High Efficiency DC Input Power Supply

KW2-13

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Project Overview

Introduction
Switching mode power supply is a type of high efficiency electrical power supply. It converts electrical power by switching the regulator between full-on, full-off and low-dissipation states. The high dissipation transitions will last only a short time during the conversion, hence the efficiency of switching mode power supply is greater than the typical linear power supply. This type of power supply is widely used in personal computers, battery chargers and data centers.

Aims and Objectives
The aim of this project is to create a DC to DC power supply model from an existing AC to DC model by modification of hardware components and software program of the microcontrollers in the power supply.

Methodology

The technical challenge of this project will be creating a stable soft start state for the power supply to avoid the output voltage jumping as high as the input voltage when switching on, otherwise it will damage the system which is powered by this power supply. In most of the functions of the power supply are controlled by digital signal, most of the modifications for the DC-DC approach can be implemented by firmware modifications.

The first half of the softstart is controlled by the secondary MCU. It will regulate the output voltage by controlling the LLC converter. The output voltage is not stable to reach 12V in the bulk voltage is not enough for output regulation. Thus, the secondary MCU will communicate with the primary MCU. The primary MCU will start to control the booster circuit to increase the output voltage. The primary MCU will maintain to increase the bulk voltage until the second half of the softstart is finished.

Results

The bulk voltage remains at 264V as the input voltage. The output voltage reaches about 12V, the duty cycle of the LLC converter is reached maximum level. The secondary MCU starts to send the analog signal through analog communication. The primary MCU uses the received analog values to calculate the duty cycle of the booster circuit to regulate the bulk voltage. The softstart of output voltage continues as the booster circuit starts to boost up the bulk voltage while the LLC converter is reached maximum duty at fixed frequency. Hence the softstart for DC-DC approach can regulate DC output with DC input as expected.