

Baseband power amplifier with attenuator

SPECIFICATION

1 FEATURES

- TSMC 65 nm CRN65LP
- Differential inputs, outputs
- High frequency 2 – 100 MHz
- Available attenuation range from 0 to 60 dB (step by 1dB)
- Power amplifier with high IM3
- Maximum output power 14 dBm
- Portable to other technologies (upon request)

2 APPLICATION

- PA signal processing

3 OVERVIEW

PA consists of attenuator, 1-stage amplifier with tunable gain. Attenuator reduces output power by 1dB from 0 to 60 dB. The amplifier gain is adjustable in increments of 2 dB.

4 STRUCTURE

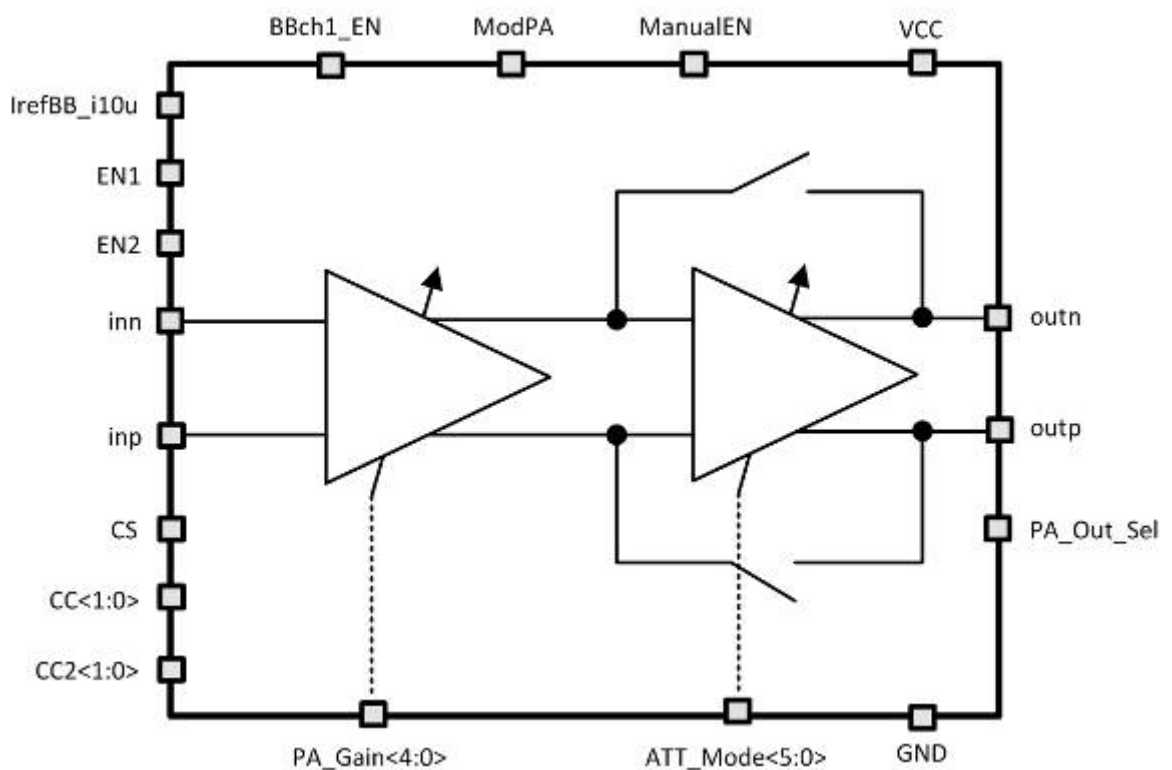


Figure 1: Baseband power amplifier with attenuator structure.

5 PIN DESCRIPTION

Name	Direction	Description
IrefBB_i10u	I	PA reference current 10 μ A
EN1	I	1 st current mirror enable/disable
EN2	I	2 nd current mirror enable/disable
inp	I	Attenuator differential input
inn	I	
BBch1_EN	I	PA enable
ModPA	I	PA gain control mode
GC_MD	I	Manual mode gain control (if ModPA = "1")
CS	I	Current mirror mode selection
CC1<1:0>	I	1 st reference current control
CC2<1:0>	I	2 nd reference current control
ATT_Mode<5:0>	I	Attenuator level select
PA_Out_sel	I	Output transistor size select
PA_Gain<4:0>	I	PA gain control
outp	O	PA differential output
outn	O	
vcc	IO	Supply voltage
gnd	IO	Ground

6 LAYOUT DESCRIPTION

The block dimensions are given in the table 1.

Table 1: Block dimensions.

Dimension	Value	Unit
Height	280	μm
Width	950	μm

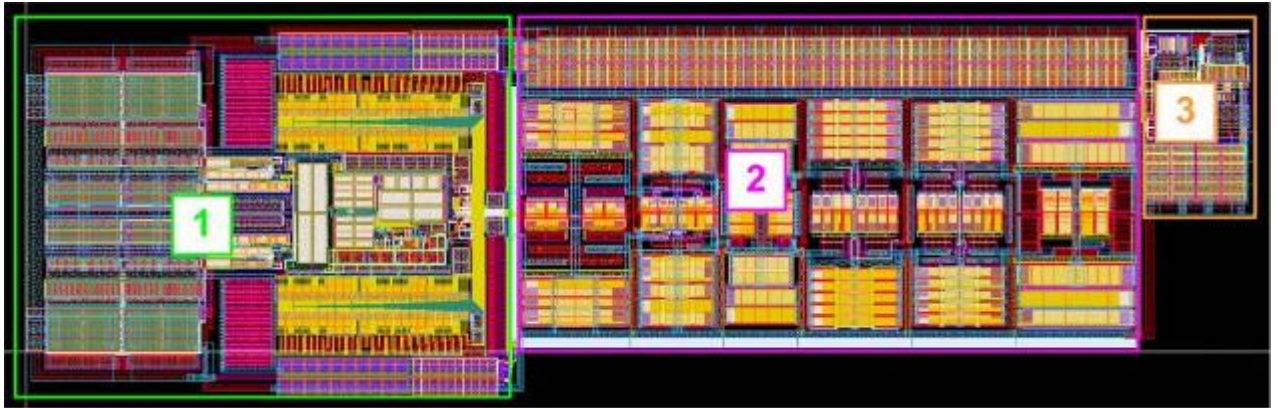


Figure 2: Device layout view.

1. Power amplifier
2. Attenuator
3. Bias

7 OPERATING CHARACTERISTICS

7.1 TECHNICAL CHARACTERISTICS

Technology _____ TSMC CMOS CRN65LP
 Status _____ silicon proven
 Area _____ 0.27mm²

7.2 ELECTRICAL CHARACTERISTICS

The values of electrical characteristics are specified for $V_{cc} = 2.375 \div 2.625$ V and $T = -40 \div +125^{\circ}\text{C}$. Typical values are at $V_{cc} = 2.5$ V, $T_a = +85^{\circ}\text{C}$, unless otherwise specified.

Parameter	Symbol	Condition	Value			Unit
			min	typ	max	
Supply voltage	V_{cc}		2.375	2.5	2.625	V
Temperature range	T_a		-40	+85	+125	$^{\circ}\text{C}$
Input power signal level	P_{in}			-11	-9	dBm
Current consumption	I_{cc}	$P_{out}=5\text{dBm}$	-	138	-	mA
Current consumption in standby mode	I_{stb}	-	-	180	-	nA
Pass band	F	-	2	-	100	MHz
Maximum output power	P_{max}	-	-	14.5	-	dBm
Minimum output power	P_{min}	-	-	-60	-	dBm
Attenuator gain control step	A_k	-	0.8	1	1.2	dB
PA gain control step	P_k	-	1.8	2	2.2	dB
Third order intermodulation	IM3	$P_{out}=5\text{dBm}$	-	54.34	-	dB
Input impedance	R_{in}	Differential	-	25	-	Ω
Output impedance	R_{out}	Differential	-	25	-	Ω
Input high-level voltage	V_{IH}	For digital input	$0.85V_{cc}$		$1.15V_{cc}$	V
Input low-level voltage	V_{IL}		-0.2	-	+0.2	V

8 TYPICAL CHARACTERISTICS

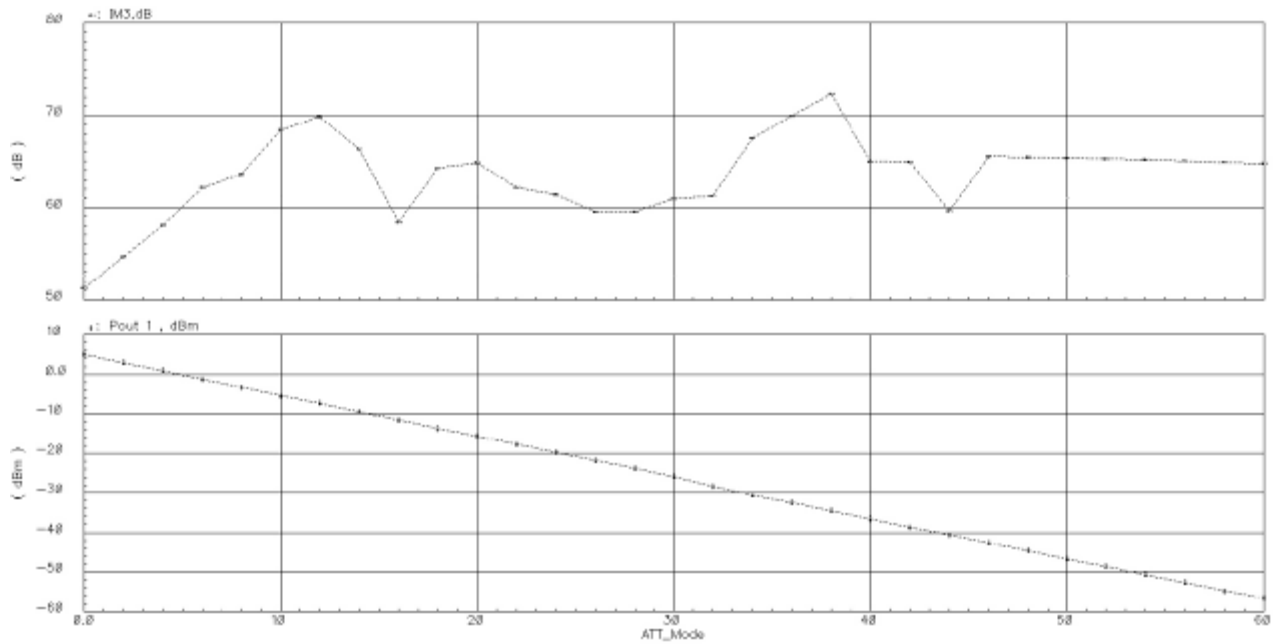


Figure 3: IM3 and output power vs attenuation code (ATT_Mode_{dec})

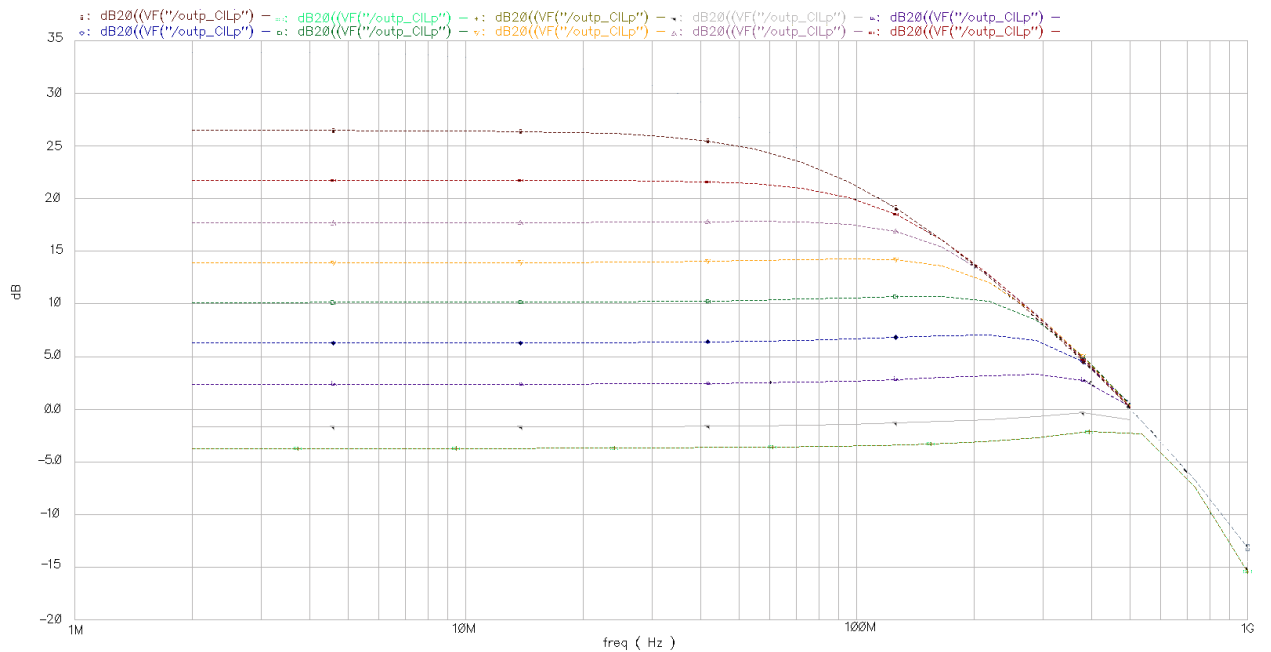


Figure 4: Frequency response ($P_{in} = -9$ dBm and attenuator gain = -2 dB)

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