

INPUT DEVICE

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application is a continuation-in-part of U.S. application Ser. No. 11/734,465, filed Apr. 12, 2007, the entire disclosure of which is incorporated herein by reference.

TECHNICAL FIELD

[0002] The present invention relates in general to an input device for operating functions in an electronic device, wherein the input device comprises a switch device having a set of switches mounted on a support structure. Moreover, the input device according to the invention comprises a soft conductive actuator for actuating the switch device. Moreover, the present invention relates to an electronic device comprising the above input device for operating functions in the electronic device.

DESCRIPTION OF RELATED ART

[0003] In order to meet an increasing demand from e.g. mobile phone users and smart phone users for increasingly advanced functions, mobile phone manufacturers such as Sony Ericsson Mobile Communications®, provide mobile phones and smart phones with increasingly advanced input/output devices. Such input/output devices include, but is not limited to, e.g. larger touch-sensitive displays, joysticks, rocker keys, etc. to operate various functions of the mobile telephones or smart phones. These input devices may be used in lap top computers together with touch pads that may be stroked and tapped by fingers to give the function of a mouse.

[0004] The European patent application EP 1 492 137 A1, filed on 26 Jun. 2003, discloses various arrangements of previously known rocker key devices. FIGS. 1A, 1B, 2A, 2B, 3A, 3B illustrate some of the rocker key devices disclosed in the above-mentioned European patent application. The rocker key device 1 shown in FIG. 1A has a rocker key 2, a select button 3, switches 4 (normally a dome), all of which are mounted on a support structure or switch pad 5, such as a Printed Circuit Board (PCB), for arrangement in e.g. a mobile telephone. With reference to FIG. 1B, an exploded bottom view of the rocker key device 1 in FIG. 1A is shown. The rocker key 2 is provided with actuator bosses 6 integrated with the rocker key 2 or in a supporting rubber for actuating the switches 4, when the rocker key 2 is actuated or depressed by a user. FIG. 2A illustrates an arrangement of the switches 4 in a four directional arrangement forming a part of a rocker key device or a joystick switch. The actuating directions are illustrated by the arrows 7. However, the increasing need for new functions and applications in e.g. mobile phones may require more actuating directions to be operated properly. In FIG. 2B a prior art arrangement to provide eight selectable directions, which is extended from the four directional arrangement shown in FIG. 1A, is illustrated. In this arrangement, four switches 4 are utilized, wherein one single switch is actuated for each of the four directions, i.e. 0°/90°/180°/270° (as illustrated by the arrows in FIG. 2A), and four additional directions 45°/135°/225°/315° (as illustrated by the arrows in FIG. 2B). Still another prior art arrangement providing eight selectable directions is based on eight switch domes positioned on 0°/45°/90°/135°/180°/225°/270°/315°, as shown in FIG. 3A. In this arrangement, a single switch 4 with a metal dome is actuated, i.e. the dome collapses short-

circuiting a known switch device, shown in FIG. 4, comprising an outer metal ring 4a electrically connected to the metal dome, shown in FIGS. 1A-4, and an inner circle 4b, which the dome contacts when it collapses short-circuiting the outer ring 4a and the inner circle 4b, one switch at a time to select one of the eight directions, whereby only one signal is output for each direction, i.e. each short-circuiting, in a known way. An exemplary side view of a rocker key device 1 comprising eight switches 4, in accordance with the configuration of FIG. 3A, is shown in FIG. 3B.

[0005] A switch device of an input device such as those described hereinabove, e.g. as shown in FIG. 5, may suffer from relatively bad reliability over time. For example, since a single switch 4 is operable to output one associated signal only when actuating the single switch 4, if the single switch 4 for any reason gets damaged or stops to function properly during its lifetime, there is consequently a risk that this single switch 4 becomes malfunctioning or even inoperable. A rocker key device with an inoperable switch 4 may result in a malfunctioning rocker key device, since the inoperable switch 4 will no longer be available to output its associated signal properly. As a consequence, it will possibly no longer be possible to actuate directions associated with the unusable or damaged switch 4. This may be annoying for the user operating such malfunctioning rocker key device. This also gives a low redundancy and an insufficient reliability for such prior art input devices. Accordingly, there is a need for providing an improved input device using a switch device and/or a soft conductive actuator operatively connected therewith. In particular, there is a need for providing an input device that mitigate, alleviate or eliminate one or more of the above-mentioned deficiencies or disadvantages in the known prior art. More specifically, there is a need for providing a solution that makes a single input device more reliable over time, as compared to the known prior art.

SUMMARY OF THE INVENTION

[0006] Accordingly, some embodiments of the present invention preferably seek to mitigate, alleviate or eliminate one or more of the above-identified deficiencies in the art and disadvantages singly or in any combination.

[0007] An aspect of the present invention relates to an input device comprising a switch device for mounting on a support structure of the input device and a soft conductive input actuator operatively connected to the switch device and adapted for mounting over the switch device, the switch device comprising at least one switch pad with a plurality of press detection switches, wherein the soft conductive input actuator is configured to make contact with at least one press detection switch of the plurality of press detection switches upon depression of the soft conductive input actuator against the switch pad such that a signal is output from the press detection switch.

[0008] In one embodiment, the switch pad comprises: a lower surface which is adapted to be attached to the support structure; and an upper surface; wherein the upper surface forms an actuator contacting surface for the plurality of press detection switches.

[0009] In one embodiment, at least one detection switch of the plurality of press detection switches is contacted simultaneously upon depression of the soft conductive input actuator.