

## DATA SHEET

# SE5005L: 5 GHz Power Amplifier with Power Detector

## Applications

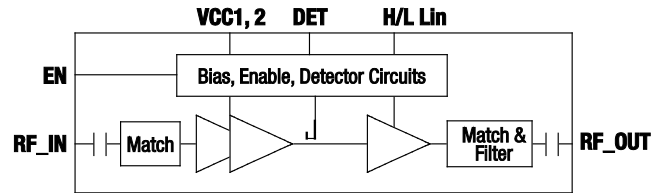
- DSSS 5 GHz WLAN (IEEE802.11a)
- Access points
- PCMCIA cards
- PC cards

## Features

- 5 GHz matched +18 dBm PA
- Integrated PA enable pin ( $V_{EN}$ )
- Buffered, temperature-compensated power detector
- High and low linearity modes
- 3% EVM, @ +18 dBm, 64 QAM, 54 Mbps
- +30 dB typical gain
- DC blocked
- QFN (16-pin, 3.0 mm x 3.0 mm x 0.9 mm) package (MSL1 @ 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.



*Note: The RF I/Os are DC blocked.*

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**Figure 1. SE5005L Block Diagram**

## Description

The SE5005L is a 5 GHz Power Amplifier (PA) that offers high linear power for wireless LAN applications.

The SE5005L offers a high level of integration for a simplified design, which provides quicker time-to-market and higher application board production yield. The SE5005L integrates all matching elements, a 3.8 GHz notch filter, and a temperature-compensated, load-insensitive power detector with +20 dB of dynamic range.

For wireless LAN applications, the SE5005L meets the requirements of IEEE 802.11a and delivers approximately +18 dBm of linear output power. The SE5005L also features a linearity mode-control function to reduce current consumption at low power.

The SE5005L integrates the reference voltage generator, which allows for a true Complementary Metal Oxide Semiconductor (CMOS) compatible digital enable (EN) function to turn the PA on and off.

A functional block diagram is shown in Figure 1. The pin configuration and package are shown in Figure 2. Signal pin assignments and functional pin descriptions are provided in Table 1.

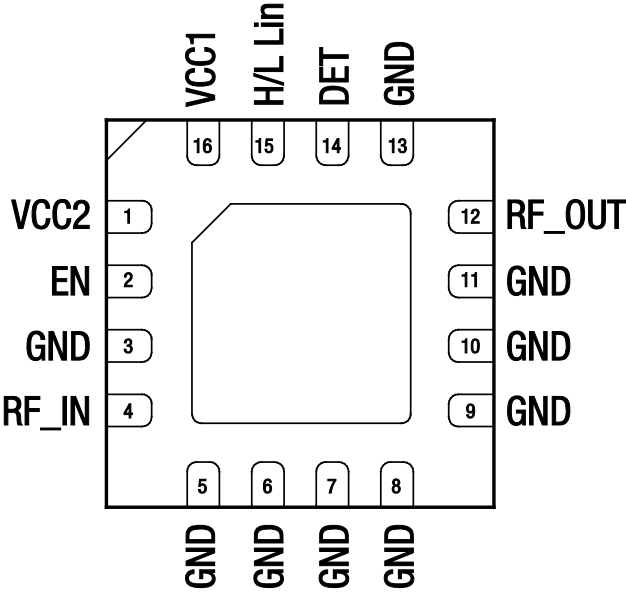


Figure 2. SE5005L Pinout  
(Top View)

Table 1. SE5005L Signal Descriptions

| Pin # | Name | Description                    | Pin # | Name    | Description                   |
|-------|------|--------------------------------|-------|---------|-------------------------------|
| 1     | VCC2 | Bias and driver supply voltage | 9     | GND     | Ground                        |
| 2     | EN   | PA enable                      | 10    | GND     | Ground                        |
| 3     | GND  | Ground                         | 11    | GND     | Ground                        |
| 4     | RFIN | TX RF input signal             | 12    | RFOUT   | 5 GHz antenna output          |
| 5     | GND  | Ground                         | 13    | GND     | Ground                        |
| 6     | GND  | Ground                         | 14    | DET     | Power detector output         |
| 7     | GND  | Ground                         | 15    | H/L Lin | High to low linearity control |
| 8     | GND  | Ground                         | 16    | VCC1    | Power stage supply voltage    |

**Table 2. SE5005L Absolute Maximum Ratings**

| Parameter                                                                  | Symbol             | Minimum | Maximum | Units |
|----------------------------------------------------------------------------|--------------------|---------|---------|-------|
| Supply voltage on VCC1 and VCC2 pins                                       | V <sub>CC</sub>    | −0.3    | 4.2     | V     |
| DC input on Enable                                                         | EN                 | −0.3    | 3.6     | V     |
| RF input power, RF_OUT into 50 $\Omega$ match                              | RFIN               |         | +12     | dBm   |
| Storage temperature range                                                  | T <sub>STG</sub>   | −40     | 150     | °C    |
| Electrostatic discharge—Human Body Model (HBM), JEDEC JESD22-A114 all pins | ESD <sub>HBM</sub> |         | 350     | V     |

**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 value. Exceeding any of the limits listed here may result in permanent damage to the device.

**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. Recommended Operating Conditions**

| Parameter                            | Symbol          | Minimum | Maximum | Units |
|--------------------------------------|-----------------|---------|---------|-------|
| Supply voltage on VCC1 and VCC2 pins | V <sub>CC</sub> | 3.0     | 3.6     | V     |
| Ambient Temperature                  | T <sub>A</sub>  | −40     | 85      | °C    |

## Electrical and Mechanical Specifications

The absolute maximum ratings of the SE5005L are provided in Table 2. The recommended operating conditions are specified in Table 3, and electrical specifications are provided in Tables 4 and 5.

The state of the SE5005L is determined by the logic provided in Table 6.

**Table 4. SE5005L Electrical Specifications: Transmit (Tx) AC Characteristics (Note 1)****(V<sub>CC</sub> = V<sub>EN</sub> = C<sub>0</sub> = H/L Lin = 3.3 V, T<sub>A</sub> = +25 °C, as Measured on Skyworks SE5005L-EK1 Evaluation Board, Unless Otherwise Noted)**

| Parameter                                                                                                     | Symbol                                                             | Test Condition                                                                                                                                                               | Min.                                                           | Typ.                                                     | Max.                              | Units   |
|---------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|----------------------------------------------------------|-----------------------------------|---------|
| Frequency range                                                                                               | f                                                                  |                                                                                                                                                                              | 5.15                                                           |                                                          | 5.75                              | GHz     |
| Output power, 802.11a, 64 QAM:<br>High linearity mode H/L Lin = 3.3 V<br><br>Low linearity mode H/L Lin = 0 V | P <sub>OUT</sub>                                                   | EVM = 3%<br>EVM < 2.2%<br>MCS0, HT20, mask compliant<br>MCS0, HT40, mask compliant<br><br>EVM = 3%<br>EVM < 2.2%<br>MCS0, HT20, mask compliant<br>MCS0, HT40, mask compliant |                                                                | +18<br>+16<br>+22<br>+21<br><br>+17<br>+15<br>+20<br>+19 | 0                                 | dBm     |
| Output 1dB compression point                                                                                  | P1dB                                                               | No modulation                                                                                                                                                                |                                                                | +27<br>+23                                               |                                   | dBm     |
| Input return loss                                                                                             | S <sub>11</sub>                                                    | P <sub>IN</sub> = -25 dBm                                                                                                                                                    | +22                                                            | +25                                                      |                                   | dBm     |
| Gain:<br>Small signal<br><br>Small signal variation<br><br>Out of band                                        | S <sub>21</sub><br><br>ΔS <sub>21</sub><br><br>S <sub>21_3.8</sub> | P <sub>IN</sub> = -25dBm<br>High linearity mode<br>Low linearity mode<br>Gain variation over single 40 MHz channel<br>Gain variation over band<br>Gain at 3.8 GHz            | +10<br>+27<br>+23<br><br>-1.5                                  | +14                                                      | +34<br>+32<br>+0.5<br>+1.5<br>+10 | dB      |
| Harmonic                                                                                                      | 2f<br>3f                                                           | P <sub>OUT</sub> = +18 dBm, OFDM                                                                                                                                             |                                                                | -50<br>-60                                               | -42<br>-42                        | dBm/MHz |
| Rise and fall time                                                                                            | t <sub>r</sub> , t <sub>f</sub>                                    |                                                                                                                                                                              |                                                                | 0.5                                                      |                                   | μs      |
| Stability                                                                                                     | STAB                                                               | P <sub>OUT</sub> = +18 dBm, 54 Mbps, 64 QAM, VSWR = 6:1, all phases                                                                                                          | All non-harmonically related outputs less than -50 dBc/100 kHz |                                                          |                                   |         |
| Ruggedness—tolerance to output load mismatching                                                               | RU                                                                 | P <sub>IN</sub> = +12 dBm, CW, VSWR = 6:1, all phases                                                                                                                        | No damage                                                      |                                                          |                                   |         |
| Robustness tolerance to input power                                                                           |                                                                    | P <sub>IN</sub> = +12 dBm, CW, VSWR = 6:1, all phases                                                                                                                        | No damage                                                      |                                                          |                                   |         |

**Note 1:** Performance is guaranteed only under the conditions listed in the above Table.**Table 5. SE5005L Power Detector Characteristics (Note 1)****(V<sub>CC</sub> = V<sub>EN</sub> = 3.3 V, f = 5.4 GHz, T<sub>A</sub> = +25 °C, as Measured on Skyworks SE2432L-EK1 Evaluation Board, Unless Otherwise Noted)**

| Parameter                     | Symbol                                                        | Test Condition                                                                        | Minimum              | Typical | Maximum             | Units |
|-------------------------------|---------------------------------------------------------------|---------------------------------------------------------------------------------------|----------------------|---------|---------------------|-------|
| P <sub>OUT</sub> detect range | PDR                                                           |                                                                                       | 0                    |         | P1dB                | dBm   |
| Detector voltage              | VDET <sub>22</sub><br>VDET <sub>16</sub><br>VDET <sub>2</sub> | P <sub>OUT</sub> = +22 dBm<br>P <sub>OUT</sub> = +16 dBm<br>P <sub>OUT</sub> = +2 dBm | 0.80<br>0.55<br>0.25 |         | 1.0<br>0.60<br>0.35 | V     |
| Output impedance              | PDZ <sub>OUT</sub>                                            |                                                                                       |                      | 5       |                     | kΩ    |

**Note 1:** Performance is guaranteed only under the conditions listed in the above Table.

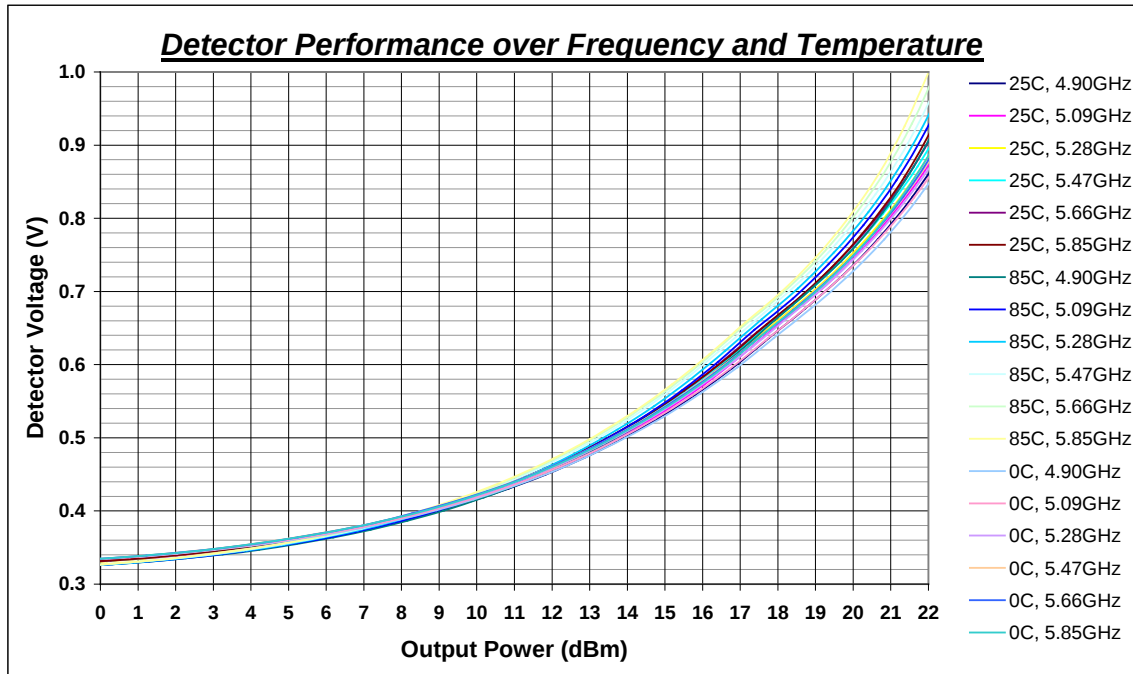


Figure 3. SE5005L Power Detector Sweep over Temperature and Frequency

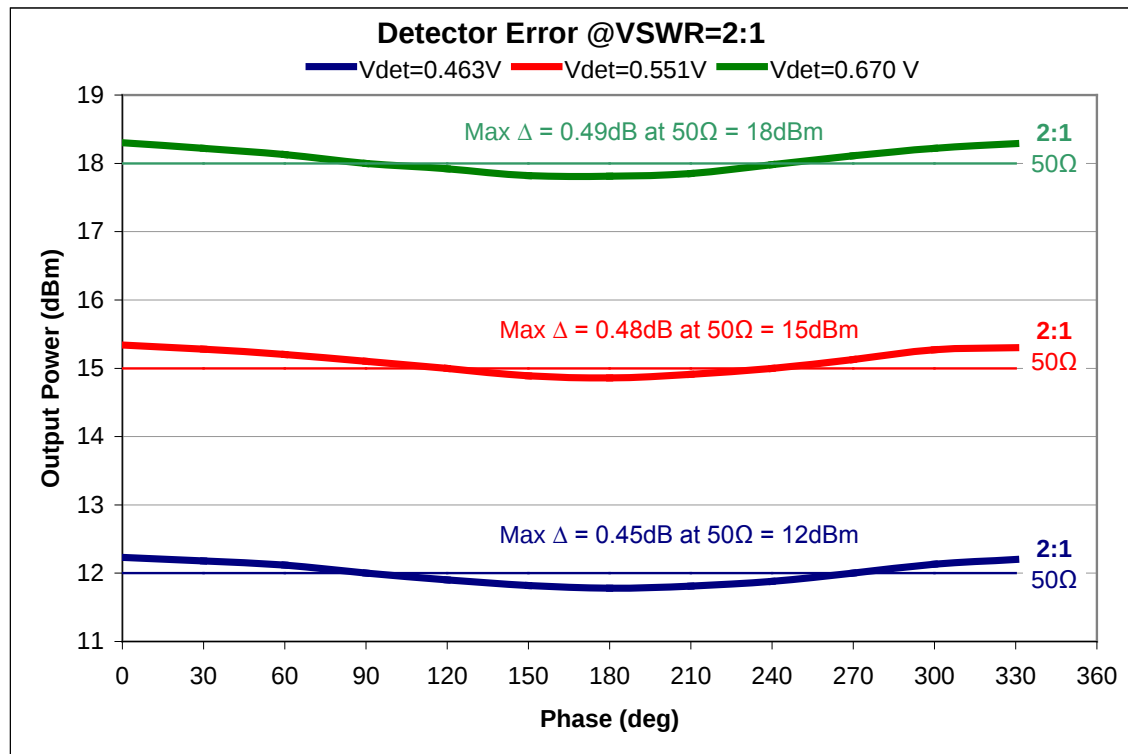


Figure 4. SE5005L Power Detector Accuracy at 2:1 Mismatch

**Table 6. SE5005L Logic Control Characteristics****(V<sub>CC</sub> = V<sub>EN</sub> = 3.3 V, T<sub>A</sub> = +25 °C, as Measured on Skyworks SE5005L-EV1 Evaluation Board, Unless Otherwise Noted)**

| Parameter                                   | Symbol                               | Test Condition                                                                                                                                                                                                                                       | Minimum      | Typical           | Maximum      | Units          |
|---------------------------------------------|--------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-------------------|--------------|----------------|
| Supply current                              | ICC-802.11a                          | P <sub>OUT</sub> = +18 dBm, 54 Mbps, 64 QAM, H/L Lin = 3.3V (high linearity mode)<br>P <sub>OUT</sub> = +14 dBm, 54 Mbps, 64 QAM, H/L Lin = 0V (low linearity mode)<br>P <sub>OUT</sub> = +5 dBm, 54 Mbps, 64 QAM, H/L Lin = 0V (low linearity mode) |              | 195<br>140<br>108 |              | mA<br>mA<br>mA |
|                                             | I <sub>OFF</sub>                     | V <sub>EN</sub> = 0 V, No RF                                                                                                                                                                                                                         |              | 0.5               |              | μA             |
| Logic voltage:<br>High<br>Low               | V <sub>ENH</sub><br>V <sub>ENL</sub> |                                                                                                                                                                                                                                                      | +2.8<br>−0.3 |                   | +3.6<br>+0.3 | V<br>V         |
| Input current logic voltage:<br>High<br>Low | I <sub>ENH</sub><br>I <sub>ENL</sub> |                                                                                                                                                                                                                                                      |              | <1                | 400          | μA<br>μA       |

## Package Dimensions

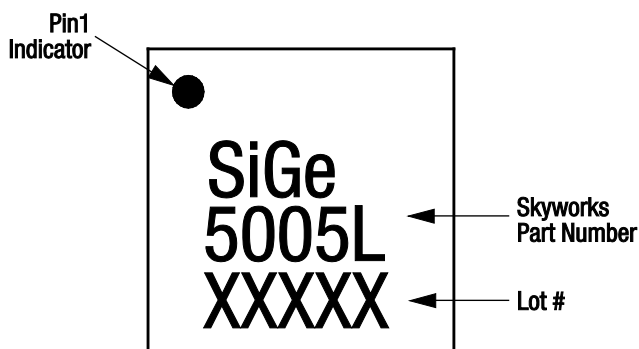
Branding information is shown in Figure 5. Package dimensions are shown in Figure 6, the recommended land and solder pattern is shown in Figure 7, and tape and reel dimensions are provided in Figure 5.

The SE5005L is rated to Moisture Sensitivity Level 1 (MSL1) at 260 °C, and can be used for lead or lead-free soldering. For additional information, refer to the Skyworks Application Note, *Solder Reflow Information* (Document Number 200164).

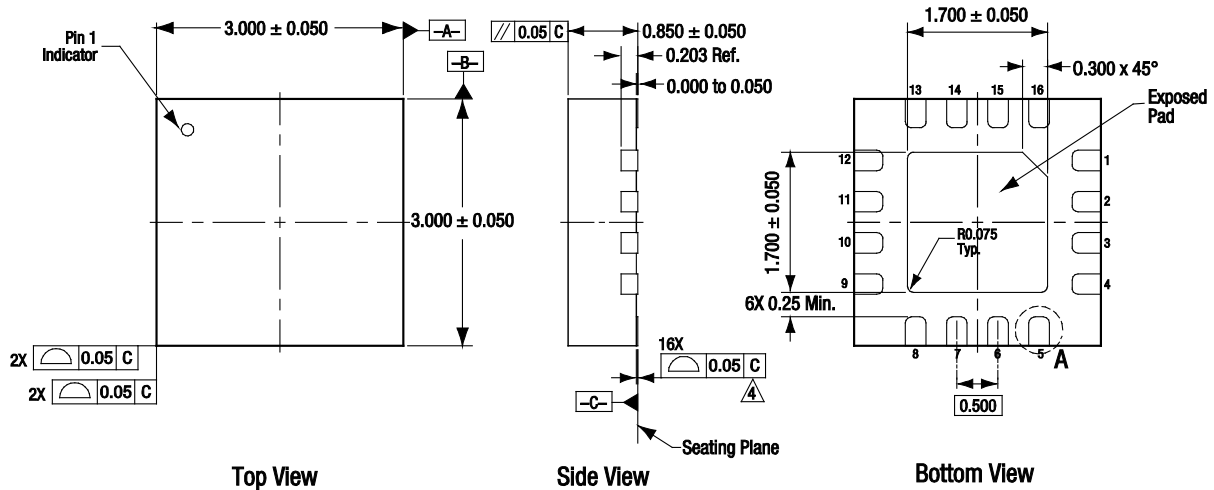
Care must be taken when attaching this product, whether it is done manually or in a production solder reflow environment. Production quantities of this product are shipped in a standard tape and reel format.

## Package and Handling Information

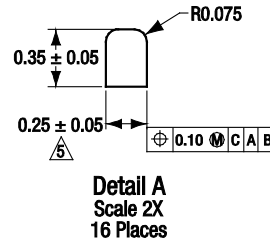
Instructions on the shipping container label regarding exposure to moisture after the container seal is broken must be followed. Otherwise, problems related to moisture absorption may occur when the part is subjected to high temperatures during solder assembly.



**Figure 5. SE5005L Typical Part Marking  
(Top View)**

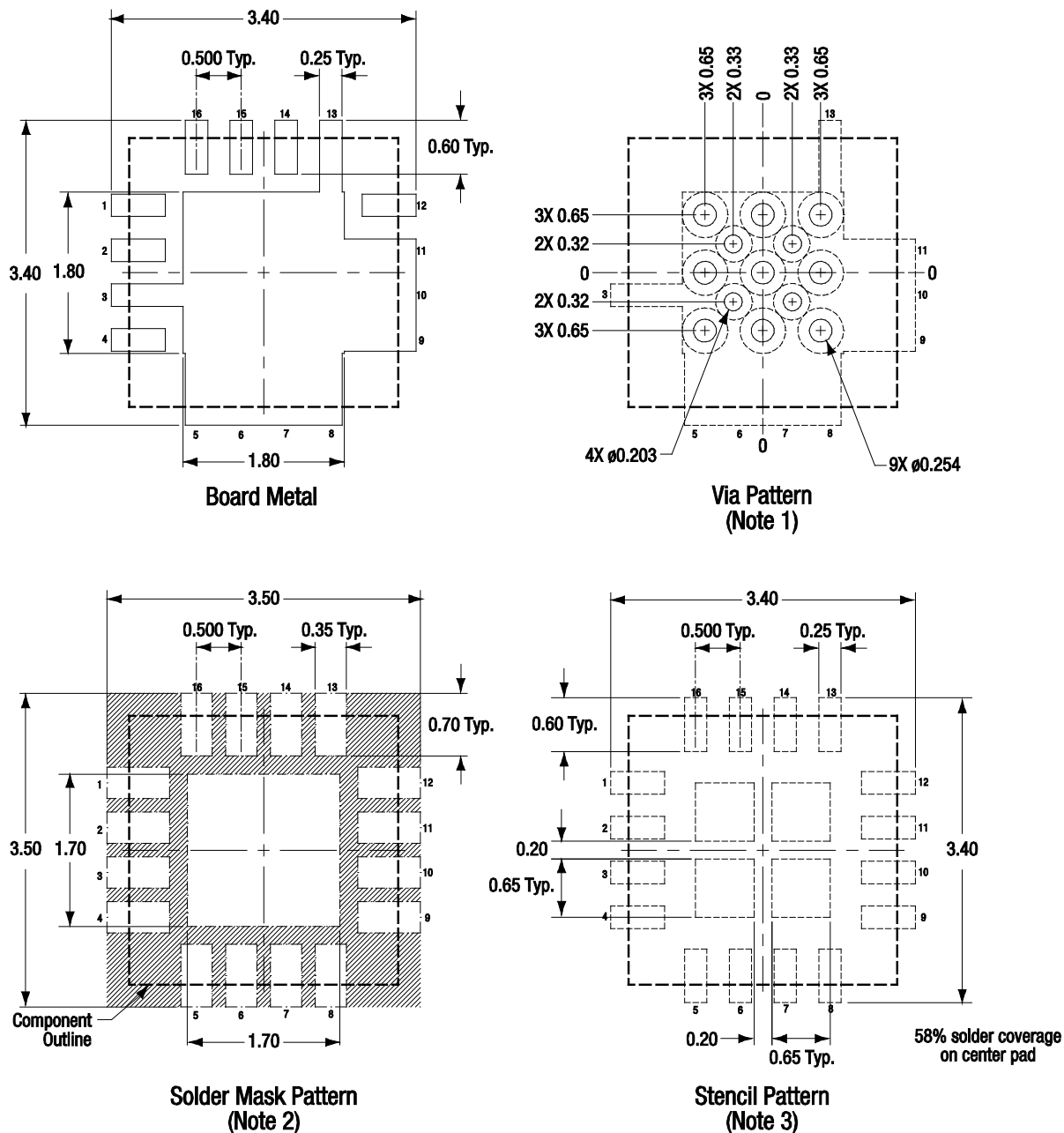


1. All measurements are in millimeters.
2. Dimensioning and tolerancing according to ASME Y14.5M-1994.  
Unless otherwise specified the following values apply:  
Decimal Tolerance:      Angular Tolerance:  
X.X (1 place) ± 0.1 mm      ±0.5°  
X.XX (2 places) ± 0.05 mm  
X.XXX (3 places) ± 0.025 mm
3. Coplanarity applies to the exposed heat sink slug as well as the terminals.
4. Dimension applies to metalized terminal. If terminal has a radius, dimension should be measured in that radius area.
5. Unless specified, dimensions are symmetrical about center lines.



S3396

Figure 6. SE5005L Package Dimensions



**NOTES:**

1. Via hole recommendations:  
0.025 mm Cu via wall plating (minimum),  
soldermask on the farside should tent  
or plug via holes.
2. Soldermask recommendations:  
Contact board fabricator for recommended  
soldermask offset and tolerance.
3. Stencil recommendations:  
0.125 mm stencil thickness, laser cut apertures,  
trapezoidal walls, and rounded corners offer  
better paste release.

Dimension and tolerancing according to ASME Y14.5M-1994.  
Unless specified, dimensions are symmetrical about center lines.  
All dimensions are in millimeters.

S3397

**Figure 7. SE5005L Recommended Land and Solder Pattern**



## Ordering Information

| Model Name                                         | Manufacturing Part Number | Evaluation Board Part Number |
|----------------------------------------------------|---------------------------|------------------------------|
| SE5005L: 5 GHz Power Amplifier with Power Detector | SE5005L                   | SE5005L-EK1                  |

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