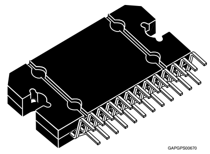
TDA7387

4 x 41 W quad bridge car radio amplifier

Datasheet — production data

Features

- High output power capability:
  - 4 x 41 W / 4 Ω max.
  - 4 x 22 W / 4 Ω @ 14.4 V, 1 kHz, 10 %
- Low 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
- 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 TDA7387 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 TDA7387 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
TDA7387	Flexiwatt25	Tube

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1 Block and pin connection diagrams

Figure 1. Block diagram

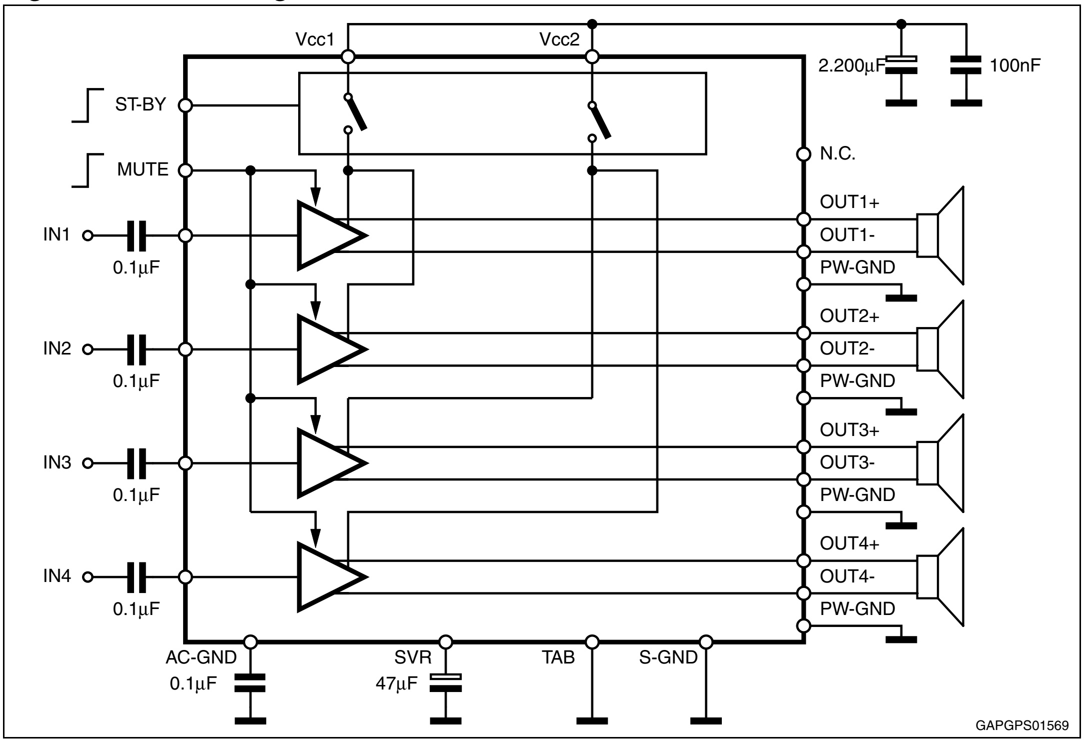
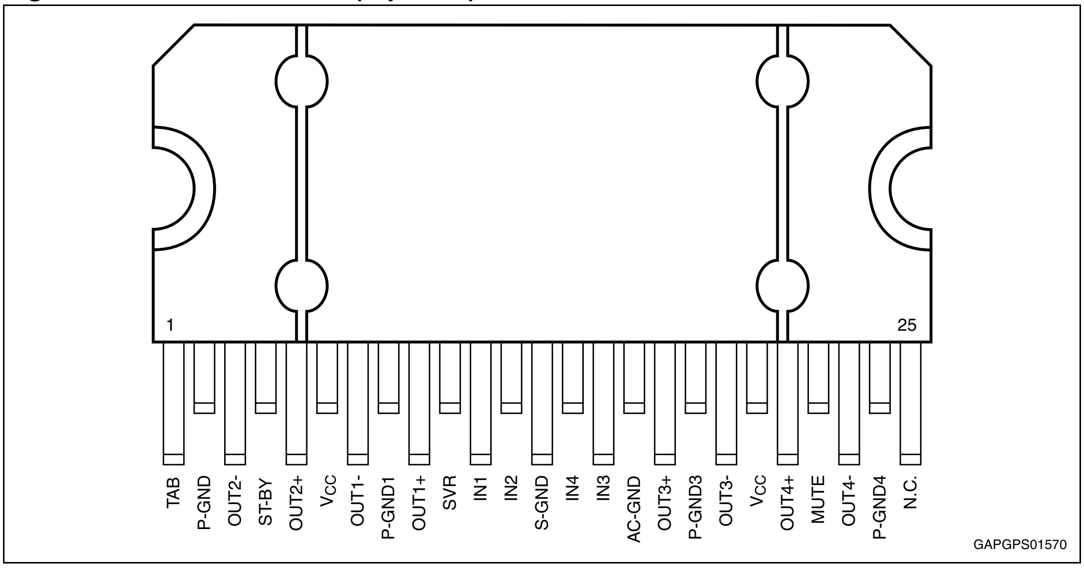


Figure 2. Pin connection (top view)



2 Electrical specifications

2.1 Absolute maximum ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_S	Operating supply voltage	18	V
$V_{S\ (DC)}$	DC supply voltage	28	V
$V_{S\ (pk)}$	Peak supply voltage (t = 50 ms)	50	V
I_O	Output peak current: Repetitive (duty cycle 10 % at f = 10 Hz) Non repetitive (t = 100 µs)	 4.5 5.5	 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

2.2 Thermal data

Table 3. Thermal data

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

2.3 Electrical characteristics

V_S = 14.4 V; f = 1 kHz; R_g = 600 Ω; R_L = 4 Ω; T_{amb} = 25 °C; Refer to the test and application diagram (*Figure 3*), unless otherwise specified.

Table 4. Electrical characteristics

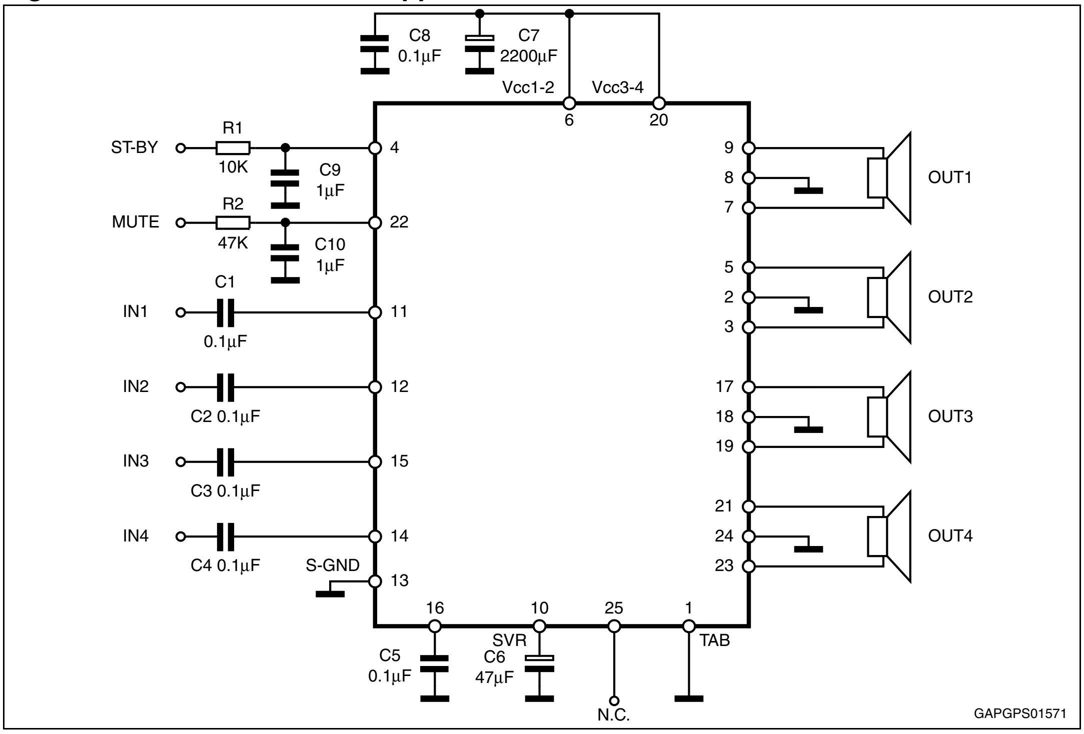
Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
I_{q1}	Quiescent current	-	-	180	300	mA
V_{OS}	Output offset voltage	-	-	-	100	mV
G_v	Voltage gain	-	25	26	27	dB
P_o	Output power	THD = 10% THD = 1%	20 -	22 18	-	W
$P_{o\ max.}$	Max. output power (1)	V_S = 14.4 V	33	37	-	W
		V_S = 15.2 V	-	41	-	
THD	Distortion	P_o = 4 W	-	0.04	0.3	%
e_{No}	Output noise	"A" Weighted Bw = 20 Hz to 20 kHz	-	50 65	 150	µV µV

Table 4. Electrical characteristics (continued)

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
SVR	Supply voltage rejection	f = 100 Hz	50	65	-	dB
f_{cl}	Low cut-off frequency	-	-	20	-	Hz
f_{ch}	High cut-off frequency	-	75		-	kHz
R_i	Input impedance	-	70	100	-	kΩ
C_T	Cross talk	f = 1 kHz	50	70	-	dB
I_{SB}	Standby current consumption	Vs_{tandby} = 0 V	-	-	15	µA
$V_{SB\ out}$	Standby out threshold voltage	(Amp: on)	3.5	-	-	V
$V_{SB\ IN}$	Standby in threshold voltage	(Amp: off)	-	-	1.5	V
A_M	Mute attenuation	V_O = 1Vrms	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
$I_{m\ (L)}$	Muting pin current	V_{MUTE} = 1.5 V (source current)	5	10	16	µA

1. Saturated square wave output.

Figure 3. Standard test and application circuit



2.4 PCB and component layout

Referred to *Figure 3: Standard test and application circuit*.

Figure 4. Components and top copper layer

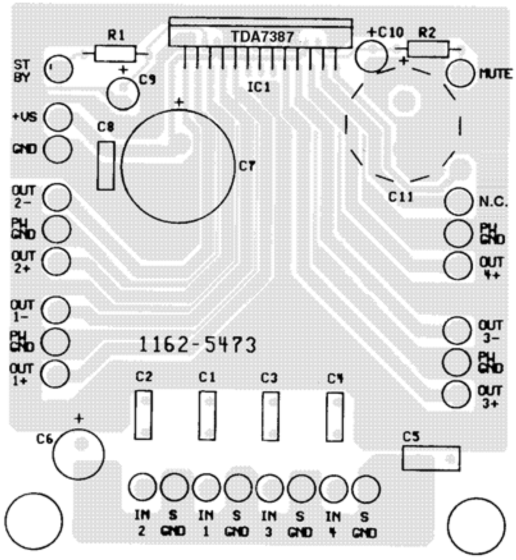
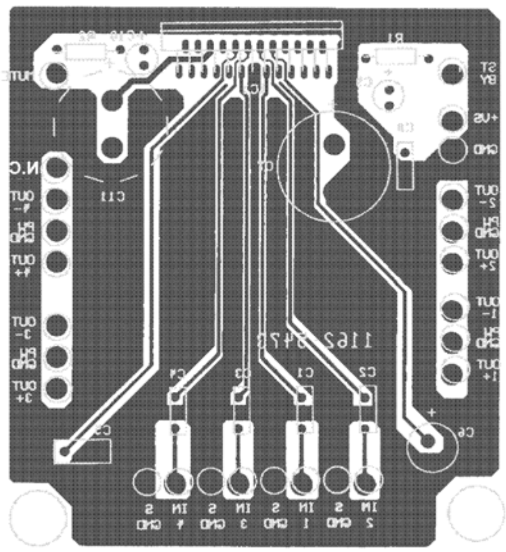


Figure 5. Bottom copper layer



2.5 Electrical characteristic curves

Figure 6. Quiescent current vs. supply voltage

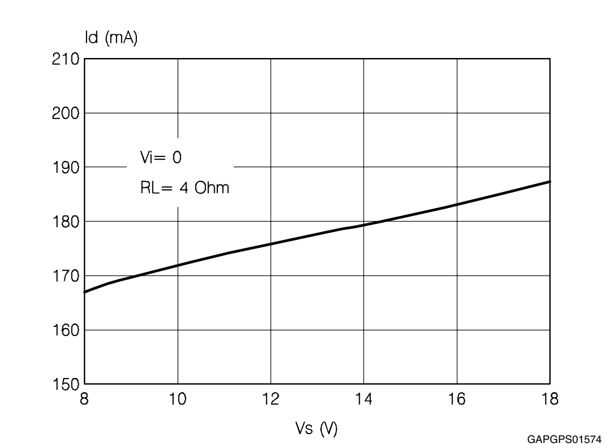


Figure 7. Quiescent output voltage vs. supply voltage

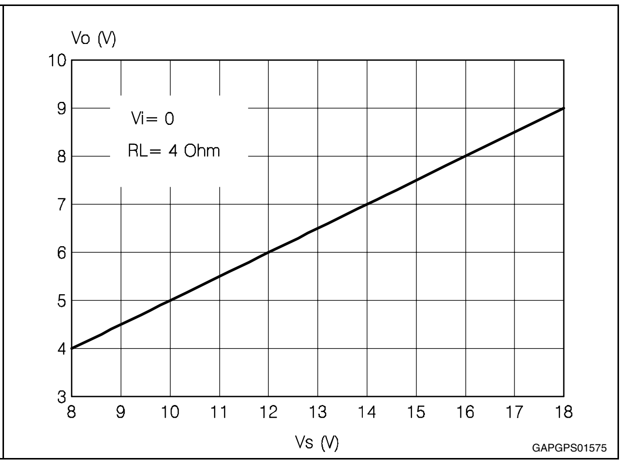


Figure 8. Output power vs. supply voltage (4Ω)

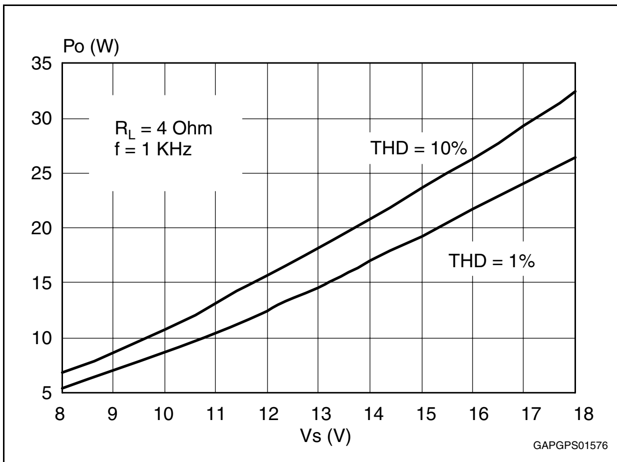


Figure 9. Distortion vs. output power

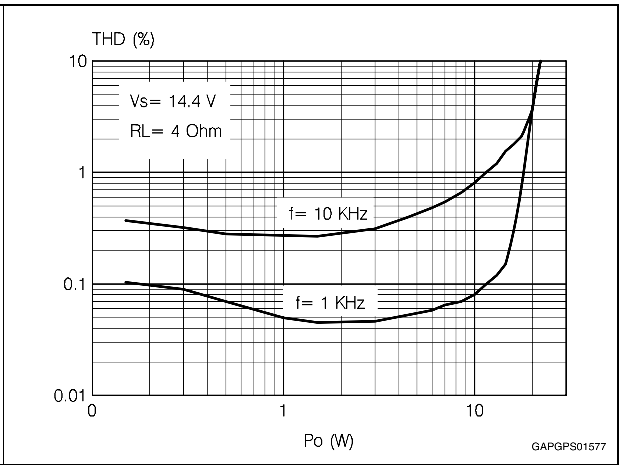


Figure 10. Distortion vs. frequency

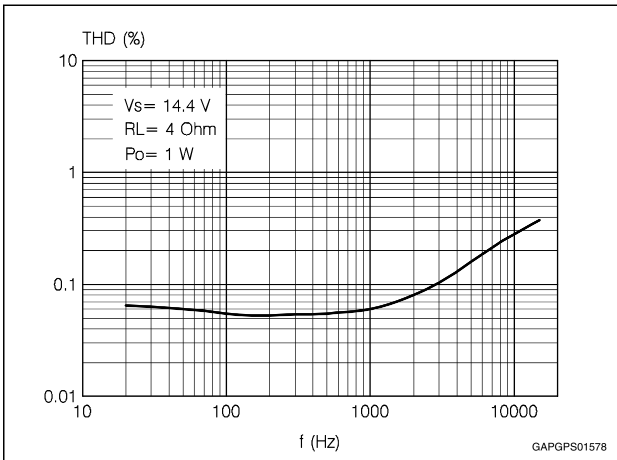
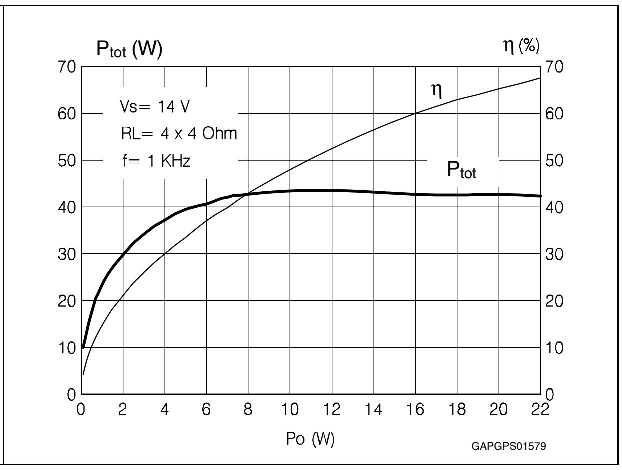


Figure 11. Power dissipation and efficiency vs. output power



3 Application hints

Referred to the circuit of *Figure 3*.

3.1 Biasing and SVR

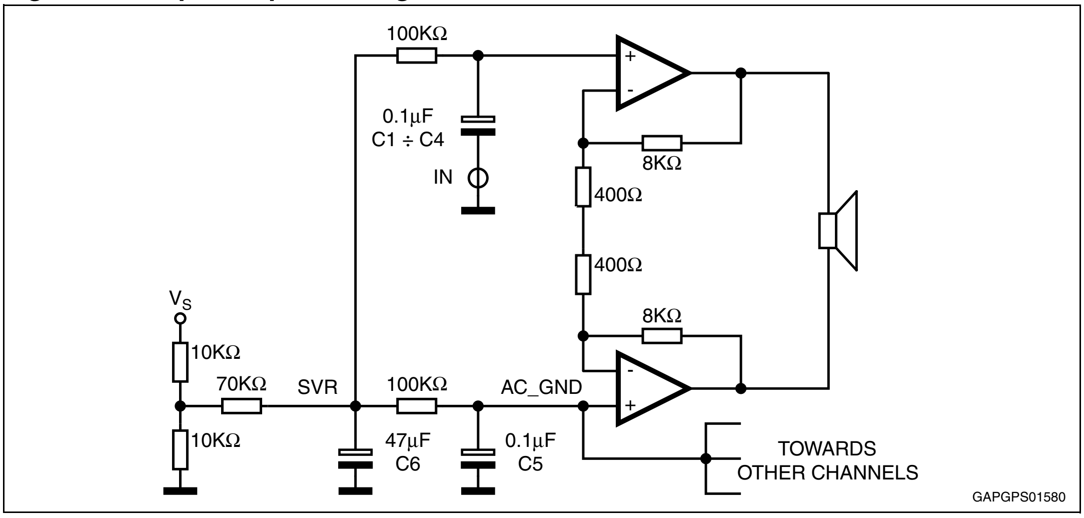
As shown by *Figure 12*, all the TDA7387's main sections, such as Inputs, Outputs AND AC-GND (pin 16) are internally biased at half supply voltage level (Vs/2), which is derived from the Supply Voltage Rejection (SVR) block. In this way no current flows through the internal feedback network. The AC-GND is common to all the 4 amplifiers and represents the connection point of all the inverting inputs.

Both individual inputs and AC-GND are connected to Vs/2 (SVR) by means of 100 kΩ resistors.

To ensure proper operation and high supply voltage rejection, it is of fundamental importance to provide a good impedance matching between Inputs and AC-GROUND terminations. This implies that **C_1, C_2, C_3, C_4, C_5 capacitors have to carry the same nominal value and their tolerance should never exceed ± 10 %.**

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**.

Figure 12. Input/output biasing.



3.2 Input stage

The TDA7387'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 µF) 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 µA normally flows out of pin 22, the maximum allowable muting-series resistance (R_2) is 70 kΩ, which is sufficiently high to permit a muting capacitor reasonably small (about 1µF).

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.

3.4 Stability and layout considerations

If properly layouted and hooked to standard car-radio speakers, the TDA7387 will be intrinsically stable with no need of external compensations such as output R-C cells. Due to the high number of channels involved, this translates into a very remarkable components saving if compared to similar devices on the market.

To simplify pc-board layout designs, each amplifier stage has its own power ground externally accessible (pins 2,8,18,24) and one supply voltage pin for each couple of them. Even more important, this makes it possible to achieve the highest possible degree of separation among the channels, with remarkable benefits in terms of cross-talk and distortion features.

About the layout grounding, it is particularly important to connect the AC-GND capacitor (C_5) to the signal GND, as close as possible to the audio inputs ground: this will guarantee high rejection of any common mode spurious signals.

The SVR capacitor (C_6) has also to be connected to the signal GND.

Supply filtering elements (C_7, C_8) have naturally to be connected to the power-ground and located as close as possible to the Vs pins.

Pin 1, which is mechanically attached to the device’s tab, needs to be tied to the cleanest power ground point in the pc-board, which is generally near the supply filtering capacitors.

4 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*.

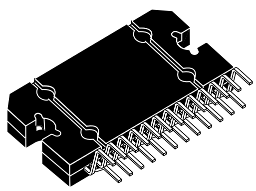
ECOPACK® is an ST trademark.

Figure 13. Flexiwatt25 mechanical data and package dimensions

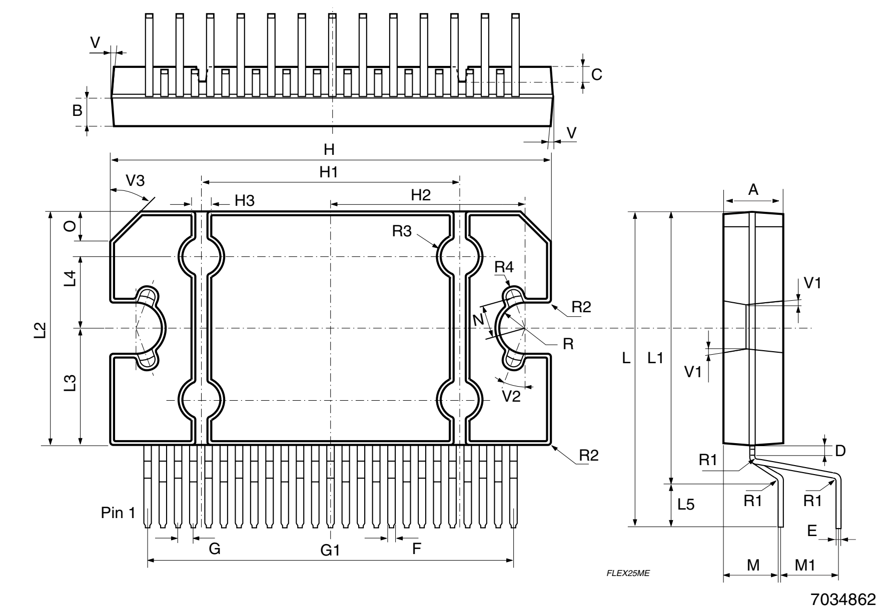
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.45	4.50	4.65	0.175	0.177	0.183
B	1.80	1.90	2.00	0.070	0.074	0.079
C		1.40			0.055	
D	0.75	0.90	1.05	0.029	0.035	0.041
E	0.37	0.39	0.42	0.014	0.015	0.016
F (1)			0.57			0.022
G	0.80	1.00	1.20	0.031	0.040	0.047
G1	23.75	24.00	24.25	0.935	0.945	0.955
H (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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5 Revision history

Table 5. Document revision history

Date	Revision	Changes
17-Nov-2008	1	Initial release.
22-Dec-2011	2	Updated *Features on page 1* and *Table 4: Electrical characteristics*.
23-May-2012	3	Updated: *Features on page 1*; *Table 4: Electrical characteristics on page 6*. Corrected typeset error in *Section 3.4: Stability and layout considerations*.