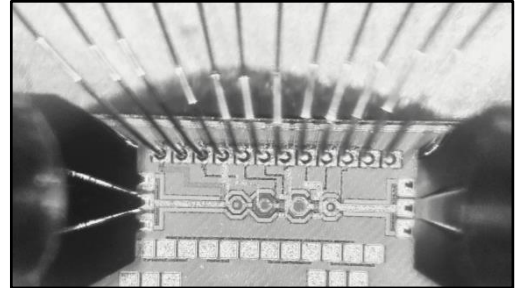


28CMOS IP · V- & E-BAND (57 – 90 GHz)

Description:

Our 28 nm *Bulk* CMOS IP portfolio comprises a wide selection of V- & E-band mmWave components, featuring best-in-class performance, small footprints, modular architectures and low-power consumption. The provided IP is *Silicon-proven* in TSMC's 28 nm HPC+RF CMOS process - but can be adapted to other foundries/nodes upon request. All mmWave & IF inputs/outputs are driven in differential-mode, optimized for an odd-mode characteristic impedance of 75 Ω and 100 Ω , respectively. A single VDD supply voltage of 0.9 V is used throughout, simplifying DC supply requirements & improving efficiency.



Each component's layout is fully *parameterized* (PCell-based) and code-generated (incl. density fill and DRC compliance). There are no "hand-drawn" features. This allows for easier scalability, rapid integration, layout fine-tuning and detailed EM/linear/non-linear/stability design verification. All IP blocks are compatible with OA EDA tools, incl. Keysight ADS, Synopsys & Cadence. In addition, a full Keysight ADS workspace incl. all relevant testbenches and models is available for each component.

Physical bare-dies are available upon request.

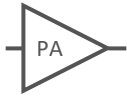
Features:

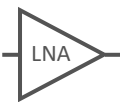
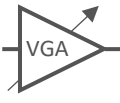
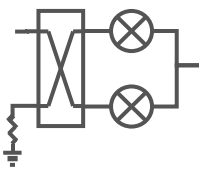
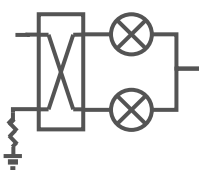
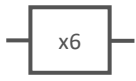
- Compatible with 28 nm *Bulk* CMOS (Si-proven in TSMC 28 nm HPC+RF)
- 0.9 V supply VDD
- Best-in-class-performance
- Parameterized (PCell-based)
- Compatible with OA EDA tools: Keysight ADS, Synopsys & Cadence
- Full Keysight ADS support: EM/linear/non-linear/stability & *tapeout-ready* layout generation

Applications:

- Last-mile, point-to-point, small cells, sat-comms
- Front-haul
- NR UE & IoT

List of components (IP):

Component	Parameter	V-band			E-band		
		Min.	Typ.	Max.	Min.	Typ.	Max
	Frequency (GHz)	57		71	71/81		76/86
	Gain (dB)		14			13	
	OP1dB (dBm)	15			17.2		
	PAE _{@1dB} (%)	18			15		
	Input RL (dB)		10			13	
	DC power (mW)			170			335
	Size core (mm. sq.)		0.6			1.2	

Component	Parameters	V-band			E-band		
		Min.	Typ.	Max.	Min.	Typ.	Max.
LNA 	Frequency (GHz)	57		71	71/81		76/86
	Gain (dB)		18			19	
	Noise figure (dB)			4.5			5
	Input RL (dB)		15			15	
	IP1dB (dBm)		-11			-12	
	DC power (mW)		20			20	
	Size core (mm. sq.)		0.4			0.35	
VGA 	Frequency (GHz)	57		71	71/81		76/86
	Gain (dB)		10			7.5	
	Tuning range (dB)	18			18		
	Noise figure (dB)	6.5		16	7		17
	Input RL (dB)		10			13	
	OP1dB (dBm)	4			7		
	DC power (mW)			50			50
Size core (mm. sq.)		0.5			0.5		
Triple-balanced up conv. 	Frequency (GHz)	57		71	71/81		76/86
	IF frequency (GHz)	0		10	0		5.5
	CG (dB)	-6			-5		
	LO power (dBm)		5			5	
	IF IP1dB (dBm)	3			2.5		
	RL IF (dB)		12			14	
	RL RF (dB)		12			15	
	LO-RF iso. (dB)	40			40		
	DC power (mW)			10			10
	Size core (mm. sq.)		0.75			0.65	
Triple-balanced down conv. 	Frequency (GHz)	57		71	71/81		76/86
	IF frequency (GHz)	0.15		10	0.15		5.5
	CG (dB)	-5			-4.5		
	LO input (dBm)		5			5	
	RF IP1dB (dBm)	4.5			4		
	RL IF (dB)		13			15	
	RL RF (dB)		15			15	
	Ampl. balance (dB)			0.5			0.5
	Phase balance (°)			2			2
	Noise figure (dB)			18			18
	LO-RF iso. (dB)	40			40		
	DC power (mW)			25			25
	Size core (mm. sq.)		1.1			0.9	
Multiplier 	Input freq. (GHz)	9.5		11.83	11.83/ 13.5		12.67/ 14.33
	Output freq. (GHz)	57		71	71/81		76/86
	Mult. factor		x6			x6	
	Input power (dBm)		0			0	
	Out. power (dBm)	5			4		
	5 harmonic iso. (dB)	31			30		
	7 harmonic iso. (dB)	40			38		
	DC power (mW)			TBC			TBC
Size core (mm. sq.)		TBC			TBC		

Supported EDA tools:
