

## Layout and Grounding Recommendations for Touch Screen Digitizers

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### INTRODUCTION

This application note provides layout suggestions to optimize the performance of the AD7843/AD7873. The AD7843/AD7873 are 12-bit successive-approximation ADCs with a synchronous serial interface and low on-resistance switches for driving touch screens. The AD7843/AD7873 operate from a single 2.2 V to 5.25 V power supply and feature throughput rates greater than 125 kSPS.

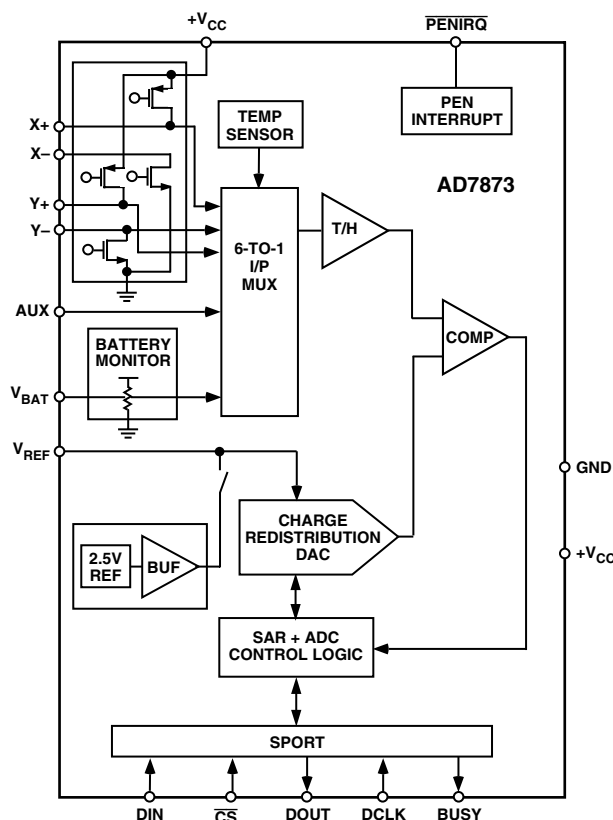
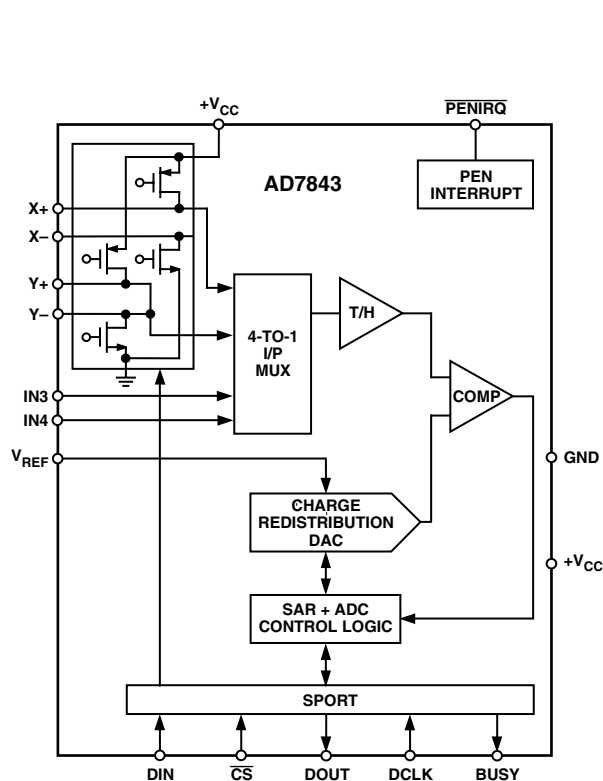
### GROUNDING AND LAYOUT

Both supplies to each of the AD7843 and AD7873 are analog supplies and should be connected directly together. Although various portable applications may have conflicting requirements with respect to power

consumption, cost, size or weight, most should have relatively clean power supplies and ground as the power supply is from a battery and most of the internal components are very low power. However care should still be taken with regard to grounding and layout. It should also be noted that each situation is unique and the following suggestions should be carefully reviewed.

The printed circuit board that houses the AD7843 or the AD7873 should be designed so the analog and digital sections are separated and confined to certain areas of the board. This facilitates the use of ground planes that can easily be separated. A minimum etch technique is generally best for ground planes as it gives the best shielding. The GND pin of the AD7843/AD7873 should be sunk in the analog ground plane. The AGND plane

### FUNCTIONAL BLOCK DIAGRAMS



and DGND plane connection should be made at one point only, a star ground point that should be established as close as possible to the GND pin of the AD7843/AD7873.

Avoid running digital lines under the device as these will couple noise onto the die. The analog ground plane should be allowed to run under the AD7843/AD7873 to avoid noise coupling. The power supply lines to the AD7843/AD7873 should use as large a trace as possible to provide low impedance paths and reduce the effects of glitches on the power supply line. Fast switching signals like clocks should be shielded with digital ground to avoid radiating noise to other sections of the board, and clock signals should never be run near the analog inputs. Care should be taken to restrict digital signals from overshoot or undershoot, even on a transient basis. Avoid crossover of digital and analog signals. Traces on opposite sides of the board should run at right angles to each other. This will reduce the effects of feedthrough through the board. A microstrip technique is by far the best but is not always possible with a double-sided board. In this technique, the component side of the board is dedicated to ground planes while signals are placed on the solder side.

Good decoupling is also important. All analog supplies should be decoupled with 10  $\mu\text{F}$  tantalum in parallel with 0.1  $\mu\text{F}$  capacitors to AGND. To achieve the best from these decoupling components, they must be placed as close as possible to the device, ideally right up against the device.

The AD7843/AD7873 architecture offers no inherent rejection of noise or voltage variation with respect to the use of an external reference. This is of particular concern if the reference input is tied to the power supply. Any noise or ripple on the supply will appear directly in the digital output. Although high-frequency noise can be filtered out, voltage variation due to line frequency (50 Hz or 60 Hz) can be difficult to remove.

### Digitizer to Touch Screen Interconnection

In the specific case of use with a resistive touch screen, care should be taken with the connection between the converter and the touch screen. Since resistive touch screens can have quite low resistance, the interconnection should be as short and robust as possible. Longer connections will act as a source of error much like the on-resistance of the internal switches which can be negated using the differential reference architecture of the devices. Similarly, loose connections can be a source of error when the contact resistance changes with flexing or vibrations. Noise can be a major source of error in touch screen applications (e.g., applications that require a back-lit LCD panel). This EMI noise can be coupled through the LCD panel to the touch screen and cause "flickering" of the converted data. Several things can be done to reduce this error, such as utilizing a touch screen with a bottom-side metal layer connected to ground. This will couple the majority of noise to ground. Additionally, filtering capacitors from Y+, Y-, X+, and X- to ground, can also help. Caution should be observed for settling time of the touch screen, especially when operating the AD7843/AD7873 in the single ended mode and at high data rates. See the AD7843 and AD7873 data sheets for more detailed information on settling time.

### Typical Connection Diagram

Figure 1 shows a typical connection diagram for the AD7873 in a touch screen control application. The AD7873 features an internal reference but this can be overdriven with an external low impedance source between 1 V and  $+V_{\text{CC}}$ . The value of the reference voltage will set the input range of the converter. For more information concerning this device, refer to the AD7873 data sheet. For further evaluation information refer to the AD7873 evaluation board and documentation.

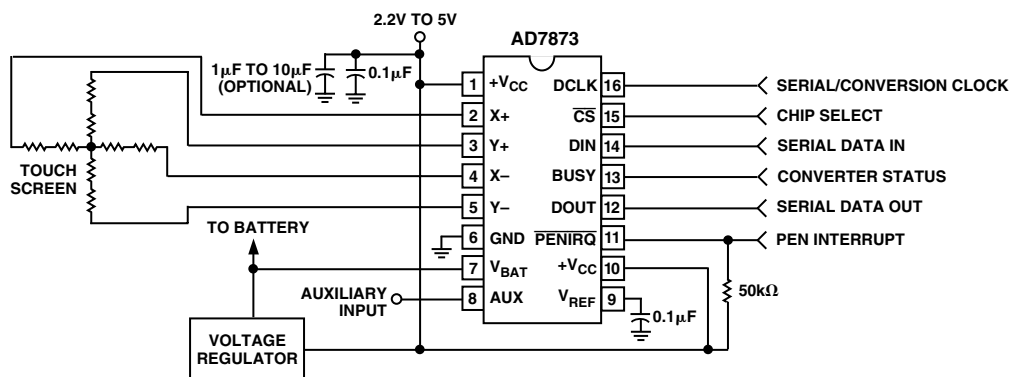


Figure 1. AD7873 Typical Application Circuit