calculatoratoz.com

unitsconverters.com

Semiconductor Characteristics Formulas

Calculators! Examples! Conversions!

Bookmark **calculatoratoz.com**, **unitsconverters.com**

Widest Coverage of Calculators and Growing - **30,000+ Calculators!**
Calculate With a Different Unit for Each Variable - **In built Unit Conversion!**
Widest Collection of Measurements and Units - **250+ Measurements!**

Feel free to SHARE this document with your friends!

Please leave your feedback here...

List of 13 Semiconductor Characteristics Formulas

Semiconductor Characteristics

1) Conductivity in Semiconductors

Open Calculator

fx $\sigma = (\rho_e \cdot [\text{Charge-e}] \cdot \mu_n) + (\rho_h \cdot [\text{Charge-e}] \cdot \mu_p)$

ex $0.868062\text{S/m} = (3.01e10\text{kg/cm}^3 \cdot [\text{Charge-e}] \cdot 180\text{m}^2\text{/V*s}) + (100000.345\text{kg/cm}^3 \cdot [\text{Charge-e}] \cdot 150\text{m}^2\text{/V*s})$

2) Conductivity of Extrinsic Semiconductor for P-Type

Open Calculator

fx $\sigma_p = N_a \cdot [\text{Charge-e}] \cdot \mu_p$

ex $0.240326\text{S/m} = 1e16/\text{m}^3 \cdot [\text{Charge-e}] \cdot 150\text{m}^2\text{/V*s}$

3) Conductivity of Extrinsic Semiconductors for N-type

Open Calculator

fx $\sigma_n = N_d \cdot [\text{Charge-e}] \cdot \mu_n$

ex $5.767836\text{S/m} = 2e17/\text{m}^3 \cdot [\text{Charge-e}] \cdot 180\text{m}^2\text{/V*s}$

4) Drift Current Density

Open Calculator

fx $J_{drift} = J_p + J_n$

ex $49.79\text{A/m}^2 = 17.79\text{A/m}^2 + 32\text{A/m}^2$

5) Electric Field due to Hall Voltage

Open Calculator

fx $E_H = \frac{V_h}{d}$

ex $1.888889\text{V/m} = \frac{0.85\text{V}}{0.45\text{m}}$

6) Electron Diffusion Length

Open Calculator

fx $L_n = \sqrt{D_n \cdot \tau_n}$

ex $44.99123\text{cm} = \sqrt{44982.46\text{cm}^2\text{/s} \cdot 45000\mu\text{s}}$

7) Energy Band Gap

Open Calculator

$$E_g = E_{G0} - (T \cdot \beta_k)$$

$$0.765601\text{eV} = 0.87\text{eV} - (290\text{K} \cdot 5.7678\text{e-}23\text{J/K})$$

8) Fermi Dirac Distribution Function

Open Calculator

$$f_E = \frac{1}{1 + e^{\frac{E_f - E_f}{[\text{BoltZ}] \cdot T}}}$$

$$0.5 = \frac{1}{1 + e^{\frac{52\text{eV} - 52\text{eV}}{[\text{BoltZ}] \cdot 290\text{K}}}}$$

9) Fermi Level of Intrinsic Semiconductors

Open Calculator

$$E_{Fi} = \frac{E_c + E_v}{2}$$

$$2.63\text{eV} = \frac{0.56\text{eV} + 4.7\text{eV}}{2}$$

10) Majority Carrier Concentration in Semiconductor

Open Calculator

$$n_0 = \frac{n_i^2}{p_0}$$

$$1.6\text{E}\hat{}8/\text{m}^3 = \frac{(1.2\text{e}8/\text{m}^3)^2}{9.1\text{e}7/\text{m}^3}$$

11) Majority Carrier Concentration in Semiconductor for p-type

Open Calculator

$$n_0 = \frac{n_i^2}{p_0}$$

$$1.6\text{E}\hat{}8/\text{m}^3 = \frac{(1.2\text{e}8/\text{m}^3)^2}{9.1\text{e}7/\text{m}^3}$$

12) Mobility of Charge Carriers

Open Calculator

$$\mu = \frac{V_d}{E_I}$$

$$2.987165\text{m}^2/\text{V*s} = \frac{10.24\text{m/s}}{3.428\text{V/m}}$$

13) Saturation Voltage using Threshold Voltage

Open Calculator

fx $V_{ds} = V_{gs} - V_{th}$

ex $0.55\text{V} = 1.25\text{V} - 0.7\text{V}$

Variables Used

- **d** Conductor Width *(Meter)*
- D_n Electron Diffusion Constant *(Square Centimeter Per Second)*
- E_c Conduction Band Energy *(Electron-Volt)*
- E_f Fermi Level Energy *(Electron-Volt)*
- E_{Fi} Fermi Level Intrinsic Semiconductor *(Electron-Volt)*
- E_g Energy Band Gap *(Electron-Volt)*
- E_{G0} Energy Band Gap at 0K *(Electron-Volt)*
- E_H Hall Electric Field *(Volt per Meter)*
- E_l Electric Field Intensity *(Volt per Meter)*
- E_v Valance Band Energy *(Electron-Volt)*
- f_E Fermi Dirac Distribution Function
- J_{drift} Drift Current Density *(Ampere per Square Meter)*
- J_n Electron Current Density *(Ampere per Square Meter)*
- J_p Holes Current Density *(Ampere per Square Meter)*
- L_n Electron Diffusion Length *(Centimeter)*
- n_0 Majority Carrier Concentration *(1 per Cubic Meter)*
- N_a Acceptor Concentration *(1 per Cubic Meter)*
- N_d Donor Concentration *(1 per Cubic Meter)*
- n_i Intrinsic Carrier Concentration *(1 per Cubic Meter)*
- p_0 Minority Carrier Concentration *(1 per Cubic Meter)*
- **T** Temperature *(Kelvin)*
- V_d Drift Speed *(Meter per Second)*
- V_{ds} Saturation Voltage *(Volt)*
- V_{gs} Gate Source Voltage *(Volt)*
- V_h Hall Voltage *(Volt)*
- V_{th} Threshold Voltage *(Volt)*
- β_k Material Specific Constant *(Joule per Kelvin)*
- μ Charge Carriers Mobility *(Square Meter per Volt per Second)*
- μ_n Mobility of Electron *(Square Meter per Volt per Second)*
- μ_p Mobility of Holes *(Square Meter per Volt per Second)*
- ρ_e Electron Density *(Kilogram per Cubic Centimeter)*
- ρ_h Holes Density *(Kilogram per Cubic Centimeter)*

- σ Conductivity *(Siemens per Meter)*
- σ_n Conductivity of Extrinsic Semiconductors (n-type) *(Siemens per Meter)*
- σ_p Conductivity of Extrinsic Semiconductors (p-type) *(Siemens per Meter)*
- τ_n Minority Carrier Lifetime *(Microsecond)*

Constants, Functions, Measurements used

- Constant: **[BoltZ]**, 1.38064852E-23
  Boltzmann constant
- Constant: **[Charge-e]**, 1.60217662E-19
  Charge of electron
- Constant: **e**, 2.71828182845904523536028747135266249
  Napier's constant
- Function: **sqrt**, sqrt(Number)
  A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.
- Measurement: **Length** in Meter (m), Centimeter (cm)
  Length Unit Conversion
- Measurement: **Time** in Microsecond (µs)
  Time Unit Conversion
- Measurement: **Temperature** in Kelvin (K)
  Temperature Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Energy** in Electron-Volt (eV)
  Energy Unit Conversion
- Measurement: **Surface Current Density** in Ampere per Square Meter (A/m²)
  Surface Current Density Unit Conversion
- Measurement: **Electric Field Strength** in Volt per Meter (V/m)
  Electric Field Strength Unit Conversion
- Measurement: **Electric Potential** in Volt (V)
  Electric Potential Unit Conversion
- Measurement: **Electric Conductivity** in Siemens per Meter (S/m)
  Electric Conductivity Unit Conversion
- Measurement: **Density** in Kilogram per Cubic Centimeter (kg/cm³)
  Density Unit Conversion
- Measurement: **Diffusivity** in Square Centimeter Per Second (cm²/s)
  Diffusivity Unit Conversion
- Measurement: **Mobility** in Square Meter per Volt per Second (m²/V*s)
  Mobility Unit Conversion
- Measurement: **Carrier Concentration** in 1 per Cubic Meter (1/m³)
  Carrier Concentration Unit Conversion
- Measurement: **Heat Capacity** in Joule per Kelvin (J/K)
  Heat Capacity Unit Conversion

Check other formula lists

- **Charge Carrier Characteristics Formulas**
- **Diode Characteristics Formulas**
- **Electrostatic Parameters Formulas**
- **Semiconductor Characteristics Formulas**
- **Transistor Operating Parameters Formulas**

Feel free to SHARE this document with your friends!

PDF Available in

English Spanish French German Russian Italian Portuguese Polish Dutch

8/14/2024 | 5:09:43 AM UTC

Please leave your feedback here...