TDA7389A

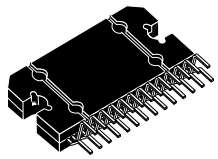
4 x 45W quad bridge car radio amplifier

Features

- High output power:
  - 4 x 45 W / 4 Ω max.
  - 4 x 28 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 (26dB)
  - No external compensation
  - No bootstrap capacitors
- Clipping detector
- Offset detector
- Diagnostic facility for:
  - Out to GND short
  - Out to V_S short
  - Thermal shutdown

Protections:

- Output short circuit to GND, to V_S, across the load
- Very inductive loads
- Overrating chip temperature with soft thermal limiter



Flexiwatt27

- Load dump voltage
- Fortuitous open GND
- Output DC offset detector
- Reversed battery
- ESD

Description

The TDA7389A is an AB class audio power amplifier, packaged in Flexiwatt 27 designed for high end car radio applications.

Based on the fully complementary PNP/NPN configuration the TDA7389A allows a rail to rail output voltage swing with no need of bootstrap capacitors.

Table 1. Device summary

Order code	Package	Packing
TDA7389A	Flexiwatt27	Tube

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1 Pin connection and block diagrams

Figure 1. Block diagram

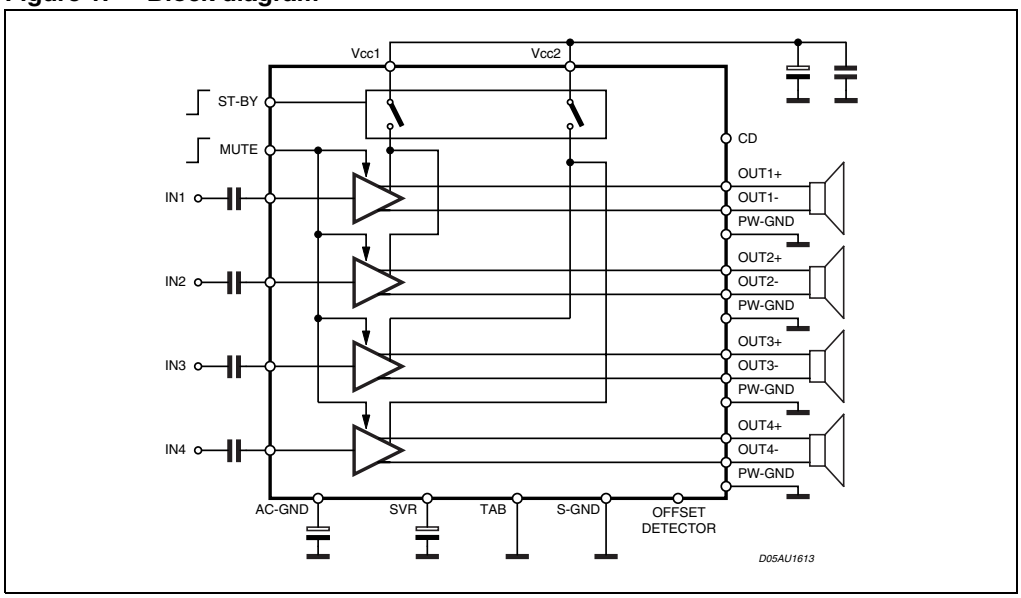
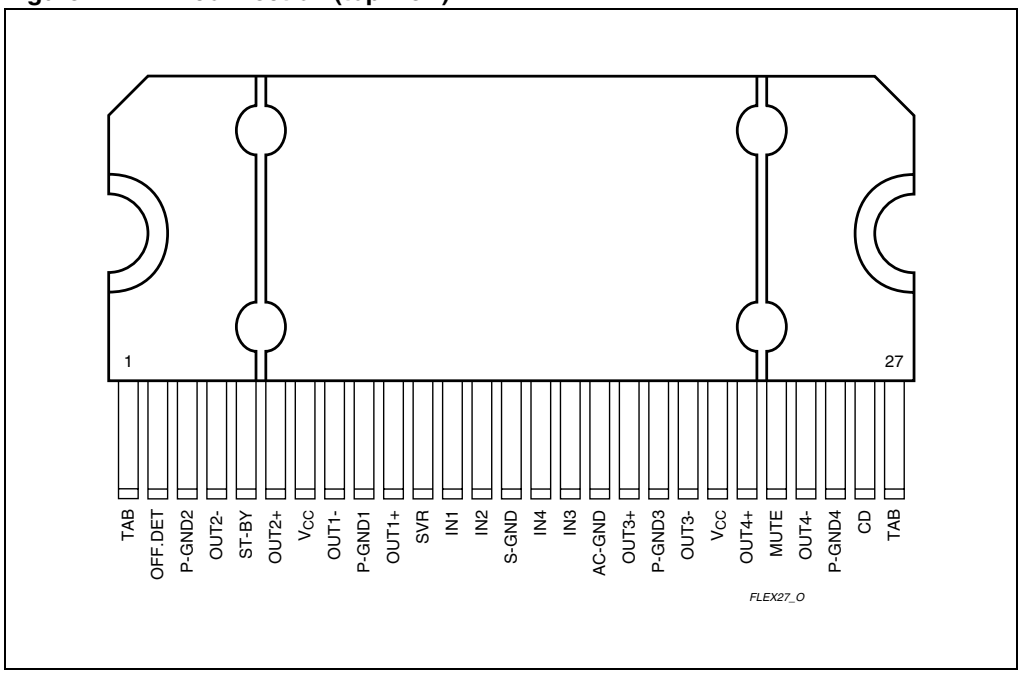


Figure 2. Pin connection (top view)



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 = 50ms)	50	V
I_O	Output peak current: Repetitive (duty cycle 10% at f = 10Hz) Non repetitive (t = 100µs)	 4.5 5.5	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

Table 4. Electrical characteristics

(V_S = 14.4V; f = 1KHz; R_g = 600Ω; R_L = 4Ω; T_{amb} = 25°C; Refer to the test and application diagram (*Figure 14*), unless otherwise specified.)

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
I_{q1}	Quiescent current	$R_L = \infty$		150	350	mA
V_{OS}	Output offset voltage	Play Mode			±80	mV
dV_{OS}	During mute on/off output offset voltagef	ITU R-ARM weighted see *Figure 13*	-10		10	mV
	During standby on/off output offset voltage		-50		50	
G_v	Voltage gain		25	26	27	dB
ΔG_v	Channel gain unbalance				±1	dB
P_o	Output power	THD = 10%; V_S = 14.4V	26	28		W
$P_{o\ max}$	Max.output power(1)	V_S = 14.4V	41	45		W

Table 4. Electrical characteristics (continued)

(V_S = 14.4V; f = 1KHz; R_g = 600Ω; R_L = 4Ω; T_{amb} = 25°C; Refer to the test and application diagram (*Figure 14*), unless otherwise specified.)

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
THD	Distortion	P_o = 4W		0.04	0.10	%
e_{No}	Output noise	"A" Weighted		50	70	µV
		Bw = 20 Hz to 20 kHz		70	100	µV
SVR	Supply voltage rejection	f = 100Hz; V_r = 1V_{rms}	50	75		dB
f_{ch}	High cut-off frequency	P_o = 0.5W	100	200		KHz
R_i	Input Impedance		70	100	150	KΩ
C_T	Cross talk	f = 1 kHz; P_o = 4W	60	75		dB
		f = 10 kHz; P_o = 4W		60		dB
I_{SB}	Standby current consumption	$V_{St\text{-}by}$ = 1.2V			50	µA
		$V_{St\text{-}by}$ = 0V			25	
I_{pin4}	Standby pin current	$V_{St\text{-}by}$ = 1.2 to 2.6V			±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 Ω (Amp: play); Att < 0.1 dB; P_O = 0.5 W		 7.6	6.5 8.5	V
I_{pin22}	Muting pin current	V_{MUTE} = 1.2 V (Source current)	5	11	20	µA
		V_{MUTE} = 2.6 V	-5	-	-20	
Offset detector						
OD_{LK}	OD leakage current				1	µA
V_{off}	Detected diff. output offset	$V_{St\text{-}by}$ =5 V	1.5	±2	2.5	V
V_{Pin2_Fw27}	Pin2_Fw27 voltage for Detection = True	I_{pin2} = 1 mA $V_{St\text{-}by}$ =5V; $\|V_{off}\|$ > 2.5 V		0.2	0.4	V
Clipping detector						
CD_{LK}	Clip det high leakage current	CD Off			1	µA
CD_{SAT}	Clip det sat voltage	DC On; I_{CD} = 1 mA		0.2	0.4	V
CD_{THD}	Clip det THD level	P_o > 16 W			2	%

1. Saturated square wave output.

2.4 Electrical characteristic curves

Figure 3. Quiescent current vs. supply voltage

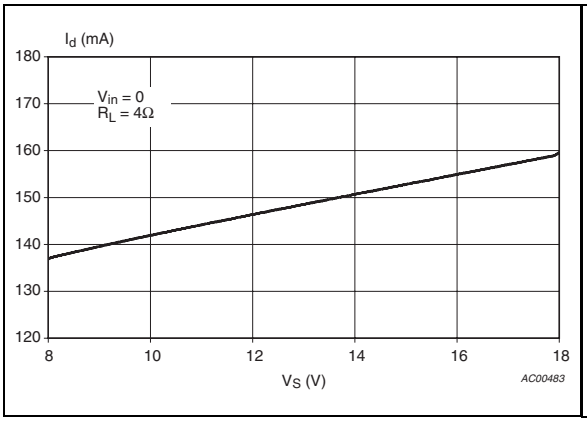


Figure 4. Quiescent output voltage vs. supply voltage

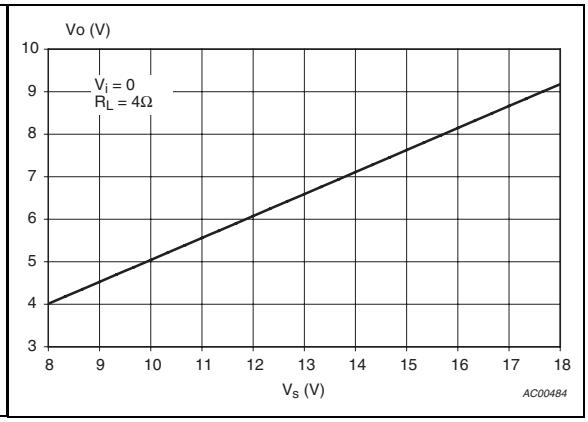


Figure 5. Output power vs. supply voltage

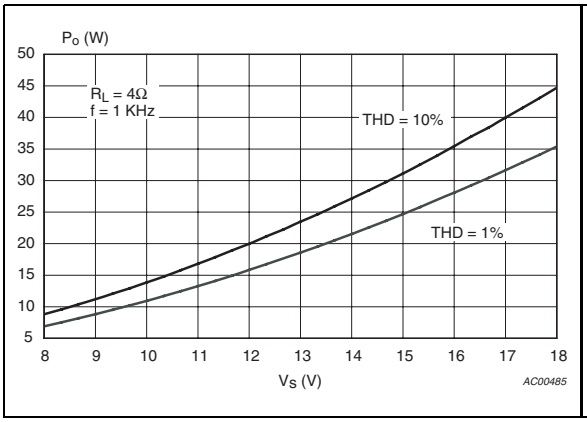


Figure 6. Maximum output power vs. supply voltage

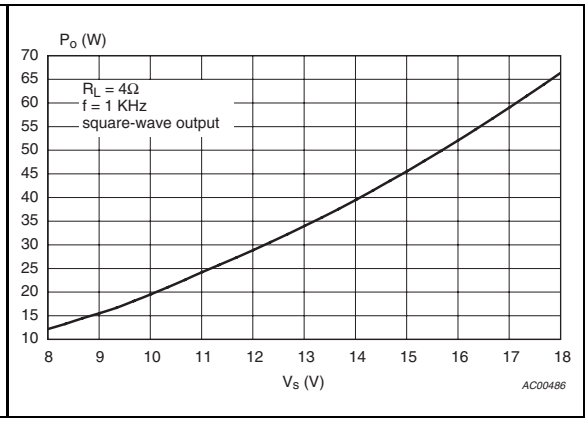


Figure 7. Distortion vs. output power

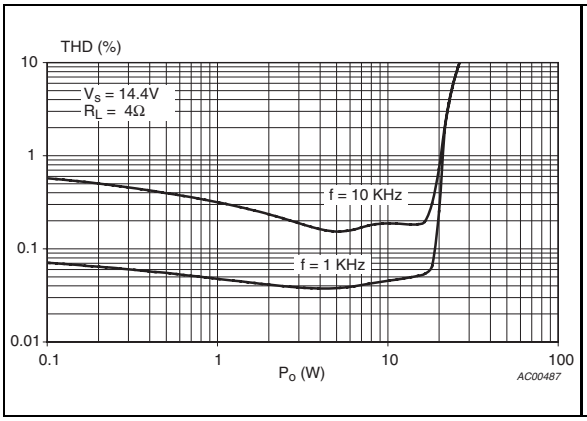


Figure 8. Distortion vs. frequency

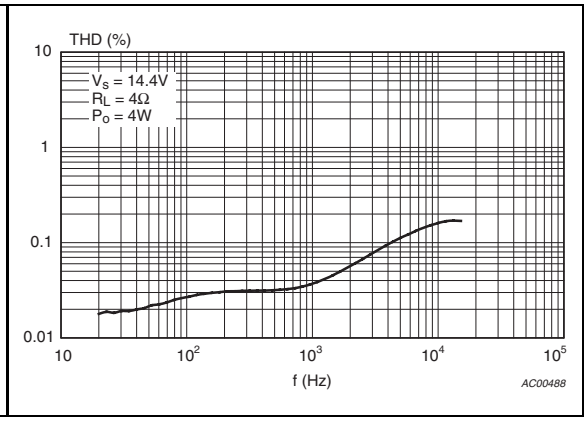


Figure 9. Supply voltage rejection vs. frequency

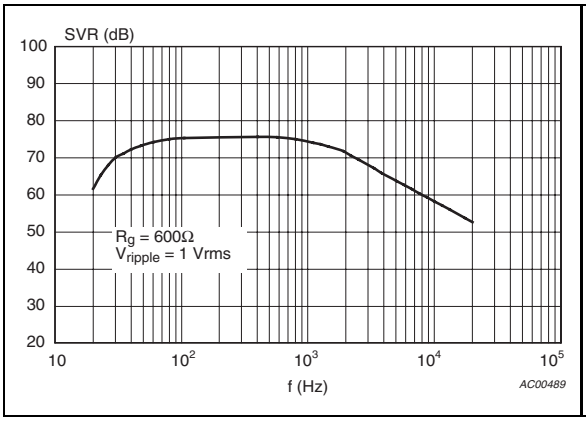


Figure 10. Crosstalk vs. frequency

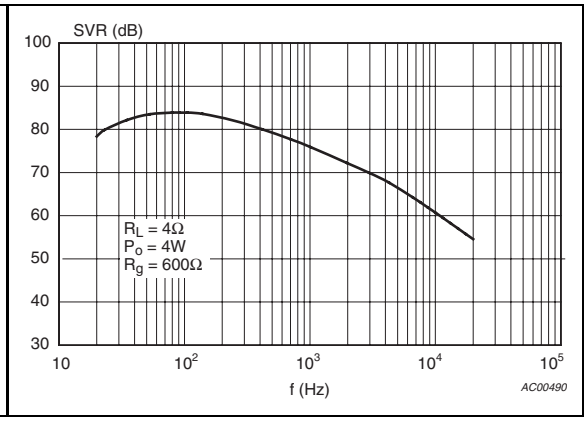


Figure 11. Output noise vs. source resistance

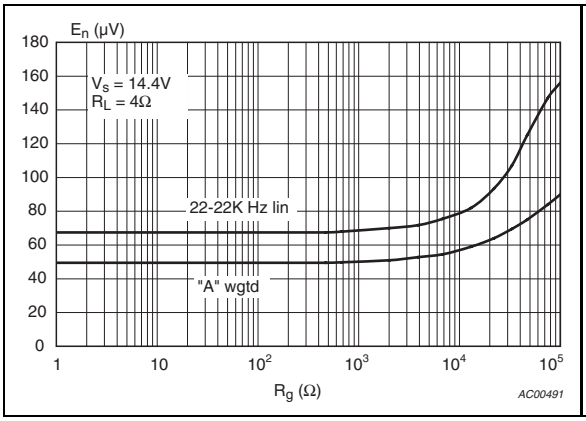


Figure 12. Power dissipation and efficiency vs. output power

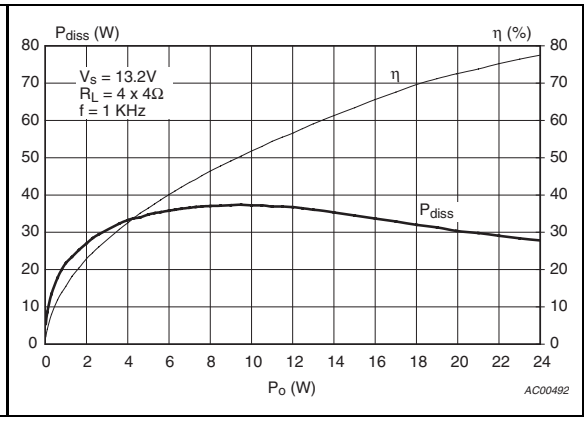
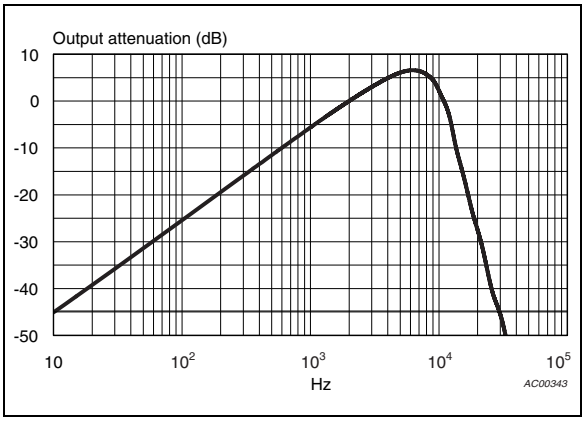
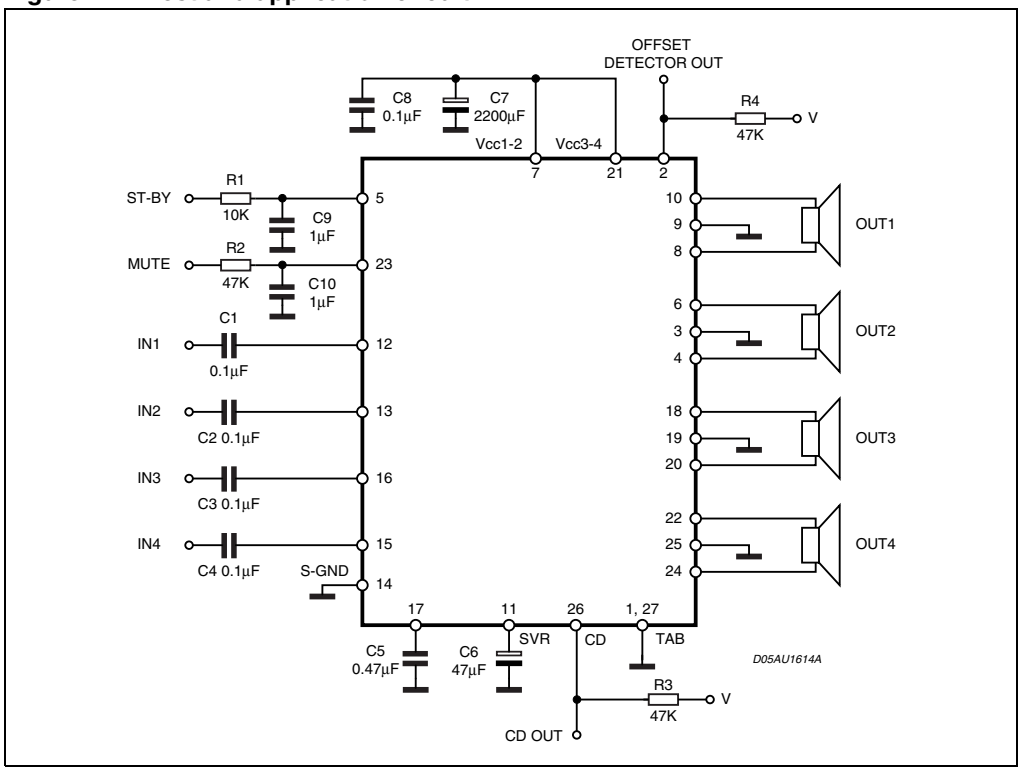


Figure 13. ITU R-ARM frequency response, weighting filter for transient pop



2.5 Test and application circuit

Figure 14. Test and application circuit



3 Application hints

Ref. to the circuit of *Figure 14*.

3.1 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 22µF**, 47µF can be used to optimize pop performances.

3.2 Input stage

The TDA7389A'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.

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

3.3 Standby and muting

Standby and muting facilities are both 3.3 V CMOS-compatible. If unused, a straight connection to V_s 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 10µA normally flows out of pin 23, 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 23 may rise to above the 1.2 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.

4 Package information

In order to meet environmental requirements, ST (also) offers these devices in ECOPACK® packages. ECOPACK® packages are lead-free. The category of second Level Interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label.

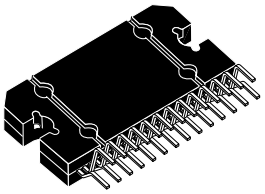
ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com.

Figure 15. Flexiwatt27 mechanical data and package dimensions

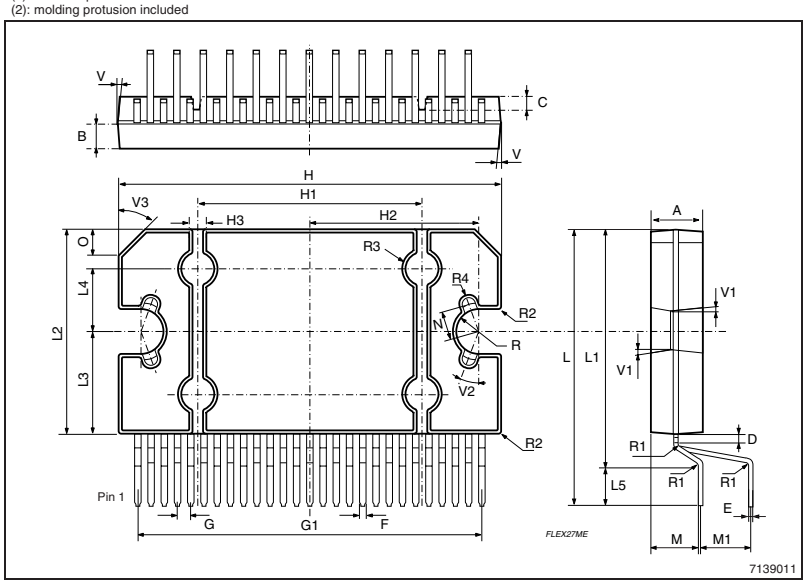
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.45	4.50	4.65	0.175	0.177	0.183
B	1.80	1.90	2.00	0.070	0.074	0.079
C		1.40			0.055	
D	0.75	0.90	1.05	0.029	0.035	0.041
E	0.37	0.39	0.42	0.014	0.015	0.016
F (1)			0.57			0.022
G	0.80	1.00	1.20	0.031	0.040	0.047
G1	25.75	26.00	26.25	1.014	1.023	1.033
H (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



Flexiwatt27 (vertical)



5 Revision history

Table 5. Document revision history

Date	Revision	Changes
14-Nov-2007	1	Initial release.
20-Oct-2008	2	Updated the *Table 3: Thermal data on page 6*.

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