TDA7560

4 X 45W QUAD BRIDGE CAR RADIO AMPLIFIER PLUS HSD

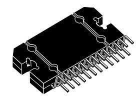
1 Features

- SUPERIOR OUTPUT POWER CAPABILITY:
  4 x 50W/4Ω MAX.
  4 x 45W/4Ω EIAJ
  4 x 30W/4Ω @ 14.4V, 1KHz, 10%
  4 x 80W/2Ω MAX.
  4 x 77W/2Ω EIAJ
  4 x 55W/2Ω @ 14.4V, 1KHz, 10%
- MULTIPOWER BCD TECHNOLOGY
- MOSFET OUTPUT POWER STAGE
- EXCELLENT 2Ω DRIVING CAPABILITY
- HI-FI CLASS DISTORTION
- LOW OUTPUT NOISE
- ST-BY FUNCTION
- MUTE FUNCTION
- AUTOMUTE AT MIN. SUPPLY VOLTAGE DETECTION
- LOW EXTERNAL COMPONENT COUNT:
  – INTERNALLY FIXED GAIN (26dB)
  – NO EXTERNAL COMPENSATION
  – NO BOOTSTRAP CAPACITORS
- ON BOARD 0.35A HIGH SIDE DRIVER

1.1 Protections:

- OUTPUT SHORT CIRCUIT TO GND, TO V_S, ACROSS THE LOAD
- VERY INDUCTIVE LOADS
- OVERRATING CHIP TEMPERATURE WITH SOFT THERMAL LIMITER
- OUTPUT DC OFFSET DETECTION
- LOAD DUMP VOLTAGE
- FORTUITOUS OPEN GND
- REVERSED BATTERY
- ESD

Figure 1. Package



FLEXIWATT25

Table 1. Order Codes

Part Number	Package
TDA7560	FLEXIWATT25

2 Description

The TDA7560 is a breakthrough BCD (Bipolar / CMOS / DMOS) technology class AB Audio Power Amplifier in Flexiwatt 25 package designed for high power car radio. The fully complementary P-Channel/N-Channel output structure allows a rail to rail output voltage swing which, combined with high output current and minimised saturation losses sets new power references in the car-radio field, with unparalleled distortion performances.

Figure 2. Block Diagram

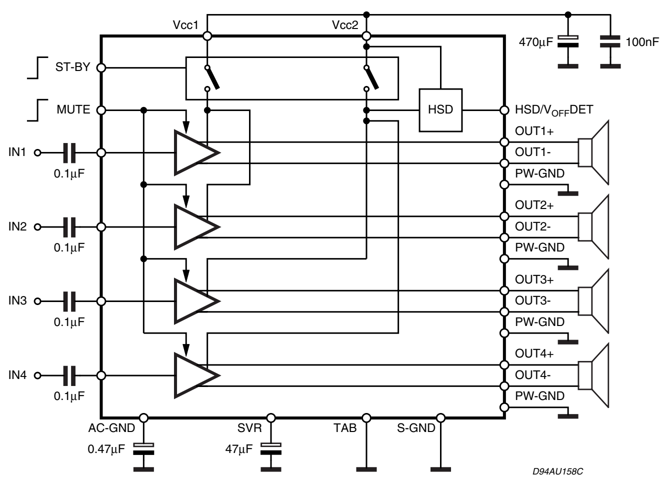


Figure 3. Pin Connection (Top view)

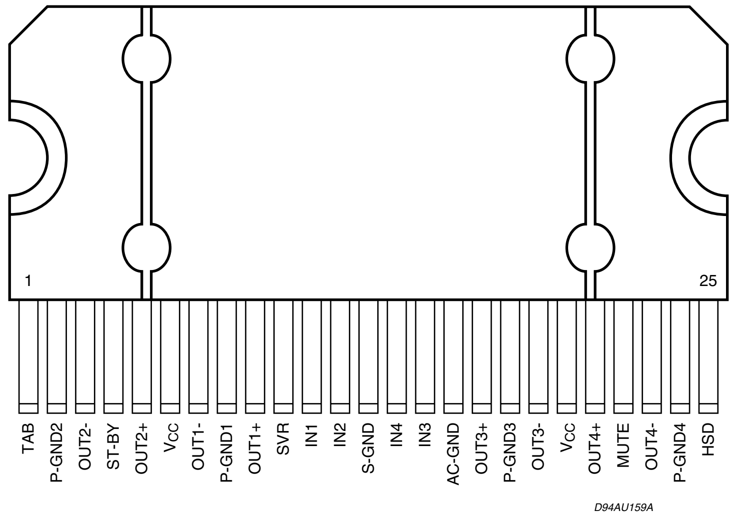


Table 2. Absolute Maximum Ratings

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 (for t = 50ms)	50	V
I_O	Output Peak Current Repetitive (Duty Cycle 10% at f = 10Hz) Non repetitive (t = 100µs)	 9 10	 A A
P_{tot}	Power Dissipation Tcase = 70°C	80	W
T_j	Junction Temperature	150	°C
T_{stg}	Storage Temperature	-55 to 150	°C

THERMAL DATA

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

Table 3. Electrical Characteristcs
(Refer to the test and application diagram, V_S = 13.2V; R_L = 4Ω; R_g = 600Ω; f = 1KHz; T_{amb} = 25°C; unless otherwise specified).

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
I_{q1}	Quiescent Current	$R_L = \infty$	120	200	320	mA
V_{OS}	Output Offset Voltage	Play Mode			±60	mV
dV_{OS}	During mute ON/OFF output offset voltage				±60	mV
G_v	Voltage Gain		25	26	27	dB
dG_v	Channel Gain Unbalance				±1	dB
P_o	Output Power	V_S = 13.2V; THD = 10% V_S = 13.2V; THD = 1% V_S = 14.4V; THD = 10% V_S = 14.4V; THD = 1%	23 16 28 20	25 19 30 23		W W W W
		V_S = 13.2V; THD = 10%, 2Ω V_S = 13.2V; THD = 1%, 2Ω V_S = 14.4V; THD = 10%, 2Ω V_S = 14.4V; THD = 1%, 2Ω	42 32 50 40	45 34 55 43		W W W W
$P_{o\ EIAJ}$	EIAJ Output Power (*)	V_S = 13.7V; R_L = 4Ω V_S = 13.7V; R_L = 2Ω	41 72	45 77		W W
$P_{o\ max.}$	Max. Output Power (*)	V_S = 14.4V; R_L = 4Ω V_S = 14.4V; R_L = 2Ω		50 80		W W
THD	Distortion	P_o = 4W P_o = 15W; R_L = 2Ω		0.006 0.015	0.05 0.07	% %
e_{No}	Output Noise	"A" Weighted Bw = 20Hz to 20KHz		35 50	50 70	µV µV
SVR	Supply Voltage Rejection	f = 100Hz; V_r = 1Vrms	50	70		dB
f_{ch}	High Cut-Off Frequency	P_O = 0.5W	100	300		KHz
R_i	Input Impedance		80	100	120	KΩ
C_T	Cross Talk	f = 1KHz P_O = 4W f = 10KHz P_O = 4W	60	70 60	- -	dB dB
I_{SB}	St-By Current Consumption	$V_{St\text{-}By}$ = 1.5V			20	µA
I_{pin5}	St-by pin Current	$V_{St\text{-}By}$ = 1.5V to 3.5V			±10	µA
$V_{SB\ out}$	St-By Out Threshold Voltage	(Amp: ON)	3.5			V
$V_{SB\ in}$	St-By 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
$V_{AM\ in}$	VS Automute Threshold	(Amp: Mute) Att ≥ 80dB; P_{Oref} = 4W (Amp: Play) Att < 0.1dB; P_O = 0.5W	6.5	7 7.5	 8	V V
I_{pin23}	Muting Pin Current	V_{MUTE} = 1.5V (Sourced Current)	7	12	18	µA
		V_{MUTE} = 3.5V	-5		18	µA
HSD SECTION						
$V_{dropout}$	Dropout Voltage	I_O = 0.35A; V_S = 9 to 16V		0.25	0.6	V
I_{prot}	Current Limits		400		800	mA

Table 3. Electrical Characteristcs (continued)
(Refer to the test and application diagram, V_S = 13.2V; R_L = 4Ω; R_g = 600Ω; f = 1KHz; T_{amb} = 25°C; unless otherwise specified).

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
OFFSET DETECTOR (Pin 26)						
V_{M_ON}	Mute Voltage for DC offset detection enabled	V_{stby} = 5V	8			V
V_{M_OFF}					6	V
V_{OFF}	Detected Differential Output Offset	V_{stby} = 5V; V_{mute} = 8V	±2	±3	±4	V
V_{25_T}	Pin 25 Voltage for Detection = TRUE	V_{stby} = 5V; V_{mute} = 8V V_{OFF} > ±4V	0		1.5	V
V_{25_F}	Pin 25 Voltage for Detection = FALSE	V_{stby} = 5V; V_{mute} = 8V V_{OFF} > ±2V	12			V

(*) Saturated square wave output.

Figure 4. Standard Test and Application Circuit

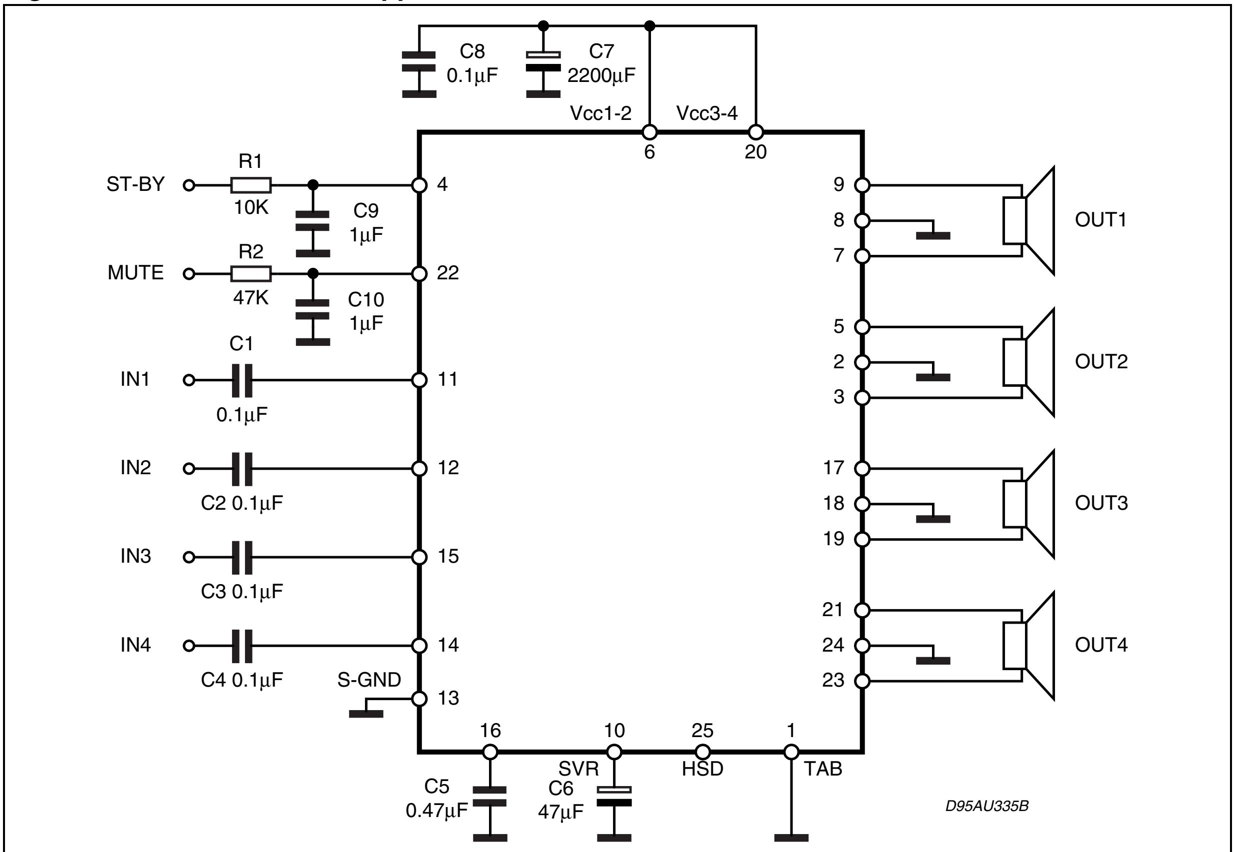
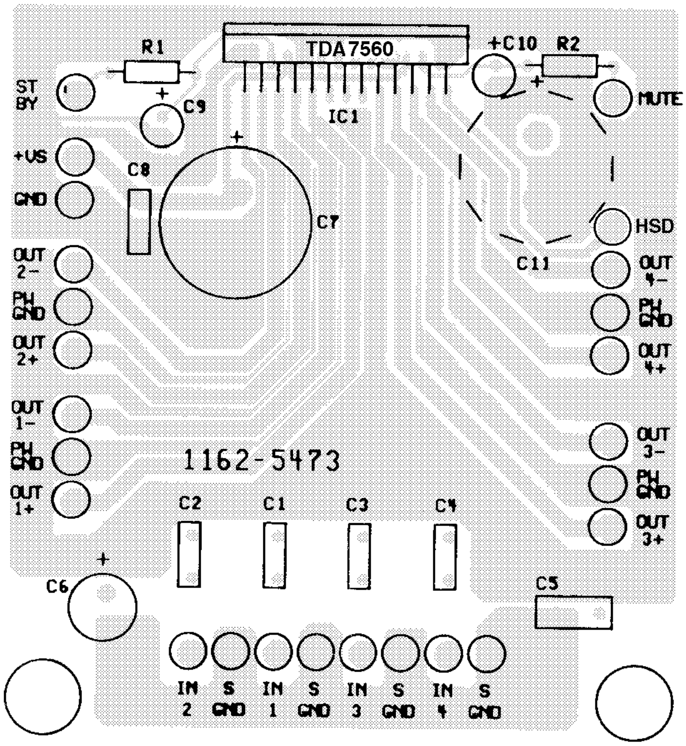


Figure 5. P.C.B. and component layout of the Figure 4.

Components & Top Copper Layer



Bottom Copper Layer

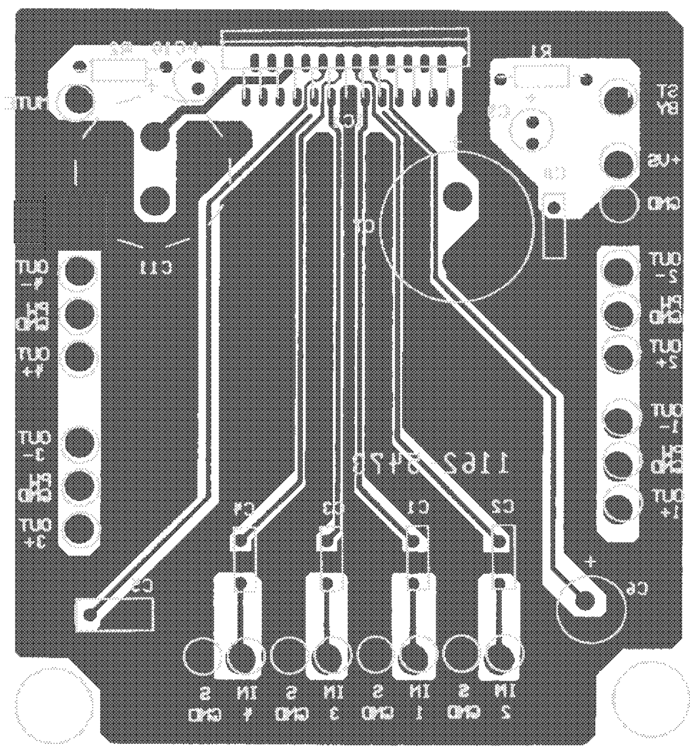


Figure 6. Quiescent current vs. supply voltage.

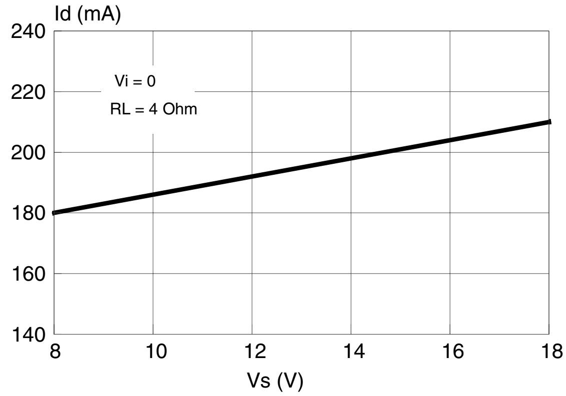


Figure 9. Distortion vs. output Power

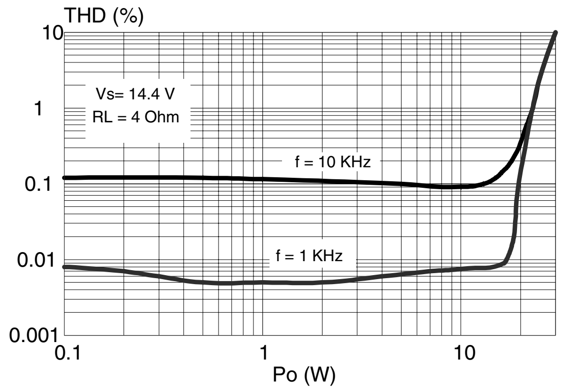


Figure 7. Output power vs. supply voltage.

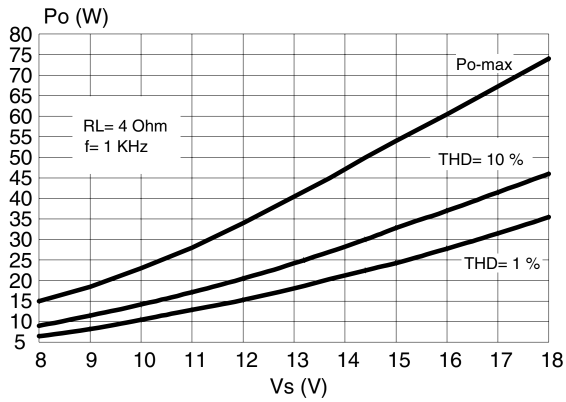


Figure 10. Distortion vs. output power

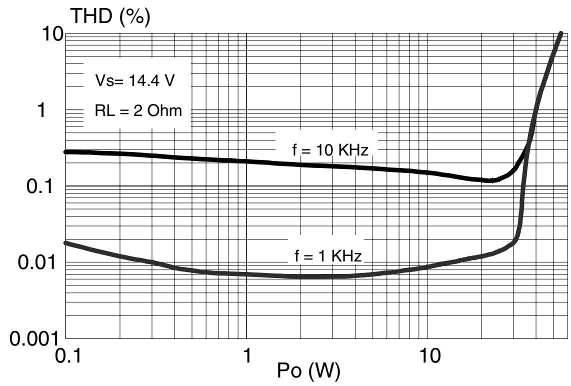


Figure 8. Output power vs. supply voltage.

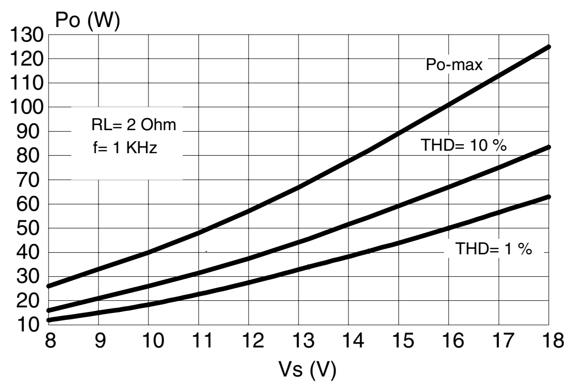


Figure 11. Distortion vs. frequency.

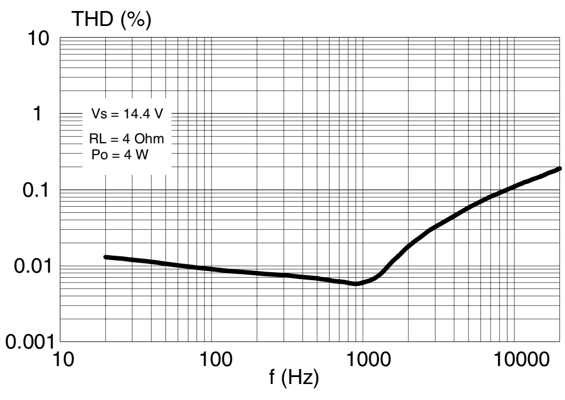


Figure 12. Distortion vs. frequency.

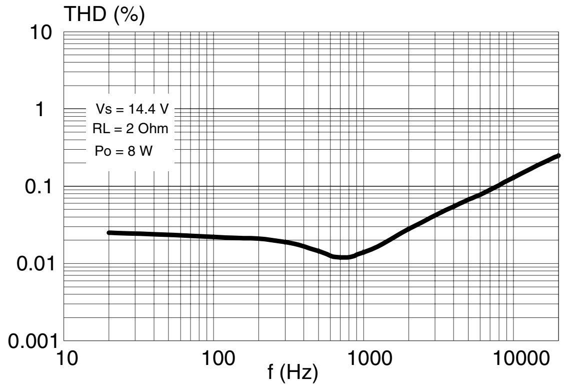


Figure 15. Output attenuation vs. supply volt.

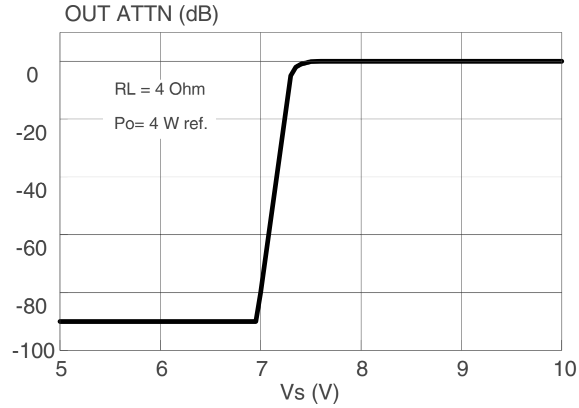


Figure 13. Crosstalk vs. frequency.

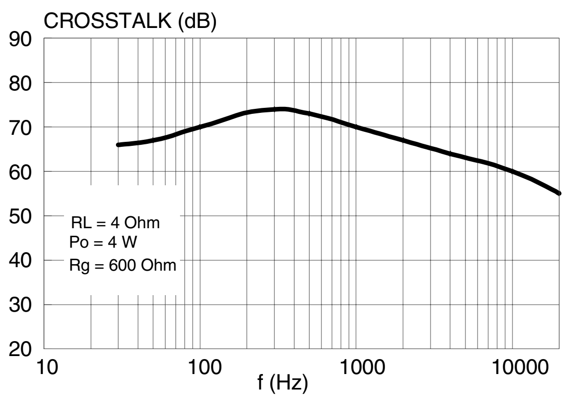


Figure 16. Output noise vs. source resistance.

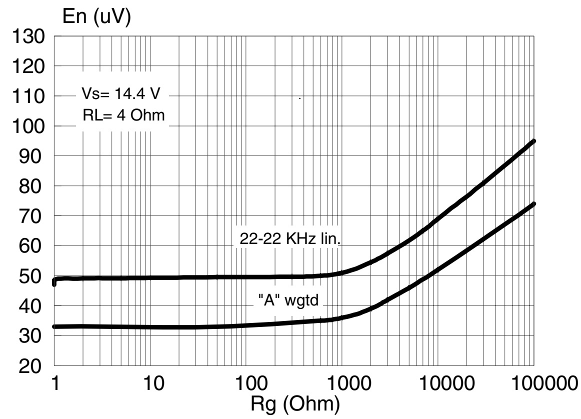


Figure 14. Supply voltage rejection vs. freq.

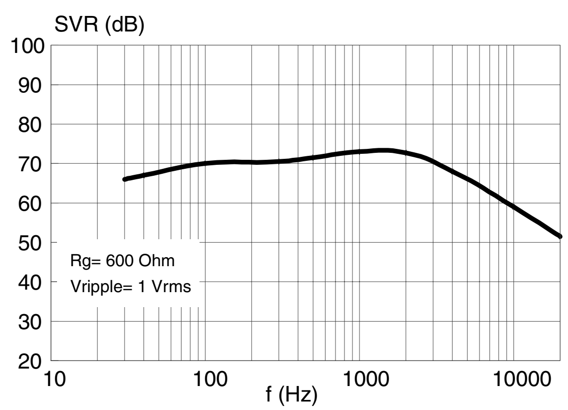


Figure 17. Power dissipation & efficiency vs. output power (sine-wave operation)

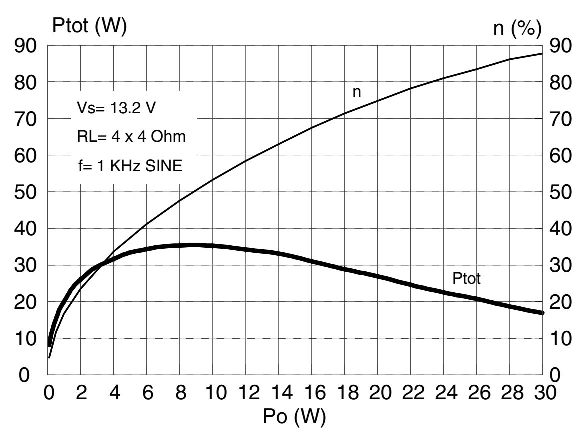


Figure 18. Power dissipation vs. ouput power (Music/Speech Simulation)

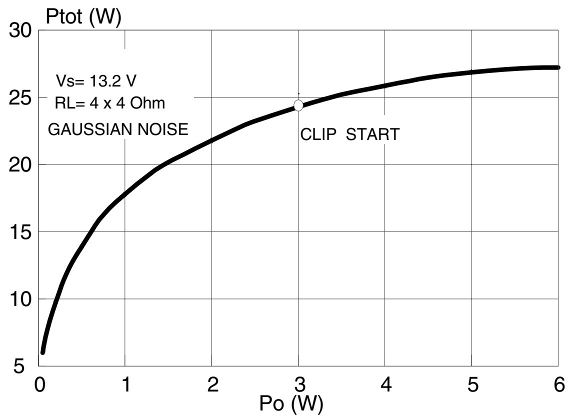
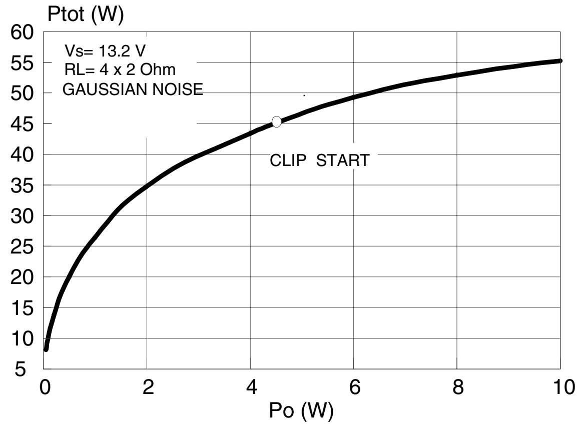


Figure 19. Power dissipation vs. output power (Music/Speech Simulation)



3 DC Offset Detector

The TDA7560 The TDA7560 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 is enabled by the MUTE pin and works with the amplifier umuted and with no signal on the inputs. The DC offset detection is signaled out on the HSD pin.

4 Application Hints (ref. to the circuit of fig. 4)

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 TDA7560's inputs are ground-compatible and can stand very high input signals (± 8Vpk) without any performances 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 STAND-BY AND MUTING

STAND-BY 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 kOhm equivalent resistance should 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 HEATSINK DEFINITION

Under normal usage (4 Ohm speakers) the heatsink's thermal requirements have to be deduced from fig. 18, 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 occurence (worst-case) will cause Pdiss = 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 occurence even after long-term and full-volume operation.

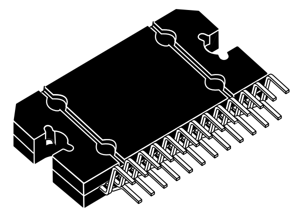
5 Package Information

Figure 20. Flexiwatt25 (vertical) Mechanical Data & Package Dimensions

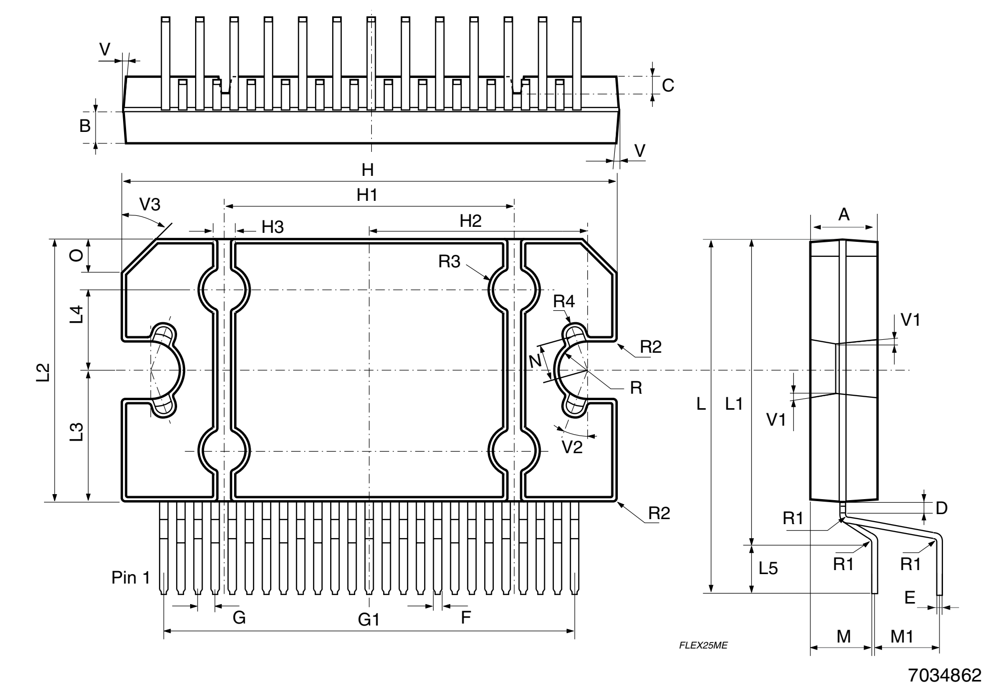
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.45	4.50	4.65	0.175	0.177	0.183
B	1.80	1.90	2.00	0.070	0.074	0.079
C		1.40			0.055	
D	0.75	0.90	1.05	0.029	0.035	0.041
E	0.37	0.39	0.42	0.014	0.015	0.016
F (1)			0.57			0.022
G	0.80	1.00	1.20	0.031	0.040	0.047
G1	23.75	24.00	24.25	0.935	0.945	0.955
H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



6 Revision History

Table 4. Revision History

Date	Revision	Description of Changes
December 2001	1	First Issue
February 2005	2	Improved value from 75 to 20µA of the "ST_BY Current Consumption" parameter in the table 3 at the page 3.