

# MAX2679/MAX2679B

## GPS/GNSS Ultra-Low Current Low-Noise Amplifier

### General Description

The MAX2679 and MAX2679B low-noise amplifiers (LNA) are designed for GPS L1, Galileo, and GLONASS applications. The devices achieve high gain and low noise figure while maximizing the input-referred 1dB compression point and the 3rd-order intercept point. The MAX2679 achieves excellent performance while consuming only 1mA supply current and providing 0.95dB noise figure. The MAX2679B achieves excellent performance while consuming only 650 $\mu$ A and providing 1.03dB noise figure.

The MAX2679/MAX2679B operates from a +1.08V to +1.98V single supply. The devices are available in a very small, lead-free, RoHS-compliant, 0.83mm x 0.83mm wafer-level package (WLP).

### Applications

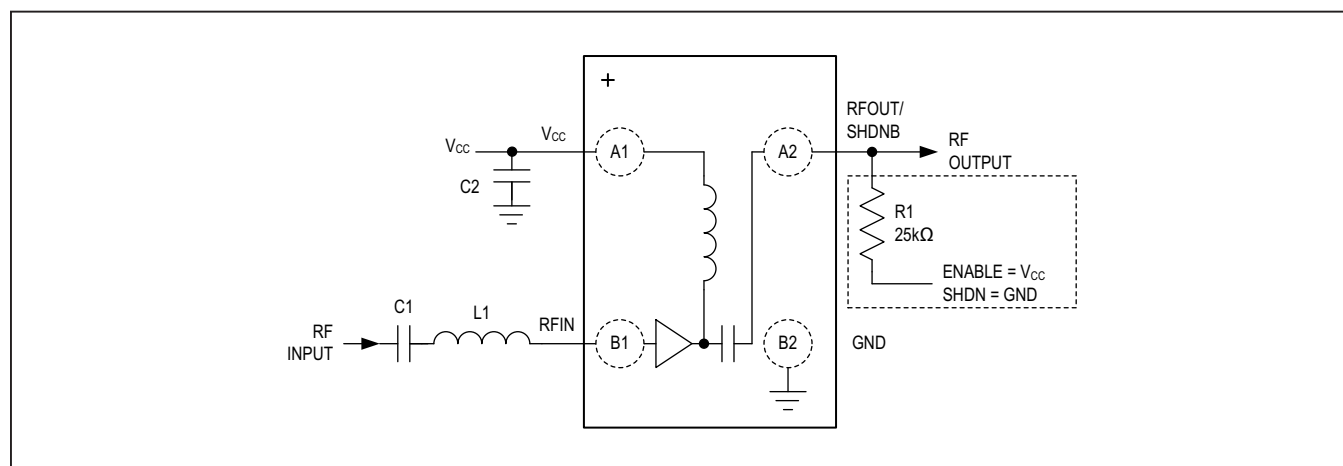
- Wearables
- Telematics (Asset Tracking and Management)
- Cellular Phones with GPS
- Notebook PCs/Ultra-Mobile PCs
- Recreational Navigation
- Watches
- Digital Cameras
- GPS Front End Modules

### Benefits and Features

- High Power Gain: 19dB (MAX2679), 16.5dB (MAX2679B)
- Low Noise Figure: 0.95dB (MAX2679), 1.03dB (MAX2679B)
- Integrated 50 $\Omega$  Output Matching Circuit
- Low Supply Current: 1mA (MAX2679), 650 $\mu$ A (MAX2679B)
- Wide Supply Voltage Range: 1.08V to 1.98V
- Low Bill of Materials: One Inductor, Two Capacitors, One Resistor
- 4-Bump, 0.4mm Pitch WLP, 0.83mm x 0.83mm

Ordering Information appears at end of data sheet.

### Simplified Block Diagram



## Absolute Maximum Ratings

$V_{CC}$  to GND ..... -0.3V to 2.2V  
 Other Pins to GND ..... -0.3V to  $V_{CC} + 0.3V$   
 Maximum RF Input Power ..... +5dBm  
 Continuous Power Dissipation (Multilayer Board)  
 ( $T_A = +70^\circ\text{C}$ , derate 9.7mW/ $^\circ\text{C}$  above  $+70^\circ\text{C}$ ) ..... 776mW

Operating Temperature Range .....  $-40^\circ\text{C}$  to  $+85^\circ\text{C}$   
 Junction Temperature .....  $+150^\circ\text{C}$   
 Storage Temperature Range .....  $-65^\circ\text{C}$  to  $+160^\circ\text{C}$   
 Lead Temperature (soldering, 10s) ..... Reflow Profile (Note 1)  
 Soldering Temperature (reflow) .....  $+260^\circ\text{C}$

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

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.

## Package Information

### WLP 0.4mm

| PACKAGE CODE                                 | N40D0+1                                        |
|----------------------------------------------|------------------------------------------------|
| Outline Number                               | <a href="#">21-100107</a>                      |
| Land Pattern Number                          | <a href="#">Refer to Application Note 1891</a> |
| <b>Thermal Resistance, Four-Layer Board:</b> |                                                |
| Junction to Ambient ( $\theta_{JA}$ )        | 102.59 $^\circ\text{C}/\text{W}$               |
| Junction to Case ( $\theta_{JC}$ )           | N/A                                            |

For the latest package outline information and land patterns (footprints), go to [www.maximintegrated.com/packages](http://www.maximintegrated.com/packages). Note that a "+", "#", or "-" in the package code indicates RoHS status only. Package drawings may show a different suffix character, but the drawing pertains to the package regardless of RoHS status.

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 [www.maximintegrated.com/thermal-tutorial](http://www.maximintegrated.com/thermal-tutorial).

## Electrical Characteristics

( $V_{CC} = 1.08V$  to  $1.98V$ ,  $T_A = -40^\circ\text{C}$  to  $+85^\circ\text{C}$ . Typical values are at  $V_{CC} = 1.8V$  and  $T_A = +25^\circ\text{C}$ , unless otherwise noted. Limits are 100% tested at  $T_A = +25^\circ\text{C}$ . Limits over the operating temperature range and relevant supply voltage range are guaranteed by design and characterization. Specifications marked "GBD" are guaranteed by design and not production tested.)

| PARAMETER                            | SYMBOL     | CONDITIONS                               | MIN               | TYP  | MAX               | UNITS         |
|--------------------------------------|------------|------------------------------------------|-------------------|------|-------------------|---------------|
| <b>DC ELECTRICAL CHARACTERISTICS</b> |            |                                          |                   |      |                   |               |
| Supply Voltage                       | $V_{CC}$   |                                          | 1.08              | 1.8  | 1.98              | V             |
| Supply Current                       | $I_{VCC}$  | Normal Operation                         | MAX2679           | 1000 |                   | $\mu\text{A}$ |
|                                      |            |                                          | MAX2679B          | 650  |                   |               |
|                                      | $I_{SHDN}$ | Shutdown Mode,<br>$V_{RFOUT}/SHDNB = 0V$ |                   | 0    | 6                 |               |
| Digital Input Logic-High             | $V_{IH}$   |                                          | 0.7 x<br>$V_{CC}$ |      |                   | V             |
| Digital Input Logic-Low              | $V_{IL}$   |                                          |                   |      | 0.3 x<br>$V_{CC}$ | V             |
| Digital Input Current<br>Logic-High  | $I_{IH}$   | At $V_{IH}$                              |                   | 0    |                   | $\mu\text{A}$ |
| Digital Input Current<br>Logic-Low   | $I_{IL}$   | At $V_{IL}$                              |                   | 0    |                   | $\mu\text{A}$ |

## Electrical Characteristics (continued)

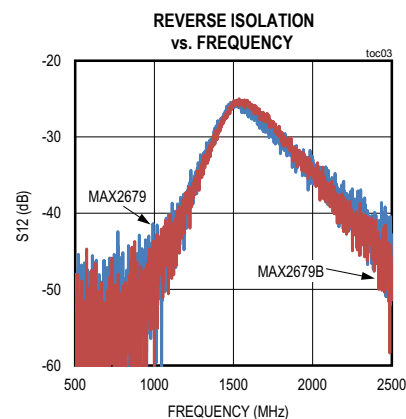
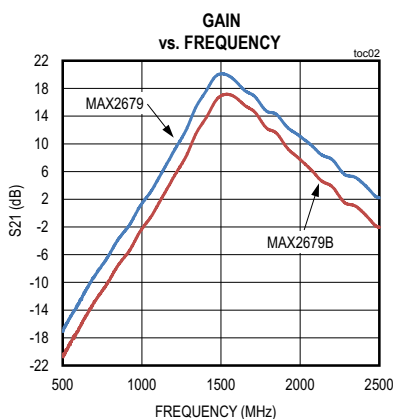
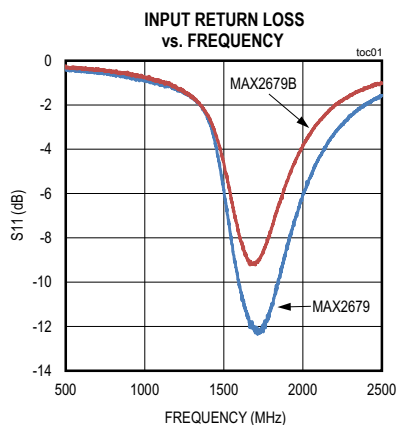
( $V_{CC} = 1.08V$  to  $1.98V$ ,  $T_A = -40^{\circ}C$  to  $+85^{\circ}C$ . Typical values are at  $V_{CC} = 1.8V$  and  $T_A = +25^{\circ}C$ , unless otherwise noted. Limits are 100% tested at  $T_A = +25^{\circ}C$ . Limits over the operating temperature range and relevant supply voltage range are guaranteed by design and characterization. Specifications marked "GBD" are guaranteed by design and not production tested.)

| PARAMETER                                   | SYMBOL    | CONDITIONS                                                                          | MIN      | TYP     | MAX | UNITS |
|---------------------------------------------|-----------|-------------------------------------------------------------------------------------|----------|---------|-----|-------|
| <b>AC ELECTRICAL CHARACTERISTICS</b>        |           |                                                                                     |          |         |     |       |
| RF Frequency                                | $f_{RF}$  |                                                                                     |          | 1575.42 |     | MHz   |
| Power Gain                                  |           | MAX2679                                                                             |          | 19      |     | dB    |
|                                             |           | MAX2679B                                                                            |          | 16.5    |     |       |
| Noise Figure                                |           | 0402 matching inductor (Note 2)                                                     | MAX2679  | 0.95    |     | dB    |
|                                             |           |                                                                                     | MAX2679B | 1.03    |     |       |
| Out-of-Band 3rd-Order Input Intercept Point | $O_{IP3}$ | $f_{RF1} = 1713MHz$ ; $P_{RF1} = -27dBm$ ; $f_{RF2} = 1851MHz$ ; $P_{RF2} = -39dBm$ | MAX2679  | -17     |     | dBm   |
|                                             |           |                                                                                     | MAX2679B | -19     |     |       |
| Input 1dB Compression Point                 | $P_{1dB}$ | $f_{RF} = 1575.42MHz$                                                               | MAX2679  | -25     |     | dBm   |
|                                             |           |                                                                                     | MAX2679B | -26     |     |       |
| Input Return Loss                           | $P_{1dB}$ | $f_{RF} = 1575.42MHz$                                                               | MAX2679  | 9       |     | dB    |
|                                             |           |                                                                                     | MAX2679B | 7       |     |       |
| Output Return Loss                          |           |                                                                                     |          | 12      |     | dB    |
| Reverse Isolation                           |           |                                                                                     |          | 26      |     | dB    |

**Note 2:** Noise figure measured in a Faraday cage to remove all interfering signals from increasing the noise floor. Includes 0.02dB loss of EV Kit trace.

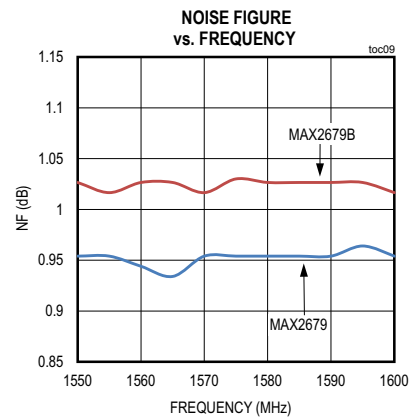
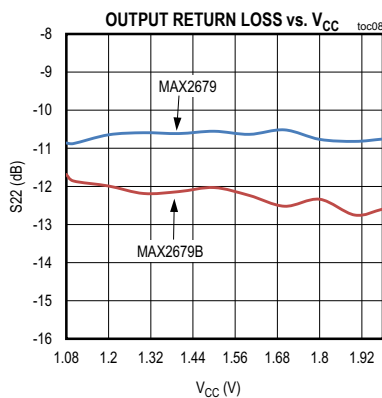
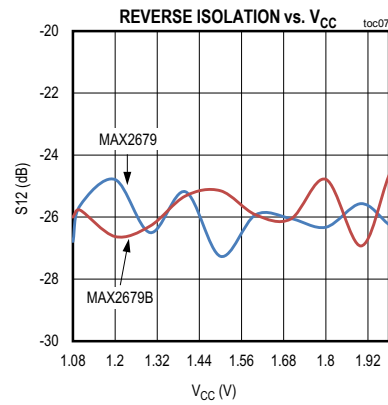
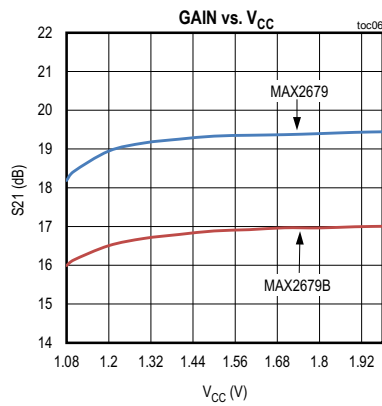
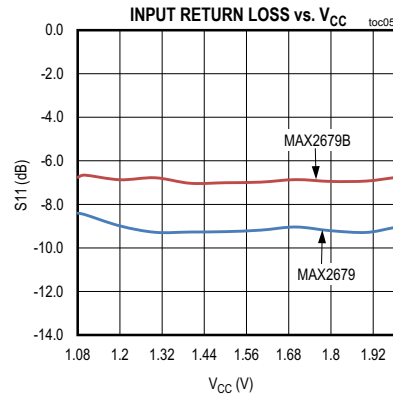
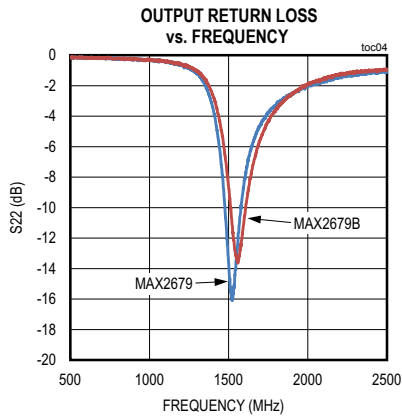
## Typical Operating Characteristics

$V_{CC} = RFOUT/SHDNB = 1.8V$  and  $T_A = +25^{\circ}C$ , at 1575.42MHz unless otherwise noted.



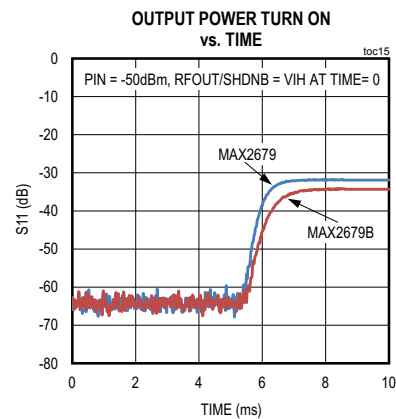
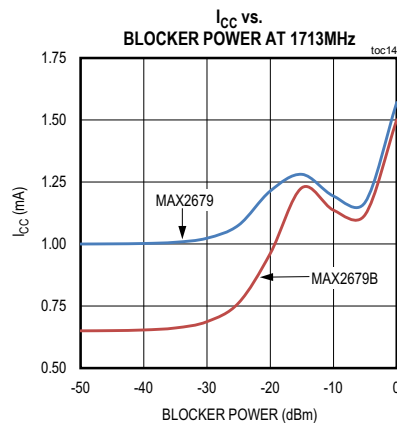
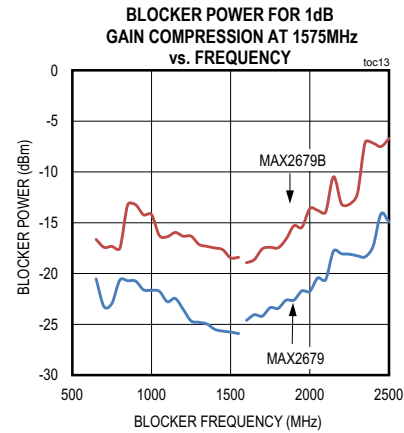
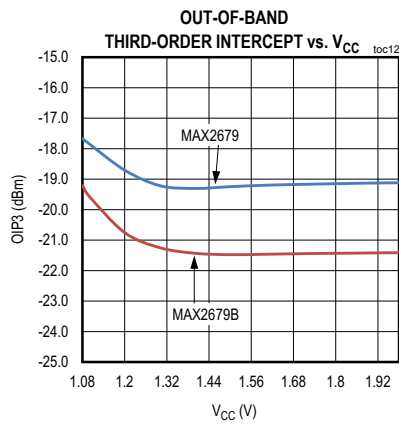
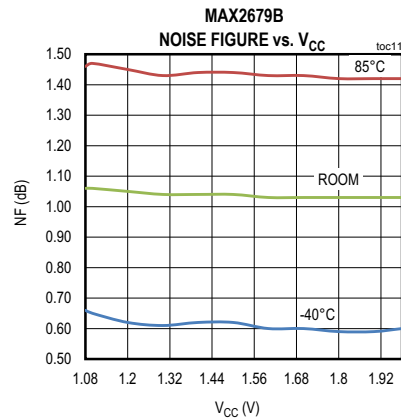
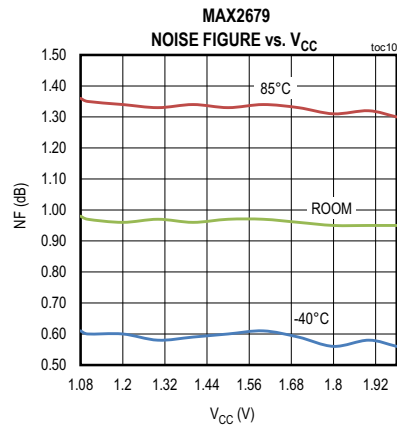
## Typical Operating Characteristics (continued)

$V_{CC} = R_{FOUT}/SHDNB = 1.8V$  and  $T_A = +25^\circ C$ , at 1575.42MHz unless otherwise noted.

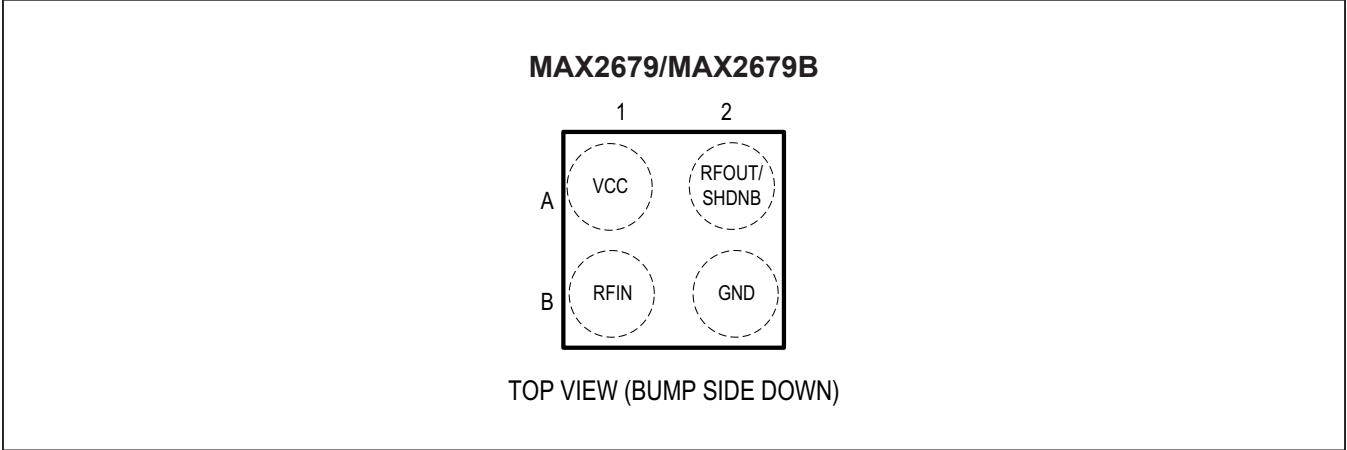


## Typical Operating Characteristics (continued)

$V_{CC} = \text{RFOUT/SHDNB} = 1.8\text{V}$  and  $T_A = +25^\circ\text{C}$ , at 1575.42MHz unless otherwise noted.



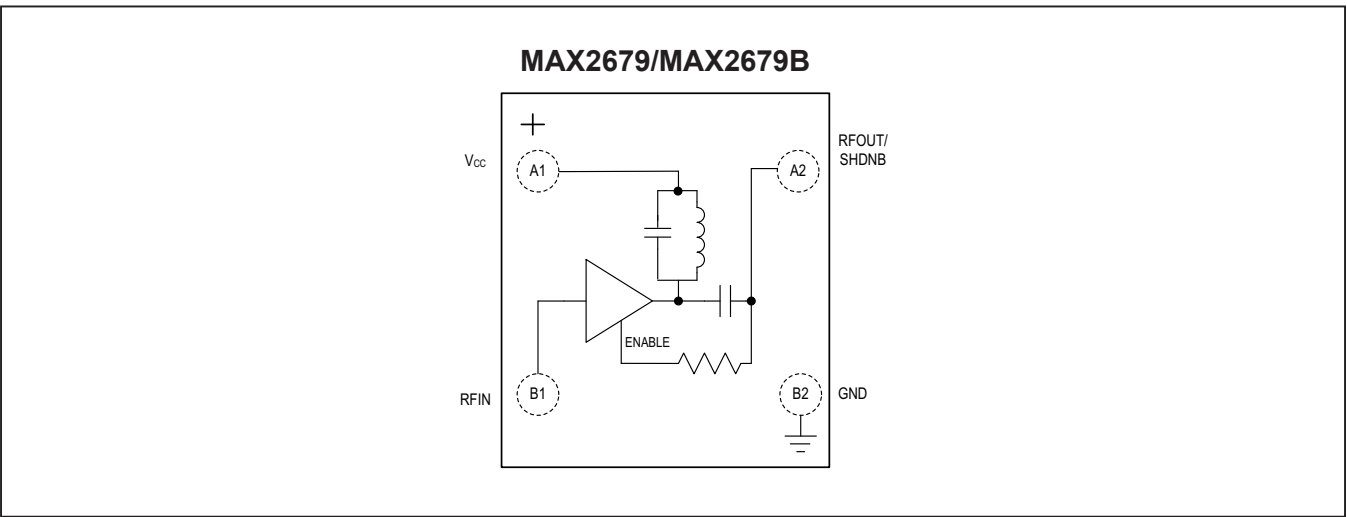
Pin Configuration



Pin Description

| PIN                  | NAME            | FUNCTION                                                                                                                                                               |
|----------------------|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| MAX2679/<br>MAX2679B |                 |                                                                                                                                                                        |
| A1                   | V <sub>CC</sub> | Supply Voltage. Bypass to ground with a 1000pF capacitor as close as possible to the IC.                                                                               |
| A2                   | RFOUT/<br>SHDNB | RF Output. RFOUT is internally matched to 50Ω. Applying logic-high through a 25kΩ resistor enables the IC. Applying logic-low through a 25kΩ resistor disables the IC. |
| B1                   | RFIN            | RF Input. Requires a DC-blocking capacitor and external matching components.                                                                                           |
| B2                   | GND             | Ground. Connect to the PCB ground plane.                                                                                                                               |

Functional Diagram



## Detailed Description

The MAX2679 and MAX2679B are LNAs designed for GPS L1, Galileo, and GLONASS applications. The devices feature an optional power-shutdown control mode to eliminate the need for an external supply switch. The device achieves high gain and low noise figure in an ultra-small package ideal for space-sensitive applications.

## Input and Output Matching

The devices require an off-chip input matching. Only an inductor in series with a DC-blocking capacitor is needed to form the input matching circuit. The [Typical Application Circuits](#) shows the recommended input-matching network. These values are optimized for the best simultaneous gain, noise figure, and return loss performance. The device integrates an on-chip matching to 50Ω at the output, eliminating the need for external matching components.

## Low-Power Shutdown Mode

The MAX2679 and MAX2679B include a shutdown feature to turn off the entire chip. Active mode is enabled by floating the RFOUT bump or by applying  $V_{IH}$  through

an external 25kΩ resistor. To enter low-power shutdown mode, apply  $V_{IL}$  to the RFOUT/SHDNB bump through an external 25kΩ resistor.

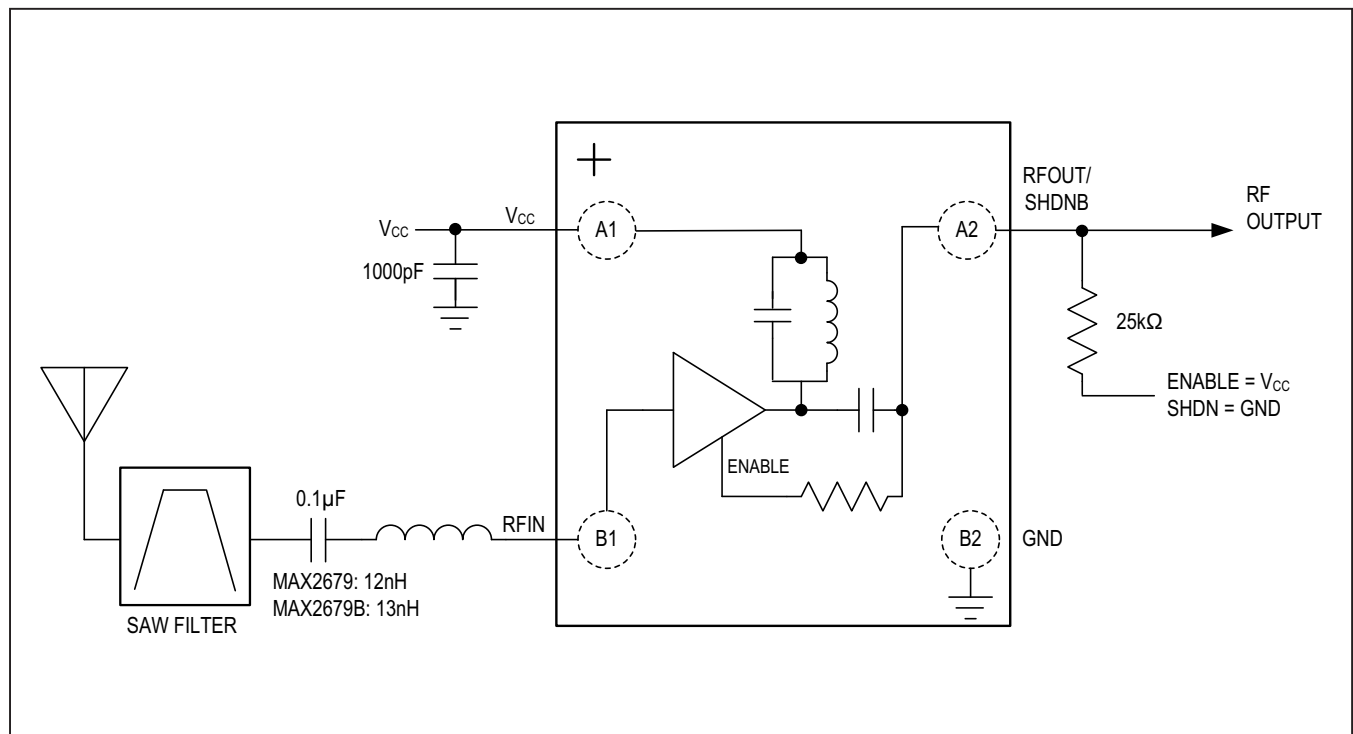
## Applications Information

### Printed Circuit Board (PCB) Design

A properly designed PCB is essential to any RF microwave circuit. Use controlled-impedance lines on all high-frequency inputs and outputs. Bypass  $V_{CC}$  with decoupling capacitors located close to the device. For long  $V_{CC}$  lines, it may be necessary to add decoupling capacitors. Locate these additional capacitors further away from the device package. Proper grounding of the GND bump is essential. If the PCB uses a topside RF ground, connect it directly to the GND bump. For a board where the ground is not on the component layer, connect the GND bump to the board with multiple vias close to the package. For general layout guidelines, refer to [www.maximintegrated.com/app-notes/index.mvp/id/5100](http://www.maximintegrated.com/app-notes/index.mvp/id/5100).

Refer to the MAX2679 EV kit schematic, Gerber data, PADS layout file, and BOM information for best practices.

## Typical Application Circuits



### Ordering Information

| PART NUMBER   | TEMP RANGE     | PIN-PACKAGE | TOP MARKING |
|---------------|----------------|-------------|-------------|
| MAX2679ENS+   | -40°C to +85°C | 4 WLP       | +1          |
| MAX2679ENS+T  | -40°C to +85°C | 4 WLP       | +1          |
| MAX2679BENS+  | -40°C to +85°C | 4 WLP       | +8          |
| MAX2679BENS+T | -40°C to +85°C | 4 WLP       | +8          |

+Denotes a lead(Pb)-free/RoHS-compliant package.

T Denotes tape-and-reel.



## Revision History

| REVISION<br>NUMBER | REVISION<br>DATE | DESCRIPTION     | PAGES<br>CHANGED |
|--------------------|------------------|-----------------|------------------|
| 0                  | 3/17             | Initial release | —                |

For pricing, delivery, and ordering information, please contact Maxim Direct at 1-888-629-4642, or visit Maxim Integrated's website at [www.maximintegrated.com](http://www.maximintegrated.com).

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Электрон  
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