A Family of Single-Phase Voltage-Doubler
High-Power-Factor SEPIC Rectifiers Operating in DCM

Introduction:

Single-phase pulse width modulation (PWM) rectifiers with a high power factor are employed in the input stage of power supplies in several applications (computers, notebooks, appliances, lighting equipment, portable tools, etc.). They provide an input current with a sinusoidal shape, reduced total harmonic distortion (THD), and high power factor. Topologies derived from a boost converter are commonly employed for power factor correction (PFC), due to the current source characteristic at the input. Topologies derived from a boost converter are commonly employed for power factor correction (PFC), due to the current source characteristic at the input.

Single-phase PFC rectifiers is to use topologies derived from the SEPIC converter which are single-stage topologies that can operate as step-down/stepup voltage regulators (boost works only as step-up). In general, the SEPIC rectifier is employed in discontinuous conduction mode (DCM), because the input current naturally follows the input voltage. Hence, the converter does not need a current control loop that simplifies its control system. Furthermore, the input current of the SEPIC rectifier in DCM does not present the third harmonic and it does not require additional bulk filters (which are needed in buck, buck-boost, or boost rectifiers in DCM).
Proposed system:
The proposed topology of the single-phase voltage-doubler SEPIC rectifier such that the structure integrates two classical SEPIC rectifiers in a single converter. The circuit works as two half-wave rectifiers, one for each half-line cycle, and the two output voltages are series-connected (the principle being similar to that of the voltage-doubler boost rectifier). The results obtained show that the proposed converter multiplies the output voltage by 2 when compared to the classic SEPIC rectifier (hence, the term “voltage-doubler”).

SEPIC rectifiers in DCM do not employ an input filter (which is used in boost rectifiers in DCM), and can supply low-level output voltage as in the case of buck rectifiers. Furthermore, in DCM, the SEPIC rectifiers have a resistive load characteristic and thus they do not require the use of a current-loop control. The proposed converter maintained all of these characteristics and, in relation to the classic SEPIC rectifier, it can either provide reduced voltage stress on the semiconductors for the same output voltage level or supply double the gain of the output voltage with the same voltage stress.

Advantages:
- Reduced voltage stress on the semiconductors for the same output voltage level.
- Double the gain of the output voltage.
Applications:
- Power factor correction applications.

Block Diagram:

- Ac input
- Single-phase voltage-doubler SEPIC rectifier
- Load
- Gate driver circuit
- Buffer circuit
- Microcontroller circuit
- 12VDC
- 5VDC