

SKY65008: 250 – 2700 MHz Linear, Low Current Power Amplifier Driver

Applications

- AMPS, PCS, DCS, 2.5G, 3G, WCDMA, WLANs
- ISM band
- Fixed WCS
- 802.11b/g WLANs
- WiMax

Features

- Wideband frequency range: 250 to 2700 MHz
- High efficiency: PAE 48%
- High gain: 18 dB
- Single DC supply, +3 V
- MCM (3-pin, 4 x 4 mm) Pb-free package (MSL3, 250 °C per JEDEC J-STD-0-20)

NEW



Skyworks offers lead (Pb)-free “environmentally friendly” packaging that is RoHS compliant (European Parliament for the Restriction of Hazardous Substances).

Description

Skyworks SKY65008 is a high performance, ultra-wideband power amplifier driver with superior output power, linearity, low current consumption, and efficiency. The high linearity and superior Adjacent Channel Power Rejection/Adjacent Channel Leakage Ratio (ACPR/ACLR) performance make the SKY65008 ideal for use in the driver stage of infrastructure transmit chains.

The SKY65008 is fabricated using Skyworks high reliability InGaP Heterojunction Bipolar Transistor (HBT) technology in the form of a Pb-free, 3-pin, 4 x 4 mm Multi-Chip Module (MCM) package. The device package and pinout are shown in Figure 1. A functional block diagram is provided in Figure 2.

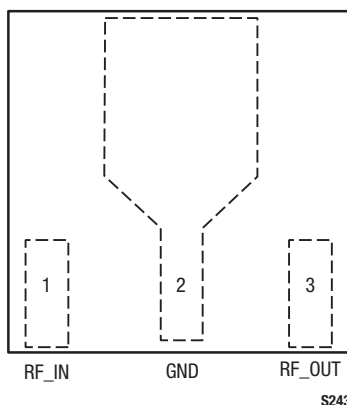


Figure 1. SKY65008 Pinout – 3-Pin MCM Package (Top View)

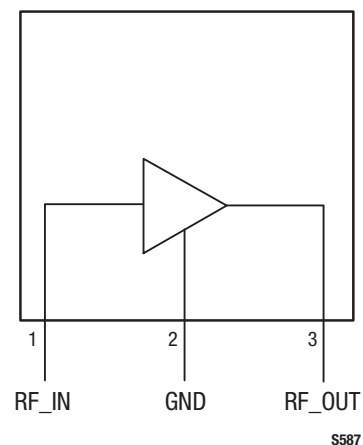


Figure 2. SKY65008 Block Diagram

Electrical and Mechanical Specifications

Signal pin assignments and functional pin descriptions for the SKY65008 are provided in Table 1. The absolute maximum ratings are provided in Table 2, and the recommended operating conditions in Table 3. Electrical characteristics of the SKY65008 are provided in Table 4.

The typical performance of the SKY65008 at various operating frequencies is illustrated in Figures 3 through 9. Package dimensions for the 3-pin MCM are shown in Figure 13, and tape and reel dimensions are shown in Figure 14.

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 SKY65008 can be used for lead or lead-free soldering. If the part is attached in a reflow oven, the temperature ramp rate should not exceed 5 °C per second. Maximum temperature

should not exceed 225 °C and the time spent at a temperature that exceeds 210 °C should be limited to less than 10 seconds. If the part is manually attached, precaution should be taken to ensure that the part is not subjected to a temperature that exceeds 300 °C for more than 10 seconds.

For details on both attachment techniques, precautions, and handling procedures recommended by Skyworks, please refer to Skyworks Application Note, *PCB Design and SMT Assembly/Rework Guidelines for MCM-L Packages*, document number 101752. Additional information on standard SMT reflow profiles can also be found in the JEDEC Standard J-STD-020.

Production quantities of both package types for this product are shipped in standard tape and reel formats. For packaging details, refer to the Skyworks Application Note, *Tape and Reel*, document number 101568.

Electrostatic Discharge (ESD) Sensitivity

The SKY65008 is a static-sensitive electronic device. Do not operate or store near strong electrostatic fields. Take proper ESD precautions.

Table 1. SKY65008 Signal Descriptions

Pin #	Name	Description
1	RF_IN	RF input
2	GND	Ground
3	RF_OUT	RF output

Table 2. SKY65008 Absolute Maximum Ratings (T_A = +25 °C, unless otherwise noted)

Parameter	Symbol	Min	Typical	Max	Units
Supply voltage	VCC			4	V
RF output power	P _{OUT}			23	dBm
Supply current	I _{CC}			110	mA
Power dissipation	P _D			400	mW
Operating case temperature	T _C	-40		+85	°C
Storage temperature	T _{ST}	-55		+125	°C
Junction temperature	T _J			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.

Table 3. SKY65008 Recommended Operating Conditions

Parameter	Symbol	Min	Typical	Max	Units
Supply voltage	VCC	3.0	3.3	3.6	V
Frequency range	F	250		2700	MHz

Table 4. SKY65008 Electrical Characteristics
(VCC = 3.3 V, Tc = 25 °C, input and output load < -8 dB, unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typical	Max	Units
Test Frequency = 900 MHz						
Small signal gain	G	CW		28.5		dB
Output power @ 1 dB compression	P _{1dB}	CW		19.5		dBm
Output 3rd Order Intercept Point	OIP3	Two tones, each @ +14 dBm/output tone		34		dBm
Noise figure	NF			3.3		dB
Test Frequency = 1960 MHz						
Small signal gain	G	CW		20		dB
Output power @ 1 dB compression	P _{1dB}	CW		21		dBm
Output 3rd Order Intercept Point	OIP3	Two tones, each @ +5 dBm/output tone		33		dBm
Noise Figure	NF			3.0		dB
Power-added efficiency	PAE	CW, P _{OUT} = +20 dBm		42		%
Quiescent current	I _Q	No RF input		76		mA
Output power @ ACPR = -45 dBc	P _{OUT}	IS-95. Nine forward channels		14		dBm
Test Frequency = 2140 MHz						
Small signal gain	G	CW		20		dB
Output power @ 1 dB compression	P _{1dB}	CW		21		dBm
Output 3rd Order Intercept Point	OIP3	Two tones, each @ +5 dBm/output tone		32		dBm
Noise Figure	NF			3.0		dB
Output power @ ACLR = -45 dBc	P _{OUT}	3G-WCDMA. Downlink test model #1 with 64 DPCH		11		dBm
Test Frequency = 2450 MHz						
Small signal gain	G	CW		18.5		dB
Output power @ 1 dB compression	P _{1dB}	CW		20		dBm
Output 3rd Order Intercept Point	OIP3	Two tones, each @ +5 dBm/output tone		33		dBm
Noise Figure	NF			3.0		dB
Test Frequency = 2650 MHz						
Small signal gain	G	CW		18		dB
Output power @ 1 dB compression	P _{1dB}	CW		19		dBm
Output 3rd Order Intercept Point	OIP3	Two tones, each @ +5 dBm/output tone		32		dBm
Noise Figure	NF			3.0		dB

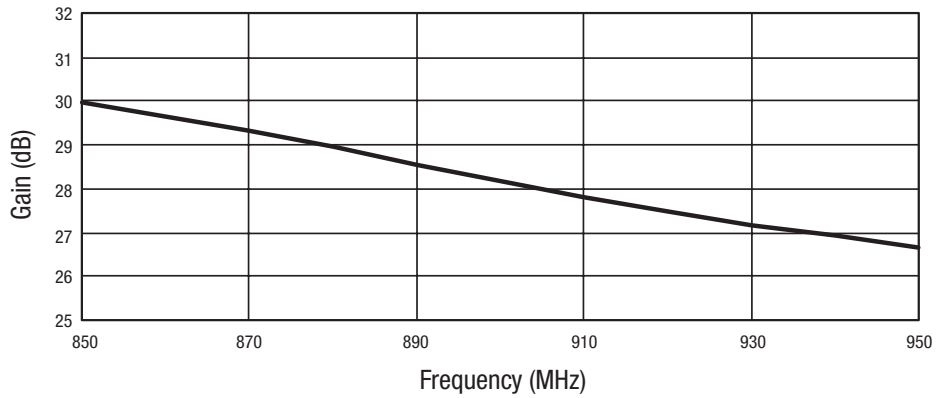


Figure 3. Typical Small Signal Gain vs Frequency in the 900 MHz Band

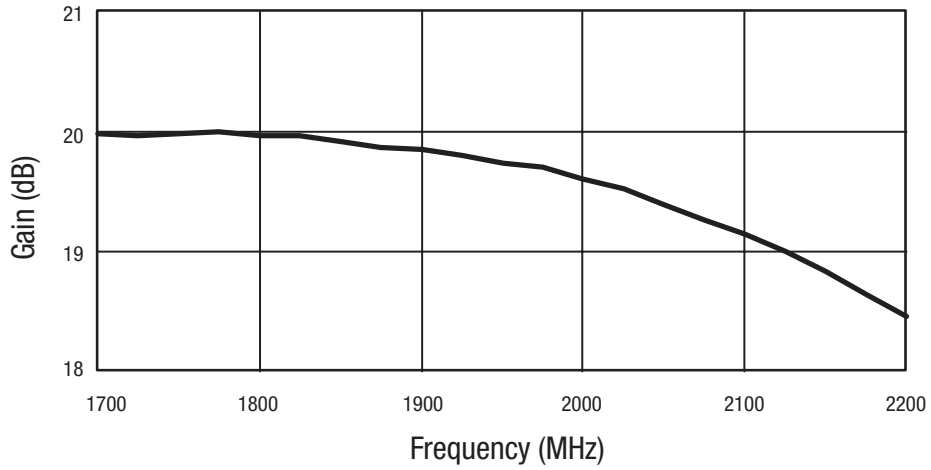


Figure 4. Typical Small Signal Gain vs Frequency in the 1900 MHz Band

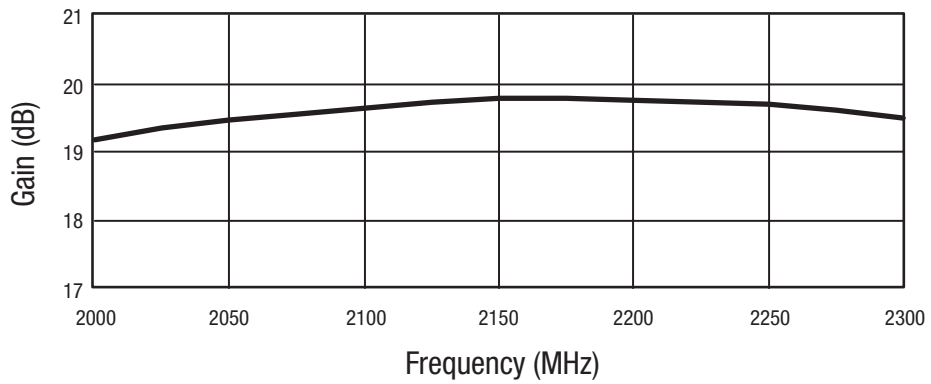


Figure 5. Typical Small Signal Gain vs Frequency in the 2100 MHz Band

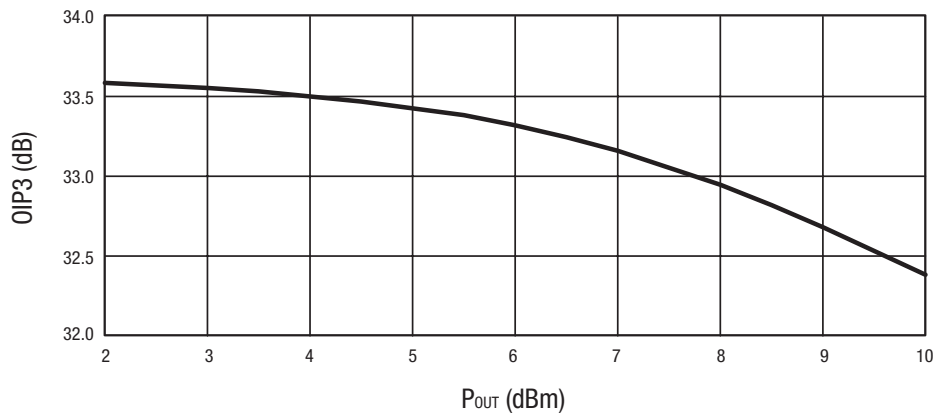


Figure 6. Typical OIP3 vs Tone Output Power in the 1960 MHz Band

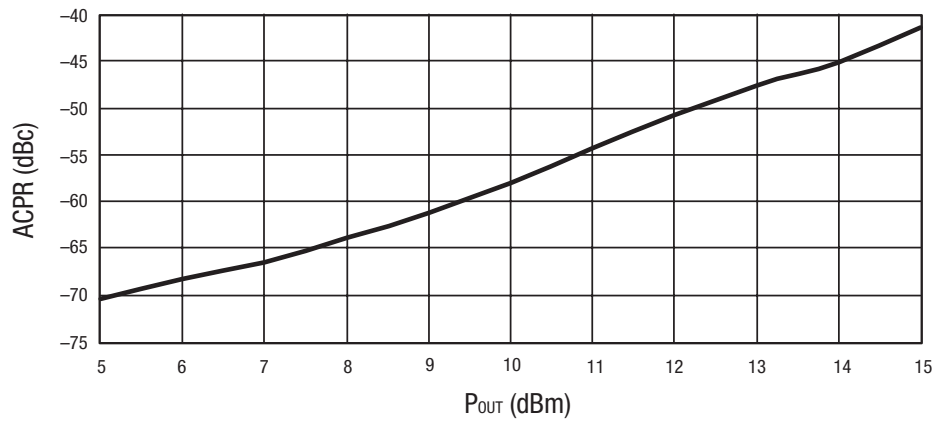


Figure 7. Typical ACPR vs Output Power in the 1960 MHz Band

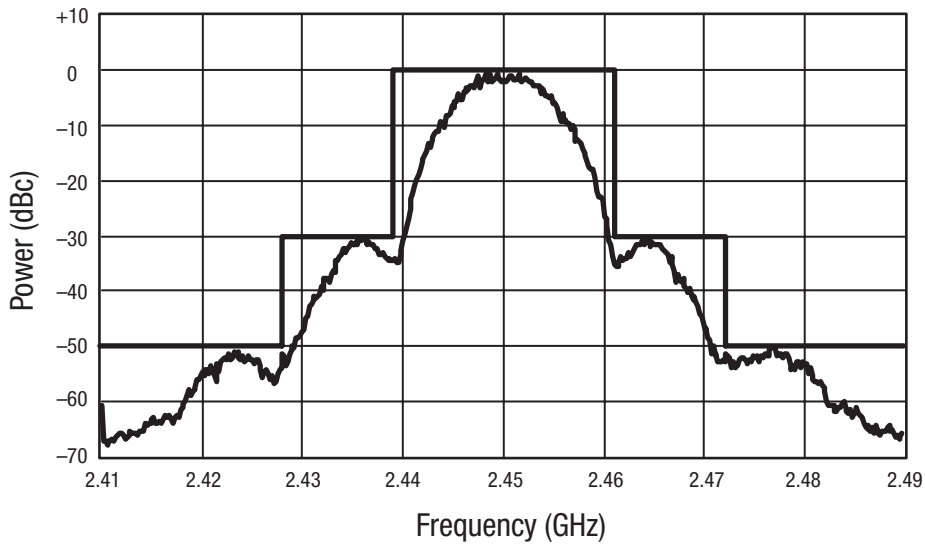


Figure 8. Spectral Mask Performance @ 2450 MHz (802.11b CCK @ 11 Mbps Input Signal, $P_{out} = 19$ dBm)

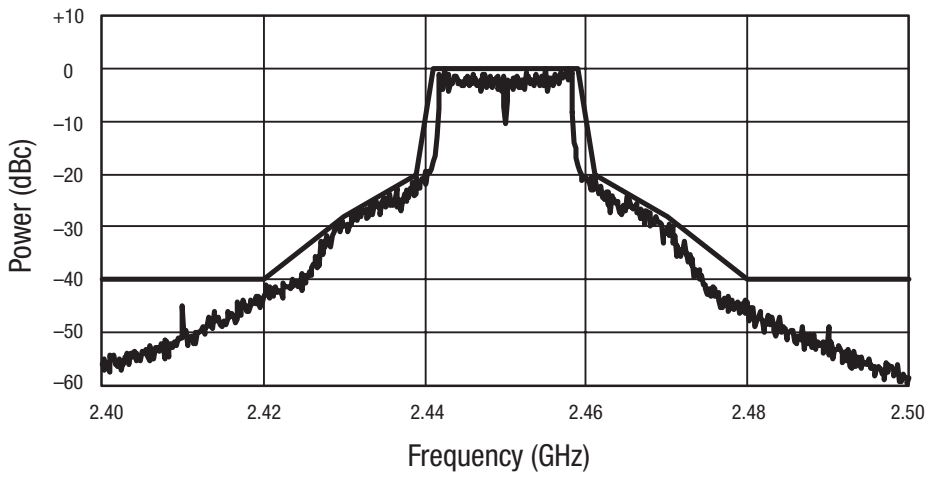


Figure 9. Spectral Mask Performance @ 2450 MHz (802.11g 64QAM @ 54 Mbps Input Signal, $P_{out} = 17$ dBm)

Evaluation Board Description

The Skyworks SKY65008 Evaluation Board is used to test the performance of the SKY65008 power amplifier driver. An assembly drawing for the Evaluation Board is shown in Figure 10 and the layer detail is provided in Figure 11.

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 SKY65008 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.

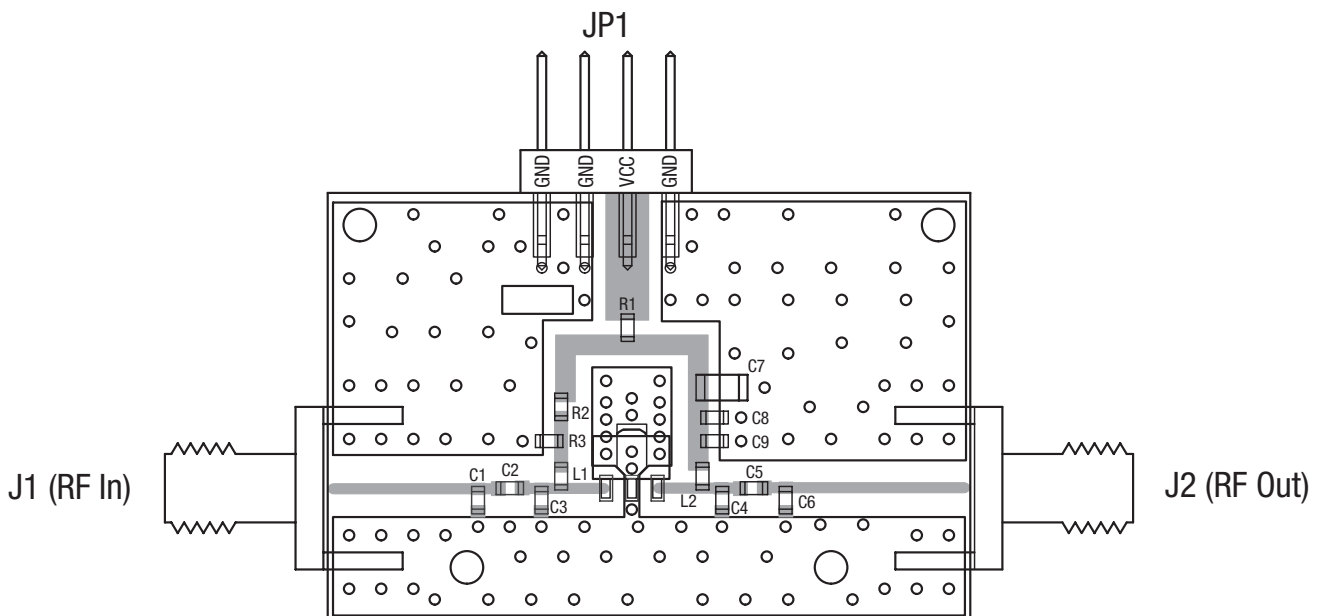
A suggested matching circuit is shown in Figure 12 with component values listed in Table 5.

Testing Procedure

Use the following procedure to set up the SKY65008 Evaluation Board for testing:

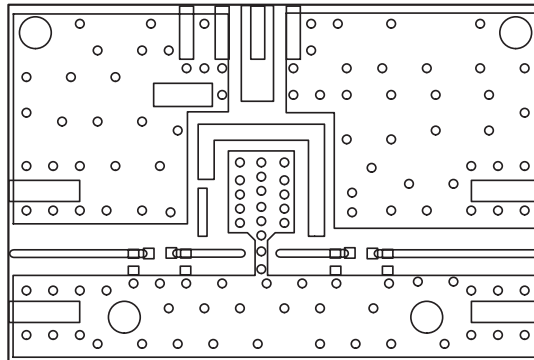
1. Connect a 3.3 V supply to VCC. If available, enable the current limiting function of the power supply to 240 mA.
2. Connect a signal generator to the RF signal input port. Set it to the desired RF frequency at a power level of -15 dBm or less to the Evaluation Board but do NOT enable the RF signal.
3. Connect a spectrum analyzer to the RF signal output port.
4. Enable the power supply.
5. Enable the RF signal.
6. Take measurements.

CAUTION: If any of the output signals exceed the rated maximum values, the SKY65008 Evaluation Board can be permanently damaged.

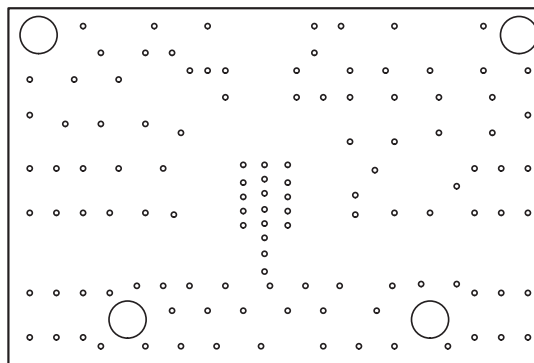


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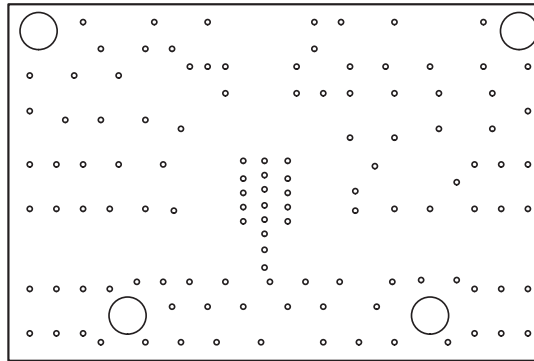
Figure 10. Evaluation Board Assembly Drawing



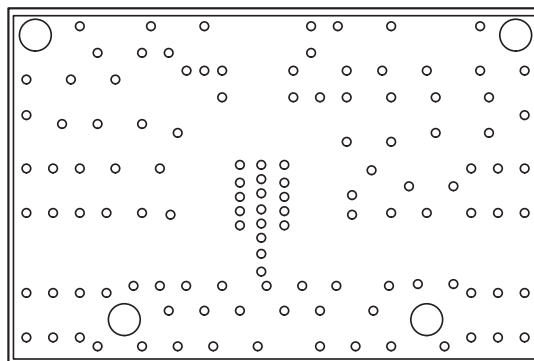
Layer 1: Top - Metal



Layer 2: Ground



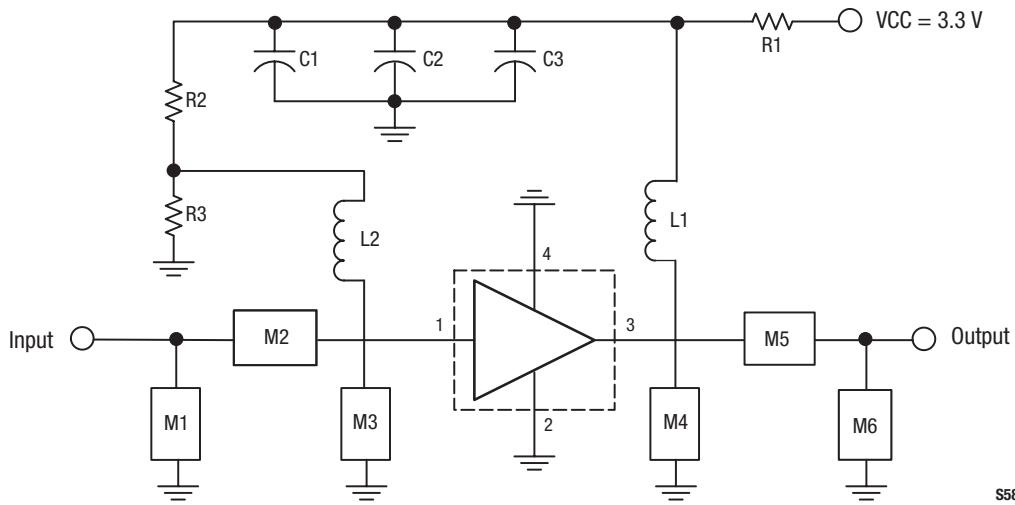
Layer 3: Ground



Layer 4: Solid Ground Plane

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Figure 11. Evaluation Board Layer Detail

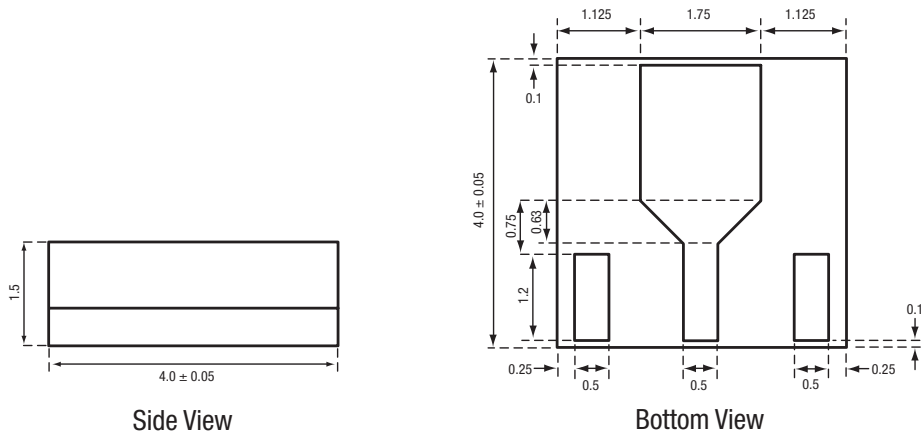


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Figure 12. SKY65008 Evaluation Board Schematic
(Refer to Table 5 for Component Values)

Table 5. SKY65008 Evaluation Board Component Values vs Frequency

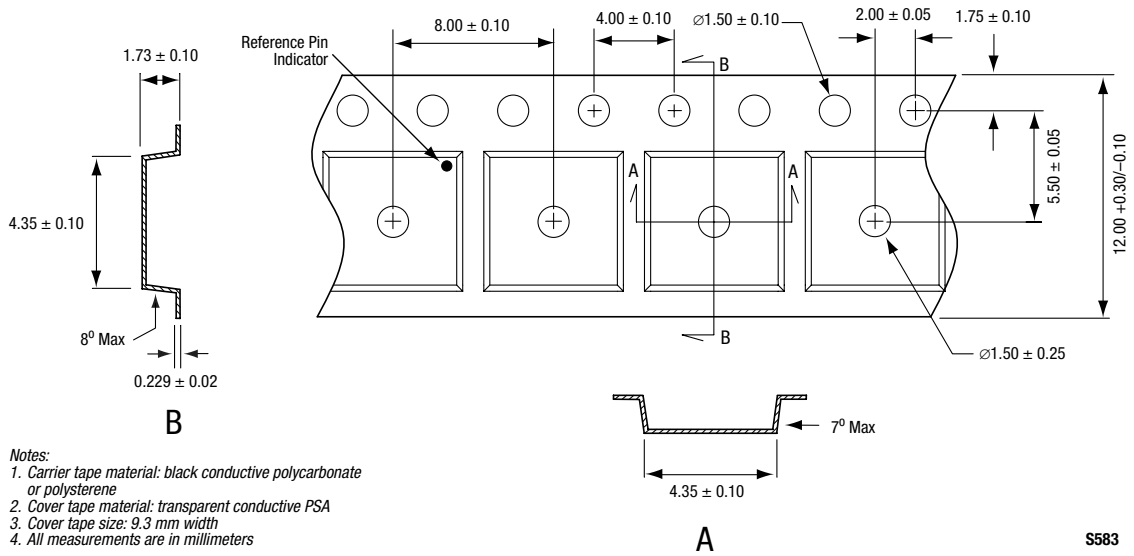
Component	Evaluation Board Frequency (MHz)				
	900	1960	2140	2450	2650
R1	0 Ω	0 Ω	0 Ω	0 Ω	0 Ω
R2	750 Ω	750 Ω	750 Ω	750 Ω	750 Ω
R3	680 Ω	680 Ω	680 Ω	680 Ω	680 Ω
C1	1.0 μF	1.0 μF	1.0 μF	1.0 μF	1.0 μF
C2	10 pF	36 pF	6.8 pF	6.8 pF	6.8 pF
C3	18 pF	6.8 pF	36 pF	18 pF	18 pF
L1	47 nH	27 nH	27 nH	18 nH	18 nH
L2	47 nH	27 nH	27 nH	18 nH	18 nH
M1	4.7 nH	1 pF	1 pF	0.5 pF	0.5 pF
M2	5.6 pF	3.9 pF	1.8 pF	1.2 pF	1.0 pF
M3	7.5 pF	DNC	DNC	DNC	DNC
M4	1.0 pF	DNC	DNC	DNC	DNC
M5	18 pF	6.8 pF	15 pF	12 pF	12 pF
M6	5.6 nH	DNC	1 pF	1 pF	1 pF



All measurements are in millimeters

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Figure 13. SKY65008 Package Dimensions



- Notes:
1. Carrier tape material: black conductive polycarbonate or polyesterene
 2. Cover tape material: transparent conductive PSA
 3. Cover tape size: 9.3 mm width
 4. All measurements are in millimeters

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Figure 14. SKY65008 Tape and Reel Dimensions

Ordering Information

Model Name	Ordering Part Number	Evaluation Kit Part Number
SKY65008 250-2700 MHz Linear, Low Current PA Driver	SKY65008-21	TW13-D781-001 (836 MHz) TW13-D782-001 (900 MHz) TW13-D783-001 (1960 MHz) TW13-D784-001 (2140 MHz) TW13-D786-001 (2450 MHz) TW13-D787-001 (2650 MHz)

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