

DATA SHEET

# SKY65081-70LF: 2000 to 3000 MHz Low-Noise Power Amplifier Driver

## Applications

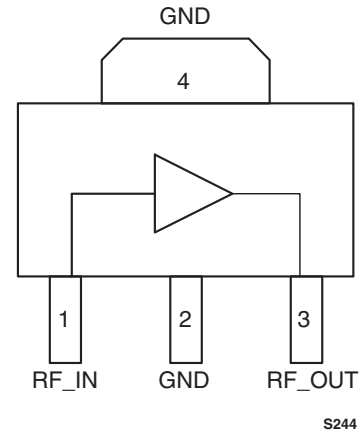
- UHF television
- TETRA radios
- 2.5G, 3G handsets
- ISM band transmitters
- WCS fixed wireless
- 802.16 WiMAX
- 3GPP LTE

## Features

- Wideband frequency range: 2000 to 3000 MHz
- Low Noise Figure: 2.0 dB
- High linearity: IIP3 = +29.6 dBm
- Output P1dB = +22.3 dBm
- High gain: 14.3 dB
- Single DC supply: +5 V
- On-chip bias circuit
- SOT-89 (4-pin, 2.4 x 4.5 mm) 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. SKY65081-70LF Pinout – 4-Pin SOT Package (Top View)**

## Description

Skyworks SKY65081-70LF is a high performance, ultra-wideband Power Amplifier (PA) driver with superior output power, low noise, linearity, and efficiency. The device provides a 2.0 dB Noise Figure (NF) and a 1 dB Output Compression Point (OP1dB) of +22.3 dBm, making the SKY65081-70LF ideal for use in the driver stage of infrastructure transmit chains.

The SKY65081-70LF uses low-cost Surface-Mount Technology (SMT) in the form of a 4-pin, 2.4 x 4.5 mm Small Outline Transistor (SOT) package. The device package and pinout are shown in Figure 1 and a functional block diagram is provided in Figure 2.

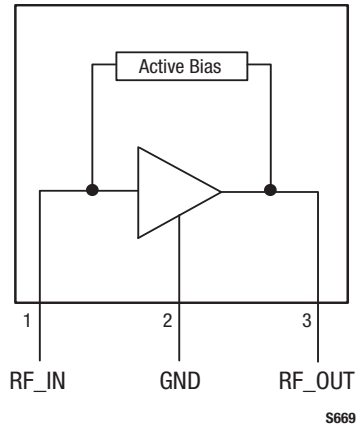


Figure 2. SKY65081-70LF Functional Block Diagram

Table 1. SKY65081-70LF Signal Descriptions

| Pin | Name   | Description |
|-----|--------|-------------|
| 1   | RF_IN  | RF input    |
| 2   | GND    | Ground      |
| 3   | RF_OUT | RF output   |
| 4   | GND    | Ground      |

### Technical Description

The SKY65081-70LF is a single stage, low-noise PA that operates with a single 5 V power supply connected through an RF choke (inductor L1) to the output signal (pin 3). The bias current is set by the on-chip active bias composed of current mirror and reference voltage transistors, which allow excellent gain tracking over temperature and voltage variations. The device is externally RF matched using surface mount components to facilitate operation over a frequency range of 2000 to 3000 MHz.

### Electrical and Mechanical Specifications

Signal pin assignments and functional pin descriptions are described in Table 1. The absolute maximum ratings of the SKY65081-70LF are provided in Table 2. The recommended operating conditions are specified in Table 3 and electrical specifications are provided in Table 4.

Typical performance characteristics of the SKY65081-70LF are illustrated in Figures 3 through 12.

**Table 2. SKY65081-70LF Absolute Maximum Ratings**

| Parameter                  | Symbol           | Min | Max  | Units |
|----------------------------|------------------|-----|------|-------|
| Supply voltage             | VCC              |     | 6    | V     |
| RF output power            | P <sub>OUT</sub> |     | +24  | dBm   |
| RF input power             | P <sub>IN</sub>  |     | +10  | dBm   |
| Supply current             | I <sub>CC</sub>  |     | 100  | mA    |
| Power dissipation          | P <sub>D</sub>   |     | 0.6  | W     |
| Operating case temperature | T <sub>C</sub>   | -40 | +85  | °C    |
| Storage temperature        | T <sub>ST</sub>  | -55 | +125 | °C    |
| Junction temperature       | T <sub>J</sub>   |     | +150 | °C    |

**Note:** 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 values. 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. SKY65081-70LF Recommended Operating Conditions**

| Parameter                  | Symbol         | Min  | Typical | Max  | Units |
|----------------------------|----------------|------|---------|------|-------|
| Supply voltage             | VCC            | 4.75 | 5.0     | 5.5  | V     |
| Operating frequency        | f              | 2000 | 2600    | 3000 | MHz   |
| Operating case temperature | T <sub>J</sub> | -40  | +25     | +85  | °C    |

**Table 4. SKY65081-70LF Electrical Characteristics (Note 1)**  
**(VCC = +5 V, T<sub>C</sub> = 25 °C, f = 2600 MHz, Unless Otherwise Noted)**

| Parameter                          | Symbol                | Test Conditions                                | Min   | Typical | Max  | Units |
|------------------------------------|-----------------------|--|-------|---------|------|-------|
| Frequency                          | f                     |  | 2500  |         | 2700 | MHz   |
| Small signal gain                  | G                     | P <sub>IN</sub> = -10 dBm                      | 13.7  | 14.3    |      | dB    |
| Input return loss                  | S <sub>11</sub>       | P <sub>IN</sub> = -20 dBm                      | 8.0   | 9.3     |      | dB    |
| Output return loss                 | S <sub>22</sub>       | P <sub>IN</sub> = -20 dBm                      | 10.0  | 12.5    |      | dB    |
| 1 dB Output Compression Point      | OP1dB                 | CW   | +21.0 | +22.3   |      | dBm   |
| 1 dB Input Compression Point       | IP1dB                 |  | +8.3  | +9.0    |      | dBm   |
| Operating current @ OP1dB          | I <sub>CC,OP1DB</sub> |  | 50    | 75      | 90   | mA    |
| Power Added Efficiency             | PAE                   | @ OP1dB  | 30    | 44      |      | %     |
| Third order input intercept point  | IIP3                  | P <sub>IN</sub> /tone = -10 dBm,<br>Δf = 1 MHz | +28.0 | +29.6   |      | dBm   |
| Third order output intercept point | OIP3                  | P <sub>IN</sub> /tone = -10 dBm,<br>Δf = 1 MHz | +41.7 | +43.9   |      | dBm   |
| Noise Figure                       | NF                    | Small signal                                   |       | 2.0     | 2.5  | dB    |
| Quiescent current                  | I <sub>CCQ</sub>      | No RF  | 40    | 55      | 70   | mA    |

**Note 1:** Performance is guaranteed only under the conditions listed in this Table.

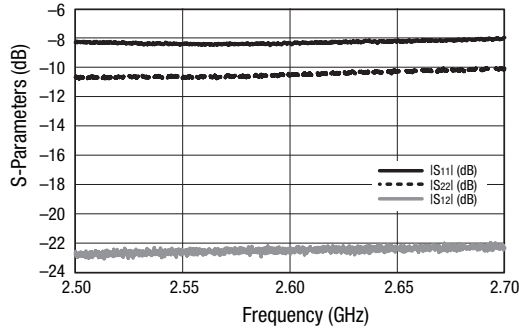


Figure 3. Return Loss vs Frequency

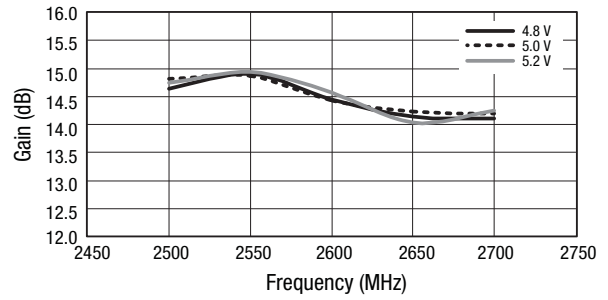


Figure 4. Gain vs Frequency Over Voltage

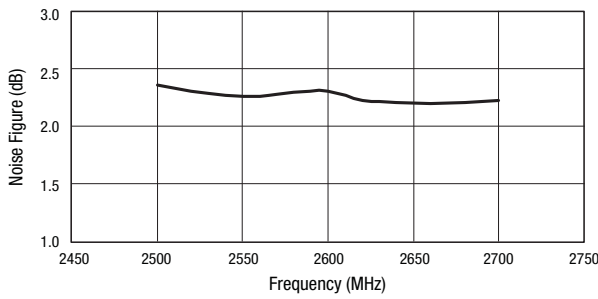


Figure 5. Noise Figure vs Frequency

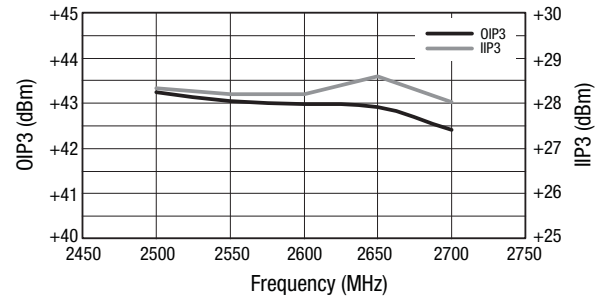


Figure 6. OIP3 vs Frequency

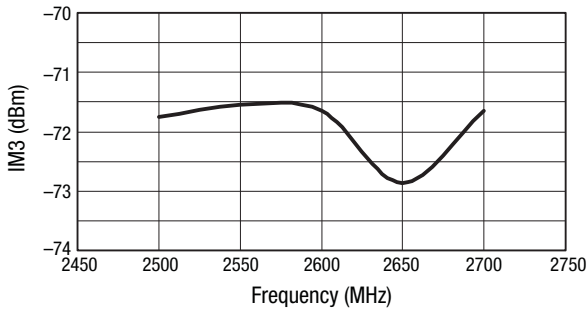


Figure 7. IM3 vs Frequency  
( $P_{IN} = -10$  dBm)

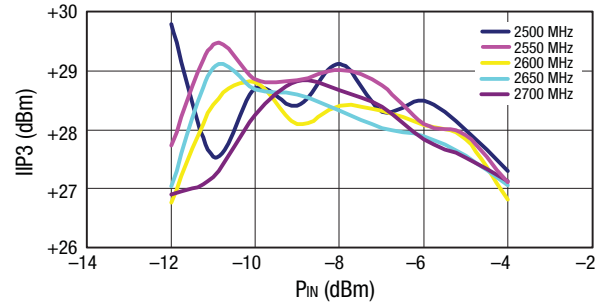


Figure 8. IIP3 vs Input Power Over Frequency

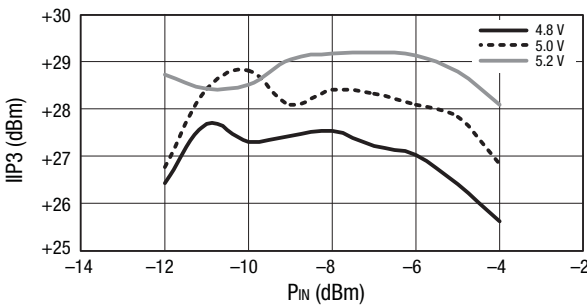


Figure 9. IIP3 vs Input Power Over Voltage

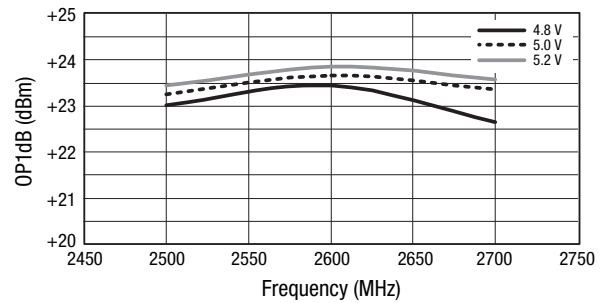
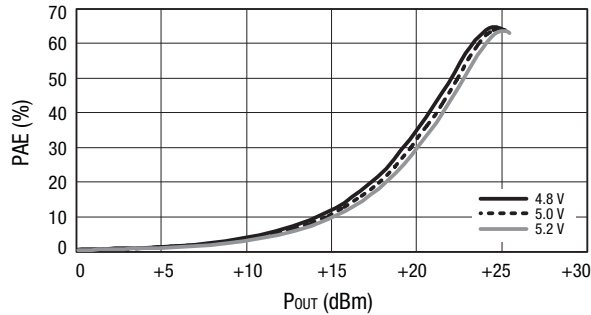
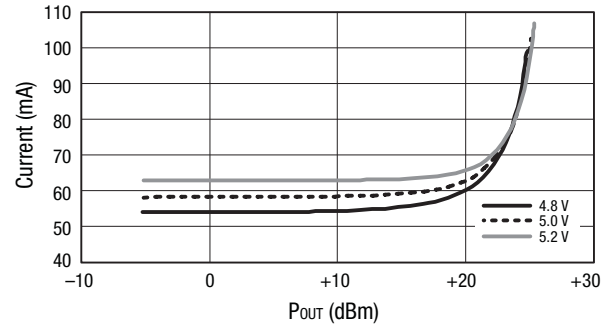


Figure 10. OP1dB vs Frequency Over Voltage



**Figure 11. PAE vs Output Power Over Voltage**



**Figure 12. Current vs Output Power Over Voltage**

## Evaluation Board Description

The Skyworks SKY65081-70LF Evaluation Board is used to test the performance of the SKY65081-70LF PA driver. An assembly drawing for the Evaluation Board is shown in Figure 13 and the layer detail is provided in Figure 14.

Capacitors C7, C8, and C9 provide DC bias decoupling for VCC. Pins 1 and 3 are the RF input and output signals, respectively. External DC blocking is required on the input and output, but can be implemented as part of the RF matching circuit. Pin 2 and the package backside metal, pin 4, are ground pins that provide the DC and RF ground, respectively.

## Circuit Design Configurations

The following design considerations are general in nature and must be followed regardless of final use or configuration.

1. Paths to ground should be made as short as possible.
2. The ground pad of the SKY65081-70LF power amplifier has special electrical and thermal grounding requirements. This pad is the main thermal conduit for heat dissipation. Since the circuit board acts as the heat sink, it must shunt as much heat as possible from the amplifier. As such, design the connection to the ground pad to dissipate the maximum wattage produced to the circuit board. Multiple vias to the grounding layer are required.

*NOTE: Junction temperature ( $T_j$ ) of the device increases with a poor connection to the slug and ground. This reduces the lifetime of the device.*

A suggested matching circuit is shown in Figure 15 with component values for the SKY65081-70LF-11 package option listed in Table 5. Component values for the SKY65081-70LF-21 package option are shown in Table 6.

## Testing Procedure

Use the following procedure to set up the SKY65081-70LF Evaluation Board for testing:

1. Connect a 5.0 V supply to VCC. If available, enable the current limiting function of the power supply to 100 mA.
2. Connect a signal generator to the RF signal input port. Set it to the desired RF frequency at a power level of  $-15$  dBm or less to the Evaluation Board but do NOT enable the RF signal.
3. Connect a spectrum analyzer to the RF signal output port.
4. Enable the power supply.
5. Enable the RF signal.
6. Take measurements.

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**CAUTION:** *If any of the output signals exceed the rated maximum values, the SKY65081-70LF Evaluation Board can be permanently damaged.*

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## Package and Handling Information

Since the device package is sensitive to moisture absorption, it is baked and vacuum packed before shipping. 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 SKY65081-70LF is rated to Moisture Sensitivity Level 1 (MSL1) at 260 °C. It can be used for lead or lead-free soldering.

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. For packaging details, refer to the Skyworks Application Note *Tape and Reel*, document number 101568.

## Package Dimensions

Package dimensions for the 4-pin SOT-89 are shown in Figure 16, and tape and reel dimensions are provided in Figure 17.

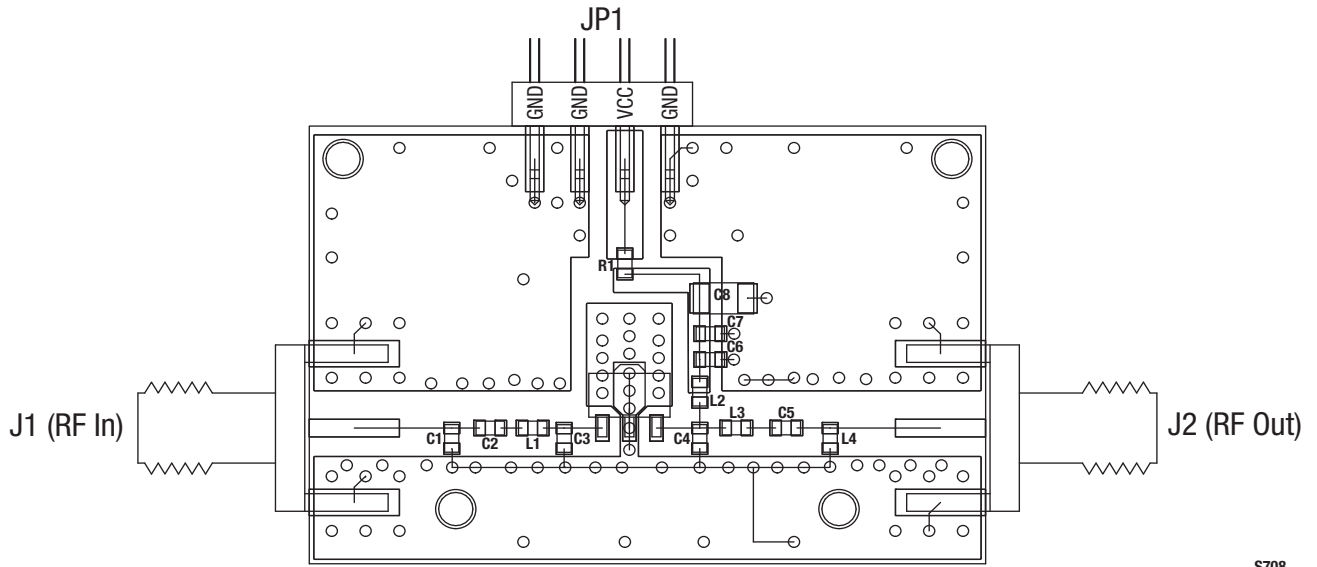
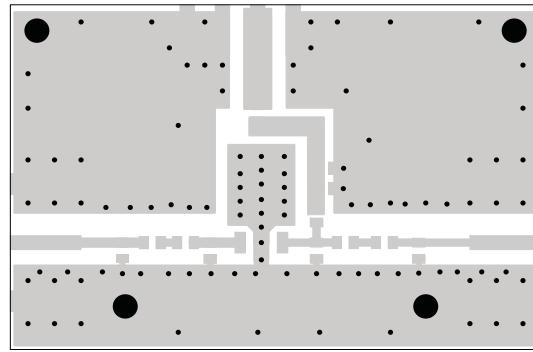
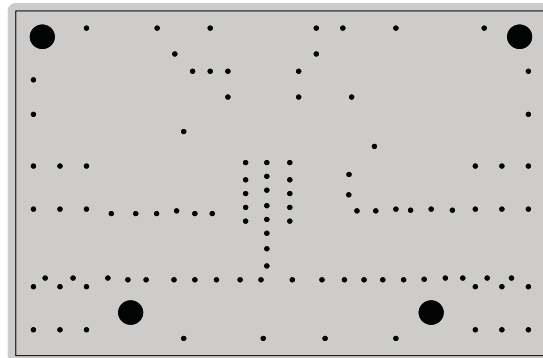


Figure 13. Evaluation Board Assembly Drawing

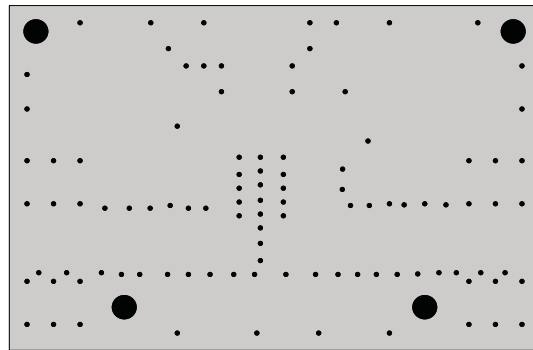
S708



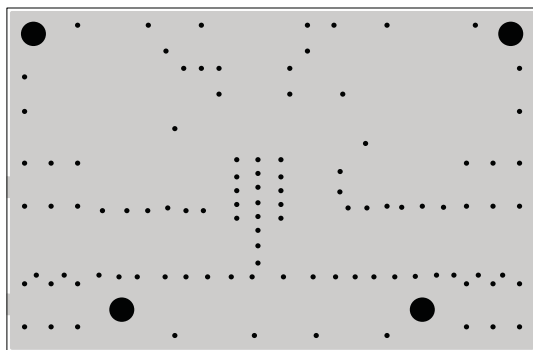
Layer 1: Top - Metal



Layer 2: Ground



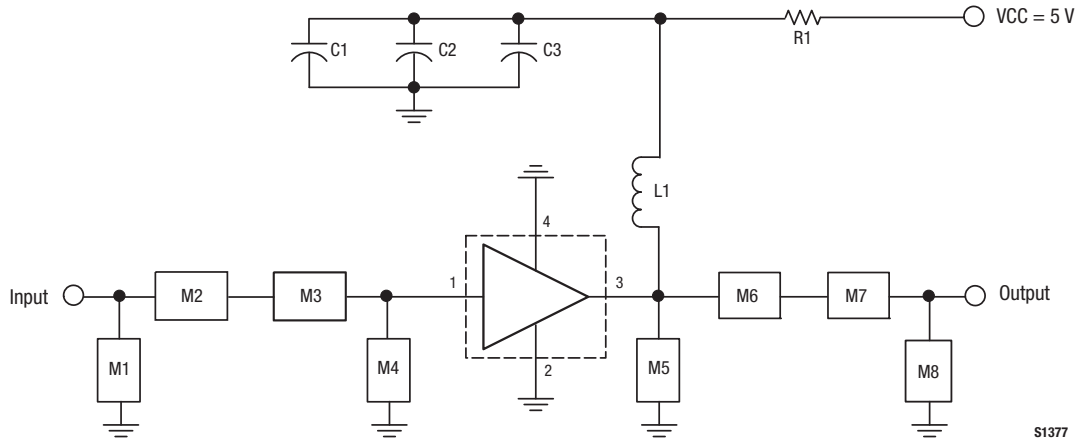
Layer 3: Ground



Layer 4: Solid Ground Plane

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**Figure 14. Evaluation Board Layer Detail**

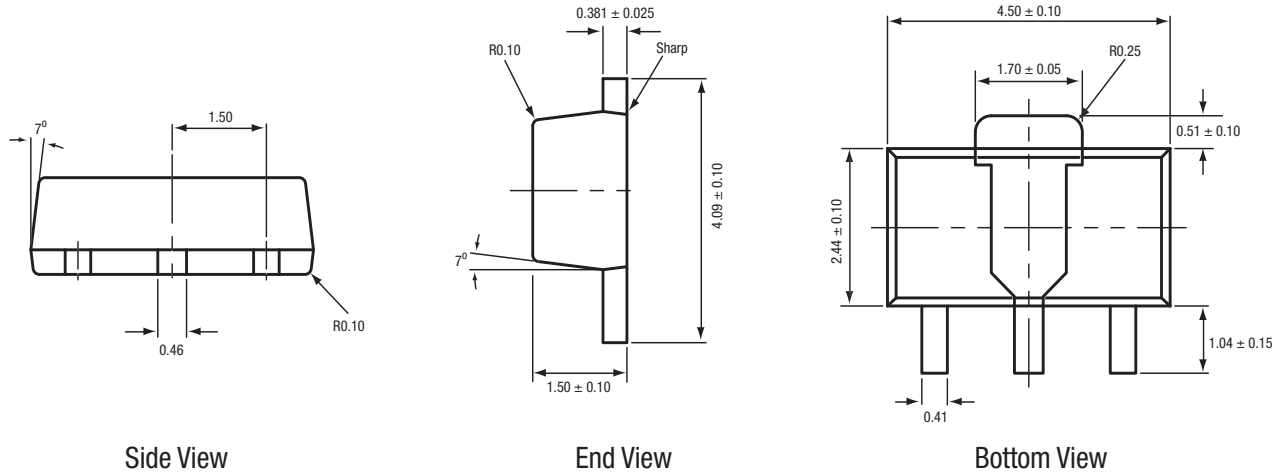


**Figure 15. SKY65081-70LF Evaluation Board Schematic (2500 MHz to 2700 MHz, IIP3 Matched)**

**Table 5. SKY65081-70LF (SOT-89 Package) Evaluation Board Bill of Materials**

| Component | Size | Value      |
|-----------|------|------------|
| C1        | 0805 | 10 $\mu$ F |
| C2        | 0603 | 2.7 pF     |
| C3        | 0603 | DNI        |
| L1        | 0603 | 3.3 nH     |
| M1        | 0603 | DNI        |
| M2        | 0603 | 1.0 pF     |
| M3        | 0603 | 0 $\Omega$ |
| M4        | 0603 | DNI        |
| M5        | 0603 | DNI        |
| M6        | 0603 | 8.2 nH     |
| M7        | 0603 | 0 $\Omega$ |
| M8        | 0603 | DNI        |
| R1        | 0603 | 0 $\Omega$ |

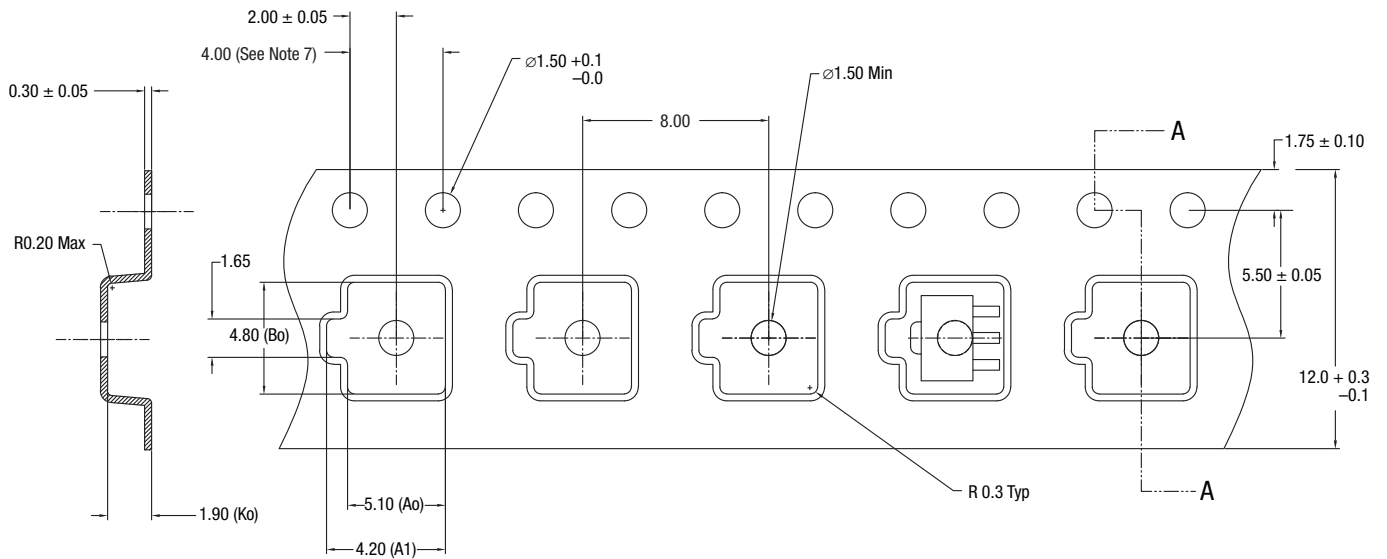




All measurements are in millimeters

S253

Figure 16. SKY65081-70LF (4-Pin SOT-89) Package Dimensions



Notes:

1. Carrier tapes must meet all requirements of Skyworks GP01-D233 procurement spec for tape and reel shipping.
2. Carrier tape material: black conductive polycarbonate or polystyrene.
3. Cover tape material: transparent conductive PSA.  
Cover tape size: 9.2 mm width.
4. Typical ESD surface resistivity must meet all ESD requirements of Skyworks specified in GP01-D233.
5. A<sub>0</sub> and B<sub>0</sub> measurement point to be 0.30 mm from bottom pocket.
6. All measurements are in millimeters.
7. 10-sprocket hole pitch cumulative tolerance 0.2 mm.

200953-100

Figure 17. SKY65081-70LF Tape and Reel Dimensions

## Ordering Information

| Model Name                        | Ordering Part Number | Evaluation Kit Part Number |
|-----------------------------------|----------------------|----------------------------|
| SKY65081-70LF Low Noise PA Driver | SKY65081-70LF        | TW17-D630                  |

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