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Opto Electronics Devices Formulas

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List of 14 Opto Electronics Devices Formulas

Opto Electronics Devices

1) Apex Angle

Open Calculator

fx $$A = \tan(\alpha)$$

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

2) 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 $$0.605102\text{mA} = 0.3\text{C} \cdot 4.8\mu\text{m}^2 \cdot 2.9\text{e}13 \cdot (6.79\mu\text{m} + 5.6\mu\text{m} + 2.1\mu\text{m})$$

3) Diffusion Length of Transition Region

Open Calculator

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

ex $$5.477816\mu\text{m} = \frac{0.60\text{mA}}{0.3\text{C} \cdot 4.8\mu\text{m}^2 \cdot 2.9\text{e}13} - (6.79\mu\text{m} + 2.1\mu\text{m})$$

4) Electron Concentration under Unbalanced Condition

Open Calculator

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

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

5) Intensity of Signal at Distance

Open Calculator

fx $$I_x = I_o \cdot \exp(-ad_c \cdot x)$$

ex $$2.717638\text{W/m}^2 = 3.5\text{W/m}^2 \cdot \exp(-2.3 \cdot 0.11\text{m})$$

6) Length of Cavity

Open Calculator

fx $$L_c = \frac{\lambda \cdot m}{2}$$

ex $$7.8\text{m} = \frac{3.9\text{m} \cdot 4}{2}$$

7) Mode Number

Open Calculator

fx $$m = \frac{2 \cdot L_c \cdot n_{ri}}{\lambda}$$

ex $$4.04 = \frac{2 \cdot 7.8\text{m} \cdot 1.01}{3.9\text{m}}$$

8) Plane of Polarizer

Open Calculator

fx $$P = P' \cdot \left(\cos(\theta)^2\right)$$

ex $$1.995 = 2.66 \cdot \left(\cos(30^\circ)^2\right)$$

9) Plane of Transmission of Analyzer

Open Calculator

fx $$P' = \frac{P}{(\cos(\theta))^2}$$

ex $$2.666667 = \frac{2}{(\cos(30^\circ))^2}$$

10) Proton Concentration under Unbalanced Condition

Open Calculator

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

ex $$38.21311\text{electrons/m}^3 = 3.6\text{electrons/m}^3 \cdot \exp\left(\frac{3.78\text{eV} - 3.7\text{eV}}{[BoltZ] \cdot 393\text{K}}\right)$$

11) Relative Population

Open Calculator

fx $$n_{rel} = \exp\left(-\frac{[hP] \cdot \nu_{rel}}{[BoltZ] \cdot T}\right)$$

ex $$1 = \exp\left(-\frac{[hP] \cdot 8.9\text{Hz}}{[BoltZ] \cdot 393\text{K}}\right)$$

12) Single Pinhole

Open Calculator

fx $$S = \frac{F_w}{\left(A \cdot \left(\frac{180}{\pi}\right)\right) \cdot 2}$$

ex $$24.5098 = \frac{400\text{m}}{\left(8.16^\circ \cdot \left(\frac{180}{\pi}\right)\right) \cdot 2}$$

13) Wavelength of Output Light

Open Calculator

fx $$\lambda_o = n_{ri} \cdot \lambda$$

ex $$3.939\text{m} = 1.01 \cdot 3.9\text{m}$$

14) Wavelength of Radiation in Vaccum

Open Calculator

fx $$F_w = A \cdot \left(\frac{180}{\pi}\right) \cdot 2 \cdot S$$

ex $$399.84\text{m} = 8.16^\circ \cdot \left(\frac{180}{\pi}\right) \cdot 2 \cdot 24.5$$

Variables Used

- **A** Apex Angle *(Degree)*
- **A_{pn}** PN Junction Area *(Square Micrometer)*
- **ad_c** Decay Constant
- **E_i** Intrinsic Energy Level of Semiconductor *(Electron-Volt)*
- **F_n** Quasi Fermi Level of Electrons *(Electron-Volt)*
- **F_w** Wavelength of Wave *(Meter)*
- **g_{op}** Optical Generation Rate
- **I_o** Initial Intensity *(Watt per Square Meter)*
- **i_{opt}** Optical Current *(Milliampere)*
- **I_x** Intensity of Signal at Distance *(Watt per Square Meter)*
- **L_c** Length of Cavity *(Meter)*
- **L_{dif}** Diffusion Length of Transition Region *(Micrometer)*
- **L_p** Length of P-Side Junction *(Micrometer)*
- **m** Mode Number
- **n_e** Electron Concentration *(Electrons per Cubic Meter)*
- **n_i** Intrinsic Electron Concentration *(Electrons per Cubic Meter)*
- **n_{rel}** Relative Population
- **n_{ri}** Refractive Index
- **P** Plane of Polarizer
- **P'** Plane of Transmission of Analyzer
- **p_c** Proton Concentration *(Electrons per Cubic Meter)*

- **q** Charge *(Coulomb)*
- **S** Single Pinhole
- **T** Absolute Temperature *(Kelvin)*
- **W** Transition Width *(Micrometer)*
- **x** Distance of Measuring *(Meter)*
- **α** Alpha
- **θ** Theta *(Degree)*
- **λ** Photon Wavelength *(Meter)*
- λ_o Wavelength of Output Light *(Meter)*
- v_{rel} Relative Frequency *(Hertz)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Constant: **[BoltZ]**, 1.38064852E-23 Joule/Kelvin
  Boltzmann constant
- Constant: **[hP]**, 6.626070040E-34 Kilogram Meter² / Second
  Planck constant
- Function: **cos**, cos(Angle)
  Trigonometric cosine function
- Function: **exp**, exp(Number)
  Exponential function
- Function: **tan**, tan(Angle)
  Trigonometric tangent function
- Measurement: **Length** in Micrometer (µm)
  Length 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 Degree (°)
  Angle Unit Conversion

- Measurement: **Frequency** in Hertz (Hz)
  Frequency Unit Conversion
- Measurement: **Wavelength** in Meter (m)
  Wavelength Unit Conversion
- Measurement: **Intensity** in Watt per Square Meter (W/m²)
  Intensity Unit Conversion
- Measurement: **Electron Density** in Electrons per Cubic Meter (electrons/m³)
  Electron Density Unit Conversion

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