

DATA SHEET

SE5006L: 5 GHz Front-End Module with Power Detector

Applications

- DSSS 5 GHz WLAN (IEEE802.11a)
- Access Points, PCMCIA, PC cards

Features

- 5GHz Front End Module with PA and T/R Switch
- Integrated power amplifier enable pin (V_{PAON})
- Buffered, temperature compensated power detector
- High and Low-Linearity mode
- 3% EVM, @17dBm, 64 QAM, 54 Mbps
- 30 dB Typical Gain
- Lead Free and RoHS compliant, halogen free package
- 16 pin 3 mm x 3 mm x 0.9 mm QFN, MSL1

Product Description

The SE5006L is a 5GHz front end module offering high linear power for wireless LAN applications. It incorporates a power detector for control of the output power.

The SE5006L offers a high level of integration for a simplified design, providing quicker time to market and higher application board production yield. The device integrates the inter-stage match, a temperature compensated, load insensitive power detector with 20dB of dynamic range, a 3.8GHz notch filter, a T/R switch and an RX balun.

For wireless LAN applications, the device meets the requirements of IEEE802.11a and delivers approximately 17dBm of linear output power. It also features a low linearity mode control to reduce current consumption at low power modes.

The SE5006L integrates the reference voltage generator, allowing for a true CMOS compatible digital PAON (enable) function to turn the power amplifier on and off.

Ordering Information

Part Number	Package	Remark
SE5006L	16 Pin QFN	Samples
SE5006L-R	16 Pin QFN	Tape and Reel
SE5006L-EK1	Evaluation Kit	Standard

Functional Block Diagram

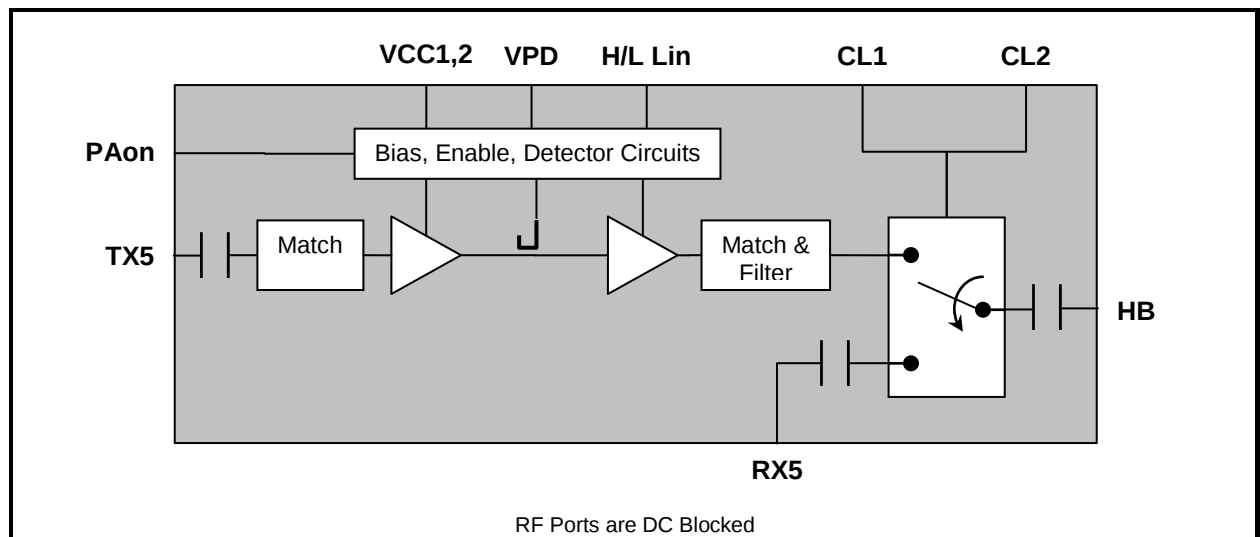


Figure 1: Functional Block Diagram

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Pin Out Diagram

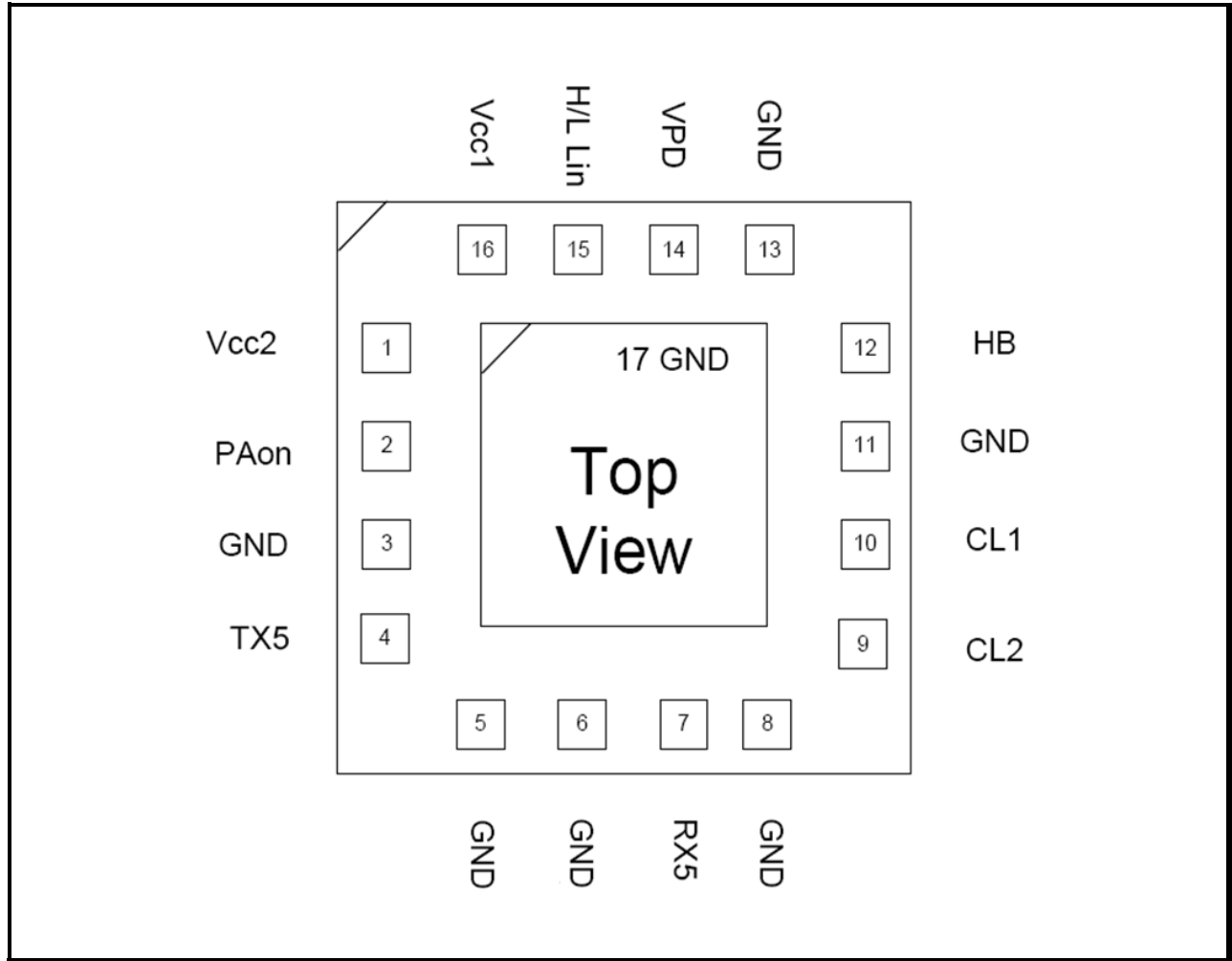


Figure 2: SE5006L Pin-Out Diagram

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Pin Out Description

Pin No.	Name	Description	Pin No.	Name	Description
1	VCC2	Bias & Driver Supply Voltage	9	CL2	Switch Control Logic 2
2	PAon	PA Enable	10	CL1	Switch Control Logic 1
3	GND	Ground	11	GND	Ground
4	TX5	TX RF Input Signal	12	HB	5GHz Antenna output
5	GND	Ground	13	GND	Ground
6	GND	Ground	14	VPD	Power Detector Output
7	RX5	RX RF output signal	15	H/L Lin	High-Low linearity Control
8	GND	Ground	16	VCC1	Power Stage Supply Voltage

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 _{CC1}	Supply Voltage on Pin 16 (VCC1)	-0.3	4.8	
V _{CC2}	Supply Voltage on pin 1 (VCC2)	-0.3	3.6	V
PAON	DC input on Enable	-0.3	3.6	V
TX5	RF Input Power, RFout into 50Ω match	-	12	dBm
T _{STG}	Storage Temperature Range	-40	150	°C
ESD _{HBM}	JEDEC JESD22-A114 all pins	Antenna Pin	1000	V
		All Other Pins	350	

Recommended Operating Conditions

Symbol	Parameter	Min.	Max.	Unit
V _{CC}	Supply Voltage on pin 16 (VCC1)	3.0	4.5	V
V _{CC}	Supply Voltage on pin 1 (VCC2)	3.0	3.6	V
T _A	Ambient Temperature	-40	85	°C

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Control Logic Characteristics

Conditions: $V_{CC1} = V_{CC2} = V_{PAON} = V_{EN} = 3.3\text{ V}$, $T_A = 25\text{ }^{\circ}\text{C}$, as measured on Skyworks Solutions' SE5006L-EV1 evaluation board, unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
ICC-802.11a	Supply Current	$P_{OUT} = 17\text{ dBm}$, 54 Mbps, 64 QAM, H/L Lin = 3.3V (High Linearity Mode)	-	195	-	mA
		$P_{OUT} = 13\text{ dBm}$, 54 Mbps, 64 QAM, H/L Lin = 0V (Low Linearity Mode)	-	140	-	
		$P_{OUT} = 5\text{ dBm}$, 54 Mbps, 64 QAM, H/L Lin = 0V (Low Linearity Mode)	-	105	-	
		$P_{OUT} = 19\text{ dBm}$, 54 Mbps, 64 QAM, H/L Lin = 3.3V, $V_{CC1} = 4.0\text{V}$	-	220	-	
I _{OFF}	Supply Current	$V_{PAON} = 0\text{ V}$, No RF	-	0.5	10	μA
V _{PAONH}	Logic High Voltage	-	2.8	-	V _{CC}	V
V _{PAONL}	Logic Low Voltage	-	-0.3	-	0.3	V
I _{PAONH}	Input Current Logic High Voltage	-	-	-	400	μA
I _{PAONL}	Input Current Logic Low Voltage	-	-	<1	-	μA

Switch Logic Characteristics

Conditions: $V_{CC} = V_{PAON} = 3.3\text{ V}$, $T_A = 25\text{ }^{\circ}\text{C}$, as measured on Skyworks Solutions' SE5006L-EK1 evaluation board, all unused ports terminated with 50 ohms, unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
ON	Low Loss Switch Control Voltage	High State = $V_{CTL_ON} - V_{CTL_OFF}$	2.8	-	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
I _{CTL}	Control Line Current	$V_{CTL} = V_{CTL_ON}$	-	-	1	mA

Switch Control Logic Table

CL1	CL2	TX ↔ ANT	RX ↔ ANT
OFF	OFF	OFF	OFF
OFF	ON	OFF	ON
ON	OFF	ON	OFF
ON	ON	Not Supported	

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SE5006L: 5 GHz Front-End Module with Power Detector
AC Electrical Characteristics
Transmit Characteristics

Conditions: $V_{CC1} = V_{CC2} = V_{PAON} = CL1 = H/L \text{ Lin} = 3.3V$, $CL2 = 0V$, $T_A = 25^\circ C$, as measured on Skyworks Solutions' SE5006L-EV1 evaluation board, unless otherwise noted

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
f_{L-U}	Frequency Range	-	4.90	-	5.85	GHz
P _{OUT}	Output Power, High Linearity Mode H/L Lin = 3.3V OFDM	802.11a, 64 QAM	EVM = 3%	-	17	-
			EVM = 2%	-	15	-
		VCC1 = 4.0V, 3% EVM	EVM = 3%	-	19	-
		MCS0, HT20, mask compliant	-	21	-	-
		MCS0, HT40, mask compliant	-	20	-	-
	Output Power, Low Linearity Mode H/L Lin = 0V OFDM	802.11a, 64 QAM, EVM = 3%	-	13	-	-
		MCS0, HT20, mask compliant	-	17	-	-
		MCS0, HT40, mask compliant	-	16	-	-
P _{1dB}	Output 1dB compression point	No modulation	-	24	-	dBm
S ₁₁	Input Return Loss	P _{IN} = -25 dBm	-	14	-	dB
S ₂₁	Small Signal Gain, P _{IN} = -25dBm	High Linearity Mode	28	31	-	dB
		Low Linearity Mode	26	30	-	
ΔS_{21}	Small Signal Gain Variation	Gain variation over single 40MHz channel	-	-	0.5	dB
		Gain Variation over band	-1.5	-	1.5	
S _{21_3.8}	Out of Band Gain	Gain at 3.8GHz	-	-	15	dB
2f	Harmonic	P _{OUT} = 17 dBm, OFDM	-	-50	-42	dBm/MHz
3f			-	-50	-42	
t _r , t _f	Rise and Fall Time	-	-	0.5	-	us
STAB	Stability	P _{OUT} = 17 dBm, 54 Mbps, 64 QAM, VSWR = 6:1, all phases	All non-harmonically related outputs less than -50 dBc/100 kHz			
Ruggedness	Tolerance to output load mismatching	Constant P _{IN} equal to P _{OUT} = 17 dBm at 50ohms, 54 Mbps, 64 QAM, VSWR = 6:1, all phases	No damage			
Robust	Robustness to input power	P _{IN} = 12dBm, CW, VSWR = 6:1, all phases	No damage			

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Receive Characteristics

Conditions: $V_{CC} = CL2 = 3.3V$, $CL1 = V_{PAON} = 0V$, $T_A = 25\text{ }^{\circ}C$, as measured on Skyworks Solutions' SE5006L-EK1 evaluation board, all unused ports terminated with 50 ohms, unless otherwise noted.

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
F_{OUT}	Frequency Range	-	5.15	-	5.75	GHz
RX_{IL}	Insertion Loss	-	-	1.0	1.5	dB
RX_{RL}	Input Return Loss	At the Antenna port	10	12	-	dB
	Output Return Loss	At RX RF output	10	12	-	
$T_{on/off}$	T/R on/off switching speed	CL1, CL2 (50%) to RF output (10% or 90%)	-	-	500	nSec

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Power Detector Characteristics

Conditions: $V_{CC} = V_{PAON} = CL1 = 3.3V$, $CL2 = 0V$, $f = 5.4\text{ GHz}$, $T_A = 25\text{ }^{\circ}\text{C}$, as measured on Skyworks Solutions' SE5006L-EV1 evaluation board, unless otherwise noted

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
PDR	P_{OUT} detect range	-	0	-	P_{1dB}	dBm
V_{DET22}	Detector voltage	$P_{OUT} = 22\text{ dBm}$	0.80	-	1.0	V
V_{DET16}	Detector voltage	$P_{OUT} = 16\text{ dBm}$	0.55	-	0.60	V
V_{DET2}	Detector voltage	$P_{OUT} = 2\text{ dBm}$	0.25	-	0.35	V
PDZ_{OUT}	Output Impedance	-	-	5	-	$K\Omega$

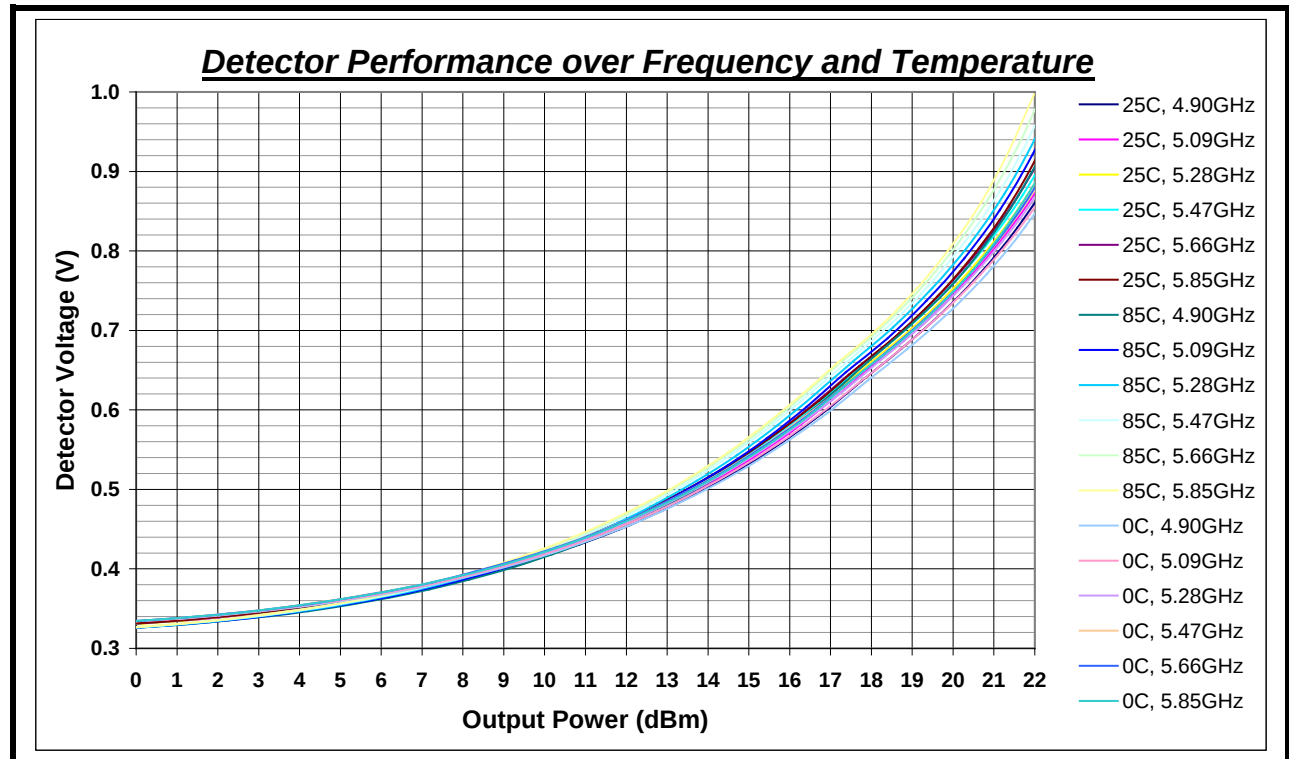


Figure 3: SE5006L Power Detector Characteristic

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Package Diagram

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

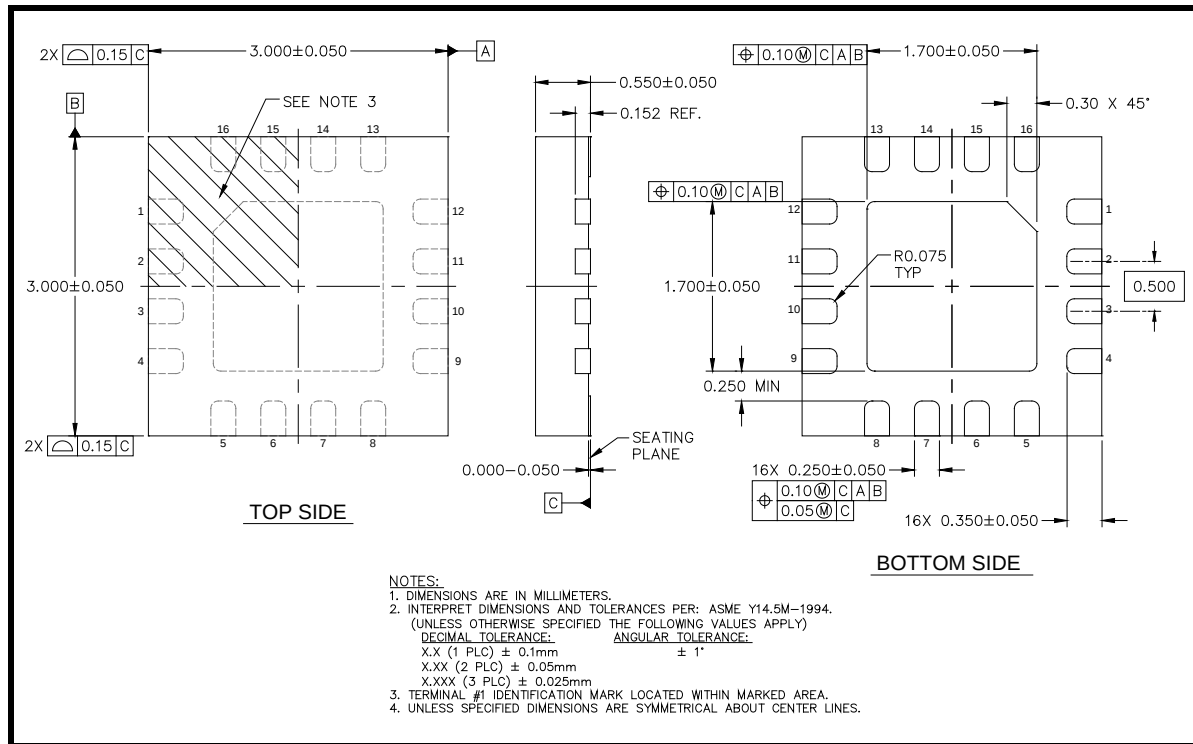
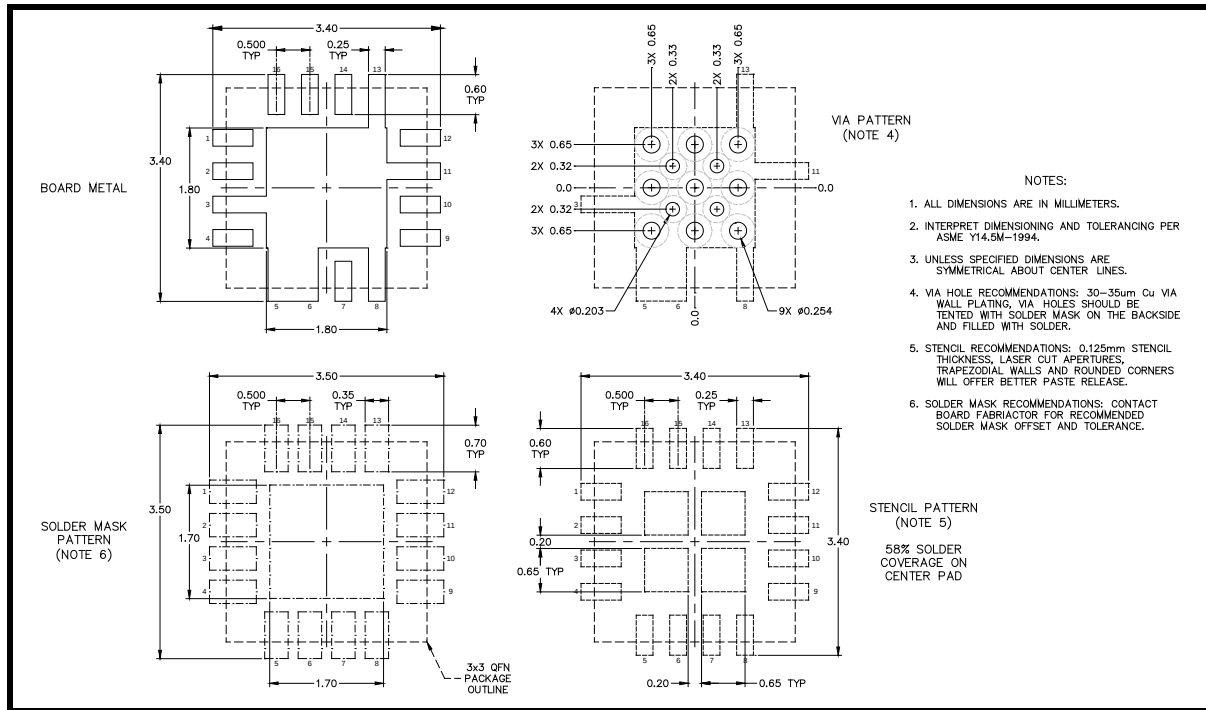


Figure 4: SE5006L Package Diagram

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SE5006L: 5 GHz Front-End Module with Power Detector
Recommended Land and Solder Patterns

Figure 5: SE5006L 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 SE5006L 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*



Caution! Class 1A ESD sensitive device

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Branding Information

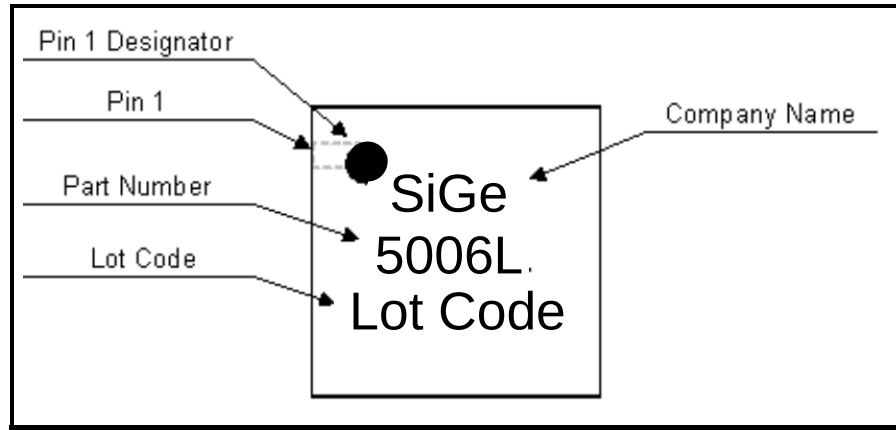


Figure 6: SE5006L Branding

Tape and Reel Information

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

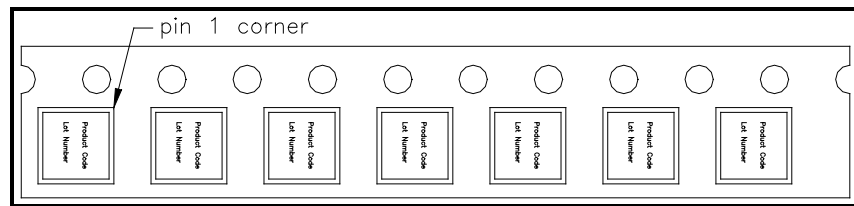


Figure 7: SE5006L-R Tape and Reel Information

Document Change History

Revision	Date	Notes
1.0	Feb 3, 2010	Created
1.1	May 07, 2010	Updated pin-out and recommended land pattern Updated RF performance to reflect DVT1 Added MSL rating (MSL3)
1.2	Oct 26, 2010	Updated switch control line current consumption
1.3	Jan 03, 2011	Updated recommended operating temperature and recommended storage temperature Updated ESD classification

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Revision	Date	Notes
1.4	Feb 24, 2011	Added 4V operation, Mask performance Added "DC Blocked" to block diagram.
1.5	Apr 03, 2012	Updated with Skyworks logo and disclaimer statement

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