Inverters Formulas... 1/11





Inverters Formulas

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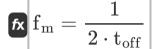


List of 15 Inverters Formulas

Inverters 🗗

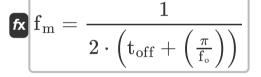
Series Resonant Inverter

1) Maximum Output Frequency for Bidirectional Switches



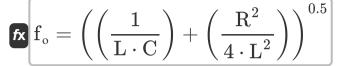
Open Calculator

2) Maximum Output Frequency for Unidirectional Switches 🗗



$$oxed{\mathbf{ex}} 0.234643 \mathrm{Hz} = rac{1}{2 \cdot \left(2 \mathrm{s} + \left(rac{\pi}{24 \mathrm{Hz}}
ight)
ight)}$$

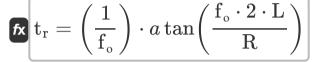
3) Resonant Frequency for Unidirectional Switches



Open Calculator 🗗

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

4) Time when Current becomes Maximum for Unidirectional Switches

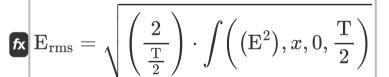


Open Calculator

 $oldsymbol{\mathsf{ex}} 0.033001 \mathrm{s} = \left(rac{1}{24 \mathrm{Hz}}
ight) \cdot a an \left(rac{24 \mathrm{Hz} \cdot 2 \cdot 0.57 \mathrm{H}}{27 \Omega}
ight)$

Single Phase Inverters &

5) RMS Output Voltage for RL Load

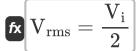


Open Calculator 🗗

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



6) RMS Output Voltage for Single Phase Inverter



Open Calculator

$$\boxed{\textbf{ex}} \ 112.5 \text{V} = \frac{225 \text{V}}{2}$$

7) RMS Output Voltage for SPWM Inverter



Open Calculator

$$oxed{ex} 209.3592 \mathrm{V} = 225 \mathrm{V} \cdot \sqrt{\sum \left(x, 1, 4, \left(rac{0.68 \mathrm{s}}{\pi}
ight)
ight)}$$

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

fx
$$\left[\mathrm{V}_{0(\mathrm{full})} = 0.9 \cdot \mathrm{V_i}
ight]$$

Open Calculator

$$\texttt{ex} \ 202.5 \text{V} = 0.9 \cdot 225 \text{V}$$

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

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

ex
$$101.25 \mathrm{V} = 0.45 \cdot 225 \mathrm{V}$$



Three Phase Inverters

10) Average Transistor Current Rating

$$\mathbf{I}_{ ext{avg}} = \left(rac{1}{2\cdot\pi}
ight)\cdot\int\!\left(rac{\mathrm{V_i}}{2\cdot\mathrm{R}},x,0,rac{2\cdot\pi}{3}
ight)$$

Open Calculator 🚰

ex
$$1.38889\mathrm{A} = \left(rac{1}{2\cdot\pi}
ight)\cdot\int\!\left(rac{225\mathrm{V}}{2\cdot27\Omega},x,0,rac{2\cdot\pi}{3}
ight)$$

11) Line to Line RMS Voltage for SPWM Inverter

$$extbf{V}_{ ext{LL}} = \sqrt{\left(rac{2}{\pi}
ight) \cdot \int \left(\left(ext{V}_{ ext{i}}^2
ight), x, 0, \left(rac{2 \cdot \pi}{3}
ight)
ight)}$$

Open Calculator 🗗

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

12) Line-to-Line RMS Voltage

fx
$$V_{
m ll} = 0.8165 \cdot V_{
m i}$$

Open Calculator 🗗

$$\texttt{ex} \ 183.7125 \text{V} = 0.8165 \cdot 225 \text{V}$$

13) Line-to-Neutral Voltage

$$V_{
m ln} = 0.4714 \cdot V_{
m i}$$

$$\texttt{ex} \ 106.065 \text{V} = 0.4714 \cdot 225 \text{V}$$





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

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

Open Calculator

15) RMS Transistor Current Rating

fx

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

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



Inverters Formulas... 7/11

Variables Used

- C Capacitance (Farad)
- **E** Input Voltage for RL Load (Volt)
- Erms RMS Output Voltage For RL Load (Volt)
- **f**_m Peak Frequency (Hertz)
- **f** Resonant Frequency (Hertz)
- I_{avq} 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_{II} Line to Line RMS Output Voltage (Volt)
- VII Line to Line RMS Output Voltage of SPWM Inverter (Volt)
- V_{In} Line to Neutral Voltage (Volt)





Inverters Formulas... 8/11

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

• V_{rms} RMS Output Voltage (Volt)





Inverters Formulas... 9/11

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





Inverters Formulas... 10/11

• 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





Inverters Formulas... 11/11

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