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Single Stage Switching LED Lamp Driver

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Abstract- This study describes a single stage switching power supply with a half bridge architecture simulation for an LED light driver. The LED bulb driver requires simply a dc power source. In this work, a dc supply is acquired as an output while an alternating current of 110V is provided as an input. It is composed of an alternating current/direct current converter and an alternating current/direct current post regulator. When compared to other switching power supplies, this one is less expensive, smaller in size, and simplifies circuit design. It improves efficiency while also allowing for variable output voltage.

Keywords: Single stage switching power supply, half bridge topology

I. INTRODUCTION

Integrated within the proposed single-stage switching power supply is one half-bridge alternating current/direct current converter and one half-bridge alternating current/direct current post regulator. With both a pulse width modulation (PWM) controller and switch integration, this system offers significant cost and space savings over a standard two-stage power supply while also simplifying the design and increasing efficiency. It is possible to produce the dc output necessary for a single dc load from a two-stage switching power supply, consisting of one alternating current/direct current converter coupled to one independently regulated alternating current/direct current post regulator. Low source current harmonics and high power factor are the two most important benefits of a two-stage switching power supply [1-8]. Although these architectures have some benefits, there are some downsides as well, including low efficiency owing to two-stage power processing and a bigger circuit layout due to the increased number of active switch components and their accompanying PWM controllers. Half-bridge topologies have several advantages, including a high power factor due to low distortion in the source current and isolation between the input and output. As a result, the half-bridge power converter structure is one of the most popular two-stage switching power supplies, with the first and second stages depicted in Figs.

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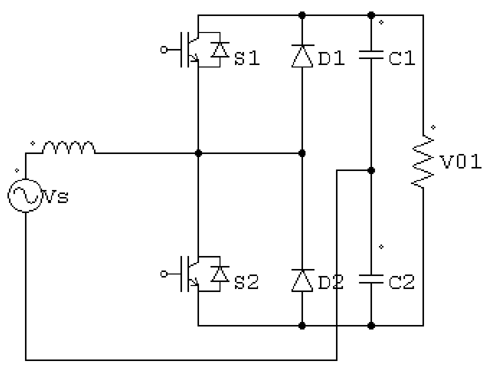
1 and 2. In order to generate the requisite dc output, these two stages are connected in series, and four active switches as well as two matching controllers are included[12-13] The two-stage construction will increase the size and expense of the circuit, as well as the complexity of the control design. Furthermore, the efficiency is lowered as a result of the topology, which has two series power stages instead of one. The proposed single stage switching power supply with half bridge topology is seen in Fig 3. It is composed of a half-bridge alternating current/direct current power factor corrector and a half-bridge alternating current/direct current post regulator.



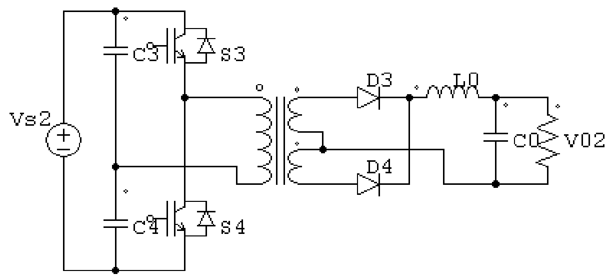


Fig1 Half bridge ac/dc converter &Fig 2 dc/dc power converter

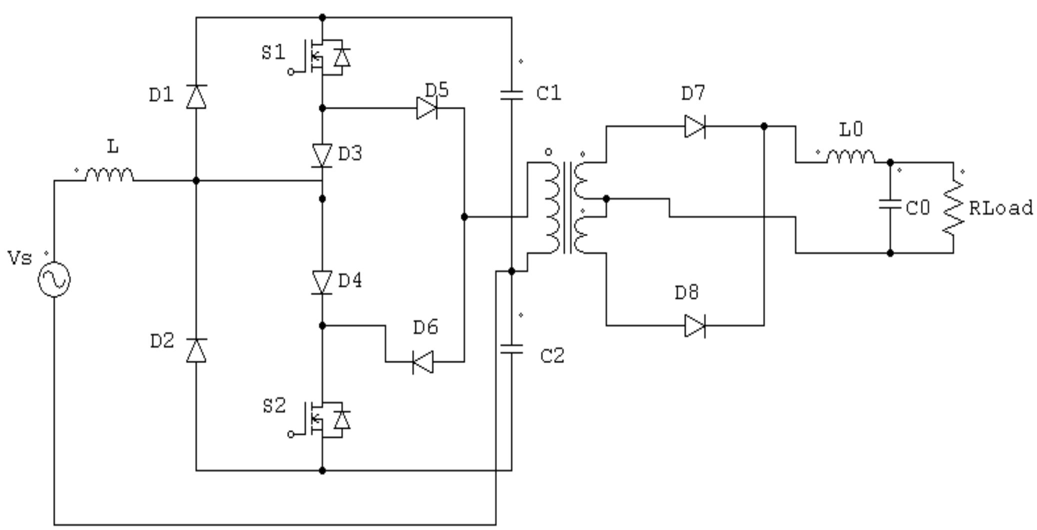


Fig 3 Proposed single stage switching power supply with half bridge topology

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II. WORKING PRINCIPLE

For the sake of simplicity, a standard switching control approach is employed to make the low-side switch S2 switch on for the positive-half-cycle of the source voltage and the high-side switch S1 switch on for the negative-half-cycle of the source voltage, as shown in Figure 1. The operations on the positive and negative cycles, as well as the accompanying waveforms, are represented in the following diagrams. It should be noted that the bulk capacitors C1 and C2 are considered to be perfect, and the voltages across both are equal, i.e., VCB1 = VCB2 = VCB, as shown in the diagram. Half cycles in the positive and negative directions are identical [5].

A. Mode 1 functioning is the default setting.

As a result of the switch S1 being turned off, the switch S2 being turned on, and the diodes S1, S2, S3, and D5 being in the "off" position This comparable circuit has three current conducting loops, which are connected in series. In the first loop, the PFC inductor current iL flows from the alternating current source via L, D4, S2, and C2 in a sequential manner. In the second loop, a single current flows through D6 and S2 in a consecutive fashion before exiting the transformer's main side. In the third loop, the output inductor current iL0 goes through L0, the output load, the lower secondary side of the transformer, and D8 in a sequential manner, as shown in the diagram.

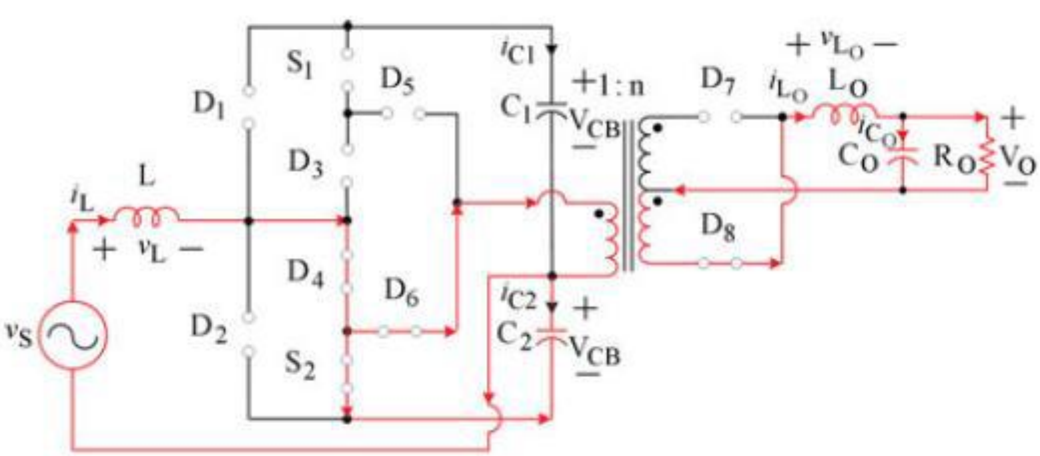

Fig 4 mode1 operation

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B.Mode 2operation Switches S1 and S2 are both turned OFF, and diode D1 is switched ON to conduct, while diodes D2, D3, D4, D5 and D6 are all turned OFF. Switches S1 and S2 are both turned OFF. In this comparable circuit, there are two loops that conduct independently of one another. One loop represents the current iL in the PFC inductor as it passes through L, D1, and C1 progressively from the alternating current source. iL0 is the output inductor current described by the other equation, which is shared by D7 and D8 since current goes through L0 and the output load in a sequential manner.

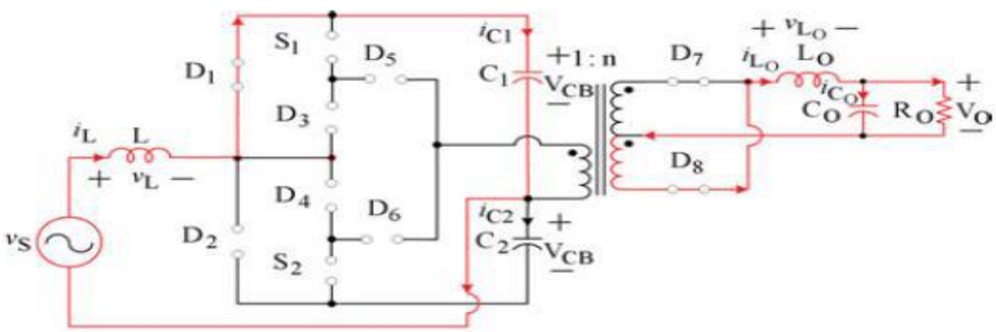

Fig 5 mode2 operation

C.Mode 3 operation The switches S1 and S2 as well as the diodes D2, D3, D4, D5 and D6 are still in the OFF position. The reason for this is because iL has decreased to zero at the conclusion of the second duration. After then, the diode D1 is switched off. In this equivalent circuit, there is only one conducting loop, which is the output inductor current iL0, which is still passing through L0 and the output sequentially, of which the circuit state on the secondary side is the same as it was in the last period of the simulation.

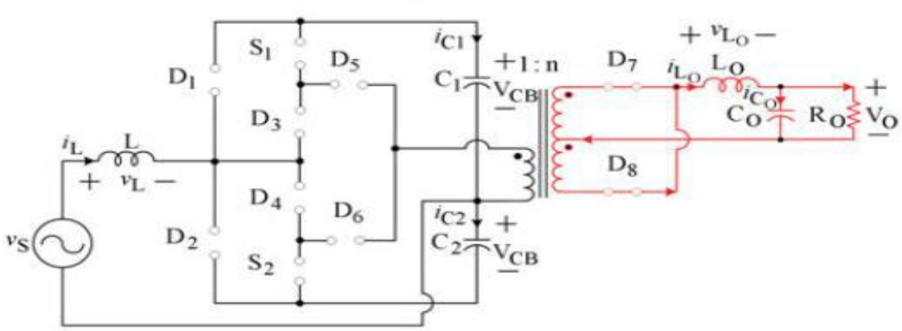

Fig 6 mode3 operation

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D. Mode 4operation The switches S1 and S2 as well as the diodes D1, D2, D3, D4, D5, and D6 are still in the OFF position. Due to the fact that the output inductor current iL0 has decreased to zero at the conclusion of the third period, diodes D7 and D8 are switched off. With the exception of the output terminal, there is no current conducting loop in this similar circuit at this point.

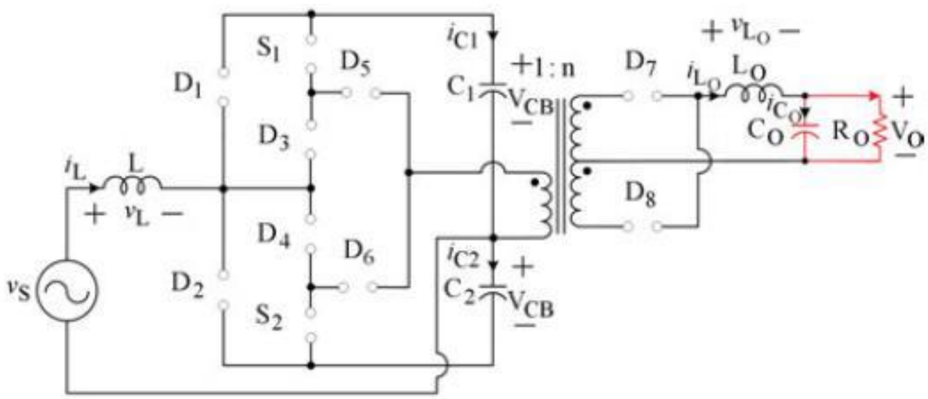

Fig 7 mode4 operation

III.SIMULATION OUTPUTS

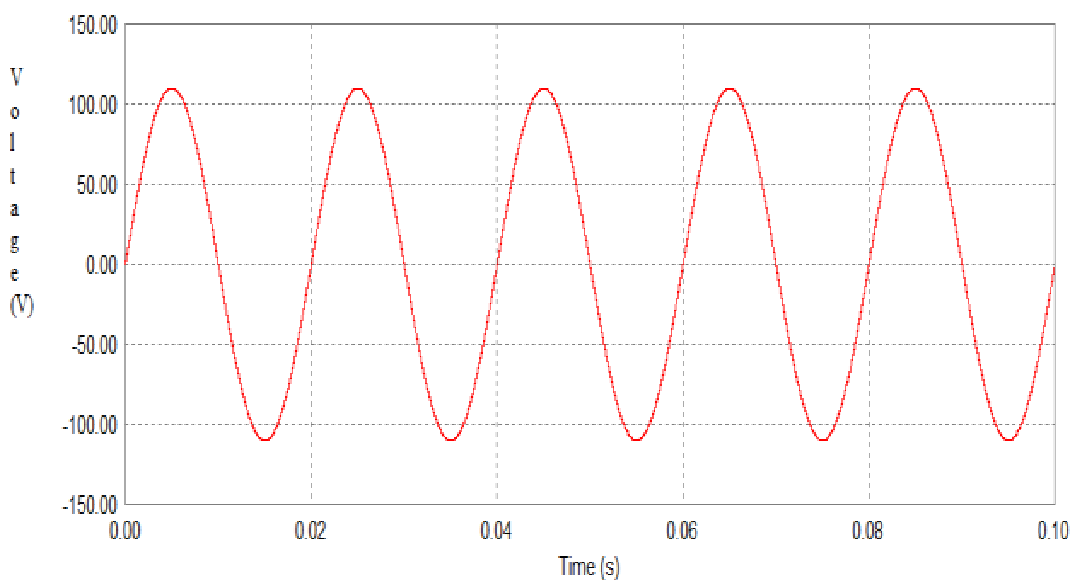

Fig .8 Input voltage waveform

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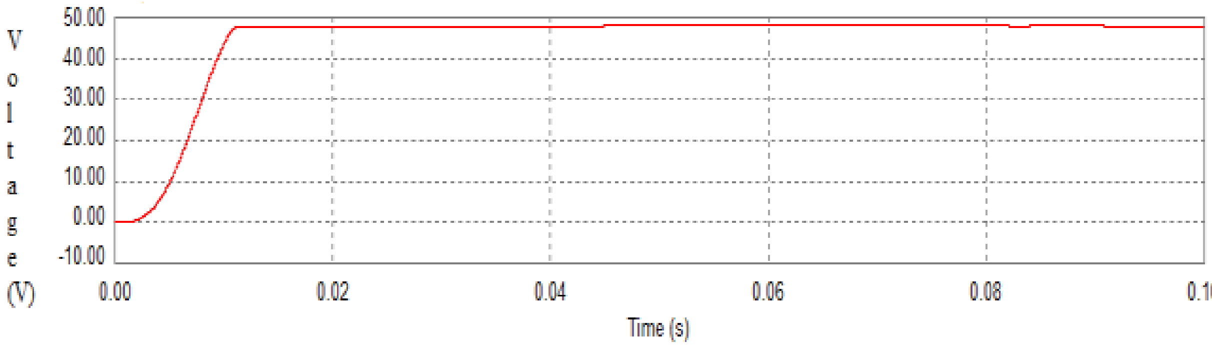

Fig 9 Output voltage wave form

IV.CONCLUSION

This article discusses single stage switching power supplies with half bridge topology simulation for LED light drivers, which are discussed in detail in the following sections. As opposed to the usual two-stage power supply, just a single stage switching power supply is utilised to deliver power to the circuit in this arrangement, which saves cost and space, simplifies the design, and boosts efficiency. The disadvantages of a two-stage switching power supply include low efficiency as a result of the two-stage power processing and a more complex circuit design. The simulation of a single stage switching power supply is carried out using the Psim programme, and the results are obtained. When powered by a 110V alternating current source, the output dc voltage is 48 V and the output power is 115 W, making it suitable for LED applications. According to calculations, the efficiency is more than 89.9 percent.

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