

Design a High Efficiency LED Power Supply Use CM6900+CM6807

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Introduction

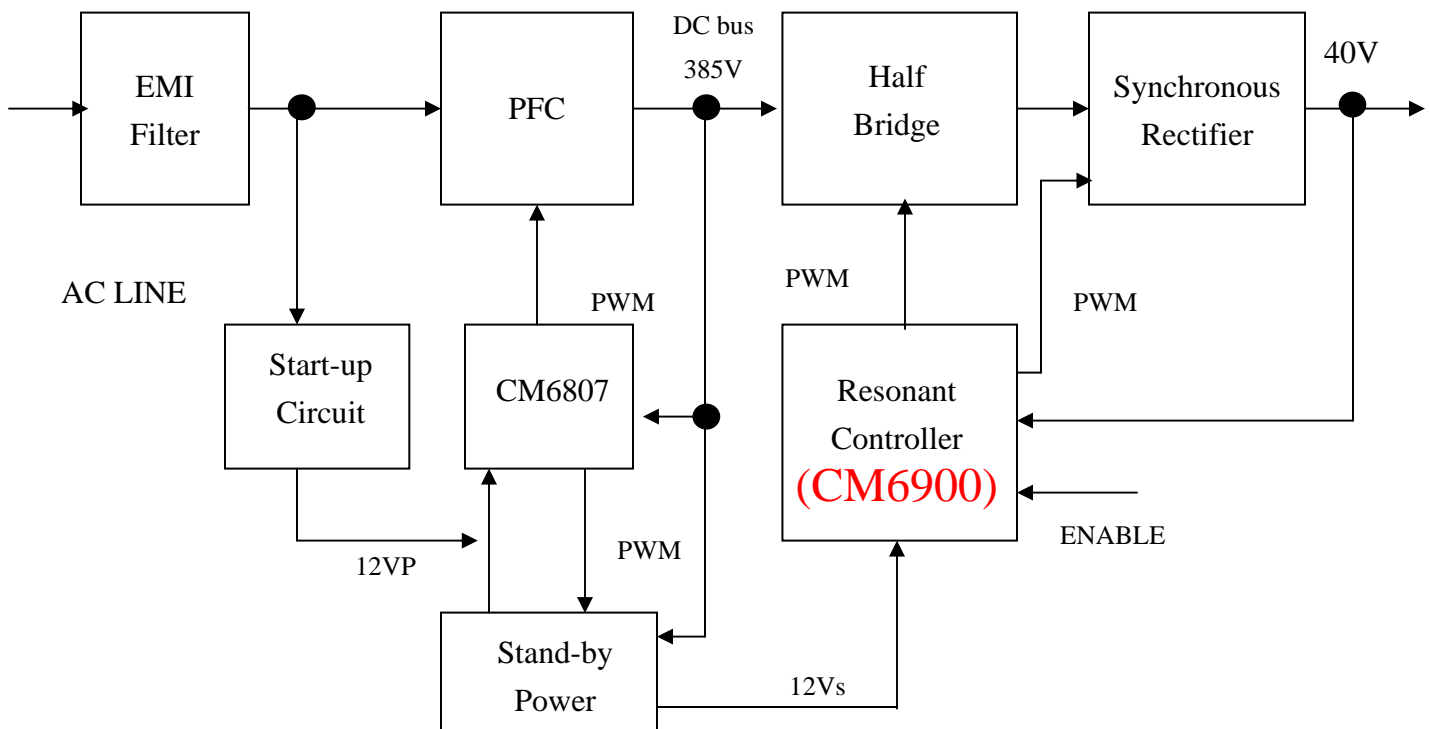
Recently, energy saving is becoming a very important topic due to the increasing seriousness of energy shortage problem and the rising demand for energy in developing industrial countries. Because of this, every country is paying close attention to new power source for lighting. Since existing lighting method mainly uses low illuminant CFL fluorescent tube, high illuminant LED became the spot of attention these few years. Applications for LED power supply differ from what were used traditionally. LED power supply is required to have high efficiency (greater than 88%) due to its high illuminant characteristic. In addition, LED lighting needs constant current mode control lighting; all LED lighting power applications require current mode control function to be added. Therefore, highly efficient power supply is very important when it comes to using LED lighting. Traditional PWM which uses switching power supply is no longer sufficient when such high efficiency is required.

Champion Microelectronic combines CM6900 resonant controller and CM6805/07 PFC series to provide a complete LED lighting power supply solution that is highly efficient (>88%), standby power (<0.5W), and constant voltage / constant current available. This solution targets to 100W – 1KW power supply, and can be used on LED lighting, street lamps, large LED display, and high voltage lighting for gym...etc. Because this solution provides high efficiency >88%, it can provide stable power source to the customers and cut down the maintenance cost. Also, the high efficiency can decrease the product temperature and prolongs the life of the lighting system.

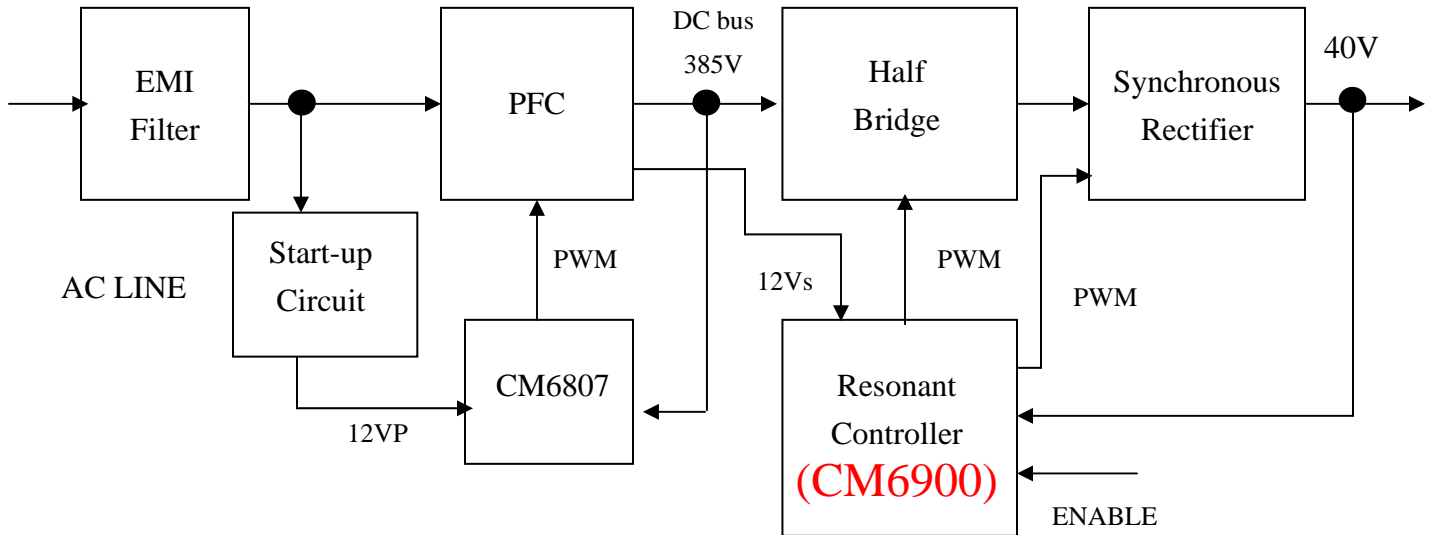
LED 350W Lighting System Specification

| Input Spec | Output Spec |
|--|--|
| 1. V_{in} : 85Vac~264Vac | 1. V_{out} : 39~44V |
| 2. I_{in} : 5A MAX. | 2. I_{out} : 4A~8A |
| 3. PF>0.95@230Vac Full Load | 3. Voltage Ripple Noise: 300mV |
| 4. Power Frequency 47-63Hz | 4. Current Ripple <0.1A |
| 5. Working Temperature 50°C | 5. Control mode: constant voltage / constant current |
| 6. Efficiency >91% @230Vac Full Load >90% @115Vac Full Load | |
| 7. Stand-by <0.5W <1W @0.35W Load | |
| 8. Heat Sink: no heat sink required | |
| 9. Working environment: airtight | |

1. LED Lighting 350W Power Supply Block Diagram (with STANDBY):

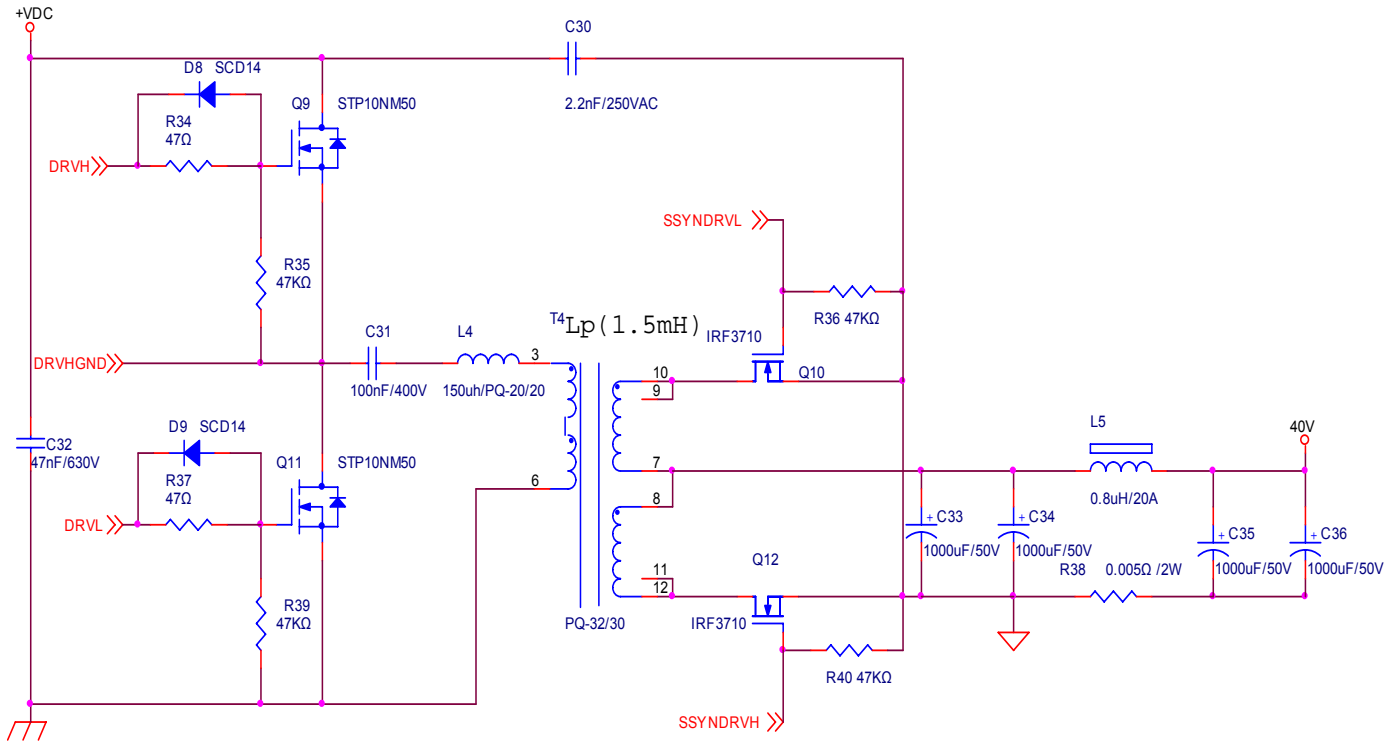


2. LED Lighting 350W Power Supply Block Diagram (without STANDBY):



Above two block diagrams are for applications that require / does not require Green Power. Designer can use according to its product spec. Below are more details on these two applications.

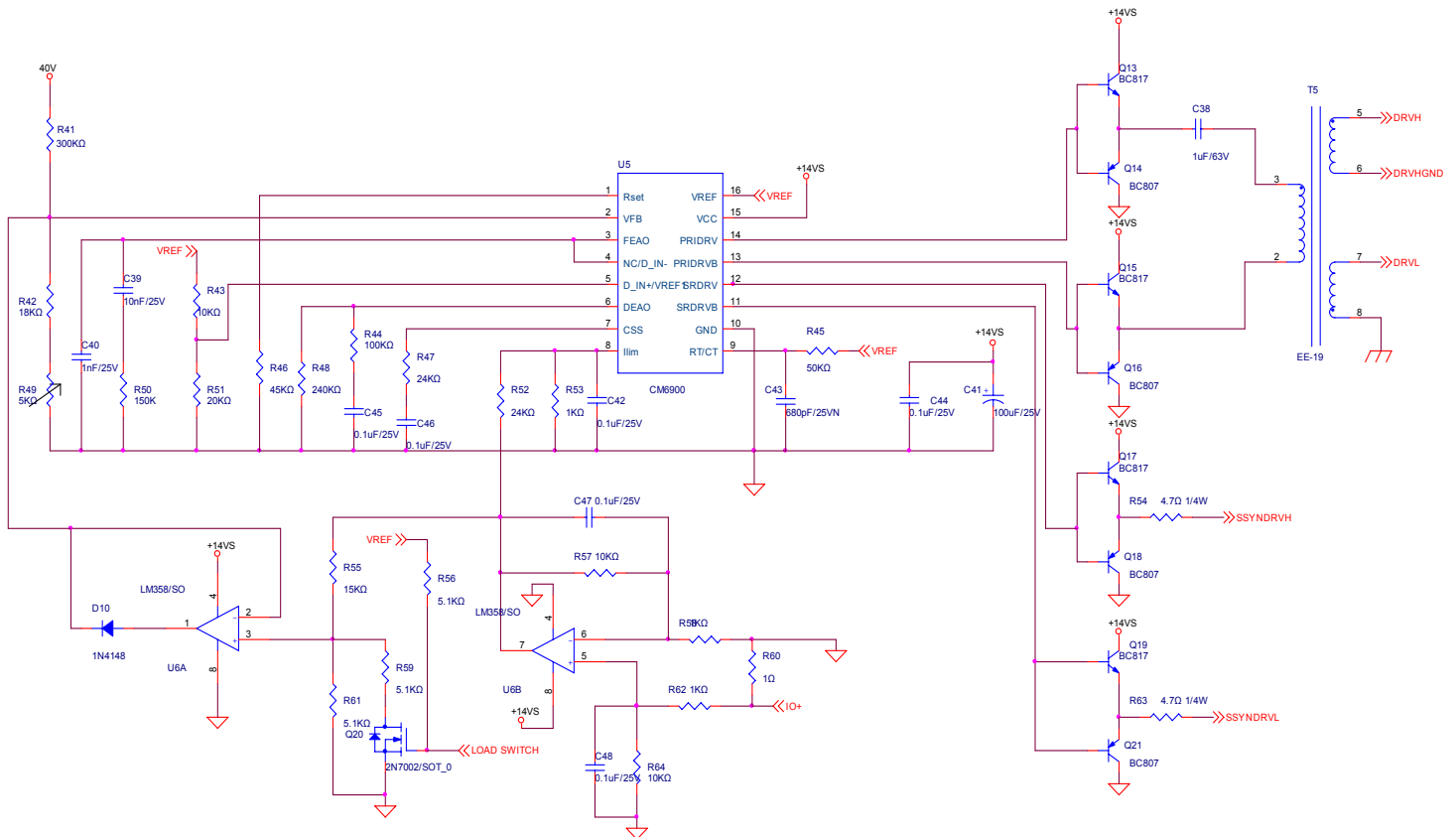
2. HB POWER STAGE



Circuit Explanation:

Above diagram is the main structure of DC/DC power supply for LED lighting. This is a SRC structure which uses synchronize rectifier to increase the efficiency of DC/DC. This structure can increase DC/DC efficiency to over 96%, which solves the industry problem of using LLC structure that only has efficiency lower than 92% and can not easily achieve synchronize rectification. After adopting SRC structure, synchronize rectification is easy to achieve and the main transformer efficiency gets better. By using CM6900, the original disadvantage of SRC is solved; therefore, SRC structure is the best choice for high efficiency requirements.

3. CM6900 CV/CC MODE CONTROLLER



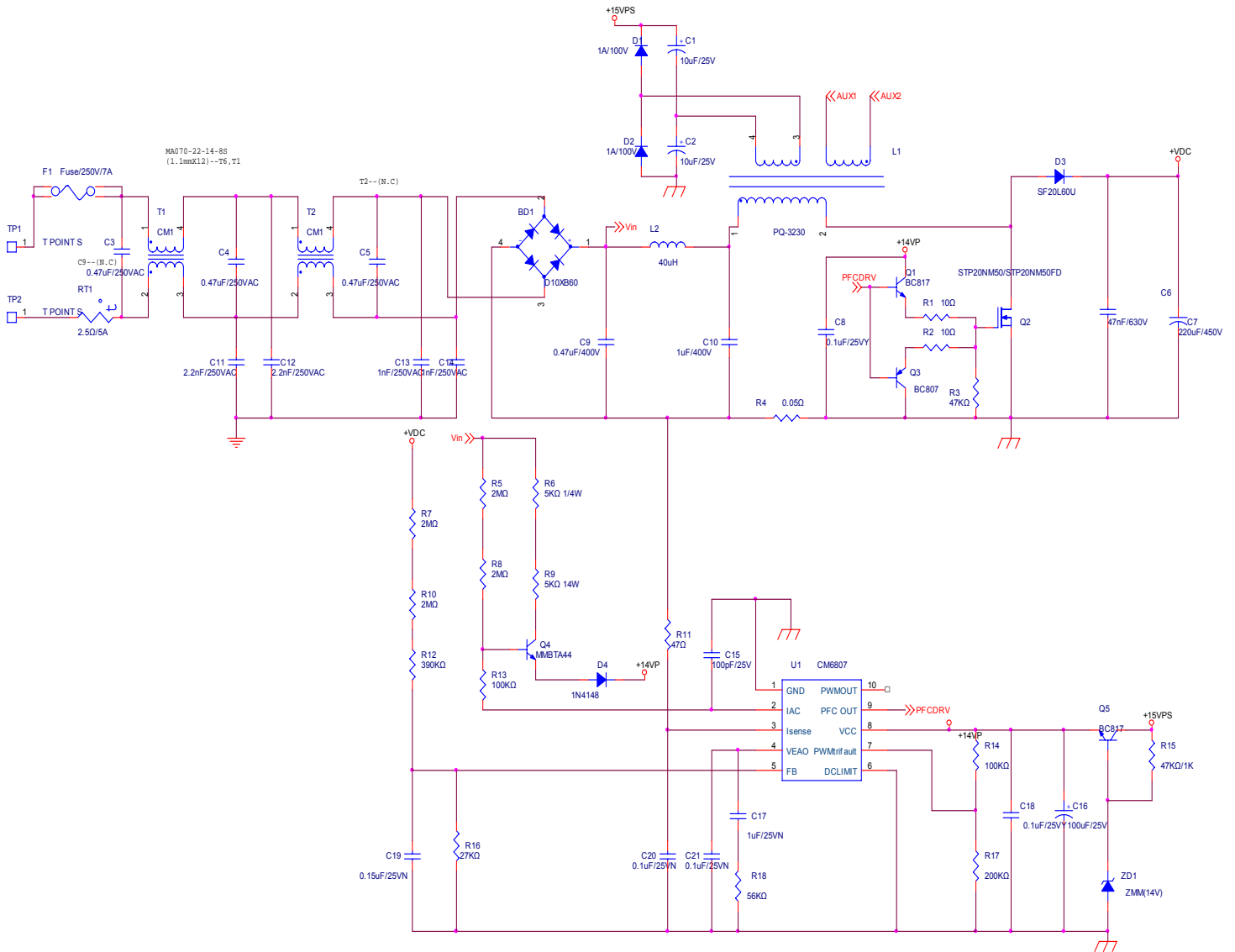
Circuit Explanation

Because of the high efficiency requirement of LED lighting power supply, there must be an appropriate controller IC for DC/DC that uses SRC structure. Champion Microelectronic CM6900 is the best choice as it has synchronize rectifier built internally. In addition, it has OVP/OCP soft start function and FM+PWM operating mode, it is very easy to use in applications requiring constant current / constant voltage mode.

The LM358 OPA is used for constant current mode feedback amplifier circuit. Adding this circuit allows CM6900 to be used in constant current mode.

二、Application Circuit Diagram (Without STANDBY Function)

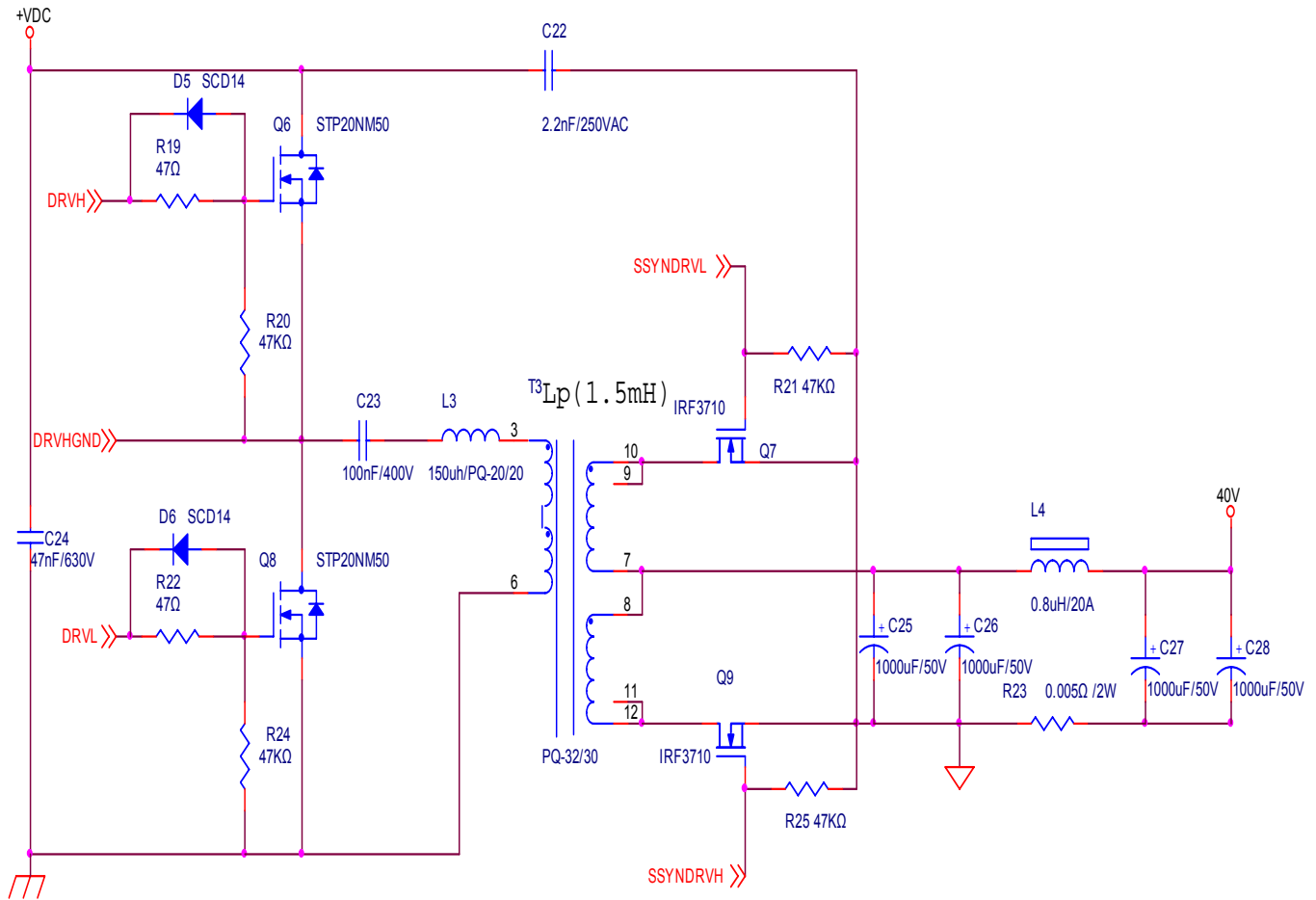
1. PFC+AUXPOWER Circuit



Circuit Explanation:

In the above diagram, PFC is achieved by using CM6807 and auxiliary power is achieved by using auxiliary winding on PFC Choke. The auxiliary power's voltage output is determined by the turns on the PFC Choke. The voltage is calculated to be ($15VP = PFC V_{dc} / N_{ratio}$).

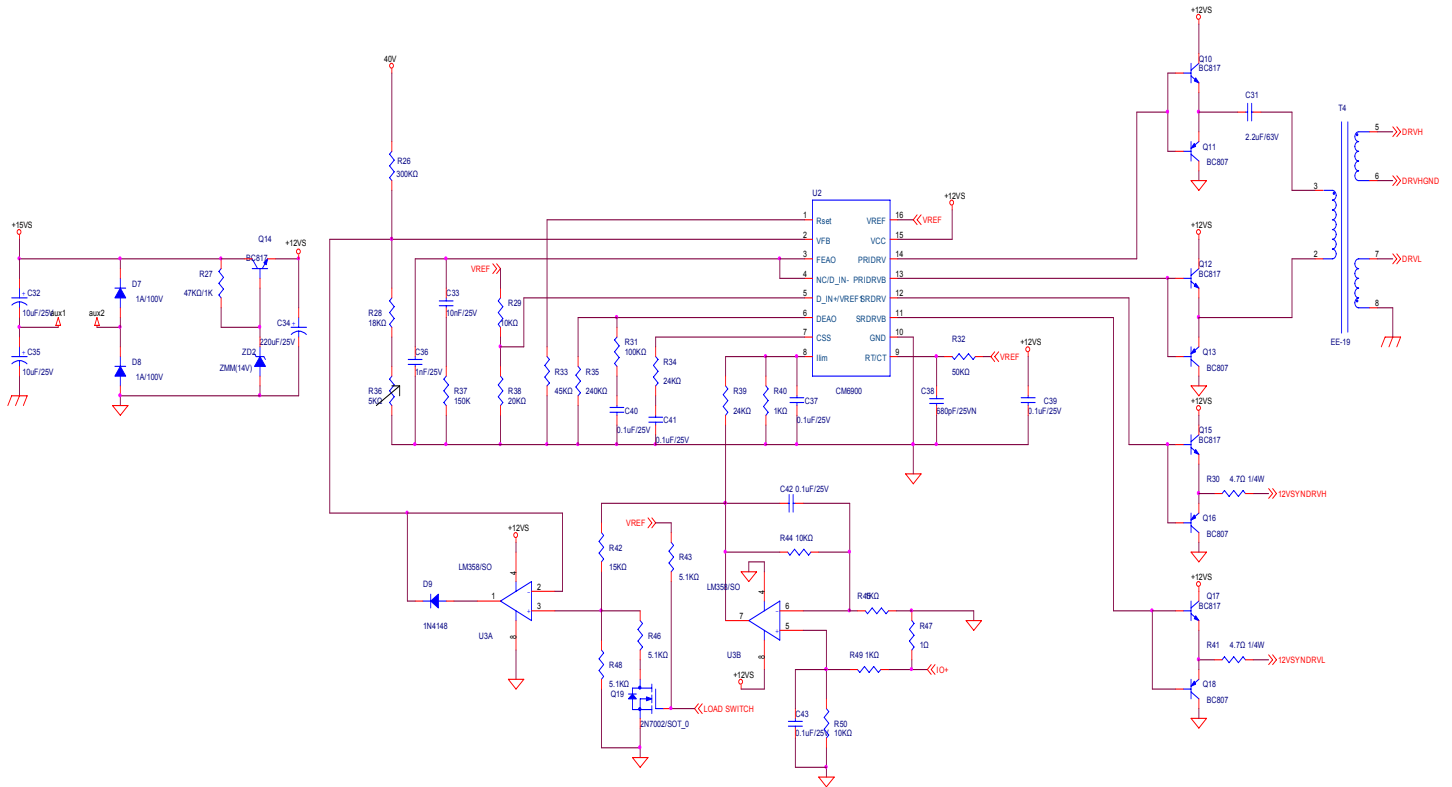
2. Half Bridge Efficiency



Circuit Explanation:

Above diagram shows the main structure of DC/DC power supply for LED lighting. This is a half bridge SRC structure, and it uses synchronize rectifier to improve the efficiency of DC/DC. This structure can increase DC/DC efficiency to over 96%, which solves the industry problem of using LLC structure that only has efficiency lower than 92% and can not easily achieve synchronize rectification. After adopting SRC structure, synchronize rectification is easily achieved and the main transformer efficiency gets better. By using CM6900, the original disadvantage of SRC is solved; therefore, SRC structure is the best choice for high efficiency requirements.

3. Control Circuit



Circuit Explanation:

Because of the high efficiency requirement of LED lighting power supply, there must be an appropriate controller IC for DC/DC that uses SRC structure. Champion Microelectronic CM6900 is the best choice as it has synchronized rectifier built internally. In addition, it has OVP/OCP soft start function and FM+PWM operating mode, it is very easy to use in applications requiring constant current / constant voltage mode.

The LM358 OPA shown above uses constant current mode feedback amplifier circuit. Adding this circuit allows CM6900 to be used in constant current mode.

The auxiliary winding's power output of 15V from the PFC choke controls the circuit power, it then support CM6900 via circuit regulator.

Conclusion:

LED lighting application is increasing, and it is a trend to provide high efficiency power supply > 90%. To meet the new LED market demand, Champion already has the complete solution to provide the best design and application for its customers.

For further information on LED lighting and IC application, please feel free to contact us for details.

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