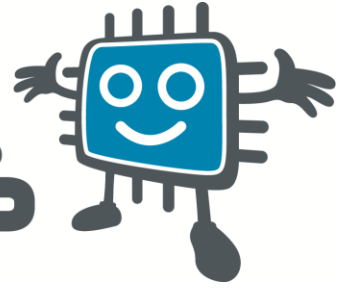Device: DSP-16S04H

This document Version: 1

Date: 17 May 2015

Description: 2.3" 4x 16 segment display module with decimals

Matches module hardware version: [20 Feb 2015 v2]

Table of Contents

Introduction

The DSP-16S04H is a 2.3" height 4 digit seven segment display module with decimals.

Features

The DSP-16S04H has a TTL (asynchronous) serial interface and I2C connection allowing easy control form your microcontroller.

Connections

The DSP-16S04H has four connection ports.

LED Power

GND	Ground connection
VLED	8.4V – 12V

I2C Port

VCC	Positive supply (3V – 5V)
SDA	I2C data
SCL	I2C clock
GND	Ground connection

TTL Serial Port

TxO	TTL serial transmit (out)
RxI	TTL serial receive (in)
GND	Ground connection
VCC	Positive supply (3V – 5V)

ICSP Port

MCLR	Reset
VCC	Positive supply
GND	Ground connection
PGD	Data
PGC	Clock
NC	No connection

The ICSP port can be used for complete reprogramming of the on-board microcontroller – however this is not usually necessary. We may find a use for these pins in the future.

Power

The DSP-16S04H requires two power supplies. The LEDs themselves are 2.1V red LEDs and have up to 4 in series. As such VLED requires at least 8.4V. A 9V regulated power supply will suit this application well.

Each LED segment uses approximately 20mA, so lighting all segments on all digits requires approximately 180mA. This can be reduced further by decreasing the brightness level of the display.

The logic part of the board can be powered from anything from 3V to 5V. Make sure that the TTL serial or I2C voltages match VCC, not VLED.

Commands

Serial commands are terminated by carriage return (character 13). The initial bit rate of the serial port is 115,200 bps.

I2C commands begin with a command identifier, followed by the data appropriate for the command.

Print

Serial Format: print "abcd"

Serial Example: print "1934"

I2C Format: 0x01 d0 d1 d2 d3

I2C Example: 0x01 0x31 0x39 0x33 0x34

Display the ASCII text on the display. The firmware will do its best to represent the characters given. Numbers are of course no problem and many characters are possible too.

Spash

Serial Format: splash [on|off]

Serial Example: splash off

I2C Format: not available

On boot up the DSP-16S04H displays its name and current version number. To turn this off, use the splash command.

Dot

Serial Format: dot d [on|off]

Serial Example: dot 0 on

I2C Format: 0x03 d [0x00|0x01]

I2C Example: 0x03 0x00 0x01

Turn decimal point on or off, where d = 0 to 3.

Clear

Serial Format: clear

Serial Example: clear

I2C Format: 0x05

I2C Example: 0x05

Clear the display (blank all digits)

Level

Serial Format: level n

Serial Example: level 128

I2C Format: 0x06 n
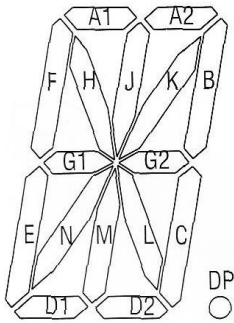
I2C Example: 0x06 0x80

Set the brightness level of the display. 0 is as dim as it gets, 255 is as bright as it gets.

Raw

Serial Format: raw aaaa,bbb,cccc,dddd

Serial Example: raw ff00,ff00,ff00,ff01

I2C Format: 0x02 msb lsb msb lsb msb lsb msb lsb

Set the individual segments directly.

Each 16 bit hexadecimal number is stored and shifted into the TLC5926 in turn.

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Segment	A1	A2	B	C	D2	D1	E	F	H	J	K	G2	L	M	N	G1

Bitrate

Serial format: bitrate n

Serial example: bitrate 115200

Changes the serial bit rate to the specified rate. Options are 2400, 4800, 9600, 19200, 38400, 57600 or 115200. The new bitrate is stored and will apply even if power is lost. There is no i2c equivalent command.
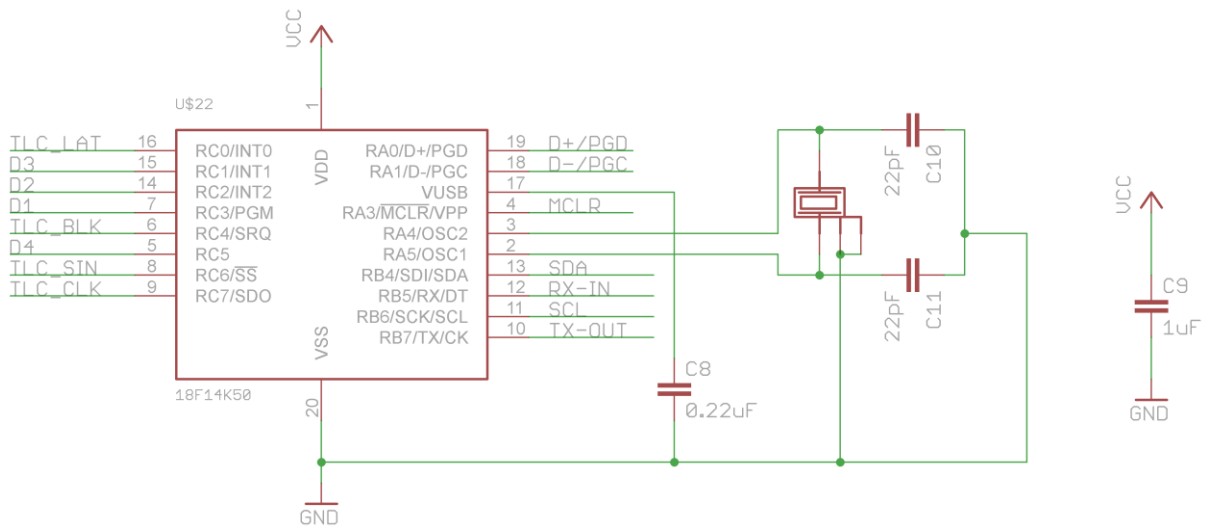
Test

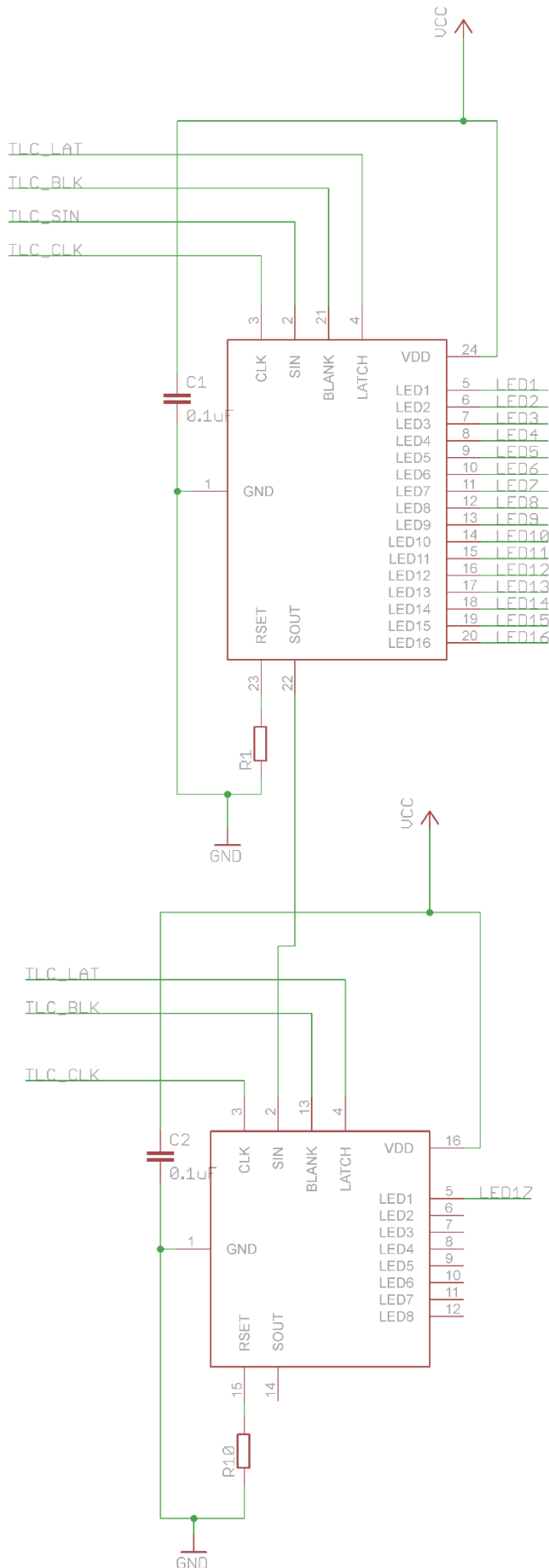Serial format: test

Serial example: test

I2C Format: 0x00 [0x00|0x01]

Toggle test mode on or off (serial command) or turns test mode on or off (I2C command).

Schematic

The PIC18F14K50 handles the interfaces with the outside world. It loads the TLC5926 for each digit and switches the digit using 9953 MOSFETs. Only one digit is actually active at any one time.

VCC

TLC_LAT
TLC_BLK
TLC_SIN
TLC_CLK

3	CLK
2	SIN
21	BLANK
4	LATCH
24	VDD

C1
0.1uF

GND	1

LED1	5	LED1
LED2	6	LED2
LED3	7	LED3
LED4	8	LED4
LED5	9	LED5
LED6	10	LED6
LED7	11	LED7
LED8	12	LED8
LED9	13	LED9
LED10	14	LED10
LED11	15	LED11
LED12	16	LED12
LED13	17	LED13
LED14	18	LED14
LED15	19	LED15
LED16	20	LED16

RSET   SOUT
23   22

R1

GND

VCC

TLC_LAT
TLC_BLK

TLC_CLK

3	CLK
2	SIN
13	BLANK
4	LATCH
16	VDD

C2
0.1uF

| GND | 1 |

| LED1 | 5 | LED17 |
LED2	6
LED3	7
LED4	8
LED5	9
LED6	10
LED7	11
LED8	12

RSET   SOUT
15   14

R10

GND

Two LED drivers are used to cover all 16 segments and decimals.

The brightness of the display, or more correctly, the current made available to each display is controlled by R1 and R10. These can be changed if you require the display to be brighter. The display can be made dimmer using the brightness command.
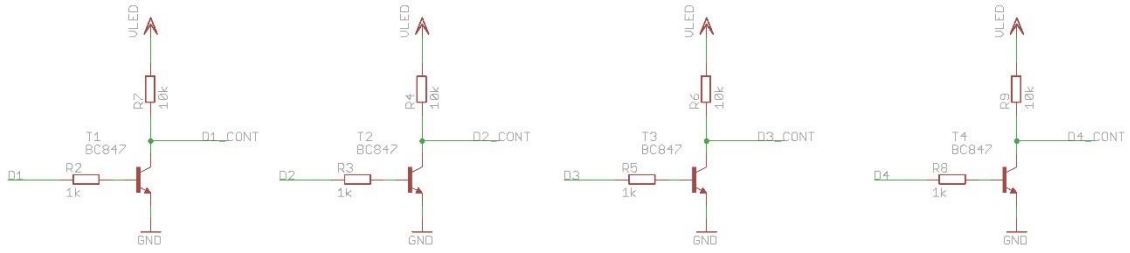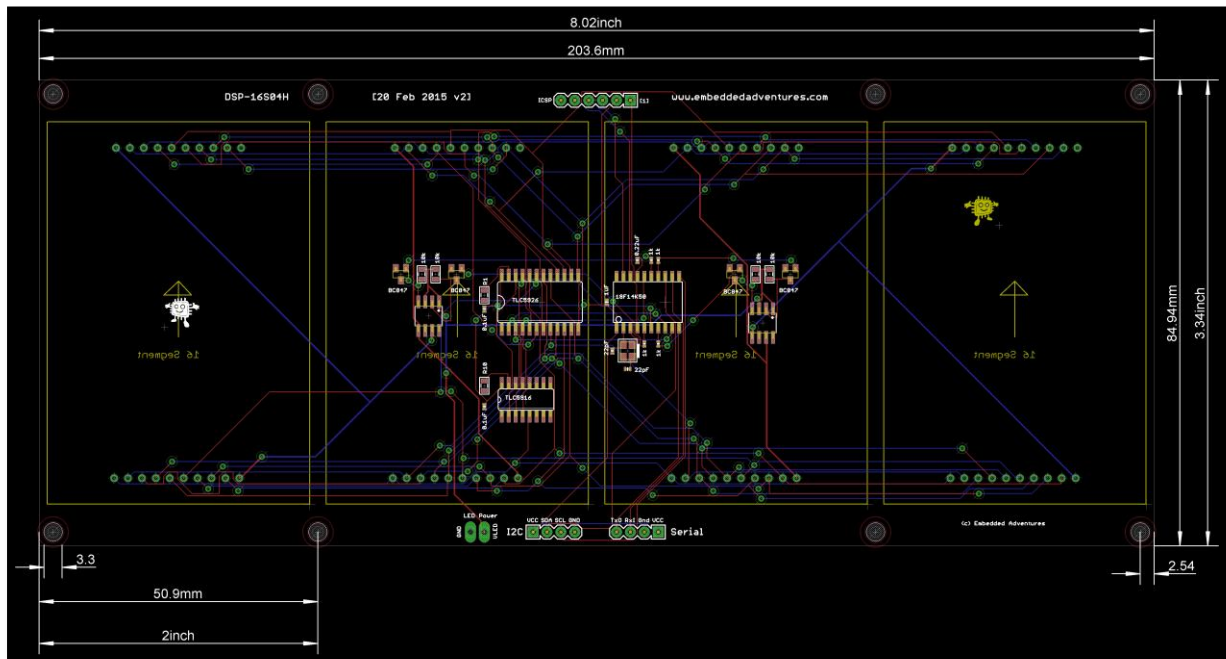
BC847 transistors are used to drive the MOSFETs.
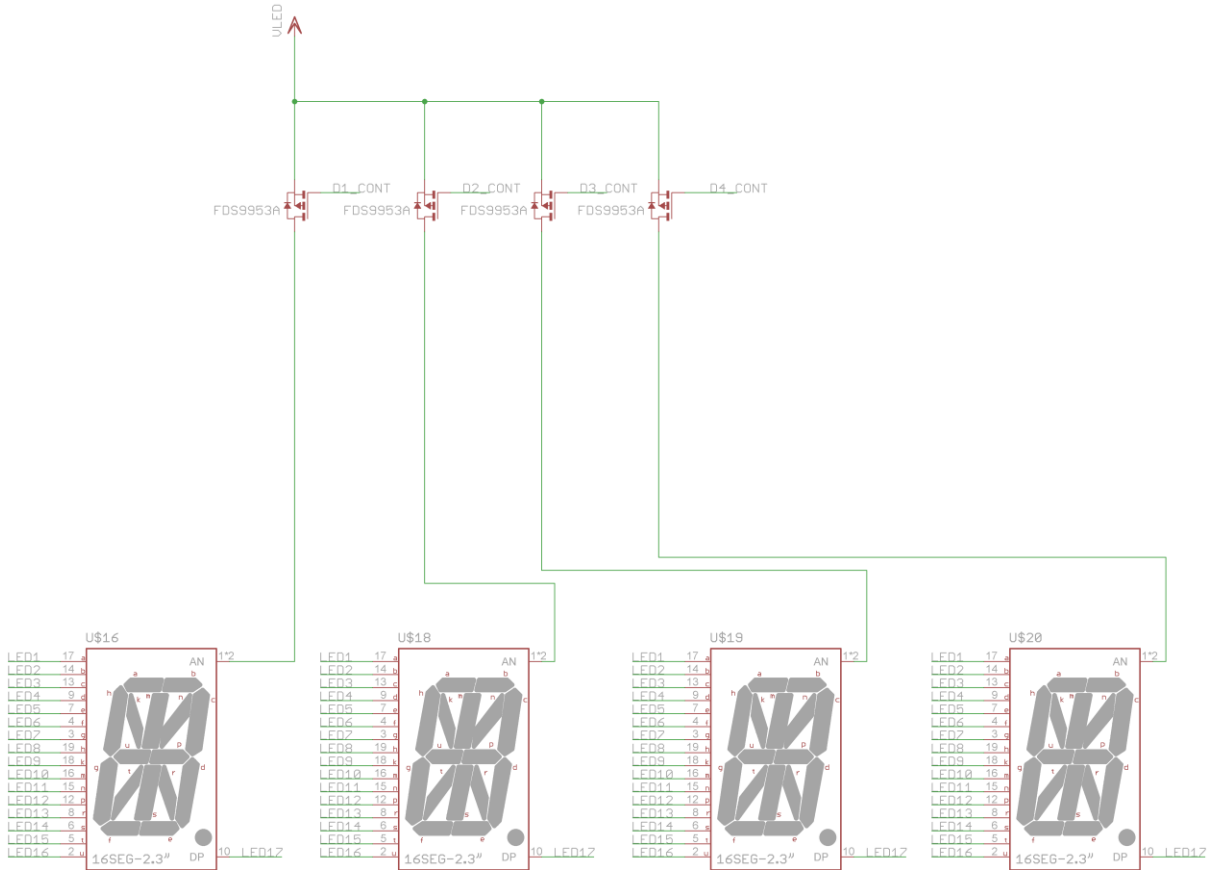
MOSFETs drive the LED modules themselves
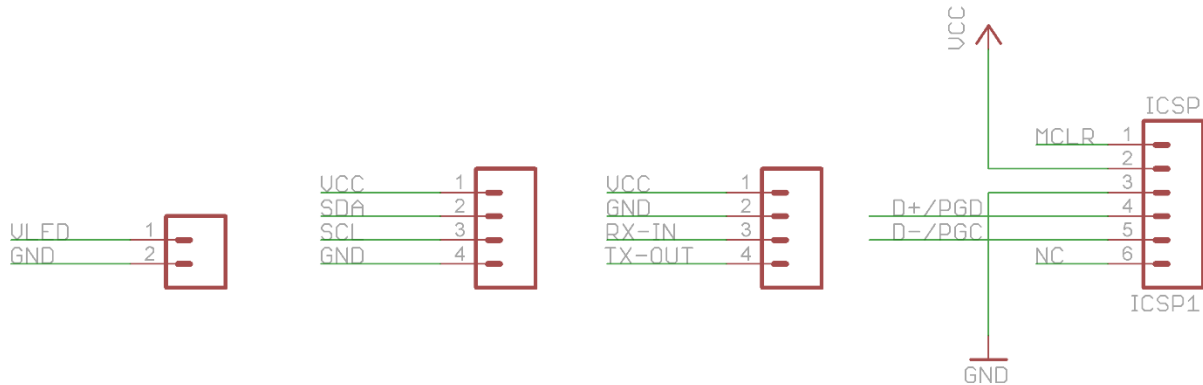
And finally we have the interfaces to the outside world.

PCB

Firmware update

It is possible to update the firmware in the on-board microcontroller, using the Screamer program. Updates to the firmware will be made when we add new features or find bugs, so please let us know if you have any problems or indeed ideas to improve the way the board works.

Contact us at support [at] embeddedadventures dot com

Check the Embedded Adventures website product page for the DSP-16S04H for any updates.

Versions

Version	Date	Comments
1	17 May 2015	Initial Version for board HW v2