

DATA SHEET

# SKY65249-11: WLAN 802.11b, g, n Intera™ Front-End Module

## Features

- 2.4 to 2.5 GHz operation
- Cardbus, mini PC1, PCIe and AP applications
- $P_{OUT}$  @ 2.5% EVM (OFDM54): 18 dBm
- Gain: 25 dB
- Integrated PA, filters, directional detector and diversity switch
- Single supply voltage : 3.0 to 3.6 V
- Dual antennas
- Small, ultra thin package 4 x 4 x 0.9 mm
- Lead (Pb)-free and RoHS-compliant

## Description

The SKY65249-11 Intera FEM contains one complete 2.4 GHz transmit/receive chain in a compact RF front-end module optimized for single band 2.4–2.5 GHz operation. The SKY65249-11 includes a PA with integrated input filtering for 3.2–3.3 GHz rejection, and temperature-compensated directional power detector with 20 dB dynamic range. Also included are low loss, high rejection harmonic filters and a diversity switch which provide high linearity in transmit and low loss in receive paths.

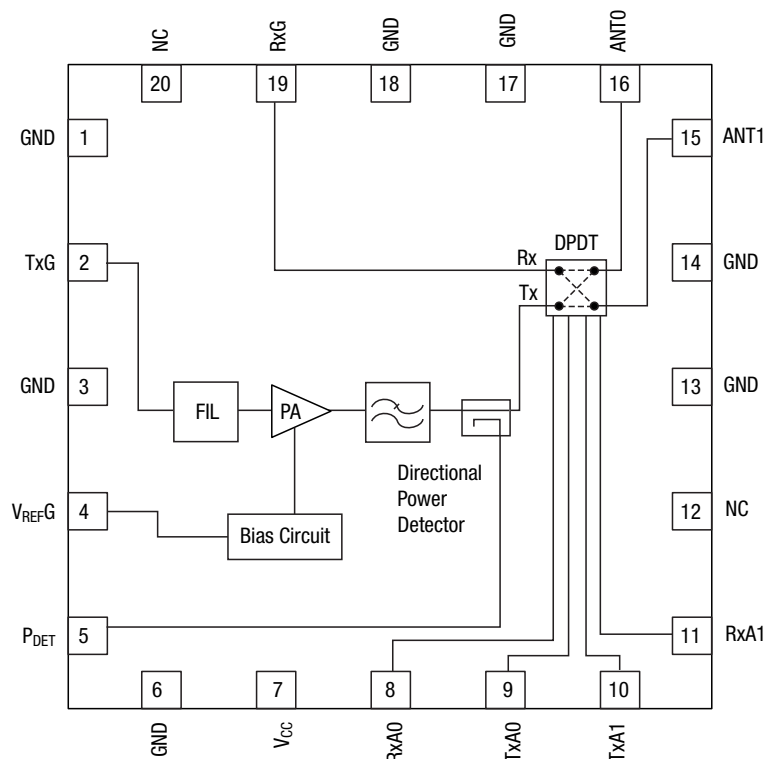
The SKY65249-11 is packaged in a lead (Pb)-free, RoHS-compliant laminate package, which measures 16 mm<sup>2</sup>.

**NEW**

Skyworks offers lead (Pb)-free, RoHS (Restriction of Hazardous Substances)-compliant packaging.



## Functional Block Diagram



### Absolute Maximum Ratings

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
V <sub>CC</sub>	V <sub>CC</sub>		-0.3		5.5	V
V <sub>REFG</sub>	V <sub>REFG</sub>		-0.3		5.5	V
Tx In	Tx IN				10	dBm
Junction temperature	T <sub>J</sub>				150	°C
Dissipated power	P <sub>D</sub>			0.6	1.0	W
Thermal resistance	Θ <sub>JC</sub>				55	°C/W
Moisture sensitivity level	MSL-3				250	°C
Operating temperature range	T <sub>OP</sub>		-20		85	°C
Storage temperature range	T <sub>STO</sub>		-65		150	°C

Performance is guaranteed only under the conditions listed in the specifications table and is not guaranteed under the full range(s) described by the Absolute Maximum specifications. Exceeding any of the absolute maximum/minimum specifications may result in permanent damage to the device and will void the warranty.

### Recommended Operating Conditions

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply voltage	V <sub>CC</sub>		3	3.3	3.6	V
Reference voltage	V <sub>REFG</sub>		2.8	2.9	3.0	V
Operating temperature	T <sub>OP</sub>		0	25	85	°C

### DC Characteristics

**Conditions: V<sub>CC</sub> = 3.3 V, T<sub>OP</sub> = 25 °C. Measurements made on Skyworks EVB with all losses de-embedded. All unused ports terminated into 50 Ω unless otherwise specified.**

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Total 802.11g Tx supply current	I <sub>CC-g</sub>	P <sub>OUT</sub> = 18 dBm, 54 Mbps OFDM, V <sub>REFG</sub> = 2.9 V		180		mA
Total 802.11g Tx quiescent current	I <sub>CC-g</sub>	No RF		95		mA
Total 802.11b Tx supply current	I <sub>CC-b</sub>	P <sub>OUT</sub> = 20 dBm, 11 Mbps CCK V <sub>REFG</sub> = 2.9 V		210		mA

### PA Logic Characteristics

**Conditions: V<sub>CC</sub> = 3.3 V, T<sub>OP</sub> = 25 °C. Measurements made on Skyworks EVB with all losses de-embedded. All unused ports terminated into 50 Ω unless otherwise specified.**

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Reference voltage high	V <sub>REFG-H</sub>		2.8	2.9	3.0	V
Reference voltage low	V <sub>REFG-L</sub>		0		0.3	V
Reference current high	I <sub>REFG-H</sub>			4		mA
Reference current low	I <sub>REFG-L</sub>			20		μA

## Switch Characteristics

Conditions:  $V_{CC} = 3.3\text{ V}$ ,  $T_{OP} = 25\text{ }^{\circ}\text{C}$ . Measurements made on Skyworks EVB with all losses de-embedded.  
All unused ports terminated into  $50\ \Omega$  unless otherwise specified.

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Control voltage - ON state	$V_{CTL\_on}$		3	3.3	3.6	V
Control voltage - OFF state	$V_{CTL\_off}$		0		0.2	V
Control current - ON state	$I_{CTL\_on}$	RF ON		10	75	$\mu\text{A}$
Control current - ON state	$I_{CTL\_on}$	RF OFF		2	20	$\mu\text{A}$

## Truth Table

MODE	RxA0 (V)	RxA1 (V)	TxA0 (V)	TxA1 (V)	$V_{CC}$ (V)	$V_{REFG}$ (V)
Rx-ANT0	3.3	0	0	0	3.3	0
Rx-ANT1	0	3.3	0	0	3.3	0
Tx-ANT0	0	0	3.3	0	3.3	2.9
Tx-ANT1	0	0	0	3.3	3.3	2.9
TxRx-ANT0	3.3	0	3.3	0	3.3	2.9

All other conditions not recommended.

**CAUTION:** Although this device is designed to be as robust as possible, Electrostatic Discharge (ESD) can damage this device. This device must be protected at all times from ESD. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection. Industry-standard ESD precautions should be employed at all times.

### 802.11b,g Transmit Specifications

**Conditions:  $V_{CC} = 3.3\text{ V}$ ,  $V_{REFG} = 2.9\text{ V}$ ,  $T_{OP} = 25\text{ }^{\circ}\text{C}$ . PA enables and control voltages set according to Truth Table. Measurements made on Skyworks EVB with all losses de-embedded. All unused ports terminated into  $50\ \Omega$  unless otherwise specified.**

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Frequency range	F		2.4		2.5	GHz
Linear output power - g	P <sub>lin_g</sub>	54 Mbps OFDM, 64 QAM, EVM = 2.5 %		18		dBm
Compliant output power - b	P <sub>OUT_b</sub>	11 Mbps CCK		21		dBm
Backed off EVM	BEVM	54 Mbps OFDM, 64 QAM, P <sub>OUT</sub> = 8 dBm		1.5		%
1 dB compression point	P <sub>1 dB</sub>		22.5	25		dBm
Small signal gain	S <sub>21</sub>			25		dB
Small signal gain variation over frequency band	$\Delta S_{21} $			2		dB
Gain, 3.2–3.3 GHz	S <sub>21</sub>   - 3.2			0		dB
Harmonics	2f, 3f	P <sub>OUT</sub> = 18 dBm, 1 Mbps, CCK, 802.11b		-50	-42	dBm/MHz
Tx switching time	t <sub>sw</sub>	50 % of V <sub>CTL</sub> to 90/10 % RF output			500	ns
Input return loss	S <sub>11</sub>	Tx In		-10		dB
Output return loss	S <sub>22</sub>	Ant A or Ant B		-8		dB
Stability	STAB	P <sub>OUT</sub> ≤ 18 dBm, load VSWR = 3:1	All non-harmonically related outputs less than -50 dBc/1 MHz			

### 802.11b,g Receive Specifications

**Conditions:  $V_{CC} = 3.3\text{ V}$ ,  $V_{REFG} = 2.9\text{ V}$ ,  $T_{OP} = 25\text{ }^{\circ}\text{C}$ . PA enables and control voltages set according to Truth Table. Measurements made on Skyworks EVB with all losses de-embedded. All unused ports terminated into  $50\ \Omega$  unless otherwise specified.**

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Frequency range	F		2.4		2.5	GHz
Insertion loss	S <sub>21</sub>			1.1	1.6	dB
Input/output return loss	S <sub>11</sub>  ,  S <sub>22</sub>	RxG, Ant 0, 1		-15		dB
Antenna to Rx isolation		PA off, switch in Tx–Ant0 (Ant1) mode		23		dB
Antenna to antenna isolation		Isolation between Ant0 and Ant1 parts Switch in any mode		19		dB

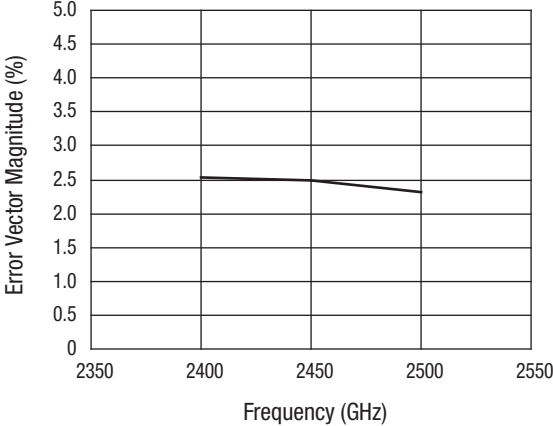
### 802.11b,g Power Detector Specification

**Conditions:  $V_{CC} = 3.3\text{ V}$ ,  $V_{REFG} = 2.9\text{ V}$ ,  $T_{OP} = 25\text{ }^{\circ}\text{C}$ . PA enables and control voltages set according to Truth Table. Measurements made on Skyworks EVB with all losses de-embedded. All unused ports terminated into  $50\ \Omega$  unless otherwise specified.**

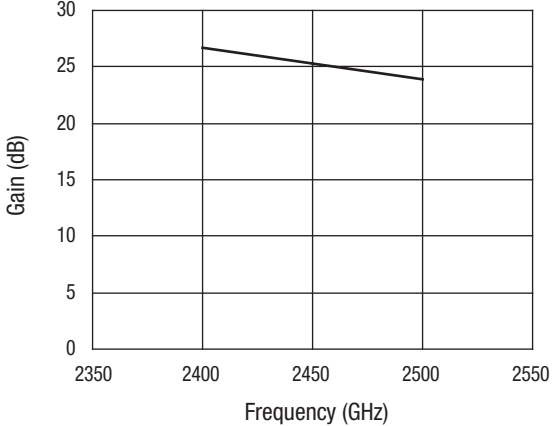
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Power detect range	PDR	Ant 0 or Ant 1	5		22	dBm
Power detector accuracy	PDacc2	Over 3:1 VSWR		±1		dB
P <sub>DET</sub> load impedance				27		k $\Omega$
P <sub>DET</sub> output impedance					6	k $\Omega$
Voltage limits		Over power range	0.1		1.1	V
Voltage range			0.3	0.6		V
Power detector -3 dB corner frequency	LPF-3 dB	10 k $\Omega$ load	270	300	400	kHz

**Typical Performance Data (2.4–2.5 GHz)**

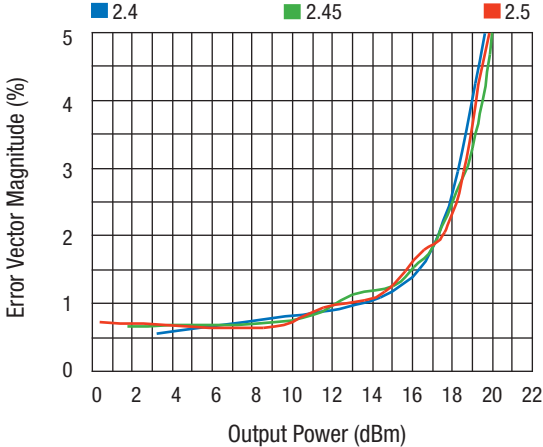
**V<sub>CC</sub> = 3.3 V, T<sub>A</sub> = 25 °C, OFDM 54 Mbps, Z<sub>0</sub> = 50 Ω, unless otherwise noted**



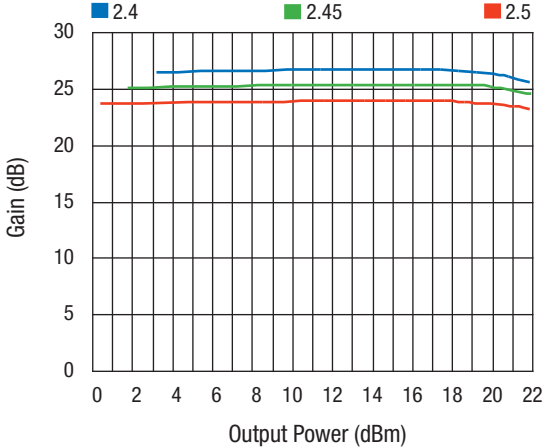
**EVM vs. Frequency**



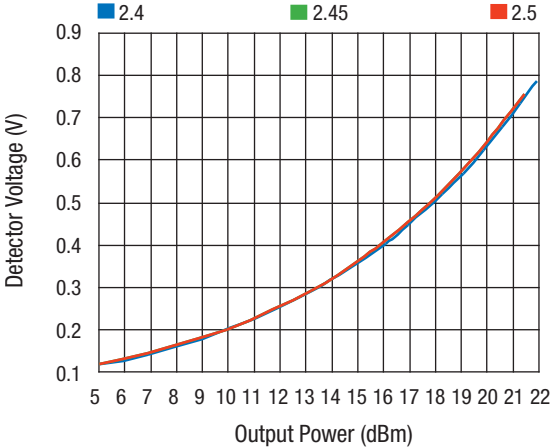
**Gain vs. Frequency**



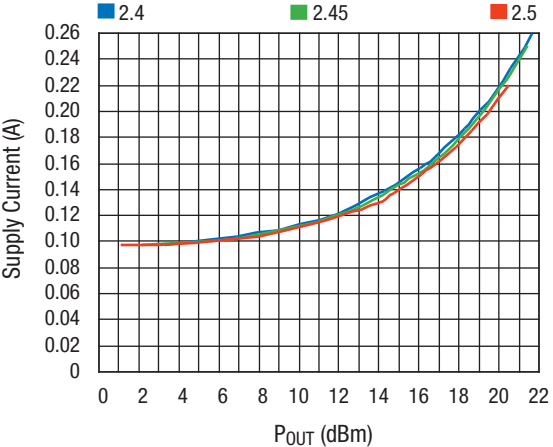
**EVM vs. Output Power**



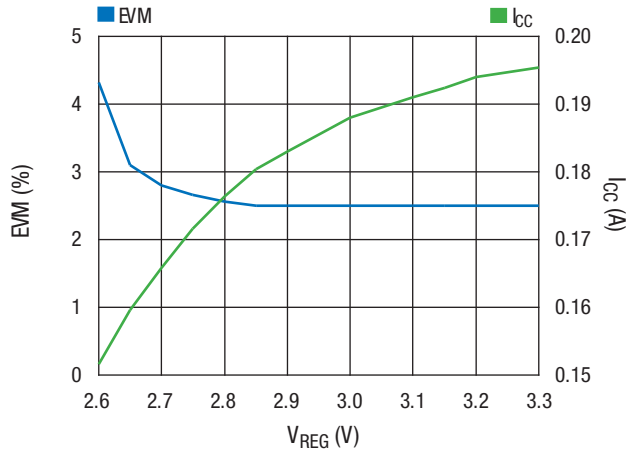
**Gain vs. Output Power**



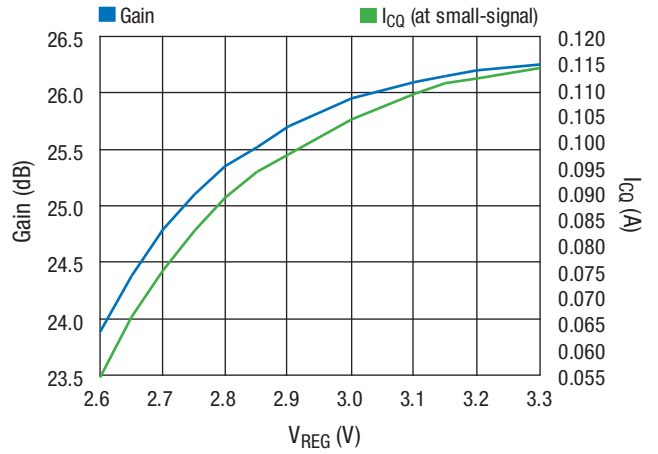
**Detector Voltage vs. Output Power**



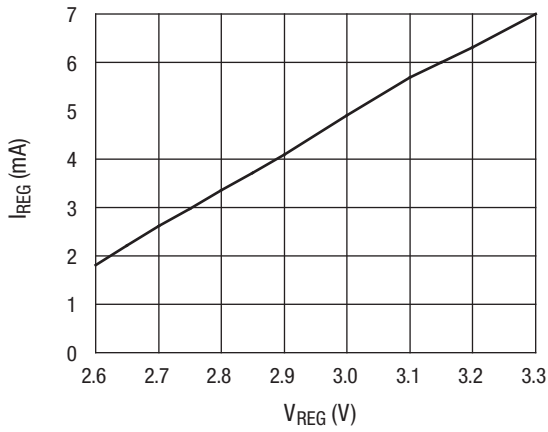
**Supply Current vs. Output Power**



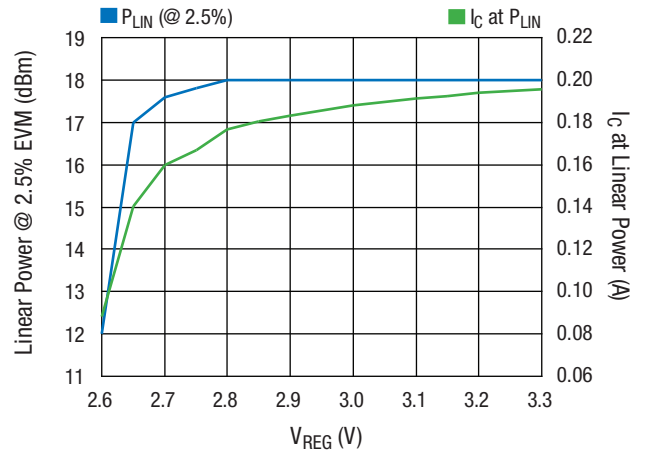
Parameters @ 18 dBm vs. V<sub>REG</sub>



Gain vs. V<sub>REG</sub>

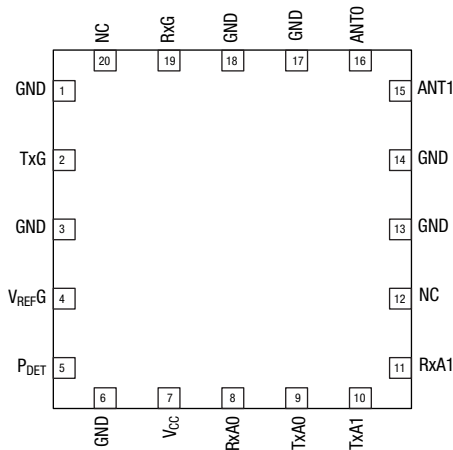


Parameters vs. V<sub>REG</sub>



Parameters vs. V<sub>REG</sub>

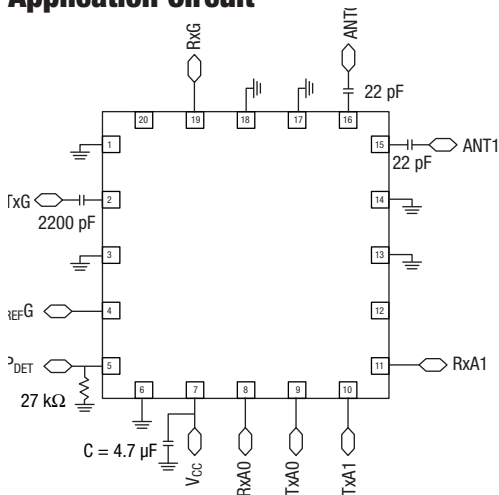
### Pin Out



### Pin Descriptions

Pin Number	Symbol	Description
1	GND	Ground
2	TxG	Transmit input port. Internally matched to 50 Ω. External DC block required (2200 pF recommended)
3	GND	Ground
4	VREFG	External reference voltage for the PA
5	PDET	Directional power detector output
6	GND	Ground
7	VCC	Power supply 3.3 V
8	RxA0	Digital control input DPDT
9	TxA0	Digital control input DPDT
10	TxA1	Digital control input DPDT
11	RxA1	Digital control input DPDT
12	NC	Not connected to anything externally
13	GND	Ground
14	GND	Ground
15	Ant1	Auxiliary antenna port. Internally matched to 50 Ω. External DC block required (22 pF recommended)
16	Ant0	Main antenna port. Internally matched to 50 Ω. External DC block required (22 pF recommended)
17	GND	Ground
18	GND	Ground
19	RxG	Receive output port. Internally matched to 50 Ω and DC blocked. No external DC block required
20	NC	Not connected to anything externally

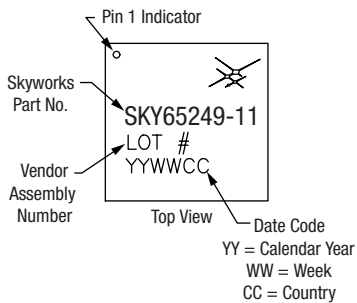
### Application Circuit



### Recommended Solder Reflow Profiles

Refer to the [“Recommended Solder Reflow Profile”](#) Application Note.

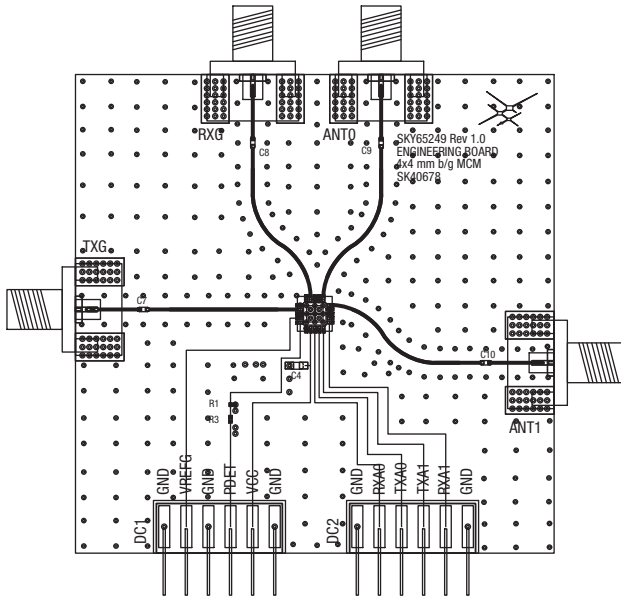
### Branding Specifications



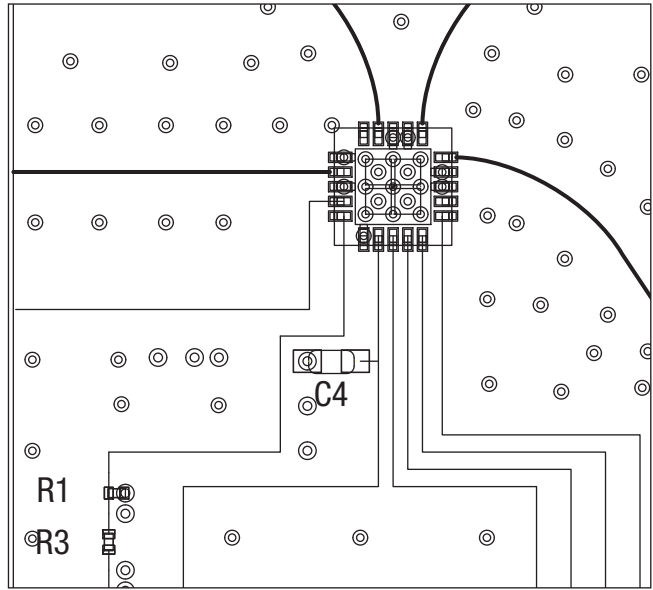
### Tape and Reel Information

Refer to the [“Discrete Devices and IC Switch/Attenuators Tape and Reel Package Orientation”](#) Application Note.

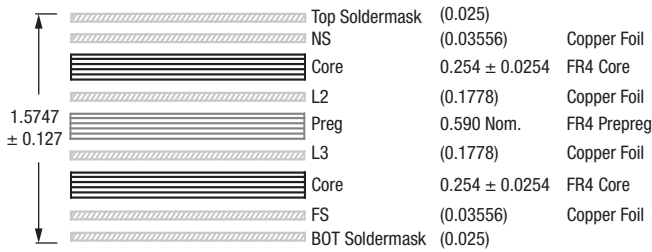
**Test Evaluation Board**



**Test Evaluation Board (Center Enlarged)**



**Layer Stackup**



Dimensions in mm.

**Design Information**

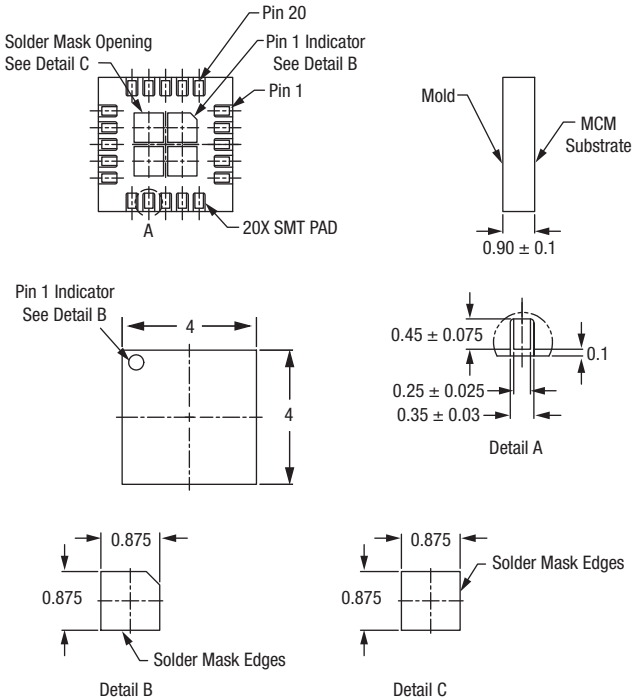
RF line width	19.3 (0.49)	mils (mm)
DC line width	11.3 (0.29)	mils (mm)
Dielectric constant	4.2	

**SMT BOM**

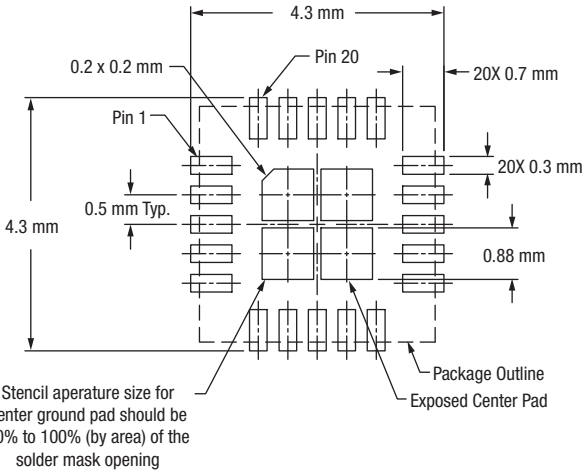
Ref Des	Qty.	Description	Value	Tolerance	Size
C4	1	Capacitor	4.7 $\mu$ F	$\pm$ 5%	SMT 0603
C7	1	Capacitor	2200 pF	$\pm$ 5%	SMT 0402
C8	1	Resistor	0 $\Omega$	$\pm$ 5%	SMT 0402
C9	1	Capacitor	22 pF	$\pm$ 5%	SMT 0402
C10	1	Capacitor	22 pF	$\pm$ 5%	SMT 0402
R1	1	Resistor	27 k $\Omega$	$\pm$ 5%	SMT 0201
R3	1	Resistor	0 $\Omega$	$\pm$ 5%	SMT 0201



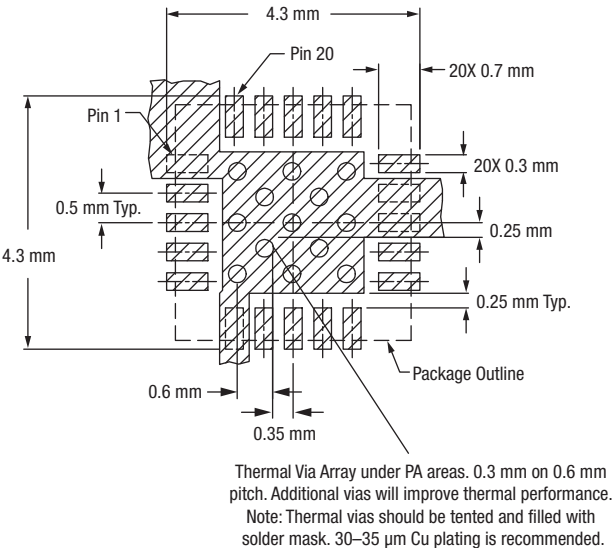
**Package Dimensions**



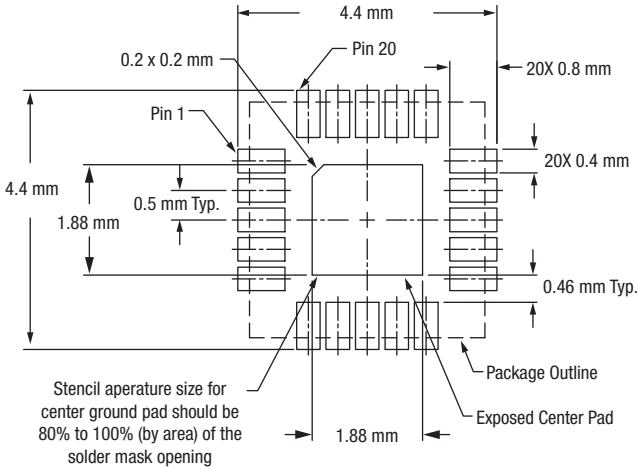
**Stencil Aperture (Top View)**



**Footprint (Top View)**



**Solder Mask Opening (Top View)**



Copyright © 2006, 2007, Skyworks Solutions, Inc. All Rights Reserved.

Information in this document is provided in connection with Skyworks Solutions, Inc. ("Skyworks") products or services. These materials, including the information contained herein, are provided by Skyworks as a service to its customers and may be used for informational purposes only by the customer. Skyworks assumes no responsibility for errors or omissions in these materials or the information contained herein. Skyworks may change its documentation, products, services, specifications or product descriptions at any time, without notice. Skyworks makes no commitment to update the materials or information and shall have no responsibility whatsoever for conflicts, incompatibilities, or other difficulties arising from any future changes.

No license, whether express, implied, by estoppel or otherwise, is granted to any intellectual property rights by this document. Skyworks assumes no liability for any materials, products or information provided hereunder, including the sale, distribution, reproduction or use of Skyworks products, information or materials, except as may be provided in Skyworks Terms and Conditions of Sale.

THE MATERIALS, PRODUCTS AND INFORMATION ARE PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND, WHETHER EXPRESS, IMPLIED, STATUTORY, OR OTHERWISE, INCLUDING FITNESS FOR A PARTICULAR PURPOSE OR USE, MERCHANTABILITY, PERFORMANCE, QUALITY OR NON-INFRINGEMENT OF ANY INTELLECTUAL PROPERTY RIGHT; ALL SUCH WARRANTIES ARE HEREBY EXPRESSLY DISCLAIMED. SKYWORKS DOES NOT WARRANT THE ACCURACY OR COMPLETENESS OF THE INFORMATION, TEXT, GRAPHICS OR OTHER ITEMS CONTAINED WITHIN THESE MATERIALS. SKYWORKS SHALL NOT BE LIABLE FOR ANY DAMAGES, INCLUDING BUT NOT LIMITED TO ANY SPECIAL, INDIRECT, INCIDENTAL, STATUTORY, OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION, LOST REVENUES OR LOST PROFITS THAT MAY RESULT FROM THE USE OF THE MATERIALS OR INFORMATION, WHETHER OR NOT THE RECIPIENT OF MATERIALS HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

Skyworks products are not intended for use in medical, lifesaving or life-sustaining applications, or other equipment in which the failure of the Skyworks products could lead to personal injury, death, physical or environmental damage. Skyworks customers using or selling Skyworks products for use in such applications do so at their own risk and agree to fully indemnify Skyworks for any damages resulting from such improper use or sale.

Customers are responsible for their products and applications using Skyworks products, which may deviate from published specifications as a result of design defects, errors, or operation of products outside of published parameters or design specifications. Customers should include design and operating safeguards to minimize these and other risks. Skyworks assumes no liability for applications assistance, customer product design, or damage to any equipment resulting from the use of Skyworks products outside of stated published specifications or parameters.

Skyworks, the Skyworks symbol, and "Breakthrough Simplicity" are trademarks or registered trademarks of Skyworks Solutions, Inc., in the United States and other countries. Third-party brands and names are for identification purposes only, and are the property of their respective owners. Additional information, including relevant terms and conditions, posted at [www.skyworksinc.com](http://www.skyworksinc.com), are incorporated by reference.