

TDA7569LV

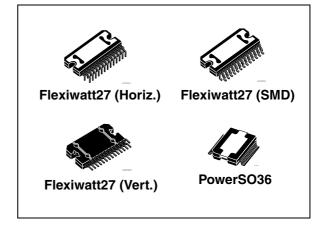
4 x 50 W power amplifier with full I²C diagnostics, high efficiency and low voltage operation

Features

- Multipower BCD technology
- MOSFET output power stage
- DMOS power output
- Class SB high efficiency
- High output power capability $4x28 \text{ W}/4 \Omega$ @ 14.4 V, 1 kHz, 10% THD, $4 \times 45 \text{ W}$ max power
- Max power 4 x 72 W / 2 Ω
- Full I²C bus driving:
 - Standby
 - Independent front/rear soft play/mute
 - Selectable gain 26 dB /16 dB (for low noise line output function)
 - High efficiency enable/disable
 - I²C bus digital diagnostics (including DC bus AC load detection)
- Full fault protection
- DC offset detection
- Four independent short circuit protection
- Clipping detector pin with selectable threshold (2 %/10 %)
- Standby/mute pin
- Linear thermal shutdown with multiple thermal warning
- ESD protection
- Very robust against misconnections
- Improved SVR suppression during battery transients
- Capable to operate down to 6 V (e.g. "Startstop")

Description

The TDA7569LV is the most advanced BCD technology quad bridge car radio amplifier of his family, including a wide range of innovative features.



The TDA7569LV is equipped with the most complete diagnostics array that communicates the status of each speaker through the I²C bus.

The dissipated output power under average listening condition is significantly reduced when compared to the conventional class AB solutions, thanks to the patented solution. Moreover it has been designed to be very robust against several kinds of misconnections.

It is moreover compliant to the most recent OEM specifications for low voltage operation (so called 'start-stop' battery profile during engine stop and re-start), helping car manufacturers to reduce the overall emissions and thus contributing to environment protection.

Table 1. Device summary

Order code	Package	Packing
TDA7569LVSM	Flexiwatt27	Tube
TDA7569LVSMTR	(SMD)	Tape and reel
TDA7569LV	Flexiwatt27 (vertical)	Tube
TDA7569LVH	Flexiwatt27 (horizontal)	Tube
TDA7569LVPD	PowerSO36	Tube
TDA7569LVPDTR	Fower3030	Tape and reel

May 2011 Doc ID 018712 Rev 3 1/39

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Contents TDA7569LV

Contents

1	Bloc	diagram and application circuits	. 6			
2	Pin (escription	. 8			
3	Elec	rical specifications	10			
	3.1	Absolute maximum ratings	10			
	3.2	Thermal data	10			
	3.3	Electrical characteristics	11			
	3.4	Electrical characteristics curves	14			
4	Diag	nostics functional description	17			
	4.1	Turn-on diagnostic	17			
	4.2	Permanent diagnostics	19			
	4.3	Output DC offset detection	20			
	4.4	AC diagnostic	20			
5	Mult	Multiple faults				
	5.1	Faults availability	22			
6	Thei	mal protection	23			
	6.1	Fast muting	23			
7	Batt	ry transitions management	24			
	7.1	Low voltage operation ("start stop")	24			
	7.2	Advanced battery management	25			
8	I ² C l	us	26			
	8.1	I ² C programming/reading sequences	26			
	8.2	Address selection and I ² C disable	26			
	8.3	I ² C bus interface	26			
		8.3.1 Data validity	26			
		8.3.2 Start and stop conditions	27			
		8.3.3 Byte format	27			



TDA7569L	V					Cor	ntents
	8.3.4	Acknowledge		 	 		27
9	Software sp	ecifications .		 	 		28
10	Examples of	f bytes sequen	ice	 	 		33
11	Package info	ormation		 	 		34
12	Revision his	etory					20

List of tables TDA7569LV

List of tables

Table 1.	Device summary	1
Table 2.	Pin list description	9
Table 3.	Absolute maximum ratings	. 10
Table 4.	Thermal data	. 10
Table 5.	Electrical characteristics	. 11
Table 6.	Double fault table for turn on diagnostic	
Table 7.	IB1	. 28
Table 8.	IB2	. 29
Table 9.	DB1	. 29
Table 10.	DB2	
Table 11.	DB3	
Table 12.	DB4	. 32
Table 13.	Document revision history	38

TDA7569LV List of figures

List of figures

Figure 1.	Block diagram	6
Figure 2.	Application circuit	
Figure 3.	Application circuit (TDA7569LVPD)	7
Figure 4.	Pin connection diagram of the Flexiwatt27 (top of view)	8
Figure 5.	Pin connection diagram of the PowerSO36 slug up (top of view)	8
Figure 6.	Quiescent current vs. supply voltage	. 14
Figure 7.	Output power vs. supply voltage (4 Ω)	. 14
Figure 8.	Distortion vs. output power (4 Ω , STD)	. 14
Figure 9.	Distortion vs. output power (4 Ω , HI-EFF)	. 14
Figure 10.	Distortion vs. output power (2 Ω , STD)	. 14
Figure 11.	Distortion vs. output power (2 Ω , HI-EFF)	. 14
Figure 12.	Distortion vs. frequency (2 Ω)	. 15
Figure 13.	Distortion vs. output power $V_s = 6 \text{ V } (4 \Omega, \text{STD})$. 15
Figure 14.	Distortion vs. frequency (4 Ω)	
Figure 15.	Crosstalk vs. frequency	
Figure 16.	Supply voltage rejection vs. frequency	. 15
Figure 17.	Power dissipation vs. average output power (audio program simulation, 2 W)	. 15
Figure 18.	Power dissipation vs. average output power (audio program simulation, 4 W)	
Figure 19.	Total power dissipation and efficiency vs. output power (4 Ω , HI-EFF, Sine)	. 16
Figure 20.	Total power dissipation and efficiency vs. output power (4 Ω , STD, Sine)	. 16
Figure 21.	ITU R-ARM frequency response, weighting filter for transient pop	. 16
Figure 22.	Turn-on diagnostic: working principle	. 17
Figure 23.	SVR and output behavior (Case 1: without turn-on diagnostic)	. 17
Figure 24.	SVR and output pin behavior (Case 2: with turn-on diagnostic)	
Figure 25.	Short circuit detection thresholds	
Figure 26.	Load detection thresholds - high gain setting	
Figure 27.	Load detection threshold - low gain setting	. 18
Figure 28.	Restart timing without diagnostic enable (permanent) - Each 1 mS time, a sampling of the fault is done	. 19
Figure 29.	Restart timing with diagnostic enable (permanent)	
Figure 30.	Current detection high: load impedance Z vs. output peak voltage	
Figure 31.	Current detection low: load impedance Z vs. output peak voltage	
Figure 32.	Thermal foldback diagram	
Figure 33.	Worts case battery cranking curve sample 1	
Figure 34.	Worst case battery cranking curve sample 2	
Figure 35.	Upwards fast battery transitions diagram	. 25
Figure 36.	Data validity on the I ² C bus	
Figure 37.	Timing diagram on the I ² C bus	. 27
Figure 38.	Acknowledge on the I ² C bus	
Figure 39.	Flexiwatt27 (horizontal) mechanical data and package dimensions	
Figure 40.	Flexiwatt27 (vertical) mechanical data and package dimensions	
Figure 41.	Flexiwatt27 (SMD) mechanical data and package dimensions	
Figure 42.	PowerSO36 (slug up) mechanical data and package dimensions	



1 Block diagram and application circuits

Figure 1. Block diagram

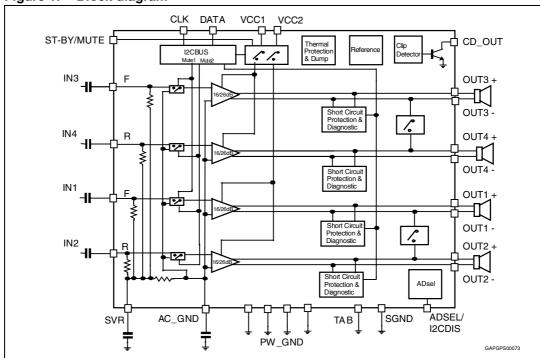
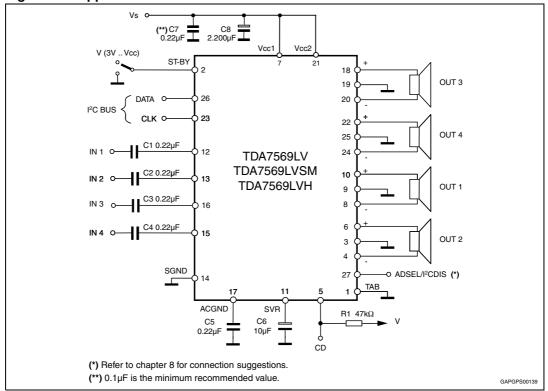


Figure 2. Application circuit



577

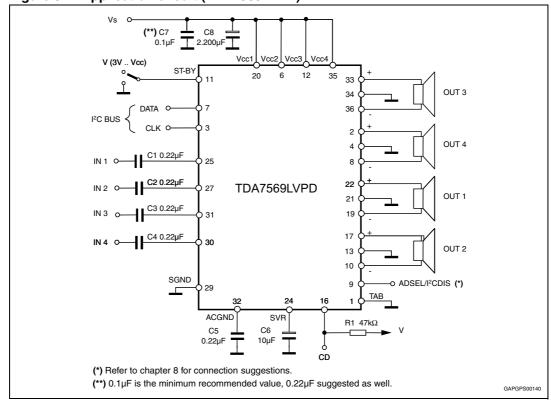


Figure 3. Application circuit (TDA7569LVPD)



Doc ID 018712 Rev 3

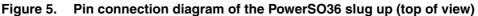
Pin description TDA7569LV

2 Pin description

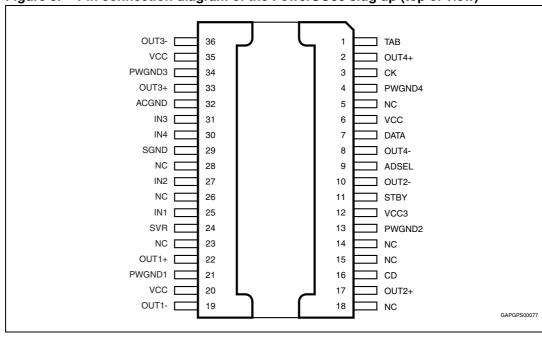
For channel name reference: CH1 = LF, CH2 = LR, CH3 = RF and CH4 = RR.

ADSEL/I2CDIS ADSEL/I2CDIS 26 DATA PWGND 4 25 П PWGND 4 25 24 OUT 4-OUT 4-24 CK СК OUT 4+ OUT 4+ 21 V_{CC2} 21 V_{CC2} 20 OUT 3-20 OUT 3-PWGND 3 19 19 PWGND 3 18 OUT 3+ 18 OUT 3+ 17 AC GND 17 AC GND 16 IN 3 16 IN 3 15 IN 4 15 SGND 14 14 S_GND 13 IN 2 \mathbf{I} 13 IN 2 12 IN 1 IN 1 12 11 SVR 11 SVR OUT 1+ 10 10 OUT 1+ PWGND 1 PWGND 1 OUT 1-OUT 1- Π V_{CC1} V_{CC1} OUT 2+ OUT 2+ CD-OUT CD-OUT OUT 2-OUT 2-П PWGND 2 3 PWGND 2 STBY TAB TAB Flexiwatt27 (horizontal/SMD) Flexiwatt27 (vertical)

Pin connection diagram of the Flexiwatt27 (top of view)



GAPGPS00141



GAPGPS0014

TDA7569LV Pin description

Table 2. Pin list description

	in list descri	F	
Pin # (PowerSo36)	Pin # (Flexiwatt27)	Pin name	Function
1	1	TAB	-
2	22	OUT4+	Channel 4, + output
3	23	CK	I ² C bus clock/HE selector
4	25	PWGND4	Channel 4 output power ground
5	-	NC	Not connected
6	21	VCC2	Supply voltage pin2
7	26	DATA	I ² C bus data pin/gain selector
8	24	OUT4-	Channel 4, - output
9	27	ADSEL	Address selector pin/ I ² C bus disable (legacy select)
10	4	OUT2-	Channel 2, - output
11	2	STBY	Standby pin
12	-	VCC3	Supply voltage pin3
13	3	PWGND2	Channel 2 output power ground
14	-	NC	Not connected
15	-	NC	Not connected
16	5	CD	Clip detector output pin
17	6	OUT2+	Channel 2, + output
18	-	NC	Not connected
19	8	OUT1-	Channel 1, - output
20	7	VCC1	Supply voltage pin1
21	9	PWGND1	Channel 1 output power ground
22	10	OUT1+	Channel 1, + output
23	-	NC	Not connected
24	11	SVR	SVR pin
25	12	IN1	Input pin, channel 1
26	-	NC	Not connected
27	13	IN2	Input pin, channel 2
28	-	NC	Not connected
29	14	SGND	Signal ground pin
30	15	IN4	Input pin, channel 4
31	16	IN3	Input pin, channel 3
32	17	AC GND	AC ground
33	18	OUT3+	Channel 3, + output
34	19	PWGND3	Channel 3 output power ground
35	-	VCC4	Supply voltage pin4
36	20	OUT3-	Channel 3, - output



3 Electrical specifications

3.1 Absolute maximum ratings

Table 3. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V _{op}	Operating supply voltage	18	V
V _S	DC supply voltage	28	V
V _{peak}	Peak supply voltage (for t _{max} = 50 ms)	50	V
GNDmax	Ground pins voltage	-0.3 to 0.3	V
V _{CK} , V _{DATA}	CK and DATA pin voltage	-0.3 to 6	V
V _{cd}	Clip detector voltage	-0.3 to V _{op}	V
V _{stby}	STBY pin voltage	-0.3 to V _{op}	V
	Output peak current (not repetitive t _{max} = 100ms)	8	Α
I _O	Output peak current (repetitive f > 10 kHz)	6] ^
P _{tot}	Power dissipation T _{case} = 70°C ⁽¹⁾	85	W
T_{stg}, T_j	Storage and junction temperature (2)	-55 to 150	°C
т	Operative temperature range (Flexiwatt package)	iwatt package) -40 to +105	
T _{amb}	Operative temperature range (PowerSO package)	-40 to +85	- °C

^{1.} This is maximum theoretical value; for power dissipation in real application conditions, please refer to curves reported in *Section 3.4: Electrical characteristics curves*.

3.2 Thermal data

Table 4. Thermal data

Symbol	Parameter	PowerSO	Flexiwatt	Unit
R _{th j-case}	Thermal resistance junction-to-case Max.	1	1	°C/W

^{2.} A suitable dissipation system should be used to keep Tj inside the specified limits.

3.3 Electrical characteristics

Refer to the test circuit, V_S = 14.4 V; R_L = 4 Ω ; f = 1 kHz; G_V = 26 dB; T_{amb} = 25 °C; unless otherwise specified.

Table 5. Electrical characteristics

TH _{WARN2} Average junction temperature for TH warning 2 Average junction temperature for C Average junction temperature for C	Symbol	Parameter	Test condition	Min.	Тур.	Max.	Unit
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	General cl	haracteristics			•		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Vs	Supply voltage range	-	6	-	18	V
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	I _d	Total quiescent drain current	-	-	170	250	mA
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	R _{IN}	Input impedance	-	45	60	70	kΩ
$V_{OS} \text{Offset voltage} \qquad \text{Mute \& play} \qquad .80 0 80 \text{mV} \\ V_{dh} \text{Dump threshold} \qquad - \qquad 19 20 21 \text{V} \\ I_{SB} \text{Standby current} \qquad V_{standby} = 0 \qquad - \qquad 1 10 \mu A \\ \text{SVR} \text{Supply voltage rejection} \qquad F_{g} = 600 \Omega \\ F_{g} = 600 \Omega \\ \text{T}_{ON} \text{Turn on timing (Mute play transition)} \qquad D2/D1 (IB1) 0 \text{to} 1 \qquad - \qquad 25 \qquad 40 \text{ms} \\ \text{T}_{OFF} \text{Turn of timing (Play mute transition)} \qquad D2/D1 (IB1) 1 \text{to} 0 \qquad - \qquad 25 \qquad 40 \text{ms} \\ \text{T}_{HWARNJ} \text{Average junction temperature for TH warning 1} \qquad DB1 (D7) = 1 \qquad - \qquad 155 \qquad - \qquad 25 \\ \text{TH}_{WARNJ} \text{Average junction temperature for TH warning 2} \qquad DB4 (D6) = 1 \qquad - \qquad 140 \qquad - \qquad ^{\circ}C \\ \text{Audio performances} \\ \text{Audio performances} \\ \text{Po} \text{Output power} \qquad \frac{Max. power^{(2)} V_{S} = 14.4 V, R_{L} = 4 \Omega}{THD 10 \%, R_{L} = 4 \Omega} \qquad 25 \qquad 28 \qquad - \qquad W \\ T_{HD} = 10 \%, R_{L} = 4 \Omega} \qquad 20 \qquad 22 \qquad - \qquad W \\ R_{L} = 2 \Omega; THD 10 \%, R_{L} = 4 \Omega} \qquad 20 \qquad 22 \qquad - \qquad W \\ R_{L} = 2 \Omega; THD 10 \%, R_{L} = 4 \Omega} \qquad 20 \qquad 22 \qquad - \qquad W \\ R_{L} = 2 \Omega; THD 10 \%, R_{L} = 4 \Omega} \qquad 20 \qquad 25 \qquad 28 \qquad - \qquad W \\ R_{L} = 2 \Omega; THD 10 \%, R_{L} = 4 \Omega} \qquad 20 \qquad 22 \qquad - \qquad W \\ R_{L} = 2 \Omega; THD 10 \%, R_{L} = 4 \Omega} \qquad 20 \qquad 25 \qquad 28 \qquad - \qquad W \\ R_{L} = 2 \Omega; THD 10 \%, R_{L} = 4 \Omega} \qquad 20 \qquad 20 \qquad 22 \qquad - \qquad W \\ R_{L} = 2 \Omega; THD 10 \%, R_{L} = 4 \Omega} \qquad 20 \qquad 20 \qquad 22 \qquad - \qquad W \\ R_{L} = 2 \Omega; THD 10 \%, R_{L} = 4 \Omega} \qquad 0.0.035 0.1 \% \\ R_{L} = 2 \Omega; THD 10 \%, STD mode} \qquad 0.0.035 0.1 \% \\ R_{D} = 1 W to 10 W; STD mode} \qquad 0.0.035 0.1 \% \\ R_{D} = 1.5 W to 10 W; STD mode} \qquad 0.0.05 0.1 \% \\ R_{D} = 1.6 GB; STD mode} \qquad 0.0.02 0.05 \% \\ R_{D} = 1.0 W, f = 10 kHz; \qquad - \qquad 0.02 0.05 \% \\ R_{D} = 1.0 W, f = 10 kHz; \qquad - \qquad 0.002 0.05 \% \\ R_{D} = 1.0 W, f = 10 kHz; \qquad - \qquad 0.002 0.05 \% \\ R_{D} = 1.0 W, f = 10 kHz; \qquad - \qquad 0.002 0.05 \% \\ R_{D} = 1.0 W, f = 10 kHz; \qquad - \qquad 0.002 0.05 \% \\ R_{D} = 1.0 $	V	Min. supply muto threshold	IB1(D7) = 1	7	7.5	8	W
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	VAM	wiiri. Supply mate threshold	IB1(D7) = 0 (default) ⁽¹⁾	5	5.5	6	v
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	V _{OS}	Offset voltage	Mute & play	-80	0	80	mV
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	V _{dth}	Dump threshold	-	19	20	21	V
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	I _{SB}	Standby current	V _{standby} = 0	-	1	10	μA
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	SVR	Supply voltage rejection	-	50	55	-	dB
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	T _{ON}		D2/D1 (IB1) 0 to 1	-	25	40	ms
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	T _{OFF}		D2/D1 (IB1) 1 to 0	-	25	40	ms
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	TH _{WARN1}		DB1 (D7) = 1	-	155	-	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	TH _{WARN2}		DB4 (D7) = 1	-	140	-	°C
$P_{O} = \begin{array}{ c c c c c c c c c c c c c c c c c c c$	TH _{WARN3}		DB4 (D6) = 1	-	125	-	
$P_{O} \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \$	Audio per	formances					
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$			Max. power ⁽²⁾ $V_s = 14.4 \text{ V}, R_L = 4 \Omega$	-	45	-	W
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$			THD = 10 %, $R_L = 4 \Omega$	25	28		W
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$			THD = 1 %, $R_L = 4 \Omega$	20	22	_	W
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	P_{O}	Output power	-	45	50		W
					-	-	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$				60	75		W
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$			Max power@ $V_s = 6 V$, $R_L = 4 \Omega$	-	6	-	W
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$			_				%
THD Total harmonic distortion $ \begin{array}{c cccc} P_O = 1 \text{-} 10 \text{ W, f} = 10 \text{ kHz;} & - & 0.3 & 0.5 & \% \\ \hline G_V = 16 \text{ dB; STD mode} & - & 0.02 & 0.05 & \% \\ \hline V_O = 0.1 \text{ to 5 VRMS} & - & 0.02 & 0.05 & \% \\ \hline \end{array} $			· ·	-			
					0.1	0.5	%
$V_{O} = 0.1 \text{ to 5 VRMS}$ - 0.02 0.05 %	THD	Total harmonic distortion	STD mode	-	0.3	0.5	%
C_T Cross talk $f = 1$ kHz to 10 kHz, $R_q = 600 \Omega$ 50 65 - dB			1 -	-	0.02	0.05	%
	C _T	Cross talk	$f = 1 \text{ kHz to } 10 \text{ kHz}, R_q = 600 \Omega$	50	65	-	dB



Doc ID 018712 Rev 3

Table 5. Electrical characteristics (continued)

Symbol	Parameter	Test condition	Min.	Тур.	Max.	Unit
G _{V1}	Voltage gain 1	-	25	26	27	dB
∆G _{V1}	Voltage gain match 1	-	-1	-	1	dB
G _{V2}	Voltage gain 2	-	15	16	17	dB
∆G _{V2}	Voltage gain match 2	-	-1	-	1	dB
E _{IN1}	Output noise voltage 1	R_g = 600 Ω 20 Hz to 22 kHz	-	50	70	μV
E _{IN2}	Output noise voltage 2	R_g = 600 Ω ; GV = 16d B 20 Hz to 22 kHz	-	20	35	μV
BW	Power bandwidth	-	100	•	-	KHz
CMRR	Input CMRR	$V_{CM} = 1 \text{ Vpk-pk}; \text{ Rg} = 0 \Omega$	-	70	-	dB
41/	During mute ON/OFF output offset voltage	ITU R-ARM weighted	-7.5	-	+7.5	mV
ΔV _{OS}	During standby ON/OFF output offset voltage	(see Figure 21)	-7.5	-	+7.5	mV
Clip detec	ctor					
CD _{LK}	Clip det. high leakage current	CD off / V _{CD} = 6 V	-	0	5	μΑ
CD _{SAT}	Clip det sat. voltage	CD on; I _{CD} = 1 mA	-	-	300	mV
CD	Clip det THD level	D0 (IB1) = 1	5	10	15	%
CD _{THD}		D0 (IB1) = 0	1	2	3	%
Control pi	in characteristics					
V _{SBY}	Standby/mute pin for standby	-	0	-	1.2	V
V _{MU}	Standby/mute pin for mute	-	2.9	-	3.5	٧
V _{OP}	Standby/mute pin for operating	-	4.5	-	18	V
	Ctondby/myto nin gurrant	V _{st-by/mute} = 4.5 V	-	1	5	μΑ
I _{MU}	Standby/mute pin current	V _{st-by/mute} < 1.2 V	-	0	5	μΑ
A _{SB}	Standby attenuation	-	90	110	-	dB
A _M	Mute attenuation	-	80	100	-	dB
Turn on d	iagnostics 1 (Power amplifier mo	de)				
Pgnd	Short to GND det. (below this limit, the Output is considered in short circuit to GND)		-	-	1.2	V
Pvs	Short to Vs det. (above this limit, the output is considered in short circuit to Vs)		Vs -1.2	-	-	V
Pnop	Normal operation thresholds. (Within these limits, the output is considered without faults).	Power amplifier in standby	1.8	-	Vs -1.8	٧
Lsc	Shorted load det.		-	-	0.5	Ω
Lop	Open load det.		85	-	-	Ω
Lnop	Normal load det.		1.5	-	45	Ω

Table 5. Electrical characteristics (continued)

Symbol	Parameter	Test condition	Min.	Тур.	Max.	Unit
Turn on d	iagnostics 2 (Line driver mode)		1		•	
Pgnd	Short to GND det. (below this limit, the output is considered in short circuit to GND)	Power amplifier in standby	-	-	1.2	٧
Pvs	Short to Vs det. (above this limit, the output is considered in short circuit to Vs)	-	Vs -1.2	-	-	٧
Pnop	Normal operation thresholds. (Within these limits, the output is considered without faults).	-	1.8	-	Vs -1.8	٧
Lsc	Shorted load det.	-	-	ı	1.5	Ω
Lop	Open load det.	-	330	-	-	Ω
Lnop	Normal load det.	-	7	ı	180	Ω
Permaner	nt diagnostics 2 (Power amplifier	mode or line driver mode)				
Pgnd	Short to GND det. (below this limit, the Output is considered in short circuit to GND)		-	-	1.2	٧
Pvs	Short to Vs det. (above this limit, the output is considered in short circuit to Vs)	Power amplifier in mute or play, one or more short circuits protection activated	Vs -1.2	-	-	٧
Pnop	Normal operation thresholds. (Within these limits, the output is considered without faults).		1.8	-	Vs -1.8	٧
1	Shorted load det.	Power amplifier mode	-	-	0.5	Ω
L _{SC}	Shorted load det.	Line driver mode	-	-	1.5	Ω
V _O	Offset detection	Power amplifier in play, AC input signals = 0	±1.5	±2	±2.5	٧
I _{NLH}	Normal load current detection	\/ . (\/ E\nk ID0 (D7) 0	500	•	-	mA
I _{OLH}	Open load current detection	$V_{O} < (V_{S}-5)pk, IB2 (D7) = 0$	-	-	250	mA
I _{NLL}	Normal load current detection	V- < (V- 5)pk IR2 (D7) = 1	250	-	-	mA
I _{OLL}	Open load current detection	$V_{O} < (V_{S}-5)pk$, IB2 (D7) = 1	-	-	125	mA
I ² C bus in	terface					
S _{CL}	Clock frequency	-	-	-	400	kHz
V _{IL}	Input low voltage	-	-	-	1.5	V
V _{IH}	Input high voltage	-	2.3	1	-	V

^{1.} In legacy mode only low threshold option is available.

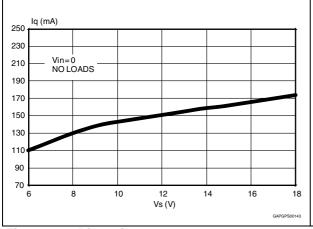
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^{2.} Saturated square wave output.

3.4 Electrical characteristics curves

Figure 6. Quiescent current vs. supply voltage

Figure 7. Output power vs. supply voltage (4Ω)



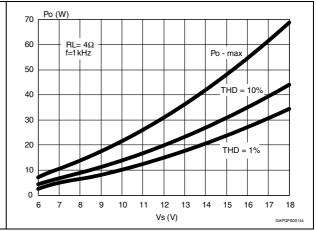
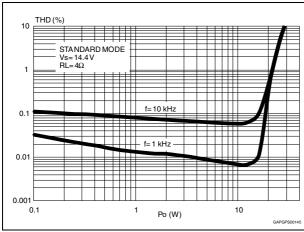


Figure 8. Distortion vs. output power $(4 \Omega, STD)$

Figure 9. Distortion vs. output power $(4 \Omega, HI-EFF)$



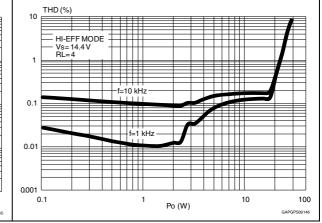
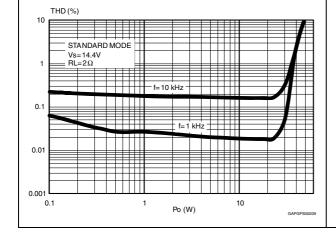
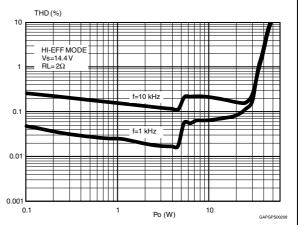


Figure 10. Distortion vs. output power (2 Ω , STD)

Figure 11. Distortion vs. output power $(2\Omega, HI-EFF)$





14/39 Doc ID 018712 Rev 3

577

Figure 12. Distortion vs. frequency (2 Ω)

Figure 13. Distortion vs. output power $V_s = 6 V$ (4 Ω , STD)

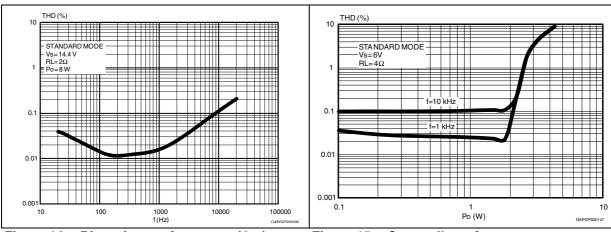


Figure 14. Distortion vs. frequency (4 Ω)

Figure 15. Crosstalk vs. frequency

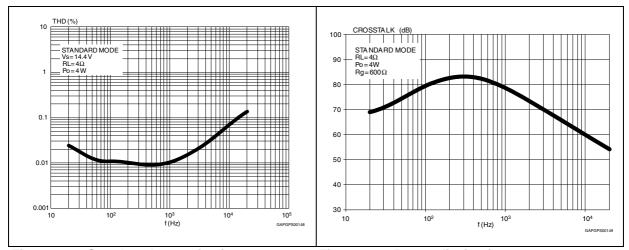
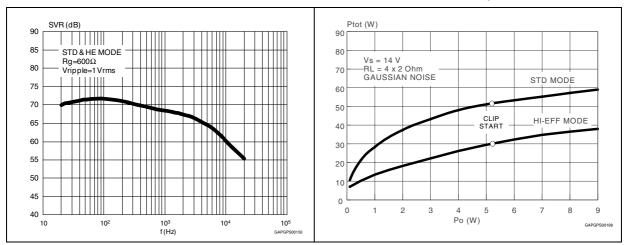


Figure 16. Supply voltage rejection vs. frequency

Figure 17. Power dissipation vs. average output power (audio program simulation, 2 Ω)

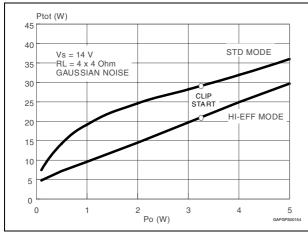


577

Doc ID 018712 Rev 3

Figure 18. Power dissipation vs. average output power (audio program simulation, 4 Ω)

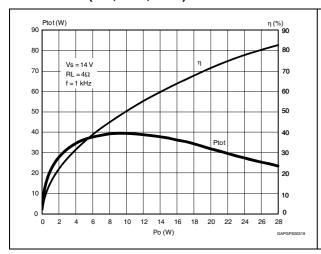
Figure 19. Total power dissipation and efficiency vs. output power (4 Ω , HI-EFF, Sine)

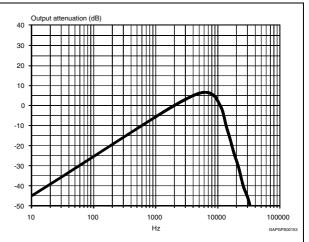


Plot (W) η (%) 90
80
VS=14
70
RL=4Ω
f=1 kHz
HIEFFmode
60
40
30
20
10
0.1
1
Po (W)
10
100
GAPGPS00218

Figure 20. Total power dissipation and efficiency vs. output power (4 Ω , STD, Sine)

Figure 21. ITU R-ARM frequency response, weighting filter for transient pop





Diagnostics functional description 4

4.1 **Turn-on diagnostic**

It is strongly recommended to activate this feature at turn-on (standby out) with I²C bus request. Detectable output faults are:

- SHORT TO GND
- SHORT TO Vs
- SHORT ACROSS THE SPEAKER
- **OPEN SPEAKER**

To verify if any of the above misconnections are in place, a subsonic (inaudible) current pulse (Figure 22) is internally generated, sent through the speaker(s) and sunk back. The Turn On diagnostic status is internally stored until a successive diagnostic pulse is requested (after a I²C reading).

If the "standby out" and "diag. enable" commands are both given through a single programming step, the pulse takes place first (power stage still in stand-by mode, low, outputs= high impedance).

Afterwards, when the Amplifier is biased, the PERMANENT diagnostic takes place. The previous Turn On state is kept until a short appears at the outputs.

Figure 22. Turn-on diagnostic: working principle ~100ms t (ms)

Figure 23 and 24 show SVR and OUTPUT waveforms at the turn-on (stand-by out) with and without turn-on diagnostic.

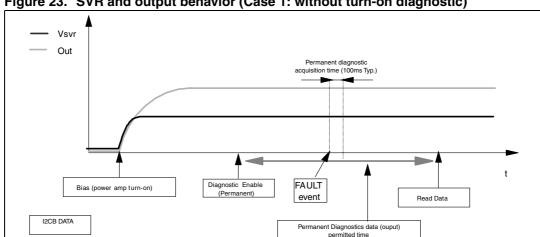


Figure 23. SVR and output behavior (Case 1: without turn-on diagnostic)

577

Doc ID 018712 Rev 3

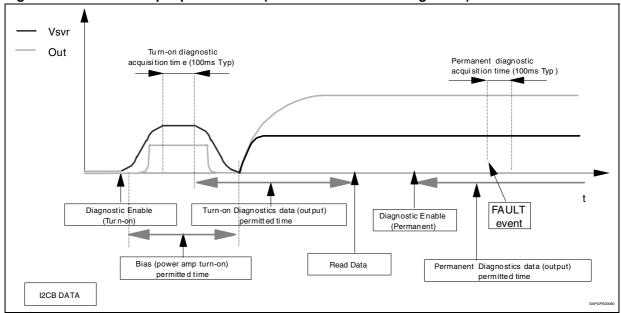
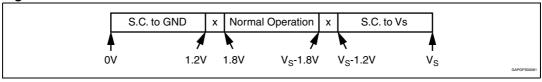


Figure 24. SVR and output pin behavior (Case 2: with turn-on diagnostic)

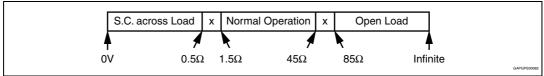
The information related to the outputs status is read and memorized at the end of the current pulse top. The acquisition time is 100 ms (typ.). No audible noise is generated in the process. As for SHORT TO GND / Vs the fault-detection thresholds remain unchanged from 26 dB to 16 dB gain setting. They are as follows:

Figure 25. Short circuit detection thresholds



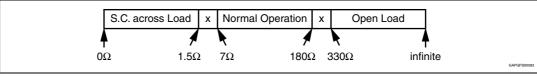
Concerning SHORT ACROSS THE SPEAKER / OPEN SPEAKER, the threshold varies from 26 dB to 16 dB gain setting, since different loads are expected (either normal speaker's impedance or high impedance). The values in case of 26 dB gain are as follows:

Figure 26. Load detection thresholds - high gain setting



If the Line-Driver mode (Gv= 16 dB and Line Driver Mode diagnostic = 1) is selected, the same thresholds will change as follows:

Figure 27. Load detection threshold - low gain setting



4.2 Permanent diagnostics

Detectable conventional faults are:

- Short to GND
- Short to Vs
- Short across the speaker

The following additional features are provided:

Output offset detection

The TDA7569LV has 2 operating statuses:

- RESTART mode. The diagnostic is not enabled. Each audio channel operates independently from each other. If any of the a.m. faults occurs, only the channel(s) interested is shut down. A check of the output status is made every 1 ms (*Figure 28*). Restart takes place when the overload is removed.
- 2. DIAGNOSTIC mode. It is enabled via I²C bus and self activates if an output overload (such to cause the intervention of the short-circuit protection) occurs to the speakers outputs. Once activated, the diagnostics procedure develops as follows (*Figure 29*):
 - To avoid momentary re-circulation spikes from giving erroneous diagnostics, a check of the output status is made after 1ms: if normal situation (no overloads) is detected, the diagnostic is not performed and the channel returns back active.
 - Instead, if an overload is detected during the check after 1 ms, then a diagnostic cycle having a duration of about 100 ms is started.
 - After a diagnostic cycle, the audio channel interested by the fault is switched to RESTART mode. The relevant data are stored inside the device and can be read by the microprocessor. When one cycle has terminated, the next one is activated by an I²C reading. This is to ensure continuous diagnostics throughout the carradio operating time.
 - To check the status of the device a sampling system is needed. The timing is chosen at microprocessor level (over half a second is recommended).

Figure 28. Restart timing without diagnostic enable (permanent) - Each 1 mS time, a sampling of the fault is done

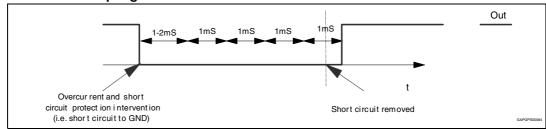
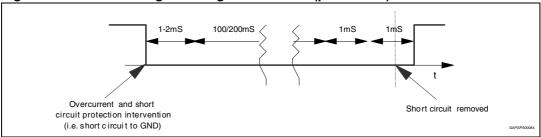


Figure 29. Restart timing with diagnostic enable (permanent)



477

Doc ID 018712 Rev 3

4.3 Output DC offset detection

Any DC output offset exceeding ±2 V is signalled out. This inconvenient might occur as a consequence of initially defective or aged and worn-out input capacitors feeding a DC component to the inputs, so putting the speakers at risk of overheating.

This diagnostic has to be performed with low-level output AC signal (or Vin = 0).

The test is run with selectable time duration by microprocessor (from a "start" to a "stop" command):

- START = Last reading operation or setting IB1 D5 (OFFSET enable) to 1
- STOP = Actual reading operation

Excess offset is signalled out if persistent throughout the assigned testing time. This feature is disabled if any overloads leading to activation of the short-circuit protection occurs in the process.

4.4 AC diagnostic

It is targeted at detecting accidental disconnection of tweeters in 2-way speaker and, more in general, presence of capacitive (AC) coupled loads.

This diagnostic is based on the notion that the overall speaker's impedance (woofer + parallel tweeter) will tend to increase towards high frequencies if the tweeter gets disconnected, because the remaining speaker (woofer) would be out of its operating range (high impedance). The diagnostic decision is made according to peak output current thresholds, and it is enabled by setting (IB2-D2) = 1. Two different detection levels are available:

- High current threshold IB2 (D7) = 0
 lout > 500 mApk = normal status
 lout < 250 mApk = open tweeter
- Low current threshold IB2 (D7) = 1
 lout > 250 mApk = normal status
 lout < 125 mApk = open tweeter

To correctly implement this feature, it is necessary to briefly provide a signal tone (with the amplifier in "play") whose frequency and magnitude are such to determine an output current higher than 500 mApk with IB2(D7) = 0 (higher than 250 mApk with IB2(D7) = 1) in normal conditions and lower than 250 mApk with IB2(D7) = 0 (lower than 125 mApk with IB2(D7) = 1) should the parallel tweeter be missing.

The test has to last for a minimum number of 3 sine cycles starting from the activation of the AC diagnostic function IB2<D2>) up to the I²C reading of the results (measuring period). To confirm presence of tweeter, it is necessary to find at least 3 current pulses over the above threadless over all the measuring period, else an "open tweeter" message will be issued.

The frequency / magnitude setting of the test tone depends on the impedance characteristics of each specific speaker being used, with or without the tweeter connected (to be calculated case by case). High-frequency tones (> 10 kHz) or even ultrasonic signals are recommended for their negligible acoustic impact and also to maximize the impedance module's ratio between with tweeter-on and tweeter-off.

Figure 30 shows the load impedance as a function of the peak output voltage and the relevant diagnostic fields.

This feature is disabled if any overloads leading to activation of the short-circuit protection occurs in the process.

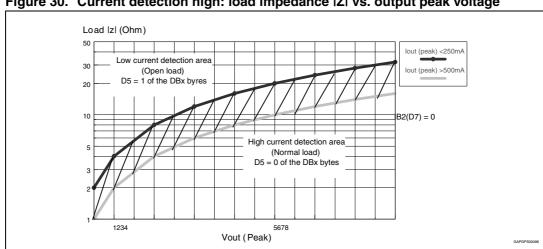
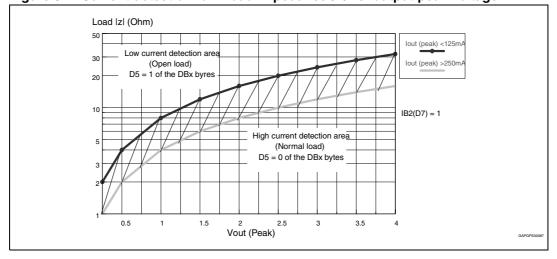


Figure 30. Current detection high: load impedance |Z| vs. output peak voltage





57

Doc ID 018712 Rev 3

Multiple faults TDA7569LV

5 Multiple faults

When more misconnections are simultaneously in place at the audio outputs, it is guaranteed that at least one of them is initially read out. The others are notified after successive cycles of I²C reading and faults removal, provided that the diagnostic is enabled. This is true for both kinds of diagnostic (Turn on and Permanent).

The table below shows all the couples of double-fault possible. It should be taken into account that a short circuit with the 4 ohm speaker unconnected is considered as double fault.

	S. GND	S. Vs	S. Across L.	Open L.
S. GND	S. GND	S. Vs + S. GND	S. GND	S. GND
S. Vs	/	S. Vs	S. Vs	S. Vs
S. Across L.	/	/	S. Across L.	N.A.
Open L.	/	/	/	Open L. (*)

Table 6. Double fault table for turn on diagnostic

In Permanent Diagnostic the table is the same, with only a difference concerning Open Load(*), which is not among the recognizable faults. Should an Open Load be present during the device's normal working, it would be detected at a subsequent Turn on Diagnostic cycle (i.e. at the successive Car Radio Turn on).

5.1 Faults availability

All the results coming from I^2C bus, by read operations, are the consequence of measurements inside a defined period of time. If the fault is stable throughout the whole period, it will be sent out.

To guarantee always resident functions, every kind of diagnostic cycles (Turn on, Permanent, Offset) will be reactivate after any I^2C reading operation. So, when the micro reads the I^2C , a new cycle will be able to start, but the read data will come from the previous diag. cycle (i.e. The device is in Turn On state, with a short to Gnd, then the short is removed and micro reads I^2C . The short to Gnd is still present in bytes, because it is the result of the previous cycle. If another I^2C reading operation occurs, the bytes do not show the short). In general to observe a change in Diagnostic bytes, two I^2C reading operations are necessary.

TDA7569LV Thermal protection

6 Thermal protection

Thermal protection is implemented through thermal foldback (Figure 32).

Thermal foldback begins limiting the audio input to the amplifier stage as the junction temperatures rise above the normal operating range. This effectively limits the output power capability of the device thus reducing the temperature to acceptable levels without totally interrupting the operation of the device.

The output power will decrease to the point at which thermal equilibrium is reached. Thermal equilibrium will be reached when the reduction in output power reduces the dissipated power such that the die temperature falls below the thermal foldback threshold. Should the device cool, the audio level will increase until a new thermal equilibrium is reached or the amplifier reaches full power. Thermal foldback will reduce the audio output level in a linear manner.

Three thermal warning are available through the I²C bus data. After thermal shut down threshold is reached, the CD could toggle (as shown in *Figure 32*) or stay low, depending on signal level.

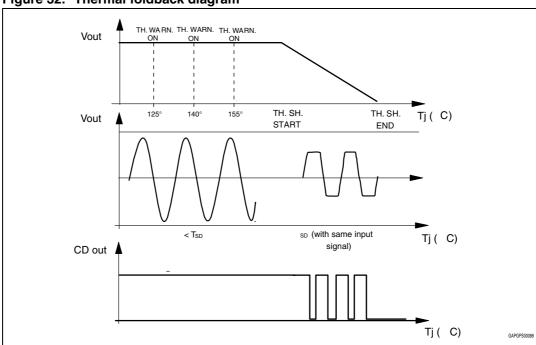


Figure 32. Thermal foldback diagram

6.1 Fast muting

The muting time can be shortened to less than 1.5ms by setting (IB2) D5 = 1. This option can be useful in transient battery situations (i.e. during car engine cranking) to quickly turnoff the amplifier for avoiding any audible effects caused by noise/transients being injected by preamp stages. The bit must be set back to "0" shortly after the mute transition.

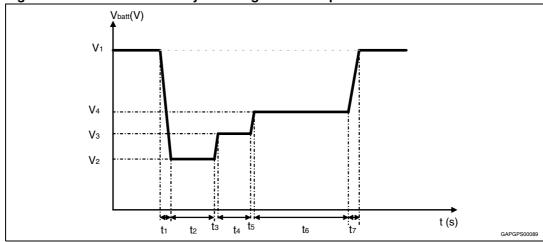
Battery transitions management 7

Low voltage operation ("start stop") 7.1

The most recent OEM specification are requiring automatic stop of car engine at traffic light, in order to reduce emissions of polluting substances. The TDA7569LV, thanks to its innovating design, allows a continuous operation when battery falls down to 6/7V during such conditions, without producing pop noise. The maximum system power will be reduced accordingly.

Worst case battery cranking curves are shown below, indicating the shape and durations of allowed battery transitions.

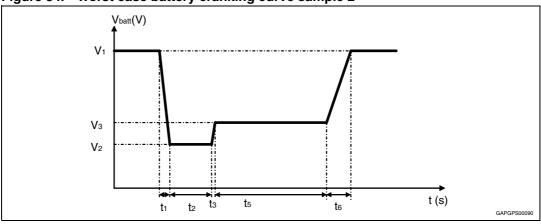
Figure 33. Worts case battery cranking curve sample 1



V1 = 12 V; V2 = 6 V; V3 = 7 V; V4 = 8 V

t1 = 2 ms; t2 = 50 ms; t3 = 5 ms; t4 = 300 ms; t5 = 10 ms; t6 = 1 s; t7 = 2 ms

Figure 34. Worst case battery cranking curve sample 2



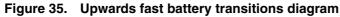
V1 = 12 V; V2 = 6 V; V3 = 7 V

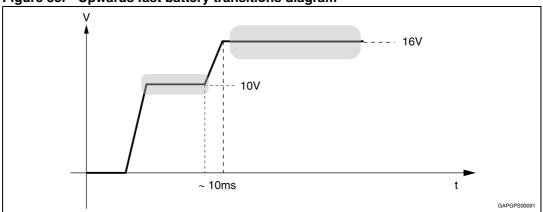
t1 = 2 ms; t2 = 5 ms; t3 = 15 ms; t5 = 1 s; t6 = 50 ms

57

7.2 Advanced battery management

In addition to compatibility with low V_{batt}, the TDA7569LV is able to substain upwards fast battery transitions (like the one showed in Figure 19) without causing unwanted audible effect, thanks to the innovative circuit topology.





Doc ID 018712 Rev 3 25/39

I²C bus TDA7569LV

8 I²C bus

8.1 I²C programming/reading sequences

A correct turn on/off sequence respectful of the diagnostic timings and producing no audible noises could be as follows (after battery connection):

- TURN-ON: PIN2 > 4.5V --- 10ms --- (STAND-BY OUT + DIAG ENABLE) --- 1 s (min) --- MUTING OUT
- TURN-OFF: MUTING IN --- 20 ms --- (DIAG DISABLE + STAND-BY IN) --- 10ms -- PIN2 = 0
- Car Radio Installation: PIN2 > 4.5V --- 10ms DIAG ENABLE (write) --- 200 ms --- I²C read (repeat until All faults disappear).
- OFFSET TEST: Device in Play (no signal) -- OFFSET ENABLE 30ms 1²C reading (repeat 1²C reading until high-offset message disappears).

8.2 Address selection and I²C disable

When the ADSEL/I2CDIS pin is left open the I²C bus is disabled and the device can be controlled by the STBY/MUTE pin.

In this status (no - I^2 C bus) the CK pin enables the HIGH-EFFICIENCY MODE (0 = STD MODE; 1 = HE MODE) and the DATA pin sets the gain (0 = 26 dB; 1 = 16 dB).

When the ADSEL/I2CDIS pin is connected to GND the I²C bus is active with address <1101100-x>.

To select the other I²C address a resistor must be connected to ADSEL/I2CDIS pin as following:

 $0 < R < 2 \text{ k}\Omega$: I²C bus active with address <1101100x>

14 < R < 24 kΩ: I^2C bus active with address <1101101x>

 $40 < R < 70 \text{ k}\Omega$: I²C bus active with address <1101110x>

 $R > 120 \text{ k}\Omega$: Legacy mode

(x: read/write bit sector)

8.3 I²C bus interface

Data transmission from microprocessor to the TDA7569LV and viceversa takes place through the 2 wires I^2C bus interface, consisting of the two lines SDA and SCL (pull-up resistors to positive supply voltage must be connected).

8.3.1 Data validity

As shown by *Figure 36*, the data on the SDA line must be stable during the high period of the clock. The HIGH and LOW state of the data line can only change when the clock signal on the SCL line is LOW.

TDA7569LV I²C bus

8.3.2 Start and stop conditions

As shown by *Figure 37* a start condition is a HIGH to LOW transition of the SDA line while SCL is HIGH. The stop condition is a LOW to HIGH transition of the SDA line while SCL is HIGH.

8.3.3 Byte format

Every byte transferred to the SDA line must contain 8 bits. Each byte must be followed by an acknowledge bit. The MSB is transferred first.

8.3.4 Acknowledge

The transmitter* puts a resistive HIGH level on the SDA line during the acknowledge clock pulse (see *Figure 38*). The receiver** the acknowledges has to pull-down (LOW) the SDA line during the acknowledge clock pulse, so that the SDA line is stable LOW during this clock pulse.

* Transmitter

- master (μP) when it writes an address to the TDA7569LV
- slave (TDA7569LV) when the μP reads a data byte from TDA7569LV

** Receiver

- slave (TDA7569LV) when the μP writes an address to the TDA7569LV
- master (μP) when it reads a data byte from TDA7569LV

Figure 36. Data validity on the I²C bus

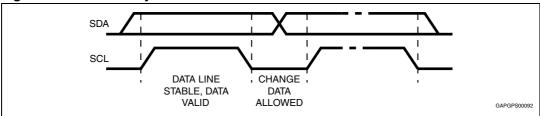


Figure 37. Timing diagram on the I²C bus

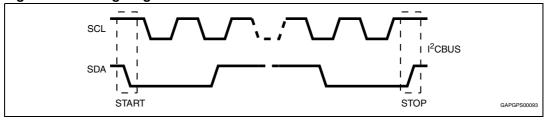
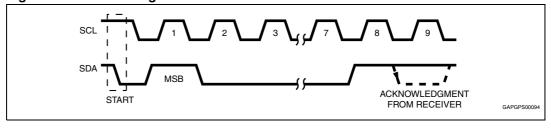


Figure 38. Acknowledge on the I²C bus



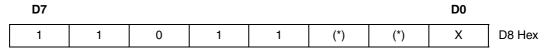


9 Software specifications

All the functions of the TDA7569LV are activated by I²C interface.

The bit 0 of the "ADDRESS BYTE" defines if the next bytes are write instruction (from μP to TDA7569LV) or read instruction (from TDA7569LV to μP).

Chip address



X = 0 Write to device

X = 1 Read from device

If R/W = 0, the μ P sends 2 "Instruction Bytes": IB1 and IB2.

(*) address selector bit, please refer to address selection description on Chapter 8.2.

Table 7. IB1

Bit	Instruction decoding bit
D7	Supply transition mute threshold high (D7 = 1) Supply transition mute threshold low (D7 = 0)
D6	Diagnostic enable (D6 = 1) Diagnostic defeat (D6 = 0)
D5	Offset Detection enable (D5 = 1) Offset Detection defeat (D5 = 0)
D4	Front Channel (CH1, CH3) Gain = 26 dB (D4 = 0) Gain = 16 dB (D4 = 1)
D3	Rear Channel (CH2, CH4) Gain = 26 dB (D3 = 0) Gain = 16 dB (D3 = 1)
D2	Mute front channels (D2 = 0) Unmute front channels (D2 = 1)
D1	Mute rear channels (D1 = 0) Unmute rear channels (D1 = 1)
D0	CD 2% (D0 = 0) CD 10% (D0 = 1)

477

Table 8. IB2

Bit	Instruction decoding bit
D7	Current detection threshold High th (D7 = 0) Low th (D7 =1)
D6	0
D5	Normal muting time (D5 = 0) Fast muting time (D5 = 1)
D4	Stand-by on - Amplifier not working - (D4 = 0) Stand-by off - Amplifier working - (D4 = 1)
D3	Power amplifier mode diagnostic (D3 = 0) Line driver mode diagnostic (D3 = 1)
D2	Current Detection Diagnostic Enabled (D2 =1) Current Detection Diagnostic Defeat (D2 =0)
D1	Right Channel Power amplifier working in standard mode (D1 = 0) Power amplifier working in high efficiency mode (D1 = 1)
D0	Left Channel Power amplifier working in standard mode (D0 = 0) Power amplifier working in high efficiency mode (D0 = 1)

If R/W = 1, the TDA7569LV sends 4 "Diagnostics Bytes" to μP : DB1, DB2, DB3 and DB4.

Table 9. DB1

Bit	Instruction decoding bit						
D7	Thermal warning 1 active (D7 = 1), T _j =155°C	-					
D6	Diag. cycle not activated or not terminated (D6 = 0) Diag. cycle terminated (D6 = 1)	-					
D5	Channel LF (CH1) Current detection IB2 (D7) = 0 Output peak current < 250 mA - Open load (D5 = 1) Output peak current > 500 mA - Normal load (D5 = 0)	Channel LF (CH1) Current detection IB2 (D7) = 1 Output peak current < 125 mA - Open load (D5 = 1) Output peak current > 250 mA - Normal load (D5 = 0)					
D4	Channel LF (CH1) Turn-on diagnostic (D4 = 0) Permanent diagnostic (D4 = 1)	-					
D3	Channel LF (CH1) Normal load (D3 = 0) Short load (D3 = 1)	-					
D2	Channel LF (CH1) Turn-on diag.: No open load (D2 = 0) Open load detection (D2 = 1) Offset diag.: No output offset (D2 = 0) Output offset detection (D2 = 1)	-					

577

Doc ID 018712 Rev 3

Table 9. DB1 (continued)

Bit	Instruction de	ecoding bit
D1	Channel LF (CH1) No short to Vcc (D1 = 0) Short to Vcc (D1 = 1)	-
D0	Channel LF (CH1) No short to GND (D1 = 0) Short to GND (D1 = 1)	-

Table 10. DB2

Bit	Instruction	on decoding bit				
D7	Offset detection not activated (D7 = 0) Offset detection activated (D7 = 1)	-				
D6	х	-				
D5	Channel LR (CH2) Current detection IB2 (D7) = 0 Output peak current < 250 mA - Open load (D5 = 1) Output peak current > 500 mA - Normal load (D5 = 0)					
D4	Channel LR (CH2) Turn-on diagnostic (D4 = 0) Permanent diagnostic (D4 = 1)	-				
D3	Channel LR (CH2) Normal load (D3 = 0) Short load (D3 = 1)	-				
D2	Channel LR (CH2) Turn-on diag.: No open load (D2 = 0) Open load detection (D2 = 1) Permanent diag.: No output offset (D2 = 0) Output offset detection (D2 = 1)	-				
D1	Channel LR (CH2) No short to Vcc (D1 = 0) Short to Vcc (D1 = 1)	-				
D0	Channel LR (CH2) No short to GND (D1 = 0) Short to GND (D1 = 1)	-				

Table 11. DB3

Bit	Instruction	decoding bit
D7	Standby status (= IB2 - D4)	-
D6	Diagnostic status (= IB1 - D6)	-
D5	Channel RF (CH3) Current detection IB2 (D7) = 0 Output peak current < 250 mA - Open load (D5 = 1) Output peak current > 500 mA - Normal load (D5 = 0)	/
D4	Channel RF (CH3) Turn-on diagnostic (D4 = 0) Permanent diagnostic (D4 = 1)	-
D3	Channel RF (CH3) Normal load (D3 = 0) Short load (D3 = 1)	-
D2	Channel RF (CH3) Turn-on diag.: No open load (D2 = 0) Open load detection (D2 = 1) Permanent diag.: No output offset (D2 = 0) Output offset detection (D2 = 1)	-
D1	Channel RF (CH3) No short to Vcc (D1 = 0) Short to Vcc (D1 = 1)	-
D0	Channel RF (CH3) No short to GND (D1 = 0) Short to GND (D1 = 1)	-

577

Table 12. DB4

Bit	Instruction of	lecoding bit
D7	Thermal warning 2 active (D7 = 1), T _j = 140°C	-
D6	Thermal warning 3 active (D6 = 1) T _j = 125°C	-
D5	Channel RR (CH4) Current detection IB2 (D7) = 0 Output peak current < 250 mA - Open load (D5 = 1) Output peak current > 500 mA - Normal load (D5 = 0)	Channel RR (CH4) Current detection IB2 (D7) = 1 Output peak current < 125 mA - Open load (D5 = 1) Output peak current > 250 mA - Normal load (D5 = 0)
D4	Channel RR (CH4) Turn-on diagnostic (D4 = 0) Permanent diagnostic (D4 = 1)	-
D3	Channel R (CH4) R Normal load (D3 = 0) Short load (D3 = 1)	-
D2	Channel RR (CH4) Turn-on diag.: No open load (D2 = 0) Open load detection (D2 = 1) Permanent diag.: No output offset (D2 = 0) Output offset detection (D2 = 1)	-
D1	Channel RR (CH4) No short to Vcc (D1 = 0) Short to Vcc (D1 = 1)	-
D0	Channel RR (CH4) No short to GND (D1 = 0) Short to GND (D1 = 1)	-

10 Examples of bytes sequence

1 - Turn-On diagnostic - Write operation

Start Address byte with D0 = 0	ACK	IB1 with D6 = 1	ACK	IB2	ACK	STOP	l
--------------------------------	-----	-----------------	-----	-----	-----	------	---

2 - Turn-On diagnostic - Read operation

Start Address byte with D0 = 1	ACK	DB1	ACK	DB2	ACK	DB3	ACK	DB4	ACK	STOP
--------------------------------	-----	-----	-----	-----	-----	-----	-----	-----	-----	------

The delay from 1 to 2 can be selected by software, starting from 1ms

3a - Turn-On of the power amplifier with 26dB gain, mute on, diagnostic defeat, CD = 2%

Start	Address byte with D0 = 0	ACK	IB1	ACK	IB2	ACK	STOP
			X0000000		XXX1XX11		

3b - Turn-Off of the power amplifier

Start	Address byte with D0 = 0	ACK	IB1	ACK	IB2	ACK	STOP
			X0XXXXXX		XXX0XXXX		

4 - Offset detection procedure enable

Start	Address byte with D0 = 0	ACK	IB1	ACK	IB2	ACK	STOP
			XX1XX11X		XXX1XXXX		

5 - Offset detection procedure stop and reading operation (the results are valid only for the offset detection bits (D2 of the bytes DB1, DB2, DB3, DB4)

Start Address byte with D0 = 1 ACK DB1 ACK DB2 ACK DB3 ACK DB4 ACK STC
--

- The purpose of this test is to check if a D.C. offset (2V typ.) is present on the outputs, produced by input capacitor with anomalous leakage current or humidity between pins.
- The delay from 4 to 5 can be selected by software, starting from 1ms

5/

Doc ID 018712 Rev 3

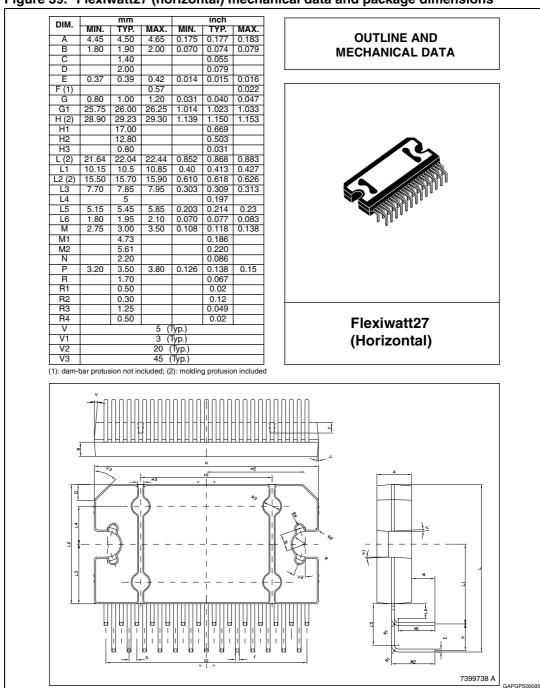
Package information TDA7569LV

11 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: <u>www.st.com</u>.

ECOPACK® is an ST trademark.

Figure 39. Flexiwatt27 (horizontal) mechanical data and package dimensions



TDA7569LV Package information

Figure 40. Flexiwatt27 (vertical) mechanical data and package dimensions

DIM	mm		inch		
	IN. TYP. MA		TYP.	MAX.	OUTLINE AND
	.45 4.50 4.6		0.177	0.183	
B 1.	.80 1.90 2.0 1.40	0.070	0.074	0.079	MECHANICAL DATA
	.75 0.90 1.0	0.029	0.035	0.041	
	.37 0.39 0.4		0.015	0.016	
F (1)	0.5			0.022	
G 0.	.80 1.00 1.2		0.040	0.047	
	5.75 26.00 26.2 5.90 29.23 29.3			1.033	
H1 20	17.00	0 1.139	0.669	1.133	
H2	12.80		0.503		_
H3	0.80		0.031		
	2.07 22.47 22.8		0.884	0.904	
	3.57 18.97 19.3		0.747	0.762	
	5.50 15.70 15.9 .70 7.85 7.9		0.618 0.309	0.626 0.313	
L3 /.	5 7.9	0.303	0.309	0.313	A. S. B. William.
L5	3.5		0.138		
M 3.	.70 4.00 4.3		0.157	0.169	Jella.
	.60 4.00 4.4	0.142		0.173	
N	2.20		0.086		
O R	1.70	_	0.079		
R1	0.5		0.067		
R2	0.3		0.12		
R3	1.25		0.049		
R4	0.50	1	0.019		
V		(Typ.)			Flexiwatt27 (vertical)
V1 V2	3	(Typ.)) (Typ.)			i ionitratter (voitioal)
V2 V3		(Typ.)			
(1): dam-bar	protusion not include				
(2): molding	protusion included				
21	V ₃	— H3	H H1	H2	R4 V1 V1 V1 V1 V1 V1 V1

Package information TDA7569LV

Figure 41. Flexiwatt27 (SMD) mechanical data and package dimensions

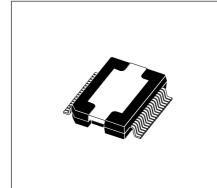
A 4.45 4.50 6.05 6.55 0.1752 0.1831 B 2.12 2.22 2.23 0.0855 0.0854 0.0913 0.0551 0.0552 0.0551 0.0552 0.0551 0.0552 0.0551 0.0552 0.0551 0.0552 0.0551 0.0552 0.0551 0.0552 0.0551 0.0552 0.0551 0.0552 0.0551 0.0552 0.055			mm			inch		
B	•	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
C								OUTLINE AND
□ 0.00 0.00 0.04 0.04 0.0142 0.0157 0.0173 F* 0.07 0.51 0.07 0.018 0.0291 0.0291 0.0294 61 25.70 26.00 0.8.30 1.0118 1.0238 1.0354 61 25.70 26.00 0.8.30 1.0118 1.0238 1.0354 61 25.70 26.00 0.8.30 1.0118 1.0238 1.0354 61 17.70 0.1 2.00 2.22 0.00690 0.0779 0.0886 61 17.70 0.1 2.00 0.0690 0.0779 0.0886 61 17.70 0.1 1.00 0.0693 0.0791 0.0891 61 17.70 0.06 0.0691 0.0731 0.0891 61 11.00 0.06 0.0691 0.0731 0.0891 61 11.00 0.06 0.0691 0.0731 0.0891 61 11.00 0.06 0.0691 0.0731 0.0891 61 11.00 0.06 0.0691 0.0731 0.0891 61 11.00 0.06 0.0691 0.0731 0.0891 61 11.00 0.06 0.0691 0.0731 0.0891 61 11.00 0.06 0.0691 0.0731 0.0891 61 11.00 0.06 0.0691 0.0931 0.0931 0.09310 61 11.00 0.06 0.0691 0.0931 0.0931 0.09310 61 11.00 0.06 0.0691 0.0931 0.0931 0.09310 61 11.00 0.06 0.0691 0.0931 0.0931 0.09310 61 11.00 0.06 0.0691 0.0931 0.0931 0.09310 61 11.00 0.06 0.0691 0.0931 0.09310 61 11.00 0.06 0.0691 0.0931 0.09310 61 11.00 0.0691 0.0931 0.0931 0.09310 61 11.00 0.0691 0.0931 0.0931 0.09310 61 11.00 0.0691 0.0931 0.09310 0.09310 61 11.00 0.0691 0.0931 0.09310 0.09310 61 11.00 0.0691 0.0931 0.09310 0.09310 61 11.00 0.0691 0.0931 0.09310 0.09310 61 11.00 0.0691 0.0931 0.09310 0.09310 61 11.00 0.0691 0.0931 0.09310 0.09310 61 11.00 0.0691 0.0931 0.09310 0.09310 61 11.00 0.0691 0.0931 0.09310 0.09310 61 11.00 0.0691 0.09310 0.09310 0.09310 0.09310 61 11.00 0.0691 0.09310 0.09		2.12		2.32	0.0835		0.0913	MECHANICAL DATA
E 0.36 0.40 0.44 0.0142 0.0157 0.0173 Pr 0.47 0.51 0.57 0.0185 0.0290 0.0224 G(Y) 0.75 1.00 1.25 0.0259 0.0293 0.0394 0.0492 G(Y) 2.50 0.00 2.50 0.0250 0.0293 0.0394 0.0492 G(Y) 1.75 2.00 2.25 0.0699 0.0787 0.0896 H(Y) 2.85 2.22 2.24 0.0 1.155 0.1556 1.1576 H1 17.00 1.50 0.0 2.50 0.050 0.0393 H2 12.00 0.0 0.0 0.0031 0.0031 H3 1.70 0.0 0.0031 0.0031 H3 1.70 0.0 0.0031 0.0031 H3 1.70 0.0 0.0031 0.0031 H3 1.10 0.50 0.0 0.0031 0.0031 L3 11.80 12.00 12.20 0.464 0.4724 0.4800 L5 1.24 14.00 1.48 1.66 0.0512 0.0585 0.0584 M 1.50 0.50 0.58 0.0585 0.0595 0.0586 M 1.50 0.50 0.58 0.0585 0.0595 0.0596 M 1.50 0.50 0.58 0.0585 0.0595 0.0596 M 1.50 0.50 0.58 0.0585 0.0595 0.0596 M 1.50 0.50 0.58 0.0585 0.0596 0.0596 M 1.50 0.50 0.58 0.0596 0.0596 0.0596 M 1.50 0.50 0.50 0.0596 0.0596 M 1.50 0.0596 0.0596 M 1.50 0.0596 0.0596 M 1.50 0.0596 0.0596 0.0596 M 1.								MEGITATIOAL DATA
F** 0.47 0.51 0.57 0.0185 0.0291 0.0294 0.0426 (***) 0.75 1.00 1.25 0.0295 0.0295 0.0294 0.0426 (***) 0.75 1.00 1.25 0.0295 0.02								
G(Y) 0.75 1.00 1.25 0.0293 0.0394 0.0492 (1 2.57 0.80 0.2934 0.0492 (1 2.57 0.80 0.2935 0.0394 0.0492 (1 2.57 0.80 0.2935 0.0395								
GI 25.70 28.00 28.50 1.0118 1.0228 1.0354 1.0354 1.0228 1.0354 1.						0.0201		
2(7) 1.75 2.00 2.25 0.0699 0.0797 0.0896 (1) 1376 (1) 1389 1.1509 (1) 1389 1.1								
MCT) 28 85 29 23 29 40 11358 11508 11575 11575 11575 11570 115								
H1								
H2		20.00		25.40	1.1000		1.1373	
H3								
L(**) 15.50 15.70 15.90 0.6102 0.6181 0.6260 L1 7.70 7.85 7.95 9.03031 0.30391 0.3130 L2 14.00 14.20 14.40 0.5512 0.5591 0.5669 L3 11.80 12.00 12.20 0.4646 0.4724 0.4603 L4 1.30 1.48 1.66 0.0512 0.0583 0.0564 L5 2.42 2.50 2.26 0.0953 0.09691 0.0964 0.1016 L6 0.42 0.50 0.58 0.0953 0.09691 0.096								
L1 7,70 7,85 7,95 0,3031 0,3091 0,3130 2 1162 114.0 0,1420 114.0 0,5112 0,5591 0,5669 1.3 11.80 12.00 12.20 0,4646 0,4724 0,4803 1.4 1,30 1,48 1,66 0,0512 0,683 0,0684 1.5 2.42 2.50 2.58 0,0983 0,0984 0,1016 1.6 0,42 0,50 0,58 0,0165 0,0691 1.7 1,10 0,50 0,58 0,0165 0,0691 1.8 1,50 1,48 1,66 0,512 0,693 1.8 1,50 1,48 1,66 0,512 0,693 1.8 1,50 1,48 1,66 0,512 0,693 1.8 1,50 1,48 1,66 0,512 0,693 1.8 1,50 1,48 1,66 0,512 0,693 1.8 1,50 1,48 1,66 0,512 0,693 1.8 1,50 1,48 1,66 0,512 0,693 1.8 1,50 1,48 1,66 0,512 0,693 1.8 1,50 1,48 1,66 0,512 0,693 1.8 1,50 1,48 1,66 0,512 0,693 1.8 1,50 1,48 1,66 0,512 0,693 1.8 1,50 1,48 1,66 0,512 0,693 1.8 1,50 1,48 1,66 0,512 0,693 1.8 1,50 1,48 1,66 0,512 0,693 1.8 1,50 1,48 1,50 1,48 1,48 1,48 1,48 1,48 1,48 1,48 1,48		15.50		15.90	0.6102		0.6260	
14								
11								
S								
1.50								
N								
N		0.42		0.58	0.0165		0.0228	
N1								
Ne(*) 2.73 2.83 2.83 0.1075 0.1114 0.1154								- SWARCA
P(Y) 4.73 4.83 4.93 0.1862 0.1902 0.1941 R 1.70 0.00 0.0689 R1 0.03.0 0.40 0.45 0.0138 0.0157 0.0177 R4 0.05.0 0.00 0.0197 0.0077 R4 0.08 0.10 0.0031 0.0039 aaa(Y) 0.01 0.0031 0.0039 aaa(Y) 0.1 0.0031 0.0039 aaa(Y) 0.1 0.1 0.0039 aaa(Y) 0.1 1 0.0039 aaa(Y) 0.1 1 0.0039 aaa(Y) 0.1 1 0.0039 A 12 15 18 12 15 18 A 13 15 18 A 14 5 5 5 5 5 B 5 5 5 B 5 5 5 5 B 5 5 5 5 B 5 5 5 5								200
R1								
R1		4.73		4.93	0.1862		0.1941	
12 0.35 0.40 0.45 0.0138 0.0157 0.0177								
R3		0.35		0.45	0.0139		0.0177	
### 10								
### Test		0.00		0.40	0.0130		0.0177	
Nation N		-0.08	0.00	0.10	-0.0031	0.0107	0.0039	
V1			0.1			0.0039		
V3 12 15 18 12 15 18 12 15 18 V4 5 5 5 5 5 5 5 5 5								
V3 12 15 18 12 15 18 12 15 18 V3 V5 V5 V5 V5 V5 V5 V5	V1		3			3		Fla
V4 5 20 5 20 20 Colden parameters)- Dimensions "F" doesn't include dam-bar protrusion Dimensions "H" and "L" include mold flash or protrusions. Detoil "A" Rototed 90" CCW H3	V2	3	5	7	0			Fiexiwatt2/
Golden parameters Dimensions "F" doesn't include dam-bar protrusion. Dimensions "H" and "L" include mold flash or protrusions. Defoil "A" Rototed 90" CCW AND THANK SEATING PLANE SEA	V3					5	/	
Golden parameters Demonsion 'F' doesn't include dam-bar protrusion. Dimensions' 'H' and 'L' include mold flash or protrusions. Parameters Rototad 90' CCW N1 N2 N1 N2 N2 N2 N3 N4 N2 N4 N2 N2 N4 N2 N2 N3 N4 N2 N4 N2 N4 N2 N4 N4 N4 N5 N5 N6 N6 N6 N6 N6 N6 N6 N6		12		18		15		
Defension "F" doesn't include mold flash or protrusions. Defoil "A" Roctard 90" CCW Defoil "A" Roctard 90" CCW N2 PLANE Lead#77 Lead#77 Lead#77		12	5	18		15 5		
AND DAME PLANE SEATING PLANE STATEMENT OF THE SEATING PLANE SEATING PLAN	V5) Golden j	parameters	5 20		12	15 5		
Leaduz?	V5) Golden (*) – Dime	parameters	5 20 esn't include	dam-bar pro	12 otrusion.	15 5 20		(SMD)
	V5) Golden (*) – Dimei – Dimei	parameters asion "F" doe nsions "H" a	5 20 esn't include nd "L" include	dam-bar pro	12 otrusion.	15 5 20		CSMD) Detaill "A" Rotated 90° CCW To august Plane SEATING PLANE N2 N2 Detaill "A" Rotated 90° CCW SEATING PLANE SEATING PLANE SEATING PLANE
	Vs) Golden in John State Sta	parameters sisten "F" doe nsions "H" a	5 20 20 snd "L" include nd "L" include	dam-bar pro	otrusion. or protrusio	15 5 20 ons.	16	(SMD) Detail "A" Rotated 90" CCW SEATING PLANE STATING PLANE S

TDA7569LV Package information

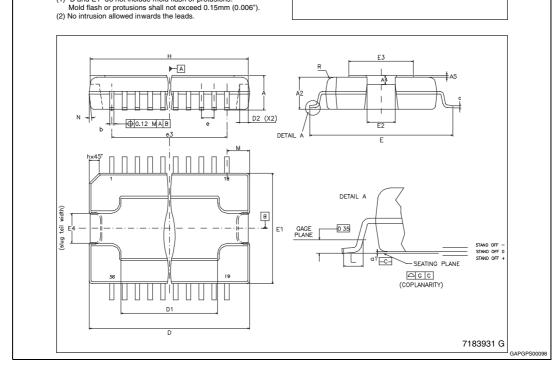
Figure 42. PowerSO36 (slug up) mechanical data and package dimensions

A 3. A2 3. A4 0. A5 a1 0. c 0. D 15 D1 9. D2 E 13	.270 .100 .800 - .030 .220 .230	TYP 0.200	3.410 3.180 1.000 - -0.040	MIN. 0.1287 0.1220 0.0315	TYP	0.1252
A2 3. A4 0. A5 a1 0. b 0. c 0. D 15 D1 9. D2 E 13	.100 .800 - .030 .220	- 0.200	3.180 1.000 -	0.1220	-	0.1343 0.1252 0.0394
A4 0. A5 a1 0. b 0. c 0. D 15 D1 9. D2 E 13	.800 - .030 .220	- 0.200 -	1.000		-	
A5 a1 0. b 0. c 0. D 15 D1 9. D2 E 13	- .030 .220 .230	-	-	0.0315	-	0.0394
a1 0. b 0. c 0. D 15 D1 9. D2 E 13	.220	-	-0.040	-	0.0070	
b 0. c 0. D 15 D1 9. D2 E 13	.220		-0.040		0.0079	-
c 0. D 15 D1 9. D2 E 13	.230	-	1	0.0012	-	-0.0016
D 15 D1 9. D2 E 13			0.380	0.0087	-	0.0150
D1 9. D2 E 13	200	-	0.320	0.0091	-	0.0126
D2 E 13		-	16.000	0.6220	-	0.6299
E 13	.400	-	9.800	0.3701	-	0.3858
		1.000	-	-	0.0394	-
E4 10	3.900	-	14.500	0.5472	-	0.5709
E1 10	0.900	-	11.100	0.4291	-	0.4370
E2	-	-	2.900	-	-	0.1142
E3 5.	.800	-	6.200	0.2283	-	0.2441
E4 2.	.900	-	3.200	0.1142	-	0.1260
е	-	0.650	-	-	0.0256	-
e3	-	11.050	-	-	0.4350	-
G	0	-	0.075	0	-	0.0031
H 15	5.500	-	15.900	0.6102	-	0.6260
h	-	-	1.100	-	-	0.0433
L 0.	.800	-	1.100	0.0315	-	0.0433
N	-	-	10	-	-	10
S	-	-8		-	-8	

OUTLINE AND MECHANICAL DATA



PowerSO36 (SLUG UP)



Revision history TDA7569LV

12 Revision history

Table 13. Document revision history

Date	Revision	Changes
08-Apr-2011	1	Initial release.
24-May-2011	2	Changed from 40 to 45 W the minimum value of the output power at R _L = 2 Ω and THD 10 %; see <i>Table 5: Electrical characteristics on page 11</i> .
25-May-2011	3	Updated Section 4.1: Turn-on diagnostic on page 17.

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