

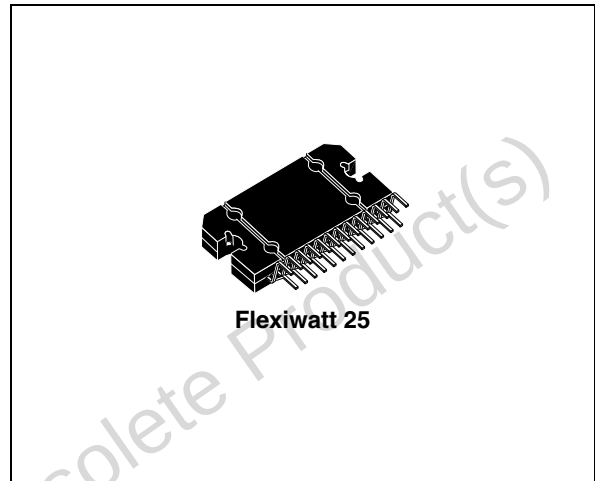
## 4 x 45W quad bridge car radio amplifier

### Features

- High output power:
  - 4 x 45 W / 4  $\Omega$  max.
  - 4 x 28 W / 4  $\Omega$  @ 14.4 V, 1 kHz, 10 %
- Low distortion
- Low output noise
- Standby function
- Mute function
- Automute at min. supply voltage detection
- Low external component count:
  - Internally fixed gain (26 dB)
  - No external compensation
  - No bootstrap capacitors
- Clipping detector
- Diagnostic facility for:
  - Out to GND short
  - Out to  $V_S$  short
  - Thermal shutdown

### Protections

- Output short circuit to GND, to  $V_S$ , across the load
- Very inductive loads
- Overrating chip temperature with soft thermal limiter



- Load dump voltage
- Fortuitous open GND
- Reversed battery
- ESD

### Description

The TDA7389 is an AB class audio power amplifier, packaged in Flexiwatt 25 and designed for high end car radio applications.

Based on a fully complementary PNP/NPN configuration the TDA7389 allows a rail to rail output voltage swing with no need of bootstrap capacitors.

**Table 1. Device summary**

| Order code | Package      | Packing |
|------------|--------------|---------|
| TDA7389    | Flexiwatt 25 | Tube    |

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Obsolete Product(s) - Obsolete Product(s)

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# 1 Pin connection and block diagrams

Figure 1. Block diagram

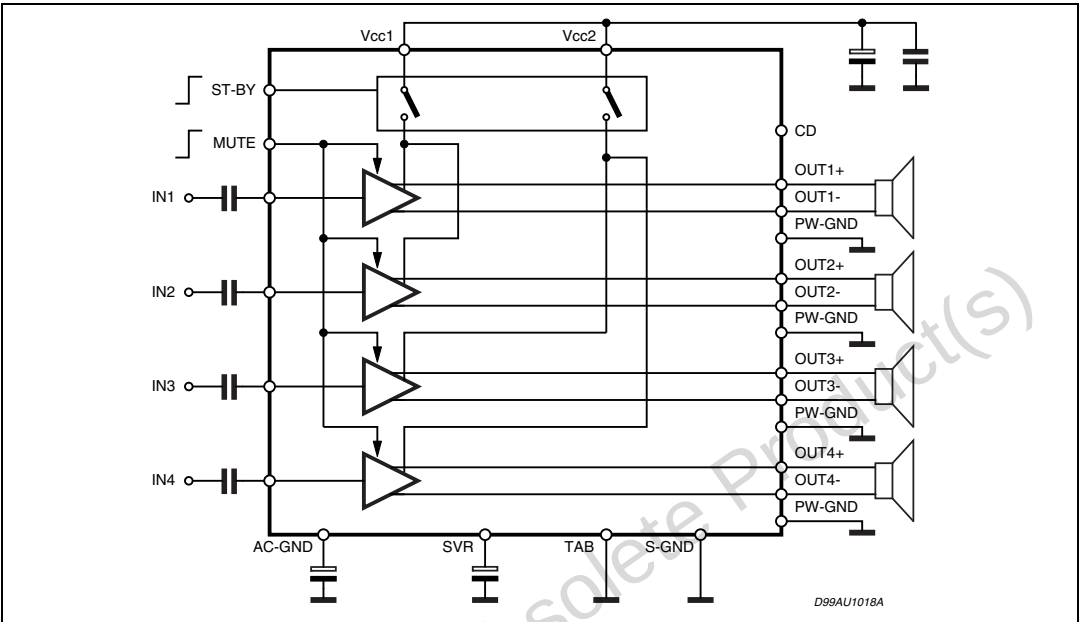
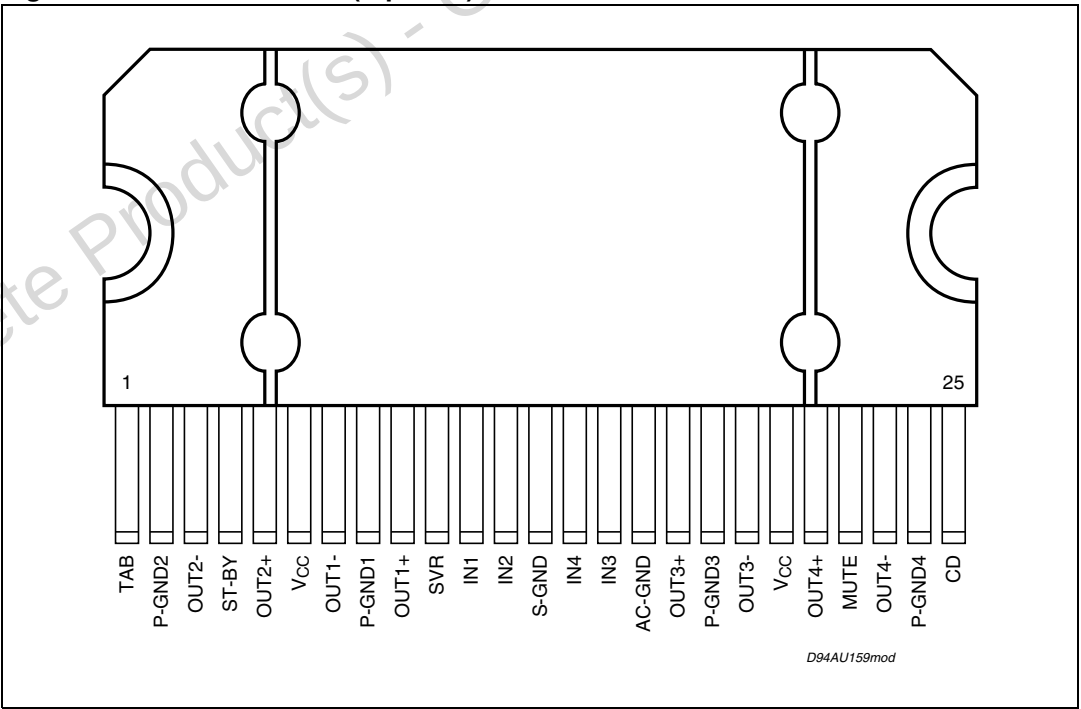


Figure 2. Pin connection (top view)



## 2 Electrical specifications

### 2.1 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 ( $t = 50$ ms)                                  | 50          | V    |
| $I_O$       | Output peak current:<br>Repetitive (duty cycle 10 % at $f = 10$ Hz) | 4.5         | A    |
|             | Non repetitive ( $t = 100$ $\mu$ s)                                 | 5.5         |      |
| $P_{tot}$   | Power dissipation, ( $T_{case} = 70$ °C)                            | 80          | W    |
| $T_j$       | Junction temperature                                                | 150         | °C   |
| $T_{stg}$   | Storage temperature                                                 | – 55 to 150 | °C   |

### 2.2 Thermal data

Table 3. Thermal data

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

### 2.3 Electrical characteristics

Table 4. Electrical characteristics

( $V_S = 14.4$  V;  $f = 1$  KHz;  $R_g = 600\Omega$ ;  $R_L = 4\Omega$ ;  $T_{amb} = 25$  °C; Refer to the test and application diagram ([Figure 14](#)), unless otherwise specified.)

| Symbol       | Parameter                                   | Test condition                                      | Min. | Typ. | Max.     | Unit |
|--------------|---------------------------------------------|-----------------------------------------------------|------|------|----------|------|
| $I_{q1}$     | Quiescent current                           | $R_L = \infty$                                      |      | 150  | 350      | mA   |
| $V_{OS}$     | Output offset voltage                       | Play mode                                           |      |      | $\pm 80$ | mV   |
| $dV_{OS}$    | During mute on/off output offset voltage    | ITU R-ARM weighted<br>see <a href="#">Figure 13</a> | -10  |      | 10       | mV   |
|              | During standby on/off output offset voltage |                                                     | -50  |      | 50       |      |
| $G_v$        | Voltage gain                                |                                                     | 25   | 26   | 27       | dB   |
| $\Delta G_v$ | Channel gain unbalance                      |                                                     |      |      | $\pm 1$  | dB   |
| $P_o$        | Output power                                | THD = 10 %; $V_S = 14.4$ V                          | 26   | 28   |          | W    |
| $P_{o\ max}$ | Max.output power <sup>(1)</sup>             | $V_S = 14.4$ V                                      | 41   | 45   |          | W    |

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

( $V_S = 14.4V$ ;  $f = 1KHz$ ;  $R_g = 600\Omega$ ;  $R_L = 4\Omega$ ;  $T_{amb} = 25^\circ C$ ; Refer to the test and application diagram (Figure 14), unless otherwise specified.)

| Symbol              | Parameter                         | Test condition                                                                                               | Min. | Typ. | Max.       | Unit |
|---------------------|-----------------------------------|--------------------------------------------------------------------------------------------------------------|------|------|------------|------|
| THD                 | Distortion                        | P <sub>o</sub> = 4W                                                                                          |      | 0.04 | 0.10       | %    |
| e <sub>No</sub>     | Output noise                      | "A" Weighted                                                                                                 |      | 50   | 70         | μV   |
|                     |                                   | Bw = 20 Hz to 20 kHz                                                                                         |      | 70   | 100        | μV   |
| SVR                 | Supply voltage rejection          | f = 100 Hz; V <sub>r</sub> = 1 V <sub>rms</sub>                                                              | 50   | 75   |            | dB   |
| f <sub>ch</sub>     | High cut-off frequency            | P <sub>o</sub> = 0.5 W                                                                                       | 100  | 200  |            | KHz  |
| R <sub>i</sub>      | Input Impedance                   |                                                                                                              | 70   | 100  | 150        | KΩ   |
| C <sub>T</sub>      | Cross talk                        | f = 1 kHz; P <sub>o</sub> = 4 W                                                                              | 60   | 75   |            | dB   |
|                     |                                   | f = 10 kHz; P <sub>o</sub> = 4 W                                                                             |      | 60   |            | dB   |
| I <sub>SB</sub>     | Standby current consumption       | V <sub>St-by</sub> = 1.2 V                                                                                   |      |      | 50         | μA   |
|                     |                                   | V <sub>St-by</sub> = 0 V                                                                                     |      |      | 25         |      |
| I <sub>pin4</sub>   | Standby pin current               | V <sub>St-by</sub> = 1.2 to 2.6 V                                                                            |      |      | ±1         | μA   |
| V <sub>SB out</sub> | Standby Out threshold voltage     | (Amp: ON)                                                                                                    | 2.6  |      |            | V    |
| V <sub>SB IN</sub>  | Standby In threshold voltage      | (Amp: OFF)                                                                                                   |      |      | 1.2        | V    |
| A <sub>M</sub>      | Mute attenuation                  | P <sub>Oref</sub> = 4 W                                                                                      | 80   | 90   |            | dB   |
| V <sub>M out</sub>  | Mute Out threshold voltage        | (Amp: play)                                                                                                  | 2.6  |      |            | V    |
| V <sub>M in</sub>   | Mute In threshold voltage         | (Amp: mute)                                                                                                  |      |      | 1.2        | V    |
| V <sub>AM in</sub>  | V <sub>S</sub> automute threshold | (Amp: mute); Att ≥ 80 dB;<br>P <sub>Oref</sub> = 4 Ω<br>(Amp: Play); Att < 0.1 dB;<br>P <sub>o</sub> = 0.5 W |      | 7.6  | 6.5<br>8.5 | V    |
| I <sub>pin22</sub>  | Muting pin current                | V <sub>MUTE</sub> = 1.2 V<br>(Source current)                                                                | 5    | 11   | 20         | μA   |
|                     |                                   | V <sub>MUTE</sub> = 2.6 V                                                                                    | -5   | -    | -20        |      |
| Clipping detector   |                                   |                                                                                                              |      |      |            |      |
| CD <sub>LK</sub>    | Clip det high leakage current     | CD Off                                                                                                       |      |      | 1          | μA   |
| CD <sub>SAT</sub>   | Clip det sat voltage              | DC On; I <sub>CD</sub> = 1m A                                                                                |      | 0.2  | 0.4        | V    |
| CD <sub>THD</sub>   | Clip det THD level                | P <sub>o</sub> > 16 W                                                                                        |      |      | 2          | %    |

1. Saturated square wave output.

2.4 Electrical characteristic curves

Figure 3. Quiescent current vs. supply voltage

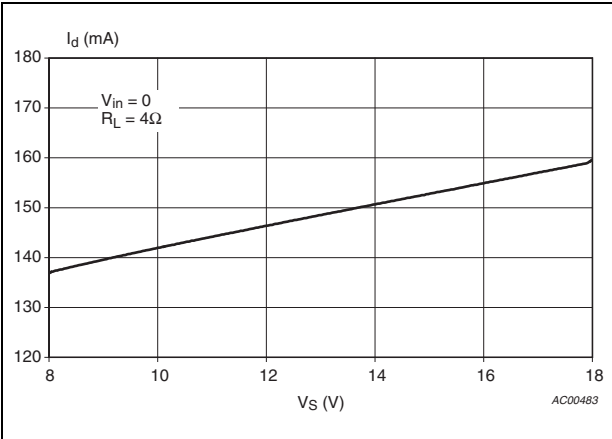


Figure 4. Quiescent output voltage vs. supply voltage

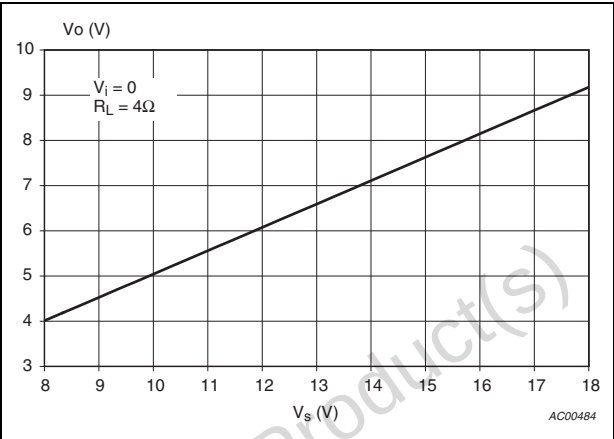


Figure 5. Output power vs. supply voltage

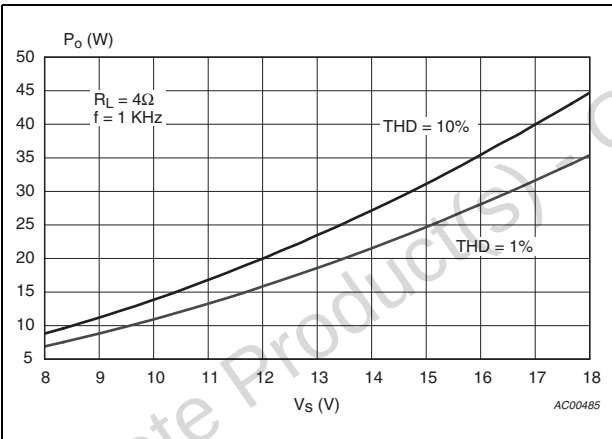


Figure 6. Maximum output power vs. supply voltage

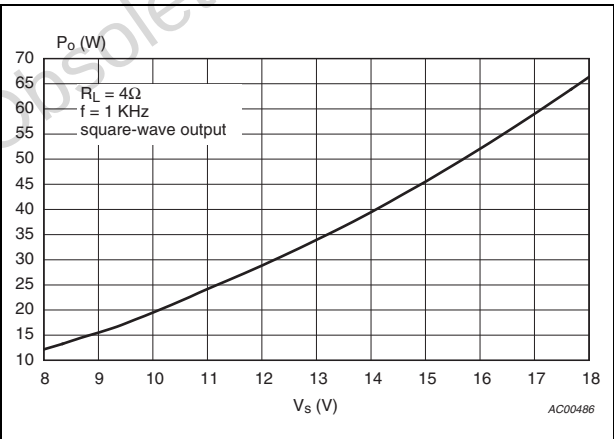


Figure 7. Distortion vs. output power

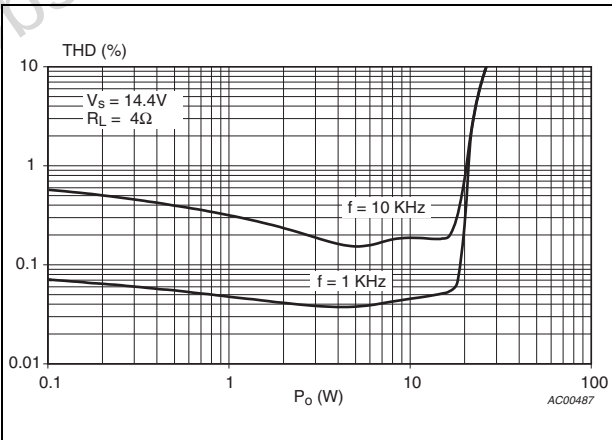


Figure 8. Distortion vs. frequency

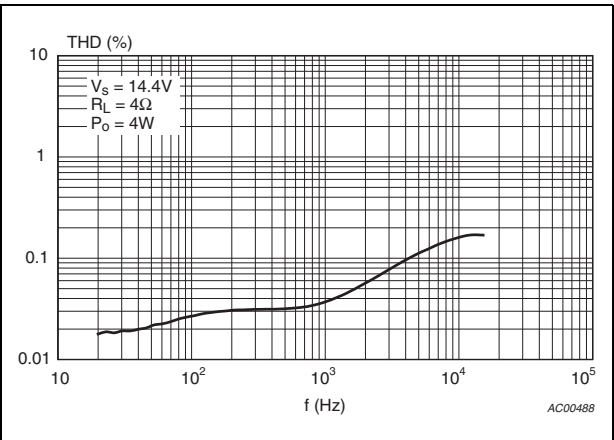


**Figure 9. Supply voltage rejection vs. frequency**

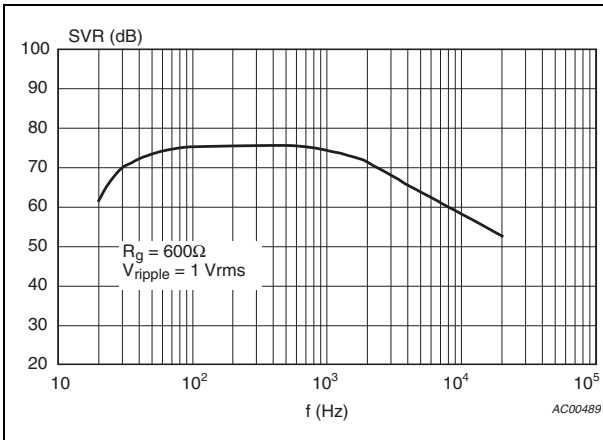


**Figure 10. Crosstalk vs. frequency**

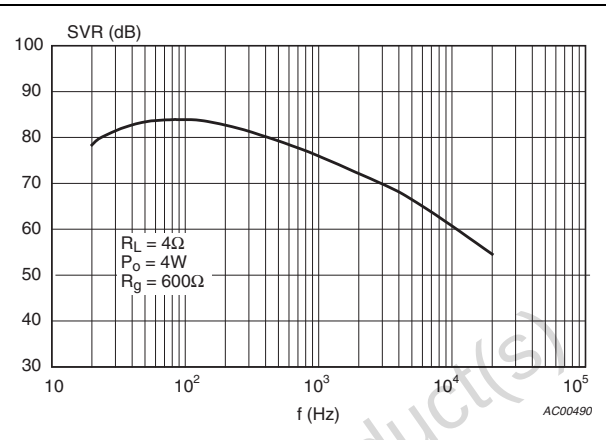


**Figure 11. Output noise vs. source resistance**

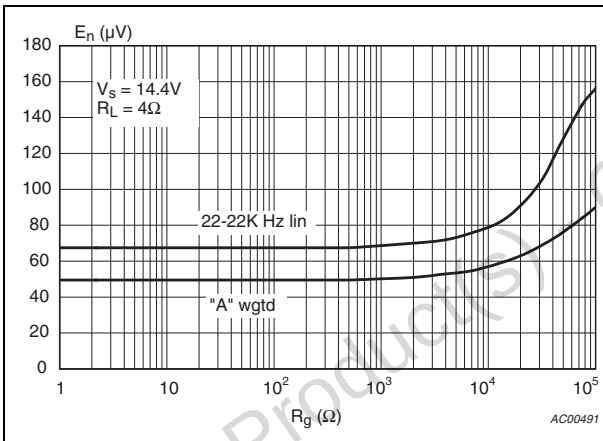


**Figure 12. Power dissipation & efficiency vs. output power**

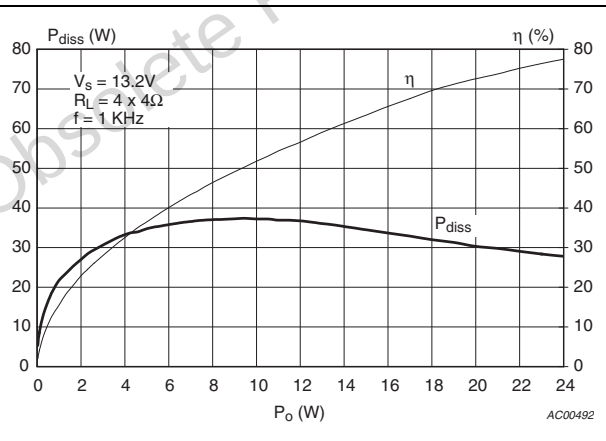
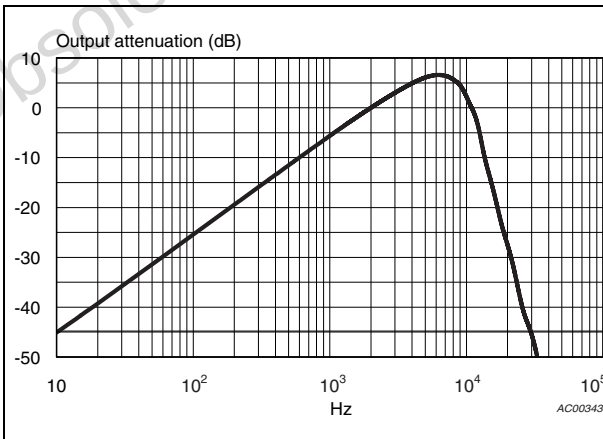
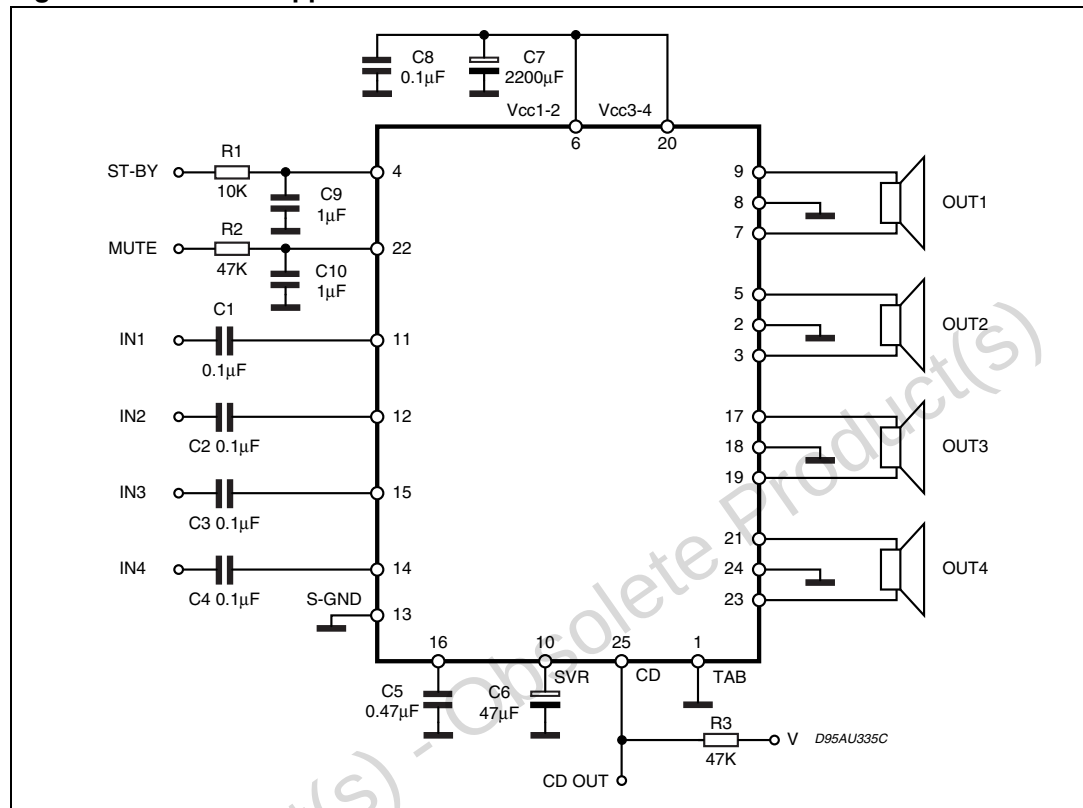


**Figure 13. ITU R-ARM frequency response, weighting filter for transient pop**





## 3 Application hints

Ref. to the circuit of [Figure 14](#).

### 3.1 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 22 $\mu$ F**, 47 $\mu$ F can be used to optimize pop performances.

### 3.2 Input stage

The TDA7389's inputs are ground-compatible and can stand very high input signals ( $\pm 8$ Vpk) without any performances degradation.

If the standard value for the input capacitors (0.1 $\mu$ F) is adopted, the low frequency cut-off will amount to 16 Hz.

The input capacitors should be 1/4 of the capacitor connected to AC-GND pin for optimum pop performances.

### 3.3 Standby and muting

Standby and Muting facilities are both 3.3V CMOS-compatible. If unused, a straight connection to  $V_s$  of their respective pins would be admissible.

Conventional/low-power transistors can be employed to drive muting and stand-by pins in absence of true CMOS ports or microprocessors. R-C cells have always to be used in order to smooth down the transitions for preventing any audible transient noises.

Since a DC current of about 10 $\mu$ A normally flows out of pin 23, the maximum allowable muting-series resistance ( $R_2$ ) is 70 k $\Omega$ , which is sufficiently high to permit a muting capacitor reasonably small (about 1 $\mu$ F).

If  $R_2$  is higher than recommended, the involved risk will be that the voltage at pin 23 may rise to above the 1.2V threshold voltage and the device will consequently fail to turn OFF when the mute line is brought down.

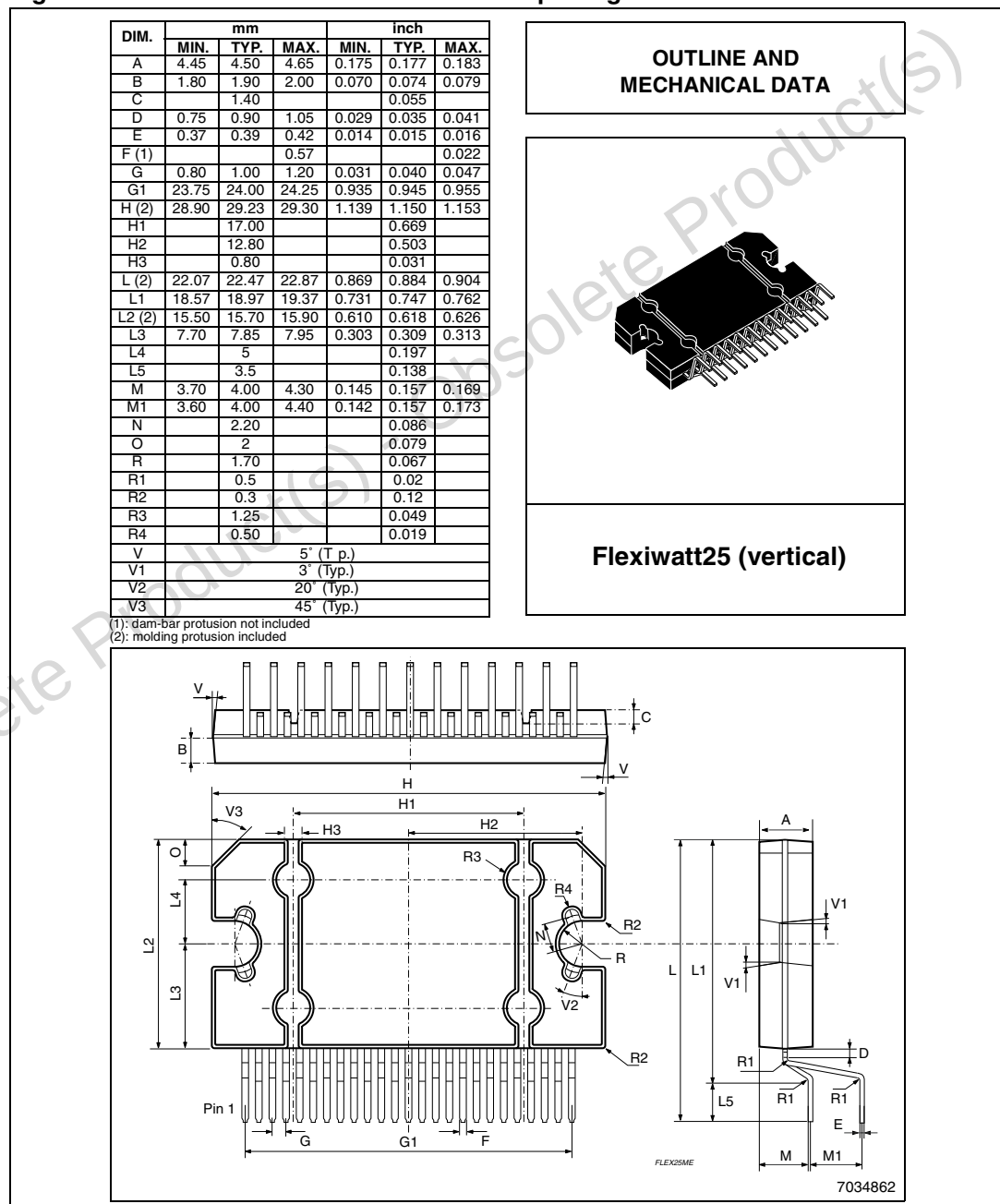
About the standby, the time constant to be assigned in order to obtain a virtually pop-free transition has to be slower than 2.5V/ms.

## 4 Package information

In order to meet environmental requirements, ST (also) offers these devices in ECOPACK<sup>®</sup> packages. ECOPACK<sup>®</sup> packages are lead-free. The category of second Level Interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label.

ECOPACK is an ST trademark. ECOPACK specifications are available at: [www.st.com](http://www.st.com).

**Figure 15. Flexiwatt25 mechanical data and package dimensions**



## 5 Revision history

**Table 5. Document revision history**

| Date        | Revision | Changes                                                       |
|-------------|----------|---------------------------------------------------------------|
| 09-Nov-2007 | 1        | Initial release.                                              |
| 20-Oct-2008 | 2        | Updated the <a href="#">Table 3: Thermal data on page 6</a> . |
| 17-Sep-2013 | 3        | Updated Disclaimer.                                           |

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