DATA SHEET

# SKY67175-306LF: 1.5 to 3.8 GHz Two-Stage, High-Gain Low-Noise Amplifier

## Applications

- LTE, GSM, WCDMA, HSDPA macro and micro base stations
- L and S band ultra low-noise receivers
- Cellular repeaters, small cell, macro cell, DAS, and RRH/RRUs
- High-temperature transceiver applications to +105 °C

## Features

- Part of complete SDARS LNA reference design
- Ultra-low reference design NF: 0.64 dB @ 3.5 GHz
- High gain: 33 dB @ 3.5 GHz
- Low quiescent current: 115 mA
- Stage 1 and 2 adjustable current
- Small, QFN (16-pin, 4 x 4 mm) Pb-free package (MSL1, 260 °C per JEDEC J-STD-020)

Skyworks Green™ products are compliant with all applicable legislation and are halogen-free. For additional information, refer to *Skyworks Definition of Green™*, document number SQ04-0074.

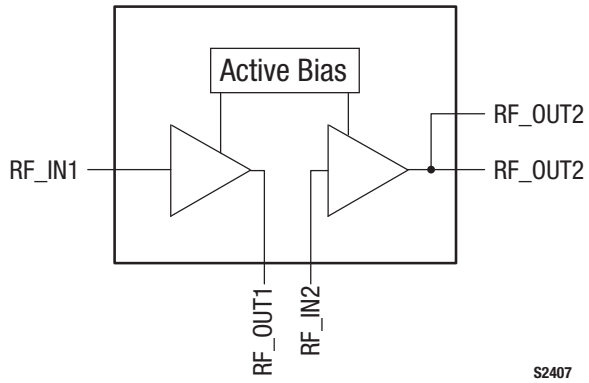



**Figure 1. SKY67175-306LF Block Diagram**

## Description

The SKY67175-306LF is a two-stage, GaAs pHEMT low-noise amplifier (LNA) with active bias and high linearity performance. The pHEMT front end of the device provides an ultra-low noise figure (NF) while the cascode output stage provides high gain, linearity, and efficiency.

With excellent thermal performance, the SKY67175-306LF is rated for operation up to +105 °C.

The SKY67175-306LF is provided in a 4 x 4 mm, 16-pin Quad Flat No-Lead (QFN) package. A functional block diagram is shown in Figure 1. The pin configuration and package are shown in Figure 2. Signal pin assignments and functional pin descriptions are provided in Table 1.

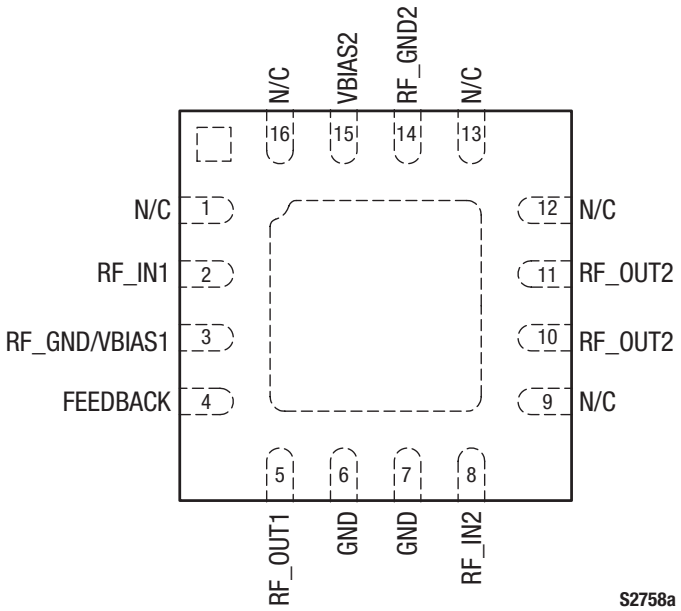



**Figure 2. SKY67175-306LF Pinout – 16-Pin QFN (Top View)**

**Table 1. SKY67175-306LF Signal Descriptions**

| Pin | Name | Description | Pin | Name | Description |
|---|---|---|---|---|---|
| 1 | N/C | No connection. May be grounded with no change in performance. | 9 | N/C | No connection. May be grounded with no change in performance. |
| 2 | RF_IN1 | RF input to first stage LNA | 10 | RF_OUT2 | RF output of second stage amplifier |
| 3 | RF_GND/VBIAS1 | AC ground for first stage bias circuit and bias voltage input that sets the first stage bias current. | 11 | RF_OUT2 | RF output of second stage amplifier |
| 4 | FEEDBACK | Feedback pin. Leave open when not used. This feedback option is typically not used since it reduces gain. | 12 | N/C | No connection. May be grounded with no change in performance. |
| 5 | RF_OUT1 | RF output of first stage LNA | 13 | N/C | No connection. May be grounded with no change in performance. |
| 6 | GND | Ground | 14 | RF_GND2 | AC ground for second stage bias circuit |
| 7 | GND | Ground | 15 | VBIAS2 | bias voltage input that sets the second stage bias current |
| 8 | RF_IN2 | RF input to second stage amplifier | 16 | N/C | No connection. May be grounded with no change in performance. |

## Electrical and Mechanical Specifications

The absolute maximum ratings of the SKY67175-306LF are provided in Table 2. Electrical specifications are provided in Table 3.

Typical performance characteristics of the SKY67175-306LF are illustrated in Figures 3 through 13.

**Table 2. SKY67175-306LF Absolute Maximum Ratings (Note 1)**

| Parameter | Symbol | Minimum | Maximum | Units |
|---|---|---|---|---|
| Supply voltage | $V_{DD}$ | | 6.0 | V |
| RF input power | $P_{IN}$ | | +20 | dBm |
| Operating temperature | $T_{OP}$ | –40 | +105 | °C |
| Storage temperature | $T_{STG}$ | –65 | +125 | °C |
| Junction temperature | $T_J$ | | +150 | °C |
| Thermal resistance:<br>Stage 1<br>Stage 2 | $\Theta_{JC}$ | | <br>50<br>65 | <br>°C/W<br>°C/W |
| Electrostatic discharge:<br>Charged Device Model (CDM), Class 4<br>Human Body Model (HBM), Class 1A<br>Machine Model (MM), Class A | ESD | | <br>1000<br>250<br>25 | <br>V<br>V<br>V |

**Note 1:** Exposure to maximum rating conditions for extended periods may reduce device reliability. There is no damage to device with only one parameter set at the limit and all other parameters set at or below their nominal value. Exceeding any of the limits listed here may result in permanent damage to the device.

***CAUTION**: Although this device is designed to be as robust as possible, electrostatic discharge (ESD) can damage this device. This device must be protected at all times from ESD. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection. Industry-standard ESD precautions should be used at all times.*

**Table 3. SKY67175-306LF Electrical Specifications (Note 1)**
**($V_{DD}$ = +5 V, $T_{OP}$ = +25 °C, $P_{IN}$ = –30 dBm, Optimized for 3.4 to 3.6 GHz Operation, Unless Otherwise Noted)**

| Parameter | Symbol | Test Condition | Min | Typical | Max | Units |
|---|---|---|---|---|---|---|
| ***RF Specifications*** | | | | | | |
| Noise figure (Note 2) | NF | @ 3500 MHz | | 0.64 | 0.84 | dB |
| Small signal gain | \|S21\| | @ 3500 MHz | 30 | 33 | | dB |
| Input return loss | \|S11\| | @ 3500 MHz | | 17 | | dB |
| Output return loss | \|S22\| | @ 3500 MHz | | 18 | | dB |
| Reverse isolation | \|S12\| | @ 3500 MHz | | 48 | | dB |
| 3rd Order Input Intercept Point | IIP3 | @ 3500 MHz,<br>$\Delta f$ = 1 MHz,<br>$P_{IN}$ = –30 dBm/tone | –3.5 | +0.5 | | dBm |
| 3rd Order Output Intercept Point | OIP3 | @ 3500 MHz,<br>$\Delta f$ = 1 MHz,<br>$P_{IN}$ = –30 dBm/tone | +29.5 | +33.5 | | dBm |
| 1 dB Input Compression Point | IP1dB | @ 3500 MHz | –19.5 | –16.5 | | dBm |
| 1 dB Output Compression Point | OP1dB | @ 3500 MHz | +13.5 | +16.5 | | dBm |
| ***DC Specifications*** | | | | | | |
| Supply voltage | $V_{DD}$ | | | 5 | | V |
| Quiescent current | $I_{DD}$ | Set with external resistor | | 115 | | mA |

**Note 1:** Performance is guaranteed only under the conditions listed in this table. Specifications are for the entire reference design including the interstage SAW filter and the output high pass filter.

**Note 2:** Noise figure has been de-embedded as 0.1 dB @ 3500 MHz for connector and board loss.

## Typical Performance Characteristics

**($V_{DD}$ = +5 V, $T_{OP}$ = +25 °C, $P_{IN}$ = –30 dBm, Reference Design Optimized for 3.4 to 3.6 GHz Operation, Unless Otherwise Noted)**

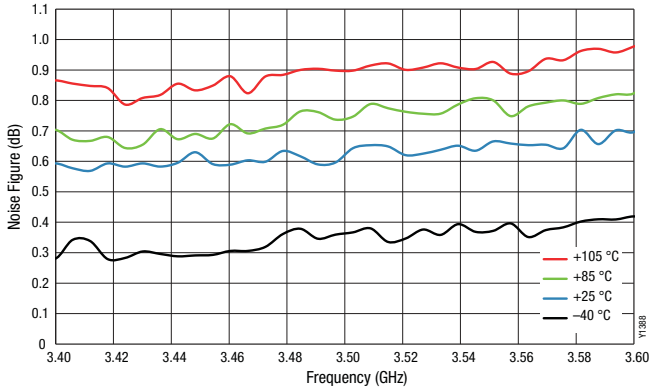



**Figure 3. Noise Figure vs Frequency Over Temperature**

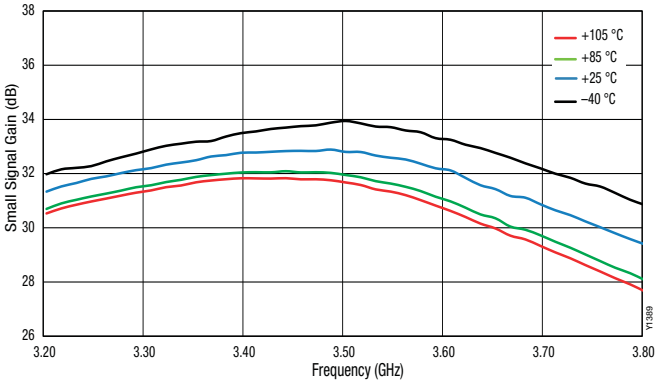



**Figure 4. Small Signal Gain vs Frequency Over Temperature Narrow Band**

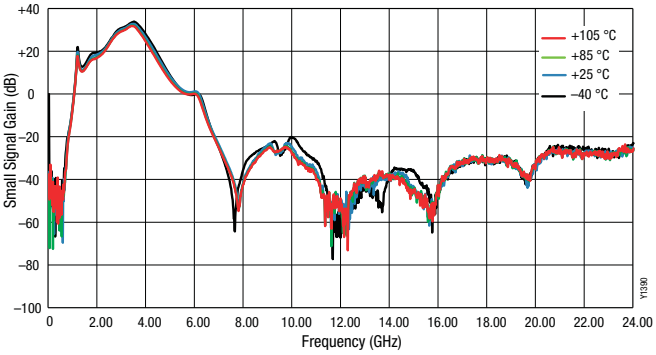



**Figure 5. Small Signal Gain vs Frequency Over Temperature, Wide Band**

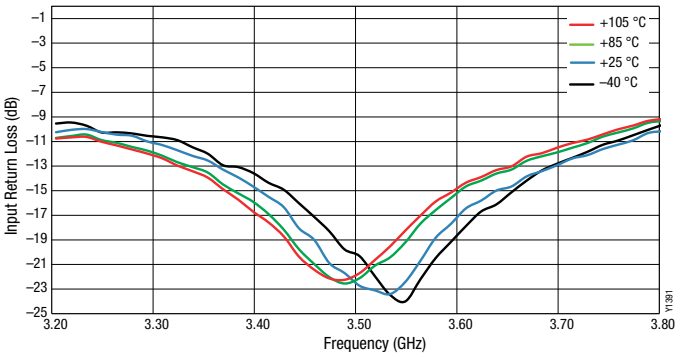



**Figure 6. Input Return Loss vs Frequency Over Temperature, Narrow Band**

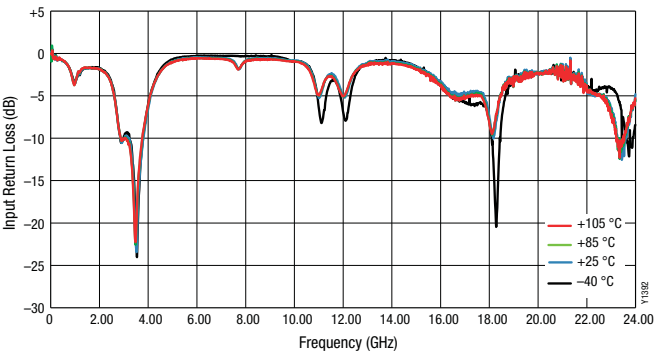



**Figure 7. Input Return Loss vs Frequency Over Temperature, Wide Band**

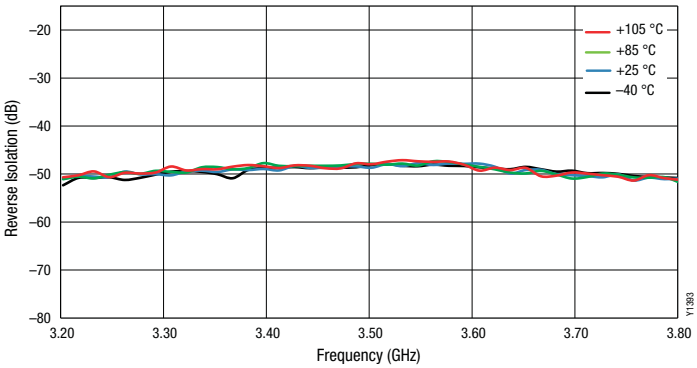



**Figure 8. Reverse Isolation vs Frequency Over Temperature, Narrow Band**

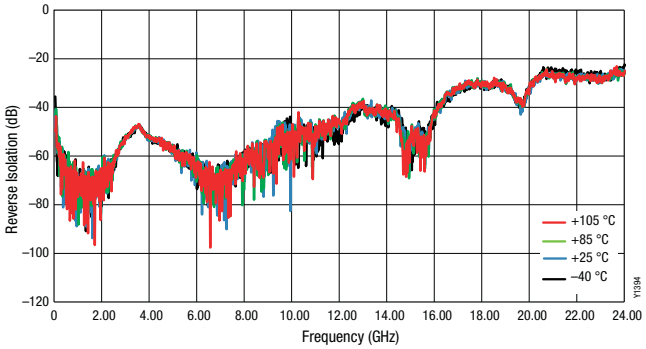



**Figure 9. Reverse Isolation vs Frequency Over Temperature, Wide Band**

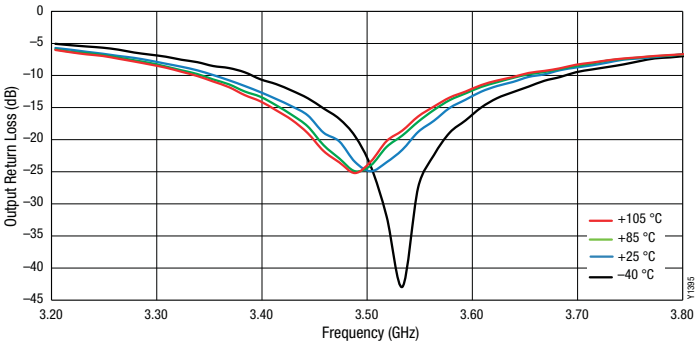



**Figure 10. Output Return Loss vs Frequency Over Temperature, Narrow Band**

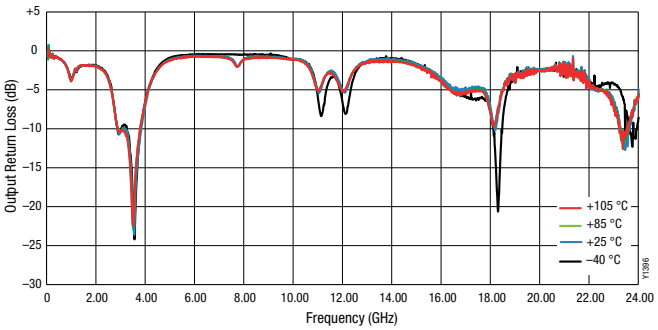



**Figure 11. Output Return Loss vs Frequency Over Temperature Wide Band**

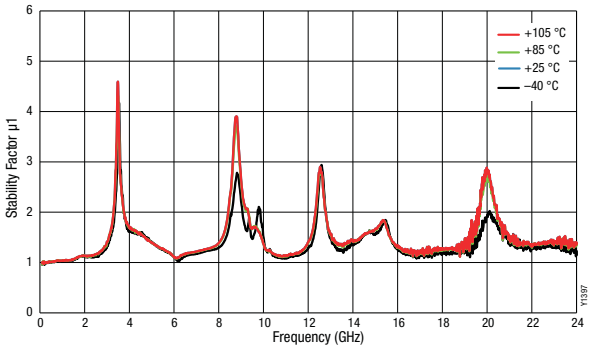



**Figure 12. Stability Factor (µ1) vs Frequency Over Temperature**

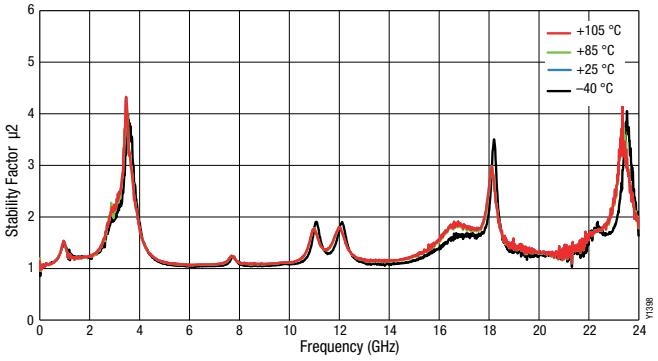



**Figure 13. Stability Factor (µ2) vs Frequency Over Temperature**

## Evaluation Board Description

The SKY67175-306LF Evaluation Board is used to test the performance of the SKY67175-306LF two-stage LNA. An Evaluation Board schematic diagram is provided in Figure 14 and Table 5 provides the Evaluation Board Bill of Materials.

The Evaluation Board assembly drawing is shown in Figure 15.

## Package Dimensions

The PCB layout footprint for the SKY67175-306LF is shown in Figure 16. Typical case markings are noted in Figure 17. Package dimensions for the 16-pin QFN are shown in Figure 18, and tape and reel dimensions are provided in Figure 19.

## Package and Handling Information

Instructions on the shipping container label regarding exposure to moisture after the container seal is broken must be followed. Otherwise, problems related to moisture absorption may occur when the part is subjected to high temperature during solder assembly.

The SKY67175-306LF is rated to Moisture Sensitivity Level 1 (MSL1) at 260 °C. It can be used for lead or lead-free soldering. For additional information, refer to the Skyworks Application Note, *Solder Reflow Information*, document number 200164.

Care must be taken when attaching this product, whether it is done manually or in a production solder reflow environment. Production quantities of this product are shipped in a standard tape and reel format.

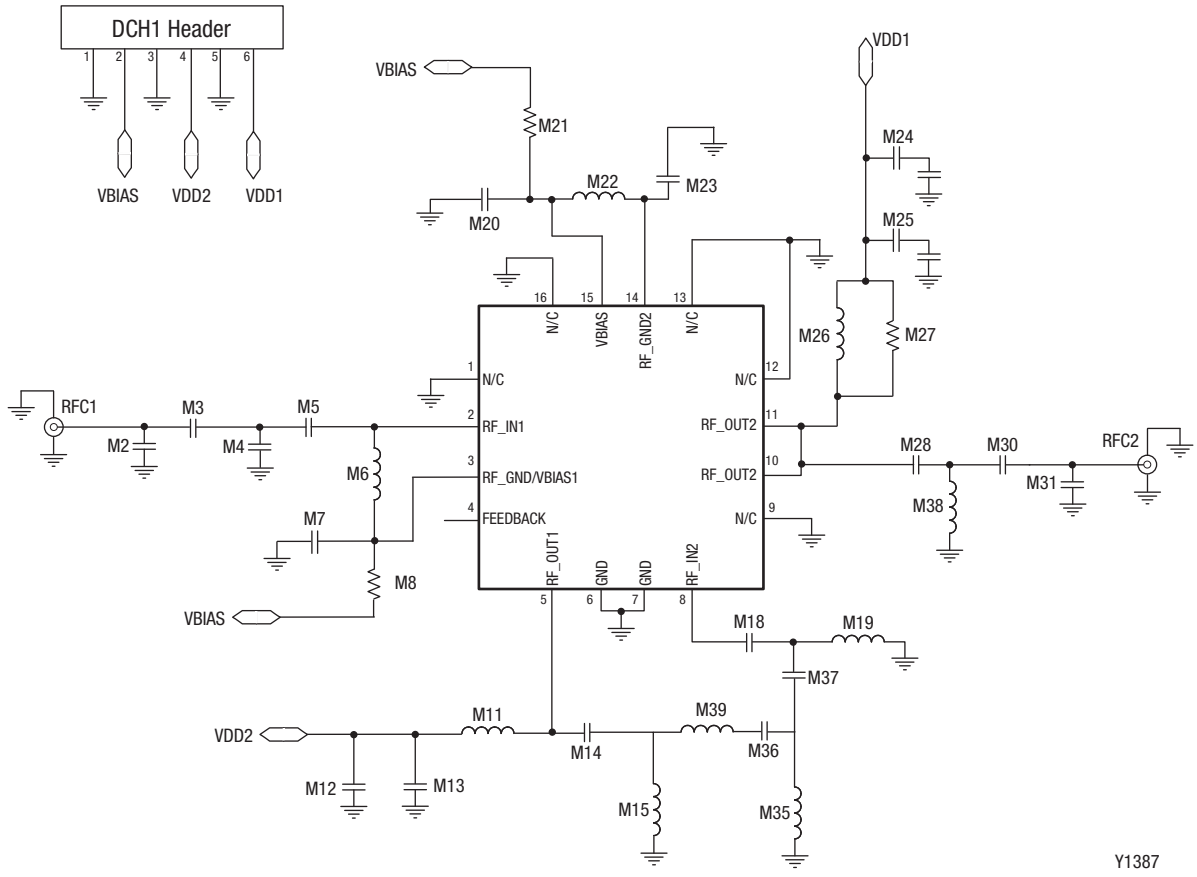



**Figure 14. SKY67175-306LF Evaluation Board Schematic**

**Table 5. SKY67175-306LF Evaluation Board Bill of Materials (Complete Reference Design)**

| Component | Type | Value | Size | Manufacturer | Manufacturer Part Number |
|---|---|---|---|---|---|
| M2 | Capacitor | DNP | | | |
| M3 | Capacitor | 8.2 pF | 0402 | Murata GJM | GJM1555C1H8R2DB01D |
| M4 | Capacitor | 1.0 pF | 0402 | Murata GJM | GJM1555C1H1R0CB01D |
| M5 | Inductor | 8.2 pF | 0402 | Murata GJM | GJM1555C1H8R2DB01D |
| M6 | Inductor | 18 nH | 0402 | Coilcraft HP | 0402HP-18NX_LU |
| M7 | | DNP | | | |
| M8 | Resistor | 18 kΩ | 0402 | Panasonic | ERJ-2RKF1802X |
| M11 | Inductor | 3.3 nH | 0402 | Murata LQG | LQG15HN3N3S02D |
| M12 | Capacitor | 1000 pF | 0402 | Murata GRM | GRM155R71H102KA01 |
| M13 | Capacitor | 10000 pF | 0402 | Murata GRM | GRM155R71H103KA88 |
| M14 | Capacitor | 100 pF | 0402 | Murata GRM | GRM1555C1H101JA01D |
| M15 | Inductor | 1 nH | 0402 | Murata LQG | LQG15HN1N0S02D |
| M18 | Capacitor | 1.0 pF | 0402 | Murata GRM | GRM1555C1H1R0BA01D |
| M19 | Inductor | 5.1 nH | 0402 | Murata LQG | LQG15HN5N1S02D |
| M20 | Capacitor | 5.6 pF | 0402 | Murata GRM | GRM1555C1H5R6DZ01 |
| M21 | Resistor | 7.5 kΩ | 0402 | Panasonic | ERJ-2RKF7501X |
| M22 | Inductor | 15 nH | 0402 | Coilcraft HP | 0402HP-15NX_L |
| M23 | Capacitor | 1000 pF | 0402 | Murata GRM | GRM155R71H102KA01 |
| M24 | Capacitor | 1 µF | 0402 | Murata GRM | GRM155R61A105KE15 |
| M25 | Capacitor | 10 pF | 0402 | Murata GRM | GRM1555C1H100JZ01 |
| M26 | Inductor | 9.1 nH | 0402 | Murata LQG | LQG15HN9N1J02D |
| M27 | | DNP | | | |
| M28 | Capacitor | 2.2 pF | 0402 | Murata GJM | GJM1555C1H2R2CB01D |
| M30 | Capacitor | 5.6 pF | 0402 | Murata GJM | GJM1555C1H5R6DB01D |
| M31 | | DNP | | | |
| M35 | | DNP | | | |
| M36 | Resistor | 0 Ω | 0402 | Panasonic | ERJ-2GE0R00X |
| M37 | Resistor | 0 Ω | 0402 | Panasonic | ERJ-2GE0R00X |
| M38 | Inductor | 1.5 nH | 0402 | Murata LQW | LQW15AN1N5B00D |
| M39 | Capacitor | 1.3 pF | 0402 | Murata GJM | GJM1555C1H1R3CB01D |

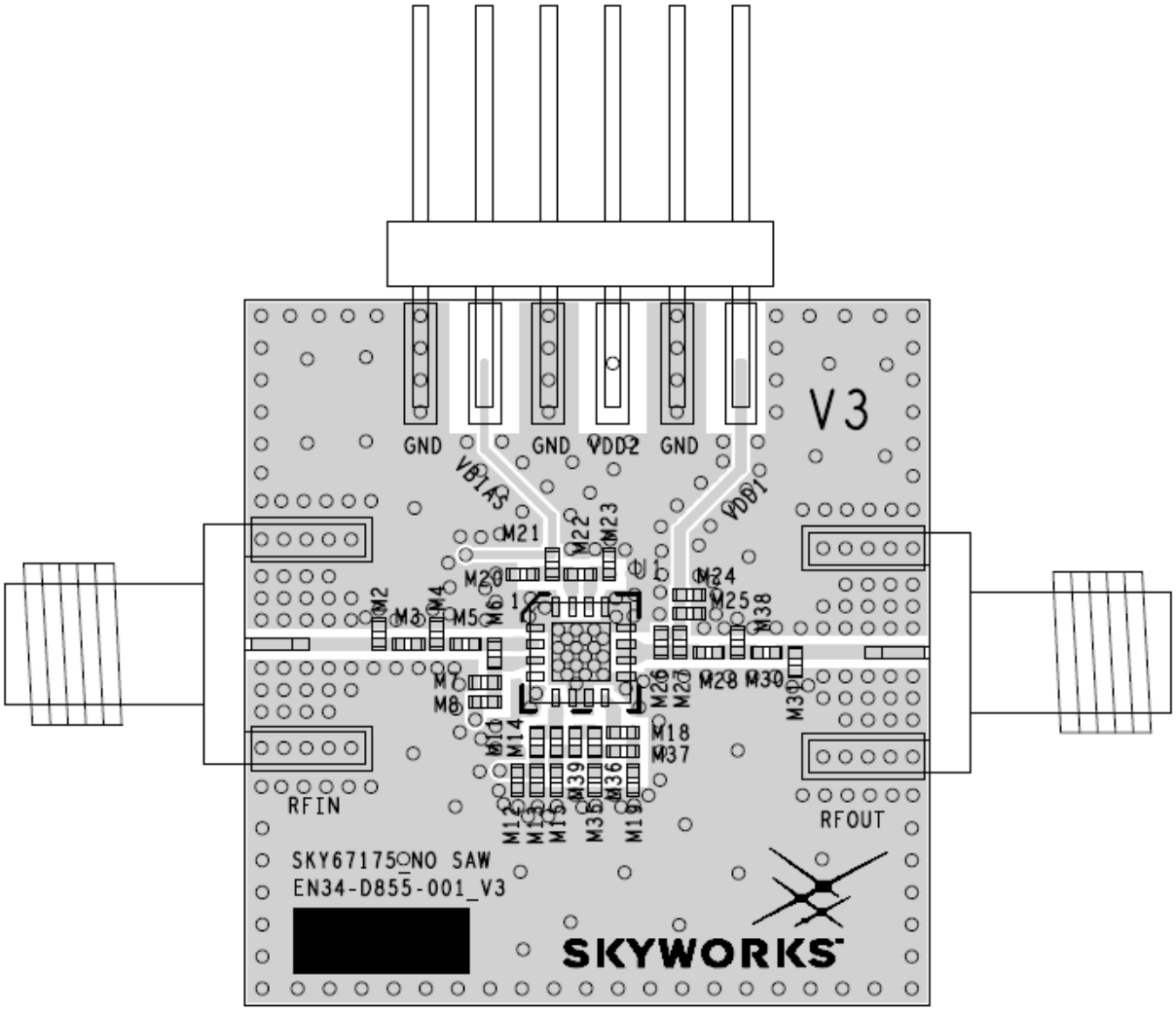



**Figure 15. SKY67175-306LF Evaluation Board Assembly Diagram**

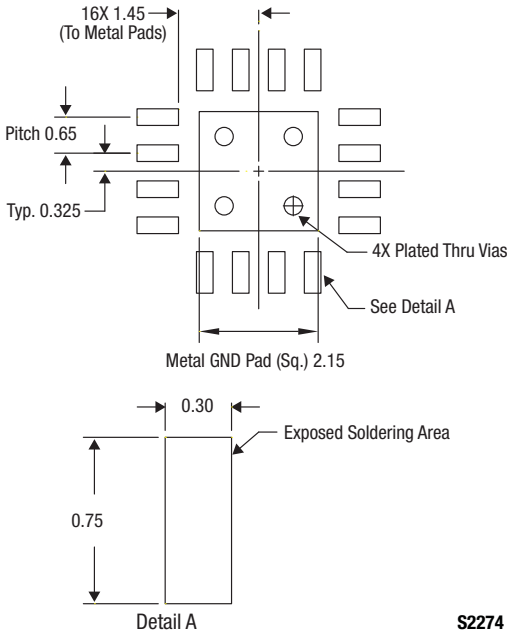



**Figure 16. SKY67175-306LF PCB Layout Footprint**

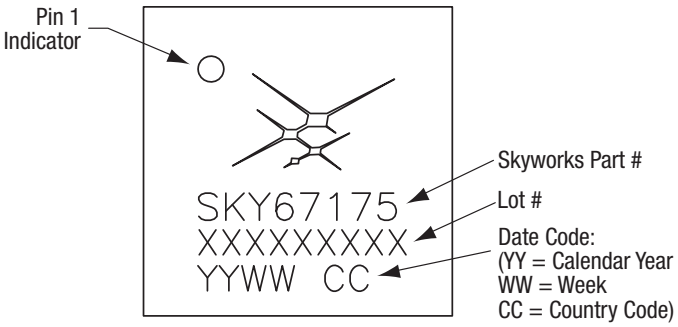
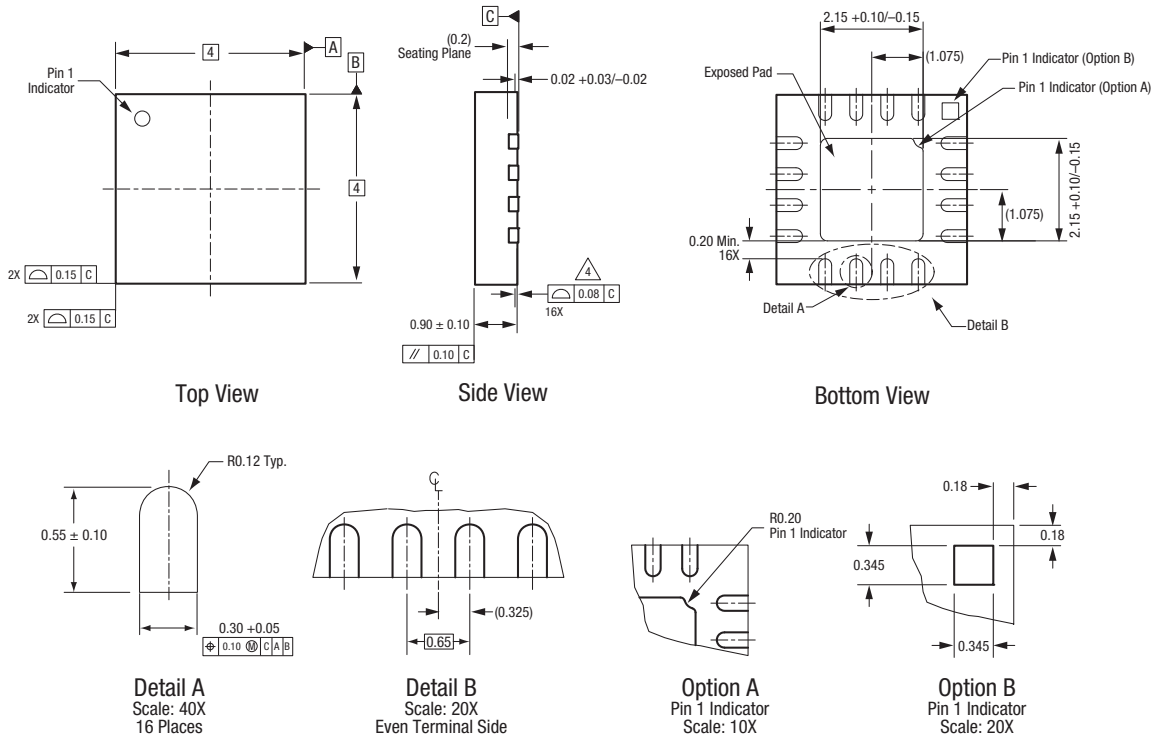



**Figure 17. Typical Case Markings**
**(Top View)**




*All measurements are in millimeters.*
*Dimensioning and tolerancing according to ASME Y14.5M-1994.*
*Coplanarity applies to the exposed heat sink slug as well as the terminals.*
*Package may have option A or option B pin 1 indicator.*

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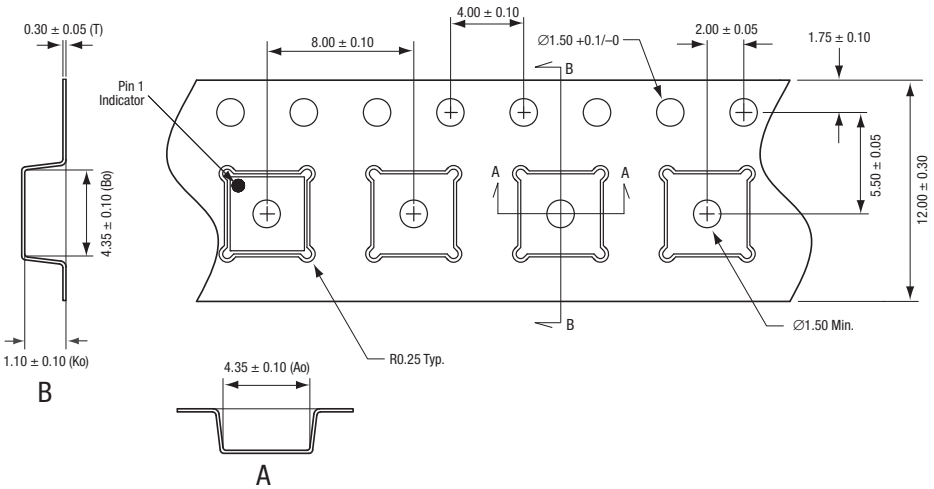
**Figure 18. SKY67175-306LF 16-Pin QFN Package Dimensions**




*Notes:*
*1. Carrier tape material: black conductive polystyrene, non-bakeable*
*2. Cover tape material: transparent conductive HSA*
*3. Cover tape size: 9.2 mm width*
*4. ESD surface resistivity is ≥1 x $10^5$ ~ ≤ 1 x $10^{10}$ Ohms/square per EIA, JEDEC TNR Specification.*
*5. All measurements are in millimeters*

S1846

**Figure 19. SKY67175-306LF Tape and Reel Dimensions**

## Ordering Information

| Model Name | Manufacturing Part Number | Evaluation Board Part Number |
|---|---|---|
| SKY67175-306LF: Two-Stage, High Gain LNA | SKY67175-306LF | SKY67175-306LF-3500 MHz-EVB |

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- Поставка более 17-ти миллионов наименований электронных компонентов;
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- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits,General Dynamics и др.);

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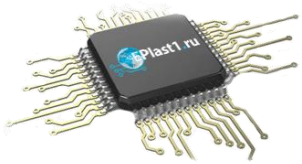
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.




**Как с нами связаться**

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