

3.3.2 DC, Small-Signal, and Intrinsic Gate Capacitance Parameters

Table 3.2 lists drain current, small-signal parameter, and intrinsic gate capacitance process parameter values for the example 0.5, 0.35, and 0.18 μm CMOS processes. As noted, the 0.35 μm process is a partially depleted (PD), silicon-on-insulator (SOI) process. The electrical gate-oxide thickness, t_{ox} , gate-oxide capacitance, C'_{ox} , low-field mobility, μ_0 , low-field transconductance factor, $k_0 = \mu_0 C'_{ox}$, body-effect factor, γ , and Fermi potential, $\phi_F = 2\phi_F$, model the drain current, transconductance, body-effect transconductance, and intrinsic gate capacitances. The velocity saturation, critical electric field, E_{CRIT} , and mobility reduction factor, θ , model the reduction in drain current and transconductance due to horizontal

Table 3.2 Drain current, small-signal parameter, and intrinsic gate capacitance parameters for 0.5, 0.35, and 0.18 μm CMOS processes ($T = 300\text{ K}$)

Parameter	Description	nMOS	pMOS	Units
t_{ox}	Gate-oxide thickness ^a			
	0.5 μm	13.5	13.5	nm
	0.35 μm , PD SOI	8	8	
	0.18 μm	4.1	4.1	
C'_{ox}	Gate-oxide capacitance			
	0.5 μm	2.56	2.56	fF/ μm^2
	0.35 μm , PD SOI	4.31	4.31	
	0.18 μm	8.41	8.41	
μ_0	Mobility (low field) ^b			
	0.5 μm	438	152	$\text{cm}^2/\text{V} \cdot \text{s}$
	0.35 μm , PD SOI	372	135	
	0.18 μm	422	89.2	
$k_0 = \mu_0 C'_{ox}$	Transconductance factor (low field) ^b			
	0.5 μm	112	39	$\mu\text{A}/\text{V}^2$
	0.35 μm , PD SOI	160	60	
	0.18 μm	355	75	
γ	Body-effect factor			
	0.5 μm	0.72	0.59	$\text{V}^{1/2}$
	0.35 μm , PD SOI	0.68	0.55	
	0.18 μm	0.56	0.61	
$\phi_F = 2\phi_F$	Fermi potential ^b			
	0.5 μm	0.8	0.8	V
	0.35 μm , PD SOI	0.7	0.7	
	0.18 μm	0.85	0.85	
E_{CRIT}	Velocity saturation critical electric field (horizontal field) ^b			
	0.5 μm	4	10.5	V/ μm
	0.35 μm , PD SOI	4	10.5	
	0.18 μm	5.6	14	
α	Velocity saturation transition exponent (enhanced drain current model)			
	0.5 μm	1.5	1.5	
	0.35 μm , PD SOI	1.5	1.5	
	0.18 μm	1.3	1.3	
θ	Mobility reduction factor (vertical field)			
	0.5 μm	0.14	0.17	1/V
	0.35 μm , PD SOI	0.2	0.24	
	0.18 μm	0.28	0.35	