calculatoratoz.com

unitsconverters.com

Devices with Optical Components 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 14 Devices with Optical Components Formulas

Devices with Optical Components

1) Angle of Rotation of Plane of Polarization

Open Calculator

fx $\theta = 1.8 \cdot B \cdot L_m$

ex $19.53\text{rad} = 1.8 \cdot 0.35\text{T} \cdot 31\text{m}$

2) Apex Angle

Open Calculator

fx $A = \tan(\alpha)$

ex $8.167315^\circ = \tan(-3)$

3) Brewsters Angle

Open Calculator

fx $\theta_B = \arctan\left(\frac{n_1}{n_{ri}}\right)$

ex $56.0463^\circ = \arctan\left(\frac{1.5}{1.01}\right)$

4) Current Due to Optically Generated Carrier

Open Calculator

fx $i_{opt} = q \cdot A_{pn} \cdot g_{op} \cdot (W + L_{dif} + L_p)$

ex $0.6\text{mA} = 0.3\text{C} \cdot 4.8\mu\text{m}^2 \cdot 2.9\text{e}13 \cdot (6.79\mu\text{m} + 5.477816\mu\text{m} + 2.1\mu\text{m})$

5) Diffraction using Fresnel-Kirchoff Formula

Open Calculator

fx $\theta_{dif} = a\sin\left(1.22 \cdot \frac{\lambda_{vis}}{D}\right)$

ex $0.0061\text{rad} = a\sin\left(1.22 \cdot \frac{500\text{nm}}{0.1\text{mm}}\right)$

6) Diffusion Coefficient of Electron

Open Calculator

$$D_E = \mu_e \cdot [BoltZ] \cdot \frac{T}{[Charge\text{-}e]}$$

$$0.003387 m^2/s = 1000 cm^2/V*s \cdot [BoltZ] \cdot \frac{393K}{[Charge\text{-}e]}$$

7) Diffusion Length of Transition Region

Open Calculator

$$L_{dif} = \frac{i_{opt}}{q \cdot A_{pn} \cdot g_{op}} - (W + L_p)$$

$$5.477816\mu m = \frac{0.60mA}{0.3C \cdot 4.8\mu m^2 \cdot 2.9e13} - (6.79\mu m + 2.1\mu m)$$

8) Effective Density of States in Conduction Band

Open Calculator

$$N_{eff} = 2 \cdot \left(2 \cdot \pi \cdot m_{eff} \cdot [BoltZ] \cdot \frac{T}{[hP]^2}\right)^{\frac{3}{2}}$$

$$3.9E\hat{}24 = 2 \cdot \left(2 \cdot \pi \cdot 0.2e\text{-}30kg \cdot [BoltZ] \cdot \frac{393K}{[hP]^2}\right)^{\frac{3}{2}}$$

9) Electron Concentration under Unbalanced Condition

Open Calculator

$$n_e = n_i \cdot \exp\left(\frac{F_n - E_i}{[BoltZ] \cdot T}\right)$$

$$0.339151 electrons/m^3 = 3.6 electrons/m^3 \cdot \exp\left(\frac{3.7eV - 3.78eV}{[BoltZ] \cdot 393K}\right)$$

10) Excitation Energy

Open Calculator

$$E_{exc} = 1.6 \cdot 10^{-19} \cdot 13.6 \cdot \left(\frac{m_{eff}}{[Mass\text{-}e]}\right) \cdot \left(\frac{1}{[Permitivity\text{-}silicon]^2}\right)$$

$$0.021783eV = 1.6 \cdot 10^{-19} \cdot 13.6 \cdot \left(\frac{0.2e\text{-}30kg}{[Mass\text{-}e]}\right) \cdot \left(\frac{1}{[Permitivity\text{-}silicon]^2}\right)$$

11) Fringe Spacing given Apex Angle

Open Calculator

fx $$S_{fri} = \frac{\lambda_{vis}}{2 \cdot \tan\left(\alpha_{opto}\right)}$$

ex $$1.41782\mu = \frac{500nm}{2 \cdot \tan(10^\circ)}$$

12) Maximum Acceptance Angle of Compound Lens

Open Calculator

fx $$\theta_{acc} = a\sin\left(n_1 \cdot R_{lens} \cdot \sqrt{A_{con}}\right)$$

ex $$22.02431^\circ = a\sin\left(1.5 \cdot 0.0025m \cdot \sqrt{10000}\right)$$

13) Peak Retardation

Open Calculator

fx $$\Phi_m = \frac{2 \cdot \pi}{\lambda_o} \cdot r \cdot n_{ri}^3 \cdot V_m$$

ex $$80.1349rad = \frac{2 \cdot \pi}{3.939m} \cdot 23m \cdot (1.01)^3 \cdot 2.12V$$

14) PN Junction Capacitance

Open Calculator

fx $$C_j = \frac{A_{pn}}{2} \cdot \sqrt{\frac{2 \cdot [Charge\text{-}e] \cdot \varepsilon_r \cdot [Permitivity\text{-}silicon]}{V_0 - (V)} \cdot \left(\frac{N_A \cdot N_D}{N_A + N_D}\right)}$$

ex $$1.9E\hat{}6fF = \frac{4.8\mu m^2}{2} \cdot \sqrt{\frac{2 \cdot [Charge\text{-}e] \cdot 78F/m \cdot [Permitivity\text{-}silicon]}{0.6V - (-4V)} \cdot \left(\frac{1e{+}22/m^3 \cdot 1e{+}24/m^3}{1e{+}22/m^3 + 1e{+}24/m^3}\right)}$$

Variables Used

- **A** Apex Angle *(Degree)*
- A_{con} Positive Constant
- A_{pn} PN Junction Area *(Square Micrometer)*
- **B** Magnetic Flux Density *(Tesla)*
- C_j Junction Capacitance *(Femtofarad)*
- **D** Diameter of Aperture *(Millimeter)*
- D_E Electron Diffusion Coefficient *(Square Meter Per Second)*
- E_{exc} Excitation Energy *(Electron-Volt)*
- E_i Intrinsic Energy Level of Semiconductor *(Electron-Volt)*
- F_n Quasi Fermi Level of Electrons *(Electron-Volt)*
- g_{op} Optical Generation Rate
- i_{opt} Optical Current *(Milliampere)*
- L_{dif} Diffusion Length of Transition Region *(Micrometer)*
- L_m Length of Medium *(Meter)*
- L_p Length of P-Side Junction *(Micrometer)*
- m_{eff} Effective Mass of Electron *(Kilogram)*
- n_1 Refractive Index of Medium 1
- N_A Acceptor Concentration *(1 per Cubic Meter)*
- N_D Donor Concentration *(1 per Cubic Meter)*
- n_e Electron Concentration *(Electrons per Cubic Meter)*
- N_{eff} Effective Density of States
- n_i Intrinsic Electron Concentration *(Electrons per Cubic Meter)*
- n_{ri} Refractive Index
- **q** Charge *(Coulomb)*
- **r** Length of Fiber *(Meter)*
- R_{lens} Radius of Lens *(Meter)*
- S_{fri} Fringe Space *(Micron)*
- **T** Absolute Temperature *(Kelvin)*
- **V** Reverse Bias Voltage *(Volt)*
- V_0 Voltage Across PN Junction *(Volt)*

- V_m Modulation Voltage *(Volt)*
- W Transition Width *(Micrometer)*
- α Alpha
- α_{opto} Angle of Interference *(Degree)*
- ε_r Relative Permittivity *(Farad per Meter)*
- θ Angle of Rotation *(Radian)*
- θ_{acc} Acceptance Angle *(Degree)*
- θ_B Brewster's Angle *(Degree)*
- θ_{dif} Diffraction Angle *(Radian)*
- λ_o Wavelength of Light *(Meter)*
- λ_{vis} Wavelength of Visible Light *(Nanometer)*
- μ_e Mobility of Electron *(Square Centimeter per Volt Second)*
- Φ_m Peak Retardation *(Radian)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Constant: **[BoltZ]**, 1.38064852E-23
  Boltzmann constant
- Constant: **[Charge-e]**, 1.60217662E-19
  Charge of electron
- Constant: **[Mass-e]**, 9.10938356E-31
  Mass of electron
- Constant: **[Permitivity-silicon]**, 11.7
  Permittivity of silicon
- Constant: **[hP]**, 6.626070040E-34
  Planck constant
- Function: **arctan**, arctan(Number)
  Inverse trigonometric functions are usually accompanied by the prefix - arc. Mathematically, we represent arctan or the inverse tangent function as tan-1 x or arctan(x).
- Function: **asin**, asin(Number)
  The inverse sine function, is a trigonometric function that takes a ratio of two sides of a right triangle and outputs the angle opposite the side with the given ratio.
- Function: **ctan**, ctan(Angle)
  Cotangent is a trigonometric function that is defined as the ratio of the adjacent side to the opposite side in a right triangle.
- Function: **exp**, exp(Number)
  n an exponential function, the value of the function changes by a constant factor for every unit change in the independent variable.
- Function: **sin**, sin(Angle)
  Sine is a trigonometric function that describes the ratio of the length of the opposite side of a right triangle to the length of the hypotenuse.
- 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.
- Function: **tan**, tan(Angle)
  The tangent of an angle is a trigonometric ratio of the length of the side opposite an angle to the length of the side adjacent to an angle in a right triangle.
- Measurement: **Length** in Meter (m), Micrometer (µm), Nanometer (nm), Millimeter (mm), Micron (µ)
  Length Unit Conversion
- Measurement: **Weight** in Kilogram (kg)
  Weight Unit Conversion
- Measurement: **Electric Current** in Milliampere (mA)
  Electric Current Unit Conversion

- Measurement: **Temperature** in Kelvin (K)
  Temperature Unit Conversion
- Measurement: **Area** in Square Micrometer (µm²)
  Area Unit Conversion
- Measurement: **Energy** in Electron-Volt (eV)
  Energy Unit Conversion
- Measurement: **Electric Charge** in Coulomb (C)
  Electric Charge Unit Conversion
- Measurement: **Angle** in Radian (rad), Degree (°)
  Angle Unit Conversion
- Measurement: **Capacitance** in Femtofarad (fF)
  Capacitance Unit Conversion
- Measurement: **Magnetic Flux Density** in Tesla (T)
  Magnetic Flux Density Unit Conversion
- Measurement: **Electric Potential** in Volt (V)
  Electric Potential Unit Conversion
- Measurement: **Diffusivity** in Square Meter Per Second (m²/s)
  Diffusivity Unit Conversion
- Measurement: **Mobility** in Square Centimeter per Volt Second (cm²/V*s)
  Mobility Unit Conversion
- Measurement: **Carrier Concentration** in 1 per Cubic Meter (1/m³)
  Carrier Concentration Unit Conversion
- Measurement: **Permittivity** in Farad per Meter (F/m)
  Permittivity Unit Conversion
- Measurement: **Electron Density** in Electrons per Cubic Meter (electrons/m³)
  Electron Density Unit Conversion

Check other formula lists

- **Devices with Optical Components Formulas** • **Photonics Devices Formulas**
- **Lasers Formulas**

Feel free to SHARE this document with your friends!

PDF Available in

English Spanish French German Russian Italian Portuguese Polish Dutch

3/12/2024 | 7:45:51 AM UTC

Please leave your feedback here...