International Journal of Emerging Technology in Computer Science & Electronics (IJETCSE)
ISSN: 0976-1353 Volume 29 Issue 5 – JUNE 2022.

ULTRA HIGH STEP-UP INTERLEAVED WITH LOW VOLTAGE SERIES

*KRISHNAVENI P [#1], S.krishnaveni [*2] and M.Kanimozhi [*3]*

[#]*Student, PG, Department of Electrical and Electronics Engineering, PSR Engineering College, Sivakasi, India, krishnavenipitchaimani24@gmail.com*

[*2]*Associate Professor, Department of Electrical and Electronics Engineering, PSR Engineering College, Sivakasi,, India, krishnavenieee@psr.edu.in*

[*3]*Associate Professor, Department of Electrical and Electronics Engineering, PSR Engineering College, Sivakasi,, India, Kanimozhi@psr.edu.in*

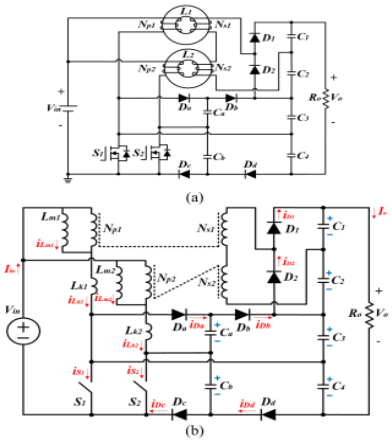
Abstract: In this paper, a new type of interleaved high step-up converter including a coupled inductor is proposed. The proposed converter has an interleaved configuration on the input side to reduce the ripple of the input current and increase the power level. Moreover, a stacked structure on the output side provides a high input/output (I/O) voltage gain. In addition, the proposed converter can avoid an extreme duty cycle, causing larger conduction losses, by combining a coupled inductor and a lossless clamp circuit with an interleaved method. These increase the efficiency by making the semiconductor device a low voltage stress and allowing the use of components with low voltage ratings. Also, the energy stored in the leakage inductor in the coupled inductor can be recycled to the output side, the MOSFETs can be partially ZCS turned ON, and the diode reverse recovery problem can be alleviated. Finally, a laboratory prototype circuit with an input voltage of 24V, an output voltage of 400V and an output of 500W was implemented to demonstrate the performance of the proposed converter

Introduction: High step-up converters are required in many industries based on renewable energy In the case of hybrid

vehicles, the fuel cell stack has various output voltages (20V-40V), and a high DC bus voltage (380V~400V) is required to drive the DC/AC inverter at the output stage of the DC/DC converter. Therefore, in order to increase the low voltage of the fuel cell stack to the high voltage of the DC bus, a high step-up converter is essential In the case of PV power generation, the output voltage of the PV panel is lower than 50V. This low voltage must be passed through the front-end stage to obtain a bus voltage of about 400V (approximately ten times the voltage gain) the isolated DC/DC topology can provide high voltage gain by increasing the turn's ratio of high frequency

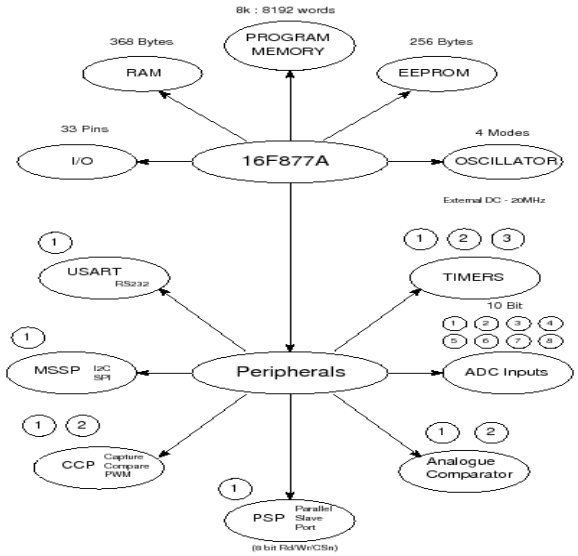
Proposed System: The primary windings Np1 and Np2 of the L1 and L2 are connected in parallel with the input side, and the secondary windings Ns1 and Ns2 of the are connected in series with the output side in the reverse direction. Fig. 1(b) depicts the equivalent circuit; magnetizing inductor (Lm1 = Lm2 = Lmx), leakage inductor (Lk1 = Lk2 = Lkx), switch (Sx = S1 = S2), diode (Da = Db = Dc = Dd = D1 = D2 = Dx), capacitor (Ca = Cb = C1 = C2 = C3 = C4), input and output voltages (Vin, Vo). The resulting currents are denoted by iLm1, iLm2, iLk1, iLk2, iS1, iS2, iDa, iDb, iDc, iDd , iD1, and iD2. The proposed converter employs the interleaved method so that the switches have a phase difference of 180 degrees and the magnetizing inductor is operated by the CCM.

In addition, the D is based on 0.5 or more, and the leakage inductor currents (iLk1 = iLk2 = iLkx) are divided between above and below 0 (zero). Therefore, the operation principle of the proposed converter is explained through two operating analysis. To simplify the analysis, the resistance and parasitic capacitance components of all devices are ignored.



Hardware Description: The hardware system of the proposed converter is implemented using a PIC micro-controller. The software system like Proteus, Mplab, and Micropro is used for the system design for coding the pulses in to the PIC controller. The power supply circuit is designed that will control the PIC and driver circuit to drive the pulses to the MOSFET.

Peripheral Details: Timer0: 8-bit timer/counter with 8-bit prescaler, Timer1: 16-bit timer/counter with prescaler, can be incremented during Sleep via external crystal/clock, Timer2: 8-bit timer/counter with 8-bit period register, prescaler and postscaler, Two Capture, Compare, PWM modules, Capture is 16-bit max, resolution is 12.5 ns Compare is 16-bit max, resolution is 200 ns, PWM max, resolution is 10-bit Synchronous Serial Port (SSP) with SPI (Master mode) and I2C (Master/Slave), Universal Synchronous Asynchronous Receiver Transmitter (USART/SCI) with 9-bit address detection, Parallel Slave Port (PSP) – 8 bits wide with external RD, WR and CS controls (40/44-pin only), Brown-out detection circuitry for Brown-out Reset BOR).



CMOS Technology: Low-power, high-speed Flash/EEPROM technology, Fully static design, Wide operating voltage range (2.0V to 5.5V), Commercial and Industrial temperature .

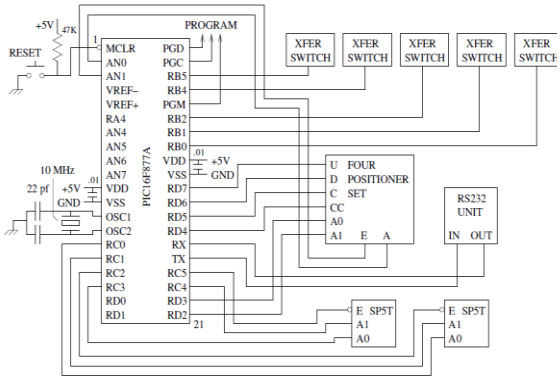


Fig: MicrocontrollerPIC16F877A

MOSFET Gate Driver:A high voltage, high speed power MOSFET and IGBT driver with independent high and low side referenced output channels. Proprietary HVIC and latch immune CMOS technologies enable ruggedized monolithic construction. Logic inputs are compatible with standard CMOS or LSTTL outputs, down to 3.3V logic. The output drivers feature a high pulse current buffer stage designed for minimum driver cross conduction. Propagation delays are matched to simplify use in high frequency applications. The floating channel can be used to drive an N-channel power MOSFET or IGBT in the high side configuration which operates up to 600 volts.

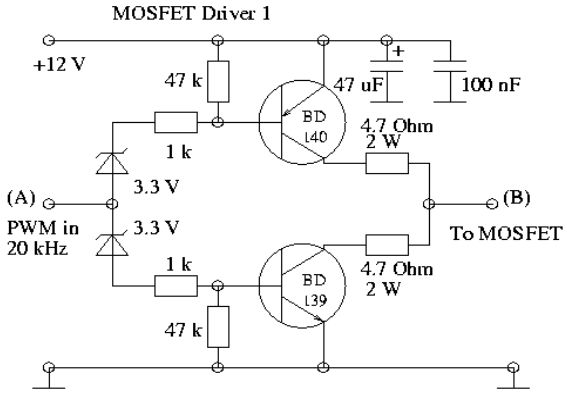


Fig.. DRIVER CKT IR2110

capacitor :(formerly known as **condenser**) is a passive two-terminal electrical component used to store energy in an electric field. The forms of practical capacitors vary widely, but all contain at least two electrical conductors separated by a dielectric (insulator); for example, one common construction consists of metal foils separated by a thin layer of insulating film. Capacitors are widely used as parts of electrical circuits in many common electrical devices.

Fig.. Capacitor

Power Supply Unit: This section describes how to generate +5V DC power supply and +12V DC power supply.

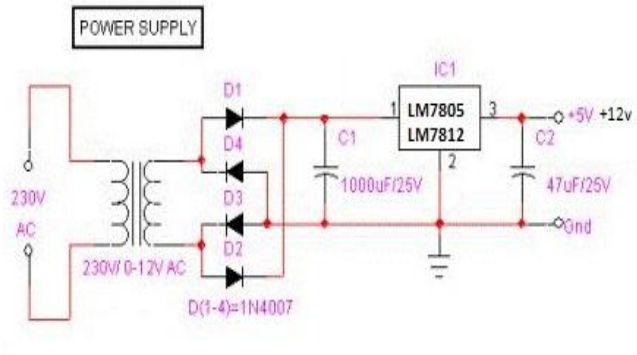
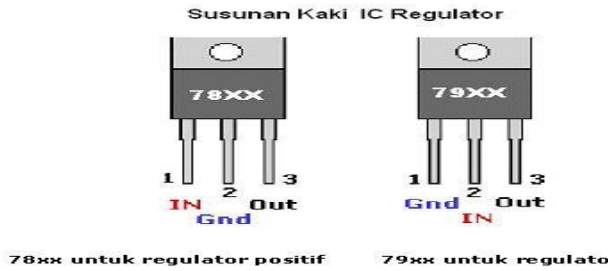


Fig. Power Supply Unit

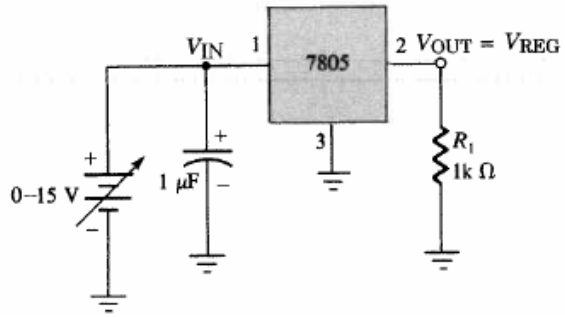
The power supply section is the important one. It should deliver constant output regulated power supply for successful working of the project. A 0-12V/1mA transformer is used for this purpose. The primary of this transformer is connected in to main supply through on/off switch& fuse for protecting from overload and short circuit protection. The secondary is connected to the diodes to convert 12V AC to 12V DC voltage. And filtered by the capacitors, which is further regulated to +5v, by using IC 7805 and +12v by using IC7812.

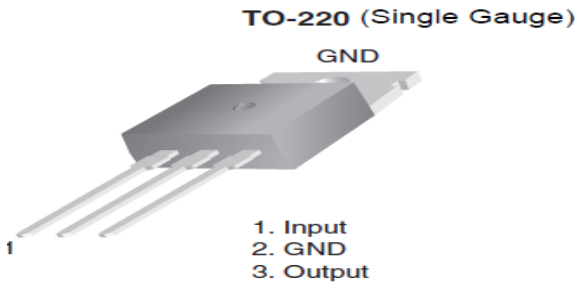
RegulatorIC's:



Load: If the load impedance is not very much higher than the power supply impedance, the voltage will drop. In a domestic environment, switching on a heating appliance may cause incandescent lights to dim noticeably.

.





APPLICATIONS

- High voltage application.
- Tele communication.
- Grid tie inverter & stand alone inverter

Future Scope:The system can be extended for more voltage range. Increase in more voltage range will increases the voltage gain and efficiency of the converter system. The output DC voltage can be inverted and we can use the AC loads also.

Conclusion: A new high step-up interleaved converter with a coupled inductor was proposed. The proposed converter has the following features. 1) The power level and input current ripple are respectively increased and reduced by interleaved operation on the input side, and high voltage gain is obtained by the series stack method on the output side.‘ 2) The conduction loss and efficiency are improved by using lower voltage rated MOSFETs and diodes. 3) The leakage inductor energy is efficiently recycled to the output energy. 4) The switches are partially ZCS turned ON under soft switching conditions, and the reverse recovery problem of the diodes is alleviated. These features of the proposed converter can be a promising candidate in

renewable energy fields that require low input voltage and high output voltage

References: S

[1] M. L. Alghaythi, R. M. O'Connell, N. E. Islam, M. M. S. Khan, and J. M. Guerrero, ''A high step-up interleaved DC-DC converter with voltage multiplier and coupled inductors for renewable energy systems,'' IEEE Access, vol. 8, pp. 123165–123174, Jul. 2020.

[2] A. Ajami, H. Ardi, and A. Farakhor, ''A novel high step-up DC/DC converter based on integrating coupled inductor and switched-capacitor techniques for renewable energy applications,'' IEEE Trans. Power Electron., vol. 30, no. 8, pp. 4255–4263, Aug. 2015.

[3] W. Chen, X. Wu, L. Yao, W. Jiang, and R. Hu, ''A step-up resonant converter for grid-connected renewable energy sources,'' IEEE Trans. Power Electron., vol. 30, no. 6, pp. 3017–3029, Jun. 2015.

[4] K. Jyotheeswara Reddy and N. Sudhakar, ''High voltage gain interleaved boost converter with neural network based MPPT controller for fuel cell based electric vehicle applications,'' IEEE Access, vol. 6, pp. 3899–3908, Feb. 2018.

[5] H. Bi, P. Wang, and Y. Che, ''A capacitor clamped H-type boost DC-DC converter with wide voltage-gain range for fuel cell vehicles,'' IEEE Trans. Veh. Technol., vol. 68, no. 1, pp. 276–290, Jan. 2019.

[6] V. F. Pires, A. Cordeiro, D. Foito, and J. F. Silva, ''High step-up DC–DC converter for fuel cell vehicles based on merged quadratic Boost–Cuk,'' IEEE Trans. Veh. Technol., vol. 68, no. 8, pp. 7521–7530, Aug. 2019.