DATA SHEET
SE5022T: 5 GHz Power Amplifier with Power Detector

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Applications

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

Features

- 5GHz Matched 16dBm 802.11ac Power Amplifier
- Integrated power amplifier enable pin (V_{EN})
- Buffered, temperature compensated power detector
- High Low Linearity Mode
- 1.8% EVM, @15dBm, 256 QAM, 802.11ac
  3% EVM, @18dBm, 64 QAM, 802.11n
- 30 dB Typical Gain
- Lead Free and RoHS compliant, halogen free package
- 16 pin 3 mm x 3 mm x 0.6 mm QFN, MSL 3

Product Description

The SE5022T is a 5GHz Power amplifier offering high linear power for wireless LAN applications.

The SE5022T offers a high level of integration for a simplified design, providing quicker time to market and higher application board production yield. The device integrates all matching elements, a temperature compensated, load insensitive power detector with 20dB of dynamic range, and a 3.8GHz notch filter.

For wireless LAN applications, the device meets the requirements of IEEE802.11ac and delivers approximately 16dBm of linear output power . It also features a linearity mode-control function to reduce current consumption at low power.

The SE5022T integrates the reference voltage generator, allowing for a true CMOS compatible digital EN (enable) function to turn the power amplifier on and off.

Ordering Information

Part Number	Package	Remark
SE5022T	16 Pin QFN	Samples
SE5022T-R	16 Pin QFN	Tape and Reel
SE5022T-EK1	Evaluation Kit	Standard

Functional Block Diagram

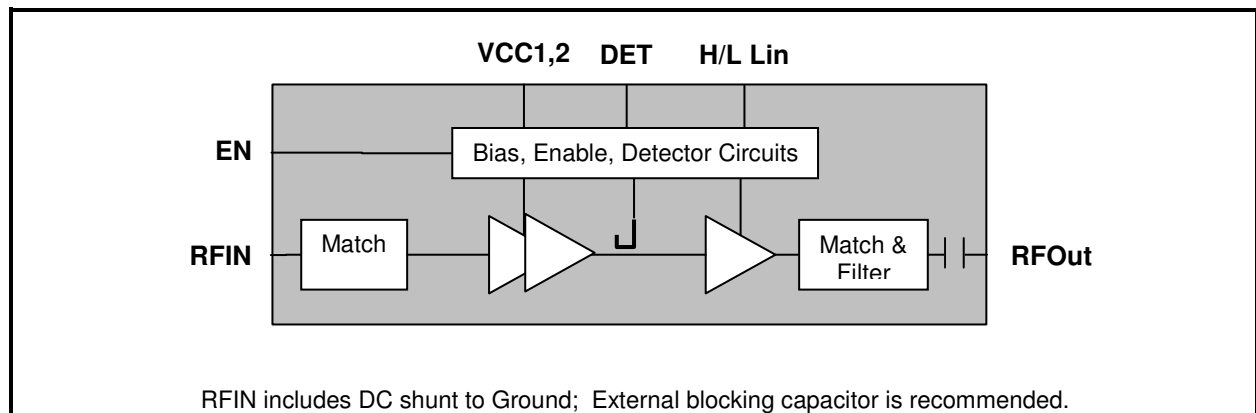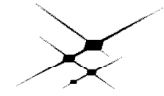**Figure 1: Functional Block Diagram**

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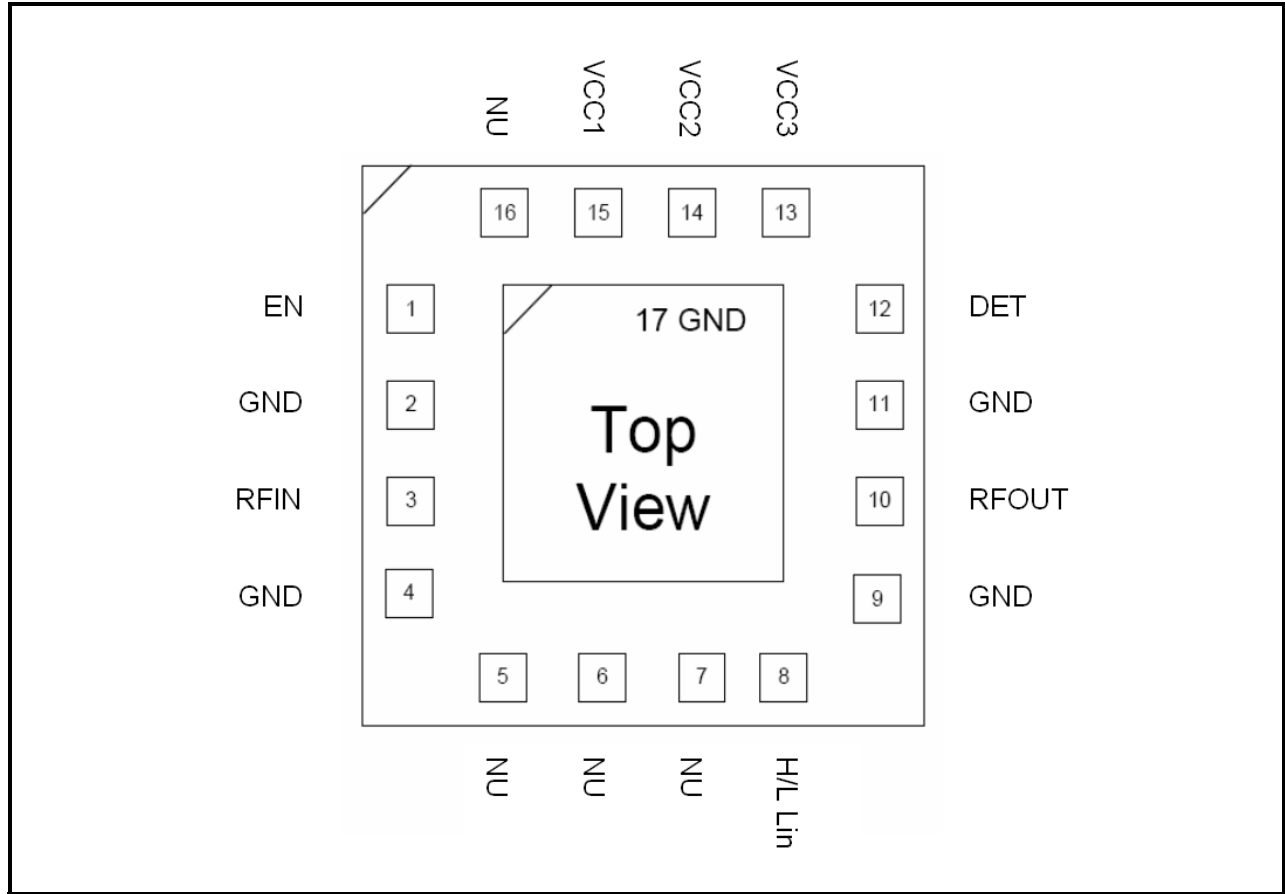
Pin Out Diagram

Figure 2: SE5022T Pin-Out Diagram

Pin Out Description

Pin No.	Name	Description
1	EN	PA Enable
2	GND	Ground
3	RFIN	TX RF Input Signal
4	GND	Ground
5	NU	Pin not connected
6	NU	Pin not connected
7	NU	Pin not connected
8	H/L Lin	High-Low linearity Control

Pin No.	Name	Description
9	GND	Ground
10	RFOUT	5GHz Antenna output
11	GND	Ground
12	DET	Power Detector Output
13	VCC3	Power Stage Supply Voltage
14	VCC2	Driver Stage Supply Voltage
15	VCC1	Pre-driver Stage & Logic Supply Voltage
16	NU	Pin not connected
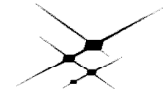
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Absolute Maximum Ratings

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_{CC}	Supply Voltage on pins VCC1, VCC2, VCC3	-0.3	3.6	V
EN	DC input on Enable	-0.3	3.6	V
RFIN	RF Input Power, RFout into 50Ω match	-	12	dBm
T_{STG}	Storage Temperature Range	-40	150	℃
ESD $_{HBM}$	JEDEC JESD22-A114 all pins	-	500	V

Recommended Operating Conditions

Symbol	Parameter	Min.	Max.	Unit
V_{CC}	Supply Voltage on pins VCC1, VCC2, VCC3	3.0	3.6	V
T_A	Ambient Temperature	-40	85	℃

Control Logic Characteristics

Conditions: $V_{CC} = V_{EN} = 3.3$ V, $T_A = 25$ ℃, as measured on SiGe Semiconductor's SE5022T-EK1 evaluation board, unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$I_{CC-802.11a}$	Supply Current	P_{OUT} = 18 dBm, 54 Mbps, 64 QAM, H/L Lin = 3.3V	-	195	-	mA
		P_{OUT} = 16 dBm, 256 QAM, H/L Lin = 3.3 V	-	175	-	
		P_{OUT} = 5 dBm, 54 Mbps, 64 QAM, H/L Lin = 0V (Low Linearity Mode)	-	108	-	
I_{OFF}	Supply Current	V_{EN} = 0 V, No RF	-	0.5	10	μA
V_{ENH}	Logic High Voltage	-	1.6	-	Vcc	V
V_{ENL}	Logic Low Voltage	-	-0.3	-	0.3	V
I_{ENH}	Input Current Logic High Voltage	-	-	-	400	μA
I_{ENL}	Input Current Logic Low Voltage	-	-	<1	-	μA
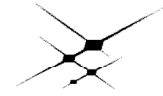
AC Electrical Characteristics

Transmit Characteristics

Conditions: V_{CC} = V_{EN} = H/L Lin = 3.3V, T_A = 25 °C, as measured on SiGe Semiconductor's SE5022T-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	802.11ac, MCS-9, HT80, 1.8% EVM	-	14	-	dBm
		802.11ac, MCS-9, HT40, 1.8% EVM	-	15	-	
		802.11ac, MCS-9, HT20, 1.8% EVM	-	16	-	
		802.11a/n, MCS-7, HT20, 3% EVM	-	18	-	
		802.11n, MCS0, Mask Compliant	-	18	-	
P_{1dB}	Output 1dB compression point	No modulation	-	25	-	dBm
S_{11}	Input Return Loss	P_{IN} = -25 dBm	10	14	-	dB
S_{21}	Small Signal Gain	P_{IN} = -25 dBm	-	32	-	dB
ΔS_{21}	Gain Variation	Within any single 80MHz channel	-	-	$\pm$0.5	dB
		Over Entire Band	-1.5	-	+1.5	
$S_{21\,3.8}$	Gain at 3.8GHz	P_{IN} = -25 dBm	-	-	0	dB
2f	Harmonic	P_{OUT} = 21 dBm	-	-50	-45	dBm/MHz
3f						
t_r, t_f	Rise and Fall Time	-	-	0.5	0.3	us
STAB	Stability	P_{OUT} = 18 dBm, 54 Mbps, 64 QAM, VSWR = 6:1, all phases	All non-harmonically related outputs less than -50 dBc/100 kHz			
Rugged-ness	Tolerance to constant input power into a mismatch load	P_{IN} = +10dBm, CW, VSWR = 6:1, all phases	No damage			
Robust-ness	Tolerance to input power					

Skyworks Solutions, Inc. ● Phone [781] 376-3000 ● Fax [781] 376-3100 ● sales@skyworksinc.com ● www.skyworksinc.com

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Power Detector Characteristics

Conditions: $V_{CC} = V_{EN} = 3.3V$, f = 5.4 GHz, T_A = 25 °C, as measured on SiGe Semiconductor's SE5022T-EK1 evaluation board, unless otherwise noted

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
PDR	P_{OUT} detect range	-	0	-	P_{1dB}	dBm
$VDET_{22}$	Detector voltage	P_{OUT} = 22 dBm	0.80	-	1.0	V
$VDET_{16}$	Detector voltage	P_{OUT} = 16 dBm	0.55	-	0.60	V
$VDET_2$	Detector voltage	P_{OUT} = 2 dBm	0.25	-	0.35	V
PDZ_{OUT}	Output Impedance	-	-	5	-	KΩ
LPF_{-3dB}	Power detector low pass filter - 3dB corner frequency	Measured into 26.5 KΩ	-	5	-	MHz
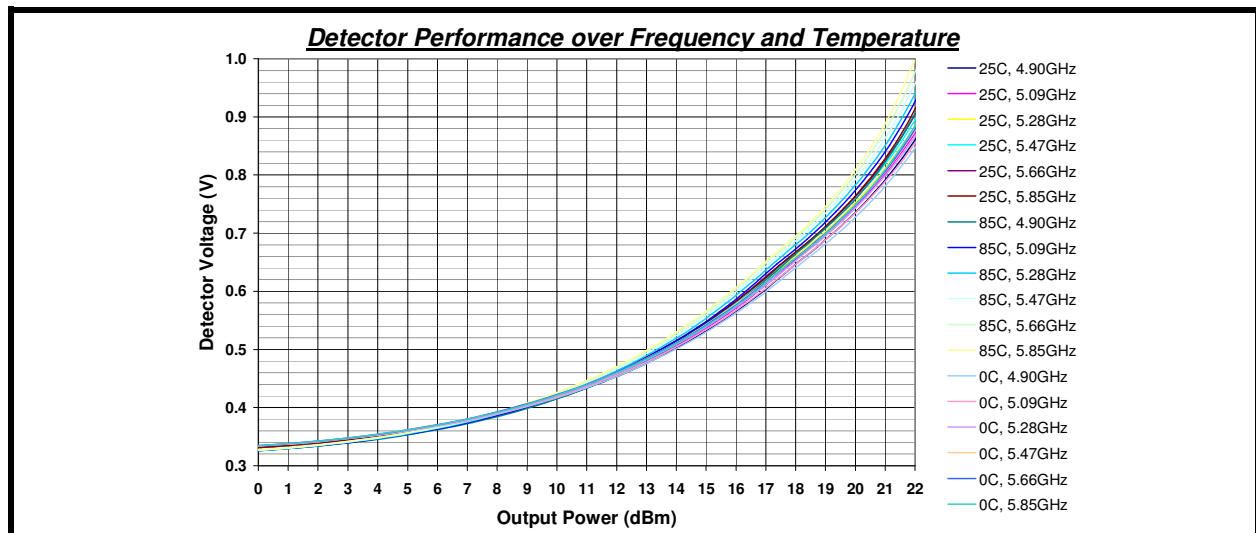
Figure 3: SE5022T Power Detector Sweep over Temperature & Frequency
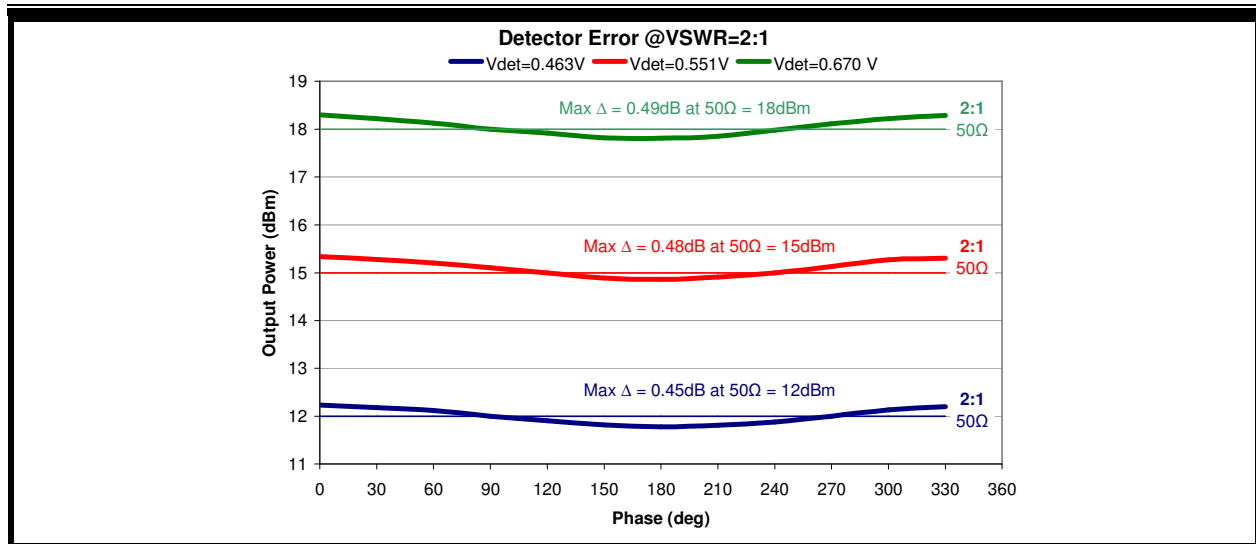
Figure 4: SE5022T Power Detector Accuracy at 2:1 Mismatch

Package Diagram

This package is Pb free and RoHS compliant. The product is rated MSL1.
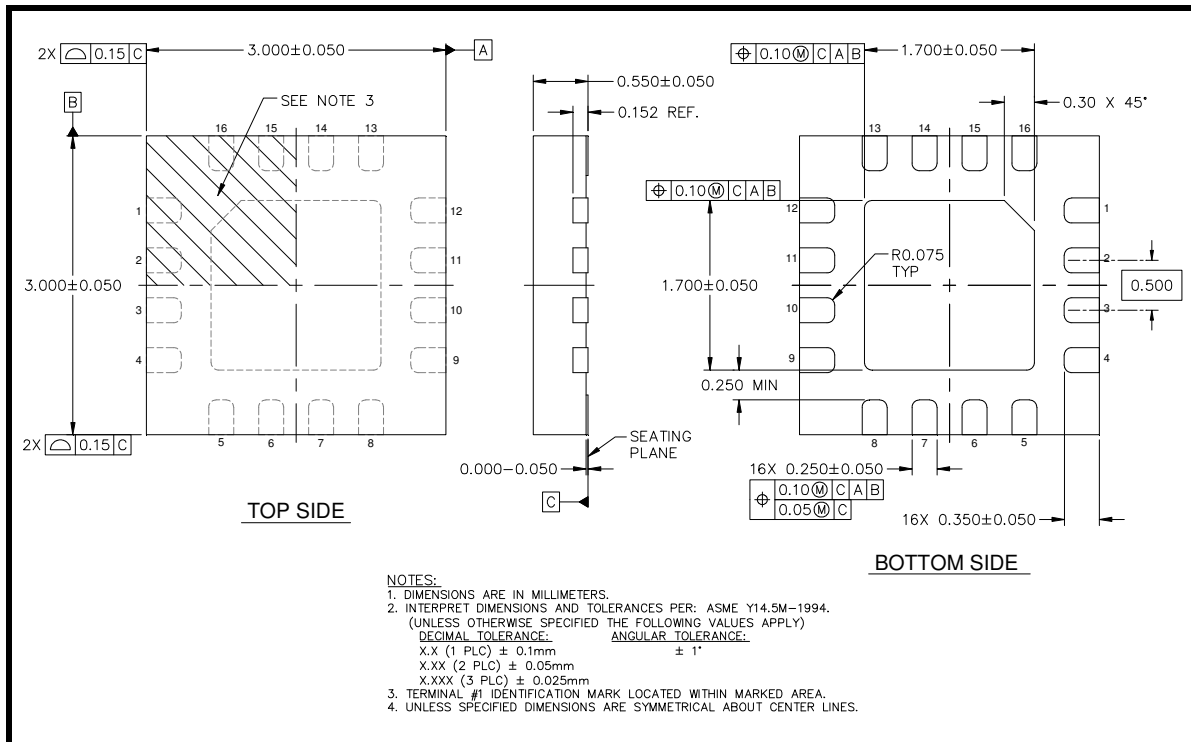
Figure 4: SE5022T Package Diagram

Recommended Land and Solder Patterns

PCB METAL & VIA HOLE
TOP (X-Ray) VIEW

PCB SOLDER MASK
TOP (X-Ray) VIEW

PCB SOLDER STENCIL
TOP (X-Ray) VIEW

PERIPHERAL PAD PATTERN DETAIL
(TYP 16 PLCS)

0.350 (SOLDER MASK)
0.600 (SOLDER MASK)
0.500 (PCB METAL)
0.250 (PCB METAL)
0.500 (SOLDER STENCIL) (SAME AS PCB METAL)
0.250 (SOLDER STENCIL) (SAME AS PCB METAL)

GENERAL NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. DIMENSIONING AND TOLERANCES CONFORM TO ASME Y14.5M-1994.
   (UNLESS OTHERWISE SPECIFIED THE FOLLOWING VALUES APPLY)
   DECIMAL TOLERANCE: ANGULAR TOLERANCE:
   X.X (1 PLC) ± 0.1mm   ± 1°
   X.XX (2 PLC) ± 0.05mm
   X.XXX (3 PLC) ± 0.025mm
3. UNLESS SPECIFIED DIMENSIONS ARE SYMMETRICAL ABOUT CENTER LINES.

RECOMMENDED FOOTPRINT NOTES:
4. VIA HOLE INFORMATION:
   4a. RECOMMENDED VIA HOLE SIZE (Ø): 0.150 - 0.300mm
   4b. RECOMMENDED VIA HOLE PITCH: AS SHOWN
   4c. RECOMMENDED VIA WALL Cu PLATING: 30-35um
   4d. RECOMMENDED THAT VIAS BE TENTED WITH SOLDERMASK ON PCB BACKSIDE AND FILLED WITH SOLDER.
   4e. TOTAL VIA COUNT AS SHOWN: 5.
5. SOLDER MASK GEOMETRY FEATURES:
   5a. ALL PERIPHERAL PCB PADS ARE NON-SOLDER MASK DEFINED.
   5b. ALL GROUND PADDLE FEATURES ARE SOLDER MASK DEFINED.
6. SOLDER STENCIL APERTURE FEATURES:
   6a. SOLDER STENCIL APERATURE OPENINGS ARE 1:1 WITH PERIPHERAL PCB METAL PADS.
   6b. RECOMMENDED SOLDER STENCIL APERTURE ARRAY TO TARGET APPROXIMATELY 50 - 80% COVERAGE OF SOLDER MASK OPENINGS, EXCEPT AS NOTED.
7. RECOMMENDED SOLDER STENCIL THICKNESS: 5.0mils (0.127mm).
8. PCB ACAD AND GERBER FILES AVAILABLE UPON REQUEST.

Figure 5: SE5022T Recommended Land and Solder 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 SE5022T 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 by SiGe, please refer to:

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

⚠ Caution! Class 1C ESD sensitive device

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Branding Information
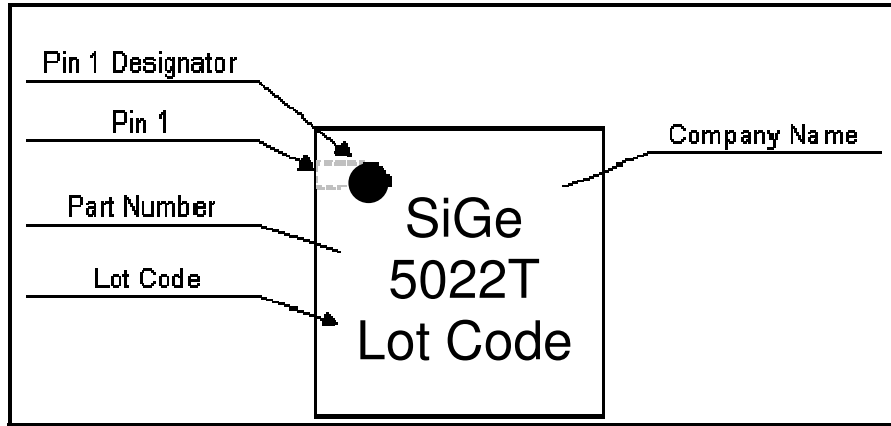
Figure 7: SE5022T Branding

Tape and Reel Information

Parameter	Value
Devices Per Reel	3000
Reel Diameter	13 inches
Tape Width	12 millimeters
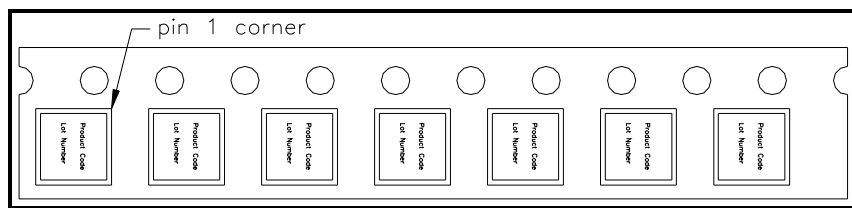
Figure 8: SE5022T-R Tape and Reel Information
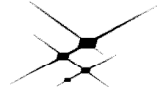
Document Change History

Revision	Date	Notes
1.0	Sep 12, 2011	Created
1.1	Dec 9, 2011	Updated EVM data

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Document Change History

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1.0	Sep 12, 2011	Created
1.1	Dec 9, 2011	Updated EVM data
1.2	Jul 05, 2012	Updated with Skyworks logo and disclaimer