BRIEF DESCRIPTION OF THE DRAWINGS

[0014] Other objects, features and advantages of the present invention will become more apparent from the following detailed description when read in conjunction with the accompanying drawings, in which:

[0015] **FIG. 1** illustrates a SAW touch panel in accordance with a first embodiment of the present invention;

[0016] **FIG. 2** shows examples of waveforms of an exciting signal and a reception signal in a location detecting operation performed by the touch panel in accordance with the first embodiment;

[0017] **FIG. 3** is a section view of the touch panel in accordance with the first embodiment;

[0018] **FIG. 4** is a section view of a touch panel in accordance with a second embodiment of the present invention;

[0019] **FIG. 5** is a plan view of the touch panel with second protrusions in accordance with the second embodiment;

[0020] **FIG. 6** is a section view of a touch panel in accordance with a third embodiment of the present invention;

[0021] **FIG. 7** is a section view of a touch panel in accordance with a fourth embodiment of the present invention;

[0022] **FIG. 8** is a section view of a touch panel in accordance with a fifth embodiment of the present invention;

[0023] **FIG. 9** is a section view of a touch panel in accordance with a sixth embodiment of the present invention;

[0024] **FIG. 10** is a section view of a touch panel in accordance with a seventh embodiment of the present invention;

[0025] **FIG. 11** is a section view of a display device in accordance with an eighth embodiment of the present invention; and

[0026] **FIG. 12** is a section view of a display device in accordance with a ninth embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

First Embodiment

[0027] The following is a description of a first embodiment of the present invention, with reference to the accompanying drawings. **FIG. 1** illustrates a SAW touch panel that is employed in the first embodiment of the present invention. **FIG. 2** illustrates an example of waveforms of an exciting signal and a reception signal in a location detecting operation performed by the touch panel in accordance with the first embodiment. A transparent resin film **4** that will be described later is not shown in **FIG. 1**, but is shown in **FIG. 3**.

[0028] As shown in **FIG. 1**, transducers **3** that generate SAWs are formed in the peripheral regions of a glass substrate **2** of a touch panel **100**. Among the four transducers **3**, two transducers **3***a* and **3***b* convert electric signals into SAWs, and transmit the SAWs along the surface of the glass substrate **2**. The other two transducers **3***c* and **3***d* receive the transmitted SAWs, and convert the SAWs into electric signals. If a user touches the surface of the glass substrate **2**, the propagations of SAWs are interrupted on the touched spot.

[0029] The transducers **3** transmit SAWs in parallel with the diagonal lines of the touch panel **100**, so that the touch panel **100** can be made compact. As shown in **FIG. 2**, a SAW burst wave generated from the drive end is turned into an output signal having a waveform that is elongated in the time axis direction on the reception end. If the SAW is interrupted by a touch with a finger or the like, the reception signal attenuates in the time corresponding to the interrupted spot. Accordingly, the touched location can be detected from the timing information of the attenuating portion.

[0030] The touch panel **100** of this embodiment is a small-sized type of approximately 2 to 8 inches, which are suitable for mobile devices such as PDAs (Personal Digital Assistants), portable telephones, and camcorders, and systems for automobiles such as car navigation systems. The glass substrate **2** is relatively thin, having a thickness of 0.5 to 1.5 mm.

[0031] **FIG. 3** is a section view of the touch panel **100** in accordance with the first embodiment. As shown in **FIG. 3**, the touch panel **100** in accordance with the first embodiment includes: the glass substrate **2** on which the surface acoustic waves are propagated; the transducers **3** that are provided at the four peripheral sides of the glass substrate **2**, and transmit and receive the surface acoustic waves; a detecting unit (not shown) that detects the location of an object touching a predetermined operation area, based on the surface acoustic waves received by the transducers **3**; and the transparent resin film **4** that has dot spacers **6** formed on the surface facing the glass substrate **2**.

[0032] When an object does not touch the operation area, the substrate-facing surface of the transparent resin film **4** is not brought into contact with the glass substrate **2**. When an object touches the operation area, the substrate-facing surface of the transparent resin film **4** is brought into contact with the glass substrate **2**.

[0033] In this embodiment, the glass substrate **2** represents a transparent substrate, the transducers **3** represent a transmission/reception unit, the transparent resin film **4** represents a sheet member, and the dot spacers **6** represent first protrusions.

[0034] The sheet member is not limited to the transparent resin film **4**, but may be any other type of sheet. However, there should be a space layer formed between the sheet member and the glass substrate **2**, and the dot spacers **6** should be formed on the substrate-facing surface of the sheet member facing the glass substrate **2**. When an object does not touch the operation area, the substrate-facing surface should not be brought into contact with the glass substrate **2**. When an object touches the operation area, the substrate-facing surface should be brought into contact with the glass substrate **2**. A polarizing plate **701** that is employed in a seventh embodiment of the present invention is also a sheet member of this type.

[0035] In the touch panel **100**, the transparent resin film **4** bonded to the glass substrate **2** faces the SAW touch panel