DATA SHEET
SE5004L: 5 GHz, 26dBm Power Amplifier with Power Detector

Applications

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

Features

- High output power amplifier
  - 26dBm at 5V
- External Analog Reference Voltage (V_{REF}) for maximum flexibility
- Buffered, temperature compensated power detector
- 3% EVM, @26dBm, 64 QAM, 54 Mbps
- 32 dB Gain
- Lead Free, RoHS compliant, halogen free MSL3 package
- 20 pin 4 mm x 4 mm x 0.9 mm QFN

Ordering Information

Part Number	Package	Remark
SE5004L	20 Pin QFN	Samples
SE5004L-R	20 Pin QFN	Tape and Reel
SE5004L-EK1	Evaluation Kit	Standard

Product Description

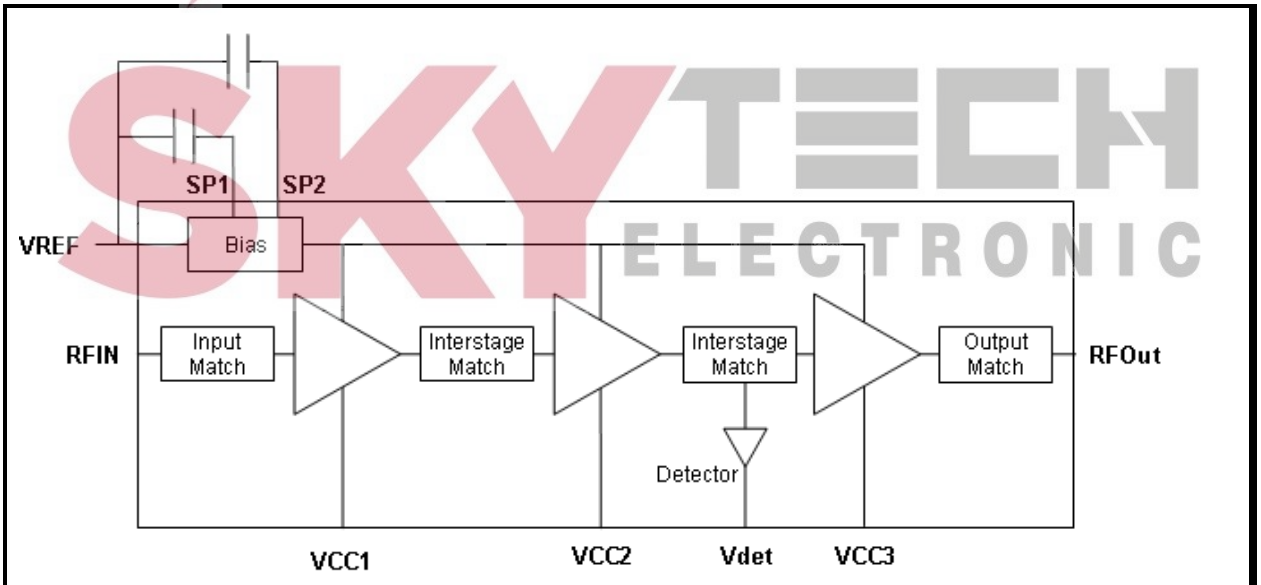
The SE5004L is a 5GHz power amplifier offering high linear power for wireless LAN applications. The SE5004L incorporates a power detector for closed loop monitoring and control of the output power.

The SE5004L offers high integration for a simplified design, providing quicker time to market and higher application board production yield. The device integrates the input match, the inter-stage match, the output match, the power detector with 15dB of dynamic range and a 3.8GHz notch filter. Only 6 external decoupling capacitors are required to complete the design.

For wireless LAN applications, the device meets the requirements of IEEE802.11a & 802.11n, and delivers approximately 26dBm of linear output power at 5V.

The SE5004L integrates temperature compensated bias voltage generators. A 2.85V reference voltage on VREF is all that is required to enable or disable the power amplifier.

Functional Block Diagram



RFIN and RFOUT include DC shunt to Ground. External blocking capacitors are recommended.

Figure 1: Functional Block Diagram

Pin Out Diagram

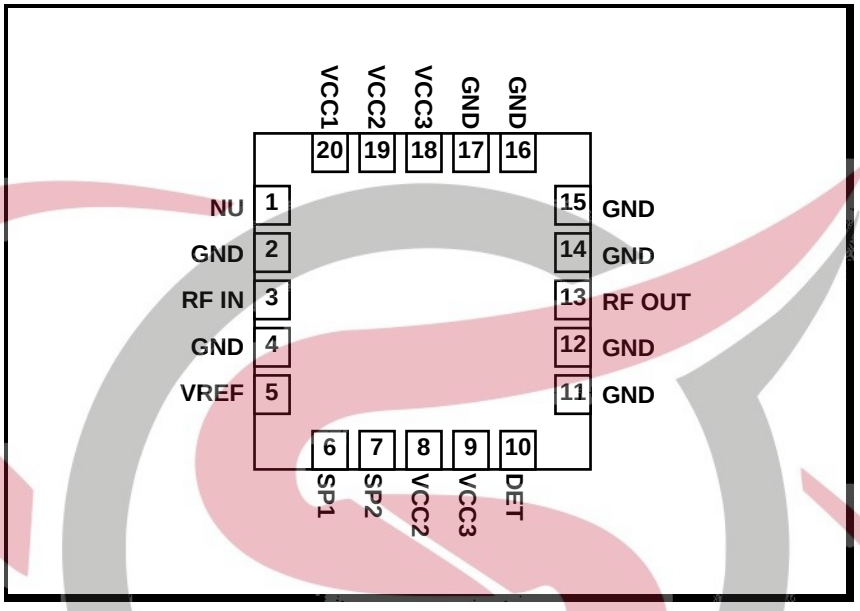


Figure 2: SE5004L Pin Out (Top View Through Package)

Pin Out Description

Pin No.	Name	Description
1	NU	Pin is not used, and is open circuit in the package
2	GND	Ground
3	RFin	Power Amplifier RF input, DC block required
4	GND	Ground
5	V_{REF}	Reference Voltage
6	SP1	Port for optional capacitor to improve dynamic EVM
7	SP2	Port for optional capacitor to improve dynamic EVM
8	VCC2	Second Stage Supply Voltage
9	VCC3	Third Stage Supply Voltage
10	DET	Analog Power Detector Output
11,12	GND	Ground
13	RF OUT	Power Amplifier RF Output
14-17	GND	Ground
18	VCC3	Third Stage Supply Voltage
19	VCC2	Second Stage Supply Voltage
20	VCC1	First 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_{CC}	Supply Voltage on pins VCC3	-0.3	+6	V
	Supply Voltage on pins VCC1, VCC2	-0.3	VCC3	
V_{REF}	Power Amplifier Enable and Reference Voltage	-0.3	3.6	V
RF_{IN}	RF Input Power, RFout into 50Ω match, T_{CASE_MAX} = 85C	-	6	dBm
T_{STG}	Storage Temperature Range	-40	160	°C
T_j	Maximum Junction Temperature	-	160	°C
ESD_{HBM}	JEDEC JESD22-A114 all pins	-	500	V

Recommended Operating Conditions

Symbol	Parameter	Min.	Max.	Unit
V_{CC}	Supply Voltage VCC3	3.0	5.5	V
	Supply Voltage VCC1, VCC2	3.0	VCC3	
T_{CASE_MAX}	Maximum Case Temperature	-40	85	°C
V_{REF}	Reference Voltage	2.8	2.9	V

DC Electrical Characteristics

Conditions: V_{CC} = 5.0V, V_{REF} = 2.85 V, T_A = 25 °C, as measured on Skyworks Solutions' SE5004L-EK1 evaluation board, unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$I_{CC\text{-}802.11a}$	Supply Current	P_{OUT} = 26 dBm, 54 Mbps, 64 QAM	-	600	800	mA
I_{QC}	Quiescent Current	No RF	-	300	-	mA
I_{OFF}	Supply Current	V_{REF} = 0 V, No RF	-	0.5	10	µA
IEN	Bias Control Current	V_{REF} = $V_{REF\ H}$ Internal 2KΩ pull down resistor	-	10	-	mA
$V_{REF\ H}$	Reference Voltage Enabled	-	2.80	2.85	2.9	V
$V_{REF\ L}$	Reference Voltage Disabled	-	0	-	0.5	V

AC Electrical Characteristics

802.11a AC Electrical Characteristics

Conditions: V_{CC} = 5.0 V, V_{REF} = 2.85 V, f = 5.4 GHz, T_A = 25 °C, as measured on Skyworks Solutions' SE5004L-EK1 evaluation board, unless otherwise noted

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
f_{L-U}	Frequency Range	-	5.15	-	5.85	GHz
P_{OUT}	Output Power	802.11a, 54Mbps, 64 QAM, 3% EVM	25.5	26	-	dBm
		802.11a, 54Mbps, 64 QAM, 2.5% EVM	24.5	25		
		802.11n, MCS0, Mask Compliant	-	29	-	
P_{1dB}	Output 1dB compression point	No modulation	30	34	-	dBm
S_{21}	Small Signal Gain	P_{IN} = -25 dBm	30	32	-	dB
ΔS_{21}	Gain Variation	Within each UNII Band	-	3	-	dB
$\Delta S_{21\ 3.8}$	Gain at 3.8GHz	P_{IN} = -25 dBm	-	-	0	dB
2f	Harmonic	P_{OUT} = 26 dBm, 5V	-	-	-45	dBm/MHz
3f						
t_r, t_f	Rise and Fall Time	-	-	0.15	0.3	us
STAB	Stability	P_{OUT} = 26 dBm, VCC = 5V, 54 Mbps, 64 QAM, VSWR = 6:1, all phases	All non-harmonically related outputs less than -50 dBc/100 kHz			
Rugged	Tolerance to constant input power into a mismatch load	P_{IN} = -10dBm, CW, VSWR = 6:1, all phases	No damage			

Power Detector

Conditions: V_{CC} = 5.0 V, V_{REF}=2.85V, f = 5.4 GHz, T_A = 25 °C, as measured on Skyworks Solutions' SE5004L-EK1 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} = 27 dBm	-	1.000	-	V
		P_{OUT} = NO RF	-	0.325	-	V
ERR_{DET}	Detector Accuracy	ΔP_{OUT} at constant V_{DET}, 5.15 GHz – 5.70 GHz 5.70 GHz – 5.85 GHz	-0.5 -0.5	- -	+0.5 +0.5	dB
		ΔP_{OUT} at constant V_{DET}, VSWR = 3:1	-1.5		+1.5	dB
PDZ_{OUT}	Output Impedance	-	-	0.7	-	KΩ
PDZ_{LOAD}	DC load impedance	-	-	26.5	-	KΩ

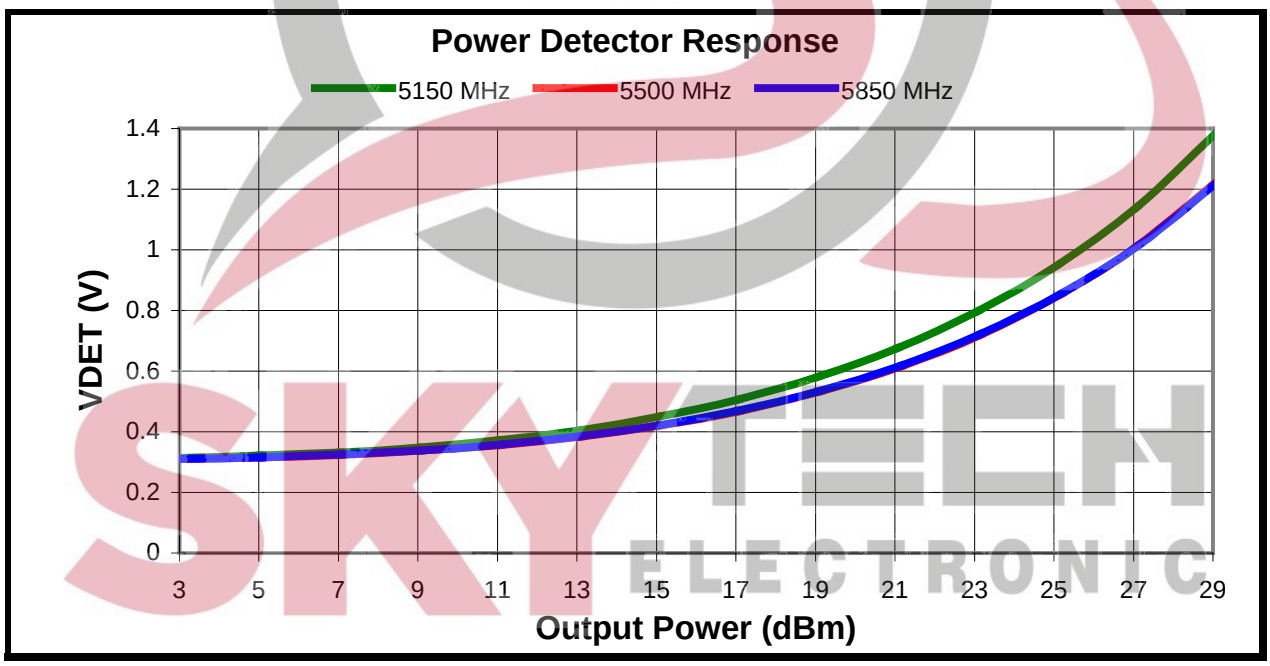


Figure 3: SE5004L Power Detector Characteristic over Frequency

Package Diagram

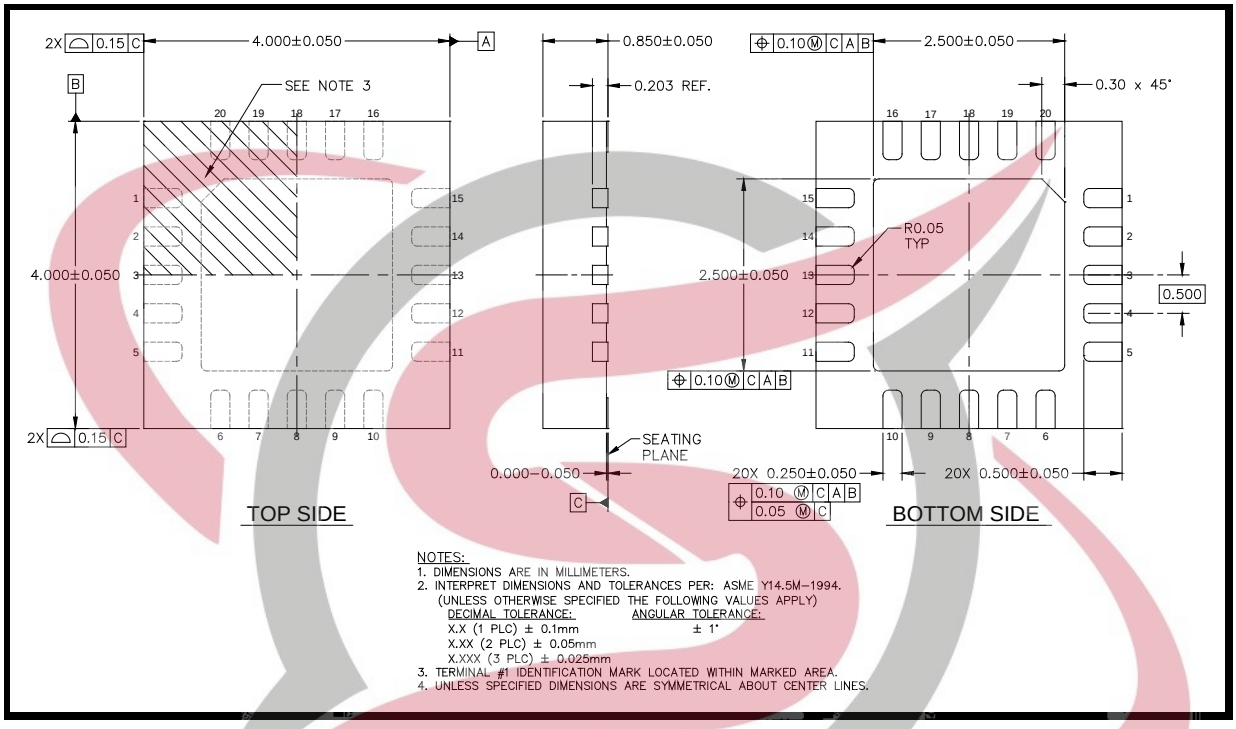


Figure 4: SE5004L Package Information

Recommended Land and Solder Pattern

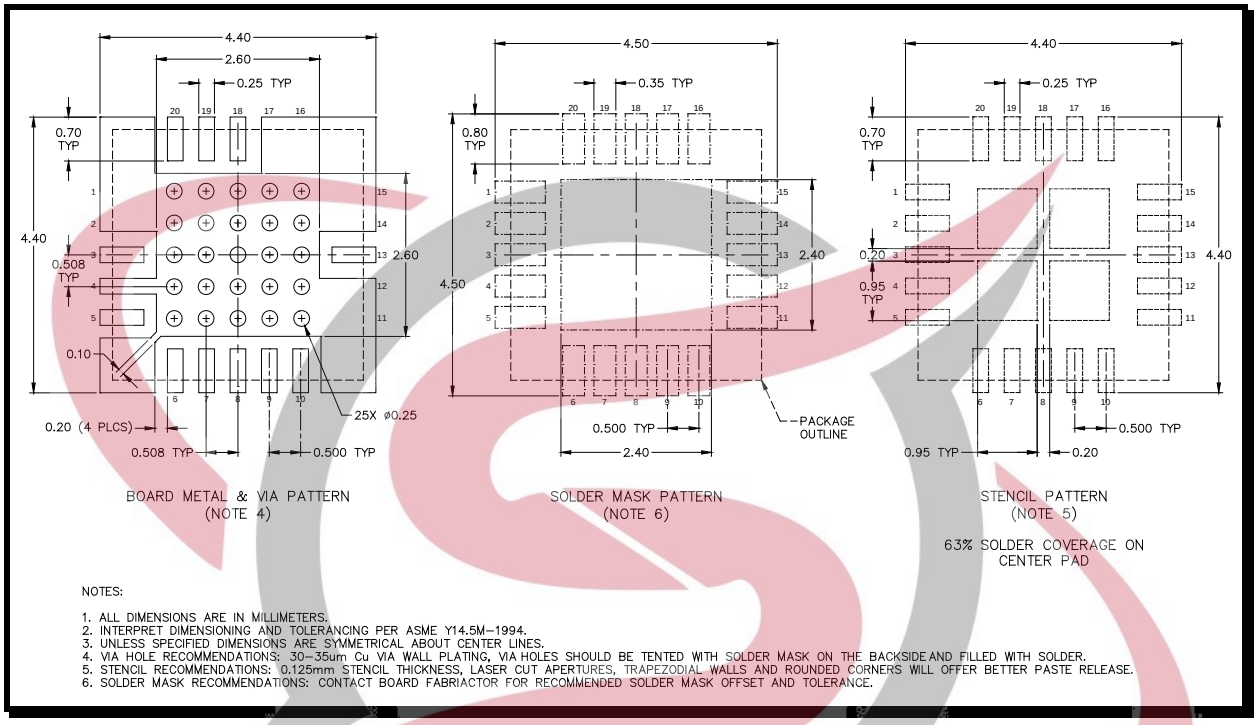


Figure 5: SE5004L Recommended Land Pattern

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 SE5004L 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 1B ESD sensitive device

Branding Information

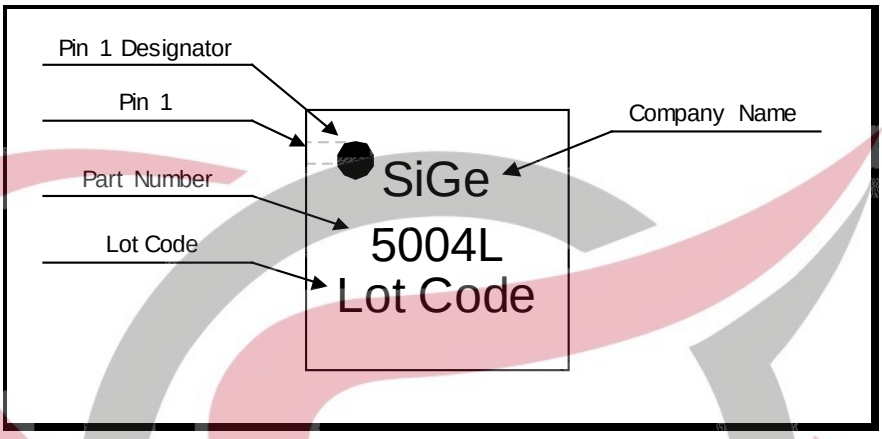


Figure 6: SE5004L Branding Information

Tape and Reel Information

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

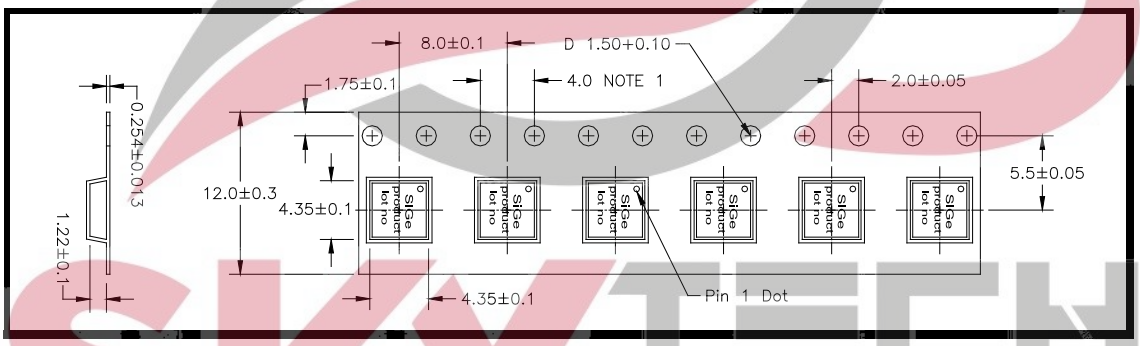


Figure 7: SE5004L-R Tape and Reel Information

Document Change History

Revision	Date	Notes
1.0	Aug 18, 2009	Created
1.1	Jan 14, 2010	Updated Pinout
1.2	May 4, 2010	Updated harmonic specification
1.3	May 7, 2010	Update T_{RISE} and T_{FALL} time Added MSL rating
1.4	May 20, 2010	Update Recommended Land and Solder Pattern Update detector plot.
1.5	Jul 20, 2010	Extended operating temperature range to -40C to +85C Updated absolute maximum ratings for VCC1 and VCC2 Updated EN pull down resistor value
1.6	Nov 20, 2010	Update Maximum Junction Temperature Updated ESD rating
1.7	Feb 25, 2011	Added Mask compliance Added Vref min/max limits to recommended operating conditions
1.8	Apr 02, 2012	Updated with Skyworks logo and disclaimer statement
1.9	Apr 12, 2012	Added min/max limits to Gain, P1dB, EVM, ICC

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

Skyworks:

SE5004L-R SE5004L-EK1 SE5004L-EK2