DATA SHEET

SKY66002-11: 1900 to 2025 MHz, +19 dBm Linear Power Amplifier

Applications

- Residential femtocells
- WCDMA, Band 2
- Small cells

Features

- Small signal gain: 29 dB
- ACLR at P_{OUT} = +19 dBm: -50 dBc
- PA on/off control
- I/O impedance internally matched to 50 Ω
- Single DC supply: 3.3 V to 4.6 V
- Minimal number of external components required
- Small footprint MCM (10-pin, 3 x 3 mm) 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.

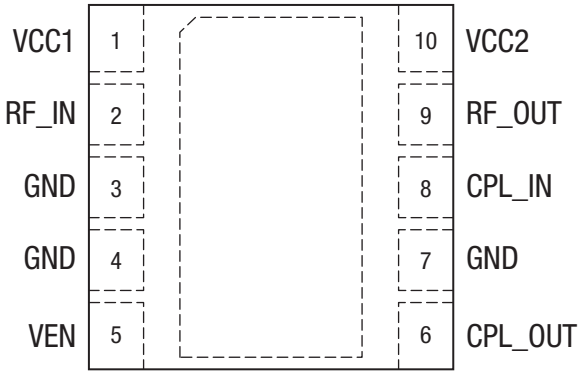


Figure 1. SKY66002-11 Pinout (Top View)

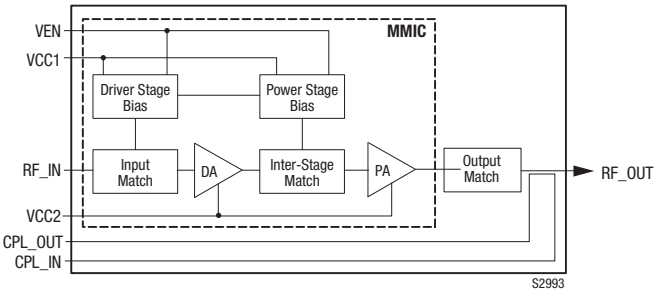


Figure 2. SKY66002-11 Linear PA Block Diagram

Description

The SKY66002-11 linear power amplifier (PA) is a fully matched surface-mount module developed for WCDMA applications operating from 1900 to 2025 MHz. The device meets the stringent spectral linearity requirements of WCDMA femtocell applications with high power-added efficiency. An integrated directional coupler eliminates the need for any external coupler.

The GaAs MMIC contains all active amplifier circuitry, which includes input and interstage matching circuits. An output match into a 50 Ω load, realized off-chip within the module package, optimizes efficiency and power performance.

The SKY66002-11 is manufactured with Skyworks InGaP GaAs HBT process, which provides for all positive voltage DC supply operation and maintains high efficiency and good linearity. The primary bias to the device can be supplied directly from any suitable power supply with an output of 4.2 V. Power down is achieved by setting the VEN pin to 0 V. No external supply side switch is needed since typical “off” leakage is a few microamps with full primary voltage supplied from the main power supply.

The SKY66002-11 is packaged in a 10-pin, 3 x 3 mm Multi-Chip Module (MCM), which allows for a highly manufacturable low-cost solution.

A functional block diagram of the SKY66002-11 is shown in Figure 1. The 10-pin MCM package and pinout are shown in Figure 2. Signal pin assignments and functional pin descriptions are provided in Table 1.

Table 1. SKY66002-11 Signal Descriptions

Pin	Name	Description	Pin	Name	Description
1	VCC1	Input stage supply voltage	6	CPL_OUT	RF coupler output
2	RF_IN	RF input port	7	GND	Ground
3	GND	Ground	8	CPL_IN	RF coupler input
4	GND	Ground	9	RF_OUT	RF output port
5	VEN	Enable	10	VCC2	Output stage supply voltage

Technical Description

The SKY66002-11 PA contains all of the needed RF matching and DC biasing circuits. The device is a two-stage, HBT InGaP device optimized for high linearity and power efficiency. These features make the device suitable for wideband digital applications where PA linearity and power consumption are of critical importance (e.g., small cell and infrastructure applications).

The device is designed for standard WCDMA 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 SKY66002-11 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 SKY66002-11 are illustrated in Figures 3 to 9.

Table 2. SKY66002-11 Absolute Maximum Ratings[1]

Parameter	Symbol	Minimum	Maximum	Units
Supply voltage (VCC1, VCC2)	V_{CC}	0	+4.6	V
Total supply current	I_{CC}		700	mA
Logic control input voltage (VEN)	V_{CTL}	-0.5	3.1	V
Case operating temperature[2]	T_C	-40	+85	°C
Storage temperature	T_{STG}	-55	+150	°C
Junction temperature	T_J		+150	°C
Thermal resistance	Θ_{JC}		60	°C/W
Electrostatic discharge:	ESD			
Charged Device Model (CDM), Class 4			1000	V
Human Body Model (HBM), Class 1C			1000	V
Machine Model (MM), Class B			200	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 3. SKY66002-11 Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Units
Frequency range	f	1900		2025	MHz
Supply voltage (VCC1, VCC2)[1]	V_{CC}	4.0	4.2	4.6	V
Logic control input voltage: Logic high Logic low	 V_{IH} V_{IL}	 1.35 0	 1.80	 3.10 0.5	 V V
PA enable current	I_{EN}			<1	mA
Case operating temperature	T_C	-20	+25	+85	°C

1 Voltage levels measured at the pads of the package. The Evaluation Board supply voltage levels may be different. Refer to the Evaluation Board schematic diagram in this data sheet.

Table 4. SKY66002-11 Electrical Specifications[1]
(VCC1 = VCC2 = +4.2 V, T_C = +25 °C, f = 1960 MHz, Characteristic Impedance [Z_0] = 50 Ω, VEN = "1," Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
Small signal gain	|S21|	CW, P_{IN} = -20 dBm	27.5	29.0		dB
Input return loss	|S11|	CW, P_{IN} = -20 dBm	20	28		dB
Quiescent current	I_{CQ}	No RF		60	65	mA
Operating current	I_{CC}	CW, P_{OUT} = +19 dBm		133	150	mA
Power-down current	I_{PD}	VEN = "0"		0.5	1.0	µA
Adjacent channel leakage ratio	ACLR5	@5 MHz offset, WCDMA test model 1, with 64 DPCH, P_{OUT} = +19 dBm		-52.5	-47.0	dBc
Error vector magnitude	EVM	P_{OUT} = +19 dBm		1.2	2.0	%
Harmonic suppression	2fo 3fo	CW, P_{OUT} = +19 dBm		-45 -49	-41 -45	dBc dBc
Third order output intercept point	OIP3	+19 dBm/tone, frequency separation = 5 MHz	+38.0	+43.5		dBm
Input coupling factor	CPL_{IN}			-20.5		dB
Output coupling factor	CPL_{OUT}			-22.0		dB
Stability (non-harmonic spurious)	$VSWR_{STABILITY}$	VSWR = 6:1		-70		dBc
Maximum ruggedness input power	P_{IN_RUG}	VSWR = 6:1		-7		dBm

1 Performance is guaranteed only under the conditions listed in this table. Both pins 6 and 8 (CPL_OUT and CPL_IN, respectively) should be terminated with 50 Ω.

Typical Performance Characteristics

(VCC1 = VCC2 = +4.2 V, Tc = +25 °C, f = 1960 MHz, Characteristic Impedance [Zo] = 50 Ω, VEN = "1," Unless Otherwise Noted)

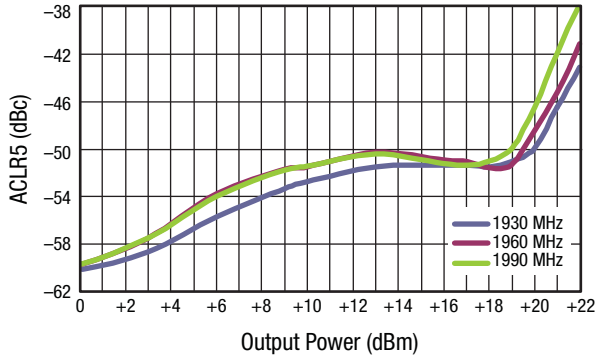


Figure 3. ACLR5 vs Output Power Over Voltage

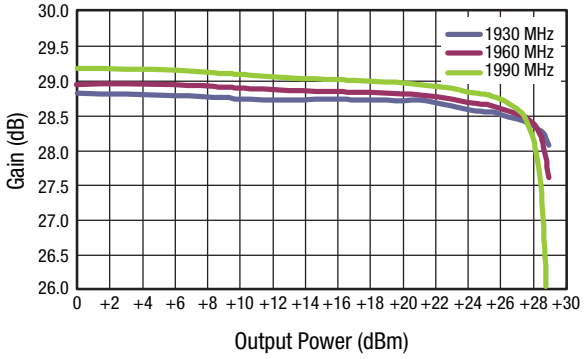


Figure 4. Gain vs Output Power

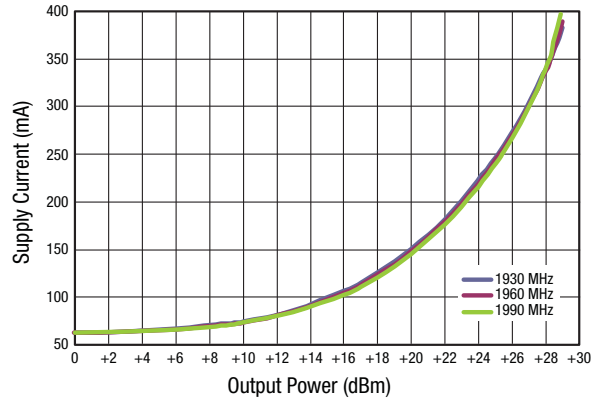


Figure 5. Supply Current vs Output Power

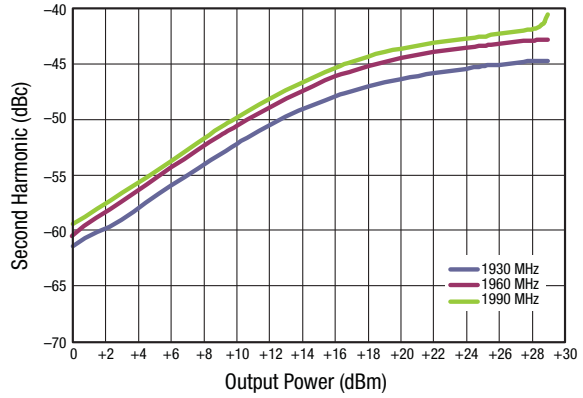


Figure 6. Second Harmonic vs Output Power

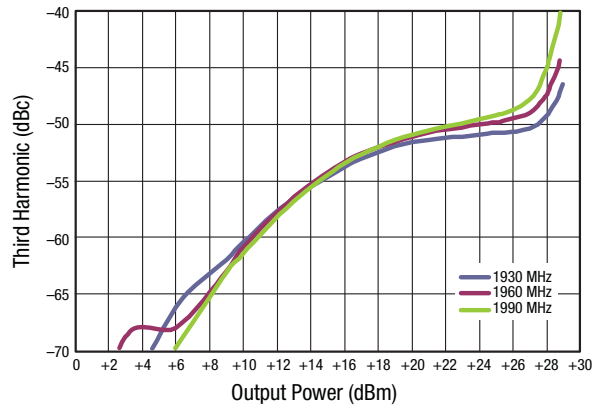


Figure 7. Third Harmonic vs Output Power

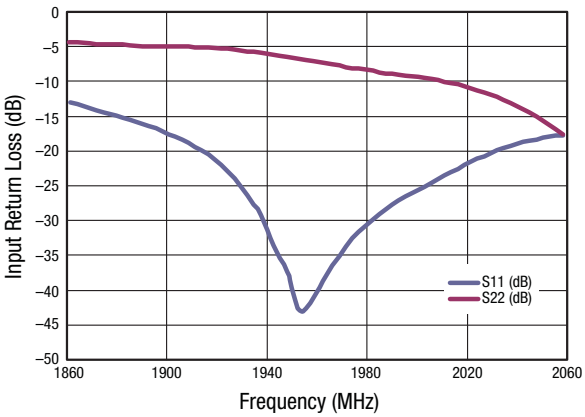


Figure 8. Input Return Loss vs Frequency

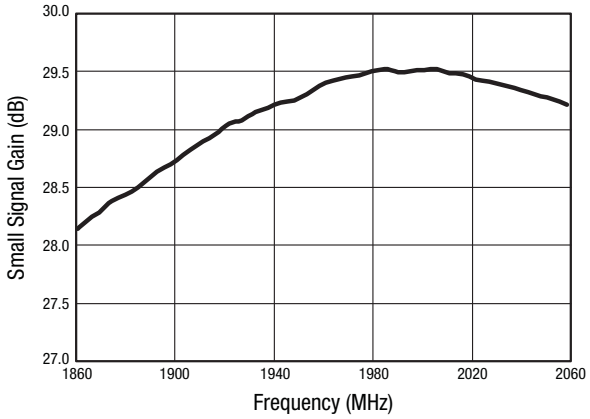


Figure 9. Small Signal Gain vs Frequency

Evaluation Board Description

The SKY66002-11 Evaluation Board is used to test the performance of the SKY66002-11 PA. A schematic diagram of the Evaluation Board is shown in Figure 10.

An assembly drawing for the Evaluation Board is shown in Figure 11, and the layer detail is provided in Figure 12.

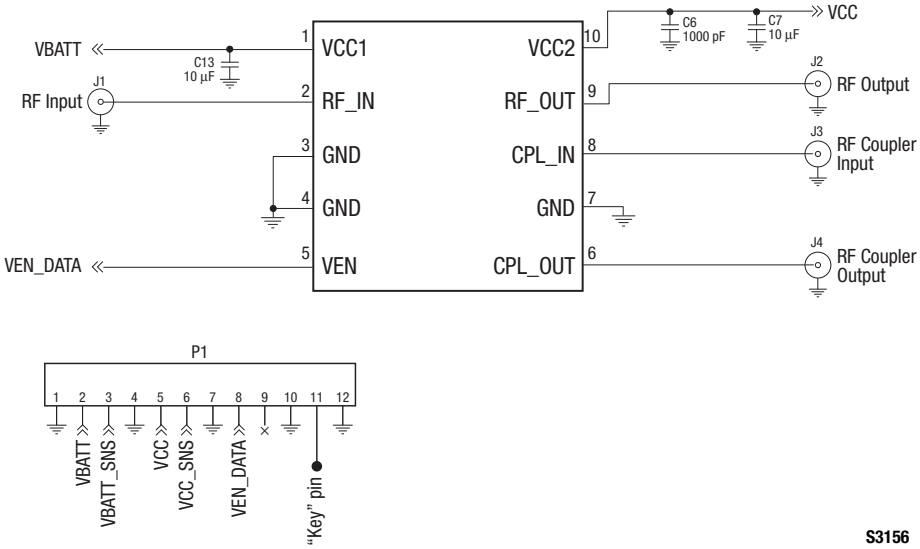
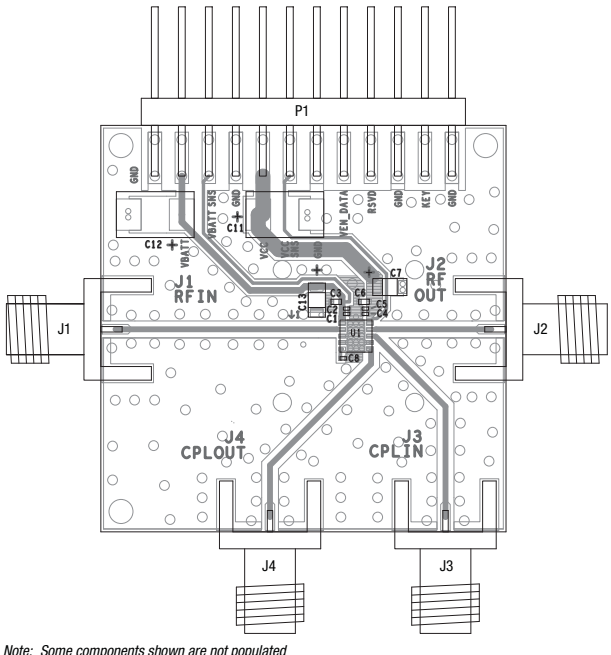
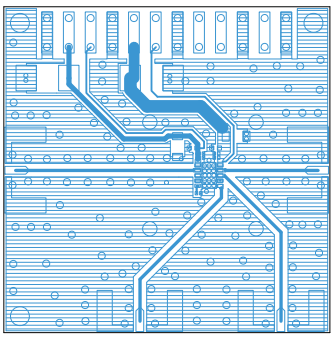


Figure 10. SKY66002-11 Evaluation Board Schematic

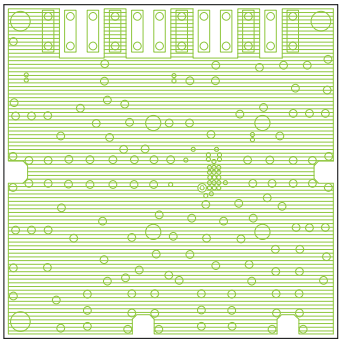


Note: Some components shown are not populated and are used only as placeholders.

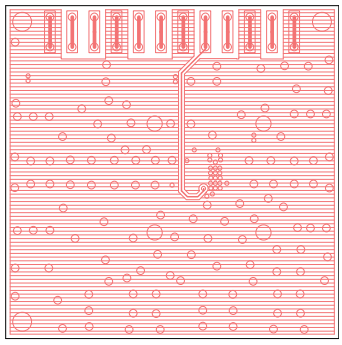
Figure 11. SKY66002-11 Evaluation Board Assembly Diagram



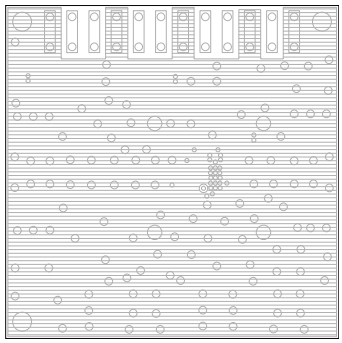
Layer 1: Top Metal



Layer 2: Ground



Layer 3: Ground



Layer 4: Bottom (Ground) Layer

S3157

Figure 12. SKY66002-11 Evaluation Board Layer Detail

Package Dimensions

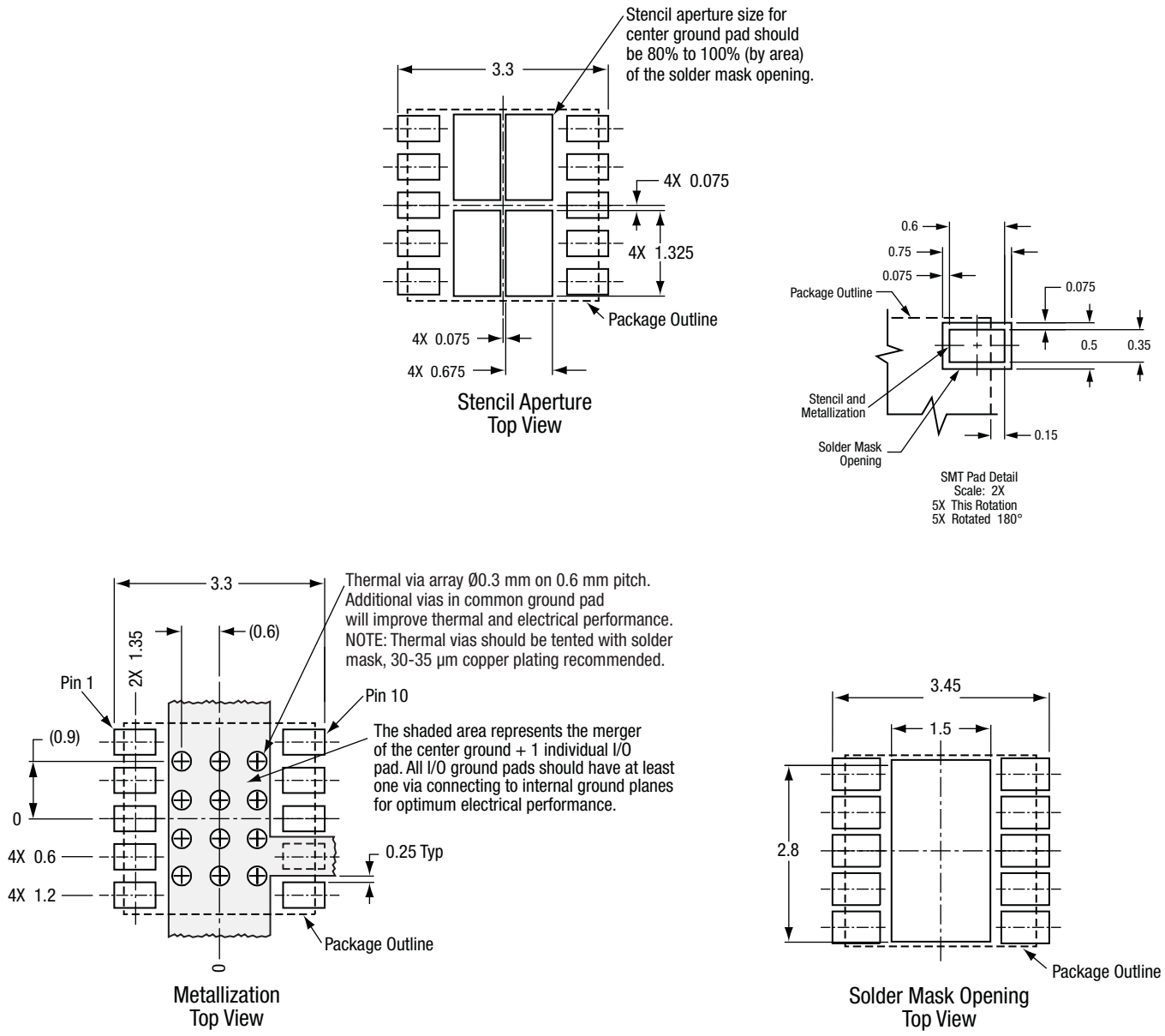
The PCB layout footprint for the SKY66002-11 is provided in Figure 13. Typical part markings are shown in Figure 14. Figure 15 shows the package dimensions, and Figure 16 provides the tape and reel dimensions.

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 SKY66002-11 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.



All dimensions are in millimeters **S2995**

Figure 13. PCB Layout Footprint for the SKY66002-11

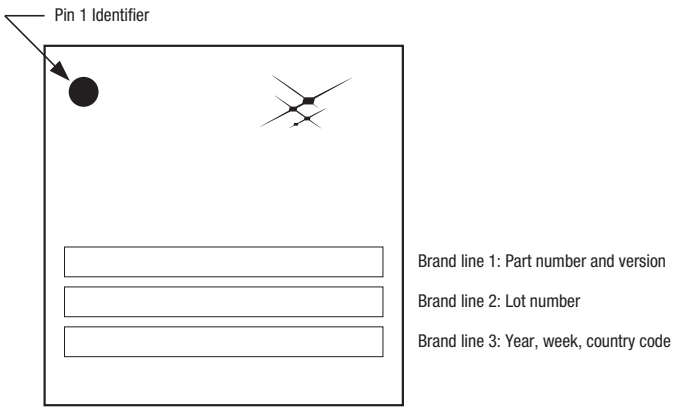
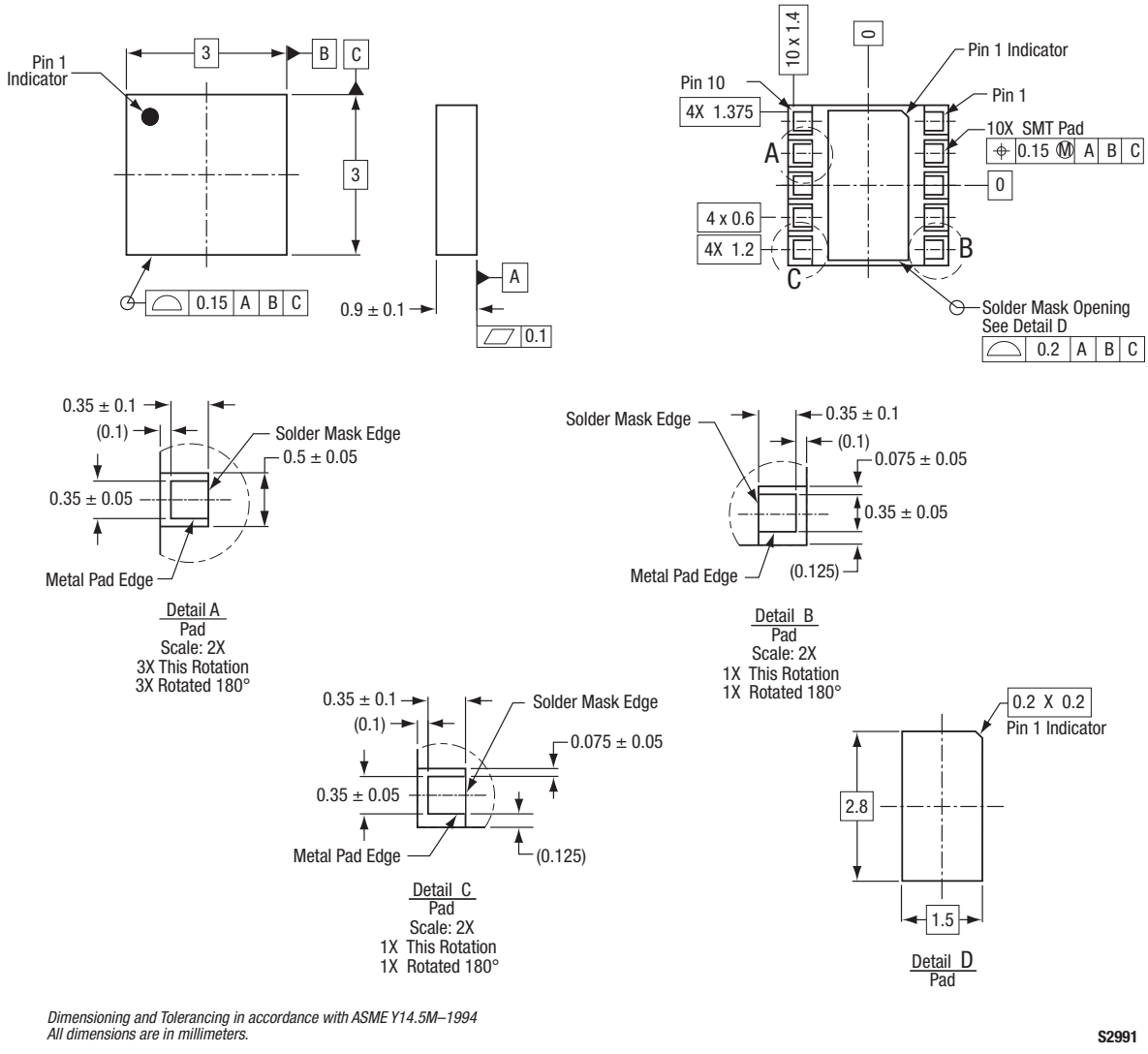


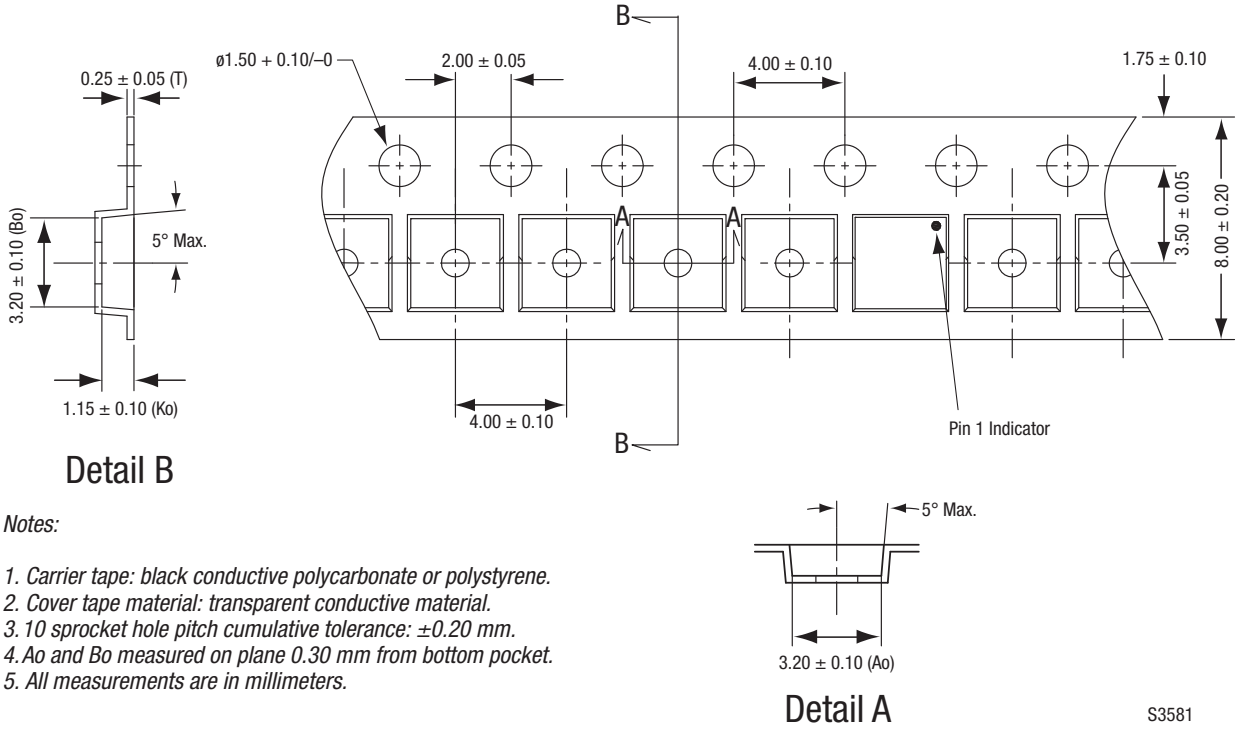
Figure 14. Typical Part Markings
(Top View)



Dimensioning and Tolerancing in accordance with ASME Y14.5M–1994
All dimensions are in millimeters.

S2991

Figure 15. SKY66002-11 Package Dimensions



Notes:

1. Carrier tape: black conductive polycarbonate or polystyrene.
2. Cover tape material: transparent conductive material.
3. 10 sprocket hole pitch cumulative tolerance: ±0.20 mm.
4. Ao and Bo measured on plane 0.30 mm from bottom pocket.
5. All measurements are in millimeters.

Figure 16. SKY66002-11 Tape and Reel Dimensions

Ordering Information

Product Description	Product Part Number	Evaluation Board Part Number
SKY66002-11 Linear PA	SKY66002-11	SKY66002-11-EVB

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