Applications

- IEEE802.11b DSSS WLAN
- IEEE802.11g,n OFDM WLAN
- Access Points, PCMCIA, PC cards

Features

- Dual Mode IEEE802.11b, IEEE802.11g, IEEE802.11n
- Integrated PA, TX Filter, Diversity switch
- Integrated Positive Slope Power Detector
- 20 dBm Output Power, 802.11b, 11 Mbps
- 17 dBm @ 3.0 % EVM, 802.11g, 3.3V
- Lead free, halogen free and RoHS compliant
- Small plated package, 3 mm x 4 mm x 0.9 mm, MSL 1

Product Description

The SE2603L is a complete 802.11bgn WLAN RF front-end module providing all the functionality of the power amplifier, power detector, diversity switch and 50 ohm matching on all RF ports in an ultra compact form factor.

The SE2603L is designed for ease of use, with all the critical matching and harmonic filtering and integrated transmit/receive DPDT switch providing a 50 Ω interface to the antenna. The SE2603L also includes a transmitter power detector with 20 dB of dynamic range and a digital enable control for transmitter power ramp on/off control. The power ramp rise/fall time is 0.5 µs typical.

Ordering Information

Part No.	Package	Remark
SE2603L	24 pin QFN	Samples
SE2603L-R	24 pin QFN	Tape & Reel
SE2603L-EK1	N/A	Evaluation kit

Functional Block Diagram

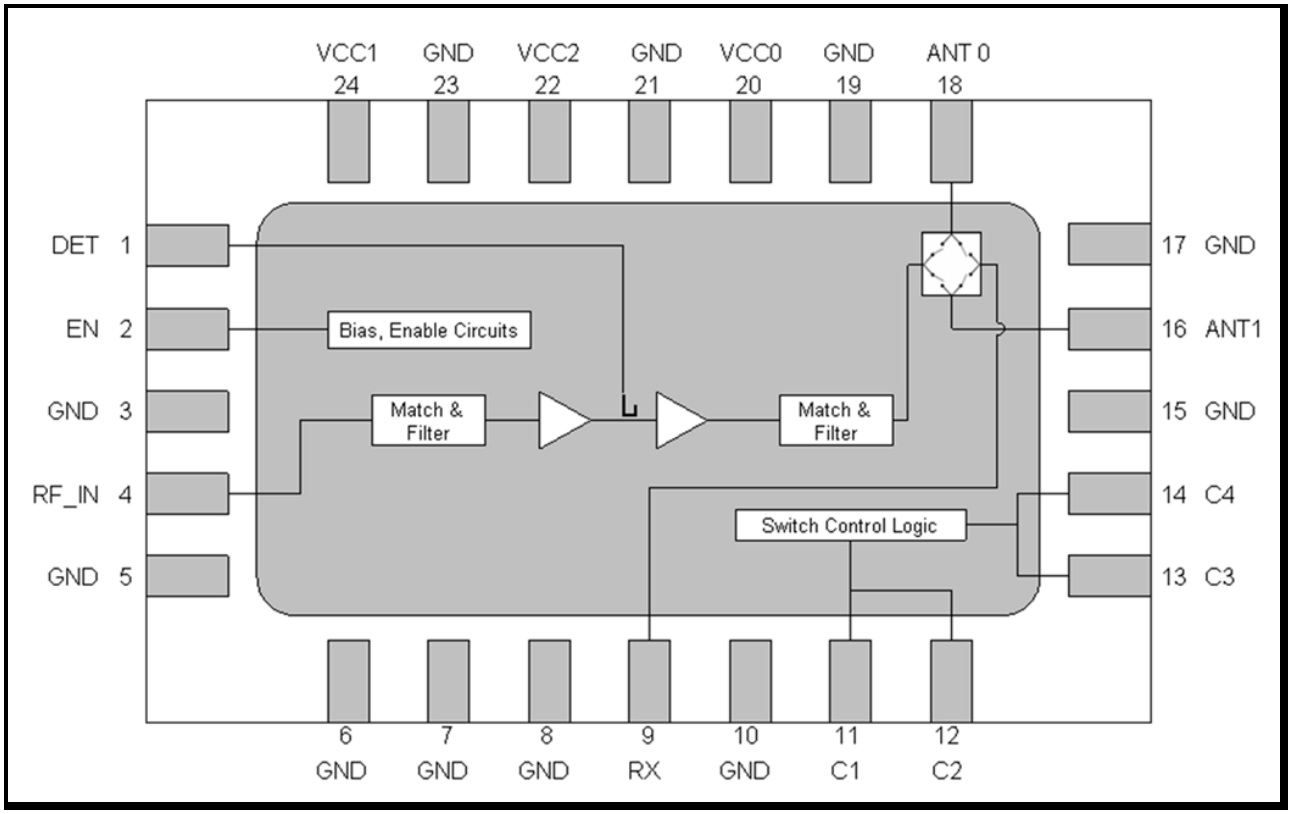

Figure 1: Functional Block Diagram

Pin Out Diagram

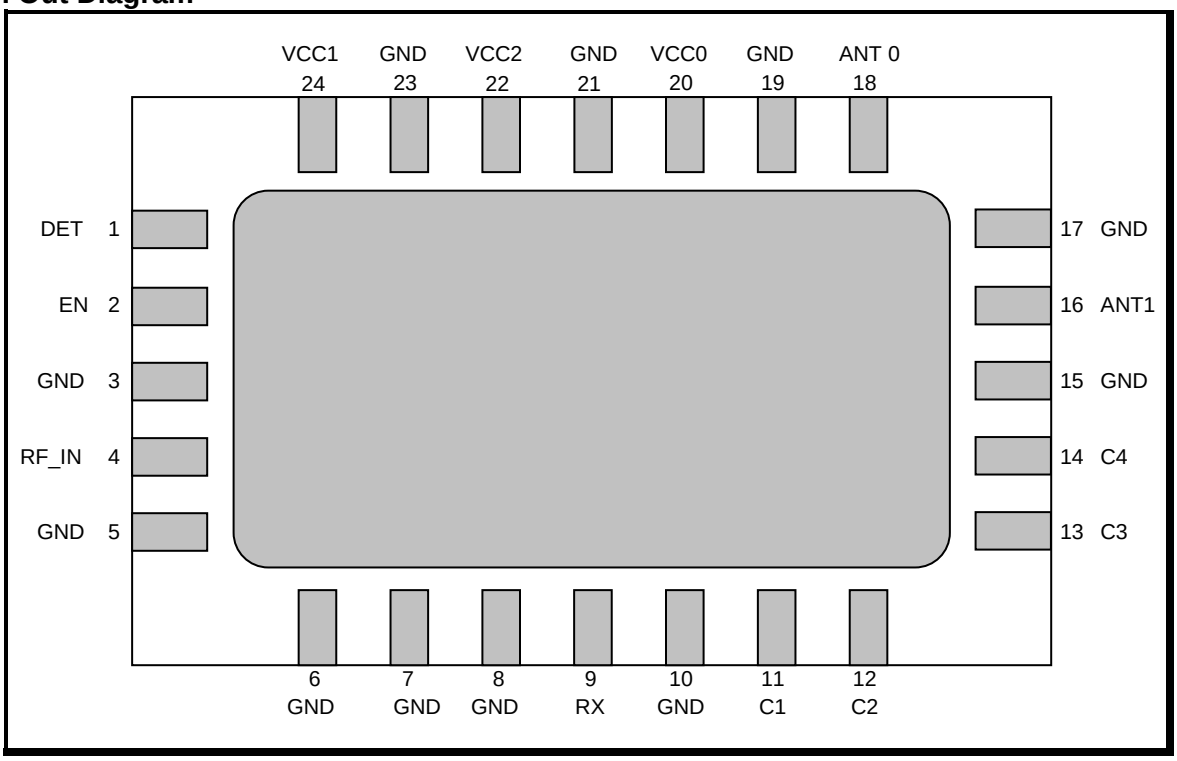

Figure 2: SE2603L Pin Out (Top View Through Package)

Pin Out Description

Pin No.	Name	Description
1	Det	Power Detector Output
2	EN	Power Amplifier Enable
3	GND	Ground
4	RF_IN	Transmit RF Input
5	GND	Ground
6	GND	Ground
7	GND	Ground
8	GND	Ground
9	RX	Receive RF Output
10	GND	Ground
11	C1	Switch Control Logic
12	C2	Switch Control Logic
13	C3	Switch Control Logic

Pin No.	Name	Description
14	C4	Switch Control Logic
15	GND	Ground
16	ANT1	Antenna 1
17	GND	Ground
18	ANT0	Antenna 0
19	GND	Ground
20	VCC0	Supply Voltage
21	GND	Ground
22	VCC2	Supply Voltage
23	GND	Ground
24	VCC1	Supply Voltage
Paddle	GND	Ground

Absolute Maximum Ratings

These are stress ratings only. Exposure to stresses beyond these maximum ratings 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
VCC	Supply Voltage on VCC	-0.3	3.6	V
V_{IN}	DC input on EN, C1, C2, C3, C4	-0.3	3.6	V
TX	RF Input Power. ANT0 and ANT1 terminated in 50Ω match	-	12.0	dBm
T_A	Operating Temperature Range	0	85	°C
T_{STG}	Storage Temperature Range	-40	150	°C

Recommended Operating Conditions

Symbol	Parameter	Min.	Typ.	Max.	Unit
T_A	Ambient temperature	-30	25	85	°C
VCC	VCC0, VCC1, VCC2 supply voltage	3.0	3.3	3.6	V

DC Electrical Characteristics

Conditions: VCC = EN = 3.3 V, T_A = 25 °C, as measured on SiGe Semiconductor's SE2603L-EK1 evaluation board (de-embedded to device), all unused ports terminated with 50 ohms, unless otherwise noted

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I_{CC-G}	Total Supply Current	POUT = 17 dBm, 54 Mbps OFDM signal, 64QAM	-	145	-	mA
I_{CC-B}	Total Supply Current	P_{OUT} = 19 dBm, 11 Mbps CCK signal, BT = 0.45	-	180	-	mA
I_{CQ}	Total Supply Current	No RF	-	90	-	mA
Icntl	Control Line Current	C1, C2, C3 or C4 = 3.3V		1	10	µA
Icc0	Supply Current on VCC0	No RF, VCC0 = 3.3V	-	70	100	µA
I_{CC_OFF}	Total Supply Current	No RF Applied, EN = R0 = T0 = T1 = R1 = VCC0 = 0 V	-	1	10	µA
		No RF Applied, EN = R0 = T0 = T1 = R1 = 0 V; VCC0 = 3.3V	-	71	110	µA

PA Logic Characteristics

Conditions: VCC = EN = 3.3 V, T_A = 25 °C, as measured on SiGe Semiconductor's SE2603L-EK1 evaluation board (de-embedded to device), all unused ports terminated with 50 ohms, unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{ENH}	Logic High Voltage (Module On)	-	1.8	3.3	3.6	V
V_{ENL}	Logic Low Voltage (Module Off)	-	0	-	0.4	V
I_{ENH}	Input Current Logic High Voltage	-	-	2	10	µA
I_{ENL}	Input Current Logic Low Voltage	-	-	2	10	µA

Switch Logic Characteristics

Conditions: VCC = EN = 3.3 V, T_A = 25 °C, as measured on SiGe Semiconductor's SE2603L-EK1 evaluation board (de-embedded to device), all unused ports terminated with 50 ohms, unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{CTL_ON}	Control Voltage (On State)	-	3.0	-	3.6	V
V_{CTL_OFF}	Control Voltage (OFF State)	-	0.0	-	0.2	V
ON	Low Loss Switch Control Voltage	High State = V_{CTL_ON} - V_{CTL_OFF}	2.7	-	3.6	V
OFF	High Loss Switch Control Voltage	Low State = V_{CTL_OFF} - V_{CTL_OFF}	0	-	0.3	V
C_{CTL}	Control Input Capacitance	-	-	-	100	pF

Switch Control Logic Table

Switch Logic				Operational Mode			
C1	**C2**	**C3**	**C4**	**TX – ANT0**	**TX – ANT1**	**RX – ANT0**	**RX – ANT1**
ON	**ON**	**ON**	**ON**	**ON**	OFF	OFF	OFF
OFF	**ON**	**ON**	**ON**	OFF	OFF	**ON**	OFF
ON	**ON**	**ON**	OFF	OFF	**ON**	OFF	OFF
OFF	**ON**	**ON**	OFF	OFF	OFF	OFF	**ON**
ON	OFF	OFF	OFF	**ON**	OFF	OFF	OFF
OFF	**ON**	OFF	OFF	OFF	OFF	OFF	**ON**
OFF	OFF	**ON**	OFF	OFF	**ON**	OFF	OFF
OFF	OFF	OFF	**ON**	OFF	OFF	**ON**	OFF
ON	**ON**	OFF	OFF	**ON**	OFF	OFF	**ON**
OFF	OFF	**ON**	**ON**	OFF	**ON**	**ON**	OFF
All other configurations				All switches set to OFF			

AC Electrical Characteristics

802.11g/n Transmit Characteristics

Conditions: VCC = EN = 3.3 V, T_A = 25 °C, as measured on SiGe Semiconductor's SE2603L-EK1 evaluation board (de-embedded to device), all unused ports terminated with 50 ohms, unless otherwise noted.

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
F_{IN}	Frequency Range	-	2400	-	2500	MHz
POUT	Output Power	54 Mbps OFDM signal, 64 QAM, 3% EVM	-	17	-	dBm
ACPR, IEEE Mask	Spectral Mask	P_{OUT} = 20 dBm, 11 Mbps CCK, BT = 0.45 11 – 22 MHz 22 – 33 MHz	-	 -35 -55	-	dBc
P_{1dB}	P1dB	-	-	23.0	-	dBm
S_{21}	Small Signal Gain	-	24	27	30	dB
ΔS_{21}	Small Signal Gain Variation	Gain variation over single 40MHz channel Gain Variation over band	-	0.5	 1.0	dB
S_{21}3.2	Gain @ limit at Ref-vco spur frequency	3206 to 3312 MHz	-	-	15	dB
2f	Harmonics	P_{OUT} = 19 dBm, 1 Mbps, CCK	-	-50	-45	dBm/MHz
3f			-	-50	-45	dBm/MHz
t_{dr}, t_{df}	Delay and rise/fall Time	50 % of V_{EN} edge and 90/10 % of final output power level	-	0.7	-	µs
S_{11}	Input Return Loss	-	10	14	-	dB
STAB	Stability	CW, P_{OUT} = 20 dBm 0.1 GHz – 20 GHz Load VSWR = 6:1	All non-harmonically related outputs less than -42 dBm/MHz			
RU	Ruggedness	P_{IN} = 12dBm, Load VSWR = 6:1	No permanent damage			

Receive Characteristics

Conditions: VCC = 3.3 V, EN = 0 V, T_A = 25 °C, as measured on SiGe Semiconductor's SE2603L-EK1 evaluation board (de-embedded to device), all unused ports terminated with 50 ohms, unless otherwise noted.

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
F_{OUT}	Frequency Range	-	2400	-	2500	MHz
RX_{IL}	Insertion Loss	-	-	0.9	1.2	dB
RX_{RL}	Return Loss	-	10	15	-	dB
Delta Rx	Delta between Rx paths	ANT0 to RX or ANT1 to RX	-	-	0.5	dB
$T_{on/off}$	T/R on/off switching speed	Switching speed between T/R modes. V_{CC0}=3.3V.		100	250	nSec
TR_{ISO}	Tx to Rx Leakage	Device transmitting (EN = 3.3 V) with 17.0 dBm. @ ANT0 or ANT1, Power measured @ RX TX ↔ ANT0 or ANT1 = ON, RX ↔ ANT0 or ANT1= OFF	-	-3	0	dBm
$ANTR_{ISOL}$	Isolation between ANT0 and ANT1	Difference in transmitted signal level on ANT1 or ANT0 while transmistting from ANT0 or ANT1. TX ↔ ANT0 or ANT1 = ON, Rx and opposite ANT port terminated in 50ohm.	18	25	-	dB

Power Detector Characteristics

Conditions: VCC = EN = 3.3 V, T_A = 25 °C, as measured on SiGe Semiconductor's SE2603L-EK1 evaluation board, unless otherwise noted.

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
F_{OUT}	Frequency Range	-	2400	-	2500	MHz
PDR	Power detect range, CW	Measured at ANT0 or ANT1	0	-	21	dBm
PDZ_{src}	DC source impedance on PD_OUT	-	-	1	-	kΩ
PDV_{NoRF}	Output Voltage, P_{OUT} = No RF	Measured into 1MΩ	-	0.12	-	V
PDV_{p18}	Output Voltage, P_{OUT} = 17 dBm CW	Measured into 1MΩ	-	0.45	-	V
PDV_{p21}	Output Voltage, P_{OUT} = 21 dBm CW	Measured into 1MΩ	-	0.75	-	V
LPF_{-3dB}	Power detect low pass filter -3dB corner frequency	PDC_{LOAD} = 390 pF	270	290	400	kHz

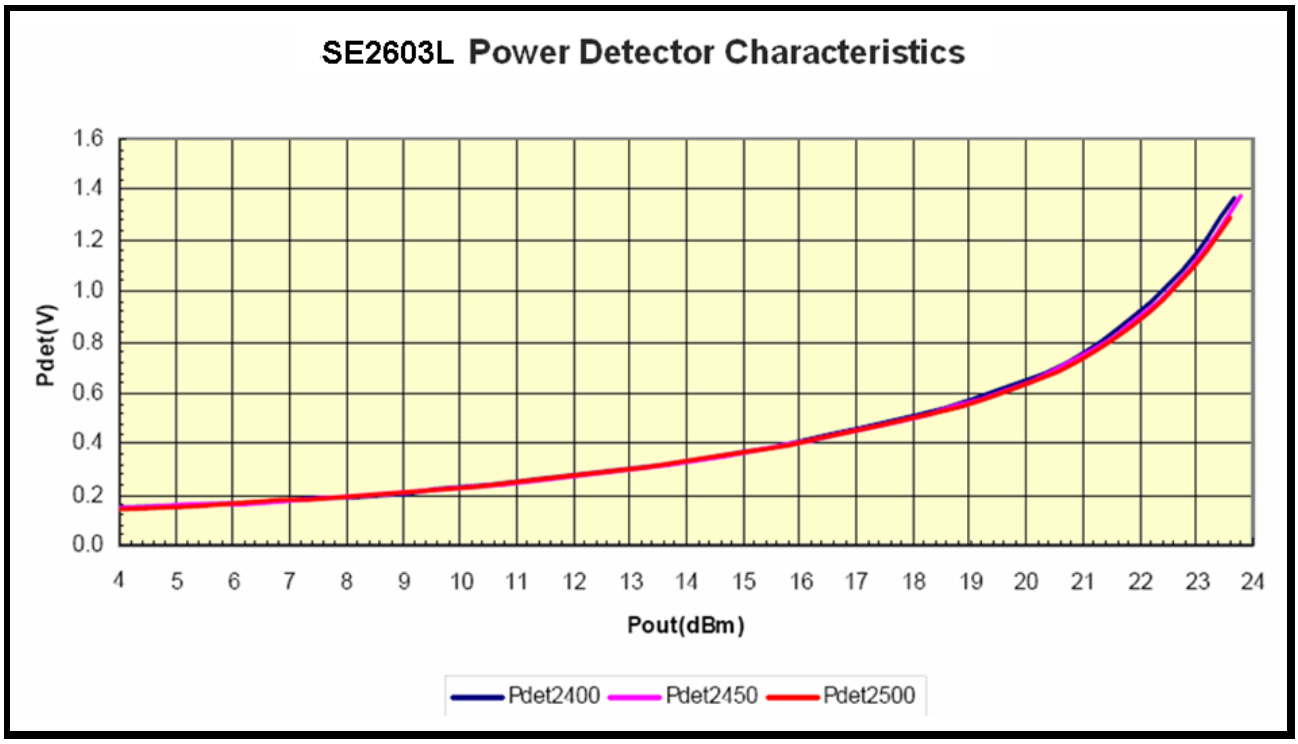

Figure 3: SE2603L Power Detector Characteristics

Package Diagram

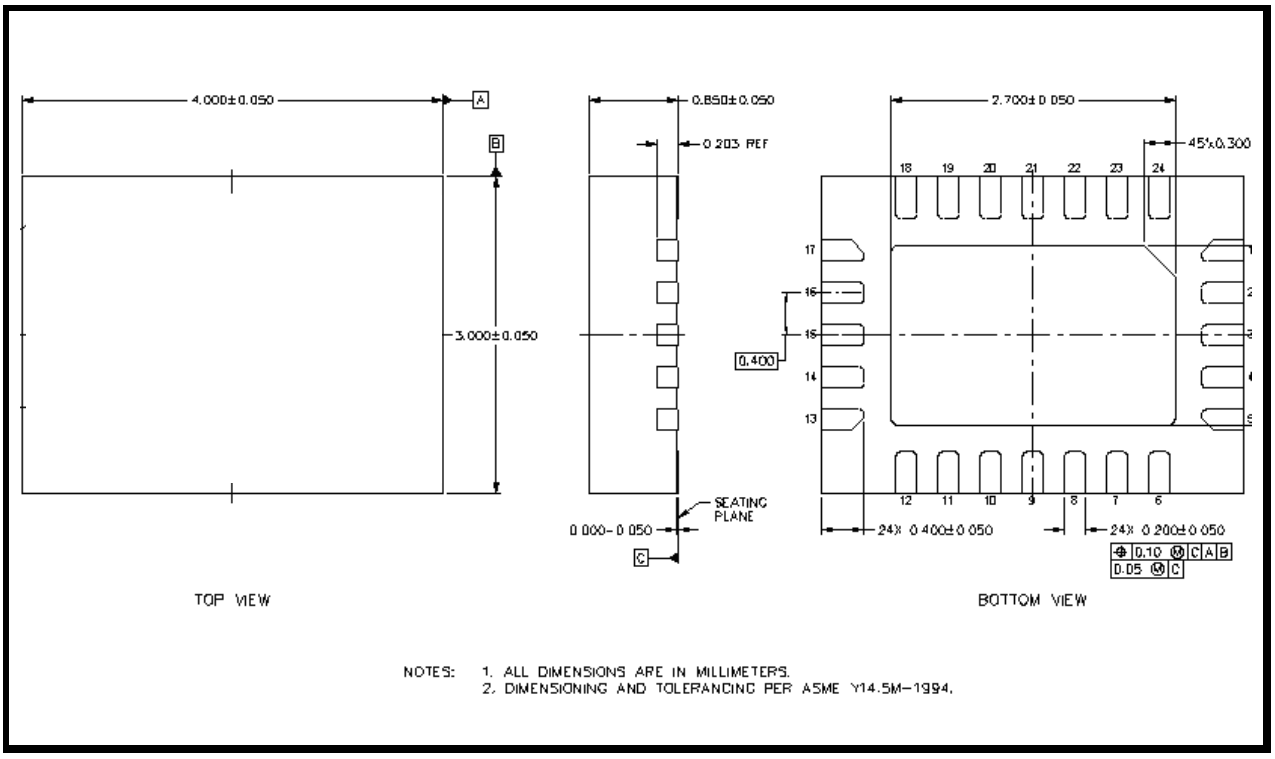

Figure 4: SE2603L Package Outline Drawing

Recommended Land and Solder Patterns

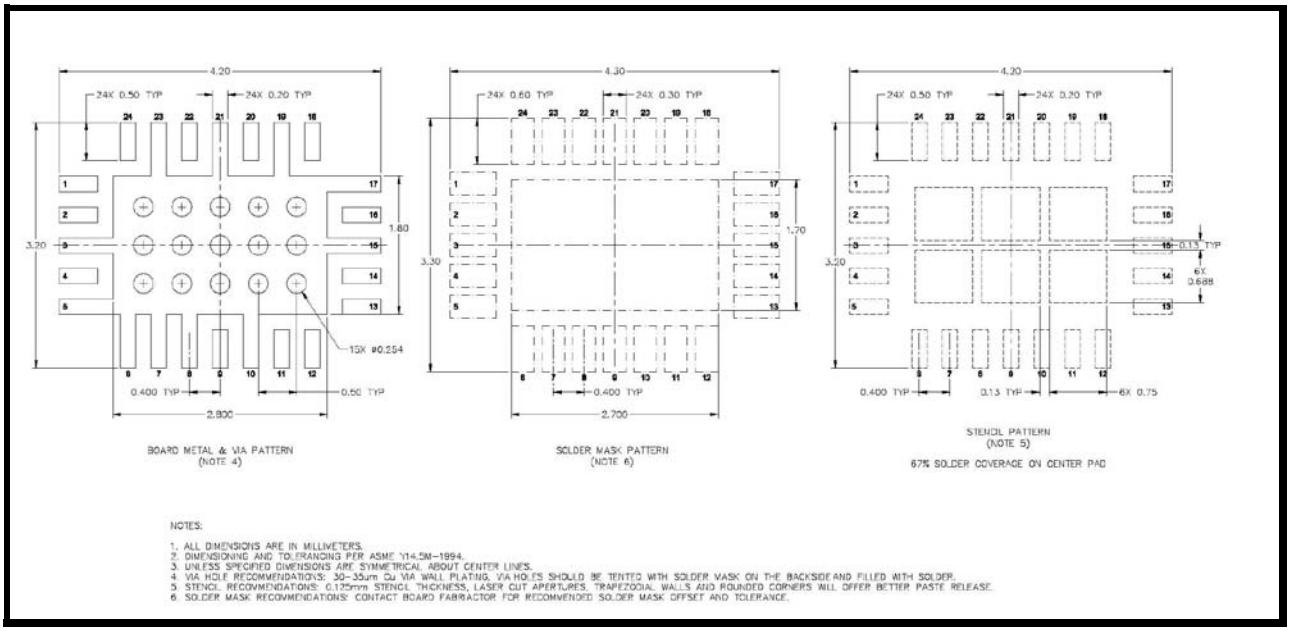

Figure 5: Recommended Land and Solder Patterns

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 SE2603L 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*
- SiGe's Application Note: "Class 0 ESD Device Handling", *Document Number QAD-00163*

Caution! Class 0 ESD sensitive device

Branding Information

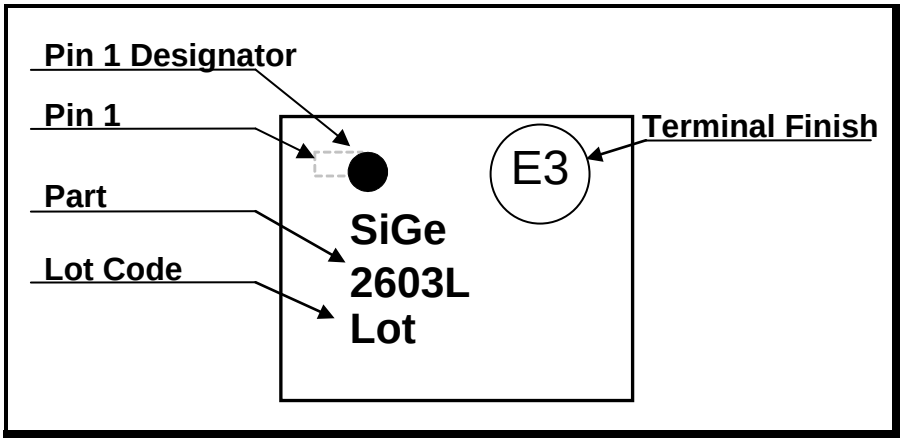

Figure 6: SE2603L Branding and Pin 1 Location

Tape and Reel Information

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

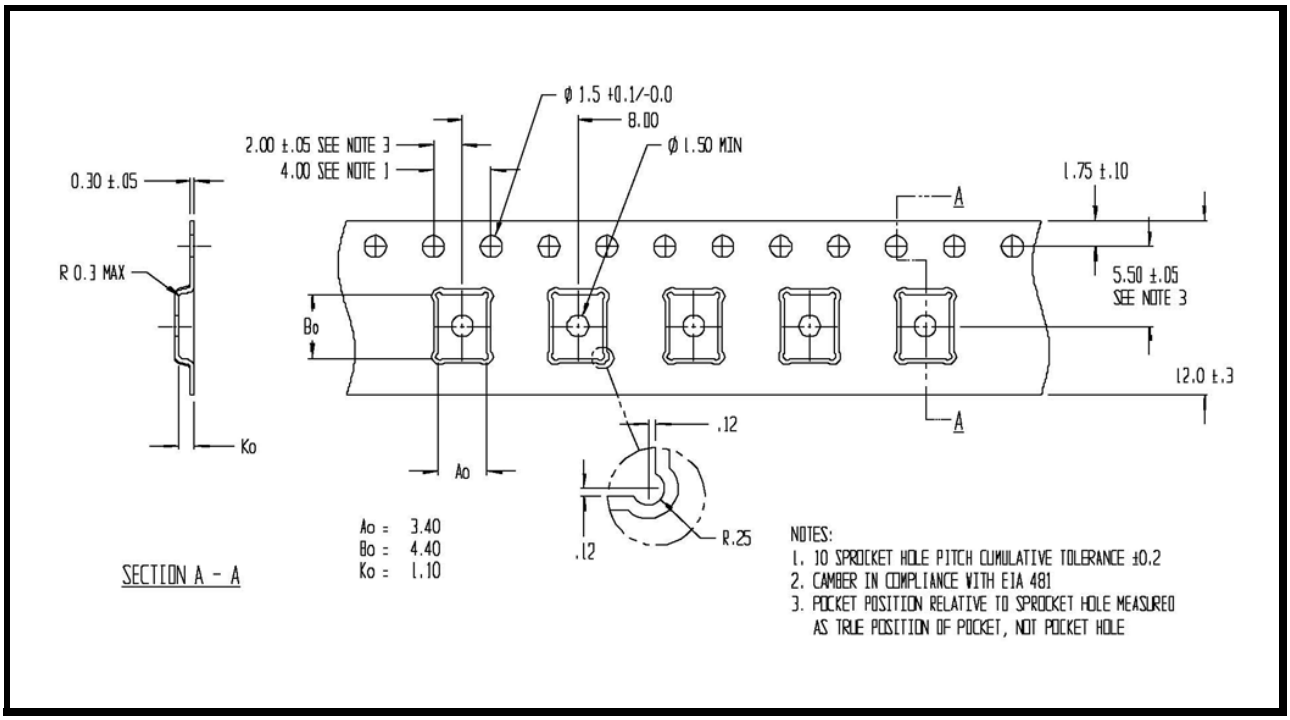

Figure 7: SE2603L-R Tape and Reel Information

Document Change History

Revision	Date	Notes
1.0	Sep 18, 2009	Created
1.1	Sep 23, 2009	Corrected operating voltage, Updated current consumption
1.2	Sep 29, 2009	Remove reference to pull down resistor. Updated leakage current.
1.3	Oct 12, 2009	Updated package outline drawing
1.4	Jan 20, 2010	Updated for ESD
1.5	Jan 29, 2010	Removed reference to the incorrect part number
1.6	Jun 9, 2010	Updated MSL rating to MSL 1

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Product Preview
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Preliminary Information
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