Application Note

Using the TPS7H500X in Voltage Mode Control

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ABSTRACT

The TPS7H500X family of devices can be used as a voltage mode converter with minimal changes. Using the internal ramp generated by the slope compensation circuit is all that is needed in order to generate the required ramp for voltage mode control.

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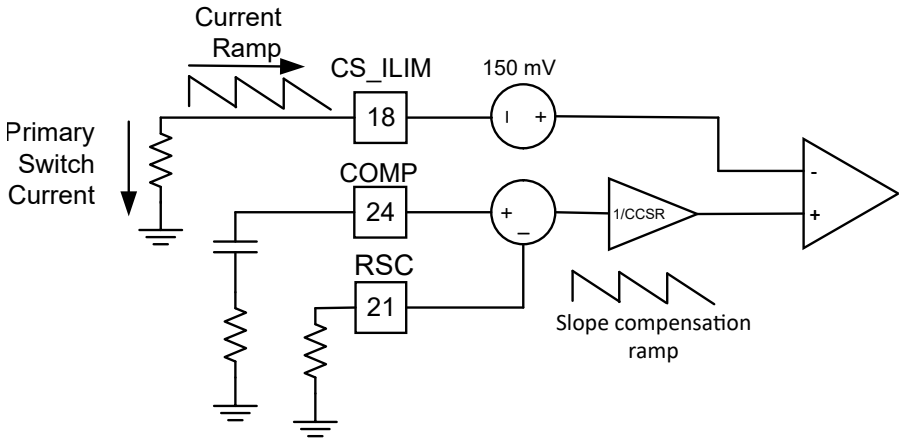
Trademarks

1 Introduction

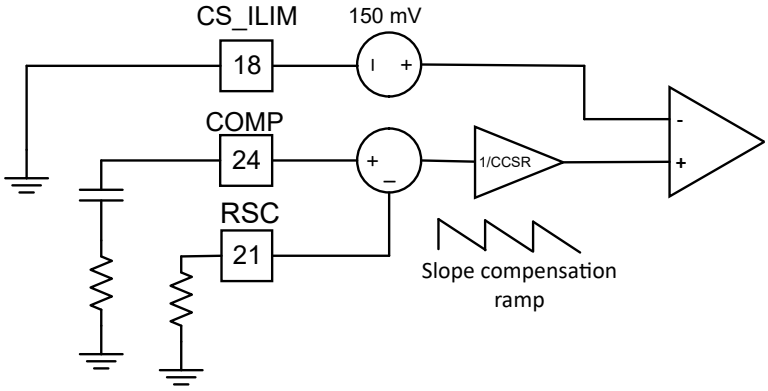
The main difference between voltage mode and current mode control from an electrical implementation standpoint is how the control ramp that is compared to the error voltage is generated. For a current mode control design the ramp will be generated by sensing the current going through the control switch.

2 Implementation

For the TPS7H500X family of devices the current ramp information is done as an input into the CS_ILIM pin.



By grounding the CS_ILIM pin and then changing the value of the RSC resistor, voltage mode can be achieved



The equation below details the RSC resistor value that will allow for the full output range of error amplifier to be used. Values below and above this value will still allow for the converter to run, but being close to this value is advised.

$$SC = f_{SW} \times 2V \quad (1)$$

Where f_{SW} is in MHz

$$R_{SC} = \frac{28.3}{SC^{1.1}} \quad (2)$$

Current limiting is disabled by doing using this method for voltage mode. One method for how to add a current limit is detailed in Space-Grade, Overcurrent Protection Circuit for TPS7H500x-SP Family of Devices Using the INA901-SP

Equations for compensation of voltage mode control a good reference is Switch-mode power converter compensation made easy.

Two designs that use voltage mode control with the TPS7H500X family of devices are the PMP23193 and the PMP23552.

3 Summary

With proper techniques the TPS7H500X family of devices can be used as a voltage mode converter. Using the built in slope compensation, one can implement the control scheme with minimal external components. This method saves space over the more traditional method of generating the ramp signal from a resistor and capacitor combination.

4 References

1. Texas Instruments, *TPS7H500x-SP Radiation-Hardness-Assured 2MHz Current Mode PWM Controllers*, datasheet.
2. Texas Instruments, PMP23193, product page.
3. Texas Instruments, PMP23552, product page.
4. Texas Instruments, *Switch-mode power converter compensation made easy*, seminar.
5. Texas Instruments, *Space-Grade, Overcurrent Protection Circuit for TPS7H500x-SP Family of Devices Using the INA901-SP*, application brief.

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