

### TDA2030

### 14W Hi-Fi AUDIO AMPLIFIER

#### DESCRIPTION

The TDA2030 is a monolithic integrated circuit in Pentawatt® package, intended for use as a low frequency class AB amplifier. Typically it provides 14W output power (d = 0.5%) at 14V/4 $\Omega$ ; at ± 14V the guaranteed output power is 12W on a 4 $\Omega$  load and 8W on a 8 $\Omega$  (DIN45500).

The TDA2030 provides high output current and has very low harmonic and cross-over distortion.

Further the device incorporates an original (and patented) short circuit protection system comprising an arrangement for automatically limiting the dissipated power so as to keep the working point of the output transistors within their safe operating area. A conventional thermal shut-down system is also included.



#### **ABSOLUTE MAXIMUM RATINGS**

Symbol	Parameter	Value	Unit
Vs	Supply voltage	± 18	V
Vi	Input voltage	Vs	
Vi	Differential input voltage	± 15	V
lo	Output peak current (internally limited)	3.5	А
P <sub>tot</sub>	Power dissipation at $T_{case} = 90^{\circ}C$	20	W
T <sub>stg</sub> , T <sub>j</sub>	Stoprage and junction temperature	-40 to 150	°C

#### TYPICAL APPLICATION



#### **PIN CONNECTION** (top view)



**TEST CIRCUIT** 



#### THERMAL DATA

Symbol	I Parameter		Unit
R <sub>th j-case</sub>	Thermal resistance junction-case max	3	°C/W

## **ELECTRICAL CHARACTERISTICS** (Refer to the test circuit, $V_s = \pm 14V$ , $T_{amb} = 25^{\circ}C$ unless otherwise specified)

Symbol	Parameter	Test condi	tions	Min.	Тур.	Max.	Unit
Vs	Supply voltage			± 6		± 18	V
l <sub>d</sub>	Quiescent drain current				40	60	mA
I <sub>b</sub>	Input bias current				0.2	2	μA
Vos	Input offset voltage	$V_s = \pm 18V$			± 2	± 20	mV
l <sub>os</sub>	Input offset current				± 20	± 200	nA
Po	Output power		<sub>v</sub> = 30 dB z	12 8	14 9		V V
		$d = 10\% \qquad G$ f = 1  KHz $R_L = 4\Omega$ $R_L = 8\Omega$	i <sub>v</sub> = 30 dB		18 11		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
d	Distortion		<sub>v</sub> = 30 dB z		0.2	0.5	%
			<sub>v</sub> = 30 dB z		0.1	0.5	%
В	Power Bandwidth (-3 dB)	$\begin{array}{l} G_v = 30 \text{ dB} \\ P_o = 12 W \end{array} \hspace{0.5cm} \text{R}$			00	Hz	
Ri	Input resistance (pin 1)			0.5	5		MΩ
Gv	Voltage gain (open loop)				90		dB
Gv	Voltage gain (closed loop)	f	= 1 kHz	29.5	30	30.5	dB
e <sub>N</sub>	Input noise voltage	B = 22 Hz to 22 K	Hz		3	10	μV
i <sub>N</sub>	Input noise current				80	200	pА
SVR	Supply voltage rejection	$ \begin{array}{c} R_L = 4\Omega & G \\ R_g = 22 \; k\Omega \\ V_{ripple} = 0.5 \; V_{eff} \\ f_{ripple} = 100 \; Hz \end{array} $	v = 30 dB	40	50		dB
l <sub>d</sub>	Drain current		$L = 4\Omega$ $L = 8\Omega$		900 500		mA mA
Tj	Thermal shut-down junction temperature				145		°C



Figure 1. Output power vs. supply voltage



Figure 2. Output power vs. supply voltage



### Figure 3. Distortion vs. output power



Figure 4. Distortion vs. output power



Figure 5. Distortion vs. output power



Figure 6. Distortion vs. frequency



## Figure 7. Distortion vs. frequency



Figure 8. Frequency response with different values of the rolloff capacitor C8 (see fig. 13)



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Figure 9. Quiescent current vs. supply voltage



### Figure 10. Supply voltage rejection vs. voltage gain



Figure 11. Power dissipation and efficiency vs. output power



Figure 12. Maximum power dissipation vs. supply voltage (sine wave operation)



#### **APPLICATION INFORMATION**

Figure 13. Typical amplifier with split power supply









#### **APPLICATION INFORMATION** (continued)

### Figure 15. Typical amplifier with single power supply

Figure 16. P.C. board and component layout for the circuit of fig. 15 (1 : 1 scale)



Figure 17. Bridge amplifier configuration with split power supply ( $P_o = 28W, V_s = \pm 14V$ )





#### PRACTICAL CONSIDERATIONS

#### **Printed circuit board**

The layout shown in Fig. 16 should be adopted by the designers. If different layouts are used, the ground points of input 1 and input 2 must be well decoupled from the ground return of the output in which a high current flows.

#### Assembly suggestion

No electrical isolation is needed between the

package and the heatsink with single supply voltage configuration.

#### **Application suggestions**

The recommended values of the components are those shown on application circuit of fig. 13. Different values can be used. The following table can help the designer.

Component	Recomm. value	Purpose	Larger than recommended value	Smaller than recommended value		
R1	22 kΩ	Closed loop gain setting	Increase of gain	Decrease of gain (*)		
R2	680 Ω	Closed loop gain setting	Decrease of gain (*)	Increase of gain		
R3	22 kΩ	Non inverting input biasing	Increase of input impedance	Decrease of input impedance		
R4	1 Ω	Frequency stability	Danger of osccilat. at high frequencies with induct. loads			
R5	≅ 3 R2	Upper frequency cutoff	Poor high frequencies attenuation	Danger of oscillation		
C1	1 μF	Input DC decoupling		Increase of low frequencies cutoff		
C2	22 μF	Inverting DC decoupling		Increase of low frequencies cutoff		
C3, C4	0.1 μF	Supply voltage bypass		Danger of oscillation		
C5, C6	100 μF	Supply voltage bypass		Danger of oscillation		
C7	0.22 μF	Frequency stability		Danger of oscillation		
C8	$\cong \frac{1}{2\pi \text{ B R1}}$	Upper frequency cutoff	Smaller bandwidth	Larger bandwidth		
D1, D2	1N4001	To protect the device again	ct the device against output voltage spikes			

(\*) Closed loop gain must be higher than 24dB



#### SHORT CIRCUIT PROTECTION

The TDA2030 has an original circuit which limits the current of the output transistors. Fig. 18 shows that the maximum output current is a function of the collector emitter voltage; hence the output transistors work within their safe operating area (Fig. 2). This function can therefore be considered as being

peak power limiting rather than simple current limiting.

It reduces the possibility that the device gets damaged during an accidental short circuit from AC output to ground.



Figure 19. Safe operating area and collector characteristics of the protected power transistor



#### **THERMAL SHUT-DOWN**

The presence of a thermal limiting circuit offers the following advantages:

- An overload on the output (even if it is permanent), or an abovelimit ambient temperature can be easily supported since the T<sub>j</sub> cannot be higher than 150°C.
- The heatsink can have a smaller factor of safety compared with that of a conventional circuit. There is no possibility of device damage due to high junction temperature. If for any reason, the

junction temperature increases up to 150°C, the thermal shut-down simply reduces the power dissipation at the current consumption.

The maximum allowable power dissipation depends upon the size of the external heatsink (i.e. its thermal resistance); fig. 22 shows this dissipable power as a function of ambient temperature for different thermal resistance.



Figure 20. Output power and drain current vs. case temperature ( $R_L = 4\Omega$ )



Figure 21. Output power and drain current vs. case temperature ( $R_L = 8\Omega$ )



# Figure 22. Maximum allowable power dissipation vs. ambient temperature



#### Figure 23. Example of heat-sink

Dimension : suggestion.

The following table shows the length that the heatsink in fig.23 must have for several values of  $P_{tot}$  and  $R_{th}$ .

Ptot (W)	12	8	6
Length of heatsink (mm)	60	40	30
Rth of heatsink (° C/W)	4.2	6.2	8.3



DIM.	mm			inch			
DIN.	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
А			4.8			0.189	
С			1.37			0.054	
D	2.4		2.8	0.094		0.110	
D1	1.2		1.35	0.047		0.053	
E	0.35		0.55	0.014		0.022	
F	0.8		1.05	0.031		0.041	
F1	1		1.4	0.039		0.055	
G		3.4		0.126	0.134	0.142	
G1		6.8		0.260	0.268	0.276	
H2			10.4			0.409	
H3	10.05		10.4	0.396		0.409	
L		17.85			0.703		
L1		15.75			0.620		
L2		21.4			0.843		
L3		22.5			0.886		
L5	2.6		3	0.102		0.118	
L6	15.1		15.8	0.594		0.622	
L7	6		6.6	0.236		0.260	
М		4.5			0.177		
M1		4			0.157		
Dia	3.65		3.85	0.144		0.152	





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