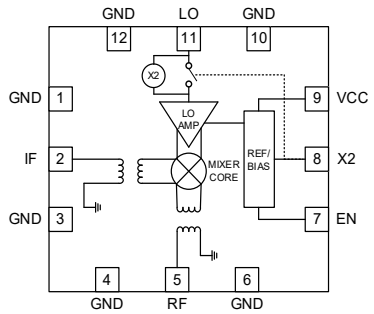
性能特点

- 上变频/下变频
- 变频损耗：8.7dB@RFin=5.8GHz
- 输入P1dB：18dBm@RFin=5.8GHz
- 输入IP3：26.5dBm@RFin=5.8GHz
- 封装尺寸：QFN 2*3 12L

典型应用

- 微波收发器
- 点对点微波
- 相控阵天线
- S、C、X波段雷达
- 测试设备

功能框图



概述

SIM287ZSP23是一款通用型无源双平衡可用于上/下变频的混频器。RF端口设计用于2GHz至14GHz频段，IF端口针对500MHz优化至6GHz工作频率。集成LO缓冲放大器支持LO频率范围为1GHz至12GHz，仅需0dBmLO功率，通过控制X2引脚可实现LO倍频功能。该SIM287ZSP23提供高IIP3和输入P1dB，且SIM287ZSP23的高集成度可以降低系统方案成本。

SIM287ZSP23	芯片内部集成IF巴伦
SIM295ZSP23	IF单端应用时，芯片需外置IF巴伦

AC 电性能表（TA=25℃）

参数	描述	最小值	典型值	最大值	单位
RF频率范围		2		14	GHz
IF频率范围		0.5		6	GHz
LO频率范围 *	En=High X2=Low	1		12	GHz
	En=X2=High	1		5	GHz
RF回波损耗			15		dB
LO回波损耗			15		dB
IF回波损耗			12		dB
LO功率范围*	En=High X2=Low	-6	0	6	dBm
	En=X2=High	-6	0	3	dBm

* X2=Low，LO倍频关闭；X2=High，LO倍频开启

DC 电性能表（TA=25℃）

参数	描述	最小值	典型值	最大值	单位
工作电压	VCC	3.0	3.3	3.6	V
EN和X2逻辑输入	高电平（开启）	1.2			V
	低电平（禁用）			0.3	V
工作电流	En=High X2=Low		107		mA
	En=X2=High		113		mA
	En=Low			100	μA

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下变频电性能表（TA=25°C, PRF=-5dBm, PLO=0dBm, VCC=3.3V, EN=High, X2=Low）

参数指标	描述	最小值	典型值	最大值	单位
变频损耗	RF Input=2GHz, LO=3.89GHz		8.4		dB
	RF Input=5.8GHz, LO=3.91GHz		8.8		dB
	RF Input=9GHz, LO=7.11GHz		10		dB
	RF Input=12GHz, LO=10.11GHz		11.7		dB
输入P1dB	RF Input=5.8GHz, LO=3.91GHz		18		dBm
输入IP3 Pin=-5dBm/tone for twotone, Δf=2MHz	RF Input=2GHz, LO=3.89GHz		23		dBm
	RF Input=5.8GHz, LO=3.91GHz		25.5		dBm
	RF Input=9GHz, LO=7.11GHz		21.8		dBm
	RF Input=12GHz, LO=10.11GHz		19.5		dBm
隔离度	LO-RF		55		dB
	LO-IF		40		dB
	RF-IF		45		dB

下变频电性能表（TA=25°C, PRF=-5dBm, PLO=0dBm, VCC=3.3V, EN=High, X2=High）

参数指标	描述	最小值	典型值	最大值	单位
变频损耗	RF Input=5.8GHz, LO=1.955GHz		8.8		dB
	RF Input=9GHz, LO=3.555GHz		10		dB
	RF Input=12GHz, LO=5.055GHz		12.5		dB
输入P1dB	RF Input=5.8GHz, LO=1.955GHz		18		dBm
输入IP3 Pin=-5dBm/tone for twotone, Δf=2MHz	RF Input=5.8GHz, LO=1.955GHz		25.2		dBm
	RF Input=9GHz, LO=3.555GHz		20.8		dBm
	RF Input=12GHz, LO=5.055GHz		16.5		dBm
隔离度	2LO-RF		50		dB
	2LO-IF		55		dB
	RF-IF		45		dB

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上变频电性能表（TA=25℃, PIF=-5dBm, PLO=0dBm, VCC=3.3V, EN=High, X2=Low）

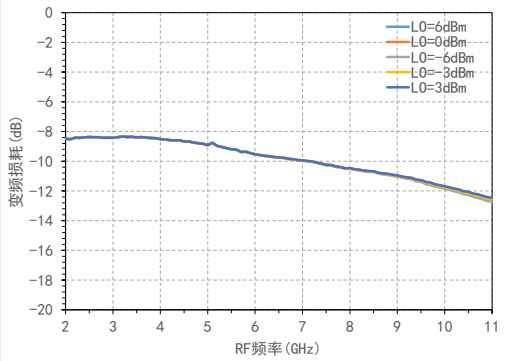
参数指标	描述	最小值	典型值	最大值	单位
变频损耗	RF Output=2GHz, LO=3.89GHz		8.5		dB
	RF Output=5.8GHz, LO=3.91GHz		8.7		dB
	RF Output=9GHz, LO=7.11GHz		9.9		dB
	RF Output=12GHz, LO=10.11GHz		11.4		dB
输入P1dB	RF Output=5.8GHz, LO=3.91GHz		18		dBm
输入IP3 Pin=-5dBm/tone for twotone, Δf=2MHz	RF Output=2GHz, LO=3.89GHz		25		dBm
	RF Output=5.8GHz, LO=3.91GHz		26.5		dBm
	RF Output=9GHz, LO=7.11GHz		21.2		dBm
	RF Output=12GHz, LO=10.11GHz		17.9		dBm
隔离度	LO-RF		55		dB
	LO-IF		40		dB
	RF-IF		45		dB

上变频电性能表（TA=25℃, PIF=-5dBm, PLO=0dBm, VCC=3.3V, EN=High, X2=High）

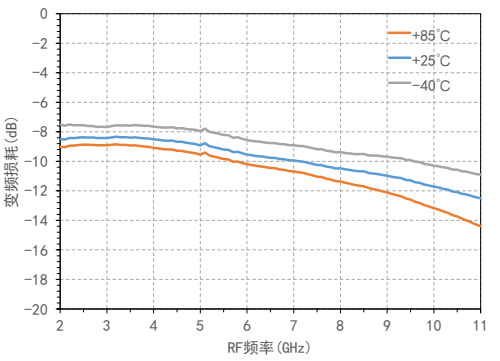
参数指标	描述	最小值	典型值	最大值	单位
变频损耗	RF Output=5.8GHz, LO=1.955GHz		8.8		dB
	RF Output=9GHz, LO=3.555GHz		10		dB
	RF Output=12GHz, LO=5.055GHz		12.3		dB
输入P1dB	RF Output=5.8GHz, LO=1.955GHz		18		dBm
输入IP3 Pin=-5dBm/tone for twotone, Δf=2MHz	RF Output=5.8GHz, LO=1.955GHz		26.5		dBm
	RF Output=9GHz, LO=3.555GHz		20.6		dBm
	RF Output=12GHz, LO=5.055GHz		15		dBm
隔离度	2LO-RF		50		dB
	2LO-IF		55		dB
	RF-IF		45		dB

下变频测试曲线（IF=1.89GHz, VCC=3.3V, EN =High, X2=Low, PRF=-5dBm, LSB）

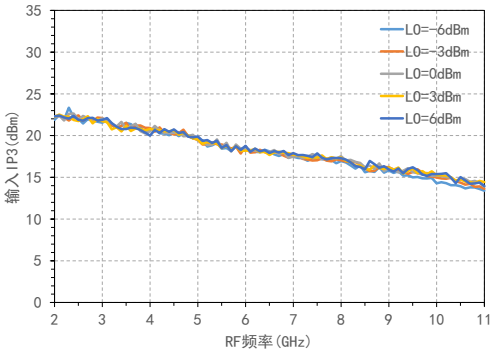
变频损耗 VS 频率@LO功率



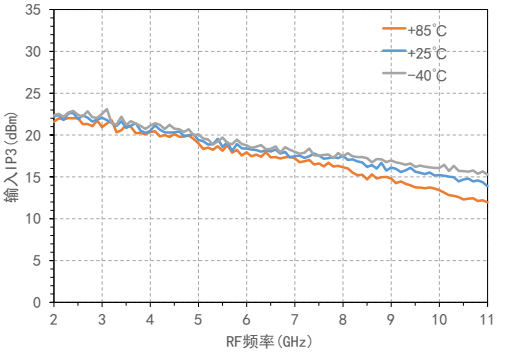
变频损耗 VS 频率@温度（LO=0dBm）



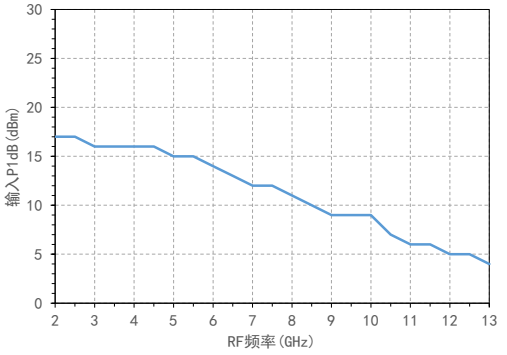
输入IP3 VS 频率@LO功率



输入IP3 VS 频率@温度（LO=0dBm）



输入P1dB VS 频率@LO功率（LO=0dBm）



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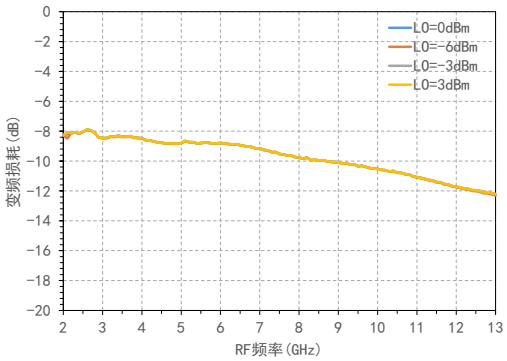
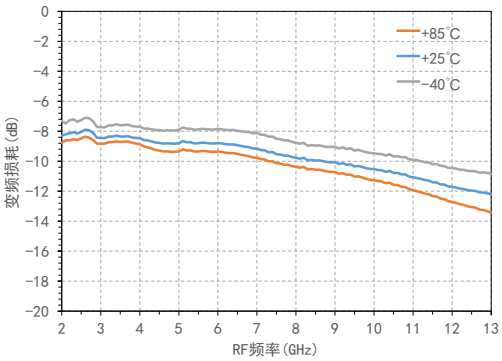
下变频测试曲线（IF=1.89GHz, VCC=3.3V, EN =High, X2=Low, PRF=-5dBm, USB）

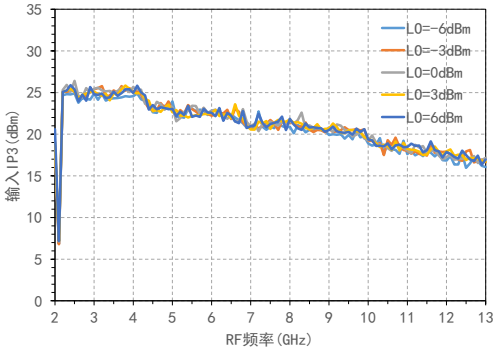
变频损耗 VS 频率@LO功率



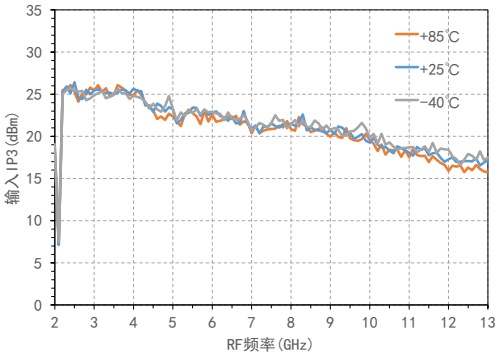
变频损耗 VS 频率@温度（LO=0dBm）



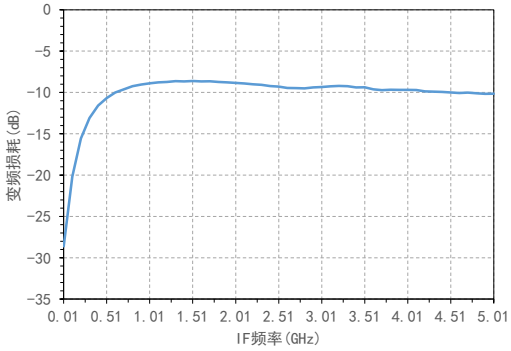
输入IP3 VS 频率@LO功率



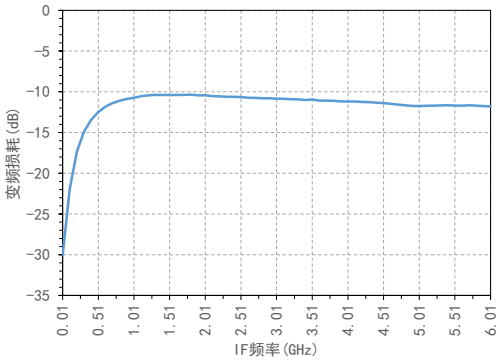
输入IP3 VS 频率@温度（LO=0dBm）



中频变频损耗 VS 频率（RF=5.8GHz）

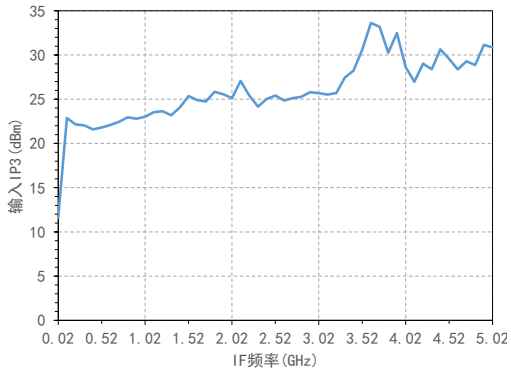


中频变频损耗 VS 频率（RF=9.8GHz）

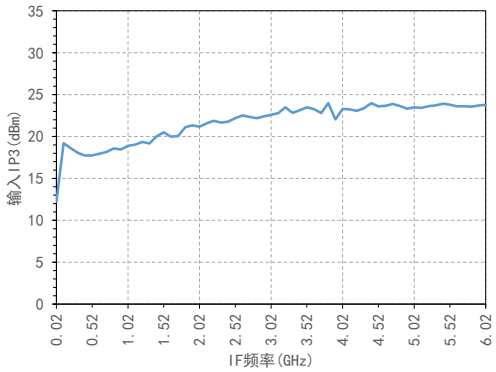


下变频测试曲线（IF=1.89GHz, VCC=3.3V, EN =High, X2=Low, PRF=-5dBm, USB）

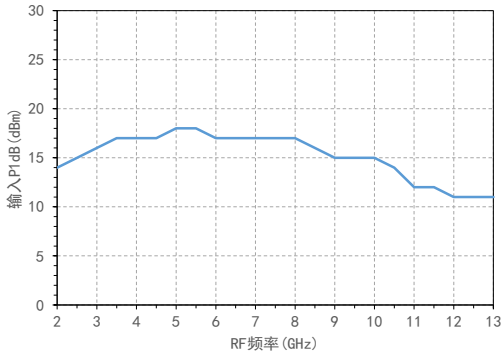
输入IP3 VS 频率@RF=5.8GHz（LO=0dBm）



输入IP3 VS 频率@RF=9.8GHz（LO=0dBm）



输入P1dB VS 频率（LO=0dBm）



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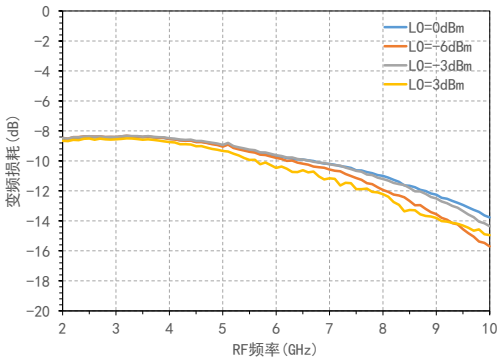
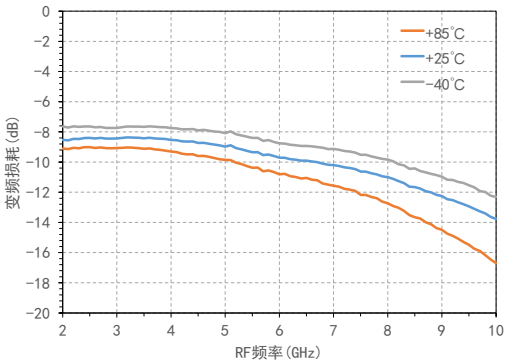
下变频测试曲线（IF=1.89GHz, VCC=3.3V, EN =High, X2=High, PRF=-5dBm, LSB）

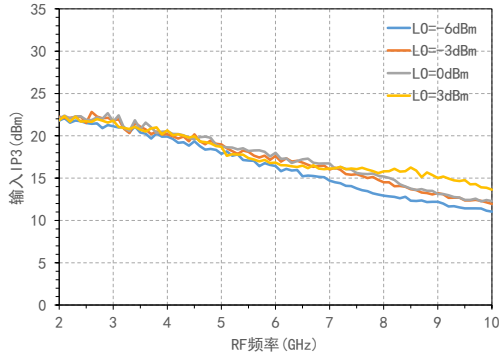
变频损耗 VS 频率@LO功率



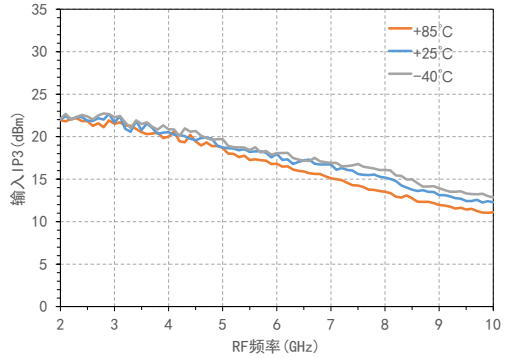
变频损耗 VS 频率@温度（LO=0dBm）



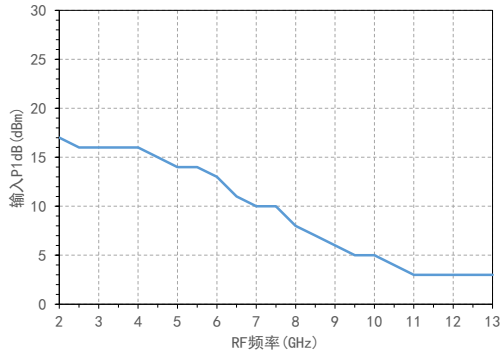
输入IP3 VS 频率@LO功率



输入IP3 VS 频率@温度（LO=0dBm）

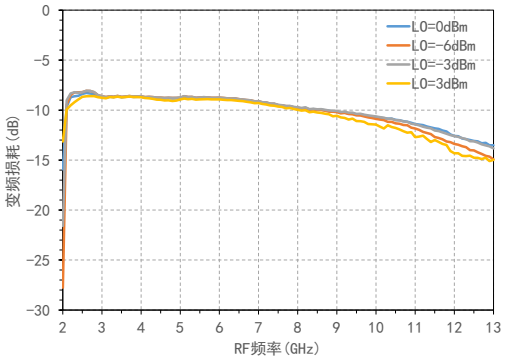


输入P1dB VS 频率@LO功率（LO=0dBm）

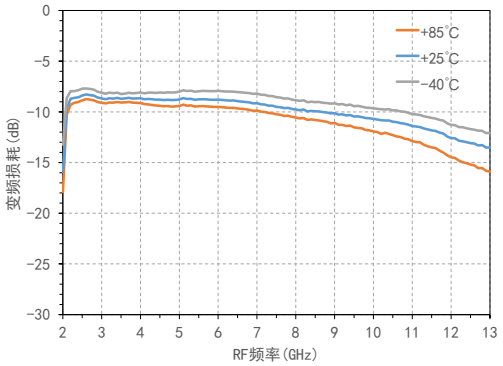


下变频测试曲线（IF=1.89GHz, VCC=3.3V, EN =High, X2=High, PRF=-5dBm, USB）

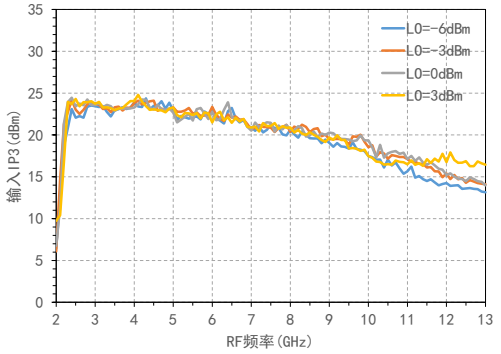
变频损耗 VS 频率@LO功率



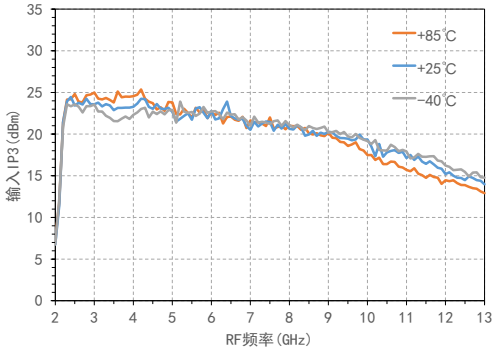
变频损耗 VS 频率@温度（LO=0dBm）



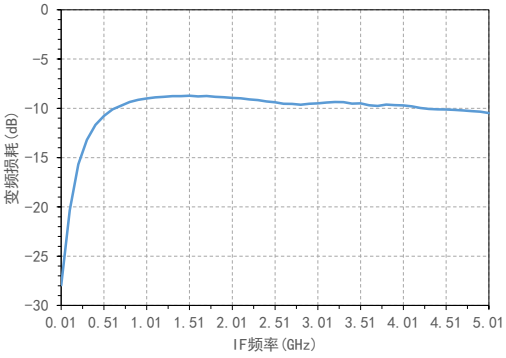
输入IP3 VS 频率@LO功率



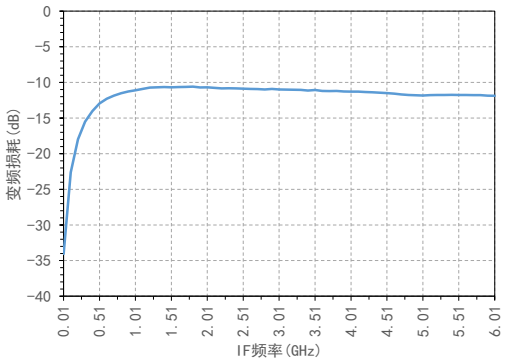
输入IP3 VS 频率@温度（LO=0dBm）



中频变频损耗 VS 频率（RF=5.8GHz）



中频变频损耗 VS 频率（RF=9.8GHz）



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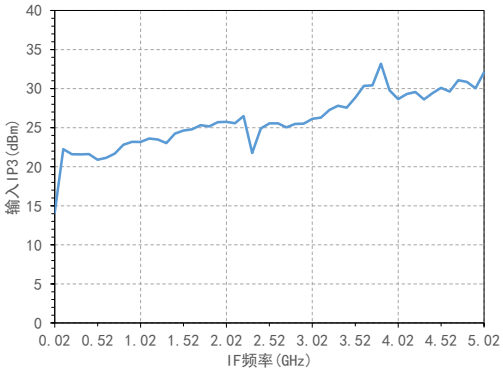
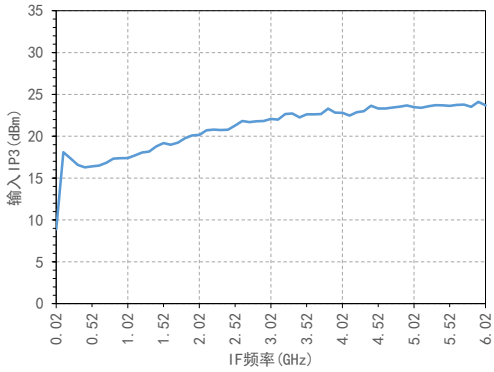
下变频测试曲线（IF=1.89GHz,VCC=3.3V,EN =High,X2=High,PRF=-5dBm,USB）

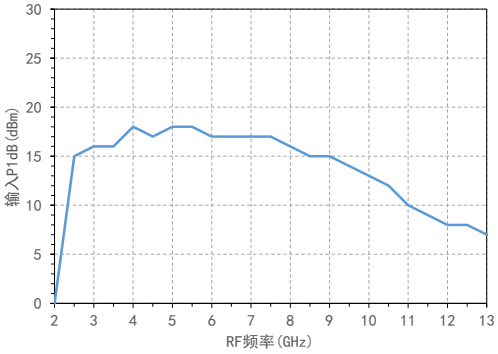
输入IP3 VS 频率@RF=5.8GHz（LO=0dBm）



输入IP3 VS 频率@RF=9.8GHz（LO=0dBm）

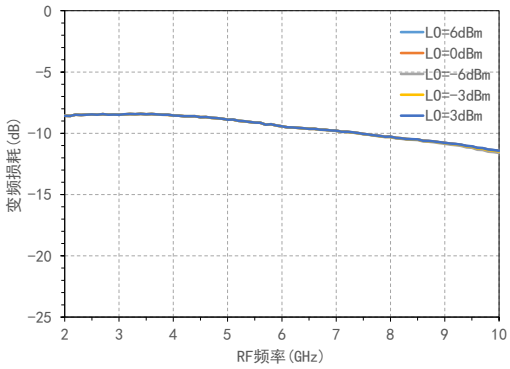


输入P1dB VS 频率（LO=0dBm）

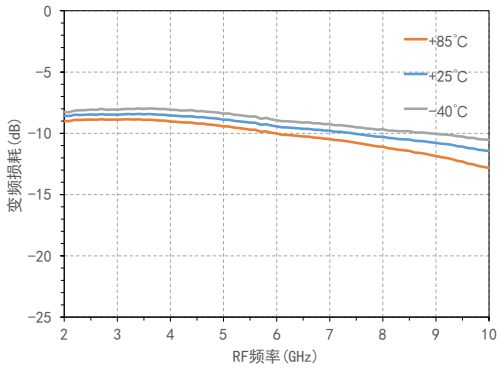


上变频测试曲线（IF=1.89GHz, VCC=3.3V, EN =High, X2=Low, PIF=-5dBm, LSB）

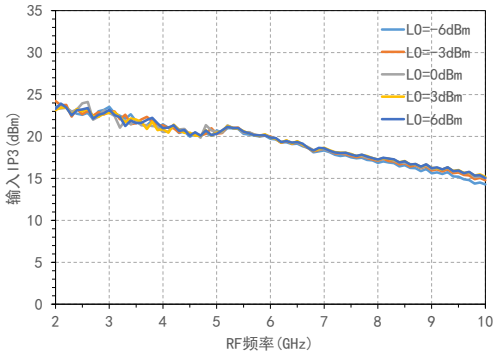
变频损耗 VS 频率@LO功率



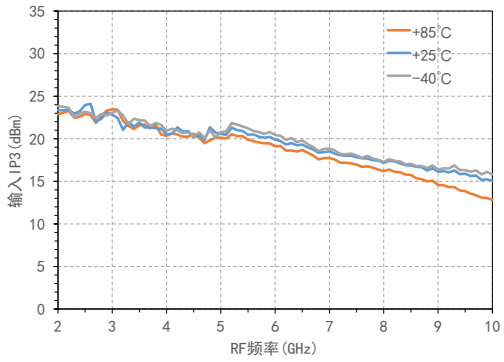
变频损耗 VS 频率@温度（LO=0dBm）



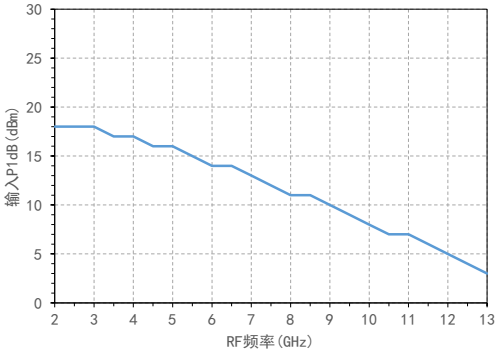
输入IP3 VS 频率@LO功率



输入IP3 VS 频率@温度（LO=0dBm）



输入P1dB VS 频率（LO=0dBm）



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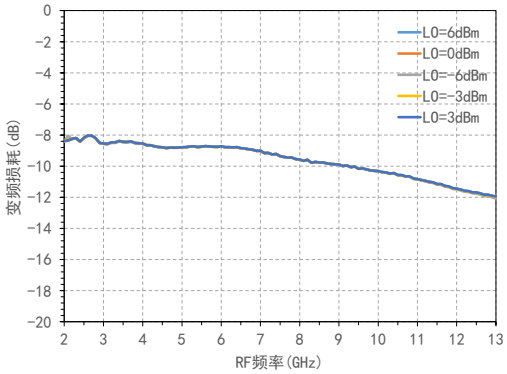
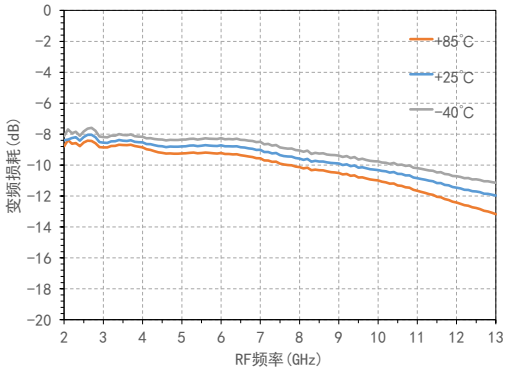
上变频测试曲线（IF=1.89GHz, VCC=3.3V, EN =High, X2=Low, PIF=-5dBm, USB）

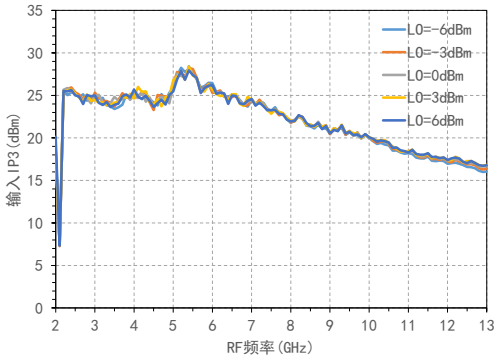
变频损耗 VS 频率@LO功率



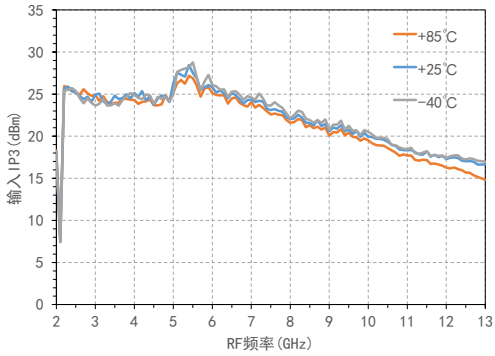
变频损耗 VS 频率@温度（LO=0dBm）



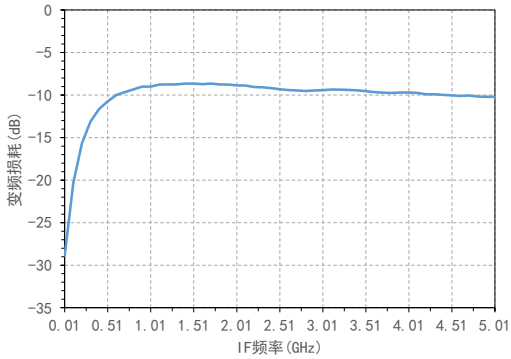
输入IP3 VS 频率@LO功率



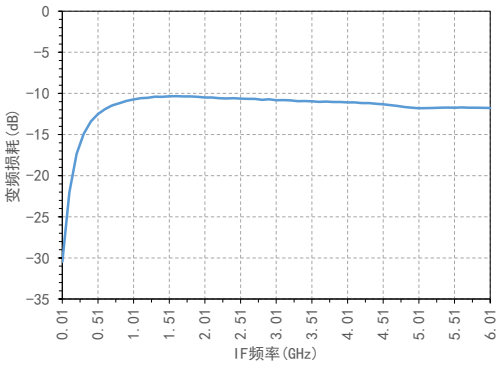
输入IP3 VS 频率@温度（LO=0dBm）



中频变频损耗 VS 频率（RF=5.8GHz）

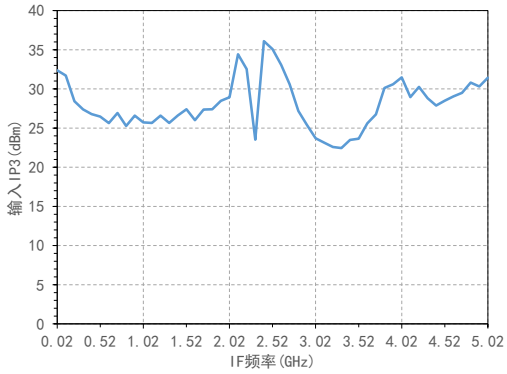


中频变频损耗 VS 频率（RF=9.8GHz）

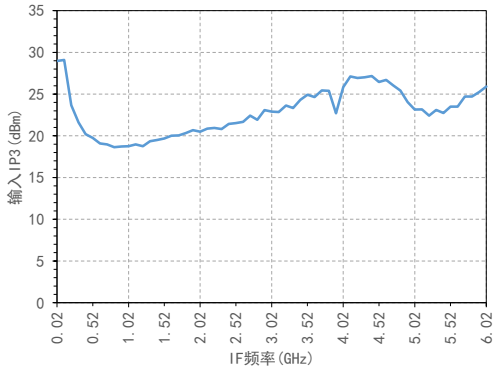


上变频测试曲线（IF=1.89GHz, VCC=3.3V, EN =High, X2=Low, PIF=-5dBm, USB）

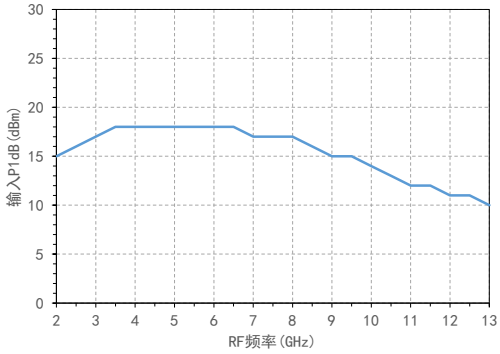
输入IP3 VS 频率@RF=5.8GHz（LO=0dBm）



输入IP3 VS 频率@RF=9.8GHz（LO=0dBm）



输入P1dB VS 频率（LO=0dBm）



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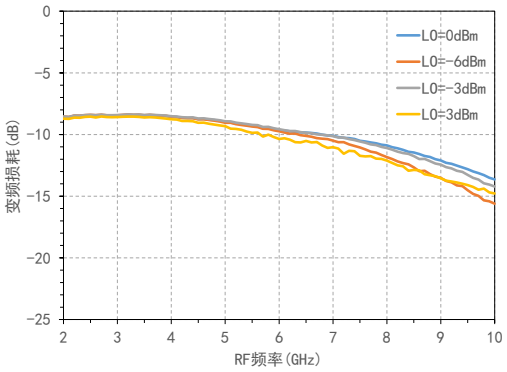
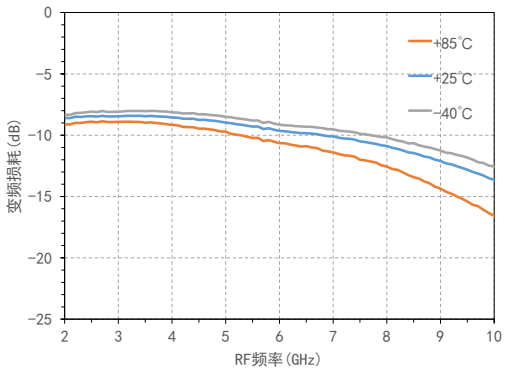
上变频测试曲线（IF=1.89GHz, VCC=3.3V, EN =High, X2=High, PIF=-5dBm, LSB）

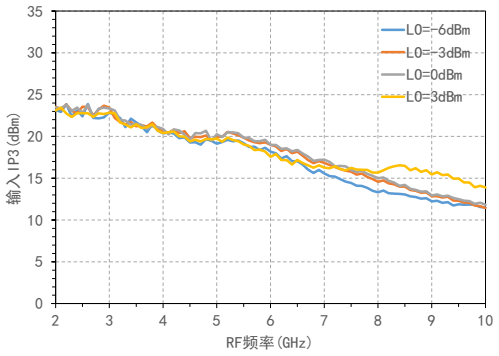
变频损耗 VS 频率@LO功率



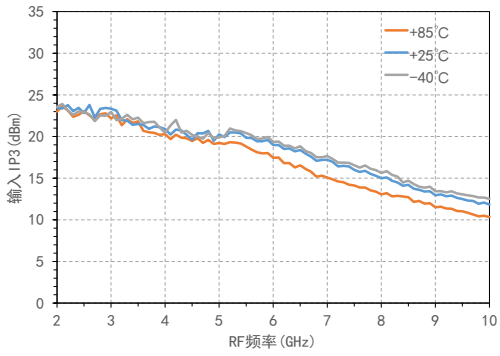
变频损耗 VS 频率@温度（LO=0dBm）



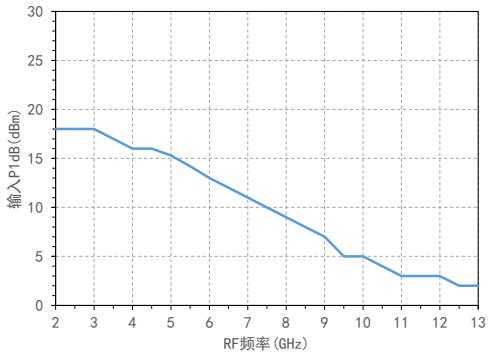
输入IP3 VS 频率@LO功率



输入IP3 VS 频率@温度（LO=0dBm）

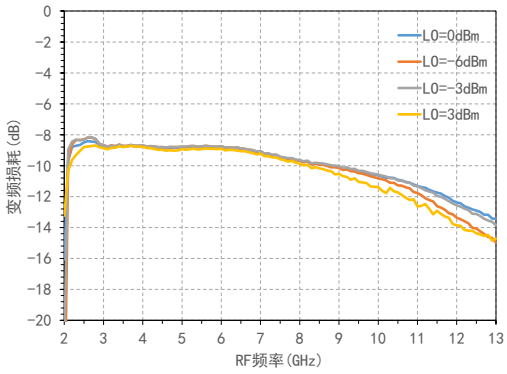


输入P1dB VS 频率@LO功率（LO=0dBm）

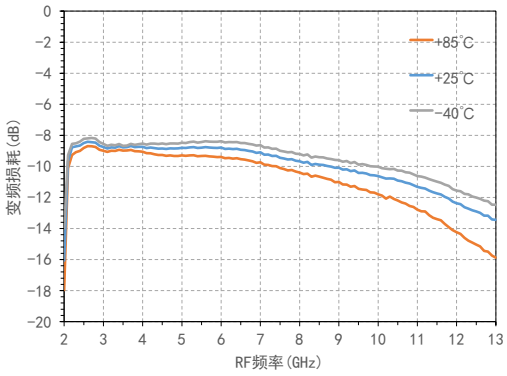


上变频测试曲线（IF=1.89GHz, VCC=3.3V, EN =High, X2=High, PIF=-5dBm, USB）

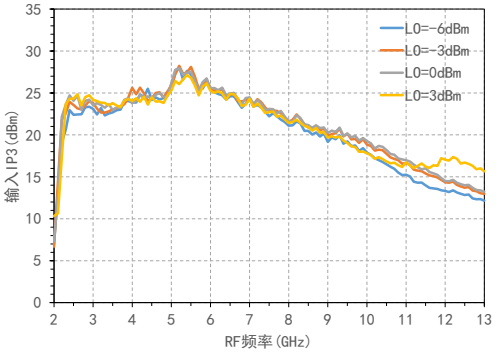
变频损耗 VS 频率@LO功率



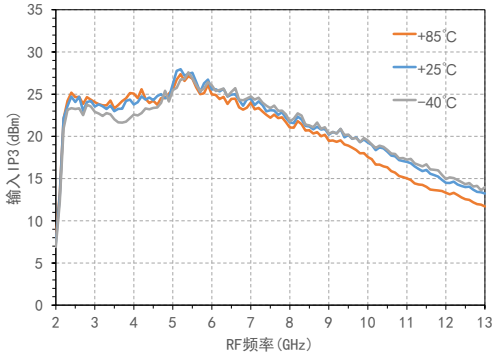
变频损耗 VS 频率@温度（LO=0dBm）



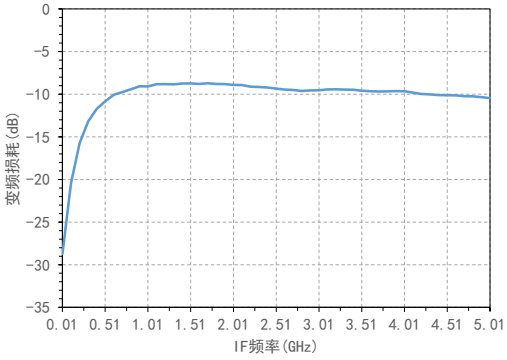
输入IP3 VS 频率@LO功率



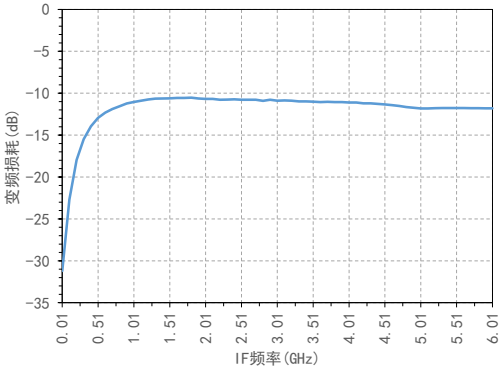
输入IP3 VS 频率@温度（LO=0dBm）



中频变频损耗 VS 频率（RF=5.8GHz）



中频变频损耗 VS 频率（RF=9.8GHz）



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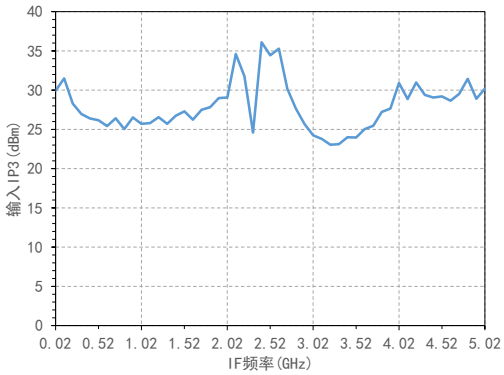
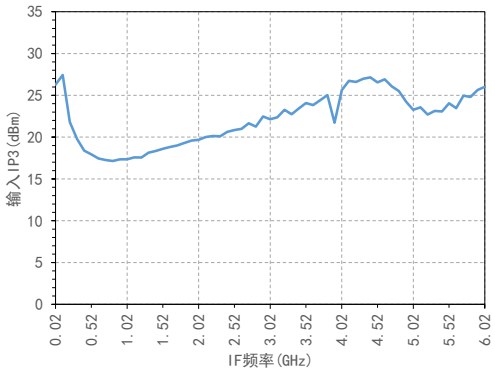
上变频测试曲线（IF=1.89GHz, VCC=3.3V, EN =High, X2=High, PIF=-5dBm, USB）

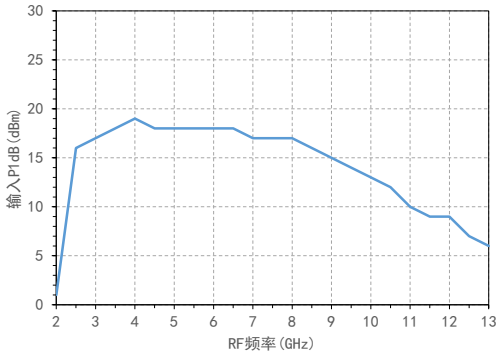
输入IP3 VS 频率@RF=5.8GHz（LO=0dBm）



输入IP3 VS 频率@RF=9.8GHz（LO=0dBm）

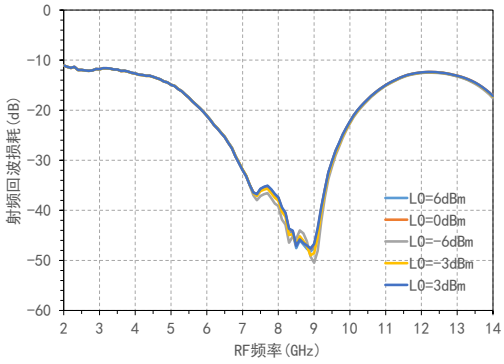


输入P1dB VS 频率（LO=0dBm）

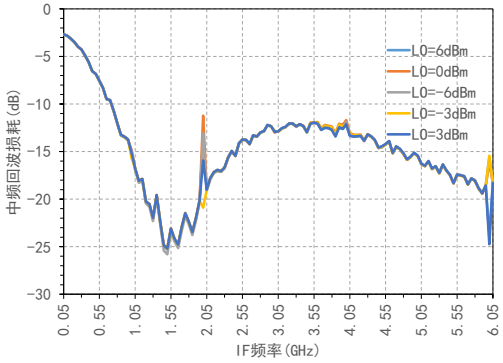


测试曲线（IF=1.89GHz, VCC=3.3V, EN=High）

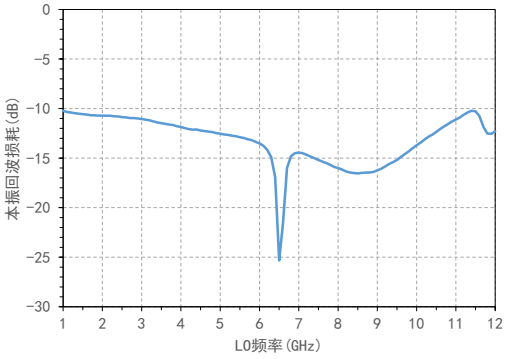
射频回波损耗 VS 频率



中频回波损耗 VS 频率（LO=2GHz）



本振回波损耗 VS 频率（LO=0dBm）



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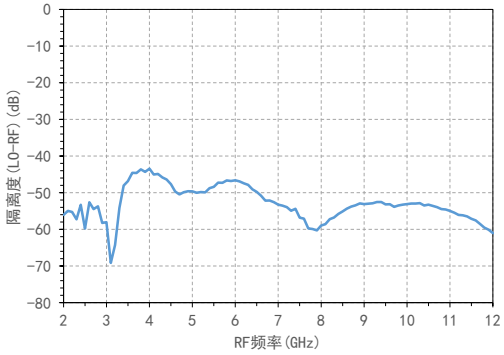
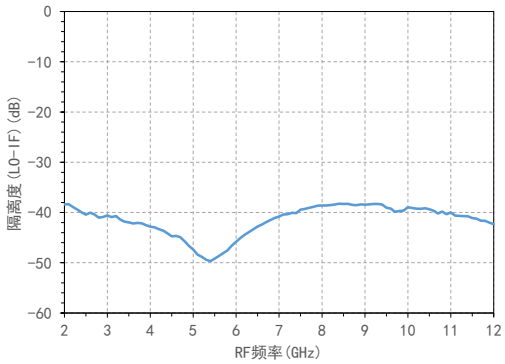
测试曲线（IF=1.89GHz,VCC=3.3V,EN=High）

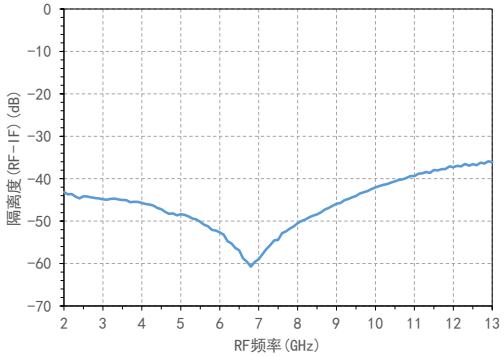
LO-RF 隔离度 VS 频率（LO=0dBm）



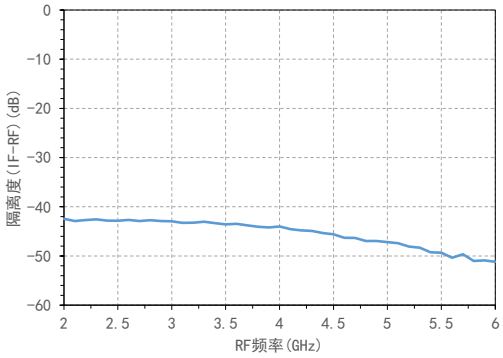
LO-IF 隔离度 VS 频率（LO=0dBm）



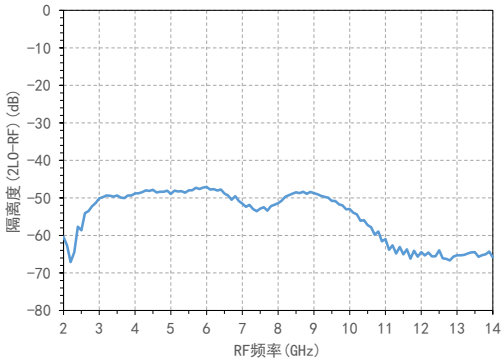
RF-IF 隔离度 VS 频率（LO=0dBm）



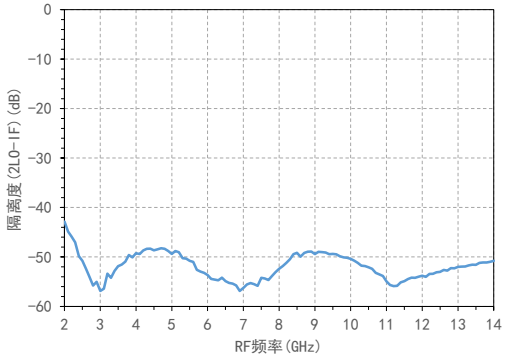
IF-RF 隔离度 VS 频率（LO=0dBm）



2LO-RF 隔离度 VS 频率（LO=0dBm）



2LO-IF 隔离度 VS 频率（LO=0dBm）



绝对最大额定值

参数	符号	最小值	典型值	最大值	单位
射频输入功率	RFin			20	dBm
本振输入功率	LOin			10	dBm
工作电压	VCC	-0.3		3.6	V
工作温度		-40		85	℃
贮存温度		-65		150	℃
正常工作最大结温	Tjmax	125			℃
热阻	Rjc	56			℃ /W
静电防护等级	HBM	1000			V
	CDM	1000			V

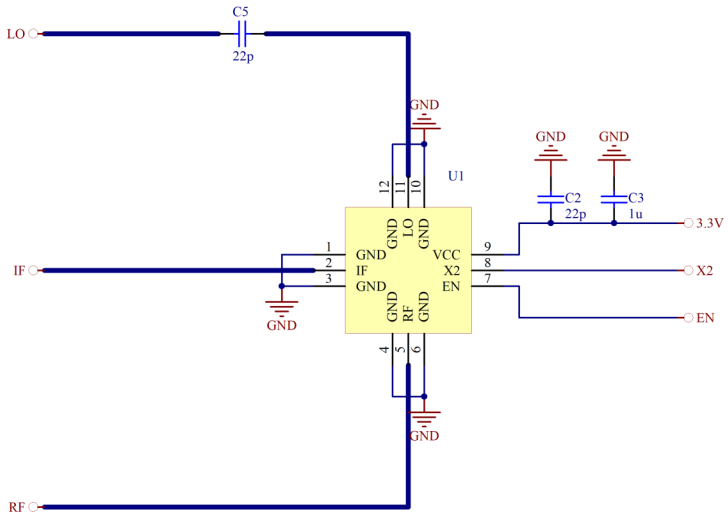
封装信息

型号	封装材料	焊盘镀层	MSL等级[1]	封装标识[2]	环保要求
SIM287ZSP23	绿色树脂化合物	Sn	MSL 3	S287Z XXXXX	符合RoHS

[1] 最高回流焊温度260℃

[2] XXXXX为批号

典型应用图



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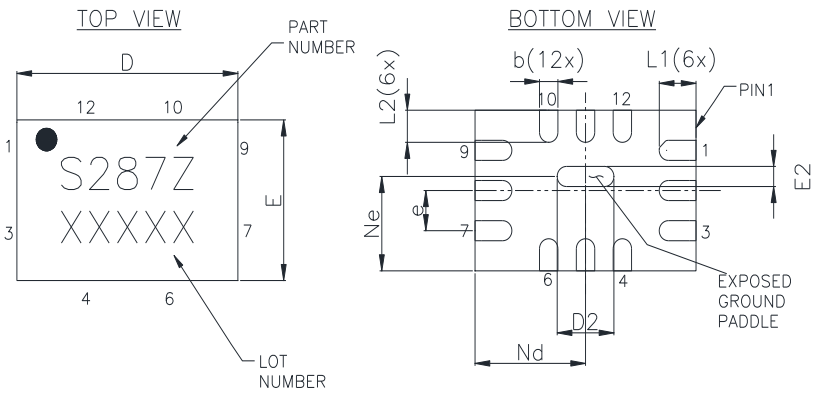
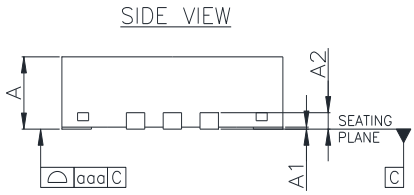
封装外形图





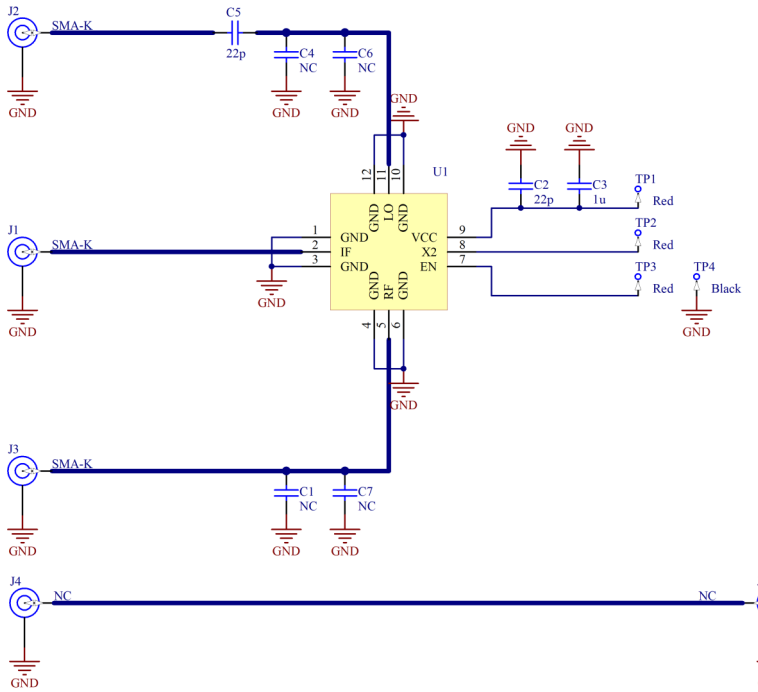
SP23 Dimension Table (unit:mm)			
Symbol	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	0.00	0.02	0.05
A2	0.20Ref		
b	0.20	0.25	0.30
D	2.90	3.00	3.10
D2	0.67	0.77	0.87
e	0.50BSC		
Ne	1.18BSC		
Nd	1.50BSC		
E	1.90	2.00	2.10
E2	0.20	0.25	0.30
L1	0.40	0.50	0.60
L2	0.30	0.40	0.50
aaa	0.08		

说明：
1. 单位：mm
2. 引线框架材料：铜合金
3. 封装表面翘曲：≤0.05mm
4. 所有接地引脚请连接PCB射频地

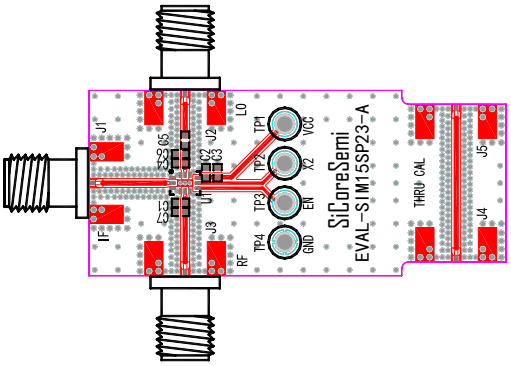
引脚定义

引脚编号	功能符号	功能描述
1, 3, 4, 6, 10, 12	GND	射频地端口，端口必须焊接到射频接地电路板上
2	IF	IF：中频端口，内部无隔直电容，内部经过巴伦直流到地，如果外部端口有直流电压时，需要使用隔直电容，避免损坏器件。
5	RF	射频端口，内部无隔直电容，内部经过巴伦直流到地，如果外部端口有直流电压时，需要使用隔直电容，避免损坏器件
7	EN	使能端口，内部300KΩ下拉电阻。当该引脚输入电压大于1.2V时，混频器启动；当输入电压小于0.3V时，混频器禁用。典型电流30uA.
8	X2	LO倍频数字控制引脚，内部300KΩ下拉电阻。当该引脚输入电压大于1.2V时，LO倍频器启动；当输入电压小于0.3V时，LO倍频器禁用。典型电流30uA.
9	VCC	电源端口，推荐使用3.3V电压，外部需连接电容。
11	LO	LO输入端口，内部无隔直电容。

评估板电路图



PCB 层叠结构
Top Copprer 1.5oz thick
R04350B (Er = 3.66) 10mil thick
Mid1 Copprer 1oz thick
FR-4 (Er = 4.6) 40mil thick
Mid2 Copprer 1oz thick
FR-4 (Er = 4.6) 10mil thick
Bottom Copprer 1.5oz thick



#	Designator	Comment	Description	Footprint	Manufacturer	Part Number	SOB	Quantity
1	!PCB	PCB	Printed Circuit Board		Si_Core	EVAL-SIM15SP23-A	Y	1
2	C1, C4, C6, C7	NC	Capacitor	0402	Murata	GJM1555C1HR15RB12D	N	4
3	C2, C5	22p	Capacitor	0402	Murata	GJM1555C1H220JB01D	Y	2
4	C3	1u	Capacitor	0402	Murata	GRM155Z71A105KE01D	Y	1
5	J1, J2, J3	SMA-K	RF Connecter	SMA_40G	傲文	D550B12E01-023	Y	3
6	J4, J5	NC	RF Connecter	SMA_40G	傲文	D360B12E01-023	N	2
7	TP1, TP2, TP3	Red	Test Point	Keystone5005	Keystone	Keystone5005	Y	3
8	TP4	Black	Test Point	Keystone5006	Keystone	Keystone5006	Y	1
9	U1	SIM287ZSP23	Mixer	SP23	Si_Core	SIM287ZSP23	Y	1