

**DATA SHEET**  
**SE2521A80: 2.4 GHz Wireless LAN Front-End**  
**Preliminary**

**Applications**

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

**Features**

- Dual Mode IEEE802.11b & IEEE802.11g
- All RF ports matched to 50 Ω
- Integrated PA, TX Filter, DPDT T/R and Diversity switches
- Integrated Power Detector
- 20 dBm @ 3.0 % EVM, 802.11g, 54 Mbits
- 20 dBm, 802.11b, ACPR = -37 dB, 11 Mbits
- Single supply voltage: 3.3 V ± 10 %
- Small lead free package, 8 mm x 7 mm x 1.2 mm, MSL 3

**Ordering Information**

Part Number	Package	Remark
SE2521A80	24 pin LGA	Samples
SE2521A80-R	24 pin LGA	Tape and Reel
SE2521A80-EK1	N/A	Evaluation kit

**Product Description**

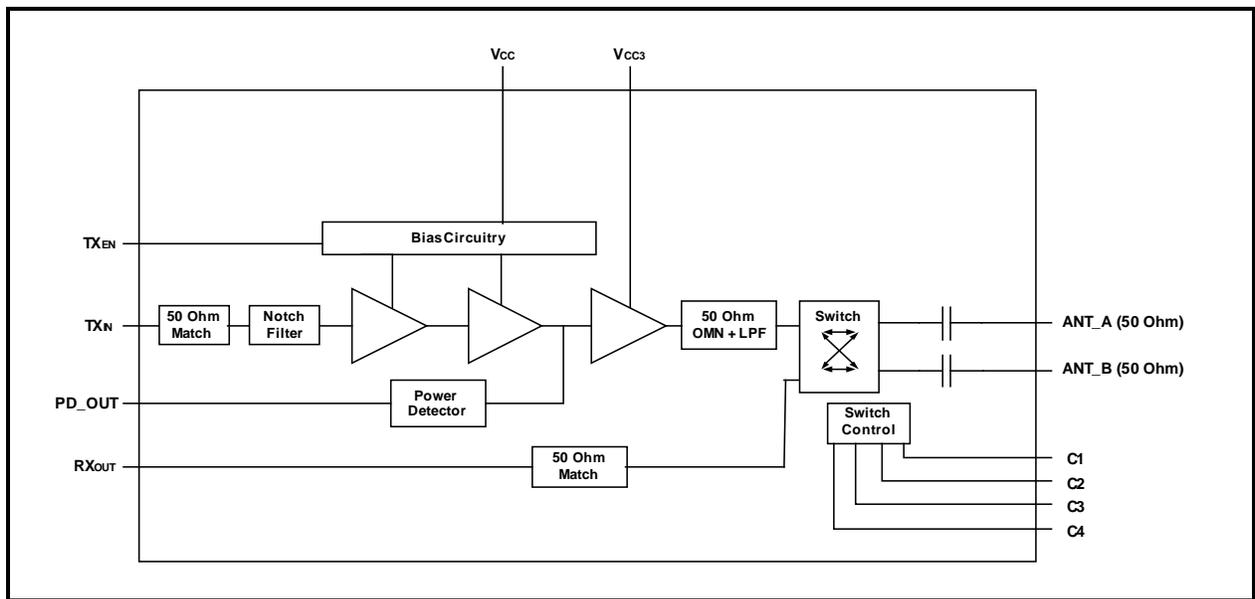
The SE2521A80 is a complete 802.11 b/g WLAN RF front-end module providing all the functionality of the power amplifier, power detector, T/R switch, diversity switch and associated matching. The SE2521A80 provides a complete 2.4 GHz WLAN RF solution from the output of the transceiver to the antennas in an ultra compact form factor.

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 SE2521A80 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 1 μsec typical.

The SE2521A80 is pin for pin compatible to Skyworks' SE2521A34 for easy transition of medium power designs to higher power designs.

The device also provides a notch filter from 3.2-3.3 GHz prior to the input of the power amplifier.

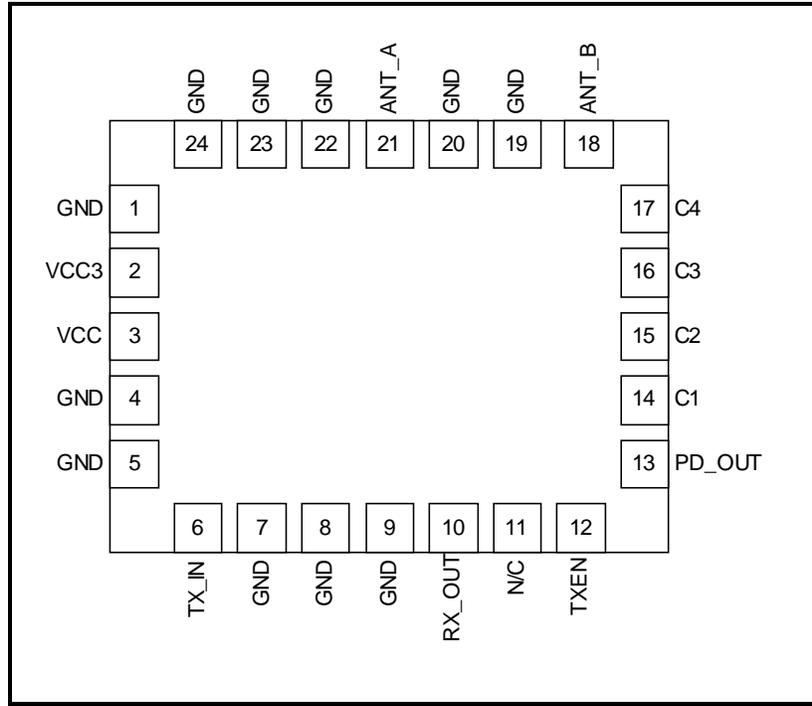
**Functional Block Diagram**



**Figure 1: Functional Block Diagram**

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**Pin Out Diagram**



**Figure 2: SE2521A80 Pin-Out (Top View Through Package)**

**Pin Out Description**

Pin No.	Name	Description
1	GND	Ground
2	VCC3	+3.3 V DC for 3 <sup>rd</sup> stage power amplifier collector voltage
3	VCC	+3.3 V DC
4,5	GND	Ground
6	TX_IN	Transmit Input
7,8,9	GND	Ground
10	RX_OUT	Receive Output
11	N/C	No Connect
12	TXEN	Transmit Enable
13	PD_OUT	Power Detector
14	C1	Control 1 Input
15	C2	Control 2 Input
16	C3	Control 3 Input
17	C4	Control 4 Input
18	ANT_B	Antenna B (50 ohm)
19,20	GND	Ground
21	ANT_A	Antenna A (50 ohm)

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Pin No.	Name	Description
22,23,24	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
V <sub>CC</sub>	Supply Voltage on V <sub>CC</sub>	-0.3	4.0	V
TX <sub>EN</sub>	Power Amplifier Enable	-0.3	4.0	V
TX <sub>RF</sub>	RF Input Power	-	2.0	dBm
T <sub>A</sub>	Operating Temperature Range	-20	85	°C
T <sub>STG</sub>	Storage Temperature Range	-40	150	°C

**Recommended Operating Conditions**

Symbol	Parameter	Min.	Typ.	Max.	Unit
V <sub>CC</sub>	Supply Voltage	3.0	3.3	3.6	V
T <sub>A</sub>	Ambient Temperature	0	25	85	°C

**DC Electrical Characteristics**

Conditions: V<sub>CC</sub> = V<sub>EN</sub> = 3.3 V, T<sub>A</sub> = 25 °C, as measured on Skyworks Solutions' SE2521A80-EV1 evaluation board (de-embedded to device), all unused ports terminated with 50 ohms, unless otherwise noted

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I <sub>CC-G</sub>	Total Supply Current	P <sub>OUT</sub> = 20 dBm, 54 Mbps OFDM signal, 64 QAM	-	275	-	mA
I <sub>CC-B</sub>	Total Supply Current	P <sub>OUT</sub> = 20 dBm, 11 Mbps CCK signal, BT = 0.45	-	300	-	mA
I <sub>CC-OFF</sub>	Total Supply Current	V <sub>EN</sub> = 0 V, No RF Applied, C1 = C2 = C3 = C4 = 0 V	-	2	10	µA

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**Logic Characteristics**

Conditions:  $V_{CC} = V_{EN} = 3.3\text{ V}$ ,  $T_A = 25\text{ }^\circ\text{C}$ , as measured on Skyworks Solutions' SE2521A80-EV1 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)	-	2.0	-	$V_{CC}$	V
$V_{ENL}$	Logic Low Voltage (Module Off)	-	0	-	0.5	V
$I_{ENH}$	Input Current Logic High Voltage	-	-	100	200	$\mu\text{A}$
$I_{ENL}$	Input Current Logic Low Voltage	-	-	0.2	-	$\mu\text{A}$

**Switch Characteristics**

Conditions:  $V_{CC} = V_{EN} = 3.3\text{ V}$ ,  $T_A = 25\text{ }^\circ\text{C}$ , as measured on Skyworks Solutions' SE2521A80-EV1 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
$SW_{ON}$	Low Loss Switch Control Voltage	High State = $V_{CTL\_ON} - V_{CTL\_OFF}$	2.8	-	$V_{CC}$	V
$SW_{OFF}$	High Loss Switch Control Voltage	Low State = $V_{CTL\_OFF} - V_{CTL\_OFF}$	0	-	0.3	V
$I_{CTL\_ON}$	Switch Control Bias Current (RF Applied)	On pin (C1,C2,C3,C4) being driven high. RF Applied	-	-	100	$\mu\text{A}$
$I_{CTL\_ON}$	Switch Control Bias Current (No RF)	On pin (C1,C2,C3,C4) being driven high. No RF	-	-	30	$\mu\text{A}$
$C_{CTL}$	Control Input Capacitance	-	-	-	100	pF

**Switch Control Logic Table**

Switch Logic				Operational Mode			
C1	C4	C2	C3	$TX_{RF} - ANTA$	$TX_{RF} - ANTB$	$RX_{RF} - ANTA$	$RX_{RF} - ANTB$
$SW_{ON}$	$SW_{OFF}$	$SW_{OFF}$	$SW_{OFF}$	ON	OFF	OFF	OFF
$SW_{OFF}$	$SW_{ON}$	$SW_{OFF}$	$SW_{OFF}$	OFF	ON	OFF	OFF
$SW_{OFF}$	$SW_{OFF}$	$SW_{ON}$	$SW_{OFF}$	OFF	OFF	ON	OFF
$SW_{OFF}$	$SW_{OFF}$	$SW_{OFF}$	$SW_{ON}$	OFF	OFF	OFF	ON

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**AC Electrical Characteristics**

**802.11g Transmit Characteristics**

Conditions:  $V_{CC} = V_{EN} = 3.3\text{ V}$ ,  $T_A = 25\text{ }^\circ\text{C}$ , as measured on Skyworks Solutions' SE2521A80-EV1 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
$P_{802.11g}$	Output power	54 Mbps OFDM signal, 64QAM, EVM = 3.0 %	-	20	-	dBm
$P_{802.11b}$	Output power	11 Mbps CCK signal, BT = 0.45 ACPR(Adj) < -35 dB ACPR(Alt) < -55 dB	-	20	-	dBm
$P_{1dB}$	P1dB	-	-	26	-	dBm
$S_{21}$	Small Signal Gain	-	27.0	30	34.0	dB
$\Delta S_{21}$	Small Signal Gain Variation Over Band	-	-	1.0	2.5	dB
$S_{21@3.2}$	Gain @ 3.2 to 3.3 GHz	-	-	3	7	dB
2f,3f	Harmonics	$P_{out} = 20\text{ dBm}$ , 2 Mbps, 802.11b CCK	-	-47	-42	dBm/MHz
IM3	3 <sup>rd</sup> Order Inter-modulation	f1 and f2 at $F_c \pm 312.5\text{ kHz}$ , $P = 20\text{ dBm}$	-	-35	-	dBc
IM5	5 <sup>th</sup> Order Inter-modulation	f1 and f2 at $F_c \pm 312.5\text{ kHz}$ , $P = 20\text{ dBm}$	-	-50	-	dBc
$t_r$	Rise Time	10 % to 90% of final output power level	-	0.20	-	$\mu\text{s}$
$t_{dr}, t_{df}$	Delay and rise/fall Time	50 % of $V_{EN}$ edge and 90/10 % of final output power level	-	1.0	-	$\mu\text{s}$
$S_{11}$	Input Return Loss	-	6.5	9.5	-	dB
STAB	Stability	$P_{IN} \leq -2\text{ dBm}$ Load VSWR = 6:1	All non-harmonically related outputs less than -50 dBc/MHz			

**Receive Characteristics**

Conditions:  $V_{CC} = V_{EN} = 3.3\text{ V}$ ,  $T_A = 25\text{ }^\circ\text{C}$ , as measured on Skyworks Solutions' SE2521A80-EV1 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

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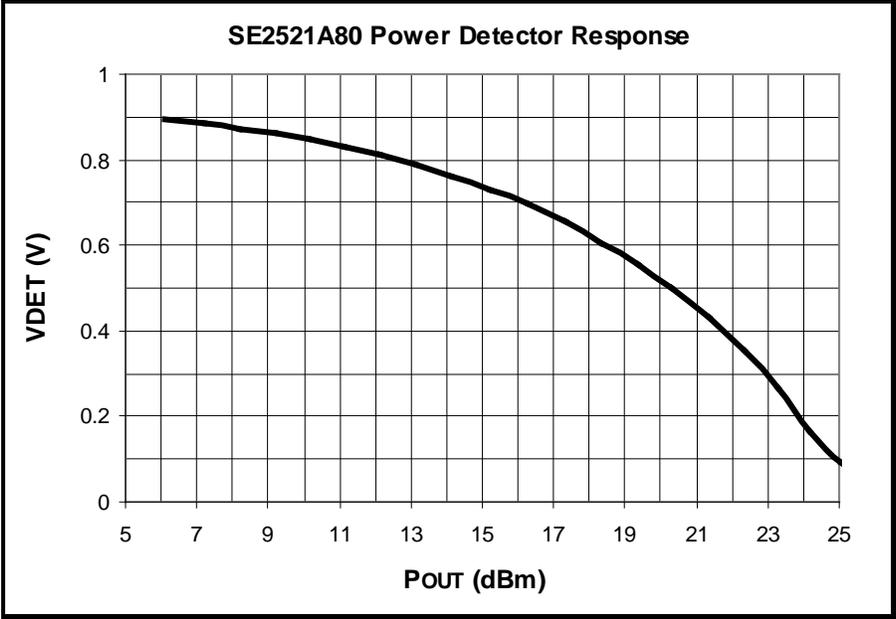
Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
RX <sub>IL</sub>	Insertion Loss	-	-	0.8	1.2	dB
RX <sub>RL</sub>	Return Loss	-	-	-15	-10	dB
Delta Rx	Delta between Rx paths	ANT_A to RX_OUT or ANT_B to RX_OUT	-	-	0.5	dB
TR <sub>ISOL-2</sub>	Rx Leakage	C1 or C4 = SWON, C2 = C3 = SWOFF, Device transmitting 20 dBm @ ANTA or ANTB, Power measured @ RX_OUT	-	-	6	dBm
ANTR <sub>ISOL</sub>	Isolation between ANT_A and ANT_B to RX_OUT	Small signal input into ANT_A or ANT_B, Device not transmitting, Power measured @ RX_OUT, C1 AND C4 = SWON, C2 and C3 = SWOFF	14	-	24	dB

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**Power Detector Characteristics**

Conditions:  $V_{CC} = V_{EN} = 3.3\text{ V}$ ,  $T_A = 25\text{ °C}$ , as measured on Skyworks Solutions' SE2521A80-EV1 evaluation board (de-embedded to device), unless otherwise noted.

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
F <sub>OUT</sub>	Frequency Range	-	2400	-	2500	MHz
PDR	Power detect range, peak power	Measured at ANT_A or ANT_B	0	-	20	dBm
PDZ <sub>LOAD</sub>	DC load impedance	-	-	2.6	-	kohm
PDV <sub>NoRF</sub>	Output Voltage, P <sub>OUT</sub> = No RF	-	0.90	0.96	1.04	V
PDV <sub>p20</sub>	Output Voltage, P <sub>OUT</sub> = 20 dBm	-	-	0.50	-	V
PDV <sub>p22</sub>	Output Voltage, P <sub>OUT</sub> = 22 dBm	-	-	0.37	-	V



**Figure 3: SE2521A80 Power Detector Performance Curve**

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**Typical Performance Data**

Conditions:  $V_{CC} = V_{EN} = 3.3\text{ V}$ , Channel = 7,  $T_A = 25\text{ }^\circ\text{C}$ , as measured on Skyworks Solutions' SE2521A80-EV1 evaluation board, all unused ports terminated with 50 ohms, unless otherwise noted.

**802.11g Typical Performance**

Conditions: 54Mbps 802.11g OFDM Signal

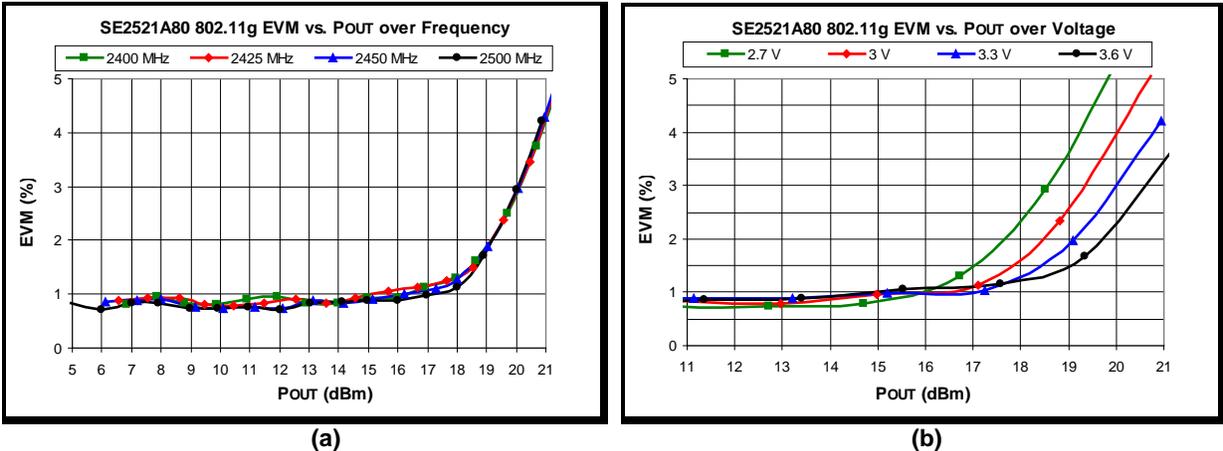


Figure 4: SE2521A80 802.11g 54 Mbps EVM vs. Pout (a) Over Frequency (b) Over Voltage

**802.11b Performance**

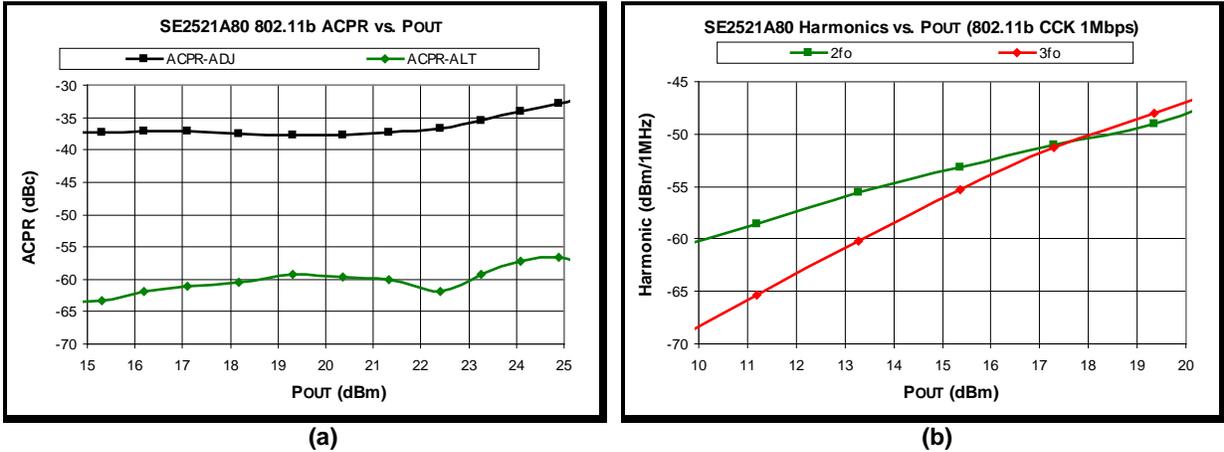
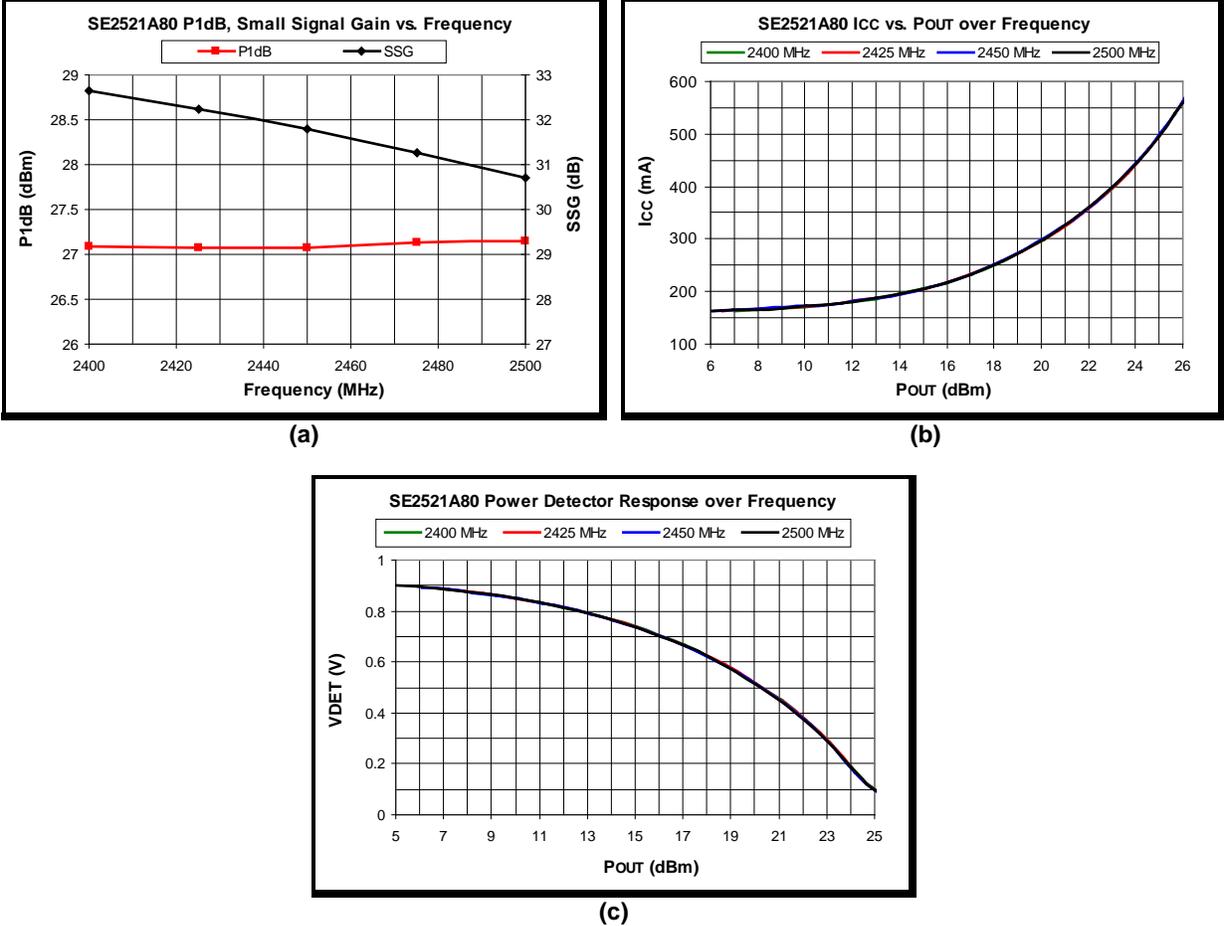


Figure 5: SE2521A80 802.11b Performance (a) ACPR vs. Pout, (b) Harmonics vs. Pout

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**CW Typical Performance**

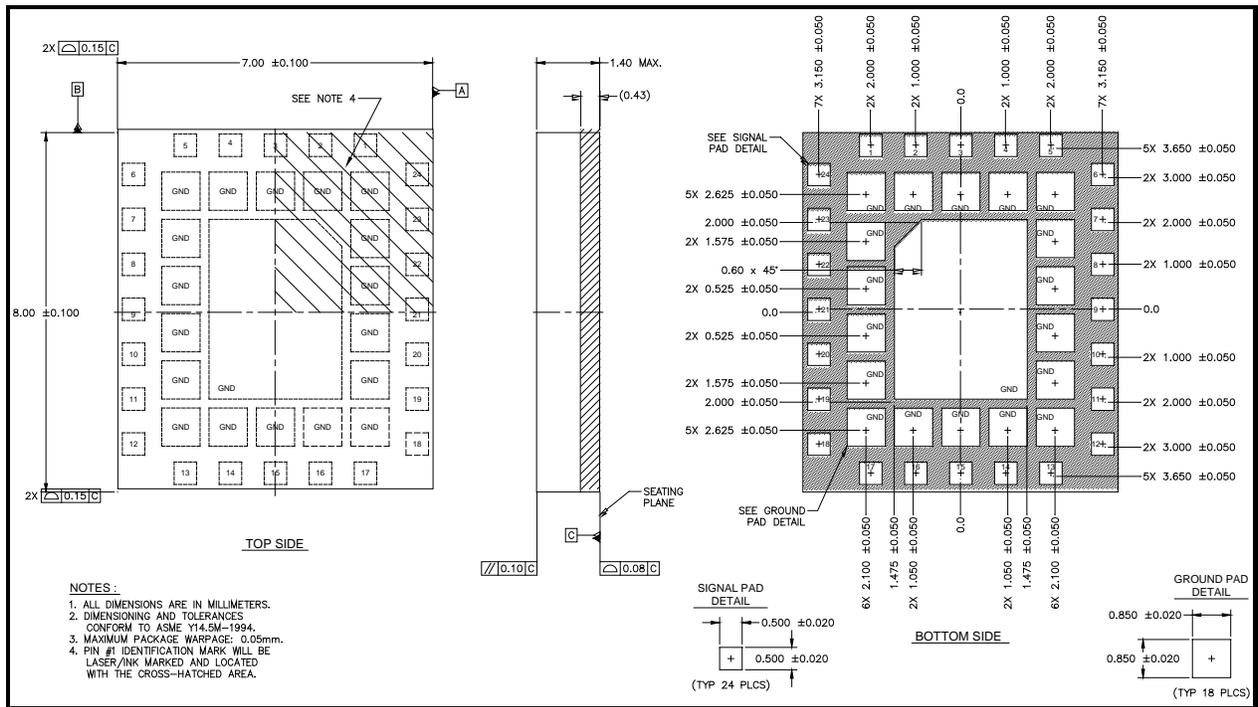


**Figure 6: SE2521A80 CW Typical Performance (a) P1dB, Gain vs. Frequency, (b) ICC vs. POUT over Frequency and (c) Power Detector Response over Frequency**

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**Package Information**

Figure 7 shows the detailed device package diagram. The pads on the Skyworks RF modules are plated with gold over nickel, with a gold thickness of nominally 0.75 um. The modules can be reflowed onto FR4 based material using eutectic SnPb or common tin based Pb free solder pastes.



**Figure 7: SE2521A80 Package Diagram**

**Package Handling Information**

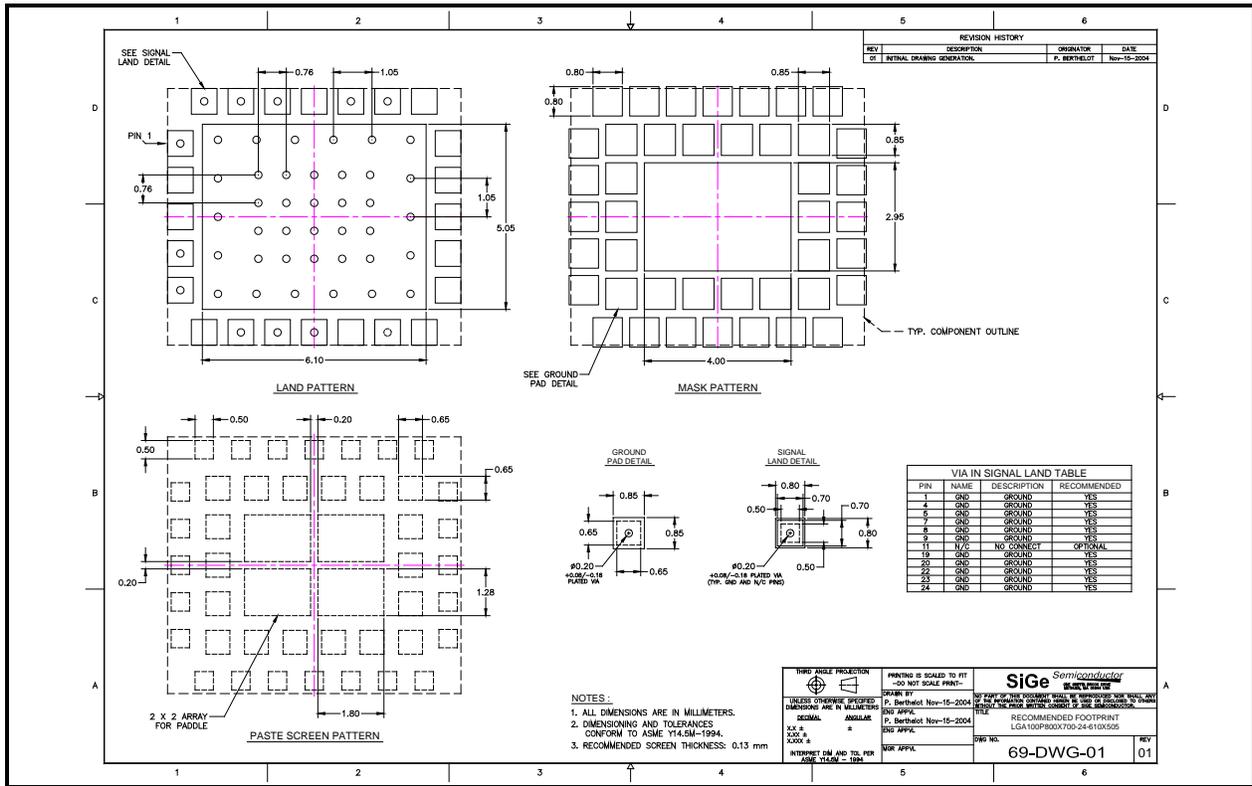
Because of its sensitivity to moisture absorption, instructions on the shipping container label must be followed regarding exposure to moisture after the container seal is broken, otherwise, problems related to moisture absorption may occur when the part is subjected to high temperature during solder assembly. The SE2521A80 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:

- “Land Grid Array Module Solder Reflow & Rework Information”, *Document Number QAD-00046*
- “Handling, Packing, Shipping and Use of Moisture Sensitive LGA”, *Document Number QAD-00047*

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**Recommended PCB Footprint**

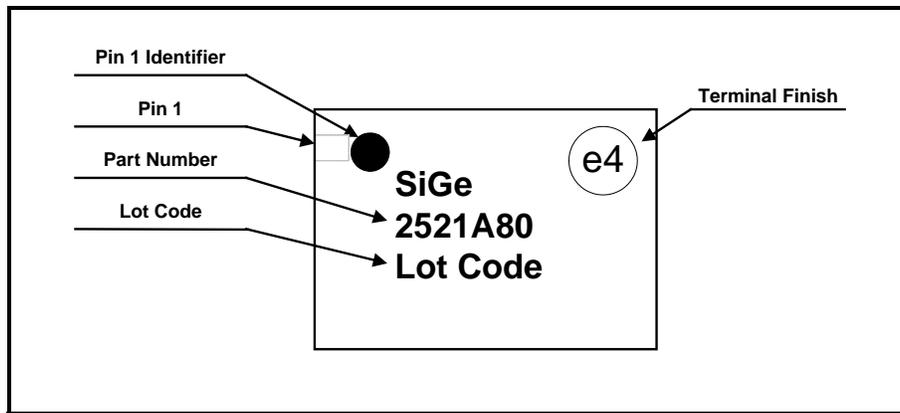
Figure 8 shows the recommended PCB footprint for the SE2521A80.



**Figure 8: SE2521A80 Recommended PCB Footprint**

**Branding Information**

The device branding is shown in Figure 9.



**Figure 9: SE2521A80 Branding and Pin 1 Location**



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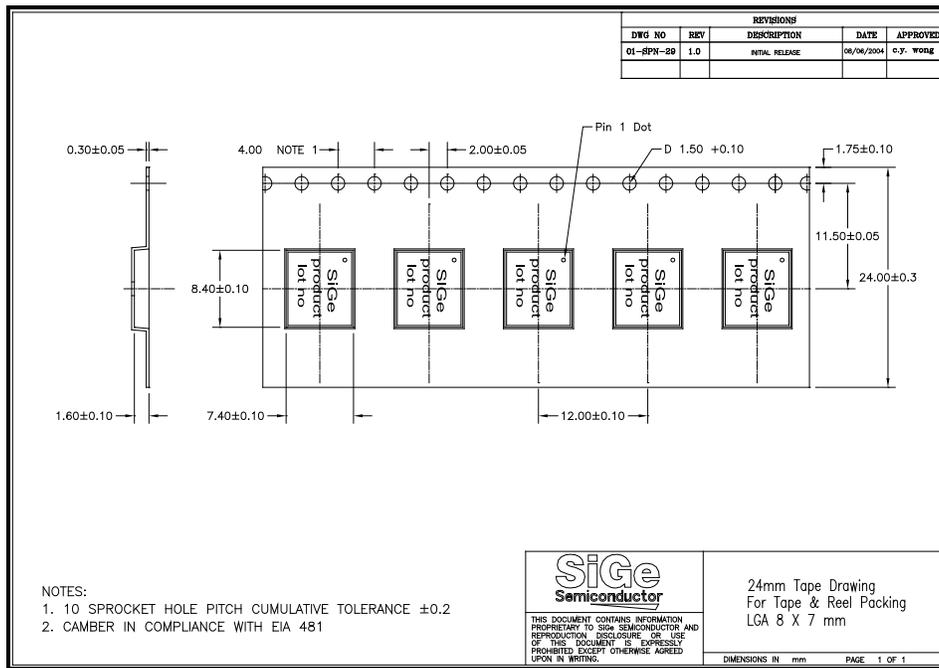
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**Tape and Reel**

Production quantities of this product are shipped in a standard tape-and-reel format. Specific tape and reel dimensions and sizing is shown in Table 1 and Figure 10.

Parameter	Value
Devices Per Reel	2500
Reel Diameter	13 inches

**Table 1: Tape and Reel Dimensions**



**Figure 10: SE2521A80 Tape and Reel Information**



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