DATA SHEET

TDA8010M; TDA8010AM
Low power mixers/oscillators for satellite tuners

Objective specification
Supersedes data of 1996 Oct 08
File under Integrated Circuits, IC02

1996 Oct 24

Philips
Semiconductors

PHILIPS

FEATURES

- Fully balanced mixer with common base input
- Wide input power and frequency range
- One-band 2 pin oscillator
- Local oscillator buffer and prescaler
- SAW filter IF preamplifier with gain control input and switchable output
- Bandgap voltage stabilizer for oscillator stability
- External IF filter between the mixer output and the IF amplifier input.

APPLICATIONS

- Down frequency conversion in DBS (Direct Broadcasting Satellite) satellite receivers.

GENERAL DESCRIPTION

The TDA8010M; TDA8010AM are integrated circuits that perform the mixer/oscillator function in satellite tuners. The devices include a gain controlled IF amplifier that can directly drive two single-ended SAW filters or a differential SAW filter using a three function switchable output. They contain an internal LO prescaler and buffer that is compatible with the input of a terrestrial or satellite frequency synthesizer. They are also suitable for digital TV tuners. These devices are available in small outline packages that give the designer the capability to design an economical and physically small satellite tuner.

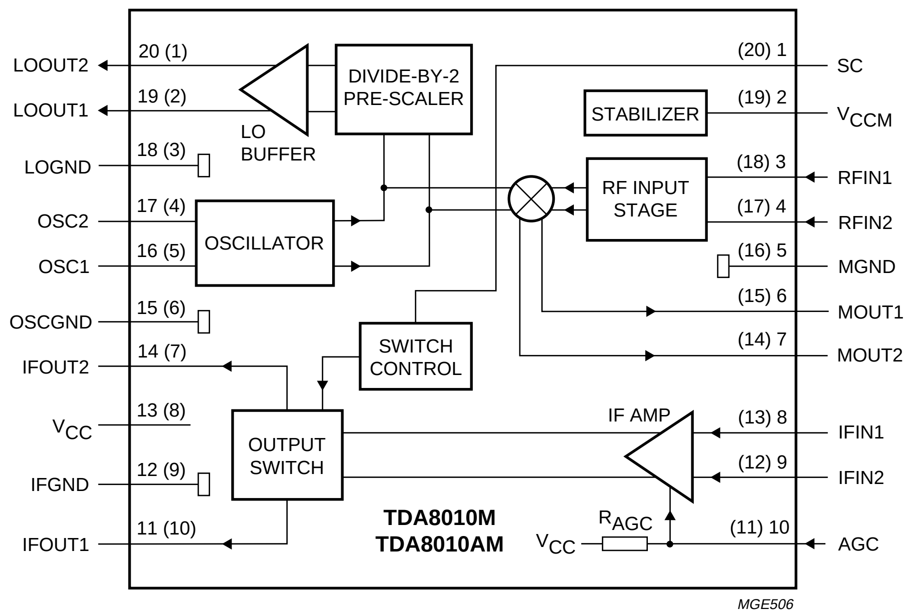
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CC}	supply voltage		4.5	5.0	5.5	V
I_{CC}	supply current		–	70	–	mA
f_{RF}	RF frequency range		700	–	2150	MHz
f_{osc}	oscillator frequency		1380	–	2650	MHz
NF_M	mixer noise figure	corrected for image	–	10	–	dB
G_{max}	maximum total gain	mixer plus IF	–	40	–	dB
G_{min}	minimum total gain	mixer plus IF	–	–17	–	dB

ORDERING INFORMATION

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
TDA8010M	SSOP20	plastic shrink small outline package; 20 leads; body width 4.4 mm	SOT266-1
TDA8010AM			

BLOCK DIAGRAM



The pin numbers given in parenthesis refer to the TDA8010AM.

Fig.1 Block diagram.

PINNING

SYMBOL	PINS		DESCRIPTION
	TDA8010M	TDA8010AM	
SC	1	20	IF output switch control
V_{CCM}	2	19	supply voltage for mixer
RFIN1	3	18	RF input 1
RFIN2	4	17	RF input 2
MGND	5	16	ground for mixer
MOUT1	6	15	mixer output 1
MOUT2	7	14	mixer output 2
IFIN1	8	13	IF amplifier input 1
IFIN2	9	12	IF amplifier input 2
AGC	10	11	IF amplifier gain control input
IFOUT1	11	10	IF amplifier output 1
IFGND	12	9	ground for IF amplifier
V_{CC}	13	8	supply voltage
IFOUT2	14	7	IF amplifier output 2
OSCGND	15	6	ground for oscillator
OSC1	16	5	oscillator tuning circuit input 1
OSC2	17	4	oscillator tuning circuit input 2
LOGND	18	3	ground for local oscillator buffer
LOOUT1	19	2	local oscillator output 1
LOOUT2	20	1	local oscillator output 2

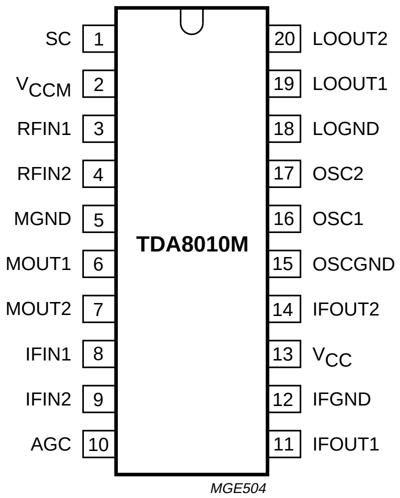


Fig.2 Pin configuration (TDA8010M).

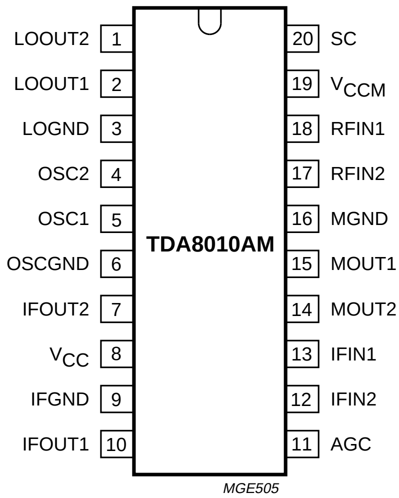


Fig.3 Pin configuration (TDA8010AM).

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_{CC}	supply voltage	–0.3	+6.0	V
$V_{i(max)}$	maximum input voltage on all pins	–0.3	V_{CC}	V
$I_{source(max)}$	maximum output source current	–	10	mA
t_{sc}	maximum short-circuit time on all outputs	–	10	s
T_{stg}	storage temperature	–55	+150	°C
T_j	junction temperature	–	150	°C
T_{amb}	operating ambient temperature	–20	+80	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient in free air	120	K/W

HANDLING

All pins withstand the ESD test in accordance with *“UZW-BO/FQ-A302 (human body model)”* and with *“UZW-BO/FQ-B302 (machine model)”*.

CHARACTERISTICS

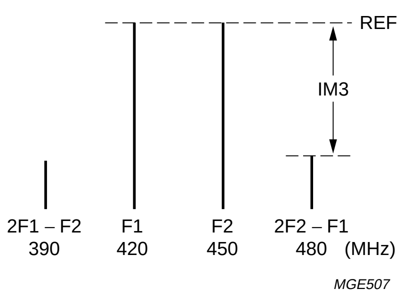
V_{CC} = 5 V; T_{amb} = 25 °C; measured in application circuit of Fig.6; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Supplies						
V_{CC}	supply voltage		4.75	5.0	5.25	V
I_{CC}	supply current		60	70	80	mA
Mixer						
f_{RF}	RF frequency range		700	–	2150	MHz
NF	total noise figure (mixer plus IF); not corrected for image	V_{AGC} = 0.9V_{CC}; f_i = 920 MHz	–	8	10	dB
		V_{AGC} = 0.9V_{CC}; f_i = 2150 MHz	–	13	15	dB
G_M	available power gain for mixer	R_L = 2.2 kΩ	–	10	–	dB
G_{max1}	maximum total gain (mixer + IFOUT1)	f_i = 920 MHz; notes 1 and 2	37	40	–	dB
		f_i = 2150 MHz; notes 1 and 2	36	38	–	dB
G_{min1}	minimum total gain (mixer + IFOUT1)	notes 1 and 2	–	–30	–14	dB
G_{max2}	maximum total gain (mixer + IFOUT2)	f_i = 920 MHz; notes 1 and 2	36	39	–	dB
		f_i = 2150 MHz; notes 1 and 2	35	37	–	dB
G_{min2}	minimum total gain (mixer + IFOUT2)	notes 1 and 2	–	–30	–15	dB
$Z_{I(RF)}$	input impedance (R_s + L_s)	from 920 to 2150 MHz	20	30	40	Ω
			5	7.5	10	nH
$Z_{O(RF)}$	output impedance (R_p//C_p) (open collector)	f_{IF} = 480 MHz	8	12	16	kΩ
			450	550	650	fF
IP3	third-order interception point	see Fig.4	–2	+2	–	dBm
IP2	second-order interception point	see Fig.5	10	25	–	dBm
Local oscillator output						
V_{LO}	output voltage	R_L = 50 Ω	87	90	93	dBμV
SRF	spurious signal on LO output with respect to LO output signal	R_L = 50 Ω; note 3	–	–35	–10	dB
LO_{leak}	local oscillator leakage	RF input	–	–50	–	dBm
		IF output (mixer)	–	–35	–	dBm
Oscillator						
f_{osc}	oscillator frequency range	V_{CC} = 4.5 to 5.5 V; T_{amb} = –20 to +80 °C	1380	–	2650	MHz
$f_{osc(max)}$	maximum oscillator frequency		–	2700	–	MHz
f_{shift}	oscillator frequency shift	V_{CC} = 4.75 to 5.25 V; at 2550 MHz	–	±350	±500	kHz
		V_{CC} = 4.75 to 5.25 V; at 2650 MHz	–	±400	±600	kHz
f_{drift}	oscillator frequency drift	ΔT = 25 °C; at 2550 MHz	–	–8	–15	MHz
		ΔT = 25 °C; at 2650 MHz	–	–8	–16	MHz

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
ΦN	oscillator phase noise	at 100 kHz	88	92	–	dBc
		at 10 kHz	62	69	–	dBc
IF amplifier						
f_{IF}	IF frequency range		60	–	625	MHz
$G_{v(max)}$	maximum voltage gain	note 1	–	40	–	dB
$G_{v(min)}$	minimum voltage gain	note 2	–	–30	–	dB
NF_{IF}	IF noise figure	note 4	–	8	–	dB
V_{oIF}	output voltage level		–	–	85	dBμV
$Z_{O(IF)}$	output impedance	single-ended	–	50	–	Ω
$Z_{I(IF)}$	input impedance (R_p//L_p)		30	33	36	Ω
			5	7	9	nH
SW_{iso}	switch isolation	note 5	33	36	–	dB
V_{SW}	switch control voltage	IF1 on; IF2 off	$0.8V_{CC}$	–	V_{CC}	V
		IF1 off; IF2 on	$0.2V_{CC}$	–	$0.6V_{CC}$	V
		differential output	0	–	$0.07V_{CC}$	V
$R_{I(AGC)}$	AGC input resistance	see Fig.6	–	4	–	kΩ

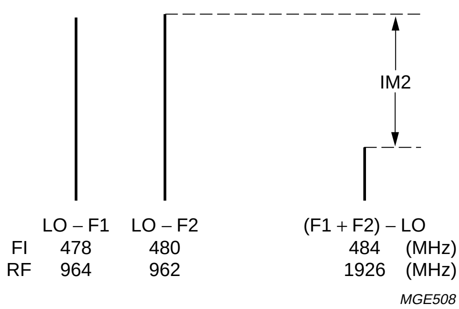
Notes

1. Maximum gain: $V_{AGC} = 0.9V_{CC}$; f_{IF} = 480 MHz; IF output single-ended.
2. Minimum gain: $V_{AGC} = 0.1V_{CC}$; f_{IF} = 480 MHz; IF output single-ended.
3. RF input power range = –70 to –20 dBm.
4. $V_{AGC} = 0.9V_{CC}$; f_{IF} = 480 MHz; R_{source} = 100 Ω.
5. Switch isolation is defined at an IF output level of 77 dBμV; f_{IF} = 480 MHz.



REF is the level if F1 or F2 were at 480 MHz.
IP3 = IM3/2 + input level.
Input level: 2 × –23 dBm.
Output level: 2 × 74 dBμV.

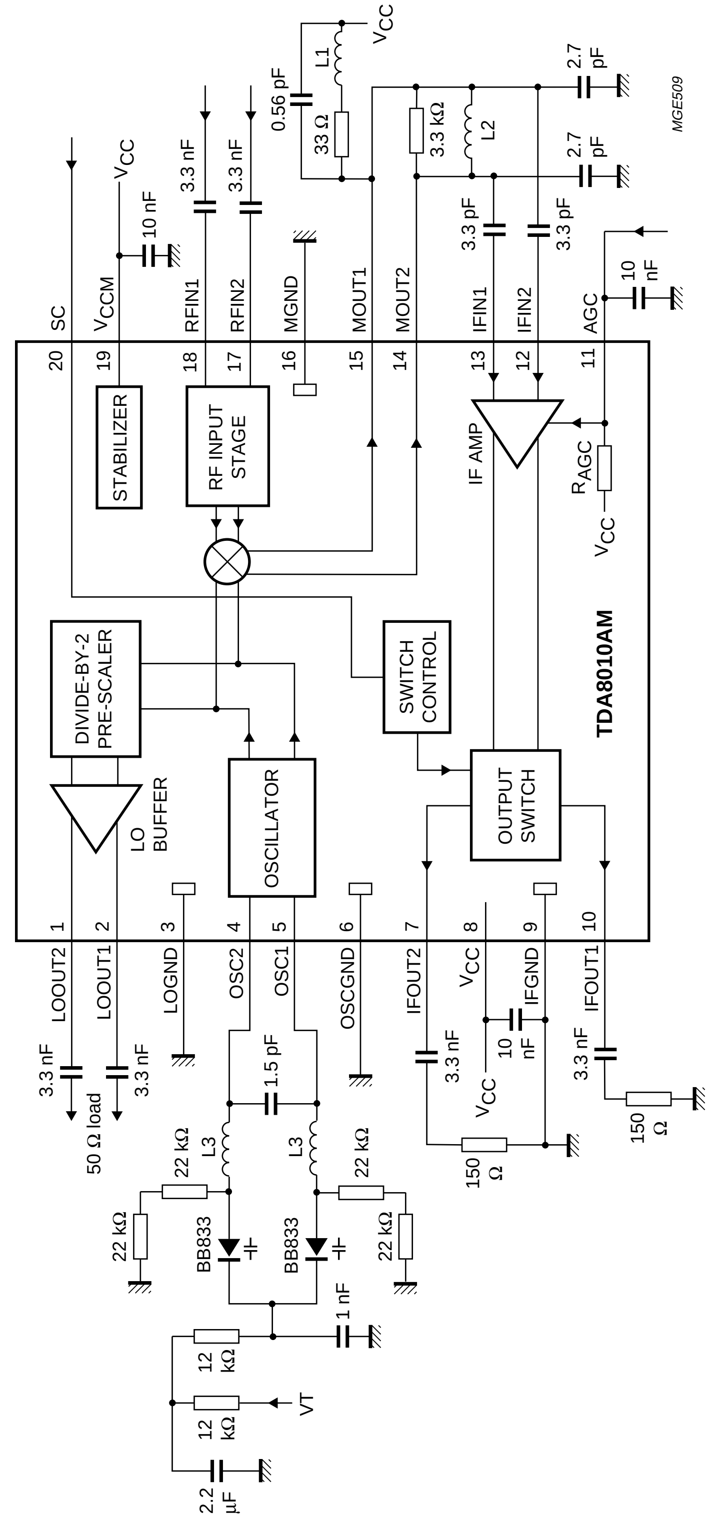
Fig.4 IP3 measurement method.



IP2 = IM2 + input level.
Input level: 2 × –23 dBm.
Output level: 2 × 74 dBμV.

Fig.5 IP2 measurement method.

APPLICATION INFORMATION

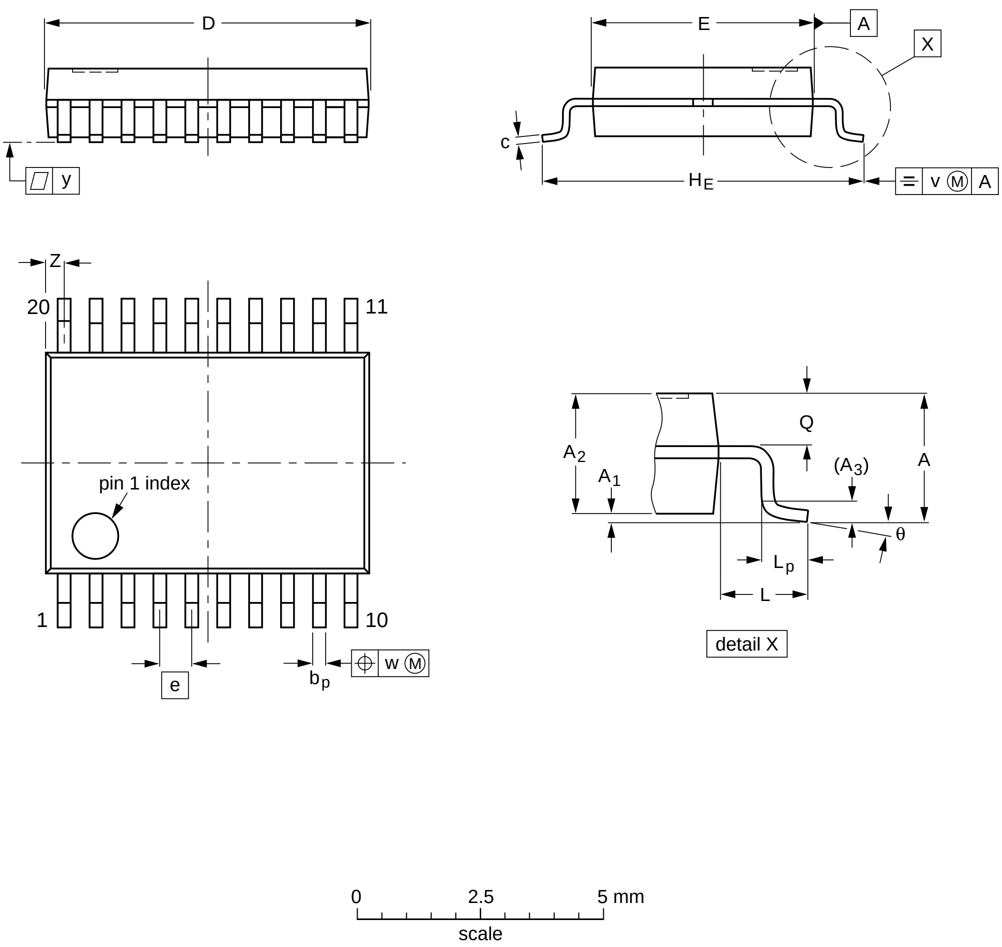


L1: 5.5 turns; diameter = 5 mm.
L2: 5.5 turns; diameter = 1.5 mm.
L3: micro-strip coil; L = 3.5 × 0.4 mm. No ground plane on the other side.
Varicaps: Siemens BB833.

Fig.6 Application diagram.

PACKAGE OUTLINE

SSOP20: plastic shrink small outline package; 20 leads; body width 4.4 mm **SOT266-1**



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	D(1)	E(1)	e	H_E	L	L_p	Q	v	w	y	Z(1)	θ
mm	1.5	0.15 0	1.4 1.2	0.25	0.32 0.20	0.20 0.13	6.6 6.4	4.5 4.3	0.65	6.6 6.2	1.0	0.75 0.45	0.65 0.45	0.2	0.13	0.1	0.48 0.18	10^o 0^o

Note

1. Plastic or metal protrusions of 0.20 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES					EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ				
SOT266-1							~~90-04-05~~ 95-02-25

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 SSOP 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 is **not** recommended for SSOP packages. This is because of the likelihood of solder bridging due to closely-spaced leads and the possibility of incomplete solder penetration in multi-lead devices.

If wave soldering cannot be avoided, the following conditions must be 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 and must incorporate solder thieves at the downstream end.**

Even with these conditions, only consider wave soldering SSOP packages that have a body width of 4.4 mm, that is SSOP16 (SOT369-1) or SSOP20 (SOT266-1).

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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