



SiGe、高线性度、2000MHz至3900MHz 下变频混频器，带有LO缓冲器

MAX19996A

概述

MAX19996A单路、高线性度下变频混频器可为2000MHz至3900MHz的WCS、LTE、WiMAX™以及MMDS无线基础设施应用提供8.7dB转换增益、+24.5dBm IIP3和9.8dB噪声系数。该混频器具有2100MHz至4000MHz超宽LO频率范围，理想用于低端或高端LO注入结构，支持2.5GHz和3.5GHz应用。对于2.5GHz特定的低端LO注入应用，请参考MAX19996数据资料。

除具有优异的线性度和噪声性能外，MAX19996A还具有非常高的元件集成度。该器件包括一个双平衡无源混频器核、一个IF放大器以及一个LO缓冲器。片内集成的非平衡变压器使器件能够接收单端RF和LO输入。MAX19996A需要一个标称0dBm的LO驱动，电源电流在 $V_{CC} = 5.0V$ 时的典型值为230mA、在 $V_{CC} = 3.3V$ 时为150mA。

MAX19996A与MAX19996 2000MHz至3000MHz混频器引脚兼容，并与MAX9984/MAX9986/MAX9986A 400MHz至1000MHz混频器以及MAX9993/MAX9994/MAX9996 1700MHz至2200MHz混频器引脚相似。这使得该系列下变频混频器非常适合多个频段采用相同PCB布局的应用。

MAX19996A采用紧凑的、5mm x 5mm、20引脚、薄型QFN封装，带有裸焊盘。在-40°C至+85°C扩展级温度范围内，可保证电气性能。

应用

2.3GHz WCS基站
2.5GHz WiMAX和LTE基站
2.7GHz MMDS基站
3.5GHz WiMAX和LTE基站
固定宽带无线接入
无线本地环路
个人移动无线装置
军用系统

特性

- ◆ 2000MHz至3900MHz RF频率范围
- ◆ 2100MHz至4000MHz LO频率范围
- ◆ 50MHz至500MHz IF频率范围
- ◆ 8.7dB转换增益
- ◆ 9.8dB噪声系数
- ◆ +24.5dBm典型输入IP3
- ◆ 11dBm典型输入1dB压缩点
- ◆ $P_{RF} = -10dBm$ 时，具有67dBc的典型2LO-2RF杂散抑制
- ◆ 集成LO缓冲器
- ◆ 内部RF和LO非平衡变压器支持单端输入
- ◆ -3dBm至+3dBm的低LO驱动
- ◆ 引脚兼容于MAX19996 2000MHz至3000MHz混频器
- ◆ 引脚类似于MAX9993/MAX9994/MAX9996系列1700MHz至2200MHz混频器以及MAX9984/MAX9986/MAX9986A系列400MHz至1000MHz混频器
- ◆ 采用5.0V或3.3V单电源供电
- ◆ 外部电流设置电阻允许折中选择混频器的低功耗/高性能工作模式

订购信息

PART	TEMP RANGE	PIN-PACKAGE
MAX19996AETP+	-40°C to +85°C	20 Thin QFN-EP*
MAX19996AETP+T	-40°C to +85°C	20 Thin QFN-EP*

+表示无铅(Pb)/符合RoHS标准的封装。

*EP = 裸焊盘。

T = 卷带包装。

WiMAX是WiMAX论坛的商标。

引脚配置/功能框图在数据资料的最后给出。



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ABSOLUTE MAXIMUM RATINGS

V _{CC} to GND	-0.3V to +5.5V	θ _{JC} (Notes 1, 3)	13°C/W
IF+, IF-, LO to GND	-0.3V to (V _{CC} + 0.3V)	Operating Case Temperature	
RF, LO Input Power	+12dBm	Range (Note 4)	T _C = -40°C to +85°C
RF, LO Current (RF and LO is DC shorted to GND through a balun)	50mA	Junction Temperature	+150°C
Continuous Power Dissipation (Note 1)	5.0W	Storage Temperature Range	-65°C to +150°C
θ _{JA} (Notes 2, 3)	+38°C/W	Lead Temperature (soldering, 10s)	+300°C

Note 1: Based on junction temperature $T_J = T_C + (\theta_{JC} \times V_{CC} \times I_{CC})$. This formula can be used when the temperature of the exposed pad is known while the device is soldered down to a PCB. See the *Applications Information* section for details. The junction temperature must not exceed +150°C.

Note 2: Junction temperature $T_J = T_A + (\theta_{JA} \times V_{CC} \times I_{CC})$. This formula can be used when the ambient temperature of the PCB is known. The junction temperature must not exceed +150°C.

Note 3: Package thermal resistances were obtained using the method described in JEDEC specification JESD51-7, using a four-layer board. For detailed information on package thermal considerations, refer to www.maxim-ic.com.cn/thermal-tutorial.

Note 4: T_C is the temperature on the exposed pad of the package. T_A is the ambient temperature of the device and PCB.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

5.0V SUPPLY DC ELECTRICAL CHARACTERISTICS

(Typical Application Circuit, V_{CC} = 4.75V to 5.25V, no input AC signals. T_C = -40°C to +85°C, unless otherwise noted. Typical values are at V_{CC} = 5.0V, T_C = +25°C, all parameters are production tested.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Supply Voltage	V _{CC}		4.75	5.0	5.25	V
Supply Current	I _{CC}			230	245	mA

3.3V SUPPLY DC ELECTRICAL CHARACTERISTICS

(Typical Application Circuit, V_{CC} = 3.0V to 3.6V, no input AC signals. T_C = -40°C to +85°C, unless otherwise noted. Typical values are at V_{CC} = 3.3V, T_C = +25°C, parameters are guaranteed by design and not production tested, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Supply Voltage	V _{CC}		3.0	3.3	3.6	V
Supply Current	I _{CC}	Total supply current, V _{CC} = 3.3V		150		mA

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RECOMMENDED AC OPERATING CONDITIONS

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
RF Frequency Range	f_{RF}	Typical Application Circuit with $C1 = 8.2\text{pF}$, see Table 1 for details (Note 5)	2000		3000	MHz
		Typical Application Circuit with $C1 = 1.5\text{pF}$, see Table 1 for details (Note 5)	3000		3900	
LO Frequency	f_{LO}	(Note 5)	2100		4000	MHz
IF Frequency	f_{IF}	Using Mini-Circuits TC4-1W-17 4:1 transformer as defined in the <i>Typical Application Circuit</i> , IF matching components affect the IF frequency range (Note 5)	100		500	MHz
		Using Mini-Circuits TC4-1W-7A 4:1 transformer as defined in the <i>Typical Application Circuit</i> , IF matching components affect the IF frequency range (Note 5)	50		250	
LO Drive	P_{LO}		-3	0	+3	dBm

5.0V SUPPLY AC ELECTRICAL CHARACTERISTICS— $f_{RF} = 2300\text{MHz TO } 2900\text{MHz}$, HIGH-SIDE LO INJECTION

(Typical Application Circuit with tuning elements outlined in **Table 1**, $V_{CC} = 4.75\text{V to } 5.25\text{V}$, RF and LO ports are driven from 50Ω sources, $P_{LO} = -3\text{dBm to } +3\text{dBm}$, $P_{RF} = -5\text{dBm}$, $f_{RF} = 2300\text{MHz to } 2900\text{MHz}$, $f_{IF} = 300\text{MHz}$, $f_{LO} = 2600\text{MHz to } 3200\text{MHz}$, $f_{RF} < f_{LO}$, $T_C = -40^\circ\text{C to } +85^\circ\text{C}$. Typical values are for $T_C = +25^\circ\text{C}$, $V_{CC} = 5.0\text{V}$, $P_{LO} = 0\text{dBm}$, $f_{RF} = 2600\text{MHz}$, $f_{LO} = 2900\text{MHz}$, $f_{IF} = 300\text{MHz}$. All parameters are guaranteed by design and characterization, unless otherwise noted.) (Note 6)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Small-Signal Conversion Gain		$f_{RF} = 2300\text{MHz to } 2900\text{MHz}$, $T_C = +25^\circ\text{C}$ (Note 7)	7.9	8.7	9.2	dB
Gain Variation vs. Frequency	ΔG_C	$f_{RF} = 2305\text{MHz to } 2360\text{MHz}$		0.1		dB
		$f_{RF} = 2500\text{MHz to } 2570\text{MHz}$		0.1		
		$f_{RF} = 2570\text{MHz to } 2620\text{MHz}$		0.1		
		$f_{RF} = 2500\text{MHz to } 2690\text{MHz}$		0.2		
		$f_{RF} = 2700\text{MHz to } 2900\text{MHz}$		0.3		
Conversion Gain Temperature Coefficient	TC_{CG}	$T_C = -40^\circ\text{C to } +85^\circ\text{C}$		-0.012		dB/ $^\circ\text{C}$
Single Sideband Noise Figure	NF_{SSB}	No blockers present		9.8	12	dB
		$f_{RF} = 2600\text{MHz}$, $f_{IF} = 300\text{MHz}$, $P_{LO} = 0\text{dBm}$, $V_{CC} = +5.0\text{V}$, $T_C = +25^\circ\text{C}$, no blockers present		9.8	10.5	
Noise Figure Temperature Coefficient	TC_{NF}	$f_{RF} = 2300\text{MHz to } 2900\text{MHz}$, single sideband, no blockers present, $T_C = -40^\circ\text{C to } +85^\circ\text{C}$		0.018		dB/ $^\circ\text{C}$
Noise Figure Under Blocking	NF_B	+8dBm blocker tone applied to RF port, $f_{RF} = 2600\text{MHz}$, $f_{LO} = 2900\text{MHz}$, $f_{BLOCKER} = 2400\text{MHz}$, $P_{LO} = 0\text{dBm}$, $V_{CC} = +5.0\text{V}$, $T_C = +25^\circ\text{C}$ (Note 8)		18	22	dB

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5.0V SUPPLY AC ELECTRICAL CHARACTERISTICS— $f_{RF} = 2300\text{MHz}$ TO 2900MHz , HIGH-SIDE LO INJECTION (continued)

(Typical Application Circuit with tuning elements outlined in **Table 1**, $V_{CC} = 4.75\text{V}$ to 5.25V , RF and LO ports are driven from 50Ω sources, $P_{LO} = -3\text{dBm}$ to $+3\text{dBm}$, $P_{RF} = -5\text{dBm}$, $f_{RF} = 2300\text{MHz}$ to 2900MHz , $f_{IF} = 300\text{MHz}$, $f_{LO} = 2600\text{MHz}$ to 3200MHz , $f_{RF} < f_{LO}$, $T_C = -40^\circ\text{C}$ to $+85^\circ\text{C}$. Typical values are for $T_C = +25^\circ\text{C}$, $V_{CC} = 5.0\text{V}$, $P_{LO} = 0\text{dBm}$, $f_{RF} = 2600\text{MHz}$, $f_{LO} = 2900\text{MHz}$, $f_{IF} = 300\text{MHz}$. All parameters are guaranteed by design and characterization, unless otherwise noted.) (Note 6)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Input 1dB Compression Point	IP _{1dB}	$T_C = +25^\circ\text{C}$ (Note 9)	9.5	11		dBm
		$f_{RF} = 2600\text{MHz}$ $T_C = +25^\circ\text{C}$ (Notes 7, 9)	10	11		
Third-Order Input Intercept Point	IIP ₃	$f_{RF1} - f_{RF2} = 1\text{MHz}$, $P_{RF1} = P_{RF2} = -5\text{dBm}$, $T_C = +25^\circ\text{C}$ (Note 7)	22.5	24.5		dBm
IIP ₃ Variation with T_C		$f_{RF} = 2300\text{MHz}$ to 2900MHz , $f_{RF1} - f_{RF2} = 1\text{MHz}$, $P_{RF1} = P_{RF2} = -5\text{dBm}$, $T_C = -40^\circ\text{C}$ to $+85^\circ\text{C}$		± 0.3		dB
2LO-2RF Spur Rejection	2 x 2	$f_{SPUR} = f_{LO} - 150\text{MHz}$	$P_{RF} = -10\text{dBm}$	60	67	dBc
			$P_{RF} = -5\text{dBm}$	55	62	
3LO-3RF Spur Rejection	3 x 3	$f_{SPUR} = f_{LO} - 100\text{MHz}$	$P_{RF} = -10\text{dBm}$	75	85	dBc
			$P_{RF} = -5\text{dBm}$	65	75	
RF Input Return Loss	RL _{RF}	LO on and IF terminated into a matched impedance		17.5		dB
LO Input Return Loss	RL _{LO}	RF and IF terminated into a matched impedance		19.5		dB
IF Output Impedance	Z _{IF}	Nominal differential impedance at the IC's IF outputs		200		Ω
IF Output Return Loss	RL _{IF}	RF terminated into 50Ω , LO driven by 50Ω source, IF transformed to 50Ω using external components shown in the <i>Typical Application Circuit</i> ; see the <i>Typical Operating Characteristics</i> for performance vs. inductor values	$f_{IF} = 450\text{MHz}$, $L1 = L2 = 120\text{nH}$		25	dB
			$f_{IF} = 350\text{MHz}$, $L1 = L2 = 270\text{nH}$		25	
			$f_{IF} = 300\text{MHz}$, $L1 = L2 = 390\text{nH}$		25	
RF-to-IF Isolation		$P_{LO} = +3\text{dBm}$ (Note 7)	27	30		dB
LO Leakage at RF Port		$P_{LO} = +3\text{dBm}$		-28.6	-22.8	dBm
2LO Leakage at RF Port		$P_{LO} = +3\text{dBm}$		-29.7		dBm
LO Leakage at IF Port		$P_{LO} = +3\text{dBm}$ (Note 7)		-28.4		dBm

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3.3V SUPPLY AC ELECTRICAL CHARACTERISTICS— $f_{RF} = 2300\text{MHz}$ TO 2900MHz , HIGH-SIDE LO INJECTION

(Typical Application Circuit with tuning elements outlined in **Table 1**, RF and LO ports are driven from 50Ω sources. Typical values are for $T_C = +25^\circ\text{C}$, $V_{CC} = 3.3\text{V}$, $P_{LO} = 0\text{dBm}$, $f_{RF} = 2600\text{MHz}$, $f_{LO} = 2900\text{MHz}$, $f_{IF} = 300\text{MHz}$, unless otherwise noted.) (Note 6)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Small-Signal Conversion Gain	G_C				8.3		dB
Gain Variation vs. Frequency	ΔG_C	$f_{RF} = 2300\text{MHz}$ to 2900MHz , any 100MHz band			0.15		dB
Conversion Gain Temperature Coefficient	T_{CCG}	$T_C = -40^\circ\text{C}$ to $+85^\circ\text{C}$			-0.012		dB/ $^\circ\text{C}$
Single Sideband Noise Figure	NF_{SSB}	No blockers present			9.6		dB
Noise Figure Temperature Coefficient	T_{CNF}	Single sideband, no blockers present, $T_C = -40^\circ\text{C}$ to $+85^\circ\text{C}$			0.018		dB/ $^\circ\text{C}$
Input 1dB Compression Point	IP_{1dB}	(Note 9)			7.75		dBm
Third-Order Input Intercept Point	IIP3	$f_{RF1} = 2600\text{MHz}$, $f_{RF2} = 2601\text{MHz}$, $P_{RF1} = P_{RF2} = -5\text{dBm}$			19.7		dBm
IIP3 Variation with T_C		$f_{RF1} = 2600\text{MHz}$, $f_{RF2} = 2601\text{MHz}$, $P_{RF1} = P_{RF2} = -5\text{dBm}$, $T_C = -40^\circ\text{C}$ to $+85^\circ\text{C}$			± 0.5		dB
2LO-2RF Spur Rejection	2×2	$f_{SPUR} = f_{LO} - 150\text{MHz}$	$P_{RF} = -10\text{dBm}$		64		dBc
			$P_{RF} = -5\text{dBm}$		59		
3LO-3RF Spur Rejection	3×3	$f_{SPUR} = f_{LO} - 100\text{MHz}$	$P_{RF} = -10\text{dBm}$		74		dBc
			$P_{RF} = -5\text{dBm}$		64		
RF Input Return Loss	RL_{RF}	LO on and IF terminated into a matched impedance			17.5		dB
LO Input Return Loss	RL_{LO}	RF and IF terminated into a matched impedance			19.5		dB
IF Output Impedance	Z_{IF}	Nominal differential impedance at the IC's IF outputs			200		Ω
IF Output Return Loss	RL_{IF}	RF terminated into 50Ω , LO driven by 50Ω source, IF transformed to 50Ω using external components shown in the <i>Typical Application Circuit</i> ; see the <i>Typical Operating Characteristics</i> for performance vs. inductor values	$f_{IF} = 450\text{MHz}$, $L1 = L2 = 120\text{nH}$		25		dB
			$f_{IF} = 350\text{MHz}$, $L1 = L2 = 270\text{nH}$		25		
			$f_{IF} = 300\text{MHz}$, $L1 = L2 = 390\text{nH}$		25		
RF-to-IF Isolation		$f_{RF} = 2300\text{MHz}$ to 2900MHz , $P_{LO} = +3\text{dBm}$			38		dB
LO Leakage at RF Port		$f_{LO} = 2600\text{MHz}$ to 3200MHz , $P_{LO} = +3\text{dBm}$			-30		dBm
2LO Leakage at RF Port		$f_{LO} = 2600\text{MHz}$ to 3200MHz , $P_{LO} = +3\text{dBm}$			-31		dBm
LO Leakage at IF Port		$f_{LO} = 2600\text{MHz}$ to 3200MHz , $P_{LO} = +3\text{dBm}$			-34		dBm

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5.0V SUPPLY AC ELECTRICAL CHARACTERISTICS— $f_{RF} = 2300\text{MHz}$ TO 2900MHz , LOW-SIDE LO INJECTION

(Typical Application Circuit with tuning elements outlined in **Table 1**, $V_{CC} = 4.75\text{V}$ to 5.25V , RF and LO ports are driven from 50Ω sources. $P_{LO} = -3\text{dBm}$ to $+3\text{dBm}$, $P_{RF} = -5\text{dBm}$, $f_{RF} = 2300\text{MHz}$ to 2900MHz , $f_{IF} = 300\text{MHz}$, $f_{LO} = 2000\text{MHz}$ to 2600MHz , $f_{RF} > f_{LO}$, $T_C = -40^\circ\text{C}$ to $+85^\circ\text{C}$. Typical values are for $T_C = +25^\circ\text{C}$, $V_{CC} = 5.0\text{V}$, $P_{LO} = 0\text{dBm}$, $f_{RF} = 2600\text{MHz}$, $f_{LO} = 2300\text{MHz}$, $f_{IF} = 300\text{MHz}$, all parameters are guaranteed by design and characterization, unless otherwise noted.) (Note 6)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Small-Signal Conversion Gain	G_C	$f_{RF} = 2300\text{MHz}$ to 2900MHz , $T_C = +25^\circ\text{C}$ (Note 7)	8.2	8.9	9.5	dB
Gain Variation vs. Frequency	ΔG_C	$f_{RF} = 2300\text{MHz}$ to 2900MHz , any 100MHz band		0.1		dB
Conversion Gain Temperature Coefficient	T_{CCG}	$T_C = -40^\circ\text{C}$ to $+85^\circ\text{C}$		-0.012		dB/ $^\circ\text{C}$
Single Sideband Noise Figure	NF_{SSB}	No blockers present		9.5	12.5	dB
		$f_{RF} = 2600\text{MHz}$, $f_{IF} = 300\text{MHz}$, $P_{LO} = 0\text{dBm}$, $V_{CC} = +5.0\text{V}$, $T_C = +25^\circ\text{C}$, no blockers present		9.5	10.5	
Noise Figure Temperature Coefficient	T_{CNF}	Single sideband, no blockers present, $T_C = -40^\circ\text{C}$ to $+85^\circ\text{C}$		0.018		dB/ $^\circ\text{C}$
Input 1dB Compression Point	IP_{1dB}	$T_C = +25^\circ\text{C}$ (Note 9)	9.5	10.7		dBm
Third-Order Input Intercept Point	$IIP3$	$f_{RF1} - f_{RF2} = 1\text{MHz}$, $P_{RF1} = P_{RF2} = -5\text{dBm}$, $T_C = +25^\circ\text{C}$ (Note 7)	22	24.05		dBm
IIP3 Variation with T_C		$f_{RF} = 2300\text{MHz}$ to 2900MHz , $P_{RF1} = P_{RF2} = -5\text{dBm}$, $T_C = -40^\circ\text{C}$ to $+85^\circ\text{C}$		± 0.5		dB
2RF-2LO Spur Rejection	2×2	$f_{SPUR} = f_{LO} + 150\text{MHz}$	$P_{RF} = -10\text{dBm}$	63	68	dBc
			$P_{RF} = -5\text{dBm}$	58	63	
3RF-3LO Spur Rejection	3×3	$f_{SPUR} = f_{LO} + 100\text{MHz}$	$P_{RF} = -10\text{dBm}$	79	84	dBc
			$P_{RF} = -5\text{dBm}$	69	74	
RF Input Return Loss	RL_{RF}	LO on and IF terminated into a matched impedance		19		dB
LO Input Return Loss	RL_{LO}	RF and IF terminated into a matched impedance		18		dB
IF Output Impedance	Z_{IF}	Nominal differential impedance at the IC's IF outputs		200		Ω
IF Output Return Loss	RL_{IF}	RF terminated into 50Ω , LO driven by 50Ω source, IF transformed to 50Ω using external components shown in the <i>Typical Application Circuit</i> ; see the <i>Typical Operating Characteristics</i> for performance vs. inductor values	$f_{IF} = 450\text{MHz}$, $L1 = L2 = 120\text{nH}$		25	dB
			$f_{IF} = 350\text{MHz}$, $L1 = L2 = 270\text{nH}$		25	
			$f_{IF} = 300\text{MHz}$, $L1 = L2 = 390\text{nH}$		25	
RF-to-IF Isolation		$f_{RF} = 2600\text{MHz}$, $P_{LO} = +3\text{dBm}$	29	36		dB
LO Leakage at RF Port		$f_{LO} = 1800\text{MHz}$ to 2900MHz , $P_{LO} = +3\text{dBm}$		-28	-20	dBm
2LO Leakage at RF Port		$f_{LO} = 1800\text{MHz}$ to 2900MHz , $P_{LO} = +3\text{dBm}$		-29	-19	dBm
LO Leakage at IF Port		$f_{LO} = 1800\text{MHz}$ to 2900MHz , $P_{LO} = +3\text{dBm}$		-24		dBm

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5.0V SUPPLY AC ELECTRICAL CHARACTERISTICS— $f_{RF} = 3100\text{MHz}$ TO 3900MHz , LOW-SIDE LO INJECTION

(Typical Application Circuit with tuning elements outlined in **Table 1**, $V_{CC} = 4.75\text{V}$ to 5.25V , RF and LO ports are driven from 50Ω sources, $P_{LO} = -3\text{dBm}$ to $+3\text{dBm}$, $P_{RF} = -5\text{dBm}$, $f_{RF} = 3100\text{MHz}$ to 3900MHz , $f_{IF} = 300\text{MHz}$, $f_{LO} = 2800\text{MHz}$ to 3600MHz , $f_{RF} > f_{LO}$, $T_C = -40^\circ\text{C}$ to $+85^\circ\text{C}$. Typical values are for $T_C = +25^\circ\text{C}$, $V_{CC} = 5.0\text{V}$, $P_{LO} = 0\text{dBm}$, $f_{RF} = 3500\text{MHz}$, $f_{LO} = 3200\text{MHz}$, $f_{IF} = 300\text{MHz}$. All parameters are guaranteed by design and characterization, unless otherwise noted.) (Note 6)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Small-Signal Conversion Gain	G_C	$T_C = +25^\circ\text{C}$ (Note 7)	7.5	8.0	8.5	dB
Gain Variation vs. Frequency	ΔG_C	$f_{RF} = 3450\text{MHz}$ to 3750MHz , any 100MHz band	0.15			dB
		$f_{RF} = 3450\text{MHz}$ to 3750MHz , any 200MHz band	0.3			
Conversion Gain Temperature Coefficient	T_{CCG}	$T_C = -40^\circ\text{C}$ to $+85^\circ\text{C}$	-0.012			dB/ $^\circ\text{C}$
Single Sideband Noise Figure	NF_{SSB}	No blockers present	10.5	13.5		dB
		$f_{RF} = 3500\text{MHz}$, $f_{IF} = 300\text{MHz}$, $P_{LO} = 0\text{dBm}$, $V_{CC} = +5.0\text{V}$, $T_C = +25^\circ\text{C}$, no blockers present	10.5	11.6		
Noise Figure Temperature Coefficient	T_{CNF}	$f_{RF} = 3100\text{MHz}$ to 3900MHz , single sideband, no blockers present, $T_C = -40^\circ\text{C}$ to $+85^\circ\text{C}$	0.018			dB/ $^\circ\text{C}$
Noise Figure Under Blocking	NF_B	+8dBm blocker tone applied to RF port, $f_{RF} = 3500\text{MHz}$, $f_{LO} = 3200\text{MHz}$, $f_{BLOCKER} = 3750\text{MHz}$, $P_{LO} = 0\text{dBm}$, $V_{CC} = +5.0\text{V}$, $T_C = +25^\circ\text{C}$ (Note 8)	18.7	21		dB
Input 1dB Compression Point	IP_{1dB}	$f_{RF} = 3500\text{MHz}$ (Note 9)	10	12		dBm
Third-Order Input Intercept Point	$IIP3$	$f_{RF1} - f_{RF2} = 1\text{MHz}$, $P_{RF1} = P_{RF2} = -5\text{dBm}$ (Note 7)	23	25		dBm
IIP3 Variation with T_C		$f_{RF} = 3100\text{MHz}$ to 3900MHz , $f_{IF} = 300\text{MHz}$, $f_{RF1} - f_{RF2} = 1\text{MHz}$, $P_{RF1} = P_{RF2} = -5\text{dBm}$, $T_C = -40^\circ\text{C}$ to $+85^\circ\text{C}$	± 0.3			dB
2RF-2LO Spur Rejection	2×2	$f_{SPUR} = f_{LO} + 150\text{MHz}$	$P_{RF} = -10\text{dBm}$	60	69	dBc
			$P_{RF} = -5\text{dBm}$	55	64	
3RF-3LO Spur Rejection	3×3	$f_{SPUR} = f_{LO} + 100\text{MHz}$	$P_{RF} = -10\text{dBm}$	78	86	dBc
			$P_{RF} = -5\text{dBm}$	68	76	
RF Input Return Loss	RL_{RF}	LO on and IF terminated into a matched impedance	20			dB
LO Input Return Loss	RL_{LO}	RF and IF terminated into a matched impedance	16.5			dB
IF Output Impedance	Z_{IF}	Nominal differential impedance at the IC's IF outputs	200			Ω

SiGe、高线性度、2000MHz至3900MHz 下变频混频器，带有LO缓冲器

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5.0V SUPPLY AC ELECTRICAL CHARACTERISTICS— $f_{RF} = 3100\text{MHz TO } 3900\text{MHz}$, LOW-SIDE LO INJECTION (continued)

(Typical Application Circuit with tuning elements outlined in **Table 1**, $V_{CC} = 4.75\text{V to } 5.25\text{V}$, RF and LO ports are driven from 50Ω sources, $P_{LO} = -3\text{dBm to } +3\text{dBm}$, $P_{RF} = -5\text{dBm}$, $f_{RF} = 3100\text{MHz to } 3900\text{MHz}$, $f_{IF} = 300\text{MHz}$, $f_{LO} = 2800\text{MHz to } 3600\text{MHz}$, $f_{RF} > f_{LO}$, $T_C = -40^\circ\text{C to } +85^\circ\text{C}$. Typical values are for $T_C = +25^\circ\text{C}$, $V_{CC} = 5.0\text{V}$, $P_{LO} = 0\text{dBm}$, $f_{RF} = 3500\text{MHz}$, $f_{LO} = 3200\text{MHz}$, $f_{IF} = 300\text{MHz}$. All parameters are guaranteed by design and characterization, unless otherwise noted.) (Note 6)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
IF Output Return Loss	RL_{IF}	RF terminated into 50Ω , LO driven by 50Ω source, IF transformed to 50Ω using external components shown in the <i>Typical Application Circuit</i> ; see the <i>Typical Operating Characteristics</i> for performance vs. inductor values		25		dB
		$f_{IF} = 450\text{MHz}$, $L1 = L2 = 120\text{nH}$				
		$f_{IF} = 350\text{MHz}$, $L1 = L2 = 270\text{nH}$				
		$f_{IF} = 300\text{MHz}$, $L1 = L2 = 390\text{nH}$		25		
RF-to-IF Isolation		$f_{RF} = 2600\text{MHz}$ $P_{LO} = +3\text{dBm}$ (Note 7)	23	27		dB
LO Leakage at RF Port		$f_{LO} = 2800\text{MHz to } 3600\text{MHz}$ $P_{LO} = +3\text{dBm}$		-31	-20	dBm
2LO Leakage at RF Port		$P_{LO} = +3\text{dBm}$		-27		dBm
LO Leakage at IF Port		$P_{LO} = +3\text{dBm}$ (Note 7)		-29.5	-20	dBm

+5.0V SUPPLY AC ELECTRICAL CHARACTERISTICS— $f_{RF} = 3100\text{MHz TO } 3900\text{MHz}$, HIGH-SIDE LO INJECTION

(Typical Application Circuit with tuning elements outlined in **Table 1**, $V_{CC} = 4.75\text{V to } 5.25\text{V}$, RF and LO ports are driven from 50Ω sources, Typical values are for $T_C = +25^\circ\text{C}$, $V_{CC} = 5.0\text{V}$, $P_{LO} = 0\text{dBm}$, $f_{RF} = 3500\text{MHz}$, $f_{LO} = 3800\text{MHz}$, $f_{IF} = 300\text{MHz}$. Parameters are guaranteed by design and not production tested.) (Note 6)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Small-Signal Conversion Gain	G_C			7.6		dB
Gain Variation vs. Frequency	ΔG_C	$f_{RF} = 3450\text{MHz to } 3750\text{MHz}$, any 100MHz band		0.15		dB
		$f_{RF} = 3450\text{MHz to } 3750\text{MHz}$, any 200MHz band		0.3		
Conversion Gain Temperature Coefficient	TC_{CG}	$T_C = -40^\circ\text{C to } +85^\circ\text{C}$		-0.012		dB/ $^\circ\text{C}$
Single Sideband Noise Figure	NF_{SSB}	No blockers present		10.9		dB
Noise Figure Temperature Coefficient	TC_{NF}	Single sideband, no blockers present, $T_C = -40^\circ\text{C to } +85^\circ\text{C}$		0.018		dB/ $^\circ\text{C}$
Input 1dB Compression Point	IP_{1dB}	(Note 9)		12.4		dBm
Third-Order Input Intercept Point	$IIP3$	$f_{RF1} = 3500\text{MHz}$, $f_{RF2} = 3501\text{MHz}$, $P_{RF1} = P_{RF2} = -5\text{dBm}$		24.7		dBm
IIP3 Variation with T_C		$f_{RF1} = 3500\text{MHz}$, $f_{RF2} = 3501\text{MHz}$, $P_{RF1} = P_{RF2} = -5\text{dBm}$, $T_C = -40^\circ\text{C to } +85^\circ\text{C}$		± 0.5		dB
2LO-2RF Spur Rejection	2 x 2	$f_{SPUR} = f_{LO} - 150\text{MHz}$	$P_{RF} = -10\text{dBm}$	69		dBc
			$P_{RF} = -5\text{dBm}$	64		

SiGe、高线性度、2000MHz至3900MHz 下变频混频器，带有LO缓冲器

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+5.0V SUPPLY AC ELECTRICAL CHARACTERISTICS— $f_{RF} = 3100\text{MHz}$ TO 3900MHz , HIGH-SIDE LO INJECTION (continued)

(Typical Application Circuit with tuning elements outlined in **Table 1**, $V_{CC} = 4.75\text{V}$ to 5.25V , RF and LO ports are driven from 50Ω sources, Typical values are for $T_C = +25^\circ\text{C}$, $V_{CC} = 5.0\text{V}$, $P_{LO} = 0\text{dBm}$, $f_{RF} = 3500\text{MHz}$, $f_{LO} = 3800\text{MHz}$, $f_{IF} = 300\text{MHz}$. Parameters are guaranteed by design and not production tested.) (Note 6)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
3LO-3RF Spur Rejection	3 x 3	$f_{SPUR} = f_{LO} - 100\text{MHz}$	$P_{RF} = -10\text{dBm}$		90		dBc
			$P_{RF} = -5\text{dBm}$		80		
RF Input Return Loss	RL_{RF}	LO on and IF terminated into a matched impedance			22		dB
LO Input Return Loss	RL_{LO}	RF and IF terminated into a matched impedance			16.3		dB
IF Output Impedance	Z_{IF}	Nominal differential impedance at the IC's IF outputs			200		Ω
IF Output Return Loss	RL_{IF}	RF terminated into 50Ω , LO driven by 50Ω source, IF transformed to 50Ω using external components shown in the <i>Typical Application Circuit</i> ; see the <i>Typical Operating Characteristics</i> for performance vs. inductor values	$f_{IF} = 450\text{MHz}$, $L1 = L2 = 120\text{nH}$		25		dB
			$f_{IF} = 350\text{MHz}$, $L1 = L2 = 270\text{nH}$		25		
			$f_{IF} = 300\text{MHz}$, $L1 = L2 = 390\text{nH}$		25		
RF-to-IF Isolation		$f_{RF} = 3100\text{MHz}$ to 3700MHz , $P_{LO} = +3\text{dBm}$			26.6		dB
LO Leakage at RF Port		$f_{LO} = 3400\text{MHz}$ to 4000MHz , $P_{LO} = +3\text{dBm}$			-38		dBm
2LO Leakage at RF Port		$f_{LO} = 3400\text{MHz}$ to 4000MHz , $P_{LO} = +3\text{dBm}$			-13.5		dBm
LO Leakage at IF Port		$f_{LO} = 3400\text{MHz}$ to 4000MHz , $P_{LO} = +3\text{dBm}$			-27		dBm

Note 5: Not production tested. Operation outside this range is possible, but with degraded performance of some parameters. See the *Typical Operating Characteristics*.

Note 6: All limits reflect losses of external components, including a 0.8dB loss at $f_{IF} = 300\text{MHz}$ due to the 4:1 impedance transformer. Output measurements were taken at IF outputs of the *Typical Application Circuit*.

Note 7: 100% production tested for functional performance.

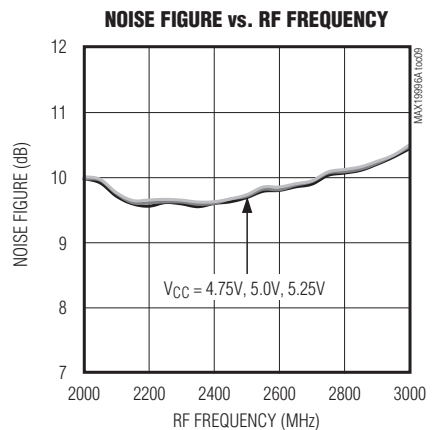
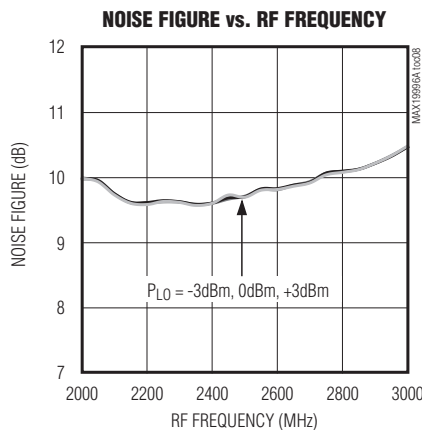
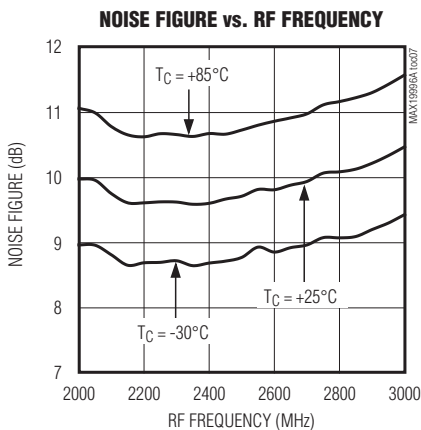
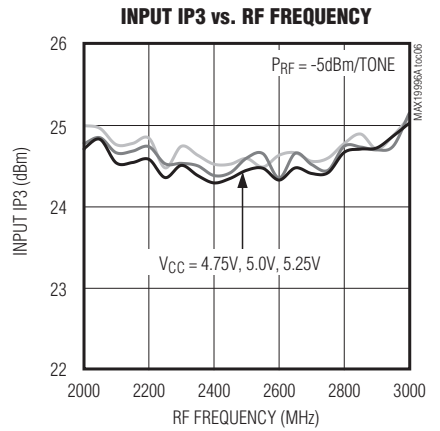
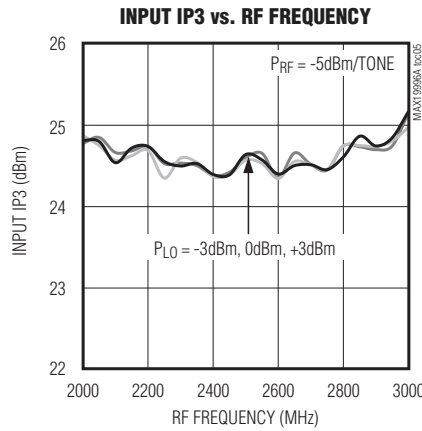
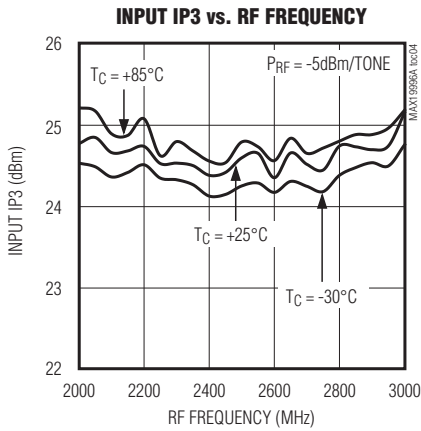
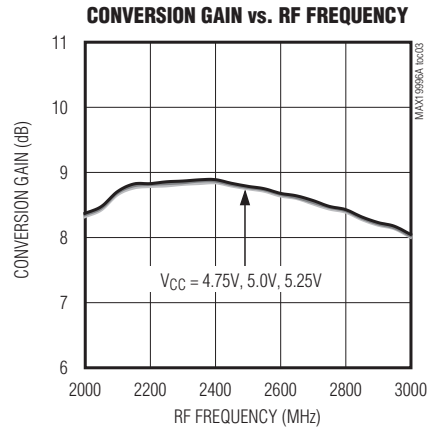
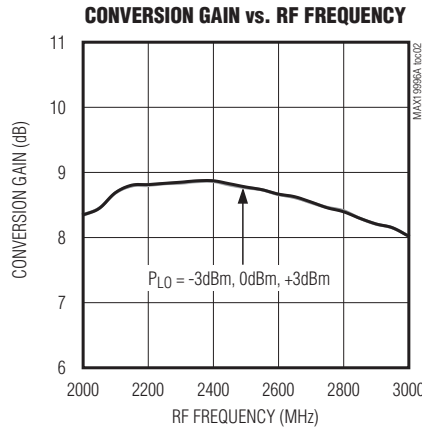
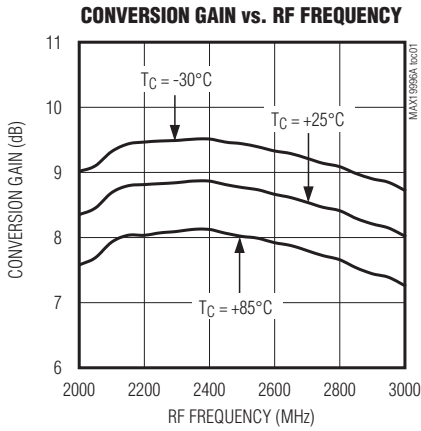
Note 8: Measured with external LO source noise filtered so that the noise floor is -174dBm/Hz . This specification reflects the effects of all SNR degradations in the mixer including the LO noise, as defined in Application Note 2021: *Specifications and Measurement of Local Oscillator Noise in Integrated Circuit Base Station Mixers*.

Note 9: Maximum reliable continuous input power applied to the RF port of this device is $+12\text{dBm}$ from a 50Ω source.

SiGe、高线性度、2000MHz至3900MHz 下变频混频器，带有LO缓冲器

典型工作特性

(Typical Application Circuit with tuning elements outlined in Table 1, $V_{CC} = 5.0V$, $f_{RF} = 2000MHz$ to $3000MHz$, LO is high-side injected for a 300MHz IF, $P_{RF} = -5dBm$, $P_{LO} = 0dBm$, $T_C = +25^\circ C$, unless otherwise noted.)

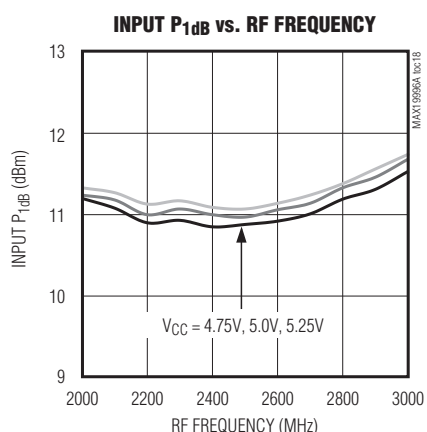
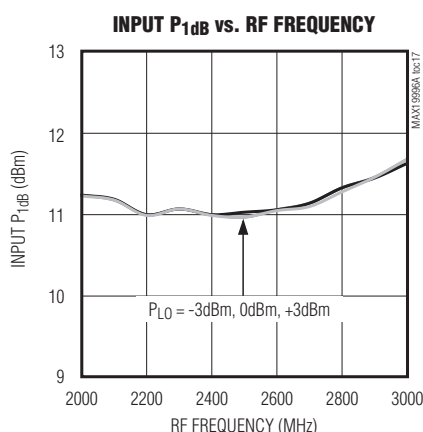
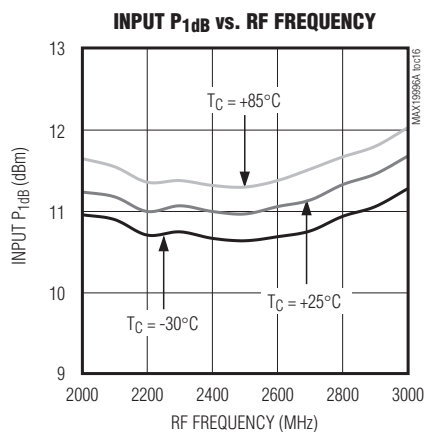
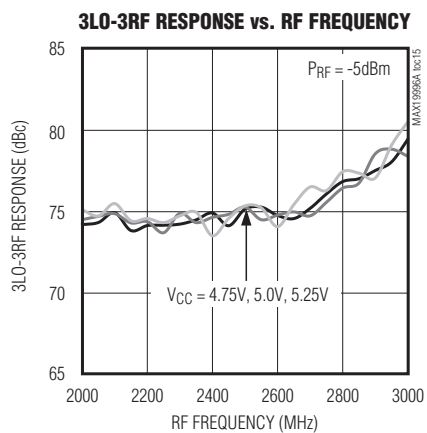
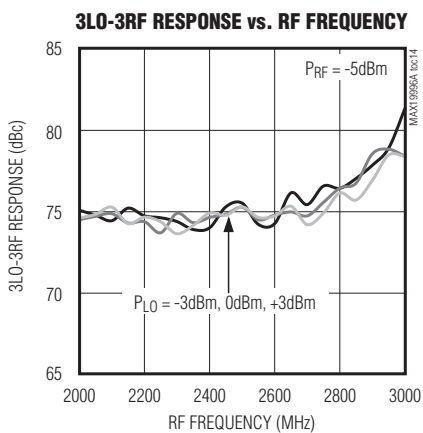
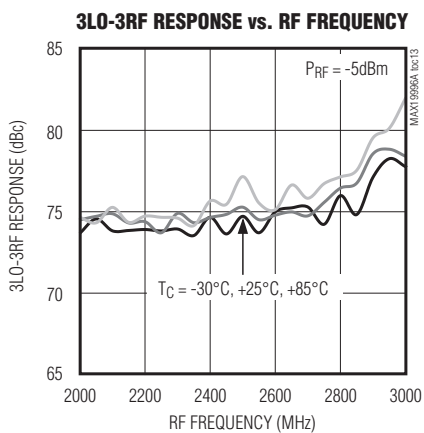
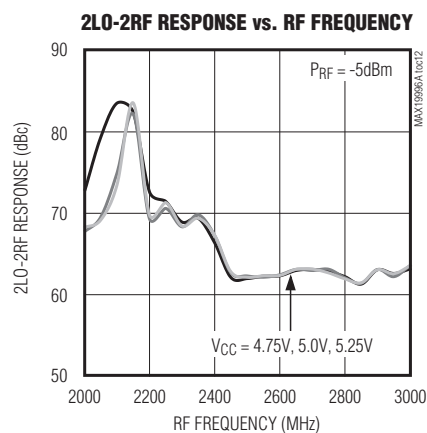
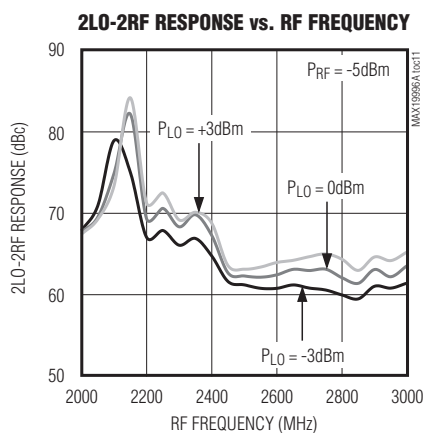
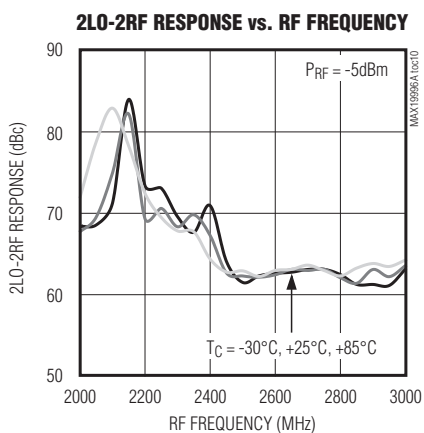


SiGe、高线性度、2000MHz至3900MHz 下变频混频器，带有LO缓冲器

典型工作特性(续)

(Typical Application Circuit with tuning elements outlined in Table 1, $V_{CC} = 5.0V$, $f_{RF} = 2000MHz$ to $3000MHz$, LO is high-side injected for a 300MHz IF, $P_{RF} = -5dBm$, $P_{LO} = 0dBm$, $T_C = +25^{\circ}C$, unless otherwise noted.)

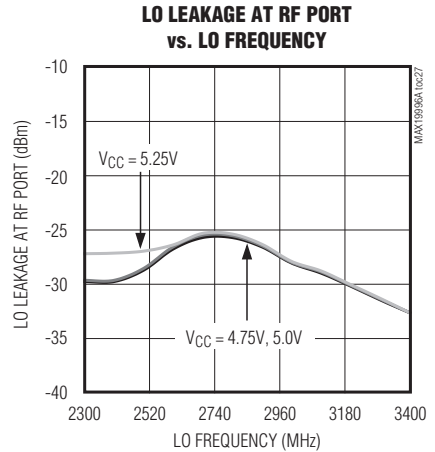
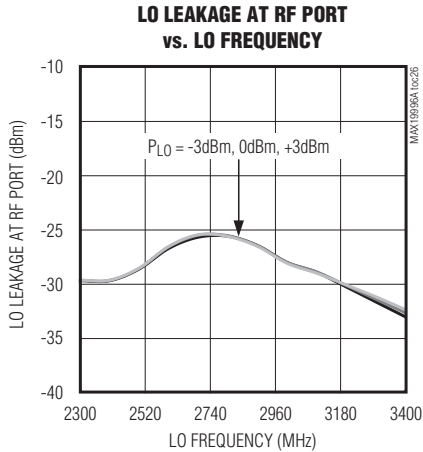
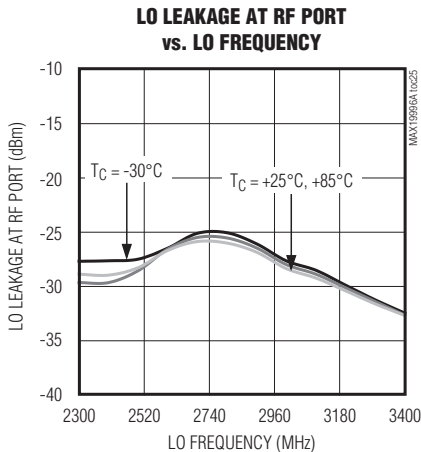
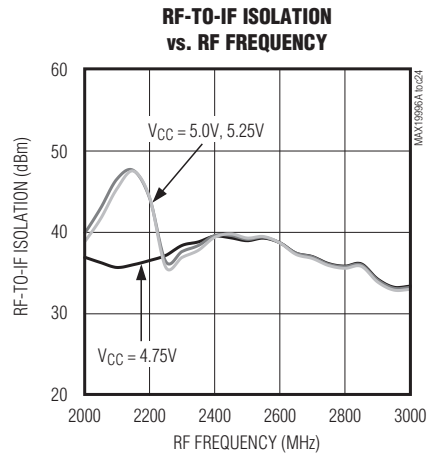
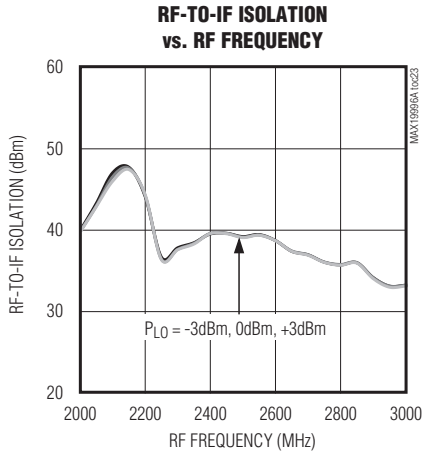
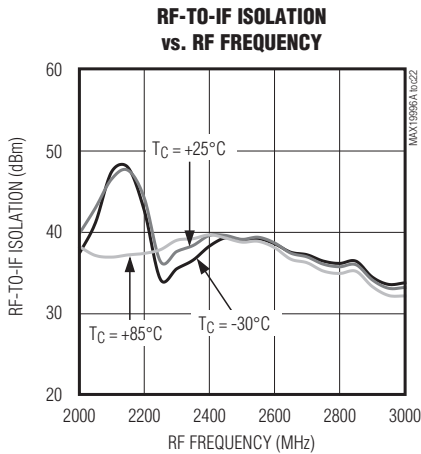
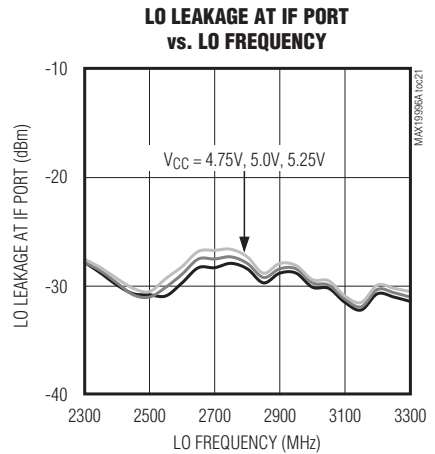
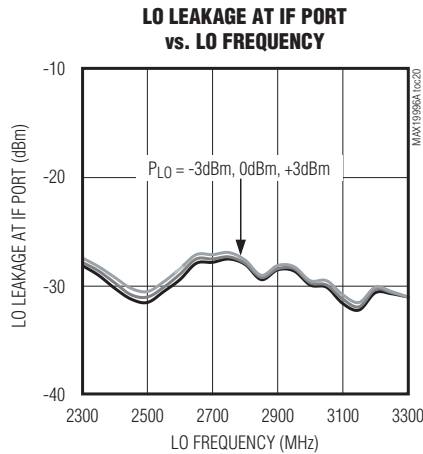
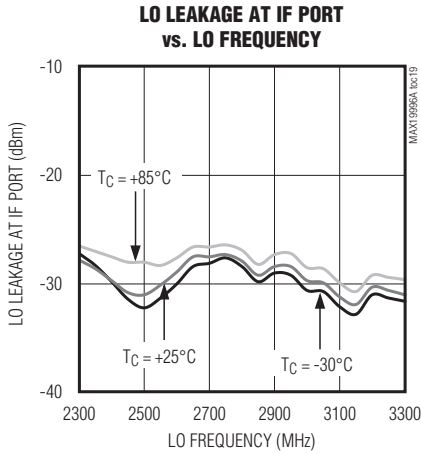
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SiGe、高线性度、2000MHz至3900MHz 下变频混频器，带有LO缓冲器

典型工作特性(续)

(Typical Application Circuit with tuning elements outlined in Table 1, $V_{CC} = 5.0V$, $f_{RF} = 2000MHz$ to $3000MHz$, LO is high-side injected for a 300MHz IF, $P_{RF} = -5dBm$, $P_{LO} = 0dBm$, $T_C = +25^\circ C$, unless otherwise noted.)

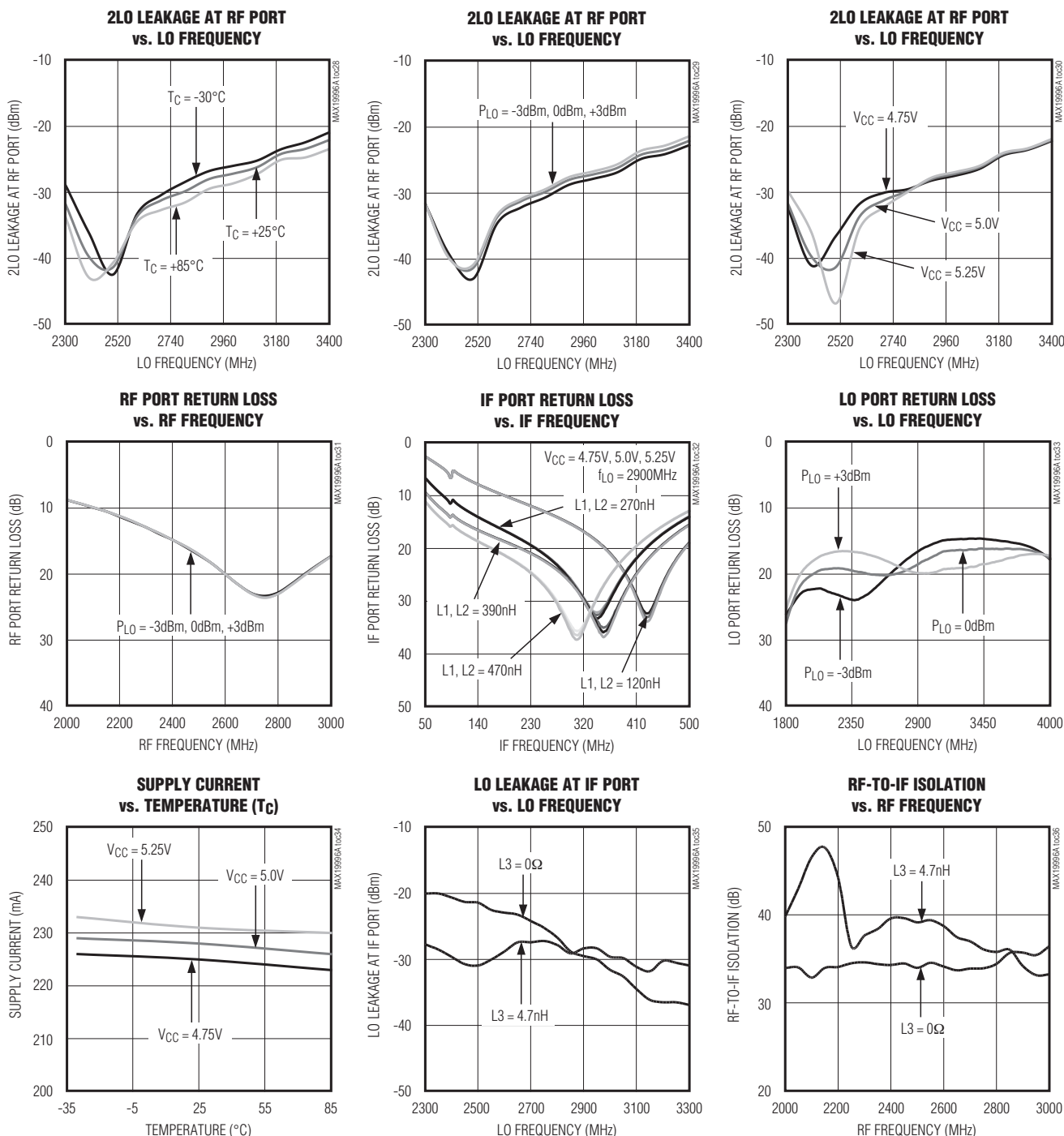


SiGe、高线性度、2000MHz至3900MHz 下变频混频器，带有LO缓冲器

典型工作特性(续)

(Typical Application Circuit with tuning elements outlined in Table 1, $V_{CC} = 5.0V$, $f_{RF} = 2000MHz$ to $3000MHz$, LO is high-side injected for a 300MHz IF, $P_{RF} = -5dBm$, $P_{LO} = 0dBm$, $T_C = +25^\circ C$, unless otherwise noted.)

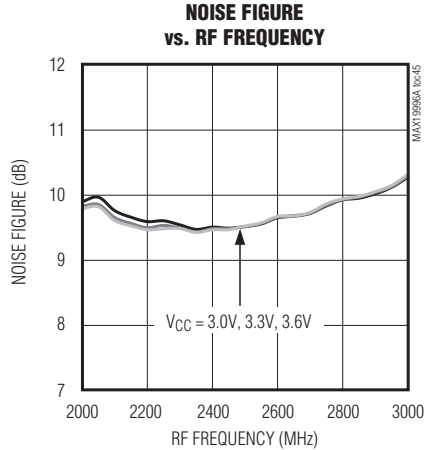
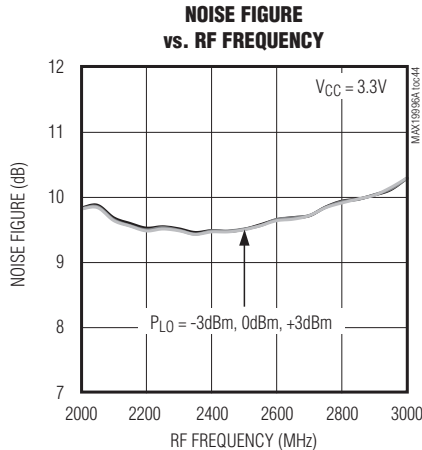
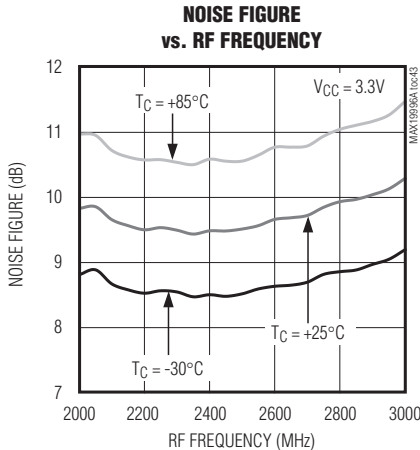
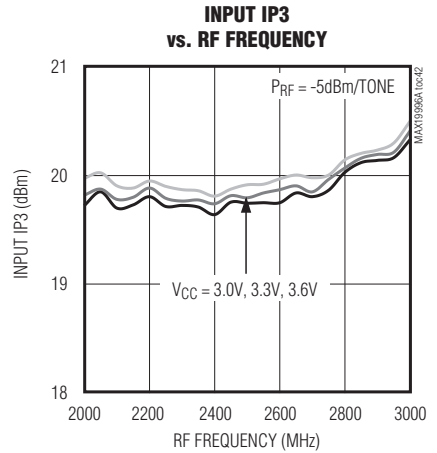
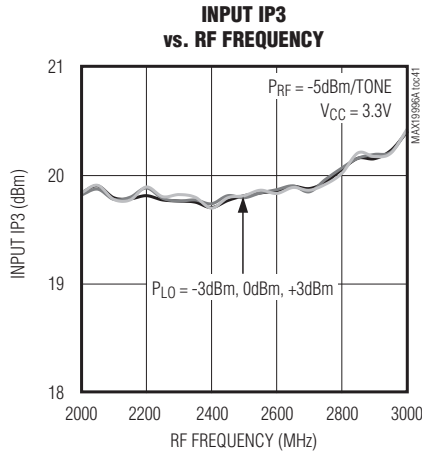
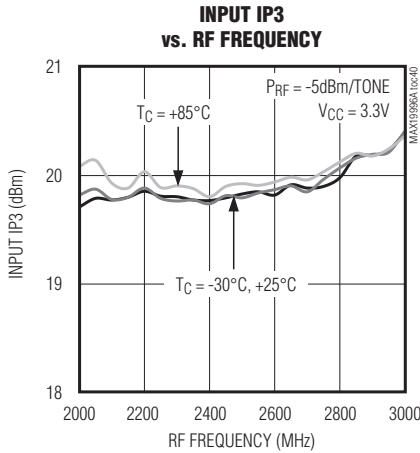
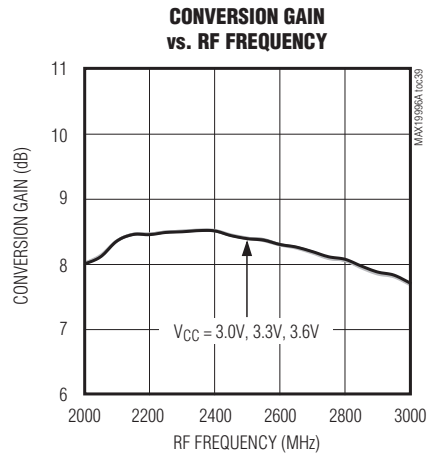
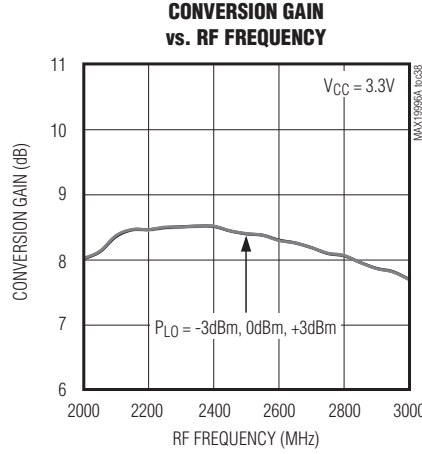
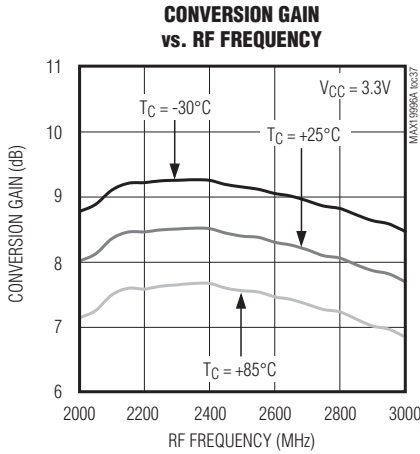
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SiGe、高线性度、2000MHz至3900MHz 下变频混频器，带有LO缓冲器

典型工作特性

(Typical Application Circuit with tuning elements outlined in Table 1, $V_{CC} = 3.3V$, $f_{RF} = 2000MHz$ to $3000MHz$, LO is high-side injected for a 300MHz IF, $P_{RF} = -5dBm$, $P_{LO} = 0dBm$, $T_C = +25^\circ C$, unless otherwise noted.)

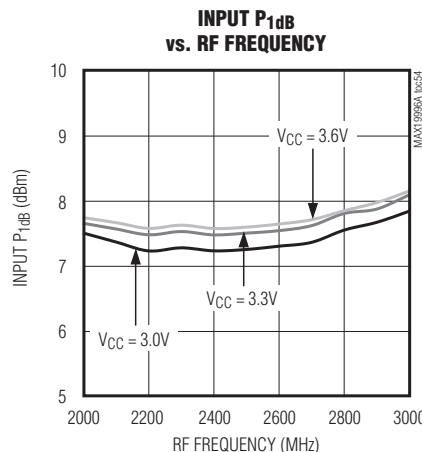
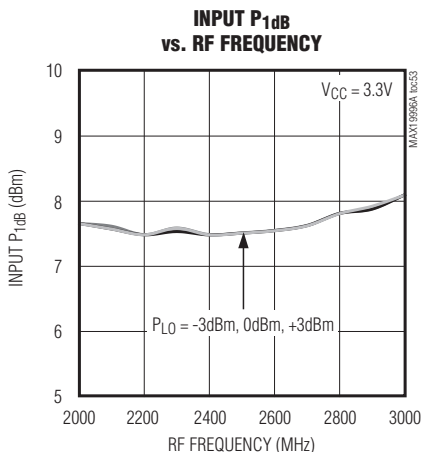
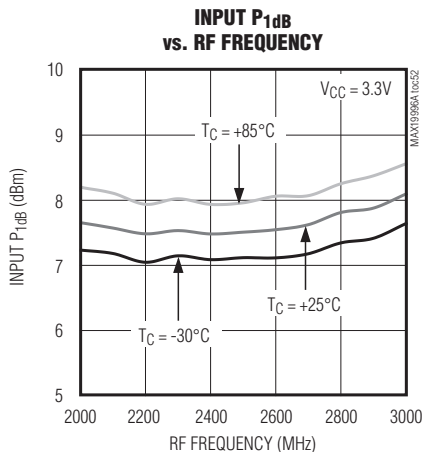
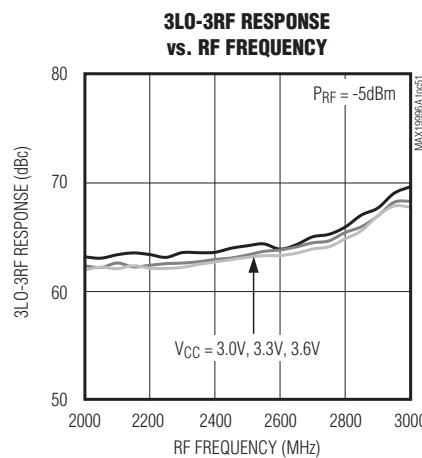
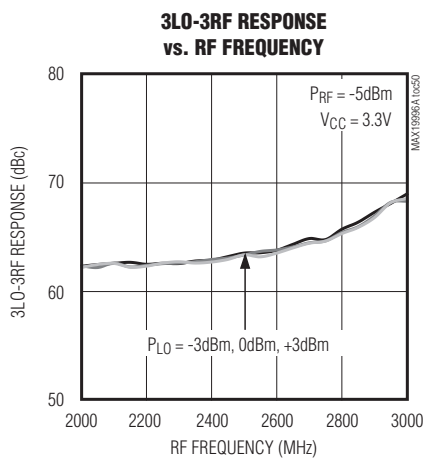
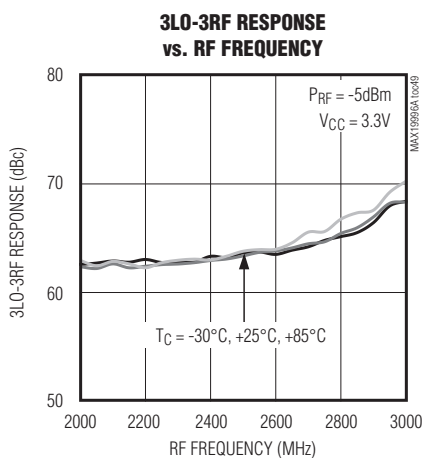
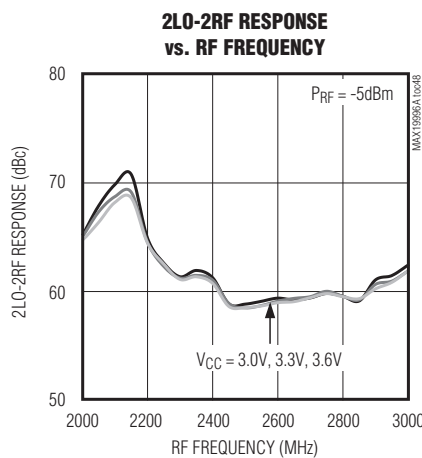
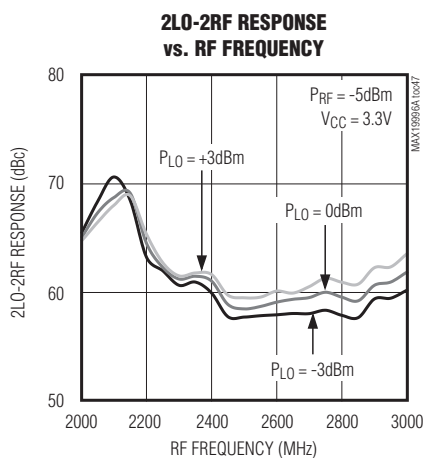
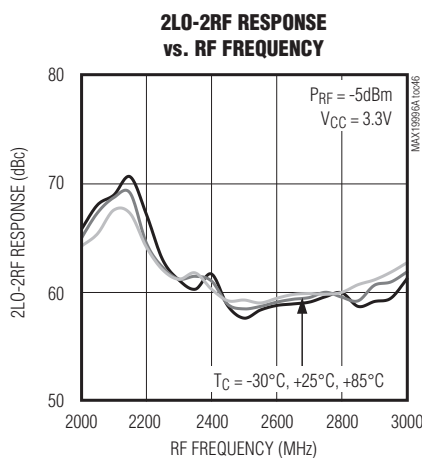


SiGe、高线性度、2000MHz至3900MHz 下变频混频器，带有LO缓冲器

典型工作特性(续)

(Typical Application Circuit with tuning elements outlined in Table 1, $V_{CC} = 3.3V$, $f_{RF} = 2000MHz$ to $3000MHz$, LO is high-side injected for a 300MHz IF, $P_{RF} = -5dBm$, $P_{LO} = 0dBm$, $T_C = +25^\circ C$, unless otherwise noted.)

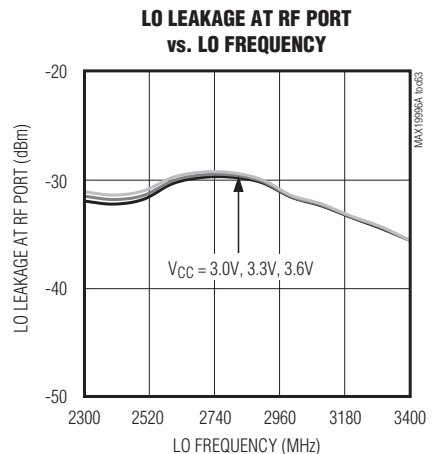
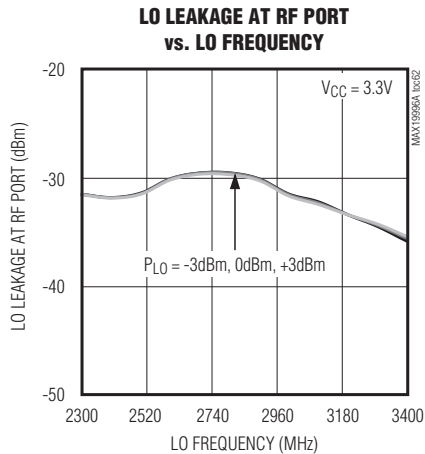
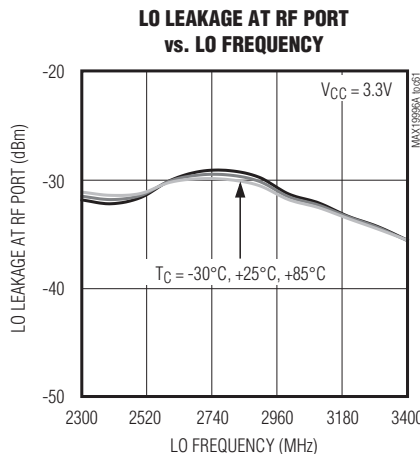
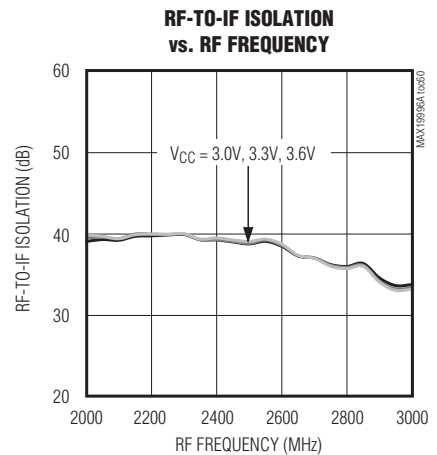
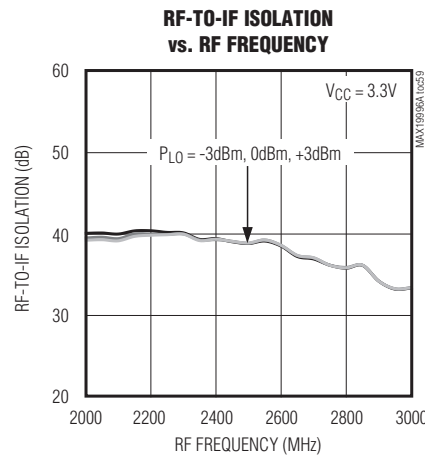
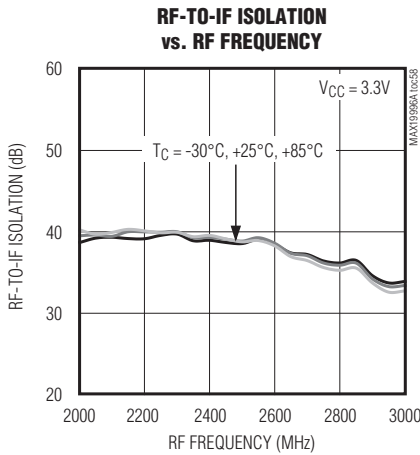
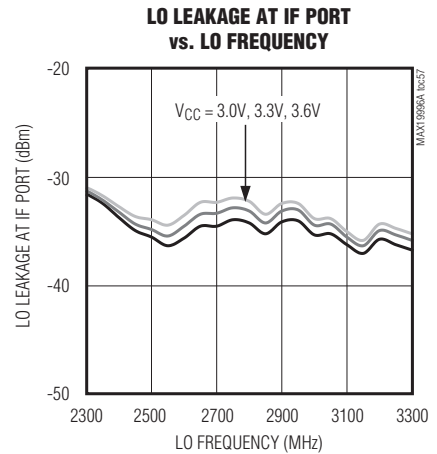
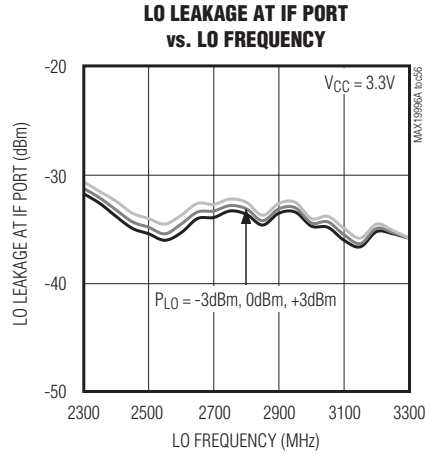
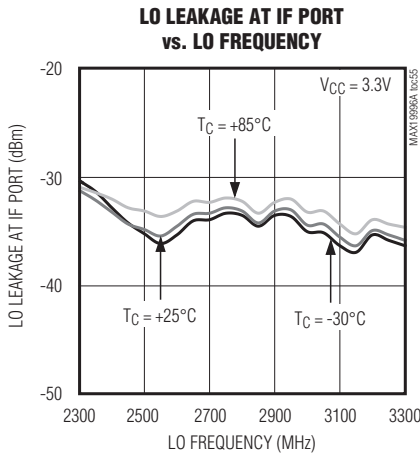
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SiGe、高线性度、2000MHz至3900MHz 下变频混频器，带有LO缓冲器

典型工作特性(续)

(Typical Application Circuit with tuning elements outlined in Table 1, $V_{CC} = 3.3V$, $f_{RF} = 2000MHz$ to $3000MHz$, LO is high-side injected for a 300MHz IF, $P_{RF} = -5dBm$, $P_{LO} = 0dBm$, $T_C = +25^\circ C$, unless otherwise noted.)

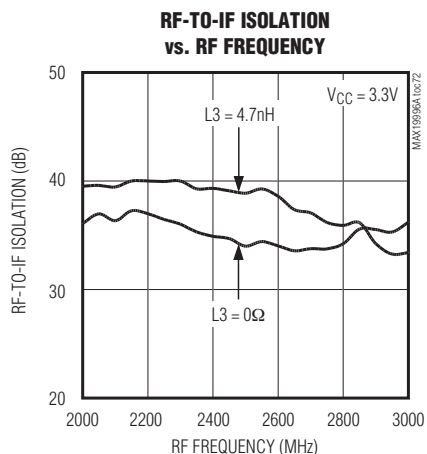
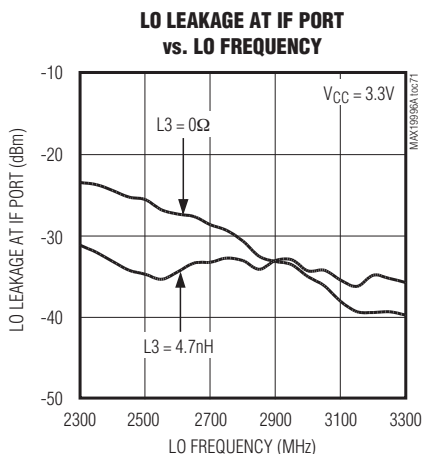
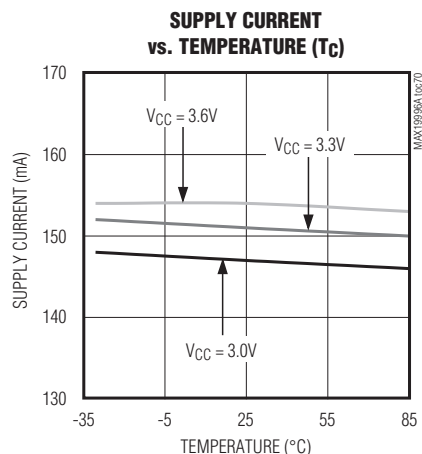
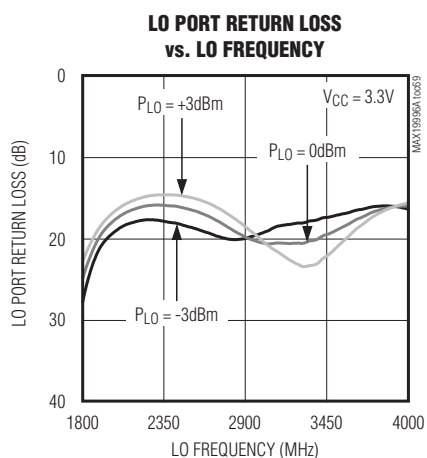
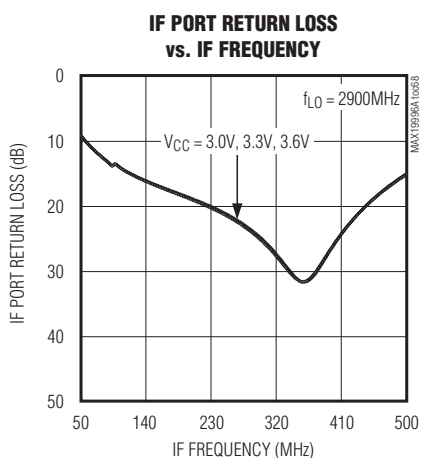
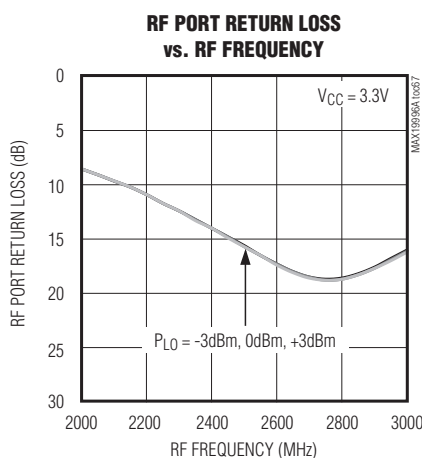
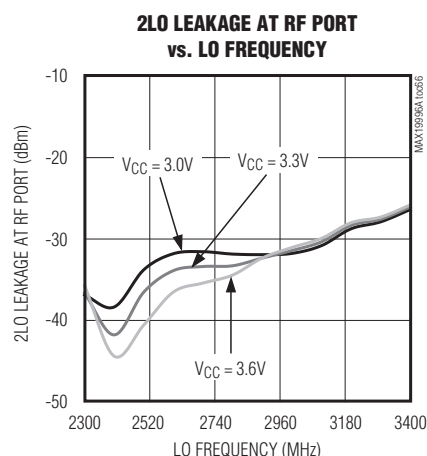
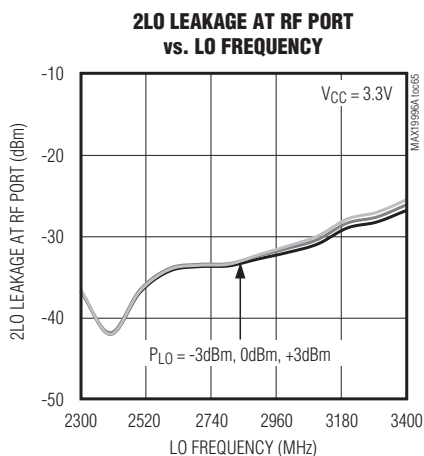
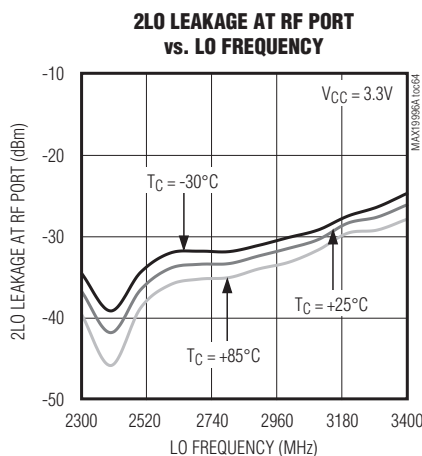


SiGe、高线性度、2000MHz至3900MHz 下变频混频器，带有LO缓冲器

典型工作特性(续)

(Typical Application Circuit with tuning elements outlined in Table 1, $V_{CC} = 3.3V$, $f_{RF} = 2000MHz$ to $3000MHz$, LO is high-side injected for a 300MHz IF, $P_{RF} = -5dBm$, $P_{LO} = 0dBm$, $T_C = +25^\circ C$, unless otherwise noted.)

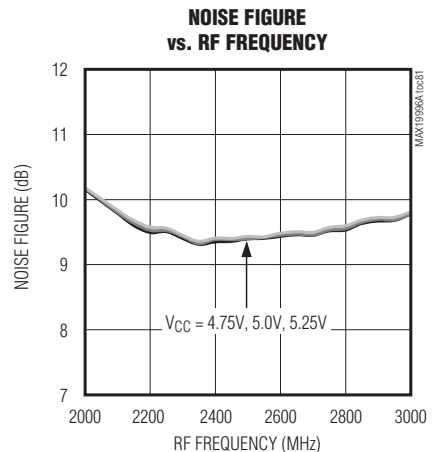
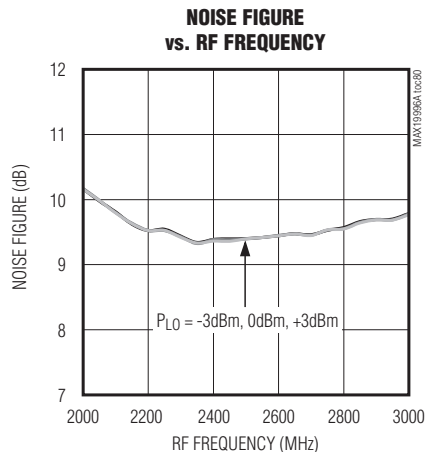
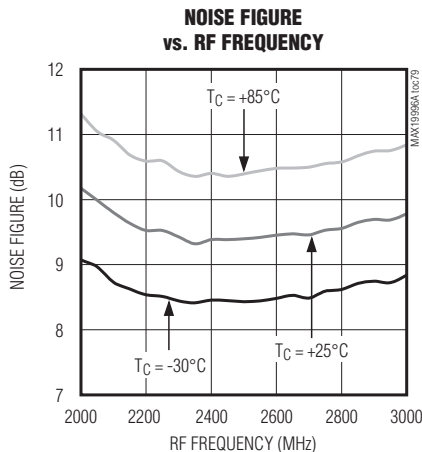
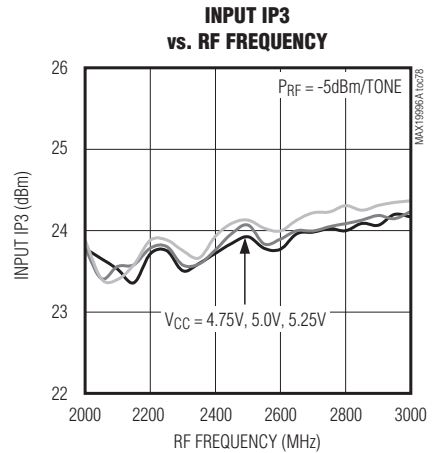
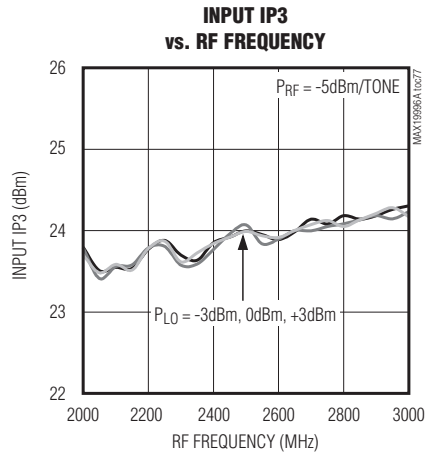
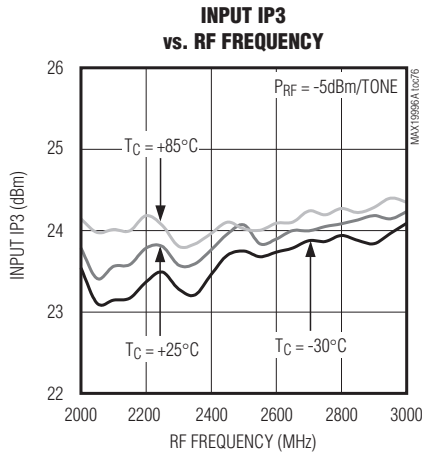
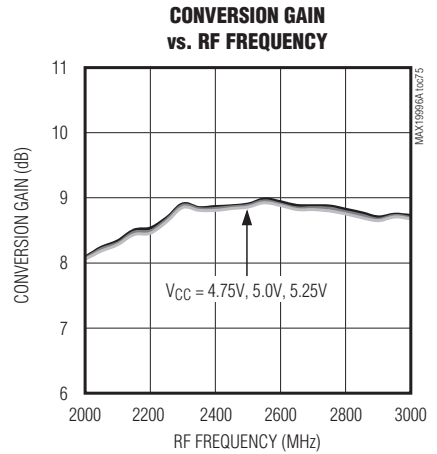
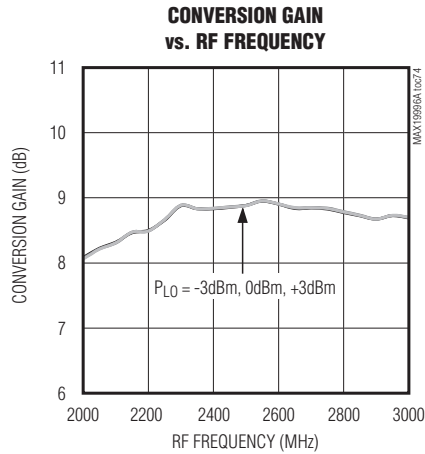
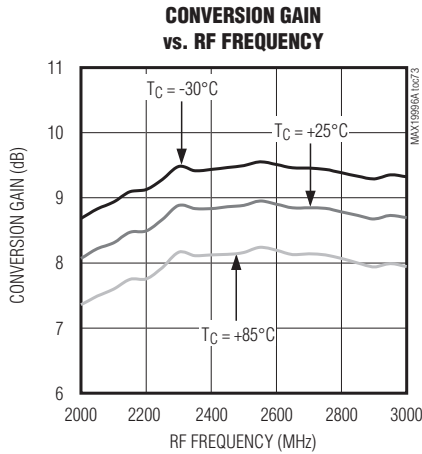
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SiGe、高线性度、2000MHz至3900MHz 下变频混频器，带有LO缓冲器

典型工作特性

(Typical Application Circuit with tuning elements outlined in Table 1, $V_{CC} = 5.0V$, $f_{RF} = 2000MHz$ to $3000MHz$, LO is low-side injected for a 300MHz IF, $P_{RF} = -5dBm$, $P_{LO} = 0dBm$, $T_C = +25^\circ C$, unless otherwise noted.)

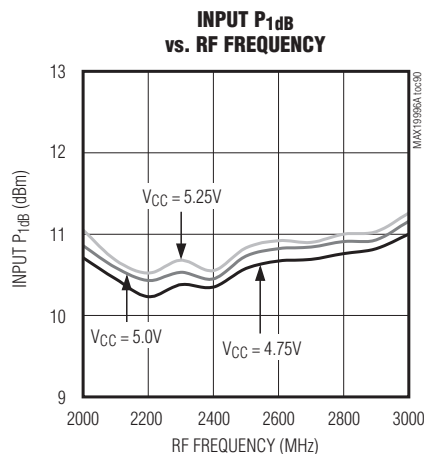
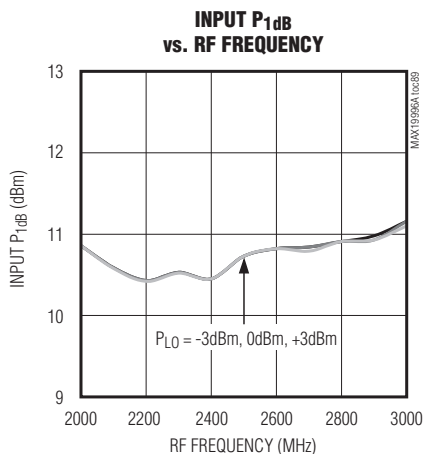
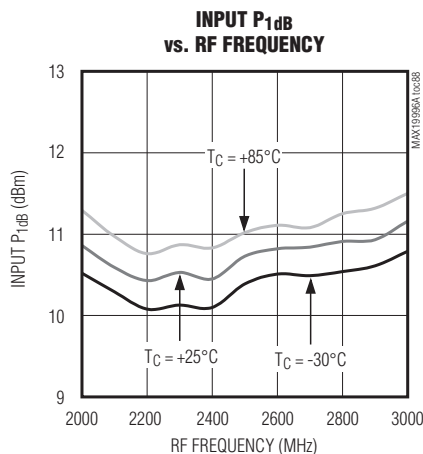
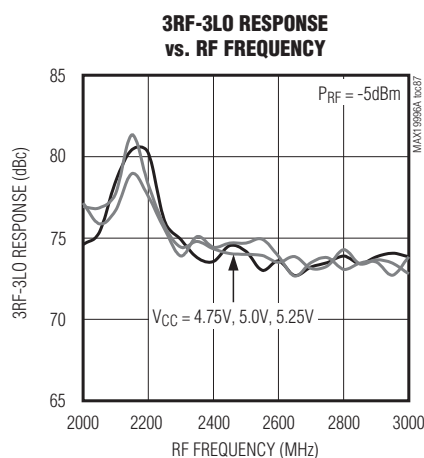
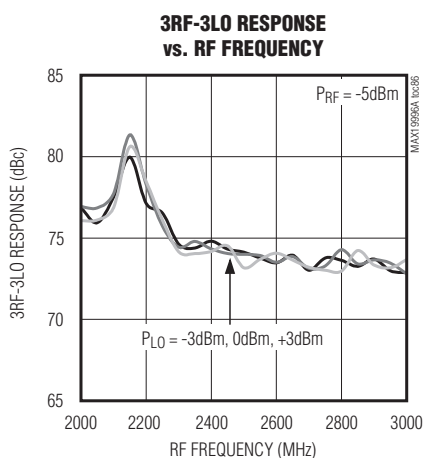
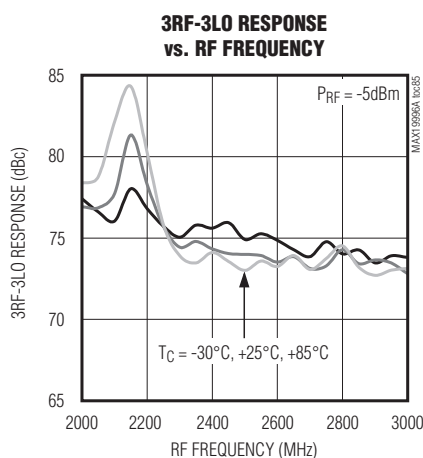
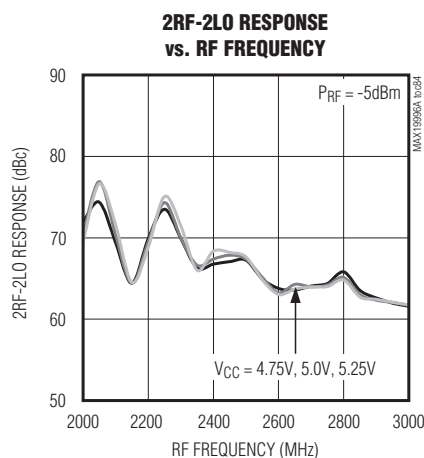
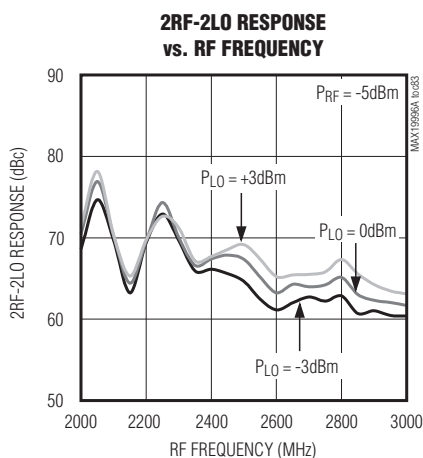
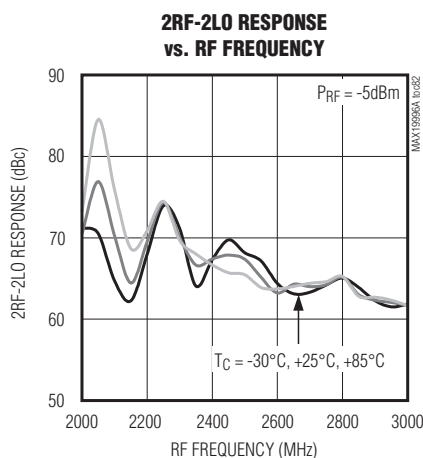


SiGe、高线性度、2000MHz至3900MHz 下变频混频器，带有LO缓冲器

典型工作特性(续)

(Typical Application Circuit with tuning elements outlined in Table 1, $V_{CC} = 5.0V$, $f_{RF} = 2000MHz$ to $3000MHz$, LO is low-side injected for a 300MHz IF, $P_{RF} = -5dBm$, $P_{LO} = 0dBm$, $T_C = +25^\circ C$, unless otherwise noted.)

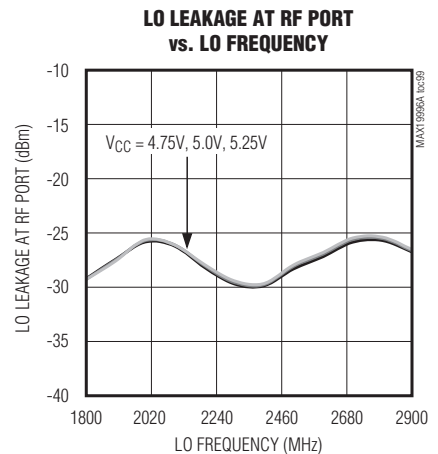
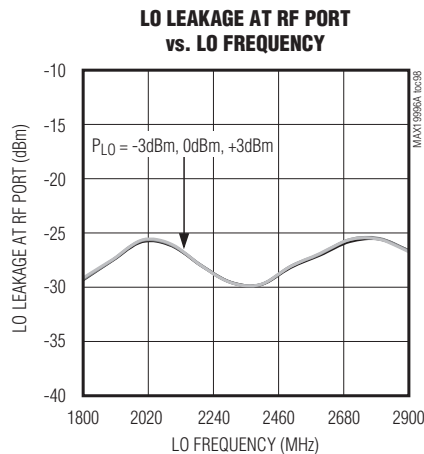
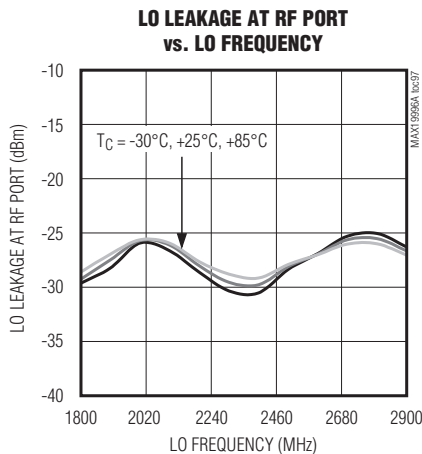
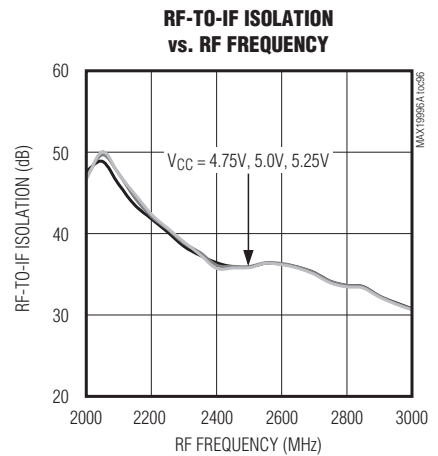
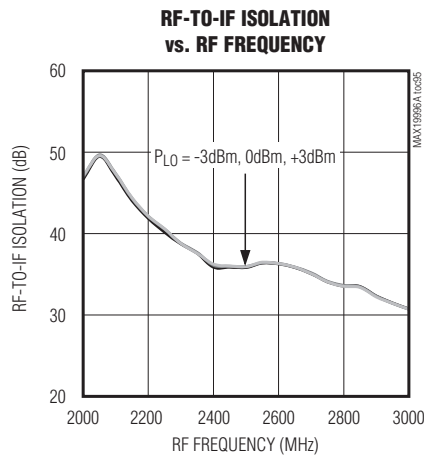
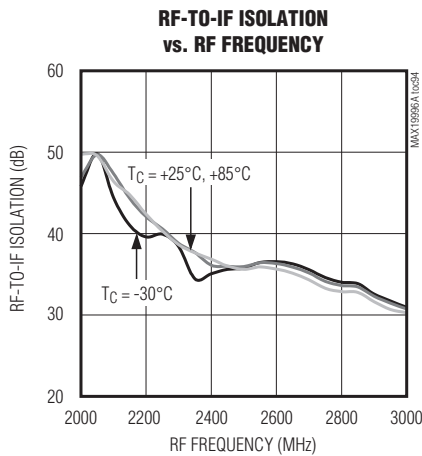
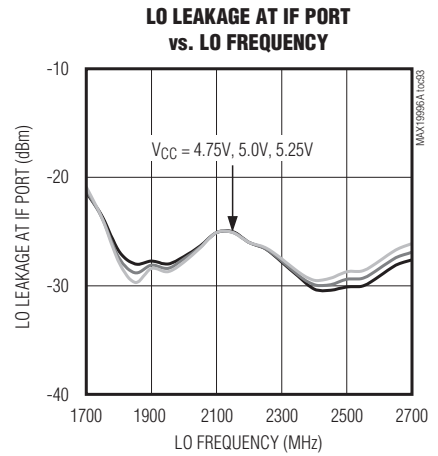
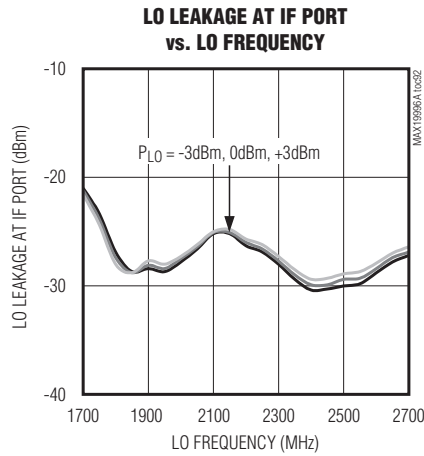
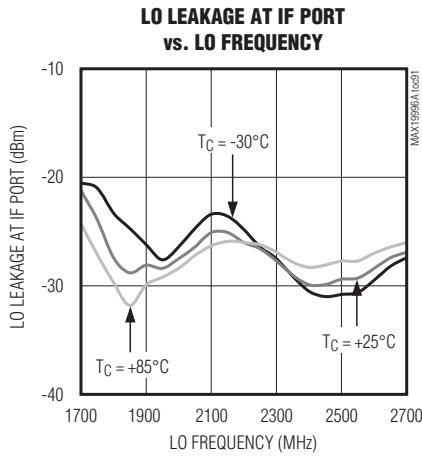
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SiGe、高线性度、2000MHz至3900MHz 下变频混频器，带有LO缓冲器

典型工作特性(续)

(Typical Application Circuit with tuning elements outlined in Table 1, $V_{CC} = 5.0V$, $f_{RF} = 2000MHz$ to $3000MHz$, LO is low-side injected for a 300MHz IF, $P_{RF} = -5dBm$, $P_{LO} = 0dBm$, $T_C = +25^\circ C$, unless otherwise noted.)

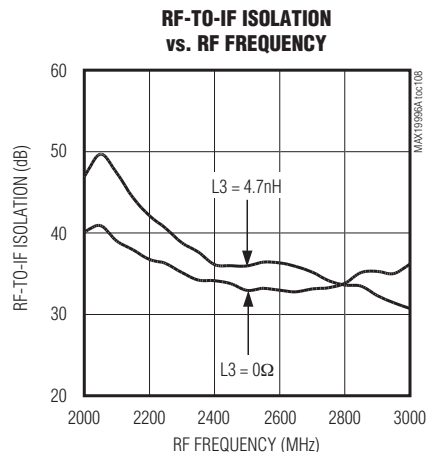
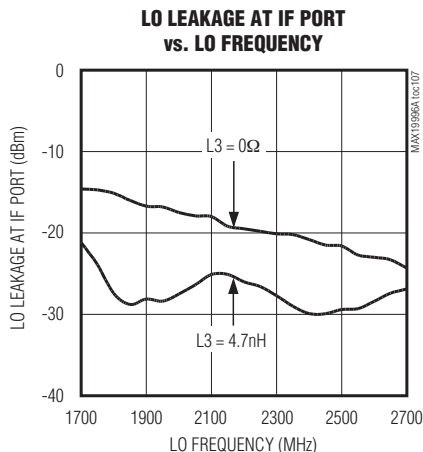
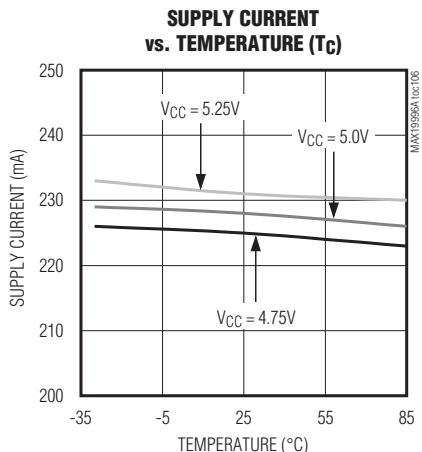
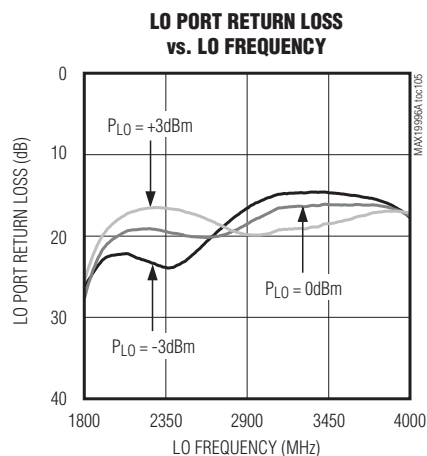
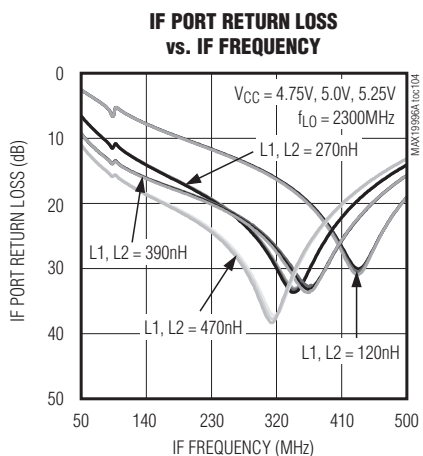
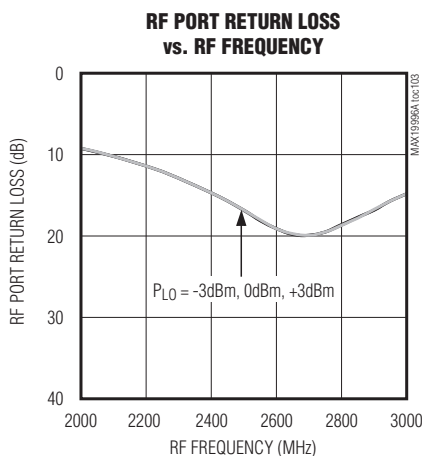
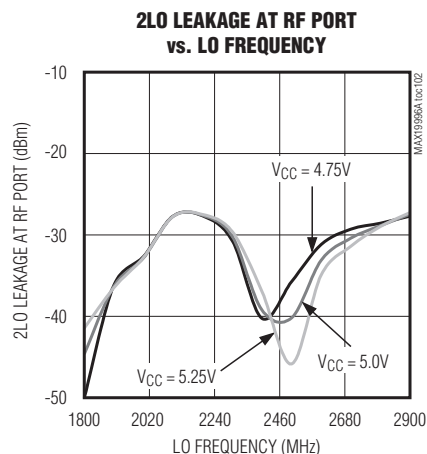
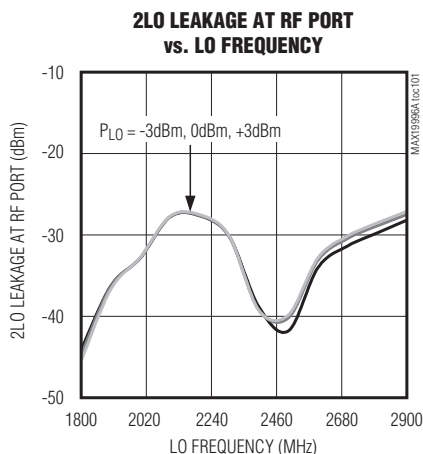
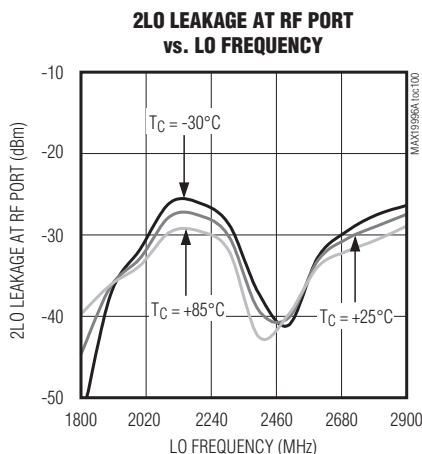


SiGe、高线性度、2000MHz至3900MHz 下变频混频器，带有LO缓冲器

典型工作特性(续)

(Typical Application Circuit with tuning elements outlined in Table 1, $V_{CC} = 5.0V$, $f_{RF} = 2000MHz$ to $3000MHz$, LO is low-side injected for a 300MHz IF, $P_{RF} = -5dBm$, $P_{LO} = 0dBm$, $T_C = +25^\circ C$, unless otherwise noted.)

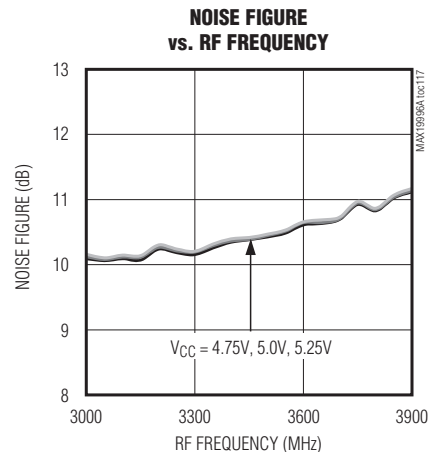
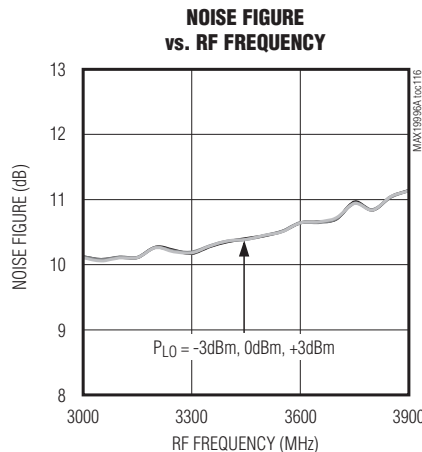
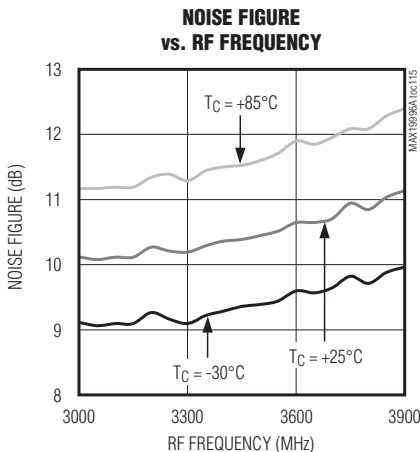
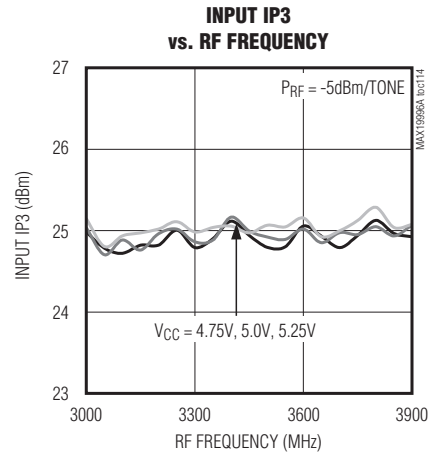
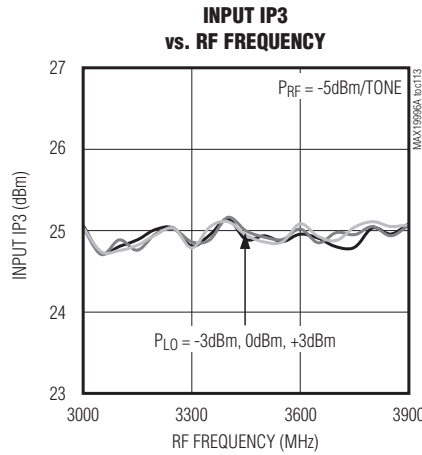
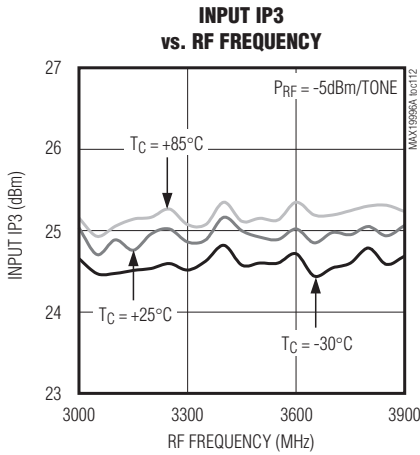
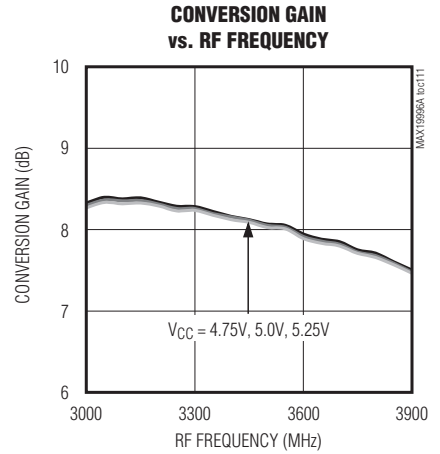
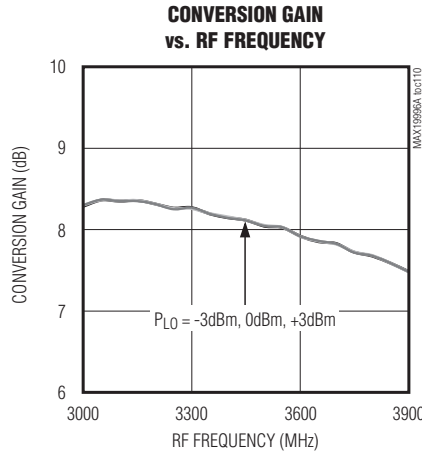
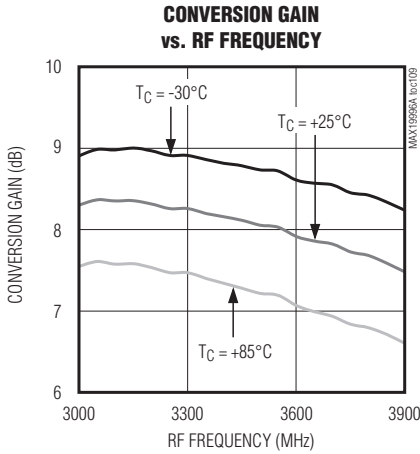
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SiGe、高线性度、2000MHz至3900MHz 下变频混频器，带有LO缓冲器

典型工作特性

(Typical Application Circuit with tuning elements outlined in Table 1, $V_{CC} = 5.0V$, $f_{RF} = 3000MHz$ to $3900MHz$, LO is low-side injected for a 300MHz IF, $P_{RF} = -5dBm$, $P_{LO} = 0dBm$, $T_C = +25^\circ C$, unless otherwise noted.)

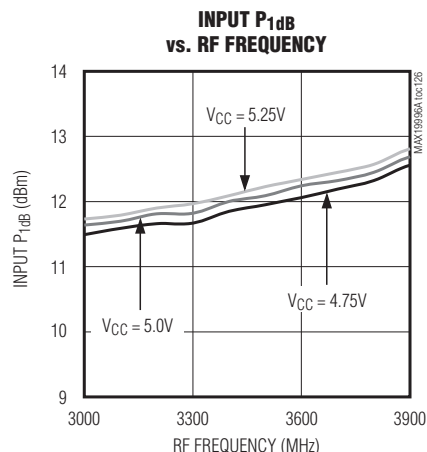
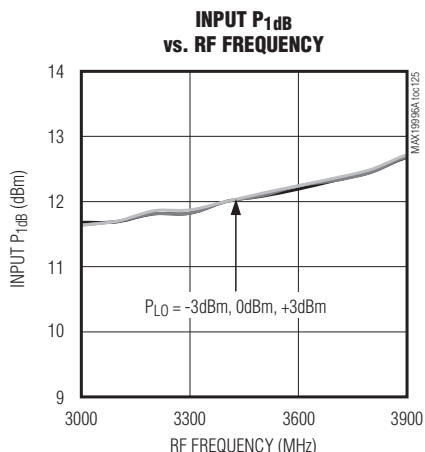
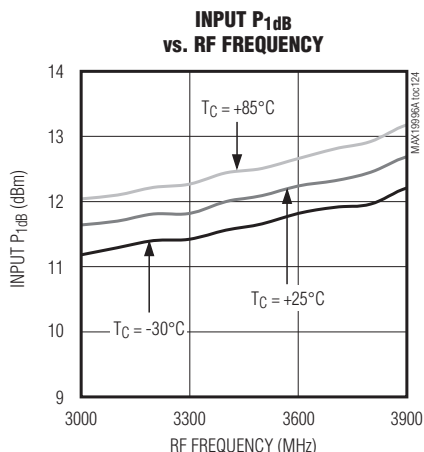
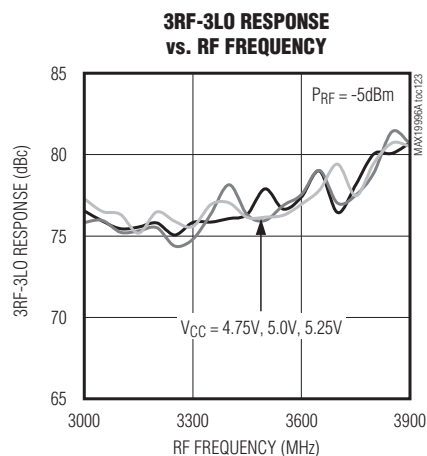
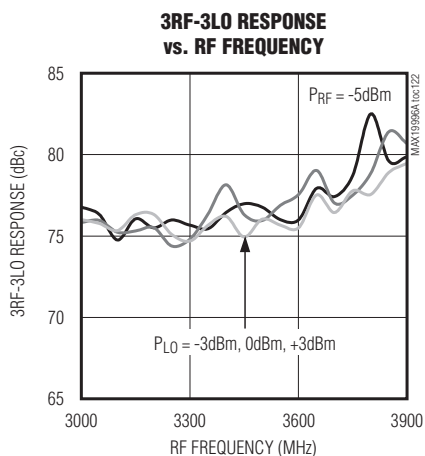
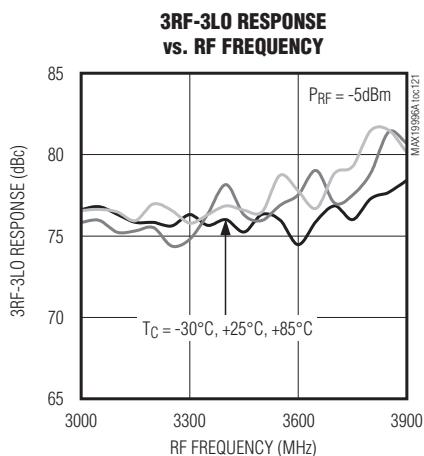
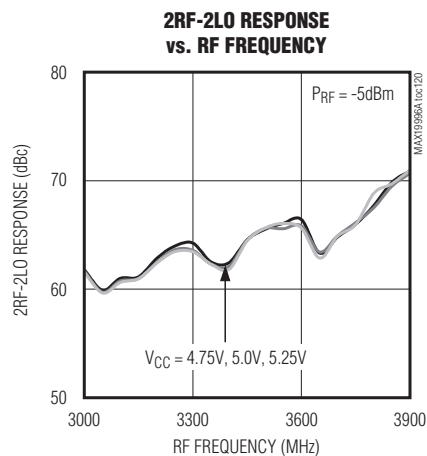
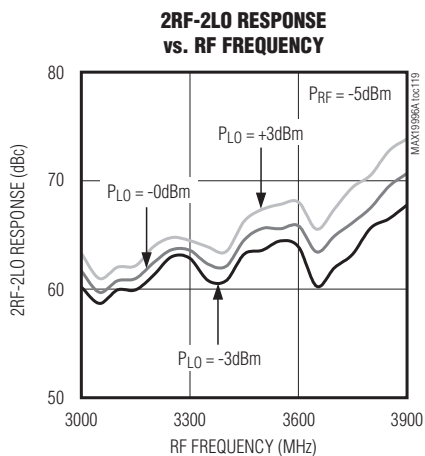
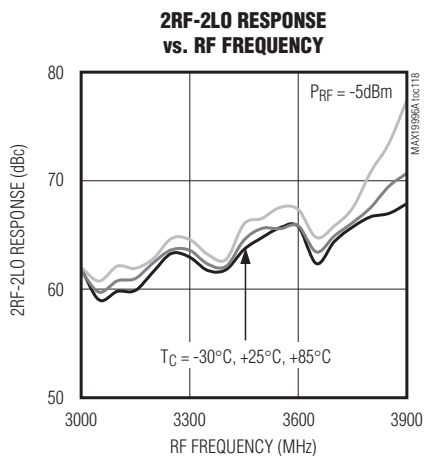


SiGe、高线性度、2000MHz至3900MHz 下变频混频器，带有LO缓冲器

典型工作特性(续)

(Typical Application Circuit with tuning elements outlined in Table 1, $V_{CC} = 5.0V$, $f_{RF} = 3000MHz$ to $3900MHz$, LO is low-side injected for a 300MHz IF, $P_{RF} = -5dBm$, $P_{LO} = 0dBm$, $T_C = +25^\circ C$, unless otherwise noted.)

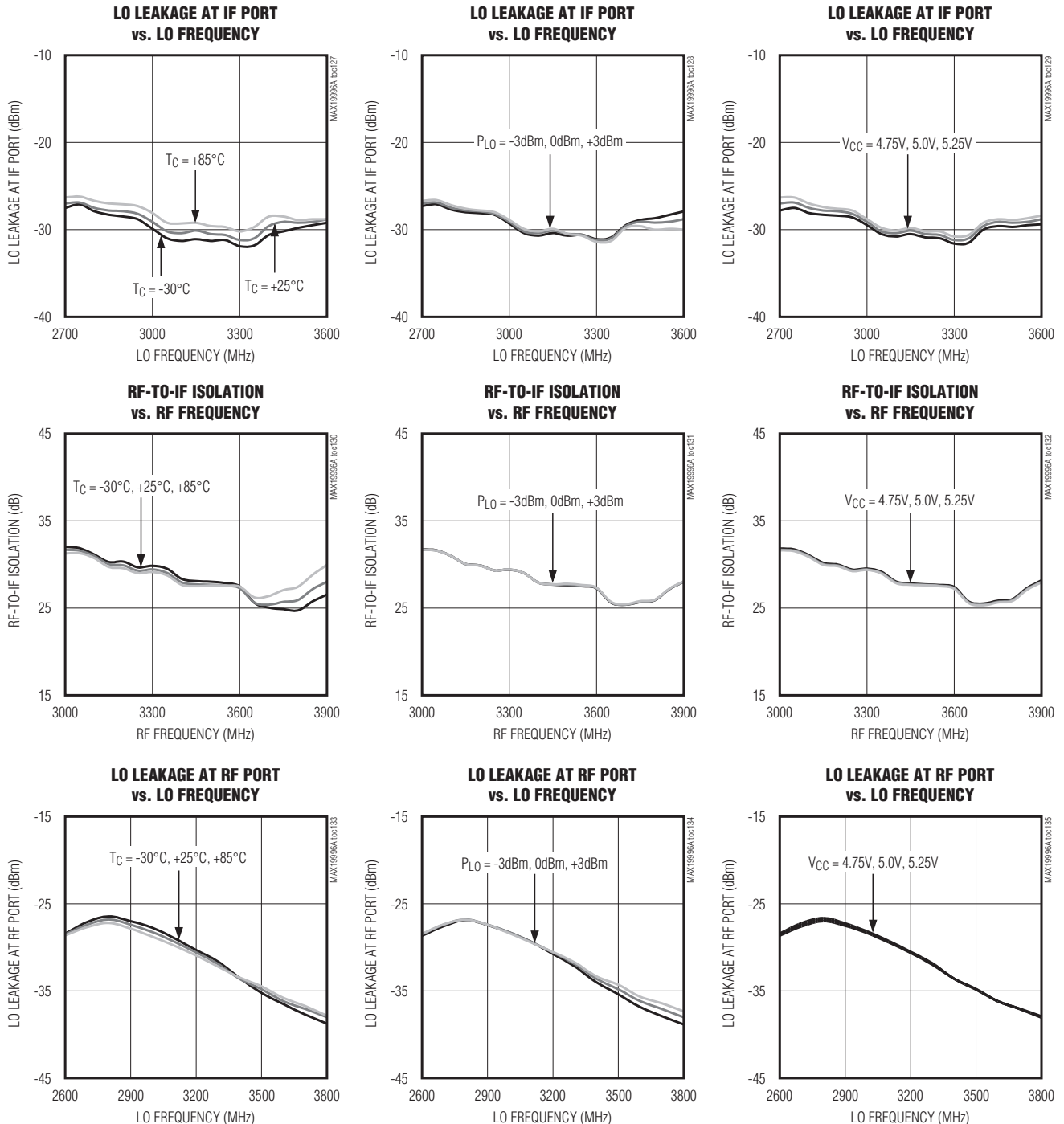
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SiGe、高线性度、2000MHz至3900MHz 下变频混频器，带有LO缓冲器

典型工作特性(续)

(Typical Application Circuit with tuning elements outlined in Table 1, $V_{CC} = 5.0V$, $f_{RF} = 3000MHz$ to $3900MHz$, LO is low-side injected for a 300MHz IF, $P_{RF} = -5dBm$, $P_{LO} = 0dBm$, $T_C = +25^\circ C$, unless otherwise noted.)

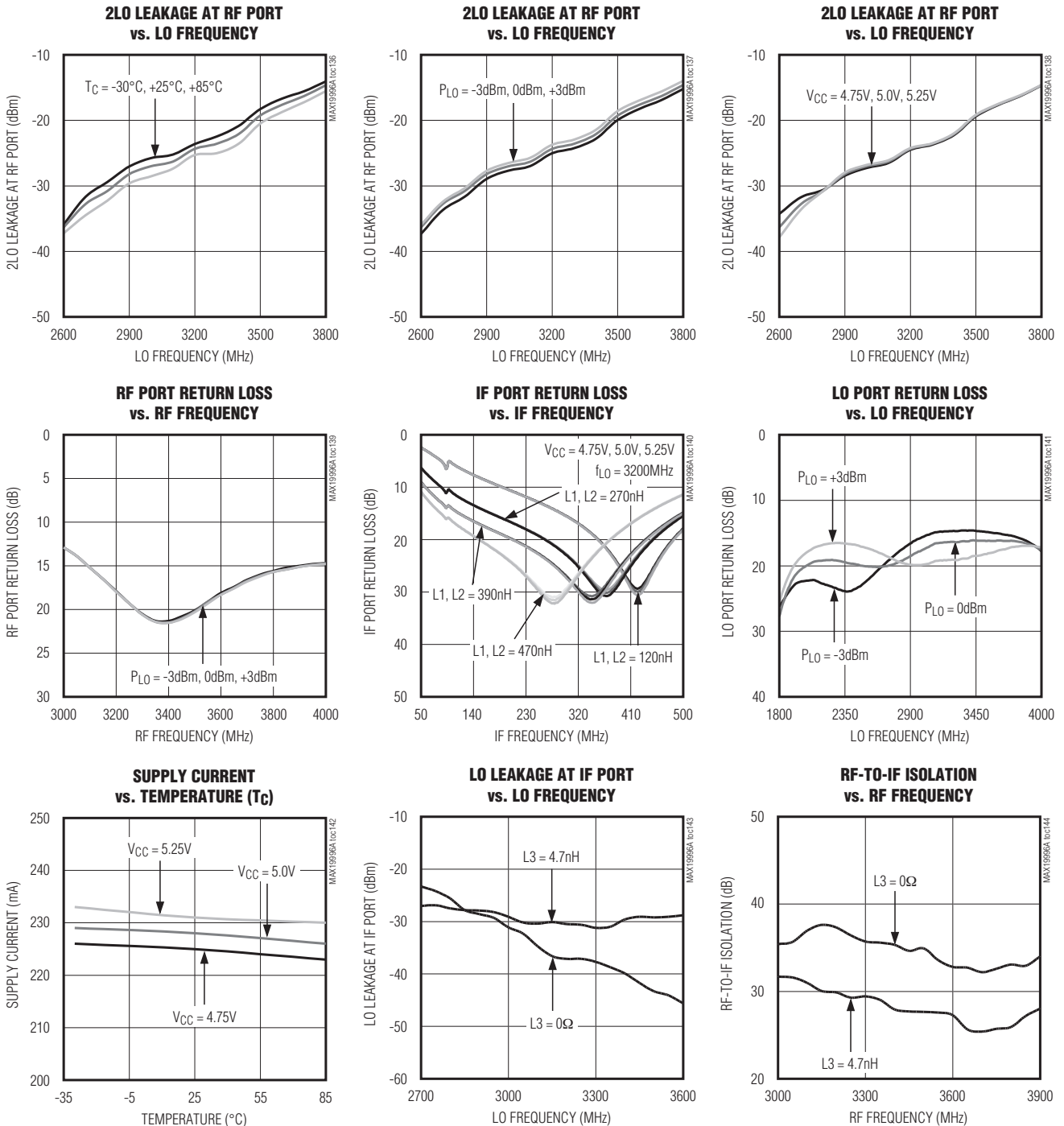


SiGe、高线性度、2000MHz至3900MHz 下变频混频器，带有LO缓冲器

典型工作特性(续)

(Typical Application Circuit with tuning elements outlined in Table 1, $V_{CC} = 5.0V$, $f_{RF} = 3000MHz$ to $3900MHz$, LO is low-side injected for a $300MHz$ IF, $P_{RF} = -5dBm$, $P_{LO} = 0dBm$, $T_C = +25^\circ C$, unless otherwise noted.)

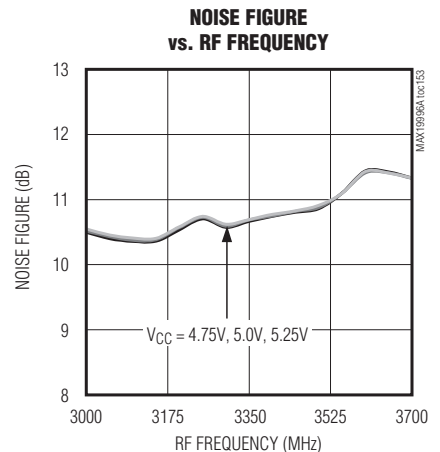
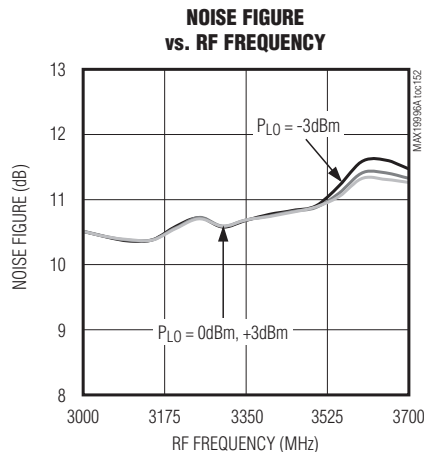
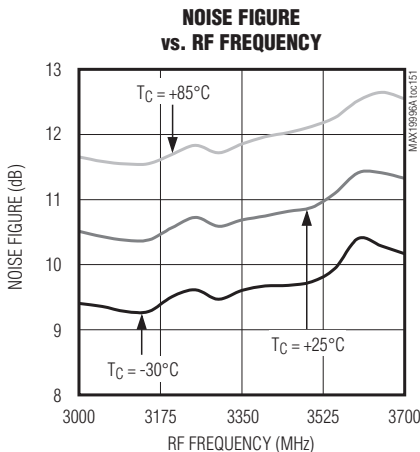
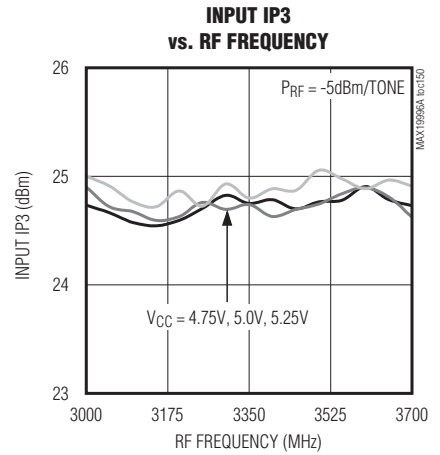
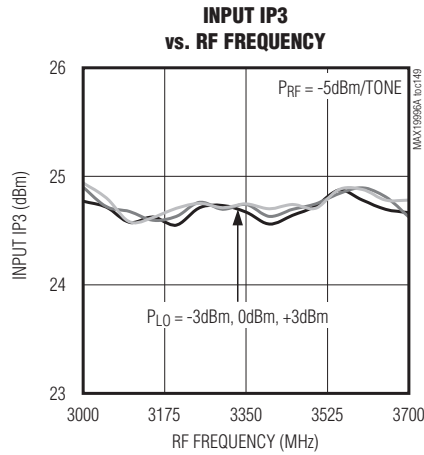
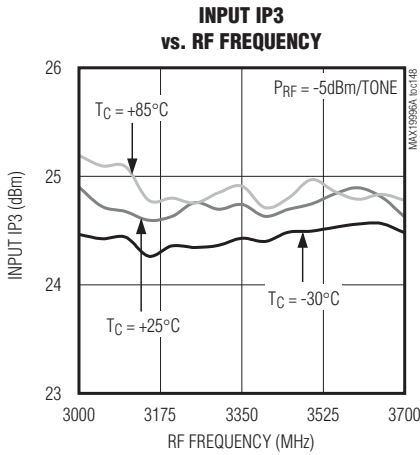
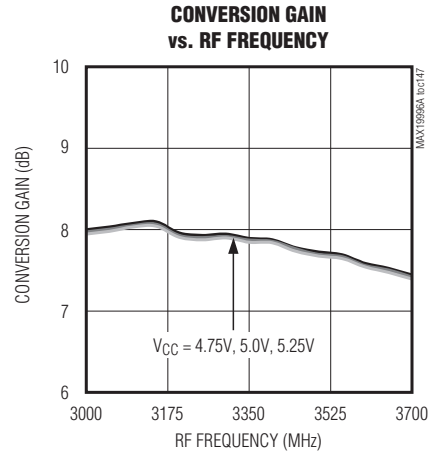
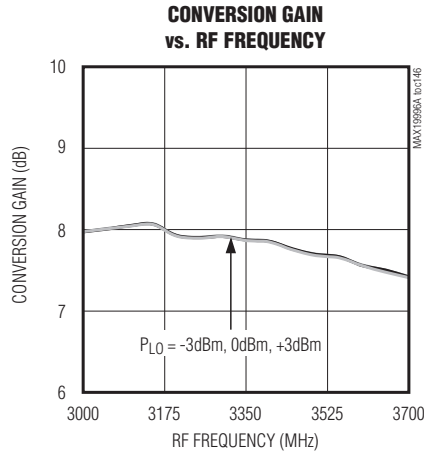
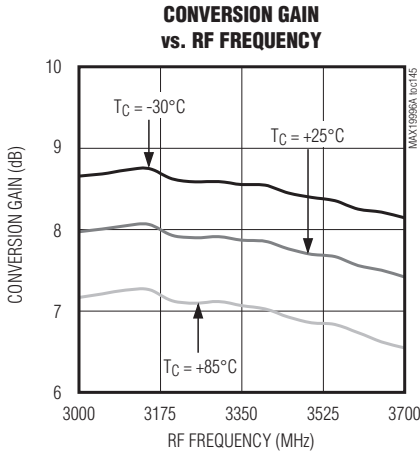
MAX19996A



SiGe、高线性度、2000MHz至3900MHz 下变频混频器，带有LO缓冲器

典型工作特性

(Typical Application Circuit with tuning elements outlined in Table 1, $V_{CC} = 5.0V$, $f_{RF} = 3000MHz$ to $3700MHz$, LO is high-side injected for a 300MHz IF, $P_{RF} = -5dBm$, $P_{LO} = 0dBm$, $T_C = +25^\circ C$, unless otherwise noted.)

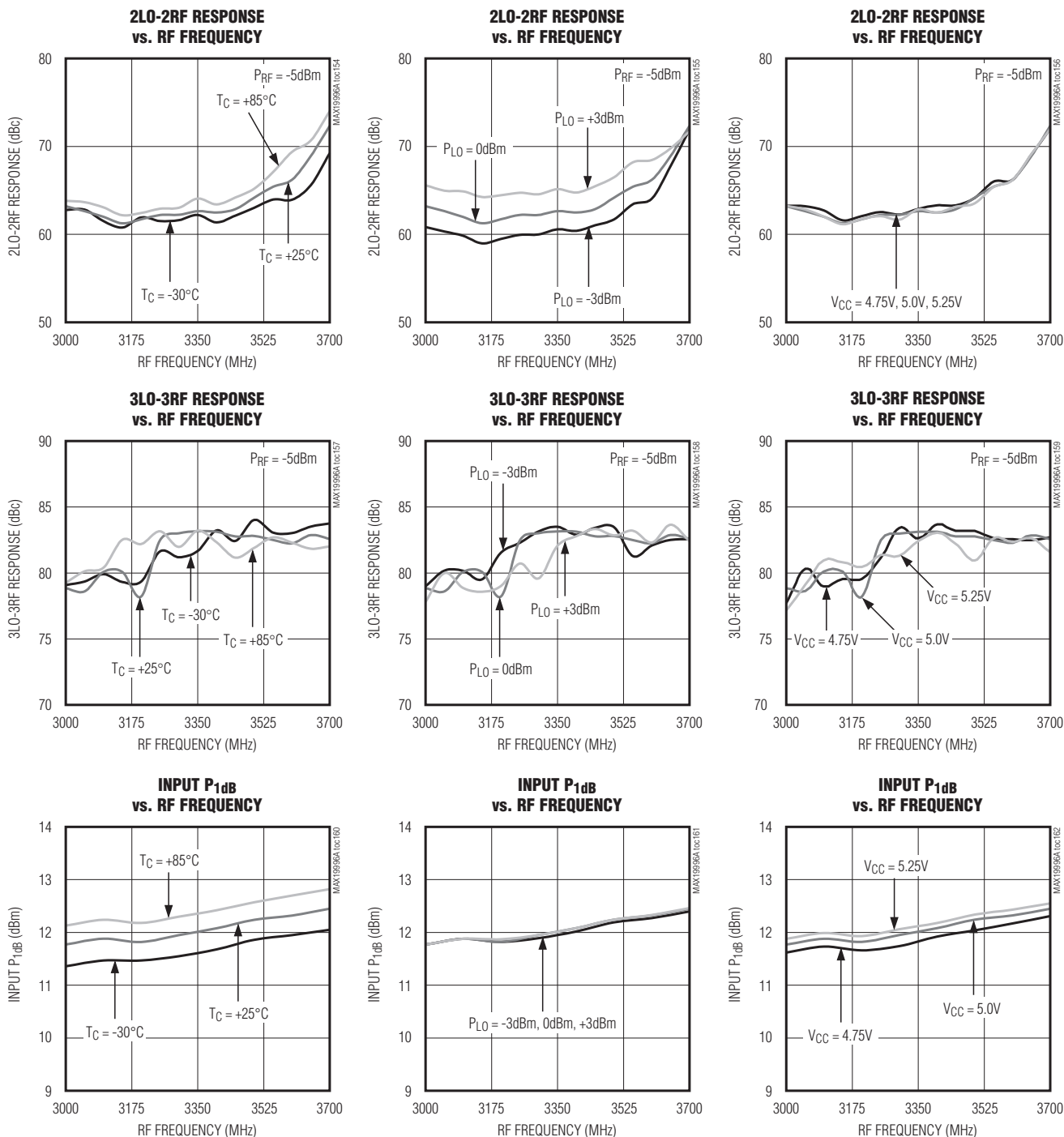


SiGe、高线性度、2000MHz至3900MHz 下变频混频器，带有LO缓冲器

典型工作特性(续)

(Typical Application Circuit with tuning elements outlined in Table 1, $V_{CC} = 5.0V$, $f_{RF} = 3000MHz$ to $3700MHz$, LO is high-side injected for a 300MHz IF, $P_{RF} = -5dBm$, $P_{LO} = 0dBm$, $T_C = +25^{\circ}C$, unless otherwise noted.)

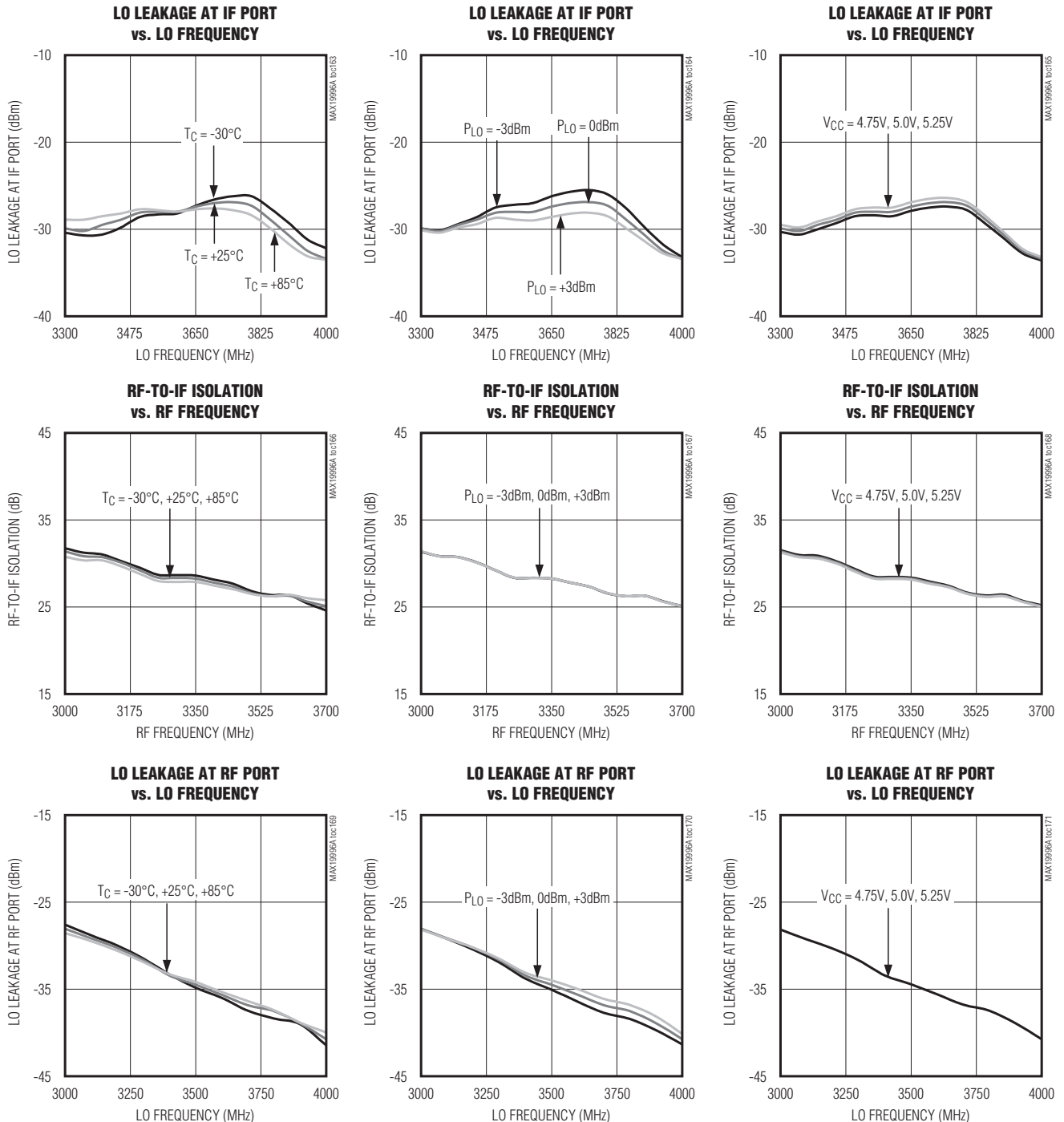
MAX19996A



SiGe、高线性度、2000MHz至3900MHz 下变频混频器，带有LO缓冲器

典型工作特性(续)

(Typical Application Circuit with tuning elements outlined in Table 1, $V_{CC} = 5.0V$, $f_{RF} = 3000MHz$ to $3700MHz$, LO is high-side injected for a 300MHz IF, $P_{RF} = -5dBm$, $P_{LO} = 0dBm$, $T_C = +25^\circ C$, unless otherwise noted.)

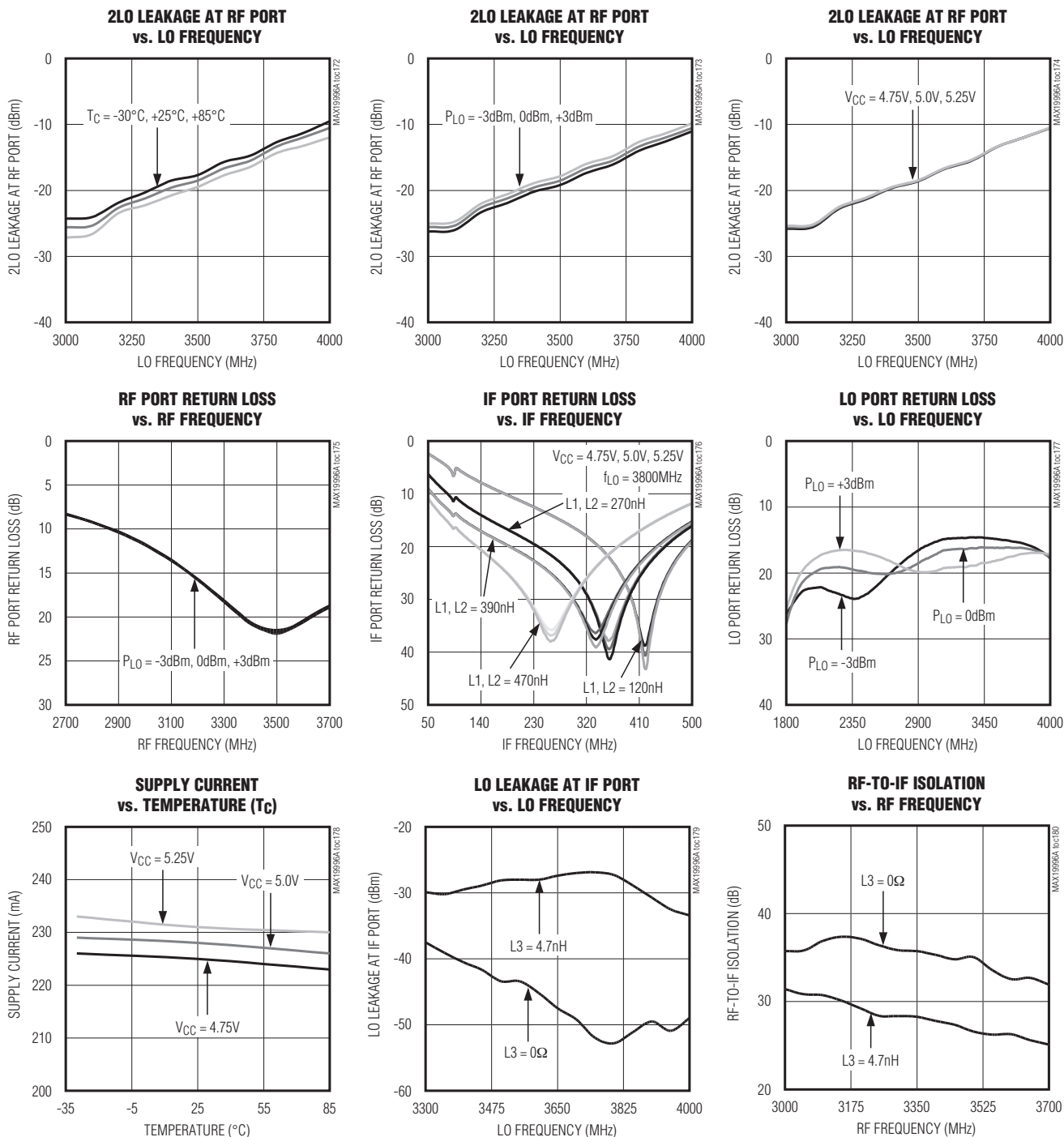


SiGe、高线性度、2000MHz至3900MHz 下变频混频器，带有LO缓冲器

典型工作特性(续)

(Typical Application Circuit with tuning elements outlined in Table 1, $V_{CC} = 5.0V$, $f_{RF} = 3000MHz$ to $3700MHz$, LO is high-side injected for a 300MHz IF, $P_{RF} = -5dBm$, $P_{LO} = 0dBm$, $T_C = +25^\circ C$, unless otherwise noted.)

MAX19996A



SiGe、高线性度、2000MHz至3900MHz 下变频混频器，带有LO缓冲器

引脚说明

引脚	名称	功能
1, 6, 8, 14	VCC	电源。使用0.01 μ F电容旁路至GND，电容应尽可能靠近引脚放置。
2	RF	单端50 Ω RF输入。该端口由内部匹配，并通过非平衡变压器直流短接到GND，需要一个输入隔直电容。
3, 4, 5, 10, 12, 13, 17	GND	地。内部连接至裸焊盘，将所有地引脚与裸焊盘(EP)连接在一起。
7	LOBIAS	LO放大器的偏置控制。LO缓冲器的输出偏置电阻连接端，在LOBIAS与地之间连接一个604 Ω 1%的电阻(偏置电流设置为230mA)。
9, 15	N.C.	无内部连接。引脚可以接地。
11	LO	本振输入。该输入端在内部匹配为50 Ω ，需要一个输入隔直电容。
16	LEXT	外部电感连接端。在该引脚和地之间连接一个电感，以提高RF与IF之间和LO与IF之间的隔离度(典型性能与电感值的对应关系请参考典型工作特性)。
18, 19	IF-, IF+	混频器差分IF输出端。各引脚均需通过上拉电感连接至VCC(参见典型应用电路)。
20	IFBIAS	IF放大器的偏置控制。IF放大器的IF偏置电阻连接端，在IFBIAS与GND之间连接一个698 Ω 1%的电阻(偏置电流设置为230mA)。
—	EP	裸焊盘，内部连接至GND，使用多个接地过孔将该焊盘焊接到一个PCB盘，为器件与PCB地层之间提供好的散热通道。多个接地过孔还有助于改善RF性能。

详细说明

当作为高端LO注入混频器工作在2300MHz至2900MHz RF频段时，MAX19996A可提供8.7dB的转换增益、+24.5dBm的IIP3和典型值为9.8dB的噪声系数。集成的非平衡变压器和匹配电路允许50 Ω 单端连接至RF端口和LO端口。集成LO缓冲器可以为混频器核提供较强的驱动能力，将MAX19996A输入端所需的LO驱动减小到-3dBm至+3dBm。IF端口配合差分输出端，有效改善了2LO-2RF性能。

该器件可在较宽的频率范围内保证性能，适用于WCS、LTE、WiMAX和MMDS基站。MAX19996A能够工作在2000MHz至3900MHz RF输入范围、2100MHz至4000MHz LO范围以及50MHz至500MHz IF范围。外部IF器件可设置在更低的频率范围(详细信息请参见典型工作特性)。允许工作在上述范围以外(更多信息请参见典型工作特性)。

RF输入和非平衡变压器

配合隔直流电容使用时，MAX19996A的RF输入提供50 Ω 匹配。由于输入端在内部通过片上非平衡变压器短路到地，所以必须使用隔直流电容。使用8.2pF隔直流电容时，在整个2300MHz至2900MHz的RF频率范围内，RF端口的输入回波损耗典型值为14dB；使用1.5pF的隔直流电容时，在3000MHz至3900MHz的RF频率范围内，回波损耗可以达到15dB。

LO输入、缓冲器和非平衡变压器

利用2100MHz至4000MHz较宽的LO驱动电路，MAX19996A可以用于低端或高端LO注入架构，支持2.5GHz和3.5GHz应用。LO输入在内部匹配为50 Ω ，只需一个2pF的隔直电容。两级内部LO缓冲器允许-3dBm至+3dBm的LO输入功率范围。片上低损耗非平衡变压器和LO缓冲器配合使用，驱动双平衡混频器。LO输入端与IF输出端之间的所有接口和匹配元件均已集成在芯片上。

SiGe、高线性度、2000MHz至3900MHz 下变频混频器，带有LO缓冲器

高线性度混频器

MAX19996A的核心是一个双平衡、高性能无源混频器。片上LO缓冲器具有较大的LO摆幅，可提供优异的线性度指标。与集成IF放大器配合使用时，IIP3、2LO-2RF抑制和噪声系数的典型值分别为+24.5dBm、67dBc和9.8dB。

差分IF输出放大器

MAX19996A具有50MHz至500MHz的IF频率范围，其低端频率取决于外部IF元件的频率响应。MAX19996A通过外部390nH的上拉偏置电感调谐至300MHz IF。对于较低的IF，则需要较大的电感，以保持较好的IF匹配。集电极开路、差分IF输出端口需要通过这些电感上拉至V_{CC}。

注意：这些差分端口能够增强2LO-2RF和2RF-2LO性能，单端IF应用需要一个4:1（阻抗比）的非平衡变压器，将200Ω的差分IF电阻转换成50Ω单端输出。IF频率高于200MHz时采用TC4-1W-17 4:1变压器；IF频率低于200MHz时采用TC4-1W-7A 4:1变压器。用户可以在混频器的IF端口使用差分IF放大器或SAW滤波器，但IF+/IF-端口需要隔直，以防止外部直流进入混频器的IF端口。

应用信息

输入和输出匹配

配合隔直流电容使用时，RF输入提供50Ω匹配。在2000MHz至3000MHz RF频率范围内，使用8.2pF隔直流电容；在3000MHz至3900MHz RF频率范围内，使用1.5pF隔直流电容，以匹配RF端口。LO输入内部匹配在50Ω，利用2pF隔直流电容覆盖2100MHz至4000MHz整个LO频率范围。IF输出阻抗为200Ω（差分）。为方便评估，通过外部低损耗4:1（阻抗比）非平衡变压器将该阻抗转化成50Ω单端输出（参见典型应用电路）。

降低功耗模式

MAX19996A具有两个引脚(LOBIAS、IFBIAS)，允许通过外部电阻设置内部偏置电流。电阻的标称值如表1所示。增大电阻值可降低功耗，但代价是性能有所下降。如果没有±1%精度的电阻，可以采用±5%的电阻替代。

选择3.3V为混频器供电也可以显著降低功耗，这种方式可以将整体功耗降低57%，具体细节请参考3.3V Supply AC Electrical Characteristics— $f_{RF} = 2300\text{MHz to } 2900\text{MHz}$, High-Side LO Injection表和典型工作特性中与3.3V供电相关的特性曲线，以折中考虑功耗和性能。

LEXT电感

用一个0Ω电阻将LEXT短接至地。在需要改善RF与IF之间和LO与IF之间隔离度的应用中，可以通过调整L3优化性能（请参考典型工作特性）。但是，混频器的负载阻抗必须保证IF-、IF+与地之间的电容不会超出几个皮法(pF)，以保证稳定工作。由于流过LEXT的电流大约为90mA，因此需要选择一个低DCR的绕线电感。

布局考虑

合理的PCB设计是任何RF/微波电路的一个重要部分。RF信号线应尽可能短，以减小损耗、辐射和电感。混频器的负载阻抗必须保证IF-、IF+与地之间的电容不会超出几个皮法。为获得最佳性能，接地引脚须直接与封装底部的裸焊盘连接。PCB上的裸焊盘必须连接至PCB的地层。建议采用多个过孔将该焊盘连接至地层。这种方法能为器件提供一个良好的RF/散热路径。将器件封装底部的裸焊盘焊接至PCB。电路板布局请参考MAX19996A评估板，Gerber文件可从www.maxim-ic.com.cn申请。

电源旁路

合理的电源旁路对高频电路的稳定性至关重要。如典型应用电路所示，对各V_{CC}引脚使用电容旁路，并参见表1。

SiGe、高线性度、2000MHz至3900MHz 下变频混频器，带有LO缓冲器

表1. 元件值

DESIGNATION	QTY	DESCRIPTION	COMPONENT SUPPLIER
C1	1	8.2pF microwave capacitor (0402). Use for RF frequencies ranging from 2000MHz to 3000MHz.	Murata Electronics North America, Inc.
		1.5pF microwave capacitor (0402). Use for RF frequencies ranging from 3000MHz to 3900MHz.	
C2, C6, C8, C11	4	0.01 μ F microwave capacitors (0402)	Murata Electronics North America, Inc.
C3, C9	0	Not installed, capacitors	—
C10	1	2pF microwave capacitor (0402)	Murata Electronics North America, Inc.
C13, C14	2	1000pF microwave capacitors (0402)	Murata Electronics North America, Inc.
C15	1	82pF microwave capacitor (0402)	Murata Electronics North America, Inc.
L1, L2	2	390nH wire-wound high-Q inductors* (0805) (see the <i>Typical Operating Characteristics</i>)	Coilcraft, Inc.
L3	1	4.7nH wire-wound high-Q inductor (0603)	Coilcraft, Inc.
R1	1	698 Ω \pm 1% resistor (0402). Use for V_{CC} = 5.0V applications.	Digi-Key Corp.
		1.1k Ω \pm 1% resistor (0402). Use for V_{CC} = 3.3V applications.	
R2	1	604 Ω \pm 1% resistor (0402). Use for V_{CC} = 5.0V applications.	Digi-Key Corp.
		845 Ω \pm 1% resistor (0402). Use for V_{CC} = 3.3V applications.	
R3	1	0 Ω resistor (1206)	Digi-Key Corp.
T1	1	4:1 IF balun TC4-1W-17*	Mini-Circuits
U1	1	MAX19996A IC (20 TQFN-EP)	Maxim Integrated Products, Inc.

*IF频率低于200MHz时，使用470nH电感和TC4-1W-7A 4:1非平衡变压器。

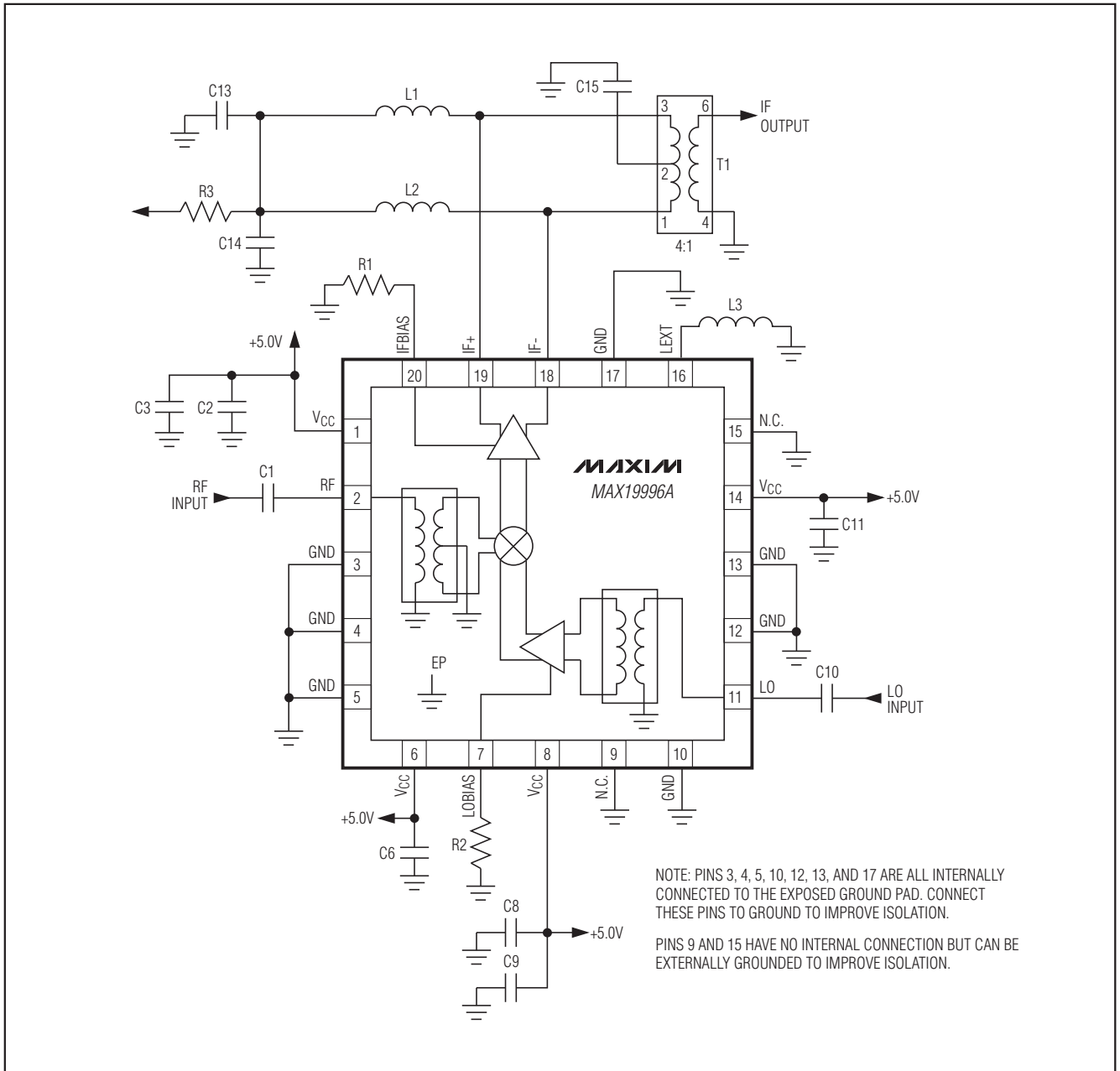
裸焊盘的RF/散热考虑

MAX19996A采用20引脚、薄型QFN封装，其裸焊盘(EP)提供了一个与管芯之间的低热阻通路。在安装MAX19996A的PCB与EP之间保持良好的热传递通道非常重要。此外，EP应通过一个低电感路径接地。EP必须直接或通过一系列电镀过孔焊接至PCB的地层。

SiGe、高线性度、2000MHz至3900MHz 下变频混频器，带有LO缓冲器

典型应用电路

MAX19996A



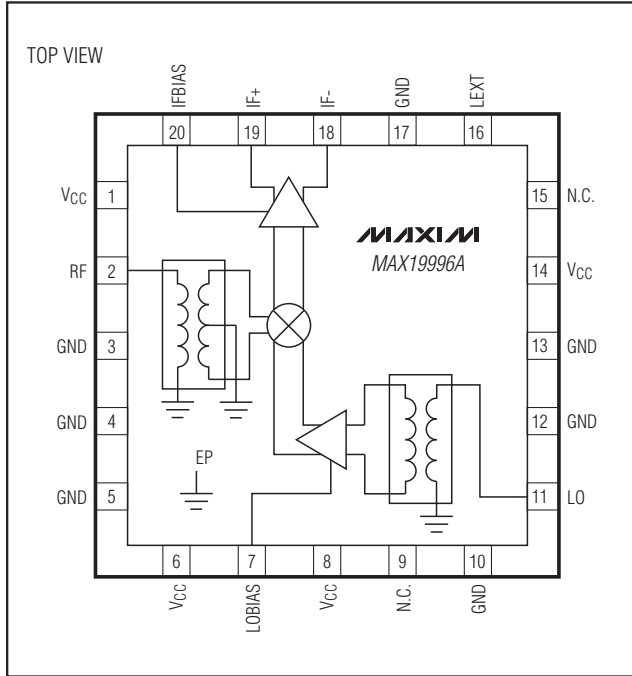
SiGe、高线性度、2000MHz至3900MHz 下变频混频器，带有LO缓冲器

引脚配置/功能框图

芯片信息

PROCESS: SiGe BiCMOS

封装信息



如需最近的封装外形信息和焊盘布局，请查询
www.maxim-ic.com.cn/packages.

封装类型	封装编码	文档编号
20引脚薄型QFN-EP	T2055+3	21-0140

SiGe、高线性度、2000MHz至3900MHz 下变频混频器，带有LO缓冲器

修订历史

修订次数	修订日期	说明	修改页
0	1/09	最初版本。	—
1	5/09	更新了 <i>Electrical Characteristics</i> 表的极限值。	6

MAX19996A

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