

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

Figure 1. Package

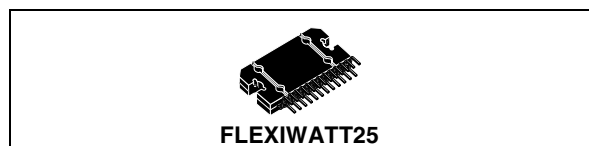


Table 1. Order Codes

| Part Number | Package |
|-------------|-------------|
| TDA7560 | FLEXIWATT25 |

- OUTPUT DC OFFSET DETECTION
- LOAD DUMP VOLTAGE
- FORTUITOUS OPEN GND
- REVERSED BATTERY
- ESD

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

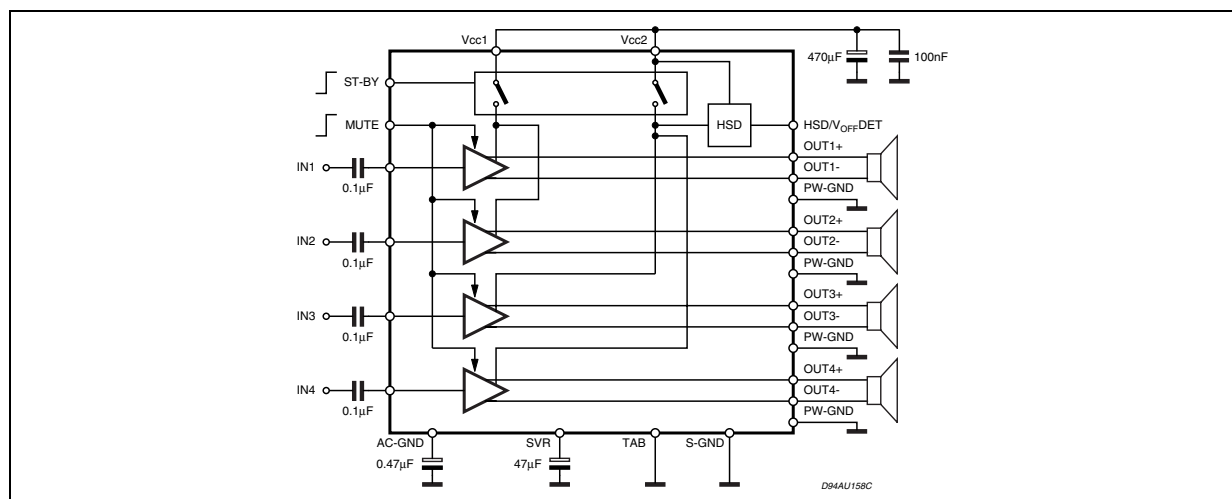


Figure 3. Pin Connection (Top view)

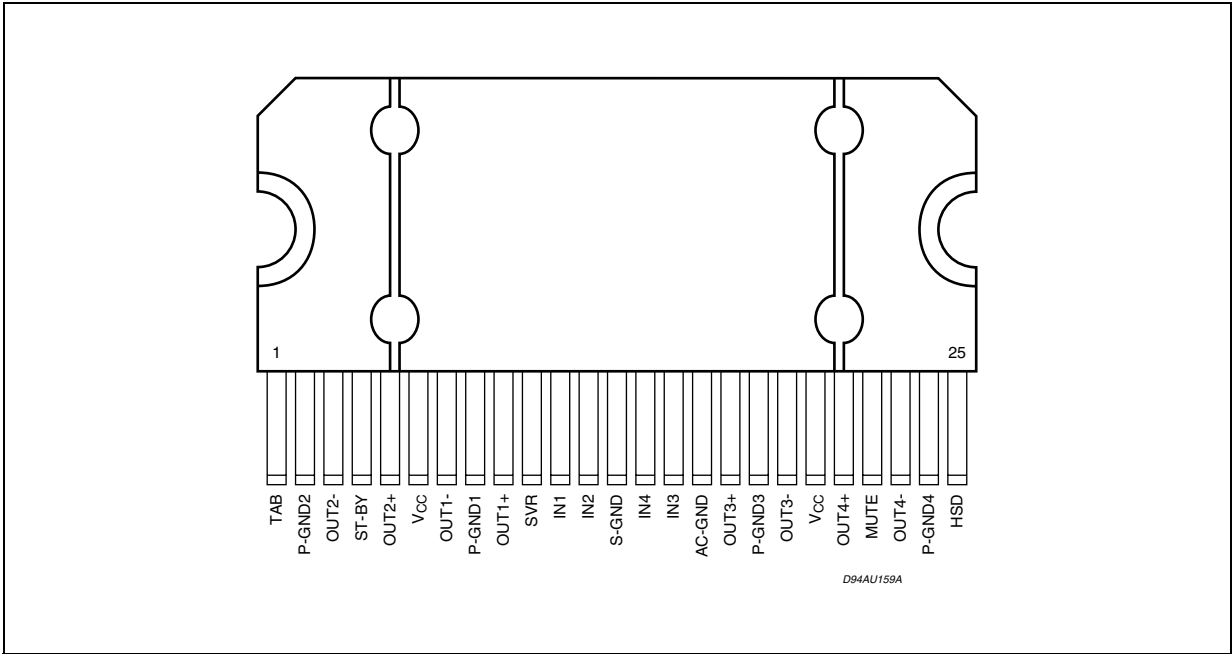


Table 2. Absolute Maximum Ratings

| 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 T _{case} = 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-case} | Thermal Resistance Junction to case | Max. 1 | °C/W |

Table 3. Electrical Characteristics

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

| Symbol | Parameter | Test Condition | Min. | Typ. | Max. | Unit |
|----------------------|--|---|------|-------|------|------|
| I _{q1} | Quiescent Current | R _L = ∞ | 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% | 23 | 25 | | W |
| | | V _S = 13.2V; THD = 1% | 16 | 19 | | W |
| | | V _S = 14.4V; THD = 10% | 28 | 30 | | W |
| | | V _S = 14.4V; THD = 1% | 20 | 23 | | W |
| | | V _S = 13.2V; THD = 10%, 2Ω | 42 | 45 | | W |
| | | V _S = 13.2V; THD = 1%, 2Ω | 32 | 34 | | W |
| | | V _S = 14.4V; THD = 10%, 2Ω | 50 | 55 | | W |
| | | V _S = 14.4V; THD = 1%, 2Ω | 40 | 43 | | W |
| P _O EIAJ | EIAJ Output Power (*) | V _S = 13.7V; R _L = 4Ω | 41 | 45 | | W |
| | | V _S = 13.7V; R _L = 2Ω | 72 | 77 | | W |
| P _O max. | Max. Output Power (*) | V _S = 14.4V; R _L = 4Ω | | 50 | | W |
| | | V _S = 14.4V; R _L = 2Ω | | 80 | | W |
| THD | Distortion | P _O = 4W | | 0.006 | 0.05 | % |
| | | P _O = 15W; R _L = 2Ω | | 0.015 | 0.07 | % |
| e _{No} | Output Noise | "A" Weighted Bw = 20Hz to 20KHz | | 35 | 50 | μV |
| | | | | 50 | 70 | 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 | 60 | 70 | - | dB |
| | | f = 10KHz P _O = 4W | | 60 | - | dB |
| I _{SB} | St-By Current Consumption | V _{St-By} = 1.5V | | | 20 | μA |
| I _{pin5} | St-by pin Current | V _{St-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) | 6.5 | 7 | | V |
| | | Att ≥ 80dB; P _{Oref} = 4W | | | | |
| | | (Amp: Play) | | 7.5 | 8 | 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 Characteristics (continued)

(Refer to the test and application diagram, $V_S = 13.2V$; $R_L = 4\Omega$; $R_g = 600\Omega$; $f = 1KHz$; $T_{amb} = 25^{\circ}C$; 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 | $V_{stby} = 5V$; $V_{mute} = 8V$ $V_{OFF} > \pm 4V$ | 0 | | 1.5 | V |
| V_{25_F} | Pin 25 Voltage for Detection = FALSE | $V_{stby} = 5V$; $V_{mute} = 8V$ $V_{OFF} > \pm 2V$ | 12 | | | V |

(*) Saturated square wave output.

Figure 4. Standard Test and Application Circuit

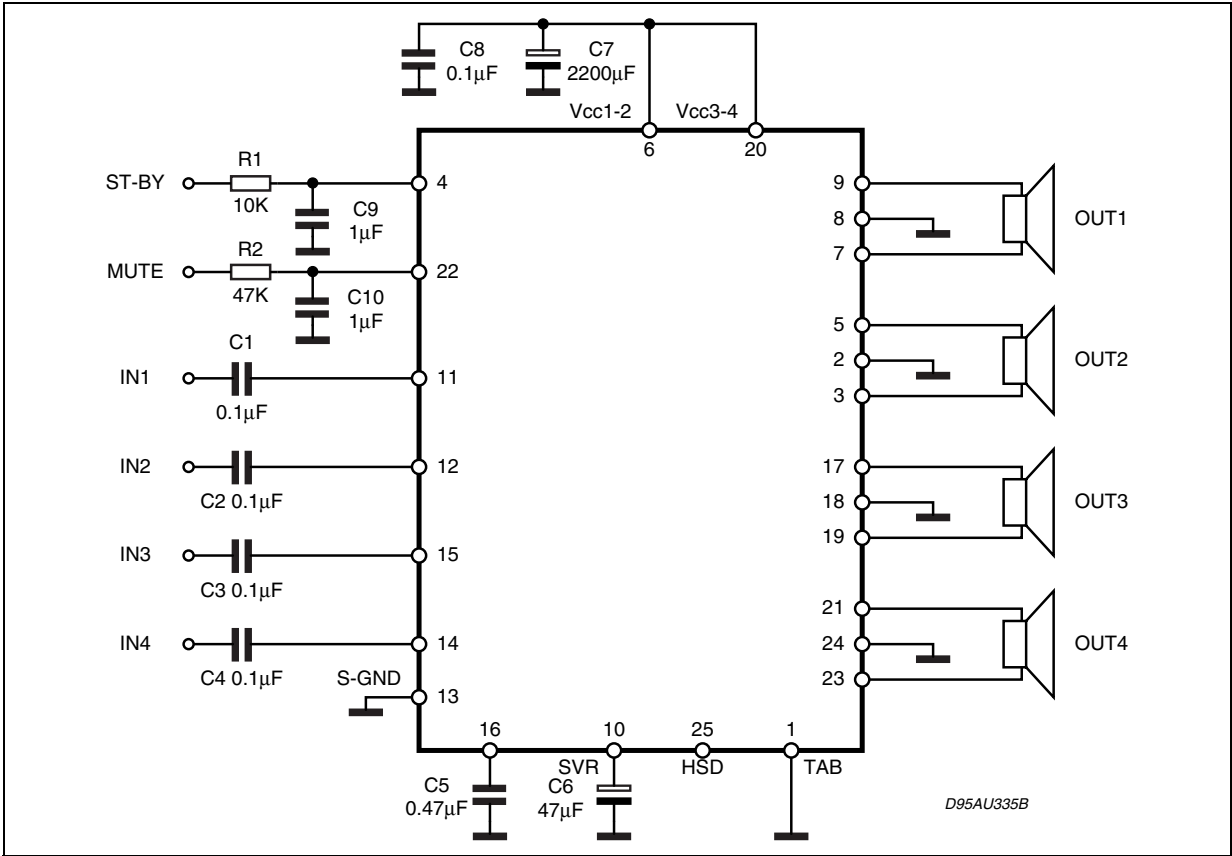
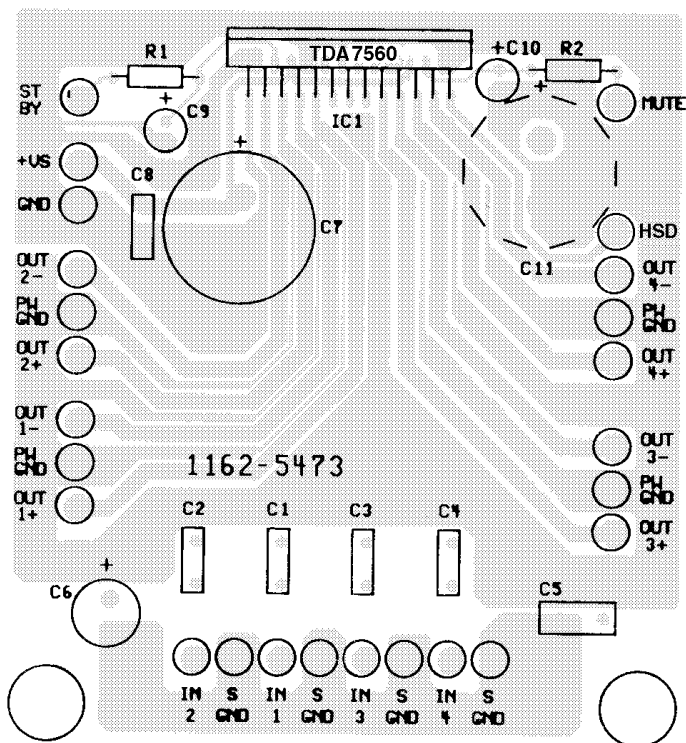


Figure 5. P.C.B. and component layout of the Figure 4.

Components & Top Copper Layer



Bottom Copper Layer

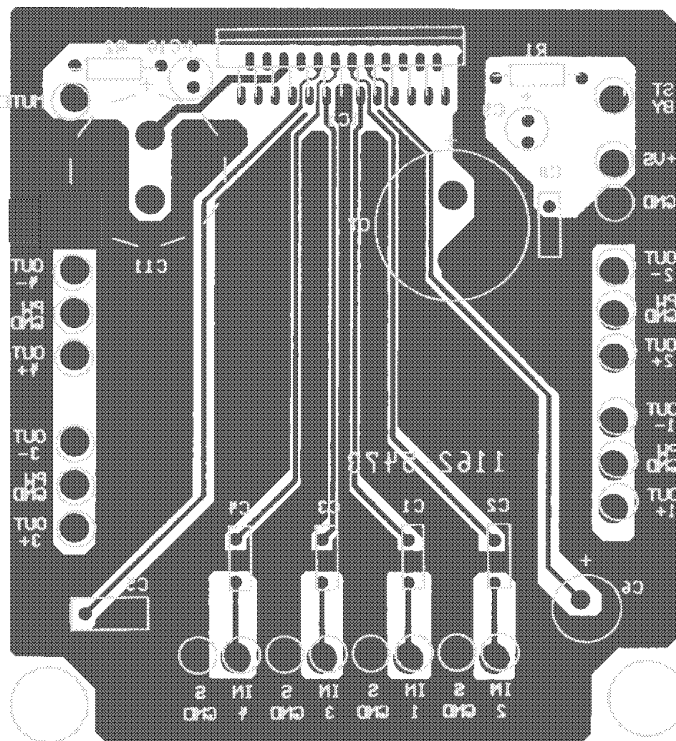


Figure 6. Quiescent current vs. supply voltage.

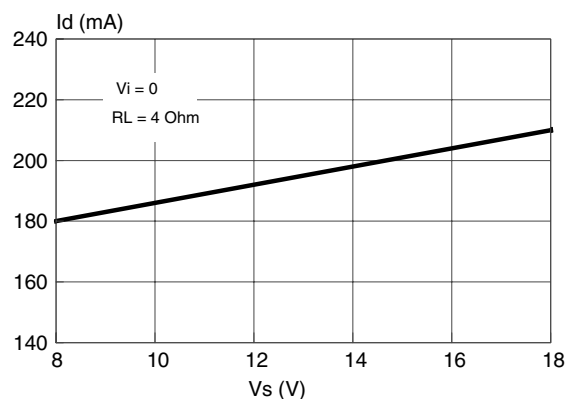


Figure 9. Distortion vs. output Power

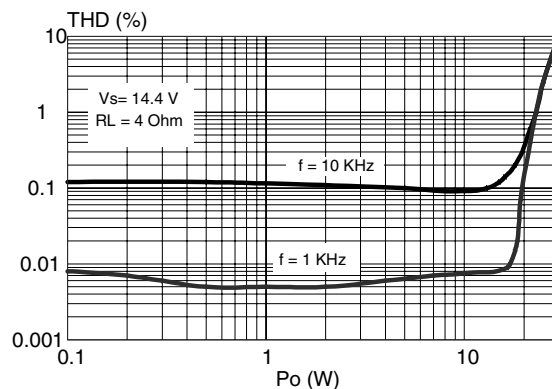


Figure 7. Output power vs. supply voltage.

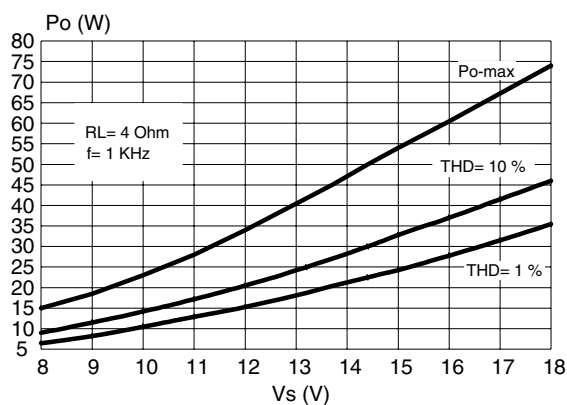


Figure 10. Distortion vs. output power

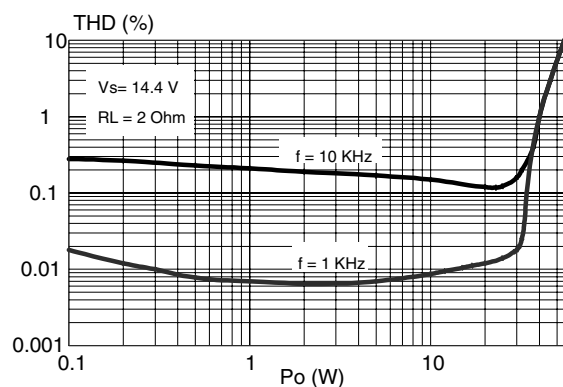


Figure 8. Output power vs. supply voltage.

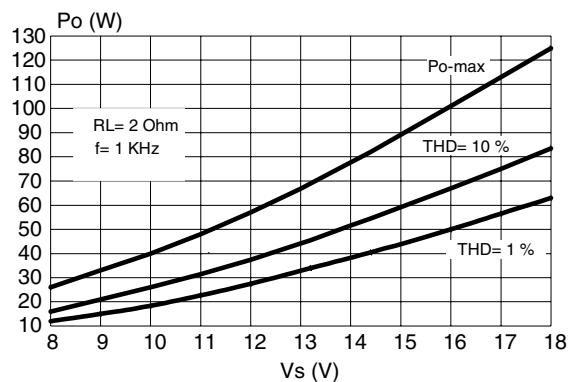


Figure 11. Distortion vs. frequency.

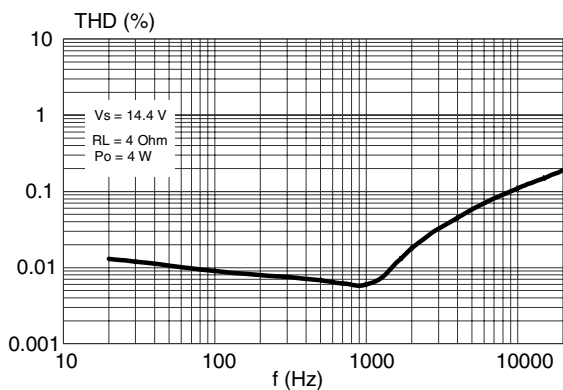


Figure 12. Distortion vs. frequency.

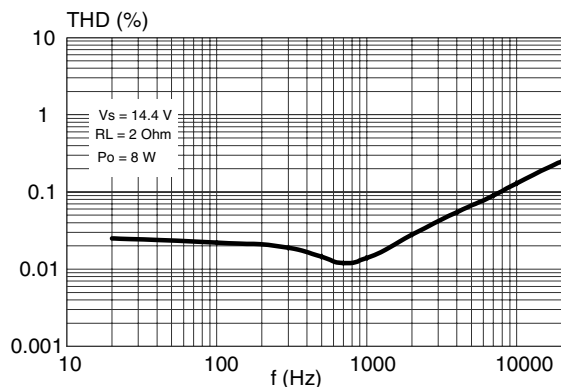


Figure 15. Output attenuation vs. supply volt.

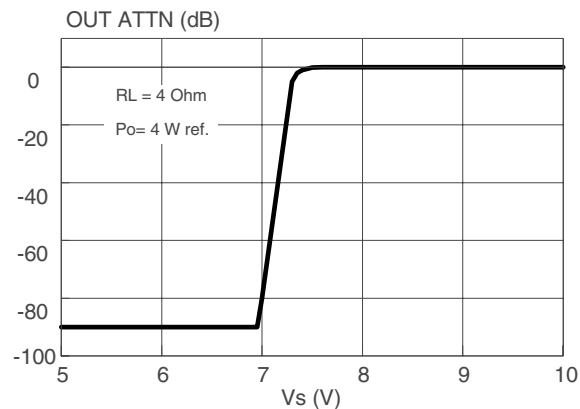


Figure 13. Crosstalk vs. frequency.

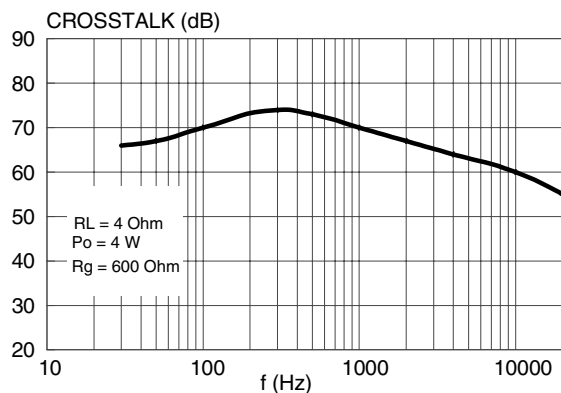


Figure 16. Output noise vs. source resistance.

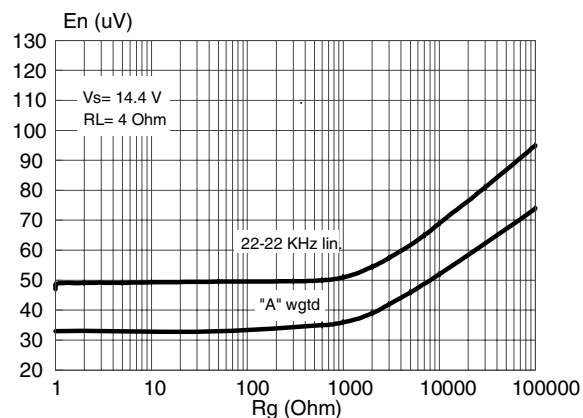


Figure 14. Supply voltage rejection vs. freq.

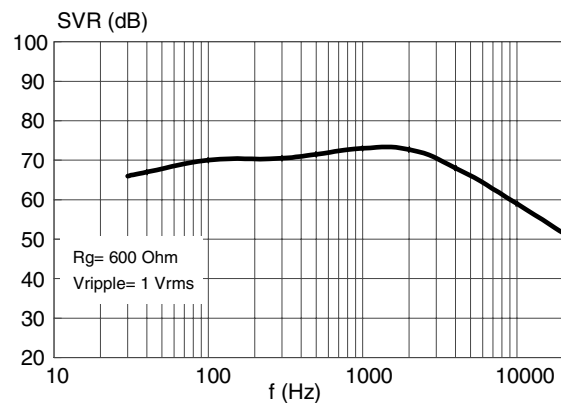


Figure 17. Power dissipation & efficiency vs. output power (sine-wave operation)

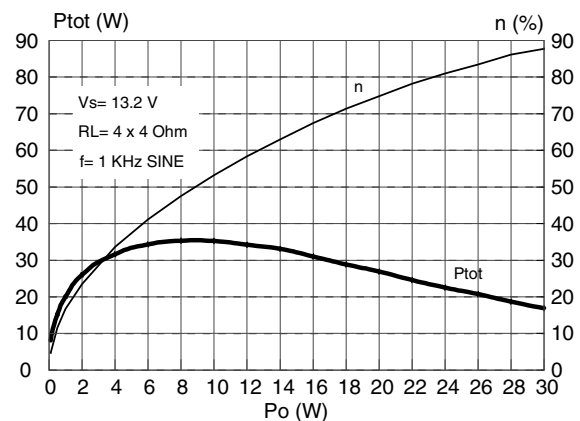


Figure 18. Power dissipation vs. output power (Music/Speech Simulation)

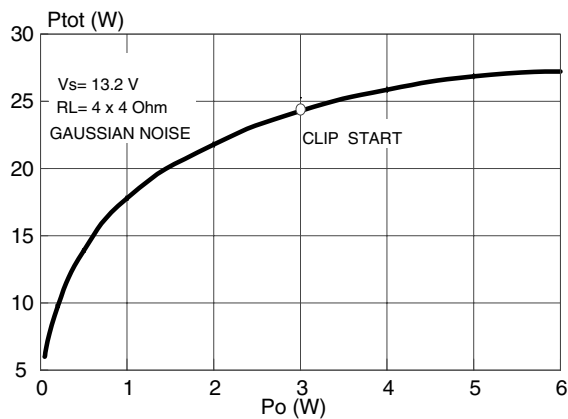
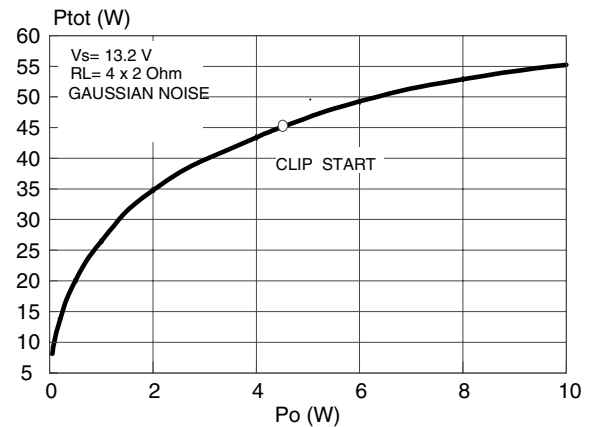


Figure 19. Power dissipation vs. output power (Music/Speech Simulation)



3 DC Offset Detector

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 10 μ F.**

4.2 INPUT STAGE

The TDA7560's inputs are ground-compatible and can stand very high input signals (± 8 Vpk) without any performances degradation.

If the standard value for the input capacitors (0.1 μ F) 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 occurrence (worst-case) will cause $P_{diss} = 26$ W. Assuming $T_{amb} = 70^{\circ}\text{C}$ and $T_{CHIP} = 150^{\circ}\text{C}$ 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.

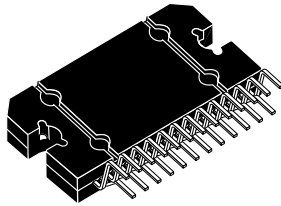
5 Package Information

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

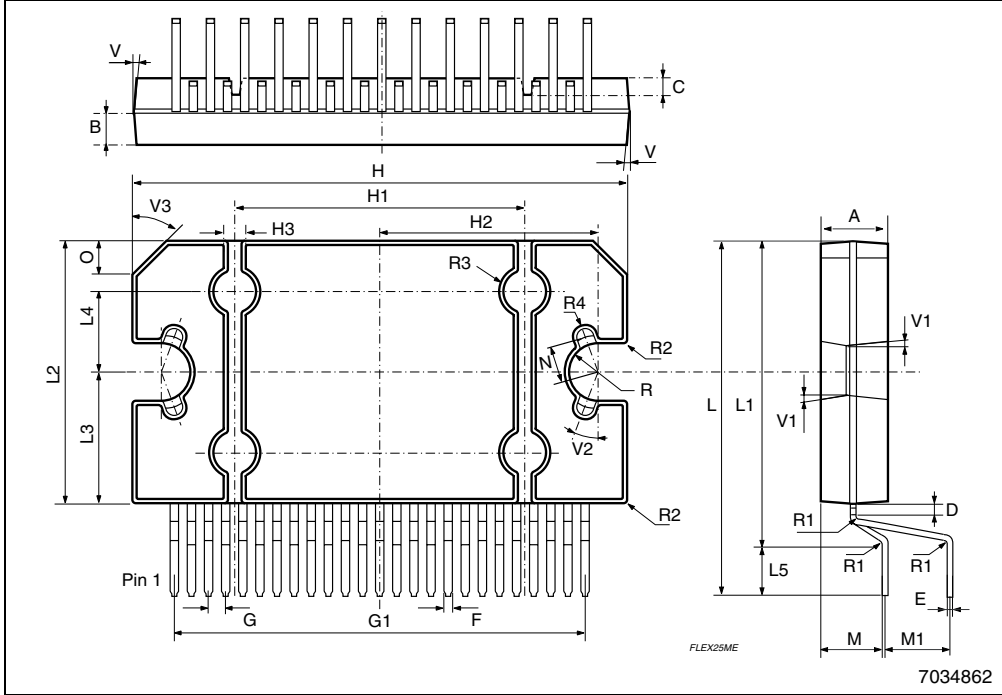
| DIM. | mm | | | inch | | |
|--------|------------|-------|-------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 4.45 | 4.50 | 4.65 | 0.175 | 0.177 | 0.183 |
| B | 1.80 | 1.90 | 2.00 | 0.070 | 0.074 | 0.079 |
| C | | 1.40 | | | 0.055 | |
| D | 0.75 | 0.90 | 1.05 | 0.029 | 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 20 μ A of the “ST_BY Current Consumption” parameter in the table 3 at the page 3. |

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