Features

- **35 dBm Output Power in CW Mode**
- **High Power Added Efficiency (PAE)**
- **Single Supply Operation (No Negative Rail)**
- **Simple Analog Power Ramp Control**
- **Low Current Consumption in Power-down Mode (Typically ≤15 mA)**
- **Small SMD Package (PSSOP28 with Heat Slug)**

Applications

- **Professional Phones**
- **Hands-free Sets**
- **ISM Band Application**
- **Wireless Infrastructure Pre-amplifiers**

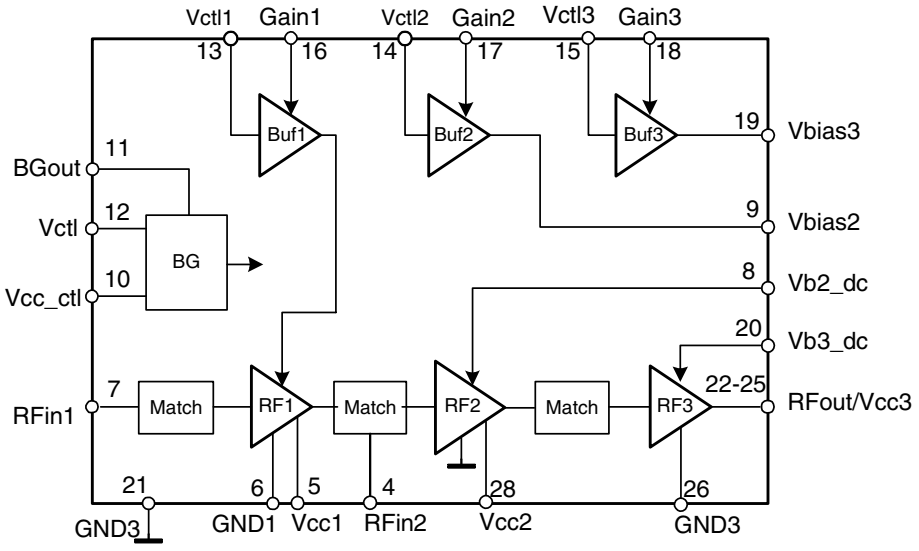
Description

The ATR0906 is a monolithic integrated power amplifier IC manufactured with Atmel's Silicon-Germanium (SiGe) process. Due to its open architecture it can be used either as a two or three-stage amplifier. Every stage can be matched individually which allows applications in a wide frequency range. The ATR0906 can be used from 600 MHz up to 1 GHz in both linear and non-linear (saturated) mode. The analog control input sets dynamically the power gain (either for every single stage or the entire power amplifier).Constant gain mode is also possible. The ATR0906 is suited for the CW mode up to 35 dBm.

All these features, including wide power ramp control, makes the ATR0906 a very flexible power amplifier serving many different applications.

In addition to phones, the application range includes car identification systems and various wireless communication systems. The single supply voltage operation at +3.5 V and a negligible leakage current in power-down mode allow to significantly simplify the power management of the application.

Figure 1. Block Diagram



General-purpose VHF/UHF Power Amplifier (600 - 1000 MHz)

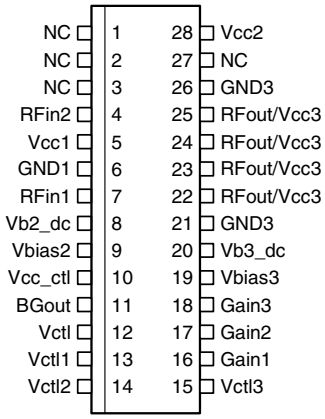
ATR0906

Preliminary

Rev. 4785B–SIGE–05/04

Pin Configuration

Figure 2. Pinning SSOP28



Pin Description

Pin	Symbol	Function
1	NC	Not connected
2	NC	Not connected
3	NC	Not connected
4	RFin2	RF input (two-stage operation)
5	Vcc1	Supply voltage (first stage)
6	GND1	Ground
7	RFin1	RF input (three-stage operation)
8	Vb2_dc	Input for gain setting (second stage)
9	Vbias2	Output Buf2
10	Vcc_ctl	Supply voltage control block
11	BGout	Output band gap
12	Vctl	Control voltage input
13	Vctl1	Control voltage input (first stage)
14	Vctl2	Control voltage input (second stage)
15	Vctl3	Control voltage input (third stage)
16	Gain1	Gain setting Buf1
17	Gain2	Gain setting Buf2
18	Gain3	Gain setting Buf3
19	Vbias3	Output Buf3
20	Vb3_dc	Input for gain setting (third stage)
21	GND3[1]	Ground
22	RFout/Vcc3	RF output/supply voltage (third stage)
23	RFout/Vcc3	RF output/supply voltage (third stage)
24	RFout/Vcc3	RF output/supply voltage (third stage)
25	RFout/Vcc3	RF output/supply voltage (third stage)
26	GND3[1]	Ground
27	NC	Not connected
28	Vcc2	Supply voltage (second stage)

Note: 1. GND2 and GND3 are internally connected and both are connected to the down-set paddle

Absolute Maximum Ratings

Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Parameters	Symbol	Value	Unit
Supply voltage V_{CC}, no RF	V_{CC1}, V_{CC2}, V_{CC3}	0 to +5.5	V
Input power	P_{RFin}	10	dBm
Gain control voltage(1)	V_{ctl}	0 to +2.5	V
Operating case temperature	T_c	-40 to +100	°C
Storage temperature	T_{stg}	-40 to +150	°C
Maximum output power	P_{RFout}	36	dBm

Note: 1. The part may not survive all maximums applied simultaneously.

Thermal Resistance

Parameters	Symbol	Value	Unit
Junction case	R_{thJC}	19	K/W

Operating Range

Parameters	Symbol	Value	Unit
Supply voltage	V_{CC}	2.7 to 5.0	V
Ambient temperature	T_{amb}	-40 to +85	°C
Input frequency	f_{RFin}	600 to 1000	MHz

Electrical Characteristics

Test conditions (if not otherwise specified): V_{CC} = +3.5 V, T_{amb} = +25° C, 50 Ω input and 50 Ω output match

No.	Parameters	Test Conditions	Pin	Symbol	Min.	Typ.	Max.	Unit	Type*
1	**Power Supply**								
1.1	Current consumption, power-down mode (leakage current)	V_{ctl} ≤0.2 V	10, 22-25, 28	I		15	25	µA	A
2	**750 MHz Amplifier Mode**								
2.1	Frequency range			$f_{RFin750}$	700		800	MHz	C
2.2	Output power, normal conditions	V_{CC} = 3.5 V T_{amb} = +25° C P_{RFin} = 3 dBm R_L = R_G = 50 Ω	22-25	$P_{RFout750}$	34	35.0		dBm	
2.3	Extreme conditions	V_{CC} = 2.4 V T_{amb} = +85° C P_{RFin} = 3 dBm R_L = R_G = 50 Ω	22-25	$P_{RFout750}$	32	33.0		dBm	
2.4	Input power		7	$P_{RFin750}$		3	10	dBm	
2.5	Power added efficiency	V_{CC} = 3.5 V P_{RFout} = 35.0 dBm	10, 22-25, 28	PAE_{750}	45	50		%	

*) Type means: A = 100% tested, B = 100% correlation tested, C = Characterized on samples, D = Design parameter

Electrical Characteristics (Continued)

Test conditions (if not otherwise specified): V_{CC} = +3.5 V, T_{amb} = +25° C, 50 Ω input and 50 Ω output match

No.	Parameters	Test Conditions	Pin	Symbol	Min.	Typ.	Max.	Unit	Type*
2.6	Current consumption, active mode	P_{RFout} = 35.0 dBm	10, 22-25, 28	I_{750}		1.81		A	
2.7	Input VSWR	P_{RFin} = 0 to 8 dBm P_{RFout} = 31.0 dBm	7	$VSWR_{750}$			2:1		
2.8	Stability/load mismatch	P_{RFout} = 31.0 dBm V_{CC} = 4.6 V	22-25	$VSWR_{750}$			8:1		
2.9	2nd harmonic distortion		22-25	$2fo_{750}$			-35	dBc	
2.10	3rd harmonic distortion		22-25	$3fo_{750}$			-35	dBc	
2.11	4th to 8th harmonic distortion		22-25	$4fo_{750}$ to $8fo_{750}$			-35	dBc	
2.12	Isolation between input and output	$P_{RFin750}$ = 8 dBm $V_{ctl} \leq$0.2 V (power down)	7, 22-25	$P_{RFout750}$			-30	dBm	
3	**830 MHz Amplifier Mode**								
3.1	Frequency range			$f_{RFin830}$	776		870	MHz	C
3.2	Output power, normal conditions	V_{CC} = 3.5 V T_{amb} = +25° C P_{RFin} = 3 dBm $R_L = R_G$ = 50 Ω	22-25	$P_{RFout830}$	34	35.0		dBm	A
3.3	Extreme conditions	V_{CC} = 2.4 V T_{amb} = +85° C P_{RFin} = 3 dBm $R_L = R_G$ = 50 Ω	22-25	$P_{RFout830}$	31.5	32.5		dBm	C
3.4	Input power		7	$P_{RFin830}$		3	10	dBm	A
3.5	Power added efficiency	V_{CC} = 3.5 V P_{RFout} = 35.0 dBm	10, 22-25, 28	PAE_{830}	43	48		%	A
3.6	Current consumption, active mode	P_{RFout} = 35.0 dBm	10, 22-25, 28	I_{830}		1.88		A	A
3.7	Input VSWR	P_{RFin} = 0 to 8 dBm P_{RFout} = 31.0 dBm	7	$VSWR_{830}$			2:1		C
3.8	Stability/load mismatch	P_{RFout} = 31.0 dBm V_{CC} = 4.6 V	22-25	$VSWR_{830}$			8:1		C
3.9	2nd harmonic distortion		22-25	$2fo_{830}$			-35	dBc	A
3.10	3rd harmonic distortion		22-25	$3fo_{830}$			-35	dBc	A
3.11	4th to 8th harmonic distortion		22-25	$4fo_{830}$ to $8fo_{830}$			-35	dBc	A
3.12	Isolation between input and output	$P_{RFin830}$ = 8 dBm $V_{ctl} \leq$0.2 V (power down)	7, 22-25	$P_{RFout830}$			-30	dBm	A

*) Type means: A = 100% tested, B = 100% correlation tested, C = Characterized on samples, D = Design parameter

Electrical Characteristics (Continued)

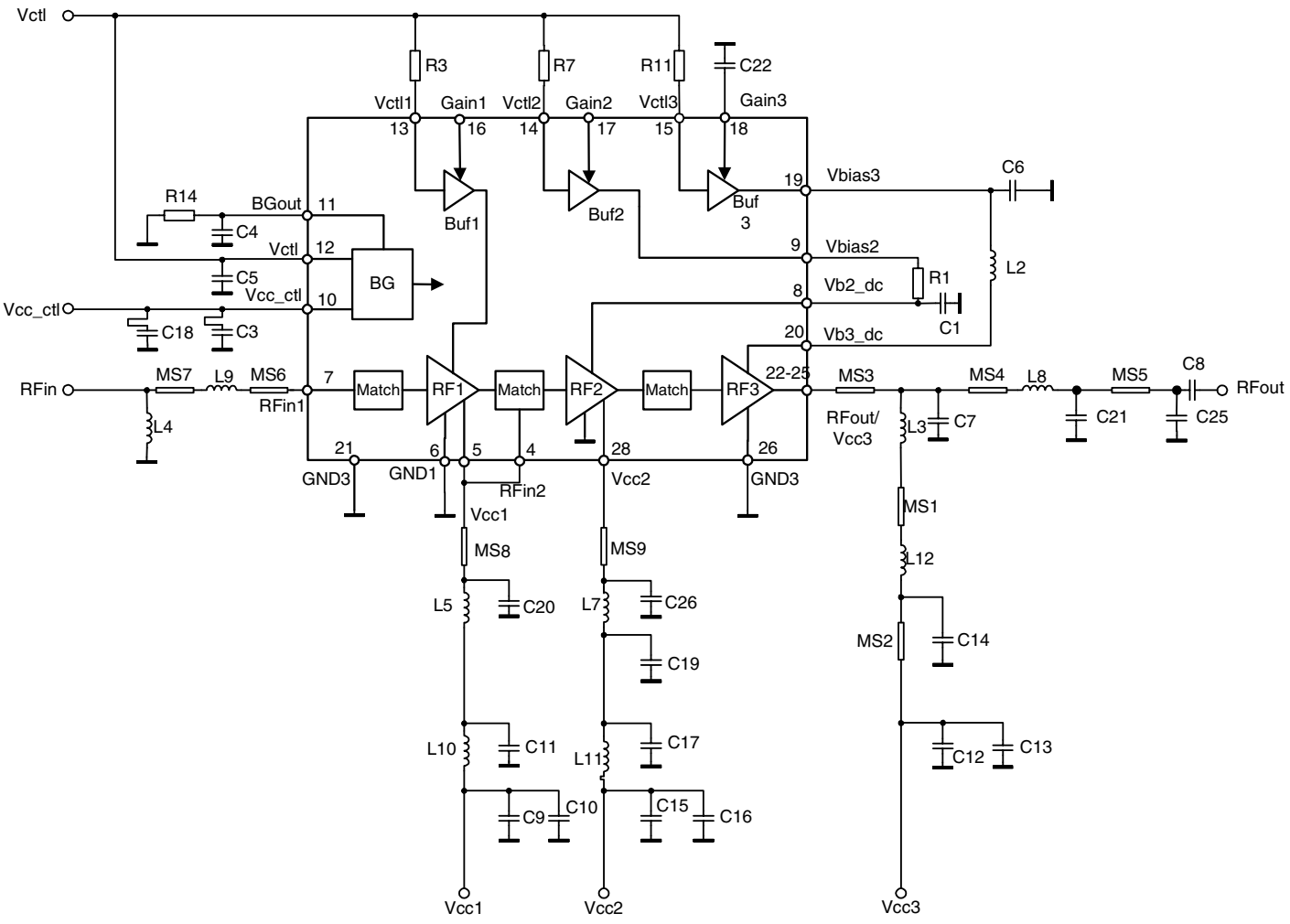
Test conditions (if not otherwise specified): V_{CC} = +3.5 V, T_{amb} = +25° C, 50 Ω input and 50 Ω output match

No.	Parameters	Test Conditions	Pin	Symbol	Min.	Typ.	Max.	Unit	Type*
4.	**940 MHz Amplifier Mode**								
4.1	Frequency range			$f_{RFin940}$	776		870	MHz	C
4.2	Output power, normal conditions	V_{CC} = 3.5 V T_{amb} = +25° C P_{RFin} = 3 dBm $R_L = R_G$ = 50 Ω	22-25	$P_{RFout940}$	33	34.0		dBm	C
4.3	Extreme conditions	V_{CC} = 2.4 V T_{amb} = +85° C P_{RFin} = 3 dBm $R_L = R_G$ = 50 Ω	22-25	$P_{RFout940}$	29	30.0		dBm	C
4.4	Input power		7	$P_{RFin940}$		3	10	dBm	C
4.5	Power added efficiency	V_{CC} = 3.5 V P_{RFout} = 34.0 dBm	10, 22-25, 28	PAE_{940}	41	46		%	C
4.6	Current consumption, active mode	P_{RFfout} = 34.0 dBm	10, 22-25, 28	I_{940}		1.56		A	C
4.7	Input VSWR	P_{RFin} = 0 to 8 dBm P_{RFout} = 31.0 dBm	7	$VSWR_{940}$			2:1		C
4.8	Stability/load mismatch	P_{RFout} = 31.0 dBm V_{CC} = 4.6 V	22-25	$VSWR_{940}$			8:1		C
4.9	2nd harmonic distortion		22-25	$2fo_{940}$			-35	dBc	C
4.10	3rd harmonic distortion		22-25	$3fo_{940}$			-35	dBc	C
4.11	4th to 8th harmonic distortion		22-25	$4fo_{940}$ to $8fo_{940}$			-35	dBc	C
4.12	Isolation between input and output	$P_{RFin940}$ = 8 dBm $V_{ctl} \leq$0.2 V (power down)	7, 22-25	$P_{RFout940}$			-30	dBm	C
5	**Power Control**								
5.1	Control curve slope	$P_{RFout} \geq$ 5 dBm $P_{RFout} \geq$ 25 dBm	22-25	S_{ctl}		300 120	350 150	dB/V dB/V	C
5.2	Power control range	V_{ctl} = 0 to 2.5 V	22-25	G_{ctl}	60			dB	C
5.3	Control voltage range		12-14	V_{ctl}	0.5		2.0	V	C
5.4	Control current	P_{RFin} = 0 to 8 dBm V_{ctl} = 0 to 2.5 V	12-14	I_{ctl}			200	µA	A

*) Type means: A = 100% tested, B = 100% correlation tested, C = Characterized on samples, D = Design parameter

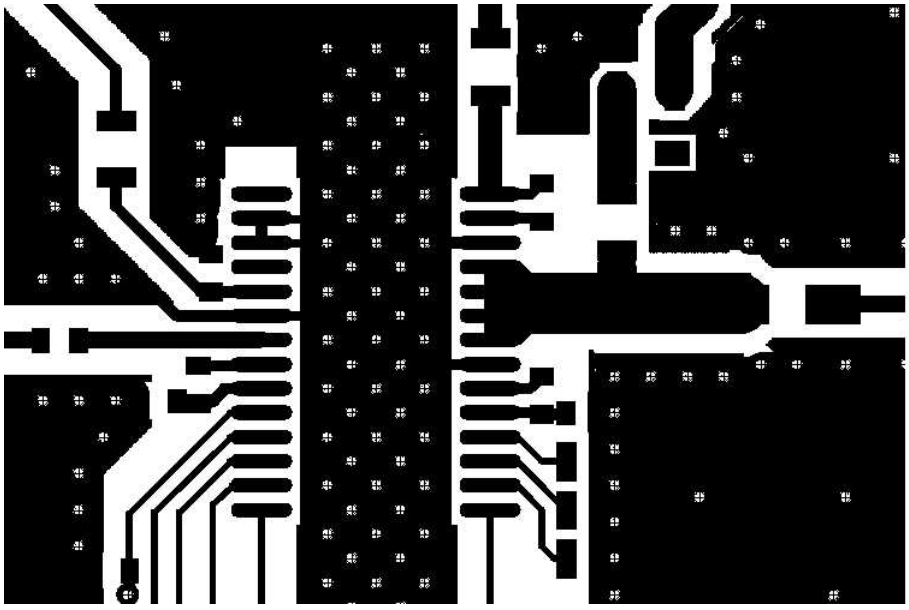
Application Example

Figure 3. Application Example for 830 MHz with Variable Gain



Recommended Package Footprint

Figure 4. Extract from the PCB Showing a Part of the Core Application (without Components)



Notes:
1. Only ground signal traces are recommended directly under the package.
2. The greatest possible density of ground vias guarantees an optimum connection of the ground layers and the best diversion of the heat.
3. The heat slug must be soldered to GND.
4. Plugging of the ground via under the heat slug is also recommended to avoid soldering problems.

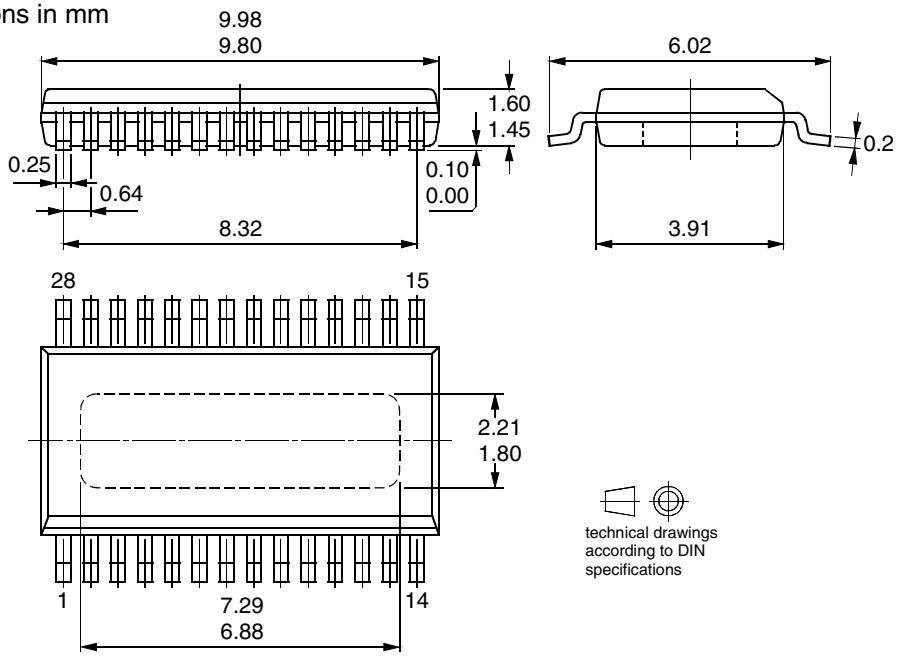
Ordering Information

Extended Type Number	Package	Remarks
ATR0906-TSPH	PSSOP28	Lead free

Package Information

Package PSSOP28

Dimensions in mm



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

4785B–SIGE–05/04