



# TDA7469

## LOW VOLTAGE ANALOG AUDIO PROCESSOR WITH HEADPHONE POWER AMPLIFIER

### 1 FEATURES

- 2 STEREO INPUT
- 1 STEREO OUTPUT
- TREBLE BOOST
- BASS CONTROL
- BASS AUTOMATIC LEVEL CONTROL
- VOLUME CONTROL IN 1dB STEPS
- MUTE
- STAND-BY FUNCTION SOFTWARE CONTROLLED
- ALL FUNCTION ARE PROGRAMMABLE VIA SERIAL BUS

Figure 1. Package



Table 1. Order Codes

Part Number	Package
TDA7469	SSOP24
TDA746913TR	Tape & Reel

### 2 DESCRIPTION

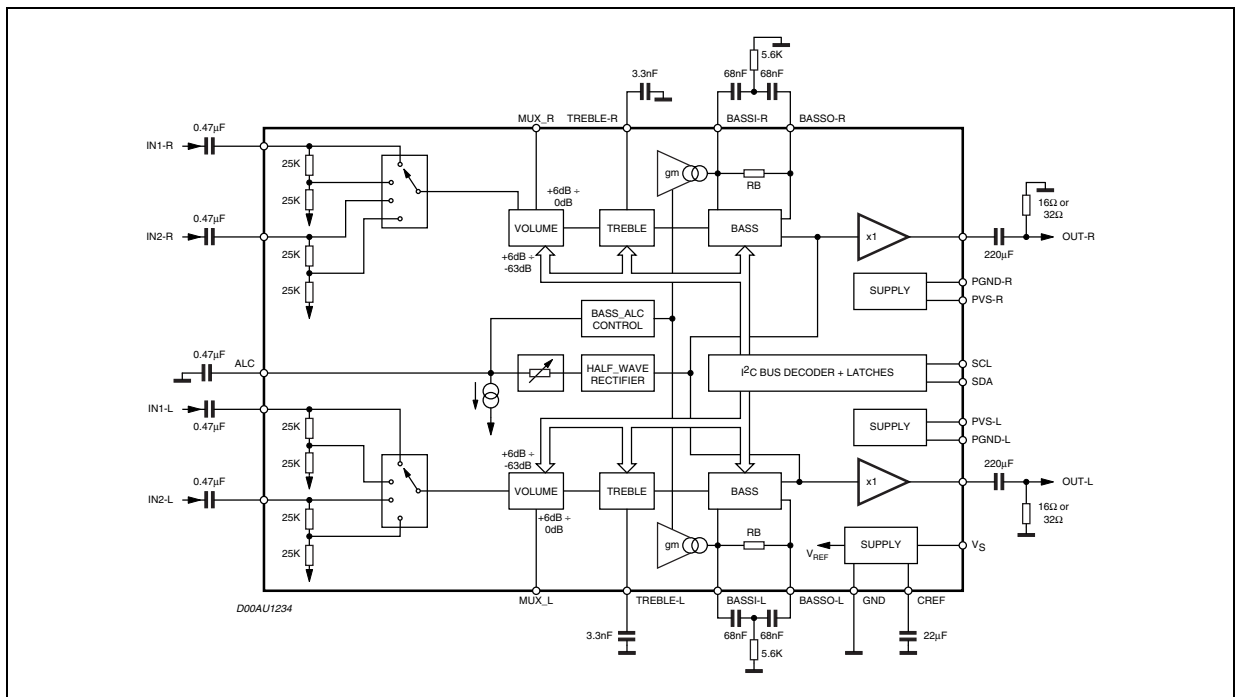
The TDA7469 is a volume tone (bass and treble) processor for quality audio applications in Low voltage supply portable systems.

Bass ALC (Automatic Level Control) function can be adjusted by a dedicated pin. The control of all the functions is accomplished by serial bus.

The AC signal setting is obtained by resistor networks and switches combined with operational amplifiers.

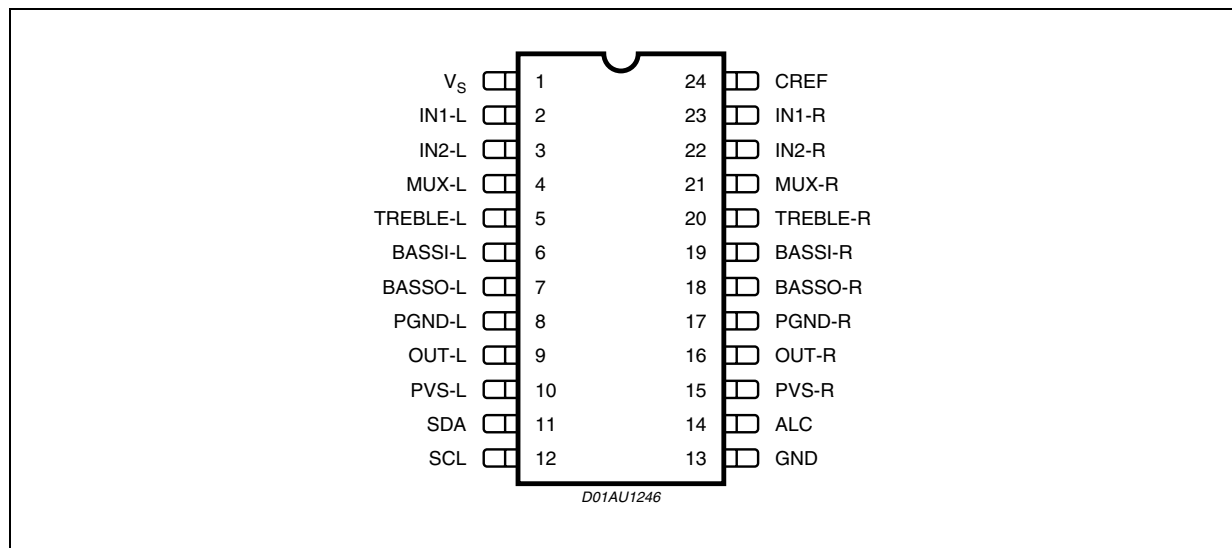
Thanks to the used BIPOLAR/CMOS Technology, Low Distortion, Low Noise and DC stepping are obtained.

Figure 2. Block Diagram



**Table 2. ABSOLUTE MAXIMUM RATINGS**

Symbol	Parameter	Value	Unit
$V_S$	Operating Supply Voltage	5.5	V
$T_{amb}$	Operating Ambient Temperature	0 to 70	°C
$T_{stg}$	Storage Temperature Range	-55 to 150	°C
ESD	Maximum ESD on PINS 11 and 12 (HBM)	500	V

**Figure 3. PIN CONNECTIONS (Top view)****Table 3. THERMAL DATA**

Symbol	Parameter	Value	Unit
$R_{th\ j-pin}$	Thermal Resistance Junction-pins	85	°C/W

**Table 4. QUICK REFERENCE DATA**

Symbol	Parameter	Min.	Typ.	Max.	Unit
$V_S$	Supply Voltage	1.8	2.4	5.0	V
$V_{ps}$	Power Supply Voltage	1.5	2.4	5.0	V
$P_{omax}$	Maximum output power THD 10%	5	10		mW
THD	Total Harmonic Distortion $V = 0.1V_{rms}$ $f = 1KHz$		0.1	0.5	%
	Volume Control (1dB step)	-63		6	dB
	Treble Control	0		12	dB
	Bass Control	0		14	dB
	Mute Attenuation		90		dB

Table 5.

**ELECTRICAL CHARACTERISTICS** (refer to the test circuit  $T_{amb} = 25^{\circ}\text{C}$ ,  $V_S = 2.4\text{V}$ , all controls flat ( $G = 0\text{dB}$ ),  $f = 1\text{KHz}$ , unless otherwise specified)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
<b>SUPPLY</b>						
$V_S$	Supply Voltage		1.8	2.4	5.0	V
$V_{PS}$	Supply Voltage		1.5	2.4	5.0	V
$I_{SQ}$	Supply Current pin 1	All circuit stop		40	100	$\mu\text{A}$
$I_{PSQ}$	Quiescent Current pin10 + pin15	Headphone Amp. OFF		1	10	$\mu\text{A}$
$I_S$		$P_o = 0.5\text{mW} + 0.5\text{mW}$		8		mA
$I_{PS}$		$P_o = 0.5\text{mW} + 0.5\text{mW}$		15		mA
<b>INPUT STAGE</b>						
$R_{IN}$	Input Resistance		35	50	65	$\text{K}\Omega$
$A_{IN}$	Input Attenuation Range		0		6	dB
<b>VOLUME CONTROL</b>						
$C_{RANGE}$	Control Range		-63		6	dB
$A_{MAX}$	Max. Attenuation		61	63	65	dB
$A_{STEP}$	Step Resolution		0.5	1	1.5	dB
$G_{MAX}$	Max. Gain			6		dB
$G_{step}$	Step Resolution			2		dB
$R_1$	Muxout Load Resistance			10		$\text{K}\Omega$
<b>BASS CONTROL</b>						
$G_b$	Control Range	Max. Boost/on		14		dB
$R_B$	Internal Feedback Resistance		75.6	100.8	126	$\text{K}\Omega$
<b>TREBLE CONTROL</b>						
$G_t$	Control Range	Max. Boost		12		dB
$R_t$	Internal Resistance			25		$\text{K}\Omega$
<b>HEADPHONE OUTPUTS</b>						
$G_{out}$	Output Gain			0		dB
$P_{omax}$	Max Output Power	THD = 10%	5	10		mW
<b>GENERAL</b>						
$E_{NO}$	Output Noise	All gains = 0dB Output Muted BW = 20Hz to 20KHz flat		5 10		$\mu\text{V}$ $\mu\text{V}$
THD	Distortion	$A_v = 0$ , $V_{in} = 0.1V_{rms}$		0.1	0.5	%
$S_C$	Channel Separation Left/Right			50		dB
RR1	Ripple Rejection	$V_S$ , $f = 100\text{Hz}$		-70		dB
RR2	Ripple Rejection	PVS, $f = 100\text{Hz}$		-75		dB
	Total Tracking Error			0	1	dB
<b>BUS INPUTS</b>						
$V_{IL}$	Input Low Voltage				0.5	V
$V_{IH}$	Input High Voltage		1.9			V
$I_{IN}$	Input Current	$V_{IN} = 0.4\text{V}$	-5		5	$\mu\text{A}$
$V_O$	Output Voltage (ACK)	$I_O = 1.6\text{mA}$			0.4	V

Note: 1. BASS and TREBLE response: The center frequency and the response quality can be chosen by the external circuitry.

### 3 DATA BYTES

Address = (HEX) 10001000

#### 3.1 FUNCTION SELECTION:

The first byte (subaddress)

Table 6.

MSB							LSB	SUBADDRESS
D7	D6	D5	D4	D3	D2	D1	D0	
X	X	X	B	0	0	0	0	VOLUME
X	X	X	B	0	0	0	1	TREBLE & BASS
X	X	X	B	0	0	1	0	INPUT & MUTE
X	X	X	B	0	0	1	1	STAND-BY & OTHERS
X	X	X	B	0	1	0	0	BASS ALC1
X	X	X	B	0	1	0	1	BASS ALC2

B = 1 incremental bus; active

B = 0 no incremental bus

;X = indifferent 0,1

Table 7. VOLUME

MSB							LSB	VOLUME
D7	D6	D5	D4	D3	D2	D1	D0	GAIN
						0	0	6
						0	1	4
						1	0	2
						1	1	0
								<b>1 dB STEPS</b>
			0	0	0			0
			0	0	1			-1
			0	1	0			-2
			0	1	1			-3
			1	0	0			-4
			1	0	1			-5
			1	1	0			-6
			1	1	1			-7
								<b>8 dB STEPS</b>
0	0	0						0
0	0	1						-8
0	1	0						-16
0	1	1						-24
1	0	0						-32
1	0	1						-40
1	1	0						-48
1	1	1						-56

VOLUME : +6 x -63dB

Table 8. TREBLE &amp; BASS

MSB							LSB		
D7	D6	D5	D4	D3	D2	D1	D0		
<b>TREBLE</b>									
						0	0	12dB	
						0	1	8dB	
						1	0	4dB	
						1	1	0dB	
<b>BASS</b>									
			0	0	0			14dB	
			0	0	1			12dB	
			0	1	0			10dB	
			0	1	1			8dB	
			1	0	0			6dB	
			1	0	1			4dB	
			1	1	0			2dB	
			1	1	1			0dB	
<b>BASS ALC</b>									
		0						ALC: VOLUME mode	
		1						ALC: BASS mode	
	1							ALC: fc shift	
	0							ALC: fc nonshift	
1								ALC: feedback gain x2	
0								ALC: feedback gain x 1	

Table 9. INPUT SELECT &amp; MUTE

MSB							LSB		
D7	D6	D5	D4	D3	D2	D1	D0	INPUT SELECT	
						0	0	IN1 (0dB)	
						0	1	IN1 (-6dB)	
						1	0	IN2 (0dB)	
						1	1	IN2 (-6dB)	
<b>MUTE</b>									
					1			Input Mute ON	
					0			Input Mute OFF	
				1				Output SoftMute ON	
				0				Output SoftMute OFF	
			1					Output Mute ON	
			0					Output Mute OFF	
<b>HEADPHONE AMP. ST-BY</b>									
		1						Headphone Amp. OFF	
		0						Headphone Amp. ON	

Table 10. STAND\_BY &amp; OTHERS

MSB							LSB		
D7	D6	D5	D4	D3	D2	D1	D0		
								<b>STAND-BY</b>	
								1	ALL Circuits Stop
								0	ALL Circuits Work
								<b>SOFT MUTE CAPACITOR</b>	
								1	Independent Capacitor
								0	Share ALC Capacitor
								<b>REFERENCE LEVEL</b>	
								1	adaptive: (VDD-0.7)/2
								0	1.10V
								0	0.85V
								1	0.55V
								1	0.45V
								<b>ZEROCROSS MODE</b>	
								1	ON
								0	OFF
								1	Zerocross Detect Point: Volume
								0	Zerocross Detect Point: Bass
								<b>CREF STAND-BY</b>	
								1	CREF Circuit Stop
								0	CREF Circuit Work

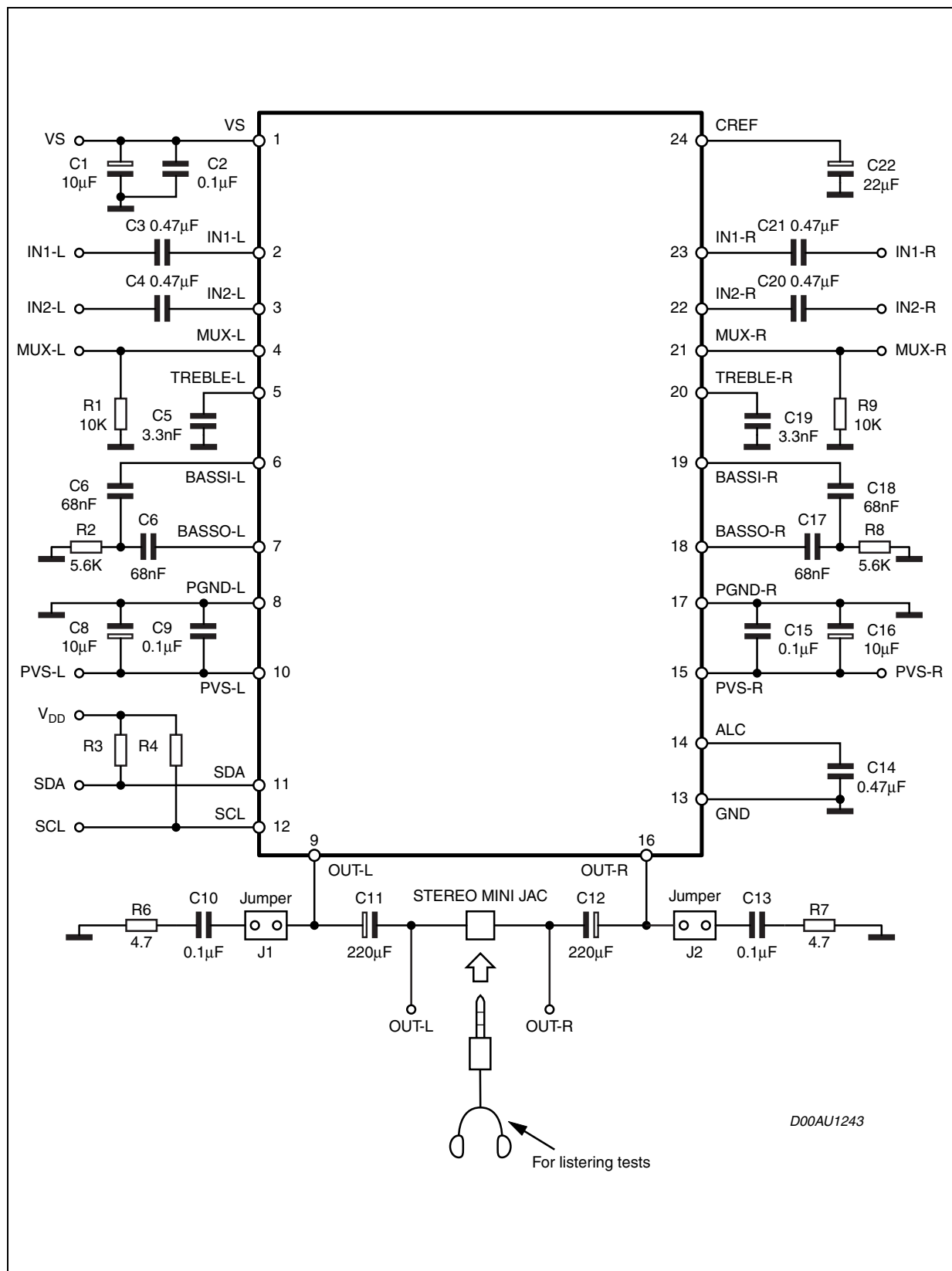
Table 11. BASS ALC1

MSB							LSB	BASS ALC	
D7	D6	D5	D4	D3	D2	D1	D0		
								<b>ALC MODE</b>	
								1	ON
								0	OFF
								<b>DETECTOR</b>	
								1	ON
								0	OFF
								<b>RELEASE CURRENT CIRCUIT</b>	
								1	ON
								0	OFF
								<b>ATTACK TIME RESISTOR</b>	
								0	12.5K $\Omega$
								0	25K $\Omega$
								1	50K $\Omega$
								1	100K $\Omega$
								<b>THRESHOLD</b>	
								0	THRESHOLD1
								0	THRESHOLD2
								1	THRESHOLD3
								1	THRESHOLD4

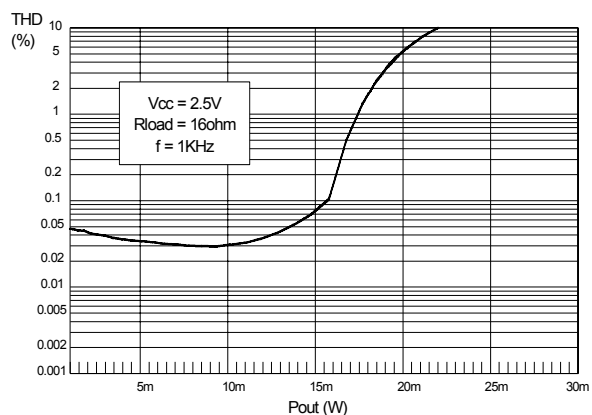
Table 12. BASS ALC2

MSB							LSB	BASS ALC	
D7	D6	D5	D4	D3	D2	D1	D0		
								<b>ALC FULL FEEDBACK CURR.</b>	
								1	ON
								0	OFF
								<b>BIG RELEASE CURRENT</b>	
								1	ON
								0	OFF

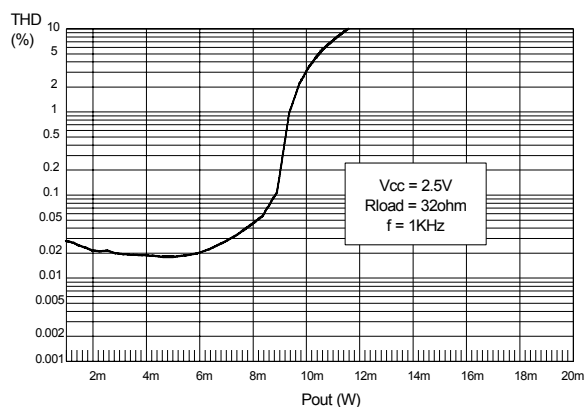
Figure 4. Typical Application Circuit (SSO24)



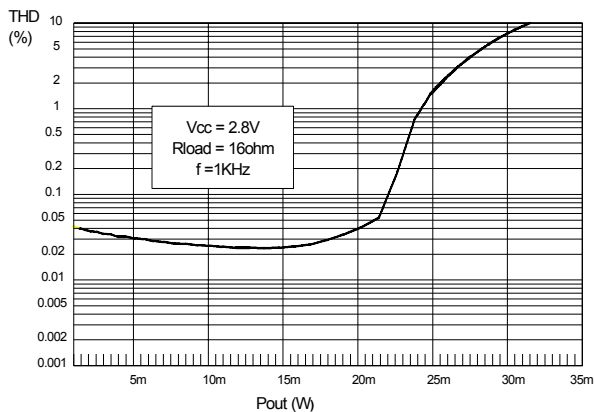
**Figure 5. THD+Noise vs Amplitude @V<sub>CC</sub> 2.5V,  
R<sub>load</sub> 16Ω**



**Figure 7. THD+Noise vs Amplitude @V<sub>CC</sub> 2.5V,  
R<sub>load</sub> 32Ω**



**Figure 6. THD+Noise vs Amplitude @V<sub>CC</sub> 2.8V,  
R<sub>load</sub> 16Ω**



**Figure 8. THD+Noise vs Amplitude @V<sub>CC</sub> 2.8V,  
R<sub>load</sub> 32Ω**

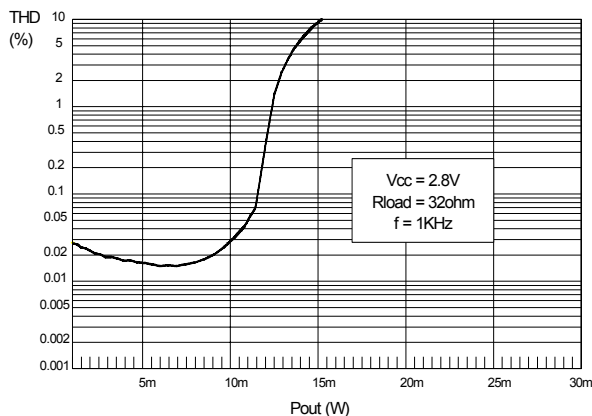




Figure 9. TDA7469 Components Layout

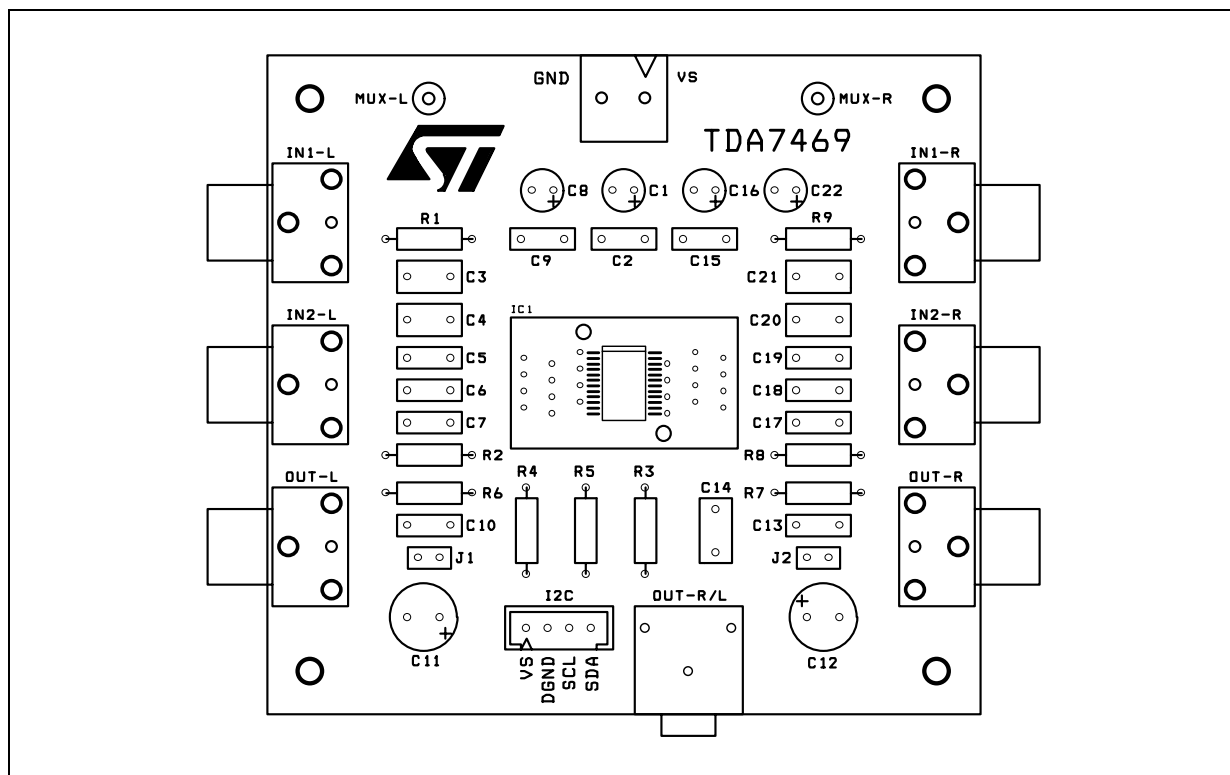


Figure 10. TDA7469 P.C. Board Layout (Top view)

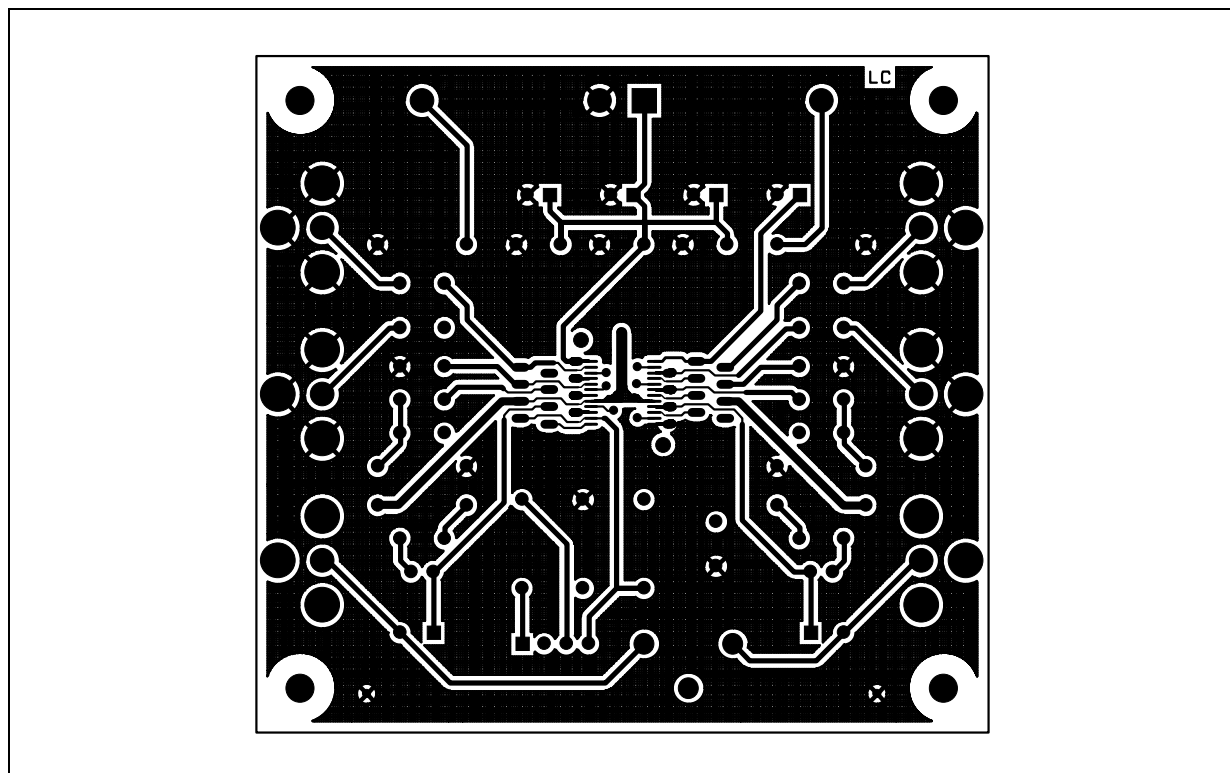


Figure 11. TDA7469 P. C. Board (Backside view)

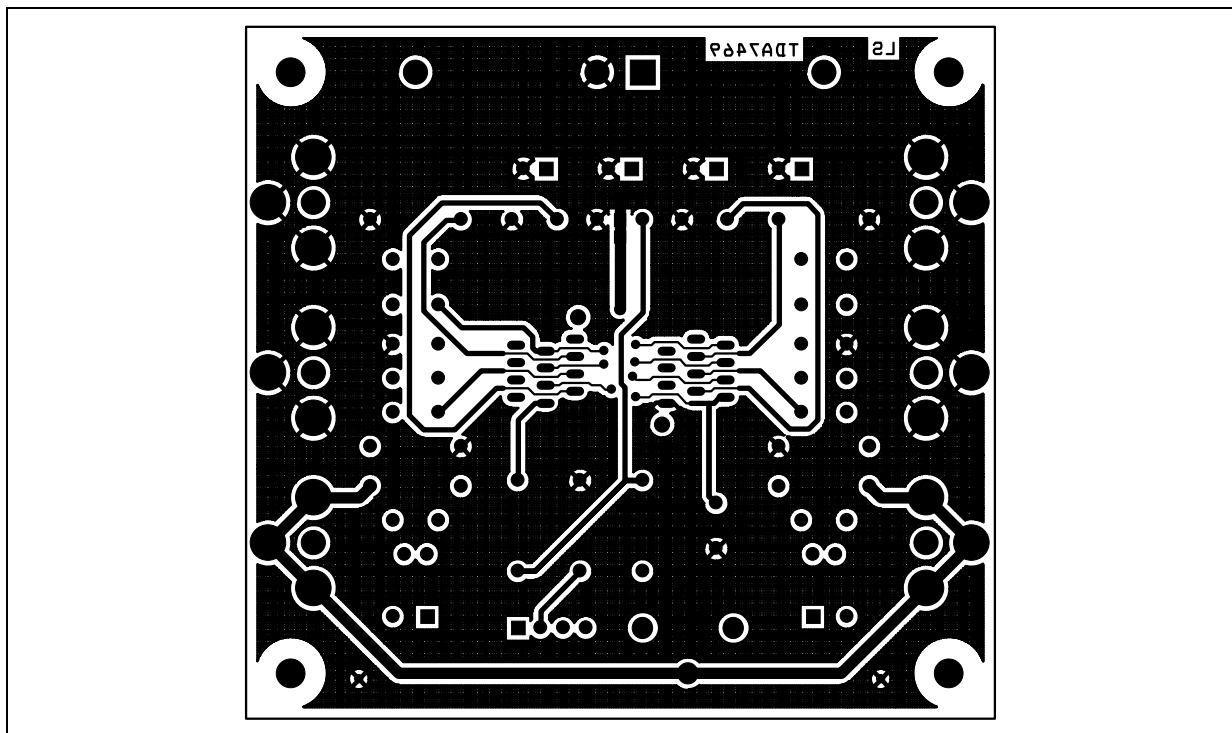
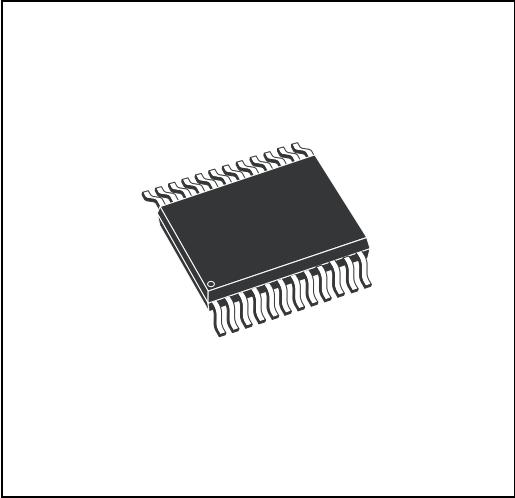


Figure 12. SSO24 Mechanical Data & Package Dimensions

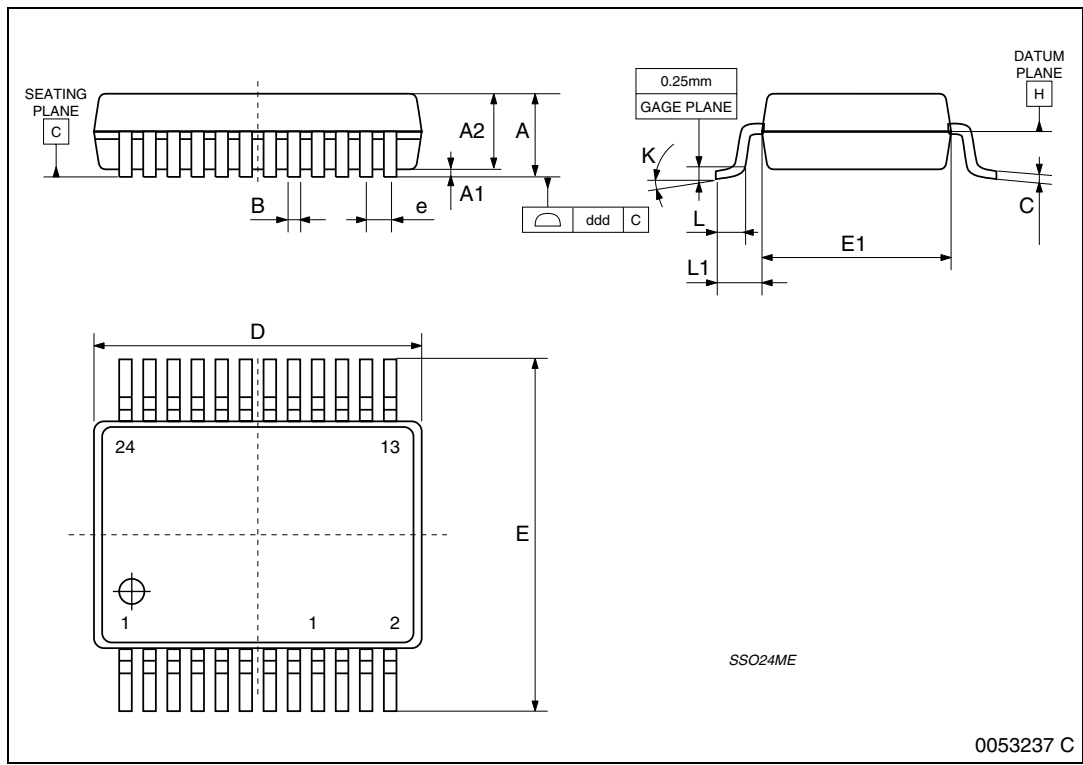
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			2.00			0.079
A1	0.05			0.002		
A2	1.65	1.75	1.85	0.060		0.079
B (2)	0.22		0.38	0.009		0.015
C	0.09		0.25	0.003		0.01
D (1)	7.9	8.2	8.5	0.31	0.32	0.33
E	7.4	7.8	8.2	0.29	0.30	0.32
E1 (1)	5.0	5.3	5.6	0.20	0.21	0.22
e		0.65			0.025	
L	0.55	0.75	0.95	0.022	0.029	0.004
L1		1.25			0.05	
k	0° (min), 4° (typ), 8° (max)					
ddd			0.1			0.004

- (1) "D and E1" dimensions do not include mold flash or protrusions, but do include mold mismatch and are measured at datum plane "H". Mold flash or protrusions shall not exceed 0.20mm in total (both side).
- (2) "B" dimension does not include dambar protrusion/intrusion.

**OUTLINE AND MECHANICAL DATA**



**SSO24 Shrink Small Outline Package**



**Table 13. Revision History**

<b>Date</b>	<b>Revision</b>	<b>Description of Changes</b>
July 2001	1	First Issue
July 2004	2	Removed packages and new style-sheet
15 December 2004	3	Modified value $P_{\text{omax}}$ typ. from 8 to 10mW and add. ESD in table 2

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