DATA SHEET

SKY66181-11: 1805 to 1880 MHz Linear Power Amplifier

Applications

- 3G/4G LTE Band 3 small cell
- Active distributed antenna system
- Cellular repeaters
- Driver amplifier

Features

- High gain: 38 dB (unconditionally stable)
- High linearity: +23 dBm with < -50 dBc ACLR @ 85°C (WCDMA Test Model 1 with 64 DPCH)
- RF input and output internally matched to 50 ohms
- Excellent output return loss: < 30 dB
- Integrated active bias: performance compensated over temp
- PA On/Off function: < 2 us switching time
- Integrated coupler for output power monitoring
- Single supply voltage: 3.3 V
- Minimal external components
- Pin-to-pin compatible PA family supporting all 3GPP bands
- Small 5 x 5 mm, 28-pin package (MSL3, 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.

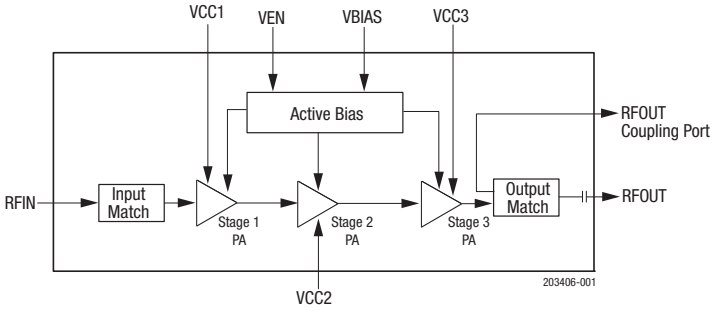


Figure 1. SKY66181-11 Linear PA Block Diagram

Description

The SKY66181-11 is a high-linearity power amplifier (PA) with fully matched input/output and high gain. The compact 5 x 5 mm PA is designed for FDD 3G/4G LTE small cell base stations operating from 1805 to 1880 MHz. The active biasing circuitry is integrated to compensate PA performance over temperature, voltage, and process variation as well as an internal coupler for power monitoring.

The SKY66181-11 requires minimal external components and is part of a high-linearity, pin-to-pin compatible PA family supporting all 3GPP bands.

A block diagram of the SKY66181-11 is shown in Figure 1. The device package and pinout for the 28-pin device are shown in Figure 2. Table 1 lists the pin-to-pin compatible parts in the PA family.

Table 1. Pin-to-Pin Compatible PA Family

Part Number	Frequency (MHz)	LTE Band
SKY66181-11	1805 to 1880	3
SKY66184-11	2110 to 2170	1, 4, and 10
SKY66185-11	851 to 894	5, 6, 18, 19, 26, and 27
SKY66186-11	728 to 768	12, 13, 14, and 17
SKY66187-11	2620 to 2690	7
SKY66188-11	758 to 803	28
SKY66189-11	1930 to 1995	2 and 25

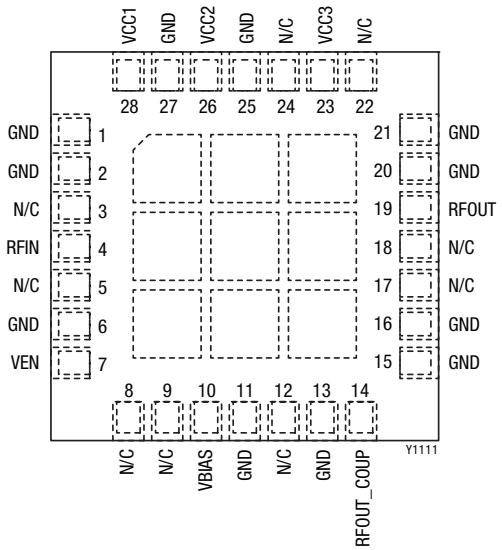


Figure 2. SKY66181-11 Pinout (Top View)

Table 2. SKY66181-11 Signal Descriptions

Pin	Name	Description	Pin	Name	Description
1	GND	Ground	15	GND	Ground
2	GND	Ground	16	GND	Ground
3	N/C	No internal connection	17	N/C	No internal connection
4	RFIN	RF input	18	N/C	No internal connection
5	N/C	No internal connection	19	RFOUT	RF output
6	GND	Ground	20	GND	Ground
7	VEN	Enable (active low)	21	GND	Ground
8	N/C	No internal connection	22	N/C	No internal connection
9	N/C	No internal connection	23	VCC3	Output stage supply voltage
10	VBIAS	Bias voltage	24	N/C	No internal connection
11	GND	Ground	25	GND	Ground
12	N/C	No internal connection	26	VCC2	Stage 2 PA supply voltage
13	GND	Ground	27	GND	Ground
14	RFOUT_COUP	RF output coupling port	28	VCC1	Input stage supply voltage

Technical Description

The SKY66181-11 PA contains all of the needed RF matching and DC biasing circuits. This three-stage device is optimized for high linearity and power efficiency. These features make the device suitable for wideband applications where PA linearity and power consumption are of critical importance (for example, small cell and infrastructure applications).

The device is designed for standard WCDMA and LTE modulated signals. Under these stringent test conditions, the device exhibits excellent spectral purity and power efficiency.

Electrical and Mechanical Specifications

The absolute maximum ratings of the SKY66181-11 are provided in Table 3. The recommended operating conditions are specified in Table 4, and electrical specifications are provided in Table 5.

Typical performance characteristics are shown in Figures 3 through 12.

Table 3. SKY66181-11 Absolute Maximum Ratings[1]

Parameter	Symbol	Minimum	Maximum	Units
Supply voltage (VCC)	V_{CC}	0	+4.0	V
Total supply current	I_{CC}		968	mA
Logic control input voltage (VEN)	V_{EN}	-0.5	3.6	V
Case operating temperature[2]	T_C	-40	+105	°C
Storage temperature	T_{STG}	-55	+150	°C
Junction temperature	T_J		+150	°C
Thermal resistance	Θ_{JC}		22	°C/W
Power dissipation	P_{DISS}		1.9	W
Electrostatic discharge:	ESD			
Charged Device Model (CDM)			500	V
Human Body Model (HBM)			100	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.

[2] Case operating temperature (Tc) refers to the temperature of the bottom ground pad.

***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 4. SKY66181-11 Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Units
Frequency range	f	1805		1880	MHz
Supply voltage (VCC1, VCC2, VCC3) [1]	V_{CC}	3.0	3.3	3.6	V
PA enable control voltage (active low):					
Disable	V_{ENH}	2.5		3.6	V
Enable	V_{ENL}	0		0.6	V
PA enable current (@ PAEN = 3.6 V)	I_{EN}			<1	mA
Case operating temperature	T_C	+25	+40	+85	°C

[1] Voltage levels measured at the pads of the package. The Evaluation Board supply voltage levels may be different.

Table 5. SKY66181-11 Electrical Specifications[1]
(V_{CC} = +3.3 V, T_C = +25 °C, f = 1842.5 MHz, Characteristic Impedance [Z_0] = 50 ohms, VEN = 0 V, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Gain	G@23dBm	CW, P_{OUT} = +23 dBm	38	41		dB
Input return loss	|S11|	CW, P_{IN} = –30 dBm	10	16		dB
Output return loss:	|S22|	CW, P_{IN} = –30 dBm:				
In-band		In-band frequency: 1805 and 1880 MHz	16	30		dB
Out-of-band		Out-of-band frequency: 1725 and 1960 MHz	12	25		dB
Quiescent current	I_{CQ}	No RF		350	400	mA
Operating current	I_{CC}	CW, P_{OUT} = +23 dBm		610	675	mA
Power-down current	I_{PD}	VEN = 2.5 V			1	mA
Adjacent channel leakage ratio	ACLR	@5 MHz offset, WCDMA test model 1, with 64 DPCH, 8.5 dB PAR, P_{OUT}=+23 dBm		-50	-46.5	dBc
Output 1 dB compression point	OP1dB	CW	+30	+31.5		dBm
Power added efficiency	PAE	CW @ P_{OUT} = +23 dBm, CW	8.5	10		%
Output coupling factor	CPLOUT	P_{OUT} = +23 dBm, CW	20.5	22.5	24.5	dB

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

Typical Performance Characteristics

(VCC = +3.3 V, TC = +25 °C, f = 1842.5 MHz, Characteristic Impedance [Z0] = 50 ohms, VEN = 0 V, Unless Otherwise Noted)

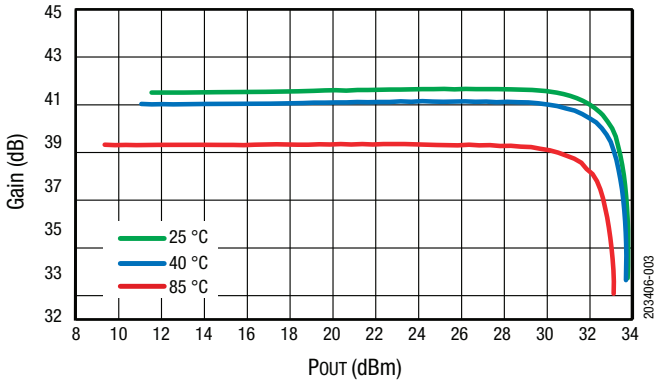


Figure 3. Gain vs Output Across Temperature

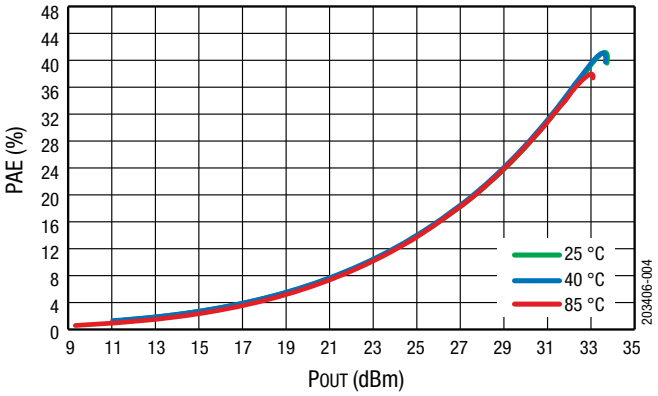


Figure 4. PAE vs POUT Across Temperature

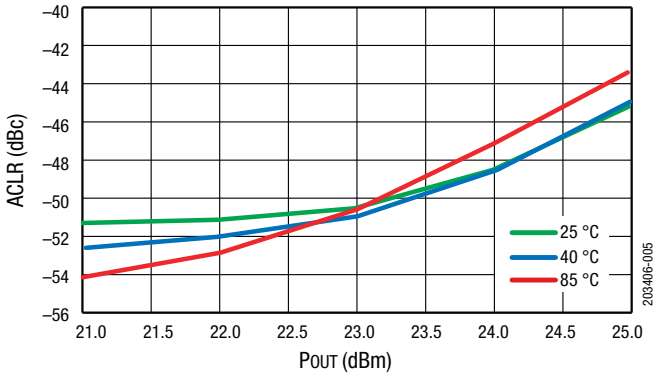


Figure 5. ACLR vs Output Power Across Temperature

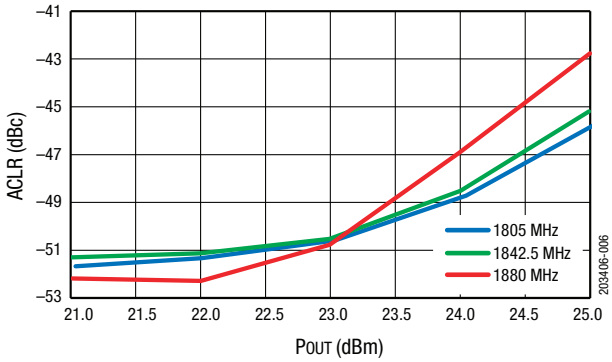


Figure 6. ACLR (5 MHz) vs POUT Across Frequency

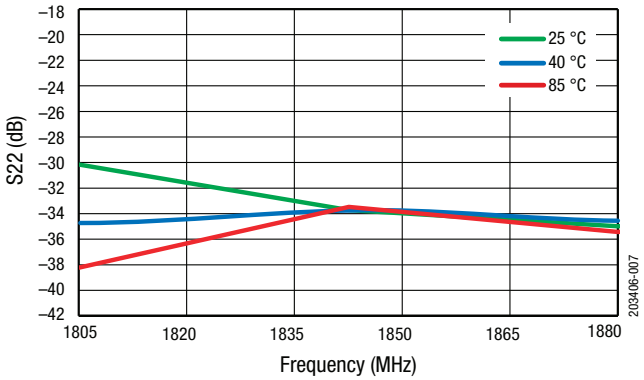


Figure 7. S22 vs Frequency Across Temperature

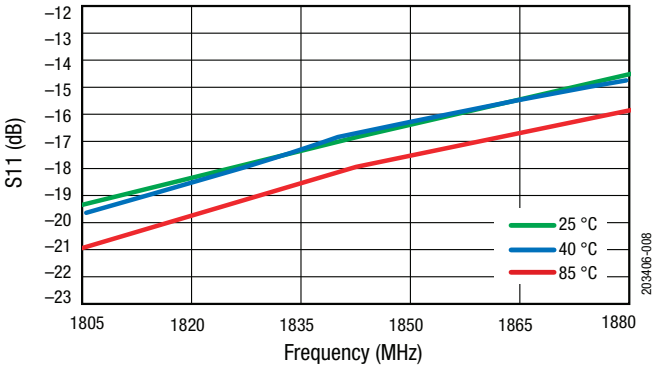


Figure 8. S11 vs Frequency Across Temperature

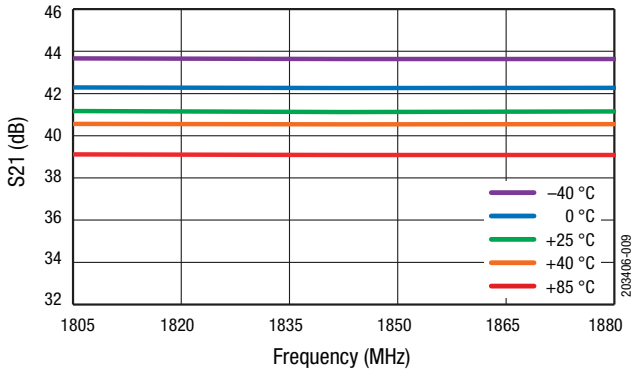


Figure 9. S21 vs Frequency Across Temperature

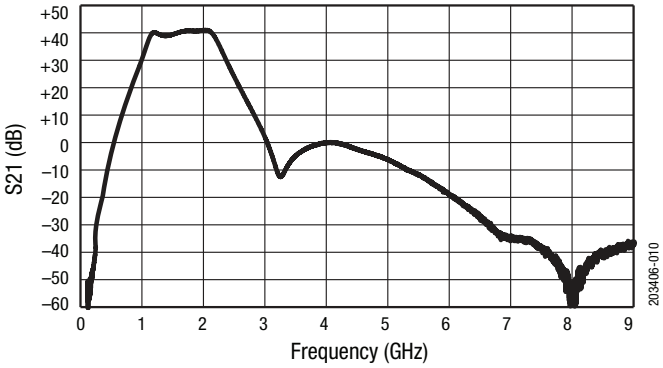


Figure 10. S21 vs Frequency

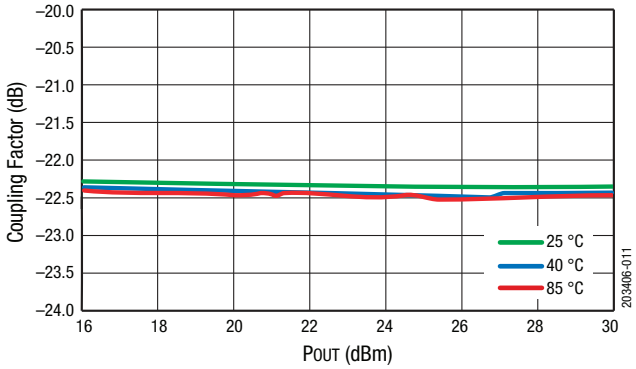


Figure 11. Coupling Factor vs POUT Across Temperature

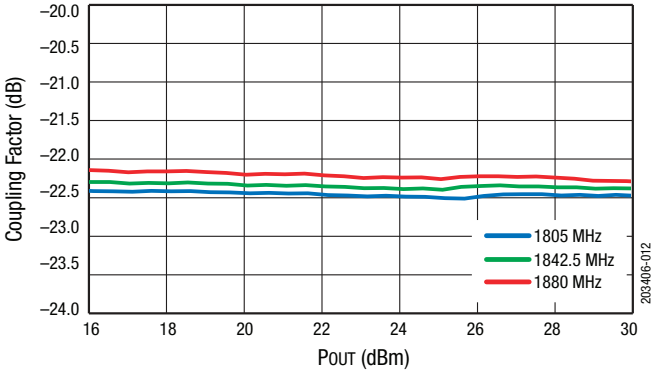


Figure 12. Coupling Factor vs POUT Across Frequency

Evaluation Board Description

The SKY66181-11 Evaluation Board is used to test the performance of the SKY66181-11 PA. A typical application schematic diagram is shown in Figure 13. A Bill of Materials for the SKY66181-11 Evaluation Board is listed in Table 6. An assembly drawing for the Evaluation Board is shown in Figure 14. The layer detail physical characteristics are shown in Figure 15.

Application Circuit Notes

Center Ground. It is extremely important to sufficiently ground the bottom ground pad of the device for both thermal and stability reasons. Multiple small vias are acceptable and work well under the device if solder migration is an issue.

GND (pins 1, 2, 6, 11, 13, 15, 16, 20, 21, 25, and 27). Attach all ground pins to the RF ground plane with the largest diameter and lowest inductance via that the layout allows. Multiple small vias are acceptable and work well under the device if solder migration is an issue.

VBIAS (pin 10). The bias supply voltage for each stage, nominally set to +3.3 V.

RFOUT (pin 19). Amplifier RF output pin (Z0 = 50 ohms). The module includes an onboard internal DC blocking capacitor. All impedance matching is provided internal to the module.

VCC1, VCC2, and VCC3 (pins 28, 26, and 23, respectively). Supply voltage for each stage collector bias is nominally set to 3.3 V. Bypass and decoupling capacitors C1, C2, C3, C4, C5, and C6 should be placed in the approximate location shown on the evaluation board assembly drawing, although exact placement is not critical.

RFIN (pin 4). Amplifier RF input pin (Z0 = 50 ohms). The module includes an onboard internal DC blocking capacitor. All impedance matching is provided internal to the module.

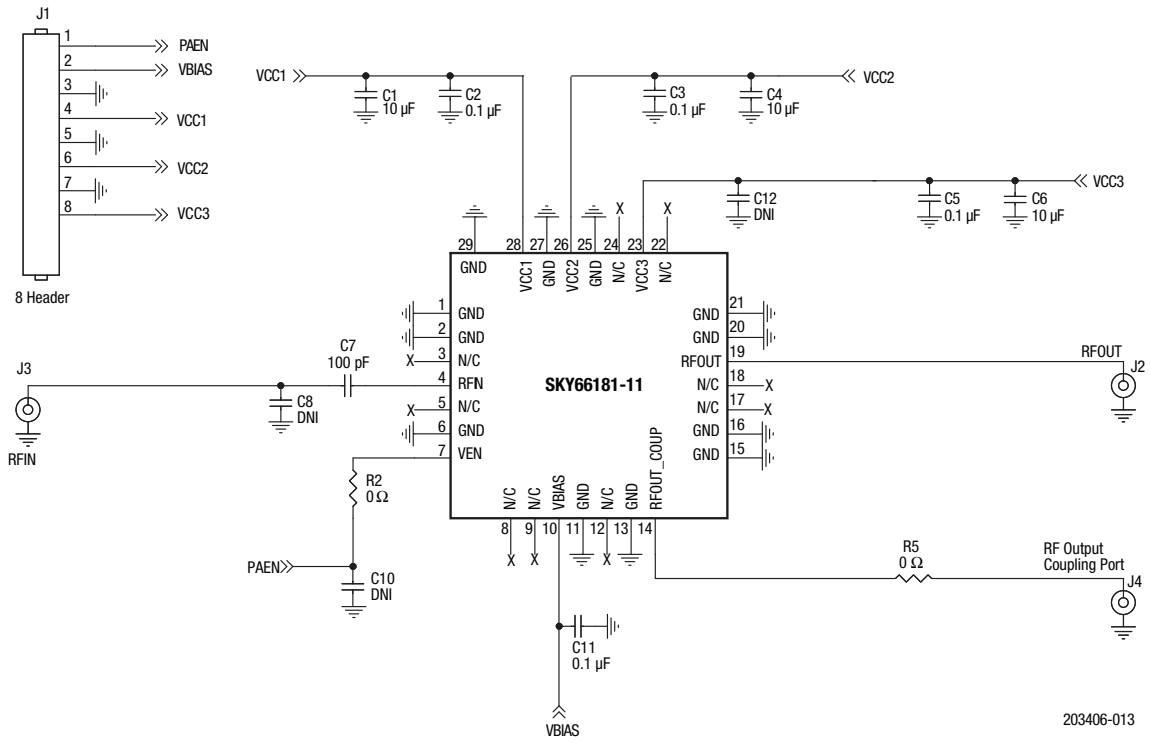
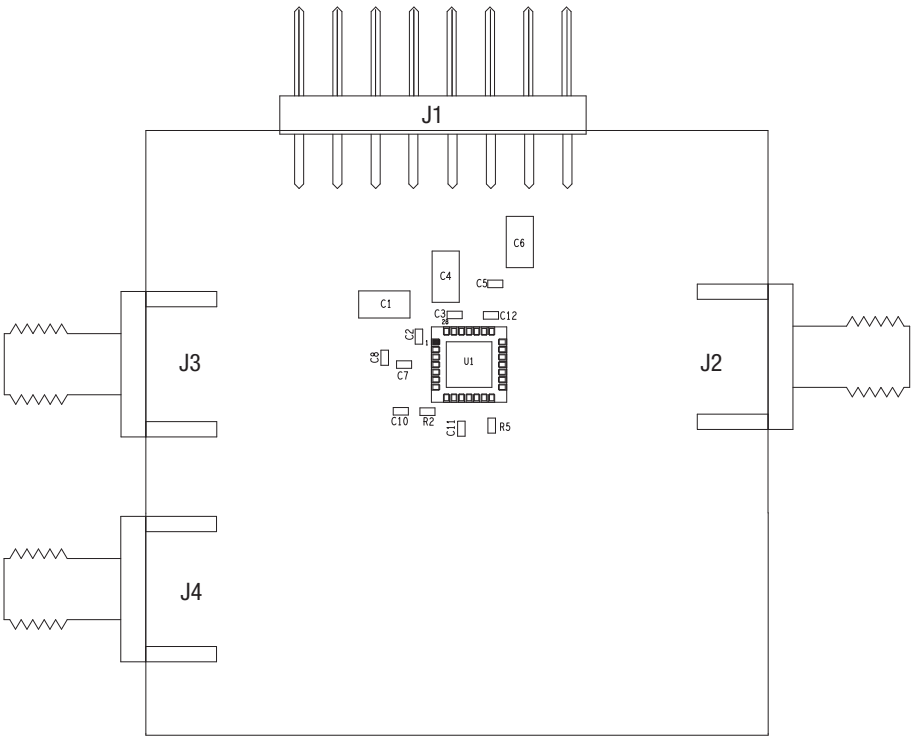


Figure 13. SKY66181-11 Application Schematic

Table 6. SKY66181-11 Evaluation Board Bill of Materials (BOM)

Quantity	Component	Size	Part Number	Description
3	C1, C4, C6	1206	C1206X7R160-106KNE	Capacitor, 10 uF, 16 V, ±10%, X7R
4	C2, C3, C5, C11	0402	GRM155R71C104KA88	Ceramic capacitor, 0.1 uF, 10%, X7R, 16 V
1	C7	0402	GRM1555C1H101JZ01J	Capacitor, 100 pF, 50 V, 5%, COG/NPO
3	C8, C10, C12		DNI	DNI
2	R2, R5	0402	ERJ2GE0R00	Resistor, 0 ohms, jumper, 0.063 W
1		PCB	TW22-D115-003	SKY66181



Notes:

The C3 and C4 components are not required.
Some of the other components shown are optional.

Figure 14. SKY66181-11 Evaluation Board Assembly Diagram

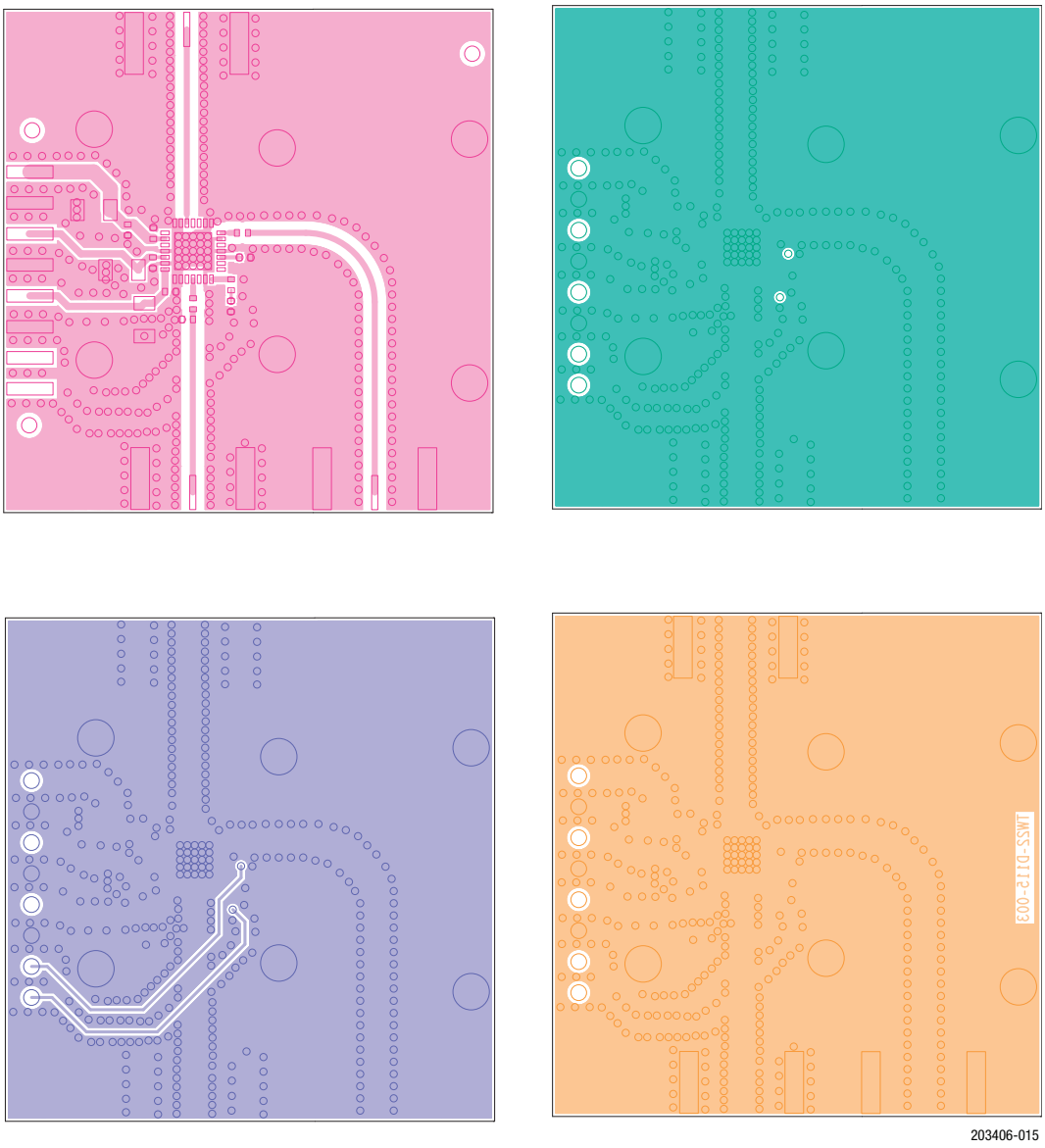


Figure 15. SKY66181-11 Board Layer Detail

Package Dimensions

The typical part marking is shown in Figure 16. The PCB layout footprint is shown in Figure 17. Figure 18 shows the package dimensions, and Figure 19 provides the tape and reel dimensions.

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 SKY66181-11 is rated to Moisture Sensitivity Level 3 (MSL3) at 260 °C. It can be used for lead or lead-free soldering. For additional information, refer to the Skyworks Application Note, *PCB Design and 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.

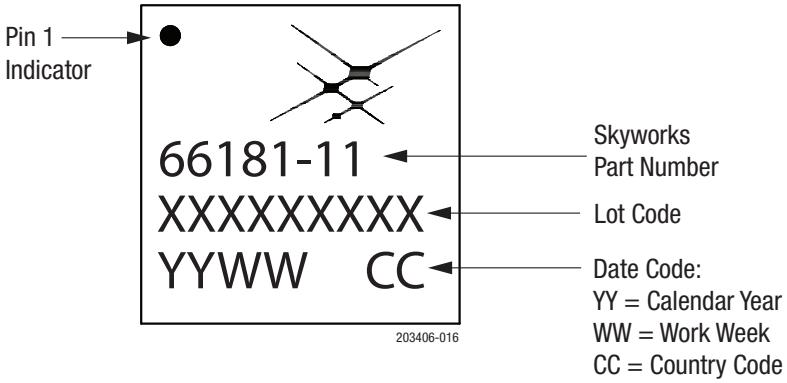
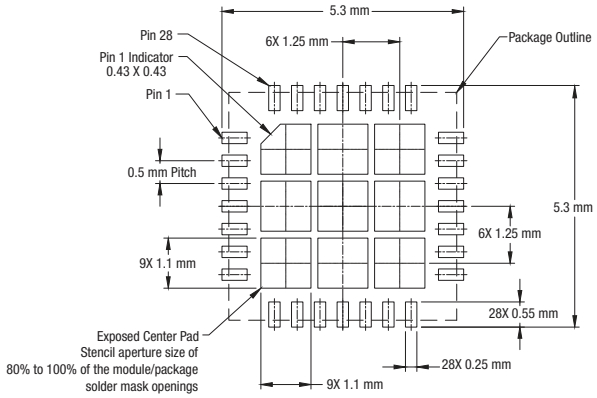
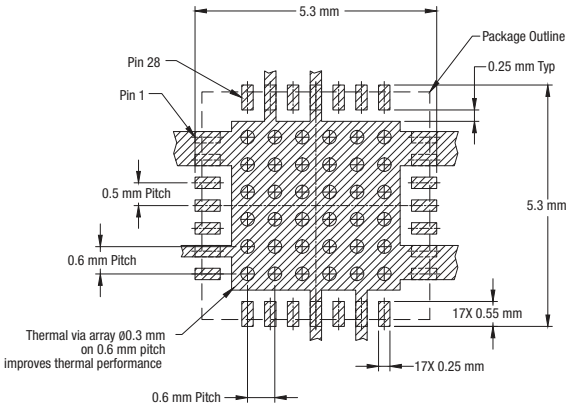


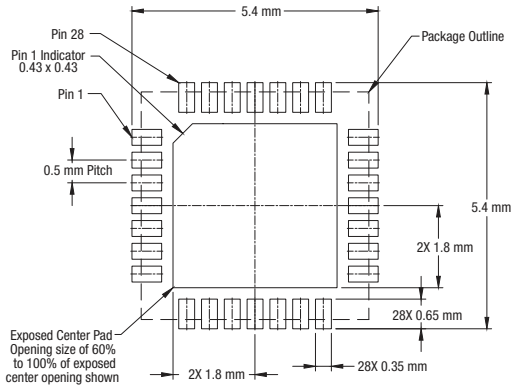
Figure 16. Typical Part Marking



Stencil Aperture
Top View



Metallization
Top View



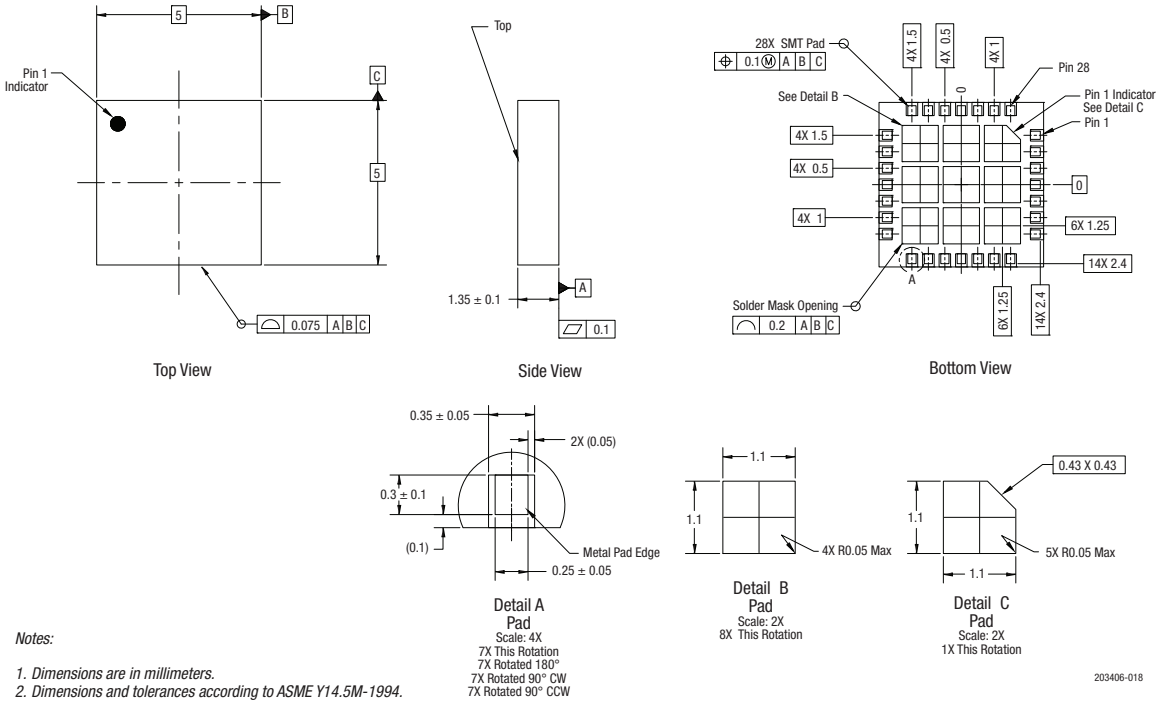
Solder Mask Opening
Top View

Notes:

1. *Thermal vias should be resin filled and capped in accordance with IPC–4761 type VII vias.*
2. *Recommended Cu thickness is 30 to 35 µm.*

203406-017

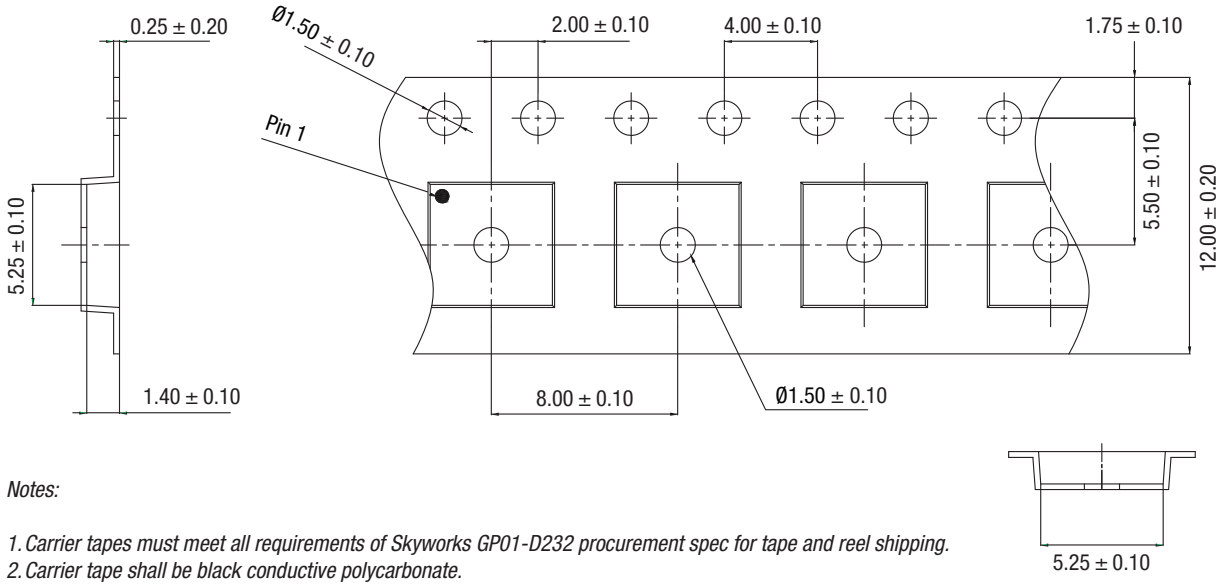
Figure 17. PCB Layout Footprint



Notes:

1. Dimensions are in millimeters.
2. Dimensions and tolerances according to ASME Y14.5M-1994.

Figure 18. SKY66181-11 Package Dimensions



Notes:

1. Carrier tapes must meet all requirements of Skyworks GP01-D232 procurement spec for tape and reel shipping.
2. Carrier tape shall be black conductive polycarbonate.
3. Cover tape shall be transparent conductive material.
4. ESD-surface resistivity shall be ≤ 1×10^{10} Ω/square per EJA, JEDEC TNR specification.
5. All measurements are in millimeters.

Figure 19. SKY66181-11 Tape and Reel Dimensions

Ordering Information

Part Number	Product Description	Evaluation Board Part Number
SKY66181-11	1805 to 1880 MHz Linear Power Amplifier	SKY66181-11-EK1

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