

### Features

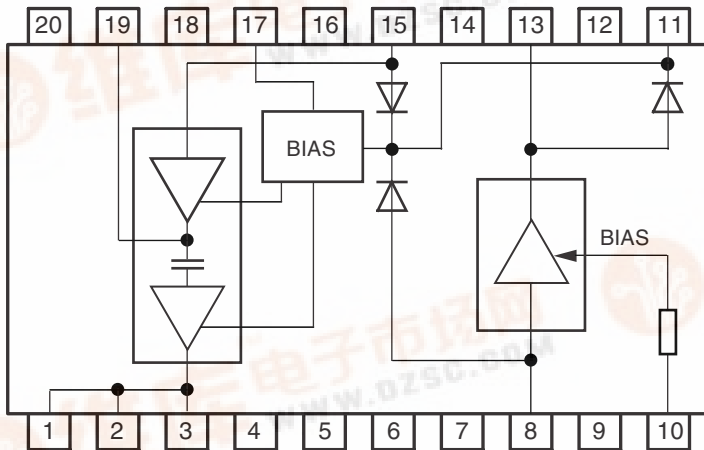
- High-power-added Efficient Power Amplifier ( $P_{out}$  Typically 29 dBm)
- Controlled Output Power
- Low-noise Preamplifier (NF Typically 1.5 dB)
- Few External Components
- PSSO20 Plastic Package with Down-set Paddle

Electrostatic sensitive device.  
Observe precautions for handling.

### 1. Description

The ATR0981 is a monolithic IC manufactured using Atmel's advanced SiGe technology. The IC performs a transmit and receive front-end function, dedicated for a frequency range of 300 MHz to 500 MHz. It consists of a Low-Noise Amplifier (LNA) and a Power Amplifier (PA) with good Power-added Efficiency (PAE).

Figure 1-1. Block Diagram



**UHF SiGe  
Front-end IC**

**ATR0981**

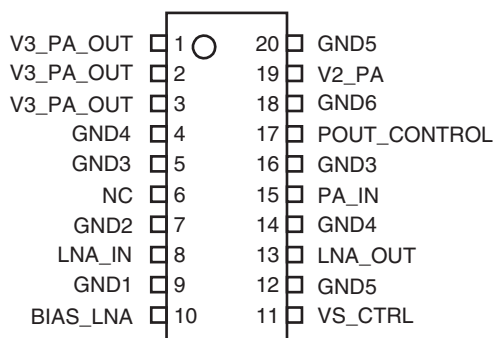
**Preliminary**





## 2. Pin Configuration

**Figure 2-1.** Pinning PSSO20 with Down Set Paddle



**Table 2-1.** Pin Description

Pin	Symbol	Function
1	V3_PA_OUT	Matching network for power amplifier output
2	V3_PA_OUT	Inductor to power supply and matching network for power amplifier output
3	V3_PA_OUT	Inductor to power supply and matching network for power amplifier output
4	GND4	Ground
5	GND3	Ground
6	NC	Not connected
7	GND2	Ground
8	LNA_IN	Low-noise amplifier input
9	GND1	Ground
10	BIAS_LNA	Resistor to $V_S$ sets the LNA current
11	VS_CTRL	Supply voltage for control of power amplifier
12	GND5	Ground
13	LNA_OUT	Low-noise amplifier output and supply voltage
14	GND4	Ground
15	PA_IN	Power amplifier input
16	GND3	Ground
17	POUT_CONTROL	Power amplifier control input
18	GND6	Ground
19	V2_PA	Supply voltage for power amplifier
20	GND5	Ground

### 3. Absolute Maximum Ratings

All voltages are referred to GND (Pins 7, 9, 16, 18, 20, Slug)

Parameters	Symbol	Min.	Max.	Unit
Supply voltage PA, TX, pins 1, 2, 3, 11, 19	$V_{S\_PA}$		5	V
Supply voltage LNA, RX, pin 13	$V_{S\_LNA}$		2.8	V
PA control voltage, TX, pin 17	$V_{CNTL}$		5	V
Junction temperature	$T_{Jmax}$		150	°C
Storage temperature	$T_{Stg}$	-55	+125	°C
Electrostatic handling HMB, all RF pins	$V_{ESD}$		200	V
Electrostatic handling HMB, all control pins	$V_{ESD}$		2	kV

### 4. Operating Range

All voltages are referred to GND (Pins 7, 9, 16, 18, 20, Slug). The following table represents the sum of all supply currents into the mentioned pins.

Parameters	Test Conditions/Pins	Symbol	Min.	Typ.	Max.	Unit
Supply voltage PA	TX, pins 1, 2, 3, 11, 19	$V_{S\_PA}$	3.0	3.6	4.5	V
Supply voltage LNA	RX, pin 13	$V_{S\_LNA}$	2.4	2.5	2.6	V
Supply current PA	TX, pins 1, 2, 3, 11, 19	$I_{S\_PA}$		400		mA
Supply current LNA	Pins 10, 13	$I_{S\_LNA}$		2.5		mA
Ambient temperature		$T_{amb}$	-30	+25	+60	°C

### 5. Thermal Resistance

Parameters	Symbol	Value	Unit
Junction ambient	$R_{thJA}$	19	K/W



## 6. Electrical Characteristics

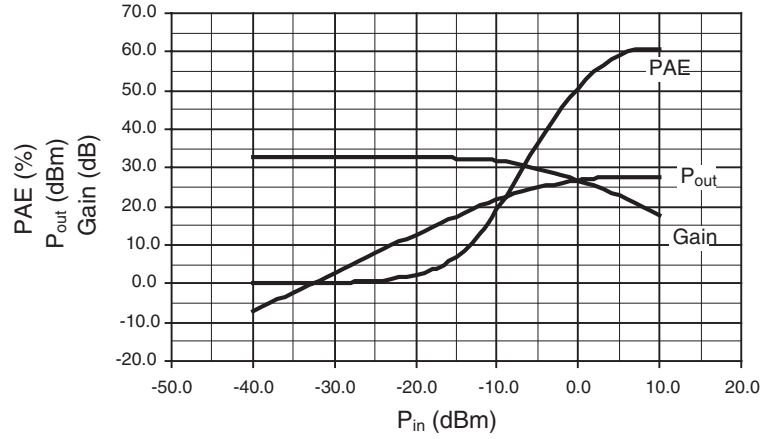
Test conditions (unless otherwise specified) :  $V_{S\_PA} = 3.6V$ ,  $T_{amb} = 25^{\circ}C$ .

Parameters	Test Conditions/Pins	Symbol	Min.	Typ.	Max.	Unit
<b>Power Amplifier<sup>(1)</sup></b>						
Supply voltage	TX, pins 1, 2, 3, 11, 19	$V_{S\_PA}$	3.0	3.6	4.5	V
Supply current	TX, pins 1, 2, 3, 11, 19	$I_{S\_PA}$		400	550	mA
Frequency range	TX	f	300		500	MHz
Power gain	TX, pin 15 to pins 1, 2, 3	Gp	30	34		dB
Output power control range	TX	$\Delta P_{out}$	$\pm 1$		$\pm 3$	dB
Control voltage	TX, output power (maximum), pin 17			2.0	2.5	V
	TX, output power (minimum), pin 17			0.7		V
Control current	Pin 17		0		400	$\mu A$
Shut down mode	Control voltage $\leq 0.1V$ , pins 1, 2, 3, 11, 19	$I_{S\_PA}$		10	20	$\mu A$
Power added efficiency	TX at 466 MHz	PAE	50	55		%
Saturated output power	TX, input power 3 dBm	$P_{sat}$	27.5	29	30.5	dBm
Harmonics	TX, input power 3 dBm	2 fo		-20		dBc
	TX, input power 3 dBm	3 fo		-20		dBc
<b>Low-noise Amplifier</b>						
Supply voltage	RX, pins 10, 13	$V_{S\_LNA}$	2.4	2.5	2.6	V
Supply current	RX, pins 10, 13	$I_{S\_LNA}$		2.5	3.5	mA
Frequency range	RX	f	300		500	MHz
Power gain	RX at $R1 = 5.6 k\Omega$ , $I_S = 2.5 mA$	Gp	17.5	19	20.5	dB
Noise figure <sup>(2)</sup>	RX at $R1 = 5.6 k\Omega$ , $I_S = 2.5 mA$	NF		1.5	2.0	dB
Isolation	RX at $R1 = 5.6 k\Omega$ , $I_S = 2.5 mA$	ISO		20		dB
Third-order input interception point	RX at $R1 = 5.6 k\Omega$ , $I_S = 2.5 mA$	IIP3	-13	-10		dBm

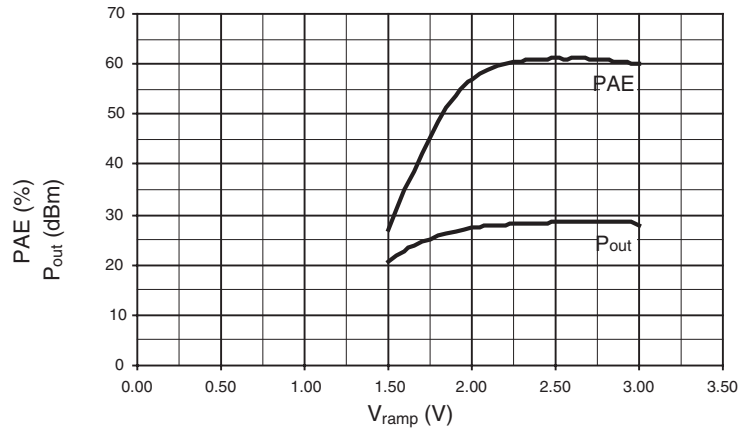
- Notes: 1. Power amplifier should be unconditionally stable, maximum duty cycle 100%, true cw operation, maximum load mismatch 10:1 for 5s at 3.6V  
 2. Ensured by design

**7. Typical Characteristics**

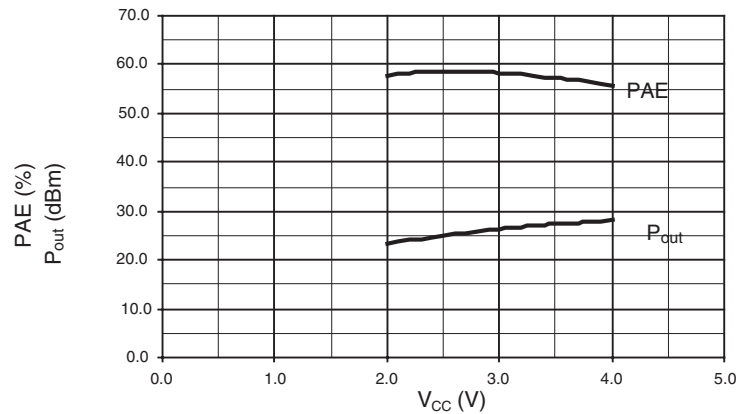
**Figure 7-1. Power Sweep**



**Figure 7-2. Ramp Sweep**

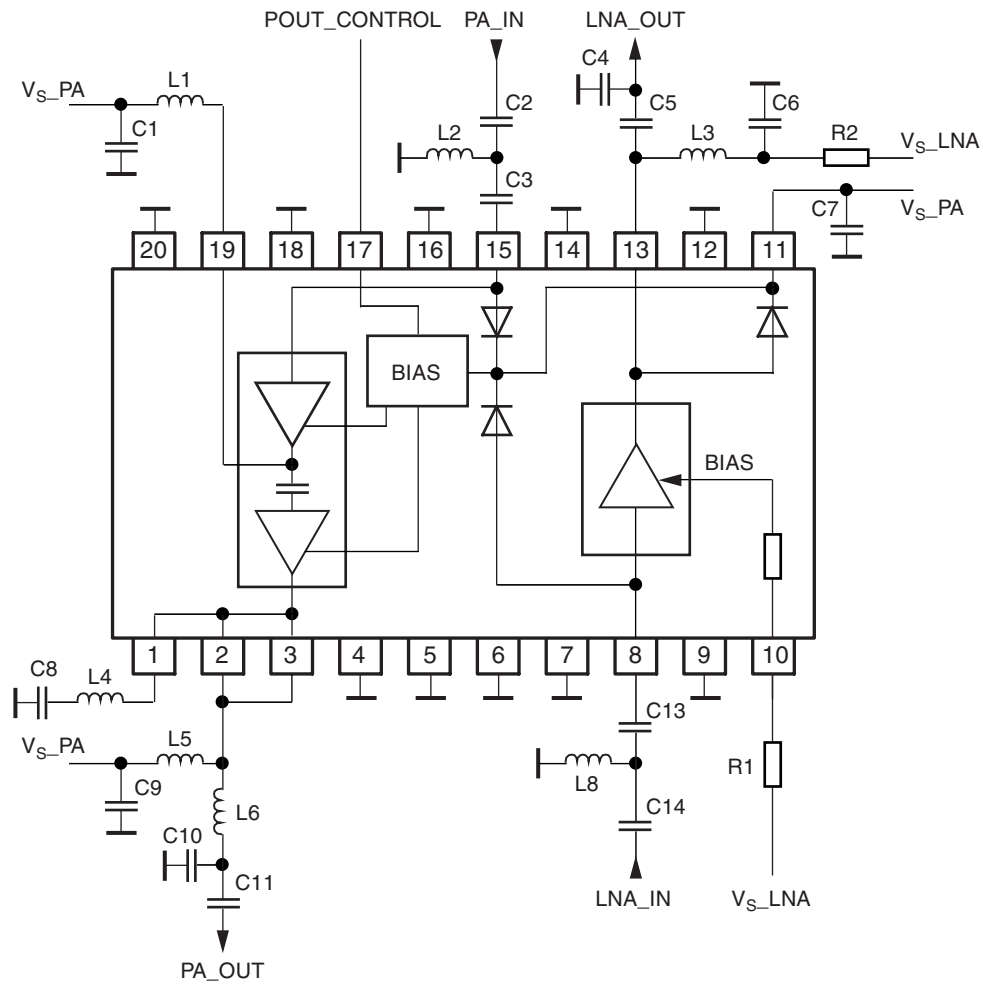


**Figure 7-3. V<sub>CC</sub> Sweep**



## 8. Application Circuit

Figure 8-1. Typical Application Circuit



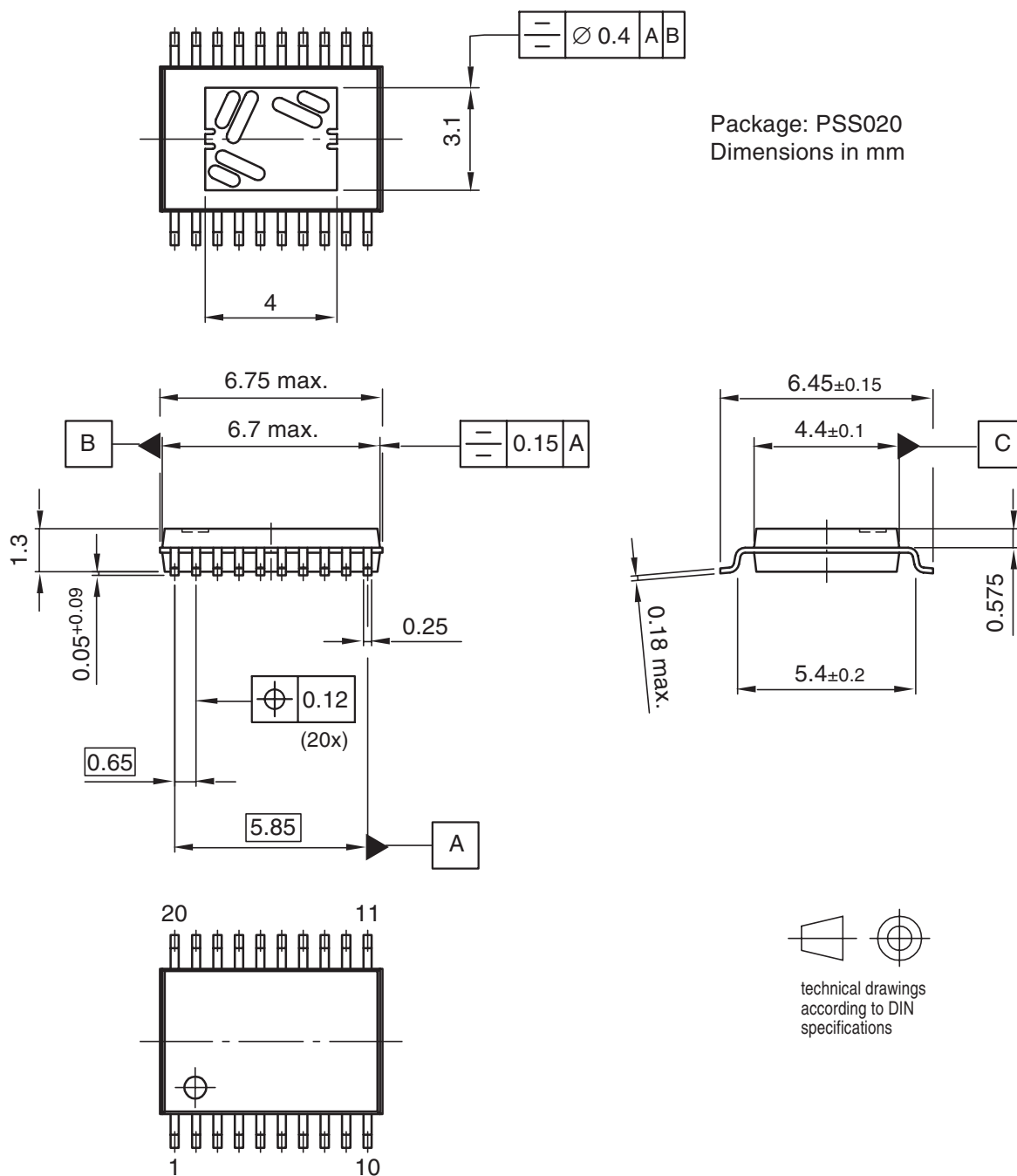
**Table 8-1.** Bill of Materials for 460 MHz Applications

Part No.	Description	Part Value	Package	Vendor
C1	Capacitor	1 nF	0603	Standard
C2, C3, C7, C9, C11, C13	Capacitor	100 pf	0603	Standard
C4	Capacitor	n.c.	0603	Standard
C5	Capacitor	3.9 pF	0603	Standard
C6	Capacitor	220 pF	0603	Standard
C8	Capacitor	2.7 pF	0604	Standard
C10	Capacitor	12 pF	0603	Standard
C14	Capacitor	8.2 pF	0603	Standard
L1	Inductor	1.5 nH	0805	Standard
L2	Inductor	39 nH	0805	Standard
L3, L5, L8	Inductor	22 nH	0805	Standard
L4	Inductor	6.8 nH	0805	Standard
L6	Inductor	3.9 nH	0805	Standard
R2	Resistor	0	0603	Standard

## 9. Ordering Information

Extended Type Number	Package	Remarks
ATR0981-TRUY	PSSO20	Tube
ATR0981-TRHY	PSSO20	Taped and reeled

## 10. Package Information



Drawing-No.: 6.543-5071.01-4

Issue: 1; 23.08.00





## Atmel Corporation

2325 Orchard Parkway  
San Jose, CA 95131, USA  
Tel: 1(408) 441-0311  
Fax: 1(408) 487-2600

## Regional Headquarters

### Europe

Atmel Sarl  
Route des Arsenaux 41  
Case Postale 80  
CH-1705 Fribourg  
Switzerland  
Tel: (41) 26-426-5555  
Fax: (41) 26-426-5500

### Asia

Room 1219  
Chinachem Golden Plaza  
77 Mody Road Tsimshatsui  
East Kowloon  
Hong Kong  
Tel: (852) 2721-9778  
Fax: (852) 2722-1369

### Japan

9F, Tonetsu Shinkawa Bldg.  
1-24-8 Shinkawa  
Chuo-ku, Tokyo 104-0033  
Japan  
Tel: (81) 3-3523-3551  
Fax: (81) 3-3523-7581

## Atmel Operations

### Memory

2325 Orchard Parkway  
San Jose, CA 95131, USA  
Tel: 1(408) 441-0311  
Fax: 1(408) 436-4314

### Microcontrollers

2325 Orchard Parkway  
San Jose, CA 95131, USA  
Tel: 1(408) 441-0311  
Fax: 1(408) 436-4314

La Chantrerie  
BP 70602  
44306 Nantes Cedex 3, France  
Tel: (33) 2-40-18-18-18  
Fax: (33) 2-40-18-19-60

### ASIC/ASSP/Smart Cards

Zone Industrielle  
13106 Rousset Cedex, France  
Tel: (33) 4-42-53-60-00  
Fax: (33) 4-42-53-60-01

1150 East Cheyenne Mtn. Blvd.  
Colorado Springs, CO 80906, USA  
Tel: 1(719) 576-3300  
Fax: 1(719) 540-1759

Scottish Enterprise Technology Park  
Maxwell Building  
East Kilbride G75 0QR, Scotland  
Tel: (44) 1355-803-000  
Fax: (44) 1355-242-743

### RF/Automotive

Theresienstrasse 2  
Postfach 3535  
74025 Heilbronn, Germany  
Tel: (49) 71-31-67-0  
Fax: (49) 71-31-67-2340

1150 East Cheyenne Mtn. Blvd.  
Colorado Springs, CO 80906, USA  
Tel: 1(719) 576-3300  
Fax: 1(719) 540-1759

### Biometrics/Imaging/Hi-Rel MPU/ High Speed Converters/RF Datacom

Avenue de Rochepleine  
BP 123  
38521 Saint-Egreve Cedex, France  
Tel: (33) 4-76-58-30-00  
Fax: (33) 4-76-58-34-80

---

## Literature Requests

[www.atmel.com/literature](http://www.atmel.com/literature)

**Disclaimer:** The information in this document is provided in connection with Atmel products. No license, express or implied, by estoppel or otherwise, to any intellectual property right is granted by this document or in connection with the sale of Atmel products. **EXCEPT AS SET FORTH IN ATMEL'S TERMS AND CONDITIONS OF SALE LOCATED ON ATMEL'S WEB SITE, ATMEL ASSUMES NO LIABILITY WHATSOEVER AND DISCLAIMS ANY EXPRESS, IMPLIED OR STATUTORY WARRANTY RELATING TO ITS PRODUCTS INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT. IN NO EVENT SHALL ATMEL BE LIABLE FOR ANY DIRECT, INDIRECT, CONSEQUENTIAL, PUNITIVE, SPECIAL OR INCIDENTAL DAMAGES (INCLUDING, WITHOUT LIMITATION, DAMAGES FOR LOSS OF PROFITS, BUSINESS INTERRUPTION, OR LOSS OF INFORMATION) ARISING OUT OF THE USE OR INABILITY TO USE THIS DOCUMENT, EVEN IF ATMEL HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.** Atmel makes no representations or warranties with respect to the accuracy or completeness of the contents of this document and reserves the right to make changes to specifications and product descriptions at any time without notice. Atmel does not make any commitment to update the information contained herein. Unless specifically provided otherwise, Atmel products are not suitable for, and shall not be used in, automotive applications. Atmel's products are not intended, authorized, or warranted for use as components in applications intended to support or sustain life.

© Atmel Corporation 2005. All rights reserved. Atmel®, logo and combinations thereof, Everywhere You Are® and others, are registered trademarks of Atmel Corporation or its subsidiaries. Other terms and product names may be trademarks of others.



Printed on recycled paper.