

DATA SHEET

TDA1020 12 W car radio power amplifier

Product specification
File under Integrated Circuits, IC01

November 1982

12 W car radio power amplifier**TDA1020**

The TDA1020 is a monolithic integrated 12 W audio amplifier in a 9-lead single in-line (SIL) plastic package. The device is primarily developed as a car radio amplifier. At a supply voltage of $V_P = 14,4$ V, an output power of 7 W can be delivered into a $4\ \Omega$ load and 12 W into $2\ \Omega$.

To avoid interferences and car ignition signals coming from the supply lines into the IC, frequency limiting is used beyond the audio spectrum in the preamplifier and the power amplifier.

The maximum supply voltage of 18 V makes the IC also suitable for mains-fed radio receivers, tape recorders or record players. However, if the supply voltage is increased above 18 V (< 45 V), the device will not be damaged (load dump protected). Also a short-circuiting of the output to ground (a.c.) will not destroy the device. Thermal protection is built-in. As a special feature, the circuit has a low stand-by current possibility.

The TDA1020 is pin-to-pin compatible with the TDA1010.

QUICK REFERENCE DATA

Supply voltage range	V_P		6 to 18 V
Repetitive peak output current	I_{ORM}	<	4 A
Output power at $d_{tot} = 10\%$ (with bootstrap)			
$V_P = 14,4$ V; $R_L = 2\ \Omega$	P_o	>	10 W
		typ.	12 W
$V_P = 14,4$ V; $R_L = 4\ \Omega$	P_o	typ.	7 W
$V_P = 14,4$ V; $R_L = 8\ \Omega$	P_o	typ.	3,5 W
Output power at $d_{tot} = 10\%$ (without bootstrap)			
$V_P = 14,4$ V; $R_L = 4\ \Omega$	P_o	>	4,5 W
Input impedance			
preamplifier (pin 8)	$ Z_i $	typ.	40 k Ω
power amplifier (pin 6)	$ Z_i $	typ.	40 k Ω
Total quiescent current at $V_P = 14,4$ V	I_{tot}	typ.	30 mA
Stand-by current	I_{sb}	<	1 mA
Storage temperature range	T_{stg}		-55 to + 150 °C
Crystal temperature	T_c	max.	150 °C

PACKAGE OUTLINE

9-lead SIL; plastic (SOT110B); SOT110-1; 1996 July 24.

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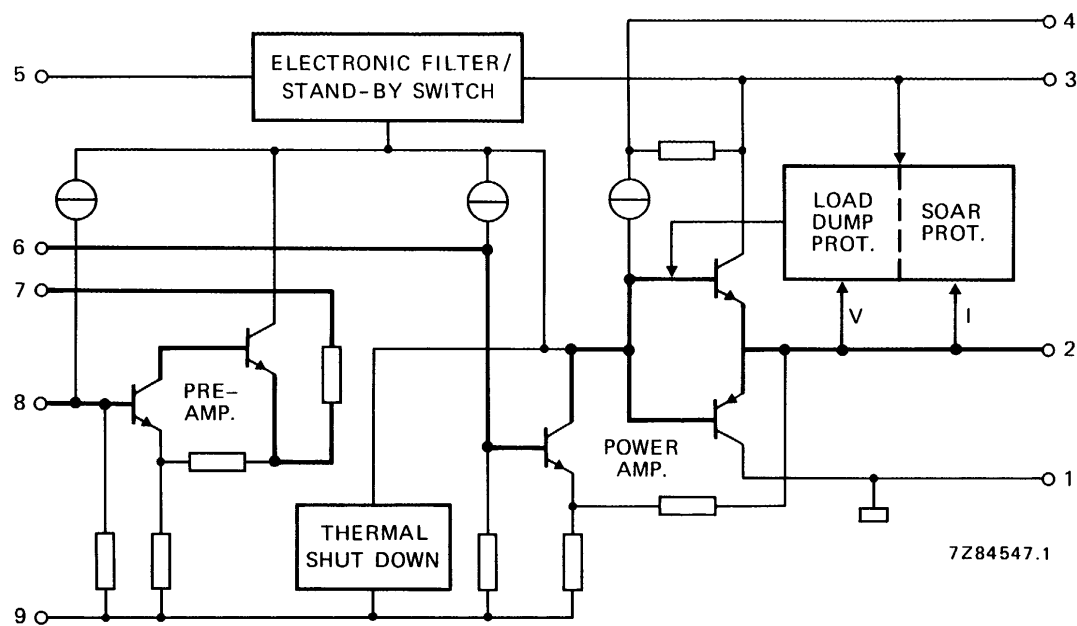


Fig.1 Internal block diagram; the heavy lines indicate the signal paths.

PINNING

1. Negative supply (substrate)
2. Output power stage
3. Positive supply (V_P)
4. Bootstrap
5. Ripple rejection filter
6. Input power stage
7. Output preamplifier
8. Input preamplifier
9. Negative supply

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RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage; operating (pin 3)	V_P	max.	18 V
Supply voltage; non-operating	V_P	max.	28 V
Supply voltage; load dump	V_P	max.	45 V
Non-repetitive peak output current	I_{OSM}	max.	6 A
Total power dissipation	see derating curves Fig.2		
Storage temperature range	T_{stg}		-55 to + 150 °C
Crystal temperature	T_c	max.	150 °C
Short-circuit duration of load behind output electrolytic capacitor at 1 kHz sine-wave overdrive (10 dB); $V = 14,4$ V	t_{sc}	max.	100 hours

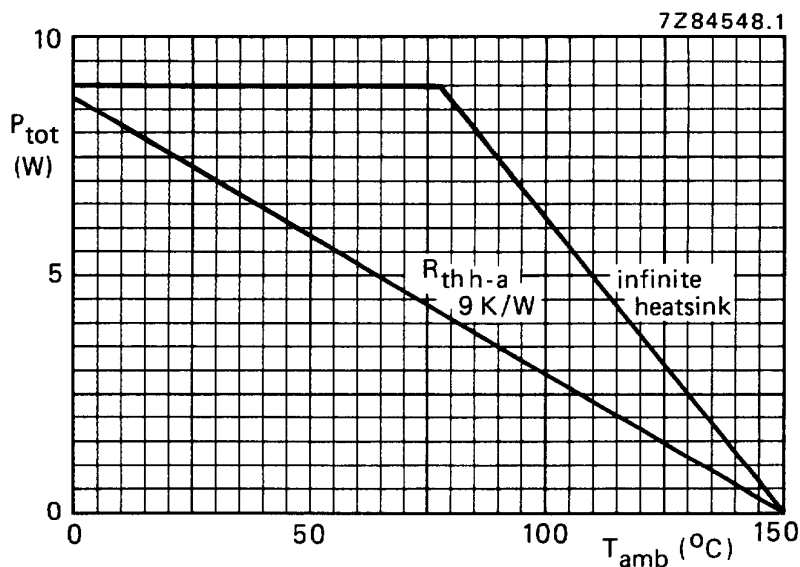


Fig.2 Power derating curves.

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HEATSINK DESIGN EXAMPLE

The derating of 8 K/W of the encapsulation requires the following external heatsink (for sine-wave drive):

10 W in 2 Ω at $V_P = 14,4$ V

maximum sine-wave dissipation: 5,2 W

$T_{amb} = 60$ °C maximum

$$R_{th\ j-a} = R_{th\ j-tab} + R_{th\ tab-h} + R_{th\ h-a} = \frac{150 - 60}{5,2} = 17,3\text{ K/W}$$

Since $R_{th\ j-tab} + R_{th\ tab-h} = 8$ K/W, $R_{th\ h-a} = 17,3 - 8 \approx 9$ K/W.

D.C. CHARACTERISTICS

Supply voltage range (pin 3)	V_P		6 to 18 V
Repetitive peak output current	I_{ORM}	<	4 A
Total quiescent current			
at $V_P = 14,4$ V	I_{tot}	typ.	30 mA
at $V_P = 18$ V	I_{tot}	typ.	40 mA

A.C. CHARACTERISTICS

$T_{amb} = 25$ °C; $V_P = 14,4$ V; $R_L = 4$ Ω ; $f = 1$ kHz; unless otherwise specified; see also Fig.3

Output power at $d_{tot} = 10\%$; with bootstrap (note 1)

$V_P = 14,4$ V; $R_L = 2$ Ω	P_o	>	10 W
		typ.	12 W
$V_P = 14,4$ V; $R_L = 4$ Ω	P_o	>	6 W
		typ.	7 W
$V_P = 14,4$ V; $R_L = 8$ Ω	P_o	typ.	3,5 W

Output power at $d_{tot} = 1\%$; with bootstrap (note 1)

$V_P = 14,4$ V; $R_L = 2$ Ω	P_o	typ.	9,5 W
$V_P = 14,4$ V; $R_L = 4$ Ω	P_o	typ.	6 W
$V_P = 14,4$ V; $R_L = 8$ Ω	P_o	typ.	3 W

Output voltage (r.m.s. value)

$R_L = 1$ k Ω ; $d_{tot} = 0,5\%$	$V_{o(rms)}$	typ.	5 V
Output power at $d_{tot} = 10\%$; without bootstrap	P_o	>	4,5 W

Voltage gain

preamplifier (note 2)	G_{v1}	typ.	17,7 dB
			16,7 to 18,7 dB
power amplifier	G_{v2}	typ.	29,5 dB
			28,5 to 30,5 dB
total amplifier	$G_{v\ tot}$	typ.	47 dB
			46,2 to 48,2 dB

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Input impedance

preamplifier	$ Z_i $	typ.	40 k Ω
			28 to 52 k Ω
power amplifier	$ Z_i $	typ.	40 k Ω
			28 to 52 k Ω

Output impedance

preamplifier	$ Z_o $	typ.	2,0 k Ω
			1,4 to 2,6 k Ω
power amplifier	$ Z_o $	typ.	50 m Ω

Output voltage (r.m.s. value) at $d_{tot} = 1\%$

preamplifier (note 2)	$V_{o(rms)}$	>	1 V
		typ.	1,5 V

Frequency response

B		50 Hz to 25 kHz
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Noise output voltage (r.m.s. value; note 3)

$R_S = 0 \Omega$	$V_{n(rms)}$	typ.	0,3 mV
		<	0,5 mV
$R_S = 8,2 k\Omega$	$V_{n(rms)}$	typ.	0,5 mV
		<	1,0 mV

Ripple rejection (note 4)

at $f = 100 \text{ Hz}$; $C_2 = 1 \mu\text{F}$	RR	typ.	44 dB
at $f = 1 \text{ kHz to } 10 \text{ kHz}$	RR	>	48 dB
		typ.	54 dB

Bootstrap current at onset of clipping (pin 4)

$R_L = 4 \Omega \text{ and } 2 \Omega$	I_4	typ.	40 mA
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Stand-by current (note 5)

I_{sb}	<	1 mA
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Crystal temperature for -3 dB gain

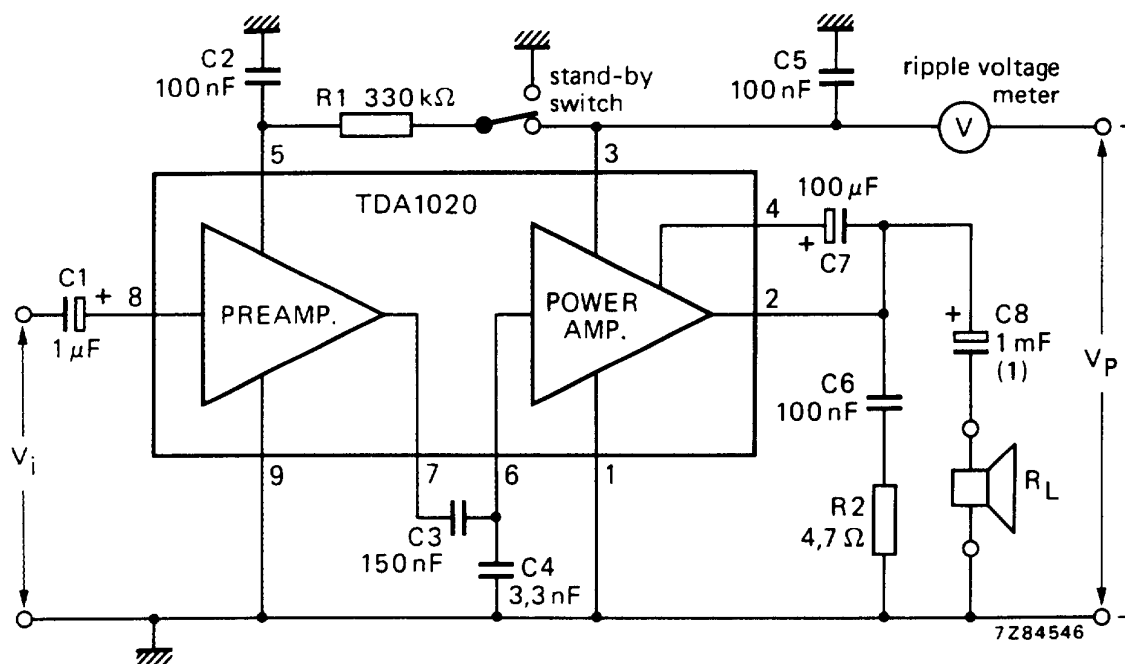
T_c	>	150 $^{\circ}\text{C}$
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Notes

1. Measured with an ideal coupling capacitor to the speaker load.
2. Measured with a load resistor of 40 k Ω .
3. Measured according to IEC curve-A.
4. Maximum ripple amplitude is 2 V; input is short-circuited.
5. Total current when disconnecting pin 5 or short-circuited to ground (pin 9).
6. The tab must be electrically floating or connected to the substrate (pin 9).

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(1) With $R_L = 2 \Omega$, preferred value of $C8 = 2200 \mu F$.

Fig.3 Test circuit.

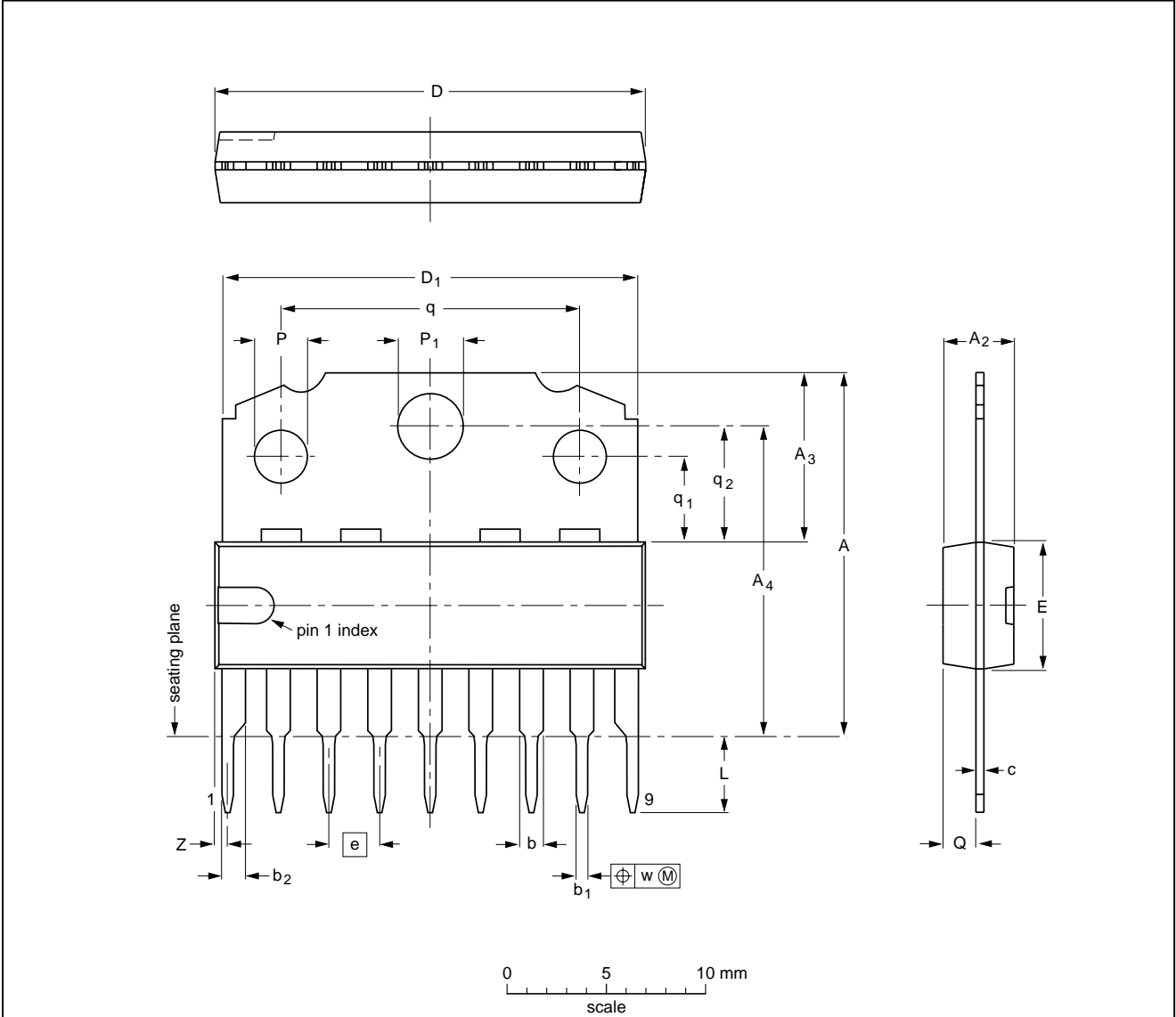
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PACKAGE OUTLINE

SIL9MPF: plastic single in-line medium power package with fin; 9 leads

SOT110-1



DIMENSIONS (mm are the original dimensions)

UNIT	A	A ₂ max.	A ₃	A ₄	b	b ₁	b ₂	c	D ⁽¹⁾	D ₁	E ⁽¹⁾	e	L	P	P ₁	Q	q	q ₁	q ₂	w	Z ⁽¹⁾ max.
mm	18.5 17.8	3.7	8.7 8.0	15.8 15.4	1.40 1.14	0.67 0.50	1.40 1.14	0.48 0.38	21.8 21.4	21.4 20.7	6.48 6.20	2.54	3.9 3.4	2.75 2.50	3.4 3.2	1.75 1.55	15.1 14.9	4.4 4.2	5.9 5.7	0.25	1.0

Note
1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT110-1						92-11-17 95-02-25

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SOLDERING**Introduction**

There is no soldering method that is ideal for all IC packages. Wave soldering is often preferred when through-hole and surface mounted components are mixed on one printed-circuit board. However, wave soldering is not always suitable for surface mounted ICs, or for printed-circuits with high population densities. In these situations reflow soldering is often used.

This text gives a very brief insight to a complex technology. A more in-depth account of soldering ICs can be found in our "IC Package Databook" (order code 9398 652 90011).

Soldering by dipping or by wave

The maximum permissible temperature of the solder is 260 °C; solder at this temperature must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds.

The device may be mounted up to the seating plane, but the temperature of the plastic body must not exceed the specified maximum storage temperature ($T_{stg\ max}$). If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature within the permissible limit.

Repairing soldered joints

Apply a low voltage soldering iron (less than 24 V) to the lead(s) of the package, below the seating plane or not more than 2 mm above it. If the temperature of the soldering iron bit is less than 300 °C it may remain in contact for up to 10 seconds. If the bit temperature is between 300 and 400 °C, contact may be up to 5 seconds.

DEFINITIONS

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

LIFE SUPPORT APPLICATIONS

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