plasma generator in accordance with one embodiment of the present invention. Diagram **300** includes a hand **306** and a top view of haptic device **304**, wherein an index finger of hand **306** is in contact with device **304**. In one embodiment, device **304** is a plasma actuator. It should be noted that the underlying concept of the exemplary embodiment of the present invention would not change if additional layer were added to or removed from diagram **300**.

[0061] In one aspect, haptic device **304** is a plasma generator capable of generating haptic feedback. Plasma generator, in one embodiment, is a haptic element capable of providing haptic feedback using plasmatic particles. For example, when the index finger of hand **306** drags across touch surface of device **304**, device **304** generates a haptic trace **302**. Haptic trace **302**, in one aspect, is a series of snaps or vibro-tactile responses generated by energy transfers through plasma generator(s). It should be noted that device **304** can also be other types of haptic generator instead of plasma generator. It should be further noted that depending on the applications, the index finger of hand **306** can be replaced with any applicable objects, such as a stylus, a pen, a pointed instrument, and the like.

[0062] Device **304** includes a capacitive pressure-sensing surface and is capable of sending input energy to exact touch location(s) of a users' interaction(s). It should be noted that a haptic feedback generator can trigger one or more vibrotactile or kinetic response(s). Alternatively, device **304** includes a resistive touch-surface surface configured to detect a contact and respond a haptic feedback to the contact or interaction location(s) acknowledging the contact. Noted that the contact surface can be either solid or deformable surface.

[0063] FIG. **3**(*b*) is a diagram **350** illustrating a top view of haptic device capable of generating haptic feedback using plasma actuation in accordance with one embodiment of the present invention. Diagram **350** includes a first hand **356**, a second hand **360**, and a top view of haptic device **354**, wherein index fingers of first and second hands are in contact with the surface of device **354**. In one aspect, haptic device **354** is a plasma generator capable of generating haptic feedback.

[0064] Plasma generator, in one embodiment, is a haptic element capable of providing multiple haptic feedbacks using plasmatic particles. For example, when the index finger of hand **356** drags across touch surface of device **354**, device **354** generates a haptic trace **352**. Haptic trace **302**, in one aspect, is a series of snaps or vibrotactile responses. Alternatively, when the index finger of first hands **356** and the index finger of second hand **360** drag across the touch surface of device **354** at the same or substantially the same time, two haptic traces **352** and **358** are generated in response to the drags. It should be noted that haptic response in a feedback of haptic trace is merely one type of feedback. Instead of generating haptic trace, device **354** can also generate tactile vibration, texture, sound, visual light, and so forth.

[0065] Device **354** can also use other types of haptic generator instead of plasma generator or a combination of plasma actuator and other haptic actuators, which will be described below, to emulate texture sensations, haptic fabric, haptic feedback acknowledgements, haptic objects, or the like. It should be noted that haptic substrates, haptic actuators, and/or haptic mechanisms as described above are used to control haptic feedback for haptic device. A combination of different haptic substrates, plasma cloud, and/or haptic mechanisms can be used in a haptic device to achieve the best haptic results. The following embodiments illustrated by FIG. **4** through FIG. **8** are additional examples of haptic devices or haptic actuators that can be used to generate haptic feedback for controlling surface texture as well as input confirmation of haptic device.

[0066] FIG. **4**(*a*) illustrates a tactile or haptic region **410** using piezoelectric materials to generate haptic effects in accordance with one embodiment of the present invention. Region **410** includes an electrical insulated layer **402**, a piezoelectric material **404**, and wires **406**. Electrical insulated layer **402** has a top surface and a bottom surface, wherein the top surface is configured to receive inputs. A grid or an array of piezoelectric materials **404** in one embodiment is constructed to form a piezoelectric or haptic layer, which also has a top and a bottom surface. The top surface of the piezoelectric layer is situated adjacent to the bottom surface of electrical insulated layer **402**. Each region **410** includes at least one piezoelectric material **404** wherein piezoelectric material **404** is used to generate haptic effects independent of other piezoelectric region **410** in piezoelectric layer. In one embodiment, multiple adjacent or neighboring regions **410** are capable of generating multiple haptic effects in response to multiple substantially simultaneous touches. In another embodiment, each of regions **410** has a unique piezoelectric material thereby it is capable of initiating a unique haptic sensation.

[0067] It should be noted that a tactile touch panel, which includes an electrical insulated layer **402** and a piezoelectric layer, in some embodiments further includes a display, not shown in the figure. This display may be coupled to the bottom surface of the piezoelectric layer and is capable of projecting images that are viewable from the top surface of electrical insulated layer **402**. It should be noted that the display can be a flat panel display or a flexible display. Piezoelectric materials **404**, in one embodiment, are substantially transparent and small. The shape of piezoelectric material **404**, for example, deforms in response to electrical potentials applied via electrical wires **406**.

[0068] During a manufacturing process, a piezoelectric film is printed to include an array or a grid of piezoelectric regions **410**. In one embodiment, a film of regions **410** containing piezoelectric materials is printed on a sheet in a cell grid arrangement. The film further includes wirings for directly addressing every region **410** in the device using electrical control signals. Region **410**, for example, can be stimulated using edge or back mounted electronics. Piezoelectric materials may include crystals and/or ceramics such as quartz (SiO_2).

[0069] FIG. **4**(*b*) illustrates a tactile or haptic region **410** generating haptic effects in accordance with an embodiment of the present invention. During operation, when a voltage potential applies to piezoelectric material **405** via wires **406**, piezoelectric material **405** deforms from its original shape of piezoelectric material **404**, as shown in FIG. **4**(*a*), to an expanded shape of piezoelectric material **405**. Deformation of piezoelectric material **405** causes electrical insulated layer **403** to deform or strain from its original state of layer **402**, as shown in FIG. **4**(*a*). In an alternative embodiment, piezoelectric materials **405** return to its original state as soon as the voltage potential is removed. It should be noted that the underlying concept of the present invention does not change if additional blocks (circuits or mechanical devices) are added to the device illustrated in FIG. **4**(*a-b*). If the piezoelectric material is replaced with other materials such as SMAs, such material may be capable of maintaining its deformed shape