Dualband SiGe Power Amplifier for GSM 900/1800/1900

Description

The TST0911 is a monolithic dualband power amplifier IC. The device is manufactured using Atmel Wireless & Microcontrollers' advanced Silicon-Germanium (SiGe) process and has been designed for use in GSM-based cellular phones.

The IC offers the functionality of two amplifiers in one package and is suited for GSM 900/1800/1900 (GSM/ DCS/ PCS) dual- or triple mobile phones. With a single supply voltage operation of 3 V and a neglectable leakage current in power-down mode, the TST0911 needs few external components.

Electrostatic sensitive device.
Observe precautions for handling.

Features

- 900-MHz amplifier and 1800/1900-MHz amplifier for dual-/tripleband application
- 35 dBm output power @ 900 MHz
  32 dBm output power @ 1800/ 1900 MHz
- Power-added efficiency (PAE) 50%
- Single supply operation at 3 V
  no negative supply voltage necessary
- Current consumption in power-down mode ≤ 10 µA, no external power-supply switch required
- Power-ramp control
- Mode switch
- AC-coupled input, simple input and output matching
- SMD package (PSSOP28 with heat slug)

Block Diagram

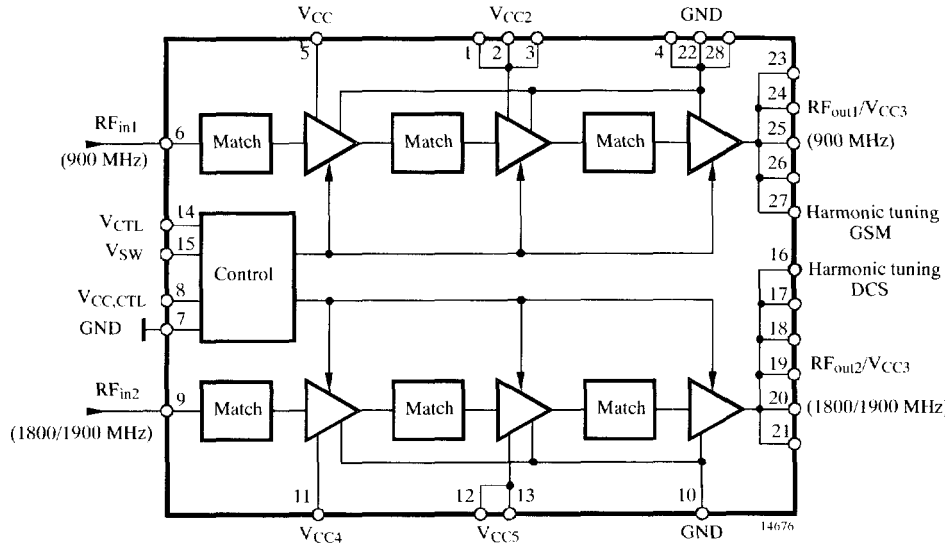

Figure 1. Block diagram

Preliminary Information

Ordering Information

Extended Type Number	Package	Remarks
TST0911-TSS	PSSOP28	Tube
TST0911-TSQ	PSSOP28	Taped and reeled

Pin Description

Pin	Symbol	Function
1	V_{CC2}	Supply voltage 2 (900-MHz amplifier)
2	V_{CC2}	
3	V_{CC2}	
4	GND	Ground
5	V_{CC1}	Supply voltage 1 (900-MHz amplifier)
6	RF_{in1}	RF input 1 (900 MHz)
7	GND	Ground (control)
8	$V_{CC,CTL}$	Supply voltage for control
9	RF_{in2}	RF input 2 (1800/1900 MHz)
10	GND	Ground
11	V_{CC4}	Supply voltage 4 (1800/1900-MHz amplifier)
12	V_{CC5}	Supply voltage 5 (1800/1900-MHz amplifier)
13	V_{CC5}	Supply voltage 5 (1800/1900-MHz amplifier)
14	VCTL	Control input
15	VSW	Mode switch
16	RF_{out2}/V_{CC6}	RF output 2 / harmonic tuning (1800/1900 MHz)
17	RF_{out2}/V_{CC6}	
18	RF_{out2}/V_{CC6}	
19	RF_{out2}/V_{CC6}	
20	RF_{out2}/V_{CC6}	
21	RF_{out2}/V_{CC6}	
22	GND	Ground
23	RF_{out1}/V_{CC3}	RF output 1 / supply voltage 3 (900 MHz)
24	RF_{out1}/V_{CC3}	
25	RF_{out1}/V_{CC3}	
26	RF_{out1}/V_{CC3}	
27	RF_{out1}/V_{CC3}	RF output 1 / harmonic tuning (900 MHz)
28	GND	Ground

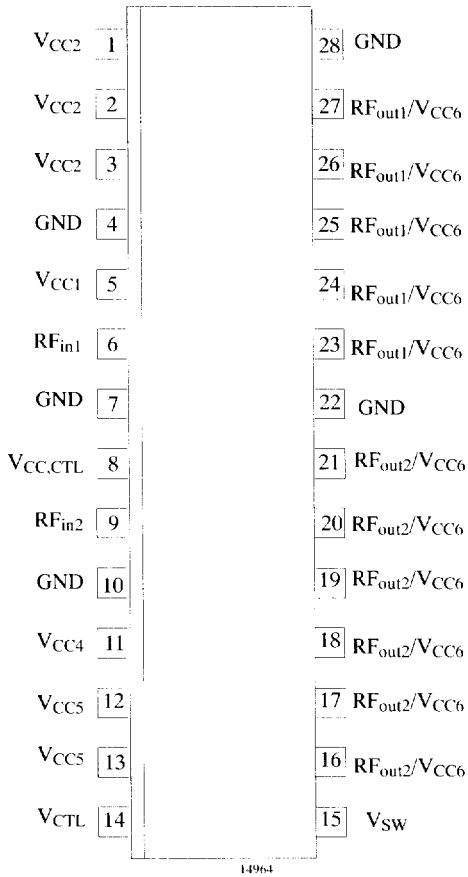

Figure 2. Pinning

Absolute Maximum Ratings

All voltages are referred to GND

Parameter		Symbol	Min.	Max.	Unit
Supply voltage V_{CC}	Pins 1, 2, 3, 5, 11, 12, 13, 16, 17, 18, 19 ,20, 21, 23, 24, 25, 26 and 27 Pin 8	V_{CC1}, V_{CC2} V_{CC3}, V_{CC4} V_{CC5}, V_{CC6} $V_{CC, CTL}$		5.0	V
Input power	Pin 6 (GSM) Pin 9 (DCS/PCS)	P_{in}		13 8	dBm dBm
Gain-control voltage	Pin 14	V_{CTL}	0	2.2	V
Duty cycle for operation				25	%
Burst duration		t_{burst}		1.2	ms
External voltage for mode switch Pin 16		V_{SW}	0	V_{CC}	V
Junction temperature		T_j		+ 150	°C
Storage temperature		T_{stg}	- 40	+150	°C

Thermal Resistance

Parameter	Symbol	Value	Unit
Junction ambient	R_{thJA}	t.b.d.	K/W

Operating Range

All voltages are referred to GND

Parameter	Symbol	Min.	Typ.	Max.	Unit
Supply voltage	V_{CC}	2.4	3.5	4.5	V
Ambient temperature	T_{amb}	- 25		+ 85	°C
Input frequency	f_{in} (Pin 6) f_{in} (Pin 9)		900 1800/1900		MHz MHz

Electrical Characteristics

Test conditions: $V_{CC} = V_{CC1}$ to V_{CC6}, $V_{CC, CTL}$ = + 3.5 V, V_{CTL} = 1.5 V, T_{amb} = + 25°C, t_{burst} = 0.577 ms, t_{period} = 4.615 ms (see application circuit) *) with external matching (see application circuit)

Parameter	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
Power supply						
Supply voltage		V_{CC}	2.7	3.5	4.5	V
Current consumption	Active mode P_{out} = 34.5 dBm, PAE = 50% P_{out} = 32.5 dBm, PAE = 42%	I		1.7 1.13		A A
Current consumption (leakage current)	Power-down mode $V_{CTL} \leq 0.2$ V	I			10	µA

Electrical Characteristics (continued)

Test conditions: $V_{CC} = V_{CC1}$ to V_{CC6}, $V_{CC, CTL}$ = + 3.5 V, V_{CTL} = 1.5 V, T_{amb} = + 25°C, t_{burst} = 0.577 ms, t_{period} = 4.615 ms (see application circuit) *) with external matching (see application circuit)

Parameter	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
900-MHz amplifier (GSM)						
Frequency range		f_{in}	880	900	915	MHz
Input impedance *)		Z_i		50		Ω
Output impedance		Z_o		50		Ω
Output power	P_{in} = 3 dBm, R_L = RG = 50 Ω V_{CC} = 3.5 V, T_{amb} = +25°C V_{CC} = 2.7 V, T_{amb} = +85°C	P_{out}	34.3 32.0	34.8 33.0		dBm dBm
Minimum output power	V_{CTL} = 0.3 V	P_{out}		- 20		dBm
Input power		P_{in}		0	10	dBm
Power-added efficiency	V_{CC} = 3 V, P_{out} = 28 dBm V_{CC} = 3 V, P_{out} = 30 dBm V_{CC} = 3 V, P_{out} = 33.5 dBm	PAE	25 35 50			%
Input VSWR *)	P_{in} = 0 to 10 dBm, P_{out} = 34.5 dBm	VSWR			2 : 1	
Stability	T_{amb} = -25 to + 85 °C no spurious ≥ -60 dBc	VSWR			10 : 1	
Load mismatch (stable, no damage)	P_{out} = 34.5 dBm, all phases	VSWR			10 : 1	
Second harmonic distortion		2fo			-35	dBc
Third harmonic distortion		3fo			-35	dBc
Noise power	P_{out} = 34 dBm, RBW = 100 kHz f = 925 to 935 MHz f ≥ 935 MHz				- 70 - 82	dBm dBm
Isolation between input and output	P_{in} = 0 to 10 dBm, V_{CTL} ≤ 0.2 V (power down)		50			dB
Isolation between GSM input and DCS/PCS output	DCS/PCS powered down, P_{in} = 10 dBm		50			dB
Control curve	see figure 3 (t.b.d.)					
Rise and fall time		t_r, t_f			0.5	µs
Output power vs. input power	see figure 1 (t.b.d.)					
Power control range			60			dB
Control voltage range		V_{CTL}	0.5		2.5	V
Control current, assuming that only GSM amplifier at a time is turned on	P_{in} = 0 to 10 dBm, V_{CTL} = 0 to 2.0 V	I_{CTL}			200	µA
Power control						
Control curve slope	P_{out} ≥ 25 dBm				150	dB/ V
Power-control range	V_{CTRL} = 0.3 to 2.0 V		50			dB
Control-voltage range		V_{CTL}	0.3		2.0	V

Electrical Characteristics (continued)

Test conditions: $V_{CC} = V_{CC1}$ to V_{CC6}, $V_{CC, CTL}$ = + 3.5 V, V_{CTL} = 1.5 V, T_{amb} = + 25°C, t_{burst} = 0.577 ms, t_{period} = 4.615 ms (see application circuit) *) with external matching (see application circuit)

Parameter	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
Control current	P_{in} = 0 to 10 dBm, V_{CTL} = 0 to 2.0 V	I_{CTL}			200	µA
1800/1900-MHz amplifier (DCS/PCS)						
Frequency range	DCS PCS	f_{in}	1710 1850		1785 1910	MHz MHz
Input impedance *)		Z_i		50		Ω
Output impedance		Z_o		50		Ω
Output power	P_{in} = 3 dBm, $R_L = R_G$ = 50 Ω V_{CC} = + 3.5 V, T_{amb} = +25°C V_{CC} = + 2.7 V, T_{amb} = +85°C	P_{out}	 31.7 30.0	 32.0 30.5		 dBm dBm
Minimum output power	V_{CTL} = 0.3 V			- 20		dBm
Input power		P_{in}		0	6	dBm
Power-added efficiency at $P_{out, max}$	V_{CC} = + 3 V, P_{out} = 26 dBm V_{CC} = + 3 V, P_{out} = 28 dBm V_{CC} = + 3 V, P_{out} = 31.5 dBm	PAE	25 35 42			%
Input VSWR *)	P_{in} = 0 to 6 dBm, P_{out} = 31.5 dBm	VSWR			2 : 1	
Stability	T_{amb} = -25 to + 85°C	VSWR			10 : 1	
Load mismatch stable, no damage	P_{out} = 31.5 dBm all phases	VSWR			10 : 1	
Second harmonic distortion		IM2			-35	dBc
Third harmonic distortion		IM3			-35	dBc
Noise power	P_{out} = 31.5 dBm, RBW = 100 kHz f = 1805-1880 MHz (DCS) f = 1930-1990 MHz (PCS)				 - 71 - 71	 dBm dBm
Isolation between input and output	P_{in} = 0 to 6 dBm, V_{CTL} ≤ 0.2 V (power down)		48			dB
Isolation between DCS/ PCS input and GSM output	GSM powered down, P_{in} = 6 dBm		50			dB
Control curve slope					150	dB/ V
Rise and fall time		t_r, t_f			0.5	µs
Power control range			50			dB
Control voltage range		V_{CTL}	0.5		2.5	V
Control current, assuming that only DCS/PCS amplifier at a time is turned on	P_{in} = 0 to 6 dBm, V_{CTL} = 0 to 2.2 V	I_{CTL}			200	µA
Mode switch						
Switching voltage	900-MHz amplifier active 1800/1900-MHz amplifier active	V_{sw}	V_{CC}-0.3 0		V_{CC} 0.3	V V
Switching current	$V_{SW} = V_{CC}$	I_{sw}			200	µA

Application Circuit

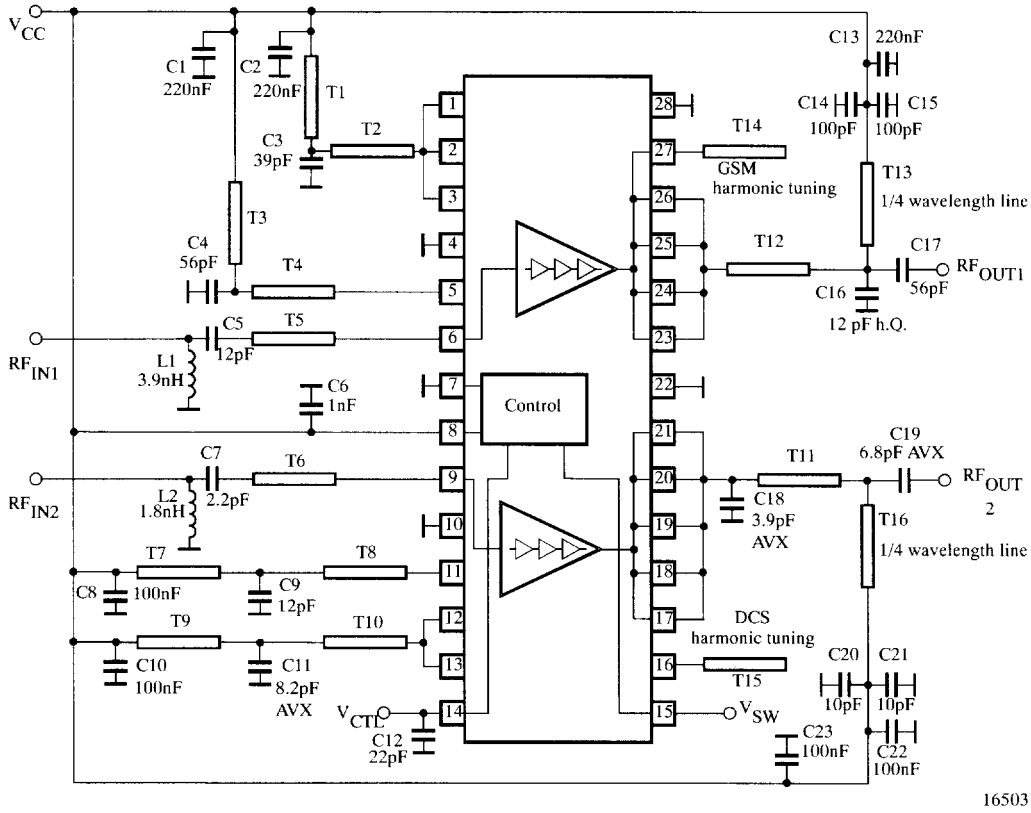

Figure 3. Application circuit

All components Tx are microstrip lines: FR4, epsilon(r) = 4.3, metal: Cu 3.5 µm;
Distance: 1. layer to RF ground = 0.5 mm

Name	l/ mm	w/ mm	
T1	21.8	0.5	
T2	2.0	1.4	
T3	37.9	0.5	
T4	10.8	0.5	
T5	2.6	1.0	+ 0.8 × 0.5
T6	1.6	1.0	+ 1.6 × 0.5
T7	31.8	0.2	
T8	4.5	0.2	

Name	l/ mm	w/ mm
T9	47.8	1.0
T10	1.7	0.5
T11	5.8	1.8
T12	8.6	1.6
T13	29.2	0.5
T14	19.6	0.2
T15	11.2	0.2
T16	29.3	0.2

Package Information

Package PSSOP28

Dimensions in mm