DATA SHEET

# SKY65450-92LF: 40 MHz to 1 GHz Broadband 75 Ω CATV Low-Noise Amplifier with Bypass Mode

## Applications

- Terrestrial and cable set-top box
- Cable modem
- Home gateway
- Personal video recorder (PVR)
- Digital video recorder (DVR)

## Features

- Small signal gain: 15 dB typical
- Best-in-class linearity
- Low noise figure: 2.9 dB typical
- Bypass mode current consumption < 5 mA
- Input/output impedance internally matched to 75 Ω
- Minimal number of external components required
- Small 6-pin SC-70 (SC-88, SOT-363) plastic SMT package

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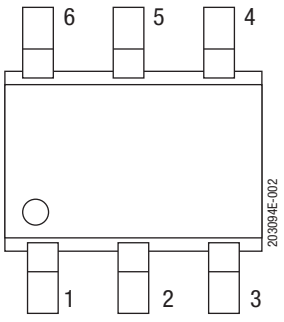


**Figure 2. SKY65450-92LF Pinout (Top View)**

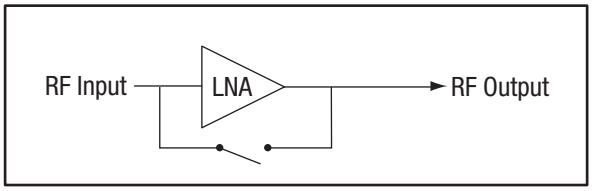


**Figure 1. SKY65450-92LF Block Diagram**

## Description

The SKY65450-92LF is a Microwave Monolithic Integrated Circuit (MMIC) front-end low-noise amplifier (LNA) designed especially for set-top box applications. The device provides high linearity, excellent gain, and best-in-class composite triple beat (CTB) and composite second order (CSO). There are minimal external components.

The SKY65450-92LF is optimized to operate between 40 MHz and 1 GHz, which makes it ideal for cable and terrestrial set-top box and home gateway applications.

The SKY65450-92LF is fabricated using SiGe BiCMOS technology. The LNA uses surface-mount technology (SMT) in a 6-pin SC-70 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.

**Table 1. SKY65450-92LF Signal Descriptions**

| Pin | Name | Description | Pin | Name | Description |
|---|---|---|---|---|---|
| 1 | RFOUT | RF output | 4 | Bypass CTRL | Bypass CTRL (0 = bypass mode, 1 = gain mode, floating = gain mode) |
| 2 | VCC | Source voltage | 5 | GND | Ground |
| 3 | NC | Not connected | 6 | RFIN | RF input |

## Technical Description

The SKY65450-92LF is a single-stage, low-noise amplifier with a bypass switch that operates with a single 3.3 V power supply connected through an RF choke (inductor L1) to the output signal (pin 1). The bias current is set by the R1 external resistor. The device is internally RF-matched and only requires input and out blocking capacitors C1 and C2 to operate over a frequency range of 40 MHz to 1 GHz.

## Electrical and Mechanical Specifications

The absolute maximum ratings of the SKY65450-92LF are provided in Table 2. The recommended operating conditions are specified in Table 3, and electrical specifications are provided in Table 4.

**Table 2. SKY65450-92LF Absolute Maximum Ratings[1]**

| Parameter | Symbol | Minimum | Maximum | Units |
|---|---|---|---|---|
| RF input power | $P_{IN}$ | | +20 | dBm |
| Supply voltage | $V_{CC}$ | 1.4 | 3.6 | V |
| Logic high voltage | $V_{HIGH}$ | | $V_{CC}$ | V |
| Storage temperature | $T_{STG}$ | -55 | +125 | °C |
| Junction temperature | $T_J$ | | +125 | °C |
| Electrostatic discharge: | ESD | | | |
| Human Body Model (HBM), Class 1C | | | 1500 | V |
| Charged-Device Model (CDM), Class C3 | | | 1500 | V |

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.

***ESD HANDLING**: 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 when handling or transporting. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection. Industry-standard ESD handling precautions should be used at all times.*

**Table 3. SKY65450-92LF Recommended Operating Conditions**

| Parameter | Symbol | Min | Typ | Max | Units |
|---|---|---|---|---|---|
| Frequency | f | 40 | | 1000 | MHz |
| Supply | | 3.1 | 3.3 | 3. 5 | V |
| Logic high voltage | $V_{IH}$ | 1.4 | | $V_{CC}$ | V |
| Logic low voltage | $V_{IL}$ | 0 | | 0.7 | V |
| Ambient temperature | | -40 | | +85 | °C |

**Table 4. SKY65450-92LF Electrical Specifications[1]**
**(VCC = 3.3 V, Bypass Control = 3.3 V, TC = +25 °C, f = 500 MHz, PIN = -15 dBm/Tone, Unless Otherwise Noted)**

| Parameter | Symbol | Min | Typ | Max | Units |
|---|---|---|---|---|---|
| ***Main Input to Output*** | | | | | |
| Impedance I/O | | | 75 | | Ω |
| Supply current[2] | Icc | | 42 | | mA |
| Supply current (bypass mode) | Icc_BYPASS | | 2.5 | 5 | mA |
| Gain | \|S21\| | 14 | 15 | 16 | dB |
| Gain (bypass mode) | | | -2.5 | | dB |
| Gain flatness | | | 0.6 | | dB |
| Reverse isolation | | | 19 | | dB |
| Noise figure | NF | | 2.9 | | dB |
| Noise figure (bypass mode) | | | 3.0 | | dB |
| Third order output intercept point @ 42 mA[3] | OIP3 | | +28.4 | | dBm |
| Third order output intercept point (bypass mode[3] | | | +28 | | dBm |
| Input return loss | \|S11\| | | 21 | | dB |
| Output return loss | \|S22\| | | 19 | | dB |
| Input return loss (bypass mode) | | | 11 | | dB |
| Output return loss (bypass mode) | | | 11 | | dB |

[1] Performance is guaranteed only under the conditions listed in this table.

[2] ICC Test Condition: No RF is applied to devices and RF input/output are 75 Ω terminated.

[3] OIP3 Test Condition: $f_1$ = 1000 MHz, $f_2$ = 1001 MHz.

## Evaluation Board Description

The Skyworks SKY65450-92LF Evaluation Board is used to test the performance of the SKY65450-92LF low-noise amplifier. Figure 3 shows an application schematic for the SKY65450-92LF. An assembly drawing for the Evaluation Board is shown in Figure 4, and the layer detail physical characteristics are noted in Figure 5. Typical part marking is shown in Figure 6.

Capacitor C5 provides DC bias decoupling for the output stage collector voltage. Pins 6 and 1 are the RF input and output signals, respectively.

External DC blocking is provided on the input and output by capacitors C1 and C2. Ground pin 5 and the center ground pad provide the DC and RF ground. Resistor R1 is the bias resistor that can be used to optimize the current and performance of the LNA and L1 is a choke inductor which connects the Vcc to the output stage of the LNA. Pin 2 provides an enable function and has an optional RC circuit held in place by resistor R2 and capacitor C3. Pin 3 is a no connect pin and can be left floating or may be grounded.

The input and output RF traces are 75 Ω traces.

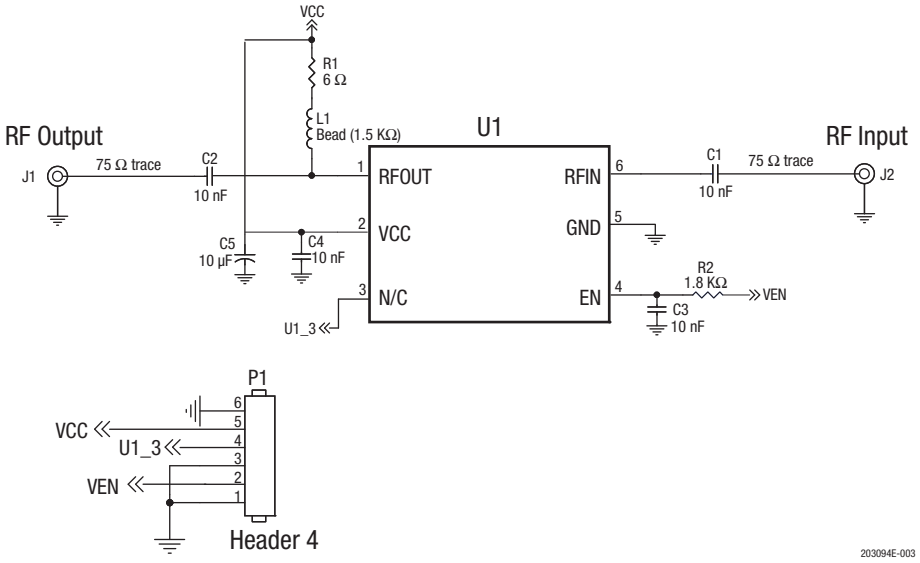


**Figure 3. SKY65450-92LF Application Schematic**

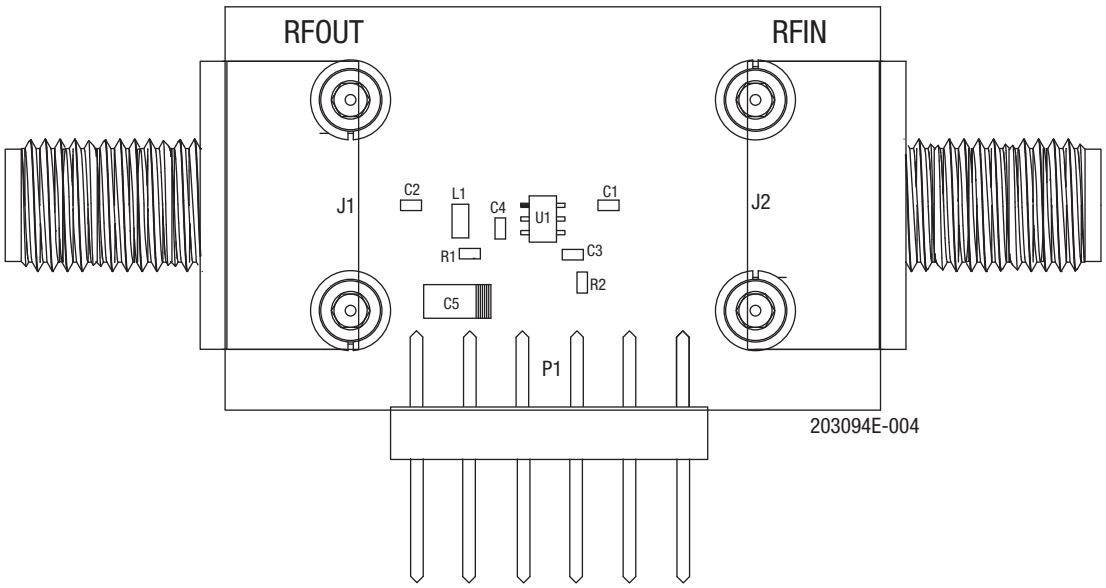


**Figure 4. SKY65450-92LF Evaluation Board Assembly Diagram**

| 75 Ω | Cross Section | Name | Thickness | Materials |
|---|---|---|---|---|
| W = 1.270 mm | | Tmask | 0.010 mm | Solder Resist |
| | | L1 | 0.025 mm | Cu – 1 oz |
| | | Dielectric | 1.500 mm | FR4 |
| | | L4 | 0.025 mm | Cu – 1 oz |
| | | Bmask | 0.010 mm | Solder Resist |

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**Figure 5. Layer Detail Physical Characteristics**

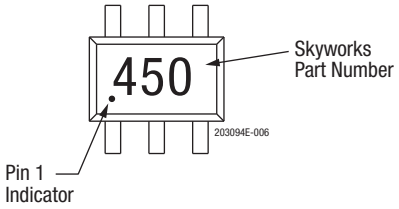



**Figure 6. Typical Part Marking**

## Package Dimensions

The SKY65450-92LF is packaged in a standard 6-Lead SC-70 (SC-88 or SOT-363). Figure 7 shows the package dimensions. Tape and reel dimensions are shown in Figure 8.

## 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 SKY65450-92LF 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.

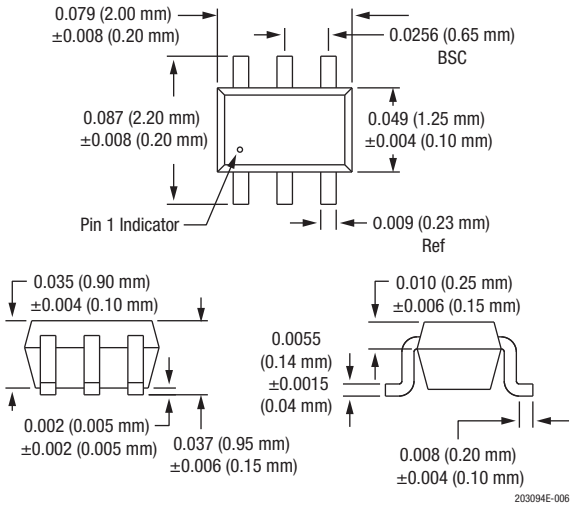
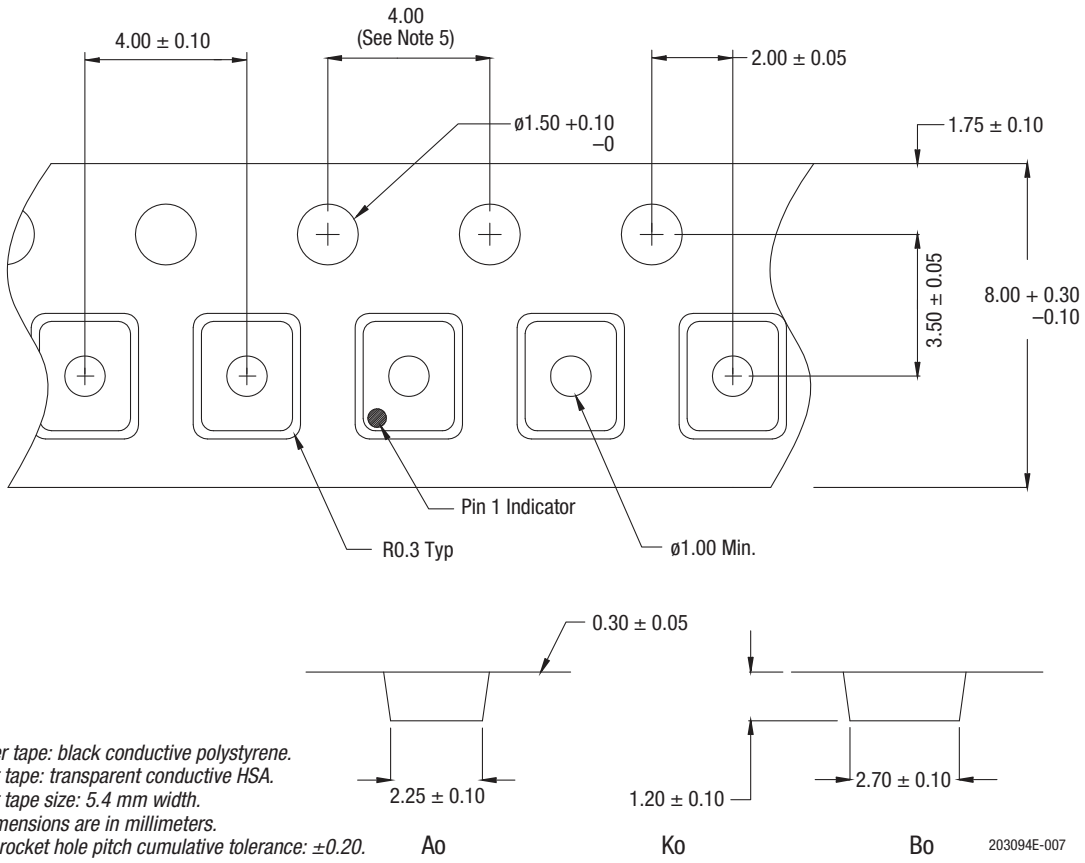



**Figure 7. SKY65450-92LF Package Dimensions**




*Notes:*

1. *Carrier tape: black conductive polystyrene.*
2. *Cover tape: transparent conductive HSA.*
3. *Cover tape size: 5.4 mm width.*
4. *All dimensions are in millimeters.*
5. *10-sprocket hole pitch cumulative tolerance: ±0.20.*

**Figure 8. SKY65450-92LF Tape and Reel Dimensions**

## Ordering Information

| Product Description | Product Part Number | Evaluation Board Part Number |
|---|---|---|
| SKY65450-92LF: 40 MHz to 1 GHz Broadband 75 Ω CATV Low-Noise Amplifier | SKY65450-92LF | SKY65450-92-EVB |

Стандарт Электрон Связь

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