INTEGRATED FM TUNER FOR RADIO RECEIVERS

GENERAL DESCRIPTION

The TDA1574T is an integrated FM tuner circuit designed for use in the RF/IF section of car radios and home-receivers. The circuit contains a mixer and an oscillator and a linear IF amplifier for signal processing. The circuit also incorporates the following features.

Features

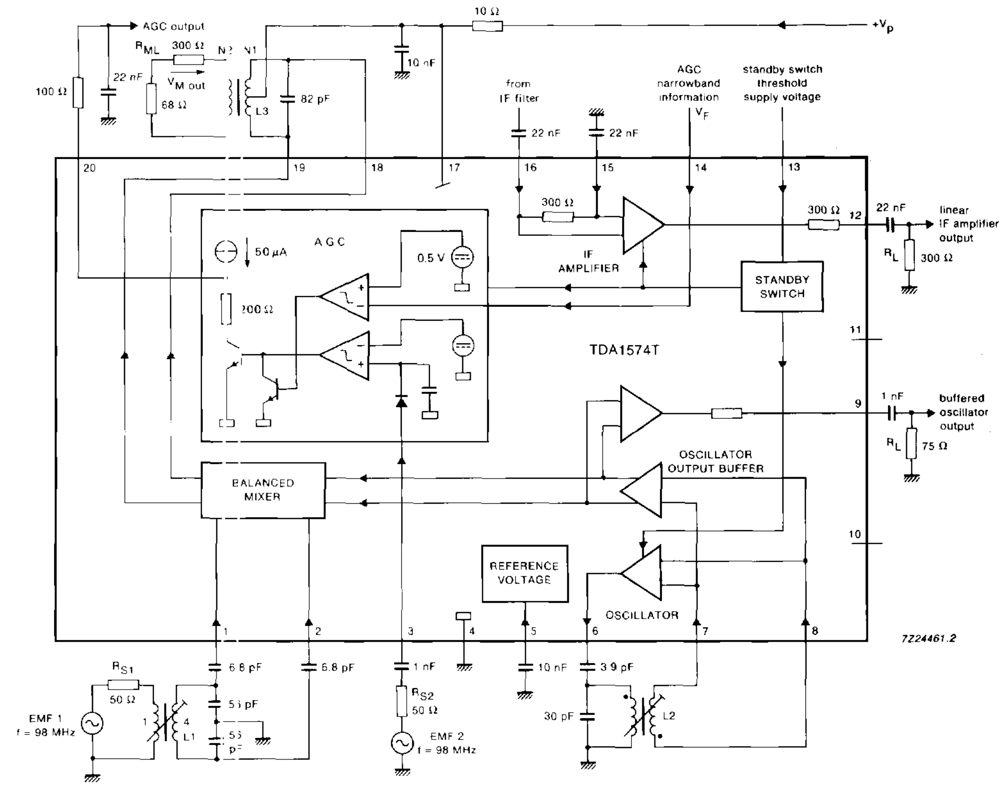
- Keyed Automatic Gain Control (AGC)
- Regulated reference voltage
- Buffered oscillator output
- Electronic standby switch
- Internal buffered mixer driving

QUICK REFERENCE DATA

parameter	conditions	symbol	min.	typ.	max.	unit
Supply voltage range (pin 17)		V_P	7	–	14	V
Mixer input bias voltage (pins 1 and 2)		$V_{1,2\text{-}4}$	–	1	–	V
Noise factor		NF	–	9	–	dB
Oscillator output voltage (pin 6)		$V_{6\text{-}4}$	–	2	–	V
Output admittance at pin 6	f = 108.7 MHz	Y22	–	1.5 + j2		ms
Oscillator output buffer DC output voltage (pin 9)		$V_{9\text{-}4}$	–	6	–	V
Total harmonic distortion		THD	–	–15	–	dB
Linear IF amplifier output voltage (pin 12)		$V_{12\text{-}4}$	–	4.5	–	V
Noise factor	R_S = 300 Ω	NF	–	6.5	–	dB
Keyed AGC output voltage range (pin 20)		$V_{20\text{-}4}$	0.5	–	V_P–0.3	V

PACKAGE OUTLINE

20-lead mini-pack; plastic (SO20; SOT163A).



Coil data

L1: TOKO MC-108, 514HNE-150023S14; L = 0.078 μH
L2: TOKO MC-111, E516HNS-200057; L = 0.08 μH
L3: TOKO Coil set 7P, N1 = 5.5 + 5.5 turns, N2 = 4 turns

Fig.1 Block diagram and test circuit.

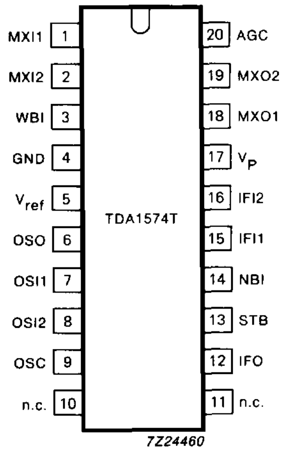


Fig.2 Pinning diagram.

PINNING

1. Mixer input 1
2. Mixer input 2
3. Wideband information input
4. Ground
5. Voltage reference
6. Oscillator output
7. Oscillator input 1
8. Oscillator input 2
9. Buffered oscillator output
10. Not connected
11. Not connected
12. IF output
13. Standby switch
14. Narrowband information input
15. IF input 1
16. IF input 2
17. Supply voltage
18. Mixer output 1
19. Mixer output 2
20. AGC output

FUNCTIONAL DESCRIPTION

Mixer

The mixer circuit uses a double balanced multiplier with a preamplifier (common base input) in order to obtain a large signal handling range and low oscillator radiation.

Oscillator

The oscillator circuit uses an amplifier with a differential input. Voltage regulation is achieved by utilizing the symmetrical tan h-transfer-function to obtain low order 2nd harmonics.

Linear IF amplifier

The IF amplifier is a one stage, differential input, wideband amplifier with an output buffer.

Keyed AGC

The AGC processor combines narrow and wideband information via an RF level detector, a comparator and an ANDing stage. The level dependent current sinking output has an active load which sets the AGC threshold.
The AGC function can either be controlled by a combination of wideband and narrowband information (keyed AGC) or by a wideband/narrowband information only. If narrowband AGC is required pin 3 should be connected to pin 5. If wideband AGC is required pin 14 should be connected to pin 15.

RATINGS

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

parameter	conditions	symbol	min.	max.	unit
Supply voltage (pin 17)		$V_{17\text{-}4}$	–	14	V
Mixer output voltage (pins 18 and 19)		$V_{18,19\text{-}4}$	–	35	V
Standby switch input voltage (pin 13)		$V_{13\text{-}4}$	–	23	V
Reference voltage (pin 5)		$V_{5\text{-}4}$	–	7	V
Total power dissipation		P_{tot}	–	500	mW
Storage temperature range		T_{stg}	–55	+ 150	°C
Operating ambient temperature range		T_{amb}	–40	+ 85	°C

THERMAL RESISTANCE

From junction to ambient (in free air) $R_{th\,j\text{-}a}$ = 95 K/W

Note to the ratings

All pins are short-circuit protected to ground.

CHARACTERISTICS

$V_P = V_{17\text{-}4} = 8.5$ V; $T_{amb} = 25$ °C; measured in test circuit Fig.1;
All measurements are with respect to ground (pin 4); unless otherwise specified

parameter	conditions	symbol	min.	typ.	max.	unit
Supply (pin 17)						
Supply voltage	$V_P = V_{17}$	V_{17}	7	–	14	V
Supply current (except mixer)	$I_P = I_{17}$	I_{17}	16	23	30	mA
Reference voltage (pin 5)		V_5	4.0	4.2	4.4	V
Mixer						
DC characteristics						
Input bias voltage (pins 1 and 2)		$V_{1,2}$	–	1	–	V
Output voltage (pins 18 and 19)		$V_{18,19}$	4	–	35	V
Output current (pins 18 and 19)		I_{18+19}	–	4.5	–	mA
AC characteristics	$f_i = 98$ MHz					
Noise figure		NF	–	9	–	dB
Noise figure including transforming network		NF	–	11	–	dB
3rd order intercept point		$EMF1_{IP3}$	–	115	–	dB/μV
Conversion power gain	note 1	G_{CP}	–	14	–	dB
Input resistance (pins 1 and 2)		$R_{1,2}$	–	14	–	Ω
Output capacitance (pins 18 and 19)		$C_{18,19}$	–	13	–	pF
Oscillator						
DC characteristics						
Input voltage (pins 7 and 8)		$V_{7,8}$	–	1.3	–	V
Output voltage (pin 6)		V_6	–	2	–	V
AC characteristics						
Residual FM (bandwidth = 300 Hz to 15 kHz)	de-emphasis = 50 μs	Δf	–	2.2	–	Hz
Linear IF amplifier						
DC characteristics						
Input bias voltage (pin 15)		V_{15}	–	1.2	–	V

CHARACTERISTICS (continued)

parameter	conditions	symbol	min.	typ.	max.	unit
Output voltage (pin 12)		V_{12}	–	4.5	–	V
AC characteristics	f_i = 10.7 MHz					
Input impedance		$R_{16\text{-}15}$	240	300	360	Ω
		$C_{16\text{-}15}$	–	13	–	pF
Output impedance		R_{12}	240	300	360	Ω
		C_{12}	–	3	–	pF
Voltage gain	note 2	G_v	27	30	–	dB
Voltage gain with variation of temperature	T_{amb} = –40 to + 85 °C	ΔG_T	–	0	–	dB
1 dB compression point (RMS value)						
at V_P = 8.5 V		$V_{12(rms)}$	–	750	–	mV
at V_P = 7.5 V		$V_{12(rms)}$	–	550	–	mV
Signal-to-noise ratio	R_S = 300 Ω	S/N	–	6.5	–	dB
Keyed AGC						
DC characteristics						
Output voltage range (pin 20)		ΔV_{20}	0.5	–	V_P–0.3	V
AGC output current						
at I_3 = 0 or V_{14} = 450 mV; V_{20} = V_P/2		$-I_{20}$	25	50	100	μA
at V_3 = 2 V and V_{14} = 1 V; V_{20} = V_{15}		I_{20}	2	–	5	mA
Narrowband threshold						
at V_3 = 2 V; V_{14} = 550 mV		V_{20}	–	–	1	V
at V_3 = 2 V; V_{14} = 450 mV		V_{20}	V_P–0.3	–	–	V
AC characteristics	f_i = 98 MHz					
Input impedance		R_3	–	4	–	kΩ
		C_3	–	3	–	pF

parameter	conditions	symbol	min.	typ.	max.	unit
Wideband threshold (RMS value) (see Figs 3, 4, 5 and 6) at V_{14} = 0.7 V; $V_{20} = V_P/2$; I_{20} = 0		$EMF_{2(rms)}$	–	17	–	mV
Oscillator output buffer (pin 9)						
DC output voltage		V_9	–	6	–	V
Oscillator output voltage (RMS value)						
at R_L = oo; C_L = 2 pF		$V_{9(rms)}$	–	110	–	mV
at R_L = 75 Ω		$V_{9(rms)}$	30	50	–	mV
DC output resistance		$R_{9\text{-}17}$	–	2.5	–	kΩ
Signal purity						
Total harmonic distortion		THD	–	–15	–	dB
Spurious frequencies at EMF1 = 1 V; R_{S1} = 50 Ω		f_S	–	–35	–	dB
Electronic standby switch (pin 11)						
Oscillator; linear IF amplifier; AGC	T_{amb} = –40 to + 85 °C					
Input switching voltage						
for threshold ON	$V_{20} = > V_P - 3$ V	V_{13}	0	–	2.3	V
for threshold OFF	$V_{20} = <$ 0.5 V	V_{13}	3.3	–	23	V
Input current						
at ON condition	V_{13} = 0 V	$-I_{13}$	–	–	150	μA
at OFF condition	V_{13} = 23 V	$-I_{13}$	–	–	10	μA
Input voltage	I_{13} = 0	V_{13}	–	–	4.4	V

Notes to the characteristics

1. Power gain conversion is equated by the following equation:

$$10 \log \frac{4\,(V_{M(out)}\ 10.7\ \text{MHz})^2}{(\text{EMF1}\ 98\ \text{MHz})^2} \times \frac{R_{S1}}{R_{ML}}$$

2. Voltage gain is equated by the following equation:

$$20 \log \frac{V_{12}}{V_{16\text{-}15}}$$

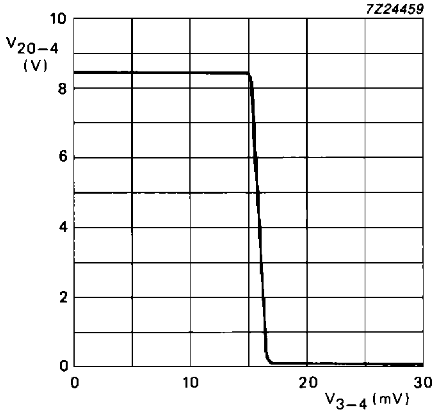


Fig.3 Keyed AGC output voltage V_{20} as a function of RMS input voltage V_3. Measured in test circuit Fig.1 at V_{14} = 0.7 V; I_{20} = 0.

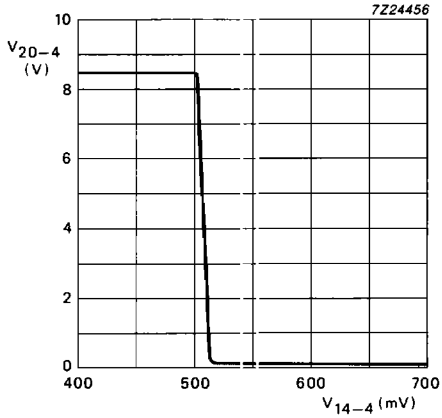


Fig.4 Keyed AGC output voltage V_{20} as a function of input voltage V_{14}. Measured in test circuit Fig.1 at V_3 = 2 V; I_{20} = 0.

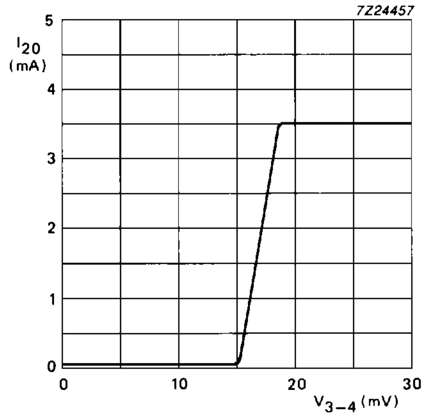


Fig.5 Keyed AGC output current I_{20} as a function of RMS input voltage V_3. Measured in test circuit Fig.1 at V_{14} = 0.7 V; V_{20} = 8.5 V.

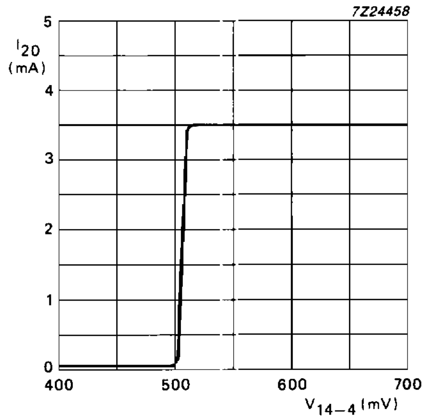
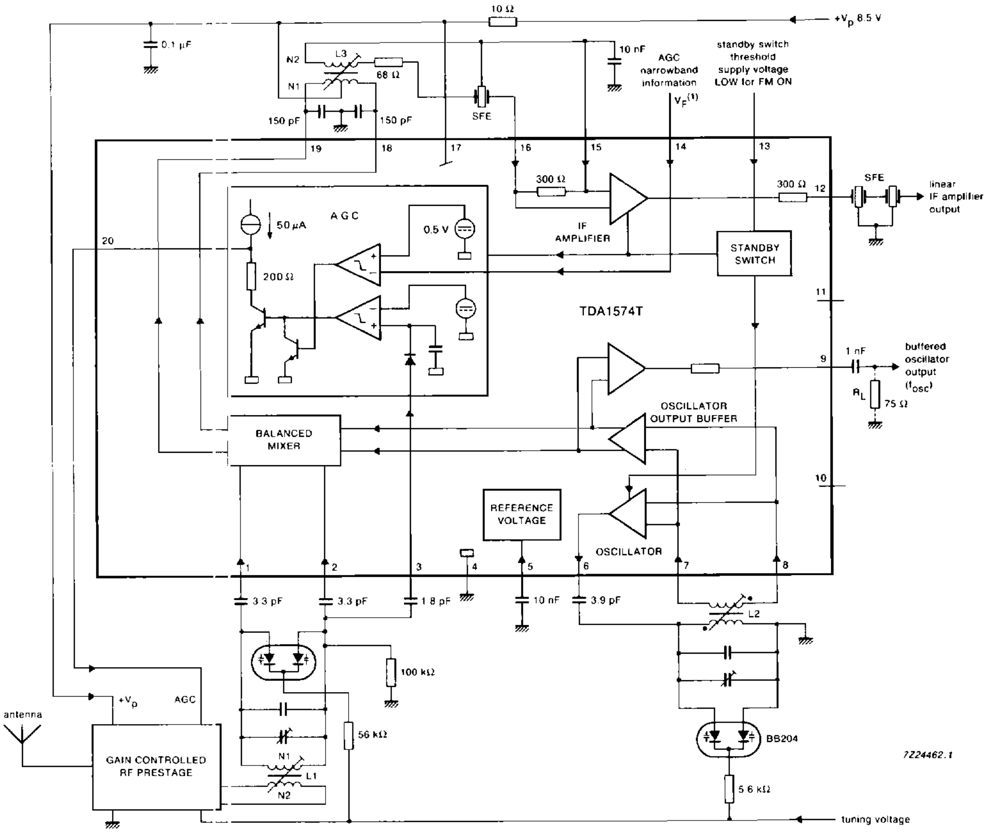


Fig.6 Keyed AGC output voltage I_{20} as a function of input voltage V_{14}. Measured in test circuit Fig.1 at V_3 = 2 V; V_{20} = 8.5 V.



Coil data

L1: TOKO MC-108, N1 = 5.5 turns, N2 = 1 turn

L2: } see Fig.1
L3: }

(1) Field strength indication of main IF amplifier.

Fig.7 TDA1574T application diagram.