MIRACLE®

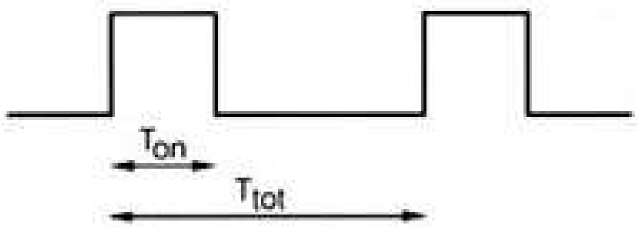
TECHNICAL DATA

Regulation & Temperature Rise

DUTY CYCLE

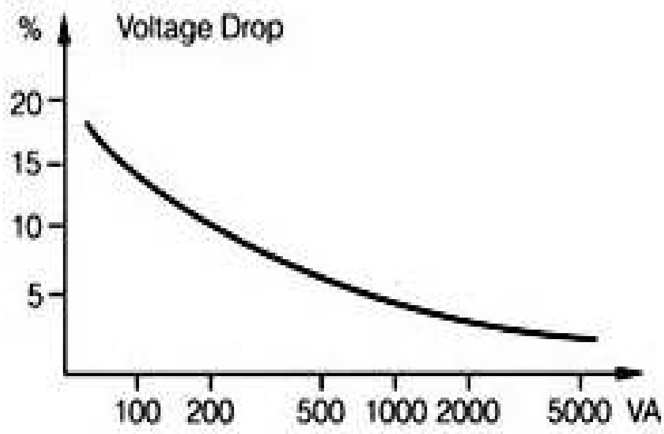
A smaller transformer can be used when the load is intermittent and the duty cycle is much shorter than the thermal time constant of the transformer (which is several hours). The power rating of the transformer is calculated as:

$$P_{nom} = P_{load} \sqrt{T_{on}/T_{tot}}$$



VOLTAGE REGULATION

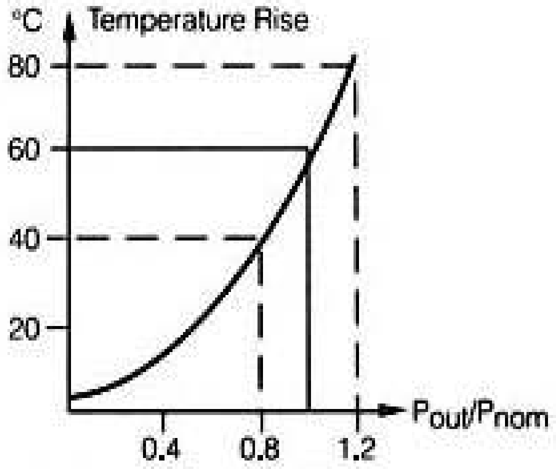
The output voltage from the toroidal transformer increases slightly at partial load. By using larger diameter wire or a larger core, the voltage drop can be reduced and the regulation improved.



TEMPERATURE RISE

POWERTRONIX transformers are designed for a temperature rise of 60 degrees Celsius above ambient temperature at full load. At lower output power, the temperature rise decreases significantly.

MIRACLE®



If required, we can provide the toroidal transformer with a thermal protector, which automatically turns off the transformer at a set temperature.

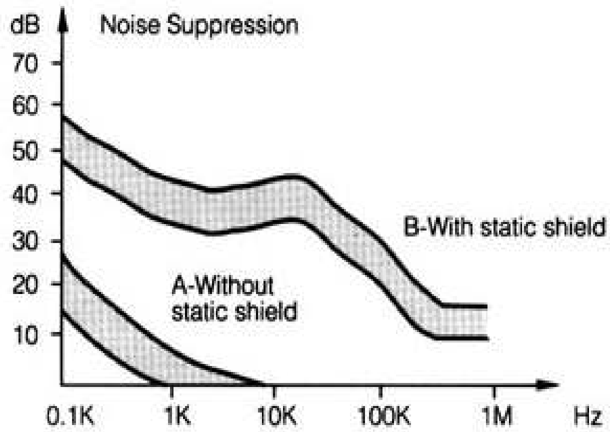
Insulation & Shielding

INSULATION SYSTEMS

POWERTRONIX Toroidal Transformers are constructed with reinforced insulation and withstand 4,000 V RMS for 1 minute. Minimum creepage distance is 8 mm.

STATIC SHIELDING

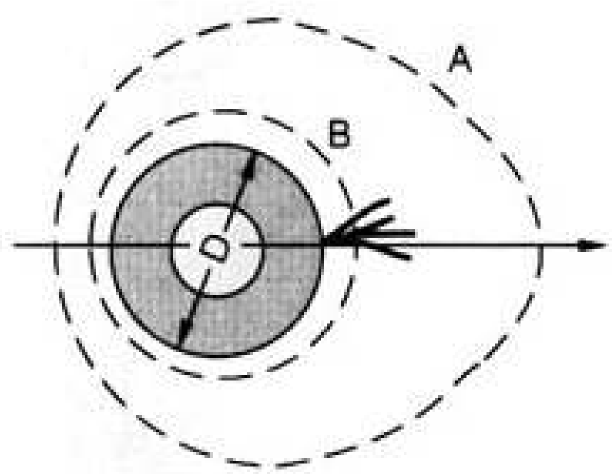
When the toroidal transformer is used in an extremely noisy environment, a static shield might be needed to reduce the capacitive coupling between the primary and secondary. The noise suppression decreases with larger core sizes.



The static shield consists of copperfoil laminated between polyester tape. Since the shield adds layers to the winding window in the transformer, a larger core size might be required.

LOW MAGNETIC STRAY FIELD

POWERTRONIX toroidals have a very low magnetic strayfield, with the primary and secondary windings uniformly wound around the entire core. For extremely sensitive applications the radiated field can be reduced further by winding a magnetic shield around the circumferenceof the transformer.

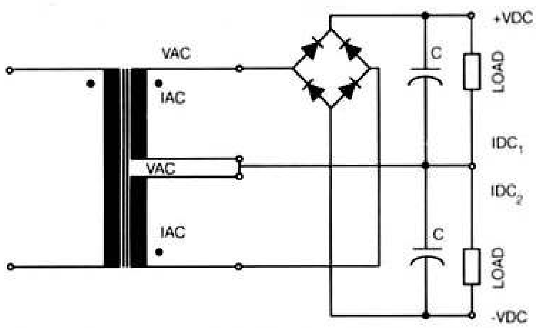


A - Without magnetic shield
B - With magnetic shield

Unregulated Linear Power Supplies

Unregulated Linear Power Supplies
Different rectifier circuits can be used when building unregulated linear power supplies. The most common circuits are shown below

1. Dual Complementary Rectifier

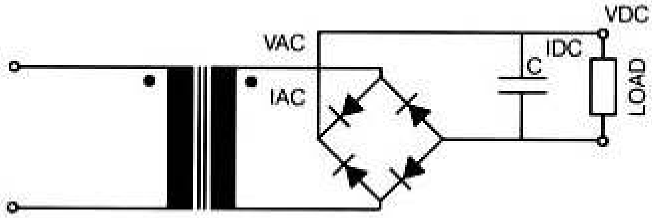


A dual complementary rectifier is the best choice, when a positive and negative DC output of the same voltage is required. The secondary windings are bifilar wound for precisely matched resistance, coupling and capacitance.

$$VAC = \frac{(VDC + 1.4)}{\sqrt{2}}$$

$$IAC = 1.8 \times \frac{\sqrt{IDC_1^2 + IDC_2^2}}{\sqrt{2}}$$

2. Full Wave Bridge

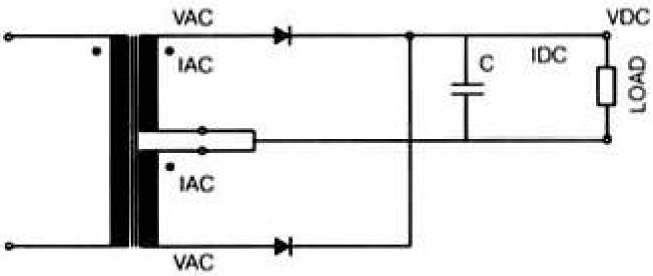


The full wave bridge rectifier is the most cost effective, since the entire transformer secondary is used on each half cycle and no center tap is required.

$$VAC = \frac{(VDC + 1.4)}{\sqrt{2}}$$

$$IAC = 1.8 \times IDC$$

3. Full Wave Center Tapped Circuits

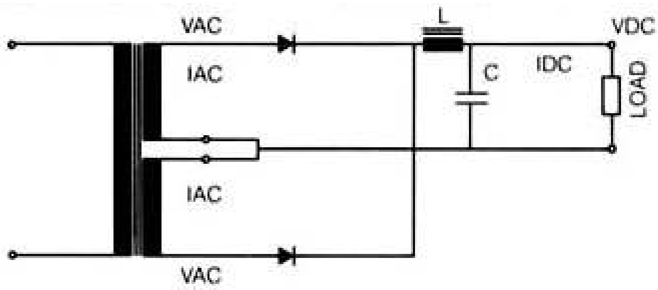


A full wave center tapped rectifier is commonly used in high current, low voltage applications, since there is only one voltage drop in the circuit. However, since only one secondary winding is used at a time, the power rating of the transformer has to be about 30% greater than for a full wave bridge transformer.

$$VAC = \frac{(VDC + 0.7)}{\sqrt{2}}$$

$$IAC = 1.27 \times IDC$$

4. Full Wave Center Tap With Choke Input



Choke input filters are commonly used in high current applications, since they reduce ripple and allow better utilization of the power capacity of the transformer.

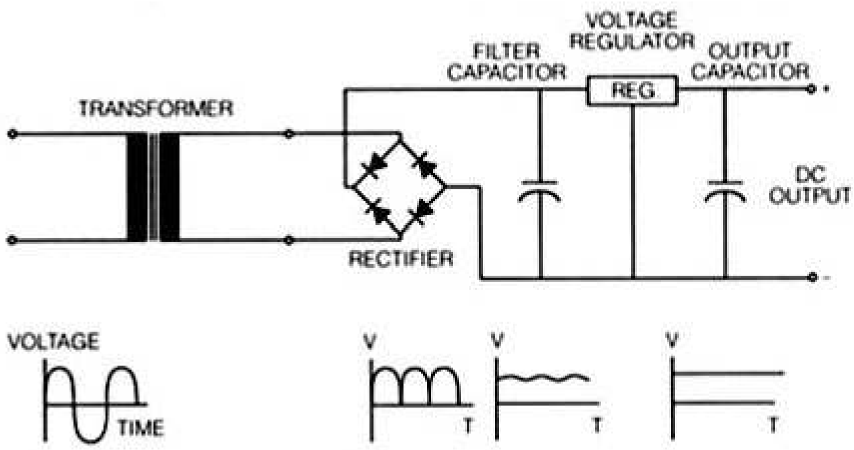
$$VAC = \frac{(VDC + 0.7)}{\sqrt{2}} + \omega L \times IDC$$

$$IAC = 0.7 \times IDC \qquad \omega = 2\pi f$$

$$L = \frac{VDC}{IDC}$$

Regulated Linear Power Supplies

Regulated linear power supplies are used to provide a constant output voltage for different loads and varying input voltage



HOW TO SPECIFY THE TRANSFORMER

A simplified formula to determine the AC voltage and current of the transformer is as follows:

$$VAC = \frac{Vdc + Vreg + Vrec + Vrip}{0.9} \times \frac{Vnom}{Vlow} \times \frac{1}{\sqrt{2}}$$

Vdc = Output DC voltage
Vreg = Voltage drop in the regulator = 3 Volt
Vrec = Voltage drop in the diodes = 0.7 Volt
Vrip = Ripple voltage = 10% of Vdc
Vnom = Nominal input voltage = 117 Volt
Vlow = Low line input voltage = 98 Volt
0.9 = Rectifier efficiency

The transformer AC voltage and current, when used in the various rectifier circuits, is calculated as shown below

Rectifier circuits	RMS voltages (V)	RMS curent (A)
Dual complimentary	VAC = 1.03VDC + 3.47	IAC = 1.8 X IDC
Full wave bridge	VAC = 1.03VDC + 4.13	IAC = 1.8 X IDC
Full wave center taped	VAC = 1.03VDC + 3.47	IAC = 1.3 X IDC