A Boost PFC Stage Utilized as Half-Bridge Converter for High-Efficiency DC–DC Stage in Power Supply Unit

Introduction:

As information technology (IT) devices, such as computer, server, and telecom, have rapidly grown, the Importance of power supply units (PSUS) has been increased. In general, PSUS need two requirements: 1) high efficiency for environmental conservation and energy saving, 2) high-power quality to meet the harmonics regulations. For these reasons, PSUS typically adopt a two-stage structure that consists of a boost power factor correction (PFC) stage and dc/dc stage.

The boost PFC stage controls the shape of the input current to achieve a high-power quality. Moreover, it provides a constant nominal link voltage with low frequency voltage ripple for the dc/dc stage as an input voltage source. The dc/dc stage, following the boost PFC stage, offers galvanic isolation and precisely regulates the output voltage using the link voltage.

Proposed system:

A boost PFC stage, which can be utilized as the HB converter, is proposed to achieve a high-efficiency HB LLC Converter. The proposed PFC stage can be effectively derived by replacing a boost diode and inductor with a switch and transformer, respectively. When
the ac line is supplied, the proposed PFC stage basically operates like the conventional boost PFC converter.

Thus, it provides nominal link voltage for the HB \( LLC \) converter at the normal state. On the other hand, during the hold-up time, the proposed PFC stage can deploy the inactive Boost PFC converter as the HB converter, which can cover wide link voltage range instead of the HB \( LLC \) converter.

The boost PFC converter is composed of the boost inductor \( LB \), boost switch \( QB \), boost diode \( DB \), and link capacitor \( c \). Moreover, the input filter capacitor \( C_{in} \) is generally employed to decrease the electromagnetic interference (EMI) noise.

**Advantages:**
- High efficiency.
- High compatibility.

**Applications:**
- High power factor correction applications.
Block Diagram:

Ac input → HB LLC converter → Rectifier → Load

12VDC → Gate driver circuit

5VDC → Buffer circuit

Microcontroller circuit