New current-mode PWM controllers support boost, flyback, SEPIC and LED-driver applications

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Introduction
With their wide input voltage range, the TPS40210 and TPS40211 PWM controllers are targeted for isolated and non-isolated power converters used in industrial, automotive, and battery-powered applications. The full freedom in selecting the power stage and its compensation—as well as the advanced features, such as programmable soft start, adjustable/synchronizable oscillator frequency and internal slope compensation—supports the use of the devices in many applications. The basic converter architecture can provide different power levels by simply changing the power stage. While the TPS40210 is designed for general-purpose applications, the TPS40211 is tailored for driving high-brightness LEDs.

Boost converter application
The devices and their basic configuration are described in detail in Reference 1.

SEPIC converter application
The SEPIC-converter shown in Figure 1 allows the input voltage to be smaller, larger, or equal to the targeted output voltage. The topology requires two single inductors or one coupled inductor, L1, and a capacitor C9, which is responsible for the energy transfer. The filter formed by L2 and C11 is optional. It reduces the output ripple voltage to 50 mVp-p in the example shown. When operating the converter at 1 MHz, the size of the power stage (inductors/capacitors) can be minimized. However, due to the increased switching loss at this high frequency, a greater than 1-A continuous output current requires Q1 to be mounted on a heat sink. Operation without a heat sink is possible at a reduced switching frequency and/or reduced maximum input voltage.

With a 2-A current output and a 1-MHz switching frequency, converter efficiency was measured as follows: 90% with a 12-V source, 88% with a 24-V source, and 85% with a 36-V source.

Features
- Input voltage: 4.5 to 52 V
- Current-mode architecture
- Switching frequency: 35-kHz to 1-MHz (programmable and synchronizable)
- Programmable soft start (closed loop)
- Reference voltage: 700 mV for TPS40210 and 260 mV for TPS40211
- Internal slope compensation
- Threshold for overcurrent detection: 150 mV
- Internal 8-V regulator and N-channel MOSFET driver
- Quiescent current when disabled: 10 µA
- MSOP10 PowerPAD™ and 3-mm x 3-mm SON package

Figure 1. SEPIC 1-MHz converter with 8- to 36-V input and 12-V/3-A output
Flyback converter application

Figure 2 shows the TPS40210 controller configured in a flyback-converter topology for a dual-output isolated supply. Key components include the transformer (T1), the snubbers (R5, C7, D1, R8, C9, R10, R11, C12 and C13), the optocoupler (U2), the secondary-side reference and error amplifier (U3), the bias resistor (R15) belonging to U3, the loop compensation (C19, C20 and R16), the output-voltage divider (R17 and R18), and the secondary-side soft-start and overshoot control (D5, R14 and C18). The circuit shown directly controls the positive output rail (VOUT+) only. Negative-rail regulation is based on the cross regulation between the two secondary windings of T1. When the negative output does not have a load, R12 and D4 provide a basic load.

High-brightness LED-driver application

DC/DC regulators are usually designed to provide a constant-voltage output; however, LED applications require a constant-current output. In Figure 3, R1 is used to sense the LED current. The losses in R1 are minimized with the TPS40211 because of its low 250-mV reference voltage. D1 protects against output overvoltage in the event of an LED-string open circuit. The brightness can be programmed by altering R1, current injection into the FB pin, or by PWM dimming. See Reference 1 for more information.

References

For more information related to this article, you can download an Acrobat Reader file at www-s.ti.com/sc/techlit/litnumber and replace “litnumber” with the TI Lit. # for the materials listed below.

Document Title  
1. “TPS40210/211” data sheet  slus772

Related device

TPS40200—4.5- to 52-V wide input range step-down converter  
www.ti.com/sc/device/TPS40200

Related Web sites

power.ti.com

www.ti.com/sc/device/TPS40210
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