INTEGRATED CIRCUITS



Product specification File under Integrated Circuits, IC02



GENERAL DESCRIPTION

The TDA5330T is a monolithic integrated circuit that performs the band A, band B and band C mixer/oscillator functions in TV and VCR tuners. This device gives the designer the capability to design an economical and physically small 3-band tuner which will be capable of meeting the most stringent requirements e.g. FTZ or FCC. The tuner development time can be drastically reduced by using this device.

Features

- Balanced mixer with a common emitter input for band A
- Amplitude-controlled oscillator for band A
- · Balanced mixer with common base input for band B and C
- Balanced oscillator for band B and C
- · Local oscillator buffer output for external prescaler
- SAW filter preamplifier with an output impedance of 100 Ω
- Bandgap voltage stabilizer for oscillator stability
- Electronic bandswitch

QUICK REFERENCE DATA

PARAMETER	CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply voltage		V _{19-2, 26}	_	12	_	V
Band A frequency range		f _A	48	-	180	MHz
Band B frequency range		f _B	160	-	470	MHz
Band C frequency range		f _C	430	_	860	MHz
Conversion noise		F	7	_	11	dB
Band A input voltage	1% cross-modulation	V ₂₄₋₂₆	_	100	_	dBµV
Band B and C input power	1% cross-modulation	Pi	_	-21	_	dBm
Band A voltage gain		G _v	-	24	-	dB
Band B voltage gain		Gv	_	37	_	dB
Band C voltage gain		Gv	_	36	_	dB

PACKAGE OUTLINE

28-lead mini-pack , plastic (SO20; SOT163A); SOT 163-1; 1996 November 28.



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		PINNIN	G	
		1	A OSC	band A oscillator input
		2	GND	ground (0 V)
		3	A OSC	band A oscillator output
	7	4	B OSC	band B oscillator input
	28 LO OUT	5	B OSC	band B oscillator output
GND 2	27 1 0 0117	6	B OSC	band B oscillator output
		7	B OSC	band B oscillator input
A OSC 3	26 RF GND	8	C OSC	band C oscillator input
B OSC 4	25 A IN	9	C OSC	band C oscillator output
B OSC 5	24 A IN	10	C OSC	band C oscillator output
		11	C OSC	band C oscillator input
B OSC 6	23 B IN	12	BS	electronic bandswitch
B OSC 7	22 B IN	13	IF OUT	IF amplifier output
c osc 8	21 C IN	14	IF OUT	IF amplifier output
		15	IF IN	IF amplifier input
		16	IF IN	IF amplifier input
C OSC 10	19 V _P	17	MIX OUT	mixer output
C OSC 11	18 MIX OUT	18	MIX OUT	mixer output
BS 12	17 MIX OUT	19	VP	positive supply voltage
		20	C IN	band C input
IF OUT 113		21	C IN	band C input
IF OUT 14	15 IF IN	22	B IN	band B input
722135	1	23	B IN	band B input
		24	A IN	band A input
		25	A IN	band A input
Fig.2 Pinning di	agram.	26	RF GND	ground for RF inputs
		27	LO OUT	local oscillator amplifier output
		28	LO OUT	local oscillator amplifier output

RATINGS

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

PARAMETER	CONDITIONS	SYMBOL	MIN.	MAX.	UNIT
Supply voltage		$V_{\rm P} = V_{19-2, 26}$	-0.3	14	V
Switching voltage		V ₁₂	0	14	V
Output current of each pin to ground		IO	-	-10	mA
Maximum short-circuit time (all pins)		t _{SC}	-	10	s
Storage temperature range		T _{stg}	-55	+150	°C
Operating ambient temperature range		T _{amb}	-25	+80	°C

THERMAL RESISTANCE

From junction to ambient in free air

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CHARACTERISTICS

 V_{P} = 12 V; T_{amb} = 25 °C; unless otherwise specified.

PARAMETER	CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply voltage		V _{19-2, 26}	10	_	13.2	V
Supply current		I ₁₉	-	42	55	mA
Switching voltage;						
band A		V ₁₂	0	_	1.1	V
band B		V ₁₂	1.6	_	2.4	V
band C		V ₁₂	3.0	_	5.0	V
Switching current;						
band C		I ₁₂	-	_	50	μA
Band A Mixer (including IF amplifier)	measured using circuit shown in Fig.9					
Frequency range		f _A	48	_	180	MHz
Noise figure	note 1;					
	50 MHz	NF	-	7.5	9	dB
	180 MHz	NF	-	9	10	dB
Optimum source						
conductance	50 MHz	G ₂₄₋₂₆	-	0.5	-	mS
	180 MHz	G ₂₄₋₂₆	-	1.1	-	mS
Input admittance	see Fig.9					
Input capacitance	50 - 180 MHz	C ₂₄₋₂₆	-	2	-	pF
Input voltage	1% cross-modulation; in channel	V ₂₄₋₂₆	97	100	-	dBµV
Input voltage	10 kHz pulling; in channel	V ₂₄₋₂₆	100	108	_	dBµV
Voltage gain	20 log					
	(V ₁₃₋₁₄ /V ₂₄)	G _v	22.5	25.0	27.5	dB
Band A mixer						
Conversion						
transadmittance	Sc = I ₁₇ /V ₂₄					
mixer	$= -I_{18}/V_{24}$	Sc _{24-17, 18}	-	3.5	-	mS
Mixer output						
admittance	pins 15 and 16		-	0.1	-	mS
Mixer output						
capacitance		C ₁₇₋₁₈	-	2	-	pF

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VHF, UHF and Hyperband mixer/oscillator for TV and VCR 3-band tuners

PARAMETER CONDITIONS SYMBOL MIN. TYP. MAX. UNIT **Band A oscillator** Frequency range 80 216 MHz fA _ $\Delta V_{P} = 10\%$ kHz Frequency shift $\Delta \mathbf{f}$ 200 ΔT = 25 °C Frequency drift Δf 400 kHz Frequency drift 5 s to 15 min after _ 200 kHz switching on $\Delta \mathbf{f}$ _ measured using circuit Band B mixer shown in (including IF) Fig.9 measurements using hybrid; note 2 Frequency range 160 470 MHz f_B _ Noise figure pins 22 and 23; 200 MHz dB NF 10 8 470 MHz NF 8 10 dB see Fig.5 Input admittance Available input power 1% cross-modulation; in channel; pins 22 and 23; 200 MHz P_{AI} -24 -21 dBm 470 MHz -24 -21 dBm P_{AI} _ pins 22 and 23; 10 kHz pulling in channel; 470 MHz dBm -11 _ _ N+5 – 1 MHz pulling note 3; dBm 430 MHz -11 _ Voltage gain note 4; 200 MHz Gv 33 36 39 dB 470 MHz 33 dB Gv 36 39 Band B oscillator Frequency range 200 500 MHz f_B Frequency shift $\Delta V_P = 10\%$ Δf 400 kHz _ _ Frequency drift ΔT = 25 °C Δf 500 kHz Frequency drift 5 s to 15 min after Δf 200 kHz switching on _

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PARAMETER	CONDITIONS	SYMBOL	MIN.	ТҮ	′P.	MAX.	UNIT
Band C mixer (including IF)	measured using circuit shown in Fig.9; measurements						
	using hybrid; note 2						
Frequency range		f _C	430	-	-	860	MHz
Noise figure	pins 20 and 21;						
	430 MHz	NF	_	ç	9	11	dB
	860 MHz	NF	-	ç	9	11	dB
Input admittance	see Fig.6						
Available input power	1% cross-modulation in channel; pins 20 and 21:						
	430 MHz	PAL	-25	-2	21	_	dBm
	860 MHz	PAL	-25	-2	21	_	dBm
10 kHz pulling	pins 20 and 21; in channel;						
	860 MHz		-	-2	20	_	dBm
N+5 – 1 MHz pulling	note 3;						
	820 MHz		-42	-3	35	_	dBm
Voltage gain	note 4;						
	430 MHz	Gv	33	3	6	39	dB
	860 MHz	G _v	33	3	6	39	dB
Band C oscillator							
Frequency range		f _C	470	-	_	900	MHz
Frequency shift	$\Delta V_{b} = 10\%$	Δf	_	-	-	400	kHz
Frequency drift	ΔT = 25 °C	Δf	_	-	-	800	kHz
Frequency drift	5 s to 15 min after						
	switching on	Δf	-	-	-	200	kHz
				mod.	phase		
IF Amplifier	note 5; differentially measured at 36 MHz; see Fig.7						
Input reflection							
coefficient		S ₁₁	-	-0,5	-2.0	-	dB/deg
Reverse transmission							
coefficient		S ₁₂	-	-41	-7	-	dB/deg
Forward transmission							
coefficient		S ₂₁	-	12	160	_	dB/deg
Output reflection							
coefficient	see Fig.8	S ₂₂	-	-9	10	-	dB/deg

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PARAMETER	CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT
LO output						
Output voltage into						
50 Ω resistor		V ₂₇₋₂₈	14	35	100	mV
Spurious signal on						
LO output with respect to LO output signal	note 6	SRF	_	_	-10	dB
LO signal harmonics						
with respect to LO signal	measured at 50 Ω	SHD	_	_	-10	dB

Notes

- 1. Measured with an input circuit for optimum noise. (see Fig.3).
- 2. The values have been corrected for hybrid and cable losses. The symmetrical output impedance of the circuit is $100 \ \Omega$.
- 3. The input level of a N+5 1 MHz signal (just visible).
- The gain is defined as the transducer gain (measured in Fig.9) plus the voltage transformation ratio of L6 to L7 (6:1, 16 dB).
- 5. All S parameters are referred to a 50 Ω system.
- Measured with 50 Ω output impedance on pins 26 and 27 and a RF input signal level of: RF level = 1 V at f < 180 MHz RF power = 0.5 dBm at 100 MHz < f < 225 MHz

RF power = -10 dBm at 225 MHz < f < 860 MHz



Table 1Component values

COMPONENT	F = 50 MHz	F = 180 MHz
L	13 t, \varnothing 5.5 mm, wire 0.7 mm	(note 1)
L2	rigid cable, 2.9 cm	(note 1)
L3	rigid cable, 4 cm	(note 1)
С	9.6 pF	(note 1)

Note

1. Value to be fixed.

Product specification

VHF, UHF and Hyperband mixer/oscillator for TV and VCR 3-band tuners

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Table 2	Electrical parameters of	f the circuit (fo	or appropriate impedance	e and selectivity)
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PARAMETER	F = 50 MHz	F = 180 MHz	UNIT
Insertion loss	0.3	(note 1)	dB
Bandwidth	8	(note 1)	MHz
Image suppression	15	(note 1)	dB
Output impedance (source for IC)	2	(note 1)	kΩ

Note

1. Value to be fixed.













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VHF, UHF and Hyperband mixer/oscillator for TV and VCR 3-band tuners

Component values of the test circuit

resistors			
R1 = 47 kΩ	R2 = 18 Ω	R3 = 22 kΩ	R4 = 22 kΩ
R5 = 22 Ω (SMD)	R6 = 22 k Ω	R7 = 1 k Ω	R8 = 2.2 kΩ
R9 = 22 kΩ	R10 = 15 kΩ	R11 = 22 kΩ	
capacitors			
C1 = 1 nF	C2 = 1 nF	C3 = 1 nF	C4 = 1 nF
C5 = 1 nF	C6 = 1 nF	C7 = 1 nF	C8 = 1 nF
C9 = 1 nF	C10 = 1 nF	C11 = 1 nF	C12 = 15 pF (N750)
C13 = 15 pF (N750)	C14 = 1 nF	C15 = 1 nF	C16 = 1 nF
C17 = 0.68 pF (SMD)	C18 = 1 pF (SMD)	C19 = 100 pF (SMD)	C20 = 5.6 pF (SMD)
C21 = 1 pF	C22 = 0.68 pF (SMD)	C23 = 150 pF (N750)	C24 = 1.8 pF (N750)
C25 = 3.3 pF (SMD)	C26 = 3.3 pF (SMD)	C27 = 1.8 pF (SMD)	C28 = 1 nF
C29 = 1 pF (NPO)	C30 = 1 pF (NPO)	C31 = 82 pF (N750)	C32 = 1 nF
C33 = 1 µF (40 V)	Cm = 18 pF (N750)		
diodes and IC			
D1 = BB911	D2 = BB909B	D3 = BB405B	
IC = TDA5330T			
coils			
L1 = 6.5 t (\$)	L2 = 1.5 t (\$)	L3 = 1.5 t (\$)	L4 = 1.5 t (¢3)
L5 = 2 × 6 t (note 1)	L6 = 12 t (note 1)	L7 = 2 t (mounted on L6)	$L8 = 5 \ \mu H$ (choke coil)
wire size for L1 to $L4 = 0.4$ ar	nd for L5 to L7 = 0.1 mm.		

Note

1. Coil type: TOKO 7 kN; material: 113 kN, screw core (03-0093), pot core (04-0026).

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VHF, UHF and Hyperband mixer/oscillator for TV and VCR 3-band tuners

PACKAGE OUTLINE

SO20: plastic small outline package; 20 leads; body width 7.5 mm



SOT163-1

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).

Reflow soldering

Reflow soldering techniques are suitable for all SO packages.

Reflow soldering requires solder paste (a suspension of fine solder particles, flux and binding agent) to be applied to the printed-circuit board by screen printing, stencilling or pressure-syringe dispensing before package placement.

Several techniques exist for reflowing; for example, thermal conduction by heated belt. Dwell times vary between 50 and 300 seconds depending on heating method. Typical reflow temperatures range from 215 to 250 °C.

Preheating is necessary to dry the paste and evaporate the binding agent. Preheating duration: 45 minutes at 45 °C.

Wave soldering

Wave soldering techniques can be used for all SO packages if the following conditions are observed:

- A double-wave (a turbulent wave with high upward pressure followed by a smooth laminar wave) soldering technique should be used.
- The longitudinal axis of the package footprint must be parallel to the solder flow.
- The package footprint must incorporate solder thieves at the downstream end.

During placement and before soldering, the package must be fixed with a droplet of adhesive. The adhesive can be applied by screen printing, pin transfer or syringe dispensing. The package can be soldered after the adhesive is cured.

Maximum permissible solder temperature is 260 °C, and maximum duration of package immersion in solder is 10 seconds, if cooled to less than 150 °C within 6 seconds. Typical dwell time is 4 seconds at 250 °C.

A mildly-activated flux will eliminate the need for removal of corrosive residues in most applications.

Repairing soldered joints

Fix the component by first soldering two diagonally- opposite end leads. Use only a low voltage soldering iron (less than 24 V) applied to the flat part of the lead. Contact time must be limited to 10 seconds at up to 300 °C. When using a dedicated tool, all other leads can be soldered in one operation within 2 to 5 seconds between 270 and 320 °C.

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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