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Power Converter Characteristics Formulas

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List of 19 Power Converter Characteristics Formulas

Power Converter Characteristics

1) Average DC Output Voltage of Single Phase Full Converter

Open Calculator

fx $$V_{avg\text{-}dc(full)} = \frac{2 \cdot V_{m\text{-}dc(full)} \cdot \cos(\alpha_{full})}{\pi}$$

ex $$73.00837V = \frac{2 \cdot 140V \cdot \cos(35^\circ)}{\pi}$$

2) Average Load Current of Three Phase Semi-Current

Open Calculator

fx $$I_{L(3\Phi\text{-}semi)} = \frac{V_{avg(3\Phi\text{-}semi)}}{R_{3\Phi\text{-}semi}}$$

ex $$0.86931A = \frac{25.21V}{29\Omega}$$

3) Average Output Voltage for Continuous Load Current

Open Calculator

fx $$V_{avg(3\Phi\text{-}half)} = \frac{3 \cdot \sqrt{3} \cdot V_{in(3\Phi\text{-}half)i} \cdot \left(\cos\left(\alpha_{d(3\Phi\text{-}half)}\right)\right)}{2 \cdot \pi}$$

ex $$38.95558V = \frac{3 \cdot \sqrt{3} \cdot 182V \cdot (\cos(75^\circ))}{2 \cdot \pi}$$

4) Average Output Voltage for PWM Control

Open Calculator

fx $$E_{dc} = \left(\frac{E_m}{\pi}\right) \cdot \sum(x, 1, p, (\cos(\alpha_k) - \cos(\beta_k)))$$

ex $$80.39156V = \left(\frac{230V}{\pi}\right) \cdot \sum(x, 1, 3, (\cos(30^\circ) - \cos(60.0^\circ)))$$

5) Average Output Voltage for Three-Phase Converter

Open Calculator

fx $$V_{avg(3\Phi\text{-}full)} = \frac{2 \cdot V_{m(3\Phi\text{-}full)} \cdot \cos\left(\frac{\alpha_{d(3\Phi\text{-}full)}}{2}\right)}{\pi}$$

ex $$115.2489V = \frac{2 \cdot 221V \cdot \cos\left(\frac{70^\circ}{2}\right)}{\pi}$$

6) Average Output Voltage of Single Phase Semi-Converter with Highly Inductive Load

Open Calculator

fx $$V_{avg(semi)} = \left(\frac{V_{m(semi)}}{\pi}\right) \cdot \left(1 + \cos\left(\alpha_{(semi)}\right)\right)$$

ex $$9.727758V = \left(\frac{22.8V}{\pi}\right) \cdot \left(1 + \cos(70.1^\circ)\right)$$

7) Average Output Voltage of Single Phase Thyristor Converter with Resistive Load

Open Calculator

fx $$V_{avg(thy)} = \left(\frac{V_{in(thy)}}{2 \cdot \pi}\right) \cdot \left(1 + \cos\left(\alpha_{d(thy)}\right)\right)$$

ex $$2.556801V = \left(\frac{12V}{2 \cdot \pi}\right) \cdot \left(1 + \cos(70.2^\circ)\right)$$

8) DC Output Voltage for First Converter

Open Calculator

fx $$V_{out(first)} = \frac{2 \cdot V_{in(dual)} \cdot \left(\cos\left(\alpha_{1(dual)}\right)\right)}{\pi}$$

ex $$73.78295V = \frac{2 \cdot 125V \cdot (\cos(22^\circ))}{\pi}$$

9) DC Output Voltage of Second Converter

Open Calculator

fx $$V_{out(second)} = \frac{2 \cdot V_{in(dual)} \cdot \left(\cos\left(\alpha_{2(dual)}\right)\right)}{\pi}$$

ex $$39.78874V = \frac{2 \cdot 125V \cdot (\cos(60^\circ))}{\pi}$$

10) Fundamental Supply Current for PWM Control

Open Calculator

fx $$I_{S(fund)} = \left(\frac{\sqrt{2} \cdot I_a}{\pi}\right) \cdot \sum(x, 1, p, (\cos(\alpha_k)) - (\cos(\beta_k)))$$

ex $$1.087478A = \left(\frac{\sqrt{2} \cdot 2.2A}{\pi}\right) \cdot \sum(x, 1, 3, (\cos(30^\circ)) - (\cos(60.0^\circ)))$$

11) RMS Harmonic Current for PWM Control

Open Calculator

$$I_n = \left(\frac{\sqrt{2}\cdot I_a}{\pi}\right)\cdot\sum\left(x,1,p,\left(\cos\left(n\cdot\alpha_k\right)\right)-\left(\cos\left(n\cdot\beta_k\right)\right)\right)$$

$$2.971044\text{A} = \left(\frac{\sqrt{2}\cdot 2.2\text{A}}{\pi}\right)\cdot\sum\left(x,1,3,\left(\cos\left(3.0\cdot 30^\circ\right)\right)-\left(\cos\left(3.0\cdot 60.0^\circ\right)\right)\right)$$

12) RMS Output Voltage for Continuous Load Current

Open Calculator

$$V_{rms(3\Phi\text{-half})} = \sqrt{3}\cdot V_{in(3\Phi\text{-half})i}\cdot\left(\left(\frac{1}{6}\right)+\frac{\sqrt{3}\cdot\cos\left(2\cdot\alpha_{d(3\Phi\text{-half})}\right)}{8\cdot\pi}\right)^{0.5}$$

$$103.1076\text{V} = \sqrt{3}\cdot 182\text{V}\cdot\left(\left(\frac{1}{6}\right)+\frac{\sqrt{3}\cdot\cos\left(2\cdot 75^\circ\right)}{8\cdot\pi}\right)^{0.5}$$

13) RMS Output Voltage for Resistive Load

Open Calculator

$$V_{rms(3\Phi\text{-half})} = \sqrt{3}\cdot V_{m(3\Phi\text{-half})}\cdot\left(\sqrt{\left(\frac{1}{6}\right)+\left(\frac{\sqrt{3}\cdot\cos\left(2\cdot\alpha_{d(3\Phi\text{-half})}\right)}{8\cdot\pi}\right)}\right)$$

$$125.7686\text{V} = \sqrt{3}\cdot 222\text{V}\cdot\left(\sqrt{\left(\frac{1}{6}\right)+\left(\frac{\sqrt{3}\cdot\cos\left(2\cdot 75^\circ\right)}{8\cdot\pi}\right)}\right)$$

14) RMS Output Voltage for Three Phase Semi-Converter

Open Calculator

$$V_{rms(3\Phi\text{-semi})} = \sqrt{3}\cdot V_{in(3\Phi\text{-semi})}\cdot\left(\left(\frac{3}{4\cdot\pi}\right)\cdot\left(\pi-\alpha_{(3\Phi\text{-semi})}+\left(\frac{\sin\left(2\cdot\alpha_{(3\Phi\text{-semi})}\right)}{2}\right)\right)^{0.5}\right)$$

$$14.0231\text{V} = \sqrt{3}\cdot 22.7\text{V}\cdot\left(\left(\frac{3}{4\cdot\pi}\right)\cdot\left(\pi-70.3^\circ+\left(\frac{\sin\left(2\cdot 70.3^\circ\right)}{2}\right)\right)^{0.5}\right)$$

15) RMS Output Voltage of Single Phase Full Converter

Open Calculator

fx $$V_{rms(full)} = \frac{V_{m(full)}}{\sqrt{2}}$$

ex $$154.8564V = \frac{219V}{\sqrt{2}}$$

16) RMS Output Voltage of Single Phase Semi-Converter with Highly Inductive Load

Open Calculator

fx $$V_{rms(semi)} = \left(\frac{V_{m(semi)}}{2^{0.5}}\right) \cdot \left(\frac{180 - \alpha_{(semi)}}{180} + \left(\frac{0.5}{\pi}\right) \cdot \sin\left(2 \cdot \alpha_{(semi)}\right)\right)^{0.5}$$

ex $$16.87107V = \left(\frac{22.8V}{2^{0.5}}\right) \cdot \left(\frac{180 - 70.1^\circ}{180} + \left(\frac{0.5}{\pi}\right) \cdot \sin(2 \cdot 70.1^\circ)\right)^{0.5}$$

17) RMS Output Voltage of Single Phase Thyristor Converter with Resistive Load

Open Calculator

fx $$V_{rms(thy)} = \left(\frac{V_{in(thy)}}{2}\right) \cdot \left(\frac{180 - \alpha_{d(thy)}}{180} + \left(\frac{0.5}{\pi}\right) \cdot \sin\left(2 \cdot \alpha_{d(thy)}\right)\right)^{0.5}$$

ex $$6.27751V = \left(\frac{12V}{2}\right) \cdot \left(\frac{180 - 70.2^\circ}{180} + \left(\frac{0.5}{\pi}\right) \cdot \sin(2 \cdot 70.2^\circ)\right)^{0.5}$$

18) RMS Output Voltage of Three-Phase Full Converter

Open Calculator

fx $$V_{rms(3\Phi\text{-full})} = \left((6)^{0.5}\right) \cdot V_{in(3\Phi\text{-full})} \cdot \left(\left(0.25 + 0.65 \cdot \frac{\cos\left(2 \cdot \alpha_{d(3\Phi\text{-full})}\right)}{\pi}\right)^{0.5}\right)$$

ex $$163.0118V = \left((6)^{0.5}\right) \cdot 220V \cdot \left(\left(0.25 + 0.65 \cdot \frac{\cos(2 \cdot 70^\circ)}{\pi}\right)^{0.5}\right)$$

19) RMS Supply Current for PWM Control

Open Calculator

fx $$I_{rms} = \frac{I_a}{\sqrt{\pi}} \cdot \sqrt{\sum(x, 1, p, (\beta_k - \alpha_k))}$$

ex $$1.555635A = \frac{2.2A}{\sqrt{\pi}} \cdot \sqrt{\sum(x, 1, 3, (60.0^\circ - 30^\circ))}$$

Variables Used

- E_{dc} Average Output Voltage of PWM Controlled Converter *(Volt)*
- E_m Peak Input Voltage of PWM Converter *(Volt)*
- I_a Armature Current *(Ampere)*
- $I_{L(3\Phi\text{-semi})}$ Load Current 3 Phase Semi Converter *(Ampere)*
- I_n RMS nth Harmonic Current *(Ampere)*
- I_{rms} Root Mean Square Current *(Ampere)*
- $I_{S(fund)}$ Fundamental Supply Current *(Ampere)*
- **n** Harmonic Order
- **p** Number of Pulse in Half-cycle of PWM
- $R_{3\Phi\text{-semi}}$ Resistance 3 Phase Semi Converter *(Ohm)*
- $V_{avg(3\Phi\text{-full})}$ Average Voltage 3 Phase Full Converter *(Volt)*
- $V_{avg(3\Phi\text{-half})}$ Average Voltage 3 Phase Half Converter *(Volt)*
- $V_{avg(3\Phi\text{-semi})}$ Average Voltage 3 Phase Semi Converter *(Volt)*
- $V_{avg(semi)}$ Average Voltage Semi Converter *(Volt)*
- $V_{avg(thy)}$ Average Voltage Thyristor Converter *(Volt)*
- $V_{avg\text{-}dc(full)}$ Average Voltage Full Converter *(Volt)*
- $V_{in(3\Phi\text{-full})}$ Peak Input Voltage 3 Phase Full Converter *(Volt)*
- $V_{in(3\Phi\text{-half})i}$ Peak Input Voltage 3 Phase Half Converter *(Volt)*
- $V_{in(3\Phi\text{-semi})}$ Peak Input Voltage 3 Phase Semi Converter *(Volt)*
- $V_{in(dual)}$ Peak Input Voltage Dual Converter *(Volt)*
- $V_{in(thy)}$ Peak Input Voltage Thyristor Converter *(Volt)*
- $V_{m(3\Phi\text{-full})}$ Peak Phase Voltage Full Converter *(Volt)*
- $V_{m(3\Phi\text{-half})}$ Peak Phase Voltage *(Volt)*
- $V_{m(full)}$ Maximum Input Voltage Full Converter *(Volt)*
- $V_{m(semi)}$ Maximum Input Voltage Semi Converter *(Volt)*
- $V_{m\text{-}dc(full)}$ Maximum DC Output Voltage Full Converter *(Volt)*
- $V_{out(first)}$ DC Output Voltage First Converter *(Volt)*
- $V_{out(second)}$ DC Output Voltage Second Converter *(Volt)*
- $V_{rms(3\Phi\text{-full})}$ RMS Output Voltage 3 Phase Full Converter *(Volt)*
- $V_{rms(3\Phi\text{-half})}$ RMS Output Voltage 3 Phase Half Converter *(Volt)*
- $V_{rms(3\Phi\text{-semi})}$ RMS Output Voltage 3 Phase Semi Converter *(Volt)*
- $V_{rms(full)}$ RMS Output Voltage Full Converter *(Volt)*

- $V_{rms(semi)}$ RMS Output Voltage Semi Converter *(Volt)*
- $V_{rms(thy)}$ RMS Voltage Thyristor Converter *(Volt)*
- $\alpha_{(3\Phi\text{-semi})}$ Delay Angle of 3 Phase Semi Converter *(Degree)*
- $\alpha_{(semi)}$ Delay Angle Semi Converter *(Degree)*
- $\alpha_{1(dual)}$ Delay Angle of First Converter *(Degree)*
- $\alpha_{2(dual)}$ Delay Angle of Second Converter *(Degree)*
- $\alpha_{d(3\Phi\text{-full})}$ Delay Angle of 3 Phase Full Converter *(Degree)*
- $\alpha_{d(3\Phi\text{-half})}$ Delay Angle of 3 Phase Half Converter *(Degree)*
- $\alpha_{d(thy)}$ Delay Angle of Thyristor Converter *(Degree)*
- α_{full} Firing Angle Full Converter *(Degree)*
- α_k Excitation Angle *(Degree)*
- β_k Symmetrical Angle *(Degree)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Function: **cos**, cos(Angle)
  Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.
- 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: **sum**, sum(i, from, to, expr)
  Summation or sigma (∑) notation is a method used to write out a long sum in a concise way.
- Measurement: **Electric Current** in Ampere (A)
  Electric Current Unit Conversion
- Measurement: **Angle** in Degree (°)
  Angle Unit Conversion
- Measurement: **Electric Resistance** in Ohm (Ω)
  Electric Resistance Unit Conversion
- Measurement: **Electric Potential** in Volt (V)
  Electric Potential Unit Conversion

Check other formula lists

- **Power Converter Characteristics Formulas**

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