Important Inverters Formulas PDF

Formulas
Examples
with Units

List of 15
Important Inverters Formulas

1) Series Resonant Inverter Formulas

1.1) Maximum Output Frequency for Bidirectional Switches Formula

Evaluate Formula

Formula

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

Example with Units

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

1.2) Maximum Output Frequency for Unidirectional Switches Formula

Evaluate Formula

Formula

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

Example with Units

$$0.2346\,\text{Hz} = \frac{1}{2 \cdot \left(2\,\text{s} + \left(\frac{3.1416}{24\,\text{Hz}} \right) \right)}$$

1.3) Resonant Frequency for Unidirectional Switches Formula

Evaluate Formula

Formula

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

Example with Units

$$23.8687\,\text{Hz} = \left(\left(\frac{1}{0.57\,\text{H} \cdot 0.2\,\text{F}} \right) + \left(\frac{27\,\Omega^2}{4 \cdot 0.57\,\text{H}^2} \right) \right)^{0.5}$$

1.4) Time when Current becomes Maximum for Unidirectional Switches Formula

Evaluate Formula

Formula

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

Example with Units

$$0.033\,\text{s} = \left(\frac{1}{24\,\text{Hz}} \right) \cdot atan\left(\frac{24\,\text{Hz} \cdot 2 \cdot 0.57\,\text{H}}{27\,\Omega} \right)$$

2) Single Phase Inverters Formulas

2.1) RMS Output Voltage for RL Load Formula

Evaluate Formula

Formula

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

Example with Units

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

2.2) RMS Output Voltage for Single Phase Inverter Formula

Evaluate Formula

Formula

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

Example with Units

$$112.5\,\text{v} = \frac{225\,\text{v}}{2}$$

2.3) RMS Output Voltage for SPWM Inverter Formula

Evaluate Formula

Formula

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

Example with Units

$$209.3592\,\text{v} = 225\,\text{v} \cdot \sqrt{\sum\left(x, 1, 4, \left(\frac{0.68\,\text{s}}{3.1416}\right)\right)}$$

2.4) RMS Value of Fundamental Component of Voltage for Full Bridge Formula

Evaluate Formula

Formula

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

Example with Units

$$202.5\,\text{v} = 0.9 \cdot 225\,\text{v}$$

2.5) RMS Value of Fundamental Component of Voltage for Half Bridge Formula

Evaluate Formula

Formula

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

Example with Units

$$101.25\,\text{v} = 0.45 \cdot 225\,\text{v}$$

3) Three Phase Inverters Formulas

3.1) Average Transistor Current Rating Formula

Evaluate Formula

Formula

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

Example with Units

$$1.3889\,\text{A} = \left(\frac{1}{2 \cdot 3.1416}\right) \cdot \int\left(\frac{225\,\text{V}}{2 \cdot 27\,\Omega}, x, 0, \frac{2 \cdot 3.1416}{3}\right)$$

3.2) Line to Line RMS Voltage for SPWM Inverter Formula

Evaluate Formula

Formula

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

Example with Units

$$259.8076\,\text{V} = \sqrt{\left(\frac{2}{3.1416}\right) \cdot \int\left(\left(225\,\text{V}^{\,2}\right), x, 0, \left(\frac{2 \cdot 3.1416}{3}\right)\right)}$$

3.3) Line-to-Line RMS Voltage Formula

Evaluate Formula

Formula

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

Example with Units

$$183.7125\,\text{V} = 0.8165 \cdot 225\,\text{V}$$

3.4) Line-to-Neutral Voltage Formula

Evaluate Formula

Formula

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

Example with Units

$$106.065\,\text{V} = 0.4714 \cdot 225\,\text{V}$$

3.5) RMS of Fundamental Component of Line-to-Line Voltage Formula

Evaluate Formula

Formula

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

Example with Units

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

3.6) RMS Transistor Current Rating Formula

Evaluate Formula

Formula

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

Example with Units

$$2.4056\,\text{A} = \sqrt{\left(\frac{1}{2 \cdot 3.1416}\right) \cdot \int\left(\left(\frac{225\,\text{V}}{2 \cdot 27\,\Omega}\right)^2, x, 0, \left(\frac{2 \cdot 3.1416}{3}\right)\right)}$$

Variables used in list of Inverters Formulas above

- **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 in list of Inverters Formulas above

- constant(s): **pi**, 3.14159265358979323846264338327950288 *Archimedes' constant*
- Functions: **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.*
- Functions: **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.*
- 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.*
- Functions: **sum**, sum(i, from, to, expr) *Summation or sigma (∑) notation is a method used to write out a long sum in a concise way.*
- Functions: **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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