DATA SHEET

# SKY65206-13 WLAN 802.11b/g Intera™ Front-End Module

## Applications

- Portable/mobile IEEE 802.11 b/g products:
  - PC cards
  - PCMCIA cards
  - MiniCards/half miniCards

## Features

- 2.4 to 2.5 GHz operation
- 27 dB small signal gain
- 802.11g linear power @ 3% EVM, +16 dBm
- 802.11b mask compliant power, +20 dBm
- Temperature-compensated directional RF power detector
- GaAs FET four-control transfer switch
- MCM (24-pin, 7 x 8 mm) Pb-free package (MSL3, 240 °C per JEDEC J-STD-020) package

NEW

Skyworks offers lead (Pb)-free, RoHS (Restriction of Hazardous Substances) compliant packaging.

## Description

The SKY65206-13 is an integrated Intera™ Front-End Module (FEM) for 802.11b/g WLAN applications. A single supply voltage and a positive supply switch control simplify bias requirements. The device is manufactured using Skyworks InGaP Heterojunction Bipolar Transistor (HBT) process.

Modules are 100 percent tested before shipment for guaranteed performance. The SKY65206-13 is targeted for high-volume 802.11b/g WLAN access point, PCMCIA, and PC card applications.

The SKY65206-13 is packaged in a lead (Pb)-free, RoHS-compliant Multi-Chip Module (MCM). 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 Table 1.

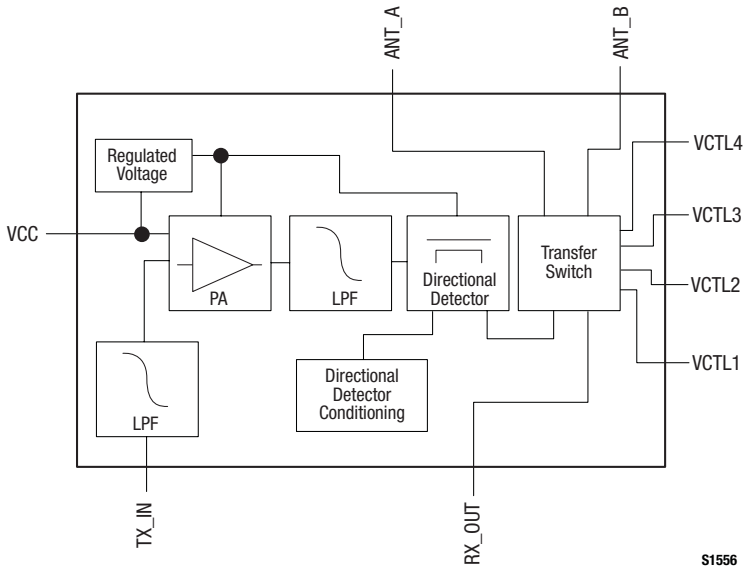



**Figure 1. SKY65206-13 Block Diagram**

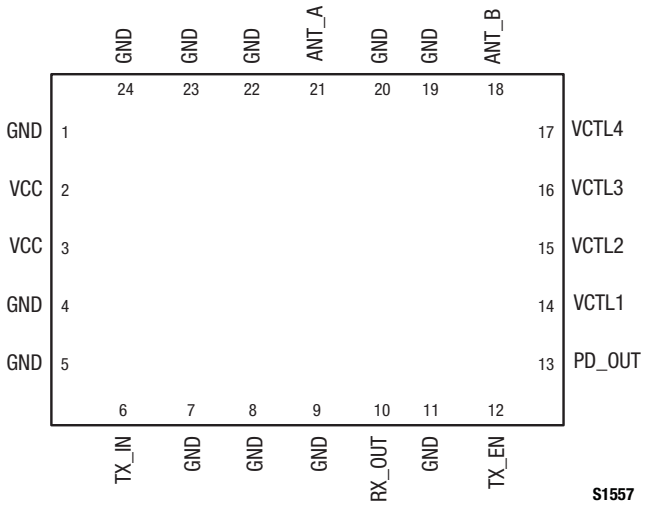



**Figure 2. SKY65206-13 Pinout – 24-Pin MCM (Top View)**

**Table 1. SKY65206-13 Signal Descriptions**

| Pin # | Name | Description | Pin # | Name | Description |
|---|---|---|---|---|---|
| 1 | GND | Ground | 13 | PD_OUT | Detected output voltage from directional detector. |
| 2 | VCC | DC power supply voltage input to PA and to the internal voltage regulator that biases the internal directional detector. Pin 2 and 3 are connected for current sharing. | 14 | VCTL1 | High impedance DC control voltage input 1 for transfer switch. |
| 3 | VCC | DC power supply voltage input to PA and to the internal voltage regulator that biases the internal directional detector. Pin 2 and 3 are connected for current sharing. | 15 | VCTL2 | High impedance DC control voltage input 2 for transfer switch. |
| 4 | GND | Ground | 16 | VCTL3 | High impedance DC control voltage input 3 for transfer switch. |
| 5 | GND | Ground | 17 | VCTL4 | High impedance DC control voltage input 4 for transfer switch. |
| 6 | TX_IN | Transmitter RF input. Nominal input impedance = 50 Ω. | 18 | ANT_B | RF antenna I/O port B. Nominal input impedance = 50 Ω. |
| 7 | GND | Ground | 19 | GND | Ground |
| 8 | GND | Ground | 20 | GND | Ground |
| 9 | GND | Ground | 21 | ANT_A | RF antenna I/O port A. Nominal input impedance = 50 Ω. |
| 10 | RX_OUT | Receiver RF output. Nominal input impedance = 50 Ω. | 22 | GND | Ground |
| 11 | GND | Ground | 23 | GND | Ground |
| 12 | TX_EN | High impedance DC control voltage input to enable/disable the PA. | 24 | GND | Ground |

## Electrical and Mechanical Specifications

The absolute maximum ratings of the SKY65206-13 are provided in Table 2. The recommended operating conditions are specified in Table 3. Electrical specifications are provided in Table 4. Table 5 provides the transmit/receive switch control logic.

Typical performance characteristics of the SKY65206-13 are illustrated in Figures 3 through 10.

**Table 2. SKY65206-13 Absolute Maximum Ratings**

| Parameter | Symbol | Minimum | Maximum | Units |
|---|---|---|---|---|
| RF input power | $P_{IN}$ | | +20 | dBm |
| Supply voltage | VCC | | 4 | V |
| Supply current | | | 600 | mA |
| Operating temperature | $T_A$ | –40 | +85 | °C |
| Storage temperature | $T_{STG}$ | –65 | +85 | °C |
| Thermal resistance | $\Theta_{JC}$ | | 55 | °C/W |

**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 value.

***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. SKY65206-13 Recommended Operating Conditions**

| Parameter | Symbol | Minimum | Typical | Maximum | Units |
|---|---|---|---|---|---|
| Supply voltage | VCC | 3.0 | 3.3 | 3.6 | V |
| Control voltage | TxEn | 2.8 | 3.0 | 3.3 | V |
| Operating temperature | $T_A$ | 0 | +25 | +85 | °C |

**Table 4. SKY65206-13 Electrical Specifications (Note 1) (1 of 2)**
**($T_A$ = +25 °C, Characteristic Impedance [$Z_0$] = 50 Ω, Unless Otherwise Noted)**

| Parameter | Symbol | Test Condition | Min | Typical | Max | Units |
|---|---|---|---|---|---|---|
| ***General RF Receive*** | | | | | | |
| Frequency range | f | | 2400 | | 2500 | MHz |
| Insertion loss | $\|S_{21}\|$ | Small signal | | 1 | | dB |
| In-band ripple | $\|\Delta S_{21}\|$ | Small signal | | 0.1 | | dB |
| Input return loss | $\|S_{11}\|$ | Small signal | | 19 | | dB |
| Output return loss | $\|S_{22}\|$ | Small signal | | 17 | | dB |
| ***General RF Transmit*** | | | | | | |
| Frequency range | f | VCC = 3.3 V | 2400 | | 2500 | MHz |
| Gain | $\|S_{21}\|$ | VCC = 3.3 V, small signal | 25 | 27 | 31 | dB |
| Gain variation over frequency | $\|\Delta S_{21}\|$ | VCC = 3.3 V, small signal | | 1.4 | | dB |
| Quiescent current | $I_{CQ}$ | VCC = 3.3 V, no RF signal | | 0.12 | | A |

**Table 4. SKY65206-13 Electrical Specifications (Note 1) (2 of 2)**
**($T_A$ = +25 °C, Characteristic Impedance [$Z_0$] = 50 Ω, Unless Otherwise Noted)**

| Parameter | Symbol | Test Condition | Min | Typical | Max | Units |
|---|---|---|---|---|---|---|
| ***General RF Transmit (continued)*** | | | | | | |
| Current consumption | $I_{CC}$ | VCC = 3.3 V,<br>CW at $P_{OUT}$ = +16 dBm | | 0.17 | 0.19 | A |
| Input return loss | $\|S_{11}\|$ | VCC = 3.3 V, small signal | | 11 | | dB |
| Output return loss | $\|S_{22}\|$ | VCC = 3.3 V, small signal | | 19 | | dB |
| 1 dB output compression point | OP1dB | VCC = 3.3 V, CW | | +23 | | dBm |
| Detector voltage | $PD_{OUT}$ | VCC = 3.3 V<br>CW at $P_{OUT}$ = +4 dBm<br>CW at $P_{OUT}$ = +12 dBm<br>CW at $P_{OUT}$ = +21 dBm | <br><br><br>0.400 | <br>0.930<br>0.826<br>0.486 | <br><br><br>0.550 | <br>V<br>V<br>V |
| ***802.11g OFDM Modulation*** | | | | | | |
| Linear power @ 2.442 GHz | $P_{OUT}$ | VCC = 3.3 V,<br>54 Mbps @ 3% EVM | | +16.4 | | dBm |
| Current consumption | $I_{CC}$ | VCC = 3.3 V,<br>54 Mbps @ linear power | | 0.17 | | A |
| ***802.11b CCK Modulation (Note 2)*** | | | | | | |
| Linear power @ 2.442 GHz | $P_{OUT}$ | VCC = 3.3 V,<br>11 Mbps | | +20 | | dBm |
| Current consumption | $I_{CC}$ | VCC = 3.3 V,<br>11 Mbps @ compliant power | | 0.23 | | A |

**Note 1:** Performance is guaranteed only under the conditions listed in this Table and is not guaranteed over the full operating or storage temperature ranges. Exceeding any of the conditions listed here may result in permanent damage to the device. Operation at elevated temperatures may reduce reliability of the device.

**Note 2**: 802.11b data is taken with a raised consine filter and an alpha factor of 0.7.

**Table 5. Transmit/Receive Mode Switch Control Logic**

| Mode | VCTL1 (V) | VCTL2 (V) | VCTL3 (V) | VCTL4 (V) | VCC (V) | TX_EN (V) |
|---|---|---|---|---|---|---|
| Receive (ANT_A) | 0 | 3.3 | 0 | 0 | 3.3 | 0 |
| Receive (ANT_B) | 0 | 0 | 3.3 | 0 | 3.3 | 0 |
| Transmit (ANT_A) | 3.3 | 0 | 0 | 0 | 3.3 | 3.0 |
| Transmit (ANT_B) | 0 | 0 | 0 | 3.3 | 3.3 | 3.0 |

**Note**: All other conditions are not recommended.

## Typical Performance Characteristics

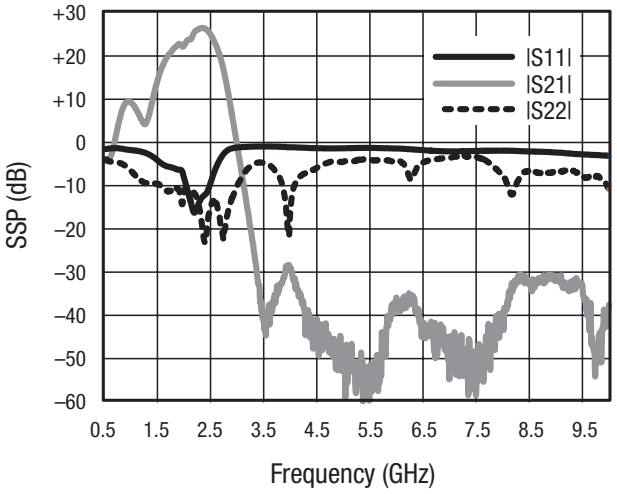



**Figure 3. Small Signal Transmit Parameters (Broadband)**
**(VCC = 3.3 V, TA = 25 °C)**

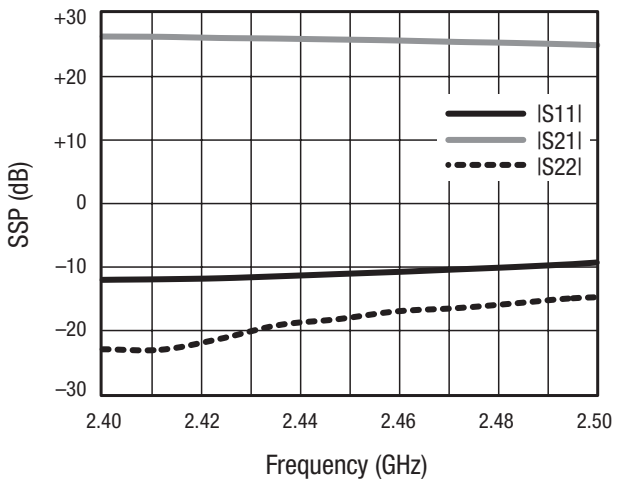



**Figure 4. Small Signal Transmit Parameters (Narrowband)**
**(VCC = 3.3 V, TA = 25 °C)**

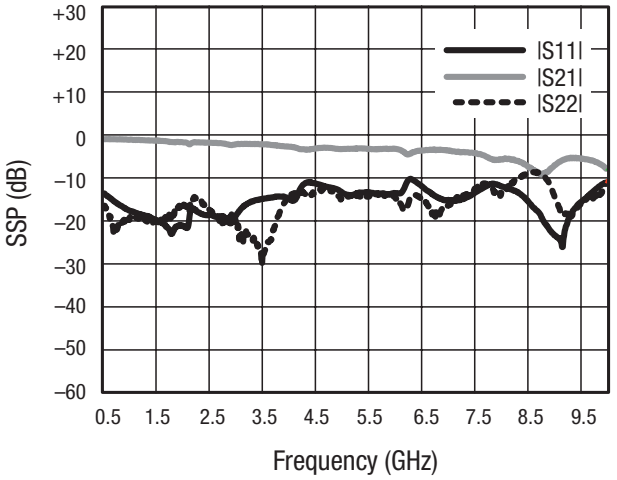



**Figure 5. Small Signal Receive Parameters (Broadband)**
**(TA = 25 °C)**

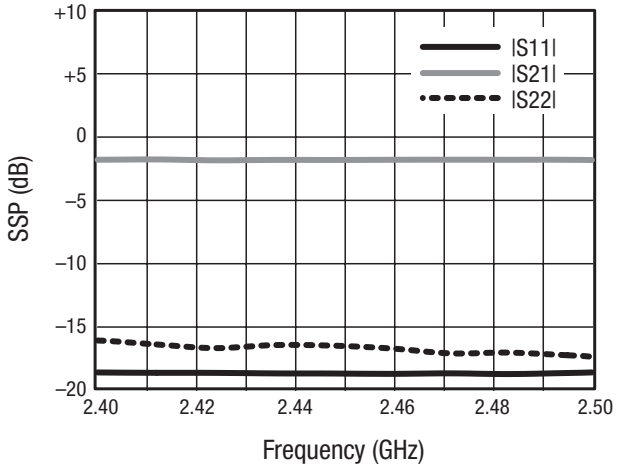



**Figure 6. Small Receive Parameters (Narrowband)**
**(TA = 25 °C)**

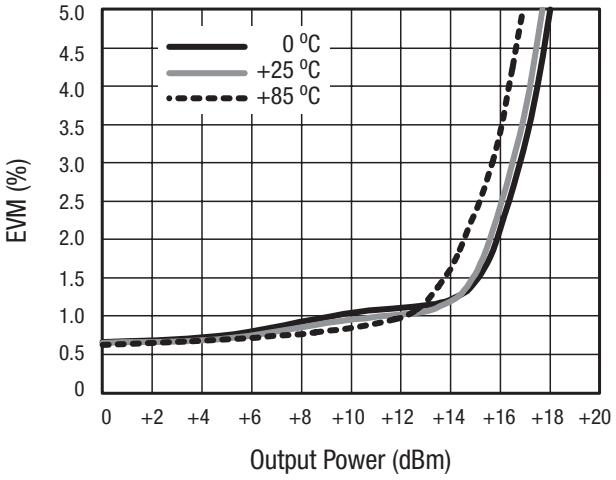



**Figure 7.EVM vs Output Power (VCC = 3.3 V, f = 2.450 GHz, OFDM = 54 Mbps)**

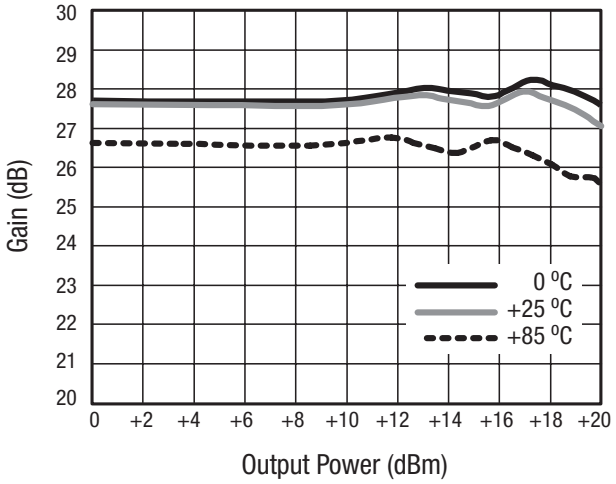



**Figure 8. Gain vs Output Power (VCC = 3.3 V, f = 2.442 GHz, OFDM = 54 Mbps)**

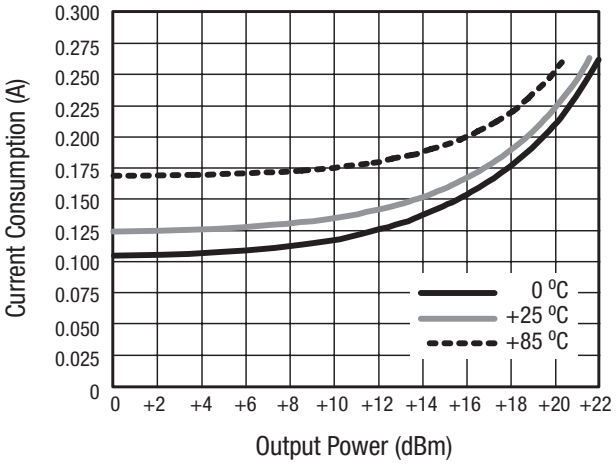



**Figure 9. Current Consumption vs Output Power (VCC = 3.3 V, f = 2.450 GHz, OFDM = 54 Mbps)**

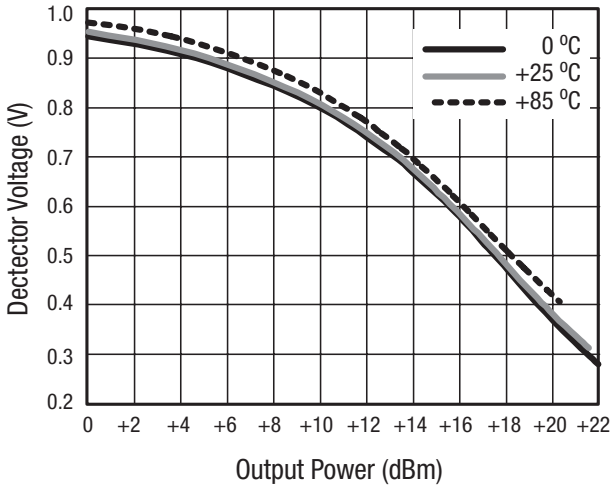



**Figure 10. Detector Voltage vs Output Power (VCC = 3.3 V, f = 2.450 GHz, OFDM = 54 Mbps)**

## Evaluation Board Description

The SKY65206 Evaluation Board is used to test the performance of the SKY65206-13 FEM. An assembly drawing for the Evaluation Board is shown in Figure 11. A schematic diagram of the SKY65206 Evaluation Board is shown in Figure 12.

### 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 pads of the SKY65206-13 have special electrical and thermal grounding requirements. These pads are 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 device. Therefore, design the connection to the ground pads to dissipate the maximum wattage produced by the circuit board.
3. Skyworks recommends including external bypass capacitors on the VCC voltage inputs of the device.

### Evaluation Board Test Procedure

Step 1: Connect a 3.3 V supply to VCC (see Figure 11). If available, enable the current limiting function of the power supply to 600 mA.

Step 2: Connect a 3.3 V supply to VCTL1, 2, 3, and 4 (these are ports C1, 2, 3, and 4, respectively, on the Evaluation Board). Any unused VCTL pins must be grounded or set to 0 V. Do not float the connections.

Step 3: Connect a 3.0 V supply to TX_EN (see Figure 11).

Step 4: Connect a digital volt meter to PD_OUT (see Figure 11).

Step 5: 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.

Step 6: Connect a spectrum analyzer to the RF signal output port.

***CAUTION**: Terminate all unused ports in 50 Ω.*

Step 7: Enable the power supplies.

Step 8: Enable the RF signal.

Step 9: Take measurements.

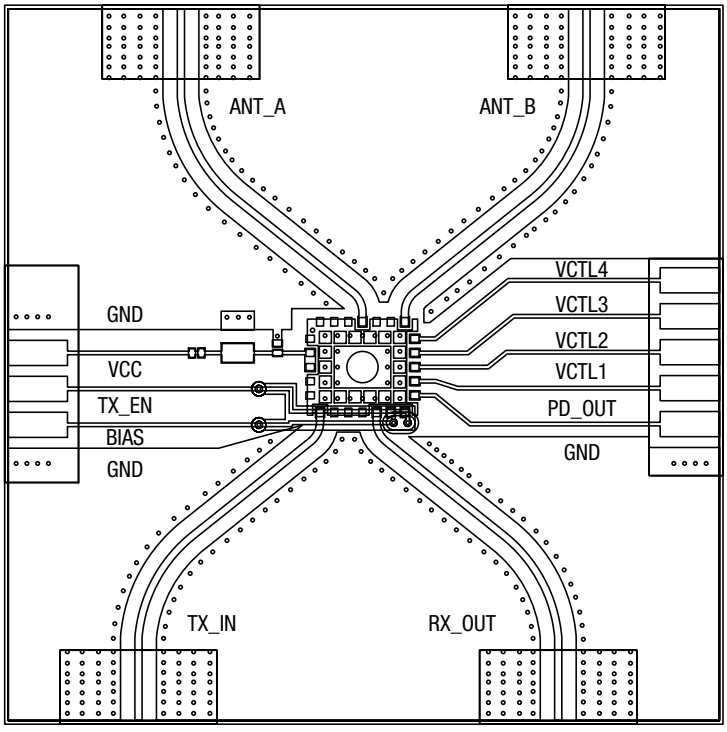



**Figure 11. SKY65206-13 Evaluation Board Assembly Drawing**

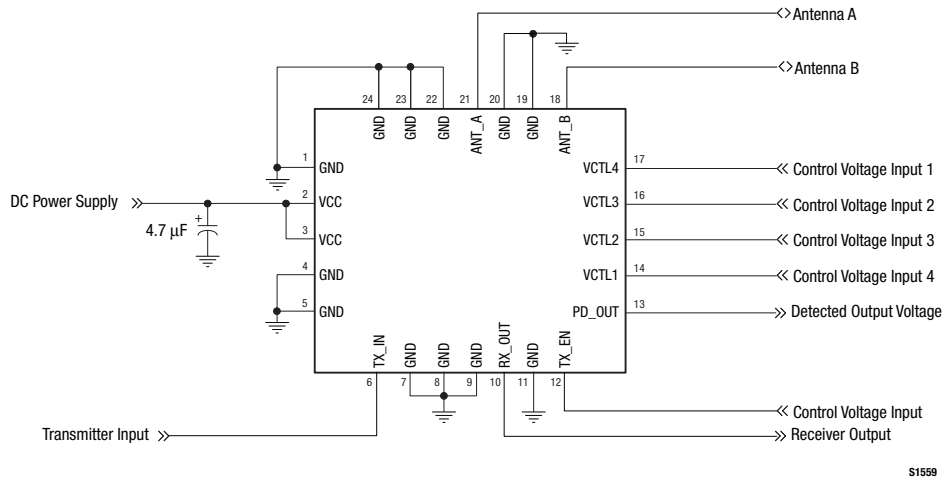



**Figure 12. SKY65206-13 Application Circuit**

## Package Dimensions

The PCB layout footprint for the SKY65206-13 is provided in Figure 13. Typical case markings are shown in Figure 14. Figure 15 provides the package dimensions for the 24-pin MCM and tape and reel dimensions are provided in Figure 16.

## 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 SKY65206-13 is rated to Moisture Sensitivity Level 3 (MSL3) at 240 °C. It can be used for lead or lead-free soldering. For additional information, refer to the Skyworks Application Note, *PCB Design & SMT Assembly/Rework Guidelines for MCM-L Packages*, document number 101752.

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.

## Electrostatic Discharge (ESD) Sensitivity

The SKY65206-13 is a static-sensitive electronic device. Do not operate or store near strong electrostatic fields. Take proper ESD precautions.

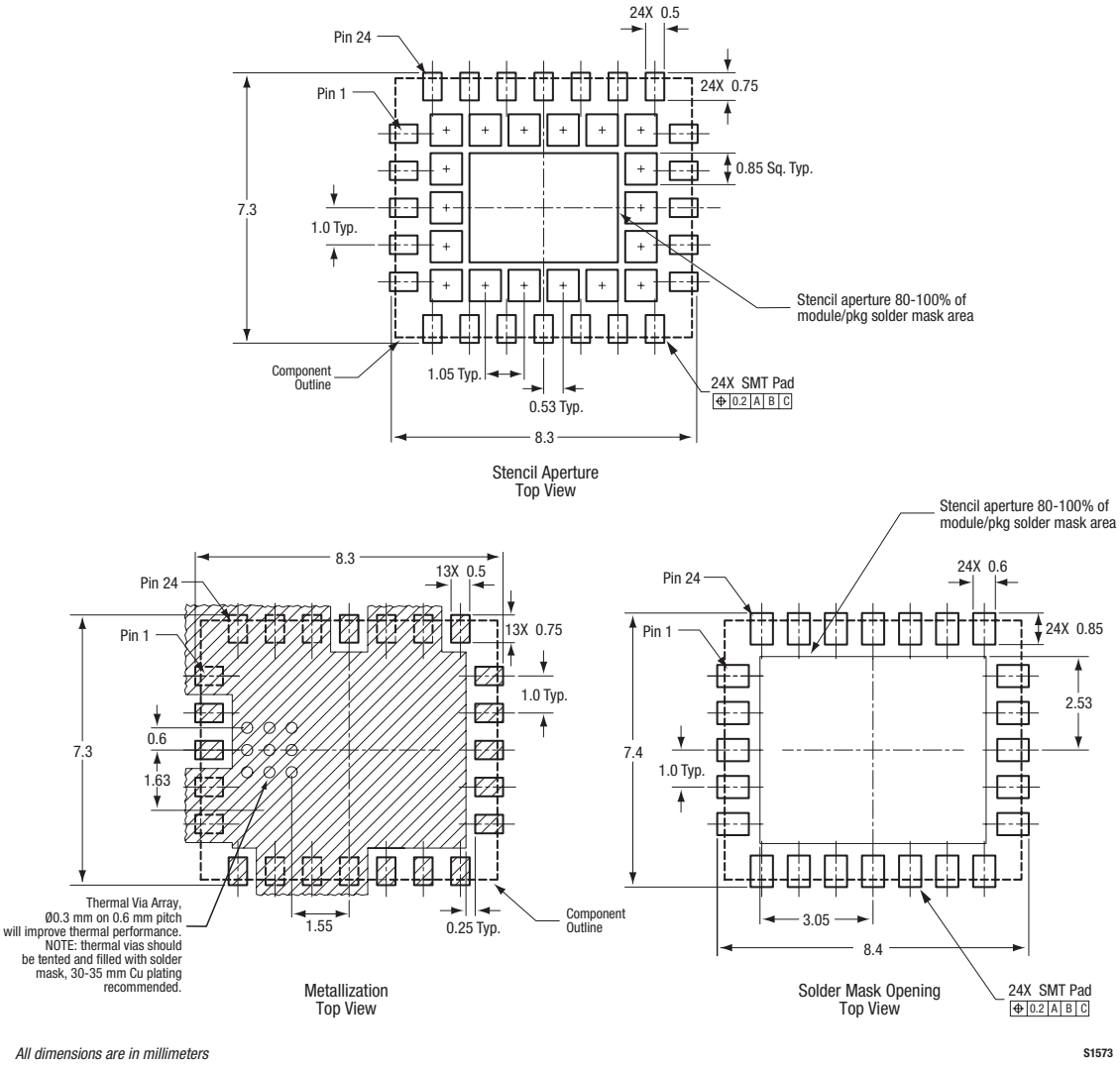



**Figure 13. Board Layout Footprint for the SKY65206-13 4 x 4 mm MCM**

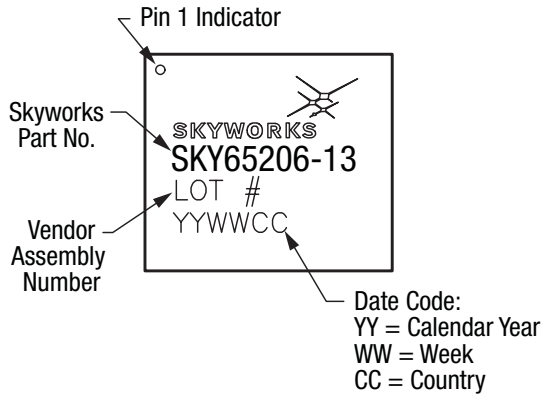
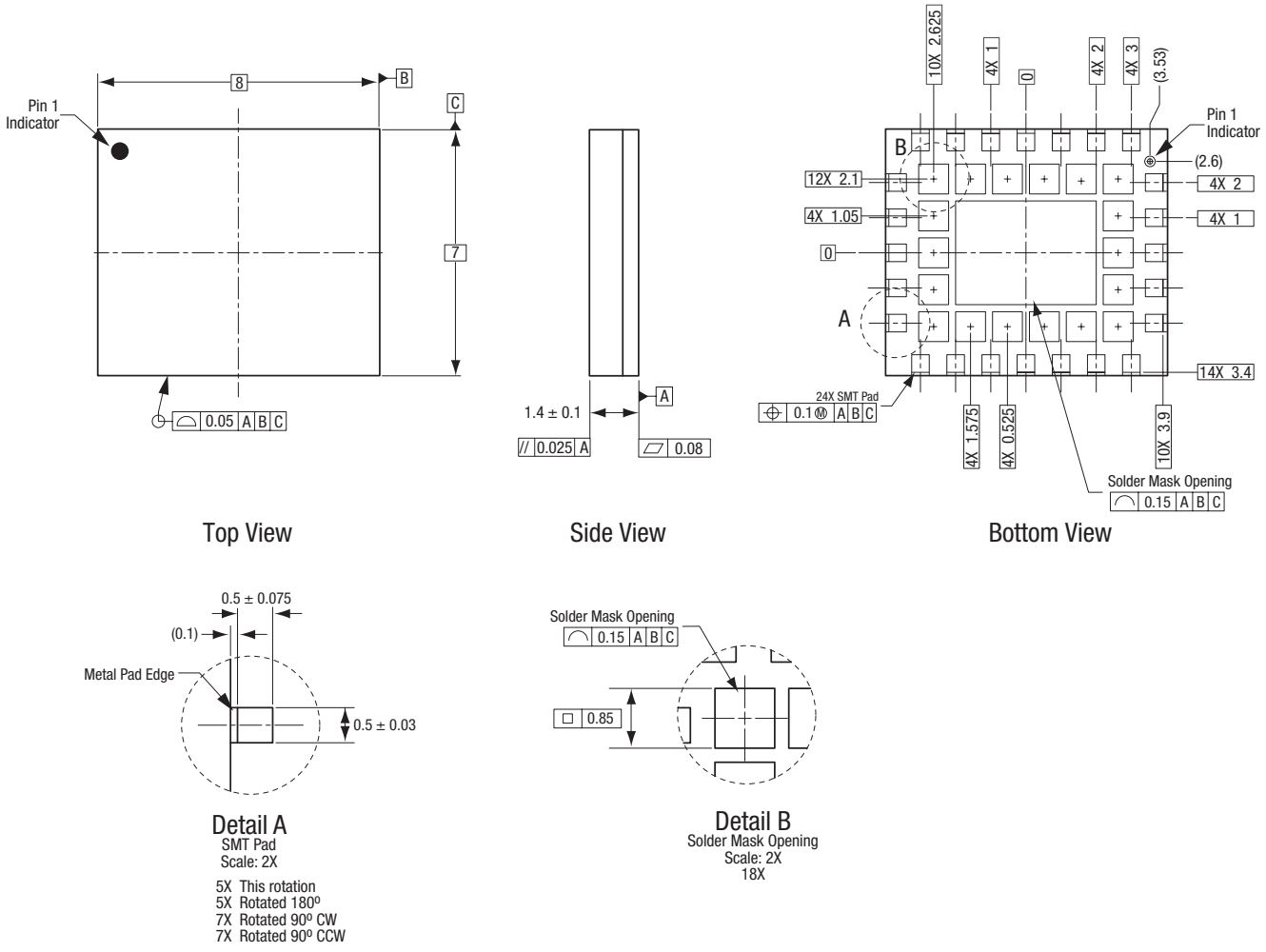



**Figure 14. Typical Case Markings (Top View)**




*All measurements are in millimeters.*
*Dimensioning and tolerancing according to ASME Y14.5M-1994.*

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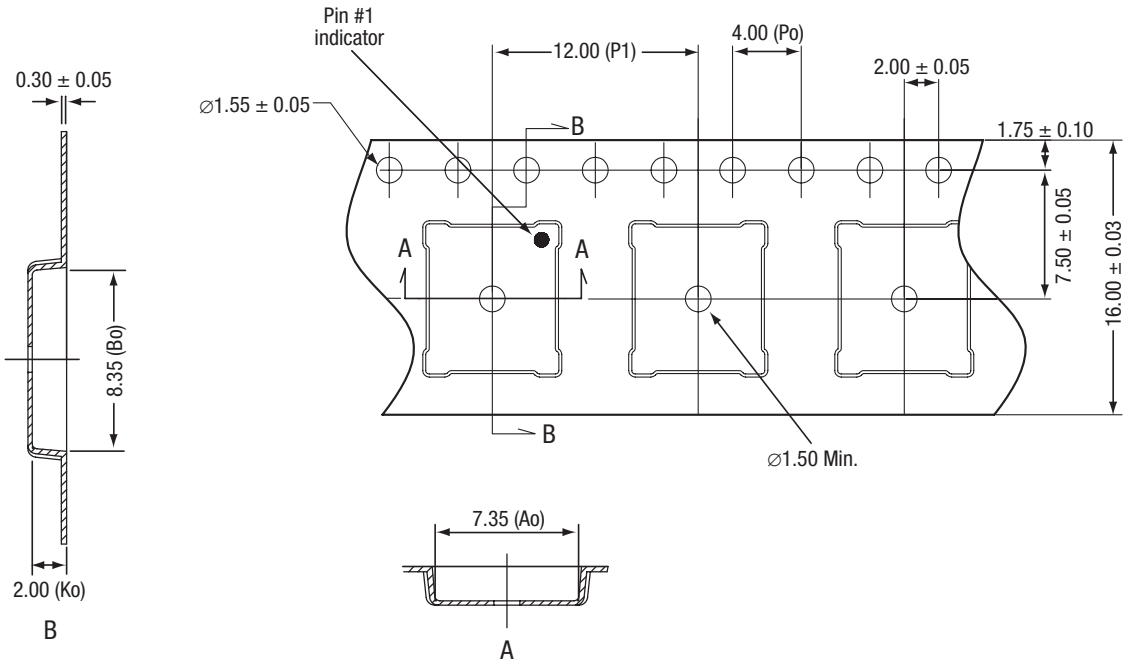
**Figure 15. SKY65206-13 20-Pin MCM Package Dimensions**




*Notes:*
*1. Carrier tape material: black conductive polystyrene*
*2. Cover tape material: transparent conductive PSA*
*3. Cover tape size: 13.3 mm width*
*4. Ao and Bo measurement point to be 0.30 from bottom pocket.*
*4. All measurements are in millimeters*

S1561

**Figure 16. SKY65206-13 Tape and Reel Dimensions**

## Ordering Information

| Model Name | Ordering Part Number | Evaluation Board Part Number |
|---|---|---|
| SKY65206-13 WLAN 801.11 b/g Front-End Moduler | SKY65206-13 (Pb-free package) | SK40350, rev. 2 |