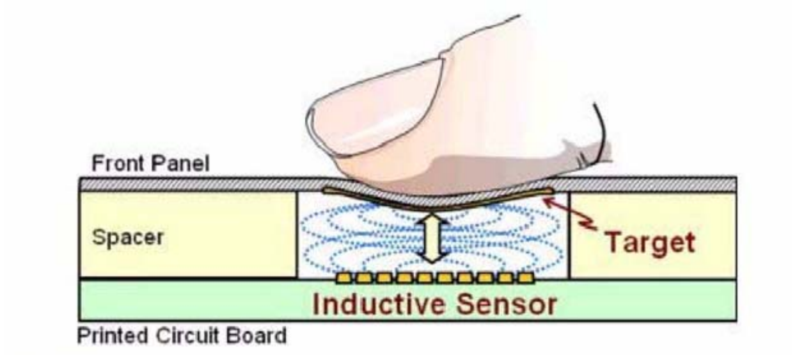
Chapter 3. Theory of Operation

An Inductive Touch system uses the magnetic coupling between a solid metal target and an inductive sensing coil. If a user presses on the front panel, then the coupling between the target and sense coil will increase due to the minute shift in the target's position toward the sensor coil, as shown in Figure 3-1. The result is a change in the impedance of the sensing coil.

FIGURE 3-1: CROSS SECTION OF AN INDUCTIVE TOUCH SENSOR

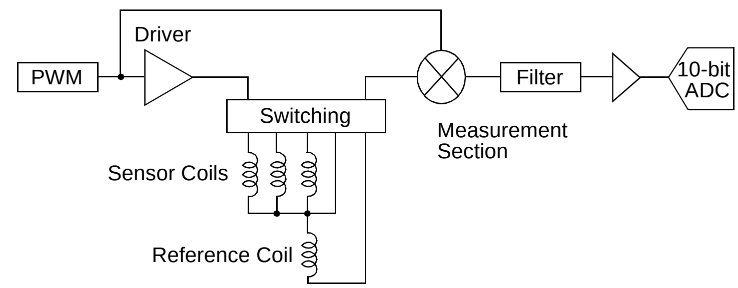


3.1 SENSOR COIL IMPEDANCE MEASUREMENT SYSTEM

To sense this change in the inductive sensing coil, an impedance measurement system and a microcontroller are required. The impedance measurement system operates by exciting the sensor coil with a pulsed current. This produces a pulsed voltage across the coil that is proportional to both the current and the impedance of the coil. The impedance measurement system then converts the pulsed voltage into a DC voltage proportional to the amplitude of the pulsed voltage using a frequency mixer, low pass filter, and amplifier. The resulting DC value is converted to a binary number using an ADC.

To assist in maintaining consistency in the readings, a reference coil has been added to remove variations in the readings due to long term variations in the current and due to temperature shifts. The reference coil is in series with the sensor coil, and is measured as part of the conversion process. The resulting value for the reference coil is divided into the sensor coil, resulting in a "normalized value" for the coil. By using the impedance ratio of the two coils, any variation in the impedances due to temperature or long term drive current variation fall out and we are left with a temperature and voltage compensated value. Figure 3-2 shows a block diagram of a typical impedance measurement system.

FIGURE 3-2: BLOCK DIAGRAM OF THE IMPEDANCE MEASUREMENT SYSTEM



3.2 POLLING SOFTWARE

The microcontroller periodically polls the various sensors by measuring impedance of the individual sensing coils. If the impedance of the sense coil has changed from the store average for each coil, then the microcontroller determines if the shift in impedance is sufficient to qualify as a user's press.

Figure 3-3 is a flowchart of the system software. The polling process includes the measurement of the voltage across both coils, just the reference coil, and the virtual ground of the system. Subtracting the various values from one another produces voltages for both coil. Dividing the sensor coil voltage by the reference coil voltage, then gives a normalized value in which temperature and drive variations have been removed. The software then compares the normalized value against a running average to determine if the shift is sufficient for a valid press by the user.

FIGURE 3-3: SYSTEM FLOWCHART