

DATA SHEET

TDA7000 FM radio circuit

Product specification
File under Integrated Circuits, IC01

May 1992

FM radio circuit

TDA7000

GENERAL DESCRIPTION

The TDA7000 is a monolithic integrated circuit for mono FM portable radios, where a minimum on peripheral components is important (small dimensions and low costs).

The IC has an FLL (Frequency-Locked-Loop) system with an intermediate frequency of 70 kHz. The i.f. selectivity is obtained by active RC filters. The only function which needs alignment is the resonant circuit for the oscillator, thus selecting the reception frequency. Spurious reception is avoided by means of a mute circuit, which also eliminates too noisy input signals. Special precautions are taken to meet the radiation requirements.

The TDA7000 includes the following functions:

- R.F. input stage
- Mixer
- Local oscillator
- I.F. amplifier/limiter
- Phase demodulator
- Mute detector
- Mute switch

QUICK REFERENCE DATA

Supply voltage range (pin 5)	V_P	2,7 to 10	V
Supply current at $V_P = 4,5$ V	I_P	typ.	8 mA
R.F. input frequency range	f_{rf}	1,5 to 110	MHz
Sensitivity for -3 dB limiting (e.m.f. voltage) (source impedance: 75 Ω ; mute disabled)	EMF	typ.	1,5 μ V
Signal handling (e.m.f. voltage) (source impedance: 75 Ω)	EMF	typ.	200 mV
A.F. output voltage at $R_L = 22$ k Ω	V_o	typ.	75 mV

PACKAGE OUTLINE

18-lead DIL; plastic (SOT102HE); SOT102-1; 1996 July 24.

FM radio circuit

TDA7000

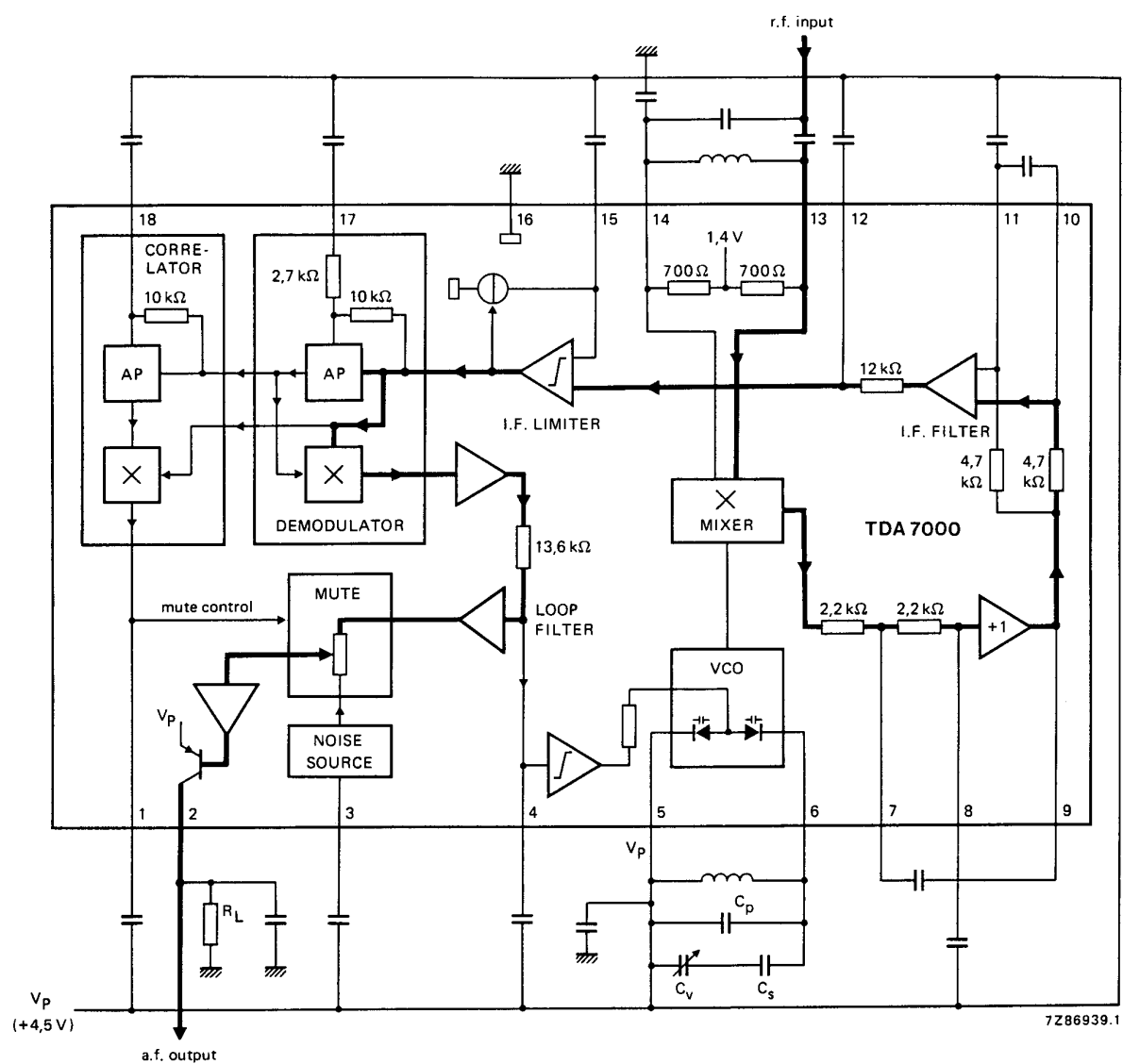


Fig.1 Block diagram.

FM radio circuit

TDA7000

RATINGS

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

Supply voltage (pin 5)	V_P	max.	12 V
Oscillator voltage (pin 6)	V_{6-5}	$V_P - 0,5$ to $V_P + 0,5$ V	
Total power dissipation		see derating curve Fig.2	
Storage temperature range	T_{stg}	-55 to +150 °C	
Operating ambient temperature range	T_{amb}	0 to + 60 °C	

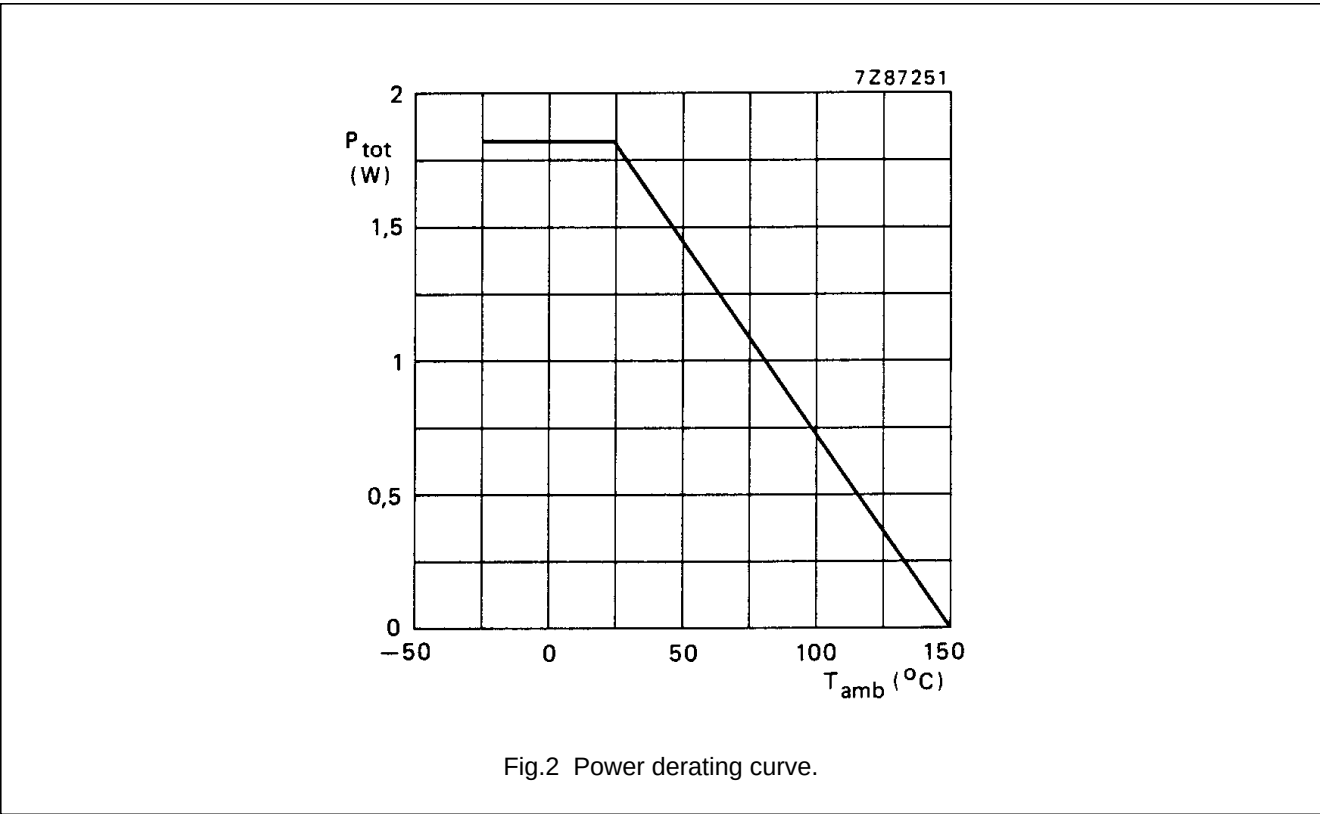


Fig.2 Power derating curve.

D.C. CHARACTERISTICS

$V_P = 4,5$ V; $T_{amb} = 25$ °C; measured in Fig.4; unless otherwise specified

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply voltage (pin 5)	V_P	2,7	4,5	10	V
Supply current at $V_P = 4,5$ V	I_P	—	8	—	mA
Oscillator current (pin 6)	I_6	—	280	—	μ A
Voltage at pin 14	V_{14-16}	—	1,35	—	V
Output current at pin 2	I_2	—	60	—	μ A
Voltage at pin 2; $R_L = 22$ k Ω	V_{2-16}	—	1,3	—	V

FM radio circuit

TDA7000

A.C. CHARACTERISTICS

$V_P = 4,5 \text{ V}$; $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$; measured in Fig.4 (mute switch open, enabled); $f_{\text{rf}} = 96 \text{ MHz}$ (tuned to max. signal at $5 \text{ } \mu\text{V}$ e.m.f.) modulated with $\Delta f = \pm 22,5 \text{ kHz}$; $f_m = 1 \text{ kHz}$; EMF = $0,2 \text{ mV}$ (e.m.f. voltage at a source impedance of $75 \text{ } \Omega$); r.m.s. noise voltage measured unweighted ($f = 300 \text{ Hz}$ to 20 kHz); unless otherwise specified.

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Sensitivity (see Fig.3) (e.m.f. voltage) for -3 dB limiting; muting disabled	EMF	—	1,5	—	μV
for -3 dB muting	EMF	—	6	—	μV
for $S/N = 26 \text{ dB}$	EMF	—	5,5	—	μV
Signal handling (e.m.f. voltage) for $\text{THD} < 10\%$; $\Delta f = \pm 75 \text{ kHz}$	EMF	—	200	—	mV
Signal-to-noise ratio	S/N	—	60	—	dB
Total harmonic distortion at $\Delta f = \pm 22,5 \text{ kHz}$	THD	—	0,7	—	%
at $\Delta f = \pm 75 \text{ kHz}$	THD	—	2,3	—	%
AM suppression of output voltage (ratio of the AM output signal referred to the FM output signal) FM signal: $f_m = 1 \text{ kHz}$; $\Delta f = \pm 75 \text{ kHz}$ AM signal: $f_m = 1 \text{ kHz}$; $m = 80\%$	AMS	—	50	—	dB
Ripple rejection ($\Delta V_P = 100 \text{ mV}$; $f = 1 \text{ kHz}$)	RR	—	10	—	dB
Oscillator voltage (r.m.s. value) at pin 6	$V_{6-5(\text{rms})}$	—	250	—	mV
Variation of oscillator frequency with supply voltage ($\Delta V_P = 1 \text{ V}$)	Δf_{osc}	—	60	—	kHz/V
Selectivity	S_{+300}	—	45	—	dB
	S_{-300}	—	35	—	dB
A.F.C. range	Δf_{rf}	—	± 300	—	kHz
Audio bandwidth at $\Delta V_o = 3 \text{ dB}$ measured with pre-emphasis ($t = 50 \text{ } \mu\text{s}$)	B	—	10	—	kHz
A.F. output voltage (r.m.s. value) at $R_L = 22 \text{ k}\Omega$	$V_{o(\text{rms})}$	—	75	—	mV
Load resistance at $V_P = 4,5 \text{ V}$	R_L	—	—	22	$\text{k}\Omega$
at $V_P = 9,0 \text{ V}$	R_L	—	—	47	$\text{k}\Omega$

FM radio circuit

TDA7000

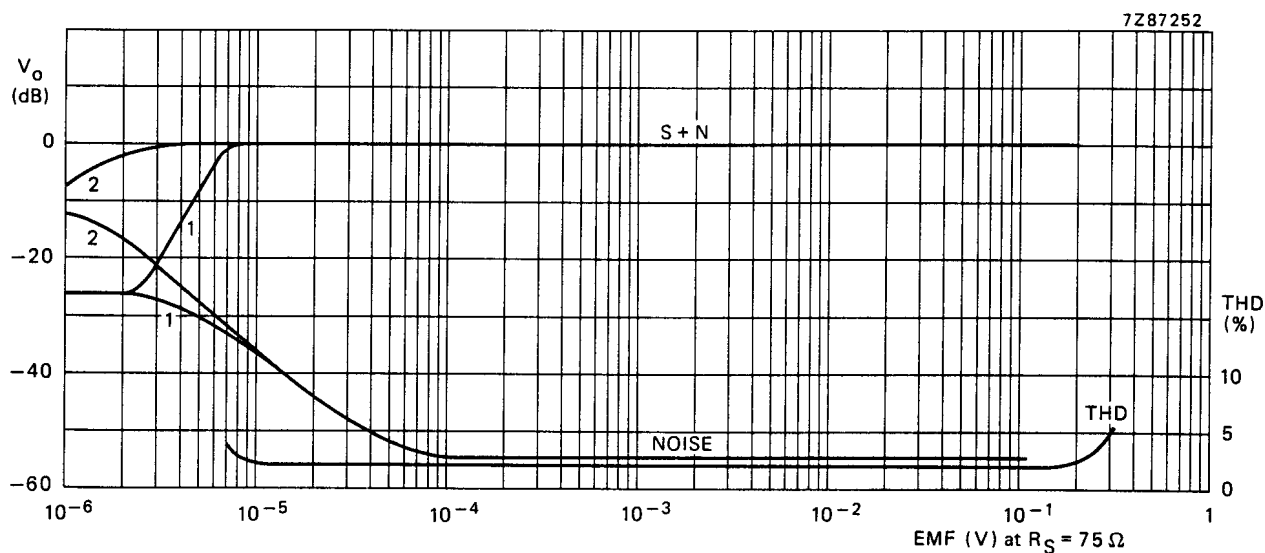


Fig.3 A.F output voltage (V_o) and total harmonic distortion (THD) as a function of the e.m.f. input voltage (EMF) with a source impedance (R_S) of 75 Ω : (1) muting system enabled; (2) muting system disabled.

Conditions: 0 dB = 75 mV; $f_{rf} = 96$ MHz.
 for S + N curve: $\Delta f = \pm 22,5$ kHz; $f_m = 1$ kHz.
 for THD curve: $\Delta f = \pm 75$ kHz; $f_m = 1$ kHz.

Notes

1. The muting system can be disabled by feeding a current of about 20 μ A into pin 1.
2. The interstation noise level can be decreased by choosing a low-value capacitor at pin 3. Silent tuning can be achieved by omitting this capacitor.

FM radio circuit

TDA7000

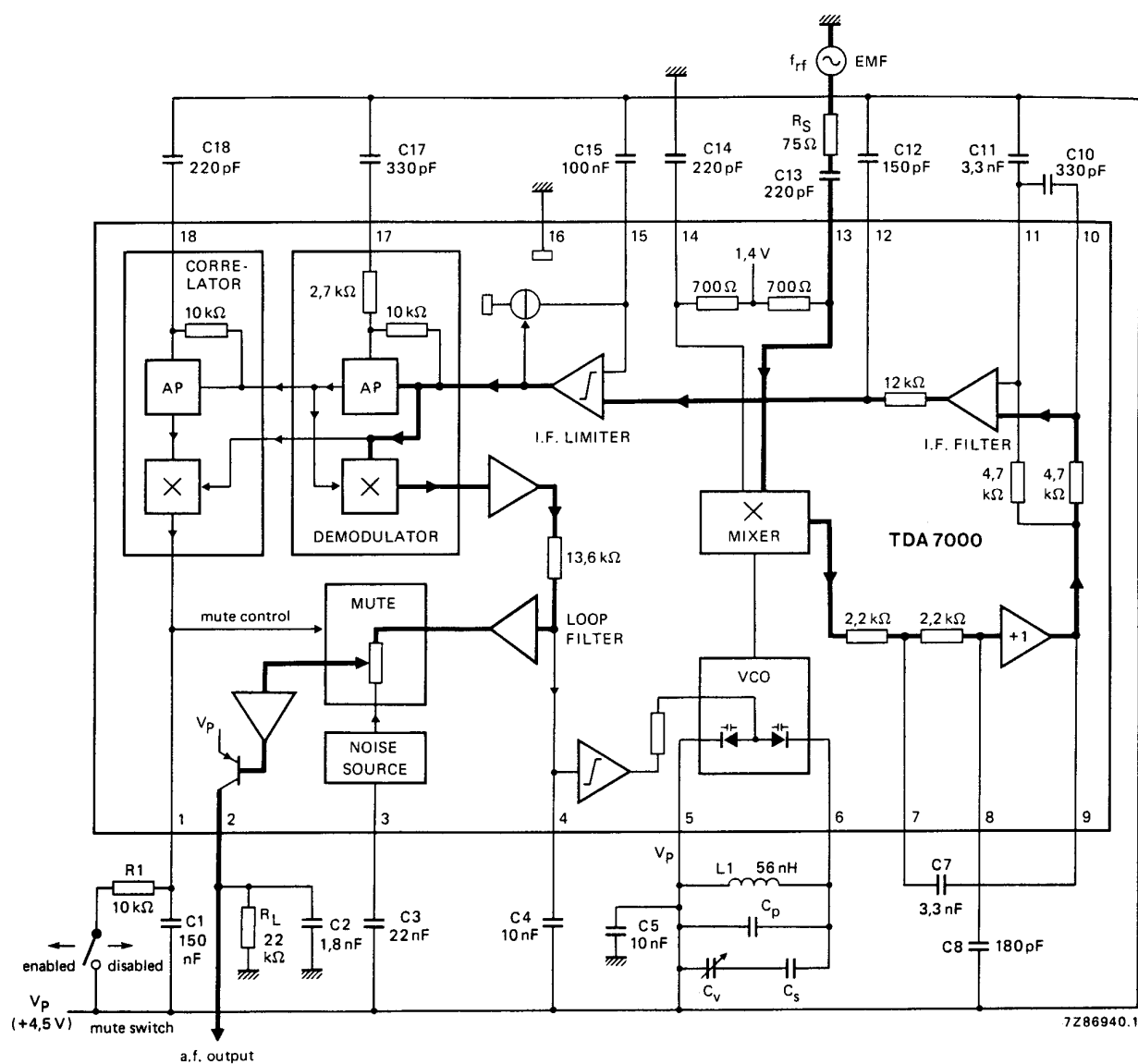


Fig.4 Test circuit; for printed-circuit boards see Figs 5 and 6.

FM radio circuit

TDA7000

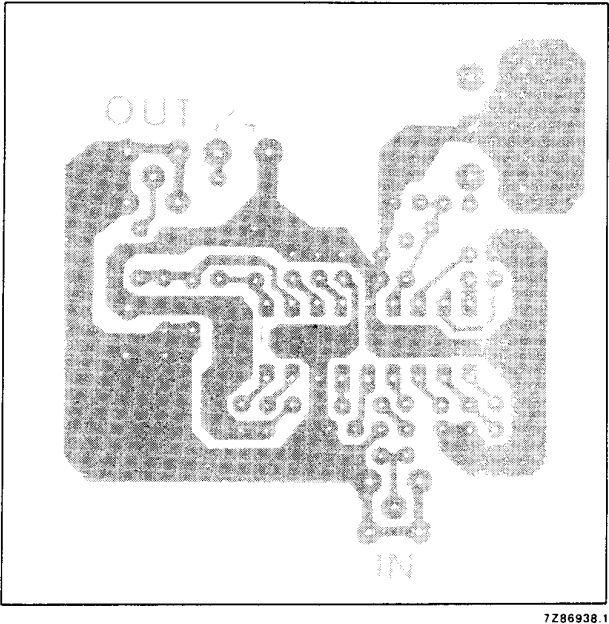


Fig.5 Track side of printed-circuit board used for the circuit of Fig.4.

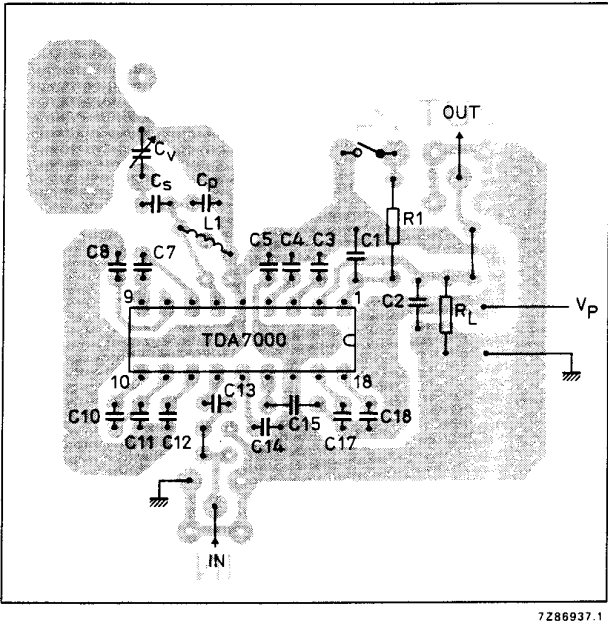


Fig.6 Component side of printed-circuit board showing component layout used for the circuit of Fig.4.

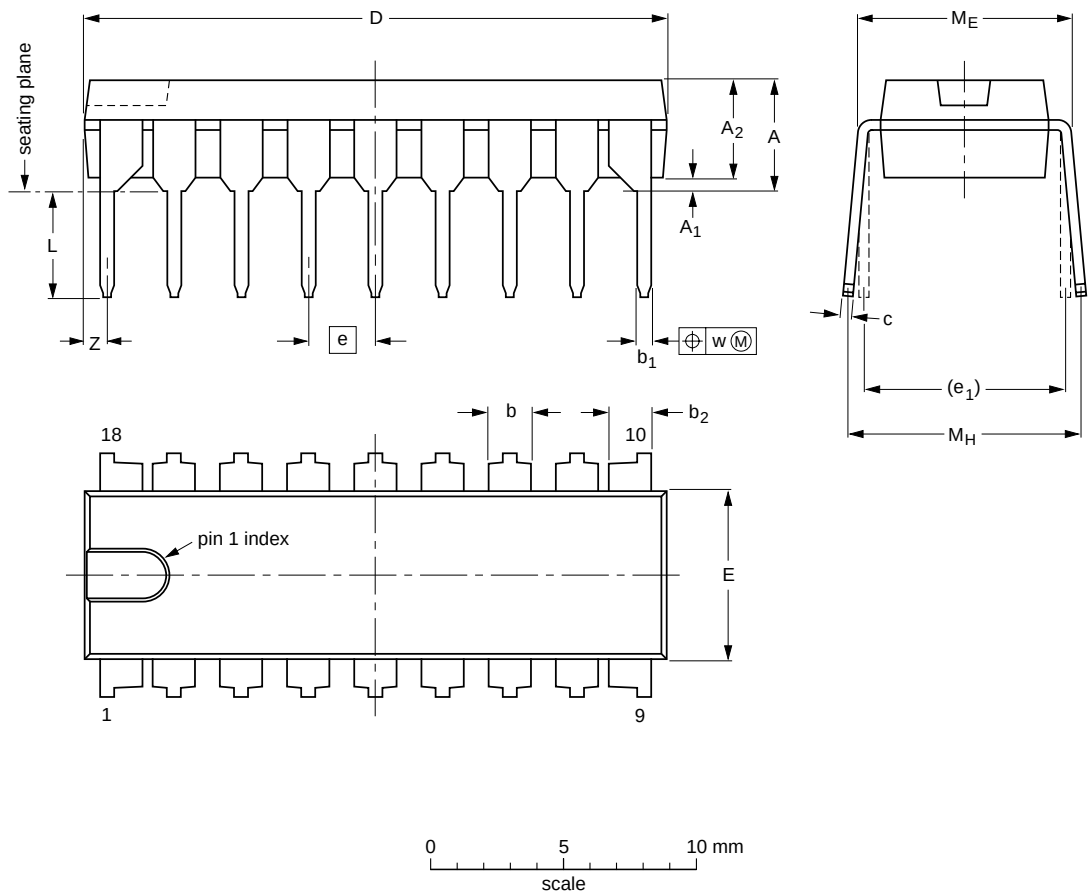
FM radio circuit

TDA7000

PACKAGE OUTLINE

DIP18: plastic dual in-line package; 18 leads (300 mil)

SOT102-1

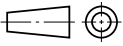


DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A ₁ min.	A ₂ max.	b	b ₁	b ₂	c	D ⁽¹⁾	E ⁽¹⁾	e	e ₁	L	M _E	M _H	w	Z ⁽¹⁾ max.
mm	4.7	0.51	3.7	1.40 1.14	0.53 0.38	1.40 1.14	0.32 0.23	21.8 21.4	6.48 6.20	2.54	7.62	3.9 3.4	8.25 7.80	9.5 8.3	0.254	0.85
inches	0.19	0.020	0.15	0.055 0.044	0.021 0.015	0.055 0.044	0.013 0.009	0.86 0.84	0.26 0.24	0.10	0.30	0.15 0.13	0.32 0.31	0.37 0.33	0.01	0.033

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			
SOT102-1						93-10-14 95-01-23

FM radio circuit

TDA7000

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 ($T_{\text{stg max}}$). 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

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.