Applications

- DSSS 2.4GHz WLAN (IEEE802.11b)
- OFDM 2.4GHz WLAN (IEEE802.11g)
- Access Points, PCMCIA, PC cards

Features

- +19 dBm, EVM = 2.7%, 802.11g, OFDM 54 Mbps
- +23 dBm, ACPR < -32 dBr, 802.11b
- +25.5 dBm P_{1dB} at 3.3 V
- Selectable integrated external or internal coupled temperature compensated power detector
- Selectable Power Detector Slope for use with multiple chipsets (Negative and Positive)
- Integrated power amplifier enable pin (V_{EN})
- Single supply voltage: 2.7 to 3.6 V
- Lead free and RoHS Compliant
- Small plastic package, 16 pin 4 mm x 4 mm QFN

Ordering Information

Type	Package	Remark
SE2525L	16 Pin QFN	Samples
SE2525L-R	16 Pin QFN	Tape and Reel
SE2525L-EK1	Evaluation Kit	Standard

Product Description

The SE2525L is a 2.4GHz power amplifier designed for use in the 2.4GHz ISM band for wireless LAN applications. The device incorporates two selectable power detectors for closed loop monitoring of the output power.

For wireless LAN applications, the device meets the requirements of 802.11g and delivers +19 dBm at an EVM of 2.7% and current of 160 mA @ 3.3 V.

The SE2525L's bias architecture provides for lower current consumption at lower output power levels. Also, the devices bias (V_B) control allows for further minor customization of the bias current for power saving at lower output powers.

The SE2525L includes a digital enable control for device on/off control.

The SE2525L has two selectable power detectors. The internally coupled signal is selected by grounding the $V_{DET}IN/DET_{SEL}$ pin. This detector detects signal at the second stage improving the accuracy under output mismatch conditions. The second detector uses an external RF input pin which would typically be taken from a directional coupler output. Both detectors are temperature compensated for minimum component count and high accuracy. Each of these power detectors also have selectable positive and negative slopes for ease of use with all chipsets.

Please note this device is not recommended for new designs. SiGe's SE2528L is a pin for pin compatible device and can be used in existing SE2525L application boards with only component value changes. Application notes are available to assist in the change.

Functional Block Diagram

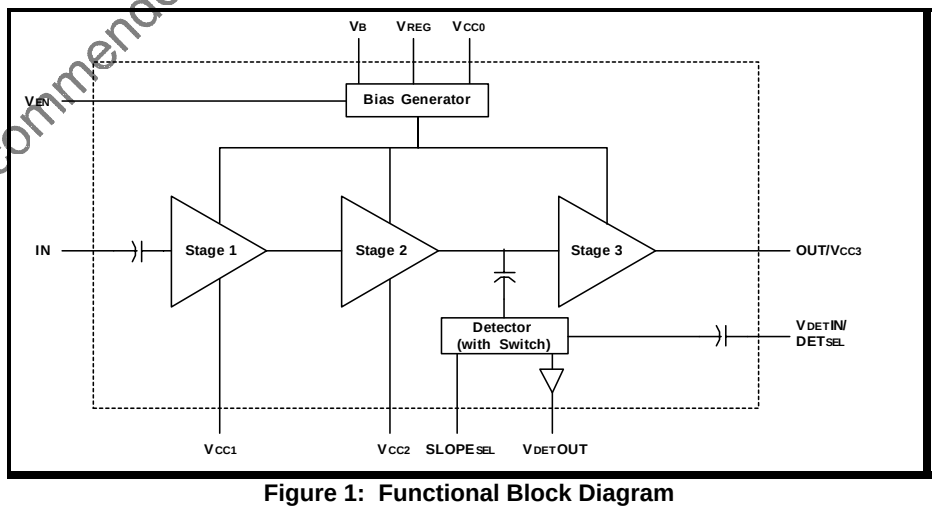


Figure 1: Functional Block Diagram

Pin Out Diagram

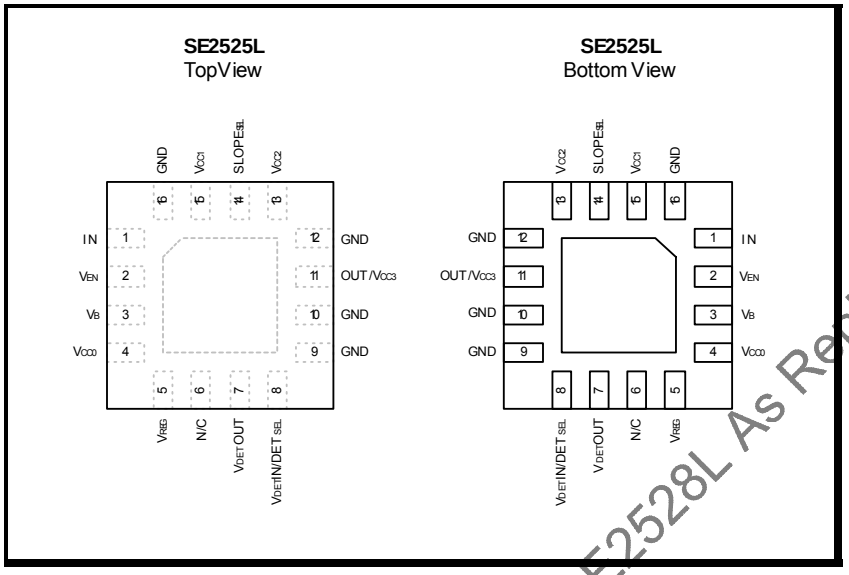


Figure 2: SE2525L Pin-Out Diagram

Pin Out Description

Pin No.	Name	Description
1	IN	Power amplifier RF input; DC block required.
2	V_{EN}	Digital pin used to power up and power down the IC
3	V_B	Controls the bias level of the power amplifier
4	V_{CC0}	Bias/control circuit supply voltage
5	V_{REG}	Internal regulator output
6	N/C	No Connect (Do not attach to GND or V_{CC})
7	V_{DET} OUT	Analog power detector output
8	V_{DET} IN/DET$_{SEL}$	Power Detector Input
9 -10	GND	Ground
11	OUT/ V_{CC3}	Power Amplifier RF output and Stage 3 collector supply voltage
12	GND	Ground
13	V_{CC2}	Stage 2 collector supply
14	SLOPE$_{SEL}$	Slope Select (N/C = Positive, GND = Negative)
15	V_{CC1}	Stage 1 collector supply
16	GND	Ground
Die Pad	GND	Exposed die pad; electrical and thermal ground

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 V_{CC0}, V_{CC1} V_{CC2} and V_{CC3}	-0.3	4.0	V
V_B	Bias Control Voltage	-0.3	4.0	V
V_{EN}	Power Amplifier Enable	-0.3	4.0	V
IN	RF Input Power	-	4.0	dBm
T_{STG}	Storage Temperature Range	-40	+150	°C
T_j	Maximum Junction Temperature	-	+150	°C

Recommended Operating Conditions

Symbol	Parameter	Min.	Max.	Unit
V_{CC}	Supply Voltage on pins V_{CC0}, V_{CC1} V_{CC2} and V_{CC3}	2.7	3.6	V
T_A	Ambient Temperature	-40	85	°C

DC Electrical Characteristics

Conditions: V_{CC} = V_{EN} = 3.3 V, V_B connected to V_{REG}, T_A = 25 °C, as measured on SiGe Semiconductor's SE2525L-EV1 evaluation board, unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$I_{CC-802.11b}$	Supply Current	P_{OUT} = 23 dBm, 11 Mbps CCK signal, BT = 0.45	-	230	-	mA
$I_{CC-802.11g}$	Supply Current	P_{OUT} = 19 dBm, 54 Mbps OFDM signal, 64 QAM	-	160	-	mA
I_{CC-1DB}	Supply Current	P_{OUT} = P_{1dB}, No modulation	-	340	-	mA
I_{OFF}	Supply Current	V_{EN} = 0 V	-	10	-	µA
V_{REG}	Regulator Voltage	I_{REG} = 120 µA(1)	-	2.5	2.75	V
I_{REG}	Regulator current	-	-	-	500	µA
V_{ENH}	Logic High Voltage	T_A = -40 to 85 °C, V_{CC} = 2.7 to 3.6 V	1.3	-	V_{CC}	V
V_{ENL}	Logic Low Voltage	T_A = -40 to 85 °C, V_{CC} = 2.7 to 3.6 V	0	-	0.5	V
V_B	Bias voltage	-	0	-	V_{REG}	V
I_B	Bias current	V_B = 2.75 V	-	-	120	µA

(1) No coupling or circuitry that provides a DC path to ground should be connected to the V_{REG} pin. Connection to the V_B is allowed.

AC Electrical Characteristics

802.11g AC Electrical Characteristics

Conditions: V_{CC} = V_{EN} = 3.3 V, f = 2.45GHz, V_B connected to V_{REG}, T_A = 25 °C, as measured on SiGe Semiconductor's SE2525L-EV1 evaluation board, unless otherwise noted

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
f_{L-U}	Frequency Range	-	2400	-	2500	MHz
P_{1dB}	Output 1dB compression point	No modulation	-	25.5	-	dBm
S_{21}	Small Signal Gain	P_{IN} = -25 dBm	28	31	-	dB
ΔS_{21}	Gain Variation over band	P_{IN} = -25 dBm, f_{IN}= 2400 to 2500 MHz	-	2	-	dB
2f	Harmonic	P_{OUT} = 23 dBm, CW	-	-27	-	dBm
3f			-	-46	-	dBm
EVM	Error Vector Magnitude	P_{OUT} = 19 dBm, 54 Mbps OFDM signal, 64 QAM		2.7	-	%
STAB	Stability	P_{IN} ≤ 2 dBm, P_{OUT} = 19 dBm, 54 Mbps OFDM signal, 64 QAM VSWR = 6:1 All Phases	All non-harmonically related outputs less than -50 dBc/100 kHz			
VSWR	Tolerance to output load mismatching	P_{IN} ≤ 2 dBm, P_{OUT} = 19 dBm, 54 Mbps OFDM signal, 64 QAM VSWR = 10:1 All Phases	No damage			

802.11b AC Electrical Characteristics

Conditions: V_{CC} = V_{EN} = 3.3 V, f = 2.45 GHz, V_B connected to V_{REG}, T_A = 25 °C, as measured on SiGe Semiconductor's SE2525L-EV1 evaluation board, unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
f_{L-U}	Frequency Range		2400		2500	MHz
P_{1dB}	Output 1dB compression point	No modulation	-	25.5	-	dBm
S_{21}	Small Signal Gain	P_{IN} = -25 dBm	28	31	-	dB
ΔS_{21}	Gain Variation over band	P_{IN} = -25 dBm, f_{IN}= 2400 to 2500 MHz	-	2.0	-	dB
2f,	Harmonics	P_{OUT} = 23 dBm, CW	-	-27		dBm/MHz
3f			-	-47	-	dBm/MHz
ACPR	Adjacent Channel Power Ratio ±11 MHz offsets from carrier ±22 MHz offsets from carrier	P_{OUT} = 23 dBm, 11 Mbps CCK signal, BT = 0.45	- -	-32 -52	- -	dBr
STAB	Stability	P_{IN} ≤ 2 dBm, P_{OUT} = 23 dBm, 11 Mbps CCK signal, BT = 0.45, VSWR = 6:1	All non-harmonically related outputs less than -50 dBc/100 kHz			
VSWR	Tolerance to output load mismatching	P_{IN} ≤ 2 dBm, P_{OUT} = 23 dBm, 11 Mbps CCK signal, BT = 0.45, VSWR = 10:1 All Phases	No damage			

Detector Selection Logic

Conditions: V_{CC} = V_{EN} = 3.3V, V_B = V_{REG}, T_A = 25°C, as measured on SiGe Semiconductor's SE2525L-EV1 evaluation board, unless otherwise noted

$SLOPE_{SEL}$	$V_{DET}IN/DET_{SEL}$	Detector Slope	Detector Signal Source
Open Circuit	AC Coupled	Positive	External
Open Circuit	Ground	Positive	Internal
Ground	AC Coupled	Negative	External
Ground	Ground	Negative	Internal

Internal Coupled Power Detector

Internal Coupled Positive Slope

Conditions: V_{CC} = V_{EN} = 3.3 V, f = 2.45 GHz, V_B connected to V_{REG}, $SLOPE_{SEL}$ = Open Circuit, V_{DET} IN/DET_{SEL} = GND, T_A = 25 °C, as measured on SiGe Semiconductor's SE2525L-EV1 evaluation board, unless otherwise noted

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
PDR	P_{OUT} detect range	-	0	-	P_{1dB}	dBm
VDET	Detector voltage	P_{OUT} = 23 dBm	-	1.15	-	V
VDET	Detector voltage	P_{OUT} = 19 dBm	-	0.73	-	V
VDET	Detector voltage	P_{OUT} = NO RF	-	0.35	-	V
PDZ_{OUT}	Output Impedance	-	250	-	700	Ω
PDZ_{LOAD}	DC load impedance	-	10	-	-	kΩ

Internal Coupled Negative Slope

Conditions: V_{CC} = V_{EN} = 3.3 V, f = 2.45 GHz, V_B connected to V_{REG}, V_{DET}OUT load = 2.4 kΩ to ground, $SLOPE_{SEL}$ = V_{DET} IN/DET_{SEL} = GND, T_A = 25 °C, as measured on SiGe Semiconductor's SE2525L-EV1 evaluation board, unless otherwise noted

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
PDR	P_{OUT} detect range	-	0	-	P_{1dB}	dBm
VDET	Detector voltage	P_{OUT} = 23 dBm	-	0.42	-	V
VDET	Detector voltage	P_{OUT} = 19 dBm	-	0.64	-	V
VDET	Detector voltage	P_{OUT} = NO RF	-	0.90	-	V

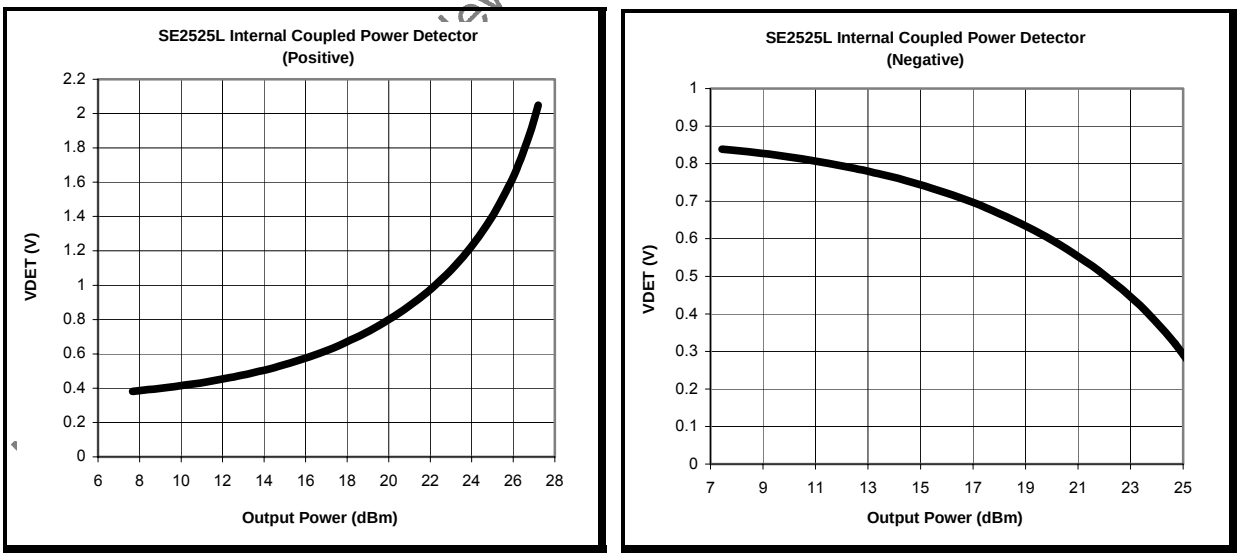


Figure 3: SE2525L Internal Coupled Power Detector Characteristic

External Coupled Power Detector

External Coupled Positive Slope

Conditions: V_{CC} = V_{EN} = 3.3 V, f = 2.45 GHz, V_B connected to V_{REG}, T_A = 25 °C, $SLOPE_{SEL}$ = Open Circuit, V_{DET} IN/DET_{SEL} = open circuit, as measured on SiGe Semiconductor's SE2525L-EV1 evaluation board, unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
PDET	Input power detect range	-	-10	-	10	dBm
VDET	Detector voltage (1)	P_{OUT} = 23 dBm	-	1.18	-	V
VDET	Detector voltage (1)	P_{OUT} = 19 dBm	-	0.8	-	V
VDET	Detector voltage (1)	P_{OUT} = NO RF	-	0.35	-	V
ZDET	Input Impedance	-	-	275//1.1	-	Ω//pF
PDZ_{OUT}	Output Impedance	-	250	-	700	Ω
PDZ_{LOAD}	DC load impedance	-	10	-	-	kΩ

(1) P_{OUT} measured at the input to the 17dB microstrip coupler on SiGe Semiconductor's SE2525L-EV1 evaluation board

External Coupled Negative Slope

Conditions: V_{CC} = V_{EN} = 3.3 V, f = 2.45 GHz, V_B connected to V_{REG}, T_A = 25 °C, V_{DET}OUT load = 2.4 kΩ to ground, $SLOPE_{SEL}$ = GND, V_{DET} IN/DET_{SEL} = open circuit, as measured on SiGe Semiconductor's SE2525L-EV1 evaluation board, unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
PDET	Input power detect range	-	-10	-	10	dBm
VDET	Detector voltage (1)	P_{OUT} = 23 dBm	-	0.3	-	V
VDET	Detector voltage (1)	P_{OUT} = 19 dBm	-	0.56	-	V
VDET	Detector voltage (1)	P_{OUT} = NO RF	-	0.90	-	V

(1) P_{OUT} measured at the input to the 17 dB microstrip coupler on SiGe Semiconductor's SE2525L-EV1 evaluation board

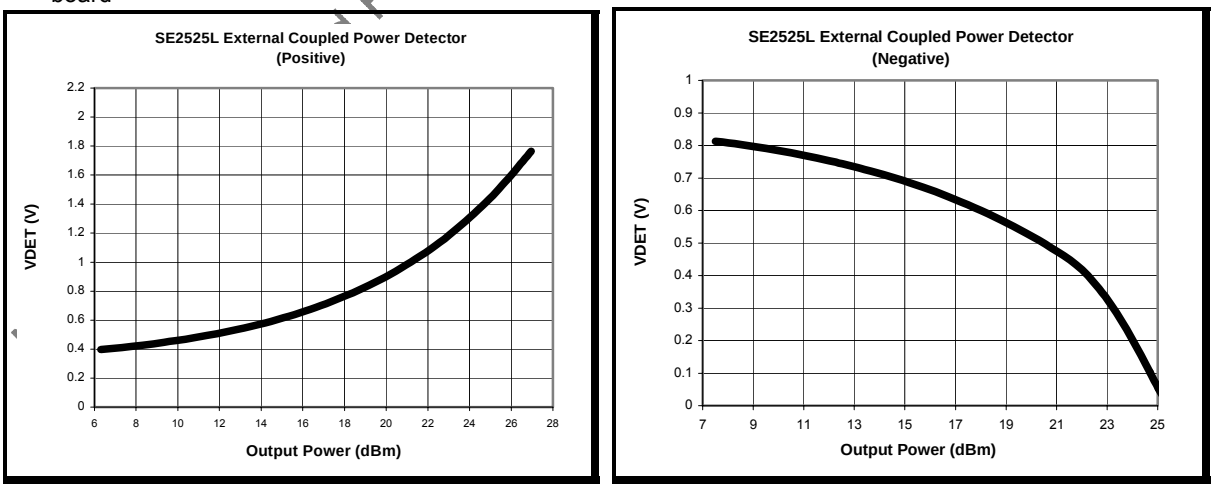


Figure 4: SE2525L External Coupled Power Detector Characteristic

Typical Performance Characteristics

Conditions: V_{CC} = V_{EN} = 3.3 V, f = 2.45 GHz, V_B connected to V_{REG}, T_A = 25 °C, as measured on SiGe Semiconductor's SE2525L-EV1 evaluation board, unless otherwise noted

General

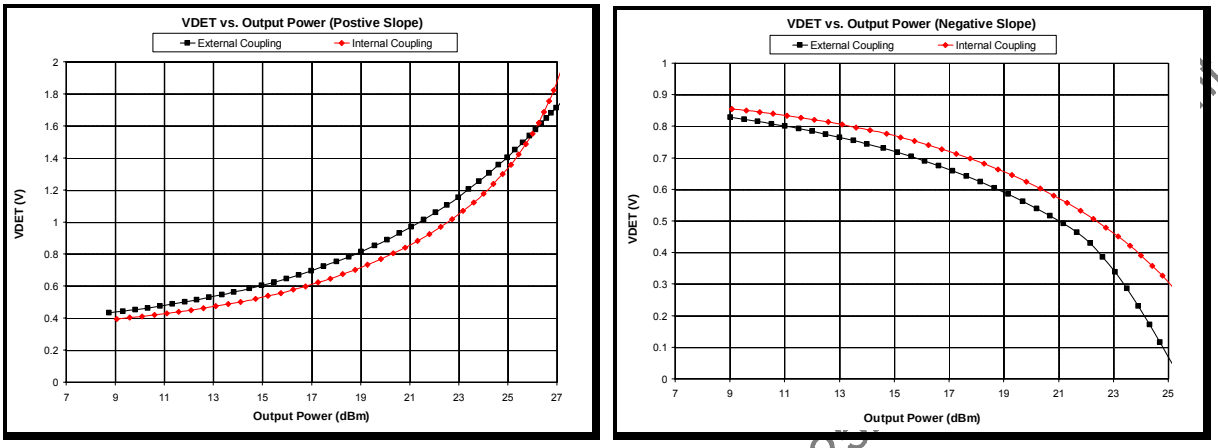


Figure 5: SE2525L Power Detector Response (Positive Slope, Negative Slope)

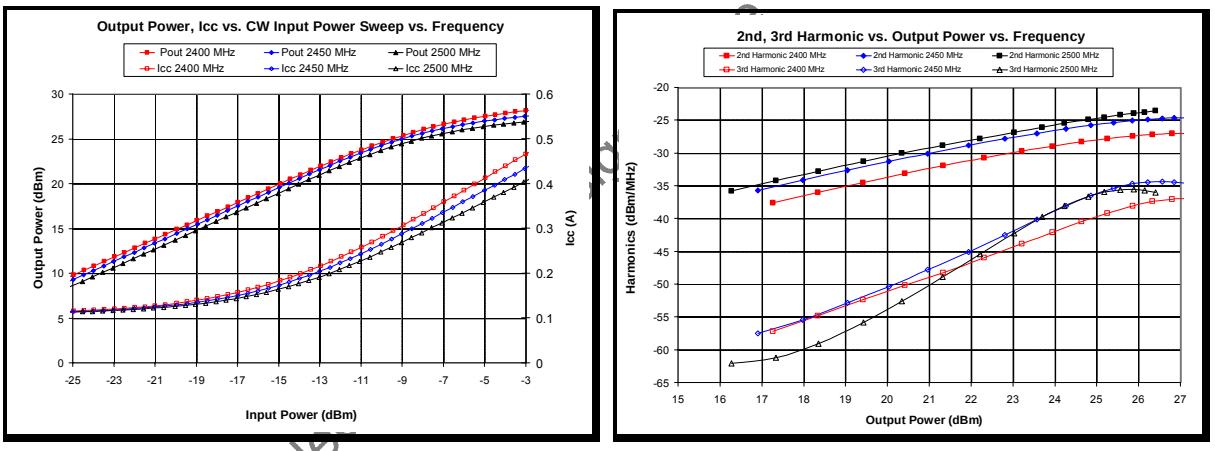
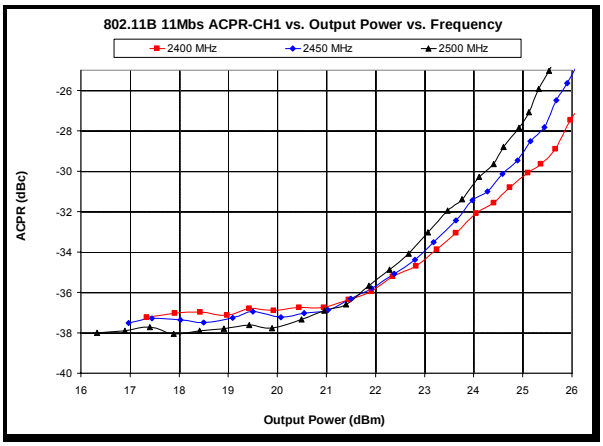


Figure 6: SE2525L CW Sweep and 2nd, 3rd Harmonics

802.11b Performance



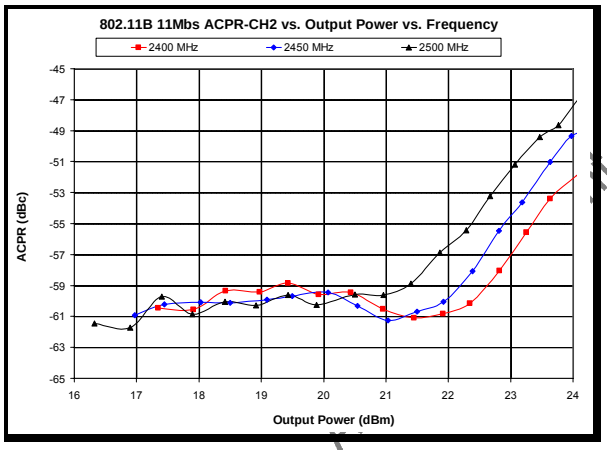
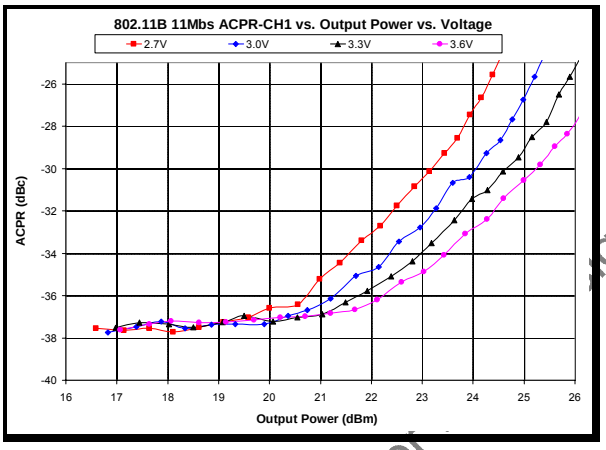


Figure 7: SE2525L Adjacent and Alternate Channel ACPR (Over Frequency)



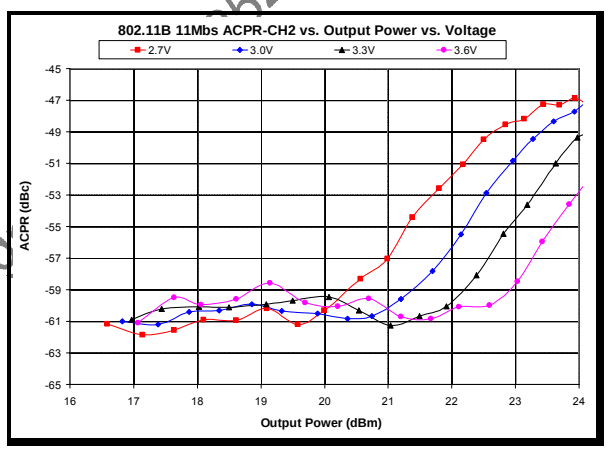
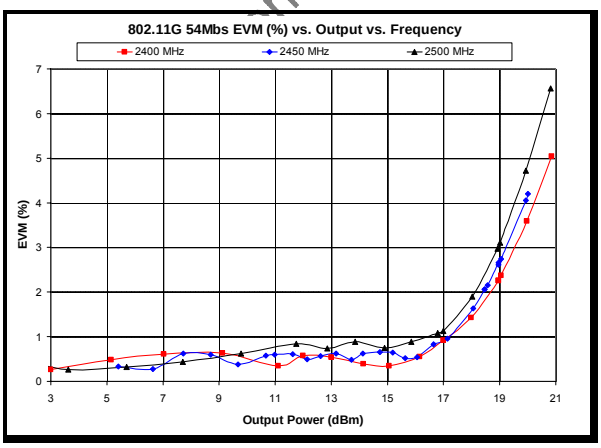


Figure 8: SE2525L Adjacent and Alternate Channel ACPR (Over Voltage)

802.11g Performance



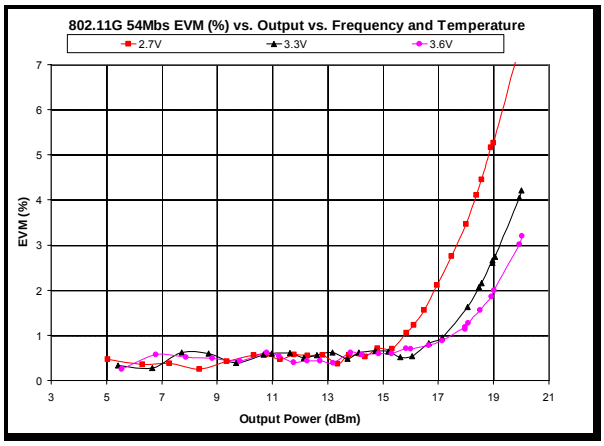
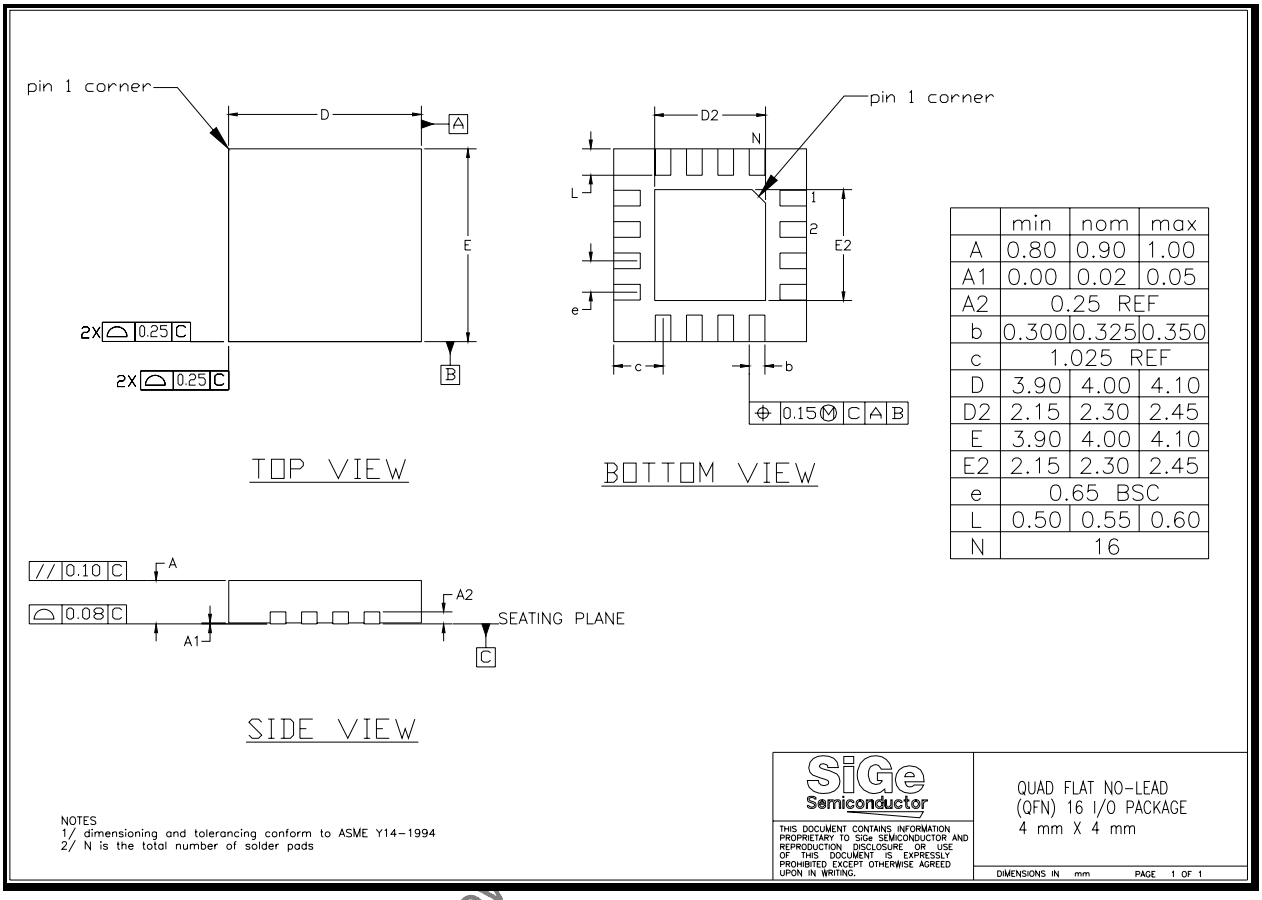


Figure 9: SE2525L 802.11g 54Mbps EVM (Over Frequency, Over Voltage)

Package Information



	min	nom	max
A	0.80	0.90	1.00
A1	0.00	0.02	0.05
A2		0.25 REF	
b	0.300	0.325	0.350
c		1.025 REF	
D	3.90	4.00	4.10
D2	2.15	2.30	2.45
E	3.90	4.00	4.10
E2	2.15	2.30	2.45
e		0.65 BSC	
L	0.50	0.55	0.60
N		16	

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Product Preview
The datasheet contains information from the product concept specification. SiGe Semiconductor, Inc. reserves the right to change information at any time without notification.

Preliminary Information
The datasheet contains information from the design target specification. SiGe Semiconductor, Inc. reserves the right to change information at any time without notification.

Production testing may not include testing of all parameters.