



DATA SHEET

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SE5022T: 5 GHz Power Amplifier with Power Detector

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

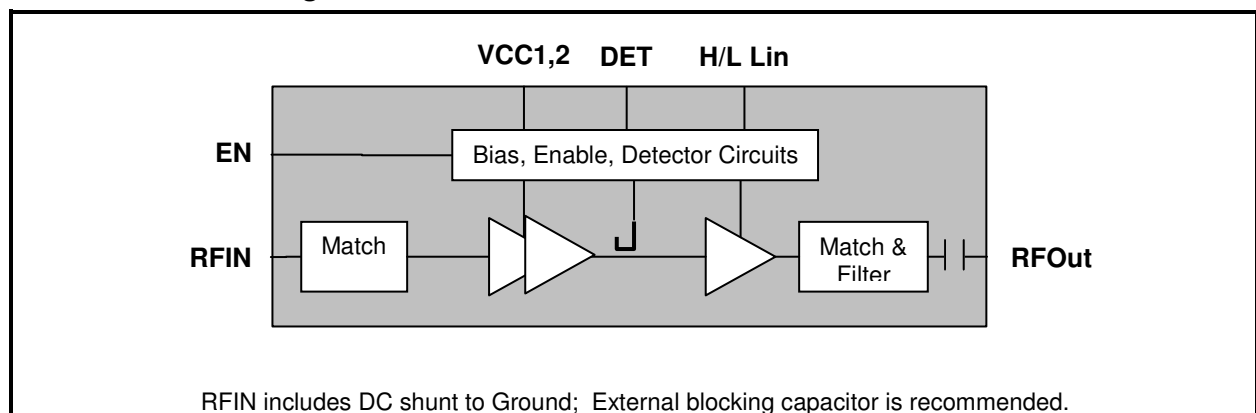
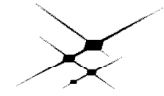


Figure 1: Functional Block Diagram



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Pin Out Diagram

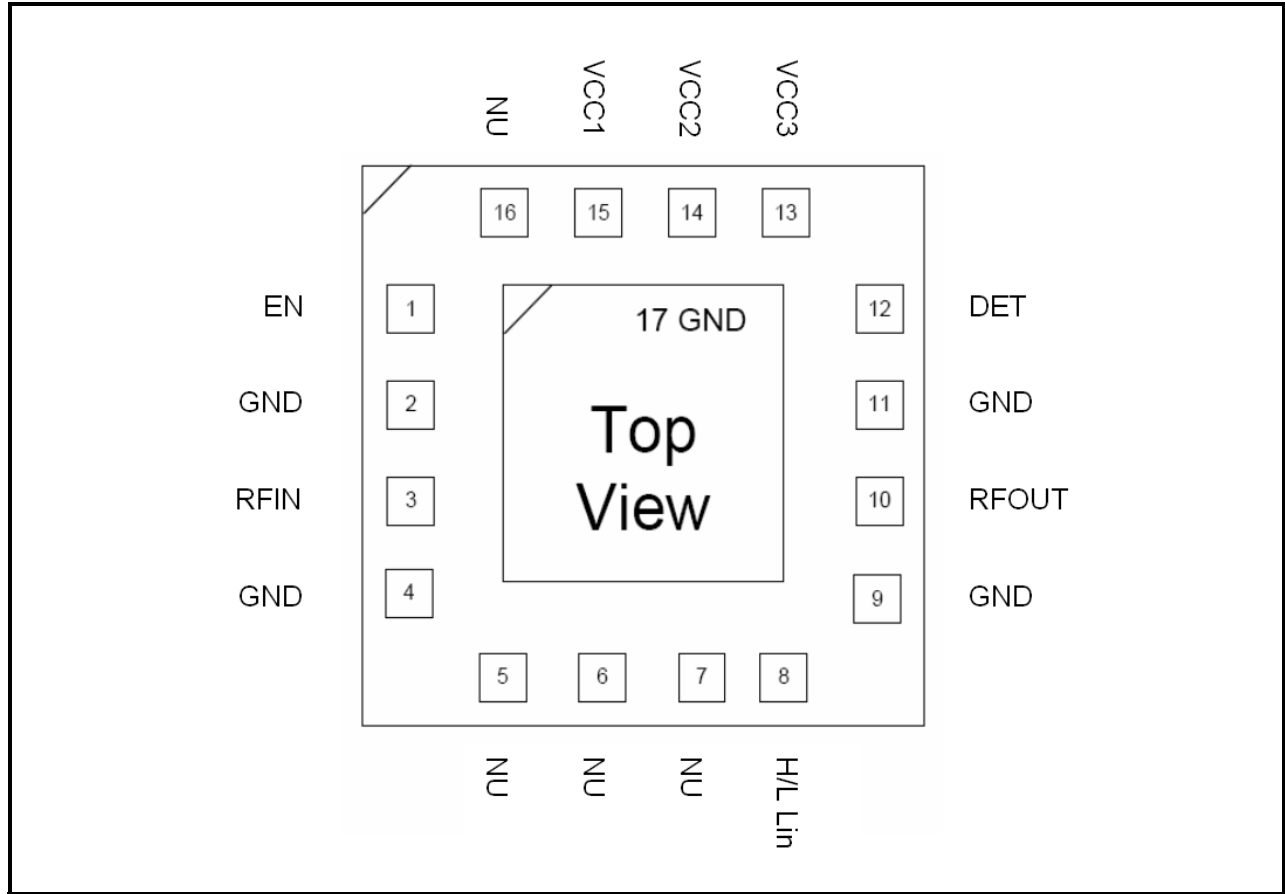
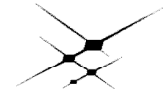


Figure 2: SE5022T Pin-Out Diagram

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 |



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 _{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 | °C |
| ESD _{HBM} | JEDEC JESD22-A114 all pins | - | 500 | V |

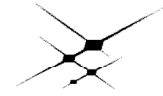
Recommended Operating Conditions

| 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 | °C |

Control Logic Characteristics

Conditions: V_{CC} = V_{EN} = 3.3 V, T_A = 25 °C, 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 | - | V _{CC} | 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 |



DATA SHEET

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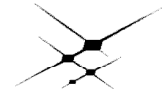
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AC Electrical Characteristics

Transmit Characteristics

Conditions: $V_{CC} = V_{EN} = H/L \text{ Lin} = 3.3V$, $T_A = 25^\circ\text{C}$, 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 | $P_{IN} = -25 \text{ dBm}$ | 10 | 14 | - | dB |
| S_{21} | Small Signal Gain | $P_{IN} = -25 \text{ dBm}$ | - | 32 | - | dB |
| ΔS_{21} | Gain Variation | Within any single 80MHz channel | - | - | ± 0.5 | dB |
| | | Over Entire Band | -1.5 | - | +1.5 | |
| $S_{21 \text{ 3.8}}$ | Gain at 3.8GHz | $P_{IN} = -25 \text{ dBm}$ | - | - | 0 | dB |
| 2f | Harmonic | $P_{OUT} = 21 \text{ dBm}$ | - | -50 | -45 | dBm/MHz |
| 3f | | | | | | |
| t_r, t_f | Rise and Fall Time | - | - | 0.5 | 0.3 | us |
| STAB | Stability | $P_{OUT} = 18 \text{ dBm}$, 54 Mbps, 64 QAM, VSWR = 6:1, all phases | All non-harmonically related outputs less than -50 dBc/100 kHz | | | |
| Ruggedness | Tolerance to constant input power into a mismatch load | $P_{IN} = +10 \text{ dBm}$, CW, VSWR = 6:1, all phases | No damage | | | |
| Robustness | Tolerance to input power | | | | | |



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Power Detector Characteristics

Conditions: $V_{CC} = V_{EN} = 3.3V$, $f = 5.4 \text{ GHz}$, $T_A = 25 \text{ }^\circ\text{C}$, 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 | $P_{OUT} = 22 \text{ dBm}$ | 0.80 | - | 1.0 | V |
| VDET ₁₆ | Detector voltage | $P_{OUT} = 16 \text{ dBm}$ | 0.55 | - | 0.60 | V |
| VDET ₂ | Detector voltage | $P_{OUT} = 2 \text{ dBm}$ | 0.25 | - | 0.35 | V |
| PDZ _{OUT} | Output Impedance | - | - | 5 | - | K Ω |
| LPF _{-3dB} | Power detector low pass filter - 3dB corner frequency | Measured into 26.5 K Ω | - | 5 | - | MHz |

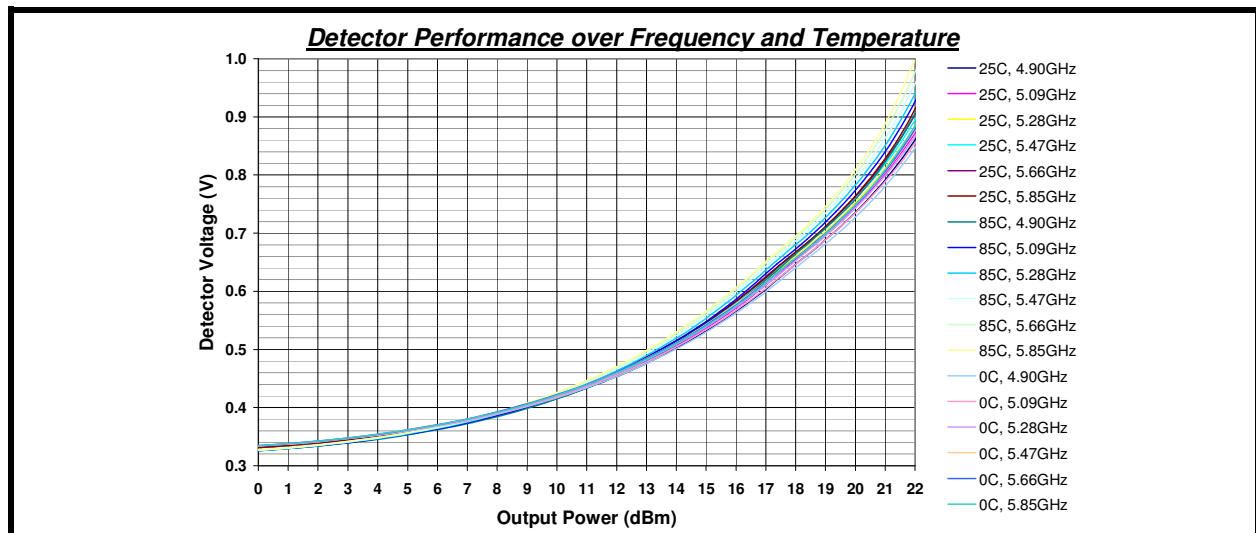


Figure 3: SE5022T Power Detector Sweep over Temperature & Frequency

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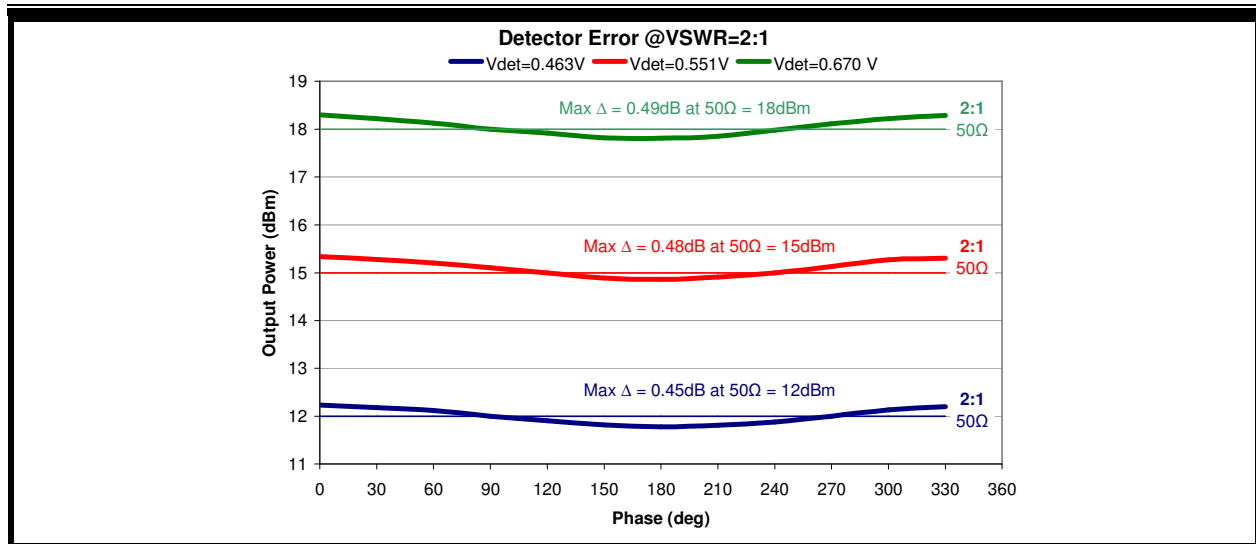


Figure 4: SE5022T Power Detector Accuracy at 2:1 Mismatch

Package Diagram

This package is Pb free and RoHS compliant. The product is rated MSL1.

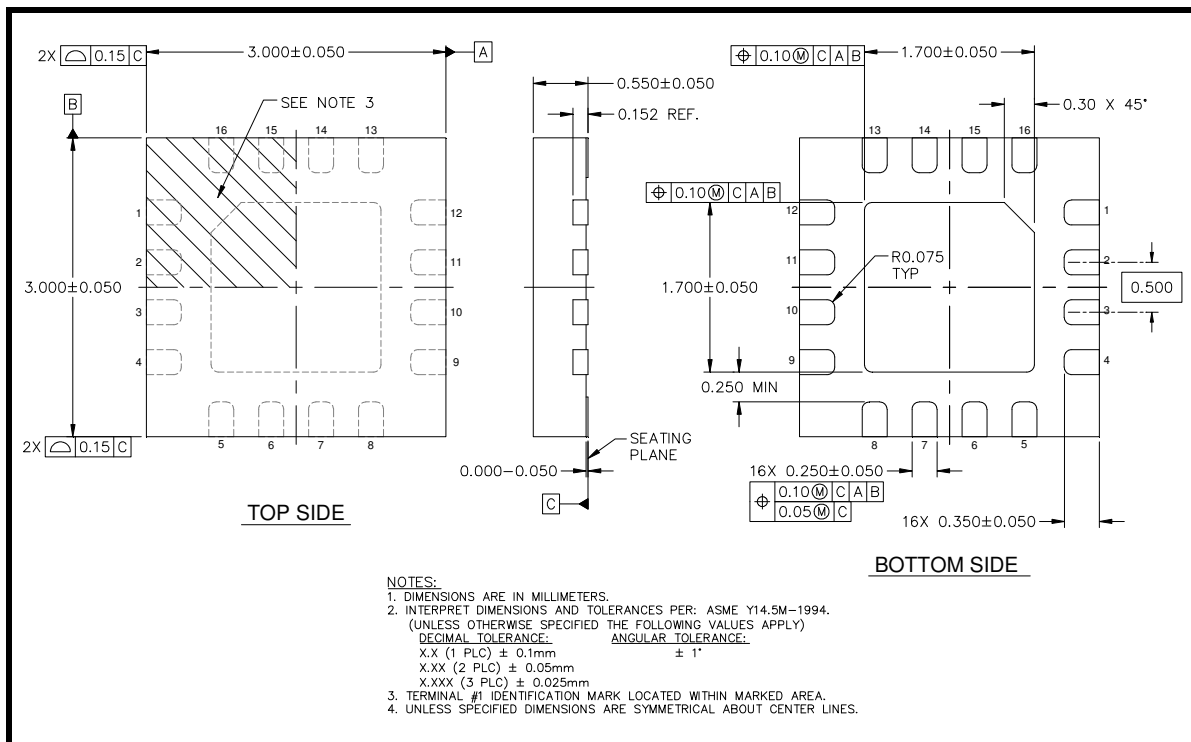


Figure 4: SE5022T Package Diagram

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Recommended Land and Solder Patterns

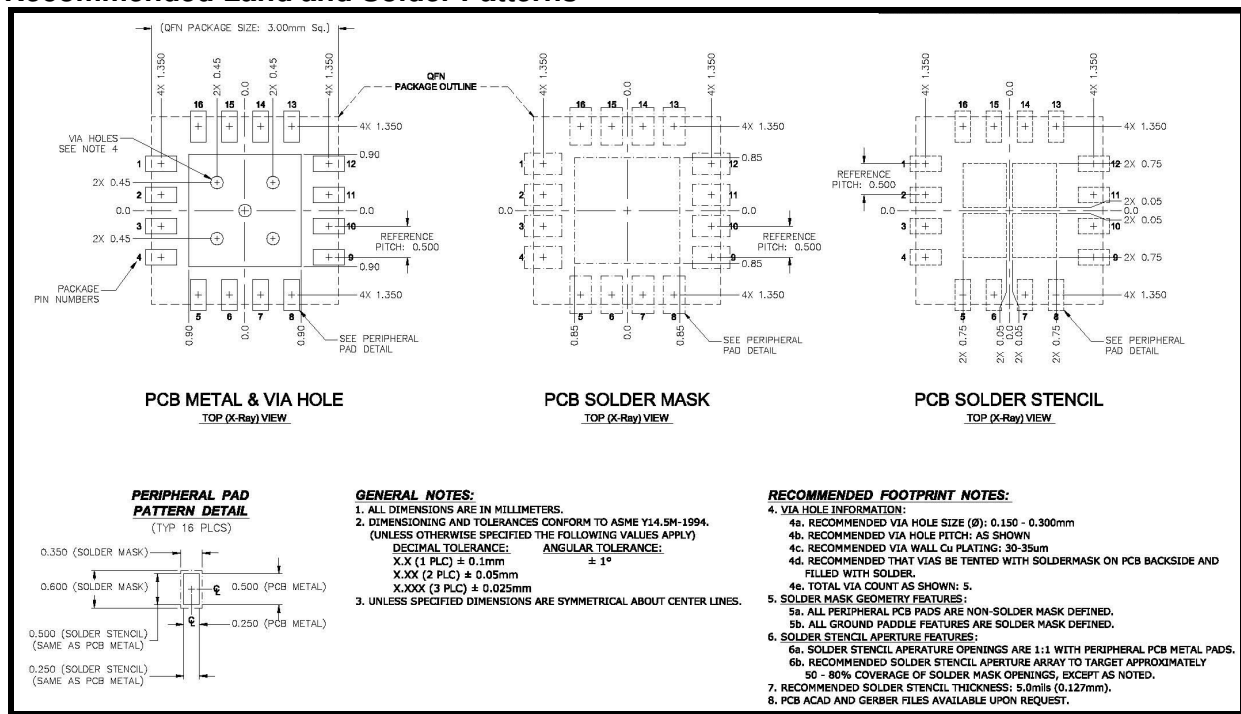


Figure 5: SE5022T Recommended Land and Solder Pattern

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

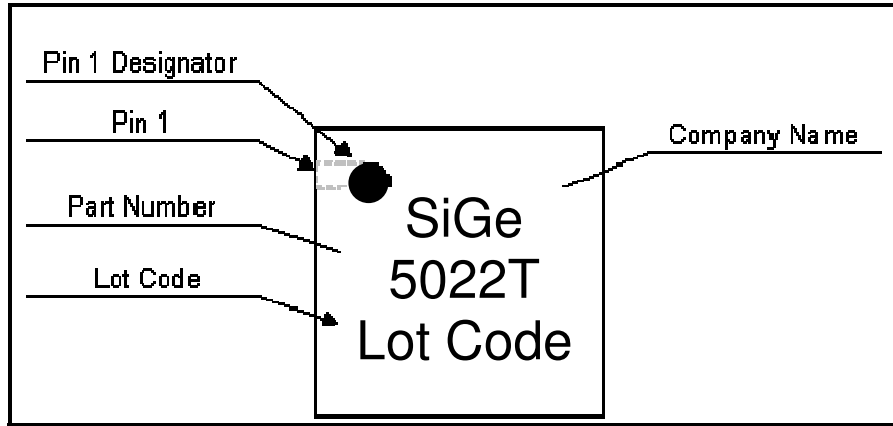


Figure 7: SE5022T Branding

Tape and Reel Information

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

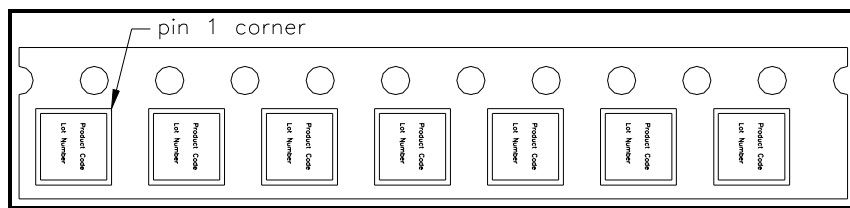
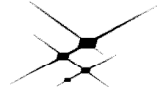


Figure 8: SE5022T-R Tape and Reel Information



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DATA SHEET

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Document Change History

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

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| 1.2 | Jul 05, 2012 | Updated with Skyworks logo and disclaimer |

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