Introduction

A touch screen interface can be added to Pictiva™ 2.7 inch or similar OLED displays to enhance its' operation. This application note shows how the hardware and software can add a touch function to an existing OLED display.

Potential Benefits of using a touch screen interface with OLED

- Create smart switches for industrial controls for a more efficient and intuitive graphical user interface.
- Save valuable real estate on bezel or console by combining switches with Indicators into smaller simpler switch control systems.

Touch Screen Unit

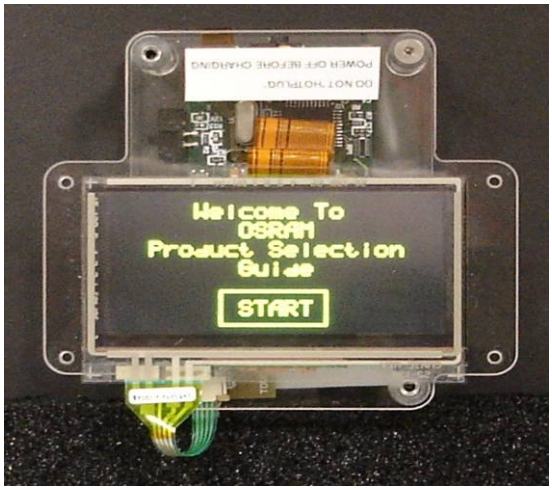

Figure 1: OLED touch display

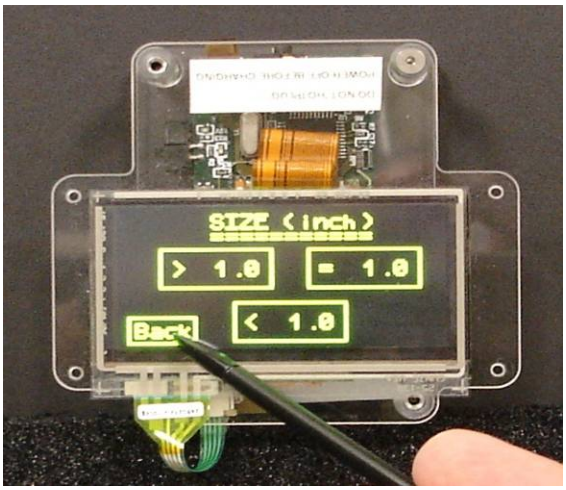

Figure 2: OLED touch display in operation

The touch screen is a 2.7 inch diagonal 4 wire resistive tactile sensor. It can sense the position of a finger or stylus that makes contact on the face of the touch sensor equipped display. An analog resistive sensor array measures the voltage drop across two sets of silver painted metal electrodes.

One set of electrodes sets up a static electric field between two planes of transparent conductive ITO. A third electrode senses the voltage drop at the point where a finger or stylus pushes the two conductive planes together.

Scanning and reading of the touch sensor is performed by an AD7843 touch controller ASIC and an 8051 based microcontroller. A block diagram of the touch screen system is in Figure 3.

The touch screen is physically sized for the OSRAM 128x64 2.7 inch monochrome display. A mechanical diagram of the touch sensor panel is shown below in Figure 4.

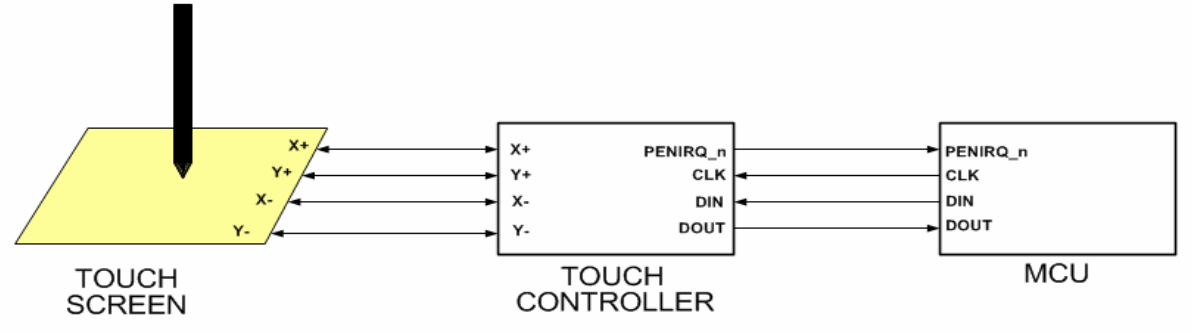

Figure 3: Block Diagram of Touch Screen System

Touch Panel Sensor

The touch sensor is a 4 wire analog resistive array with a base glass substrate and two flexible resistive ITO layers separated by an array of insulating dots. A finger or stylus pushes the two layers together at a single point causing a change in resistance and voltage drop at a fixed point.

An Analog Devices AD7843 scans the X and Y axes and determines the unique voltage drop for each axis. The four electrodes for scanning are labeled **X+, X-, Y+,** and **Y-**. These electrodes are connected to the AD7843 touch screen controller and the touch sensor is scanned and the analog voltages read.

Full schematics are in the appendix on **pages 6 and 7**.

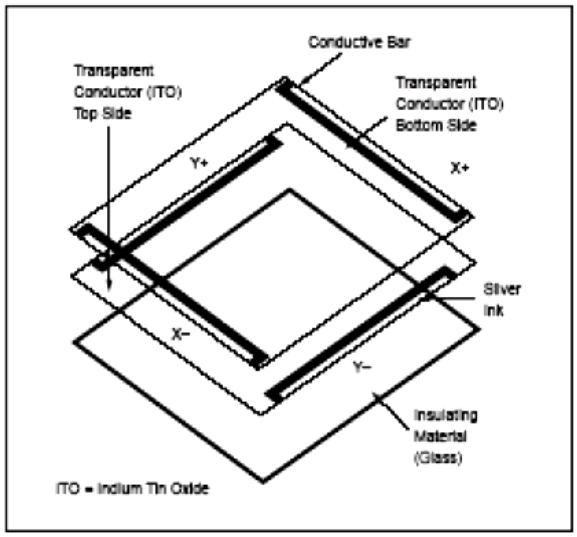

Figure 4: Touch Screen mechanical diagram

Touch Controller ASIC

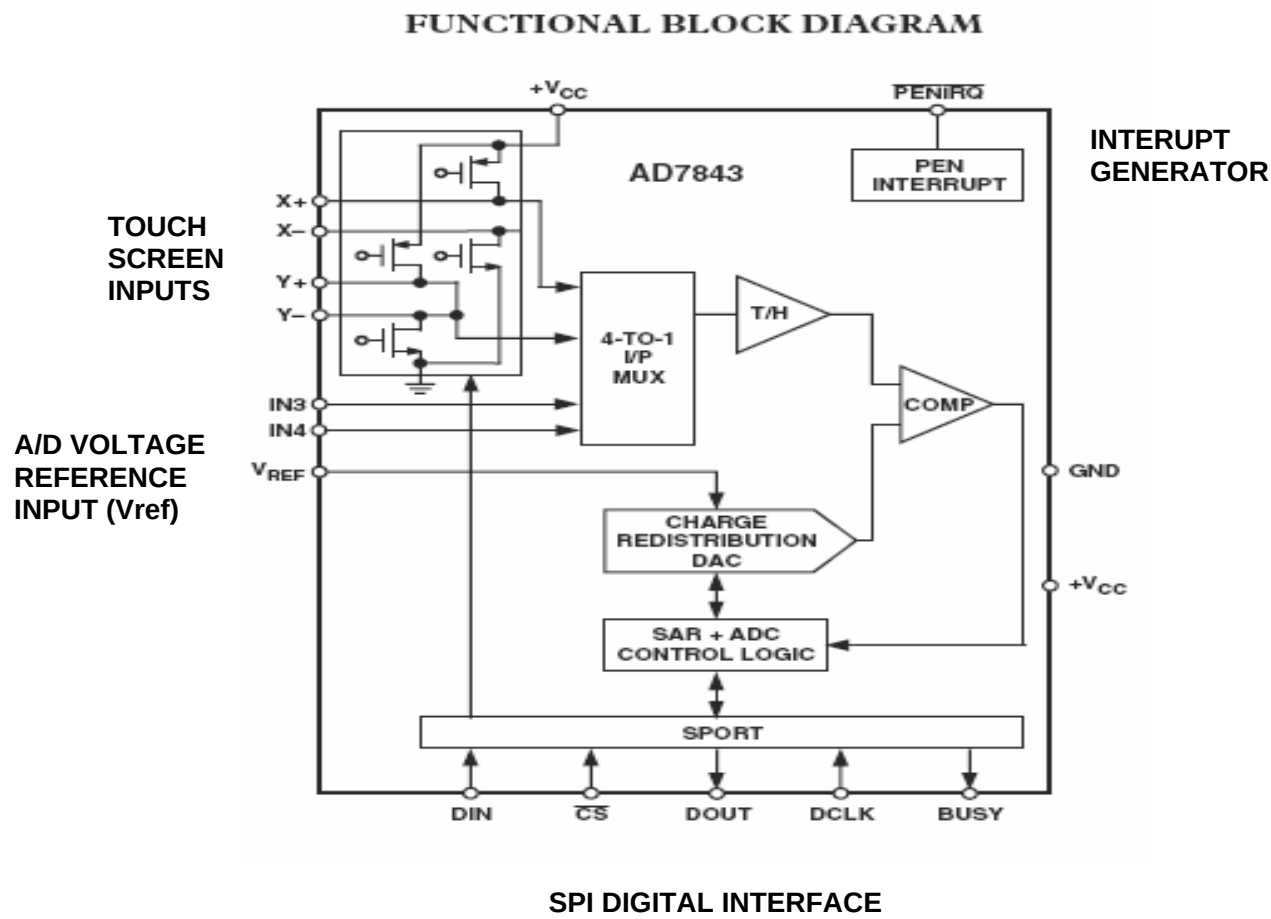

Figure 5: Touch Controller ASIC block diagram

The four touch electrodes are connected to the inputs X+, X-, Y+, and Y- of the AD7843. A selected axis (X or Y) pair of electrodes is energized with a static voltage and the voltage of the positive electrode of the other pair in the 4 wire touch panel is measured. The sensed voltage is measured and converted to either an 8 bit or 12 bit resolution. A digital word representing the voltage at the contacting point on the touch panel is created and sent out via a high speed SPI serial interface.

A SAR type ADC is used to do the analog to digital conversion. The SAR ADC is stabilized and calibrated using an external +2.5Vdc voltage reference regulator. The Analog Devices analog to digital converter is capable of either 8 bit or 12 bit resolution. ADC operation and touch electrode biasing can be configure to read X and Y axis voltage drops using single ended or differential measurement techniques.

A finger or stylus touching the sensing Panel generates an interrupt (/PEN-IRQ) which causes the 8051 microcontroller to begin issuing commands for the touch screen controller to scan the X and Y axis for location of the contacting object. Photographs of the controllers are in Figure 6.

Figure 5 shows the touch ADC configuration set up by the 8051 to read position along the Y axis. Bias voltage and ground are applied to the Y+ and Y- electrodes respectively and the X+ electrode senses a voltage drop at the contact point of the touch screen plane.

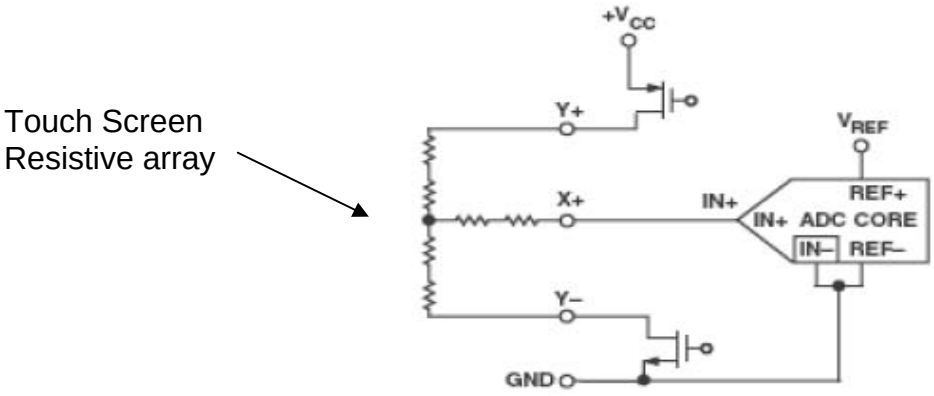

Figure 5: Touch Controller biasing and sensing touch point along Y axis.

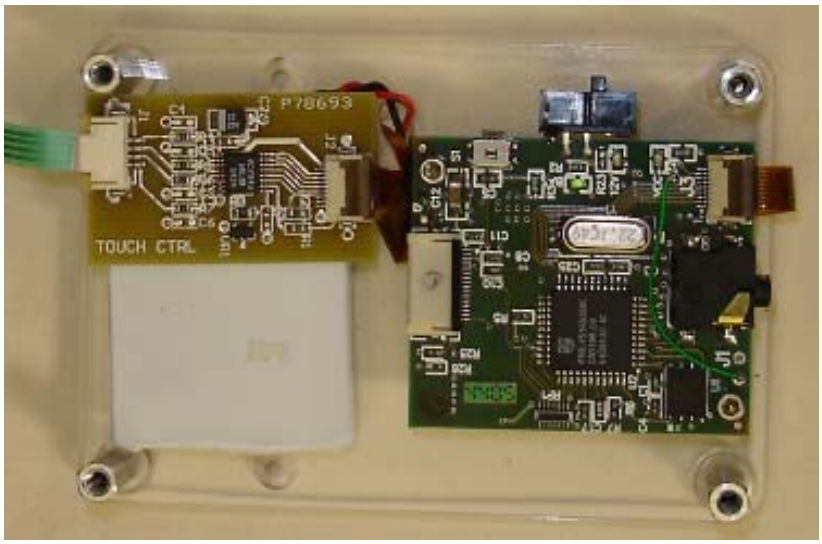

Figure 6: AD7843 touch controller and 8051 controller boards

Touch Panel Sequence of Events

The touch panel starts in an idle mode. The master Microcontroller unit (MCU) is waiting for activity from the Touch Controller. At the touch of the stylus below, a change in voltage is generated at the X+ electrode and sent to the touch controller.

Full software block diagram is in the appendix section on **page 8**.

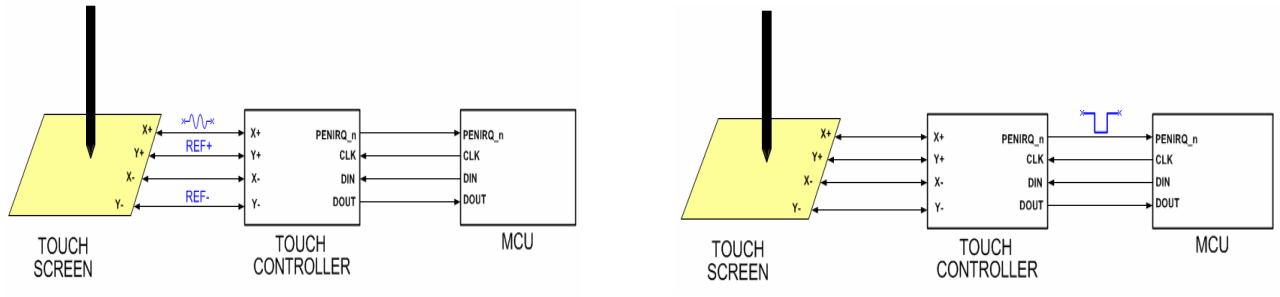

Figure 7: Touch Screen Interrupt Creation and Detection

Touch Controller generates and an active low interrupt (/PENIRQ) which wakes up the MCU. MCU responds to the interrupt by commanding the Touch Controller to begin scanning the touch screen along the X axis.

The X and Y axes are scanned and outputs of binary data coordinates are sent to the supervisory MCU.

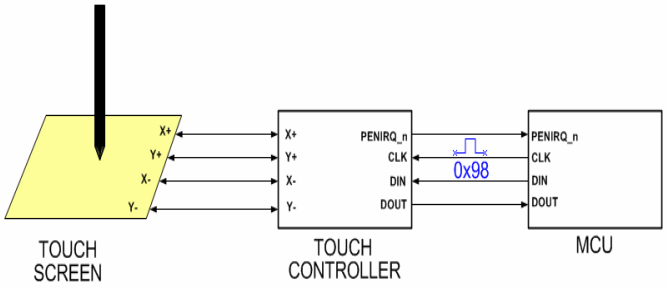

Figure 8: MCU commands scan of X axis

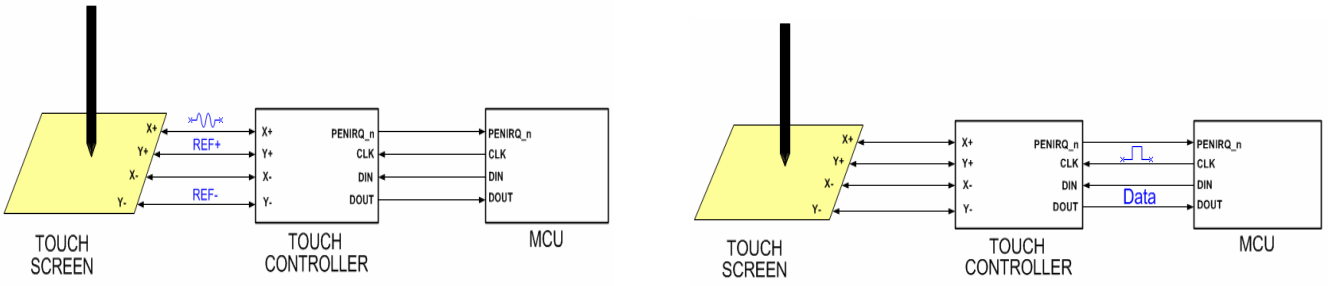

Figure 9: X Axis Scanning and output of Coordinate routines.

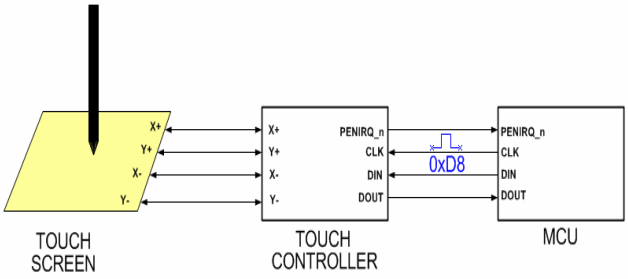

Figure 10: MCU commands scan of Y axis

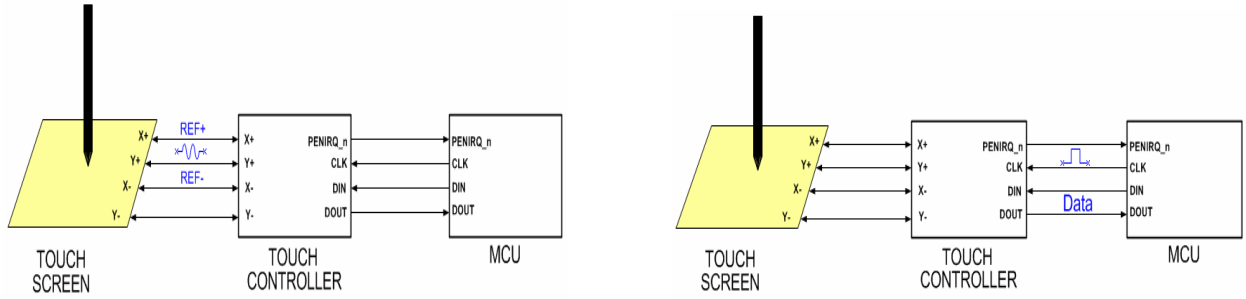

Figure 11: Y Axis Scanning and output of Coordinate routines.

MCU will reset the touch screen back to a detection mode unless a finger or stylus is still touching the sense pad. In that case, the controller will perform another scan and update the contact position. Complete schematics on the MCU and operating software may be found in the OSRAM Reference Design Kit.

Further Information

The touch controller, Analog Devices AD7843 is a standard off the shelf touch controller and is obtainable from other semiconductor vendors. The firmware and MCU control software is written in 'C' (Please contact Osram OLED Applications Engineering for referral to 3rd party software resources). The base controller is a modified OSRAM Reference Design Kit microcontroller.

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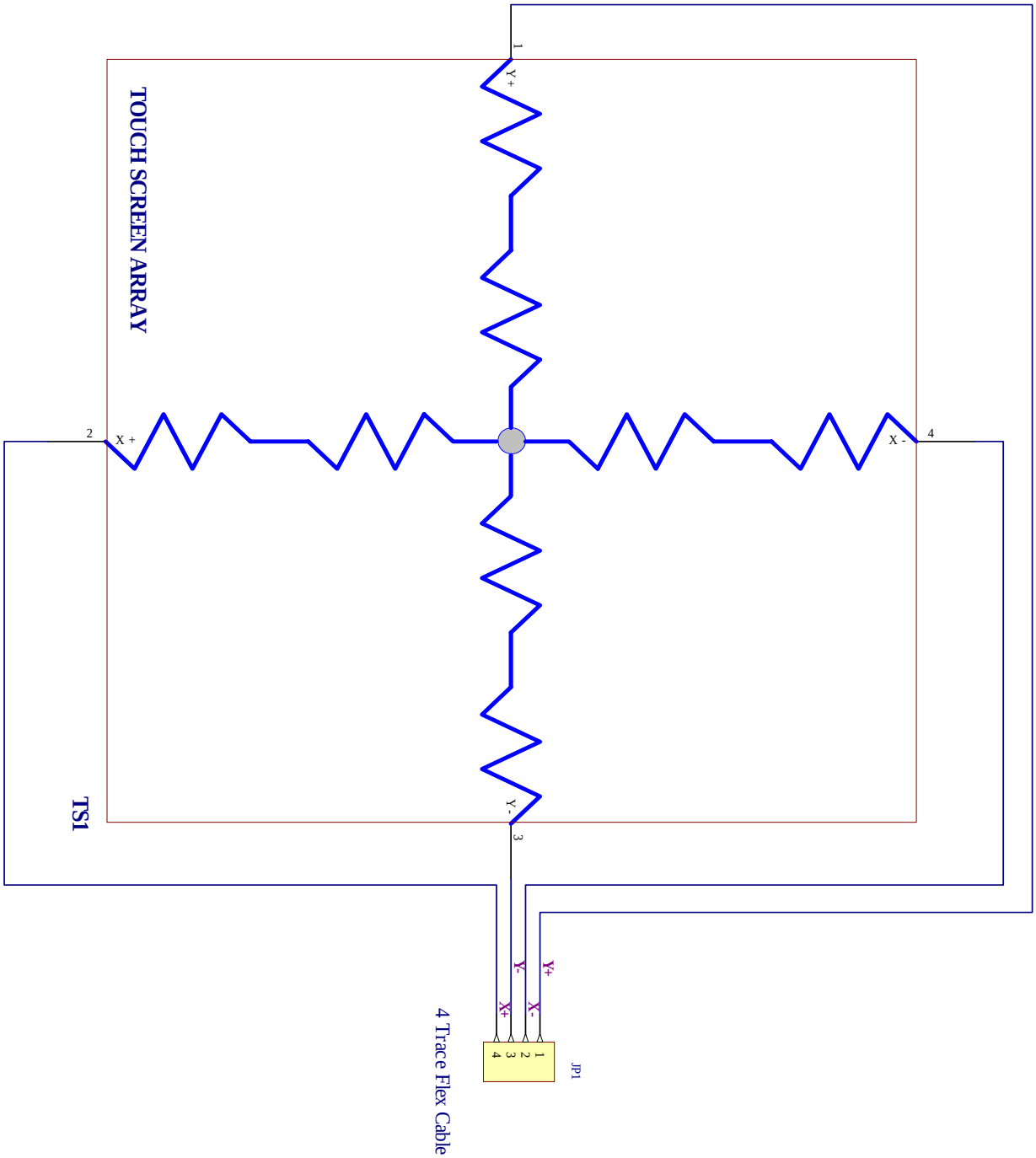
October, 2006.

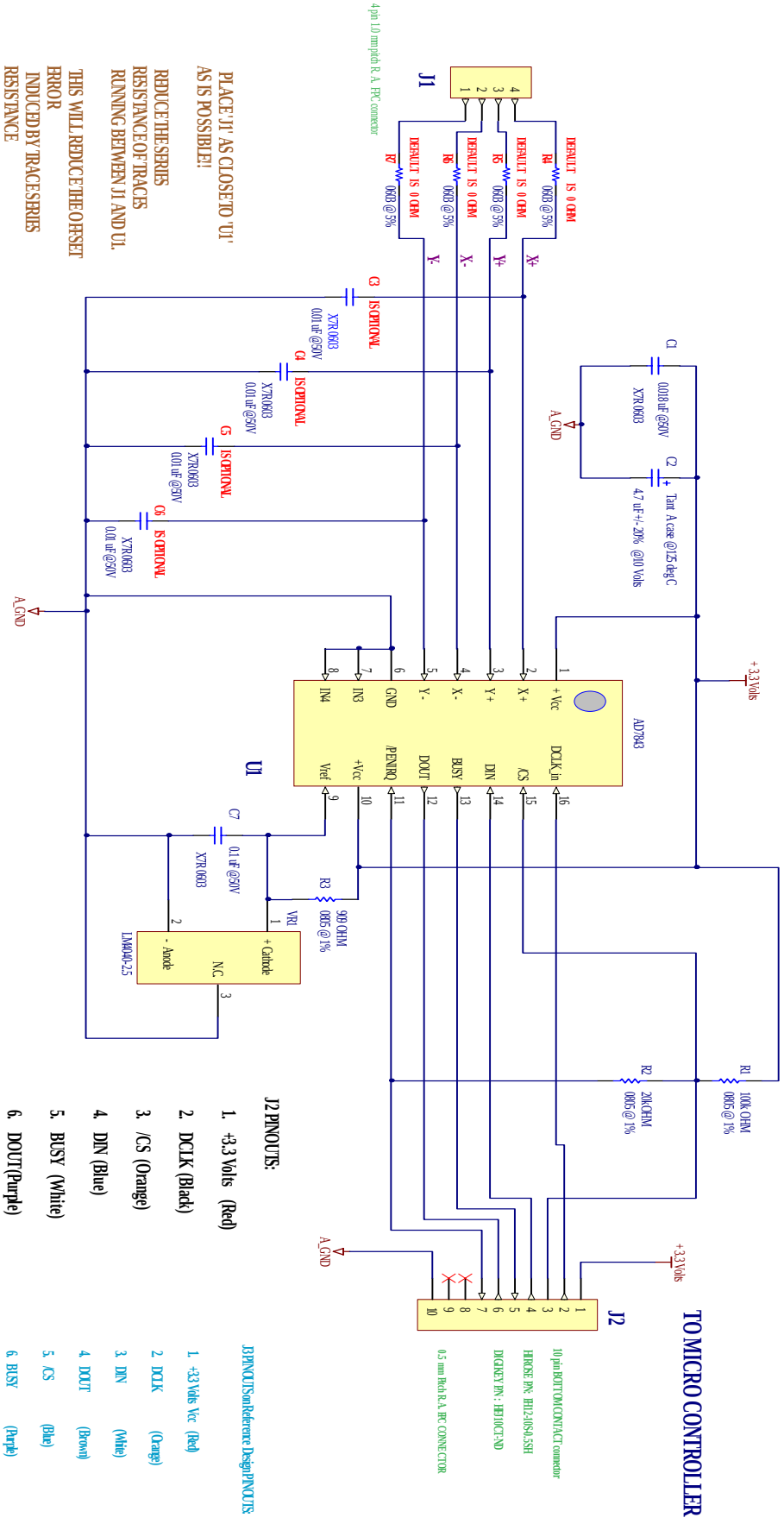
About Osram Opto Semiconductors
Osram Opto Semiconductors GmbH, Regensburg, is a wholly owned subsidiary of Osram GmbH, one of the world's three largest lamp manufacturers, and offers its customers a range of solutions based on semiconductor technology for lighting, sensor and visualisation applications. The company operates facilities in Regensburg (Germany), San José (USA) and Penang (Malaysia). Further information is available at www.osram-os.com.

APPENDIX

Touch Screen Schematic



Touch Controller Schematic



Touch Screen Firmware Block Diagram