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APPLICATION BULLETIN
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EVALUATING THE ADS7846 USING THE DEM-ADS7843E/45E EVALUATION FIXTURE

By Rick Downs

The ADS7846 is the next-generation version to the industry standard ADS7843 4-wire touch-screen controller. The ADS7846 is 100% pin-compatible with the existing ADS7843, and will drop into the same socket. This allows for easy upgrade of current applications to the new version.

Only software changes will be required to take advantage of the added features of direct battery measurement, temperature measurement, and touch-pressure measurement.

Since the ADS7846 has the same pin-out as the ADS7843, it can be evaluated using the DEM-ADS7843E/45E Evaluation Fixture, using the guidelines presented here.

INSTALLATION AND SET UP

The DEM-ADS7843E/45E is designed to allow evaluation using either the on-board clocking circuitry or in a stand-alone mode.

Stand-alone evaluation is done by removing all the jumper shunts of JP4, and using J1 and J2 for direct connections to the device-under-test (DUT).

Using the on-board clocking circuitry of the evaluation fixture, however, provides all the appropriate digital interface circuitry to drive the DUT Data Clock, Chip Select, and Serial Data In, which is coordinated with the BUSY and $\overline{\text{PENIRQ}}$ to provide serial and parallel output data.

The DEM-ADS7843E/45E has two positions on the evaluation board where the DUT may be installed. Position 1 is the socket, DUT1, on the board. The ADS7846 may be placed in this spring-loaded socket which allows the user to quickly swap in or out the device being evaluated. Alternatively, the DUT may be soldered onto the board in the X1 position.

The user must connect a +5V power supply to J4, and a 4-wire resistive touch screen to J1 and J1A. On the DEM-ADS7843E/45E, J1B is labeled as inputs IN3 and IN4; for use with the ADS7846, IN3 corresponds to the battery input (VBAT) and IN4 corresponds to the auxiliary input, IN.

REFERENCE VOLTAGE

The ADS7843 does not have an internal reference, therefore, the DEM-ADS7843E/45E provides three possible reference voltages on the board, which are jumper-selectable at JP1. Since the ADS7846 has an internal reference, no external reference is required. Therefore, to evaluate an ADS7846 in the DEM-ADS7843E/45E fixture, all the jumper shunts for JP1 should be removed, and the ADS7846 operated in differential mode.

EVALUATING THE ADS7846

With the hardware of the DEM-ADS7843E/45E set up as described previously, evaluation of the ADS7846 can begin.

In stand-alone mode, the user must supply the signals to the ADS7846 to access all its features. See the ADS7846 data sheet for help in developing software to drive the part.

Using the on-board clocking circuitry of the DEM-ADS7843E/45E, the user can test all the same features as the ADS7843, and can also access the extended feature set of the ADS7846. Using the jumper set, JP3, which allows the user to set the address bits in the control byte, the settings are then processed by a parallel-to-serial converter and transmitted to the DUT at the appropriate time under control of the on-board clocking circuitry.

TEMPERATURE MEASUREMENT

To read temperature data from the ADS7846, JP3 should be configured so that shunts on JP3A and JP3B are not installed (PD0 = PD1 = 1), JP3C is not installed (SER/$\overline{\text{DIF}}$ = 1), JP3D is installed (MODE = 0), JP3E, JP3F, and JP3G are installed (A0 = A1 = A2 = 0) and JP3H is not installed (S = 1). This configures the ADS7846 to read the on-board temperature sensing diode bias voltage at a bias current TEMP0. This voltage is typically 600mV at +25C, and has a temperature coefficient of –2.1mV/C. Thus, the temperature is given by:

$$°C = \frac{V_{TEMP0} - 600mV}{-2.1mV/°C} + 25°C$$

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This measurement of course is only as accurate as the initial 600mV reading; in actual use, the forward voltage of the diode would need to be measured at a known room temperature, and used as the initial offset in this calculation.

A second mode of temperature measurement is possible, which does not require an initial calibration. This method uses two temperature measurements to eliminate the need for absolute temperature calibration. This mode requires a second conversion of the diode voltage now at a bias current TEMP1.

The first measurement is made as described above for the single-measurement mode. The second measurement is then made by removing JP3E, JP3F, and JP3G, so that A0=A1=A2=1. The resulting voltage reading, V_{TEMP1}, is then used with the initial reading V_{TEMP0}, to calculate the temperature by:

$$\Delta V(mV) = V_{TEMP1} - V_{TEMP0}$$

$$°C = 2.68 \bullet \Delta V(mV) - 273°C$$

It is important to note that the difference in the voltage readings, ΔV, is expressed in millivolts.

BATTERY MEASUREMENT

The ADS7846 has the additional feature of being able to directly monitor a battery voltage, which can vary from 0.5V to 6V, even when the ADS7846 is powered from 2.7V, 3.3V, etc. The battery voltage, V_{BAT}, is internally divided down by 4 so that a 6.0V battery is represented as 1.5V to the ADC.

To perform a battery voltage measurement, JP3 should be configured so that shunts on JP3A and JP3B are not installed (PD0 = PD1 = 1). In addition JP3C is not installed (SER/$\overline{DIF}$ = 1), JP3D is installed (MODE = 0), JP3E and JP3G are installed (A0 = A2 = 0), but JP3F is not installed (A1 = 1) and JP3H is not installed (S = 1).

The resulting measurement is the battery voltage measured at IN3 on the DEM-ADS7843E/45E board, divided by four.

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