

Room temperature properties of		Si	GaAs	GaN	(Unit)
Lattice constant	$a_0 =$	5.43095	5.6533	$a_0 = 3.189$ $c_0 = 5.185$	Å Å
Bandgap energy	$E_g =$	1.12	1.42	3.4	eV
Intrinsic carrier concentration	$n_i =$	1×10^{10}	2×10^6	2×10^{-10}	cm^{-3}
Effective DOS at CB edge	$N_c =$	2.8×10^{19}	4.7×10^{17}	2.3×10^{18}	cm^{-3}
Effective DOS at VB edge	$N_v =$	1.0×10^{19}	7.0×10^{18}	1.8×10^{19}	cm^{-3}
Electron mobility	$\mu_n =$	1500	8500	1500	$\text{cm}^2/(\text{Vs})$
Hole mobility	$\mu_p =$	450	400	30	$\text{cm}^2/(\text{Vs})$
Electron diffusion constant	$D_n =$	39	220	39	cm^2 / s
Hole diffusion constant	$D_p =$	12	10	0.75	cm^2 / s
Minority carrier lifetime	$\tau =$	10^{-6}	10^{-8}	10^{-9}	s
Electron effective mass	$m_e^* =$	$0.98 m_e$	$0.067 m_e$	$0.2 m_e$	—
Heavy hole effective mass	$m_{hh}^* =$	$0.49 m_e$	$0.45 m_e$	$0.8 m_e$	—
Relative dielectric constant	$\epsilon_r =$	11.9	13.1	8.9	—
Refractive index	$n_{\text{optical}} =$	3.3	3.4	2.5	—
Absorption coefficient near E_g	$\alpha =$	10^3	10^4	10^4	cm^{-1}

Note:

- DOS = Density of states. CB = Conduction band. VB = Valence band.
- Diffusion constants and mobilities are related by Einstein's relation: $D = \mu (k T / e)$
- Minority carrier diffusion lengths are given by $L_n = (D_n \tau)^{1/2}$ and $L_p = (D_p \tau)^{1/2}$
- The mobilities and diffusion constants apply to low doping concentrations ($\approx 10^{15} \text{ cm}^{-3}$). As the doping concentration increases, mobilities and diffusion constants decrease.
- The minority carrier lifetime τ applies to doping concentrations of 10^{18} cm^{-3} . For other doping concentrations, τ is given by $\tau = B^{-1} (n + p)^{-1}$, where $B_{\text{GaAs}} \approx 10^{-10} \text{ cm}^3/\text{s}$, $B_{\text{Si}} \approx 10^{-12} \text{ cm}^3/\text{s}$, and $B_{\text{GaN}} \approx 10^{-10} \text{ cm}^3/\text{s}$.

Room temperature properties of		SiO₂	and	Si₃N₄
Bandgap energy	$E_g =$	9.0 eV		5.0 eV
Dielectric constant	$\epsilon_r =$	3.9		7.5
Refractive index	$n_{\text{optical}} =$	1.46		2.05
Dielectric strength (or breakdown field)	$E =$	10^7 V/cm		10^7 V/cm