19-6004; Rev 0; 9/11
备有评估板

MAX2692/MAX2695

WLAN/WiMAX低噪声放大器

概述

MAX2692/MAX2695低噪声放大器(LNA)设计用于WLAN/WiMAX®应用。器件采用Maxim先进的SiGe工艺，在提供高增益、低噪声系数的同时，保持最高三阶截点。

器件采用+1.6V至+3.6V单电源供电，可选择关断模式使器件电源电流降至10µA以下。器件采用超小尺寸、无铅并符合RoHS标准的0.86mm x 0.86mm x 0.65mm晶片级封装(WLP)。

应用

智能手机

笔记本PC/平板电脑

工业WLAN/WiMAX

嵌入式模块

汽车

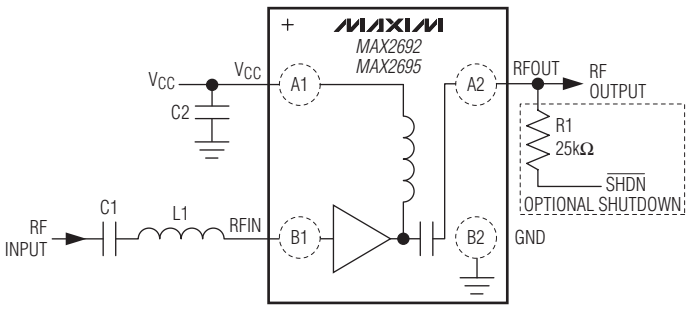
特性

- ♦ 2.5GHz WLAN (MAX2692)
- ♦ 3.7GHz WiMAX (MAX2695)
- ♦ 高功率增益：18dB (MAX2692)
- ♦ 低噪声系数：1.1dB (MAX2692)
- ♦ 高输入IP3：–3dBm (MAX2695)
- ♦ 集成50Ω输出匹配电路
- ♦ 低电源电流：4.0mA
- ♦ 较少的材料清单：1个电感、2个电容
- ♦ 小尺寸封装：0.86mm x 0.86mm

定购信息在数据资料的最后给出。

*相关型号以及配合该器件使用的推荐产品，请参见：**china.maxim-ic.com/MAX2692.related**。*

典型工作电路



MAX2692	MAX2695
L1 = 4.3nH	L1 = 3.3nH
C1 = 100nF	C1 = 100nF
C2 = 1nF	C2 = 100nF

WiMAX是WiMAX论坛的注册商标。

ABSOLUTE MAXIMUM RATINGS

V_{CC} to GND.....-0.3V to +3.9V
RFOUT to GND.....-0.3V to (operating V_{CC} + 0.3V)
Maximum RF Input Power.....+5dBm
Continuous Power Dissipation (T_A = +70°C)
WLP (derates 9.7mW/°C above +70°C).....776mW
Maximum Current into RF Input.....10mA

Operating Temperature Range.....-40°C to +85°C
Junction Temperature.....+150°C
Storage Temperature Range.....-65°C to +160°C
Soldering Temperature (reflow).....+260°C

Note 1: Refer to Application Note 1891: *Wafer-Level Packaging (WLP) and its Applications.*

CAUTION! ESD SENSITIVE DEVICE

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

(MAX2692/MAX2695 EV kit, V_{CC} = 1.6V to 3.6V, T_A = -40°C to +85°C, no RF signals are applied. Typical values are at V_{CC} = 2.85V and T_A = +25°C, unless otherwise noted.) (Note 2)

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
Supply Voltage			1.6	2.85	3.6	V
Supply Current	$\overline{SHDN}$ = high	MAX2692		4.0		mA
		MAX2695		4.0		
	Shutdown mode, $V_{\overline{SHDN}}$ = 0V				10	µA
Digital Input Logic-High	(Note 3)		1.2			V
Digital Input Logic-Low	(Note 3)				0.45	V

AC ELECTRICAL CHARACTERISTICS

(MAX2692/MAX2695 EV kit, V_{CC} = 1.6V to 3.6V, T_A = -40°C to +85°C, MAX2692 f_{RFIN} = 2.45GHz, MAX2695 f_{RFIN} = 3.5GHz. Typical values are at V_{CC} = 2.85V and T_A = +25°C, unless otherwise noted.) (Note 3)

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
RF Frequency	MAX2692 (WLAN)			2.45		GHz
	MAX2695 (WiMax)			3.5		
Power Gain	V_{CC} = 2.85V (Note 4)	MAX2692	13.5	18.2		dB
		MAX2695	11.1	15.6		
	V_{CC} = 1.6V	MAX2692	13.2	18		
		MAX2695	10.9	15.6		
Noise Figure	V_{CC} = 1.6V to 3.6V	MAX2692		1.1		dB
		MAX2695		1.2		
3rd-Order Input Intercept Point	(Note 5)	MAX2692		-3		dBm
		MAX2695		-3		
Input 1dB Compression Point	(Note 6)	MAX2692		-16		dBm
		MAX2695		14.5		
Input Return Loss	MAX2692			8.5		dBm
	MAX2695			7.5		

AC ELECTRICAL CHARACTERISTICS (continued)

(MAX2692/MAX2695 EV kit, V_{CC} = 1.6V to 3.6V, T_A = -40°C to +85°C, MAX2692 f_{RFIN} = 2.45GHz, MAX2695 f_{RFIN} = 3.5GHz. Typical values are at V_{CC} = 2.85V and T_A = +25°C, unless otherwise noted.) (Note 2)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Output Return Loss	MAX2692		17		dB
	MAX2695		14		
Reverse Isolation	MAX2692		32		dB
	MAX2695		28		

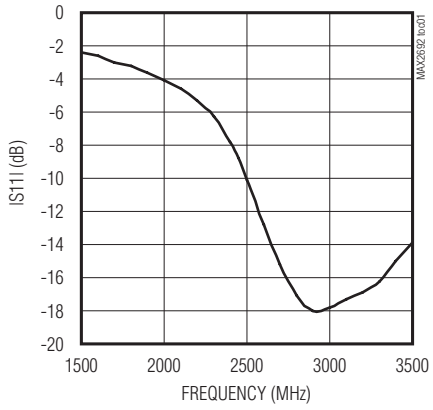
Note 2: Min and max limits guaranteed by test at T_A = +25°C and guaranteed by design and characterization at T_A = -40°C and T_A = +85°C, unless otherwise noted.
Note 3: Min and max limits guaranteed by test at T_A = +25°C.
Note 4: Min limit guaranteed by design and characterization.
Note 5: Measured with the two tones located at 1MHz and 2MHz offset from the center of the band with -30dBm/tone.
Note 6: Measured with a tone located at 2.45GHz for the MAX2692 and 3.5GHz for the MAX2695.

典型工作特性

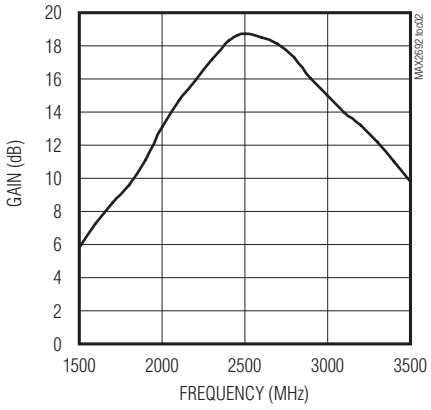
(MAX2692/MAX2695 EV kit. Typical values are at V_{CC} = 2.85V, T_A = +25°C, unless otherwise noted.)

MAX2692

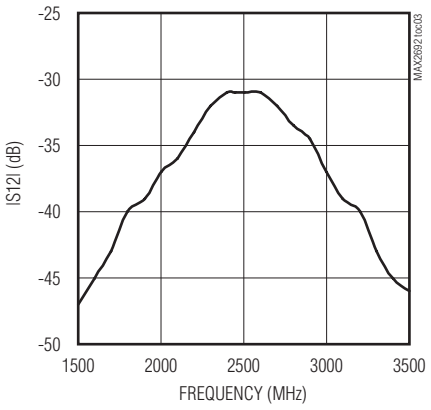
INPUT RETURN LOSS vs. FREQUENCY



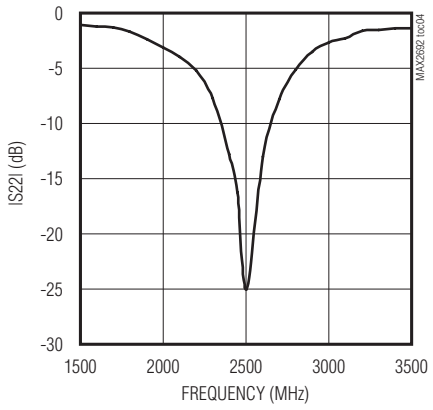
GAIN vs. FREQUENCY



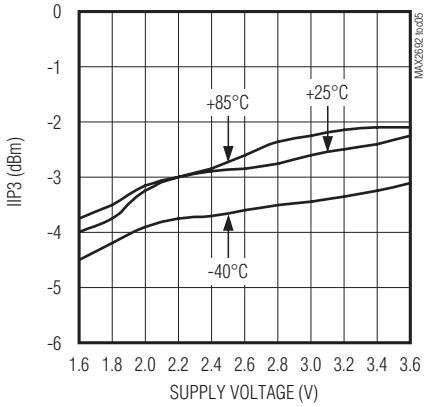
REVERSE ISOLATION vs. FREQUENCY



OUTPUT RETURN LOSS vs. FREQUENCY



IN-BAND IIP3 vs. SUPPLY VOLTAGE AND TEMPERATURE

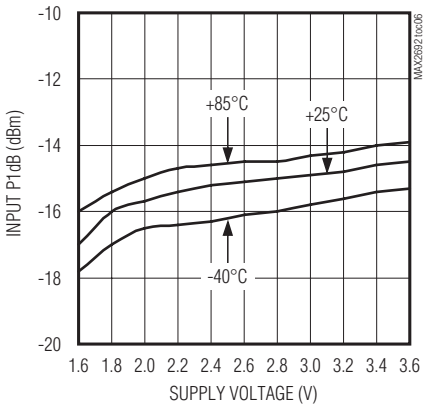


典型工作特性(续)

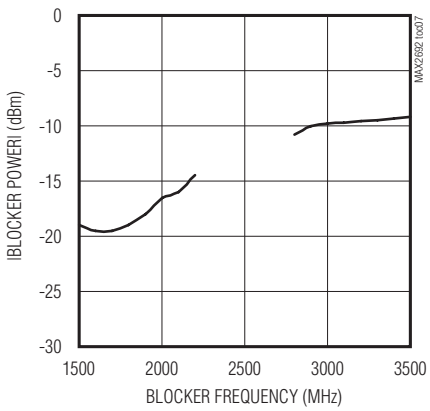
(MAX2692/MAX2695 EV kit. Typical values are at V_{CC} = 2.85V, T_A = +25°C, unless otherwise noted.)

MAX2692

INPUT P1dB vs. SUPPLY VOLTAGE AND TEMPERATURE

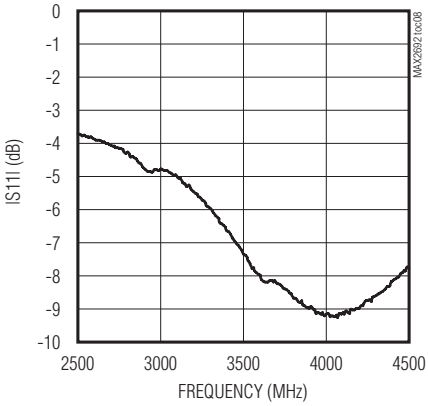


1dB GAIN DESENSE vs. BLOCKER FREQUENCY

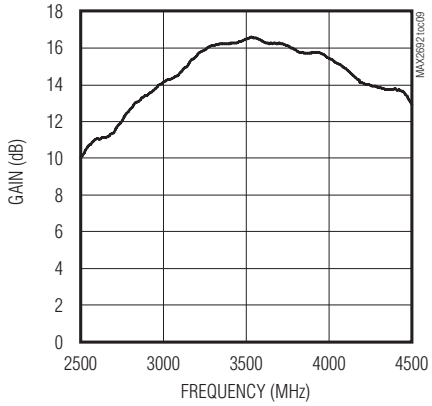


MAX2695

INPUT RETURN LOSS vs. FREQUENCY



GAIN vs. FREQUENCY

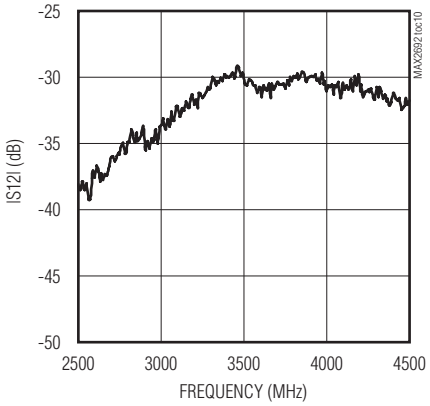


典型工作特性(续)

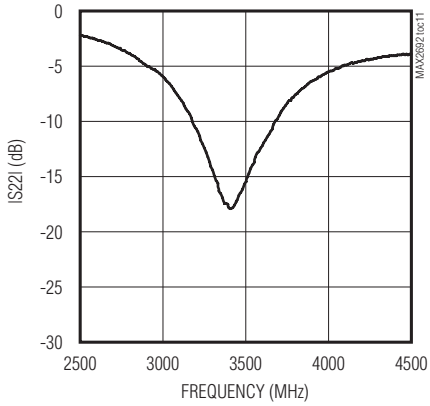
(MAX2692/MAX2695 EV kit. Typical values are at V_{CC} = 2.85V, T_A = +25°C, unless otherwise noted.)

MAX2695

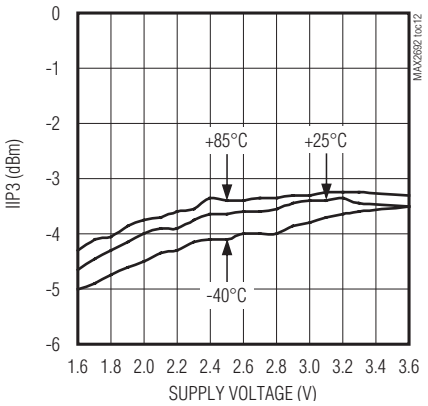
REVERSE ISOLATION vs. FREQUENCY



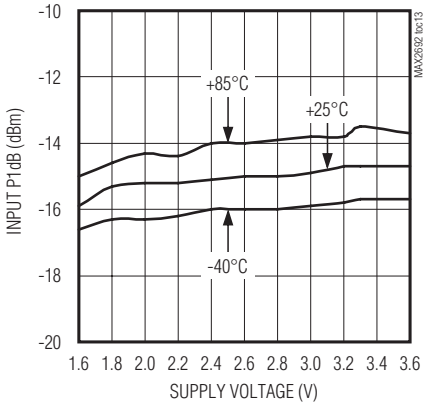
OUTPUT RETURN LOSS vs. FREQUENCY



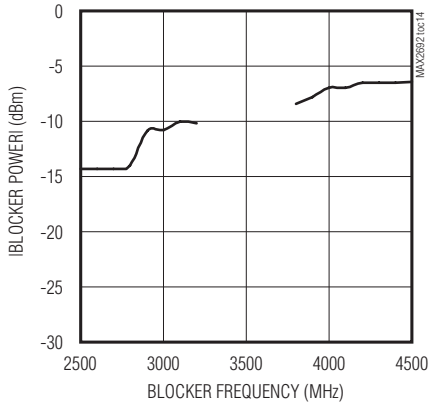
IN-BAND IIP3 vs. SUPPLY VOLTAGE AND TEMPERATURE



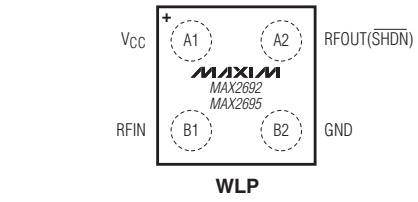
INPUT P1dB vs. SUPPLY VOLTAGE AND TEMPERATURE



1dB GAIN DESENSE vs. BLOCKER FREQUENCY



焊球配置



WLP

焊球说明

焊球	名称	功能
A1	V_{CC}	电源电压，通过10pF电容旁路至地，电容应尽量靠近IC放置。
A2	RFOUT ($\overline{SHDN}$)	RF输出/$\overline{SHDN}$输入，RFOUT在内部匹配至50Ω并通过25kΩ电阻上拉到V_{CC}。$\overline{SHDN}$与RFOUT共用一个焊球，默认状态下，一旦V_{CC}施加电源将立即进入有效工作模式；可从外部将RFOUT ($\overline{SHDN}$)拉至直流低电平，关断器件。
B1	RFIN	RF输入，需要外部连接隔直流电容和匹配元件。
B2	GND	地，连接到PCB地层。

详细说明

MAX2692/MAX2695是针对WLAN/WiMAX应用设计的LNA，器件具有可选择的关断控制模式，无需外部电源开关。器件具有高增益、低噪声系数和优异的线性指标。

输入和输出匹配

器件需要外部输入匹配电路，只需一个电感与隔直流电容串联，即可构建输入匹配电路。*典型工作电路*给出了所推荐的输入匹配网络。这些数值同时优化于最佳的增益、噪声系数、回波损耗等性能指标。器件内部集成了50Ω输出匹配电路，无需外部匹配元件，表1和表2列出了器件的典型S参数和K_f系数，典型噪声参数如表3和表4所示。

关断

器件包含关断功能，用于关断整个芯片的工作。由于器件内部，RFOUT (与$\overline{SHDN}$输入共用同一焊球)通过上拉电阻拉至V_{CC}，默认条件下，一旦V_{CC}施加电源，器件将立即进入有效工作模式；通过一个适当的外部电阻(例如，25kΩ)，在RFOUT端作用一个低电平关断器件，避免器件在有效工作期间在RF输出信号增加负载。

表1. MAX2692的典型S参数和K系数

FREQ. (MHz)	S11 MAG (dB)	S11 PHASE (DEGREES)	S21 MAG (dB)	S21 PHASE (DEGREES)	S12 MAG (dB)	S12 PHASE (DEGREES)	S22 MAG (dB)	S22 PHASE (DEGREES)	K_f
2000	-1.9	-160.0	9.8	94.6	-41.1	107.6	-2.6	68.0	2.7
2100	-2.0	-168.2	10.8	79.9	-39.5	99.8	-3.1	47.2	2.2
2200	-2.1	-177.4	10.9	74.5	-39.7	73.5	-4.2	20.6	3.0
2300	-2.5	175.1	13.7	62.0	-35.6	57.1	-6.3	3.7	2.0
2400	-2.8	167.6	15.1	40.3	-35.5	37.7	-7.7	-24.3	2.0
2500	-3.2	159.6	15.9	20.5	-34.4	15.1	-10.1	-65.9	1.9
2600	-3.6	153.0	16.1	-1.4	-32.8	-5.3	-12.0	-130.0	1.7
2700	-4.1	147.8	16.0	-24.2	-34.4	-31.7	-9.8	164.6	2.1
2800	-4.3	144.0	15.6	-45.1	-34.2	-57.8	-6.8	120.6	1.9
2900	-4.4	140.2	14.7	-60.7	-36.2	-72.0	-4.7	89.4	2.2
3000	-4.3	135.0	13.4	-77.1	-37.3	-83.2	-3.4	65.0	2.3

表2. MAX2695的典型S参数和K系数

FREQ. (MHz)	S11 MAG (dB)	S11 PHASE (DEGREES)	S21 MAG (dB)	S21 PHASE (DEGREES)	S12 MAG (dB)	S12 PHASE (DEGREES)	S22 MAG (dB)	S22 PHASE (DEGREES)	K_f
3000	-1.9	119.7	11.5	14.2	-35.9	42.9	-5.4	-26.8	1.7
3100	-1.9	112.1	12.1	0.4	-34.6	32.1	-6.9	-46.6	1.6
3200	-1.9	104.5	12.7	-15.1	-34.1	21.7	-8.9	-68.3	1.6
3300	-2.1	97.1	13.2	-29.2	-34.2	1.5	-11.7	-95.9	1.8
3400	-2.2	90.0	13.4	-42.8	-32.7	-2.8	-15.0	-135.5	1.7
3500	-2.4	83.1	13.5	-57.2	-32.4	-23.2	-16.2	166.3	1.8
3600	-2.6	77.0	13.5	-72.2	-33.2	-37.1	-13.7	116.2	2.1
3700	-2.6	70.7	13.7	-84.6	-31.9	-41.3	-11.1	86.1	1.7
3800	-2.8	64.0	13.5	-96.0	-32.1	-57.3	-8.8	62.7	1.8
3900	-3.0	58.4	13.4	-112.5	-32.7	-68.4	-7.1	42.1	1.8
4000	-3.2	52.7	13.7	-123.5	-31.0	-80.0	-6.0	23.8	1.4

表3. MAX2692的典型噪声参数(V_{CC} = 2.85V，T_A = +25℃)

FREQUENCY (MHz)	FMIN (dB)	$\lvert\Gamma_{OPT}\rvert$	$\lvert\Gamma_{OPT}\rvert$ ANGLE	R_N (Ω)
2300	0.84	0.49	44	12.0
2350	0.84	0.48	45	11.9
2400	0.85	0.48	46	11.8
2450	0.85	0.48	47	11.8
2500	0.86	0.48	48	11.7
2550	0.87	0.47	49	11.7
2600	0.87	0.47	50	11.7

表4. MAX2695的典型噪声参数(V_{CC} = 2.85V，T_A = +25℃)

FREQUENCY (MHz)	FMIN (dB)	$\|\Gamma_{OPT}\|$	$\|\Gamma_{OPT}\|$ ANGLE	R_N (Ω)
3400	1.02	0.44	65	11.3
3450	1.03	0.44	66	11.2
3500	1.03	0.44	67	11.2
3550	1.04	0.44	68	11.1
3600	1.04	0.44	69	11.1
3650	1.05	0.43	69	11.0
3700	1.06	0.43	70	10.9

应用信息

合理设计PCB是任何RF微波电路设计的基础，在所有高频输入和输出采用阻抗受控引线。利用去耦电容旁路V_{CC}，电容应尽可能靠近器件放置。V_{CC}引线较长时，可能需要增加去耦电容，这些增添的电容应远离器件放置。GND焊球采用适当的接地也非常重要，如果PCB的顶层为RF地，可以将GND焊球直接连接到该接地层。如果电路板的地不在元件层，则将GND焊球通过多个过孔连接到电路板地，过孔须尽量靠近器件。

MAX2692/MAX2695的评估板原理图、Gerber文件、PADS布局文件以及BOM信息，请参考：**china.maxim-ic.com/datasheet/index.mvp/id/6939/t/do**。

芯片信息

PROCESS: SiGe BiCMOS

定购信息

PART	TEMP RANGE	PIN-PACKAGE
MAX2692EWS+T	-40°C to +85°C	4 WLP
MAX2695EWS+T	-40°C to +85°C	4 WLP

+表示无铅(Pb)/符合RoHS标准的封装。
T = 卷带包装。

封装信息

如需最近的封装外形信息和焊盘布局(占位面积)，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	外形编号	焊盘布局编号
4 WLP	W40A0+1	**21-0480**	参见 **应用笔记1891**

修订历史

修订号	修订日期	说明	修改页
0	9/11	最初版本。	—

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