DATA SHEET

CX65105: 1700 – 2200 MHz Linear Power Amplifier

Applications

- PCS/DCS/UMTS
- Repeaters
- WLL and ISM bands
- Mobile radio
- Telematics

Features

- Typical P_{OUT} of 28.5 dBm
- High linearity
- Low power consumption
- Single +5 V supply
- LCC (8-pin, 8 x 8 mm) package

Description

Skyworks CX65105 Power Amplifier (PA) is a fully matched, 8-pin Leadless Chip Carrier (LCC) surface mount module, developed for Personal Communications System (PCS), Digital Communications System (DCS), and Universal Mobile Telephone System (UMTS) applications. Wireless Local Loop (WLL) and Industrial, Scientific, Medical (ISM) applications are also supported.

This small, power-efficient PA has a full 1700 to 2200 MHz bandwidth coverage packed into a single compact package. All active circuitry in the module is contained in a single Gallium Arsenide (GaAs) Microwave Monolithic Integrated Circuit (MMIC). The CX65105 is manufactured with Skyworks Aluminum (Al) GaAs Heterojunction Bipolar Transistor (HBT) process, which allows for single supply operation while maintaining high efficiency and good linearity.

The 8-pin Leadless Chip Carrier (LCC) device package and pinout are shown in Figure 1. Figure 2 shows a functional block diagram for the CX65105. Signal pin assignments and functional pin descriptions are provided in Table 1.

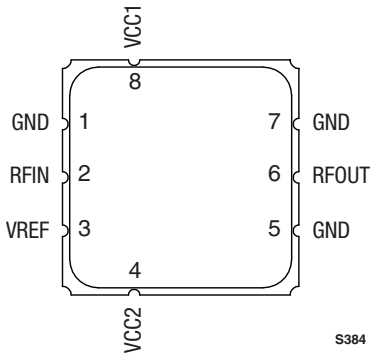


Figure 1. CX65101 Pinout– 8-Pin LCC Package (Top View)

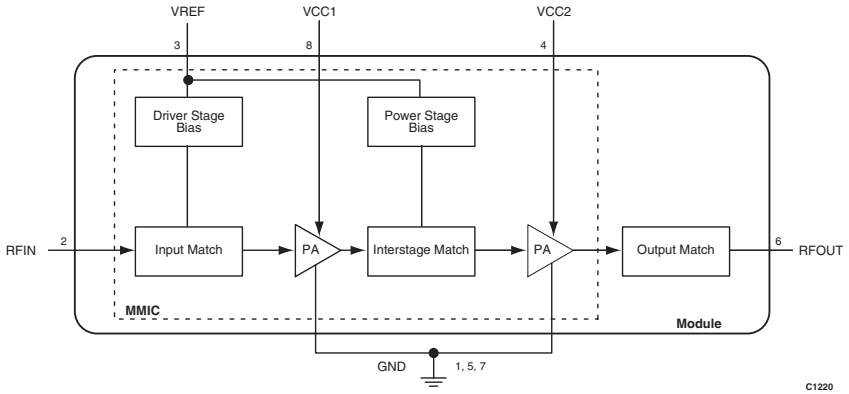


Figure 2. CX65105 Functional Block Diagram

Table 1. CX65105 Signal Descriptions

Pin #	Name	Description	Pin #	Name	Description
1	GND	Ground	5	GND	Ground
2	RFIN	RF input	6	RFOUT	Rf output
3	VREF	Reference voltage	7	GND	Ground
4	VCC2	Supply voltage	8	VCC1	Supply voltage

Technical Description

The CX65105 is comprised of two amplifier stages. The matching circuits for the input stage, inter-stage, and output stage are contained within the device. The bias circuits for both input and output stages are included within the device for optimum temperature tracking performance.

The CX65105 is internally matched for optimum linearity and efficiency. The input and output stages are independently supplied using the VCC1 and VCC2 supply lines, pins 8 and 4 respectively. The bias reference voltage is supplied using a common VREF (pin 3) line.

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.

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.

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.

Electrical and Mechanical Specifications

The absolute maximum ratings of the CX65105 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 over temperature of the CX65105 are illustrated in Figures 3 through 8.

Figure 13 shows the package dimensions for the 8-pin CX65105 LCC and Figure 14 provides the tape and reel dimensions.

Electrostatic Discharge (ESD) Sensitivity

The CX65105 is a static-sensitive electronic device. Do not operate or store near strong electrostatic fields. Take proper ESD precautions.

Table 2. CX65105 Absolute Maximum Ratings

Parameter	Symbol	Min	Typical	Max	Units
RF input power	P_{IN}			7	dBm
Supply voltage	V_{CC}			6	V
Reference voltage	V_{REF}			4	V
Case operating temperature	T_C	–40		+85	°C
Storage temperature	T_{ST}	–55		+125	°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. CX65105 Recommended Operating Conditions

Parameter	Symbol	Min	Typical	Max	Units
Supply voltage	VCC		5		V
Reference voltage	V_{REF}		3.6		V
Operating frequency	F_O	1700	1900	2200	MHz

Table 4. CX65105 Electrical Characteristics
(VCC = 5.0 V, V_{REF} = 3.6 V, Frequency = 1900 MHz, Tc = 25 °C, unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typical	Max	Units
Analog Inputs						
Frequency range			1700	1900	2200	MHz
Quiescent current	I_Q			143	185	mA
Small signal gain	G	P_{IN} = –15 dBm	23.5	25.0		dB
Output power	P_{OUT}	P_{IN} = 5 dBm	27	28.5		dBm
Efficiency	PAE	P_{IN} = 5 dBm	25	30		%
Noise Figure (NF)	NF			6	7	dB
Output IP3	OIP3	Two tones with 100 kHz spacing, P_{IN} = 0 dBm per tone	36	40		dBm
P_{OUT} @ ACPR = –45 dBc	P_{OUT_ACPR}	f = 1960 MHz	22	24		dBm
P_{OUT} @ ACLR = –45 dBc	P_{OUT_ACLR}	f = 2140 MHz	18	20		dBm

Note: The above specifications apply only to the 1900 MHz operating frequency.

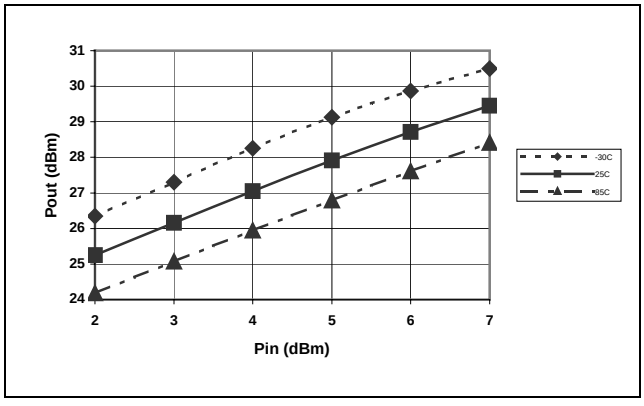


Figure 3. Typical P_{OUT} vs P_{IN} Over Temperature

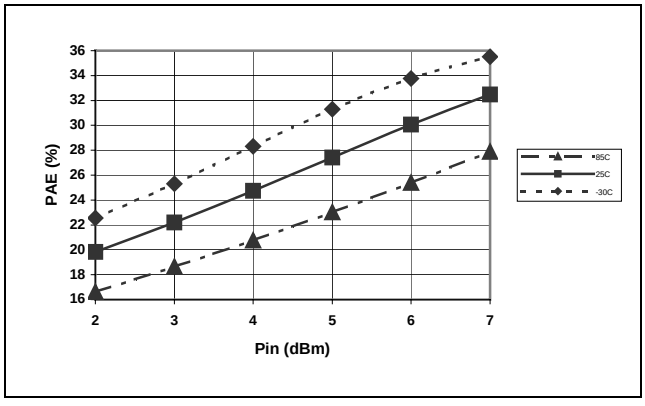


Figure 4. Typical PAE vs P_{IN} Over Temperature

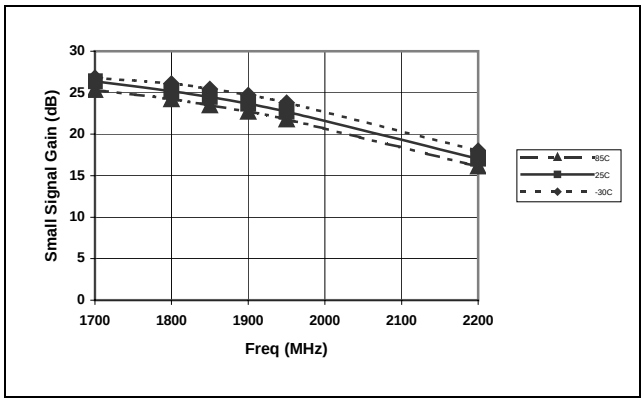


Figure 5. Typical Small Signal Gain vs Frequency Over Temperature

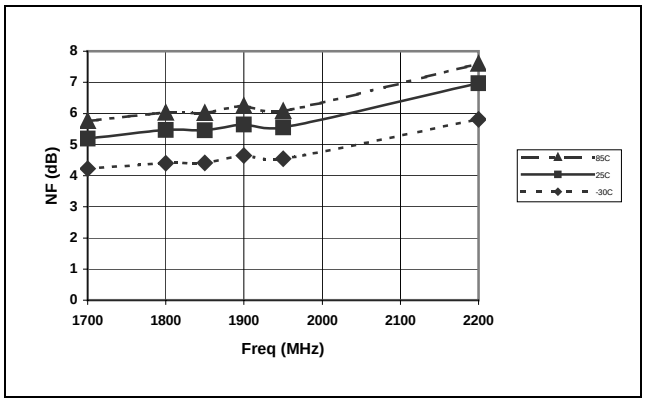


Figure 6. Typical Noise Figure vs Frequency Over Temperature

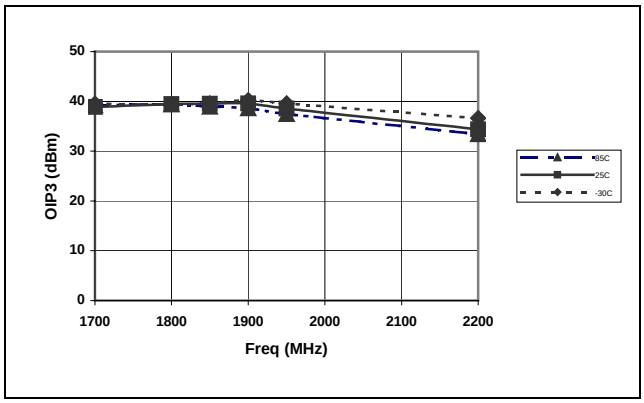


Figure 7. Typical OIP3 vs Frequency Over Temperature

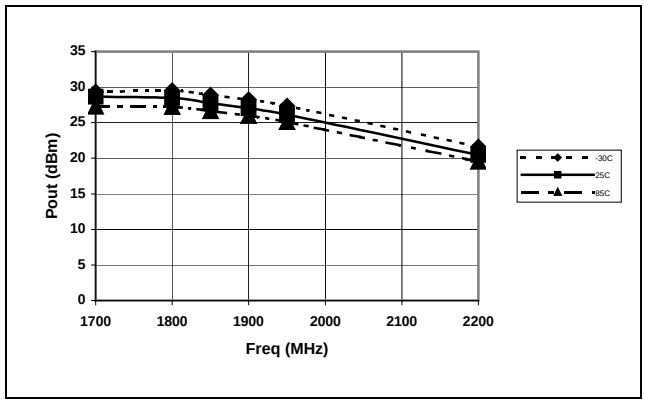


Figure 8. Typical P_{OUT} vs Frequency Over Temperature

Evaluation Board Description

Skyworks CX65105 Evaluation Board is used to test the performance of the CX65105 PA. The Evaluation Board schematic diagram is shown in Figure 9. The schematic shows the basic design of the board for the 1700 to 2200 MHz range. Figure 10 provides the Evaluation Board assembly diagram. Figure 11 provides the Evaluation Board layer detail.

Circuit Design Considerations

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 CX65105 PA 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.
3. Two external output bypass capacitors (0.01 μF and 4.7 μF) are required on the VCC1 (pin 8) supply input. The same two capacitors are also required on the VCC2 (pin 4) supply input. Both capacitors should be placed in parallel between the supply line and ground. Also, a bypass capacitor of 0.01 μF is required on the VREF input (pin 3). See Figure 9 for a detailed diagram.
4. VCC1 (pin 8) and VCC2 (pin 4) may be connected together at the supply.
5. At the RF input (pin 2), a DC blocking capacitor is required.
6. The RF output includes an onboard internal DC blocking capacitor. All impedance matching is provided internally. Therefore, the application only needs to provide a good 50 Ω load.

Testing Procedure

Use the following procedure to set up the CX65105 Evaluation Board for testing. Refer to Figure 12 for guidance:

1. Connect a +5.0 V supply voltage to VCC1 and VCC2, and +3.6 V supply voltage to VREF. If available, enable the current limiting function of the power supplies to 1.0 A for the +5.0 V supply current and 30 mA for the +3.6 V supply current.
2. Connect a signal generator to the RF signal input port. Set it to the desired RF frequency at a power level of 7 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 the input signal exceeds the rated power, the CX65105 Evaluation Board can be permanently damaged.*

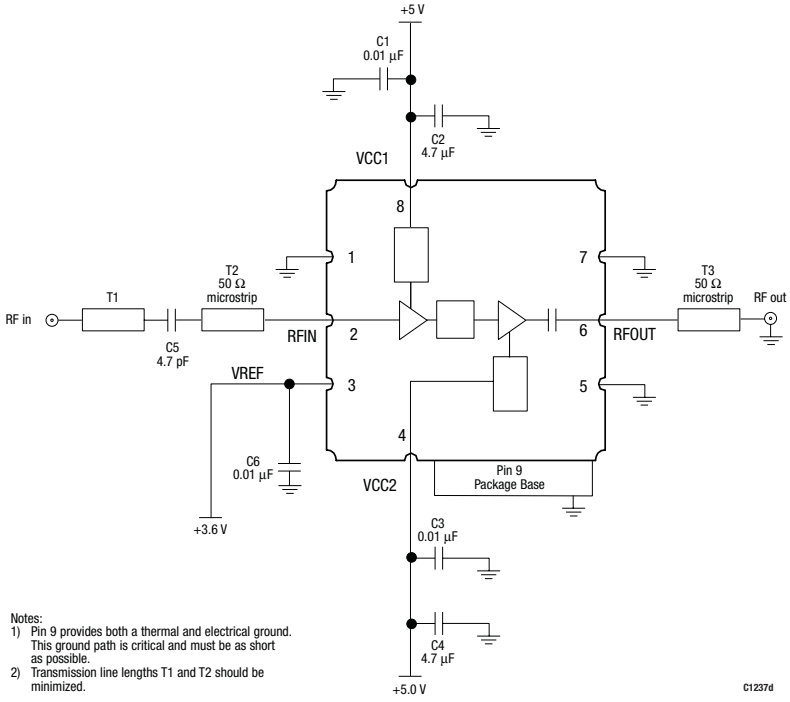


Figure 9. Evaluation Board Schematic, 1700 MHz to 2200 MHz

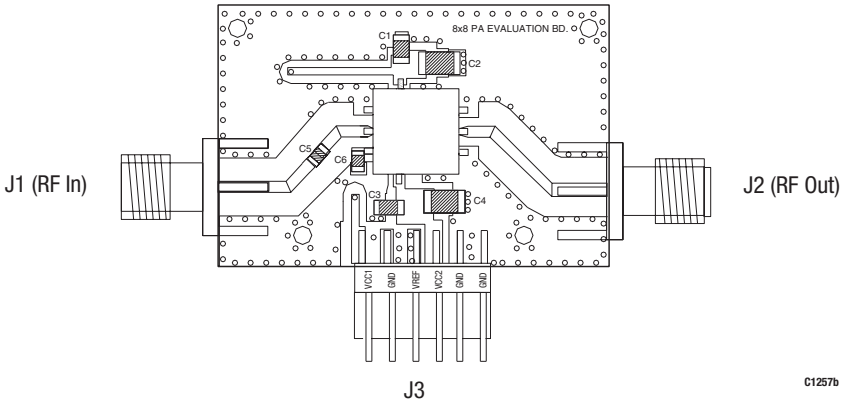
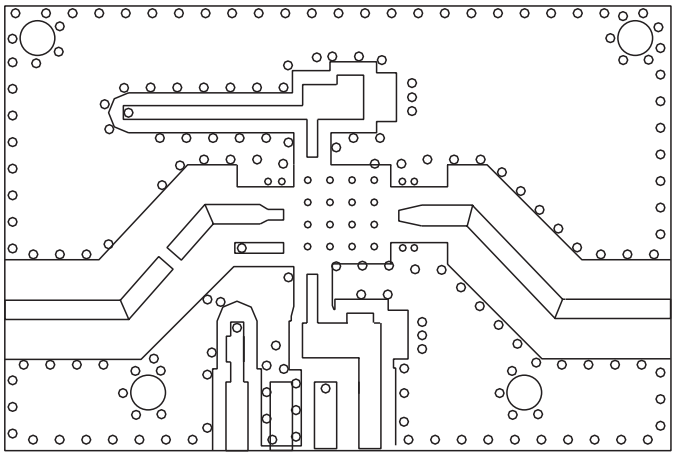
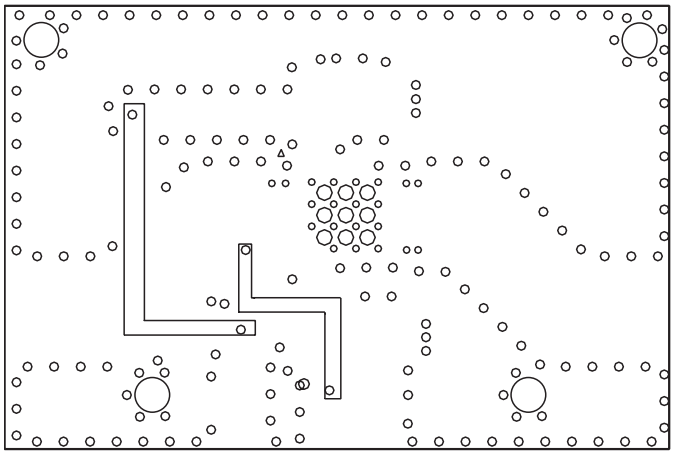


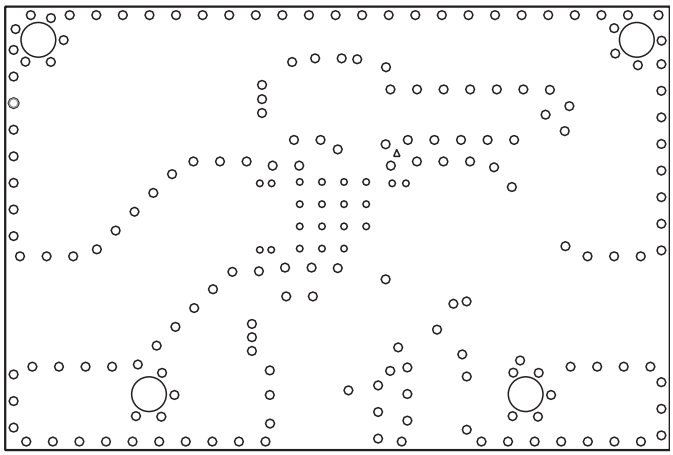
Figure 10. Evaluation Board Assembly Diagram



Layer 1: Top - Metal



Layer 2: Inner Traces



Layer 3: Solid Ground Plane

C1253d

Figure 11. Evaluation Board Layer Detail

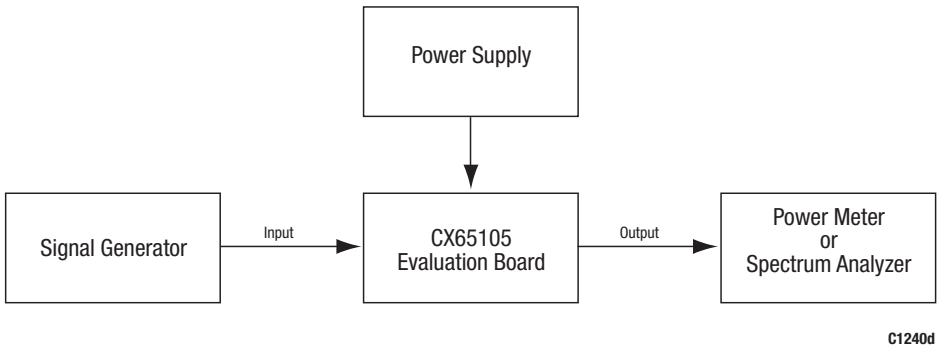


Figure 12. CX65105 Evaluation Board Testing Configuration

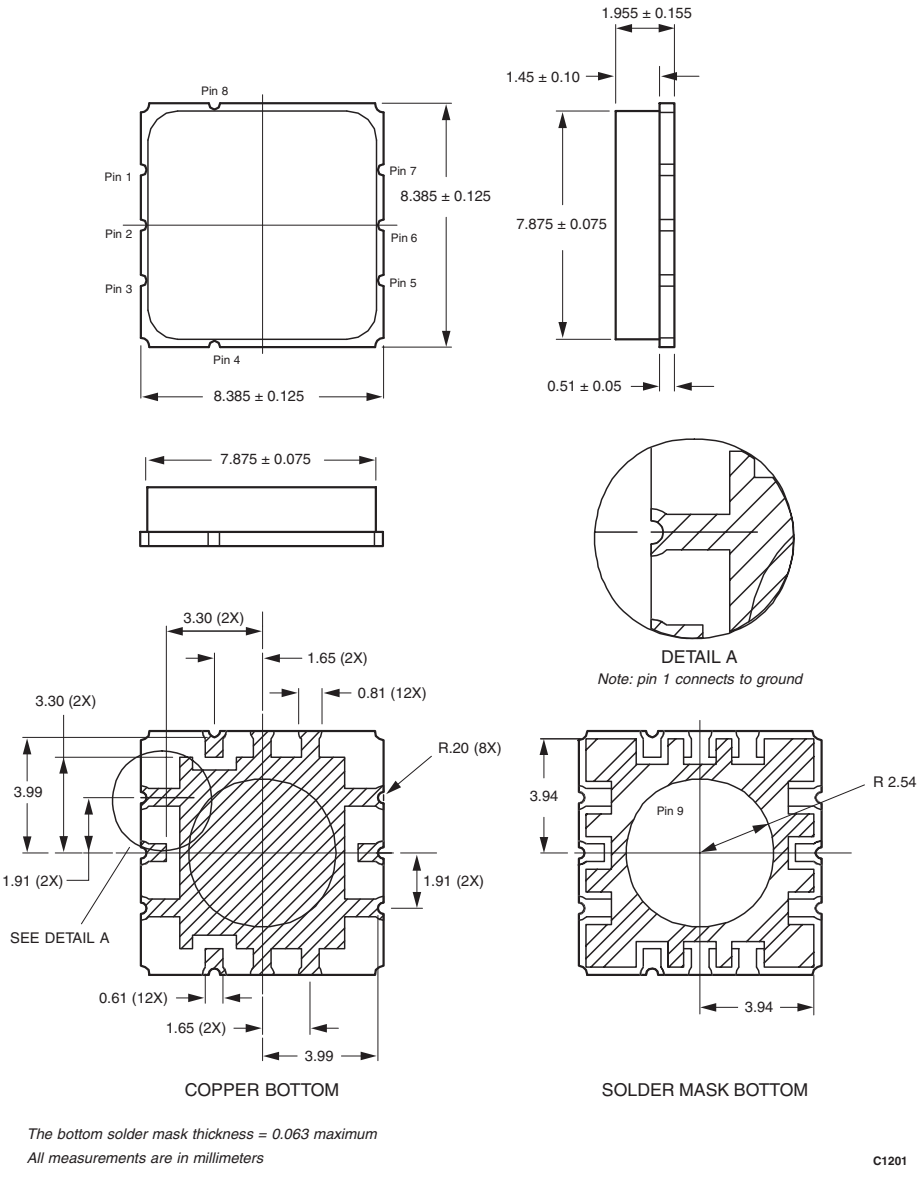
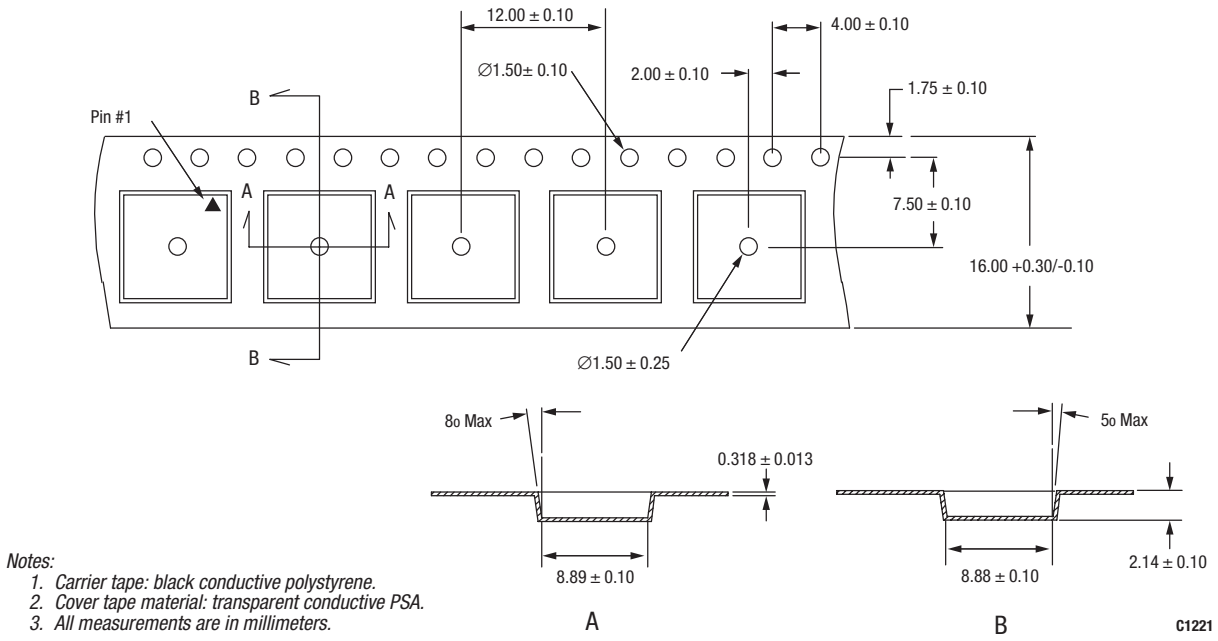


Figure 9. CX65105 8-Pin LCC Package Dimensions



Notes:
1. *Carrier tape: black conductive polystyrene.*
2. *Cover tape material: transparent conductive PSA.*
3. *All measurements are in millimeters.*

Figure 10. CX65105 8-Pin LCC Tape and Reel Dimensions

Ordering Information

Model Name	Manufacturing Part Number	Evaluation Kit Part Number
CX65105 1700-2200 MHz Linear Power Amplifier	CX65105-11	TW10-D842