

## SiGe Power Amplifier for CW Applications

### Description

The T0930 is a monolithic integrated power amplifier IC. The device is manufactured in Atmel Wireless & Microcontrollers' Silicon-Germanium (SiGe) technology and has been designed for use in 900-MHz two-way pagers, PDAs, meter readers and ISM phones.

With a single supply voltage operation of + 2.4 to 3.4 V

and a neglectable leakage current in power-down mode, the pager amplifier needs less external components and thus helps to reduce system costs. It is suited for operation in CW mode.

Electrostatic sensitive device. Observe precautions for handling.



### Features

- Up to 33 dBm output power in CW mode
- Power Added Efficiency (PAE) 47%
- Single supply operation at 2.4 V (1 W) or 3.2 V (2 W) no negative voltage necessary
- Current consumption in power-down mode  $\leq 10 \mu\text{A}$ , no external power supply switch required
- Power ramp control
- Simple input and output matching
- Simple output matching for maximum flexibility
- SMD package (PSSOP16 with heat slug)

### Block Diagram

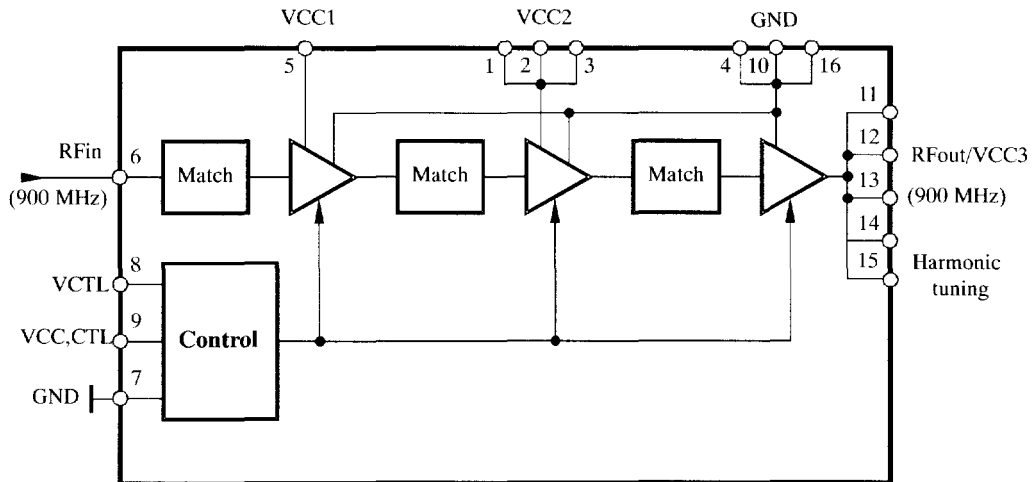


Figure 1. Block diagram

### Ordering Information

Extended Type Number	Package	Remarks
T0930-TJT	PSSOP16	Tube
T0930-TJQ	PSSOP16	Taped and reeled

## Pin Description

Pin	Symbol	Function
1	VCC2	Supply voltage 2
2	VCC2	Supply voltage 2
3	VCC2	Supply voltage 2
4	GND	Ground
5	VCC1	Supply voltage 1
6	RFin	RF input
7	GND	Ground (control)
8	VCTL	Control input
9	VCC,CTL	Supply voltage for control
10	GND	Ground (optional)
11	RFout/VCC3	RF output / supply voltage 3
12	RFout/VCC3	RF output / supply voltage 3
13	RFout/VCC3	RF output / supply voltage 3
14	RFout/VCC3	RF output / supply voltage 3
15	RFout/VCC3	RF output / harmonic tuning
16	GND	Ground

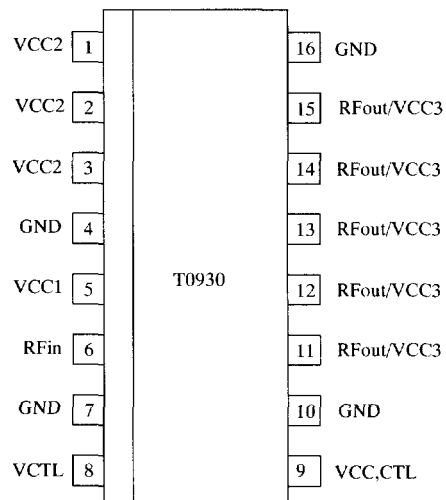


Figure 2. Pinning

## Absolute Maximum Ratings

All voltages are referred to GND

Parameter	Symbol	Min.	Max.	Unit
Supply voltage $V_{CC}$ @ $V_{CTL} = 1.7$ V	Pin 5 $V_{CC1}$ Pin 1, 2, 3 $V_{CC2}$ Pins 11, 12, 13, 14 and 15 $V_{CC3}$ Pin 9 $V_{CC,CTL}$		4.0 4.0 4.0 4.0	V V V V
Input power	Pin 6 $P_{in}$		12	dBm
Gain control voltage *)	Pin 8 $V_{CTL}$	0	2	V
Duty cycle for operation			100	%
Junction temperature	$T_j$		+ 150	°C
Storage temperature	$T_{stg}$	- 40	+150	°C

## Operating Range

All voltages are referred to GND

Parameter	Symbol	Min.	Typ.	Max.	Unit
Supply voltage $V_{CC}$ *) 1 W application	$V_{CC1}, V_{CC2}, V_{CC3}, V_{CC,CTL}$	1.8	2.4	3.0	V
Supply voltage $V_{CC}$ *) 2 W application	$V_{CC1}, V_{CC2}, V_{CC3}, V_{CC,CTL}$	2.6	3.2	3.6	V
Ambient temperature	$T_{amb}$	- 25		+ 85	°C
Input frequency	$f_{in}$		900		MHz

Note: \*)

The gain control voltage should be always 0.2 V below the supply voltage. RF should be applied before ramp-up.

## Electrical Characteristics for 1 Watt Application

$V_{CC} = V_{CC1}, \dots, V_{CC3}, V_{CC,CTL} = +2.4 \text{ V}, V_{CTL} = 1.7 \text{ V}, T_{amb} = +25^\circ\text{C}$ , 50- $\Omega$  input and 50- $\Omega$  external output match

Parameter	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
<b>Power supply</b>						
Supply voltage		$V_{CC}$	1.8	2.4	3.0	V
Current consumption: active mode	$P_{out} = 30 \text{ dBm}$ , $PAE = 47\%$	I		0.9		A
Current consumption (leakage current) in power-down mode	$V_{CTL} \leq 0.2 \text{ V}$	I			10	$\mu\text{A}$
<b>RF input</b>						
Frequency range		$f_{in}$	880	900	935	MHz
Input impedance *)		$Z_i$		50		$\Omega$
Input power		$P_{in}$		5	12	dBm
Input VSWR *)	$P_{in} = 0 \text{ to } 12 \text{ dBm}$ , $P_{out} = 30 \text{ dBm}$				2 : 1	
<b>RF output</b>						
Output impedance *)		$Z_o$		50		$\Omega$
Output power: normal conditions	$P_{in} = 5 \text{ dBm}$ , $R_L = R_G = 50 \Omega$ $V_{CC} = 2.4 \text{ V}, T_{amb} = +25^\circ\text{C}$ $V_{CC} = 1.8 \text{ V}, T_{amb} = +25^\circ\text{C}$	$P_{out}$ $P_{out}$		30 27		dBm dBm
Minimum output power	$V_{CTL} = 0.3 \text{ V}$			-20		dBm
Power-added efficiency	$V_{CC} = 2.4 \text{ V}, P_{out} = 27 \text{ dBm}$ $V_{CC} = 2.4 \text{ V}, P_{out} = 30 \text{ dBm}$	PAE PAE		40 47		% %
Stability	Temp = -25 to +85 $^\circ\text{C}$ , no spurious $\geq -60 \text{ dBc}$	VSWR			10 : 1	
Load mismatch (stable, no damage)	$P_{out} = 30 \text{ dBm}$ , all phases	VSWR			10 : 1	
Second harmonic distortion		2fo			-35	dBc
Third harmonic distortion		3fo			-35	dBc
Noise power f = 925 to 935 MHz f $\geq$ 935 MHz	$P_{out} = 30 \text{ dBm}$ , RBW = 100 kHz			-73 -85	-70 -82	dBm dBm
Rise and fall time					0.5	$\mu\text{s}$
Isolation between input and output	$P_{in} = 0 \text{ to } 10 \text{ dBm}$ , $V_{CTL} \leq 0.2 \text{ V}$ (power down)		50			dB
<b>Power control</b>						
Control curve	$P_{out} \geq 25 \text{ dBm}$				150	dB/V
Power control range	$V_{CTL} = 0.3 \text{ to } 2.0 \text{ V}$		50			dB
Control voltage range		$V_{CTL}$	0.3		2.0	V
Control current	$P_{in} = 0 \text{ to } 10 \text{ dBm}$ , $V_{CTL} = 0 \text{ to } 2.0 \text{ V}$	$I_{CTL}$			200	$\mu\text{A}$

Note: \*) with external matching (see application circuit)

## Electrical Characteristics for 2 Watt Application

$V_{CC} = V_{CC1}, \dots, V_{CC3}, V_{CC,CTL} = +3.2 \text{ V}$ ,  $V_{CTL} = 1.9 \text{ V}$ ,  $T_{amb} = +25^\circ\text{C}$ , 50-Ω input and 50-Ω external output match

Parameter	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
<b>Power supply</b>						
Supply voltage		$V_{CC}$	2.6	3.2	3.6	V
Current consumption: active mode	$P_{out} = 33 \text{ dBm}$ , $PAE = 47\%$	I		1.33		A
Current consumption (leakage current) in power-down mode	$V_{CTL} \leq 0.2 \text{ V}$	I			10	μA
<b>RF input</b>						
Frequency range		$f_{in}$	880	900	935	MHz
Input impedance *)		$Z_i$		50		Ω
Input power		$P_{in}$		5	12	dBm
Input VSWR *)	$P_{in} = 0 \text{ to } 12 \text{ dBm}$ , $P_{out} = 30 \text{ dBm}$				2 : 1	
<b>RF output</b>						
Output impedance *)		$Z_o$		50		Ω
Output power: normal conditions	$P_{in} = 5 \text{ dBm}$ , $R_L = R_G = 50 \text{ } \Omega$ $V_{CC} = 3.2 \text{ V}$ , $T_{amb} = +25^\circ\text{C}$ $V_{CC} = 2.2 \text{ V}$ , $T_{amb} = +25^\circ\text{C}$	$P_{out}$ $P_{out}$		33 30		dBm dBm
Minimum output power	$V_{CTL} = 0.3 \text{ V}$			-20		dBm
Power-added efficiency	$V_{CC} = 3.2 \text{ V}$ , $P_{out} = 27 \text{ dBm}$	PAE		47		%
Stability	Temp = -25 to +85 °C, no spurious >= -60 dBc	VSWR			10 : 1	
Load mismatch (stable, no damage)	$P_{out} = 33 \text{ dBm}$ , all phases	VSWR			10 : 1	
Second harmonic distortion		2fo			-35	dBc
Third harmonic distortion		3fo			-35	dBc
Noise power f = 925 to 935 MHz f ≥ 935 MHz	$P_{out} = 33 \text{ dBm}$ , RBW = 100 kHz			-73 -85	-70 -82	dBm dBm
Rise and fall time					0.5	μs
Isolation between input and output	$P_{in} = 0 \text{ to } 10 \text{ dBm}$ , $V_{CTL} \leq 0.2 \text{ V}$ (power down)		50			dB
<b>Power control</b>						
Control curve	$P_{out} \geq 25 \text{ dBm}$				150	dB/V
Power control range	$V_{CTL} = 0.3 \text{ to } 2.0 \text{ V}$		50			dB
Control voltage range		$V_{CTL}$	0.3		2.0	V
Control current	$P_{in} = 0 \text{ to } 10 \text{ dBm}$ , $V_{CTL} = 0 \text{ to } 2.0 \text{ V}$	$I_{CTL}$			200	μA

Note: \*) with external matching (see application circuit)

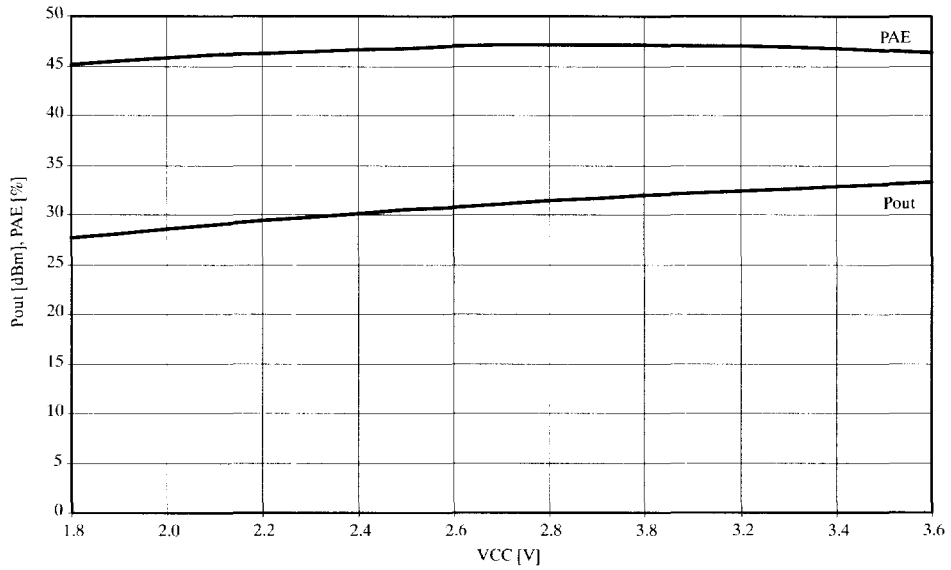


Figure 3. Pout and PAE versus VCC (1 W application)

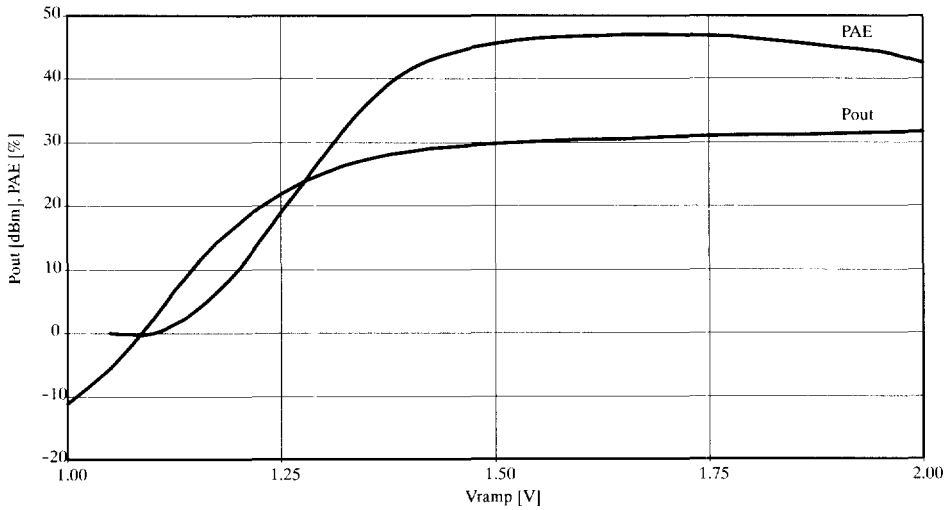


Figure 4. Pout and PAE versus Vramp (1 W application)

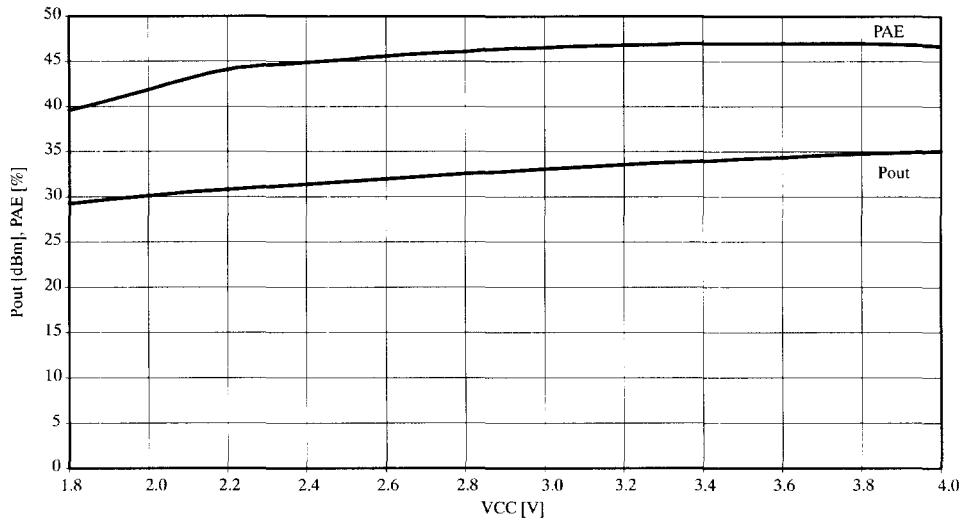


Figure 5. Pout and PAE versus VCC (2 W application)

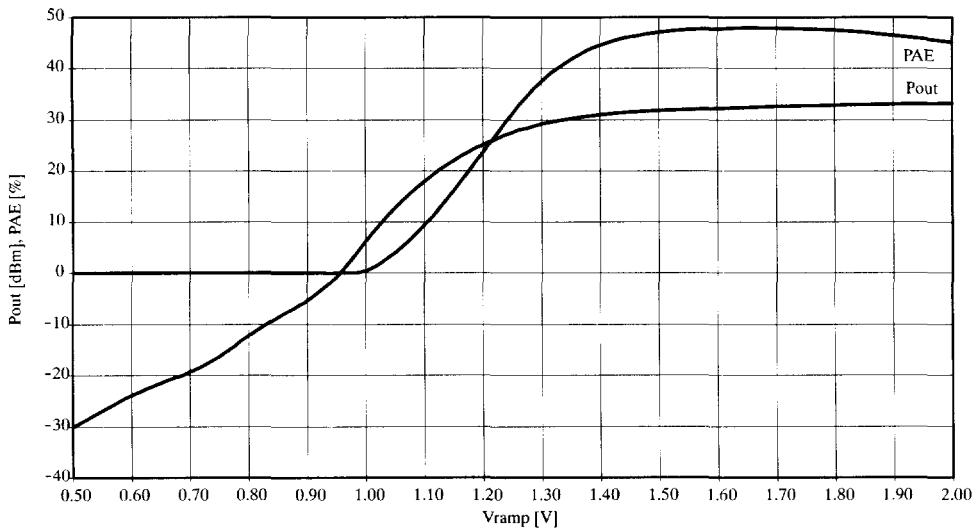


Figure 6. Pout and PAE versus Vramp (2 W application)

