



# TDA7560

## 4 x 45W QUAD BRIDGE CAR RADIO AMPLIFIER PLUS HSD

PRODUCT PREVIEW

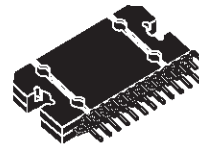
- SUPERIOR OUTPUT POWER CAPABILITY:
  - 4 x 50W/4Ω MAX.
  - 4 x 45W/4Ω EIAJ
  - 4 x 30W/4Ω @ 14.4V, 1KHz, 10%
  - 4 x 80W/2Ω MAX.
  - 4 x 77W/2Ω EIAJ
  - 4 x 55W/2Ω @ 14.4V, 1KHz, 10%
- EXCELLENT 2Ω DRIVING CAPABILITY
- HI-FI CLASS DISTORTION
- LOW OUTPUT NOISE
- ST-BY FUNCTION
- MUTE FUNCTION
- AUTOMUTE 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

### 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

### MULTIPOWER BCD TECHNOLOGY

### MOSFET OUTPUT POWER STAGE



FLEXIWATT25

ORDERING NUMBER: TDA7560

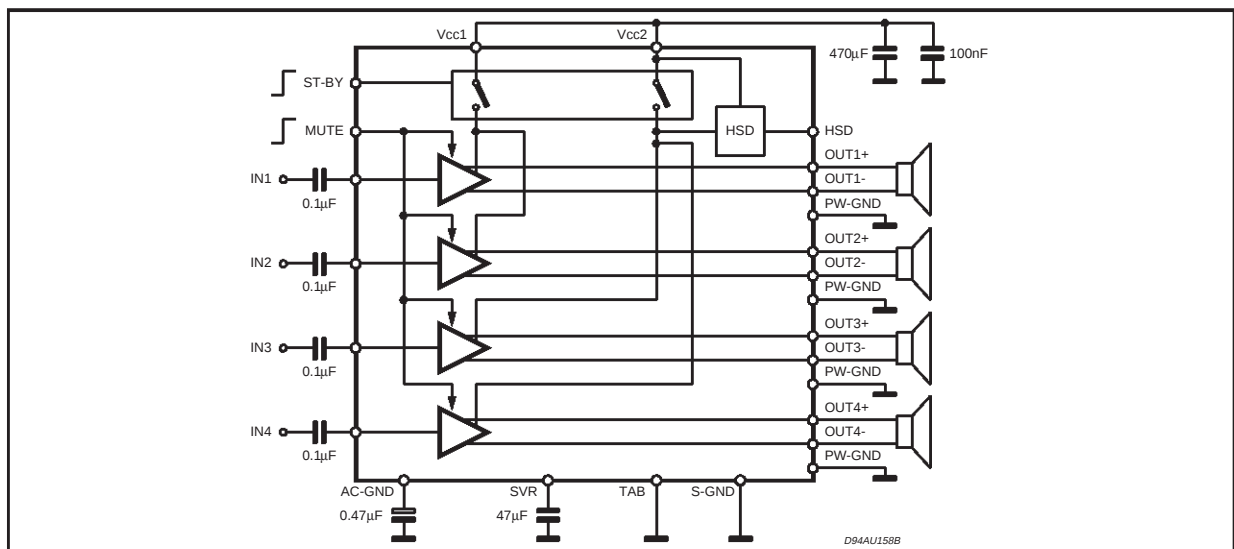
- FORTUITOUS OPEN GND
- REVERSED BATTERY
- ESD

### 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.

### BLOCK AND APPLICATION DIAGRAM

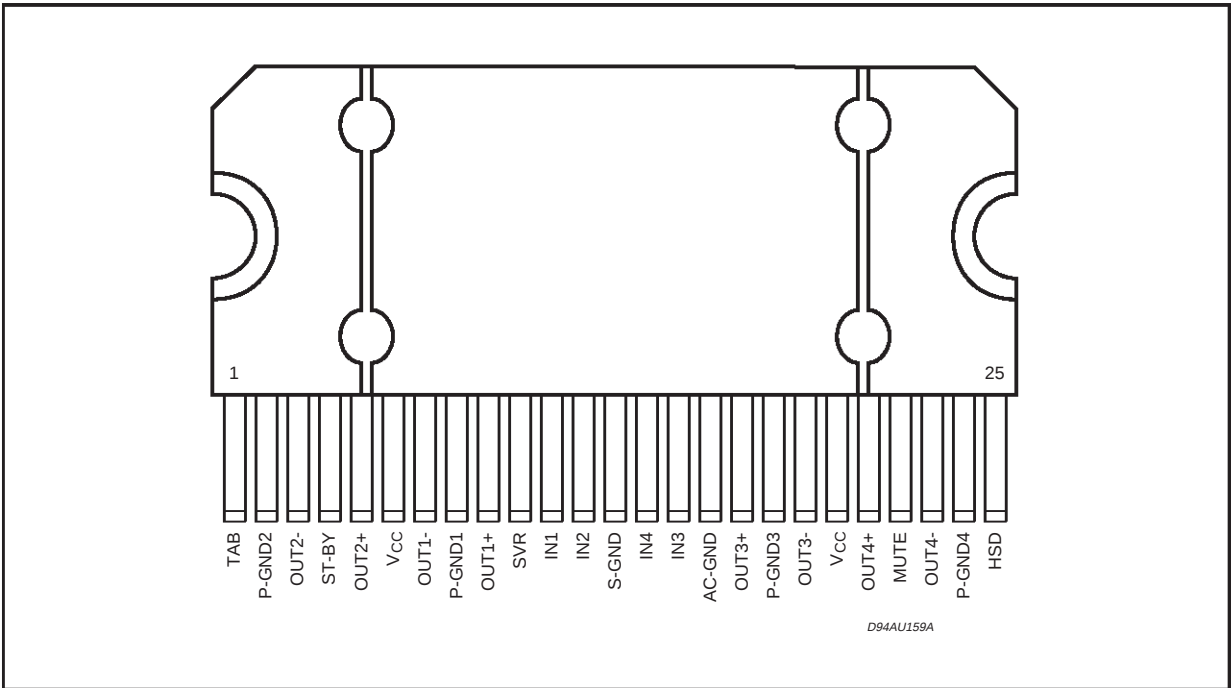


# TDA7560

## 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:<br>Repetitive (Duty Cycle 10% at f = 10Hz)<br>Non Repetitive (t = 100μs) | 9           | A    |
|              |                                                                                               | 10          | A    |
| $P_{tot}$    | Power dissipation, (T <sub>case</sub> = 70°C)                                                 | 80          | W    |
| $T_j$        | Junction Temperature                                                                          | 150         | °C   |
| $T_{stg}$    | Storage Temperature                                                                           | – 55 to 150 | °C   |

## PIN CONNECTION (Top view)



## THERMAL DATA

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

**ELECTRICAL CHARACTERISTICS** ( $V_S = 13.2V$ ;  $f = 1KHz$ ;  $R_g = 600\Omega$ ;  $R_L = 4\Omega$ ;  $T_{amb} = 25^\circ C$ ;  
Refer to the test and application diagram, unless otherwise specified.)

| Symbol               | Parameter                                | Test Condition                                    | Min. | Typ.  | Max. | Unit |
|----------------------|------------------------------------------|---------------------------------------------------|------|-------|------|------|
| I <sub>q1</sub>      | Quiescent Current                        | R <sub>L</sub> = ∞                                | 120  | 200   | 320  | mA   |
| V <sub>OS</sub>      | Output Offset Voltage                    | Play Mode                                         |      |       | ±80  | mV   |
| dV <sub>OS</sub>     | During mute ON/OFF output offset voltage |                                                   |      |       | ±80  | mV   |
| G <sub>v</sub>       | Voltage Gain                             |                                                   | 25   | 26    | 27   | dB   |
| dG <sub>v</sub>      | Channel Gain Unbalance                   |                                                   |      |       | ±1   | dB   |
| P <sub>o</sub>       | Output Power                             | V <sub>S</sub> = 13.2V; THD = 10%                 | 23   | 25    |      | W    |
|                      |                                          | V <sub>S</sub> = 13.2V; THD = 1%                  | 16   | 19    |      | W    |
|                      |                                          | V <sub>S</sub> = 14.4V; THD = 10%                 | 28   | 30    |      | W    |
|                      |                                          | V <sub>S</sub> = 14.4V; THD = 1%                  | 20   | 23    |      | W    |
|                      |                                          | V <sub>S</sub> = 13.2V; THD = 10%, 2Ω             | 42   | 45    |      | W    |
|                      |                                          | V <sub>S</sub> = 13.2V; THD = 1%, 2Ω              | 32   | 34    |      | W    |
| P <sub>o</sub> EIAJ  | EIAJ Output Power (*)                    | V <sub>S</sub> = 14.4V; THD = 10%, 2Ω             | 50   | 55    |      | W    |
|                      |                                          | V <sub>S</sub> = 14.4V; THD = 1%, 2Ω              | 40   | 43    |      | W    |
|                      |                                          | V <sub>S</sub> = 13.7V; R <sub>L</sub> = 4Ω       | 41   | 45    |      | W    |
|                      |                                          | V <sub>S</sub> = 13.7V; R <sub>L</sub> = 2Ω       | 75   | 77    |      | W    |
| P <sub>o</sub> max.  | Max. Output Power (*)                    | V <sub>S</sub> = 14.4V; R <sub>L</sub> = 4Ω       |      | 50    |      | W    |
|                      |                                          | V <sub>S</sub> = 14.4V; R <sub>L</sub> = 2Ω       |      | 80    |      | W    |
| THD                  | Distortion                               | P <sub>o</sub> = 4W                               |      | 0.006 | 0.05 | %    |
|                      |                                          | P <sub>o</sub> = 10W; R <sub>L</sub> = 2Ω         |      | 0.015 | 0.07 | %    |
| e <sub>No</sub>      | Output Noise                             | "A" Weighted<br>Bw = 20Hz to 20KHz                |      | 35    | 50   | μV   |
|                      |                                          |                                                   |      | 50    | 70   | μV   |
| SVR                  | Supply Voltage Rejection                 | f = 100Hz; V <sub>r</sub> = 1Vrms                 | 50   | 70    |      | dB   |
| f <sub>ch</sub>      | High Cut-Off Frequency                   | P <sub>O</sub> = 0.5W                             | 100  | 300   |      | KHz  |
| R <sub>i</sub>       | Input Impedance                          |                                                   | 80   | 100   | 120  | KΩ   |
| C <sub>T</sub>       | Cross Talk                               | f = 1KHz P <sub>O</sub> = 4W                      | 60   | 70    | –    | dB   |
|                      |                                          | f = 10KHz P <sub>O</sub> = 4W                     |      | 60    | –    | dB   |
| I <sub>SB</sub>      | St-By Current Consumption                | V <sub>St-By</sub> = 1.5V                         |      |       | 75   | μA   |
| I <sub>pin4</sub>    | St-by pin Current                        | V <sub>St-By</sub> = 1.5V to 3.5V                 |      |       | ±10  | μA   |
| V <sub>SB out</sub>  | St-By Out Threshold Voltage              | (Amp: ON)                                         | 3.5  |       |      | V    |
| V <sub>SB in</sub>   | St-By in Threshold Voltage               | (Amp: OFF)                                        |      |       | 1.5  | V    |
| A <sub>M</sub>       | Mute Attenuation                         | P <sub>Oref</sub> = 4W                            | 80   | 90    |      | dB   |
| V <sub>M out</sub>   | Mute Out Threshold Voltage               | (Amp: Play)                                       | 3.5  |       |      | V    |
| V <sub>M in</sub>    | Mute In Threshold Voltage                | (Amp: Mute)                                       |      |       | 1.5  | V    |
| V <sub>AM in</sub>   | V <sub>S</sub> Automute Threshold        | (Amp: Mute)                                       | 6.5  | 7     |      | V    |
|                      |                                          | Att ≥ 80dB; P <sub>Oref</sub> = 4W                |      |       |      |      |
|                      |                                          | (Amp: Play)                                       |      | 7.5   | 8    | V    |
| I <sub>pin22</sub>   | Muting Pin Current                       | Att < 0.1dB; P <sub>O</sub> = 0.5W                |      |       |      |      |
|                      |                                          | V <sub>MUTE</sub> = 1.5V<br>(Sourced Current)     | 7    | 12    | 18   | μA   |
|                      |                                          | V <sub>MUTE</sub> = 3.5V                          | -5   |       | 18   | μA   |
| HSD SECTION          |                                          |                                                   |      |       |      |      |
| V <sub>dropout</sub> | Dropout Voltage                          | I <sub>o</sub> = 0.35A; V <sub>S</sub> = 9 to 16V |      | 0.25  | 0.6  | V    |
| I <sub>prot</sub>    | Current Limits                           |                                                   | 400  |       | 800  | mA   |

(\*) Saturated square wave output.

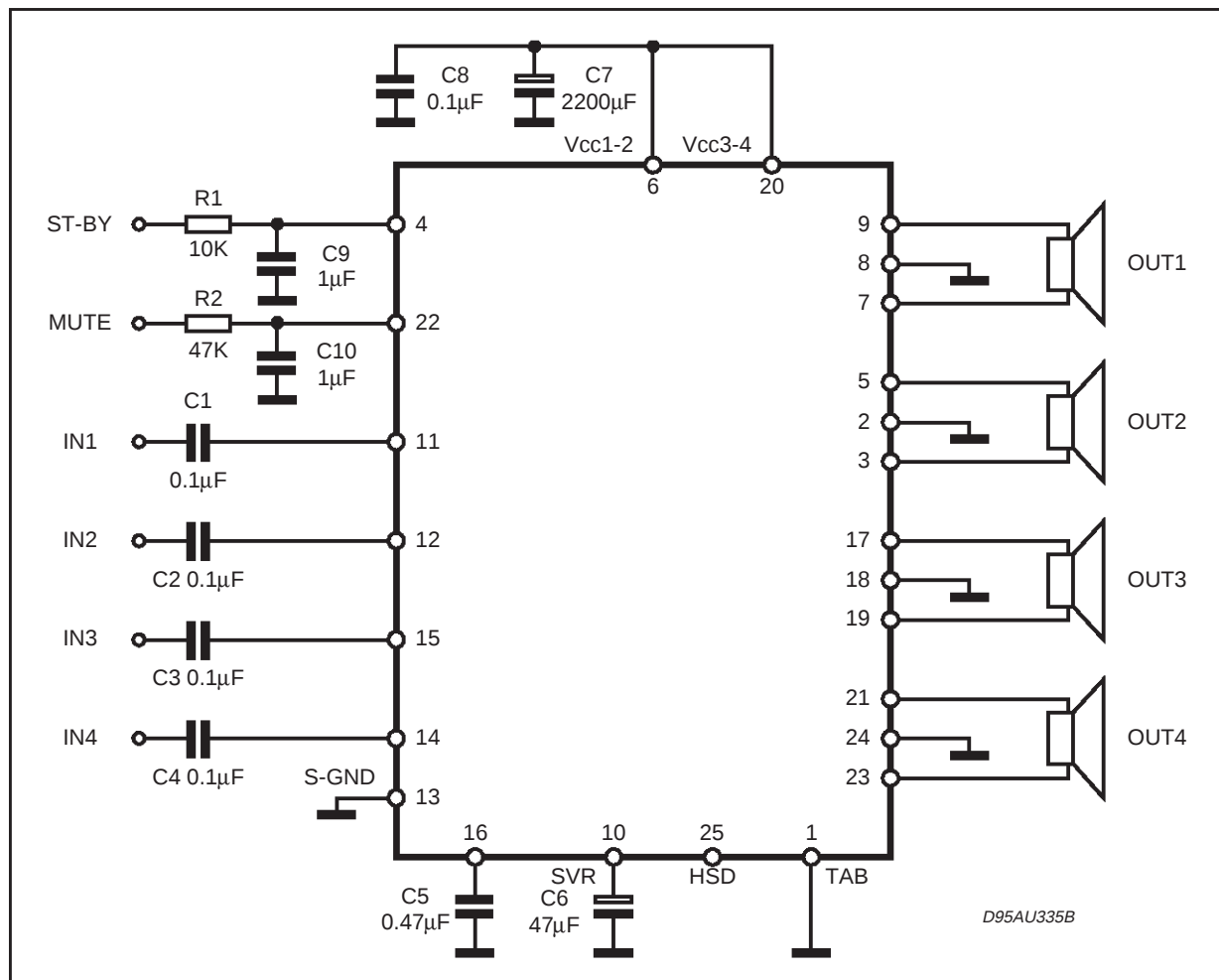
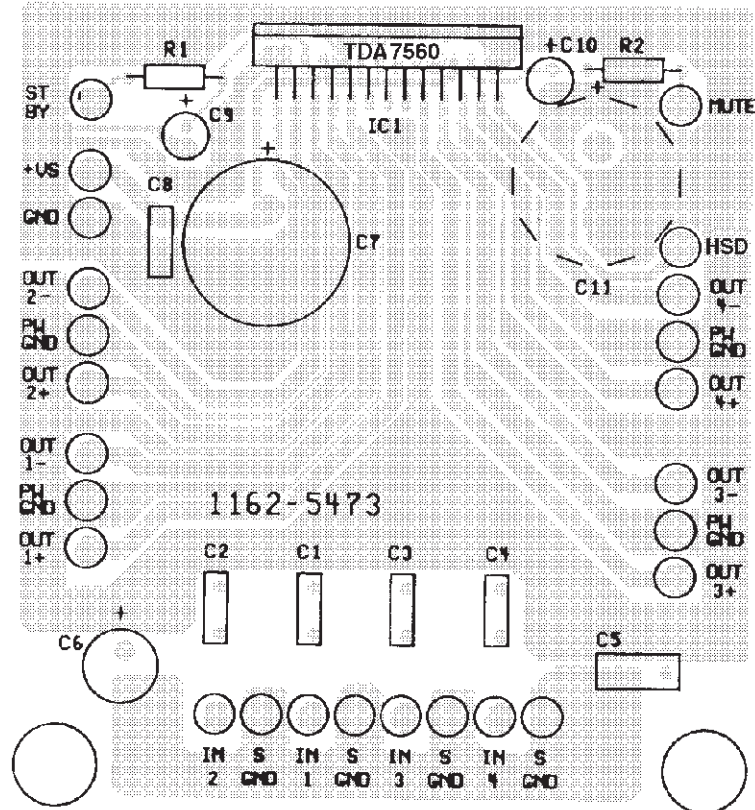


Figure 2: P.C.B. and component layout of the figure 1 (1:1 scale)

COMPONENTS &  
TOP COPPER LAYER

## BOTTOM COPPER LAYER

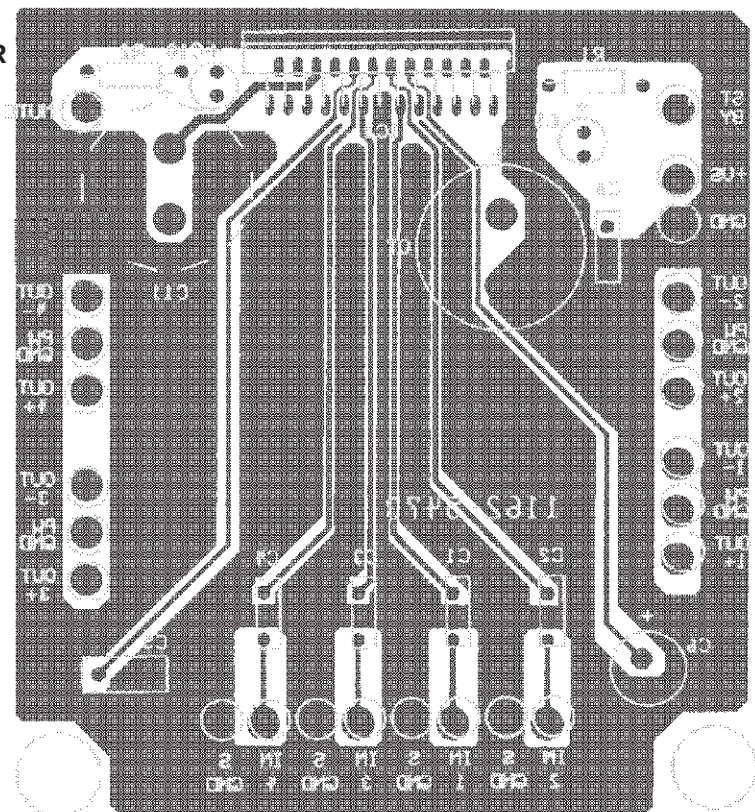


Figure 3. Quiescent current vs. supply voltage.

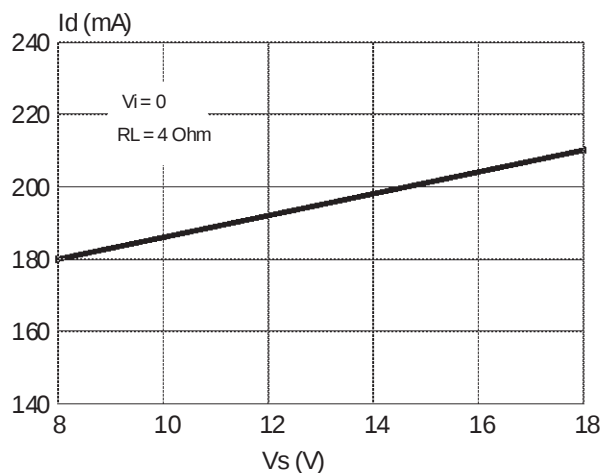


Figure 4. Output power vs. supply voltage.

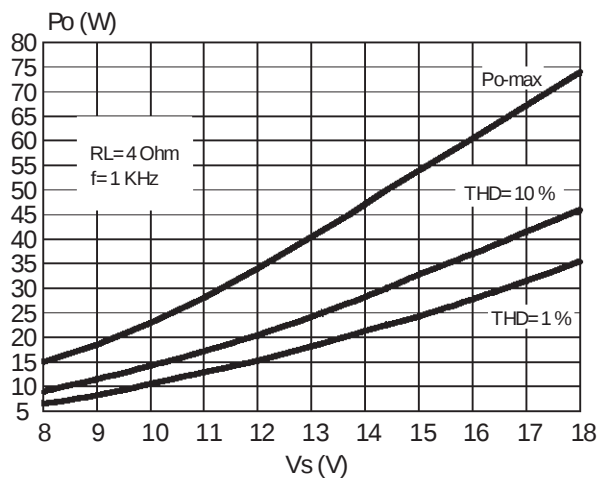


Figure 5. Output power vs. supply voltage.

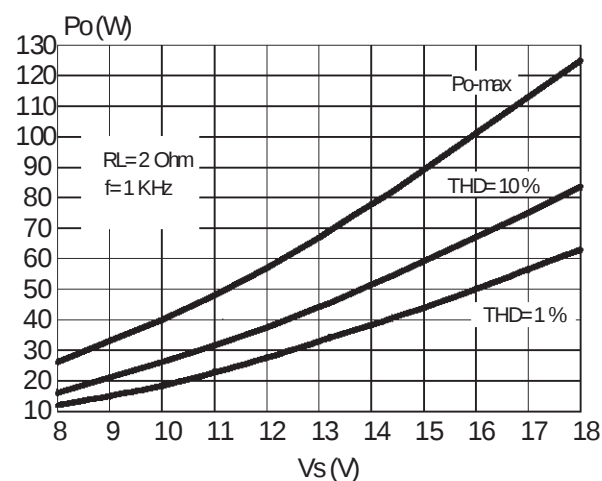


Figure 6. Distortion vs. output Power

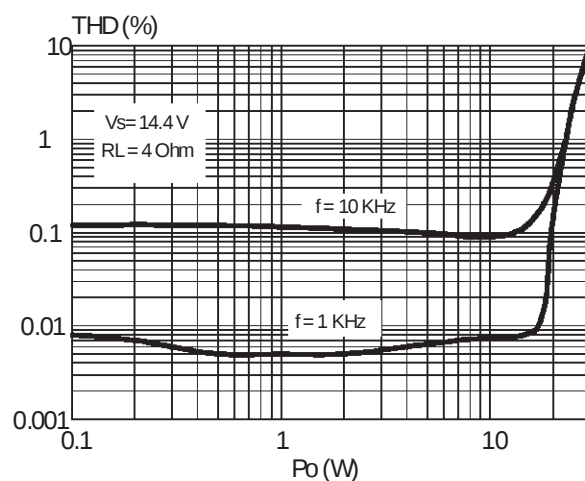


Figure 7. Distortion vs. output power

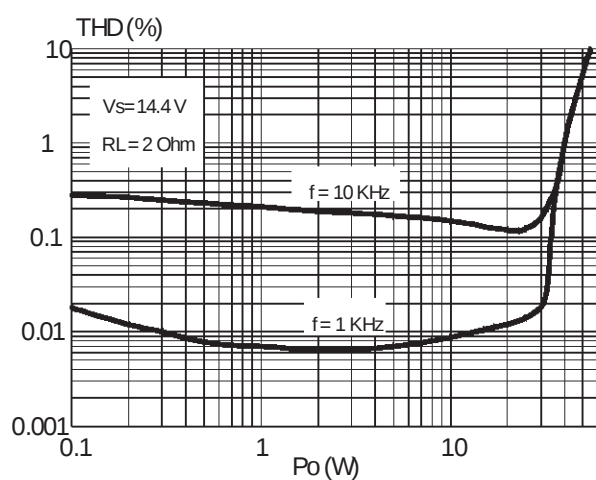


Figure 8. Distortion vs. frequency.

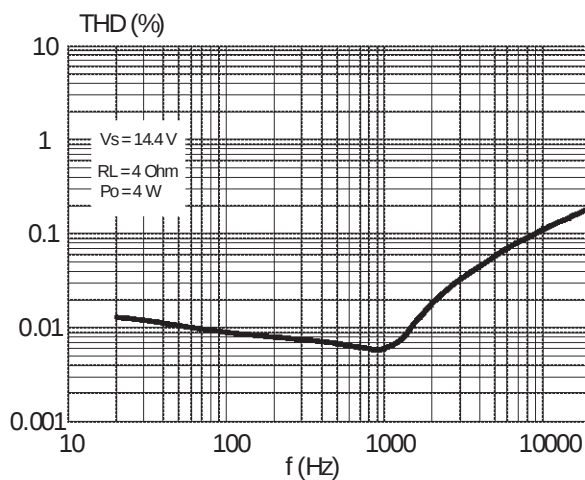


Figure 9. Distortion vs. frequency.

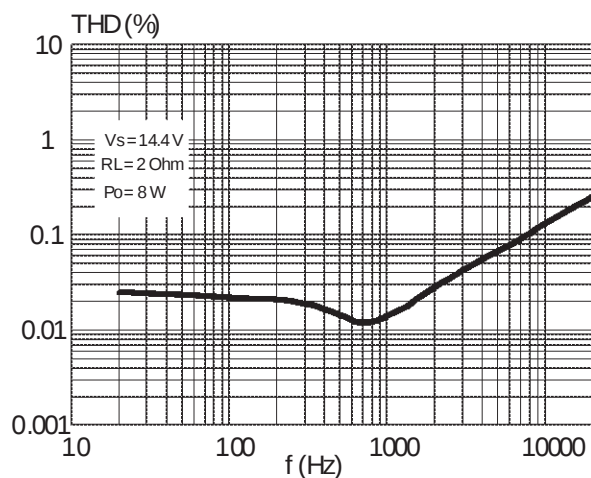


Figure 10. Crosstalk vs. frequency.

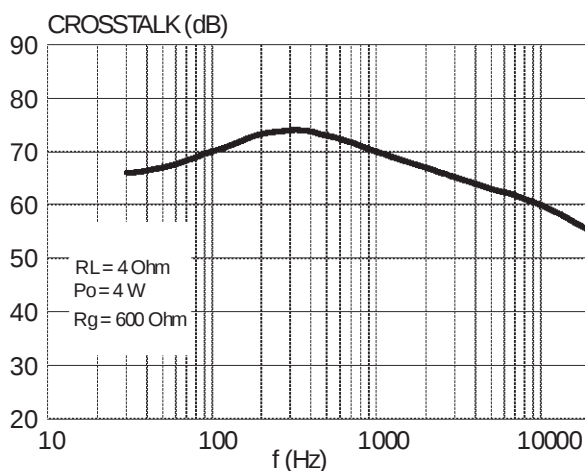


Figure 11. Supply voltage rejection vs. frequency.

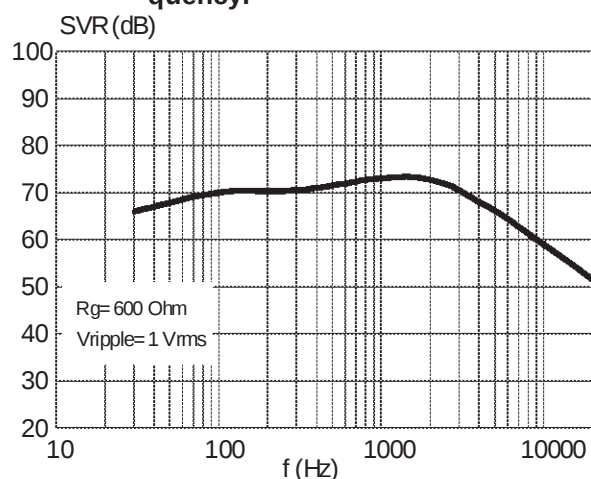


Figure 12. Output attenuation vs. supply voltage.

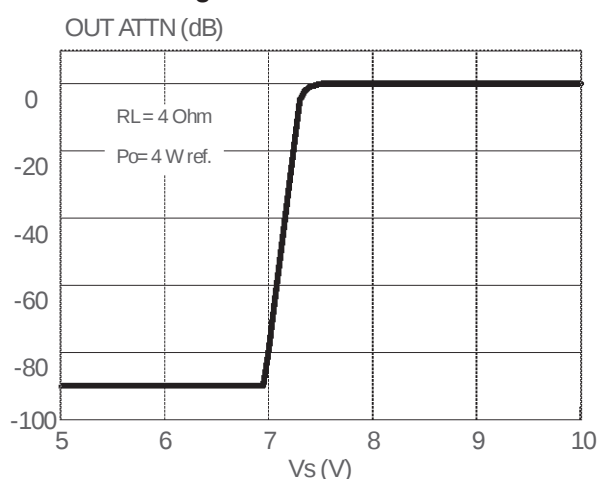


Figure 13. Output noise vs. source resistance.

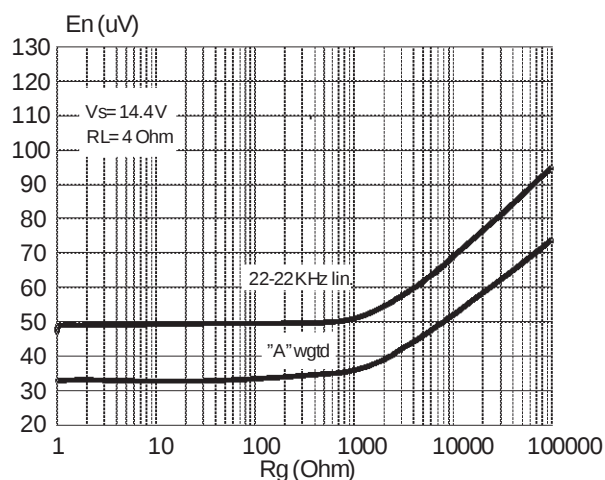
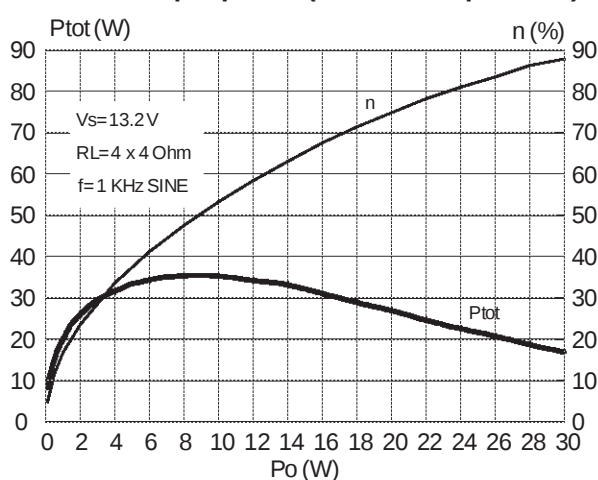
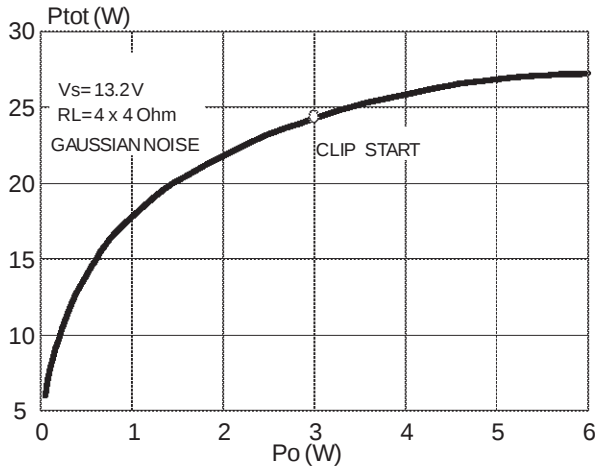


Figure 14. Power dissipation &amp; efficiency vs. output power (sine-wave operation)



**Figure 15. Power dissipation vs. output power (Music/Speech Simulation)**



**APPLICATION HINTS** (ref. to the circuit of fig. 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.**

**INPUT STAGE**

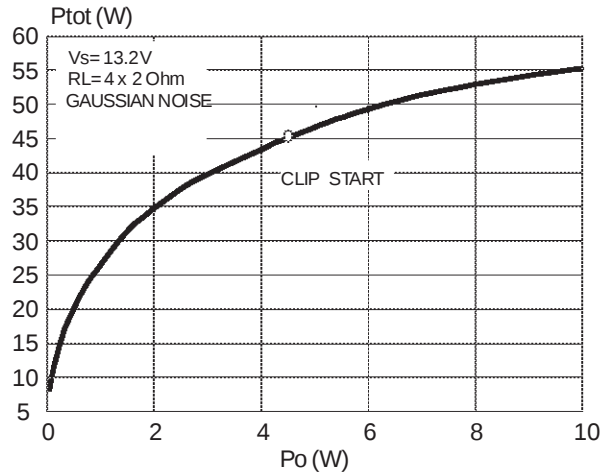
The TDA7560's inputs are ground-compatible and can stand very high input signals ( $\pm 8V_{pk}$ ) without any performances degradation.

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

**STAND-BY AND MUTING**

STAND-BY 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

**Figure 16. Power dissipation vs. output power (Music/Speech Simulation)**



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.

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.

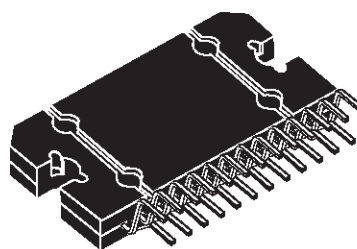
**HEATSINK DEFINITION**

Under normal usage (4 Ohm speakers) the heatsink's thermal requirements have to be deduced from fig. 15, 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  $T_{amb} = 70^{\circ}C$  and  $T_{CHIP} = 150^{\circ}C$  as boundary conditions, the heatsink's thermal resistance should be approximately  $2^{\circ}C/W$ . This would avoid any thermal shutdown occurrence even after long-term and full-volume operation.

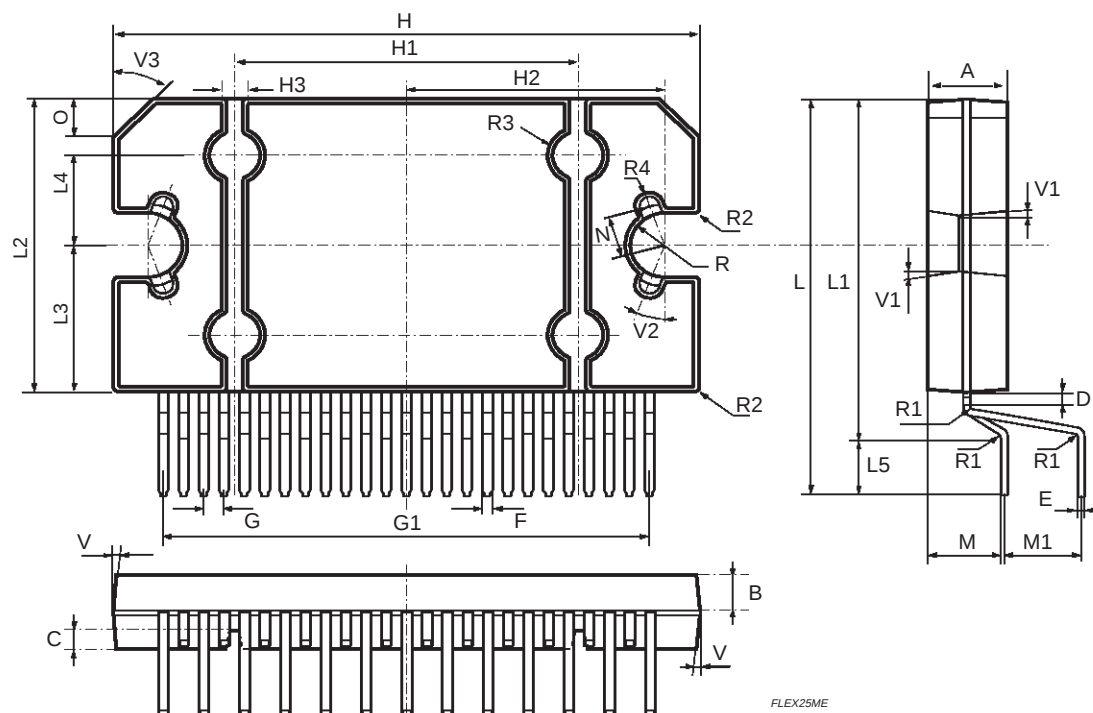
| DIM.   | mm         |       |       | inch  |       |       |
|--------|------------|-------|-------|-------|-------|-------|
|        | MIN.       | TYP.  | MAX.  | MIN.  | TYP.  | MAX.  |
| A      | 4.45       | 4.50  | 4.65  | 0.175 | 0.177 | 0.183 |
| B      | 1.80       | 1.90  | 2.00  | 0.070 | 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 | 1.138 | 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



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