

MULTI-LAYER SOLID STATE KEYBOARD

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority from U.S. Provisional Patent Application Ser. No. 60/464,483, filed on Apr. 22, 2003, the disclosure of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0002] 1. The Technical Field

[0003] The present invention is directed generally to a solid state keyboard. More particularly, the present invention is directed to a solid state keyboard integrating decorative and functional layers.

[0004] 2. The Related Art

[0005] Keypad input systems typically are assemblies of several components. For example, a typical keypad includes a glass, plastic, or flexible film face plate or front panel that acts as a user interface. This face plate might include graphics that describe the keypad's functionality and/or other indicia, such as a logo, for purely decorative purposes. Such a keypad further includes another panel that includes, for example, field effect sensor electrodes and control circuitry. These two panels typically are manufactured as separate subassemblies that are later joined to form a finished keypad.

[0006] Some keypads use reconfigurable keys in connection with a reconfigurable display. One example of such a system includes a dot matrix display that provides prompts to a user and solicits input from the user via one or more mechanical switches, for example, membrane switches, situated about the display and proximate the various prompts. Such a system may guide a user through various menu levels, wherein the displayed prompts corresponding to a particular switch vary from level to level and the function of the switch changes correspondingly. One drawback with such a system is that it is not always clear to the user which switch, if any, is associated with a particular display prompt. Another is that membrane switches, commonly used in such applications, are prone to premature failure when used in high traffic applications.

[0007] Computer touch screen technology, as sometimes used in connection with cash register input pads and consumer product information kiosks, offers a better solution, but involves greater cost and complexity. Indeed, such systems typically require PC-based or proprietary decoding hardware. Further, the hardware requirements for such systems prohibit their use in applications where little space is available.

SUMMARY OF THE INVENTION

[0008] The present invention is an integrated solid state keypad having multiple layers, including decorative layers and functional layers. The keypad includes one or more keys which preferably are embodied as field effect sensors. In certain embodiments, one or more of the keys are reconfigurable keys that can be used in connection with a reconfigurable display. Preferably, the reconfigurable keys are embodied as field effect sensors having transparent electrode structure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. 1 is a front elevation view of a keypad according to the present invention;

[0010] FIG. 2 is a side elevation view of a keypad according to the present invention;

[0011] FIG. 3 is a rear elevation view of a keypad according to the present invention, illustrating a transparent conductive layer on a substrate;

[0012] FIG. 4 is a rear elevation view of a keypad according to the present invention, illustrating a conventional conductive layer on a substrate;

[0013] FIG. 5 is a rear elevation view of a keypad according to the present invention, illustrating a solder mask or dielectric layer on a substrate;

[0014] FIG. 6 is a rear elevation view of a keypad according to the present invention, illustrating an additional dielectric layer on a substrate; and

[0015] FIG. 7 is a rear elevation view of a keypad according to the present invention, illustrating crossovers for connecting a first conductive layer to a second conductive layer.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENT

[0016] FIG. 1 illustrates the front, or user interface, side 12 of a keypad 10 according to a preferred embodiment of the present invention. Keypad 10 includes a viewing window 14, three reconfigurable keys 16, and twenty non-reconfigurable keys 18 disposed on a substrate 20. Keys 16, 18 correspond to field effect sensors, capacitive sensors, or other sensors disposed on the rear side of keypad 10, as will be discussed further below. The precise combination of features illustrated in FIG. 1 is not essential to the invention and is shown for illustration only. Indeed, other embodiments of the invention could have more or fewer viewing windows, reconfigurable keys, or non-reconfigurable keys. Further, some embodiments might lack one or more of these features entirely.

[0017] FIG. 2 is a side elevation view showing the various layers comprising keypad 10. FIG. 2 illustrates a preferred arrangement of the various layers. In other embodiments, the various layers can be arranged in other ways and/or sequences, as would be understood by one skilled in the art. Substrate 20, which forms the core of keypad 10, can be any rigid or flexible material suitable for receiving decorative materials and conductive thin films. For example, substrate 20 can be a piece of glass or plastic or a flexible carrier made of polyester.

[0018] Layers 22, 24, 26, 28 are layers of decorative material. These decorative material layers can provide functional information, such as graphics depicting the function of a particular key, or purely decorative graphics, for example, a decorative pattern or logo, are applied to one or both sides of substrate 20. FIG. 2 illustrates one decorative layer 22 on the user interface side of substrate 20 and three decorative layers 24, 26, 28 on the rear side of substrate 20. In other embodiments more or fewer decorative layers can be used on each side of substrate 20.