

RF Power amplifier

SPECIFICATION

1 FEATURES

- TSMC CMOS 65 nm
- A class PA
- Frequency range (75 MHz – 3 GHz)
- High linearity
- Supported foundries: TSMC, UMC, Global Foundries, SMIC

2 APPLICATION

- Portable transmitters
- Portable transceivers
- Mobile communication devices

3 OVERVIEW

Device is a broadband power amplifier, which consist of three cascades. With a view to use QAM, QPSK, OFDM modulations schemes amplifier with increased linearity operating in A class is used. First cascade operates as preamplifier of incoming signal, also due to scheme of connection with common gate it provides matching of input impedance in wide range of frequencies.

Broadband amplification is reached due to tuning of resonance frequencies of two cascades to different values and also by including additional resistors into load networks, this provides necessary amplification levels on low frequencies.

4 STRUCTURE

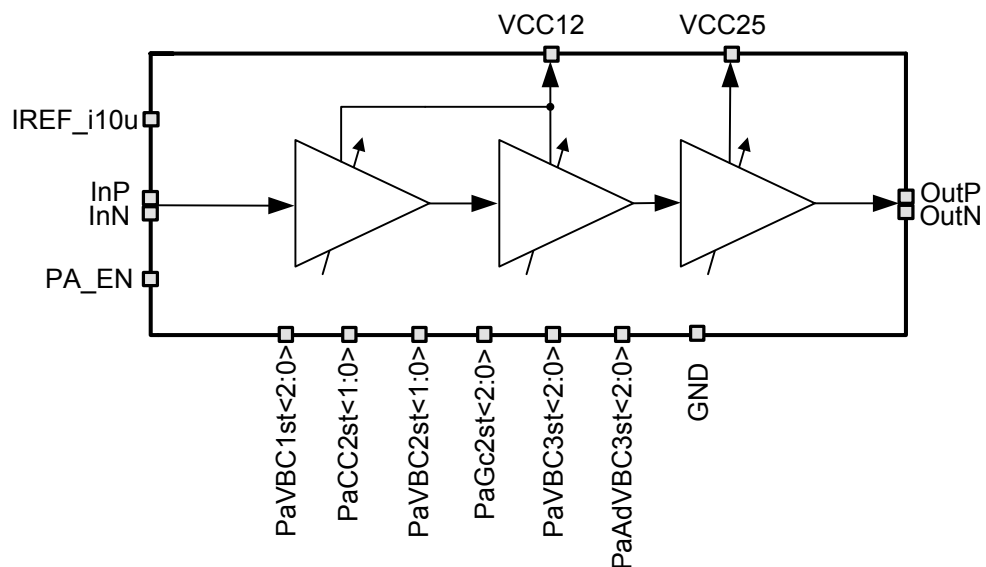


Figure 1: RF Power amplifier structure.

5 PIN DESCRIPTION

Name	Direction	Description
IREF_i10u	IO	PA reference current 10 uA
PA_EN	I	Enable/disable of power amplifier (PA)
InP	I	Input differential signal
InN		
PaVBC1st<2:0>	I	Bias level for 1-st stage
PaCC2st<1:0>	I	Current control for 2 stage of PA
PaVBC2st<1:0>	I	Additional transistors bias selection (in 2 stage of PA)
PaGC2st<2:0>	I	Gain adjustment for 2 stage of PA
PaVBC3st<2:0>	I	Bias level for 3 stage of PA
PaAdVBC3st<2:0>	I	Additional transistors bias selection (in 3 stage of PA)
OutP	O	PA differential output
OutN		
VCC25	IO	Supply voltage 2.5 V
VCC12	IO	Supply voltage 1.2 V
GND	IO	Ground

6 LAYOUT DESCRIPTION

Power amplifier dimensions are given in the table 1.

Table 1: Block dimension.

Dimension	Value	Unit
Height	1170	um
Width	1880	um

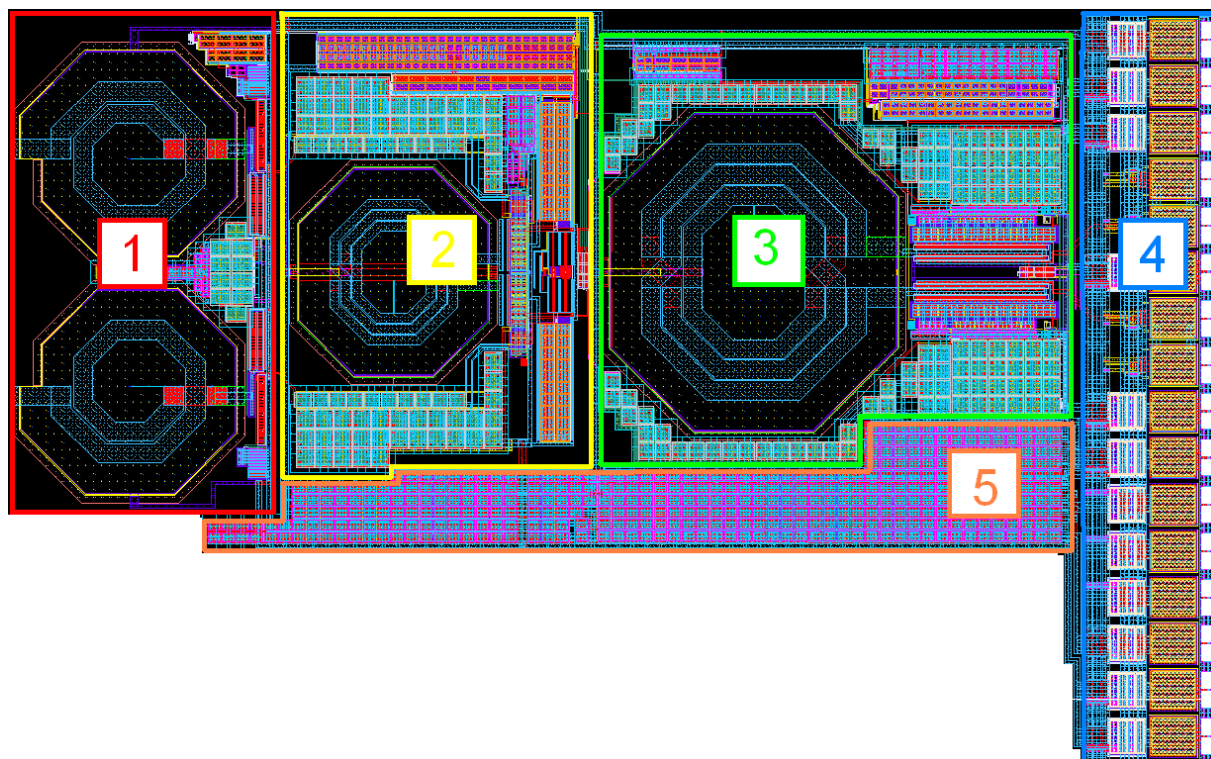


Figure 2: Power amplifier layout view.

1. First stage
2. Second stage
3. Third stage
4. Contact pads
5. Filtering capacitors

7 OPERATING CHARACTERISTICS

7.1 TECHNICAL CHARACTERISTICS

Technology _____ TSMC 0.065um CMOS
 Status _____ silicon proven
 Area _____ 1.65 mm²

7.2 ELECTRICAL CHARACTERISTICS

The values of electrical characteristics are special for $V_{cc25} = 2.375 \div 2.625$ V, $V_{cc12} = 1.14 \div 1.26$ and $T = -40 \div 125$ °C. Typical value are at $V_{cc25} = 2.5$ V, $V_{cc12} = 1.2$ V, $T = +85$ °C, unless otherwise specified.

Parameter	Symbol	Condition	Value			Unit	
			min	typ	max		
First supply analog voltage	V_{cc25}	-	2.375	2.5	2.625	V	
Second supply analog voltage	V_{cc12}	-	1.14	1.20	1.26	V	
Operating temperature range	T	-	-40	+85	+125	°C	
Operating frequency range	F	-	75	-	3000	MHz	
Input resistance	Rin	-	-	25	-	Ω	
Output resistance	Rout	-	-	25	-	Ω	
Maximum output power	Pout_max	Pin=-13 dBm, F=3 GHz	-	8.0	-	dBm	
Input 1dB compression point	P_{1dB}	F = 75 MHz	-	-9.5	-	dBm	
		F = 3 GHz	-	-10.5	-	dBm	
Linear output third-order intercept point	OIP3	F = 75 MHz	-	1	-	dBm	
		F = 1.5 GHz	-	1.98	-	dBm	
		F = 3 GHz	-	1.95	-	dBm	
Current consumption in an active mode at maximum power output	I_{ccmaxP}	V_{cc25}	F = 75 MHz	-	178	-	mA
			F = 1.5 GHz	-	145	-	mA
			F = 3 GHz	-	156	-	mA
	V_{cc12}	F = 75 MHz	-	68.4	-	mA	
		F = 1.5 GHz	-	67.1	-	mA	
		F = 3 GHz	-	61.9	-	mA	
Current consumption in a standby mode	Ist	V_{cc25}	-	425	-	nA	
		V_{cc12}	-	277	-		
Input logic-high level	VIH	-	0.8 V_{cc25}	-	V_{cc25}	V	
Input logic-low level	VIL	-	0	-	0.2 V_{cc25}	V	

8 TYPICAL CHARACTERISTICS

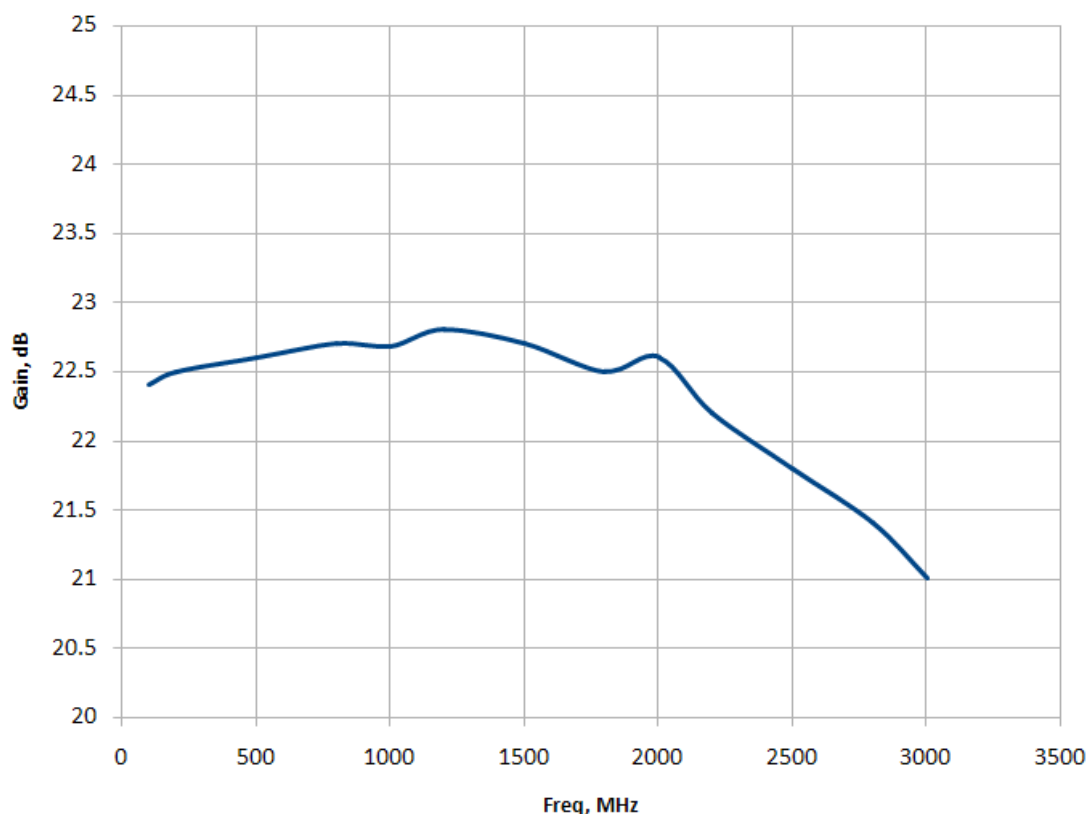


Figure 3: Gain.

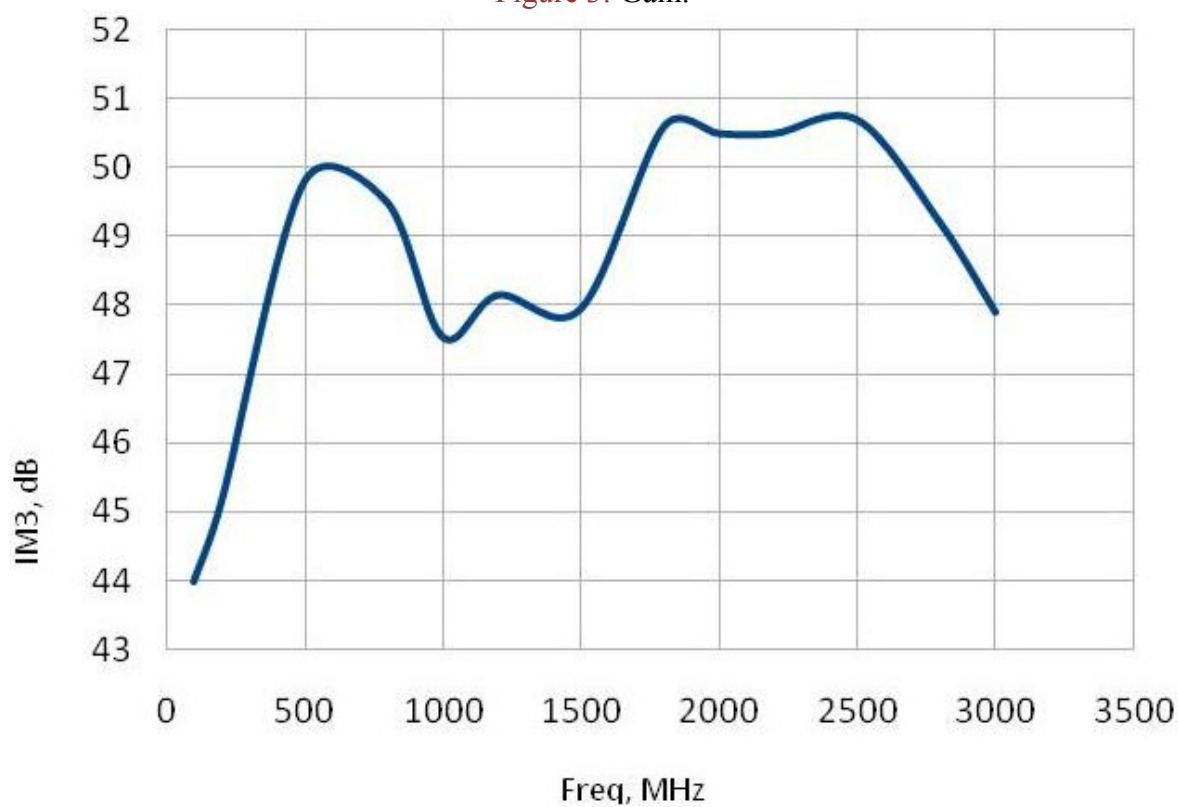


Figure 4: IM3 on P_{out} = 8 dBm.

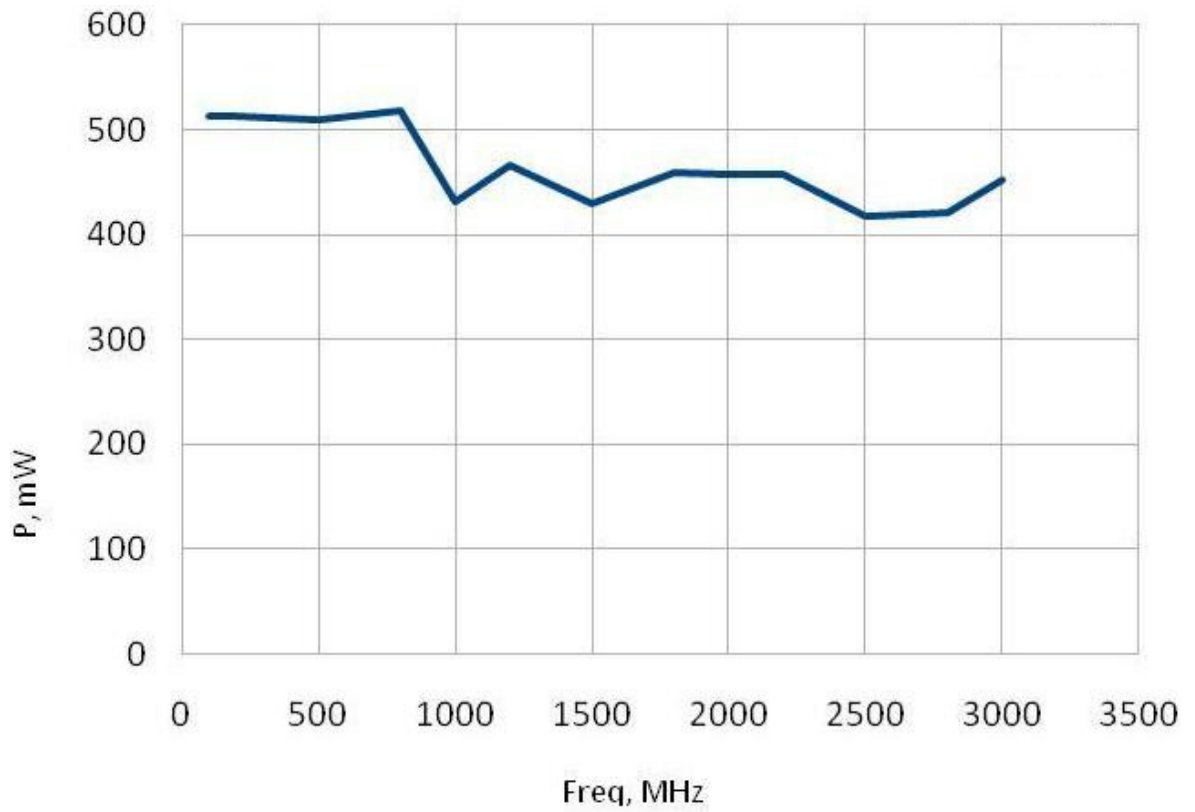


Figure 5: Power consumption.

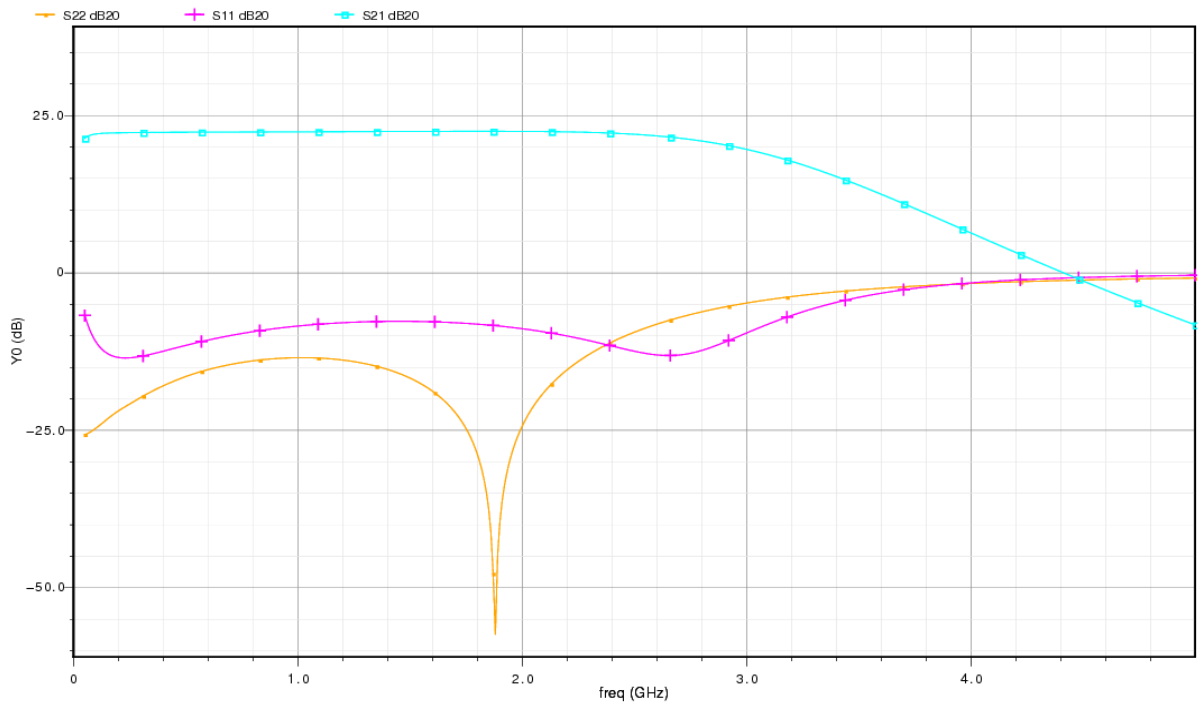


Figure 6: Power amplifier scattering parameters.

9 DELIVERABLES

IP contents:

- Schematic or NetList
- Layout or blackbox
- Extracted view (optional)
- GDSII
- DRC, LVS, antenna report
- Test bench with saved configurations (optional)
- Documentation