19-4679; Rev 0; 8/09

MAXIM

SiGe、高线性度、2000MHz至3000MHz上/下变频混频器，带有LO缓冲器

MAX2042

概述

MAX2042单路、高线性度上/下变频混频器可为2000MHz至3000MHz的WCS、LTE、WiMAX™以及MMDS无线基础设施应用提供+36dBm IIP3、7.3dB噪声系数和7.2dB转换损耗。该混频器具有1800MHz至2800MHz较宽的LO频率范围，理想用于低端LO注入接收器和发送器结构。MAX2042A支持高端LO注入，与MAX2042引脚和功能兼容。

除具有优异的线性度和噪声性能外，MAX2042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。MAX2042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120mA。

MAX2042与MAX2042A 2000MHz至3900MHz混频器引脚兼容，并与MAX2029/MAX2031 650MHz至1000MHz混频器、MAX2039/MAX2041 1700MHz至3000MHz混频器以及MAX2044/MAX2044A 3000MHz至4000MHz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。

MAX2042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

2.3GHz WCS基站

2.5GHz WiMAX和LTE基站

2.7GHz MMDS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

定购信息

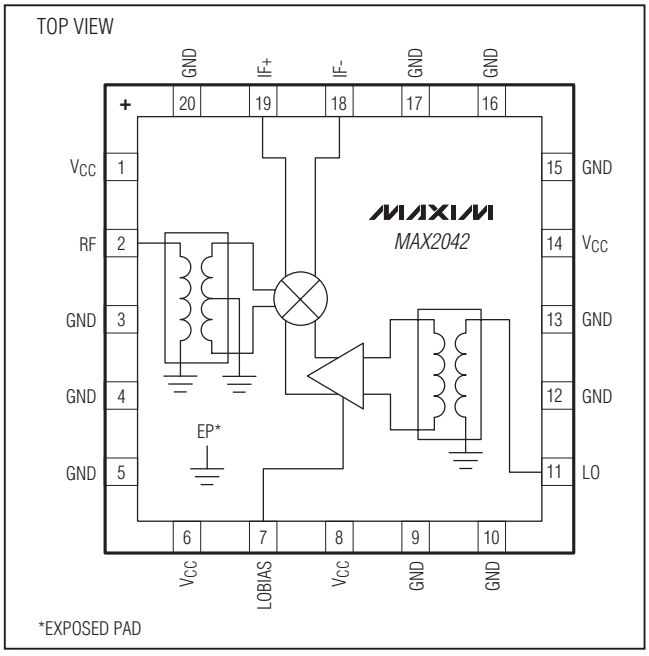
PART	TEMP RANGE	PIN-PACKAGE
MAX2042ETP+	-40°C to +85°C	20 Thin QFN-EP*
MAX2042ETP+T	-40°C to +85°C	20 Thin QFN-EP*

+表示无铅(Pb)/符合RoHS标准的封装。
**EP = 裸焊盘。*
T = 卷带包装。

特性

- 2000MHz至3000MHz RF频率范围
- 1800MHz至2800MHz LO频率范围
- 50MHz至500MHz IF频率范围
- 7.2dB转换损耗
- 7.3dB噪声系数
- +36dBm (典型值) IIP3
- +23.4dBm (典型值)输入1dB压缩点
- P_{RF} = -10dBm时，具有70dBc (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MAX2042A 2000MHz至3900MHz高端LO注入混频器
- 引脚类似于MAX2029/MAX2031 650MHz至1000MHz混频器、MAX2039/MAX2041 1700MHz至3000MHz混频器以及MAX2044/MAX2044A 3000MHz至4000MHz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

引脚配置/功能框图



WiMAX是WiMAX论坛的商标。

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 are DC shorted to GND through a balun).....50mA
Continuous Power Dissipation (Note 1) 5.0W
θ_{JA} (Notes 2, 3)..... +38°C/W
θ_{JC} (Notes 1, 3)..... +13°C/W
Operating Case Temperature Range (Note 4)..... -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 AC signals. T_C = -40°C to +85°C, unless otherwise noted. Typical values are at V_{CC} = +5.0V, T_C = +25°C, all parameters are production tested.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Supply Voltage	V_{CC}		4.75	5.0	5.25	V
Supply Current	I_{CC}			138	150	mA

+3.3V SUPPLY DC ELECTRICAL CHARACTERISTICS

(Typical Application Circuit, V_{CC} = +3.0V to +3.6V, no input AC signals. T_C = -40°C to +85°C, unless otherwise noted. Typical values are at V_{CC} = +3.3V, T_C = +25°C, all parameters are production tested.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Supply Voltage	V_{CC}		3.0	3.3	3.6	V
Supply Current	I_{CC}			120	135	mA

RECOMMENDED AC OPERATING CONDITIONS

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
RF Frequency Range		*Typical Application Circuit* with C1 = 8.2pF, see Table 1 for details (Notes 5, 6)	2000		3000	MHz
LO Frequency	f_{LO}	(Notes 5, 6)	1800		2800	MHz
IF Frequency	f_{IF}	Using M/A-Com MABAES0029 1:1 transformer as defined in the *Typical Application Circuit*, IF matching components affect the IF frequency range (Notes 5, 6)	50		500	MHz
LO Drive	P_{LO}	(Notes 5, 6)	-3	0	+3	dBm

+5.0V SUPPLY AC ELECTRICAL CHARACTERISTICS (DOWNCONVERTER OPERATION)

(*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} = 2300MHz to 2900MHz, f_{IF} = 300MHz, f_{LO} = 2000MHz to 2600MHz, $f_{RF} > f_{LO}$, T_C = -40°C to +85°C. Typical values are for T_C = +25°C, V_{CC} = +5.0V, P_{RF} = 0dBm, P_{LO} = 0dBm, f_{RF} = 2300MHz, f_{LO} = 2300MHz, 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 Loss	L_C	f_{RF} = 2300MHz to 2900MHz, T_C = +25°C (Note 8)		6.7	7.2	8.1	dB
Loss Variation vs. Frequency	ΔL_C	f_{RF} = 2305MHz to 2360MHz			0.15		dB
		f_{RF} = 2500MHz to 2570MHz			0.15		
		f_{RF} = 2570MHz to 2620MHz			0.15		
		f_{RF} = 2500MHz to 2690MHz			0.15		
		f_{RF} = 2700MHz to 2900MHz			0.20		
Conversion Loss Temperature Coefficient	TC_{CL}	T_C = -40°C to +85°C			0.0071		dB/°C
Single Sideband Noise Figure	NF_{SSB}	No blockers present			7.3		dB
Noise Figure Temperature Coefficient	TC_{NF}	f_{RF} = 2300MHz to 2900MHz, single sideband, no blockers present, T_C = -40°C to +85°C			0.019		dB/°C
Noise Figure Under Blocking	NF_B	+8dBm blocker tone applied to RF port, f_{RF} = 2600MHz, f_{LO} = 2300MHz, $f_{BLOCKER}$ = 2795MHz, P_{LO} = 0dBm, V_{CC} = 5.0V, T_C = +25°C (Notes 5, 9)			20.8	25	dB
Input 1dB Compression Point	IP_{1dB}	T_C = +25°C (Notes 5, 10)	f_{RF} = 2300MHz	22.5	23.4		dBm
			f_{RF} = 2600MHz	20.6	22.1		
			f_{RF} = 2900MHz	17.6	20.7		
Third-Order Input Intercept Point	IIP3	P_{RF1} = P_{RF2} = 0dBm/tone, P_{LO} = 0dBm, T_C = +25°C	f_{RF1} = 2300MHz, f_{RF2} = 2301MHz, f_{LO} = 2000MHz (Note 5)	34	36		dBm
			f_{RF1} = 2600MHz, f_{RF2} = 2601MHz, f_{LO} = 2300MHz (Note 8)	31	34		
			f_{RF1} = 2900MHz, f_{RF2} = 2901MHz, f_{LO} = 2600MHz (Note 5)	28	30		
IIP3 Variation with T_C		f_{RF} = 2300MHz to 2900MHz, f_{RF1} - f_{RF2} = 1MHz, P_{RF1} = P_{RF2} = 0dBm/tone, T_C = -40°C to +85°C			±0.5		dB
2RF - 2LO Spur Rejection	2 x 2	f_{SPUR} = f_{LO} + 150MHz (Note 5)	P_{RF} = -10dBm	64	70		dBc
			P_{RF} = 0dBm	54	60		
3RF - 3LO Spur Rejection	3 x 3	f_{SPUR} = f_{LO} + 100MHz (Note 5)	P_{RF} = -10dBm	80	92		dBc
			P_{RF} = 0dBm	60	72		
RF Input Return Loss	RL_{RF}	LO on and IF terminated into a matched impedance			17		dB
LO Input Return Loss	RL_{LO}	RF and IF terminated into a matched impedance			15		dB

+5.0V SUPPLY AC ELECTRICAL CHARACTERISTICS (DOWNCONVERTER OPERATION) (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} = 2300MHz to 2900MHz, f_{IF} = 300MHz, f_{LO} = 2000MHz to 2600MHz, $f_{RF} > f_{LO}$, T_C = -40°C to +85°C. Typical values are for T_C = +25°C, V_{CC} = +5.0V, P_{RF} = 0dBm, P_{LO} = 0dBm, f_{RF} = 2300MHz, f_{LO} = 2300MHz, f_{IF} = 300MHz. All parameters are guaranteed by design and characterization, unless otherwise noted.) (Note 7)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
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 50Ω source, IF transformed to 50Ω using external components shown in the *Typical Application Circuit*		18		dB
RF-to-IF Isolation		P_{LO} = +3dBm (Note 8)	30	37		dB
LO Leakage at RF Port		f_{LO} = 2000MHz to 2800MHz, P_{LO} = +3dBm (Note 8)		-28	-22	dBm
2LO Leakage at RF Port		P_{LO} = +3dBm		-36		dBm
LO Leakage at IF Port		f_{LO} = 2000MHz to 2800MHz, P_{LO} = +3dBm (Note 8)		-24.2	-16	dBm

+3.3V SUPPLY AC ELECTRICAL CHARACTERISTICS (DOWNCONVERTER OPERATION)

(*Typical Application Circuit* with tuning elements outlined in **Table 1**, RF and LO ports are driven from 50Ω sources. Typical values are for T_C = +25°C, V_{CC} = +3.3V, P_{RF} = 0dBm, P_{LO} = 0dBm, f_{RF} = 2600MHz, f_{LO} = 2300MHz, f_{IF} = 300MHz, unless otherwise noted.) (Note 7)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Small-Signal Conversion Loss	L_C	(Note 8)		7.2		dB
Loss Variation vs. Frequency	ΔL_C	f_{RF} = 2300MHz to 2900MHz, any 100MHz band		0.2		dB
Conversion Loss Temperature Coefficient	TC_{CL}	T_C = -40°C to +85°C		0.008		dB/°C
Single Sideband Noise Figure	NF_{SSB}	No blockers present		7.5		dB
Noise Figure Temperature Coefficient	TC_{NF}	Single sideband, no blockers present, T_C = -40°C to +85°C		0.019		dB/°C
Input 1dB Compression Point	IP_{1dB}	(Note 10)		20		dBm
Third-Order Input Intercept Point	IIP3	f_{RF1} = 2600MHz, f_{RF2} = 2601MHz, P_{RF1} = P_{RF2} = 0dBm/tone		31		dBm
IIP3 Variation with T_C		f_{RF1} = 2600MHz, f_{RF2} = 2601MHz, P_{RF1} = P_{RF2} = 0dBm/tone, T_C = -40°C to +85°C		±0.25		dB
2RF - 2LO Spur Rejection	2 x 2	P_{RF} = -10dBm, f_{SPUR} = f_{LO} + 150MHz		72		dBc
		P_{RF} = 0dBm, f_{SPUR} = f_{LO} + 150MHz		62		
3RF - 3LO Spur Rejection	3 x 3	P_{RF} = -10dBm, f_{SPUR} = f_{LO} + 100MHz		87		dBc
		P_{RF} = 0dBm, f_{SPUR} = f_{LO} + 100MHz		67		

+3.3V SUPPLY AC ELECTRICAL CHARACTERISTICS (DOWNCONVERTER OPERATION) (continued)

(*Typical Application Circuit* with tuning elements outlined in **Table 1**, RF and LO ports are driven from 50Ω sources. Typical values are for T_C = +25°C, V_{CC} = +3.3V, P_{RF} = 0dBm, P_{LO} = 0dBm, f_{RF} = 2600MHz, f_{LO} = 2300MHz, 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		15		dB
LO Input Return Loss	RL_{LO}	RF and IF terminated into a matched impedance		12		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 50Ω source, IF transformed to 50Ω using external components shown in the *Typical Application Circuit*		18		dB
Minimum RF-to-IF Isolation		f_{RF} = 2300MHz to 2900MHz, P_{LO} = +3dBm		36		dB
Maximum LO Leakage at RF Port		f_{LO} = 1800MHz to 2800MHz, P_{LO} = +3dBm		-24.5		dBm
Maximum 2LO Leakage at RF Port		f_{LO} = 1800MHz to 2800MHz, P_{LO} = +3dBm		-24		dBm
Maximum LO Leakage at IF Port		f_{LO} = 1800MHz to 2800MHz, P_{LO} = +3dBm		-20		dBm

+5.0V SUPPLY AC ELECTRICAL CHARACTERISTICS (UPCONVERTER OPERATION)

(*Typical Application Circuit* with tuning elements outlined in **Table 2**, V_{CC} = +4.75V to +5.25V, RF and LO ports are driven from 50Ω sources, P_{LO} = -3dBm to +3dBm, P_{IF} = 0dBm, f_{RF} = 2300MHz to 2900MHz, f_{IF} =200MHz, f_{LO} = 2100MHz to 2700MHz, $f_{RF} > f_{LO}$, T_C = -40°C to +85°C. Typical values are for T_C = +25°C, V_{CC} = +5.0V, P_{IF} = 0dBm, P_{LO} = 0dBm, f_{RF} = 2600MHz, f_{LO} = 2400MHz, f_{IF} = 200MHz. All parameters are guaranteed by design and characterization, unless otherwise noted.) (Note 7)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Small-Signal Conversion Loss	L_C	(Note 8)		6.8		dB
Loss Variation vs. Frequency	ΔL_C	f_{RF} = 2300MHz to 2960MHz, any 100MHz band		0.2		dB
Conversion Loss Temperature Coefficient	TC_{CL}	T_C = -40°C to +85°C		0.007		dB/°C
Input 1dB Compression Point	IP_{1dB}	(Note 10)		22.7		dBm
Third-Order Input Intercept Point	IIP3	f_{IF1} = 200MHz, f_{IF2} = 201MHz, P_{IF1} = P_{IF2} = 0dBm/tone, f_{LO} = 2400MHz, P_{LO} = 0dBm, T_C = +25°C (Note 8)	30	32.4		dBm
IIP3 Variation with T_C		f_{IF1} = 200MHz, f_{IF2} = 201MHz, P_{IF1} = P_{IF2} = 0dBm/tone, f_{LO} = 2400MHz, P_{LO} = 0dBm, T_C = -40°C to +85°C		±0.5		dB
LO ± 2IF Spur Rejection	1 x 2	LO - 2IF		70		dBc
		LO + 2IF		67		
LO ± 3IF Spur Rejection	1 x 3	LO - 3IF		82		dBc
		LO + 3IF		77		
Output Noise Floor		P_{OUT} = 0dBm (Note 9)		-163		dBm/Hz

+3.3V SUPPLY AC ELECTRICAL CHARACTERISTICS (UPCONVERTER OPERATION)

(*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} = 2600MHz, f_{LO} = 2400MHz, f_{IF} = 200MHz, unless otherwise noted.) (Note 7)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Small-Signal Conversion Loss	L_C			6.8		dB
Loss Variation vs. Frequency	ΔL_C	f_{RF} = 2300MHz to 2900MHz, any 100MHz band		0.15		dB
Conversion Loss Temperature Coefficient	TC_{CL}	T_C = -40°C to +85°C		0.008		dB/°C
Input 1dB Compression Point	IP_{1dB}	(Note 10)		19		dBm
Third-Order Input Intercept Point	IIP3	f_{IF1} = 200MHz, f_{IF2} = 201MHz, P_{IF1} = P_{IF2} = 0dBm/tone		29.5		dBm
IIP3 Variation with T_C		f_{IF1} = 200MHz, f_{IF2} = 201MHz, P_{IF1} = P_{IF2} = 0dBm/tone, f_{LO} = 2400MHz, P_{LO} = 0dBm, T_C = -40°C to +85°C		±0.75		dB
LO ± 2IF Spur Rejection	1 x 2	LO - 2IF		72		dBc
		LO + 2IF		70		
LO ± 3IF Spur Rejection	1 x 3	LO - 3IF		73		dBc
		LO + 3IF		70		
Output Noise Floor		P_{OUT} = 0dBm (Note 9)		-160		dBm/Hz

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

Note 8: 100% production tested for functional performance.

Note 9: Measured with external LO source noise filtered so that the noise floor is -174dBm/Hz. This specification reflects the effects of all SNR degradations in the mixer including the LO noise, as defined in Application Note 2021: *Specifications and Measurement of Local Oscillator Noise in Integrated Circuit Base Station Mixers*.

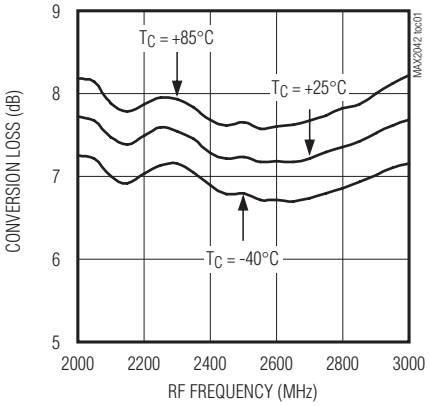
Note 10: Maximum reliable continuous input power applied to the RF port of this device is +20dBm from a 50Ω source.

典型工作特性

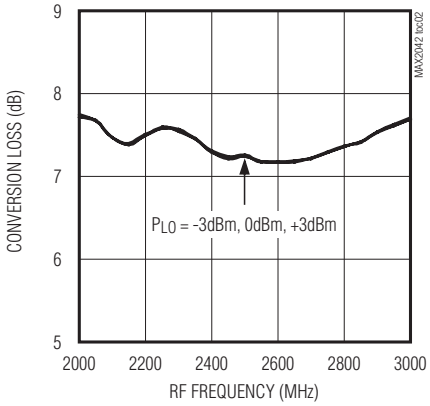
(*Typical Application Circuit* with tuning elements outlined in **Table 1, V_{CC} = +5.0V**, $f_{RF} > f_{LO}$, f_{IF} = 300MHz, P_{RF} = 0dBm, P_{LO} = 0dBm, T_C = +25°C, unless otherwise noted.)

+5.0V Downconverter Curves

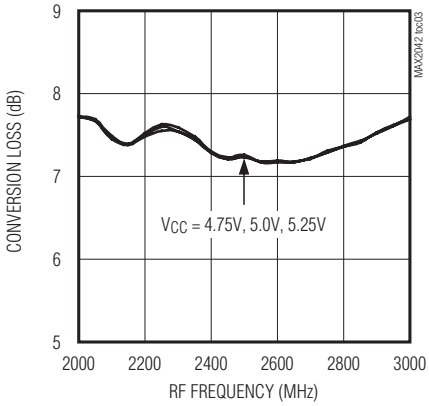
CONVERSION LOSS vs. RF FREQUENCY



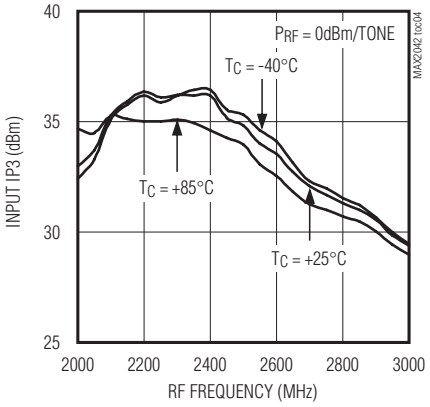
CONVERSION LOSS vs. RF FREQUENCY



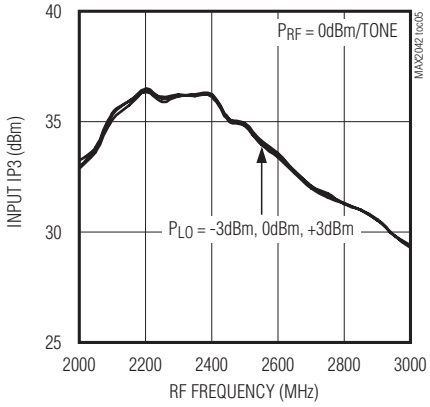
CONVERSION LOSS vs. RF FREQUENCY



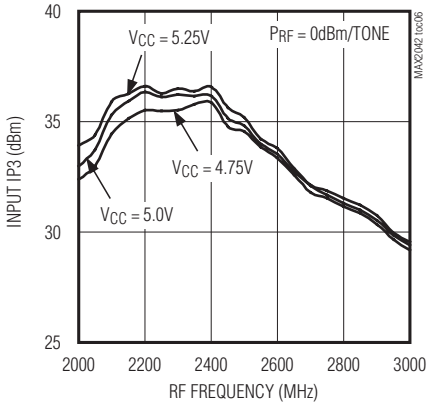
INPUT IP3 vs. RF FREQUENCY



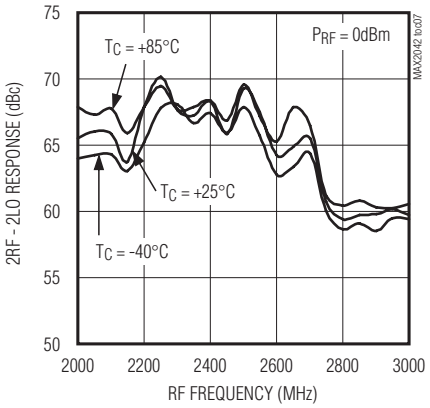
INPUT IP3 vs. RF FREQUENCY



INPUT IP3 vs. RF FREQUENCY



2RF - 2LO RESPONSE vs. RF FREQUENCY



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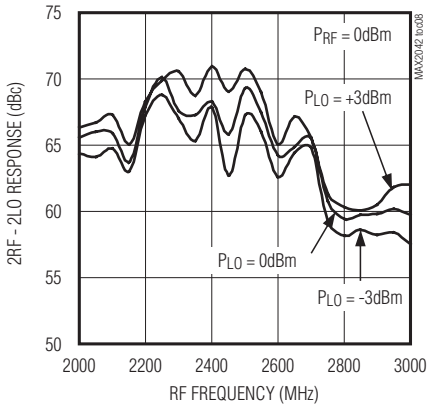

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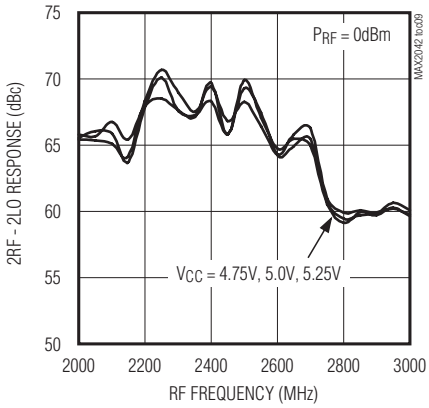


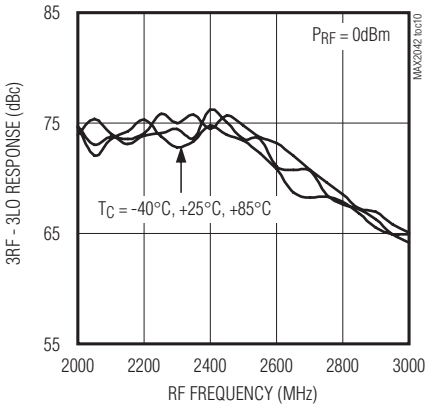
SiGe、高线性度、2000MHz至3000MHz上/下变频混频器，带有LO缓冲器

典型工作特性(续)

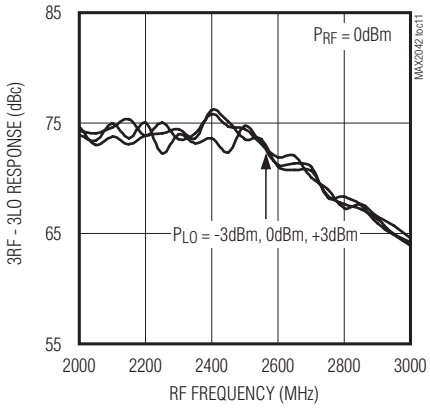
(*Typical Application Circuit* with tuning elements outlined in **Table 1, V_{CC} = +5.0V**, $f_{RF} > f_{LO}$, f_{IF} = 300MHz, P_{RF} = 0dBm, P_{LO} = 0dBm, T_C = +25°C, unless otherwise noted.)

+5.0V Downconverter Curves

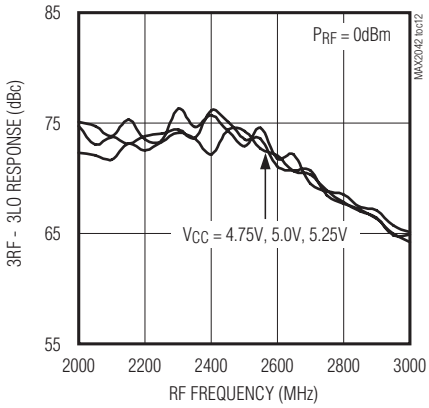
3RF - 3LO RESPONSE vs. RF FREQUENCY



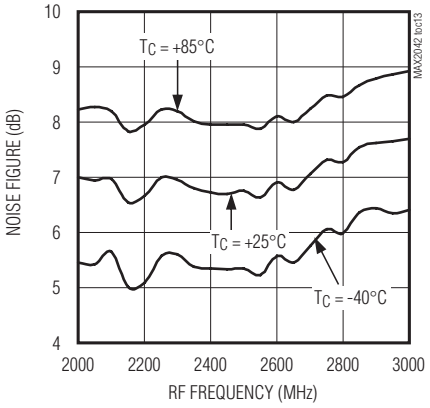
3RF - 3LO RESPONSE vs. RF FREQUENCY



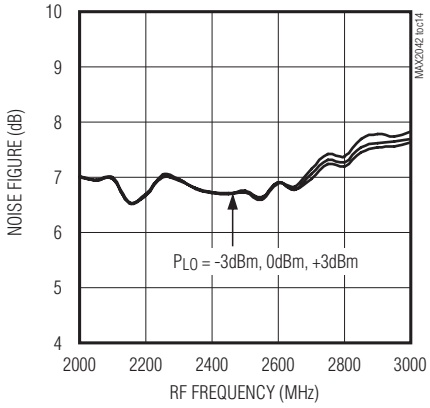
3RF - 3LO RESPONSE vs. RF FREQUENCY



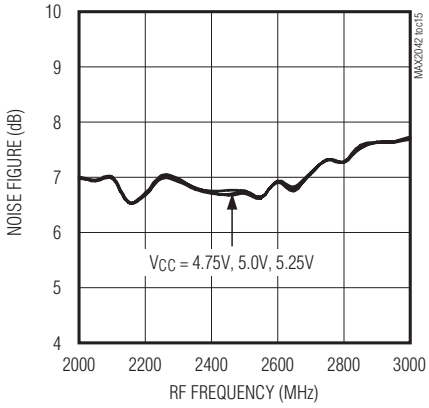
NOISE FIGURE vs. RF FREQUENCY



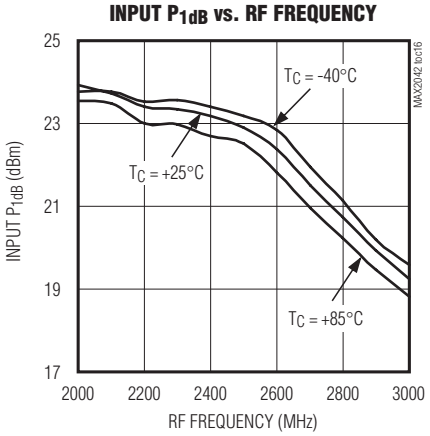
NOISE FIGURE vs. RF FREQUENCY



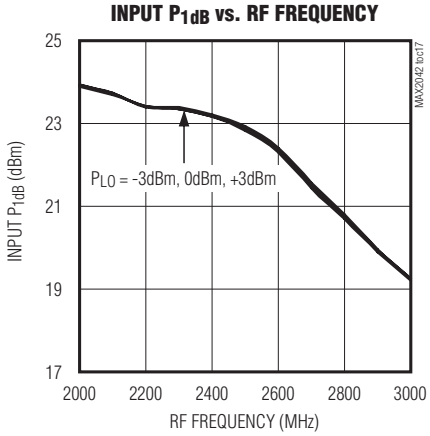
NOISE FIGURE vs. RF FREQUENCY



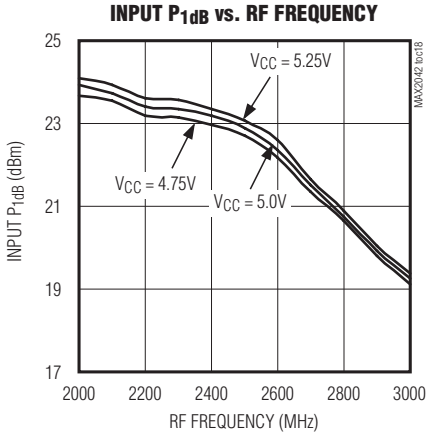
INPUT P_{1dB} vs. RF FREQUENCY



INPUT P_{1dB} vs. RF FREQUENCY



INPUT P_{1dB} vs. RF FREQUENCY

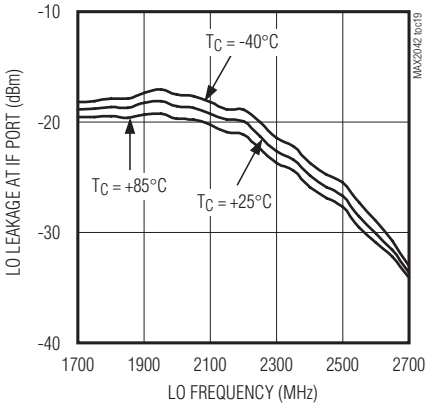


典型工作特性(续)

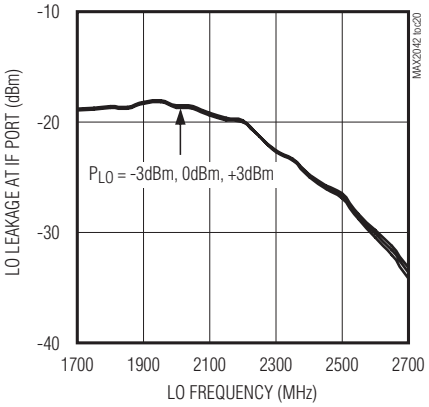
(*Typical Application Circuit* with tuning elements outlined in **Table 1, V_{CC} = +5.0V**, $f_{RF} > f_{LO}$, f_{IF} = 300MHz, P_{RF} = 0dBm, P_{LO} = 0dBm, T_C = +25°C, unless otherwise noted.)

+5.0V Downconverter Curves

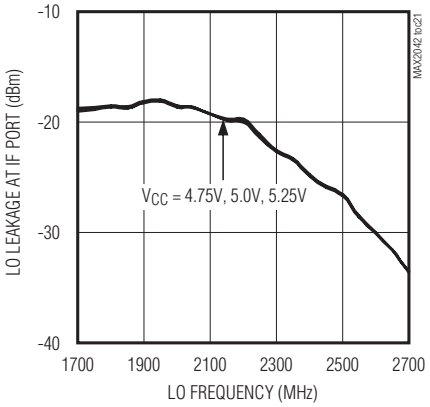
LO LEAKAGE AT IF PORT vs. LO FREQUENCY



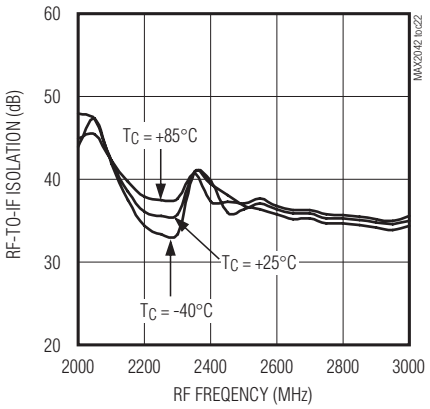
LO LEAKAGE AT IF PORT vs. LO FREQUENCY



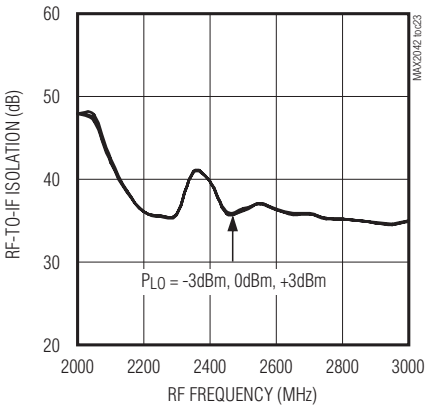
LO LEAKAGE AT IF PORT vs. LO FREQUENCY



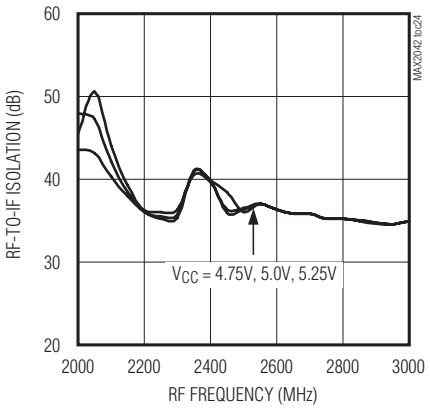
RF-TO-IF ISOLATION vs. RF FREQUENCY



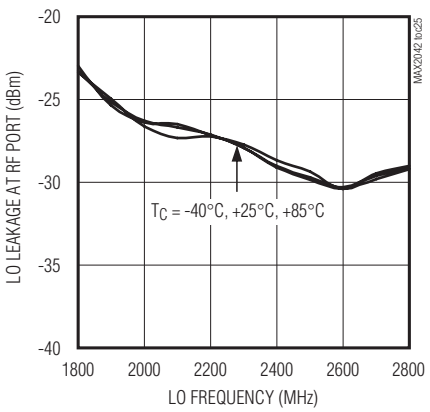
RF-TO-IF ISOLATION vs. RF FREQUENCY



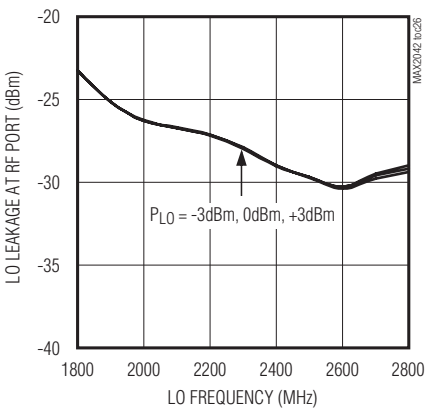
RF-TO-IF ISOLATION vs. RF FREQUENCY



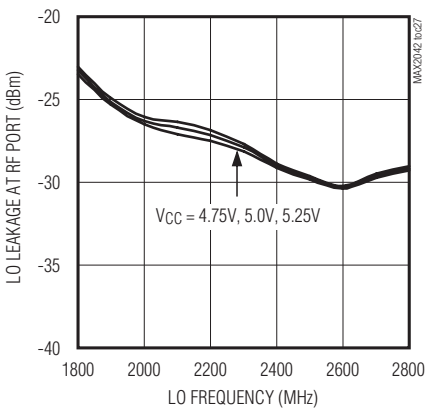
LO LEAKAGE AT RF PORT vs. LO FREQUENCY



LO LEAKAGE AT RF PORT vs. LO FREQUENCY



LO LEAKAGE AT RF PORT vs. LO FREQUENCY

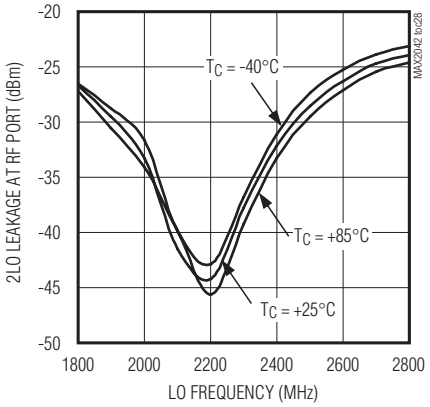


典型工作特性(续)

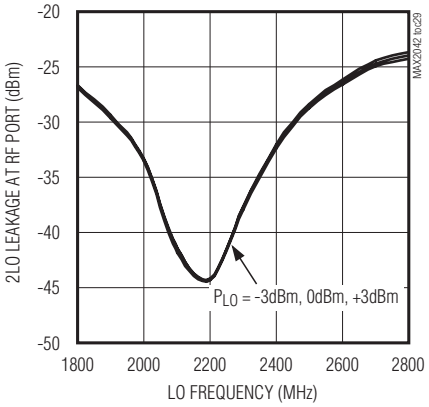
(*Typical Application Circuit* with tuning elements outlined in **Table 1, V_{CC} = +5.0V**, $f_{RF} > f_{LO}$, f_{IF} = 300MHz, P_{RF} = 0dBm, P_{LO} = 0dBm, T_C = +25°C, unless otherwise noted.)

+5.0V Downconverter Curves

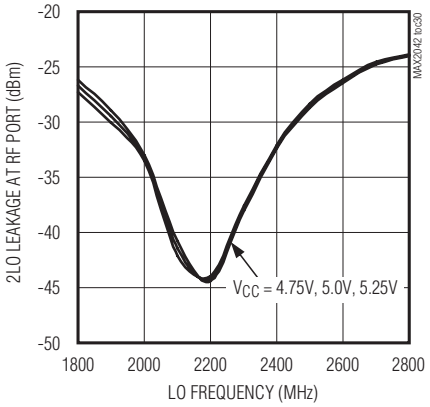
2LO LEAKAGE AT RF PORT vs. LO FREQUENCY



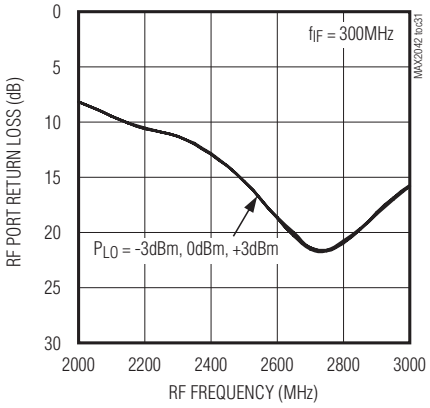
2LO LEAKAGE AT RF PORT vs. LO FREQUENCY



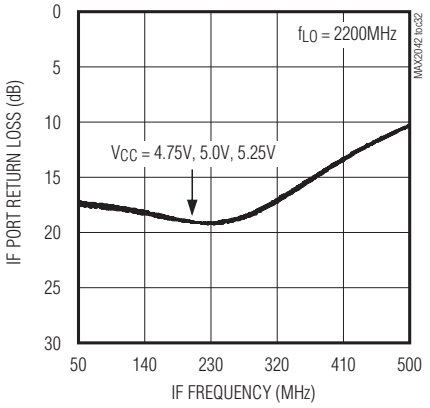
2LO LEAKAGE AT RF PORT vs. LO FREQUENCY



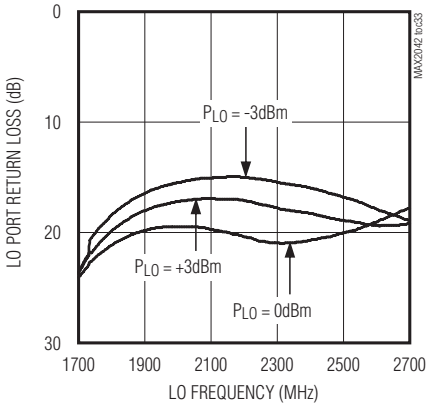
RF PORT RETURN LOSS vs. RF FREQUENCY



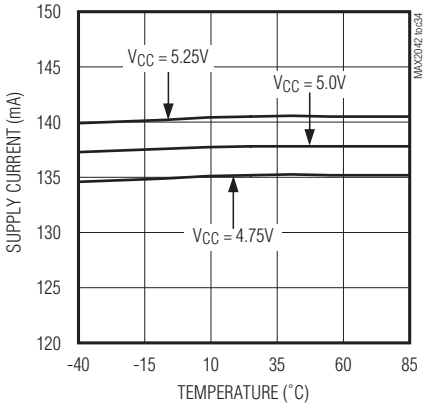
IF PORT RETURN LOSS vs. IF FREQUENCY



LO PORT RETURN LOSS vs. LO FREQUENCY



SUPPLY CURRENT vs. TEMPERATURE (T_C)

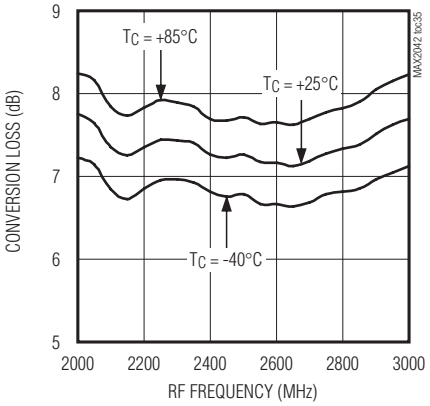


典型工作特性(续)

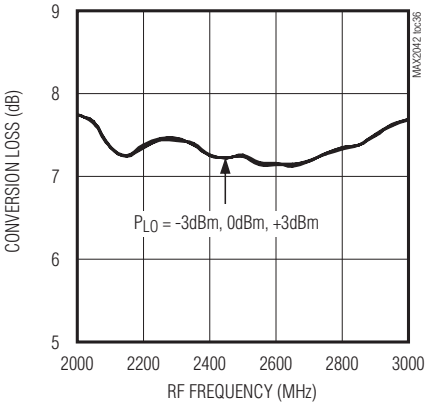
(*Typical Application Circuit* with tuning elements outlined in **Table 1, V_{CC} = +3.3V**, $f_{RF} > f_{LO}$, f_{IF} = 300MHz, P_{RF} = 0dBm, P_{LO} = 0dBm, T_C = +25°C, unless otherwise noted.)

+3.3V Downconverter Curves

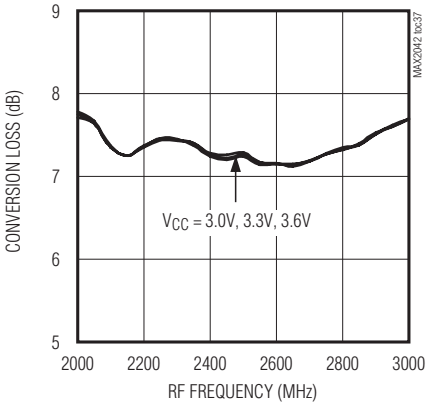
CONVERSION LOSS vs. RF FREQUENCY



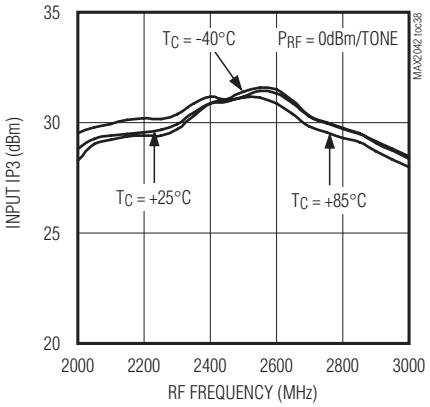
CONVERSION LOSS vs. RF FREQUENCY



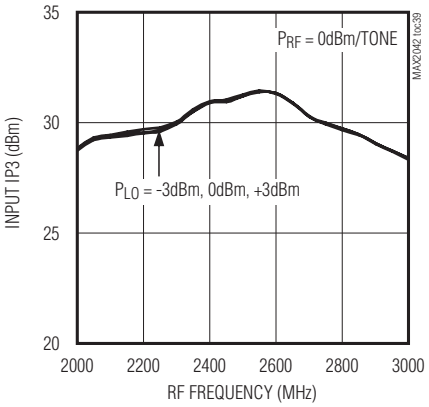
CONVERSION LOSS vs. RF FREQUENCY



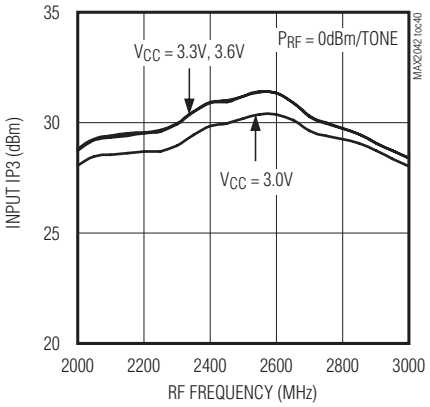
INPUT IP3 vs. RF FREQUENCY



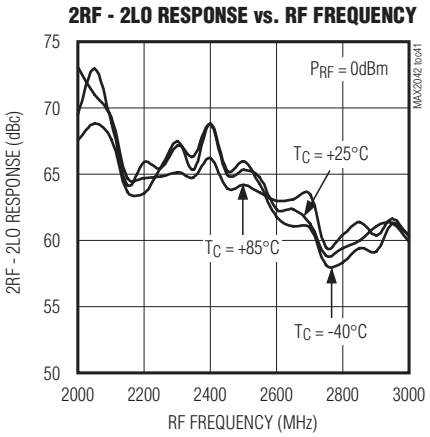
INPUT IP3 vs. RF FREQUENCY



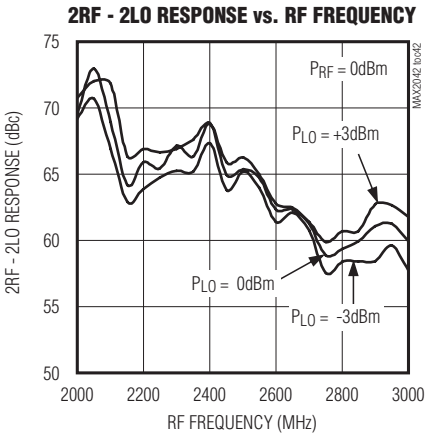
INPUT IP3 vs. RF FREQUENCY



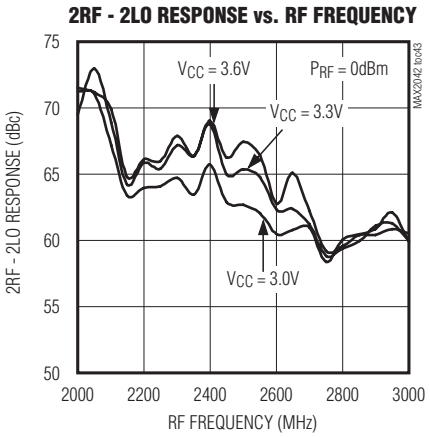
2RF - 2LO RESPONSE vs. RF FREQUENCY



2RF - 2LO RESPONSE vs. RF FREQUENCY



2RF - 2LO RESPONSE vs. RF FREQUENCY



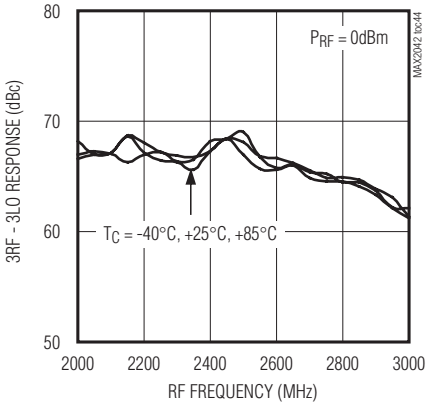
SiGe、高线性度、2000MHz至3000MHz上/下变频混频器，带有LO缓冲器

典型工作特性(续)

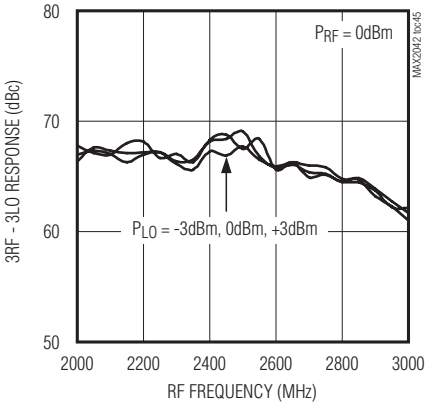
(*Typical Application Circuit* with tuning elements outlined in **Table 1, V_{CC} = +3.3V**, $f_{RF} > f_{LO}$, f_{IF} = 300MHz, P_{RF} = 0dBm, P_{LO} = 0dBm, T_C = +25°C, unless otherwise noted.)

+3.3V Downconverter Curves

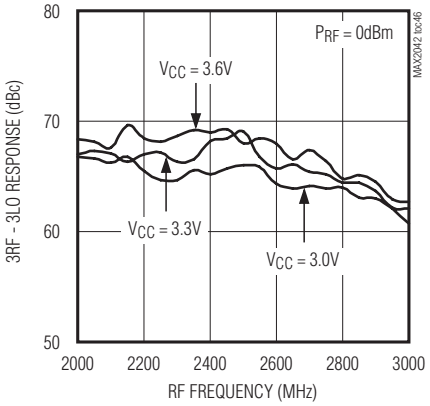
3RF - 3LO RESPONSE vs. RF FREQUENCY



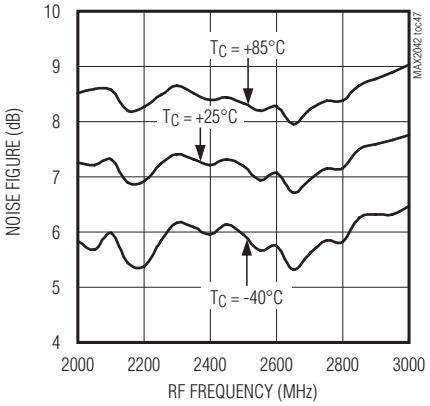
3RF - 3LO RESPONSE vs. RF FREQUENCY



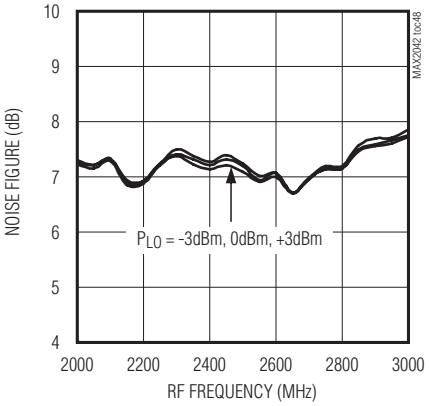
3RF - 3LO RESPONSE vs. RF FREQUENCY



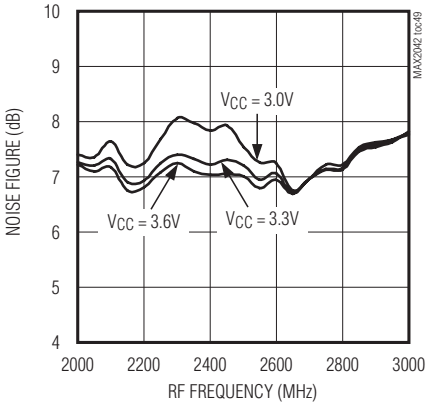
NOISE FIGURE vs. RF FREQUENCY



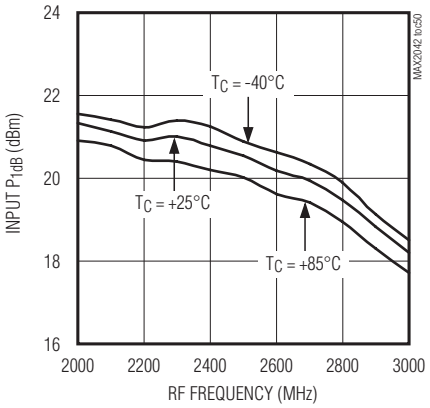
NOISE FIGURE vs. RF FREQUENCY



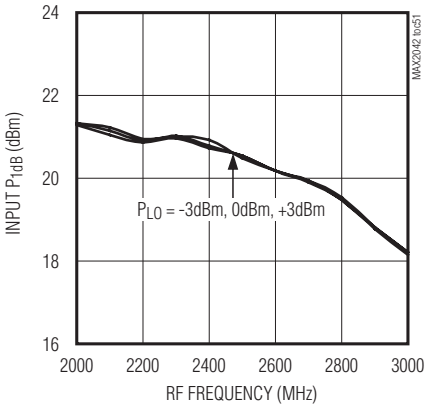
NOISE FIGURE vs. RF FREQUENCY



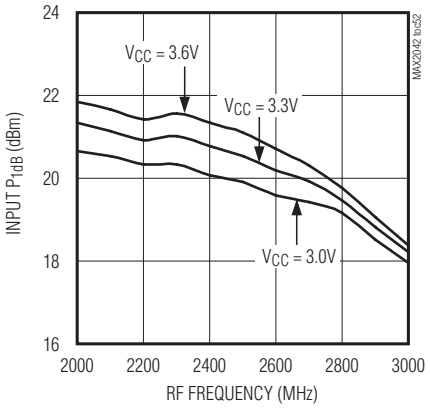
INPUT P_{1dB} vs. RF FREQUENCY



INPUT P_{1dB} vs. RF FREQUENCY



INPUT P_{1dB} vs. RF FREQUENCY

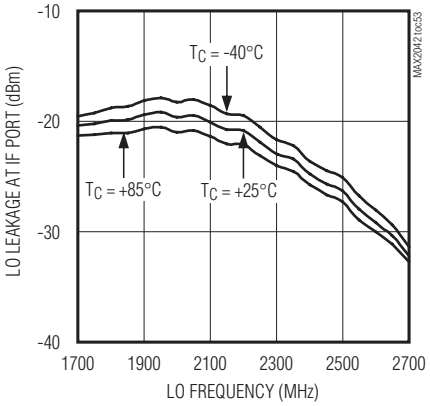


典型工作特性(续)

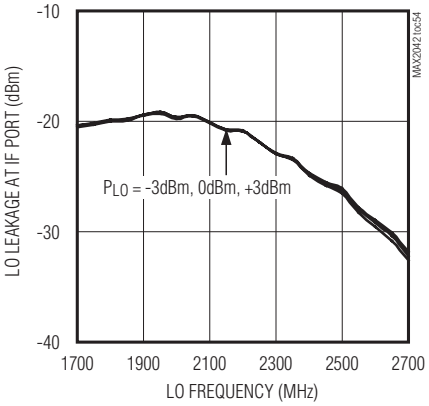
(*Typical Application Circuit* with tuning elements outlined in **Table 1, V_{CC} = +3.3V**, $f_{RF} > f_{LO}$, f_{IF} = 300MHz, P_{RF} = 0dBm, P_{LO} = 0dBm, T_C = +25°C, unless otherwise noted.)

+3.3V Downconverter Curves

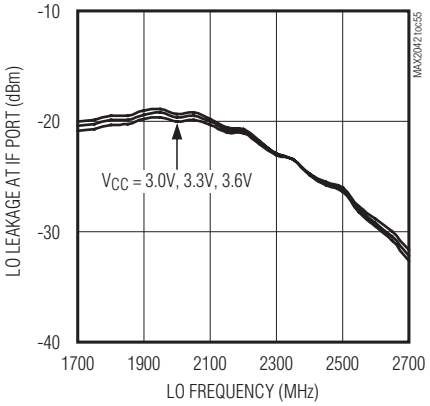
LO LEAKAGE AT IF PORT vs. LO FREQUENCY



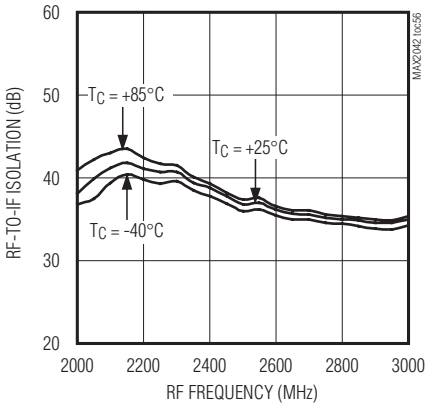
LO LEAKAGE AT IF PORT vs. LO FREQUENCY



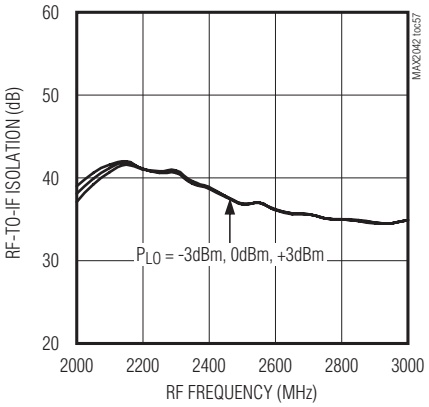
LO LEAKAGE AT IF PORT vs. LO FREQUENCY



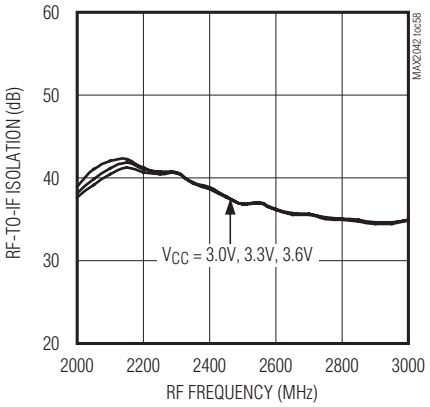
RF-TO-IF ISOLATION vs. RF FREQUENCY



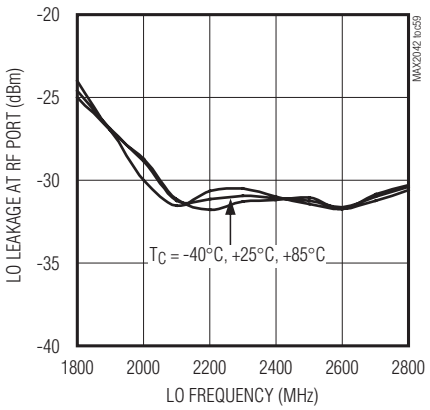
RF-TO-IF ISOLATION vs. RF FREQUENCY



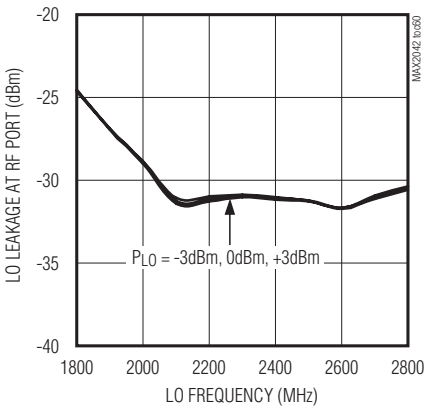
RF-TO-IF ISOLATION vs. RF FREQUENCY



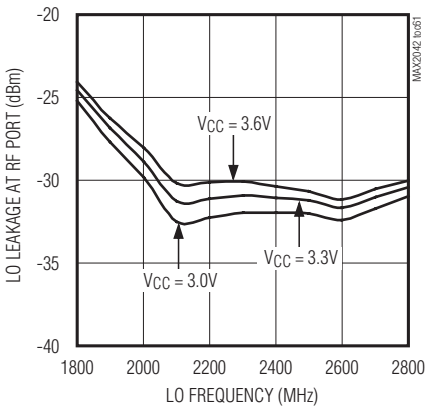
LO LEAKAGE AT RF PORT vs. LO FREQUENCY



LO LEAKAGE AT RF PORT vs. LO FREQUENCY



LO LEAKAGE AT RF PORT vs. LO FREQUENCY



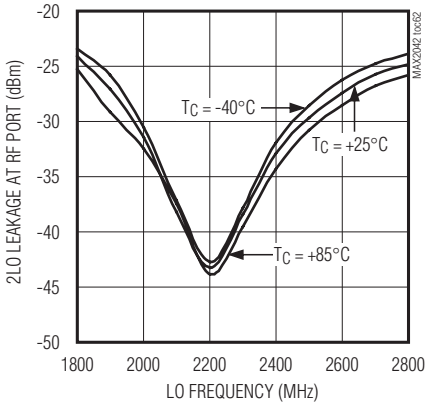
SiGe、高线性度、2000MHz至3000MHz上/下变频混频器，带有LO缓冲器

典型工作特性(续)

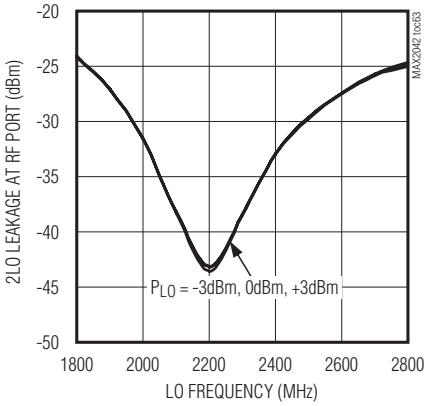
(*Typical Application Circuit* with tuning elements outlined in **Table 1, V_{CC} = +3.3V**, $f_{RF} > f_{LO}$, f_{IF} = 300MHz, P_{RF} = 0dBm, P_{LO} = 0dBm, T_C = +25°C, unless otherwise noted.)

+3.3V Downconverter Curves

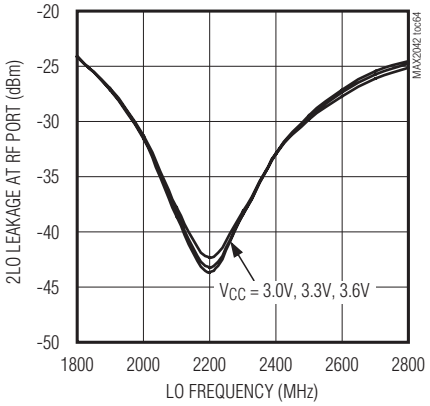
2LO LEAKAGE AT RF PORT vs. LO FREQUENCY



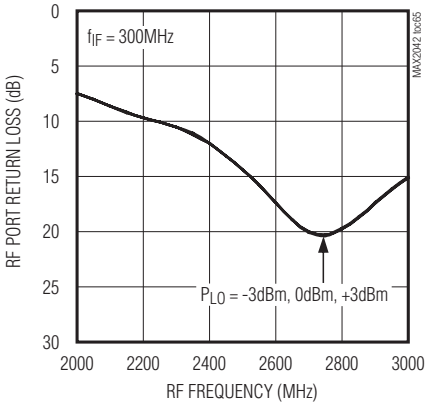
2LO LEAKAGE AT RF PORT vs. LO FREQUENCY



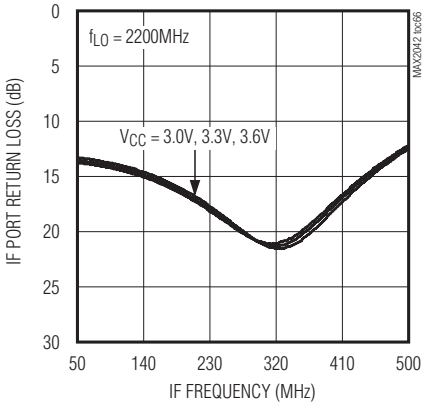
2LO LEAKAGE AT RF PORT vs. LO FREQUENCY



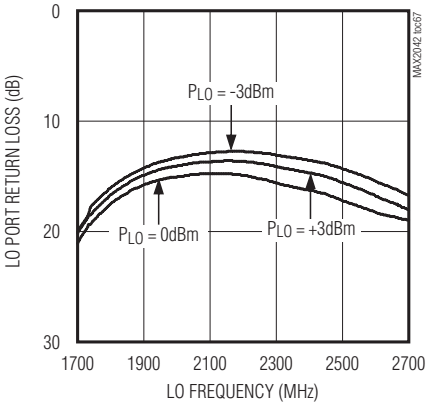
RF PORT RETURN LOSS vs. RF FREQUENCY



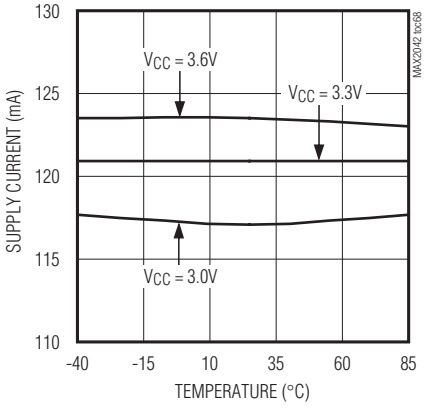
IF PORT RETURN LOSS vs. IF FREQUENCY



LO PORT RETURN LOSS vs. LO FREQUENCY



SUPPLY CURRENT vs. TEMPERATURE

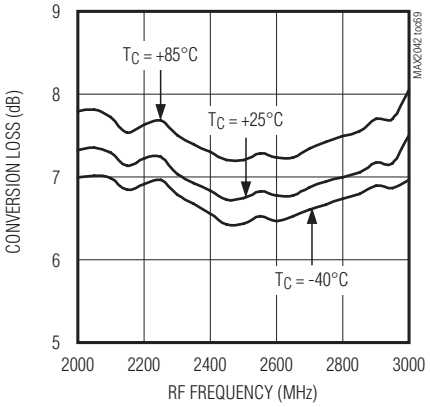


典型工作特性(续)

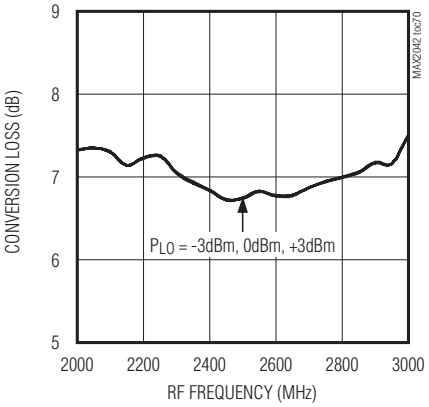
(*Typical Application Circuit* with tuning elements outlined in **Table 2, V_{CC} = +5.0V**, $f_{RF} = f_{LO} + f_{IF}$, f_{IF} = 200MHz, P_{IF} = 0dBm, P_{LO} = 0dBm, T_C = +25°C, unless otherwise noted.)

+5.0V Upconverter Curves

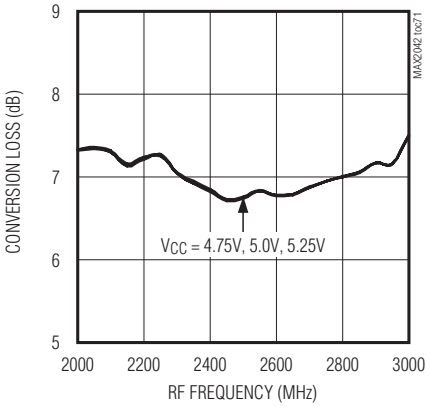
CONVERSION LOSS vs. RF FREQUENCY



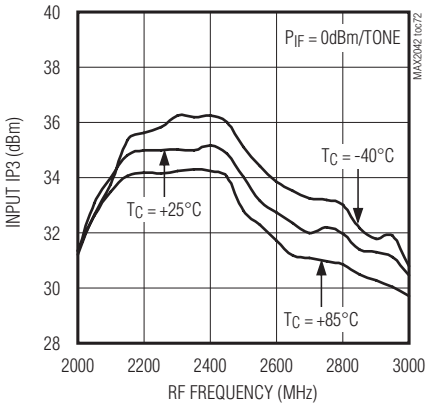
CONVERSION LOSS vs. RF FREQUENCY



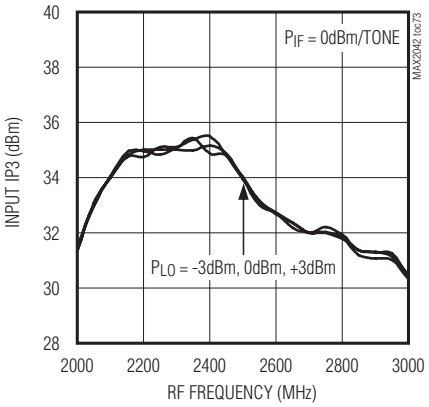
CONVERSION LOSS vs. RF FREQUENCY



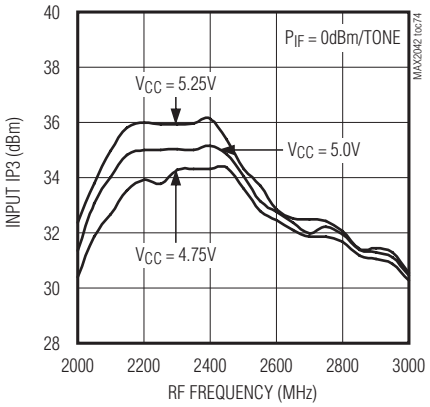
INPUT IP3 vs. RF FREQUENCY



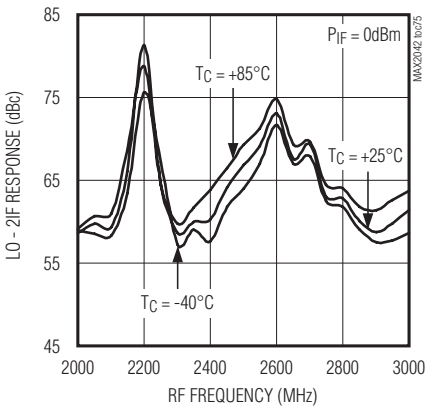
INPUT IP3 vs. RF FREQUENCY



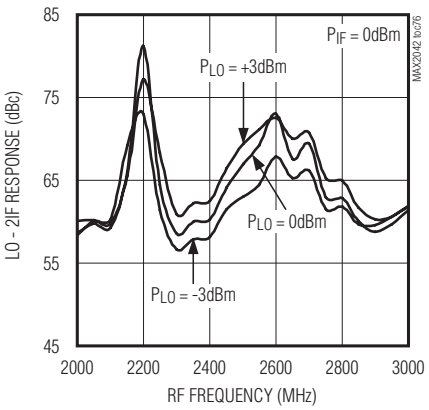
INPUT IP3 vs. RF FREQUENCY



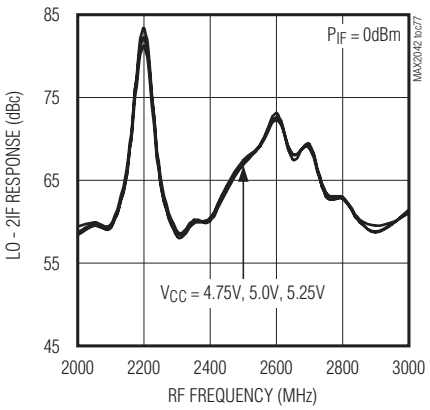
LO - 2IF RESPONSE vs. RF FREQUENCY



LO - 2IF RESPONSE vs. RF FREQUENCY



LO - 2IF RESPONSE vs. RF FREQUENCY



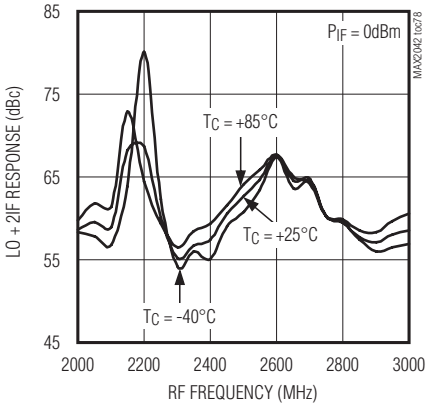
SiGe、高线性度、2000MHz至3000MHz上/下变频混频器，带有LO缓冲器

典型工作特性(续)

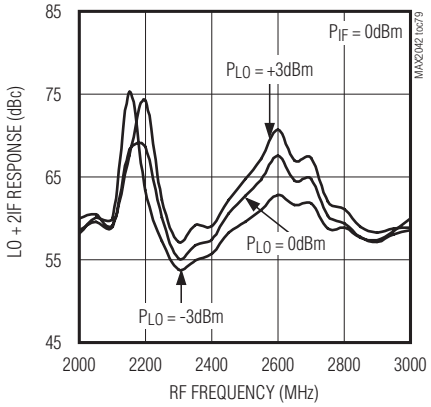
(*Typical Application Circuit* with tuning elements outlined in **Table 2, V_{CC} = +5.0V**, $f_{RF} = f_{LO} + f_{IF}$, f_{IF} = 200MHz, P_{IF} = 0dBm, P_{LO} = 0dBm, T_C = +25°C, unless otherwise noted.)

+5.0V Upconverter Curves

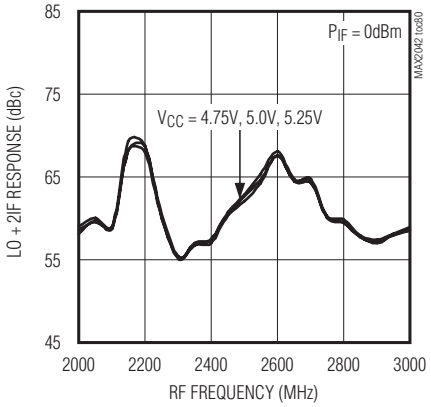
LO + 2IF RESPONSE vs. RF FREQUENCY



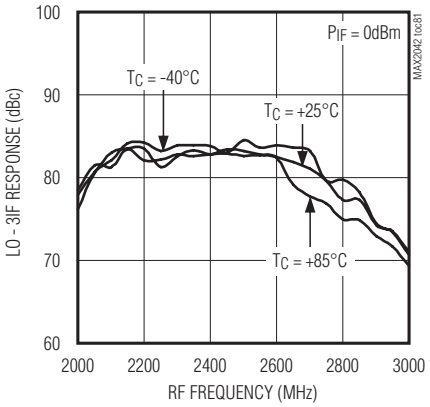
LO + 2IF RESPONSE vs. RF FREQUENCY



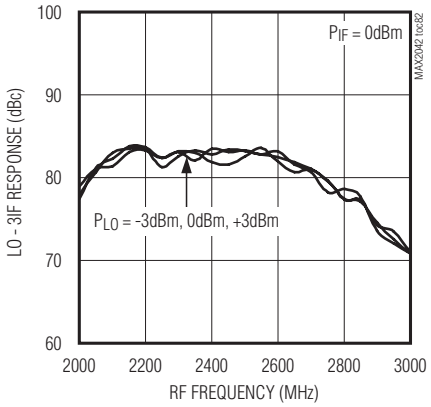
LO + 2IF RESPONSE vs. RF FREQUENCY



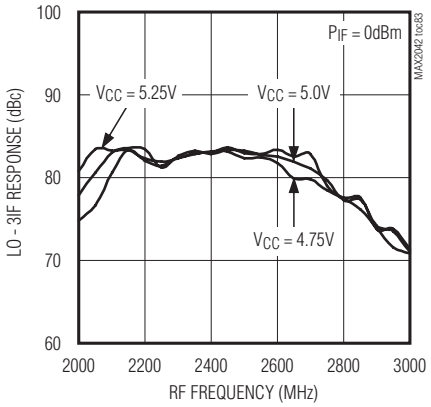
LO - 3IF RESPONSE vs. RF FREQUENCY



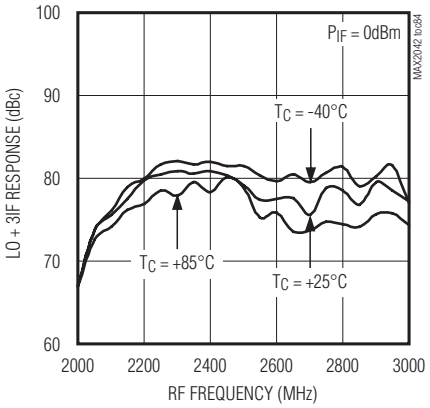
LO - 3IF RESPONSE vs. RF FREQUENCY



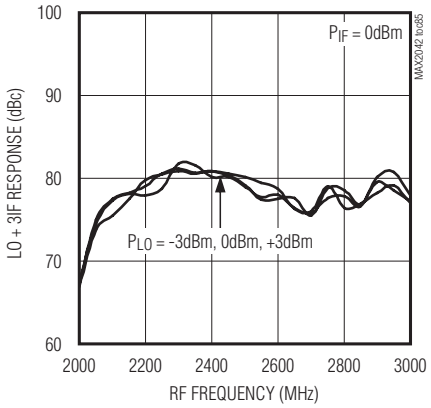
LO - 3IF RESPONSE vs. RF FREQUENCY



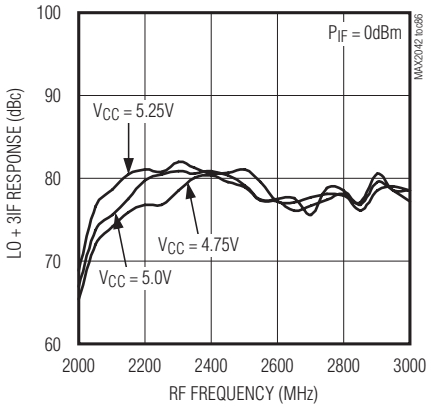
LO + 3IF RESPONSE vs. RF FREQUENCY



LO + 3IF RESPONSE vs. RF FREQUENCY



LO + 3IF RESPONSE vs. RF FREQUENCY

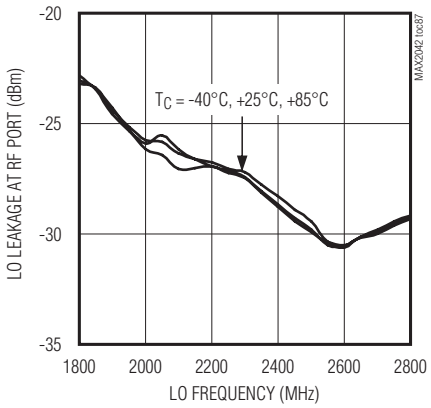


典型工作特性(续)

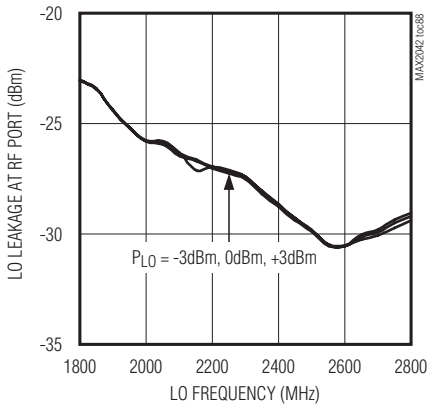
(*Typical Application Circuit* with tuning elements outlined in **Table 2, V_{CC} = +5.0V**, $f_{RF} = f_{LO} + f_{IF}$, f_{IF} = 200MHz, P_{IF} = 0dBm, P_{LO} = 0dBm, T_C = +25°C, unless otherwise noted.)

+5.0V Upconverter Curves

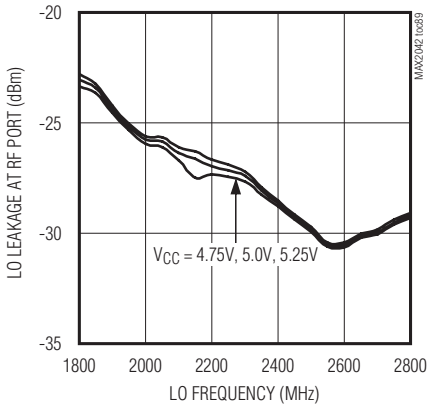
LO LEAKAGE AT RF PORT vs. LO FREQUENCY



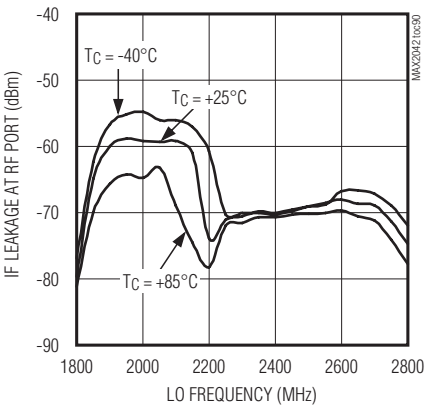
LO LEAKAGE AT RF PORT vs. LO FREQUENCY



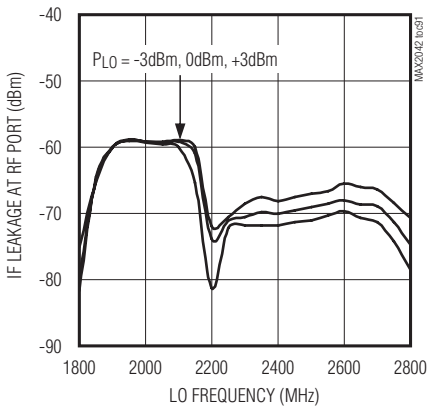
LO LEAKAGE AT RF PORT vs. LO FREQUENCY



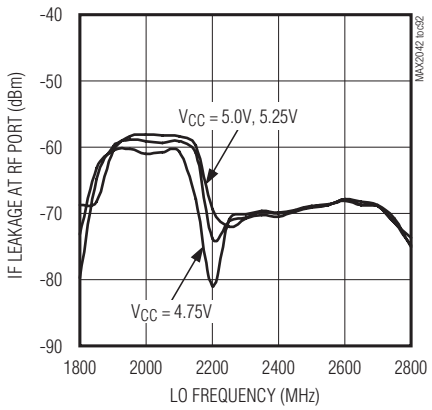
IF LEAKAGE AT RF PORT vs. LO FREQUENCY



IF LEAKAGE AT RF PORT vs. LO FREQUENCY



IF LEAKAGE AT RF PORT vs. LO FREQUENCY



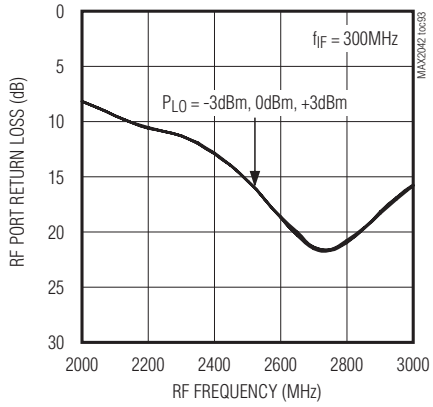
SiGe、高线性度、2000MHz至3000MHz上/下变频混频器，带有LO缓冲器

典型工作特性(续)

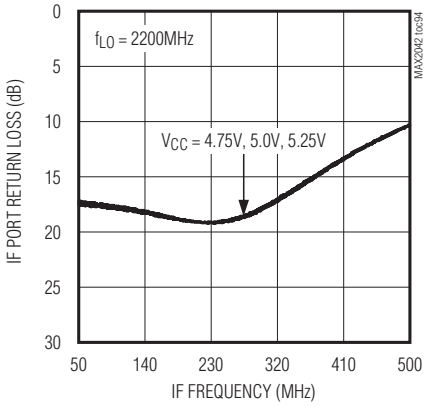
(*Typical Application Circuit* with tuning elements outlined in **Table 2, VCC = +5.0V**, fRF = fLO + fIF, fIF = 200MHz, PIF = 0dBm, PLO = 0dBm, TC = +25°C, unless otherwise noted.)

+5.0V Upconverter Curves

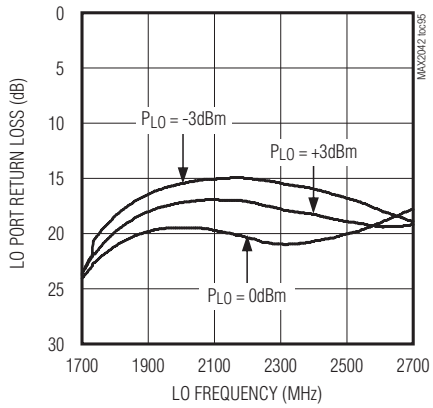
RF PORT RETURN LOSS vs. RF FREQUENCY



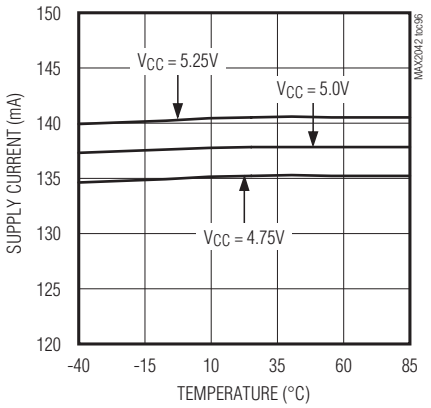
IF PORT RETURN LOSS vs. IF FREQUENCY



LO PORT RETURN LOSS vs. LO FREQUENCY



SUPPLY CURRENT vs. TEMPERATURE (TC)

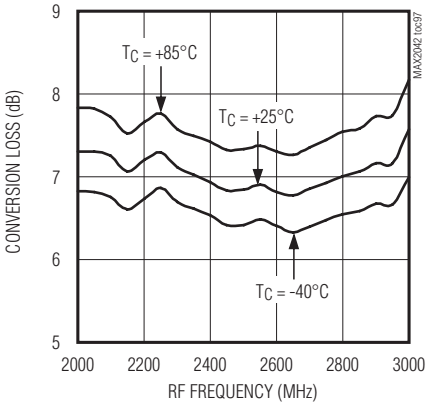


典型工作特性(续)

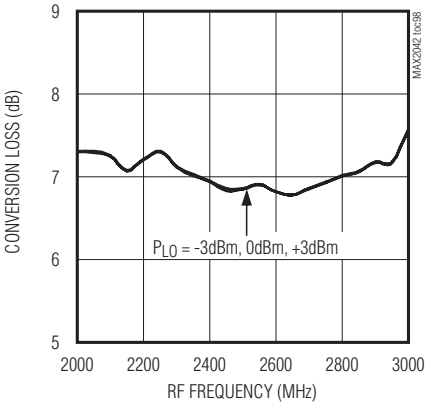
(*Typical Application Circuit* with tuning elements outlined in **Table 2, VCC = +3.3V**, fRF = fLO + fIF, fIF = 200MHz, PIF = 0dBm, PLO = 0dBm, TC = +25°C, unless otherwise noted.)

+3.3V Upconverter Curves

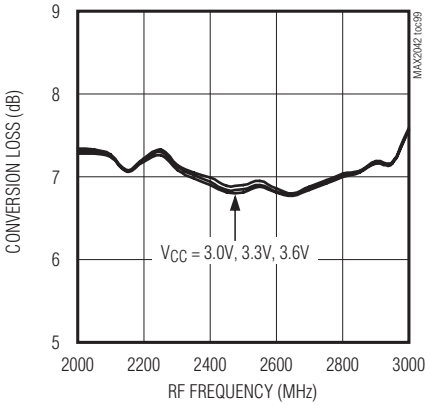
CONVERSION LOSS vs. RF FREQUENCY



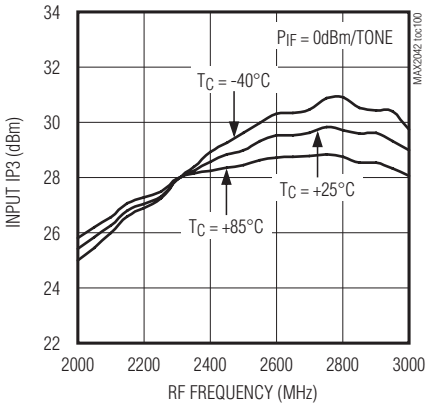
CONVERSION LOSS vs. RF FREQUENCY



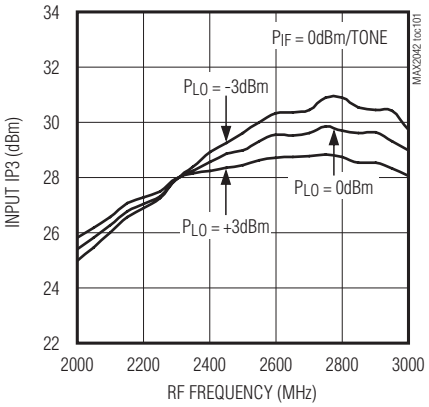
CONVERSION LOSS vs. RF FREQUENCY



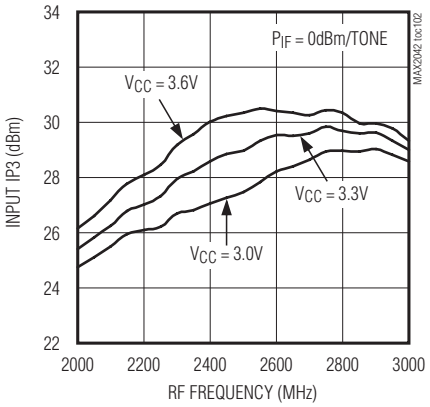
INPUT IP3 vs. RF FREQUENCY



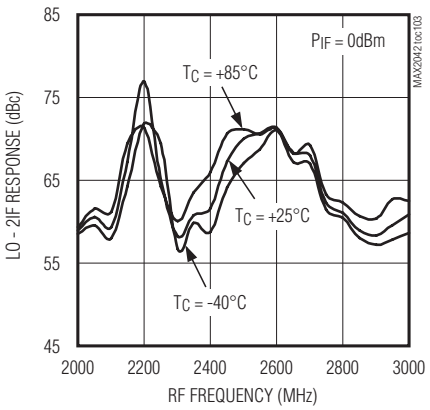
INPUT IP3 vs. RF FREQUENCY



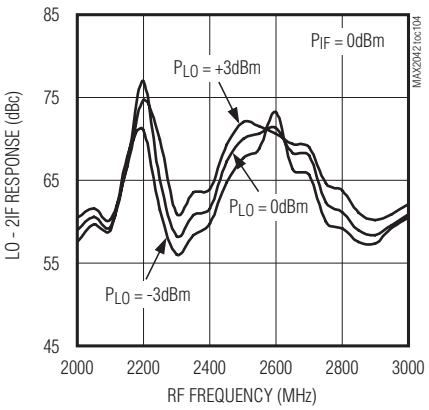
INPUT IP3 vs. RF FREQUENCY



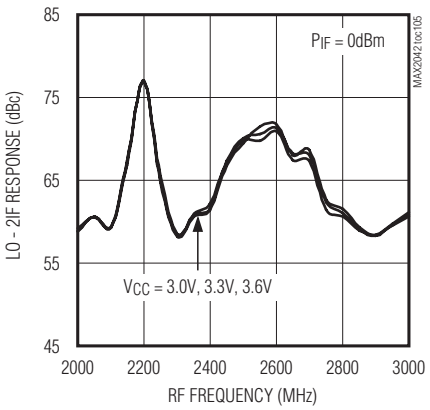
LO - 2IF RESPONSE vs. RF FREQUENCY



LO - 2IF RESPONSE vs. RF FREQUENCY



LO - 2IF RESPONSE vs. RF FREQUENCY



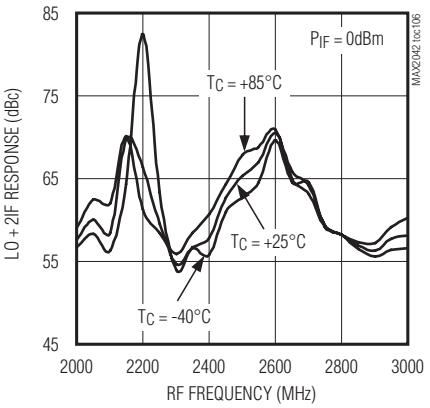
SiGe、高线性度、2000MHz至3000MHz上/下变频混频器，带有LO缓冲器

典型工作特性(续)

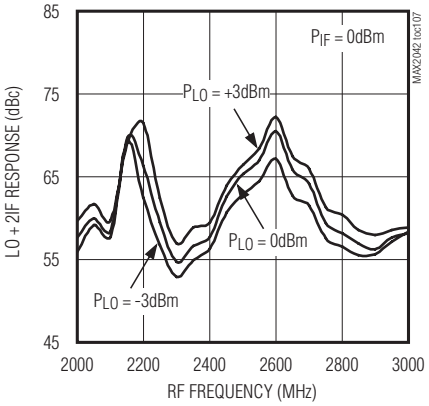
(*Typical Application Circuit* with tuning elements outlined in **Table 2, V_{CC} = +3.3V**, $f_{RF} = f_{LO} + f_{IF}$, f_{IF} = 200MHz, P_{IF} = 0dBm, P_{LO} = 0dBm, T_C = +25°C, unless otherwise noted.)

+3.3V Upconverter Curves

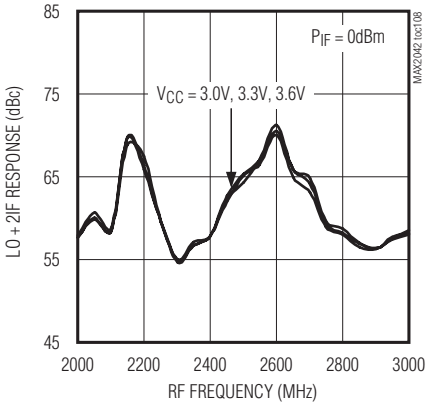
LO + 2IF RESPONSE vs. RF FREQUENCY



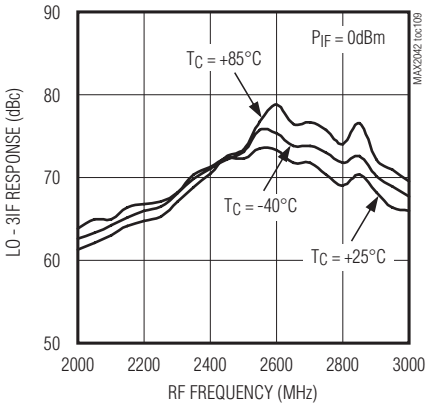
LO + 2IF RESPONSE vs. RF FREQUENCY



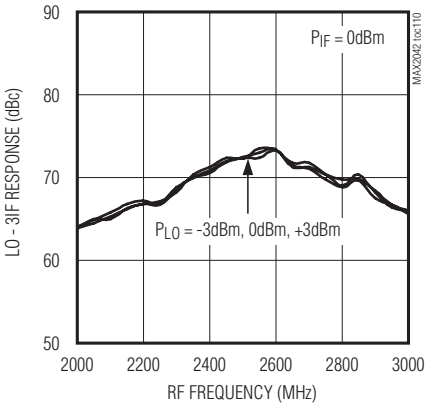
LO + 2IF RESPONSE vs. RF FREQUENCY



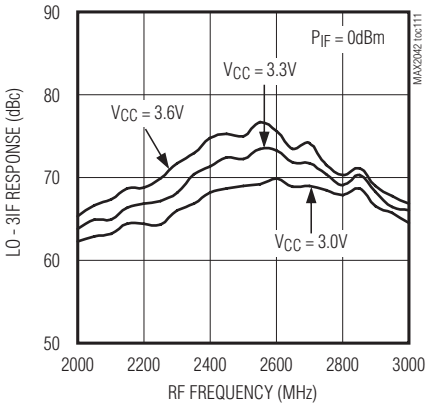
LO - 3IF RESPONSE vs. RF FREQUENCY



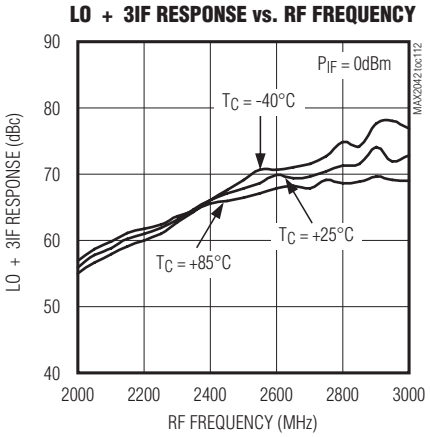
LO - 3IF RESPONSE vs. RF FREQUENCY



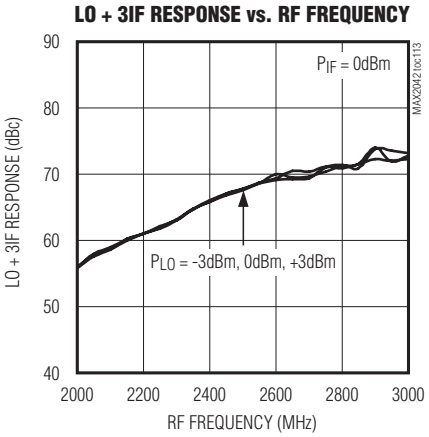
LO - 3IF RESPONSE vs. RF FREQUENCY



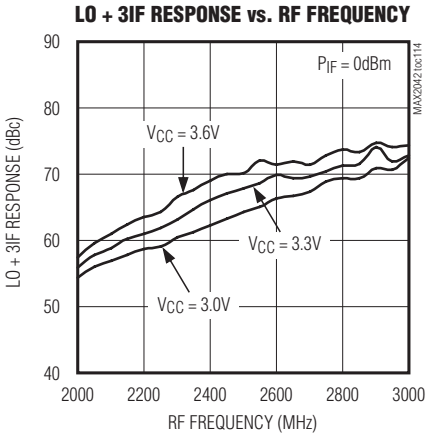
LO + 3IF RESPONSE vs. RF FREQUENCY



LO + 3IF RESPONSE vs. RF FREQUENCY



LO + 3IF RESPONSE vs. RF FREQUENCY

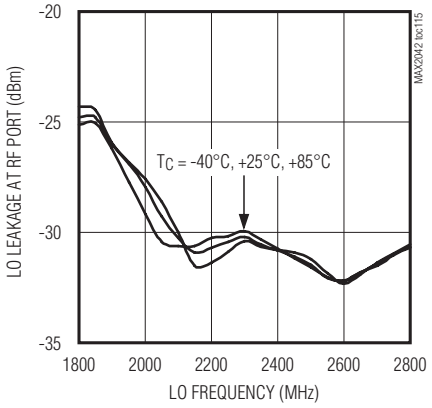


典型工作特性(续)

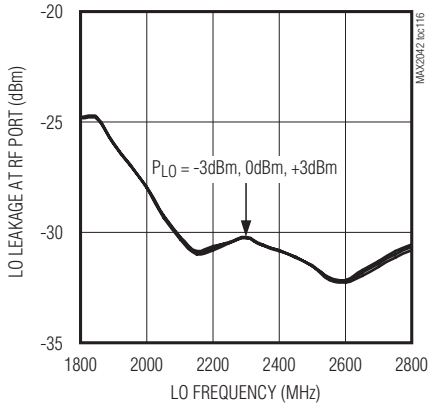
(*Typical Application Circuit* with tuning elements outlined in **Table 2, V_{CC} = +3.3V**, $f_{RF} = f_{LO} + f_{IF}$, f_{IF} = 200MHz, P_{IF} = 0dBm, P_{LO} = 0dBm, T_C = +25°C, unless otherwise noted.)

+3.3V Upconverter Curves

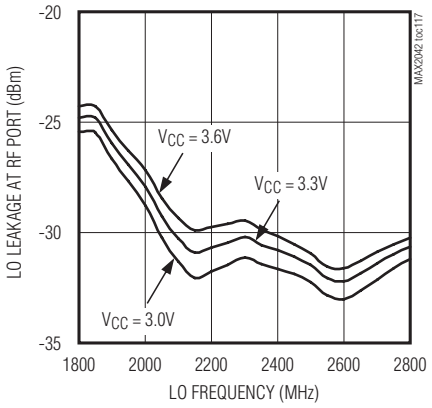
LO LEAKAGE AT RF PORT vs. LO FREQUENCY



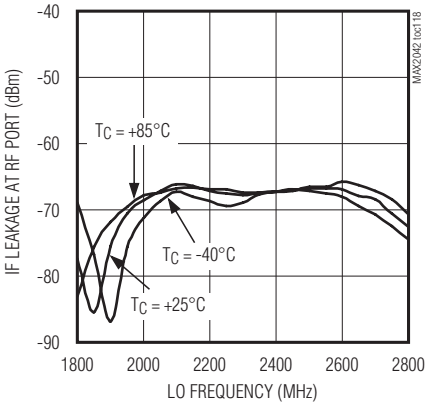
LO LEAKAGE AT RF PORT vs. LO FREQUENCY



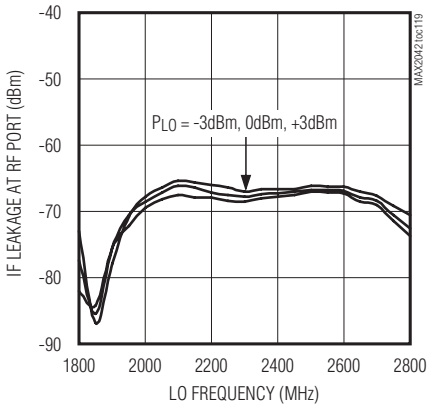
LO LEAKAGE AT RF PORT vs. LO FREQUENCY



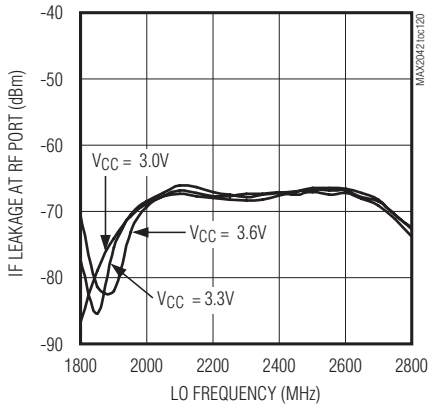
IF LEAKAGE AT RF PORT vs. LO FREQUENCY



IF LEAKAGE AT RF PORT vs. LO FREQUENCY



IF LEAKAGE AT RF PORT vs. LO FREQUENCY



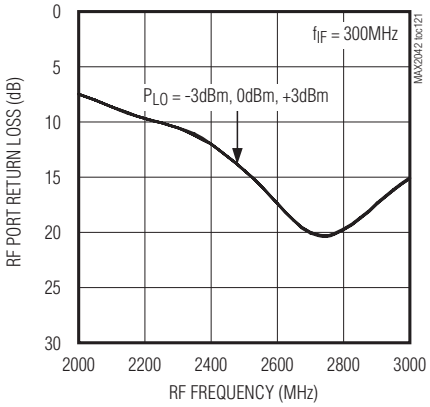
SiGe、高线性度、2000MHz至3000MHz上/下变频混频器，带有LO缓冲器

典型工作特性(续)

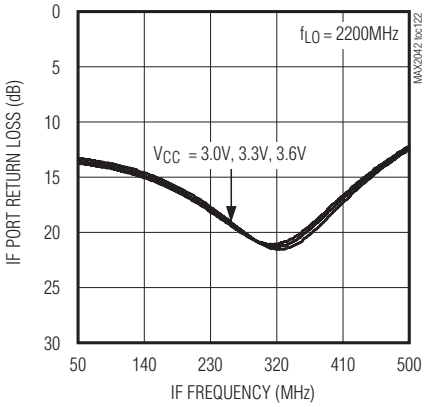
(*Typical Application Circuit* with tuning elements outlined in **Table 2, VCC = +3.3V**, fRF = fLO + fIF, fIF = 200MHz, PIF = 0dBm, PLO = 0dBm, TC = +25°C, unless otherwise noted.)

+3.3V Upconverter Curves

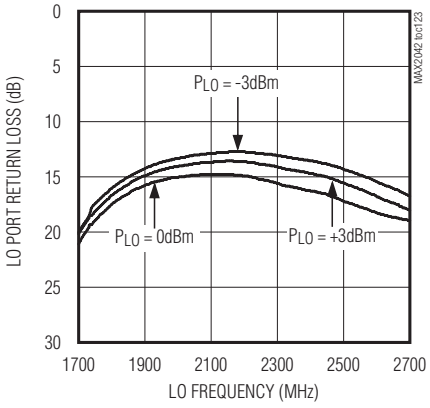
RF PORT RETURN LOSS vs. RF FREQUENCY



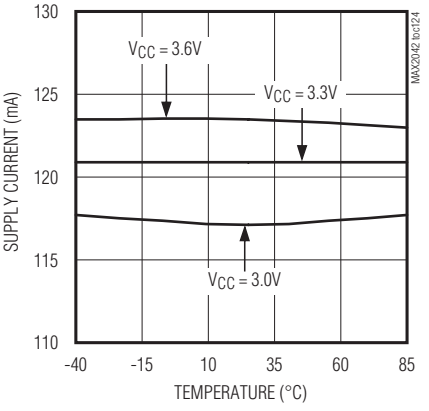
IF PORT RETURN LOSS vs. IF FREQUENCY



LO PORT RETURN LOSS vs. LO FREQUENCY



SUPPLY CURRENT vs. TEMPERATURE (TC)



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。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电容。电容也用于RF匹配调谐。
3, 4, 5, 10, 12, 13, 17	GND	地。内部连接至裸焊盘，将所有地引脚与裸焊盘(EP)连接在一起。
7	LOBIAS	LO放大器偏置控制。LO缓冲器的输出偏置电阻连接端，在LOBIAS与地之间连接一个698Ω ±1%的电阻(标称偏置条件)。从该电阻测得的最大等效电流为3mA。
9, 15	GND	地，没有内部连接。这些引脚可以接地或悬空。
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。电容也用于LO匹配调谐。
16, 20	GND	地，将所有地引脚与裸焊盘(EP)连接在一起。
18, 19	IF-, IF+	混频器差分IF输出/输入端。
—	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、2000MHz至3000MHz上/下变频混频器，带有LO缓冲器

详细说明

在2300MHz至2900MHz频段用作低端LO注入的混频器时，MAX2042能够提供+36dBm的IIP3和典型值为7.3dB的噪声系数以及7.2dB的转换损耗。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MAX2042输入端所需的LO驱动减小到-3dBm至+3dBm。IF端口配合差分接口，有效改善了2RF - 2LO性能。

该器件可在较宽的频率范围内保证性能，适用于WCS、LTE、WiMAX和MMDS基站。MAX2042能够工作在2000MHz至3000MHz RF输入范围、1800MHz至2800MHz LO范围以及50MHz至500MHz IF范围。外部IF变压器可设置在更低的频率范围(详细信息请参见*典型工作特性*)。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端口和非平衡变压器

配合串联隔直流电容使用时，MAX2042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2500MHz至2900MHz的RF频率范围内，RF端口的输入回波损耗典型值为15dB。

LO输入、缓冲器和非平衡变压器

MAX2042优化用于低端LO注入架构，LO频率范围为1800MHz至2800MHz。LO输入在内部匹配至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上。

高线性度混频器

MAX2042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+36dBm、70dBc和7.3dB。

差分IF接口

MAX2042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。

MAX2042的差分端口有效改善了2RF - 2LO性能，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。典型应用中，可以使用一个1:1变压器(例如: MABAES0029)将50Ω差分接口转换成50Ω单端接口，数据资料的参数规格中给出了变压器损耗指标。此外，通过将IF-短接至地、在IF+和地之间连接一个1kΩ电阻，可使IF接口直接支持单端交流耦合的IF+输入或输出信号。

应用信息

输入和输出匹配

配合串联隔直流电容使用时，RF输入提供50Ω匹配。在2000MHz至3000MHz RF频率范围内，使用8.2pF隔直流电容。LO输入内部匹配在50Ω，利用2pF隔直流电容可覆盖1800MHz至2800MHz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*)。

降低功耗模式

MAX2042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，请参考*典型工作特性*折中考虑功耗和性能。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43%，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。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和表2。

裸焊盘的RF/散热考虑

MAX2042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MAX2042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1. 下变频模式元件值

DESIGNATION	QTY	DESCRIPTION	COMPONENT SUPPLIER
C1	1	8.2pF microwave capacitor (0402)	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, capacitors	—
C5	0	Not installed, capacitor	—
C10	1	2pF microwave capacitor (0402)	Murata Electronics North America, Inc.
R1	1	698Ω ±1% resistor (0402)	Digi-Key Corp.
T1	1	1:1 IF balun MABAES0029	M/A-Com, Inc.
U1	1	MAX2042 IC (20 TQFN)	Maxim Integrated Products, Inc.

表2. 上变频模式元件值

DESIGNATION	QTY	DESCRIPTION	COMPONENT SUPPLIER
C1	1	8.2pF microwave capacitor (0402)	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, capacitors	—
C5	0	Not installed, capacitor	—
C10	1	2pF microwave capacitor (0402)	Murata Electronics North America, Inc.
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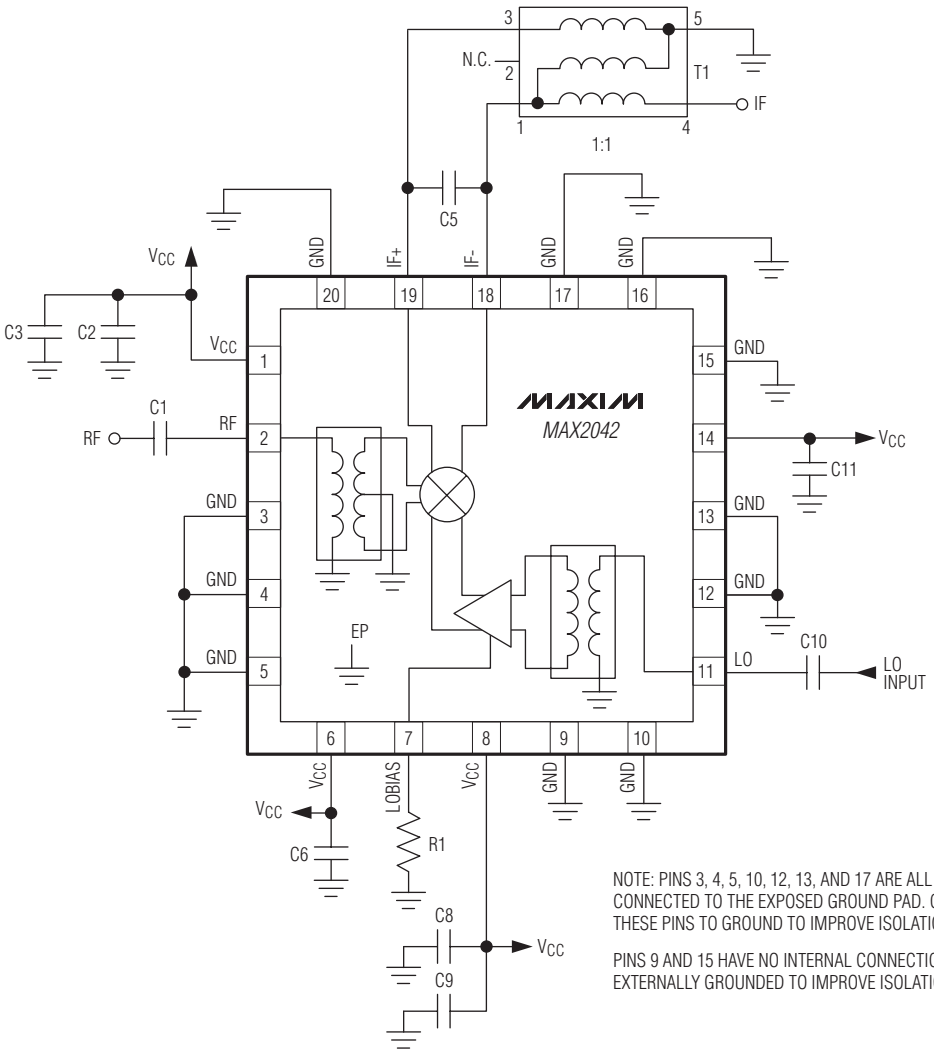
SiGe、高线性度、2000MHz至3000MHz上/下变频混频器，带有LO缓冲器

典型应用电路



NOTE: PINS 3, 4, 5, 10, 12, 13, AND 17 ARE ALL INTERNALLY CONNECTED TO THE EXPOSED GROUND PAD. CONNECT THESE PINS TO GROUND TO IMPROVE ISOLATION.

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

SiGe、高线性度、2000MHz至3000MHz上/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**。

封装类型	封装编码	文档编号
20 TQFN-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