

DATA SHEET

SKY66001-11: 2100 to 2200 MHz, +19 dBm Linear Power Amplifier

Applications

- Residential femtocells
- WCDMA, Band 1
- Small cells

Features

- Small signal gain: 28.6 dB
- ACLR at $P_{OUT} = +19$ dBm: -51 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)



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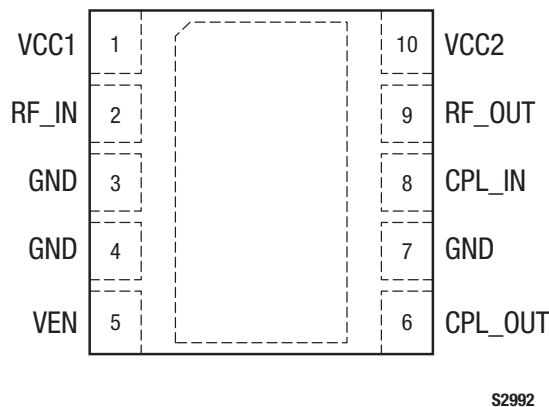


Figure 2. SKY66001-11 Pinout (Top View)

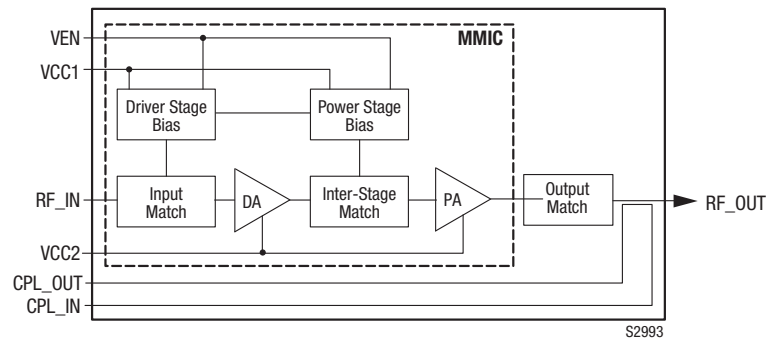


Figure 1. SKY66001-11 Linear PA Block Diagram

Description

The SKY66001-11 linear power amplifier (PA) is a fully matched surface-mount module developed for WCDMA applications operating from 2100 to 2200 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 SKY66001-11 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 SKY66001-11 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 SKY66001-11 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. SKY66001-11 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 SKY66001-11 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 SKY66001-11 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 SKY66001-11 are illustrated in Figures 3 to 11.

Table 2. SKY66001-11 Absolute Maximum Ratings¹

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			500	V
Human Body Model (HBM), Class 1C			1000	V
Machine Model (MM), Class A			150	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 (T_C) 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. SKY66001-11 Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Units
Frequency range	f	2100		2200	MHz
Supply voltage (VCC1, VCC2) ¹	VCC	4.0	4.2	4.6	V
Logic control input voltage: Logic high	V _{IH}	1.35	1.80	3.10	V
Logic low	V _{IL}	0		0.5	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. SKY66001-11 Electrical Specifications¹

(VCC1 = VCC2 = +4.2 V, T_C = +25 °C, f = 2140 MHz, Characteristic Impedance [Z₀] = 50 Ω, VEN = "1," Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
Small signal gain	IS21I	CW, P _{IN} = -20 dBm	27.0	28.6		dB
Input return loss	IS11I	CW, P _{IN} = -20 dBm	14	17		dB
Quiescent current	I _{CQ}	No RF		57	64	mA
Operating current	I _{CC}	CW, P _{OUT} = +19 dBm		120	134	mA
Power-down current	I _{PD}	VEN = "0"		0.1	10.0	μA
Adjacent channel leakage ratio	ACLR5	@5 MHz offset, WCDMA test model 1, with 64 DPCH, P _{OUT} = +19 dBm		-51	-47	dBc
Error vector magnitude	EVM	P _{OUT} = +19 dBm		1.3	2.0	%
Harmonic suppression	2f _o 3f _o	CW, P _{OUT} = +19 dBm		-52 -52	-47 -46	dBc dBc
Third order output intercept point	OIP3	+19 dBm/tone, frequency separation = 5 MHz	+37	+40		dBm
Input coupling factor	CPL _{IN}			-29		dB
Output coupling factor	CPL _{OUT}			-18		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 = 2140 MHz, Characteristic Impedance [Zo] = 50 Ω, VEN = "1," Unless Otherwise Noted)

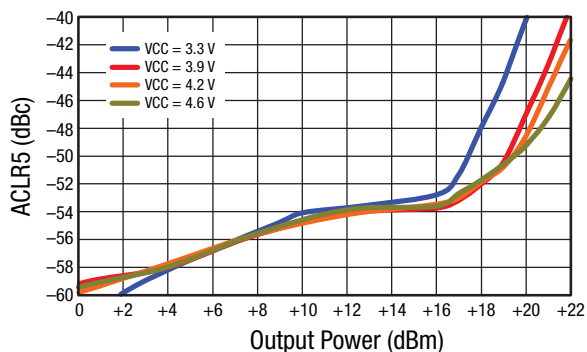


Figure 3. ACLR5 vs Output Power Over Voltage

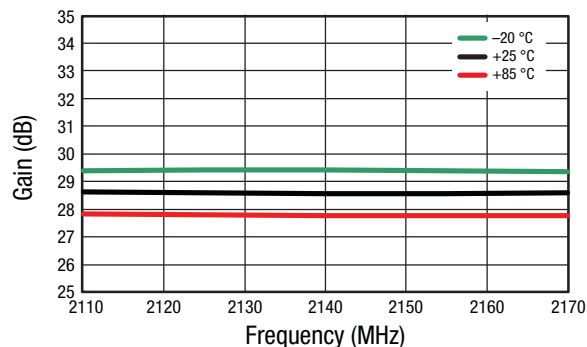


Figure 4. Small Signal Gain Over Frequency and Temperature

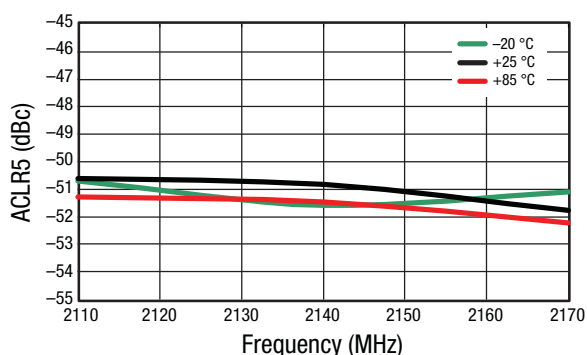


Figure 5. ACLR Over Frequency and Temperature

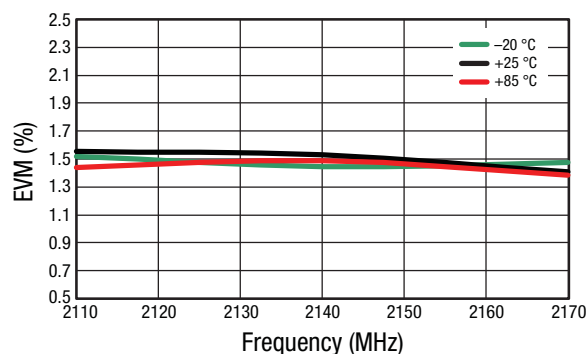


Figure 6. EVM Over Frequency and Temperature

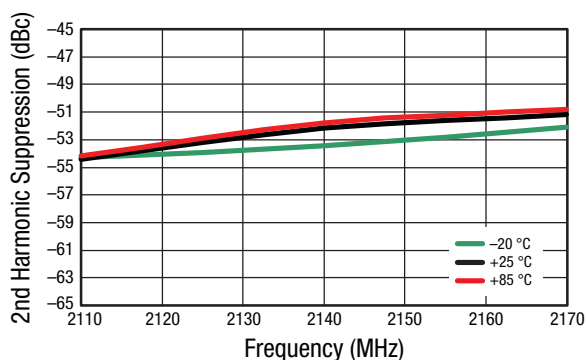


Figure 7. Second Harmonic Suppression Over Frequency and Temperature

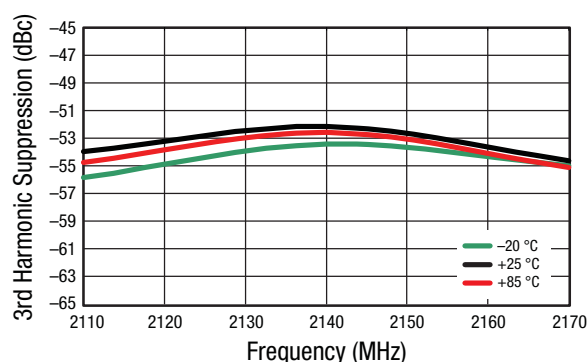


Figure 8. Third Harmonic Suppression Over Frequency and Temperature

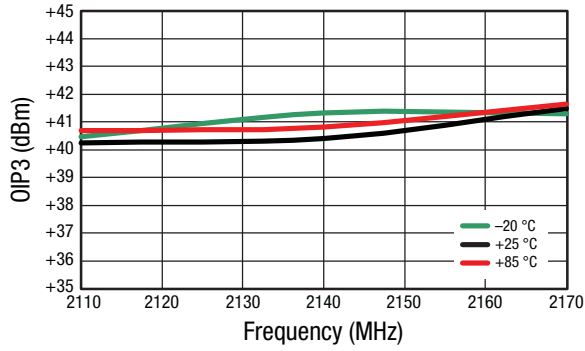


Figure 9. OIP3 Over Frequency and Temperature

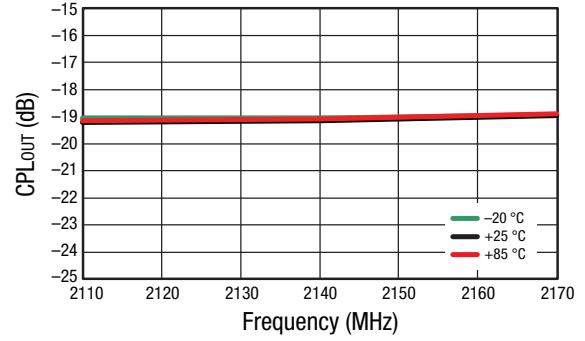


Figure 10. Output Coupling Factor Over Frequency and Temperature

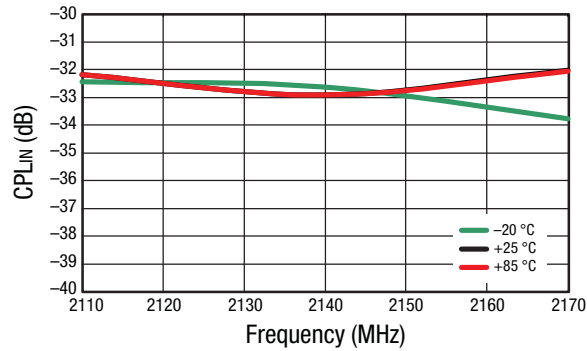


Figure 11. Input Coupling Factor Over Frequency and Temperature

Evaluation Board Description

The SKY66001-11 Evaluation Board is used to test the performance of the SKY66001-11 PA. A typical application schematic diagram is shown in Figure 12.

An assembly drawing for the Evaluation Board is shown in Figure 13 and the layer detail is provided in Figure 14.

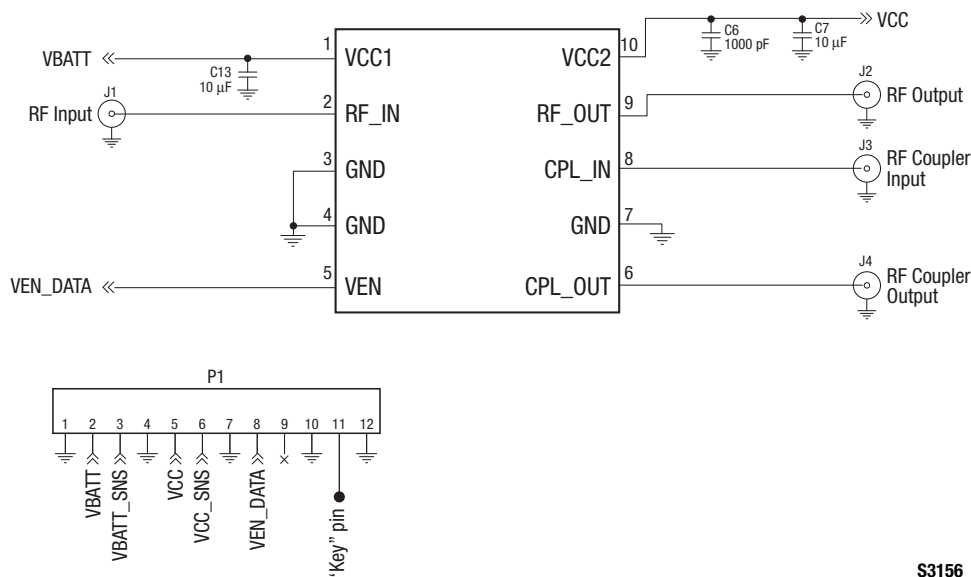
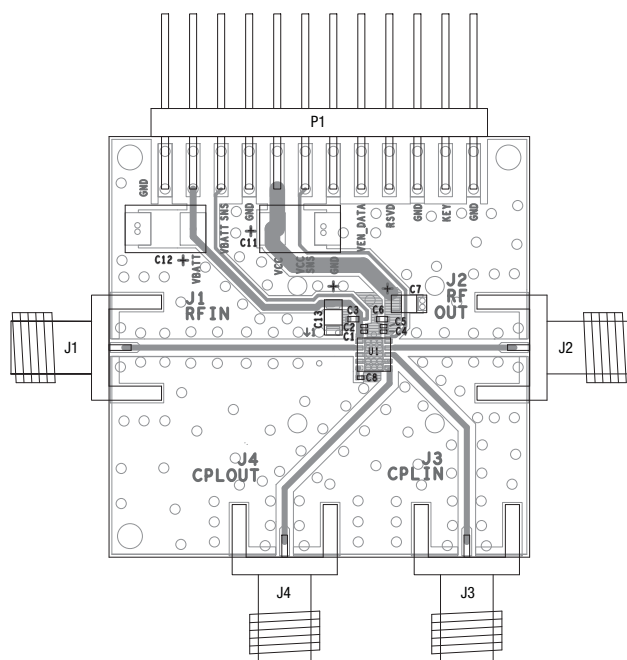


Figure 12. SKY66001-11 Application Schematic

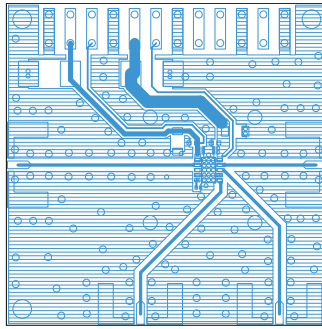
S3156



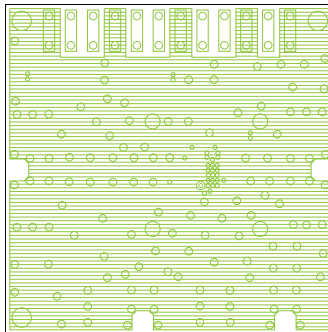
Note: Some components shown are not populated and are used only as placeholders.

S3155

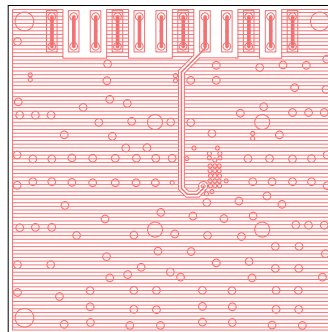
Figure 13. SKY66001-11 Evaluation Board Assembly Diagram



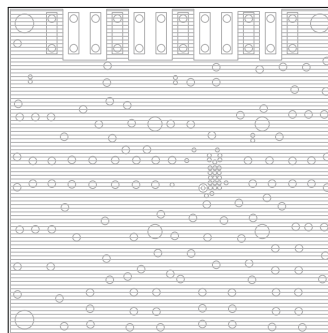
Layer 1: Top Metal



Layer 2: Ground



Layer 3: Ground



Layer 4: Bottom (Ground) Layer

S3157

Figure 14. SKY66001-11 Evaluation Board Layer Detail

Package Dimensions

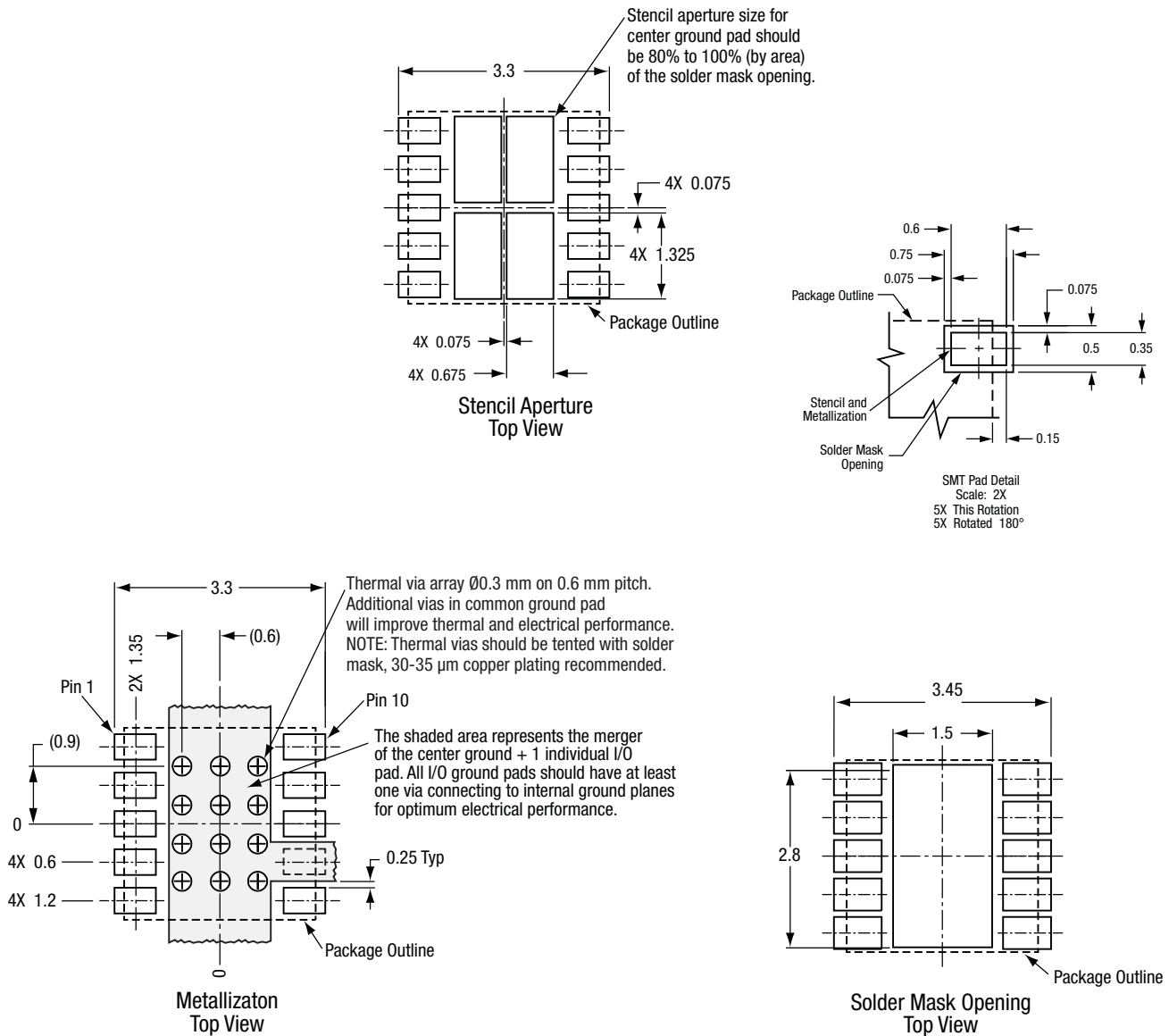
The PCB layout footprint for the SKY66001-11 is provided in Figure 15. Typical part markings are shown in Figure 16. Figure 17 shows the package dimensions, and Figure 18 provides the tape and reel dimensions.

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 SKY66001-11 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.

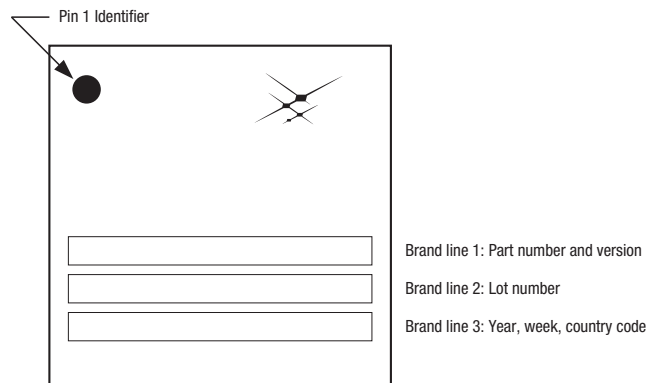
Care must be taken when attaching this product, whether it is done manually or in a production solder reflow environment. Production quantities of this product are shipped in a standard tape and reel format.



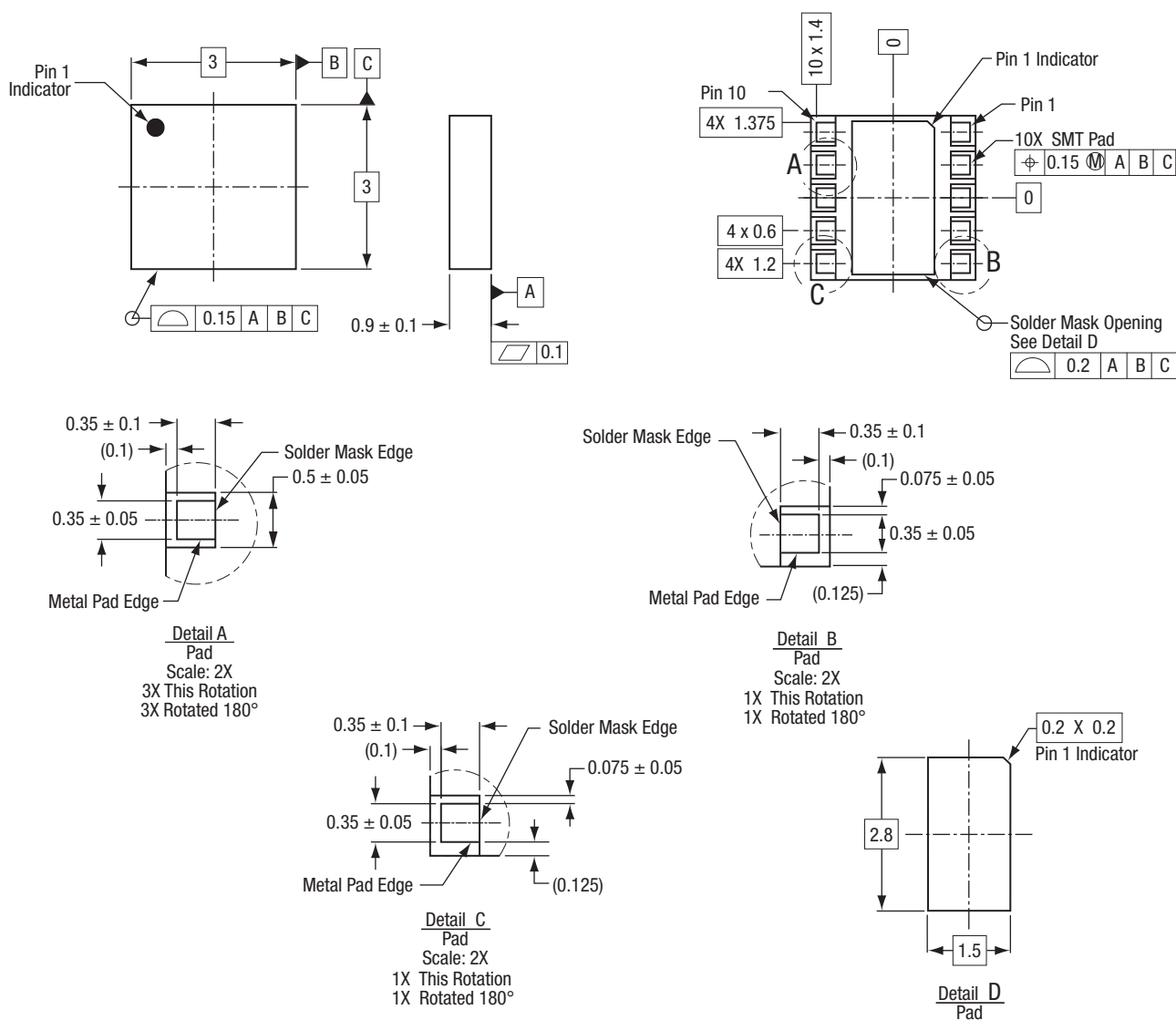
All dimensions are in millimeters

S2995

Figure 15. PCB Layout Footprint for the SKY66001-11



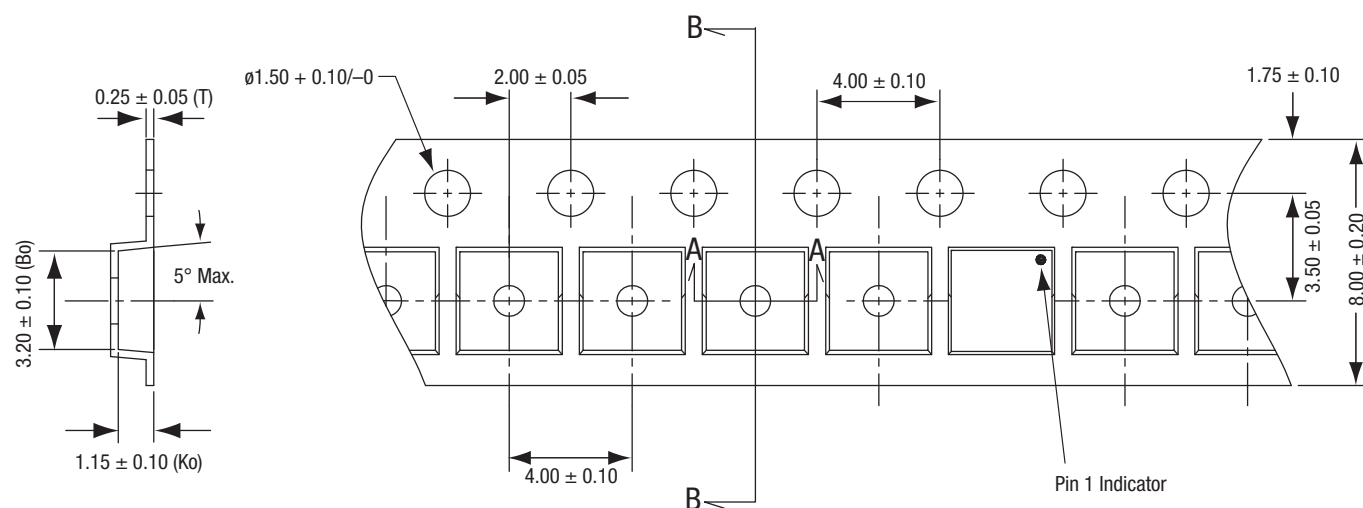
**Figure 16. Typical Part Markings
(Top View)**



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

S2991

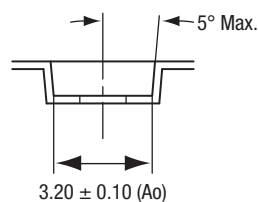
Figure 17. SKY66001-11 Package Dimensions



Detail B

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.



Detail A

S3581

Figure 18. SKY66001-11 Tape and Reel Dimensions

Ordering Information

Product Description	Product Part Number	Evaluation Board Part Number
SKY66001-11 Linear PA	SKY66001-11	SKY66001-11-EVB

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