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ELAN MICROELECTRONICS
CORPORATION

UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF CALIFORNIA

SAN JOSE DIVISION

ELAN MICROELECTRONICS CORPORATION,

Plaintiff,

v.

APPLE, INC.,

Defendant.

AND RELATED COUNTERCLAIMS

Case No. 09-cv-01531 RS (PSG)

DECLARATION OF ROBERT DEZMELYK IN SUPPORT OF ELAN'S MOTION OF PARTIAL SUMMARY JUDGMENT OF INFRINGEMENT

[Public Version]

I, Robert Dezmelyk, declare and state as follows:

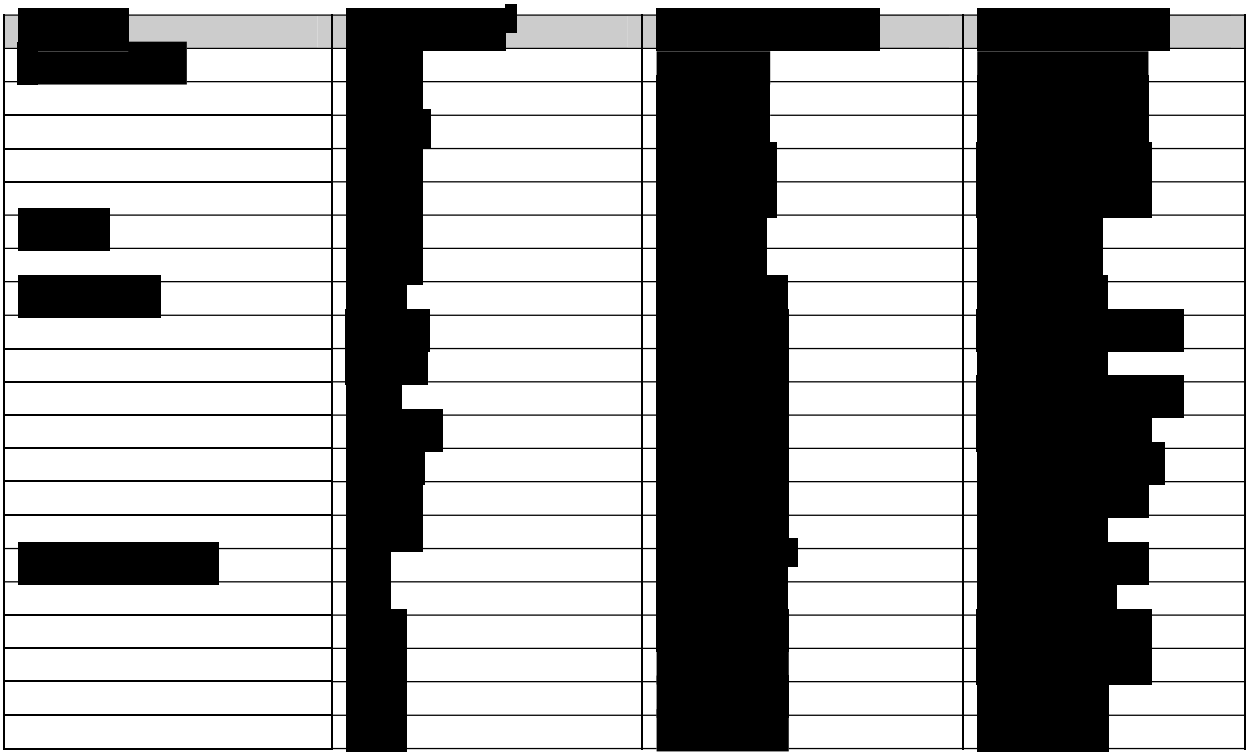
1. I have been retained by Elan Microelectronics Corp. ("Elan") as an expert witness in this lawsuit. I am providing this declaration to set forth my analysis of certain of the accused Apple products and state the bases of my opinions, set forth in detail below, that those products infringe at least claims 1, 7, 16, 18, 21, and 30 of Elan's U.S. Patent No. 5,825,352 ("the '352 patent").

I. BACKGROUND AND QUALIFICATIONS

2. I received my bachelor's degree from the Massachusetts Institute of Technology (MIT) in 1979 in a special program that spanned the mechanical and electrical engineering departments for the study of computer-based control systems. I am founder and CEO of LCS/Telegraphics ("LCS"), a leading supplier of input device software and consulting services for the last thirty years. Prior customers or licensees of LCS include Logitech, Synaptics, Cirque, Microsoft, Alps, Mitsumi, IBM, Sony, Sharp, and many others. I have been founder, chairman, and participant of multiple groups involved with setting industry standards and have also contributed to and had final editorial authority over the publication of various specifications. I am also a member of the Institute of Electrical and Electronics Engineers (IEEE). A listing of my involvement with industry standards groups, publication of specifications, as well as the cases for which I have provided opinions and testimony are provided in my current CV, attached hereto as **Exhibit A**.

II. THE RELEVANT APPLE PRODUCTS

3. I understand that Elan's Motion for Partial Summary Judgment of Infringement relates to versions of Apple's iBook, MacBook, MacBook Pro, and PowerBook laptop computers introduced between 2004 and 2007. Those products incorporated touchpads developed by Apple and referred to as the [redacted] or [redacted] touchpads. I have reviewed Apple's responses to Elan's Second Set of Interrogatories, which describe the Touchpad model included with each Apple laptop computer relevant to this motion. The products I have reviewed for purposes of this declaration, the internal Apple code name for those products and the touchpads incorporated into those computers are summarized in the following table taken from Apple's interrogatory responses:



[redacted]

III. INFORMATION RELIED UPON

[redacted]

7. In forming my opinions set out below, I reviewed the '352 patent, its file history, and cited references. I have reviewed and applied the Court's November 1, 2010 Claim Construction Order. [Dkt. No. 183]. I have also reviewed Apple's discovery responses including its answers to interrogatories identifying its products by code name and the source code associated with those products. I have also reviewed documents produced by Apple comprising specifications and datasheets for the controller ICs used in the relevant products, and Engineering Requirement Specifications (ERS) and circuit schematics for the relevant trackpads. A complete list of the Apple documents I have reviewed is set forth in **Exhibit B** hereto. I have also reviewed the transcripts of depositions of Apple employees Wayne Westerman and Steven Hotelling.

IV. TECHNOLOGY BACKGROUND

8. The '352 patent relates generally to touch sensitive input devices. Touch-sensitive input devices, implemented with a variety of sensing technologies, have long been used as input

devices for computers and other electronic devices. In general, a touch sensitive input device comprises a flat panel, which may be a translucent pad or may be transparent and mounted over a computer display, that can detect the presence of a user's finger or other object like a stylus. These devices can also determine the location of the contact on the surface. That information, along with information regarding the previous position of the object, is used to provide input to a computer to control, for example, the cursor location or the engagement of virtual buttons. Touchpads have become a standard input device on portable "laptop" computers, and touchscreens are becoming a standard feature of many devices such as smart phones, GPS devices and the like. Many different methods of determining the presence of a finger and its location have been developed. In my declaration regarding claim construction I described resistive and capacitive touch sensing technologies, and a variety of different approaches to using each technology. [*See* Dkt. No. 89 at 3-13]. Because the preferred embodiment of the '352 patent and the relevant Apple products are capacitive touch sensors, I will limit my discussion here to such devices.

9. A projected capacitance sensor uses electrodes formed in a pattern underneath the touch surface. The touch sensor measures either the change in capacitance between electrodes, or the extent to which the signals in one or more electrodes are coupled to other electrodes as a result of the presence of the user's finger. The diagrams below show how the presence of the user's finger increases the capacitance between an electrode and its neighbor (shown as a ground plane in the simplified example in Figs. 1 and 2).

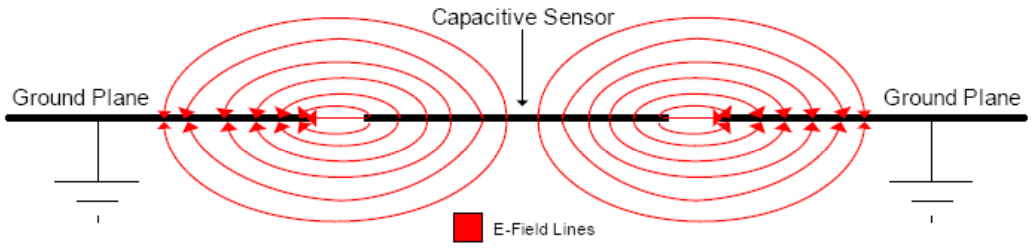


Figure 1 - Electric field lines between electrodes before the user touches the sensor

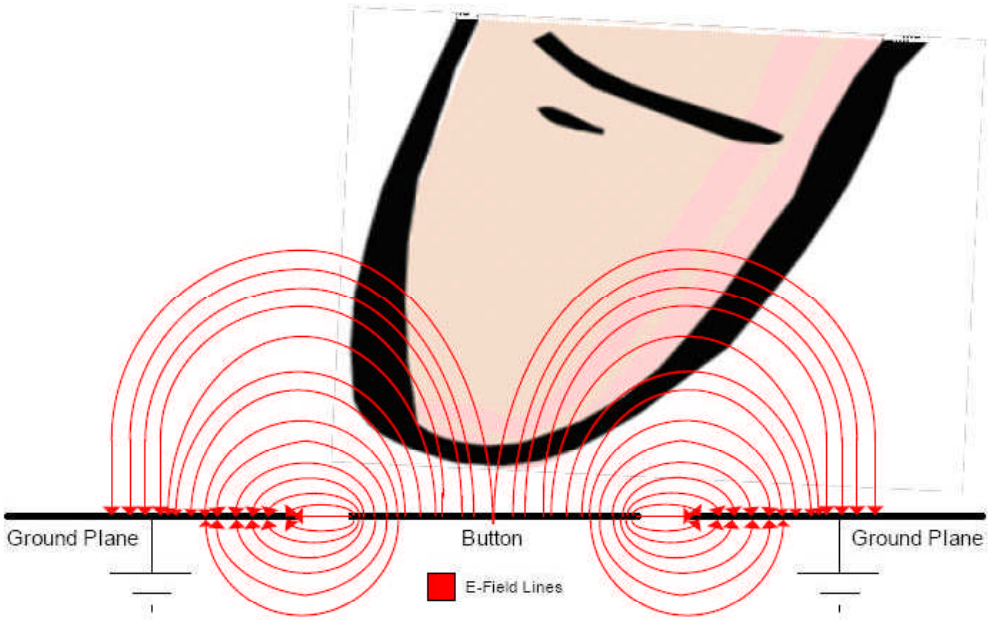


Figure 2 - The increased density of electric field lines increases the capacitance between the electrodes

10. A variety of different electrode patterns may be used. The shape of the electrodes is an important aspect of the overall design of the sensor. Conceptually, however, for purposes of a basic understanding of the technology, the electrodes can be considered as a grid of lines running perpendicular to each other. The most common sensors are actually arrays of diamond-shaped conducting elements connected together in a line. In this following diagram, diamond shaped electrodes are connected together along lines in the X direction and in the Y direction. Thus, they are analogous to a grid of horizontal lines and vertical lines, and those in the field often discuss them in this way.

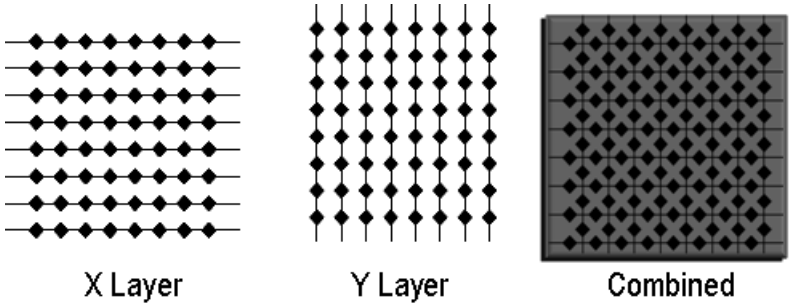


Figure 3 - A typical electrode pattern for a projected capacitance touch sensor, and cross section views of the sensor

11. A typical touchpad is made up of layers consisting of the X and Y trace lines, a ground layer and a "parts" layer. The parts layer is typically a printed circuit board that holds the IC or ICs used to measure the capacitance and control the operation of the touchpad.

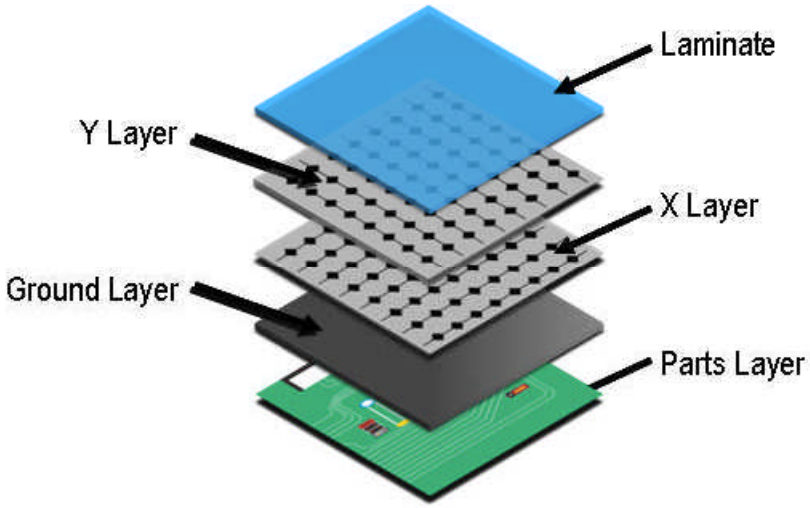


Figure 4 - A typical touchpad for a projected capacitance touch sensor

12. The effect of placing a finger on or near the sensor electrodes is to create a varying amount of capacitance or capacitive coupling that is related to the distance from the electrode to the finger. In order to determine the location where the user is touching, the capacitive coupling (or the change in capacitance) is measured by scanning the sensor elements. The capacitance measured at each sensor trace is converted from an analog signal into a digital value. Once all of the sensor traces have been scanned and converted, the result is a number of capacitance values in each of the x and y directions. The controller then analyzes this data to determine the finger location and other operative data, such as the amount of pressure applied to the surface.

V. DESCRIPTION OF THE '352 PATENT

13. The '352 patent, entitled "Multiple Fingers Contact Sensing Method For Emulating Mouse Buttons and Mouse Operations on a Touch Sensor Pad," was issued to Stephen J. Bisset and Bernard Kasser on October 20, 1998. The patent discloses analyzing touch pad data to detect the presence of multiple fingers to emulate the operation of a mouse. Liu Decl., Ex. 1 ('352 Patent) at Abstract.

14. Touchpads and touch screens were developed mainly as a substitute for a computer mouse in situations where space was limited such as in a laptop or portable device. However, touch sensor technology was mainly limited to the detection of a single finger. Thus, mouse button functions, such as a click or a drag, were accomplished by analyzing the data of a single finger on the touch screen. Liu Decl., Ex. 1 ('352 Patent) at 1:40-42. For example, U.S. Patent No. 5,543,591, (Liu Decl., Ex. 7), to Gillespie *et al.* of Synaptics Inc. taught that a "tap" could be detected if a user removed and replaced a single finger within a specified amount of time, referred to as "TapTime." *Id*. at Fig. 15A & 32:30-60. Such a "tap" could be interpreted as a virtual button click, so that the user would not need to press a separate mechanical button. Likewise, a "drag" could occur if a user removed and replaced the finger within a specified amount of time and "then moves the finger in a desired direction." *Id*. at Fig. 15B & 32:65-67. Again, this can be done without pressing and holding a separate mechanical button. However, these methods failed as a suitable replacement to the computer mouse because the methods required more time and more finger motion than a traditional computer mouse and were limited by the number of gestures that could be accomplished by a single finger. Liu Decl., Ex. 1 ('352 Patent) at 1:54-59).

15. The inventors of the '352 patent disclosed a simple and elegant solution by recognizing that the minima between two maximas in a capacitive grid could be used to detect the presence of two fingers, and that the presence of two fingers, along with other variables such as the duration of the contact and movement of the fingers, to invoke button clicks and other control functions.

16. As shown below, two fingers, represented as 10A and 10B, are placed on the touch screen, 20. Liu Decl., Ex. 1 ('352 Patent) at 1:54-59. The electrodes in the touch sensor are scanned (*Id*. at Fig. 2) and the measurements are stored in memory. *Id*. at 5:58-65. The change in capacitance measurements stored in memory can be conceptualized as a grid or a plot.

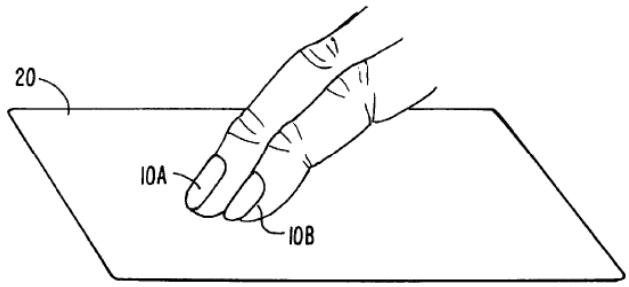


FIG. 1.

17. Fig. 4 of the ’352 patent shown below illustrates the capacitive data as taken in one dimension. Liu Decl., Ex. 1 (’352 Patent) at Fig. 4. The controller analyzes the capacitance data by comparing the capacitance at each point to its neighbors to identify maximas, 105 and 110. The controller also identifies a local minima, 100, that is between the maximas. *Id.* at 6:26-38. The ’352 patent explains that the local minima is not the absolute minima (*i.e.* does not have to be zero) but rather is the intermediate minimum between the two maxima 105 and 110. *Id*. at 6:39-47.

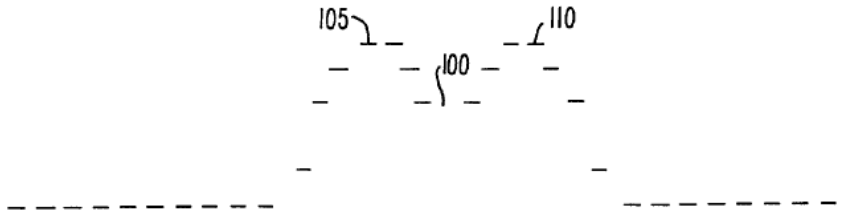


FIG. 4.

18. The ’352 patent recognizes and discloses that other post-identification techniques can be used to ensure that the maximas and minima represent valid finger contact. Liu Decl., Ex. 1 (’352 Patent) at 6:58-57. For example, whether the distance between the maximas meet a threshold, or whether the value of the minima is within a threshold, etc. can be used to increase the systems’ precision. *Id*. However, the primary disclosure by the ’352 patent is analyzing the capacitive data to identify maximas and corresponding intermediate local minima between the maximas.

19. In addition to disclosing how to detect the simultaneous presence and location of multiple fingers, the '352 patent also discloses novel functions for use with the multiple fingers. For example, a "click" function occurring in response to the detection of a second maxima (Liu Decl., Ex. 1 ('352 Patent) at 2:60-61), a "select" function occurring in response to the detection of a second maxima (*Id*. at 13:8-12), or a "two finger tap" in response to both fingers being removed and reappearing on the touch screen. *Id*. at 13:23-31. As another example, the '352 patent discloses that the location of two fingers allows for the distance between the fingers to be determined which can be used "in paint or other programs to determine line width or other spacing functions. . . ." *Id*. at 3:20-26. Thus, the '352 patent discloses (1) how to detect the presence and location of multiple fingers and (2) various functions that can be implemented based on the detection

VI. INFRINGEMENT ANALYSIS

A. Independent Claim 1

20. Claim 1 of the '352 patent reads:

> 1. A method for detecting the operative coupling of multiple fingers to a touch sensor involving the steps of
>
> scanning the touch sensor to (a) identify a first maxima in a signal corresponding to a first finger, (b) identify a minima following the first maxima, (c) identify a second maxima in a signal corresponding to a second finger following said minima, and
>
> providing an indication of the simultaneous presence of two fingers in response to identification of said first and second maxima.

Liu Decl., Ex. 1 ('352 Patent) at 16:14-24.

21. I understand that the Court issued a claim construction order on November 1, 2010 ("Claim Construction Order"). [Dkt. No. 183]. I understand that the Court has construed certain terms in independent claims 1 and 18 and has invalidated dependent claim 19. In my analysis, I apply this Claim Construction Order. I list in the table below, the Court's Claim Construction Order regarding terms in independent claims 1 and 18:

Claim Term	Construction by Court
identify a first maxima in a signal corresponding to a first finger	Identify a first peak value in a finger profile taken on a line obtained from scanning the touch sensor.
identify a minima following the first maxima	Identify the lowest value in the finger profile taken on said line that occurs after the first peak value and before another peak

	value is identified.
identify a second maxima in a signal corresponding to the second finger following said minima"	After identifying the lowest value in the finger profile taken on said line, identify a second peak value in the finger profile taken on said line.

22. Other claim terms were construed in that Order and I understand that the parties agreed to the meaning of other terms. [Dkt. No. 84-1]. I have applied the construction of the relevant claim terms agreed to by the parties or adopted by the Court in arriving at my opinions regarding infringement. For terms where there has been no agreement or resolution by the Court, I provide my opinion as to the proper construction.

1. "Scanning the Touch Sensor . . ."

23. The parties agree that the claim term "scanning the touch sensor" means "measuring the values generated by a touch sensor to detect operative coupling and determining the corresponding position at which measurements are made." All of the relevant Apple Products scan the touch sensor under this definition. [redacted]

2. "Identify a first maxima . . . Identify a minima following the first maxima . . . Identify a second maxima . . ."

[redacted]

[redacted]

[redacted]

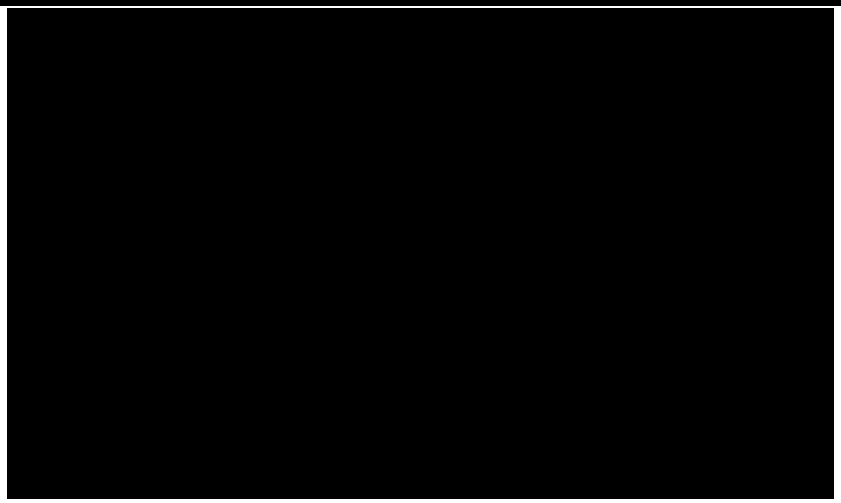
[redacted]










[redacted]

[redacted]

[redacted]

44. Taken together, it is my opinion that the Accused Apple Products contain code that when two fingers are placed on the touchpad on the Accused Products infringe independent claim 1 of the '352 patent.

45. Independent claim 1 is a method claim. As set forth above, the method is performed whenever two fingers are in contact with the touchpad. I have reviewed the user guides for the Accused Products. The user guides for the iBook and PowerBook G4 instruct that "[t]he trackpad is designed to allow scrolling when you use two adjoining fingers . . . ." Liu Decl., Ex. 8 (iBook G4 User Guide) at ELN000302; Ex. 9 (PowerBook G4 User Guide) at ELN000641. Likewise, the user guides for the MacBook and MacBook Pro instruct that "[t]he trackpad lets you scroll by dragging two fingers, and the scrolling feature is turned on by default." Liu Decl., Ex. 13 (MacBook User

Guide) at ELN000894; Ex. 21 (MacBook Pro User Guide) at ELN000750. Later MacBook and MacBook Pro user guides instructs that the gesture "*Secondary clicking or 'right clicking'*" emulates the right click function of a mouse when the user places two fingers on the trackpad and clicks the trackpad button. *See, e.g.*, Liu Decl., Ex. 15 (MacBook User Guide) at ELN001128. When determining whether to perform these gestures, the Apple Products perform the method steps described above.

46. It is my opinion that the method is performed by Apple when its employees test, display, and use their products and also by Apple's customers who purchase the products and use the products in an infringing manner - such as when performing the two finger scrolling or secondary clicking gestures. Furthermore, it is my opinion that Apple instructs customers to use Apple products in an infringing manner by advertising its multi-finger capabilities in its user guides.

B. Dependent Claim 6

47. Claim 6 depends on claim 1 and further requires that the "touch sensor includes a plurality of lines, said maxima being a largest local variation in a signal value on one of said lines due to capacitive coupling of a finger." Liu Decl., Ex. 1 ('352 Patent) at 16:36-39.

[redacted]

[redacted]

C. Dependent Claim 7

49. Claim 7 depends on claim 6 and further requires that the "maxima are peaks." Liu Decl., Ex. 1 ('352 Patent) at 16:40. A peak is a trace having a value that is larger than its neighbors *Id.* at 9:51-60; 10:9-18. [redacted]

D. Dependent Claim 16

50. Claim 16 depends on claim 1 and further requires "calculating first and second centroids corresponding to said first and second fingers." Liu Decl., Ex. 1 ('352 Patent) at 17:21-23.

[redacted]

[redacted]

E. Independent Claim 18

52. Claim 18 reads:

> A touch sensor for detecting the operative coupling of multiple fingers comprising:
>
> means for scanning the touch sensor to (a) identify a first maxima in a signal corresponding to a first finger, (b) identify a minima following the first maxima, and (c) identify a second maxima in a signal corresponding to a second finger following said minima, and
>
> means for providing an indication of the simultaneous presence of two fingers in response to identification of said first and second maxima.

Liu Decl., Ex. 1 ('352 Patent) at 17:27-37.

53. I understand that this claim is governed by 35 U.S.C. § 112 ¶ 6 and is infringed if an Accused Product contains structure that performs the identical recited function and the structure is identical or equivalent to the structure found in the patent specification. I further understand that the parties agree that for the claim term "means for scanning the touch sensor" the recited function is "scanning the touch sensor" and the corresponding structure is "an analog multiplexer, a circuit to measure changes in capacitance of sensor conductors, an analog to digital converter, a microcontroller, and equivalents thereof". [Dkt. No. 60 at 1].

54. As explained above for independent claim 1, the host computer contains the requisite code to perform the functions of (a) identifying a first maxima in a signal corresponding to a first finger, (b) identifying a minima following a first maxima, and (c) identifying a second maxima in a signal corresponding to a second finger following said minima and for providing an indication of the simultaneous presence of two fingers in response to identification of said first and second maxima. As explained further below, the [redacted] and [redacted] Trackpads perform the identical

function of "scanning the touch sensor" and "providing an indication of the simultaneous presence of two fingers" and contain the requisite identical, or equivalent, structure.

1. "Means for scanning the touch sensor . . ."

[redacted]

(i) Analog Multiplexer

56. As explained by the ’352 patent, an analog multiplexer is a device that "selects which traces of the matrix [] will be sampled". Liu Decl., Ex. 1 (’352 Patent) at 5:32-35. This definition is consistent with the understanding of a person of ordinary skill in the art at the time of invention as the IEEE dictionary explains that a multiplexer is "[a] device for selecting one of a number of inputs and switching its information to the output." Ex. 26 (The New IEEE Standard Dictionary of Electrical and Electronics Terms (1/15/1993) at 829. [redacted]

[redacted]

(ii) Circuit to measure changes in capacitance of sensor conductors

[redacted]

[redacted]

(iii) Analog to digital converter

59. As explained in the ’352 patent, the sensor measurements are "provided to an analog to digital converter [], which operates as described . . . to convert the capacitance values from the circuit [] into a digital representation . . . ." Liu Decl., Ex. 1 (’352 Patent) at 5:44-48. [redacted]

(iv) Microcontroller

60. As explained in the ’352 patent, "the analog to digital converter [] then supplies the signals to the microcontroller [] . . . . Depending on the operation being performed at the particular time, the output of the microcontroller [] is then supplied to an interface to a PC or other device, such as a PS/2 interface, an RS-232 interface, or an Apple Desktop Bus (ADB)." Liu Decl., Ex. 1 (’352 Patent) at 5:48-55. [redacted]

[redacted]

(i) Analog Multiplexer

62. As explained by the ’352 patent, an analog multiplexer is a device that "selects which traces of the matrix [] will be sampled". Liu Decl., Ex. 1 (’352 Patent) at 5:32-35. [redacted]

(ii) Circuit to measure changes in capacitance of sensor conductors

[redacted]

[redacted]

(iii) Analog to digital converter

64. As explained in the ’352 patent, the sensor measurements are "provided to an analog to digital converter [], which operates as described . . . to convert the capacitance values from the circuit [] into a digital representation . . . ." Liu Decl., Ex. 1 (’352 Patent) at 5:44-48. [redacted]

(iv) Microcontroller

65. As explained in the ’352 patent, "the analog to digital converter [] then supplies the signals to the microcontroller [] . . . . Depending on the operation being performed at the particular time, the output of the microcontroller [] is then supplied to an interface to a PC or other device, such as a PS/2 interface, an RS-232 interface, or an Apple Desktop Bus (ADB)." Liu Decl., Ex. 1 (’352 Patent) at 5:48-55. [redacted]

(i) Analog Multiplexer

68. As explained by the ’352 patent, an analog multiplexer is a device that "selects which traces of the matrix [] will be sampled". Liu Decl., Ex. 1 (’352 Patent) at 5:32-35. [redacted]

(ii) Circuit to measure changes in capacitance of sensor conductors

69. As explained above, the datasheet for the Cypress CY8C24794 and CY8C21434 chips explains that the devices "enable[] *capacitive measurement* for applications such as touch sensing." Liu Decl., Ex. 34 (Cypress CY8C24794 Datasheet) at APEL1617590; Ex. 38 (Cypress CY8C21434 Datasheet) at APEL0010824 (emphasis added). The Cypress CY8C24794 and CY8C21434 each contain a circuit to measure the change in capacitance of sensor conductors and converts the measurement from analog to digital, as described further below. Therefore, it is my opinion that the Accused Products containing a [redacted] contain a circuit to measure changes in capacitance of sensor conductors as required by independent claim 18.

(iii) Analog to digital converter

70. As explained in the ’352 patent, the sensor measurements are "provided to an analog to digital converter [], which operates as described . . . to convert the capacitance values from the circuit [] into a digital representation . . . ." Liu Decl., Ex. 1 (’352 Patent) at 5:44-48. The Cypress CY8C24794 and CY8C21434 datasheets explains for the analog multiplexer system, discussed above, that "[t]he bus also connects to the analog system for analysis with comparators and *analog-*

to-digital converters." Liu Decl., Ex. 34 (Cypress CY8C24794 Datasheet) at APEL1617590; Ex. 38 (Cypress CY8C21434 Datasheet) at APEL0010824 (emphasis added). The analog to digital converts the analog capacitance values into a digital representation. Therefore, as explained above, it is my opinion that the Accused Products containing a [redacted] contain an analog to digital converter as required by independent claim 18.

(iv) Microcontroller

71. As explained in the '352 patent, "the analog to digital converter [] then supplies the signals to the microcontroller [] . . . . Depending on the operation being performed at the particular time, the output of the microcontroller [] is then supplied to an interface to a PC or other device, such as a PS/2 interface, an RS-232 interface, or an Apple Desktop Bus (ADB)." Liu Decl., Ex. 1 ('352 Patent) at 5:48-55. [redacted]

opinion that the hardware in the [redacted] performs the identical recited function of "scanning the touch sensor" as required by independent claim 18. As explained further below, it is also my opinion that the requisite structural elements are also present in the [redacted].

(i) Analog Multiplexer

73. As explained by the '352 patent, an analog multiplexer is a device that "selects which traces of the matrix [] will be sampled". Liu Decl., Ex. 1 ('352 Patent) at 5:32-35. [redacted] The datasheet for the Cypress CY8C24794 chip explains that these ports use an "analog multiplexer system" that "enables capacitive measurement for applications such as touch sensing." Liu Decl., Ex. 34 (Cypress CY8C24794 Datasheet) at APEL1617590. Therefore, it is my opinion that the Accused Products containing a [redacted] contain an analog multiplexer as explained above as required by independent claim 18.

(ii) Circuit to measure changes in capacitance of sensor conductors

74. As explained above, the datasheet for the Cypress CY8C24794 chip explains that the devices "enable[] *capacitive measurement* for applications such as touch sensing." Liu Decl. Ex. 34 (Cypress CY8C24794 Datasheet) at APEL1617590 (emphasis added). The Cypress CY8C24794 chip contains a circuit to measure the change in capacitance of sensor conductors and converts the measurement from analog to digital, as described further below. Therefore, it is my opinion that the Accused Products containing a [redacted] contain a circuit to measure changes in capacitance of sensor conductors as required by independent claim 18.

(iii) Analog to digital converter

75. As explained in the '352 patent, the sensor measurements are "provided to an analog to digital converter [], which operates as described . . . to convert the capacitance values from the circuit [] into a digital representation . . . ." Liu Decl., Ex. 1 ('352 Patent) at 5:44-48. The Cypress CY8C24794 datasheet explains for the analog multiplexer system, discussed above, that "[t]he bus also connects to the analog system for analysis with comparators and *analog-to-digital* converters."

Liu Decl., Ex. 35 (Cypress CY8C24794 Datasheet) at APEL1617590. The analog to digital converts the analog capacitance values into a digital representation. Therefore, as explained above, it is my opinion that the Accused Products containing a [redacted] contain an analog to digital converter as required by independent claim 18.

(iv) Microcontroller

76. As explained in the '352 patent, "the analog to digital converter [] then supplies the signals to the microcontroller [] . . . . Depending on the operation being performed at the particular time, the output of the microcontroller [] is then supplied to an interface to a PC or other device, such as a PS/2 interface, an RS-232 interface, or an Apple Desktop Bus (ADB)." Liu Decl., Ex. 1 ('352 Patent) at 5:48-55. [redacted]

[redacted]

(i) Analog Multiplexer

78. As explained by the ’352 patent, an analog multiplexer is a device that "selects which traces of the matrix [] will be sampled". Liu Decl., Ex. 1 (’352 Patent) at 5:32-35. [redacted]

(ii) Circuit to measure changes in capacitance of sensor conductors

79. As explained above, the datasheet for the Cypress CY8C24994 chip explains that the devices "enable[] *capacitive measurement* for applications such as touch sensing." Liu Decl., Ex. 34 (Cypress CY8C24994 Datasheet) at APEL1617590 (emphasis added). The Cypress CY8C24994 chip contains a circuit to measure the change in capacitance of sensor conductors and converts the measurement from analog to digital, as described further below. Therefore, it is my opinion that the Accused Products containing a [redacted] contain a circuit to measure changes in capacitance of sensor conductors as required by independent claim 18.

(iii) Analog to digital converter

80. As explained in the ’352 patent, the sensor measurements are "provided to an analog to digital converter [], which operates as described . . . to convert the capacitance values from the circuit [] into a digital representation . . . ." Liu Decl., Ex. 1 (’352 Patent) at 5:44-48. [redacted]

(iv) Microcontroller

81. As explained in the ’352 patent, "the analog to digital converter [] then supplies the signals to the microcontroller [] . . . . Depending on the operation being performed at the particular time, the output of the microcontroller [] is then supplied to an interface to a PC or other device, such as a PS/2 interface, an RS-232 interface, or an Apple Desktop Bus (ADB)." Liu Decl., Ex. 1 (’352 Patent) at 5:48-55. [redacted]

2. “identify a first maxima . . . indentify a minima . . . identify a second maxima”

According to claim 18, the purpose of scanning the touch sensor is to

(a) identify a first maxima in a signal corresponding to a first finger, (b) identify a minima following the first maxima, and (c) identify a

second maxima following said minima

Liu Decl., Ex. 1 ('352 Patent) at 17:29-34.

82. As discussed above, the relevant products that included the [redacted] or [redacted] touchpads analyzed the capacitive measurements taken from the scanning process and identified the maxima and minima values in a manner identical to the requirements of this claim language as construed by the Court. It is therefore my opinion that these products meet the limitations of claim 18.

3. "Means for providing an indication of the simultaneous presence of two fingers . . ."

83. As explained above for independent claim 1, the host computer contains the requisite code to perform the function of providing an indication of the simultaneous presence of two fingers in response to identification of said first and second maxima.

84. I understand that Apple has argued that the corresponding structure is "the algorithm found in Fig. 8-1, which sets a Finger value equal to two after determining if a scan in either the X direction or the Y direction has detected two fingers." [Dkt. No. 84-1 at 7-8]. While I disagree with this construction, I nonetheless find that the Apple Products meet this limitation under Apple's construction. [redacted]

85. I disagree with Apple's construction because, for example, in Figures 5 and 6-2, the indication of the simultaneous presence of two fingers is provided when the BUTTON variable is set to DOWN. Liu Decl., Ex. 1 ('352 Patent) at 6:54-56. In the operation illustrated in these flowcharts, "one [finger] is used for cursor control and a second as a button…" *Id.* at 6:48-55. In Fig 6-2 at step 310 the Xbutton variable is set to Down whenever there are two fingers on the touchpad, i.e. if there has been an identification of two maxima in the X direction. While not shown separately, the same process is performed for values on the Y axis and would result in the Ybutton variable being set to Down if two maxima were identified on the Y traces. *Id.* at 8:47-51. In Fig. 5

the variable "BUTTON" is set to DOWN the first time two fingers are detected in either the X or Y direction, if the button was previously UP. *Id.* As another example, Figure 9-2 shows that the variable Xfinger is set equal to 2 based on the identification of two maxima in the X direction and, again, is not dependent on the detection of maxima in the Y direction. *Id.* at Fig. 9-2. The patent specification explicitly states that "then a determination is made that two fingers are in contact with the sensor and the variable Xfinger is set to two". *Id.* at 15:22-31. Thus, in my opinion the structure disclosed in the '352 patent that performs the function of providing an indication of the simultaneous presence of two fingers in response to identification of said first and second maxima is a logic function that sets a variable or data structure to a condition that indicates two fingers, including step 465 in Fig. 5, step 310 in Fig. 6-2, step 860 in Fig. 8-1 and step 980 in Fig. 9-2 or their equivalents. The Accused Products include code that implements the algorithm shown in step 860 of Fig. 8-1. It is therefore my opinion that the Accused Products literally meet this claim limitation.

F. Dependent Claim 21

86. Claim 21 depends on claim 18 and further requires that the "maxima are peaks." Liu Decl., Ex. 1 ('352 Patent) at 17:47-48.

87. A peak is a trace having a value that is larger than its neighbors. Liu Decl., Ex. 1 ('352 Patent) at 9:51-60; 10:9-18. [redacted]

G. Dependent Claim 30

88. Claim 30 depends on claim 18 and further requires "means for calculating first and second centroids corresponding to said first and second fingers." Liu Decl., Ex. 1 ('352 Patent) at 9:44-46.

89. I understand that the parties agree that the recited function is "calculating first and second centroids corresponding to said first and second fingers." [Dkt. No. 60-1 at 11]. As I explained above for dependent claim 16, the Accused Products calculate the first and second centroids that correspond to the first and second fingers and therefore perform the identical function.

90. I understand that Apple has argued that this claim is indefinite "[b]ecause the specification does not disclose a corresponding structure." [Dkt. No.60-1 at 11-12]. Apple appears to take the position that because the flowcharts illustrate calculating a single centroid for both fingers, there is no disclosure of calculating separate centroids for each finger. I disagree with Apple because the patent expressly discloses "a second implementation, *a centroid value may be calculated for each maxima, yielding multiple centroid values when multiple fingers interact with the pad. For purposes of clarity, the following description will be limited to the first implementation.*" Liu Decl., Ex. 1 ('352 Patent) at 10:35-45 (emphasis added).

91. Capacitive touch sensors typically determine the finger location by calculating the coordinates of the centroid of the curve of capacitance values. The centroid function is commonly used in physics and engineering to calculate a single point which represents the center of an object or set of measurements. The centroid function is often called the center of mass, or center of gravity, since it is used to calculate the coordinates of the point that is at the center of the mass of a physical object. For capacitive sensors the centroid of the curve of capacitance values is a way to calculate the coordinates of a point which represents the location of the center of the finger contact. The centroid for an axis is calculated by adding up the products of the change in capacitance at each sensor location, multiplied by the coordinate of the senor, and then dividing that total by the total of the changes in capacitance. Centroid calculation to provide a precise location of finger contact was used in the art well before the '352 patent. For example, U.S. Patent No. 5,463,388 to Boie et al. ("Boie" or "the Boie patent") was filed in 1993 and discloses a method for calculating the location of the finger touch using the centroid of the measured capacitance values on a capacitive touch sensor. Liu Decl., Ex. 48 (U.S. Patent No. 5,463,388) at 5:20-50.

92. The '352 patent discloses a means for calculating the centroid of finger contact, providing the equation XweightSum = xweightSum + X*X(N)/Xsum. Liu Decl., Ex. 1 ('352 Patent) at Fig. 6-1 at 220 & Fig. 6-2 at 295. Where N is the entire range of measured values in the X direction, one centroid would be calculated for all of the fingers in proximity to the sensor. *Id.* at 10:31-42. As I explained above, while the flowchart in Fig. 6-1 and 6-2 illustrates calculating a single centroid for both fingers, the '352 patent expressly teaches that centroids may also be calculated separately for each maxima, giving separate locations for each finger. *Id.* at 10:40-45. In order to compute the centroid for each maxima, one of ordinary skill in the art at the time of the '352 patent would have readily known to compute the centroid of the data from the start of the first curve or hill to the minima (e.g., set the range of N to be the sensor locations with values over the threshold before the minima), and then start computing the centroid for the second maxima after the minima. [redacted].

93. Thus, it is my opinion that the Apple Accused Products contain the requisite "means for calculating first and second centroids corresponding to said first and second fingers."

I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct. Executed May 5, 2011, at Newton, New Hampshire.

Robert Dezmelyk

FILER'S ATTESTATION

Pursuant to General Order No. 45, Section X (B) regarding signatures, I, Sean P. DeBruine, attest that concurrence in the filing of this document has been obtained.

/s/ Sean P. DeBruine
Sean P. DeBruine

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