

USEFUL DESIGN PARAMETERS (simplified)

Name	Symbol	0.18 μm		0.13 μm		Units
		NMOS	PMOS	NMOS	PMOS	
Channel Length (rounded for convenience)	L	200	200	100	100	nm
Supply Voltage	V_{DD}	1.8	1.8	1.2	1.2	V
Oxide Thickness	t_{ox}	35	35	22	22	Å
Oxide Capacitance	C_{ox}	1.0	1.0	1.6	1.6	$\mu\text{F}/\text{cm}^2$
Threshold Voltage	V_{TO}	0.5	-0.5	0.4	-0.4	V
Body-Effect Term	γ	0.3	0.3	0.2	0.2	$\text{V}^{1/2}$
Fermi Potential	$2 \phi_F $	0.84	0.84	0.88	0.88	V
Junction Capacitance Coefficient	C_{j0}	1.6	1.6	1.6	1.6	$\text{fF}/\mu\text{m}^2$
Built-In Junction Potential	ϕ_B	0.9	0.9	1.0	1.0	V
Grading Coefficient	m	0.5	0.5	0.5	0.5	—
Nominal Mobility (low vertical field)	μ_0	540	180	540	180	$\text{cm}^2/\text{V-s}$
Effective Mobility (high vertical field)	μ_e	270	70	270	70	$\text{cm}^2/\text{V-s}$
Critical Field	E_c	6×10^4	24×10^4	6×10^4	24×10^4	V/cm
Critical Field $\times L$	$E_c L$	1.2	4.8	0.6	2.4	V
Effective Resistance	R_{eff}	12.5	30	12.5	30	$\text{k}\Omega/\square$

Name	Symbol	Value	Units
Gate Capacitance Coefficient	C_g	2	$\text{fF}/\mu\text{m}$
Self Capacitance Coefficient	C_{eff}	1	$\text{fF}/\mu\text{m}$
Wire Capacitance Coefficient	C_w	0.1–0.25	$\text{fF}/\mu\text{m}$
Al Wire Resistance	R_{\square}	25–60	$\text{m}\Omega/\square$
Cu Wire Resistance	R_{\square}	20–40	$\text{m}\Omega/\square$
Wire Inductance	L_{eff}	0.4–0.5	$\text{pH}/\mu\text{m}$

USEFUL PHYSICAL AND MATERIAL CONSTANTS

Name	Symbol	Value	Units
Electron Charge	q	1.6×10^{-19}	C
Boltzmann's Constant	k	1.38×10^{-23}	J/°K
Room Temperature	T	300	°K (27°C)
Thermal Voltage	$V_{th} = kT/q$	26	mV (at 27°C)
Dielectric Constant of Vacuum	ϵ_0	8.85×10^{-14}	F/cm
Dielectric Constant of Silicon	ϵ_{si}	$11.7 \epsilon_0$	F/cm
Dielectric Constant of SiO ₂	ϵ_{ox}	$3.97 \epsilon_0$	F/cm
Intrinsic Carrier Concentration	n_i	1.45×10^{10}	cm ⁻³ (at 27°C)
Carrier Saturation Velocity In Silicon	v_{sat}	8×10^6	cm/s
Aluminum Resistivity	ρ_{Al}	2.7	$\mu\Omega\text{-cm}$
Copper Resistivity	ρ_{Cu}	1.7	$\mu\Omega\text{-cm}$
Tungsten Resistivity	ρ_W	5.5	$\mu\Omega\text{-cm}$

ENGINEERING SCALE FACTORS

G	giga	10^9
M	mega	10^6
k	kilo	10^3
c	centi	10^{-2}
m	milli	10^{-3}
μ	micro	10^{-6}
n	nano	10^{-9}
p	pico	10^{-12}
f	femto	10^{-15}
a	atto	10^{-18}

METER CONVERSION FACTORS

$$1 \mu\text{m} = 10^{-4} \text{ cm} = 10^{-6} \text{ m}$$

$$1 \text{ m} = 10^2 \text{ cm} = 10^6 \mu\text{m}$$

$$0.1 \mu\text{m} = 100 \text{ nm}$$

$$1 \text{ \AA} = 10^{-8} \text{ cm} = 10^{-10} \text{ m}$$