

PROPERTIES OF SEMICONDUCTORS  
(UPDATED 10/2002)

Property	Unit	Si	Ge	GaAs
Density of atoms	cm <sup>-3</sup>	5x10 <sup>22</sup>	4.4 x 10 <sup>22</sup>	2.2 x 10 <sup>22</sup>
Lattice Constant	Angstroms	5.43102		5.65325
Energy gap (300 K)	eV	1.12	0.66	1.42
Effective mass m*/m <sub>0</sub>	(1)			
electron (density of states)		1.182	0.553	0.063
electron (conductivity)		0.26	0.12	
hole (density of states)		0.81	0.357	0.0524
hole (conductivity)		0.69		0.57
Effective mass m*/m <sub>0</sub>	(1)			
electron l		0.92	1.64	
electron t		0.19	0.082	
hole (light hole)		0.15	0.044	
hole (heavy hole)		0.54	0.45	
Effective density of states (300 K)cm <sup>-3</sup>				
conduction band		2.86x10 <sup>19</sup>	1.04x10 <sup>19</sup>	4.7x10 <sup>17</sup>
valence band		2.66x10 <sup>19</sup>	6.0x10 <sup>18</sup>	7.0x10 <sup>18</sup>
Intrinsic carrier density	cm <sup>-3</sup>	9.65x10 <sup>9</sup>	2.17 x 10 <sup>13</sup>	2.25 x 10 <sup>6</sup>
Intrinsic Resistivity	Ω-cm	3.3x10 <sup>5</sup>		2.9x10 <sup>8</sup>
Minoroty Carrier Lifetime	s	3x10 <sup>-2</sup>		~10 <sup>-8</sup>
Mobility at low doping	cm <sup>2</sup> (V-s) <sup>-1</sup>			
electron		1450	3900	9200
hole		505	1900	320
Dielectric Constant	(1)	11.7		12.4
Breakdown field	V/cm	3x10 <sup>5</sup>	10 <sup>5</sup>	4x10 <sup>5</sup>
Relative permittivity	(1)	11.8	15.8	13.1
Electron affinity	eV	4.05	4.00	4.07
Atomic number	(1)	14	32	31/33
Atomic weight	(1)	28.09	72.60	144.64
Density (25°C),	g/cm <sup>-3</sup>	2.329	5.323	5.317
Melting point	°C	1412	936	1240
Boiling point	°C		2700	2600
Thermal conductivity	W/(cm K)	1.31	0.606	0.455

Specific heat (Cp)	J/(g K)	0.70	0.32	0.35
Thermal diffusivity	cm <sup>2</sup> /sec	0.87	0.36	0.44
Coefficient of linear expansion	C <sup>-1</sup>	2.59x10 <sup>-6</sup>	5.7x10 <sup>-6</sup>	5.9x10 <sup>-6</sup>
Vapor Pressure	Pa	1 @ 1650C 10 <sup>-6</sup> @ 1650C		100 @ 1050C 1 @ 900C
Optical phonon mean free path				
Electron	nm	6.2	6.5	3.5
Hole	nm	4.5	6.5	6.5
Hardness	Mohs	70		
Elastic constants				
C <sub>11</sub>	dyne/cm <sup>2</sup>	1.656 x 10 <sup>12</sup>		
C <sub>12</sub>	dyne/cm <sup>2</sup>	0.639 x 10 <sup>12</sup>		
C <sub>44</sub>	dyne/cm <sup>2</sup>	0.796 x 10 <sup>12</sup>		
Young's modulus <111> direction	dyne/cm <sup>2</sup>	1.9 x 10 <sup>12</sup>		
Poisson's ratio	(1)	0.42		
Surface tension at melting temp	dyne/cm <sup>2</sup>	720		
Latent heat of fusion	eV	0.41		
Expansion on freezing	%	9.0		
Cut-off freq of lattice vibration	Hz	1.39 x 10 <sup>13</sup>		
Index of Refraction	(1)	3.42		3.3

#### FOOT NOTES

(1) dimensionless

#### Data Sources:

H.F. Wolf, Semiconductors, Wiley (1971)

A. S. Grove, Physics of Semiconductor Devices, Wiley, (1967)

S. M. Sze, Physics of Semiconductor Devices, Wiley, (1981)

T. Mouthaan, Semiconductor Devices Explained, Wiley, (1999).