
SLCD43 Controller Manual V1.26

Hardware Revisions A, B, H01 and H02

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1. Introduction

1.1. Overview

The SLCD43 controller provides complete Graphical User Interface for embedded systems. It was designed to work with specific 4.3 inch LCD TFT panels. Using the SLCD family of controllers is simply the quickest way to generate a user interface without a lot of graphical programming. It has a small size to fit in space-constrained applications.

1.2. Features

- ♦ Fits exact footprint of many popular 4.3 inch LCD panels
- ♦ Touch controller (4 wire resistive) on board
- ♦ Beeper for audible touch feedback and alarms
- ♦ On-board LED Backlight driver
- ♦ RS232 / 3.3V CMOS up to 230,400 baud or USB level interface up to 460,800 baud
- ♦ User downloadable bitmaps with RLE compression (4Mb of flash memory)
- ♦ Backlight enable and wide range brightness control
- ♦ Low cost
- ♦ Firmware is field-reprogrammable
- ♦ Supports either landscape or portrait mode display (firmware option)
- ♦ Available with mounting tabs in vertical or horizontal alignment
- ♦ Can be powered from USB (board plus panel)
- ♦ Can be modified for specific OEM requirements
- ♦ RoHS Compliant as of Jan 1, 2008

1.3. SLCD43 (Vertical) Board Picture

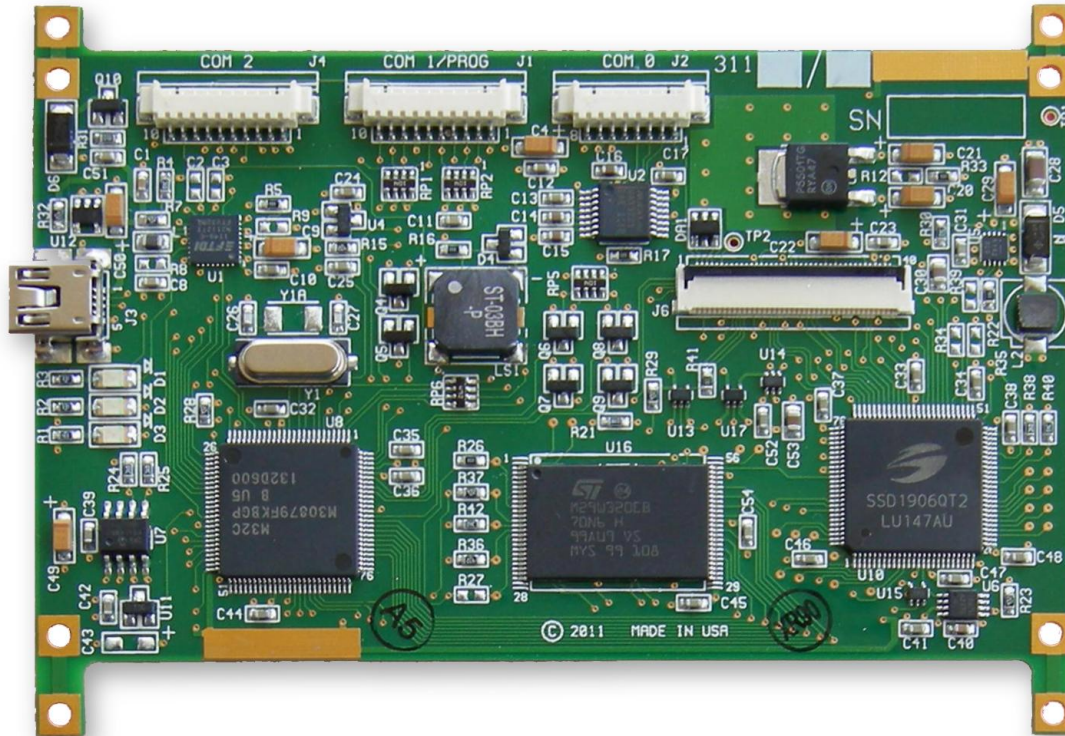


Figure 1: SLCD43 40-pin Revision H02 Board Image

1.4. SLCD43 Board Dimensional Drawing (Revision H02, H01 and B)

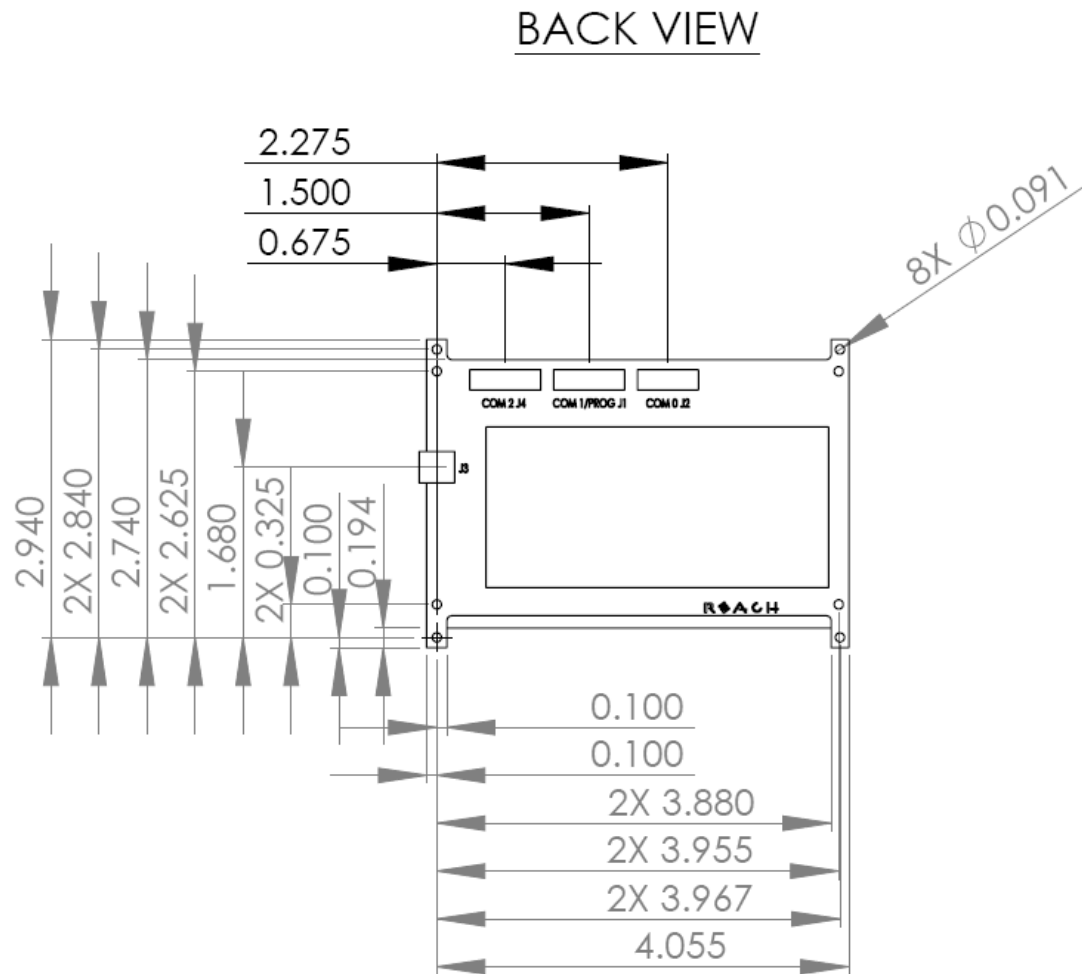


Figure 2: Board Physical Dimensions (inches)

1.5. SLCD43H (Horizontal) Board Picture

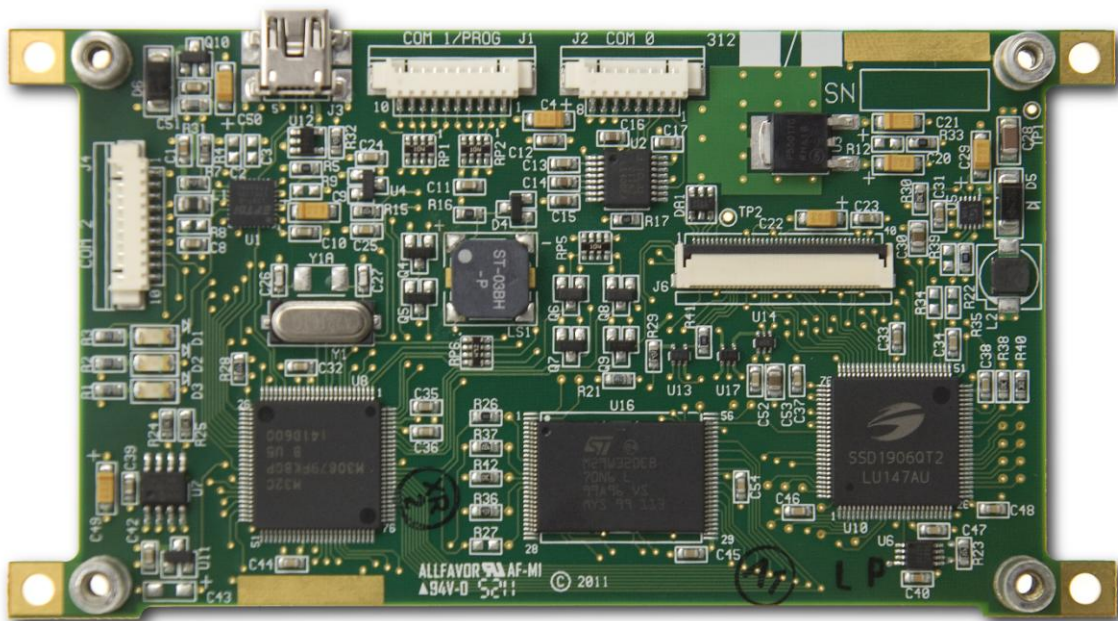


Figure 3: SLCD43H Board Image

1.6. SLCD43H Board Dimensional Drawing (Revision H01)

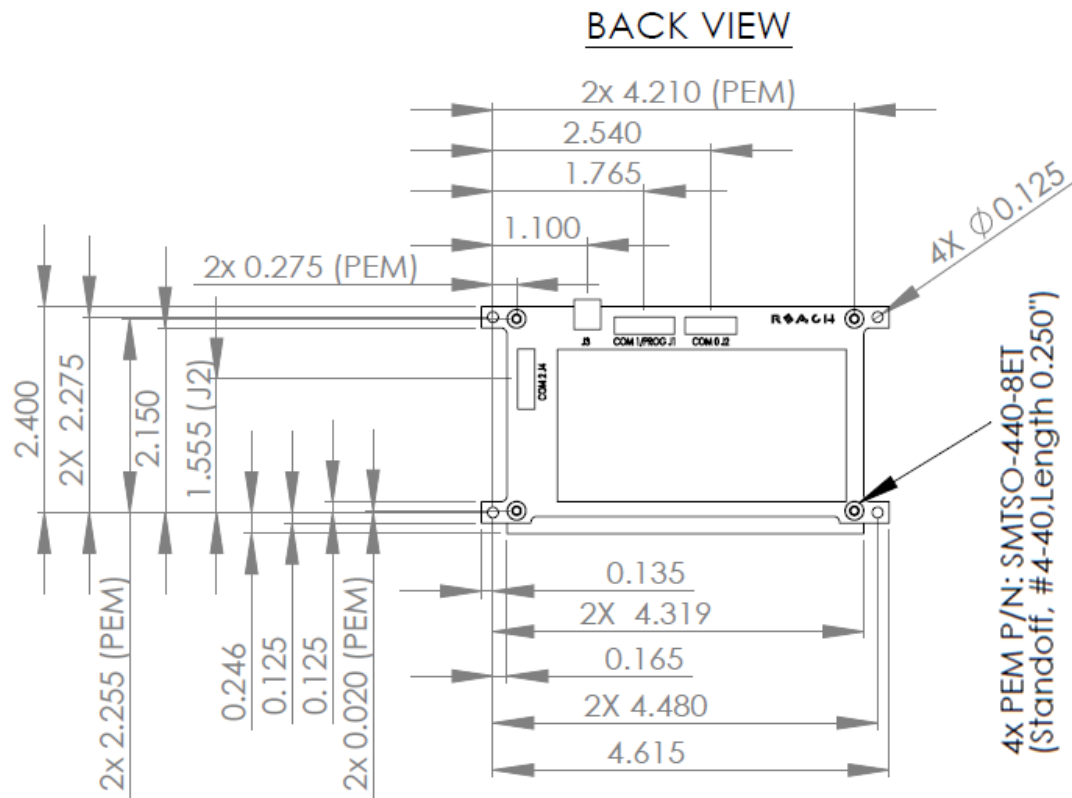


Figure 4: SLCDH Board Physical Dimensions (inches)

1.7. Electrical Characteristics

The standard SLCD43 controller board requires 5V DC. Please consult Reach for options to run at 3.3V and lower power modes for battery operation.

For current draw specifications with an attached LCD panel, please refer to the individual data sheets for the various SLCD43 Display Module products.

Current draw for the SLCD43 controller board is as follows:

<i>Configuration</i>	<i>Typical A @ 5V</i>	<i>Max. A @ 5V</i>
SLCD43 controller board, 5v power, beeper on max	0.130	0.182
SLCD43 controller board, 5v power, beeper off	0.065	0.091
SLCD43 controller board, USB power, beeper on max	0.145	0.203
SLCD43 controller board, USB power, beeper off	0.080	0.112

1.8. Environmental

The standard SLCD43 controller is rated for commercial temperature operation of -20°C to 70°C. This is the same temperature range as the supported 4.3" panels. Contact Reach for extended temperature requirements.

2. System Overview

2.1. General - SLCD43 controller

The SLCD43 plus attached LCD touch panel acts as a "smart terminal" and is generally connected to a "host" processor that implements the desired Graphical User Interface (GUI). The host can be any kind of processor from an eight bit microcontroller to a PC. The host issues commands to the SLCD43 and receives button press responses from the SLCD43. In this manual, the term "host" is used to describe the device connected to the SLCD43.

Note that the SLCD43 board can also work with panels that do not have a touch screen. In this case, the touch-related commands are not used.

The SLCD43 board contains flash memory that is used for bitmap and macro storage. (This is sometimes referred to as "external" flash to distinguish it from the processor's internal flash memory that stores the SLCD43 processor firmware.) A bitmap is equivalent to a Windows TM bitmap file – it is a rectangular image. Bitmaps, the BMPload program used to store these into the SLCD43, and macros which are a stored command sequence are all described in the SLCD Command Reference Manual.

The SLCD43 is connected to the host processor via a serial port. The SLCD43 has 3 separate serial ports plus a USB/Serial device port. There are several reasons for having multiple ports:

- a) Host program development and debugging. One port is connected to the host and another to a PC. The PC is used to download images and macros that the host uses. The two ports allow both the host and PC to be connected without having to switch cables. The PC can also be used for interactive command execution / testing.
- b) The SLCD43 supports serial pass-through via the "aout" and "ain" commands. This allows serial peripherals to be attached to the SLCD43 and accessed by the host. This is useful for systems where all serial ports are in use and an existing serial-attached device can be moved over to an SLCD43 serial port.

2.2. LED indicators

The SLCD43 board has Three LEDs to indicate operational status.

D1 shows USB activity.

D2 is lit while the SLCD43 is executing a command or running a looping macro. It is useful to determine the activity level of the SLCD

D3 turns on when power is applied and the microcontroller is operating correctly. It can also be turned off and on via the SET LED command.

3. Configuration Guide

3.1. Power

The SLCD43 requires 5VDC power. See Section 4 for connector pinouts. Power is applied to connector J2 which also contains the COM0 serial interface.

3.2. Serial

The SLCD43 has three serial ports. Any of them can be used to send commands to the board.

The physical interface options are as follows:

- COM0 - RS232 (or factory option for 3.3V CMOS levels).
- COM1 - 3.3V CMOS level signaling with RTS handshaking for an external transceiver such as RS485.
- COM2 - 3.3V CMOS level signaling (Revision B board only).
- COM3 - USB (looks like a serial port to the host PC)

By default, all serial communications is 115200 baud, 8 data bits, no parity, with 1 stop bit, and receive flow control via XON / XOFF. This can be changed by using a “power-on macro” which is described in the Command Reference manual.

3.3. TFT Panel Orientation

The SLCD43 firmware is available in landscape or portrait modes. The ordering part number contains the firmware revision, which specifies the orientation.

3.4. Grounding

The SLCD43 mounting holes are connected to digital ground. These must also be connected to Chassis ground either directly or through a transient protection diode for ESD. The touch circuit has ESD protection that shorts ESD on the touch panel to board mounting hole ground.

4. Connectors

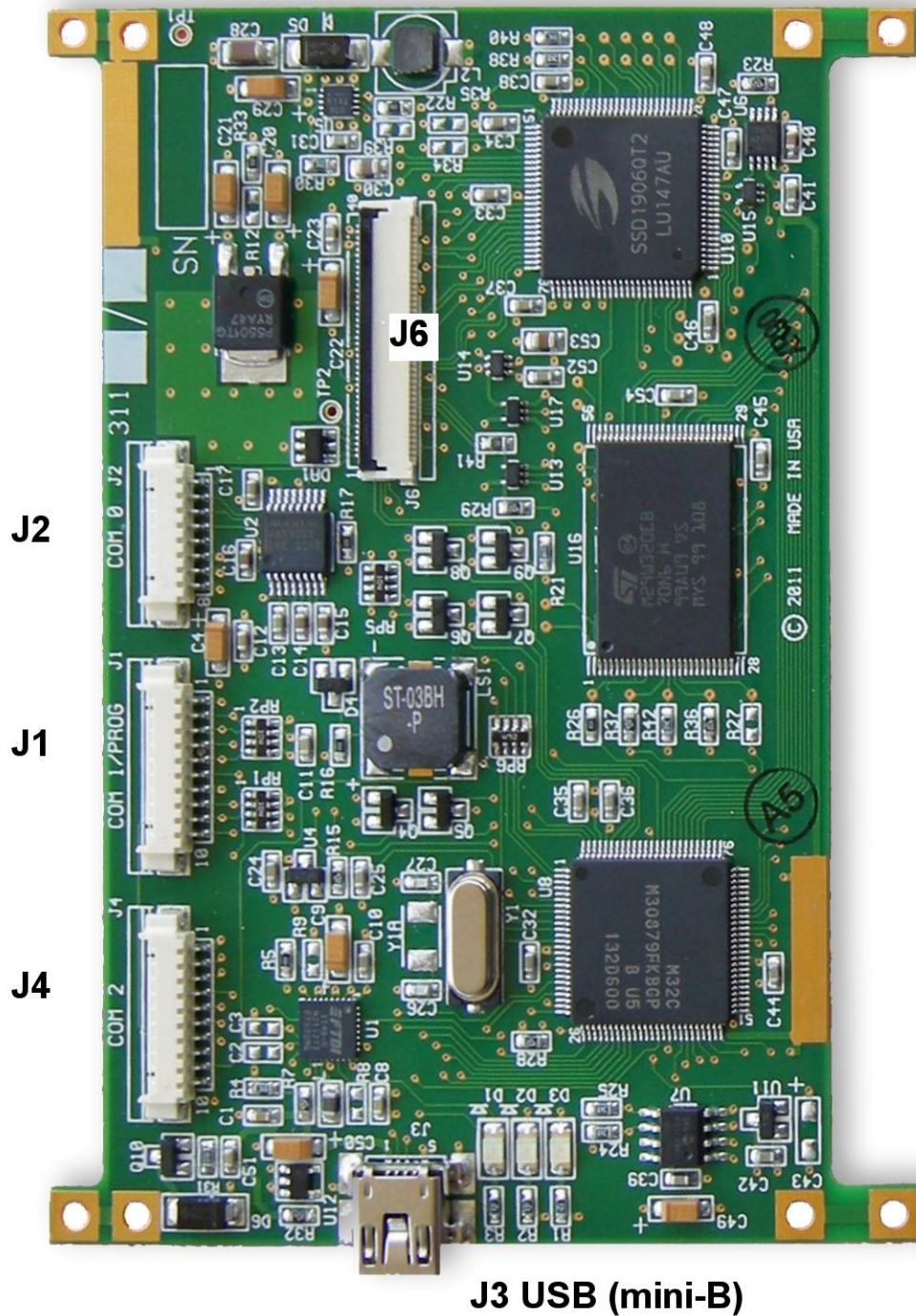


Figure 5: SLCD43 Connector Locations (Rev H01, H02, B)

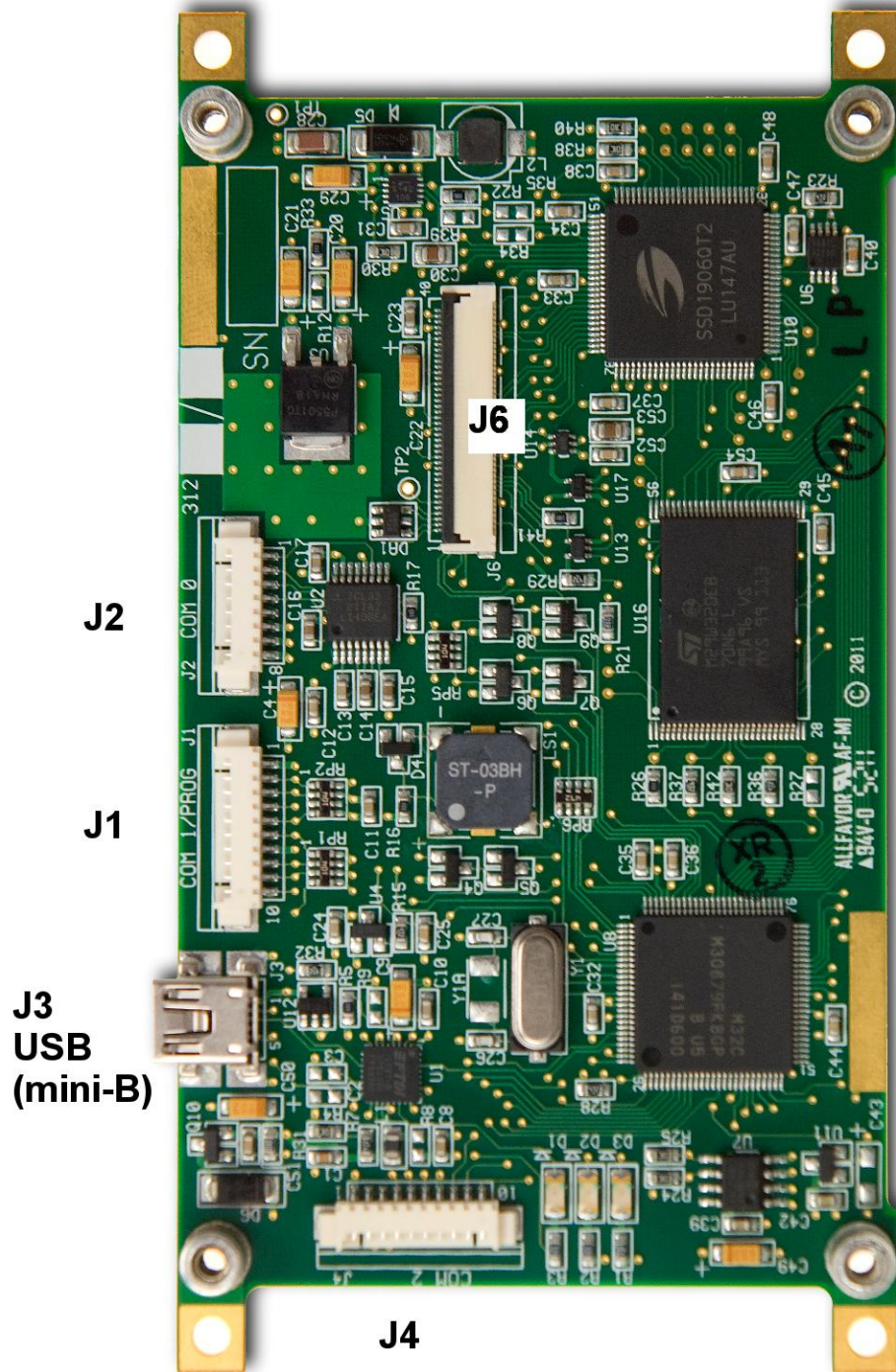


Figure 6: SLCD43H Connector Locations

4.1. J2 - Power and COM0 RS232 communications (COM 0 Connector)

J2 – 8-Pin Molex 53261-0871 for Power and Communications

Pin	RS232 Mode – R17 installed on board
1	do not connect
2	do not connect
3	RS232 input * (ESD protected)
4	RS232 output (ESD protected)
5	5V DC input ⁺ , Backlight only
6	GND (power and communications)
7	5V DC input**, BOARD_VIN, General Power
8	GND (power and communications)

* RS232 input valid only if R17 installed as zero ohms.

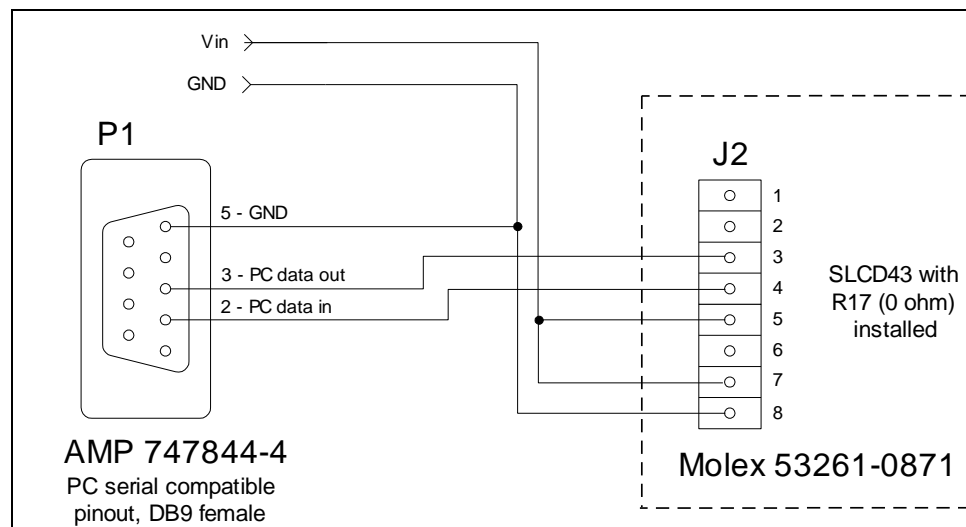
This is the factory default.

⁺ If R33 is removed can be used for battery operation input of 3.3-10V. The battery power will then be input to a Micrel 40V PWM Boost Regulator(MIC2297) driving the backlight. (Revision B only)

** See Appendix F.2 for 3.3V option.

For ESD protection details, refer to the specifications of the ICL3222E transceiver chip.

Typical connection from a PC is as follows:



4.2. J6 - Flat Flex LCD Connector (LCD Connector)

J6 – 40-Pin Omron XF2M-4015-1A or equivalent 0.5mm pitch Zero-Insertion-Force Connector

<i>Pin</i>	<i>Signal</i>	<i>Pin</i>	<i>Signal</i>
1	Y Up	21	Green 7
2	X Left	22	Green 6
3	Y Down (Y Bot?)	23	Green 5
4	X Right	24	Green 4
5	GND	25	Green 3
6	Test Point 2	26	Green 2
7	Data Enable (NC on FFC)	27	Green 1
8	Vsync	28	Green 0
9	Hsync	29	Red 7
10	PON	30	Red 6
11	Pixel Clock	31	Red 5
12	GND	32	Red 4
13	Blue 7	33	Red 3
14	Blue 6	34	Red 2
15	Blue 5	35	Red 1
16	Blue 4	36	Red 0
17	Blue 3	37	LCD VCC
18	Blue 2	38	GND
19	Blue 1	39	LED Cath +
20	Blue 0	40	LED Anode -

NOTE: the panel pin numbering is reversed due to top vs. bottom contact

4.3. J3 – USB (USB Connector)

This connector is a mini-USB type which connects to an FTDI FT232R USB-to-Serial bridge chip. To use this port, download the VCP (Virtual Com Port) drivers at:

www.ftdichip.com/Drivers/VCP.htm

J3 – Molex 54819-0572

<i>Pin</i>	<i>Signal</i>
1	VBUS
2	D-
3	D+
4	n/c
5	GND

4.4. J1 – COM1 / Programming Header (COM 1/PROG Connector)

This connector is used *either* for updating the firmware of the SLCD, *or* for communicating using the COM1 serial port. It also has a hardware reset signal for the SLCD43 processor. (For firmware update, use the Reach P/N 42-0056 USB programmer.)

J1 – 10 Pin Molex 53261-1071

Pin	Signal
1	VCC (3.3V) – can be used to power external transceiver
2	DE (active high) – use if needed to enable external 422 / 485 driver
3	Do not use
4	RxD1 – Com1 input
5	Do not use
6	Do not use
7	GND
8	RESET- input; drive low to hardware reset the SLCD43 processor
9	Do not use
10	TxD1 – Com1 output

4.5. J4 – Processor Expansion Header (COM 2 Connector)

This connector is used for expanding the processor functionality to support additional features. Contact Reach technical support for specific applications.

J4 – 10 Pin Molex 53261-1071

Pin	Signal
1	Directly connected to J2-7 (BOARD_VIN). Can be used as board power to as a pass-through to power an external circuit board.
2	I2C Data/Address
3	I2C Clock
4	RxD3 (input) COM2
5	Expansion I/O
6	EXPWM - expansion PWM or GPIO
7	GND
8	RESET- (pull low to GND via switch or open drain to reset)
9	SPKO – 0V-BOARD_VIN square wave audio signal for external audio amplifier.
10	TxD3 (output) COM2

4.6. J1 and J4 Electrical Specifications

Electrical specifications for J1 and J4 signals: DE, RxD1, RESET, TxD1, I2C Data, I2C Clock, RxD3, Expansion I/O, EXPWM, RESET, TxD3.

Input voltage	-0.3 / VCC+.3	Absolute Min / Max
Input voltage	0.8xVCC	High min
Input voltage	0.2xVCC	Low max
Output current High	1mA	Min, Vout = 0.9xVCC
Output current Low	-1mA	Min, Vout = 0.1xVCC

5. Software Command Reference

The software commands and utilities are described in a separate document, the SLCD Command Reference Manual.

6. SLCD43 Development Kits

The SLCD43 is available in a development kit form that includes a "production module" (SLCD43 board plus attached display and touch screen). The kit comes pre-loaded with bitmaps and macros that implement a demo. The demo runs if the unit is powered on with the main communications port looped back transmit to receive. This loopback is affected via a jumper on the "PowerCom4" board. The demo macro is #1. See the SLCD Command Reference Manual for information on macros.

The SLCD43 board in the development kit has panel-specific hardware and firmware options loaded. In general, it is not advised to use a Development kit board to drive a different panel. Though it seems like this should not be an issue if the connectors look like they match, there are many details that can cause a panel not to work. Unfortunately there is no standard pinout for these panels, even when the connectors have the same number of pins.

The development kit includes a two-port DB9 interface board that makes it easier to set up a development environment. One port can be used to download bitmaps from a PC while the other connects to the "host" computer. The SLCD43 also has a USB device port that can be used to connect it to a PC.

6.1. Getting Started

The SLCD43 kit as shipped contains a demo that allows you to verify its functionality. Plug the supplied power supply into the barrel connector on the triangular shaped PowerCom 4 board. The display should light up and lead you through various touch-activated screens.

Note that the demo is pre-loaded into the flash memory, and includes both bitmap files and a macro file. To best learn how the SLCD43 board and this kit works, start with simple commands using the serial interface and leave the creation and use of macros for later. Appendix G of the SLCD Command Reference manual provides a short tutorial.

A video tutorial on using the SLCD43 kit, called “Getting a Development Kit Up and Running”, can be found on the Reach Web site www.reachtech.com. Click on the “Tutorials” link in the “Support” section of the left-hand navigation bar.

6.2. Connecting the kit to a PC - Serial or USB

The kit should be connected to a PC so that the serial command interface can be experimented with. This is a preliminary step before the unit is connected to the embedded system that will control the display in the embedded system. ***PLEASE NOTE: In order to communicate over the main serial port, the Demo jumper JP1 on the PowerCom4 board must be removed.*** This jumper loops back transmit to receive on the serial port and this is what tells the display to run the demo.

The SLCD43 Rev B board can be powered entirely through the USB port. Before using the USB port, download and install the VCOM (Virtual COM port) drivers from FTDI [here](#). The chip on the SLCD43 is the FT232R. The driver should be installed before the USB port is plugged into the PC.

As shipped, all serial ports including USB are set to 115,200 baud, 8 bit, 1 start, 1 stop, no parity. Connect the PC using a straight through cable to the DB9 marked "MAIN" (P1). If the PC does not have a serial port, use the SLCD43 USB port.

A USB-to-serial adapter cable can also be used. ***Note: the Belkin USB-serial adapter has software compatibility issues and is not recommended; Reach recommends either Prolific or FTDI chip based adapters.***

Once connected, use a terminal emulator such as Tera Term or RealTerm to send and receive commands from the kit. Tera Term is able to run macros which can simulate the user interface on the SLCD43 using a PC. The old Windows™ terminal emulator, HyperTerminal, has limitations that can cause problems; specifically, some versions cannot send the "escape" character.

6.3. *Developing the application GUI with an embedded controller as host*

To develop the host-driven GUI, connect the SLCD43 main port to the host and any of the other ports to a PC. This way either the host or the PC can drive the SLCD. Typically the PC is used to experiment and determine what command is needed for a graphical element, and to download new bitmaps and macros without having to disconnect the embedded system.

The SLCD43 has a console "autoswitch" feature that allows any serial port to be used as the main control port. Only one SLCD43 port is the active or "main" port at any time. However, when any other port receives three <return> characters in a row, it auto switches to become the main port. This way, the PC can take control of the SLCD43 communications channel and send commands or download new bitmaps. The reset button, *RESET command, or a power cycle restores the previously active main port.

[Note: the *prevCons command will also restore the previously active main port. Also, the control port autoswitch character is <return> by default but can be set to a different value with the *auxEsc command. See the SLCD Command Reference Manual]

The SLCD43 has non-volatile memory which remembers which port is the "main" control port. This allows any of the SLCD43 serial/USB ports to be the main port on power-on. See the SET CONTROL PORT command.

6.4. PowerCom4 Board

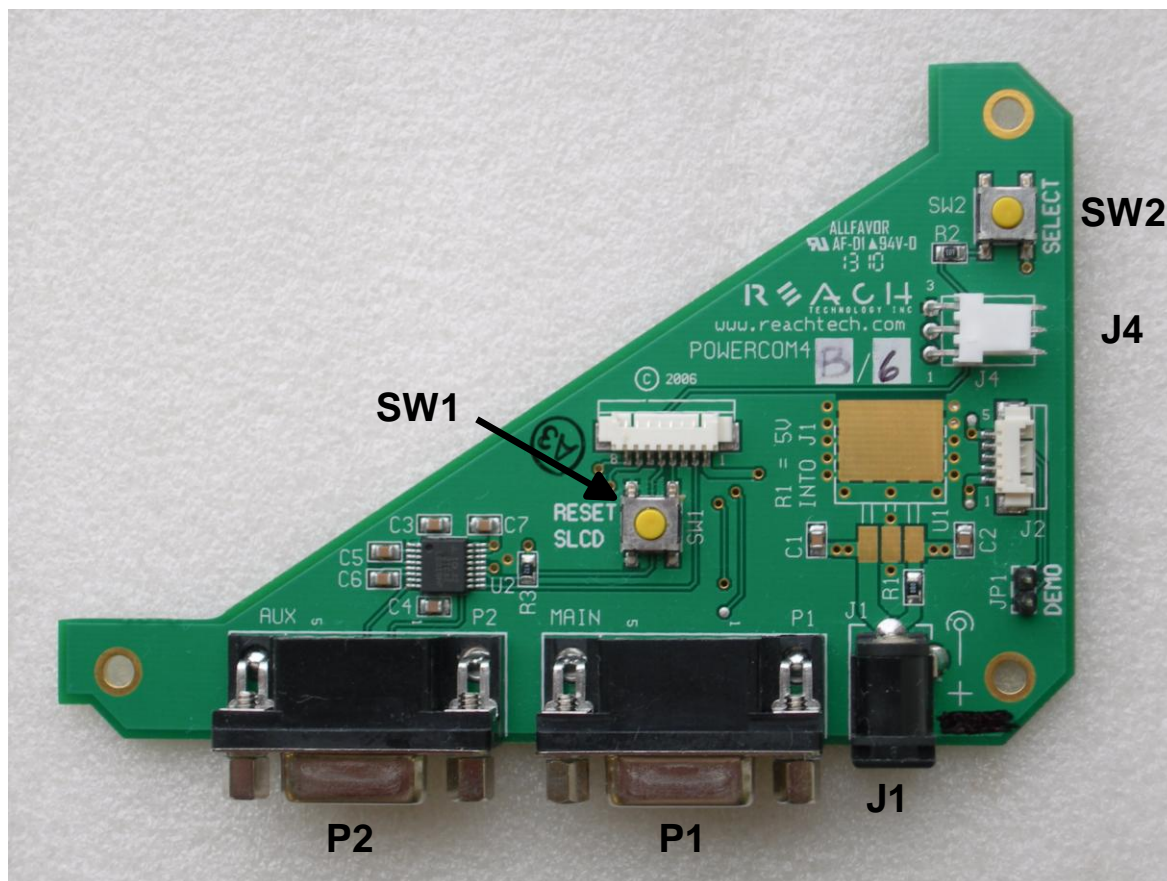


Figure 7: PowerCom4 Board Image

6.5. PowerCom4 Schematic

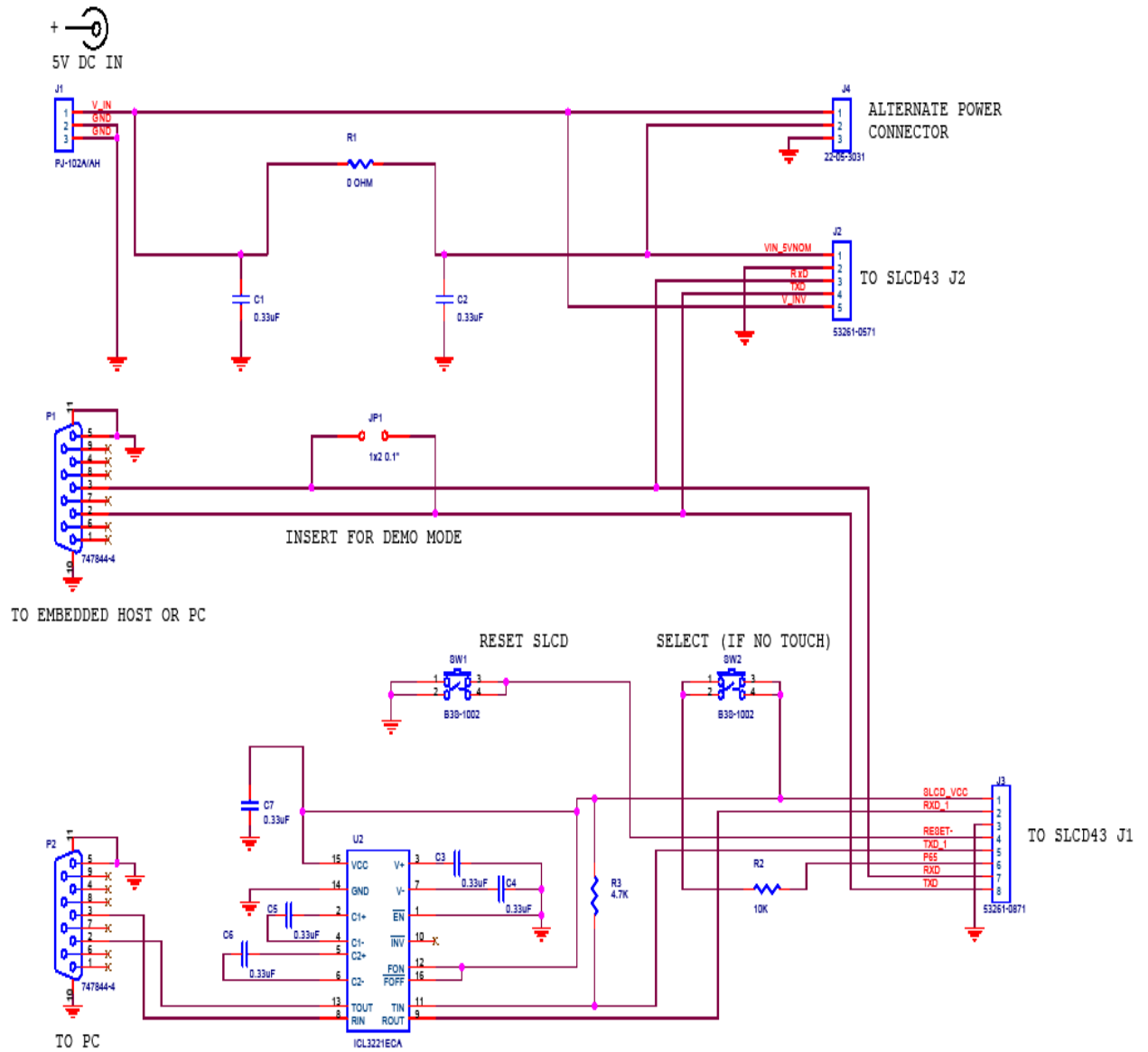


Figure 8: PowerCom4 Schematic

6.6. PowerCom4-SLCDx Cable Pinouts

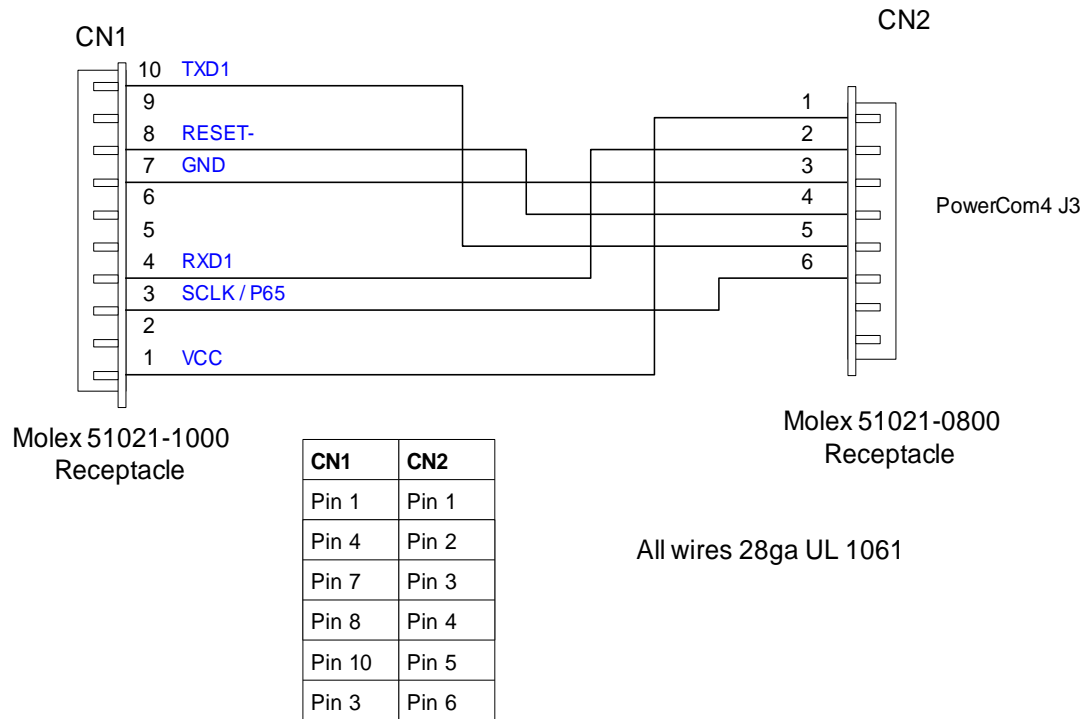


Figure 9: Cable #23-0101 Diagram

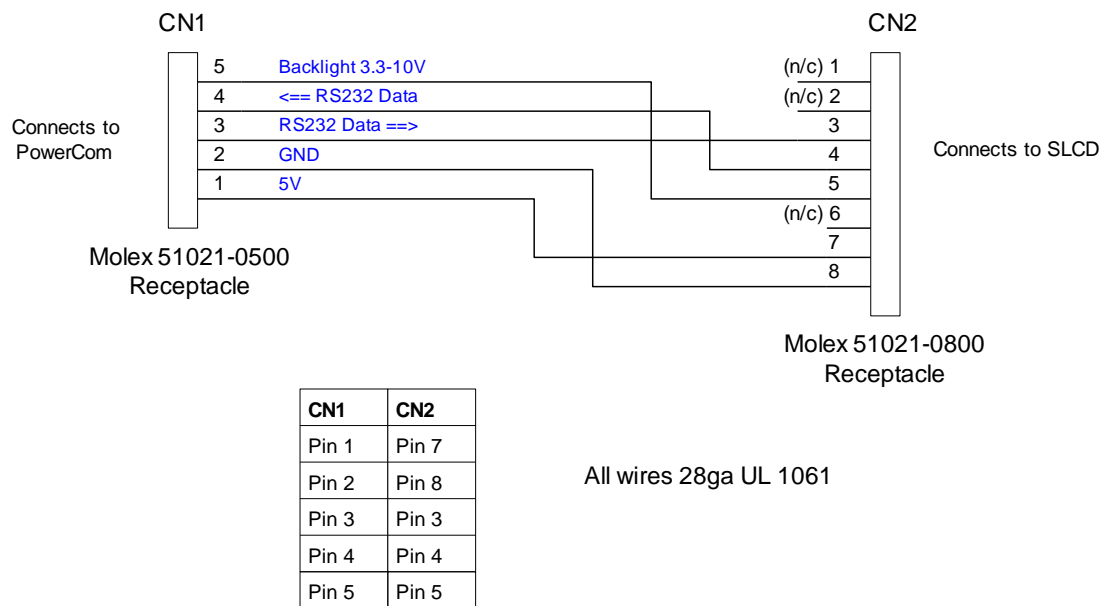


Figure 10: Cable #23-0064 Diagram

6.7. Kit / PowerCom4 Operational Notes

1. The unit default baud rate is 115200. The unit does not echo characters (for communications efficiency), so you must select "echo characters locally" or "half duplex" in your PC communications program. Also, all return strings are terminated by a <return> only, so you need to specify "add line feed to line return" as well.
2. The demo requires a certain set of bitmaps to be loaded. These are loaded as part of the kit. If these are not present, it will not run correctly. Copies of these are provided in the "BMPs and Macros" directory on the CD provided. Use the BMPload program and load the demo.lst and macros.mac files to restore the demo.
3. The SW1 "RESET" button on the PowerCom4 board resets the SLCD43 processor and performs the equivalent of a power-on reset.
4. The SW2 "SELECT" button on the PowerCom4 board is intended for use with kits that don't have a touch screen, and is not implemented on a standard kit.
5. Jumper JP1 is the "DEMO" serial loopback jumper that is installed at the factory in order to automatically run the demo at power up. Remove the jumper prior to attempting serial communications with SLCD43 controller.
6. The J1 barrel connector is the external power supply connector for the development kit. With the SLCD43, the power supply is 5VDC input and the barrel connector is 2.5mm center pin positive.
7. PowerCom4 connector J2 provides the communications path for the P1 "MAIN" RS232 serial port. It connects to J2 of the SLCD43 controller via cable 23-0064. This connection also provides 5VDC power to the SLCD43 controller.
8. Connector J3 of the PowerCom4 board is the communications path for the P2 "AUX" RS232 serial port. It connects to J1 of the SLCD43 controller via the 23-0101 cable. This provides the path for the "RESET", and "SELECT" signal buttons. As well as the communications path for downloading of bitmaps and macros to the SLCD43 controller.
9. Connector J4 is reserved for future use.

Appendix A - Parts and suppliers for SLCD43 controller connections

A.1 *Connectors and cables for J1, J4, J2*

The board connectors for J1, J4 and J2 are Molex type 53261-1071 (J1, J4) and 53261-0871 (J2). The mating connector is made of two parts: a receptacle housing, and crimp pins. A special tool is needed to make the crimps. Alternatively, custom cables can be purchased. See [B.2](#) for cable vendors.

J2 Receptacle housing Molex P/N 51021-0800

J1, J4 Receptacle housing Molex P/N 51021-1000

Crimp pins Molex 50079 or 50058

Prototype (small qty) crimp tool Molex 63811-0200

Production crimp tool Molex 63811-0000

All of the above are available from www.digikey.com

A.2 *Discrete wire cable vendors*

The cables needed for J1 and J2 can be specified and supplied as assembled cables by the following vendors:

International Component Technology
www.intcomptech.com

Appendix B - Ordering information

B.1 *Contact Reach directly for ordering information.*

Reach Technology Inc
4575 Cushing Parkway
Fremont, California 94538
(510) 770-1417

Appendix C - Troubleshooting

C.1 *Touch unreliable or non-operative*

If the touch screen is unreliable or non-operative, do the following:

1. Run the TOUCH CALIBRATE command, "tc". This will reset the calibration values and allow you to recalibrate the touch screen.
2. If after doing this the touch is still non-operative, check the cable connection into the SLCD43 board.

To determine the accuracy and sensitivity of the touch, you can use the "debug" command as follows:

*debug 1<return>

This puts an "X" on the screen whenever a valid touch is recognized. To turn off, use:

*debug 0<return>

Appendix D – 3.3V CMOS UART Interface

It is generally recommended that the RS232 interface be used to communicate with the SLCD43. The advantages are the ability to remote the display from the host, and easier debugging by spying on the RS232 interface. However, in retrofit situations, an RS232 port may not be available.

There are two options to connect to the SLCD43 via UART at 3.3V CMOS levels:

D.1 COM2 via J4.

The connector J4 has power, ground, reset-, and UART TxD and RxD. This is the easiest way to connect at 3.3V CMOS levels. The BMPload program can be used to set COM2 as the active main port.

D.2 COM0 via J2.

The SLCD43 serial port COM0 is typically used for communication using RS232 levels. However, by removing resistor R17, it can use 3.3V CMOS logic levels. This is typically a factory option, but the user may make this change as needed. R17 is located under U2 which is under connector J2.

COM0 Logic Level Mode:

1. Resistor R17 (below U2) must be removed.

With R17 removed, connector J2 **must** be wired for Logic Level Mode:

J2 – 8 Pin Molex 53261-0871 for Power and Communications

Pin	Logic level mode – R17 not installed
1	TxD- output from the SLCD43
2	RxD- input to SLCD43 *
3	do not connect
4	do not connect
5	5V Input
6	GND (power and communications)
7	5V Input
8	GND (power and communications)

- * R17 must be removed to avoid conflict with RS232 on-board receiver.

Appendix E – Battery Operation Options

E.1 *Running the backlight directly from the battery.*

When the SLCD43 is used with a battery supplying the power, efficiency is important for long battery life. The largest power drain when operating is the backlight. Driving the backlight directly from the battery without going through a DC-DC converter can help. (This assumes a max battery voltage of under 10V). To do this:

1. Remove resistor R33 that shorts J2 pin 5 and J2 pin 7
2. Supply 3.3-10V from the battery to J2 pin 5. This directly drives the backlight up-converter.

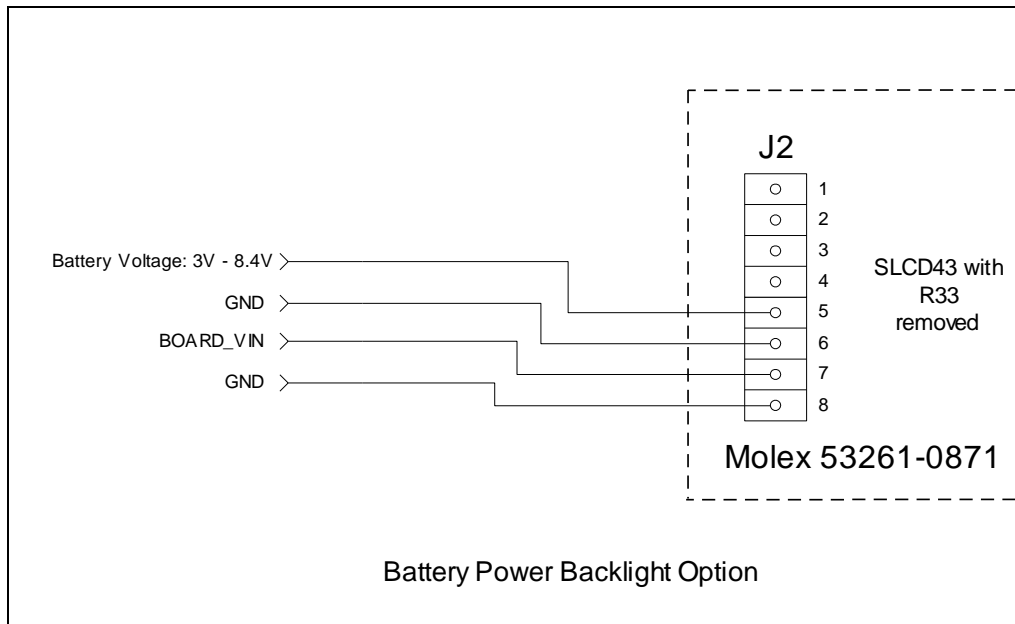


Figure 11: Battery Power Diagram

E.2 *Running the board from 3.3V instead of 5V.*

The SLCD43 generates its own 3.3V supply via a linear regulator. Powering the board with 3.3V will save $1.7/5 = 34\%$ power compared to 5V. To do this, the LDO is shorted and the diode that allows the unit to be powered from the USB port (5V) is removed. Once this change has been made, the board cannot be powered from the USB port.

To do this:

1. Add zero ohm resistor, size 0805 to location R12
2. Remove diode D6
3. Supply 3.3V to J2-7 instead of 5V.

Contact Reach for other power saving options.

F.2 45-pin Board Picture (Rev B)



Figure 13: SLCD43 45-pin Revision B Board Image

F.3 45-pin Board Picture (Rev A)

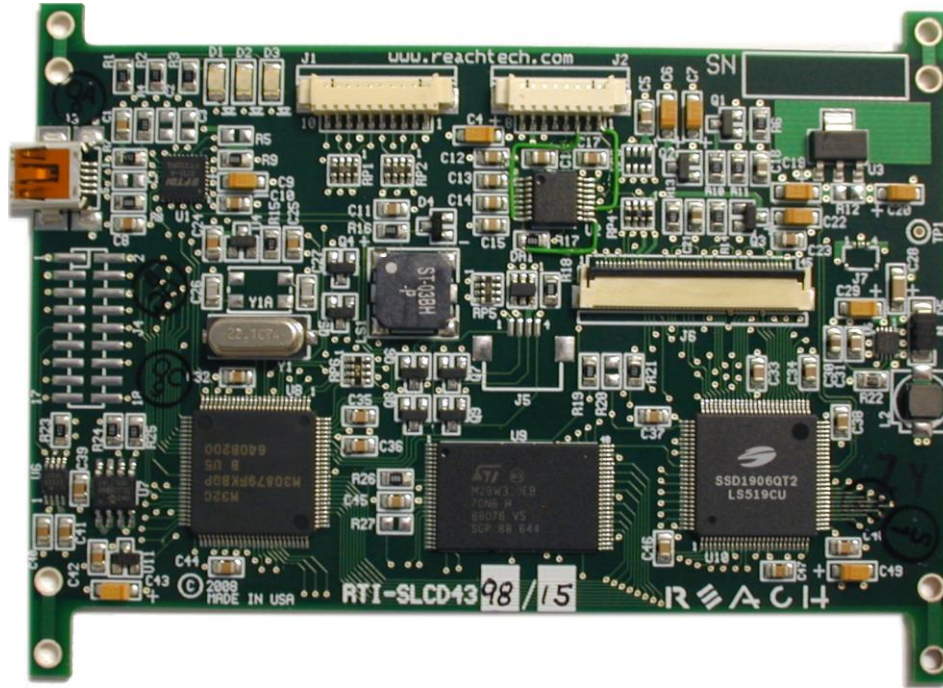


Figure 14: SLCD43 45-pin Revision A Board Image

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F.5 Legacy Connectors

F.5.1 J5 – 4 Wire Touch (TOUCH Connector)

This connector is installed if the SLCD43 is used with the Sharp 4.3 inch display or similar.

J5 – 4 Pin Molex 52207-0460 or equivalent 1mm pitch bottom contact ZIF Connector

<i>Pin</i>	<i>Signal</i>
1	X Right
2	Y Down
3	X Left
4	Y Up

Note: touch calibration can accommodate swap between right and left, and / or up and down.

F.5.2 J6 – 45-pin Flat Flex LCD Connector (LCD Connector)

Location J6 has a 45 pin or a 40 pin connector installed; the 45 pin is for the LB043 or similar panels and the 40 pin is for the LQ043 or similar panel.

J6 – 45 Pin Omron XF2H-4515-1LW or equivalent 0.5mm pitch Zero-Insertion-Force Connector
(40 Pin Omron XF2H-4015-1LW or equivalent 0.5mm pitch Zero-Insertion-Force Connector)

<i>Pin</i>	<i>Signal</i>	<i>Pin</i>	<i>Signal</i>
1	NC	24 (19)	Blue 1
2	NC	25 (20)	Blue 0
3	LED +	26 (21)	Green 7
4	LED -	27 (22)	Green 6
5	GND	28 (23)	Green 5
6 (1)	X Right	29 (24)	Green 4
7 (2)	Y Down	30 (25)	Green 3
8 (3)	X Left	31 (26)	Green 2
9 (4)	Y Up	32 (27)	Green 1
10 (5)	GND	33 (28)	Green 0
11 (6)	Power Sel	34 (29)	Red 7
12 (7)	Data Enable	35 (30)	Red 6
13 (8)	LCD FP (Vsync)	36 (31)	Red 5
14 (9)	LCD LP (Hsync)	37 (32)	Red 4
15 (10)	PON	38 (33)	Red 3
16 (11)	Pixel Clock	39 (34)	Red 2
17 (12)	GND	40 (35)	Red 1
18 (13)	Blue 7	41 (36)	Red 0
19 (14)	Blue 6	42 (37)	LCD VCC
20 (15)	Blue 5	43 (38)	LCD VCC
21 (16)	Blue 4	44 (39)	GND
22 (17)	Blue 3	45 (40)	GND
23 (18)	Blue 2		

NOTE: the panel pin numbering is reversed due to top vs. bottom contact

F.5.3 J7 – LED Backlight Output

J7 – 4 Pin Hirose FH19C-4S-0.5H(05)

<i>Pin</i>	<i>Signal</i>
1	LED Backlight +
2	NC
3	NC
4	LED Backlight -

This connector is installed if the SLCD43 is used with the Sharp 4.3 inch display.