19-4827; Rev 0; 10/09

可提供评估板

SiGe、高线性度、2300MHz至4000MHz下变频混频器，带有LO缓冲器

MAX19998

概述

MAX19998单路、高线性度下变频混频器可为2300MHz至4000MHz的WiMAX™、LTE以及MMDS接收应用提供8.7dB转换增益、+24.3dBm输入IP3、+11.3dBm 1dB输入压缩点和9.7dB噪声系数。MAX19998具有2600MHz至4300MHz超宽LO频率范围，该器件可用于所有2.5GHz和3.5GHz应用的低端或高端LO注入架构。关于针对2.5GHz可变调谐的高端注入产品，请参考MAX19996A。

除具有优异的线性度和噪声性能外，MAX19998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。MAX19998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。

MAX19998与MAX19996/MAX19996A 2000MHz至3900MHz系列混频器引脚兼容，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。

MAX19998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

2.5GHz 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

- 2300MHz至4000MHz RF频率范围
- 2600MHz至4300MHz LO频率范围
- 50MHz至500MHz IF频率范围
- 8.7dB转换增益
- 9.7dB噪声系数
- +24.3dBm (典型值)输入IP3
- +11.3dBm (典型值)输入1dB压缩点
- P_{RF} = -10dBm时，具有67dBc (典型值)的2RF - 2LO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/MAX19996A 2000MHz至3900MHz混频器
- 引脚相似于MAX9984/MAX9986/MAX9986A 400MHz至1000MHz混频器以及MAX9993/MAX9994/MAX9996 1700MHz至2200MHz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/低性能工作模式

定购信息

PART	TEMP RANGE	PIN-PACKAGE
MAX19998ETP+	-40°C to +85°C	20 Thin QFN-EP*
MAX19998ETP+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。

SiGe、高线性度、2300MHz至4000MHz下变频混频器，带有LO缓冲器

ABSOLUTE MAXIMUM RATINGS

V_{CC} to GND.....-0.3V to +5.5V
IF+, IF-, LOBIAS, IFBIAS to GND..... -0.3V to (V_{CC} + 0.3V)
RF, LO Input Power.....+12dBm
RF, LO Current
(RF and LO is DC shorted to GND through balun).....50mA
Continuous Power Dissipation (Note 1).....5W
θ_{JA} (Notes 2, 3)..... +38°C/W
θ_{JC} (Notes 1, 3)..... +13°C/W
Operating Case Temperature Range
(Note 4)..... T_C = -40°C to +85°C
Junction Temperature .....+150°C
Storage Temperature Range..... -65°C to +150°C
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 **china.maxim-ic.com/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, **R1 = 698Ω, R2 = 604Ω**, V_{CC} = 4.75V to 5.25V, no input RF or LO 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}	Total supply current		230	247	mA

3.3V SUPPLY DC ELECTRICAL CHARACTERISTICS

(Typical Application Circuit, **R1 = 845Ω, R2 = 1.1kΩ**, V_{CC} = 3.0V to 3.6V, no input RF or LO 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, unless otherwise noted.) (Note 5)

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		150		mA

RECOMMENDED AC OPERATING CONDITIONS

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
RF Frequency Range	f_{RF}	(Notes 5, 6)	2300		4000	MHz
LO Frequency	f_{LO}	(Notes 5, 6)	2600		4300	MHz
IF Frequency	f_{IF}	Using a Mini-Circuits TC4-1W-17 4:1 transformer as defined in the *Typical Application Circuit*, IF matching components affect the IF frequency range (Notes 5, 6)	100		500	MHz
		Using a Mini-Circuits TC4-1W-7A 4:1 transformer as defined in the *Typical Application Circuit*, IF matching components affect the IF frequency range (Notes 5, 6)	50		250	
LO Drive	P_{LO}		-3	0	+3	dBm

5.0V SUPPLY AC ELECTRICAL CHARACTERISTICS—fRF = 3100MHz to 3900MHz, LOW-SIDE LO INJECTION

(*Typical Application Circuit*, with tuning elements outlined in Table 1, **R1 = 698Ω, R2 = 604Ω**, V_{CC} = 4.75V to 5.25V, RF and LO ports are driven from 50Ω sources, P_{LO} = -3dBm to +3dBm, P_{RF} = -5dBm, f_{RF} = 3100MHz to 3900MHz, f_{IF} = 300MHz, f_{LO} = 2800MHz to 3600MHz, $f_{RF} > f_{LO}$, T_C = -40°C to +85°C. Typical values are for T_C = +25°C, V_{CC} = 5.0V, P_{RF} = -5dBm, P_{LO} = 0dBm, f_{RF} = 3500MHz, f_{LO} = 3200MHz, f_{IF} = 300MHz. All parameters are guaranteed by design and characterization, unless otherwise noted.) (Note 7)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Small-Signal Conversion Gain	G_C	T_C = +25°C (Notes 8, 9)		7.6	8.7	9.4	dB
Gain Variation vs. Frequency	ΔG_C	f_{RF} = 3100MHz to 3900MHz, any 100MHz band			0.15		dB
		f_{RF} = 3100MHz to 3900MHz, any 200MHz band			0.3		
Conversion Gain Temperature Coefficient	TC_{CG}	f_{RF} = 3100MHz to 3900MHz, T_C = -40°C to +85°C			-0.01		dB/°C
Input 1dB Compression Point	IP_{1dB}	(Note 10)		10.0	11.4		dBm
Third-Order Input Intercept Point	IIP3	f_{RF1} - f_{RF2} = 1MHz, P_{RF1} = P_{RF2} = -5dBm/tone, T_C = +25°C (Note 9)		22	24.3		dBm
IIP3 Variation with T_C		f_{RF} = 3100MHz to 3900MHz, f_{RF1} - f_{RF2} = 1MHz, P_{RF1} = P_{RF2} = -5dBm/tone, T_C = -40°C to +85°C			±0.2		dBm
Single-Sideband Noise Figure	NF_{SSB}	No blockers present (Note 5)			9.7	12.5	dB
		No blockers present, T_C = +25°C (Note 5)			9.7	11.0	
Noise Figure Temperature Coefficient	TC_{NF}	Single sideband, no blockers present, T_C = -40°C to +85°C			0.018		dB/°C
Noise Figure Under Blocking	NF_B	+8dBm blocker tone applied to RF port, f_{RF} = 3500MHz, f_{LO} = 3200MHz, $f_{BLOCKER}$ = 3750MHz, P_{LO} = 0dBm, V_{CC} = +5.0V, T_C = +25°C (Notes 5, 11)			21	25	dB
2RF - 2LO Spur Rejection	2 x 2	$f_{SPUR} = f_{LO} + 150MHz$	P_{RF} = -10dBm (Note 5)	63	67		dBc
			P_{RF} = -5dBm (Note 9)	58	62		
3RF - 3LO Spur Rejection	3 x 3	$f_{SPUR} = f_{LO} + 100MHz$	P_{RF} = -10dBm (Note 5)	80	85		dBc
			P_{RF} = -5dBm (Note 9)	70	75		
RF Input Return Loss	RL_{RF}	LO on and IF terminated into a matched impedance			25		dB
LO Input Return Loss	RL_{LO}	RF and IF terminated into a matched impedance			16		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 *Typical Application Circuit*. See the *Typical Operating Characteristics* for performance vs. inductor values.	f_{IF} = 450MHz, L1 = L2 = 120nH		20		dB
			f_{IF} = 350MHz, L1 = L2 = 270nH		20		
			f_{IF} = 300MHz, L1 = L2 = 390nH		20		

5.0V SUPPLY AC ELECTRICAL CHARACTERISTICS—fRF = 3100MHz to 3900MHz, LOW-SIDE LO INJECTION (continued)

(*Typical Application Circuit*, with tuning elements outlined in Table 1, **R1 = 698Ω, R2 = 604Ω**, V_{CC} = 4.75V to 5.25V, RF and LO ports are driven from 50Ω sources, P_{LO} = -3dBm to +3dBm, P_{RF} = -5dBm, f_{RF} = 3100MHz to 3900MHz, f_{IF} = 300MHz, f_{LO} = 2800MHz to 3600MHz, $f_{RF} > f_{LO}$, T_C = -40°C to +85°C. Typical values are for T_C = +25°C, V_{CC} = 5.0V, P_{RF} = -5dBm, P_{LO} = 0dBm, f_{RF} = 3500MHz, f_{LO} = 3200MHz, f_{IF} = 300MHz. All parameters are guaranteed by design and characterization, unless otherwise noted.) (Note 7)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
RF-to-IF Isolation		f_{RF} = 3500MHz, P_{LO} = +3dBm (Note 9)	27	29.5		dB
LO Leakage at RF Port		f_{LO} = 2800MHz to 3600MHz, P_{LO} = +3dBm (Note 9)		-26		dBm
2LO Leakage at RF Port		P_{LO} = +3dBm		-29		dBm
LO Leakage at IF Port		P_{LO} = +3dBm (Note 9)		-22		dBm

3.3V SUPPLY AC ELECTRICAL CHARACTERISTICS—fRF = 3100MHz to 3900MHz, LOW-SIDE LO INJECTION

(*Typical Application Circuit*, with tuning elements outlined in Table 1, **R1 = 845Ω, R2 = 1.1kΩ**, RF and LO ports are driven from 50Ω sources, $f_{RF} > f_{LO}$. Typical values are for T_C = +25°C, V_{CC} = 3.3V, P_{RF} = -5dBm, P_{LO} = 0dBm, f_{RF} = 3500MHz, f_{LO} = 3200MHz, f_{IF} = 300MHz, unless otherwise noted.) (Note 7)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Small-Signal Conversion Gain	G_C				8.4		dB
Gain Variation vs. Frequency	ΔG_C	f_{RF} = 3100MHz to 3900MHz, any 100MHz band			0.15		dB
Conversion Gain Temperature Coefficient	TC_{CG}	f_{RF} = 3100MHz to 3900MHz, T_C = -40°C to +85°C			-0.01		dB/°C
Input 1dB Compression Point	IP_{1dB}	(Note 10)			7.7		dBm
Third-Order Input Intercept Point	IIP3	f_{RF1} - f_{RF2} = 1MHz, P_{RF1} = P_{RF2} = -5dBm/tone			20.1		dBm
IIP3 Variation with T_C		f_{RF1} - f_{RF2} = 1MHz, P_{RF1} = P_{RF2} = -5dBm/tone, T_C = -40°C to +85°C			±0.2		dB
Single-Sideband Noise Figure	NF_{SSB}	No blockers present			9.3		dB
Noise Figure Temperature Coefficient	TC_{NF}	Single sideband, no blockers present, T_C = -40°C to +85°C			0.018		dB/°C
2RF - 2LO Spur Rejection	2 x 2	$f_{SPUR} = f_{LO}$ + 150MHz	P_{RF} = -10dBm		64		dBc
			P_{RF} = -5dBm		59		
3RF - 3LO Spur Rejection	3 x 3	$f_{SPUR} = f_{LO}$ + 100MHz	P_{RF} = -10dBm		74		dBc
			P_{RF} = -5dBm		64		
RF Input Return Loss	RL_{RF}	LO on and IF terminated into a matched impedance			30		dB
LO Input Return Loss	RL_{LO}	RF and IF terminated into a matched impedance			20		dB
IF Output Impedance	Z_{IF}	Nominal differential impedance at the IC's IF outputs			200		Ω

3.3V SUPPLY AC ELECTRICAL CHARACTERISTICS—fRF = 3100MHz to 3900MHz, LOW-SIDE LO INJECTION (continued)

(*Typical Application Circuit*, with tuning elements outlined in Table 1, **R1 = 845Ω, R2 = 1.1kΩ**, RF and LO ports are driven from 50Ω sources, $f_{RF} > f_{LO}$. Typical values are for T_C = +25°C, V_{CC} = 3.3V, P_{RF} = -5dBm, P_{LO} = 0dBm, f_{RF} = 3500MHz, f_{LO} = 3200MHz, f_{IF} = 300MHz, unless otherwise noted.) (Note 7)

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 *Typical Application Circuit*. See the *Typical Operating Characteristics* for performance vs. inductor values.	f_{IF} = 450MHz, L1 = L2 = 120nH		17		dB
			f_{IF} = 350MHz, L1 = L2 = 270nH		17		
			f_{IF} = 300MHz, L1 = L2 = 390nH		17		
RF-to-IF Isolation		f_{RF} = 3100MHz to 3900MHz, P_{LO} = +3dBm			27		dB
LO Leakage at RF Port		f_{LO} = 2800MHz to 3600MHz, P_{LO} = +3dBm			-30		dBm
2LO Leakage at RF Port		f_{LO} = 2800MHz to 3600MHz, P_{LO} = +3dBm			-26.5		dBm
LO Leakage at IF Port		f_{LO} = 2800MHz to 3600MHz, P_{LO} = +3dBm			-27.5		dBm

5.0V SUPPLY AC ELECTRICAL CHARACTERISTICS—fRF = 3100MHz to 3900MHz, HIGH-SIDE LO INJECTION

(*Typical Application Circuit*, with tuning elements outlined in Table 1, **R1 = 698Ω, R2 = 604Ω**, V_{CC} = 4.75V to 5.25V, RF and LO ports are driven from 50Ω sources, P_{LO} = -3dBm to +3dBm, P_{RF} = -5dBm, f_{RF} = 3100MHz to 3900MHz, f_{IF} = 300MHz, f_{LO} = 3400MHz to 4200MHz, $f_{RF} < f_{LO}$, T_C = -40°C to +85°C. Typical values are for T_C = +25°C, V_{CC} = 5.0V, P_{RF} = -5dBm, P_{LO} = 0dBm, f_{RF} = 3500MHz, f_{LO} = 3800MHz, f_{IF} = 300MHz, unless otherwise noted.) (Note 7)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Small-Signal Conversion Gain	G_C	T_C = +25°C			8.4		dB
Gain Variation vs. Frequency	ΔG_C	f_{RF} = 3100MHz to 3900MHz, any 100MHz band			0.15		dB
		f_{RF} = 3100MHz to 3900MHz, any 200MHz band			0.3		
Conversion Gain Temperature Coefficient	TC_{CG}	f_{RF} = 3100MHz to 3900MHz, T_C = -40°C to +85°C			-0.01		dB/°C
Input 1dB Compression Point	IP_{1dB}	(Note 10)			11.4		dBm
Third-Order Input Intercept Point	IIP3	$f_{RF1} - f_{RF2}$ = 1MHz, $P_{RF1} = P_{RF2}$ = -5dBm/tone, T_C = +25°C			24.8		dBm
IIP3 Variation with T_C		f_{RF} = 3100MHz to 3900MHz, $f_{RF1} - f_{RF2}$ = 1MHz, $P_{RF1} = P_{RF2}$ = -5dBm/tone, T_C = -40°C to +85°C			±0.2		dBm
Single-Sideband Noise Figure	NF_{SSB}	No blockers present			9.8		dB
Noise Figure Temperature Coefficient	TC_{NF}	Single sideband, no blockers present, T_C = -40°C to +85°C			0.018		dB/°C
2LO - 2RF Spur Rejection	2 x 2	$f_{SPUR} = f_{LO}$ - 150MHz	P_{RF} = -10dBm		70		dBc
			P_{RF} = -5dBm		65		
3LO - 3RF Spur Rejection	3 x 3	$f_{SPUR} = f_{LO}$ - 100MHz	P_{RF} = -10dBm		89		dBc
			P_{RF} = -5dBm		79		

5.0V SUPPLY AC ELECTRICAL CHARACTERISTICS—fRF = 3100MHz to 3900MHz, HIGH-SIDE LO INJECTION (continued)

(*Typical Application Circuit*, with tuning elements outlined in Table 1, **R1 = 698Ω, R2 = 604Ω**, V_{CC} = 4.75V to 5.25V, RF and LO ports are driven from 50Ω sources, P_{LO} = -3dBm to +3dBm, P_{RF} = -5dBm, f_{RF} = 3100MHz to 3900MHz, f_{IF} = 300MHz, f_{LO} = 3400MHz to 4200MHz, $f_{RF} < f_{LO}$, T_C = -40°C to +85°C. Typical values are for T_C = +25°C, V_{CC} = 5.0V, P_{RF} = -5dBm, P_{LO} = 0dBm, f_{RF} = 3500MHz, f_{LO} = 3800MHz, f_{IF} = 300MHz, unless otherwise noted.) (Note 7)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
RF Input Return Loss	RL_{RF}	LO on and IF terminated into a matched impedance			24		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 *Typical Application Circuit*. See the *Typical Operating Characteristics* for performance vs. inductor values.	f_{IF} = 450MHz, L1 = L2 = 120nH		20		dB
			f_{IF} = 350MHz, L1 = L2 = 270nH		20		
			f_{IF} = 300MHz, L1 = L2 = 390nH		20		
RF-to-IF Isolation		P_{LO} = +3dBm			30		dB
LO Leakage at RF Port		P_{LO} = +3dBm			-30.3		dBm
2LO Leakage at RF Port		P_{LO} = +3dBm			-19		dBm
LO Leakage at IF Port		P_{LO} = +3dBm			-23		dBm

5.0V SUPPLY AC ELECTRICAL CHARACTERISTICS—fRF = 2300MHz to 2900MHz, HIGH-SIDE LO INJECTION

(*Typical Application Circuit*, with tuning elements outlined in Table 1, **R1 = 698Ω, R2 = 604Ω**, V_{CC} = 4.75V to 5.25V, RF and LO ports are driven from 50Ω sources, P_{LO} = -3dBm to +3dBm, P_{RF} = -5dBm, f_{RF} = 2300MHz to 2900MHz, f_{IF} = 300MHz, f_{LO} = 2600MHz to 3200MHz, $f_{RF} < f_{LO}$, T_C = -40°C to +85°C. Typical values are for T_C = +25°C, V_{CC} = 5.0V, P_{RF} = -5dBm, P_{LO} = 0dBm, f_{RF} = 2600MHz, f_{LO} = 2900MHz, f_{IF} = 300MHz, unless otherwise noted.) (Note 7)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Small-Signal Conversion Gain	G_C	T_C = +25°C		8.4		dB
Gain Variation vs. Frequency	ΔG_C	f_{RF} = 2300MHz to 2900MHz, any 100MHz band		0.15		dB
		f_{RF} = 2300MHz to 2900MHz, any 200MHz band		0.3		
Conversion Gain Temperature Coefficient	TC_{CG}	f_{RF} = 2300MHz to 2900MHz, T_C = -40°C to +85°C		-0.01		dB/°C
Input 1dB Compression Point	IP_{1dB}	(Note 10)		11.4		dBm
Third-Order Input Intercept Point	IIP3	f_{RF1} - f_{RF2} = 1MHz, P_{RF1} = P_{RF2} = -5dBm/tone, T_C = +25°C		25.0		dBm

5.0V SUPPLY AC ELECTRICAL CHARACTERISTICS—fRF = 2300MHz to 2900MHz, HIGH-SIDE LO INJECTION (continued)

(*Typical Application Circuit*, with tuning elements outlined in Table 1, **R1 = 698Ω, R2 = 604Ω**, V_{CC} = 4.75V to 5.25V, RF and LO ports are driven from 50Ω sources, P_{LO} = -3dBm to +3dBm, PRF = -5dBm, f_{RF} = 2300MHz to 2900MHz, f_{IF} = 300MHz, f_{LO} = 2600MHz to 3200MHz, $f_{RF} < f_{LO}$, T_C = -40°C to +85°C. Typical values are for T_C = +25°C, V_{CC} = 5.0V, P_{RF} = -5dBm, P_{LO} = 0dBm, f_{RF} = 2600MHz, f_{LO} = 2900MHz, f_{IF} = 300MHz, unless otherwise noted. (Note 7)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
IIP3 Variation with T_C		f_{RF} = 2300MHz to 2900MHz, f_{RF1} - f_{RF2} = 1MHz, P_{RF1} = P_{RF2} = -5dBm/tone, T_C = -40°C to +85°C			±0.2		dBm
Single-Sideband Noise Figure	NF_{SSB}	No blockers present			10.0		dB
Noise Figure Temperature Coefficient	TC_{NF}	Single sideband, no blockers present, T_C = -40°C to +85°C			0.018		dB/°C
2LO - 2RF Spur Rejection	2 x 2	$f_{SPUR} = f_{LO}$ - 50MHz	P_{RF} = -10dBm		77		dBc
			P_{RF} = -5dBm		72		
3LO - 3RF Spur Rejection	3 x 3	$f_{SPUR} = f_{LO}$ - 100MHz	P_{RF} = -10dBm		86		dBc
			P_{RF} = -5dBm		76		
RF Input Return Loss	RL_{RF}	LO on and IF terminated into a matched impedance			30		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 *Typical Application Circuit*. See the *Typical Operating Characteristics* for performance vs. inductor values.	f_{IF} = 450MHz, L1 = L2 = 120nH		25		dB
			f_{IF} = 350MHz, L1 = L2 = 270nH		25		
			f_{IF} = 300MHz, L1 = L2 = 390nH		25		
RF-to-IF Isolation		P_{LO} = +3dBm			45		dB
LO Leakage at RF Port		P_{LO} = +3dBm			-28.8		dBm
2LO Leakage at RF Port		P_{LO} = +3dBm			-42.3		dBm
LO Leakage at IF Port		P_{LO} = +3dBm			-26.3		dBm

Note 5: Not production tested.

Note 6: Operation outside this range is possible, but with degraded performance of some parameters. See the *Typical Operating Characteristics*.

Note 7: All limits reflect losses of external components, including a 0.8dB loss at f_{IF} = 300MHz due to the 4:1 impedance transformer. Output measurements were taken at IF outputs of the *Typical Application Circuit*.

Note 8: Guaranteed by design and characterization.

Note 9: 100% production tested for functional performance.

Note 10: Maximum reliable continuous input power applied to the RF port of this device is +12dBm from a 50Ω source.

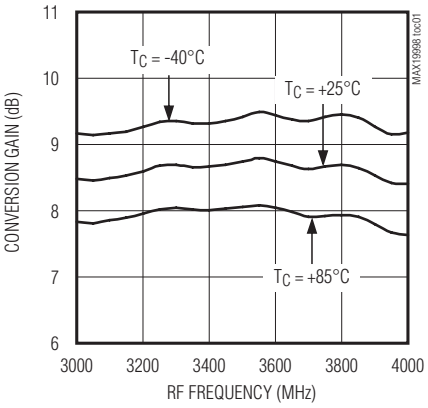
Note 11: Measured with external LO source noise filtered so that the noise floor is -174dBm/Hz. This specification reflects the effects of all SNR degradations in the mixer including the LO noise, as defined in Application Note 2021: *Specifications and Measurement of Local Oscillator Noise in Integrated Circuit Base Station Mixers.*

SiGe、高线性度、2300MHz至4000MHz下变频混频器，带有LO缓冲器

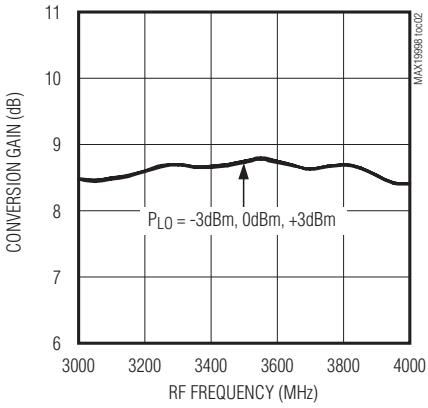
典型工作特性

(*Typical Application Circuit* with tuning elements outlined in **Table 1, V_{CC} = 5.0V, f_{RF} = 3100MHz to 3900MHz, LO is low-side injected** for a 300MHz IF, P_{RF} = -5dBm, P_{LO} = 0dBm, T_C = +25°C, unless otherwise noted.)

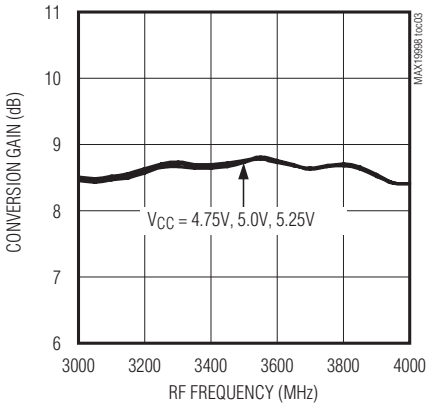
CONVERSION GAIN vs. RF FREQUENCY



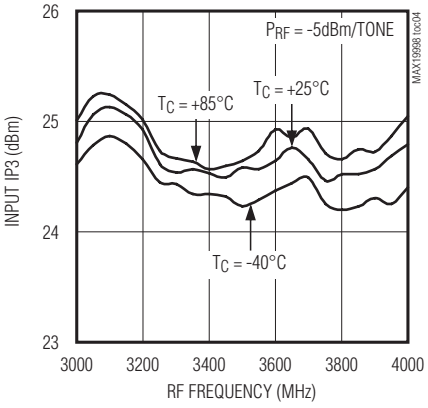
CONVERSION GAIN vs. RF FREQUENCY



CONVERSION GAIN vs. RF FREQUENCY



INPUT IP3 vs. RF FREQUENCY



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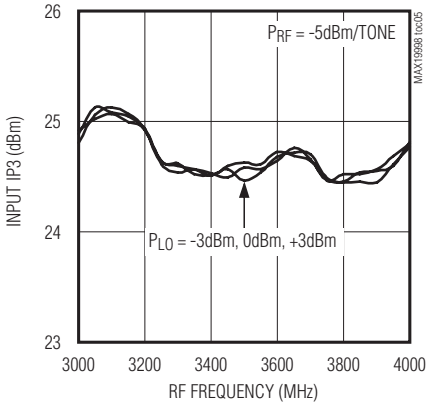
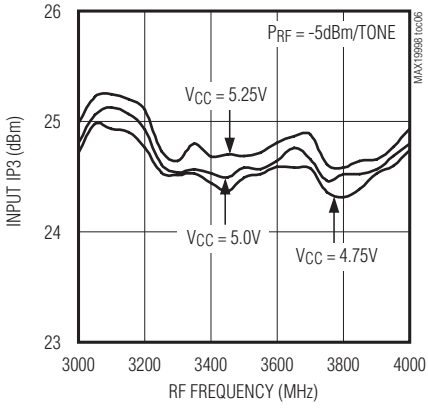
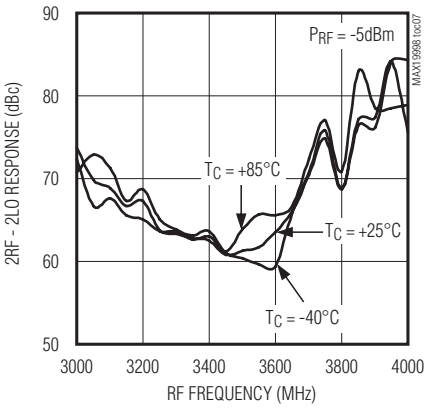


INPUT IP3 vs. RF FREQUENCY



2RF - 2LO RESPONSE vs. RF FREQUENCY



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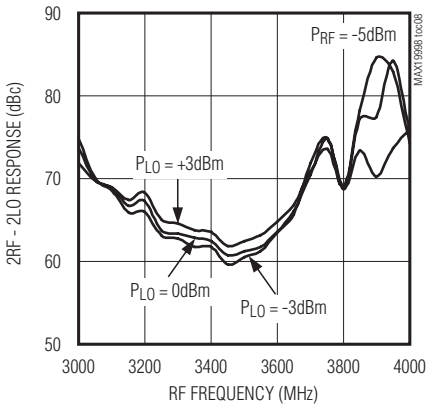

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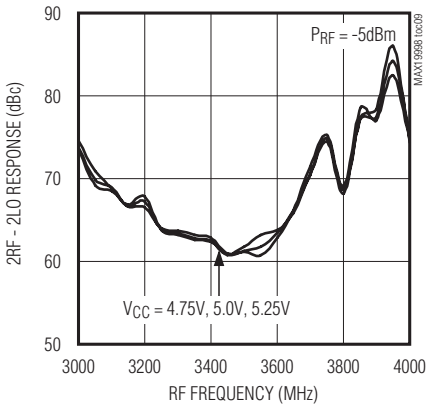

典型工作特性(续)

(*Typical Application Circuit* with tuning elements outlined in **Table 1, V_{CC} = 5.0V, f_{RF} = 3100MHz to 3900MHz, LO is low-side injected** for a 300MHz IF, P_{RF} = -5dBm, P_{LO} = 0dBm, T_C = +25°C, unless otherwise noted.)

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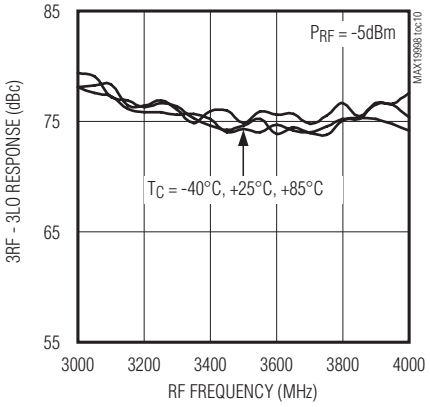

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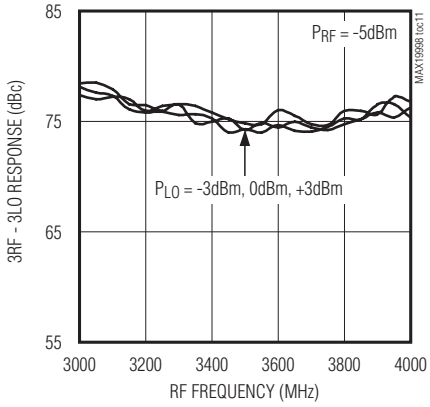

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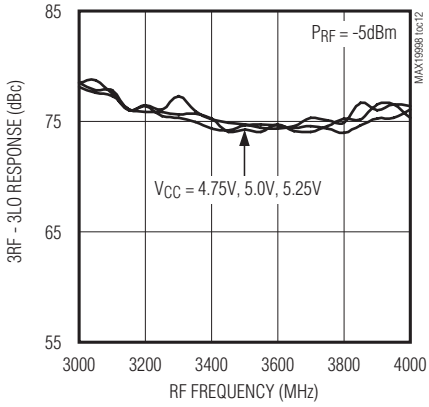
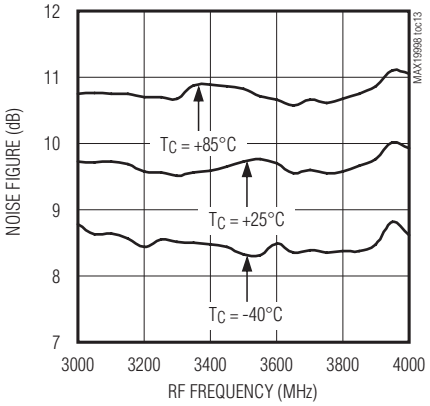


NOISE FIGURE vs. RF FREQUENCY



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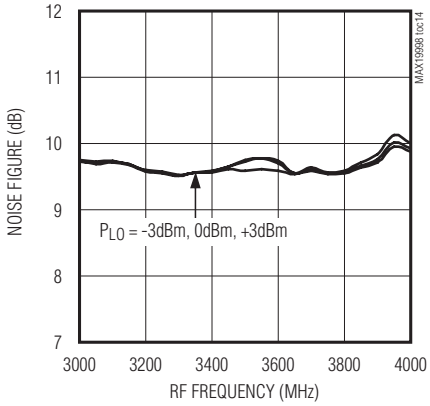

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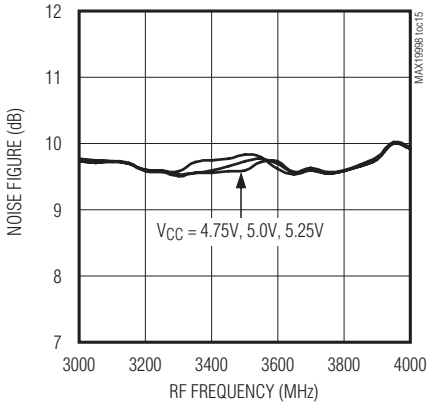
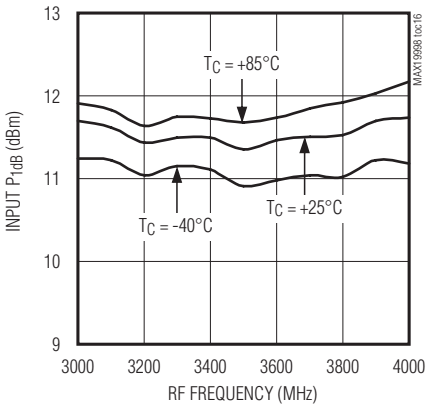


INPUT P_{1dB} vs. RF FREQUENCY



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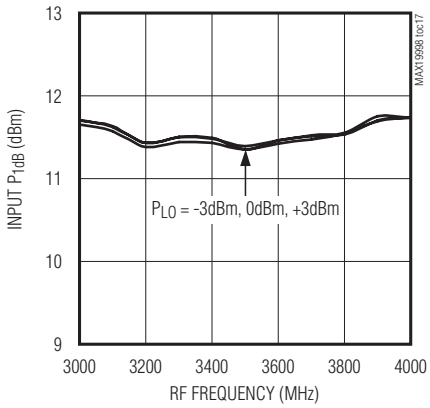

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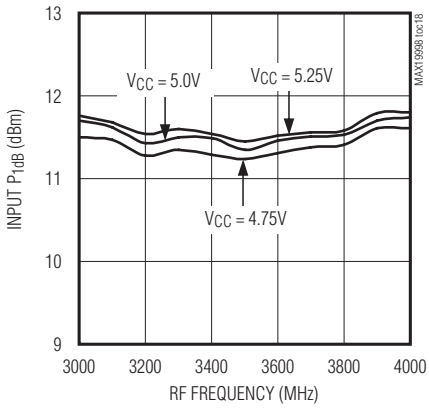

SiGe、高线性度、2300MHz至4000MHz下变频混频器，带有LO缓冲器

典型工作特性(续)

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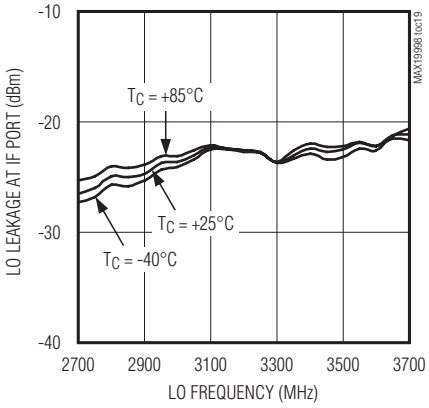
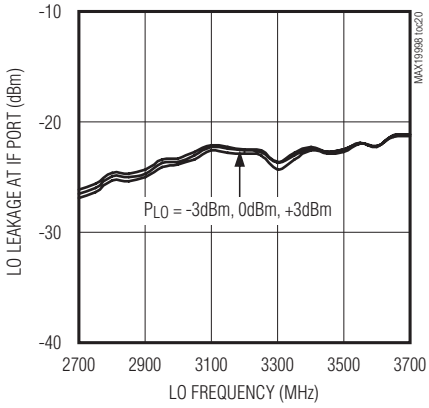
LO LEAKAGE AT IF PORT vs. LO FREQUENCY



LO LEAKAGE AT IF PORT vs. LO FREQUENCY



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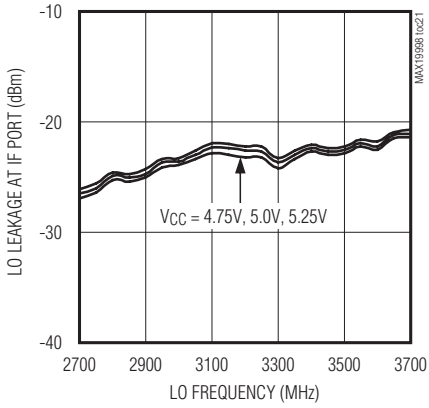
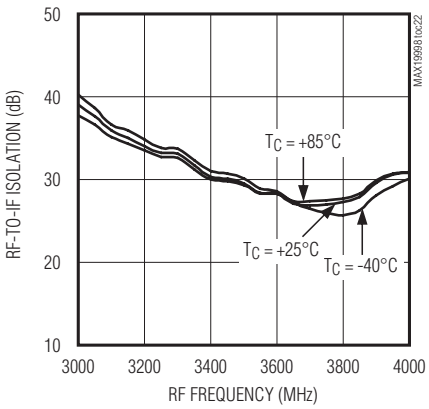
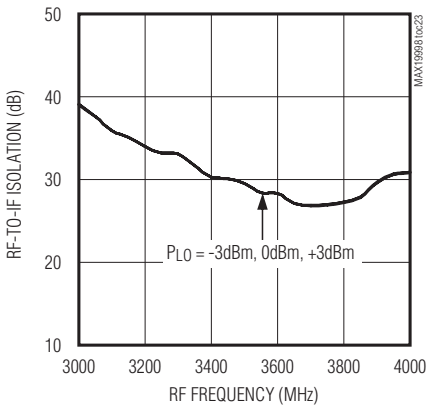


RF-TO-IF ISOLATION vs. RF FREQUENCY



RF-TO-IF ISOLATION vs. RF FREQUENCY



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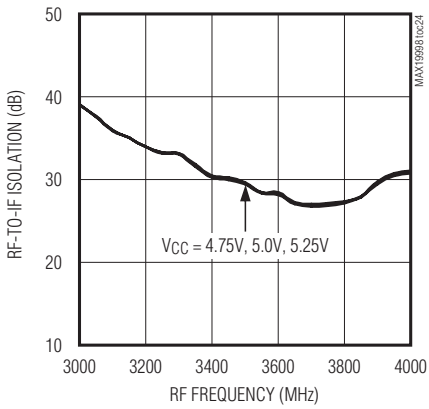
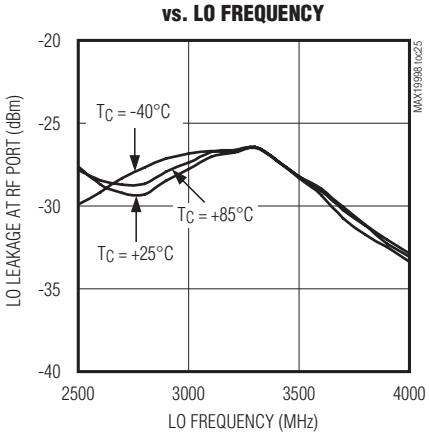
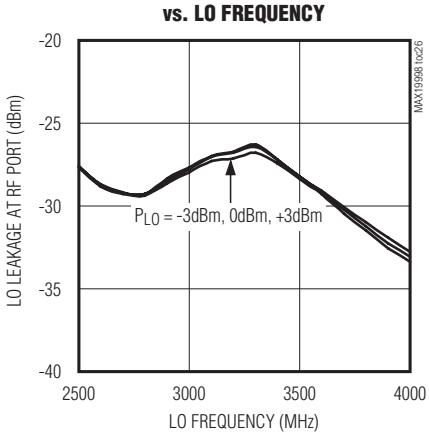


LO LEAKAGE AT RF PORT vs. LO FREQUENCY



LO LEAKAGE AT RF PORT vs. LO FREQUENCY



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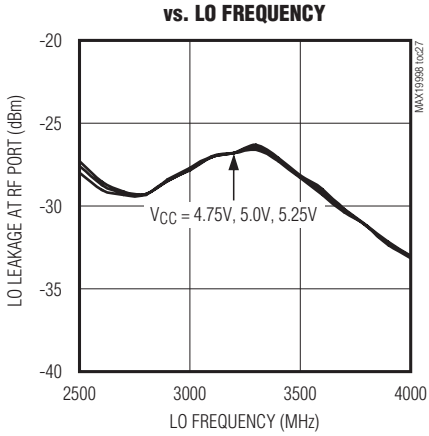

典型工作特性(续)

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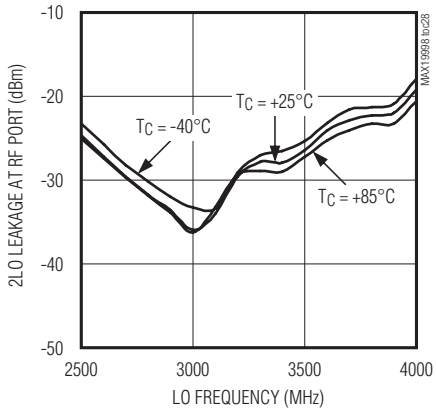
2LO LEAKAGE AT RF PORT vs. LO FREQUENCY



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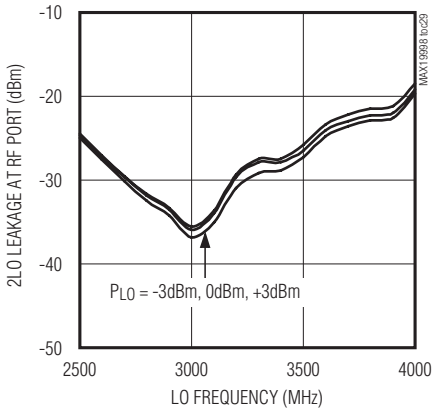
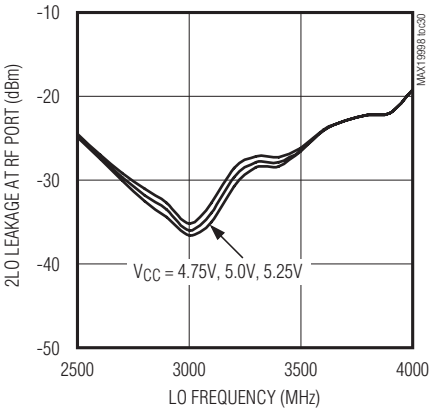
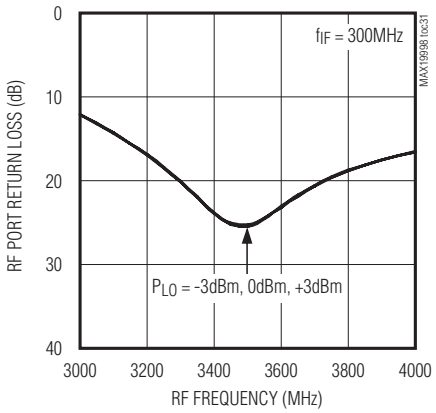


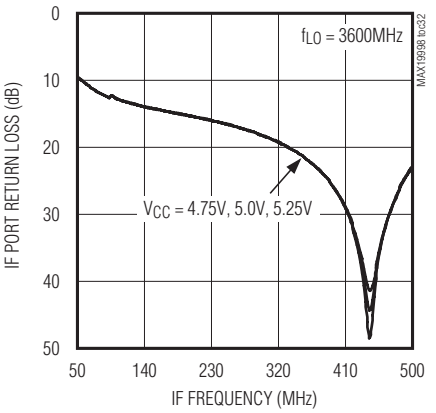
2LO LEAKAGE AT RF PORT vs. LO FREQUENCY



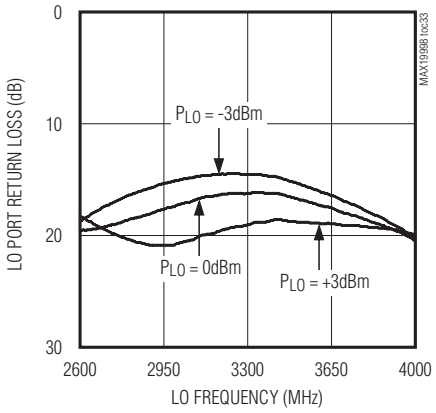
RF PORT RETURN LOSS vs. RF FREQUENCY



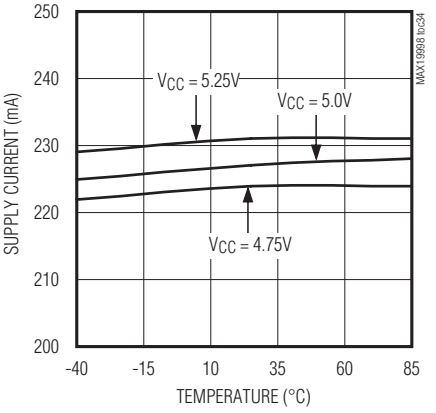
IF PORT RETURN LOSS vs. IF FREQUENCY



LO PORT RETURN LOSS vs. LO FREQUENCY



SUPPLY CURRENT vs. TEMPERATURE (T_C)



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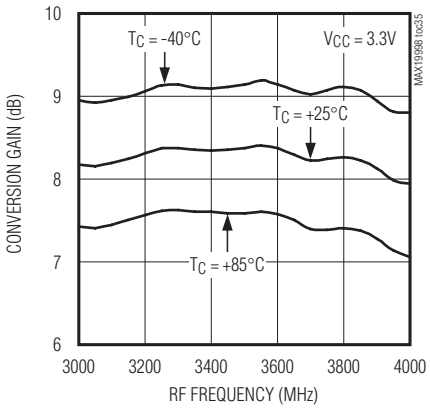
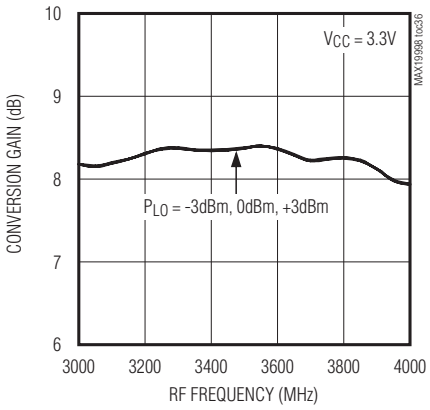


CONVERSION GAIN vs. RF FREQUENCY



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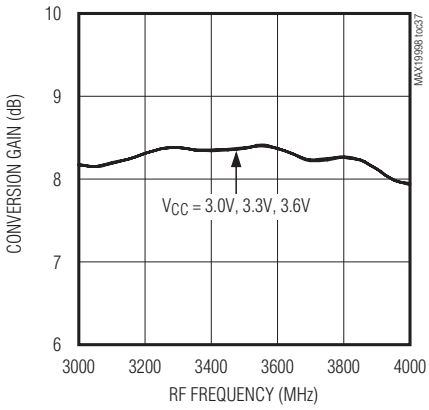
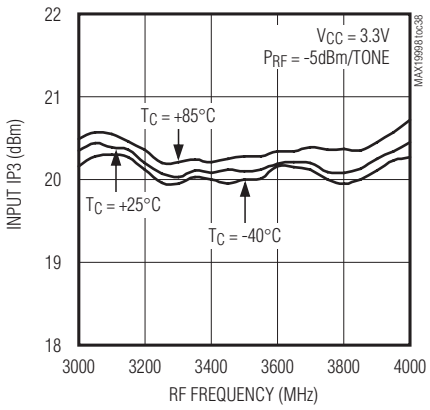


INPUT IP3 vs. RF FREQUENCY



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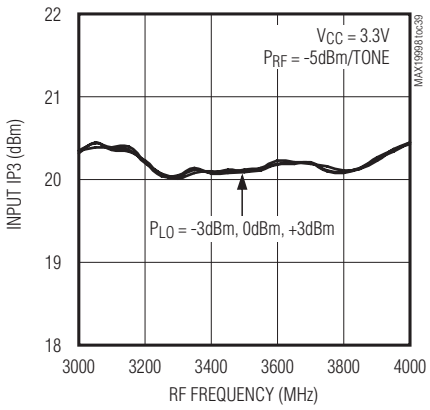

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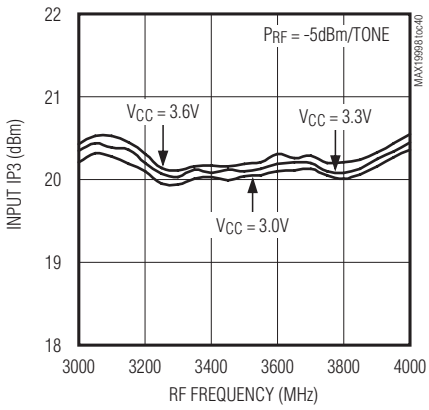

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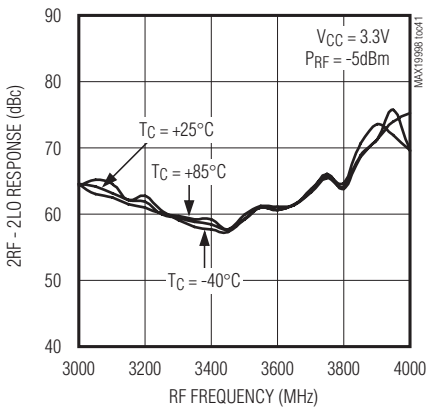

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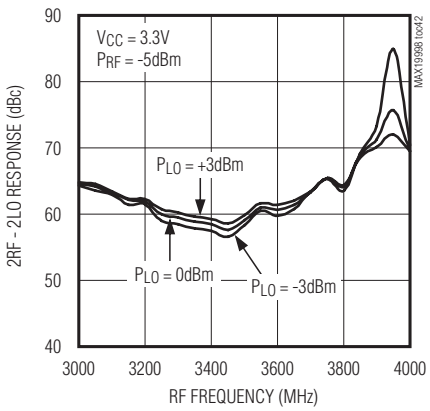

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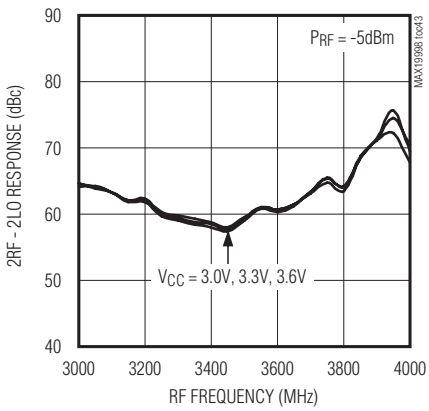

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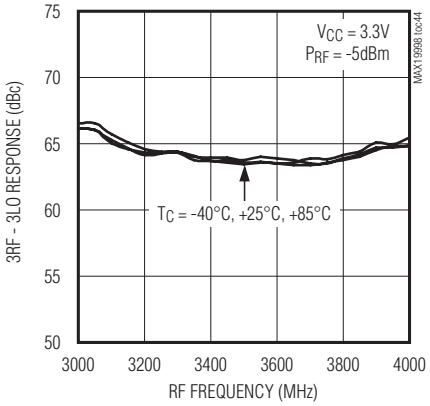

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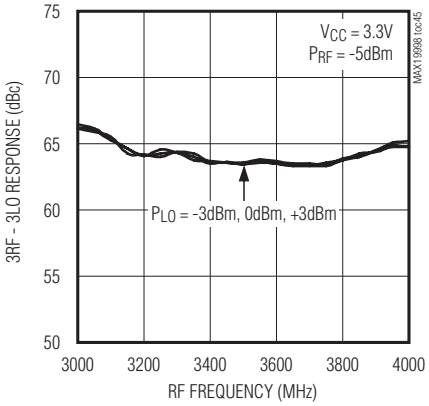

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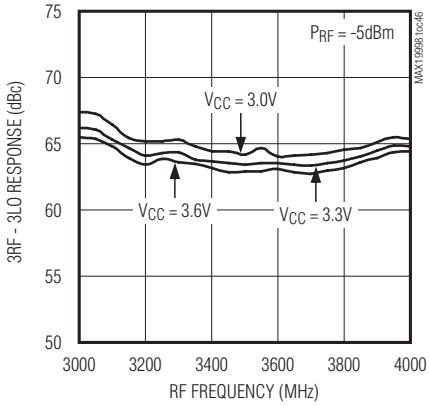
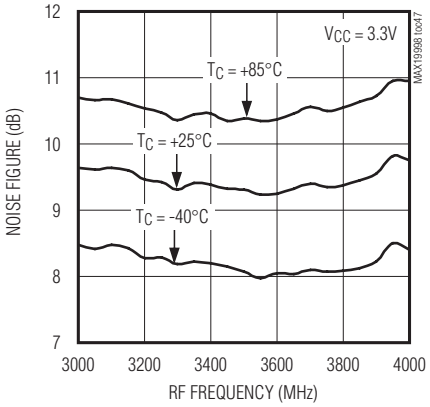


NOISE FIGURE vs. RF FREQUENCY



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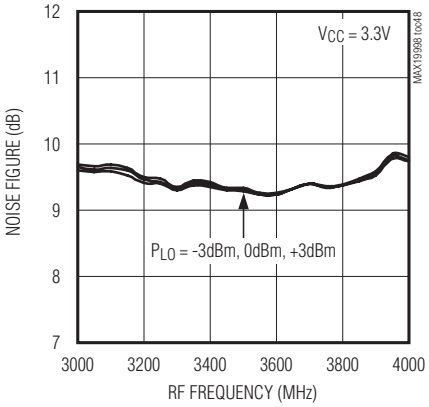

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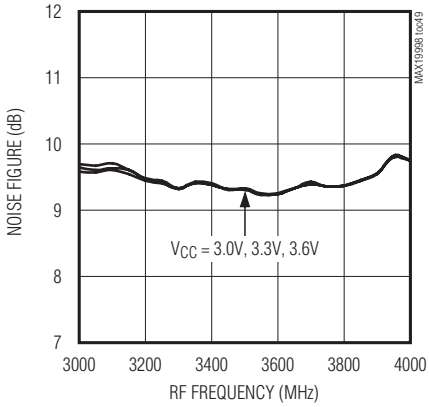
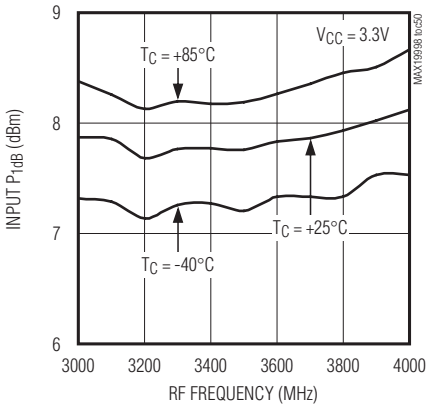
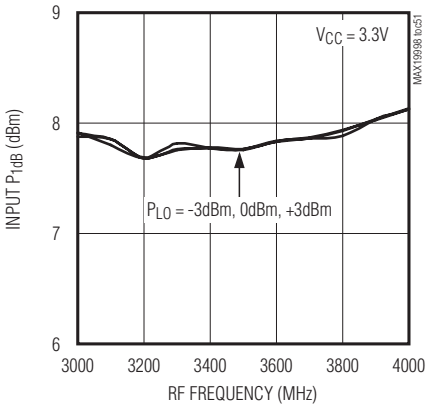


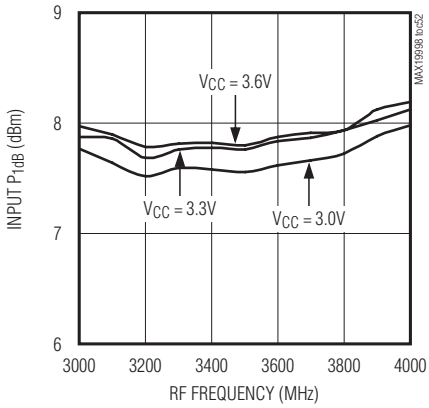
INPUT P_{1dB} vs. RF FREQUENCY



INPUT P_{1dB} vs. RF FREQUENCY



INPUT P_{1dB} vs. RF FREQUENCY



SiGe、高线性度、2300MHz至4000MHz下变频混频器，带有LO缓冲器

典型工作特性(续)

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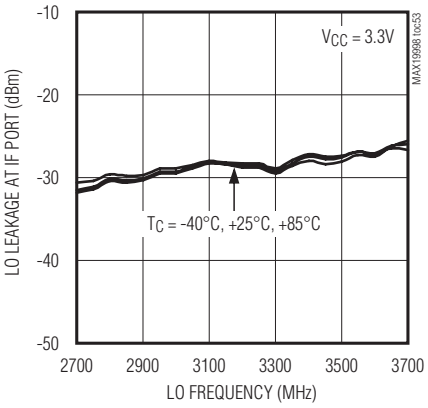
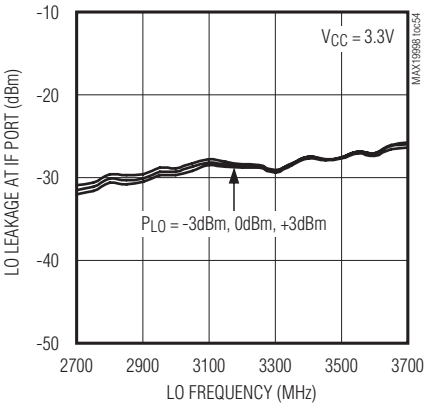
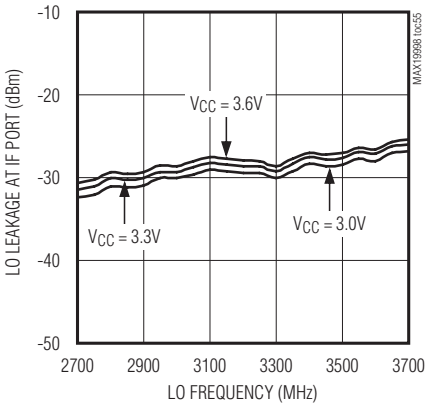
LO LEAKAGE AT IF PORT vs. LO FREQUENCY



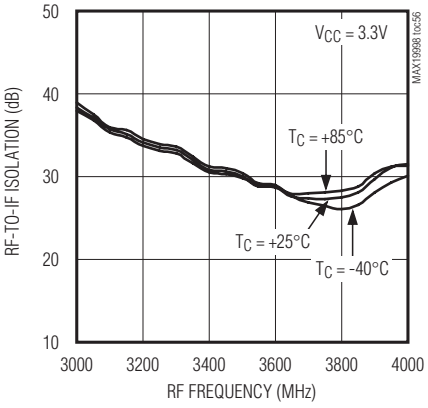
LO LEAKAGE AT IF PORT vs. LO FREQUENCY



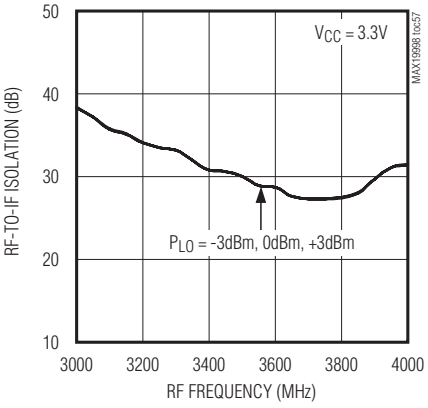
LO LEAKAGE AT IF PORT vs. LO FREQUENCY



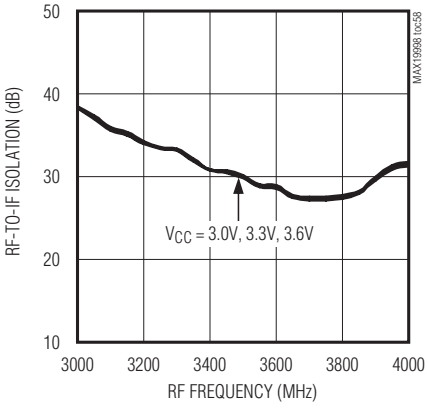
RF-TO-IF ISOLATION vs. RF FREQUENCY



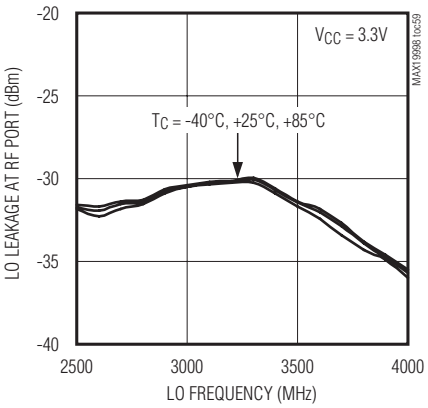
RF-TO-IF ISOLATION vs. RF FREQUENCY



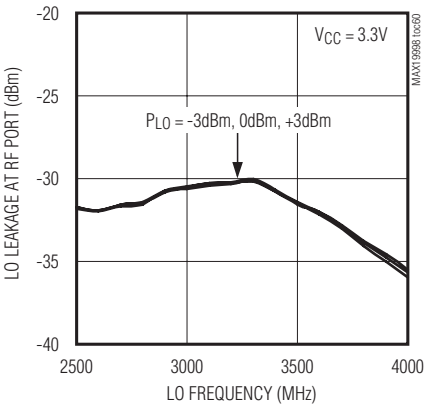
RF-TO-IF ISOLATION vs. RF FREQUENCY



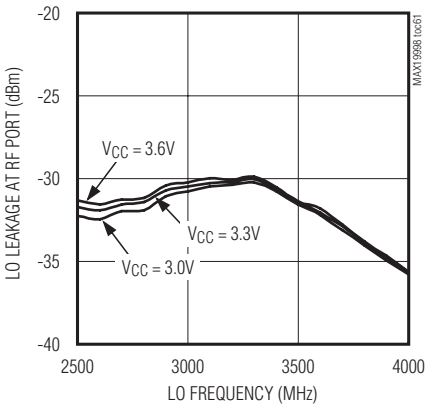
LO LEAKAGE AT RF PORT vs. LO FREQUENCY



LO LEAKAGE AT RF PORT vs. LO FREQUENCY



LO LEAKAGE AT RF PORT vs. LO FREQUENCY



典型工作特性(续)

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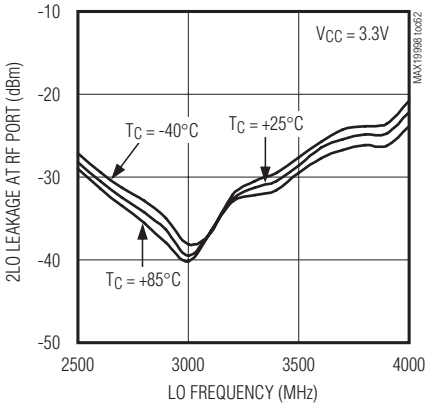
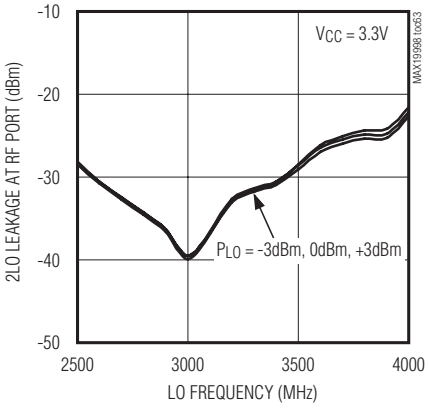
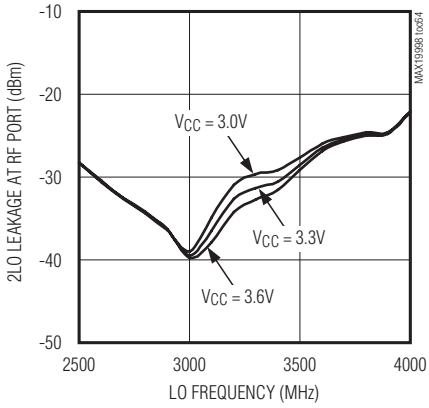
2LO LEAKAGE AT RF PORT vs. LO FREQUENCY



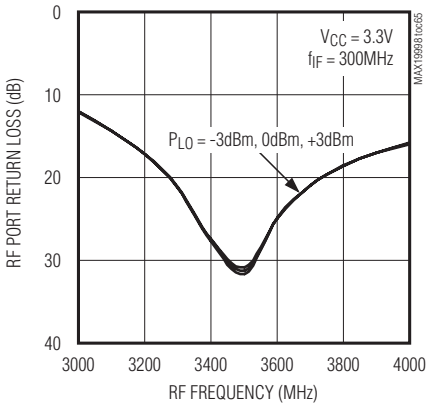
2LO LEAKAGE AT RF PORT vs. LO FREQUENCY



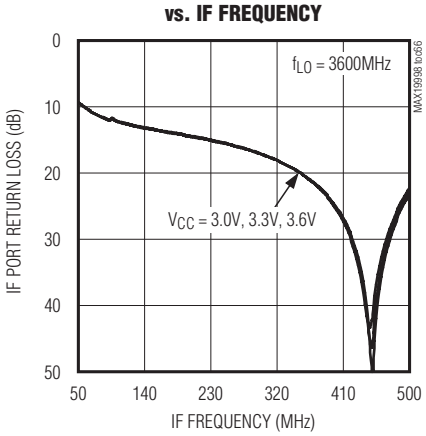
2LO LEAKAGE AT RF PORT vs. LO FREQUENCY



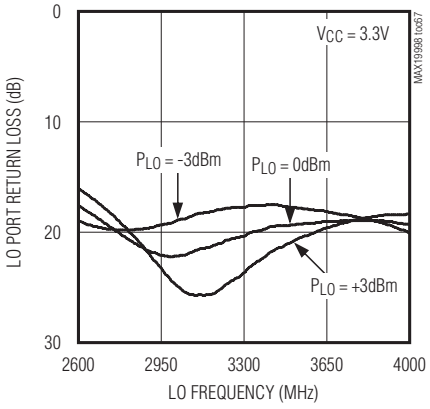
RF PORT RETURN LOSS vs. RF FREQUENCY



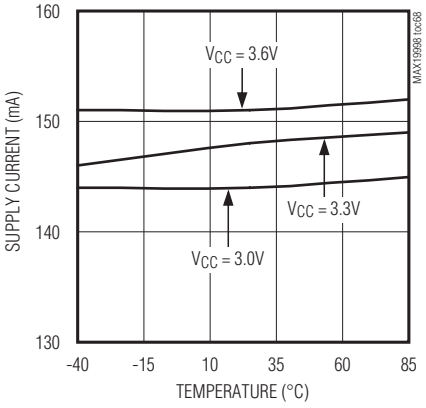
IF PORT RETURN LOSS vs. IF FREQUENCY



LO PORT RETURN LOSS vs. LO FREQUENCY



SUPPLY CURRENT vs. TEMPERATURE (T_C)



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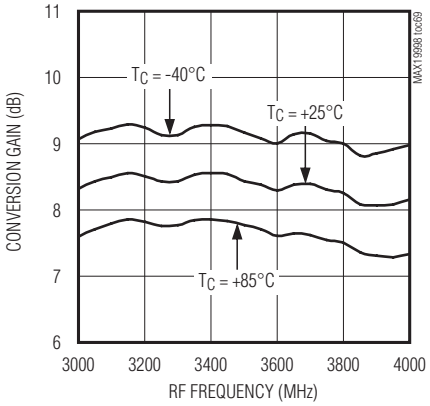
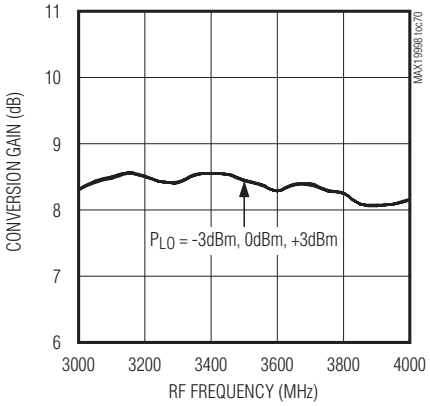
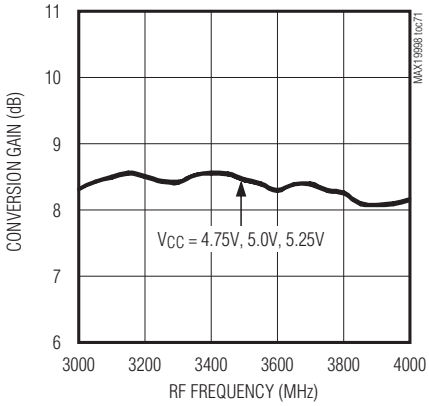
CONVERSION GAIN vs. RF FREQUENCY



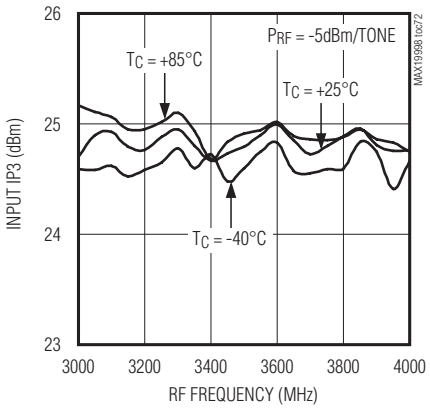
CONVERSION GAIN vs. RF FREQUENCY



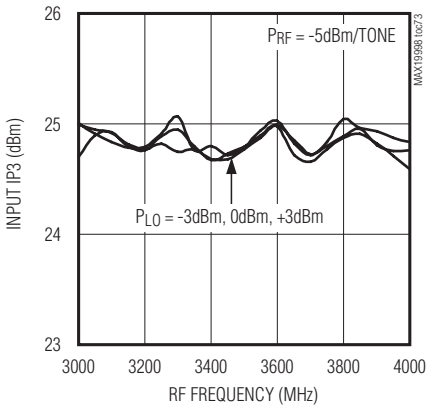
CONVERSION GAIN vs. RF FREQUENCY



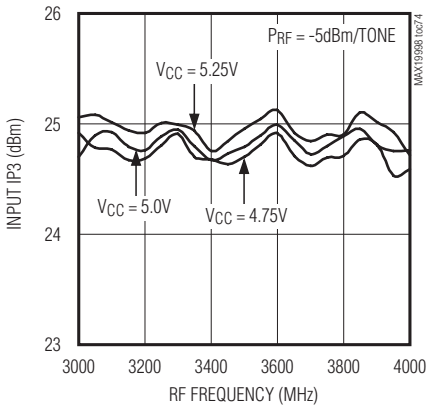
INPUT IP3 vs. RF FREQUENCY



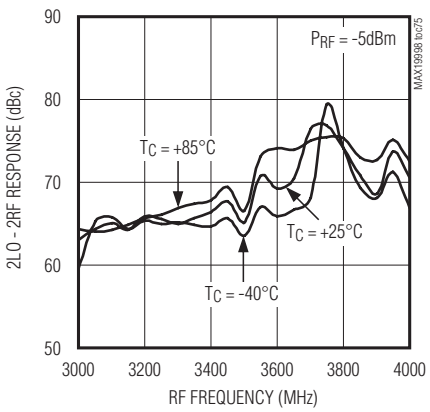
INPUT IP3 vs. RF FREQUENCY



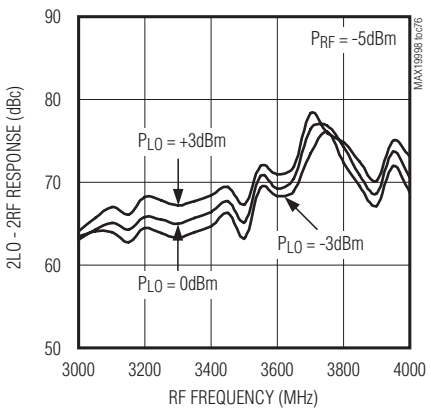
INPUT IP3 vs. RF FREQUENCY



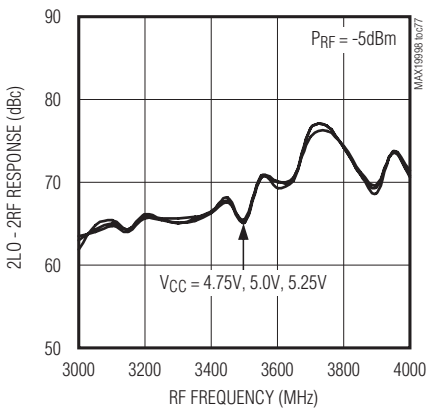
2LO - 2RF RESPONSE vs. RF FREQUENCY



2LO - 2RF RESPONSE vs. RF FREQUENCY



2LO - 2RF RESPONSE vs. RF FREQUENCY



典型工作特性(续)

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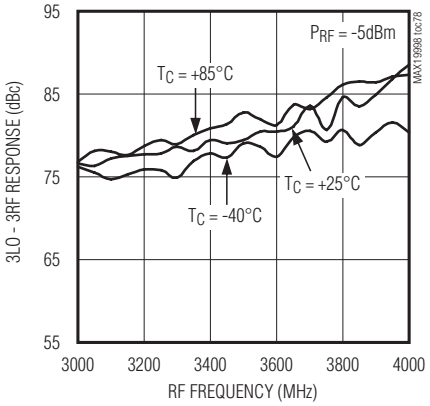
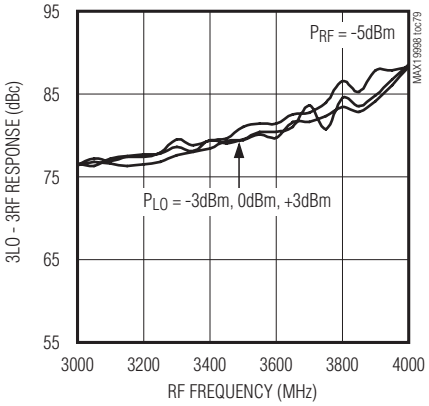
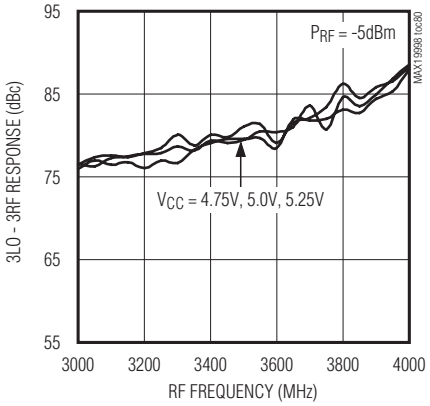
3LO - 3RF RESPONSE vs. RF FREQUENCY



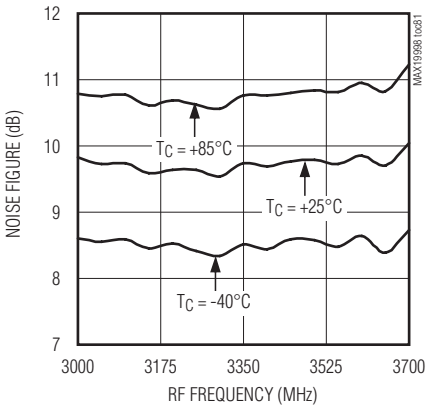
3LO - 3RF RESPONSE vs. RF FREQUENCY



3LO - 3RF RESPONSE vs. RF FREQUENCY



NOISE FIGURE vs. RF FREQUENCY



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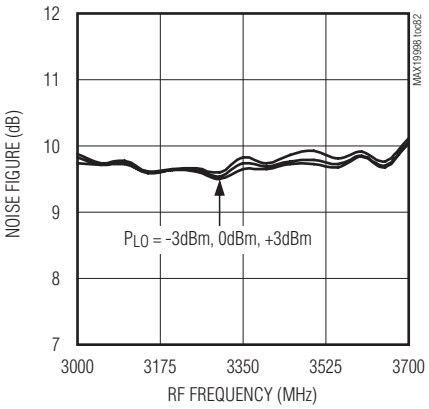
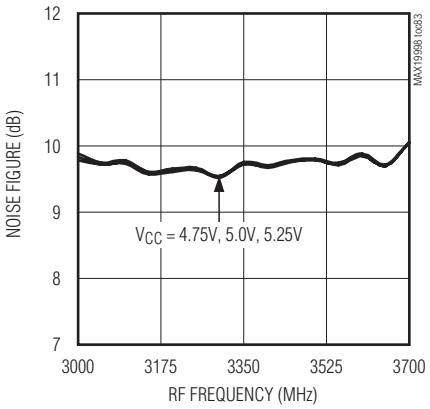
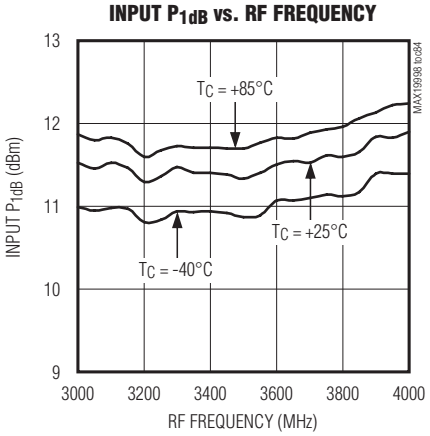


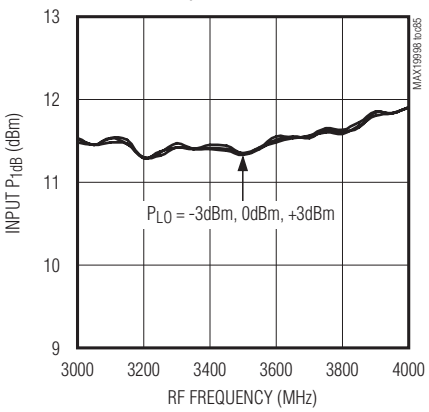
NOISE FIGURE vs. RF FREQUENCY



INPUT P_{1dB} vs. RF FREQUENCY



INPUT P_{1dB} vs. RF FREQUENCY



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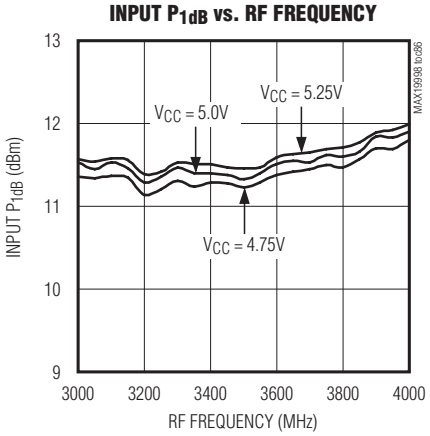

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典型工作特性(续)

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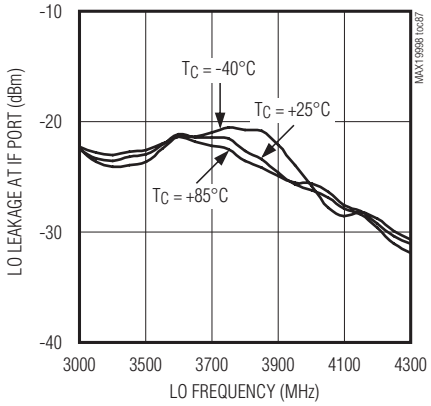
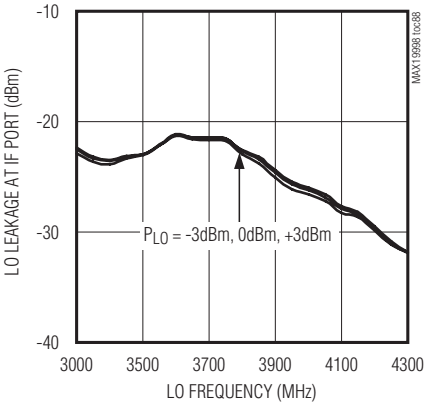
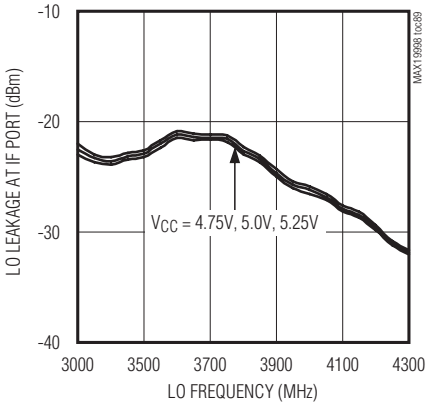


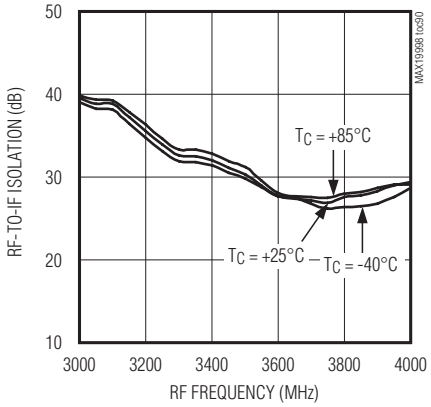
LO LEAKAGE AT IF PORT vs. LO FREQUENCY



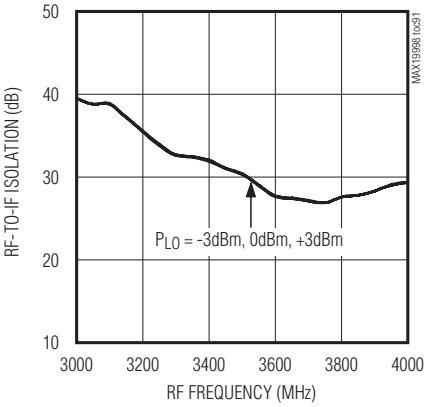
LO LEAKAGE AT IF PORT vs. LO FREQUENCY



RF-TO-IF ISOLATION vs. RF FREQUENCY



RF-TO-IF ISOLATION vs. RF FREQUENCY



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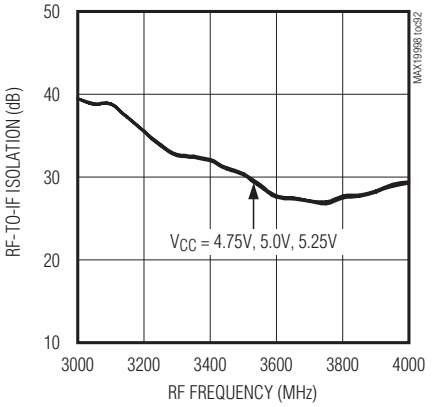
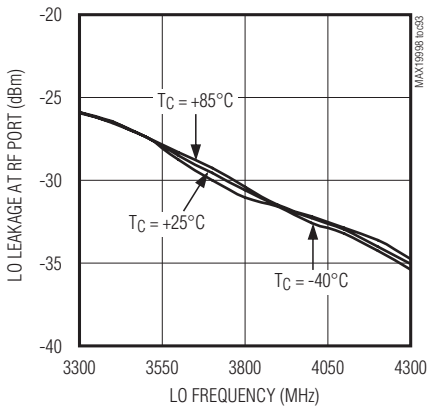
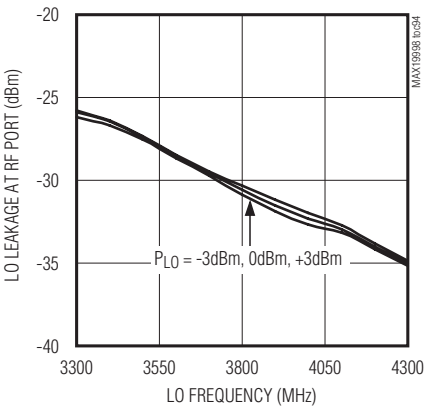


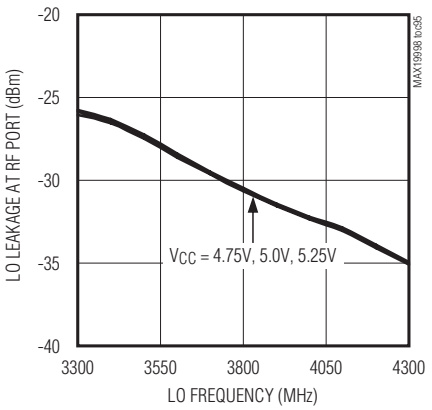
LO LEAKAGE AT RF PORT vs. LO FREQUENCY



LO LEAKAGE AT RF PORT vs. LO FREQUENCY



LO LEAKAGE AT RF PORT vs. LO FREQUENCY



典型工作特性(续)

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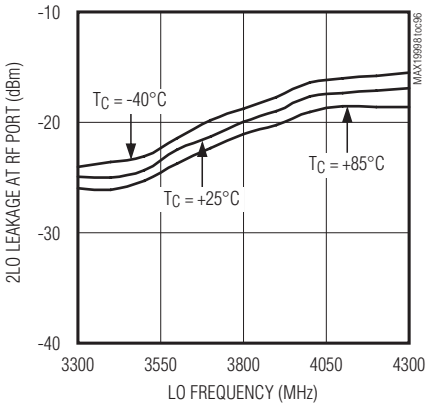

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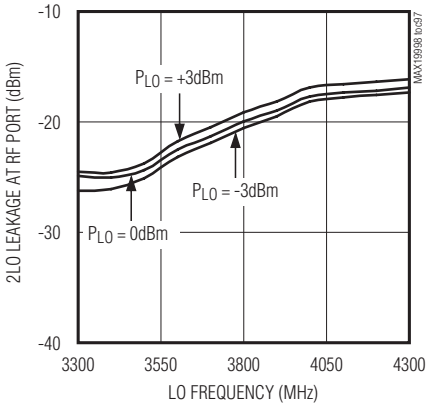
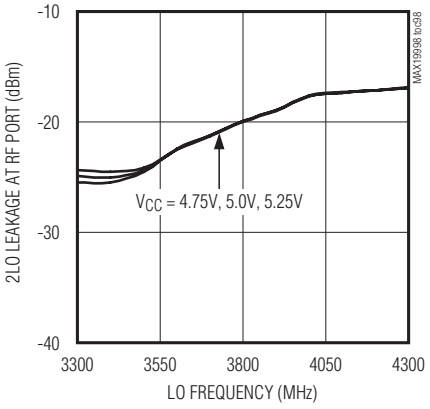
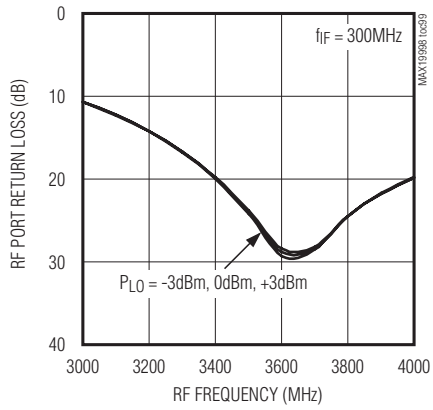


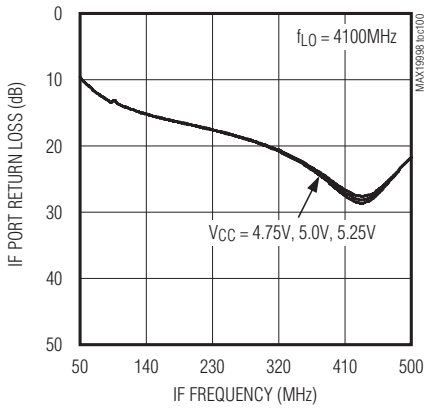
2LO LEAKAGE AT RF PORT vs. LO FREQUENCY



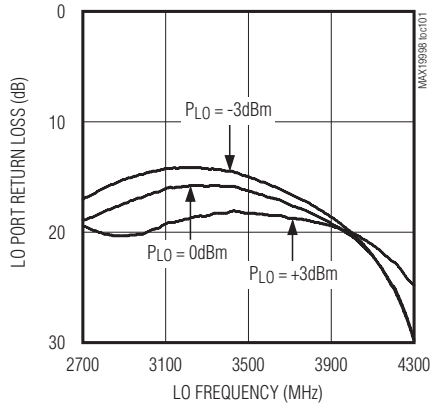
RF PORT RETURN LOSS vs. RF FREQUENCY



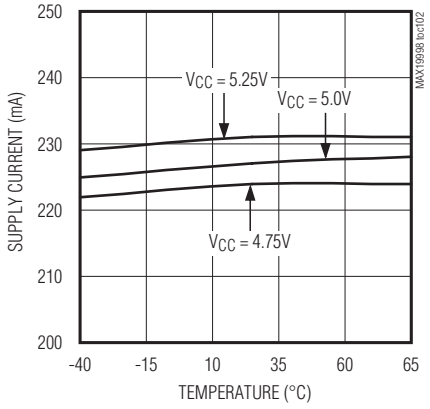
IF PORT RETURN LOSS vs. IF FREQUENCY



LO PORT RETURN LOSS vs. LO FREQUENCY



SUPPLY CURRENT vs. TEMPERATURE (T_C)

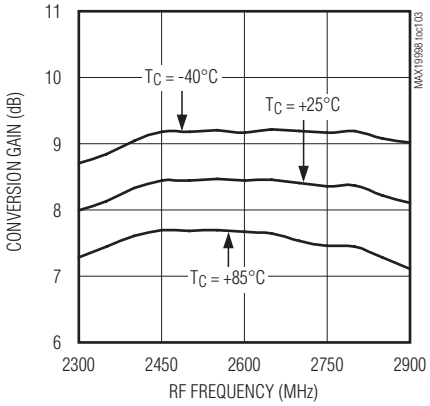


SiGe、高线性度、2300MHz至4000MHz下变频混频器，带有LO缓冲器

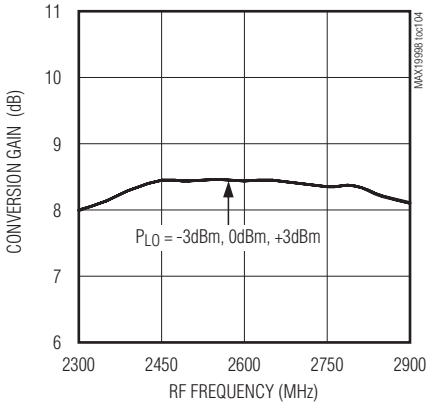
典型工作特性(续)

(*Typical Application Circuit* with tuning elements outlined in **Table 1, V_{CC} = 5.0V, f_{RF} = 2300MHz to 2900MHz, LO is high-side injected** for a 300MHz IF, P_{RF} = -5dBm, P_{LO} = 0dBm, T_C = +25°C, unless otherwise noted.)

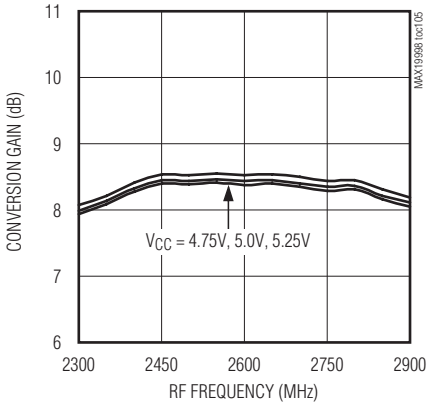
CONVERSION GAIN vs. RF FREQUENCY



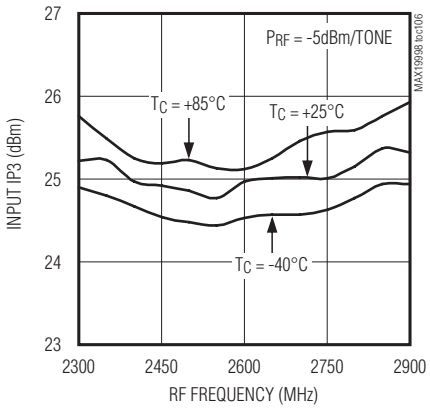
CONVERSION GAIN vs. RF FREQUENCY



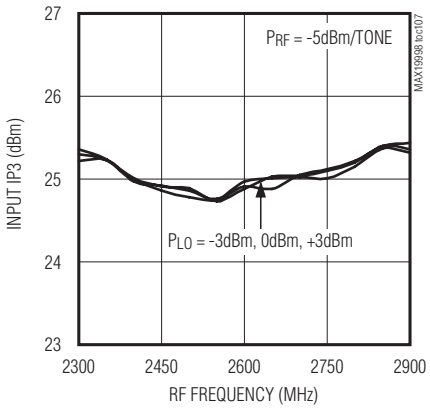
CONVERSION GAIN vs. RF FREQUENCY



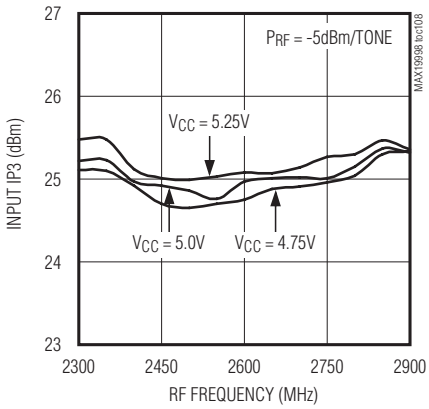
INPUT IP3 vs. RF FREQUENCY



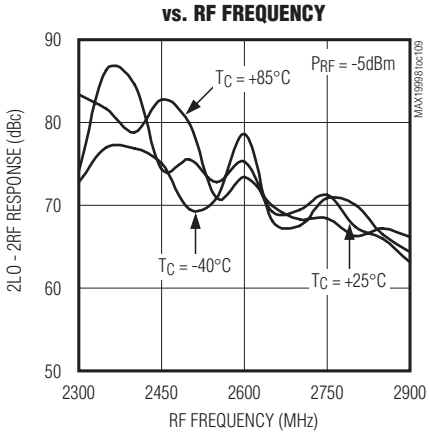
INPUT IP3 vs. RF FREQUENCY



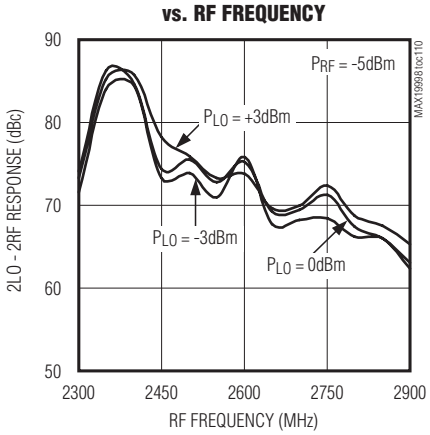
INPUT IP3 vs. RF FREQUENCY



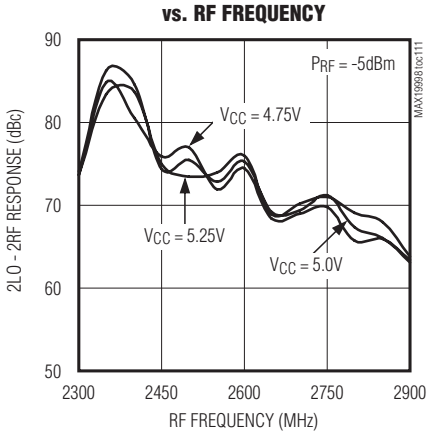
2LO - 2RF RESPONSE vs. RF FREQUENCY



2LO - 2RF RESPONSE vs. RF FREQUENCY



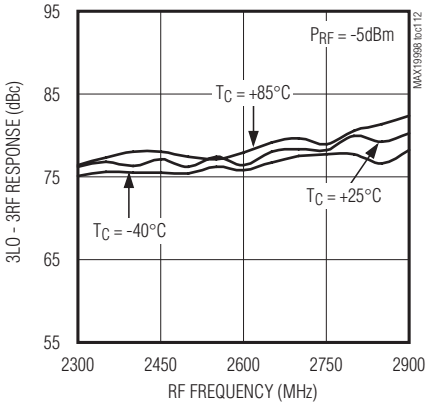
2LO - 2RF RESPONSE vs. RF FREQUENCY



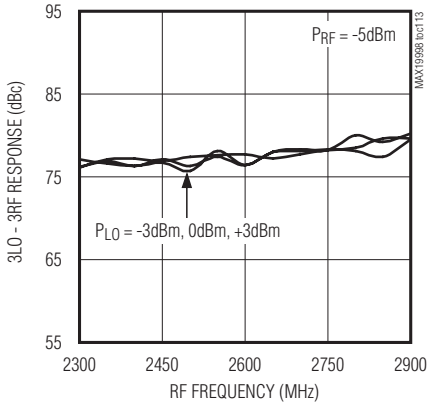
典型工作特性(续)

(*Typical Application Circuit* with tuning elements outlined in **Table 1, V_{CC} = 5.0V, f_{RF} = 2300MHz to 2900MHz, LO is high-side injected** for a 300MHz IF, P_{RF} = -5dBm, P_{LO} = 0dBm, T_C = +25°C, unless otherwise noted.)

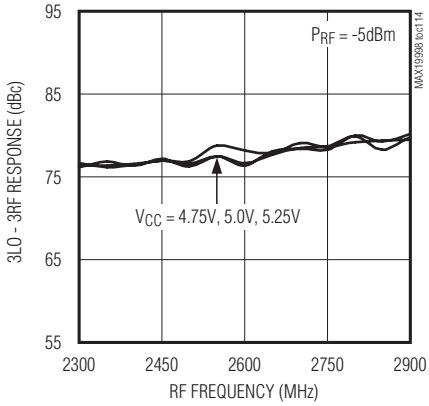
3LO - 3RF RESPONSE vs. RF FREQUENCY



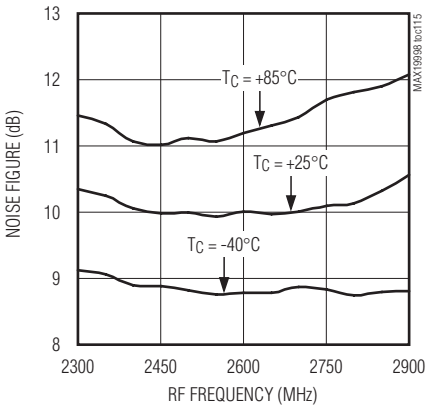
3LO - 3RF RESPONSE vs. RF FREQUENCY



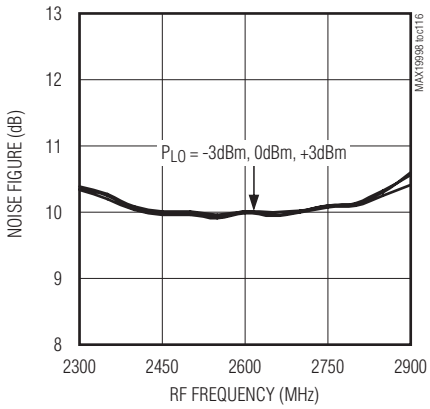
3LO - 3RF RESPONSE vs. RF FREQUENCY



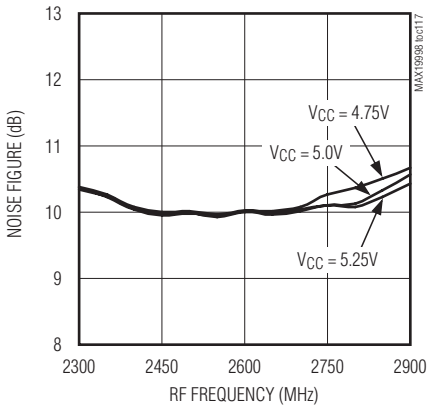
NOISE FIGURE vs. RF FREQUENCY



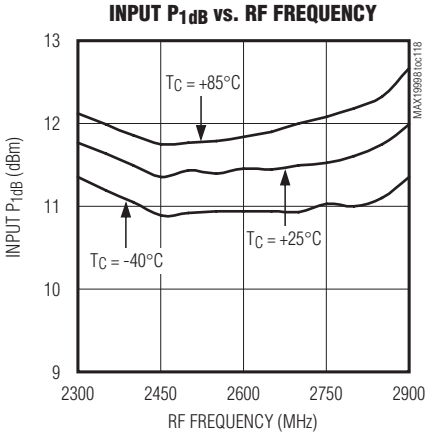
NOISE FIGURE vs. RF FREQUENCY



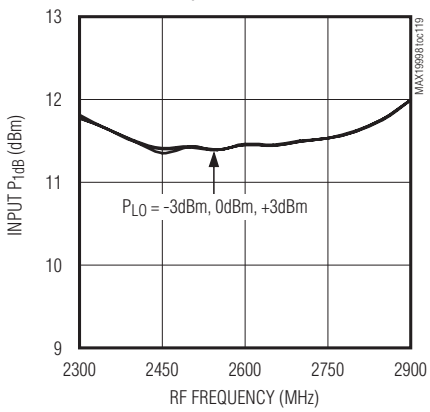
NOISE FIGURE vs. RF FREQUENCY



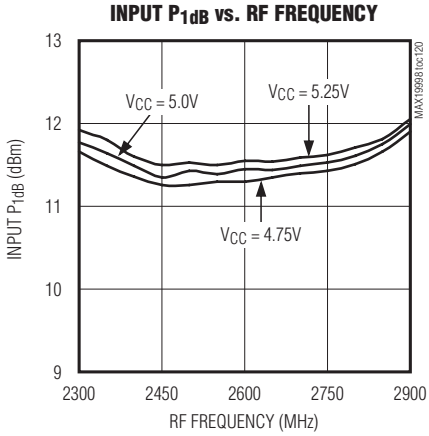
INPUT P_{1dB} vs. RF FREQUENCY



INPUT P_{1dB} vs. RF FREQUENCY



INPUT P_{1dB} vs. RF FREQUENCY



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典型工作特性(续)

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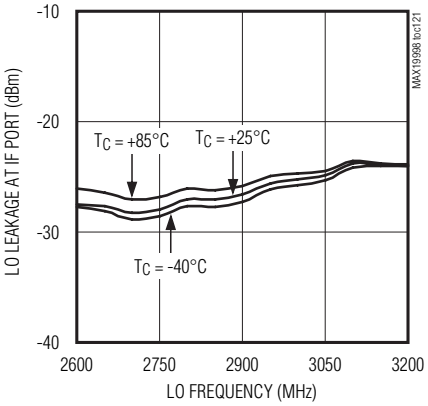
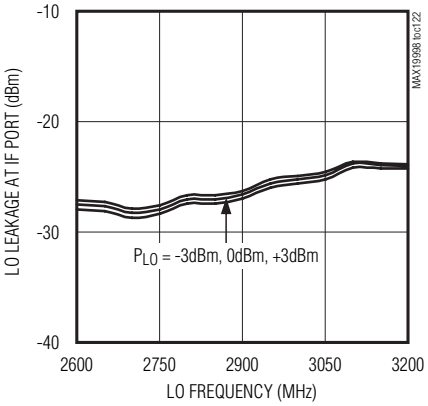
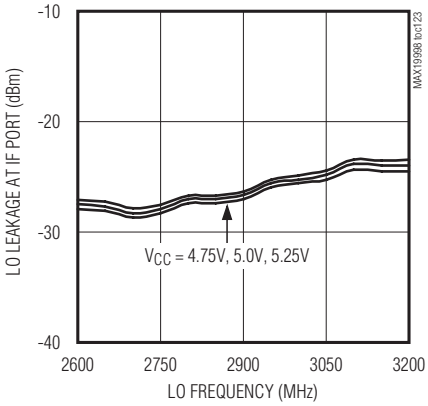
LO LEAKAGE AT IF PORT vs. LO FREQUENCY



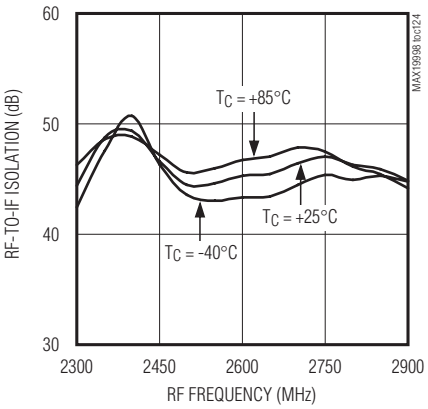
LO LEAKAGE AT IF PORT vs. LO FREQUENCY



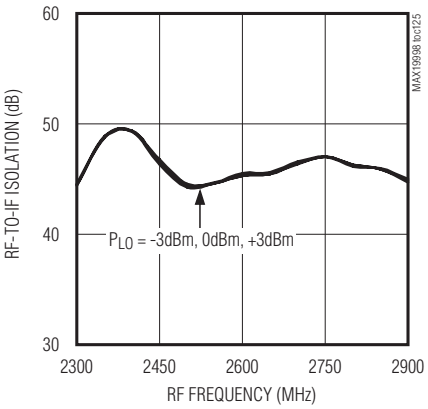
LO LEAKAGE AT IF PORT vs. LO FREQUENCY



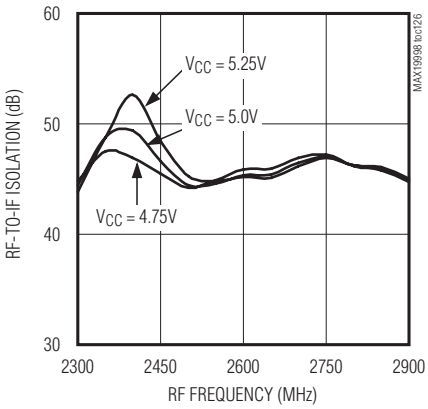
RF-TO-IF ISOLATION vs. RF FREQUENCY



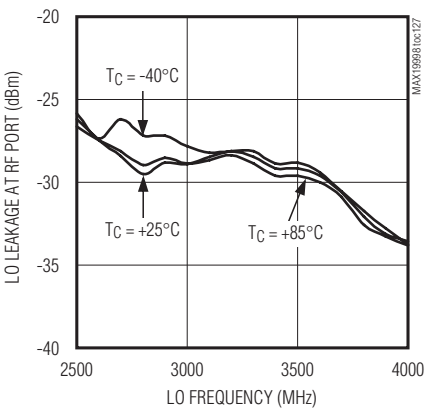
RF-TO-IF ISOLATION vs. RF FREQUENCY



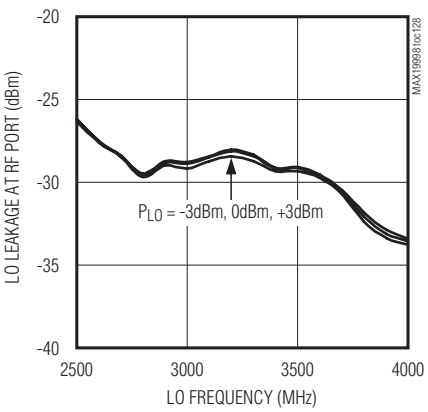
RF-TO-IF ISOLATION vs. RF FREQUENCY



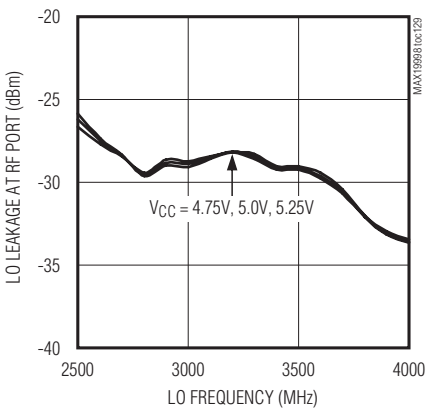
LO LEAKAGE AT RF PORT vs. LO FREQUENCY



LO LEAKAGE AT RF PORT vs. LO FREQUENCY



LO LEAKAGE AT RF PORT vs. LO FREQUENCY



典型工作特性(续)

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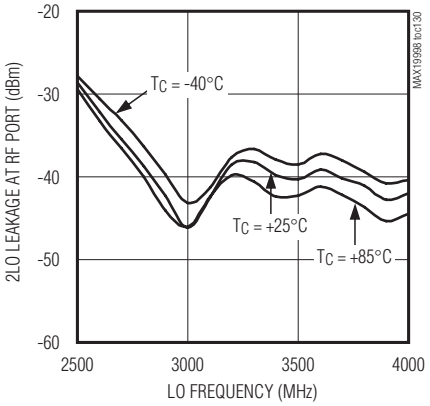
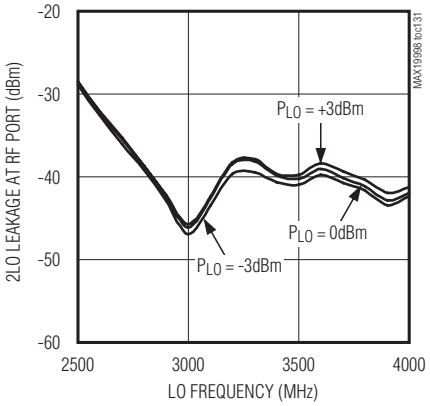
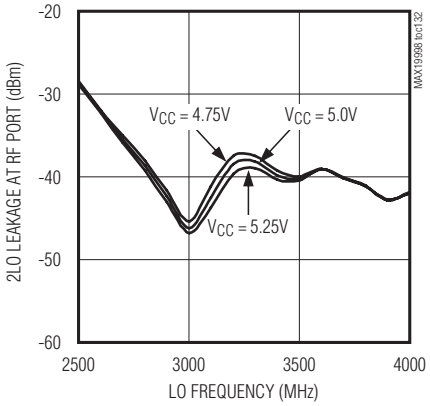
2LO LEAKAGE AT RF PORT vs. LO FREQUENCY



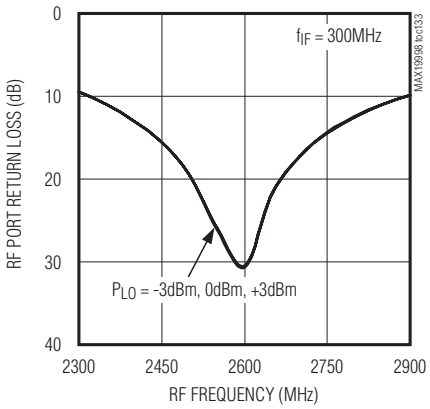
2LO LEAKAGE AT RF PORT vs. LO FREQUENCY



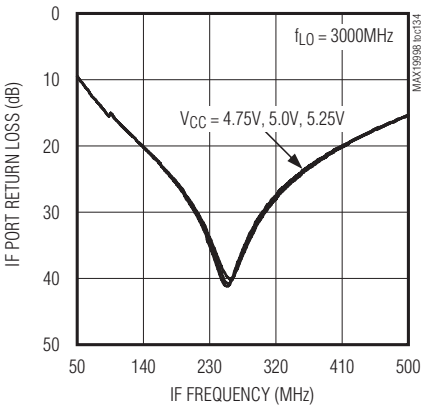
2LO LEAKAGE AT RF PORT vs. LO FREQUENCY



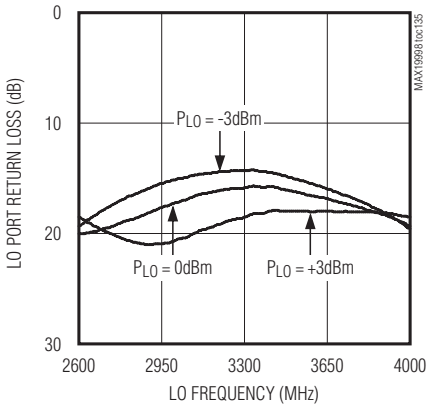
RF PORT RETURN LOSS vs. RF FREQUENCY



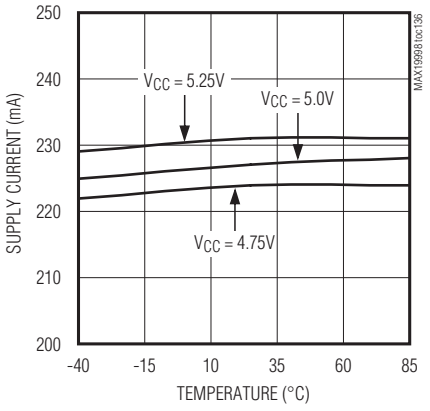
IF PORT RETURN LOSS vs. IF FREQUENCY



LO PORT RETURN LOSS vs. LO FREQUENCY

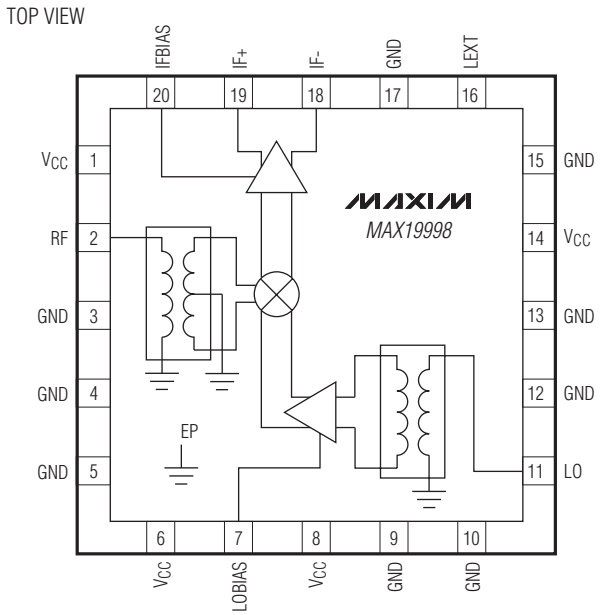


SUPPLY CURRENT vs. TEMPERATURE (T_C)



SiGe、高线性度、2300MHz至4000MHz下变频混频器，带有LO缓冲器

引脚配置/功能框图



引脚说明

引脚	名称	功能
1, 6, 8, 14	V_{CC}	电源。使用0.01µF电容旁路至GND，电容应尽可能靠近引脚放置。
2	RF	单端50Ω 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，需要的话可以在输入连接隔直电容。
3, 9, 13, 15	GND	地。内部没有连接，这些引脚可以接地。
4, 5, 10, 12, 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604Ω电阻(设置为5V、230mA偏置)。
11	LO	本振输入。该输入端在内部匹配为50Ω，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低ESR的4.7nH电感，以提高RF与IF之间和LO与IF之间的隔离度。该引脚可直接接地以减少元件数量，代价是降低了RF与IF和LO与IF之间的隔离度。
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V_{CC} (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698Ω电阻(设置为5V、230mA偏置)。
—	EP	裸焊盘。内部连接至GND，使用多个接地过孔将该裸焊盘焊接到一个PCB焊盘，为器件与PCB地层之间提供良好的散热通道。多个接地过孔还有助于改善RF性能。

SiGe、高线性度、2300MHz至4000MHz下变频混频器，带有LO缓冲器

详细说明

MAX19998为2300MHz至4000MHz WiMAX、LTE和MMDS基站等多种应用提供高线性度、低噪声系数。器件工作在2600MHz至4300MHz LO范围和50MHz至500MHz IF范围。集成的非平衡变压器和匹配电路允许50Ω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MAX19998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2RF - 2LO和2LO - 2RF性能。

RF输入和非平衡变压器

配合隔直流电容使用时，MAX19998的RF输入提供50Ω匹配。由于输入端在内部通过片上非平衡变压器直流短路到地，所以必须使用隔直流电容。使用8.2pF隔直流电容时，在整个3200MHz至3900MHz的RF频率范围内，RF端口的输入回波损耗典型值为17dB，请参考表1所示较低频段的调谐。

LO输入、缓冲器和非平衡变压器

LO输入在内部匹配为50Ω，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内。

高线性度混频器

MAX19998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、2RF - 2LO抑制和噪声系数的典型值分别为+24.3dBm、67dBc和9.7dB，采用低端LO注入，覆盖3000MHz至4000MHz RF频率范围。

差分IF输出放大器

MAX19998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。MAX19998混频器通过外部390nH的上拉偏置电感调谐至300MHz IF。对于较低的IF频率，则需要较大的L1、L2电感，以保持良好的IF匹配。差分、集电极开路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-端口需要隔直流，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

配合适当的调谐电路，RF和LO输入提供50Ω匹配。在3000MHz至4000MHz RF频率范围内，在RF端口使用8.2pF隔直流电容；在2300MHz至2900MHz频率范围内，RF端口使用3.3nH串联电感和0.3pF并联电容。在LO端口使用2pF隔直流电容，覆盖2600MHz至4300MHz整个工作频率范围。

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

MAX19998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%（典型值），请参考*3.3V Supply AC Electrical Characteristics*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。

SiGe、高线性度、2300MHz至4000MHz下变频混频器，带有LO缓冲器

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120mA，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MAX19998评估板，Gerber文件可从china.maxim-ic.com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，元件值参见表1。

表1. 元件值

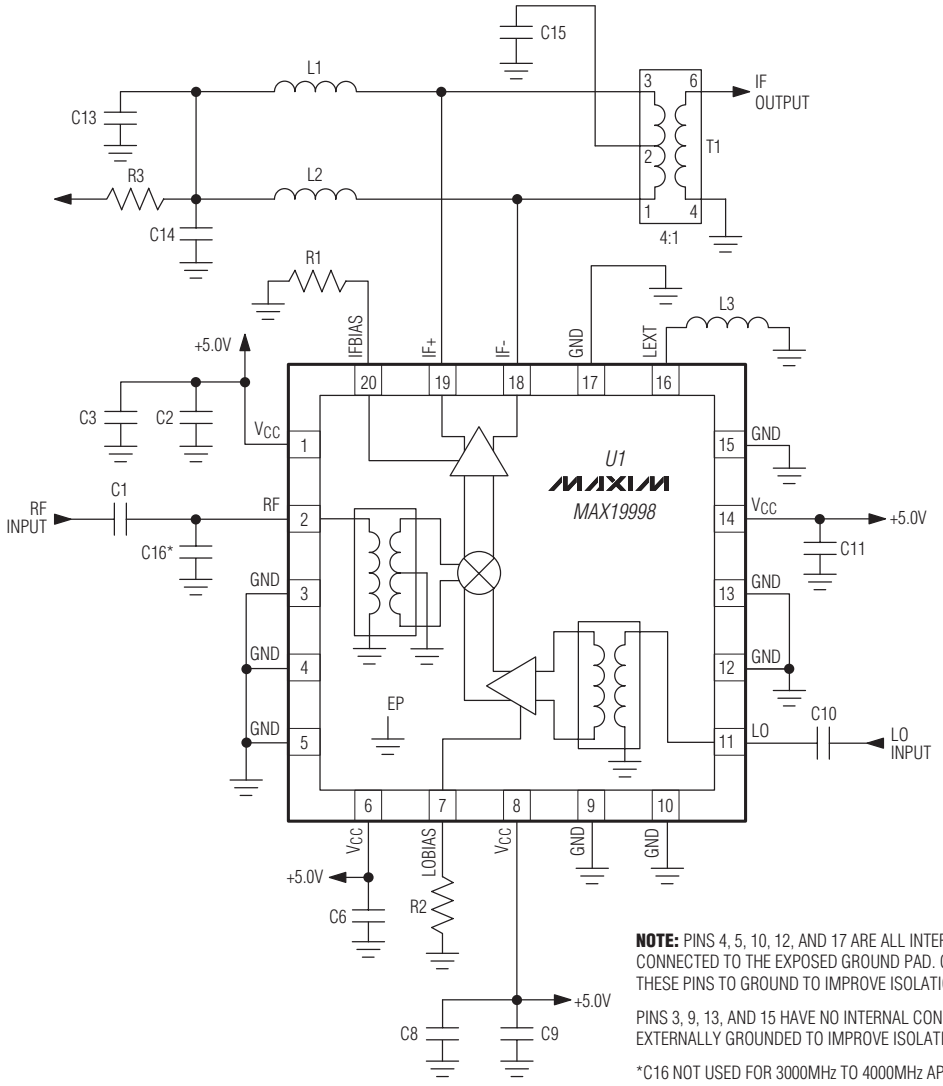
DESIGNATION	QTY	DESCRIPTION	COMPONENT SUPPLIER
C1	1	8.2pF microwave capacitor (0402). Use for RF frequencies ranging from 3000MHz to 4000MHz.	Murata Electronics North America, Inc.
		3.3nH microwave inductor (0402). Use for RF frequencies ranging from 2300MHz to 2900MHz.	Coilcraft, Inc.
C2, C6, C8, C11	4	0.01µF 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.
C16	1	Not installed for RF frequencies ranging from 3000MHz to 4000MHz	—
		0.3pF microwave capacitor (0402). Use for RF frequencies ranging from 2300MHz to 2900MHz.	Murata Electronics North America, Inc.
L1, L2	2	390nH wire-wound high-Q inductors* (0805)	Coilcraft, Inc.
L3	1	4.7nH wire-wound high-Q inductor (0603)	Coilcraft, Inc.
R1	1	698Ω ±1% resistor (0402). Use for **V_{CC} = 5.0V** applications.	Digi-Key Corp.
		845Ω ±1% resistor (0402). Use for **V_{CC} = 3.3V** applications.	
R2	1	604Ω ±1% resistor (0402). Use for **V_{CC} = 5.0V** applications.	Digi-Key Corp.
		1.1kΩ ±1% resistor (0402). Use for **V_{CC} = 3.3V** applications.	
R3	1	0Ω resistor (1206)	Digi-Key Corp.
T1	1	4:1 IF balun TC4-1W-17*	Mini-Circuits
U1	1	MAX19998 IC (20 Thin QFN-EP)	Maxim Integrated Products, Inc.

**IF频率低于200MHz时，使用较大的电感值和TC4-1W-7A 4:1非平衡变压器。*

裸焊盘的RF/散热考虑

MAX19998采用20引脚、薄型QFN-EP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MAX19998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。

典型应用电路



NOTE: PINS 4, 5, 10, 12, AND 17 ARE ALL INTERNALLY CONNECTED TO THE EXPOSED GROUND PAD. CONNECT THESE PINS TO GROUND TO IMPROVE ISOLATION.

PINS 3, 9, 13, AND 15 HAVE NO INTERNAL CONNECTION, BUT CAN BE EXTERNALLY GROUNDED TO IMPROVE ISOLATION.

*C16 NOT USED FOR 3000MHz TO 4000MHz APPLICATIONS.

SiGe、高线性度、2300MHz至4000MHz下变频混频器，带有LO缓冲器

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**china.maxim-ic.com/packages**。请注意，封装编码中的“+”、“#”或“-”仅表示RoHS状态。封装图中可能包含不同的尾缀字符，但封装图只与封装有关，与RoHS状态无关。

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

Maxim北京办事处
北京8328信箱 邮政编码 100083
免费电话: 800 810 0310
电话: 010-6211 5199
传真: 010-6211 5299