

SKY77336 Power Amplifier Module for Quad-Band GSM / GPRS

Applications

- Quad-band cellular handsets
- GMSK Modulation
 - Class 4 GSM850/900
 - Class 1 DCS1800/PCS1900
 - Class 12 GPRS multi-slot operation
- EDGE modulation
 - Class E2 GSM850/900
 - Class E2 DCS1800/PCS1900

Features

- High efficiency:
 - GSM850, 55%
 - GSM900, 55%
 - DCS, 53%
 - PCS, 53%
- Small outline
 - 5 x 5 mm
- Low profile
 - 1.15 mm Max
- Low VRAMP current
 - 10 μ A

NEW Skyworks Green™ products are lead (Pb)-free, RoHS (Restriction of Hazardous Substances)-compliant, conform to the EIA/EICTA/JEITA Joint Industry Guide (JIG) Level A guidelines, and are free from antimony trioxide and brominated flame retardants.



Description

SKY77336 Power Amplifier Module (PAM) is designed in a compact form factor for quad-band cellular handsets comprising GSM850/900, DCS1800 and PCS1900, supporting Gaussian Minimum-Shift Keying (GMSK) and Polar Enhanced Data for GSM Evolution (EDGE) modulation. Class 12 General Packet Radio Service (GPRS) multi-slot operation is also supported.

The module consists of GSM850/900 PA and DCS1800/PCS1900 PA blocks, impedance matching circuitry for 50 Ω input and output impedances, and a Power Amplifier Control (PAC) block. The custom CMOS integrated circuit provides the internal PAC function and interface circuitry. Fabricated in InGaP/GaAs, the Heterojunction Bipolar Transistor (HBT) PA blocks support the GSM850/900 bands and DCS1800/PCS1900 bands. Both PA blocks share common power supply pads to distribute current. The InGaP/GaAs die, Silicon (Si) controller die, and passive components are mounted on a multi-layer laminate substrate and the entire assembly is encapsulated with plastic overmold.

RF input and output ports of the SKY77336 are internally matched to a 50 Ω load to reduce the number of external components for a quad-band design. Extremely low leakage current (10 μ A, typical) of the PAM module maximizes handset standby time.

The SKY77336 also contains band-select switching circuitry to select GSM (logic 0) or DCS/PCS (logic 1) as determined from the Band Select (BS) signal. See Figure 1 shown below.

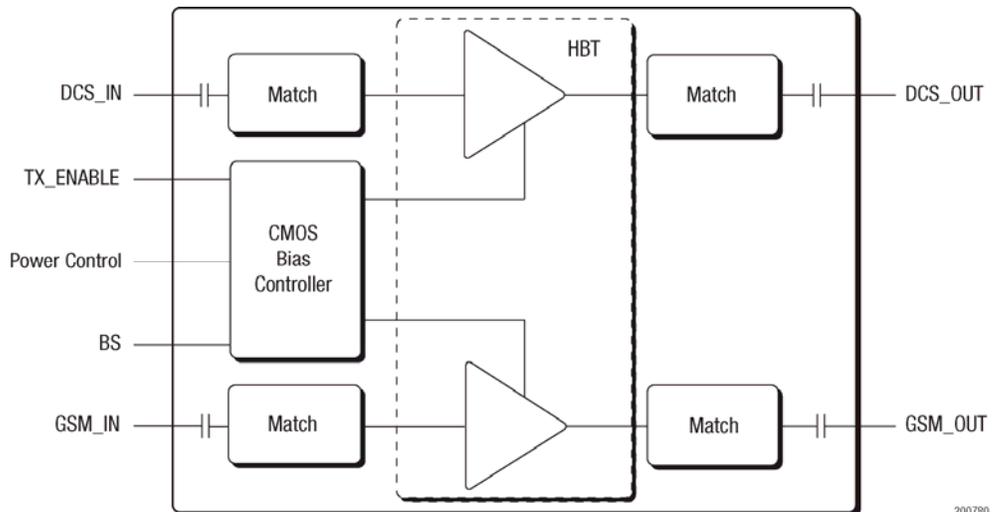


Figure 1. SKY77336 Functional Block Diagram

200780_001

Electrical Specifications

The absolute maximum ratings of SKY77336 are provided in [Table 1](#). [Table 2](#) specifies the recommended operating conditions for achieving the electrical performance shown in [Table 5](#) through

[Table 11](#). [Table 3](#) provides loop requirement and [Table 4](#) provides the mode control logic.

Table 1. SKY77336 Absolute Maximum Ratings¹

Parameter	Symbol	Minimum	Nominal	Maximum	Units
RF Input Power	P _{IN}	—	6	15	dBm
Supply Voltage (≤ 100 ms) Supporting Operation at Max. P _{OUT} @ 50 ohm Load @ +25 °C	V _{BATT}	—	3.5	5.5	V
Logic Signals (ENABLE, BS)	V _{CONT}	-0.5	—	V _{BATT} - 0.2	V
Input Modulating Signal and Power Control	V _{APC}	-0.5	1.6	V _{BATT} - 0.2	V
Temperatures	Operating ²	T _{CASE}	-30	+90	°C
	Storage	T _{STG}	-55	+150	
	Re-flow solder	T _{SOLDER}	—	J-STD-020C	
	Moisture Sensitivity Level	MSL	—	3/260	
Burst Duty Cycle	D _B	—	12.5	50	%
Voltage Standing Wave Ratio	V _{SWR}	—	2.5:1	100:1	

¹ No damage assuming only one parameter is set at limit at a time with all other parameters set at nominal values.

² Case Operating Temperature refers to the temperature of the GROUND PAD at the underside of the package.

Table 2. SKY77336 Recommended Operating Conditions

Parameter	Symbol	Minimum	Nominal	Maximum	Units
Supply Voltage	V _{BATT}	3.0	3.5	4.8	V
Leakage Current V _{BATT} = 4.8 V TX_EN = 0 V V _{APC} = 0-1.6 V No RF applied	I _L	—	—	10	µA
Operating Temperature (full specifications)	T _{CASE}	-25	+25	+85	°C
Power Supply Noise Rejection		—	TBD	—	
Tx Enable Switch Time		—	—	1	µs
Tx Enable Current		—	10	20	µA
Band Select Current		—	10	20	µA
Duty Cycle		—	—	50	%
Analog Power Control Voltage Range		0.0	—	1.6	V
Analog Power Control Input Current		—	—	10	µA
Impedance System for RF Ports	Z	—	50	—	Ω

Table 3. SKY77336 Loop Requirement

Parameter	Symbol	Test Conditions	Minimum	Typical	Maximum	Unit
V _{APC} Bandwidth (Corresponding to the f – 3 dB of the Transfer Function V _{OUT} /V _{APC})	BW_VAPC	P _{IN} = Min. to Max. P _{OUT} = Min. to Max. V _{BATT} = Min. to Max. T _{CASE} = Min. to Max.	6	9	14	MHz

Table 4. SKY77336 Control Logic

Mode	Input Control Bits		850/EGSMTx	DCS/PCSTx
	Tx_EN	BS		
Standby	0	X	Disable	Disable
Tx 850/EGSM	1	0	Enable	Disable
Tx DCS/PCS	1	1	Disable	Enable

Table 5. SKY77336 Electrical Specifications¹ (1 of 2)

850/900 Tx GMSK & EDGE Mode							
Parameter	Symbol	Condition	Minimum	Typical	Maximum	Unit	
Frequency	GSM850	f	—	824	849	MHz	
	GSM900		—	880	915		
Input Power	P _{IN}	—	3.0	6.0	8.0	dBm	
Supply Voltage	V _{BATT}	—	3.0	3.5	4.8	V	
Leakage Current	I _L	V _{BATT} = 3.5 V V _{APC} ≤ 25 mV T _{CASE} = +25 °C No input power	—	—	10	μA	
Harmonics	2 ND	2f _o	6.5 dBm ≤ P _{OUT} ≤ 34.5 dBm at 50 ohm load	—	—	-10	dBm
	3 RD to 15 TH	3f _o to 15f _o	6.5 dBm ≤ P _{OUT} ≤ 34.5 dBm at 50 ohm load	—	—	-15	
	3 RD to 7 TH	3f _o to 7f _o	6.5 dBm ≤ P _{OUT} ≤ 34.5 dBm V _{BATT} = 3.5 V T _{CASE} = +25 °C Load: VSWR of 5:1 for all phases.	—	-12	-10	
Cross Harmonics		Fundamental	—	—	5	dBm	
		Harmonics	—	—	-20		
Current at Mismatch	I _{BATT_LOAD}	Load VSWR = 5:1, all phase angles. V _{APC} is set to the number that delivers P _{OUT} = 34.5 dBm at 50 ohm load	—	2.1	—	A	
Input VSWR	Γ _{IN}	P _{OUT} ≤ 34.5 dBm	—	—	2.5:1		

Table 5. SKY77336 Electrical Specifications¹ (2 of 2)

[continued] 850 / 900 Tx GMSK & EDGE Mode							
Parameter	Symbol	Condition	Minimum	Typical	Maximum	Unit	
Forward Isolation		Tx_EN = low PIN = 8 dBm	—	—	-30	dBm	
		Tx_EN = high PIN = 8 dBm VAPC ≤ 0.2 V	—	—	-15		
Stability	S	All combinations of the following parameters. PIN = Min. to Max. VBATT = 3.0 V to 4.8 V TCASE = -20 °C to +85 °C Load VSWR = 10:1, all phase angles.	No parasitic oscillation > -36 dBm				
Spurious		f < 1 GHz Load VSWR = 8:1	—	—	-36	dBm	
		f > 1 GHz Load VSWR = 8:1	—	—	-30		
Ruggedness	Ru	All combinations of the following parameters. PIN = Min. to Max. VBATT = 3.0 V to 4.8 V VBATT = 7.0 V for ≤ 1 μs VBATT = 5.5 V for ≤ 100 ms Load VSWR= 10:1, all phase angles	No module damage or permanent degradation				
Noise Power	GSM 850	PNOISE	RX = 869 to 894 MHz VBATT = 3.5 V PIN = 6 dBm TCASE = +25 °C	—	-87	—	dBm/ 100 kHz
	GSM 900		RX = 925 to 935 MHz VBATT = 3.5 V PIN = 6 dBm TCASE = +25 °C	—	—	-76	
	GSM 900		RX = 935 to 960 MHz VBATT = 3.5 V PIN = 6 dBm TCASE = +25 °C	—	-87	—	

¹ Unless otherwise specified:
50 Ω system; pulsed operation with pulse width 2308 μs; duty cycle 1:8; TCASE = -20 °C to 85 °C; VBATT = 3.0 V to 4.8 V

Table 6. SKY77336 Electrical Specifications¹

850 / 900 Tx GMSK Mode						
Parameter	Symbol	Condition	Minimum	Typical	Maximum	Unit
Frequency Range	GSM850	f	824	—	849	MHz
	GSM900	—	880	—	915	
Input Power	P _{IN}	—	3.0	6.0	8.0	dBm
Supply Voltage	V _{BATT}	—	3.0	3.5	4.8	V
Output Power (Average)	P _{OUT}	P _{IN} = 6 dBm V _{BATT} = 3.5 V T _{CASE} = +25 °C	34.5	35.0	—	dBm
	P _{OUT_DEG}	P _{IN} = 0 dBm V _{BATT} = 3.4 V – 4.8 V T _{CASE} = –20 °C to 85 °C V _{APC} is set to deliver P _{OUT} = 34.5 dBm at V _{BATT} = 3.5 V T _{CASE} = +25 °C	32.5	—	—	
Power Added Efficiency	PAE	P _{IN} = 6 dBm P _{OUT} = Max. V _{BATT} = 3.5 V T _{CASE} = +25 °C	50	55	—	%
Phase Change		The change in phase for P _{OUT} V _{APC} = sawtooth signal f = 2166 Hz P _{OUT} ≤ 34.5 dBm	—	1	—	deg./dB
Dynamic Range		—	49.5	—	—	dB

¹ Unless otherwise specified:
50 Ω system; pulsed operation with pulse width 2308 μs; duty cycle 1:8; T_{CASE} = –20 °C to 85 °C; V_{BATT} = 3.0 V to 4.8 V

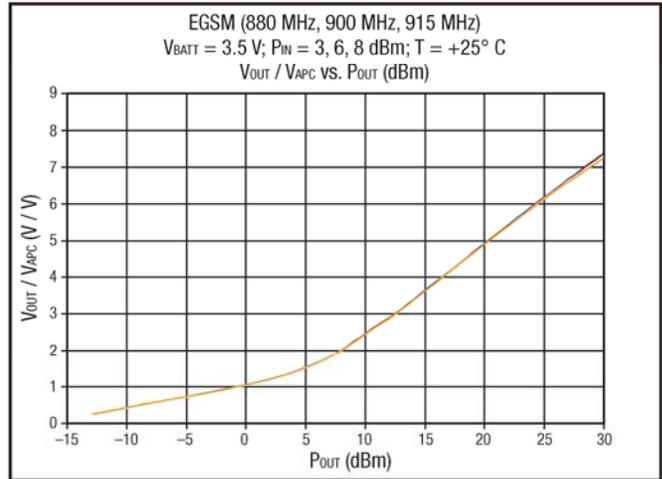
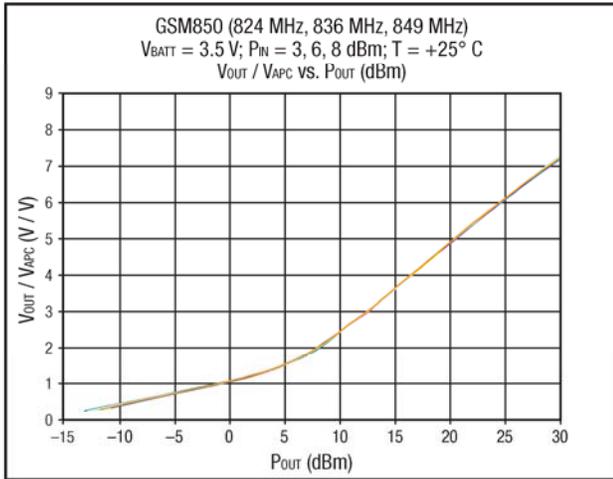
Table 7. SKY77336 Electrical Specifications¹

850 / 900 Tx EDGE Mode						
Parameter	Symbol	Condition	Minimum	Typical	Maximum	Unit
Frequency Range	GSM850	f	824	—	849	MHz
	GSM900	—	880	—	915	
Input Power	P _{IN}	—	3.0	6.0	8.0	dBm
Supply Voltage	V _{BATT}	—	3.0	3.5	4.8	V
Output Power (average)	P _{OUT}	P _{IN} = 6 dBm V _{BATT} = 3.5 V T _{CASE} = +25 °C	29	—	—	dBm
	P _{OUT_DEG1}	P _{IN} = 0 dBm V _{BATT} = 3.0 V – 4.8 V T _{CASE} = –30 °C to 90 °C at V _{BATT} = 3.5 V T _{CASE} = +25 °C	28.5	—	—	
Power Added Efficiency	PAE	P _{IN} = 6 dBm P _{OUT} = 28.5 dBm V _{BATT} = 3.5 V T _{CASE} = +25 °C	24	28	—	%

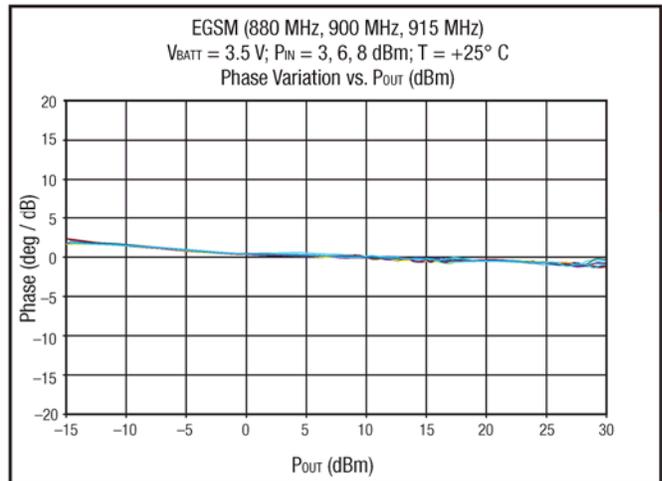
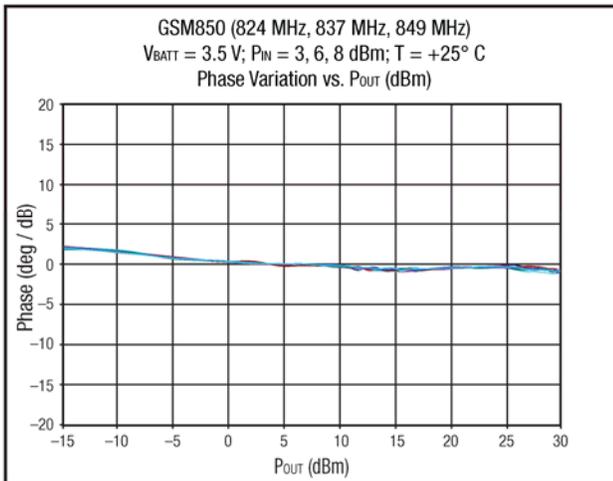
¹ Unless otherwise specified:

50 Ω system; pulsed operation with pulse width 2308 μs; duty cycle 1:8; T_{CASE} = –20 °C to 85 °C; V_{BATT} = 3.0 V to 4.8 V

AM / AM RESPONSE



AM / PM RESPONSE



200780_002

Figure 2. Typical AM/AM and AM/PM Response Charts for Low Band – SKY77336 Power Amplifier Module

Table 8. SKY77336 Electrical Specifications¹ (1 of 2)

1800 / 1900 Tx GMSK & EDGE Mode							
Parameter	Symbol	Condition	Minimum	Typical	Maximum	Unit	
Frequency Range	DCS 1800	f	—	—	1785	MHz	
	PCS 1900		1710	—	1910		
Input Power	P _{IN}	—	3.0	6.0	8.0	dBm	
Supply Voltage	V _{BATT}	—	3.0	3.5	4.8	V	
Leakage Current	I _L	V _{BATT} = 3.5 V V _{APC} ≤ 25 mV T _{CASE} = +25 °C No input power	—	—	10	μA	
Harmonics	2 ND	2f _o	1.5 dBm ≤ P _{OUT} ≤ 32 dBm at 50 ohm load	—	—	-10	dBm
	3 RD to 7 TH	3f _o to 7f _o	1.5 dBm ≤ P _{OUT} ≤ 32 dBm at 50 ohm load	—	—	-15	
	3 RD to 7 TH	3f _o to 7f _o	1.5 dBm ≤ P _{OUT} ≤ 32 dBm V _{BATT} = 3.5 V T _{CASE} = +25 °C Load: VSWR of 5:1 for all phases.	—	-12	-10	
Current at Mismatch	I _{BATT_LOAD}	Load VSWR = 5:1, all phase angles. V _{APC} set to the number that delivers P _{OUT} = 32 dBm at 50 ohm load.	—	1.4	—	A	
Input VSWR	Γ _{IN}	P _{OUT} ≤ 32 dBm	—	—	2.5:1		

Table 9. SKY77336 Electrical Specifications¹ (2 of 2)

[continued] 1800 / 1900 Tx GMSK & EDGE Mode							
Parameter	Symbol	Condition	Minimum	Typical	Maximum	Unit	
Forward Isolation		Tx_EN = low P _{IN} = 8 dBm	—	—	-30	dBm	
		Tx_EN = high P _{IN} = 8 dBm V _{APC} ≤ 0.2 V	—	—	-20		
Cross Harmonics		Fundamental	—	—	5	dBm	
		Harmonics	—	—	-20		
Stability	S	All combinations of the following parameters. P _{IN} = Min. to Max. V _{BATT} = 3.0 V to 4.8 V T _{CASE} = -20 °C to +85 °C Load VSWR = 10:1, all phase angles.	No parasitic oscillation > -36 dBm				
Spurious		f < 1 GHz Load VSWR = 8:1	—	—	-36	dBm	
		f > 1 GHz Load VSWR = 8:1	—	—	-30		
Ruggedness	Ru	All combinations of the following parameters. P _{IN} = Min. to Max. V _{BATT} = 3.0 V to 4.8 V V _{BATT} = 7.0 V for ≤ 1 μs V _{BATT} = 5.5 V for ≤ 100 ms Load VSWR = 10:1, all phase angles.	No module damage or permanent degradation				
Noise Power	DCS	P _{NOISE}	RX = 1805 to 1880 MHz V _{BATT} = 3.5 V P _{IN} = 6 dBm T _{CASE} = +25 °C	—	—	-79	dBm/ 100 kHz
	PCS		RX = 1930 to 1990 MHz V _{BATT} = 3.5 V P _{IN} = 6 dBm T _{CASE} = +25 °C	—	—	-79	

¹ Unless otherwise specified:
50 Ω system; pulsed operation with pulse width 2308 μs; duty cycle 1:8; T_{CASE} = -20 °C to 85 °C; V_{BATT} = 3.0 V to 4.8 V

Table 10. SKY77336 Electrical Specifications¹

1800 / 1900 Tx GMSK						
Parameter	Symbol	Condition	Minimum	Typical	Maximum	Unit
Frequency Range	GSM1800	—	1710	—	1785	MHz
	GSM1900		1850	—	1910	
Input Power	P _{IN}	—	3.0	6.0	8.0	dBm
Supply Voltage	V _{BATT}	—	3.0	3.5	4.8	V
Output Power (average)	P _{OUT}	P _{IN} = 6 dBm V _{BATT} = 3.5 V T _{CASE} = +25 °C	32.0	33	—	dBm
	P _{OUT_DEG}	P _{IN} = 0 dBm V _{BATT} = 3.4 V – 4.8 V T _{CASE} = –20 °C to 85 °C V _{APC} is set to deliver P _{OUT} = 32 dBm at V _{BATT} = 3.5 V T _{CASE} = +25 °C	30.5	—	—	
Power Added Efficiency	PAE	P _{IN} = 6 dBm P _{OUT} = Max. V _{BATT} = 3.5 V T _{CASE} = +25° C duty cycle = 1:8	48	53	—	%
Phase Change		The change in phase for P _{OUT} V _{APC} = sawtooth signal f = 2166 Hz P _{OUT} ≤ 32 dBm	—	1		deg./dB
Dynamic Range		—	52	—	—	dB

¹ Unless otherwise specified:

50 Ω system; pulsed operation with pulse width 2308 μs; duty cycle 1:8; T_{CASE} = –20 °C to 85 °C; V_{BATT} = 3.0 V to 4.8 V

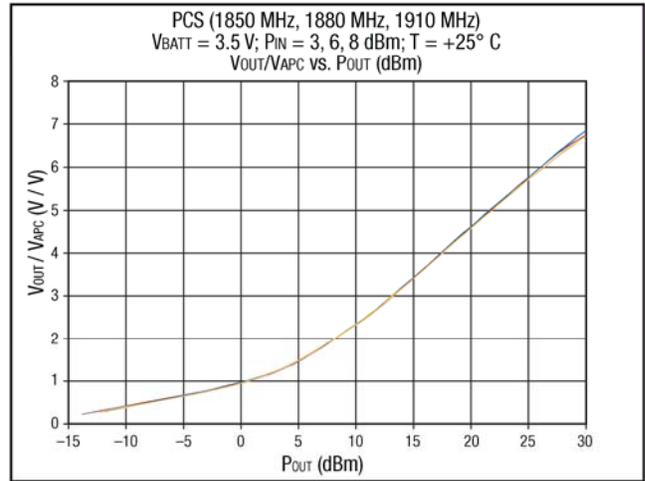
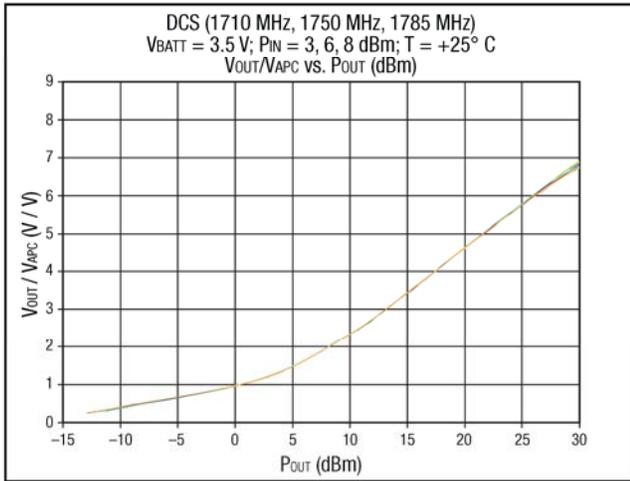
Table 11. SKY77336 Electrical Specifications¹

<i>1800 / 1900 Tx EDGE</i>						
Parameter	Symbol	Condition	Minimum	Typical	Maximum	Unit
Frequency Range	GSM1800	—	1710	—	1785	MHz
	GSM1900		1850	—	1910	
Input Power	P _{IN}	—	3.0	6.0	8.0	dBm
Supply Voltage	V _{BATT}	—	3.0	3.5	4.8	V
Output Power (average)	P _{OUT}	P _{IN} = 6 dBm V _{BATT} = 3.5 V T _{CASE} = +25 °C	28.5	—	—	dBm
	P _{OUT_DEG 1}	P _{IN} = 0 dBm V _{BATT} = 3.0 V – 4.8V T _{CASE} = –30 °C to 90 °C at V _{BATT} = 3.5 V T _{CASE} = +25 °C	28	—	—	
Power Added Efficiency	PAE	P _{IN} = 6 dBm P _{OUT} = 28.5 dBm V _{BATT} = 3.5 V T _{CASE} = +25 °C duty cycle = 1:8	26	30	—	%

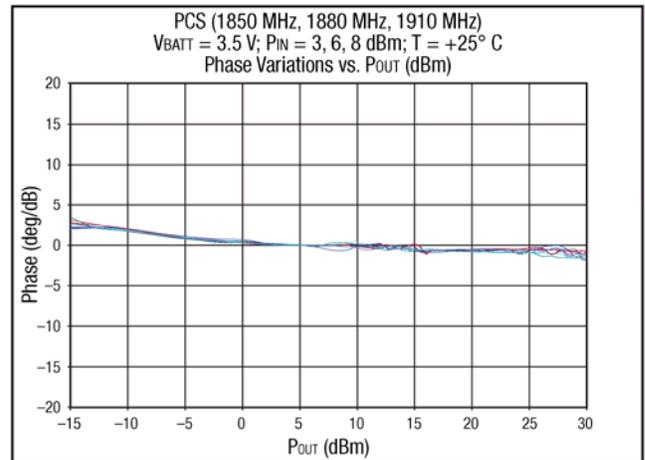
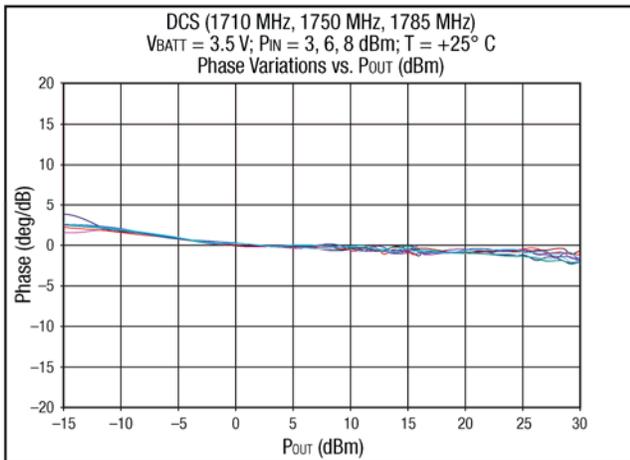
¹ Unless otherwise specified:

50 Ω system; pulsed operation with pulse width 2308 μs; duty cycle 1:8; T_{CASE} = –20 °C to 85 °C; V_{BATT} = 3.0 V to 4.8 V

AM / AM RESPONSE



AM / PM RESPONSE



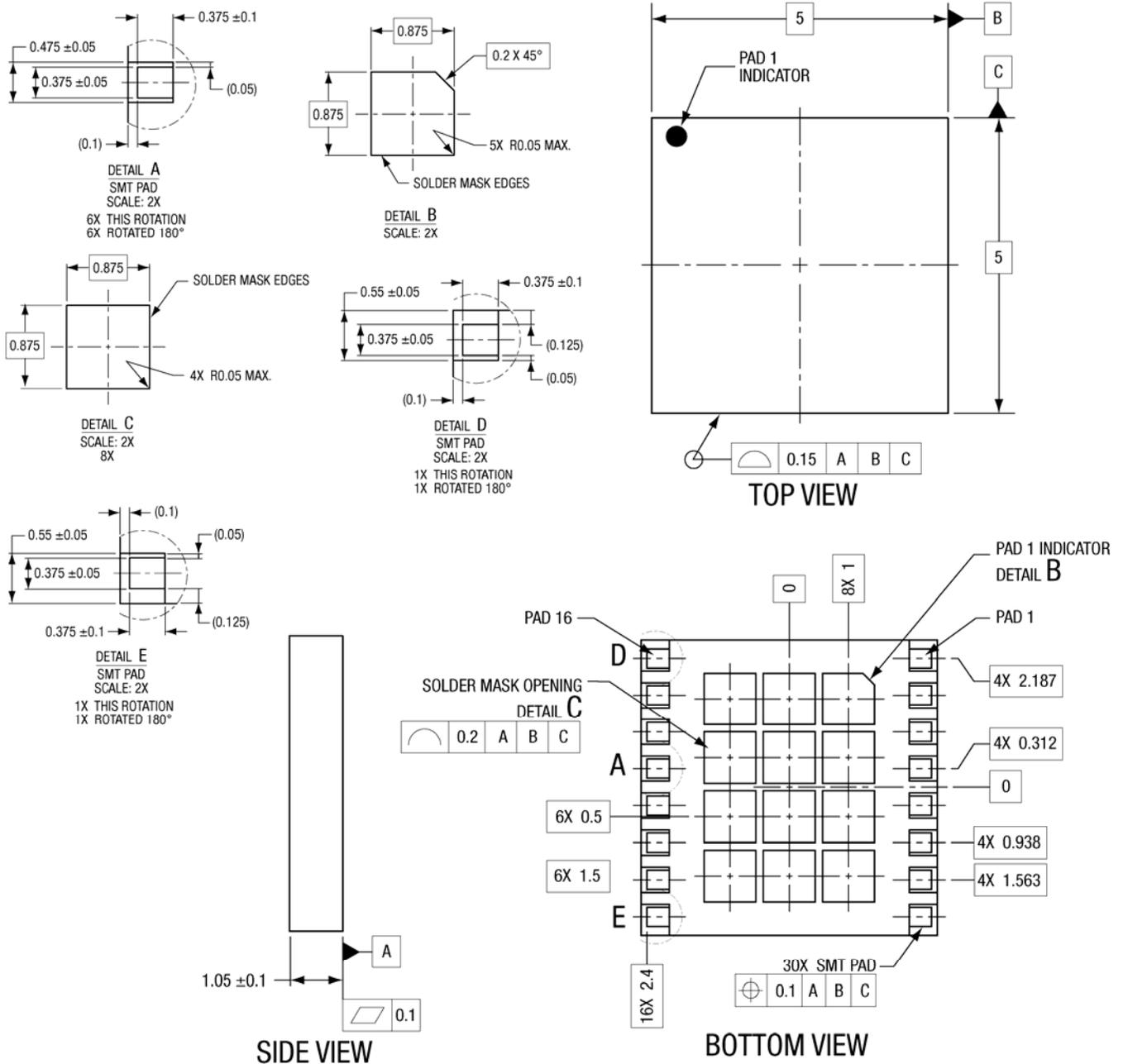
200780_003

Figure 3. Typical AM/AM and AM/PM Response Charts for High Band – SKY77336 Power Amplifier Module

Package Dimensions

Figure 4 is a mechanical drawing of the pad layout for the SKY77336, a 16-pad, leadless, PA module. Figure 5 provides a recommended phone board layout footprint for the PAM to help

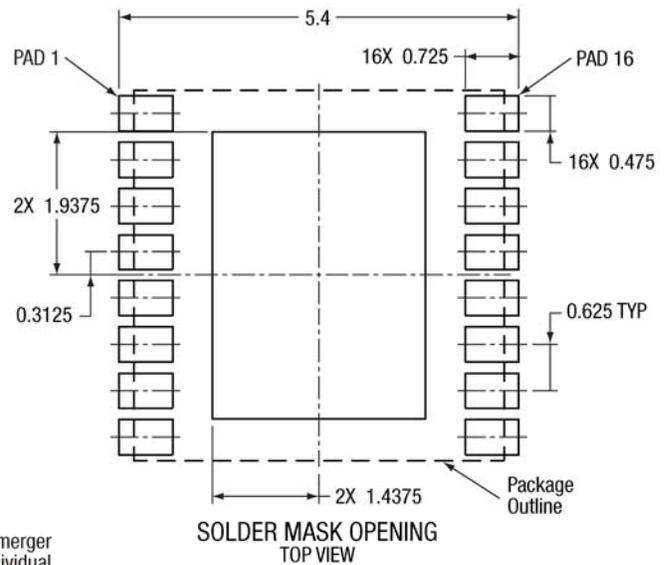
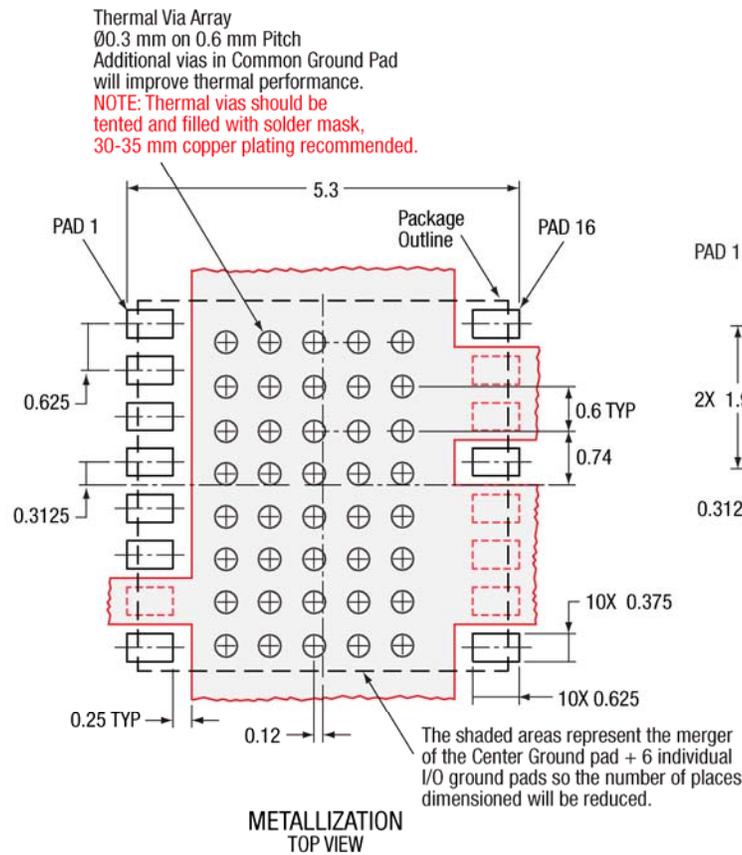
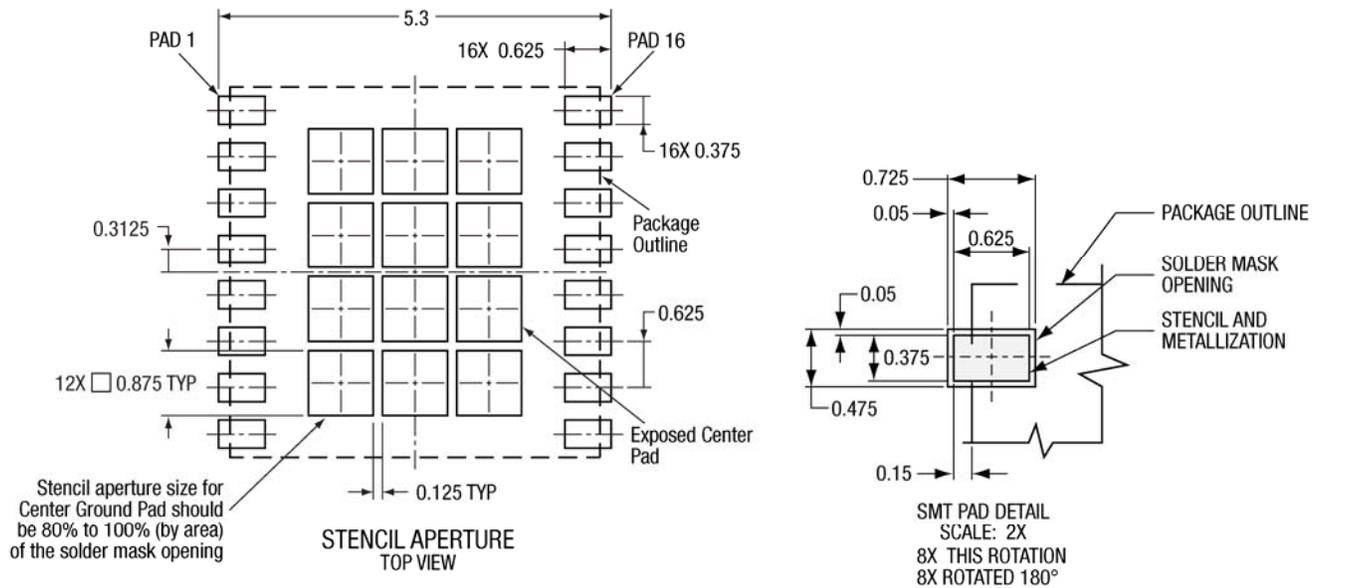
the designer attain optimum thermal conductivity, good grounding, and minimum RF discontinuity for the 50-ohm terminals.



- NOTES: UNLESS OTHERWISE SPECIFIED.
 1. DIMENSIONING AND TOLERANCING IN ACCORDANCE WITH ASME Y14.5M-1994.
 2. PAD DEFINITION PER DETAILS ON DRAWING.
 3. ALL DIMENSIONS IN MILLIMETERS.

Figure 4. Dimensional Diagram for 5 mm x 5 mm x 1.05 mm, 16-Pad MCM Package – SKY77336 Specific

200780_004



ALL DIMENSIONS ARE IN MILLIMETERS.

Figure 5. Phone Board Layout Footprint for 5 x 5 mm MCM Package – SKY77336

Package Description

Figure 6 shows the device pad configuration and numbering convention, which starts at the upper left as indicated, and increments counter-clockwise around the package. Table 12 lists the pad names and signal descriptions. Figure 1 interprets typical case markings.

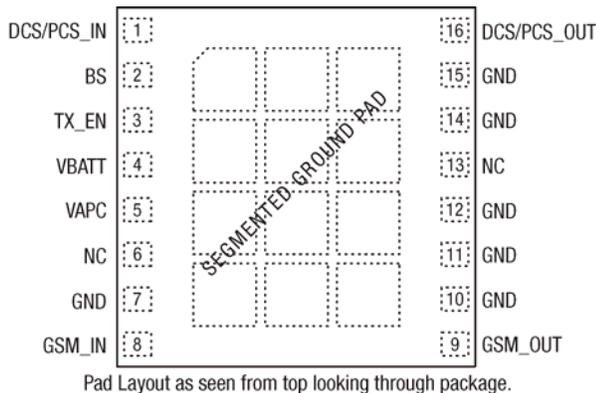


Figure 6. SKY77336 Pad Configuration

Table 12. Pad Signal Names and Functions

Pad	Signal	Function
1	DCS/PCS_IN	Input Tx signal 1800 / 1900 MHz
2	BS	Band Select
3	TX_EN	Enable
4	VBATT	Battery Supply Voltage
5	VAPC	Input modulating signal / power control
6	NC	No connect
7	GND	Ground
8	GSM_IN	Input Tx signal 850 / 900 MHz
9	GSM_OUT	Output Tx signal 850 / 900 MHz
10	GND	Ground
11	GND	Ground
12	GND	Ground
13	NC	No Connect
14	GND	Ground
15	GND	Ground
16	DCS_OUT	Output Tx signal 1800 / 1900 MHz
GROUND PAD		Segmented Ground Pad is device underside

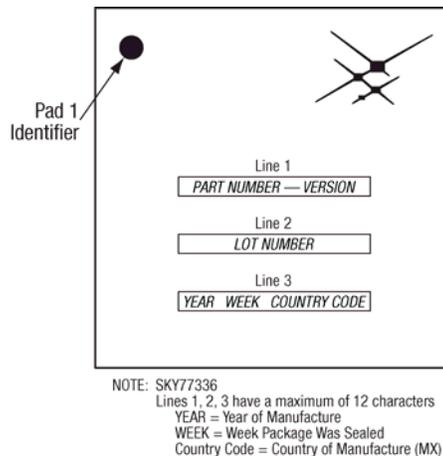


Figure 7. Typical Case Marking

Package Handling Information

Because of its sensitivity to moisture absorption, this device package is baked and vacuum-packed prior to shipment in accordance with IPC J-STD 033 guidelines. Instructions on the shipping container label are in accordance with IPC J-STD 020B regarding exposure to moisture after the container seal is broken. These instructions must be followed; otherwise, problems related to moisture absorption may occur when the part is subjected to high temperature during solder assembly.

SKY77336 is capable of withstanding an MSL3/260 °C 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 attached in a reflow oven, the temperature ramp rate should not exceed 3°C per second; maximum temperature should not exceed 260 °C. If the part is manually attached, precaution should be taken to insure that the part is not subjected to temperatures exceeding 260 °C for more than 10 seconds. For details on attachment techniques, precautions, and handling procedures recommended by Skyworks, please refer to Skyworks Application Note: *PCB Design and SMT Assembly/Rework*, Document Number 101752. Additional information on standard SMT reflow profiles can also be found in the *JEDEC Standard J-STD-020*.

Production quantities of this product are shipped in the standard tape-and-reel format. For packaging details, refer to Skyworks Application Note: *Tape and Reel Information – RF Modules*, Document Number 101568.

Electrostatic Discharge Sensitivity

SKY77336 is a Class 1 device. ESD testing was performed in compliance with JEDEC standards JESD22–A114 (Human Body Model), JESD22–A115 (Machine Model), and JESD22–C101 (Charged Device Model).

Various failure criteria can be utilized when performing ESD testing. Many vendors employ relaxed ESD failure standards, which fail devices only after “the pad fails the electrical

specification limits” or “the pad becomes completely non–functional”. Skyworks’ most stringent criteria fail devices as soon as the pad begins to show any degradation on a curve tracer. To avoid ESD damage, both latent and visible, it is very important that the product assembly and test areas follow the Class 1 ESD handling precautions listed below.

- Personnel Grounding
 - Wrist Straps
 - Conductive Smocks, Gloves and Finger Cots
 - Antistatic ID Badges
- Protective Workstation
 - Dissipative Table Top
 - Protective Test Equipment (Properly Grounded)
 - Grounded Tip Soldering Irons
 - Solder Conductive Suckers
 - Static Sensors
- Facility
 - Relative Humidity Control and Air Ionizers
 - Dissipative Floors (less than $10^9 \Omega$ to GND)
- Protective Packaging and Transportation
 - Bags and Pouches (Faraday Shield)
 - Protective Tote Boxes (Conductive Static Shielding)
 - Protective Trays
 - Grounded Carts
 - Protective Work Order Holders

Ordering Information

Model Number	Manufacturing Part Number	Product Revision	Package	Operating Temperature
SKY77336	SKY77336		5 x 5 x 1.05 MCM-16	-25 °C to +85 °C

Revision History

Revision	Date	Description
A	November 12, 2007	Initial Release – Preliminary Information
B	March 13, 2008	Revise: Table 2, add Nominal column; Page 5, Table 5 (2 of 8), Forward Isolation, first row, Maximum Column: change -10 to -30
C	May 28, 2008	Revise: Features (p1) Low profile 1.0 to 0.9 Add: GREEN tag (p1)
D	July 24, 2008	Revise: Figure 6 and Table 6, rename pad 13 from VCC_OUT to NC
E	September 19, 2008	Revise: Features (p1) Low profile 0.9 mm to 1.15 mm Max.; Tables 2, 5-11; Figure 4

References

Skyworks Application Note: PCB Design and SMT Assembly/Rework, Document Number 101752.

Skyworks Application Note: Tape and Reel, Information – RF Modules Document Number 101568

Standard SMT Reflow Profiles: JEDEC Standard J-STD-020

Electrostatic Discharge Sensitivity (ESD) Testing: JEDEC Standard, JESD22-A114 Human Body Model (HBM)

Electrostatic Discharge Sensitivity (ESD) Testing: JEDEC Standard, JESD22-A115 Machine Model (MM)

Electrostatic Discharge Sensitivity (ESD) Testing: JEDEC Standard, JESD22-C101 (Charged Device Model)

Copyright © 2007–2008, 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, "Breakthrough Simplicity," DCR, Helios, HIP3, Innovation to Go, Intera, iPAC, LIPA, Polar Loop, and System Smart 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.skyworksin.com, are incorporated by reference.