



Wireless Components

Mixer / Oscillator

TDA 6131 Version 1.0

Specification March 2000

preliminary

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Product Info	Product Info	Ordering code completed

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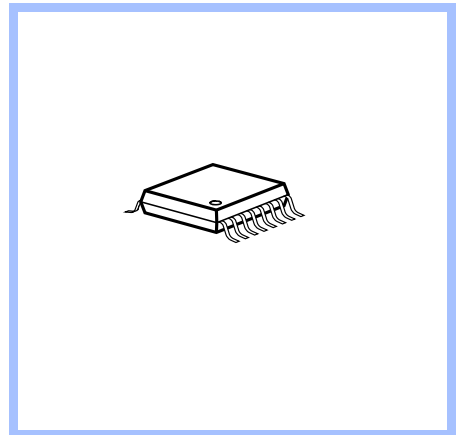
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Product Info

General Description

- 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

Package



Features

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

Application

- All wireless systems
- Various TV and SAT applications

Ordering Information

Type	Ordering Code	Package
TDA 6131XS	Q67036-A1021-A702	P-TSSOP-16

1

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2 Product Description

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2.1 Overview

- 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

2.2 Features

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 :

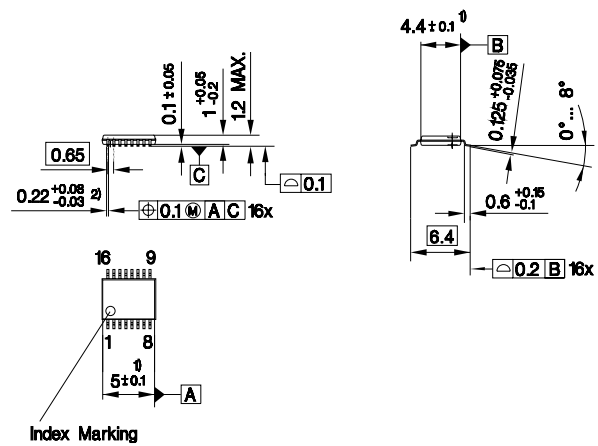
- Internal biased single transistor stage
- Multi purpose operation possible (oscillator, amplifier)
- Low noise performance
- Current adjustable

2.3 Application

- All wireless systems
- Various TV and SAT applications

2.4 Package Outlines

P-TSSOP-16



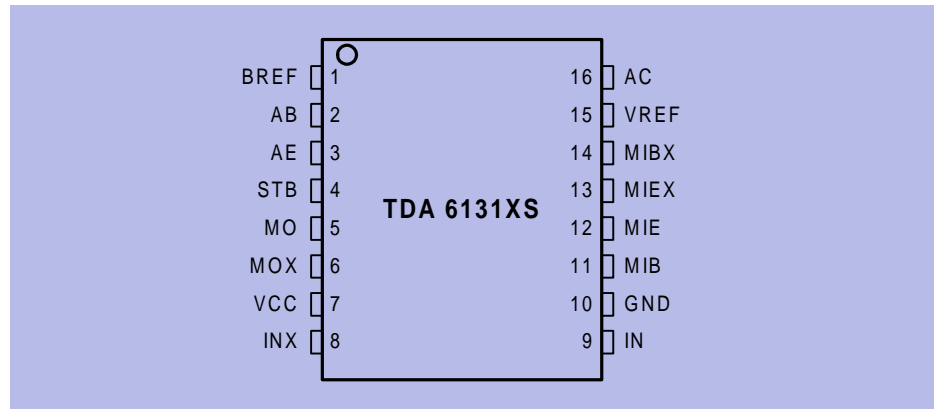
- Index Marking
- 1) Does not include plastic or metal protrusion of 0.15 max. per side
 - 2) Does not include dambar protrusion

3 Functional Description

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3.1 Pin Configuration



Pin_config.wmf

Figure 3-1 Pin Configuration

3.2 Pin Definition and Function

Table 3-1 Pin Definition and Function			
Pin No.	Symbol	Equivalent I/O-Schematic	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

3.3 Functional Block Diagram

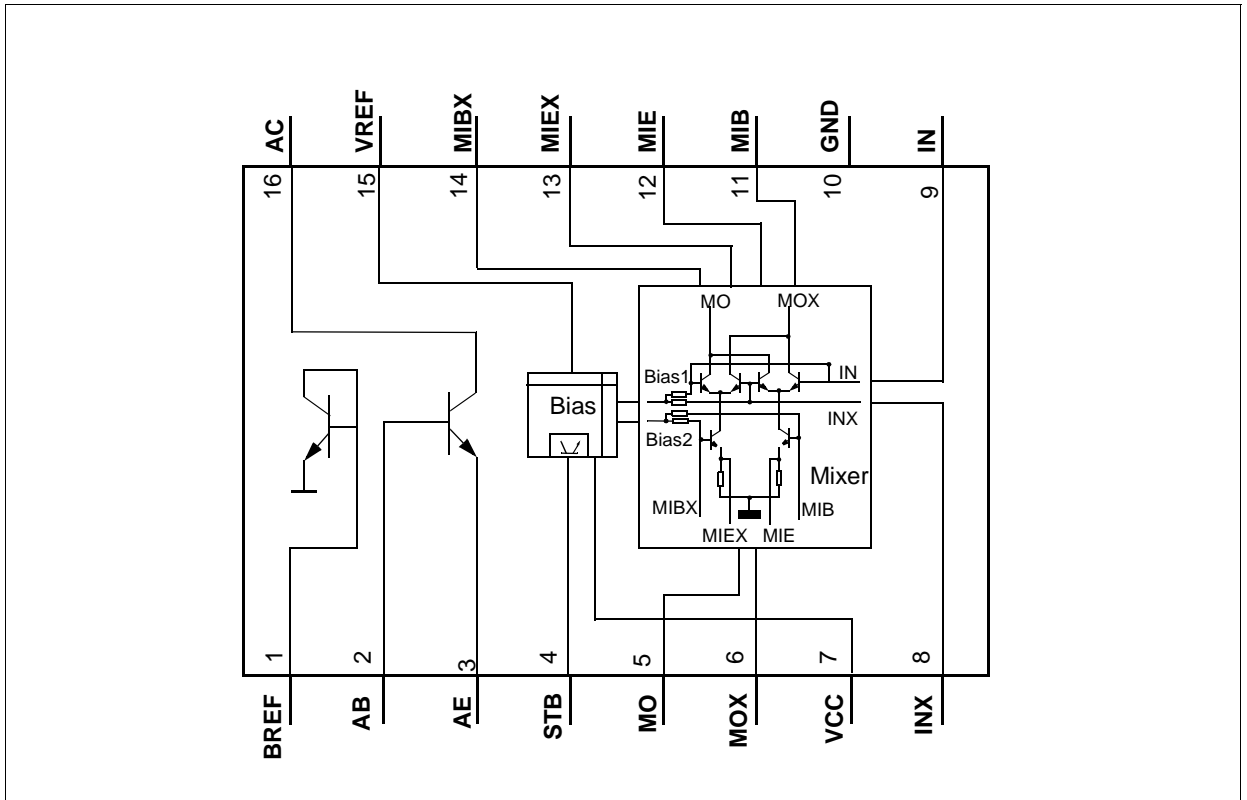


Figure 3-2 Functional Block Diagram

3.4 Circuit Description

3.4.1 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.

3.4.2 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.

3.4.3 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.

4 Applications

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4.1 Test Circuits

4.1.1 Test Circuit 1

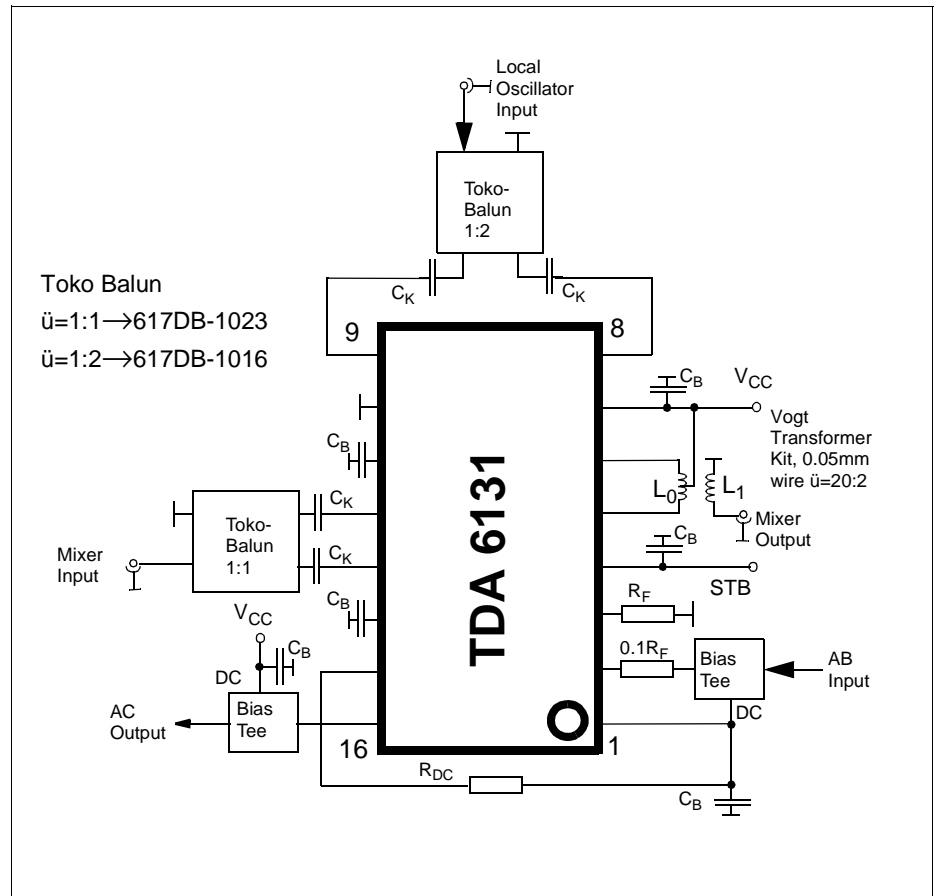


Figure 4-1 Test Circuit 1

Mixer Circuit Base Grounded,
 Amplifier With Feedback Resistor

4.1.2 Test Circuit 2

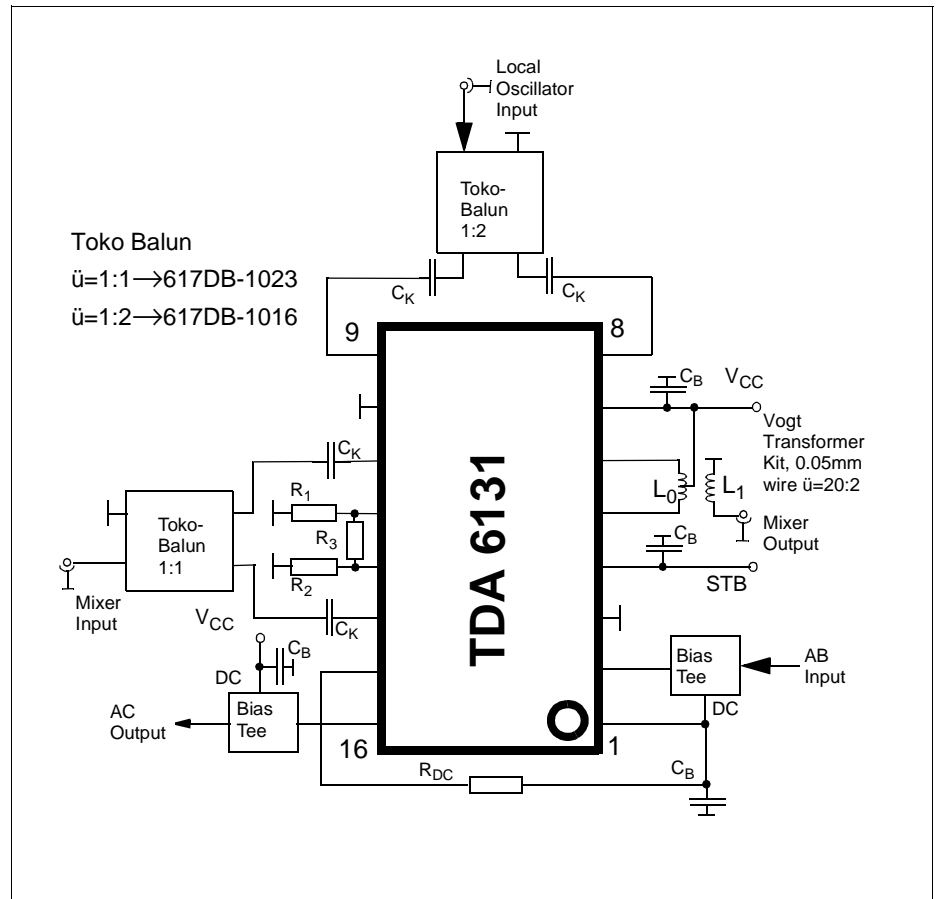


Figure 4-2 Test Circuit 2

Mixer Circuit Emitter Grounded,
Mixer Current Increased With Resistor R₁,R₂

4.1.3 Test Circuit 3

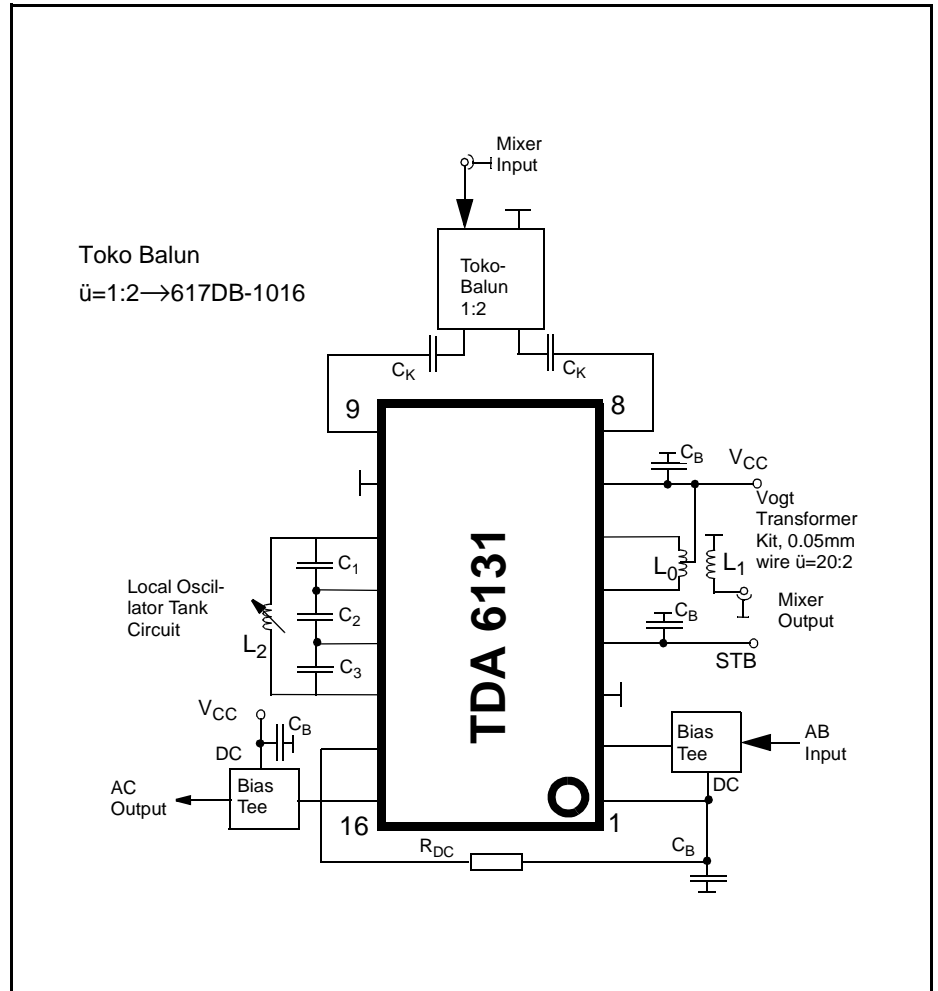


Figure 4-3 Test Circuit 3

Mixer With Internal Oscillator

4.2 Hints

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5.1 Absolute Maximum Ratings



WARNING

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

Table 5-1 Absolute Maximum Ratings, Ambient temperature $T_{AMB} = -40^{\circ}\text{C} \dots + 85^{\circ}\text{C}$

#	Parameter	Symbol	Limit Values		Unit	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_{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

5.2 Operating Range

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

Table 5-2 Operating Range

#	Parameter	Symbol	Limit Values		Unit	Test Conditions	L	Item
			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			

■ This value is only guaranteed in lab.

5.3 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.

Table 5-3 AC/DC Characteristics with T_A 25 °C, $V_{VCC} = 2.7V \dots 4.5V$

#	Parameter	Symbol	Limit Values			Unit	Test Conditions	L	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, $I_{AC}=5.5mA$
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, $I_{AC}=10mA$
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, $I_{AC}=5.5mA$
2	Supply current, total IC	$I_{4,5,6,7,16}$		<20		μA	STB OFF, $R_{DC}=820\Omega$		1

■ This value is only guaranteed in lab.

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

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

Table 5-3 AC/DC Characteristics with T_A 25 °C, $V_{CC} = 2.7V \dots 4.5V$ (continued)

#	Parameter	Symbol	Limit Values			Unit	Test Condi- tions	L	Test Circuit
			min	typ	max				
Mixer, Signal Input MIE/MIEX, Downconversion, R1,2=180 Ω									
3	Max. input level, 1db compression at MO/X, IF= 45MHz	P_{MI}		-15		dBm	f=0.9GHz	■	1
4	Input intercept point, $\Delta f=800kHz$, IF= 45MHz	$IICP3_{MI}$		0		dBm	f=0.9GHz	■	1
5	Noise figure, ssb (NFssb≈NFdsb+3dB) IF=45MHz	F_{MI}		9		dB	f=0.9GHz	■	1*
Mixer, Local Oscillator Input IN/INX, Downconversion, R1,2=180 Ω									
6	Input level	P_{LO}		-3		dBm	f=0.9GHz		1**
Mixer, Signal Output MO/MOX, Downconversion, R1,2=180 Ω									
7	Output current	I_{MO+MOX}		4.0		mA	incl. R1,R2		1
8	Output resistance	R_{MODiff}		32		k Ω	IF=45MHz	■	1
9	Output capacitance	C_{MODiff}		0.36		pF	IF=45MHz	■	1
10	Power gain, IF=45MHz	P_{MI}		15		db	f=0.9GHz	■	1

■ This value is only guaranteed in lab.

*matching network used

** referenced for specified mixer performance