SWITCHING POWER SUPPLY TUTORIAL

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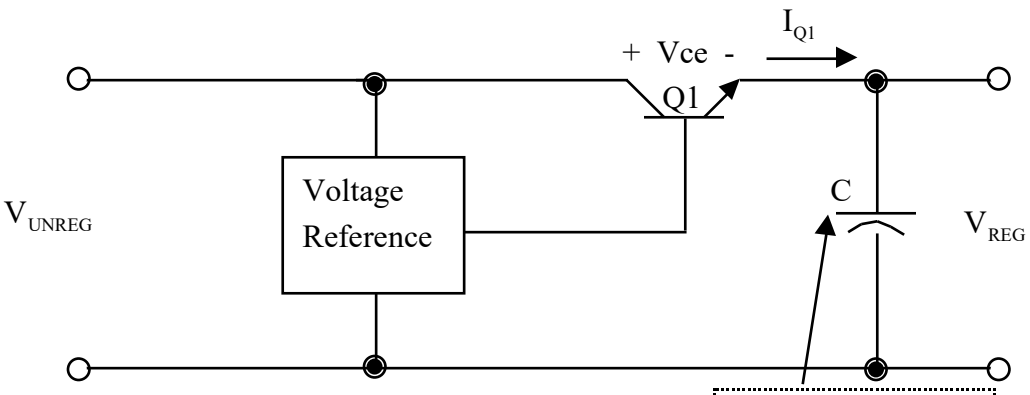
[Conventional Linear Pass-Transistor Supply]



Power Dissipation Calculation Model:

$$P_{Q1} = V_{ce} \times I_{Q1}$$

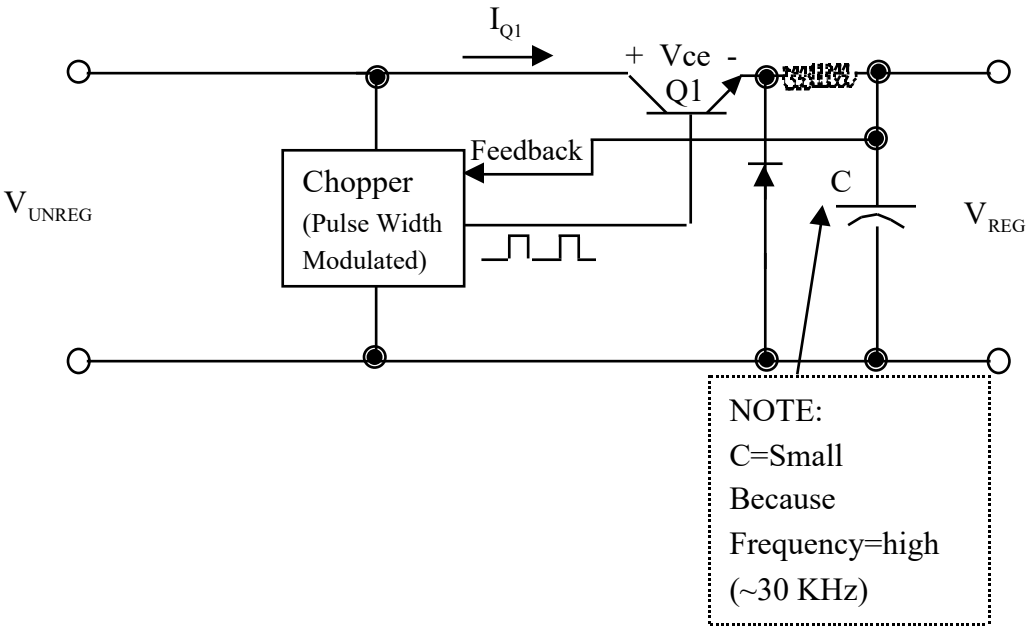
For the conditions: V_{UNREG} = 18 V; V_{REG} = 14 V; I_{Q1} = 1 A

$$P_{Q1} = (18V - 14V) \times (1A) = 4W$$

NOTES:

* An advantage of the pass-transistor supply is that it is simple in design, and easy to repair. This is a reliable design due to its simplicity and small number of parts.
* A disadvantage is that the unregulated voltage must not be very much higher than the regulated output voltage, or the power dissipation in the pass transistor becomes unacceptably large. This requires the use of a transformer on the input to bring the line voltage down to a value relatively close to the regulated output voltage. This design is therefore heavier and dissipates more power.

[Switch-Mode Power Supply]



For the conditions: V_{UNREG} = 18 V; V_{REG} = 14 V; I_{Q1} = 1 A

Since Q1 is chopped...
Vce ≈ 18 V @ 0 A -- (Q1 cutoff, therefore no power dissipated),
or Vce ≈ .5 V@ I_{Q1}(average) -- (Q1 saturated)

$$P_{Q1} = (.5V) \times (1A) = .5W$$

NOTES:
*Advantages are: 1) Runs cooler; 2) Is lighter due to no need for large transformers or inductors; 3) The unregulated voltage can be much higher than the regulated output voltage and the power dissipation still remains low. This design will operate over a very wide input voltage range.
* A disadvantage of the switch-mode power supply is that due to the chopper circuit, it might generate some RFI. This can be overcome by fully enclosing it in a grounded case, and with good input and output RF filtering.
* Another disadvantage is that this design has a larger number of parts, thus making it more complex to diagnose and repair problems, as well as having a lower reliability.