



Device: DSP-0801

This document Version: 1.0

Date: 1 August 2011

Description: 8 digit 14 segment Alpha-numeric display with 0.56 inch digits

Matches module hardware version: [12 May 11 v6]

Table of Contents

| | |
|--------------------|---|
| Introduction..... | 3 |
| Features..... | 3 |
| Construction | 3 |
| Connections..... | 3 |
| Power | 3 |
| Usage..... | 4 |
| Schematic..... | 6 |
| PCB..... | 6 |
| Versions | 9 |

Introduction

The DSP-0801 is a 8 digit, fourteen segment display module powered by two CAT4016 serial LED driver chips and a PIC18F14K50.

Features

The DSP-0801 is a microcontroller-based display. Two digits of the 8 are lit at any one time. The display can be controlled via TTL asynchronous serial or a synchronous serial interface. Multiple displays can be daisy chained to form a larger display.

Construction

It's all done for you! Solder yourself some header pins or connecting wires and away you go.

Connections

The DSP-0801B has four connection ports.

JP1 - Input

| | |
|-----|---|
| GND | Ground (Vss) connection |
| SIN | Serial In |
| CLK | Clock |
| BL | Blank – pull high to blank display, low to enable |
| LAT | Latch |
| VCC | Positive supply |

JP2 - Output

| | |
|------|-------------------------|
| GND | Ground (Vss) connection |
| SOUT | Serial Out |
| CLK | Clock |
| BL | Blank |
| LAT | Latch |
| VCC | Positive supply |

JP3 – Asynchronous (TTL) serial

| | |
|-----|-------------------------|
| TxO | Serial Output |
| RxI | Serial Input |
| Gnd | Ground (Vss) connection |
| Vcc | Positive supply |

JP4 - ICSP – In circuit serial programming

Pin 1 is marked [1]

Power

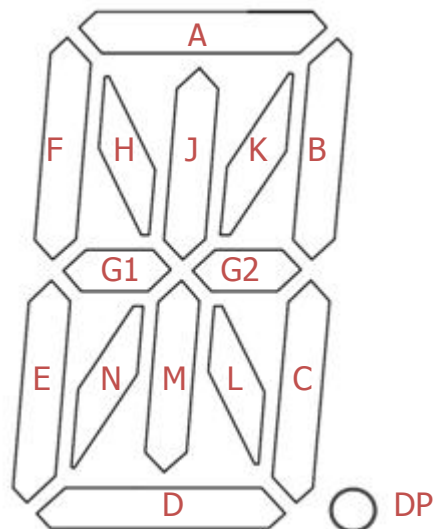
The DSP-0801 has a single power connection that is available on any of the connection ports. The same supply is used for the microcontroller, driver chips, and LEDs themselves.

The board can be powered from 3V – 5V.

Usage

Synchronous serial

Each segment of each LED digit is individually addressable.



On JP1, for each digit, shift in 16 bits by setting the SIN line correctly, and pulsing the CLK line from low to high then back to low.

| | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|----|----|----|----|----|----|----|----|----|----|
| D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| NC | DP | N | M | L | K | J | H | G2 | G1 | F | E | D | C | B | A |

Where NC means *not connected*

So to shift in the letter A, shift in 0b0000000011110111. This will light segments A, B, C, E, F, G1 and G2 which is a pretty neat letter A.

Once you have shifted in *all* digits, pulse the LAT line high, which will change all digits at the same time. If you have several boards chained together, you can shift in the digits for all boards, then pulse the LAT line to change all at once.

You will need to pull the BL (Blank) line low, otherwise no digits will light. You can use PWM on the BL line for more finely controlled brightness levels.

After all the digits have been shifted in, they will start to appear out the "out" port on JP2. This means you can connect JP2 (out) on one board to JP1 (in) on the next, and create larger displays. For example, if you connected two boards, you would have a 16 digit display. Simply shift in all 16 digits, starting with the left most one, and then pulse the latch pin as before.

Asynchronous serial

The serial port connected to JP3 runs at 115,200 bits per second. When first powered up the board will print:

```
Embedded Adventures DSP-0801 Firmware
```

```
<17:17:03 Aug 01 2011>
Version 1.0 for board v6
Reset: BOR POR
Commands:

pSTRING - print string
d - dim
b - bright

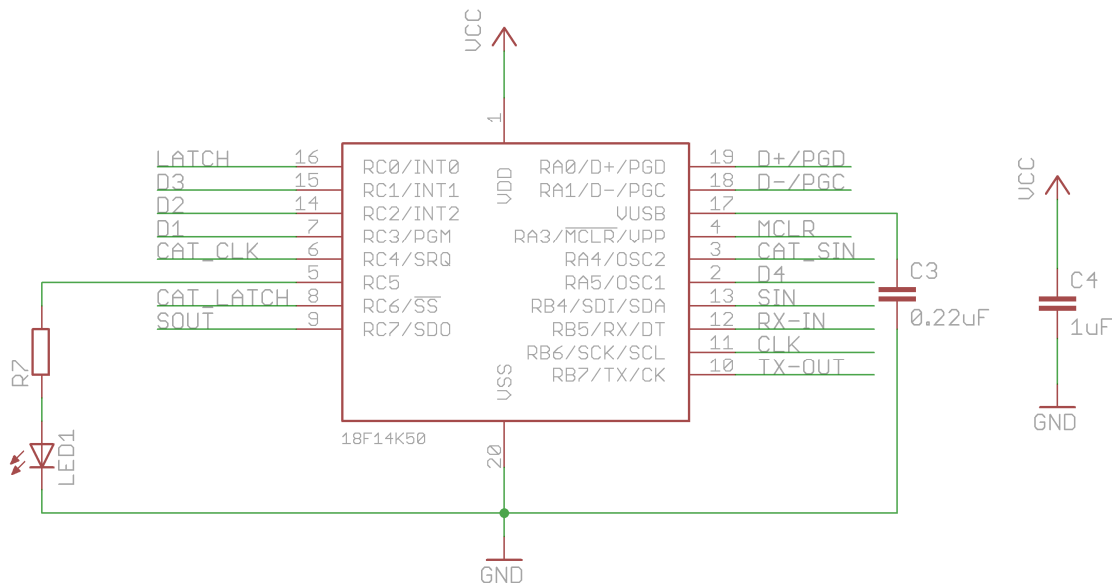
>
```

With a terminal program or another microcontroller board, you can simply issues commands such as pHELLO<enter> to display HELLO on the board. Any characters the board doesn't know how to display with be replaced by a space. You can enter d<enter> to dim the display, or b<enter> to return to the normal brightness. Don't tell anyone, but you can get the board to go into self-test mode if you enter !<enter>. You can also get the board to self test if you connect SIN from JP1 to SOUT on JP2 and apply power to the board.

Remember! Even if you use the asynchronous serial port JP3, you will still need to pull the BL pin to ground to have the display light up. You can do this by just connecting any BL pin (JP1 or JP2) to GND if you are not using the synchronous serial port.

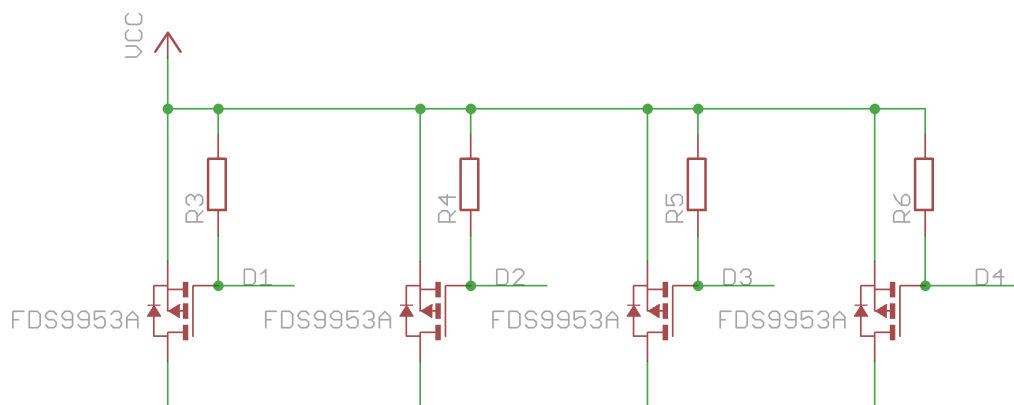
Schematic

Processor



The main processor, the PIC18F14K50, is in a pretty standard configuration. RC5 is used to show the indicator LED (which is lit on startup to indicate bootloader presence and when the board is in self-test mode). RC3, RC2, RC1 and RA5 are used control the four MOSFETs which determine which pair of digits are lit. RC4, RC6, RA4 are used as CLK, LATCH and SIN for the CAT4016 display driver chips. RB7 and RB5 are used as TX/RX for asynchronous serial. The internal hardware SPI peripheral available on RC7, RB4 and RB6 is used for the synchronous serial interface.

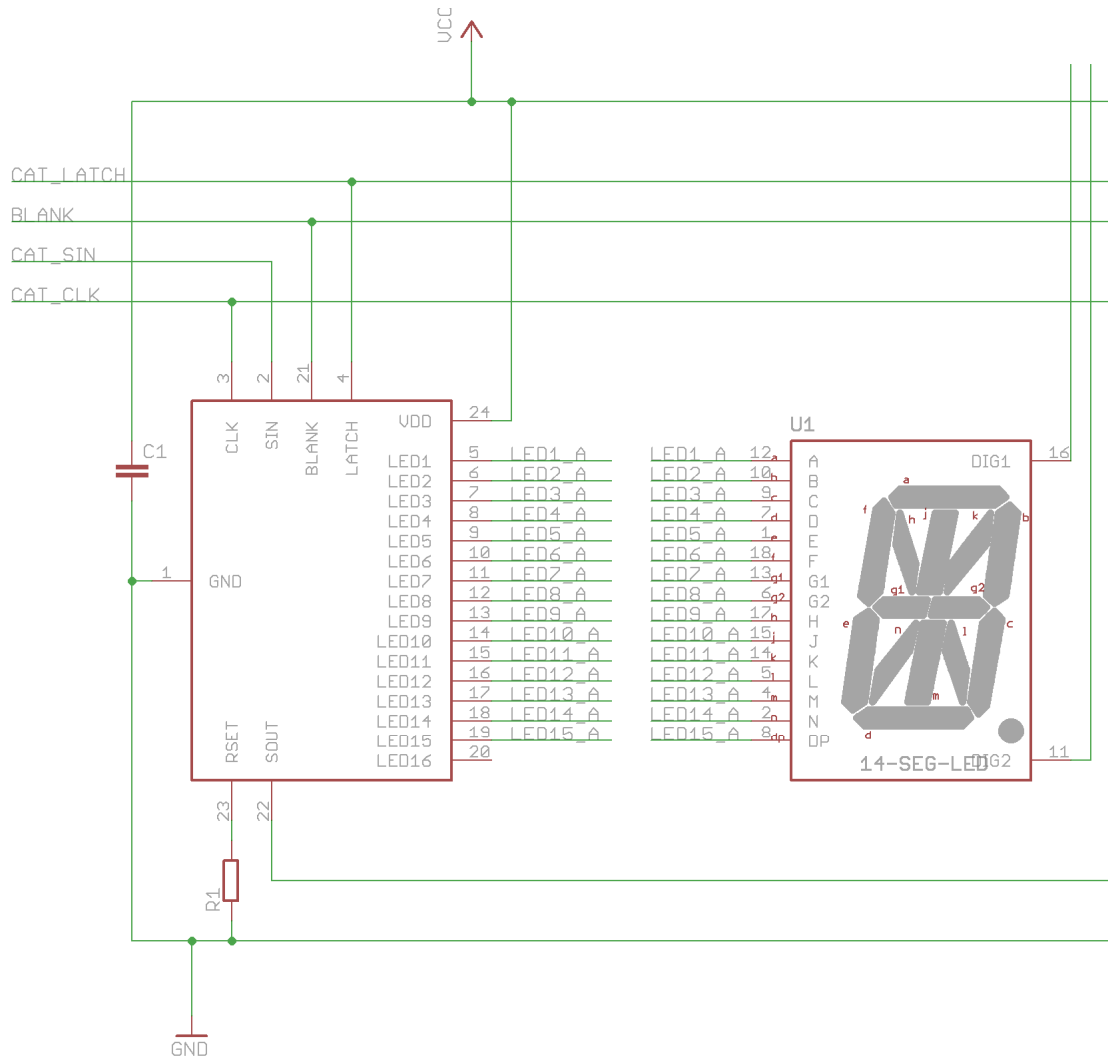
MOSFETs



D1 – D4 control the four MOSFETs (two in each of the FDS9953A packages). Since only one digit of each dual-display can be lit at once, enabling D1 allows digits 1 and 5 to be displayed. D2 for digits 2 and 6, D3 for digits 3 and 7 and D4, unsurprisingly powers digits 4 and 8. In this way, digits 1 and 5 are loaded into the two CAT4016

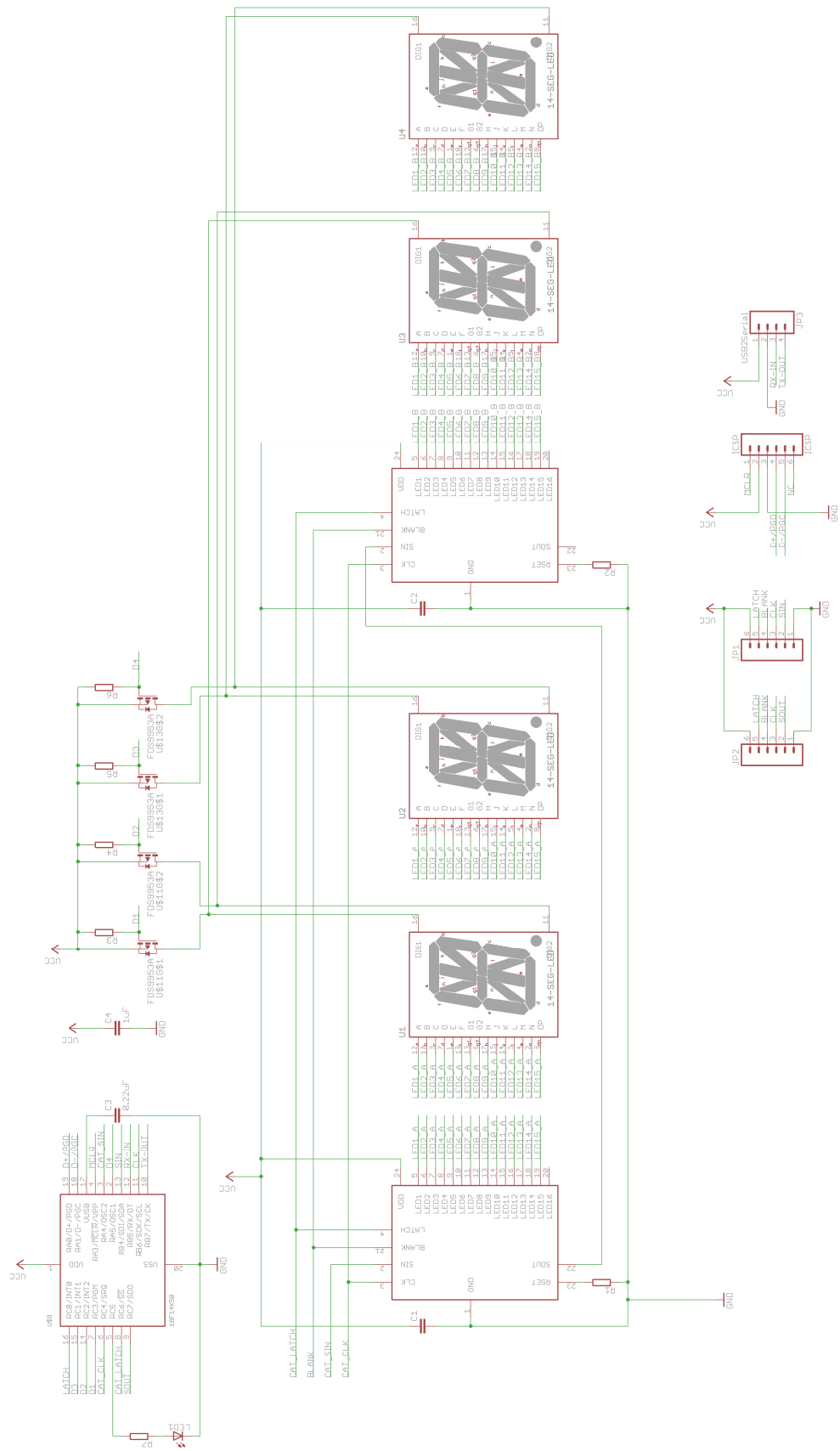
drivers, then D1 (alone) used to display those digits momentarily. Next, digits 2 and 6 and D2 is enabled. And so on. Current flows through each of the MOSFETs when the appropriate driver line (D1 etc) is pulled low. The pull-ups (R3 – R6) are used so that the MOSFETs are held in an off state until required.

LED drivers

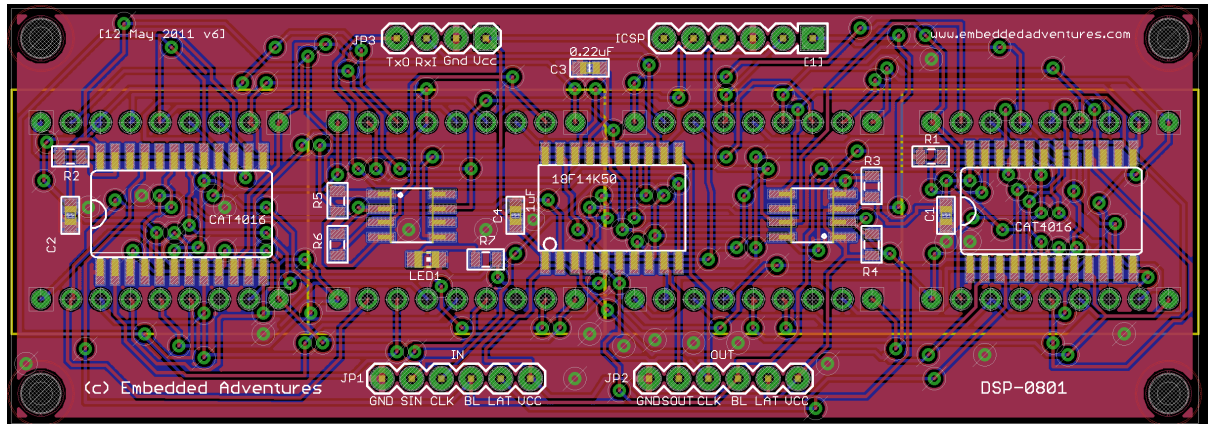


Only one driver is shown here for clarity; however both CAT4016 chips are daisy chain fed serially from the 18F14K50. Their BLANK lines are available externally as BL on JP1 and JP2. As such, the display won't do anything unless these lines are pulled low. Only one dual-digit module is shown here, with pins 16 and 11 fed from D1 and D2. R1 (R2 for the other CAT4016) determines the amount of current fed to each digit. If you want a generally brighter display, you could substitute the 3K3 value for another – see the CAT4016 datasheet for details.

Full schematic



PCB



Versions

| Version | Date | Comments |
|-------------|---------------|--|
| Version 1.0 | 1 August 2011 | Initial Version for board [12 May 11 v6] |