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MIXER/OSCILLATOR

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Ausgabe 03.98

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TDA6131XS**Revision History:****Current Version: 03.98**

Previous Version:

Preliminary Specification

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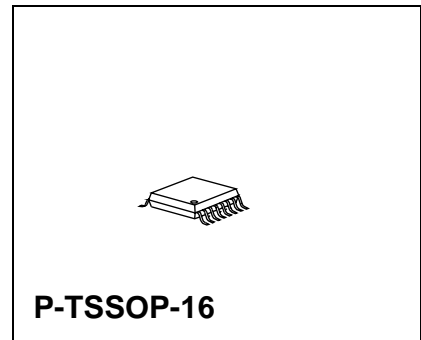
Version 1.0

Bipolar IC

1 Overview

1.1 Functional Description, Benefits

- New B6HF bipolar technology, 25GHz ft
- Frequency range up to 3.0 GHz
- Small outline P-TSSOP 16 package
- 2.7-4.5V supply voltage
- -40°C to +85°C operational temperature range
- Standby function
- Reduced external components
- High isolation between mixer ports
- Good crosstalk performance



MIXER:

- Universal Gilbert cell mixer with adjustable mixer current
- Frequency range up to 3GHz
- Comparable with SO42P or TBB042G
- LO can be driven with external source or internal oscillator

OSCILLATOR :

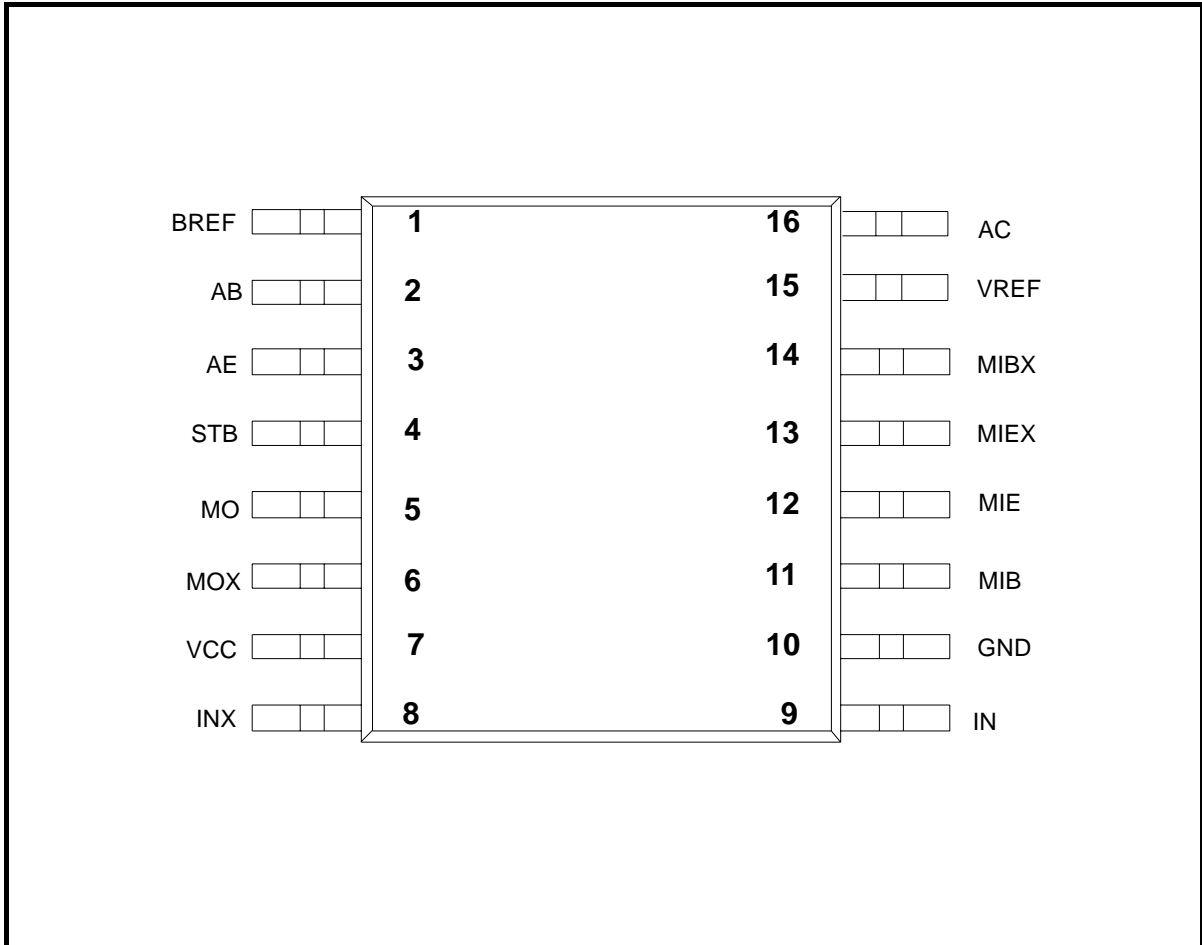
- Internal biased single transistor stage
- Multi purpose operation possible (oscillator, amplifier)
- Low noise performance
- Current adjustable

1.2 Applications:

- All wireless systems
- Various TV and SAT applications

Type	Ordering Code	Package
TDA6131XS		P-TSSOP-16

1.3 Pin Configuration (top view)

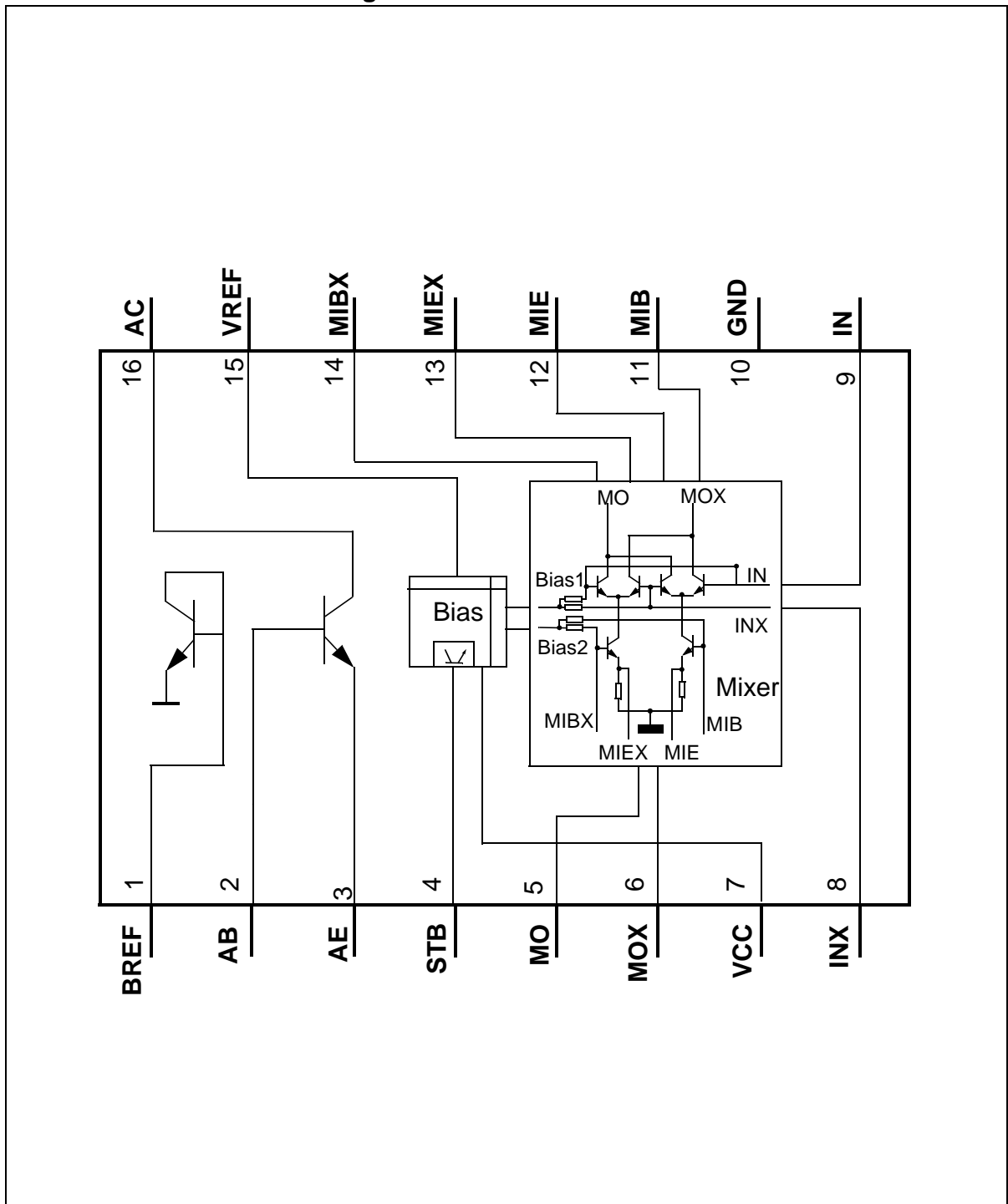


P-TSSOP-16

1.4 Pin Definitions and Functions

Pin No.	Symbol	Function
1	BREF	Reference voltage for amplifier/oscillator V_{BE}
2	AB	Amplifier / Oscillator base
3	AE	Amplifier / Oscillator emitter
4	STB	Standby circuit
5	MO	Mixer signal open collector output, not inverted
6	MOX	Mixer signal open collector output, inverted,
7	VCC	Voltage supply
8	INX	Mixer signal base input, inverted
9	IN	Mixer signal base input, not inverted
10	GND	Ground
11	MIB	Mixer local oscillator base input, not inverted
12	MIE	Mixer local oscillator emitter input, not inverted
13	MIEX	Mixer local oscillator emitter input, inverted
14	MIBX	Mixer local oscillator base input, inverted
15	VREF	Constant reference voltage
16	AC	Amplifier / Oscillator collector

1.5 Functional Block Diagram



1.6 Circuit Description

MIXER

The mixer used in this design is a general purpose up-/down conversion gilbert cell mixer that can be used in various configurations. The RF can enter the IC either via the pins MIE/MIEX or via MIB/MIBX. Using an external supplied local oscillator at IN/INX a converted output signal is created at the open collector output pins MO/MOX. In a second configuration the RF should be connected to the pins IN/INX and the pins MIB/MIBX/MIE/MIEX need to be connected to an external tank circuit, thus forming for example an colpitts oscillator using the internal transistor stages. In both cases the open collector pins MO/MOX need to be connected to an external supply voltage. To improve the mixer performance external resistors at MIE/MIEX make it possible to adjust the mixer current. The RF connections to the mixer input can be single ended or balanced, capacitive or inductive. Supply voltage for the mixer has to be connected to the pin VCC and to GND.

OSCILLATOR / AMPLIFIER

Using the additional transistor stage it is possible to realize via external components an oscillator or an amplifier circuit. Base AB, emitter AE and collector AC are external available. To adjust the amplifier/oscillator current using a current mirror the internal reference voltage at VREF has to be connected to BREF with an external resistor and BREF needs to be connected to the base AB. This can be done via a resistor and/or a choke. External matching networks at the in- and output of the transistor stage will improve the amplifier performance.

COMMON

Differential signals and symmetrical circuits are used throughout the mixer part of the IC. An internal bias driver generates supply voltage and temperature compensated reference voltages. The STB pin allows the IC to be switched in a low power mode. The pins BREF, VREF, STB, VCC, IN, INX, and MO, MOX are ESD protected.

1.7 Absolute Maximum Ratings

The maximum ratings may not be exceeded under any circumstances, not even momentarily and individually, as permanent damage to the IC will result.

Ambient temperature $T_{amb} = -40^{\circ}\text{C}...+85^{\circ}\text{C}$

#	Parameter	Symbol	Limit Values		Units	Remarks
			Min	Max		
1	Supply Voltage	V_S	-0.3	5.0	V	
2	Input Voltage MIE/X	$V_{MIE/MIE X}$	-0.3	1.9	V	$V_S = 0$, MIB/X open
3	Input Voltage MIB/X	$V_{MIB/MIB X}$	-0.3	1.9	V	
4	Input Voltage IN/INX	$V_{IN/IN X}$	0.6	$V_S+0.3$ 5.0max.	V V	
5	Input Voltage AB	V_{AB}	-0.3	$V_{AC}+0.3$ 3.5max.	V V	
6	Input Voltage AE	V_{AE}	-0.3	0.6	V	
7	Output Voltage VREF	V_{VREF}	1.3	2.0	V	
8	Input Voltage STB	V_{STB}	-0.3	$V_S+0.3$ 5.0max.	V V	
9	Output Voltage BREF	V_{BREF}	-0.3	3.5	V	
10	Open Collector Output Voltage	$V_{MO/MOX}$	1.7	$V_S+0.3$ 5.0max.	V V	
11	Open Collector Output Voltage	V_{AC}	-0.3	3.5	V	Base open
12	Open Collector Output Voltage	V_{AC}	-0.3	7.0	V	$R_B < 50\text{K}\Omega$
13	Amplifier / Oscillator Current	I_{AC}		30	mA	
14	Reference Current	I_{BREF}		3	mA	
15	Differential Input Voltage	$V_{I_{DIFF}}$		2.0	V_{PP}	
16	Junction Temperature	T_j		125	$^{\circ}\text{C}$	
17	Storage Temperature	T_S	-40	125	$^{\circ}\text{C}$	
18	Thermal Resistance	R_{thJA}		213	K/W	1)
19	ESD integrity, pins 1,5,6,7,8,9,15	V_{ESD}	-1000	1000	V	2)

1) Attention: Do not exceed the maximum. junction temperature

2) HBM according to MIL STD 883D, method 3015.7 and EOS/ESD Assn. Standard S5.1-1993

1.8 Operational Range

Within the operational range the IC operates as described in the circuit description. The AC/DC characteristic limits are not guaranteed.

Supply voltage $V_{VCC} = 2.7V \dots 4.5V$, Ambient temperature $T_{amb} = -40^{\circ}C \dots 85^{\circ}C$

#	Parameter	Symbol	Limit Values		Units	Remarks
			Min	Max		
1	AB Input Frequency	f_{AI}		3000	MHz	
2	MIE/X or MIB/X Input Frequency	f_{MI}		3000	MHz	
3	IN/X Input Frequency	f_{IN}		3000	MHz	
4	MO/X Intermediate Frequency	f_{MO}		3000	MHz	
5	Standby Voltage On	STB_{ON}	2.0	V_S	V	
6	Standby Voltage Off	STB_{OFF}	0	0.5	V	

1.9 AC/DC Characteristics

AC/DC characteristics involve the spread of values guaranteed within the specified supply voltage and ambient temperature range. Typical characteristics are the median of the production.

Supply voltage $V_{VCC} = 2.7V \dots 4.5V$, Ambient temperature $T_{amb} = +25^{\circ}C$

#	Parameter	Symbol	Limit Values			Units	Test Conditions	Test Circuit
			Min	Typ	Max			

Supply Current

1a	Supply current, total IC	$I_{4,5,6,7,16}$		7.8		mA	STB ON, $R_1=R_2=\infty$ $R_{DC}=820\Omega$	1, $I_{AC}=5.5$ mA
1b	Supply current, total IC	$I_{4,5,6,7,16}$		13.1		mA	STB ON, $R_1=R_2=\infty$ $R_{DC}=330\Omega$	1, $I_{AC}=10$ mA
1c	Supply current, total IC	$I_{4,5,6,7,16}$		11.1		mA	STB ON, $R_1=R_2=180\Omega$ $R_{DC}=820\Omega$	1, $I_{AC}=5.5$ mA
2	Supply current, total IC	$I_{4,5,6,7,16}$		<20		μA	STB OFF, $R_{DC}=820\Omega$	1

* Minimum value for external resistors at MIE/MIEX: $R_1=R_2=68\Omega$

* Minimum value for external resistor between VREF and BREF: $R_{DC}=180\Omega$

AC/DC Characteristics

AC/DC characteristics involve the spread of values guaranteed within the specified supply voltage and ambient temperature range. Typical characteristics are the median of the production.

#	Parameter	Symbol	Limit Values			Unit	Test Conditions	Test Circuit
			Min	Typ	Max			

MIXER, Signal Input MIE/MIEX, Downconversion, R1,2=180Ohm

1	Max. input level, 1db compression at MO/X, IF= 45MHz	P_{MI}		-15		dBm	f=0.9GHz	1
2	Input intercept point, $\Delta f=800kHz$, IF= 45MHz	$IICP3_{MI}$		0		dBm	f=0.9GHz	1
3	Noise figure, ssb (NF _{ssb} ≈NF _{dsb} +3dB) IF=45MHz	F_{MI}		9		dB	f=0.9GHz	1*

MIXER, Local Oscillator Input IN/INX, Downconversion, R1,2=180Ohm

4	Input level	P_{LO}		-3		dBm	f=0.9GHz	1**
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MIXER, Signal Output MO/MOX, Downconversion, R1,2=180Ohm

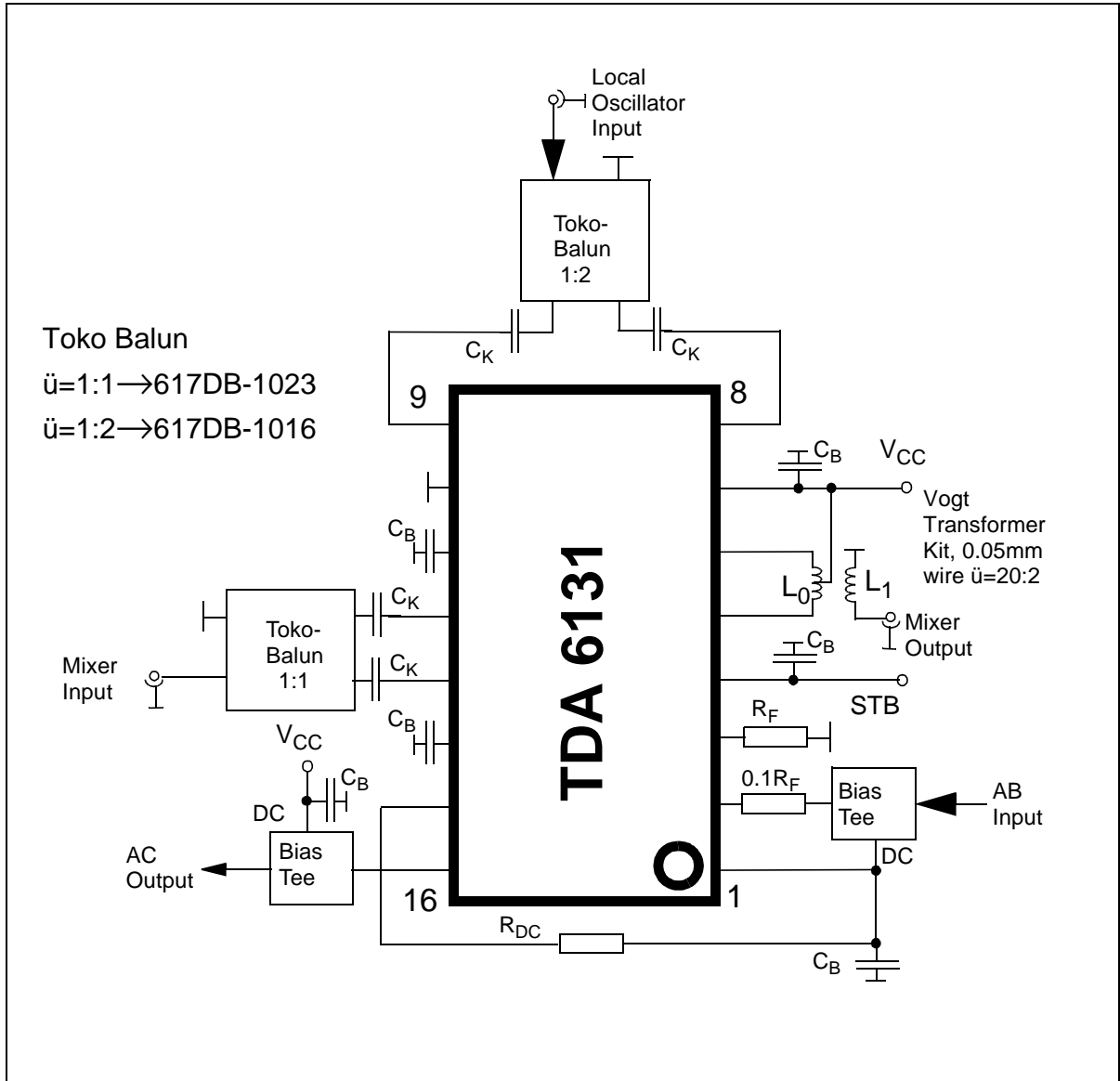
5	Output current	I_{MO+MOX}		4.0		mA	incl. R1,R2	1
6	Output resistance	R_{MODiff}		32		kOhm	IF=45MHz	1
7	Output capacitance	C_{MODiff}		0.36		pF	IF=45MHz	1
8	Power gain, IF=45MHz	P_{MI}		15		db	f=0.9GHz	1

* matching network used

** referenced for specified mixer performance

1.10 Test Circuit

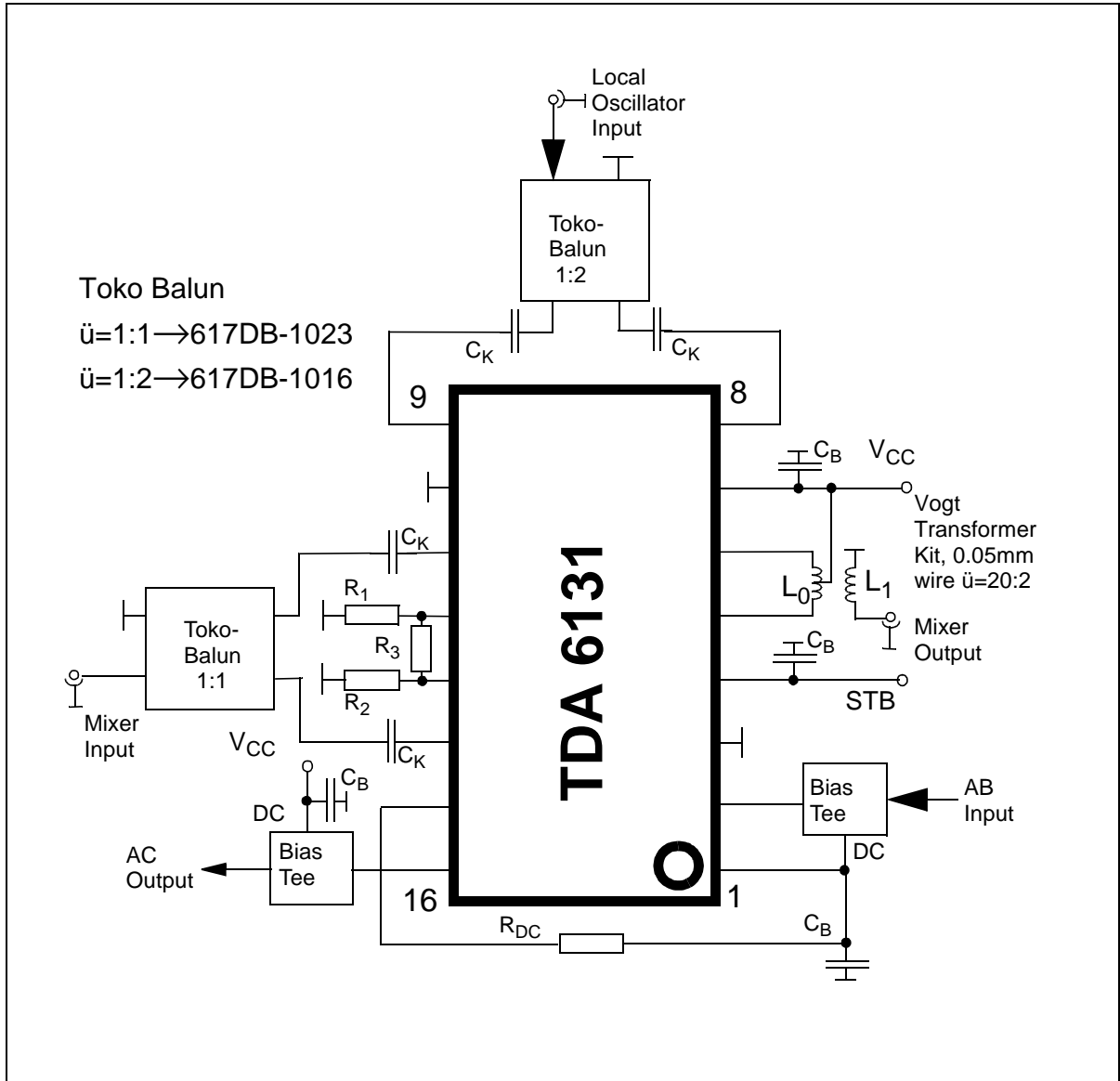
Test Circuit 1



Mixer Circuit Base Grounded,
 Amplifier With Feedback Resistor

1.11 Test Circuit

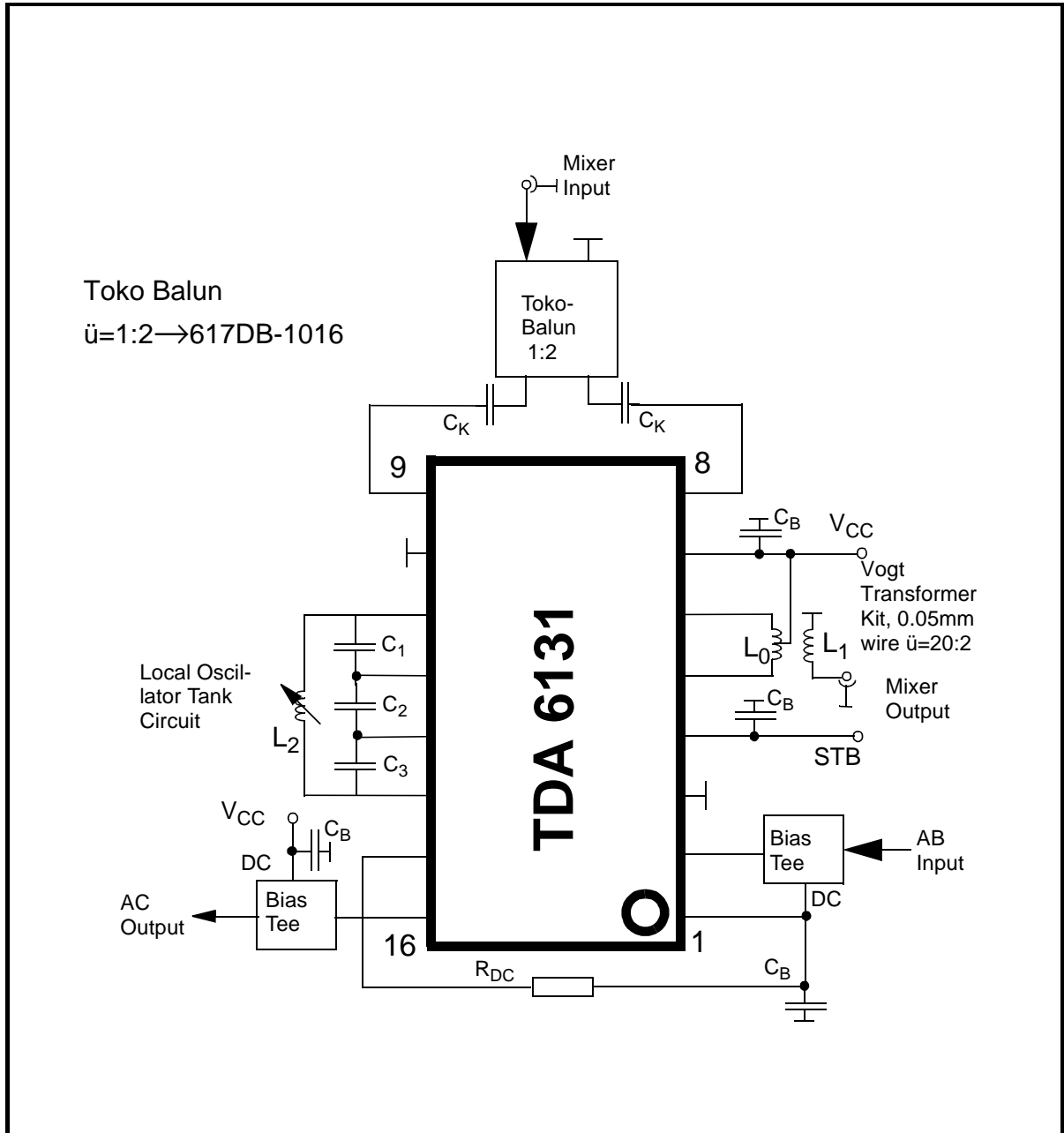
Test Circuit 2



Mixer Circuit Emitter Grounded,
 Mixer Current Increased With Resistor R_1, R_2

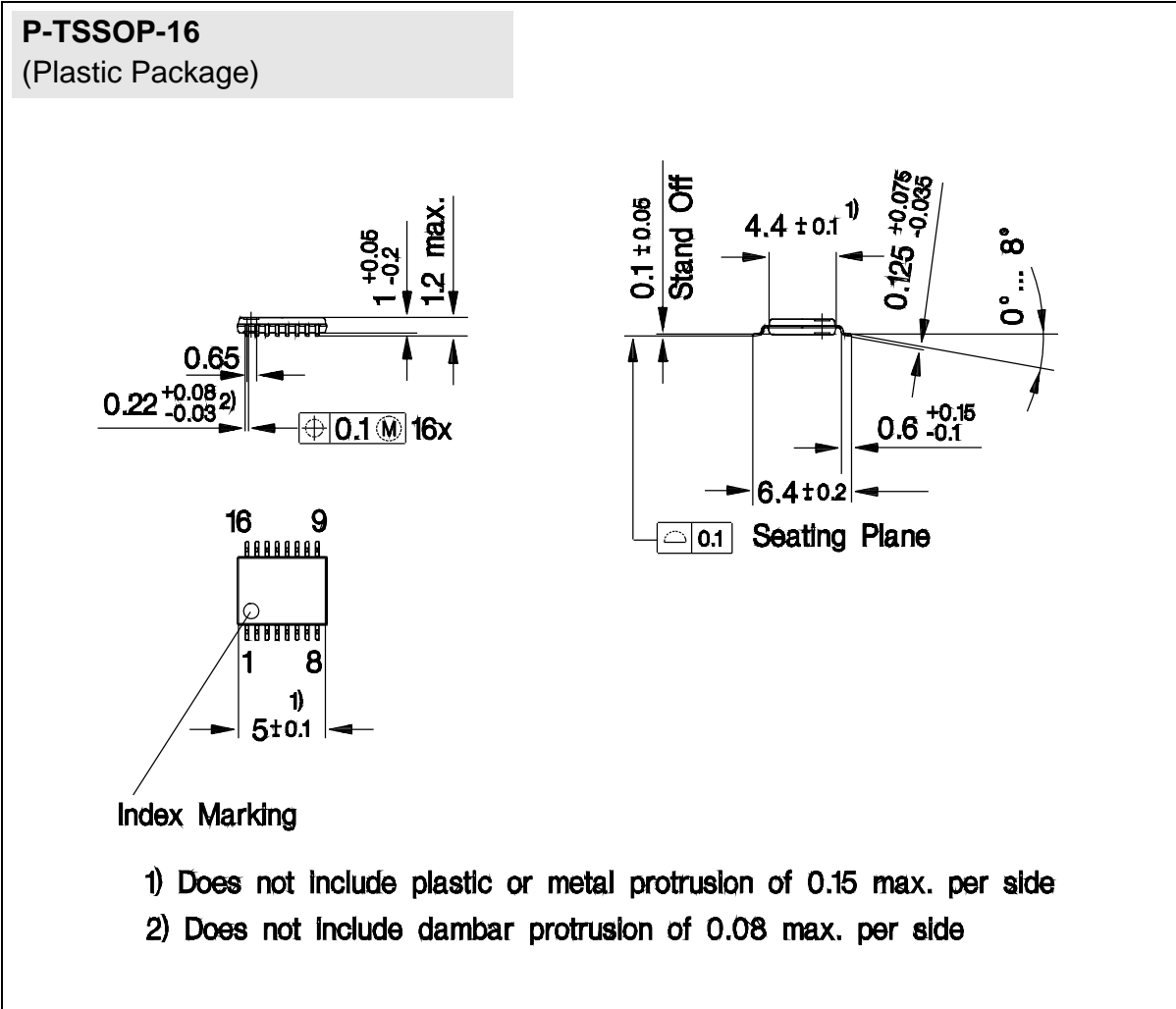
1.12 Test Circuit

Test Circuit 3



Mixer With Internal Oscillator

2 Package Outlines



Sorts of Packing

Package outlines for tubes, trays etc. are contained in our Data Book "Package Information".

SMD = Surface Mounted Device

Dimensions in mm