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Inverters Formulas

Calculators! Examples! Conversions!

List of 15 Inverters Formulas

Inverters

Series Resonant Inverter

1) Maximum Output Frequency for Bidirectional Switches

Open Calculator

fx $$f_m = \frac{1}{2 \cdot t_{off}}$$

ex $$0.25\text{Hz} = \frac{1}{2 \cdot 2\text{s}}$$

2) Maximum Output Frequency for Unidirectional Switches

Open Calculator

fx $$f_m = \frac{1}{2 \cdot \left(t_{off} + \left(\frac{\pi}{f_o}\right)\right)}$$

ex $$0.234643\text{Hz} = \frac{1}{2 \cdot \left(2\text{s} + \left(\frac{\pi}{24\text{Hz}}\right)\right)}$$

3) Resonant Frequency for Unidirectional Switches

Open Calculator

fx $$f_o = \left(\left(\frac{1}{L \cdot C}\right) + \left(\frac{R^2}{4 \cdot L^2}\right)\right)^{0.5}$$

ex $$23.86868\text{Hz} = \left(\left(\frac{1}{0.57\text{H} \cdot 0.2\text{F}}\right) + \left(\frac{(27\Omega)^2}{4 \cdot (0.57\text{H})^2}\right)\right)^{0.5}$$

4) Time when Current becomes Maximum for Unidirectional Switches

Open Calculator

fx $$t_r = \left(\frac{1}{f_o}\right) \cdot a\tan\left(\frac{f_o \cdot 2 \cdot L}{R}\right)$$

ex $$0.033001\text{s} = \left(\frac{1}{24\text{Hz}}\right) \cdot a\tan\left(\frac{24\text{Hz} \cdot 2 \cdot 0.57\text{H}}{27\Omega}\right)$$

Single Phase Inverters

5) RMS Output Voltage for RL Load

Open Calculator

fx $$E_{rms} = \sqrt{\left(\frac{2}{\frac{T}{2}}\right) \cdot \int\left(\left(E^2\right), x, 0, \frac{T}{2}\right)}$$

ex $$296.9848\text{V} = \sqrt{\left(\frac{2}{\frac{1.148\text{s}}{2}}\right) \cdot \int\left(\left((210.0\text{V})^2\right), x, 0, \frac{1.148\text{s}}{2}\right)}$$

6) RMS Output Voltage for Single Phase Inverter

Open Calculator

fx $$V_{rms} = \frac{V_i}{2}$$

ex $$112.5V = \frac{225V}{2}$$

7) RMS Output Voltage for SPWM Inverter

Open Calculator

fx $$V_{o(rms)} = V_i \cdot \sqrt{\sum\left(x, 1, N_p, \left(\frac{P_m}{\pi}\right)\right)}$$

ex $$209.3592V = 225V \cdot \sqrt{\sum\left(x, 1, 4, \left(\frac{0.68s}{\pi}\right)\right)}$$

8) RMS Value of Fundamental Component of Voltage for Full Bridge

Open Calculator

fx $$V_{0(full)} = 0.9 \cdot V_i$$

ex $$202.5V = 0.9 \cdot 225V$$

9) RMS Value of Fundamental Component of Voltage for Half Bridge

Open Calculator

fx $$V_{0(half)} = 0.45 \cdot V_i$$

ex $$101.25V = 0.45 \cdot 225V$$

Three Phase Inverters

10) Average Transistor Current Rating

Open Calculator

fx $$I_{avg} = \left(\frac{1}{2\cdot\pi}\right)\cdot\int\left(\frac{V_i}{2\cdot R}, x, 0, \frac{2\cdot\pi}{3}\right)$$

ex $$1.388889A = \left(\frac{1}{2\cdot\pi}\right)\cdot\int\left(\frac{225V}{2\cdot 27\Omega}, x, 0, \frac{2\cdot\pi}{3}\right)$$

11) Line to Line RMS Voltage for SPWM Inverter

Open Calculator

fx $$V_{LL} = \sqrt{\left(\frac{2}{\pi}\right)\cdot\int\left(\left(V_i^2\right), x, 0, \left(\frac{2\cdot\pi}{3}\right)\right)}$$

ex $$259.8076V = \sqrt{\left(\frac{2}{\pi}\right)\cdot\int\left(\left((225V)^2\right), x, 0, \left(\frac{2\cdot\pi}{3}\right)\right)}$$

12) Line-to-Line RMS Voltage

Open Calculator

fx $$V_{ll} = 0.8165\cdot V_i$$

ex $$183.7125V = 0.8165\cdot 225V$$

13) Line-to-Neutral Voltage

Open Calculator

fx $$V_{ln} = 0.4714\cdot V_i$$

ex $$106.065V = 0.4714\cdot 225V$$

14) RMS of Fundamental Component of Line-to-Line Voltage

Open Calculator

fx $$V_{0(3rms)} = 0.7797 \cdot V_i$$

ex $$175.4325\text{V} = 0.7797 \cdot 225\text{V}$$

15) RMS Transistor Current Rating

Open Calculator

fx $$I_{rms} = \sqrt{\left(\frac{1}{2 \cdot \pi}\right) \cdot \int\left(\left(\frac{V_i}{2 \cdot R}\right)^2, x, 0, \left(\frac{2 \cdot \pi}{3}\right)\right)}$$

ex $$2.405626\text{A} = \sqrt{\left(\frac{1}{2 \cdot \pi}\right) \cdot \int\left(\left(\frac{225\text{V}}{2 \cdot 27\Omega}\right)^2, x, 0, \left(\frac{2 \cdot \pi}{3}\right)\right)}$$

Variables Used

- **C** Capacitance *(Farad)*
- **E** Input Voltage for RL Load *(Volt)*
- E_{rms} RMS Output Voltage For RL Load *(Volt)*
- f_m Peak Frequency *(Hertz)*
- f_o Resonant Frequency *(Hertz)*
- I_{avg} Average Transistor Current Rating *(Ampere)*
- I_{rms} RMS Transistor Current Rating *(Ampere)*
- **L** Inductance *(Henry)*
- N_p Number of Pulse in Half-cycle
- P_m Pulse Width *(Second)*
- **R** Resistance *(Ohm)*
- **T** Time Period *(Second)*
- t_{off} Off Time of Thyristor *(Second)*
- t_r Time *(Second)*
- $V_{0(3rms)}$ Fundamental Component RMS Voltage *(Volt)*
- $V_{0(full)}$ Fundamental Component Voltage Full Wave *(Volt)*
- $V_{0(half)}$ Fundamental Component Voltage Half Wave *(Volt)*
- V_i Input Voltage *(Volt)*
- V_{ll} Line to Line RMS Output Voltage *(Volt)*
- V_{LL} Line to Line RMS Output Voltage of SPWM Inverter *(Volt)*
- V_{ln} Line to Neutral Voltage *(Volt)*

- **$V_{o(rms)}$** RMS Output Voltage of SPWM Inverter *(Volt)*
- **V_{rms}** RMS Output Voltage *(Volt)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Function: **atan**, atan(Number)
  Inverse tan is used to calculate the angle by applying the tangent ratio of the angle, which is the opposite side divided by the adjacent side of the right triangle.
- Function: **int**, int(expr, arg, from, to)
  The definite integral can be used to calculate net signed area, which is the area above the x -axis minus the area below the x -axis.
- 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.
- Function: **tan**, tan(Angle)
  The tangent of an angle is a trigonometric ratio of the length of the side opposite an angle to the length of the side adjacent to an angle in a right triangle.
- Measurement: **Time** in Second (s)
  Time Unit Conversion
- Measurement: **Electric Current** in Ampere (A)
  Electric Current Unit Conversion
- Measurement: **Frequency** in Hertz (Hz)
  Frequency Unit Conversion
- Measurement: **Capacitance** in Farad (F)
  Capacitance 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

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