DATA SHEET
SE5511T: Dual Band 802.11n WLAN/BT Front End

Applications

- IEEE802.11b DSSS WLAN
- IEEE802.11a,g,n OFDM WLAN
- Embedded applications with Bluetooth (Mobile)

Features

- All RF ports matched to 50 Ω
- Integrated 2.4,5 GHz PA, 5 GHz LNA, SP3T, SP2T switches and filtering
- Integrated Power Detector
- 19.5 dBm @ 3 % EVM, 802.11g, 54 Mbps
- 18 dBm @ 3 % EVM, 802.11a, 54 Mbps
- Lead free, Halogen Free and RoHS compliant
- Compact package, 3 x 4 x 0.6 mm, MSL 1

Ordering Information

| Part No.	Package	Remark
SE5511T	28 pin QFN	Samples
SE5511T-R	28 pin QFN	Tape & Reel
SE5511T-EK1	N/A	Evaluation kit

Product Description

The SE5511T is a complete 802.11n WLAN RF front-end module providing all the functionality of the power amplifiers, LNA, power detector, Antenna switches, filtering and associated matching. The SE5511T provides a complete 2.4 GHz and 5 GHz WLAN RF solution from the output of the transceiver to the antennas in a compact form factor.

The receive path is designed to maximize performance by providing both a 5 GHz Low noise amplifier with bypass mode, for use when high power signals are being received.

Designed for ease of use, all RF ports are matched to 50 Ω to simplify PCB layout and the interface to the transceiver RFIC. The SE5511T also includes a transmitter power detector for each band with 20 dB of dynamic range.
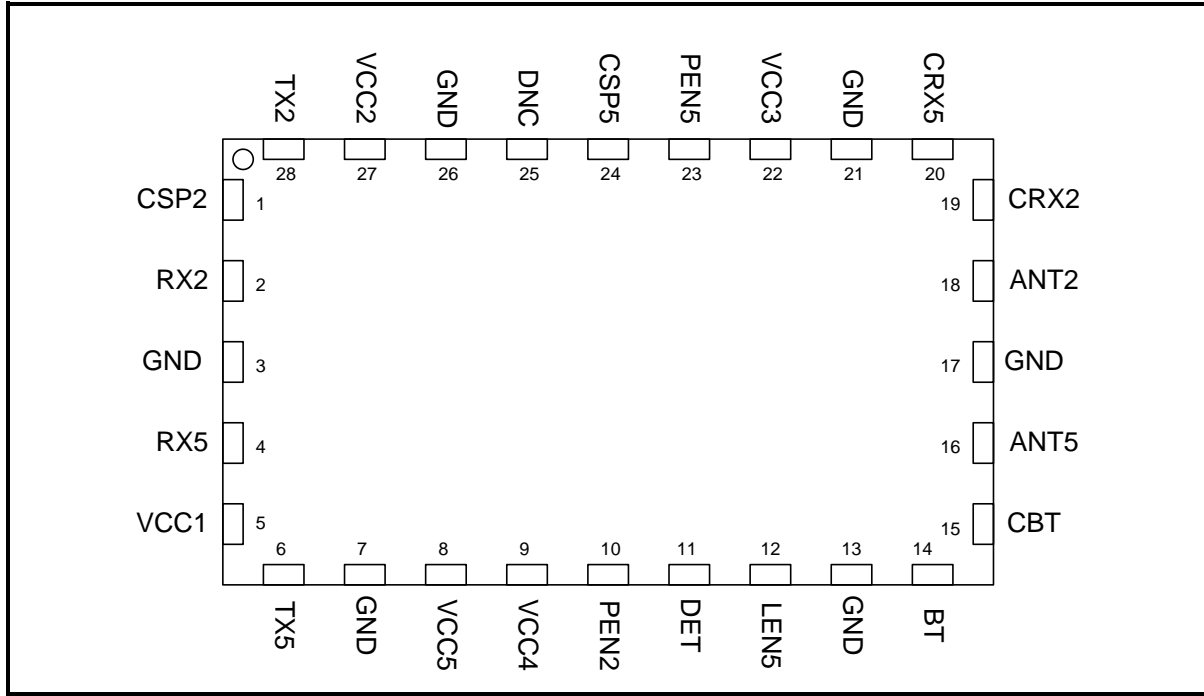
Functional Block Diagram
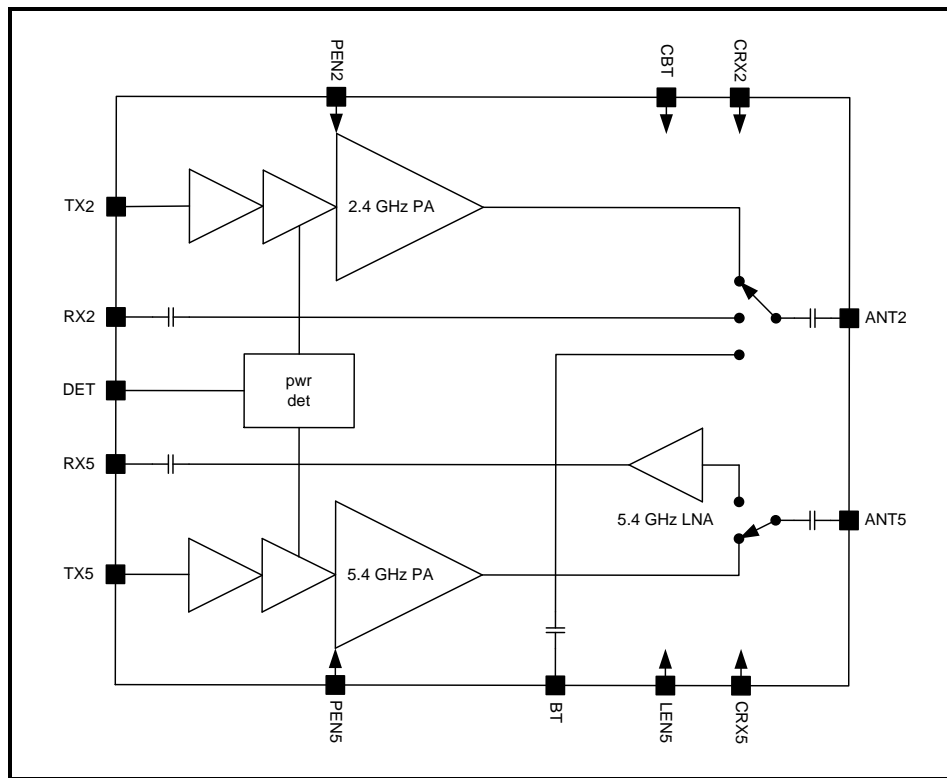
Figure 1: Functional Block Diagram

Pin Out Diagram

Figure 2: SE5511T Pin Out (Top View Through Package)

Pin Out Description

Pin No.	Name	Description
1	CSP2	2.4 GHz PA bias speed-up
2	RX2	2.4 GHz Receive port
3	GND	Ground
4	RX5	5 GHz Receive port
5	VCC1	Power Supply
6	TX5	5 GHz Transmit port
7	GND	Ground
8	VCC5	Power Supply
9	VCC4	Power Supply
10	PEN2	Enable for 2.4 GHz PA and Transmit Switch
11	DET	Power Detector Output
12	LEN5	Enable for 5 GHz LNA and Receive Switch
13	GND	Ground
14	BT	Bluetooth Port
15	CBT	Control for Bluetooth port

Pin No.	Name	Description
16	ANT5	5 GHz Antenna port
17	GND	Ground
18	ANT2	2.4 GHz Antenna port
19	CRX2	Control for 2.4 GHz Receive
20	CRX5	Control for 5 GHz Receive
21	GND	Ground
22	VCC3	Power Supply
23	PEN5	Enable for 5 GHz PA and Transmit switch
24	CSP5	5 GHz PA bias speed-up
25	DNC	Do Not Connect
26	GND	Ground
27	VCC2	Power Supply
28	TX2	2.4 GHz Transmit port

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
V_{CC}	Supply Voltage	-0.3	5.5	V
V_{IN}	Control Pin Voltages	-0.3	3.6	V
TX_{RFIN}	TX2/TX5, with ANT2/ANT5 terminated in 50Ω	-	+10	dBm
T_A	Operating Temperature Range	-40	85	°C
T_{STG}	Storage Temperature Range	-40	150	°C
ESD_{HBM}	JEDEC JESD22-A114 All pins		1000	V

Recommended Operating Conditions

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{CC}	Supply Voltage	2.97	3.3	3.6	V
T_A	Ambient Temperature	-40	25	85	°C

Control Logic Characteristics

Conditions: V_{CC} = 3.3 V, T_A = 25 °C, as measured on Skyworks Solutions' SE5511T-EK1 evaluation board (de-embedded to device), all unused ports terminated with 50 ohms, unless otherwise noted.

Parameter	min	nom	max	Units
Logic input high : VIH	1.4		Vcc+0.3 upto 3.6	V
Logic input low : VIL	0		0.3	V
Logic input current : IIH All control pins except CRX2, CRX5 CRX2, CRX5			1 50	µA
Logic input current : IIL All control pins except CRX2, CRX5 CRX2, CRX5			1 20	µA

DC Electrical Characteristics

Conditions: V_{CC} = 3.3 V, T_A = 25 °C, as measured on Skyworks Solutions' SE5511T-EK1 evaluation board (de-embedded to device), all unused ports terminated with 50 ohms, unless otherwise noted

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
TXI_{CC-G}	Total 802.11g Transmit Supply Current	P_{OUT} = 20 dBm, 54 Mbps OFDM signal, 64QAM, PEN2 = Hi,	-	215		mA
		P_{OUT} = 18 dBm, 54 Mbps OFDM signal, 64QAM, PEN2 = Hi,		185		
TXI_{CQ-G}	Quiescent current , 802.11g Transmit supply Current	No RF applied, PEN2=Hi	-	120	-	mA
TXI_{CC-A}	Total 802.11a Transmit Supply Current	P_{OUT} = 18 dBm, 54 Mbps OFDM signal, 64QAM, PEN5= Hi	-	230		mA
		P_{OUT} = 16 dBm, 54 Mbps OFDM signal, 64QAM, PEN5= Hi		210		
TXI_{CQ-A}	Quiescent current , 802.11a Transmit supply Current	No RF applied, PEN5- Hi	-	155	-	mA
RXI_{CC-A}	Total 802.11a Receive Supply Current	CRX5 = Hi, LEN= Hi	-	10		mA
		CRX5 = Hi, LEN = Lo		0.25		
RXI_{CC-G}	Total 802.11g Receive Supply Current	CRX2 = Hi		0.25		mA
I_{CC-BT}	Total BT Supply Current	CBT = Hi	-	0.25		mA
I_{CC_OFF}	Total Supply Current	No RF, PEN2=PEN5=CRX2=CRX5=CBT =LEN5=0V	-	5		µA

Operating Modes

Mode#	Mode Description	PEN2	PEN5	LEN5	CRX2	CRX5	CBT
0	All Off	0	0	0	0	0	0
1	BT	0	0	0	0	0	1
2	BT + RX5(Low gain)	0	0	0	0	1	1
3	BT + RX5(High gain)	0	0	1	0	1	1
4	BT + TX5	0	1	0	0	0	1
5	RX2 + RX5(Low gain)	0	0	0	1	1	0
6	RX2 + RX5(High gain)	0	0	1	1	1	0
7	TX2	1	0	0	0	0	0
8	TX5	0	1	0	0	0	0
9	RX2	0	0	0	1	0	0
10	RX5 (Low Gain)	0	0	0	0	1	0
11	RX5 (High Gain)	0	0	1	0	1	0

AC Electrical Characteristics

2.4 GHz Transmit Characteristics

Conditions: V_{CC} = 3.3 V, PEN2= Hi, T_A = 25 °C, as measured on Skyworks Solutions' SE5511T-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
P_{OUT}	Output Power, 54 Mbps OFDM, 64 QAM	EVM=3% EVM=2.5%	18.5	19.5 18		dBm
S_{21}	Gain	2400 – 2500 MHz		27.5		dB
S_{21_OOB}	Out of Band Gain	<2170 MHz			19	dB
ΔS_{21}	Gain Variation	Over band			1.5	dBpp
S_{11}	Input Return Loss			-10		dB
S_{22}	Output Return Loss			-10	-5	dB
NF	Noise Figure			10		dB
2f	11b Harmonics	2f @ Pout= 22 dBm		-35	-25	dBm/MHz
3f		3f @ Pout = 22 dBm		-35	-30	
ACP11b	Spectral Mask	11b @ Pout=22 dBm: fc +/- 11 MHz fc +/- 22 MHz		-34 -54	-32 -52	dBc
STAB	Stability	Pout ≤ 23dBm Load VSWR = 4:1	All non-harmonically related outputs less than -45 dBm/MHz			
TEN	Enable time	10% to 90% of TX RF power, from time that PEN2 is at 50%			800	nsec

2.4 GHz Receive Characteristics

Conditions: VCC = 3.3V, CRX2 = Hi, T$_A$ = 25 °C, as measured on Skyworks Solutions' SE5511T-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
RX2$_{IL}$	Insertion Loss	CRX2= Hi	-	1.0		dB
S$_{11}$	RX2 Port Return Loss	CRX2= Hi	-	-14		dB
ISOL$_{SW}$	Switch Isolation	ANT2-RX2, PEN2=Hi	26		-	dB
IP1dB	Input P1dB	CRX2= Hi	15			dBm
T$_{EN}$	Enable Time	10% to 90% of RX RF power, from time that CRX2 is at 50%	-	-	800	nsec

Bluetooth Characteristics

Conditions: V$_{CC}$ = 3.3 V, CBT= Hi, T$_A$ = 25 °C, as measured on Skyworks Solutions' SE5511T-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
BT$_{IL}$	Insertion Loss	CBT= Hi	-	1.0		dB
S$_{11}$	BT Port Return Loss	CBT= Hi	-	-14		dB
ISOL$_{SW}$	Switch Isolation	ANT2-BT, PEN2=Hi	20	-	-	dB
IP1dB	Input P1dB	CBT= Hi	15			dBm
T$_{EN}$	Enable Time	10% to 90% of BT RF power, from time that CBT is at 50%	-	-	800	nsec

5 GHz Transmit Characteristics

Conditions: VCC = 3.3 V, PEN5= Hi, T$_A$ = 25 °C, as measured on Skyworks Solutions' SE5511T-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	-	4900	-	5850	MHz
P$_{OUT}$	Output Power, 54 Mbps OFDM, 64 QAM	EVM=3% EVM=2.5%	17.0	18 16		dBm
S$_{21}$	Gain			28		dB
ΔS$_{21}$	Gain Variation	Over 40 MHz Channel			1.5	dBpp
S$_{11}$	Input Return Loss			-14	-10	dB
S$_{22}$	Output Return Loss			-10	-5	dB
2f	Harmonics @ Pout=18 dBm	2f (5150-5300 MHz) 2f (5300-5850 MHz)		-40 -50	-35 -42	dBm/MHz
3f		3f @ Pout = 18 dBm		-50	-45	
ACP11a	Spectral Mask	11a @ Pout=18 dBm: fc +/- 11 MHz fc +/- 20 MHz fc +/- 30 MHz		-23 -30 -43	-20 -28 -40	dBc
	Stability	P$_{OUT}$ ≤ 21dBm Load VSWR = 4:1	All non-harmonically related outputs less than -45 dBm/MHz			
T$_{EN}$	Enable Time	10% to 90% of TX RF power, from time that PEN5 is at 50%	-	-	800	nsec

5 GHz Receive Characteristics

Conditions: VCC = 3.3 V, LEN5= Hi, T$_A$ = 25 °C, as measured on Skyworks Solutions' SE5511T-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	-	4900	-	5900	MHz
S21	Gain	LEN5 = Hi		12		dB
		LEN5 = Lo		-7		dB
NF	Noise Figure	LEN5=Hi	-	2.5		dB
IP1dB	Input P1dB	LEN5= Hi LEN5=Lo	-8 +5	-6 +7	-	dBm
S$_{11}$	Input Return Loss	-	-	-10		dB
T$_{EN}$	Enable Time	10% to 90% of RX RF power, from time that	-	-	800	nsec

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
		LEN5 is at 50%				

Power Detector Characteristics

Conditions: V_{CC} = 3.3 V, T_A = 25 °C, as measured on Skyworks Solutions' SE5511T-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	PEN2= Hi PEN5 = Hi	2400 4900	-	2500 5900	MHz
PDR	Power detect range, peak power	Measured at ANT	0	-	23	dBm
PDZ_{LOAD}	DC load impedance	-	-	2.5		kΩ
PDV_{P23}	Output Voltage, P_{OUT} = 23 dBm	PEN2= Hi	0.8		1.0	V
PDV_{P19}	Output Voltage, P_{OUT} = 19 dBm	PEN5= Hi 4950 MHz 5150-5850 MHz	0.4 0.5		0.8 1.0	V
PDV_{pnoRF}	Output Voltage, P_{OUT} = No RF	-	-	0.125	-	V
PD_{VAR}	Power Detector Accuracy vs Load VSWR	Pout=20 dBm, 2:1 load VSWR, any angle	-1		+0.6	dB

Package Diagram
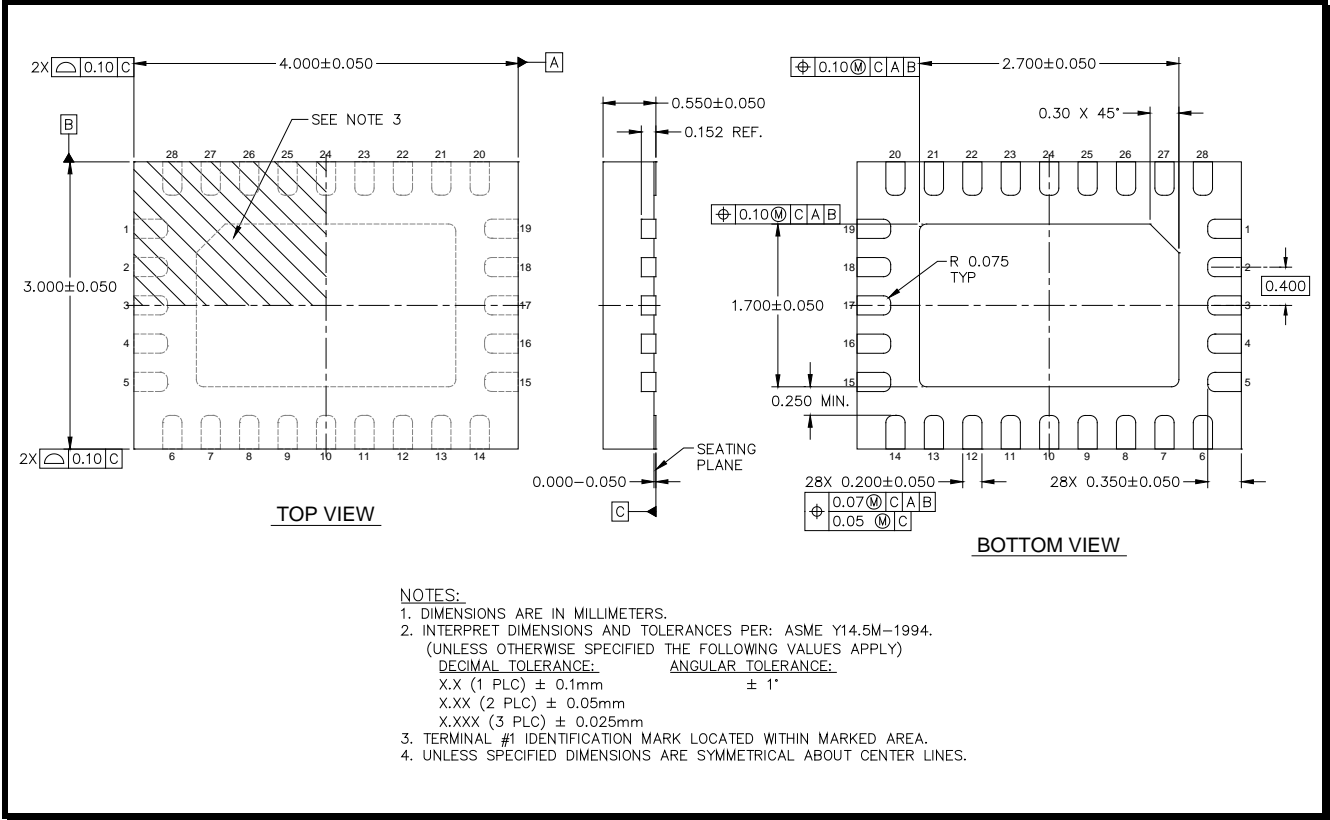
Figure 3: Package Outline Drawing

Branding Information
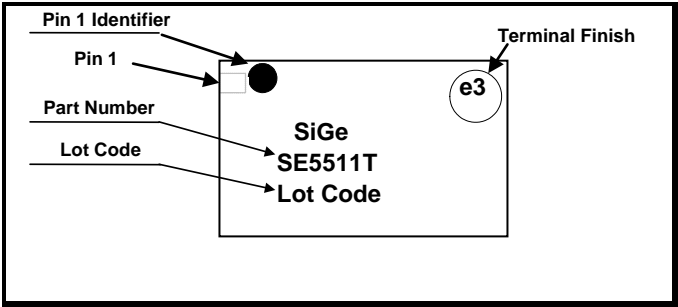
Figure 4: SE5511T Branding Information

Recommended PCB Footprint
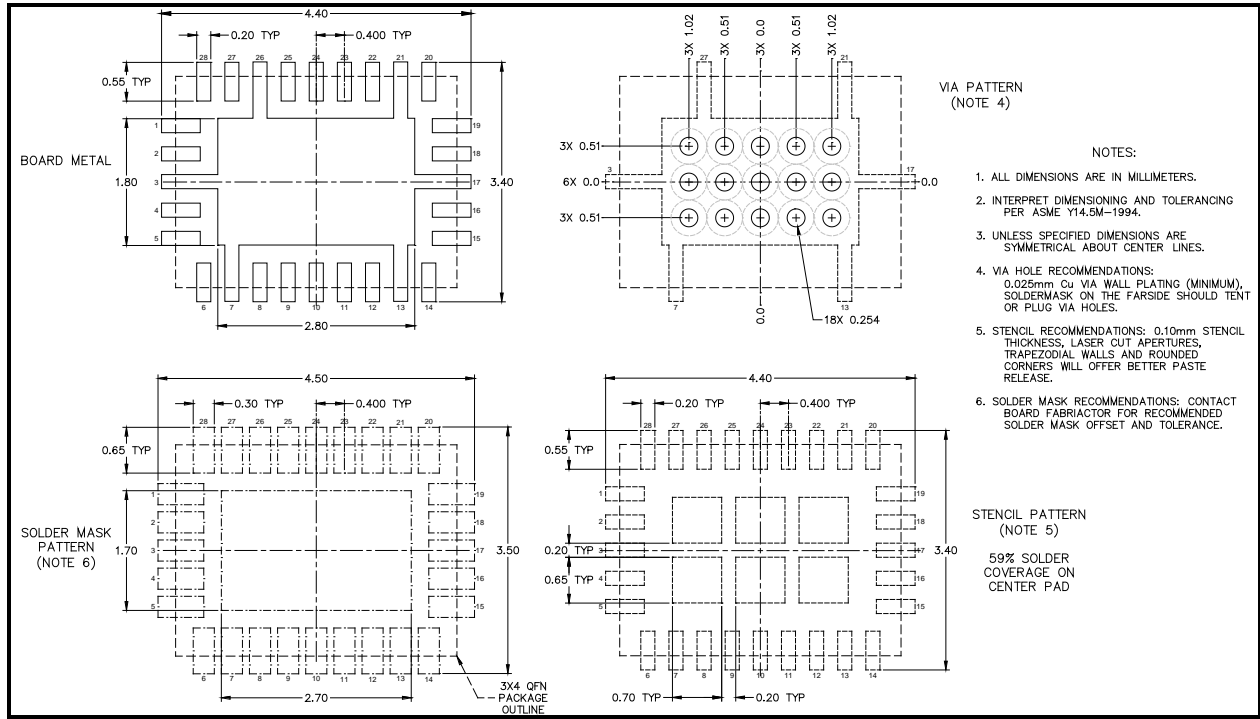
Figure 5: Recommended PCB footprint

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 SE5511T 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*.

Tape and Reel Information

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

Figure 6: SE5511T-R Tape and Reel Information
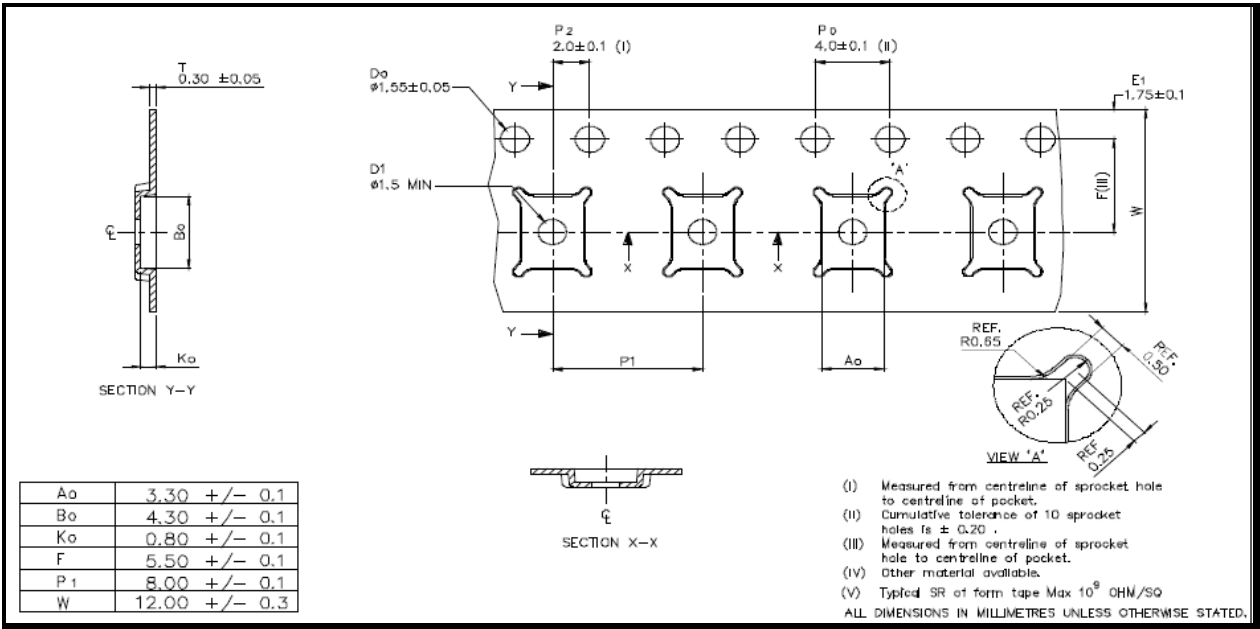
Document Change History

Revision	Date	Notes
1.0	August-04-2010	Created
1.1	April-07-2011	Updated Functional block diagram
1.2	June-09-2011	Updated specifications
1.3	July-06-2011	Updated RX2 isolation specification
1.4	November-22-2011	Updated specifications
1.5	February-03-2012	Updated temperature range, updated tape and reel info
1.6	April-11-2012	Updated with Skyworks logo and disclaimer statement
1.7	August-14-2012	Updated recommended pcb footprint