



DATA SHEET

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

Applications

- Residential femtocells
- WCDMA, Band II
- 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)



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Description

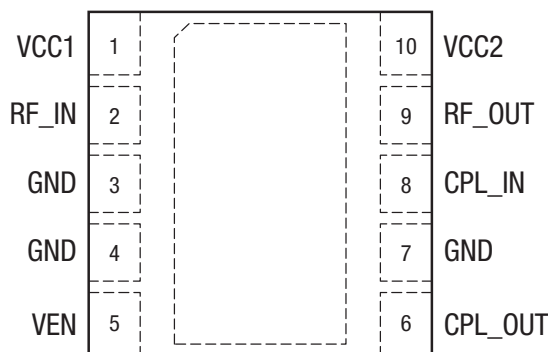
The SKY66002-11 linear Power Amplifier (PA) is a fully matched surface mount module developed for WCDMA applications operating from 1900 to 2025 MHz. The device meets the stringent spectral linearity requirements of WCDMA femtocell applications with high power-added efficiency. An integrated directional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

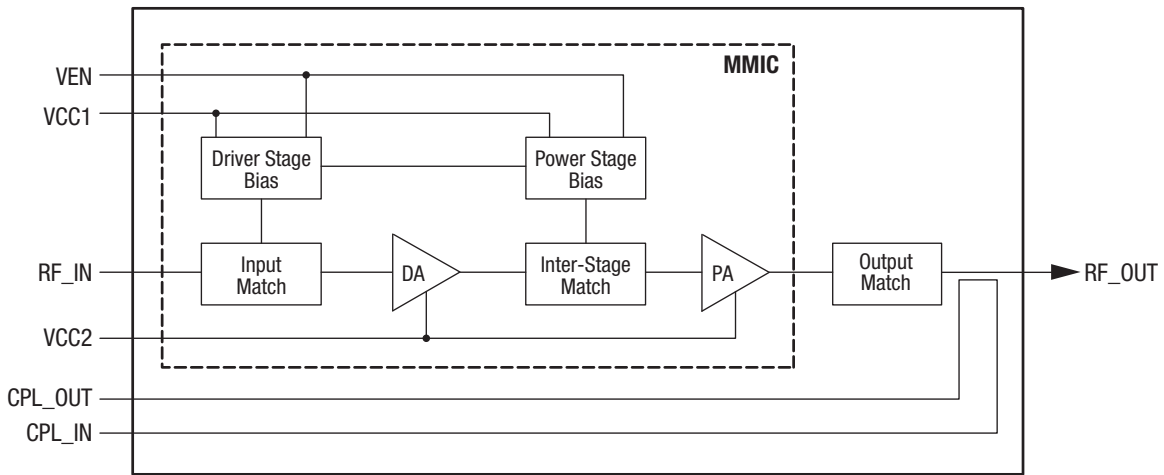
The SKY66002-11 is packaged in a 10-pin, 3 x 3 mm Multi-Chip Module (MCM), which allows for a highly manufacturable low-cost solution.

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



S2992

Figure 1. SKY66002-11 Pinout – 10-Pin MCM (Top View)



S2993

Figure 2. SKY66002-11 Linear PA Block Diagram

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 (Note 1)

| Parameter | Symbol | Minimum | Maximum | Units |
|-------------------------------------|--------|---------|---------|-------|
| Supply voltage (VCC1, VCC2) | Vcc | 0 | +4.6 | V |
| Total supply current | Icc | | 700 | mA |
| Logic control input voltage (VEN) | VCTL | -0.5 | 3.1 | V |
| Case operating temperature (Note 2) | Tc | -40 | +85 | °C |
| Storage temperature | TSTG | -55 | +150 | °C |
| Junction temperature | TJ | | +150 | °C |
| Thermal resistance | ΘJC | | 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 |

Note 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.

Note 2: Case operating temperature (Tc) refers to the temperature of the bottom ground pad.

CAUTION: 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. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection. Industry-standard ESD precautions should be used at all times.

Table 3. SKY66002-11 Recommended Operating Conditions

| Parameter | Symbol | Minimum | Typical | Maximum | Units |
|--------------------------------------|-----------------|---------|---------|---------|-------|
| Frequency range | f | 1900 | | 2025 | MHz |
| Supply voltage (VCC1, VCC2) (Note 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 | Tc | -20 | +25 | +85 | °C |

Note 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 (Note 1)

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

| Parameter | Symbol | Test Condition | Min | Typical | Max | Units |
|--|---------------|---|-------|------------|------------|------------|
| Small signal gain | IS211 | CW, PIN = -20 dBm | 27.5 | 29.0 | | dB |
| Input return loss | IS111 | CW, PIN = -20 dBm | 20 | 28 | | dB |
| Quiescent current | ICQ | No RF | | 60 | 65 | mA |
| Operating current | ICC | CW, POUT = +19 dBm | | 133 | 150 | mA |
| Power-down current | IPD | VEN = “0” | | 0.5 | 1.0 | μA |
| Adjacent Channel Leakage Ratio | ACLR5 | @5 MHz offset, WCDMA test model 1, with 64 DPCH, POUT = +19 dBm | | -52.5 | -47.0 | dBc |
| Error Vector Magnitude | EVM | POUT = +19 dBm | | 1.2 | 2.0 | % |
| Harmonic suppression | 2fo 3fo | CW, POUT = +19 dBm | | -45 -49 | -41 -45 | dBc dBc |
| 3 rd Order Output Intercept Point | OIP3 | +19 dBm/tone, frequency separation = 5 MHz | +38.0 | +43.5 | | dBm |
| Input coupling factor | CPLIN | | | -20.5 | | dB |
| Output coupling factor | CPLOUT | | | -22.0 | | dB |
| Stability (non-harmonic spurious) | VSWRSTABILITY | VSWR = 6:1 | | -70 | | dBc |
| Maximum ruggedness input power | PIN_RUG | VSWR = 6:1 | | -7 | | dBm |

Note 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)

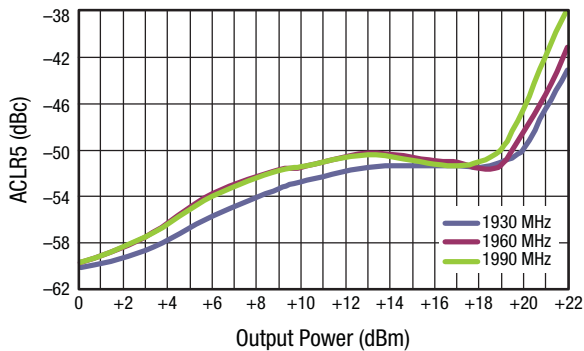


Figure 3. ACLR5 vs Output Power Over Voltage

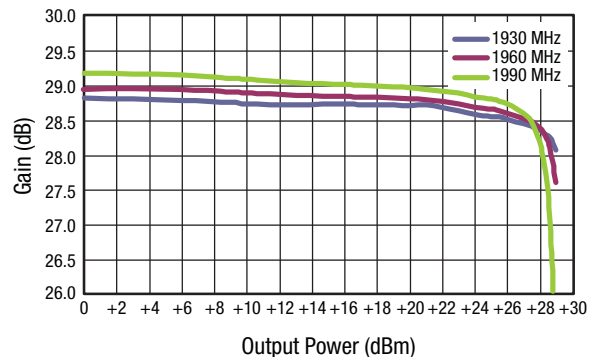


Figure 4. Gain vs Output Power

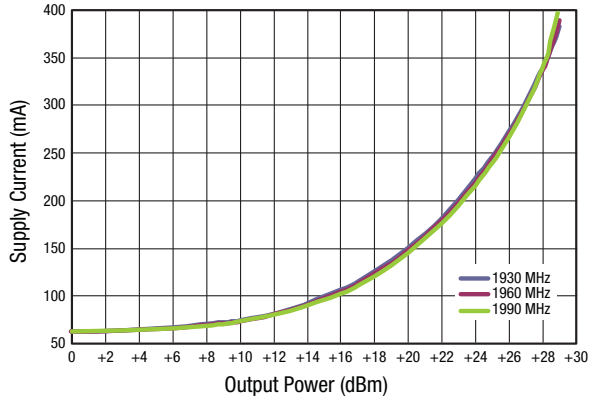


Figure 5. Supply Current vs Output Power

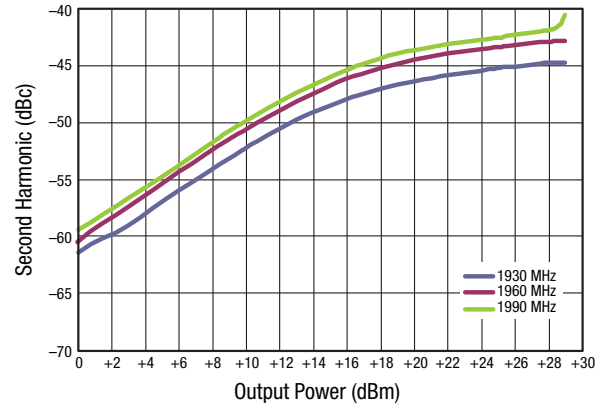


Figure 6. Second Harmonic vs Output Power

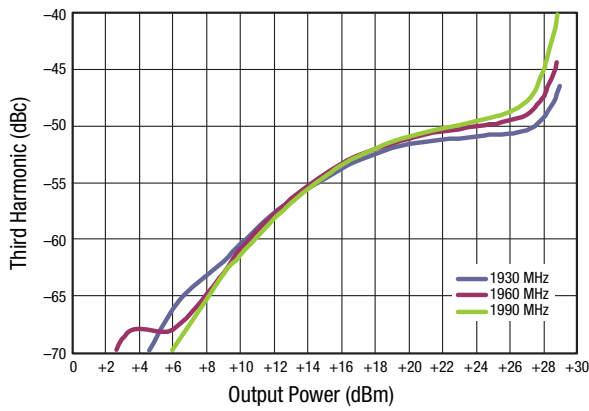


Figure 7. Third Harmonic vs Output Power

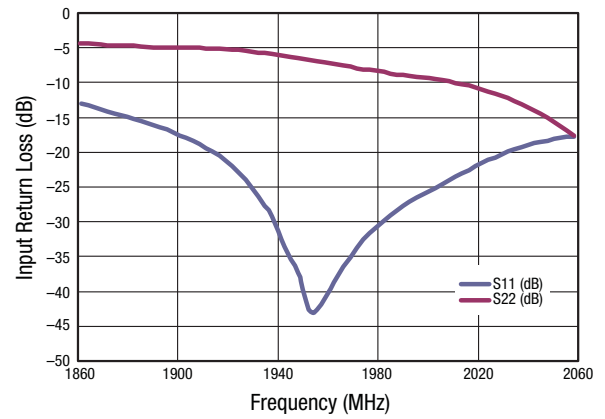


Figure 8. Input Return Loss vs Frequency

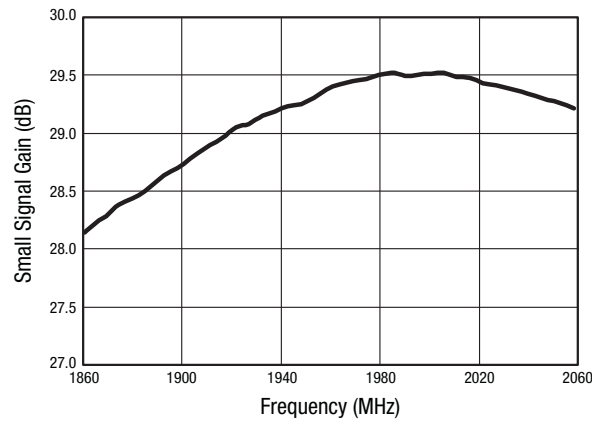


Figure 9. Small Signal Gain vs Frequency

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.

Package Dimensions

The PCB layout footprint for the SKY66002-11 is provided in Figure 13. Typical case markings are shown in Figure 14. Figure 15 shows the package dimensions for the 10-pin MCM, and Figure 16 provides the tape and reel dimensions.

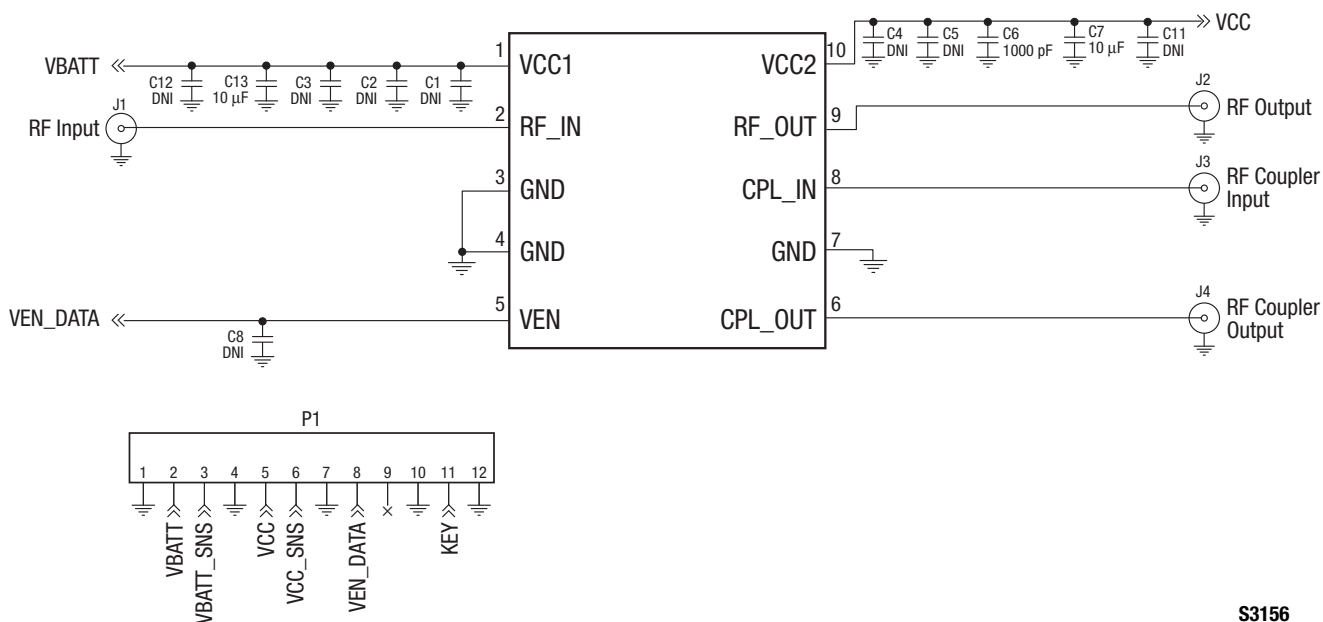
shipping container label regarding exposure to moisture after the container seal is broken must be followed. Otherwise, problems related to moisture absorption may occur when the part is subjected to high temperature during solder assembly.

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.

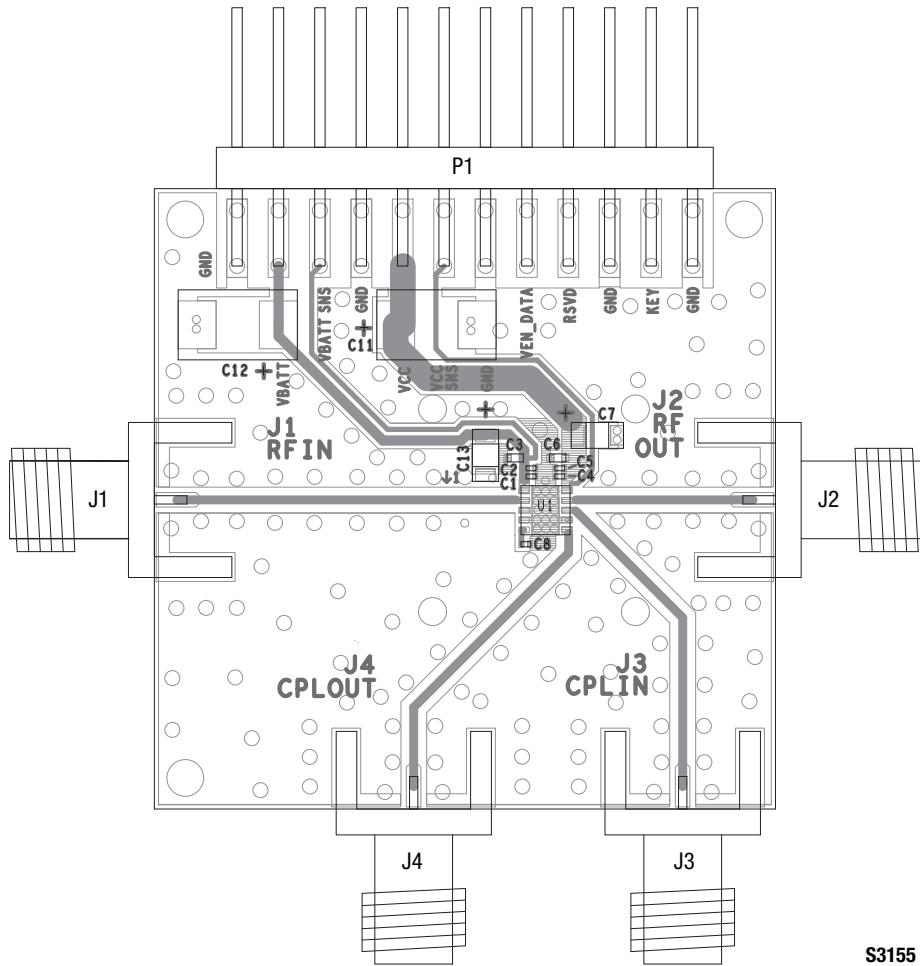
Package and Handling Information

Since the device package is sensitive to moisture absorption, it is baked and vacuum packed before shipping. Instructions on the



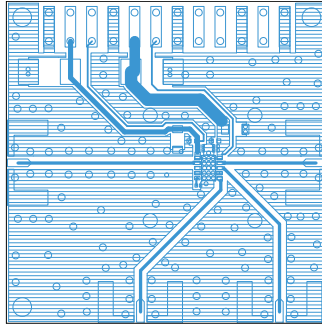
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Figure 10. SKY66002-11 Evaluation Board Schematic

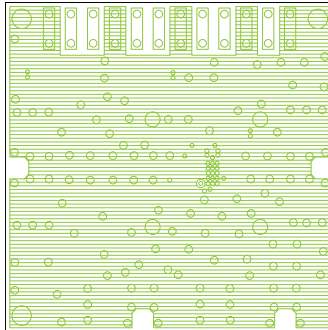


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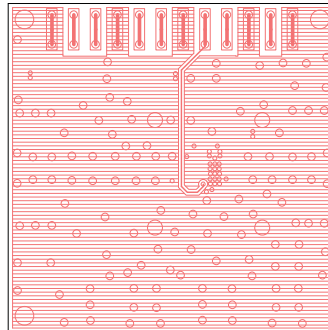
Figure 11. SKY66002-11 Evaluation Board Assembly Diagram



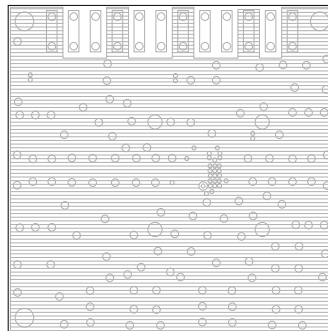
Layer 1: Top Metal



Layer 2: Ground



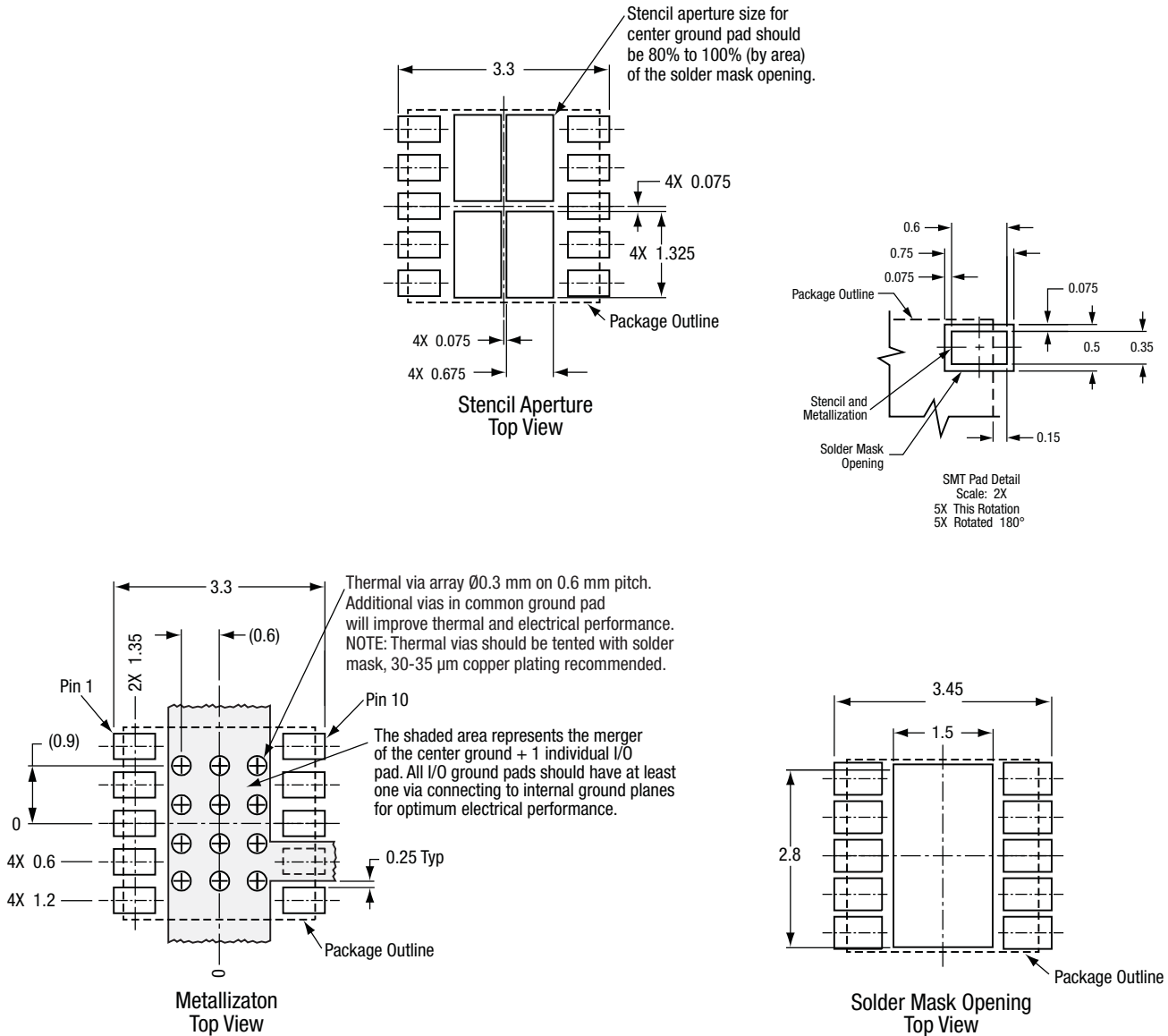
Layer 3: Ground



Layer 4: Bottom (Ground) Layer

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Figure 12. SKY66002-11 Evaluation Board Layer Detail



All dimensions are in millimeters

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Figure 13. PCB Layout Footprint for the SKY66002-11 3 x 3 mm MCM

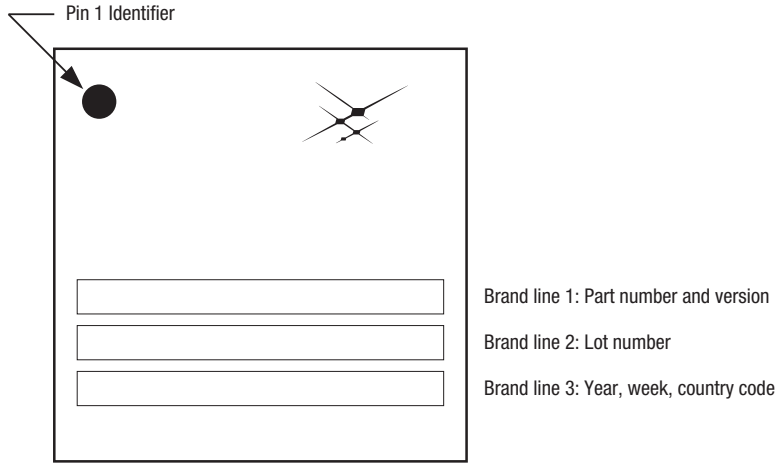
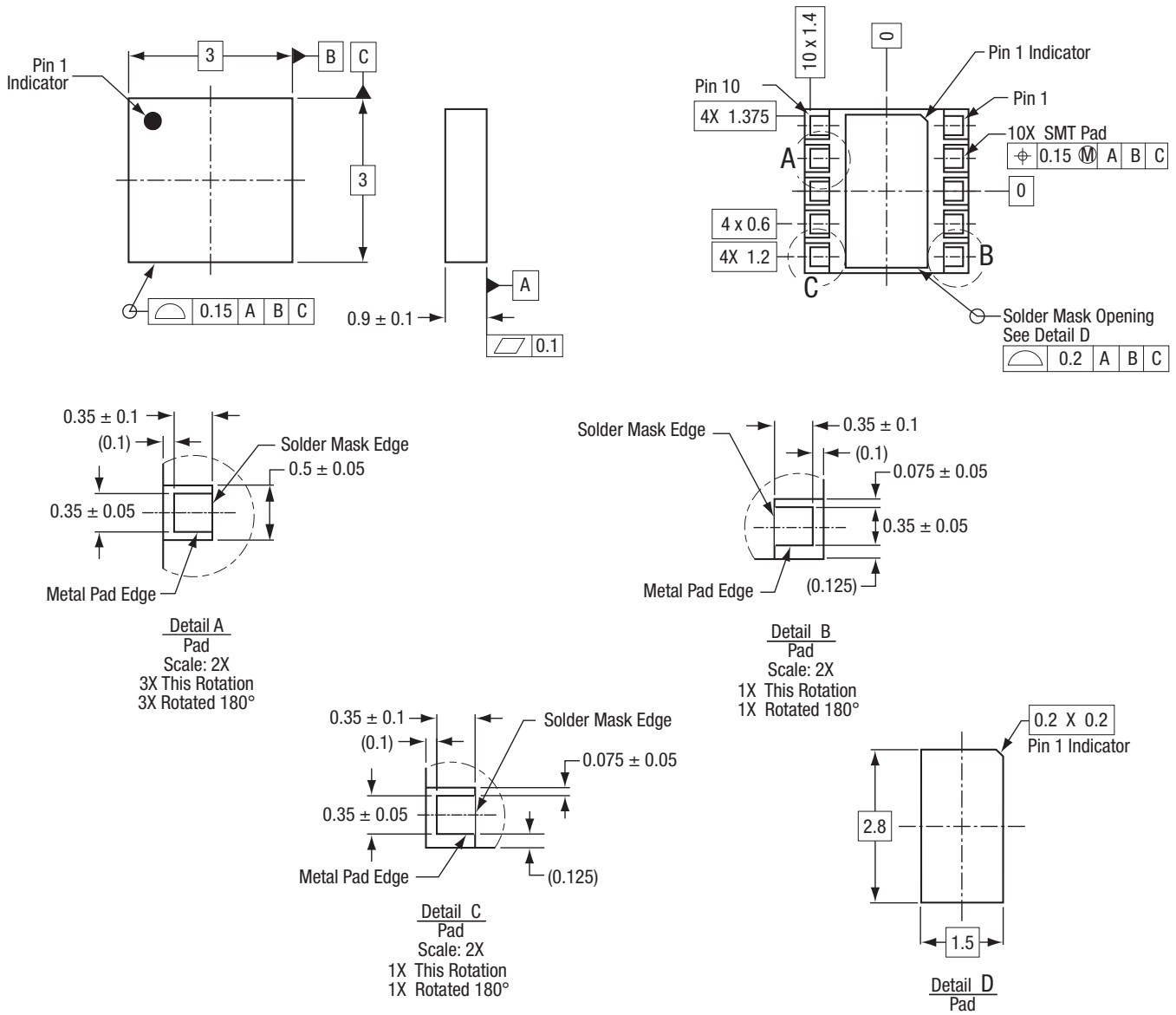


Figure 14. Typical Case Markings (Top View)



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

S2991

Figure 15. SKY66002-11 10-Pin MCM Package Dimensions

Ordering Information

| Model Name | Manufacturing Part Number | Evaluation Board Part Number |
|-----------------------|---------------------------|------------------------------|
| SKY66002-11 Linear PA | SKY66002-11 | EN40-D605 |

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