Important Diode Characteristics Formulas PDF

Formulas
Examples
with Units

List of 16
Important Diode Characteristics Formulas

1) Average DC Current Formula

Evaluate Formula

Formula

$$I_{av} = 2 \cdot \frac{I_m}{\pi}$$

Example with Units

$$3.4377\,\text{mA} = 2 \cdot \frac{5.4\,\text{mA}}{3.1416}$$

2) Capacitance of Varactor Diode Formula

Evaluate Formula

Formula

$$C_j = \frac{k}{\left(V_b + V_R\right)^n}$$

Example with Units

$$1521.8897\,\mu\text{F} = \frac{5\text{e-}3}{\left(0.85\,\text{V} + 9\,\text{V}\right)^{0.52}}$$

3) Cut-off Frequency of Varactor Diode Formula

Evaluate Formula

Formula

$$f_c = \frac{1}{2 \cdot \pi \cdot R_{se} \cdot C_j}$$

Example with Units

$$3.0756\,\text{Hz} = \frac{1}{2 \cdot 3.1416 \cdot 34\,\Omega \cdot 1522\,\mu\text{F}}$$

4) Diode Equation for Germanium at Room Temperature Formula

Evaluate Formula

Formula

$$I_{ger} = I_o \cdot \left(e^{\frac{V_d}{0.026}} - 1\right)$$

Example with Units

$$4841.0346\,\text{A} = 0.46\,\mu\text{A} \cdot \left(e^{\frac{0.6\,\text{V}}{0.026}} - 1\right)$$

5) Ideal Diode Equation Formula

Evaluate Formula

Formula

$$I_d = I_o \cdot \left(e^{\frac{[\text{Charge-e}] \cdot V_d}{[\text{BoltZ}] \cdot T}} - 1\right)$$

Example with Units

$$12299.5337\,\text{A} = 0.46\,\mu\text{A} \cdot \left(e^{\frac{1.6\text{E-}19\,\text{C} \cdot 0.6\,\text{V}}{1.4\text{E-}23\,\text{J/K} \cdot 290\,\text{K}}} - 1\right)$$

6) Maximum Wavelight Formula

Evaluate Formula

Formula

$$\lambda_{max} = \frac{1.24}{E_g}$$

Example with Units

$$6.4\text{E+}20\,\text{m} = \frac{1.24}{0.012\,\text{eV}}$$

7) Non-Ideal Diode Equation Formula

Evaluate Formula

Formula

$$I_0 = I_o \cdot \left(e^{\frac{[Charge\text{-}e] \cdot V_d}{\eta \cdot [BoltZ] \cdot T}} - 1 \right)$$

Example with Units

$$24.3533\,A = 0.46\,\mu A \cdot \left(e^{\frac{1.6E\text{-}19\,c \cdot 0.6\,v}{1.35 \cdot 1.4E\text{-}23\,J/K \cdot 290\,K}} - 1 \right)$$

8) Quality Factor of Varactor Diode Formula

Evaluate Formula

Formula

$$q = \frac{f_c}{f_o}$$

Example with Units

$$1.0982 = \frac{3.075\,Hz}{2.8\,Hz}$$

9) Responsivity Formula

Evaluate Formula

Formula

$$R = \frac{I_p}{P_o}$$

Example with Units

$$0.168 = \frac{430\,mA}{2.56\,W}$$

10) Saturation Drain Current Formula

Evaluate Formula

Formula

$$I_s = 0.5 \cdot g_m \cdot \left(V_{gs} - V_{th} \right)$$

Example with Units

$$9.9\,mA = 0.5 \cdot 0.036\,S \cdot \left(1.25\,v - 0.7\,v \right)$$

11) Self-Resonance Frequency of Varactor Diode Formula

Evaluate Formula

Formula

$$s_o = \frac{1}{2 \cdot \pi \cdot \sqrt{L_s \cdot C_j}}$$

Example with Units

$$2.2805\,Hz = \frac{1}{2 \cdot 3.1416 \cdot \sqrt{3.2\,H \cdot 1522\,\mu F}}$$

12) Thermal Voltage of Diode Equation Formula

Evaluate Formula

Formula

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

Example with Units

$$0.025\,v = 1.4E\text{-}23\,J/K \cdot \frac{290\,K}{1.6E\text{-}19\,c}$$

13) Voltage Equivalent of Temperature Formula

Evaluate Formula

Formula

$$V_{temp} = \frac{T_{room}}{11600}$$

Example with Units

$$0.0259\,v = \frac{300\,K}{11600}$$

14) Zener Current Formula

Evaluate Formula

Formula

$$I_z = \frac{V_i - V_z}{R_z}$$

Example with Units

$$150.1344\,\text{mA} = \frac{21.21\,\text{V} - 10.6\,\text{V}}{70.67\,\Omega}$$

15) Zener Resistance Formula

Evaluate Formula

Formula

$$R_z = \frac{V_z}{I_z}$$

Example with Units

$$70.6667\,\Omega = \frac{10.6\,\text{V}}{150\,\text{mA}}$$

16) Zener Voltage Formula

Evaluate Formula

Formula

$$V_z = R_z \cdot I_z$$

Example with Units

$$10.6005\,\text{V} = 70.67\,\Omega \cdot 150\,\text{mA}$$

Variables used in list of Diode Characteristics Formulas above

- C_j Capacitance of Varactor Diode *(Microfarad)*
- E_g Energy Gap *(Electron-Volt)*
- f_c Cut-off Frequency *(Hertz)*
- f_o Operating Frequency *(Hertz)*
- g_m Transconductance Parameter *(Siemens)*
- I_0 Non Ideal Diode Current *(Ampere)*
- I_{av} Direct Current *(Milliampere)*
- I_d Diode Current *(Ampere)*
- I_{ger} Germanium Diode Current *(Ampere)*
- I_m Peak Current *(Milliampere)*
- I_o Reverse Saturation Current *(Microampere)*
- I_p Photo Current *(Milliampere)*
- I_s Diode Saturation Current *(Milliampere)*
- I_z Zener Current *(Milliampere)*
- **k** Material Constant
- L_s Inductance of Varactor Diode *(Henry)*
- **n** Doping Constant
- P_o Incident Optical Power *(Watt)*
- **q** Quality Factor
- **R** Responsivity
- R_{se} Series Field Resistance *(Ohm)*
- R_z Zener Resistance *(Ohm)*
- s_o Self Resonance Frequency *(Hertz)*
- **T** Temperature *(Kelvin)*
- T_{room} Room Temperature *(Kelvin)*
- V_b Barrier Potential *(Volt)*
- V_d Diode Voltage *(Volt)*
- V_{gs} Gate Source Voltage *(Volt)*
- V_i Input Voltage *(Volt)*
- V_R Reverse Voltage *(Volt)*
- V_t Thermal Voltage *(Volt)*

Constants, Functions, Measurements used in list of Diode Characteristics Formulas above

- constant(s): **pi**, 3.14159265358979323846264338327950288 *Archimedes' constant*
- constant(s): **[BoltZ]**, 1.38064852E-23 *Boltzmann constant*
- constant(s): **[Charge-e]**, 1.60217662E-19 *Charge of electron*
- constant(s): **e**, 2.71828182845904523536028747135266249 *Napier's constant*
- Functions: **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) *Length Unit Conversion*
- Measurement: **Electric Current** in Milliampere (mA), Ampere (A), Microampere (µA) *Electric Current Unit Conversion*
- Measurement: **Temperature** in Kelvin (K) *Temperature Unit Conversion*
- Measurement: **Energy** in Electron-Volt (eV) *Energy Unit Conversion*
- Measurement: **Power** in Watt (W) *Power Unit Conversion*
- Measurement: **Frequency** in Hertz (Hz) *Frequency Unit Conversion*
- Measurement: **Capacitance** in Microfarad (µF) *Capacitance Unit Conversion*
- Measurement: **Electric Resistance** in Ohm (Ω) *Electric Resistance Unit Conversion*
- Measurement: **Electric Conductance** in Siemens (S) *Electric Conductance Unit Conversion*
- Measurement: **Inductance** in Henry (H) *Inductance Unit Conversion*
- Measurement: **Electric Potential** in Volt (V) *Electric Potential Unit Conversion*

- V_{temp} Volt-Equivalent of Temperature *(Volt)*
- V_{th} Threshold Voltage *(Volt)*
- V_z Zener Voltage *(Volt)*
- λ_{max} Maximum Wavelight *(Meter)*
- Π Ideality Factor

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