

Mainboard 0.3 - LCD

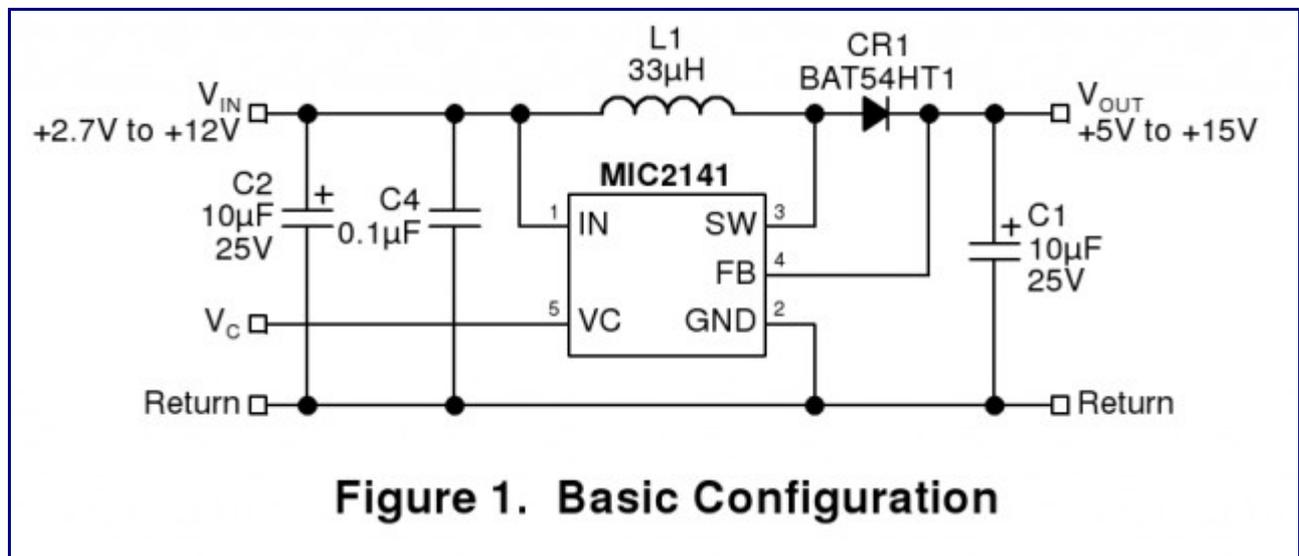
2010-04-17 17:04:55 by Nick

The latest version of my mainboard prototype is hardware version 0.3. The schematic for this hardware is large so I've split it up into 3 separate schematics, titled "i2c", "lcd", and "mcu".

The LCD schematic includes the external capacitors required for LCD contrast voltage creation, and the connections to the LCD. In addition, it includes a boost converter that outputs 15 Volts DC from a 5 Volt input, for powering the actual LCD screen.

The LCD screen I selected actually does contain an on-board 15 Volt power supply, which is integrated into the LCD's ST7528 controller IC. Unfortunately, the on-board 15 Volt supply has a very weak output, and is incapable of providing adequate voltage to the LCD when more than about 1/2 of the segments are lit.

To resolve this problem, I had to implement an external 15-volt power supply for the LCD driving voltage. I chose the MIC2141 IC for this task because it has a wide input and output voltage range and requires few external components. The typical application wiring diagram from the MIC2141 datasheet is shown below



The MIC2141 is an IC that implements a boost converter, which is a type of switch mode power supply (SMPS). The MIC2141 supports a wide range of input and output voltages. In my configuration, I am using it to produce 15 volts from a 5 volt input.

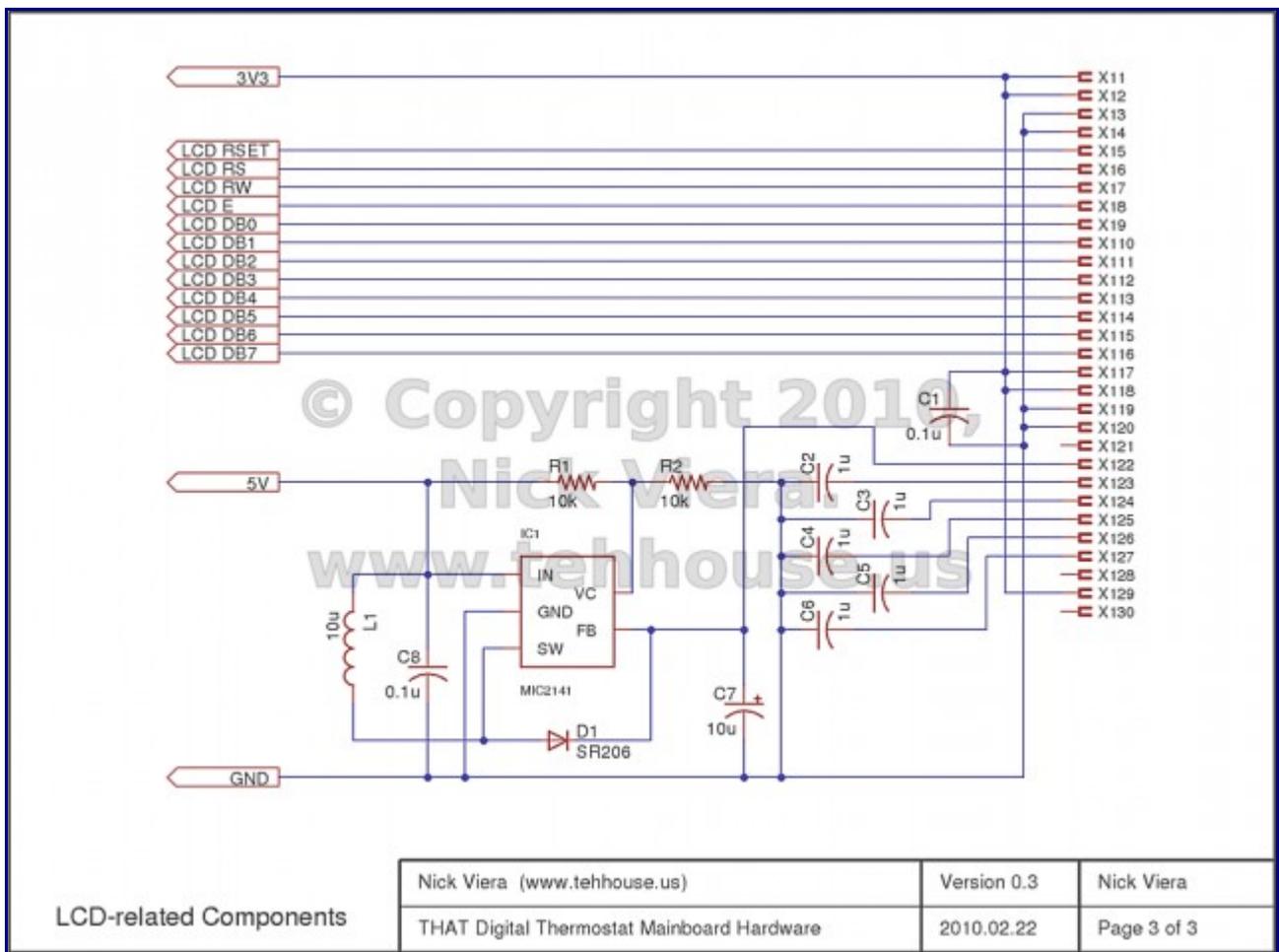
A list of inductor values and flyback diodes which are recommended for use with the MIC2141 when the input voltage is regulated are shown in the table below (from the MIC2141 datasheet). A table listing the minimum inductance required for various configurations is also shown below. I chose a 10uH inductor since it is a very common size and meets the minimum inductance value for a 5 volt input and 15 volt output.

V_{IN}	V_{OUT}	I_{OUT}	L1	CR1	I_{PEAK} (typical)
3.3V±5%	5V	13mA	10μH	BAT54	253mA
	9V	5mA	10μH	BAT54	253mA
	12V	3mA	10μH	BAT54	253mA
	15V	2.3mA	10μH	BAT54	253mA
	20V	1.7mA	10μH	BAT54	253mA
5V±5%	9V	17mA	8.2μH	MBR0530	467mA
	12V	10.4mA	8.2μH	MBR0530	467mA
	15V	7.5mA	8.2μH	MBR0530	467mA
	20V	2.2mA	22μH	MBR0530	174mA
12V±5%	15V	44mA	18μH	MBR0530	511mA
	20V	8.3mA	47μH	BAT54	196mA

Table 5. Typical Maximum Power Configurations for Regulated Inputs

V_{IN}	Output Voltage	
	16V to 22V	4.5V to 15V
2.5V	15μH	15μH
3.0V	12μH	12μH
3.3V	10μH	10μH
3.5V	8.2μH	8.2μH
4.0V	27μH	6.8μH
4.5V	27μH	6.8μH
5.0V	22μH	8.2μH
6.0V	27μH	10μH

The mainboard LCD schematic is shown below. Some notes subsequently follow the schematic.



Notes:

- C2 through C6 are used to stabilize the LCD driving voltages which are created internally by the LCD controller IC. Each capacitor has a varying percentage of the LCD contrast voltage (15 Volts) across it. For example, if even distributed, the capacitors would be at 3,6,9,12, and 15 Volts, respectively.
- IC1, L1, and D1 create a switch-mode boost converter which outputs 15 Volts from the 5 Volt input. This output is used to provide the LCD driving power.
- C7 is used as a buffer / stabilizer for the 15 Volt rail.