

Buffer amplifier and LED improve PWM power controller's low-load operation

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Texas Instruments' UCC3895 offers a good base for building a high-efficiency, pulse-width-modulated, switched-mode power supply that suits either current- or voltage-mode control. Designed for driving a full-bridge power inverter using two sets of complementary outputs, Out A through D, the circuit controls power by phase-shifting outputs C and D with respect to A and B. The manufacturer's data sheet provides a detailed description (Reference 1). However, when lightly loaded and configured for current-mode control, the controller can produce asymmetric-width pulses on its lagging outputs, C and D, under start-up conditions. Reference 2 provides a complete description of the

problem and a workaround.

Unfortunately, the workaround evokes other problems when you use the IC in other circuit implementations. Figure 1, from Reference 2, shows a partial schematic featuring the UCC3895 in a peak-current-mode-control circuit in which R_1 serves as a pullup resistor, providing a dc offset for the voltage ramp. However, for a significant portion of the ramp waveform, diode D_1 doesn't conduct and therefore narrows the power supply's dynamic range by cutting off a portion of the ramp voltage at IC₁'s Pin 3.

Figure 2 shows another approach that requires additional components but delivers the full magnitude of the voltage ramp to Pin 3 of IC₁ and provides

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the approximately 1V-dc offset that Reference 1 requires. Transistors Q_1 and Q_2 , resistors R_1 and R_2 , and LED D_3 form an emitter-follower amplifier for the ramp voltage available at IC₁, Pin 7 across timing capacitor C_1 . This arrangement provides reliable current-mode operation over the full range from no-load to full-load output current by delivering a

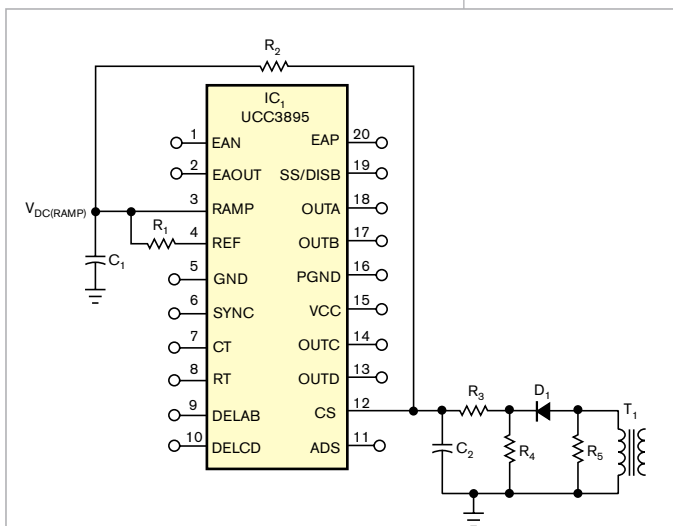


Figure 1 An added resistor, R_1 , helps improve light-load operation of a popular switched-mode power-supply controller by eliminating output asymmetry.

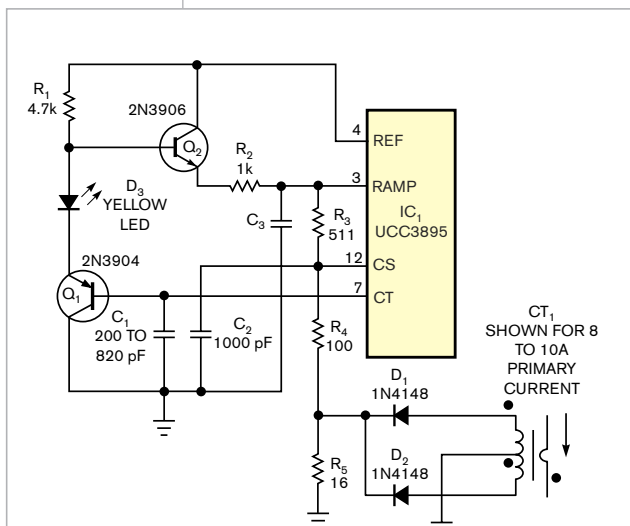


Figure 2 For even better performance, add a level-shifting amplifier to the ramp-voltage path.

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sawtooth drive with a dc offset to IC₁'s ramp input. Diode D₃, a yellow LED, performs a 1.7V level translation without introducing any substantial signal loss. The component values not shown depend on the application. **EDN**

REFERENCES

1 "UCC3895 BICMOS Advanced Phase Shift PWM Controller," Texas Instruments data sheet, <http://focus.ti.com/docs/prod/folders/print/ucc3895.html>.

2 Mappus, S, "UCC3895 OUTC/OUTD Asymmetric Duty Cycle Operation," Texas Instruments Application Report, SLUA275, September 2002.