Process C1212
BiCMOS 1.2µm
12 Volt Bipolar Operation

Electrical Characteristics

T=25°C Unless otherwise noted

N-Channel Transistor	Symbol	Minimum	Typical	Maximum	Unit	Comments
Threshold Voltage	VT_N	0.55	0.75	0.95	V	100x1.2µm
Body Factor	γ_N		0.34		$V^{1/2}$	100x1.2µm
Conduction Factor	β_N	64	75	86	µA/V²	100x100µm
Effective Channel Length	$Leff_N$	0.8	1.0	1.2	µm	100x1.2µm
Width Encroachment	ΔW_N		0.6		µm	Per side
Punch Through Voltage	$BVDSS_N$	9			V	
Poly Field Threshold Voltage	$VTF_{P(N)}$	10			V	

P-Channel Transistor	Symbol	Minimum	Typical	Maximum	Unit	Comments
Threshold Voltage	VT_P	–0.7	–0.9	–1.1	V	100x1.2µm
Body Factor	γ_P		0.38		$V^{1/2}$	100x1.2µm
Conduction Factor	β_P	21	25	29	µA/V²	100x100µm
Effective Channel Length	$Leff_P$	0.9	1.1	1.3	µm	100x1.2µm
Width Encroachment	ΔW_P		0.8		µm	Per side
Punch Through Voltage	$BVDSS_P$	–9			V	
Poly Field Threshold Voltage	$VTF_{P(P)}$	–10			V	

Diffusion & Thin Films	Symbol	Minimum	Typical	Maximum	Unit	Comments
Well (field) Sheet Resistance	$\rho_{N\text{-well(f)}}$	0.6	1.0	1.3	KΩ/□	n-well
N+ Sheet Resistance	ρ_{N+}	20	35	50	Ω/□	
N+ Junction Depth	x_{jN+}		0.35		µm	
P+ Sheet Resistance	ρ_{P+}	50	75	100	Ω/□	
P+ Junction Depth	x_{jP+}		0.35		µm	
Gate Oxide Thickness	T_{GOX}		24		nm	
Field Oxide Thickness	T_{FIELD}		800		nm	
Gate Poly Sheet Resistance	ρ_{POLY2}	15	22	30	Ω/□	
Bottom Poly Sheet Res.	ρ_{POLY1}		35		Ω/□	
Metal-1 Sheet Resistance	ρ_{M1}		50		mΩ/□	
Metal-2 Sheet Resistance	ρ_{M2}		30		mΩ/□	
Passivation Thickness	T_{PASS}		200+900		nm	oxide+nit.

Capacitance	Symbol	Minimum	Typical	Maximum	Unit	Comments
Gate Oxide	C_{OX}	1.28	1.38	1.58	fF/µm²	
Metal-1 to Poly-1	C_{M1P}		0.057		fF/µm²	
Metal-1 to Silicon	C_{M1S}		0.028		fF/µm²	
Metal-2 to Metal-1	C_{MM}		0.035		fF/µm²	
Poly-1 to Poly-2	C_{P1P2}	0.69	0.86	1.03	fF/µm²	

Electrical Characteristics

NPN Bipolar Transistor Characteristics (Emitter size 4.5 x 4.5μm)

	Sym	Min	Typ	Max	Unit	Comments
Current Gain	h_{FE}		105			@5μA
Early Voltage	V_A		22		V	
Cut - Off Frequency	f_τ		6.2		GHz	
Collector-Emitter Saturation Voltage	V_{CESAT}		0.33		V	
Collector to Emitter Breakdown Voltage	BV_{CEO}	14			V	
Collector to Base Breakdown Voltage	BV_{CBO}	27			V	
Emitter to Base Breakdown Voltage	BV_{EBO}	6			V	
Emitter Resistance	R_E		40		Ω	
Base Spreading Resistance	R_B		500		Ω	
Collector Saturation Resistance	R_C		100		Ω	
Base to Emitter Capacitance	C_{BEO}		0.10		pF	
Base to Collector Capacitance	C_{BCO}		0.04		pF	
Base to Substrate Capacitance	C_{CS}		0.125		pF	

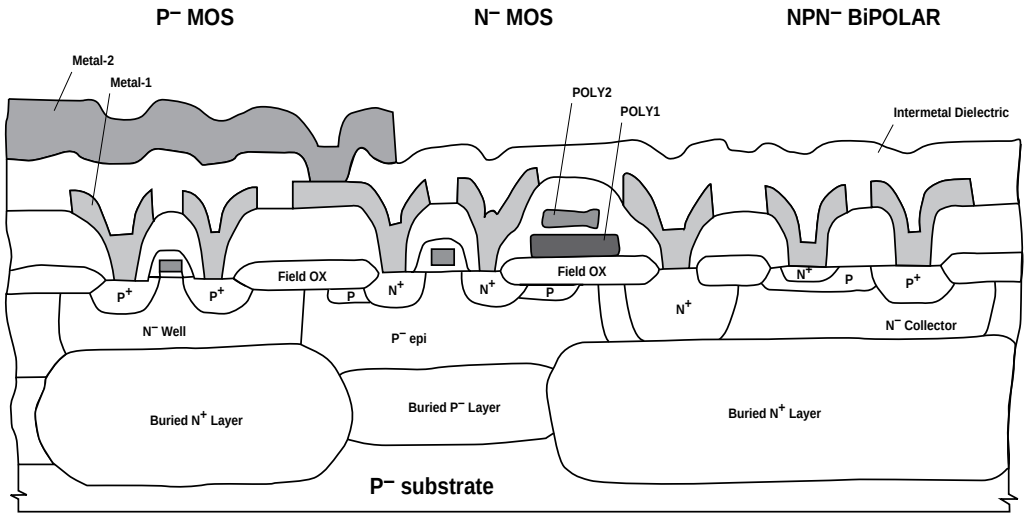
NPN Bipolar Transistor Characteristics (Emitter size 31.5 x 4.5μm)

	Sym	Min	Typ	Max	Unit	Comments
Current Gain	h_{FE}		115			@5μA
Early Voltage	V_A		22		V	
Cut - Off Frequency	f_τ		6.4		GHz	
Collector-Emitter Saturation Voltage	V_{CESAT}		0.38		V	
Collector to Emitter Breakdown Voltage	BV_{CEO}	6			V	
Collector to Base Breakdown Voltage	BV_{CBO}	27			V	
Emitter to Base Breakdown Voltage	BV_{EBO}	14			V	
Emitter Resistance	R_E		6		Ω	
Base Spreading Resistance	R_B		100		Ω	
Collector Saturation Resistance	R_C		15		Ω	
Base to Emitter Capacitance	C_{BEO}		0.10		pF	
Base to Collector Capacitance	C_{BCO}		0.04		pF	
Base to Substrate Capacitance	C_{CS}		0.125		pF	

Physical Characteristics

Starting Material	P <100>	N+/P+ Width/Space	2.5 / 2.0µm
Starting Mat. Resistivity	25 - 50 Ω-cm	N+ To P+ Space	9.0µm
Typ. Operating Voltage	5V	Contact To Poly Space	1.5µm
Well Type	N-well	Contact Overlap Of Diffusion	1.0µm
Metal Layers	2	Contact Overlap Of Poly	1.0µm
Poly Layers	2	Metal-1 Overlap Of Contact	1.0µm
Contact Size	1.5x1.5µm	Metal-1 Overlap Of Via	1.0µm
Via Size	1.5x1.5µm	Metal-2 Overlap Of Via	1.0µm
Metal-1 Width/Space	2.5 / 1.5µm	Minimum Pad Opening	65x65µm
Metal-2 Width/Space	2.5 / 1.5µm	Minimum Pad-to-Pad Spacing	5.0µm
Gate Poly Width/Space	1.5 / 2.0µm	Minimum Pad Pitch	80.0µm

Special Feature of C1212 Process: BiCMOS 1.2µm technology with a cut-off frequency of 6.4GHz and Bipolar operating voltage up to 12Volts.



Cross-scetional view of the BiCMOS 1.2 process