

A Bridgeless Interleaved Continuous Conduction Mode Boost Power Factor Correction Converter

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ABSTRACT: A single-phase, Interleaved AC/DC power factor correction (PFC) rectifier with high gain output voltage is proposed in this paper.

For low output voltage product applications, the rectifier is designed to convert high input voltage to low output voltage. Due to no bridge-diodes required and thus decreased input conduction losses, the proposed rectifier efficiency can be improved.

The proposed rectifier operates in discontinuous conduction mode and the current-loop circuit is hence not needed. Also, only a single switch is used in the rectifier to simplify the control circuit design.

A simple translation method to have the positive output voltage in the interleaved converter is presented in the rectifier to reduce the component counts and the cost as well.

The operational principles, steady-state analysis, and design procedure of the proposed rectifier are addressed in detail in this project.

I. INTRODUCTION

In recent years, switched-mode power supply technologies have developed rapidly. Most switched-mode power supplies for electronic products are used to convert AC to DC sources in different applications. The use of a transformer, a bridge rectifier, and capacitors can achieve a DC-output voltage easily, but the input current may be seriously distorted. Therefore, the PFC converters are critically required for AC-DC conversion. A variety of circuit topologies have been developed for the PFC Applications. The conventional PFC converter is a full-bridge rectifier followed by a interleaved boost converter. The converter is widely used, because of its simplicity.

However, due to boosting behavior of the converter, the output voltage is always greater than the input voltage. In many applications, such as low-voltage and low-power supplies, it is desired to have the output voltage.

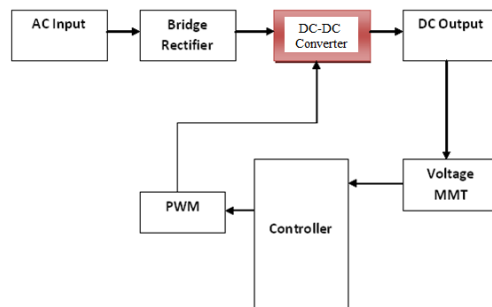
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II. EXISTING SYSTEM



III. DRAWBACKS

- 2. They are physically larger for the same capacitance and working voltage as other types.
 - 3. They have a higher leakage current than most other types.
 - 3. They are not very good for low frequency applications.
- They can only be mounted vertically because of the liquid electrolyte inside them.

IV. PROPOSED SYSTEM

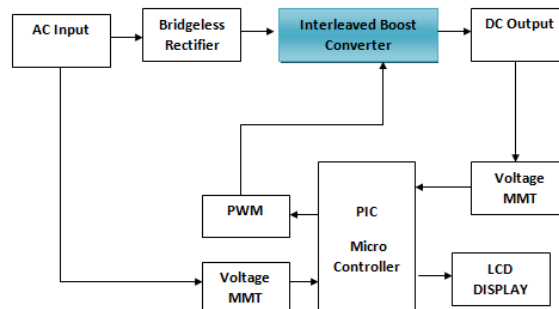


Figure 2:Block Diagram

PIC MICRO CONTROLLER: CONCEPTS OF MICROCONTROLLER

Microcontroller is a general purpose device, which integrates a number of the components of a microprocessor system on to single chip. It has inbuilt CPU, memory and peripherals to make it as a mini computer. A microcontroller combines on to the same microchip:

- The CPU core
- Memory(both ROM and RAM)
- Some parallel digital i/o

Microcontrollers will combine other devices such as:

- A timer module to allow the microcontroller to perform tasks for certain time periods.
- A serial i/o port to allow data to flow between the controller and other devices such as a PIC or another microcontroller.

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- An ADC to allow the microcontroller to accept analogue input data for processing.

Microcontrollers are :

- Smaller in size
- Consumes less power
- Inexpensive

Micro controller is a stand alone unit ,which can perform functions on its own without any requirement for additional hardware like i/o ports and external memory.

MEMORY ORGANISATION

There are three memory blocks in each of the PIC16F877 MUC's. The program memory and Data Memory have separate buses so that concurrent access can occur.

PROGRAM MEMORY ORGANISATION

The PIC16f877 devices have a 13-bit program counter capable of addressing 8K *14 words of FLASH program memory. Accessing a location above the physically implemented address will cause a wraparound. The RESET vector is at 0000h and the interrupt vector is at 0004h.

DATA MEMORY ORGANISATION

The data memory is partitioned into multiple banks which contain the General Purpose Registers and the special functions Registers. Bits RP1 (STATUS<6>) and RP0 (STATUS<5>) are the bank selected bits.

RP1:RP0	Banks
00	0
01	1
10	2
11	3

Each bank extends up to 7Fh (1238 bytes). The lower locations of each bank are reserved for the Special Function Registers. Above the Special Function Registers are General Purpose Registers, implemented as static RAM. All implemented banks contain special function registers. Some frequently used special function registers from one bank may be mirrored in another bank for code reduction and quicker access.

INTERLEAVED BOOST CONVERTER

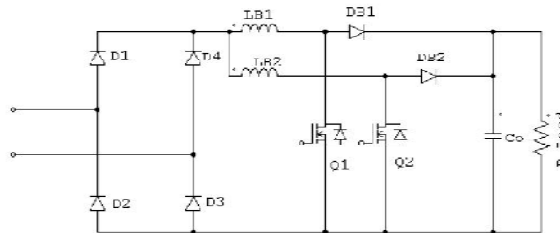
The interleaved boost converter, it operates depending upon the Interleaving property. The circuit contains two boost converters in parallel operating 180° out of phase. The inductor's ripple currents are out of phase, so They tend to cancel each other and reduce the input ripple current caused by the boost switching action. The input current is the sum of the two inductor currents ILB1 and ILB2. Moreover, the effective switching frequency is increased by switching 180° out of phase and introduces smaller input current ripples. So the EMI filters in the input side will be smaller.

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V. SOFTWARE SIMULATOR

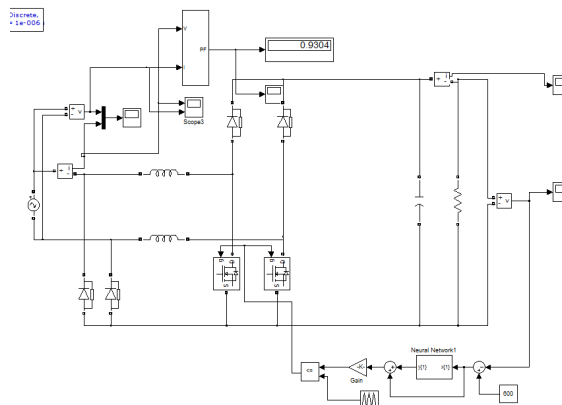
MATLAB

MATLAB is a high-performance language for technical computing. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation.

Typical uses include:

- ❖ Math and computation
- ❖ Algorithm development
- ❖ Modeling, simulation, and prototyping
- ❖ Data analysis, exploration, and visualization
- ❖ Scientific and engineering graphics
- ❖ Application development, including Graphical User Interface building

MATLAB is an interactive system whose basic data element is an array that does not require dimensioning. This allows you to solve many technical computing problems, especially those with matrix and vector formulations, in a fraction of the time it would take to write a program in a scalar non-interactive language such as C or FORTRAN.



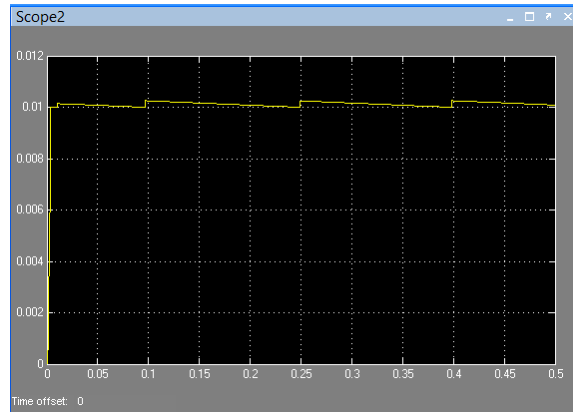
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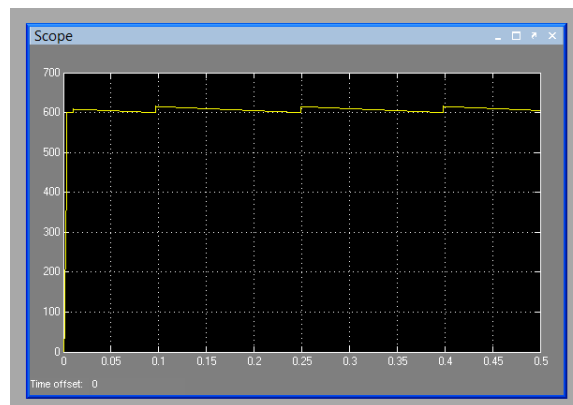
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OUTPUT CURRENT



OUTPUT VOLTAGE



Advantage:

1. Easy to implement.
2. Low noise at output.
3. Low price, at high powers.
4. Compact design.
5. Easy to get closed loop

Application:

- The Cuk converter has several advantages in power factor correction applications.
- such as easy implementation of transformer isolation, natural protection against inrush current occurring at start-up or overload current, lower input current ripple, and less electromagnetic interference(EMI) associated with discontinuous conduction mode topology.
- LED-based street lighting is an application in which the cost of the LED driver is less important than its efficiency due to the amount of energy consumed by street lighting every day.

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VI. CONCLUSIONS

The Interleaved Boost PFC rectifier with high gain output voltage has been proposed and experimentally verified. The experimental results have shown good agreements with the predicted waveforms analyzed in the paper. The power factor of the circuit has at all the specified input and output conditions. Satisfaction of the requirements can be easily achieved by the proposed circuit. Moreover, with higher efficiency and high power factor the proposed topology is able to be applied to most of the consumer electronic products of 150W rating in the market. Also, with only a single switch employed, the implemented system control circuit is simple to achieve high power factor by applying any PWM control.

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