Appendix 3: Material Parameters

Name	Symbol	Germanium	Silicon	GaAs
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	m_n (cm^2/V-s)	3900	1400[†]	8800
Holes	m_p (cm^2/V-s)	1900	450[†]	400
Effective mass for conductivity calculations				
Electrons	m_e^{*}/m_0	0.12	0.26	0.067
Holes	m_h^{*}/m_0	0.21	0.386	0.34
Relative dielectric constant	$\varepsilon_s/\varepsilon_0$	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 - i 0.785	3.875 - i 0.0181	3.856 - 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