

## TOUCH SCREEN ASSEMBLY AND DISPLAY FOR AN ELECTRONIC DEVICE

### TECHNICAL FIELD

[0001] This invention relates in general to displays for electronic devices, and more particularly to touch screen displays for electronic devices, and further to touch screen displays for electronic devices operable in more than one configuration.

### BACKGROUND OF THE INVENTION

[0002] Portable electronic devices have been designed to perform a large variety of functions, including personal digital assistants (PDAs), pagers and two-way pagers, cellular and radiotelephones to name some of the most popular devices. All of these devices store information and perform tasks under direction of the user of the device, and therefore have a user interface. A typical user interface includes a means for displaying information, a means for inputting information and operation control, and often a means for playing sounds and audio signals.

[0003] One of the most common means for allowing a user to control the device or input, information is a keypad or buttons. A keypad is a collection of buttons that are typically arranged in a conventional format, depending on the type of device. For example, two-way pagers typically have a so called "QWERTY" keypad, similar to that of a keyboard for a computer. Cellular phones typically have a conventional pushbutton telephone keypad layout, with the addition of specialized keys for operating the cellular phone. In both of these devices, perhaps the most widely used button mechanism is a popple switch button. A small dome may be fabricated from various grades of sheet-metal, typically 0.005" stainless steel, rendering the entire popple as a conductive element for switching functionality; or in an alternative embodiment, a dome is formed from a non-conductive polymer sheet (such as Mylar™) but with the addition of a conductive element (such as Carbon based Ink). In either method of popple construction, (metal or polymer) the popple is adhered into place using a separate tape with adhesive, and positioned on a printed circuit board. When the popple is depressed, it creates a connection between the conductor layer disposed on the PCB and the conductor pad under the popple dome, completing an electrical circuit which is detected by a controller of the device. To press the popple, a mechanical actuator is disposed over the popple. Typically an image or character is printed on the actuator indicating when that particular button is pushed, that particular character will be entered, or an action associated with the image will be taken by the device. A very similar button mechanism is a membrane button. A membrane button may use a popple dome and have the character or image printed on the dome, or it may simply be two insulator layers separated by a spacer. Each of the insulator layers has a conductor disposed on them which make contact when pushed or pressed together. By printing images or characters on the button, however, limits the button to a fixed function or character or number. Sometimes one of several alternative characters may be selected by repeatedly pressing the button until the desired character appears on a display of the device, as is common on cellular phones.

[0004] The limitation of fixed buttons is somewhat alleviated by the use of so called "soft" keys. Soft keys are

buttons located near a display of the device, and in the course of operating the device, various characters, images, or words will be displayed on the display at a location corresponding to the button. Typically at least two soft keys are used so as to permit the user to select one of two alternative actions. In addition to popple and membrane buttons, numerous other button mechanisms are known. Other than soft keys or repeated pressing to select alternative characters, however, these buttons are essentially fixed in meaning.

[0005] An alternative to fixed buttons is the touch screen display. A touch screen display comprises a conventional display with a touch detection overlay. Information can be displayed on the display and the user touches the display at a desired location corresponding to the desired information, image, or icon. When the user touches the touch detection overlay, the electrical parameters are changed, and by sensing the change from various positions at the edge of the overlay the position where the user touched the overlay can be inferred. Although it allows a user to touch anywhere in the two dimensional plane of the display, the algorithm that performs this inference is fairly complicated. In fact, very few portable electronic devices use this type of input mechanism partly because of the complexity involved, and also because of the lack of applications that require being able to detect a touch anywhere on the screen.

### BRIEF DESCRIPTION OF THE DRAWINGS

[0006] FIG. 1 shows an exploded isometric view of a touch screen assembly, in accordance with the invention;

[0007] FIG. 2 shows an electrical schematic of a touch screen apparatus and detection circuitry, in accordance with the invention;

[0008] FIG. 3 shows a side view of a touch screen display, in accordance with the invention;

[0009] FIG. 4 shows a portion of a display using a touch screen for a portable electronic device operated in a first configuration;

[0010] FIG. 5 shows a portion of a display using a touch screen for a portable electronic device operated in a second configuration;

[0011] FIG. 6 shows a portable electronic device utilizing a touch screen and configured in a first configuration;

[0012] FIG. 7 shows a portable electronic device utilizing a touch screen and configured in a second configuration;

[0013] FIG. 8 shows a portable electronic device utilizing a touch screen and in a closed configuration; and

[0014] FIG. 9 shows a memory table for selecting characters to be displayed on a display of a portable multi-configuration electronic device, in accordance with the invention.

### DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

[0015] While the specification concludes with claims defining the features of the invention that are regarded as novel, it is believed that the invention will be better understood from a consideration of the following description in