

Single-chip 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: 75Ω ; mute disabled)	EMF	typ. $1,5 \mu V$
Signal handling (e.m.f. voltage) (source impedance: 75Ω)	EMF	typ. 200 mV
A.F. output voltage at $R_L = 22$ k Ω	V_o	typ. 75 mV

Single-chip FM radio circuit

TDA7000

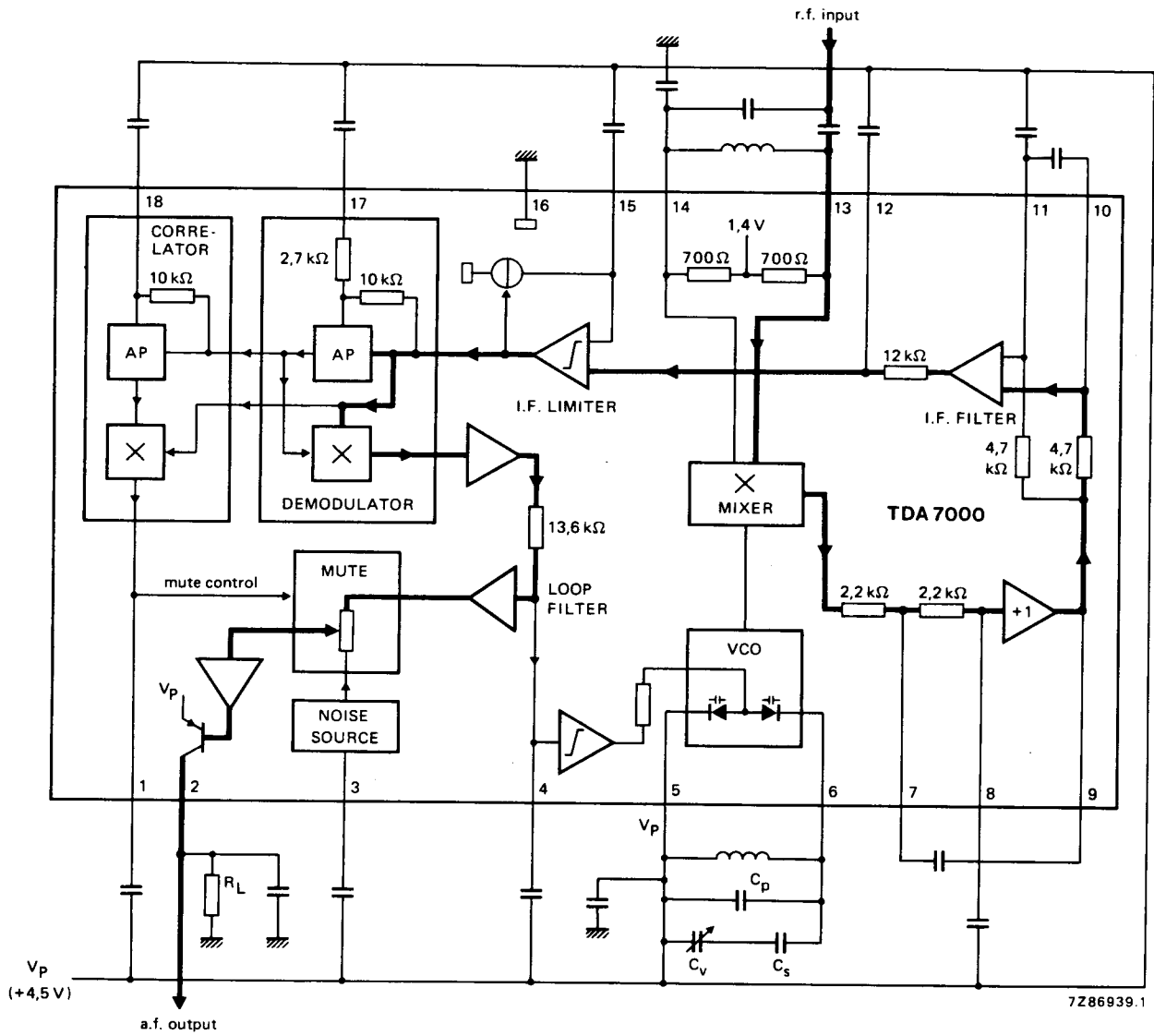


Fig. 1 Block diagram.

Single-chip 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

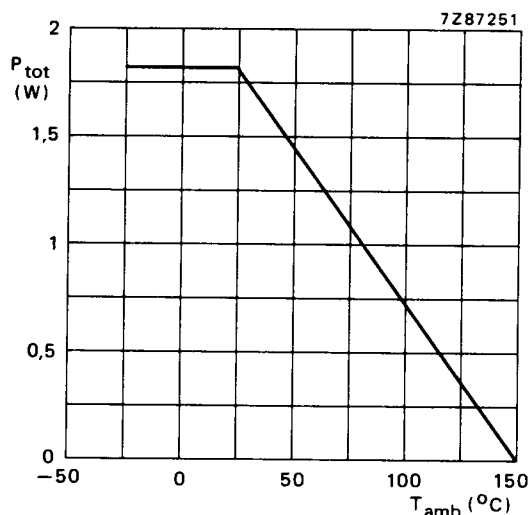


Fig. 2 Power derating curve.

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

Single-chip FM radio circuit

TDA7000

A.C. CHARACTERISTICS

$V_p = 4,5 \text{ V}$; $T_{amb} = 25 \text{ }^\circ\text{C}$; measured in Fig. 4 (mute switch open, enabled); $f_{rf} = 96 \text{ MHz}$ (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	$\text{k}\Omega$

Single-chip FM radio circuit

TDA7000

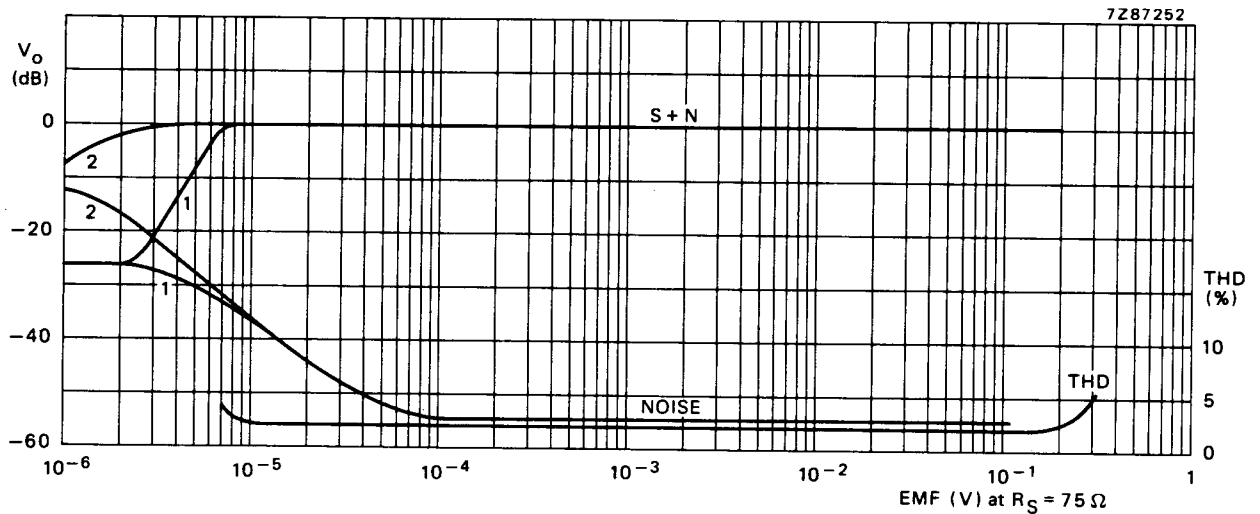


Fig. 3 A.F. output voltage (V_o) and total harmonic distortion (THD) as a function of the e.m.f. input voltage (EMF) with a source impedance (R_S) of 75Ω : (1) muting system enabled; (2) muting system disabled.

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 $20 \mu\text{A}$ 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.

Single-chip FM radio circuit

TDA7000

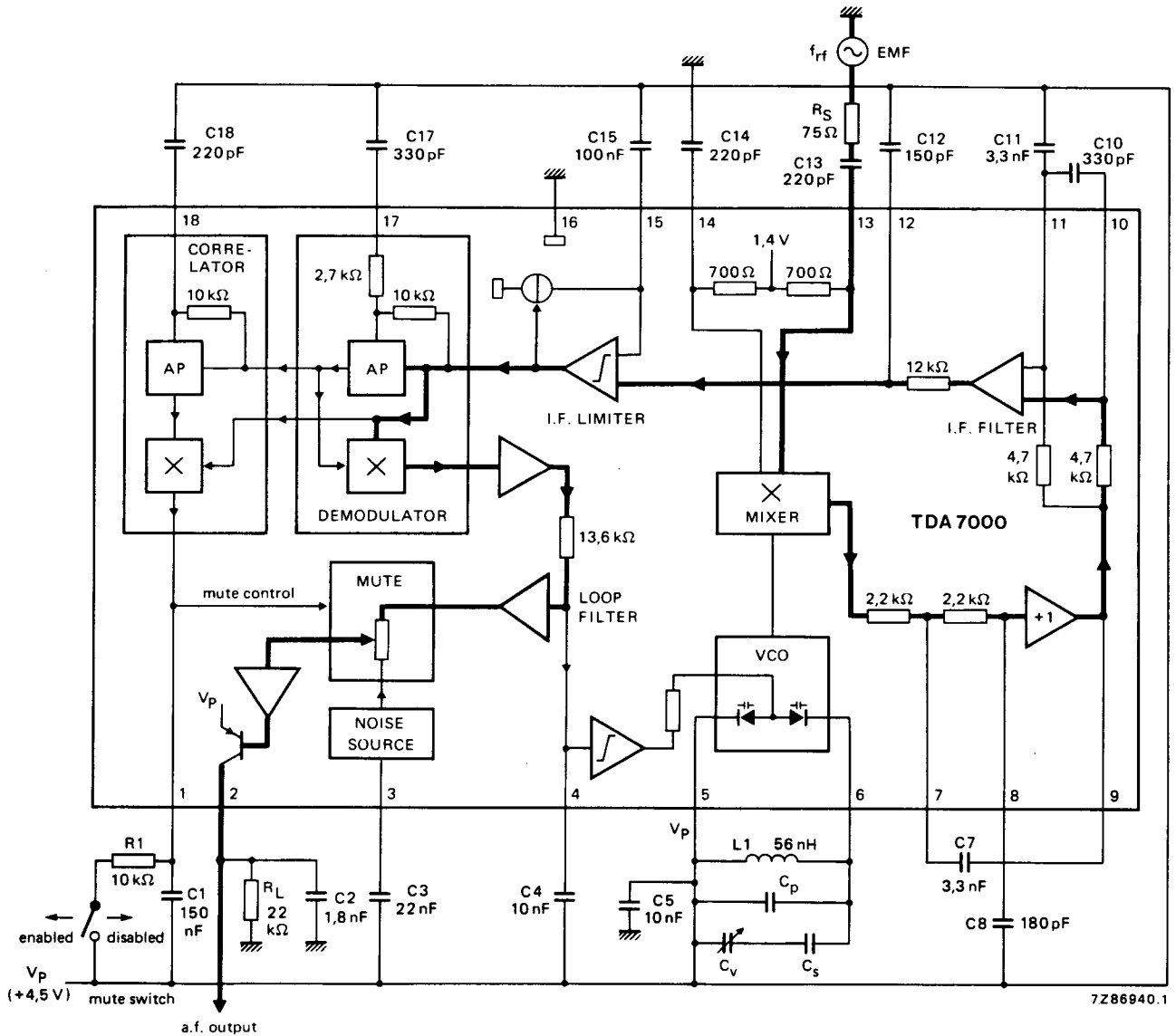
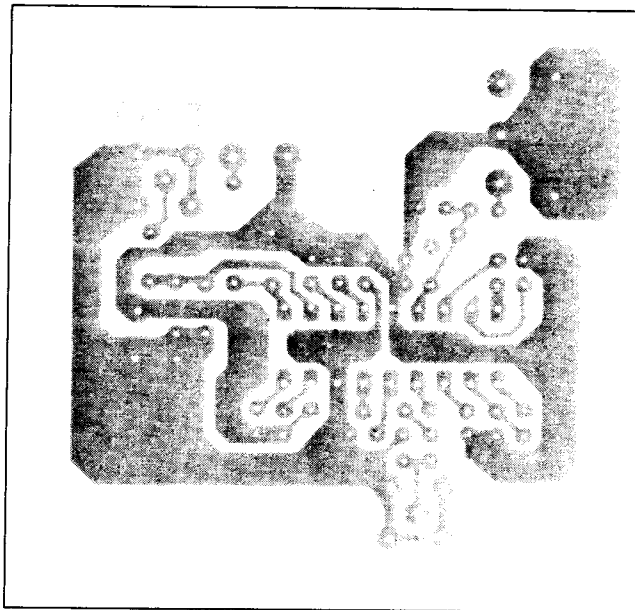


Fig. 4 Test circuit; for printed-circuit boards see Figs 5 and 6.

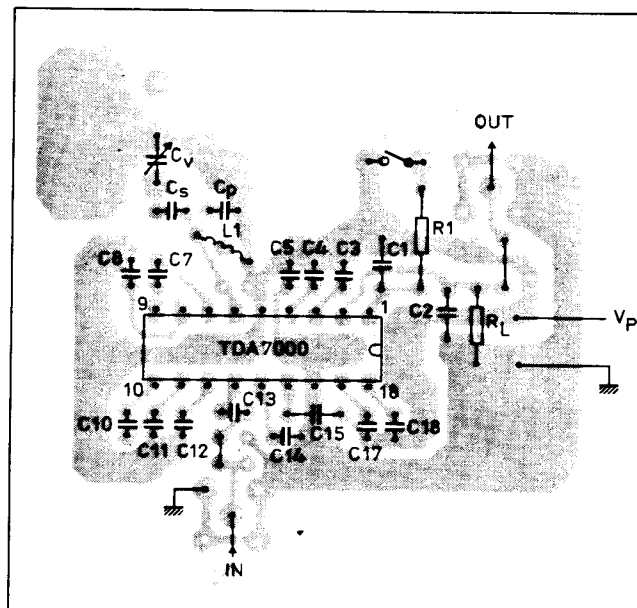
Single-chip FM radio circuit

TDA7000



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



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