

**DATA SHEET**  
**SE5003L: 5 GHz, 23dBm Power Amplifier with Power Detector**

**Applications**

- DSSS 5 GHz WLAN (IEEE802.11a)
- DSSS 5 GHz WLAN (IEEE802.11n)
- Access Points, PCMCIA, PC cards

**Features**

- High output power amplifier  
 - 23dBm at 5V
- External Analog Reference Voltage ( $V_{REF}$ ) for maximum flexibility
- Buffered, temperature compensated power detector
- 3% EVM, @23dBm, 64 QAM, 54 Mbps
- 32 dB Gain
- Lead Free, RoHS compliant and halogen free package, MSL3
- 20 pin 4 mm x 4 mm x 0.9 mm QFN

**Product Description**

The SE5003L is a 5GHz power amplifier offering high linear power for wireless LAN applications. The SE5003L incorporates a power detector for closed loop monitoring and control of the output power.

The SE5003L offers high integration for a simplified design, providing quicker time to market and higher application board production yield. The device integrates the input match, the inter-stage match, the output match, the power detector with 15dB of dynamic range and a 3.8GHz notch filter. Only 6 external decoupling capacitors are required to complete the design.

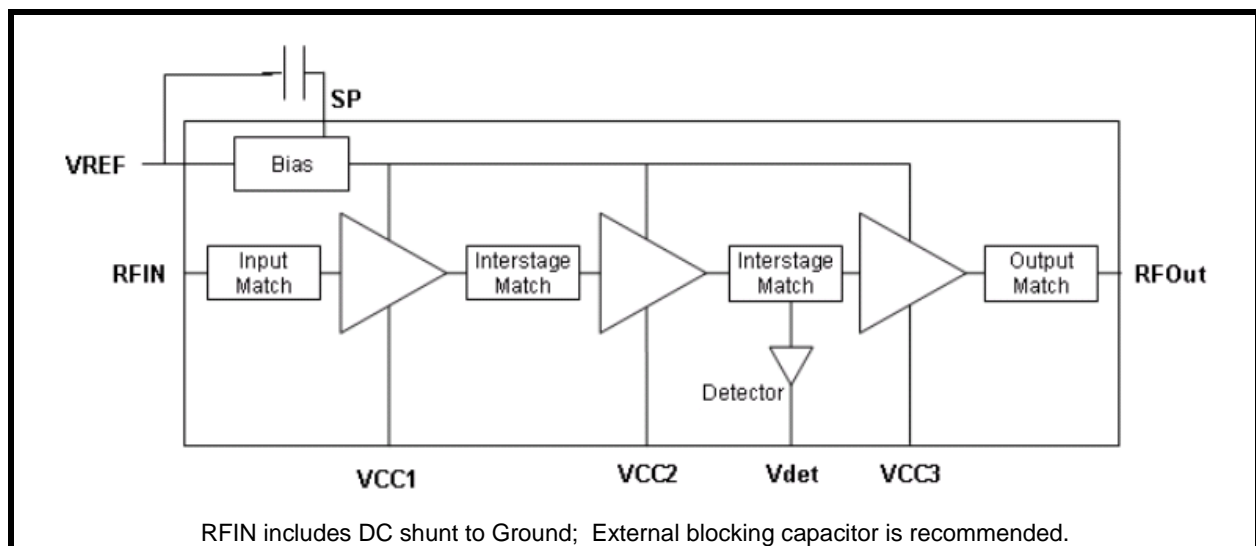
For wireless LAN applications, the device meets the requirements of IEEE802.11a & 802.11n, and delivers approximately 23dBm of linear output power at 5V.

The SE5003L integrates the reference voltage generator. A 2.85V reference voltage on  $V_{REF}$  is all that is required to enable or disable the power amplifier.

**Ordering Information**

| Part Number | Package        | Remark        |
|-------------|----------------|---------------|
| SE5003L     | 20 Pin QFN     | Samples       |
| SE5003L-R   | 20 Pin QFN     | Tape and Reel |
| SE5003L-EK1 | Evaluation Kit | Standard      |

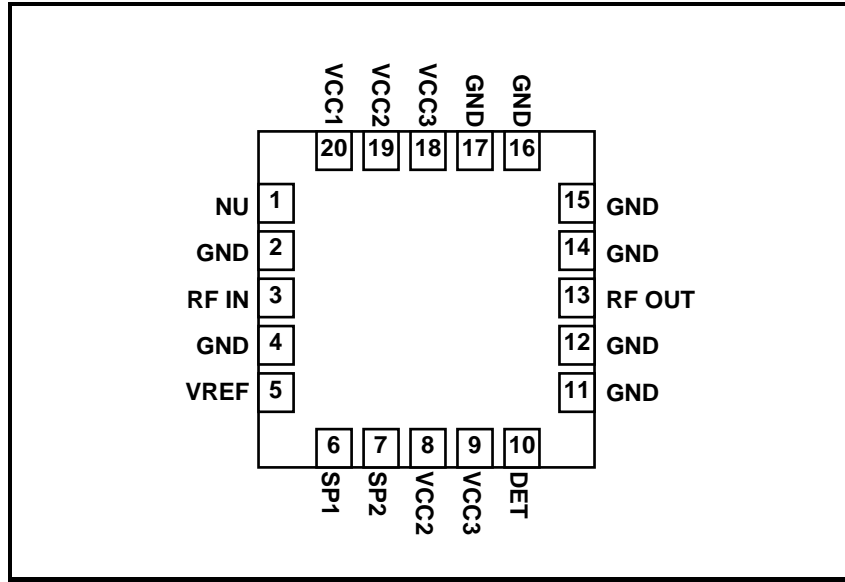
**Functional Block Diagram**



**Figure 1: Functional Block Diagram**

**DATA SHEET**  
**SE5003L: 5 GHz, 23dBm Power Amplifier with Power Detector**

**Pin Out Diagram**



**Figure 2: SE5003L Pin Out (Top View Through Package)**

**Pin Out Description**

| Pin No. | Name   | Description   |
|---------|--------|---|
| 1       | NU     | Pin is Not Used, and is open circuit in the package |
| 2       | GND    | Ground  |
| 3       | RFin   | Power Amplifier RF input, DC block required         |
| 4       | GND    | Ground  |
| 5       | VREF   | Reference Voltage                                   |
| 6       | SP1    | Ports for optional capacitor to improve dynamic EVM |
| 7       | SP2    |   |
| 8       | VCC2   | Second Stage Supply Voltage                         |
| 9       | VCC3   | Third Stage Supply Voltage                          |
| 10      | DET    | Analog Power Detector Output                        |
| 11,12   | GND    | Ground  |
| 13      | RF OUT | Power Amplifier RF Output                           |
| 14-17   | GND    | Ground  |
| 18      | VCC3   | Third Stage Supply Voltage                          |
| 19      | VCC2   | Second Stage Supply Voltage                         |
| 20      | VCC1   | First Stage Supply Voltage                          |

**DATA SHEET**  
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**Absolute Maximum Ratings**

These are stress ratings only. Exposure to stresses beyond these maximum ratings for a long period of time may cause permanent damage to, or affect the reliability of the device. Avoid operating the device outside the recommended operating conditions defined below. This device is ESD sensitive. Handling and assembly of this device should be at ESD protected workstations.

| Symbol             | Definition  | Min.    | Max. | Unit |
|--------------------|---|---------|------|------|
| V <sub>CC</sub>    | Supply Voltage on pins VCC3   | -0.3    | +6   | V    |
|                    | Supply Voltage on pins VCC1, VCC2   | -0.3    | VCC3 |      |
| V <sub>REF</sub>   | Power Amplifier Enable and reference voltage                                  | -0.3    | 3.6  | V    |
| R <sub>FIN</sub>   | RF Input Power, R <sub>Fout</sub> into 50Ω match, T <sub>CASE_MAX</sub> = 85C | -       | 6    | dBm  |
| T <sub>STG</sub>   | Storage Temperature Range   | -40     | 160  | °C   |
| T <sub>j</sub>     | Maximum Junction Temperature  | -       | 160  | °C   |
| ESD <sub>HBM</sub> | JEDEC JESD22-A114 all pins  | Class1A |      |      |

**Recommended Operating Conditions**

| Symbol                | Parameter                       | Min. | Max. | Unit |
|-----------------------|---------------------------------|------|------|------|
| V <sub>CC</sub>       | Supply Voltage VCC1, VCC2, VCC3 | 3.0  | 5.5  | V    |
| T <sub>CASE_MAX</sub> | Max Case Temperature            | -40  | 85   | °C   |
| V <sub>REF</sub>      | Reference Voltage               | 2.8  | 2.9  | V    |

**DC Electrical Characteristics**

Conditions: V<sub>CC</sub> = 5.0V, V<sub>REF</sub> = 2.85 V, T<sub>A</sub> = 25 °C, as measured on Skyworks' SE5003L-EK1 evaluation board, unless otherwise noted.

| Symbol                  | Parameter                  | Conditions  | Min. | Typ. | Max. | Unit |
|-------------------------|----------------------------|---|------|------|------|------|
| I <sub>CC-802.11a</sub> | Supply Current             | P <sub>OUT</sub> = 23 dBm, 5.0V, 54 Mbps, 64 QAM                        | -    | 340  | 650  | mA   |
| I <sub>QC</sub>         | Quiescent Current          | No RF   | -    | 150  | -    | mA   |
| I <sub>OFF</sub>        | Supply Current             | V <sub>REF</sub> = 0 V, No RF   | -    | 0.5  | 10   | μA   |
| I <sub>EN</sub>         | Bias Control Current       | V <sub>REF</sub> = V <sub>REFH</sub><br>Internal 2KΩ pull down resistor | -    | 10   | -    | mA   |
| V <sub>REFH</sub>       | Reference Voltage Enabled  | -   | 2.8  | 2.85 | 2.9  | V    |
| V <sub>REFL</sub>       | Reference Voltage Disabled | -   | 0    | -    | 0.5  | V    |

**DATA SHEET**  
**SE5003L: 5 GHz, 23dBm Power Amplifier with Power Detector**

**AC Electrical Characteristics**

**802.11a AC Electrical Characteristics**

Conditions:  $V_{CC} = 5.0\text{ V}$ ,  $V_{REF} = 2.85\text{ V}$ ,  $f = 5.4\text{ GHz}$ ,  $T_A = 25\text{ }^\circ\text{C}$ , as measured on Skyworks' SE5003L-EK1 evaluation board, unless otherwise noted

| Symbol               | Parameter  | Conditions  | Min.   | Typ. | Max. | Unit    |
|----------------------|--|---|--|------|------|---------|
| $f_{L-U}$            | Frequency Range  | -   | 5.15   | -    | 5.85 | GHz     |
| $P_{OUT}$            | Output Power   | 802.11a, 54Mbps, 64 QAM, 3% EVM   | 22   | -    | -    | dBm     |
|                      |  | 802.11n, MCS0, Mask Compliant   | -  | 26   | -    |         |
| $P_{1dB}$            | Output 1dB compression point                           | No modulation   | 28   | 32   | -    | dBm     |
| $S_{21}$             | Small Signal Gain                                      | $P_{IN} = -25\text{ dBm}$   | 28   | 32   | -    | dB      |
| $\Delta S_{21}$      | Gain Variation   | Withing each UNII Band  | -  | 3    | -    | dB      |
| $\Delta S_{21\ 3.8}$ | Gain at 3.8GHz   | $P_{IN} = -25\text{ dBm}$   | -  | -    | 0    | dB      |
| 2f                   | Harmonic   | $P_{OUT} = 23\text{ dBm}$ , 5V  | -  | -45  | -    | dBm/MHz |
| 3f                   |  |   |  |      |      |         |
| $t_r, t_f$           | Rise and Fall Time                                     | -   | -  | 0.5  | -    | us      |
| STAB                 | Stability  | $P_{OUT} = 23\text{ dBm}$ , $V_{CC} = 5V$ , 54 Mbps, 64 QAM, VSWR = 6:1, all phases | All non-harmonically related outputs less than -50 dBc/100 kHz |      |      |         |
| Rugged               | Tolerance to constant input power into a mismatch load | $P_{IN} = -10\text{ dBm}$ , CW, VSWR = 6:1, all phases                              | No damage  |      |      |         |

**DATA SHEET**  
**SE5003L: 5 GHz, 23dBm Power Amplifier with Power Detector**

**Power Detector**

Conditions:  $V_{CC} = 5.0\text{ V}$ ,  $V_{REF} = 2.85\text{ V}$ ,  $f = 5.4\text{ GHz}$ ,  $T_A = 25\text{ °C}$ , as measured on Skyworks' SE5003L-EK1 evaluation board, unless otherwise noted

| Symbol              | Parameter              | Conditions  | Min. | Typ. | Max.      | Unit       |
|---------------------|------------------------|---|------|------|-----------|------------|
| PDR                 | $P_{OUT}$ detect range | -   | 0    | -    | $P_{1dB}$ | dBm        |
| VDET                | Detector voltage       | $P_{OUT} = 23\text{ dBm}$                                       | -    | 1.00 | -         | V          |
|                     |                        | $P_{OUT} = \text{NO RF}$  | -    | 0.35 | -         | V          |
| ERR <sub>DET</sub>  | Detector Accuracy      | $\Delta P_{OUT}$ at constant $V_{DET}$ ,<br>5.15 GHz – 5.70 GHz | -0.5 | -    | +0.5      | dB         |
|                     |                        | 5.70 GHz – 5.85 GHz   | -0.5 | -    | +0.5      | dB         |
|                     |                        | $\Delta P_{OUT}$ at constant $V_{DET}$ ,<br>VSWR = 3:1          | -1.5 |      | +1.5      | dB         |
| PDZ <sub>OUT</sub>  | Output Impedance       | -   | -    | 700  | -         | $\Omega$   |
| PDZ <sub>LOAD</sub> | DC load impedance      | -   | -    | 26.5 | -         | K $\Omega$ |

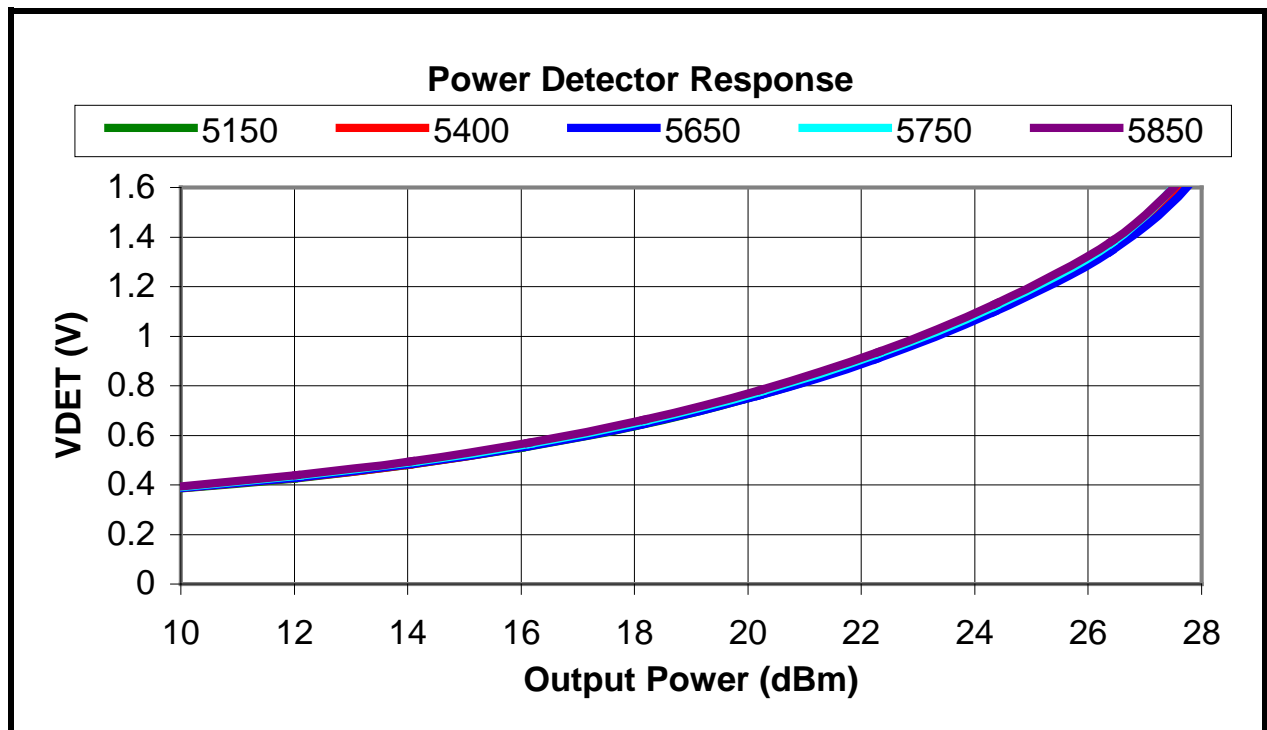
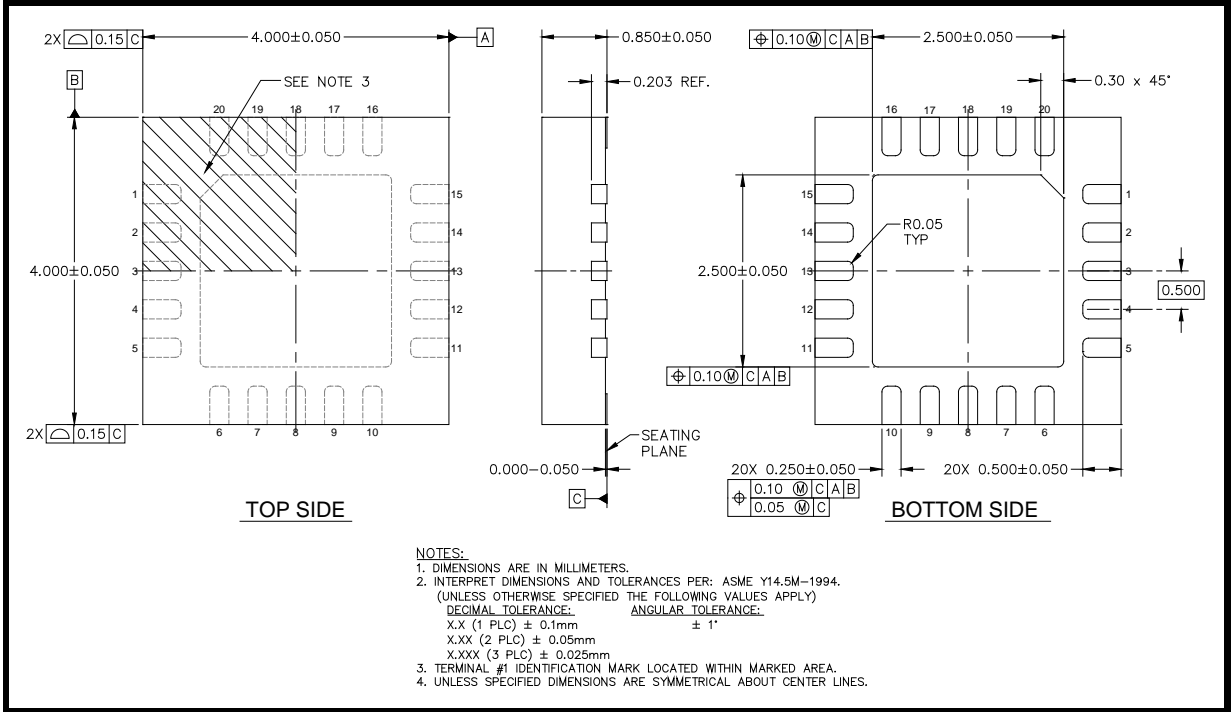


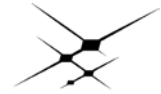
Figure 3: SE5003L Power Detector Characteristic over Frequency

**DATA SHEET**  
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**Package Diagram**



**Figure 4: SE5003L Package Information**



DATA SHEET  
SE5003L: 5 GHz, 23dBm Power Amplifier with Power Detector

Recommended Land and Solder Pattern

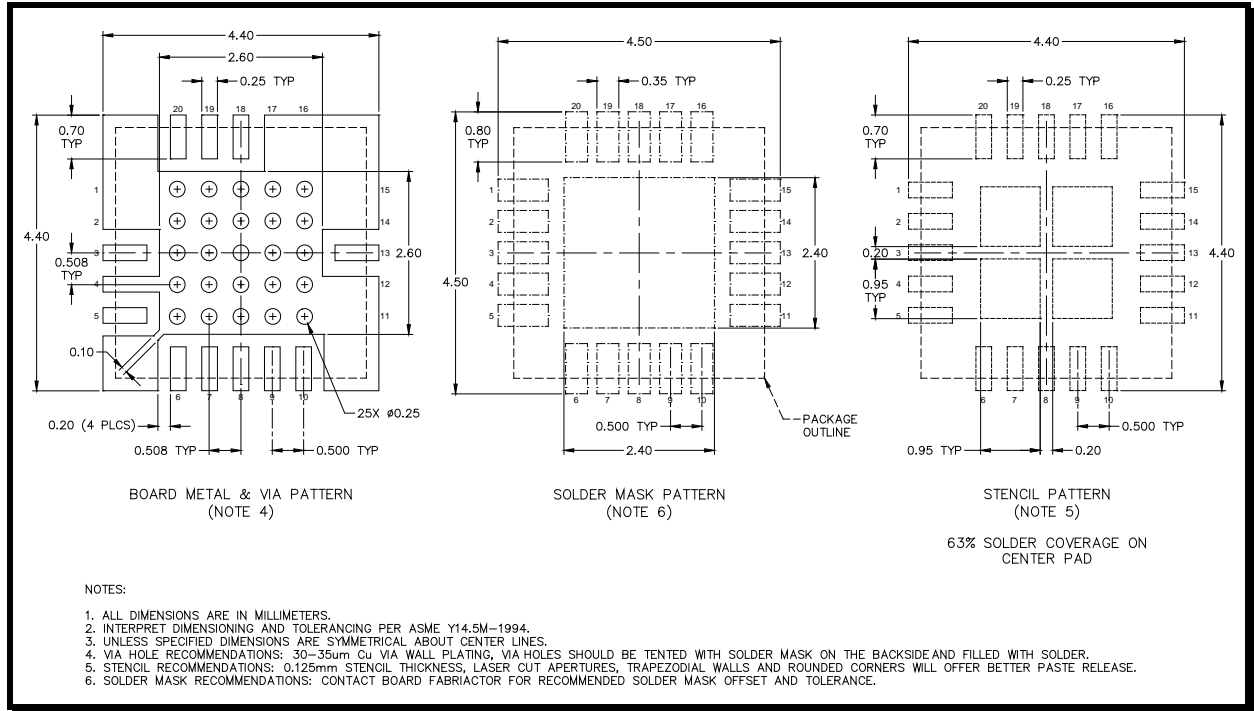


Figure 5: SE5003L Recommended Land Pattern

Package Handling Information

Because of its sensitivity to moisture absorption, instructions on the shipping container label must be followed regarding exposure to moisture after the container seal is broken, otherwise, problems related to moisture absorption may occur when the part is subjected to high temperature during solder assembly. The SE5003L is capable of withstanding a Pb free solder reflow. Care must be taken when attaching this product, whether it is done manually or in a production solder reflow environment. If the part is manually attached, precaution should be taken to insure that the device is not subjected to temperatures above its rated peak temperature for an extended period of time. For details on both attachment techniques, precautions, and handling procedures recommended, please refer to:

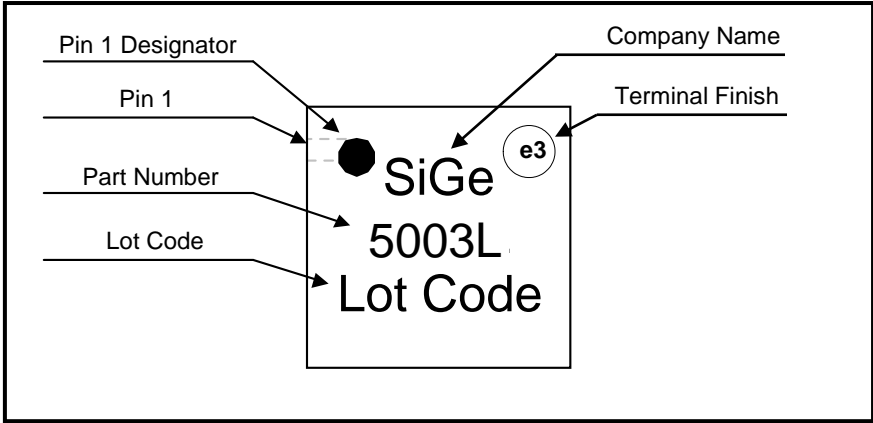
- "Quad Flat No-Lead Module Solder Reflow & Rework Information", Document Number QAD-00045
- "Handling, Packing, Shipping and Use of Moisture Sensitive QFN", Document Number QAD-00044



Caution! Class 1B ESD sensitive device

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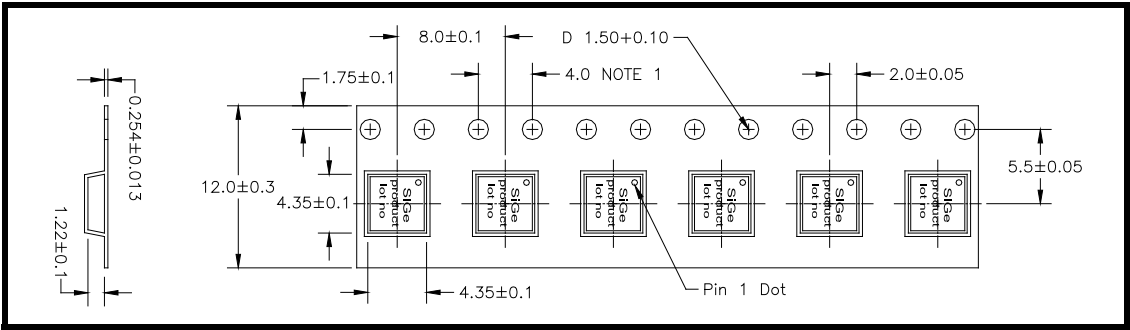
**Branding Information**



**Figure 6: SE5003L Branding Information**

**Tape and Reel Information**

| Parameter        | Value          |
|------------------|----------------|
| Devices Per Reel | 3000           |
| Reel Diameter    | 13 inches      |
| Tape Width       | 12 millimeters |



**Figure 7: SE5003L-R Tape and Reel Information**



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**Document Change History**

| Revision | Date         | Notes   |
|----------|--------------|---|
| 1.0      | Aug 18, 2009 | Created   |
| 1.1      | Jan 12, 2010 | Updated package pin out   |
| 1.2      | May 25, 2010 | Added Recommended Solder Land Pattern<br>Updated Power Detector Curve<br>Extend temperature range to -40 to +85   |
| 1.3      | Aug 20, 2010 | Updated IOFF Specification to 50uA max.<br>Updated Branding Information.  |
| 1.4      | Feb 25, 2011 | Updated Maximum Junction Temperature<br>Updated ESD rating<br>Updated Harmonic specifications<br>Added VREF min/max limits to recommended operating condition |
| 1.5      | Mar 28, 2012 | Updated with Skyworks logo and disclaimer statement   |
| 1.6      | Apr 12, 2012 | Remove "Preliminary" from header<br>Added min/max limits to Gain, P1dB, EVM, ICC  |
| 1.7      | May 31, 2012 | Updated ESD rating  |

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