ISSN 2278-3091

International Journal of Advanced Trends in Computer Science and Engineering, Vol.2 , No.2, Pages : 222- 225 (2013)
Special Issue of NCRTECE 2013 - Held during 8-9 February, 2013 in SMK Fomra Institute of Technology, OMR, Thaiyur, Kelambakkam, Chennai

High Step Up Dc-Dc Converter With Single Transformer For Low Dc Renewable Energy Source

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Abstract--A high efficiency, low profile, and high step-up dc-dc converter is proposed for low dc voltage renewable energy systems. The switching power losses are reduced for high step up application. Multiple transformers and resonant rectifiers are employed for a low profile design .This series and parallel connection is designed for high output voltage and high output current respectively. A newly-suggested high step-up topology employing Series-connected Forward-Fly Back (SFFB) converter, which has a high boosting voltage-transfer gain is used in this project.

Key words:Forward And Flyback Converter, Multi winding transformer.

I. INTRODUCTION

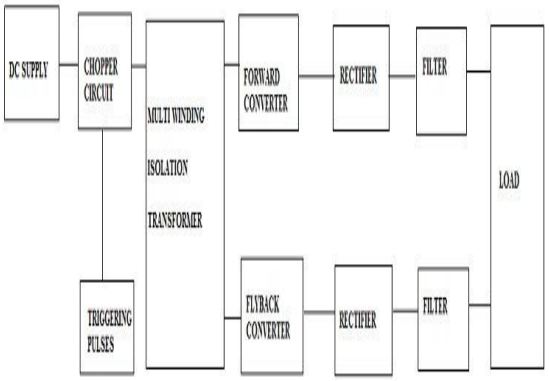

Fig.1. Block Diagram

The primary has a pulse width modulation (PWM) switching voltages occurred by a single main switch. The secondary is a structure where the forward converter and the fly back converter are separated by transformer winding. However, the outputs are serially connected for the output voltage boost.

The flyback delivers power to the load during the off time of the transistor and the rectifiers work as peak rectifiers. That means the output voltages follow the peaks of the transformer secondaries during the flyback period.If you have multiple outputs, the voltages across transformer secondaries during the flyback period will tend to follow one another, because of transformer action. Because of the peak rectification, it follows that the output voltages will follow one another. In a forward, transformer action is still present, but the power is delivered during the on time and the rectifiers work as average rectifiers. That means the

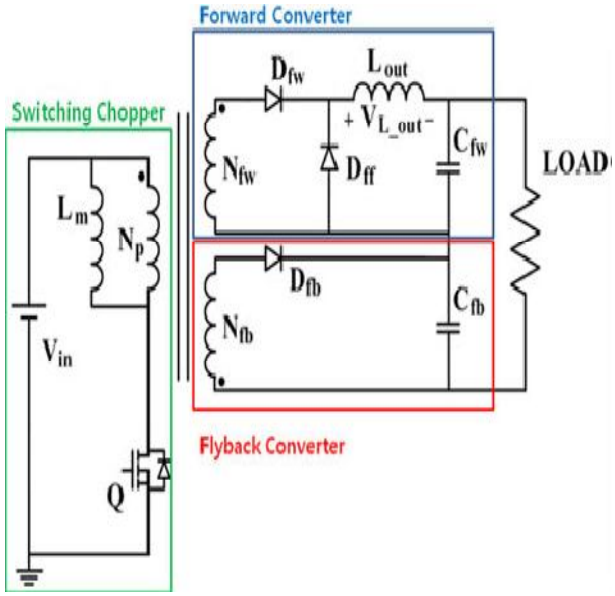

Fig.2.Circuit Diagram For Flyback Converter

output voltages are the averages of the voltage across the transformer secondaries during the on time. But the averages depend on the duty-cycle. And the duty-cycle is adjusted to regulate the master output. But that means the duty-cycle will only be right for the master output and it could be totally wrong for a slave output, because the output could be fully loaded (needing a large duty-cycle), while the master output is only lightly loaded (needing and forcing a low duty-cycle). Or the other way around: the master is

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fully loaded, forcing a large duty-cycle, while a slave output is only lightly loaded, thus needing a low duty-cycle.

II. MODES OF OPERATION

MODE 1

Current flows to the magnetizing inductance and the primary winding N_p as a result of turning ON switch Q. The primary current is transferred to the secondary N_{fw} coil of the forward converter via the magnetic linkage. Then, the ac power is rectified into dc which load requires through a forward diode D_{fw} and a low-pass filter Lout and C_{fw}. Since a flyback diode D_{fb} is reverse biased, the output capacitor provides the load current during this mode

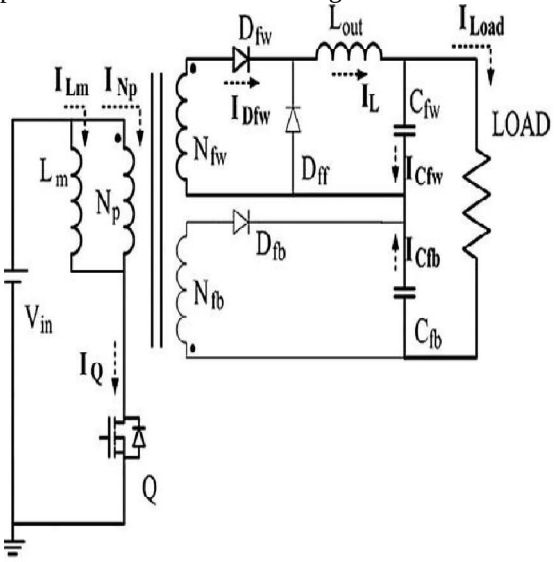

Fig.3.Mode 1

MODE 2

When switch Q is turned OFF, a forward diode D_{fw} is reverse biased and the energy stored in Lout is transferred to the load by the freewheeling current via D_{ff} and at the same time, the energy magnetically stored at Lm is also supplied to load through D_{fb} of the flyback converter. Thus, all the freewheeling current in magnetic devices decreases linearly

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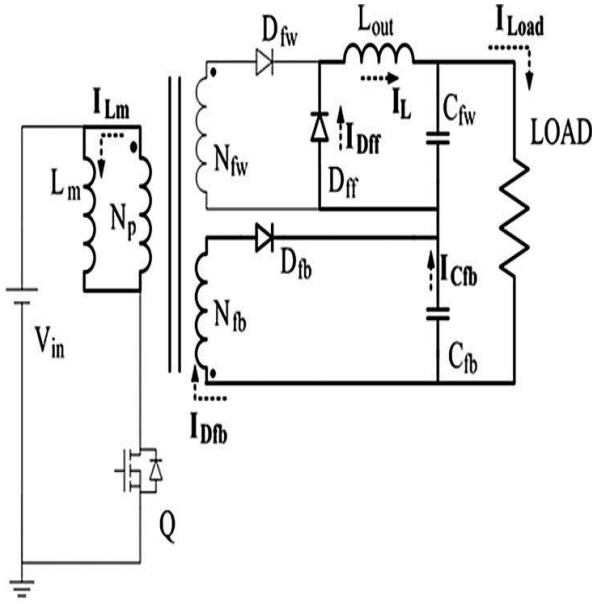

Fig.4.Mode 2

MODE 3

The forward converter starts to operate in DCM when all the energy in Lout is discharged, and then a freewheeling diode D_{ff} is reverse biased. The energy only stored in Lm is supplied to load through the flyback converter

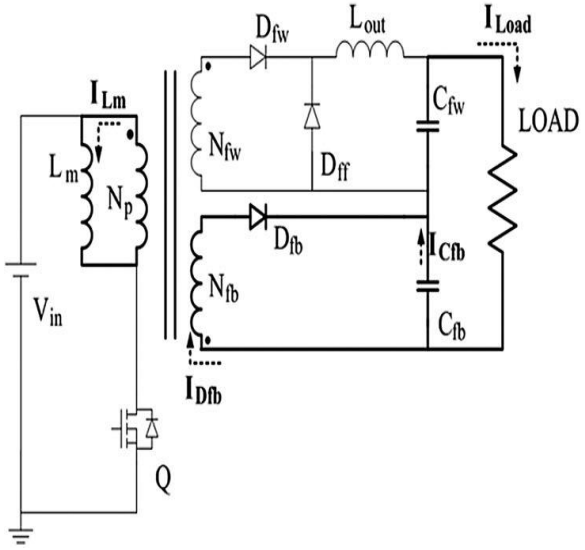

Fig.5.Mode 3

MODE 4

The transformer of the forward–flyback converter is demagnetized completely during this period and the output voltage is maintained by the discharge of the output capacitors C_{fw} and C_{fb} . All the rectifier diodes are reverse biased

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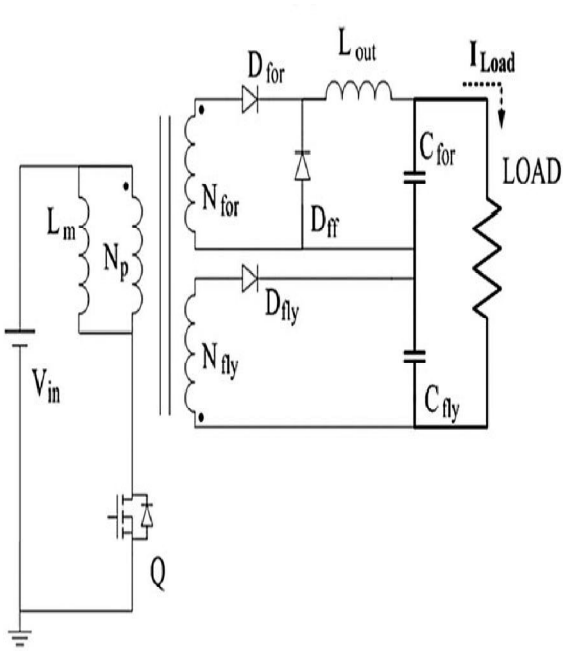

Fig.5.Mode 4

III. SIMULATION RESULTS

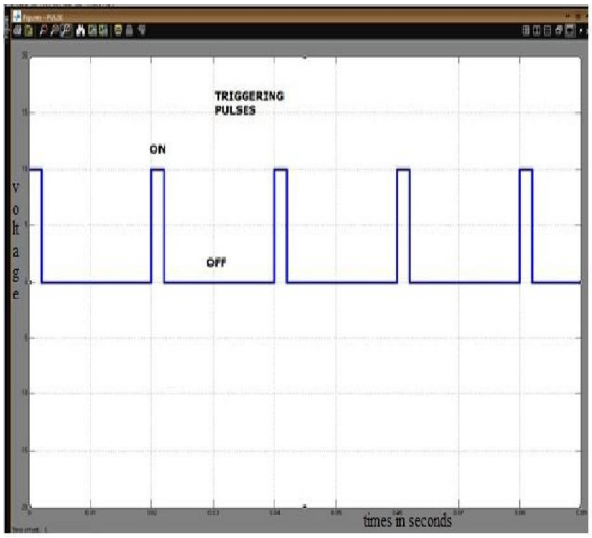

Fig.6. Triggering Pulse

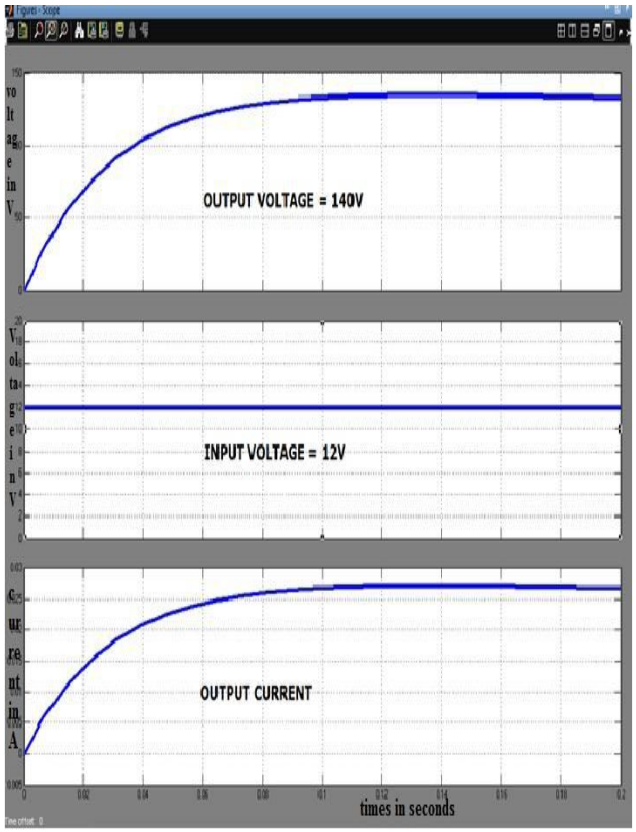

Fig.7.Output Voltage And Current

IV. CONCLUSION

Thus the required output voltage will be obtained by giving low dc renewable energy source such as 12V input to the circuit. Later the given voltage will be boosted up by the forward and fly back converter. The boosted up voltage will then filtered from harmonics by using filter. The generated voltage is ready to Supply the load. With Transformer ratio we can vary the output voltage to reach maximum.

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