**UCx84x Current-Mode PWM Controllers**

In this section controller is introduced and circuit calculations are made.

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Description automatically generatedThis controller produced by Texas Instruments however many manufacturers produce the exact product. Analog Devices is one of them it helps us the simulate this circuit with LTspice.

**Figure 1:** Features and Applications

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**Figure 2:** Description

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**Figure 3:** Pin-Out

For the startup circuit is designed with the Webench power designer and then all of the components are examined. Components which are not necessary for the application is excluded.

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**Figure 4:** Webench Circuit Design

**Pin Analysis**

**1. Comp**

This pin is defined as error amplifier compensation pin. It helps to control section of the circuit. Phase margin and bode plots can be modified with this pin. However, since it is a complex process, recommended values from TI are used.

Hence 1 nf capacitor and 10 kΩ resistor is used.

**2. Vfb**

This is a feedback pin which is connected to the internal error amplifier of UC3845.

**3. Isense**

This is a sense pin for the controller. It is connected to the current sense resistor. However, we did not implement current mode control because there is a power dissipation on the sense resistor which is high for our application. The aimed circuit is the most efficient circuit possible.

For the current mode tried sense resistor value is 30m which helps the circuit not exceeds 27A.

3-4 W power dissipation significantly reduces our efficiency therefore voltage mode is preferred.

It is known that voltage mode control can be applied with any current mode controller. TI describes this operation in the datasheet:

We would need to apply 0.9V peak sawtooth waveform to the input of the current sense pin, which can be accomplished by using a fraction of the oscillator timing capacitor waveform.

For the simplicity we prefer to connect this pin to the ground.

**4. RT/CT**

The frequency of the oscillator can be estimated with the following equations:

At up to a 100% duty cycle, the UCx842 and UCx843's OUTPUT gate drive's frequency, fSW, is the same as fOSC. At up to 50% duty cycle, the UCx844 and UCx845 frequencies are equal to half of the fOSC frequency.

Moreover, timing resistor should be higher than 5 kΩ.

is chosen as 8.66 kΩ.

is 100 kHz. However, in order to set switching frequency to 100 kHz; of the IC is set to 200 kHz.

Therefore,

**5. Ground**

This pin is connected to the ground.

**6. Output**

This pin produces a gate signal to the MOSFET.

Gate resistor selection is researched. [1]

The procedure is as follows:

1. Determine the oscillator ringing frequency:

Do not connect any external gate resistor to the MOSFET and the measure the ringing frequency.

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**Figure 5:** External Gate Resistor RGATE = 0-Ω

2. Calculate the source inductance according to the MOSFET input capacitance .

3. Choose a gate resistor with a Q value between 0.5 (critically damped) and 1 (under damped).

For the predesign stage gate resistor is selected as 8 Ω.

**7. VCC**

This is the supply voltage pin.

At the webench circuit schematic supply voltage provided with the third winding. However, our input voltage is 12-18 V therefore no additional winding is required. Controller can be supplied up to 30V.

**8. VREF**

This pin produces 5-V reference voltage. It is connected to the optocoupler.

**References**

1.Begue, M. (2018). External Gate Resistor Design Guide for Gate Drivers. *Application Note:SLLA385*.