

APPLICATION NOTE 239

Regulated LCD-Bias Generator Requires No Inductor

A stringent height limitation on the PC boards for personal digital assistants (PDAs) and palmtop computers compels the use of expensive, low-profile inductors in switch-mode power supplies. As an alternative, however, certain switch-mode circuits can be replaced with one based on a charge pump (**Figure 1**). This example generates a regulated negative voltage suitable for biasing an LCD.

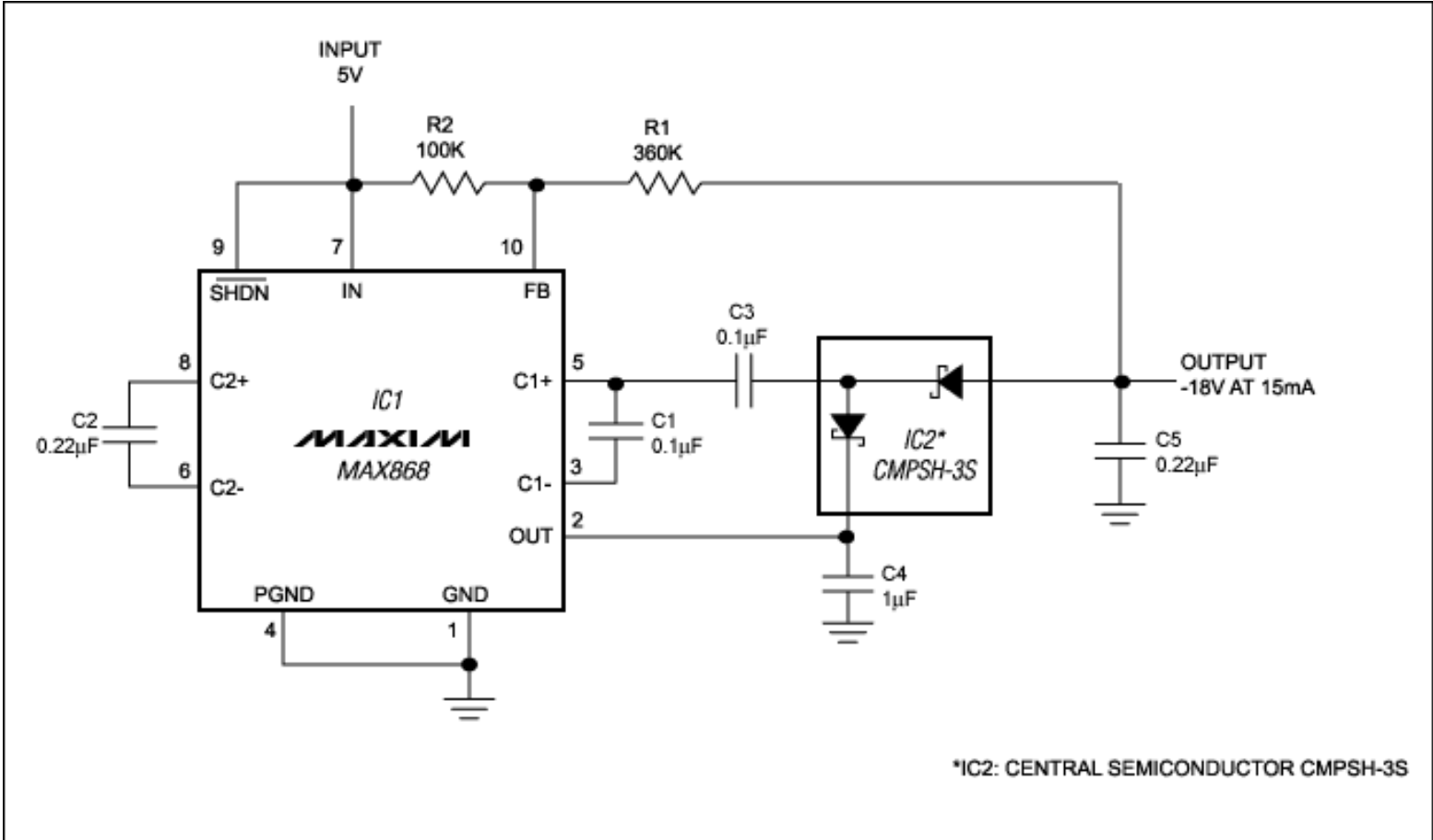


Figure 1. Adding a few inexpensive components in the feedback path of IC1 enables the generation of regulated output voltages nearly as high as $-4V_{IN}$.

IC1 contains a regulated, inverting charge pump that produces output voltages as high as $-2V_{IN}$, in which the supply voltage (V_{IN}) can range from +1.8V to +5.5V. The IC regulates V_{OUT} through pulse-frequency modulation (PFM), with a maximum frequency of 450kHz. The IC's low quiescent current (30µA) provides excellent light-load efficiency without sacrificing full-load capability.

Inserting an external, discrete charge pump (consisting of C3, C4, and the Schottky diodes) in the feedback path of IC1 produces an "inverter-quadrupler" circuit whose regulated output level is set by the ratio of feedback resistors R1 and R2:

$$V_{OUT} = -V_{IN} (R1/R2)$$

Configured as shown, the circuit provides up to 15mA at $V_{OUT} = -18V$, with 76% efficiency and 60mV of output voltage ripple. Lower V_{OUT} allows higher output currents: $V_{OUT} = -15V$ yields 20mA, and $V_{OUT} = -12V$ yields 30mA.

A similar idea appeared in the 3/9/98 issue of *Electronic Design*.

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