TOUCH SCREEN WITH POLARIZER AND METHOD OF MAKING SAME

RELATED APPLICATIONS

[0001] This application claims benefit of U.S. Provisional application Ser. No. 60/179,873 filed Feb. 2, 2000 entitled "POLARIZER TOUCH SCREEN FOR A LIQUID CRYSTAL DISPLAY DEVICE."

FIELD OF INVENTION

[0002] This invention relates to a touch screen with a polarizer in the top sheet and to such a touch screen integrated with an LCD, with one polarizer of the LCD in the topsheet of the touch screen.

BACKGROUND OF INVENTION

[0003] Touch screens are widely used in many applications, including computer interfaces, LCDs, and many of today's small portable devices such as personal data assistants and cellular telephones. Touch screen/LCD combinations are especially useful in such portable devices. Touch screens include, but are not limited to, resistive film type and capacitive touch screens.

[0004] The optical efficiency of typical resistive film type touch screens is 75 to 85%. LCDs are even less efficient, due to the polarizer layers which are inherent to polarizers, with typical optical efficiencies of only 50% being common.

[0005] Polarizer layers have been added to touch screens to improve the optical efficiency of touch screen/LCD combinations, however, the polarizer layer was placed above the polycarbonate support layer, i.e., closer to the touch surface of the touch screen. This implementation exposes the polarizer layer to substantial physical contact. Because the polarizer layer is less durable than the polyethylene terephthalate (PET) layer which is near the touch surface of typical touch screens, such a placement of the polarizer layer results in a less durable touch screen.

[0006] Additionally, the placement of the polarizer above the support layer requires that the support layer be optically isotropic for the touch screen/LCD combination to function properly. This results in a thicker and more costly touch screen because the polycarbonate support layer cannot be made from a drawn polycarbonate material, which is cheaper and may be drawn to much smaller thicknesses than polycarbonate materials which are cast or formed by other methods. Also, drawn polycarbonate material is not sufficiently optically isotropic for such applications.

[0007] One such structure is disclosed in the article "Vanguard of Liquid Crystal and PDP Development" by Y. Mitani, et al. (Japan, 1997) and is shown in **FIG. 1**. This structure includes a polarizer **56**, comprising polyvinylalcohol (PVA) polarizing layer **50** sandwiched between two cellulose triacetate (CTA) layers **52**, **54**. This is coated on the top surface with a hardcoat **58**, which reduces scratches on the top surface. The polarizer is bonded to polycarbonate support layer **60** coated with indium tin oxide (ITO) layer **62**. The polycarbonate provides physical support required of a topsheet, and is optically isotropic.

SUMMARY OF THE INVENTION

[0008] It is therefore an object of this invention to provide an improved touch screen with a polarizer which is more durable.

[0009] It is a further object of this invention to provide such an improved touch screen which is lower in cost.

[0010] It is a further object of this invention to provide such an improved touch screen which is lighter in weight.

[0011] It is a further object of this invention to provide such an improved touch screen which is thinner.

[0012] It is a further object of this invention to provide a method of manufacturing such a polarizing topsheet for a touch screen.

[0013] This invention follows from the realization that touch screens can benefit greatly from having a polarizer layer below the support layer of the topsheet to provide the optical benefits of a polarizer layer while being more durable, less costly, thinner and lighter than polarizer layers above the support layer.

[0014] The present invention features a topsheet for a touch screen including a support layer having a touch surface and a second surface opposite the touch surface, a polarizer layer having a first surface and a second surface with the first surface of the polarizer in contact with the second surface of the support layer, and a first conductive layer in contact with the second surface of the polarizer.

[0015] In a preferred embodiment, the support layer may be a polyester sheet or it may be a polycarbonate sheet. The polarizer layer may include a K type polarizer. A first hardcoat layer may be in contact with the second surface of the polarizer layer and the first conductive layer may be in contact with the first hardcoat layer. The first hardcoat layer may have a roughened finish.

[0016] An adhesion promoting agent may be in contact with the second surface of the polarizer layer. A second hardcoat layer may be in contact with the touch surface of the support layer. The first conductive layer may include a plurality of discrete sections of conductive material.

[0017] The touch screen may be a resistive film type touch screen, and the first conductive layer may engage a second conductive layer of the touch screen.

[0018] This invention also features a method for manufacturing a topsheet including providing a support layer having a touch surface and a second surface opposite the touch surface, laminating a polarizer layer to the second surface of the support layer, the polarizer layer having first and second surfaces, and coating the second surface of the polarizer layer with at least a conductive coating.

[0019] In a preferred embodiment, the method may also include applying a first hardcoat layer to the second surface of the polarizer layer prior to the coating step. An adhesion promoting agent may be applied to the second surface of the polarizer layer before applying the first hardcoat layer. The hardcoat layer may include a rough surface. A second hardcoat layer may be applied to the touch surface of the support layer.

[0020] The coating step may be a vacuum sputtering process. The polarizer layer may be vacuum etched prior to the coating step. The first hardcoat layer may be plasma etched before the vacuum sputtering process. A thin film metal oxide layer may be applied to the second surface of the