19-5002; Rev 0; 10/09

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

概述

MAX2044单路、高线性度上/下变频混频器可为2300MHz至4000MHz的LTE、WiMAX™以及MMDS无线基础设施应用提供+32.5dBm输入IP3、8.5dB噪声系数和7.7dB转换损耗。MAX2044具有2600MHz至4300MHz较宽的LO频率范围，可用于所有2.5GHz和3.5GHz应用中的低端或高端LO注入结构。

除具有优异的线性度和噪声性能外，MAX2044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LO缓冲器以及支持单端RF和LO输入的片内非平衡变压器。MAX2044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138mA、在V_{CC} = 3.3V时为121mA。

MAX2044与MAX2029/MAX2031 650MHz至1000MHz混频器以及MAX2039/MAX2041/MAX2042 1700MHz至3000MHz混频器引脚相似。这使得该系列上/下变频混频器非常适合多个频段采用相同PCB布局的应用。

MAX2044采用紧凑的20引脚、薄型QFN (5mm x 5mm)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
- 7.7dB转换损耗
- 8.5dB噪声系数
- +32.5dBm (典型值)输入IP3
- 21dBm (典型值)输入1dB压缩点
- P_{RF} = -10dBm时，具有68dBc (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
- 引脚相似于MAX2029/MAX2031 650MHz至1000MHz系列混频器和MAX2039/MAX2041/MAX2042 1700MHz至3000MHz系列混频器
- 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
MAX2044ETP+	-40°C to +85°C	20 Thin QFN-EP*
MAX2044ETP+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上变频/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 to GND ..... -0.3V to (V_{CC} + 0.3V)
RF, LO Input Power ..... +20dBm
RF, LO Current (RF and LO is DC shorted to GND through a 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*, 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}			138	155	mA

3.3V SUPPLY DC ELECTRICAL CHARACTERISTICS

(*Typical Application Circuit*, 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.)

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		121	135	mA

RECOMMENDED AC OPERATING CONDITIONS

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
RF Frequency Range	f_{RF}	*Typical Application Circuit* with C1 = 3.3nH and C12 = 0.3pF, see Table 1 for details (Note 5)	2300		3000	MHz
		Typical Application Circuit with C1 = 8.2pF and C12 not installed, see Table 1 for details (Note 5)	3000		4000	
LO Frequency	f_{LO}	(Note 5)	2600		4300	MHz
IF Frequency	f_{IF}	Using an M/A-Com MABAES0029 1:1 transformer as defined in the *Typical Application Circuit*, IF matching components affect the IF frequency range (Note 5)	50		500	MHz
LO Drive	P_{LO}	(Note 5)	-3	0	+3	dBm

5.0V SUPPLY AC ELECTRICAL CHARACTERISTICS (DOWNCONVERTER MODE, f_{RF} = 3100MHz to 3900MHz, LOW-SIDE LO INJECTION)

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

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Conversion Loss	L_C	T_C = +25°C (Notes 7, 8)		7.2	7.7	8.5	dB
Loss Variation vs. Frequency	ΔL_C	f_{RF} = 3100MHz to 3900MHz, over any 100MHz band			0.15		dB
		f_{RF} = 3100MHz to 3900MHz, over any 200MHz band			0.25		
Conversion Loss Temperature Coefficient	TC_{CL}	f_{RF} = 3100MHz to 3900MHz, T_C = -40°C to +85°C			0.01		dB/°C
Input Compression Point	IP_{1dB}	(Note 9)			21		dBm
Third-Order Input Intercept Point	IIP3	f_{RF1} - f_{RF2} = 1MHz, P_{RF} = 0dBm per tone (Note 7, 8)		28.3	32.5		dBm
		f_{RF} = 3500MHz, f_{RF1} - f_{RF2} = 1MHz, P_{RF} = 0dBm per tone. T_C = +25°C (Notes 7, 8)		30.0	32.5		
Third-Order Input Intercept Point Variation Over Temperature		f_{RF} = 3100MHz to 3900MHz, f_{IF} = 300MHz, f_{RF1} - f_{RF2} = 1MHz, P_{RF} = 0dBm per tone, T_C = -40°C to +85°C			±0.5		dBm
Noise Figure	NF_{SSB}	Single sideband, no blockers present (Notes 7, 10)			8.5	10	dB
		Single sideband, no blockers present, T_C = +25°C (Notes 7, 10)			8.5	9.2	
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 Conditions	NF_B	+8dBm blocker tone applied to RF port, $f_{BLOCKER}$ = 3750MHz, f_{RF} = 3500MHz, f_{LO} = 3200MHz, P_{LO} = 0dBm, V_{CC} = 5.0V, T_C = +25°C (Notes 7, 10, 11)			17.5	20	dB
2RF - 2LO Spurious Rejection	2 x 2	f_{SPUR} = f_{LO} + 150MHz, T_C = +25°C	P_{RF} = -10dBm (Notes 7, 10)	62	68		dBc
			P_{RF} = 0dBm (Notes 7, 8)	52	58		
		f_{SPUR} = f_{LO} + 150MHz	P_{RF} = -10dBm (Notes 7, 10)	60	68		
			P_{RF} = 0dBm (Notes 7, 8)	50	58		

5.0V SUPPLY AC ELECTRICAL CHARACTERISTICS (DOWNCONVERTER MODE, f_{RF} = 3100MHz to 3900MHz, LOW-SIDE LO INJECTION) (continued)

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

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
3RF - 3LO Spurious Rejection	3 x 3	$f_{SPUR} = f_{LO}$ + 100MHz, T_C = +25°C	P_{RF} = -10dBm (Notes 7, 10)	82	89		dBc
			P_{RF} = 0dBm (Notes 7, 8)	62	69		
		$f_{SPUR} = f_{LO}$ + 100MHz	P_{RF} = -10dBm (Notes 7, 10)	81	89		
			P_{RF} = 0dBm (Notes 7, 8)	61	69		
RF Input Return Loss	RL_{RF}	LO on and IF terminated into a matched impedance			16		dB
LO Input Return Loss	RL_{LO}	RF and IF terminated into a matched impedance			14		dB
IF Output Impedance	Z_{IF}	Nominal differential impedance at the IC's IF outputs			50		Ω
IF Output Return Loss	RL_{IF}	RF terminated into 50Ω, LO driven by a 50Ω source, IF transformed to 50Ω using external components shown in the *Typical Application Circuit*			16		dB
RF-to-IF Isolation		f_{RF} = 3500MHz, P_{LO} = +3dBm (Note 8)		33	42		dB
LO Leakage at RF Port		f_{LO} = 2500MHz to 4000MHz, P_{LO} = +3dBm (Notes 7, 8)			-31		dBm
2LO Leakage at RF Port		P_{LO} = +3dBm			-35		dBm
LO Leakage at IF Port		P_{LO} = +3dBm (Note 8)			-28		dBm

3.3V SUPPLY AC ELECTRICAL CHARACTERISTICS (DOWNCONVERTER MODE, f_{RF} = 3100MHz to 3900MHz, LOW-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 at V_{CC} = 3.3V, P_{RF} = 0dBm, P_{LO} = 0dBm, f_{RF} = 3500MHz, f_{LO} = 3200MHz, f_{IF} = 300MHz, T_C = +25°C, unless otherwise noted.) (Note 6)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Conversion Loss	L_C				7.7		dB
Loss Variation vs. Frequency	ΔL_C	f_{RF} = 3100MHz to 3900MHz, over any 100MHz band			0.1		dB
Conversion Loss Temperature Coefficient	TC_{CL}	f_{RF} = 3100MHz to 3900MHz, T_C = -40°C to +85°C			0.009		dB/°C
Input Compression Point	IP_{1dB}	(Note 9)			19.5		dBm
Third-Order Input Intercept Point	IIP3	f_{RF1} - f_{RF2} = 1MHz, P_{RF} = 0dBm per tone			29.5		dBm
Third-Order Input Intercept Variation Over Temperature		f_{RF1} - f_{RF2} = 1MHz, P_{RF} = 0dBm per tone, T_C = -40°C to +85°C			±0.2		dB
Noise Figure	NF_{SSB}	Single sideband, no blockers present			8.5		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 Spurious Rejection	2 x 2	f_{SPUR} = f_{LO} + 150MHz	P_{RF} = -10dBm		69		dBc
			P_{RF} = 0dBm		64		
3RF - 3LO Spurious Rejection	3 x 3	f_{SPUR} = f_{LO} + 100MHz	P_{RF} = -10dBm		73.3		dBc
			P_{RF} = 0dBm		63.3		
RF Input Return Loss	RL_{RF}	LO on and IF terminated into a matched impedance			18		dB
LO Input Return Loss	RL_{LO}	RF and IF terminated into a matched impedance			19		dB
IF Output Impedance	Z_{IF}	Nominal differential impedance at the IC's IF outputs			50		Ω
IF Output Return Loss	RL_{IF}	RF terminated into 50Ω, LO driven by a 50Ω source, IF transformed to 50Ω using external components shown in the *Typical Application Circuit*			14.5		dB
RF-to-IF Isolation		f_{RF} = 3100MHz to 3900MHz, P_{LO} = +3dBm			41		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			-25.6		dBm
LO Leakage at IF Port		f_{LO} = 2800MHz to 3600MHz, P_{LO} = +3dBm			-27		dBm

5.0V SUPPLY AC ELECTRICAL CHARACTERISTICS (DOWNCONVERTER MODE, f_{RF} = 2300MHz 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 at V_{CC} = 5.0V, P_{RF} = 0dBm, P_{LO} = 0dBm, f_{RF} = 2600MHz, f_{LO} = 2900MHz, f_{IF} = 300MHz, T_C = +25°C, unless otherwise noted.) (Note 6)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Conversion Loss	L_C				8.1		dB
Loss Variation vs. Frequency	ΔL_C	f_{RF} = 2300MHz to 2900MHz, over any 100MHz band			0.15		dB
Conversion Loss Temperature Coefficient	TC_{CL}	f_{RF} = 2300MHz to 2900MHz, T_C = -40°C to +85°C			0.008		dB/°C
Third-Order Input Intercept Point	IIP3	f_{RF1} - f_{RF2} = 1MHz, P_{RF} = 0dBm per tone			34		dBm
Third-Order Input Intercept Variation Over Temperature		f_{RF1} - f_{RF2} = 1MHz, P_{RF} = 0dBm per tone, T_C = -40°C to +85°C			±0.2		dB
2LO - 2RF Spurious Rejection	2 x 2	$f_{SPUR} = f_{LO}$ - 150MHz	P_{RF} = -10dBm		67		dBc
			P_{RF} = 0dBm		62		
3LO - 3RF Spurious Rejection	3 x 3	$f_{SPUR} = f_{LO}$ - 100MHz	P_{RF} = -10dBm		79		dBc
			P_{RF} = 0dBm		69		
RF Input Return Loss	RL_{RF}	LO on and IF terminated into a matched impedance			23		dB
LO Input Return Loss	RL_{LO}	RF and IF terminated into a matched impedance			17		dB
IF Output Impedance	Z_{IF}	Nominal differential impedance at the IC's IF outputs			50		Ω
IF Output Return Loss	RL_{IF}	RF terminated into 50Ω, LO driven by a 50Ω source, IF transformed to 50Ω using external components shown in the *Typical Application Circuit*			13.6		dB
RF-to-IF Isolation		f_{RF} = 2300MHz to 2900MHz, P_{LO} = +3dBm			39		dB
LO Leakage at RF Port		f_{LO} = 2600MHz to 3200MHz, P_{LO} = +3dBm			-29.5		dBm
2LO Leakage at RF Port		f_{LO} = 2600MHz to 3200MHz, P_{LO} = +3dBm			-43		dBm
LO Leakage at IF Port		f_{LO} = 2600MHz to 3200MHz, P_{LO} = +3dBm			-28.6		dBm

5.0V SUPPLY AC ELECTRICAL CHARACTERISTICS (DOWNCONVERTER MODE, f_{RF} = 3100MHz to 3900MHz, 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 at V_{CC} = 5.0V, P_{RF} = 0dBm, P_{LO} = 0dBm, f_{RF} = 3500MHz, f_{LO} = 3800MHz, f_{IF} = 300MHz, T_C = +25°C, unless otherwise noted.) (Note 6)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Conversion Loss	L_C				7.8		dB
Loss Variation vs. Frequency	ΔL_C	f_{RF} = 3100MHz to 3900MHz, over any 100MHz band			0.15		dB
Conversion Loss Temperature Coefficient	TC_{CL}	f_{RF} = 3100MHz to 3900MHz, T_C = -40°C to +85°C			0.008		dB/°C
Third-Order Input Intercept Point	IIP3	f_{RF1} - f_{RF2} = 1MHz, P_{RF} = 0dBm per tone			31.5		dBm
Third-Order Input Intercept Variation Over Temperature		f_{RF1} - f_{RF2} = 1MHz, P_{RF} = 0dBm per tone, T_C = -40°C to +85°C			±0.2		dB
2LO - 2RF Spurious Rejection	2 x 2	$f_{SPUR} = f_{LO}$ - 150MHz	P_{RF} = -10dBm		67		dBc
			P_{RF} = 0dBm		62		
3LO - 3RF Spurious Rejection	3 x 3	$f_{SPUR} = f_{LO}$ - 100MHz	P_{RF} = -10dBm		76.7		dBc
			P_{RF} = 0dBm		66.7		
RF Input Return Loss	RL_{RF}	LO on and IF terminated into a matched impedance			17.7		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			50		Ω
IF Output Return Loss	RL_{IF}	RF terminated into 50Ω, LO driven by a 50Ω source, IF transformed to 50Ω using external components shown in the *Typical Application Circuit*			15		dB
RF-to-IF Isolation		f_{RF} = 3100MHz to 3900MHz, P_{LO} = +3dBm			41		dB
LO Leakage at RF Port		f_{LO} = 3400MHz to 4200MHz, P_{LO} = +3dBm			-30		dBm
2LO Leakage at RF Port		f_{LO} = 3400MHz to 4200MHz, P_{LO} = +3dBm			-21		dBm
LO Leakage at IF Port		f_{LO} = 3400MHz to 4200MHz, P_{LO} = +3dBm			-27.2		dBm

5.0V SUPPLY AC ELECTRICAL CHARACTERISTICS (UPCONVERTER OPERATION, f_{RF} = 3100MHz to 3900MHz, LOW-SIDE LO INJECTION)

(*Typical Application Circuit* with tuning elements outlined in **Table 2**, RF and LO ports are driven from 50Ω sources. Typical values are for T_C = +25°C, V_{CC} = 5.0V, P_{IF} = 0dBm, P_{LO} = 0dBm, f_{RF} = 3500MHz, f_{LO} = 3300MHz, f_{IF} = 200MHz, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Conversion Loss	L_C			7.7		dB
Conversion Loss Variation vs. Frequency	ΔL_C	f_{RF} = 3100MHz to 3900MHz, over any 100MHz band		0.2		dB
		f_{RF} = 3100MHz to 3900MHz, over any 200MHz band		0.25		
Conversion Loss Temperature Coefficient	TC_{CL}	T_C = -40°C to +85°C		0.01		dB/°C
Input Third-Order Intercept Point	IIP3	f_{IF1} = 200MHz, f_{IF2} = 201MHz, P_{IF} = 0dBm/tone		33.5		dBm
IIP3 Variation with T_C		f_{IF1} = 200MHz, f_{IF2} = 201MHz, P_{IF} = 0dBm/tone, T_C = -40°C to +85°C		±0.2		dB
LO ± 2IF Spur	1 x 2	LO - 2IF		61.6		dBc
		LO + 2IF		60.2		
LO ± 3IF Spur	1 x 3	LO - 3IF		78.2		dBc
		LO + 3IF		80.3		
Output Noise Floor		P_{OUT} = 0dBm (Note 11)		-165		dBm/Hz

3.3V SUPPLY AC ELECTRICAL CHARACTERISTICS (UPCONVERTER OPERATION, f_{RF} = 3100MHz to 3900MHz, LOW-SIDE LO INJECTION)

(*Typical Application Circuit* with tuning elements outlined in **Table 2**, RF and LO ports are driven from 50Ω sources. Typical values are for T_C = +25°C, V_{CC} = 3.3V, P_{IF} = 0dBm, P_{LO} = 0dBm, f_{RF} = 3500MHz, f_{LO} = 3200MHz, f_{IF} = 200MHz, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Conversion Loss	L_C			8		dB
Conversion Loss Variation vs. Frequency	ΔL_C	f_{RF} = 3100MHz to 3900MHz, over any 100MHz band		0.2		dB
		f_{RF} = 3100MHz to 3900MHz, over any 200MHz band		0.25		
Conversion Loss Temperature Coefficient	TC_{CL}	T_C = -40°C to +85°C		0.01		dB/°C
Input Third-Order Intercept Point	IIP3	f_{IF1} = 200MHz, f_{IF2} = 201MHz, P_{IF} = 0dBm/tone		29.5		dBm
IIP3 Variation with T_C		f_{IF1} = 200MHz, f_{IF2} = 201MHz, P_{IF} = 0dBm/tone, T_C = -40°C to +85°C		±0.2		dB

3.3V SUPPLY AC ELECTRICAL CHARACTERISTICS (UPCONVERTER OPERATION, f_{RF} = 3100MHz to 3900MHz, LOW-SIDE LO INJECTION) (continued)

(*Typical Application Circuit* with tuning elements outlined in **Table 2**, RF and LO ports are driven from 50Ω sources. Typical values are for T_C = +25°C, V_{CC} = 3.3V, P_{IF} = 0dBm, P_{LO} = 0dBm, f_{RF} = 3500MHz, f_{LO} = 3200MHz, f_{IF} = 200MHz, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
LO ± 2IF Spur	1 x 2	LO - 2IF		58.9		dBc
		LO + 2IF		57.8		
LO ± 3IF Spur	1 x 3	LO - 3IF		69.4		dBc
		LO + 3IF		69.5		
Output Noise Floor		P_{OUT} = 0dBm (Note 11)		-165		dBm/Hz

Note 5: 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 0.5dB loss at f_{IF} = 300MHz due to the 1:1 impedance transformer. Output measurements were taken at IF outputs of the *Typical Application Circuit*.

Note 7: Guaranteed by design and characterization.

Note 8: 100% production tested for functional performance.

Note 9: Maximum reliable continuous input power applied to the RF or IF port of this device is +20dBm from a 50Ω source.

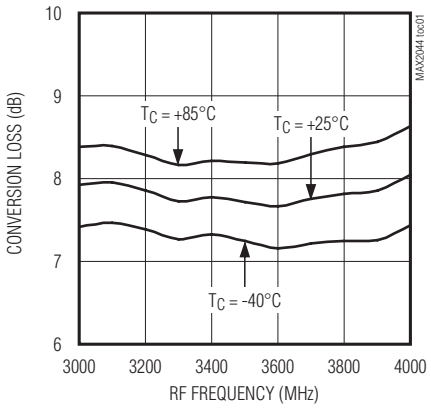
Note 10: Not production tested.

Note 11: Measured with external LO source noise filtered so 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*.

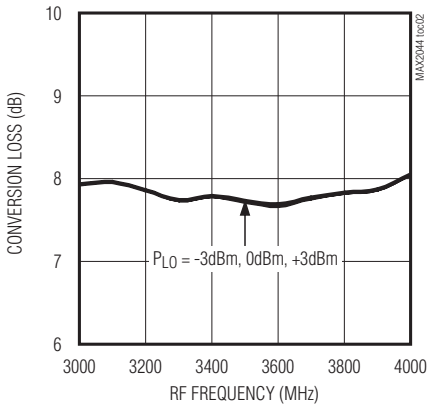
典型工作特性

(*Typical Application Circuit* with tuning elements outlined in **Table 1, Downconverter Mode, V_{CC} = 5.0V, f_{RF} = 3000MHz to 4000MHz, LO is low-side injected** for a 300MHz IF, P_{RF} = 0dBm, P_{LO} = 0dBm, T_C = +25°C, unless otherwise noted.)

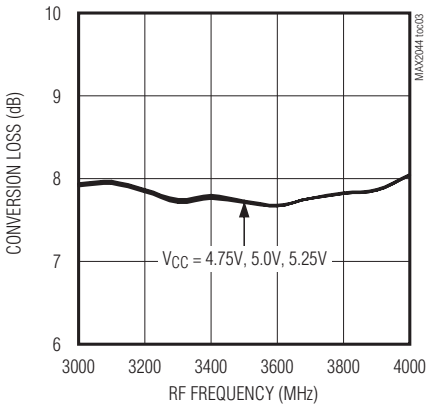
CONVERSION LOSS vs. RF FREQUENCY



CONVERSION LOSS vs. RF FREQUENCY



CONVERSION LOSS vs. RF FREQUENCY

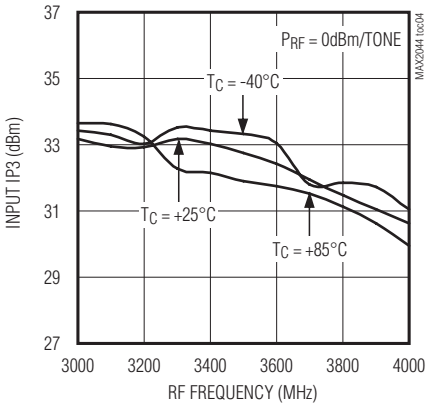


SiGe、高线性度、2300MHz至4000MHz上变频/下变频混频器，带有LO缓冲器

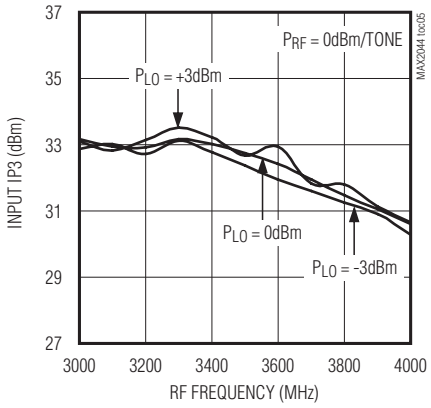
典型工作特性(续)

(*Typical Application Circuit* with tuning elements outlined in **Table 1, Downconverter Mode, V_{CC} = 5.0V, f_{RF} = 3000MHz to 4000MHz, LO is low-side injected** for a 300MHz IF, P_{RF} = 0dBm, P_{LO} = 0dBm, T_C = +25°C, unless otherwise noted.)

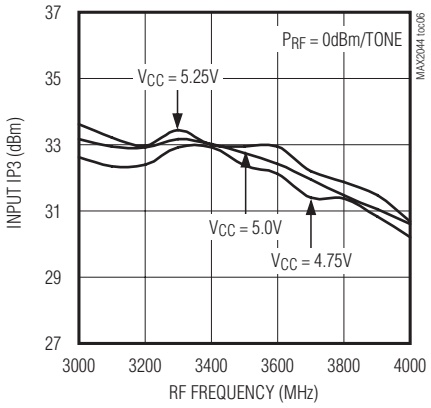
INPUT IP3 vs. RF FREQUENCY



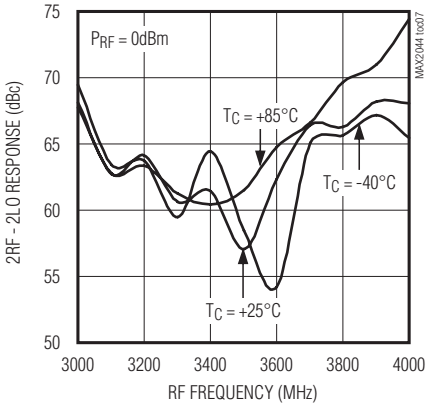
INPUT IP3 vs. RF FREQUENCY



INPUT IP3 vs. RF FREQUENCY



2RF - 2LO RESPONSE vs. RF FREQUENCY



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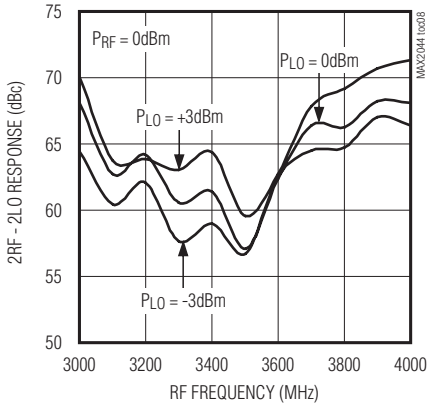

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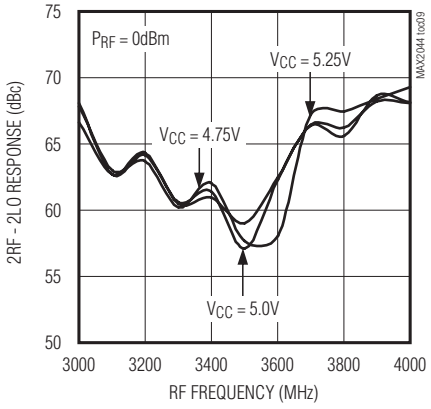
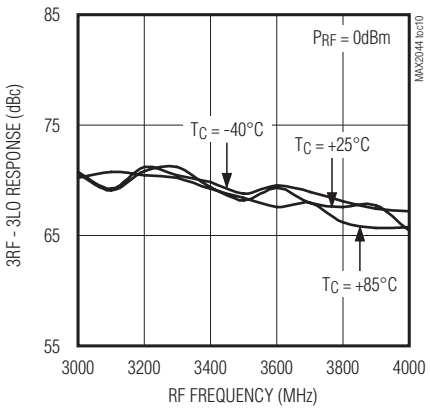
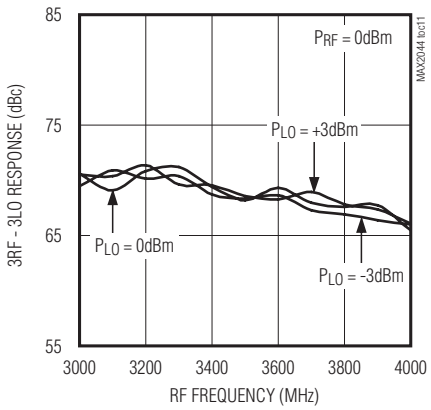


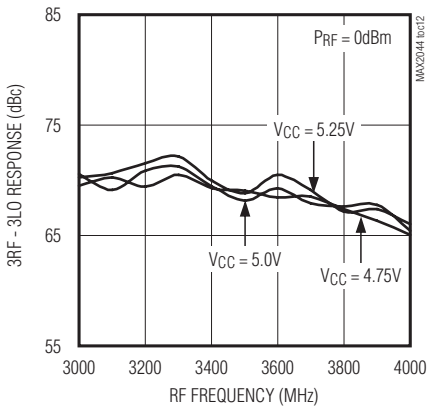
3RF - 3LO RESPONSE vs. RF FREQUENCY



3RF - 3LO RESPONSE vs. RF FREQUENCY



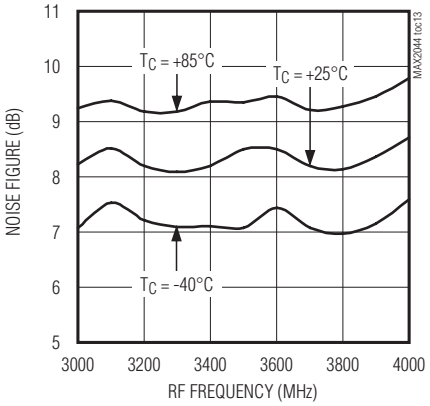
3RF - 3LO RESPONSE vs. RF FREQUENCY



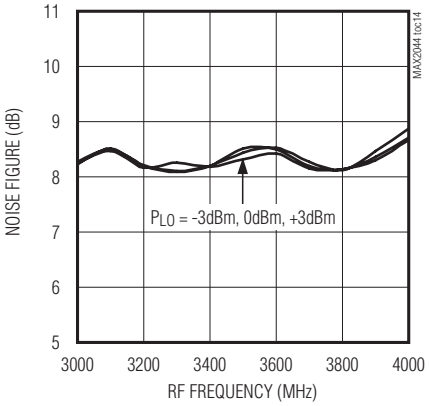
典型工作特性(续)

(*Typical Application Circuit* with tuning elements outlined in **Table 1, Downconverter Mode, V_{CC} = 5.0V, f_{RF} = 3000MHz to 4000MHz, LO is low-side injected** for a 300MHz IF, P_{RF} = 0dBm, P_{LO} = 0dBm, T_C = +25°C, unless otherwise noted.)

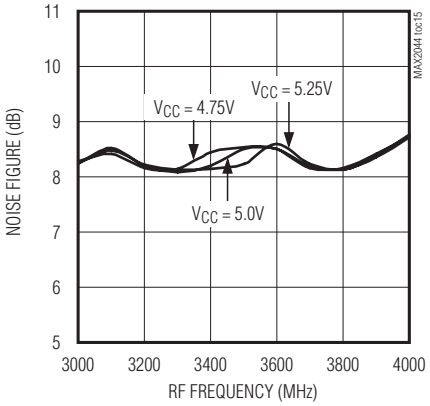
NOISE FIGURE vs. RF FREQUENCY



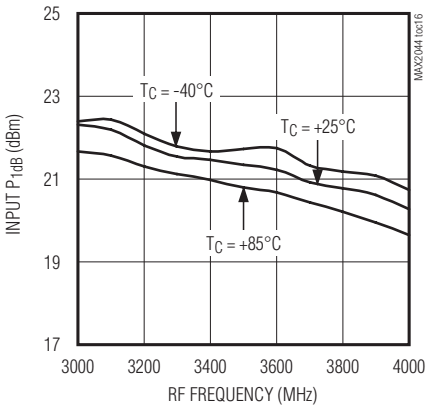
NOISE FIGURE vs. RF FREQUENCY



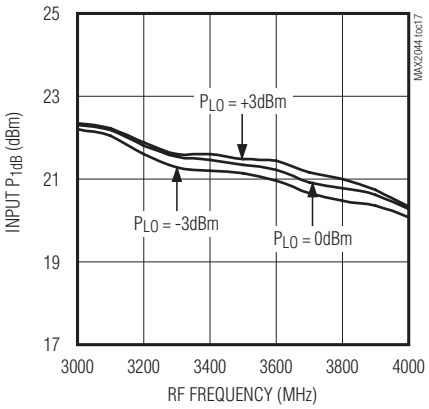
NOISE FIGURE vs. RF FREQUENCY



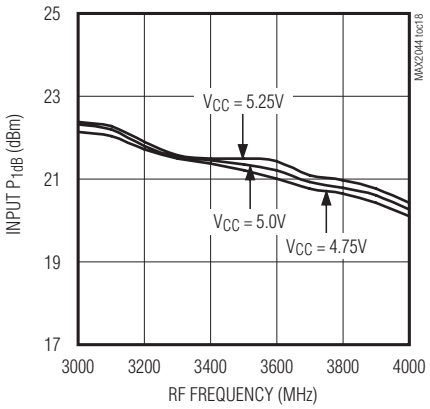
INPUT P_{1dB} vs. RF FREQUENCY



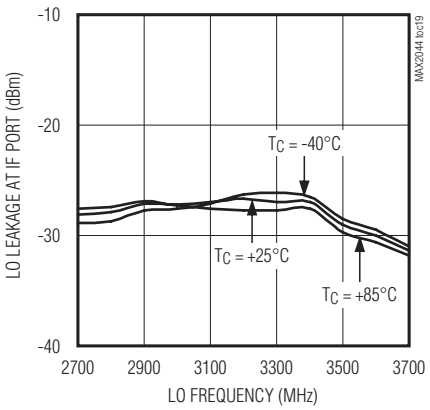
INPUT P_{1dB} vs. RF FREQUENCY



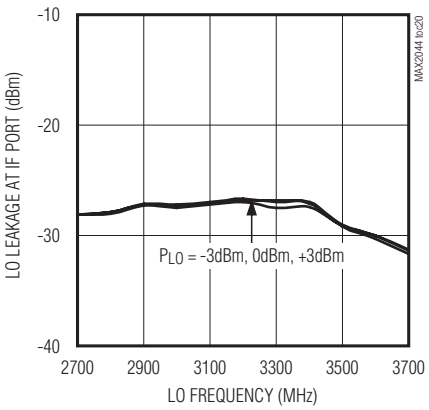
INPUT P_{1dB} vs. RF FREQUENCY



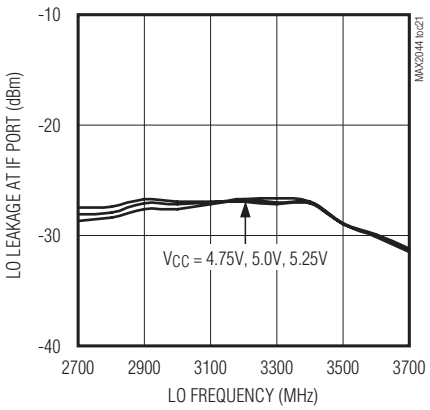
LO LEAKAGE AT IF PORT vs. LO FREQUENCY



LO LEAKAGE AT IF PORT vs. LO FREQUENCY



LO LEAKAGE AT IF PORT vs. LO FREQUENCY



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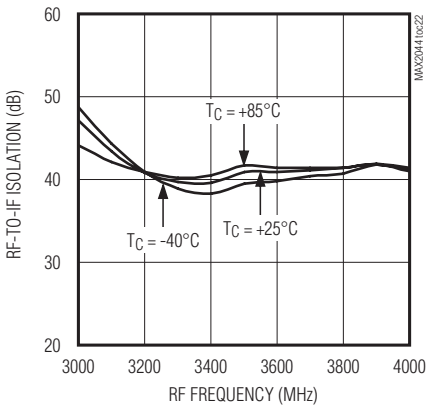
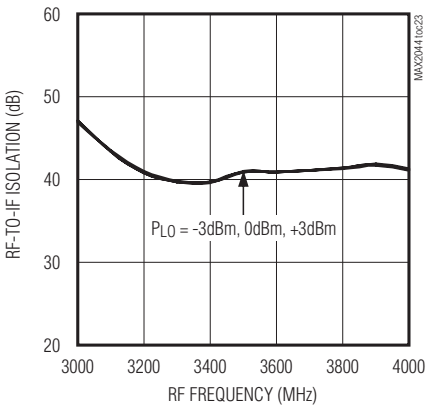
典型工作特性(续)

(*Typical Application Circuit* with tuning elements outlined in **Table 1, Downconverter Mode, V_{CC} = 5.0V, f_{RF} = 3000MHz to 4000MHz, LO is low-side injected** for a 300MHz IF, P_{RF} = 0dBm, P_{LO} = 0dBm, T_C = +25°C, unless otherwise noted.)

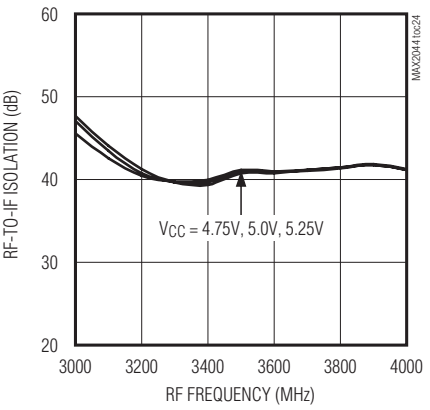
RF-TO-IF ISOLATION vs. RF FREQUENCY



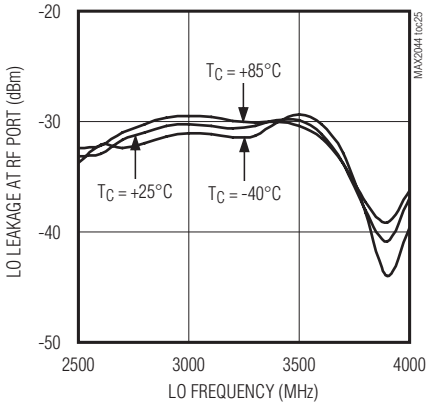
RF-TO-IF ISOLATION vs. RF FREQUENCY



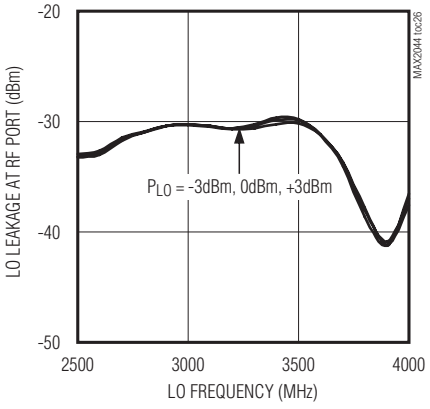
RF-TO-IF ISOLATION vs. RF FREQUENCY



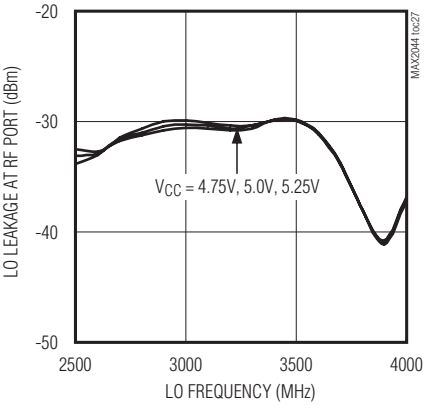
LO LEAKAGE AT RF PORT vs. LO FREQUENCY



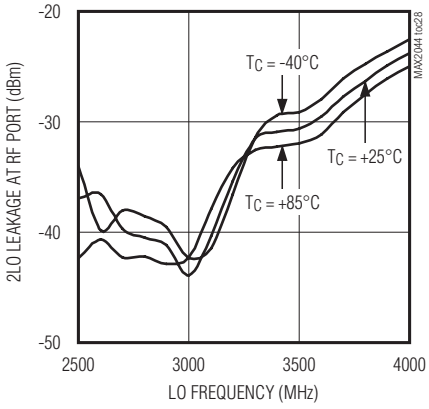
LO LEAKAGE AT RF PORT vs. LO FREQUENCY



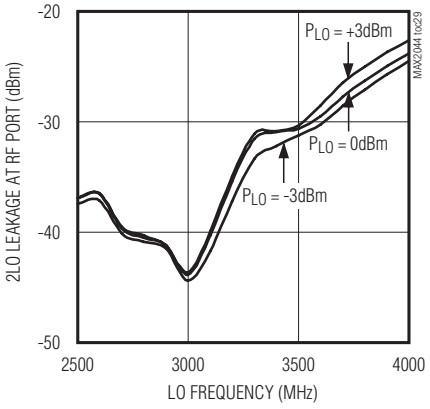
LO LEAKAGE AT RF PORT vs. LO FREQUENCY



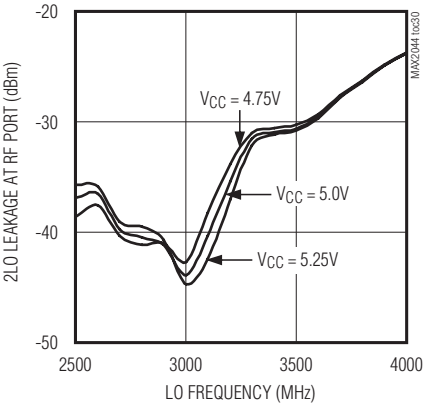
2LO LEAKAGE AT RF PORT vs. LO FREQUENCY



2LO LEAKAGE AT RF PORT vs. LO FREQUENCY



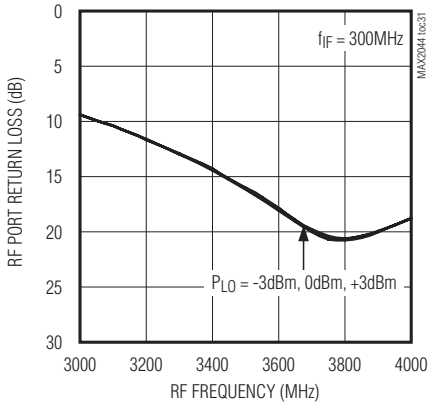
2LO LEAKAGE AT RF PORT vs. LO FREQUENCY



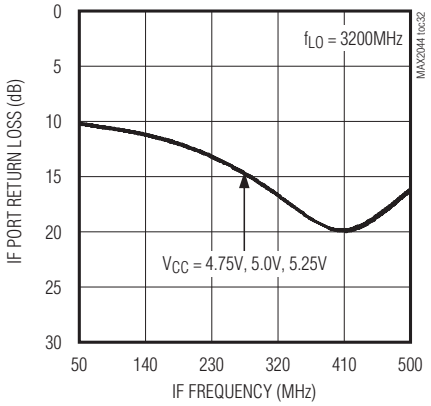
典型工作特性(续)

(*Typical Application Circuit* with tuning elements outlined in **Table 1, Downconverter Mode, V_{CC} = 5.0V, f_{RF} = 3000MHz to 4000MHz, LO is low-side injected** for a 300MHz IF, P_{RF} = 0dBm, P_{LO} = 0dBm, T_C = +25°C, unless otherwise noted.)

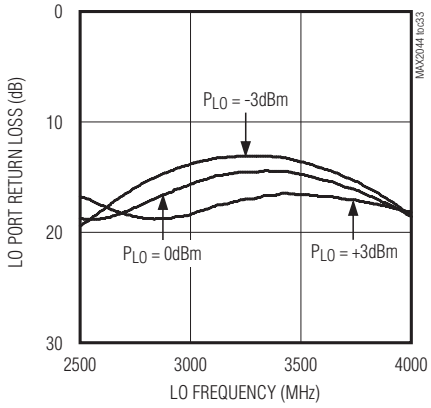
RF PORT RETURN LOSS vs. RF FREQUENCY



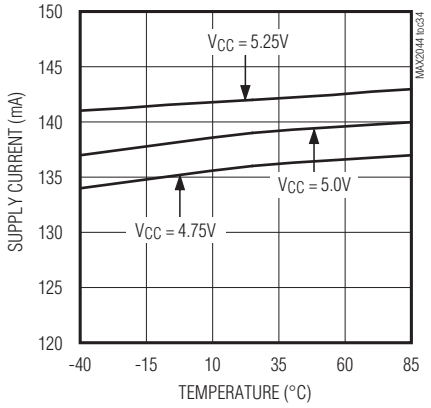
IF PORT RETURN LOSS vs. IF FREQUENCY



LO PORT RETURN LOSS vs. LO FREQUENCY



SUPPLY CURRENT vs. TEMPERATURE (T_C)



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典型工作特性(续)

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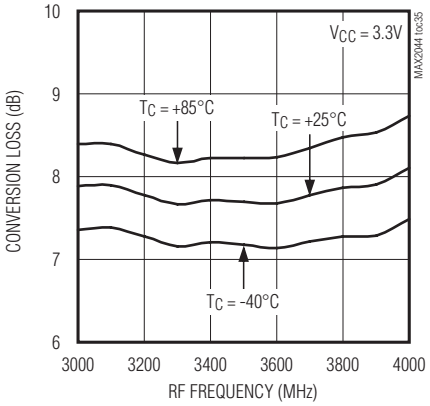
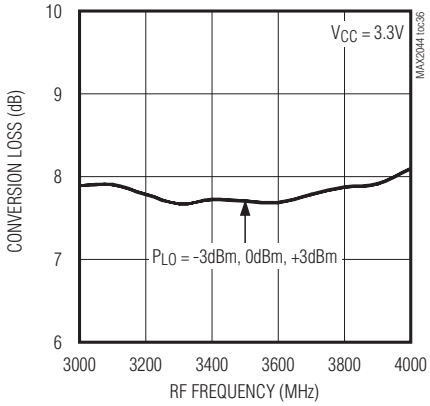
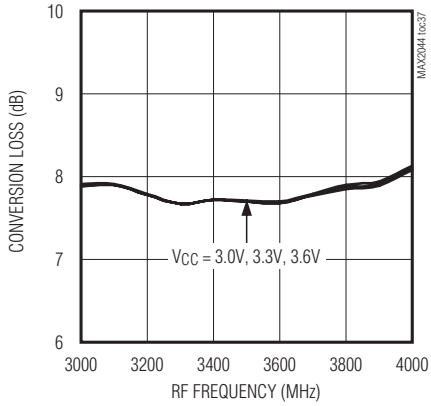
CONVERSION LOSS vs. RF FREQUENCY



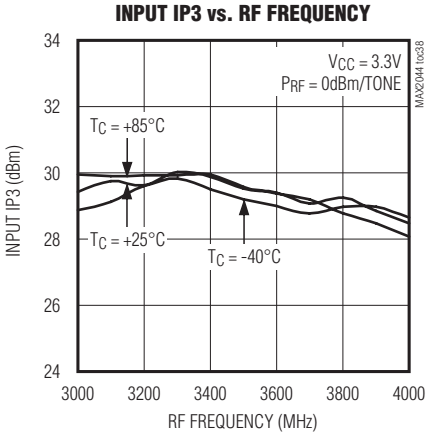
CONVERSION LOSS vs. RF FREQUENCY



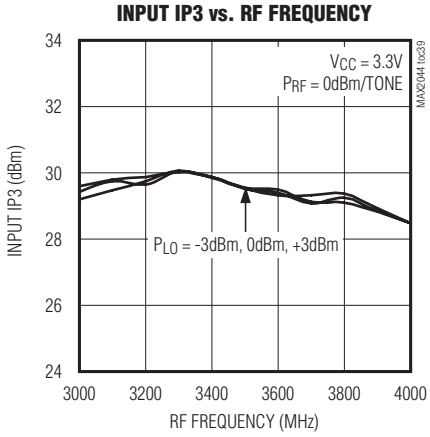
CONVERSION LOSS vs. RF FREQUENCY



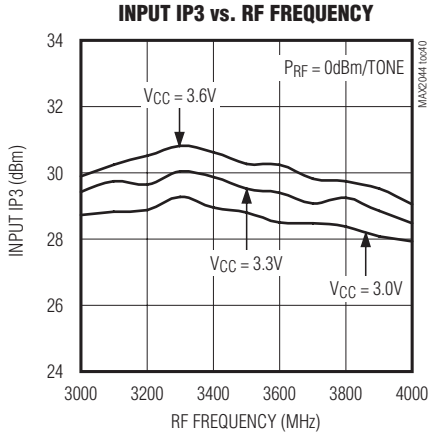
INPUT IP3 vs. RF FREQUENCY



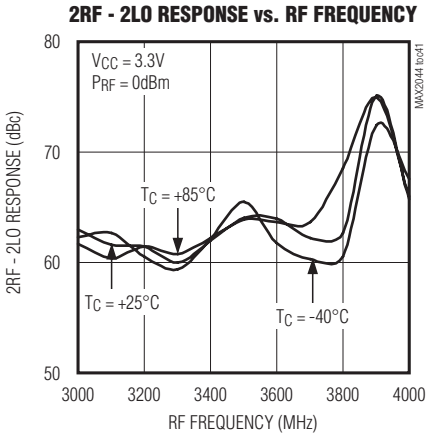
INPUT IP3 vs. RF FREQUENCY



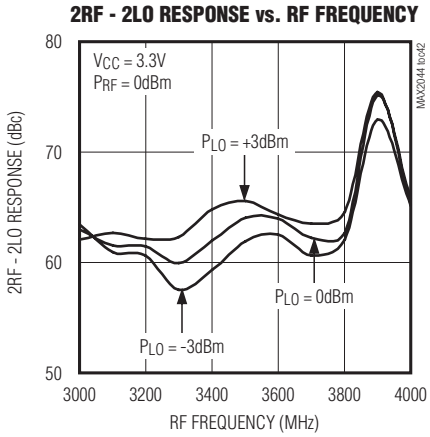
INPUT IP3 vs. RF FREQUENCY



2RF - 2LO RESPONSE vs. RF FREQUENCY



2RF - 2LO RESPONSE vs. RF FREQUENCY



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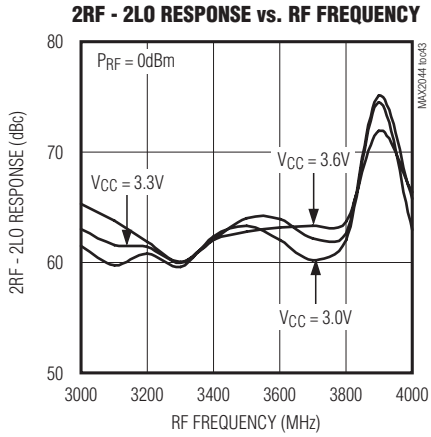

典型工作特性(续)

(*Typical Application Circuit* with tuning elements outlined in **Table 1, Downconverter Mode, V_{CC} = 3.3V, f_{RF} = 3000MHz to 4000MHz, LO is low-side injected** for a 300MHz IF, P_{RF} = 0dBm, P_{LO} = 0dBm, T_C = +25°C, unless otherwise noted.)

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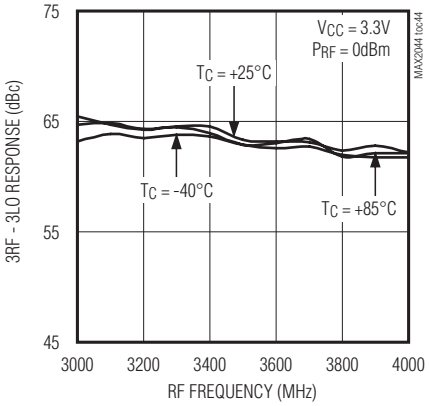
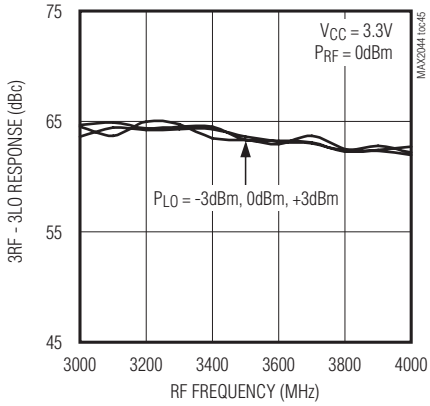
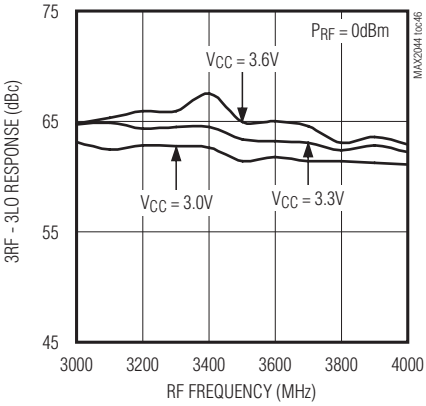


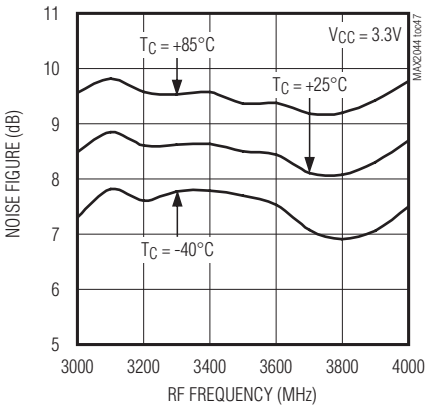
3RF - 3LO RESPONSE vs. RF FREQUENCY



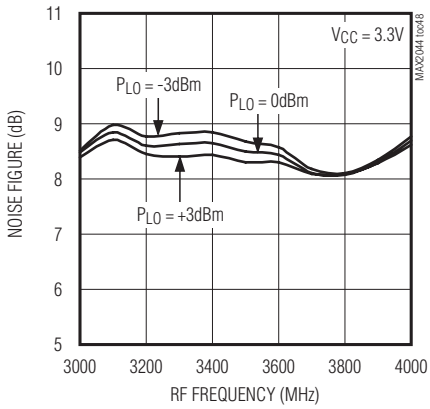
3RF - 3LO RESPONSE vs. RF FREQUENCY



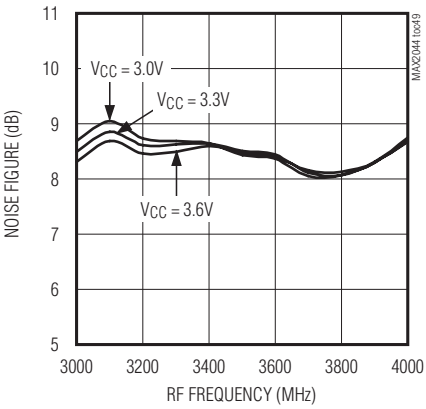
NOISE FIGURE vs. RF FREQUENCY



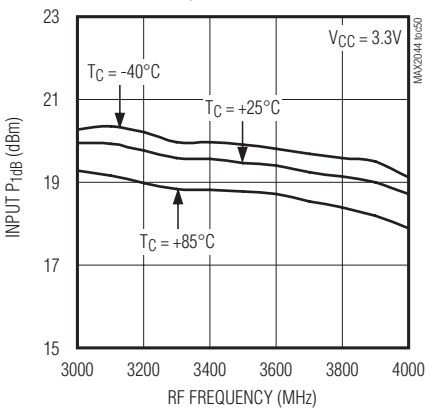
NOISE FIGURE vs. RF FREQUENCY



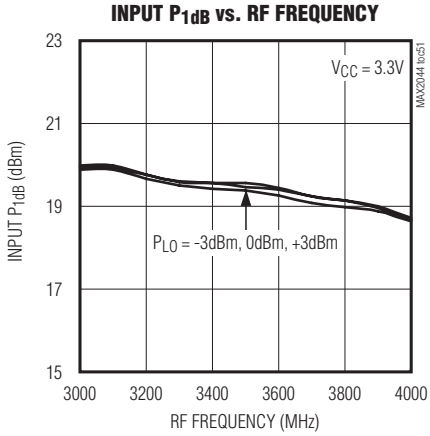
NOISE FIGURE vs. RF FREQUENCY



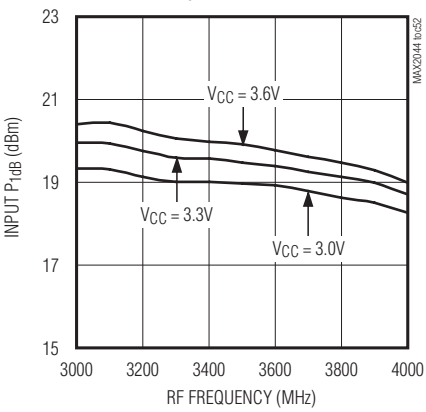
INPUT P_{1dB} vs. RF FREQUENCY



INPUT P_{1dB} vs. RF FREQUENCY



INPUT P_{1dB} vs. RF FREQUENCY

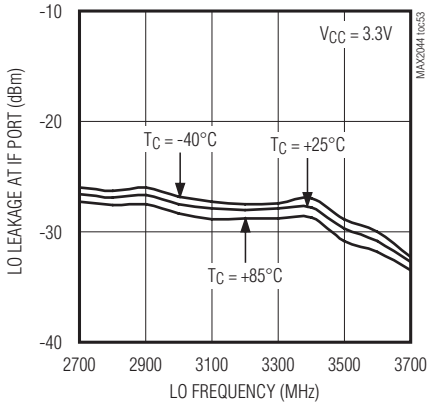


SiGe、高线性度、2300MHz至4000MHz上变频/下变频混频器，带有LO缓冲器

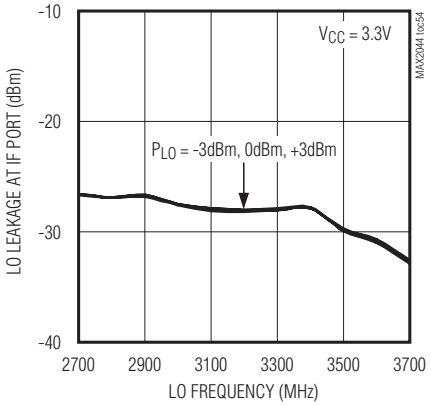
典型工作特性(续)

(*Typical Application Circuit* with tuning elements outlined in **Table 1, Downconverter Mode, V_{CC} = 3.3V, f_{RF} = 3000MHz to 4000MHz, LO is low-side injected** for a 300MHz IF, P_{RF} = 0dBm, P_{LO} = 0dBm, T_C = +25°C, unless otherwise noted.)

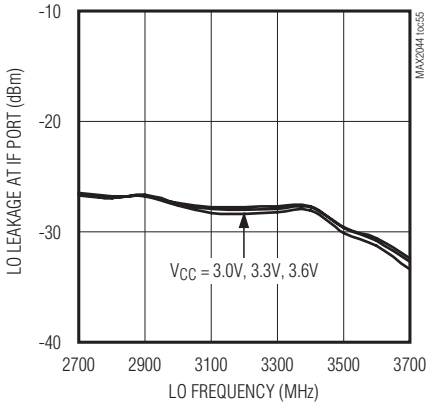
LO LEAKAGE AT IF PORT vs. LO FREQUENCY



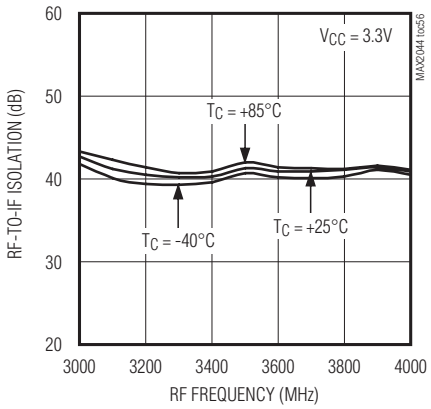
LO LEAKAGE AT IF PORT vs. LO FREQUENCY



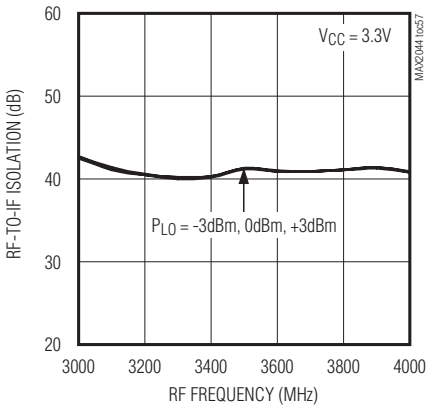
LO LEAKAGE AT IF PORT vs. LO FREQUENCY



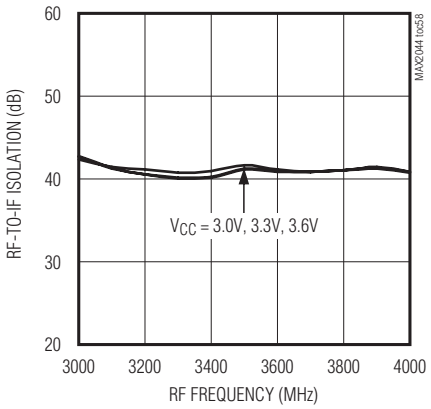
RF-TO-IF ISOLATION vs. RF FREQUENCY



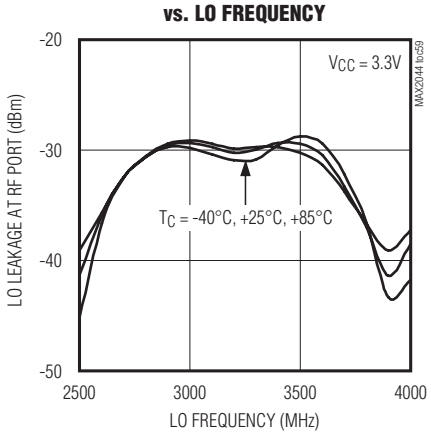
RF-TO-IF ISOLATION vs. RF FREQUENCY



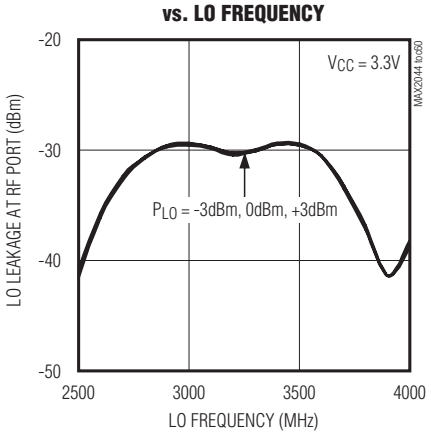
RF-TO-IF ISOLATION vs. RF FREQUENCY



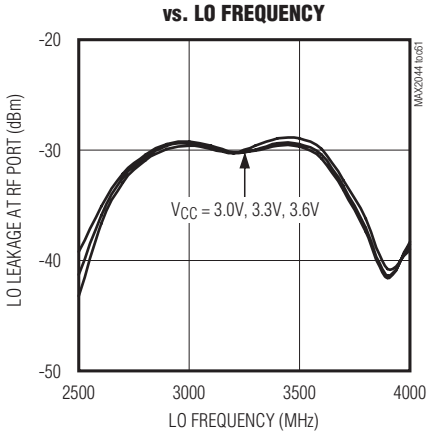
LO LEAKAGE AT RF PORT vs. LO FREQUENCY



LO LEAKAGE AT RF PORT vs. LO FREQUENCY



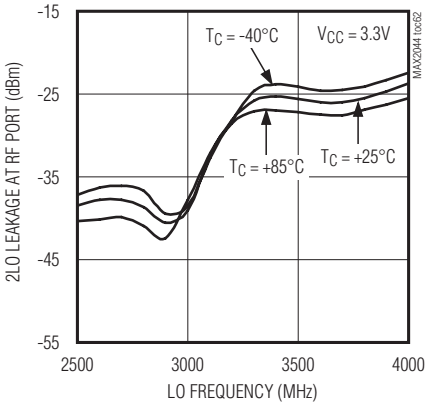
LO LEAKAGE AT RF PORT vs. LO FREQUENCY



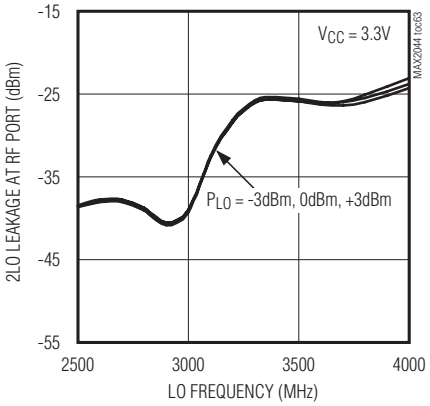
典型工作特性(续)

(*Typical Application Circuit* with tuning elements outlined in **Table 1, Downconverter Mode, V_{CC} = 3.3V, f_{RF} = 3000MHz to 4000MHz, LO is low-side injected** for a 300MHz IF, P_{RF} = 0dBm, P_{LO} = 0dBm, T_C = +25°C, unless otherwise noted.)

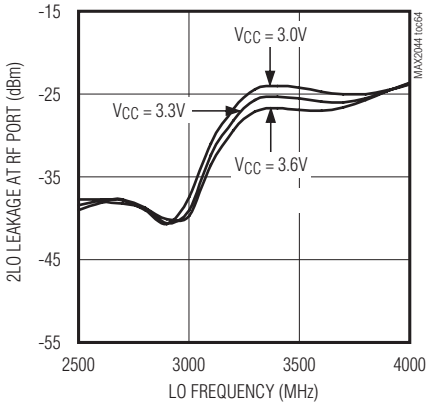
2LO LEAKAGE AT RF PORT vs. LO FREQUENCY



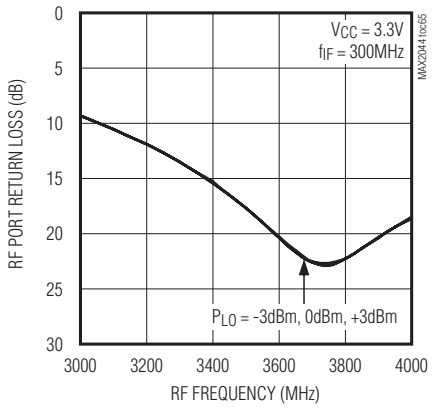
2LO LEAKAGE AT RF PORT vs. LO FREQUENCY



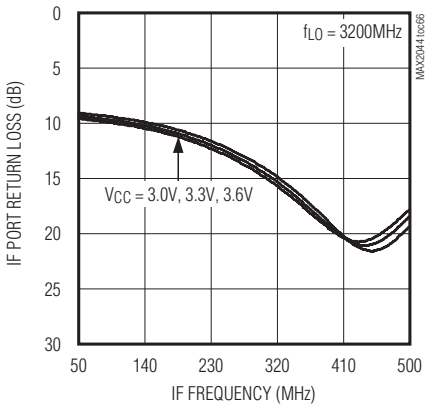
2LO LEAKAGE AT RF PORT vs. LO FREQUENCY



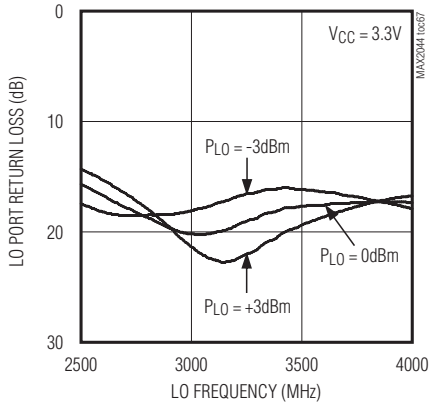
RF PORT RETURN LOSS vs. RF FREQUENCY



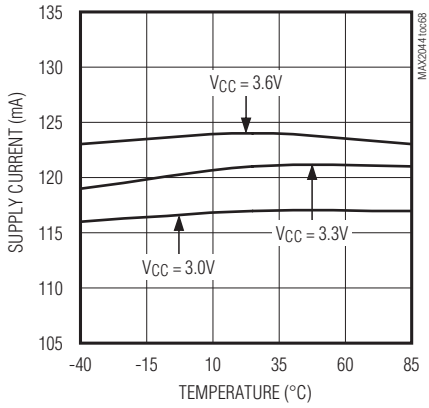
IF PORT RETURN LOSS vs. IF FREQUENCY



LO PORT RETURN LOSS vs. LO FREQUENCY



SUPPLY CURRENT vs.TEMPERATURE (T_C)



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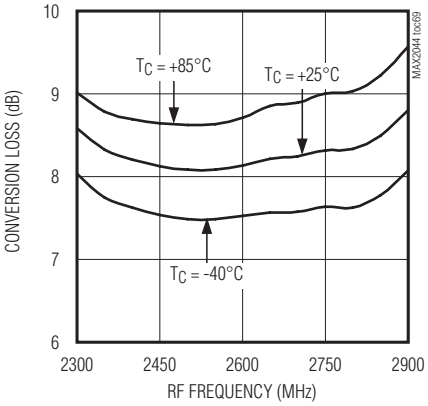
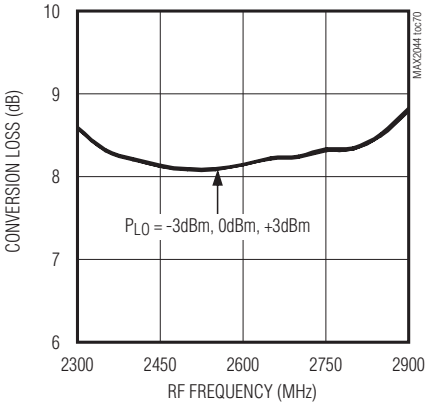
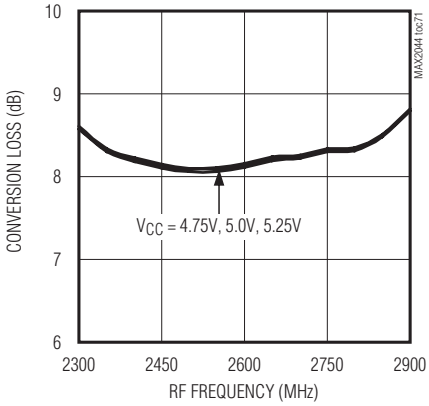
CONVERSION LOSS vs. RF FREQUENCY



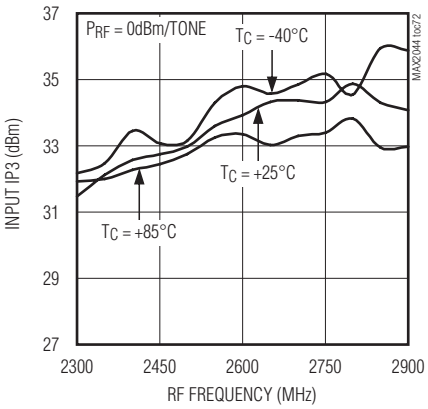
CONVERSION LOSS vs. RF FREQUENCY



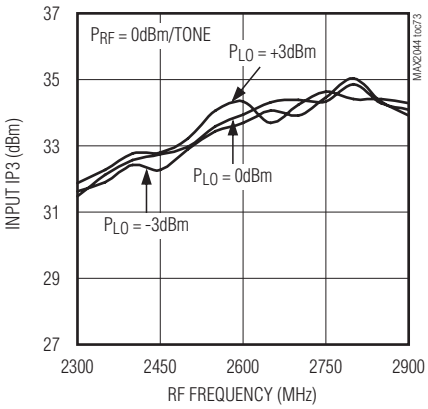
CONVERSION LOSS vs. RF FREQUENCY



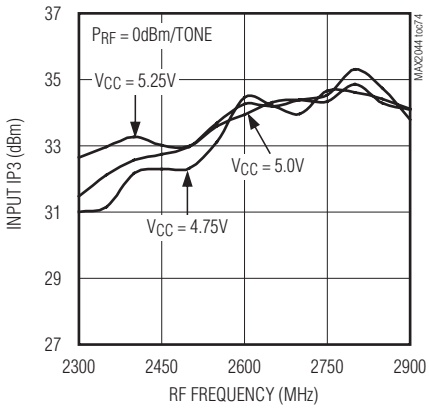
INPUT IP3 vs. RF FREQUENCY



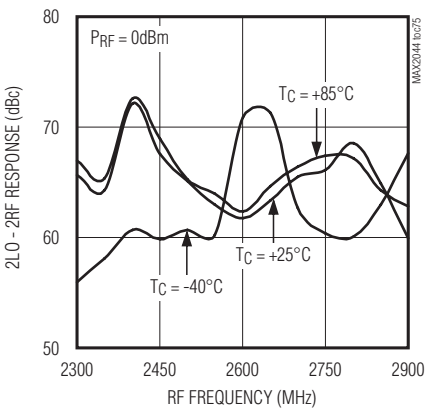
INPUT IP3 vs. RF FREQUENCY



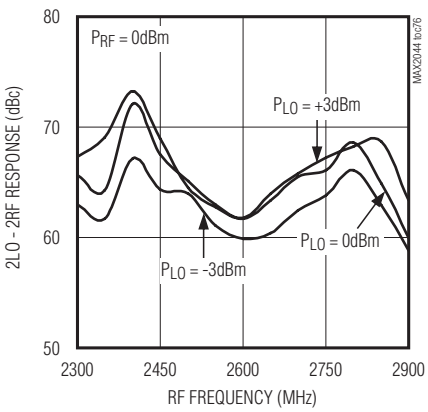
INPUT IP3 vs. RF FREQUENCY



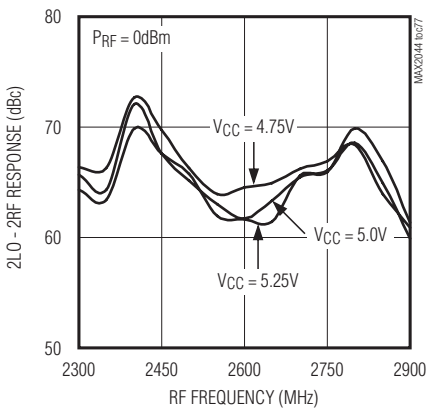
2LO - 2RF RESPONSE vs. RF FREQUENCY



2LO - 2RF RESPONSE vs. RF FREQUENCY



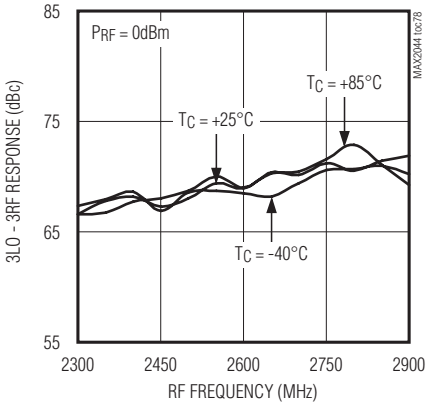
2LO - 2RF RESPONSE vs. RF FREQUENCY



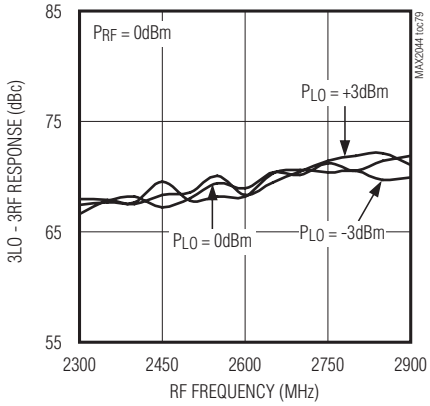
典型工作特性(续)

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

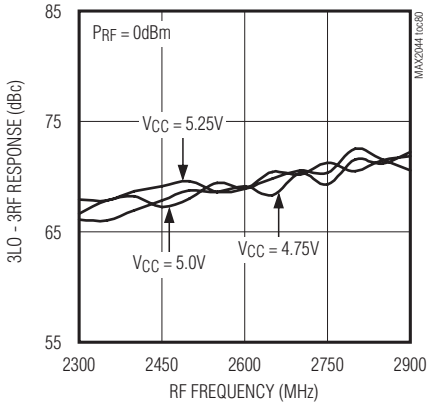
3LO - 3RF RESPONSE vs. RF FREQUENCY



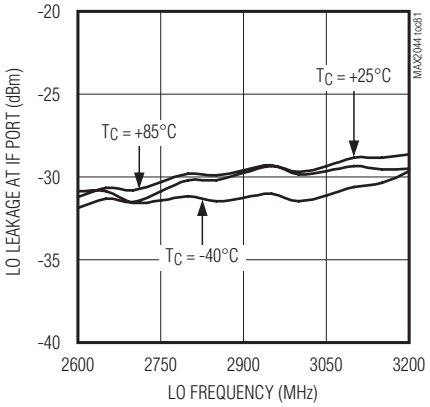
3LO - 3RF RESPONSE vs. RF FREQUENCY



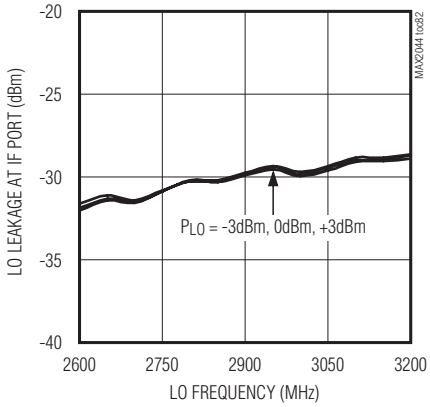
3LO - 3RF RESPONSE vs. RF FREQUENCY



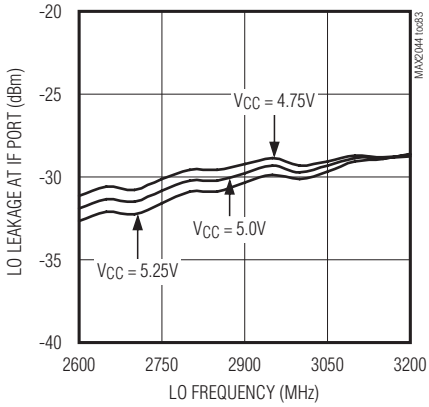
LO LEAKAGE AT IF PORT vs. LO FREQUENCY



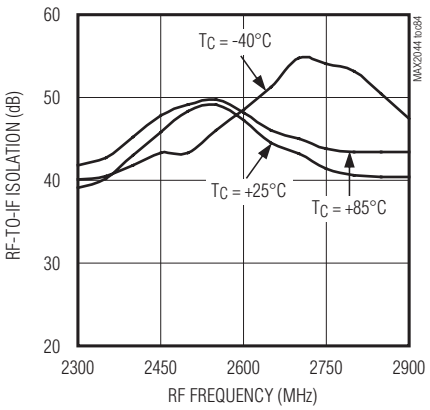
LO LEAKAGE AT IF PORT vs. LO FREQUENCY



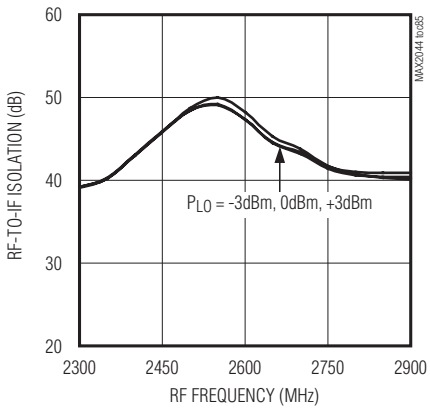
LO LEAKAGE AT IF PORT vs. LO FREQUENCY



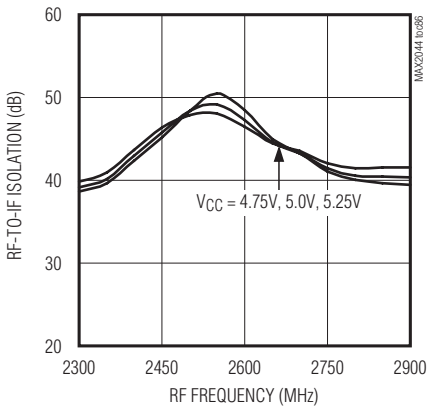
RF-TO-IF ISOLATION vs. RF FREQUENCY



RF-TO-IF ISOLATION vs. RF FREQUENCY



RF-TO-IF ISOLATION vs. RF FREQUENCY



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典型工作特性(续)

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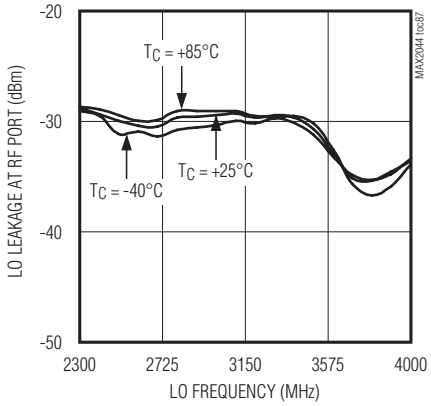
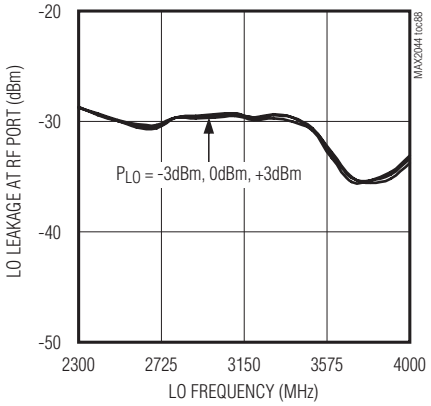
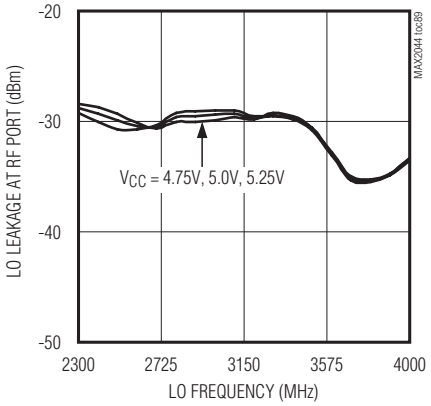
LO LEAKAGE AT RF PORT vs. LO FREQUENCY



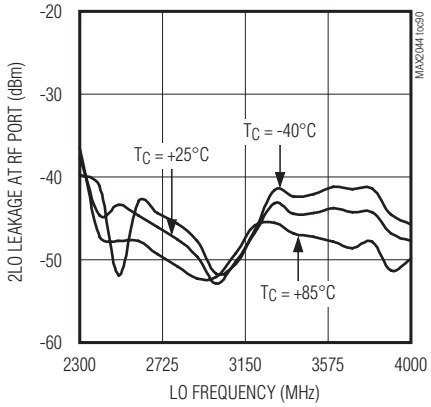
LO LEAKAGE AT RF PORT vs. LO FREQUENCY



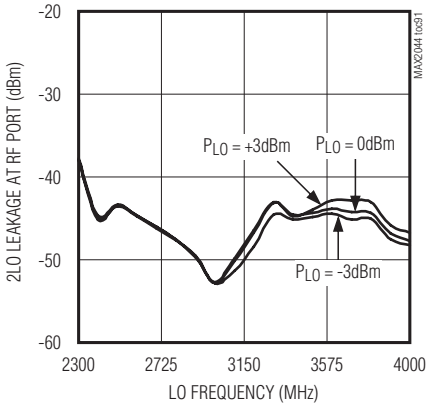
LO LEAKAGE AT RF PORT vs. LO FREQUENCY



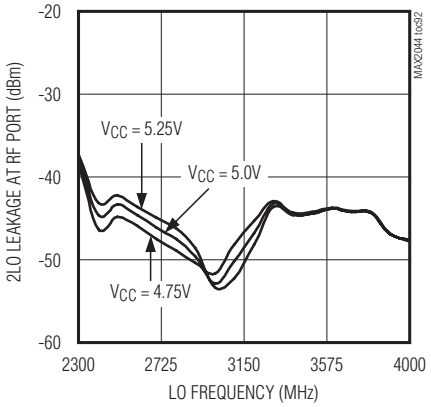
2LO LEAKAGE AT RF PORT vs. LO FREQUENCY



2LO LEAKAGE AT RF PORT vs. LO FREQUENCY



2LO LEAKAGE AT RF PORT vs. LO FREQUENCY



典型工作特性(续)

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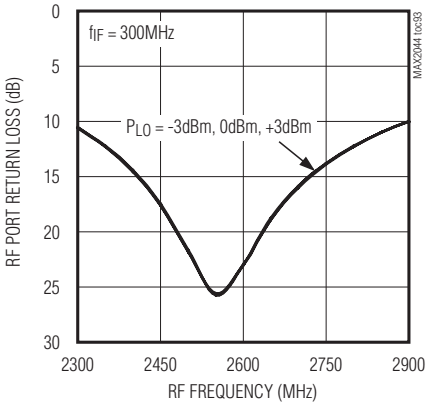
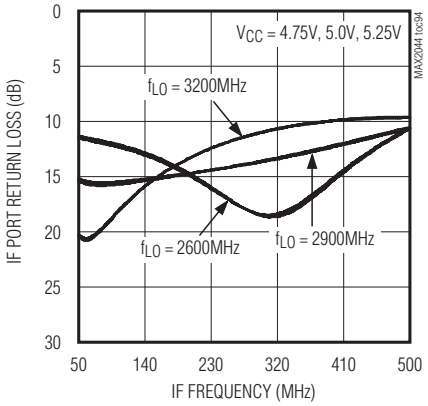
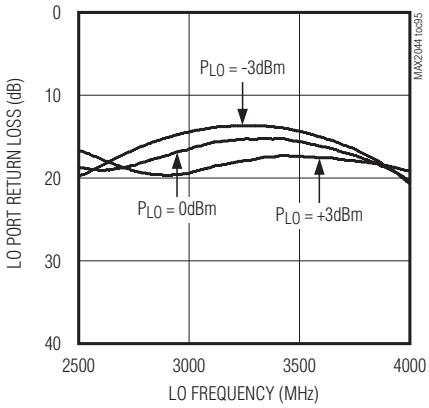
RF PORT RETURN LOSS vs. RF FREQUENCY



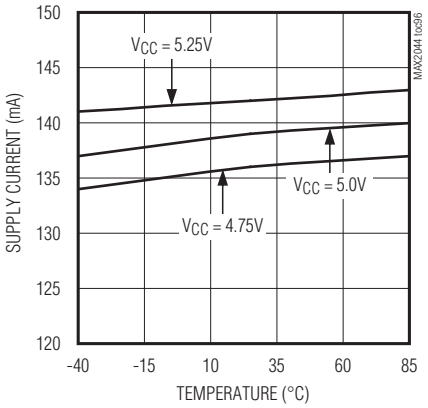
IF PORT RETURN LOSS vs. IF FREQUENCY



LO PORT RETURN LOSS vs. LO FREQUENCY



SUPPLY CURRENT vs. TEMPERATURE (T_C)



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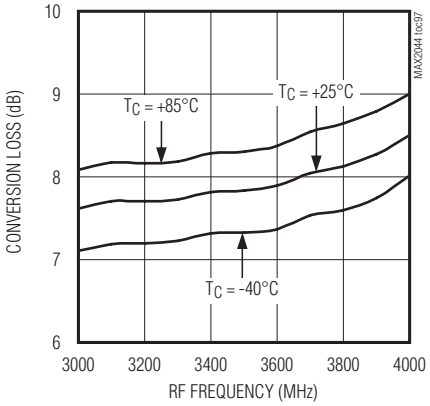
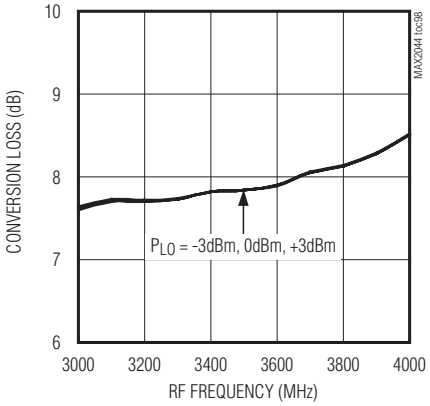
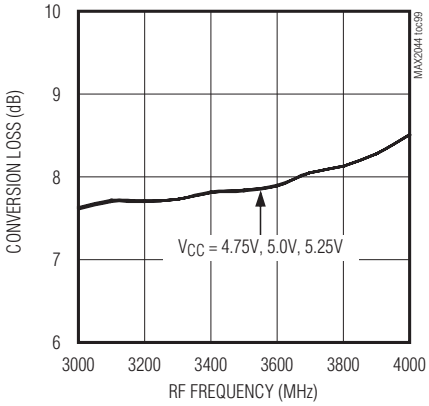
CONVERSION LOSS vs. RF FREQUENCY



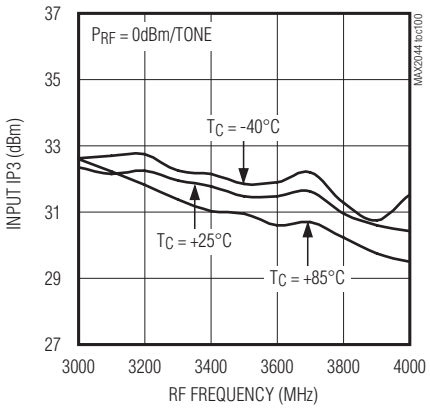
CONVERSION LOSS vs. RF FREQUENCY



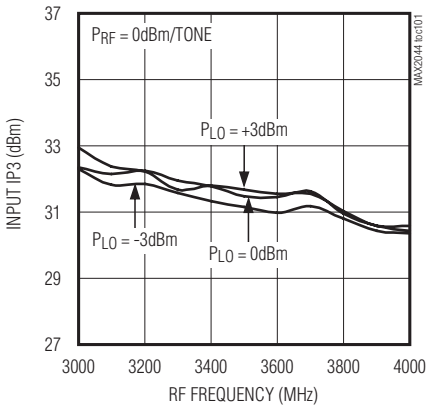
CONVERSION LOSS vs. RF FREQUENCY



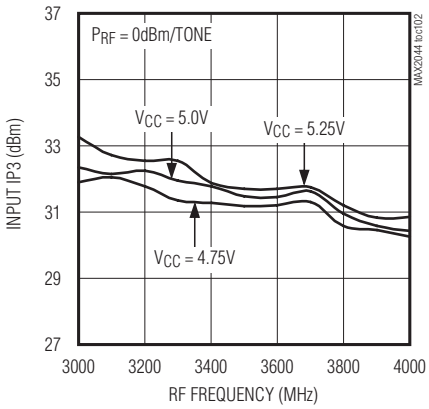
INPUT IP3 vs. RF FREQUENCY



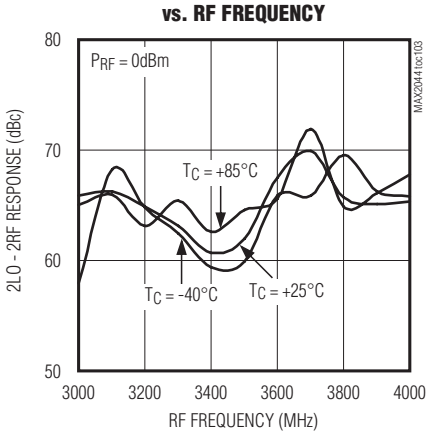
INPUT IP3 vs. RF FREQUENCY



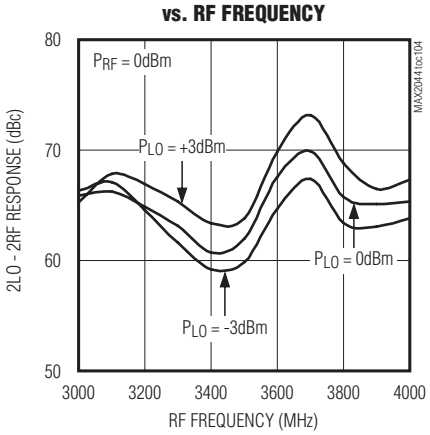
INPUT IP3 vs. RF FREQUENCY



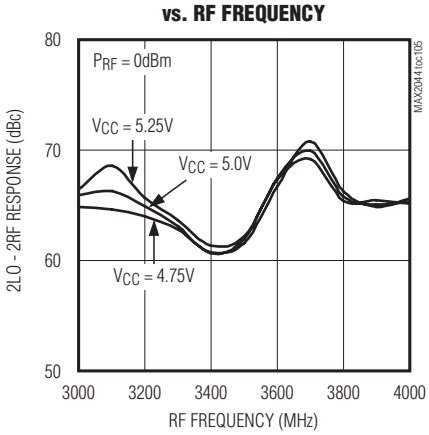
2LO - 2RF RESPONSE vs. RF FREQUENCY



2LO - 2RF RESPONSE vs. RF FREQUENCY



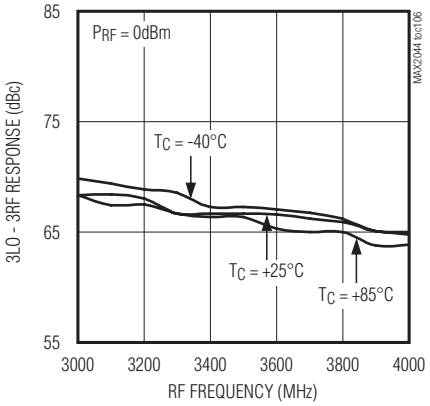
2LO - 2RF RESPONSE vs. RF FREQUENCY



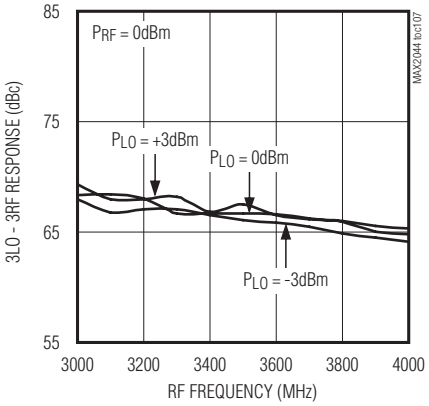
典型工作特性(续)

(*Typical Application Circuit* with tuning elements outlined in **Table 1, Downconverter Mode, V_{CC} = 5.0V, f_{RF} = 3000MHz to 4000MHz, LO is high-side injected** for a 300MHz IF, P_{RF} = 0dBm, P_{LO} = 0dBm, T_C = +25°C, unless otherwise noted.)

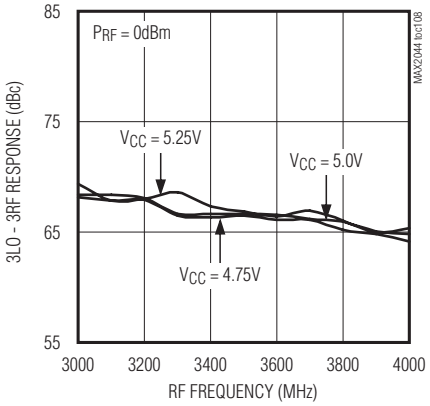
3LO - 3RF RESPONSE vs. RF FREQUENCY



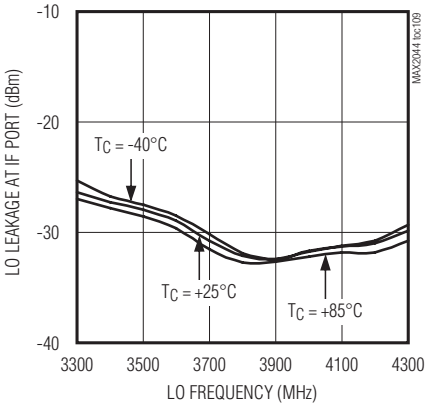
3LO - 3RF RESPONSE vs. RF FREQUENCY



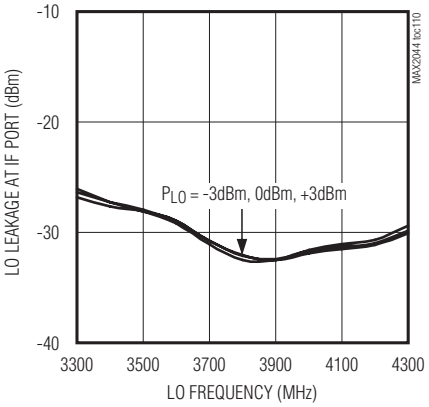
3LO - 3RF RESPONSE vs. RF FREQUENCY



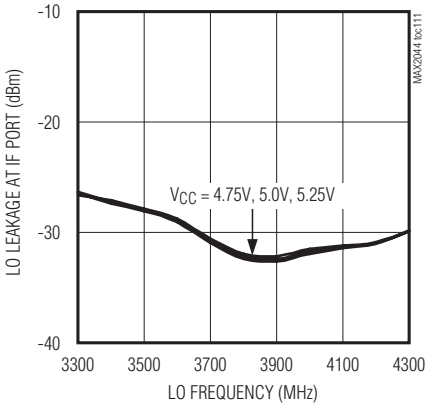
LO LEAKAGE AT IF PORT vs. LO FREQUENCY



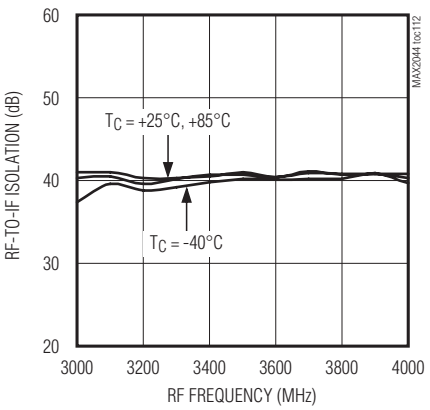
LO LEAKAGE AT IF PORT vs. LO FREQUENCY



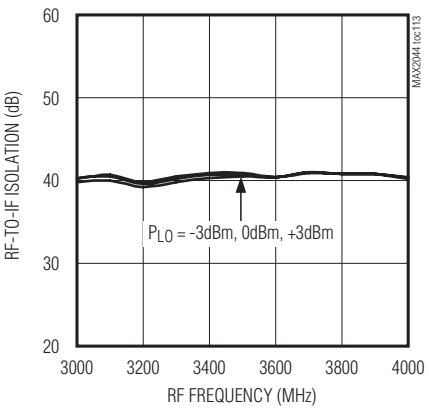
LO LEAKAGE AT IF PORT vs. LO FREQUENCY



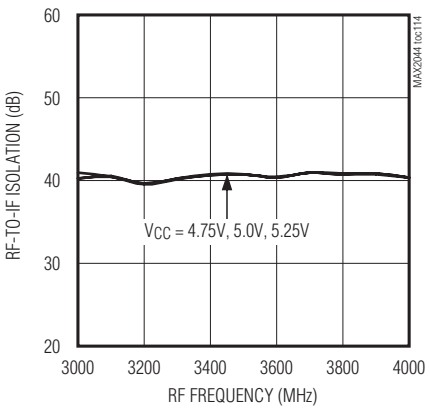
RF-TO-IF ISOLATION vs. RF FREQUENCY



RF-TO-IF ISOLATION vs. RF FREQUENCY



RF-TO-IF ISOLATION vs. RF FREQUENCY

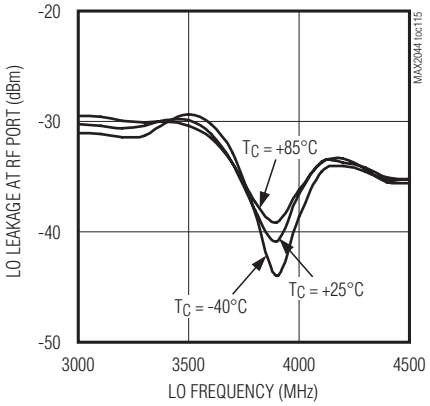


SiGe、高线性度、2300MHz至4000MHz上变频/下变频混频器，带有LO缓冲器

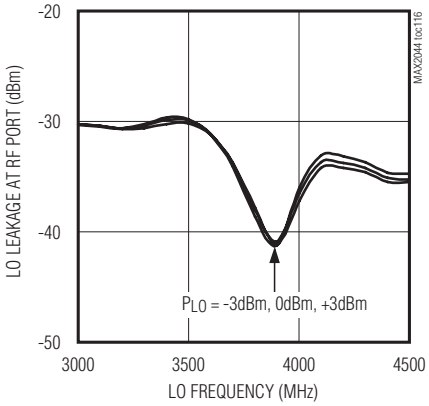
典型工作特性(续)

(*Typical Application Circuit* with tuning elements outlined in **Table 1, Downconverter Mode, V_{CC} = 5.0V, f_{RF} = 3000MHz to 4000MHz, LO is high-side injected** for a 300MHz IF, P_{RF} = 0dBm, P_{LO} = 0dBm, T_C = +25°C, unless otherwise noted.)

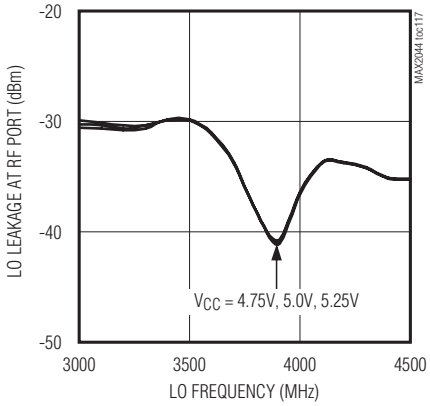
LO LEAKAGE AT RF PORT vs. LO FREQUENCY



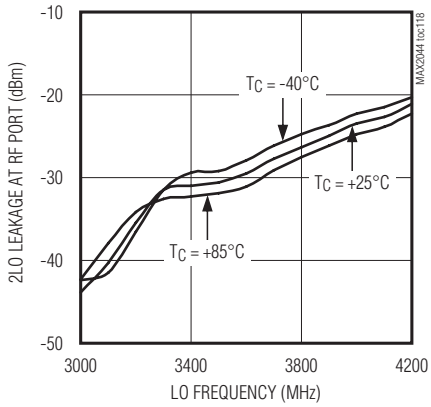
LO LEAKAGE AT RF PORT vs. LO FREQUENCY



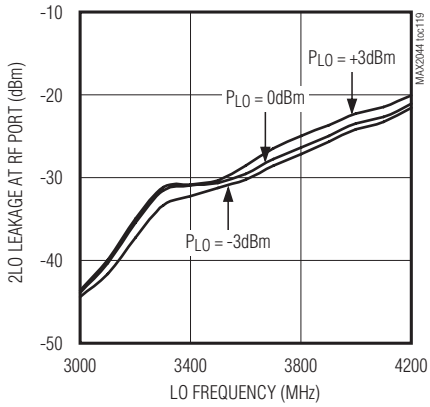
LO LEAKAGE AT RF PORT vs. LO FREQUENCY



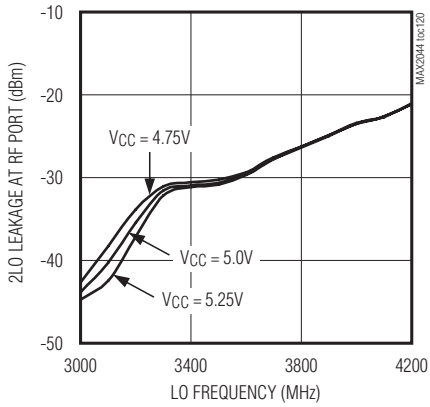
2LO LEAKAGE AT RF PORT vs. LO FREQUENCY



2LO LEAKAGE AT RF PORT vs. LO FREQUENCY



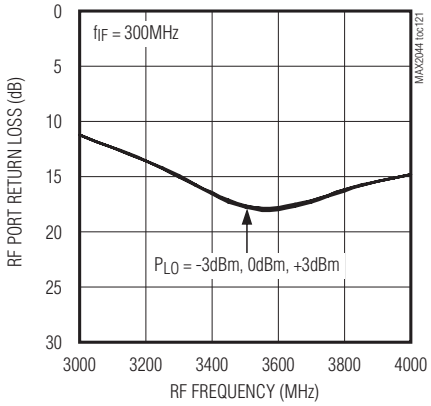
2LO LEAKAGE AT RF PORT vs. LO FREQUENCY



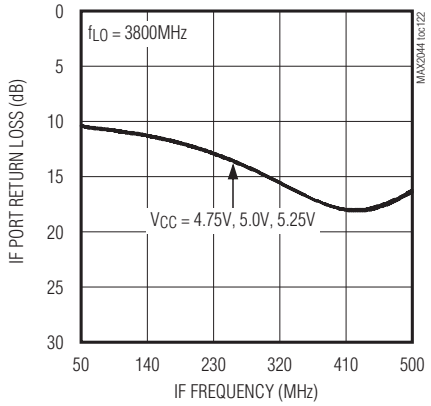
典型工作特性(续)

(*Typical Application Circuit* with tuning elements outlined in **Table 1, Downconverter Mode, V_{CC} = 5.0V, f_{RF} = 3000MHz to 4000MHz, LO is high-side injected** for a 300MHz IF, P_{RF} = 0dBm, P_{LO} = 0dBm, T_C = +25°C, unless otherwise noted.)

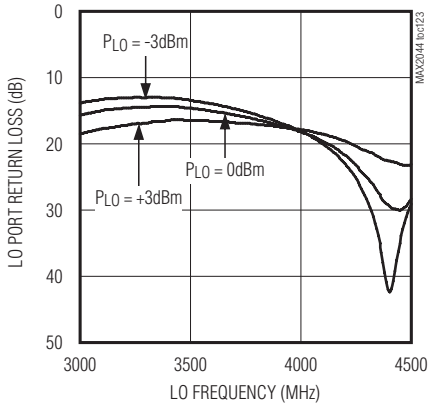
RF PORT RETURN LOSS vs. RF FREQUENCY



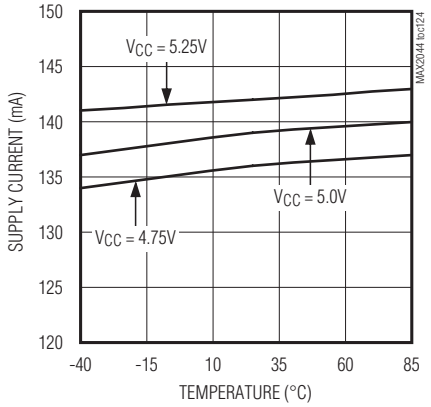
IF PORT RETURN LOSS vs. IF FREQUENCY



LO PORT RETURN LOSS vs. LO FREQUENCY



SUPPLY CURRENT vs. TEMPERATURE (T_C)



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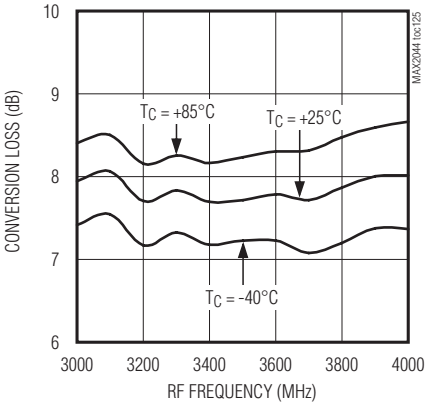
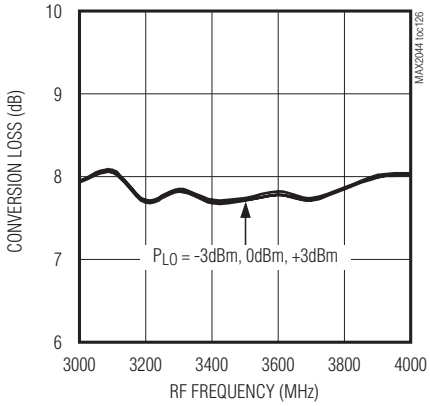
典型工作特性(续)

(*Typical Application Circuit* with tuning elements outlined in **Table 2, Upconverter Mode, V_{CC} = 5.0V, f_{RF} = 3000MHz to 4000MHz, LO is low-side injected,** f_{IF} = 200MHz, P_{IF} = 0dBm, P_{LO} = 0dBm, T_C = +25°C, unless otherwise noted.)

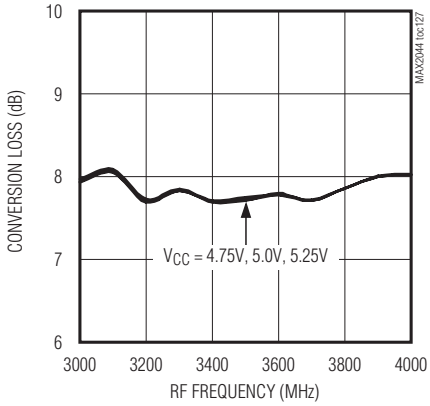
CONVERSION LOSS vs. RF FREQUENCY



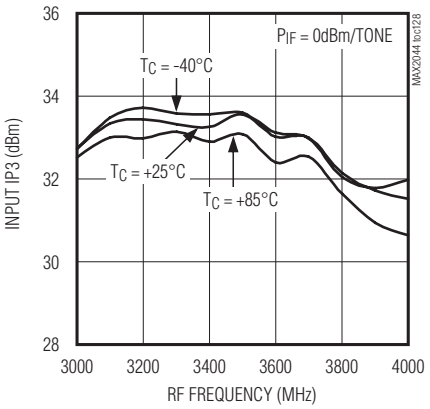
CONVERSION LOSS vs. RF FREQUENCY



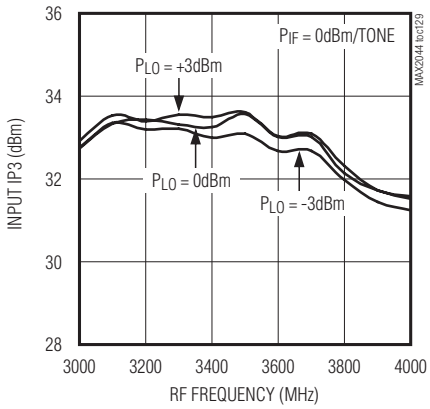
CONVERSION LOSS vs. RF FREQUENCY



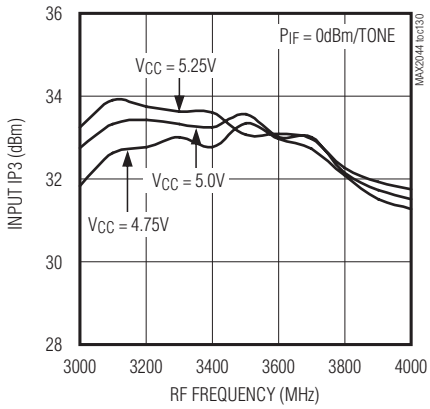
INPUT IP3 vs. RF FREQUENCY



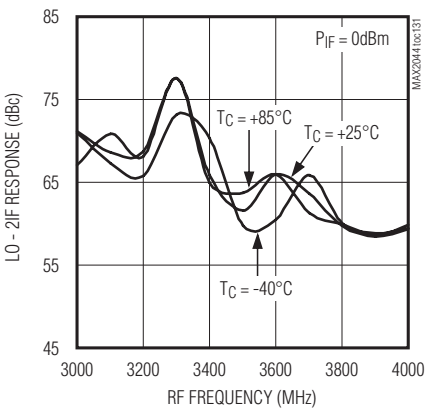
INPUT IP3 vs. RF FREQUENCY



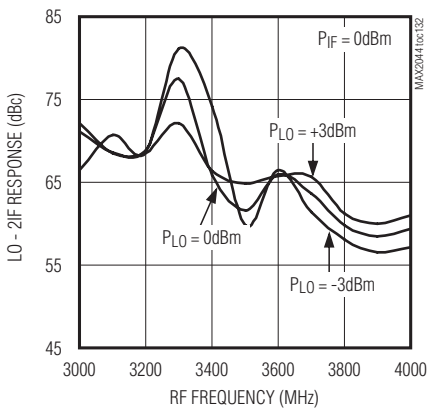
INPUT IP3 vs. RF FREQUENCY



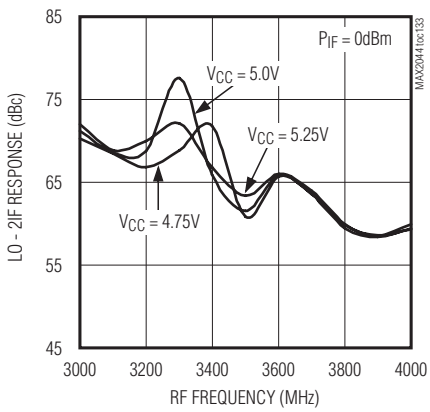
LO - 2IF RESPONSE vs. RF FREQUENCY



LO - 2IF RESPONSE vs. RF FREQUENCY



LO - 2IF RESPONSE vs. RF FREQUENCY



典型工作特性(续)

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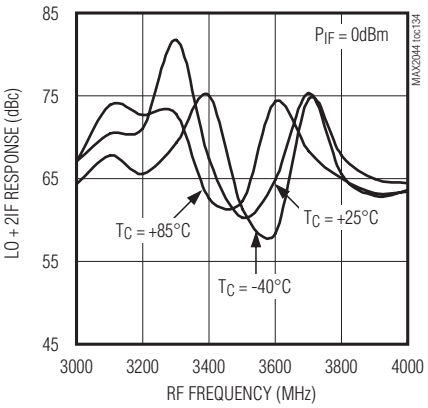
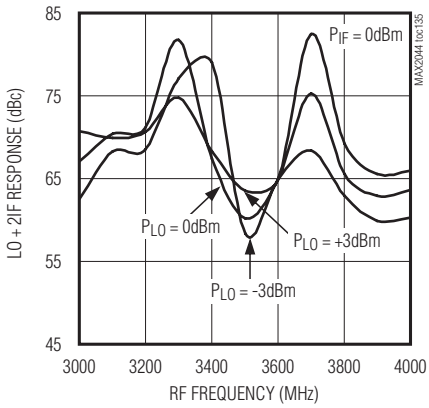
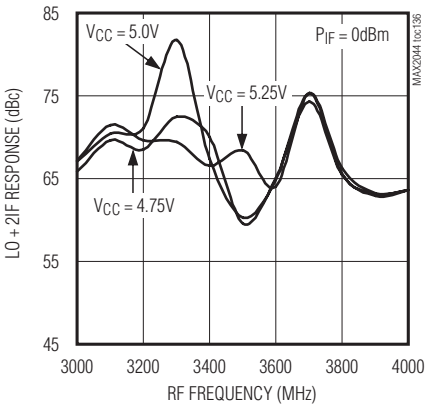
LO + 2IF RESPONSE vs. RF FREQUENCY



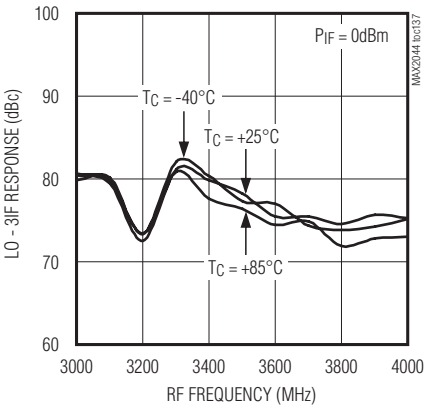
LO + 2IF RESPONSE vs. RF FREQUENCY



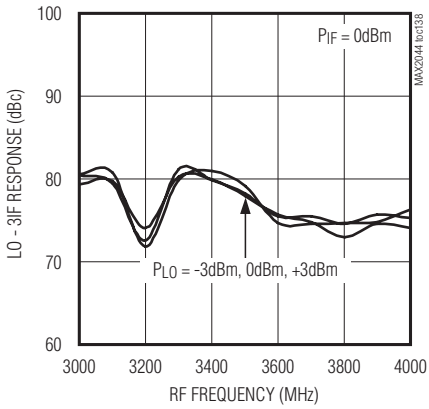
LO + 2IF RESPONSE vs. RF FREQUENCY



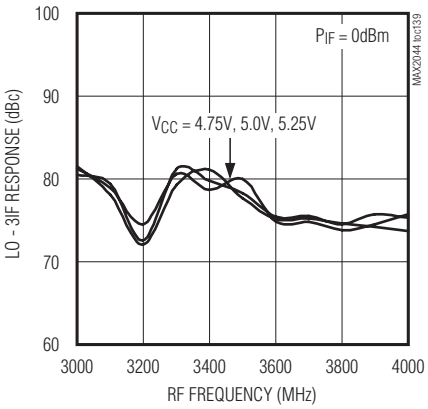
LO - 3IF RESPONSE vs. RF FREQUENCY



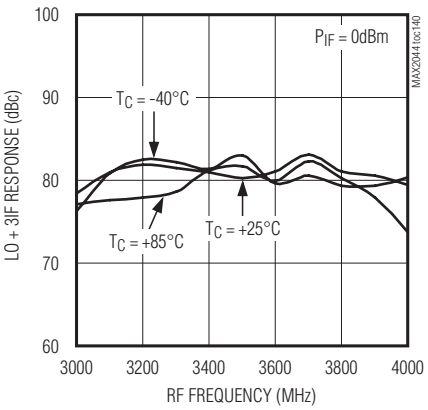
LO - 3IF RESPONSE vs. RF FREQUENCY



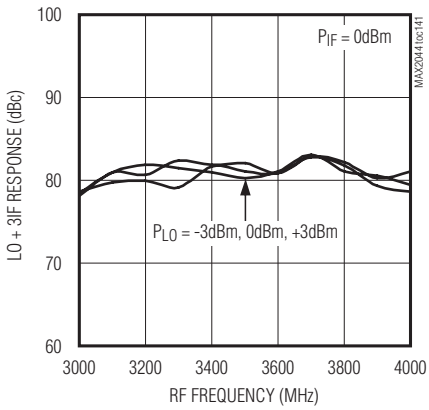
LO - 3IF RESPONSE vs. RF FREQUENCY



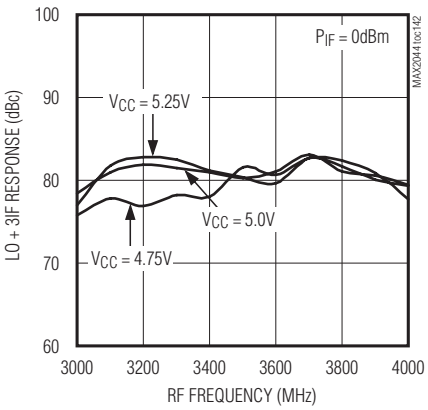
LO + 3IF RESPONSE vs. RF FREQUENCY



LO + 3IF RESPONSE vs. RF FREQUENCY



LO + 3IF RESPONSE vs. RF FREQUENCY



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典型工作特性(续)

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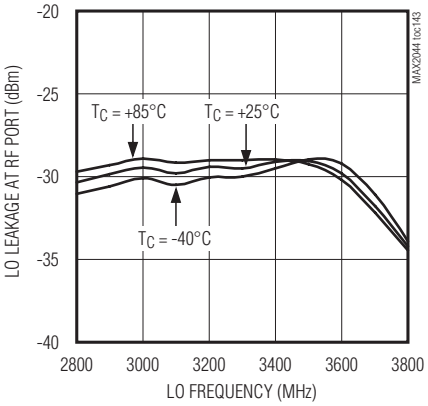
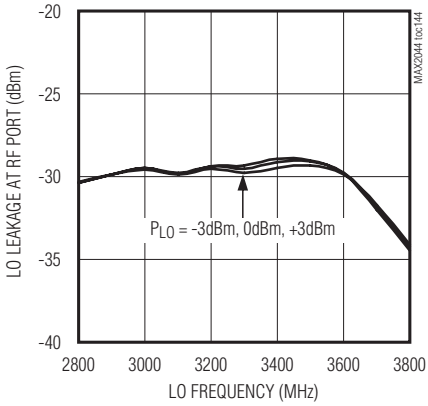
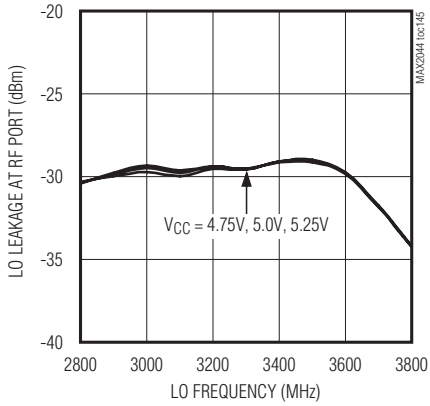
LO LEAKAGE AT RF PORT vs. LO FREQUENCY



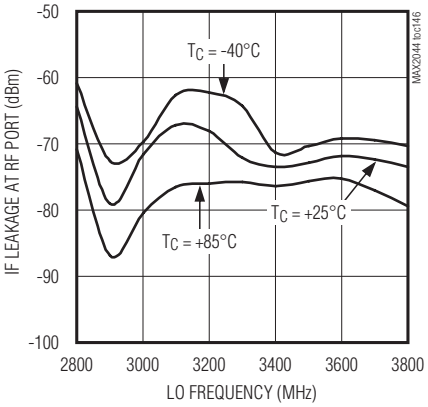
LO LEAKAGE AT RF PORT vs. LO FREQUENCY



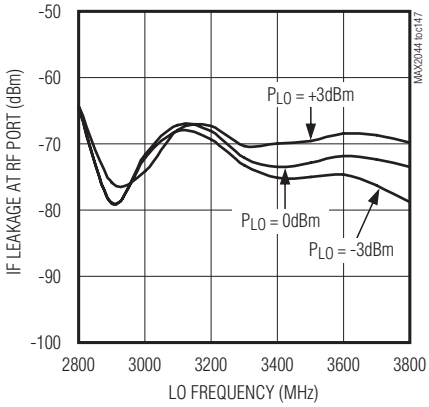
LO LEAKAGE AT RF PORT vs. LO FREQUENCY



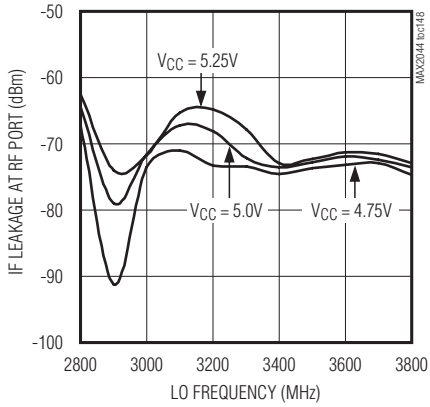
IF LEAKAGE AT RF PORT vs. LO FREQUENCY



IF LEAKAGE AT RF PORT vs. LO FREQUENCY



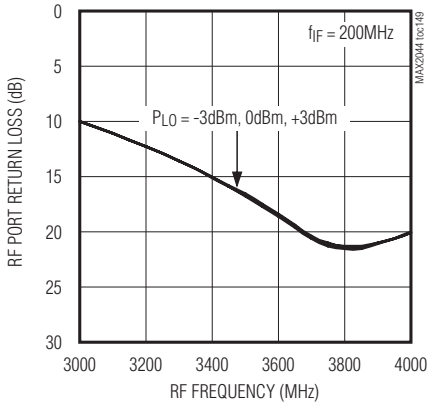
IF LEAKAGE AT RF PORT vs. LO FREQUENCY



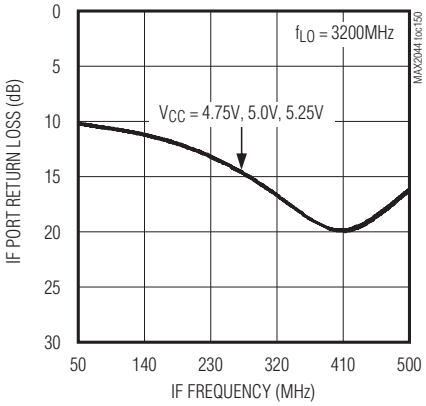
典型工作特性(续)

(*Typical Application Circuit* with tuning elements outlined in **Table 2, Upconverter Mode, V_{CC} = 5.0V, f_{RF} = 3000MHz to 4000MHz, LO is low-side injected,** f_{IF} = 200MHz, P_{IF} = 0dBm, P_{LO} = 0dBm, T_C = +25°C, unless otherwise noted.)

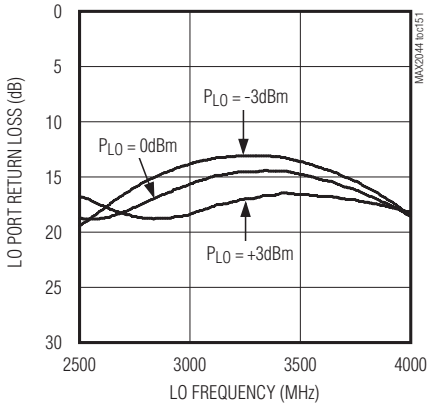
RF PORT RETURN LOSS vs. RF FREQUENCY



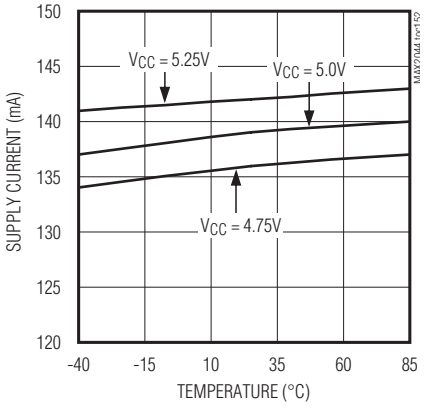
IF PORT RETURN LOSS vs. IF FREQUENCY



LO PORT RETURN LOSS vs. LO FREQUENCY



SUPPLY CURRENT vs. TEMPERATURE (T_C)

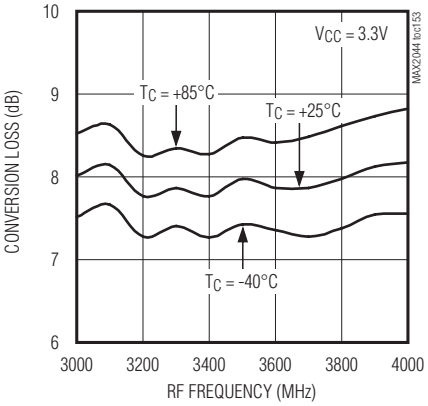


SiGe、高线性度、2300MHz至4000MHz上变频/下变频混频器，带有LO缓冲器

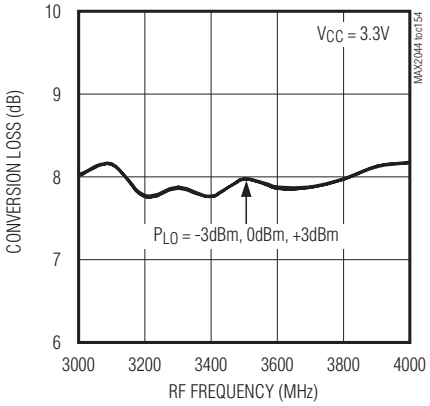
典型工作特性(续)

(*Typical Application Circuit* with tuning elements outlined in **Table 2, Upconverter Mode, V_{CC} = 3.3V, f_{RF} = 3000MHz to 4000MHz, LO is low-side injected,** f_{IF} = 200MHz, P_{IF} = 0dBm, P_{LO} = 0dBm, T_C = +25°C, unless otherwise noted.)

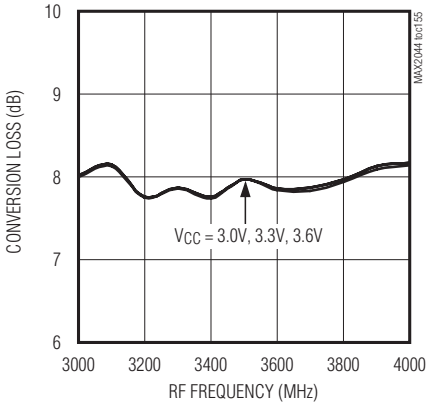
CONVERSION LOSS vs. RF FREQUENCY



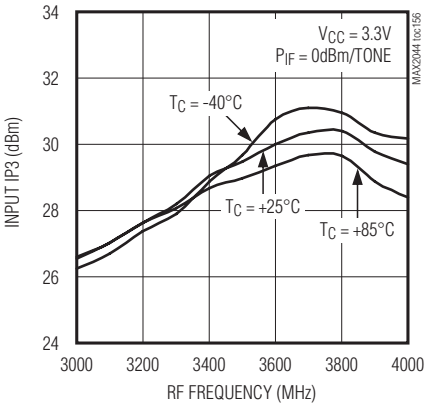
CONVERSION LOSS vs. RF FREQUENCY



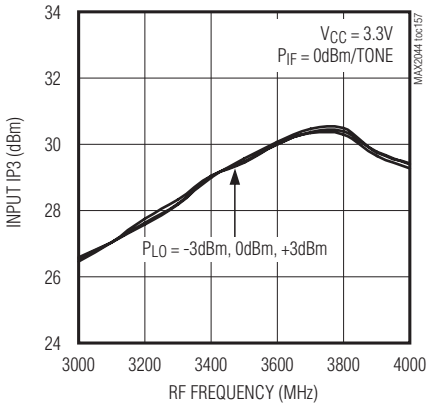
CONVERSION LOSS vs. RF FREQUENCY



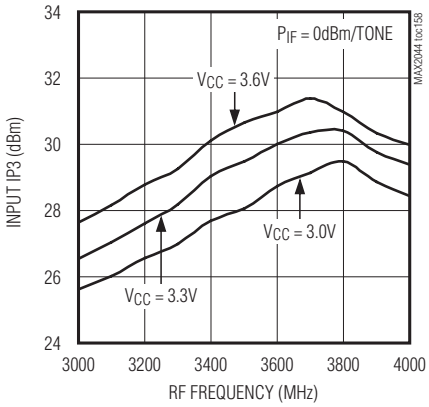
INPUT IP3 vs. RF FREQUENCY



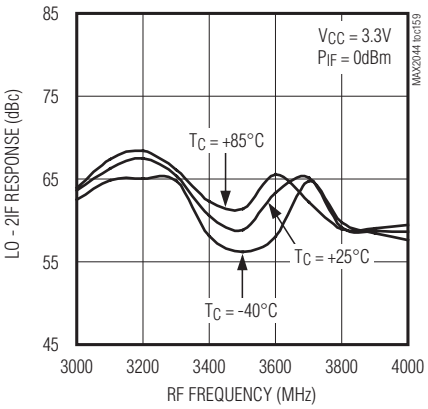
INPUT IP3 vs. RF FREQUENCY



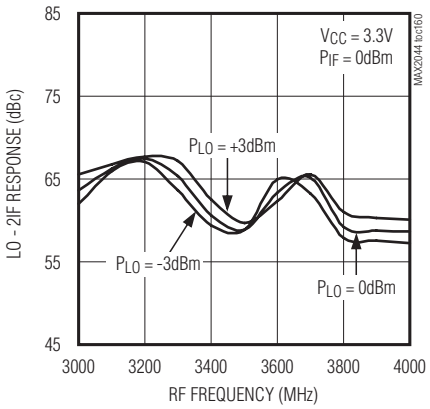
INPUT IP3 vs. RF FREQUENCY



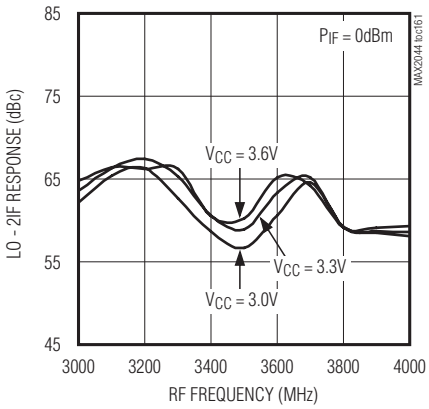
LO - 2IF RESPONSE vs. RF FREQUENCY



LO - 2IF RESPONSE vs. RF FREQUENCY



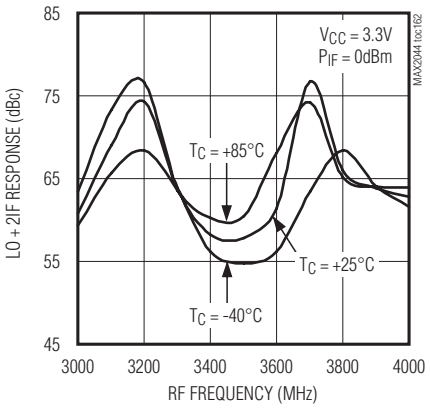
LO - 2IF RESPONSE vs. RF FREQUENCY



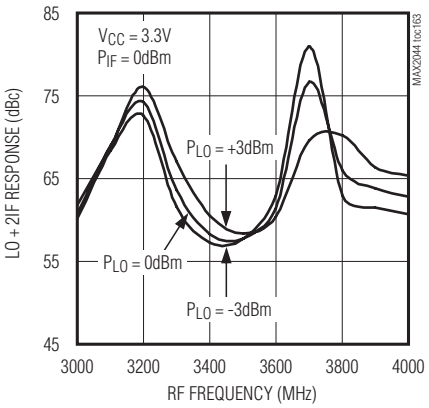
典型工作特性(续)

(*Typical Application Circuit* with tuning elements outlined in **Table 2, Upconverter Mode, V_{CC} = 3.3V, f_{RF} = 3000MHz to 4000MHz, LO is low-side injected,** f_{IF} = 200MHz, P_{IF} = 0dBm, P_{LO} = 0dBm, T_C = +25°C, unless otherwise noted.)

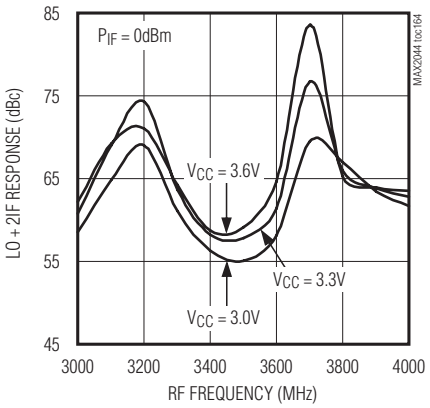
LO + 2IF RESPONSE vs. RF FREQUENCY



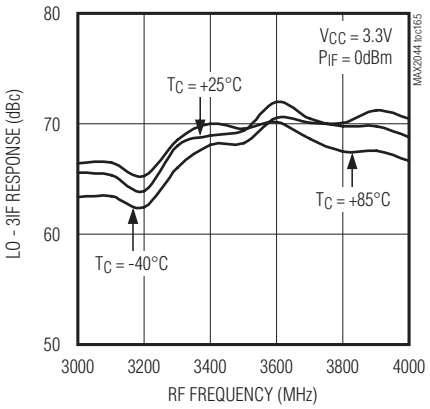
LO + 2IF RESPONSE vs. RF FREQUENCY



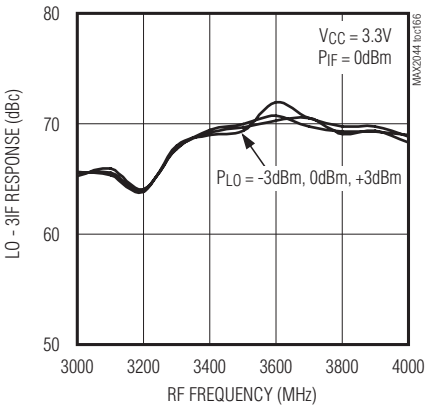
LO + 2IF RESPONSE vs. RF FREQUENCY



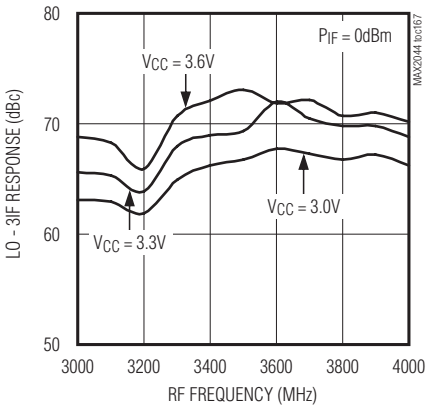
LO - 3IF RESPONSE vs. RF FREQUENCY



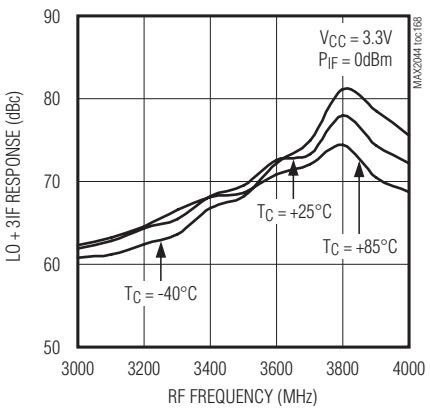
LO - 3IF RESPONSE vs. RF FREQUENCY



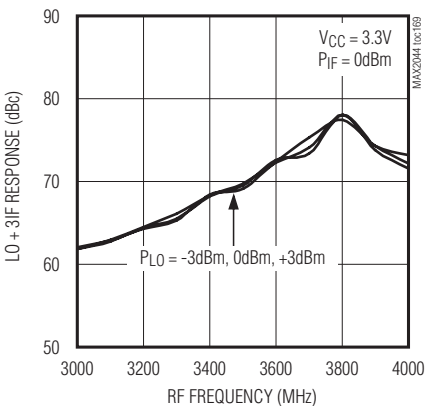
LO - 3IF RESPONSE vs. RF FREQUENCY



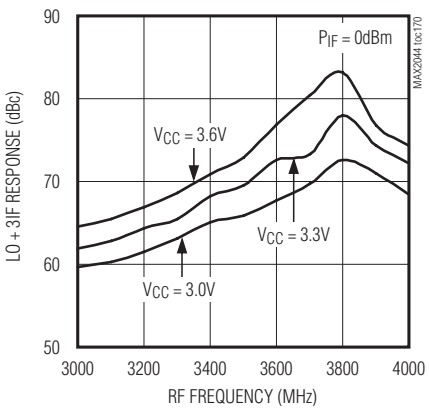
LO + 3IF RESPONSE vs. RF FREQUENCY



LO + 3IF RESPONSE vs. RF FREQUENCY



LO + 3IF RESPONSE vs. RF FREQUENCY

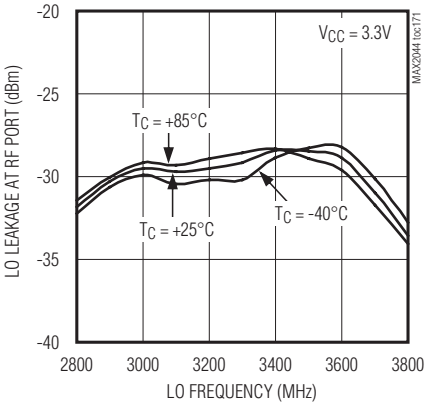


SiGe、高线性度、2300MHz至4000MHz上变频/下变频混频器，带有LO缓冲器

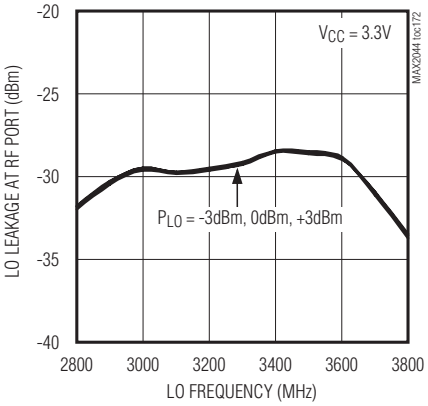
典型工作特性(续)

(*Typical Application Circuit* with tuning elements outlined in **Table 2, Upconverter Mode, V_{CC} = 3.3V, f_{RF} = 3000MHz to 4000MHz, LO is low-side injected,** f_{IF} = 200MHz, P_{IF} = 0dBm, P_{LO} = 0dBm, T_C = +25°C, unless otherwise noted.)

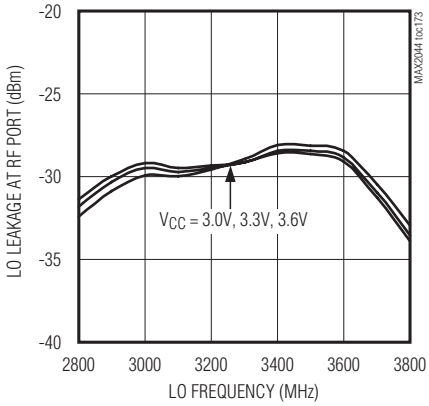
LO LEAKAGE AT RF PORT vs. LO FREQUENCY



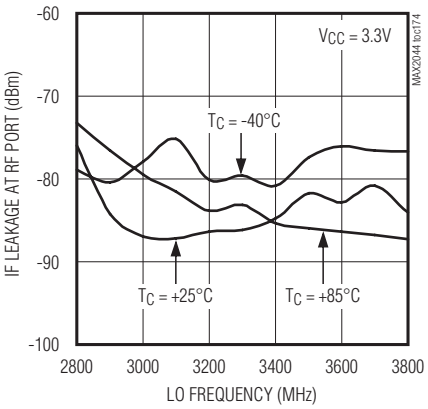
LO LEAKAGE AT RF PORT vs. LO FREQUENCY



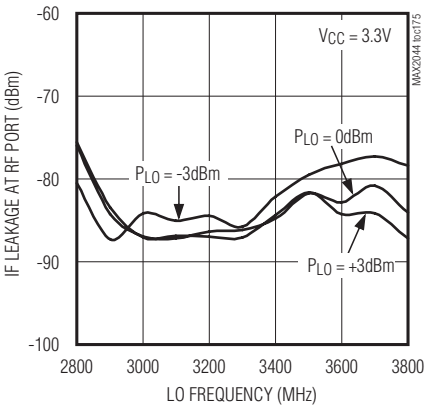
LO LEAKAGE AT RF PORT vs. LO FREQUENCY



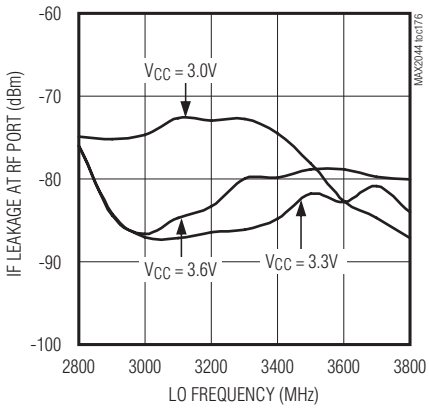
IF LEAKAGE AT RF PORT vs. LO FREQUENCY



IF LEAKAGE AT RF PORT vs. LO FREQUENCY



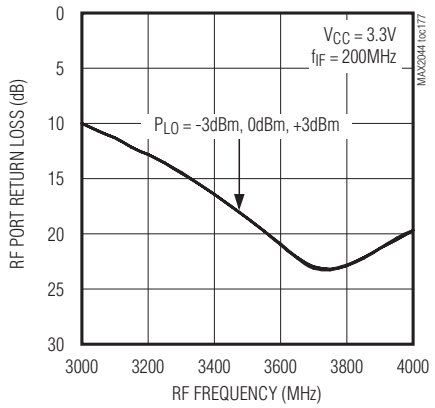
IF LEAKAGE AT RF PORT vs. LO FREQUENCY



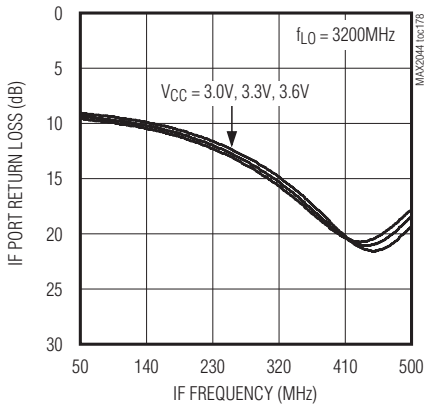
典型工作特性(续)

(*Typical Application Circuit* with tuning elements outlined in **Table 2, Upconverter Mode, V_{CC} = 3.3V, f_{RF} = 3000MHz to 4000MHz, LO is low-side injected,** f_{IF} = 200MHz, P_{IF} = 0dBm, P_{LO} = 0dBm, T_C = +25°C, unless otherwise noted.)

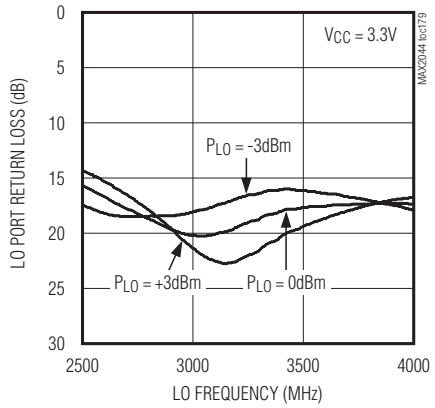
RF PORT RETURN LOSS vs. RF FREQUENCY



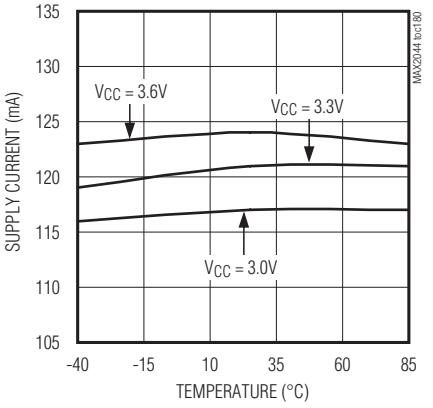
IF PORT RETURN LOSS vs. IF FREQUENCY



LO PORT RETURN LOSS vs. LO FREQUENCY

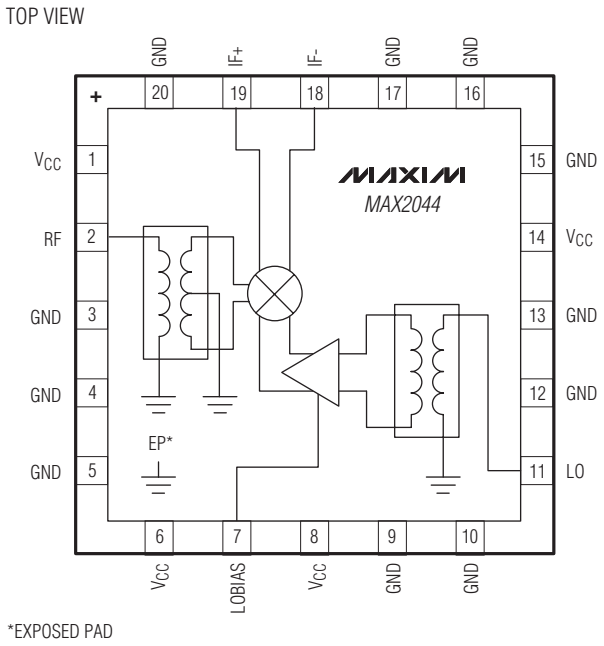


SUPPLY CURRENT vs. TEMPERATURE (T_C)



SiGe、高线性度、2300MHz至4000MHz上变频/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/输出端。该端口由内部匹配，并通过非平衡变压器直流短接到GND，必要时在输入端连接隔直流电容。
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(EP)，将所有地引脚与裸焊盘连接在一起。
7	LOBIAS	LO输出偏置电阻，用于LO缓冲器。在LOBIAS与地之间连接一个698Ω的1%精度电阻(偏置在138mA)。
11	LO	本振输入。该输入端在内部匹配为50Ω，需要一个输入隔直流电容。
16, 20	GND	地，将这些引脚接地。
18, 19	IF-, IF+	混频器差分IF输出/输入端。必要时提供隔直流电容，这些端口由内部偏置在V_{CC}/2。
—	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上变频/下变频混频器，带有LO缓冲器

详细说明

MAX2044为高线性度无源混频器，设计用于2.5GHz和3.5GHz无线基础架构。2600MHz至4300MHz超宽范围的LO频率，能够使MAX2044用于低端和高端LO注入架构，支持所有WiMAX、LTE和MMDS接收、发送应用。

在3000MHz至4000MHz频段用作低端LO注入的下变频混频器时，MAX2044可提供+32.5dBm的输入IP3，变换损耗和噪声系数典型值仅为7.7dB和8.5dB。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MAX2044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或2LO - 2RF性能。

该器件可在较宽的频率范围内保证性能，适用于WiMAX、LTE和MMDS基站。MAX2044能够工作在2300MHz至4000MHz RF输入范围、2600MHz至4300MHz LO范围以及50MHz至500MHz IF范围，也可以工作在上述频率范围以外(详细信息请参见*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，MAX2044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3300MHz至3900MHz RF频率范围内，RF端口的输入回波损耗典型值优于13dB。按照表1和表2所示更换输入匹配元件，在2400MHz至2700MHz频率范围内，回波损耗可以达到15dB。可以选择C1、C12的其它组合形式，优化2300MHz至4000MHz频率范围内的RF回波损耗。

LO输入、缓冲器和非平衡变压器

利用2600MHz至4300MHz较宽频率的LO驱动电路，MAX2044可以用于低端或高端LO注入架构，支持所有2.5GHz和3.5GHz应用。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

MAX2044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。IIP3、2RF - 2LO抑制和噪声系数的典型值分别为+32.5dBm、68dBc和8.5dB。

差分IF输出

MAX2044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。

MAX2044的差分端口能够增强2RF - 2LO和2LO - 2RF性能，单端IF应用需要一个1:1 (阻抗比)的非平衡变压器，将50Ω的差分IF电阻转换成50Ω单端输出。针对该器件特性选用MABAES0029 1:1变压器，数据资料的参数规格中给出了其损耗指标。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。由于IF+和IF-端由内部偏置在$V_{CC}/2$，需要连接C4和C7隔直流电容。

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3000MHz至4000MHz RF频率范围内，使用8.2pF隔直流电容；工作在2300MHz至3000MHz RF频率范围时，请参考表1和表2替换元件，以实现优异的匹配性能。LO输入内部匹配在50Ω，使用2pF隔直流电容可覆盖2600MHz至4300MHz工作频率范围。IF输出阻抗为50Ω (差分)。为方便评估，通过外部低损耗1:1 (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*)。

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

降低功耗模式

MAX2044提供一个引脚(LOBIAS)，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和表2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42%（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。

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. 下变频模式元件值

DESIGNATION	QTY	DESCRIPTION	COMPONENT SUPPLIER
C1	1	3.3nH microwave inductor (0402). Use for RF frequencies ranging from **2300MHz to 3000MHz**.	Coilcraft, Inc.
		8.2pF microwave capacitor (0402). Use for RF frequencies ranging from **3000MHz to 4000MHz**.	Murata Electronics North America, Inc.
C2, C6, C8, C11	4	0.01µF microwave capacitors (0402)	Murata Electronics North America, Inc.
C3, C9	0	Not installed, microwave capacitors (0402)	—
C4, C7	2	470pF microwave capacitors (0402)	Murata Electronics North America, Inc.
C5	0	Not installed, microwave capacitor (0402)	—
C10	1	2pF microwave capacitor (0402)	Murata Electronics North America, Inc.
C12	1	0.3pF microwave capacitor (0402). Use for RF frequencies ranging from **2300MHz to 3000MHz**.	Murata Electronics North America, Inc.
	0	Microwave capacitor (0402) not installed for RF frequencies ranging from **3000MHz to 4000MHz**.	—
R1	1	698Ω ±1% resistor (0402). Use for **V_{CC} = +5.0V** applications.	Digi-Key Corp.
		698Ω ±1% resistor (0402). Use for **V_{CC} = +3.3V** applications.	Digi-Key Corp.
T1	1	1:1 IF balun MABAES0029	M/A-Com
U1	1	MAX2044 IC (20 TQFN)	Maxim Integrated Products, Inc.

裸焊盘的RF/散热考虑

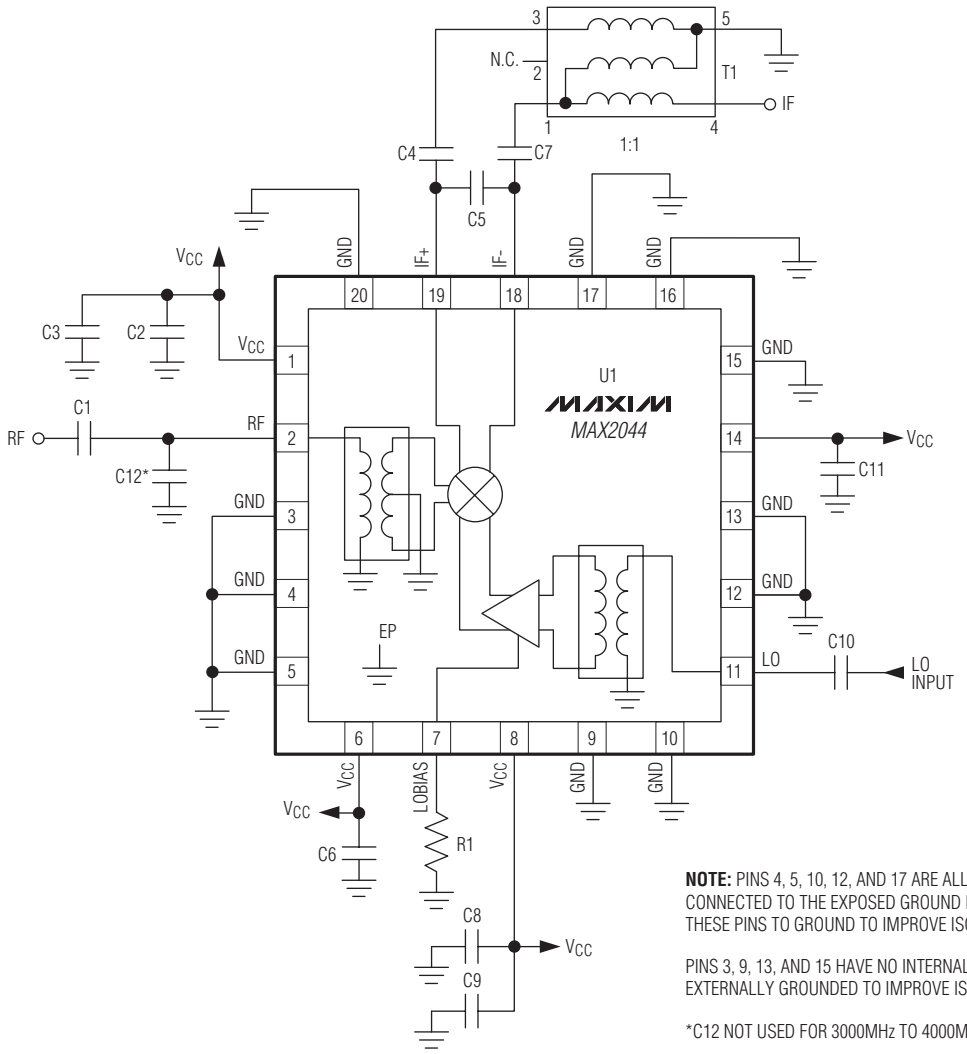
MAX2044采用20引脚、薄型QFN封装，其裸焊盘(EP)提供了一个与管芯之间的低热阻通路。在安装MAX2044的PCB与EP之间保持良好的热传递通道非常重要。此外，EP应通过一个低电感路径接地。EP**必须**直接或通过一系列电镀过孔焊接至PCB的地层。

表2. 上变频模式元件值

DESIGNATION	QTY	DESCRIPTION	COMPONENT SUPPLIER
C1	1	3.3nH microwave inductor (0402). Use for RF frequencies ranging from **2300MHz to 3000MHz**.	Coilcraft, Inc.
		8.2pF microwave capacitor (0402). Use for RF frequencies ranging from **3000MHz to 4000MHz**.	Murata Electronics North America, Inc.
C2, C6, C8, C11	4	0.01µF microwave capacitors (0402)	Murata Electronics North America, Inc.
C3, C9	0	Not installed, microwave capacitors (0402)	—
C4, C7	2	470pF microwave capacitors (0402)	Murata Electronics North America, Inc.
C5	0	Not installed, microwave capacitor (0402)	—
C10	1	2pF microwave capacitor (0402)	Murata Electronics North America, Inc.
C12	1	0.3pF microwave capacitor (0402). Use for RF frequencies ranging from **2300MHz to 3000MHz**.	Murata Electronics North America, Inc.
	0	Microwave capacitor (0402) not installed for RF frequencies ranging from **3000MHz to 4000MHz**.	—
R1	1	698Ω ±1% resistor (0402). Use for **V_{CC} = +5.0V** applications.	Digi-Key Corp.
		698Ω ±1% resistor (0402). Use for **V_{CC} = +3.3V** applications.	Digi-Key Corp.
T1	1	1:1 IF balun MABAES0029	M/A-Com
U1	1	MAX2044 IC (20 TQFN)	Maxim Integrated Products, Inc.

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

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.

*C12 NOT USED FOR 3000MHz TO 4000MHz APPLICATIONS.

SiGe、高线性度、2300MHz至4000MHz上变频/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 TQFN-EP	T2055+3	**21-0140**

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