- **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 µA)**
- **Small SMD Package (PSSOP28 with Heat Slug)**

Applications

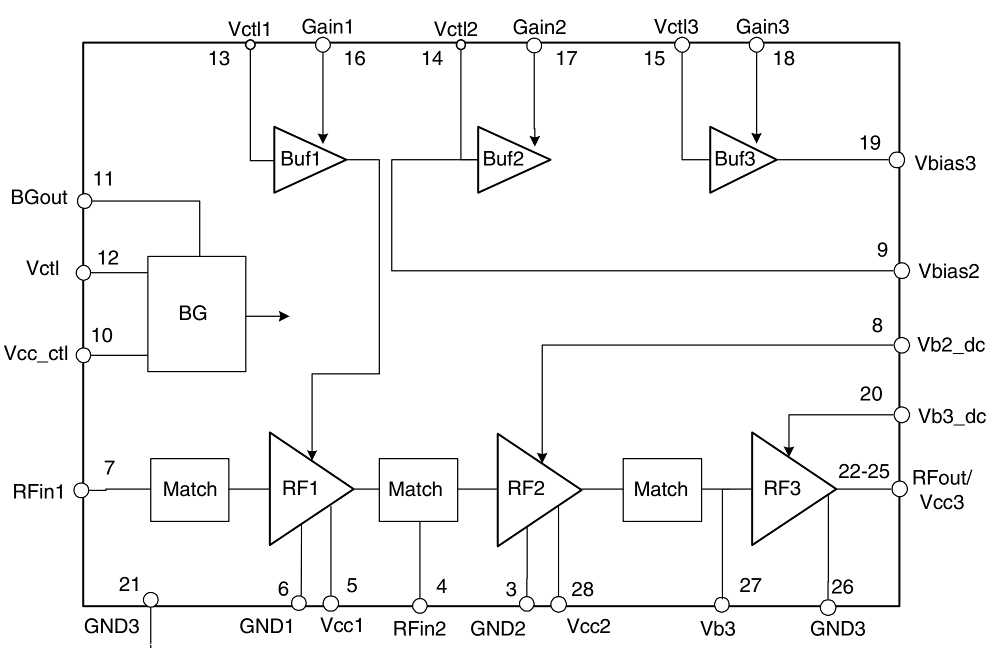
- **Professional Phones**
- **Hands-free Sets**
- **ISM Band Application**
- **Wireless Infrastructure Preamplifiers**

Description

The T0905 is a monolithic integrated power amplifier IC manufactured with Atmel's Silicon-Germanium (SiGe) process. Due to its open architecture, the device can be used either as a two or three-stage amplifier. Every stage can be matched individually, thus allowing applications in a wide frequency range. The T0905 can be used from 135 MHz up to 600 MHz in both linear and non-linear (saturated) mode. The power gain can be set dynamically by means of an analog control input optionally for each single stage or for the entire power amplifier. Constant gain mode is also possible. The T0905 is suited for CW mode up to 35 dBm. These features, including wide power ramp control, make the T0905 a very flexible power amplifier for many different applications.

Apart from telephone applications, the T0905 can also be used for car identification systems and several other wireless communication systems. The single supply voltage operation at +3.5 V and a negligible leakage current in power-down mode enable a remarkable simplification of the application's power management.

Figure 1. Block Diagram



General-purpose VHF/UHF Power Amplifier (135 to 600 MHz)

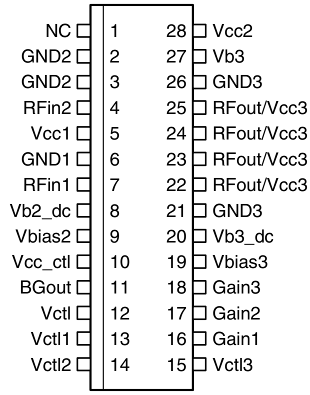
T0905

Preliminary

Rev. 4751A–SIGE–09/03

Pin Configuration

Figure 2. Pinning PSSOP28



Pin Description

Pin	Symbol	Function
1	NC	Not connected
2	GND2	Ground
3	GND2	Ground
4	RFin2	RF input (2-stage operation)
5	Vcc1	Supply voltage, first stage
6	GND1	Ground
7	RFin1	RF input (3-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	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	Ground
27	Vb3	Pin to extend the input capacity of stage 3
28	Vcc2	Supply voltage second stage

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	-30 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

All voltages are referred to GND

Parameters	Symbol	Value	Unit
Supply voltage	V_{CC}	2.4 to 5.0	V
Ambient temperature	T_{amb}	-30 to +85	°C
Input frequency	f_{Rfin}	135 to 600	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)	$V_{ctlx} \leq 0.2$ V	10, 22 - 25, 28	I		15	25	µA	A
2	**150-MHz Amplifier Mode**								
2.1	Frequency range			$f_{Rfin150}$	135		178	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	$P_{RFout150}$	34.0	35.0		dBm	C
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	$P_{RFout150}$	32.0	33.0		dBm	C
2.4	Input power		4	$P_{RFin150}$		3	10	dBm	C

*) 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*
2.5	Power added efficiency	V_{CC} = 3.5 V P_{RFout} = 35.0 dBm	10, 22 - 25, 28	PAE_{150}	50	55		%	C
2.6	Current consumption active mode	P_{RFout} = 35 dBm	10, 22 - 25, 28	I_{150}		1.64		A	C
2.7	Input VSWR	P_{RFin} = 0 to 8 dBm P_{RFout} = 31.0 dBm	4	$VSWR_{150}$			2:1		C
2.8	Stability/load mismatch	P_{RFout} = 31.0 dBm V_{CC} = 4.6 V	22 - 25	$VSWR_{150}$			8:1		C
2.9	2nd harmonic distortion		22 - 25	$2fo_{150}$			-35	dBc	C
2.10	3rd harmonic distortion		22 - 25	$3fo_{150}$			-35	dBc	C
2.11	4th to 8th harmonic distortion		22 - 25	$4fo..8fo_{150}$			-35	dBc	C
2.12	Isolation between input and output	$P_{Rfin150}$ = 8 dBm $V_{ctl} \leq 0.2$ V (power down)	4, 22 - 25	$P_{RFout150}$			-30	dBm	C
3	**450-MHz Amplifier Mode**								
3.1	Frequency range			$f_{Rfin450}$	380		520	MHz	A
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	$P_{RFout450}$	34.0	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	$P_{RFout450}$	32.0	33.0		dBm	C
3.4	Input power		4	$P_{RFin450}$		3	10	dBm	A
3.5	Power added efficiency	V_{CC} = 3.5 V P_{RFout} = 35.0 dBm	10, 22 - 25, 28	PAE_{450}	50	55		%	A
3.6	Current consumption active mode	P_{RFout} = 35 dBm PAE = 55%	10, 22 - 25, 28	I_{450}		1.64		A	A
3.7	Input VSWR	$P_{Rfin450}$ = 0 to 8 dBm P_{RFout} = 31.0 dBm	4	$VSWR_{450}$			2:1		C
3.8	Stability/load mismatch	$P_{RFout450}$ = 31.0 dBm V_{CC} = 4.6 V	22 - 25	$VSWR_{450}$			8:1		C
3.9	2nd harmonic distortion		22 - 25	$2fo_{450}$			-35	dBc	A
3.10	3_{rd} harmonic distortion		22 - 25	$3fo_{450}$			-35	dBc	A
3.11	4th to 8th harmonic distortion		22 - 25	$4fo..8fo_{450}$			-35	dBc	C
3.12	Isolation between input and output	$P_{Rfin150}$ = 8 dBm $V_{ctl} \leq 0.2$ V (power down)	4, 22 - 25	$P_{RFout450}$			-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	**Power Control**								
4.1	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
4.2	Power control range	V_{ctl} = 0 to 2.5 V	22 - 25	G_{ctl}	60			dB	C
4.3	Control voltage range		12 - 14	V_{ctl}	0.5		2.0	V	C
4.4	Control current	P_{RFin} = 0 to 8 dBm V_{ct}l = 0 to 2.0 V	12 - 14	I_{ctll}			200	µA	A

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

Figure 3. Application Example for 450-MHz PA with Variable Gain

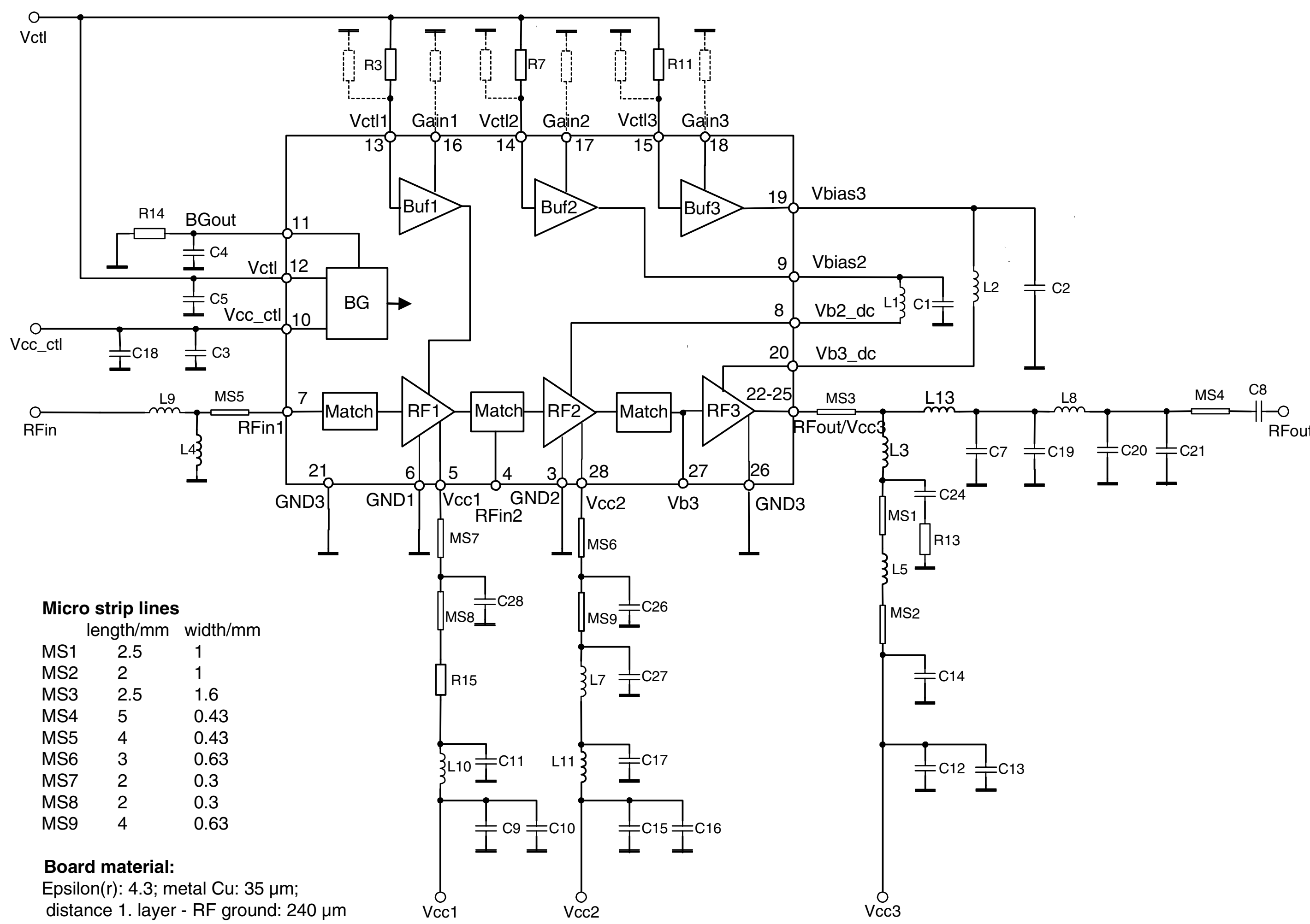
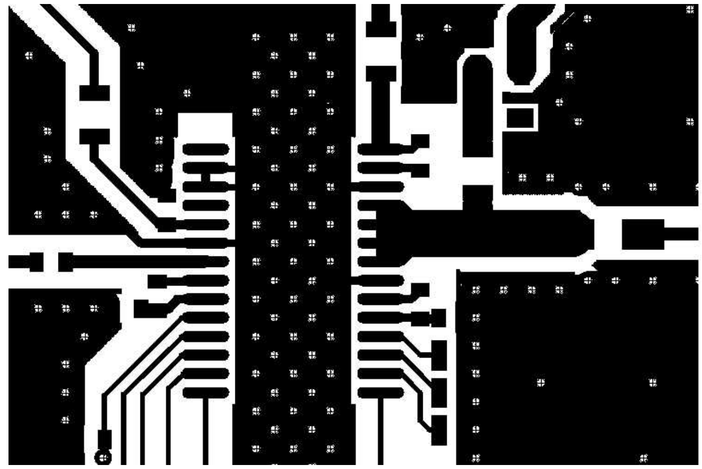


Figure 4. Recommended Package Footprint Extract from the PCB Showing a Part of the Core Application (Without Components)

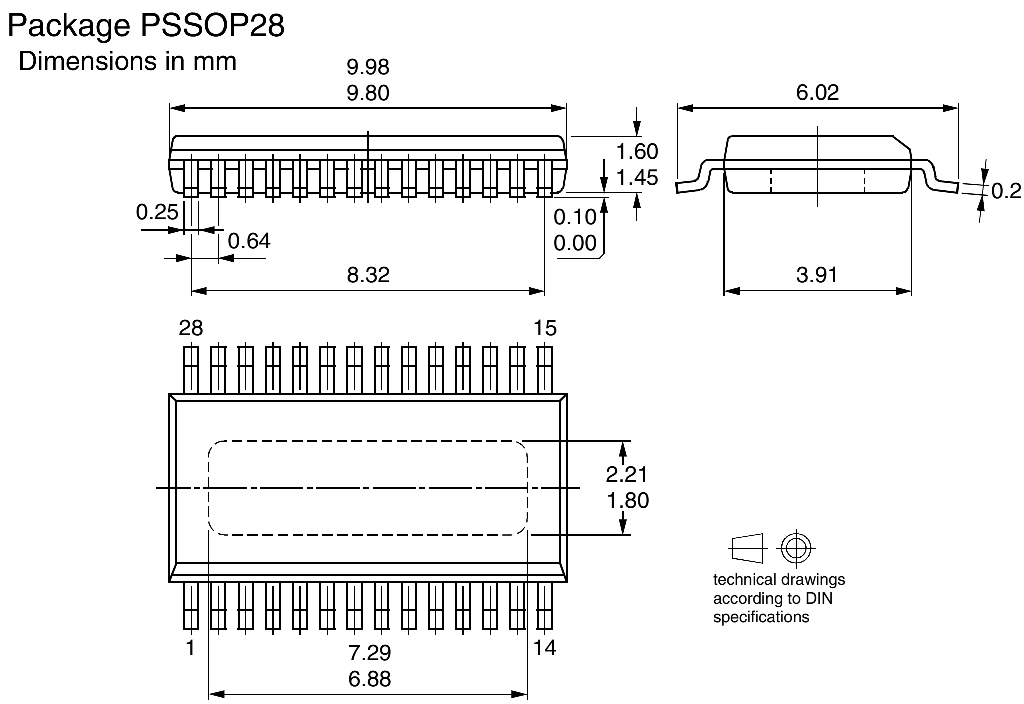


- Only ground signal traces are recommended directly under the package.
- Maximum density of ground vias guarantees an optimum connection of the ground layers and the best diversion of the heat.
- Heat slug must be soldered to GND.
- Plugging of the ground vias under the heat slug is recommended to avoid soldering problems.

Ordering Information

Extended Type Number	Package	Remarks
T0905	PSSOP28	–

Package Information



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