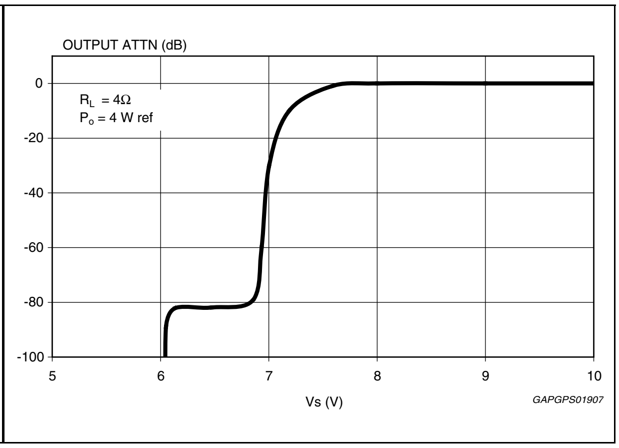


**Figure 14. Power dissipation and efficiency vs. output power ($R_L$ = 4 Ω, SINE)**

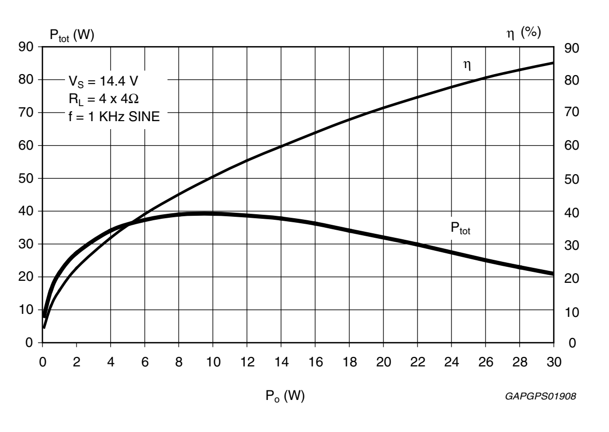



**Figure 15. Power dissipation and efficiency vs. output power ($R_L$ = 2 Ω, SINE)**

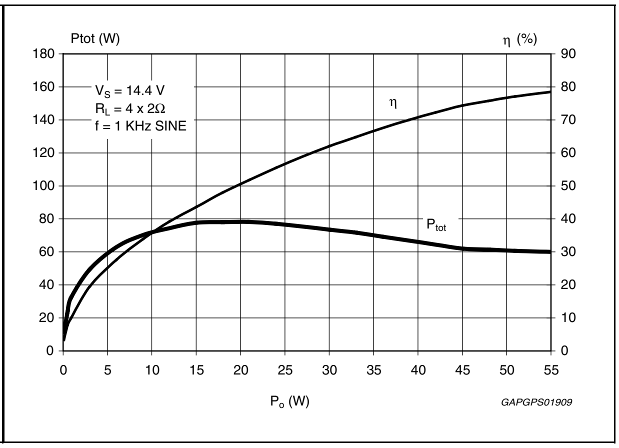



**Figure 16. Power dissipation vs. output power ($R_L$ = 4Ω, audio program simulation)**

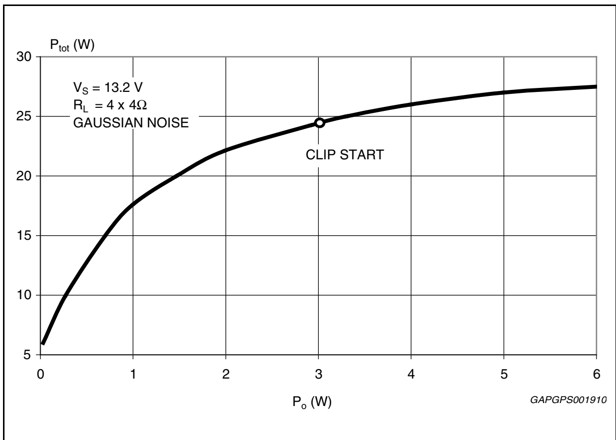



**Figure 17. Power dissipation vs. output power ($R_L$ = 2Ω, audio program simulation)**

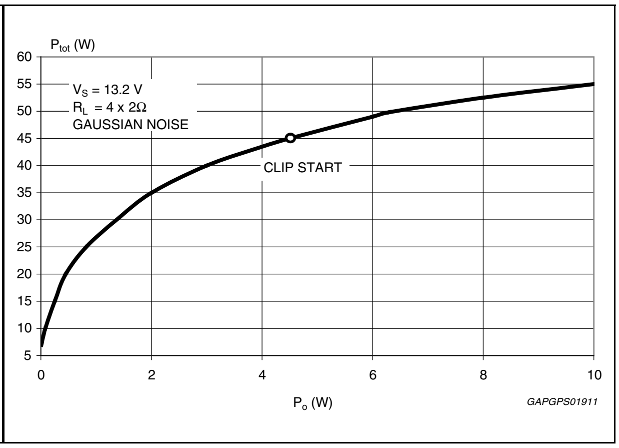
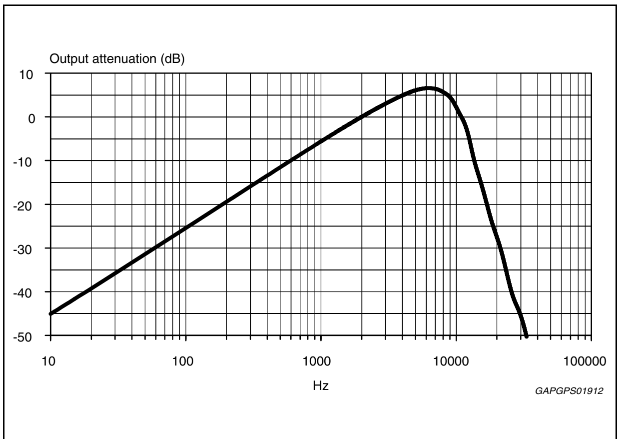



**Figure 18. ITU R-ARM frequency response, weighting filter for transient pop**



# 4 Application hints

Ref. to the circuit of *Figure 2*.

## 4.1 SVR

Besides its contribution to the ripple rejection, the SVR capacitor governs the turn ON/OFF time sequence and, consequently, plays an essential role in the pop optimization during ON/OFF transients. To conveniently serve both needs, **Its minimum recommended value is 10µF**.

## 4.2 Input stage

The TDA7850A's inputs are ground-compatible and can stand very high input signals (± 8Vpk) without any performance degradation.
If the standard value for the input capacitors (0.1µF) is adopted, the low frequency cut-off will amount to 16 Hz.

## 4.3 Standby and muting

STANDBY and MUTING facilities are both CMOS compatible. In absence of true CMOS ports or microprocessors, a direct connection to Vs of these two pins is admissible but a 470kΩ equivalent resistance should be present between the power supply and the muting and stand-by pins.
R-C cells have always to be used in order to smooth down the transitions for preventing any audible transient noises.
About the stand-by, the time constant to be assigned in order to obtain a virtually pop-free transition has to be slower than 2.5V/ms.

## 4.4 DC offset detector

The TDA7850A integrates a DC offset detector to avoid that an anomalous DC offset on the inputs of the amplifier may be multiplied by the gain and result in a dangerous large offset on the outputs which may lead to speakers damage for overheating.
The feature works with the amplifier unmuted and no signal at the inputs.
The DC offset detection can be available at 2 different pins:

- Pin 2 (always enabled)
- Pin 26. Only enabled if Vmute (pin23) is set higher than 8V. If not (Vmute < 6 V) pin 26 will revert to the original HSD function.

## 4.5 Heatsink definition

Under normal usage (4 Ohm speakers) the heatsink's thermal requirements have to be deduced from *Figure 16*, which reports the simulated power dissipation when real music/speech programmes are played out. Noise with gaussian-distributed amplitude was employed for this simulation. Based on that, frequent clipping occurrence (worst-case) will cause $P_{diss}$ = 26W. Assuming $T_{amb}$ = 70°C and $T_{CHIP}$ = 150°C as boundary conditions, the heatsink's thermal resistance should be approximately 2°C/W. This would avoid any thermal shutdown occurrence even after long-term and full-volume operation.

# 5 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: *www.st.com*.

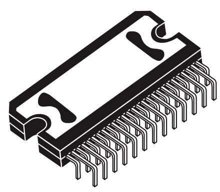
ECOPACK® is an ST trademark.

**Figure 19. Flexiwatt27 (horizontal) mechanical data and package dimensions**

| DIM. | mm | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 4.45 | 4.50 | 4.65 | 0.175 | 0.177 | 0.183 |
| B | 1.80 | 1.90 | 2.00 | 0.070 | 0.074 | 0.079 |
| C | | 1.40 | | | 0.055 | |
| D | | 2.00 | | | 0.079 | |
| E | 0.37 | 0.39 | 0.42 | 0.014 | 0.015 | 0.016 |
| F (1) | | | 0.57 | | | 0.022 |
| G | 0.75 | 1.00 | 1.25 | 0.0295 | 0.040 | 0.0492 |
| G1 | 25.70 | 26.00 | 26.30 | 1.0118 | 1.023 | 1.0354 |
| H (2) | 28.90 | 29.23 | 29.30 | 1.139 | 1.150 | 1.153 |
| H1 | | 17.00 | | | 0.669 | |
| H2 | | 12.80 | | | 0.503 | |
| H3 | | 0.80 | | | 0.031 | |
| L (2) | 21.64 | 22.04 | 22.44 | 0.852 | 0.868 | 0.883 |
| L1 | 10.15 | 10.5 | 10.85 | 0.40 | 0.413 | 0.427 |
| L2 (2) | 15.50 | 15.70 | 15.90 | 0.610 | 0.618 | 0.626 |
| L3 | 7.70 | 7.85 | 7.95 | 0.303 | 0.309 | 0.313 |
| L4 | | 5 | | | 0.197 | |
| L5 | 5.15 | 5.45 | 5.85 | 0.203 | 0.214 | 0.23 |
| L6 | 1.80 | 1.95 | 2.10 | 0.070 | 0.077 | 0.083 |
| M | 2.75 | 3.00 | 3.50 | 0.108 | 0.118 | 0.138 |
| M1 | | 4.73 | | | 0.186 | |
| M2 | | 5.61 | | | 0.220 | |
| N | | 2.20 | | | 0.086 | |
| P | 3.20 | 3.50 | 3.80 | 0.126 | 0.138 | 0.15 |
| R | | 1.70 | | | 0.067 | |
| R1 | | 0.50 | | | 0.02 | |
| R2 | | 0.30 | | | 0.12 | |
| R3 | | 1.25 | | | 0.049 | |
| R4 | | 0.50 | | | 0.02 | |
| V | 5° (Typ.) | | | | | |
| V1 | 3° (Typ.) | | | | | |
| V2 | 20° (Typ.) | | | | | |
| V3 | 45° (Typ.) | | | | | |

(1): dam-bar protusion not included; (2): molding protusionincluded

**OUTLINE AND MECHANICAL DATA**



**Flexiwatt27 (Horizontal)**

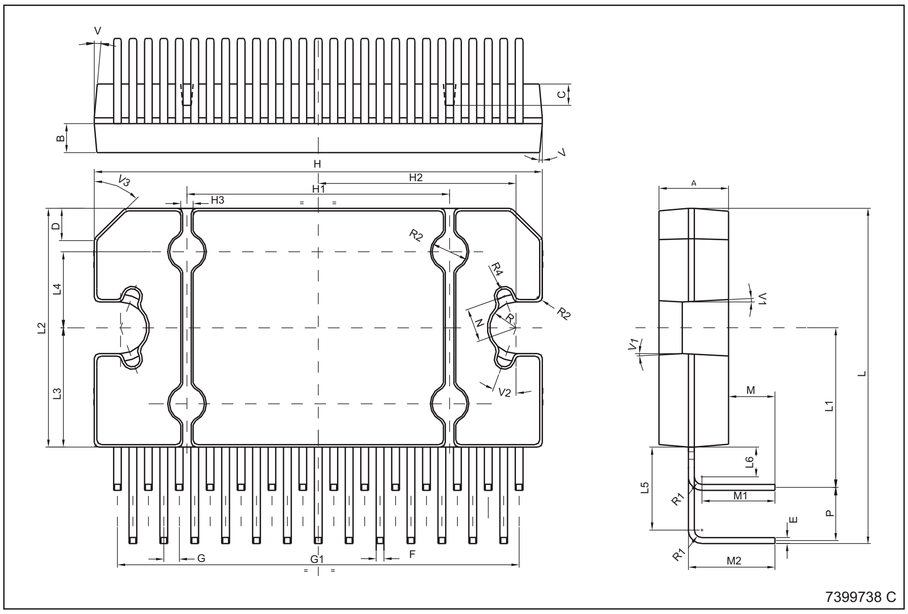
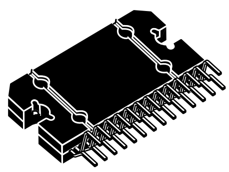


**Figure 20. Flexiwatt27 (vertical) mechanical data and package dimensions**

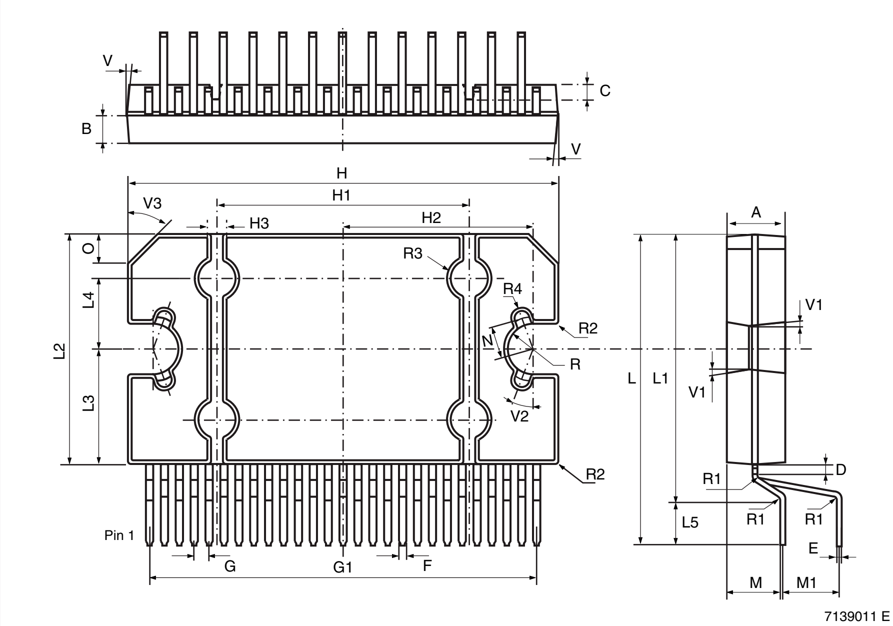
| DIM. | mm | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 4.45 | 4.50 | 4.65 | 0.175 | 0.177 | 0.183 |
| B | 1.80 | 1.90 | 2.00 | 0.070 | 0.074 | 0.079 |
| C | | 1.40 | | | 0.055 | |
| D | 0.75 | 0.90 | 1.05 | 0.029 | 0.035 | 0.041 |
| E | 0.37 | 0.39 | 0.42 | 0.014 | 0.015 | 0.016 |
| F (1) | | | 0.57 | | | 0.022 |
| G | 0.80 | 1.00 | 1.20 | 0.031 | 0.040 | 0.047 |
| G1 | 25.75 | 26.00 | 26.25 | 1.014 | 1.023 | 1.033 |
| H (2) | 28.90 | 29.23 | 29.30 | 1.139 | 1.150 | 1.153 |
| H1 | | 17.00 | | | 0.669 | |
| H2 | | 12.80 | | | 0.503 | |
| H3 | | 0.80 | | | 0.031 | |
| L (2) | 22.07 | 22.47 | 22.87 | 0.869 | 0.884 | 0.904 |
| L1 | 18.57 | 18.97 | 19.37 | 0.731 | 0.747 | 0.762 |
| L2 (2) | 15.50 | 15.70 | 15.90 | 0.610 | 0.618 | 0.626 |
| L3 | 7.70 | 7.85 | 7.95 | 0.303 | 0.309 | 0.313 |
| L4 | | 5 | | | 0.197 | |
| L5 | | 3.5 | | | 0.138 | |
| M | 3.70 | 4.00 | 4.30 | 0.145 | 0.157 | 0.169 |
| M1 | 3.60 | 4.00 | 4.40 | 0.142 | 0.157 | 0.173 |
| N | | 2.20 | | | 0.086 | |
| O | | 2 | | | 0.079 | |
| R | | 1.70 | | | 0.067 | |
| R1 | | 0.5 | | | 0.02 | |
| R2 | | 0.3 | | | 0.12 | |
| R3 | | 1.25 | | | 0.049 | |
| R4 | | 0.50 | | | 0.019 | |
| V | 5° (Typ.) | | | | | |
| V1 | 3° (Typ.) | | | | | |
| V2 | 20° (Typ.) | | | | | |
| V3 | 45° (Typ.) | | | | | |

(1): dam-bar protusion not included; (2): molding protusion included.

**OUTLINE AND MECHANICAL DATA**



**Flexiwatt27 (vertical)**




GAPGPS00096

# 6 Revision history

**Table 5. Document revision history**

| Date | Revision | Changes |
|---|---|---|
| 09-Oct-2007 | 1 | Initial release. |
| 12-Sep-2008 | 2 | Updated the values of $V_{OS}$ and THD parameters on the *Table 4*. |
| 07-Nov-2008 | 3 | Modified max. values of the THD distortion in *Table 4: Electrical characteristics* on page 8. |
| 14-Aug-2012 | 4 | Updated *Section 5: Package information*. |
| 17-Sep-2013 | 5 | Updated Disclaimer. |

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