[0026] In this embodiment, a cover sheet, shown in **FIG. 3**, is attached to the touch sensor, such that it is electrically insulated from surface of the touch sensor, and is allowed to come into contact at points under gentle pressure from fingers or other objects. One method for obtaining the analog information would be to measure the amplitude of electrical signal on the cover sheet as a measure of the voltage drop along the conducting band **3**. A controller causes energizing circuits **5** and **6** apply potentials across the individual conducting bands **3** in a sequential manner. As each band is energized, the controller directs the analog-to-digital circuit (ADC) to measure the voltage on the cover sheet. The ADC comprises a voltage measuring circuit and a bias voltage that allows a determination to be made of 1) contact between the cover sheet and the energized band and 2) the potential of the point-of-contact with the band. If contact is ascertained by the voltage measurement being in the range of potential applied to the band, then the x-coordinate of the contact point is recorded as associated with the x-position of the band thus energized. Otherwise, the band is de-energized and another band is energized to test for contact. When contact is ascertained, the y-coordinate is recorded as associated with the magnitude of the voltage recorded. For example, if the conducting bands are uniform in width and resistivity, the contact position is linearly related to voltage measured. The process is continued until the entire touch screen or region-of-interest has been examined. In this way, multiple contacts between the cover sheet and the touch sensor can be ascertained and located.

[0027] Another analog method of this embodiment would be to measure the current delivered to each end of the conducting band **3**, which is biased at a potential different from the cover sheet. The proportional position of contact along the band is related to the current ratio in a straightforward manner; and from Ohm's law, the resistance between the two points of contact on a selected band could be reported as well.

[0028] In a manner of speaking, this produces a large number of one-dimensional vertical touch screens lined up above the x-axis, for example. Because of the electrical isolation, there is no current flow between the conducting bands **3** even when a continuous cover sheet is used to make multiple contacts. Also note that in the design shown in **FIG. 2**, if fingers are used normally, being distributed generally perpendicular to bands, it is unlikely that more than one touch will be seen on each small vertical touch screen at the same time. In the unlikely case that one finger touch region overlaps an adjacent finger touch region, the overlapping region will produce a signal that is the average of the two finger signals. However, the finger locations can be fully resolved by the non-overlapping regions. Additionally, the lateral width of the finger contact, which is a function of the finger size and pressure, is also available.

[0029] A number of scanning methods are available to determine the x (digital) coordinate quickly. If only a coarse resolution is needed, then lines can be grouped together and treated as one average value of x. Where the greater resolution is desired, all lines are scanned in smaller groups or individually. In this manner, the widths of the contacts can be determined. If a single touch is anticipated, the touch sensor can in a binomial search. For example, one half of the screen could be tested for touch contact as a group, followed by tests on smaller groups of conducting bands **3**. By systematically testing the appropriate half of the previous group of conducting bands, it can be seen that the number of tests required is just the logarithm to the base two of the digital resolution. For example, by using 1024 bands at their full resolution, ten tests are needed to determine the location of a single point. Likewise, for multiple contacts, the binomial search would be extended for each region where touch contact is indicated. Thus, the number of tests increases proportionately to the number of touches. This is illustrated in **FIG. 4** for one and two touches. With this design, it is also possible to truncate the scans to obtain limited resolution along the x coordinate and to decrease the energy consumption and overall time required to determine all touches.

[0030] The cycle time or time to record each touch is an important specification in any touch screen method and is especially significant in MultiTouch where a number of points must be sensed. The cycle times are examined in **FIG. 5**, assuming that the dominate delay is given by a single ADC conversion time, which is illustrated as 10 microseconds. For all practical circumstances, it may be assumed that the cycle time can be less than 1 millisecond, even for the case of as many as ten contacts made using both hands at the same time. This time is quite adequate for typing speeds and the recording of cursor-drag operations.

[0031] Another major concern in touch sensor technology is energy consumption, especially in portable applications. Using ordinary conductive, transparent material (doped tin oxide) with 200 ohms per square, the individual elements of a Digalog sensor have high resistance and low power consumption. **FIG. 5** also shows the energy consumed by the touch sensor in digitizing a single touch. The energy consumption during one measurement cycle can be used for a proper comparison between two sensors employing different technologies. As a simple example, let us assume that the complete measurement period for applying a voltage to a screen element and waiting for settling and analog-to-digital (ADC) conversion is 10 microseconds. With a conventional five-wire touchscreen, two conversions are required to complete a measurement cycle. With the conventional screen biased at 1 volt, the energy required would be 400 nanojoules, neglecting capacitive and resistive losses and internal power consumption by the control electronics. For a Digalog sensor with similar resistivity (200 ohms per square), whose size is 256 mm×192 mm and having 256 channels of lateral resolution (0.5-mm conducting bands), only 33 nanojoules would be consumed—a factor of twelve reduction. For 64 channels with the same strip widths, this drops to 8 nanojoules—about 50 times less than that of a conventional touchscreen.

[0032] A number of options are available for the controller electronics with the Digalog concept, depending on the packaging desired. For instance, the controller could be entirely external to the touch screen. This external controller would connect each end of the individual isolated strips to a voltage source in a timed sequence in which each analog measurement is made. An attractive alternative would be to incorporate transistor switches and control logic on both ends of the individual sensor strips, as a part of the sensor. This arrangement could allow fewer control lines to be attached to the sensor in which part of the controller activates individual and groups of strips to gain both digital and analog information. This information can give the location of all the points touched in a cluster (i.e., set of multiple