

Low-Cost Single-Inductor Triple-Output TFT LCD Supply

By the Power Management Business Unit Staff

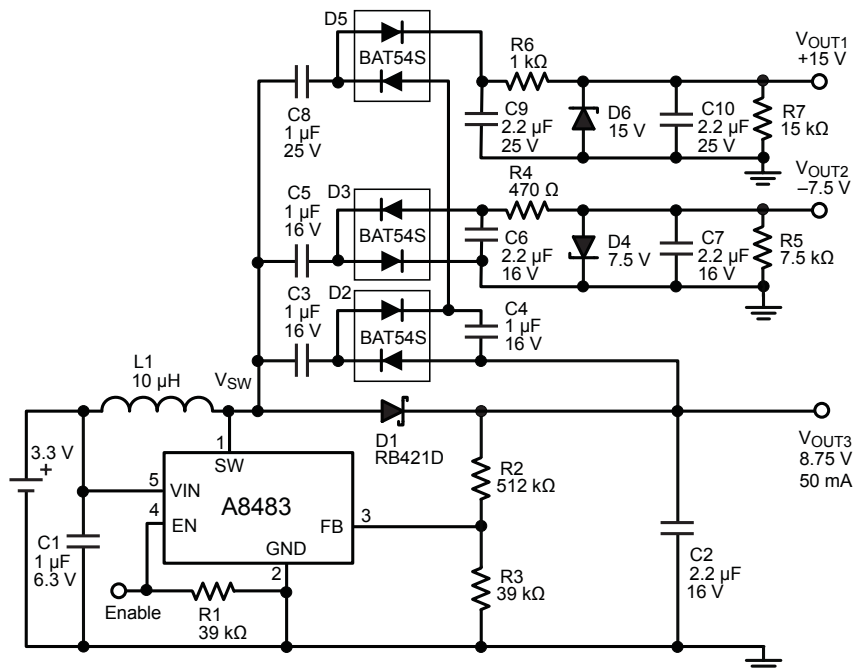
This application note describes an easy method of conversion from a single power supply to three distinct voltage levels. This method eliminates all but one inductor, thereby reducing matching effort during design, as well as limiting final application size and cost. The Allegro® A8483 device is examined as an integral component of this solution.

The vast majority of portable devices today feature thin-film transistor (TFT) LCD displays. Such displays need to operate from a low-voltage input supply or a battery source, in the range of +3 to +5 volts. A typical TFT LCD bias supply requires a main supply, also referred to as AV_{DD} (typically in the range of +8 V to +12 V), a positive gate-drive bias (typically in the range of +12 V to +18 V), and a negative gate-drive bias (typically in the range of -5 V to -10 V).

Because portable electronics applications demand small size and low profile, the supply must operate at sufficiently high frequency to reduce the size of external filter components. Additionally, a single dc-to-dc controller generating three outputs is highly desirable, because it limits the cost of the solution and minimizes the PCB area required. The circuit shown in the figure below uses a combination boost regulator and charge pump circuitry to accomplish this task.

Boost Regulator

The circuit employs a single dc-to-dc controller (the A8483, a current-mode-controlled boost regulator) to generate a +8.75 V main supply, capable of delivering up to 50 mA. (Selecting an appropriate feedback voltage divider can change the output voltage.) The 1.2 MHz operating



This circuit delivers three output voltages from a single supply, by combining regulator topologies.

frequency reduces the inductor size and allows operation with tiny ceramic capacitors.

Internal compensation simplifies circuit design and reduces external component count. The low-profile (0.75 mm nominal height) MLP/TDFN package allows the boost regulator to be mounted on either side of the PCB to optimize footprint and minimize height.

Positive and Negative Charge Pumps

When the internal switch of the A8483 is on, the SW node

is near 0 V, with low impedance to circuit ground. When the internal switch of the A8483 switches off in order to provide boost action, the SW node goes up to approximately 9.05 V. This operation allows for an easy implementation of the charge pump with diodes and capacitors, to generate gate-drive supplies at +15 V and -7.5 V with 1 mA output-current capability.

The circuit diagram shows optional Zener diodes across gate-driver outputs. These can help to provide good regulation.

Additional sequencing features can be added to this solution as needed, by providing pass elements in series with the outputs.

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