

Important Single Phase Uncontrolled Rectifiers Formulas PDF



Formulas
Examples
with Units

List of 19 Important Single Phase Uncontrolled Rectifiers Formulas

1) Full Wave Formulas

1.1) Average Output Current of Single Phase Full Wave Midpoint Diode Rectifier with R Load Formula

Formula

$$I_{\text{avg(f)}} = \frac{2 \cdot V_{(\text{max})}}{\pi \cdot r}$$

Example with Units

$$2.3846 \text{ A} = \frac{2 \cdot 221 \text{ V}}{3.1416 \cdot 59 \Omega}$$

Evaluate Formula

1.2) Average Output Voltage of Single Phase Full Wave Midpoint Diode Rectifier with R Load Formula

Formula

$$V_{\text{dc(f)}} = \frac{2 \cdot V_{(\text{max})}}{\pi}$$

Example with Units

$$140.693 \text{ V} = \frac{2 \cdot 221 \text{ V}}{3.1416}$$

Evaluate Formula

1.3) Output Average Power of Single Phase Full Wave Midpoint Diode Rectifier with R Load Formula

Formula

$$P_{(\text{avg})} = \left(\frac{2}{\pi} \right)^2 \cdot V_{(\text{max})} \cdot I_{\text{max}}$$

Example with Units

$$434.4044 \text{ W} = \left(\frac{2}{3.1416} \right)^2 \cdot 221 \text{ V} \cdot 4.85 \text{ A}$$

Evaluate Formula

1.4) Ripple Voltage of Single Phase Full Wave Midpoint Diode Rectifier with R Load Formula

Formula

$$V_{r(f)} = 0.3077 \cdot V_{(\text{max})}$$

Example with Units

$$68.0017 \text{ V} = 0.3077 \cdot 221 \text{ V}$$

Evaluate Formula

1.5) RMS Output Current of Single Phase Full Wave Midpoint Diode Rectifier with R Load Formula

Formula

$$I_{\text{out(rms)}} = \frac{V_s}{r}$$

Example with Units

$$7.4576 \text{ A} = \frac{440 \text{ V}}{59 \Omega}$$

Evaluate Formula

1.6) RMS Output Voltage of Single Phase Full Wave Midpoint Diode Rectifier with R Load Formula

Formula

$$V_{\text{rms(f)}} = \frac{V_{(\text{max})}}{\sqrt{2}}$$

Example with Units

$$156.2706 \text{ V} = \frac{221 \text{ V}}{\sqrt{2}}$$

Evaluate Formula



2) Half Wave Formulas

2.1) Average Load Current of Single Phase Half Wave Diode Rectifier with Inductive Load Formula

Formula

$$I_L = \frac{V_{(\max)}}{\omega \cdot L}$$

Example with Units

$$2.425 \text{ A} = \frac{221 \text{ v}}{30 \text{ rad/s} \cdot 3.0378 \text{ H}}$$

Evaluate Formula 

2.2) Average Load Current of Single Phase Half Wave Diode Rectifier with Resistive Load Formula

Formula

$$I_L = \frac{V_{(\max)}}{\pi \cdot r}$$

Example with Units

$$1.1923 \text{ A} = \frac{221 \text{ v}}{3.1416 \cdot 59 \Omega}$$

Evaluate Formula 

2.3) Average Output Current of Single Phase Half Wave Diode Rectifier with Resistive and Inductive Load Formula

Formula

$$I_{\text{avg(h)}} = \frac{\frac{V_{(\max)}}{2 \cdot \pi \cdot r}}{1 - \cos(\beta_{\text{diode}})}$$

Example with Units

$$0.3053 \text{ A} = \frac{\frac{221 \text{ v}}{2 \cdot 3.1416 \cdot 59 \Omega}}{1 - \cos(60 \text{ rad})}$$

Evaluate Formula 

2.4) Average Output Current of Single Phase Half Wave Diode Rectifier with RL Load and Freewheeling Diode Formula

Formula

$$I_{\text{avg(h)}} = \frac{V_{(\max)}}{\pi \cdot r}$$

Example with Units

$$1.1923 \text{ A} = \frac{221 \text{ v}}{3.1416 \cdot 59 \Omega}$$

Evaluate Formula 

2.5) Average Output Voltage of Single Phase Half Wave Diode Rectifier with Resistive Load Formula

Formula

$$V_{\text{dc(h)}} = \frac{V_{(\max)}}{\pi}$$

Example with Units

$$70.3465 \text{ v} = \frac{221 \text{ v}}{3.1416}$$

Evaluate Formula 

2.6) Average Output Voltage of Single Phase Half Wave Diode Rectifier with RL Load Formula

Formula

$$V_{\text{dc(h)}} = \left(\frac{V_{(\max)}}{2 \cdot \pi} \right) \cdot (1 - \cos(\beta_{\text{diode}}))$$

Example with Units

$$68.6727 \text{ v} = \left(\frac{221 \text{ v}}{2 \cdot 3.1416} \right) \cdot (1 - \cos(60 \text{ rad}))$$

Evaluate Formula 

2.7) Average Output Voltage of Single Phase Half Wave Diode Rectifier with RL Load and Freewheeling Diode Formula

Formula

$$V_{\text{dc(h)}} = \frac{V_{(\max)}}{\pi}$$

Example with Units

$$70.3465 \text{ v} = \frac{221 \text{ v}}{3.1416}$$

Evaluate Formula 



2.8) Output DC Power of Single-Phase Half Wave Diode Rectifier with R Load Formula

Formula

$$P_{(dc)} = \frac{V_{(max)} \cdot I_{max}}{\pi^2}$$

Example with Units

$$108.6011\text{W} = \frac{221\text{V} \cdot 4.85\text{A}}{3.1416^2}$$

Evaluate Formula 

2.9) Peak Load Current in Single Phase Half Wave Diode Rectifier with Inductive Load Formula

Formula

$$I_{max} = \frac{2 \cdot V_{(max)}}{\omega \cdot L}$$

Example with Units

$$4.85\text{A} = \frac{2 \cdot 221\text{V}}{30\text{rad/s} \cdot 3.0378\text{H}}$$

Evaluate Formula 

2.10) Ripple Voltage of Single-Phase Half Wave Diode Rectifier with R Load Formula

Formula

$$V_{r(h)} = 0.3856 \cdot V_{(max)}$$

Example with Units

$$85.2176\text{V} = 0.3856 \cdot 221\text{V}$$

Evaluate Formula 

2.11) RMS Load Current of Single Phase Half Wave Diode Rectifier with RE Load Formula

Formula

$$I_{Lrms} = \sqrt{\frac{\left(V_s^2 + E_L^2 \right) \cdot \left(\pi - \left(2 \cdot \theta_r \right) \right) + V_s^2 \cdot \sin \left(2 \cdot \theta_d \right) - 4 \cdot V_{(max)} \cdot E_L \cdot \cos \left(\theta_d \right)}{2 \cdot \pi \cdot r^2}}$$

Example with Units

$$6.6237\text{A} = \sqrt{\frac{\left(440\text{V}^2 + 333\text{V}^2 \right) \cdot \left(3.1416 - \left(2 \cdot 0.01\text{rad} \right) \right) + 440\text{V}^2 \cdot \sin \left(2 \cdot 84.26^\circ \right) - 4 \cdot 221\text{V} \cdot 333\text{V} \cdot \cos \left(84.26^\circ \right)}{2 \cdot 3.1416 \cdot 59\Omega^2}}$$

Evaluate Formula 

2.12) RMS Load Current of Single Phase Half Wave Diode Rectifier with Resistive Load Formula

Formula

$$I_{Lrms} = \frac{V_{(max)}}{2 \cdot r}$$

Example with Units

$$1.8729\text{A} = \frac{221\text{V}}{2 \cdot 59\Omega}$$

Evaluate Formula 

2.13) RMS Output Voltage of Single Phase Half Wave Diode Rectifier with Resistive Load Formula

Formula

$$V_{rms(h)} = \frac{V_{(max)}}{2}$$

Example with Units

$$110.5\text{V} = \frac{221\text{V}}{2}$$

Evaluate Formula 



Variables used in list of Single Phase Uncontrolled Rectifiers Formulas above

- E_L Load EMF (Volt)
- $I_{avg(f)}$ Average Output Current Full (Ampere)
- $I_{avg(h)}$ Average Output Current Half (Ampere)
- I_L Average Load Current SP (Ampere)
- I_{Lrms} RMS Load Current SP (Ampere)
- I_{max} Peak Load Current (Ampere)
- $I_{out(rms)}$ RMS Output Current (Ampere)
- L Inductance (Henry)
- $P_{(avg)}$ Average Output Power SP (Watt)
- $P_{(dc)}$ DC Power Output SP (Watt)
- r Resistance SP (Ohm)
- $V_{(max)}$ Peak Input Voltage SP (Volt)
- $V_{dc(f)}$ Average Output Voltage Full (Volt)
- $V_{dc(h)}$ Average Output Voltage Half (Volt)
- $V_{r(f)}$ Ripple Voltage Full (Volt)
- $V_{r(h)}$ Ripple Voltage Half (Volt)
- $V_{rms(f)}$ RMS Output Voltage Full (Volt)
- $V_{rms(h)}$ RMS Output Voltage Half (Volt)
- V_s Source Voltage (Volt)
- β_{diode} Diode Extinction Angle (Radian)
- θ_d Diode Turn On Angle Degrees (Degree)
- θ_r Diode Turn On Angle Radians (Radian)
- ω Angular Frequency (Radian per Second)

Constants, Functions, Measurements used in list of Single Phase Uncontrolled Rectifiers Formulas above

- **constant(s):** π , 3.14159265358979323846264338327950288
Archimedes' constant
- **Functions:** $\cos$, $\cos(\text{Angle})$
Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.
- **Functions:** $\sin$, $\sin(\text{Angle})$
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.
- **Functions:** $\sqrt{}$, $\sqrt{\text{Number}}$
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:** **Electric Current** in Ampere (A)
Electric Current Unit Conversion 
- **Measurement:** **Power** in Watt (W)
Power Unit Conversion 
- **Measurement:** **Angle** in Radian (rad), Degree ($^{\circ}$)
Angle Unit Conversion 
- **Measurement:** **Electric Resistance** in Ohm (Ω)
Electric Resistance Unit Conversion 
- **Measurement:** **Inductance** in Henry (H)
Inductance Unit Conversion 
- **Measurement:** **Electric Potential** in Volt (V)
Electric Potential Unit Conversion 
- **Measurement:** **Angular Frequency** in Radian per Second (rad/s)
Angular Frequency Unit Conversion 



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