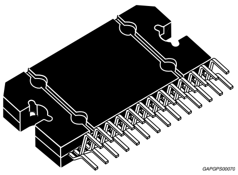
4 x 42 W quad bridge car radio amplifier

Datasheet - production data



Flexiwatt27

Features

- High output power capability:
  – 4 x 42 W / 4 Ω max.
  – 4 x 27 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
- 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
  – Load dump voltage
  – Fortuitous open GND
  – Output DC offset detector
  – Reversed battery
  – ESD

Description

The TDA7388A is a new technology class AB audio power amplifier in Flexiwatt27 package designed for high end car radio applications.

Thanks to the fully complementary PNP/NPN output configuration the TDA7388A allows a rail to rail output voltage swing with no need of bootstrap capacitors. The extremely reduced components count allows very compact sets.

The TDA7388A is also equipped with Clipping detector and Offset detector features.

Table 1. Device summary

Order code	Package	Packing
TDA7388A	Flexiwatt27	Tube

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1 Pin connection and test/application diagrams

Figure 1. Pin connections (top view)

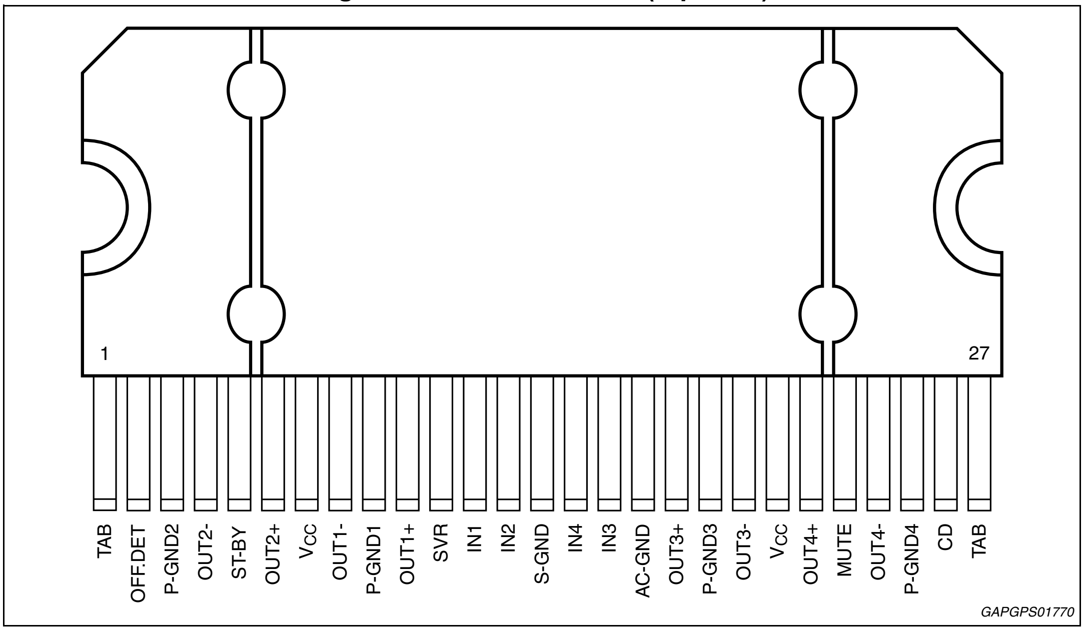
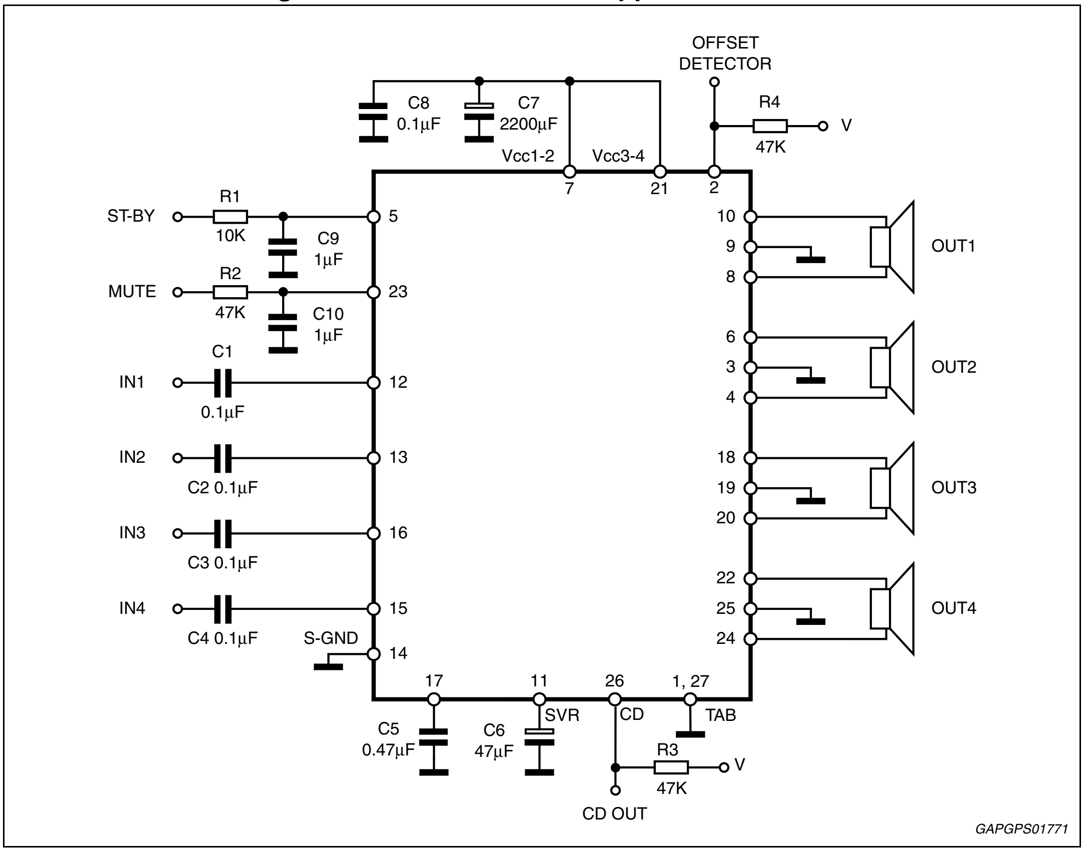


Figure 2. Standard test and application circuit



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
T_{amb}	Operative temperature range	– 40 to 105	°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 2*), unless otherwise specified.

Table 4. Electrical characteristics

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
I_{q1}	Quiescent current	$R_L = \infty$	100	190	350	mA
V_{OS}	Output offset voltage	Play mode	-	-	±100	mV
dV_{OS}	During mute ON/OFF output offset voltage	ITU R-ARM weighted see *Figure 11*	-10	-	+10	mV
	During St-By ON/OFF output offset voltage		-50	-	+50	mV
G_v	Voltage gain	-	25	26	27	dB
ΔG_v	Channel gain unbalance	-	-	-	±1	dB
P_o	Output power	THD = 10 %; V_S = 14.4 V	25	27	-	W

Table 4. Electrical characteristics (continued)

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
$P_{o\ max}$	Max.output power(1)	V_S = 14.4 V	39	42	-	W
THD	Distortion	P_o = 4 W	-	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 = 100 Hz; V_r = 1 V_{rms}	50	65	-	dB
f_{ch}	High cut-off frequency	P_o = 0.5 W	100	200	-	kHz
R_i	Input Impedance	-	70	100	-	kΩ
C_T	Cross talk	f = 1 kHz; P_o = 4 W	60	70	-	dB
		f = 10 kHz; P_o = 4 W	-	60	-	dB
I_{SB}	Standby current consumption	V_{St-By} = 0 V	-	-	20	µA
I_{pin4}	Standby pin current	V_{St-By} = 1.2 to 2.6 V	-	-	±10	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 W (Amp: Play); Att < 0.1 dB; P_O = 0.5 W	-	7.6	6.5 8.5	V V
I_{pin22}	Muting pin current	V_{MUTE} = 1.2 V (Source current)	5	11	20	µA
Offset detector						
V_{off}	Detected diff. output offset	V_{St-by} =5V	±1.4	±2	±2.6	V
$V_{OFF\ LK}$	V_{OFF} high leakage current	OD off	-	-	10	µA
$V_{OFF\ SAT}$	V_{OFF} det saturation voltage	OD on; I_{OD} = 1 mA	-	300	-	mV
Clipping detector						
CD_{LK}	Clip det high leakage current	CD Off	-	-	10	µA
CD_{SAT}	Clip det sat voltage	DC On; I_{CD} = 1 mA	-	300	-	mV
CD_{THD}	Clip det THD level	-	-	0.2	-	%

1. Saturated square wave output.

2.4 Electrical characteristic curves

Figure 3. Quiescent current vs. supply voltage

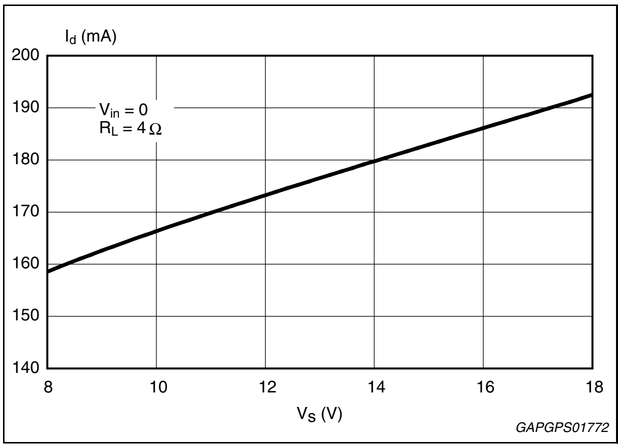


Figure 4. Output power vs. supply voltage (4 Ohm)

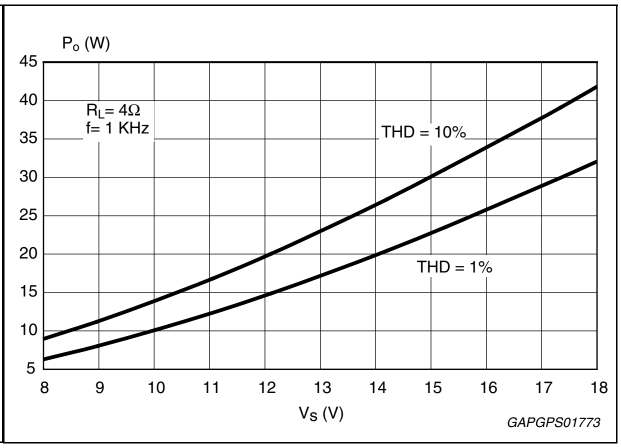


Figure 5. Distortion vs. output power

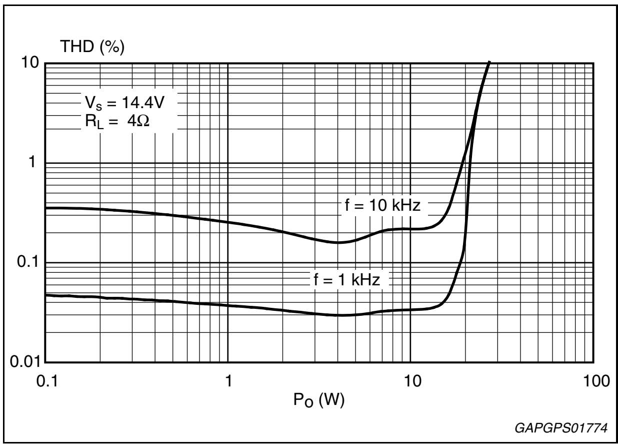


Figure 6. Distortion vs. frequency

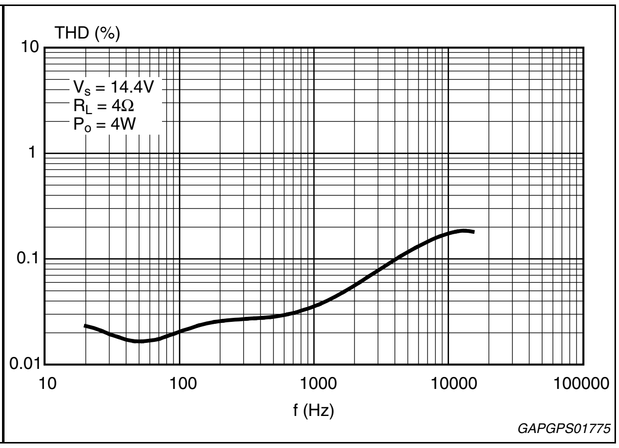


Figure 7. Supply voltage rejection vs. frequency

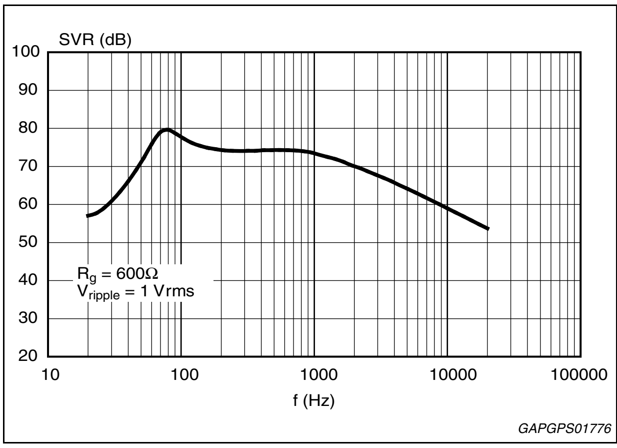


Figure 8. Crosstalk vs. frequency

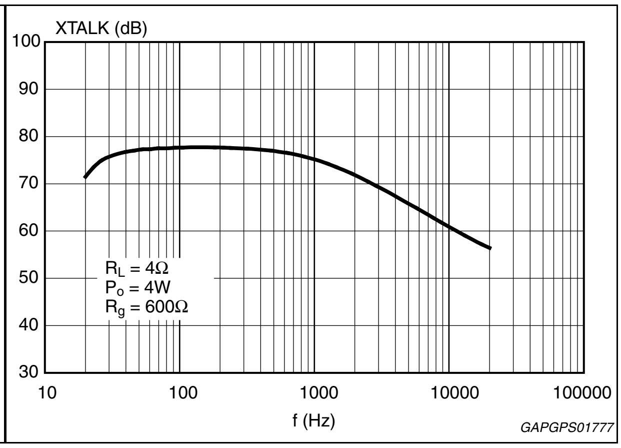


Figure 9. Output noise vs. source resistance

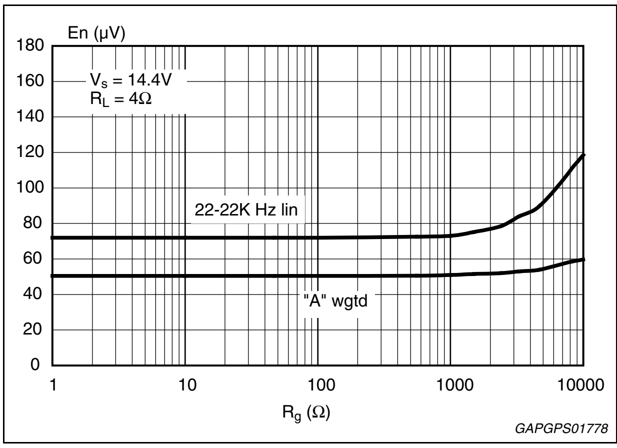


Figure 10. Power dissipation & efficiency vs. output power

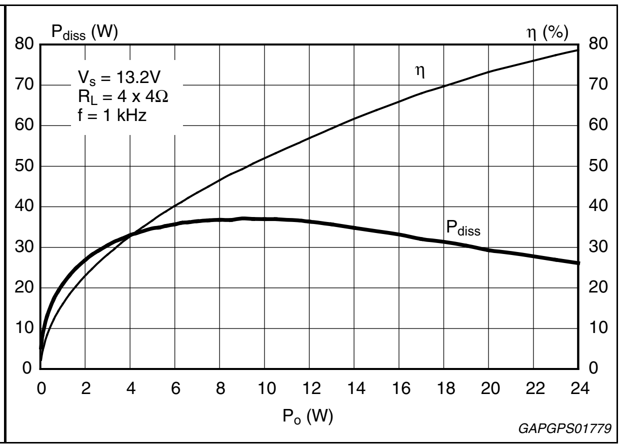
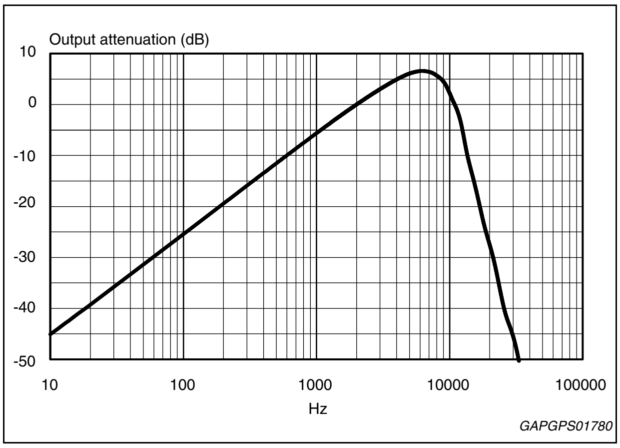


Figure 11. ITU R-ARM frequency response, weighting filter for transient pop



3 Application hints

Ref. to the circuit of *Figure 2*.

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 10 µF**.

3.2 Input stage

The TDA7388A'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 3.3V 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 10 µA 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 1 µF).

If R_2 is higher than recommended, the involved risk will be that the voltage at pin 23 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 2.5 V/ms.

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.

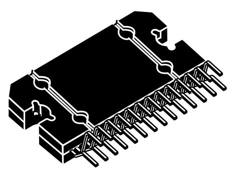
ECOPACK® is an ST trademark.

Figure 12. Flexiwatt27 mechanical data and package dimensions

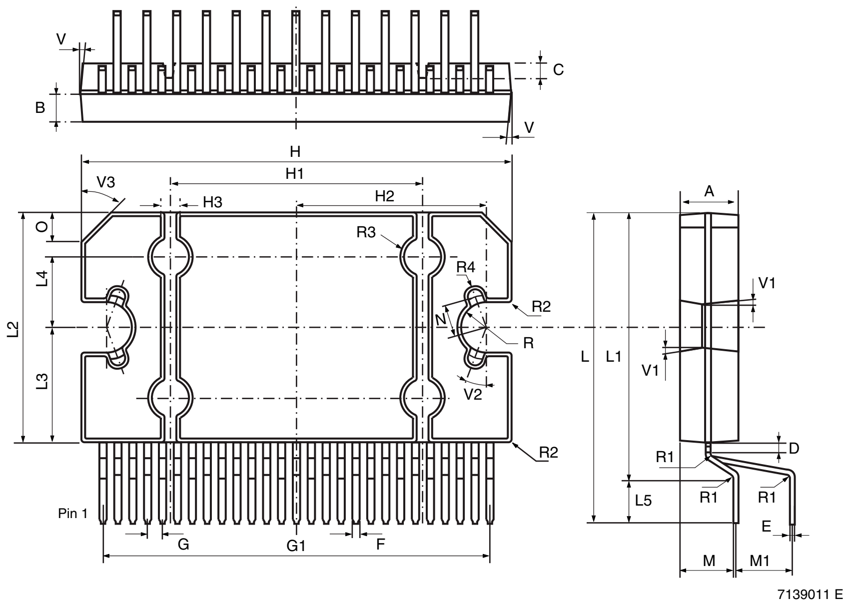
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.45	4.50	4.65	0.175	0.177	0.183
B	1.80	1.90	2.00	0.070	0.074	0.079
C		1.40			0.055	
D	0.75	0.90	1.05	0.029	0.035	0.041
E	0.37	0.39	0.42	0.014	0.015	0.016
F (1)			0.57			0.022
G	0.80	1.00	1.20	0.031	0.040	0.047
G1	25.75	26.00	26.25	1.014	1.023	1.033
H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



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5 Revision history

Table 5. Document revision history

Date	Revision	Changes
06-Dec-2007	1	Initial release.
15-Oct-2008	2	Document status promoted from preliminary data to datasheet. Updated *Table 3: Thermal data on page 6*.
06-Jul-2012	3	Updated *Table 2: Absolute maximum ratings on page 6*.
11-Mar-2013	4	Update *Figure 8: Crosstalk vs. frequency on page 9*.
17-Sep-2013	5	Updated Disclaimer.