

Important Magnetron Oscillator Formulas PDF



Formulas Examples with Units

List of 17 Important Magnetron Oscillator Formulas

1) Anode Current Formula ↻

Formula

$$I_0 = \frac{P_{\text{gen}}}{V_0 \cdot \eta_e}$$

Example with Units

$$2.1251 \text{ A} = \frac{33.704 \text{ kW}}{26000 \text{ V} \cdot 0.61}$$

Evaluate Formula ↻

2) Characteristic Admittance Formula ↻

Formula

$$Y = \frac{1}{Z_0}$$

Example with Units

$$0.4739 \text{ S} = \frac{1}{2.11 \Omega}$$

Evaluate Formula ↻

3) Circuit Efficiency in Magnetron Formula ↻

Formula

$$\eta = \frac{G_r}{G_r + G}$$

Example with Units

$$0.9346 = \frac{2e-4 \text{ S}}{2e-4 \text{ S} + 1.4e-5 \text{ S}}$$

Evaluate Formula ↻

4) Cyclotron Angular Frequency Formula ↻

Formula

$$\omega_c = B_Z \cdot \left(\frac{[\text{Charge-e}]}{[\text{Mass-e}]} \right)$$

Example with Units

$$7914.6901 \text{ rad/s} = 4.5e-8 \text{ Wb/m}^2 \cdot \left(\frac{1.6E-19 \text{ C}}{9.1E-31 \text{ kg}} \right)$$

Evaluate Formula ↻

5) Distance between Anode and Cathode Formula ↻

Formula

$$d = \left(\frac{1}{B_{0c}} \right) \cdot \sqrt{2 \cdot \left(\frac{[\text{Mass-e}]}{[\text{Charge-e}]} \right) \cdot V_0}$$

Evaluate Formula ↻

Example with Units

$$0.0604 \text{ m} = \left(\frac{1}{0.009 \text{ Wb/m}^2} \right) \cdot \sqrt{2 \cdot \left(\frac{9.1E-31 \text{ kg}}{1.6E-19 \text{ C}} \right) \cdot 26000 \text{ V}}$$



6) Electron Uniform Velocity Formula

Formula

$$E_{vo} = \sqrt{(2 \cdot V_o) \cdot \left(\frac{[\text{Charge-e}]}{[\text{Mass-e}]} \right)}$$

Example with Units

$$258524.9715 \text{ m/s} = \sqrt{(2 \cdot 0.19 \text{ v}) \cdot \left(\frac{1.6\text{E-}19\text{c}}{9.1\text{E-}31\text{kg}} \right)}$$

Evaluate Formula 

7) Electronic Efficiency Formula

Formula

$$\eta_e = \frac{P_{\text{gen}}}{P_{\text{dc}}}$$

Example with Units

$$0.6128 = \frac{33.704 \text{ kW}}{55 \text{ kW}}$$

Evaluate Formula 

8) Hull Cutoff Magnetic Flux Density Formula

Formula

$$B_{0c} = \left(\frac{1}{d} \right) \cdot \sqrt{2 \cdot \left(\frac{[\text{Mass-e}]}{[\text{Charge-e}]} \right) \cdot V_o}$$

Example with Units

$$0.0091 \text{ Wb/m}^2 = \left(\frac{1}{0.06 \text{ m}} \right) \cdot \sqrt{2 \cdot \left(\frac{9.1\text{E-}31\text{kg}}{1.6\text{E-}19\text{c}} \right) \cdot 26000 \text{ v}}$$

Evaluate Formula 

9) Hull Cut-off Voltage Formula

Formula

$$V_c = \left(\frac{1}{2} \right) \cdot \left(\frac{[\text{Charge-e}]}{[\text{Mass-e}]} \right) \cdot B_{0c}^2 \cdot d^2$$

Example with Units

$$25643.5959 \text{ v} = \left(\frac{1}{2} \right) \cdot \left(\frac{1.6\text{E-}19\text{c}}{9.1\text{E-}31\text{kg}} \right) \cdot 0.009 \text{ Wb/m}^2^2 \cdot 0.06 \text{ m}^2$$

Evaluate Formula 

10) Magnetron Phase Shift Formula

Formula

$$\Phi_n = 2 \cdot \pi \cdot \left(\frac{M}{N} \right)$$

Example with Units

$$90^\circ = 2 \cdot 3.1416 \cdot \left(\frac{4}{16} \right)$$

Evaluate Formula 

11) Modulation Linearity Formula

Formula

$$m = \frac{\Delta f_m}{f_m}$$

Example with Units

$$0.1667 = \frac{7.5 \text{ Hz}}{45 \text{ Hz}}$$

Evaluate Formula 



12) Noise Ratio Formula

Formula

$$SNR = \left(\frac{SNR_{in}}{SNR_{out}} \right) - 1$$

Example

$$0.3589 = \left(\frac{0.761}{0.56} \right) - 1$$

Evaluate Formula 

13) Receiver Sensitivity Formula

Formula

$$S_r = RNF + SNR$$

Example with Units

$$6.458 \text{ dB} = 6.1 \text{ dB} + 0.358$$

Evaluate Formula 

14) Repetition Frequency of Pulse Formula

Formula

$$f_r = \frac{f_{sl} - f_c}{N_s}$$

Example with Units

$$1.43 \text{ Hz} = \frac{10.25 \text{ Hz} - 3.1 \text{ Hz}}{5}$$

Evaluate Formula 

15) RF Pulse Width Formula

Formula

$$T_{eff} = \frac{1}{2 \cdot BW}$$

Example with Units

$$0.0089 \text{ s} = \frac{1}{2 \cdot 56 \text{ Hz}}$$

Evaluate Formula 

16) Space Charge Reduction Factor Formula

Formula

$$R = \frac{\omega_q}{f_p}$$

Example with Units

$$0.8571 = \frac{1.2 \text{e6 rad/s}}{1.4 \text{e6 rad/s}}$$

Evaluate Formula 

17) Spectral Line Frequency Formula

Formula

$$f_{sl} = f_c + N_s \cdot f_r$$

Example with Units

$$10.25 \text{ Hz} = 3.1 \text{ Hz} + 5 \cdot 1.43 \text{ Hz}$$

Evaluate Formula 



Variables used in list of Magnetron Oscillator Formulas above

- **B_{0c}** Hull Cutoff Magnetic Flux Density (Weber per Square Meter)
- **B_Z** Magnetic Flux Density in Z Direction (Weber per Square Meter)
- **BW** Bandwidth (Hertz)
- **d** Distance Between Anode and Cathode (Meter)
- **E_{vo}** Electron Uniform Velocity (Meter per Second)
- **f_c** Carrier Frequency (Hertz)
- **f_m** Peak Frequency (Hertz)
- **f_p** Plasma Frequency (Radian per Second)
- **f_r** Repetition Frequency (Hertz)
- **f_{sl}** Spectral Line Frequency (Hertz)
- **G** Conductance of Cavity (Siemens)
- **G_r** Resonator Conductance (Siemens)
- **I₀** Anode Current (Ampere)
- **m** Modulation Linearity
- **M** Number of Oscillation
- **N** Number of Resonant Cavities
- **N_s** Number of Samples
- **P_{dc}** DC Power Supply (Kilowatt)
- **P_{gen}** Power Generated in Anode Circuit (Kilowatt)
- **R** Space Charge Reduction Factor
- **RNF** Receiver Noise Floor (Decibel)
- **S_r** Receiver Sensitivity (Decibel)
- **SNR** Signal Noise Ratio
- **SNR_{in}** Input Signal Noise Ratio
- **SNR_{out}** Output Signal Noise Ratio
- **T_{eff}** RF Pulse Width (Second)
- **V₀** Anode Voltage (Volt)
- **V_c** Hull Cut off Voltage (Volt)
- **V_o** Beam Voltage (Volt)

Constants, Functions, Measurements used in list of Magnetron Oscillator Formulas above

- **constant(s):** pi, 3.14159265358979323846264338327950288 Archimedes' constant
- **constant(s):** [Charge-e], 1.60217662E-19 Charge of electron
- **constant(s):** [Mass-e], 9.10938356E-31 Mass of electron
- **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: Time** in Second (s)
Time Unit Conversion 
- **Measurement: Electric Current** in Ampere (A)
Electric Current Unit Conversion 
- **Measurement: Speed** in Meter per Second (m/s)
Speed Unit Conversion 
- **Measurement: Power** in Kilowatt (kW)
Power Unit Conversion 
- **Measurement: Angle** in Degree (°)
Angle Unit Conversion 
- **Measurement: Noise** in Decibel (dB)
Noise Unit Conversion 
- **Measurement: Frequency** in Hertz (Hz)
Frequency Unit Conversion 
- **Measurement: Electric Resistance** in Ohm (Ω)
Electric Resistance Unit Conversion 
- **Measurement: Electric Conductance** in Siemens (S)
Electric Conductance Unit Conversion 
- **Measurement: Magnetic Flux Density** in Weber per Square Meter (Wb/m²)
Magnetic Flux Density Unit Conversion 
- **Measurement: Electric Potential** in Volt (V)
Electric Potential Unit Conversion 



- **Y** Characteristic Admittance (*Siemens*)
 - **Z_o** Characteristic Impedance (*Ohm*)
 - **Δf_m** Maximum Frequency Deviation (*Hertz*)
 - **η** Circuit Efficiency
 - **η_e** Electronic Efficiency
 - **Φ_n** Phase Shift in Magnetron (*Degree*)
 - **ω_c** Cyclotron Angular Frequency (*Radian per Second*)
 - **ω_q** Reduced Plasma Frequency (*Radian per Second*)
- **Measurement: Angular Frequency** in Radian per Second (rad/s)
Angular Frequency Unit Conversion 



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