

Designing of Neon Sign's Power Supply for Advertising Board by Using the Stray Capacitance Discharge Technique

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Abstract. This paper, designing and development of power supply for neon sign based on TV flyback transformers was proposed. The power supply was designed for 12-12.5 VDC at the input that applied from the photovoltaic system. The TV flyback transformer was used for igniting the neon sign. It operated as a switching circuit that requires 12 VDC as input voltage for converting to 2 KV. The flyback converter was used for converting 12 VDC from power supply to 2 KV as requirement of the TV flyback transformer. The proposed flyback converter was input controlled by use stray capacitance technique and fixed frequency and duty ratio controller at 20 kHz of switching frequency and 50% of duty ratio. The neon sign having 5 feet of length and 10 millimeters of diameter was experimented. From the results, it was ignited smoothly with input current as 0.5A or input power as only 6 W.

Keywords: TV Flyback Transformer, Neon Sign, Stray Capacitance Technique.

1. Introduction

Electrical power generation process in recent day, petroleum oil, natural gas and natural fossil are importantly used in power plants. However, they cause the environmental problems. In the past, these were not costly and had sufficiently in many countries but in nowadays, these are very costly and decreasing rapidly which may be emptied in soon future although the need of energy consuming tends to be high. Therefore, the energy saving and renewable energy are necessary choices as discussion topic nowadays. Advertising board area also should be considered to be supported by use stray capacitance technique based on flyback converter. Usually, The neon sign is an important part in commercial advertising boards because at the night, it uses to show the shop name or advertising wording on electronic board that can be seen from far distance such as supper highway or the outside of the building [1]. This paper proposes the neon sign power supply that consumes less energy using for a stray capacitance technique.

The losing reduction of the circuit by using stray capacitance discharge technique that appear at the main switch, this facts, stray capacitance accumulation between drain (D) with source (S) of mosfets or its calling that "Input Capacitance" thus, losing reduction of a boundary of drain with source, for efficiency increasing of the circuit. Which accumulate value of a strays capacitance will increase or decrease, by it's depended on the supplying the voltage to gate/source (Vgs). The capacitance accumulation (Qg) of a gate between turn-on and turn-off of main switch then considered. By can write an equation is:

$$P_g = (Q_g \cdot V_{gs} \cdot f_s) \quad 1.$$

When

Pg: Power loss of gate (Watt)

Qg: Stray capacitance of gate (coulomb)

Vgs: Voltage bias of gate to source (Volt)

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Fs: Frequency Switching (Hz)

And

$$I_{\text{charge}} = (C_{\text{gs}} \cdot V_{\text{gs}}) / t_r \quad 2.$$

When

I_{charge} : Current of gate to source (Ampere)

C_{gs} : Capacity of gate to source (Pico Farad)

t_r : Rise Time of pulse (Second)

From equations (2), increasing of stray capacitance accumulation of gate, it an affected to increase current charging on a boundary of gate and source. There are pulse delays (t_r) for frequency switching of main switch. So, the turning-on and turning-off on time period operated of main switch an incorrectness for designing, especially, is non - zero voltage crossing on main switch and then transient voltage affected [3].

2. RESEARCH METHODOLOGY

The power supply is the most important part in the system due to it operates as neon sign igniting device. The proposed power supply was a system that consisted of flyback converter and TV flyback transformer as shown block diagram in Fig.1.

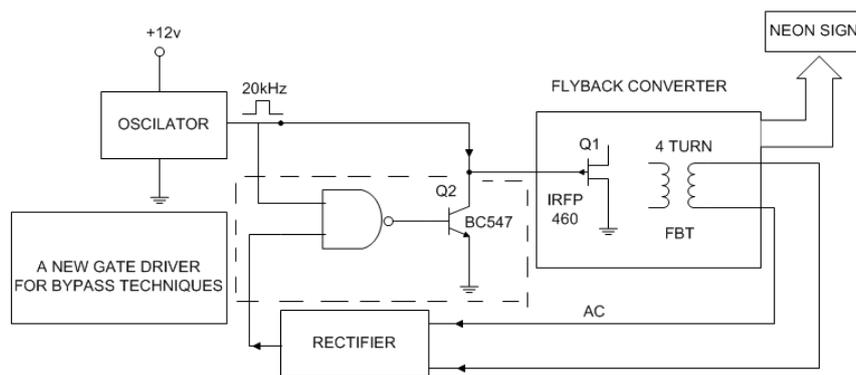


FIGURE1. Block diagram of systems.

The flyback converter operates for converting VDC from voltage power supply to AC high voltage for neon sign ignition. The neon sign was ignited by operation of TV flyback transformer that converts DC voltage level from DC-DC flyback converter to high voltage in AC waveform. The transformer was a regular part in monitor circuit of TV receiver due to the TV monitor needs high voltage for its operation. The principle of stray capacitance accumulation discharge technique, by use the wire about size of number: 1*1.5 SQ.MM and 4 turns around the axis of flyback transformer number: TLF14511B, part to the rectifier circuit from 10 VAC to 5VDC. This time, the 5VDC was supplying to a pin of NAND gate of digital circuit and then oscillator circuit was supplying to a pin of NAND gate. The voltage biasing on Q2 from output signal of NAND gate, and Q1 turned-off. Previously, the stray capacitance accumulation from operate of main switch (Q1), when Q1 operated, the output signal of NAND gate, it's not supply to Q2. Show in Fig.1.

3. EXPERIMENTAL RESULTS

To verify the proposed power supply, the circuit experiment of the proposed power supply for neon sign having 5 feet of length and 10 millimeters of diameter was applied. In the circuit, 12 volts/0.3-0.5amp from input DC power supply was used and connected to flyback converter. The flyback transformer used for generating 2 kilovolts in AC for igniting the neon sign. The power supply was controlled by the well-known voltage control mode ICs number timer 555 that were set as the fixed frequency and duty ratio controller.

Many duty ratios were applied to determine the optimizing operation. The flyback converter was controlled at 20 kHz of switching frequency and 50% of duty ratio.

From the experimental results, the neon sign could be smoothly ignited at 20 kHz and 50% of switching frequency and duty ratio respectively. Fig. 2 shows the voltage waveform of gate pin of main switch (Q1) and frequency switching at 20 KHz, when neon sign ignited condition. By using the proposed power supply, input power was consumed only 6 W at 0.5 A of the input current and the neon sign was ignited smoothly as show in Fig.3.

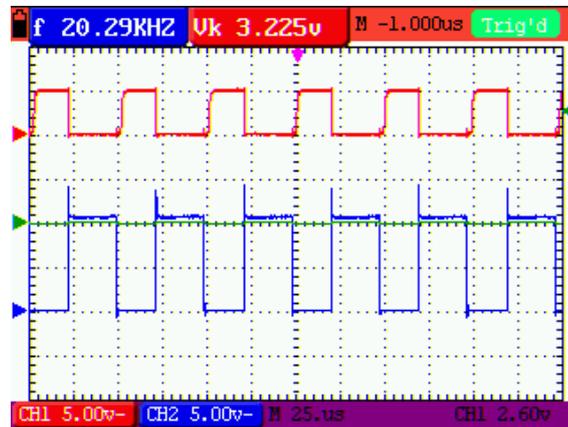


FIGURE2. Shows voltage waveform of the gate pin of flyback converter circuit for neon sign ignited.

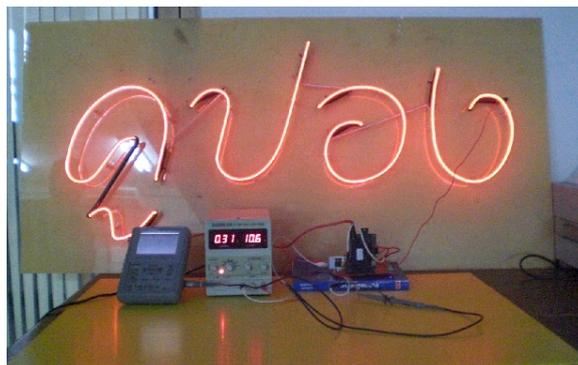


FIGURE3. Proposed power supply of neon sign ignited for advertising board.

4. CONCLUSSION

This paper, power supply for photovoltaic powered neon sign for advertising board in remote area based on TV flyback transformers was introduced. The proposed power supply was controlled by simple operation as fixed frequency and fixed duty ratio that accomplished by 555 timer control ICs. By using proposed power supply for igniting 5 feet of length of neon sign, the neon sign was ignited smoothly by 6W of input power consumption. Therefore, it is available for applying to the stray capacitance discharge technique for advertising board designing that use neon sign as wording display [1],[2].

5. References

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