19-4965; Rev 0; 9/09

可提供评估板

高线性度、650MHz至1000MHz上变频/下变频混频器，带有LO缓冲器/开关

MAX2032

概述

MAX2032高线性度、无源上变频或下变频混频器在650MHz至1000MHz的RF频段具有+33dBm IIP3、7dB NF和7dB变频损耗，支持多种基站应用。混频器LO频率范围为650MHz至1250MHz，适用于高端LO注入结构。如需引脚兼容的低端LO注入混频器，请参考MAX2029。

MAX2032不仅具有出色的线性度和低噪声性能，还具有非常高的器件集成度。该器件含有一个双平衡无源混频器核、一个双输入LO选择开关和一个LO缓冲器。片内集成的非平衡变压器允许下变频的单端RF输入(或上变频的单端RF输出)以及单端LO输入。MAX2032需要标称0dBm的LO驱动，电源电流保证小于100mA。

MAX2032与MAX2039/MAX2041 1700MHz至2200MHz混频器引脚兼容，使该系列无源上变频和下变频混频器非常适合两个频段采用相同PCB布局的应用。

MAX2032采用紧凑的20引脚薄型QFN封装(5mm x 5mm)，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

WCDMA/LTE、cdma2000®基站

GSM 850/GSM 900 2G和2.5G EDGE基站

集成数字增强网络(iDEN®)基站

WiMAX™基站和企业设备

预失真接收器

微波和固定宽带无线接入设备

无线本地环路

数字与扩频通信系统

cdma2000是电信工业协会的注册商标。
iDEN是Motorola, Inc.的注册商标。
WiMAX是WiMAX论坛的商标。

特性

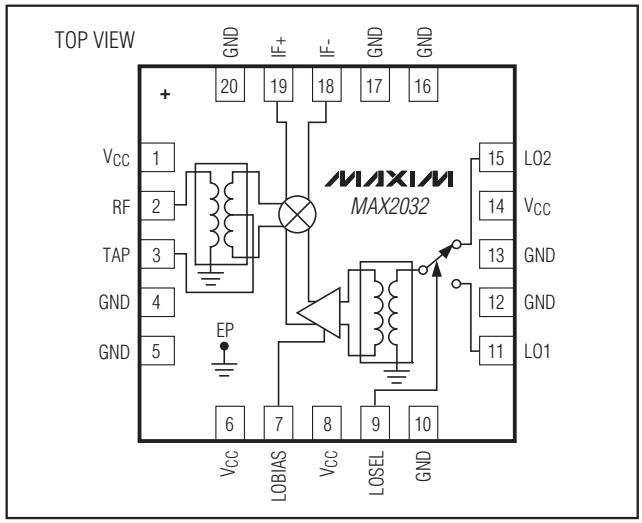
- 650MHz至1000MHz RF频率范围
- 650MHz至1250MHz LO频率范围
- 570MHz至900MHz LO频率范围(参考MAX2029数据资料)
- 直流至250MHz IF频率范围
- 7dB变频损耗
- +33dBm输入IP3
- +24dBm输入1dB压缩点
- 7dB噪声系数
- 集成LO缓冲器
- 集成RF和LO非平衡变压器
- -3dBm至+3dBm较低的LO驱动
- 内置SPDT LO开关，LO1至LO2隔离度为49dB，开关时间为50ns
- 引脚兼容于MAX2039/MAX2041 1700MHz至2200MHz混频器
- 外部电流设置电阻允许折中选择混频器的低功耗/低性能工作模式

定购信息

PART	TEMP RANGE	PIN-PACKAGE
MAX2032ETP+	-40°C to +85°C	20 Thin QFN-EP*
MAX2032ETP+T	-40°C to +85°C	20 Thin QFN-EP*

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

引脚配置/功能框图



ABSOLUTE MAXIMUM RATINGS

V_{CC} to GND .....-0.3V to +5.5V
RF (RF is DC shorted to GND through a balun).....50mA
LO1, LO2 to GND .....-0.3V to +0.3V
IF+, IF- to GND .....-0.3V to (V_{CC} + 0.3V)
TAP to GND .....-0.3V to +1.4V
LOSEL to GND .....-0.3V to (V_{CC} + 0.3V)
LOBIAS to GND.....-0.3V to (V_{CC} + 0.3V)
RF, LO1, LO2 Input Power (Note 1) .....+20dBm
Continuous Power Dissipation (Note 2).....5W
θ_{JA} (Notes 3, 4).....+38°C/W
θ_{JC} (Notes 2, 3).....+13°C/W
Operating Temperature Range (Note 5).....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: Maximum, reliable, continuous input power applied to the RF and IF port of this device is +12dBm from a 50Ω source.

Note 2: 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 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: 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 5: 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.

DC ELECTRICAL CHARACTERISTICS

(*Typical Application Circuit*, V_{CC} = 4.75V to 5.25V, no RF signals applied, T_C = -40°C to +85°C. IF+ and IF- are DC grounded through an IF balun. Typical values are at V_{CC} = 5V, T_C = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Supply Voltage	V_{CC}		4.75	5.00	5.25	V
Supply Current	I_{CC}			85	100	mA
LOSEL Input Logic-Low	V_{IL}				0.8	V
LOSEL Input Logic-High	V_{IH}		2			V

RECOMMENDED AC OPERATING CONDITIONS

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
RF Frequency	f_{RF}	Components tuned for the 700MHz band (Table 1), C1 = 7pF, C5 = 3.3pF (Notes 6, 7)	650		850	MHz
		Components tuned for the 800MHz/900MHz cellular band (Table 1), C1 = 82pF, C5 = 2.0pF (Note 6)	800		1000	
LO Frequency	f_{LO}	(Notes 6, 7)	650		1250	MHz
IF Frequency	f_{IF}	IF frequency range depends on external IF transformer selection	0		250	MHz
LO Drive Level	P_{LO}	(Note 6)	-3		+3	dBm

AC ELECTRICAL CHARACTERISTICS (800MHz/900MHz CELLULAR BAND DOWNCONVERTER OPERATION)

(*Typical Application Circuit,* optimized for the **800MHz/900MHz cellular band (see Table 1)**, C1 = 82pF, C5 = 2pF, L1 and C4 not used, V_{CC} = 4.75V to 5.25V, RF and LO ports driven from 50Ω sources, P_{LO} = -3dBm to +3dBm, P_{RF} = 0dBm, f_{RF} = 815MHz to 1000MHz, f_{LO} = 960MHz to 1180MHz, f_{IF} = 160MHz, $f_{LO} > f_{RF}$, T_C = -40°C to +85°C, unless otherwise noted. Typical values are at V_{CC} = 5V, P_{RF} = 0dBm, P_{LO} = 0dBm, f_{RF} = 910MHz, f_{LO} = 1070MHz, f_{IF} = 160MHz, T_C = +25°C, unless otherwise noted.) (Note 8)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Conversion Loss	L_C			7.0		dB
Conversion Loss Flatness		Flatness over any one of three frequency bands (f_{IF} = 160MHz): f_{RF} = 827MHz to 849MHz f_{RF} = 869MHz to 894MHz f_{RF} = 880MHz to 915MHz		±0.18		dB
Conversion Loss Variation Over Temperature		T_C = +25°C to -40°C		-0.3		dB
		T_C = +25°C to +85°C		0.2		
Input 1dB Compression Point	P_{1dB}	(Note 9)		24		dBm
Input Third-Order Intercept Point	IIP3	f_{RF1} = 910MHz, f_{RF2} = 911MHz, P_{RF} = 0dBm/tone, f_{LO} = 1070MHz, P_{LO} = 0dBm, T_C = +25°C (Note 10)	29	33		dBm
Input IP3 Variation Over Temperature	IIP3	T_C = +25°C to -40°C		0.3		dB
		T_C = +25°C to +85°C		-0.3		
2LO - 2RF Spurious Response at IF	2 x 2			65		dBc
3LO - 3RF Spurious Response at IF	3 x 3			75		dBc
Noise Figure	NF	Single sideband		7.0		dB
Noise Figure Under Blocking (Note 11)		$P_{BLOCKER}$ = +8dBm		18		dB
		$P_{BLOCKER}$ = +12dBm		22		
LO1-to-LO2 Isolation (Note 10)		LO2 selected, P_{LO} = +3dBm, T_C = +25°C	42	51		dB
		LO1 selected, P_{LO} = +3dBm, T_C = +25°C	42	49		
Maximum LO Leakage at RF Port		P_{LO} = +3dBm		-27		dBm
Maximum LO Leakage at IF Port		P_{LO} = +3dBm		-35		dBm
LO Switching Time		50% of LOSEL to IF, settled within 2 degrees		50		ns
Minimum RF-to-IF Isolation				45		dB
RF Port Return Loss				17		dB
LO Port Return Loss		LO1/LO2 port selected, LO2/LO1, RF, and IF terminated into 50Ω		28		dB
		LO1/LO2 port unselected, LO2/LO1, RF, and IF terminated into 50Ω		30		
IF Port Return Loss		LO driven at 0dBm, RF terminated into 50Ω		17		dB

AC ELECTRICAL CHARACTERISTICS (700MHz BAND DOWNCONVERTER OPERATION)

(*Typical Application Circuit*, optimized for the **700MHz band (see Table 1)**, C1 = 7pF, C5 = 3.3pF, L1 and C4 are not used, V_{CC} = 4.75V to 5.25V, RF and LO ports driven from 50Ω sources, P_{LO} = -3dBm to +3dBm, P_{RF} = 0dBm, f_{RF} = 650MHz to 850MHz, f_{LO} = 790MHz to 990MHz, f_{IF} = 140MHz, $f_{LO} > f_{RF}$, T_C = +25°C, unless otherwise noted. Typical values are at V_{CC} = 5V, P_{RF} = 0dBm, P_{LO} = 0dBm, f_{RF} = 750MHz, f_{LO} = 890MHz, f_{IF} = 140MHz, T_C = +25°C, unless otherwise noted.) (Notes 8, 10)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Conversion Loss	L_C		6.1	6.9	8.1	dB
Input 1dB Compression Point	P_{1dB}	f_{RF} = 750MHz, P_{RF} = 0dBm, P_{LO} = 0dBm		24		dBm
Input Third-Order Intercept Point	IIP3	f_{RF1} = 749MHz, f_{RF2} = 750MHz, f_{LO} = 890MHz, P_{RF} = 0dBm/tone, P_{LO} = 0dBm	29	33		dBm
LO Leakage at IF Port		P_{LO} = +3dBm		-33		dBm
LO Leakage at RF Port		P_{LO} = +3dBm		-20		dBm
RF-to-IF Isolation			36	49		dB
2LO - 2RF Spurious Response	2 x 2			65		dBc
3LO - 3RF Spurious Response	3 x 3			75		dBc

AC ELECTRICAL CHARACTERISTICS (UPCONVERTER OPERATION)

(*Typical Application Circuit*, L1 = 4.7nH, C4 = 6pF, C1 = 82pF, C5 not used, 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} = 815MHz to 1000MHz, f_{LO} = 960MHz to 1180MHz, f_{IF} = 160MHz, $f_{LO} > f_{RF}$, T_C = -40°C to +85°C, unless otherwise noted. Typical values are at V_{CC} = 5V, P_{IF} = 0dBm, P_{LO} = 0dBm, f_{RF} = 910MHz, f_{LO} = 1070MHz, f_{IF} = 160MHz, T_C = +25°C, unless otherwise noted.) (Note 8)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Conversion Loss	L_C			7.4		dB
Conversion Loss Flatness		Flatness over any one of three frequency bands (f_{IF} = 160MHz): f_{RF} = 827MHz to 849MHz f_{RF} = 869MHz to 894MHz f_{RF} = 880MHz to 915MHz		±0.3		dB
Conversion Loss Variation Over Temperature		T_C = +25°C to -40°C		-0.3		dB
		T_C = +25°C to +85°C		0.4		
Input 1dB Compression Point	P_{1dB}	(Note 9)		24		dBm
Input Third-Order Intercept Point	IIP3	f_{IF1} = 160MHz, f_{IF2} = 161MHz, P_{IF} = 0dBm/tone, f_{LO} = 1070MHz, P_{LO} = 0dBm, T_C = +25°C (Note 10)	28	31		dBm
Input IP3 Variation Over Temperature	IIP3	T_C = +25°C to -40°C		1.2		dB
		T_C = +25°C to +85°C		-0.9		
LO ± 2IF Spur				64		dBc
LO ± 3IF Spur				83		dBc
Output Noise Floor		P_{OUT} = 0dBm (Note 11)		-167		dBm/Hz

Note 6: Operation outside this range is possible, but with degraded performance of some parameters.

Note 7: Not production tested.

Note 8: All limits include external component losses. Output measurements are taken at IF or RF port of the *Typical Application Circuit*.

Note 9: Compression point characterized. It is advisable not to continuously operate the mixer RF/IF inputs above +12dBm.

Note 10: Guaranteed by design.

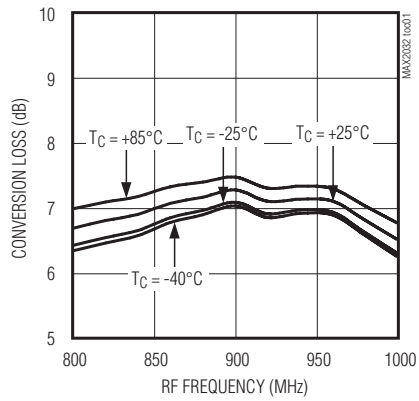
Note 11: Measured with external LO source noise filtered, so its noise floor is -174dBm/Hz. This specification reflects the effects of all SNR degradations in the mixer, including the LO noise as defined in Application Note 2021: *Specifications and Measurement of Local Oscilator Noise in Integrated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

典型工作特性

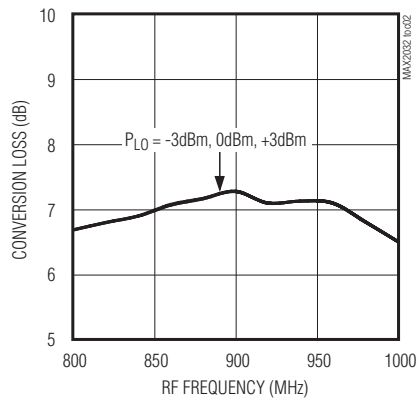
(*Typical Application Circuit*, optimized for the **800MHz/900MHz cellular band (see Table 1)**, C1 = 82pF, C5 = 2pF, L1 and C4 not used, V_{CC} = 5.0V, P_{LO} = 0dBm, P_{RF} = 0dBm, $f_{LO} > f_{RF}$, f_{IF} = 160MHz, T_C = +25°C, unless otherwise noted.)

Downconverter Curves

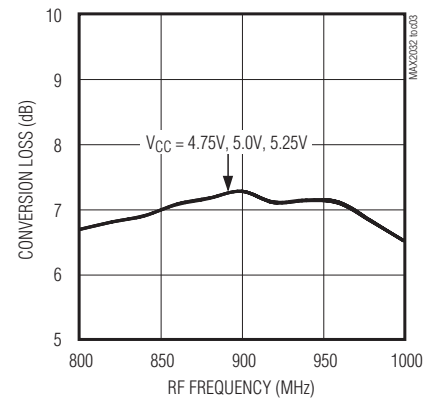
CONVERSION LOSS vs. RF FREQUENCY



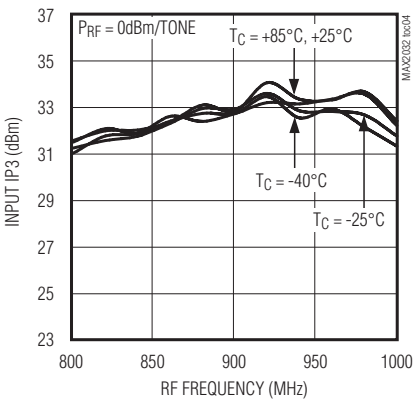
CONVERSION LOSS vs. RF FREQUENCY



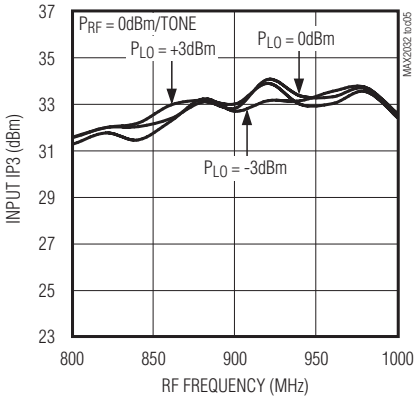
CONVERSION LOSS vs. RF FREQUENCY



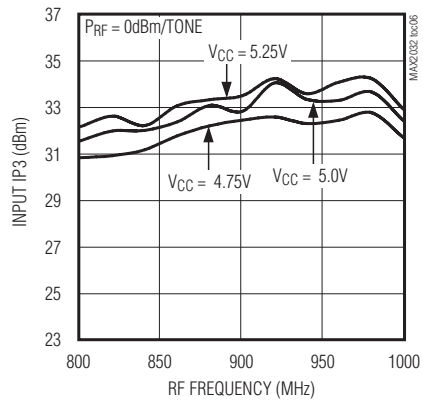
INPUT IP3 vs. RF FREQUENCY



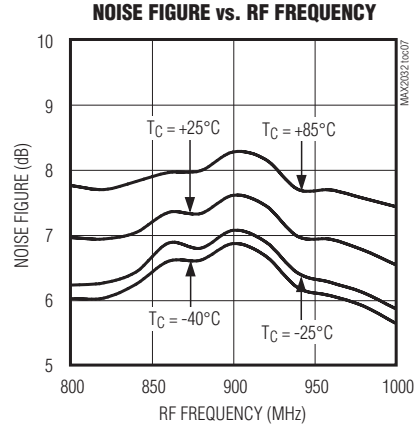
INPUT IP3 vs. RF FREQUENCY



INPUT IP3 vs. RF FREQUENCY



NOISE FIGURE vs. RF FREQUENCY



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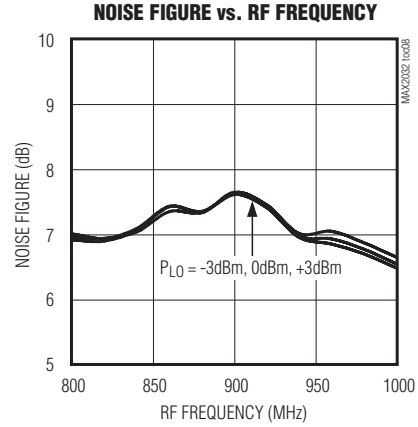

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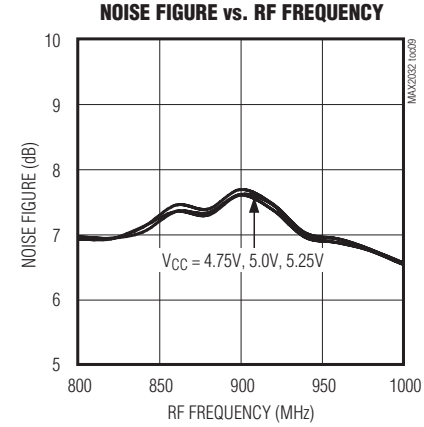
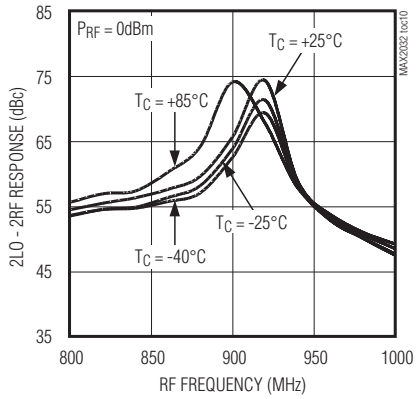


典型工作特性(续)

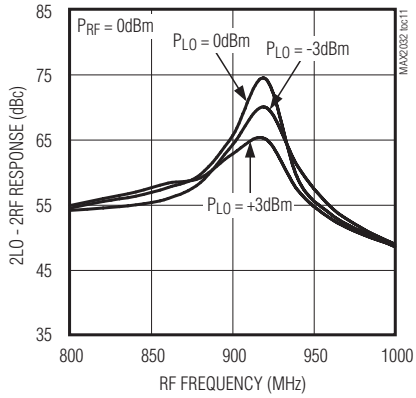
(*Typical Application Circuit*, optimized for the **800MHz/900MHz cellular band (see Table 1)**, C1 = 82pF, C5 = 2pF, L1 and C4 not used, V_{CC} = 5.0V, P_{LO} = 0dBm, P_{RF} = 0dBm, $f_{LO} > f_{RF}$, f_{IF} = 160MHz, T_C = +25°C, unless otherwise noted.)

Downconverter Curves

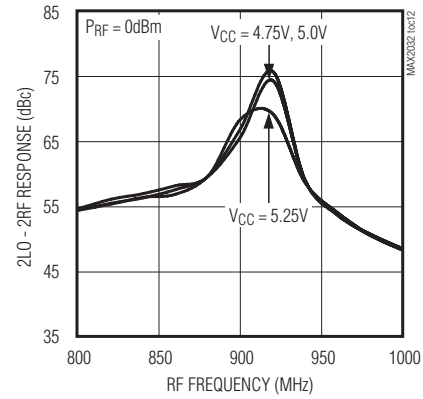
2LO - 2RF RESPONSE vs. RF FREQUENCY



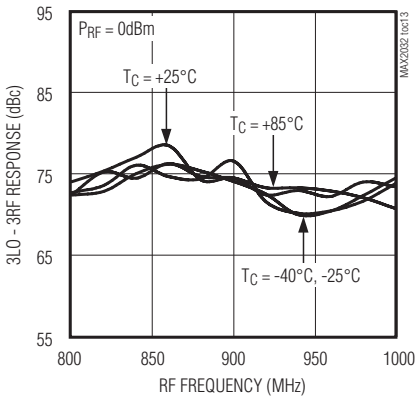
2LO - 2RF RESPONSE vs. RF FREQUENCY



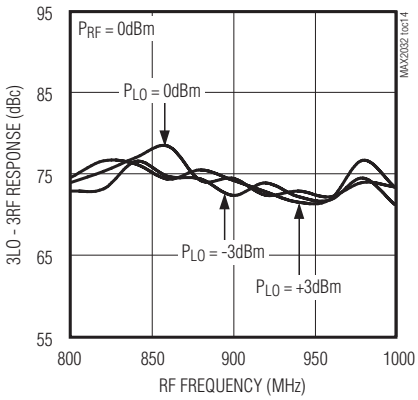
2LO - 2RF RESPONSE vs. RF FREQUENCY



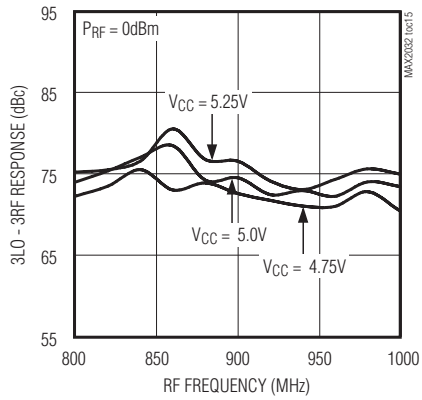
3LO - 3RF RESPONSE vs. RF FREQUENCY



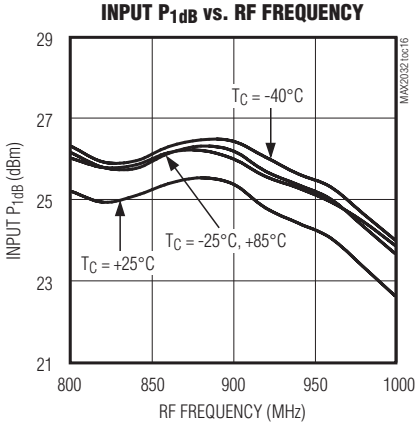
3LO - 3RF RESPONSE vs. RF FREQUENCY



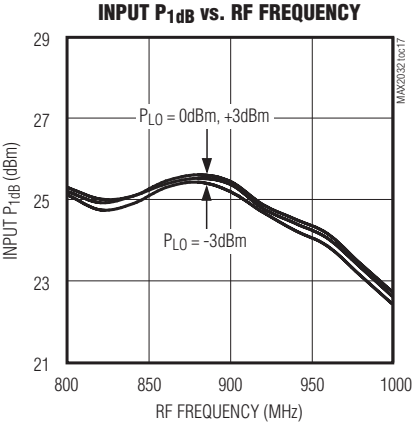
3LO - 3RF RESPONSE vs. RF FREQUENCY



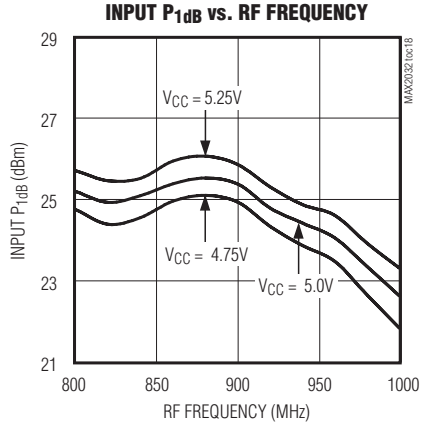
INPUT P_{1dB} vs. RF FREQUENCY



INPUT P_{1dB} vs. RF FREQUENCY



INPUT P_{1dB} vs. RF FREQUENCY

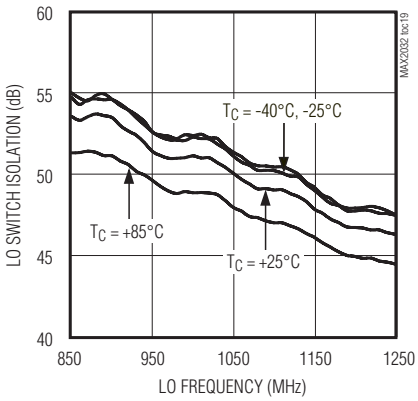


典型工作特性(续)

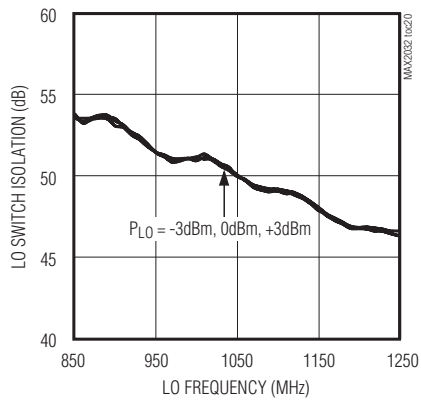
(*Typical Application Circuit*, optimized for the **800MHz/900MHz cellular band (see Table 1)**, C1 = 82pF, C5 = 2pF, L1 and C4 not used, V_{CC} = 5.0V, P_{LO} = 0dBm, P_{RF} = 0dBm, $f_{LO} > f_{RF}$, f_{IF} = 160MHz, T_C = +25°C, unless otherwise noted.)

Downconverter Curves

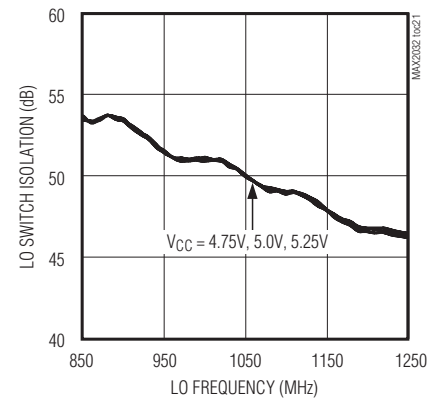
LO SWITCH ISOLATION vs. LO FREQUENCY



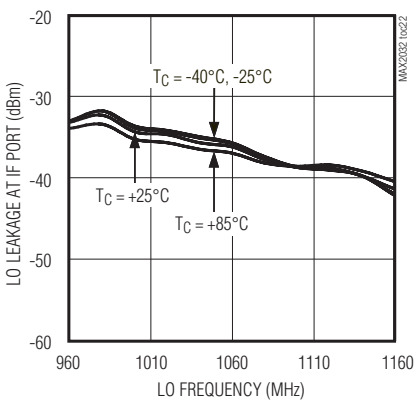
LO SWITCH ISOLATION vs. LO FREQUENCY



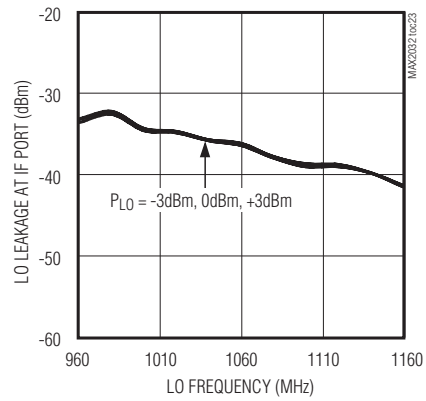
LO SWITCH ISOLATION vs. LO FREQUENCY



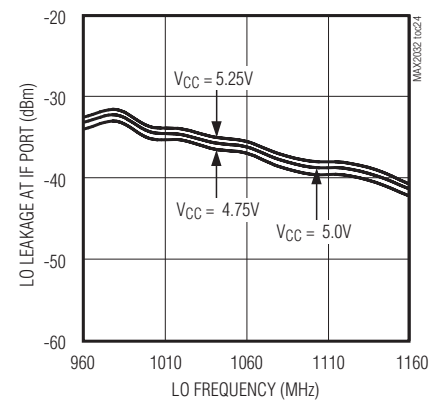
LO LEAKAGE AT IF PORT vs. LO FREQUENCY



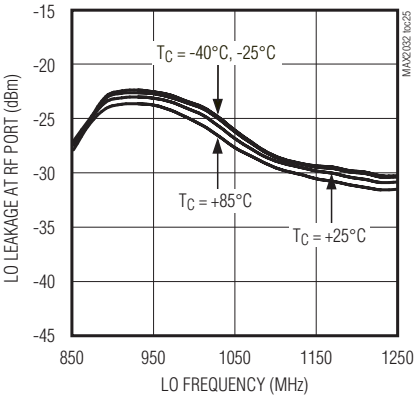
LO LEAKAGE AT IF PORT vs. LO FREQUENCY



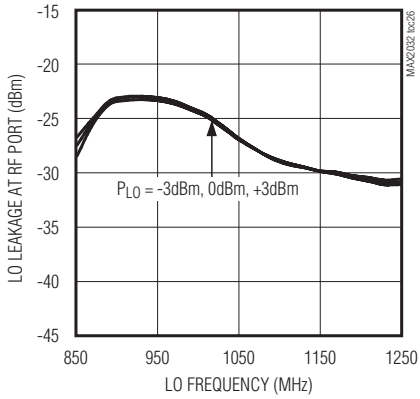
LO LEAKAGE AT IF PORT vs. LO FREQUENCY



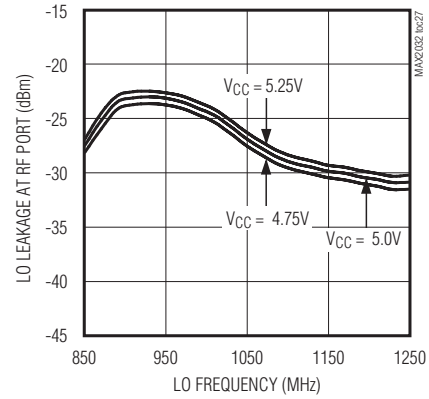
LO LEAKAGE AT RF PORT vs. LO FREQUENCY



LO LEAKAGE AT RF PORT vs. LO FREQUENCY



LO LEAKAGE AT RF PORT vs. LO FREQUENCY



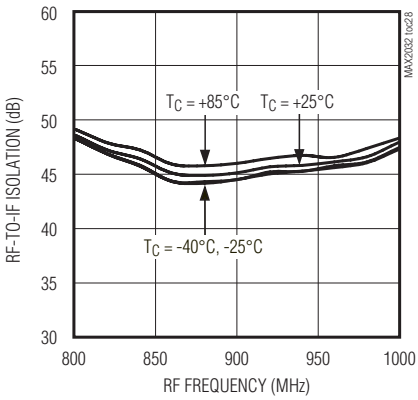
高线性度、650MHz至1000MHz 上变频/下变频混频器，带有LO缓冲器/开关

典型工作特性(续)

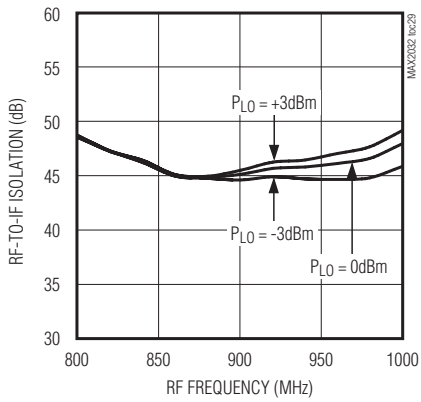
(*Typical Application Circuit*, optimized for the **800MHz/900MHz cellular band (see Table 1)**, C1 = 82pF, C5 = 2pF, L1 and C4 not used, V_{CC} = 5.0V, P_{LO} = 0dBm, P_{RF} = 0dBm, $f_{LO} > f_{RF}$, f_{IF} = 160MHz, T_C = +25°C, unless otherwise noted.)

Downconverter Curves

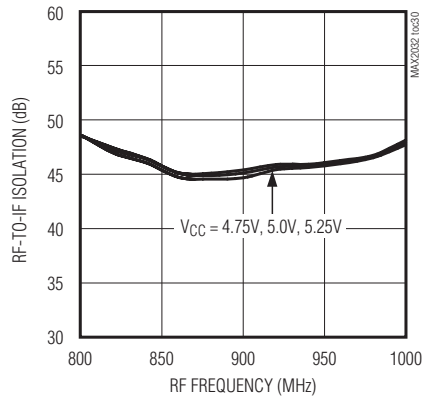
RF-TO-IF ISOLATION vs. RF FREQUENCY



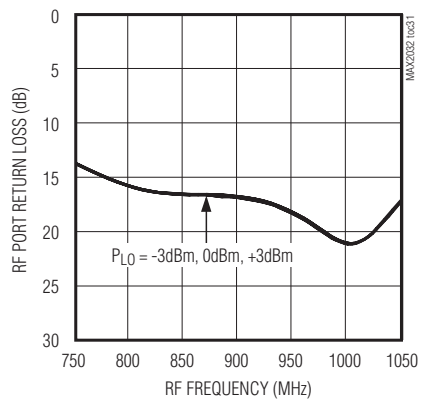
RF-TO-IF ISOLATION vs. RF FREQUENCY



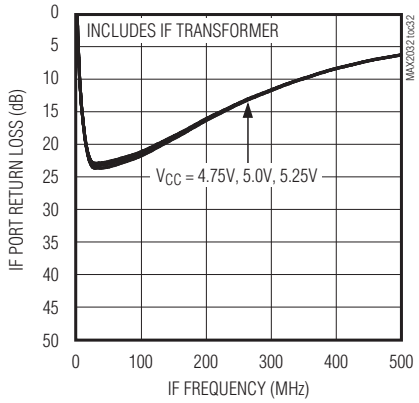
RF-TO-IF ISOLATION vs. RF FREQUENCY



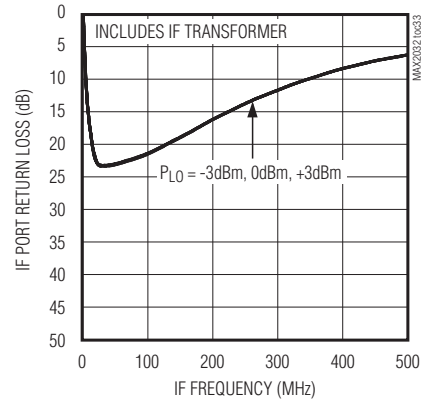
RF PORT RETURN LOSS vs. RF FREQUENCY



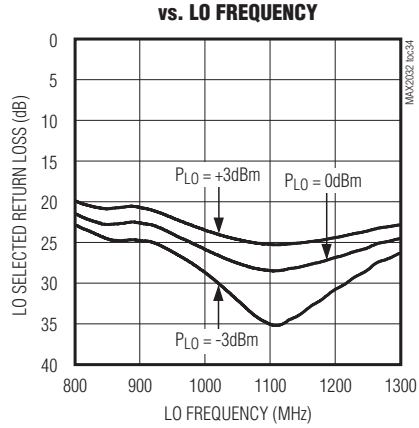
IF PORT RETURN LOSS vs. IF FREQUENCY



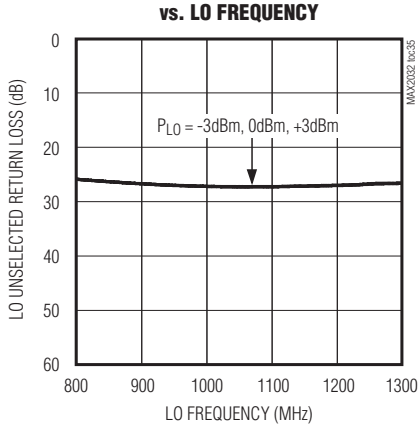
IF PORT RETURN LOSS vs. IF FREQUENCY



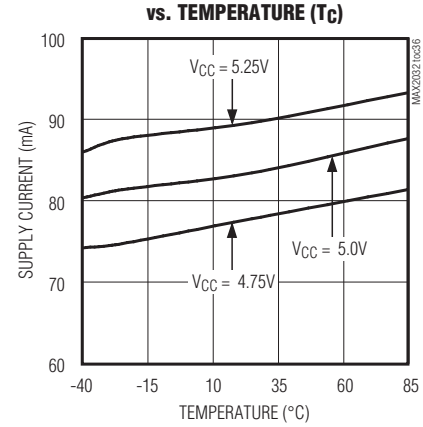
LO SELECTED RETURN LOSS vs. LO FREQUENCY



LO UNSELECTED RETURN LOSS vs. LO FREQUENCY



SUPPLY CURRENT vs. TEMPERATURE (T_C)

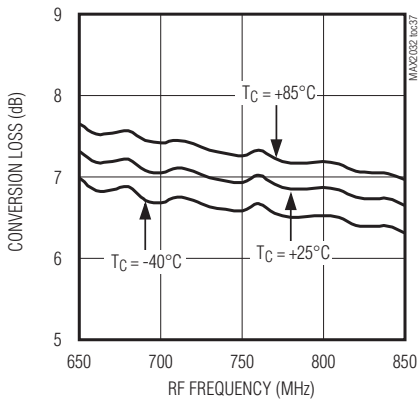


典型工作特性(续)

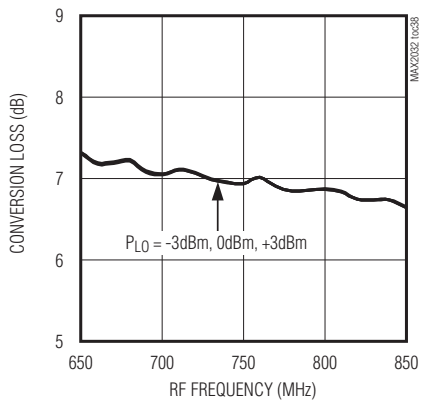
(*Typical Application Circuit,* optimized for the **700MHz band (see Table 1)**, C1 = 7pF, C5 = 3.3pF, L1 and C4 are not used, V_{CC} = 5V, P_{LO} = 0dBm, P_{RF} = 0dBm, $f_{LO} > f_{RF}$, f_{IF} = 140MHz, T_C = +25°C, unless otherwise noted.)

Downconverter Curves

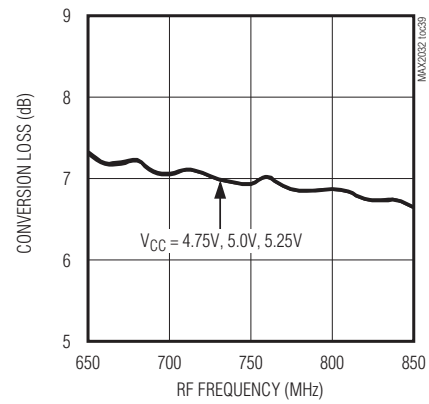
CONVERSION LOSS vs. RF FREQUENCY



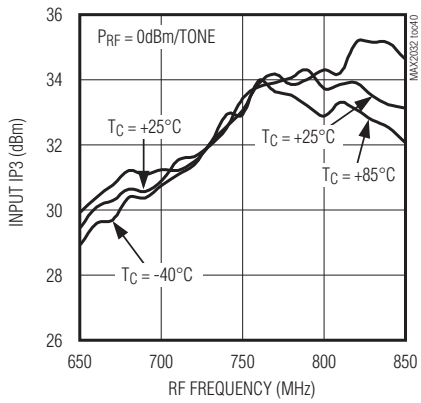
CONVERSION LOSS vs. RF FREQUENCY



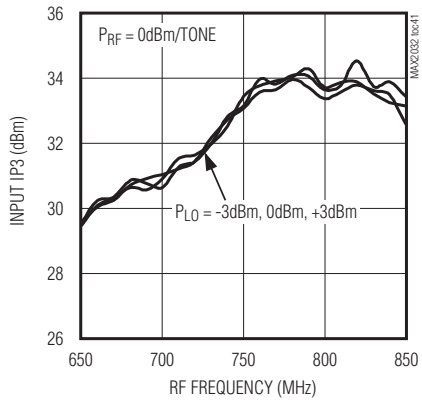
CONVERSION LOSS vs. RF FREQUENCY



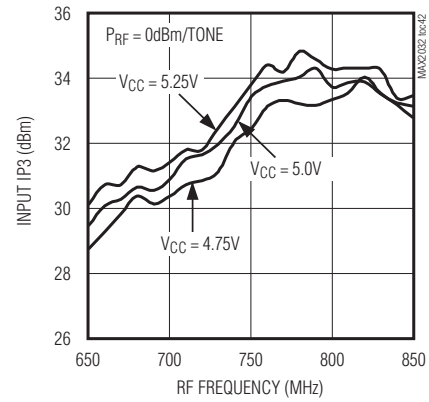
INPUT IP3 vs. RF FREQUENCY



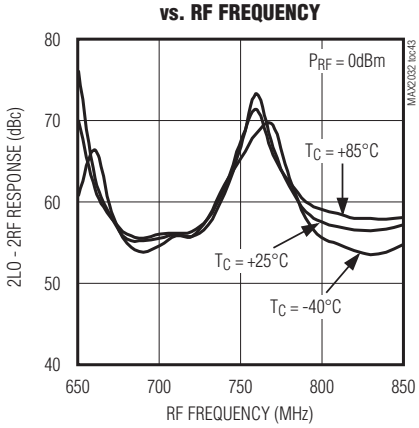
INPUT IP3 vs. RF FREQUENCY



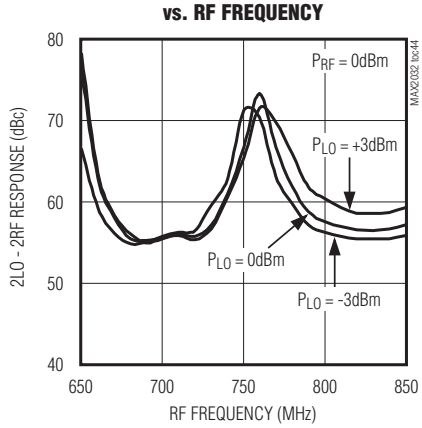
INPUT IP3 vs. RF FREQUENCY



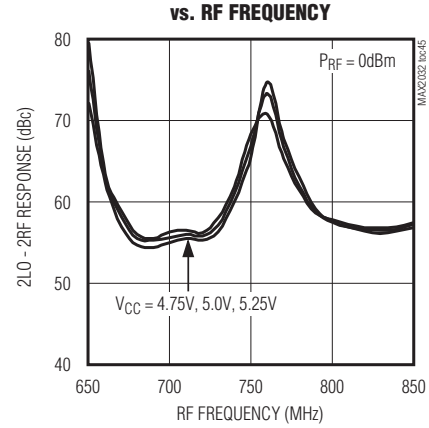
2LO - 2RF RESPONSE vs. RF FREQUENCY



2LO - 2RF RESPONSE vs. RF FREQUENCY



2LO - 2RF RESPONSE vs. RF FREQUENCY



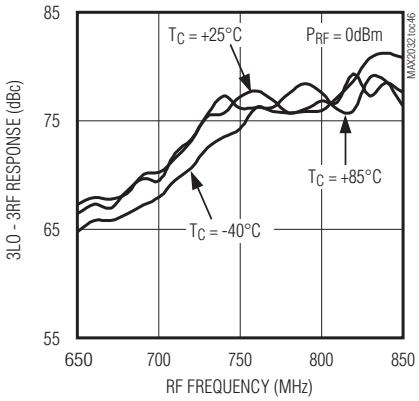
高线性度、650MHz至1000MHz上变频/下变频混频器，带有LO缓冲器/开关

典型工作特性(续)

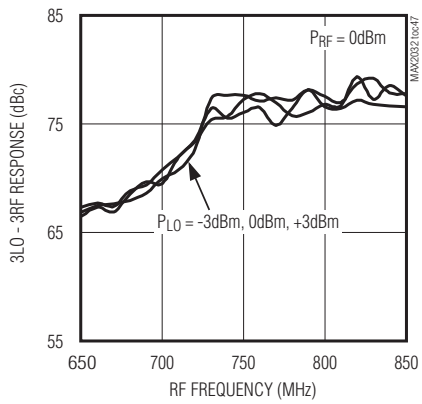
(*Typical Application Circuit,* optimized for the **700MHz band (see Table 1)**, C1 = 7pF, C5 = 3.3pF, L1 and C4 are not used, V_{CC} = 5V, P_{LO} = 0dBm, P_{RF} = 0dBm, $f_{LO} > f_{RF}$, f_{IF} = 140MHz, T_C = +25°C, unless otherwise noted.)

Downconverter Curves

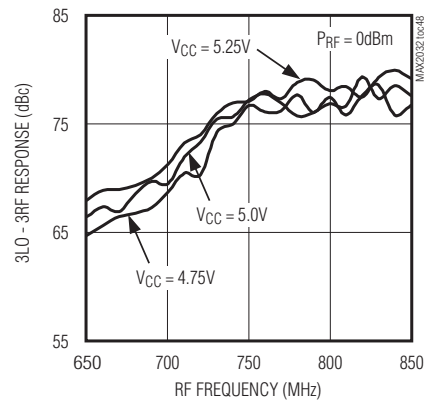
3LO - 3RF RESPONSE vs. RF FREQUENCY



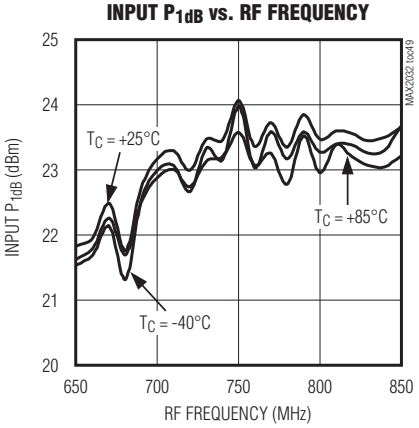
3LO - 3RF RESPONSE vs. RF FREQUENCY



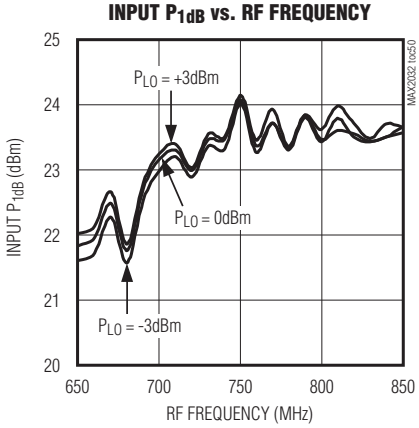
3LO - 3RF RESPONSE vs. RF FREQUENCY



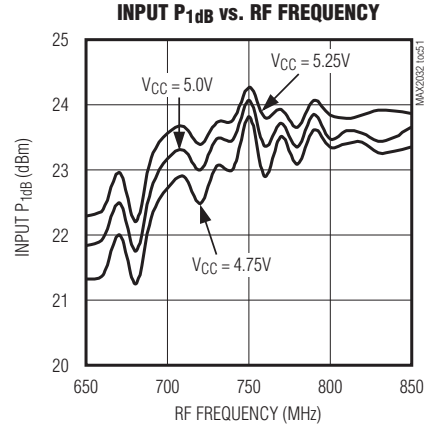
INPUT P_{1dB} vs. RF FREQUENCY



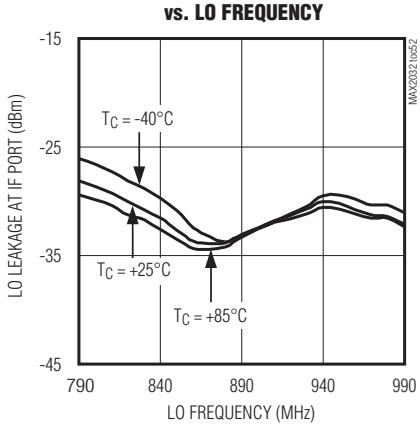
INPUT P_{1dB} vs. RF FREQUENCY



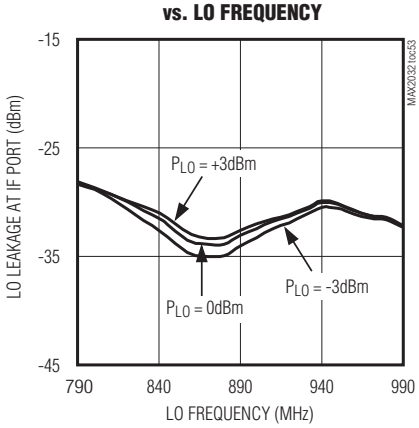
INPUT P_{1dB} vs. RF FREQUENCY



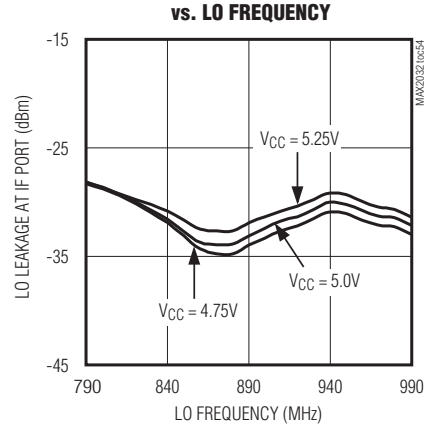
LO LEAKAGE AT IF PORT vs. LO FREQUENCY



LO LEAKAGE AT IF PORT vs. LO FREQUENCY



LO LEAKAGE AT IF PORT vs. LO FREQUENCY

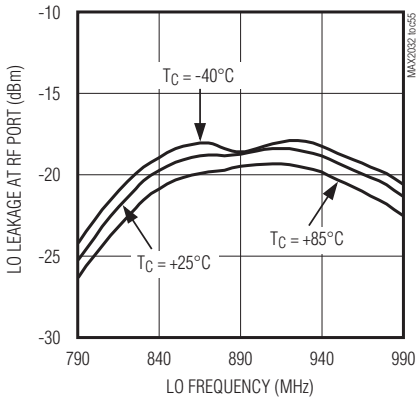


典型工作特性(续)

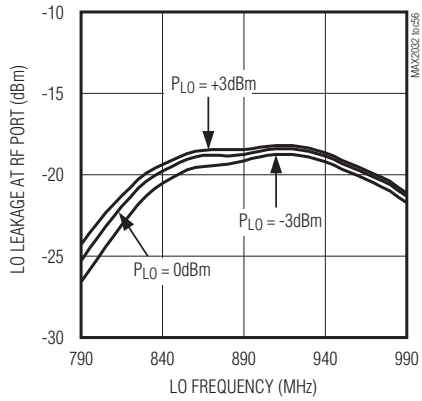
(*Typical Application Circuit,* optimized for the **700MHz band (see Table 1)**, C1 = 7pF, C5 = 3.3pF, L1 and C4 are not used, V_{CC} = 5V, P_{LO} = 0dBm, P_{RF} = 0dBm, $f_{LO} > f_{RF}$, f_{IF} = 140MHz, T_C = +25°C, unless otherwise noted.)

Downconverter Curves

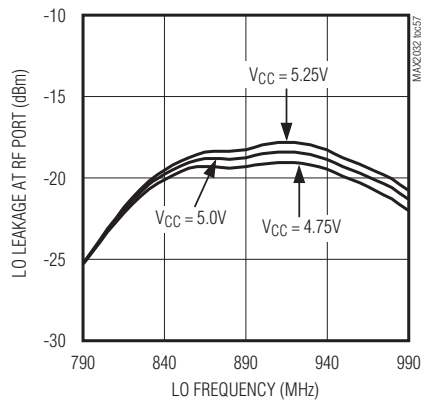
LO LEAKAGE AT RF PORT vs. LO FREQUENCY



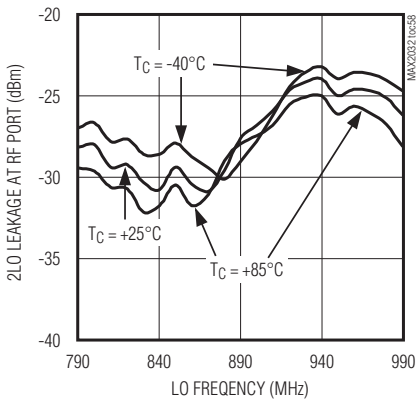
LO LEAKAGE AT RF PORT vs. LO FREQUENCY



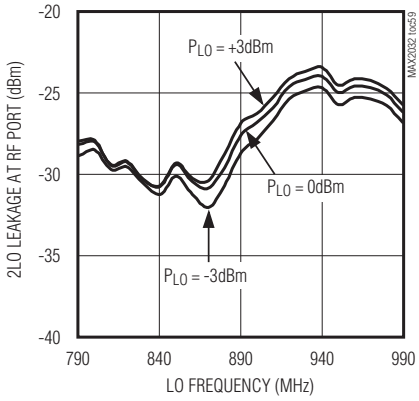
LO LEAKAGE AT RF PORT vs. LO FREQUENCY



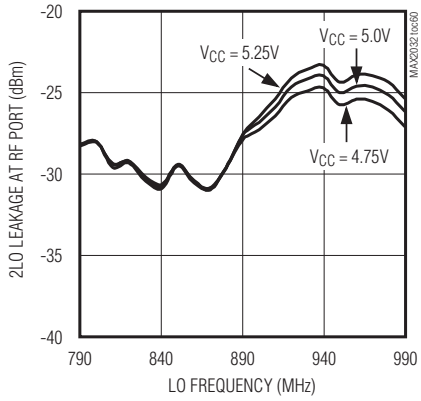
2LO LEAKAGE AT RF PORT vs. LO FREQUENCY



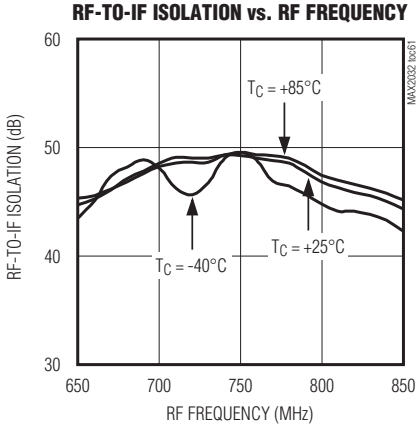
2LO LEAKAGE AT RF PORT vs. LO FREQUENCY



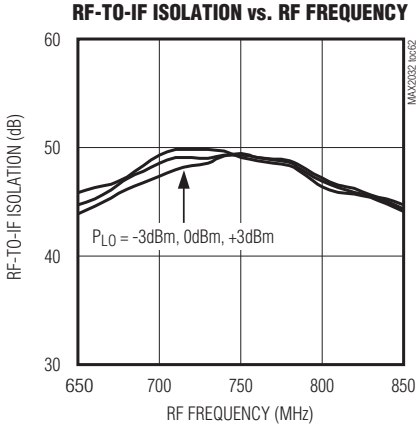
2LO LEAKAGE AT RF PORT vs. LO FREQUENCY



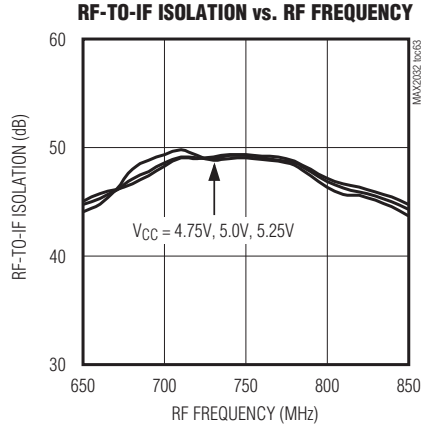
RF-TO-IF ISOLATION vs. RF FREQUENCY



RF-TO-IF ISOLATION vs. RF FREQUENCY



RF-TO-IF ISOLATION vs. RF FREQUENCY

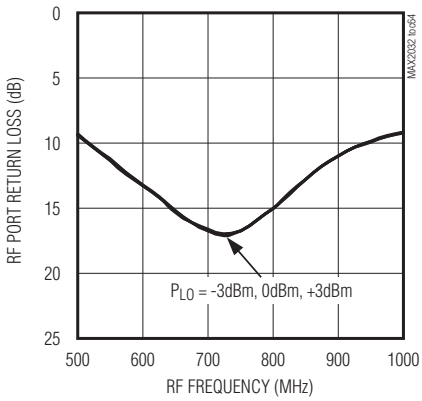


典型工作特性(续)

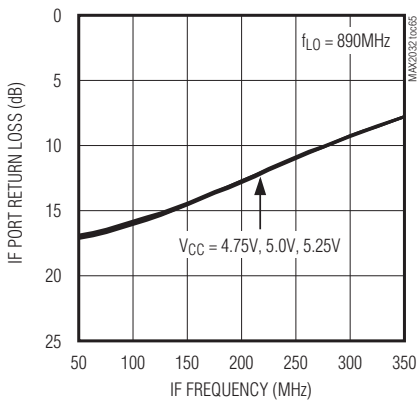
(*Typical Application Circuit,* optimized for the **700MHz band (see Table 1)**, C1 = 7pF, C5 = 3.3pF, L1 and C4 are not used, V_{CC} = 5V, P_{LO} = 0dBm, P_{RF} = 0dBm, $f_{LO} > f_{RF}$, f_{IF} = 140MHz, T_C = +25°C, unless otherwise noted.)

Downconverter Curves

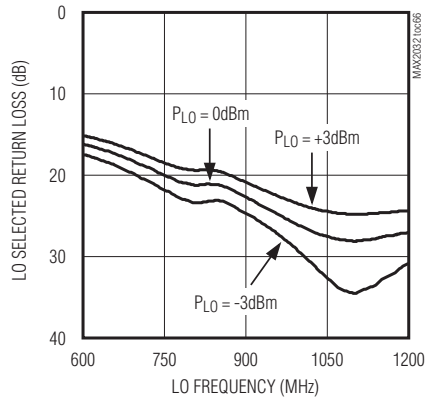
RF PORT RETURN LOSS vs. RF FREQUENCY



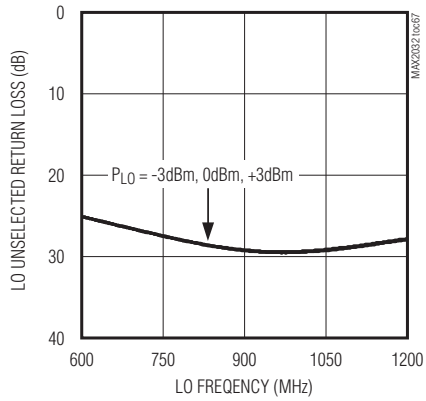
IF PORT RETURN LOSS vs. IF FREQUENCY



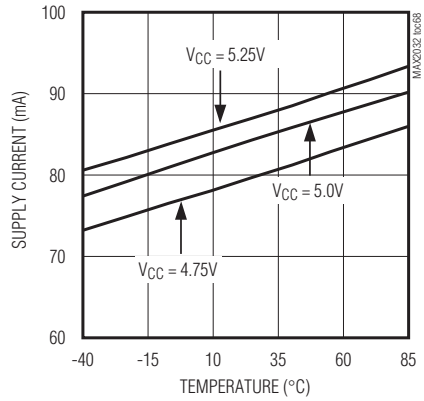
LO SELECTED RETURN LOSS vs. LO FREQUENCY



LO UNSELECTED RETURN LOSS vs. LO FREQUENCY



SUPPLY CURRENT vs. TEMPERATURE (T_C)

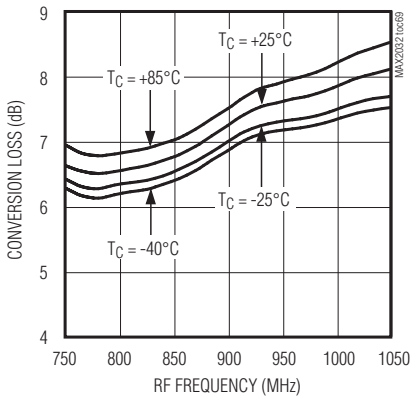


典型工作特性(续)

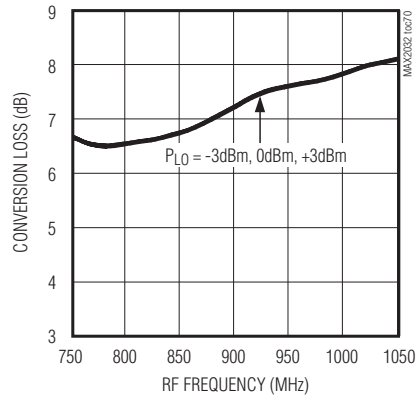
(*Typical Application Circuit*, L1 = 4.7nH, C4 = 6pF, C5 not used, V_{CC} = 5.0V, P_{LO} = 0dBm, P_{IF} = 0dBm, $f_{RF} = f_{LO} + f_{IF}$, f_{IF} = 160MHz, T_C = +25°C, unless otherwise noted.)

Upconverter Curves

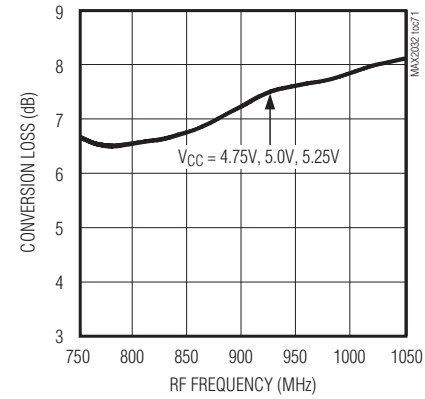
CONVERSION LOSS vs. RF FREQUENCY (L-C BPF TUNED FOR 810MHz RF FREQUENCY)



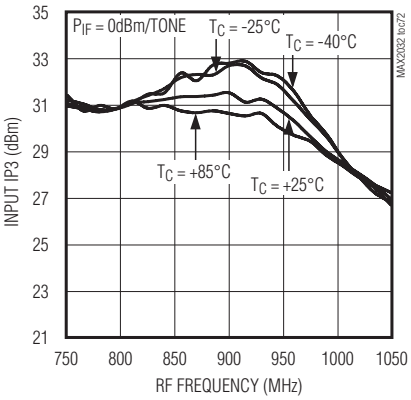
CONVERSION LOSS vs. RF FREQUENCY (L-C BPF TUNED FOR 810MHz RF FREQUENCY)



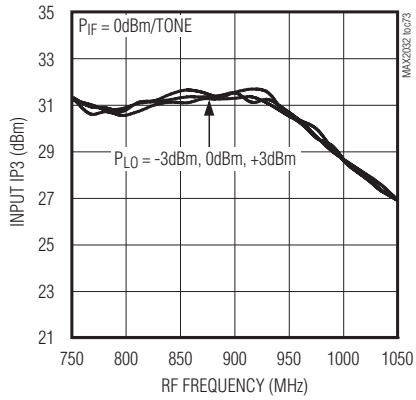
CONVERSION LOSS vs. RF FREQUENCY (L-C BPF TUNED FOR 810MHz RF FREQUENCY)



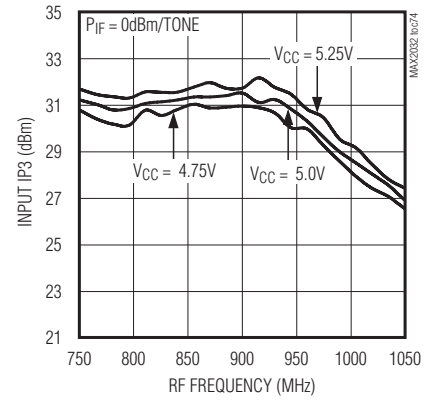
INPUT IP3 vs. RF FREQUENCY (L-C BPF TUNED FOR 810MHz RF FREQUENCY)



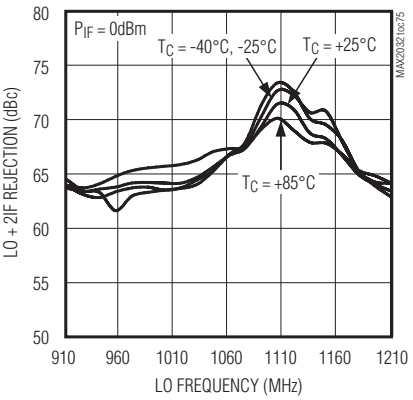
INPUT IP3 vs. RF FREQUENCY (L-C BPF TUNED FOR 810MHz RF FREQUENCY)



INPUT IP3 vs. RF FREQUENCY (L-C BPF TUNED FOR 810MHz RF FREQUENCY)



LO + 2IF REJECTION vs. LO FREQUENCY (L-C BPF TUNED FOR 810MHz RF FREQUENCY)



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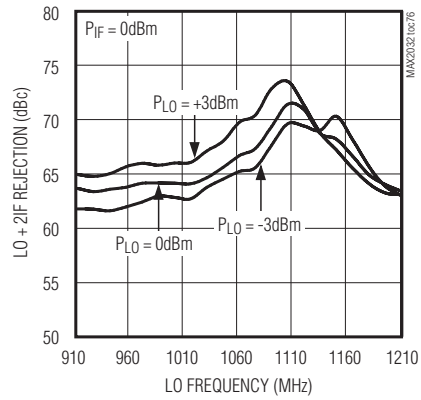

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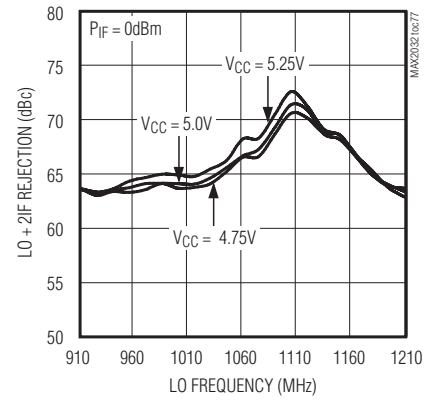


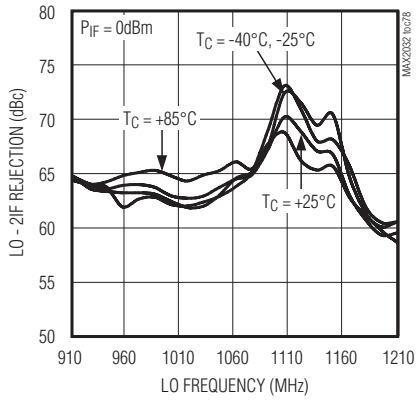
高线性度、650MHz至1000MHz 上变频/下变频混频器，带有LO缓冲器/开关

典型工作特性(续)

(*Typical Application Circuit*, L1 = 4.7nH, C4 = 6pF, C5 not used, V_{CC} = 5.0V, P_{LO} = 0dBm, P_{IF} = 0dBm, $f_{RF} = f_{LO} + f_{IF}$, f_{IF} = 160MHz, T_C = +25°C, unless otherwise noted.)

Upconverter Curves

LO - 2IF REJECTION vs. LO FREQUENCY (L-C BPF TUNED FOR 810MHz RF FREQUENCY)



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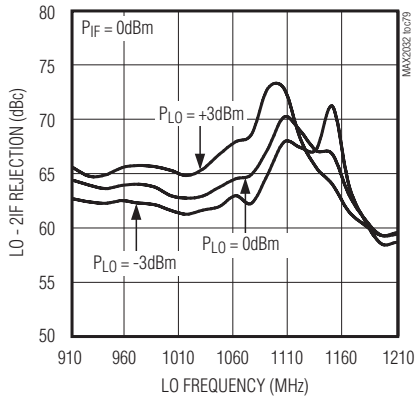

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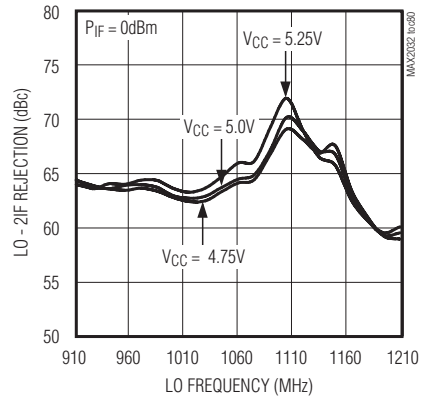

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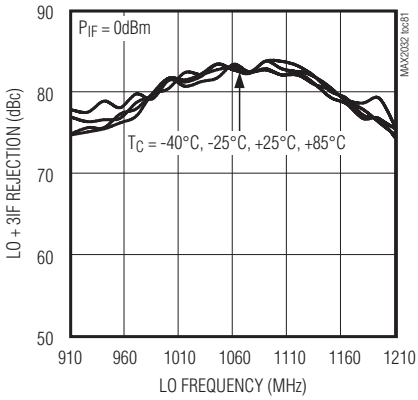

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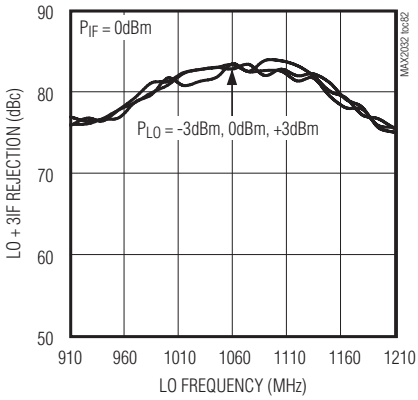

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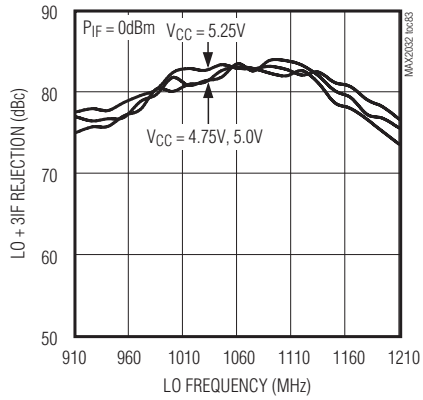

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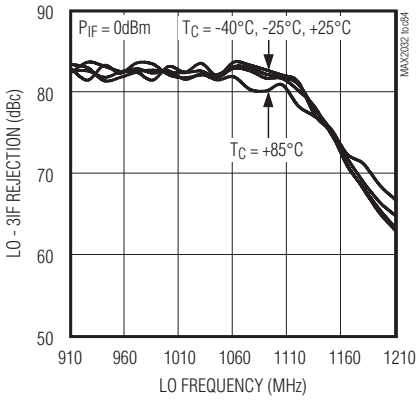

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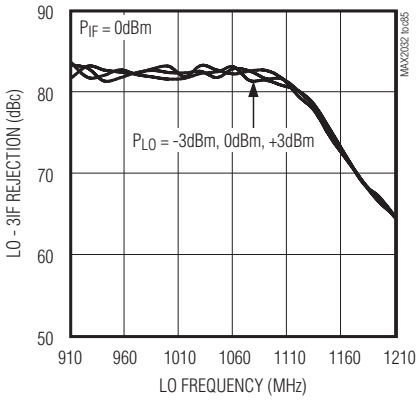

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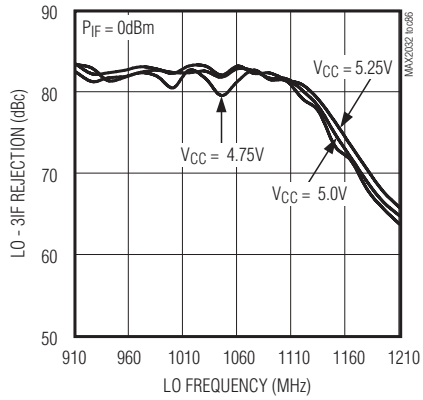
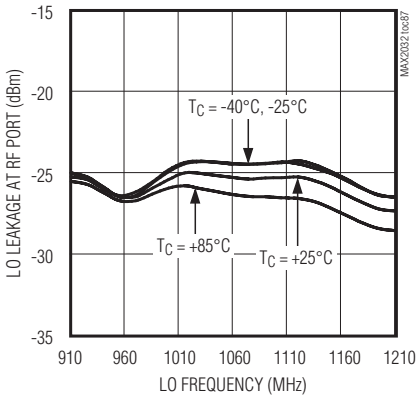


典型工作特性(续)

(*Typical Application Circuit*, L1 = 4.7nH, C4 = 6pF, C5 not used, V_{CC} = 5.0V, P_{LO} = 0dBm, P_{IF} = 0dBm, $f_{RF} = f_{LO} + f_{IF}$, f_{IF} = 160MHz, T_C = +25°C, unless otherwise noted.)

Upconverter Curves

LO LEAKAGE AT RF PORT vs. LO FREQUENCY (L-C BPF TUNED FOR 810MHz RF FREQUENCY)



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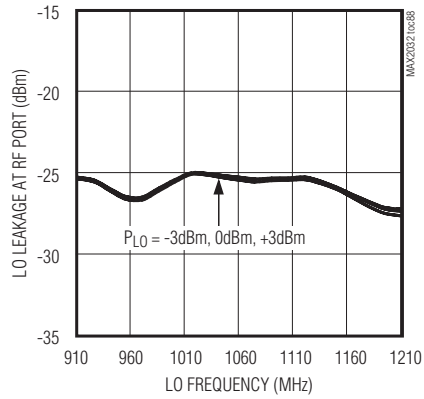
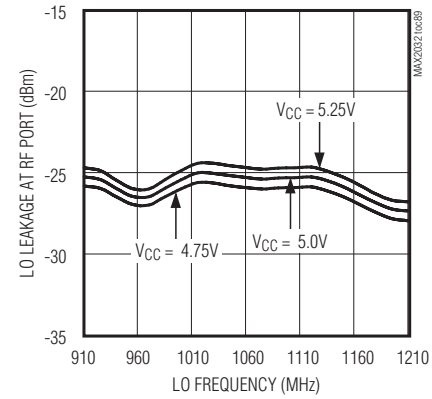
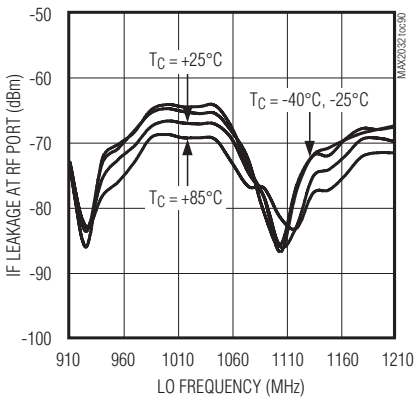


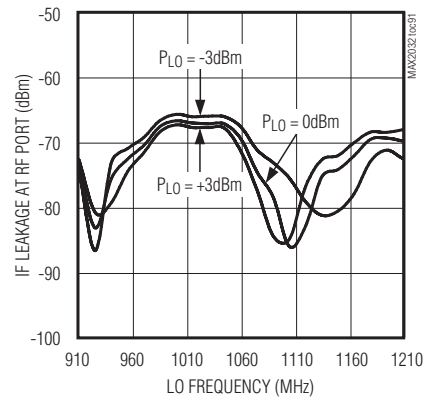
LO LEAKAGE AT RF PORT vs. LO FREQUENCY (L-C BPF TUNED FOR 810MHz RF FREQUENCY)



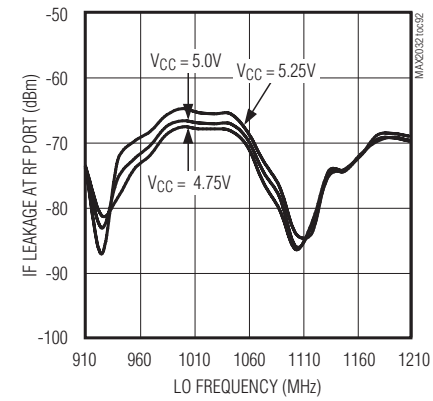
IF LEAKAGE AT RF PORT vs. LO FREQUENCY (L-C BPF TUNED FOR 810MHz RF FREQUENCY)



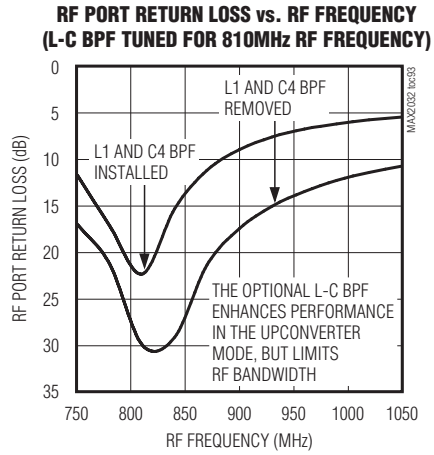
IF LEAKAGE AT RF PORT vs. LO FREQUENCY (L-C BPF TUNED FOR 810MHz RF FREQUENCY)



IF LEAKAGE AT RF PORT vs. LO FREQUENCY (L-C BPF TUNED FOR 810MHz RF FREQUENCY)



RF PORT RETURN LOSS vs. RF FREQUENCY (L-C BPF TUNED FOR 810MHz RF FREQUENCY)



高线性度、650MHz至1000MHz上变频/下变频混频器，带有LO缓冲器/开关

引脚说明

引脚	名称	功能
1, 6, 8, 14	V_{CC}	电源，将每个V_{CC}引脚都通过电容旁路到GND，如*典型应用电路*所示。
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路到GND。
3	TAP	内部RF非平衡变压器的中心抽头，连接至地。
4, 5, 10, 12, 13, 16, 17, 20	GND	地。
7	LOBIAS	内部LO缓冲器的偏置电阻，在LOBIAS与电源之间接一个523Ω ±1%的电阻。
9	LOSEL	本地振荡器选择，通过逻辑控制输入选择LO1或LO2。
11	LO1	本地振荡器输入1，将LOSEL驱动至低电平选择LO1。
15	LO2	本地振荡器输入2，将LOSEL驱动至高电平选择LO2。
18, 19	IF-, IF+	差分IF输入/输出。
—	EP	裸焊盘，内部连接到GND。该裸焊盘通过多个接地过孔焊接到PCB焊盘，以改善器件到PCB地平面的散热。多个接地过孔还有助于改善RF性能。

详细说明

MAX2032可作为下变频混频器或上变频混频器使用，提供大约7dB的变频损耗，噪声系数典型值为7dB。工作在下变频和上变频模式时，相应的IIP3分别为+33dBm和+31dBm。集成非平衡变压器和匹配电路允许RF端口和两个LO端口进行50Ω单端连接。RF端口可作为下变频器的输入或上变频器的输出。单刀双掷(SPDT)开关在两个LO输入之间切换时具有50ns的开关时间，LO之间的隔离度为49dB。此外，集成LO缓冲器可为混频器核提供高驱动电平，将MAX2032输入所需的LO驱动减小到-3dBm至+3dBm。下变频时，IF端口具有差分输出，可理想改善IIP2性能；上变频时，IF端口作为差分输入。

器件能够保证在较宽的频率范围内符合规范要求，可广泛地用于WCDMA、cdmaOne™、cdma2000和GSM 850/GSM 900 2.5G EDGE基站。MAX2032工作在650MHz至1000MHz的RF频率范围、650MHz至1250MHz的LO频率范围、以及直流至250MHz的IF频率范围。器件也可工作在上述频率范围之外，详细信息请参见*典型工作特性*。

MAX2032优化工作于高端LO注入结构，器件也可以工作在低端LO注入，具有扩展的LO范围，但其性能会随着f_{LO}的下降而降低。*典型工作特性*中给出了f_{LO}低于960MHz时的测试结果。关于针对LO频率低于960MHz而优化的引脚兼容器件，请参考MAX2029。

RF端口和非平衡变压器

当MAX2032作为下变频器使用时，RF输入端内部匹配至50Ω，无需外部匹配元件。由于输入端口通过内部非平衡变压器直流短路到地，所以需要隔直流电容。作为上变频器使用时，RF端口作为单端输出同样匹配至50Ω。

LO输入、缓冲器和非平衡变压器

MAX2032针对650MHz至1250MHz LO频率范围的高端LO注入结构进行了优化。对于LO频率范围为570MHz至900MHz的器件，请参考MAX2029。MAX2032还包括内部LO SPDT开关，这一附加功能使其能够用于跳频设计。该开关用来选择两个单端LO端口，允许外部振荡器在开关接通之前建立在特定频率上。LO开关时间典型值小于50ns，能够满足几乎所有的GSM应用要求。如果不使用跳频功能，将开关设置到任意一个LO输入。该开关由数字输入(LOSEL)控制：数字输入为逻辑高电平时，选中LO2；为逻辑低电平时，选中LO1。为避免这部分电路损坏，在给LOSEL施加数字逻辑电平之前，**必须**先给V_{CC}加电(参见*Absolute Maximum Ratings*)。LO1和LO2输入内部匹配至50Ω，每个输入端需接一只82pF的隔直电容。

cdmaOne是CDMA Development Group的商标。

高线性度、650MHz至1000MHz上变频/下变频混频器，带有LO缓冲器/开关

两级内部LO缓冲器为LO驱动提供很宽的输入功率范围。所有指标均规定于-3dBm至+3dBm LO信号功率条件下。片上低损耗非平衡变压器和LO缓冲器共同驱动双平衡混频器。LO输入至IF输出之间的接口和匹配元件均已集成在芯片内部。

高线性度混频器

MAX2032的核心是一个双平衡、高性能的无源混频器。内部LO缓冲器输出具有较高的LO摆幅，提供出色的线性度。

差分IF

MAX2032混频器的IF频率范围为直流至250MHz。这些差分端口对于提供增强的IIP2性能非常有效。单端IF应用需要一个1:1非平衡变压器将IF 50Ω差分阻抗转化为50Ω单端阻抗。经过非平衡变压器转换之后，IF回波损耗优于15dB。用作上变频器时，差分IF作为输入端口。用户可在混频器之后接一个差分IF放大器，但此时两个IF引脚需要隔直流。

应用信息

输入和输出匹配

RF和LO输入端内部匹配至50Ω，无需外接匹配元件。用作下变频器时，在整个输入范围(650MHz至1000MHz)内，RF端口的典型回波损耗优于15dB；LO端口的典型回波损耗为15dB (960MHz至1180MHz)。RF和LO输入端只需要连接隔直流电容(如表1所示)。

可以选择在RF端口安装L-C带通滤波器(BPF)，以提高上变频转换性能。*典型应用电路*和*典型工作特性*中提供了配合调谐在810MHz RF频率的L-C BPF工作时，上变频器的工作状况。选择不同的L1和C4，可以针对其它频率优化工作性能。移除L1和C4可以获得更宽的匹配范围，但会降低性能指标，详细信息请联系工厂。

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为50Ω单端输出(参见*典型应用电路*)。

表1. 典型应用电路元件列表

DESIGNATION	QTY	DESCRIPTION	SUPPLIER
C1	1	82pF microwave capacitor (0603). Use for **800MHz/ 900MHz cellular band** applications.	Murata Electronics North America, Inc.
		7pF microwave capacitor (0603). Use for **700MHz band** applications.	
C2, C7, C8, C10, C11, C12	6	82pF microwave capacitors (0603)	Murata Electronics North America, Inc.
C3, C6, C9	3	0.01µF microwave capacitors (0603)	Murata Electronics North America, Inc.
C4*	1	6pF microwave capacitor (0603)	—
C5**	1	2pF microwave capacitor (0603). Use for **800MHz/ 900MHz cellular band** applications.	Murata Electronics North America, Inc.
		3.3pF microwave capacitor (0603). Use for **700MHz band** applications.	
L1*	1	4.7nH inductor (0603)	—
R1	1	523Ω ±1% resistor (0603)	Digi-Key Corp.
T1	1	MABAES0029 1:1 transformer (50:50)	M/A-Com, Inc.
U1	1	MAX2032 IC (20 TQFN)	Maxim Integrated Products, Inc.

** 仅在混频器用作上变频器时安装C4和L1。*

*** 仅在混频器用作下变频器时安装C5。*

高线性度、650MHz至1000MHz上变频/下变频混频器，带有LO缓冲器/开关

偏置电阻

LO缓冲器的偏置电流可以通过微调电阻R1进行优化。如果需要以降低性能为代价来降低电流，请与工厂联系获得详细信息。如果很难找到±1%的偏置电阻，可以用±5%的标准电阻代替。

布局考虑

设计合理的PCB是RF/微波电路的基本要求，需保证RF信号线尽可能短，以减小损耗、辐射和电感。为获得最佳性能，将接地引脚直接连接到封装底部的裸焊盘，PCB的裸焊盘**必须**连接至PCB的地层。连接裸焊盘至地层时，推荐使用多个过孔。这种方法为器件提供了良好的RF/导热路径，将器件封装背面的裸焊盘焊接至PCB。电路板布局可以参考MAX2032评估板，Gerber文件可在china.maxim-ic.com申请得到。

电源旁路

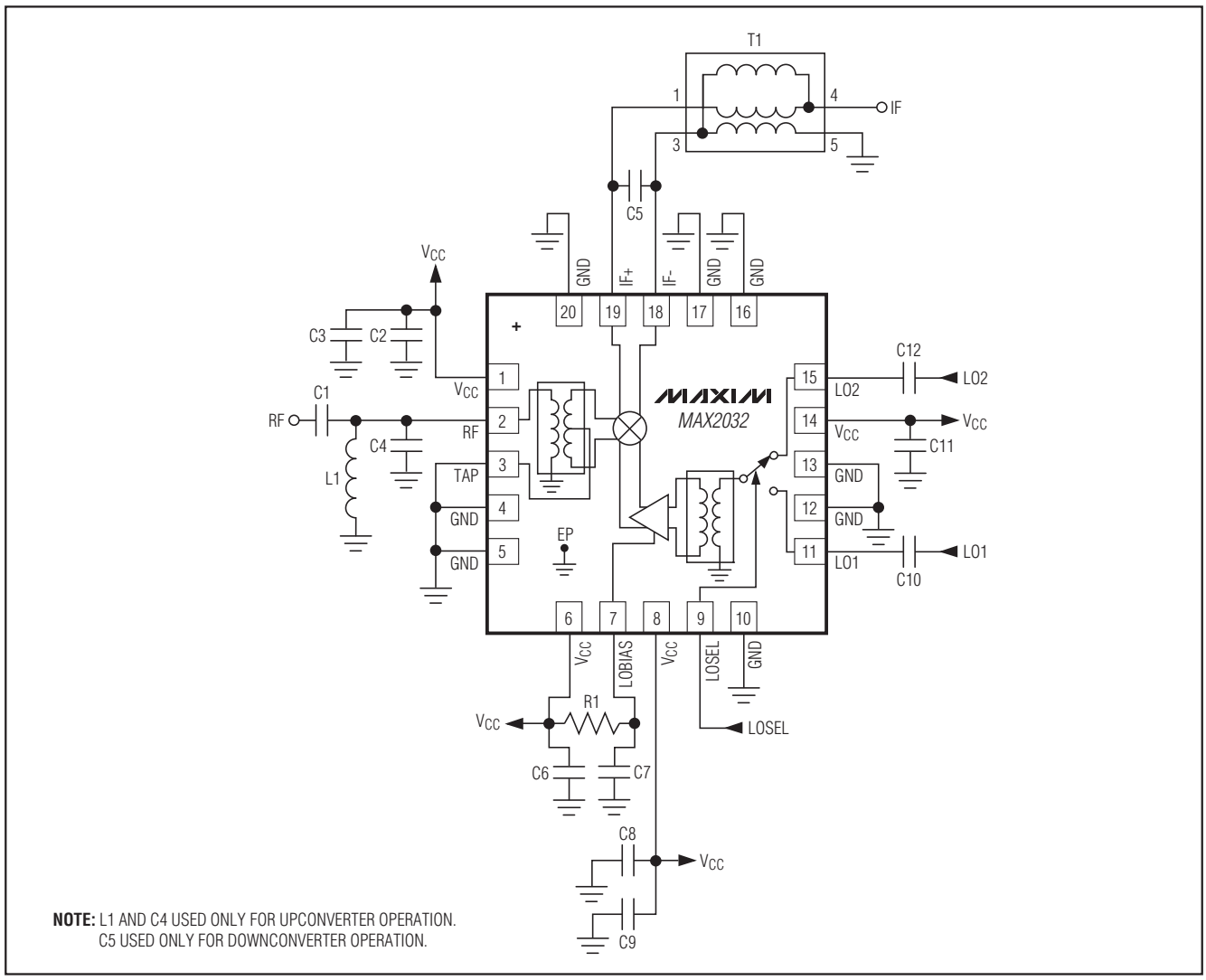
合理的电源旁路对高频电路的稳定性至关重要。用电容旁路每一个V_{CC}引脚，如*典型应用电路*所示，并参考表1。

裸焊盘RF/散热考虑

MAX2032 20引脚薄型QFN-EP封装的裸焊盘(EP)提供了一条连接至管芯的低热阻通路。在安装MAX2032的PCB与EP之间保持良好的热传递通道非常重要。此外，EP与电气地之间还提供了一条低电感通路。EP**必须**直接或通过一系列电镀过孔焊接至PCB的地层。

高线性度、650MHz至1000MHz上变频/下变频混频器，带有LO缓冲器/开关

典型应用电路



NOTE: L1 AND C4 USED ONLY FOR UPCONVERTER OPERATION.
C5 USED ONLY FOR DOWNCONVERTER OPERATION.

芯片信息

PROCESS: SiGe BiCMOS

封装信息

如需最近的封装外形信息和焊盘布局，请查询 **china.maxim-ic.com/packages**。请注意，封装编码中的“+”、“#”或“-”仅表示RoHS状态。封装图中可能包含不同的尾缀字符，但封装图只与封装有关，与RoHS状态无关。

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