cover electrodes **130**. In some applications, electrodes **130**, or more generally, electrical circuitry **165** may be partially covered or not covered by the glass layer **160** and/or bonding layer **150**. Touch sensor **100** may further include additional electrically conductive segments (not shown in **FIG. 1**) to further electrically connect linearization pattern **140** to electrodes **130**.

[**0047**] In the exemplary embodiment shown in **FIG. 1**, conductive film **120** is disposed onto substrate **110**. According to one aspect of the invention, conductive film **120** can be disposed on the bottom surface of glass layer **160**. Electrodes **130** and linearization pattern **140** can also be disposed on the bottom surface of the glass layer. Furthermore, electrodes **130** and linearization pattern **140** can be disposed between conductive film **120** and substrate **110**. In general, taking conductive film **120**, electrodes **130**, and linearization pattern **140** as a group, a portion of the group can be disposed on substrate **110** and the remaining portion of the group can be disposed on the bottom surface of glass layer **160**. For example, in the exemplary embodiment shown in **FIG. 1**, the entire group is disposed on substrate **120**. As another example, the entire group can be disposed on the bottom side of glass layer **160**.

[**0048**] **FIG. 5** illustrates a schematic three dimensional view of a touch sensor according to another aspect of the present invention. For ease of illustration and without loss of generality, some of the layers and components shown in **FIG. 1** are not reproduced in **FIG. 5**. In **FIG. 5**, conductive film **120** and linearization pattern **140** are disposed on substrate **110**. Furthermore, electrodes **130** are disposed on the bottom surface of glass layer **160**. **FIG. 5** further shows an optional electrical tail **139** disposed, for example, onto the bottom surface of glass layer **160**. Tail **139** can, as another example, be disposed onto substrate **110**. Conductive leads **131** (not shown in **FIG. 5**) can, for example, be electrically connected to electrodes **130** via tail **139**.

[**0049**] Referring back to **FIG. 1**, touch sensor **100** can further include an optional conductive shield **180** and a ground electrode **190** to isolate the sensing surface from noise and stray capacitance associated with, for example, the display and/or the display bezel.

[**0050**] The top and/or bottom surface of glass layer **160** can be smooth or structured. The structure can, for example, be random or include a regular pattern. For example, a surface can have a random matte finish. The surface can have one or two-dimensional microstructures. A structured surface can reduce glare. A structured top surface can also reduce the possibility of slippage when, for example, a touch implement is applied to the glass layer. A structured surface may also reduce the visibility of fingerprints on the touch surface.

[**0051**] Touch sensor **100** can further include other optional layers. For example, touch sensor **100** can include an anti-reflection (AR) coating **170** disposed onto glass layer **160** to reduce specular reflection. The top surface of AR coating **170** may be matte to further reduce specular reflection and slippage. Layer **170** can include a multilayer film. The multilayer film can, for example, include alternate layers having high and low indices of refraction. Other optional layers that can be incorporated in touch sensor **100** include polarizers, neutral density filters, color filters, compensation films, retarders, optical diffusers and privacy films.

[**0052**] Touch sensor **100** can further include optional layers to protect the conductive film **120** from other layers in the sensor. For example, an optional hard coat or barrier layer can be disposed between the conductive film **120** and the optional bonding layer **150** to protect the conductive film against potential damage from the bonding layer. One such potential damage may, for example, be from the acidic nature of an adhesive-type bonding layer that could potentially attack and degrade the performance of the conductive film **120**.

[**0053**] According to one aspect of the present invention, controller **155** is configured to detect a signal induced by capacitive coupling between conductive film **120** and a conductive touch input applied to glass layer **160**. The signal detected by the controller can be used to determine the touch location. For example, the characteristics of the detected signal, such as magnitude and phase, can be such that the controller can distinguish the detected signal from any background noise or undesired signal, thereby resulting in a sufficiently large signal to noise ratio to determine the touch location.

[**0054**] In general, as the thickness of glass layer **160** increases, the signal to noise ratio can decrease. In one aspect of the invention, an improved controller may be employed to increase the signal to noise ratio in some applications. For example, the controller available from 3M Touch Systems, Inc. under the trade designation EX II may be used to increase the signal to noise ratio. Advantages of the EX II controller include higher speed and resolution. The controller can have a 16 bit resolution compared to 10-12 bit conventional controllers. A higher bit resolution can typically improve the accuracy of determining a touch location. Furthermore, the EX II controller can be capable of a sampling rate of 1.3 ms compared to a sampling rate of about 2 ms for conventional controllers. Another advantage of the EX II controller is the capability to drive the conductive shield **180** at voltages other than the conventional ground potential. For example, the EX II controller can drive the conductive shield at a voltage level used to drive the touch sensitive area, typically 3.3, 5 or 12 volts. As a result, stray capacitance can be reduced or eliminated leading to an increase in signal to noise ratio. Another advantage of the EX II controller is the capability to filter a detected signal through a narrower band pass filter than typically used in conventional controllers. A narrower band pass filter can filter out more of the noise resulting in a higher signal to noise ratio.

[**0055**] In general, any controller that is capable of generating a sufficiently large signal to noise ratio may be used with the present invention.

[**0056**] Referring back to **FIG. 1**, at least a portion of conductive leads **131** may be disposed onto a layer or a film in the touch sensor. For example, at least a portion of conductive leads **131** may be disposed onto substrate **110**, conductive film **120**, or glass layer **160**. As another example, portions of conductive leads **130** may be disposed on various layers or films in the touch sensor. For example, a portion of the conductive leads may be disposed on conductive film **120** while a different portion may be disposed on glass layer **160**. As yet another example, conductive leads **131** may be disposed onto an auxiliary layer, not shown in **FIG. 1**, that is disposed, for example, between the glass layer **160** and