

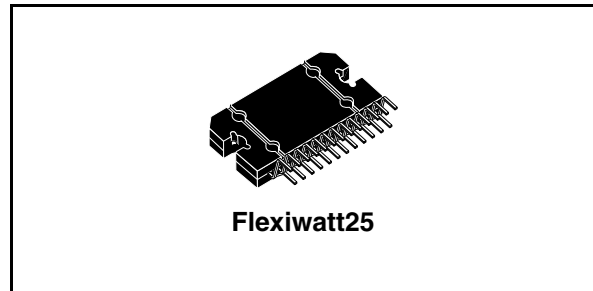
## 4 x 45 W quad bridge car radio amplifier

### Features

- High output power capability:
  - 4 x 45W/4Ω max.
  - 4 x 28W/4Ω @ 14.4V, 1KHz, 10%
  - 4 x 24W/4Ω @ 13.2V, 1KHz, 10%
- Low distortion
- Low output noise
- Standby function
- Mute function
- Automute at min. supply voltage detection
- Low external component count:
  - Internally fixed gain (26dB)
  - No external compensation
  - No bootstrap capacitors

### 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 TDA7386 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 TDA7386 allows a rail to rail output voltage swing with no need of bootstrap capacitors. The extremely reduced boundary components count allows very compact sets.

**Table 1. Device summary**

Order code	Package	Packing
TDA7386	Flexiwatt25	Tube

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# 1 Block and pin connection diagrams

Figure 1. Block diagram

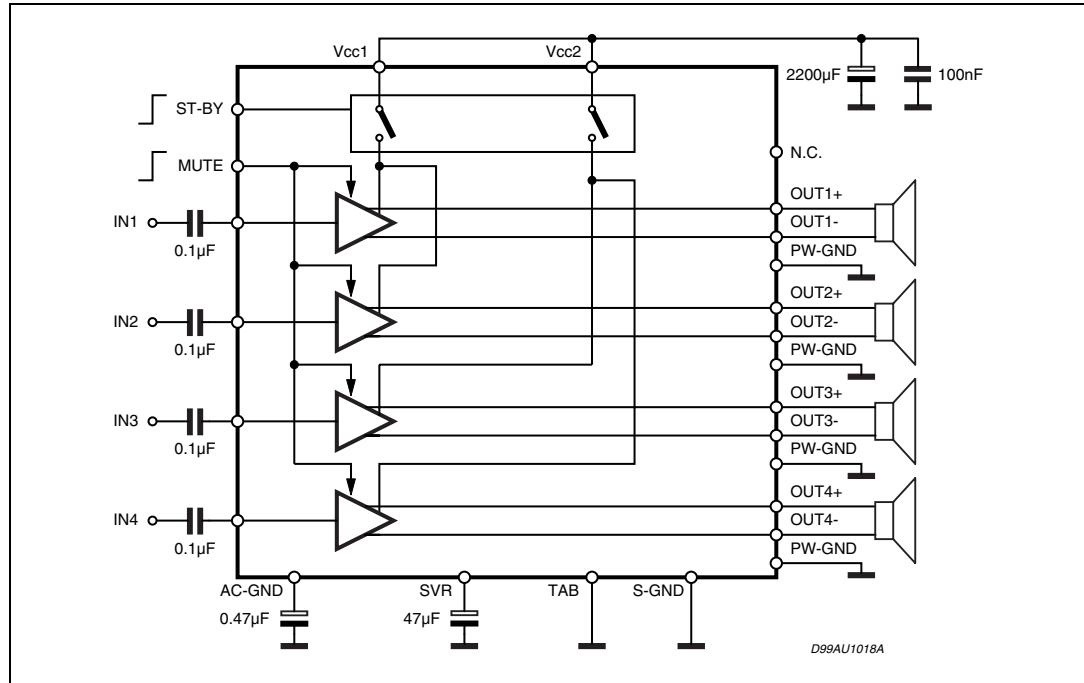
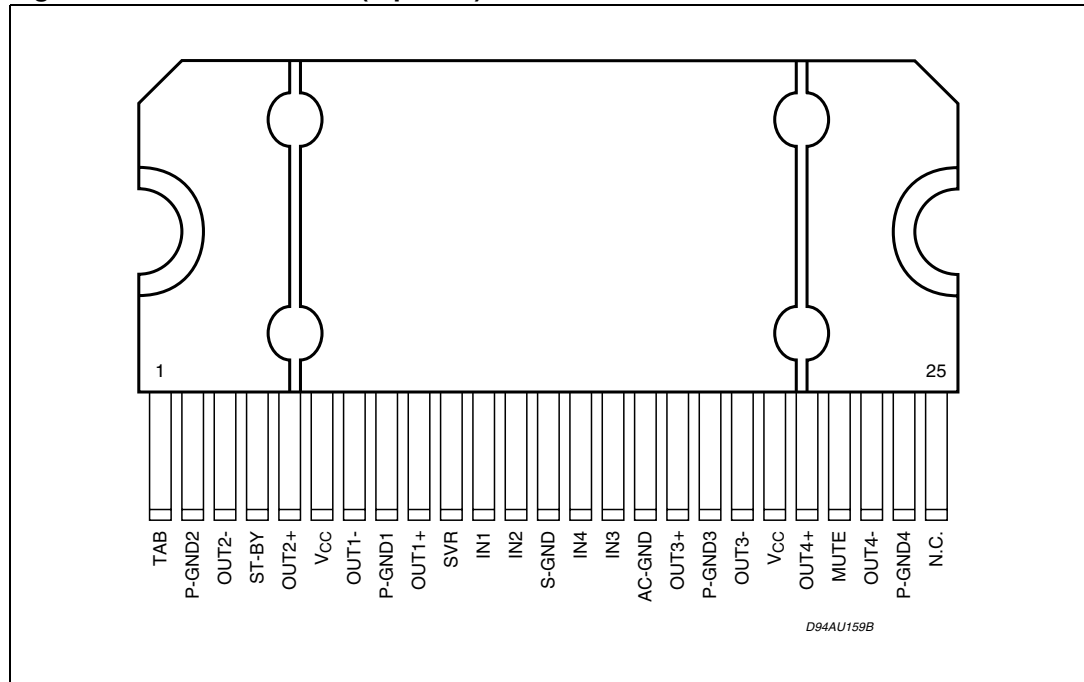


Figure 2. Pin connection (top view)



## 2 Electrical specifications

### 2.1 Absolute maximum ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
$V_{CC}$	Operating supply voltage	18	V
$V_{CC(DC)}$	DC supply voltage	28	V
$V_{CC(pk)}$	Peak supply voltage (t = 50ms)	50	V
$I_O$	Output peak current: Repetitive (Duty Cycle 10% at f = 10Hz)	4.5	A
	Non Repetitive (t = 100 $\mu$ s)	5.5	A
$P_{tot}$	Power dissipation, ( $T_{case} = 70^{\circ}C$ )	80	W
$T_{amb}$	Operating temperature range	- 40 to 105	$^{\circ}C$
$T_j$	Junction temperature	150	$^{\circ}C$
$T_{stg}$	Storage temperature	- 55 to 150	$^{\circ}C$

### 2.2 Thermal data

Table 3. Thermal data

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

### 2.3 Electrical characteristics

Table 4. Electrical characteristics

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

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
$I_{q1}$	Quiescent current	$R_L = \infty$		190	350	mA
$V_{OS}$	Output offset voltage	Play Mode			$\pm 80$	mV
$\Delta V_{OS}$	During mute on/off output offset voltage				$\pm 80$	mV
$G_v$	Voltage gain		25	26	27	dB
$\Delta G_v$	Channel gain unbalance				$\pm 1$	dB
$P_O$	Output power	THD = 10%; $V_S = 13.2V$	22	24		W
		THD = 0.8%; $V_S = 13.2V$	16.5	18		W
		THD = 10%; $V_S = 14.4V$	26	28		W
$P_{Omax}$	Max.output power <sup>(1)</sup>	$V_S = 14.4V$	43	45		W

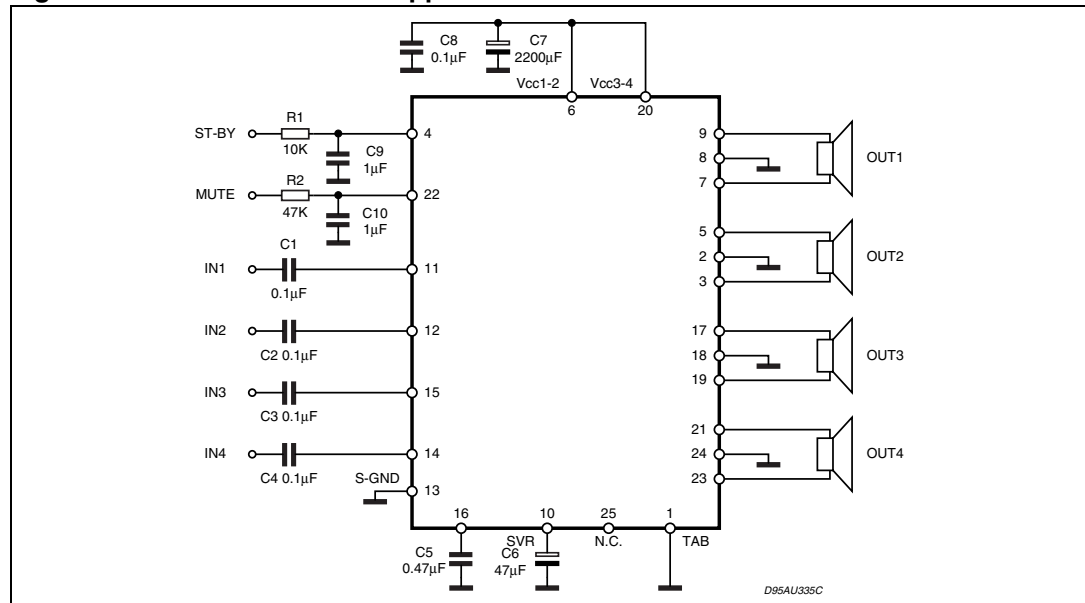
**Table 4. Electrical characteristics (continued)**

$V_S = 14.4\text{ V}$ ;  $f = 1\text{ kHz}$ ;  $R_G = 600\ \Omega$ ;  $R_L = 4\ \Omega$ ;  $T_{\text{amb}} = 25\text{ }^\circ\text{C}$ ; Refer to the test and application diagram, unless otherwise specified.

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
THD	Distortion	$P_o = 4\text{ W}$		0.04	0.15	%
$e_{\text{No}}$	Output noise	"A" Weighted		50	70	$\mu\text{V}$
		$B_w = 20\text{ Hz to } 20\text{ kHz}$		70	100	$\mu\text{V}$
SVR	Supply voltage rejection	$f = 100\text{ Hz}$ ; $V_r = 1V_{\text{rms}}$	50	75		dB
$f_{\text{ch}}$	High cut-off frequency	$P_o = 0.5\text{ W}$	80	200		KHz
$R_i$	Input impedance		70	100		$\text{K}\Omega$
$C_T$	Cross talk	$f = 1\text{ kHz}$ ; $P_o = 4\text{ W}$	60	70		dB
		$f = 10\text{ kHz}$ ; $P_o = 4\text{ W}$		60		dB
$I_{\text{SB}}$	Standby current consumption	$V_{\text{St-by}} = 1.5$			50	$\mu\text{A}$
		$V_{\text{St-by}} = 0\text{ V}$			20	$\mu\text{A}$
$I_{\text{pin4}}$	Standby pin current	$V_{\text{St-by}} = 1.5\text{ to } 3.5\text{ V}$			$\pm 1$	$\mu\text{A}$
$V_{\text{SB out}}$	Standby out threshold voltage	(Amp: on)	3.5			V
$V_{\text{SB IN}}$	Standby in threshold voltage	(Amp: off)			1.5	V
$A_M$	Mute attenuation	$P_{\text{Oref}} = 4\text{ W}$	80	90		dB
$V_{\text{M out}}$	Mute out threshold voltage	(Amp: play)	3.5			V
$V_{\text{M in}}$	Mute in threshold voltage	(Amp: mute)			1.5	V
$V_{\text{AM in}}$	$V_S$ automute threshold	(Amp: mute); $\text{Att} \geq 80\text{ dB}$ ; $P_{\text{Oref}} = 4\Omega$			6.5	V
		(Amp: play); $\text{Att} < 0.1\text{ dB}$ ; $P_o = 0.5\Omega$		7.6	8.5	V
$I_{\text{pin22}}$	Muting pin current	$V_{\text{MUTE}} = 1.5\text{ V}$ (Source current)	5	11	20	$\mu\text{A}$
		$V_{\text{MUTE}} = 3.5\text{ V}$	-5	-	20	$\mu\text{A}$

1. Saturated square wave output.

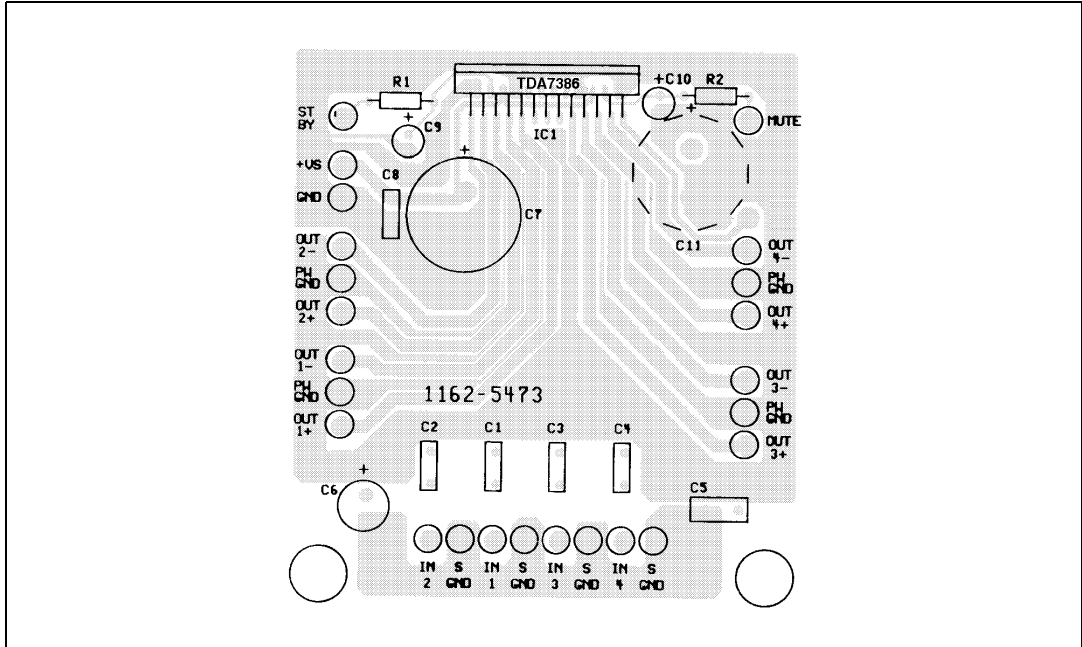
**Figure 3. Standard test and application circuit**



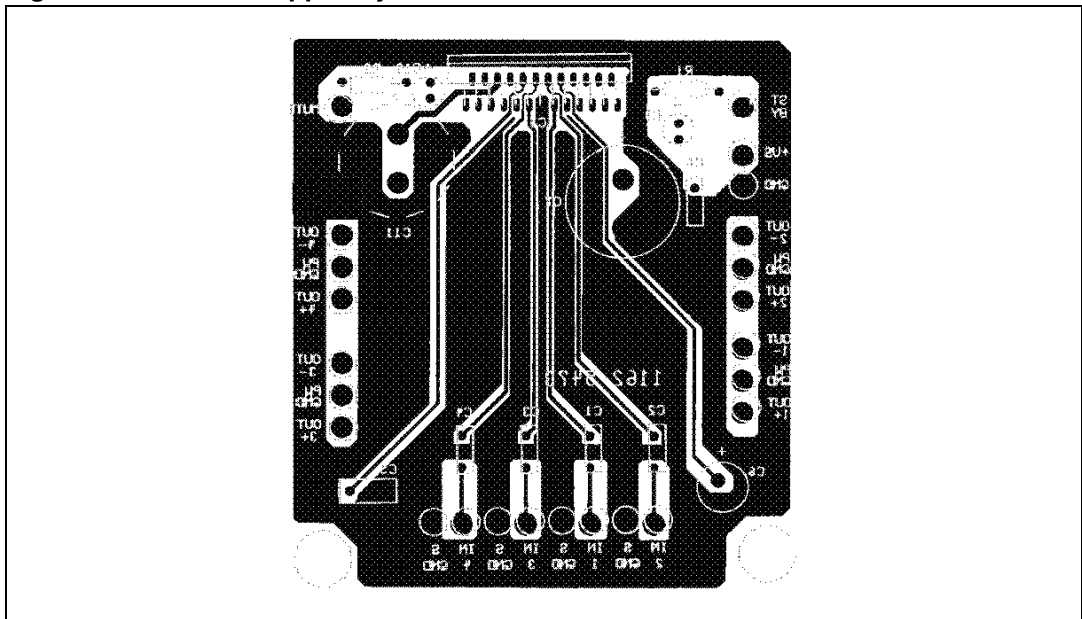
## 2.4 PCB and component layout

Referred to the circuit of [Figure 3](#).

**Figure 4. Components and top copper layer**



**Figure 5. Bottom copper layer**





## 2.5 Electrical characteristics curves

Figure 6. Quiescent current vs. supply voltage      Figure 7. Quiescent output voltage vs. supply voltage

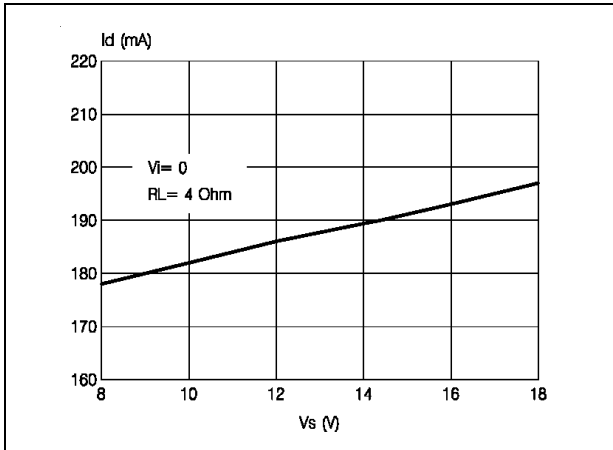


Figure 8. Output power vs. supply voltage

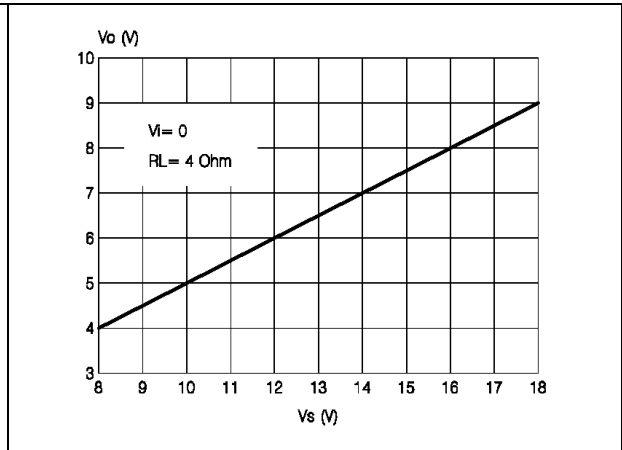


Figure 9. Max. output power vs. supply voltage

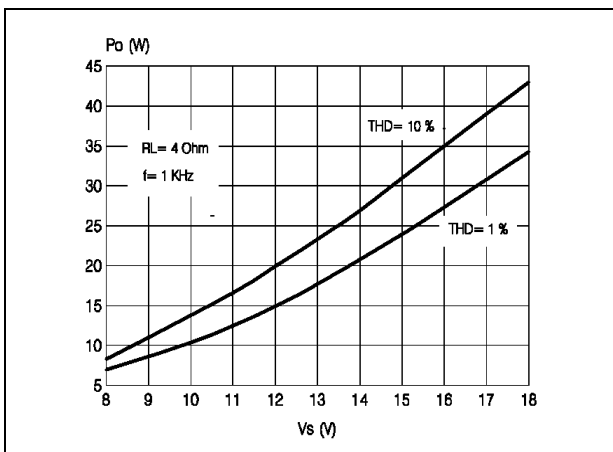


Figure 10. Distortion vs. output power

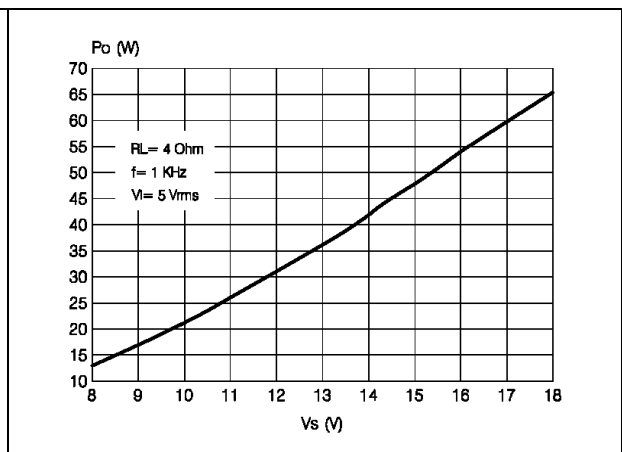


Figure 11. Distortion vs. frequency

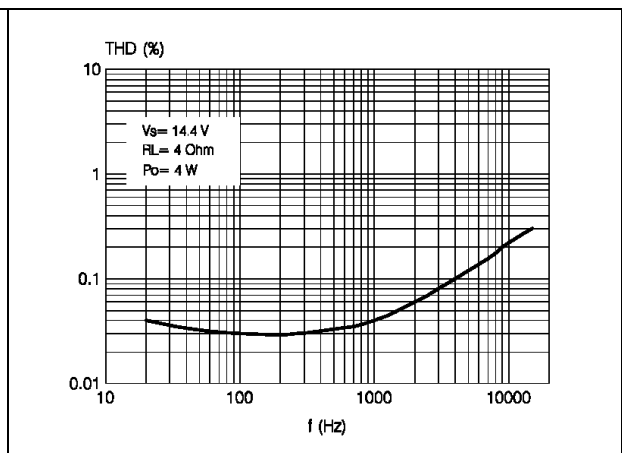
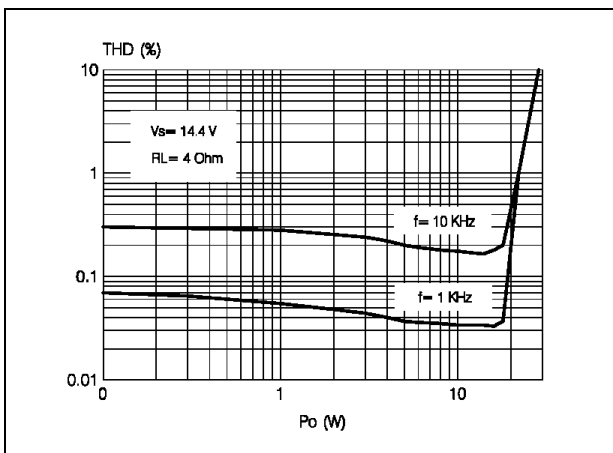


Figure 12. Supply voltage rejection vs. frequency

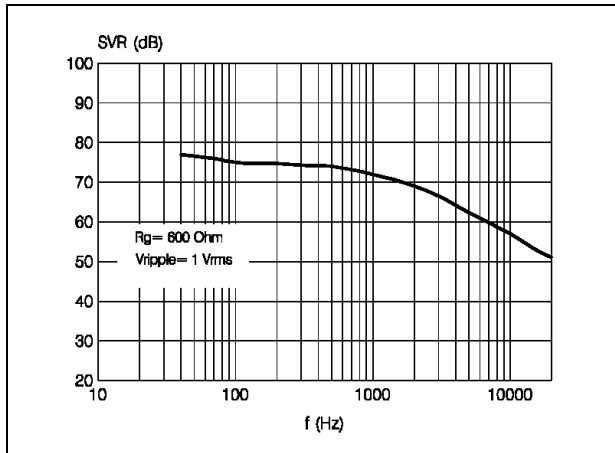


Figure 13. Crosstalk vs. frequency

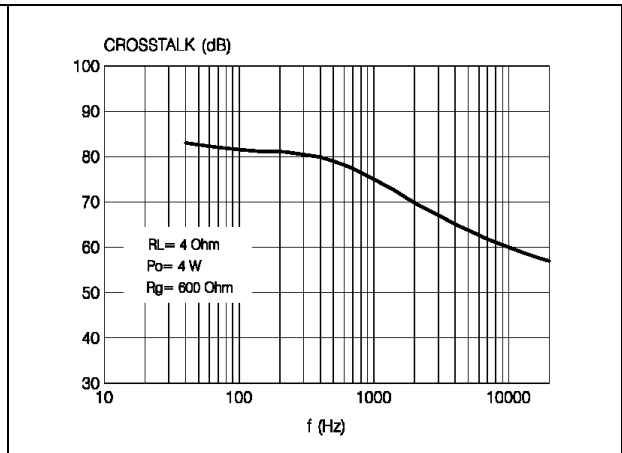


Figure 14. Output noise vs. source resistance

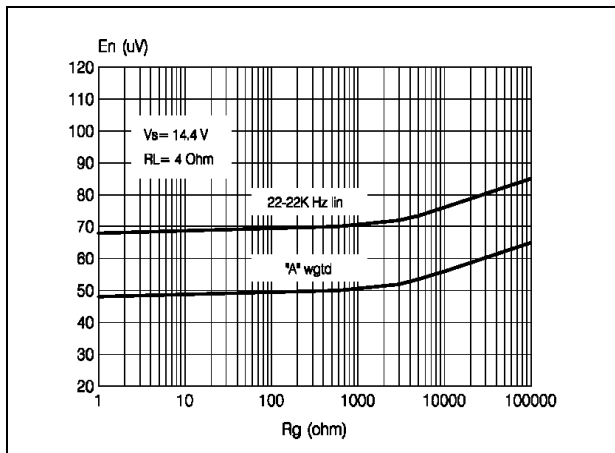
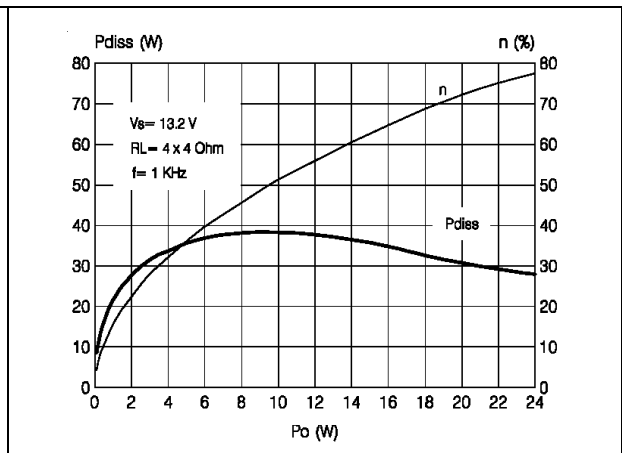


Figure 15. Power dissipation and efficiency vs. output power



## 3 Application hints

Referred to the circuit of [Figure 3](#).

### 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 10 $\mu$ F**.

### 3.2 Input stage

The TDA7386'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.

### 3.3 Standby and muting

Standby and muting facilities are both CMOS-compatible. If unused, a straight connection to Vs 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 22, 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 22 may rise to above the 1.5 V threshold voltage and the device will consequently fail to turn OFF when the mute line is brought down.

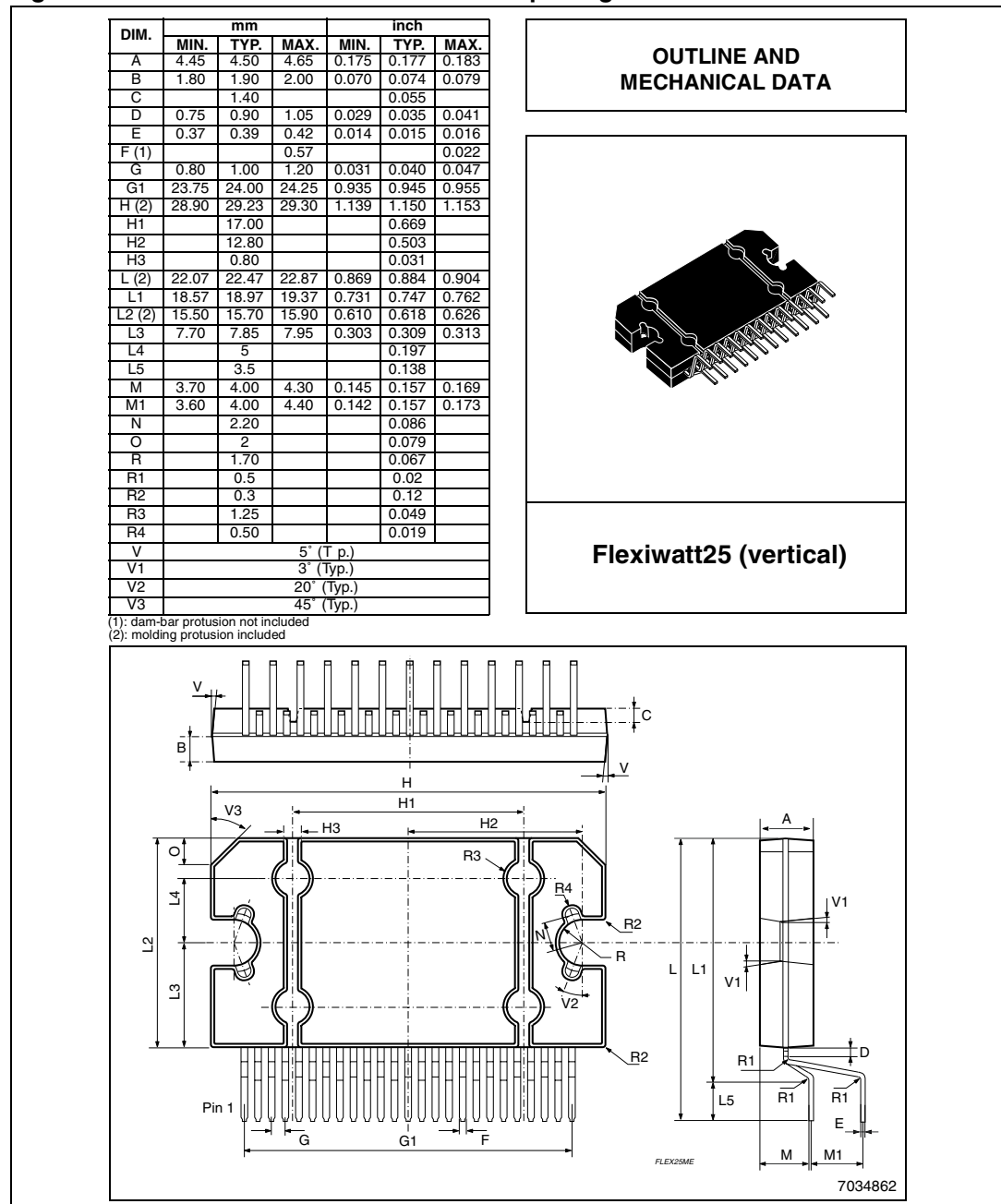
About the stand-by, the time constant to be assigned in order to obtain a virtually pop-free transition has to be slower than 2.5V/ms.

# 4 Package information

In order to meet environmental requirements, ST (also) offers these devices in ECOPACK® packages. ECOPACK® 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 16. Flexiwatt25 mechanical data and package dimensions**



## 5 Revision history

**Table 5. Document revision history**

Date	Revision	Changes
24-Nov-2001	1	Initial release.
20-Dec-2007	2	Document reformatted. Modified the <i>Features on page 1</i> . Modified the <i>Figure 1</i> and <i>2</i> . Updated the <i>Table 4: Electrical characteristics</i> .
29-Oct-2008	3	Updated the <i>Table 3: Thermal data on page 6</i> .
19-Nov-2008	4	Update the <i>Table 2: Absolute maximum ratings on page 6</i> .

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