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DESIGN AND DEVELOPMENT OF POSITIVE OUTPUT SUPER-LIFT CONVERTER USING PROTEUS SOFTWARE

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Abstract: DC to DC converters area unit vital in transportable electronic devices like cellular phones and laptop computer computers, that area unit furnished power from batteries. Such electronic devices usually contain many sub circuits that every need distinctive voltage levels totally different than equipped by the battery. Voltage carry technique may be a in style methodology wide employed in electronic circuit style. However, the voltage will increase stage by stage on patterned advance. However during this project super carry technique is employed, during this super-lift device, the output will increase stage by stage on a geometrical progression. During this progression the output voltage is thrice the input voltage. Therefore it effectively enhances the transfer gain in series and introducing the characteristic of high potency, high power density, low-cost topology in easy structure and near-zero output voltage and current ripples. This device is wide employed in peripheral} equipment, industrial applications and switch mode power provide, particularly for top voltage-voltage comes. The simulation model of the positive output super-lift device circuit was developed in Proteus package.

I. INTRODUCTION

DC to DC converters provide a technique of generating multiple controlled voltages from one variable battery voltage, thereby saving house rather than exploitation multiple batteries to produce totally different elements of the device. during this project exploitation the super voltage carry [2] technique wont to style the convertor circuit exploitation the proteus package. the bottom of the project was Luo convertor technique and also the technique was super voltage carry. The Luo converters [1] ar DC-DC shift Mode Boost converters. a lift convertor (step-up convertor) may be a power converter with Associate in Nursing output dc voltage bigger than its input dc voltage. Luo converters ar a category of converters providing a high gain with comparatively lesser variety of elements. though Luo converters give a high gain, once cascaded, the gain will increase stage by stage solely in progression i.e. these converters use the voltage lift (VL) technique [2]. so as to unravel this discrepancy within the Classical Luo Converters, another category of converters referred to as Super-lift Luo Converters [1], [4] were developed. whereas the positive aspects of the Classical Luo Converters ar maintained in Super-lift converters, Super-lift convertors even have the advantage that the gain during this converter will increase in progression, stage by stage.

II. VOLTAGE LIFT TECHNIQUE

Voltage Lift (VL) technique [2],[6] may be a widespread technique wide employed in electronic devices. it's been with success used in dc-dc convertor applications in recent years, and opened some way to style high voltage gain converters. Four series Luo-Converters square measure the samples of VL technique implementations. However, the output voltage will increase in stage by stage simply on the progression. Geometric progressions contemplate the sequence a pair of, 6, 18, 54 … Here, every term within the sequence is three times the previous term. allow us to write down a general progression, victimization pure mathematics. We tend to shall take a to be the primary term. thus we tend to shall let "r" be this common magnitude relation. Progression will be expressed as a, ar, ar2, ar3 . . .So the n-th will be calculated quite simply. it's arn−1, wherever the ability (n−1) is often one but the position n of the term within the sequence In our initial example, we tend to had a = 2 a pair of and r =3 three, thus we tend to may write the sequence as2, 2 × 3, 2 × 32, 2 × 33, . . . so as to concentrate the super-lift perform, we tend to describe these converters operating within the steady state with the condition of continuous physical phenomenon mode (CCM). conjointly to kind these converters completely different from existing VL converters, we tend to entitle these converters "Positive Output Super-lift converters.

III. SUPER-LIFT LUO-CONVERTER

A. Positive Output Super-Lift Luo-Converter

Voltage carry (VL) technique [1], [6] has been wide utilized in electronic circuit style. attributable to the impact of parasitic components, the output voltage and power transfer potency of all DC-DC converters is restricted. Added, voltage carry technique still has its disadvantages, like the output voltage will increase in patterned advance. in conjunction with the event of conversion technique, Super-Lift (SL) technique [3] has shown a a lot of powerful ability than voltage carry technique. supported the super-lift technique, Super-Lift Luo-Converters ar wide wont to turn out high output voltages. Super-Lift Luo-Converter has many blessings. Firstly, it's a awfully high voltage transfer gain. The output voltage may be accumulated in patterned advance. Secondly, it's a high potency and a high power density. additionally, Super-Lift Luo-Converter has the power to scale back ripple voltage and current.

This device consists of Vin, capacitors C1 and C2, inductor L, power switch IGBT and freewheel diodes D_1 and D_2. Also, it's a voltage carry circuit (VLC). VLC consists of diode D_1 and electrical condenser C1.

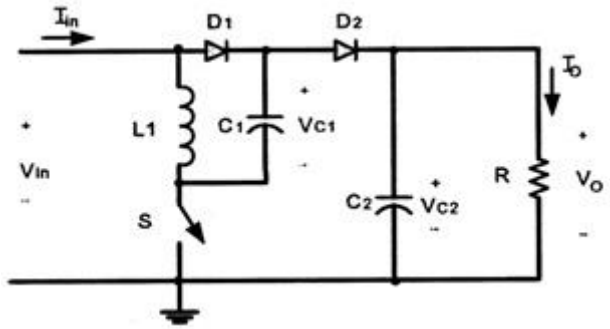

Figure 1. Circuit diagram of POSLLC

IV. MODES OF OPERATION

A. Mode -1

The switch is within the ON state and therefore the dc output transmitted on to the electrical device L and electrical condenser C1. During this mode the voltage across electrical condenser C1 is charged to Vin once switch S is in on position. as a result of electrical device L and electrical condenser C1 square measure connected in paralle``l, the present IL1 can increase with voltage Vin. The electrical device charges to the voltage of

$$V_{in}KT_{ie}\Delta I = V_{in}Kt/L \qquad (1)$$

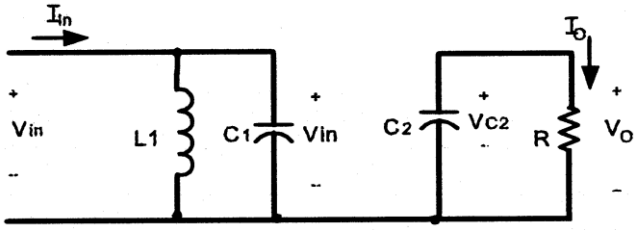

Figure 2. MODE-1

Inductor L charges
Capacitor C1 charges to Vin
Capacitor C2 supplies the load
Diode D2 is Off
Diode D1 is ON

B. Mode- 2

In mode 2, the switch is turned OFF, during this state, the voltage across inductor L will become

$$-(V_a - 2V_{in})\Delta I = -(V_a - 2V_{in})(1-KT)/L \qquad (2)$$

So the current IL1 will decrease. It is assumed that kT is the switch-on period and (l-k)T is the switch-off period.

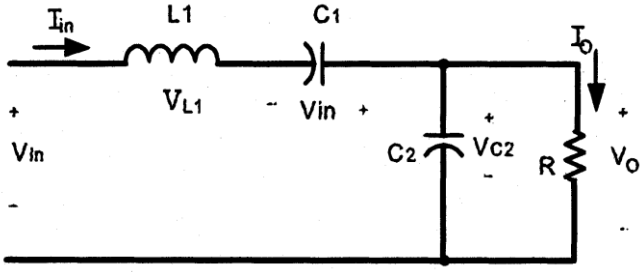

Figure 3. MODE- 2

Inductor current flows to C1
Capacitor C2 charges
Diode D2 is ON
Diode D1 is Off

Equating equations (1) & (2) we can obtain the following equation:

$$V_{in}KT + \left[-(V_0 - 2V_{in})(1-K)T\right] = 0 \qquad (3)$$

Then the output voltage can be calculated from the above formula:

$$V_0 = \frac{2-k}{1-k}V_{in} \qquad (4)$$

voltage transfer gain is:

$$G = \frac{V_0}{V_{in}} = \frac{2-k}{1-k} \qquad (5)$$

k is the conduction duty ratio. If k is changed, the output voltage will also be changed subsequently. The input current iin is equal to $(i_{L1} + i_{c1})$ during switching- on and only equal to iL1 during switching-off. Capacitor current i_{c1} is equal to i_{L1} during switching-off. In steady state, the average charges across capacitor C1 should not change. We have the following relation

$$i_{in-off} = i_{L1-off} = i_{c1-off}$$

$$i_{in-off} = i_{l1-on} + i_{c1-on}$$

and average input current

$$I_{in} = K_{in-on} + (1-k)i_{in-off} = i_{L1} + (1-K)I_{L1}$$

$$= (2-k)I_{L1}$$

$$considering\, T = \frac{1}{f}\, and\, \frac{V_{in}}{i_{in}} = \left(\frac{(1-k)}{(2-k)}\right)^2 R$$

The variation ratio of inductor current i_{L1} is

$$\varepsilon_1 = \frac{k(1-k)^2}{2(2-k)}\frac{R}{fL_1} \qquad V_0 = \frac{1-k}{fC_2}\frac{V_0}{R} \qquad \varepsilon = \frac{\Delta V_0/2}{V_0}$$

$$= \frac{1-k}{2RfC_2}$$

V. PROTEUS SOFTWARE

A. Introduction

Proteus is package for chip and microcontroller simulation, schematic capture, and computer circuit board (PCB) style. it's developed by science lab Center physical science. Figure shows Proteus window. Proteus consists of one application with several modules like ISIS Schematic Capture, PROSPICE Mixed mode SPICE simulation, ARES PCB Layout and VSM (Virtual System Modeling). This project can use ISIS Schematic twenty three Captures to style the buck convertor circuit and VSM mode to simulate the buck convertor circuit.

Proteus main features are as follows.

- Friendly User-Interface
- Wealth of Experimental Resources

- Powerful Virtual Instrument
- Unique Simulation Approach

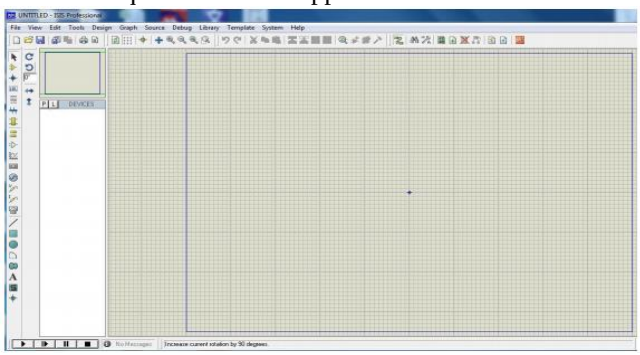

Figure 4. Proteus window

Proteus virtual application development technology for the microcontroller comprehensive design projects includes five steps:

- Development of system solutions,
- Proteus circuit design,
- Virtual system simulation,
- Physical production and Testing.

B. Proteus circuit design:

It includes simulation circuit style and code programming. On the one hand, style the virtual simulation circuit with the standard style technique that typically includes the microcontroller core module, the fundamental input-output modules, every purposeful sub-module, etc. style and draw the hardware schematic with Proteus, at a similar time, sight the sub-module circuit accuracy. On the opposite hand, style code program consistent with the functions of every module, build the most program of the system and therefore the module software package flow chart. Program and right ASCII text file within the Proteus programming atmosphere or a third-party application development tools, like Keil, BASCOM-AVR, etc. Proteus contains everything you wish to develop; take a look at and nearly paradigm your embedded system styles primarily based round the silicon chip Technologies™ PIC16 series of microcontrollers. The distinctive nature of schematic primarily based microcontroller simulation with Proteus facilitates fast, versatile and parallel development of each the system hardware and therefore the system microcode. This style natural process permits engineers to evolve their comes additional quickly, empowering them with the flexibleness to form hardware or microcode changes at can and reducing the time to promote. Proteus VSM models can essentially work with the precise same HEX file as you'd program the physical device with, binary files (i.e. Intel or Motorola Hex files) made by any program or compiler. Proteus provides many key options that build it associate degree exceptional platform for analysis on parallel systems:

- *Flexibility:* Proteus will simulate a good sort of MIMD multiprocessors, as well as each shared-memory and message-passing machines.
- *Performance:* Proteus' performance permits simulation of applications and machine sizes that square measure prohibited by different simulators.
- *Performance/Accuracy Trade-of:* By providing solely the specified accuracy, Proteus maximizes performance; this enables exceptional performance throughout development since users will merely switch to correct modules once required.
- *Repeatability:* Proteus provides repeatability, that is essential to quality debugging, however seldom accessible on real multiprocessors. It lets users rerun simulations till they need pinpointed a haul. Proteus has sure limitation they're
    - .Brown-out Reset isn't enforced.
    - .Power provides voltage dynamic isn't supported.
    - JTAG and different in-circuit debugging interfaces aren't supported.
    - External programming of recollections isn't supported.
    - Electrical characteristic dependency of the temperature isn't enforced.

C. Simulation:

Proteus is software for microprocessor and microcontroller simulation, schematic capture, and printed circuit board (PCB) design. It is developed by Lab Center Electronics. Proteus consists of a single application with many modules such as ISIS Schematic Capture, PROSPICE Mixed mode SPICE simulation, ARES PCB Layout and VSM (Virtual System Modeling). This project will use ISIS Schematic 23 Capture to design the buck converter circuit and VSM mode to simulate the buck converter circuit

VI. DESIGN PARAMETERS OF POSLC

TABLE I DESIGN PARAMETERS

Parameters Name	Symbols	value
Input voltage	V_{in}	12v
Output voltage	V_0	36v
Inductor	L	100µf
Capacitor	C_1	30µf
Capacitor	C_2	30µf
Switching frequency	f_s	100kHz
Load resistance	R_L	100Ω

VII. SIMULATION CIRCUIT

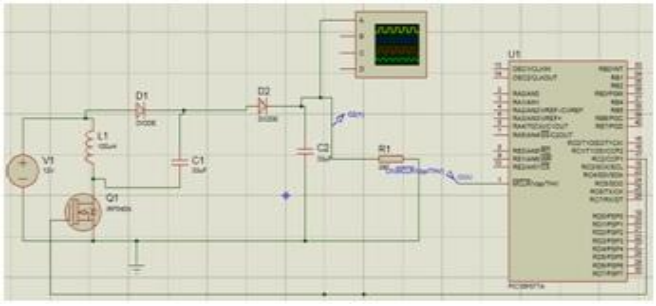

Figure 4. Open Loop Simulation Diagram

The open loop simulation of positive output super-lift converter. Here the MOSFET switch is turned ON using pulse generator with 50% duty ratio and the output voltage is obtained. Figure shows the Luo converter proteus simulation file.

A. Simulation Input Waveform

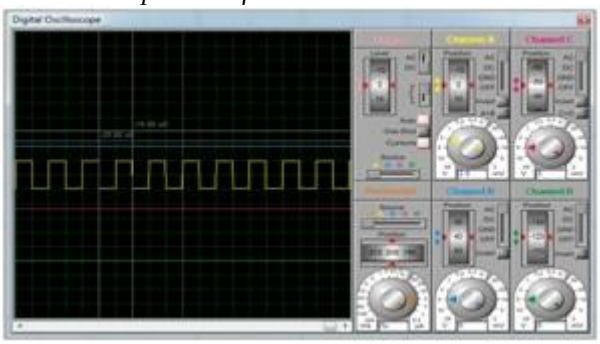

Figure 5. PWM MOSFET Switching Pulse Input Wave Form

B. Simulation Output Waveform

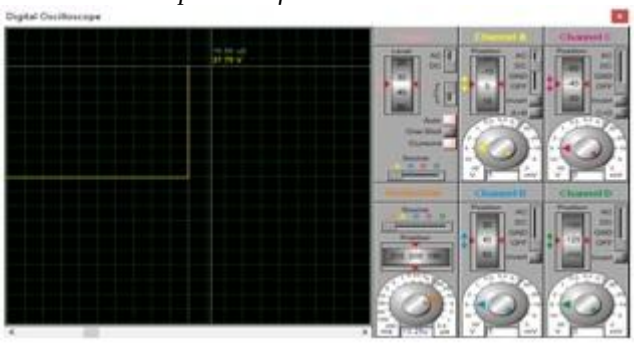

Figure 6. POSLC Simulation Output Wave Form

The output voltage of open loop simulation of POSLLC. It has small overshoot and settles very fast.

VIII. MERITS OF SUPER-LIFT CONVERTER

The conventional boost converter will increase the output in arithmetic progression However, the output voltage increases in arithmetic progression. In proposed system super lift technique is used. This technique in the system implements the output voltage increasing in geometric progression. It effectively enhances the voltage transfer gain in power-law. It is used in man application but mainly in computer peripheral equipment and industrial applications.

IX. CONCLUSION

The DC-DC converters Positive output super-lift converters has been successfully developed. It largely increases the voltage transfer gain in power law, very high output voltage is easily obtained. Simulation and experimental results verified the design and calculations. The effect of the parasitic elements of DC-DC converters limits their output voltage and power transfer efficiency. This work introduced the advanced voltage super lift techniques to be successfully applied. They overcome the effect of parasitic elements and greatly increase the output voltage of the DC-DC converters, introducing the characteristic of high efficiency, high power density, cheap topology in simple structure and near-zero output voltage and current ripples.

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