

Appendix 3: Material Parameters

Name	Symbol	Germanium	Silicon	Gallium Arsenide
Bandgap energy at 300 K	E_g (eV)	0.66	1.12	1.424
Breakdown Field	E_{br} (V/cm)	10^5	3×10^5 *	4×10^5
Density	(g/cm ³)	5.33	2.33	5.32
Effective density of states in the conduction band at 300 K	N_c (cm ⁻³)	1.02×10^{19}	2.82×10^{19}	4.35×10^{17}
Effective density of states in the valence band at 300 K	N_v (cm ⁻³)	5.65×10^{18}	1.83×10^{19}	7.57×10^{18}
Intrinsic concentration at 300 K	n_i (cm ⁻³)	2.8×10^{13}	1.0×10^{10}	2.0×10^6
Effective mass for density of states calculations				
Electrons	m_e^* / m_0	0.55	1.08	0.067
Holes	m_h^* / m_0	0.37	0.81	0.45
Electron affinity	χ (V)	4.0	4.05	4.07
Lattice constant	a (pm)	564.613	543.095	565.33
Mobility at 300 K (undoped)				
Electrons	μ_n (cm ² /V-s)	3900	1400 [†]	8800
Holes	μ_p (cm ² /V-s)	1900	450 [†]	400
Relative dielectric constant	ϵ_s / ϵ_0	16	11.9	13.1
Thermal conductivity at 300 K	χ (W/cmK)	0.6	1.5	0.46
Refractive index at 632.8 nm wavelength	n	5.441	3.875	3.856
		- i 0.785	- i 0.0181	- i 0.196

* See also section 4.5.1: Breakdown field in silicon at 300 K

† See also section 2.7.2: Mobility of doped silicon at 300 K