

14 W hi-fi audio amplifier

Features

- Wide-range supply voltage, up to 36 V
- Single or split power supply
- Short-circuit protection to ground
- Thermal shutdown

Description

The TDA2030 is a monolithic integrated circuit in the Pentawatt package, intended for use as a low frequency class-AB amplifier. Typically it provides 14 W output power (d = 0.5%) at 14 V/4 Ω . At ±14 V or 28 V, the guaranteed output power is 12 W on a 4 Ω load and 8 W on an 8 Ω (DIN45500).

The TDA2030 provides high output current and has very low harmonic and crossover distortion.

Furthermore, 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 operating point of the output transistors within their safe operating range. A conventional thermal shutdown system is also included.

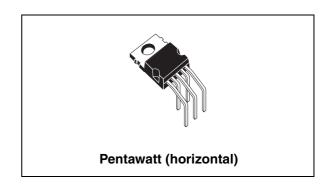
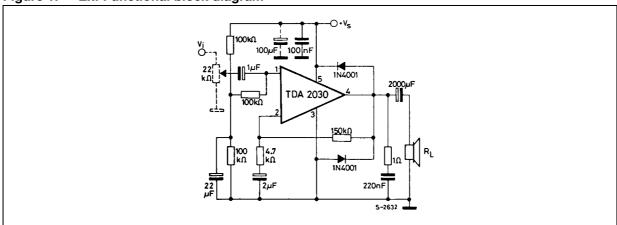


Table 1. Device summary

Order code	Package
TDA2030H	Pentawatt horizontal

Figure 1. Ex: Functional block diagram



Device overview TDA2030

1 Device overview

Figure 2. Pin connections (top view)

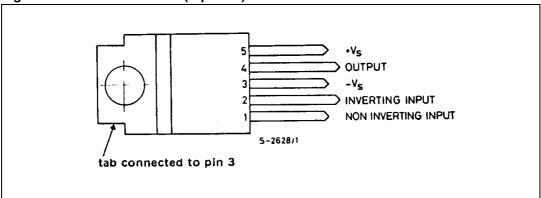
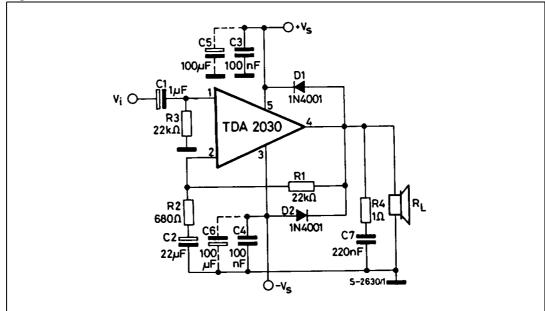


Figure 3. Test circuit



2 Electrical specifications

2.1 Absolute maximum ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V _s	Supply voltage	±18 (36)	V
V _i	Input voltage	Vs	
V _i	Differential input voltage	±15	V
Io	Output peak current internally limited)	3.5	Α
P _{tot}	Power dissipation at T _{case} = 90 °C	20	W
T _{stg} , T _j	Storage and junction temperature	-40 to 150	°C

2.2 Thermal data

Table 3. Thermal data

	Symbol	Parameter	Value	Unit
Ī	R _{th j-case}	Thermal resistance junction-case	max 3	С

2.3 Electrical characteristics

Refer to the test circuit in *Figure 3*; $V_S = \pm 14 \text{ V}$, $T_{amb} = 25^{\circ}\text{C}$ unless otherwise specified.

Table 4. Electrical characteristics

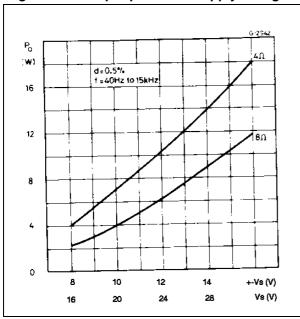
Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
٧s	Supply voltage		± 6 12		± 18 36	V
I _d	Quiescent drain current			40	60	mA
I _b	Input bias current			0.2	2	μΑ
V _{OS}	Input offset voltage			± 2	± 20	mV
Ios	Input offset current	$V_s = \pm 18 \text{ (Vs} = 36)$		± 20	± 200	nA
		d = 0.5%, f = 40 to 15,000 Hz; G_V = 30 dB R_L = 4 Ω	12	14		W
Po	Output power	$R_L = 8 \Omega$	8	9		W
		d = 10%, f =1 kHz; G_V = 30 dB R_L = 4 Ω R_L = 8 Ω	12 8	14 9		W W

Table 4. Electrical characteristics (continued)

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
	Distantian	$P_{o} = 0.1 \text{ to } 12 \text{ W}, R_{L} = 4 \Omega,$ $G_{V} = 30 \text{ dB}$ f = 40 to 15.000 Hz		0.2	0.5	%
d	Distortion	P_{o} = 0.1 to 8 W, R_{L} = 8 Ω, G_{V} = 30 dB f = 40 to 15.000 Hz		0.1	0.5	%
В	Frequency response (-3 dB)	P_o = 12 W, R_L = 4 Ω ; G_V = 30 dB	1	10 Hz to 140		Hz
R _i	Input resistance (pin 1)		0.5	5		МΩ
G _V	Voltage gain (open loop)			90		dB
G _V	Voltage gain (closed loop)	f = 1 kHz	29.5	30	30.5	dB
e _N	Input noise voltage	— B = 22 Hz to 22 kHz		3	10	μV
i _N	Input noise current	D = 22 112 to 22 KHZ		80	200	pА
SVR	Supply voltage rejection	$\begin{aligned} G_V &= 30 \text{ dB; } R_L = 4 \ \Omega, \\ R_g &= 22 \text{ k}\Omega, f_{ripple} = 100 \text{ Hz;} \\ V_{ripple} &= 0.5 \text{ Veff} \end{aligned}$	40	50		dB
^l d	Drain current	$P_{o} = 14 \text{ W}, R_{L} = 4 \Omega$ $P_{o} = 9 \text{ W}, R_{L} = 8 \Omega$		900 500		mA
Тј	Thermal shutdown junction temperature				145	°C

2.4 Characterizations

Figure 4. Output power vs. supply voltage Figure 5. Output power vs. supply voltage



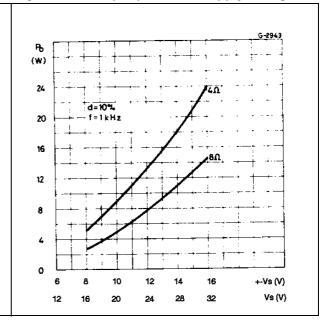


Figure 6. Distortion vs. output power

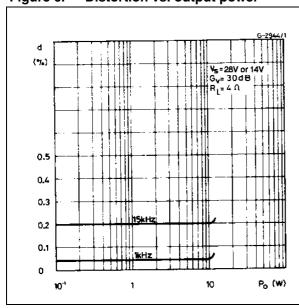


Figure 7. Distortion vs. output power

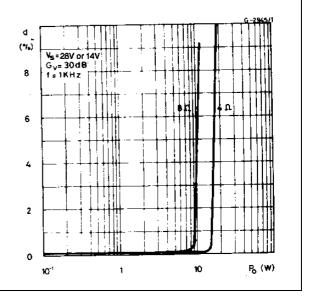


Figure 8. Distortion vs. output power

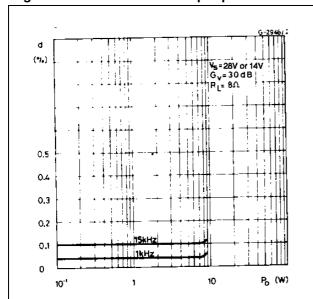


Figure 9. Distortion vs. frequency

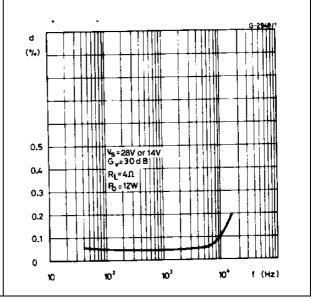
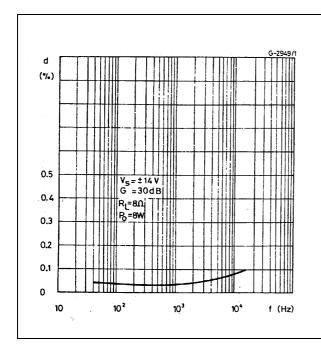


Figure 10. Distortion vs. frequency

Figure 11. Frequency response with different values of the rolloff capacitor C8 (see typical amplifier with split power supply)



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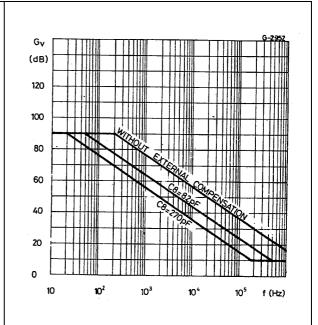
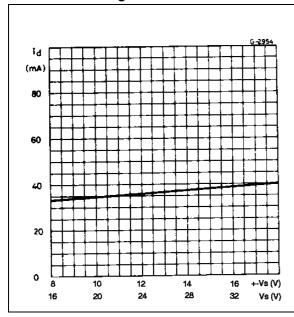


Figure 12. Quiescent current vs. supply voltage

Figure 13. Supply voltage rejection vs. voltage gain



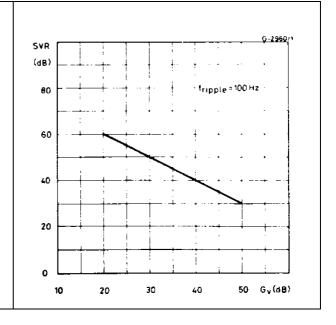
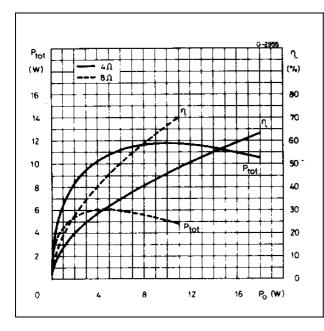
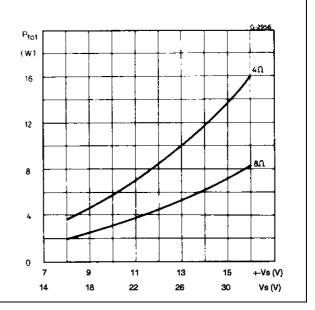


Figure 14. Power dissipation and efficiency vs. output power

Figure 15. Maximum power dissipation vs. supply voltage (sine wave operation)





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Applications TDA2030

3 Applications

Figure 16. Typical amplifier with split power Figure 19.

Figure 17. Typical amplifier with single power supply

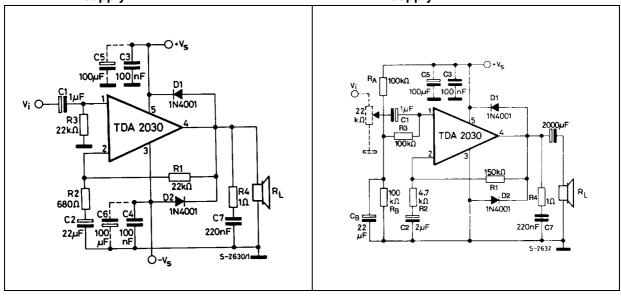
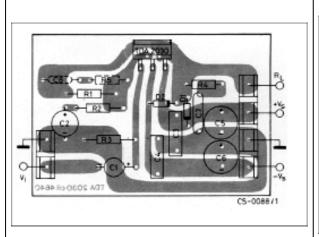
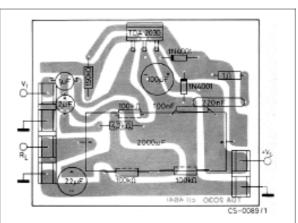


Figure 18. PC board and component layout for Figure 19. PC board and component layout for a typical amplifier with split power supply

PC board and component layout for a typical amplifier with single power supply





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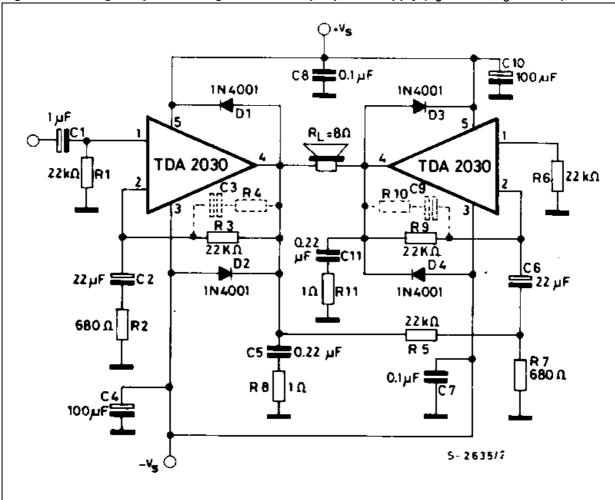


Figure 20. Bridge amplifier configuration with split power supply ($P_o = 28 \text{ W}$, $V_s = \pm 14 \text{ V}$)

Practical considerations TDA2030

4 Practical considerations

4.1 Printed circuit board

The layout shown in *Figure 19* 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.

4.2 Assembly suggestion

No electrical isolation is needed between the package and the heatsink with single supply voltage configuration.

4.3 Application suggestions

The recommended values of the components are those shown on application circuit of *Figure 16*. However, if different values are chosen, then the following table can be helpful.

Table 5. Variations from recommended values

Component	Recommanded value	Purpose	Larger than recommanded value	Smaller than recommanded value
R ₁	22 kΩ	Closed loop gain setting	Increase of gain	Decrease in gain ⁽¹⁾
R ₂	680 Ω	Closed loop gain setting	Decrease of gain ⁽¹⁾	Increase in gain
R ₃	22 kΩ	Non-inverting input biasing	Increase of input impedance	Decrease in input impedance
R ₄	1 Ω	Frequency stability	Danger of oscillation at high frequencies with inductive loads	
R ₅	3 R ₂	Upper frequency cutoff Poor high-frequency attenuation		Danger of oscillation
C ₁	1 µF	Input DC decoupling		Increase in low- frequency cutoff
C ₂	22 µF	Inverting input DC decoupling		Increase in low- frequency cutoff
C ₃ C ₄	0.1 μF	Supply voltage bypass		Danger of oscillation
C ₅ C ₆	100 μF	Supply voltage bypass		Danger of oscillation
C ₇	0.22 μF	Frequency stability		Danger of oscillation
C ₈	1 2πBR ₁	Upper frequency cutoff	Smaller bandwidth	Larger bandwidth
D ₁ D ₂	1N4001	To protect the device against output voltage spikes		

^{1.} Closed loop gain must be higher than 24 dB

Table 6. Single supply application

Component	Recommanded value	Purpose	Larger than recommanded value	Smaller than recommanded value
R ₁	150 kΩ	Closed loop gain setting	Increase in gain	Decrease in gain ⁽¹⁾
R ₂	4.7 kΩ	Closed loop gain setting	Decrease in gain ⁽¹⁾	Increase in gain
R ₃	100 kΩ	Non-inverting input biasing	Increase of input impedance	Decrease in input Impedance
R ₄	1 Ω	Frequency stability	Danger of oscillation at high frequencies with inductive loads	
R _A /R _B	100 kΩ	Non-inverting input biasing	Poor high-frequency attenuation	Danger of oscillation
C ₁	1 µF	Input DC decoupling		Increase in low- frequency cutoff
C ₂	22 µF	Inverting DC decoupling		Increase in low- frequency cutoff
C ₃	0.1 μF	Supply voltage bypass		Danger of oscillation
C ₅	100 μF	Supply voltage bypass		Danger of oscillation
C ₇	0.22 μF	Frequency stability		Danger of oscillation
C ₈	<u>1</u> 2πBR ₁	Upper frequency cutoff	Smaller bandwidth	Larger bandwidth
D ₁ D ₂	1N4001	To protect the device against output voltage spikes.		

^{1.} Closed loop gain must be higher than 24 dB

5 Short-circuit protection

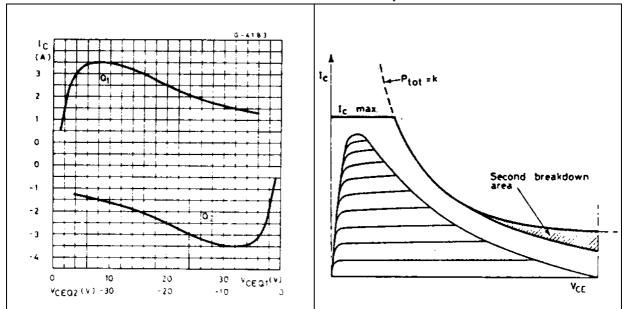
The TDA2030 has an original circuit which limits the current of the output transistors. *Figure 21* shows that the maximum output current is a function of the collector emitter voltage; hence the output transistors work within their safe operating area (*Figure 5*).

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 21. Maximum output current vs. voltage [V_{CEsat}] across each output transistor

Figure 22. Safe operating area and collector characteristics of the protected power transistor



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TDA2030 Thermal shutdown

6 Thermal shutdown

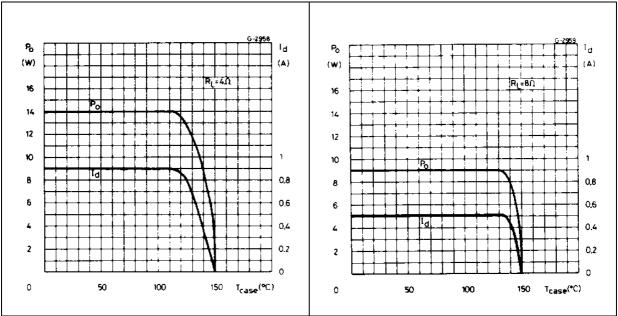
The presence of a thermal limiting circuit offers the following advantages:

 An overload on the output (even if it is permanent), or an above limit ambient temperature can be easily supported since T_i cannot be higher than 150°C.

2. 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 to 150°C, the thermal shutdown 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); *Figure 25* shows this power dissipation as a function of ambient temperature for different thermal resistances.

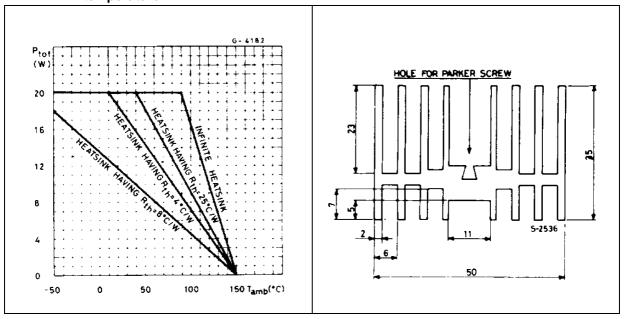
Figure 23. Output power and drain current vs. Figure 24. Output power and drain current vs. case temperature ($R_L = 4 \Omega$) case temperature ($R_L = 8 \Omega$)



Thermal shutdown TDA2030

Figure 25. Maximum allowable power dissipation vs. ambient temperature

Figure 26. Example of heatsink



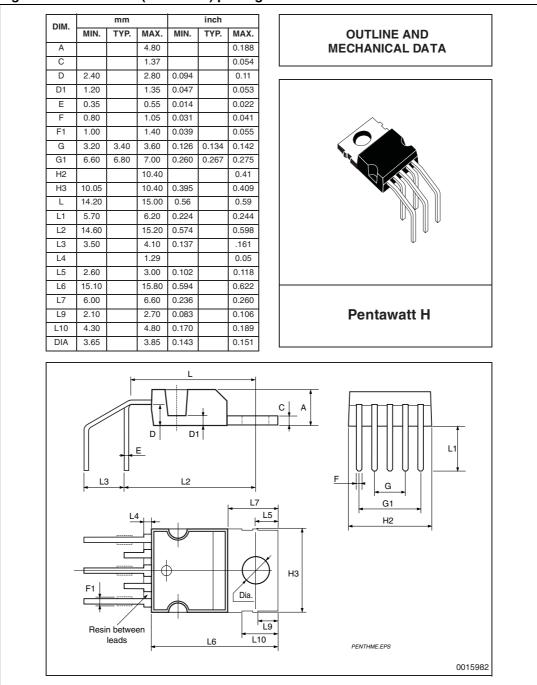
The following table shows the length that the heatsink in Figure 26 must have for several values of P_{tot} and R_{th} .

Table 7. Recommended values of heatsink

Dimension	Recommended values			Unit
P _{tot}	12	8	6	W
Length of heatsink	60	40	30	mm
R _{th} of heatsink	4.2	6.2	8.3	°C/W

7 Package mechanical data

Figure 27. Pentawatt (horizontal) package outline and dimensions



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Revision history TDA2030

8 Revision history

Table 8. Document revision history

Date	Revision	Changes	
June 1998	2	Second issue	
21-Jun-2011	3	Added Features on page 1 Removed Pentawatt (vertical) package option Replaced Figure 27 with Pentawatt (horizontal) package data Updated presentation of document, minor textual changes	

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