

PRELIMINARY DATA SHEET

SKY77181 Power Amplifier Module for WCDMA / HSDPA (880–915 MHz)

Applications

- WCDMA Handsets
- HSDPA Handsets
- Personal Communications Services (PCS)
- Wireless local loop (WLL)

Features

- No VREF required
- Low voltage positive bias
 3.1 V to 4.6 V
- Supports low collector voltage operation
- Good linearity
- High efficiency at all power levels (13.5% at 15 dBm)
- Large dynamic range
- Low Profile package3 x 3 x 1.1 mm
- 8-pad configuration
- Power down control
- InGaP
- Digital Venable
- Digital or Analog VCONTROL



Description

The SKY77181 Power Amplifier module is a fully matched 8-pad surface mount module developed for Wideband Code Division Multiple Access (WCDMA) applications. This small and efficient power amplifier packs full coverage of the 880–915 MHz bandwidth into a single compact package. The SKY77181 meets the stringent spectral linearity requirements of High Speed Downlink Packet Access (HSDPA) data transmission with high power added efficiency for power output of up to 28 dBm. Because of high efficiencies attained throughout the entire power range, the SKY77181 delivers unsurpassed talk-time advantages.

The single Gallium Arsenide (GaAs) Microwave Monolithic Integrated Circuit (MMIC) contains all active circuitry in the module. The MMIC includes on-board bias circuitry, as well as input and interstage matching circuits. The output match is realized off-chip within the module package to optimize efficiency and power performance into a 50 Ω load. This device is manufactured with Skyworks' InGaP GaAs Heterojunction Bipolar Transistor (HBT) process that provides for all positive voltage DC supply operation while maintaining high efficiency and good linearity. Primary bias to the SKY77181 is supplied directly from a three-cell Ni-Cd, a single-cell Li-lon, or other suitable battery with an output in the 3.1 to 4.6 volt range. No VREF voltage is required. Power down is accomplished by setting the voltage on VENABLE to zero volts. Digital bias control can be used to optimize efficiency at high and low power or analog bias control can be used to optimize efficiency over the entire power range. No external supply side switch is needed as typical "off" leakage is a few microamperes with full primary voltage supplied from the battery.

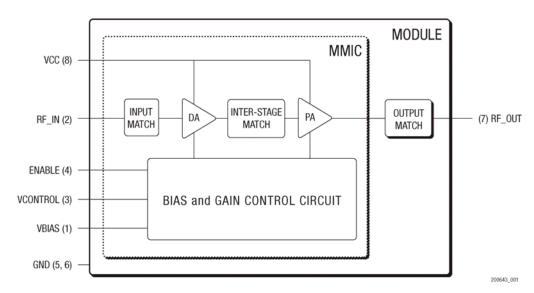


Figure 1. SKY77181 Functional Block Diagram

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Electrical Target Specifications

The following tables list the electrical characteristics of the SKY77181 Power Amplifier. Table 1 lists the absolute maximum ratings, while Table 2 shows the recommended operating conditions to achieve the performance characteristics for WCDMA and HSDPA listed, respectively, in Table 4 and Table 6.

Table 3 lists the recommended Supply and Control voltage conditions over Output Power. Standard test configurations for WCDMA and HSDPA are shown in Table 5 and Table 7, respectively,.

Table 1. Absolute Maximum Ratings 1

Parameter		Symbol	Minimum	Maximum	Unit
RF Input Power		Pin	_	9	dBm
Supply Voltage		Vcc, VBIAS (no RF)	_	7	Volts
Control Voltage		VCONT	0	1.5	Volts
Enable Voltage		VEN	_	3	Volts
Case Temperature	Operating	TCASE	-30	110	°C
case remperature	Storage	Тѕтс	- 55	125	U
Ruggedness – no damage ²		Ru	_	10:1	VSWR

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

Table 2. Recommended Operating Conditions

Parameter		Symbol	Minimum	Nominal	Maximum	Unit	
RF Output Power	WCDMA	Po max	_	_	28.5	dBm	
ni Output Fowei	HSDPA	T U_IMAX	_	_	28.0	dbiii	
Operating Frequency		Fo	880.0	897.5	915.0	MHz	
Supply Voltage ¹	V BATT	Vcc	3.1	3.4	4.6	Volts	
	DC/DC		0.5	3.4	3.4	VOILS	
Bias Voltage		VBIAS	3.4	3.6	4.6	Volts	
Enable Voltage	PA On	VEN	1.3	_	2.75	Volts	
Litable voltage	PA Off	VEN	0.0	_	0.4	Voits	
VCONTROL Range		VCONT	0.6	_	1.2	Volts	
oad Mismatch (all angles)		VSWR	_	1	_	VSWR	
Case Operating Temperature	e	TCASE	-20	+25	+85	°C	

¹ When VCC supply is 3.1 V, PO_MAX must be backed off 1 dB.

² Po_MAX, all phases, time = 10 sec, continuous modulated signal.

Table 3. Recommended Supply Voltage (Vcc) and Control Voltage (Vcont) Conditions Over Output Power (Po)

Pse	r (dBm)	V cont	Vcc
WCDMA	HSDPA		
-20	-21	0.72	1.15
-10	-11	0.72	1.15
- 5	-6	0.81	1.17
0	-1	0.92	1.20
5	4	1.05	1.25
10	9	1.05	1.45
15	14	1.10	1.63
20	19	1.10	2.00
23	22	1.10	2.35
25	24	1.10	2.70
26	25	1.10	2.85
27	26	1.10	3.10
28	27	1.10	3.40
28.5	28	1.10	3.40

Table 4. SKY77181 Electrical Specifications for WCDMA — Recommended Operating Conditions ¹

Refer to Table 5. Standard Test Configuration — WCDMA Voice Mode (Uplink Reference Measurement Channel: 12.2 kbps)

		WCDMA (Wideband (Code Division Multiple Acce	ss) ²				
Characterist	ics	Symbol	Condition	Minimum	Typical	Maximum	Unit	
Gain Conditions	High Power	Gніgн	Po_max	27.0	30.0	33.0	dB	
dail Collulions	Low Power	GLOW	Po = -10 dBm	12.5	16.0	19.5	ub ub	
Gain Variation Over Frequency			Fixed Vcc, Temp, PIN	_	_	1	dB	
Power Added Efficiency	High Power	PAEHIGH	Po_max Tcase = +25 °C	36.0	_	_	%	
Tower Added Emissions	Low Power	PAELow	$P_0 = 15 \text{ dBm}$ $T_{CASE} = +25 \text{ °C}$	12.5	_	_	70	
Error Vector Magnitude		EVM	_	_		5	%	
	5 MHz	ACLR1_H	Po_max	_	-38.0	-35.5		
Adjacent Channel Leakage power		ACLR1_L	Po ≤ 9 dBm	_	-45.0	-42.0	dBc	
Ratio ³	10 MHz	ACLR2_H	Po_max	_	-50.0	-48.0	- ubc	
		ACLR2_L	$P_0 \le 9 \text{ dBm}$	_	-56.0	-53.0		
Harmonic Suppression	Second	fH2	Voc. 2.4V	_	-8	0	dBm/1	
	Third	fL3	Vcc = 3.4 V	_	-46	-30	MHz	
		Pn_WRX	Band VIII_RX: 925– 960 MHz, 45 MHz duplex	_	-90	-88		
		Pn_WRX2	WCDMArx = 925 MHz WCDMAtx = 915 MHz	_	-69	-65	-	
Noise Power		Pn_GPS	A-GPS Band: 1570– 1580 MHz	_	-110	-100	dBm/30 kHz	
		Pn_DCS	WCDMArx = 1805- 1880 MHz	_	-111	-100	1	
		Pn_UMTS	2110-2170 MHZ	_	-112	-100		
		Pn_BT1	2400–2480 MHz	_	-107	-90		
Input Voltage Standing Wave Ratio (VSWR)		VSWR	_	_	1.5	2.0	_	
Stability		S	VSWR = 6:1 all phases	_	_	-46	dBm	
Total Current Quiescent Current		ITOTAL	Po_max		550	578	mA	
		Ica	Vcc = 1.5 V Vcont = 1.0 V, no RF		50	75	mA	
Control Current		Ісонт	_	_	_	500	μА	
Digital Enable Current		len	$V\text{en} \geq 1.0 \text{ V}$	_		5	μА	
Leakage Current		ILEAK	Vref = off Ven = off	_	5	10	μА	

 $^{^{\,1}\,}$ Refer to conditions in Table 2 and Table 3, unless otherwise specified.

 $^{^{\,2}\,\,}$ Data in this Table were verified with the signal configuration shown in Table 5.

³ ACLR is specified per 3GPP as the ratio of total in-band power to adjacent power, both measured in 3.84 MHz bandwidth at specified offsets.

Table 5. Standard Test Configuration — WCDMA Voice Mode (Uplink Reference Measurement Channel: 12.2 kbps)

Parameter	Level	Spread Code	Spread Factor	I/Q	βс	βd	βhs	Relative Power
Information Bit Rate	12.2 kbps	_		_	_	_	_	
DPCCH	15.0 kbps	0	256	Q	8/15	_	_	−6.57 dB
DPDCH	60.0 kbps	16	64	I	_	15/15	_	-1.087 dB
TFCI	ON	_	_	_	_	_	_	_

Table 6. SKY77181 Electrical Specifications for HSPDA — Recommended Operating Conditions ¹

Refer to Table 7: Standard Test Configuration — HSDPA Mode

	HSDPA (High Speed Downlink Packet Access) ²							
Characteristics		Symbol	Condition	Minimum	Typical	Maximum	Unit	
Gain Conditions	High Power	Gніgн	Ро_мах	27.0	30.0	33.0	dB	
dain conditions	Low Power	GLOW	Po = -10 dBm	12.5	16.0	19.5	uБ	
Gain Variation Over Frequency			Fixed Vcc, Temp.	_	ı	1	dB	
Power Added Efficiency	High Power	PAEHIGH	Po_max Tcase = +25 °C	34.0	36.0	_	%	
Tower Added Emidency	Low Power	PAELOW	$P_0 = 14 \text{ dBm}$ $T_{CASE} = +25 \text{ °C}$	11.0	12.0	_	70	
Error Vector Magnitude		EVM	_	_	ı	5	%	
	5 MHz offset	ACLR1_H	Po_max	_	-38.0	-35.5		
Adjacent Channel Leakage power Ratio ³	ACLR1_L VCONT = 15 V	* * * * * * * * * * * * * * * * * * * *	_	-45.0	-42.0	dBc		
Augusti Shamor Lourago porror Hatto	10 MHz offset	ACLR2_H	Po_max	_	-52.0	-48.0	ubo	
		ACLR2_L	VCONT = 15 V Po = 9 dBm	_	-60.0	-53.0		

¹ Refer to condition in Table 2 and Table 3, unless otherwise specified.

Table 7. Standard Test Configuration — HSDPA Mode

Parameter	Level	Spread Code	Spread Factor	I/Q	βс	βd	βhs	Relative Power
DPCCH	15 kbps	0	256	Q	12/15	_	_	−8.17 dB
DPDCH	60 kbps	16	64	I	_	15/15	_	−6.23 dB
HS- DPDCH	15 kbps	64	256	Q	_		24/15	−2.15 dB
TFCI	On	_	_	_	_	_	_	_

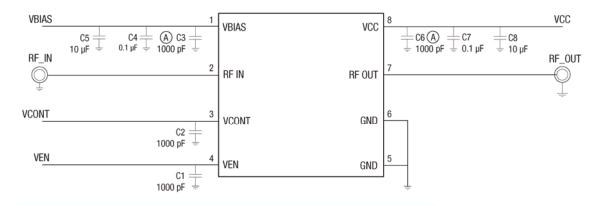
 $^{^{\,2}\,\,}$ Data in this Table were verified with the signal configuration shown in Table 7.

³ ACLR is specified per 3GPP as the ratio of in-band power to adjacent power, both measured in 3.84 MHz bandwidth at specified offsets.

Evaluation Board Description

The evaluation board is a platform for testing and interfacing design circuitry. To accommodate the interface testing of the SKY77181, the evaluation board schematic and diagrams are

included for preliminary analysis and design. Figure 2 shows the basic schematic of the board for the 880 MHz to 915 MHz range.



A Place caps at closest proximity to PA module with the capacitor grounds directly connected to the PAM grounds.

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Figure 2. SKY77181 Evaluation Board Schematic

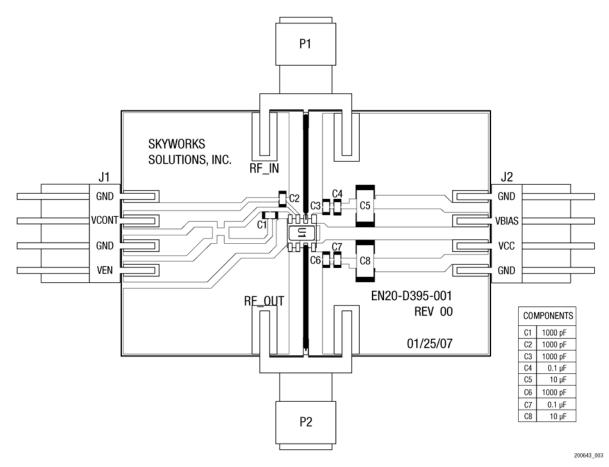
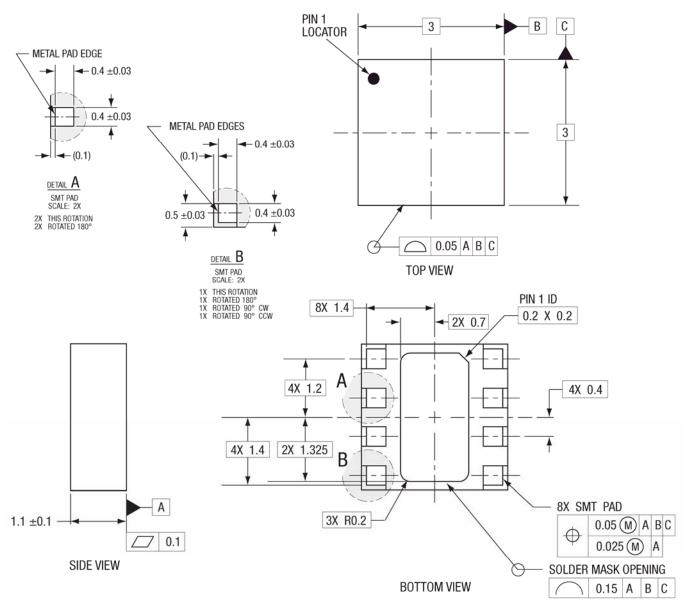


Figure 3. SKY77181 Evaluation Board Assembly Diagram

Package Dimensions and Pad Descriptions

The SKY77181 is a multi-layer laminate base, overmold encapsulated modular package designed for surface mount solder attachment to a printed circuit board. Figure 4 is a mechanical drawing of the pad layout for this package. 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. Figure 6 shows the pad names and the pad numbering convention, which starts with pad 1 at the upper left, and increments counterclockwise around the package. Figure 7 illustrates typical case markings.

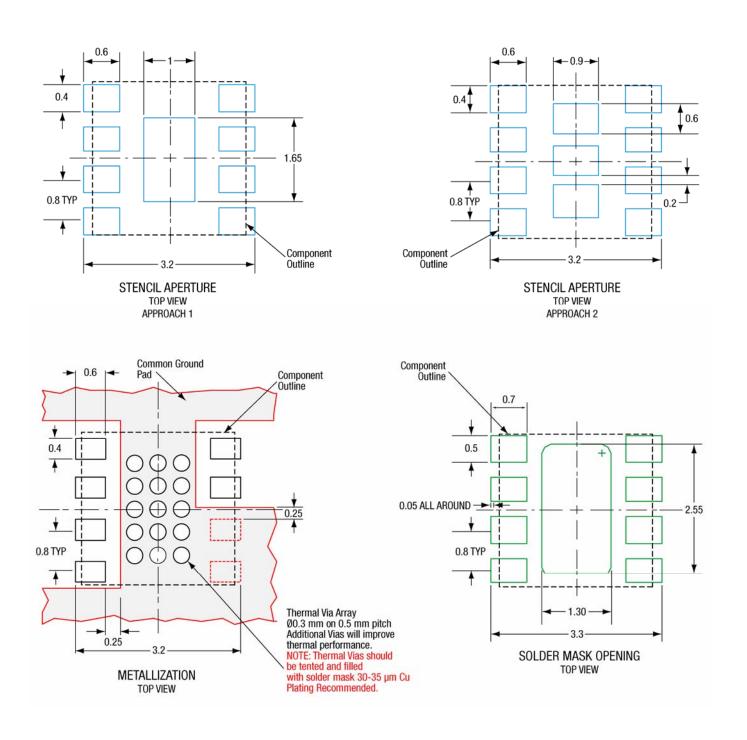


NOTES: Unless otherwise specified

- 1. DIMENSIONING AND TOLERANCES IN ACCORDANCE WITH ASME Y14.5M-1994.
- 2. SEE APPLICABLE BONDING DIAGRAM AND DEVICE ASSEMBLY DRAWING FOR DIE AND COMPONENT PLACEMENT.
- 3. PADS ARE SOLDER MASK DEFINED ON ALL INSIDE EDGES.
- 4. ALL DIMENSIONS ARE IN MILLIMETERS.

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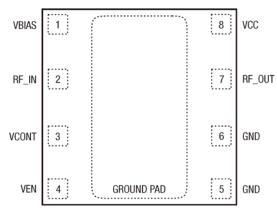
Figure 4. Dimensional Drawing for 3 x 3 x 1.1.1 mm, 8-pad Package – SKY77181 (All Views)



All dimensions are in millimeters.

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Figure 5. Phone PCB Layout Footprint for 3 x 3 x 1.1 mm, 8-pad Package – SKY77181



Pad layout as seen from top view looking through package. GROUND PAD is package underside.

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Figure 6. SKY77181 Pad Configuration

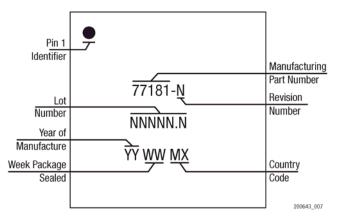


Figure 7. Typical Case Markings – 3 mm x 3 mm Package

Package and Handling Information

Because of its sensitivity to moisture absorption, this device package is baked and vacuum-packed prior to shipment. 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 SKY77181 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

The SKY77181 is a Class 1 device. Figure 8 lists the Electrostatic Discharge (ESD) immunity level for each non-ground pad of the SKY77181 product. The numbers in Figure 8 specify the ESD threshold level for each pad where the I-V curve between the pad and ground starts to show degradation. ESD testing was performed in compliance with MIL-STD-883E Method 3015.7 using the Human Body Model. If ESD damage threshold magnitude is found to consistently exceed 2000 volts on a given pad, this so is indicated. If ESD damage threshold below 2000 volts is measured for either polarity, numbers are indicated that represent worst case values observed in product characterization.

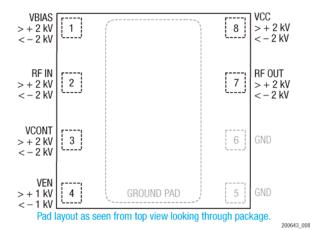


Figure 8. SKY77181 ESD Sensitivity Areas

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 nonfunctional". Skyworks employs most stringent criteria, fails devices as soon as the pad begins to show any degradation on a curve tracer.

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SKY77181 POWER AMPLIFIER MODULE FOR WCDMA (880-915 MHz)

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
SKY77181	SKY77181		MCM3x3LM	−20 °C to 85 °C

Revision History

Revision	Level	Date	Description
Α		January 7, 2008	Initial Issue – Preliminary Information

References

Application Note: PCB Design and SMTP Assembly/Rework, Document Number 101752 Application Note: Tape and Reel Information – RF Modules, Document Number 101568

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

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