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PV based High Voltage Bidirectional Dc to Dc Converter

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Abstract: ***This paper presents a basic style of PV integrated two-way dc-dc device to be used in low power applications. The planned topology is predicated on a full-bridge on the first and a current-fed push-pull on the secondary aspect of a high frequency isolation electrical device. Achieving two-way flow of power victimization a similar power elements provides a straightforward, economical isolated topology with PV panel boost that's particularly enticing to be used in battery charge/discharge circuits in dc applications. The dc mains (provided by the ac mains), once bestowed, powers the downstream load devices and therefore the two-way converter that primarily operates within the buck mode to charge the battery to a par value of 12V. On failure of the dc mains (derived from the ac mains), the device operation is corresponding to that of a lift and therefore the battery regulates the bus voltage and thereby provides power to the downstream converters. Little signal and steady state analyzes are bestowed for this specific application. The look of a laboratory example is enclosed. The device exhibits sensible transient response beneath load variations and switchover from one mode of operation to a different.***
Keywords: PV panel, MOSFET Bridge, Battery, Filter.

I. INTRODUCTION

Choppers are wide accustomed acquire a variable DC output voltage from a continuing DC voltage. It may be used for change of magnitude and step down operation. Implementation of two-way converters victimization resonant, soft switch and laborious switch PWM are re-portable within the literature. But, these topologies might usually cause a rise in element ratings, circuit quality and physical phenomenon losses in resonant mode implementations, high output current ripple and loss of sentimental switch at light-weight hundreds for soft-switched circuits, and lack of galvanic isolation in integrated topologies. however this paper presents a two-way dc-dc device topology for battery charger/discharger. Within the planned topology, the bi-directional power flow is achieved by 2 topologies specifically [*fr1] bridge and current fed push-pull topology. the first aspect of the device could be a [*fr1] bridge and is connected to the dc mains. The secondary aspect, connected to the battery, forms a current-fed push-pull. the advantages of a current fed push-pull device are reduced switch losses in push-pull stage and therefore the output rectification may be simply optimized. A simulation study of the planned device is administered victimization matlab. The planned device topology with feedback has been bestowed and simulated victimization matlab. The device demonstrates high potency (86.6% within the forward mode and ninety.5% within the backup mode), low half count thanks to its bi-directional feature and galvanic isolation. The results are verified with hardware.

II. LITERATURE SURVEY

A review of isolated two-way dc-dc converters within the literature is predicated on two-way converters that may be classified into 2 major types: laborious switched and soft-switched. Some examples from the literature are summarized below. The two-way dc-dc device together with energy storage has become a promising possibility for several power connected systems, as well as hybrid vehicle, In renewable energy applications, the multiple-input two-way dc-dc device may be accustomed mix differing kinds of energy sources . a electric cell primarily based system for domestic applications. The multi-input two-way dc-dc device is that the core that interconnects power sources and storage parts and manages the facility flow . This two-way dc-dc device options galvanic isolation between the load and therefore the electric cell, two-way power flow, capability to match completely different voltage levels, quick response to the transient load demand, etc. Recently, clean energy resources like electrical phenomenon arrays and wind turbines are exploited for developing renewable power generation systems. The two-way dc-dc device is usually accustomed transfer the solar power to the electrical phenomenon energy supply throughout the sunny time, whereas to deliver energy to the load once the dc bus voltage is low . Varied topologies for doable implementation as two-way dc-dc converters are reportable thus.

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III. METHODOLOGY

A. Bidirectional DC-DC converter

The converters will regulate a large vary of power from few watts to many kilowatts. Galvanic isolation is needed in bound applications exacting Personal safety, noise reduction further as correct operation of protection systems. Conjointly bound systems need voltage matching between the various stages for the correct style and therefore the improvement of various stages. Typically Voltage matching and galvanic isolation is achieved by the electrical device during power electronic equipment. This necessitates the need of the ac link for the energy transfer. Therefore the system quality grows up with the incorporation of all this options. Primarily most of the isolated two-way DC -DC converters has the structure as shown within the on top of figure.

This system needs 2 switch dc to ac converters in operation at a high frequency thus on convert the dc input to high frequency ac quantities. Galvanic isolation between the supply and cargo aspect is provided by the high-frequency trans-former. Electrical device conjointly performs voltage matching between the supplies and therefore the load aspect since the voltage quantitative relation between them is incredibly high. The electrical device works with ac quantities and thus a dc-ac device is needed at each the terminals. Since the system is supposed for the energy transfer in each the directions, dc to ac converters utilized should have the potential of two-way power. This converters conjointly just like the non-isolated two-way DC-DC converters works in 2 modes of operation i.e. in buck or boost.

Isolated two-way DC- DC converters may be broadly speaking classified into 2 classes on the idea of their configuration:

1) A current fed isolated two-way DC-DC device has associate inductance at its terminals that acts sort of a current supply sort of a standard boost device with associate inductance at the input terminals.

2) A voltage fed isolated two-way DC-DC device as shown within the g.2.8 includes a electrical device at its terminals that acts sort of a voltage supply sort of a standard buck device with a electrical device at its input terminals.

Since the isolated two-way DC-DC are having additional advanced structure, are additional large, costlier and heavier than the non-isolated two-way DC-DC converters thanks to the presence of the electrical device, they're typically use for the HEV application. two-way DC-DC device is chosen for the current style.

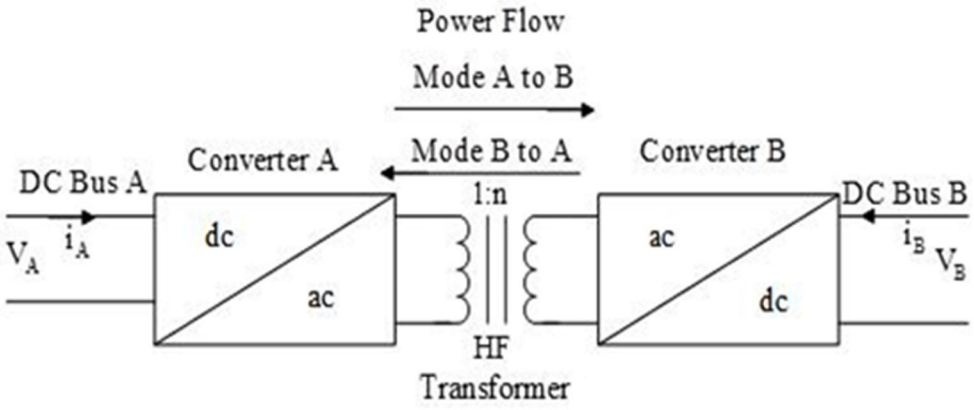

Figure 1: design of bidirectional dc-dc converter

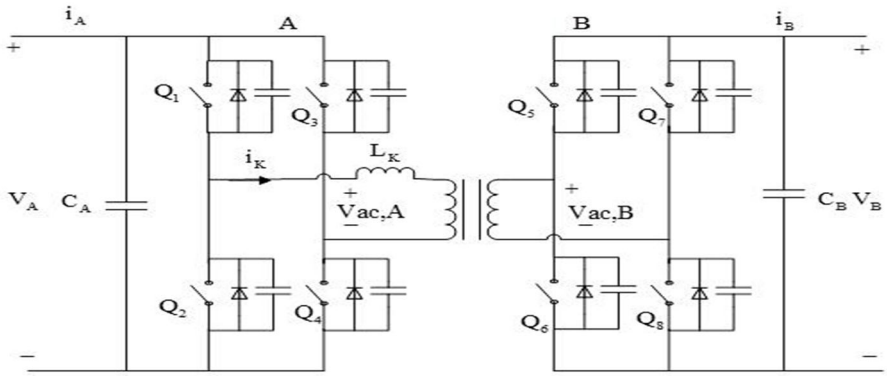

Figure 2: Dual Bridge Isolated Voltage Fed Bidirectional DC-DC Converter

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B. DCM operation of the Converter

Bidirectional DC-DC device are typically operated within the continuous physical phenomenon mode (CCM), and thus its style needs a bigger valued lter inductance. A bigger inductance may end up in a rise in physical size of the inductance, that isn't fascinating. This massive lter inductance can even impede the transient response of the device further as impede any variety of mode transitioning. With the circuit in operation within the discontinuous physical phenomenon mode (DCM), the inductance worth significantly reduces . Since the DCM operation facilitates the diminution of the inductance worth and therefore creating the response quicker, thus the device will designed to possess a high power density by in operation in DCM mode. Another vital advantage is that the zero-turn on loss and thus low reverse recovery loss in diode throughout DCM operation. But, since within the DCM operation the most switch is switched o at double the worth of the load current, thus the losses throughout flip o will increase. Conjointly due to this, the inductance current exhibits parasitic ringing throughout turning o of the switch since the output capacitance of the switch in association with the inductance tries to oscillate and thus causes power dissipation and electrical stresses on the devices. This can be the key disadvantage related to the DCM operation. The potency reduces due to all this negative effects of the DCM operation. Thus the soft switch techniques further because the remedial measures for the parasitic ringing ought to be ensured within the device style.

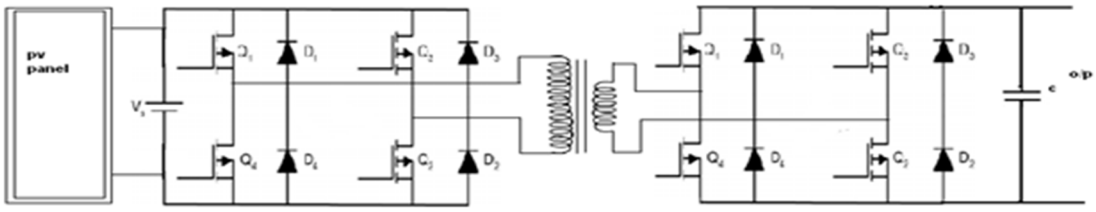

Figure 2: basic circuit design of bidirectional dc-dc converter

C. Soft Switching Methods

If the device circuit doesn't have any auxiliary elements , then the switches operates beneath laborious switch operation and this results in the respectable quantity of the facility loss and high electrical stress among the switches throughout activate and switch o condition due to terribly massive values of the present and voltage at the same time across it. Typically altogether the converters in operation beneath laborious switch conditions and notably within the high power converters, switch losses puts the key limitation on the rise of the switch frequency that is desired for the reduction in elements values and thus the scale value and therefore the compactness of the device. Thus a compromise is formed with the worth of the switch frequency within the much acceptable vary thus on accomplish the high potency within the device and at a similar time to and limit its value. The reduction within the worth of the switch frequency will increase the scale of the passive elements like the capacitors, inductors, transformers etc. and makes the DC-DC device heavier and hulking. Soft switch techniques once utilized for the facility converters, helps in increasing energy conversion potency, shifts up the higher limit for increasing switch frequency and thereby the reduction within the size ,weight and therefore the value of the passive elements further because the reduction of the electrical and therefore thermal stresses on the switch devices and the EMI reduction throughout switch. Thus the facility loss throughout switch is eliminated from the device. Soft switch may be achieved by the addition of the resonant elements (snubber electrical device or inductor) as an alternative by the employment of the parasitic element of the device circuit. Soft switch is accomplished within the DC-DC converters circuit by the addition of the resonant switches consisting of a controlled semiconductor switch (power MOSFET or associate IGBT), associate anti parallel external diode and a resonant electrical device or a resonant inductance. Here the Soft switch may be achieved by the either zero voltage or zero current switch condition. The condition of sentimental switch will solely be accomplished within the device circuit if the resonant a part of the switch has the potential to reset itself (i.e. discharge itself) at the time of switch. If the resonant electrical device or the inductance across the switches will discharge themselves and thereby acquire zero voltage of zero current at the time of the switch, soft switch is established. therefore by the addition of the external circuit parts, the circuit may be created to control beneath soft switch condition.

IV. CONCLUSION

A bi-directional DC-DC converter in forward and reverse charging modes have been presented in this paper. Moreover, to boost the dynamic response of the device, a feedback system is additionally utilized and therefore the output voltage is regulated. Therefore, the planned device are an acceptable topology for PV applications..

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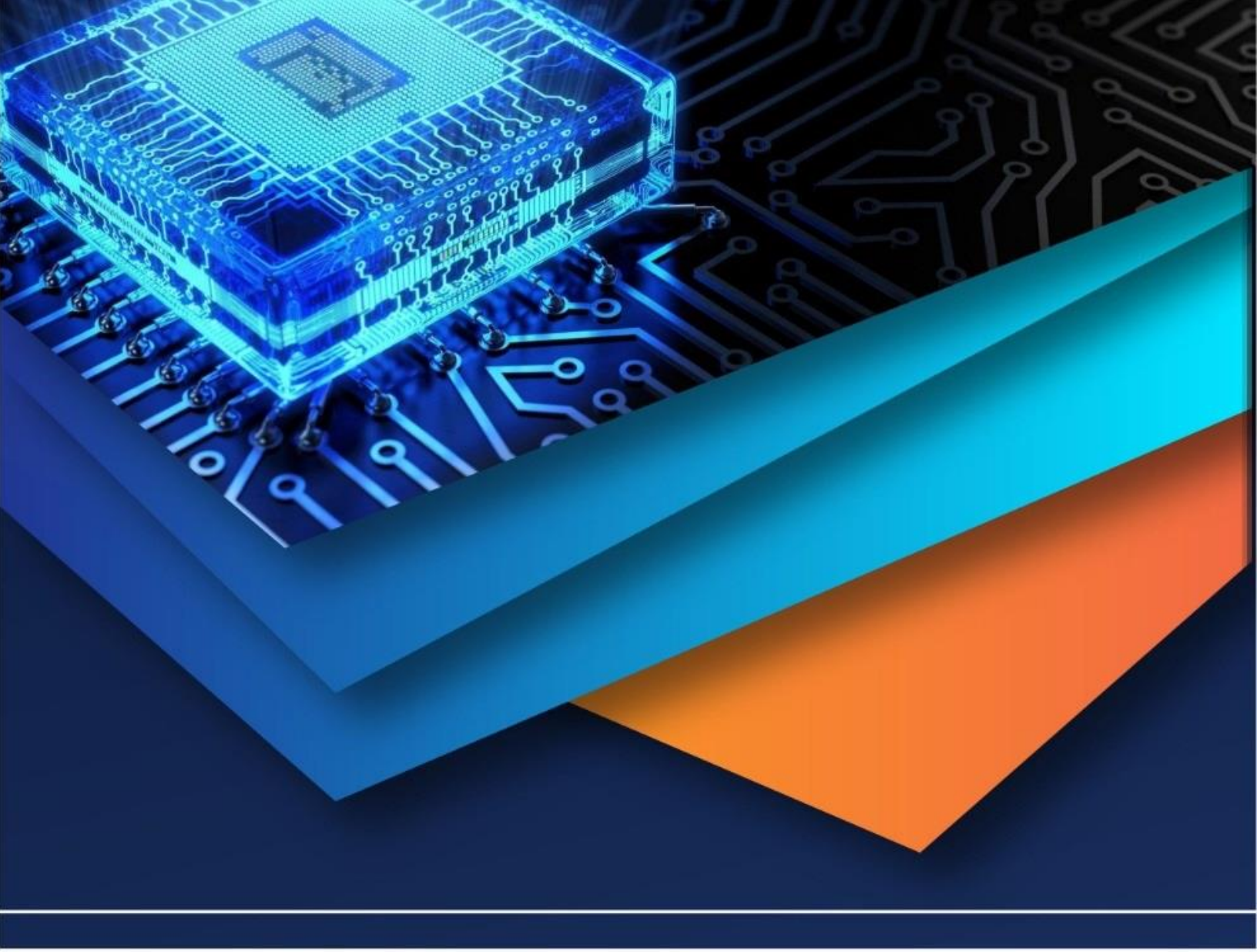

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