

## 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.

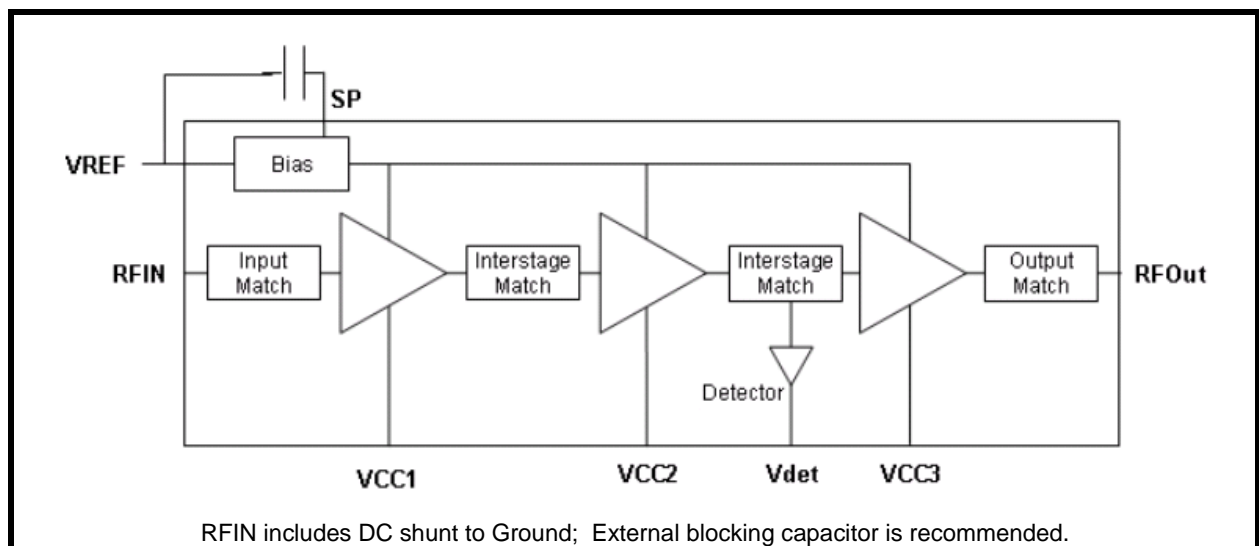
For wireless LAN applications, the device meets the requirements of IEEE802.11a & 802.11n, and delivers approximately 23dBm of linear output power at 5V.

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.

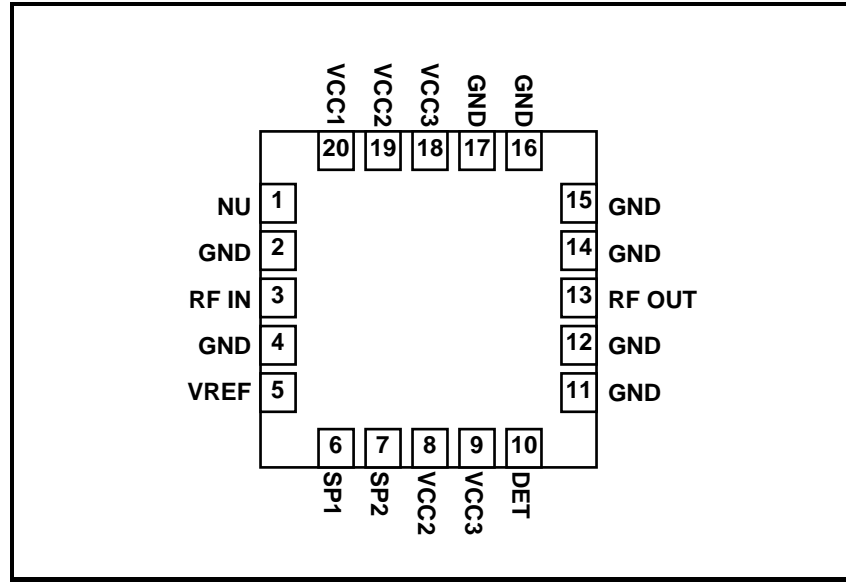
#### Ordering Information

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**
**SE5003L: 5 GHz, 23dBm Power Amplifier with Power Detector**
**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> = 85°C	-	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> Internal 2KΩ pull down resistor	-	10	-	mA
V <sub>REF H</sub>	Reference Voltage Enabled	-	2.8	2.85	2.9	V
V <sub>REF L</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**

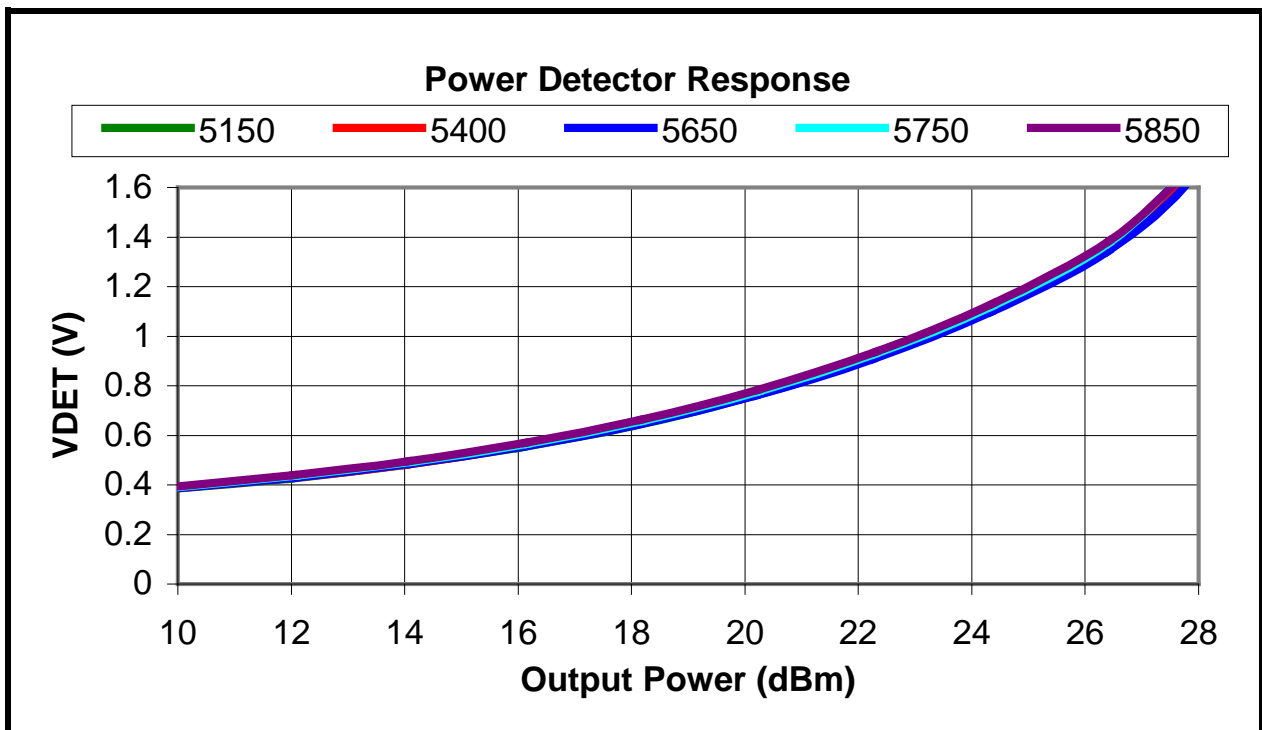
Conditions:  $V_{CC} = 5.0\text{ V}$ ,  $V_{REF} = 2.85\text{ V}$ ,  $f = 5.4\text{ GHz}$ ,  $T_A = 25\text{ }^{\circ}\text{C}$ , as measured on Skyworks' SE5003L-EK1 evaluation board, unless otherwise noted

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

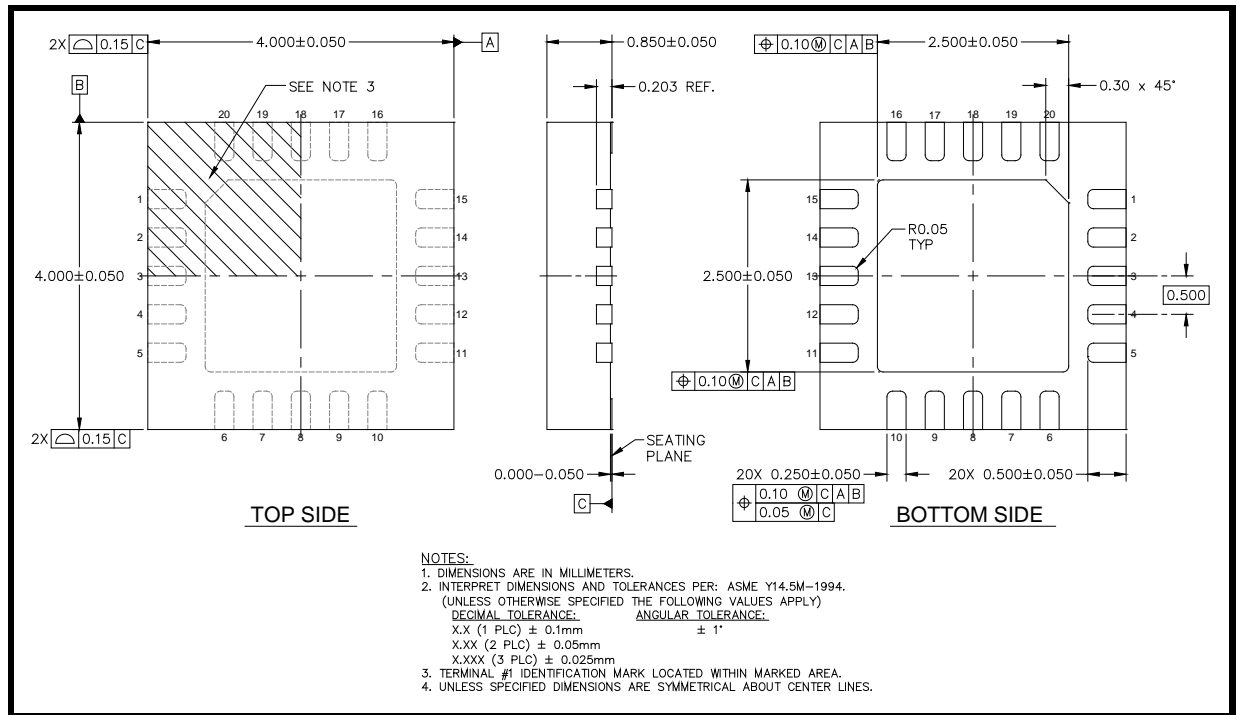
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
PDR	$P_{OUT}$ detect range	-	0	-	$P_{1dB}$	dBm
VDET	Detector voltage	$P_{OUT} = 23\text{ dBm}$	-	1.00	-	V
		$P_{OUT} = \text{NO RF}$	-	0.35	-	V
ERR <sub>DET</sub>	Detector Accuracy	$\Delta P_{OUT}$ at constant $V_{DET}$ , 5.15 GHz – 5.70 GHz	-0.5	-	+0.5	dB
		5.70 GHz – 5.85 GHz	-0.5	-	+0.5	dB
		$\Delta P_{OUT}$ at constant $V_{DET}$ , 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**  
**SE5003L: 5 GHz, 23dBm Power Amplifier with Power Detector**

**Package Diagram**



**Figure 4: SE5003L Package Information**

## DATA SHEET

### SE5003L: 5 GHz, 23dBm Power Amplifier with Power Detector

#### Recommended Land and Solder Pattern

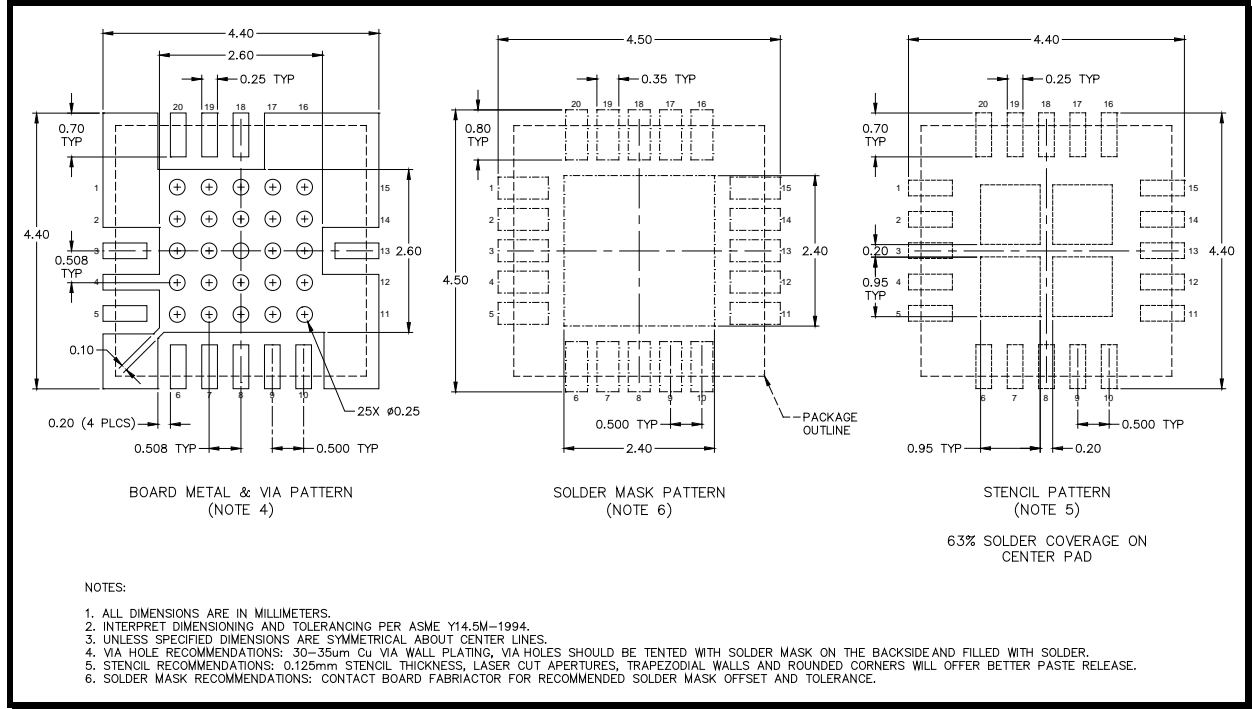


Figure 5: SE5003L Recommended Land Pattern

#### 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:

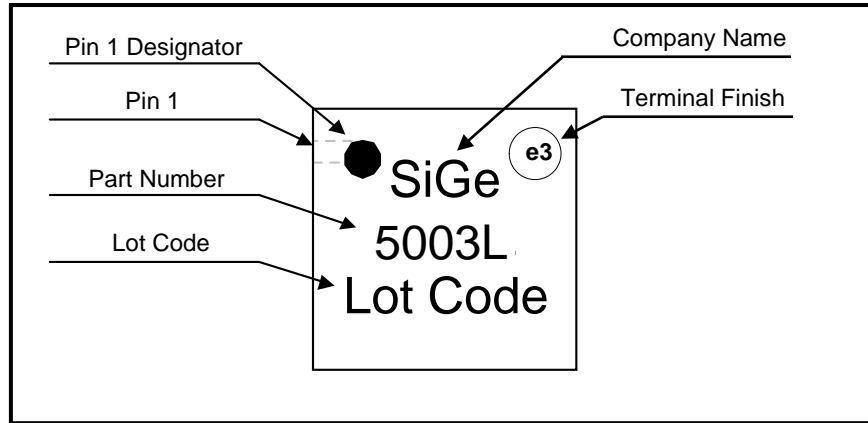
- "Quad Flat No-Lead Module Solder Reflow & Rework Information", *Document Number QAD-00045*
- "Handling, Packing, Shipping and Use of Moisture Sensitive QFN", *Document Number QAD-00044*



Caution! Class 1B ESD sensitive device

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

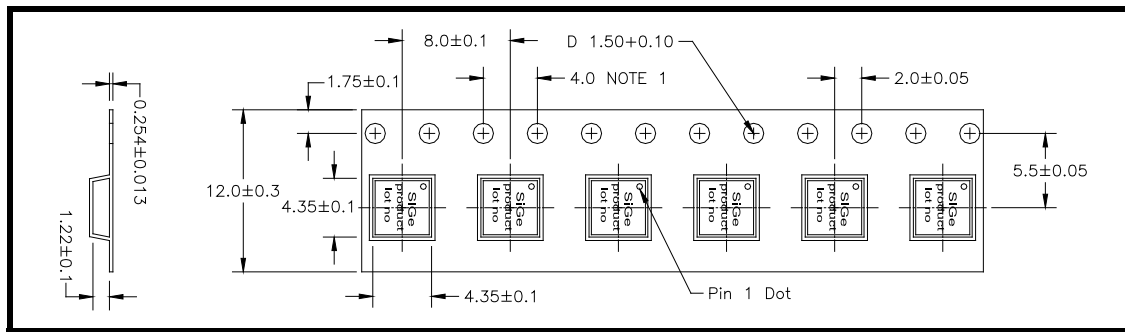
**Branding Information**



**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**



**DATA SHEET**  
**SE5003L: 5 GHz, 23dBm Power Amplifier with Power Detector**
**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 Updated Power Detector Curve Extend temperature range to -40 to +85
1.3	Aug 20, 2010	Updated IOFF Specification to 50uA max. Updated Branding Information.
1.4	Feb 25, 2011	Updated Maximum Junction Temperature Updated ESD rating Updated Harmonic specifications 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 Added min/max limits to Gain, P1dB, EVM, ICC
1.7	May 31, 2012	Updated ESD rating

Copyright © 2012 Skyworks Solutions, Inc. All Rights Reserved.

Information in this document is provided in connection with Skyworks Solutions, Inc. ("Skyworks") products or services. These materials, including the information contained herein, are provided by Skyworks as a service to its customers and may be used for informational purposes only by the customer. Skyworks assumes no responsibility for errors or omissions in these materials or the information contained herein. Skyworks may change its documentation, products, services, specifications or product descriptions at any time, without notice. Skyworks makes no commitment to update the materials or information and shall have no responsibility whatsoever for conflicts, incompatibilities, or other difficulties arising from any future changes.

No license, whether express, implied, by estoppel or otherwise, is granted to any intellectual property rights by this document. Skyworks assumes no liability for any materials, products or information provided hereunder, including the sale, distribution, reproduction or use of Skyworks products, information or materials, except as may be provided in Skyworks Terms and Conditions of Sale.

THE MATERIALS, PRODUCTS AND INFORMATION ARE PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND, WHETHER EXPRESS, IMPLIED, STATUTORY, OR OTHERWISE, INCLUDING FITNESS FOR A PARTICULAR PURPOSE OR USE, MERCHANTABILITY, PERFORMANCE, QUALITY OR NON-INFRINGEMENT OF ANY INTELLECTUAL PROPERTY RIGHT; ALL SUCH WARRANTIES ARE HEREBY EXPRESSLY DISCLAIMED. SKYWORKS DOES NOT WARRANT THE ACCURACY OR COMPLETENESS OF THE INFORMATION, TEXT, GRAPHICS OR OTHER ITEMS CONTAINED WITHIN THESE MATERIALS. SKYWORKS SHALL NOT BE LIABLE FOR ANY DAMAGES, INCLUDING BUT NOT LIMITED TO ANY SPECIAL, INDIRECT, INCIDENTAL, STATUTORY, OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION, LOST REVENUES OR LOST PROFITS THAT MAY RESULT FROM THE USE OF THE MATERIALS OR INFORMATION, WHETHER OR NOT THE RECIPIENT OF MATERIALS HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

Skyworks products are not intended for use in medical, lifesaving or life-sustaining applications, or other equipment in which the failure of the Skyworks products could lead to personal injury, death, physical or environmental damage. Skyworks customers using or selling Skyworks products for use in such applications do so at their own risk and agree to fully indemnify Skyworks for any damages resulting from such improper use or sale.

Customers are responsible for their products and applications using Skyworks products, which may deviate from published specifications as a result of design defects, errors, or operation of products outside of published parameters or design specifications. Customers should include design and operating safeguards to minimize these and other risks. Skyworks assumes no liability for applications assistance, customer product design, or damage to any equipment resulting from the use of Skyworks products outside of stated published specifications or parameters.

Skyworks, the Skyworks symbol, and "Breakthrough Simplicity" are trademarks or registered trademarks of Skyworks Solutions, Inc., in the United States and other countries. Third-party brands and names are for identification purposes only, and are the property of their respective owners. Additional information, including relevant terms and conditions, posted at [www.skyworksinc.com](http://www.skyworksinc.com), are incorporated by reference.