



TDA7564B

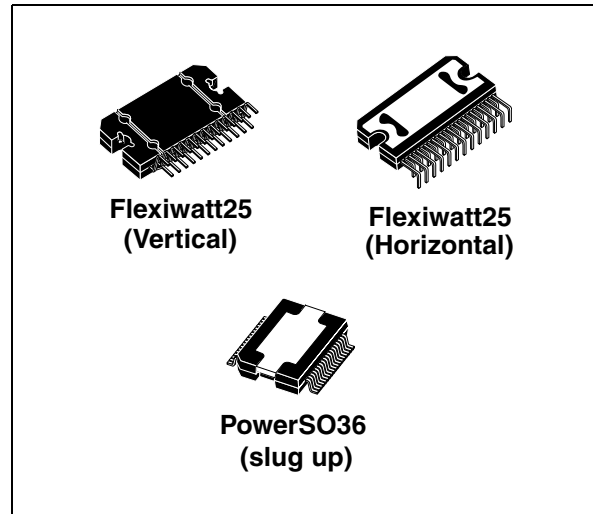
4 x 50W multifunction quad power amplifier
with built-in diagnostics feature

Features

- Multipower BCD technology
- MOSFET output power stage
- DMOS power output
- New high efficiency (class SB)
- High output power capability 4x28 W/4 Ω @ 14.4 V, 1 kHz, 10 % THD, 4x50 W max, power
- Max. output power 4x72 W/2 Ω
- Full I²C bus driving:
 - Standby
 - Independent front/rear soft play/mute
 - Selectable gain (for low noise line output function)
 - High efficiency enable/disable
 - I²C bus digital diagnostics (including AC and DC load detection)
- Full fault protection
- DC offset detection
- Four independent short circuit protection
- Clipping detector (2 %/10 %)
- Linear thermal shutdown with multiple thermal warning
- ESD protection

Description

The TDA7564B is a new BCD technology quad bridge type of car radio amplifier in Flexiwatt25 /



PowerSO36 package specially intended for car radio applications.

Thanks to the DMOS output stage the TDA7564B has a very low distortion allowing a clear powerful sound. Among the features, its superior efficiency performance coming from the internal exclusive structure, makes it the most suitable device to simplify the thermal management in high power sets.

The dissipated output power under average listening condition is in fact reduced up to 50% when compared to the level provided by conventional class AB solutions. This device is equipped with a full diagnostics array that communicates the status of each speaker through the I²C bus.

Table 1. Device summary

Order code	Package	Packing
TDA7564B	Flexiwatt25 (vertical)	Tube
TDA7564BH	Flexiwatt25 (horizontal)	Tube
TDA7564BPD	PowerSO36	Tube
TDA7564BPDTR	PowerSO36	Tape and reel

Contents

1	Block diagrams and application circuit	6
2	Pins description	7
3	Electrical specifications	8
3.1	Absolute maximum ratings	8
3.2	Thermal data	8
3.3	Electrical characteristics	8
3.4	Electrical characteristics curves	11
4	Diagnostics functional description	14
4.1	Turn-on diagnostic	14
4.2	Permanent diagnostics	16
4.3	Output DC offset detection	17
4.4	AC diagnostic	17
5	Multiple faults	19
5.1	Faults availability	19
6	Thermal protection	20
6.1	I2C programming/reading sequences	20
7	Fast muting	21
8	I²C bus interface	22
8.1	Data validity	22
8.2	Start and stop conditions	22
8.3	Byte format	22
8.4	Acknowledge	22
9	Software specifications	24
10	Examples of bytes sequence	29

11 **Package information** **30**

12 **Revision history** **33**

List of tables

Table 1.	Device summary	1
Table 2.	Absolute maximum ratings	8
Table 3.	Thermal data	8
Table 4.	Electrical characteristics	8
Table 5.	Double fault table for turn-on diagnostic	19
Table 6.	IB1	24
Table 7.	IB2	25
Table 8.	DB1	25
Table 9.	DB2	26
Table 10.	DB3	27
Table 11.	DB4	28
Table 12.	Document revision history	33

List of figures

Figure 1.	Block diagram	6
Figure 2.	Application circuit	6
Figure 3.	Flexiwatt25 pins connection diagram (top of view)	7
Figure 4.	PowerSO36 (slug-up) pins connection diagram (top of view)	7
Figure 5.	Quiescent current vs. supply voltage	11
Figure 6.	Output power vs. supply voltage (4 W)	11
Figure 7.	Output power vs. supply voltage (2 W)	11
Figure 8.	Distortion vs. output power (4 W, STD)	11
Figure 9.	Distortion vs. output power (4 Ω , HI-EFF)	12
Figure 10.	Distortion vs. output power (2 Ω , STD)	12
Figure 11.	Distortion vs. frequency (4 W)	12
Figure 12.	Distortion vs. frequency (2 W)	12
Figure 13.	Crosstalk vs. frequency	12
Figure 14.	Supply voltage rejection vs. freq.	12
Figure 15.	Power dissipation and efficiency vs. output power (4 W, STD, SINE)	13
Figure 16.	Power dissipation and efficiency vs. output power (4 Ω , Hi-eff, SINE)	13
Figure 17.	Power dissipation vs. average output power (audio program simulation, 4 W)	13
Figure 18.	Power dissipation vs. average output power (audio program simulation, 2 W)	13
Figure 19.	Turn - on diagnostic: working principle	14
Figure 20.	SVR and output behavior (case 1: without turn-on diagnostic)	14
Figure 21.	SVR and output pin behavior (case 2: with turn-on diagnostic)	15
Figure 22.	Short circuit detection thresholds	15
Figure 23.	Load detection thresholds - high gain setting	15
Figure 24.	Load detection threshold - low gain setting	15
Figure 25.	Restart timing without diagnostic enable (permanent)	16
Figure 26.	Restart timing with diagnostic enable (permanent)	16
Figure 27.	Current detection high: load impedance Z vs. output peak voltage	18
Figure 28.	Current detection low: load impedance Z vs. output peak voltage	18
Figure 29.	Thermal foldback diagram	20
Figure 30.	Data validity on the I2C bus	22
Figure 31.	Timing diagram on the I2C bus	23
Figure 32.	Acknowledge on the I2C bus	23
Figure 33.	Flexiwatt25 (horizontal) mechanical data and package dimensions	30
Figure 34.	Flexiwatt25 (vertical) mechanical data and package dimensions	31
Figure 35.	PowerSO36 (slug up) mechanical data and package dimensions	32

1 Block diagrams and application circuit

Figure 1. Block diagram

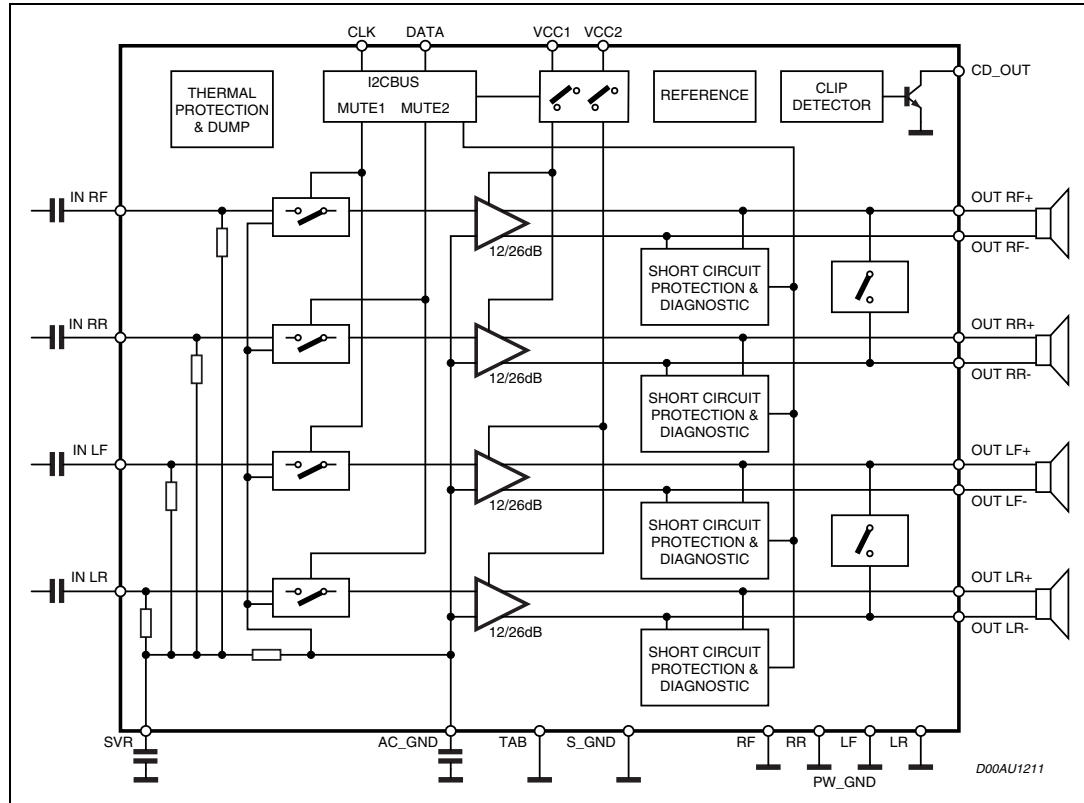
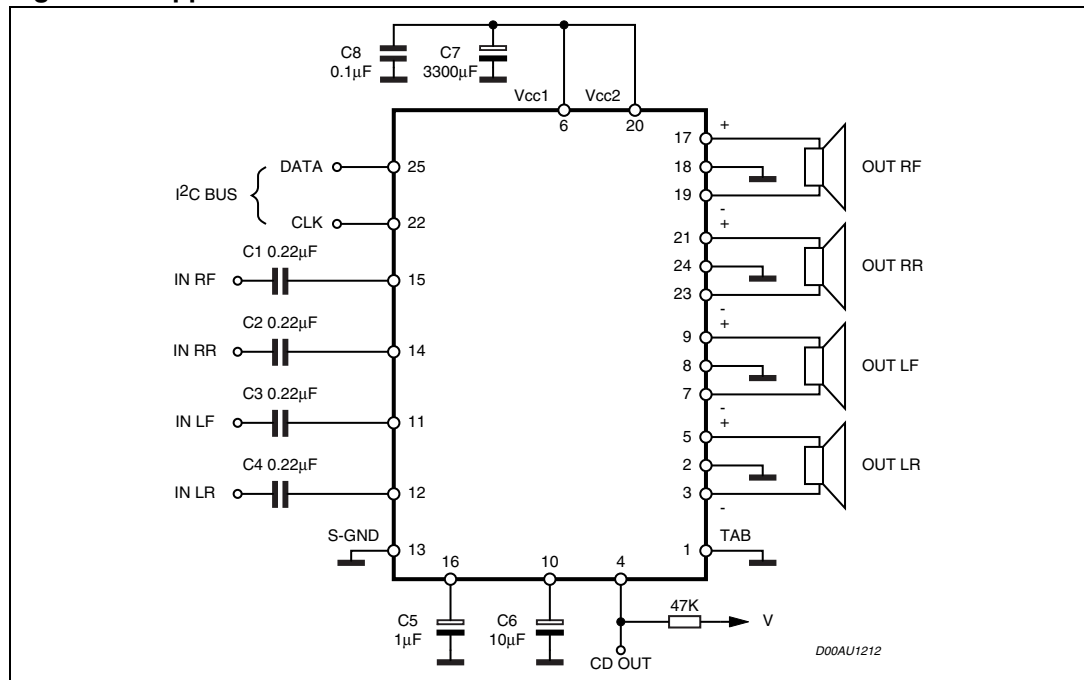


Figure 2. Application circuit



2 Pins description

Figure 3. Flexiwatt25 pins connection diagram (top of view)

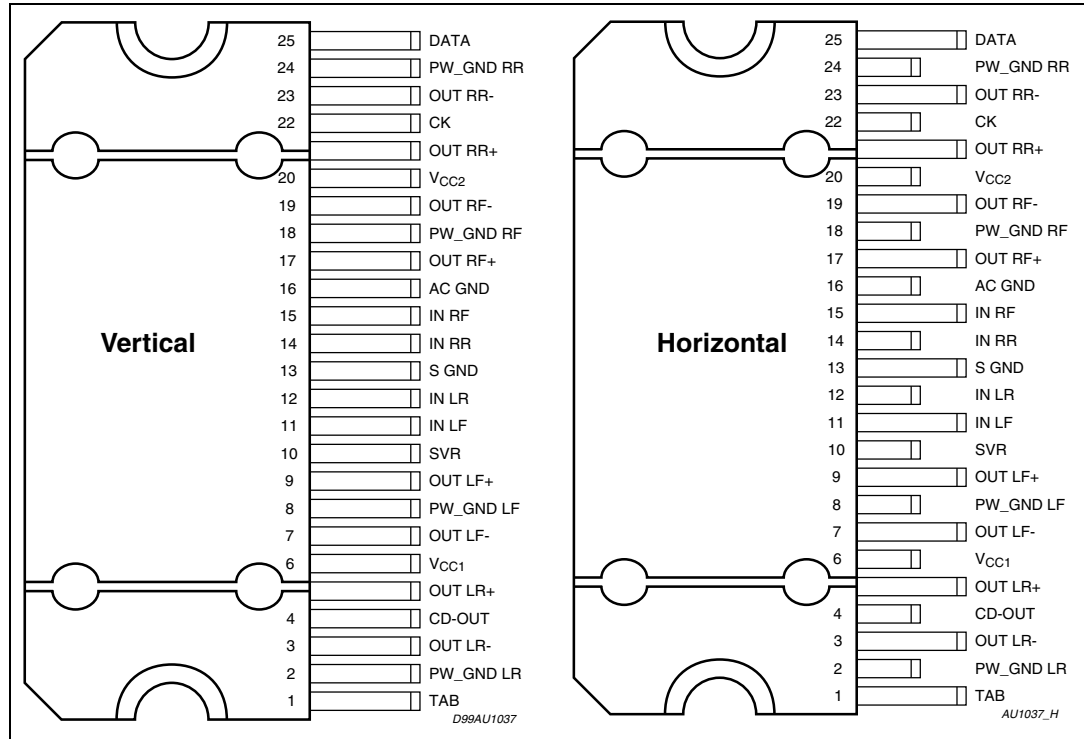
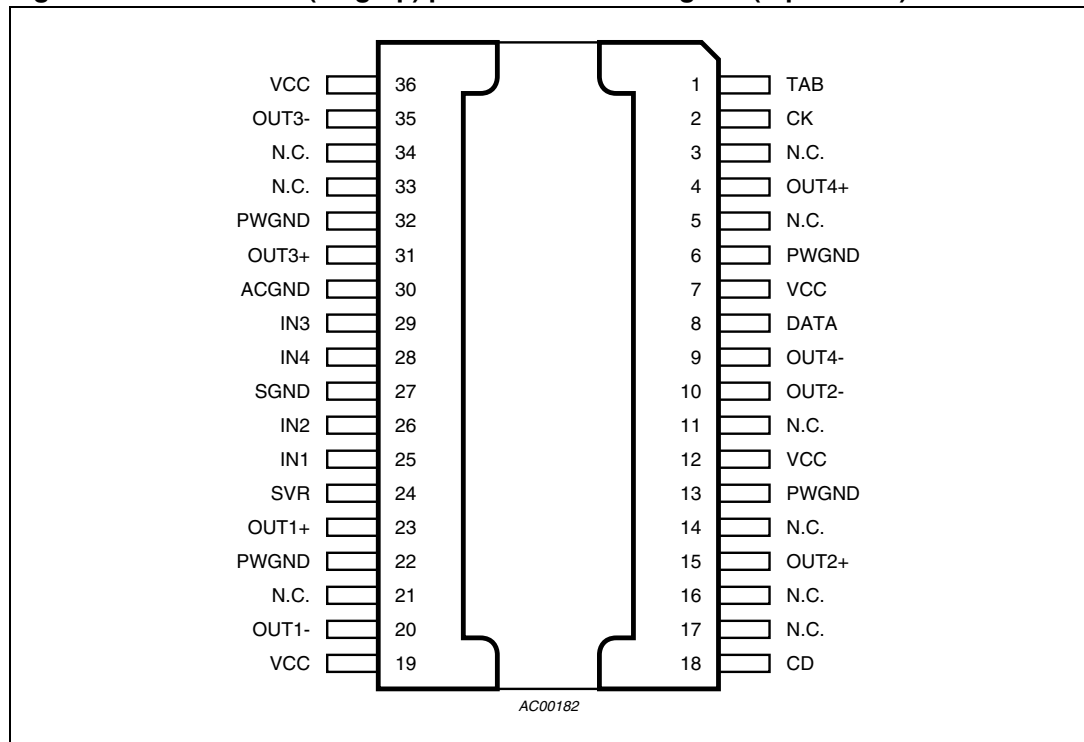


Figure 4. PowerSO36 (slug-up) pins connection diagram (top of view)



3 Electrical specifications

3.1 Absolute maximum ratings

Table 2. 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 $t = 50$ ms)	50	V
V_{CK}	CK pin voltage	6	V
V_{DATA}	Data pin voltage	6	V
I_O	Output peak current (not repetitive $t = 100$ ms)	8	A
I_O	Output peak current (repetitive $f > 10$ Hz)	6	A
P_{tot}	Power dissipation $T_{case} = 70$ °C	85	W
T_{stg}, T_j	Storage and junction temperature	-55 to 150	°C

3.2 Thermal data

Table 3. Thermal data

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

3.3 Electrical characteristics

Refer to the test circuit, $V_S = 14.4$ V; $R_L = 4$ Ω; $f = 1$ kHz; $G_V = 30$ dB; $T_{amb} = 25$ °C; unless otherwise specified.

Table 4. Electrical characteristics

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
Power amplifier						
V_S	Supply voltage range	-	8	-	18	V
I_d	Total quiescent drain current	-	-	170	300	mA
P_O	Output power	Max. power ($V_S = 15.2$ V, square wave input (2 Vrms))	-	50	-	W
		THD = 10 %	25	28	-	W
		THD = 1 %	20	22	-	W

Table 4. Electrical characteristics (continued)

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
P _O	Output power	R _L = 2 Ω; EIAJ (V _S = 13.7V)	55	68		W
		R _L = 2 Ω; THD 10%	40	50	-	
		R _L = 2 Ω; THD 1%	32	40		
		R _L = 2 Ω; max. power	60	75		
THD	Total harmonic distortion	P _O = 1 W to 10 W; STD mode HE MODE; P _O = 1.5 W HE MODE; P _O = 8 W	-	0.02 0.015 0.15	0.1 0.1 0.5	%
		G _V = 12 dB; STD mode V _O = 0.1 to 5 V _{RMS}	-	0.02	0.05	%
C _T	Cross talk	f = 1 kHz to 10 kHz, R _g = 600 Ω	50	60	-	dB
R _{IN}	Input impedance	-	60	100	130	kΩ
G _{V1}	Voltage gain 1	-	25	26	27	dB
ΔG _{V1}	Voltage gain match 1	-	-1	-	1	dB
G _{V2}	Voltage gain 2	-	11	12	13	dB
ΔG _{V2}	Voltage gain match 2	-	-1	-	1	dB
E _{IN1}	Output noise voltage 1	R _g = 600 Ω 20 Hz to 22 kHz	-	35	100	μV
E _{IN2}	Output noise voltage 2	R _g = 600 Ω; G _V = 12 dB 20 Hz to 22 kHz	-	12	30	μV
SVR	Supply Voltage Rejection	f = 100 Hz to 10 kHz; V _r = 1 Vpk; R _g = 600 Ω	50	60	-	dB
BW	Power bandwidth	-	100	-	-	kHz
A _{SB}	Standby attenuation	-	90	110	-	dB
I _{SB}	Standby current	V _{st-by} = 0	-	25	50	μA
A _M	Mute attenuation	-	80	100	-	dB
V _{OS}	Offset voltage	Mute and play	-100	0	100	mV
V _{AM}	Min. supply mute threshold	-	6.5	7	8	V
CMRR	Input CMRR	V _{CM} = 1 Vpk-pk; R _g = 0 Ω	-	55	-	dB
T _{ON}	Turn ON Delay	D2/D1 (IB1) 0 to 1	-	20	40	ms
T _{OFF}	Turn OFF Delay	D2/D1 (IB1) 1 to 0	-	20	40	ms
CD _{LK}	Clip det high leakage current	CD off	-	0	5	μA
CD _{SAT}	Clip det sat. voltage	CD on; I _{CD} = 1 mA	-	150	300	mV
CD _{THD}	Clip det THD level	D0 (IB1) = 1	5	10	15	%
		D0 (IB1) = 0	1	2	3	%

Table 4. Electrical characteristics (continued)

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
Turn on diagnostics 1 (Power amplifier mode)						
Pgnd	Short to GND det. (below this limit, the output is considered in short circuit to GND)	Power amplifier in standby	-	-	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).		1.8	-	Vs -1.8	V
Lsc	Shorted load det.		-	-	0.5	Ω
Lop	Open load det.		85	-	-	Ω
Lnop	Normal load det.		1.5	-	45	Ω
Turn on diagnostics 2 (Line driver mode)						
Pgnd	Short to GND det. (below this limit, the output is considered in short circuit to GND)	Power amplifier in standby	-	-	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).	-	1.8	-	Vs -1.8	V
Lsc	Shorted load det.	-	-	-	2	Ω
Lop	Open load det.	-	330	-	-	Ω
Lnop	Normal load det.	-	7	-	180	Ω
Permanent 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)	Power amplifier in mute or play, one or more short circuits protection activated	-	-	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).		1.8	-	Vs -1.8	V
L _{SC}	Shorted load det.	Pow. amp. mode	-	-	0.5	Ω
		Line driver mode	-	-	2	Ω
V _O	Offset detection	Power amplifier in play, AC Input signals = 0	±1.5	±2	±2.5	V
I _{NLH}	Normal load current detection	V _O < (V _S - 5)pk IB2 (D7) = 0	500	-	-	mA