



[Maxim](#) > [Design Support](#) > [Technical Documents](#) > [Application Notes](#) > [Power-Supply Circuits](#) > APP 1864

Keywords: STN LCD, LCD contrast, triple-output regulated LCD supply, dual boost converter, step-up converter. DC-DC converter

APPLICATION NOTE 1864

Regulated Dual Voltages Control STN-LCD Contrast

Jan 31, 2003

Abstract: This design note shows how a single IC generates the dual voltages required to control contrast in an STN LCD. The stable, dual-voltage LCD-contrast supply uses a dual-output boost converter, the MAX1677, and only four Schottky diodes and two flying capacitors.

A similar version of this article appeared in the May 21, 2001 issue of *Electronic Design* magazine.

Generating a stable, dual-voltage, LCD-contrast supply can be difficult, especially if the two voltage amplitudes must track each other with respect to a given reference level. In **Figure 1**, the $\pm 20\text{V}$ outputs are centered around a reference level (V_M) of 3V. The contrast voltages must be symmetric about V_M to avoid a DC component across the liquid crystal, which in turn would damage the LCD or shorten its life.

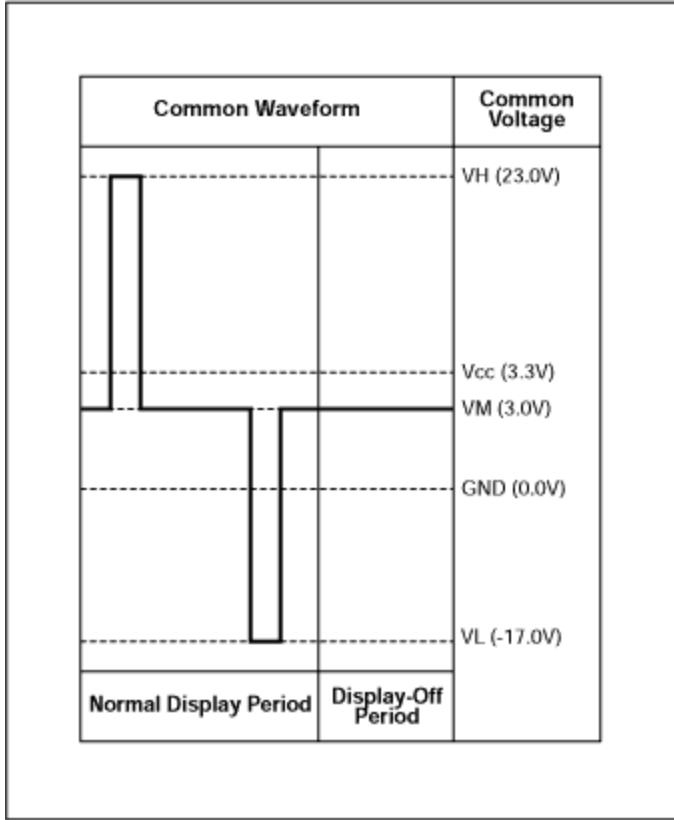


Figure 1. To avoid a damaging DC component across the LCD, these contrast waveforms are symmetric about the reference level VM.

To create a triple-output regulated LCD supply, which produces a main-supply voltage and two LCD voltages symmetric around the LCD offset voltage (VM), we add four Schottky diodes (D1-D4) and two flying capacitors (C2-C3) to a dual-V_{OUT} circuit (**Figure 2**). U1 normally supplies a digital V_{MAIN} (typically 3.3V) and an LCD supply up to 28V. In Figure 2, the ±LCD output equals VM ± (LCD Reference output).

additional diode drop across D5:

$$+LCD\ Out = LCDR + VM - V_{DIODE}$$

These load equations show that -LCD Out and +LCD Out track each other with respect to LCDR, and are offset by VM less one diode drop. The Schottky diodes D1-D5 can be MBR0530 or EP10QY03 types. C2-C3 can be 1 μ F, preferably with voltage ratings of at least 2LCDR. Typical L1–L2 values are 10 μ H each, and the output capacitors (C4–C6, shown as 10 μ F) may be sized according to the allowable output ripple.

Related Parts

[MAX1677](#)

Compact, High-Efficiency, Dual-Output Step-Up and LCD Bias DC-DC Converter

[Free Samples](#)

More Information

For Technical Support: <http://www.maximintegrated.com/support>

For Samples: <http://www.maximintegrated.com/samples>

Other Questions and Comments: <http://www.maximintegrated.com/contact>

Application Note 1864: <http://www.maximintegrated.com/an1864>

APPLICATION NOTE 1864, AN1864, AN 1864, APP1864, Appnote1864, Appnote 1864

Copyright © by Maxim Integrated Products

Additional Legal Notices: <http://www.maximintegrated.com/legal>