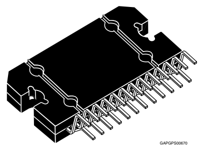
TDA7851F

4 x 48 W MOSFET quad bridge power amplifier

Datasheet — production data

Features

- Multipower BCD technology
- High output power capability:
  - 4 x 48 W/4 Ω max.
  - 4 x 28 W/4 Ω @ 14.4 V, 1 kHz, 10 %
  - 4 x 72 W/2 Ω max.
- MOSFET output power stage
- Excellent 2 Ω driving capability
- Hi-Fi class 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
- Output DC offset detector
- 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



Flexiwatt25

Description

The TDA7851F is a breakthrough MOSFET technology class AB audio power amplifier, designed for high-power car radio.

The fully complementary P-Channel/N-Channel output structure allows a rail-to-rail output voltage swing. This, combined with high output current and minimized saturation losses, sets new power references in the car-radio field, with unparalleled distortion performance.

Table 1. Device summary

Order code	Package	Packing
TDA7851F	Flexiwatt25	Tube

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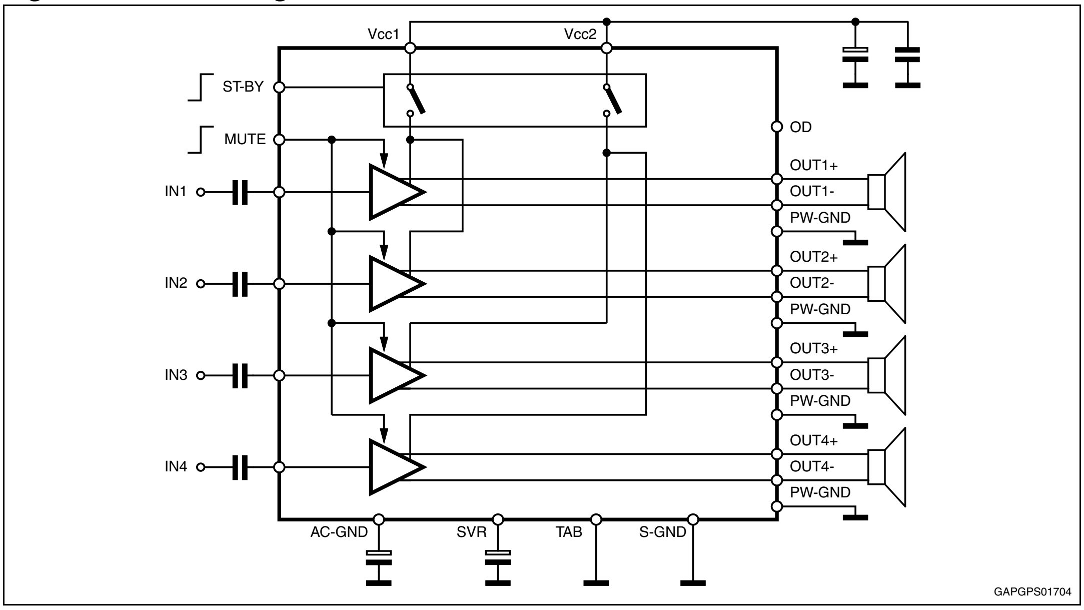
1 Block diagram and application circuit

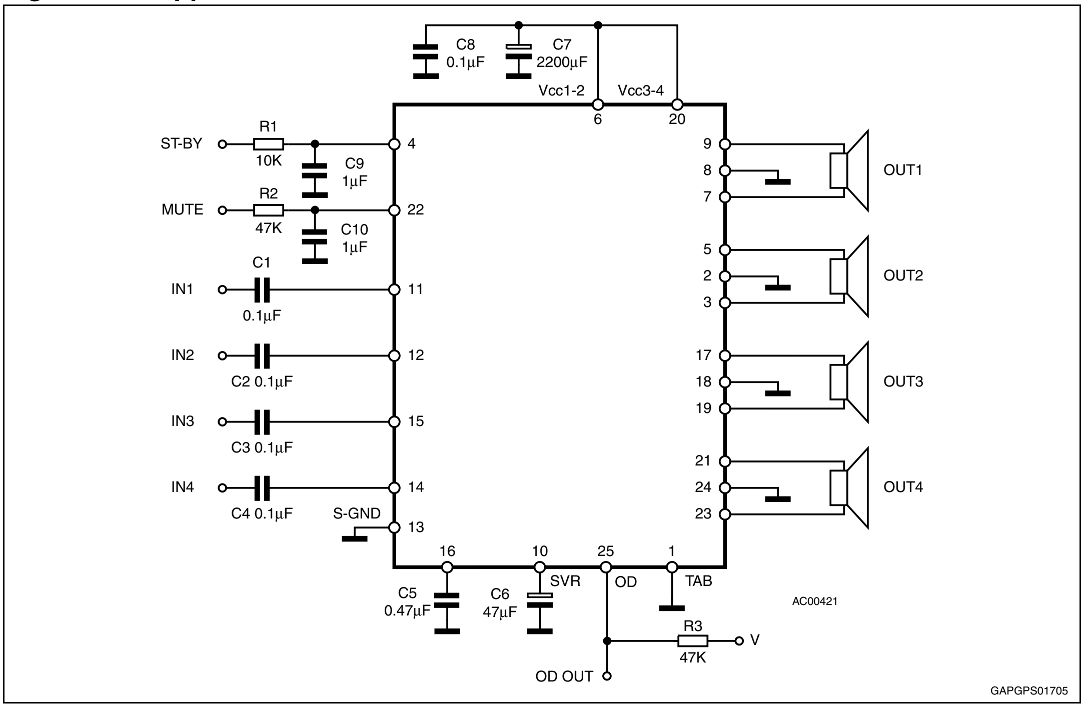
1.1 Block diagram

Figure 1. Block diagram



1.2 Application circuit

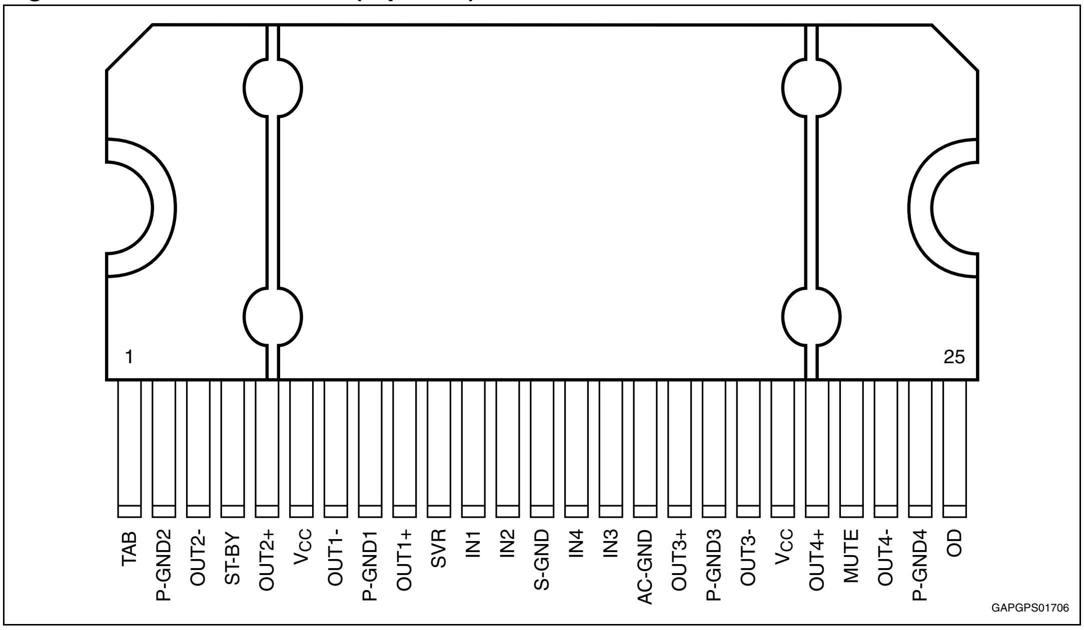
Figure 2. Application circuit



2 Pin description

2.1 Pin connection

Figure 3. Pin connection (top view)



2.2 Thermal data

Table 2. Thermal data

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

3 Electrical specifications

3.1 Absolute maximum ratings

Table 3. 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 Non repetitive (t = 100 µs) Repetitive (duty cycle 10 % at f = 10 Hz)	 10 9	 A A
P_{tot}	Power dissipation T_{case} = 70 °C	85	W
T_j	Junction temperature	150	°C
T_{stg}	Storage temperature	-55 to 150	°C

3.2 Electrical characteristics

Refer to the test and application diagram, V_S = 14.4 V; R_L = 4Ω; 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
V_S	Supply voltage range	-	8	-	18	V
I_{q1}	Quiescent current	$R_L = \infty$	100	150	300	mA
V_{OS}	Output offset voltage	Play mode / Mute mode	-60	-	+60	mV
dV_{OS}	During mute ON/OFF output offset voltage	ITU R-ARM weighted see *Figure 18*	-10	-	+10	mV
	During standby ON/OFF output offset voltage		-10	-	+10	mV
G_v	Voltage gain	-	25	26	27	dB
dG_v	Channel gain unbalance	-			±1	dB
P_o	Output power	V_S = 14.4 V; THD = 10 % V_S = 14.4 V; THD = 1 %	25	28 22	-	W W
		V_S = 14.4 V; THD = 10 %, 2 Ω V_S = 14.4 V; THD = 1 %, 2 Ω	-	48 38	-	W W
$P_{o\ max.}$	Max. output power(1)	V_S = 14.4 V; R_L = 4 Ω V_S = 14.4 V; R_L = 2 Ω; Vs = 15.2V; R_L = 4 Ω (square wave input (2 Vrms))	-	45 75 48	-	W

Table 4. Electrical characteristics (continued)

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
THD	Distortion	$P_o = 4$ W	-	0.01	0.05	%
e_{No}	Output noise	"A" Weighted Bw = 20 Hz to 20 kHz	-	35 50	 100	µV µV
SVR	Supply voltage rejection	f = 100 Hz; $V_r = 1$ Vrms	50	70	-	dB
f_{ch}	High cut-off frequency	$P_O = 0.5$W	100	300	-	kHz
R_i	Input Impedance	-	70	100	130	kΩ
C_T	Cross talk	f = 1 kHz $P_O = 4$ W f = 10 kHz $P_O = 4$ W	60	70 60	- -	dB dB
I_{SB}	Standby current consumption	$V_{St\text{-}By} = 1.2$ V	-	-	20	µA
		$V_{St\text{-}By} = 0$	-	-	10	µA
I_{pin5}	Standby pin current	$V_{St\text{-}By} = 1.2$ V to 2.6 V	-	-	±1	µA
$V_{SB\ out}$	Standby out threshold voltage	(Amp: ON)	2.6	-		V
$V_{SB\ in}$	Standby in threshold voltage	(Amp: OFF)	-	-	1.2	V
A_M	Mute attenuation	$P_{Oref} = 4$ W	80	90		dB
$V_{M\ out}$	Mute out threshold voltage	(Amp: Play)	2.6	-		V
$V_{M\ in}$	Mute in threshold voltage	(Amp: Mute)	-	-	1.2	V
$V_{AM\ in}$	V_S automute threshold	(Amp: Mute) Att ≥ 80 dB; $P_{Oref} = 4$ W (Amp: Play) Att < 0.1 dB; $P_O = 0.5$ W	6.7	7 7.5	 8	V V
Ipin23	Muting pin current	$V_{MUTE} = 1.2$ V (Sourced current)	7	12	18	µA
		$V_{MUTE} = 2.6$ V	-5	-	18	µA
Offset detector						
V_{OFF}	Detected diff. output offset	$V_{ST\text{-}BY} = 5$ V	±1	±2	±3	V
V_{OFF_SAT}	Off detector sat voltage	Vo > ±3 V, $I_{off\ Det} = 1$ mA 0 V < $V_{off\ Det}$ < 18 V	-	0.2	0.4	V
V_{OFF_LK}	Off detector leakage current	Vo < ±1 V	-	0	15	µA

1. Saturated square wave output

3.3 Electrical characteristics curves

Figure 4. Quiescent current vs. supply voltage

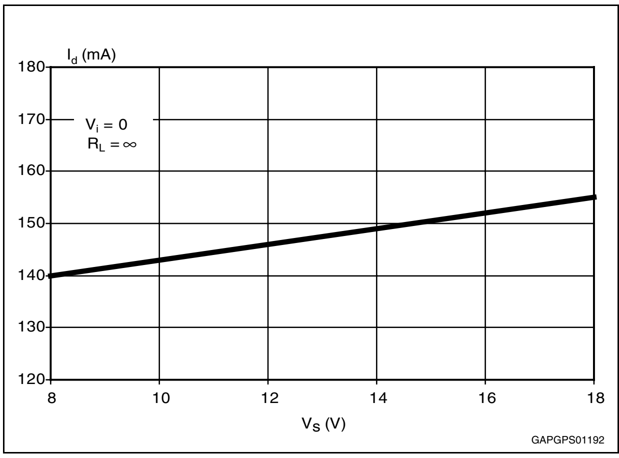


Figure 5. Output power vs. supply voltage (R_L = 4 Ω)

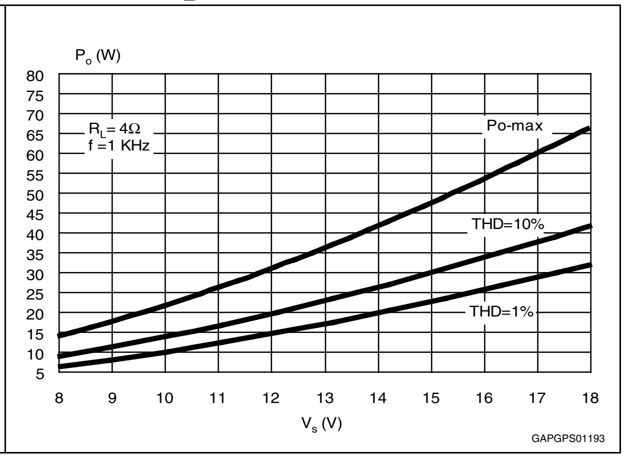


Figure 6. Output power vs. supply voltage (R_L = 2 Ω)

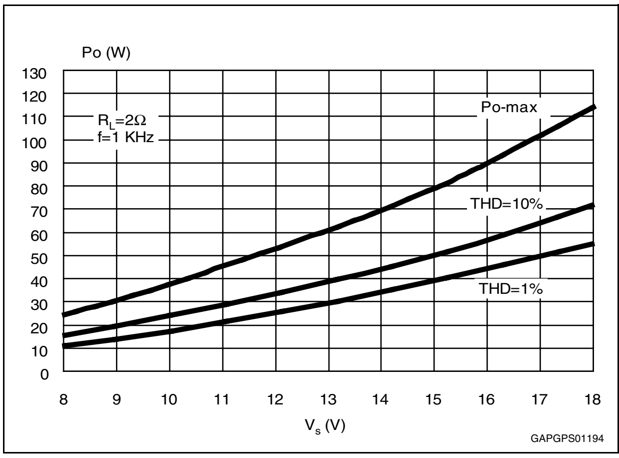


Figure 7. Distortion vs. output power (R_L = 4 Ω)

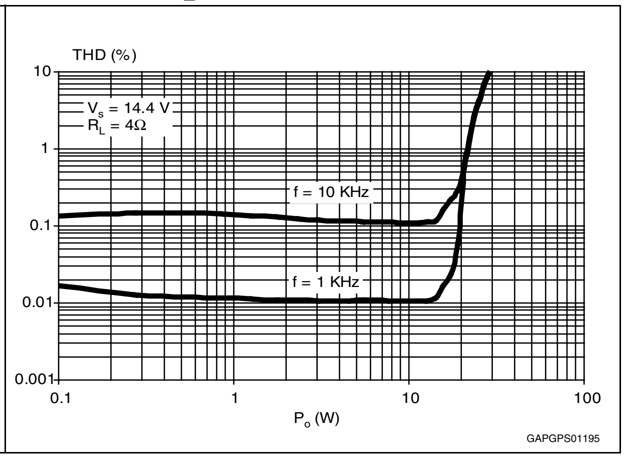


Figure 8. Distortion vs. output power (R_L = 2 Ω)

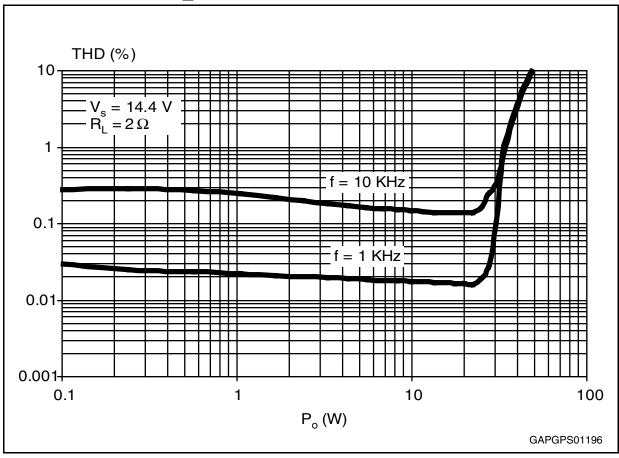


Figure 9. Distortion vs. frequency (R_L = 4 Ω)

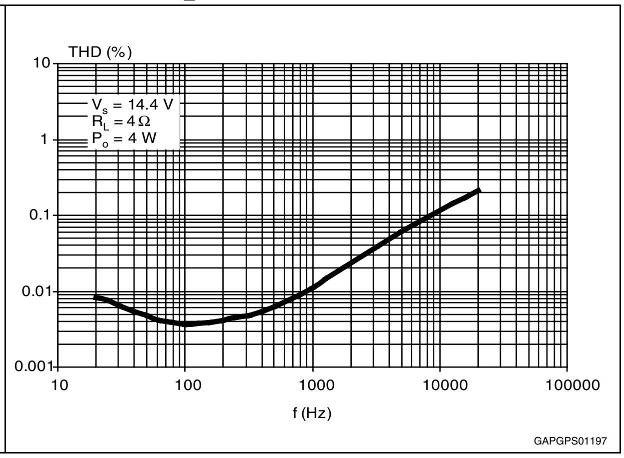


Figure 10. Distortion vs. frequency (R_L = 2 Ω)

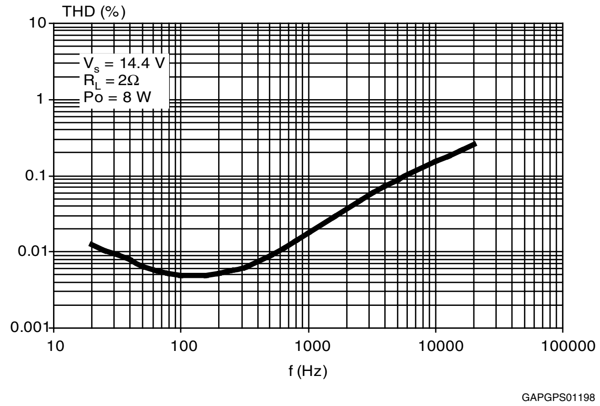


Figure 11. Crosstalk vs. frequency

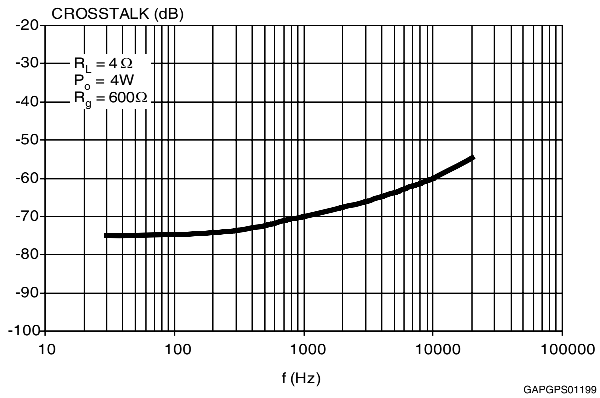


Figure 12. Supply voltage rejection vs. frequency

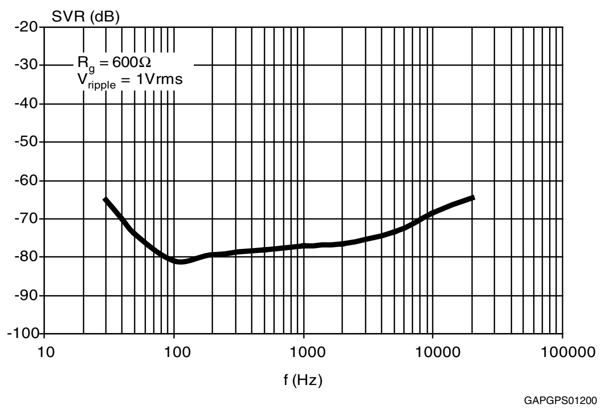


Figure 13. Output attenuation vs. supply voltage

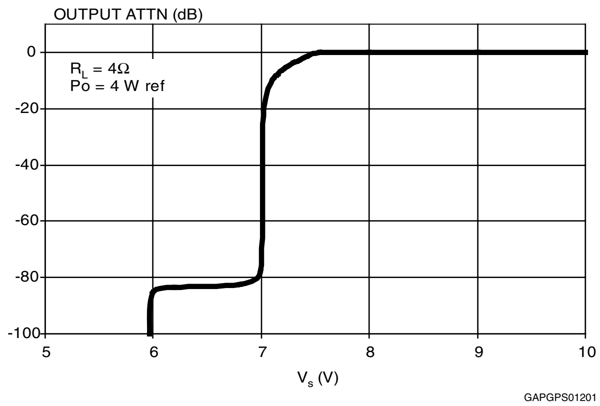


Figure 14. Power dissipation and efficiency vs. output power (R_L = 4 Ω, SINE)

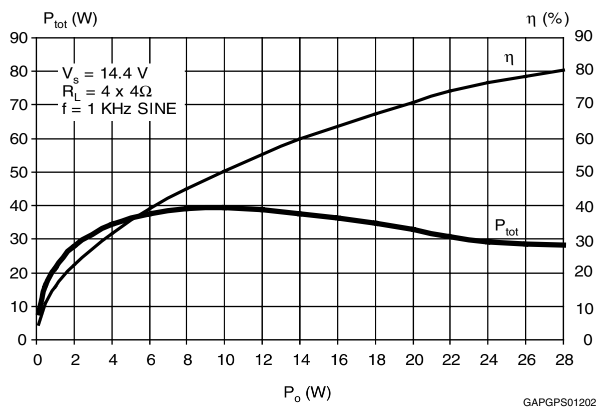


Figure 15. Power dissipation and efficiency vs. output power (R_L = 2 Ω, SINE)

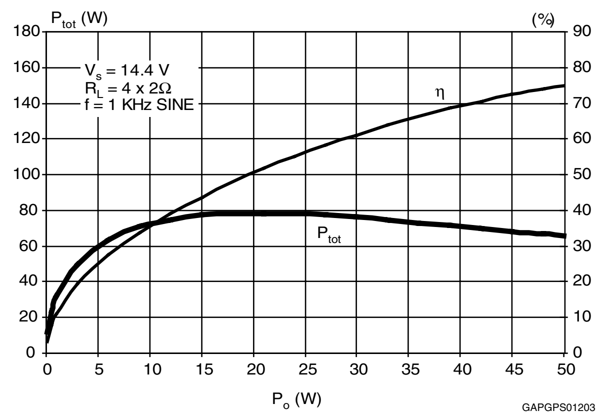


Figure 16. Power dissipation vs. output power (R_L = 4 Ω, audio program simulation)

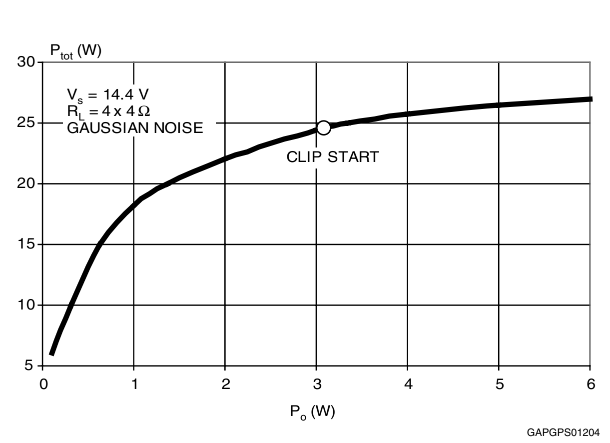


Figure 17. Power dissipation vs. output power (R_L = 2 Ω, audio program simulation)

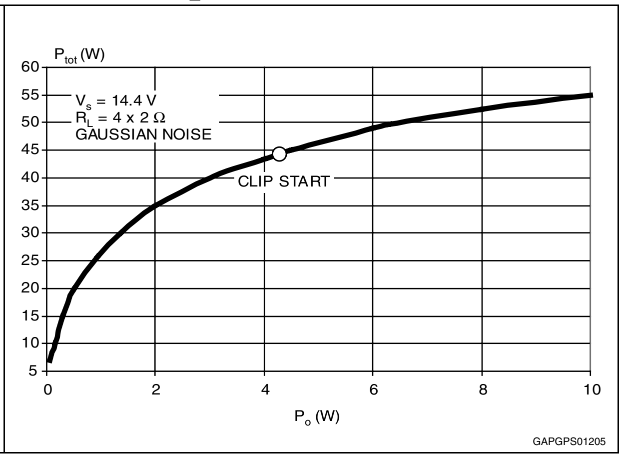
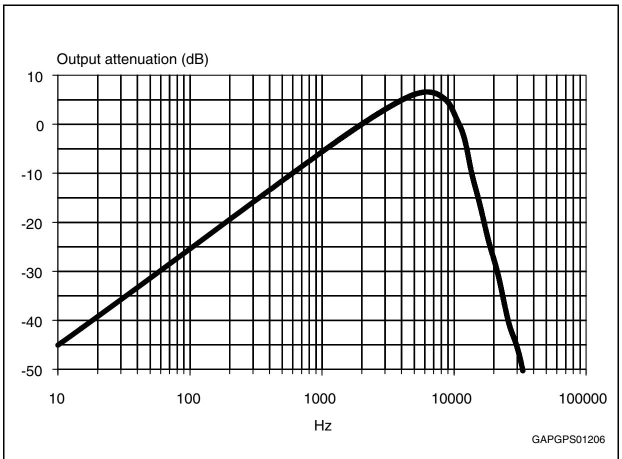


Figure 18. ITU R-ARM frequency response, weighting filter for transient pop



4 Application hints

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 10 µF**.

4.2 Input stage

The TDA7851's inputs are ground-compatible and can stand very high input signals (± 8 Vpk) without any performance degradation.
If the standard value for the input capacitors (0.1 µF) is adopted, the low frequency cut-off amounts to 16 Hz.

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

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 470 kΩ equivalent resistance should be present between the power supply and muting and standby pins.
R-C cells have always to be used in order to smooth down the transitions for preventing any audible transient noise.
About standby, the time constant to be assigned in order to obtain a virtually pop-free transition has to be slower than 2.5 V /ms.

4.4 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) causes P_{diss} = 26 W. 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*.

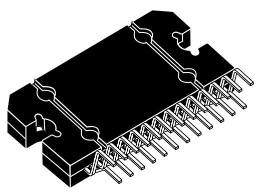
ECOPACK® is an ST trademark.

Figure 19. Flexiwatt25 mechanical data and package dimensions

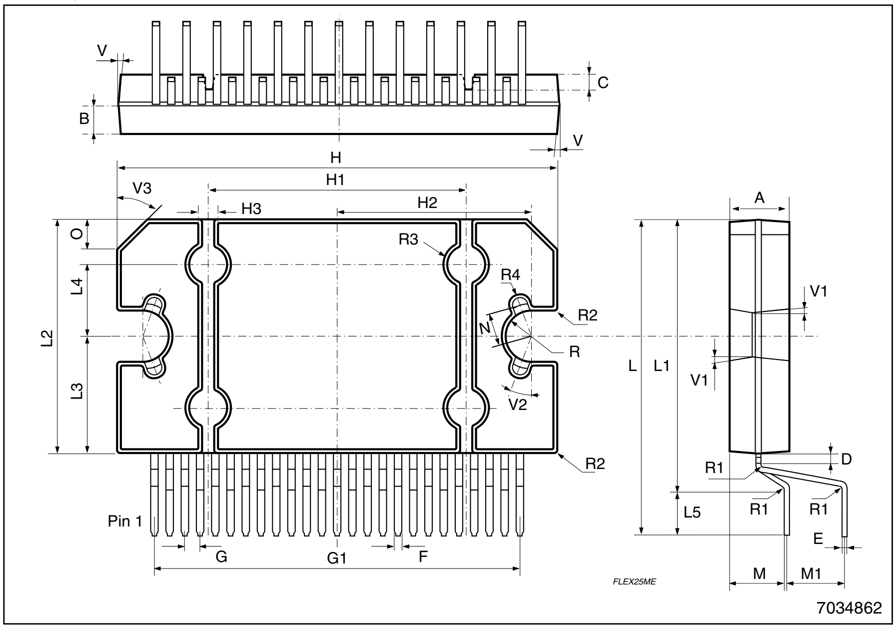
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.45	4.50	4.65	0.175	0.177	0.183
B	1.80	1.90	2.00	0.070	0.074	0.079
C		1.40			0.055	
D	0.75	0.90	1.05	0.029	0.035	0.041
E	0.37	0.39	0.42	0.014	0.015	0.016
F (1)			0.57			0.022
G	0.80	1.00	1.20	0.031	0.040	0.047
G1	23.75	24.00	24.25	0.935	0.945	0.955
H (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



Flexiwatt25 (vertical)



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6 Revision history

Table 5. Document revision history

Date	Revision	Changes
09-Jul-2010	1	Initial release.
13-Jun-2012	2	Updated *Features on page 1*; Updated *Section 3.2: Electrical characteristics on page 7*.