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Single Switch Isolated DC-DC Boost Converter

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ABSTRACT: This paper proposes a single switch isolated dc-dc boost converter. The proposed converter is able to offer high power density in step-up application because of its simple structure; low rated lossless snubber; reduced transformer volume compared to isolation based converters due to low magnetizing current. The proposed converter is capable to stabilize the output efficiency. Experimental results are provided to validate the proposed concept. The Simulation is done with the help of MATLAB Software using Simulink.

KEYWORDS: Isolated step-up dc–dc converter, single switch, soft switching.

I.INTRODUCTION

Isolated step-up dc–dc converters are used in many applications, such as photovoltaic module-integrated converter (MIC) systems, portable fuel cell systems, and vehicle inverters where high efficiency, high power density, and low cost are required [1]–[4]. Owing to smaller input current ripple, lower diode voltage rating and lower transformer turns ratio, the current-fed isolated converter is better suited for step-up applications. The current-fed isolated converter has two types: passive- clamped [5]–[7] and active-clamped [8]. The passive- clamped current-fed converter has simple structure and small switch count, but suffers from excessive power losses dissipated in the RCD snubber and associated with hard switching of main switch. Active-clamped current-fed converters have actively been developed based on three basic topologies: push–pull [8], full-bridge [9] and half-bridge. They achieve not only lossless clamping of voltage spikes caused by transformer leakage inductance but also zero-voltage switching (ZVS) turn on of switches. However, they may not be expected to achieve high efficiency and low cost in relatively low power application since they need at least four switches and gate driver circuits. Isolated converters with reduced switch count have been proposed for low power application. Isolated dc–dc converters with one main switch and one clamp switch achieve ZVS turn on of switches, but switches are turned off with hard switching. Isolated single switch dc–dc converters are more attractive to achieve low cost [8]–[6]. Z-source converter [8] and flyback converter [2]–[3] are hard switched at both turn-on and turn-off instants. Frequency-controlled flyback converter [4] and series-connected forward-flyback converter [5] achieve zero-current switching (ZCS) turn-on of switch, but the switch is hard switched at turn-off instant. The aforementioned single switch topologies have increased transformer volume since magnetizing inductor is used for energy transfer. An isolated single-switch resonant converter [6] achieves both ZCS turn-on and ZCS turn-off of switch, but need high transformer turn ratio for step-up application due to low voltage gain and hence is not suited to step-up application.

II. RELATED WORK

In this existing system, then high harmonics for that power factor is low, current values of the main component is larger.

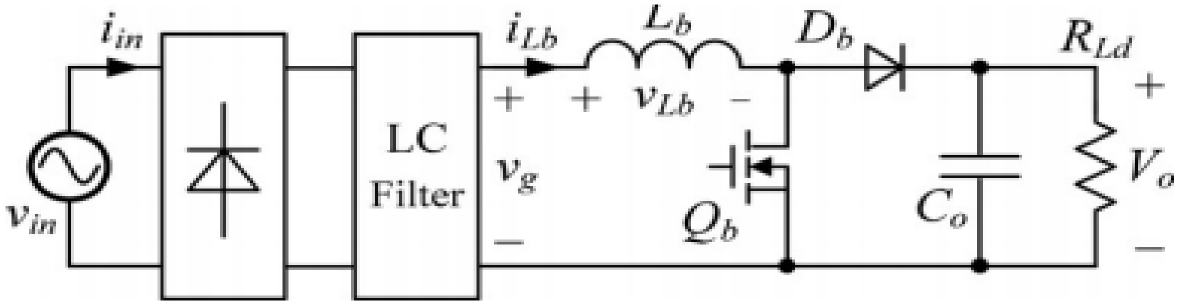

Fig1: conventional boost converter

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Then efficiency get reduced, switch turn-off loss occur and higher conduction. The CRM boost PFC converter has such advantages as zero-current turn-on of the switch, no reverse recovery in diode, and a high PF. However, the switching frequency is variable, resulting in difficulty in the design of the inductor and EMI filter. The CRM boost PFC converter is mainly used in medium- and low-power applications.

II. PROPOSED METHODOLOGY

BLOCK DIAGRAM AND EXPLANATION

In this diagram represents for input DC supply passed through boost converter. This boost converter is used to boost the applied voltage. This signal is applied to the snubber circuit which removes the noise. This signal is applied to step up transformer. The output from transformer is applied to the rectifier and resonant circuit; this block converts the AC to DC and filters out the unwanted noise. This rectified DC output is applied to the load.

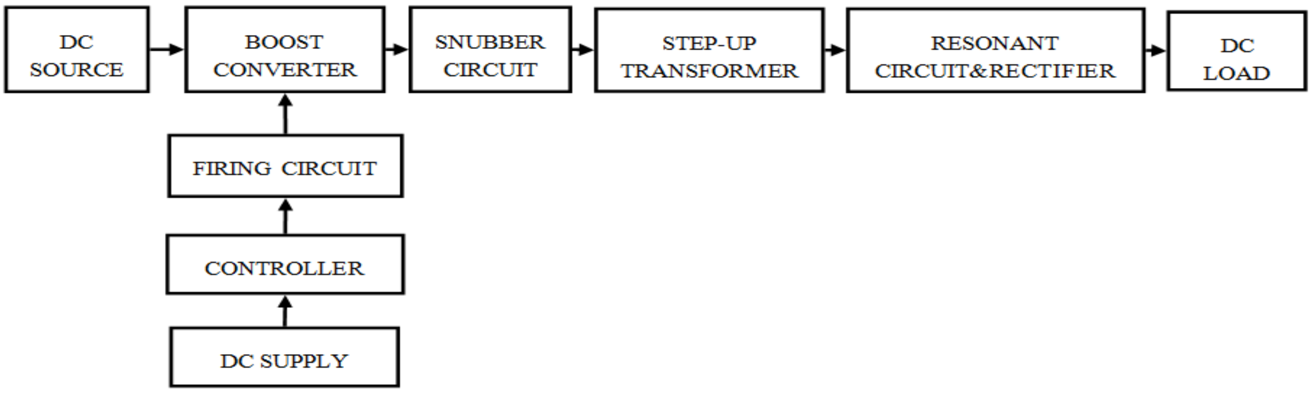

Fig. 3.7: Proposed System Block Diagram

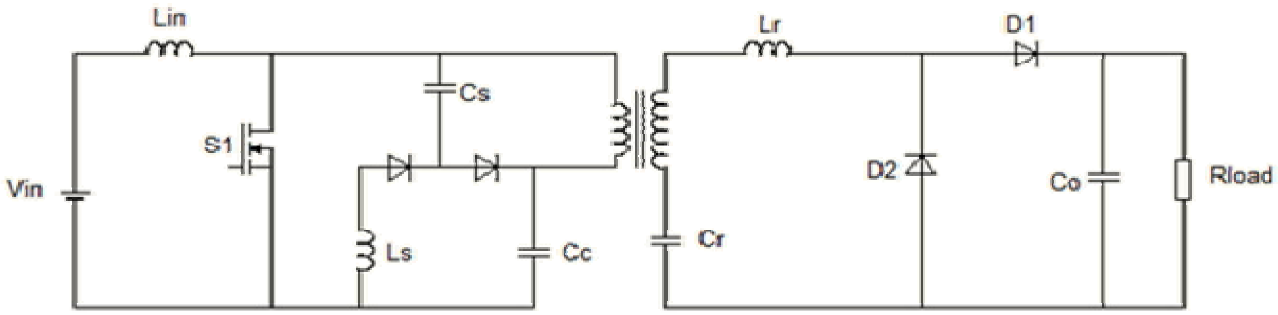

Fig 2: proposed circuit

Then a fully soft switch single switch isolated dc-dc converter from excessive power losses will be reduced in the main switch. Number of snubber components is used in this converter and excessive snubber loss is reduced.

Power for the boost converter can come from any suitable DC sources, such as batteries, solar panels, rectifiers and DC generators. A process that changes one DC voltage to a different DC voltage is called DC to DC conversion. A boost converter is a DC to DC converter with an output voltage greater than the source voltage. A boost converter is sometimes called a step-up converter since it "steps up" the source voltage. Since power ($P = VI$) must be conserved, the output current is lower than the source current.

III. SIMULATION RESULTS AND TABULATION

The simulation circuit of the proposed system is as shown below, in which a DC signal is converted to an AC signal and applied to the step up transformer, this boosted signal is converted to a DC signal. The respective gate pulse, input and output waveform are as follows.

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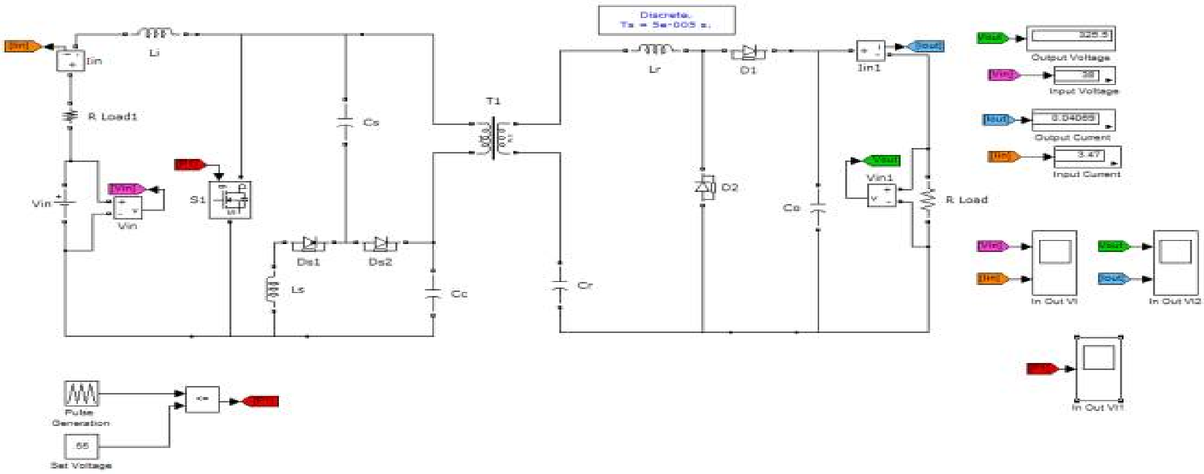

Fig. 3.1: Simulation Circuit of Proposed System

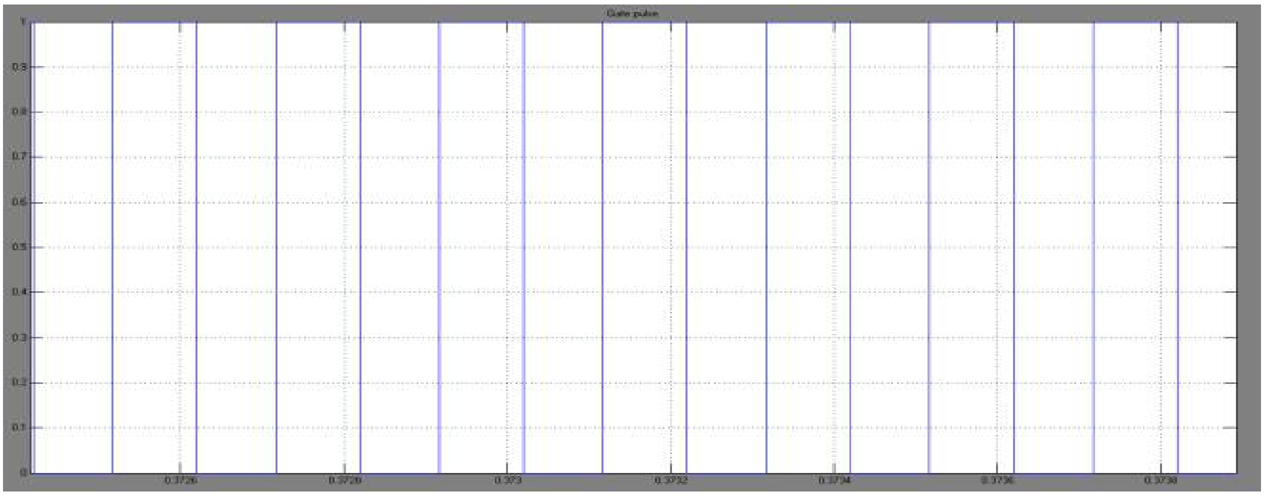

Fig. 3.2: Gate Pulse of Proposed System

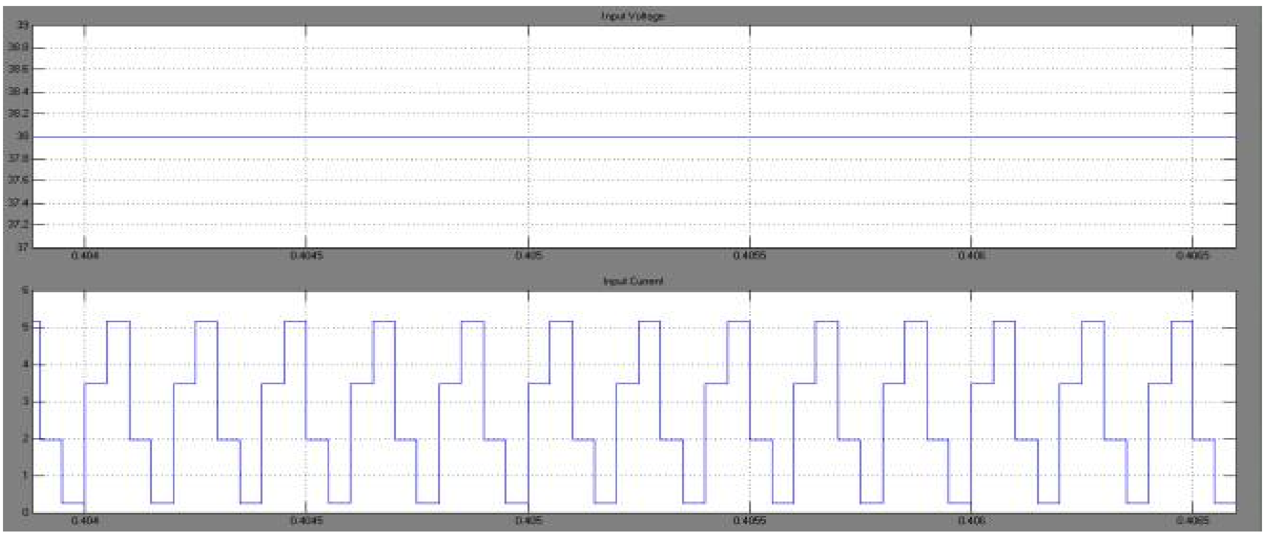

Fig. 3.3: Input waveform of Proposed System

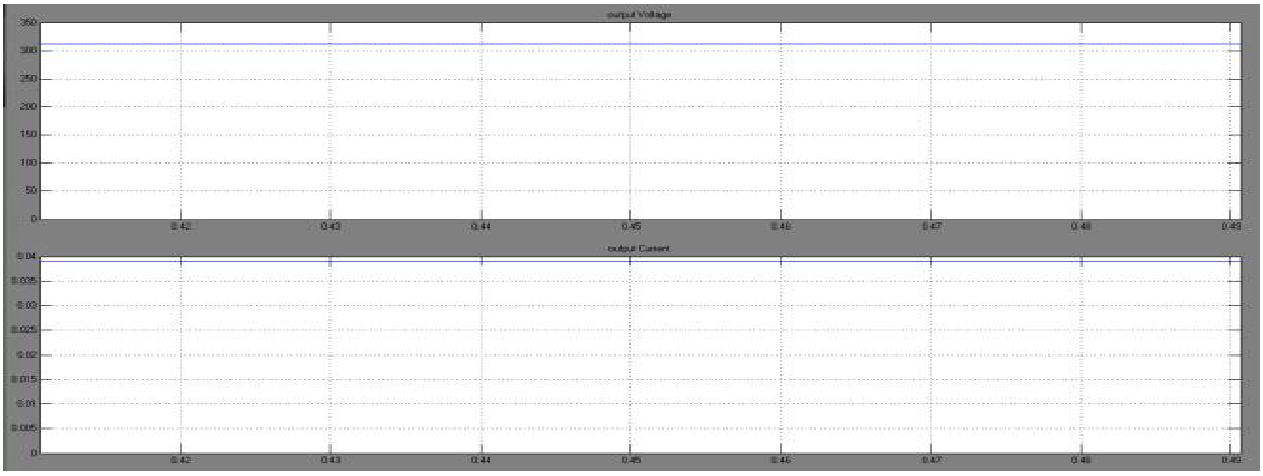

Fig. 3.4: Output waveform of Proposed System

Measurement	Existing System		Proposed System	
	Input	Output	Input	Output
Voltage	48Vac	198Vdc	38Vdc	312Vdc
Current	6A	0.03A	3.4A	0.03A

Table 1: Comparison of existing and proposed system

V.CONCLUSION

In this paper, a single switch isolated DC-DC boost converter was proposed for step-up application such as portable fuel cell systems, and vehicle inverters. Improved features such as isolated switched characteristics of switch and diode, low-rated lossless snubber, and reduced transformer volume makes the proposed converter achieve higher power density compared to the conventional non isolated converter. Experimental results and prototype are provided to validate the proposed concept.

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