19-0492; Rev 0; 10/05

可提供评估板

# 450MHz CDMA/OFDM低噪声放大器/混频器

MAX2335

## 概述

MAX2335是专为450MHz CDMA和OFDM应用设计的射频前端接收器芯片。

MAX2335包括一个输入三阶交调截点(IIP3)可调的低噪声放大器(LNA)，大大降低了强干扰信号下对交调的敏感度。

混频器具有专为实现高线性度和低噪声而设计的差分中频输出，非常适合CDMA和OFDM应用。

片内分频器允许采用标准的1GHz VCO。也可旁路该分频器而采用低频VCO。

MAX2335采用带裸露焊盘的28引脚TQFN封装。工作在-40°C至+85°C扩展级温度范围内。该器件还提供无铅封装。

## 特性

- 1.5dB低噪声放大器(LNA)噪声系数
- 16dB低噪声放大器(LNA)增益
- 2.1dB串联噪声系数
- 可调的低噪声放大器(LNA)输入三阶交调截点(IIP3)
- 发送器带本振(LO)输出缓冲器
- 本振(LO)分频器
- 小尺寸5mm x 5mm、28引脚(无铅) TQFN封装

## 定购信息

| PART | TEMP RANGE | PIN-PACKAGE | PKG CODE |
|---|---|---|---|
| MAX2335ETI | -40°C to +85°C | 28 Thin QFN-EP* (5mm x 5mm) | T2855-3 |
| MAX2335ETI+ | -40°C to +85°C | 28 Thin QFN-EP* (5mm x 5mm) | T2855+3 |

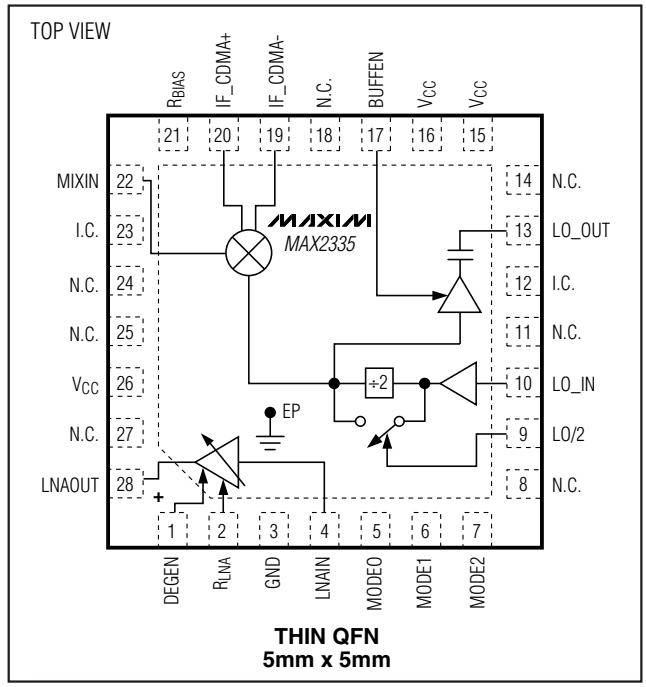
*EP = 裸焊盘。*

*+表示无铅封装。*

## 应用

450MHz频段、WCDMA、IS-95、IS-2000、OFDM、无线数据链路

## 引脚配置和功能框图




**THIN QFN 5mm x 5mm**

## ABSOLUTE MAXIMUM RATINGS

$V_{CC}$ to GND .....-0.3V to +4.3V
All Other Pins to GND.....-0.3V to ($V_{CC}$ + 0.3V)
AC Input Pins (LNAIN, LO_IN, MIXIN) to GND .....1V Peak
Continuous Power Dissipation ($T_A$ = +70°C)
28-Pin Thin QFN (derate 34.5mW/°C above +70°C) .....2.7W
Operating Temperature Range .....-40°C to +85°C
Junction Temperature.....+150°C
Storage Temperature Range .....-65°C to +150°C
Lead Temperature (soldering, 10s) .....+300°C

*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.*

**CAUTION!** ESD SENSITIVE DEVICE

## DC ELECTRICAL CHARACTERISTICS

($V_{CC}$ = +2.9V to +3.3V, $R_{BIAS}$ = 18kΩ, $R_{LNA}$ = 24kΩ, BUFFEN = LOW, LO/2 = HIGH, $T_A$ = -40°C to +85°C, unless otherwise noted. Typical values are at $V_{CC}$ = +2.9V, LOW = 0V, HIGH = +3.0V, $T_A$ = +25°C, unless otherwise noted.) (Note 1)

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|
| Operating Supply Current | $I_{CC}$ | HGHL mode (MODE[2:0] = 111) | | 32 | 38 | mA |
| | | HGLL mode (MODE[2:0] = 101) | | 24 | 29 | |
| | | LG mode (MODE[2:0] = 011) | | 27 | 31 | |
| Shutdown Supply Current | $I_{CC}$ | Shutdown mode (MODE[2:0] = 000) | | 0.2 | 10 | µA |
| LO Buffer Supply Current | $I_{CC}$ | Addition for BUFFEN = HIGH | | 7 | 13 | mA |
| Digital Input-Logic High | $V_{IH}$ | | 2 | | | V |
| Digital Input-Logic Low | $V_{IL}$ | | | | 0.6 | V |
| Digital Input Current (Logic-High) | $I_{IH}$ | | | | 5 | µA |
| Digital Input Current (Logic-Low) | $I_{IL}$ | | -25 | | | µA |

## AC ELECTRICAL CHARACTERISTICS

(MAX2335 EV Kit, $V_{CC}$ = +2.9V to +3.3V, $f_{LNAIN}$ = $f_{MIXIN}$ = 465MHz, $f_{IF}$ = 110MHz, $f_{LO}$ = 2 x ($f_{MIXIN}$ + $f_{IF}$), 50Ω system impedance, $R_{BIAS}$ = 18kΩ, $R_{LNA}$ = 24kΩ, cascaded performance includes 2dB interstage filter loss, $T_A$ = -40°C to +85°C, unless otherwise noted. Typical values are at $V_{CC}$ = +2.9V, $P_{LO\_IN}$ = -7dBm, LOW = 0V, HIGH = +3.0V, $T_A$ = +25°C, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|
| **OVERALL PERFORMANCE** | | | | | | |
| RF Frequency Range | $f_{RF}$ | | | 420 to 470 | | MHz |
| LO Frequency Range | $f_{LO}$ | After optional LO/2 | | 500 to 660 | | MHz |
| IF Frequency Range | $f_{IF}$ | | | 80 to 190 | | MHz |
| LO Input Power | | (Note 2) | -7 | -3 | 0 | dBm |
| LO Buffer Output Power | | BUFFEN = HIGH | -10 | -6 | | dBm |
| Return Loss | | All modes, all active ports, including 2-element matching network, if necessary | | 10 | | dB |
| **CASCADED PERFORMANCE** | | | | | | |
| **HIGH-GAIN, HIGH-LINEARITY MODE (MODE[2:0] = 111)** | | | | | | |
| Gain | G | (Note 1) | 23.0 | 27 | 31.5 | dB |
| Noise Figure | NF | Including off-chip matching, $T_A$ = +25°C (Note 2) | | 2.2 | 2.6 | dB |
| Input Third-Order Intercept Point | IIP3 | $T_A$ = +25°C (Notes 1, 3) | -14 | -11.5 | | dBm |

## AC ELECTRICAL CHARACTERISTICS (continued)

(MAX2335 EV Kit, $V_{CC}$ = +2.9V to +3.3V, $f_{LNAIN}$ = $f_{MIXIN}$ = 465MHz, $f_{IF}$ = 110MHz, $f_{LO}$ = 2 x ($f_{MIXIN}$ + $f_{IF}$), 50Ω system impedance, $R_{BIAS}$ = 18kΩ, $R_{LNA}$ = 24kΩ, cascaded performance includes 2dB interstage filter loss, $T_A$ = -40°C to +85°C, unless otherwise noted. Typical values are at $V_{CC}$ = +2.9V, $P_{LO\_IN}$ = -7dBm, LOW = 0V, HIGH = +3.0V, $T_A$ = +25°C, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|
| **HIGH-GAIN, LOW-LINEARITY MODE (MODE[2:0] = 101)** | | | | | | |
| Gain | G | (Note 1) | 21.0 | 26.5 | 30.5 | dB |
| Noise Figure | NF | Including off-chip matching, $T_A$ = +25°C (Note 2) | | 2.1 | 2.5 | dB |
| Input Third-Order Intercept Point | IIP3 | $T_A$ = +25°C (Notes 1, 3) | -15 | -12.5 | | dBm |
| **LOW-GAIN MODE (MODE[2:0] = 011)** | | | | | | |
| Gain | G | (Note 1) | 5 | 9 | 14 | dB |
| Noise Figure | NF | Including off-chip matching, $T_A$ = +25°C (Note 2) | | 12 | 15 | dB |
| Input Third-Order Intercept Point | IIP3 | $T_A$ = +25°C (Notes 1, 3) | 3 | 7 | | dBm |
| **LNA PERFORMANCE** | | | | | | |
| **HIGH-GAIN, HIGH-LINEARITY MODE (MODE[2:0] = 111)** | | | | | | |
| Gain | $G_{LNA}$ | | | 15.5 | | dB |
| Noise Figure | $NF_{LNA}$ | Including off-chip matching | | 1.7 | | dB |
| Input Third-Order Intercept Point | $IIP3_{LNA}$ | (Note 3) | | +7 | | dBm |
| **HIGH-GAIN, LOW-LINEARITY MODE (MODE[2:0] = 101)** | | | | | | |
| Gain | $G_{LNA}$ | | | 14.5 | | dB |
| Noise Figure | $NF_{LNA}$ | Including off-chip matching | | 1.5 | | dB |
| Input Third-Order Intercept Point | $IIP3_{LNA}$ | (Note 3) | | +5 | | dBm |
| **LOW-GAIN MODE (MODE[2:0] = 011)** | | | | | | |
| Gain | $G_{LNA}$ | | | -2.7 | | dB |
| Noise Figure | $NF_{LNA}$ | Including off-chip matching | | 5.5 | | dB |
| Input Third-Order Intercept Point | $IIP3_{LNA}$ | (Note 3) | | +14 | | dBm |
| **MIXER PERFORMANCE** | | | | | | |
| **HIGH-GAIN, HIGH-LINEARITY MODE (MODE[2:0] = 111)** | | | | | | |
| Gain | $G_{MIXER}$ | | | 14 | | dB |
| Noise Figure | $NF_{MIXER}$ | Including off-chip matching | | 7 | | dB |
| Input Third-Order Intercept Point | $IIP3_{MIXER}$ | (Note 3) | | +2 | | dBm |
| **HIGH-GAIN, LOW-LINEARITY MODE (MODE[2:0] = 101)** | | | | | | |
| Gain | $G_{MIXER}$ | | | 13.5 | | dB |
| Noise Figure | $NF_{MIXER}$ | Including off-chip matching | | 6.7 | | dB |
| Input Third-Order Intercept Point | $IIP3_{MIXER}$ | (Note 3) | | 0 | | dBm |
| **LOW-GAIN MODE (MODE[2:0] = 011)** | | | | | | |
| Gain | $G_{MIXER}$ | | | 14 | | dB |
| Noise Figure | $NF_{MIXER}$ | Including off-chip matching | | 7 | | dB |
| Input Third-Order Intercept Point | $IIP3_{MIXER}$ | (Note 3) | | +2 | | dBm |

**Note 1:** Specifications at $T_A$ = +25°C and +85°C are guaranteed by production test. Specifications at $T_A$ = -40°C are guaranteed by design and characterization.

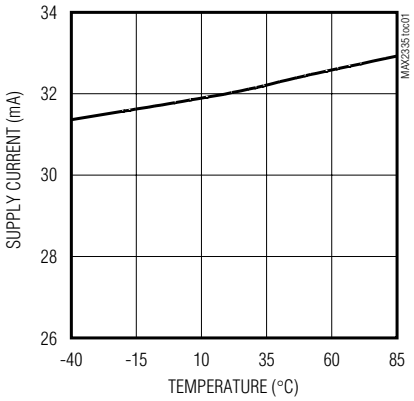
**Note 2:** Guaranteed by design and characterization.

**Note 3:** Two-tone IIP3 tested at $f_{RF1}$ = 465.9MHz and $f_{RF2}$ = 466.7MHz at -25dBm/tone.

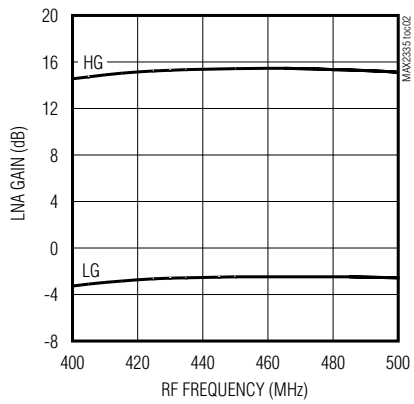
## 典型工作特性

(MAX2335 EV Kit, $V_{CC}$ = +2.9V, $f_{LNAIN}$ = 465MHz, $f_{IF}$ = 110MHz, $f_{LO\_IN}$ = 1150MHz, $P_{LO\_IN}$ = -7dBm, $R_{BIAS}$ = 18kΩ, $R_{LNA}$ = 24kΩ, $T_A$ = +25°C, unless otherwise noted.)

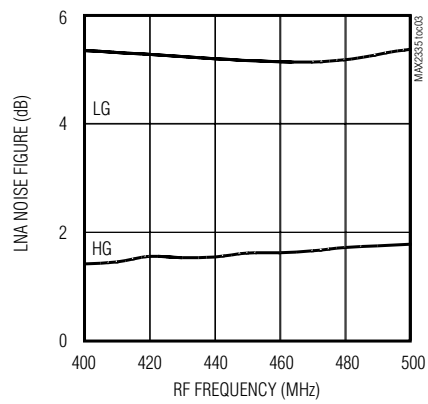
**SUPPLY CURRENT (HGHL) vs. TEMPERATURE**



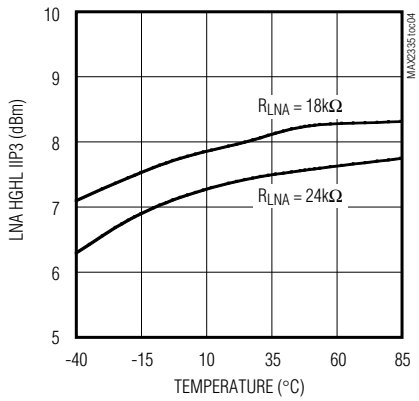

**LNA GAIN VS RF FREQUENCY**



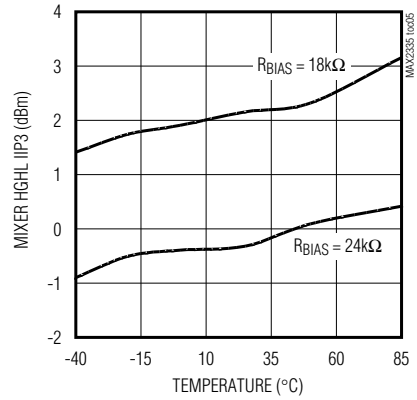

**LNA NOISE FIGURE vs. RF FREQUENCY**



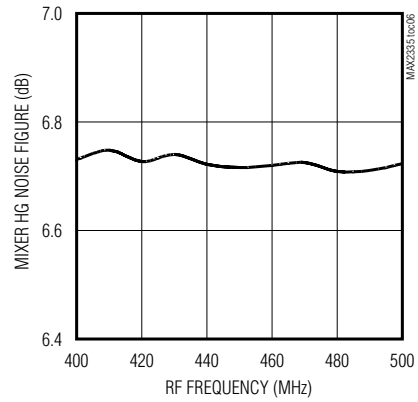

**LNA HGHL IIP3 vs. TEMPERATURE**



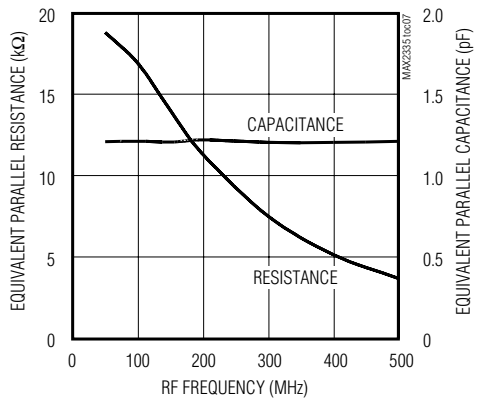

**MIXER HGHL IIP3 vs. TEMPERATURE**




**MIXER HG NOISE FIGURE vs. RF FREQUENCY**




**MIXER IF PORT DIFFERENTIAL PORT IMPEDANCE**



## 引脚说明

| 引脚 | 名称 | 功能 |
|---|---|---|
| 1 | DEGEN | LNA衰退. DEGEN引脚对地接一个1nH至3nH的电感. |
| 2 | $R_{LNA}$ | 低噪声放大器偏置，$R_{LNA}$引脚对地接18kΩ到24kΩ的电阻，在HGHL模式通过调整$R_{LNA}$引脚的偏置调整输入低噪声放大器的线性。 |
| 3 | GND | 地，用低感抗过孔连接到PCB地平面. |
| 4 | LNAIN | RF输入，要求接一个隔直流电容，它可作为匹配网络的一部分。 |
| 5 | MODE0 | 逻辑输入，参照表1。 |
| 6 | MODE1 | 逻辑输入，参照表1。 |
| 7 | MODE2 | 逻辑输入，参照表1。 |
| 8, 11, 14, 18, 24, 25, 27 | N.C. | 没有连接，这些引脚内部没有连接，直接连接到PCB地平面。 |
| 9 | LO/2 | 逻辑输入，LO/2的使能端，高电平有效。 |
| 10 | LO_IN | 本振输入，内部匹配至50Ω。要求外加隔直流电容。将LO/2驱动至高电平，可使本振输入频率经过2分频后送入混频器。 |
| 12, 23 | I.C. | 内部已连接，正常工作时，这些引脚不用连接。 |
| 13 | LO_OUT | 本振缓冲输出，内部匹配到50Ω。不需要接隔直流电容。当LO/2为高电平时，缓冲器输出频率等于本振频率的二次分频；当LO/2为低电平时，缓冲器输出频率等于本振频率。 |
| 15, 16, 26 | $V_{CC}$ | 电源，在尽量靠近16引脚和26引脚处对地接旁路电容。该电容的接地过孔不能与其它接地过孔共用。 |
| 17 | BUFFEN | LO输出缓冲器使能控制。高电平时，LO输出缓冲器使能；低电平时，LO输出缓冲器禁止。 |
| 19, 20 | IF_CDMA-, IF_CDMA+ | 差分中频输出端口，要求接一上拉电感到$V_{CC}$，它可作为匹配网络的一部分。 |
| 21 | $R_{BIAS}$ | 连接偏置电阻。$R_{BIAS}$接18kΩ至24kΩ的电阻到地，通过调节$R_{BIAS}$，可以调节HGHL模式以外其它模式下的输入低噪声放大器的线性特性和所有模式下混频器的线性特性。 |
| 22 | MIXIN | 混频输入，要求外加匹配网络。 |
| 28 | LNAOUT | 低噪声放大器输出，要求接一上拉电感到$V_{CC}$，并需要接隔直流电容，它们可作为匹配网络的一部分。 |
| — | EP | 裸露接地焊盘，为保证正常工作，焊盘(EP)要均匀地与主板地连接。 |

# 450MHz CDMA/OFDM低噪声放大器/混频器

## 详细说明

### 低噪声放大器(LNA)

MAX2335低噪声放大器的增益和线性度可通过MODE[2:0]输入调整，表1列出了不同工作模式下引脚的设置。为降低强干扰信号(如系统处于发射状态时)下对交调的敏感度，需使用高增益、高线性模式(HGHL)；当发射端关闭，交调影响很小时，可采用高增益、低线性模式(HGLL)；接收大信号时，采用低增益模式(LG)。调整$R_{LNA}$可改变HGHL模式下低噪声放大器的电流和线性。调整$R_{BIAS}$可改变HGLL和LG模式下低噪声放大器的电流和线性。

### 下变频混频器

混频器输入端需要一个隔直流电容，输出端需要上拉电感。隔直流电容和上拉电感可设计为匹配网络的一部分，见表1不同工作模式的设置。

### 本振输出缓冲器

本振输出缓冲器内部已匹配到50Ω，包括隔直流电容。当BUFFEN输入为高电平时，缓冲器有效；当BUFFEN输入为低电平时，禁止缓冲器。当LO/2为高电平时，缓冲器输出频率等于本振频率的二次分频；当LO/2为低电平时，缓冲器输出频率等于本振频率。

## 应用信息

### LNA/混频器串联性能

低噪声放大器和混频器的串联性能在所有高增益、高线性模式下达到最优，在HGHL模式下，低噪声放大器和混频器有低噪声系数、高增益、高线性特性；低噪声放大器的高增益特性有助于减小混频器噪声的影响，从而提高接收灵敏度；低噪声放大器的高线性度可有效抑制交调失真。当发射端关闭，交调影响较小时，可以使用HGLL模式；当接收信号较强时，线性度成为关键因素，此时须采用LG模式，降低低噪声放大器的增益可改善系统的线性特性。

### S参数

表2、3、4的S参数可用于设计RF匹配网络。

**表1. 工作模式**

| MODES | FUNCTION | | | | | | | CONTROL PINS | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | LO/1 | LO/2 | HGHL LNA | HGLL LNA | LG LNA | HGHL MIXER | HGLL MIXER | MODE2 | MODE1 | MODE0 | LO/2 |
| HGHL (LO Frequency Divided by Two) | | ✓ | ✓ | | | ✓ | | 1 | 1 | 1 | 1 |
| HGLL (LO Frequency Divided by Two) | | ✓ | | ✓ | | | ✓ | 1 | 0 | 1 | 1 |
| LG (LO Frequency Divided by Two) | | ✓ | | | ✓ | ✓ | | 0 | 1 | 1 | 1 |
| HGHL (LO Frequency Undivided) | ✓ | | ✓ | | | ✓ | | 1 | 1 | 1 | 0 |
| HGLL (LO Frequency Undivided) | ✓ | | | ✓ | | | ✓ | 1 | 0 | 1 | 0 |
| LG (LO Frequency Undivided) | ✓ | | | | ✓ | ✓ | | 0 | 1 | 1 | 0 |
| Shutdown Mode | | | | | | | | 0 | 0 | 0 | X |
| Undefined | | | | | | | | 1 | X | 0 | X |
| Undefined | | | | | | | | X | 1 | 0 | X |

表2. MAX2335低噪声放大器在HGHL模式下的S参数

| FREQUENCY (MHz) | S11 (dB) | ∠S11 (DEGREES) | S21 (dB) | ∠S21 (DEGREES) | S12 (dB) | ∠S12 (DEGREES) | S22 (dB) | ∠S22 (DEGREES) |
|---|---|---|---|---|---|---|---|---|
| 50 | -0.693 | -20.000 | 22.265 | 2.173 | -45.196 | -39.133 | -0.607 | 55.183 |
| 100 | -1.302 | -38.600 | 21.655 | -41.256 | -37.836 | -83.956 | -0.532 | 10.563 |
| 150 | -1.957 | -54.244 | 20.037 | -68.340 | -33.411 | -107.964 | -0.819 | -11.252 |
| 200 | -2.407 | -68.840 | 18.300 | -89.560 | -31.340 | -124.383 | -1.051 | -26.637 |
| 250 | -2.656 | -82.550 | 16.860 | -105.680 | -29.466 | -136.021 | -1.250 | -39.640 |
| 300 | -2.813 | -97.830 | 15.354 | -120.500 | -28.422 | -147.784 | -1.420 | -51.424 |
| 350 | -2.959 | -112.274 | 14.262 | -133.400 | -26.605 | -161.620 | -1.492 | -63.020 |
| 400 | -2.953 | -127.226 | 12.926 | -144.921 | -25.600 | -172.633 | -1.590 | -73.860 |
| 410 | -2.944 | -130.500 | 12.710 | -146.900 | -25.519 | -174.766 | -1.630 | -76.200 |
| 420 | -2.914 | -133.724 | 12.530 | -149.125 | -25.062 | -177.340 | -1.628 | -78.540 |
| 430 | -2.876 | -136.800 | 12.439 | -151.380 | -24.960 | -179.138 | -1.634 | -80.612 |
| 440 | -2.878 | -139.320 | 12.220 | -153.900 | -24.780 | 177.020 | -1.650 | -82.870 |
| 450 | -2.884 | -142.833 | 12.000 | -155.650 | -24.500 | 176.320 | -1.665 | -84.900 |
| 460 | -2.850 | -145.863 | 11.820 | -158.324 | -24.465 | 173.850 | -1.667 | -87.422 |
| 470 | -2.828 | -149.000 | 11.550 | -160.300 | -24.239 | 171.027 | -1.697 | -89.183 |
| 480 | -2.828 | -159.962 | 11.343 | -161.928 | -24.180 | 169.065 | -1.711 | -91.480 |
| 490 | -2.811 | -155.360 | 11.150 | -163.540 | -23.736 | 167.483 | -1.720 | -93.335 |
| 500 | -2.763 | -158.386 | 11.060 | -165.000 | -23.568 | 164.144 | -1.718 | -95.970 |
| 550 | -2.628 | -174.012 | 10.298 | -174.600 | -22.850 | 152.660 | -1.756 | -107.020 |
| 600 | -2.444 | 169.970 | 9.810 | 178.350 | -21.890 | 139.530 | -1.770 | -117.930 |
| 650 | -2.230 | 153.600 | 9.255 | 170.400 | -21.400 | 128.572 | -1.778 | -129.730 |
| 700 | -1.989 | 137.420 | 9.200 | 162.304 | -20.375 | 117.290 | -1.776 | -141.100 |
| 750 | -1.733 | 121.170 | 9.164 | 154.522 | -20.230 | 106.200 | -1.828 | -152.555 |
| 800 | -1.464 | 104.500 | 9.470 | 146.813 | -19.626 | 94.020 | -1.778 | -164.610 |
| 850 | -1.236 | 87.855 | 9.690 | 135.700 | -19.430 | 83.711 | -1.810 | -176.805 |
| 900 | -0.978 | 73.488 | 10.432 | 127.430 | -18.654 | 70.714 | -1.860 | 170.521 |
| 950 | -0.889 | 53.876 | 10.613 | 112.950 | -18.512 | 59.976 | -1.887 | 158.326 |
| 1000 | -0.858 | 36.186 | 11.417 | 101.010 | -17.839 | 45.167 | -2.033 | 145.377 |

# 450MHz CDMA/OFDM低噪声放大器/混频器

### 电源布局

为减小IC不同部分的耦合，理想的电源布局为星形连接，在$V_{CC}$中心节点处放置大的去耦电容。$V_{CC}$引线从该节点引出，连接到MAX2335的各个$V_{CC}$节点。在每个电源线的末端使用电容对地旁路，保证在敏感频点对地阻抗小于1Ω。这种分布使得每个$V_{CC}$引脚处具有去耦电容，为减小接地感抗，每个旁路电容至少要有一个接地过孔。同样，连接裸露焊盘到PCB地，尽可能采用多个接地过孔，以减小感抗。

### 匹配网络的布局

匹配网路的布局对电路中的寄生参数非常敏感。为了减小寄生电感，应保证所有连线尽可能短，元件尽可能靠近芯片安装。

为达到尽可能低的噪声系数，低噪声放大器的输入匹配网络要使用高Q值器件，保证混频器输出差分信号线等间距、等长度，确保信号的平衡。

### 芯片信息

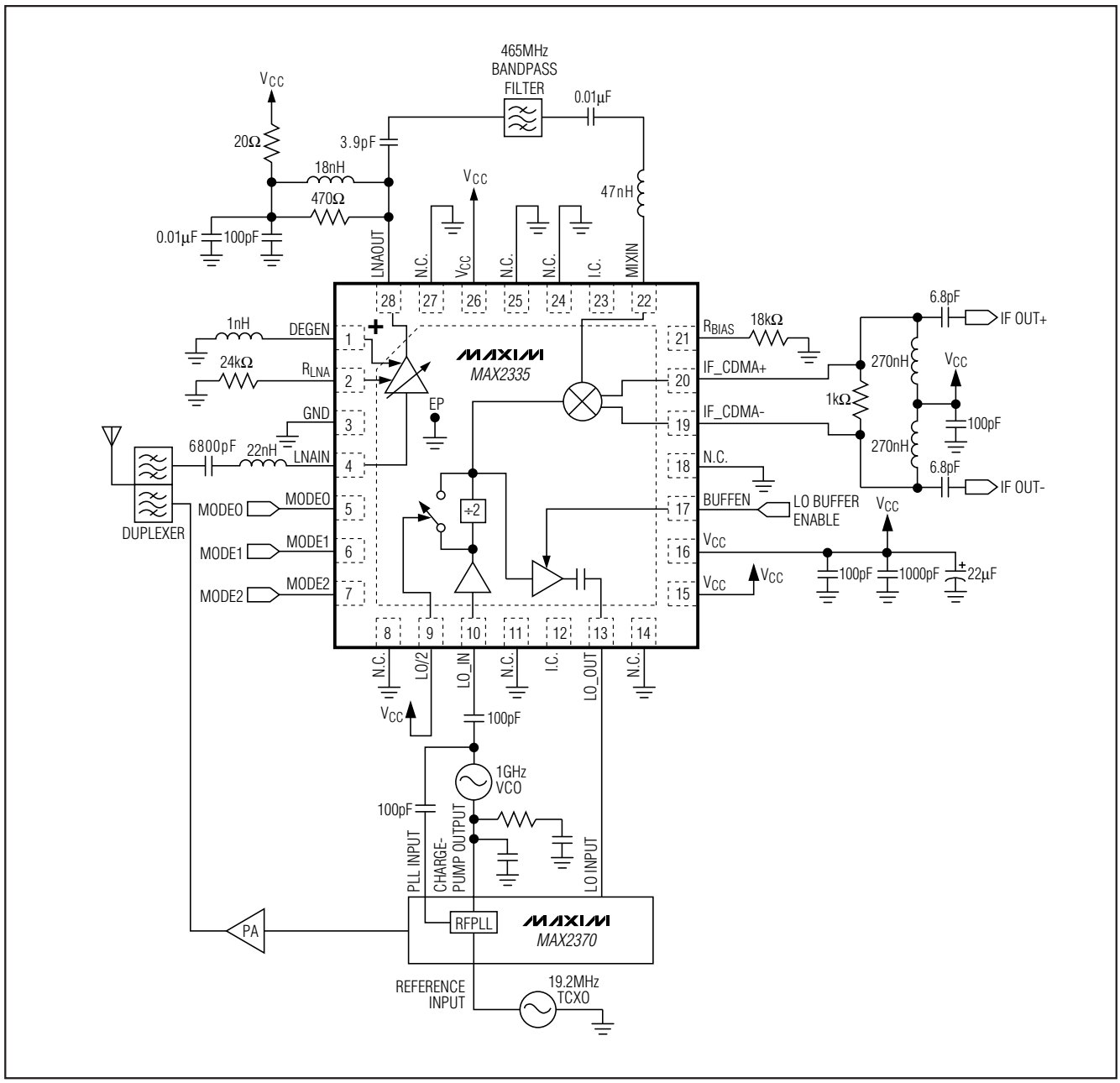
PROCESS: SiGe

表3. MAX2335混频器在HGHL模式下的输入阻抗

| FREQUENCY (MHz) | S11 (dB) | ∠S11 (DEGREES) |
|---|---|---|
| 400 | -1.2 | 77.23 |
| 410 | -1.229 | 74.52 |
| 420 | -1.247 | 71.7 |
| 430 | -1.24 | 69.124 |
| 440 | -1.24 | 66.47 |
| 450 | -1.25 | 63.97 |
| 460 | -1.28 | 61.455 |
| 470 | -1.32 | 58.68 |
| 480 | -1.33 | 55.87 |
| 490 | -1.35 | 53.565 |
| 500 | -1.35 | 50.87 |

表4. MAX2335混频器在HGHL模式下的输出阻抗(并联RC)

| IF FREQUENCY (MHz) | EQUIVALENT SHUNT RESISTANCE (kΩ) | EQUIVALENT SHUNT CAPACITANCE (pF) |
|---|---|---|
| 80 | 17.7 | 1.21 |
| 100 | 16.961 | 1.21 |
| 120 | 15.79 | 1.21 |
| 140 | 14.616 | 1.21 |
| 160 | 13.49 | 1.21 |
| 190 | 11.87 | 1.21 |

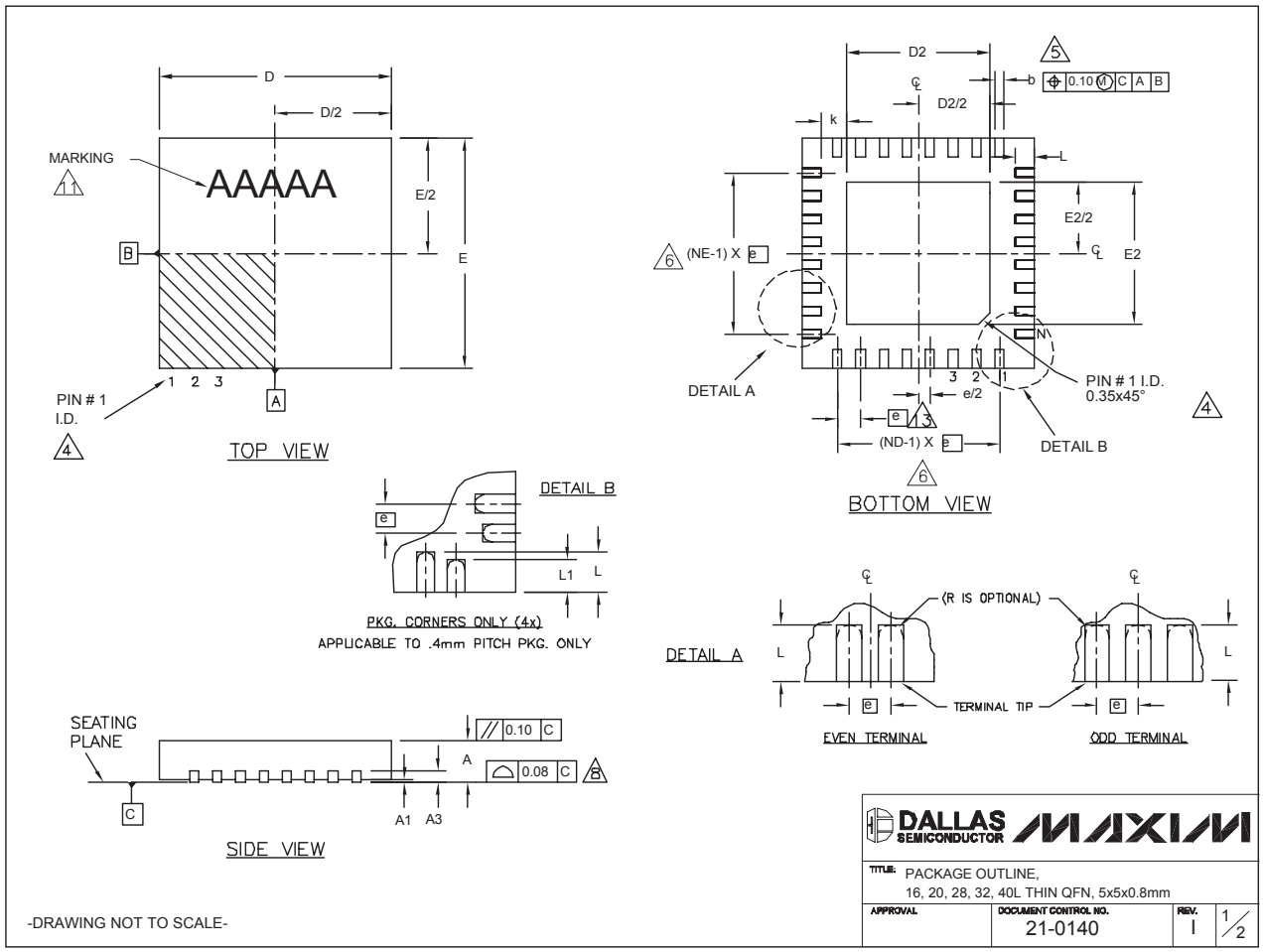

465MHz
BANDPASS
FILTER
0.01µF
VCC
20Ω
3.9pF
18nH
470Ω
47nH
0.01µF
100pF
LNAOUT
N.C.
VCC
N.C.
N.C.
I.C.
MIXIN
28
27
26
25
24
23
22
1nH
DEGEN
1
24kΩ
RLNA
2
GND
3
6800pF
22nH
LNAIN
4
MODE0
5
MODE1
6
MODE2
7
MAXIM
MAX2335
EP
÷2
21
20
19
18
17
16
15
RBIAS
18kΩ
IF_CDMA+
IF_CDMA-
N.C.
BUFFEN
LO BUFFER
ENABLE
VCC
6.8pF
IF OUT+
270nH
1kΩ
100pF
270nH
6.8pF
IF OUT-
1000pF
22µF
DUPLEXER
8
9
10
11
12
13
14
N.C.
LO/2
LO_IN
N.C.
I.C.
LO_OUT
N.C.
100pF
1GHz
VCO
100pF
PLL INPUT
CHARGE-
PUMP OUTPUT
LO INPUT
PA
RFPLL
MAXIM
MAX2370
REFERENCE
INPUT
19.2MHz
TCXO

# 450MHz CDMA/OFDM低噪声放大器/混频器

## 封装信息

(本数据资料提供的封装图可能不是最近的规格，如需最近的封装外型信息，请查询 www.maxim-ic.com.cn/packages。)

QFN THIN.EPS



## 封装信息（续）

(本数据资料提供的封装图可能不是最近的规格，如需最近的封装外型信息，请查询 **www.maxim-ic.com.cn/packages**。)

| COMMON DIMENSIONS | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PKG. | 16L 5x5 | | | 20L 5x5 | | | 28L 5x5 | | | 32L 5x5 | | | 40L 5x5 | | |
| SYMBOL | MIN. | NOM. | MAX. | MIN. | NOM. | MAX. | MIN. | NOM. | MAX. | MIN. | NOM. | MAX. | MIN. | NOM. | MAX. |
| A | 0.70 | 0.75 | 0.80 | 0.70 | 0.75 | 0.80 | 0.70 | 0.75 | 0.80 | 0.70 | 0.75 | 0.80 | 0.70 | 0.75 | 0.80 |
| A1 | 0 | 0.02 | 0.05 | 0 | 0.02 | 0.05 | 0 | 0.02 | 0.05 | 0 | 0.02 | 0.05 | 0 | 0.02 | 0.05 |
| A3 | 0.20 REF. | | | 0.20 REF. | | | 0.20 REF. | | | 0.20 REF. | | | 0.20 REF. | | |
| b | 0.25 | 0.30 | 0.35 | 0.25 | 0.30 | 0.35 | 0.20 | 0.25 | 0.30 | 0.20 | 0.25 | 0.30 | 0.15 | 0.20 | 0.25 |
| D | 4.90 | 5.00 | 5.10 | 4.90 | 5.00 | 5.10 | 4.90 | 5.00 | 5.10 | 4.90 | 5.00 | 5.10 | 4.90 | 5.00 | 5.10 |
| E | 4.90 | 5.00 | 5.10 | 4.90 | 5.00 | 5.10 | 4.90 | 5.00 | 5.10 | 4.90 | 5.00 | 5.10 | 4.90 | 5.00 | 5.10 |
| e | 0.80 BSC. | | | 0.65 BSC. | | | 0.50 BSC. | | | 0.50 BSC. | | | 0.40 BSC. | | |
| k | 0.25 | - | - | 0.25 | - | - | 0.25 | - | - | 0.25 | - | - | 0.25 | 0.35 | 0.45 |
| L | 0.30 | 0.40 | 0.50 | 0.45 | 0.55 | 0.65 | 0.45 | 0.55 | 0.65 | 0.30 | 0.40 | 0.50 | 0.40 | 0.50 | 0.60 |
| L1 | - | - | - | - | - | - | - | - | - | - | - | - | 0.30 | 0.40 | 0.50 |
| N | 16 | | | 20 | | | 28 | | | 32 | | | 40 | | |
| ND | 4 | | | 5 | | | 7 | | | 8 | | | 10 | | |
| NE | 4 | | | 5 | | | 7 | | | 8 | | | 10 | | |
| JEDEC | WHHB | | | WHHC | | | WHHD-1 | | | WHHD-2 | | | ----- | | |

| EXPOSED PAD VARIATIONS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| PKG. CODES | D2 | | | E2 | | | L exceptions | DOWN BONDS ALLOWED |
| | MIN. | NOM. | MAX. | MIN. | NOM. | MAX. | ±0.15 | |
| T1655-2 | 3.00 | 3.10 | 3.20 | 3.00 | 3.10 | 3.20 | ** | YES |
| T1655-3 | 3.00 | 3.10 | 3.20 | 3.00 | 3.10 | 3.20 | ** | NO |
| T1655N-1 | 3.00 | 3.10 | 3.20 | 3.00 | 3.10 | 3.20 | ** | NO |
| T2055-3 | 3.00 | 3.10 | 3.20 | 3.00 | 3.10 | 3.20 | ** | YES |
| T2055-4 | 3.00 | 3.10 | 3.20 | 3.00 | 3.10 | 3.20 | ** | NO |
| T2055-5 | 3.15 | 3.25 | 3.35 | 3.15 | 3.25 | 3.35 | 0.40 | YES |
| T2855-3 | 3.15 | 3.25 | 3.35 | 3.15 | 3.25 | 3.35 | ** | YES |
| T2855-4 | 2.60 | 2.70 | 2.80 | 2.60 | 2.70 | 2.80 | ** | YES |
| T2855-5 | 2.60 | 2.70 | 2.80 | 2.60 | 2.70 | 2.80 | ** | NO |
| T2855-6 | 3.15 | 3.25 | 3.35 | 3.15 | 3.25 | 3.35 | ** | NO |
| T2855-7 | 2.60 | 2.70 | 2.80 | 2.60 | 2.70 | 2.80 | ** | YES |
| T2855-8 | 3.15 | 3.25 | 3.35 | 3.15 | 3.25 | 3.35 | 0.40 | YES |
| T2855N-1 | 3.15 | 3.25 | 3.35 | 3.15 | 3.25 | 3.35 | ** | NO |
| T3255-3 | 3.00 | 3.10 | 3.20 | 3.00 | 3.10 | .20 | ** | YES |
| T3255-4 | 3.00 | 3.10 | 3.20 | 3.00 | 3.10 | .20 | ** | NO |
| T3255-5 | 3.00 | 3.10 | 3.20 | 3.00 | 3.10 | 3.20 | ** | YES |
| T3255N-1 | 3.00 | 3.10 | 3.20 | 3.00 | 3.10 | 3.20 | ** | NO |
| T4055-1 | 3.20 | 3.30 | 3.40 | 3.20 | 3.30 | 3.40 | ** | YES |

** SEE COMMON DIMENSIONS TABLE

NOTES:

1. DIMENSIONING & TOLERANCING CONFORM TO ASME Y14.5M-1994.
2. ALL DIMENSIONS ARE IN MILLIMETERS. ANGLES ARE IN DEGREES.
3. N IS THE TOTAL NUMBER OF TERMINALS.
4. THE TERMINAL #1 IDENTIFIER AND TERMINAL NUMBERING CONVENTION SHALL CONFORM TO JESD 95-1 SPP-012. DETAILS OF TERMINAL #1 IDENTIFIER ARE OPTIONAL, BUT MUST BE LOCATED WITHIN THE ZONE INDICATED. THE TERMINAL #1 IDENTIFIER MAY BE EITHER A MOLD OR MARKED FEATURE.
5. DIMENSION b APPLIES TO METALLIZED TERMINAL AND IS MEASURED BETWEEN 0.25 mm AND 0.30 mm FROM TERMINAL TIP.
6. ND AND NE REFER TO THE NUMBER OF TERMINALS ON EACH D AND E SIDE RESPECTIVELY.
7. DEPOPULATION IS POSSIBLE IN A SYMMETRICAL FASHION.
8. COPLANARITY APPLIES TO THE EXPOSED HEAT SINK SLUG AS WELL AS THE TERMINALS.
9. DRAWING CONFORMS TO JEDEC MO220, EXCEPT EXPOSED PAD DIMENSION FOR T2855-3 AND T2855-6.
10. WARPAGE SHALL NOT EXCEED 0.10 mm.
11. MARKING IS FOR PACKAGE ORIENTATION REFERENCE ONLY.
12. NUMBER OF LEADS SHOWN ARE FOR REFERENCE ONLY.
13. LEAD CENTERLINES TO BE AT TRUE POSITION AS DEFINED BY BASIC DIMENSION "e", ±0.05.

-DRAWING NOT TO SCALE-

DALLAS SEMICONDUCTOR MAXIM

TITLE: PACKAGE OUTLINE, 16, 20, 28, 32, 40L THIN QFN, 5x5x0.8mm

| APPROVAL | DOCUMENT CONTROL NO. | REV. | |
|---|---|---|---|
| | 21-0140 | I | 2/2 |

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