





Figure 1. Besides reducing the number of required GPIO lines from eleven to two, this circuit also provides programmable contrast and backlight control.

Op amp U3B buffers DAC output OUT1, which controls the contrast voltage. DAC output OUT0 controls a constant-current sink consisting of op amp U3A, MOSFET N1, and resistors R1, R5, and R6. This current sink draws 500mA when the DAC voltage output is at full scale.

You might need to adjust the maximum LED backlight current according to the size of the LCD display. To do that, use the following equations to calculate resistor values R1, R5, and R6:

$$R_1 \leq \frac{V_{DD(\min)} - V_{FLED(\max)} - R_{DS(on)} \cdot I_{FLED(\max)}}{I_{FLED(\max)}}$$

$$P_{R1} = I_{FLED(\max)}^2 \cdot R_1$$

$$R_5 = R_6 \cdot \left( \frac{V_{FS(DAC)}}{R_1 \cdot I_{FLED(\max)}} - 1 \right)$$

where

$V_{DD(\min)}$  = minimum anode supply voltage (4.5V typ),

$V_{FLED(\max)}$  = maximum forward LED voltage,

$I_{FLED(\max)}$  = maximum forward LED current,

$R_{DS(ON)}$  = on-resistance of switch N1,

$V_{FS(DAC)}$  = full-scale voltage output of DAC,

$P_{R1}$  = minimum power rating of resistor  $R_1$ , and  $R_6 = 10k\Omega$ .

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